VT 240 Series

Pocket Service Guide

VT100.net

digital	DECwriter	RSTS
DEC	DIBOL	RSX
DECmate	MASSBUS	UNIBUS
DECnet	PDP	VAX
DECsystem-10	P/OS	VMS
DECSYSTEM-20	Professional	VT
DECUS	Rainbow	Work Processor

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A   VT240 DOCUMENTATION

B   FRU EXPLODED VIEW DRAWING

C   CABLE INFORMATION

D   PHYSICAL/FUNCTIONAL DIAGRAMS

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INTRODUCTION

PURPOSE
This pocket service guide provides the following information for servicing the VT240 series terminal.

Testing and troubleshooting field replaceable units (FRUs)
Removing and replacing FRUs
Aligning the VR201 monitor
Servicing the VR241-A color monitor
Using set-up
Related documentation
Cable information
FRU exploded view drawing
Physical/functional diagrams

WARNINGS, CAUTIONS, AND NOTES
Warnings, cautions, and notes appear throughout this pocket service guide. They are defined as follows.

WARNING	Contains information essential to the safety of personnel.
CAUTION	Contains information essential to the safety of the equipment and software.
NOTE	Contains an important message alerting you to information you should be aware of.

THE VT240
The VT240 is a general-purpose video terminal for text and graphics. The VT240 is compatible with the VT102 and VT125.

The VT240 terminal supports different language versions of the LK201 corporate keyboard. The VT240 has an antiglare, 12-inch (305 mm) monochrome monitor that can display 24 rows of text in an 80- or 132-column format. The monitor tilt mechanism lets the user adjust the screen for optimum viewing comfort.

A color monitor and an integral modem are available as options. Chapter 4 provides information for servicing the VR241-A color monitor.

The VT240 has three standard interface connectors: two asynchronous serial ports (EIA and printer) and one 20 mA port. You can use the EIA host port or 20 mA host port to connect the VT240 to a host computer.

- The EIA host port is a 25-pin (EIA RS232C and RS423) male connector.
- The 20 mA host port is an 8-pin 20 mA female connector.
- The printer port is a 9-pin (EIA RS232C) male connector used to connect the terminal to a printer.

The VT240 operates only on full-duplex asynchronous communication lines.

TOOLS REQUIRED
You need the following tools to service the VT240 series terminal.

Tool	Part Number
VOM (volt ohmmeter)	29-13510-00
Slotted screwdriver, 3/16 inch	29-10988-00
Phillips screwdriver, no. 2	29-11005-00
Tuning wand	29-23189-00
Video alignment tool	29-23190-00
Video alignment template	29-24371-00
CRT screen cleaner	29-24791-00
Anode discharge tool	29-24717-00
VR241 adjustment tool	29-24746-00
EIA data loopback connector	12-15336-00
Printer port loopback connector	29-24794-00
20 mA loopback connector	70-15503-00

1 TESTING AND TROUBLESHOOTING

1.1 GENERAL

This chapter contains the information needed to perform
the self-test functions and troubleshoot the VT240 series
terminal. See Chapter 4 if you have a color monitor.

1.2 TESTING AND TROUBLESHOOTING

There are a series of internal self-tests to help you isolate
failures to the field replaceable units (FRUs). (See Appen-
dix B.) Table 1-1 lists the self-tests.

   If a test finds a faulty FRU, adjust or replace the faulty
unit. Then repeat all of the tests listed in Table 1-1 to
ensure that your terminal operates correctly.

> **NOTE**
> Each self-test resets the terminal set-up fea-
> tures to the saved defaults. You must select the
> set-up features for each self-test before you run
> the test. The following procedures include the
> required set-up features.
>
> Make sure the EIA port is not connected to a
> host when you use VT240 self-tests and align-
> ment patterns.

Table 1-1   Self-Test Chart

Self-Tests	Prerequisites	Sequence*
Power-up (Para. 1.3)	None	Turn terminal power on.

Power-up (invoked after terminal is operating)	• Set-up
	  – Local
	  – VT100
		Once:
		ESC [4 ; 1 y
		Continuously:
		ESC [4 ; 1 ; 9 y

EIA port data lines loopback (Para. 1.4)	• Set-up
	  – Local
	  – VT100
	• EIA loopback connector
		Once:
		ESC [4 ; 2 y
		Continuously:
		ESC [4 ; 2 ; 9 y

Printer port external loopback (Para. 1.5)	• Set-up
	  – Local
	  – VT100
	• Printer port loopback connector
		Once:
		ESC [4 ; 3 y
		Continuously:
		ESC [4 ; 3 ; 9 y

EIA port control lines loopback (Para. 1.6)	• Set-up
	  – Local
	  – VT100
	• EIA loopback connector
		Once:
		ESC [4 ; 6 y
		Continuously:
		ESC [4 ; 6 ; 9 y

20 mA port loopback (Para. 1.7)	• Set-up
	  – Local
	  – VT100
	• 20 mA loopback connector
		Once:
		ESC [4 ; 7 y
		Continuously:
		ESC [4 ; 7 ; 9 y

Integral modem analog loopback (Para. 1.8.1)	• Integral modem
	• Set-up
	  – Local
	  – VT100
		Once:
		ESC [4 ; 14 y
		Continuously:
		ESC [4 ; 14 ; 9 y

Table 1-1   Self-Test Chart (Cont)

Test Patterns	Prerequisites	Sequence*

Integral modem remote loopback (Para. 1.8.2)	• Integral modem
	• Set-up
	  – VT100
	  Integral modem port
	  – 1200 baud
	  – Receive=
	  Transmit
	• Shift-Data/Talk
	• Dial phone number
	• Enter set-up
	  – Local
		Once:
		ESC [4 ; 15 y
		Continuously:
		ESC [4 ; 15 ; 9 y

Screen of E's	• Set-up
	  – Local
	  – VT100
	  – 80 columns/line
	  – Normal video
	  – Monochrome display
		ESC # 8

Graphics alignment	• Set-up
	  – Clear display
	  – Local
	  – VT100
	  – 80 columns/line
	  – Reverse video
	  – Monochrome display
		ESC Pp
		P [390,240]
		C [200]

* Do not type spaces between the parameters of any escape sequence. The parameters are shown with spaces for clarity only.

1.3   POWER-UP SELF-TEST

This test checks the terminal's internal memory, the keyboard, and the video circuitry. The test also makes a partial check of the communication and printer ports to see if they are operating correctly.

A successful power-up self-test ends when the following occur.

1. The keyboard LED indicators (Figure 1-1) are off.

2. The keyboard generates a bell tone.

3. A VT240 OK message enclosed by a rectangle appears on the screen (Figure 1-1). This message disappears from the screen when (1) the terminal receives any character except XON, (2) you press the set-up key, or (3) you let 30 minutes elapse.

If an error occurs, check your monitor first. Your screen will display VT240 plus an error message, and your keyboard will generate two bell tones. Table 1-2 lists the error messages. (See Paragraph 1.11.)

If an error occurs that makes it impossible for you to continue operating your monitor, the keyboard LED indicators will also display the error code. Table 1-2 also lists the error codes. (See Paragraph 1.11.)
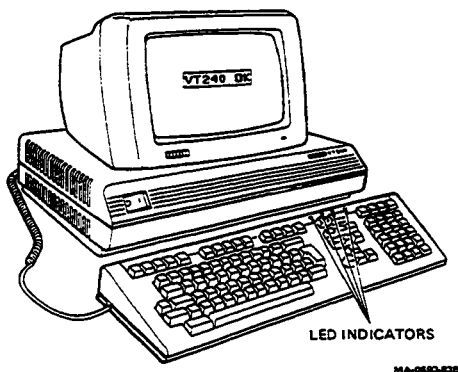
Figure 1-1 Indication of Successful
Self-Test

If other problems occur, see Paragraph 1.12. Table 1-3 lists common symptoms and their probable causes, and suggests corrective actions. If you have a color monitor, see Chapter 4.

Start the power-up self-test with one of the following two methods.

1. Turn the power to the VT240 on. (The power-up self-test runs automatically each time the terminal is turned on.)

2. Type one of the following sequences. (Read the following note first.)

   NOTE
   If you are already operating your terminal, enter set-up. Then put your terminal in local and in VT100 mode.

   ESC [4 ; 1 y   (Performs test once.)
   ESC [4 ; 1 ; 9 y   (Performs test continuously.)

   NOTE
   The continuously running power-up self-test ends only if an error occurs or you turn off the power. The keyboard generates a bell tone at the end of each successful test in the sequence.

When you run the power-up self-test, the following occur.

1. All LED indicators turn on. After the test ends successfully, the LED indicators turn off.

2. A bell tone sounds.

3. A VT240 OK message appears on the screen.

1.4 EIA PORT DATA LINES LOOPBACK SELF-TEST

For this test, you connect the terminal's transmit and receive lines together with a data loopback connector (Figure 1-2). The terminal sends a predefined set of characters on its transmit line and receives them on its receive line. Then the terminal compares the output characters to the input characters. If the characters do not match, the terminal displays an error code at the LEDs and an error message on the screen. (See Paragraph 1.10.)

Comm
EIA HOST PORT
CONNECTOR

20 mA
HOST PORT
CONNECTOR

POWER OK
INDICATOR

VIDEO MONITOR
CONNECTOR

PR
PRINTER PORT
CONNECTOR

DATA LOOPBACK CONNECTOR

PN 12 · 15336 · 00

FROM PIN	TO PIN	TO PIN
2	3	15
4	5	8
20	6	22
19	12	17

20mA LOOPBACK
CONNECTOR

PN 70 · 15503 · 00

FROM PIN	TO PIN
1	3
2	7
5	8

PRINTER PORT
LOOPBACK CONNECTOR

PN 29-24794-00

FROM PIN	TO PIN
2	3
5	6

MA-1357-83

Figure 1-2 VT240 Rear Connector Panel

A successful test ends when the following occur.

1. The keyboard LED indicators are off.
2. The keyboard generates a bell tone.
3. A VT240 OK message appears on the screen.

Run the EIA port data lines loopback self-test as follows.

1. Enter set-up and put your terminal in local and in VT100 mode. Then exit set-up.
2. Connect the data loopback connector (PN 12-15336-00) to the host port (Figure 1-2).
3. Type one of the following sequences to perform the data loopback self-test.

   ESC [4 ; 2 y (Performs test once.)
   ESC [4 ; 2 ; 9 y (Performs test continuously.)

   NOTE
   The continuously running test ends only if an error occurs or you turn off the power. The keyboard generates a bell tone each time the test ends successfully.

If the EIA port data lines loopback self-test finds an error, your terminal displays

VT240 EIA Port Data Error - 4

on the screen and an error code at the keyboard LED indicators. (See Paragraph 1.11.)

1.5   PRINTER PORT EXTERNAL
LOOPBACK SELF-TEST

For this test, you connect the printer port transmit and
receive lines together with a printer port loopback connec-
tor (Figure 1-2). The terminal sends a predefined set of
characters on its transmit line and receives them on its
receive line. Then the terminal compares the input charac-
ters with the output characters. If the characters do not
match, the terminal displays an error message on the
screen and an error code at the LED indicators. (See
Paragraph 1.11.)

A successful test ends when the following occur.

1. The keyboard LED indicators are off.

2. The keyboard generates a bell tone.

3. A VT240 OK message appears on the screen.

Run the printer port loopback self-test as follows.

1. Enter set-up and put your terminal in local and in
   VT100 mode. Then exit set-up.

2. Connect the printer port loopback connector
   (PN 29-24794-00) to the printer port (Figure 1-2).

3. Type one of the following sequences to perform the
   printer port external loopback test.

   ESC [4 ; 3 y   (Performs test once.)

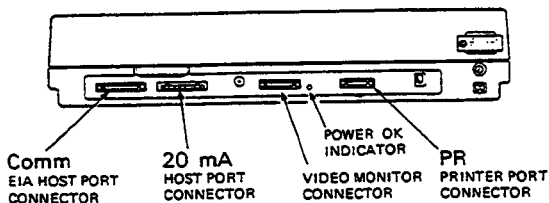   ESC [4 ; 3 ; 9 y   (Performs test continuously.)

   NOTE
   **The continuously running test ends only if an
   error occurs or you turn off the power. The
   keyboard generates a bell tone each time the
   test ends successfully.**

If the printer port loopback self-test finds an error, your
terminal displays

VT240 Printer Port Error - 2

on the screen and an error code at the keyboard LED
indicators. (See Paragraph 1.11.)

1.6 EIA PORT CONTROL LINES
LOOPBACK SELF-TEST

This procedure tests data terminal ready, request to send, carrier detect, data set ready, and clear to send.

A successful test ends when the following occur.

1. The keyboard LED indicators are off.

2. The keyboard generates a bell tone.

3. A VT240 OK message appears on the screen.

Run the EIA port control lines loopback self-test as follows.

1. Enter set-up and put your terminal in local and in VT100 mode. Then exit set-up.

2. Install an EIA loopback connector (PN 12-15336-00) to the EIA host port (Figure 1-2).

3. Type one of the following sequences to perform the EIA port control lines loopback self-test.

   ESC [4 ; 6 y   (Performs test once.)

   ESC [4 ; 6 ; 9 y   (Performs test continuously.)

   NOTE
   The continuously running test ends only if an error occurs or you turn off the power. The keyboard generates a bell tone each time the test ends successfully.

If the EIA port control lines loopback self-test finds an error, your terminal displays

VT240 EIA Port Control Error - 5

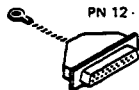on the screen and an error code at the keyboard LED indicators. (See Paragraph 1.11.)

1.7   20 mA PORT LOOPBACK SELF-TEST

For this test, you connect the terminal's transmit and receive lines together with a 20 mA data loopback connector (Figure 1-2). The terminal sends a predefined set of characters on its transmit line and receives them on its receive line. Then the terminal compares the output characters to the input characters. If the characters do not match, the terminal displays an error message on the screen and an error code at the LED indicators. (See Paragraph 1.11.)

A successful test ends when the following occur.

1. The keyboard LED indicators are off.
2. The keyboard generates a bell tone.
3. A VT240 OK message appears on the screen.

Run the 20 mA port loopback self-test as follows.

1. Enter set-up and put your terminal in local and in VT100 mode. Then exit set-up.
2. Connect a 20 mA loopback connector (PN 70-15503-00) to the 20 mA port (Figure 1-2).
3. Type one of the following sequences.

ESC [4 ; 7 y   (Performs test once.)

ESC [4 ; 7 ; 9 y   (Performs test continuously.)

NOTE
The continuously running test ends only if an error occurs or you turn off the power. The keyboard generates a bell tone each time the test ends successfully.

If the 20 mA port loopback self-test finds an error, your terminal displays

VT240 20 mA Port Error - 3

on the screen and an error code at the keyboard LED indicators. (See Paragraph 1.11.)

1.8   INTEGRAL MODEM SELF-TESTS

The terminal uses two integral modem self-tests, the analog loopback self-test and remote loopback self-test.

1.8.1   Integral Modem Analog Loopback Self-Test

In this test, the terminal sends a predefined set of characters to the modem and receives them back. Then the terminal compares the output characters to the input characters. If the characters do not match, the terminal displays an error message on the screen and an error code at the LED indicators. (See Paragraph 1.11.)

The terminal runs the analog loopback self-test at power-up if the system board senses a modem present.

A successful test ends when the following occur.

1. The keyboard LED indicators are off.

2. The keyboard generates a bell tone.

3. A VT240 OK message appears on the screen.

Run the integral modem analog loopback self-test as follows.

1. Enter set-up and put your terminal in local and in VT100 mode. Then exit set-up.

2. Type one of the following sequences to perform the integral modem analog loopback self-test.

ESC [4 ; 14 y   (Performs test once.)

ESC [4 ; 14 ; 9 y   (Performs test continuously.)

NOTE
The continuously running test ends only if an error occurs or you turn off the power. The keyboard generates a bell tone each time the test ends successfully.

If the integral modem analog loopback self-test finds an error, your terminal displays

VT240 Modem Error — 8

on the screen and an error code at the keyboard LED indicators. (See Paragraph 1.11.)

1.8.2   Integral Modem Remote Loopback Self-Test
If the analog loopback self-test passes, run the remote
loopback self-test. To run the remote loopback self-test,
you must first make a connection with a remote modem (a
DF03, or Bell System 212A).

> **NOTE**
> **The remote modem must have the Response to**
> **Digital Loopback option enabled.**

   The remote loopback self-test sends data from the inte-
gral modem option, across the telephone lines, to the
remote modem. The remote modem then loops the data
back to your terminal. In effect, you are fully testing the
integral modem option as well as the telephone lines.
   Run the remote loopback self-test as follows.

1. Press the Set-Up key.

2. Use the arrow keys to move the highlighted cell over
   the General field. Press Enter.

3. In the General Set-Up screen, use the arrow keys to
   highlight the terminal mode field. Press Enter until
   you select VT100 mode.

4. Use the arrow keys to highlight the To Directory
   field. Press Enter.

5. Use the arrow keys to highlight the Comm field. Press
   Enter.

6. Use the arrow keys to highlight the host port selection
   field. Press Enter until you select Integral Modem
   Port.

7. Use the arrow keys to highlight the Transmit= field.
   Press Enter until you select 1200 baud. (If the remote
   modem is a 300 baud modem, select a transmit speed
   of 300.)

8. Use the arrow keys to highlight the Receive= field.
   Press Enter until you select Receive=Trans.

9. Press Set-Up to exit set-up.

10. Press Shift and Data/Talk(F4) together to enter dial-
    ing mode.

11. Dial the telephone number of the remote modem.

12. When a connection is established, the terminal exits
    dialing mode and displays Exiting dialing mode
    on the screen. Press Enter to enter set-up.

13. Use the arrow keys to highlight the on-line/local field. Press **Enter** until you select **Local**.

14. Type one of the following sequences to run the integral modem remote loopback self-test.

    ESC [4 ; 15 y   (Performs test once.)

    ESC [4 ; 15 ; 9 y   (Performs test continuously.)

15. If each test passes, a **VT240 OK** message appears on the screen. If each test fails, replace the integral modem. If each test continues to fail, the problem is caused by either the telephone line or the remote modem. Try using a different telephone line and/or dialing a different modem.

    NOTE
    Before you decide that the problem is in the telephone line, check the remote modem. Make sure the remote modem is enabled for loopbacks.

1.9   SCREEN ALIGNMENT TEST

The screen alignment test fills the screen with uppercase E's for making display height, width, and linearity adjustments.

Run the screen alignment self-test as follows.

1. Enter set-up and select the following.

    a. 80 columns per line

    b. VT100 mode

    c. Local

    d. Normal video (light text, dark screen)

    e. Monochrome display

    Then exit set-up.

2. Type **ESC # 8**. (Your screen will display all uppercase E's.)

3. See Chapter 3 for a complete description of all monitor adjustments used with this test pattern.

4. To remove the test pattern from the screen, enter set-up and select **Clear Display**.

1.10   PRINTER PROBLEMS

If the printer does not print, perform the following steps to isolate the problem to the printer or to the video terminal.

1. Perform the power-up self-test (Paragraph 1.3). If the terminal passes the self-test, go to step 2.

2. Perform the printer port external loopback self-test (Paragraph 1.5). If your terminal passes this test, go to step 3.

   NOTE
   If your terminal passes the above tests, it is running correctly; the problem is not a malfunctioning terminal.

3. Test the printer. (See your printer pocket service guide for the correct procedure.) If your printer is operating, go to step 4.

4. Check the following set-up features to make certain that your VT240 and your printer are compatible.

   • Baud rate (VT240 and printer)

   • Data bits per character (VT240 and printer)

   • Parity (VT240 and printer)

   • Printer Ready must appear on VT240 set-up status line.

   • Printer must be set to Full Duplex in set-up.

5. Check for the correct cable between your terminal and the printer (Appendix C). Make sure the connectors are securely fastened at both ends of the cable.

6. Perform steps 1 and 2 of the screen alignment test, (Paragraph 1.9).

7. Press the **Print Screen** key. The video display should print out if the printer is operating correctly.

1.11   SELF-TEST ERROR CODES

If your screen displays an error message, see Table 1-2. Each error message includes a reference to the FRU you must replace to correct the problem.

   If a video problem occurs, see Table 1-2 for error codes shown by the LED indicators. The LED indicators always display the error code for the test currently running. This test must run successfully before your VT240 terminal clears the error readout.

   See Table 1-3 for other troubleshooting procedures.

Table 1-2   VT240 Error Messages

Error Message	LEDs*	Corrective Action
NO ERROR MESSAGES - FATAL ERROR	oooo ooo● oo●o oo●● o●oo o●o●	Replace terminal controller board (Para. 2.4).
VT240 Display Processor Error - 1	o●●o	Replace terminal controller board.
VT240 Printer Port Error - 2	o●●●	Replace terminal controller board.
VT240 20 mA Port Error - 3	●ooo	Replace terminal controller board.
VT240 EIA Port Data Error - 4	●ooo	Replace terminal controller board.
VT240 EIA Port Control Error - 5	●oo●	Replace terminal controller board.
VT240 Keyboard Error - 6	xxxx	1. Plug in keyboard. 2. Replace keyboard (Para. 2.8). 3. Replace terminal controller board.
VT240 Keyboard Port Error - 7	xxxx	1. Plug in keyboard. 2. Replace keyboard. 3. Replace terminal controller board.
VT240 Modem Error - 8	●o●o	Replace integral modem option (Para. 2.7).
No dial tone detected.	oooo	Plug the telephone service line into the modem connector marked (–).

* The LED pattern from left to right is Hold (L1), Lock (L2), Compose (L3), and Wait (L4).

● = on
o = off
x = varying LED display

Table 1-2   VT240 Error Messages (Cont)

Error Message	LEDs*	Corrective Action
No number stored, please reenter number.	oooo	Refer to the *VT240 Owner's Manual* for storing telephone numbers.
VT240 Monitor Error - 9	●ooo●	1. Plug in VR201 monitor (LED indicator only). 2. Reverse monitor cable. 3. Replace monitor cable.
VT240 NVR Error - 10	●●oo	Replace terminal controller board.
VT240 Display Memory Error - 11	●●o●	Replace terminal controller board.
VT240 Video Error - 12	●●●o	Replace terminal controller board.

*   The LED pattern from left to right is Hold (L1), Lock (L2), Compose (L3), and Wait (L4).

● = on
o = off
x = varying LED display

1.12   TROUBLESHOOTING GENERAL PROBLEMS

Table 1-3 lists some common problem symptoms and their probable causes, and suggests corrective actions.

Table 1-3   VT240 Troubleshooting Chart

Symptom	Probable Cause	Corrective Action
No VT240 OK display, power OK indicator off, no bell tone, fan off.	Not plugged in, or no power at wall outlet.	Plug in VT240, or try another outlet.
	Voltage selection switch on wrong setting.	Set switch to correct setting.
	Power fuse	Replace if fuse open.
	Power supply connection	Check power supply connections.
	Power supply faulty.	Replace power supply chassis (Para. 2.3).
	System box	Replace system box (Para. 2.5).
	AC line cord	Check for opens/ shorts.
No VT240 OK display, power OK indicator on, no bell tone fan on.	Terminal controller board	Replace terminal controller board (Para. 2.4).
No VT240 OK display, power OK indicator on, bell tone present.	Brightness set too low.	Adjust contrast and brightness controls on VR201 monitor.
	Terminal controller board	Replace terminal controller board (Para. 2.4).
	Monitor	Replace VR201 monitor.

Table 1-3   VT240 Troubleshooting Chart (Cont)

Symptom	Probable Cause	Corrective Action
VT240 OK display present, power OK indicator on, bell tone present, VT240 cannot communicate with host, fan on.	VT240 host port connection loose.	Check if host is plugged in.
	Host port circuits faulty.	Run EIA or 20 mA loopback test. If no failure occurs, enter set-up and check parity, data bits, and baud rate.
	Wrong communication settings	
VT240 OK display present, power OK indicator on, bell tone present, fan off.	Fan faulty.	Replace power supply chassis (Para. 2.3).
Random characters appear on screen.	Wrong communication settings	Enter set-up and check parity, data bits, and baud rate.
	Terminal controller board	Replace terminal controller board (Para. 2.4).
Only a horizontal or vertical line appears on screen.	Monitor faulty.	Replace VR201 monitor (Para. 2.6).
	Terminal controller board	Replace terminal controller board (Para 2.4).
Screen display distorted.	Monitor is out of alignment.	Align monitor.
	Monitor faulty.	Replace VR201 monitor (Para. 2.6).
Screen display jittery.	Monitor is out of alignment.	Align monitor.
	Monitor faulty.	Replace VR201 monitor (Para. 2.6).

Table 1-3   VT240 Troubleshooting Chart (Cont)

Symptom	Probable Cause	Corrective Action
No bell tone.	Keyboard speaker bad.	Replace keyboard (Para. 2.8).
Different characters appear on screen than were typed in local.	Alternate character set selected.	Clear with Reset field in set-up
	Keyboard	Replace keyboard (Para. 2.8).
	Terminal controller board	Replace terminal controller board (Para. 2.4).
Different characters appear on screen than were typed on-line with host. (Terminal works in local.)	Transmit and receive speeds are set wrong	Set speeds to match host.
	Bits per character set wrong.	Set bits to match.
	Parity is set wrong.	Set parity to match host.
	Stop bits is set wrong.	Set to match host.
Terminal display does not scroll, Hold Screen indicator on.	Hold screen mode enabled.	Press the Hold Screen key to disable.
Terminal appears locked, does not respond to data from host.		Clear terminal with Clear Comm field in set-up.
		Cycle power.
Screen goes blank after successful power-up, then is inactive for one-half hour. Power OK indicator on.	CRT saver feature on.	Press any key to reactivate screen.

Table 1-3   VT240 Troubleshooting Chart (Cont)

Symptom	Probable Cause	Corrective Action
Messages are incomplete.	XON/XOFF not selected.	Enable in set-up.
	Terminal controller board	Replace terminal controller board (Para. 2.4).
	Host port connections	Check host ports.
Terminal does not respond to escape sequences.	Incorrect mode selected.	Make sure terminal is set up for escape sequence desired (Table 1-1).

2 REMOVING AND REPLACING FRUs

2.1 GENERAL
This chapter shows you how ro remove and replace FRUs for the VT240 series terminal. Paragraph 2.9 provides the recommended spares list.

2.2 TOP COVER
Remove the top cover as follows.

1. Set the system box power switch to 0 (off). Then remove the power cord from the wall outlet and from the power cord connector on the rear of the system box.

MA-1290-83
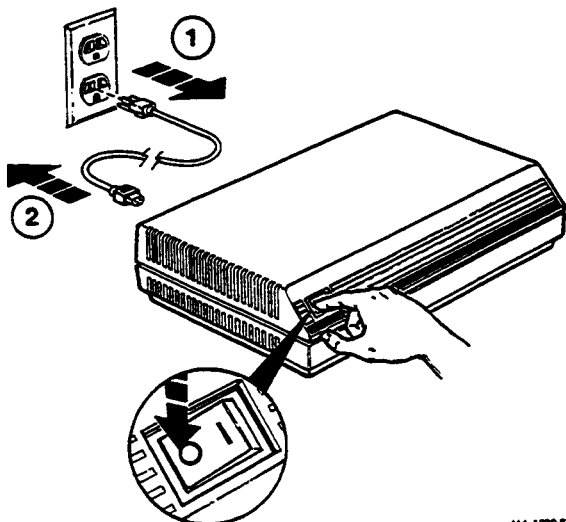
2. Disconnect all other cables from the rear panel of the system box, including the following.
   - EIA host port cable
   - 20 mA host port cable
   - composite video output cable
   - video monitor cable
   - printer port cable
   - keyboard cable
   - modem cables

3. Place the system box with the bottom side up and remove the two top cover retaining screws with a 7/32-inch slotted screwdriver.
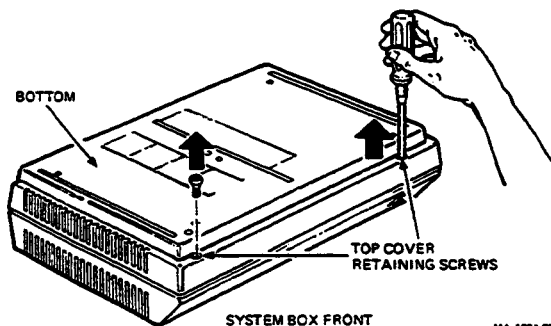
SYSTEM BOX FRONT

MA-123-80

4. Turn the system box over. Lift the cover up from the front and pull forward to release the hinge hooks.

NOTE
You may have to press the power switch on the front of the system box halfway in before you can lift the top cover free of the bottom cover.
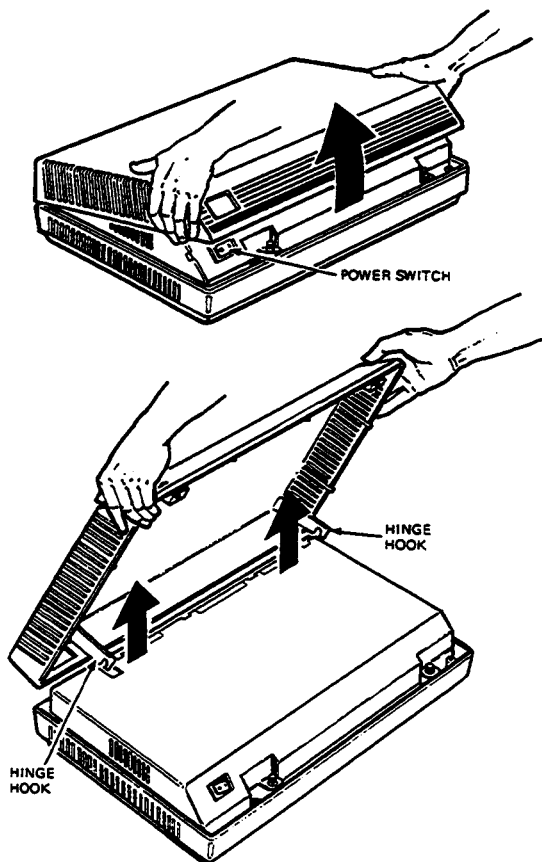
To install the top cover, reverse steps 1 through 4.

2.3 POWER SUPPLY CHASSIS

Remove the power supply chassis as follows.

1. Remove the top cover (Paragraph 2.2).
2. Pull up the two pop fasteners on the front of the power supply chassis.
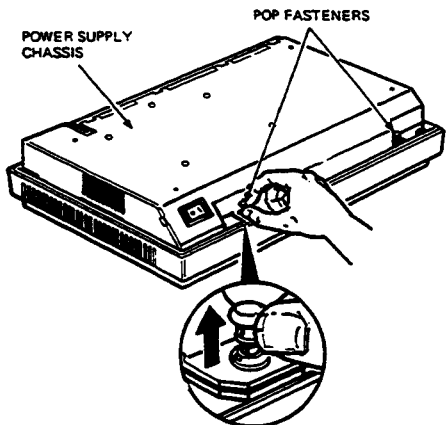
3. Lift the front of power supply chassis just enough to get your fingers under the front edge.

   NOTE
   The power supply chassis is firmly in place and may require firm pressure to free it after you release the pop fasteners.
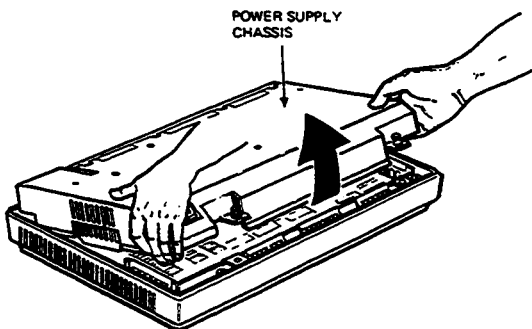
4. Slowly work the power supply chassis away from the rear chassis panel, until the tabs on the power supply chassis are out of the slots in the rear chassis panel.
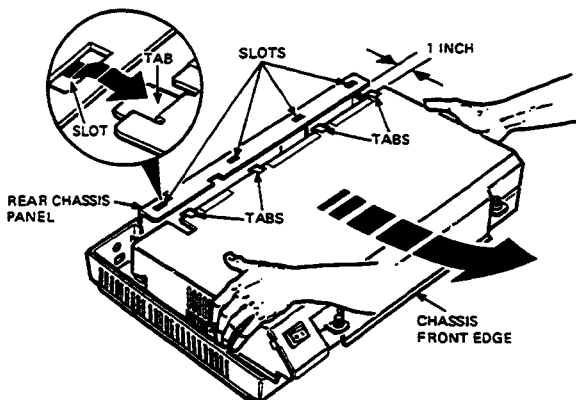
5. Disconnect the power supply cable connector from the power supply on the bottom side of the power supply chassis. Put the power supply chassis out of the way.
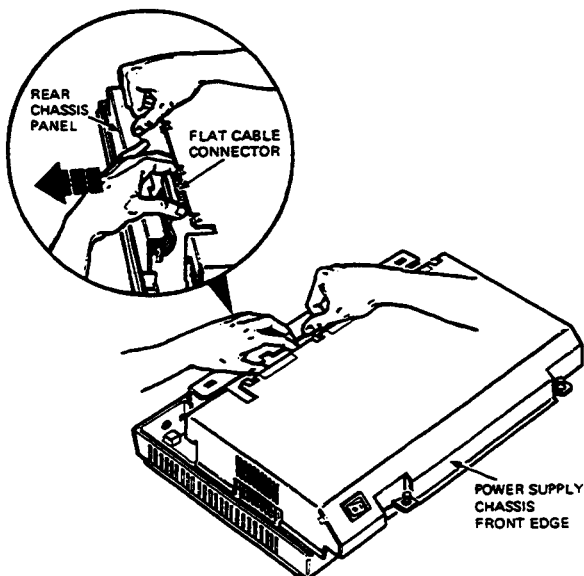
To install the power supply chassis, reverse steps 1 through 5.

2.4 TERMINAL CONTROLLER BOARD

The VT240 system box has one of two possible terminal controller boards – a full-size board or half-size board. The boards are functionally identical. The next figure shows both boards. Remove the terminal controller board as follows.

1. Remove the top cover (Paragraph 2.2).

2. Remove the power supply chassis (Paragraph 2.3).

   NOTE
   If an integral modem is installed, you must remove the modem before replacing the terminal controller board. (See Paragraph 2.7.)

3. Pull up the pop fasteners that hold the terminal controller board to the bottom chassis panel. (The full-size board has three fasteners, the half-size board has one fastener.)
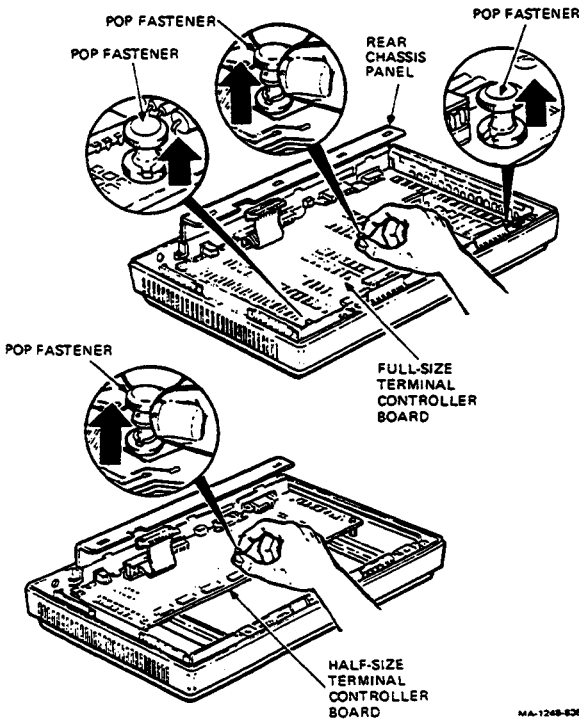
4. Remove the terminal controller board by taking the tabs out of the rear chassis panel. Then remove the dc power cable from the terminal controller board.
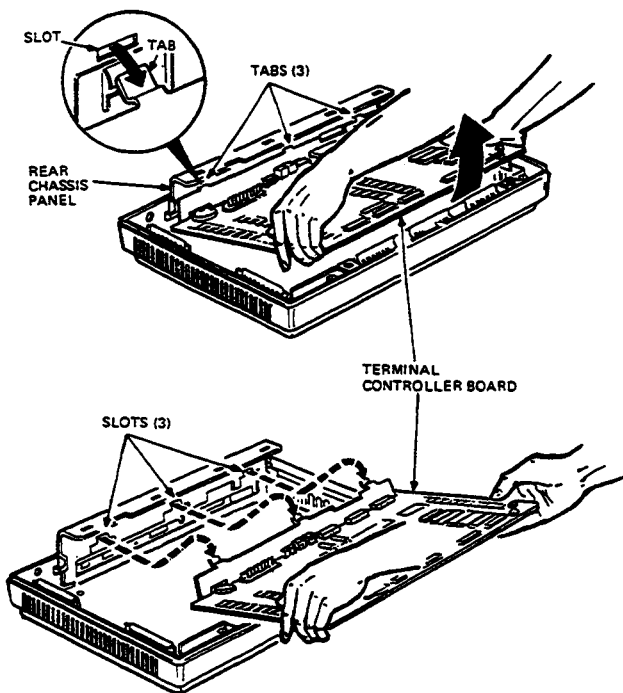
To install the terminal controller board, reverse steps 1 through 7.

CAUTION
Before pressing down the pop fasteners, make sure the bottom of the fasteners are seated in their retaining holes.

2.5 SYSTEM BOX

If the screen is blank or the power OK indicator on the rear panel of the system box is off, first check for probable defective devices such as the wall socket, power cord, fuse, terminal controller board, and power supply. If you cannot correct the problem, replace the system box (whole option swap).

Replace the system box as follows.

1. Set the system box power switch to 0 (off). Then remove the power cord from the wall outlet and from the power cord connector on the rear of the system box.

MA-1236-83
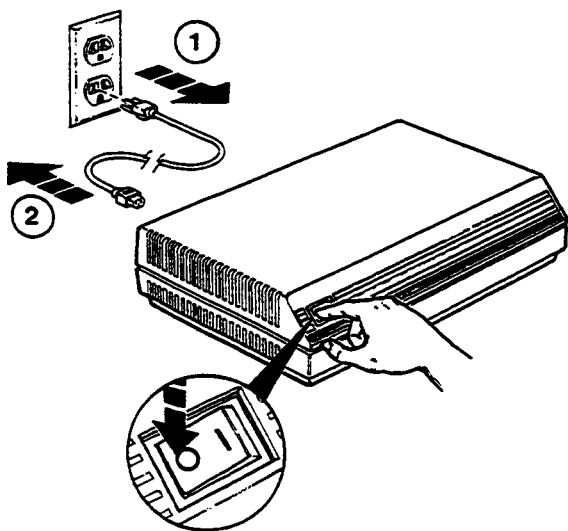
2. Disconnect all other cables from the rear panel of the system box, including the following.

   - EIA host port cable
   - 20 mA host port cable
   - composite video output cable
   - video monitor cable
   - printer port cable
   - keyboard cable
   - modem cables

To install the new system box, reverse steps 1 and 2.

2.6 VT240 SERIES MONITOR

If you see the following error message on your screen

```
VT240 Monitor Error - 9
```

the system has failed to sense the monitor present pin on the monitor cable. This error message indicates one of the two following conditions.

1. The monitor cable is connected in reverse of normal. (Connect the cable end with the 90 degree bend to the VR201 monitor.)
2. The cable is defective.

If no error message appears on your screen, but the LEDs indicate a monitor error (Table 1-2), then one of two conditions exist.

1. The monitor cable is not connected.
2. The cable is defective.

If you find a problem with the VT240 series monitor, first try the video alignment and adjustment. See Chapter 4 if you have a color monitor. If you cannot correct the problem, replace the monitor (whole option swap). Do not try to remove or repair any part of the CRT assembly in the field.

Replace the VT240 series monitor as follows.

1. Set the system box power switch to **0** (off).
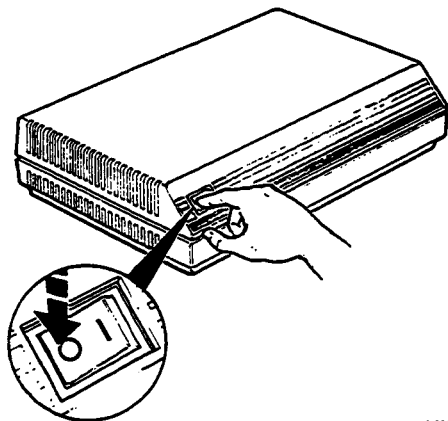
2. Disconnect the video monitor and keyboard cables from the rear of your VT240 monitor.
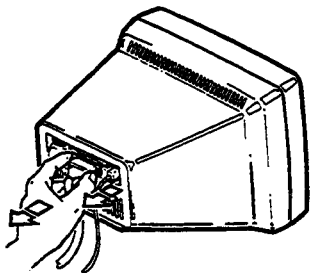
To install the new VT240 monitor, reverse steps 1 and 2.

2.7 INTEGRAL MODEM

The integral modem circuit board may be mounted on a full-size or half-size terminal controller board. (See Paragraph 2.4.)

2.7.1 On a Full-Size Terminal Controller Board

If you see the following error message on your screen

```
VT240 Modem Error - 8
```

or if the LED indicators indicate a faulty modem (Table 1-2), replace the modem.

Remove the modem circuit board as follows.

1. Remove the top cover (Paragraph 2.2).

2. Remove the power supply chassis (Paragraph 2.3).

3. Hold one standoff clamp away from the modem circuit board with your thumb and lift the board off the standoff with your other hand. Repeat this step for the other three standoff clamps.
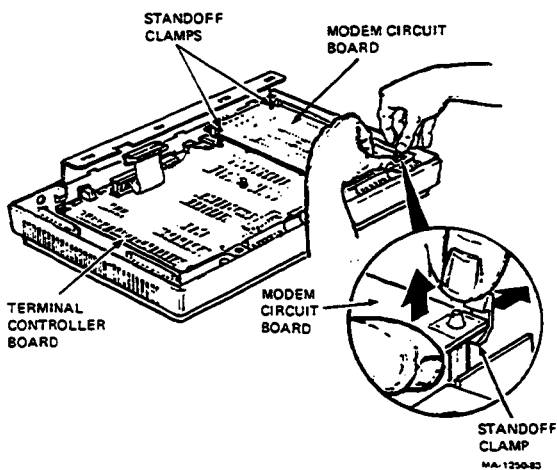
4. Hold the modem circuit board in the middle. Then lift up to disconnect the connector that holds the board to the terminal controller board.
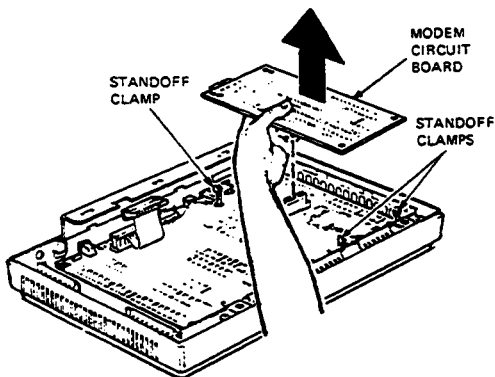
Install the modem circuit board as follows.

1. Fit the connectors on the modem circuit board through the cutout in the modem filler panel.
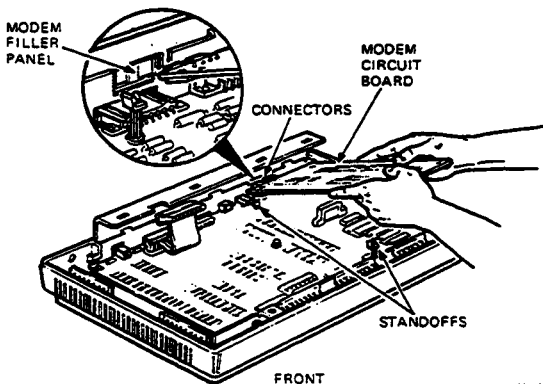
2. Place the modem circuit board on the standoffs. Then press the board in the middle to connect the connector to the terminal controller board connector.
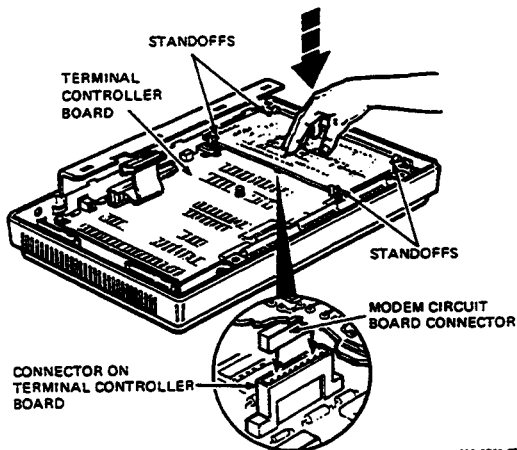
3. Reverse steps 1 through 3 of the removal procedure.

2.7.2 On a Half-Size Terminal Controller Board
If you see the following error message on your screen

```
VT240 Modem Error - 8
```

or if the LED indicators indicate a faulty modem (Table 1-2), replace the modem.
  Remove the modem circuit board as follows.

1. Remove the top cover (Paragraph 2.2).
2. Remove the power supply chassis (Paragraph 2.3).

3. Release the modem circuit board from the two stand-off *clips*. Hold one standoff clamp away from the modem circuit board with your thumb and lift the board off the standoff with your other hand. Repeat this step for the other standoff clamp.
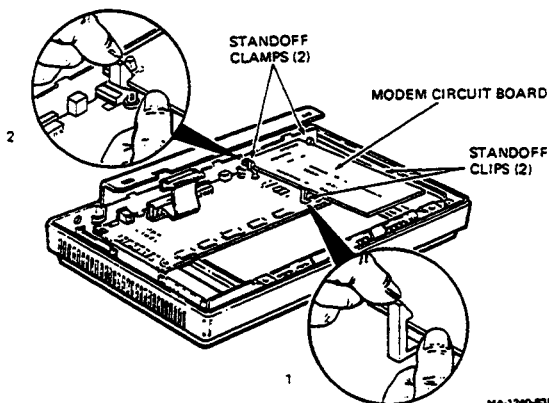
4. Hold the modem circuit board in the middle. Then lift up to disconnect the connector that holds the board to the terminal controller board.
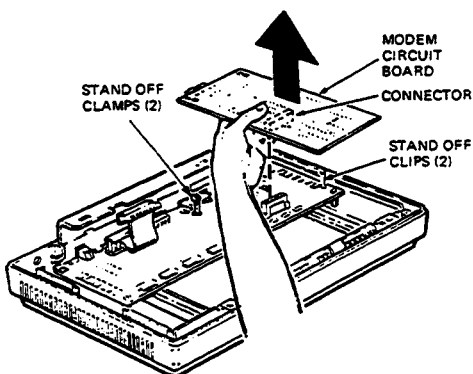
Install the modem circuit board as follows.

1. Fit the connectors on the modem circuit board through the cutout in the modem filler panel.
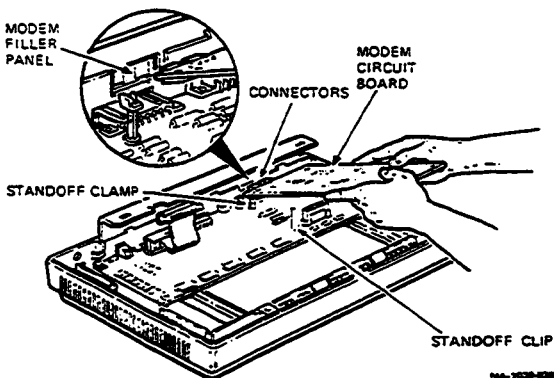
2. Place the modem circuit board on the standoffs. Then press the board in the middle to connect the connector to the terminal controller board connector.
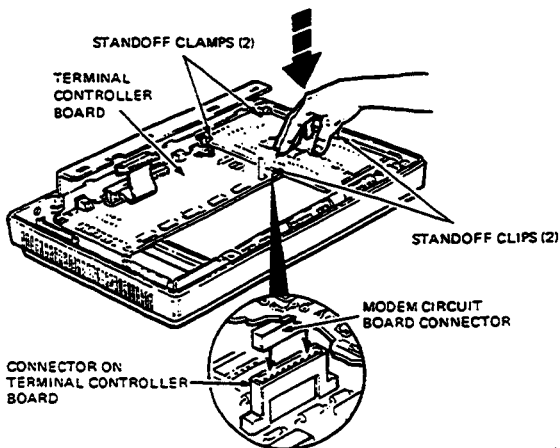
3. Reverse steps 1 through 3 of the removal procedure.

2.8 KEYBOARD

If the keyboard is faulty, replace the keyboard (whole option swap). Remove the keyboard as follows.

1. Turn off power to the video monitor.
2. Disconnect the keyboard cable from the cable connector on the rear panel of your monitor, or from your system box (as applies).
3. Disconnect the keyboard cable from the keyboard.

KEYBOARD
(BOTTOM VIEW)

KEYBOARD
CABLE
CONNECTOR

KEYBOARD CABLE

VIDEO MONITOR
(REAR VIEW)

KEYBOARD CABLE
CONNECTOR

SYSTEM BOX
(REAR VIEW)

KEYBOARD CABLE
CONNECTOR

MA-0787-83A
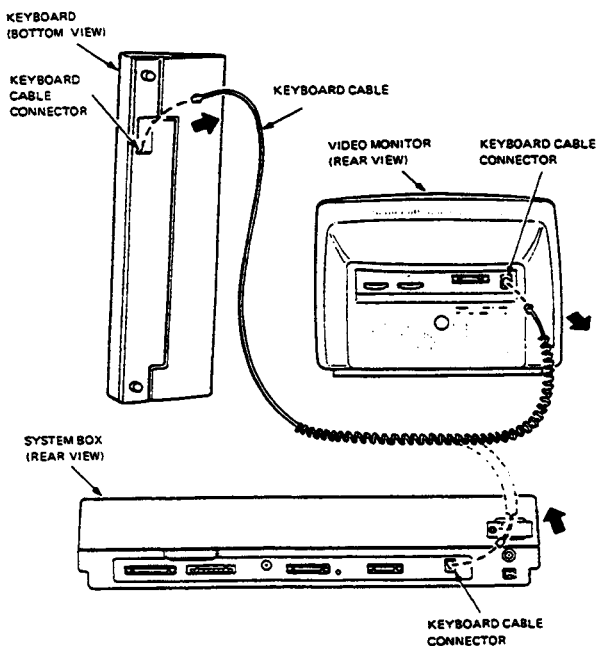
Install the keyboard as follows.

Install the Legend Strip

1. Open the clear plastic window.
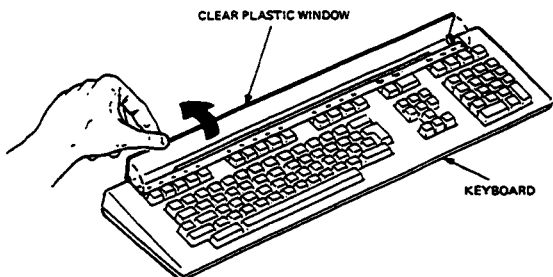
2. Remove the legend strip from the defective keyboard.
3. Insert the old legend strip directly over the one already on the new keyboard.
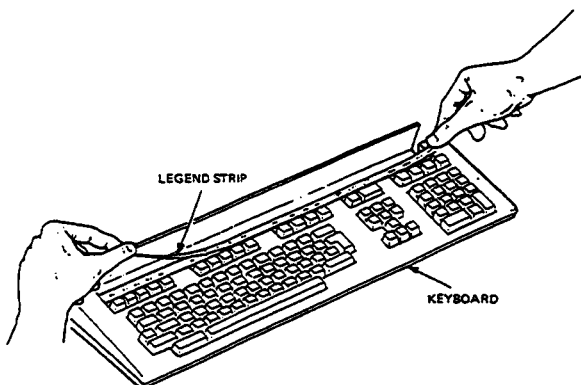
4. Close the clear plastic window.

Install the Keyboard Standoffs

KEYBOARD STANDOFF

KEYBOARD
(BOTTOM VIEW)
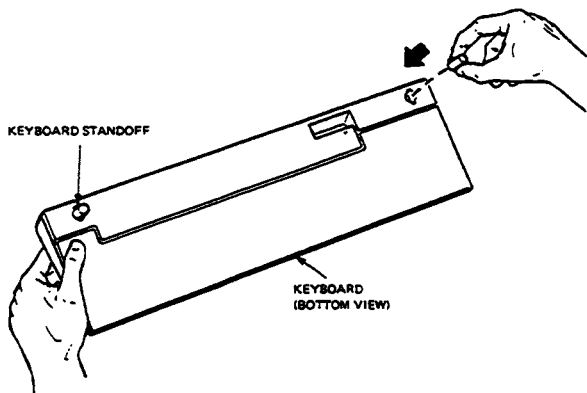
MA-0778-83

Connect the Keyboard to the Monitor or System Box

1. Insert the keyboard cable into the connector on the bottom of the keyboard.
2. Press the cable into the short groove if routing to the left.
3. Press the cable into the long groove if routing to the right.
4. Insert the keyboard cable into the connector on the rear of the monitor or system box (as applies).
5. Turn on power to the monitor.

SHORT GROOVE

LONG GROOVE

KEYBOARD
(BOTTOM VIEW)

KEYBOARD
CABLE
CONNECTOR

KEYBOARD CABLE

VIDEO MONITOR
(REAR VIEW)

KEYBOARD CABLE
CONNECTOR

SYSTEM BOX
(REAR VIEW)

KEYBOARD CABLE
CONNECTOR

MA-0797-83
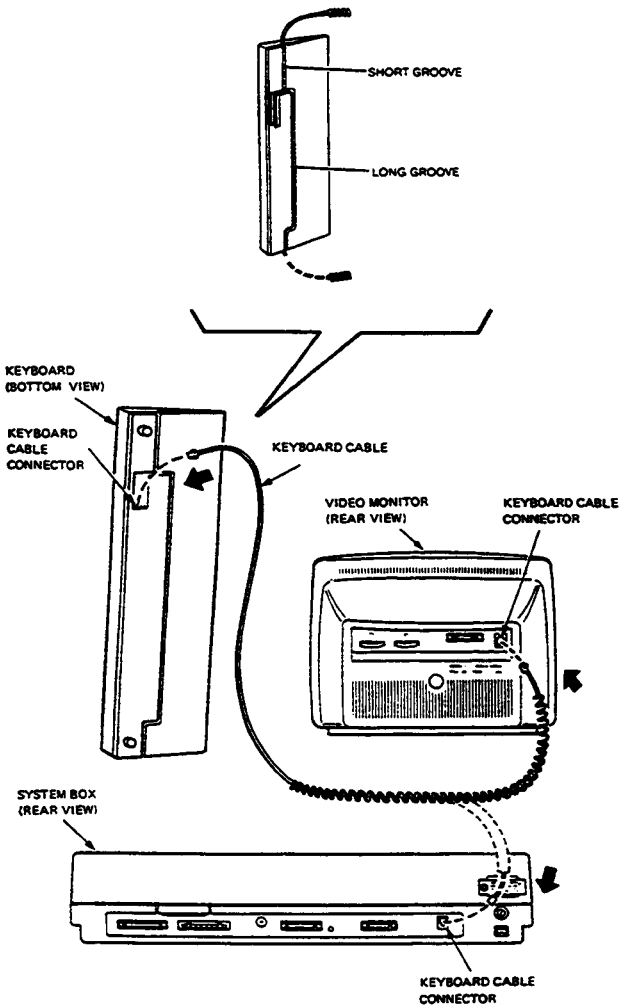
2.9 RECOMMENDED SPARES LIST

Table 2-1 is the recommended spares list for the VT240.

Table 2-1   Recommended Spares List

Description	Part Number
System box (full size)	VS240-BA
System box (half size)	VS240-BB
Power supply chassis	70-19499-01
Power supply 75 W	30-21383-01
Fan assembly	70-19921-00
Terminal controller (full size)	54-15495-02
Terminal controller (half size)	54-15495-03
Video monitor cable (VR201)	BCC02
Video monitor cable (VR241 color monitor)	BCC03
Monitor assembly (white)	VR201-A
Monitor assembly (green)	VR201-B
Monitor assembly (amber)	VR201-C
United States/Canadian keyboard	LK201-AA
Belgian keyboard	LK201-AB
French Canadian keyboard	LK201-AC
Danish keyboard	LK201-AD
British keyboard	LK201-AE
Finnish keyboard	LK201-AF
German keyboard	LK201-AG
Dutch keyboard	LK201-AH
Italian keyboard	LK201-AI
Swiss (French) keyboard	LK201-AK
Swiss (German) keyboard	LK201-AL
Swedish keyboard	LK201-AM
Norwegian keyboard	LK201-AN
French keyboard	LK201-AP
Spanish keyboard	LK201-AS
Australian keyboard	LK201-AZ
Keyboard legend strip	36-20220-28
Integral modem	54-15643-01
EIA loopback connector	12-15336-00
20 mA loopback connector	70-15503-00
Printer port loopback connector	29-24794-00
Video alignment tool	29-23190-00
Tuning wand	29-23189-00
Fuse (U.S.) 3 A	90-07217-00
Fuse (Europe) 1 A	12-19285-00
Fuse holder (Faston)	12-21126-01
Fuse holder (solder)	12-96391-00
Fuse carrier (U.S.)	12-21126-03
Fuse carrier (Europe)	12-21126-04
Filter assembly (Faston)	70-19936-01

3 ALIGNING THE VR201 MONITOR

3.1 GENERAL

This chapter shows you how to align the VR201 mono-chrome monitor. See Chapter 4 if you have a VR241-A color monitor. You do not have to make every adjustment each time you align your monitor. However, you should check all adjustments, because some adjustments affect others. If you find a correct setting, you can go on to check the next setting.

Unless directed otherwise, make all the adjustments under the following conditions.

Enter set-up and select the following.

- Normal video (light text, dark screen)
- 80 columns per line
- VT100 mode
- Local

Use the video alignment template (PN 29-24371) for determining alignment adjustments. Make sure that all adjustments are made under the above conditions.

3.2   REMOVING THE ACCESS COVER

Remove the access cover as follows.

WARNING
This procedure exposes you to the CRT anode,
which may contain a stored high voltage. Use
caution while the access cover is off the
terminal.

1. Set the power switch on the system box to 0 (off).

2. Disconnect the video and keyboard cables from the
   rear of your monitor.
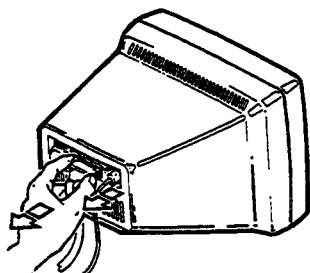
MA-0009A82

NOTE
Before you go to step 3, place a piece of paper
on a flat work surface to avoid scratching the
monitor bezel. Carefully place the monitor face
down on this paper.

Make sure to clean the face of the CRT after
you service the monitor. Use the cleaning solu-
tion supplied with the monitor or use isopropyl
alcohol.

3. Completely extend the tilt leg mechanism. Then care-
   fully place the monitor face down as described in the
   above note.

4. Use a small-bladed screwdriver to remove the round plastic cap on the rear panel of the access cover.

TILT LEG
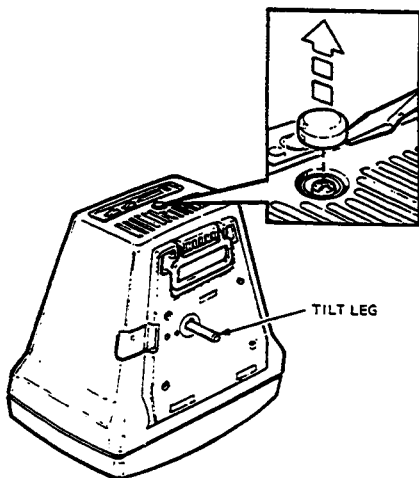
MA-1247-83

5. Use a phillips screwdriver to remove the screw and washer that were exposed when you removed the cap. This screw holds the access cover to the monitor's chassis.
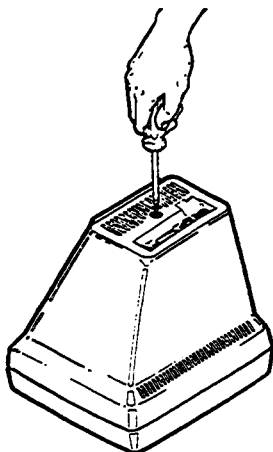
MA-0009C82

6. Remove the cover by sliding it straight up.
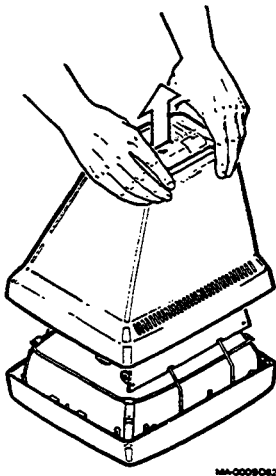
CAUTION
**When replacing the monitor cover, make sure
the tilt mechanism foot is fully extended.**

To replace the access cover, reverse steps 1 through 6.

3.3 MONITOR ADJUSTMENTS
Figure 3-1 shows the locations for most adjustments.
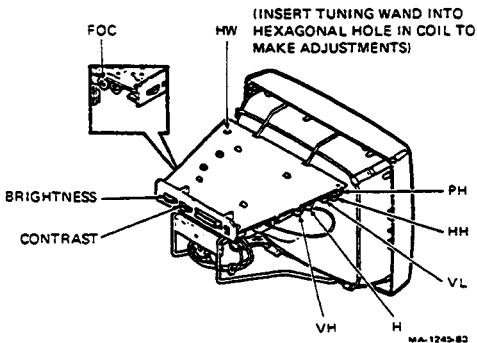
Figure 3-1 Video Adjustment Locations

3.3.1 Initial Preparations

Before you perform any adjustments, complete the following steps.

1. Place your terminal as shown in Figure 3-1. Make sure your monitor is on a nonconductive surface.

2. Reconnect the video and keyboard cables.

3. Turn the power switch to 1 (on).

4. After VT240 OK appears on your screen, set up the terminal as described in Paragraph 3.1. Then type ESC # 8. Your screen will display all uppercase E's. This is your alignment pattern.

   NOTE
   Your alignment pattern may not be distinct. Start with the following alignment procedures to correct the problem.

3.3.2 Character Quality

This section covers brightness, contrast, vertical linearity, and focus adjustments.

3.3.2.1 Brightness – Adjust the brightness as follows.

1. Let the terminal warm up for at least five minutes.

2. Increase both the brightness and contrast to maximum (Figure 3-1).

3. Decrease the brightness until the white diagonal lines (raster) just disappear.

4. Go to Paragraph 3.3.2.2.

3.3.2.2 Contrast – Set the contrast control (Figure 3-1) for the desired screen intensity.

3.3.2.3 Vertical Linearity – Check and adjust the vertical linearity (VL) as follows.

1. Check character heights at the four corners of the screen. All characters should be the same height.

2. If necessary, adjust the vertical linearity (VL) control (Figure 3-1) until all characters are the same height.

3. Go to Paragraph 3.3.2.4.

3.3.2.4 Focus – Check and adjust the focus (FO) as follows.

1. Check the characters at the four corners and at the center of the screen. You should be able to see the individual dots in the vertical segments of each E.

   NOTE
   Make sure the screen is clean. This condition can appear to affect the focus.

   In some cases, the operator may want the focus adjusted to suit personal preference. If the focus is adjusted as desired, go to step 3.

2. Adjust the focus (FO) control (Figure 3-1) for the best overall character presentation, if necessary.
3. Go to Paragraph 3.3.3.

3.3.3 Display Instability
This section covers the vertical hold and horizontal hold adjustments.

3.3.3.1 Vertical Hold – Check and adjust the vertical hold (VH) as follows.

1. Examine the screen for rolling or any other sign of vertical instability.
2. If necessary, adjust the vertical hold (VH) control (Figure 3-1) to stabilize the screen display.
3. Go to Paragraph 3.3.3.2.

3.3.3.2 Horizontal Hold – Check and adjust the horizontal hold (HH) as follows.

1. Examine the screen for tearing or any other signs of horizontal instability.
2. If necessary, adjust the horizontal hold (HH) control (Figure 3-1) to stabilize the display.
3. Go to Paragraph 3.3.4.

3.3.4 Display Centering
This section covers the yoke rotation, horizontal centering, and vertical centering adjustments.

3.3.4.1 Yoke Rotation -- Check the display rotation as follows.

1. Use the scale on the alignment template (PN 29-24371-00) to make the following measurements (Figure 3-2).

2. Find the point that is five columns of E's from the left and 12 rows of E's from the bottom of the alignment pattern. Measure the distance **a1** from this point to the monitor bezel.

3. Find the point that is five columns of E's from the right and 12 rows of E's from the bottom of the alignment pattern. Measure the distance **a2** from this point to the monitor bezel.

4. Compare the measurements in steps 2 and 3. The difference between measurements should be within ±2 mm.

   NOTE
   If the yoke is adjusted correctly, do not go to step 2. Go to Paragraph 3.3.4.2.

5. If the display rotation is out of tolerance, replace the monitor (whole option swap).

6. Go to Paragraph 3.3.4.2.
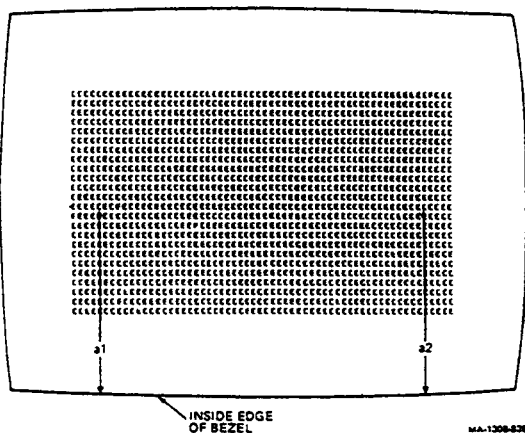
Figure 3-2 Rotation Check

3.3.4.2 Horizontal Centering – Check and adjust the horizontal centering (PH) as follows.

1. Use your alignment template to make the following measurements (Figure 3-3).

2. Measure the distance **a1** between the center of the left edge of the alignment pattern of E's and the monitor bezel.

3. Measure the distance **a2** between the center of the right edge of the alignment pattern of E's and the monitor bezel.

4. Compare the measurements in steps 2 and 3. If the difference between the two measurements is greater than 6 mm, adjust the horizontal centering (PH) control (Figure 3-1).

5. Perform steps 2 and 3 again to verify the adjustment.

NOTE
If the PH control adjusts the horizontal centering correctly, go to Paragraph 3.3.4.3.

6. If necessary, check and adjust the display size (Paragraph 3.3.5).

INSIDE EDGE
OF BEZEL
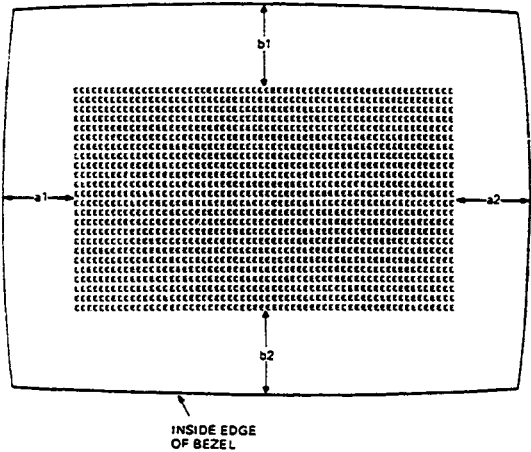
MA-1308-53C

Figure 3-3 Vertical Centering Check

3.3.4.3   Vertical Centering – Check the vertical center-
ing dimensions as follows.

1. Use the scale on the alignment template to make the
   following measurements (Figure 3-3).
2. Measure the distance **b1** from the top center of the
   alignment to the monitor bezel.
3. Measure the distance **b2** from the bottom center of
   the alignment pattern to the monitor bezel.
4. Compare the two measurements in steps 2 and 3. The
   distance **b1** must be greater than the distance **b2**.
   This difference must be within the range of 2 mm to
   14 mm. If not, go to step 5. Otherwise, go to Para-
   graph 3.3.5.

   NOTE
   **The electrical center of the screen is not the
   same as the apparent physical center. When the
   monitor is adjusted correctly, the screen display
   is offset towards the bottom of the screen.**

5. If your measurement is out of tolerance, replace the
   monitor (whole option swap). You cannot adjust ver-
   tical centering.
6. Go to Paragraph 3.3.5.

3.3.5   Aspect Ratio
Check and adjust the aspect ratio as follows.

1. Enter set-up. Clear the screen and select reverse video
   (dark text, light screen).
2. Put the terminal in local and in VT100 mode.
3. Exit set-up.
4. Type the following escape sequence to invoke the
   graphics alignment pattern.

   NOTE
   **Do not type spaces or carriage returns. The
   spaces are included only for clarity.**

   ESC Pp
   P [390,240]
   C [200]

5. Check the circle for ovalness or flattening. If the circle appears incorrect, go to step 6. If the circle is normal, go to step 12.

6. Use your alignment template to make the following measurements (Figure 3-4).

7. Measure the distance **a1** from the center of the left edge of the alignment pattern to the monitor bezel.

8. Measure the distance **a2** from the center of the right edge of the alignment pattern to the monitor bezel.

9. Subtract the sum (**a1** + **a2**) from 242 mm (the width of the monitor screen) to find the width of the video display.

   Example

   a1 = 21 mm   a2 = 20 mm
   a1 + a2 = 41 mm
   Width = 242 - 41 mm = 201 mm

10. The video display width must be within the range of 200 to 210 mm. If necessary, adjust the horizontal width (HW) control (Figure 3-1) until the video display width is within the range specified.

11. Adjust the height (H) control if necessary to improve the appearance of the circle.

12. Type **ESC ** to exit ReGIS graphics mode.

INSIDE EDGE
OF BEZEL
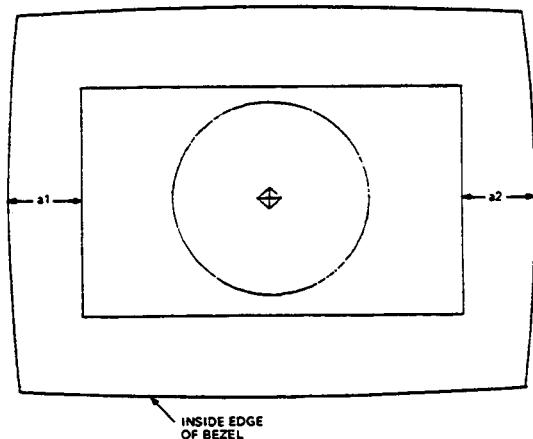
MA-1208-83A

Figure 3-4 Aspect Ratio Check

4 SERVICING THE VR241-A COLOR MONITOR

4.1 GENERAL

This chapter provides the following information on servicing the VR241-A color video monitor.

Troubleshooting
Quality checks and adjustment procedures
Physical/functional descriptions

This information applies to VT240 host system units that have the following standard test patterns. (See Table 4-1.)

Display alignment pattern (See Figure 4-1.)
Color bar pattern (See Figure 4-2.)
Red screen
Blue screen
Green screen

Tools Required

You need the following tools to service the VR241-A color video monitor.

Tool	Part Number
Phillips screwdriver	none
Video alignment template	29-24371-00
VR241 adjustment tool	29-24746-00
Hex core alignment tool	29-23190-00

Table 4-1   VR241-A Test Pattern Summary

Terminal Set-Up
Before you select any test pattern with the sequences below, set up
your terminal as follows. (Column 3 lists exceptions.)

1. Enter set-up.
2. Select the following.
   - Local
   - VT100 mode
   - 80 columns per line
   - Color display
   - Normal video (light text, dark screen)
3. Exit set-up.

Test Pattern*	Sequence†	Exception
Display alignment (screen of E's)	ESC # 8	• Monochrome display
Graphics alignment	ESC Pp P [390,240] C [200]	• Monochrome display • Reverse video (dark text, light screen)
Color bar	ESC [4 ; 4 y	–
Blue screen	ESC [4 ; 10 y	–
Red screen	ESC [4 ; 11 y	–
Green screen	ESC [4 ; 12 y	–
White screen	ESC [4 ; 13 y	–

*   Test patterns 3 through 7 reset the terminal set-up features to the
    saved defaults. You must set up the terminal as described above
    before running each self-test.

†   Do not type spaces between parameters of escape sequences. The
    parameters are spaced for clarity only.

   NOTE
   Make sure the EIA port is not connected to a host when
   running the self-tests and alignment patterns.
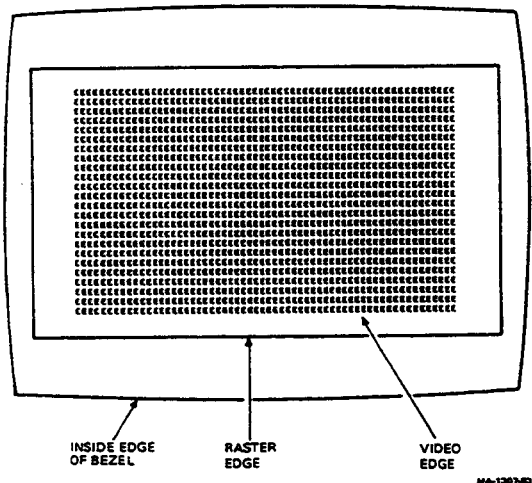
Figure 4-1 Screen of E's Alignment Pattern

NOTE: VT240 TERMINALS WITH V1.3 OR EARLIER WILL DISPLAY
BLACK/BLUE/RED/GREEN COLOR PATTERN.

MA-1370-83A
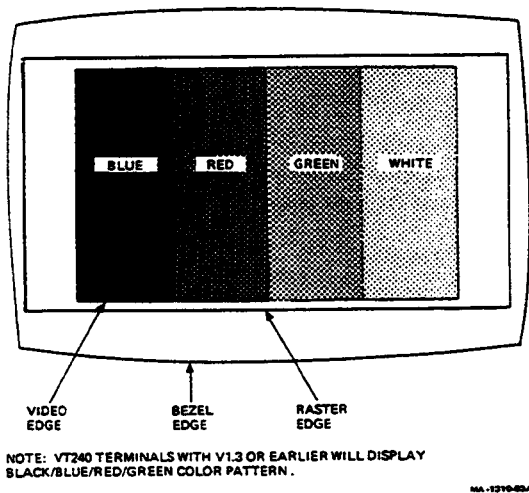
Figure 4-2 Color Bar Pattern

4.2 TROUBLESHOOTING THE VR241-A

This section provides information to troubleshoot the four types of problems that may affect your VR241-A color monitor: no video, distorted video, color problems, and alignment problems. Refer to the section that most closely describes your monitor's problem. Then match the symptom and take the corrective action suggested.

The corrective procedures assume that only one assembly has failed or only one problem exists. The symptoms that your monitor displays may indicate more than one failure or problem, because some monitor circuits may interact with other circuits. You should troubleshoot to the most obvious symptom.

4.2.1 No Video

Use Table 4-2 when the VR241-A does not display an image sent by the VT240 system box.

> **NOTE**
> Let the VR241-A warm up for at least 15 minutes before troubleshooting the monitor.

4.2.2 Distorted Video

Use Table 4-3 when your monitor display is distorted. Typical display distortions include rolling, flickering, blooming (bright, thick, out of focus characters), and displays that do not disappear at minimum contrast and brightness control settings.

> **NOTE**
> Let the VR241-A warm up for at least 15 minutes before troubleshooting the monitor.

4.2.3 Color Problems

Use Table 4-4 when your monitor distorts the color of the picture sent by the VT240 system box.

> **NOTE**
> Let the VR241-A warm up for at least 15 minutes before troubleshooting the monitor.

4.2.4 Alignment Problems

Use Table 4-5 when the display from the VT240 system box is misaligned on your monitor.

> **NOTE**
> Let the VR241-A warm up for at least 15 minutes before troubleshooting the monitor.

Table 4-2   No-Video Troubleshooting Chart

Symptom	Probable Cause	Corrective Action
No VT240 OK display, no video or raster, and the green power OK indicator is off.	One end of the power cord is disconnected.	Reconnect power cord.
	Monitor power switch is off.	Turn monitor power switch to 1 (on).
	No power at the wall outlet.	Make sure there is power at the outlet.
	Monitor's fuse has blown.	Replace fuse.
	You performed all the steps above, but the problem remains.	Replace monitor.
No VT240 OK display, no video or raster, but green power OK indicator is on.	Brightness and contrast controls are set to minimum.	Turn brightness and contrast controls to maximum.
	Service switch is set to SERVICE.	Set switch to NORMAL.
	Monitor is faulty.	Replace monitor.
There is a raster, but no video.	Signal cable is disconnected.	Connect signal cable between monitor and VT240 system box.
	VT240 system box is not on.	Turn system box power switch to 1 (on).
	Contrast is set to minimum.	Turn contrast control maximum to see video.
	Signal cable is faulty.	Replace signal cable.
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.
Only a horizontal line appears on the	Service switch is set to SERVICE.	Set switch to NORMAL.
	Monitor is faulty.	Replace monitor.

Table 4-3   Distorted-Video Troubleshooting Chart

Symptom	Probable Cause	Corrective Action
Video rolls vertically and horizontally.	Video cable is connected incorrectly, or an external video sync is required from the VT240 system box.	Check video cable at monitor and VT240 system box, or add an external sync cable if required by VT240 system box.
	Synchronization switch is set to wrong position.	Check the switch settings on monitor, and match setting to VT240 system box. (See Para. 4.5.7 for correct setting.)
	Signal cable is faulty.	Replace signal cable.
	Monitor is out of adjustment.	Perform synchronization procedure (Para. 4.3.2).
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.
Video rolls vertically.	Monitor sync is out of adjustment.	Perform synchronization procedure (Para. 4.3.2).
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.
Video rolls horizontally.	Monitor sync is out of adjustment.	Perform synchronization procedure (Para. 4.3.2).
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.

Table 4-3   Distorted-Video Troubleshooting Chart (Cont)

Symptom	Probable Cause	Corrective Action
Video shows blooming at high intensity levels.	Impedance switch is set incorrectly for your system configuration.	Check monitor's impedance switch setting for your system configuration. (See Para. 4.5.7 for correct setting.)
	White balance is out of adjustment.	Perform white balance procedure (Para. 4.3.14).
	Monitor is faulty.	Replace monitor.
Raster and/or video does not disappear when brightness and contrast controls are at minimum.	White balance is out of adjustment.	Perform white balance procedure (Para. 4.3.14).
	Monitor is faulty.	Replace monitor.

Table 4-4   Color Troubleshooting Chart

Symptom	Probable Cause	Corrective Action
Wrong color displayed and color bars in wrong position.	Video cables are connected incorrectly.	Check video cables at monitor and VT240 system box.
	Monitor is faulty.	Replace monitor.
Wrong color displayed, but color bars in correct position.	Host software is faulty.	Have customer verify software.
Color bar pattern is missing a color.	Signal cable is faulty.	Replace signal cable.
	White balance is not normal.	Perform white balance procedure (Para. 4.3.14).
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.

Table 4-4   Color Troubleshooting Chart (Cont)

Symptom	Probable Cause	Corrective Action
Convergence or color purity is not normal.	Monitor needs degaussing.	Turn monitor off for 10 minutes. Then turn it back on to activate internal degaussing circuits.
	Monitor is near strong magnetic field.	Move monitor to an area free of strong magnetic fields.
	Monitor is faulty.	Replace monitor.
White balancing is not normal.	Impedance switch is set incorrectly for your system configuration.	Check monitor impedance switch setting for system configuration. (See Para. 4.5.7 for correct setting.)
	Video cables are connected incorrectly.	Check video cables at monitor and at VT240 system box.
	White balance is out of adjustment.	Perform white balance procedure (Para. 4.3.14).
	VT240 system box is faulty.	See Table 1-3.
	Monitor is faulty.	Replace monitor.

Table 4-5   Alignment Troubleshooting Chart

Symptom	Probable Cause	Corrective Action
Video is rotated.	Rotation is out of adjustment.	Replace monitor.

CAUTION
Do not try to adjust the yoke.

Symptom	Probable Cause	Corrective Action
Video unstable or jittery after new display.	Sync is out of adjustment.	Perform synchronization procedure (Para. 4.3.2).
	Monitor is faulty.	Replace monitor.
Video is not centered.	Centering is out of adjustment.	Perform appropriate centering procedures (Paras. 4.3.3 through 4.3.5).
	Monitor is faulty.	Replace monitor.
Video is not rectangular.	Rectangularity is out of adjustment.	Perform rectangularity procedure (Para. 4.3.8).
	Monitor is faulty.	Replace monitor.
Video has incorrect aspect ratio.	Aspect ratio is out of alignment.	Perform aspect ratio procedure (Para. 4.3.8).
	Monitor is faulty.	Replace monitor.
Video is not linear.	Linearity is out of adjustment.	Perform appropriate linearity procedures (Paras. 4.3.9 and 4.3.10).
	Monitor is faulty.	Replace monitor.
Video is not focused.	Focus is out of adjustment.	Perform focus procedure (Para. 4.3.11).
	Monitor is faulty.	Replace monitor.

4.2.5   Terminal Set-Up
See Table 4-1 to set-up the VT240 before selecting any
test pattern.

> **CAUTION**
> **Magnetic fields affect the performance of the
> VR241-A. Do not operate your monitor near
> electromechanical devices (such as printers), or
> near large magnetized objects (such as filing
> cabinets or steel beams in walls).**

4.3 QUALITY CHECKS AND ADJUSTMENT
PROCEDURES
This section describes how to check and adjust the quality
of the video display. You should perform these procedures
in order, because some adjustments affect others. If you
find a correct setting, you can go on to the next setting.
See Paragraph 4.5 for a summary of adjustment and oper-
ating control locations.

Only use these procedures when your monitor can
display information. If your monitor cannot display infor-
mation, use the troubleshooting procedures in Paragraph
4.2.

If an adjustment is necessary, perform the preadjust-
ment procedure (Paragraph 4.3.1) one time. Then contin-
ue with the other procedures. After you complete all pro-
cedures, make these final checks.

- Make sure the brightness and contrast controls (Fig-
  ure 4-15) turn freely.

- Make sure the ground cable is connected to the rear,
  lower-left tab (Figure 4-3).

- When installing the cabinet cover, make sure the
  white plastic shield around the brightness and con-
  trast controls is tucked inside the cover.
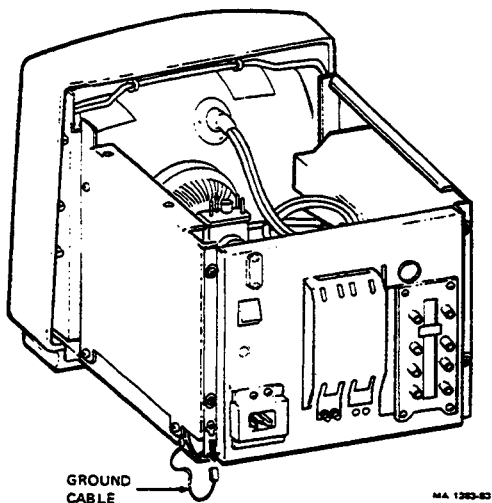
Figure 4-3 VR241-A Monitor Ground
           Cable

4.3.1 Preadjustment
Perform this procedure only if an adjustment is needed.

1. Set the power switch to 0 (off) and wait 30 seconds
   before continuing.

   WARNING
   **Static charges on the CRT can cause shock
   injury. Static charges take at least 30 seconds
   to dissipate after the monitor is turned off.**

2. Disconnect power cables.
3. Disconnect video cables.

4. Remove the tilt swivel if installed.

5. Carefully set the monitor face down.

   CAUTION
   **Do not scratch the bezel or screen. Place the
   monitor on a nonabrasive surface, such as a
   large desk pad or soft cloth.**

6. Remove the four screws that hold the cover (Figure
   4-4).

7. Pull the cover straight up and set out of the way.

8. Carefully set the monitor back on its base.

9. Reconnect all cables.

10. Turn the monitor on and let it warm up for 15
    minutes.

11. Adjust these controls, unless directed otherwise.

    a. Set the brightness control so raster just disappears.

    b. Set the contrast control at the desired display
       intensity.
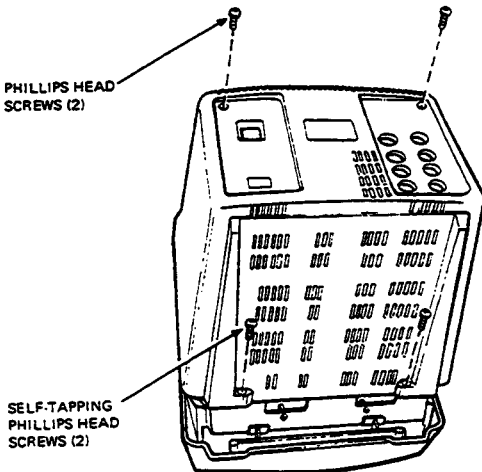
Figure 4-4 Monitor Cover Removal

4.3.2 Video Synchronization

Check and adjust video synchronization as follows.

1. Make sure the terminal is set up correctly (Table 4-1).

2. Set the contrast and brightness controls for the desired viewing comfort.

3. Display any test pattern.

4. Slide the synchronization switch (Figure 4-5) back and forth.

5. Look at the display. The pattern should lock in quickly, with no tearing of the top lines.

   NOTE
   If the display is normal, go to the vertical centering procedure (Paragraph 4.3.3). If the display is not normal, make sure you completed the preadjustment. Then go to step 6.

6. Set up the terminal as described in Table 4.1.

7. Display the alignment pattern (a screen of all E's) by typing **ESC # 8**.

8. Slide the synchronization switch so that the screen rolls. A rolling screen means no synchronization input signal is applied.

9. Adjust the horizontal hold (H. HOLD) control (Figure 4-5) so the display almost stops rolling horizontally.
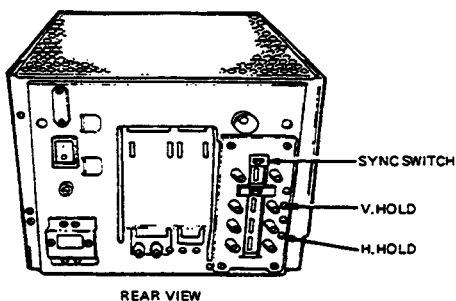
Figure 4-5 Video Sync Adjustments

10. Turn the vertical hold (V. HOLD) control (Figure 4-5) so the display rolls vertically one way. Then turn V. HOLD so the display rolls the opposite way. Now set V. HOLD in the center of this vertical synchronization holding range.

11. Slide the synchronization switch so the test pattern locks in and stops rolling. This means the synchronization input signal is applied.

4.3.3 Vertical Centering
Check and adjust the vertical centering as follows.

1. Make sure that terminal is set up correctly (Table 4-1).

2. Display the alignment pattern (full screen of E's) by typing **ESC # 8**.

3. Measure the distance **b1** from the center of the top edge of the alignment pattern to the monitor bezel (Figure 4-6).

4. Measure the distance **b2** from the center of the bottom edge of the alignment pattern to the monitor bezel.

5. Check that the two measurements are equal or within 5 mm of each other.

NOTE
If the measurements are within tolerance, go to the horizontal centering procedure (Paragraph 4.3.4). If the measurements are not within tolerance, make sure you completed the preadjustment procedure. Then go to step 6.

6. Turn the vertical centering (V. CENT) control (Figure 4-6) until **b1** and **b2** are within 5 mm of each other.
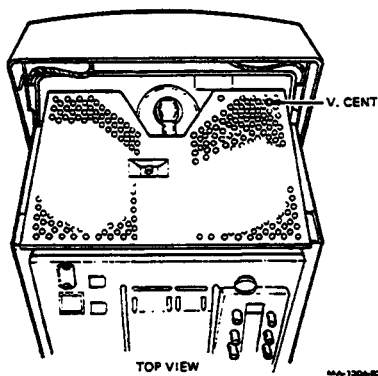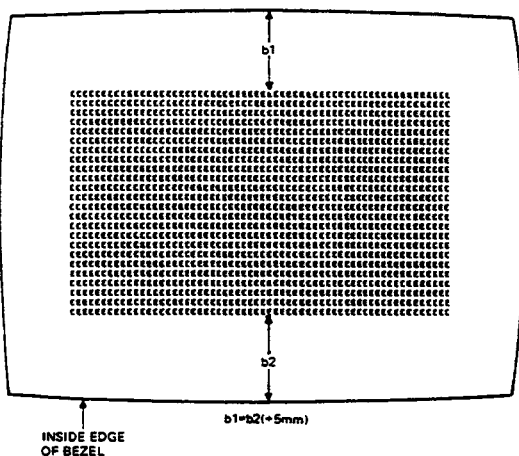
Figure 4-6 Vertical Centering Adjustments

4.3.4 Horizontal Centering
Check and adjust the horizontal centering as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the alignment pattern (full screen of E's) by typing ESC # 8.
3. Turn the contrast and brightness controls so raster is visible.
4. Measure the distance a from the left center of raster edge to the bezel (Figure 4-7).
5. Measure the distance b from the right center of raster edge to the bezel.
6. Check that the two measurements are equal or within 5 mm of each other.

   NOTE
   If the measurements are within tolerance, go to the horizontal phase procedure (Paragraph 4.3.5). If the measurements are not within tolerance, make sure you completed the preadjustment procedure. Then go to step 7.

RASTER EDGE   INSIDE EDGE
                   OF BEZEL

a=b (±5mm[H.CENT])
c=d (±2mm[H.PHASE])

MA-1308-838
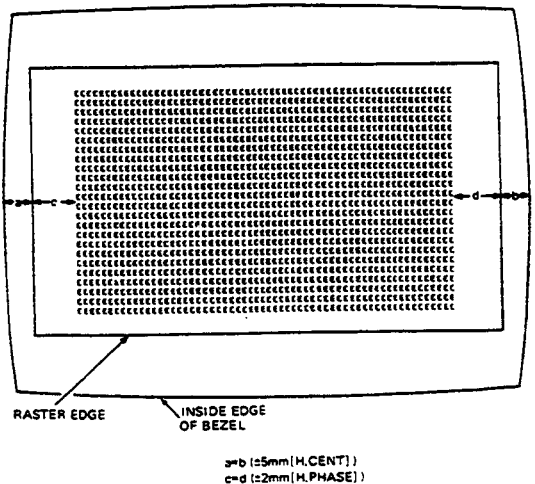
Figure 4-7 Horizontal Centering and Phase
           Checks

7. Turn the horizontal centering (H. CENT) control
   (Figure 4-8) until **a** and **b** are within 5 mm of each
   other.
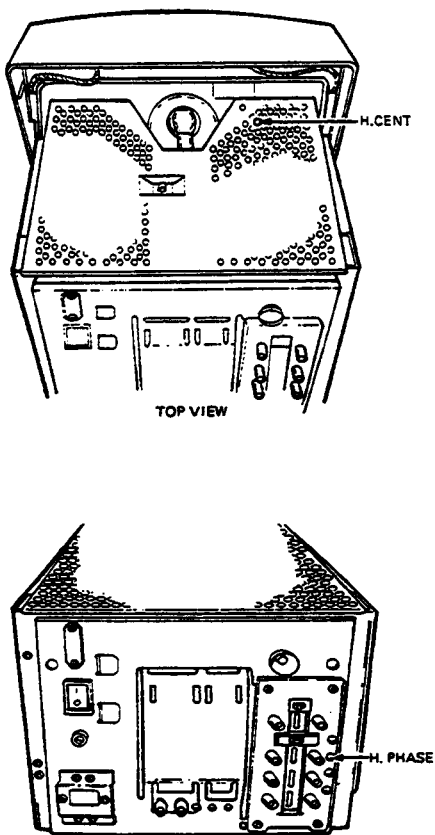
Figure 4-8 Horizontal Centering and Phase
Adjustments

4.3.5   Horizontal Phase

Check and adjust the horizontal phase as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the alignment pattern (full screen of E's) by typing **ESC # 8**.
3. Turn the contrast and brightness controls so raster is visible.
4. Measure the distance c from the left center of the raster edge to the left center of the E pattern (Figure 4-7).
5. Measure the distance d from the right center of the raster edge to the right center of the E pattern.
6. Check that the measurements are equal or within 2 mm of each other.

> **NOTE**
> **If the measurements are within tolerance, go to the rotational check procedure (Paragraph 4.3.6). If the measurements are not within tolerance, make sure you completed the preadjustment procedure. Then go to step 7.**

7. Adjust the brightness and contrast controls until the E alignment pattern and raster are visible.
8. Turn the horizontal phase (H. PHASE) control (Figure 4-8) until c and d are within 2 mm of each other.

> **NOTE**
> **When you make this adjustment, some host system units cause raster distortion (discoloration of right raster edge). If this distortion occurs, adjust H. PHASE so no raster distortion is visible. Then center the video display to the bezel by adjusting H. CENT.**

4.3.6   Rotation
Check the rotation as follows.

1. Make sure the terminal is set up correctly (Table 4-1).

2. Display the alignment pattern (full screen of E's) by typing ESC # 8.

3. Use the scale on the alignment template to make the following measurements (Figure 4-9). Find the point that is five columns of E's from the left and one row of E's from the bottom of the alignment pattern. Measure the distance a1 from this point to the monitor bezel.

4. Find the point that is five columns of E's from the right and one row of E's from the bottom of the alignment pattern. Measure the distance a2 from this point to the monitor bezel.

5. Check that the two measurements are equal or within 3 mm of each other.

NOTE
You cannot adjust rotation. Replace the monitor if measurements are not within tolerance. Go to the rectangularity procedure (Paragraph 4.3.7) if rotation is normal.
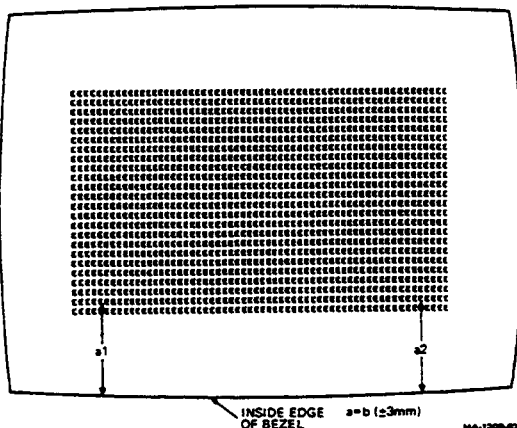
Figure 4-9 Rotation Check

4.3.7   Rectangularity
Check the rectangularity as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the red screen pattern by typing **ESC [4 ; 11 y**.
3. Measure from the lower-right corner, right middle edge, and upper-right corner of the pattern to the bezel (Figure 4-10).

INSIDE EDGE
OF BEZEL

INSIDE EDGE   a IS LESS THAN 3 mm
OF BEZEL   b IS LESS THAN 3 mm

MA-0828-83
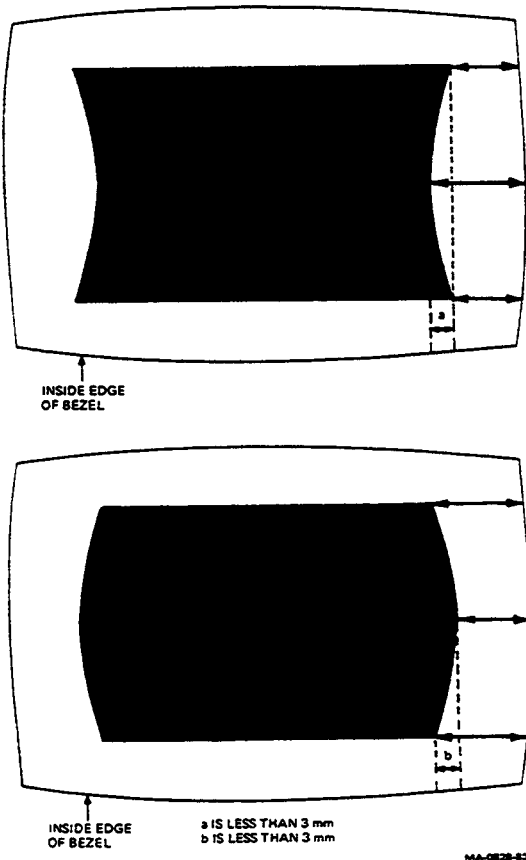
Figure 4-10 Rectangularity Check

4. Measure from the lower-left corner, left middle edge, and upper-left corner of the pattern to the bezel.

5. Check that the maximum difference between all three measurements in steps 3 and 4 is less than 3 mm.

NOTE
If the measurements are within tolerance, go to the aspect ratio procedure (Paragraph 4.3.8). If the measurements are not within tolerance, make sure you completed the preadjustment procedure. Then go to step 6.

6. Turn the SIDE PIN control (Figure 4-11) so the left and right sides of display appear vertical without any bowing when viewed straight on. The maximum bowing in or out must be less than 3 mm.
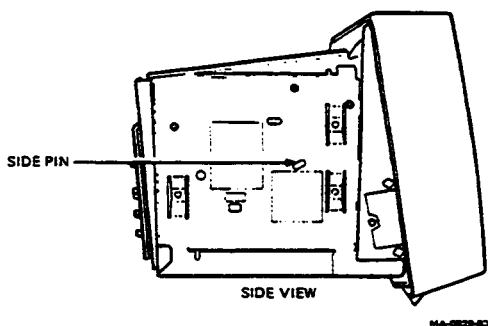
Figure 4-11 Rectangularity Adjustment

4.3.8   Aspect Ratio
Check and adjust the aspect ratio as follows.

1. Enter set-up and select the following.
   - Local
   - Clear display
   - Reverse video (dark text, light screen)
   - Monochrome display

2. Exit set-up. Then type

   ESC Pp
   P [390,240]
   C [200]

3. Check the circle for ovalness or flattening (Figure 4-12).

If the circle appears incorrect, perform steps 4 through 7.

4. Use your alignment template to make the following measurements (Figure 4-12). Measure the distance **a1** from the center of the left edge of the alignment pattern to the monitor bezel.

5. Measure the distance **a2** from the center of the right edge of the alignment pattern to the monitor bezel.

6. Subtract the sum **(a1 + a2)** from 293 mm (the width of the screen) to find the width of the video display.

   Example
   a1 = 26 mm   a2 = 25 mm
   a1 + a2 = 51 mm
   Width = 293 - 51 mm = 242 mm

7. The video display width must be within the range of 235 mm to 245 mm. If necessary, adjust the horizontal size (H. SIZE) control (Figure 4-12) until the video display width is within the range specified.

   CAUTION
   Do not adjust H. SIZE too much, or the coil core will fall out.

8. Adjust the vertical size (V. SIZE) control (Figure 4-12) to improve the appearance of the circle.

9. Type **ESC ** to exit ReGIS graphics mode.
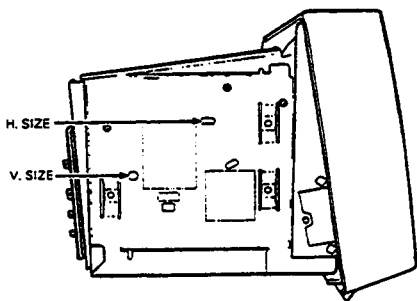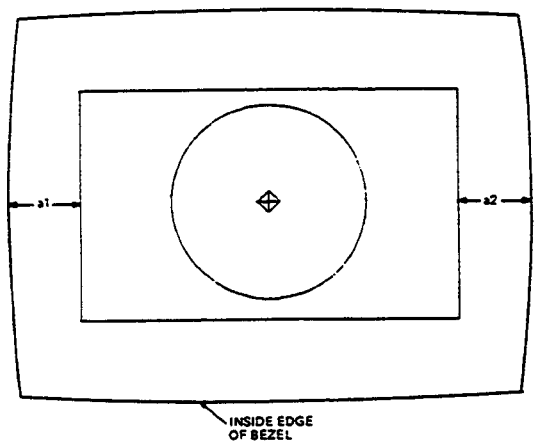
Figure 4-12 Aspect Ratio Check and
            Adjustment

4.3.9   Vertical Linearity
Check and adjust the vertical linearity as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the alignment pattern (full screen of E's, no reverse video) by typing ESC # 8.
3. Check the E's from the top row to the bottom row for uniform height.
4. If necessary, adjust the vertical linearity (V. LIN) control (Figure 4-13) to correct the height.

4.3.10   Horizontal Linearity
Check the horizontal linearity as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the alignment pattern (full screen of E's, no reverse video) by typing ESC # 8.
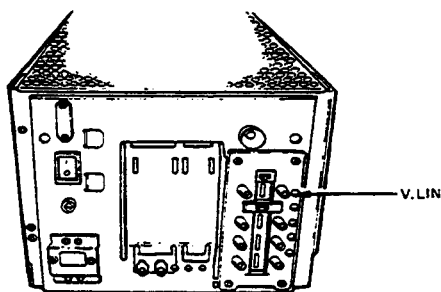
Figure 4-13 Vertical Linearity Adjustment

3. Check the E's from left to right in the center row for uniform width.

NOTE
You cannot adjust horizontal linearity. Replace the monitor if the E's are not a uniform width. Go to the focus procedure (Paragraph 4.3.11) if the width is normal.

4.3.11 Focus
Check and adjust the focus as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the alignment pattern (full screen of E's, no reverse video) by typing **ESC # 8**.
3. Check that the E's are in clear focus over the complete screen.

NOTE
If the E pattern is clear, go to the color purity procedure (Paragraph 4.3.12). If the focus is not clear, make sure you completed the preadjustment procedure. Then go to step 4.

4. Turn the FOCUS control (Figure 4-14) until the E's are clear over the complete screen.
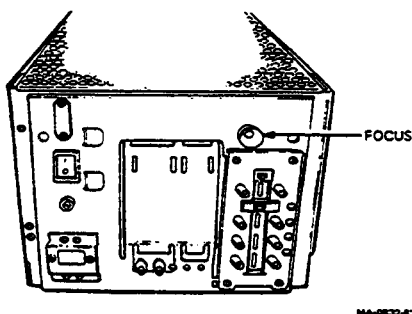
Figure 4-14 Focus Adjustment

4.3.12   Color Purity
Check the color purity as follows.

1. Make sure the terminal is set up correctly (Table 4-1).
2. Display the red screen pattern by typing **ESC [4 ; 11 y.**
3. Check that the screen is evenly red over the complete screen, without any other colors present.

   NOTE
   If a color does not appear normal, turn the monitor off for 10 minutes. Then turn it on and recheck the color after the monitor has warmed up for 5 minutes.

   Make sure there are no objects that produce strong magnetic fields near the monitor, such as motors, printers, magnetized filing cabinets, or structural beams. If so, relocate the monitor or the object.

   You cannot adjust color purity. If the monitor cannot display normal color, replace the monitor. If color is normal, go to the convergence procedure (Paragraph 4.3.13).

4.3.13   Convergence
Check convergence as follows.

1. Enter set-up and select the following.
   - Local
   - Clear display
   - Reset terminal
   - Normal video (light text, dark screen)
   - Monochrome display
   - VT100 mode.

2. Exit set-up. Then display the alignment pattern (full screen of E's) by typing ESC # 8.

3. View the center of the pattern at arm's length. There should not be any color fringing.

NOTE
Some color fringing may occur at the outer edges of the display. This fringing should not be objectionable at a normal viewing distance.

If the E characters are poorly converged, turn the monitor off for 10 minutes. Then turn it on and recheck the display for fringing after your monitor has warmed up for 5 minutes.

Make sure there are no objects that produce strong magnetic fields near the monitor, such as motors, printers, or magnetized filing cabinets. If so, relocate the monitor or the object.

You cannot adjust convergence. If the display still has fringing, replace the monitor. If the display is acceptable, go to the white balance procedure (Paragraph 4.3.14).

4.3.14   White Balance
Check and adjust the white balance as follows.

1. Make sure the terminal is set up correctly (Table 4-1).

   NOTE
   If you are color blind, do not try to perform the following procedure.

2. Display the white screen pattern by typing ESC [4 ; 13 y.
3. Vary the contrast control (Figure 4-15) between maximum and minimum.
4. Check that the white screen goes from white, through shades of gray, to black.
5. Set the brightness control (Figure 4-15) to maximum.
6. Set the contrast control to minimum.
7. Check that raster is white.
8. Repeat step 1.
9. Display the color bar pattern by typing ESC [4 ; 4 y.
10. Vary the contrast control between maximum and minimum.
11. Check that all colors fade equally and no color drops out before any others do at usable intensity levels.
12. Set the brightness and contrast controls to minimum and check that the complete screen is black (no display or raster visible).

   NOTE
   If your monitor passes the white balance procedure, reassemble the monitor if necessary. (Perform the preadjustment procedure, Paragraph 4.3.1, in reverse.)

   If your monitor does not pass, make sure you completed the preadjustment procedure. Then go to the white balance presets (Paragraph 4.3.14.1).
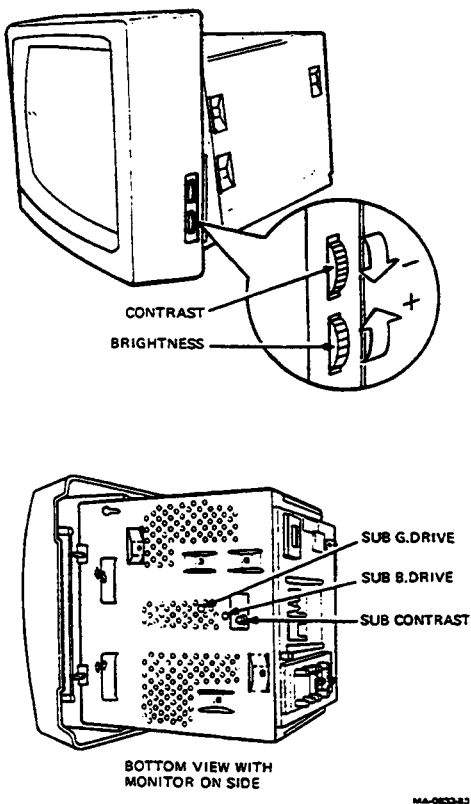
Figure 4-15 White Balance Presets (Part 1)

4.3.14.1   White Balance Presets – Preset the white balance as follows. See Figures 4-15 and 4-16.

1. Turn the brightness control to maximum.
2. Turn the contrast control to minimum.
3. Set the monitor on its side with the brightness and contrast controls facing up.

   NOTE
   The display may show signs of color impurity or poor convergence. Turn off the monitor for 10 minutes. Then turn it on again and wait 5 minutes for the monitor to warm up.

   Perform the remaining procedures with the monitor on its side. Only move the monitor when you access the service switch (Figure 4-16). Then place the monitor back on its side.

4. Turn the SUB-CONTRAST control to midrange.
5. Turn the sub-green drive (SUB-G. DRIVE) and sub-blue drive (SUB-B. DRIVE) controls fully clockwise.
6. Turn the green drive (G. DRIVE) and blue drive (B. DRIVE) controls fully counterclockwise.
7. Turn the SUB-BRIGHTNESS control fully counterclockwise.
8. Turn the red background (R. BKG), green background (G. BKG), and blue background (B. BKG) controls fully counterclockwise.
9. Turn the SCREEN control fully clockwise, then turn back 45 degrees.
10. Set the service switch to the SERVICE position.
11. Disconnect the video signal cables.
12. Slide the impedance switch to the 75-ohm position.

    NOTE
    The screen should be completely black. Go to the white balance cutoff procedure (Paragraph 4.3.14.2).

270°
MAX
180°
0°
MIN
45°
90°

G.DRIVE
B.DRIVE
SUB BRIGHTNESS
R.BKG
G.BKG
B.BKG

SCREEN
(ACCESSED THROUGH
SPACE BETWEEN
TOP AND REAR
PANEL)

C

IMPEDANCE
SWITCH

VIEW OF MONITOR REAR
WITH MONITOR ON SIDE

SERVICE
SWITCH
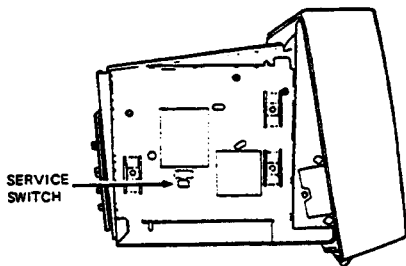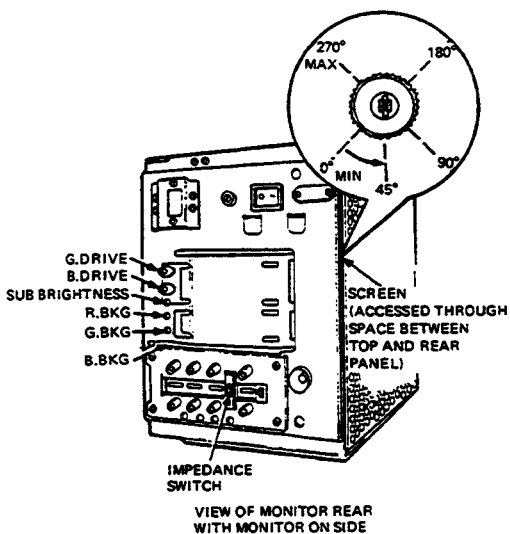
MA-0834-83

Figure 4-16 White Balance Presets (Part 2)

4.3.14.2 White Balance Cutoff – Adjust the white balance cutoff as follows. See Figure 4-17.

1. Turn the R. BKG control clockwise until a red line just appears on the screen. Then turn the control counterclockwise until the line just disappears.
2. Turn the G. BKG control clockwise until a green line just appears on the screen. Then turn the control counterclockwise until the line just disappears.
3. Turn the B. BKG control clockwise until a blue line just appears on the screen. Then turn the control counterclockwise until the line just disappears.
4. Set the service switch to the NORMAL position.

NOTE
The screen should show a red raster. Go to the white balance white raster procedure (Paragraph 4.3.14.3).
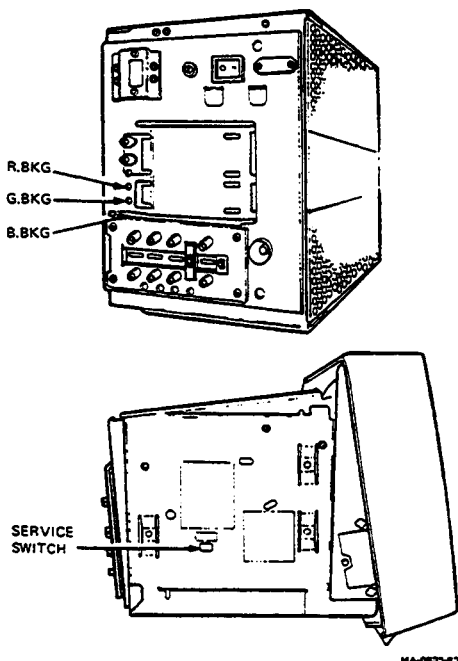
Figure 4-17 Cutoff Adjustment

4.3.14.3 White Balance White Raster – Adjust the white balance white raster as follows.

> **NOTE**
> **Read steps 1 through 3 before starting. See Figure 4-18.**

1. Adjust the brightness control to display a dim red raster.

> **NOTE**
> **If you set the red raster as dim as you can work with, steps 2 through 4 are easier to perform.**

2. Turn the SUB-G. DRIVE control only until the red disappears in the center of the screen.

> **NOTE**
> **You start with a red screen; it turns yellow, then green. You must stop increasing green exactly when the center of the screen goes from a yellow tint to a green tint. If you do this correctly, the screen has a green tint, but not brilliant green. The level of green is critical.**
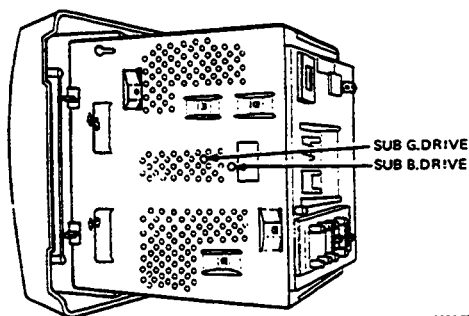
Figure 4-18 White Raster Adjustment (Part 1)

3. Turn the SUB-B. DRIVE control only until the center of the raster turns gray.

   NOTE
   You should get gray easily by adding blue. If you cannot get gray, you have too little or too much green.

   A red or purple tint means you have too little green.

   A blue or green tint means you have too much green.

4. Slowly turn the brightness control from maximum to minimum (Figure 4-19). Make sure the raster goes from white to gray. Adjust the SUB-G. DRIVE and SUB-B. DRIVE controls as necessary to obtain a white and gray raster at all brightness levels.

5. Turn the brightness control to minimum. Then turn it one-half turn towards maximum.

6. Make sure the contrast control is set to minimum.

   NOTE
   The screen should be completely black.

7. Turn the SUB-BRIGHTNESS control (Figure 4-19) clockwise until raster appears.

8. Adjust the SUB-BRIGHTNESS control counter-clockwise until the complete screen goes black.

9. Go to the white balance white video procedure (Paragraph 4.3.14.4).
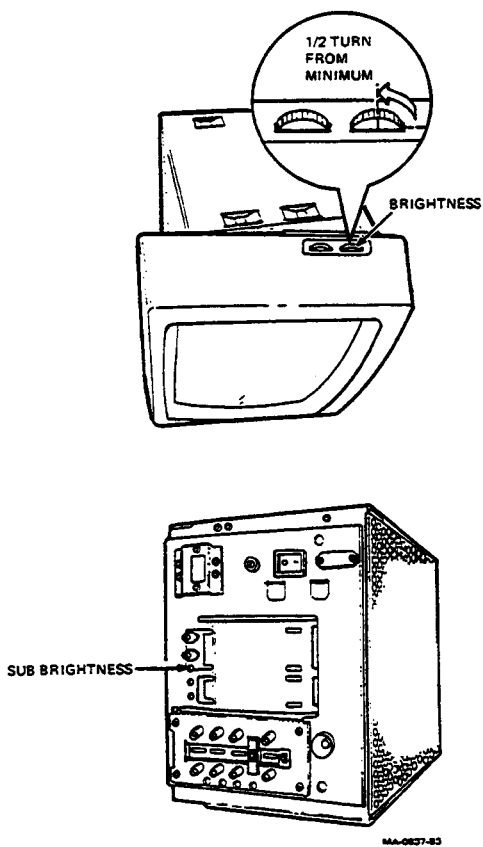
Figure 4-19 White Raster Adjustment (Part 2)

4.3.14.4   White Balance White Video – Adjust the white balance white video.

> **NOTE**
> **Read steps 1 through 6 before starting. See Figure 4-20.**

1. Reconnect the video signal cables.
2. Turn the brightness control to minimum.
3. Turn the contrast control until the video is dim.

> **NOTE**
> **If you set the video as dim as you can work with, steps 5 through 7 are easier to perform.**

4. Set up the terminal correctly (Table 4-1).
5. Display the white screen pattern by typing **ESC [4 ; 13 y**.

> **NOTE**
> **The screen should display red video.**
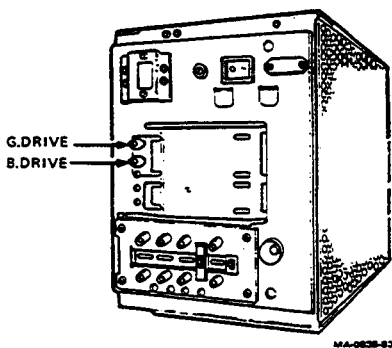
Figure 4-20 White Video Adjustment

6. Turn the G. DRIVE control only until the red disappears in the center of the screen.

   NOTE
   Step 5 is critical. Like step 2 in Paragraph 4.3.14.3, you start with a red screen; it turns yellow, then green. You must stop increasing green exactly when the screen center goes from a yellow tint to a green tint. If you do this correctly, the screen has a green tint, but not a brilliant green.

7. Turn the B. DRIVE control only until the raster turns gray in the center of the screen.

   NOTE
   You should get gray easily by adding blue. If you cannot get gray, you have too little or too much green.

   A red or purple tint means you have too little green.

   A blue or green tint means you have too much green.

8. Slowly turn the contrast control from maximum to minimum. Make sure the video turns from white to gray. Readjust B. DRIVE and G. DRIVE controls as necessary to get white and gray at all contrast levels in the center of the screen.

9. Set up the terminal correctly (Table 4-1).

10. Display the color bar test pattern by typing ESC [4 ; 4 y.

11. Check the color bars for correct color.

12. Slowly turn the contrast control from maximum to minimum. Make sure no color drops out before the others. (All colors should fade equally.)

    NOTE
    If green drops out, G. DRIVE is set too low. If blue drops out, B. DRIVE is set too low. If red drops out, G. DRIVE and B. DRIVE controls are set too high, or R. BKG is set too low. (Check G. DRIVE and B. DRIVE first.) If the R. BKG is misadjusted, perform the white balance adjustment procedure again (Paragraph 4.3.14.1).

4.3.14.5 Subcontrast Adjustment and Final Checks –
Adjust the subcontrast and make final checks as follows.

1. Enter set-up and select the following.
   - Local
   - Clear display
   - Reset terminal
   - Normal video (light text, dark screen)
   - Monochrome display
   - VT100 mode

2. Exit set-up. Then display the alignment pattern (full screen of E's) by typing **ESC # 8**.

3. Turn the brightness control only until the raster disappears.

4. Turn the contrast control to maximum.

5. Adjust the SUB-CONTRAST control (Figure 4-21) to maximum intensity without distortion or blooming of display.

6. Display the white screen pattern by typing **ESC [4 ; 13 y**.
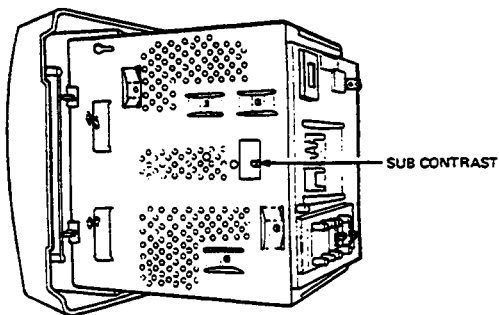
Figure 4-21 Subcontrast Adjustment

7. Turn the contrast control to minimum. Slowly turn
    the brightness control from maximum to minimum
    while you check for white to gray background raster.

    NOTE
    **If you cannot get the correct background raster
    at this point, you did not perform the cutoff
    procedure or white raster procedure correctly,
    or the monitor is faulty. Perform the white bal-
    ance procedure again (Paragraphs 4.3.14.1
    through 4.3.14.3).**

8. With the brightness control set for no raster, slowly
    turn the contrast control from maximum to minimum
    while you check for white to gray video.

    NOTE
    **If you cannot get correct video at this point, you
    did not perform the white video procedure cor-
    rectly, or the monitor is faulty. Perform the
    white video procedure again (Paragraph
    4.3.14.4).**

4.4 RECOMMENDED SPARES LIST

Table 4-6 is a list of replaceable parts and accessories for
maintaining the VR241-A color video monitor.

Table 4-6   VR241-A Recommended Spares List

Description	Part Number
Color monitor (whole option)	VR241-A
Screen cleaner (1 oz)	29-24791-00
VR241 adjustment tool	29-24746-00
Alignment tool (yellow)	29-10144-00
Hex-core alignment tool (white)	29-23190-00
Fuses (2.5 A)	90-08387-00
RGB signal cable	17-00284-00

4.5 PHYSICAL/FUNCTIONAL DESCRIPTION
This section describes how to find and operate the VR241-A external controls and how to find the alignment points.

4.5.1 Voltage Selection Switch
The voltage selection switch (Figure 4-22) is on the back of the color monitor. The switch has two positions, 115 V and 230 V.

4.5.2 Power Switch
The power switch (Figure 4-22) is on the back of the color monitor. Pressing **1** turns on the color monitor. Pressing **0** turns off the color monitor.
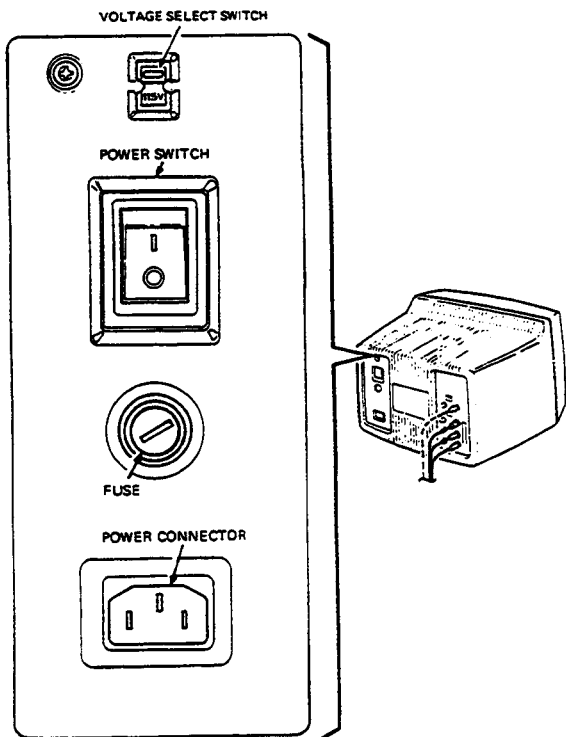
Figure 4-22 Power Controls

4.5.3   Fuse

The fuse (Figure 4-22) is on the back of the color monitor. The fuse is a 2.5 A, 250 V fuse, set in a 1/4 inch by 1-1/4 inch fuse carrier for the United States. The color monitor also comes with a 2.5 A, 250 V set in a 5 mm by 20 mm fuse carrier for use outside the United States.

> **CAUTION**
> **Do not use the 5 mm by 20 mm fuse and fuse carrier in the United States.**

4.5.4   Power Indicator

The color monitor has one power indicator (Figure 4-23). This indicator is on when the following are true.

- AC power is applied.
- The power switch is on.
- The fuse is good.
- Power is applied to the monitor circuits.

4.5.5   Contrast – Picture Intensity Adjustment

This control (Figure 4-23) lets you adjust the picture's intensity for viewing preference.

4.5.6   Brightness – Background Intensity Adjustment

This control (Figure 4-23) lets you adjust the raster to cutoff, which compensates for room lighting.
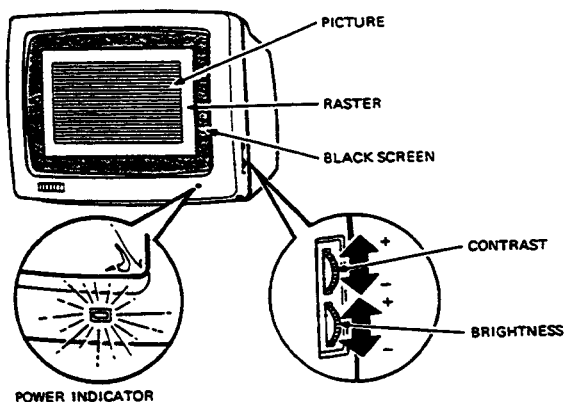
Figure 4-23 Video Controls and Indicators

4.5.7 Synchronization and Impedance Switch Settings
The synchronization switch (Figure 4-24) selects the line
that the monitor uses to receive the synchronization signal
from the host system unit. The monitor can receive the
signal on the green video line or on the external sync line.

Hosts that provide three video signals to the color moni-
tor (synchronization on green) should have the synchroni-
zation switch in the INT (internal) position. Hosts that
provide four video signals to the color monitor (external
synchronization) should have the synchronization switch in
the EXT (external) position.

The impedance switch lets you operate the color moni-
tor correctly in termination or loop-through mode.

- *Termination mode* is when your color monitor is the
  only monitor connected to the host, or your monitor
  is the last monitor in a string of monitors connected
  to a host. In termination mode, set the impedance
  switch to 75 ohms.

- *Loop-through mode* is when your monitor is connect-
  ed between a host and another monitor, but is not the
  last monitor connected. In loop-through mode, set the
  impedance switch to the HIGH position.
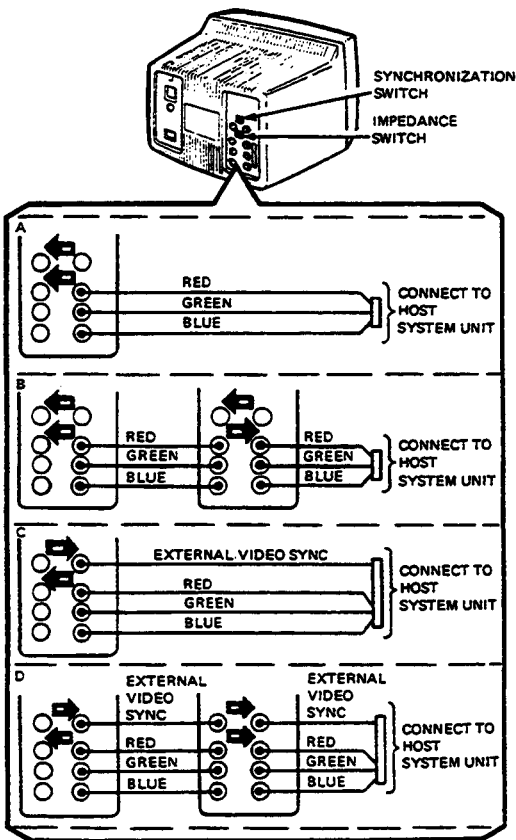
Figure 4-24 Synchronization and Impedance
              Switch Settings

4.5.8 Alignment Adjustment Locations and Controls

Figures 4-25 and 4-26 show the VR241-A alignment point locations. Table 4-7 lists and defines the video alignment controls. Table 4-8 lists and defines the white balance alignment controls.

BOTTOM VIEW

REAR VIEW
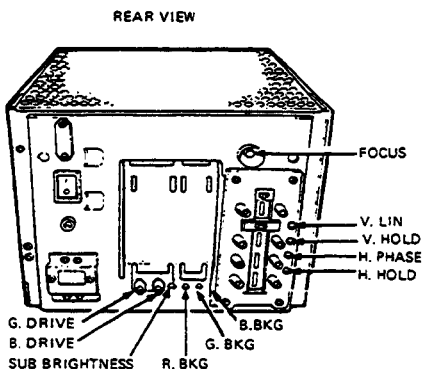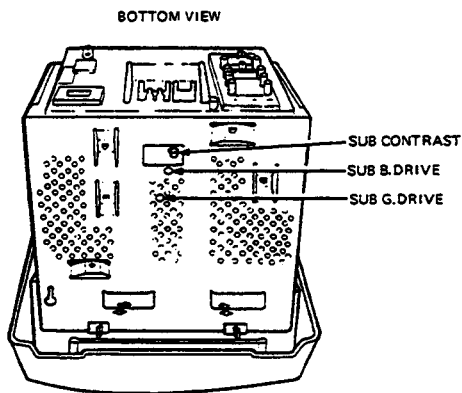
MA-0882-83A

Figure 4-25 Adjustment Locations (Part 1)
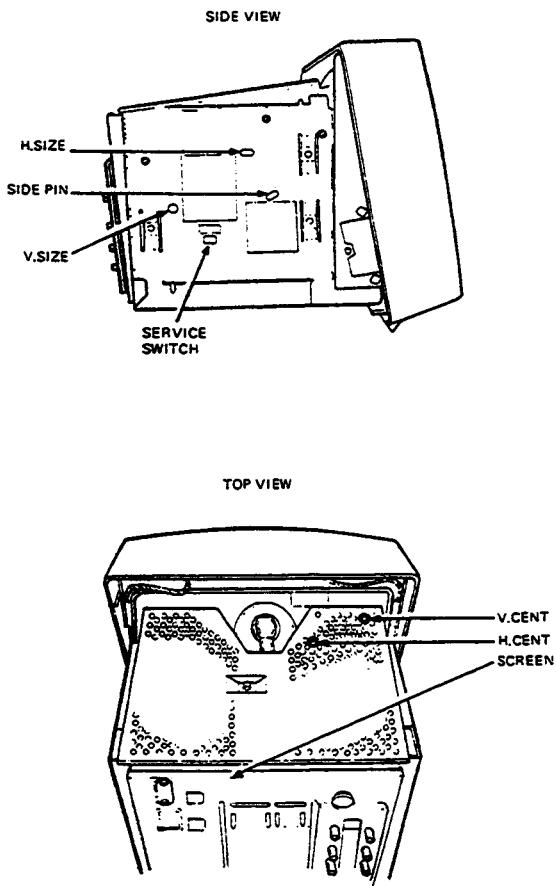
Figure 4-26 Adjustment Locations (Part 2)

Table 4-7   Video Alignment Controls

Control	Paragraph	Definition
H. HOLD	4.3.2	Horizontal synchronization
V. HOLD	4.3.2	Vertical synchronization
V. CENT	4.3.3	Vertical video centering
H. CENT	4.3.4	Horizontal raster and video centering
H. PHASE	4.3.5	Horizontal video centering on raster
SIDE PIN	4.3.7	Rectangularity
H. SIZE	4.3.8	Aspect ratio horizontal size
V. SIZE	4.3.8	Aspect ratio vertical size
V. LIN	4.3.9	Vertical linearity
FOCUS	4.3.11	Video focus

Table 4-8   White Balance Alignment Controls

Adjustment	Paragraph	Definition
SCREEN	4.3.14.1	Presets bias on CRT control grid 2 (G2).
Service switch	4.3.14.1	Selects service for cutoff adjustment.
R BKG	4.3.14.2	Sets cutoff point of red gun.
G. BKG	4.3.14.2	Sets cutoff point of green gun.
B. BKG	4.3.14.2	Sets cutoff point of blue gun.
SUB-G. DRIVE	4.3.14.3	Sets amount of green background raster.
SUB-B. DRIVE	4.3.14.3	Sets amount of blue background raster.

NOTE
The red background raster is fixed.

SUB-BRIGHTNESS	4.3.14.3	Sets the range of user brightness control.
G. DRIVE	4.3.14.4	Sets amount of green video.
B. DRIVE	4.3.14.4	Sets amount of blue video.

NOTE
The red video is fixed.

SUB-CONTRAST	4.3.14.5	Sets range of user contrast control.

5 USING SET-UP

5.1 GENERAL

The VT240 series terminal has a set-up state that lets you change the settings of operating features. Refer to the *VT240 Owner's Manual* (EK-VT240-UG) for the set-up summaries for the VT240 series terminal.

5.2 USING SET-UP

The set-up state consists of a series of set-up screens. Each screen has a group of related operating features (for example, communications or keyboard). You can move from screen to screen in set-up.

You enter set-up by pressing the **Set-Up** key (F3). This key is the third from the left in the top row of the keyboard. When you press **Set-Up**, the Set-Up Directory screen appears.

You can move the cursor to different fields in a set-up screen by using the arrow keys. There are four types of fields.

- Screen selection – When you move to the field and press **Enter**, the selected set-up screen appears. For example, when you move to General in the Set-Up Directory screen and press **Enter**, the General Set-Up screen appears.

- Action – When you move to an action field and press **Enter**, the terminal performs the action.

- Parameter – When you move to a parameter field, you can use **Enter** to view the different possible settings. Each time you press **Enter**, a new setting appears. When you leave the field, the last displayed value becomes the new setting.

- Text parameter – When you move to one of these fields, you can enter a value at the keyboard. First you press **Enter**. Then you enter a value. Finally, you press **Enter** again to select that value.

There are two ways to exit the set-up state.

- Move to the Exit field in the Set-Up Directory screen and press **Enter**.
- Press **Set-Up** while in any of the set-up screens.

5.3 SAVING SET-UP VALUES

You can save values selected in set-up as follows. (You must still be in set-up.)

1. Move to the Save field in the Set-Up Directory screen.
2. Press **Enter**.

5.4 RECALLING SET-UP VALUES

You can recall the last set of saved values in set-up as follows.

1. Enter set-up.
2. Move to the Recall field in the Set-Up Directory screen.
3. Press **Enter**.

Recall returns the terminal to the last set of *saved* values. You can change values without saving them, then use Recall to return to the original values.

A VT240 DOCUMENTATION

The following documents on the VT240 are available from Digital.

VT240 Owner's Manual   EK-VT240-UG

This manual provides the user with the information needed to operate and service the VT240 series terminal. The manual includes an overview of the VT240's physical and functional structure. Specific operational features such as set-up procedures, controls and indicators, communication interfaces, and test functions are also described.

Installation Guide   EK-VT240-IN

This guide provides the user with the information needed to unpack, assemble, and bring the VT240 series terminal to operating status.

VT240 Programmer Reference   EK-VT240-RM
Manual

This manual provides the programmer with the information needed to use the communication and character processing features of the VT240 series terminal.

VT240 Programmer Pocket Guide   EK-VT240-HR

This guide provides the programmer with a summary of the information needed to program the VT240 series terminal.

VT240 Pocket Service Guide   EK-VT240-PS

This guide provides service personnel with the information needed to test, troubleshoot, and repair the VT240 series terminal.

VT240 Technical Manual   EK-VT240-TM

This manual provides the user with a technical description
to isolate and repair VT240 problems that go beyond the
FRU level of repair. The manual includes an overview of
both hardware and software components, and detailed
descriptions of communication components and subsys-
tems to the major circuit level.

VT240 Terminal IPB   EK-VT240-IP

This document is a detailed parts breakdown of the
VT240 terminal's FRUs. This document does not contain
part numbers for components on the printed circuit
boards. However, these components are listed in the
VT240 Field Maintenance Print Set, ordered separately.

VT241 Terminal IPB   EK-VT241-IP

This document is a detailed parts breakdown of the
VT241 terminal's FRUs. This document does not contain
part numbers for components on the printed circuit
boards. However, these components are listed in the
VT241 Field Maintenance Print Set, ordered separately.

VT240 Field Maintenance Print Set   MP-01807-00

This print set includes the following documents. These
documents provide the user with a complete set of electri-
cal and mechanical schematic diagrams for the VT240
terminal. The print set also includes a purchase specifica-
tion for the power supply.

• System box (VS240)	MP-01597-00
• Monitor (VR201)	MP-01410-00
• Keyboard (LK201)	MP-01395-00

VT241 Field Maintenance Print Set   MP-02002-01

This print set includes the following documents. These
documents provide the user with a complete set of electri-
cal and mechanical schematic diagrams for the VT241
terminal. The print set also includes a purchase specifica-
tion for the power supply.

• System box (VS240)	MP-01597-00
• Color monitor (VR241)	MP-01893-01
• Keyboard (LK201)	MP-01395-00

B FRU EXPLODED VIEW DRAWING
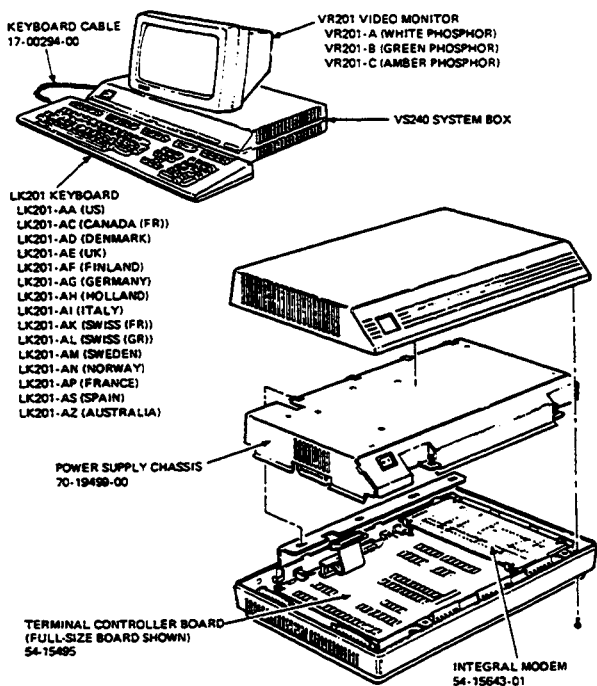
Figure B-1 VT240 FRUs (Exploded View)

C CABLE INFORMATION

Figure C-1 shows the cable connections for the VT240.
Table C-1 lists the interface cables, and Table C-2 lists the
modem control selections.
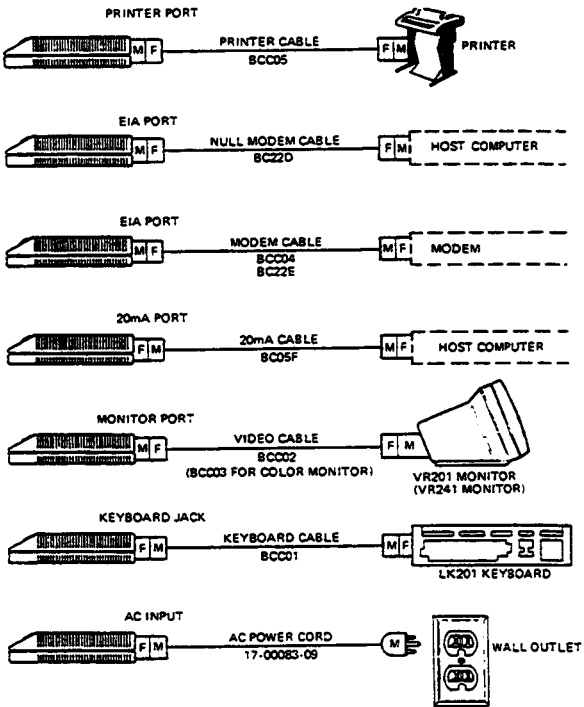
Figure C-1 Cable Summary

Table C-1   Interface Cables

Cable	Number	Connector
Printer Cable (VT240 to printer)		
BCC05-10	17-00300-00	9-pin F RS232
BCC05-25	17-00300-01	to 25-pin F RS232
Null Modem Cable (VT240 to host)		
BC22D-10	17-00313-01	25-pin F RS232
BC22D-25	17-00313-02	to 25-pin F RS232
BC22D-50	17-00313-04	
Modem Cable (VT240 to modem)		
BCC04-10	17-00289-00	25-pin F RS232
BCC04-25	17-00289-01	to 25-pin M RS232
20 mA Cable (VT240 to host)		
BC05F-15	17-XXXXX-XX	8-pin M
Video Cable (VR201 monitor to system box)		
BCC02-02	17-00283-01	–
Video Cable (VR241 monitor to system box)		
BCC03-06	17-00284-00	15-pin F RS232 to 3 coaxial connectors and a keyboard jack
Keyboard Cable (VT240 to keyboard)		
BCC01-06	17-00294-00	Telephone jack
U.S. 125 Vac Power Cable		
–	17-00083-09	–
U.S. 250 Vac Power Cable		
–	17-00083-10	–
Australian AC Power Cable		
–	17-00198-00	–
German AC Power Cable		
–	17-00199-00	–
United Kingdom AC Power Cable		
–	17-00209-00	–

M = male, F = female

Table C-1   Interface Cables (Cont)

Cable	Number	Connector
Swiss AC Power Cable		
–	17-00210-00	–
Danish AC Power Cable		
–	17-00311-01	–

M = male, F = female

Table C-2   Modem Control Selections

Selection	Description	Usual Application
EIA data leads only	Full duplex, no EIA modem control (data leads only)	Full-duplex communication with a null modem (direct) connection to the computer, or with a modem that does not use modem control signals
EIA modem control	Full duplex with EIA modem control	Full-duplex communication with a modem that uses modem control signals, or with a port on the host computer supporting modem controls

D PHYSICAL/FUNCTIONAL DIAGRAMS

Figures D-1 and D-2 are physical/functional diagrams showing how VT240 components work together. Figure D-1 shows the full-size terminal controller board. Figure D-2 shows the half-size terminal controller board. Pin descriptions for both figures are identical. See Table 2-1 for part numbers.

NOTE
All voltage readings are based on a line voltage of 115 Vac. Your readings may differ in accordance with any variations in your line voltage.
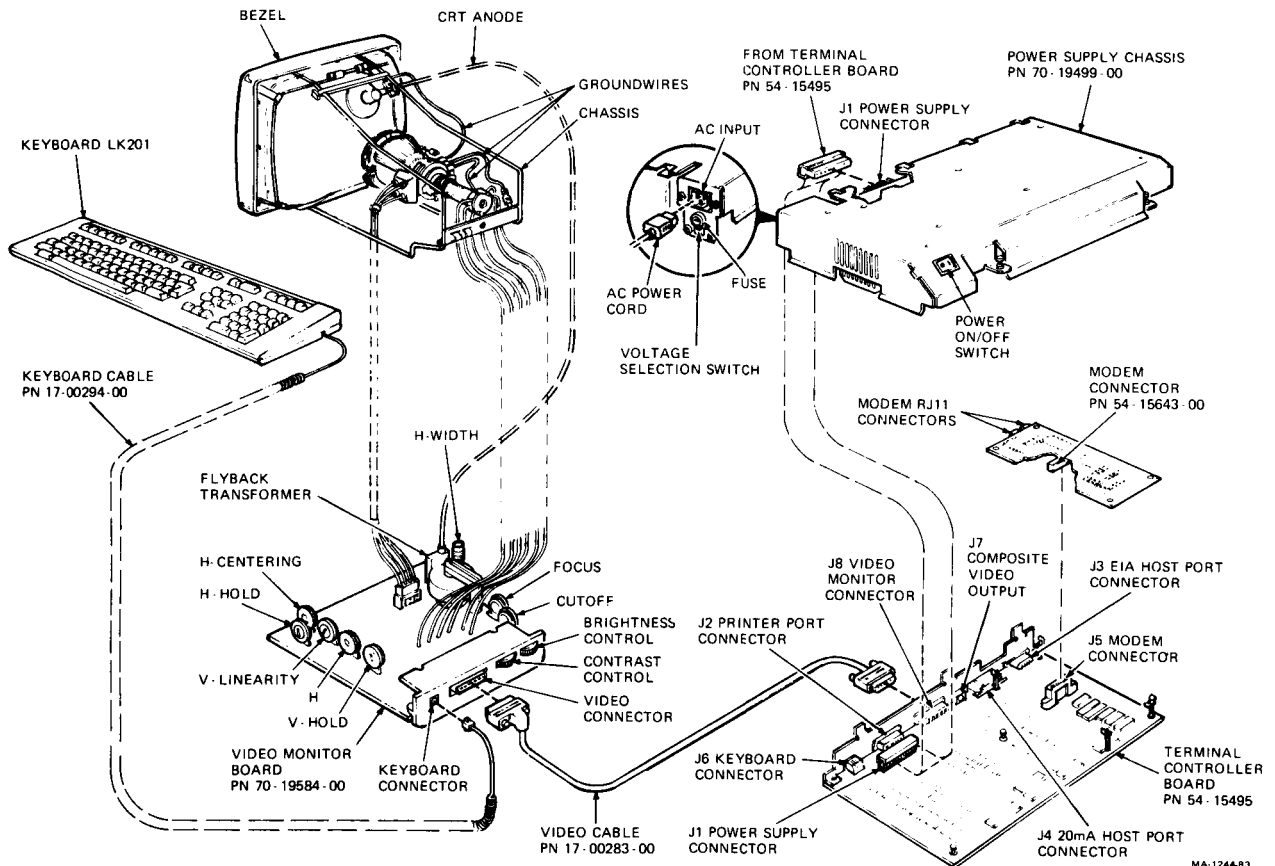

Figure D-1   Physical/Functional Diagram
(Full-Size Terminal Controller Board)

J1 Power Supply Connector

Pin 1 Not used
     2 Not used
     3 Not used
     4 −12 volts
     5 −12 volts
     6 Ground
     7 Ground
     8 Ground
     9 Ground
    10 Ground
    11 +12 volts
    12 +12 volts
    13 +12 volts
    14 +12 volts
    15 Ground
    16 +5 volts
    17 +5 volts
    18 +5 volts

J2 Printer Port Connector

Pin 1 Not used
     2 Transmitted data
     3 Received data
     4 Not used
     5 Data terminal ready
     6 Data set ready
     7 Signal ground
     8 Signal ground
     9 Not used

J3 EIA Host Port Connector

Pin 1 Not used
     2 Transmitted data
     3 Received data
     4 Request to send
     5 Clear to send
     6 Data set ready
     7 Signal ground
     8 Received line signal detector
     9 Not used
    10 Not used
    11 Not used
    12 Speed indicator

13 Not used
14 Not used
15 Not used
16 Not used
17 Not used
18 Not used
19 Not used
20 Data terminal ready
21 Not used
22 Not used
23 Speed select
24 Not used
25 Not used

J4 20 mA Host Port Connector

Pin 1 Not used
     2 Transmit −
     3 Receive −
     4 Not used
     5 Transmit +
     6 Not used
     7 Receive +
     8 Ground

J5 Modem Connector

Pin 1 +12 volts
     2 Mode select
     3 Data set ready
     4 Received data
     5 Speed indicator
     6 Transmitted data
     7 Speed select
     8 Ground
     9 Data available
    10 Off hook drive
    11 Modem 9-bit character/10-bit character
    12 Modem present
    13 Talk/data
    14 Modem A/B
    15 Not used
    16 Domestic/Europe
    17 Dial tone detect
    18 Not used
    19 −12 volts
    20 Coupler cut through

21 Switch hook
22 Off hook modem
23 Not used
24 Analog test
25 Remote data loop

J6 Keyboard Connector

Pin 1 Transmitted data
     2 +12 volts
     3 Signal ground
     4 Received data

J7 Composite Video Output Connector

Pin 1 Video output
     2 Signal ground

J8 Video Monitor Connector

Pin 1 Ground
     2 Ground
     3 Ground
     4 Ground
     5 Ground
     6 Ground
     7 +12 volts
     8 +12 volts
     9 Blue output
    10 Green output
    11 Red output
    12 Monochrome output
    13 Monitor present
    14 Keyboard transmit
    15 Keyboard receive

BEZEL
CRT ANODE
FROM TERMINAL CONTROLLER BOARD PN 54 - 15495
POWER SUPPLY CHASSIS PN 70 - 19499 - 00
GROUNDWIRES
CHASSIS
J1 POWER SUPPLY CONNECTOR
AC INPUT
KEYBOARD LK201
AC POWER CORD
FUSE
VOLTAGE SELECTION SWITCH
POWER ON/OFF SWITCH
KEYBOARD CABLE PN 17-00294-00
MODEM CONNECTOR PN 54 - 15643 - 00
MODEM RJ11 CONNECTORS
H - WIDTH
FLYBACK TRANSFORMER
FOCUS
J7 COMPOSITE VIDEO OUTPUT
J8 VIDEO MONITOR CONNECTOR
J3 EIA HOST PORT CONNECTOR
H - CENTERING
CUTOFF
J2 PRINTER PORT CONNECTOR
H - HOLD
BRIGHTNESS CONTROL
J5 MODEM CONNECTOR
CONTRAST CONTROL
V - LINEARITY
VIDEO CONNECTOR
H
V - HOLD
J6 KEYBOARD CONNECTOR
TERMINAL CONTROLLER BOARD PN 54 - 15495
VIDEO MONITOR BOARD PN 70 - 19584 - 00
KEYBOARD CONNECTOR
VIDEO CABLE PN 17 - 00283 - 00
J1 POWER SUPPLY CONNECTOR
J4 20mA HOST PORT CONNECTOR

MA-1244-83A

Figure D-2   Physical/Functional Diagram
(Half-Size Terminal Controller Board)

J1 Power Supply Connector

Pin 1 Not used
2 Not used
3 Not used
4 −12 volts
5 −12 volts
6 Ground
7 Ground
8 Ground
9 Ground
10 Ground
11 +12 volts
12 +12 volts
13 +12 volts
14 +12 volts
15 Ground
16 +5 volts
17 +5 volts
18 +5 volts

J2 Printer Port Connector

Pin 1 Not used
2 Transmitted data
3 Received data
4 Not used
5 Data terminal ready
6 Data set ready
7 Signal ground
8 Signal ground
9 Not used

J3 EIA Host Port Connector

Pin 1 Not used
2 Transmitted data
3 Received data
4 Request to send
5 Clear to send
6 Data set ready
7 Signal ground
8 Received line signal detector
9 Not used
10 Not used
11 Not used
12 Speed indicator

13 Not used
14 Not used
15 Not used
16 Not used
17 Not used
18 Not used
19 Not used
20 Data terminal ready
21 Not used
22 Not used
23 Speed select
24 Not used
25 Not used

J4 20 mA Host Port Connector

Pin 1 Not used
2 Transmit −
3 Receive −
4 Not used
5 Transmit +
6 Not used
7 Receive +
8 Ground

J5 Modem Connector

Pin 1 +12 volts
2 Mode select
3 Data set ready
4 Received data
5 Speed indicator
6 Transmitted data
7 Speed select
8 Ground
9 Data available
10 Off hook drive
11 Modem 9-bit character/10-bit character
12 Modem present
13 Talk/data
14 Modem A/B
15 Not used
16 Domestic/Europe
17 Dial tone detect
18 Not used
19 −12 volts
20 Coupler cut through

21 Switch hook
22 Off hook modem
23 Not used
24 Analog test
25 Remote data loop

J6 Keyboard Connector

Pin 1 Transmitted data
2 +12 volts
3 Signal ground
4 Received data

J7 Composite Video Output Connector

Pin 1 Video output
2 Signal ground

J8 Video Monitor Connector

Pin 1 Ground
2 Ground
3 Ground
4 Ground
5 Ground
6 Ground
7 +12 volts
8 +12 volts
9 Blue output
10 Green output
11 Red output
12 Monochrome output
13 Monitor present
14 Keyboard transmit
15 Keyboard receive

TECHNICAL DOCUMENTATION
CHANGE NOTICE

VT240 SERIES
POCKET SERVICE GUIDE
EK-VT240-PS-002

This change notice updates the references to the
half-size controller board for the VT240 video
terminal.

The half-size controller board (54-15495-03) referred
to in the VT240 Series Pocket Service Guide will
not be available as a substitute for the present con-
troller board (54-15495-02).

You should disregard references to the half-size con-
troller board in the following sections of the pocket
service guide.

- 2.4 Terminal Controller Board
- 2.7 Integral Modem
- 2.7.2 On a Half-Size Terminal Controller
  Board
- 2.9 Recommended Spares List
- Appendix D Physical/Functional Diagrams

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