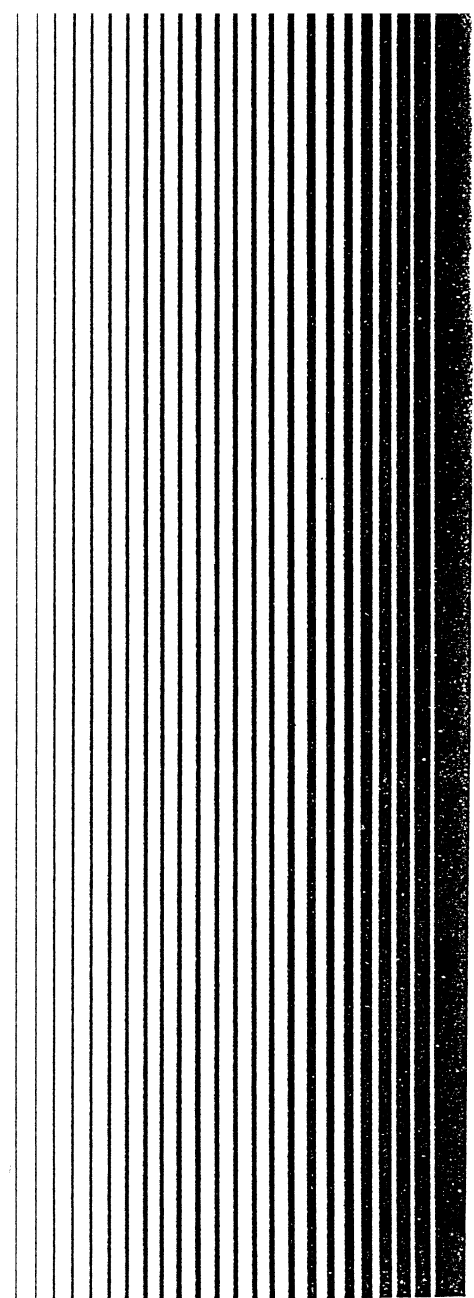


**WY-325/ES
Maintenance
Manual**

WYSE
1 1 1 1



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WY-325/ES

Maintenance Manual

881863-02 Rev. A
January 1992

Wyse Technology Inc.
3471 N. First Street
San Jose, CA 95134-1803 U.S.A.

Printed in U.S.A.

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Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

The use of shielded I/O cables is required when connecting this equipment to any and all optional peripheral or host devices. Failure to do so may violate FCC rules.

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Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.



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1

General Information

INTRODUCTION

The WY-325/ES terminal is a high-quality, full-function ergonomic color terminal that incorporates the following key features:

- Twelve ASCII-based (including WY-60) operating modes (*personalities*)
- Four ANSI-based operating modes (*personalities*)
- A 26/44-line by 80/132-column display
- Up to six pages of display memory
- Hidden or nonhidden, character/line/page-based display attributes, and double-high, double-wide line attributes
- Ten predefined color palettes and one soft color palette
- ASCII, 105-key ANSI, or Enhanced PC-style keyboard options with international language support and programmable function and editing keys
- Two serial communication ports and one parallel port
- A voltage-selection switch for setting the terminal to either 115 V (120 volts) for operation in the United States and Canada or 230 V (220/240 volts) for operation in other countries

Note *ES* refers to the low emissions version of the product.

ENVIRONMENTAL CONSIDERATIONS

Position the terminal on a clean horizontal surface that is free from vibration and out of direct sunlight. Allow three inches of clearance on all sides of the terminal for air circulation and movement of the tilt/swivel mechanism.

INSTALLATION

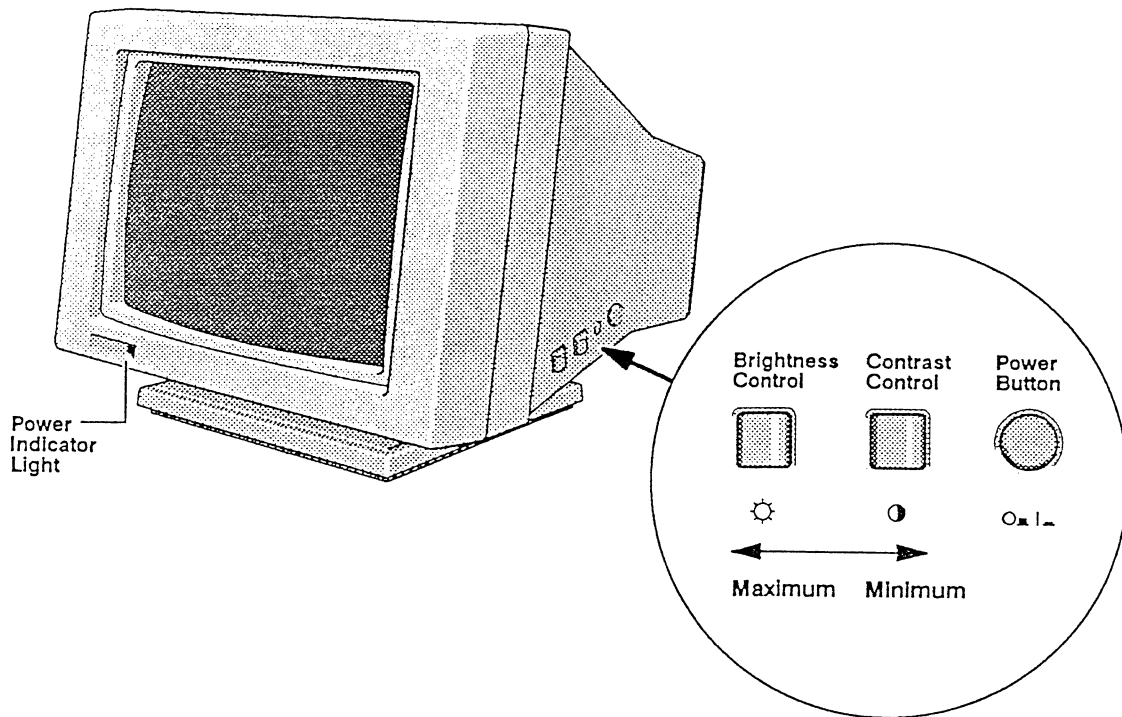
To install the terminal, follow these steps:

- 1 Connect the power cord to an AC power receptacle.
- 2 Connect the communications cable to the Serial 1 port. Secure the communications cable to the connector using the two captive screws that are attached to the cable plug. *Do not use excessive force when tightening these screws.*

OPERATOR CONTROLS

The terminal's operator controls are located on the side of the unit. Operator controls consist of a power button, a brightness control, and a contrast control (see Figure 1-1). Press the power button to turn on the terminal. You'll see the power indicator light go on and hear an immediate beep if the terminal is receiving power.

Figure 1-1 Terminal Controls



CLEANING

Whenever it becomes soiled, turn off the terminal and clean it with a commercial grade of plastic and/or glass cleaner. Never pour or spray cleaners directly on any part of the terminal. Moisten a cloth with the cleaner and use the cloth to wipe the surface.

SPECIFICATIONS

Table 1-1 lists the specifications of the terminal.

Table 1-1 Terminal Specifications

Description	Specification
Power Requirements	
Line voltage	120/230 VAC
Line frequency	50/60 Hz
Power consumption	84 Watts
Fuse	3 A, 250 V, slow blow
Fuse	3.15 A, 250 V, slow blow (ES version)
Power Inrush Current	
120 VAC	30 Amps maximum
230 VAC	60 Amps maximum

Table 1-1 Terminal Specifications, Continued

Description	Specification																																										
Input Voltage Range																																											
120 VAC	90-132 Volts																																										
230 VAC	180-264 Volts																																										
Input Frequency Range																																											
	47-63 Hz																																										
Environmental Requirements																																											
Operating temperature	10 to 40 degrees C (50 to 104 degrees F)																																										
Storage temperature	-10 to 60 degrees C (14 to 140 degrees F)																																										
Operating altitude	10,000 feet (3048 meters)																																										
Nonoperating altitude	40,000 feet (12192 meters)																																										
Humidity	20% to 80% noncondensing																																										
Display Size																																											
Horizontal image	254 mm ± 4.0 mm																																										
Vertical image	193 mm ± 4.0 mm																																										
Resolution																																											
Mode	<table border="1"> <thead> <tr> <th>Hort Lines</th> <th>Vert Lines</th> <th>Horz Freq</th> <th>Vert Freq</th> <th>Rows</th> <th>Col</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>800</td> <td>416</td> <td>31.372</td> <td>60</td> <td>26</td> </tr> <tr> <td>2</td> <td>800</td> <td>338</td> <td>31.372</td> <td>78</td> <td>26</td> </tr> <tr> <td>3</td> <td>1188</td> <td>416</td> <td>31.372</td> <td>60</td> <td>26</td> </tr> <tr> <td>4</td> <td>1188</td> <td>338</td> <td>31.372</td> <td>78</td> <td>26</td> </tr> <tr> <td>5</td> <td>800</td> <td>396</td> <td>31.372</td> <td>60</td> <td>44</td> </tr> <tr> <td>6</td> <td>1188</td> <td>396</td> <td>31.372</td> <td>60</td> <td>44</td> </tr> </tbody> </table>	Hort Lines	Vert Lines	Horz Freq	Vert Freq	Rows	Col	1	800	416	31.372	60	26	2	800	338	31.372	78	26	3	1188	416	31.372	60	26	4	1188	338	31.372	78	26	5	800	396	31.372	60	44	6	1188	396	31.372	60	44
Hort Lines	Vert Lines	Horz Freq	Vert Freq	Rows	Col																																						
1	800	416	31.372	60	26																																						
2	800	338	31.372	78	26																																						
3	1188	416	31.372	60	26																																						
4	1188	338	31.372	78	26																																						
5	800	396	31.372	60	44																																						
6	1188	396	31.372	60	44																																						
Centering																																											
Horizontal	± 4.0 mm																																										
Vertical	± 4.0 mm																																										
Pincushion and Tilt																																											
Horizontal/vertical	2.5 mm																																										
Brightness (Maximum)																																											
Full	> 45 fL																																										
Raster	< 1.0 fL																																										
Luminescence Uniformity																																											
	60%																																										
Chromaticity (at 30 fL)																																											
x	.281 + .042 - .056																																										
y	.311 + .047 - .077																																										
Misconvergence																																											
Center	.45 mm																																										
Display area	.50 mm																																										
Linearity																																											
Horizontal	10%																																										
Vertical	10% $\left(\frac{X_{max} - X_{min}}{X_{avg}} \times 100\% \right)$																																										
Wave and Jitter																																											
	< 0.1 mm																																										
CRT																																											
Diagonal size	14-inch																																										
Dot pitch	.28																																										
Phosphor	P22																																										
Protection	Tension band																																										
Transmittance	47%																																										
Surface	Anti-glare																																										

Table 1-1 Terminal
Specifications, Continued

Description	Specification
Dimensions	
Height	342.9 mm
Width	358.8 mm
Depth	409.5 mm
Net weight	13.2 kg
Regulatory Agency Approvals	
Safety	EN 60950
	UL 1950 W/D3
	CSA C22.2 No. 950
	TUV VDE0806
	DHHS 21 CFR Sub-chapter J
EMI	FCC Rules and Regulations, Part 15, Class A
	VDE 0871 Level B Radio Protection Mark
	EN 55022 Class A
	MPR 1990:10
	CISPR 22
SWEDAC Recommended	MPR 1990:10 (ES version only)
	CISPR 22 (ES version only)

2

Removal and Replacement Procedures

INTRODUCTION

This chapter provides removal and replacement procedures for major modules.

Tools

To perform these procedures, you'll need the following tools:

- Insulated No. 1 Phillips screwdriver
 - Insulated No. 2 Phillips screwdriver
 - Insulated 12-inch flat-blade screwdriver
 - Long-nose pliers
 - Test leads
-

Safety

Before beginning any procedure, familiarize yourself with the following safety warnings and cautions:

- ⚠ **Warning** When the cover of the terminal is removed, you are exposed to high-voltage electrical hazards. If you need to work with the cover removed,
 - Turn the power off and unplug the power cord before removing the cover.
 - Use insulated or nonconductive tools.
 - Remove jewelry from your hands and wrists.
 - Keep one hand behind you while working on the terminal.
 - Test the potential of high-voltage circuits with a voltmeter prior to handling. Residual high voltage that can cause electrical shock may be present for long periods of time.
- ⚠ **Warning** Use extreme caution when working with or around the CRT. Even a slight fracture of the glass envelope can result in an implosion due to the vacuum inside the tube. This can result in the electron gun in the neck of the CRT penetrating the viewing surface. Always hold the CRT with the neck pointing toward you.
- **Caution** To help prevent damage to circuit components,
 - Avoid wearing clothing made of synthetic fabrics.
 - Handle circuit boards only by their edges.
 - Wear a grounding strap that is connected to the terminal's chassis.
- ⚠ **Warning** If you wear a grounding strap, remove it before turning on the terminal.

PROCEDURES

Except for the logic PCB/firmware, all assemblies are accessible only after the cover is removed.

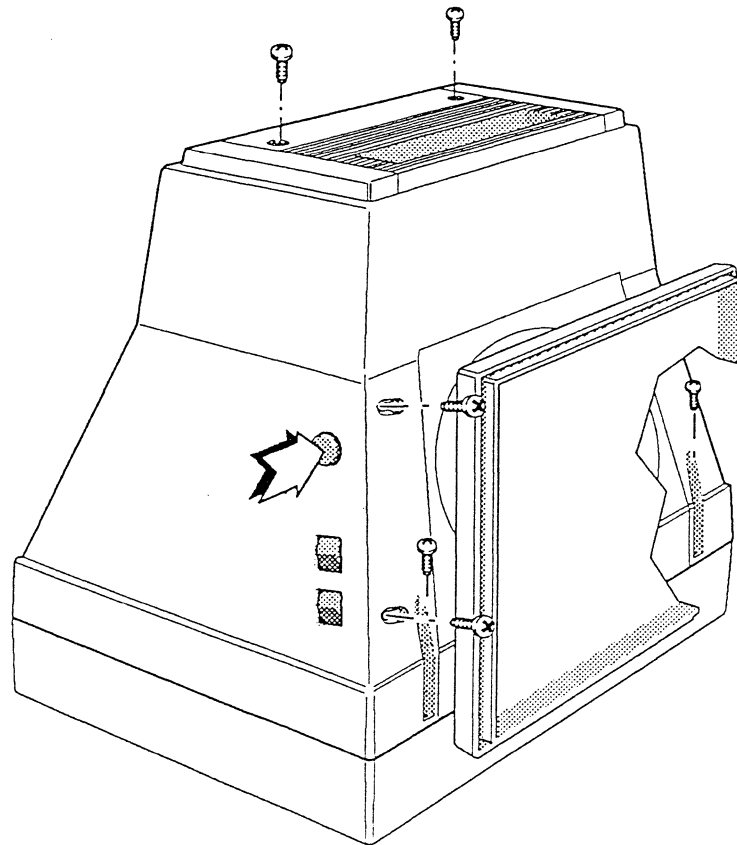
- Note** To replace assemblies, perform removal procedures in the reverse order.
-

Cover

Perform the following steps to remove the cover (see Figure 2-1):

- 1 Rest the display face of the terminal on a padded nonscratch surface.
 - 2 Remove the two screws at the rear of the terminal.
 - 3 Remove the two screws at the base of the bezel.
 - 4 Remove the two screws that secure the operator control assembly. Push the operator control assembly back into the terminal as far as it will go.
 - 5 Carefully lift the cover straight up and away from the terminal.
-

Figure 2-1 Cover Removal



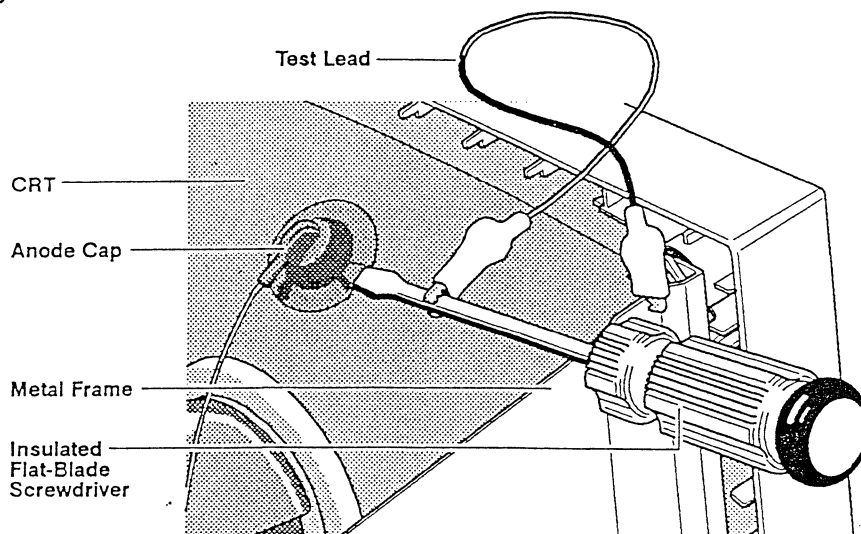
Discharging the Anode and Disconnecting the Anode Cap

Perform the following steps to discharge the anode and disconnect the anode cap (see Figure 2-2):

⚠ Warning You must always discharge the anode before removing the monitor PCB or CRT, but be aware that the anode will build a residual charge even when the power is off. Avoid touching the anode when handling the CRT.

- 1 Turn off the terminal.
- 2 Unplug the power cable.
- 3 With a test lead, ground the shaft of an insulated flat-blade screwdriver to the terminal's metal frame.
- 4 Slip the screwdriver blade between the anode cap and the CRT, and touch the blade to the spring clips under the cap.
- 5 Disconnect the anode lead from the CRT by squeezing the spring clips together with long-nose pliers.

Figure 2-2 Discharging the Anode

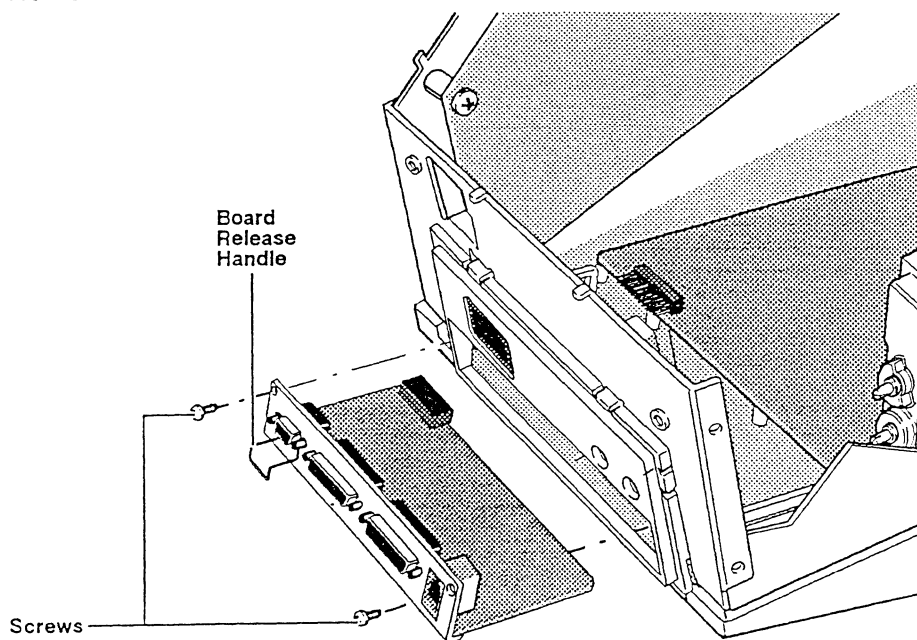


Logic PCB

Perform the following steps to remove the logic PCB from the terminal (see Figure 2-3):

- 1 Remove the two screws that secure the logic PCB to the terminal.
- 2 Grasp the board release handle at the connector labeled *SERIAL 2* and pull the logic PCB assembly straight out and away from the terminal.

Figure 2-3 Logic PCB Removal

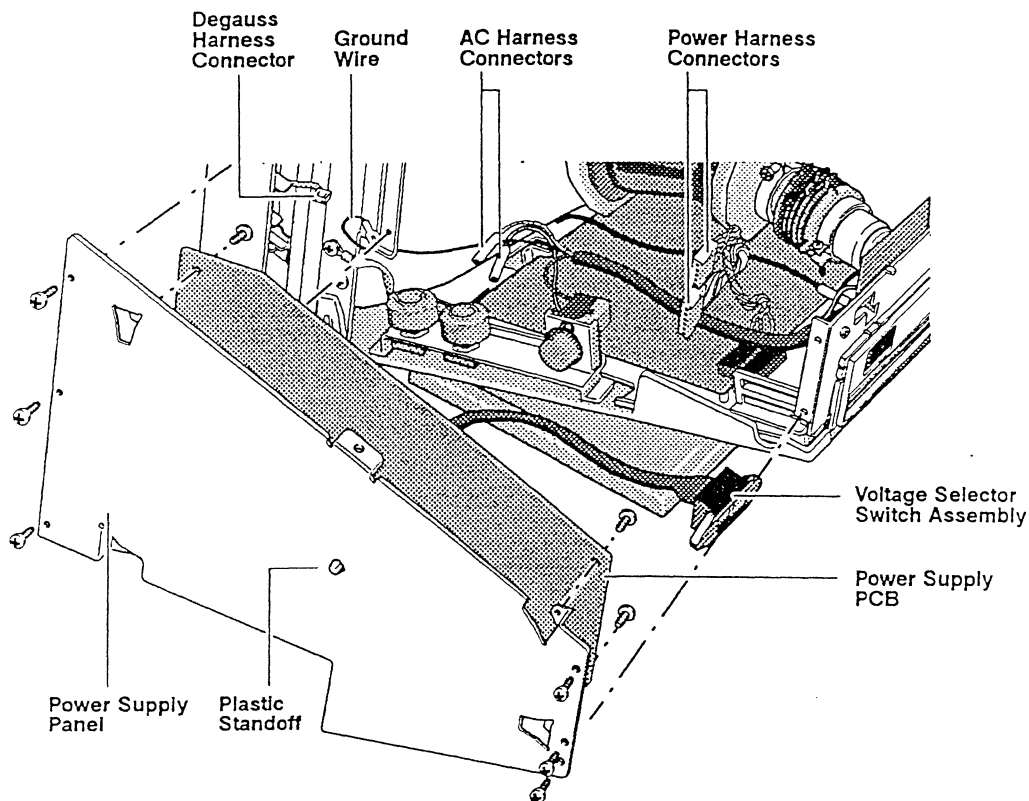


Power Supply PCB

Perform the following steps to remove the power supply PCB from the terminal (see Figure 2-4):

- 1 Remove the cover of the terminal.
 - 2 Remove the six screws that secure the power supply panel to the terminal. (Note that one of the screws holds the AC harness black ground wire to the power supply panel.)
 - 3 Remove the two screws that secure the voltage selector switch assembly and remove the switch assembly from the rear bracket assembly.
 - 4 Unplug the following harness from the power supply PCB:
 - Degauss harness, blue and brown wires (2-pin connector marked *P101*)
 - Power supply to monitor harness (6-pin connector marked *P102*)
 - Power supply to monitor harness (5-pin connector marked *P103*)
 - AC power connector harness, brown wire (1-pin connector marked *L*)
 - AC power connector harness, blue wire (1-pin connector marked *N*)
 - 5 Carefully remove the power supply assembly from the unit.
 - 6 Remove the four screws holding the power supply PCB to the power supply panel.
 - 7 Use needle-nose pliers to press in on the plastic standoff (see Figure 2-4) and push it through the power supply panel. Separate the power supply PCB from the panel.
- Note** Do not remove the plastic standoff from the power supply PCB.

Figure 2-4 Power Supply Removal



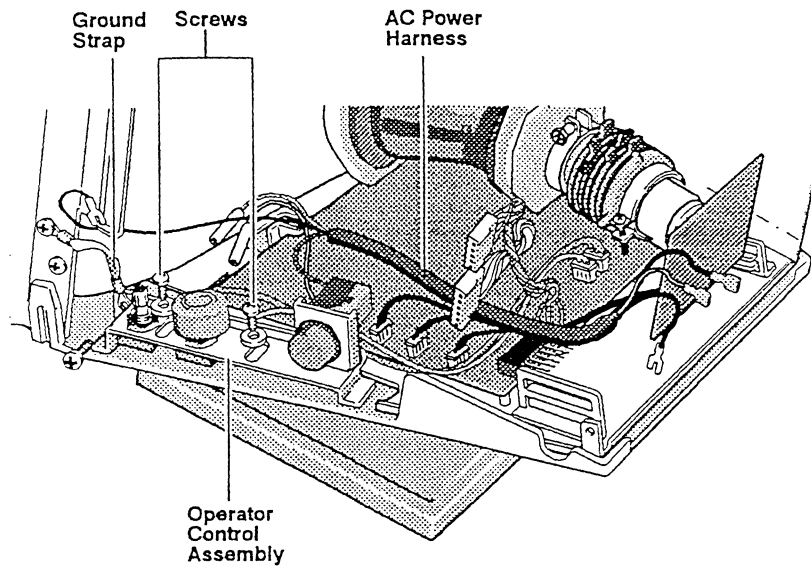
Operator Control Assembly

Perform the following steps to remove the operator control assembly (see Figure 2-5):

- 1 Remove the cover of the terminal.
- 2 Remove the two screws that secure the operator control assembly to the base of the terminal.
- 3 Unplug the AC power connector harness (brown and blue wires) from the AC input filter.
- 4 Loosen the screw that secures the AC harness ground (black wire) to the power supply panel and disconnect the wire.
- 5 Loosen the screw that secures the AC harness ground (black wire) to the rear bracket assembly and disconnect the wire.
- 6 Unplug the brown wire of the AC power connector harness (1-pin connector marked *L*) from the power supply.
- 7 Unplug the blue wire of the AC power connector harness (1-pin connector marked *N*) from the power supply.
- 8 Unplug the contrast harness, grey wire (3-pin connector marked *VR501*), from the monitor PCB.
- 9 Unplug the brightness harness, brown wire (3-pin connector marked *VR502*), from the monitor PCB.

- 10 Carefully remove the operator control assembly from the unit.

Figure 2-5 Operator Control Assembly Removal



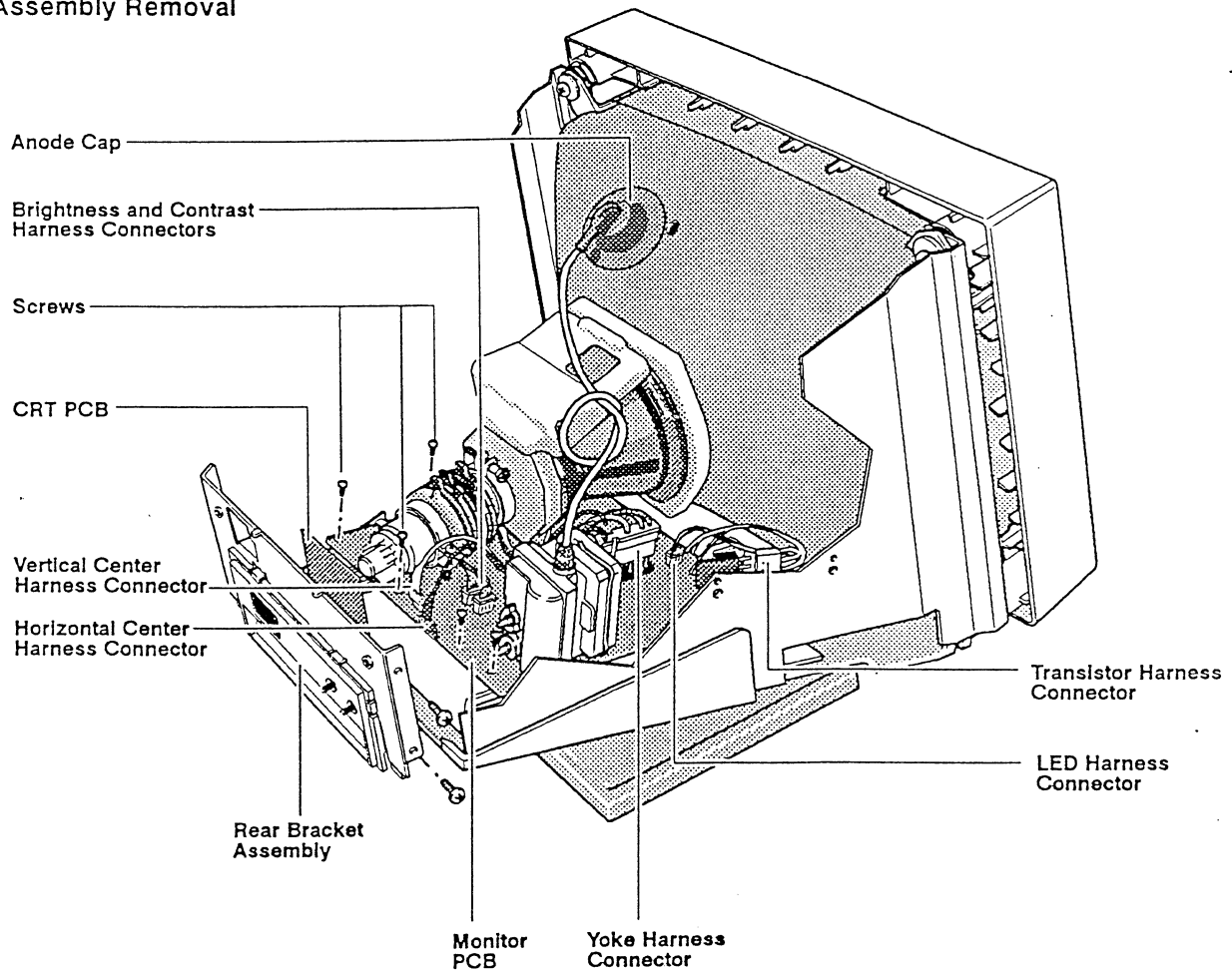
Monitor PCB Assembly

Perform the following steps to remove the monitor PCB assembly (see Figure 2-6):

- 1 Remove the cover of the terminal.
- 2 Remove the logic PCB.
- 3 Remove the power supply assembly.
- 4 Remove the two screws that secure the rear bracket assembly panel to the unit.
- 5 Unplug the vertical center harness, grey wire (3-pin connector marked *P303*), from the centering PCB on the rear bracket assembly.
- 6 Unplug the horizontal center harness, brown wire (3-pin connector marked *P801*), from the centering PCB on the rear bracket assembly.
- 7 Discharge the CRT anode and disconnect the anode cap.
- 8 Unplug the CRT PCB.
- 9 Unplug the CRT ground wire (black) from the CRT PCB.
- 10 Unplug the yoke harness (6-pin connector marked *P201*) from the monitor PCB.
- 11 Unplug the horizontal output harness from the horizontal output transistor.
- 12 Remove the six screws that secure the monitor PCB to the base.
- 13 Unplug the power indicator harness (2-pin connector marked *P301*) from the monitor PCB.

14 Carefully remove the monitor PCB assembly from the unit.

Figure 2-6 Monitor PCB Assembly Removal



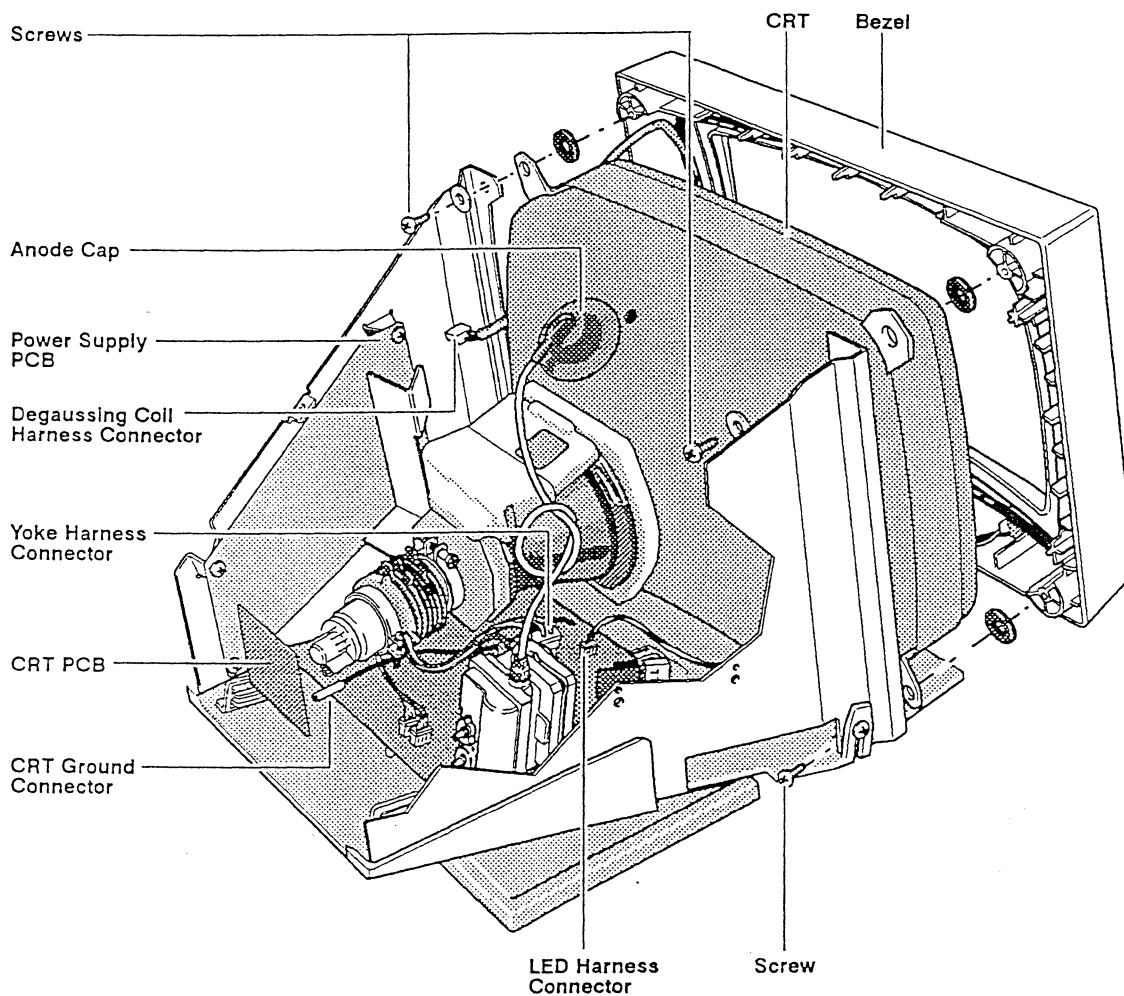
CRT Assembly and Bezel

Perform the following steps to remove the CRT assembly and bezel (see Figure 2-7 for the location of components in this procedure):

- 1 Rest the display face of the terminal on a padded nonscratch surface.
- 2 Remove the cover of the terminal.
- 3 Unplug the power indicator harness (2-pin connector marked *P301*) from the monitor PCB.
- 4 Unplug the yoke harness (6-pin connector marked *P201*) from the monitor PCB.
- 5 Unplug the CRT PCB.
- 6 Unplug the CRT ground wire (black) from the CRT PCB.
- 7 Unplug the degauss harness (6-pin connector marked *P101*) from the power supply PCB.

- 8 Discharge the CRT anode and unplug the anode cap.
- 9 Remove the four screws holding the CRT assembly to the bezel and remove the base.
- 10 Carefully lift the CRT assembly from the bezel.

Figure 2-7 CRT and Bezel Removal



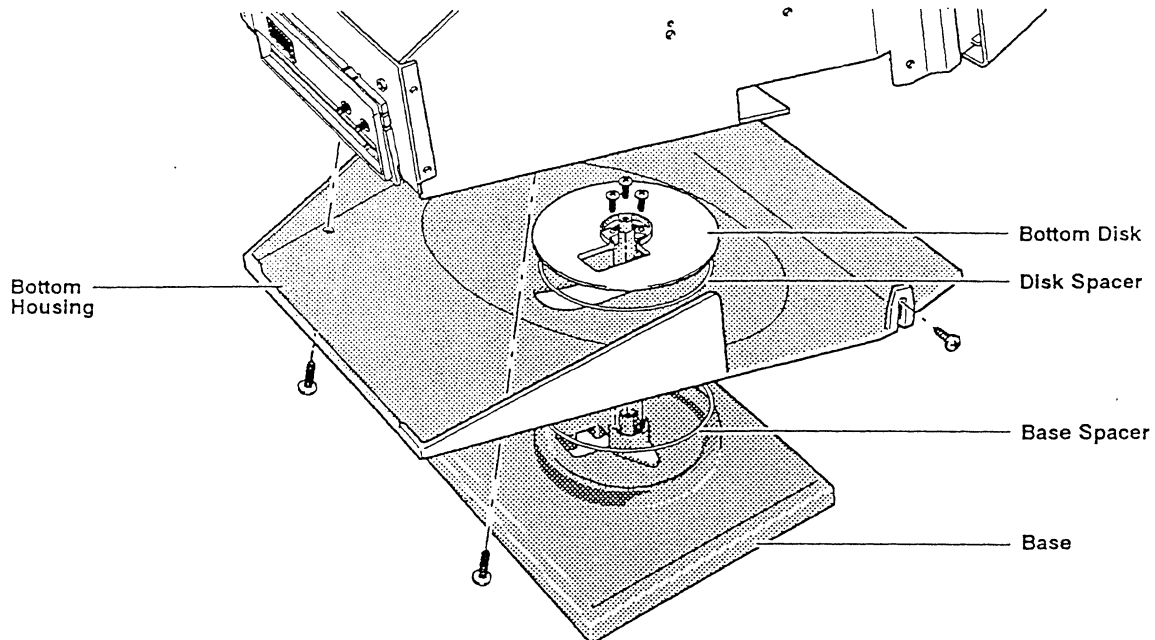
Tilt/Swivel Base

Perform the following steps to remove the tilt/swivel base (see Figure 2-8 for the location of the tilt/swivel base components in this procedure):

- 1 Rest the display face of the terminal on a padded nonscratch surface.
- 2 Remove the cover of the terminal.
- 3 Remove the two screws holding the bottom housing and tilt/swivel base assembly to the metal frame of the terminal. These screws are accessed from the bottom of the unit.
- 4 Remove the two screws that secure the operator control assembly to the bottom housing.

- 5 Separate the bottom housing and tilt/swivel base assembly from the metal frame.
- 6 Remove the three screws holding the tilt/swivel base together.

Figure 2-8 Tilt/Swivel Base Removal

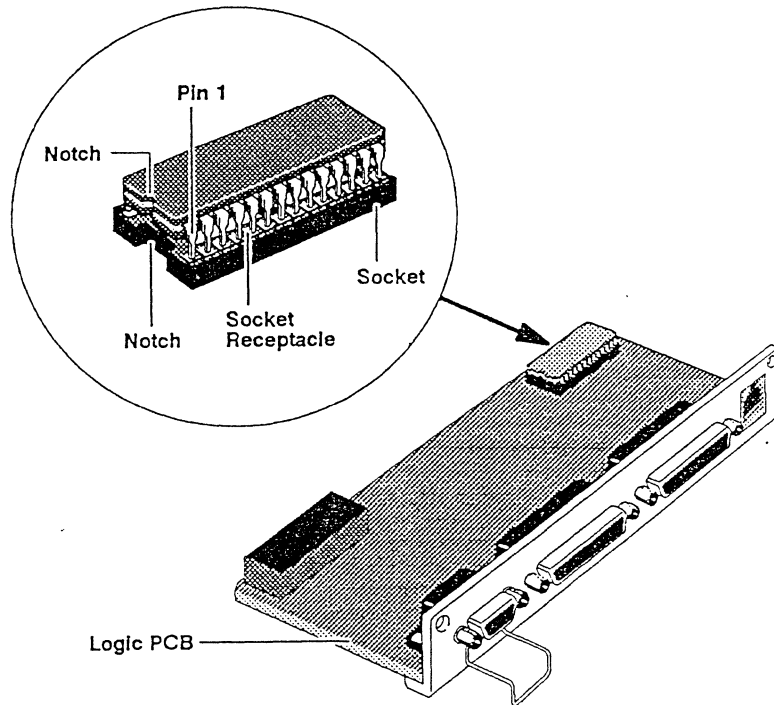


EPRM

Perform the following steps to remove and replace the EPRM (see Figure 2-9):

- 1 Remove the logic PCB.
 - 2 Locate and remove the EPRM at location U5.
 - 3 Place the updated EPRM over the socket at location U5.
 - 4 Ensure that the pins are aligned with the socket receptacle and the notch on the EPRM is aligned with the notch on the socket.
- **Caution** The pins on the EPRM are very fragile and bend easily. Be particularly careful with them, and make sure that each pin is aligned at a 90-degree angle with its receptacle. Hold the chip at each end with your thumb and index finger as you insert it in the socket.
- 5 Press on the EPRM until it is seated in the socket.
 - 6 Inspect the EPRM for bent pins. If it is not seated correctly, repeat these instructions starting with step 3.
 - 7 Replace the logic PCB.

Figure 2-9 EPROM Removal and Replacement

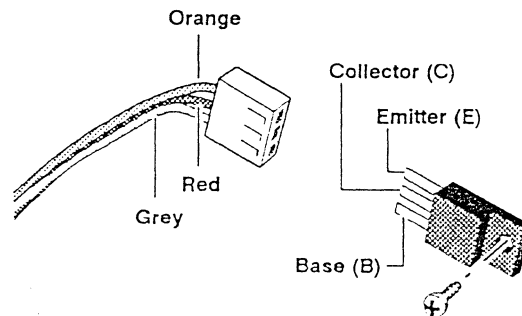


Horizontal Output Transistor

Perform the following steps to remove the horizontal output transistor (see Figure 2-10):

- 1 Remove the cover of the terminal.
- 2 Unplug the 3-pin harness at the horizontal output transistor.
- Note** Observe the orientation of the harness as you unplug it from the horizontal output transistor. Remember that the orange wire faces the top of the unit.
- 3 Remove the screw that secures the horizontal output transistor to the metal frame of the terminal.
- 4 Remove the horizontal output transistor.

Figure 2-10 Horizontal Output Transistor Removal



3

Module-Level Troubleshooting

INTRODUCTION

This chapter describes symptoms and solutions for problems you may encounter when servicing this terminal. The material is organized to help you diagnose a problem as quickly as possible.

- Note** If any disassembly is required, refer to Chapter 2, “Removal and Replacement Procedures.”

Tools


We recommend that you have the following tools and test equipment available when servicing the terminal:

- Insulated 12-inch flat-blade screwdriver
- Insulated No. 1 Phillips screwdriver
- Insulated No. 2 Phillips screwdriver
- Test leads
- Digital multimeter
- High-voltage probe
- 150 MHz oscilloscope
- DB-25 even parallel loopback connector (part number 120163-01)
- DB-25 odd parallel loopback connector (part number 120164-01)
- DB-25 serial loopback connector (part number 120182-01)
- 9-pin loopback connector (part number 120095-01)

- Note** See Tables 3-3 through 3-6 at the end of this chapter for the wiring connections of the four loopback connectors.

Safety

Before beginning any procedure, familiarize yourself with the following safety warning:

-  **Warning** This terminal contains lethal voltage levels. Observe all normal high-voltage equipment servicing precautions.
- Turn the power off and unplug the power cord before removing the cover.
 - Use only insulated or nonconductive tools.
 - Remove jewelry from your hands and wrists.
 - Turn off power except when making voltage or signal checks.
 - Discharge the anode lead before disconnecting the lead from the CRT. Refer to the procedure “Discharging the Anode” in Chapter 2.
 - Use extreme caution when working near the CRT. The tube may implode if the glass is fractured.
 - Keep one hand behind you when working inside the terminal.

- **Caution** To help prevent damage to circuit components,
 - Avoid wearing clothing made of synthetic fabrics.
 - Handle circuit boards only by their edges.
 - Wear a grounding strap that is connected to the terminal's chassis.
- ⚠ **Warning** If you wear a grounding strap, remove it before turning on the terminal.
 - Always use the manufacturer's replacement components. Critical components, as indicated on the circuit schematics, should not be replaced with any component other than the manufacturer's. Where a short circuit has occurred, replace those components that indicate evidence of overheating.

PRIMARY TROUBLESHOOTING PROCEDURES Begin troubleshooting by preparing the terminal properly and running the diagnostic self-test.

Diagnostic Self-Test The diagnostic self-test checks the functionality of several sections of the logic on the PCB, and it can identify some video problems. If the test detects an error, an error code is displayed on the screen. Error codes are defined in Table 3-1.

Table 3-1 Error Codes

Code	Failure
0	Character RAM
1	Attribute RAM
2	Font RAM
A	Main Port RTS to CTS
C	Main Port DTR to DCD
D	Serial 2 RTS to CTS
E	Serial 2 RTS to DTR
F	Serial 2 DTR to DCD
K	Lost Setup (Battery)
P	EPROM Checksum
R	Main Port DTR to DSR
X	Main Port TXD to RXD
Y	Serial 2 TXD to RXD
a	Parallel Port D6 to D7 (Error) Error
b	Parallel Port D2 to D3 (Busy) Error
c	Parallel Port D4 to D5 (PE) Error
d	Parallel Port D0 to D1 (Error) Error

Perform the following steps to run the diagnostic self-test:

- 1 Plug the loopback connectors into the appropriate ports.
- **Note** This test will function with either parallel loopback connector. It is recommended that you execute the test twice—once with the even parallel loopback connector, and once with the odd loopback connector. In each case, the LED on the parallel port connectors will blink continuously to show proper operation.
- 2 Turn on the terminal. If the terminal is operating correctly, it will eventually show a display of all possible characters shifting across the screen.

- 3 If any one of the error codes listed in Table 3-1 is displayed, replace the logic PCB.
- 4 If there is no display on the screen, the information in Figure 3-1 will help determine if the CRT, the power supply PCB, the monitor PCB, or the logic PCB requires replacement.

Figure 3-1 Troubleshooting Flowchart

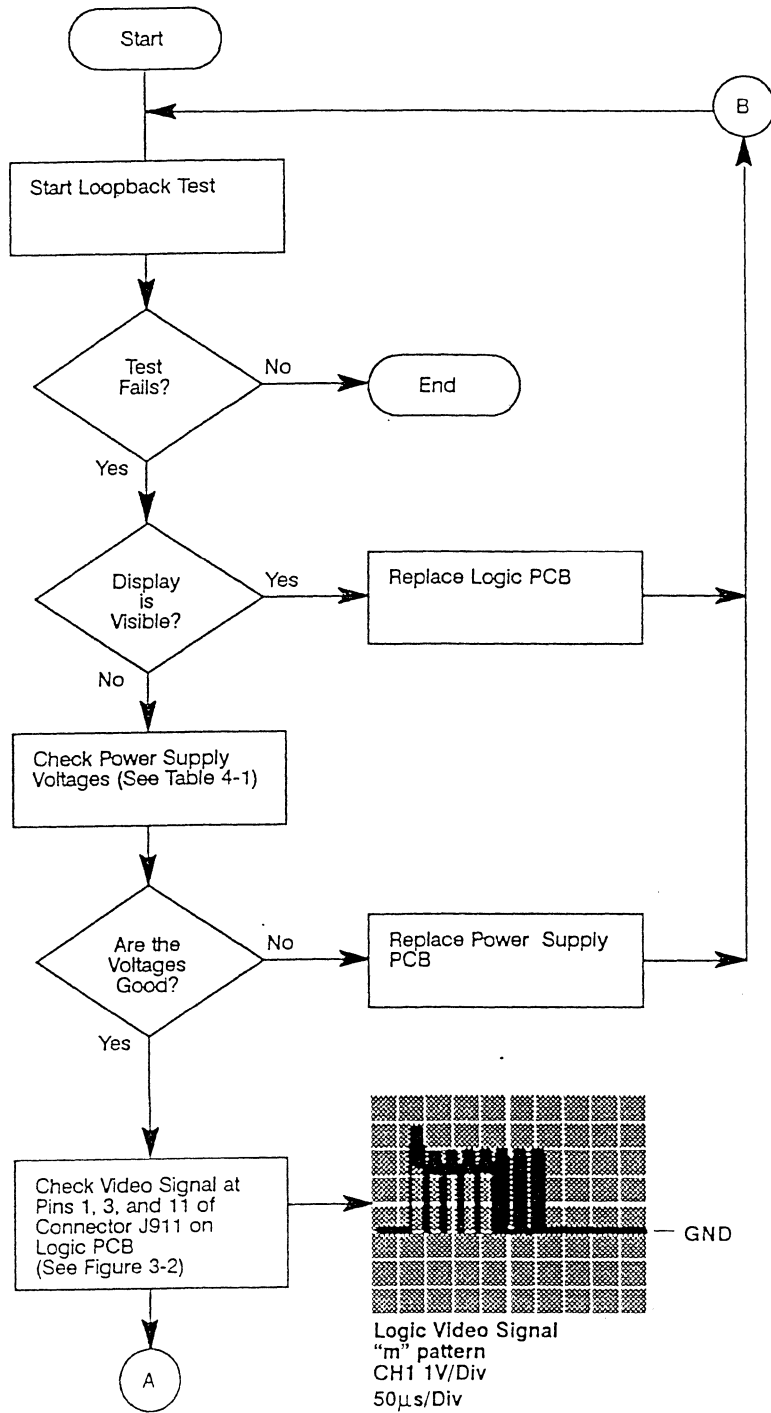


Figure 3-1 Troubleshooting Flowchart, Continued

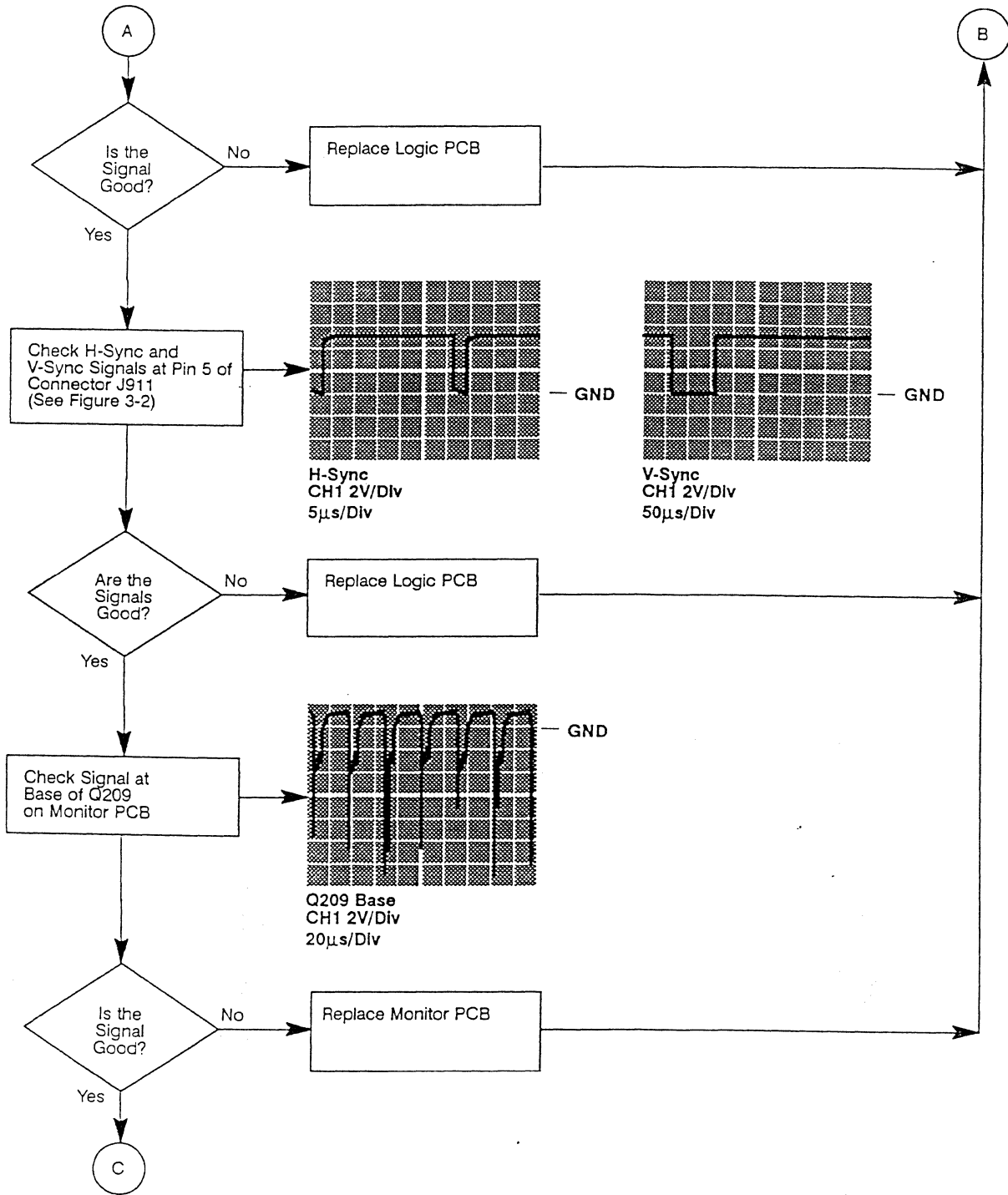


Figure 3-1 Troubleshooting Flowchart, Continued

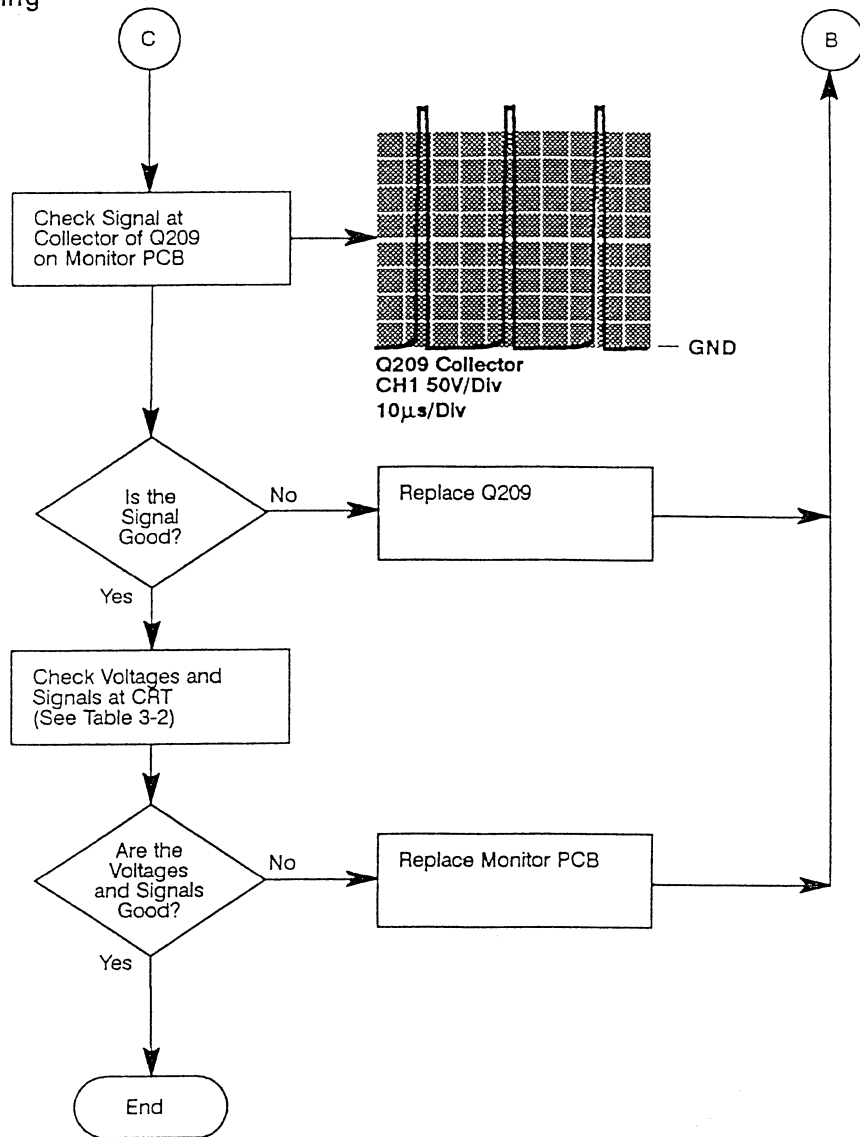


Figure 3-2 Connector J911 Pin Assignments

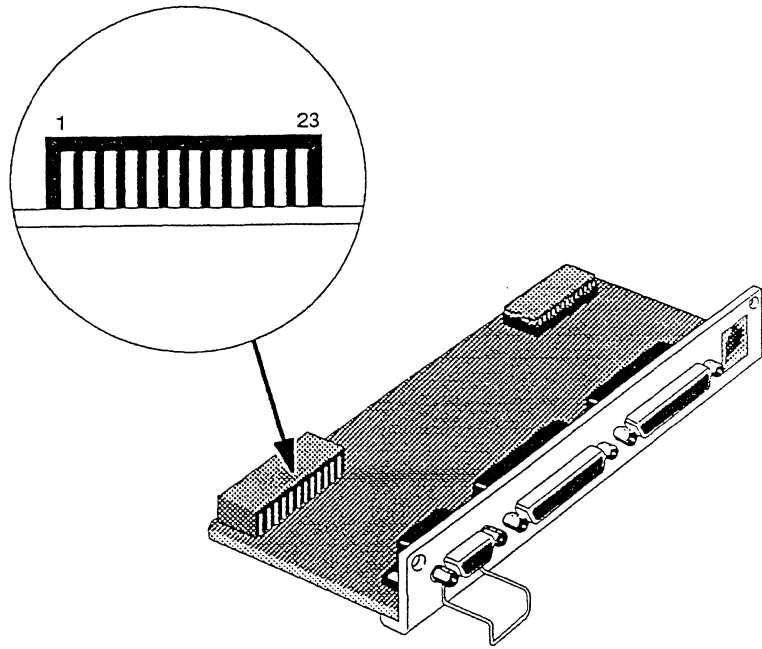
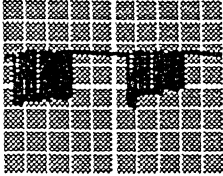
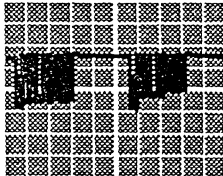
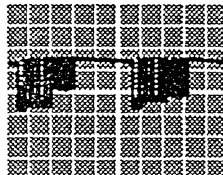
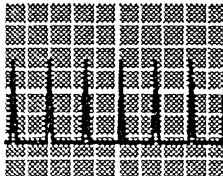


Table 3-2 CRT Voltages and Signals

Test Point	Voltage	Signal
G1	-26.5 VDC	None
G2	+ 259 VDC	None
KB	+ 62 VDC	 <p>"m" pattern CH1 20V/Div 100μs/Div</p> <p>GND</p>
KG	+ 65.3 VDC	 <p>"m" pattern CH1 20V/Div 100μs/Div</p> <p>GND</p>
KR	+ 59.7 VDC	 <p>"m" pattern CH1 20V/Div 100μs/Div</p> <p>GND</p>
H1	0 VDC (Ground)	None
H2	+ .3 VAC	 <p>CH1 20V/Div 100μs/Div</p> <p>GND</p>

**LOOPBACK CONNECTOR
WIRING REFERENCES**

Tables 3-3 through 3-6 will direct you in wiring the loopback connectors correctly. These tables are intended as a guide for preparing the loopback connectors for use when running the diagnostic self-test procedure.

**Table 3-3 DB-25 Even Parallel
Loopback Connector Wiring**

From Pin	To Pin
2	10
4	11
6	12
8	15
1*	17*

* An LED is installed between pin 1 (cathode side of LED) and pin 17 (anode side of LED) of the DB-25 even parallel loopback connector.

**Table 3-4 DB-25 Odd Parallel
Loopback Connector Wiring**

From Pin	To Pin
3	10
5	11
7	12
9	15
1*	17*

* An LED is installed between pin 1 (cathode side of LED) and pin 17 (anode side of LED) of the DB-25 odd parallel loopback connector.

**Table 3-5 DB-25 Serial
Loopback Connector Wiring**

From Pin	To Pin
2	3
4	5
6	8
8	20

**Table 3-6 9-Pin Loopback
Connector Wiring**

From Pin	To Pin
1	4
2	3
4	6
6	9
7	8

4

Alignment and Adjustment Procedures

OVERVIEW

This chapter is divided into three sections:

- Section one provides an introduction and general setup instructions.
- Section two provides alignment and adjustment procedures.
- Section three provides a quick reference to the alignment and adjustment procedures.

Each adjustment is composed of four parts:

- Part one is the name of the adjustment.
- Part two is the test point and/or setup procedure for making the adjustment.
- Part three is the specification and tolerance for the adjustment.
- Part four is the actual adjustment.

The adjustment procedures are presented in the order in which they should be performed. If you are performing a complete terminal alignment, do not deviate from the order in which the adjustments are shown. If you are performing a subset of the complete alignment, check the tolerances of all procedures that follow the subset.

Tools

To verify or perform the adjustments for this terminal, you will need the following tools and test equipment:

- Insulated No. 1 Phillips screwdriver
- Insulated 12-inch flat-blade screwdriver
- Hex-head, nonconductive, tuning (alignment) tool
- Digital multimeter
- Photometer (recommended photometer: Minolta TV-2130)
- Test leads
- DB-25 even parallel loopback connector (part number 120163-01)
- DB-25 odd parallel loopback connector (part number 120164-01)
- DB-25 serial loopback connector (part number 120182-01)
- 9-pin loopback connector (part number 120095-01)

Safety

Before beginning any procedure, familiarize yourself with the following safety warning:

- ⚠ Warning** This terminal contains lethal voltage levels. Observe all normal high-voltage equipment servicing precautions.
- Turn the power off and unplug the power cord before removing the cover.
 - Use only insulated or nonconductive tools.
 - Remove jewelry from your hands and wrists.
 - Turn off power except when making voltage or signal checks.
 - Discharge the anode lead before disconnecting the lead from the CRT. Refer to the procedure “Discharging the Anode” in Chapter 2.
 - Use extreme caution when working near the CRT. The tube may implode if the glass is fractured.
 - Keep one hand behind you when working inside the terminal.
- Caution** To help prevent damage to circuit components,
- Avoid wearing clothing made of synthetic fabrics.
 - Handle circuit boards only by their edges.
 - Wear a grounding strap that is connected to the terminal’s chassis.
- ⚠ Warning** If you wear a grounding strap, remove it before turning on the terminal.
- Always use the manufacturers’s replacement components. Critical components, as indicated on the circuit schematics, should not be replaced with any component other than the manufacturer’s. Where a short circuit has occurred, replace those components that indicate evidence of overheating.

GENERAL SETUP

Refer to Figures 4-1 through 4-3 for locations of test and adjustment points.

- 1 Remove the terminal housing (refer to the instructions in Chapter 2).
- 2 Install the loopback connectors into the appropriate jacks.
- 3 Point the neck of the CRT west.
- 4 Turn on the terminal. The terminal will enter into its self-test routine; twenty-five rows of text will scroll across the screen. If the terminal displays any error codes, refer to Chapter 3. “Module-Level Troubleshooting,” and repair the unit before proceeding with the alignment.
- 5 Allow the terminal to warm up for 30 minutes.
- 6 Enter the “m” test pattern by pressing Spacebar.

Several test patterns are called for in this procedure. Please refer to Figure 4-4 for information about how to display the requested test pattern. Test patterns are displayed by pressing a numeric or control key on the keyboard.

Figure 4-1 Power Supply PCB
Test and Adjustment Points

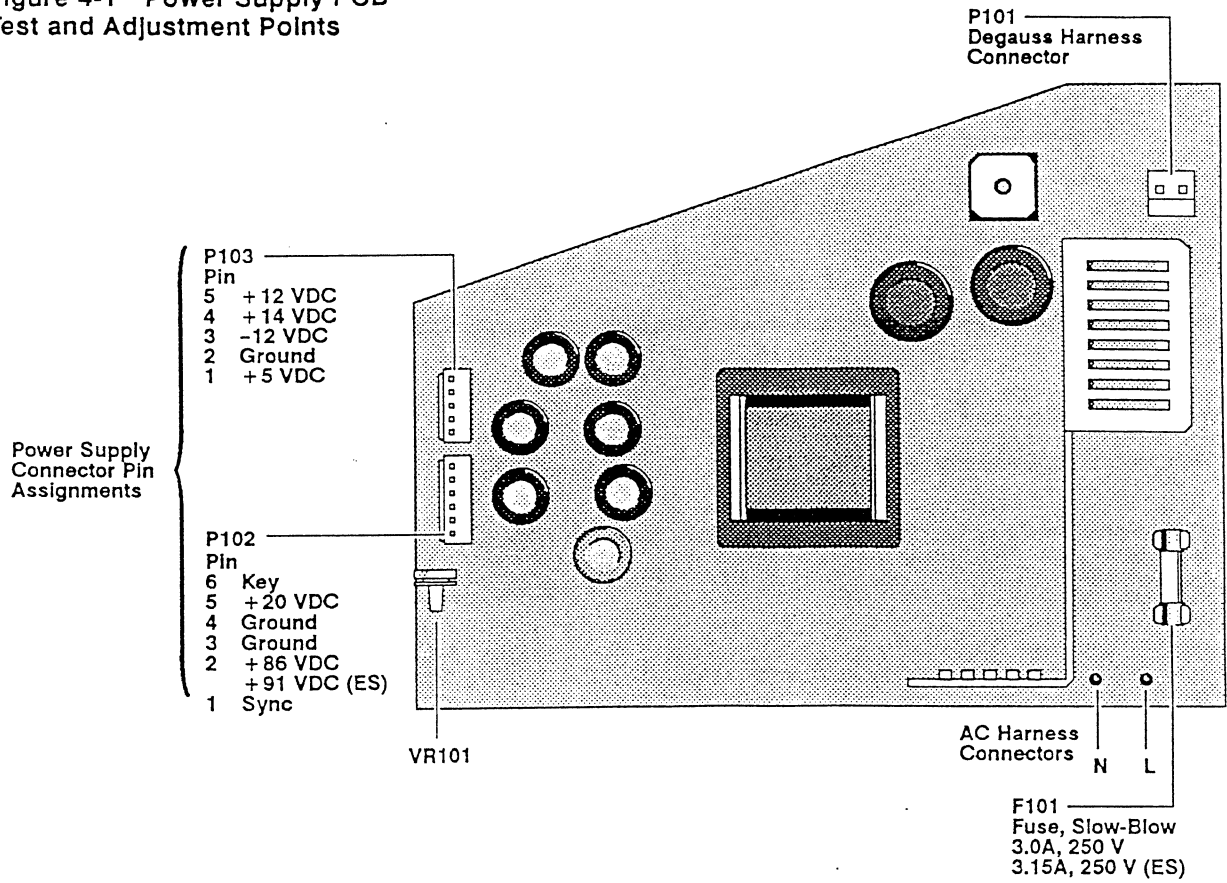


Figure 4-2 Monitor PCB Test and Adjustment Points

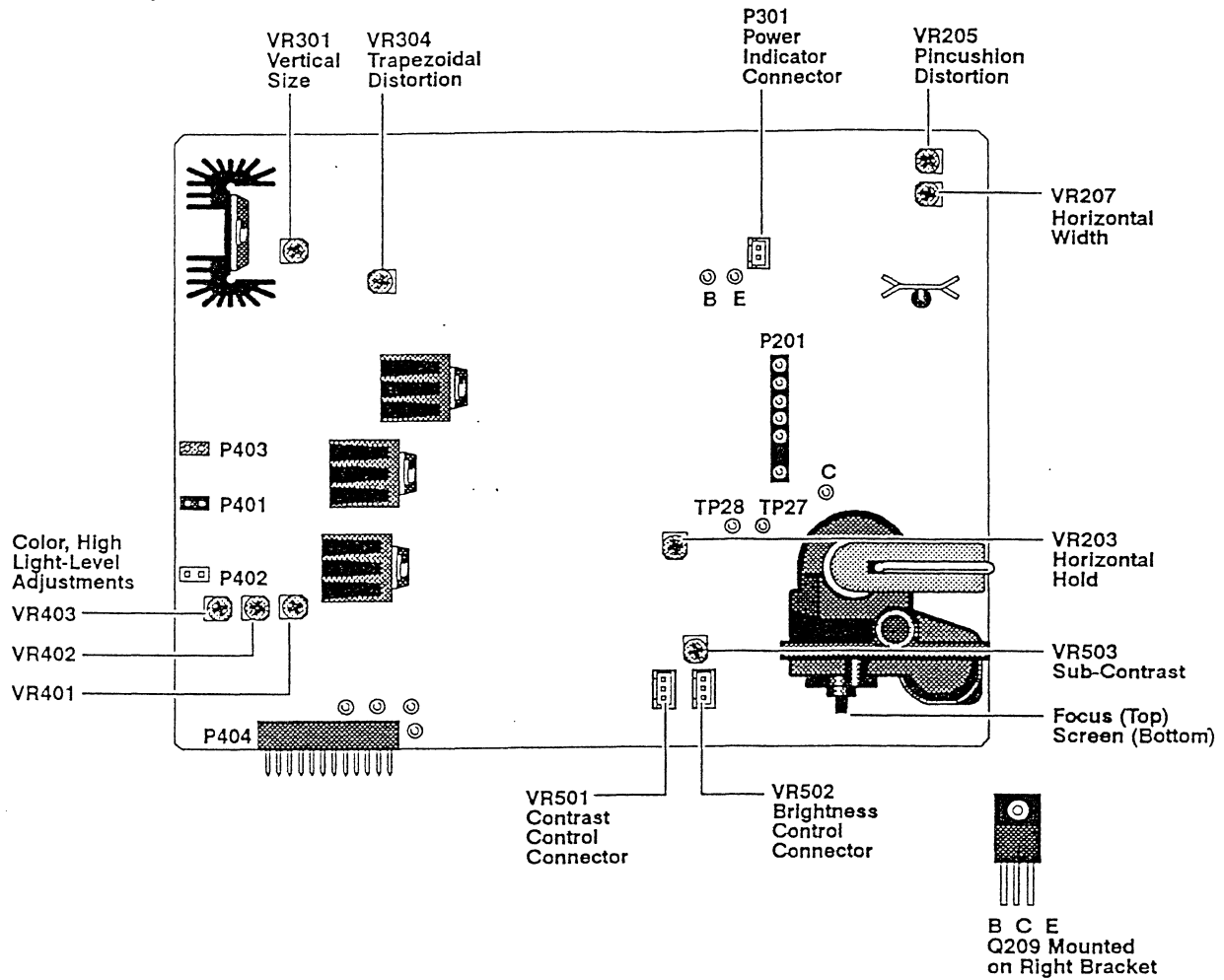


Figure 4-3 CRT PCB Test and Adjustment Points

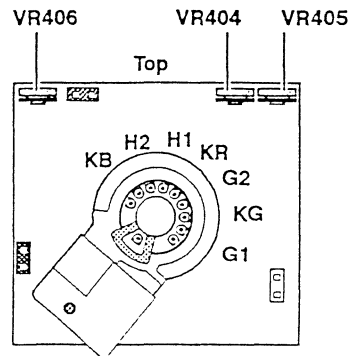
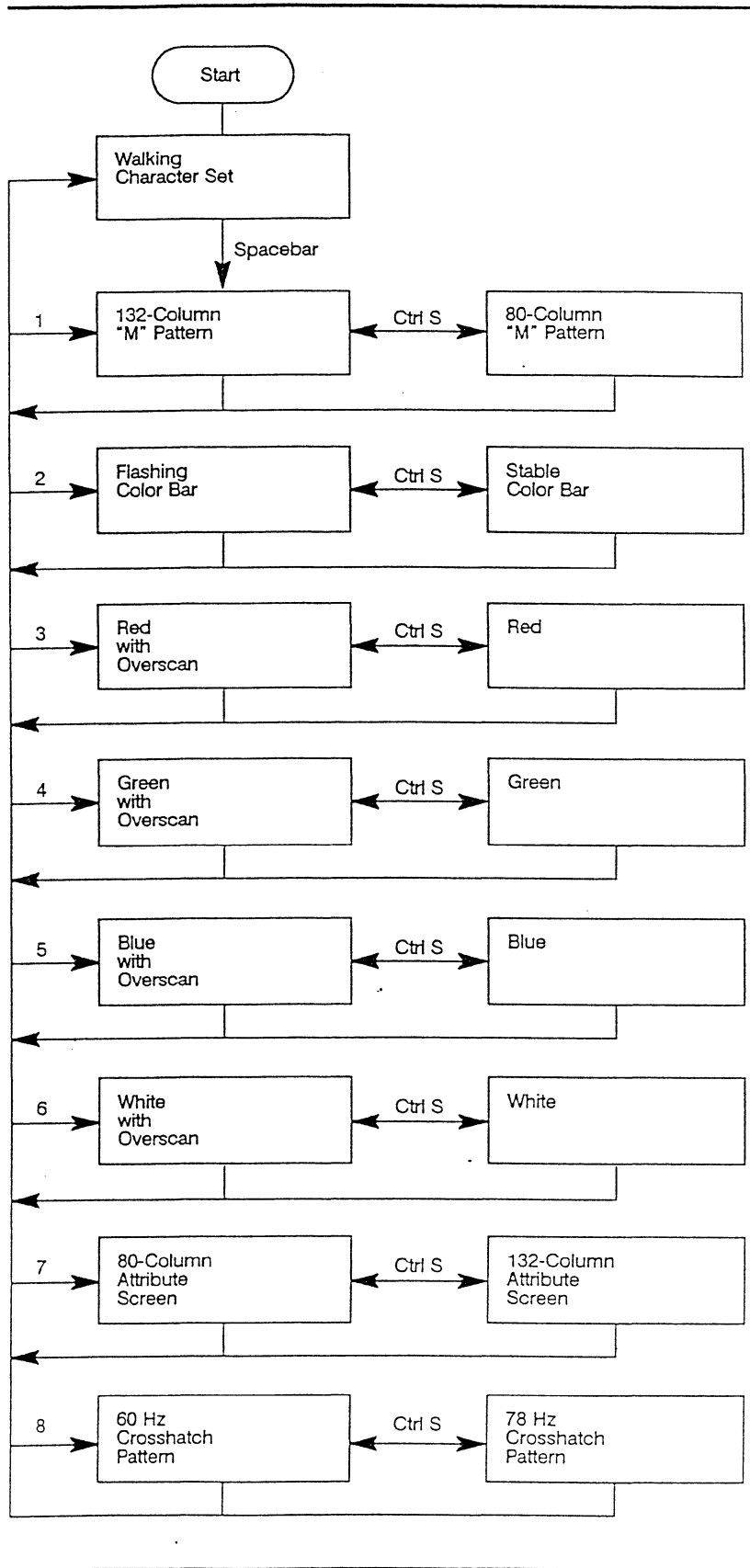


Figure 4-4 Test Pattern Flowchart



**ALIGNMENT AND
ADJUSTMENT PROCEDURES**

This section describes the alignment and adjustment procedures for this terminal. Refer to Figures 4-1 through 4-3 for locations of test and adjustment points.

Before proceeding to the next section, familiarize yourself with the test pattern flowchart (Figure 4-4). The adjustments in the following procedures require the test patterns shown in the flowchart to be displayed on the screen.

- Note** If you are aligning the terminal, adjust all parameters to specification. If you are checking terminal alignment, the parameters may be anywhere within the stated tolerance. If you adjust a parameter, you must check all other parameters following that procedure.

Power Supply Adjustment

Refer to Figure 4-1 for the test and adjustment points on the power supply.

Test point/setup—Using a digital multimeter, measure the DC voltage at pin 2 of P102 (red wire at P102).

Measurement— + 86 VDC \pm 0.5 VDC (+ 91 VDC \pm 0.5 VDC for ES version).

Adjustment—Adjust VR102 to meet the power supply adjustment specification.

Test point/setup—Using a digital multimeter, measure the supply voltages listed in Table 4-1 for correct tolerance.

**Table 4-1 Power Supply
Voltages**

Voltage	Tolerance	Test Point
+ 86 VDC	\pm 0.5 VDC	P102 pin 2 (red wire)
+ 91 VDC (ES)	\pm 0.5 VDC	P102 pin 2 (red wire)
+ 20 VDC	\pm 2.0 VDC	P102 pin 5 (orange wire)
+ 14 VDC	\pm 0.7 VDC	P103 pin 4 (orange wire)
+ 12 VDC	\pm 0.6 VDC	P103 pin 5 (yellow wire)
+ 5 VDC	\pm 0.25 VDC	P103 pin 1 (brown wire)
-12 VDC	\pm 0.6 VDC	P103 pin 3 (red wire)

X-Ray Protection

Test point/setup—Display the 132-column “m” pattern on the screen.

Attach the test lead between TP27 to TP28 on the monitor PCB (see Figure 4-2). The display must disappear. If the display appears, repair the monitor PCB before proceeding.

Remove the test lead and turn off the power. Wait a few seconds and turn the power on; the display should return.

Horizontal Center Adjustment

Test point/setup—Display the crosshatch pattern on the screen.

Turn up the brightness control until the background raster is visible.

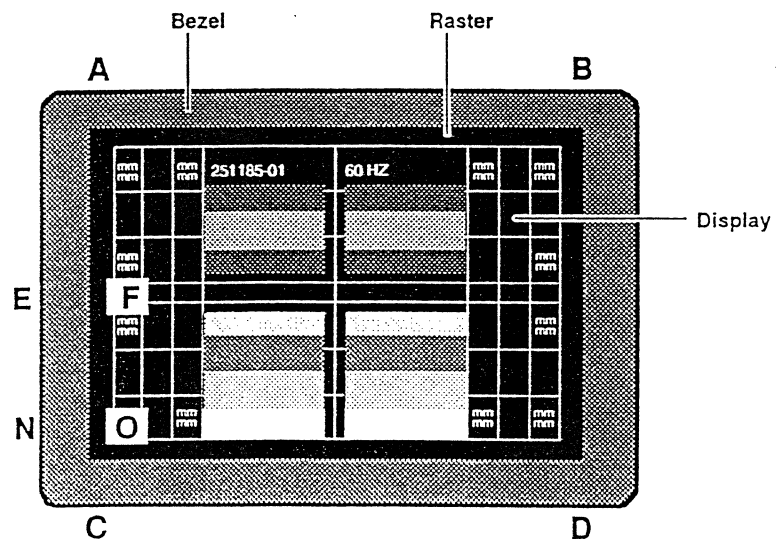
Measurement—The raster should be centered to the bezel (< 3 mm).

Adjustment—Adjust VR801 on the centering PCB at the rear of the terminal to center the raster to the bezel.

- Note** It may be necessary to reduce the picture size by adjusting VR207 to complete the horizontal center adjustment procedure. For instructions on how to adjust VR207, refer to “Horizontal Width Adjustment” later in this chapter.

Horizontal Phase Adjustment	<p>Test point/setup—Display the crosshatch pattern on the screen. Turn up the brightness control until the background raster is visible.</p> <p>Measurement—The test pattern should be centered to the raster (<3 mm).</p> <p>Adjustment—Adjust VR203 on the monitor PCB (see Figure 4-2) to center the display to the raster.</p>
Vertical Center Adjustment	<p>Test point/setup—Display the crosshatch pattern on the screen.</p> <p>Measurement—The test pattern should be centered to the bezel (<3 mm).</p> <p>Adjustment—Adjust VR803 on the centering PCB at the rear of the terminal to center the display in the vertical aspect.</p>
Vertical Size	<p>Test point/setup—Display the crosshatch pattern on the screen.</p> <p>Measurement—The test pattern should be correct vertical size (190 mm \pm 3 mm).</p> <p>Adjustments—Adjust VR301 on the monitor PCB (see Figure 4-2) to meet the vertical size specification.</p>
Horizontal Width Adjustment	<p>Test point/setup—Display the crosshatch pattern on the screen.</p> <p>Measurement—The test pattern should be the correct horizontal width (254 mm \pm 3 mm).</p> <p>Adjustment—Adjust VR207 on the monitor PCB (see Figure 4-2) to meet the horizontal width specification.</p>
Trapezoidal Distortion	<p>Test point/setup—Display the crosshatch pattern on the screen.</p> <p>Measurement—Trapezoidal distortion must be <2.0 mm.</p> <p>Adjustment—Adjust VR304 on the monitor PCB (see Figure 4-2) for proper screen geometry.</p> <p>Measurement and tolerance can be verified using the following formula (see Figure 4-5):</p> $ AB-CD < 2.0 \text{ mm}$

Figure 4-5 Screen Parameters



Pincushion Distortion

Test point/setup—Display the crosshatch pattern on the screen.

Measurement—There should be a minimum pincushion distortion (< 2.0 mm).

Adjustment—Adjust VR205 on the monitor PCB (see Figure 4-2) for minimize pincushion distortion.

Measurement and tolerance can be verified using the following formula (see Figure 4-5):

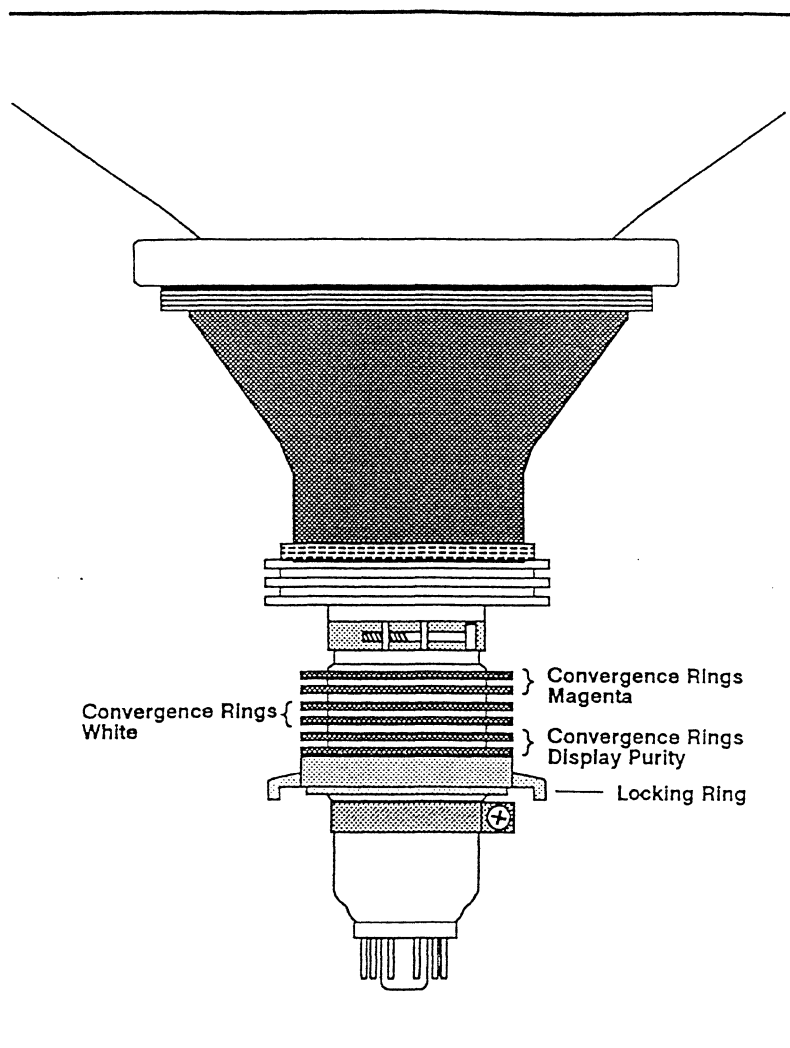
$$|EF - NO| < 2.0 \text{ mm}$$

Convergence

This adjustment is done with the convergence rings located on the neck of the CRT just behind the deflection yoke. The ring set is made up of six rings. These rings are grouped into three sets of two as follows:

- The first set of two rings is the set closest to the rear of the terminal. These are called purity rings. They are used for adjusting overall display purity.
- The second set of rings is to fine-tune the convergence and are adjusted using the white crosshatch pattern. This set moves the red and blue electron beams together so they can be adjusted to lay directly over the green electron beam.
- The third set of rings is used for converging the red and blue beams using the magenta crosshatch pattern. This set of rings moves the red and blue beams separately so they can be aligned to each other.

Figure 4-6 Convergence Rings on the CRT Neck



- Note** This adjustment should be done only if the convergence is noticeably misaligned.

Before attempting this adjustment, check the convergence. The specifications for convergence are:

Center	Not more than .40 mm
2/3 from center	Not more than .50 mm
Outside edges	Not more than .75 mm

To adjust for proper convergence, perform the following steps:

- 1 Display the "m" pattern on the screen.
- 2 Set the operator brightness control to the center detent position.
- 3 Using the photometer, adjust the contrast control for 25 fL on the center box.
- 4 Display the full white pattern on the screen.
- 5 Allow the CRT to warm up for 30 minutes before making any convergence adjustments.
- 6 Degauss the entire screen using an external degaussing coil.
- 7 Loosen the locking ring on the CRT.

- 8 Display the crosshatch pattern on the screen.
- 9 Adjust the third set of convergence rings so the crosshatch pattern shows optimum convergence of the red and blue guns.
- 10 Adjust the second set of centering rings for optimum convergence.
- 11 Carefully tighten the locking ring on the CRT.

Purity

Purity is the overall integrity of the display. When checking purity, you must observe the entire screen for any differences in hue.

Test point/setup—To check purity, display the full white test pattern. Look for any shading or hue differences on the display. For further inspection, display the red, green, and blue screens.

If purity adjustments are necessary, perform the following steps (see Figure 4-6):

- 1 Loosen the locking ring on the CRT.
- 2 Display the full white test pattern on the screen.
- 3 Rotate the purity rings until there is no perceptible hue in the display.
- 4 Carefully tighten the locking ring on the CRT.
- 5 Verify the display convergence; if convergence is incorrect, perform the convergence adjustment procedure.

Screen

To adjust the screen, perform the following steps:

- 1 Turn off the terminal.
- 2 Remove all the loopback connectors from the back of the terminal.
- 3 Turn the terminal on.
- Note** Do not display any test pattern on the screen.
- 4 Set the brightness control to its detent position.
- 5 Set the contrast control to its minimum level.
- 6 Turn off the lights in the room and adjust the screen potentiometer on the flyback transformer assembly to the point where the raster just disappears.
- Note** If it is not possible to turn off the lights, make a hood out of nonconductive material and cover the display. The goal is to have as little light as possible on the screen while you make this adjustment.
- 7 Replace the loopback connectors.
- 8 Reset the terminal power.
- 9 Press to display the “m” test pattern.

Color Adjustments

The chromaticity (color) is measured using an x/y coordinate system. The values of x and y determine the color of the screen. For all adjustments on this terminal the x and y values are:

$$x = .281 + .042$$

$$y = .311 + .056$$

High Light-Level Adjustment

Test point/setup—Display the full white test pattern on the screen. Set the operator contrast control to its maximum position. Using a color analyzer, adjust the operator brightness control for a reading of 30 fL at the center of the screen.

Measurement—The test pattern should be the proper color balance. The correct readings on the Minolta TV-2130 are:

$$x = .281 + .042 - .070$$

$$y = .311 + .047 - .077$$

Adjustment—With the color analyzer probe at the center of the screen, adjust VR401, VR402, and VR403 for the proper color balance.

Low Light-Level Adjustment

Test point/setup—Display the full white test pattern on the screen. Set the operator brightness control to its detent position. Using a color analyzer, adjust the operator contrast control for 1 fL.

Measurement—The test pattern should be the proper color balance. The correct readings on the Minolta TV-2130 are:

$$x = .281 + .042 - .070$$

$$y = .311 + .047 - .077$$

Adjustment—Adjust VR404, VR405, and VR406 for the proper color balance.

Sub-Contrast Adjustment

Test point/setup—Display the “m” test pattern on the screen. Set the brightness control to its detent position. Set the contrast control to its maximum level.

Adjustment—Using a photometer, adjust VR503 for 31 fL \pm 1.5 fL on the bright white box at the left of the screen.

Test point/setup—Set the brightness control to its maximum position. Set the contrast control to its maximum level.

Adjustment—Using a photometer, verify that the white box at the left of the screen is >45 fL. If necessary, readjust VR503 to 45 fL.

Focus Adjustment

Test point/setup—Display the “m” test pattern on the screen. Set the brightness control to its detent position. Set the contrast control to its maximum position.

Measurement—The “m” characters in the test pattern should all be in focus.

Adjustment—Adjust the focus potentiometer on the flyback transformer assembly for optimum focus on total screen.

**ADJUSTMENT AND ALIGNMENT
QUICK REFERENCE GUIDE**

This section should be used only by technicians who have experience servicing this particular terminal. Table 4-2 lists the adjustments in the order that they are to be performed. The format indicates an adjustment name and abbreviated adjustment procedure, the test pattern, and the adjustment point. If more information about the adjustment is needed, please refer to the full description in the previous section.

**Table 4-2 Adjustment Quick
Reference Guide**

Adjustment/ Specification	Test Pattern	Adjustment Point
Power Supply	None	VR102
+ 86 VDC \pm 0.5 VDC	Measure at : P102 pin 2 (red wire)	
+ 20 VDC \pm 2.0 VDC	P102 pin 5 (orange wire)	
+ 14 VDC \pm 0.7 VDC	P103 pin 4 (orange wire)	
+ 12 VDC \pm 0.6 VDC	P103 pin 5 (yellow wire)	
+ 5 VDC \pm 0.25 VDC	P103 pin 1 (brown wire)	
-12 VDC \pm 0.6 VDC	P103 pin 3 (red wire)	
For ES version only: + 91 VDC \pm 0.5 VDC	P102 pin 2 (red wire)	
X-Ray Protection	"m" test pattern; short TP27 to TP28	None
Horizontal Center Raster is centered < 3 mm	Crosshatch test pattern	VR801
Horizontal Phase < 3 mm	Crosshatch test pattern	VR203
Vertical Center Test pattern is centered < 3 mm	Crosshatch test pattern	V803
Vertical Size 190 mm \pm 3 mm	Crosshatch test pattern	V301
Horizontal Width 254 mm \pm 3 mm	Crosshatch test pattern	VR207
Trapezoidal Distortion < 2 mm	Crosshatch test pattern	VR304
Pincushion Distortion < 2 mm	Crosshatch test pattern	VR205
Convergence (center) < .40 mm	"m" test pattern Crosshatch test pattern	Centering rings
Convergence (2/3 from center) < .50 mm	"m" test pattern Crosshatch test pattern	Centering rings
Convergence (outside edges) < .75 mm	"m" test pattern Crosshatch test pattern	Centering rings
Purity No excessive shading or hue	Full white, red, blue, and green test patterns	Centering rings

Table 4-2 Adjustment Quick Reference Guide, Continued

Adjustment/ Specification	Test Pattern	Adjustment Point
Screen Raster disappears	None	Flyback transformer screen potentiometer
High Light-Level Proper color balance	Full white test pattern	VR401, VR402, and VR403
Low Light-Level Proper color balance	Full white test pattern	VR404, VR405, and VR406
Sub-Contrast $31 \text{ fL} \pm 1.5 \text{ fL}$	"m" test pattern	VR503
Focus Optimum focus	"m" test pattern	Flyback transformer focus potentiometer




5

Module-Level Parts List

INTRODUCTION

This chapter lists the modular-level repair parts available for servicing the WY-325/ES terminal, and it shows an exploded view of the terminal illustrating some of the parts listed.

PRODUCT SAFETY NOTICE

Some electrical and mechanical parts in this display unit have special safety related characteristics. These are often not evident from visual inspection, nor can the protection afforded by them necessarily be obtained by using replacement components rated for higher voltage, wattage, etc. Replacement parts that have these special safety characteristics are identified by a  mark on the parts list in this chapter.



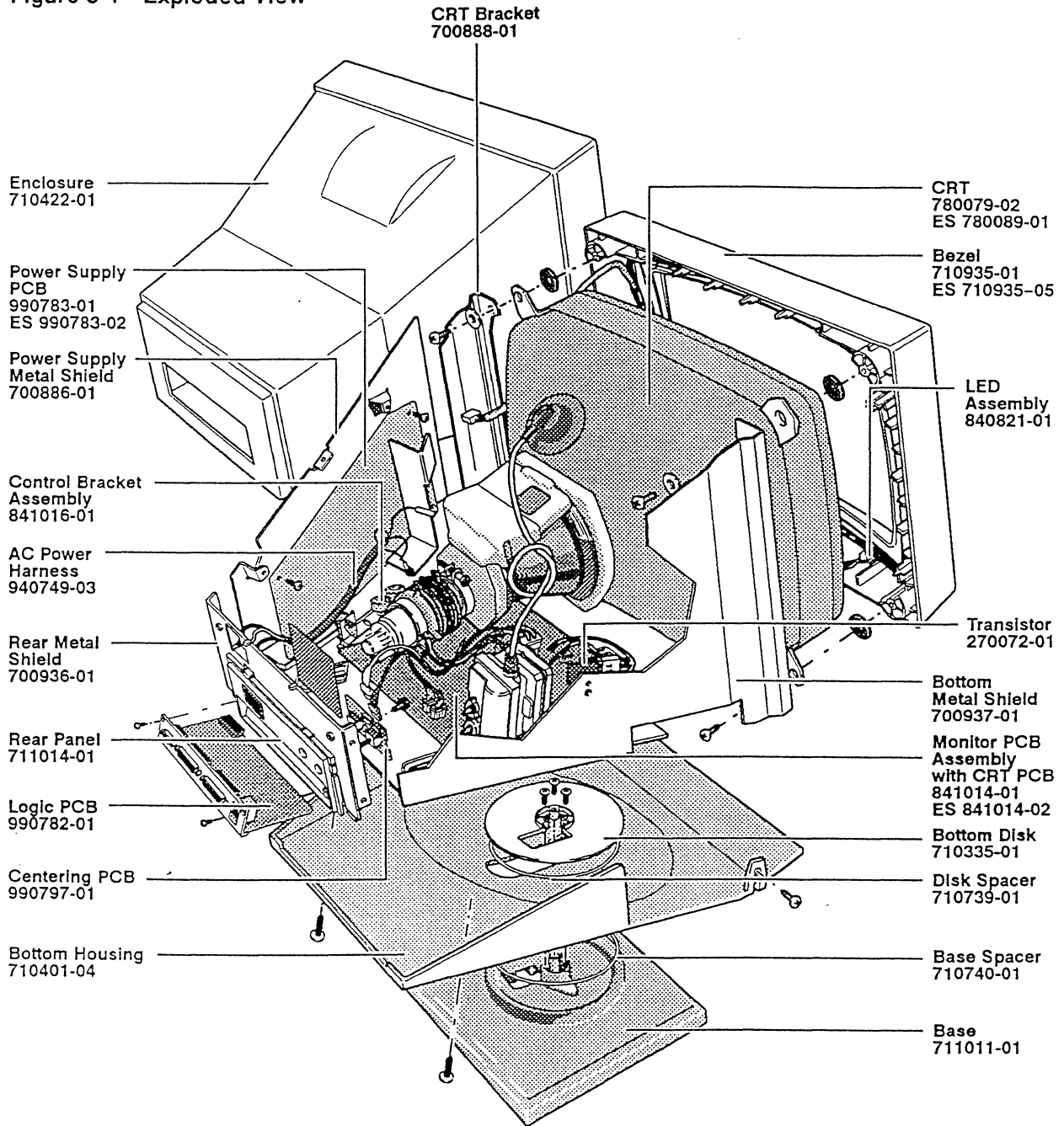
 **Warning** Replace a failed component or assembly identified by a  mark only with the identical component in this manual. Using another component may create shock, fire, X-radiation, or other hazards and may violate DHHS rules. Don't degrade the safety of the terminal through improper servicing.

Table 5-1 Spare Parts List

Description	Part Number
Cables and Harnesses	
AC power connector to power supply harness	940749-03
CRT to metal frame harness	940773-01
Ground harness	940079-01
Power cord	728500-01
Power switch to power supply harness	940752-01
Complete Unit	
WY-325 color terminal, 120V/240V	900979-01
WY-325ES color terminal, 120V/240V	900979-02
Housing Parts	
Base spacer	710740-01
Base with foot	711011-01
Bezel, WY-325	710935-01
Bezel, WY-325ES	710935-05
Bottom disk	710335-01
Bottom housing	710401-04
Disk spacer	710739-01
Enclosure	710422-01
Rear panel	711014-01
Miscellaneous	
Brightness/contrast knob	460020-01
Control bracket assembly	841016-01
CRT bracket	700888-01
⚠ CRT, color	780079-02
⚠ CRT, color ES	780089-01
Firmware, EPROM	251185-01
Fuse, 3.0A, 250V, slow-blow, WY-325	530013-20
Fuse, 3.15A, 250V, slow-blow, WY-325ES	530013-21
LED assembly	840821-01
Metal shield, bottom	700937-01
Metal shield, power supply panel	700886-01
Power switch knob	460019-01
Rear bracket assembly	841013-01
Rear metal shield	700936-01
Shield for horizontal output transistor	710864-01
Transistor holder	700507-01
⚠ Transistor, horizontal output, 2SD2125	270072-01
PCBs	
Centering PCB, horizontal and vertical	990797-01
LED PCB	990798-01
Logic PCB	990782-01
⚠ Monitor PCB assembly with CRT PCB, WY-325	841014-01
⚠ Monitor PCB assembly with CRT PCB, WY-325ES	841014-02
⚠ Power supply PCB, WY-325	990783-01
⚠ Power supply PCB, WY-325ES	990783-02

Figure 5-1 Exploded View



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