

The logo consists of the word "WANG" in a bold, white, sans-serif font, centered within a black, rounded rectangular background.

3404

## **2110A TERMINAL**

**Model: 2110A**

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**Customer Engineering  
Product Maintenance Manual**

**741-1740**

**COMPANY CONFIDENTIAL**

## **PREFACE**

This document is the Product Maintenance Manual (PMM) for the Wang 2110A Terminal. The manual is organized in accordance with Customer Engineering Technical Documentation's approved PMM outline. The scope of this manual reflects the type of maintenance philosophy selected for this product.

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with sufficient instructions to operate, troubleshoot, and repair the 2110A Terminal. The manual will be updated on a regular schedule or as necessary. Such updates will be published either as Publication Update Bulletins (PUBs) or as full revisions.

### **First Edition (October, 1986)**

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# Publication

# Update

# Bulletin

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742-1740

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Reason For Change: This PUB adds 2110A operating and setup mode information to the unpacking and setup section and makes minor corrections to other sections of the manual.

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**WANG**

741-1740-1

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**Instructions:** Remove and insert attached microfiche and/or pages as follows:

**Remove Fiche:**

1 and 2

**Insert Fiche:**

1 and 2

**Remove Page:**

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**Insert Page:**

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## SECTION 1 INTRODUCTION

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## 1.1 Scope and Purpose

---

This Product Maintenance Manual contains installation, operation, troubleshooting, and repair information for the 2110A Terminal, a low cost terminal designed for data entry use. This terminal is designed to be used with both Wang and non-Wang systems. This manual also contains a functional description of the 2110A and an illustrated breakdown of field-replaceable parts.

The purpose of the manual is to provide Customer Engineering personnel with the information necessary to install, troubleshoot, and repair the 2110A Terminal in the field.

## 1.2 Organization and Layout

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This manual is divided into 12 sections numbered 1 through 12. Each section describes a separate maintenance subject and is arranged to minimize references to other sections. Referencing to other sections is made by means of an arrow (➡) followed by the section being referenced. Also, all or most of the information pertaining to a specific task is located on a single or double frame. Each frame in turn contains illustrations, numbered steps, and/or text describing the individual steps required to accomplish each task. Each section is preceded by the section number and a section table of contents. The sections and the corresponding frames are arranged in numerical sequence from left-to-right and from top-to-bottom on the individual fiche cards.

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# **IDENTIFICATION**

# SECTION 2 CONTENTS

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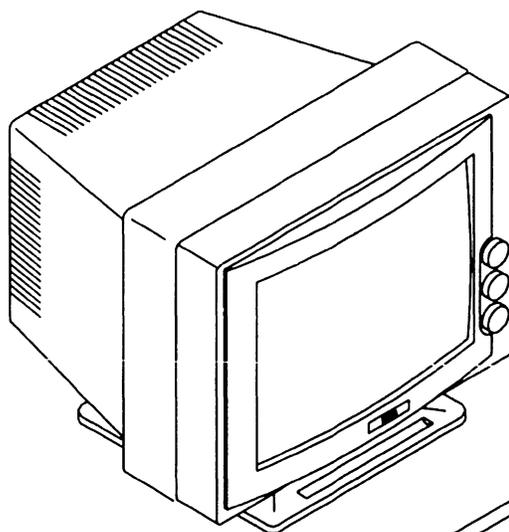
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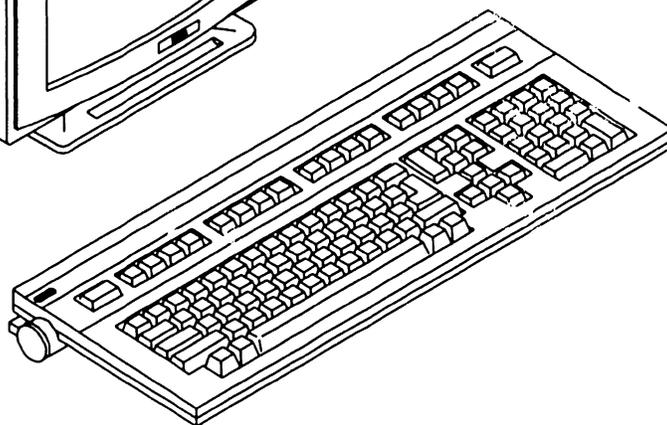
# 2.1 Major Assemblies

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# IDENTIFICATION



**Monitor,  
14 inch display**

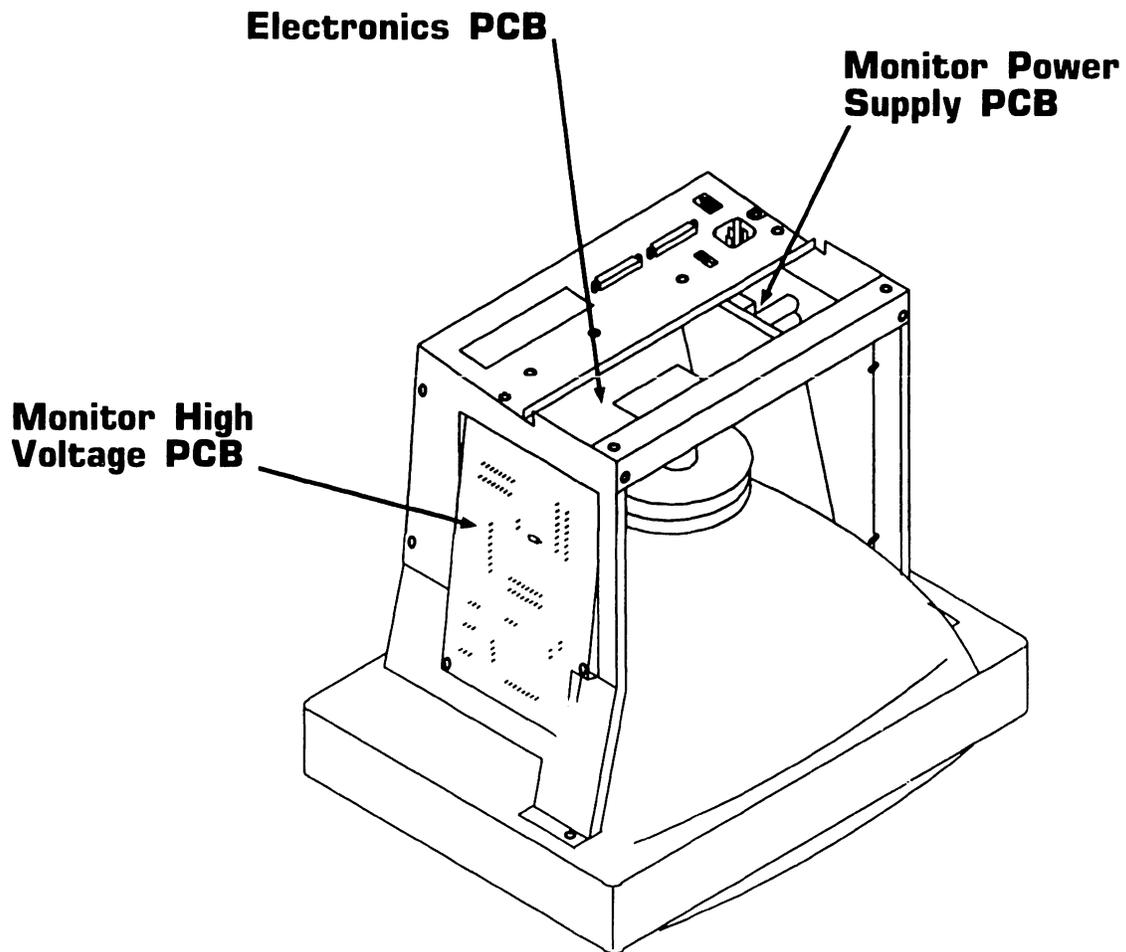


**Keyboard, 105 key**

# 2.2 Monitor Major Parts

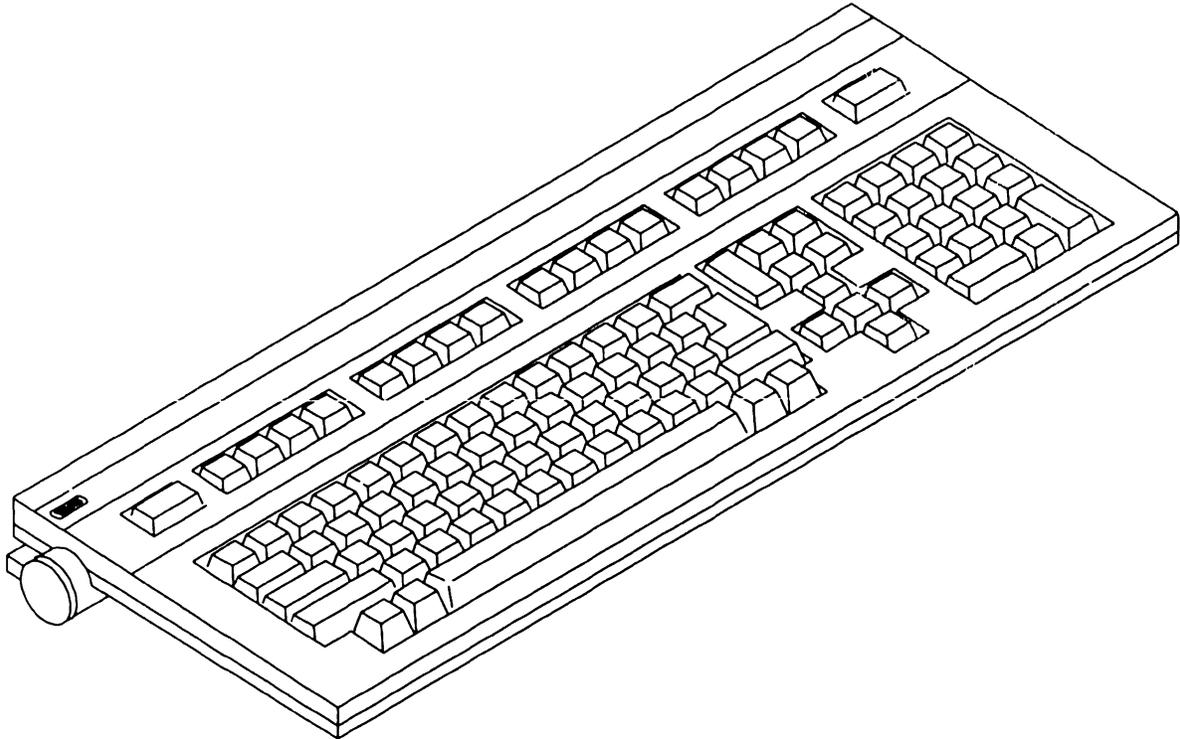
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# IDENTIFICATION



## 2.3 Keyboard Major Parts

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**720 Keyboard, 105 Key**

**SECTION**

**3**

**CONTROLS AND  
INDICATORS**

# SECTION 3 CONTENTS

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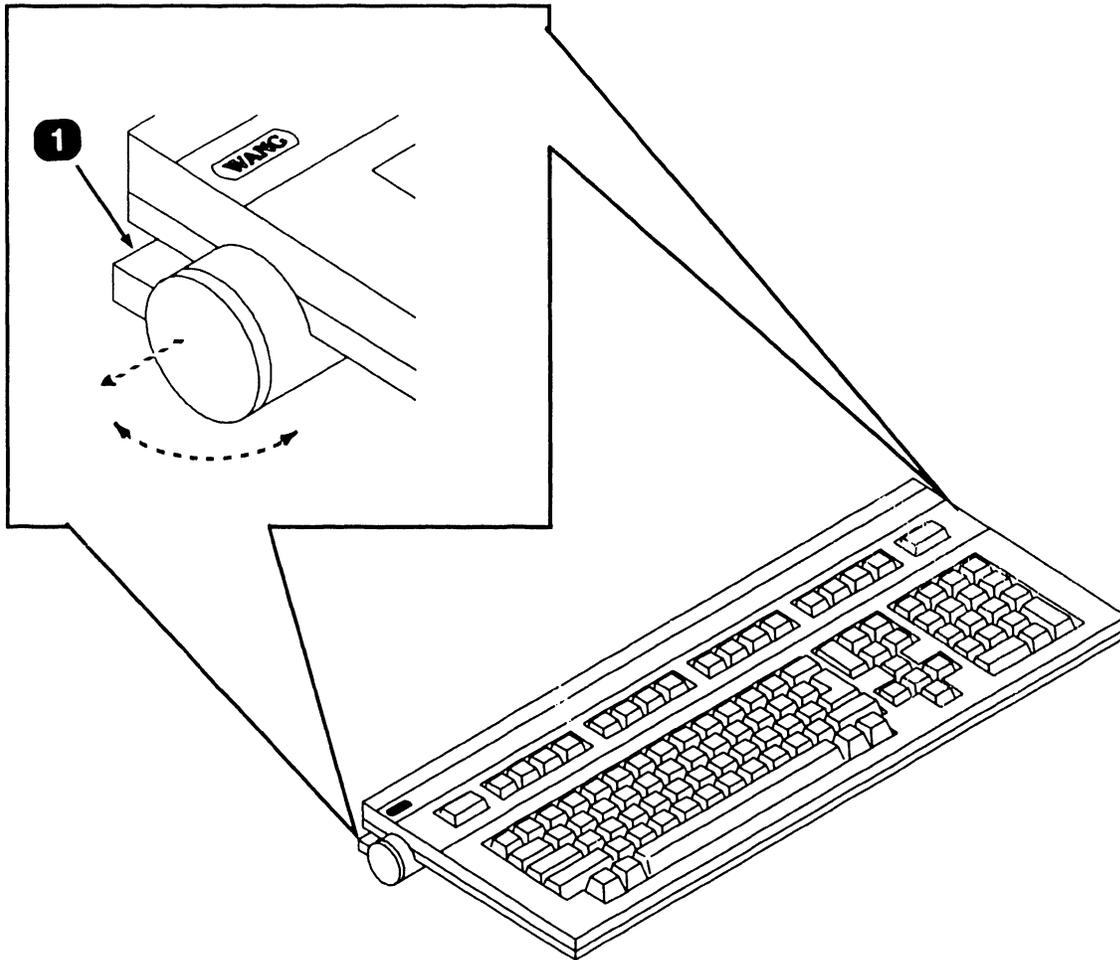
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# 3.1 CONTROLS AND INDICATORS

## 3.1.1 Operator Controls

### 3.1.1 Keyboard Operator Controls



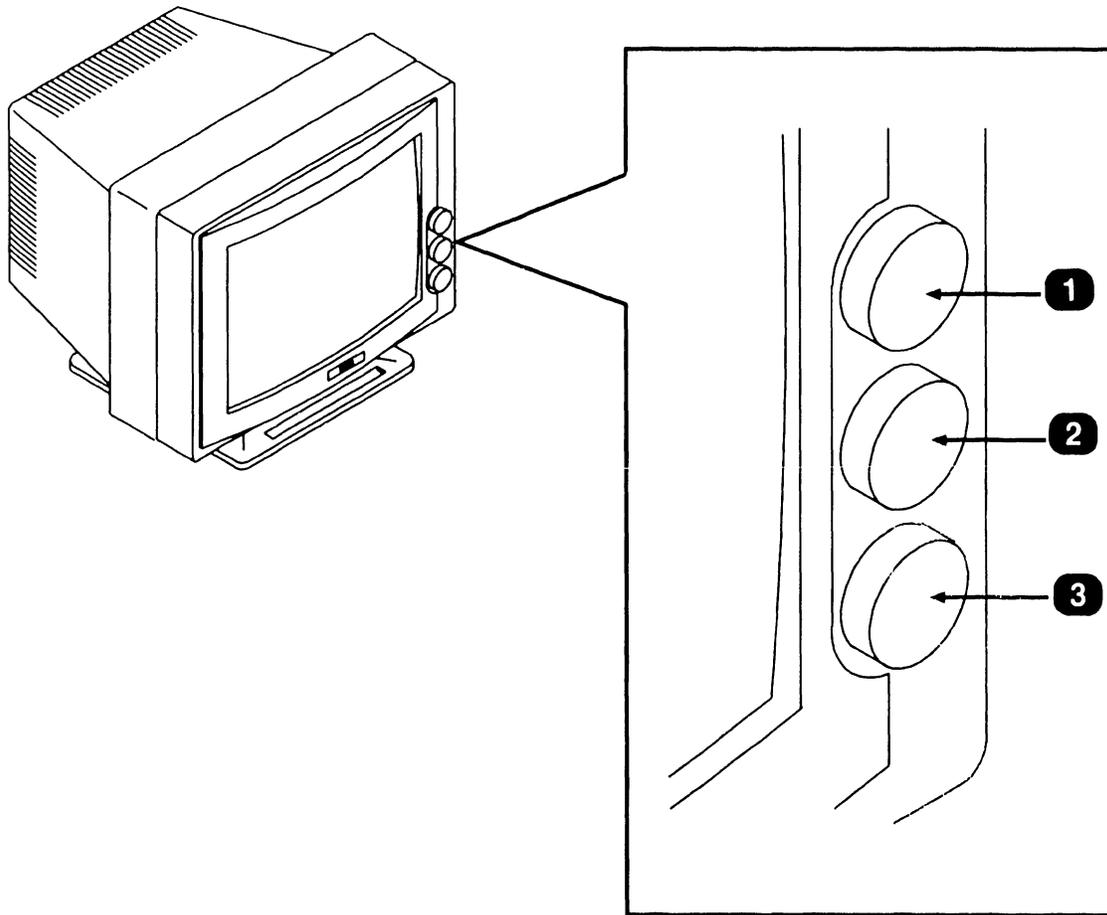
<i>Item</i>	<i>Name</i>	<i>Type and Function</i>
1	Tilt Adjust	3-Position tilt adjustment; pull out and turn knob clockwise or counterclockwise to either raise or lower keyboard.

● END

# 3.1 CONTROLS AND INDICATORS

## 3.1 Operator Controls

### 3.1.2 Monitor Operator Controls



<i>Item</i>	<i>Name</i>	<i>Type and Function</i>
1	Power On/Off Switch	Potentiometer Type Control; Power On/Off.
2	Brightness	Potentiometer Type Control; Adjusts desired Monitor display brightness.
3	Contrast	Potentiometer Type Control; Adjusts desired Monitor display contrast.

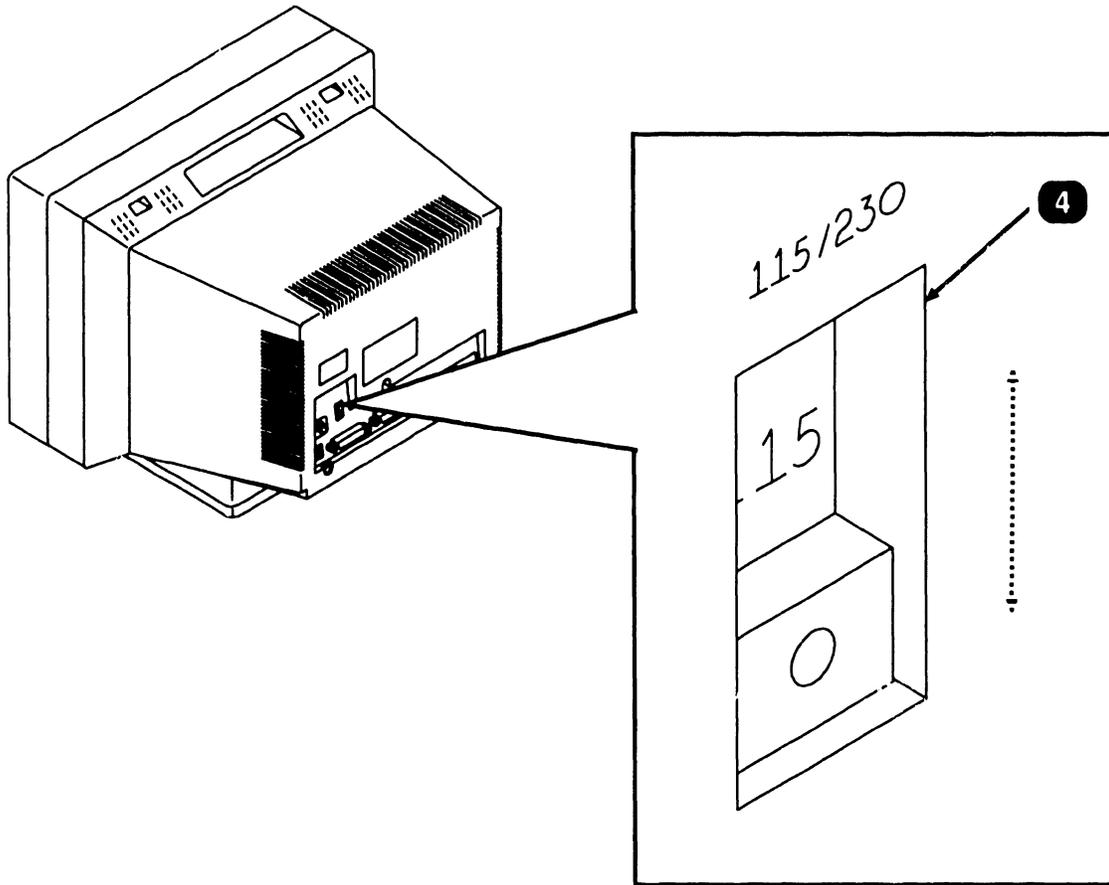
➡ NEXT

# 3.1 CONTROLS AND INDICATORS

## 3.1.1 Operator Controls

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### 3.1.2 Monitor Operator Controls



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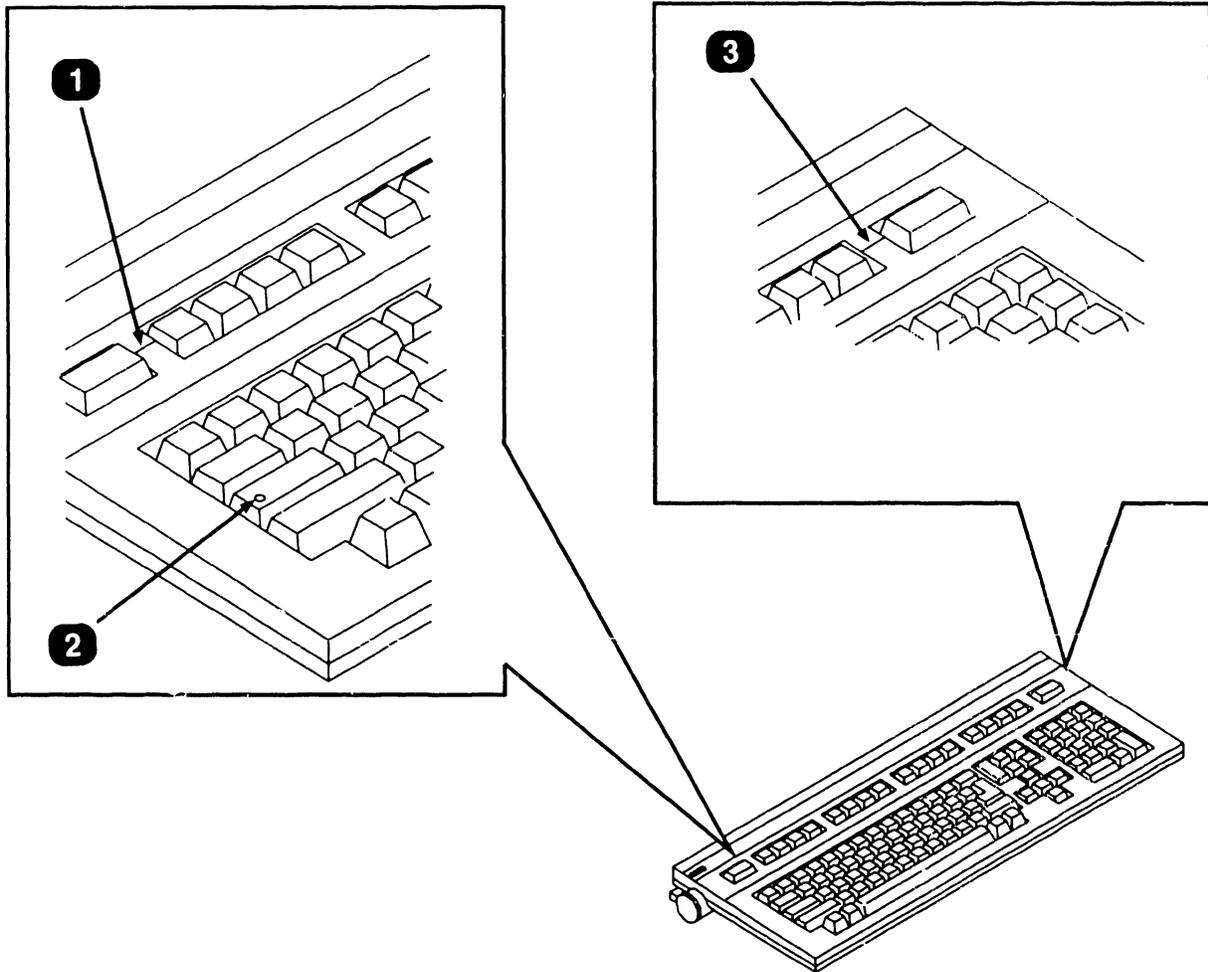
<i>Item</i>	<i>Name</i>	<i>Type and Function</i>
4	Operating Voltage Select	Slider Switch; Selects Operating Voltage of 115 Vac or 230 Vac.

---

◆ END

# 3.2 CONTROLS AND INDICATORS

## Keyboard Indicators



<i>Item</i>	<i>Name</i>	<i>Type and Function</i>
1	Help	LED; Responds to a variety of LED control commands for message signalling and general purpose applications.
2	Shift (LOCK)	LED; Indicates keyboard is in shift or caps lock mode.
3	Num Lock	LED; Indicates IBM 'NUM LOCK' condition.

● END

**SECTION**

**4**

**OPERATION**

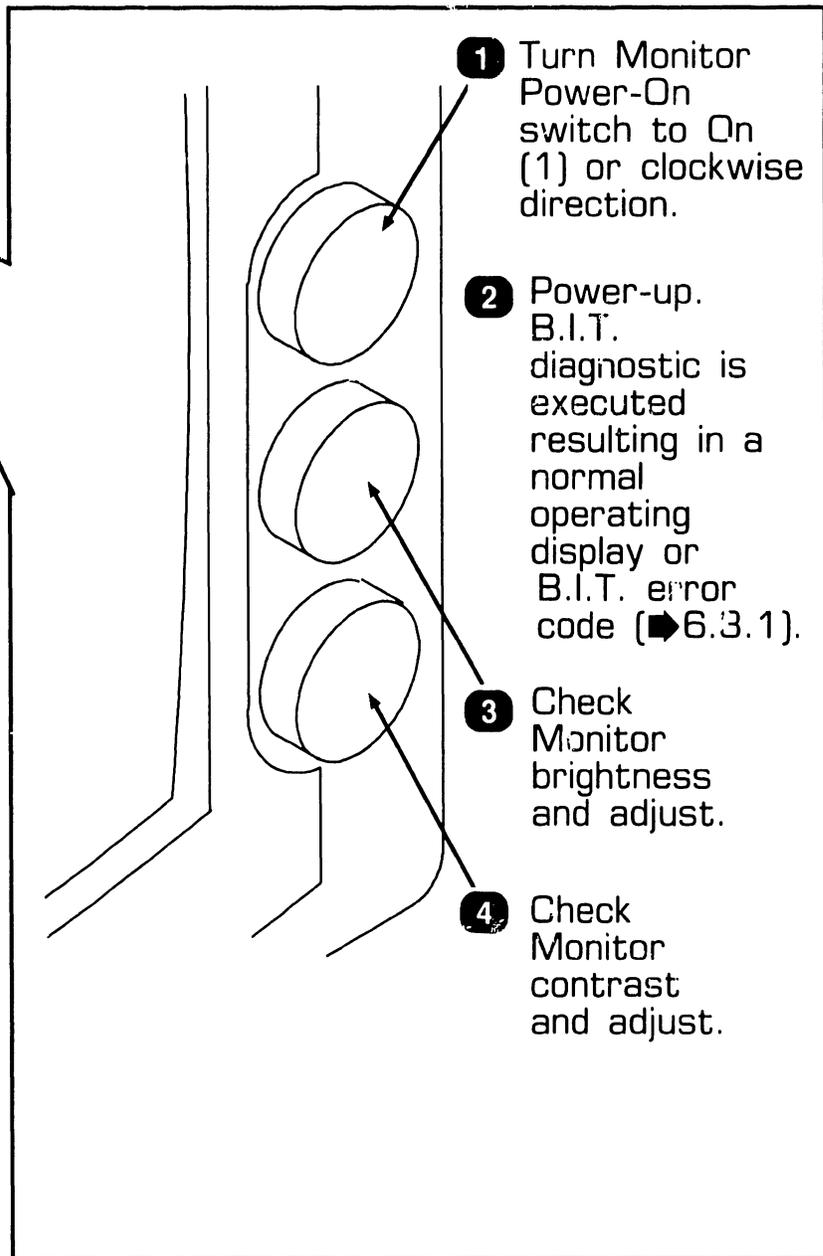
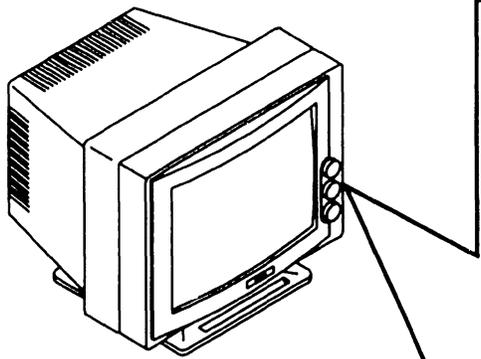
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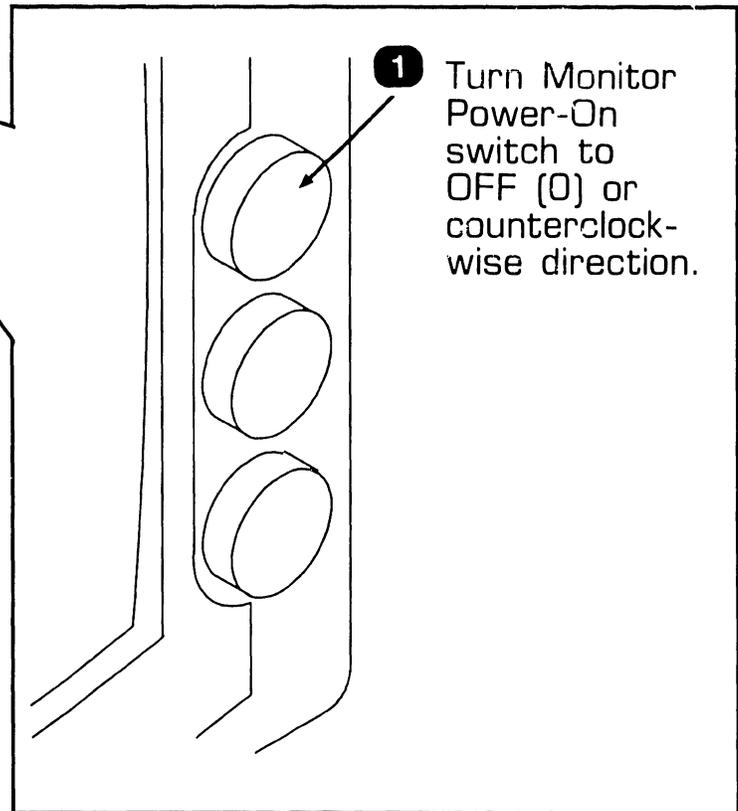
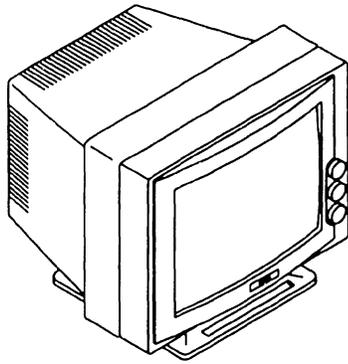
## 4.1 Power-Up Procedure



● END

## 4.2 Power-down Procedure

---



● END

**SECTION**

**5**

**PREVENTIVE  
MAINTENANCE**

# SECTION 5 CONTENTS

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# **5.1 PREVENTIVE MAINTENANCE**

## **MATERIALS REQUIRED**

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The CE tool kit and a DVM are required to perform preventive maintenance on the 2110A Terminal.

# **5.2 PREVENTIVE MAINTENANCE**

## **PM SCHEDULE**

---

Preventive maintenance should be performed on a regular semi-annual basis to help prevent degradation and workstation equipment failures.

# 5.3 PREVENTIVE MAINTENANCE

## CLEANING

---

### *Exterior Cleaning:*

- 1 Remove dust from exterior with clean cloth and vacuum.
- 2 Dust keyboard with a soft-bristled brush.
- 3 Clean the Monitor cover and screen using a good quality glass cleaner and a soft lint-free cloth.

# **5.4 PREVENTIVE MAINTENANCE**

## **ADJUSTMENTS**

---

*Mechanical:* None Required.

*Electrical:* None Required.

**SECTION**

**6**

**TROUBLESHOOTING**

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## SECTION 6 TROUBLESHOOTING

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# TROUBLESHOOTING

## 6.1 Tools and Equipment

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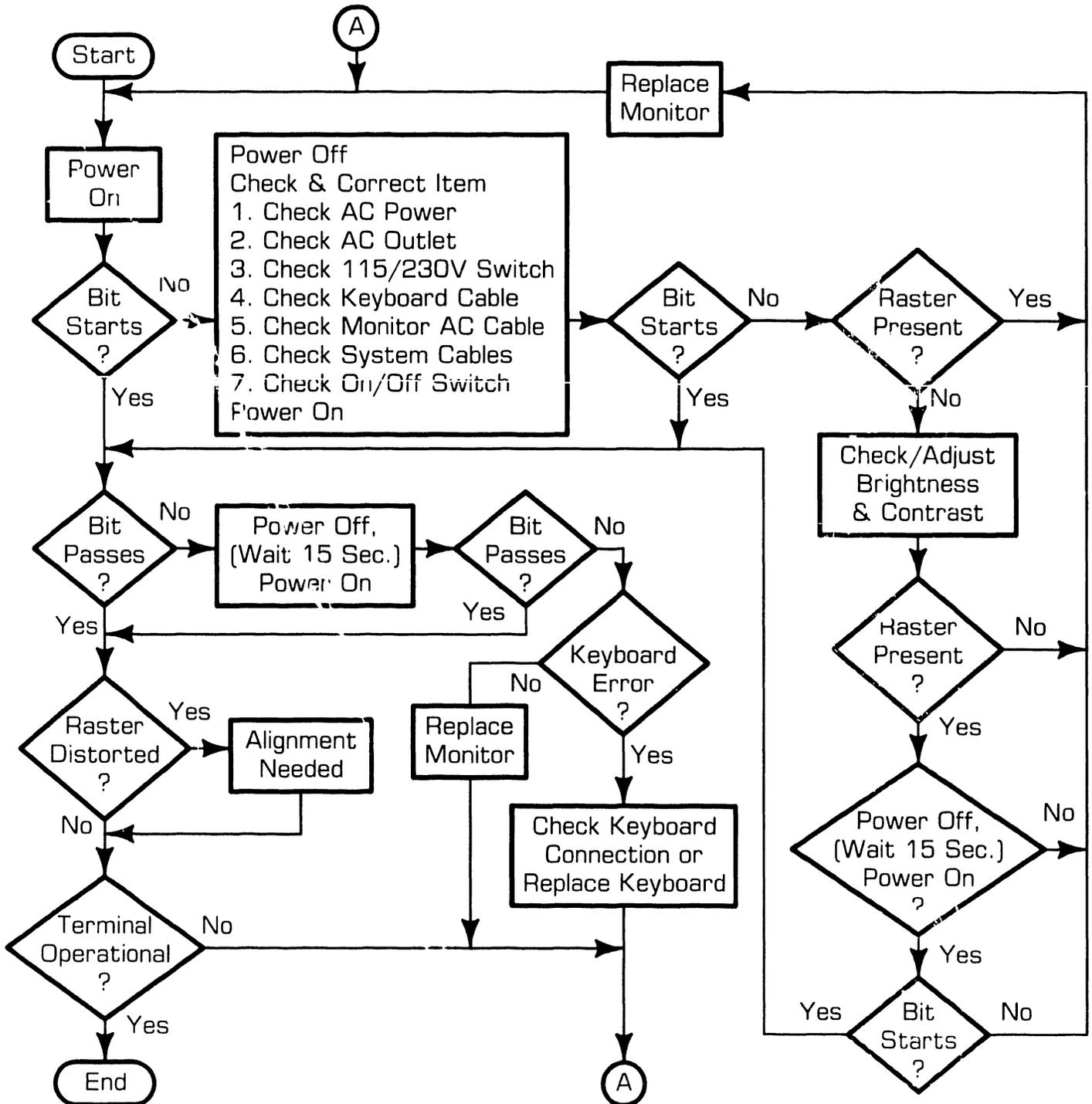
Tools and equipment required to troubleshoot the 2110A Terminal consist of the standard C.E. Tool Kit and a DVM.

# 6.2

# TROUBLESHOOTING

## Troubleshooting Flowcharts

### 6.2.1 Power-Up Procedure



● END

# TROUBLESHOOTING

## 6.3 Power-up Diagnostic

### 6.3.1 Power-Up Diagnostic Self-Test (Sheet 1 of 2)

The 2110A completes the self-test as part of the terminal power-up procedure. The B.I.T. is resident in an eeprom chip located on the Electronics PCB, and is run each time the unit is powered-up. When the terminal completes the self-test, the screen is cleared, and the cursor is displayed at HOME position. When a power-up test failure occurs, the failed test function is identified on the CRT screen as a component failure location. At the same time, a CRT screen error message is displayed, and the keyboard beeps an audio tone. Alternative methods of identifying self-test failures are further described. Individual power-up self-test functional failures and associated error messages are described below.

#### ***Program PROM Checksum Verification***

A program PROM checksum is generated and compared. The 2110A Program PROM checksum is adjusted by placing an offset byte value in an unused memory location, which will read a checksum LSB of '00'. The checksum comparison failure message displayed is: U47 Failure. This message is accompanied by two (2) beeps on the Keyboard bell.

#### ***System RAM Verification***

The operation of the system RAM

memory element designated as U45, is evaluated via Read/Write data testing. The error message displayed is: U45 Failure. This message is accompanied by three (3) beeps on the Keyboard bell.

#### ***System RAM Verification***

The operation of the system RAM memory element designated as U46, is evaluated via Read/Write data testing. The error message displayed is: U46 Failure. This message is accompanied by four (4) beeps on the Keyboard bell.

#### ***Display RAM Verification***

The operation of the character display RAM memory element designated as U50, is evaluated via Read/Write data testing. The error message displayed is : U50 Failure. This message is accompanied by five (5) beeps on the Keyboard bell.

#### ***Attribute RAM Verification***

The operation of the character attribute display RAM memory element designated as U49, is evaluated via Read/Write data testing. The error message displayed is: U49 Failure. This message is accompanied by six (6) beeps on the Keyboard bell.

►NEXT

# TROUBLESHOOTING

## 6.3 Power-up Diagnostic

---

### 6.3.1 Power-Up Diagnostic Self-Test (Sheet 2 of 2)

#### *Internal Character Generator RAM Verification*

The operation of the RAM memory element associated with the host downloadable character sets, is evaluated via Read/Write data testing. The error message displayed is: U51 Failure. This message is accompanied by seven (7) beeps on the Keyboard bell.

#### *Non-Volatile Memory Verification*

The operation of the non-volatile RAM element associated with the terminal SETUP mode, is evaluated via Read/Write data testing. The error message displayed is: U36 Failure. This message is accompanied by eight (8) beeps on the Keyboard bell.

#### *Communications DUART Verification*

The communication DUART component associated with the terminals MAIN and AUX ports, is verified in the following manner: Read/Write access to DUART control registers MRA0, MRA1, MRB0, and MRB1 is checked. The error message displayed is: U55 Failure. This message is accompanied by nine (9) beeps on the Keyboard bell.

#### *CRT Controller Verification*

The terminal CRT Controller device is evaluated via Read/Write access to the cursor position register. The error message displayed is: U26 Failure. This message is accompanied by ten (10) beeps on the Keyboard bell.

#### *Keyboard Verification*

The correct operation of the keyboard and keyboard interface hardware, is verified via a terminal transmitted 'Spec/Code Revision Level Query' (X'09') to the 720 Keyboard. If the keyboard fails to respond within 150 ms, or if the response format is incorrect, the error message displayed is: K.B. Failure (screen display: inverse video).

● END

# TROUBLESHOOTING

## 6.4 Terminal Diagnostic

### 6.4.1 Terminal Test Functions Mode (Sheet 1 of 3)

To access Terminal Diagnostic Functions mode, enter Terminal SETUP Mode, then select either 2110 or 2110A operating mode. To access Terminal Self-test Diagnostic mode, type key sequence CTRL+2ND+HOME. When Self-test mode is selected, the following menu is displayed:

\*\* V2110A V.X \*\*

- 0 Align
- 1 Reverse
- 2 Dim
- 3 Tx/Rx A
- 4 Tx/Rx B
- 5 Scroll
- 6 80
- 7 132
- 8 Burn-in
- 9 Exit

---

#### **NOTE**

Individual test functions are selected via keystrokes on the numeric keypad only. To access a particular test, key the number corresponding to test referred to in above list. In case test does not terminate or return to menu automatically, terminate test by typing RETURN key on numeric keypad.

---

**Align:** Enter 'Align' selftest function by keying '0' on numeric keypad. Terminal displays Monitor Alignment Display using high intensity attribute. Keying RETURN, displays Monitor Alignment Display with normal intensity attribute enabled. Keying RETURN again, restores test selection menu.

**Reverse:** Enter Reverse selftest function by keying '1' on numeric keypad. Terminal displays selftest selection menu with reverse video attribute enabled. Key RETURN key to terminate test, and restore test selection menu with normal attribute enabled.

**Dim:** Enable the Dim (Screen Saver) selftest function by keying '2' on numeric keypad. This function displays selftest select menu at reduced intensity. Key RETURN to terminate test, and restore normal display intensity.

**Tx/Rx A:** Enter the first half of MAIN/AUX Tx/Rx selftest function, by keying '3' on numeric keypad. This test verifies function of input/output pins on MAIN/AUX

➡NEXT

# TROUBLESHOOTING

## 6.4 Terminal Diagnostic

### 6.4.1 Terminal Test Functions Mode (Sheet 2 of 3)

ports. Test requires loopback connector attached between MAIN and AUX ports. Refer to loopback connector information below. Transmit/receive test results are displayed on left of menu selection field, at test completion as either PASS or FAIL.

**Tx/Rx B:** Enter the second half of MAIN/AUX Tx/Rx selftest function, by keying '4' on numeric keypad. This test verifies function of both MAIN/AUX ports ability to transmit and receive data. All baud rates are checked as part of this test. Test requires loopback connector attached between MAIN and AUX ports. Refer to loopback connector information in Figure 1. Transmit/receive test results are displayed on left of menu selection field, at test completion as either PASS or FAIL.

**Scroll:** Enter Scroll selftest function by keying '5' on numeric keypad. With smooth scroll func-

tion enabled, display screen is filled with upper case 'W' characters. Screen scrolls continuously until test is exited. Key RETURN to terminate test and restore selftest menu.

**80:** Enter 80 column character generator and attribute selftest function, by keying '6' on numeric keypad. 80 column display mode is enabled, and contents of Internal Character Generator ROM with normal intensity attribute is displayed. Balance of screen is filled with fields containing, upper case 'H' characters displayed with various combinations of normal intensity, underscore, reverse video, blinking, double width, and double width plus double height attributes. Key RETURN to enable inverse video screen display attribute. Key RETURN again to restore normal screen display attribute, and selftest function selection menu.

**132:** Enter 80 column character generator and attribute selftest function, by keying '7' on numeric keypad. 132 column display mode is enabled, and contents of Internal Character Generator ROM with normal intensity attribute is displayed.

►NEXT

# TROUBLESHOOTING

## 6.4 Terminal Diagnostic

### 6.4.1 Terminal Test Functions Mode (Sheet 3 of 3)

Balance of screen is filled with fields containing, upper case 'H' characters displayed with various combinations of normal intensity, underscore, reverse video, blinking, double width, and double width plus double height attributes. Key RETURN to enable inverse video screen display attribute. Key RETURN again to restore 80 column display mode, and selftest function selection menu.

**Burn-in:** Enter Burn-in selftest function by keying '8' on numeric keypad. Terminal displays a block mode style cursor which increments continuously across and down the display screen. Cursor display is enabled and disabled at 1/2 second intervals.

**Loopback Connector Wiring:**

Main Port Connector

Pin 2 to AUX pin 3  
Pin 3 to AUX pin 2  
Pin 7 to AUX pin 7  
Pins 4, 5, & 6 tied together  
Pin 8, 12, 20, & 23 tied together

Aux Port Connector

Pin 2 to MAIN port pin 3  
Pin 3 to MAIN port pin 3  
Pin 7 to MAIN port pin 7  
Pins 4, 5, & 6 tied together  
Pins 8 & 20 tied together

#### CAUTION

When Burn-in test is selected, and terminal is powered off prior to exit from selftest, burn-in test is reenabled when power is restored. Terminate Burn-in mode by keying RETURN on numeric keypad. Terminal restores and saves SETUP mode factory defaults, and returns to selftest function selection menu, at power-up.

**Exit:** Enter default selection by keying '9' on numeric keypad, as the normal means of exiting from terminal selftest mode. Keying '9' will restore terminal operation to that stored in SETUP mode.

**Figure 1**

● END

# **SECTION 7**

# **REPAIR**

# SECTION 7 CONTENTS

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## SECTION 7 REPAIR

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# **7.1 Tools and Equipment**

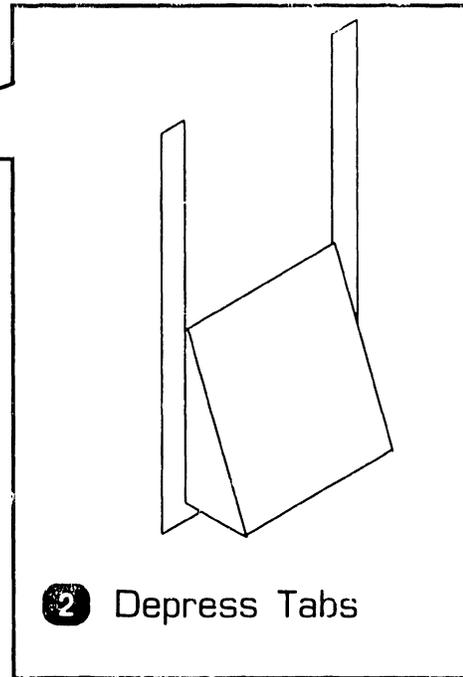
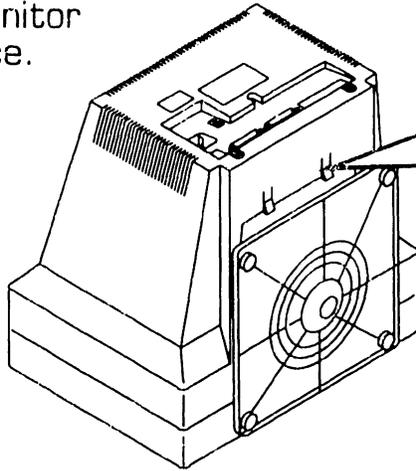
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No special tools or test equipment are required to repair the 2110A Terminal. All necessary repair can be accomplished using the CE tool kit (WLI#726-9401).

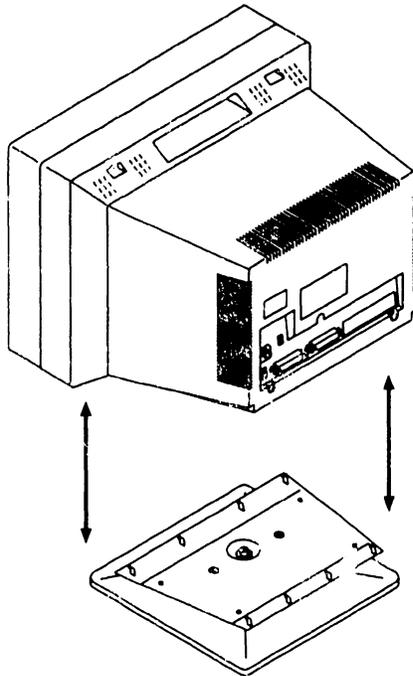
# 7.2 Removal Procedures

## 7.2.1 Monitor Base Removal

1 Position Monitor on CRT Face.



2 Depress Tabs



3 Remove Monitor Base

● END

# 7.2 Removal Procedures

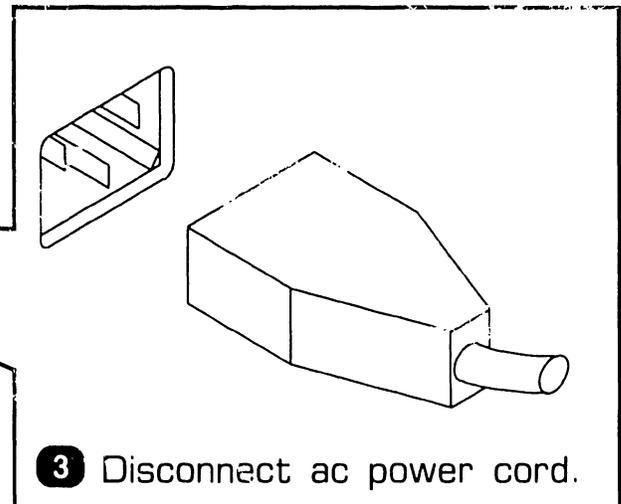
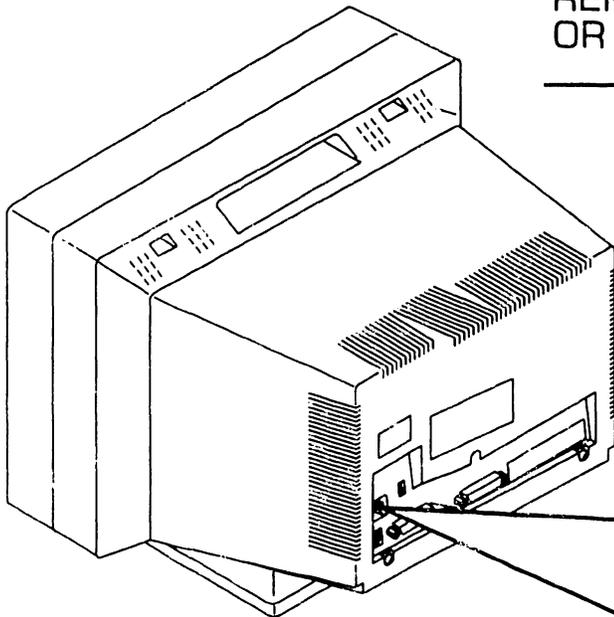
# REPAIR

## 7.2.2 Rear Cover Removal (Sheet 1 of 3)

- 1 Power-off monitor and disconnect ac power cord from wall outlet.
- 2 Remove Monitor Base (▶7.2.1).

### WARNING

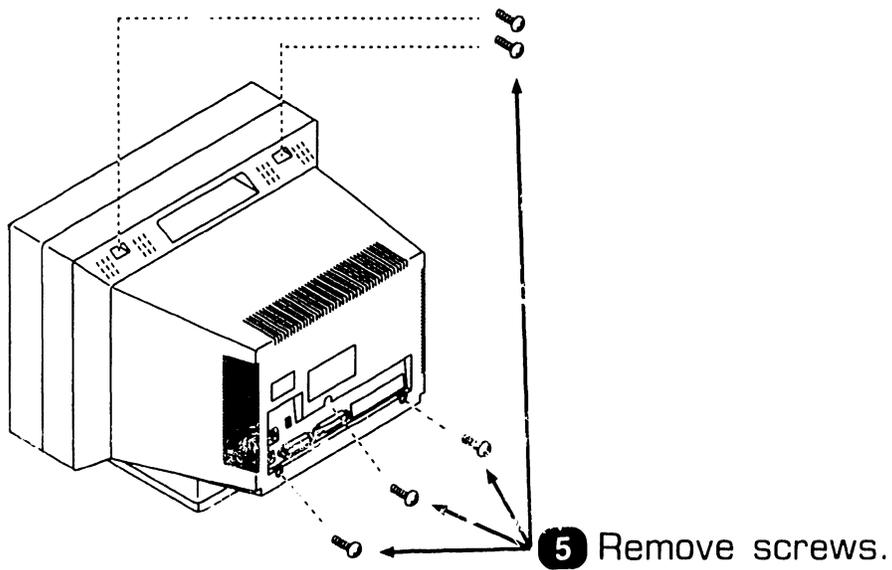
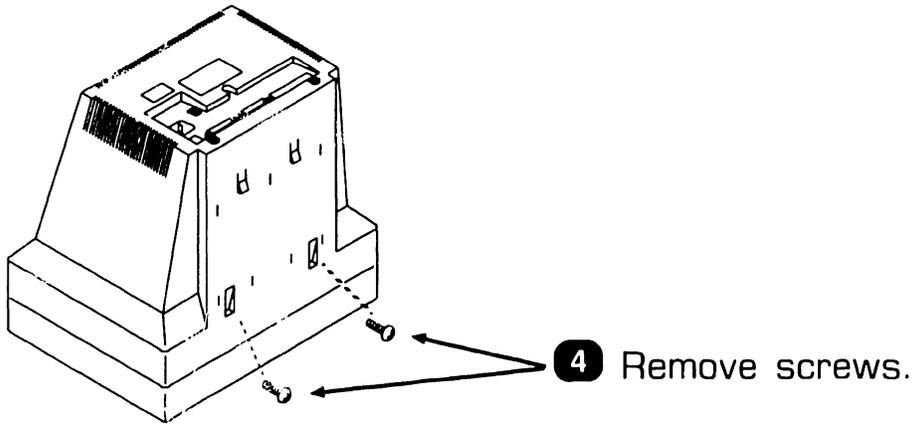
DO NOT TOUCH MONITOR/POWER SUPPLY PCB OR HIGH VOLTAGE POWER SUPPLY PCB WHILE MONITOR IS POWERED-UP. DANGEROUS VOLTAGES EXCEEDING 300 VOLTS DC ARE PRESENT WITHIN THE PCB'S. DISCONNECT AC CORD AND TURN ON/OFF SWITCH TO OFF (O) BEFORE REMOVING MONITOR COVER FOR PCB REPLACEMENT OR ADJUSTMENT. ALLOW ONE MINUTE BEFORE REMOVING MONITOR/POWER SUPPLY OR HIGH VOLTAGE PCB'S.



▶NEXT

## 7.2 Removal Procedures

### 7.2.2 Rear Cover Removal (Sheet 2 of 3)

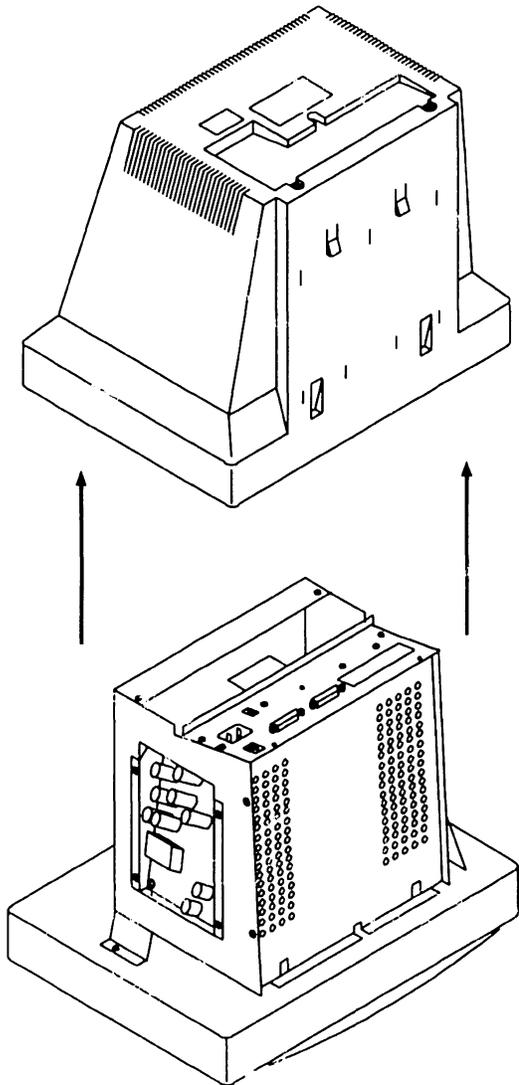


▶ NEXT

# 7.2 Removal Procedures

# REPAIR

## 7.2.2 Rear Cover Removal (Sheet 3 of 3)



- 6 Position monitor on CRT face and remove cover.

● END

**SECTION**

**8**

**ADJUSTMENTS**

# SECTION 8 CONTENTS

---

## SECTION 8 ADJUSTMENTS

	Page
8.1 TOOLS AND EQUIPMENT .....	8-1
8.1.1 Special Tools .....	8-1
8.2 ELECTRICAL ADJUSTMENTS .....	8-2
8.2.1 Monitor PCB Alignment Procedure .....	8-2

## 8.1 Tools and Equipment

---

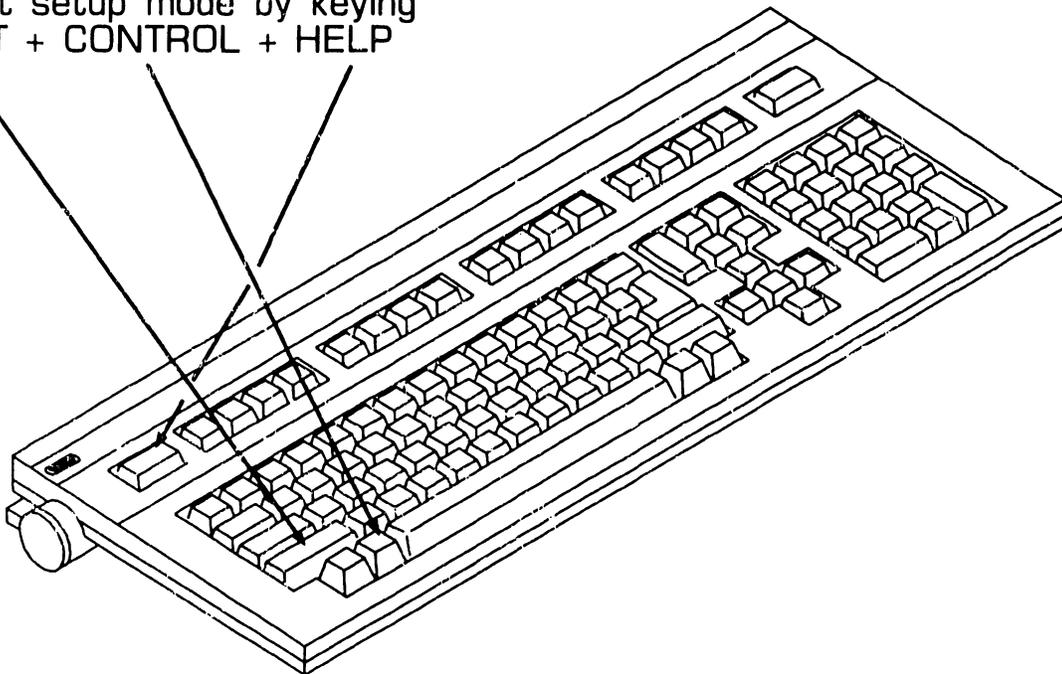
### 8.1.1 Special Tools

Use only non-metallic tools when performing adjustments or alignments on 2110A Terminal.

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (1 of 9)

- 1 Remove Terminal Monitor Base (▶7.2.1).
- 2 Remove Terminal Monitor Cover (▶7.2.2).
- 3 Power-up Terminal Monitor (▶4.1). Allow Terminal to warm-up for five minutes before attempting adjustments.
- 4 Adjust Brightness Control fully clockwise (▶4.1).
- 5 Select setup mode by keying SHIFT + CONTROL + HELP



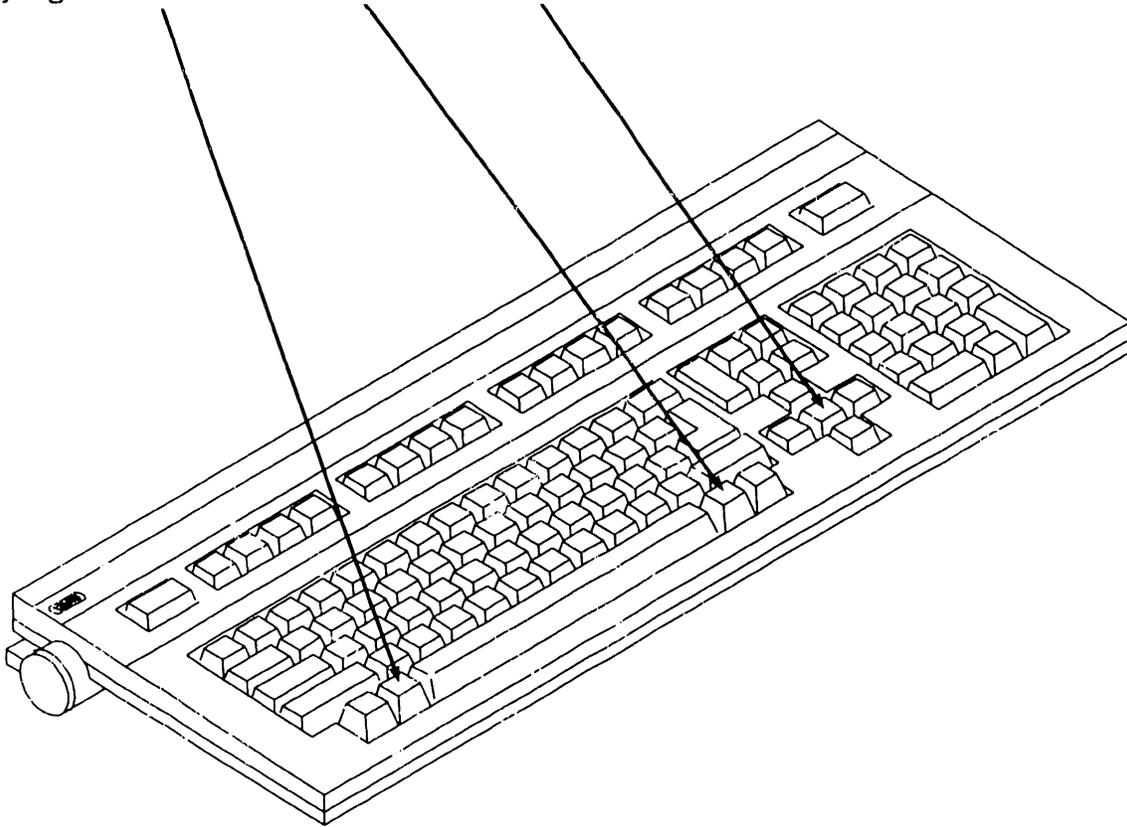
▶NEXT

## 8.2 Electrical Adjustments

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### 8.2.1 Monitor PCB Alignment Procedure (2 of 9)

- 6 Select Self-test Diagnostic mode by keying CONTROL + 2ND + HOME



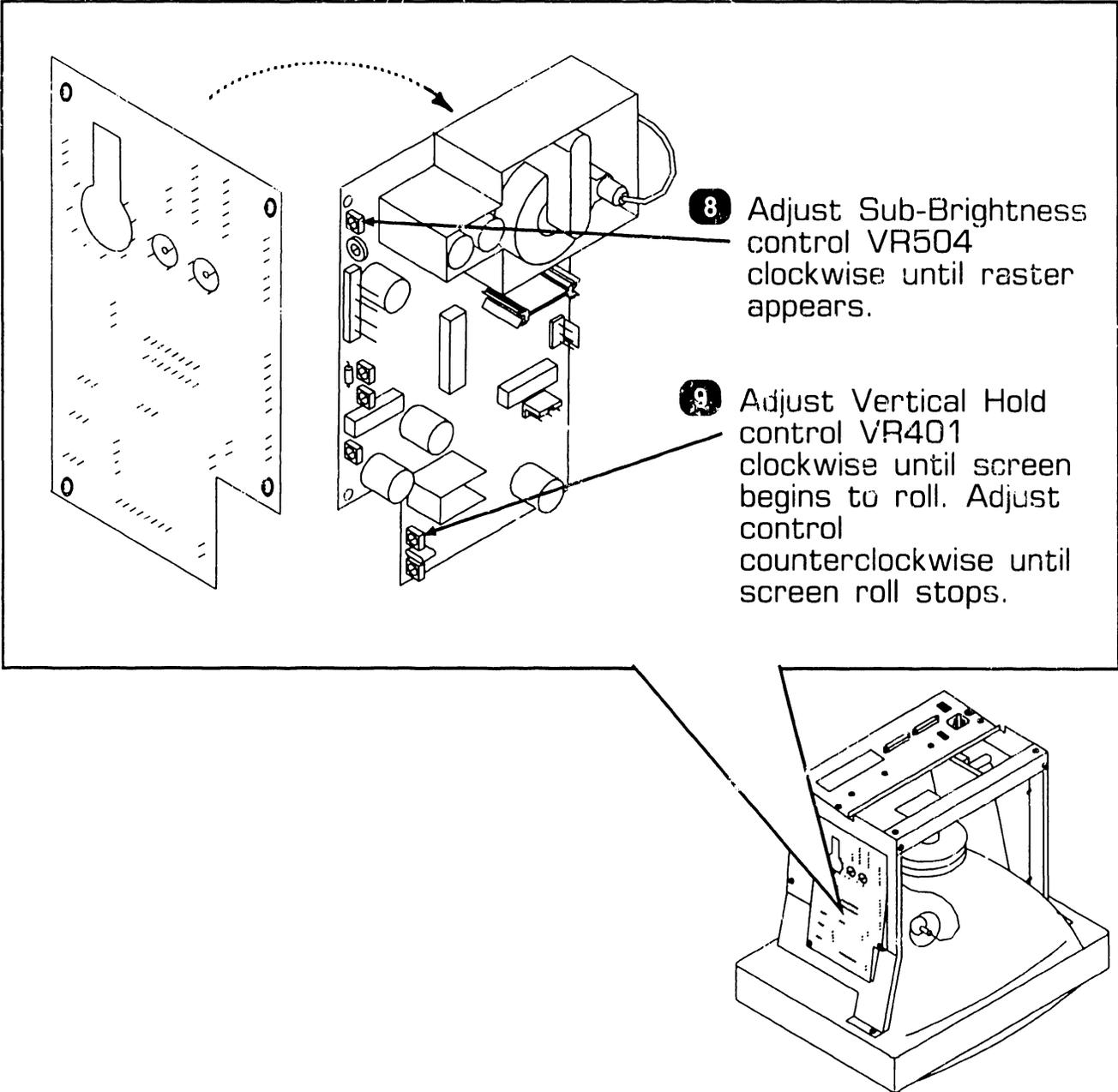
▶ NEXT



# ADJUSTMENTS

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (4 of 9)

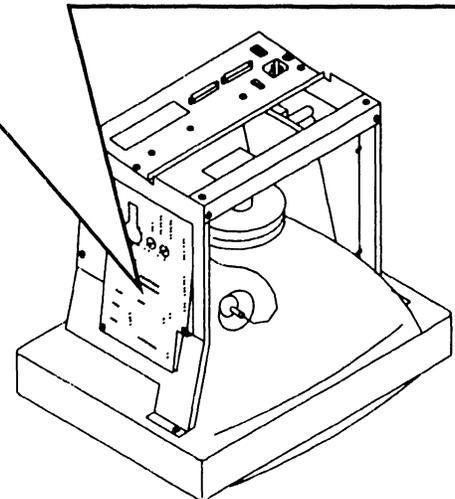
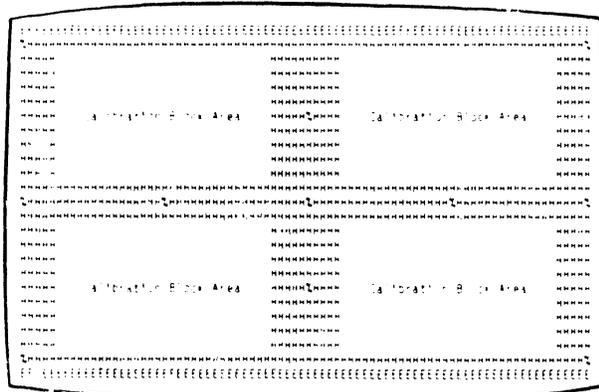
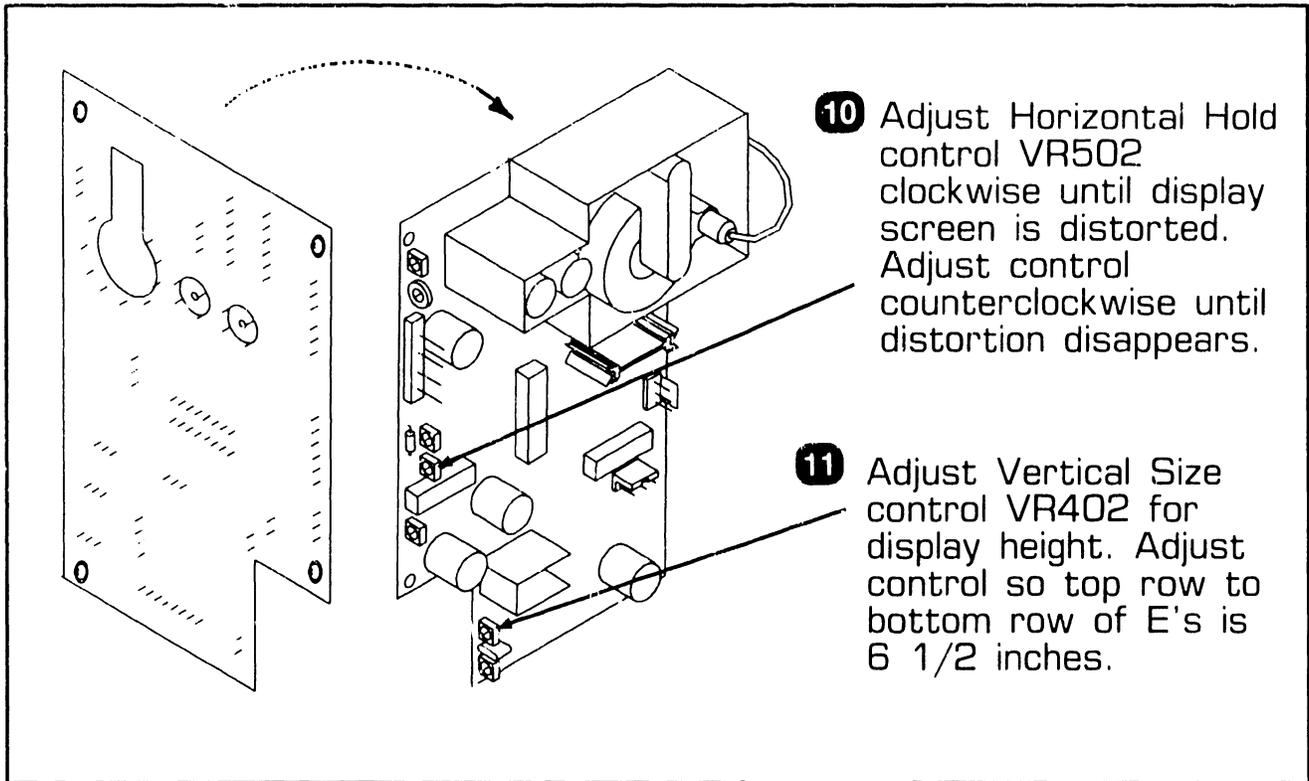


◆ NEXT

# 8.2 Electrical Adjustments

# ADJUSTMENTS

## 8.2.1 Monitor PCB Alignment Procedure (5 of 9)

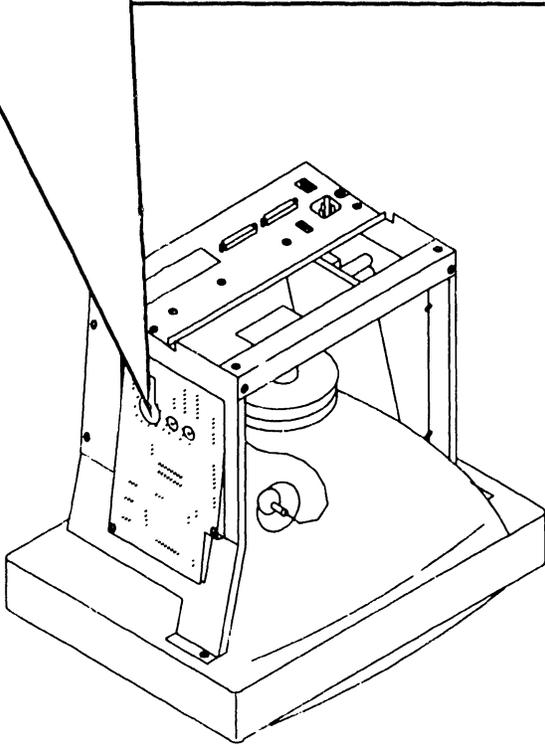
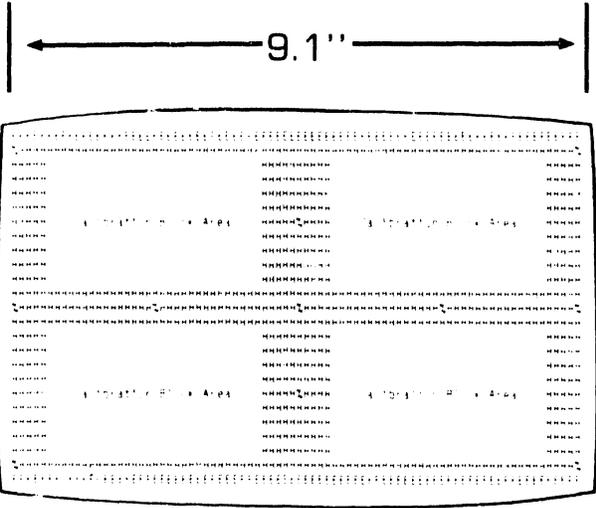
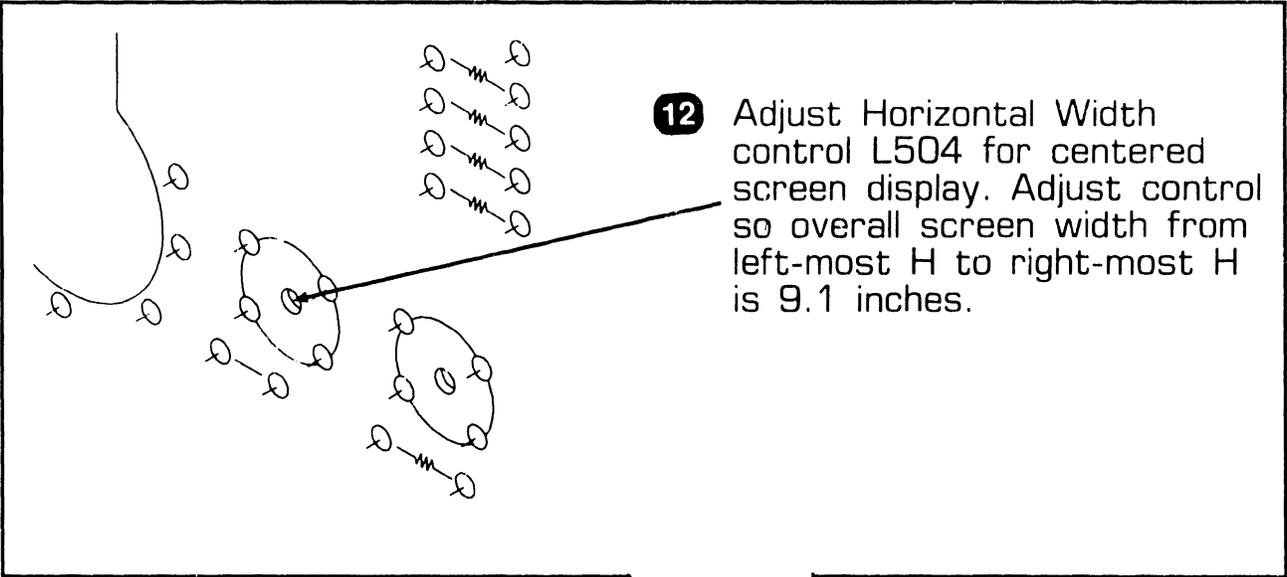


▶NEXT

# ADJUSTMENTS

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (6 of 9)

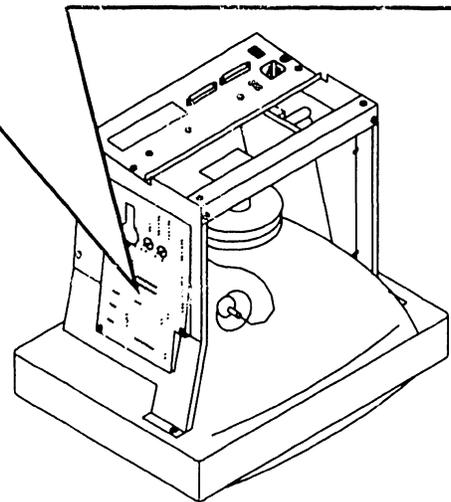
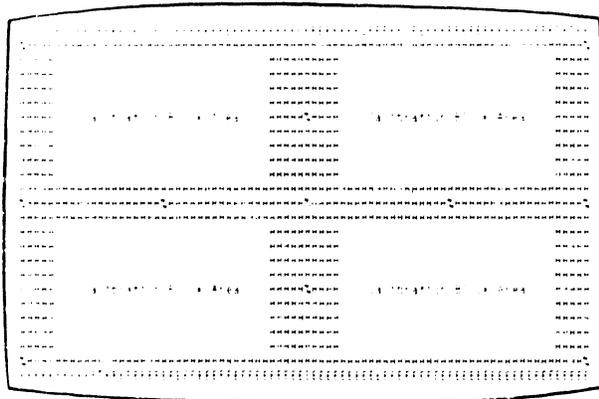
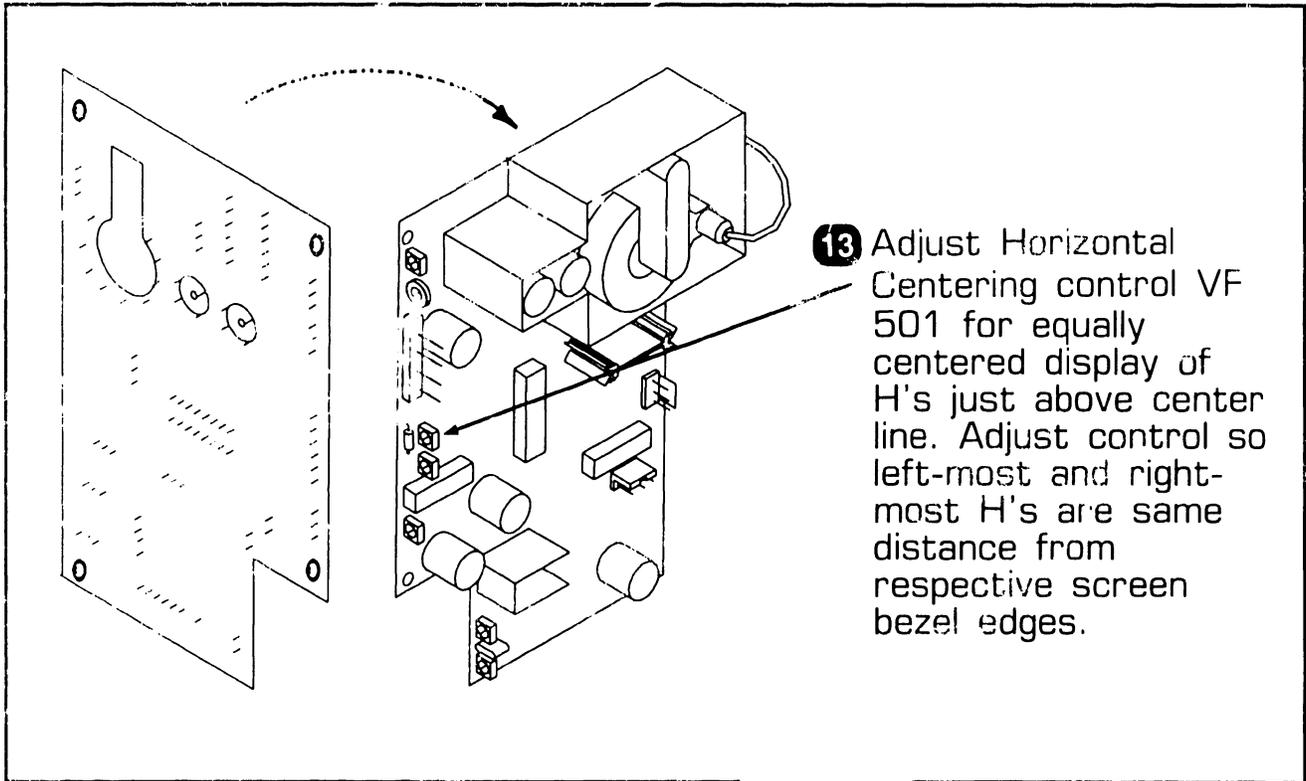


▶ NEXT

# ADJUSTMENTS

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (7 of 9)

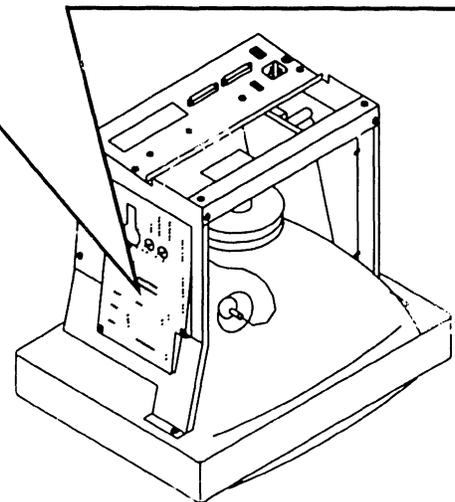
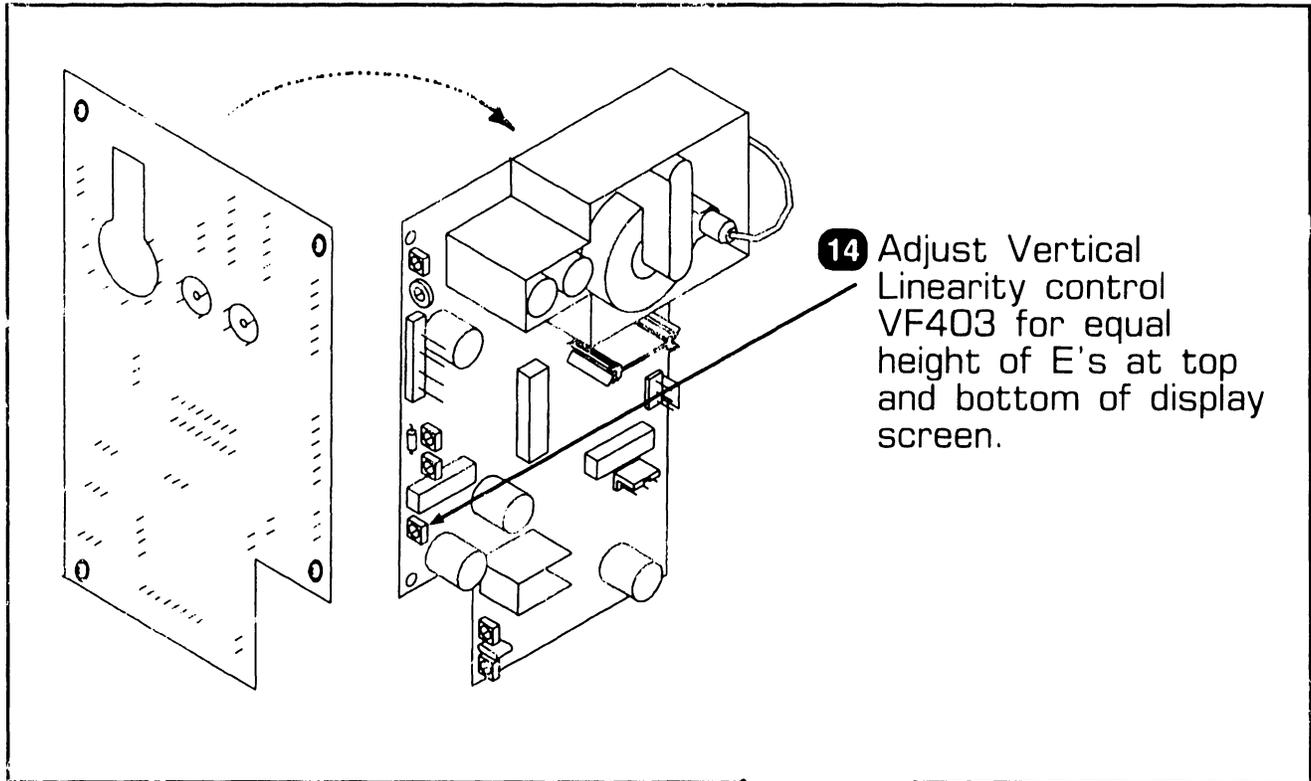


▶ NEXT

# ADJUSTMENTS

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (8 of 9)

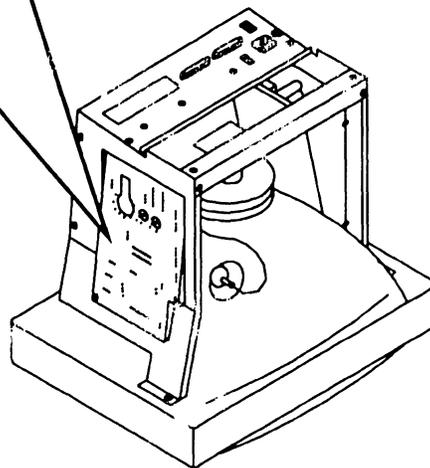
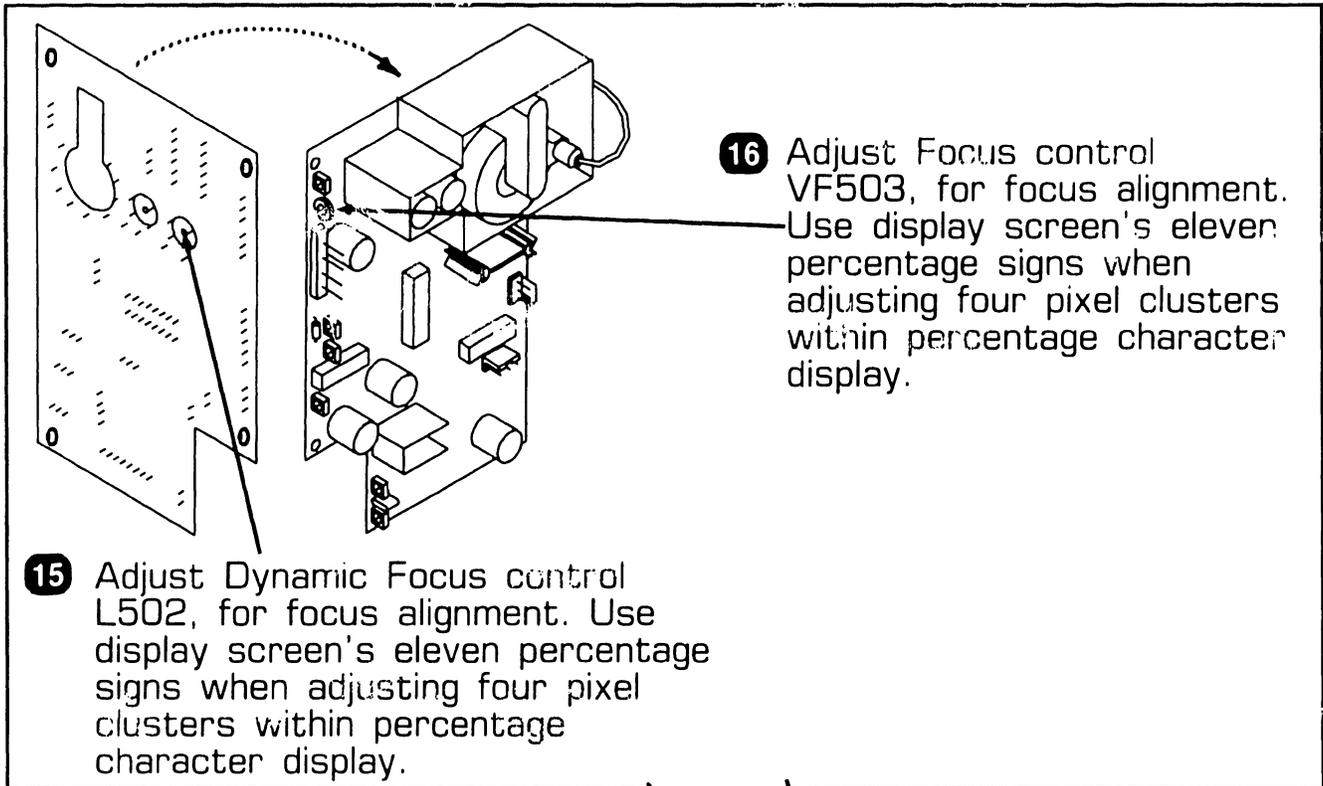


▶ NEXT

# ADJUSTMENTS

## 8.2 Electrical Adjustments

### 8.2.1 Monitor PCB Alignment Procedure (9 of 9)



- 17** Power-down Monitor, replace Monitor Cover, and attach Base. ● END

**SECTION 9**  
**UNPACKING**  
**AND**  
**SETUP**

# SECTION 9 CONTENTS

---

## SECTION 9 UNPACKING AND SETUP

	Page
9.1 INSTALLATION SITE CHECK .....	9-1
9.2 TOOLS AND TEST EQUIPMENT .....	9-2
9.3 UNPACKING PROCEDURE .....	9-3
9.3.1 Unpacking and Inspecting Monitor .....	9-3
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9.4.1 Monitor Rear Panel Connections .....	9-5
9.5 CONNECTIONS .....	9-6
9.5.1 Monitor Rear Panel Connections .....	9-6
9.6 OPERATING AND SETUP MODES .....	9-7
9.6.1 Operating Modes .....	9-7
9.6.2 Setup Mode .....	9-8

# 9.1 UNPACKING AND SETUP

## Installation Site Check

---

Proper location and area preparation is important for overall operating efficiency. Ideally, the terminal location should be easily accessible, relatively dust free, and temperature and humidity controlled. A dedicated, regulated, noise free ac power outlet should be provided to minimize electromagnetic interference. Ensure adequate clearance (6 inches, minimum) is provided at the rear of the terminal to allow for cable connections.

# 9.2 UNPACKING AND SETUP

## Tools and Test Equipment

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- Standard CE Tool Kit  
WLI #726-9401
- Digital Voltmeter

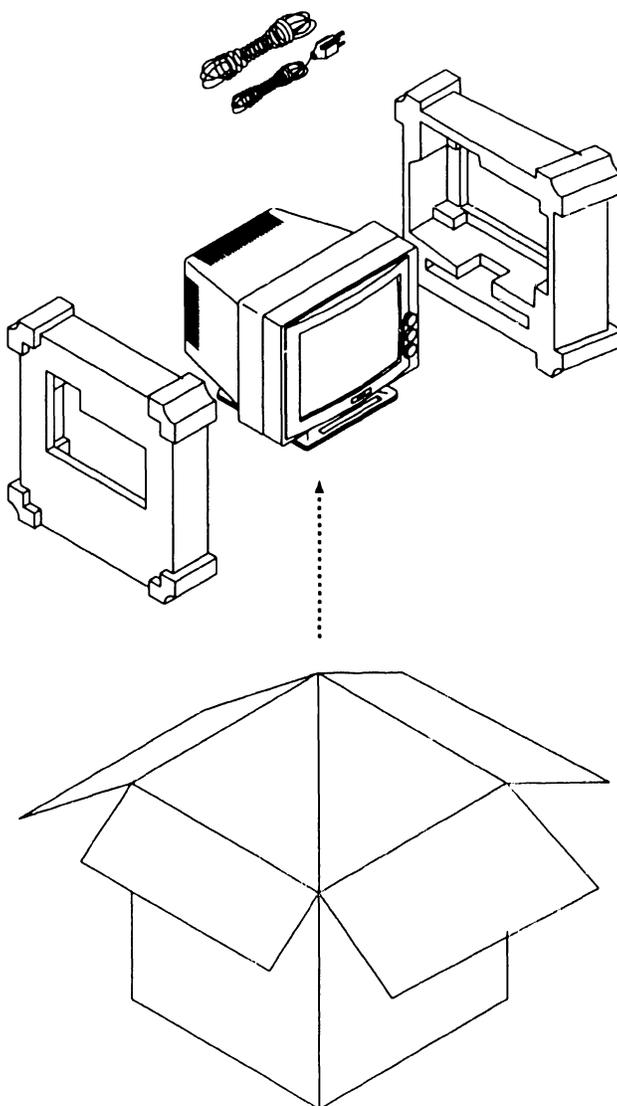
# 9.3 UNPACKING AND SETUP

## 9.3 Unpacking Procedure

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### 9.3.1 Unpacking and Inspecting Monitor

- 1 Unpack Monitor from shipping carton.
- 2 Visually inspect Monitor, and cables for external damage.



● END

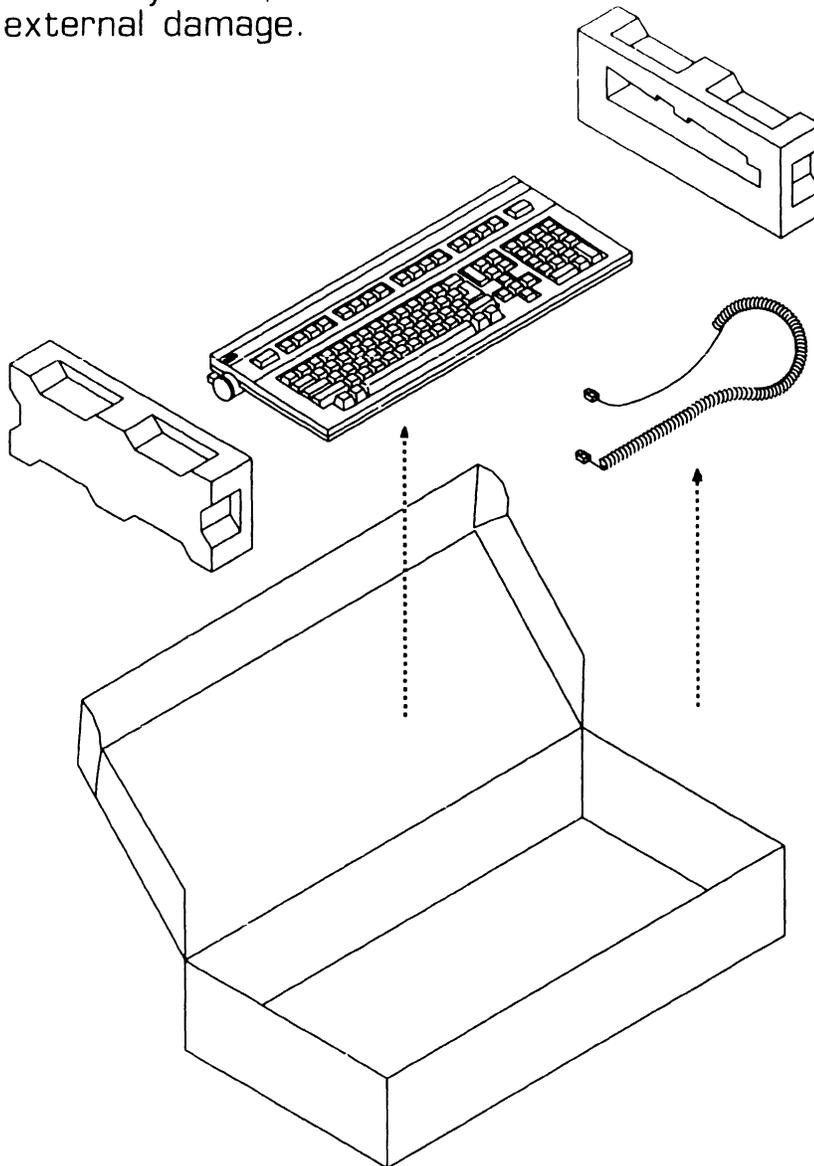
# 9.3 UNPACKING AND SETUP

## 9.3 Unpacking Procedure

---

### 9.3.2 Unpacking and Inspecting Keyboard

- 1 Unpack Keyboard from shipping carton.
- 2 Visually inspect Keyboard, and coil cable for external damage.



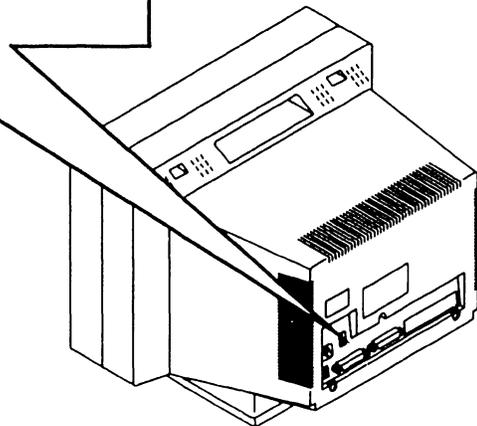
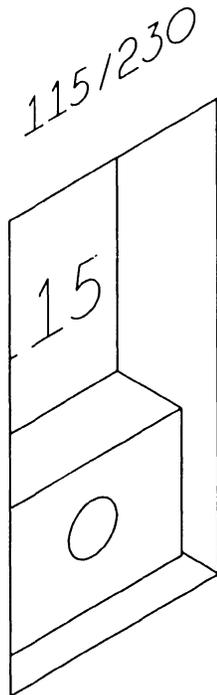
● END

# 9.4 UNPACKING AND SETUP

## 9.4.1 Switch Settings

### 9.4.1 Monitor Rear Panel Connections

- 1 Set Monitor VOLTAGE SELECT switch to correct ac line voltage setting (115/230 vac).



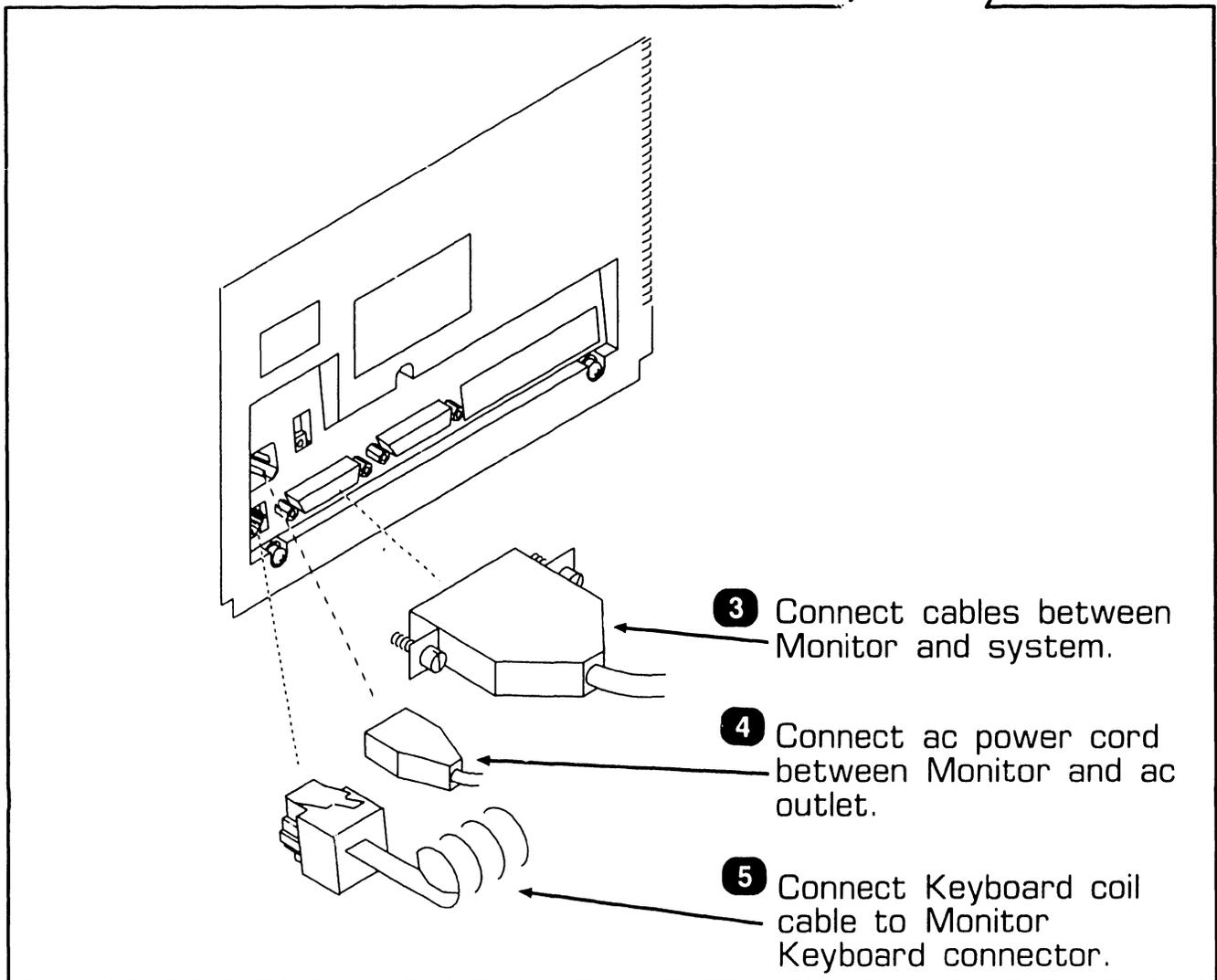
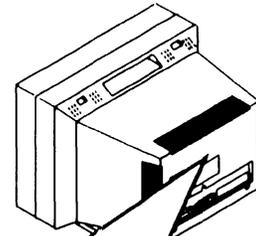
● END

# 9.5 UNPACKING AND SETUP

## 9.5 Connections

### 9.5.1 Monitor Rear Panel Connections

- 1 Ensure ac switch is set to "0"  
(▶4.2)
- 2 Ensure ac voltage select switch  
is set to correct line voltage  
(▶9.4.1)



● END

# 9.6 UNPACKING AND SETUP

## Operating and Setup Modes

---

### 9.6.1 Operating Modes

The following is a list of keyboard character codes required to implement the most frequently used terminal operating functions. For complete operating instructions, refer to the user's guide for the terminal.

#### **To enter or exit the Terminal set-up mode:**

Press SHIFT, CONTROL and HELP keys simultaneously.

#### **To move cursor from field-to-field:**

Use ARROW keys.

#### **To select or change a parameter or function:**

Press EXECUTE key.

#### **To refresh a screen after exit from the set-up mode:**

Press CONTROL and L keys simultaneously.

#### **To save a screen setup in the set-up mode:**

Press EXECUTE key.

#### **To enable printer continuously:**

Press CONTROL and PRINT keys simultaneously.

#### **To disable printer continuously:**

Press CONTROL and PRINT keys simultaneously a second time.

#### **To "hot print" a screen:**

Press SHIFT and PRINT keys simultaneously.

● END

# 9.6 UNPACKING AND SETUP

## 9.6.1 Operating and Setup Modes

### 9.6.2 Setup Mode

The Terminal has a set-up mode which allows the operator to change the factory default settings to match the characteristics of an attached host, auxiliary devices, the local power environment and modem support. It also allows you to select the keyboard layout. The set-up mode is represented by five separate menu screens which contain a complement of communication, display, printer, and keyboard functions and parameters which may be altered to suit a specific installation. The menu screens and a description of the screens characteristics are presented in the following pages.

#### NOTE

There are always two copies of the setup mode options when the terminal is operating. One copy is stored in non-volatile RAM. The second copy (the actual current setup options) is stored in a working RAM. The setup mode directly changes only the copy in the working RAM, but gives you the ability to copy the current working options into NV RAM for future recall.

**Main Menu:** The main menu is displayed immediately upon entering the set-up mode. It allows the operator to access each of the following menus and to select or alter general terminal operating characteristics. The following figure illustrates the main menu screen with factory default settings. The characteristics, optional selections, and their definitions are listed in the table that follows.

2110A SETUP MODE: Main Menu

**MAIN PORT COMMUNICATIONS** AUX PORT COMMUNICATIONS KEYBOARD CONFIGURATION

MODEM SUPPORT SAVE SETUP RECALL SETUP RESTORE FACTORY DEFAULTS

SCREEN WIDTH:80 POWER FREQUENCY:60 HZ DEFAULT CHARACTER SET:INTERNAL

AUTO-WRAP:NO SCROLL:JUMP VIDEO:NORMAL CURSOR STYLE:UNDERScore

CURSOR BLINK:ON SCREEN SAVE:ON POWER-ON DEFAULT SCREEN LENGTH:25

OPERATING MODE:2110A INT ENABLE:YES DATA REPRESENTATION MODE:8-BIT

➡ NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Menu Description

<i>Function/Parameter Selection</i>		<i>Definition</i>
MAIN PORT COMMUNICATIONS	EXEC to select	Replaces main menu screen with main port communications screen.
AUX PORT COMMUNICATIONS	EXEC to select	Replaces main menu screen with aux port communications screen.
KEYBOARD CONFIGURATION	EXEC to select	Replaces main menu screen with keyboard configuration screen.
MODEM SUPPORT	EXEC to select	Replaces main menu screen with modem support screen.
SAVE SETUP	EXEC to select	Saves current setup parameters from all setup screens into non-volatile memory.
RECALL SETUP	EXEC to select	Replaces "working" setup parameters with "saved" values.
RESTORE FACTORY DEFAULTS	EXEC to select	Restores factory installed terminal parameters as working parameters.
SCREEN WIDTH	80, 132	Selects an 80 or 132 column screen for text.
POWER FREQUENCY	50 HZ, 60 HZ	Selects terminal power frequency compatibility with local power line frequency.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Menu Description (Cont.)

<i>Function/Parameter Selection</i>		<i>Definition</i>
DEFAULT CHARACTER SET	INTERNAL EXTERNAL	Displays an internal character set or an optional cartridge based external character set.
AUTO WRAP	YES, NO	When enabled (YES), causes a received character after the right margin to be automatically displayed in the first position of the next line. When disabled (NO), causes a received character after the right margin to be overwritten into the last position of the current line.
SCROLL	JUMP, SMOOTH	Selecting JUMP vertical scroll causes instantaneous text line display updates. Selecting SMOOTH allows text to be scrolled at a continuous steady pace.
VIDEO	NORMAL, INVERSE	Selects either a normal (light character on dark field) or inverse (dark character on light field).
CURSOR STYLE	UNDERScore, BLOCK	UNDERScore highlights the pixels in the bottom two rows of the character cell. BLOCK highlights the entire cell.

➡NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.1 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Menu Description (Cont.)

<i>Function/Parameter Selection</i>		<i>Definition</i>
CURSOR BLINK	ON, OFF	Cursor may be displayed as blinking (ON) or steady (OFF).
SCREEN SAVE	ON, OFF	When enabled (ON), causes terminal to automatically reduce CRT brightness after 20 minutes of inactivity.
POWER-ON DEFAULT SCREEN LENGTH	24, 25	Selects a 24 or 25 line display for text.
OPERATING MODE	2110A, 2110, VT-102	Selects current terminal operating mode.
INT ENABLE	YES, NO	Enable interrupt control. Allows user to enable (YES) or disable (NO) the immediate processing of the INT control sequence.
DATA REPRESENTATION MODE	7-BIT, 8-BIT	Selects the control sequence expression format used for terminal/host communication. 8-bit may not be selected when the terminal/host data format currently selected is 7 bits. (See Data Bits under main port communications menu).

● END

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

---

### 9.6.2 Setup Mode

#### Main Port Communications Menu:

The main port communications menu allows the operator to select terminal characteristics to match those of the host system. The next figure illustrates the menu with factory default settings. The table that follows defines the various options.

---

2110A SETUP MODE: Main Port Communications

**MAIN MENU** NEXT MENU BAUD RATE:19200 PARITY:NONE DATA BITS:8 STOP BITS:1

LOCAL ECHO:OFF AUTO XON/XOFF:ON ONLINE COMMUNICATIONS:FDX

HDX B TURNAROUND:CR HDX INITIAL:XMIT EFFECTIVE XMIT RATE:19200 ANSWERBACK

AUTO LINEFEED:OFF AUTO NEW LINE:OFF AUTO TURNAROUND

◆NEXT

# 9.6 UNPCKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Port Communications Menu Description

<i>Function/Parameter Selection</i>		<i>Definition</i>
MAIN MENU	EXEC to select	Replaces main port communications menu with main menu screen.
NEXT MENU	EXEC to select	Replaces main port communications menu with next menu (Aux port communications screen).
BAUD RATE	75, 110, 134.5 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19,200	Selects speed at which data is transmitted and received.
PARITY	NONE, EVEN, ODD, SPACE, MARK	Selects character format used for communication with host computer.
DATA BITS	7, 8	Selects data character format used for communication with host computer. 7-bit format may not be selected if 8-bit mode is currently selected.
STOP BITS	1, 1.5, 2	Sets number of stop bits used by host port.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Port Communications Menu Description (Cont.)

<i>Function/Parameter Selection</i>		<i>Definition</i>
LOCAL ECHO	ON OFF	Enables or disables local echo feature. When enabled (ON), every code, except XON and XOFF, that is transmitted from the terminal is displayed on screen.
AUTO XON/XOFF	ON, OFF	Paces data transmission between host and terminal. When enabled (ON), terminal automatically prevents buffer overflow.
ONLINE/LOCAL	Either	Allows terminal to communicate with host (ONLINE) or to operate independently (LOCAL).
COMMUNICATIONS	FDX, HDX A, HDX B	Selects main port communication mode. FDX = Full Duplex, HDX A = Half Duplex A, HDX B = Half Duplex B.
HDX B TURNAROUND	CR, EXT, FF, DC3, EOT	Selects a specific single byte code that terminal recognizes as the turnaround character.
HDX INITIAL	XMIT, RECV	Allows terminal to either initiate or receive transmission of data when HDX B is enabled.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Main Port Communications Menu Description (Cont.)

<i>Function/Parameter Selection</i>		<i>Definition</i>
EFFECTIVE XMIT RATE	75, 110, 134.5 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19,200	Selects effective data transmission rate to host computer. Rate selected by values are selected value -10 regardless of current parity, number of data bits, and number of stop bits. Implementation may be limited by resolution of timer support.
ANSWERBACK	Text Entry Menu	Allows up to 32 bytes of answerback message entry.
AUTO LINEFEED	ON, OFF	When enabled (ON), causes cursor to automatically move down one line when RETURN is received.
AUTO NEWLINE	ON, OFF	Selects whether keyboard RETURN key generates a character return only or a carriage return and a line feed (ON). Also, received line feeds are interpreted as carriage return plus line feed.
AUTO TURN- AROUND/ MANUAL TURNAROUND	Either	When enabled (AUTO), terminal automatically transmits turnaround character when RETURN is keyed.

● END

# 9.6 UNPACKING AND SETUP

## 9.6 Operating and Setup Modes

---

### 9.6.2 Setup Mode

#### Aux Port Communications Menu:

This menu allows the operator to select terminal characteristics to match auxiliary devices. The menu is illustrated below. The aux port communications options are listed in the table that follows.

2110A SETUP MODE: Aux Port Communications

**MAIN MENU** NEXT MENU BAUD RATE:1200 PARITY:NONE DATA BITS:8 STOP BITS:1

HOST ACCESS:NO TRANSMIT ENABLE:NONE RECEIVE ENABLE:NONE

AUX DEVICE ON SIGNAL:ON AUTO XON/XOFF:ON LOCAL PRINTING:WISCII

PRINTER LINE TERMINATOR:CR+LF SCREEN PRINTER TERMINATOR:FF AUX DEVICE TYPE

PRINTER WIDTH:80 PRINTER SCREEN REGION:FULL

➡NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Aux Port Communications Menu Description

<i>Function/Parameter</i>	<i>Selection</i>	<i>Definition</i>
MAIN MENU	EXEC to select	Replaces Aux Port Communications menu with main menu screen.
NEXT MENU	EXEC to select	Replaces Aux Port Communications menu with next menu (keyboard menu) screen.
BAUD RATE	75, 110, 134.5 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19,200	Selects speed at which data is transmitted and received between terminal and an auxiliary device.
PARITY	NONE, EVEN, ODD, SPACE, MARK	Selects character format used to communicate with auxiliary device (See data bits).
DATA BITS	7, 8	Selects character format used to communicate with auxiliary device.
STOP BITS	1, 1.5, 2	Selects number of stop bits used by aux port.
HOST ACCESS	YES, NO	Enables or disables host access to aux port.
TRANSMIT ENABLE	DSR, DSR+CTS DSR+CTS+DCD DSR+CTS-DCD NONE	Selects the aux port signal that enables the terminal to transmit data to the aux device.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.1 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Aux Port Communications Menu Description (Cont.)

<i>Function/Parameter Selection</i>	<i>Definition</i>
RECEIVE ENABLE      NONE, RTS	Selects whether or not the terminal may pace the aux device via the RTS signal level.
AUX DEVICE ON SIGNAL              ON, DSR	Determines if a signal is needed for terminal to establish the ON/OFF status of the aux device. Device is assumed on if ON is selected.
AUTO XON/XOFF      ON, OFF	Enables software pacing of transmission between aux device and terminal. When enabled (ON), allows terminal or printer to automatically prevent buffer overflow.
LOCAL PRINTING      WISCII, ASCII	Selects Wang WISCII or non-Wang ASCII character set for local printing.
PRINTER LINE TERMINATOR          CR+LF, CR	Selects either a carriage return (CR) or a carriage return plus a line feed (CR+LF) to be output to the printer at the end of a print line as part of print line and print page functions.

◆NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.1 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Aux Port Communications Menu Description (Cont.)

<i>Function/Parameter Selection</i>	<i>Definition</i>
SCREEN PRINTER TERMINATOR	FF, NONE
AUX DEVICE TYPE	EXEC TO SELECT
PRINTER WIDTH	40, 80, 132
PRINTER SCREEN REGION	FULL, HOST

◆ END

# 9.6 UNPACKING AND SETUP

## 9.6.1 Operating and Setup Modes

---

### 9.6.2 Setup Mode

#### **Keyboard Configuration Menu:**

The keyboard configuration menu defines the keyboard characteristics available to the operator. The menu is shown below. The options are defined in the table that follows.

2110A SETUP MODE: Keyboard Configuration

**MAIN MENU**    NEXT MENU    ALARM VOLUME:4    KEYCLICK ENABLE:YES

KEYCLICK VOLUME:4    KEY REPEAT RATE:25 CPS    KEY REPEAT DELAY:.3 SEC

KEYBOARD LANGUAGE:US    LOCK KEY:SHIFT LOCK    PF1 PF2 PF3 PF4 PF5 PF6 PF7

PF8 PF9 PF10 PF11 PF12 PF13 PF14 PF15 PF16 PF17 PF18 PF19 PF20

PF21 PF22 PF23 PF24 PF25 PF26 PF27 PF28 PF29 PF30 PF31 PF32

◆NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Keyboard Configuration Menu Description

<i>Function/Parameter Selection</i>		<i>Definition</i>
MAIN MENU	EXEC to select	Replaces keyboard configuration menu with main menu screen.
NEXT MENU	EXEC to select	Replaces keyboard configuration menu with next menu (modem support) screen.
ALARM VOLUME	OFF, 1, 2, 3, 4, 5, 6, 7	Selects volume at which terminal responds with a beep.
KEYCLICK ENABLE	YES, NO	Enables or disables a keyboard click sound each time a key is pressed.
KEYCLICK VOLUME	OFF, 1, 2, 3, 4, 5, 6, 7	Selects level of keyclick volume when keys are pressed. Note: Level "1" is inactive.
KEY REPEAT RATE	6 CPS, 7 CPS 8 CPS, 10CPS 12 CPS, 17CPS 25 CPS, 50 CPS	Selects number of characters per second a pressed key will generate.
KEY REPEAT DELAY	.1 SEC, .2 SEC .3 SEC, .4 SEC .15 SEC, .25 SEC .35 SEC, .45 SEC	Selects time interval before a pressed key starts repeating.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Keyboard Configuration Menu Description

<i>Function/Parameter Selection</i>	<i>Definition</i>
KEYBOARD LANGUAGE* US, AE, AZ, CA CF, FL, IT, SE SP, SL, UK, WL DV, EDA, EFI, EGE, EIC, ENL ENO, EPO, ESF ESG, ESW, ETU	Selects correct terminal operation for keyboard type. (See keyboard mnemonic definitions below).
LOCK KEY SHIFT LOCK CAPS LOCK	SHIFT LOCK generates shifted data for all keys. Lock state is entered by pressing LOCK key. SHIFT LOCK cleared by pressing SHIFT key. CAPS LOCK generates only upper case alphabetic keys. Locked state is toggled by pressing LOCK key.
PF1 through PF32 EXEC to select	Allows operator to input text or control codes which can be accessed at any time by pressing appropriate PF key

\*US: USA/QWERTY, AE: Belgium/English AZERTY, AZ: France/AZERTY, CA: Canadian/English, CF: Canadian/French, FL: Belgium/Flemish, IT: Italian, SE: South African, SP: Spanish, SL: Spanish(Latin), UK: United Kingdom, WL: World Languages, DV: Dvorak, EDA: Expanded Danish, EFI: Expanded Finnish, EGE: Expanded German, EIC: Expanded Icelandic, ENL: Expanded Dutch, ENO: Expanded Norwegian, EPO: Expanded Portuguese, ESF: Expanded Swiss/French, ESG: Expanded Swiss/German, ESW: Expanded Swedish, ETU: Expanded Turkish.

● END

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

---

### 9.6.2 Setup Mode

#### **Modem Support Menu:**

The modem support menu enables the operator to match the characteristics of the terminal to those of a modem device. The menu is shown below followed by a description of the options available.

2110A SETUP MODE: Modem Support

**MAIN MENU** NEXT MENU MODEM COMMAND POWERON:NO ALTERNATE BAUD SELECT:CCITT

ALTERNATE BAUD RATE:NONE COMMAND SCREEN:LIMITED

COMMAND MODE HOST NOTIFICATION:NO MODEM COMMAND PF1 MODEM COMMAND PF2

◆NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

### 9.6.2 Setup Mode

#### Modem Support Menu Description

<i>Function/Parameter</i>	<i>Selection</i>	<i>Definition</i>
MAIN MENU	EXEC to select	Replaces modem support menu with main menu screen.
NEXT MENU	EXEC to select	Replaces modem support menu with next menu (main menu).
MODEM COMMAND POWERON	YES, NO	When enabled (YES), allows automatic entry into modem command mode at completion of power-on or terminal reset.
ALTERNATE BAUD SELECT	CCITT, BEL	Selects international (CCITT) or domestic (BELL) baud rate standard.
ALTERNATE BAUD RATE	NONE, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19,200	Selects an alternate host port baud rate.
COMMAND SCREEN	FULL, LIMITED	When FULL is selected, terminal reset is performed on entry/exit to modem command mode and full screen area is made available. When LIMITED is selected, terminal reset is not performed and original screen contents are not lost. A limited screen area is available for terminal modem dialog.

►NEXT

# 9.6 UNPACKING AND SETUP

## 9.6.2 Operating and Setup Modes

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### 9.6.2 Setup Mode

#### Modem Support Menu Description (Cont.)

<i>Function/Parameter</i>	<i>Selection</i>	<i>Definition</i>
COMMAND MODE HOST NOTIFICATION	YES, NO	When enabled (YES), causes terminal to notify host of entry into or exit from modem command mode.
MODE COMMAND PF1	EXEC to select	Allows up to 32 bytes of direct text entry.
MODE COMMAND PF2	EXEC to select	Allows up to 32 bytes of direct text entry.

● END

**SECTION**

**10**

**FUNCTIONAL  
DESCRIPTION**

# SECTION 10 CONTENTS

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## SECTION 10 FUNCTIONAL DESCRIPTION

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# FUNCTIONAL DESCRIPTION

## 10.1 Introduction (Sheet 1 of 2)

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The 2110A Async Data Entry Terminal is an enhanced ergonomically designed CRT display terminal, which has multi-page and multi-viewport capability. The 2110A communicates with both Wang and non-Wang host systems over public networks, via an RS-232-C auxiliary port utilizing ANSI-compatible protocol. Non-Wang system access is accomplished by utilizing an emulation mode for access to host computers and networks. The 2110A Terminal functionality includes an operating mode that provides downward compatibility with existing 2110 applications. In addition, the 2110A is designed for use with the VS/ADC, VS/EADC, and APC/MTC system/controller configurations.

The 2110A Terminal consists of a Power Supply PCB, a Monitor PCB, an Electronics PCB, and a 720 Keyboard. Connection to the master is accomplished via a 2681 DUART. The Power Supply PCB outputs are: regulated 12, +24, and +5 volts. General features include:

- Three board Terminal
- 1 MHz 6809E Microprocessor CPU
- 14 inch Monitor
- Bi-directional auxiliary RS-232-C remote printing port
- Detachable, low profile, 720 Keyboard
- User Terminal options via main menu
- Built-in stand-alone test diagnostics
- 80 or 132 columns by 25 lines displayed

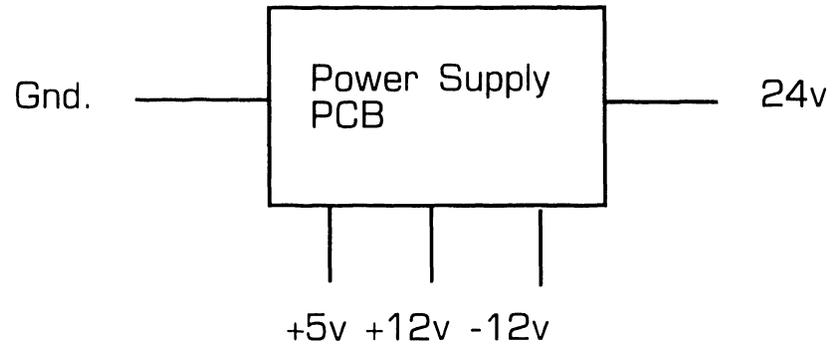
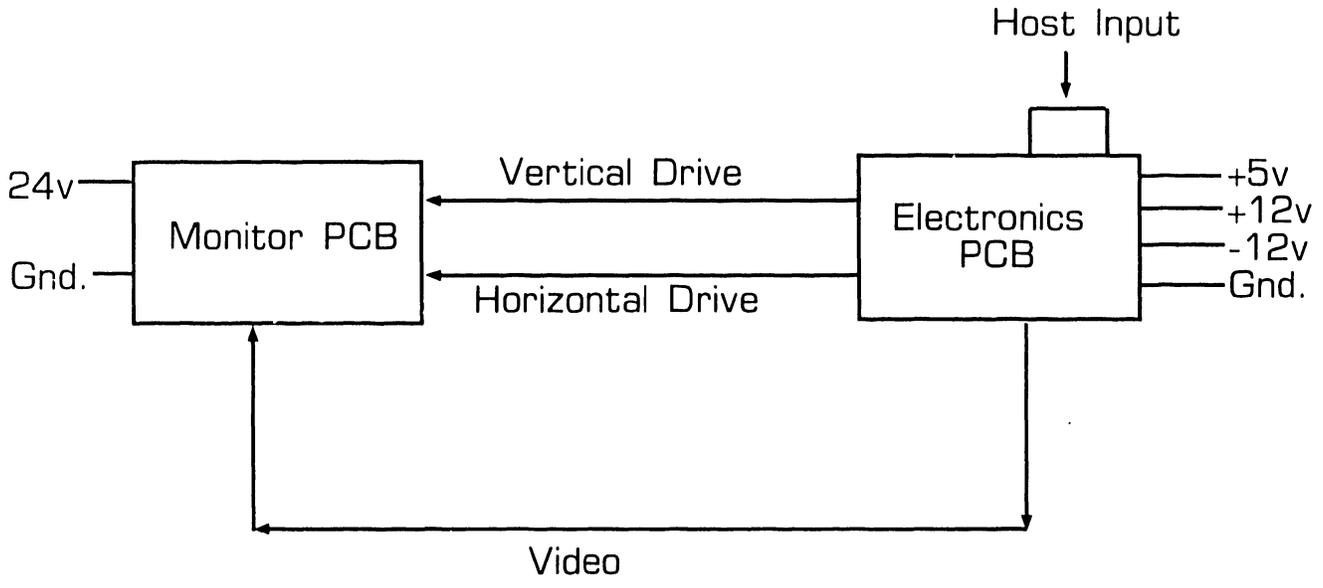
- Adjustable operator controls for Power-On/Off, Brightness, and Contrast
- Two piece package (Monitor and Keyboard)
- 720 Serial Keyboard Interface UART
- 32K Program SRAM
- 4K System SRAM
- 4 Memories of 8K Character Attribute RAM
- 2674 CRT Controller Chip
- Main Port Transmit Enhancement
- CRT SCREEN SAVER feature
- Direct generation of ASCII characters
- PROM based terminal microcode

►NEXT

# FUNCTIONAL DESCRIPTION

## 10.1 Introduction (Sheet 2 of 2)

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● END

# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

(Sheet 1 of 11)

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This section describes the theory of operation for the 2110A Terminal on a block diagram level. The information is intended to provide customer engineering personnel with a basic understanding of the terminal design.

Three PCB's reside in the 2110A Terminal. They are the Electronics PCB, a Monitor PCB, and a Power Supply PCB.

### *Electronics PCB*

Data flow between the various components of the terminal occurs on the 2110A Terminal's internal bus network. The bus network comprises signals representing data, control, and address information. All the processing logic for the 2110A is contained on the Electronics PCB.

### *2110A Main/Aux Async Communication Ports*

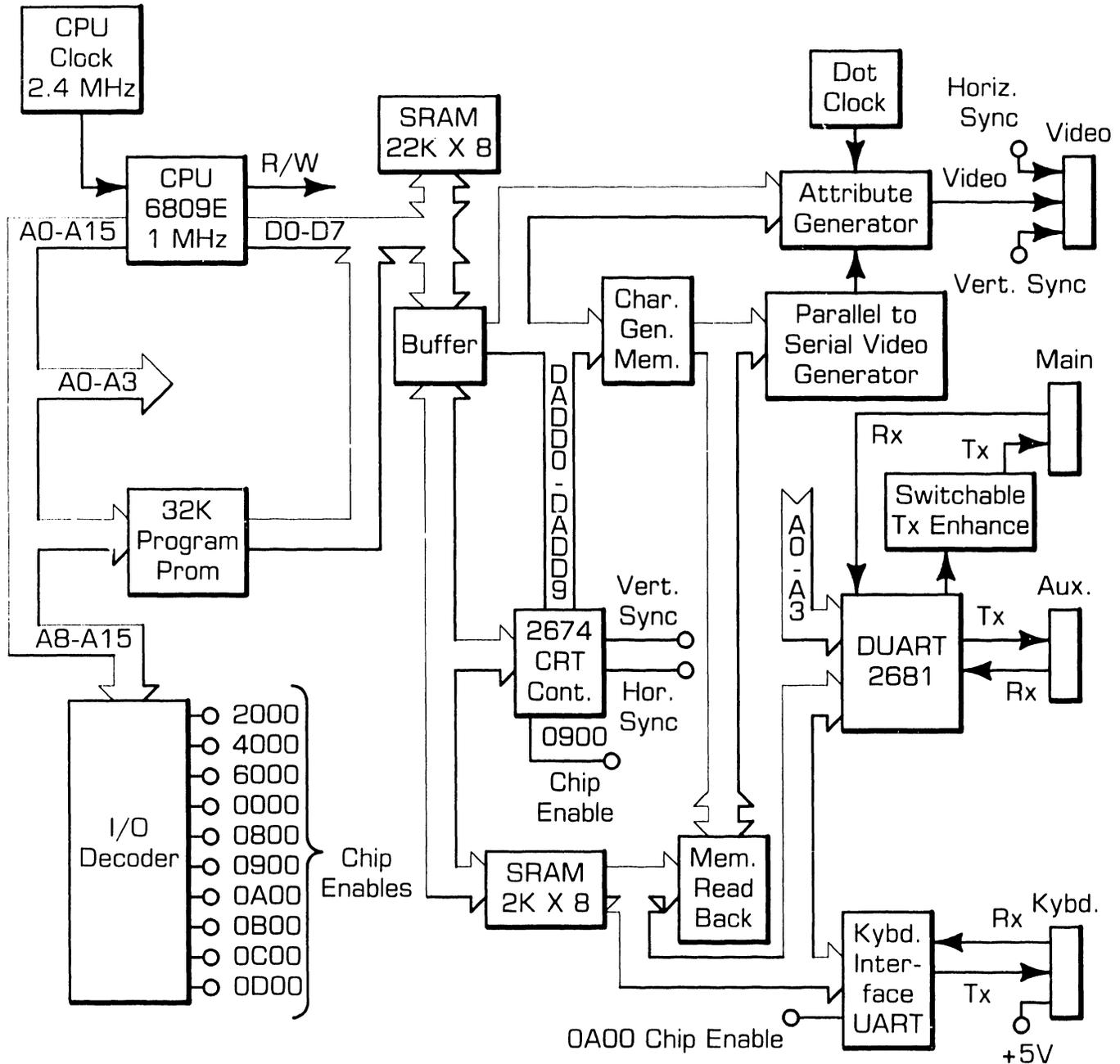
The 2110A Terminal provides two EIA RS-232-C communication ports defined as MAIN and AUX, with operational modes that include on-line full duplex, half duplex, and a local mode. The MAIN port is dedicated to host communication, and the auxiliary (AUX) port is available to provide a data path between the host and an auxiliary device, or to support local print functions. The MAIN port interface incorporates a low impedance

transmit enhancement, that permits communication over cable lengths up to 2000 feet. The MAIN and AUX communication port cable connections are mounted on the back of the Monitor. The 2110A Terminal also monitors host data path switching controls, and data flow control between host and AUX device. The 2110A Terminal will support the use of intelligent modems. When local mode is selected, the terminal operates independently of the host. Data in the terminal's MAIN port transmit buffer is transferred into the MAIN port receive buffer. No data is transmitted from the terminal's MAIN port. Parity, Baud rate, and required number of data bits and stop bits for AUX port communication are configured independently of the MAIN port. Configuration is determined by the SETUP mode operation. All data is internally buffered and manipulated within the terminal as 8-bit data. When either port is configured as a 7-bit port, the high data bit to be transmitted is ignored.

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# 10.2 FUNCTIONAL DESCRIPTION

## Block Diagram Description (Sheet 2 of 11)



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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

(Sheet 3 of 11)

---

### *Program Memory*

There are two areas of program memory that are assigned to program memory address range. These are the Internal Program ROM, and the 32K Program ROM internal to the terminal. At power-up, the 6809E Microprocessor initially defaults to execute instructions which are downloaded from ROM Memory. At the same time, the internal Character Generator RAM contents are cleared.

### *System Ram*

The 2110A Terminal provides 4K of system RAM within the terminal. System RAM is available to the processor as scratch area for buffers, flags, and general terminal useage. The system RAM allocation is made for MAIN port, AUX port, and keyboard buffers as follows:

- MAIN receive buffer: 256K bytes
- MAIN transmit buffer: 256K bytes
- AUX port receive buffer: 256K bytes
- AUX port transmit buffer: 256K bytes
- Keyboard receive buffer: 80K bytes
- Keyboard transmit buffer: 80K bytes

### *Display Ram*

The 2110A Terminal display RAM will provide storage for both display characters and associated attributes. Display storage is available for a maximum of 4 pages of 80 column by 25 row data. The terminal's 16K bytes of display memory are included in the processor's address space. Each character display position is assigned one byte for storage of character code, and one byte for storage of character associated attributes. This Character Generator Memory attribute bit pair selects one of four possible Character Generator Memory elements used for character display. The following attributes are supported on a per-character basis: Blink, High Intensity, Single Underscore, Reverse Video, Blank, Double Underscore, and Character Generator Memory Selector (2 bits). Screen display attributes are available in normal (light on dark field) or inverse (dark on light field).

### *Character Generator Memory*

The 2110A Terminal Character Generator Memory supports 80 and 132 column display through modification of the number of pixel columns (width) of a character cell, while maintaining a constant pixel dot rate. Provisions are made for addressing all 8K bytes of each of the four possible Character Generator Memory elements. This is accomplished via the processor's

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

(Sheet 4 of 11)

address space, and includes read/write access for internal Character Generator RAM, and external Character Generator Memory elements. When access is required, the processor selects which of the four Character Generator memories are mapped into processor address space. Access is provided for host downloading, and inter-Character Generator Memory element copying of character set data. As part of power-on initialization, internal Character Generator RAM contents are cleared. Hardware implementation will be such that access to an external Character Generator Memory (which is not present) will result in character cells displayed as a solid block (all pixels on). In 80 column display mode, the stored character cell size is 14 pixels high by 10 pixels wide, and normal character size is 10 pixels high by 9 pixels wide. In 132 column display mode, the stored character cell size is 14 pixels high by 6 pixels wide, and the normal character size is 10 pixels high by 5 pixels wide. Character Generator Memory elements are defined as:

- Internal Character Generator ROM. Storage for 256 characters (both 80 and 132 column fonts).
- Internal Character Generator RAM. Storage for 256 characters (both 80 and 132 column fonts).

- External Character Generator Memory elements where each element provides storage for 256 characters in both 80 and 132 column fonts.

The Character Generator Memory provides storage, so that individual control adjustment of each pixel's character cell on/off state is available, regardless of the terminal's display mode. Character cells are displayed immediately adjacent, and no inter-cell spacing is provided. The internal Character Generator ROM supports 256 displayable characters in both 80 and 132 formats. The 256 characters include the Wang WISCII-I character set along with 32 additional graphics symbols.

### *6809E CPU*

The 6809E is responsible for decoding and executing software that is downloaded from the internal PROM Memory. Bus operations are controlled by the 6809E CPU. The CPU receives sequential instructions from Main Memory over the Data Bus. It assigns device access and tasks based on these instructions, and communicates with monitor and keyboard interface logic through the Data, Address, and Control Buses.

CPU signals are sequenced according to both the CPU's internal instruction

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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set and instructions received from Main Memory over the Data Bus. The CPU requires a single, +5 Vdc supply and employs a 1 MHz clock as its time base.

Bi-directional data flow is accomplished by an 8-bit, tri-state Data Bus. The CPU transmits address information through a 16-bit, tri-state Address Bus. Both the Data Bus and Address Bus are buffered, thus imposing only one TTL load on the CPU. A reset line initializes the CPU and control-output lines. The four control-output lines are:

R, Read: When active, indicates that the CPU will input data while performing a memory-access or I/O instruction.

W, Write: When active, indicates that the CPU will output data while performing a memory-access or I/O instruction.

BA, Bus Available: An output signal which indicates the presence of a control signal making other busses of CPU become high impedance. When BA goes low, the bus is reacquired following a dead cycle.

In addition to the control-output lines, there are four CPU input control lines, which are:

Halt: A low level input causes the CPU to stop running at the end of the present instruction and remain halted indefinitely without loss of data. While halted, the CPU will not respond to real-time requests.

IRQ, Interrupt Request: A low level input initiated by an interrupt request sequence, which is cleared by an interrupt service routine.

RESET: A low level signal, longer than one cycle, that is inputted to both CPU and DUART as a reset. During IPL, the RESET signal is held low until the clock input signals are fully operational.

FIRQ, Fast Interrupt Request: A low level signal which initiates a Fast-Interrupt sequence which has priority over standard interrupt requests. An interrupt service routine will clear the interrupt signal.

The 2110A employs 6809E interrupt modes type 0 and type 2. A mode 2 interrupt is the most powerful mode in the 6809E CPU control set, in that it allows for an in-direct call to any location in memory. In this mode, the CPU forms a 16-bit memory address where the upper eight bits are the contents of the interrupt page register (I register) in the CPU. The low order eight bits are supplied by the

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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interrupting peripheral. The address thus formed points to the first two bytes in a table where the address of the appropriate service routine is located. The CPU automatically obtains the starting address and performs a CALL to this address, thus servicing the peripheral. After the routine is complete, the content of the program counter is retrieved from the stack and the program continues from where it left off before the interrupt.

### *I/O Decoder*

The I/O Decode circuit decodes the memory mapped Address Bus (A11-A14) presented to its input pin when A15 is enabled low. The I/O Decode is cascaded, selecting two additional I/O Decode circuits when A13, A14 and A15 are low. The I/O Decode enables the various RAM devices, DUART and CRT Controller.

### *CRT Controller*

The 2674 LSI Chip formats and inputs video signals along with video generator Vertical and Horizontal Sync, and Display Enable signals to the Monitor PCB. Character video generator signals are created within the 2674 CRT Controller chip. The 6809E CPU controls the CRT Controller, and writes commands to the

CRTC device's internal registers. The CRT Controller performs the interface of digital system logic between the 6809E CPU and the raster scan CRT display.

Interconnection between the 2110A Electronics PCB and the Monitor PCB is accomplished by feeding TTL video signal levels to the monitor via a shielded cable. These signals include Horizontal and Vertical Sync, and Display Video Logic. These levels are generated by a 2674 CRT Controller chip located on the Electronics PCB. The 2674 CRT Controller chip controls the timing relationships for the following signals: Frame Refresh Rate, Active Scan Lines, Vertical Sync Delayed, Vertical Sync Width, Horizontal Frequency, Horizontal Sync Delayed, Horizontal Sync Width, and Pixel Clock Rate.

### *Keyboard Interface UART*

The 56850 UART chip is the interface device between the CPU chip and the Keyboard. The UART transmits data at 62.5K Baud in a full-duplex mode of operation. The UART performs Serial-to-Parallel data conversion (serial keyboard input), and Parallel-to-Serial data conversion (CPU Control words sent to keyboard i.e. light LED, initialize keyboard on power-up, etc.). The UART is enabled by the I/O Decode

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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Address 0A00 which is active high. The direction of the data (Transmit and Receive) is controlled by the CPU Control signal MEWR. When MEWR is active high (RD), serial keyboard data (converted to parallel format internal to the UART device) is placed on the data bus and presented to the CPU. When MEWR is low (WR), the parallel data on the data bus is read into the UART device, converted to a serial format, and presented to the microprocessor internal to the keyboard.

### *Main and Auxiliary Interface DUART*

THE UART interfaces to the Keyboard via an RJ11-C Phone Jack connector. The RJ11-C connector pin-out is as follows:

Pin 1	+5V	(Keyboard Power)
Pin 2	GND	(Keyboard GND)
Pin 3	XMT	(Serial Out to Keyboard)
Pin 4	RXD	(Serial In from Keyboard)

The 2681 DUART chip (Dual Universal Async Receiver/Transmitter) is the interface device between the CPU chip, and the Main and AUX ports.

The DUART (Channel A and B) is software selectable for baud rates, data transmission formats, and mode of duplex [half-duplex, full-duplex] (Note Channel A is exclusive and independent of Channel B): The following baud rates are supported:

75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600 and 19200.

The data transmission formats supported are:

7 or 8 Data Bits  
Even/Odd, Mark/Space, or No Parity  
Stop Bits of 1, 1.5 and 2

The DUART performs Serial-to-Parallel data conversion (Main/AUX input) and Parallel-to-Serial data conversion (data sent to Main/AUX). The DUART is enabled by the I/O Decode Address 0800 which is active low. The direction of the data (Transmit and Receive) is controlled by the CPU control signal MEWR. When MEWR is active high (RD), serial data (converted to parallel format internal to the DUART device) is placed on the data bus and presented to the CPU. When MEWR is low (WR), the parallel data on the data bus is read into the DUART device, converted to a serial format and presented to the micro

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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processor internal to the keyboard.

Channel A (HOST Port) and Channel B (AUX Port) interface via two RS232-C 25-pin 'D' connectors denoted HOST and AUX. RS-232-C connector pin-out is as follows:

### *Main Port*

Pin 1 Protective Ground  
Pin 2 Transmit Data (Out) Switch settable, Enhanced  
Pin 3 Receive Data (In)  
Pin 4 RXD (Serial In from Keyboard)  
Pin 5 Request to Send  
Pin 6 Clear to Send  
Pin 7 Signal Ground  
Pin 8 Data Carrier Detect  
Pin 12 Secondary Received Line Signal Detector  
Pin 20 Data Terminal Ready  
Pin 23 Data Signal Rate Detector  
Pins 9-11, 13-19, 21,22,24-25 NOT Used

### *Aux Port*

Pin 1 Protective Ground  
Pin 2 Transmit Data (Out)  
Pin 3 Receive Data (In)  
Pin 4 RXD (Serial-In from Keyboard)

Pin 5 Request to Send  
Pin 6 Clear to Send  
Pin 7 Signal Ground  
Pin 8 Data Carrier Detect  
Pin 20 Data Terminal Ready  
Pins 9-19, 21-25 NOT Used

At Power-On time, the DUART's internal registers are cleared by the signal RESET. The CPU then addresses the DUART's internal registers via Address Bus line A0-A3. The CPU then presents the information on the Data Bus (D0-D7) of the DUART (i.e. BAUD RATE, Mode of Duplex, Transmission type, etc.) and the DUART will write this information into the internal registers. Note that the baud rate can be changed by the CPU (via software) at anytime the DUART is not BUSY (polling). A 3.6 MHz clock is used for the DUART's internal baud rate generators. The +5 volts presented to pin 40 of the DUART provides all necessary voltage requirements.

### *Attribute Generator*

There is 8K of address space reserved for Attribute Memory and determination of which screen display attributes are used for each displayed character (i.e. Blink, Reverse Video, Single Underscore, etc.). The attribute and character memories are

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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mapped in exactly the same way. There is one attribute byte of memory for each character byte. The Attribute Memory stores information which defines how the character appears on the CRT.

### *Transmit Enhancement*

The Main Port is configured with a low impedance enhancement modification to permit communication over a maximum of 2000 feet of cable. When enabled, the transmitted data signal is enhanced through use of circuitry which takes +5 volt input, and amplifies it to 12 volt output for sufficient drive level useage with 2000 feet of cable.

### *Read Back Buffer*

Provides CPU access to the Character Generator Memory Data Bus for a read back of the video memory at any given moment.

### *Power Supply PCB*

The 2110A Terminal is equipped with a Power Supply PCB which provides three regulated DC voltages (+24v, 12v, +5v) to operate the Monitor, Keyboard, Monitor PCB, and Electronics PCB.

### *Monitor/Monitor PCB*

The Monitor contains a 14 inch green-on-black CRT along with three PCB's which are: a Power Supply PCB, a Monitor PCB, and an Electronics PCB. The Monitor PCB processes video and synchronization signals it receives from the Electronics PCB. The CRT screen has a capacity of 25 lines with 80 characters per line for a total of 2000 characters displayed. In addition, the CRT screen also has a capability of displaying 132 characters per line for a total of 3300 characters.

The Monitor PCB receives +24 Vdc from the Power Supply PCB, which directly supplies the high current horizontal deflection circuitry and the CRT filament.

Input signals to the Monitor PCB include VIDEO, HORIZONTAL SYNC AND VERTICAL SYNC which are generated on the Electronics PCB.

The VIDEO input is applied to a push-pull stage which provides amplification and inversion of the incoming video signal. The amplified and inverted video drives the cathode of the 14-inch (diagonal) CRT.

The Horizontal (HD) input is applied to the horizontal processor device,

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# FUNCTIONAL DESCRIPTION

## 10.2 Block Diagram Description

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which is followed by a driver and a horizontal output amplifier. The Horizontal Hold and Horizontal Center adjustments are inputs to the horizontal sync and deflection device. The horizontal processor device provides for a phase and frequency-stable horizontal deflection ramp, which is fed to the horizontal output stage.

The horizontal output transistor feeds the horizontal deflection coils of the yoke with a sawtooth-type deflection waveform. The current in the yoke windings develops an electromagnetic field for deflection of the CRT electron beam in the horizontal direction. The Horizontal Width adjustment is part of the total horizontal deflection coil load.

At horizontal retrace (flyback) time, the current field in the horizontal deflection coils of the yoke collapses, and the resultant energy is stepped up by the flyback transformer. On the secondary side of the flyback transformer, there are separate windings which feed diode rectifiers and associated voltage divider circuits. Anode operating potential, focus (G3), G1 and G2 voltages, are all derived from these rectifier and voltage divider circuits.

The Vertical (VD) input is applied to the vertical deflection circuitry. Verti

cal processing is performed wholly by a vertical processor device, which develops the final vertical sawtooth waveform that drives the vertical deflection coils of the yoke. Vertical Hold, Vertical Size and Vertical Linearity adjustments are all inputs to the Vertical Sync and deflection device.

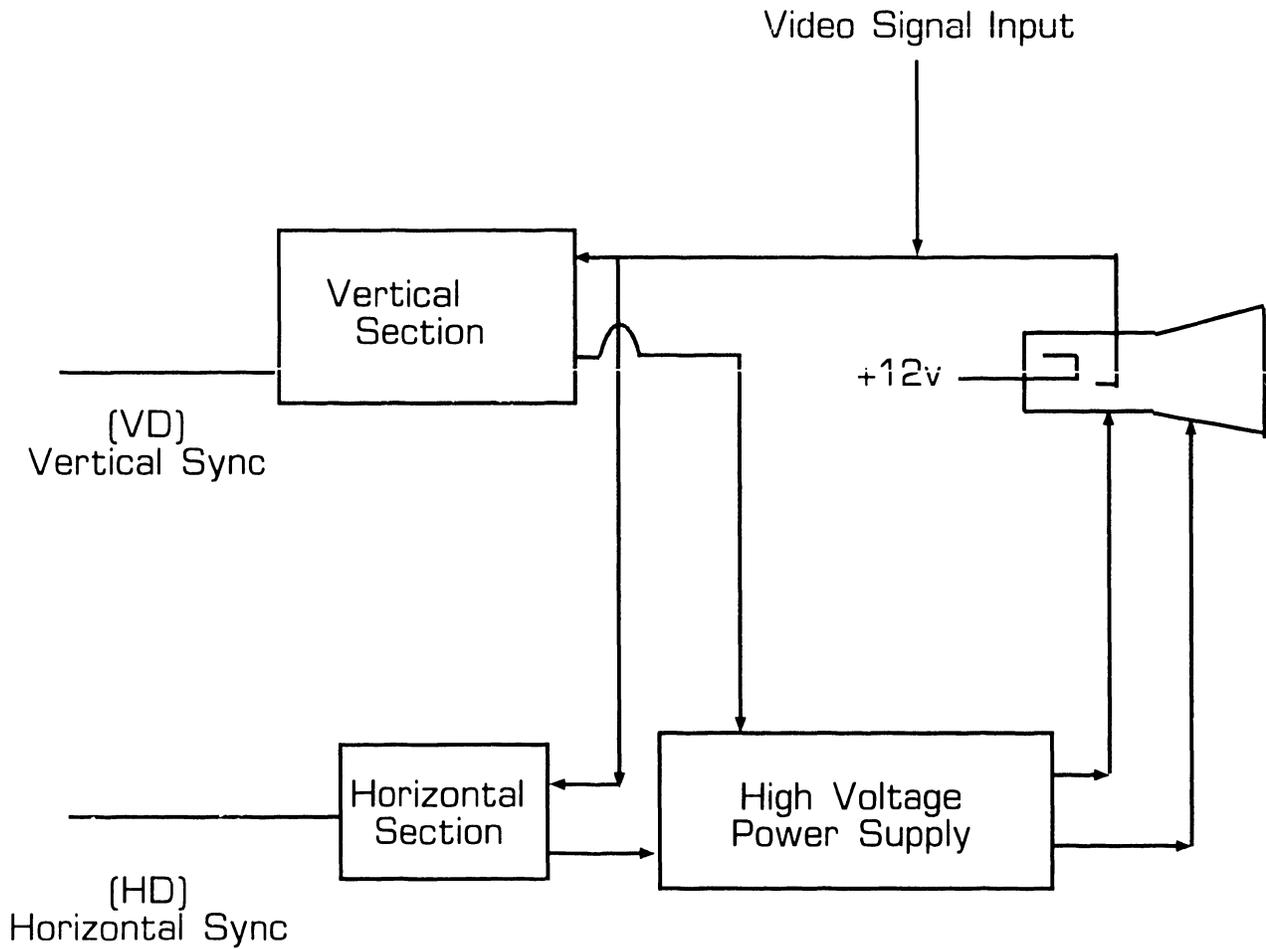
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## 10.2 Block Diagram Description

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◆ END

**SECTION**

**11**

**SPECIFICATIONS**

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## SECTION 11 SPECIFICATIONS

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# SPECIFICATIONS

## 11.1 Equipment

---

### *Monitor Physical Dimensions:*

Height: 13.5 inches (34.2 cm.)  
Width: 15.25 inches (38.7 cm.)  
Depth: 15.0 inches (38.1 cm.)

### *Monitor:*

Weight: 22 pounds (9.98 kgs.)

### *Keyboard Physical Dimensions:*

Height: 1.7 inches (4.3 cm.)  
Width: 18.3 inches (46.5 cm.)  
Depth: 7.8 inches (19.8 cm.)

### *Keyboard:*

Weight: 4.5 pounds (2.0 kgs.)

### *Input Power Requirements:*

120 vac, 60 Hz, 0.70 A.  
240 vac, 50 Hz, 0.35 A.  
29 Watts, 47.43 Volt/amps.  
No power-up current surge.

### *Operating Voltage Range:*

90 vac to 132 vac, +/- 0.5 Hz  
180 vac to 264 vac, +/- 0.5 Hz

### *Operating Environment:*

Ambient Temperature: 32F. to 104F.  
(0C. to 40C.)  
Relative Humidity: 20% to 80%  
(non-condensing)

### *Storage Environment:*

Ambient Temperature: -40F. to 140F.  
(-40C. to 60C.)  
Relative Humidity: 10% to 90%  
(non-condensing)

### *CRT Characteristics:*

Diagonal size: 14 inch diagonal  
Display Capacity: 80/132 column by  
25 lines  
Phosphor: P42 green on black back-  
ground

### *Keyboard Characteristics:*

Keyboard: 105 Key with numeric  
keypad  
Characters: 256 in both 80 and  
132 line formats  
Character set: WISCII-I and  
32 graphics characters  
Character set attributes: Blink, high  
intensity, single/double underscore,  
reverse video and blank.  
Special Function keys: 18 keys

# SPECIFICATIONS

## 11.1 Equipment

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### *Heat Dissipation:*

222 BTU/HR

### *Communication Modes:*

Operational modes: On line full and half duplex, (FDX, HDX A, AND HDX B), and local mode.

### *Transmission Rates:*

75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19200 Baud.

### *Character Format:*

Data transmission format can be 7 or 8 data bits. Parity may be EVEN, ODD, MARK, SPACE, OR NONE. Stop Bits may be 1, 1.5, or 2 stop bits.

### *Data Link Characteristics:*

62.5K Baud, Asynchronous

### *Keyboard Interface Characteristics:*

4.275 Mbps, Serial Asynchronous

### *CPU:*

6809E Microprocessor

### *Power Consumption:*

50 watts

### *Voltage Selection:*

115/230 Vac switchable at rear of monitor.

### *Power Factor:*

0.60 leading

### *Leakage Current:*

(Grounding requirements)  
.001 Ampere @ 120 vac 60 Hz

**SECTION 12**  
**ILLUSTRATED**  
**PARTS**

# SECTION 12 CONTENTS

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## SECTION 12 ILLUSTRATED PARTS

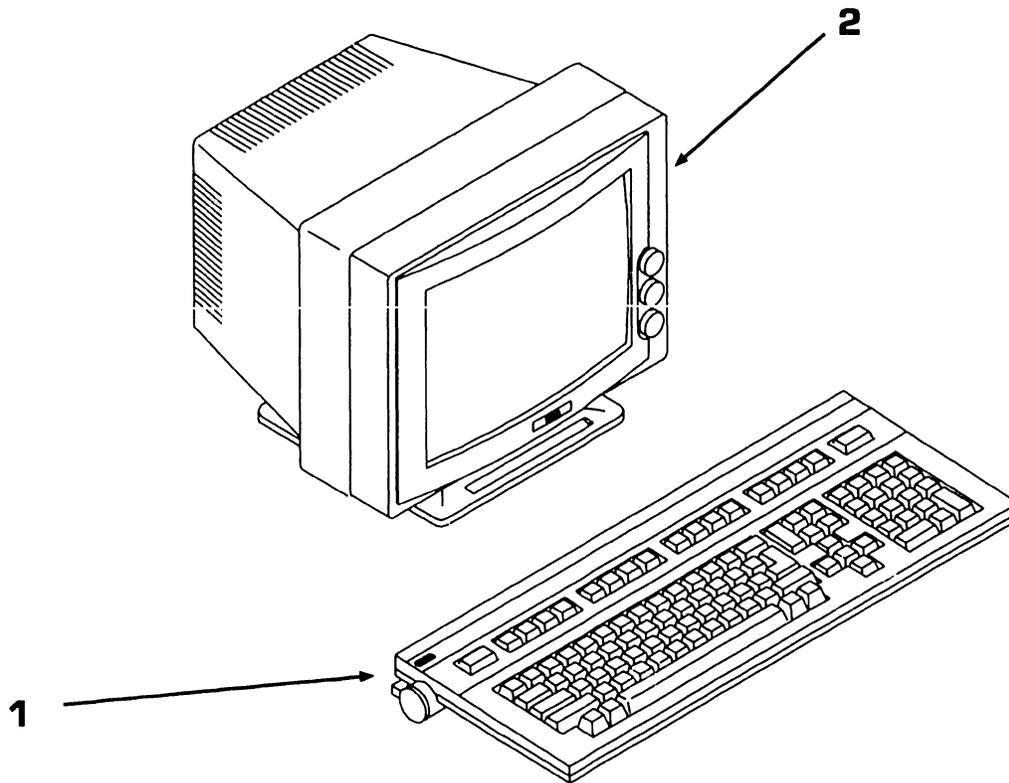
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# ILLUSTRATED PARTS

## 12.1 Major Assemblies

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### 12.1.1 System Components



<i>Item</i>	<i>Part Number</i>	<i>Description</i>
1	725-3335-US	2110A Workstation 720 Keyboard, 105 Key
2	177-7458	2110A Workstation Monitor, 14 inch

**WANG**

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