



3401

# 2436DW/DE INTERACTIVE TERMINAL

**Customer Engineering  
Product Maintenance Manual**

**741-1727**

**COMPANY CONFIDENTIAL**

# PREFACE

This document is the Illustrated Product Maintenance Manual for the Wang 2436DW/DE Interactive Terminal. The scope of this manual reflects the type of maintenance philosophy selected for this product (swap unit, printed circuit assembly, power supply, or any combination thereof).

The purpose of this manual is to provide instructions to operate, troubleshoot, and repair the 2436DW/DE Interactive Terminal. It will be updated on a regular schedule.

## First Edition (April, 1986)

This is the first edition of the Wang 2436DW/DE Product Maintenance Manual. The material in this document may only be used for the purpose stated in the Preface. Updates and/or changes to this document will be published as PUBs or subsequent editions.

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# PUBLICATION UPDATE BULLETIN

TITLE: 2436 DW/DE Interactive Terminal

DATE: 04/02/87

This PUB affects: 741-1727  
742-1727

CLASS CODE: 3401

Previous Notice(s): None

### REASON FOR CHANGE:

This PUB corrects and adds part numbers. It also adds the switch settings for even parity and 7 data bits.

### INSTRUCTIONS:

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

	REMOVE PAGES	INSERT PAGES
1.	9-7/9-8	9-7/9-8
2.	12-1/12-2	12-1/12-2
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

	REMOVE FICHE	INSERT FICHE
1.	1	1
2.	2	2
3.		
4.		

This page constitutes a permanent record of revisions; place it directly following title page.



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**SECTION**

**1**

**INTRODUCTION**

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## SECTION 1 INTRODUCTION

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## 1 .1

### Scope and Purpose

---

This manual contains installation, operation, troubleshooting, and repair information for the 2436DW/DE Interactive Terminal, a low cost workstation designed to communicate and control the Wang 2200 MicroVP computer system. The manual also contains a functional description of the 2436DW/DE and an illustrated parts breakdown of replaceable parts. Model DW of the 2436 is capable of both data processing and word processing. Model DE performs data processing only. For simplicity, the 2436DW is described in this manual. The information, however, applies to the 2436DE as well.

The purpose of this manual is to provide Customer Engineering personnel with the information necessary to install, troubleshoot, and repair the Terminal in the field. Familiarity with word processing and office information systems is recommended for effective use of this manual.

The 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 a hand symbol (  ) followed by the section being referenced. Also, all or most of the information pertaining to a specific task is located on a single 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 a 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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**2**

**IDENTIFICATION**

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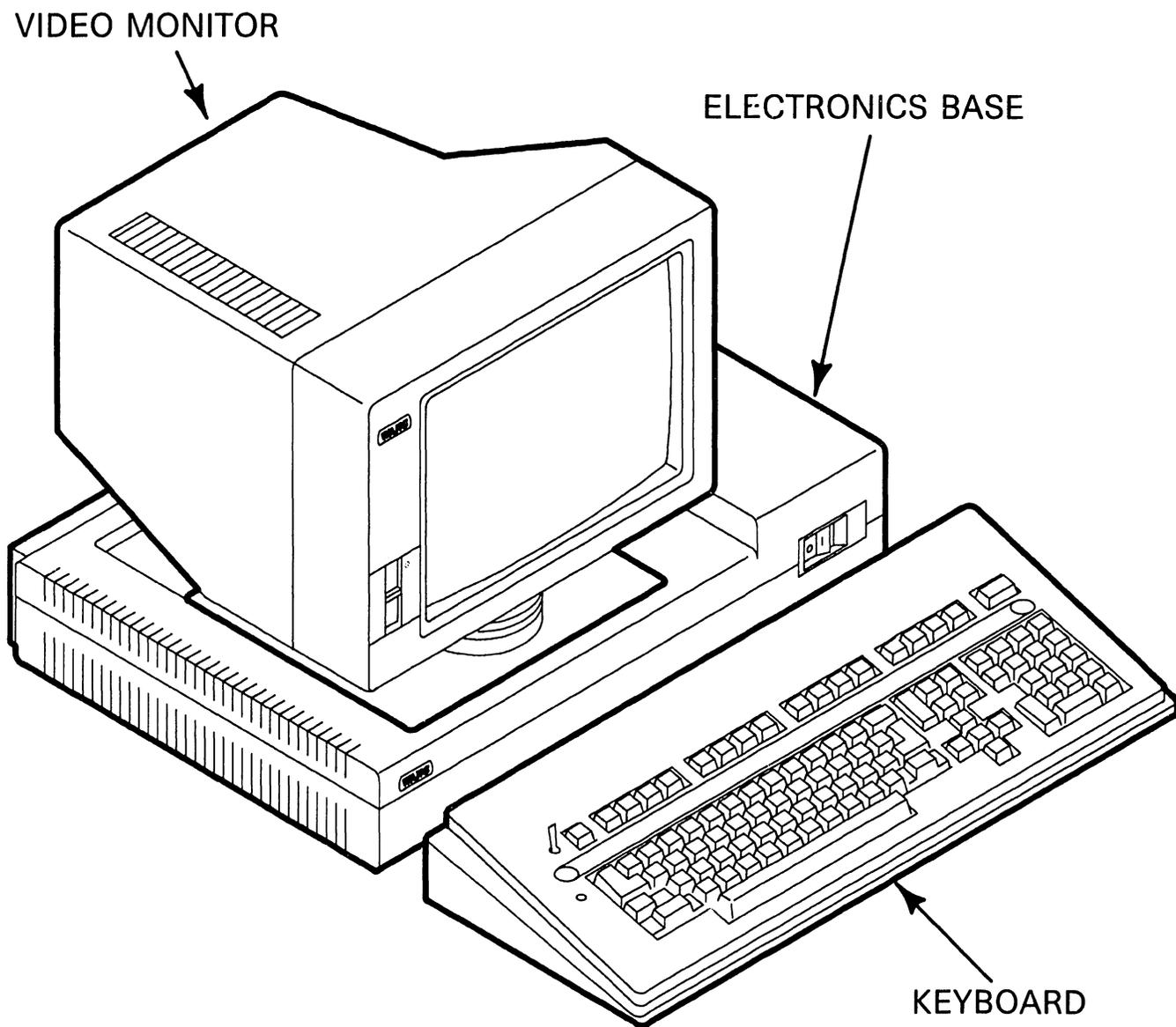
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# 2.1

## Major Assemblies

# IDENTIFICATION



# 2.2

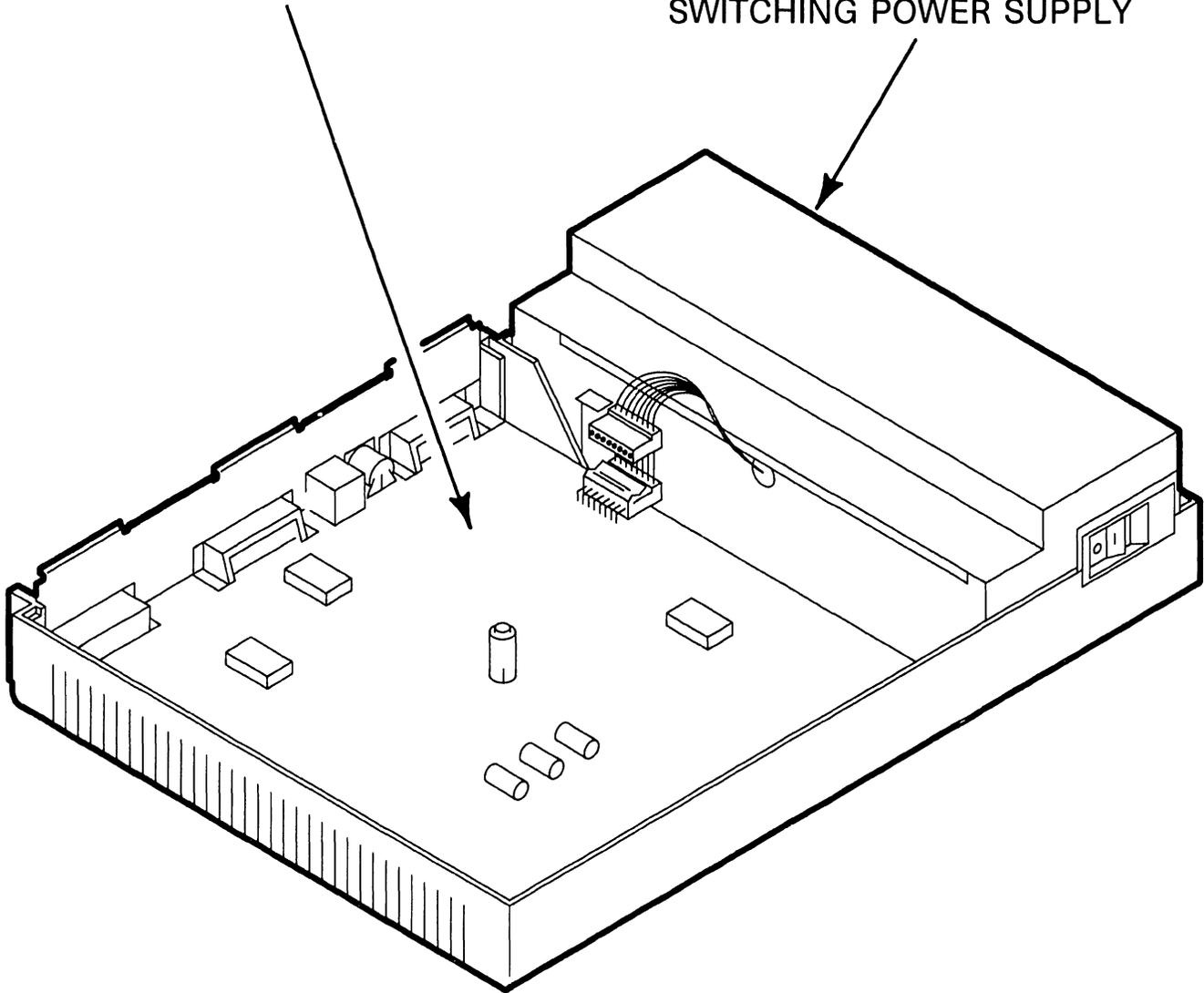
# IDENTIFICATION

## Electronics Base Unit Major Parts

---

CPU PRINTED CIRCUIT ASSEMBLY

SWITCHING POWER SUPPLY



**SECTION**  
**3**  
**CONTROLS**  
**AND**  
**INDICATORS**

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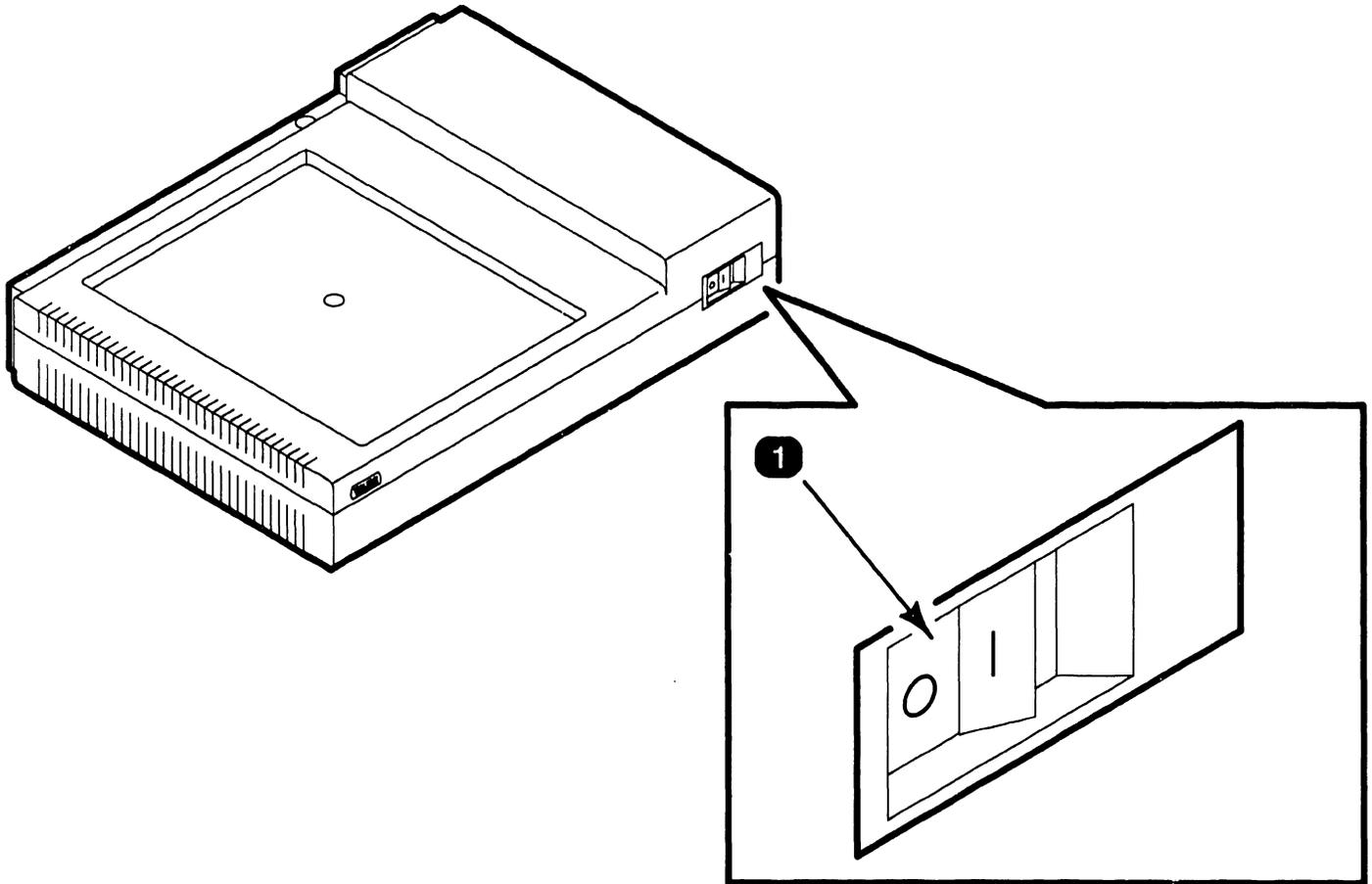
# 3.1

# CONTROLS AND INDICATORS

## Operator Controls

### 3.1.1

### Electronics Base Unit Front Panel Controls



<i>Item</i>	<i>Name</i>	<i>Type/Function</i>
1	Power On Switch	AC power rocker-type switch. Pressing "1" applies ac power to base unit which energizes all Terminal assemblies. Pressing "0" removes ac power from base unit and de-energizes all assemblies.

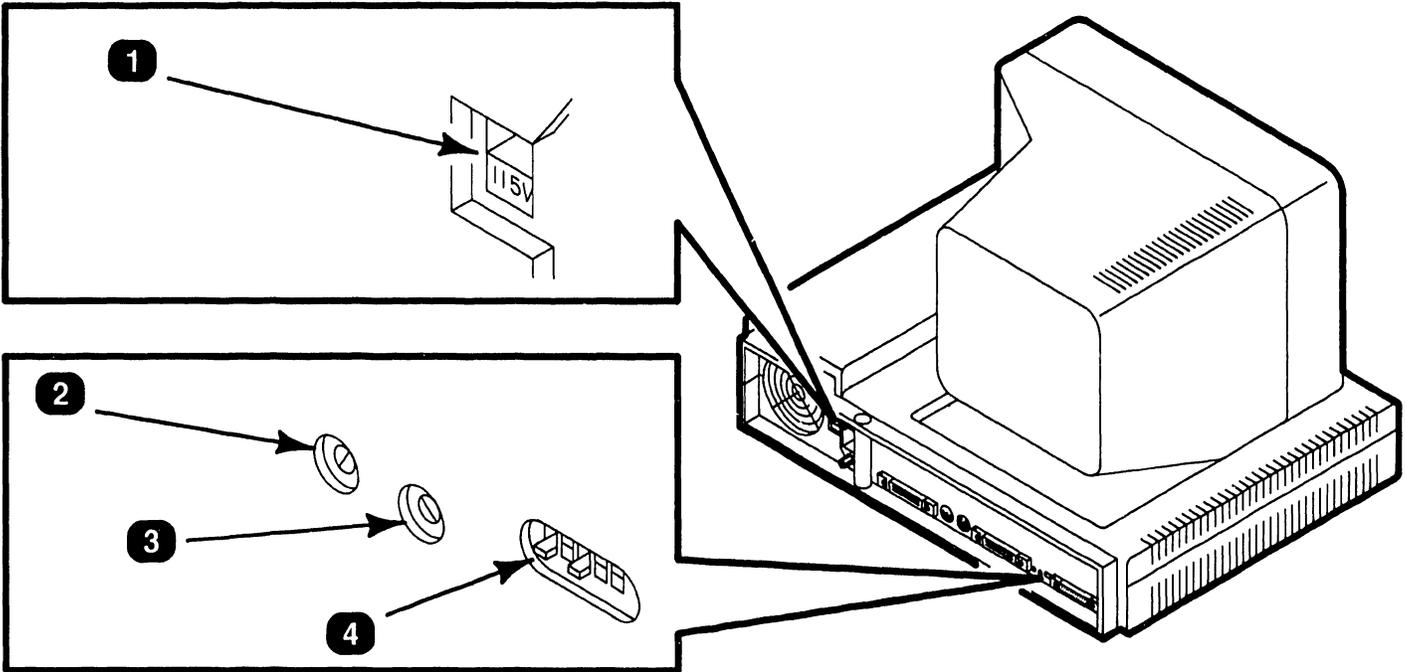
# 3.1

# CONTROLS AND INDICATORS

## Operator Controls

### 3.1.2

### Electronics Base Unit Rear Panel Controls



<i>Item</i>	<i>Name</i>	<i>Type/Function</i>
1	AC Select	Slider-type switch; selects ac operating voltage of 115 or 230 vac determined by available line voltage (shown in 115 vac position).
2	Speaker	Potentiometer; adjusts audio level of Terminal alarm which indicates errors or special conditions.  8.2.1
3	Keyboard Clicker	Potentiometer; adjusts audio level of keys when pressed.  8.2.1
4	Baud Rate	Slider-type 5-bit switch bank; controls data transmission rate between Terminal and master CPU.  9.4.2

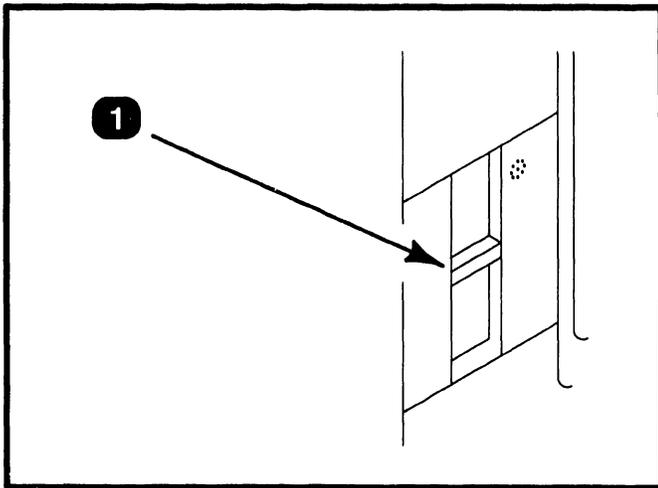
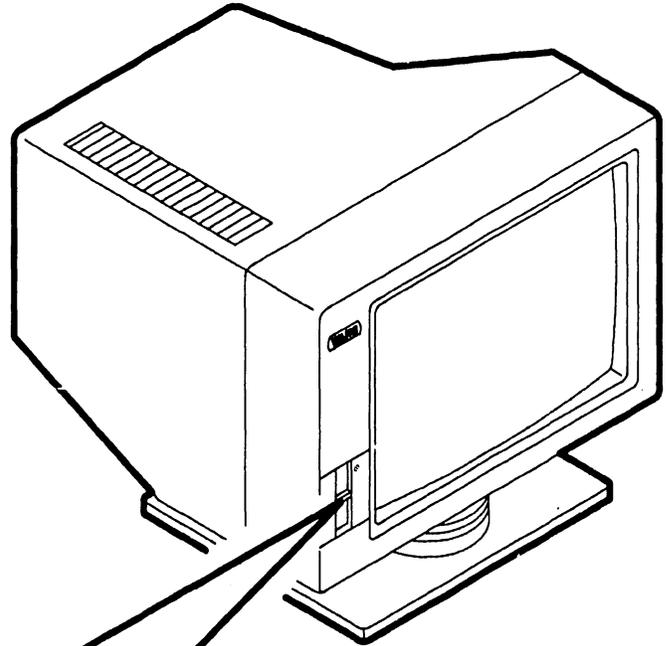
# 3.1

# CONTROLS AND INDICATORS

## Operator Controls

### 3.1.3

### Video Monitor Front Panel Controls



<i>Item</i>	<i>Name</i>	<i>Type/Function</i>
1	Brightness	Slider-type potentiometer; adjusts brightness of video display.

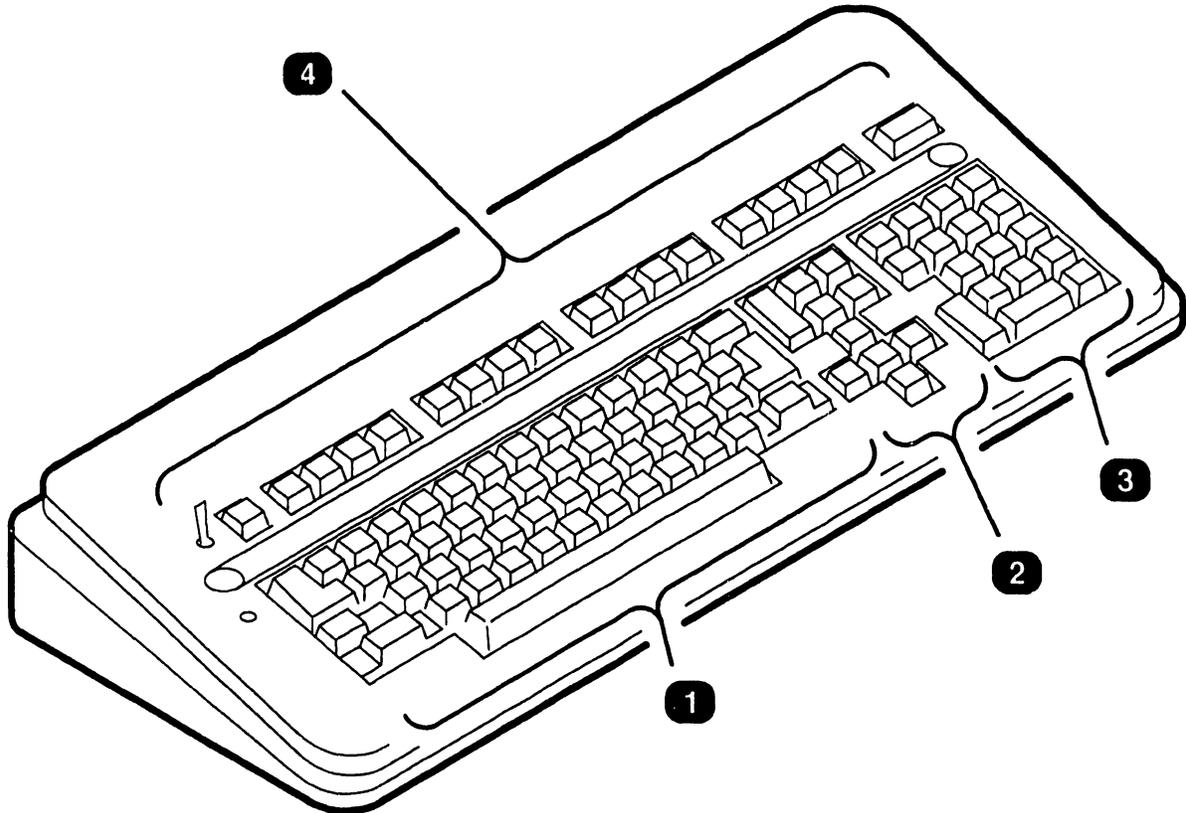
# 3.1

# CONTROLS AND INDICATORS

## Operator Controls

### 3.1.4

### Keyboard Controls



<i>Item</i>	<i>Name</i>	<i>Type/Function</i>
1	Zone 1 Keys	Typewriter keyboard; standard typewriter keys consisting of alphanumeric and special purpose characters.
2	Zone 2 Keys	Cursor control and editing keys.
3	Zone 3 Keys	Numeric keypad; standard 10-key numeric pad for rapid entry of numbers.
4	Zone 4 Keys	Word processing and special function keys.

**SECTION**

**4**

**OPERATION**

# SECTION 4 CONTENTS

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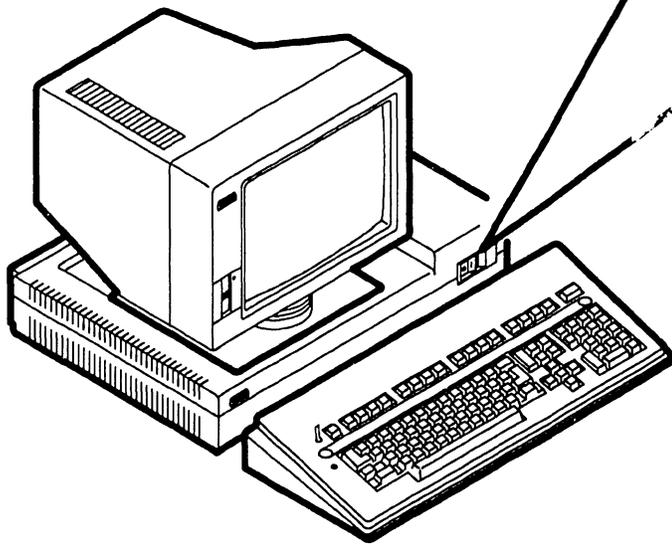
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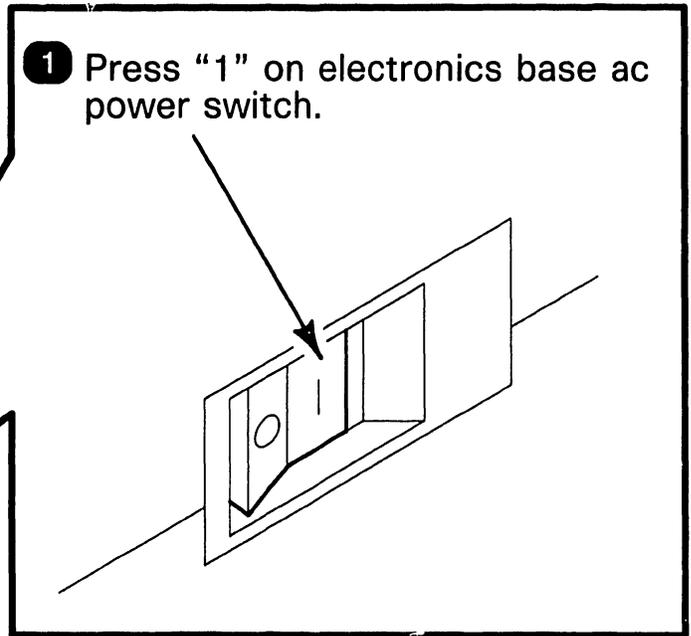
# 4.1

# OPERATION

## Power-Up and B.I.T. Diagnostic Procedure



- 1 Press "1" on electronics base ac power switch.

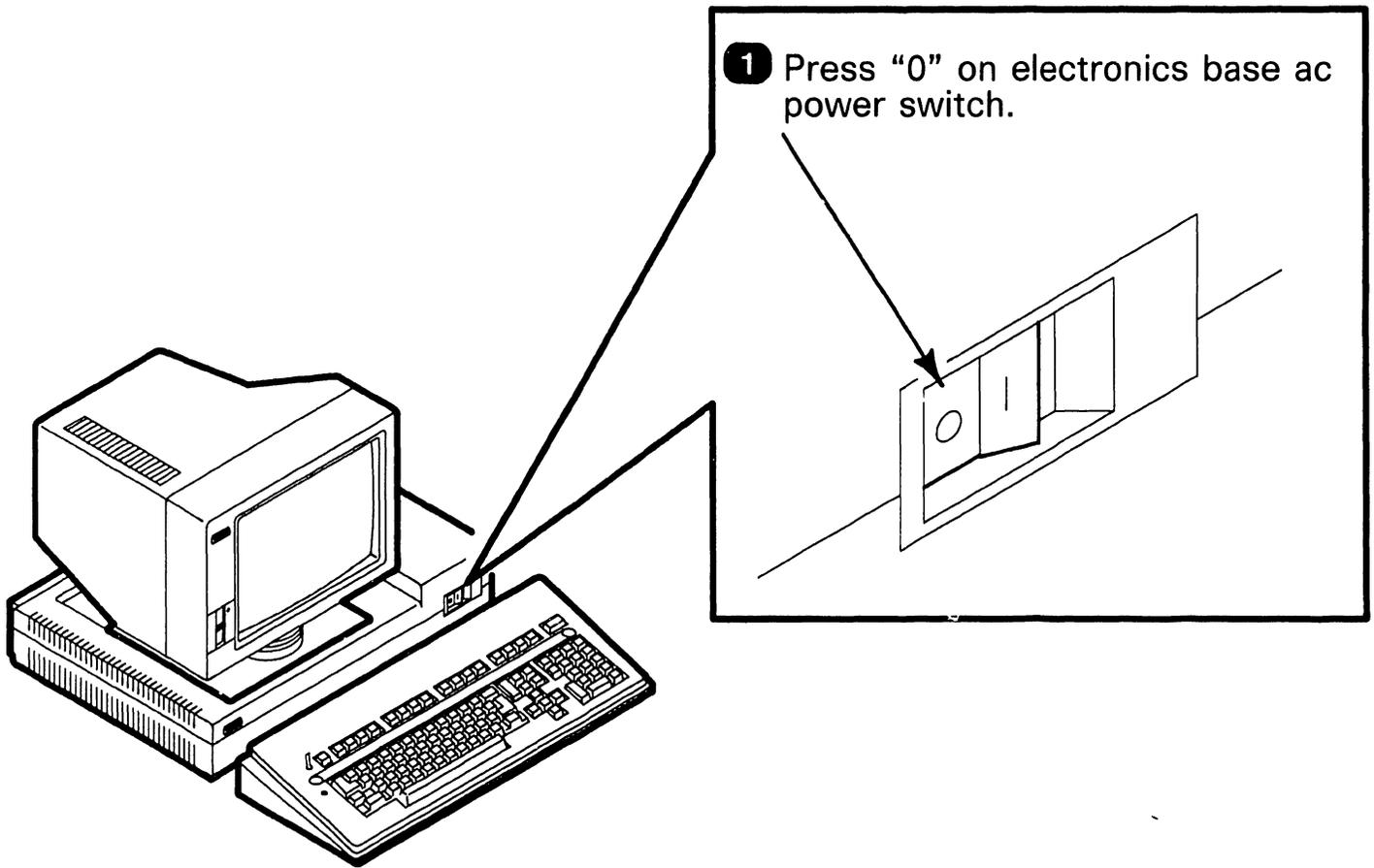


- 2 Power-up B.I.T. diagnostic is executed resulting in a normal operating display or B.I.T. error code.  6.3.2

# 4.2

## Power-Down Procedure

# OPERATION



**SECTION**

**5**

**PREVENTIVE  
MAINTENANCE**

# SECTION 5 CONTENTS

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# 5.1

# PREVENTIVE MAINTENANCE

## Materials Required

---

The CE tool kit and a DVM are required to perform preventive maintenance on the 2436DW interactive terminal.

# 5.2

# PREVENTIVE MAINTENANCE

## PM Schedule

---

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

# 5.3

# PREVENTIVE MAINTENANCE

## Cleaning and Inspection

---

### Exterior Cleaning:

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

### Interior Cleaning:

- 1 Power-down terminal and remove ac cord from wall outlet.
- 2 Remove top cover from base unit.  7.2.1
- 3 Vacuum interior of base unit.
- 4 Clean I/O cable connectors.

### Inspection:

- 1 Check for loose, missing, or damaged parts.
- 2 Check PCB and PROM revision levels.
- 3 Check power supply fan operation  
(Warning: Check externally. Do not remove power supply cover).
- 4 Check baud rate switch settings.  
 9.4.2

# 5.4

# PREVENTIVE MAINTENANCE

## Adjustments

---

Mechanical: None Required.

Electrical:

- 1 Base unit speaker and keyboard clicker.  8.2.1
- 2 CRT video monitor board: Refer to Product Maintenance Manual 741/742-1647.

**SECTION**

**6**

**TROUBLESHOOTING**

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Tools and equipment required to troubleshoot the 2436DW/DE interactive terminal consists of a standard CE tool kit, a DVM, and a standard RS-232 loopback connector (WLI #220-0286). All diagnostic checks are performed internally during power-up or as a loopback check using the keyboard.

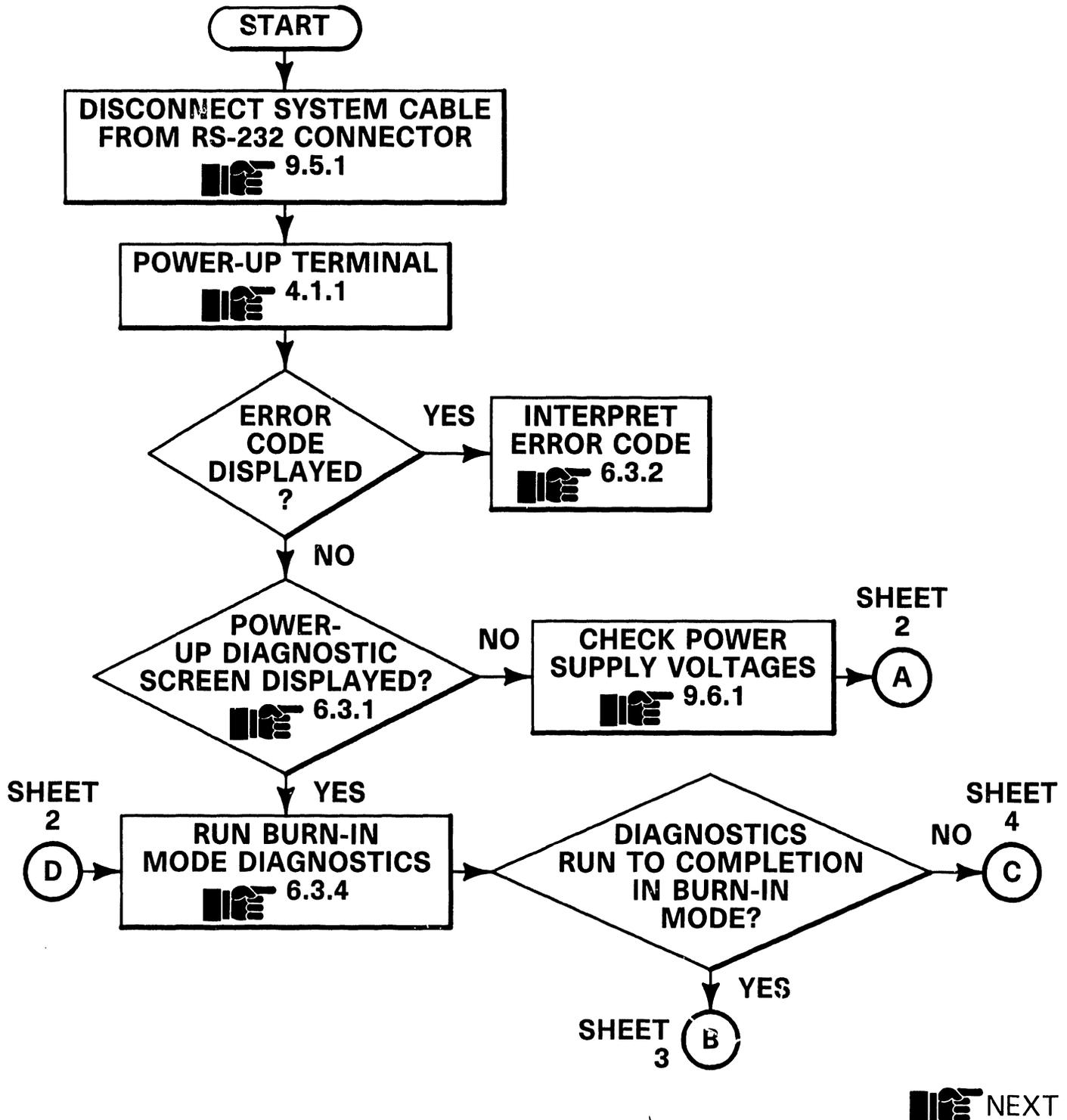
# 6.2

# TROUBLESHOOTING

## Troubleshooting Flowcharts

6.2.1

Power-Up For System Operation (Sheet 1 of 4)



NEXT

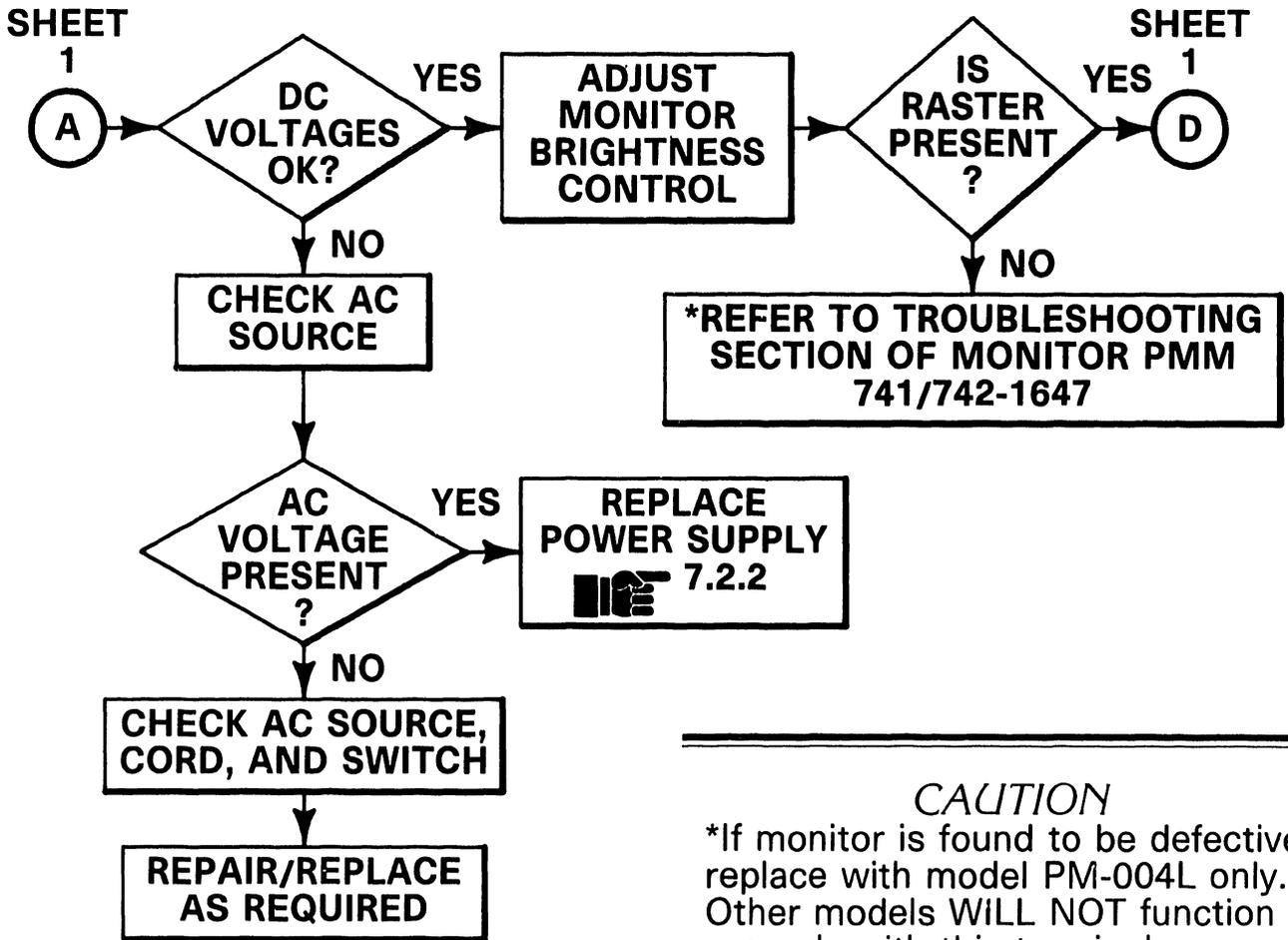
# 6.2

# TROUBLESHOOTING

## Troubleshooting Flowcharts

6.2.1

Power-Up For System Operation (Sheet 2 of 4)



### CAUTION

\*If monitor is found to be defective, replace with model PM-004L only. Other models WILL NOT function properly with this terminal.



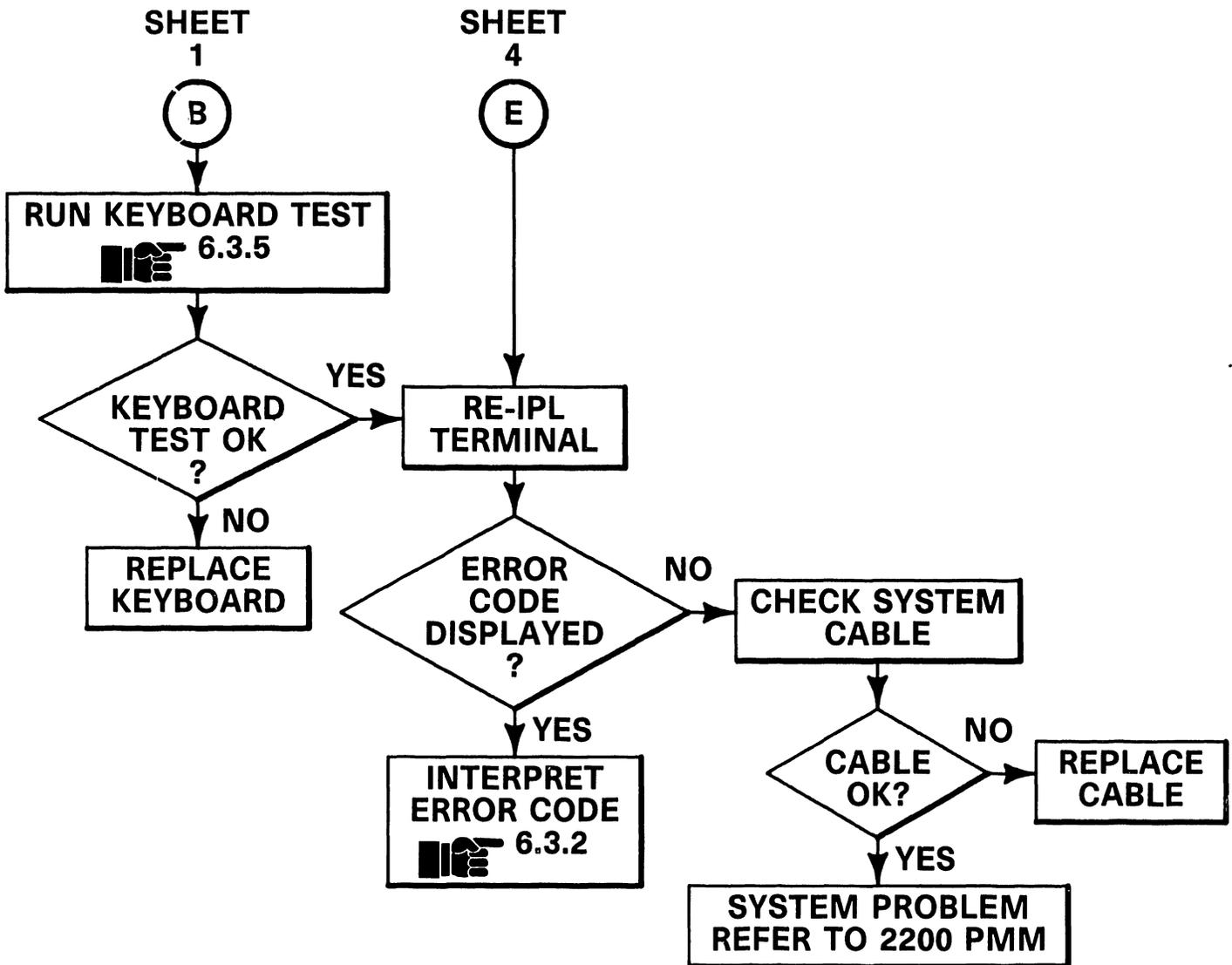
# 6.2

# TROUBLESHOOTING

## Troubleshooting Flowcharts

6.2.1

Power-Up For System Operation (Sheet 3 of 4)



NEXT

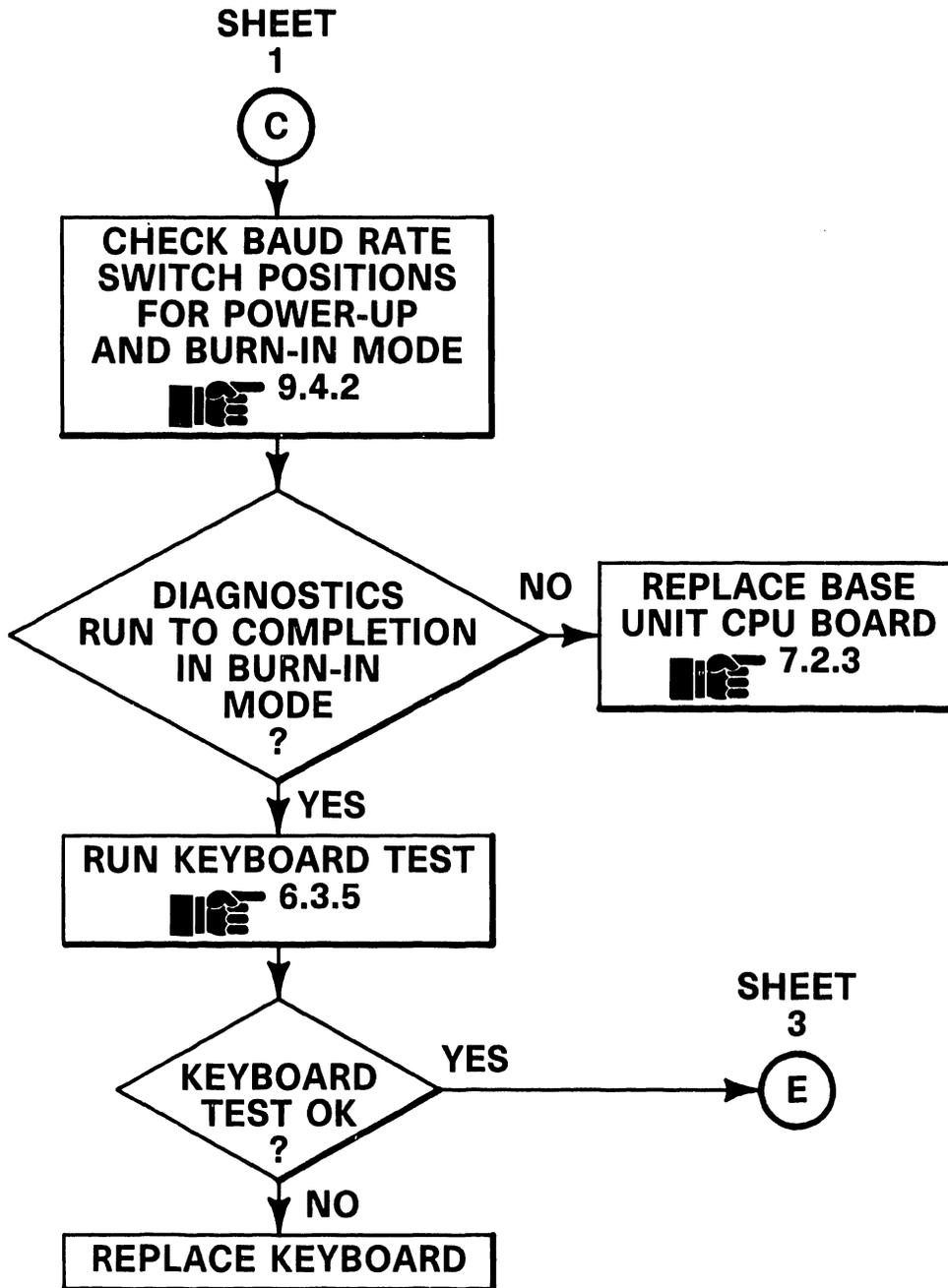
# 6.2

# TROUBLESHOOTING

## Troubleshooting Flowcharts

6.2.1

Power-Up For System Operation (Sheet 4 of 4)



 END

# TROUBLESHOOTING

## 6.3

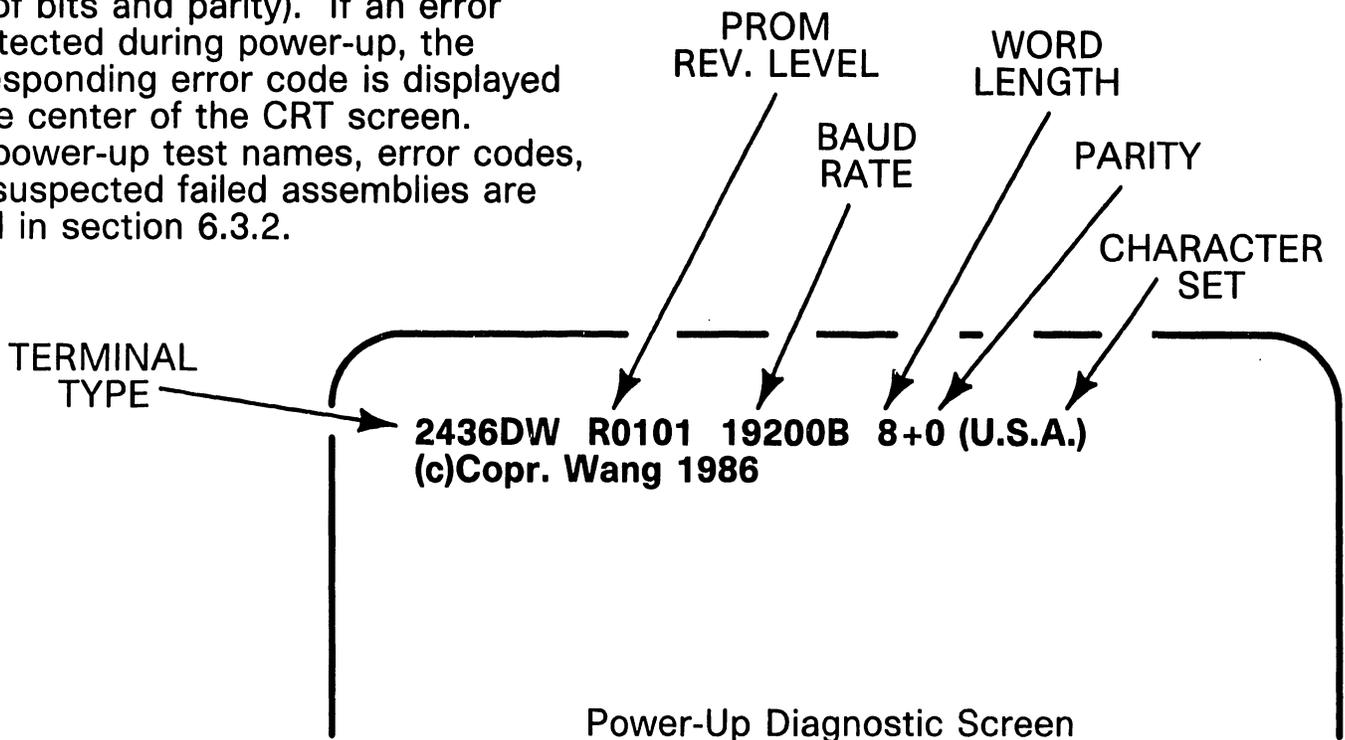
### Diagnostics

#### 6.3.1 Power-up Diagnostics

##### NOTE

Disconnect the RS-232 cable connection from the 2200 MicroVP system before proceeding with the power-up diagnostics.

The power-up diagnostics performs a series of circuit checks during the power-up sequence and then passes control to the terminal microcode. The diagnostic procedure is executed automatically each time the base unit ac power switch is turned on. If the diagnostic is successful (no errors displayed on the CRT), the microcode will display the terminal type, PROM revision level, baud rate, and word length state (no. of bits and parity). If an error is detected during power-up, the corresponding error code is displayed at the center of the CRT screen. The power-up test names, error codes, and suspected failed assemblies are listed in section 6.3.2.



# 6.3

# TROUBLESHOOTING

## Diagnostics

### 6.3.2 Power-Up Error Codes

<i>Error Code</i>	<i>Test Description</i>	<i>Suspected Failure</i>
01	Z-80 Register	CPU Board
02	UART Power-up	CPU Board
03	VTAC Power-up	CPU Board
04	PIO Power-up	CPU Board
05	Z-80 Register Flag	CPU Board
06	Z-80 Register Foreground & Prime	CPU Board
07	PROM Checksum	CPU Board
08	Character or Control RAM	CPU Board
09	CTC Register Read/Write	CPU Board
09	CTC Timer Counter	CPU Board
09	CTC Interrupt	CPU Board
09	CTC Vertical Sweep Sync	CPU Board
10	UART Transmitter Not Ready	CPU Board
11	UART Receiver Not Ready	CPU Board
12	Transmit Error	CPU Board
13	Receive Not Ready	CPU Board
14	Receiver Error	CPU Board
15	CTC Transmitter Ready Counter	CPU Board
16	CTC Receiver Ready Counter	CPU Board
17	UART Error Set	CPU Board
18	Overrun Cleared	CPU Board

## 6.3

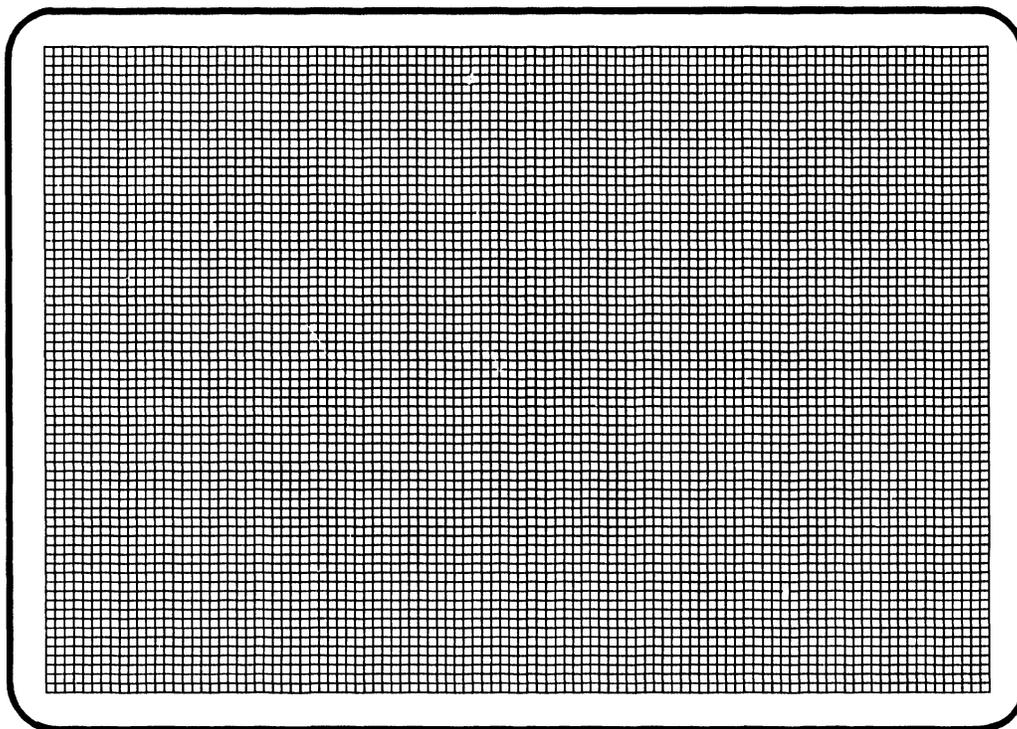
### Diagnostics

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#### 6.3.3

#### Power-up and Screen Alignment

The power-up and screen alignment test generates a blinking test pattern on the CRT screen for alignment of the video monitor. The test pattern is produced by powering-up the Terminal while pressing special function key "13". When alignment is complete, press special function key "15" to return to system code and normal operation. Refer to Product Maintenance Manual 741/742-1647 for detailed alignment instructions for the PM-004L video monitor.



Power-Up Diagnostic Alignment Screen

#### 6.3.4 Power-up and Burn-in Mode

The power-up and burn-in mode diagnostic is performed when an error is detected during power-up or an intermittent problem is occurring with the terminal.

The power-up and burn-in mode diagnostic is accomplished as follows:

- 1 Set the base unit ac power switch to off (0).
- 2 Disconnect the system cable from the RS-232 connector on the rear panel of the base unit.  9.5.1
- 3 Connect the loopback connector to the RS-232 port.
- 4 Set baud rate switches 1 and 2 to off and 3, 4, and 5 to on.  9.4.2
- 5 Set the base unit ac power switch to on (1) and observe the CRT display. The terminal should loop on the error code being displayed.

# TROUBLESHOOTING

## 6.3

### Diagnostics

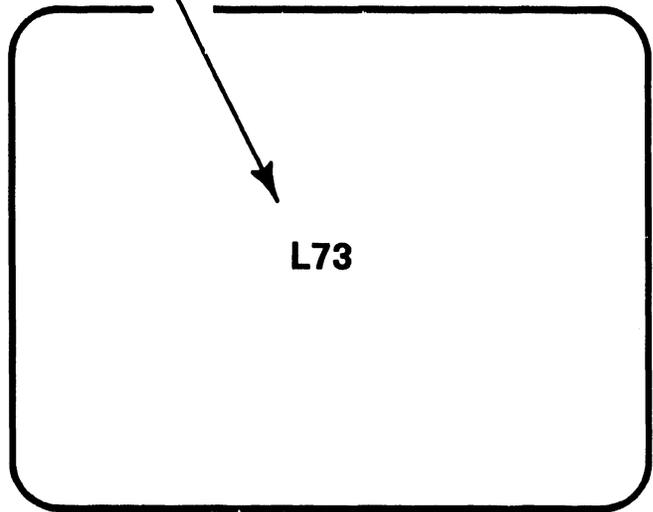
#### 6.3.5 Keyboard Test

The keyboard test gives a visual check of the individual keys on the keyboard. When a key is pressed, its key coordinates and its upper or lower case state is displayed in the center of the screen. Perform the keyboard test as follows:

- 4 Systematically press the desired key and observe the corresponding key coordinate in the center of the CRT. The validity of the keyboard closure should be as shown below.

#### NOTE

Ensure the terminal has successfully passed the power-up diagnostics (see 6.3.1) before proceeding with the test.



- 1 Perform the power-up and burn-in mode test. (see 6.3.4)
- 2 Set the keyboard upper/lower case switch to lower case (A/a).
- 3 Press the lower case "s" key to initiate test.

36	7E	7D	7C	7B	7A	79	78	77	76	75	74	73	72	71	70	11	12
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

6F	6E	6D	6C	6B	6A	69	68	67	66	65	2F	64	2B	63	62	61	18	60	13	14	
	5F	5E	5D	5C	5B	5A	59	58	57	56	55	54		53	52	51	19	50	15	16	
None	4F	4E	4D	4C	4B	4A	49	48	47	46	45	44		43	29	42	1A	41	40	17	
	U/L	3F	3E	3D	3C	3B	3A	39	38	2A	37	U/L		2D	26	25	1B	31	30	10	
					SPACE	2C								27	28	35	1C	34	33	32	

#### *CAUTION*

This test should only be performed if the CE determines the error will not cause fatal errors in data or operation. Also, the CE must inform the customer as to the nature of the problem, possible consequences, or leave terminal in non-operational state until repairs can be made.

---

---

- 1 Perform the power-up diagnostic test.  6.3.1
- 2 When an error is detected, it may be overridden by pressing special function key "15" on the keyboard.

**SECTION**

**7**

**REPAIR**

# SECTION 7 CONTENTS

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## SECTION 7 REPAIR

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## 7.1

### Tools and Test Equipment

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No special tools or test equipment are required to repair the 2436DW interactive terminal. All necessary repair can be accomplished using the Wang CE tool kit (WLI # 726-9401).

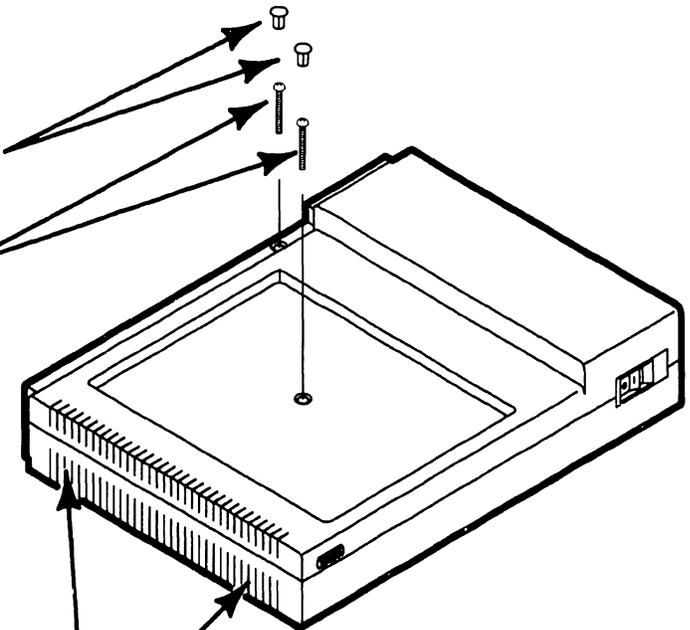
# 7.2

## Removal Procedures

# REPAIR

### 7.2.1 Electronics Base Unit Cover Removal

- 1 Power-down terminal and disconnect ac cord from wall outlet.
- 2 Remove dust plugs from screw wells in top cover.
- 3 Unscrew and remove Phillips head screws.

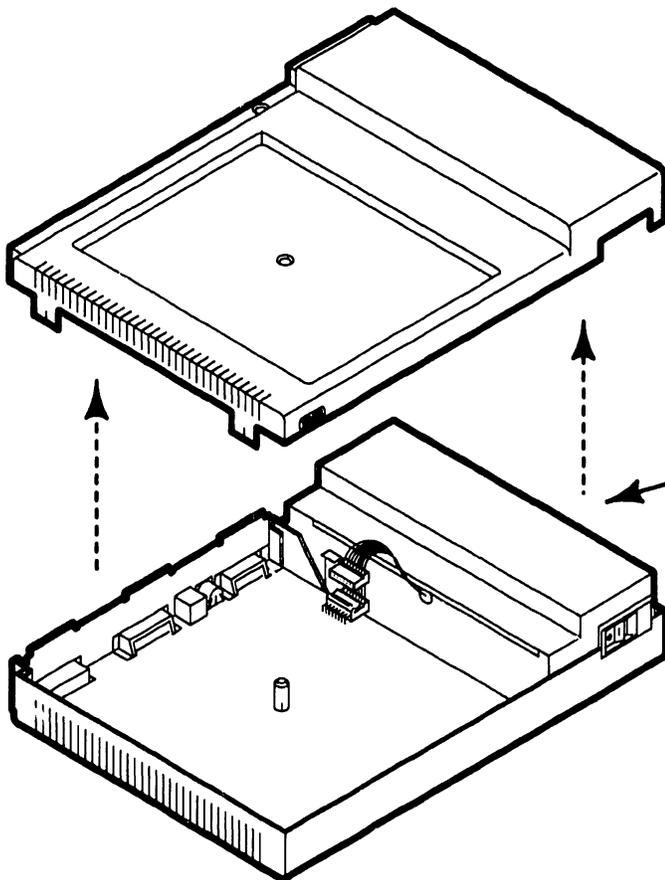


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**CAUTION**  
To prevent cover damage, do not twist screwdriver in next step.

---

- 4 Using a flat-blade screwdriver, disengage interlocking tabs on one side of unit by pushing inward while pulling top cover away from base.
- 5 Repeat step 4 on opposite side of unit.
- 6 Separate top cover from base unit.



## 7.2

### Removal Procedures

#### 7.2.2

#### Electronics Base Unit Power Supply Removal

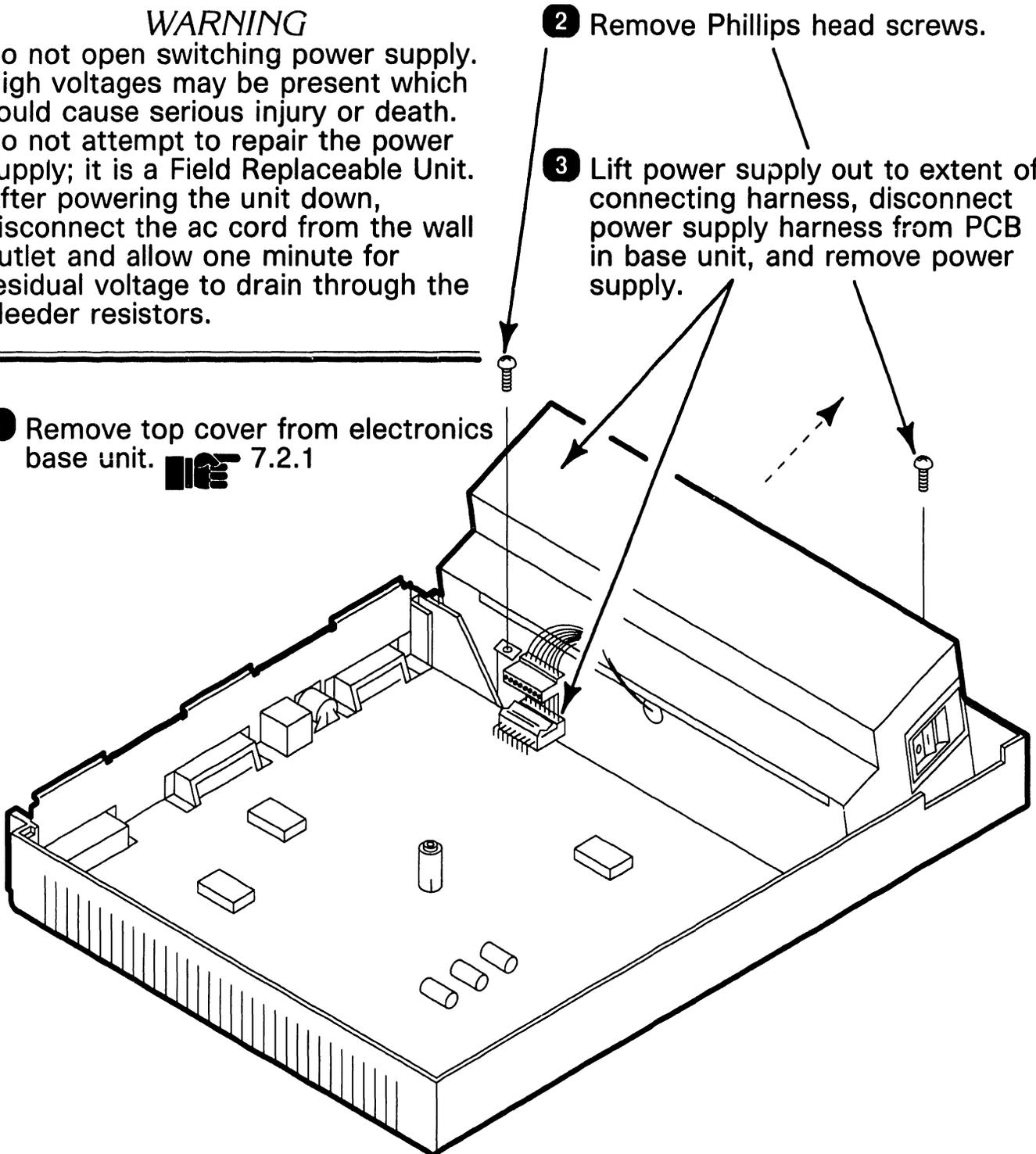
##### WARNING

Do not open switching power supply. High voltages may be present which could cause serious injury or death. Do not attempt to repair the power supply; it is a Field Replaceable Unit. After powering the unit down, disconnect the ac cord from the wall outlet and allow one minute for residual voltage to drain through the bleeder resistors.

- 1** Remove top cover from electronics base unit.  7.2.1

- 2** Remove Phillips head screws.

- 3** Lift power supply out to extent of connecting harness, disconnect power supply harness from PCB in base unit, and remove power supply.



## 7.2

### Removal Procedures

#### 7.2.3

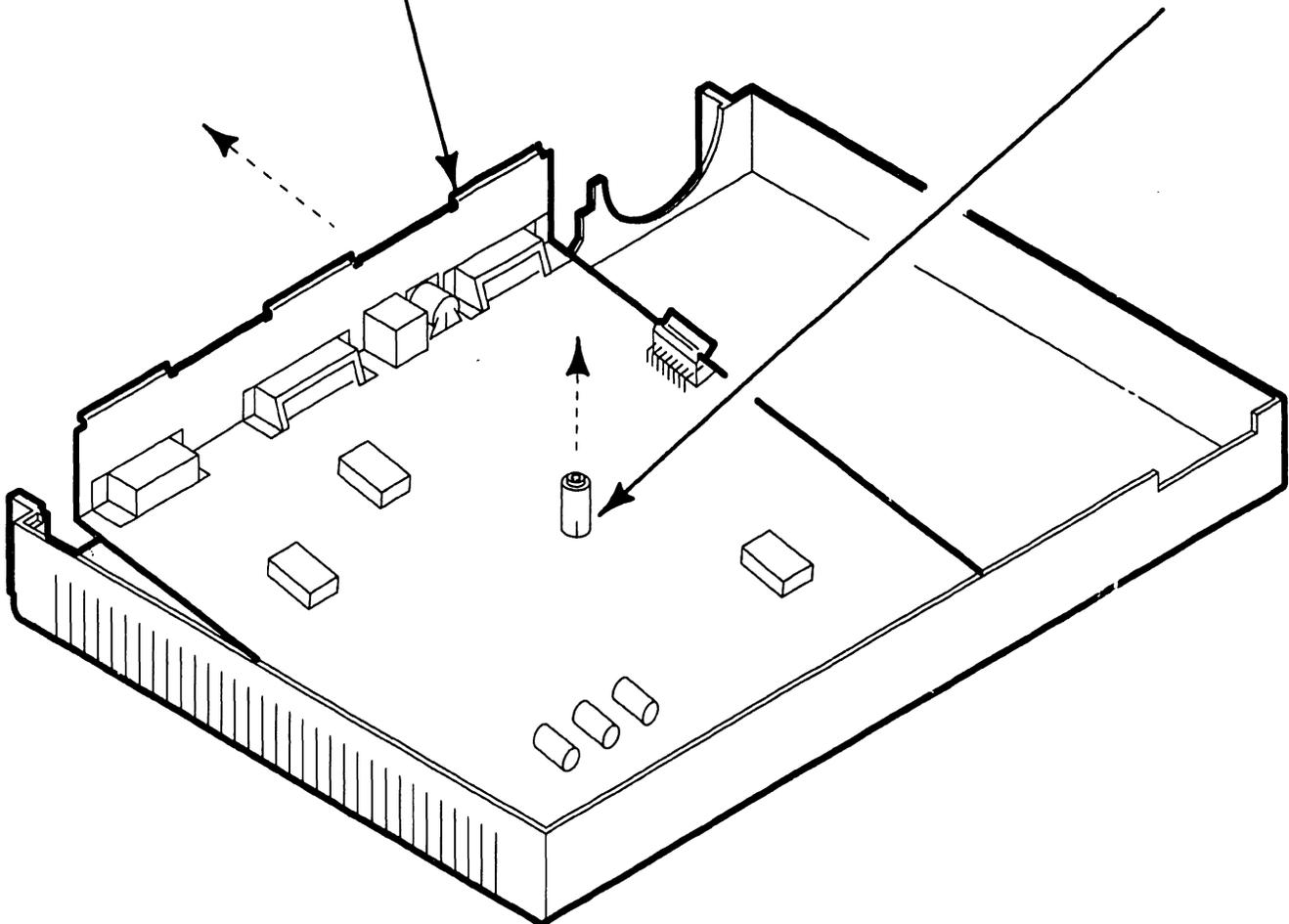
#### Electronics Base Unit Printed Circuit Board Removal

1 Remove top cover from electronics base unit.  7.2.1

2 Remove power supply assembly.  7.2.2

3 Lift printed circuit board up and clear of base unit.

4 Remove center support/spacer from center hole of PCB by squeezing locking tabs together on bottom side of board while pulling spacer on opposite side of board. Retain support/spacer for reinstallation.



## 7.2

### Removal Procedures

---

#### 7.2.4

#### Monitor Video Printed Circuit Board Removal

Refer to section 5 of Maintenance Manual 741/742-1647 for the monitor video printed circuit board removal procedure.

**SECTION**

**8**

**ADJUSTMENTS**

# SECTION 8 CONTENTS

---

## SECTION 8 ADJUSTMENTS

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8.2 ELECTRICAL ADJUSTMENTS .....	8-2
8.2.1 Electronics Base Speaker and Keyboard Clicker.....	8-2
8.2.2 Video Monitor Printed Circuit Board .....	8-3

## 8.1

### Tools and Equipment

---

#### 8.1.1

#### Special Tools

No special tools or equipment are required to perform adjustments and alignment on the 2436DW terminals. All adjustments and alignment can be accomplished using the tools supplied in the Wang CE tool kit.

# ADJUSTMENTS

## 8.2

### Electrical Adjustments

#### 8.2.1

#### Electronics Base Speaker and Keyboard Clicker

- 1 Power-up terminal.  4.1

---

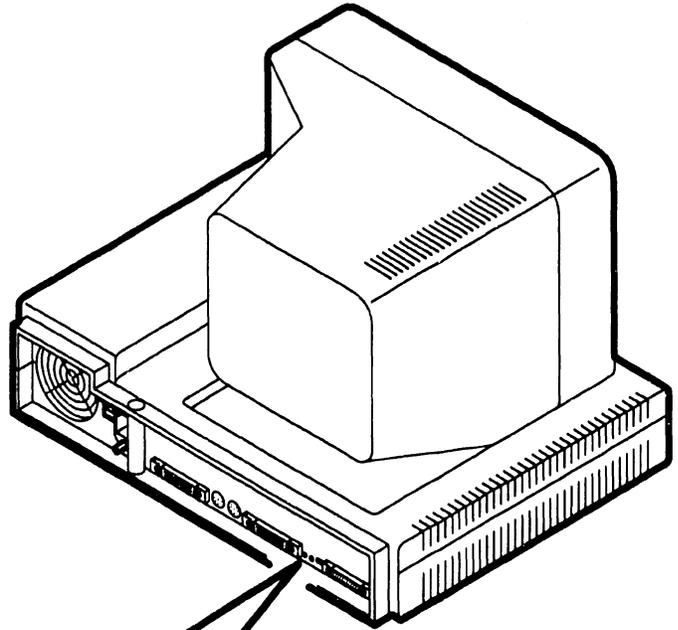
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*NOTE*

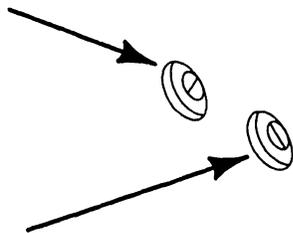
The terminal speaker alarm must be activated periodically while making the following adjustment.

---

---



- 2 Adjust the speaker potentiometer clockwise to increase or counterclockwise to decrease the audio level of the alarm.



- 3 While pressing the keyboard keys, adjust the keyboard clicker potentiometer clockwise to increase or counterclockwise to decrease the audio level of the keyboard clicker.

## 8.2

### Electrical Adjustments

---

#### 8.2.2

#### Video Monitor Printed Circuit Board

Refer to the adjustment section of Product Maintenance Manual 741/742-1647 for the video board adjustment procedure.

**SECTION**

**9**

**UNPACKING**

**AND**

**SETUP**

# SECTION 9 CONTENTS

---

## SECTION 9 UNPACKING AND SETUP

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9.2	TOOLS AND TEST EQUIPMENT ..... 9-2
9.3	UNPACKING PROCEDURES ..... 9-3
9.3.1	Unpacking and Inspecting Electronics Base..... 9-3
9.3.2	Unpacking and Inspecting Monitor ..... 9-4
9.3.3	Unpacking and Inspecting Keyboard ..... 9-5
9.4	SWITCH SETTINGS..... 9-6
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9.5	CONNECTIONS ..... 9-8
9.5.1	Terminal Rear Panel Connections ..... 9-8
9.6	VOLTAGE CHECKS ..... 9-9
9.6.1	Power Supply DC voltage Checks ..... 9-9

# 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. The terminal draws 0.7 amps @ 120 vac or 0.4 amps @ 240 vac during operation. There is no surge current. Ensure adequate clearance (6 inches, minimum) is provided at the rear of the terminal to allow for cable connections and proper airflow by the power supply fan.

# 9.2

# UNPACKING AND SETUP

## Tools and Test Equipment

---

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

# 9.3

# UNPACKING AND SETUP

## Unpacking Procedures

### 9.3.1

### Unpacking and Inspecting Electronics Base

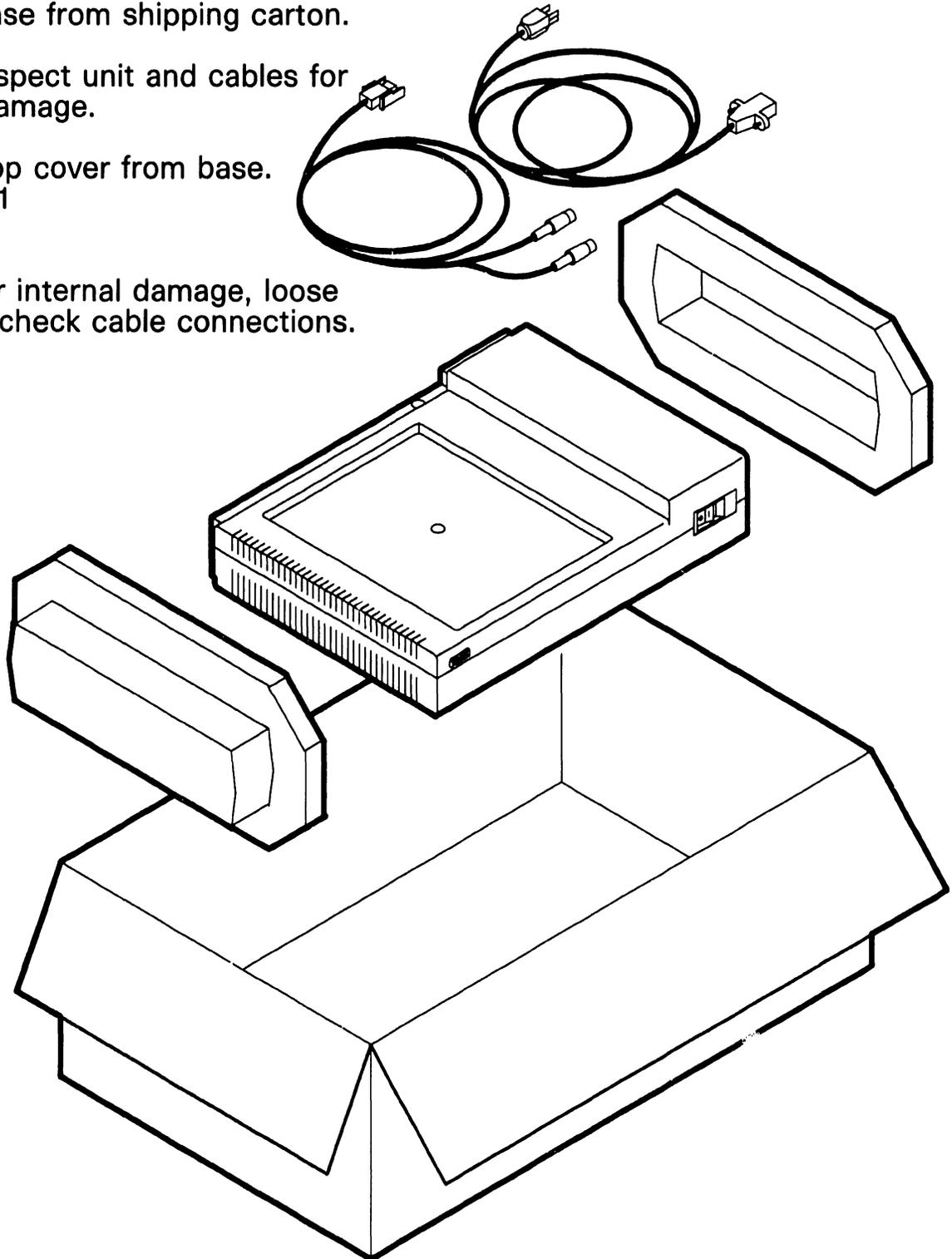
1 Unpack base from shipping carton.

2 Visually inspect unit and cables for external damage.

3 Remove top cover from base.



4 Inspect for internal damage, loose parts and check cable connections.



# 9.3

# UNPACKING AND SETUP

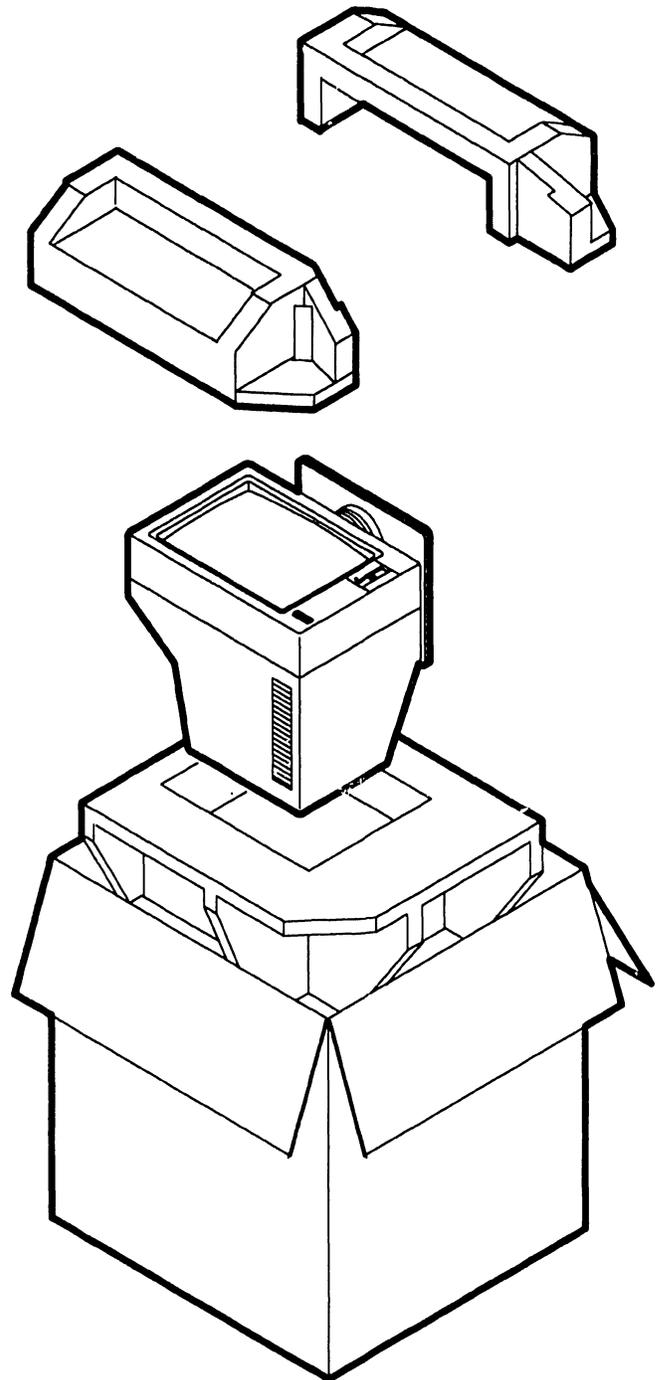
## Unpacking Procedures

---

### 9.3.2

### Unpacking and Inspecting Monitor

- 1 Unpack monitor from shipping carton.
- 2 Visually inspect unit for external damage.



# 9.3

# UNPACKING AND SETUP

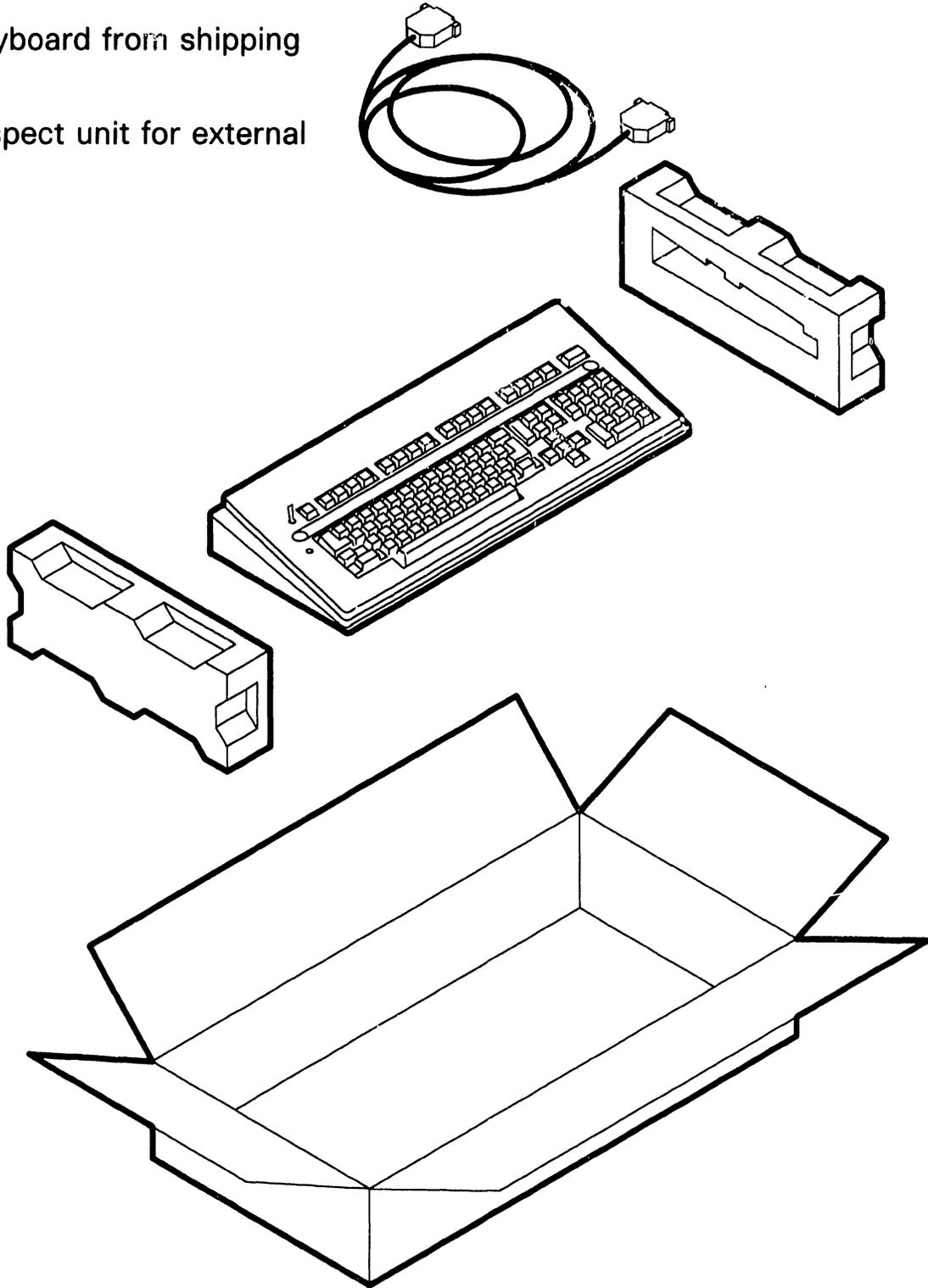
## Unpacking Procedures

---

### 9.3.3

### Unpacking and Inspecting Keyboard

- 1 Unpack keyboard from shipping carton.
- 2 Visually inspect unit for external damage.



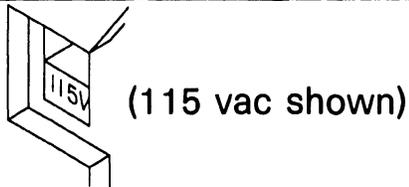
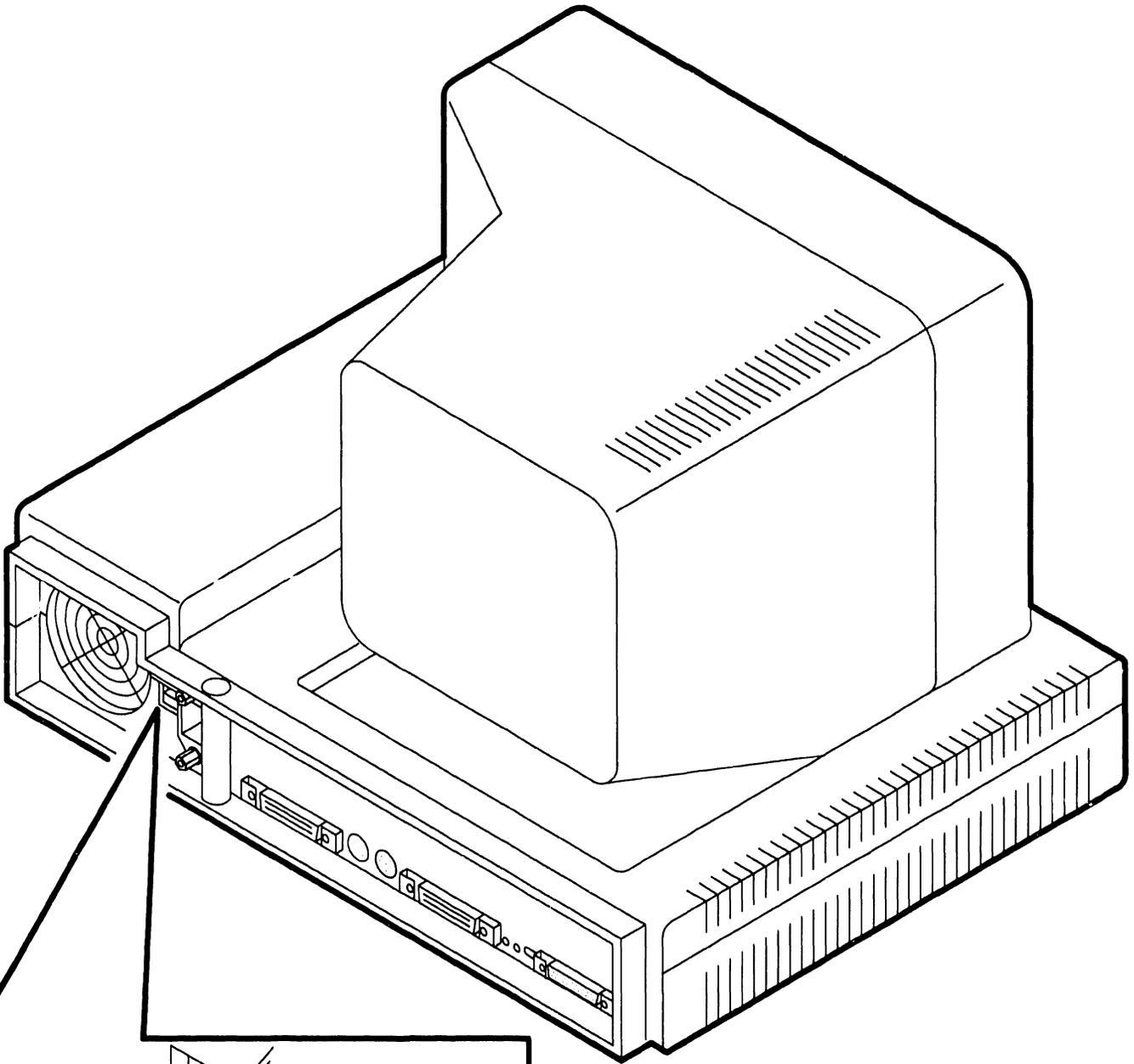
# 9.4

# UNPACKING AND SETUP

## Switch Settings

### 9.4.1

### Electronics Base Line Voltage Select Switch



- 1 Set base unit ac select switch to correct line voltage setting (115/220 vac).

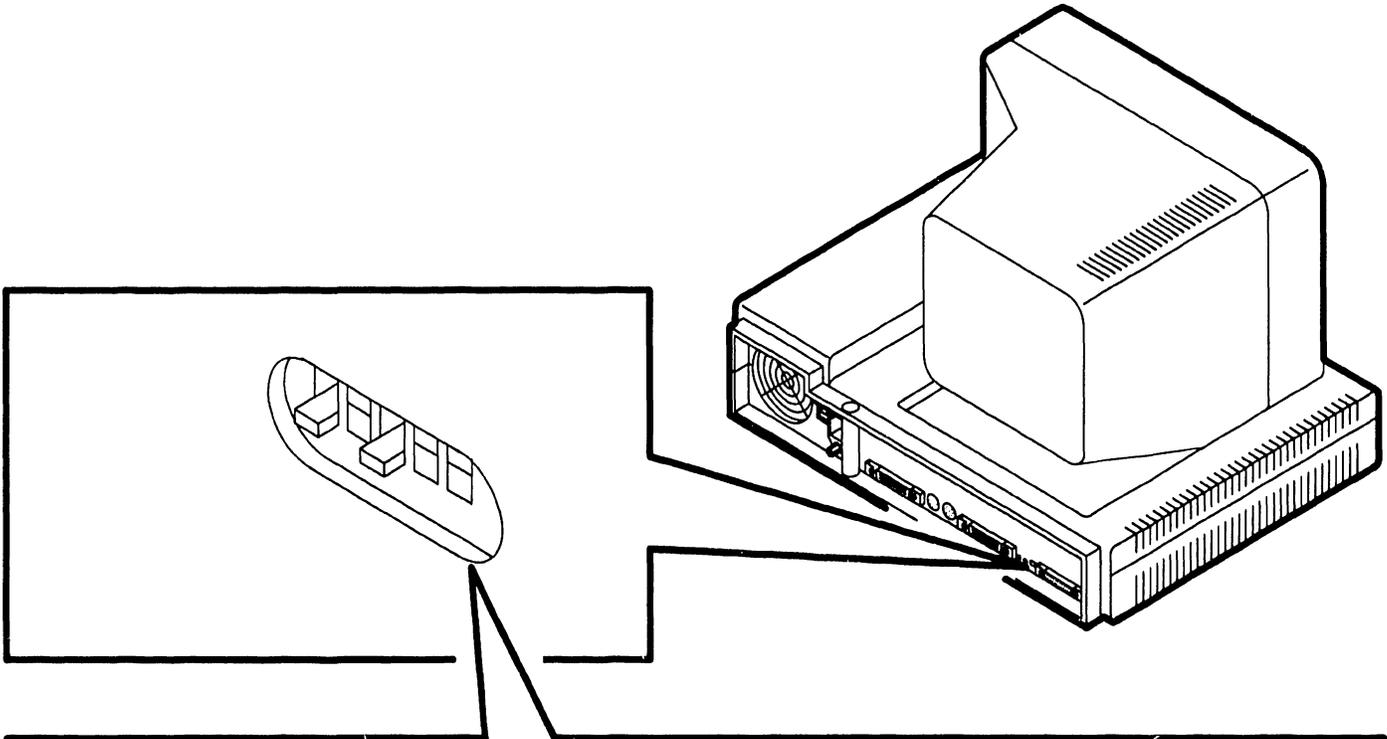
# 9.4

# UNPACKING AND SETUP

## Switch Settings

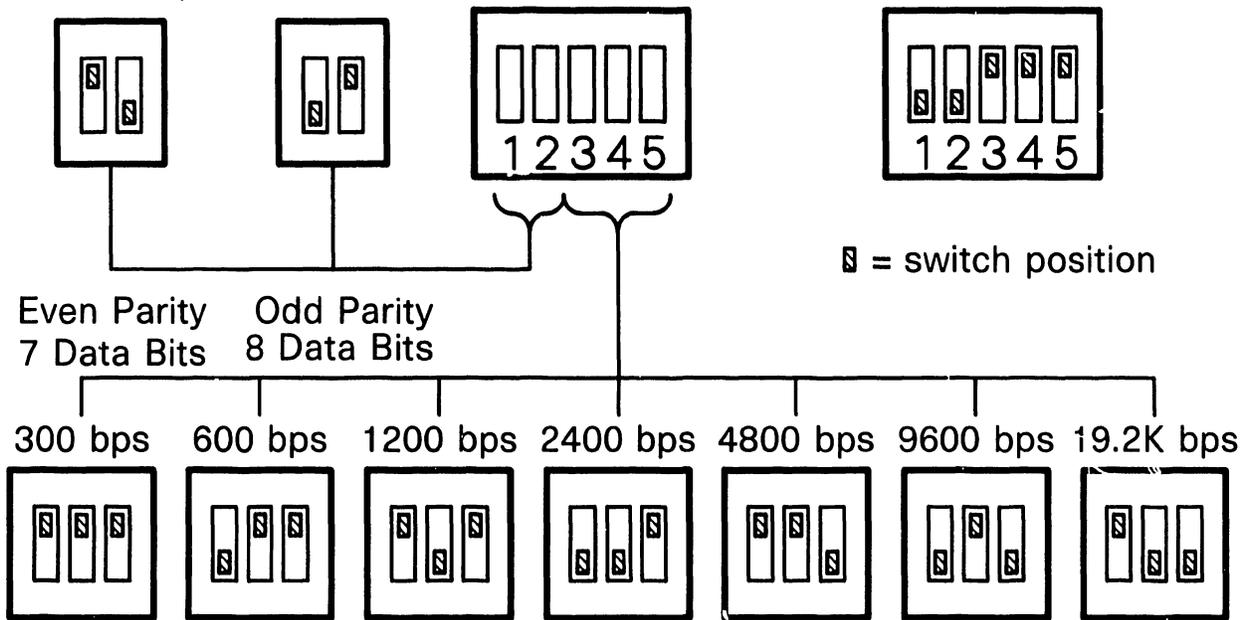
### 9.4.2

### Electronics Base Baud Rate Select Switch



- 1** Set the base unit BAUD RATE switch to the desired settings for parity, number of bits, and baud rate (bits per second) as follows:

Power-up and Burn-in mode



# 9.5

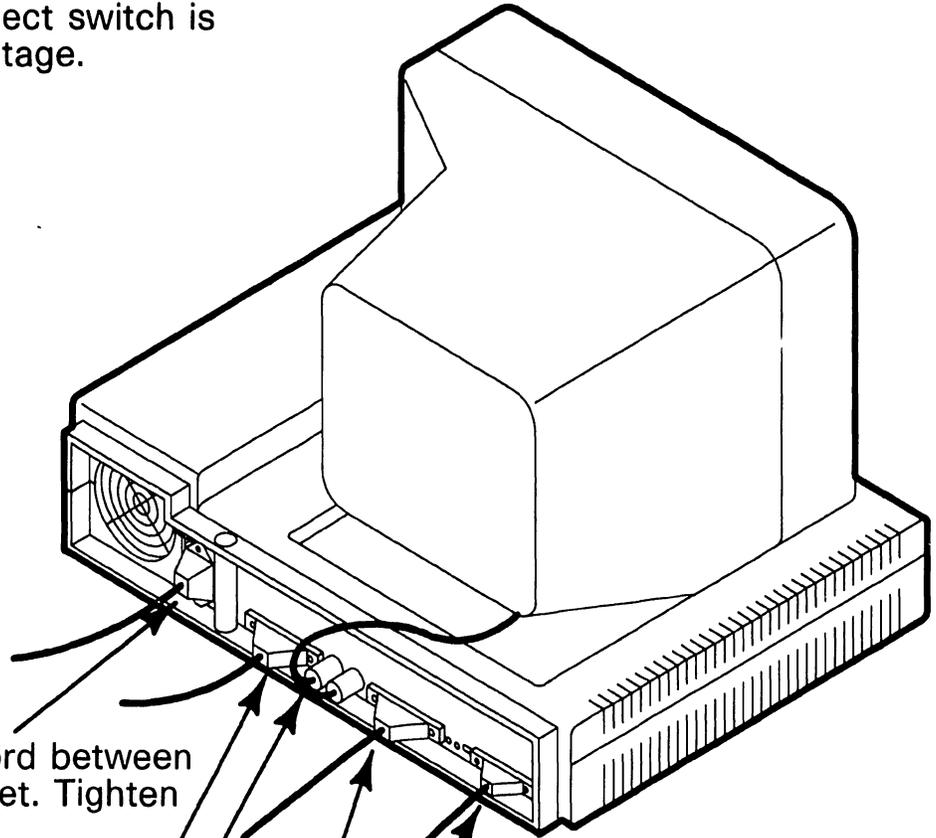
# UNPACKING AND SETUP

## Connections

### 9.5.1

### Terminal Rear Panel Connections

- 1 Ensure ac power switch is set to "0".  4.2
- 2 Ensure ac voltage select switch is set to correct line voltage.  9.4.1



- 3 Connect ac power cord between base unit and ac outlet. Tighten connector screws.
- 4 Connect keyboard cable to terminal keyboard connector. Tighten connector screws.
- 5 Connect video cables between monitor and base (match symbols for proper connection).
- 6 If terminal is equipped with local printer, connect printer cable between printer connector and printer. Tighten connector screws.
- 7 Connect RS-232 cable between terminal and host 2200 MVP system master. Ensure terminal end of cable is closest to workstation.

# 9.6

# UNPACKING AND SETUP

## Voltage Checks

### 9.6.1

### Power Supply DC Voltage Checks

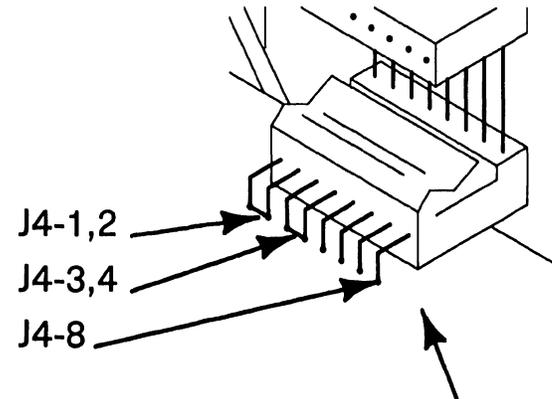
- 1 Remove top cover from base unit.



- 2 Set ac power switch to "1".

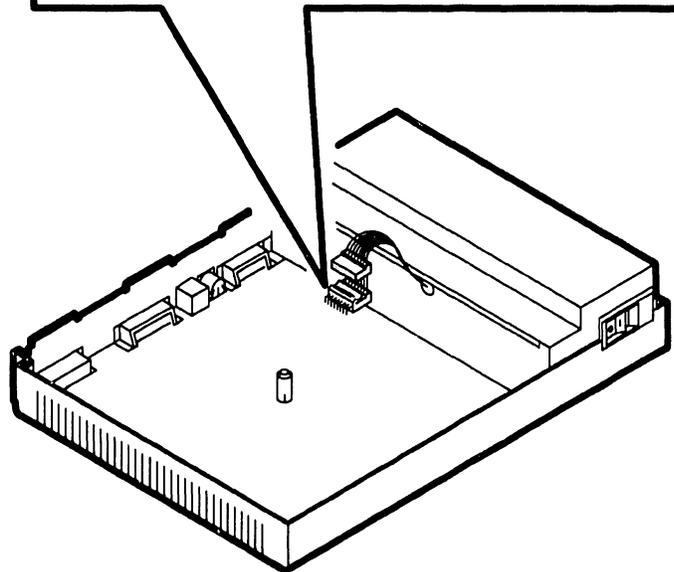


- 3 Connect negative lead of DVM to chassis ground.



- 4 Connect positive lead of DVM to J4 on the CPU board and verify the following voltage limits:

Test Point	Voltage	Limits (Vdc)
J4-1,2	+12V	+11.8 - 12.2
J4-3,4	+5V	+4.9 - 5.1
J4-8	-12V	-11.4 - -12.6



**SECTION**

**10**

**FUNCTIONAL  
DESCRIPTION**

# SECTION 10 CONTENTS

---

## SECTION 10 FUNCTIONAL DESCRIPTION

		Page
10.1	INTRODUCTION .....	10-1
10.2	BLOCK DIAGRAM DESCRIPTION .....	10-2

# 10.1 FUNCTIONAL DESCRIPTION

## Introduction

---

The 2436DW/DE interactive terminal is a low cost, full function, workstation designed to communicate with a Wang 2200 MicroVP computer system. The terminal is designed for maximum comfort and ease of use in the modern office environment. The 2436DV/ consists of an adjustable CRT display, an electronics base unit which houses the CPU board and the terminal power supply, and a lightweight low profile movable keyboard. The CRT design includes an adjustable video display that can be easily adjusted to enhance the natural line of vision and preferred working posture. As the model number implies, two models of the 2436 interactive terminal are manufactured, DW and DE. Model DE is capable of data processing only. Model DW has all the data processing capabilities of the DE version and is capable of document oriented word processing as well. For simplicity, the 2436DW/DE will be referred to as the 2436 (or simply the "terminal") during the following descriptions.

The terminal is connected to the 2200 MicroVP host system through an asynchronous modified "null modem" connection. All cable connections are made at the rear panel of the electronics base unit which provides the interface for the CRT, the keyboard, a local printer, as well as the connection to the 2200 system. Major features of the 2436DW include highlighted displays with special character display attributes such as bright, blinking, underlined, and reverse video. All characters may be displayed using one or more character display attributes. Also, the

terminal is capable of both box and character graphics.

The 2436 is capable of supporting a local printer allowing hard copy output to be produced on a printer connected to the terminal. A screen dump to the local printer can be initiated from the keyboard resulting in a hardcopy printout of the standard characters displayed on the screen. Connecting a Wang matrix printer to the terminal allows the box and character graphics to be included in the screen dump.

When connected to the 2200 MicroVP through the model 2236MXE Terminal Processor, the 2436 can save its screen contents in a variable of a BASIC program. The screen can then be reproduced on the system printer, saved on a disk file for future processing, or sent to another system.

The 2436DW integrated terminal allows the operator to perform word processing and data processing applications at the same workstation. The WP functions are executed by the 2200/WP software. The features of the software are: operator prompts, automatic word wraparound, automatic indexing and centering, indenting, decimal alignment, global search and replace, text movement and copy, and right margin justification. Editing capabilities include the insertion and deletion of characters, words lines, paragraphs, or entire sections of text.

# 10.2

# FUNCTIONAL DESCRIPTION

## Block Diagram Description (Sheet 1 of 3)

---

This section describes the theory of operation for the 2436 on a functional block diagram level. The information applies to both the DW and DE models of the terminal and is intended to provide customer engineering personnel with a basic understanding of the terminal design.

Data flow between the various components of the terminal occurs on the 2436 bus, the terminal's internal bus network. The bus network comprises signals representing data, control, and address information. All of the processing logic for the 2436 is contained on the CPU board located in the electronic base unit.

The CPU board contains a Z80 microprocessor which executes the operating code, manages the display on the screen, and controls the transfer of data and commands between the various components of the terminal. The Z80 is sequenced with an operating system in two KBytes of PROM including a power-up diagnostic routine. When power is initially applied to the terminal, the microprocessor is reset and begins executing its program from the microcode located in the PROMs. The program contains the code necessary to initialize the programmable components (VTAC, CTC, UART, and PIO) for their default functions. The Z80 also administers a series of tests to verify the vital functions of the board. When all operational functions have passed the power-up diagnostics, the microprocessor reads and displays a message on the CRT which identifies the terminal type, its baud

rate, the PROM revision level, parity, and the keyboard translation table (USA, International).

The CTC (Counting and Timing Circuit) provides the terminal with a general purpose interval timer. Its function is to generate interrupts for the Z80 in order to initiate and control operations which require the use of the 2436 bus such as transmit or receive.

The 2436 memory is divided into three sections: main memory (RAM), PROM, and CRT memory (RAM). The CRT memory is further divided into two sections namely, character code and display and forms control. The CRT RAM is addressed by the Z80 as two separate sections, but when operating with the CRT display, it is merged into one section of 2K words x 16 bits. The CRT RAM is mapped to the display screen where a character is addressed according to its position (row and column) on the screen.

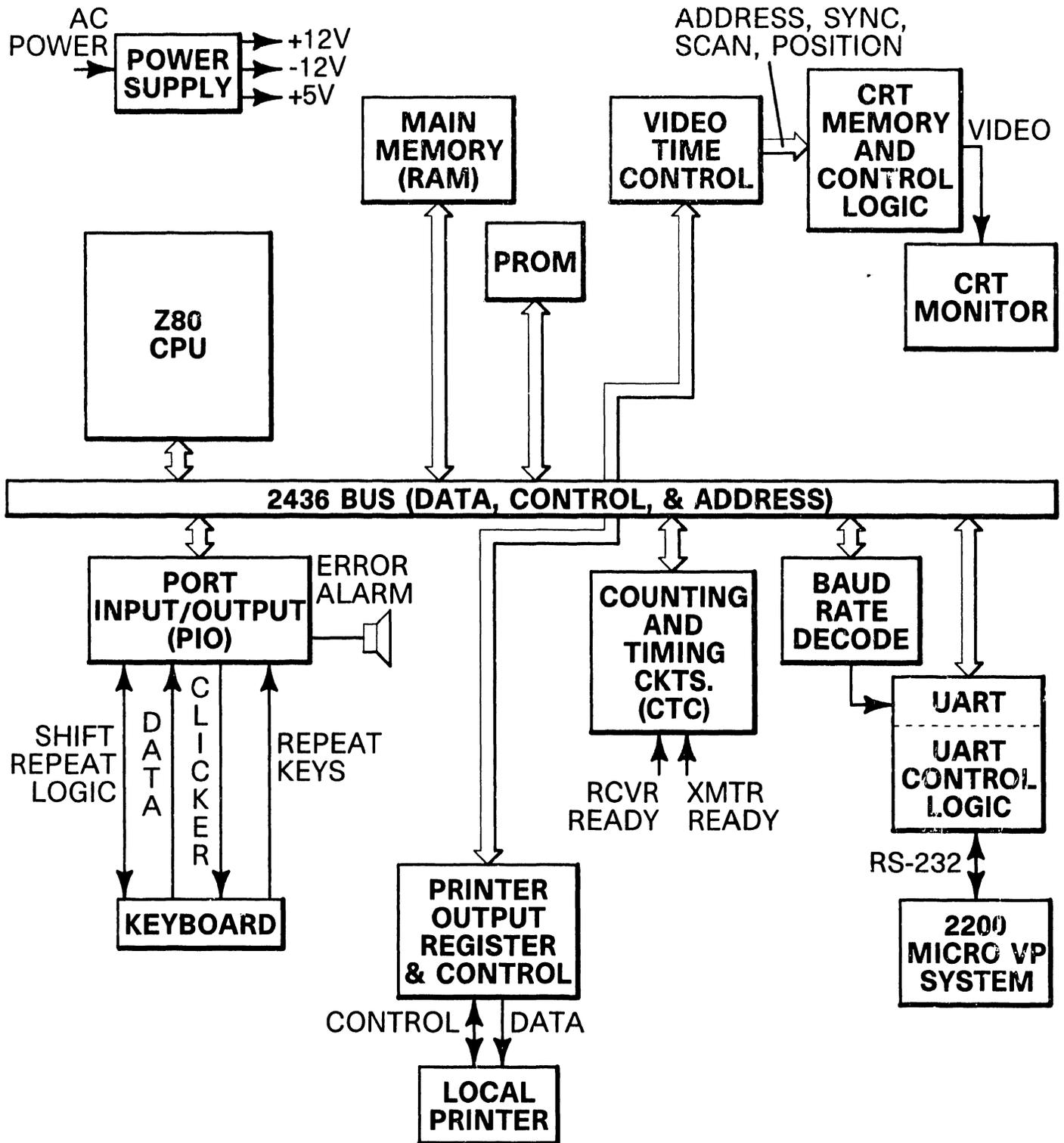
The CRT control logic controls the display of video information, stored in the CRT memory, to the CRT monitor. The control logic receives its input from the Video Time Controller (VTAC) circuit. The VTAC generates the timing signals necessary to display video data on the CRT monitor. They include dot-matrix outlines of characters, the horizontal and vertical scan signals, and the placement characters in a given row and column. In conjunction with character memory, the VTAC maintains the display on the screen through the "CRT memory and control logic" function which provides the drive for the CRT.



# 10.2

# FUNCTIONAL DESCRIPTION

Block Diagram Description (Sheet 2 of 3)



# 10.2

# FUNCTIONAL DESCRIPTION

## Block Diagram Description (Sheet 3 of 3)

The 2436 communicates with the 2200 MicroVP CPU through the standard RS-232 async protocol. The terminal may be located up to 2000 feet from the 2200 terminal controller. Data is sent and received via the UART chip. The UART supplies the Z80 CPU with status, location, and the operational state of the various signals. Receiver ready and transmitter ready are applied to the CTC circuit so that they cause interrupts when active.

The BAUD rate decode circuit is controlled by a five position switch bank which controls the communications logic. Switches 3, 4, and 5 determine the baud rate desired. The first switch selects the word length. The second selects even or odd parity. The baud rate switch settings are outlined in detail in section 9 of this manual (  9.4.2).

The keyboard interfaces with the PIO (Port Input/Output) function when interacting with the terminal's logic. When a key is struck, a code is generated and an interrupt is applied to the Z80 which accepts and processes it based on priority. Repeated interrupts are generated when a key is pressed for more than 300 ms, and will continue as long as the key is held down. The keyboard clicker will sound when the key code is accepted. The PIO function also produces and controls the error alarm signal to the terminal's speaker. The signal notifies the operator of prompts and special conditions during the word processing program.

The printer output register and control circuit interfaces the terminal to a local

printer. Print data is output to the printer via a one byte buffer register. Each time a byte is loaded, the terminal generates a data strobe to the printer. A "printer acknowledge" signal is returned from the printer each time it receives a character.

The 2436 is physically attached to the 2200 MicroVP CPU through one of two devices: a 22C32 Triple Controller that connects the terminal to either a 2200VP or a 2200 MVP system, or a 2236MXD Terminal Processor that connects the terminal to a 2200MVP multi-user system. By using a combination of two 2236MXDs and one 22C32, a total of nine terminals may be connected to an MVP system. Only one terminal can be connected to a VP system. The 2200 Controllers between the terminal and the CPU serve as buffers for data transmitted to and from the terminal. Communications is asynchronous, full duplex. The 2236MXD controller offers selectable line speeds ranging from 300 to 19.2 KBaud. The 22C32 controller has a fixed communication rate of 19.2 KBaud. Controller switch settings which establish transmission rates are outlined in detailed in the 2200 MicroVP product maintenance manual. Refer to the manual when installing and setting up the terminal.

The terminal is equipped with a fan cooled switching power supply. The supply provides three regulated dc voltages (+12V, -12V, and +5V) to operate the CRT, keyboard and the terminal's CPU board. The output voltages are not adjustable in the field.



END

**SECTION**

**11**

**SPECIFICATIONS**

# SECTION 11 CONTENTS

---

## SECTION 11 SPECIFICATIONS

	Page
11.1 EQUIPMENT .....	11-1

# SPECIFICATIONS

## 11.1

### Equipment

---

#### Physical Dimensions

Height: 17 inches (43.2 cm)  
Width: 16 inches (40.6 cm)  
Depth: 12 inches (30.5 cm)

#### Weight

15 pounds (6.8 kgs.)

#### Power Requirements

115 vac, 60 Hz, (+17 v, -25 v,  $\pm 2$  Hz)  
220 vac, 50 Hz, (+43 v, -40 v,  $\pm 3$  Hz)

#### Operating Environment

Ambient Temperature:  
32°-104° F (0°-40° C)  
Relative Humidity:  
5 - 90% nonoperating or operating

#### CRT Characteristics

Display Size: 12 inches (30.5 cm)  
diagonal  
Display Capacity: 24 lines, 80  
characters/line

#### Keyboard Characteristics

Character Set: 128, upper and lower  
case letters.

Alternate Character Set: 64 graphic  
characters with additional special  
symbols.

Character Set Attributes: High/low  
intensity display, blinking, reverse  
video, or underlining.

Typewriter Keyboard: 88 ASCII  
characters

Special Function Keys: 17 user  
defineable

Numeric Keypad

#### Communication Mode:

Asynchronous, full duplex

#### Transmission Rates:

300, 600, 1200, 2400, 4800, 9600, or  
19.2K baud, manually selectable for  
each terminal.

#### Character Format:

1 start bit, 1 stop bit  
8 data bits, plus odd parity (11 bits/  
character).

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

# SECTION 12 CONTENTS

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## SECTION 12 ILLUSTRATED PARTS

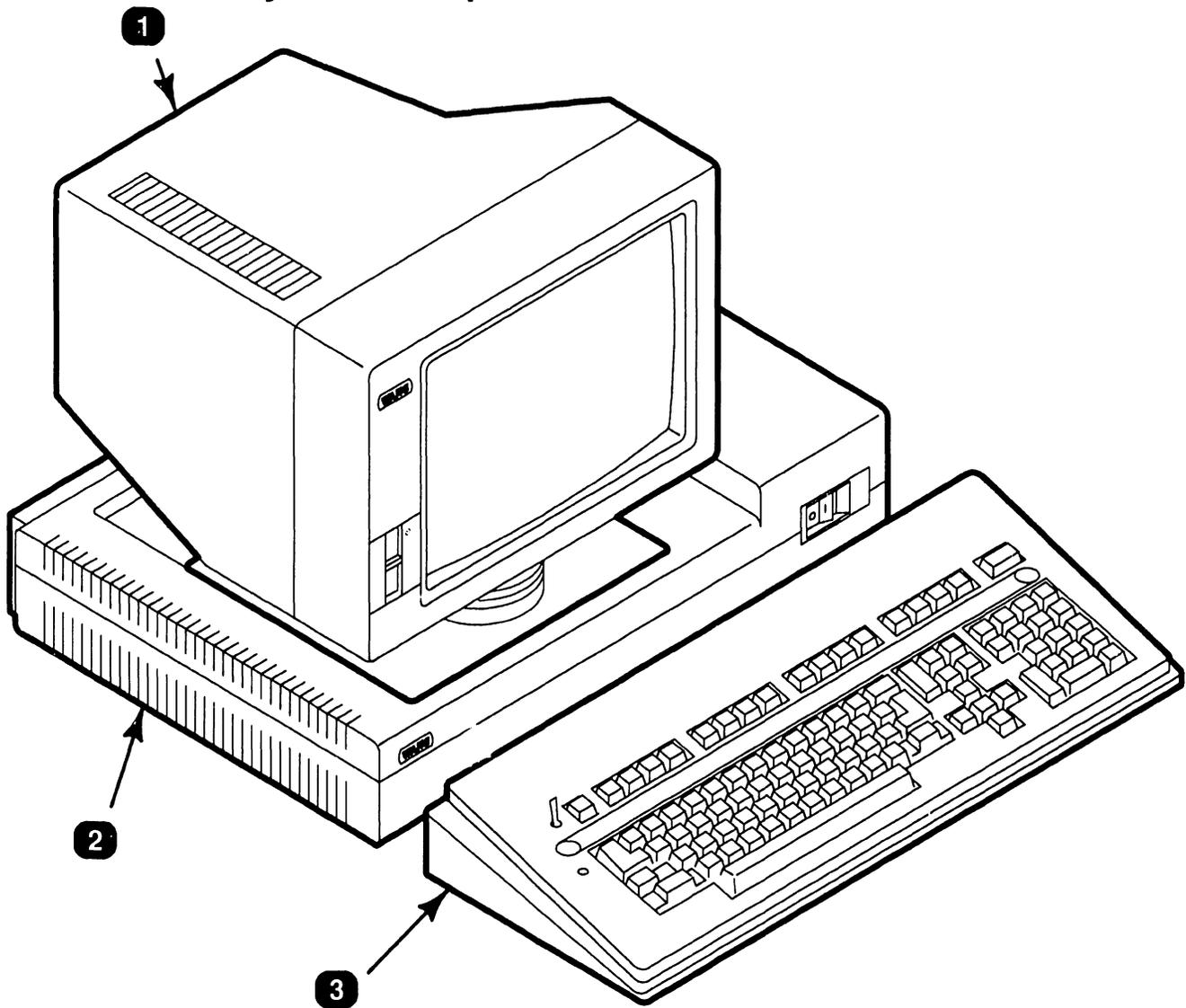
	Page
12.1 MAJOR ASSEMBLIES .....	12-1
12.1.1 System Components .....	12-1
12.1.2 Electronics Base Assembly .....	12-2

# 12.1

# ILLUSTRATED PARTS

## Major Assemblies

### 12.1.1 System Components



<i>Item</i>	<i>Part Number</i>	<i>Description</i>
1	279-0659-PM004-L	Display Monitor
2	177-3647	Electronics Base Assembly (DE)
	177-3648	Electronics Base Assembly (DW)
3	725-2618	Keyboard Assembly (DE Standard)
	725-2637	Keyboard Assembly (DW Standard)
	725-2652	Keyboard Assembly (DE Expanded)
	725-2651	Keyboard Assembly (DW Expanded)

# 12.1

## Major Assemblies

# ILLUSTRATED PARTS

### 12.1.2

### Electronics Base Unit (Sheet 1 of 2)

<i>Item</i>	<i>Part Number</i>	<i>Description</i>
1	650-4643	Screw, 8 - 32 X 2" PH Phil
2	449-0772	Hole Plug
3	650-4135	Screw, 8 - 32 X 3/8" PH Phil
4	450-0917	Top Cover
5	420-2025	Power Cord Plug Receptacle Unsheilded
6	650-4080	Screw, 8 - 32 X 1/4" PH Phil
7	725-2749-10	Switching Power Supply
8	449-0676	Switch Insert
9	210-8577-A	CPU PCB (DE)
	210-8577-B	CPU PCB (DW)
10	449-0674	Center Support Spacer
11	450-0916	Bottom Base
12	655-0297	Feet, 9/16"D X 1/8" Self Adhesive
13	220-0491	Video/Power Cable Molded 4'
14	421-0030	Cable Assembly Molded (25P)

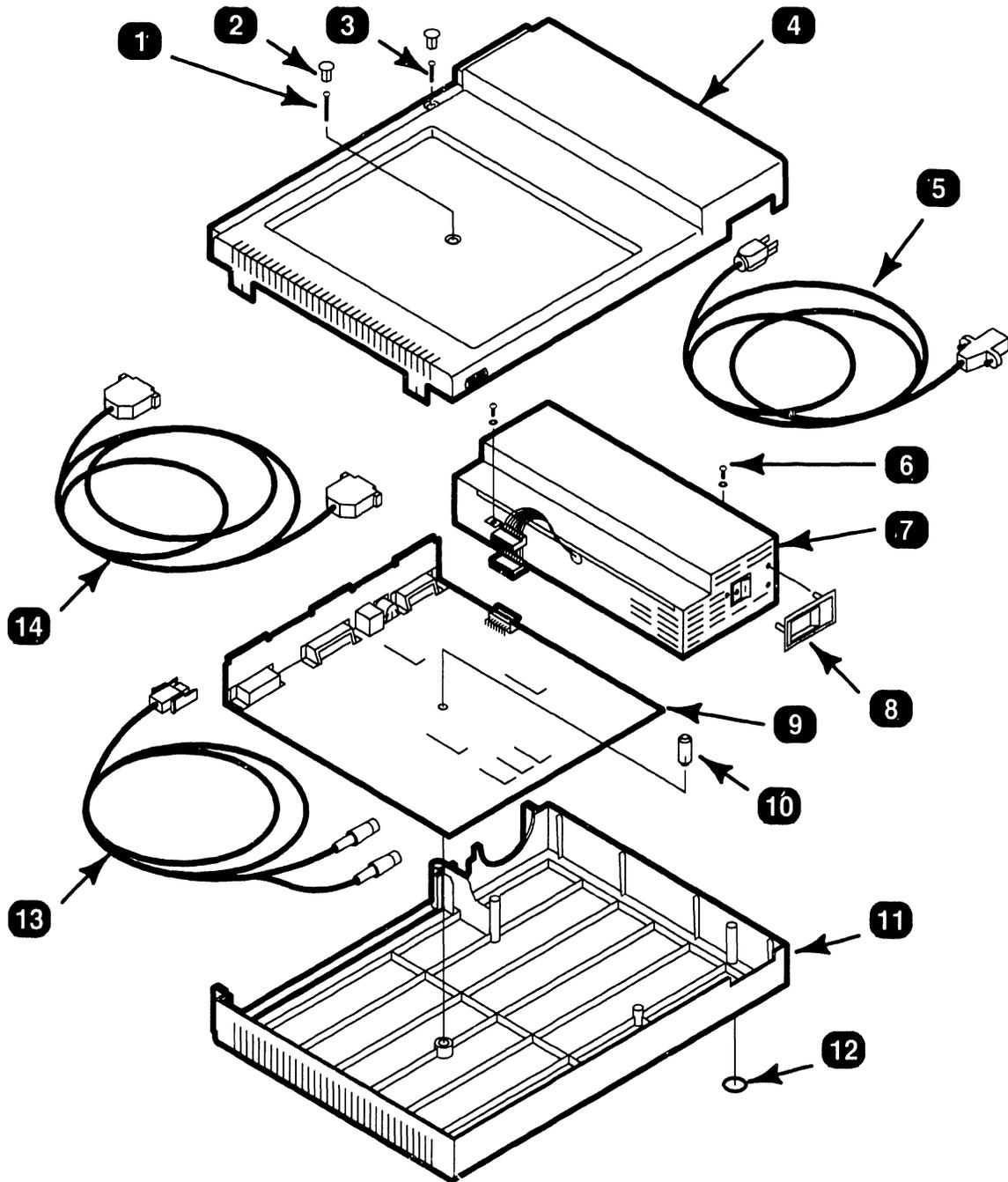
# 12.1

# ILLUSTRATED PARTS

## Major Assemblies

### 12.1.2

### Electronics Base Unit (Sheet 2 of 2)



# **SCHEMATICS**

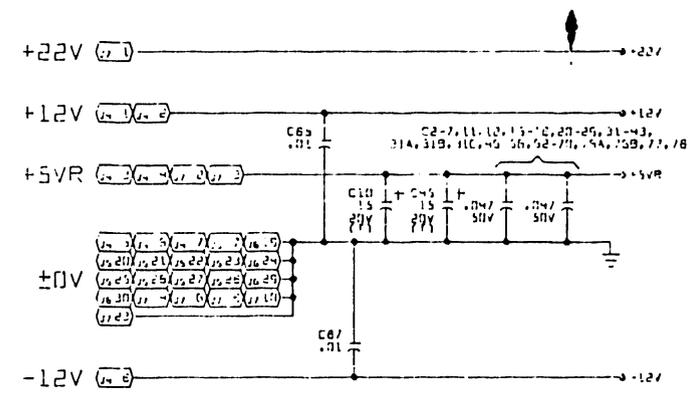
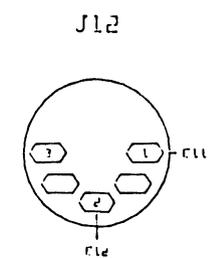
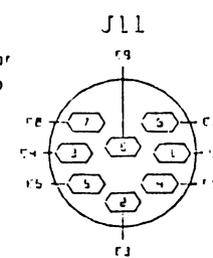
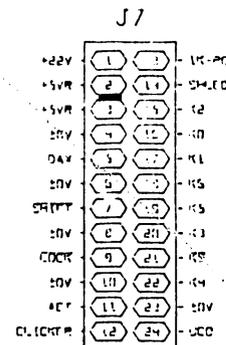
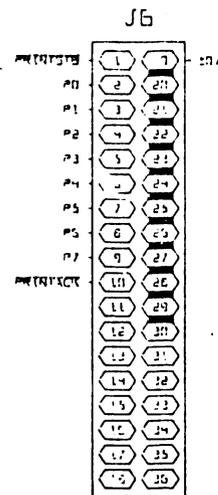
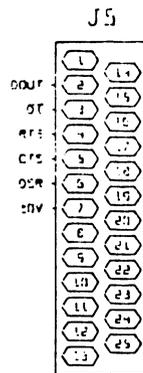
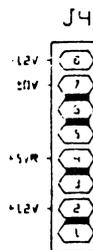
ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE INDICATED.

NOTES

1. ALL RESISTOR VALUES IN OHMS.
2. ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE INDICATED.
3. ALL RESISTORS 1/4W 5% UNLESS OTHERWISE INDICATED.

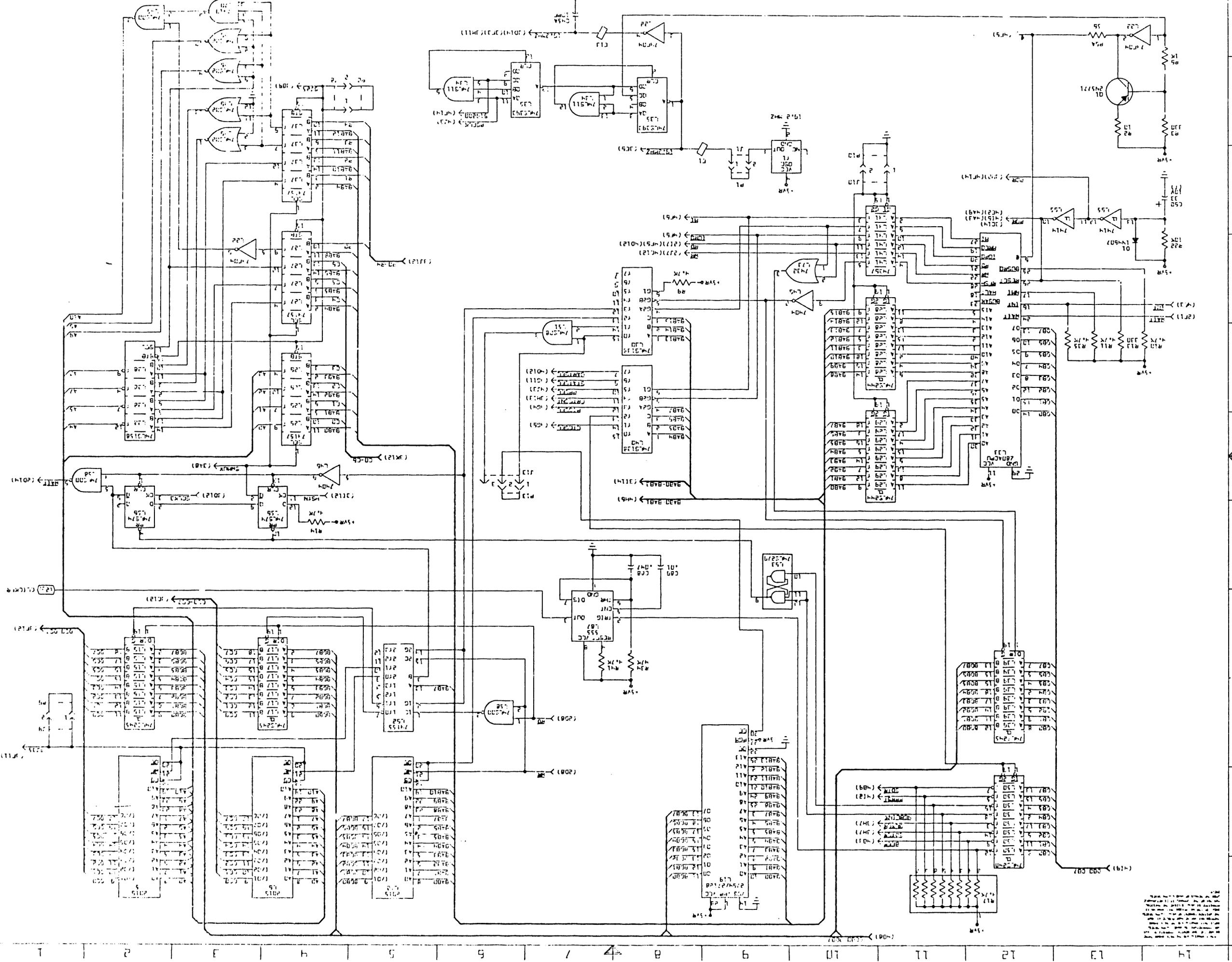
MNEMONICS	COORD.
1 (A)7	401
AI7	4G1
CLICR7	4H1
C75	4014
D4V	401
D7	4014
DDU7	4A5
D7R	4014
D7R	4A7
E2-F9	4B1
F11-F12	4C1
H11-K5	4H1
RS	4K7
COCK	4K7
PH-P7	4L1
PHN1P7	4C4
PHN1S7B	4J1
R75	4A7
SP1P7	4K4
SH-L73	4K2
UCO	4G1

IC TYPE	LOCATION	SPARES
7404	4J	4
7404	4J2	2
74005	4J1	1
7410	4J0	1
74011	4J4	1
7407	4J4	1
74032	4J3	1
74074	4J1	1
74086	4J0	1
740219	4J3	1



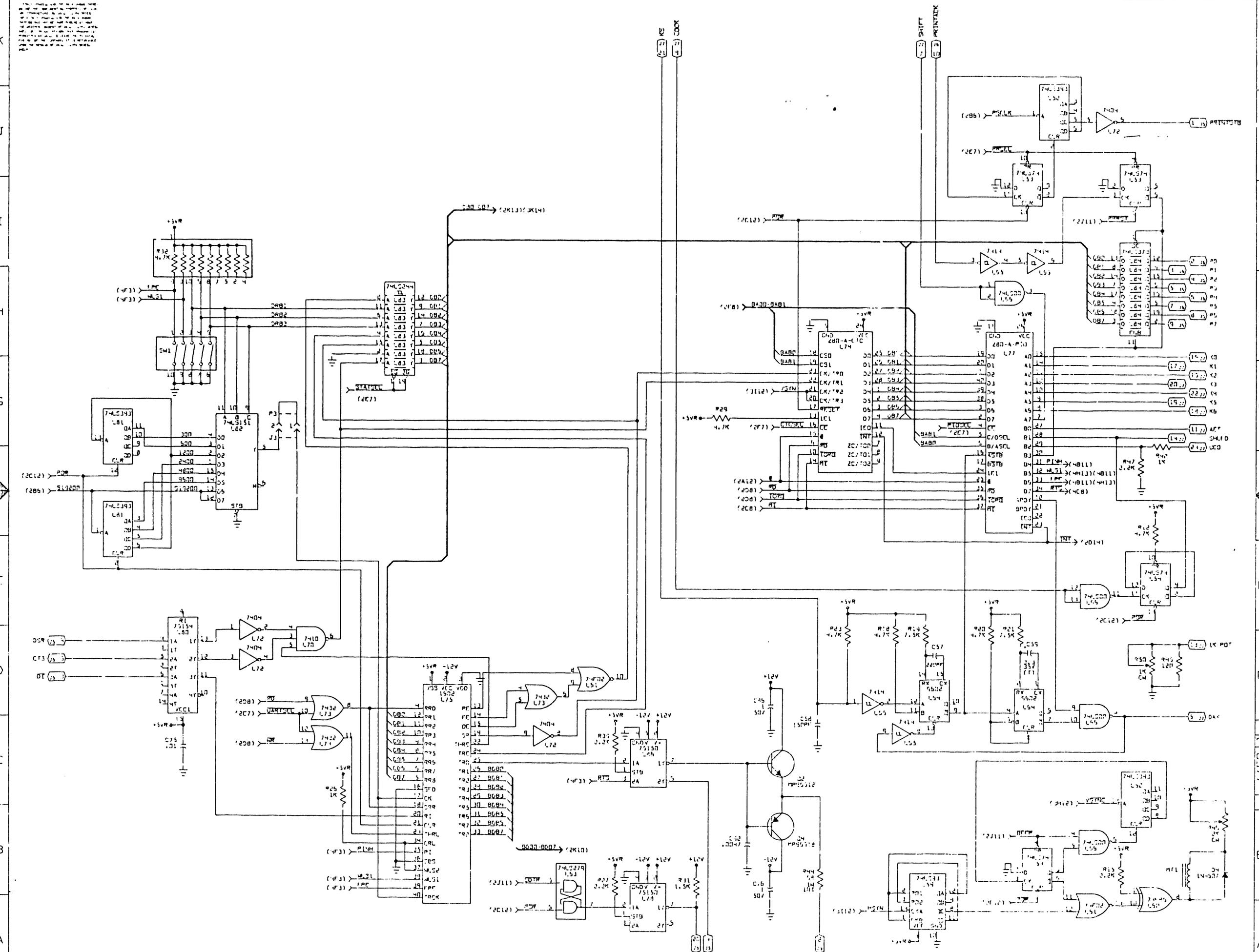
REV 0 N

(WANG) ENGINEERING		SCHEMATIC DIAGRAM	
TITLE		2405 WORKSTATION	
DATE	REV	BY	CHK
8-15-64	001	ENG	001
SCALE	DRWING NUMBER	SIZE	TRANS NUMBER



1. This circuit is a digital logic circuit designed to perform a specific function. It consists of several integrated circuits (ICs) connected together to form a complex logic network. The ICs used include 74LS11, 74LS13, 74LS15, 74LS16, 74LS17, 74LS18, 74LS19, 74LS20, 74LS21, 74LS22, 74LS23, 74LS24, 74LS25, 74LS26, 74LS27, 74LS28, 74LS29, 74LS30, 74LS31, 74LS32, 74LS33, 74LS34, 74LS35, 74LS36, 74LS37, 74LS38, 74LS39, 74LS40, 74LS41, 74LS42, 74LS43, 74LS44, 74LS45, 74LS46, 74LS47, 74LS48, 74LS49, 74LS50, 74LS51, 74LS52, 74LS53, 74LS54, 74LS55, 74LS56, 74LS57, 74LS58, 74LS59, 74LS60, 74LS61, 74LS62, 74LS63, 74LS64, 74LS65, 74LS66, 74LS67, 74LS68, 74LS69, 74LS70, 74LS71, 74LS72, 74LS73, 74LS74, 74LS75, 74LS76, 74LS77, 74LS78, 74LS79, 74LS80, 74LS81, 74LS82, 74LS83, 74LS84, 74LS85, 74LS86, 74LS87, 74LS88, 74LS89, 74LS90, 74LS91, 74LS92, 74LS93, 74LS94, 74LS95, 74LS96, 74LS97, 74LS98, 74LS99, 74LS100, 74LS101, 74LS102, 74LS103, 74LS104, 74LS105, 74LS106, 74LS107, 74LS108, 74LS109, 74LS110, 74LS111, 74LS112, 74LS113, 74LS114, 74LS115, 74LS116, 74LS117, 74LS118, 74LS119, 74LS120, 74LS121, 74LS122, 74LS123, 74LS124, 74LS125, 74LS126, 74LS127, 74LS128, 74LS129, 74LS130, 74LS131, 74LS132, 74LS133, 74LS134, 74LS135, 74LS136, 74LS137, 74LS138, 74LS139, 74LS140, 74LS141, 74LS142, 74LS143, 74LS144, 74LS145, 74LS146, 74LS147, 74LS148, 74LS149, 74LS150, 74LS151, 74LS152, 74LS153, 74LS154, 74LS155, 74LS156, 74LS157, 74LS158, 74LS159, 74LS160, 74LS161, 74LS162, 74LS163, 74LS164, 74LS165, 74LS166, 74LS167, 74LS168, 74LS169, 74LS170, 74LS171, 74LS172, 74LS173, 74LS174, 74LS175, 74LS176, 74LS177, 74LS178, 74LS179, 74LS180, 74LS181, 74LS182, 74LS183, 74LS184, 74LS185, 74LS186, 74LS187, 74LS188, 74LS189, 74LS190, 74LS191, 74LS192, 74LS193, 74LS194, 74LS195, 74LS196, 74LS197, 74LS198, 74LS199, 74LS200.







LABORATORIES, INC.

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