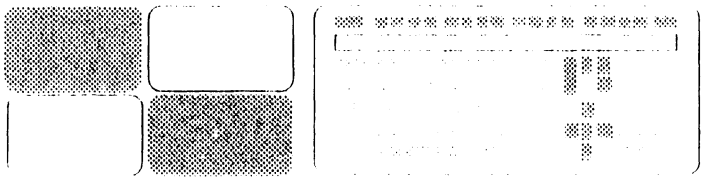
WANG

CUSTOMER SERVICE DOCUMENTATION



Professional Computer

Model: PC 240

COMPANY PROPRIETARY STATEMENT

Product Maintenance Manual 741-1808

PREFACE

This document is the Illustrated Product Maintenance Manual for the Wang PC 240 computer. The manual's purpose is to provide the Customer Engineer with information to install, operate, troubleshoot, and repair the PC 240 computer in the field.

First Edition (November, 1988)

This is the first edition of the PC 240 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 Publication Update Bulletins (PUBs) or subsequent revised editions.

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SECTION 1

INTRODUCTION

INTRODUCTION

1.1 Scope and Purpose

This manual contains installation, operation, troubleshooting, and repair information for the Wang PC 240 IBM-compatible computer.

The manual's purpose is to provide Customer Engineering personnel with the information necessary to install, operate, troubleshoot, and repair the PC 240 computer in the field.

● END

1.2 Organization and Layout

Each section of this manual describes a separate maintenance subject. Every section is preceded by the section number and a section table of contents. Within each section, information pertaining to a specific task is contained in a frame or frames. Each frame comprises illustrations, numbered steps, and/or text to describe the actions required to accomplish each task. References to other frames are indicated by an arrow (➡), followed by the section number(s) being referenced. The manual's sections and frames are arranged in numerical sequence from left-to-right and from top-to-bottom on the microfiche cards.

● END

1.3 Abbreviations and Symbols Used in this Manual (Sheet 1 of 2)

Abbreviation/Symbol	*Definition*
BIT	Built-In Test
BMAC	Buffer Management and Controller
BMCP	Buffer Manager Control Processor
DACK	Direct Memory Access Request Acknowledge
CGA	Color Graphics Adapter
COM	Communications
DC	Disk Controller
DRWC	Diskette Read/Write Controller
ECC	Error Correction Code
EGA	Enhanced Graphics Adapter
FRU	Field-Replaceable Unit
H	Hexidecimal Notation
HDC	Hard Disk Controller
HDINIT	Hard Disk Initialization
H/HT	Half-Height
I/O	Input/Output
IRQ	Interrupt Request
LED	Light-Emitting Diode
LSI	Large Scale Integration
MB	Megabyte

➡NEXT

1.3 Abbreviations and Symbols Used in This Manual (Sheet 2 of 2)

Abbreviation/Symbol	*Definition*
MDA	Monochrome Display Adapter
MHz	Megahertz
MFM	Modified Frequency Modulation
NMI	Non-Maskable Interrupt
PM	Preventative Maintenance
PAL	Programmable Array Logic
P/N	Part Number
RAM	Random-Access Memory
RAS	Row Address Strobe
RGB	Red Green Blue (signals)
RTC	Real Time Clock
RWC	Read/Write Controller
SIMM	Single In-Line Memory Module
SW	Switch
TP	Test Point
TTL	Transistor-Transistor Logic
V	Volts
VCO	Voltage Controlled Oscillator
WDC	Wang Disk Controller
WDI	Wang Disk Interface
WLOC	Wang Local Office Connection

● END

SECTION 2

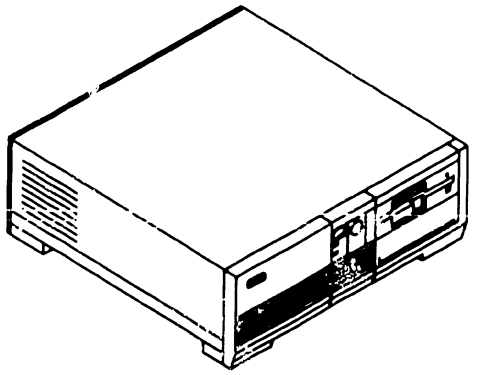
IDENTIFICATION

SECTION 2 CONTENTS

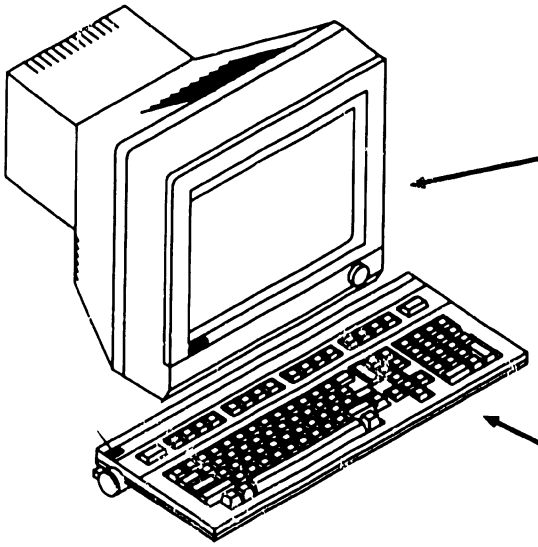
SECTION 2

IDENTIFICATION

2.1 Major Assemblies



ELECTRONICS ENCLOSURE

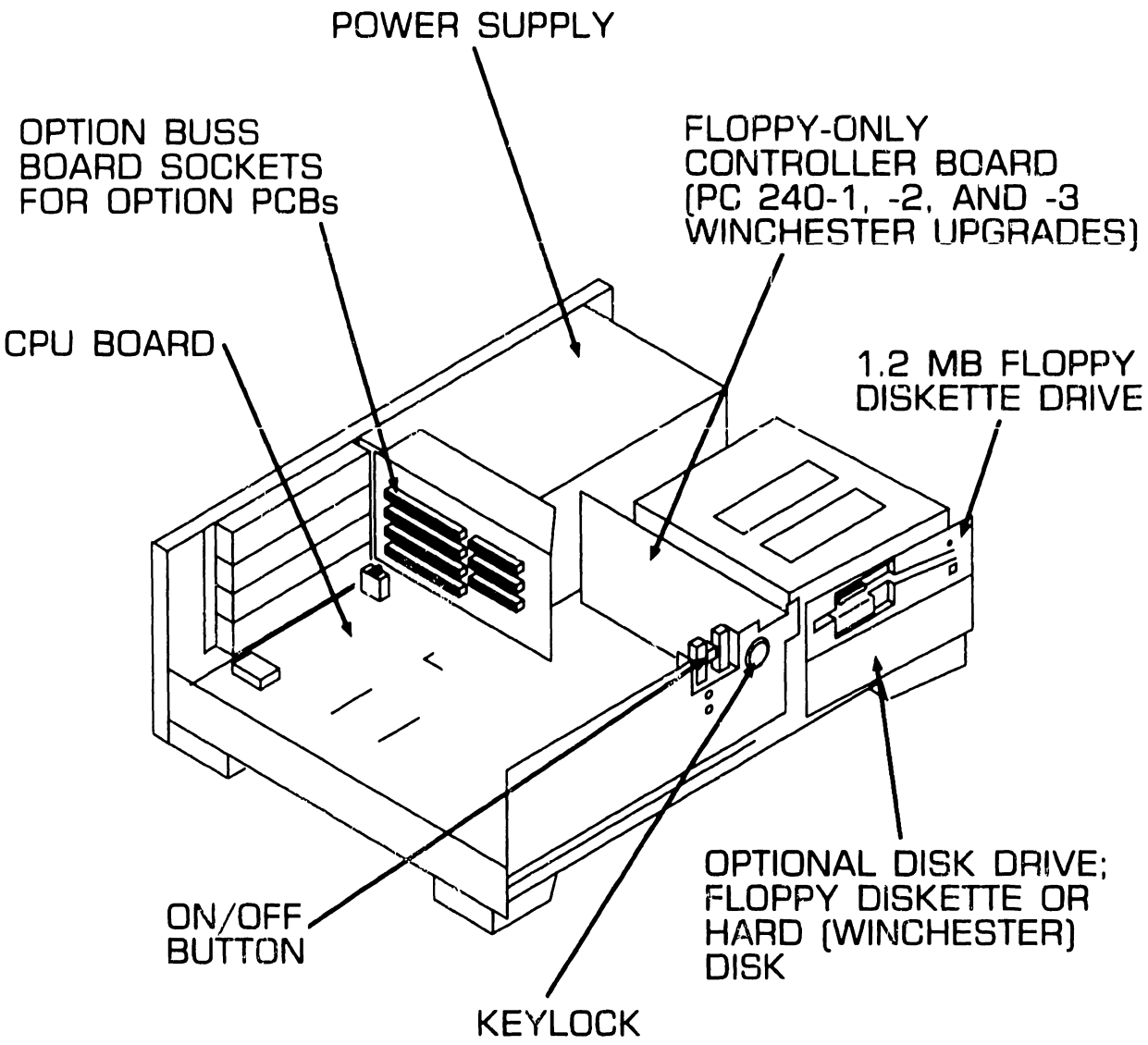


MONITOR (MONOCHROME OR COLOR)

KEYBOARD

● END

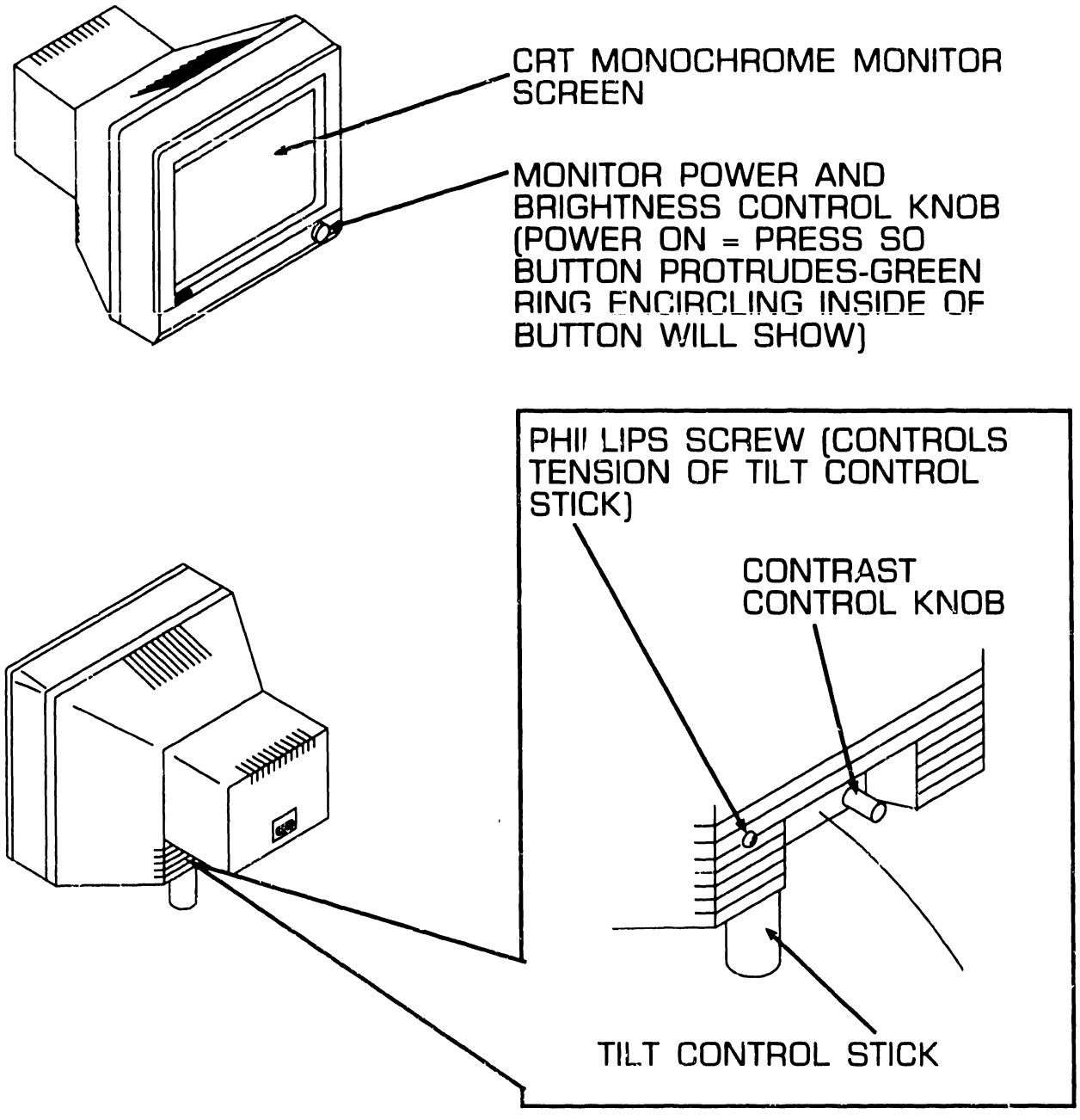
2.2 Electronics Enclosure Major Parts



● END

2.3 Workstation Monitor Major Parts

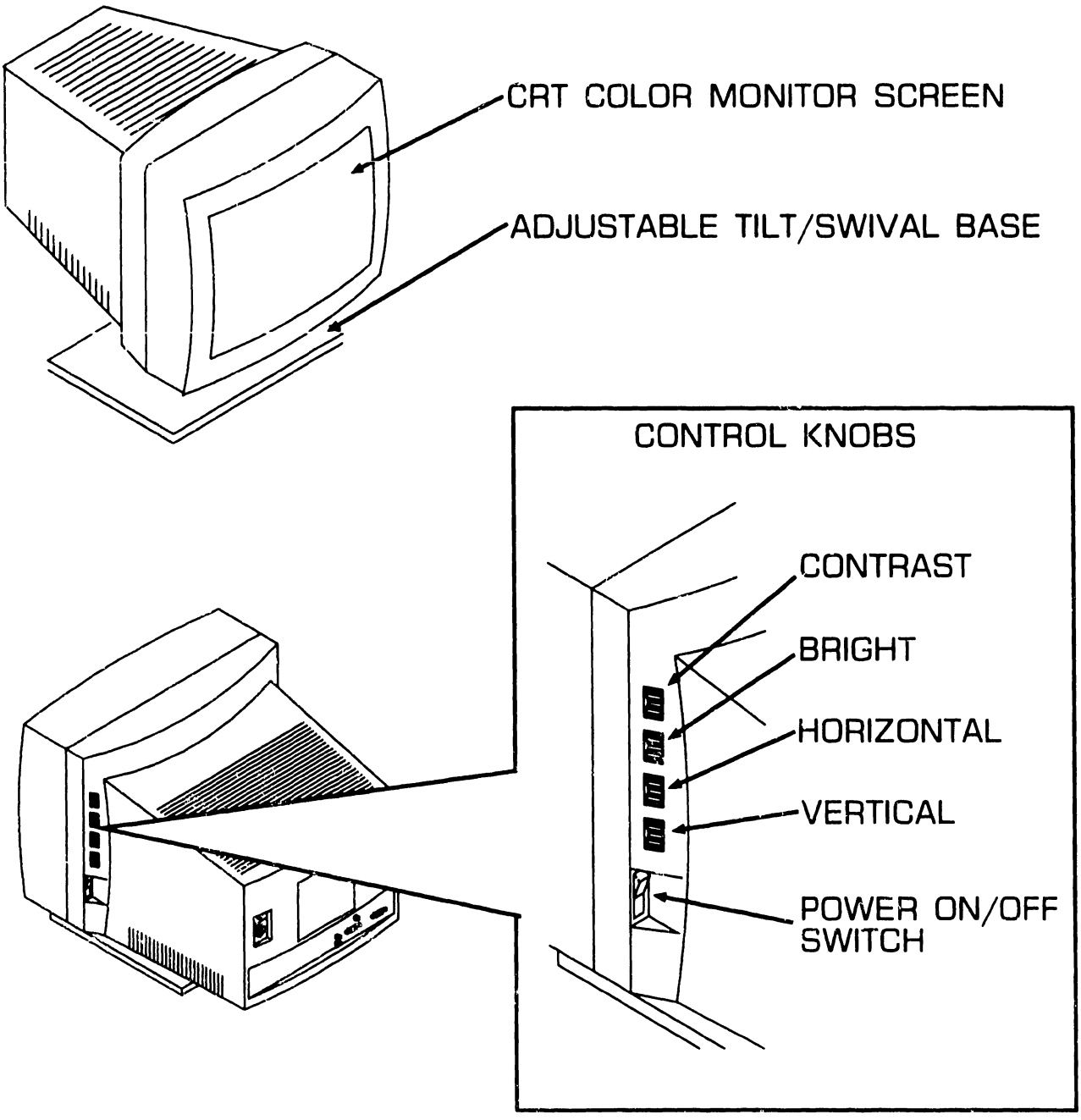
2.3.1 Monochrome Monitor Major Parts



● END

2.3 Workstation Monitor Major Parts

2.3.2 Color Monitor Major Parts



● END

SECTION 3

CONTROLS AND INDICATORS

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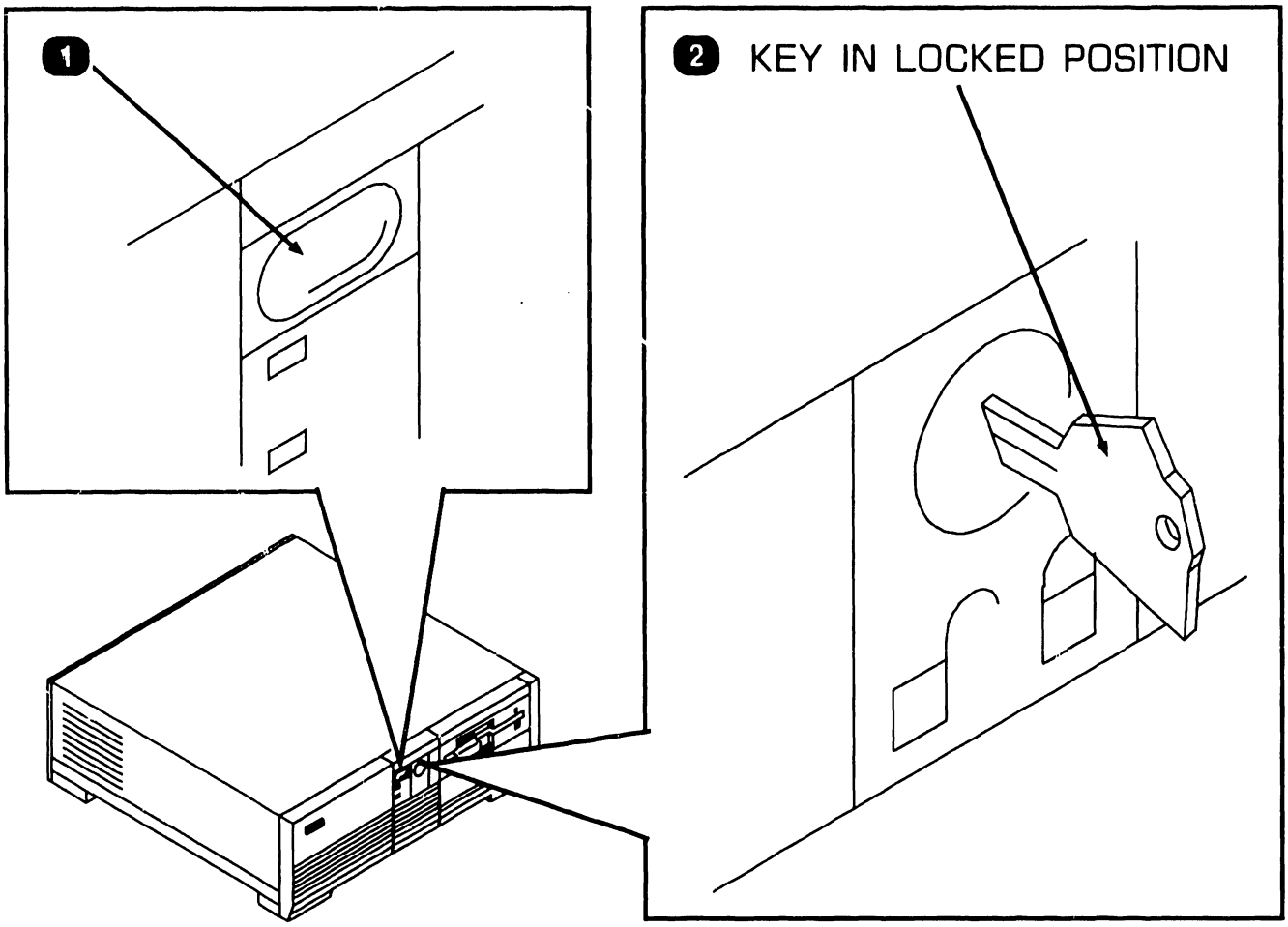
SECTION 3

CONTROLS AND INDICATORS

3 CONTROLS AND INDICATORS

3.1 Operator Controls

3.1.1 Electronics Enclosure Front Panel Controls

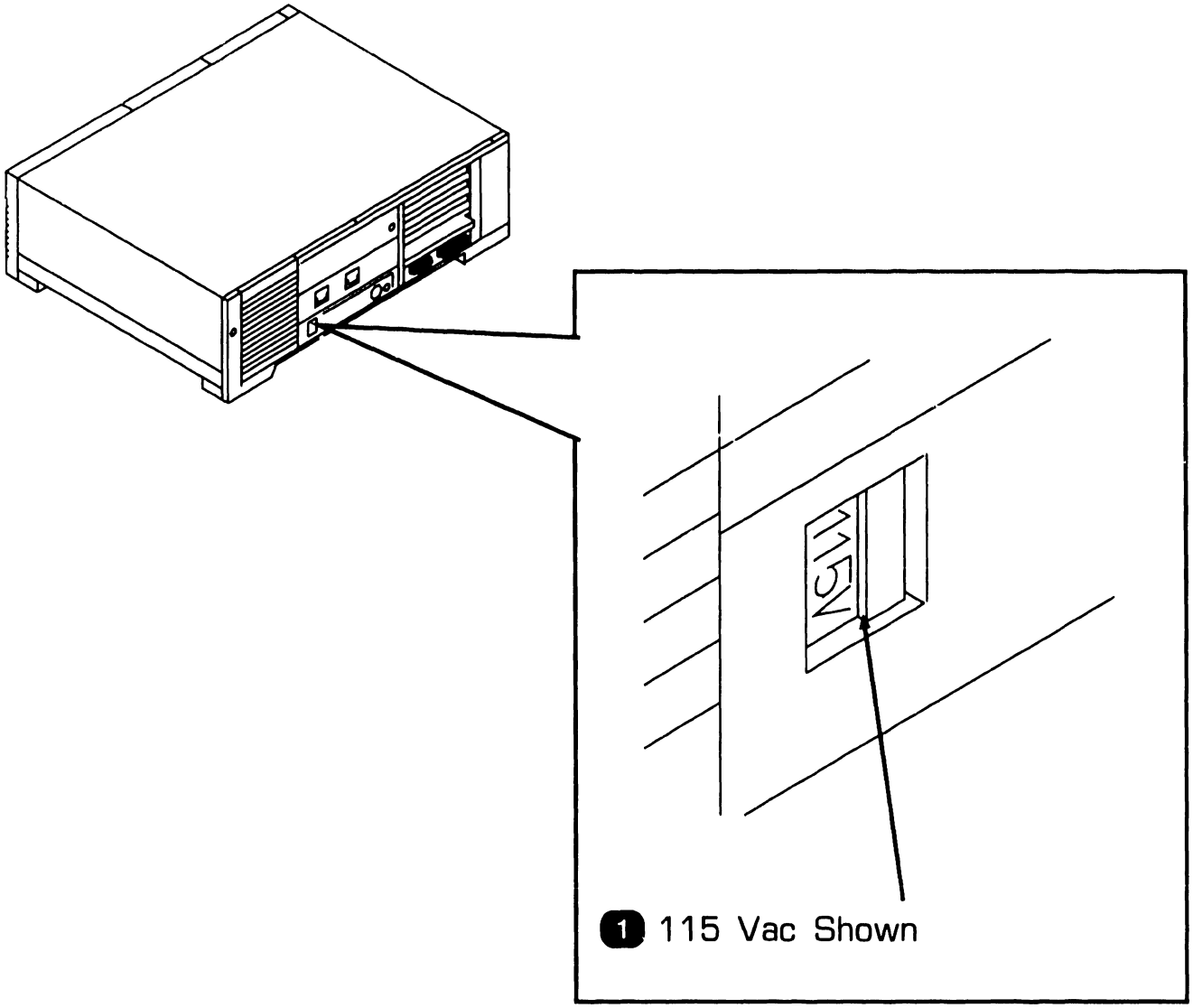


Item	*Name*	*Type and Function*
1	Power On/Off Button	Push-button; applies or removes power from system, initiates B.I.T. power-up diagnostics and Initial Program Load.
2	Keylock	Locked position -- prevents removal of top/front cover and locks keyboard. Unlocked position -- permits removal of top/front cover and allows keyboard communication with system.

● END

3 CONTROLS AND INDICATORS
3.1 Operator Controls

3.1.2 Electronics Enclosure Rear Panel Controls



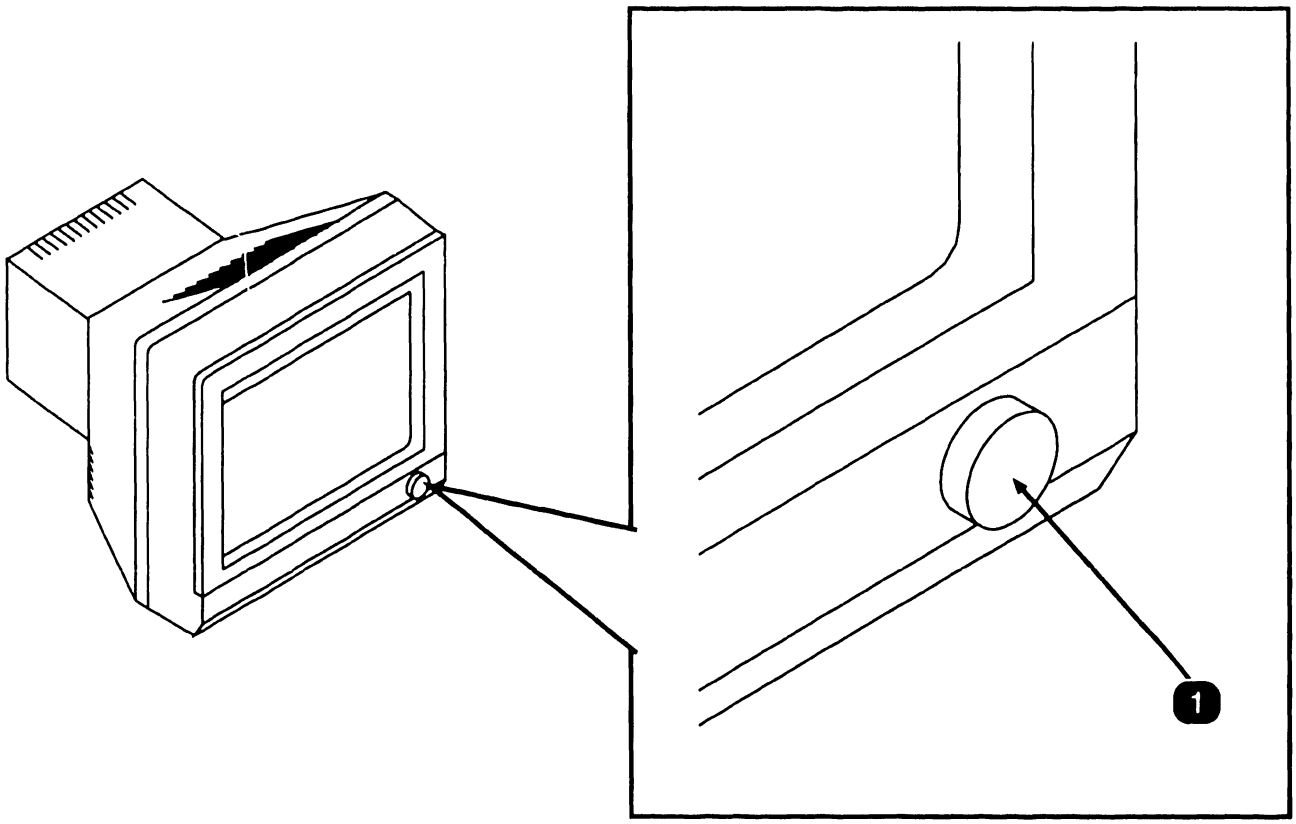
1 115 Vac Shown

Item	*Name*	*Type and Function*
1	Voltage Select Switch	Slider-type switch; selects ac operating voltage of 115V or 220V (determined by available line voltage).

● END

3 CONTROLS AND INDICATORS
3.1 Operator Controls

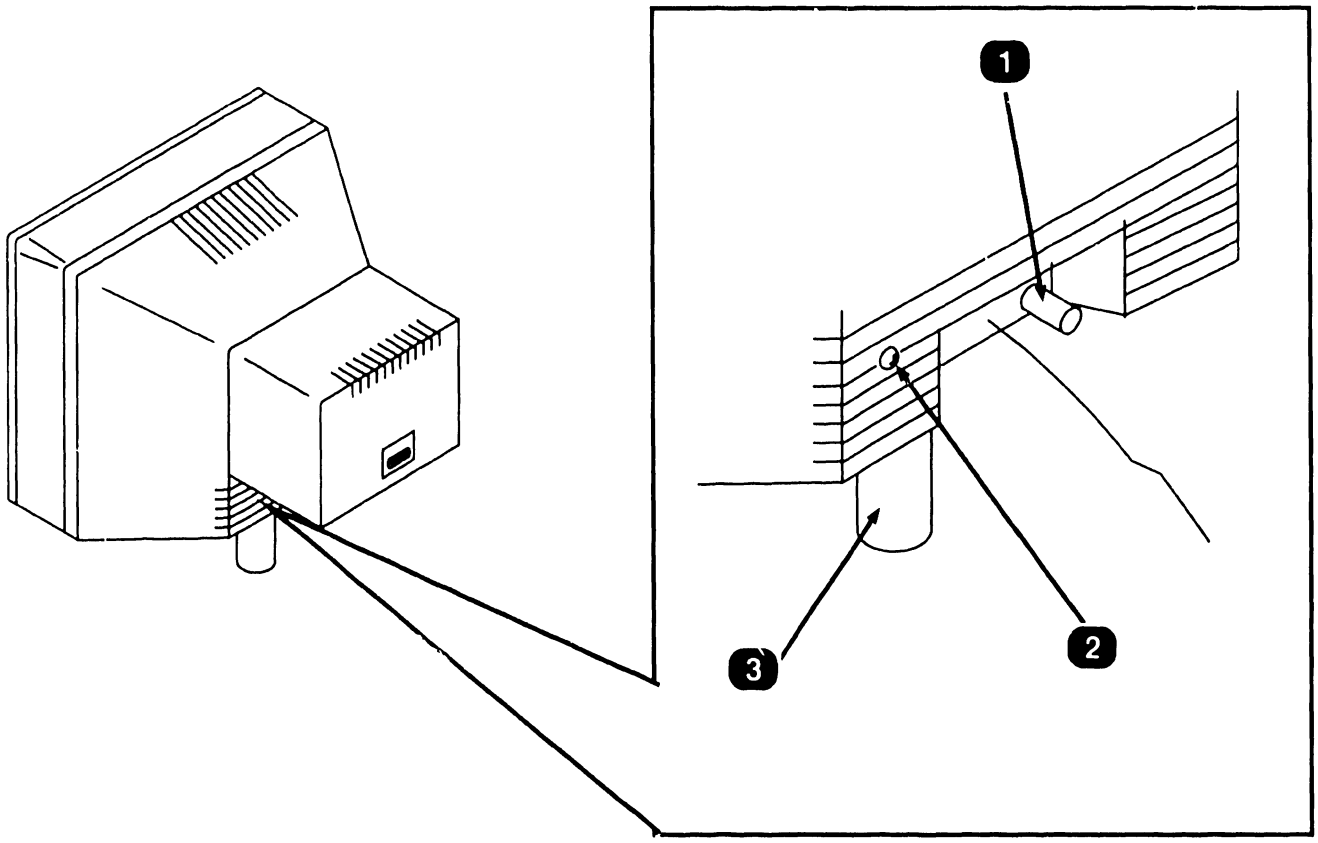
3.1.3 Monochrome Monitor Controls: Front



Item	*Name*	*Type and Function*
1	Power Button and Brightness Control	Push-button, potentiometer-type control; applies and removes power from monitor and adjusts display brightness.

● END

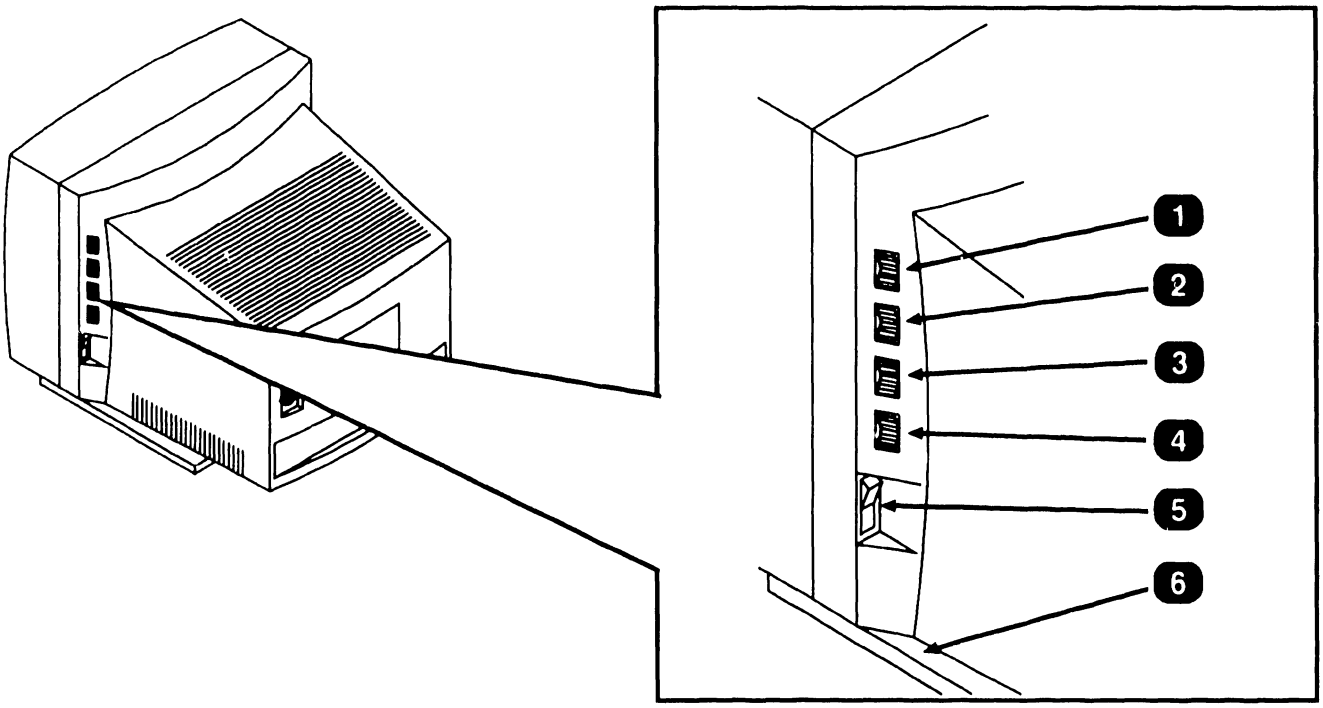
3.1.4 Monochrome Monitor Controls: Rear



Item	*Name*	*Type and Function*
1	Contrast Control	Potentiometer-type control; adjusts contrast of monitor display.
2	Tilt Control Screw	Phillips-head screw; adjusts spring-loaded tension of monitor tilt control stick.
3	Tilt Control Stick	Variable-length stick; may be adjusted to alter angle of monitor screen.

● END

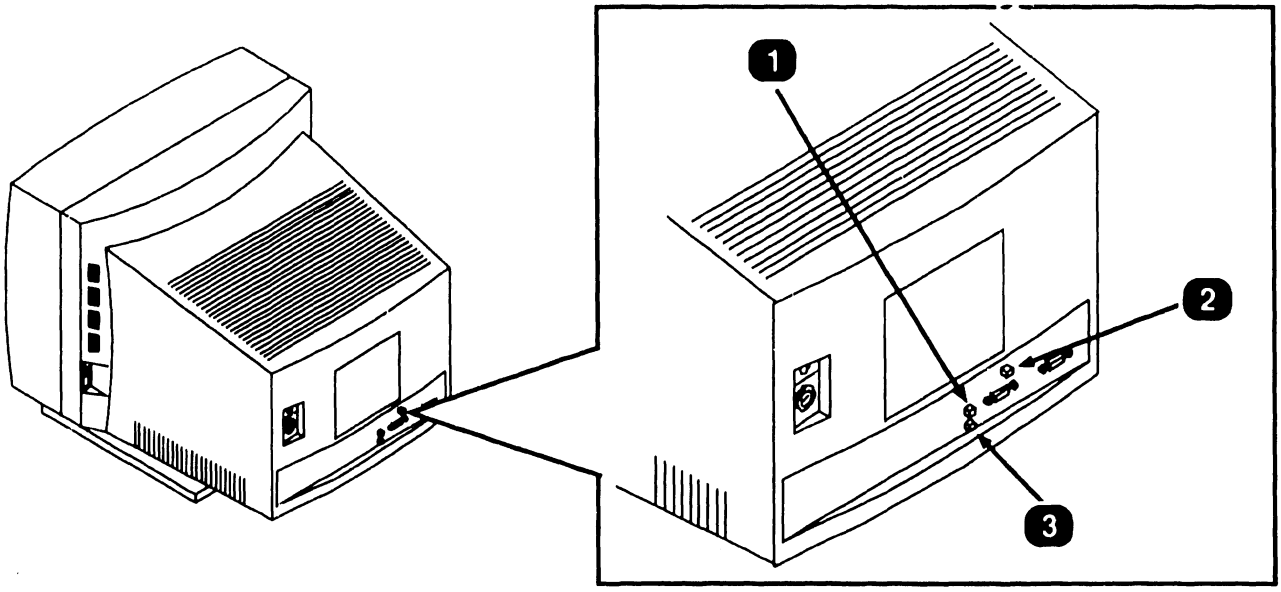
3.1.5 Workstation Color Monitor Controls: Rear (Sheet 1 of 2)



Item	*Name*	*Type and Function*
1	Contrast Control	Potentiometer-type control; adjusts Contrast of monitor display.
2	Brightness Control	Potentiometer-type control; adjusts brightness of monitor display.
3	Horizontal Control	Potentiometer-type control; adjusts horizontal alignment of monitor display.
4	Vertical Control	Potentiometer-type control; adjusts vertical alignment of monitor display.
5	Power ON/OFF Button	Rocker-type switch; applies or removes power from monitor.
6	Adjustable Tilt/ Swival Base	May be adjusted to alter angle of monitor screen.

➡NEXT

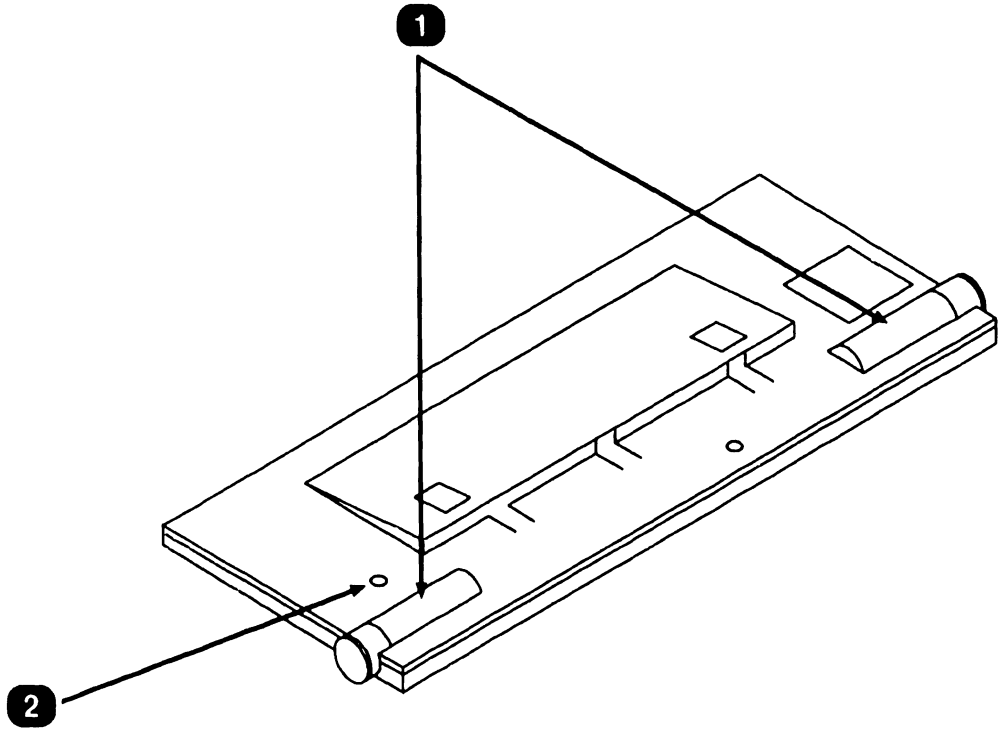
3.1.5 Workstation Color Monitor Controls: Rear (Sheet 2 of 2)



Item	*Name*	*Type and Function*
1	Preset Switch	Push-button type switch; sets correct sub control operations depending on input signals. AUTO (OUT): When connected to IBM or IBM-compatible computer. A (IN): When connected to the computer other than above.
2	Analog/TTL Select Switch	Push-button type switch; OUT: Selects TTL type video output; IN: Selects analog type video output.
3	Over Scan Switch	Push-button type switch; switches picture size on the screen. AUTO (OUT): When connected to the IBM or IBM-compatible. OVER SCAN (IN): When connected to the computer other than above and the picture displayed is too small.

END

3.1.6 Workstation Keyboard Controls

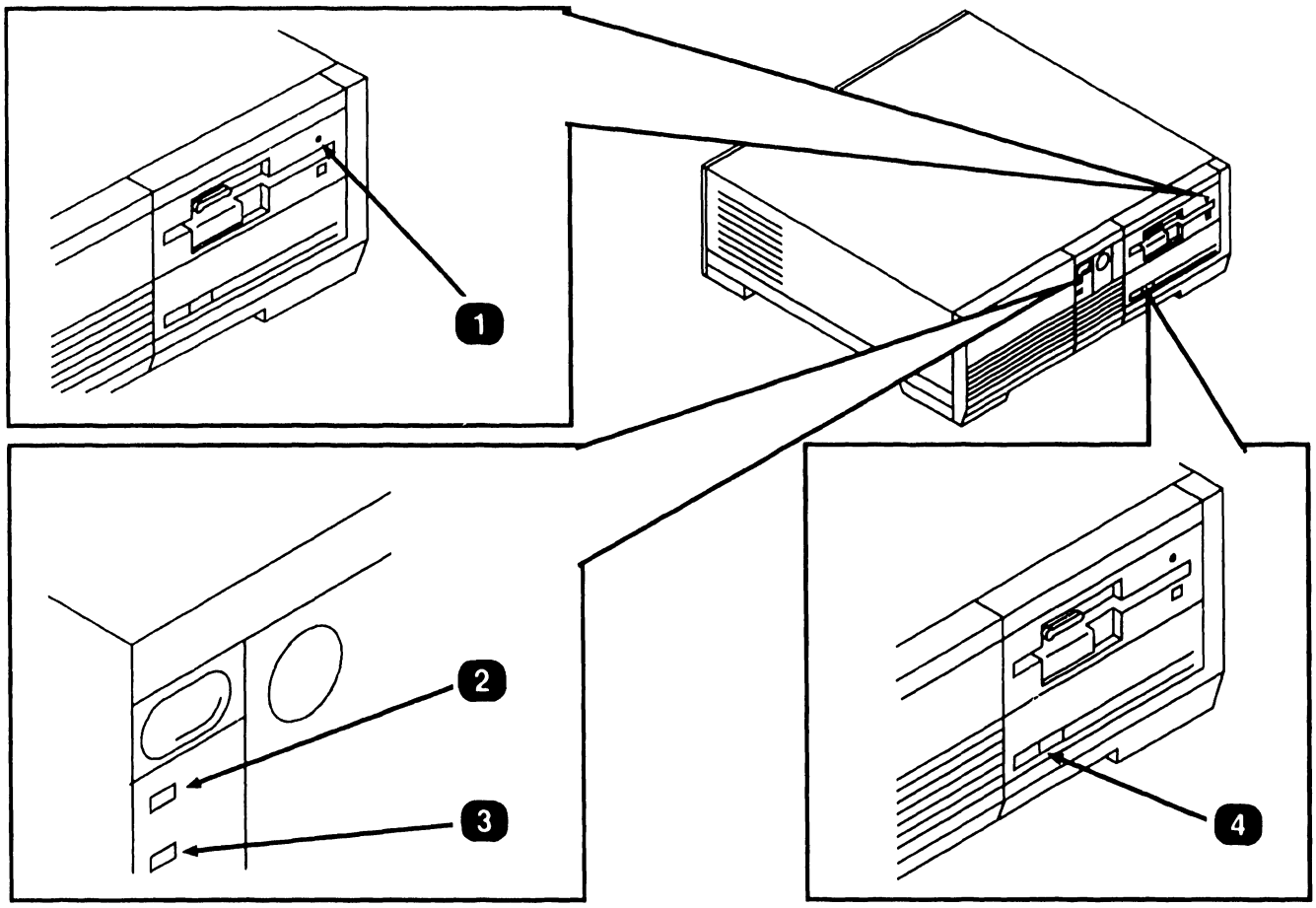


Item	*Name*	*Type and Function*
1	Keyboard Tilt Controls	Potentiometer-type controls; adjusts keyboard tilt and height.
2	Keyboard Clicker Control	Potentiometer-type control; adjusts volume of keystroke clicking when keys are pressed.

● END

3.2 CONTROLS AND INDICATORS
Operator Indicators

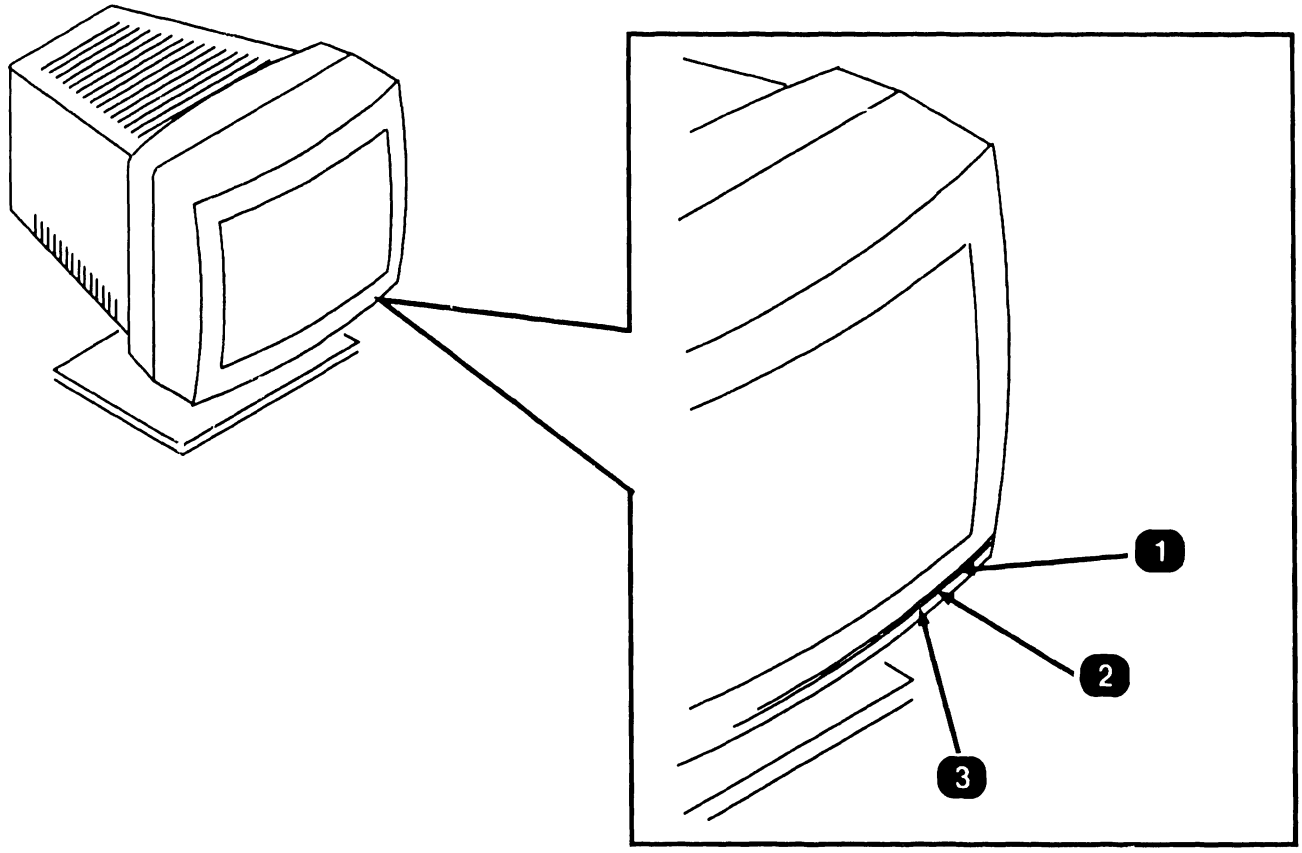
3.2.1 Electronics Enclosure Front Panel Indicators



Item	*Name*	*Type and Function*
1	Floppy Diskette Drive Activity LED	LED (amber); illuminates to indicate activity on floppy diskette drive.
2	System Power LED	LED (green); illuminates when power is applied to system.
3	Hard (Winchester) Disk Drive Activity LED	LED (red); illuminates to indicate activity on Winchester drive.
4	Hard Disk Drive SELECT LED	LED (red); illuminates when power is applied to the Winchester drive.

● END

3.2.2 Color Monitor Indicators: Front

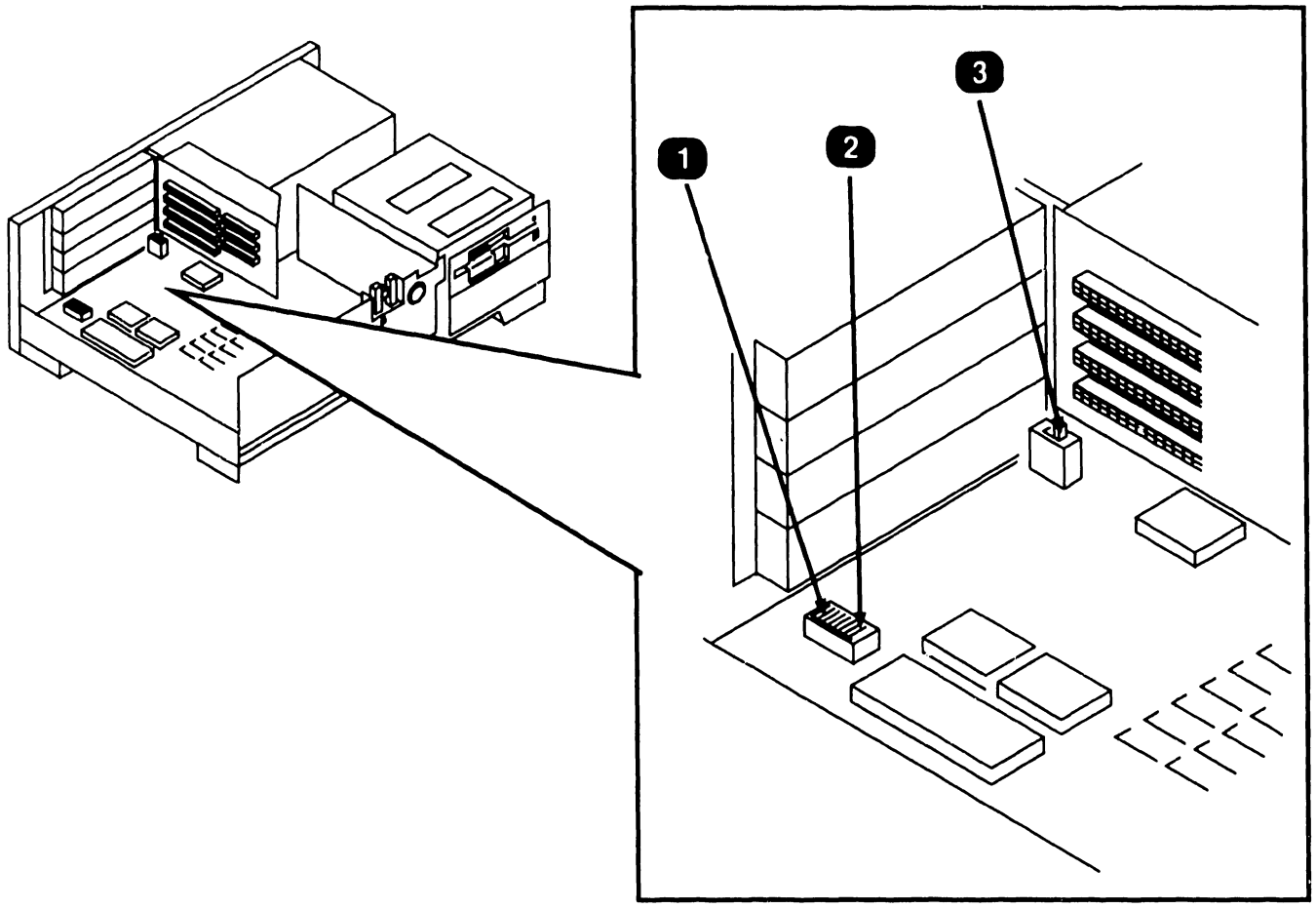


Item	*Name*	*Type and Function*
1	Power LED	LED (amber); illuminates to indicate power is applied to monitor.
2	Analog LED	LED (amber); illuminates to indicated monitor is set for analog compatability.
3	TTL LED	LED (red); illuminates to indicated monitor is set for TTL compatability.

● END

3 CONTROLS AND INDICATORS
3.3 Service Controls

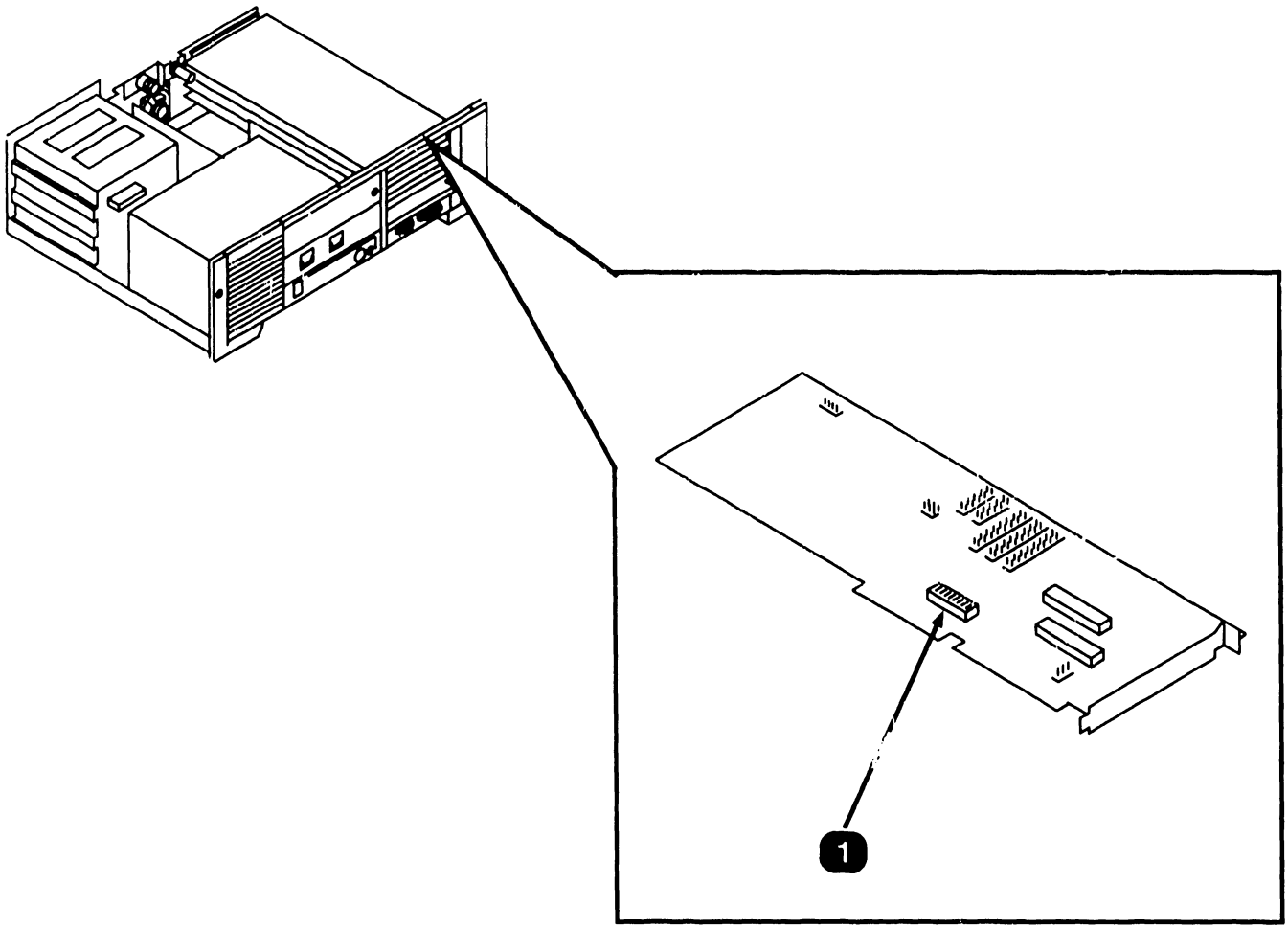
3.3.1 Electronics Enclosure: CPU Board Controls



Item	*Name*	*Type and Function*
1	Serial Port Switch (J12)	Rocker-type, 4-bit switch bank; used to designate/disable serial port.
2	Parallel Port Switch (J13)	Rocker-type, 4-bit switch bank; used to designate/disable parallel port.
3	Monitor Adapter Switch	Two-position slide switch; specifies monochrome or color monitor operation. (Not used when monochrome/color video board configured with system.)

● END

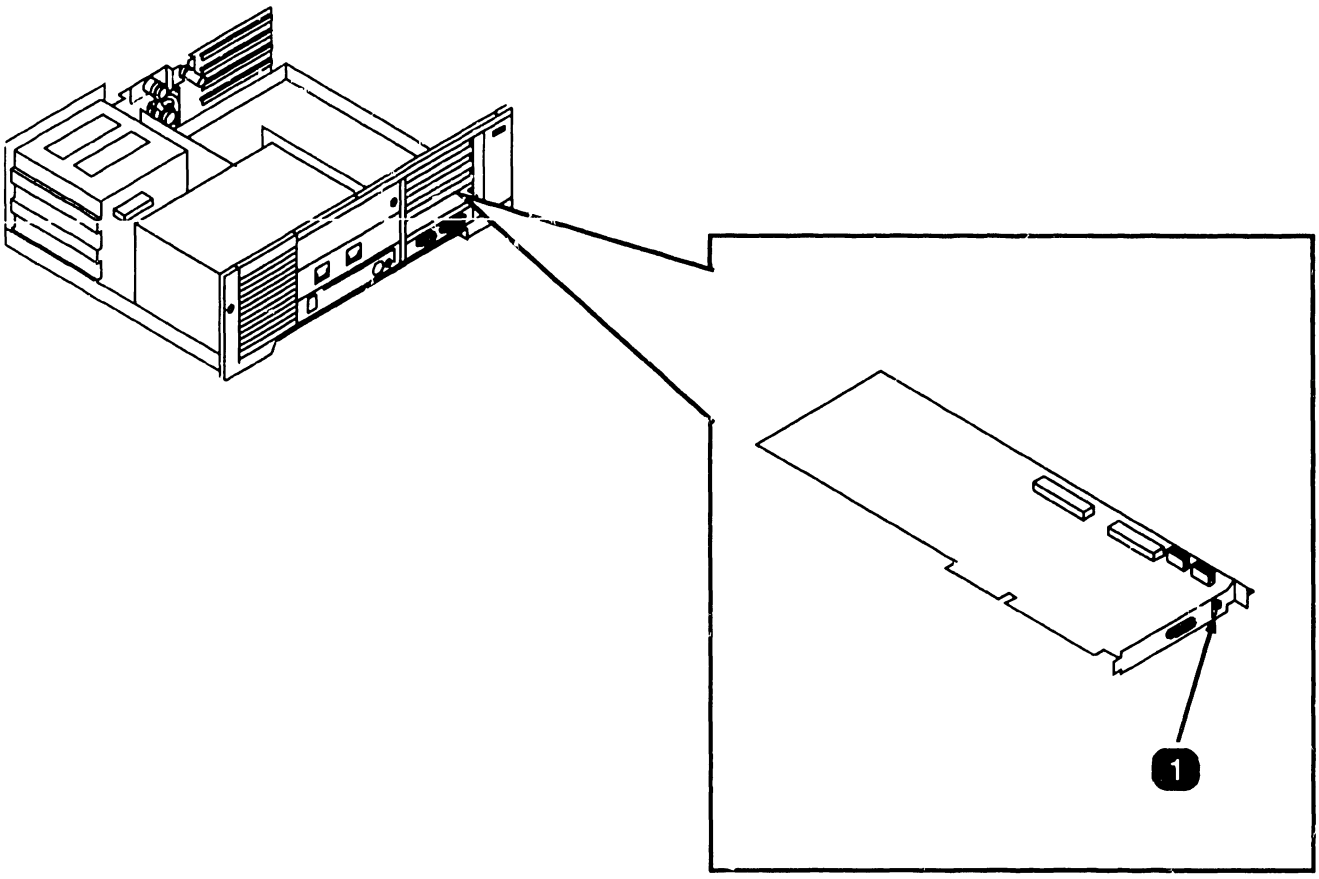
3.3.2 Electronics Enclosure: Winchester/ Floppy Controller Board Controls



Item	*Name*	*Type and Function*
1	Drive Control Switch (SW1)	8-bit, rocker-type switch bank; allows the Winchester/Floppy Controller and the Floppy-Only Controller to coexist with each other. The switch may be set so board controls Winchester and Floppy drives or just the Winchester drive.

● END

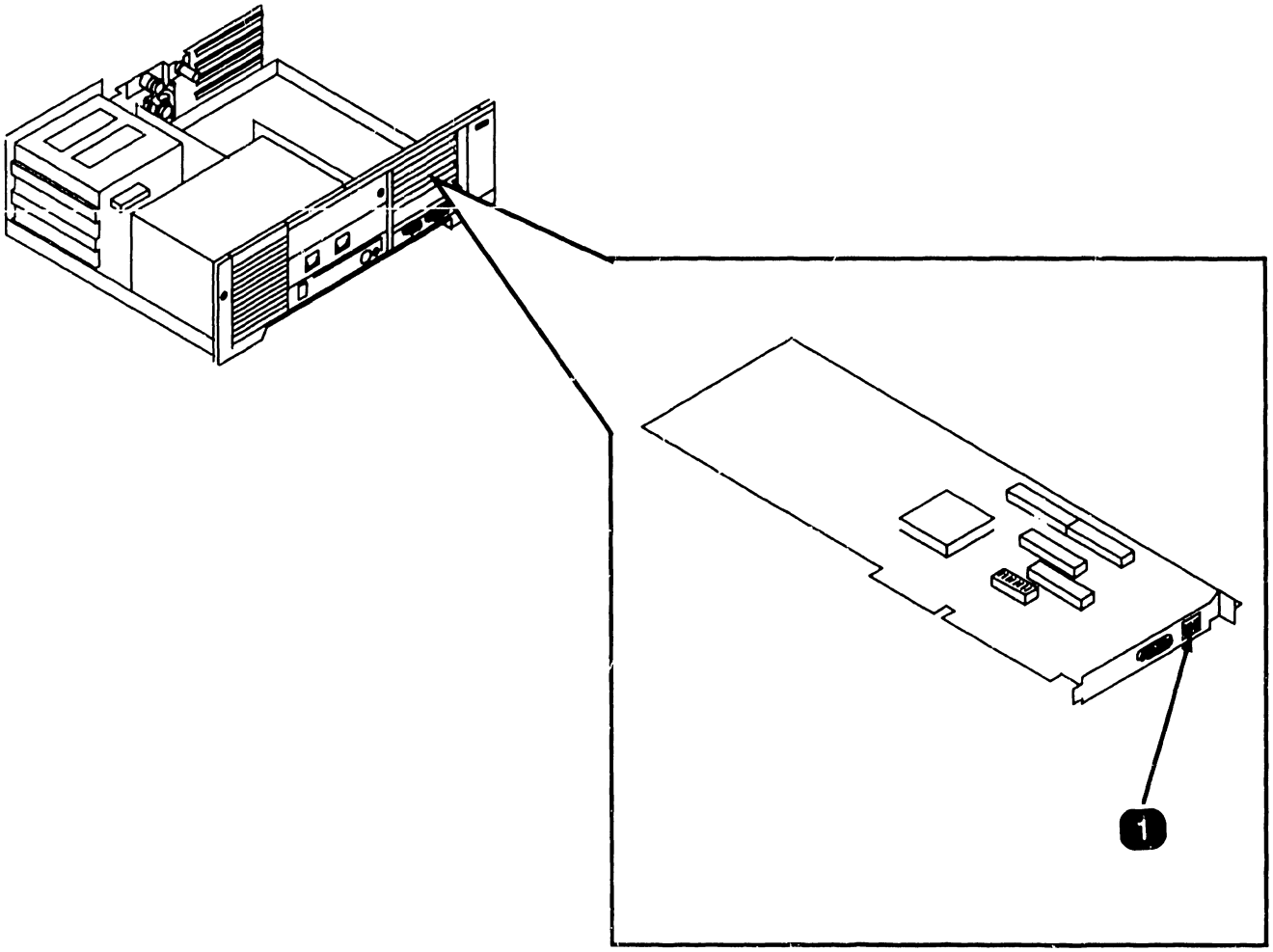
3.3.3 Electronics Enclosure: Monochrome Video Board Controls



Item	*Name*	*Type and Function*
1	(SW1)	2-position slide switch; designates type of workstation monitor used. Switch in UP position for 16.0 MHz monitor. Switch in the DOWN position for 19.2 MHz monitor.

● END

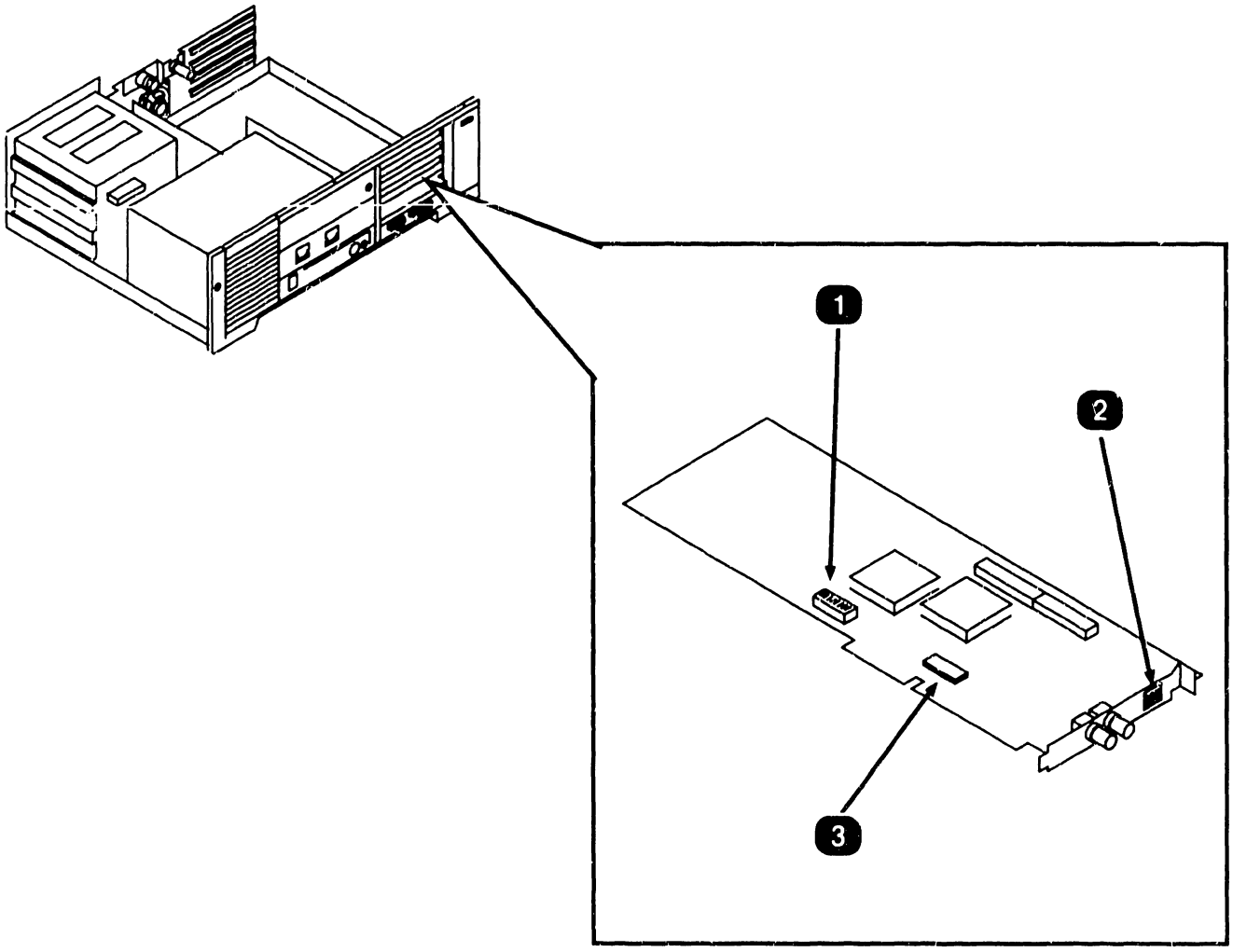
3.3.4 Electronics Enclosure: EGA/Monochrome/ Color Video Board Controls



Item	*Name*	*Type and Function*
1	Monitor Identification Switch	6-bit, rocker-type switch bank; designates type of workstation monitor used (monochrome, standard color, enhanced color).

● END

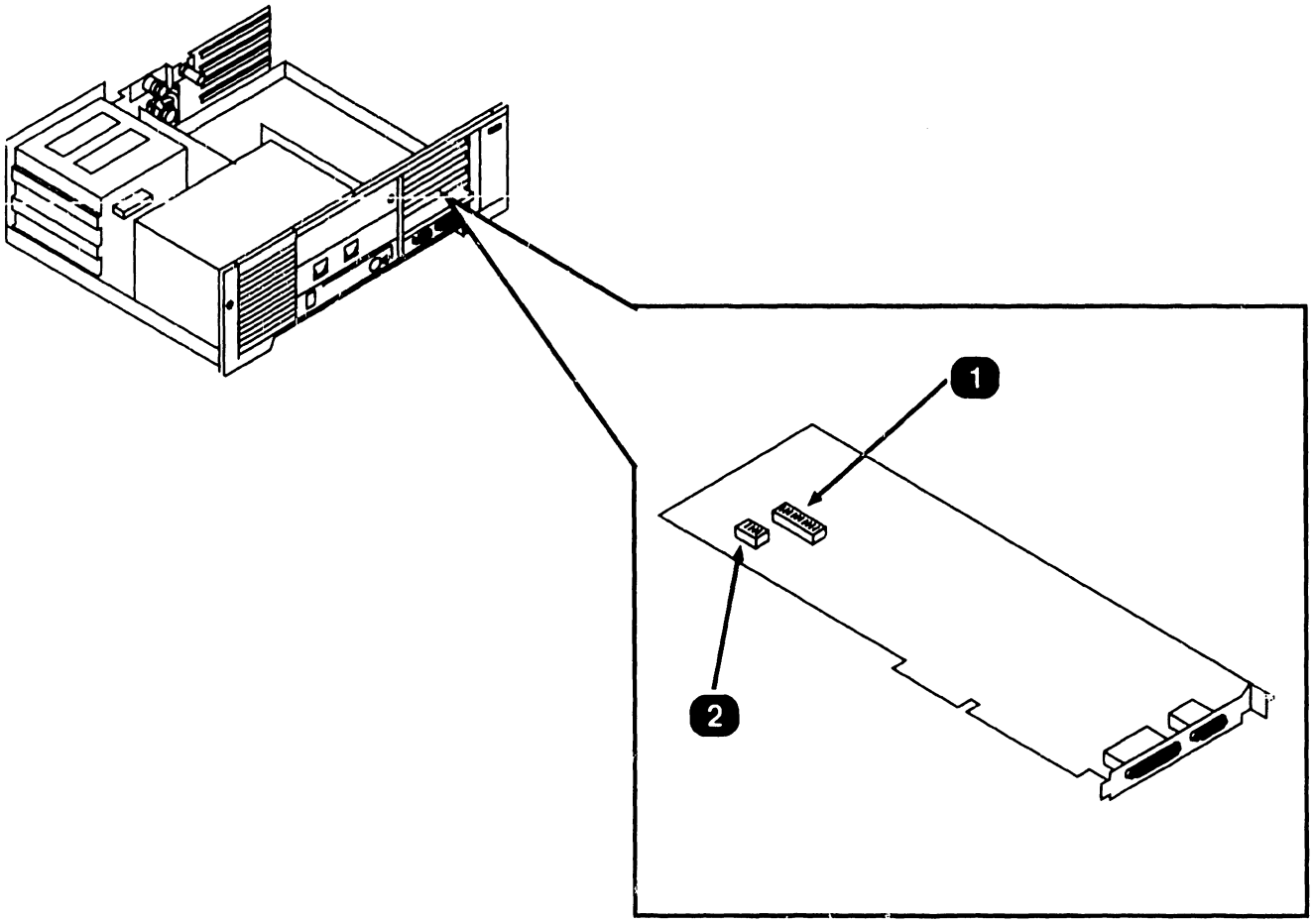
3.3.5 Electronics Enclosure: Wang Local Office Connection (WLOC) Board Controls



Item	*Name*	*Type and Function*
1	PCB Address Switch (SW1)	10-bit, rocker-type switch; sets board address.
2	PROM Enable Switch (SW2)	5-bit, rocker-type switch; enables/disables PROM and sets PROM address.
3	Interrupt Jumper	11-position jumper; sets interrupt level.

● END

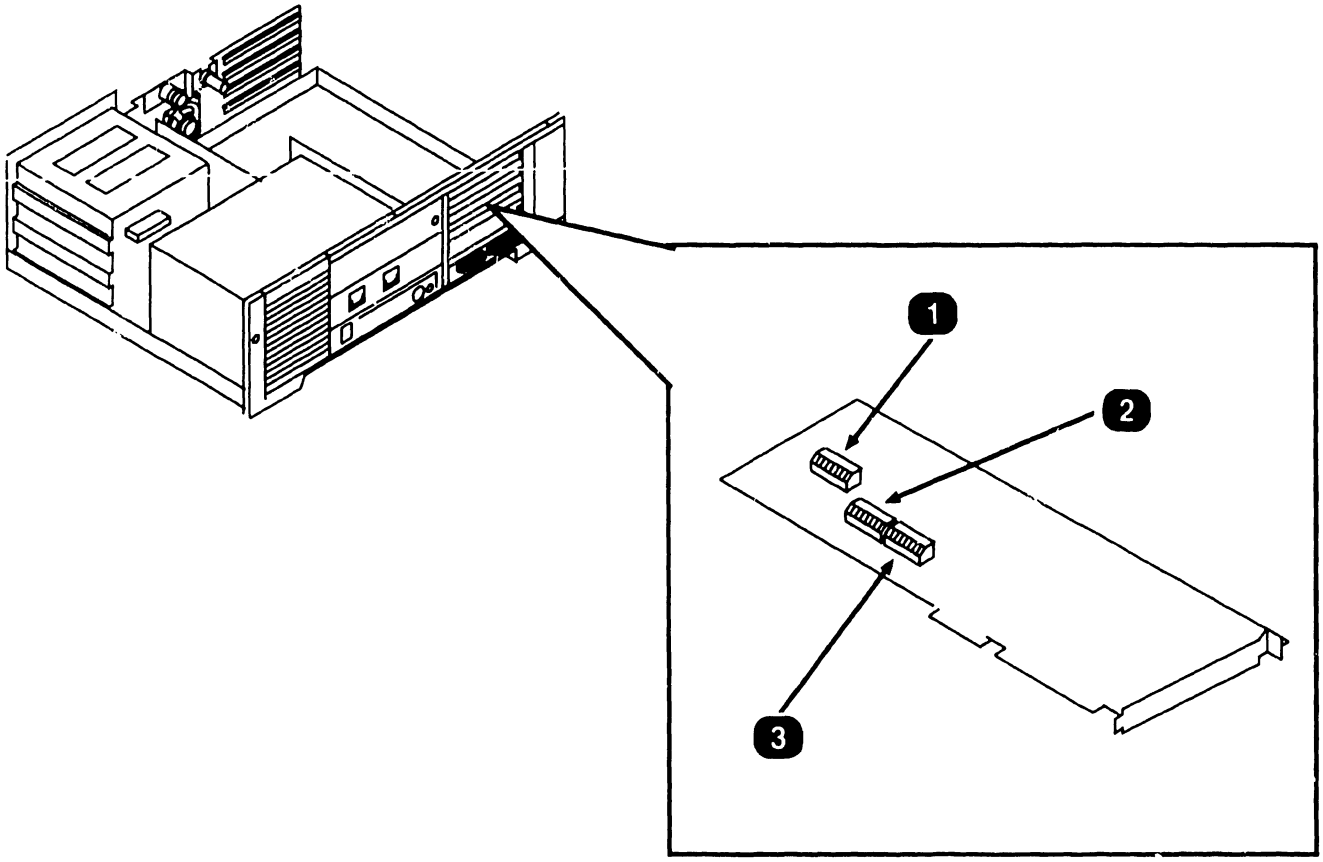
3.3.6 Electronics Enclosure: Synchronous/Asynchronous Board Controls



Item	*Name*	*Type and Function*
1	Serial Port Address Switch (SW1)	10-bit, rocker-type switch; sets synchronous/asynchronous serial port bus I/O address.
2	Asynchronous Serial Port and Interrupt Level Switch (SW1A)	4-bit, rocker-type switch; sets bus I/O address and interrupt level for asynchronous serial port.

● END

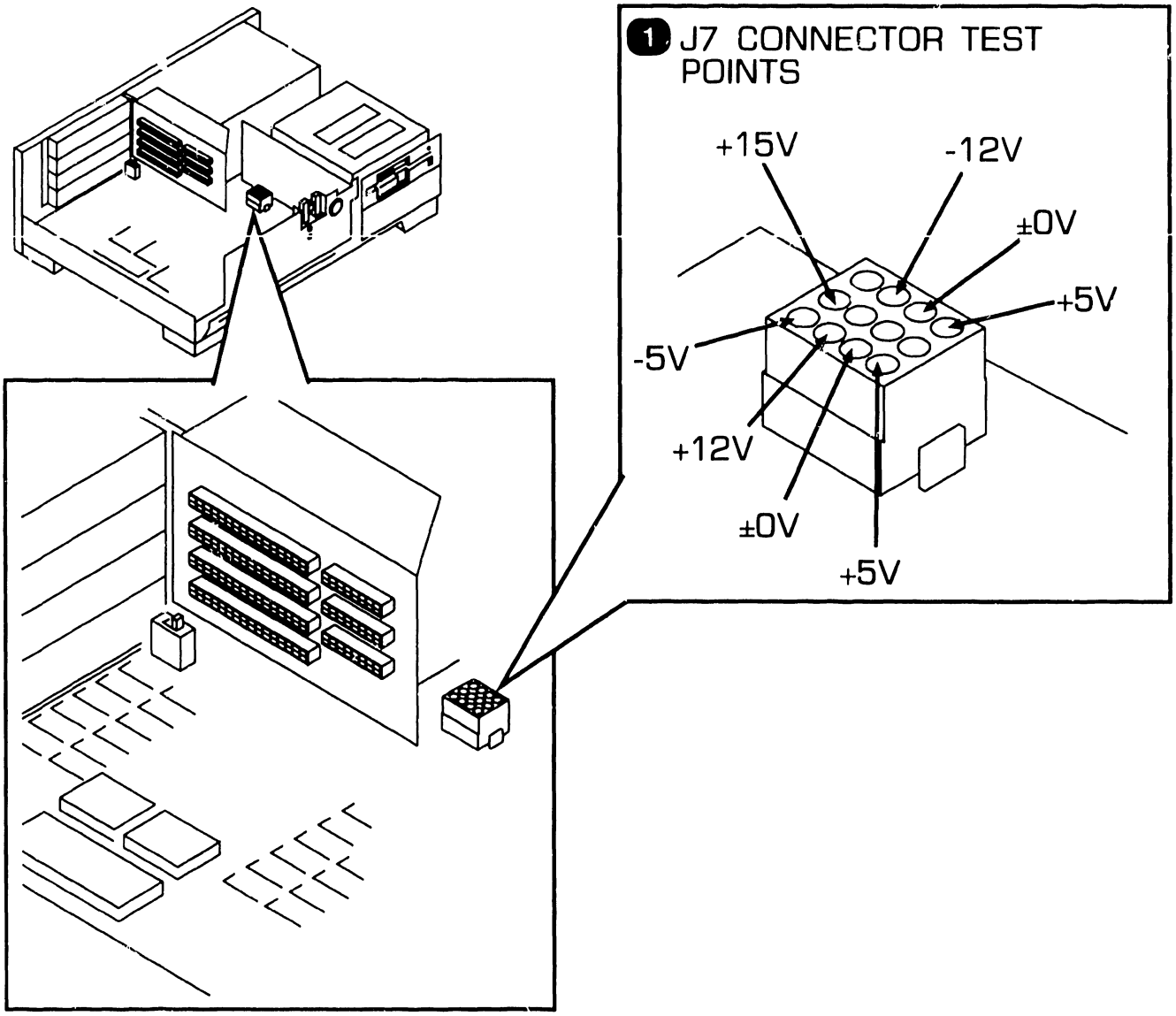
3.3.7 Electronics Enclosure: Expanded Memory Board Controls



Item	*Name*	*Type and Function*
1	Hex. Address Switch (SW1)	10-bit, rocker-type switch; sets board hexidecimal address.
2	Existing Memory Switch (SW2)	8-bit, rocker-type switch; set to correspond to amount of memory present in system prior to installing expanded memory board.
3	Memory Allocation Switch (SW3)	8-bit, rocker-type switch; used to allocate expanded memory as non-paged and paged memory.

● END

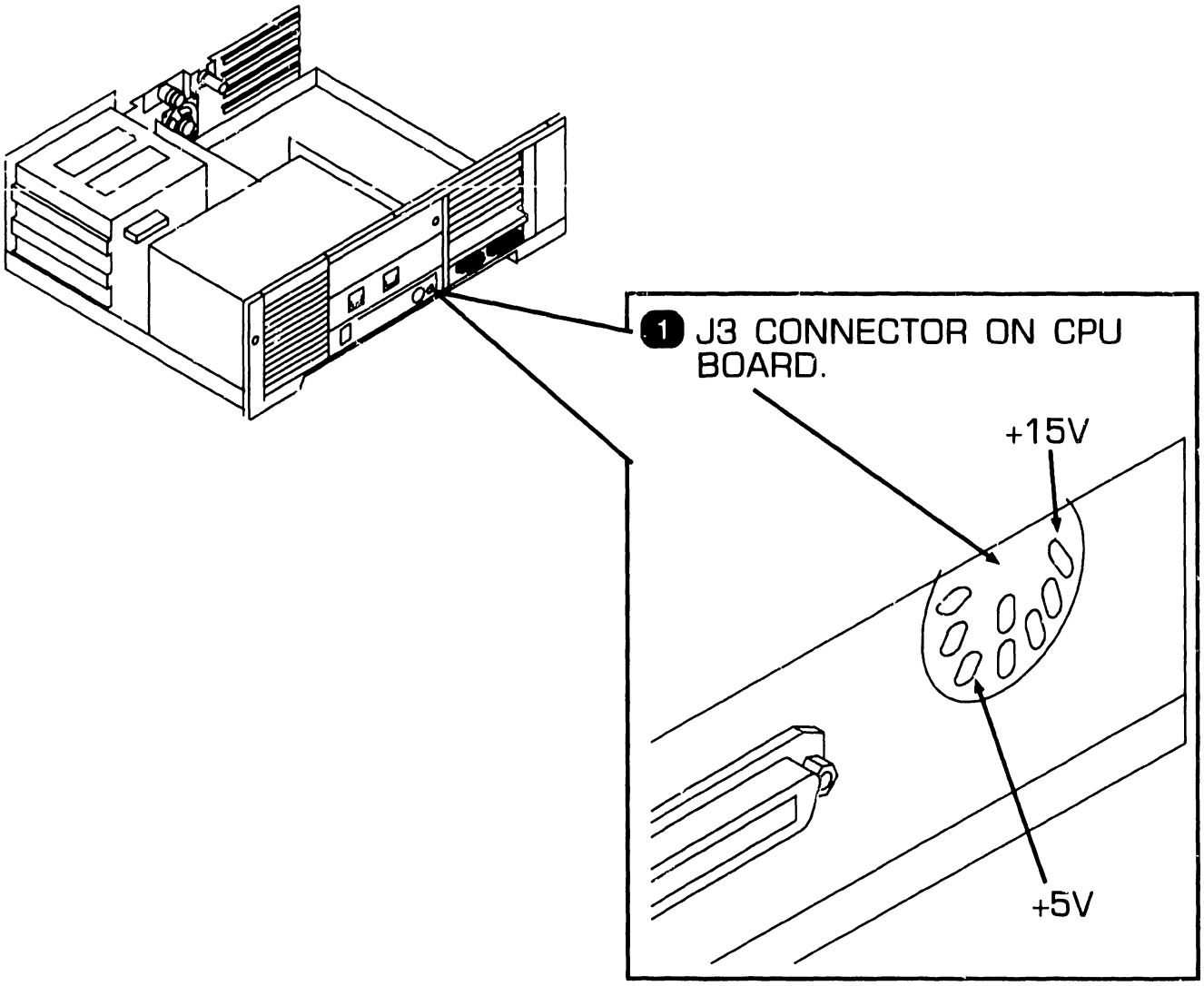
3.4.1 CPU Board: Power Supply DC Voltage Test Points



Item	*Name*	*Type and Function*
1	Power Supply DC Voltage Test Points (J7)	Connector on CPU board; voltage test points for checking power supply voltages.

● END

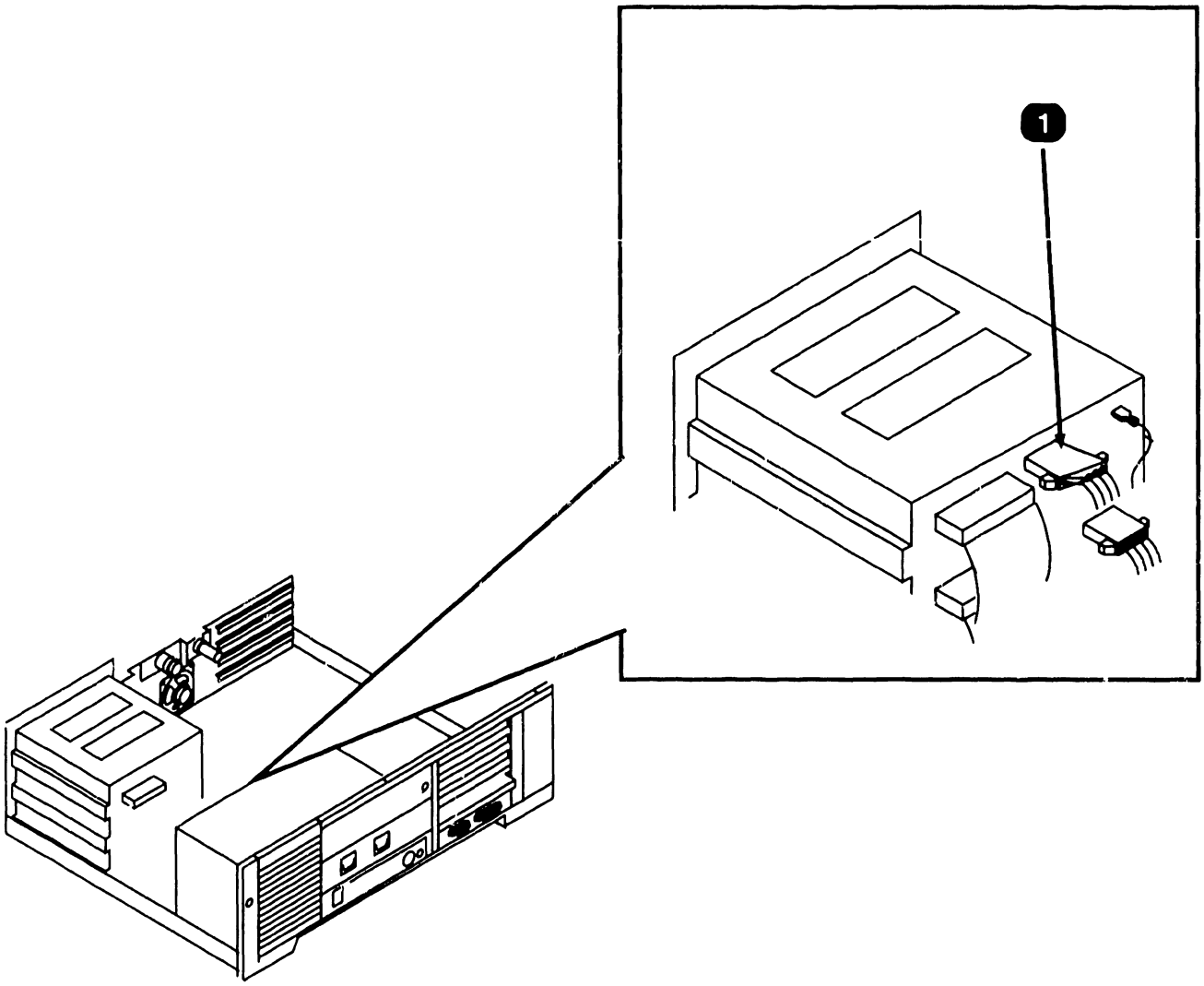
3.4.2 CPU Board: Monitor and Keyboard Voltage Test Points



Item	*Name*	*Type and Function*
1	Monitor and Keyboard Voltage Test Points (J3)	Connector on CPU board; voltage test points for checking keyboard voltage (+5V) and monitor voltage (+15V).

● END

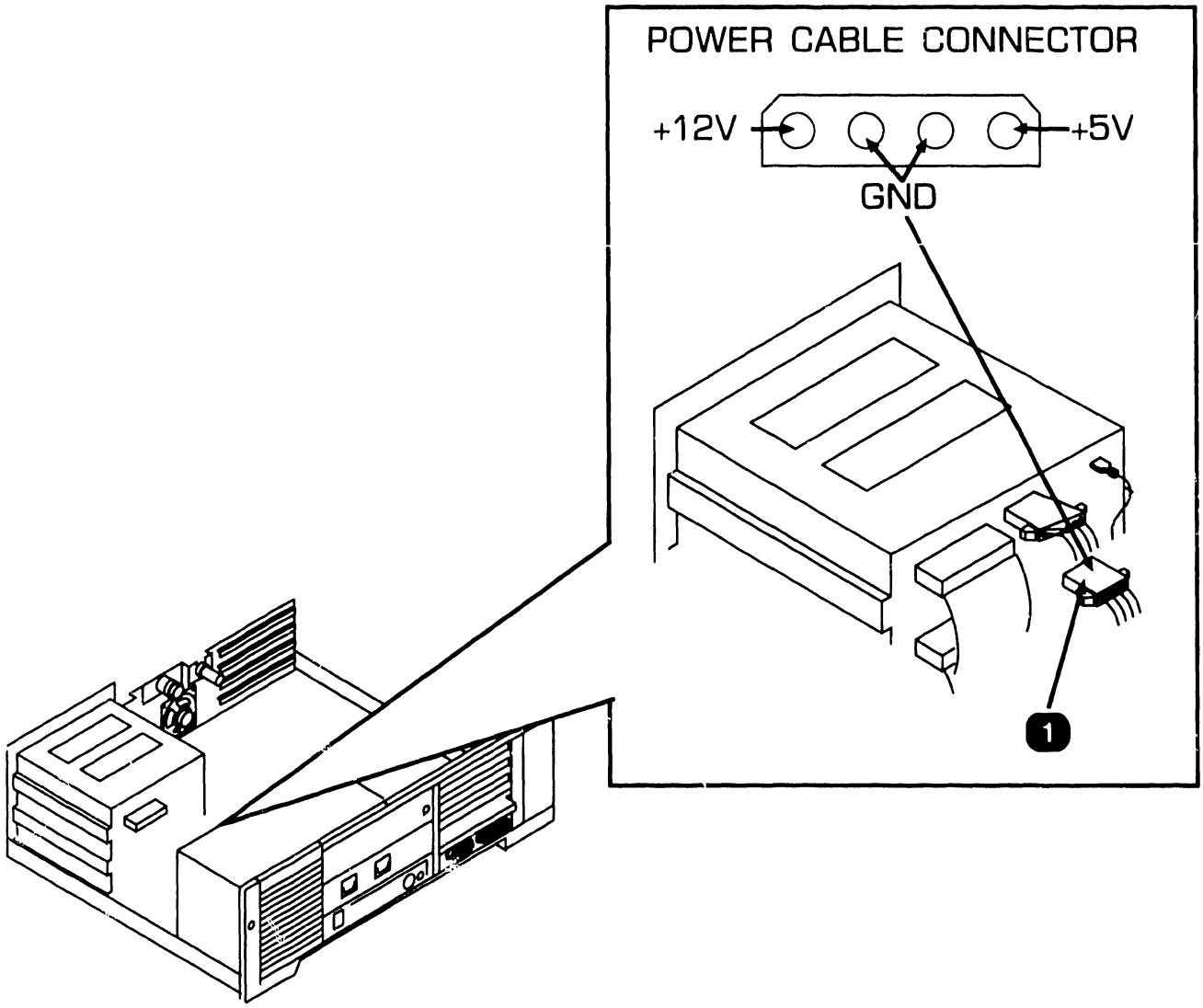
3.4.3 Floppy Drive Voltage Test Points



Item	*Name*	*Type and Function*
1	Floppy Drive Voltage Test Points	Power cable connector on floppy drive; voltage test points for checking floppy drive voltages (+5V, +12V).

● END

3.4.4 Optional Drive Voltage Test Points



Item	*Name*	*Type and Function*
1	Optional Drive Voltage Test Points	Power cable connector; voltage test points for checking optional drive voltages (+5V, +12V).

● END

SECTION 4

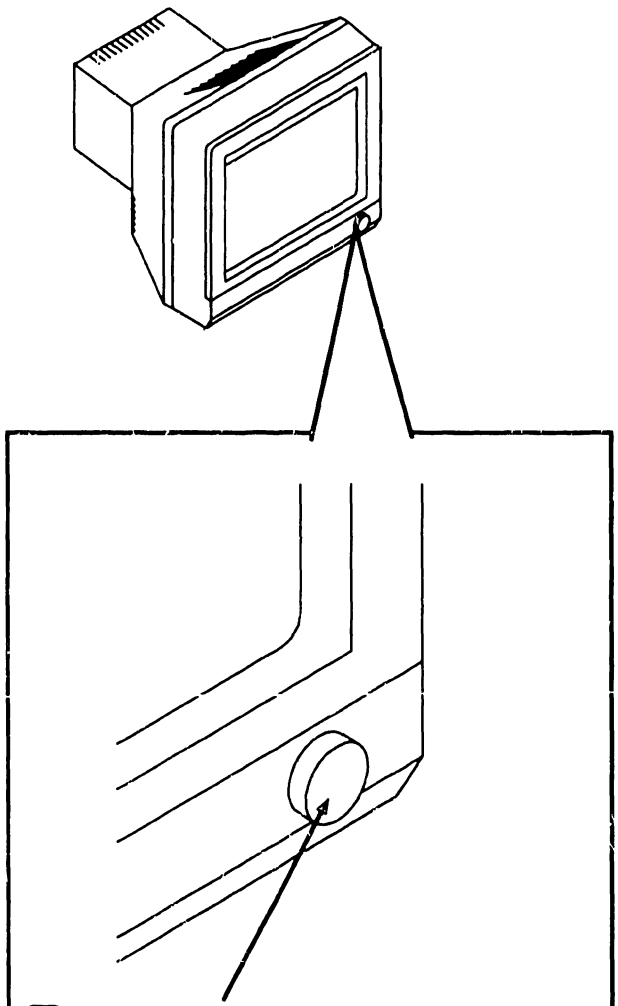
OPERATION

SECTION 4 CONTENTS

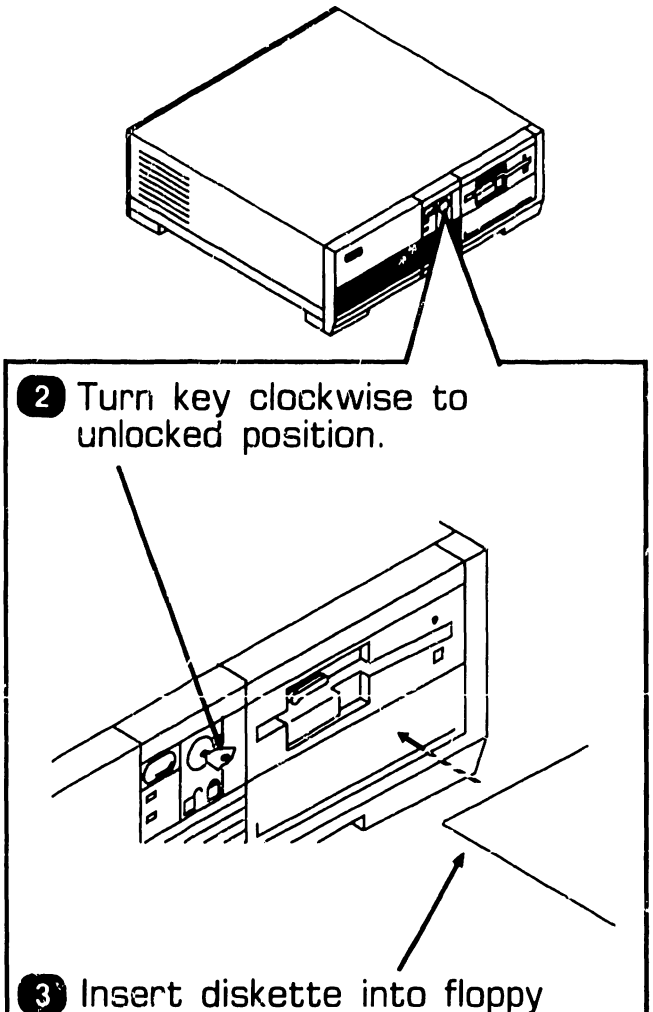
SECTION 4

OPERATION

4.1 Power-Up and B.I.T. Diagnostic Procedure (Sheet 1 of 2)



1. Set power and monitor brightness control to "out" (green ring around power and brightness control shows.)

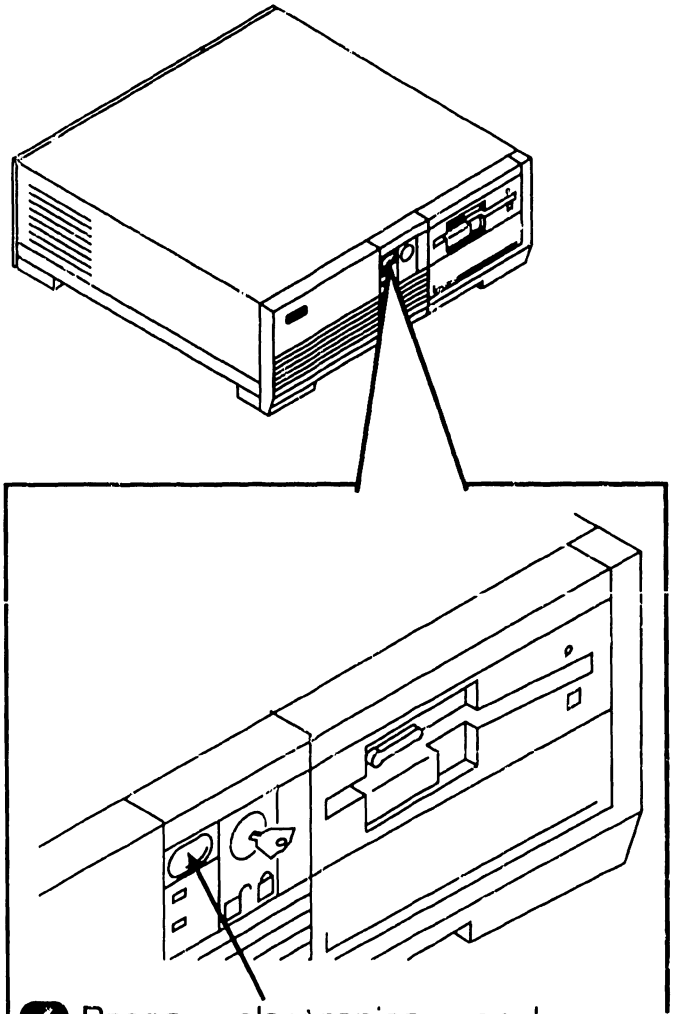


2. Turn key clockwise to unlocked position.

3. Insert diskette into floppy drive "A" if starting from floppy drive; leave floppy door open if starting system from Winchester drive.

➡NEXT

4.1 Power-Up and B.I.T Diagnostic Procedure (Sheet 2 of 2)



4 Press electronics enclosure power-on/off button; green power-on LED illuminates next to power-on/off button and workstation automatically cycles through diagnostic built-in tests. (To bypass memory diagnostics, press keyboard space bar).

5 Enter date and time.

6 Power-on peripherals.

NOTE

Upon successful B.I.T. completion, system generates one beep and start-up screen appears on monitor, followed by date and time display. If an error occurs during power-up, a message shows on monitor screen and/or speaker emits a beep code. (➡Section 6).

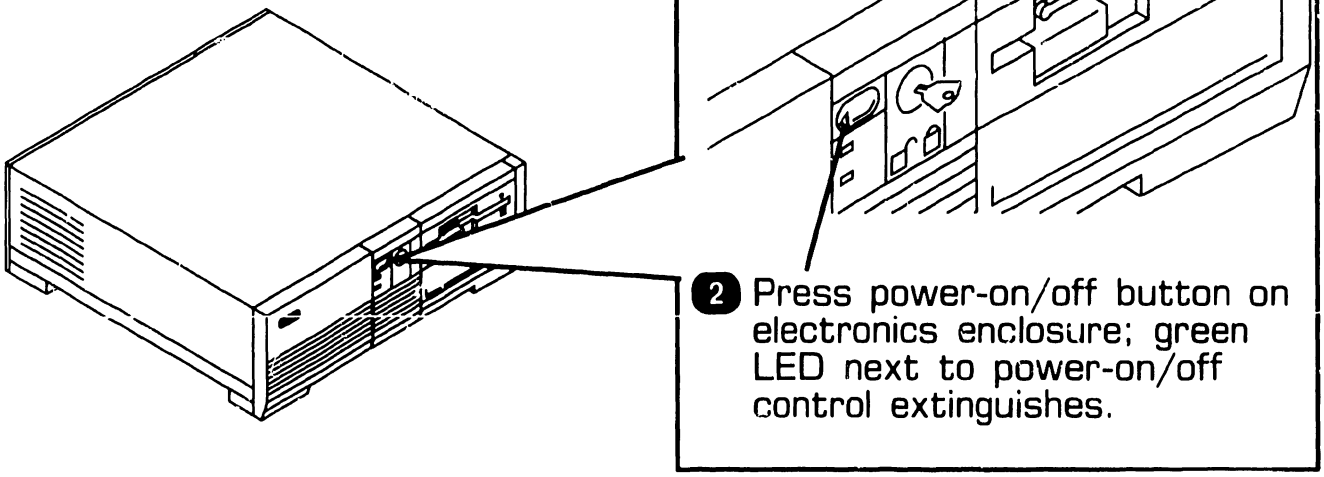
● END

4.2 Power-Down Procedure

CAUTION

To ensure integrity, exit from program; i.e., cancel back to main menu before executing power-down procedure.

1. Power-off peripherals.



2. Press power-on/off button on electronics enclosure; green LED next to power-on/off control extinguishes.

● END

SECTION 5

PREVENTIVE MAINTENANCE

SECTION 5 CONTENTS

SECTION 5

PREVENTIVE MAINTENANCE

5 PREVENTIVE MAINTENANCE

5.1 PM Schedule

Replace the lithium battery every two years (➡7.2.7).

● END

SECTION 6

TROUBLESHOOTING

SECTION 6 CONTENTS

SECTION 6

TROUBLESHOOTING

TROUBLESHOOTING

6.1 Tools and Equipment

Equipment and tools required to troubleshoot the PC 240 computer include: a standard CE tool kit, a DVM, and diagnostic test routines. The diagnostic routines are contained on diskettes and should be used when troubleshooting at the customer's site as an aid in isolating system problems.

● END

6.2 Power-Up Diagnostic (Built-In Test)

6.2.1 Built-In Test (B.I.T.) Description

The built-in test (B.I.T.) checks basic system hardware and provides fatal and non-fatal error indications that allow isolation of subassembly failures. The B.I.T. executes automatically when the PC 240 is powered-on. Invalid configuration data or hardware malfunctions are displayed on the monitor screen (➡6.2.2) or as audible codes generated by the system speaker (➡6.2.3).

● END

6.2 Power-Up Diagnostic (Built-In Test)

6.2.2 B.I.T. Error Messages (Sheet 1 of 2)

B.I.T. Error Message	*Suspected Failure*
Diskette drive 0 seek to track 0 failed	Floppy drive
Diskette drive reset failed	Floppy drive
Diskette read failure -- strike F1 to retry boot	Floppy drive, drive cable
Display adapter failed; using alternate	Video board
Gate A20 failure	CPU board
Hard disk controller failure	Winchester/floppy controller board
Hard disk failure	Winchester drive cables, Winchester drive
Hard disk read failure -- strike F1 to retry boot	Winchester cables, Winchester drive
Invalid configuration information -- please run SETUP program	Lithium battery
Keyboard clock line failure	Keyboard
Keyboard controller failure	CPU board
Keyboard data line failure	Keyboard
Keyboard stuck key failure	Keyboard
Memory address line failure at XXXXX, read XXXXX expecting XXXXX	CPU board, expanded memory board
Memory data line failure at XXXXX, read XXXXX expecting XXXXX	CPU board, expanded memory board
Memory high address line failure at XXXXX	CPU board, expanded memory board

➡NEXT

6.2 Power-Up Diagnostic (Built-In Test)

6.2.2 B.I.T. Error Messages (Sheet 2 of 2)

B.I.T. Error Message	*Suspected Failure*
Memory odd/even logic failure at XXXXX, read XXXXX expecting XXXXX	CPU board, expanded memory board
Memory parity failure at XXXXX	CPU board, expanded memory board
Memory write/read failure at XXXXX, read XXXXX expecting XXXXX	CPU board, expanded memory board
No boot device available -- strike F1 to retry boot	Winchester/floppy drive cables
No boot sector on hard disk -- strike F1 to retry boot	Winchester drive (format), drive cables
No timer tick	CPU board
Not a boot diskette -- strike F1 to retry boot	Diskette
XXXXX optional ROM bad checksum = XXXXX	BIOS PROM on CPU board
Shutdown failure	CPU board
Time-of-day clock stopped	CPU board
Timer chip counter 2 failed	CPU board
Timer of interrupt controller bad	CPU board
Unexpected interrupt in protected mode	CPU board

● END

6.2 Power-Up Diagnostic (Built-In Test)

6.2.3 B.I.T. Error Beep Codes (Sheet 1 of 2)

B.I.T. Error Beep Code Sequence	*Suspected Failure*
1-1-3	CPU board
1-1-4	BIOS PROM on CPU board
1-2-1	CPU board
1-2-2	CPU board
1-2-3	CPU board
1-3-1	CPU board
1-3-3	CPU board
1-3-4	CPU board
1-4-1	CPU board
1-4-2	CPU board
2-1-1	CPU board
2-1-2	CPU board
2-1-3	CPU board
2-1-4	CPU board
2-2-1	CPU board
2-2-2	CPU board
2-2-3	CPU board
2-2-4	CPU board
2-3-1	CPU board
2-3-2	CPU board

➡NEXT

6.2 Power-Up Diagnostic (Built-In Test)

6.2.3 B.I.T. Error Beep Codes (Sheet 2 of 2)

B.I.T. Error Beep Code Sequence	*Suspected Failure*
2-3-3	CPU board
2-4-1	CPU board
2-4-2	CPU board
2-4-3	CPU board
2-4-4	CPU board
3-1-1	CPU board
3-1-2	CPU board
3-1-3	CPU board
3-1-4	CPU board
3-2-4	CPU board
3-3-4	Video board
3-4-1	Video board
3-4-2	Video board
4-2-1	CPU board
4-2-2	CPU board
4-2-3	CPU board
4-2-4	CPU board
4-3-1	Expanded memory board
4-3-3	CPU board
4-3-4	CPU board

● END

6.3 Diagnostic Utility

6.3.1 Diagnostic Utility Description

The diagnostic utility is a diskette-based troubleshooting aid designed to run with minimal user intervention.

The non-bootable 360 KB diskette contains files for one specific option only and can be made bootable when system files are copied onto it using the SYS command.

● END

6.3 Diagnostic Utility

6.3.2 Running System Diagnostic Utility

NOTE

Single options ship with a 360KB diskette that contains diagnostics for that option only. The diagnostic can be loaded into the 1.2MB diskette.

1. Copy system files onto diagnostic utility diskette using SYS command.
2. Load diagnostic utility into diskette drive "A" and boot system from diagnostic diskette (➡4.1).
3. Press keyboard "y" key after disclaimer screen appears. Pressing "y" key causes test selection screen to appear.
4. Use keyboard INSERT and DELETE keys to deselect unwanted tests. (INSERT selects test; DELETE deselects test and Space Bar moves cursor.)
5. Press keyboard EXEC key. (While test executes, test status information shows on screen.)

NOTE

If an error is detected, a message specifying failed hardware appears on screen. To continue running diagnostic program, press EXEC key.

● END

6.4 Troubleshooting Strategy (Sheet 1 of 3)

Fault Condition	*Troubleshooting Action*
Fan does not run after system power-up and proper ac voltage not present at input to power supply.	• Check voltage at electrical outlet. • Source voltage O.K.: Check continuity of ac power cord; replace if bad • Source voltage incorrect: Try another outlet; if voltage still bad inform customer.
Fan does not run after system power-up and proper ac voltage is present at input to power supply.	• Unplug monitor cable from CPU board; if fan runs replace monitor. • If fan still does not run: Check for bad power button on electronics enclosure. • Replace power supply if power button operational.
B.I.T. fails after system powered-on and error message or beep code present.	• Refer to section 6.2.2 (error messages) or section 6.2.3 (error beep codes).
B.I.T. fails after system powered-on and no error messages or beep codes present.	• Check all cable connections. • Secure or replace cable(s).
B.I.T. fails after system powered-on, no error messages or beep codes present, but all cable connections O.K.	• Check voltages (➡9.5). • Voltages wrong: Replace power supply. • Voltages correct: Check hardware for visible physical damage (e.g., bent pins, broken components). Replace damaged hardware.
B.I.T. fails after system powered-on, no error messages or beep codes present, and no visible damage to hardware.	• Remove all non-Wang option boards; replace boards one-at-a-time until faulty board isolated.

➡NEXT

6.4 Troubleshooting Strategy (Sheet 2 of 3)

Fault Condition	*Troubleshooting Action*
B.I.T. fails after system powered-on, no error messages or beep codes present, no visible damage to hardware, and removal of all non-Wang boards fails to correct problem.	• Remove all Wang boards except CPU board. • Replace CPU board if system does not emit error beep codes. • If system emits beep codes after all Wang boards (except CPU board) have been removed, replace Wang boards one-at-a-time until faulty board isolated.
Diagnostic utility detects faulty FRU.	• Check configuration of FRU (➡9.3). • Replace FRU if configuration correct.
Problem with system, and diagnostic utility fails to detect faulty FRU.	• If diagnostic menu contains tests for all FRUs present, suspect software. • If menu does not contain required test(s): Are files for desired test(s) on utility? Yes -- check FRU I/O addresses; no -- replace diskette with diagnostic that contains necessary file(s).
System powered-on, B.I.T. completes successfully, but diagnostic menu does not appear on monitor.	• Remove all option boards except Winchester/floppy controller and video board. • If diagnostic menu appears, replace option boards one-at-a-time until faulty board isolated. • Check configuration of faulty board; replace if necessary.
System powered-on, B.I.T. completes successfully, but diagnostic menu still does not appear, even after all option boards (except Winchester/ floppy controller and video board) are removed.	• Replace diskette in drive "A" with system diskette 1. If MS-DOS loads properly, diagnostic diskette was faulty.

➡NEXT

6.4 Troubleshooting Strategy (Sheet 3 of 3)

Fault Condition	*Troubleshooting Action*
Diagnostic menu does not appear after power-up and MS-DOS does not load properly even after drive "A" diskette is replaced by system diskette 1.	If system contains Winchester drive: • Unplug drive "A" and boot from hard disk. • Replace diskette drive "A" if MS-DOS loads properly. • Replace Winchester/floppy controller if MS-DOS does not load. • Replace CPU board. If system not configured with Winchester drive: • Swap diskette drive "A" and "B" cables, insert system diskette 1 into drive "B" and boot system. • Replace diskette drive "A" if MS-DOS loads properly. • Replace Winchester/floppy controller if MS-DOS does not load properly. • Replace CPU board.

● END

SECTION 7
REPAIR

SECTION 7 CONTENTS

SECTION 7

REPAIR

7.1 Tools and Test Equipment

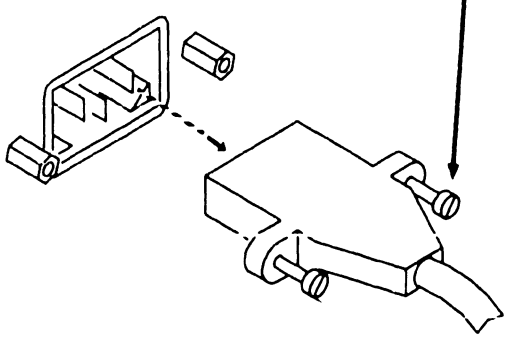
- Wang CE tool kit, P/N 726-9401
- Diagnostic disk, P/N 732-8098 (package number 195-5537-9)

● END

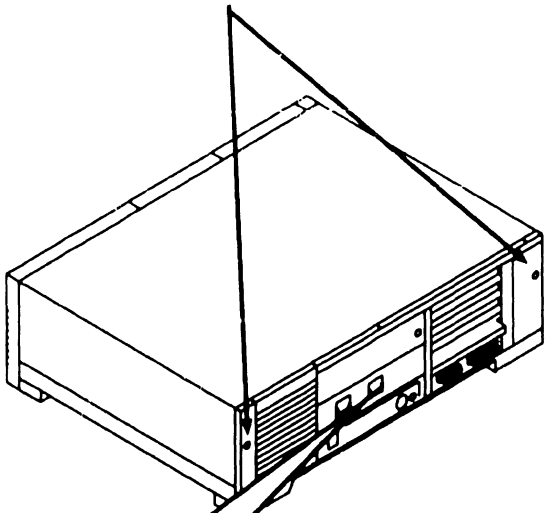
7.2 Removal Procedures

7.2.1 Unfastening Electronics Enclosure Top Cover Screws

1. Power down workstation. (➡4.2).
2. Unplug ac power cord from ac outlet.
3. Loosen captive screws that secure ac power cord to power connector. Remove power cord.



4. Loosen captive screws that secure top cover to electronics enclosure.

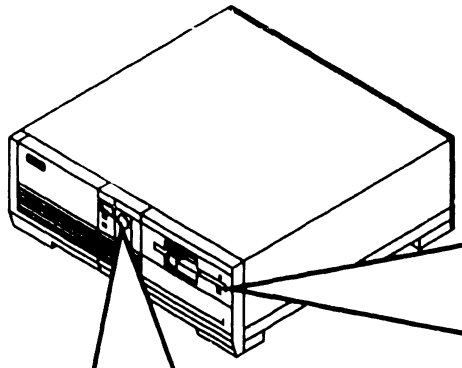


● END

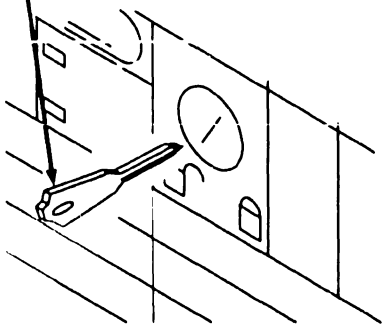
7.2 Removal Procedures

.2.2 Electronics Enclosure Top/Front Cover Removal

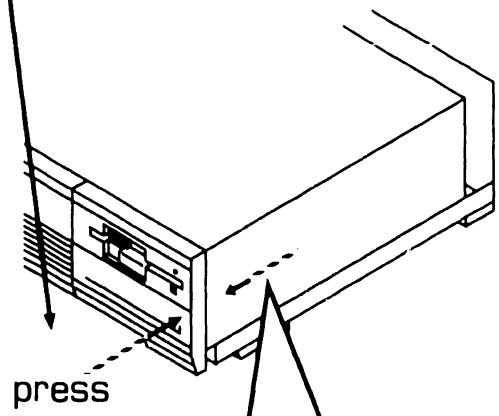
1. Power-down workstation (➡4.2)
2. Unscrew top cover screws (➡7.2.1).



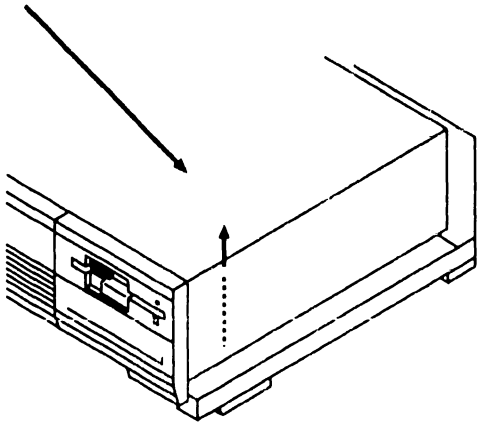
3. Unlock keylock; remove key. (unlocked position)



4. With thumb on bottom drive, push in while sliding cover approximately 2 inches toward front of electronics enclosure until the tabs of cover are clear of the slots on the base.



5. Gently lift cover to separate from electronics enclosure.



NOTE

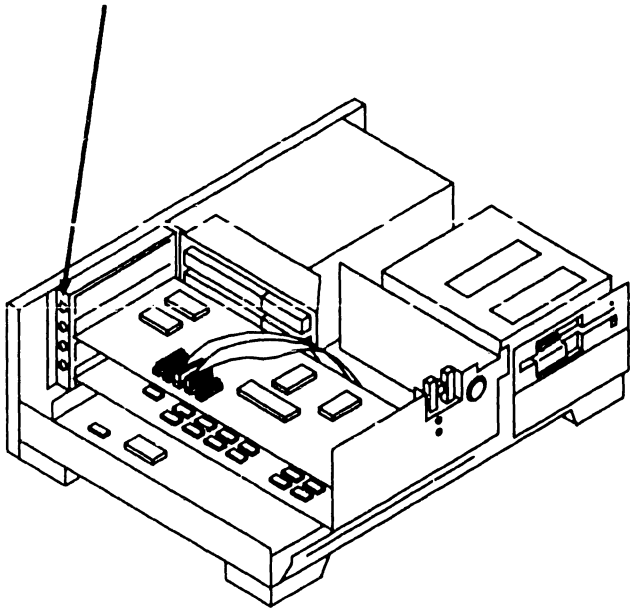
For key replacement contact:
C & K Components Inc.
Highway 70 East
P.O. Box 687
Clayton, N.C. 27520

● END

7.2 Removal Procedures

7.2.3 General Board Removal (Sheet 1 of 3)

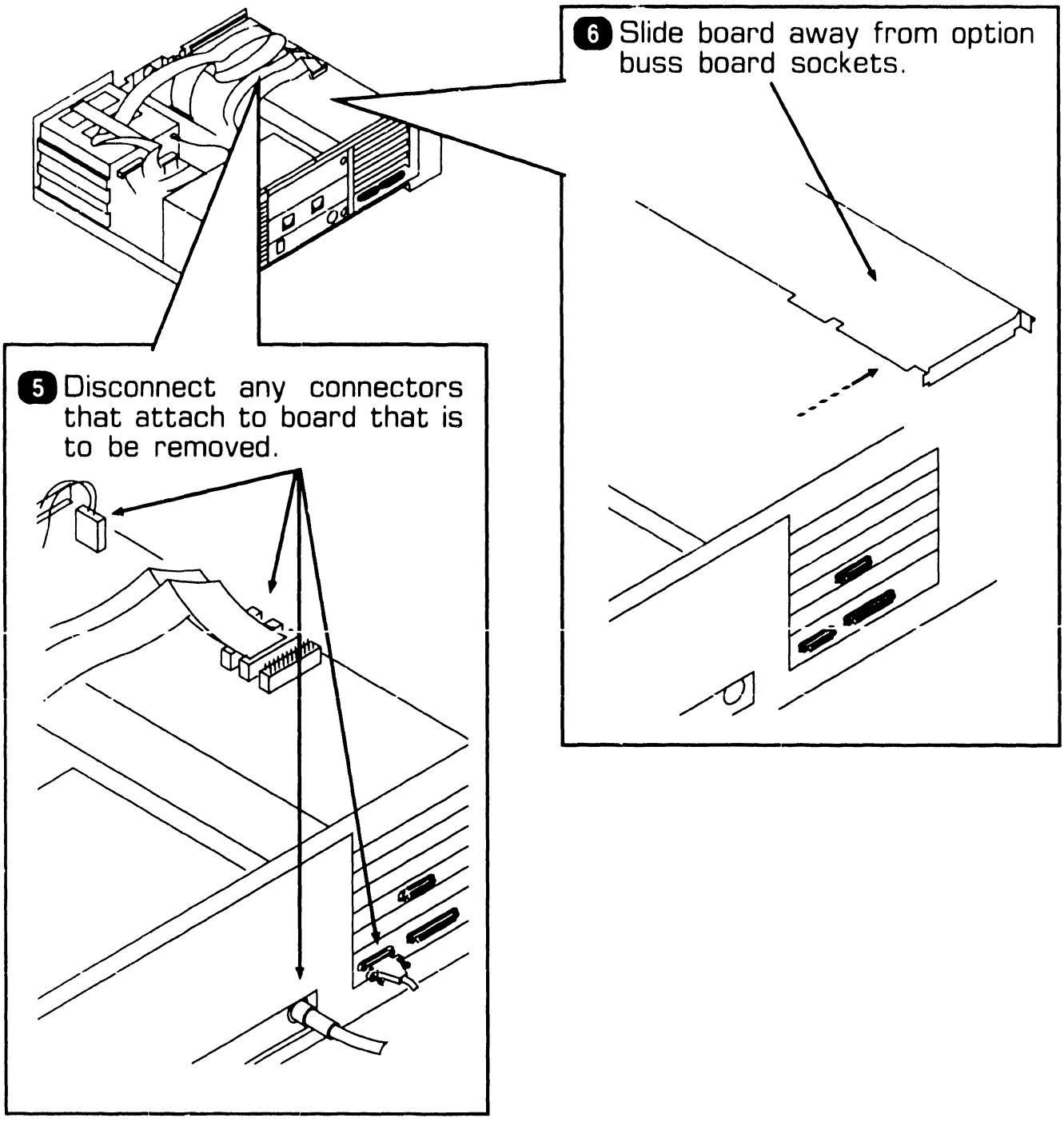
1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1).
3. Remove top/front cover (➡7.2.2).
4. Unscrew and remove Phillips-head screw that secures board to electronics enclosure.



➡NEXT

7.2 Removal Procedures

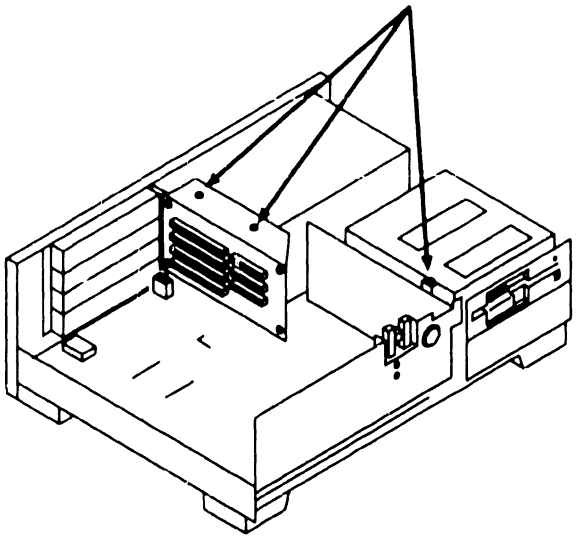
7.2.3 General Board Removal (Sheet 2 of 3)



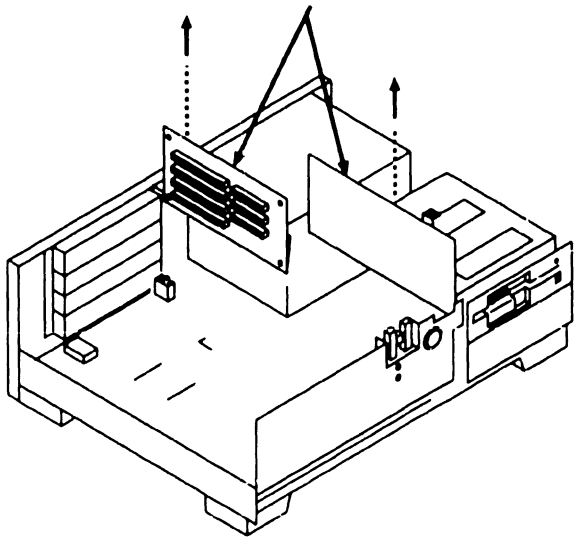
➡NEXT

7.2.3 General Board Removal (Sheet 3 of 3)

7 To remove option buss board and floppy-only controller board, unscrew Phillips-head screws securing boards to enclosure.



8 Lift option buss board and floppy-only controller board from CPU board sockets.

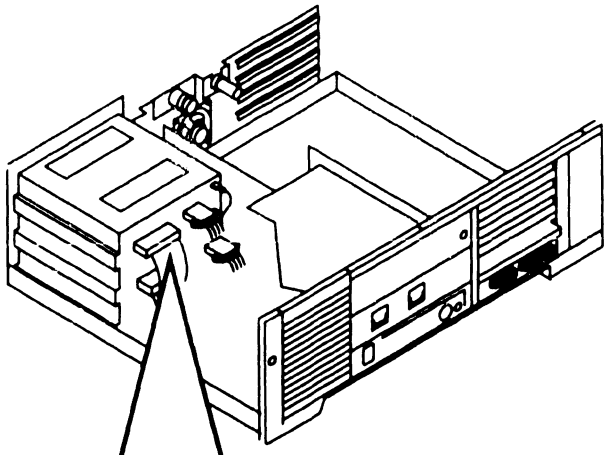


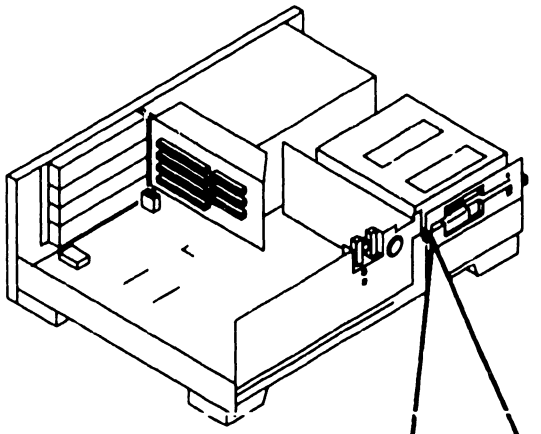
● END

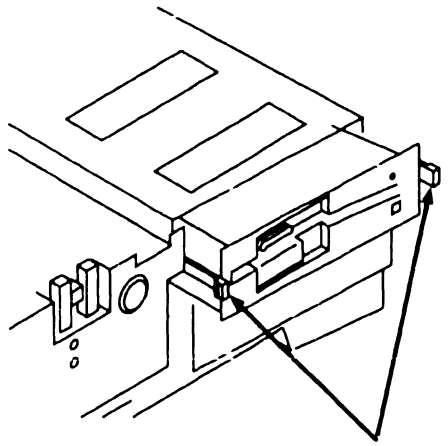
7.2 Removal Procedures

7.2.4 Drive Removal (Sheet 1 of 2)

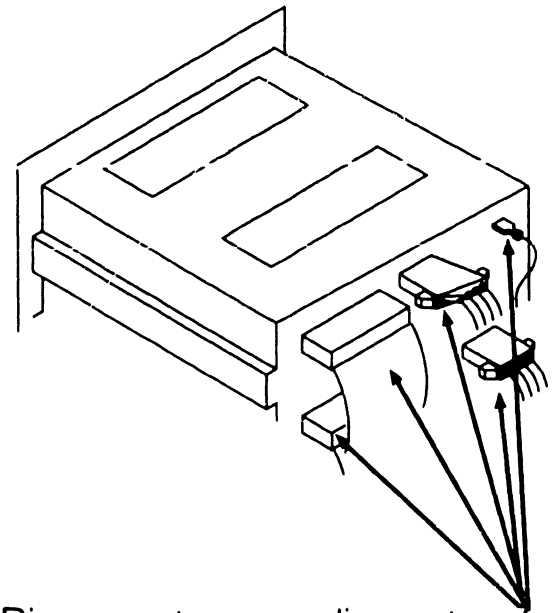
1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1).
3. Remove top/front cover. (➡7.2.2).







4. Press guide rails inward and pull drive(s) about 1 inch out of enclosure.

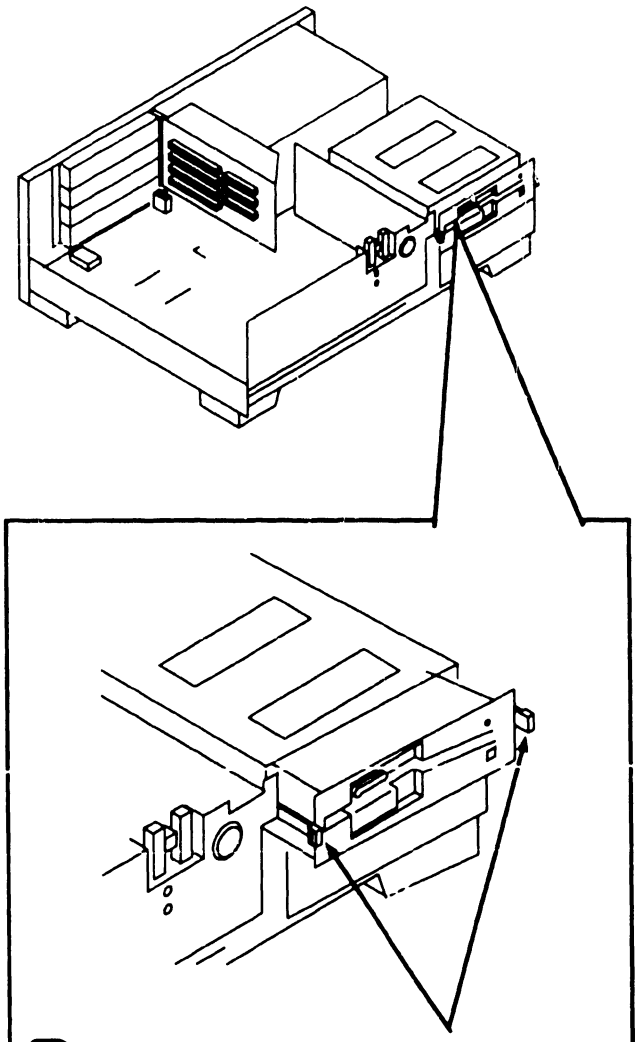


5. Disconnect grounding strap(s), power cables(s), and data cable(s) from back of drives(s).

➡NEXT

7.2 Removal Procedures

7.2.4 Drive Removal (Sheet 2 of 2)



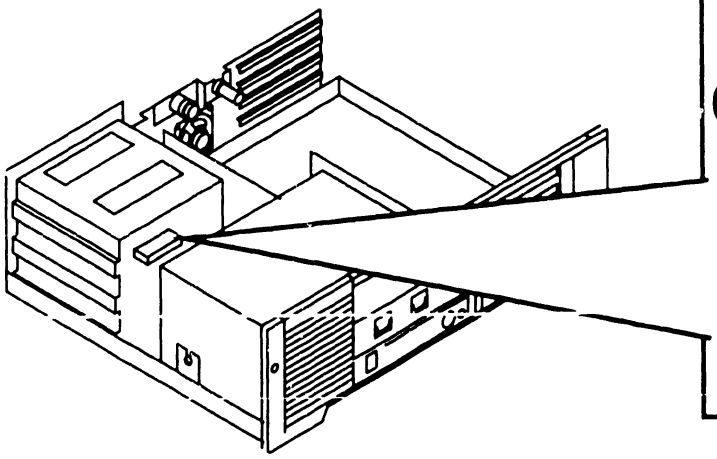
6 Gently slide/pull drive completely out of enclosure.

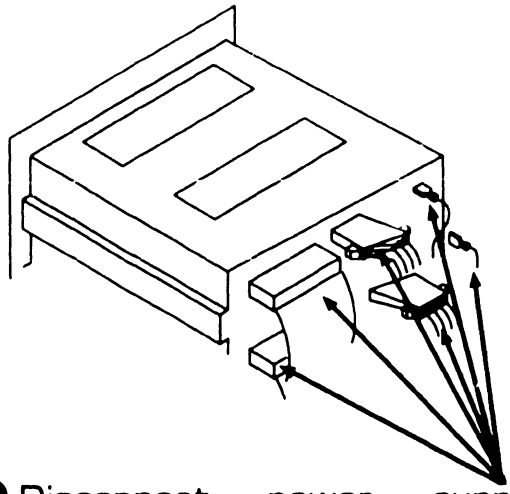
● END

7.2 Removal Procedures

7.2.5 Power Supply Removal (Sheet 1 of 3)

1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1).
3. Remove top/front cover (➡7.2.2).



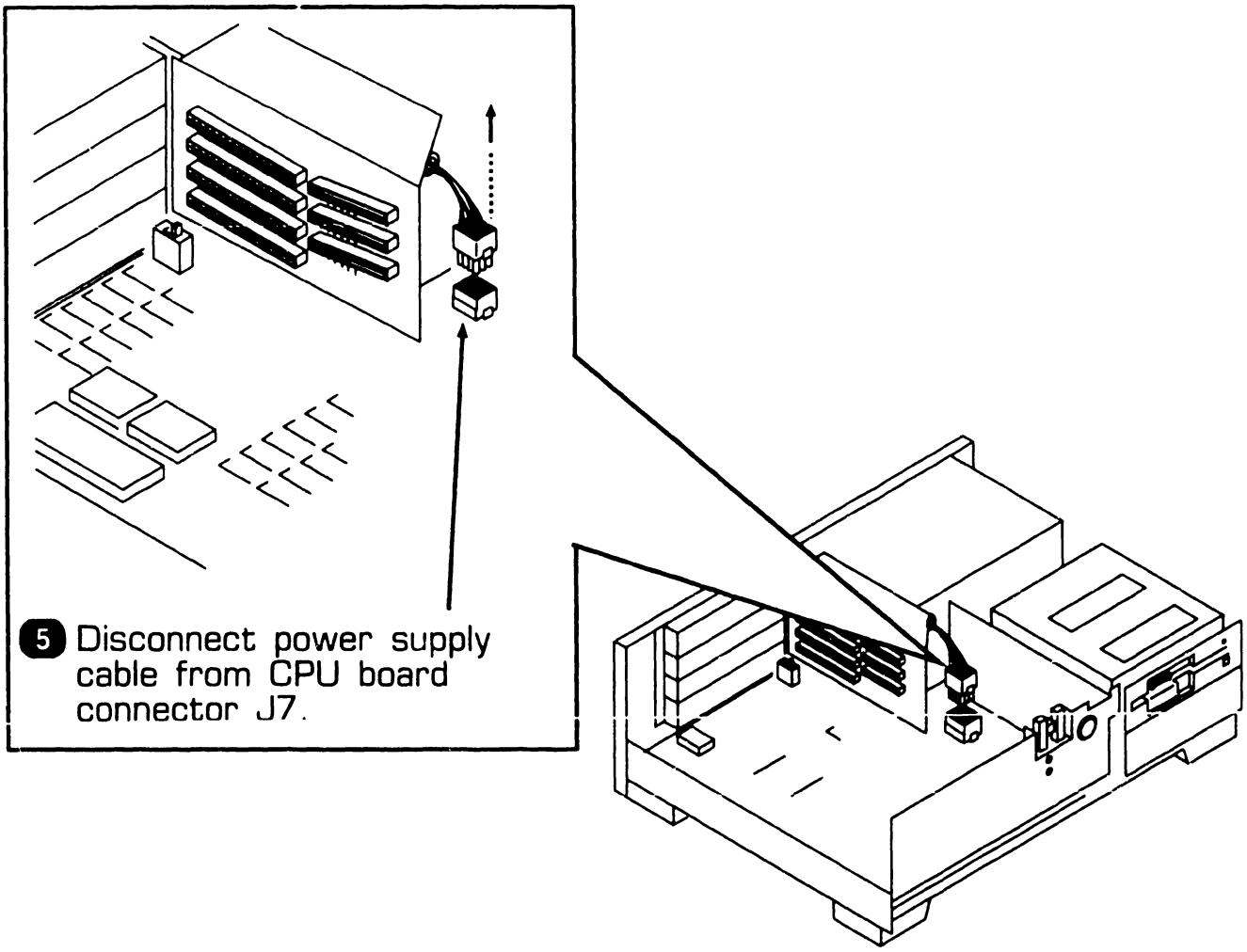


4. Disconnect power supply cable(s) and grounding straps from connectors on rear of drives. (Disconnecting cable(s) from these drives might require partial removal of drives from enclosure (➡7.2.4 Step 4).

➡NEXT

7.2 Removal Procedures

7.2.5 Power Supply Removal (Sheet 2 of 3)



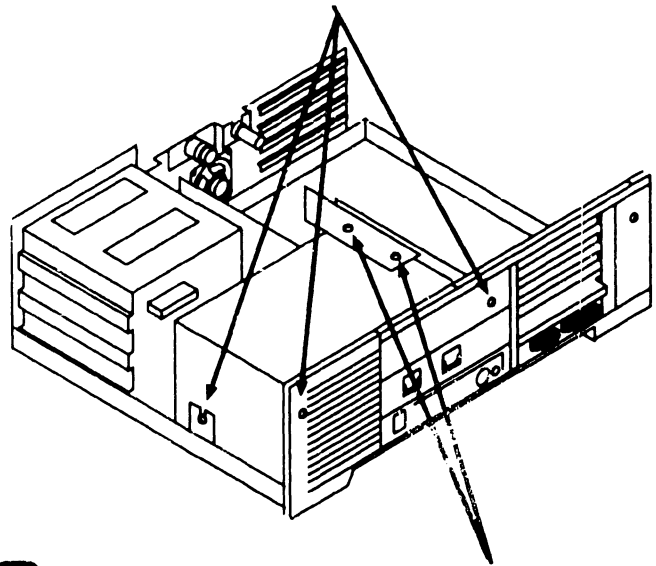
5 Disconnect power supply cable from CPU board connector J7.

➡NEXT

7.2 Removal Procedures

7.2.5 Power Supply Removal (Sheet 3 of 3)

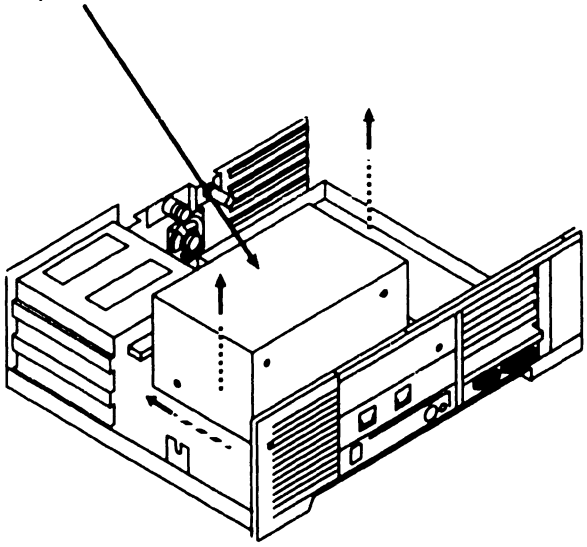
6 Unscrew and remove Phillips-head screws in rear and side of chassis.



7 Remove and unscrew Phillips-head screws securing bracket to power supply. Remove bracket.

8 Remove floppy-only controller board (➡7.2.3 steps 5 and 7).

9 Slid power supply toward front of enclosure to clear rear plate and lift out of unit.

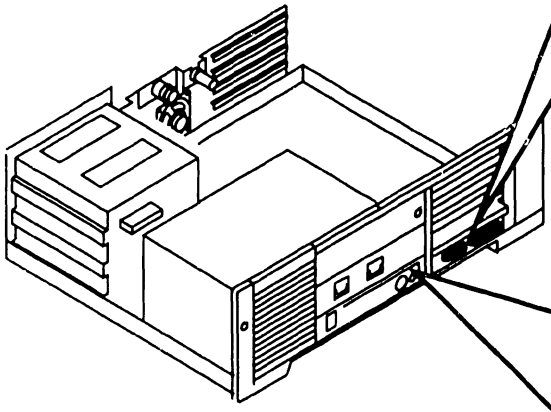


● END

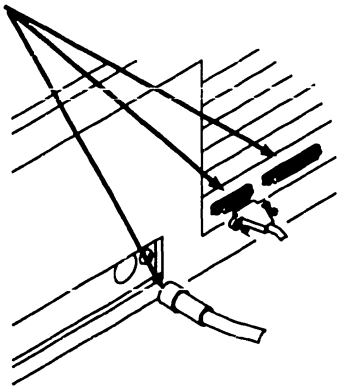
7.2 Removal Procedures

7.2.6 CPU Board Removal (Sheet 1 of 3)

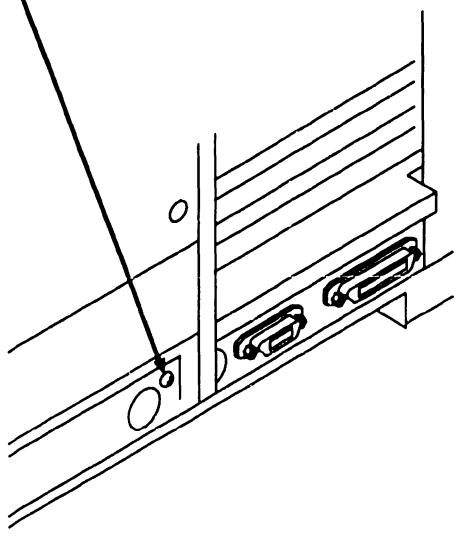
1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1).
3. Remove top/front cover (➡7.2.2).
4. Remove option boards, option buss board, and Floppy-Only Controller board from CPU board sockets (➡7.2.3).



5. Disconnect any cables from CPU board connectors on rear panel.



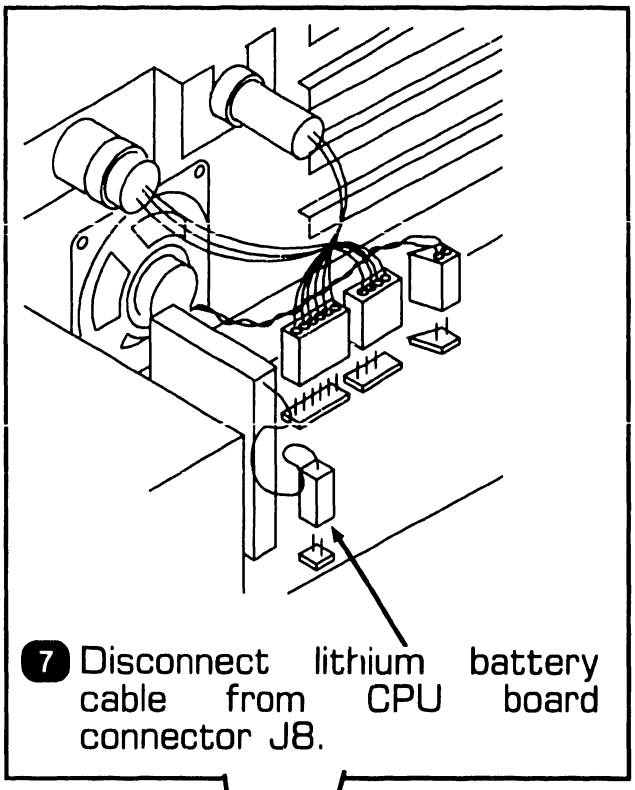
6. Unscrew captive screw that secures side of CPU board to enclosure rear plate.



➡NEXT

7.2 Removal Procedures

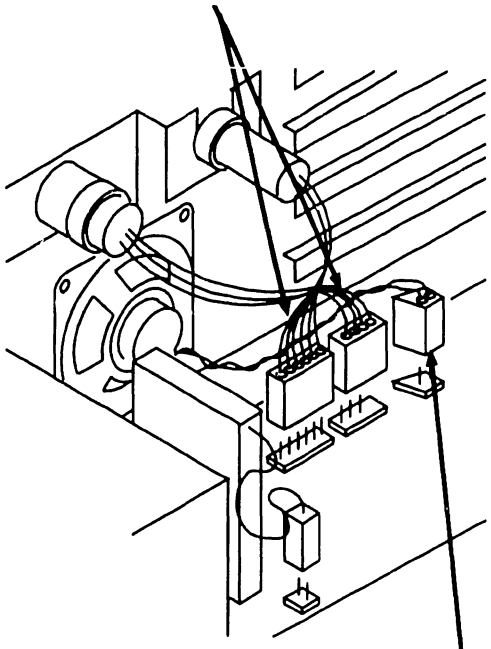
7.2.6 CPU Board Removal (Sheet 2 of 3)



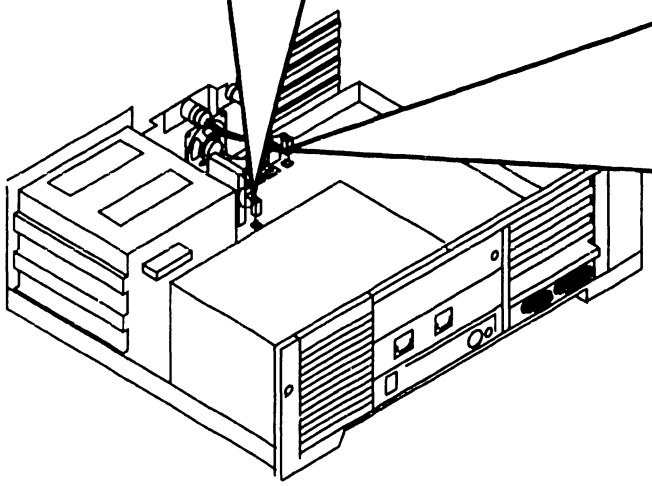
7 Disconnect lithium battery cable from CPU board connector J8.

8 Disconnect power supply cable from CPU board connector J7 (➡7.2.5 step 5).

9 Disconnect keylock cable harness (220-2562) from CPU board connectors J10 and J11.



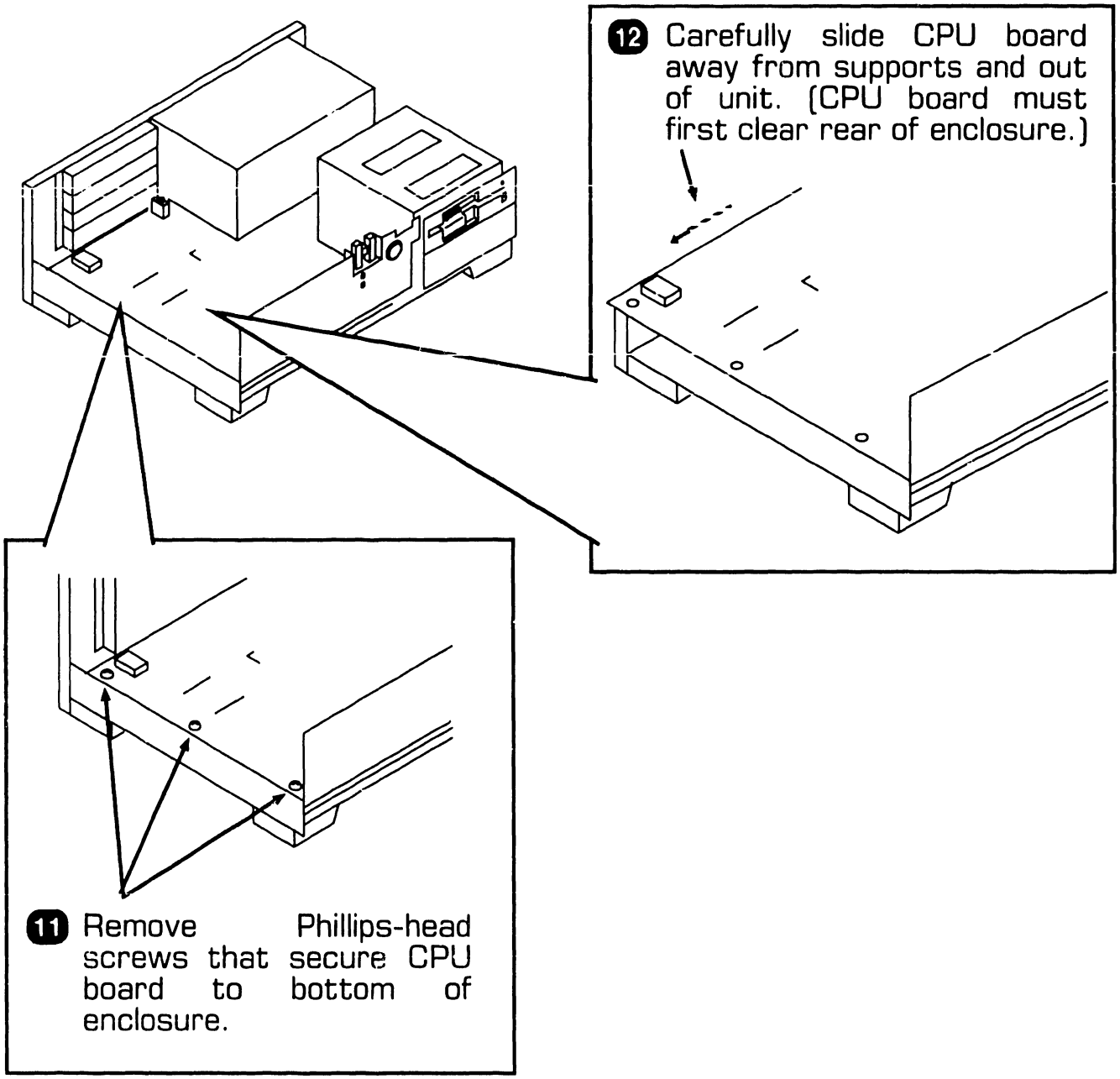
10 Disconnect speaker cable 220-2563 from CPU board connector J9.



➡NEXT

7.2 Removal Procedures

7.2.6 CPU Board Removal (Sheet 3 of 3)



12 Carefully slide CPU board away from supports and out of unit. (CPU board must first clear rear of enclosure.)

11 Remove Phillips-head screws that secure CPU board to bottom of enclosure.

● END

7.2 Removal Procedures

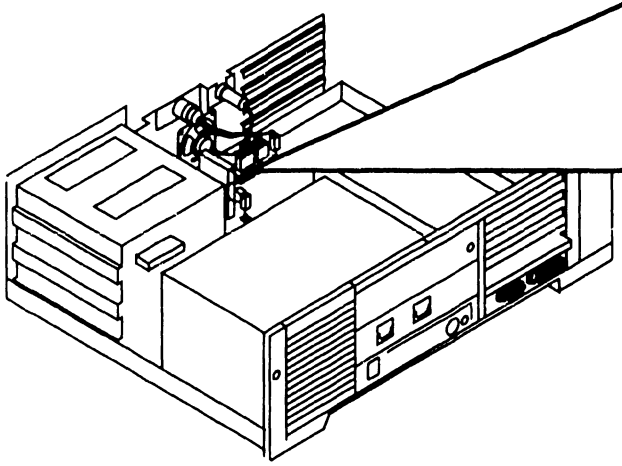
7.2.7 Lithium Battery Removal

1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1).
3. Remove top/front cover (➡7.2.2).

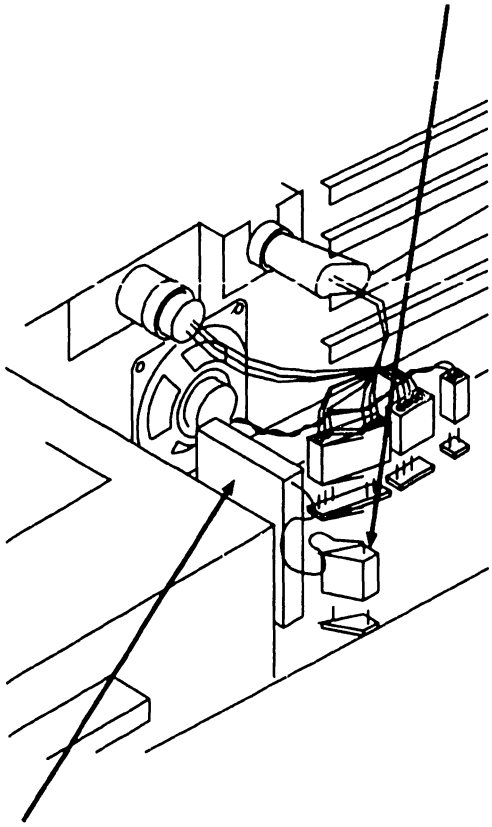
CAUTION

Disconnecting lithium battery cable will result in erasure of CPU CMOS RAM. Run SETUP program.

4. Remove floppy-only controller board (➡7.2.3 steps 5 and 7).



5. Disconnect lithium battery cable from CPU board connector J8.



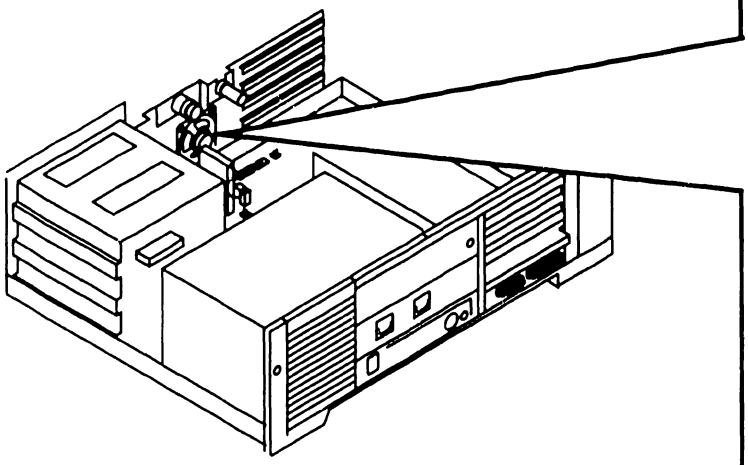
6. Pull battery away from hook and loop pad on inside wall of electronics near the drive units.

● END

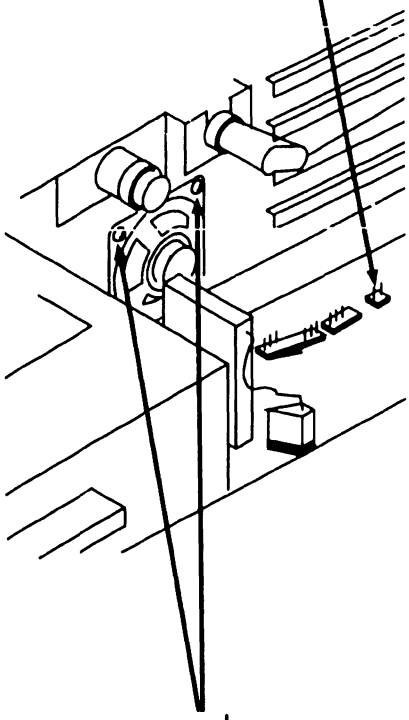
7.2 Removal Procedures

7.2.8 Speaker Removal

1. Power down workstation (➡4.2).
2. Unscrew top cover screws (➡7.2.1)
3. Remove top/front cover. (➡7.2.2)
4. If applicable, remove floppy-only controller board. (➡7.2.3).



5. Disconnect speaker cable (220-2563) from CPU board connector J9.



6. Unscrew and remove Phillips-head screws (2) that secure speaker assembly to enclosure front plate.

● END

SECTION
8
ADJUSTMENTS

SECTION 8 CONTENTS

SECTION 8

ADJUSTMENTS

Page

8.1 Tools and Equipment

8.1.1 Special Tools

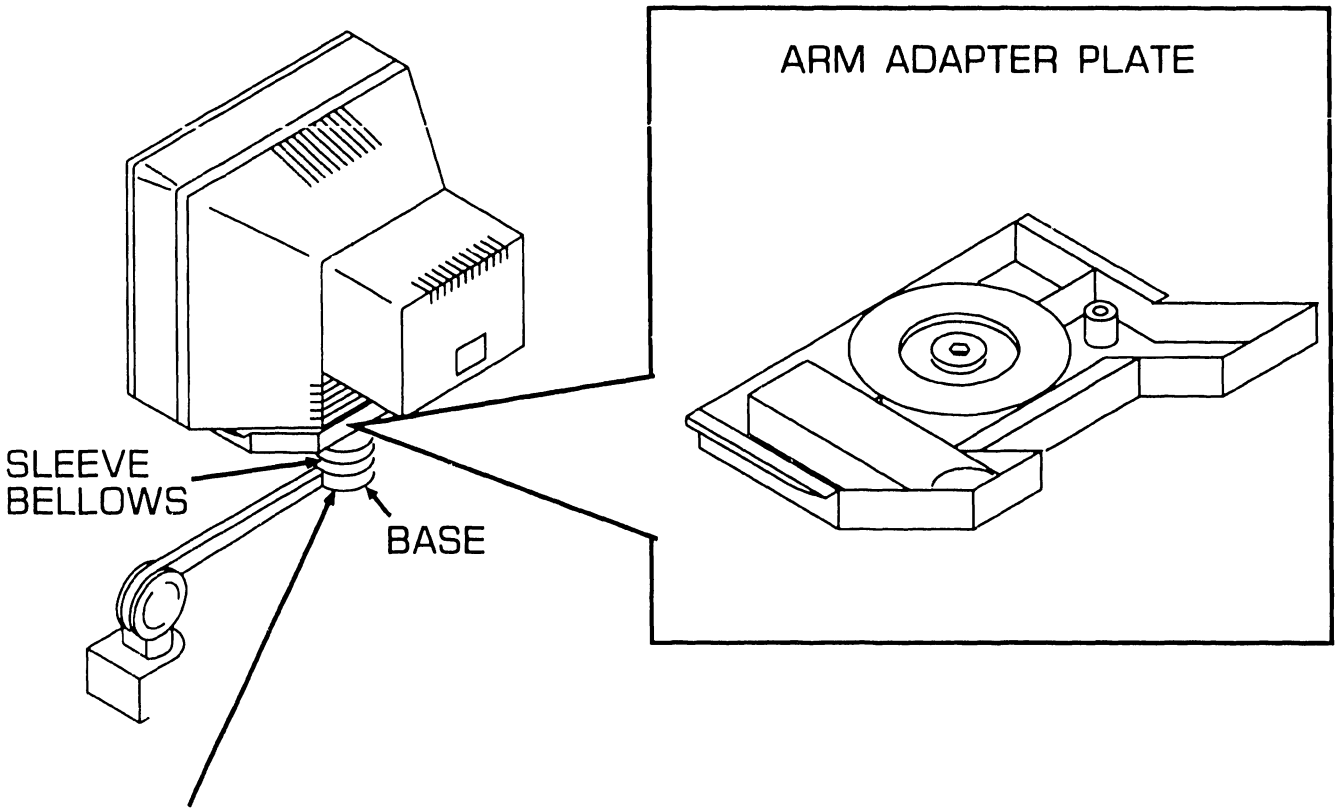
Special equipment or tools are not required to perform adjustments on the PC 240 computer.

● END

8.2 Mechanical Adjustments

8.2.1 Mating Arm Adapter Plate To Monitor Arm

A simple mechanical adjustment secures the arm adapter plate to the monitor arm. (The arm adapter plate connects the workstation monitor to the monitor arm.)



1. Sufficiently tighten locknut on base underneath sleeve bellows.

● END

SECTION 9
UNPACKING AND SETUP

SECTION 9 CONTENTS

SECTION 9

UNPACKING AND SETUP

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SECTION 9

UNPACKING AND SETUP (CONT.)

9 UNPACKING AND SETUP

9.1 Tools and Equipment

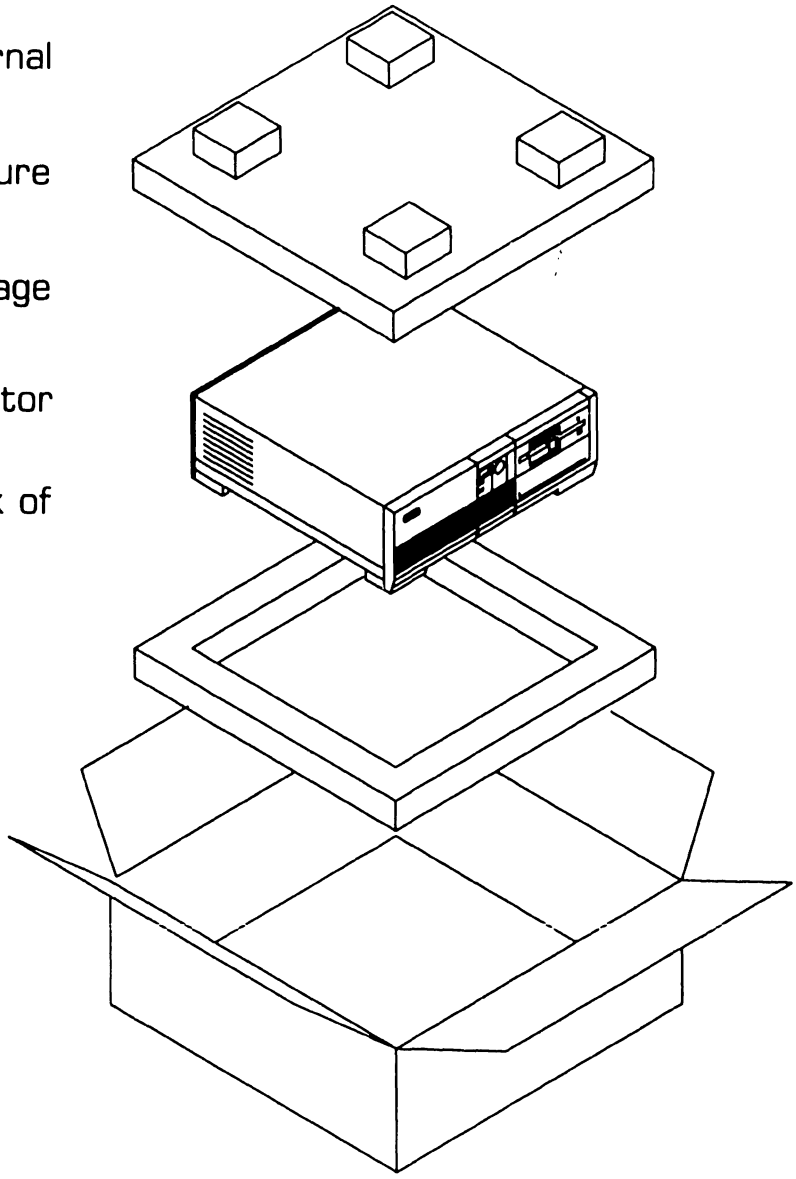
- Standard CE tool kit, P/N 726-9401
- Digital multimeter
- Customer-runnable diagnostic

● END

9.2 Unpacking Procedures

9.2.1 Unpacking And Inspecting Electronics Enclosure

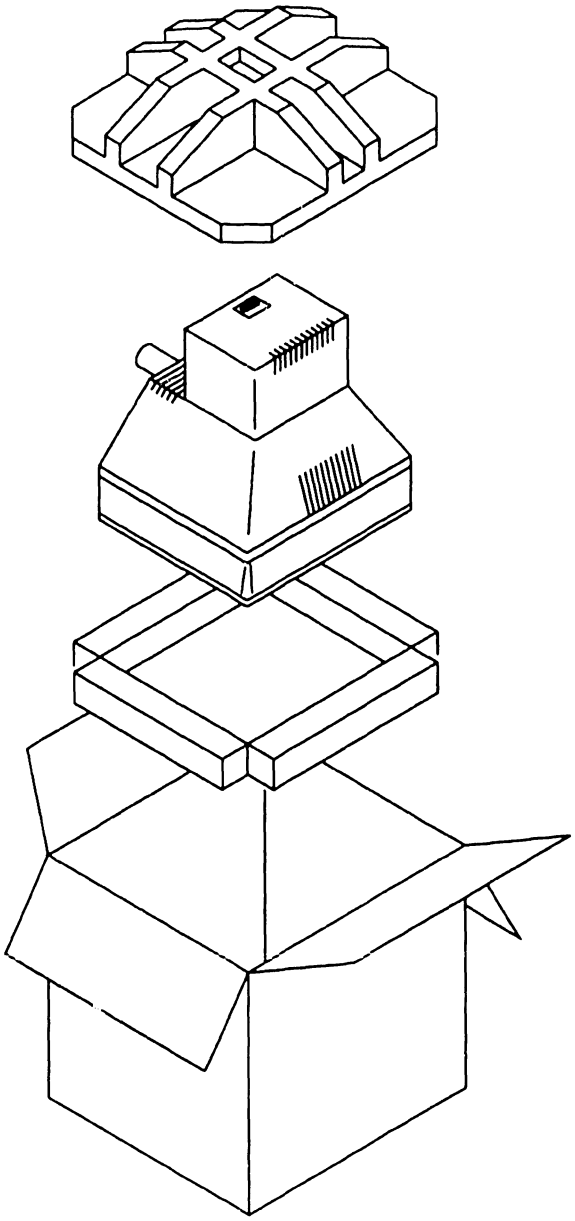
1. Remove electronics enclosure from shipping carton.
2. Inspect unit for external damage.
3. Remove electronics enclosure top/front cover.
4. Inspect for internal damage and loose parts.
5. Remove shipping protector from diskette drives.
6. Remove keys taped to back of unit.



● END

9.2.2 Unpacking Workstation Monitor

1. Remove monitor from shipping carton.
2. Inspect unit for external damage.



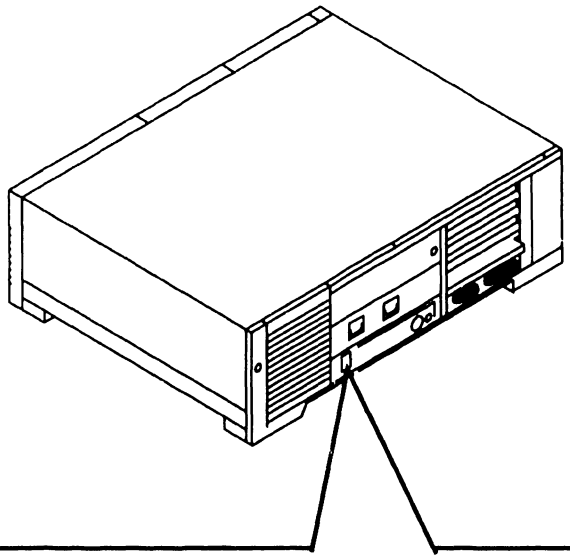
● END

9.2.3 Options Overpack Box

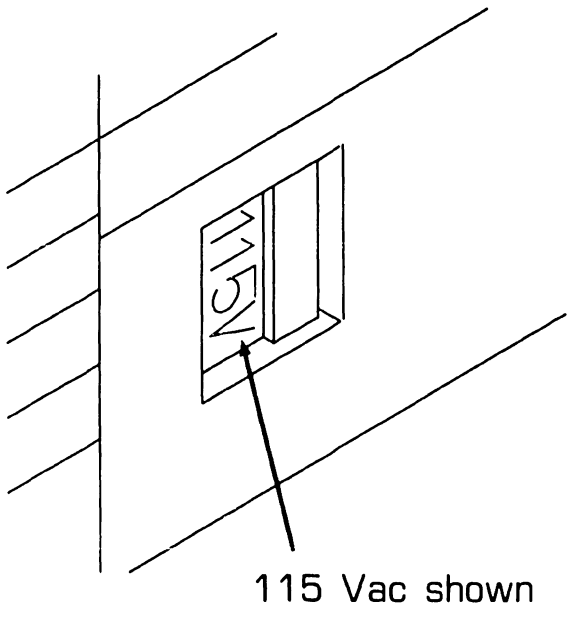
The Options Overpack box may include: Winchester disk and floppy diskette drives, option boards, cabling, and keyboard country kit. (Keyboard country kit contains keyboard, set-up utilities, diagnostics, and literature.)

● END

9.3.1 Electronics Enclosure Line Voltage Select Switch



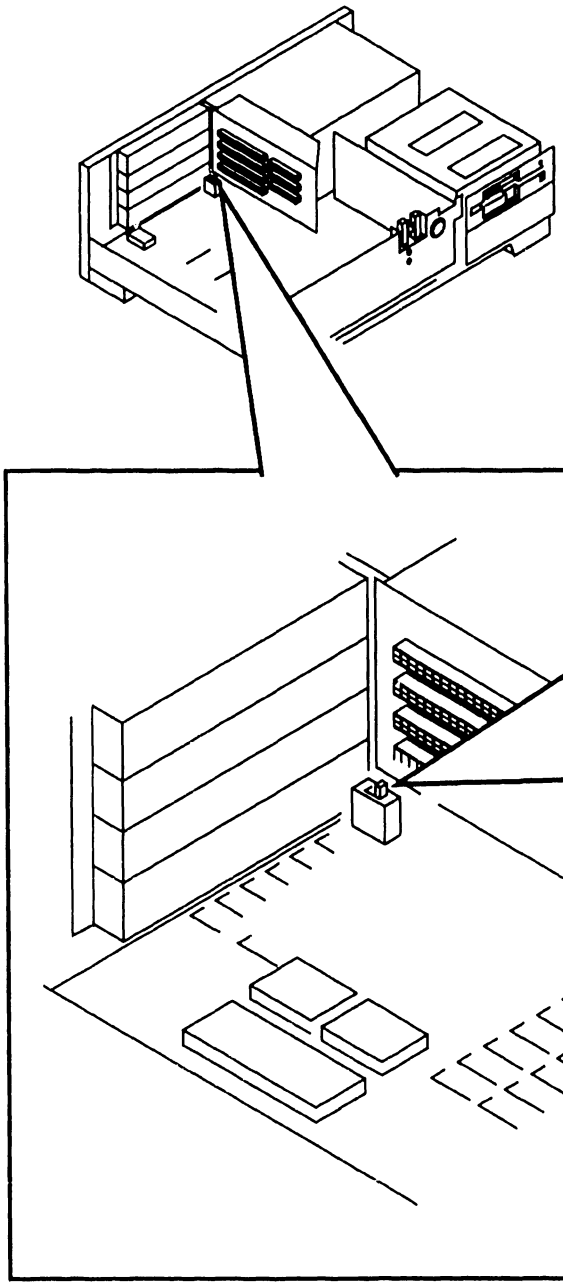
1. Set electronics enclosure voltage selection switch to correct line voltage setting. (115/220 Vac).



● END

9.3.2 CPU Board: Monitor Adapter Switch

1. Remove top/front cover (➡7.2.2).

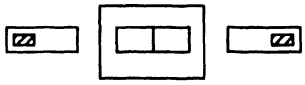


NOTE

Monitor adapter switch is not used when system is configured with EGA/monochrome/color video controller board.

2. Slide two-position monitor adapter switch to appropriate setting (monochrome or color video operation).

MONOCHROME COLOR

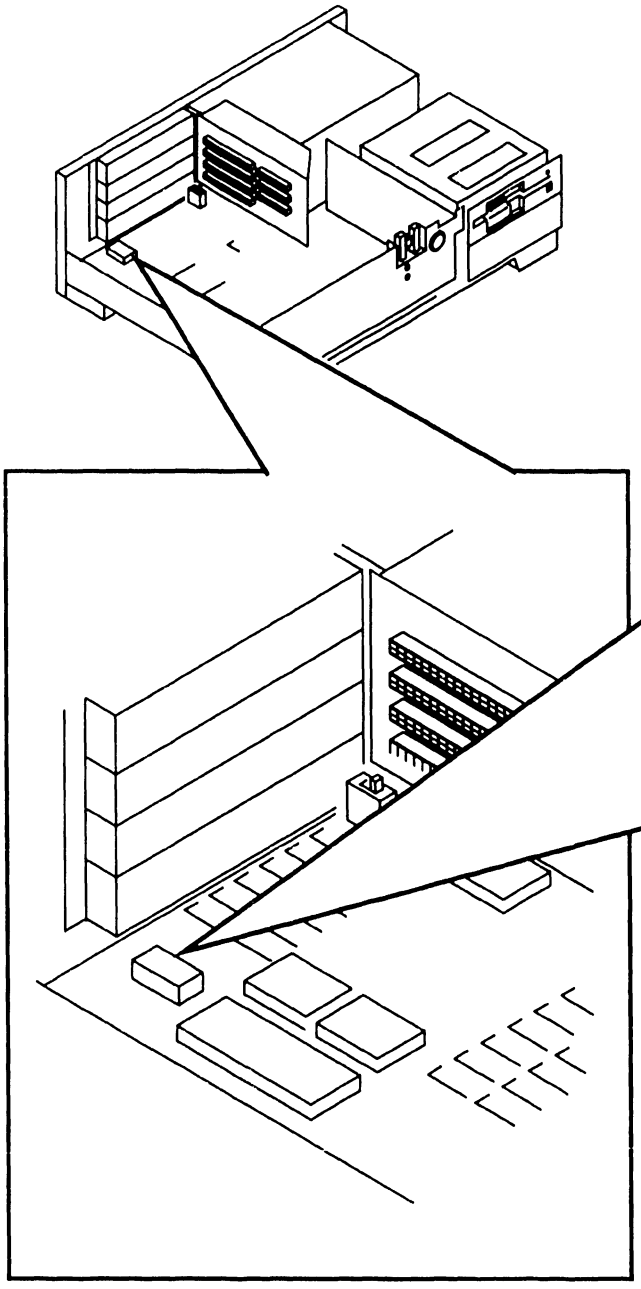


▨ = SWITCH POSITION

● END

9.3.3 CPU Board: Serial And Parallel Port Switch Settings

1. Remove top/front cover (➡7.2.2).



2. Verify proper switch settings of J12/J13 switch bank.

J12

SERIAL PORT	COM. 1	COM. 2	PORT DISABLED
J12 1	X	O	O
J12 2	X	O	O
J12 3	O	X	O
J12 4	O	X	O

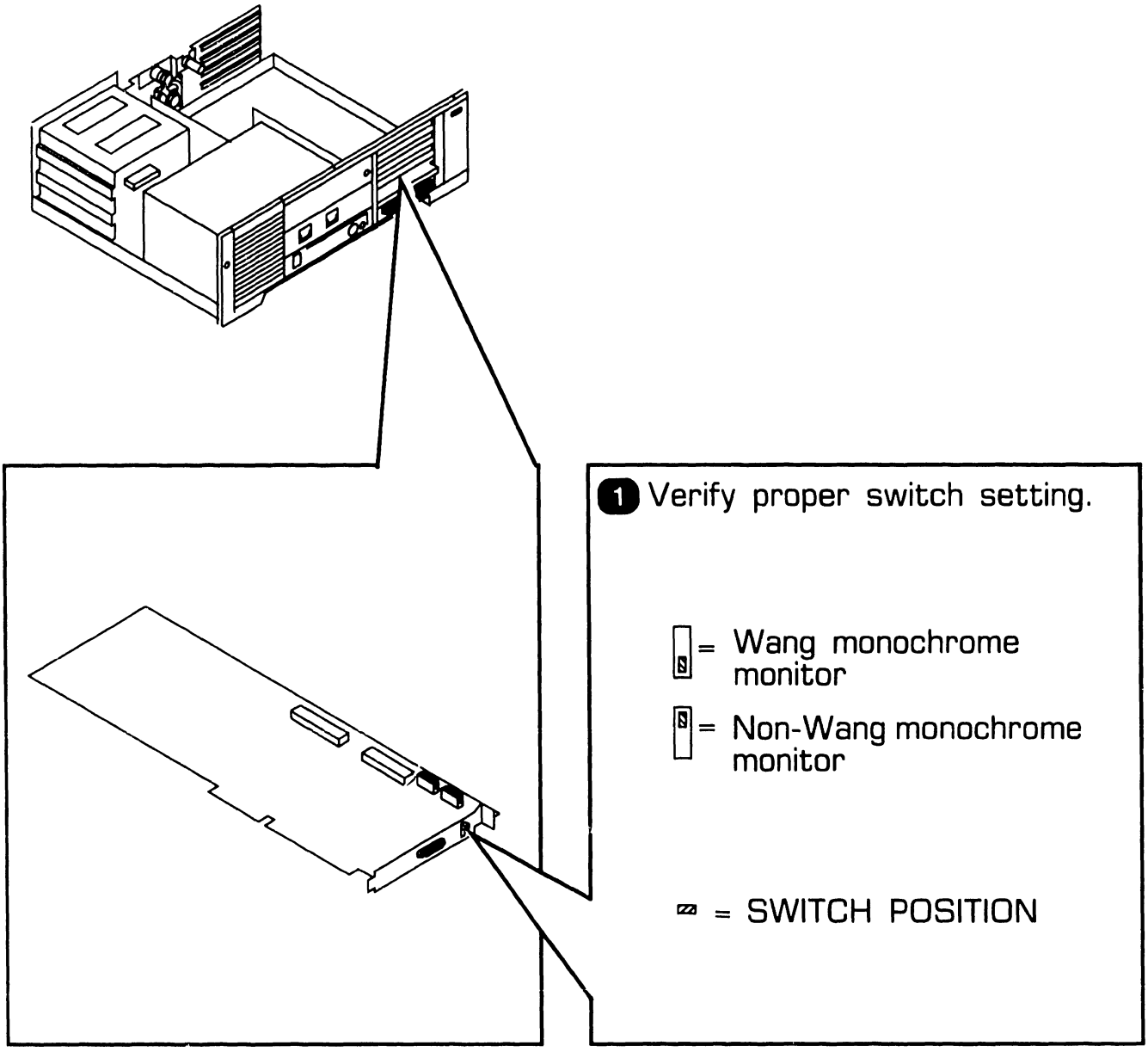
J13

PARALLEL PORT	LPT 1	LPT 2	PORT DISABLED
J13 5	O	X	O
J13 6	O	X	O
J13 7	X	O	O
J13 8	X	O	O

▨ = SWITCH POSITION
O = OPEN CONTACTS
X = CLOSED CONTACTS

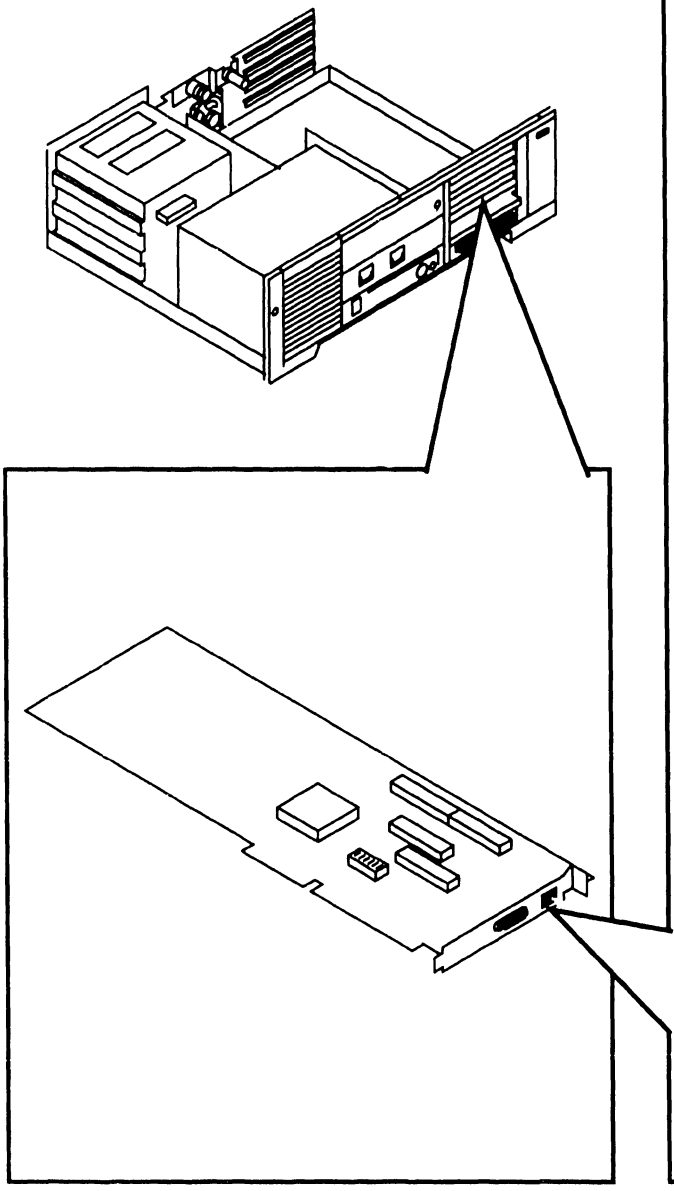
● END

9.3.4 Monochrome Video Board: Switch Settings

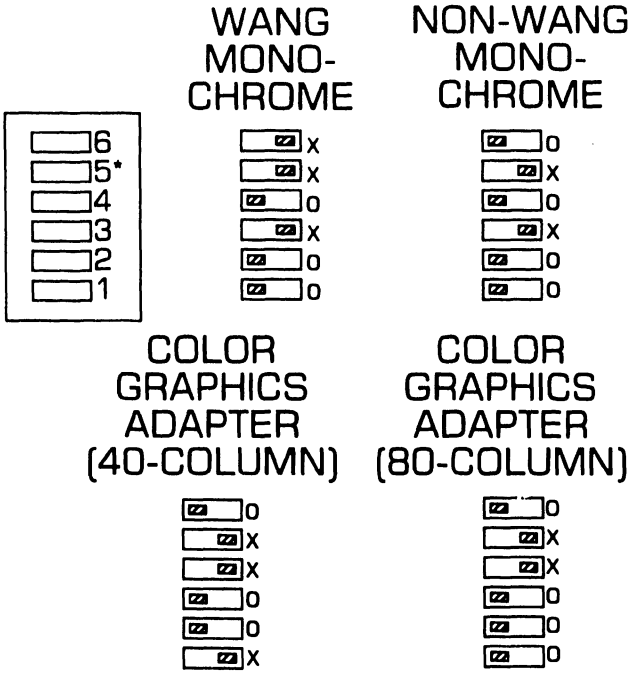


● END

9.3.5 EGA/Monochrome/Color Video Board: Switch Settings (Sheet 1 of 2)



1 Verify proper switch settings.



* Switch 5 enables/disables Auto-switch feature;

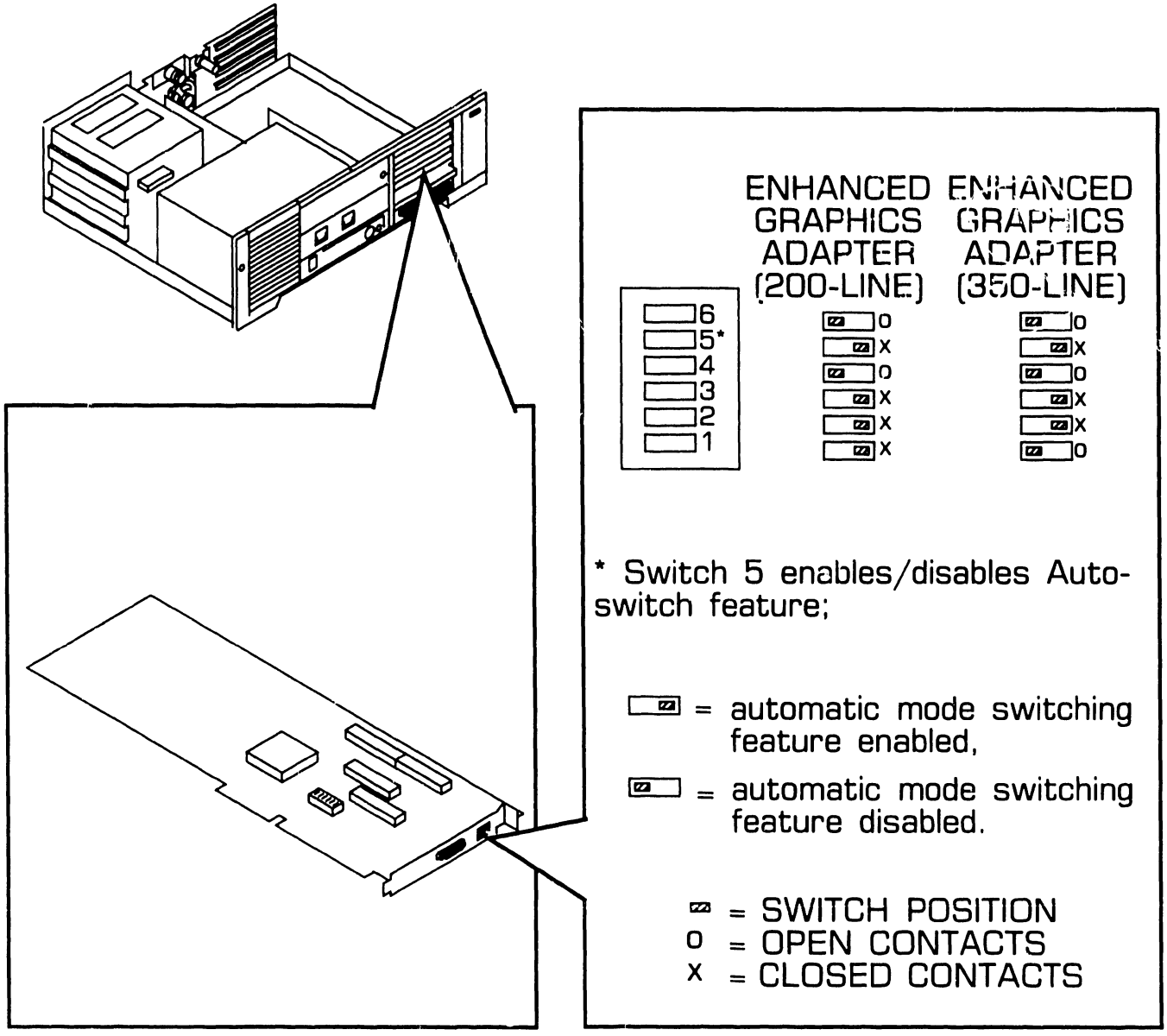
▭ = automatic mode switching feature enabled,

▭ = automatic mode switching feature disabled.

▭ = SWITCH POSITION
o = OPEN CONTACTS
x = CLOSED CONTACTS

➡NEXT

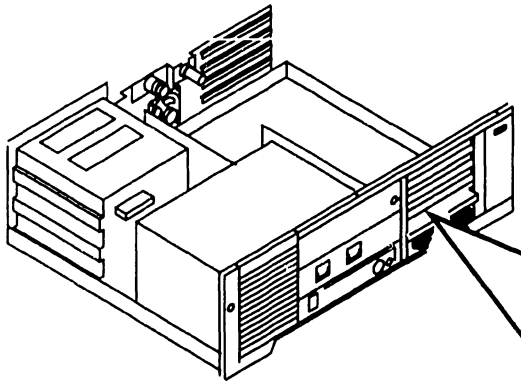
9.3.5 EGA/Monochrome/Color Video Board: Switch Settings (Sheet 2 of 2)



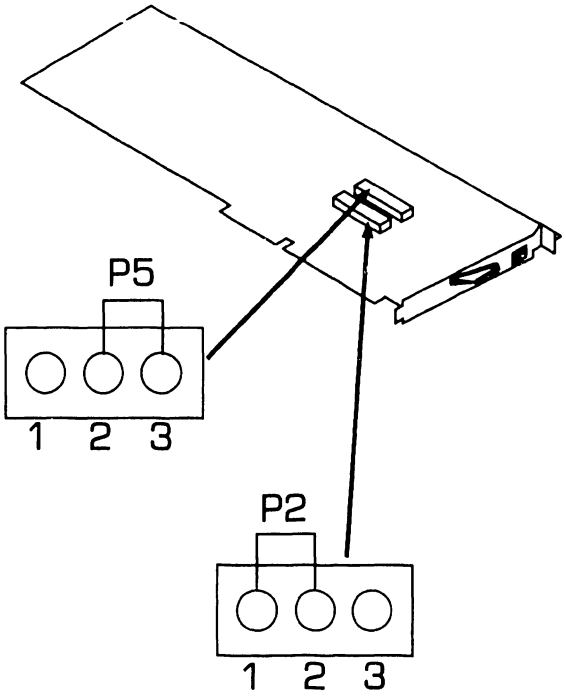
● END

9.3.6 EGA/Monochrome/Color Video Board: Jumper Locations

1. Remove top/front cover (➡7.2.2).



2. Remove EGA/monochrome/color video board (➡7.2.3).

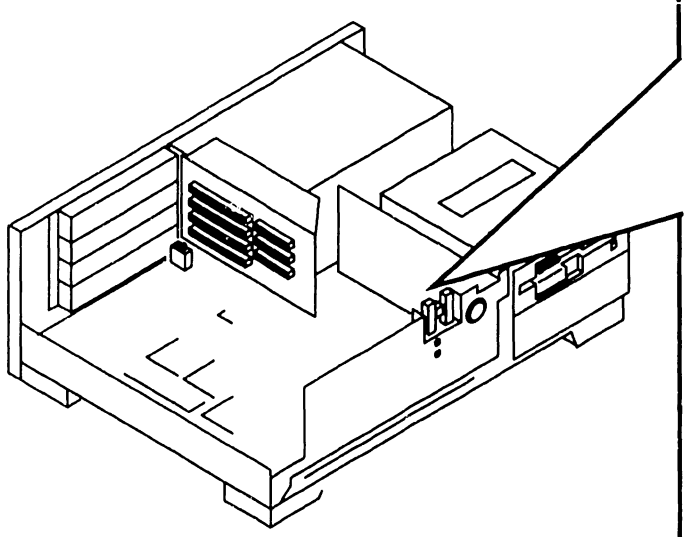


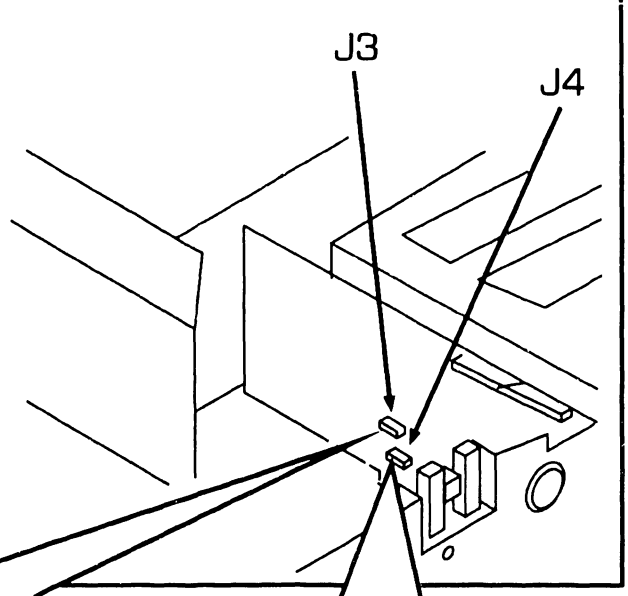
3. Verify proper jumper locations.

● END

9.3.7 Floppy-Only Controller Board: Jumper Locations

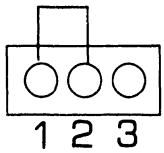
1. Remove top/front cover (➡7.2.2).
2. Remove floppy-only diskette controller board (➡7.2.3).
3. Verify proper jumper locations.





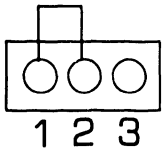
J3

DRIVE TYPE JUMPER: WANG AND IBM COMPATIBLE FLOPPY DRIVES (E1-E3).

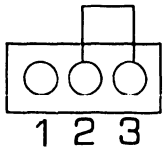


J4

FLOPPY DISKETTE CONTROLLER PRIMARY ADDRESS (E1-E2).



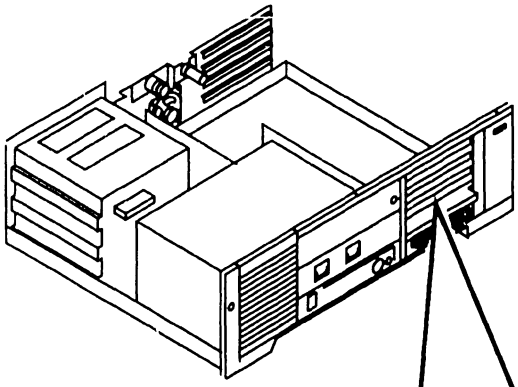
FLOPPY DISKETTE CONTROLLER SECONDARY ADDRESS (E2-E3).



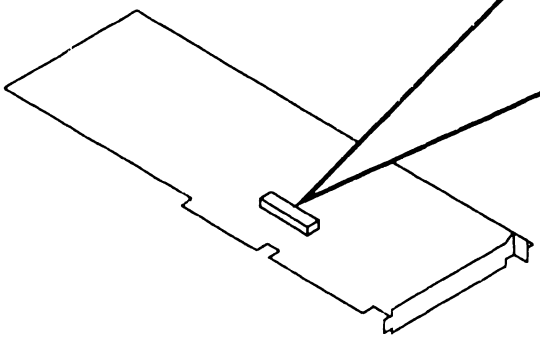
● END

9.3.8 Winchester/Floppy Controller Board: Switch Settings

1. Remove top/front cover (➡7.2.2).

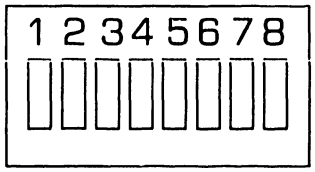


2. Remove Winchester/floppy controller board (➡7.2.3).

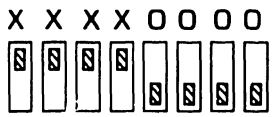


3. Verify proper switch settings.

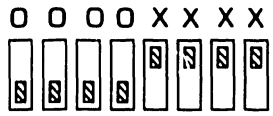
SW1



WINCHESTER AND FLOPPY



WINCHESTER ONLY



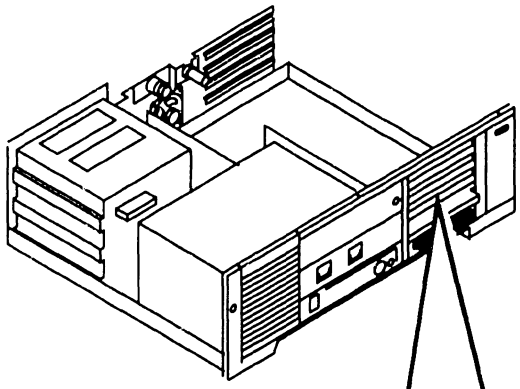
(For PC 240-3 Winchester upgrades.)

▨ = SWITCH POSITION
O = OPEN CONTACTS
X = CLOSED CONTACTS

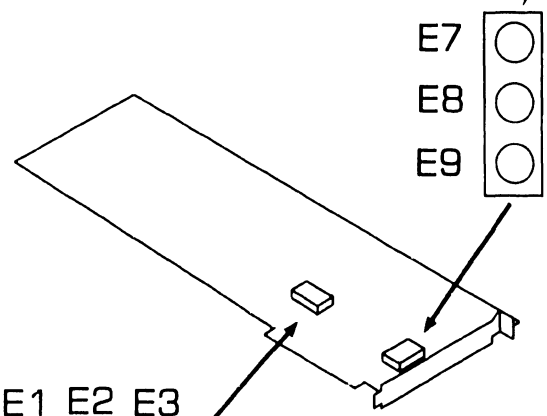
● END

9.3.9 Winchester/Floppy Controller Board: Jumper Locations

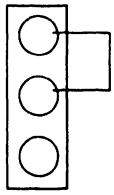
1. Remove top/front cover (➡7.2.2).
2. Remove Winchester/floppy controller board (➡7.2.3).

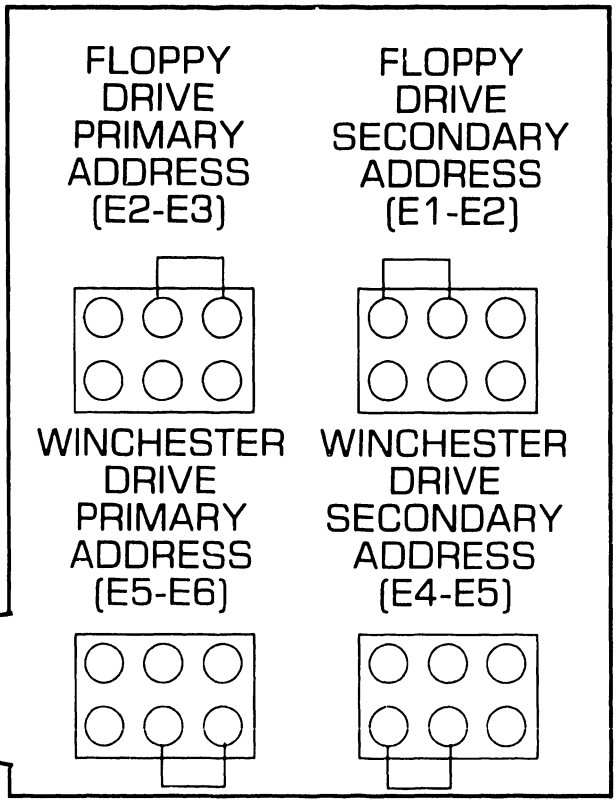


3. Verify proper jumper locations.



DRIVE-TYPE JUMPER; WANG AND IBM COMPATIBLE FLOPPY DRIVES (E7-E8)

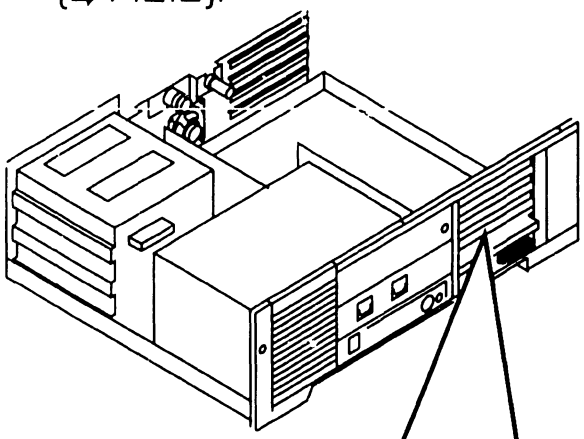




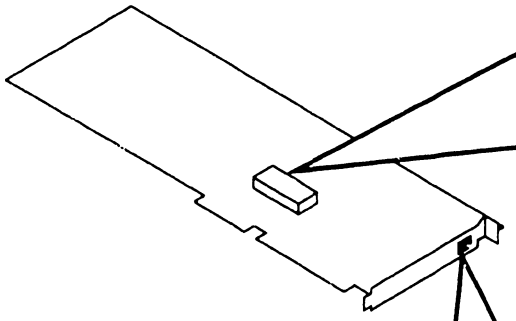
● END

9.3.10 Wang Local Office Connection (WLOC) Board: Switch Settings

1. Remove top/front cover (➡7.2.2).

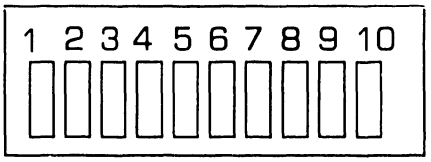


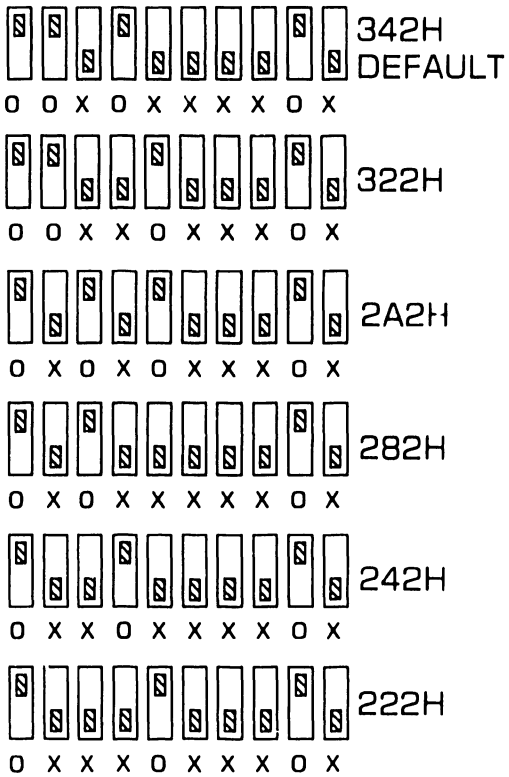
2. Remove WLOC board (➡7.2.3).



3. Verify SW1 (address) settings.

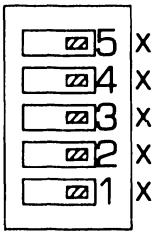
SW1 (ADDRESS)





▨ = SWITCH POSITION
o = OPEN CONTACTS
x = CLOSED CONTACTS

4. Verify SW2 (PROM Enable) settings.

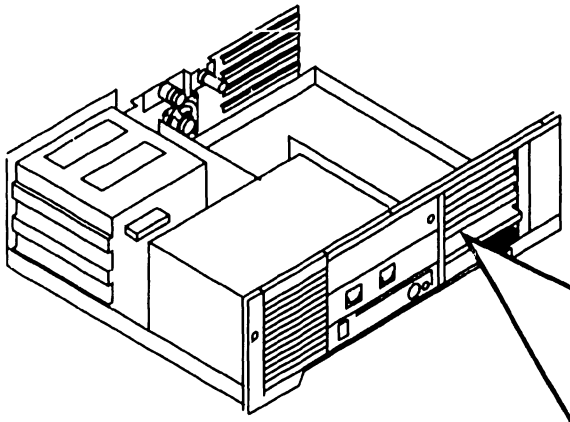


SW2 (PROM ENABLE)

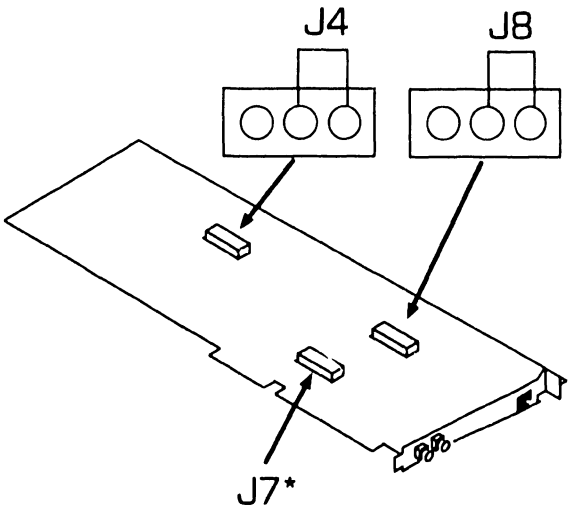
● END

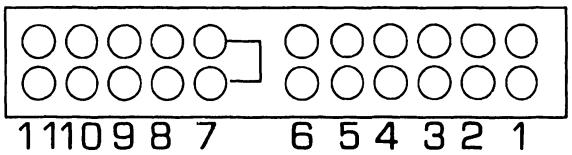
9.3.11 Wang Local Office Connection Board: Jumper Locations

1. Remove top/front cover (➡7.2.2).



2. Remove WLOC board (➡7.2.3).
3. Verify proper jumper locations.





1 1 1 0 9 8 7 6 5 4 3 2 1

(POSITION)

15* 12 11 10 * 7 * 5 4 3
(INTERRUPT REQUEST)

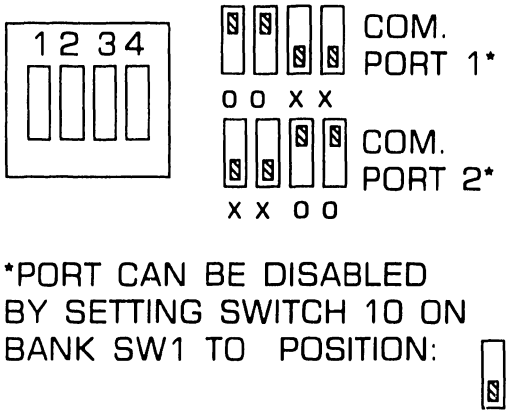
* JUMPER POSITIONS 4, 6, AND 10 ARE DISABLED; DO NOT USE THESE POSITIONS.

● END

9.3.12 Synchronous/Asynchronous Communications Board: Switch Settings

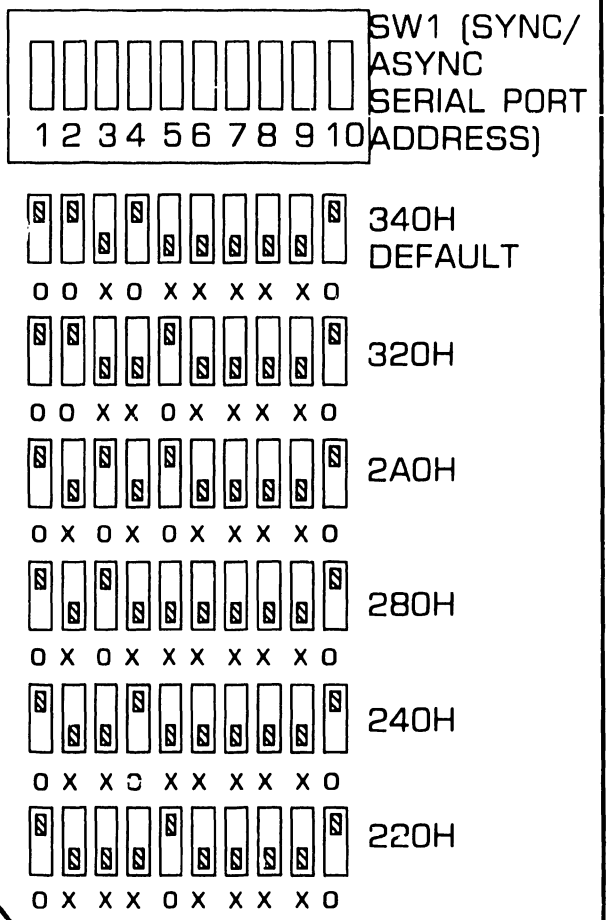
1. Remove top/front cover (➡7.2.2).
2. Remove synchronous/ asynchronous board (➡7.2.3).
3. Verify SW1A settings.

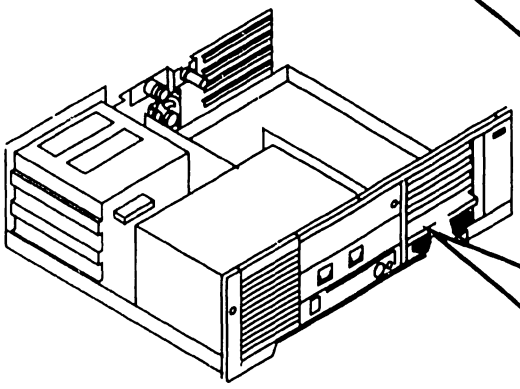
SW1A (SERIAL PORT, ADDRESS/ INTERRUPT LEVEL)



*PORT CAN BE DISABLED BY SETTING SWITCH 10 ON BANK SW1 TO POSITION:

4. Verify SW1 settings.



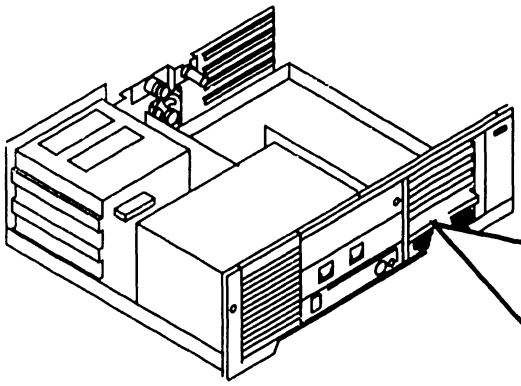


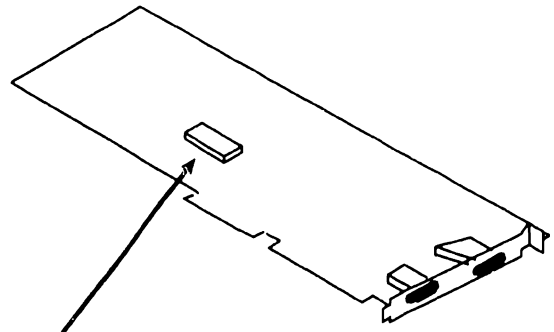
= SWITCH POSITION
o = OPEN CONTACTS
x = CLOSED CONTACTS

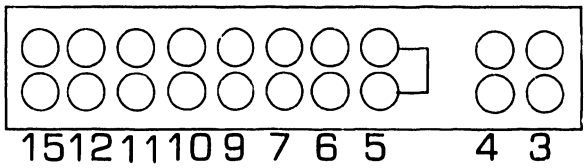
● END

9.3.13 Synchronous/Asynchronous Communications Board: Jumper Locations

1. Remove top/front cover (➡7.2.2).
2. Remove synchronous/asynchronous board (➡7.2.3).
3. Verify proper jumper location.







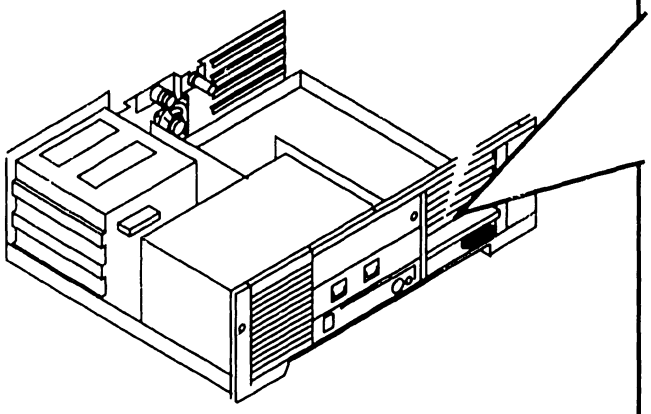
● END

9.3.14 Expanded Memory Board: Switch Settings (Sheet 1 of 7)

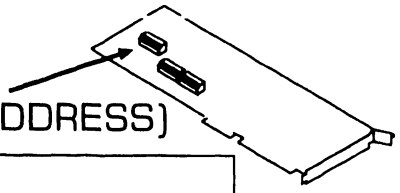
NOTE

An Expanded Memory Card Installation Assistant program is available to help set switches on expanded memory board(s). Insert diskette into floppy drive "A" and type "ASSIST" after "A▷" appears on screen. Press "RETURN" and follow prompts.

1. Remove top/front cover (➡7.2.2).



2. Remove expanded memory board (➡7.2.3).
3. Verify proper switch settings.



SW1 (ADDRESS)

	1	2	3	4	5	6	7	8	9	10
344H	o	o	x	o	x	x	x	o	x	x
324H	o	o	x	x	o	x	x	o	x	x
2A4H	o	x	o	x	o	x	x	o	x	x
284H	o	x	o	x	x	x	x	o	x	x
244H	o	x	x	o	x	x	x	o	x	x
224H	o	x	x	x	o	x	x	o	x	x

▨ = SWITCH POSITION
o = OPEN CONTACTS
x = CLOSED CONTACTS

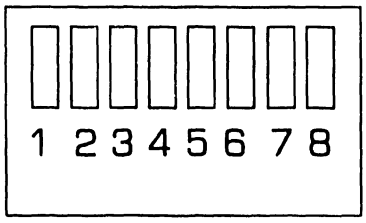
➡NEXT

9.3.14 Expanded Memory Board: Switch Settings (Sheet 2 of 7)

1. Remove top/front cover (➡7.2.2).

2. Remove expanded memory board (➡7.2.3).

3. Verify proper switch settings (➡9.3.14 sheets 3, 4 & 5).



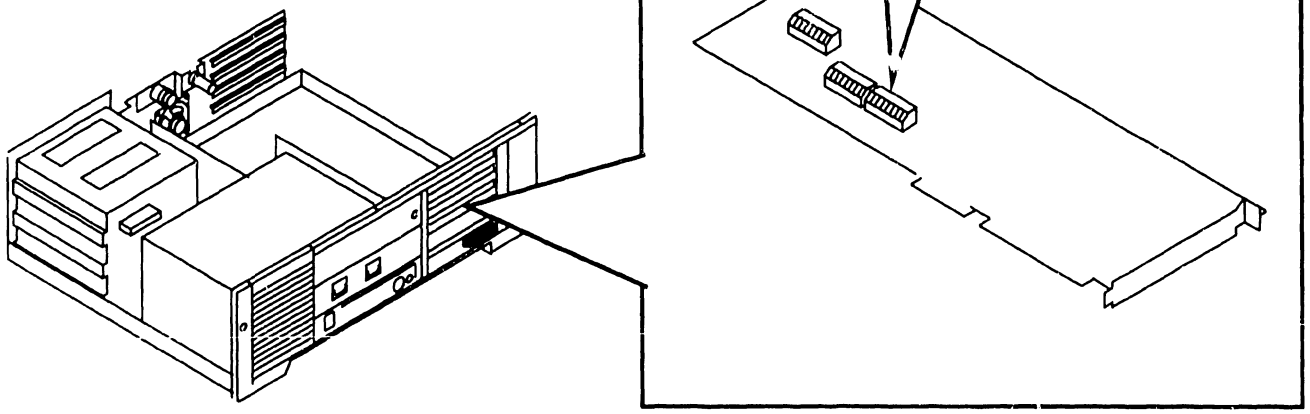
SW2
(EXISTING MEMORY)

NOTE

SW2 specifies amount of direct (non-paged) memory already residing in system before expanded memory board is installed. Setting switch specifies that a certain amount of memory has already been installed.

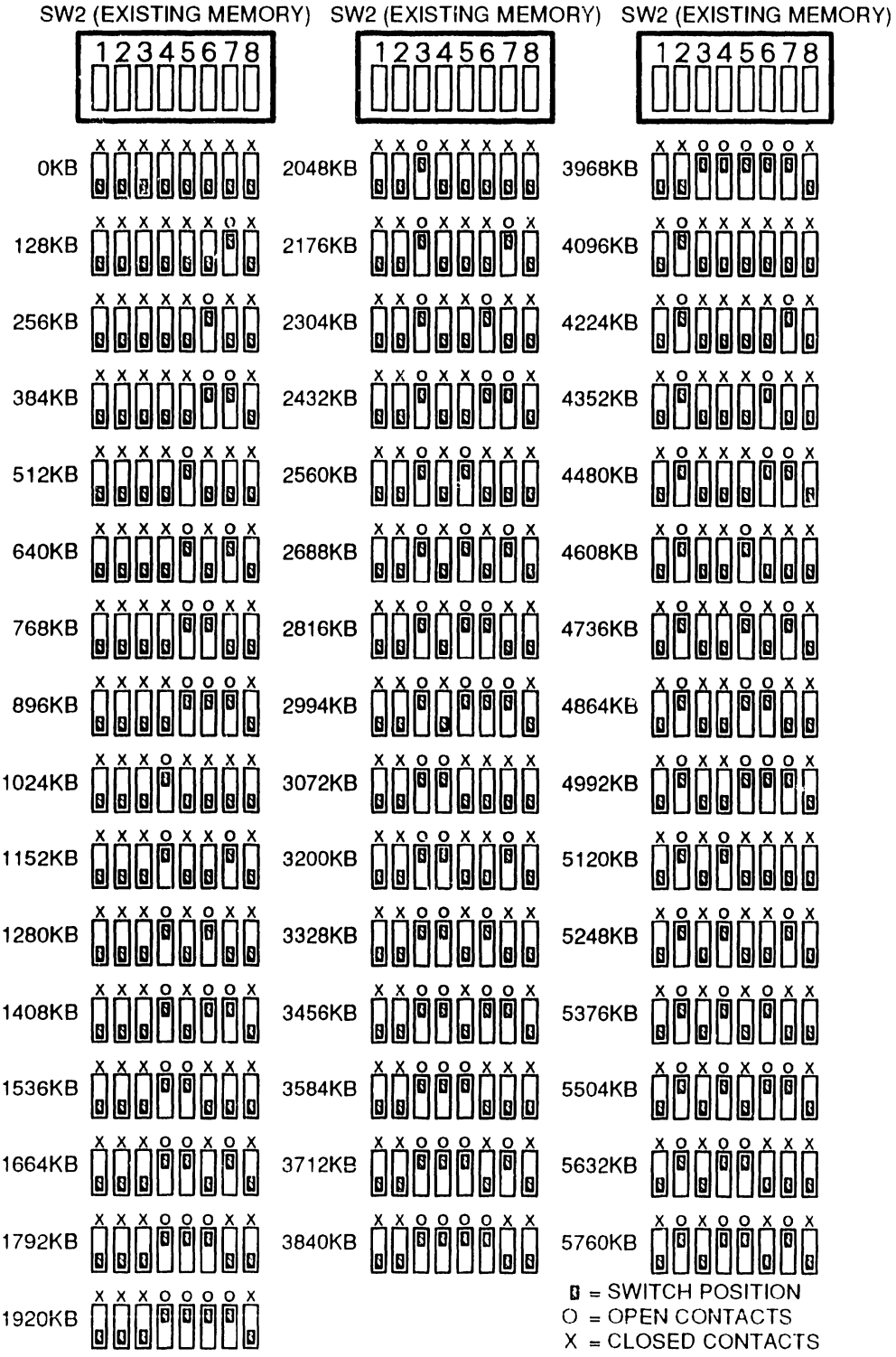
These values are
SW1 = 8192KB
SW2 = 4096KB
SW3 = 2048KB
SW4 = 1024KB
SW5 = 512KB
SW6 = 256KB
SW7 = 128KB
SW8 = parity enable/disable.

▨ = Switch Position



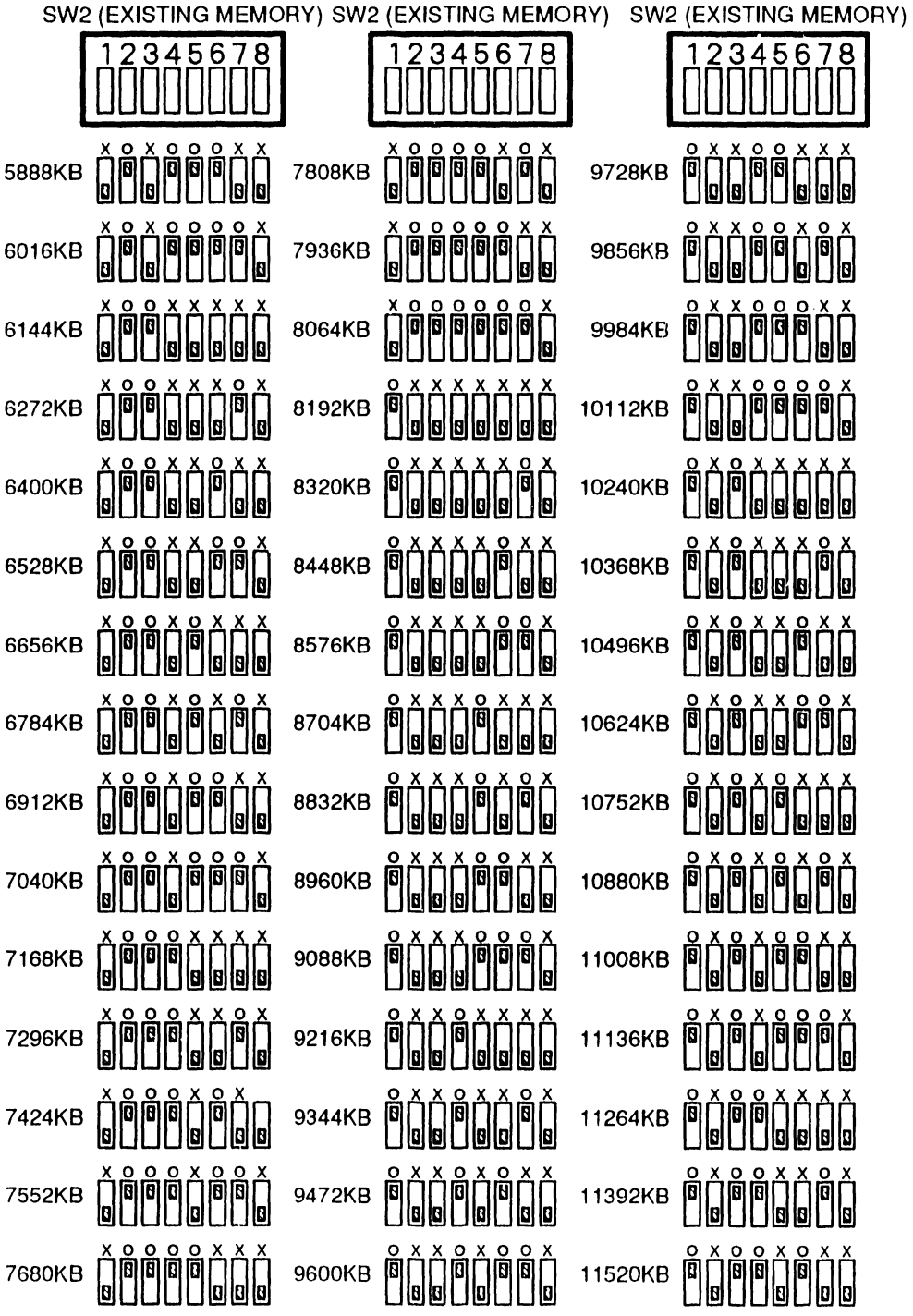
➡NEXT

9.3.14 Expanded Memory Board: Switch Settings (Sheet 3 of 7)



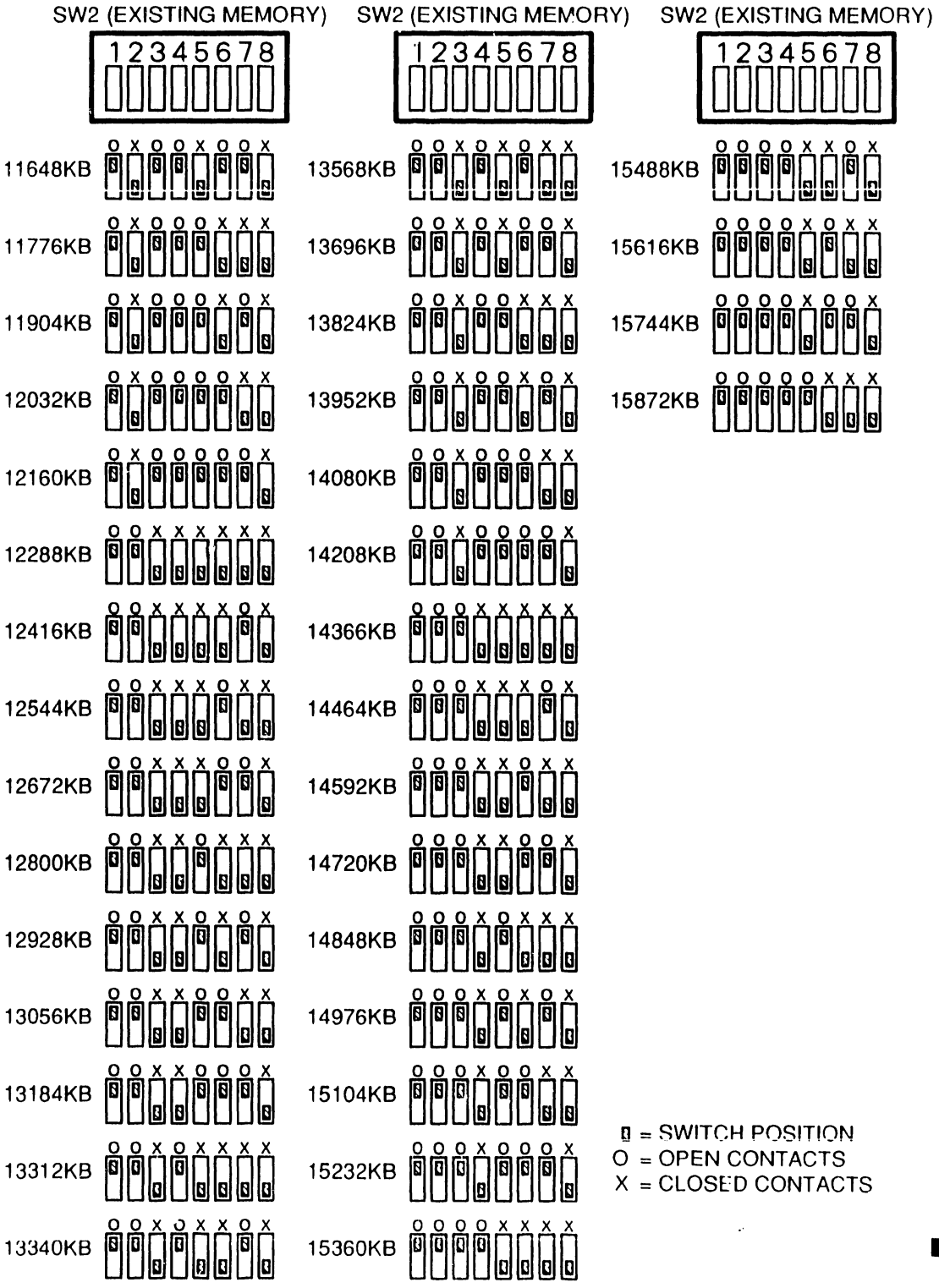
➡NEXT

9.3.14 Expanded Memory Board: Switch Settings (Sheet 4 of 7)



➡NEXT

9.3.14 Expanded Memory Board: Switch Settings (Sheet 5 of 7)

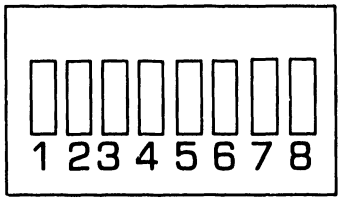


➡NEXT

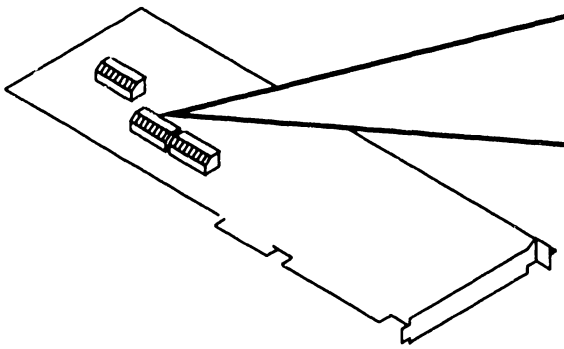
9.3.14 Expanded Memory Board: Switch Settings (Sheet 6 of 7)

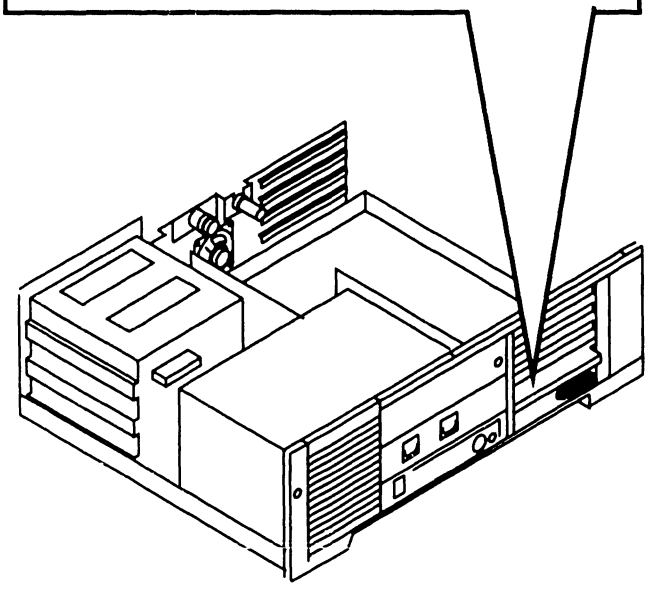
1. Remove top/front cover (➡7.2.2).
2. Remove expanded memory board (➡7.2.3).
3. Verify proper switch settings (➡9.3.14 sheet 7).

SW3 (MEMORY ALLOCATION)



▨ = SWITCH POSITION
O = OPEN CONTACTS
X = CLOSED CONTACTS

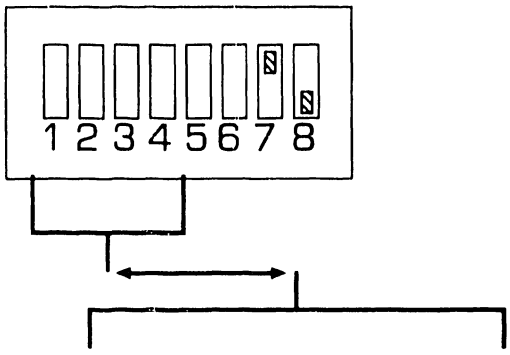




➡NEXT

9.3.14 Expanded Memory Board: Switch Settings (Sheet 7 of 7)

SW3 (MEMORY ALLOCATION)



▭ = SWITCH POSITION
O = OPEN CONTACTS
X = CLOSED CONTACTS

128KB	X X X X	1152KB	O X X X
256KB	X X X O	1280KB	O X X O
384KB	X X O X	1408KB	O X O X
512KB	X X O O	1536KB	O X O O
640KB	X O X X	1664KB	O O X X
768KB	X O X O	1792KB	O O X O
896KB	X O O X	1920KB	O O O X
1024KB	X O O O	2048KB	O O O O

SW3-1 through SW3-4 define amount of memory allocated as direct (non-paged) memory.

IN ORDER TO OVERRIDE SW3-1 THROUGH SW3-4, SET SW3-8 TO: ▭

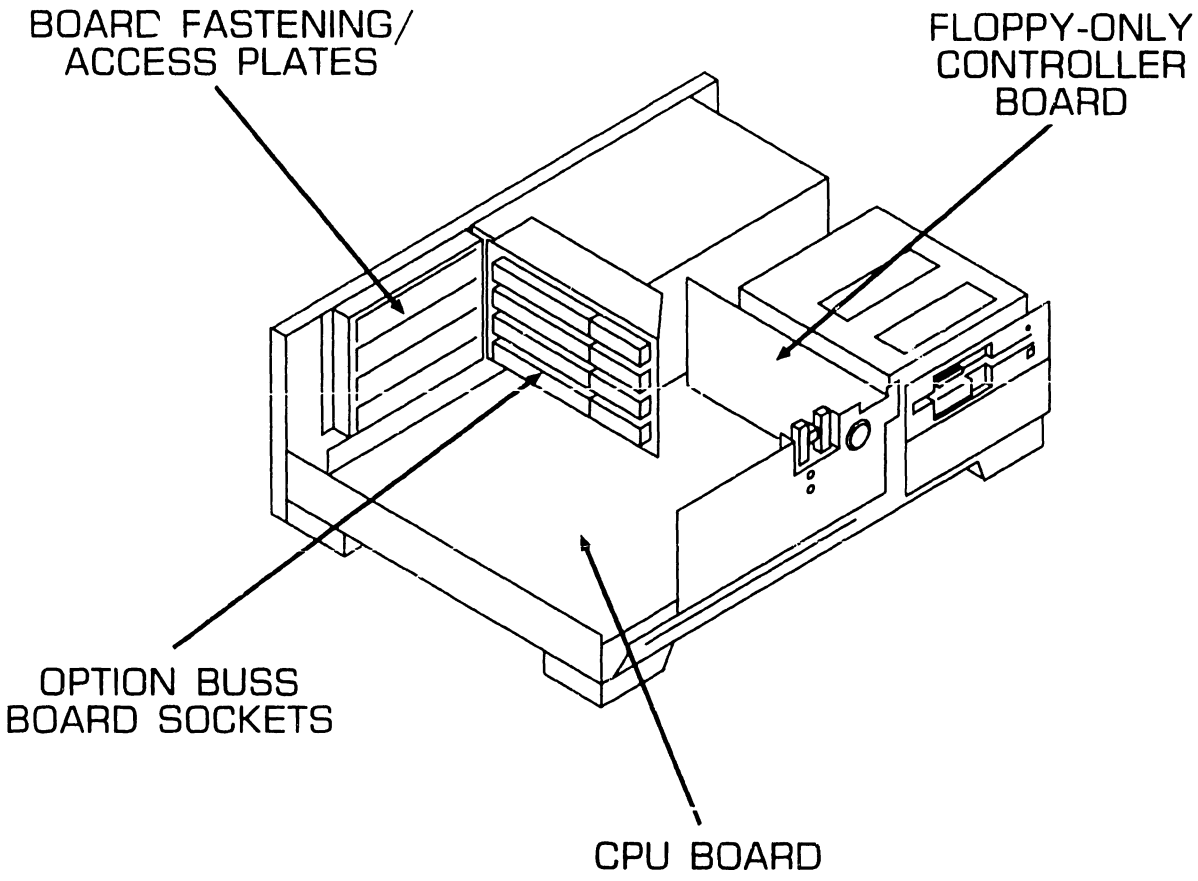
SWITCHES 5 AND 6 NOT USED; SET TO: ▭

SW3-7: IF EXPANDED MEMORY BOARD IS USED IN A NON-WANG SYSTEM, SET SW3-7 TO: ▭

SW3-8 ENABLES/DISABLES CPU DIRECT MODE ADDRESSING OF MEMORY ON EXPANDED MEMORY BOARD. DEFAULT SETTING IS: ▭

● END

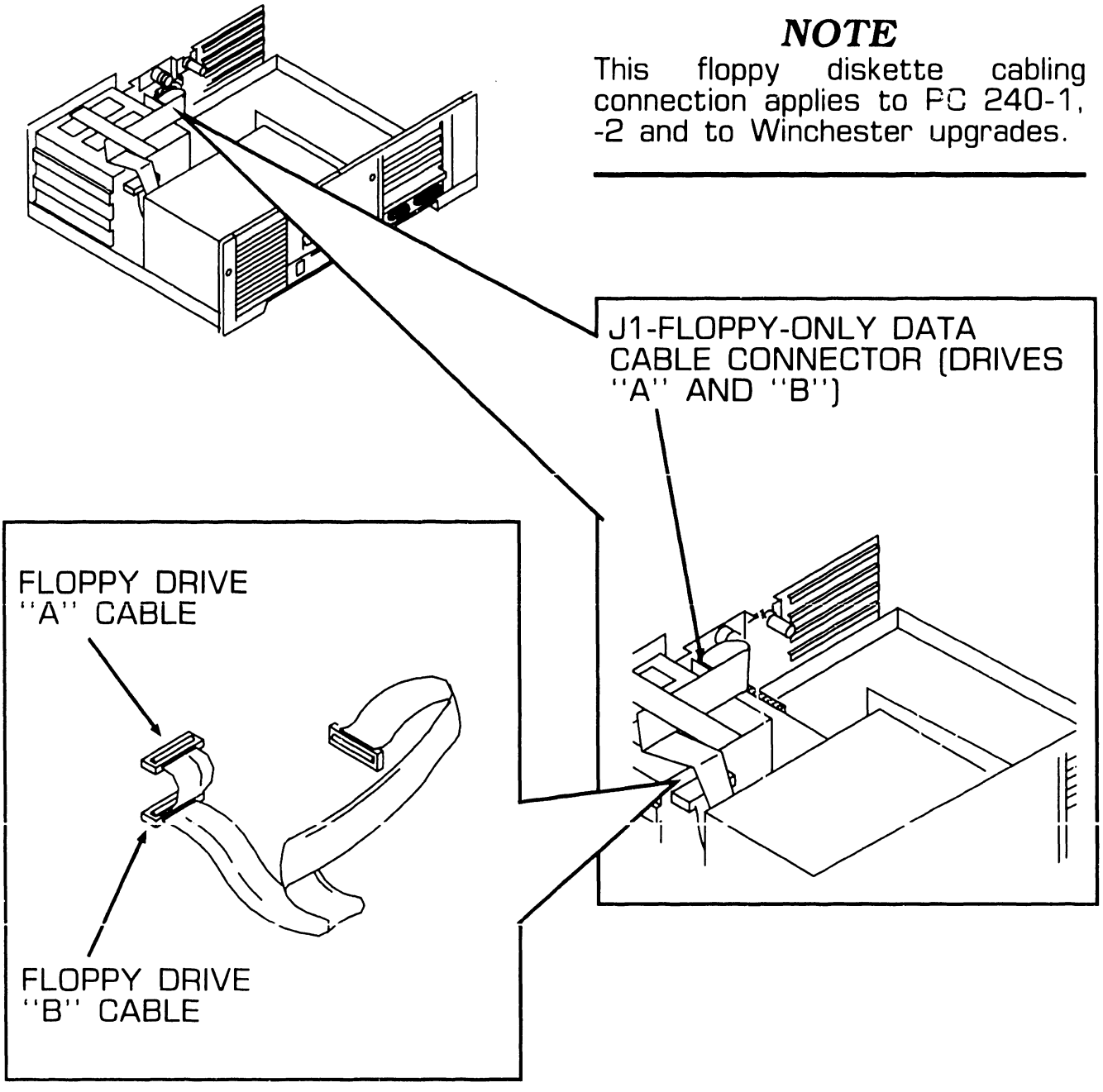
9.4.1 Electronics Enclosure: Board Locations



● END

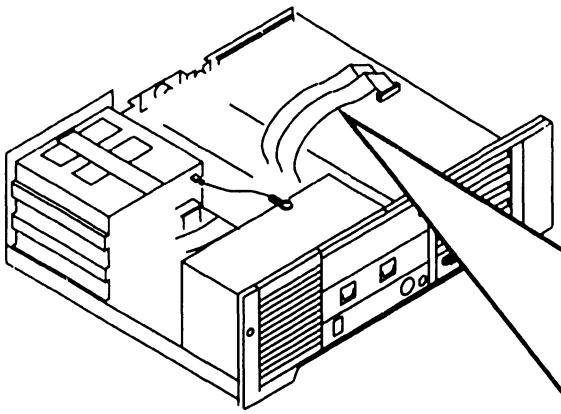
9.4.2 Floppy-Only Controller Cabling Connections

> ***NOTE***
> This floppy diskette cabling connection applies to PC 240-1, -2 and to Winchester upgrades.



● END

9.4.3 Winchester/Floppy Controller Cabling Connections



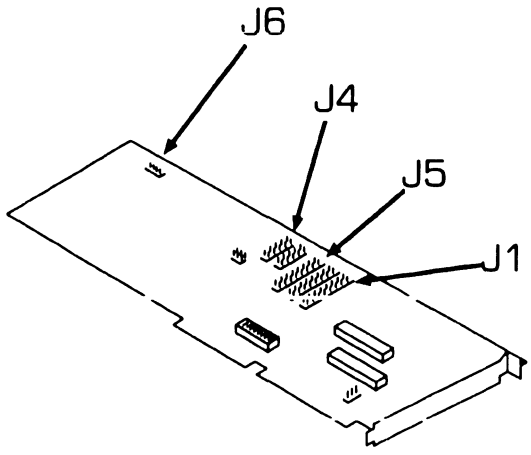
WINCHESTER/FLOPPY CONTROLLER BOARD CABLING CONNECTIONS:

J6-HARD DISK DRIVE ACTIVITY LED CABLE

J4-DRIVE "C" CONNECTOR

J5-WINCHESTER DATA CABLE CONNECTOR (DRIVES "C" AND "D")

J1-FLOPPY DATA CABLE CONNECTOR

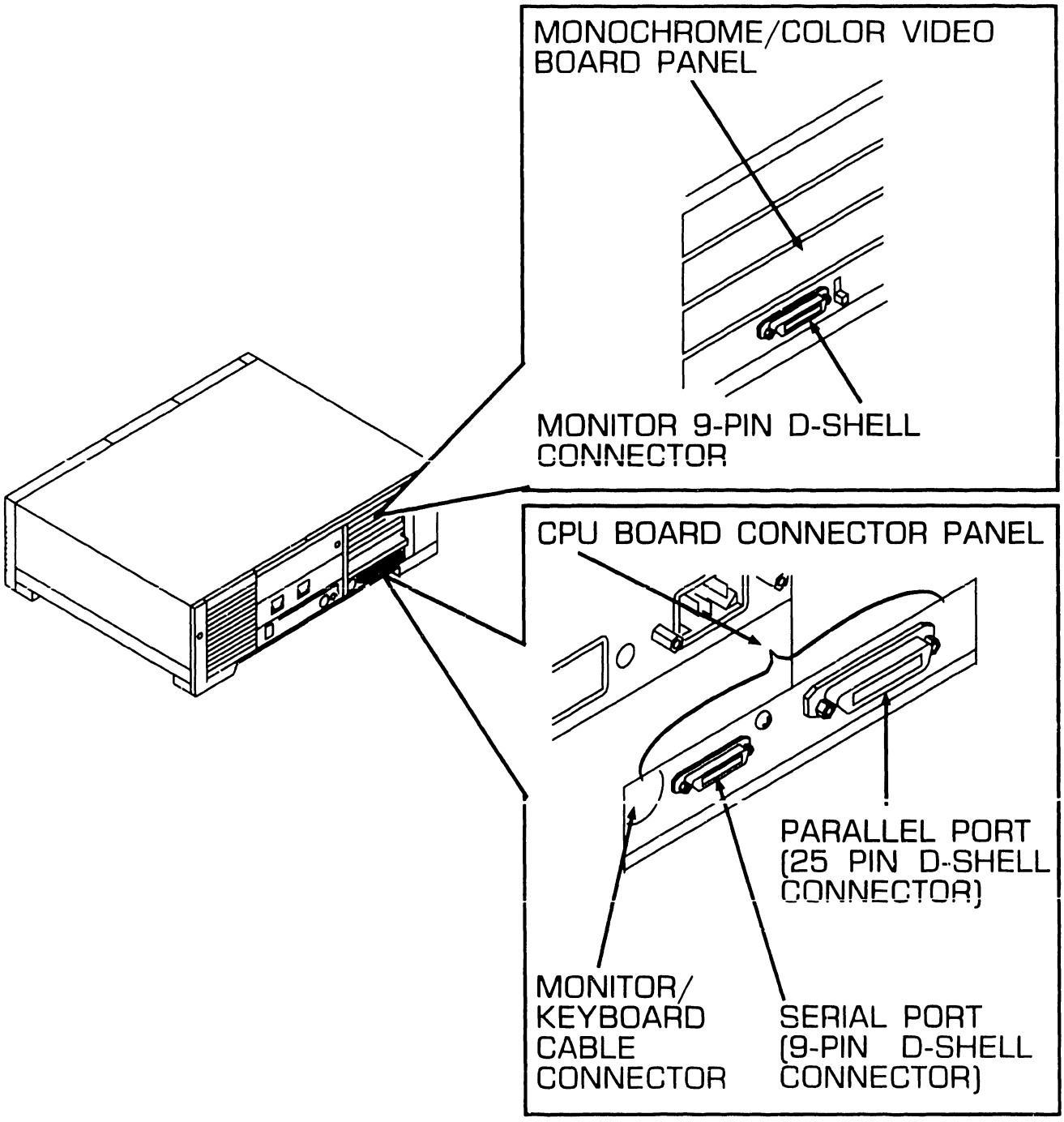


NOTE

PC 240-3 configuration is shipped with this J1 floppy diskette drive connection. For PC 240-3 Winchester upgrade see 9.4.2.

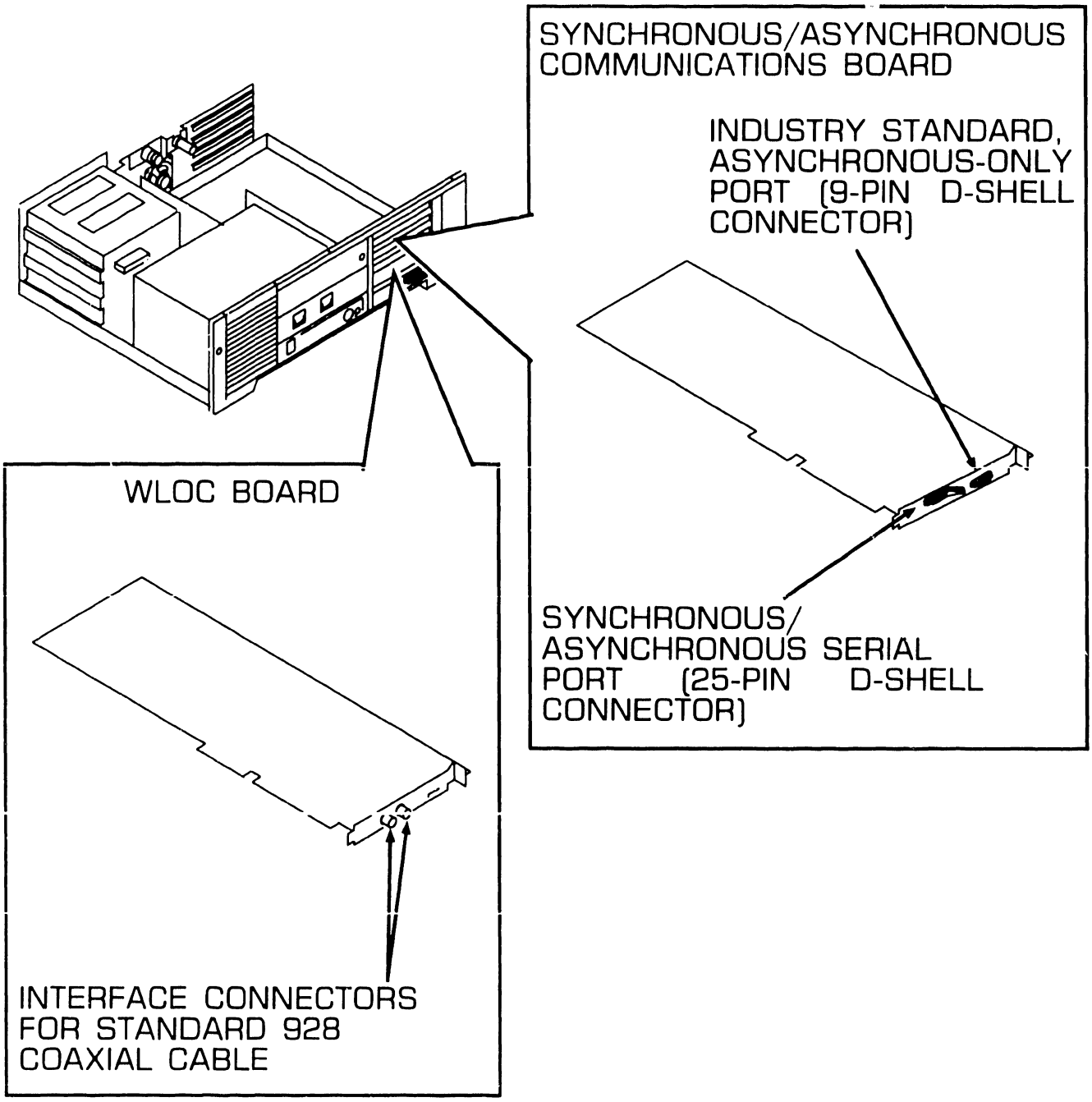
● END

9.4.4 Electronics Enclosure: I/O Connections (Sheet 1 of 2)



➡NEXT

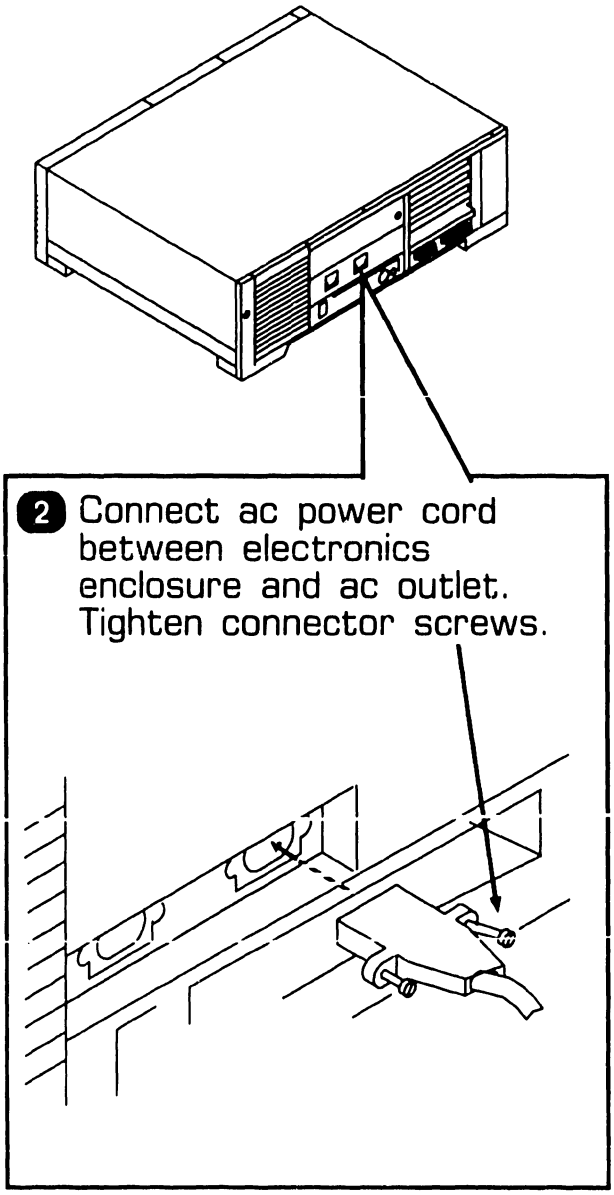
9.4.4 Electronics Enclosure: I/O Connections (Sheet 2 of 2)



● END

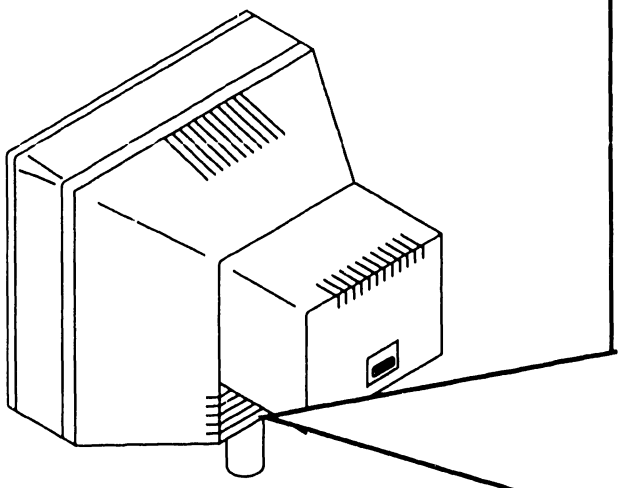
9.4.5 Electronics Enclosure: AC Power Connection

1. Set voltage selection switch to proper line voltage (➡9.3.1).

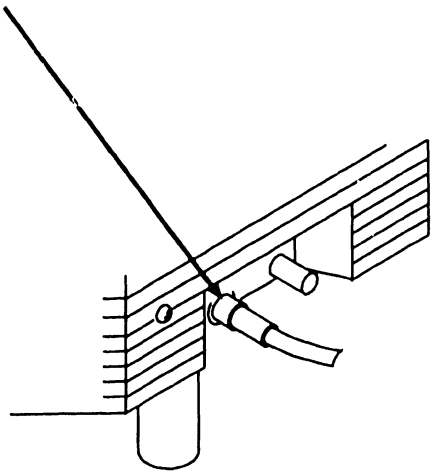


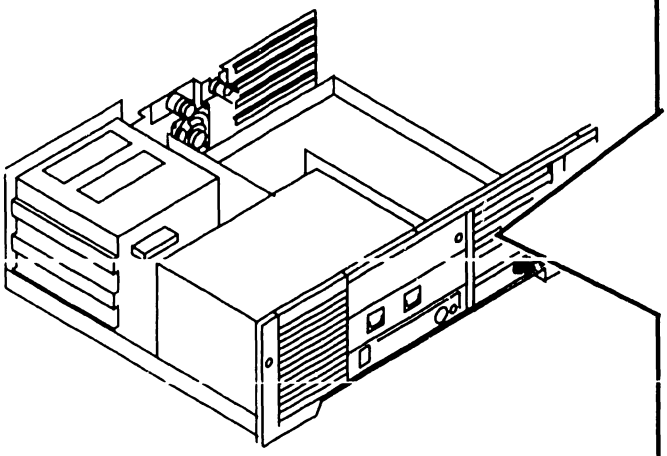
● END

9.4.6 Monochrome Monitor Connections

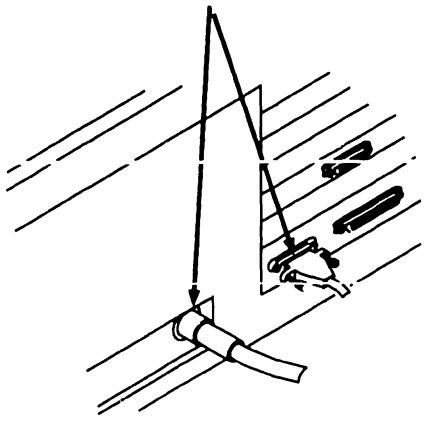


1 Connect keyboard cable to connector in rear of monitor.



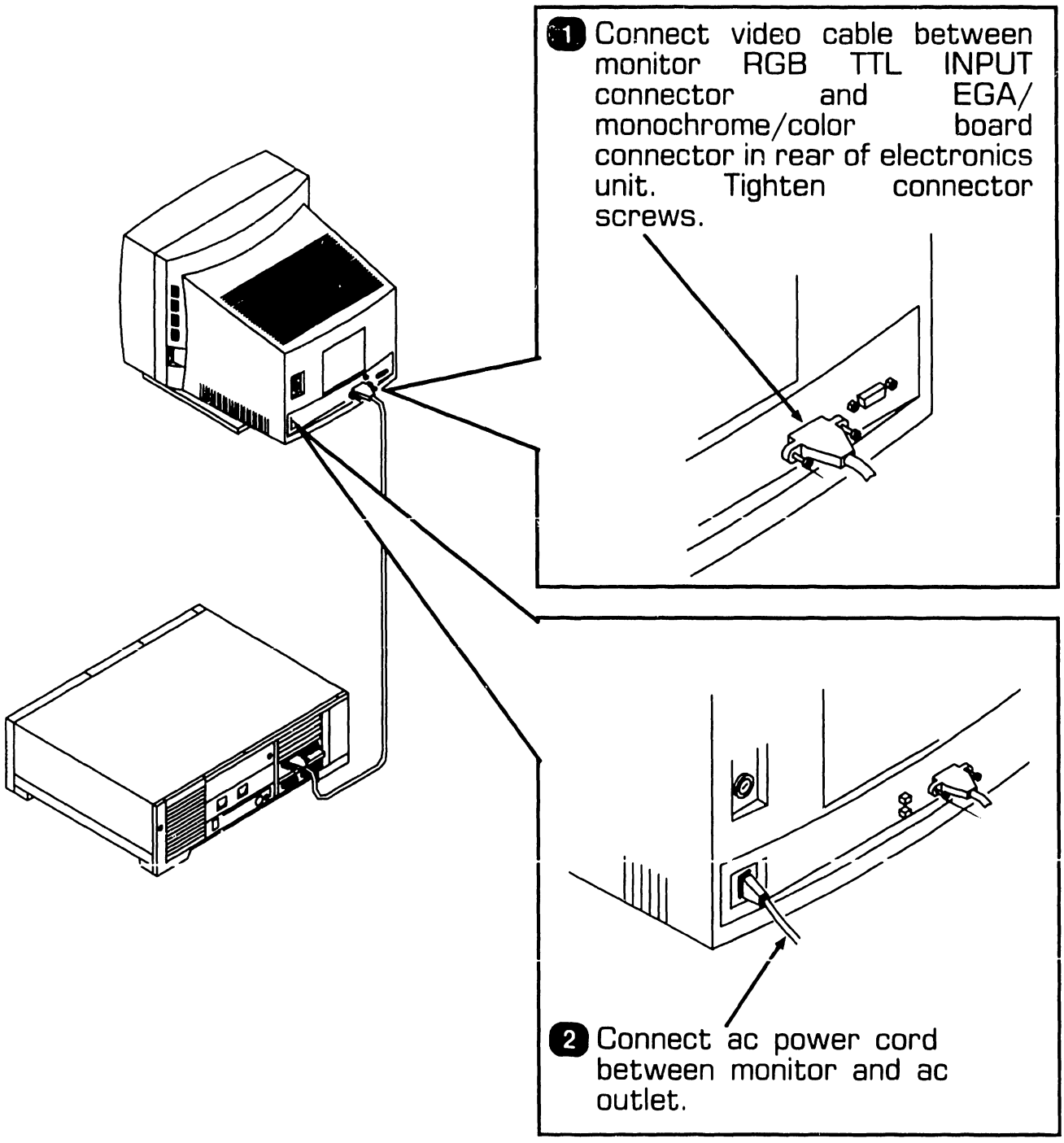


2 Connect monitor cables (2) to EGA/monochrome/color video and CPU board ports. Tighten D-shell connector screws.



● END

9.4.7 Color Monitor Connections

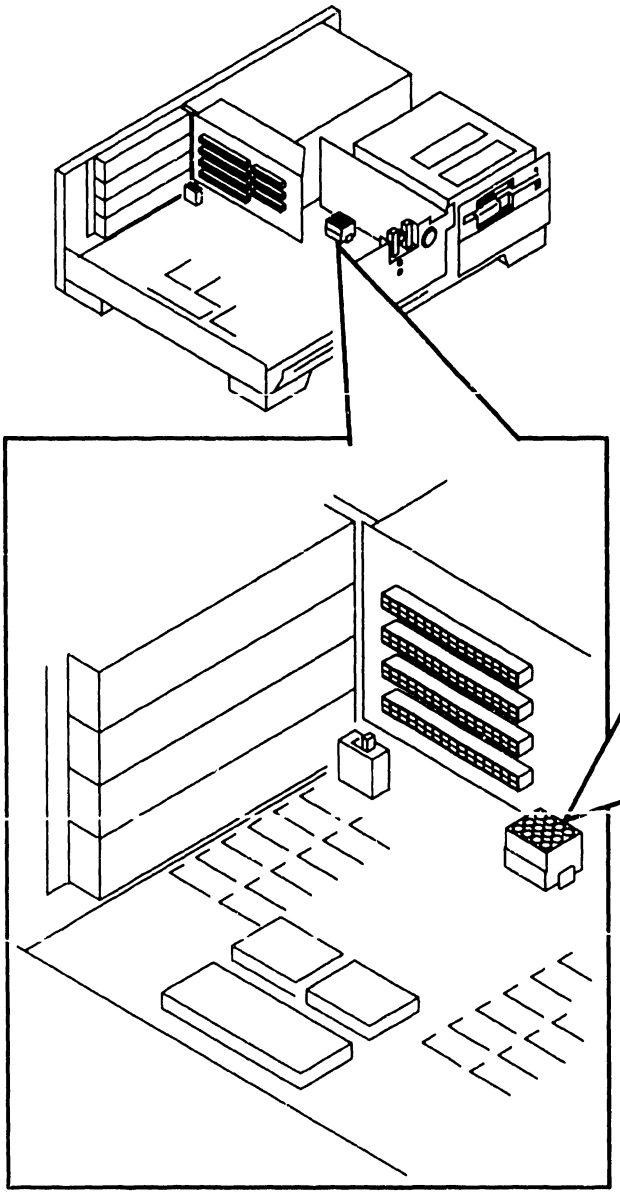


● END

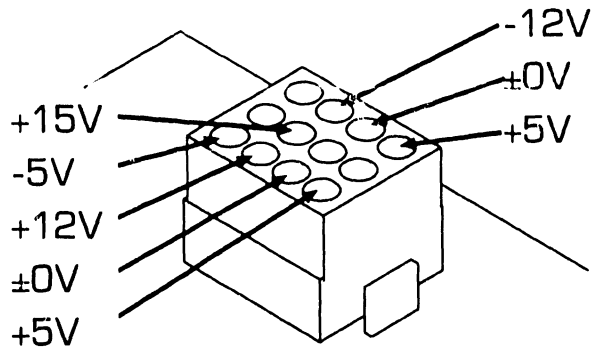
9.5 Voltage Checks

9.5.1 CPU Board: DC Voltage and Ripple Checks

1. Remove top/front cover (➡7.2.2).
2. Set electronics enclosure power-on/off button to ON position (➡3.1.1).



J7 CONNECTOR TEST POINTS



3. Connect common lead of DVM to ±0V test point on CPU board J7 connector.
4. Connect positive lead of DVM to -5V, -12V, +15V, +12V, +5V test on J7 connector and verify dc voltage limits.

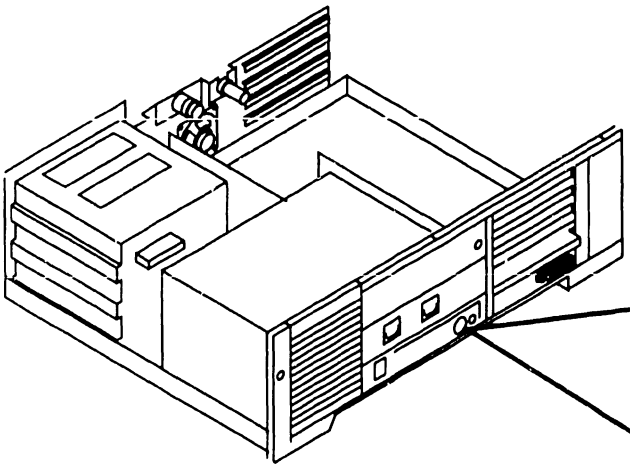
Test Point Voltage	*Limits (Vdc)*	
-5V	-4.75	-5.25
-12V	-11.4	-12.6
+15V	+14.4	+15.6
+12V	+11.4	+12.6
+5V	+4.75	+5.25

● END

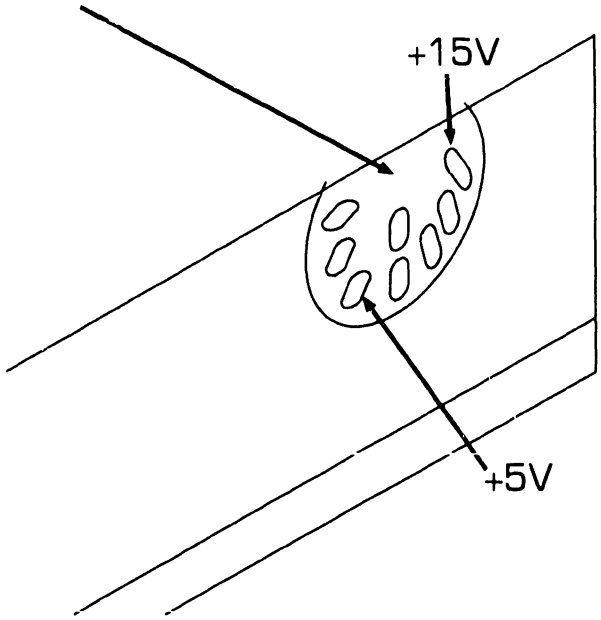
9.5 Voltage Checks

9.5.2 CPU Board Rear Panel: Monitor and Keyboard DC Voltage and Ripple Checks

1. Remove top/front cover (➡7.2.2).
2. Set electronics enclosure power-on/off button to ON position (➡3.1.1).
3. Connect common lead of DVM to ±0V test point on CPU board J7 connector (➡9.5.1).



J3 CONNECTOR ON CPU BOARD.



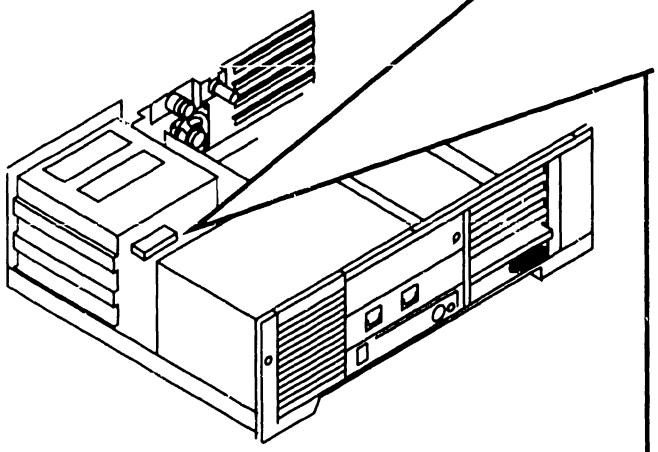
4. Connect positive lead of DVM to +5V, +15V test points on J3 connector on CPU board rear panel and verify dc voltage limits.

Test Point Voltage	*Limits (Vdc)*	
+5V	+4.75	+5.25
+15V	+14.4	+15.6

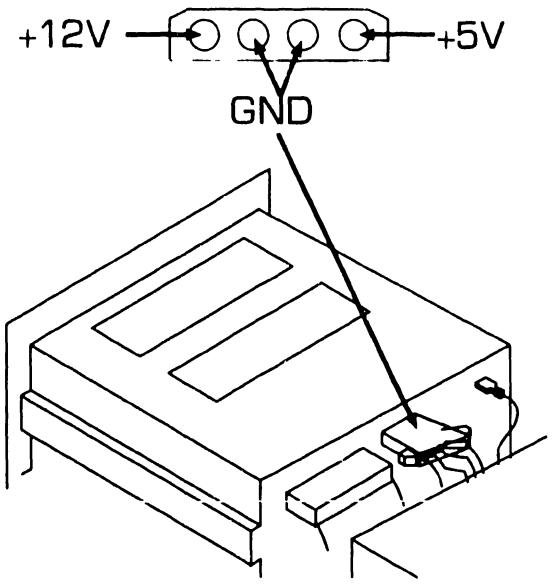
● END

9.5.3 Floppy Diskette Drive: DC Voltage and Ripple Checks

1. Remove top/front cover (➡7.2.2).
2. Disconnect power cable connector from floppy drive (➡7.2.4).
3. Set electronics enclosure power-on/off button to ON position (➡3.1.1).



POWER CABLE CONNECTOR



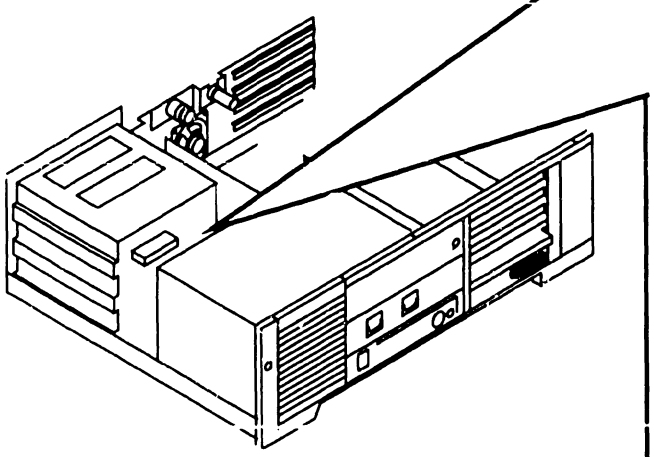
4. Connect common lead of DVM to one of ground test points on floppy diskette power cable connector.
5. Connect positive lead of DVM to +5V, +12V test points on floppy diskette power cable connector and verify dc voltage limits.

Test Point Voltage	*Limits (Vdc)*	
+5V	+4.75	+5.25
+12V	+11.4	+12.6

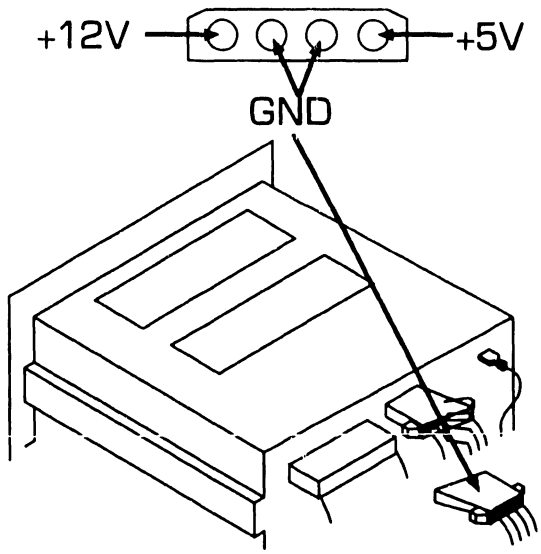
● END

9.5.4 Winchester Disk Drive: DC Voltage and Ripple Checks

1. Remove top/front cover (➡7.2.2).
2. Disconnect power cable connector from floppy drive (➡7.2.4).
3. Set electronics enclosure power-on/off button to ON position (➡3.1.1).



POWER CABLE CONNECTOR



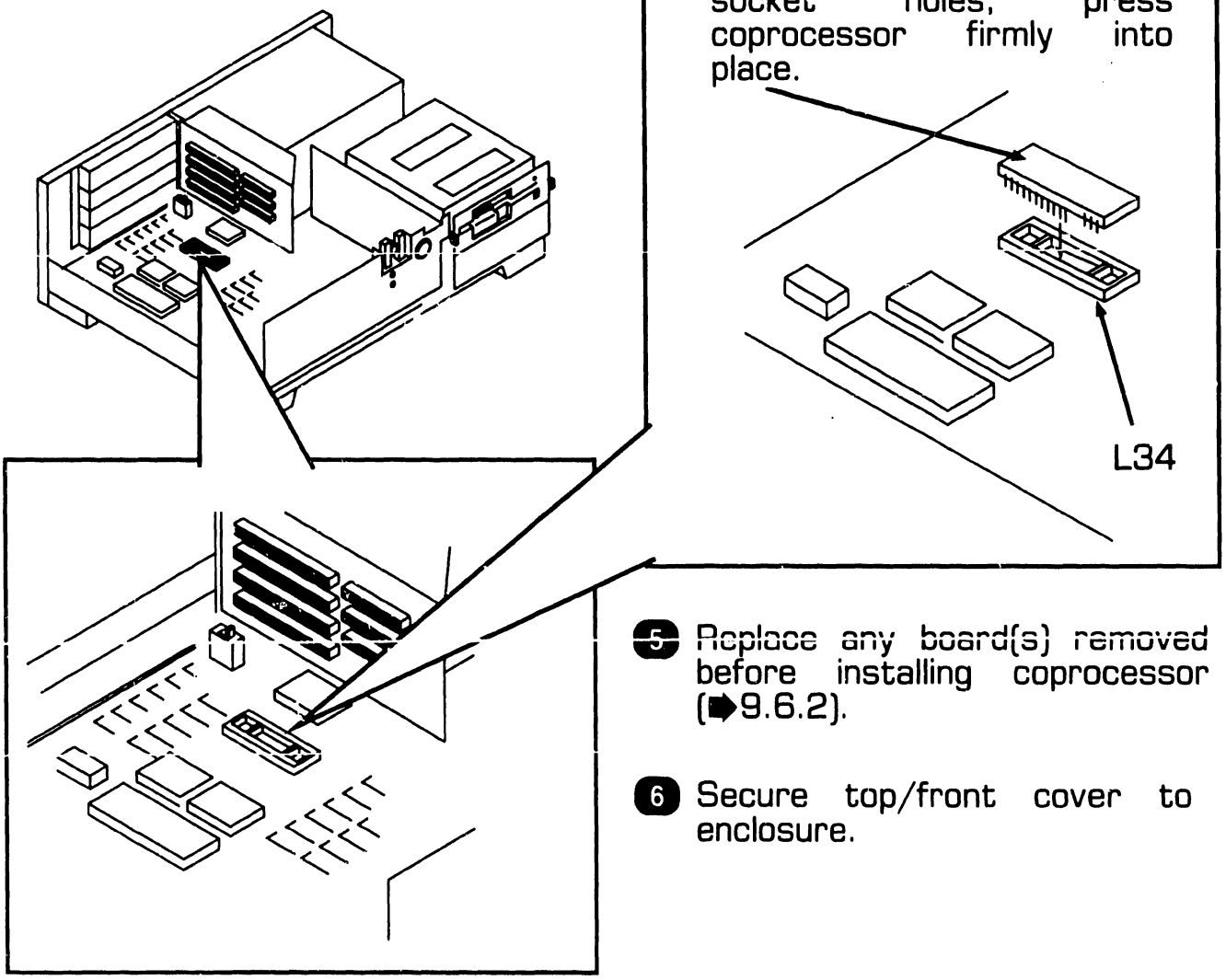
4. Connect common lead of DVM to one of ground test points on floppy diskette power cable connector.
5. Connect positive lead of DVM to +5V, +12V test points on floppy diskette power cable connector and verify dc voltage limits.

Test Point Voltage	*Limits (Vdc)*	
+5V	+4.75	+5.25
+12V	+11.4	+12.6

● END

9.6.1 80287 Coprocessor Installation

1. Remove top/front cover (➡7.2.2).
2. Remove any board(s) hindering access to CPU board socket L34 (➡7.2.3).
3. Position coprocessor over L34 socket; align coprocessor notch with socket notch.
4. Align coprocessor pins with socket holes; press coprocessor firmly into place.

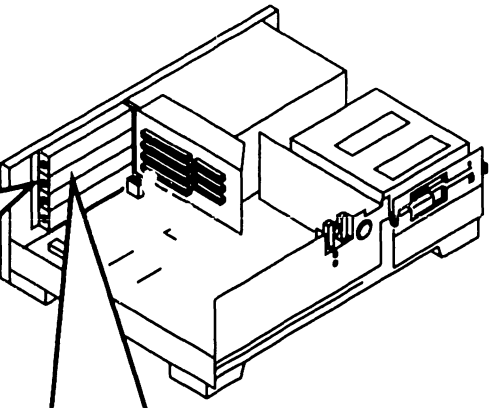


5. Replace any board(s) removed before installing coprocessor (➡9.6.2).
6. Secure top/front cover to enclosure.

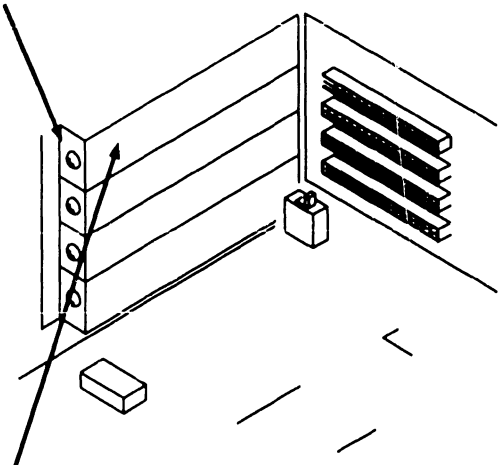
● END

9.6.2 Option Board Installation

1. Remove top/front cover (➡7.2.2).

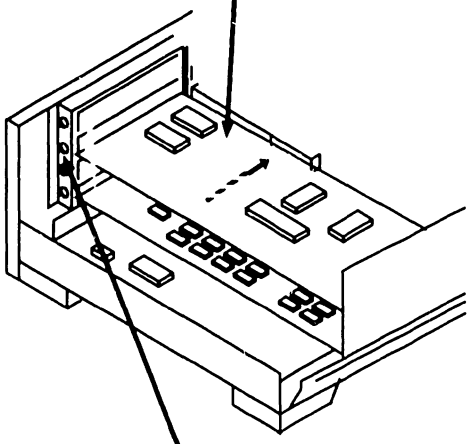


2. Remove screw that secures fastening/access plate to enclosure.



3. Lift fastening/access plate out of slot.

4. Slide option boards between card guides on inside of enclosure and into option bus board sockets.



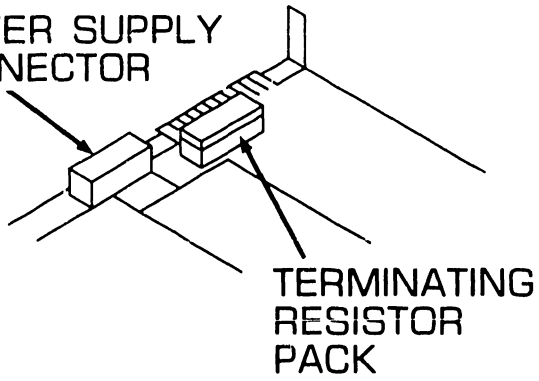
5. Replace screw that secures option board to enclosure.

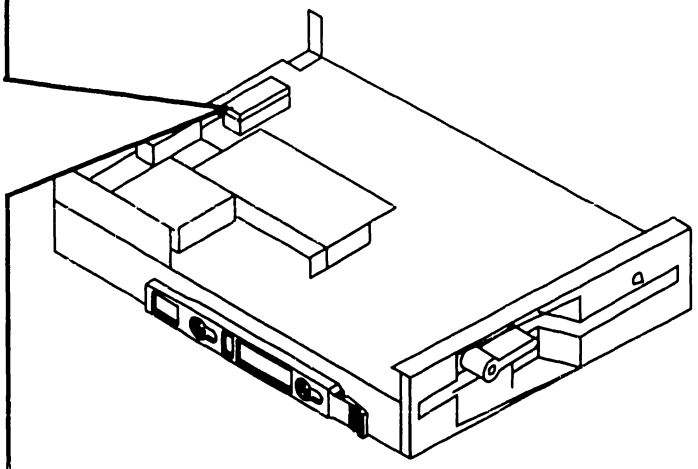
6. Connect cables (if applicable).

● END

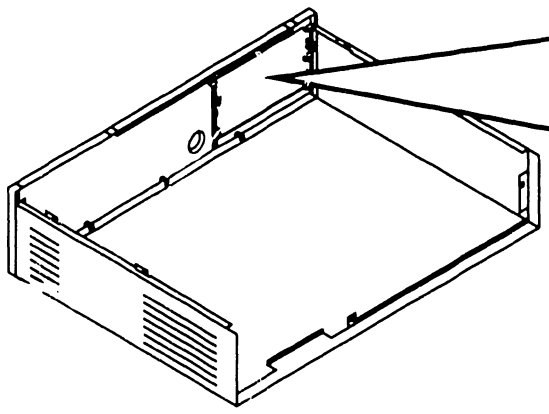
9.6.3 Floppy Diskette Drive "B" Installation (Sheet 1 of 4)

1 Remove terminating resistor pack from 360 KB Floppy drive. (The 720 KB Floppy drive does not have a terminating resistor pack.)

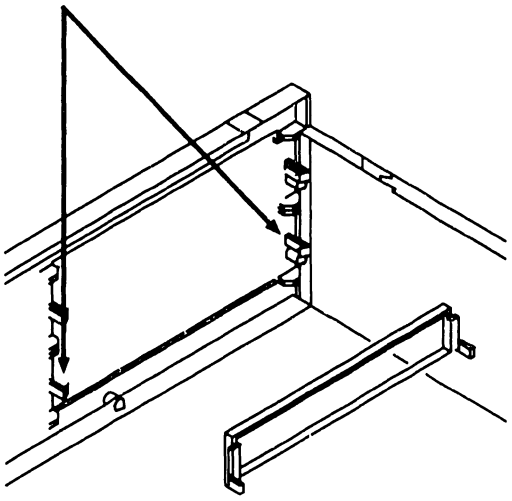




2 Remove top/front cover (➡7.2.2).

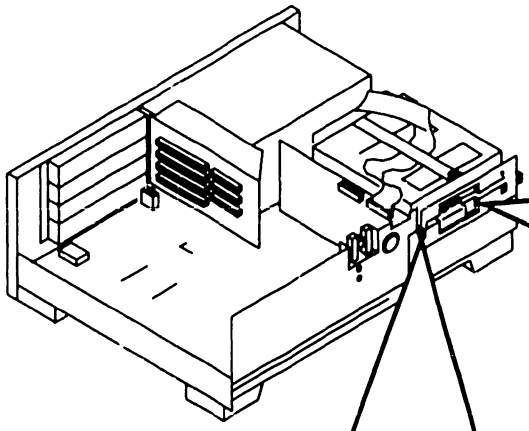


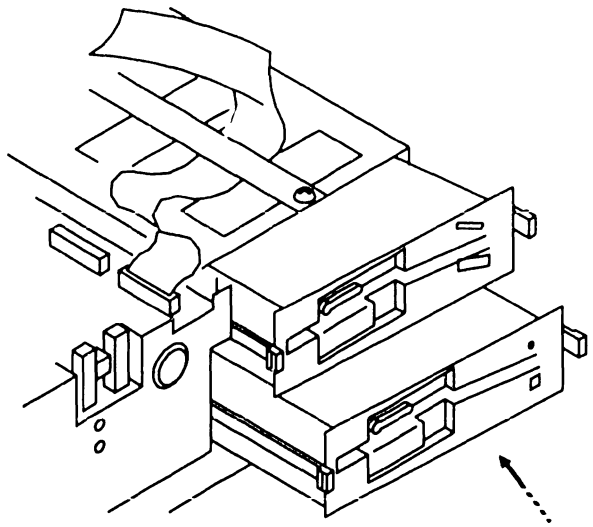
3 If applicable remove drive "B" plastic cover plate by pushing outward on tabs that secure plate to top/front cover.



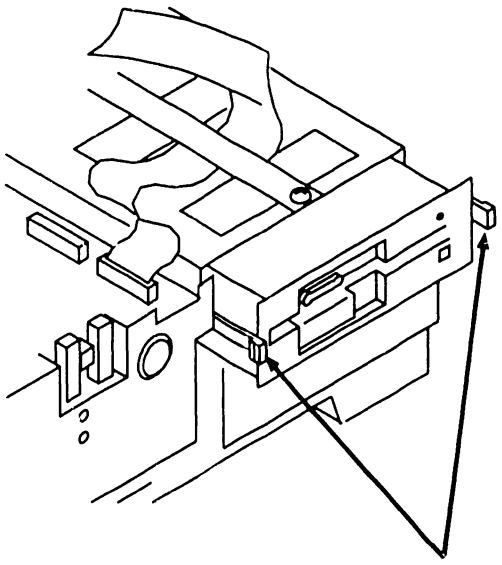
➡NEXT

9.6.3 Floppy Diskette Drive "B" Installation (Sheet 2 of 4)





5 Partially slide optional floppy drive into "B" of enclosure.

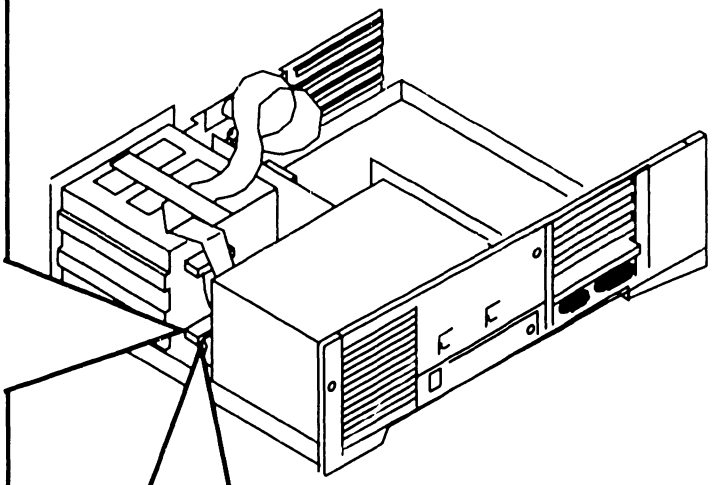


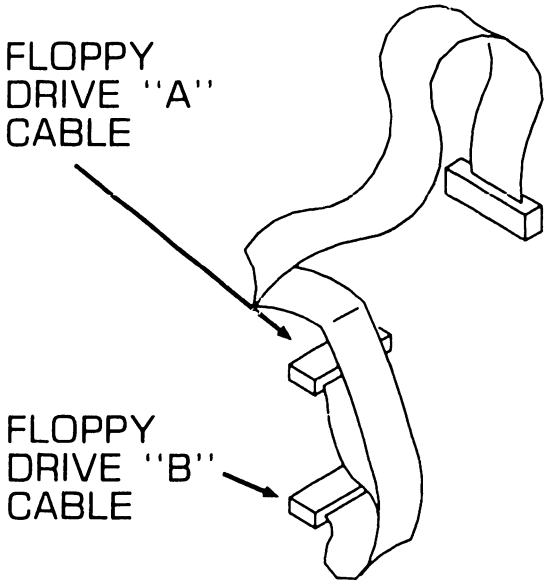
4 Press in on floppy drive "A" guide rails; pull drive "A" slightly forward.

➡NEXT

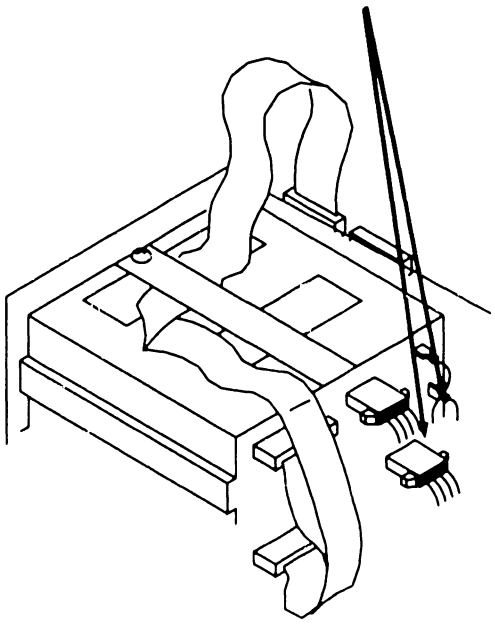
9.6.3 Floppy Diskette Drive "B" Installation (Sheet 3 of 4)

6 Locate the connector for floppy drive "B". (The drive cable is pre-installed and the connector is keyed to avoid improper connection of the cable.) Connect the cable to floppy drive "B".





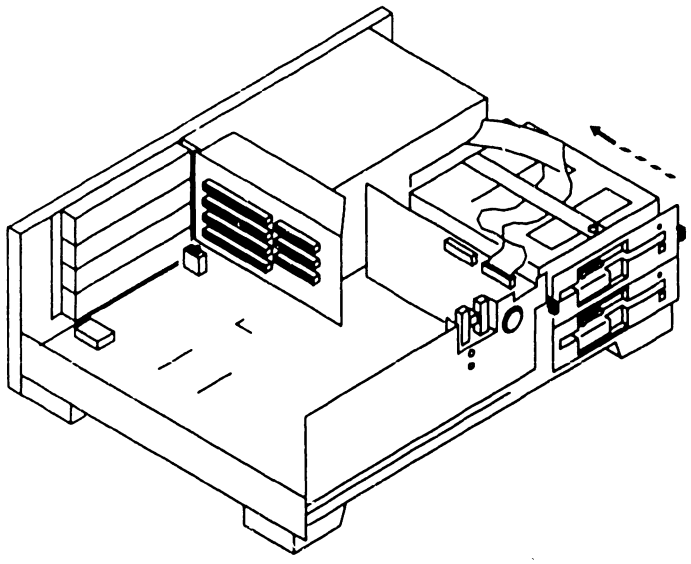
7 Connect power supply cable and grounding strap to floppy drive "B".



➡NEXT

9.6.3 Floppy Diskette Drive "B" Installation (Sheet 4 of 4)

8 Completely slide floppy drives "A" and "B" into enclosure.



9 Secure top/front cover to electronics enclosure.

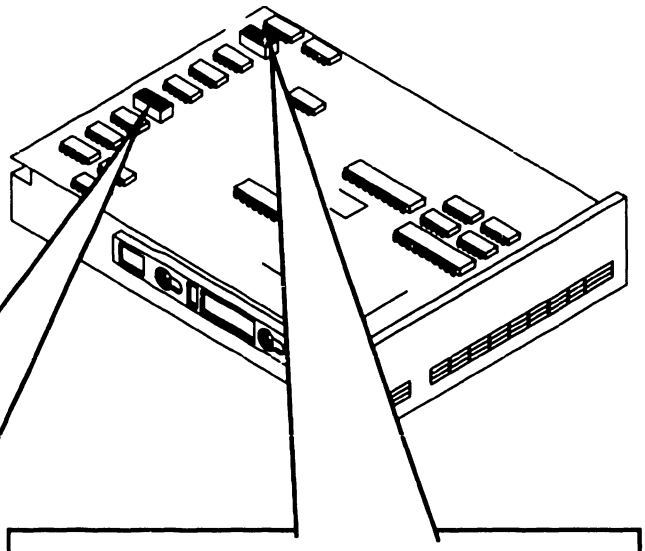
● END

9.6 Installing Options

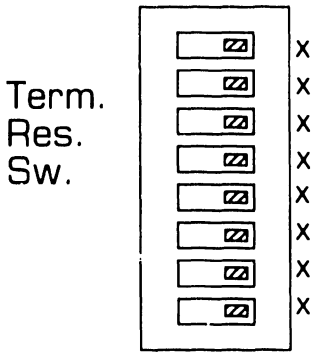
9.6.4 Half-Height Winchester Drive "C" Upgrade Installation (Sheet 1 of 4)

NOTE

The PC 240-3 Winchester upgrade consists of installing the Winchester/Floppy Controller board and two cables as well as setting SW1 to control only the Winchester drive. The floppy drive remains connected to the Floppy-Only Controller board at J1.



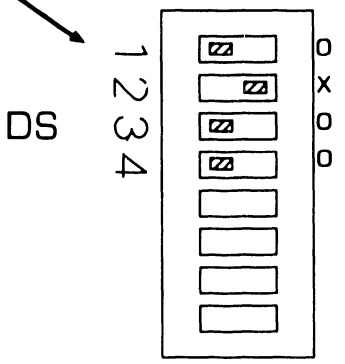
1 Place the drive bottom side up.



■ = Switch Position
o = Contacts Open
x = Contacts Closed

2 Set terminating resistor switches to "x" position. (If terminating resistor pack is used instead of switch bank, make sure the pack is installed.)

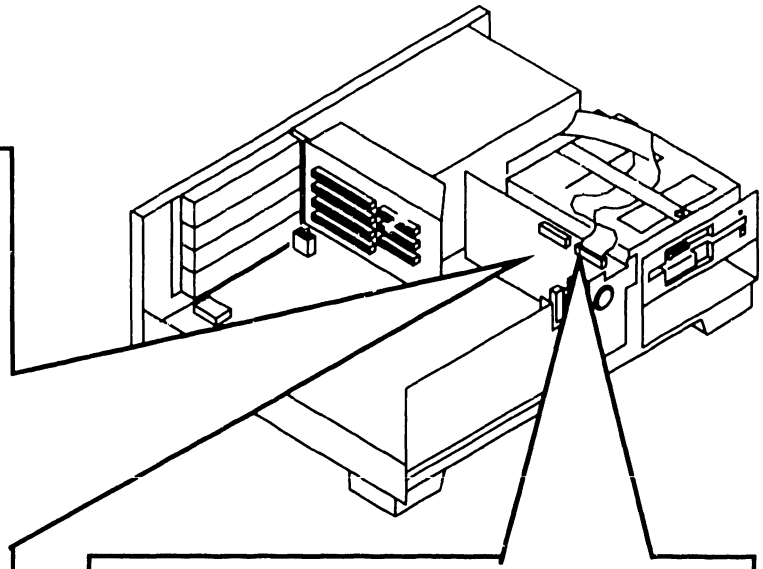
3 Set drive select (DS) switch to DS2. All other switches on DS bank should be OPEN. (Some drives will have a jumper pack instead of a switch. Set jumper to DS2.)



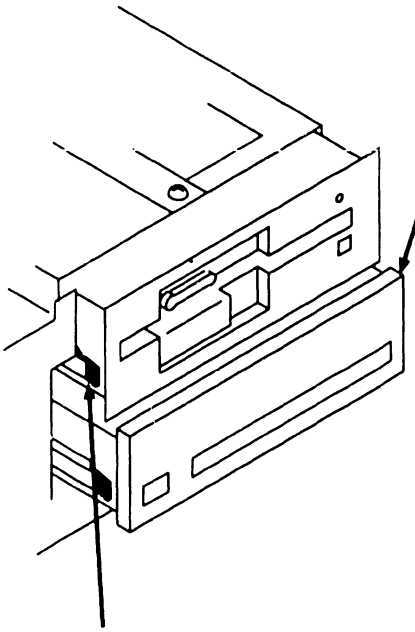
➡NEXT

9.6.4 Half-Height Winchester Drive "C" Upgrade Installation (Sheet 2 of 4)

4 Remove top/front cover (➡7.2.2).

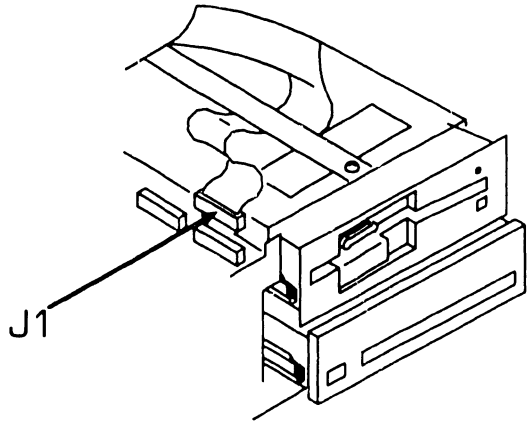


5 With circuit board side of drive on the underside, partially slide drive into location "C".



6 Press in on floppy drive "A" guide rails; pull floppy drive "A" slightly forward.

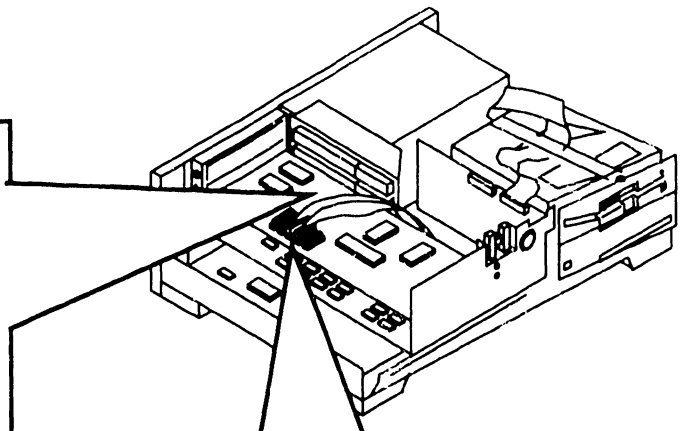
7 Disconnect cable at J1 on the Floppy-Only Controller board and remove Floppy-Only Controller board (➡7.2.3 steps 7 and 8). (This allows cables to lie flat against the CPU board.)



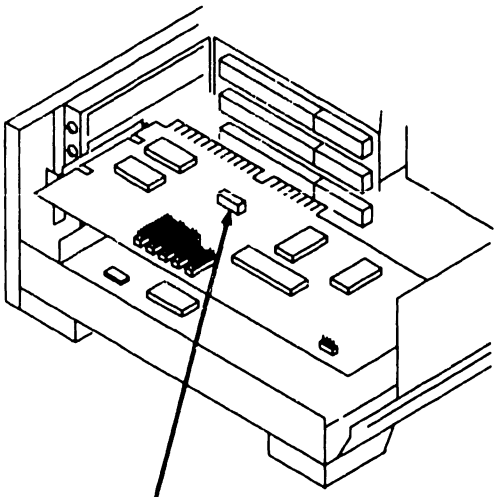
➡NEXT

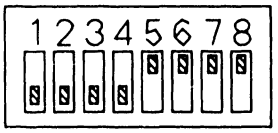
9.6.4 Half-Height Winchester Drive "C" Upgrade Installation (Sheet 3 of 4)

8 Install the Winchester/Floppy Controller board into option bus board slot (➡9.6.2).



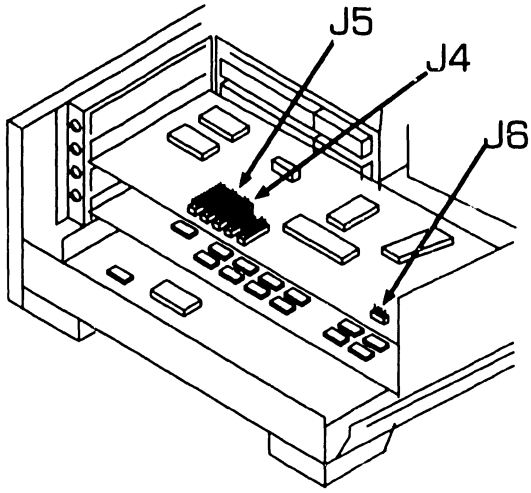
9 Set SW1 on Winchester/ Floppy Controller board for "Winchester Only".





S = Switch Position
o = Contacts Open
x = Contacts Closed

10 Connect drive "C" cables (220-3603 and 220-3604) to J4 and J5 on the Winchester/ Floppy Coantroller board.

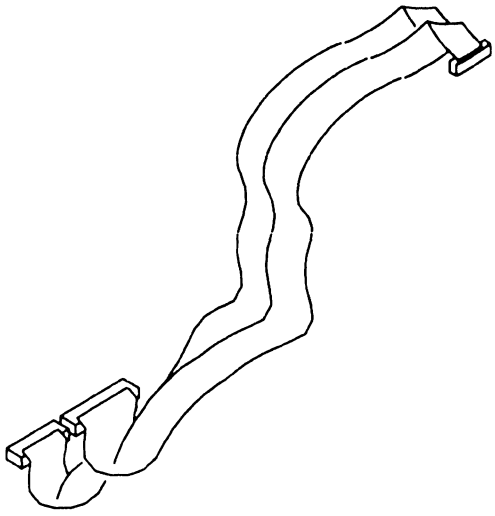


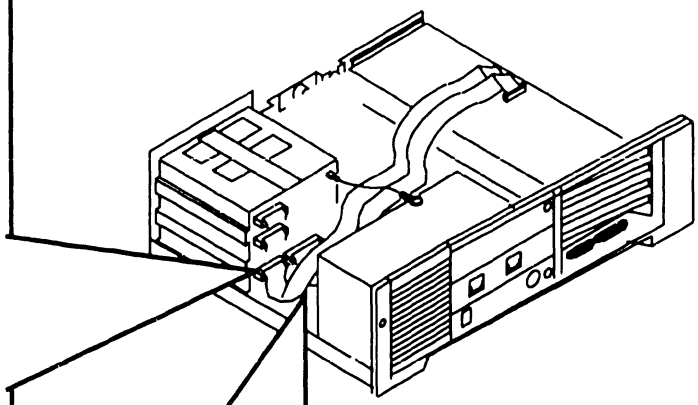
11 Connect hard disk select LED cable to J6 on the Winchester/Floppy Controller board.

➡NEXT

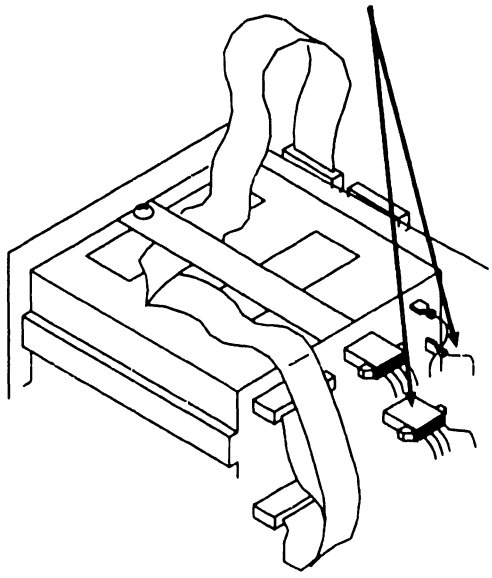
9.6.4 Half-Height Winchester Drive "C" Upgrade Installation (Sheet 4 of 4)

12 Fold cables (220-3603 and 220-3604) to lie flat and route them across CPU board and into connectors at rear of drive.





13 Connect power cable and grounding strap to drive "C".



14 Reinstall Floppy-Only Controller board and reconnect cable at J1. (Reverse task outlined in step 7.)

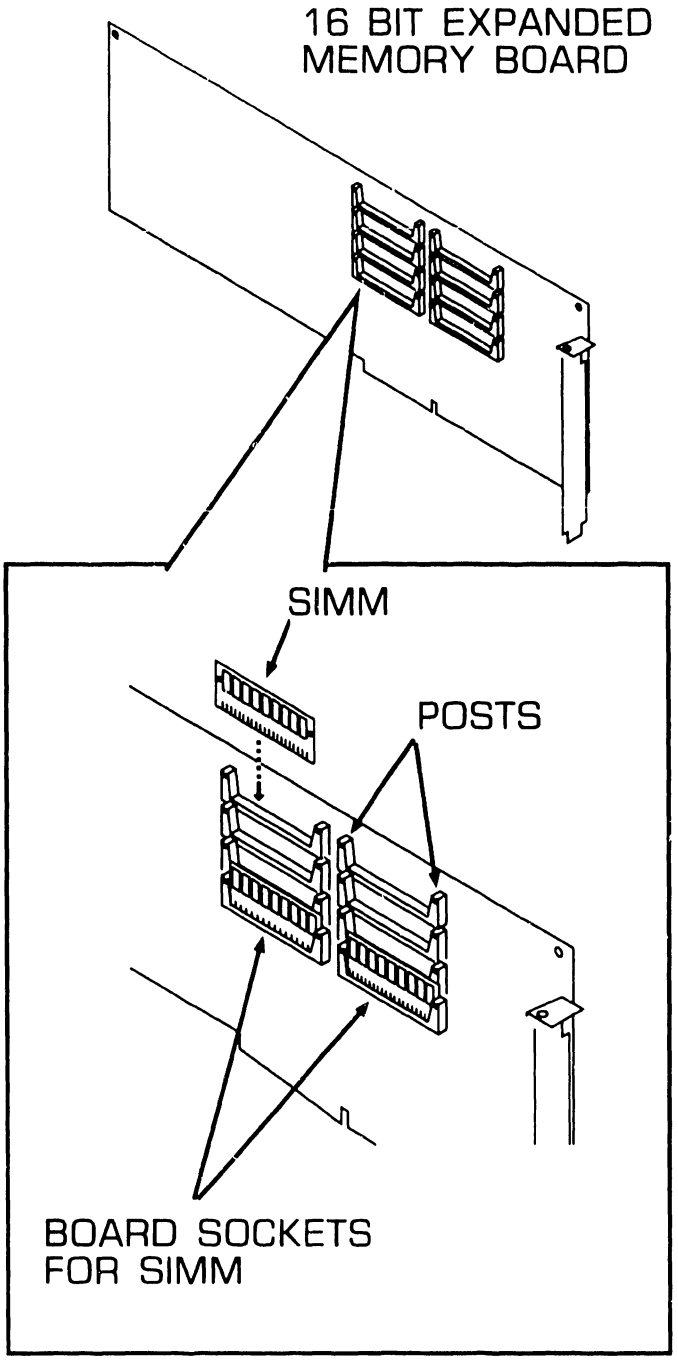
● END

9.6.5 Installing Single In-Line Memory Module (SIMM)

CAUTION

SIMMs are sensitive to static electricity. Handle carefully and do not touch component side of the SIMM.

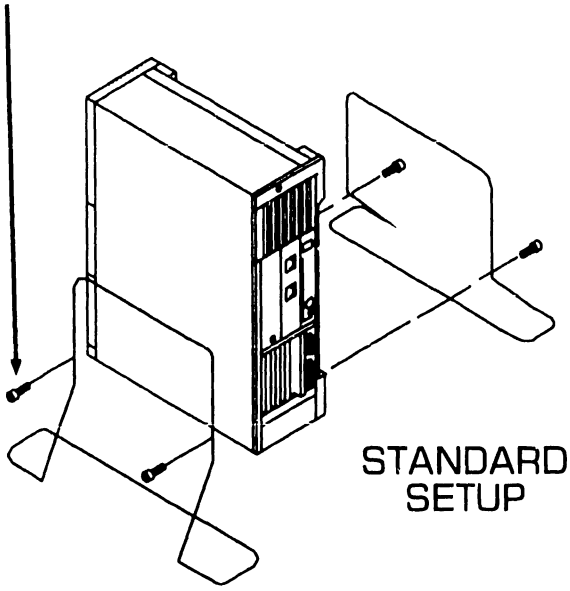
1. Position SIMM above appropriate socket on expanded memory board.
2. Insert SIMM into board socket; connectors on bottom of SIMM must be aligned with pins on board socket. Apply light pressure to top of SIMM.
3. Align holes in corners of SIMM with the two posts on either side of board socket. Press on edges of SIMM and rotate it backwards into socket. Board socket latches should snap over SIMM.



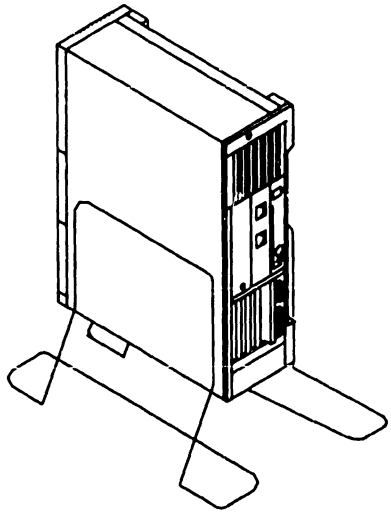
● END

9.6.6 Floor Stand Installation

1. Use Allen wrench to assemble floor stand to the side frame supports.

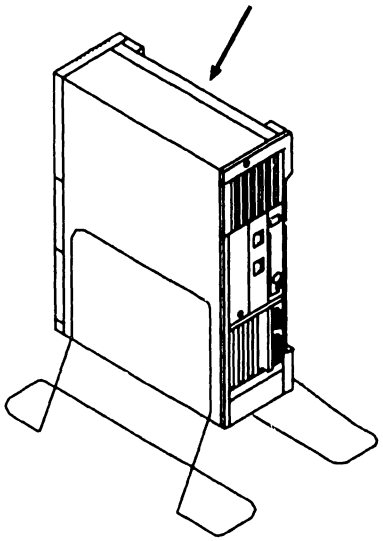


STANDARD SETUP



SETUP FOR AGAINST THE WALL

2. Place electronics unit in vertical position and slide between sides of floor stand.



● END

9.7.1 INSTALL Program: Description

The INSTALL program consists of four utilities: SETUP, HDINIT (Winchester or hard disk initialization), FDISK (Winchester partition), and FORMAT (partition format). These utilities are executed from a file on system diskette 1.

SETUP is a software program that identifies the options installed on the system, the amount of memory available, and the date/time. The information is then stored in battery-backed memory. This utility must be executed after all internal and external options have been configured. If the CPU board or lithium battery is replaced, or if any new options are added, SETUP must be run again.

The HDINIT (Winchester initialization) utility formats the hard disk drive and detects and marks any defective tracks on the disk.

The FDISK (Winchester partition) utility creates the largest MS-DOS partition acceptable on the hard disk drive (operating system will recognize a disk partition of up to 32MB).

The FORMAT (partition format) program sets up an MS-DOS boot sector in the partition created by FDISK. FORMAT also prepares the partition to accept files by setting up a file allocation table (FAT) and root directory.

● END

9.7.2 Preparing Winchester Drive

CAUTION

Preparing Winchester drive results in destruction of all data already present on hard disk.

1. Run "HDINIT" utility.*
2. Run "FDISK" utility.
3. Run "FORMAT" utility.
4. Type "SYSC:" to copy system files to Winchester.
5. Copy files from system diskettes to Winchester drive.

* Executing "HDINIT" utility can take 2 to 4 hours.

● END

SECTION 10 FUNCTIONAL DESCRIPTION

SECTION 10 CONTENTS

SECTION 10

FUNCTIONAL DESCRIPTION

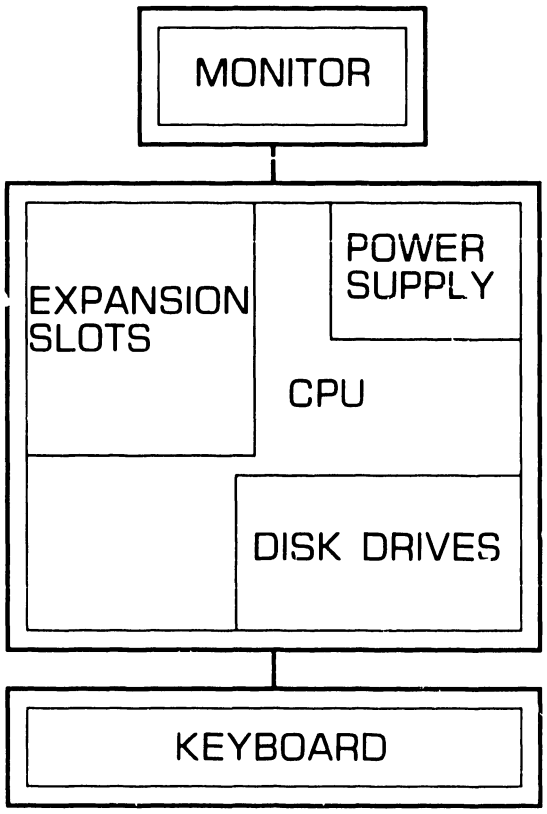
10 FUNCTIONAL DESCRIPTION

10.1 Introduction

This section discusses functional description for the PC 240 computer system at a block level. It is intended to supply Wang-trained Customer Engineers with information necessary to obtain a basic understanding of system operation.

The PC 240's modular design allows for ease of expansion. The system unit contains most of the electronics that make the system work. It consists of the CPU PCA, disk drive(s), expansion slots, and power supply.

The Keyboard allows the user to communicate with the CPU PCA. In addition, the system uses the keyboard's speaker to signal the usr when a valid or invalid key is pressed. The monitor is the primary means by which the system communicates visually with the user. Monitors are either monochrome or color, and support a variety of applications, depending on such variables as monitor resolution, video controller type and application program. The PC 240 also provides the user with built-in parallel (printer) and serial ports. These ports support a wide range of peripherals including printers, tape drives, pointing devices, etc.



● END

10.2 Bus Structure

The PC 240 functional block diagram (10.2.1) shows how system components are interconnected. Of greatest importance is the System Bus because it allows the CPU PCB to communicate with the expansion slots; i.e., Monochrome/Color Video Controller PCA and Winchester/ Floppy Disk Controller etc. Other connections allow the keyboard, and the serial and parallel ports to communicate with the CPU PCA.

The PC 240 bus structure is virtually the same as the IBM PC-AT bus. It is composed of 62 separate lines (the same as the original IBM-PC) plus an additional 36 separate lines.

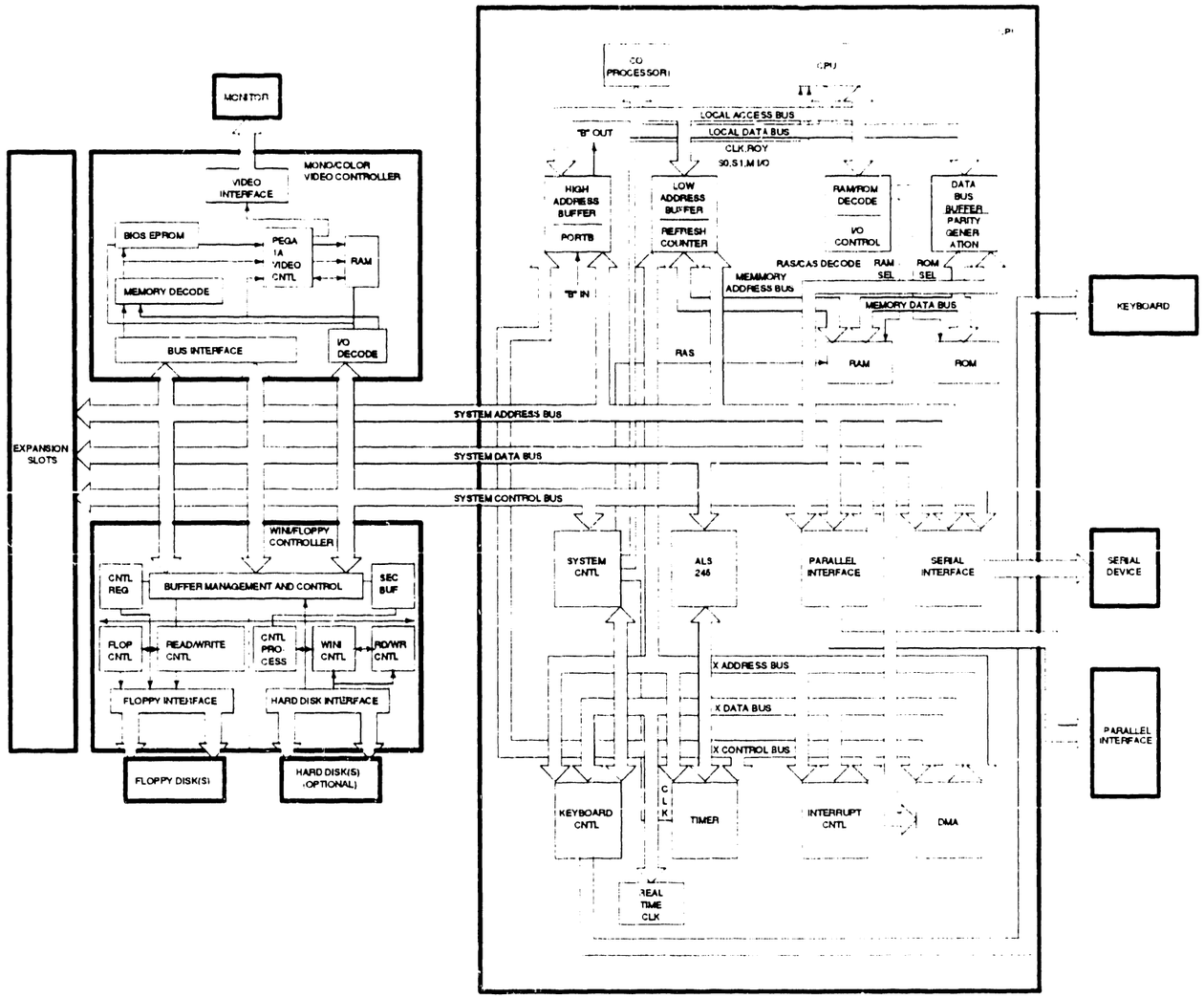
The 62 lines (A1- 31, B1-31) consist of five power lines, three ground lines, twenty address lines, eight data lines and 26 control lines. Address lines are used in two modes; as a memory address and as a port address. An address is placed on the address bus and then data is placed on the data bus. The data bus is used to pass data between system devices. Control lines perform specific functions; i. e., to indicate bus status, to indicate activity on a serial port, to signal a DMA Request Acknowledge (DACK) or to signal an Interrupt Request (IRQ).

The additional 36 lines (C1-18, D1-18), which make the PC 240 bus IBM PC-AT-compatible consist of eight address lines, eight data lines and twenty control lines.

● END

10.2 FUNCTIONAL DESCRIPTION
Bus Structure

10.2.1 Functional Block Diagram



● END

FUNCTIONAL DESCRIPTION

10.3 I/O Mapping (Sheet 1 of 4)

Every device which communicates with the CPU PCA is assigned an I/O "port" address block. Types of devices that are assigned I/O port addresses include individual chips as well as PCAs.

The address blocks (defined in the I/O address map) represent "ports" in which parameter and status information associated with I/O operations for various system devices is stored. The I/O port address area consists of addresses 000-3FF. Depending on device requirements, an address block "I/O port" may range in size from two bytes to 32 bytes. I/O ports located in the first 256 bytes of the I/O address RAM (locations 000 - 0FF) are dedicated to the standard system elements indicated; their addresses and lengths are fixed. I/O ports located in the 100 - 3FF address range are fixed for certain devices; other devices are assigned I/O addresses by switch or jumper settings.

I/O address conflicts will result if two active I/O devices attempt to access the same I/O address.

To minimize the possibility of I/O conflicts, primary or "default" I/O address switch and jumper settings have been established for the PC-240. The defaults represent standard settings that should always be used unless a combination of option boards results in a conflict. If a conflict occurs, the I/O address of one of the conflicting devices must be reconfigured to an alternate or secondary setting. Consult the Input/Output Map below when an I/O address conflict is suspected.

➡NEXT

10.3 FUNCTIONAL DESCRIPTION
I/O Mapping (Sheet 2 of 4)

Address	*Device*
000 - 01F	DMA Controller 1
020 - 03F	Interrupt Controller 1
040 - 05F	Timer
060 - 06F	8042 Keyboard
070 - 07F	Real time clock, NMI mask
080 - 09F	DMA page register
0A0 - 0BF	Interrupt Controller 2
0C0 - 0DF	DMA controller 2
0F0 - 0FF	Math coprocessor
100 - 16F	FREE
170 - 177	Fixed disk secondary address
178 - 1EF	FREE
1F0 - 1F7 *	Fixed disk primary address
1F8 - 1FF	FREE
200 - 207	Game I/O
208 - 21F	FREE
220 - 221	Sync./async. option 6th address (port "A")
222 - 223	WLOC 6th address
224 - 22F	Expanded memory board 6th address
230 - 23F	FREE
240 - 241	Sync./async. option 5th address (port "A")
242 - 243	WLOC option 5th address
244 - 24F	Expanded memory memory board 5th address
250 - 277	Free

➡NEXT

10 FUNCTIONAL DESCRIPTION
10.3 I/O Mapping (Sheet 3 of 4)

Address	*Device*
278 - 27F	Parallel printer port 2
280 - 281	Sync./async. option 4th address (port "A")
282 - 283	WLOC option 4th address
284 - 28F	Expanded memory board 4th address
290 - 29F	FREE
2A0 - 2A1	Sync./async. option 3rd address (port "A")
2A2 - 2A3	WLOC option 3rd address
2A4 - 2AF	Expanded memory board 3rd address
2B0 - 2F7	FREE
2F8 - 2FF*	Serial port 2 (sync./async. option)
300 - 31B	Prototype board
31C - 31F *	FREE
320 - 321	WLOC option 2nd address
322 - 323	Sync./async. option 2nd address (port "A")
324 - 32F	Expanded memory board 2nd address
330 - 33F	FREE
340 - 341 *	Sync./async. option 1st address (port "A")
342 - 343 *	WLOC option 1st address
344 - 34F *	Expanded memory board 1st address
350 - 35F	FREE
360 - 36F	Reserved

* Default I/O Address

➡NEXT

Address	*Device*
370 - 377	Diskette controller secondary address
378 - 37F*	Parallel printer port 1
380 - 38F	SDLC, bisynchronous 2
390 - 39F	FREE
3A0 - 3AF	Bisynchronous 1
3B0 - 3BF*	Monochrome display and printer adapter
3C0 - 3CF	Reserved
3D0 - 3DF*	Color/graphics monitor adapter
3E0 - 3EF	FREE
3F0 - 3F7*	Diskette controller primary address
3F8 - 3FF*	Serial port 1

* Default I/O Address

● END

10.4.1 Overview

The CPU PCA utilizes an 80286 microprocessor, an optional 80287 co-processor, two 4-channel 8237-5 DMA controllers, two 8259A interrupt controller chips, an 8254 timer chip, and five LSI chips (supplied by CHIPS and Technologies, Inc.) which provide most of the circuitry required for IBM AT compatibility. The CPU board also incorporates a 723 serial keyboard interface utilizing an 8042 microcontroller.

The board supports seven channels of DMA, sixteen levels of interrupts (all or any of which may be masked), three programmable timers, 64 KB ROM (expandable to 128 KB), 640 KB of on-board DRAM, a battery-backed real-time clock, on-board serial and parallel ports, and five I/O option slots (three standard IBM 16-bit slots, one standard IBM 8-bit slot, and one special 8-bit slot for Wang Floppy-Only Controller board). The 16-bit slots have 62- and 36-pin bus connectors and the 8-bit slots only have 62-pin bus connectors. 16-bit slots support PC and PC-AT type boards while the IBM standard 8-bit slots only support PC type boards.

Option boards use DMA Request signals along with the Master signal to gain control of the System Bus.

Three switch banks (SW1, J12, J13) are pre-set to minimize the possibility of I/O addressing conflicts.

SW1 defines the type of monitor, monochrome or color, that is attached to the PC 240; however, the switch does not function if a EGA/Monochrome/Color Video Controller PCB is installed.

J12 defines the serial port on the rear of the unit as COM1 or COM2.

J13 defines the parallel (printer) port on the rear of the unit as LPT1 or LPT2.

● END

10.4.2 80286 Processor/80287 Coprocessor

The 80286 microprocessor can operate at 6, 8, or 10MHz; the speed is software selectable. The default speed is 6 MHz; however, most application programs take advantage of the 10 MHz speed. The 6 or 8 MHz speeds are only used when the application program, i.e., a floppy disk protection program, requires one of them. The 80286 executes a superset of 86/88 instructions. The 80286 has built-in memory protection that supports operating system and task isolation as well as task privacy within programs. The 80286 can operate in either the real mode or the protected mode. In real mode, the 80286 acts like an 8086, only faster, so it is compatible with programs that run on an IBM PC. Physical memory can be up to 1 MB in 64 KB segments. In protected mode, the 80286 exhibits additional features which increase the reliability and number of programs the computer can work on at one time. These features include extended memory, virtual memory and multi-tasking. Extended memory allows up to 16MB of memory to be installed in the computer. Virtual memory allows the computer to give each program up to 1GB of memory to work with. Multi-tasking allows the computer to appear as though it is working on more than one program at a time.

The 80287 is an optional numeric math coprocessor which operates in parallel with the 80286. It extends the math capabilities of the 80286 to include floating point, extended integer and BCD operations. In all, the 80287 adds a total of over 50 instructions to the 80286's instruction set.

● END

10.4.3 Interrupt Control (Sheet 1 of 3)

The PC 240 can be considered as being an interrupt-driven machine because interrupts are used to control the CPU. There are two basic types of interrupts, hardware and software. Examples of hardware interrupts include an 'out of paper' condition from a printer or a 'key pressed' interrupt from the keyboard. Software interrupts are built-in to the system's programming and often involve the ROM-BIOS.

When an interrupt occurs, the system takes the following general actions:

- The device requesting the interrupt notifies the CPU
- The CPU suspends normal processing and tucks away information that it will need to resume processing after the interrupt has been serviced
- The interrupt number assigned to a device is used to identify the interrupt handler routine corresponding to the interrupt
- The interrupt routine is executed by the CPU
- The CPU returns to normal processing where it left off

NOTE

The device with the highest priority is serviced first, even if another interrupt is being serviced already.

➡NEXT

10.4.3 Interrupt Control (Sheet 2 of 3)

The 80286 microprocessor Non-Maskable Interrupt (NMI) and two 8259A interrupt controller chips provide 16 levels of system interrupts. Any or all of the interrupts may be masked (including the microprocessor's NMI).

Note: The 8259A's Interrupt Mask Register (IMR) allows individual interrupt requests to be masked (blanked/disabled). If the interrupt request bit for a particular line is masked, that line cannot generate an interrupt.

Interrupt request levels define the microprocessor's priorities in servicing I/O interrupts. A device is assigned an interrupt request level to establish the priority of its interrupts in relation to other system devices. Most standard I/O devices have "fixed" interrupt levels, while the interrupt levels of most optional I/O devices are assigned by switch or jumper setting.

Two devices having the same interrupt request level will result in a conflict which must be corrected for proper system operation.

PC 240 System Interrupt Request Levels defines fixed and default settings for the PC 240. To avoid conflicts, these settings should be used whenever possible.

➡NEXT

10.4.3 Interrupt Control (Sheet 3 of 3)

*Interrupt Request Level**	*Description*
IRQ 0	Timer output 0
IRQ 1	Keyboard (output buffer full)
IRQ 2	Interrupt from CTRL 2
IRQ 8	Real-time clock interrupt
IRQ 9	Reserved for software
IRQ 10	WLOC option
IRQ 11	Assignable
IRQ 12	Assignable
IRQ 13	Math Coprocessor
IRQ 14	Fixed disk controller
IRQ 15	Assignable
IRQ 3	Communications port 2 (serial port "B" -- sync/ async. communications board)
IRQ 4	Communications port 1 (CPU serial port)
IRQ 5	Sync./async. port "A" (sync/async. communications board)
IRQ 6	Diskette controller
IRQ 7	Parallel port 1 (CPU parallel port)

* Listed in descending priority order.

● END

10.4.4 Direct Memory Access (DMA)

DMA allows high-speed data transfers between memory and other systems devices directly, bypassing the 80286.

The system supports 7 DMA channels through the use of two Intel 8237A-5 DMA controller chips, each with four channels.

Chan. Num.	*DMA CNTL1*	*Chan. Num.*	*DMA CNTL2*
0	Dynamic RAM Refresh	4	Cascade /DMA1
1	SDLC	5	Spare
2	Floppy	6	Spare
3	Spare	7	Spare

DMA Controller 1 channels (0 - 3) support 8-bit option PCAs and 8- or 16-bit system memory. Each channel can transfer data throughout the 16 MB system address space in 64 KB blocks.

DMA Controller 2 channel 4 is used to cascade DMA 1 channels 0 - 3 to the microprocessor. Channels 5, 6, and 7 support 16-bit data transfers between 16-bit option PCAs and 16-bit system memory. These DMA channels can transfer data throughout the 16 MB system address space in 128 KB blocks.

● END

10.4.5 IBM Emulation Chip Set

Five chips on the PCA contain much of the circuity which makes the PC 240 IBM PC-AT compatible. Each chip provides specific functions as described below.

The 82C201 System Control chip performs the following functions:

- Clock Generation and Reset/Ready Sync
- Command and Control Signal Generation
- 16-bit Data Conversions to and from 8-bit Devices
- Wait State Control
- DMA and Refresh Control
- Co-Processor Control
- NMI and Error Logic Enables

The 82C202 RAM/ROM Decode - I/O Control chip performs the following functions:

- RAM/ROM Decode and Latch
- Parity Error Detection
- Clock/Calendar, Keyboard, Status/ Control Port, and NMI Enable Latch I/O Decode

The 82A203 High Address Bus Buffer & Port B Control chip provides:

- Drivers and Buffers for the CPU, System and Local I/O control Busses
- Port B - Status Latch

The 82A204 Low Address Buffer & Refresh Counter provides:

- Drivers/Buffers for Address Signals (A1 - A16)
- Drivers for Memory Address Signals (MA0 - MA7)
- Refresh Counter Address Generation

The 82A205 Data Bus Buffer & Parity Generator provides:

- Data Bus Buffers and Drivers (D0 - D15)
- CPU Data Bus (D0 - D15), System Data Bus (SD0 - SD15), and the Memory Data bus (MD0 - MD15) Control
- Low Byte to High Byte Conversion Logic
- Parity Generation and Check Logic.

● END

10.4.6 RAM/ROM

The CPU PCA contains 640 KBytes of on board dynamic RAM and 64 KBytes (expandable to 128 KB) of PROM. The system memory map defines address blocks assigned to various system memory components.

Decimal Address	*Hex Address*	*Name and Function*
	Conventional Memory	
0 to 512K	000000 to 07FFFF	512KB CPU PCA Memory
512 to 640K	080000 to 09FFFF	128KB CPU PCA Memory
640 to 768K	0A0000 to 0BFFFF	128KB Video Memory (Graphics Display Buffer)
768 to 832K	0C0000 to 0CFFFF	128KB I/O Expansion ROM (Reserved for ROM on I/O Option Boards)
832 to 896K	0D0000 to 0DFFFF	Memory Paging and Expanded Addresses
896 to 960K	0E0000 to 0EFFFF	64K Reserved on CPU PCA (Duplicated Code Assignment at Address FE0000)
960 to 1MB	0F0000 to 0FFFFF	64K ROM Reserved on CPU PCA (Duplicated Code Assignment at Address FF0000)
	Extended Memory	
1 MB	100000 to FDFFFF	Maximum Memory 15MB (I/O Option Board Memory)
• •	FE0000 to FEFFFF	64KB Reserved on CPU PCA (Duplicated Code Assignment at Address 0E0000
16MB	FF0000 to FFFFFF	64KB ROM Reserved on System Board (Duplicated Code Assignment at Address 0F0000)

● END

10.4.7 Keyboard Control

The Keyboard Controller (Intel 8042) is a single chip microprocessor that is programmed to support the 723 keyboard serial interface. The Keyboard Controller receives serial data from the keyboard, checks the parity of the data, translates scan codes, and presents the data to the system as a byte of data in its output buffer. The Keyboard Controller communicates with the system through an 8-bit, read only, status register; an 8-bit, read only, output buffer; and an 8-bit, write only,input buffer. The Keyboard Controller will interrupt the system when data is placed in its output buffer. The status register contains bits that indicate if an error was detected while receiving the data.

Data may be sent to the keyboard by writing to the Keyboard Controller's input buffer. The byte of data will be sent to the keyboard serially with an odd parity bit automatically inserted. The keyboard is required to acknowledge all data transmissions received. Additionally, transmissions will not be sent to the keyboard until acknowledgment is received for the previous byte.

● END

10.4.8 Parallel Interface

Connection is made through a 25-pin D-shell connector. An adapter cable with a 25-pin D-shell on one end and a 36-pin Centronics type connector on the other end is required to connect to a standard Centronics parallel printer.

The printer port may be addressed as either Parallel (printer) Port 1 (LPT1) at I/O "port" address block 378-37F, interrupt level 7 or Parallel (printer) Port 2 (LPT2) at I/O "port" address block 278-27F, interrupt level 5 as defined by a switch bank on the CPU PCB.

Data Latch - Writing to address x78 (LPT1), x7C (LPT2) causes data to be stored in the printer's data buffer. Reading this address sends the contents of the printer's data buffer to the system microprocessor.

Printer Controls - Printer control signals are stored at address x7A, x7E to be read by the system microprocessor.

Printer Status - Printer status signals are stored at address x79, x7D to be read by the system microprocessor.

NOTE

x = 2 or 3 depending on "port" address block selection.

● END

10.4.9 Serial Interface

The Serial Communications Controller (NS16450) is a programmable, asynchronous communications controller. The NS16450 handles serial to parallel conversion on data characters received from a modem or data set and parallel to serial conversion on data characters received from the CPU. It will add and remove start, stop, and parity bits.

Five, six, seven, and eight bit characters with 1, 1.5, or 2 stop bits are supported. A prioritized interrupt system controls transmit, receive, error, and line status as well as data set interrupts. A programmable baud rate generator allows operation from 50 - 9600 baud.

The serial I/O port located on the rear of the unit may be addressed as either Communications Port 1 (COM1) at I/O "port" address block 3F8-3FF, interrupt level 4 or Communications Port 2 (COM2) at I/O "port" address block 2F8-2FF, interrupt level 3 as defined by a switch bank on the CPU PCA.

● END

10.4.10 Timer

The 8254 programmable timer allows the system to provide accurate timimg/counting functions. It contains three independent 16-bit counters and an 8-bit control word register that is used to define the operation of the counters. The three counters are identical in operation. Counters are programmed by writing a control word and then an initial count. The control word specifies which counter is being programmed. The initial count is programmed directly into the counter. In this system the counters are used by the tone generator, the refresh circuitry, and interrupt request 0.

● END

10.4.11 Real Time Clock (RTC)

The RTC (Motorola MC146818) contains the real time clock and 64 bytes of CMOS RAM with battery backup. The internal clock uses 14 bytes of this RAM and the rest is user defined. The memory consists of 50 general user defined bytes, 10 bytes which normally contain the time, calendar, and alarm data, and 4 control and status bytes.

● END

10 FUNCTIONAL DESCRIPTION

10.5 Monochrome/Color Video Controller PCA (Sheet 1 of 2)

The Wang EGA (WEGA) Monochrome/Color Video Controller PCA is a graphics controller that supports both monochrome and color direct drive displays in a variety of modes (IBM Enhanced Graphics Adapter, Color Graphics Adapter, Monochrome Display Adapter or Hercules Monochrome graphics).

NOTE

'Direct drive' means that video information sent to the monitor from the video controller is used as it is presented without having to be superimposed on a carrier frequency as would be the case if a standard TV receiver was used as the display.

In addition to the direct drive port, a light pen interface is provided. A 32-pin feature connector allows access to internal functions. Another 32-pin connector is reserved for future use.

A switch bank on the PCA selects the type of monitor the card is driving and whether or not Automatic Mode Switching is enabled.

If the Autoswitch feature is enabled, the PCA will automatically switch to whatever mode (EGA, CGA, MDA, Hercules) is required by the application being run.

Jumper P2 defines I/O address mapping as 3?x, where ? = B in monochrome modes and D in color modes; jumper P5 is undefined.

The 84-pin PEGA-1A video controller chip is customed designed by Paradise Systems, Inc. and provides most of the circuitry required for PCB operation. The following functions are provided on the chip:

- CRT Controller
- Sequencer
- Graphics Controller
- Attribute Controller

➡NEXT

10.5 Monochrome/Color Video Controller PCA (Sheet 2 of 2)

The CRT Controller generates horizontal and vertical synchronous timing, cursor and underlining timing, and refresh addressing for RAM memory.

The Sequencer generates basic timing for dynamic RAM and character clock for controlling regenerative memory fetches. It allows the processor to access memory during active display intervals by inserting dedicated processor memory cycles periodically between display memory cycles.

The Graphics Controller directs the data from memory to the Attribute Controller and the processor. The Graphics Controller also formats the data for compatible modes and provides color comparators for use in color painting modes.

The Attribute Controller provides a color palette of 16 colors, each of which may be specified separately. Six color outputs are available for driving a display. Blinking and underlining are also controlled by this section. Data is taken from display memory and formatted for display on the CRT.

The display buffer consists of 256 K bytes of dynamic memory configured as four 64 K byte video bit planes.

The ROM BIOS contains character generators and control code.

The bus interface/decoding circuitry performs two functions; it provides memory and I/O access through three PALs and ALS244/245 bus drivers and it provides the circuitry needed for automatic mode switching between native EGA and emulated CGA and MDA/Hercules modes.

● END

10 FUNCTIONAL DESCRIPTION

10.6 Hard Disk/Diskette Controller PCA

(Sheet 1 of 2)

The Hard Disk/Diskette Controller (WHDC) is an IBM PC-AT bus compatible printed circuit board that interfaces a ST-412 type hard disk drive and a 5.25 in. diskette drive to the System Bus structure. An additional diskette connector is provided to be compatible to IBM drive specification D or E. The diskette circuitry can be disabled via SW1.

The hard disk control section includes a WD11C00 Buffer Management And Controller (BMAC), a WD2010 Hard Disk Controller (HDC), a WD1015 Buffer Manager Control Processor (BMCP), a WD10C20 Read/Write (data) Controller (RWC), and a 1024 x 8 bit RAM for sector data buffering. The diskette section includes a standard UPD765 Diskette Controller (DC) and a WD16C92 Diskette Read/Write (data and logic) Controller (DRWC).

The HDC interfaces to the system address, data, and I/O control bus signals. All fixed disk read/write data transfers are 16 bits wide and occur between the bus and the sector data buffer memory. Diskette data and both control and status transfers are 8 bits wide and use the lower data byte (SD07-SD00) only.

The BMAC includes the data buffer address control, command, status, and data registers; the drive control registers; and interfaces to the system and board (local) bus structures.

The DC supports both single and double density diskette formats. In addition, it includes both host and drive data and control interfaces. The units major features include:

- Multiple sector and track read/write commands
- Host DMA and programmed I/O data transfers
- Internal address mark and data format controls

➡NEXT

10 FUNCTIONAL DESCRIPTION

10.6 Hard Disk/Diskette Controller PCA

(Sheet 2 of 2)

The DRWC provides diskette, (FM/MFM), read data phase detection, Voltage Controlled Oscillator (VCO) frequency control, write data pre-compensation, and multiple rate clock selection. The unit also includes the diskette rate control register and other circuitry for general logic reduction. The DRWC and associated VCO components permit the board to control both single and double density diskette drives at four separate data rates.

A Diskette Interface controller interfaces to the floppy drives via one 34-pin data and control cable per the 5.25 in. PC-AT standard.

The BMCP is an eight-bit microprocessor (type 8749H) that operates with the HDC and the BMAC logic array to aid in processing the disk commands, to help in error recovery procedures, and to perform board diagnostics. The processor chip includes internal RAM and ROM memory.

The HDC provides the hard disk drive(s) data and control interface and sector data buffer control logic. The major features of this device include:

- Multiple sector read/write commands
- 32-bit Error Correction Code (ECC) with error correction capability
- Programmable format and error recovery algorithms

Hard drive read data separation and write data pre-compensation are performed by the RWC (WD10C20). This chip contains all of the necessary components for complete Modified Frequency Modulation (MFM) read/write data control.

A 2048 x 8 static RAM memory buffers the sector data between the drive(s) and the IBM PC-AT System Bus and ECC correction information between the WDC and the BMCP.

The WDI (ST-412) interfaces to the fixed disk drives via one 34-pin control cable and two 20-pin data cables in conformance with ST-412 signal definitions.

A switch enables or disables diskette drive control. A set of jumpers defines primary and secondary I/O port addresses and interrupt levels.

● END

SECTION 11

SPECIFICATIONS

SECTION 11 CONTENTS

SECTION 11

SPECIFICATIONS

SPECIFICATIONS

11.1 Hardware

Electronics Enclosure Dimensions (resting flat, no stand)

Height: 5.0 in. (12.7 cm)
Width: 14.75 in. (37.5 cm)
Depth: 17.0 in. (43.2 cm)
System Unit Cable: 7.5 ft. (2.3m)

Electronics Enclosure Weight

Model PC 240-1: 17.7 lb. (8.0 Kg)
Model PC 240-3: 21.0 lb. (9.5 Kg)

Electronics Enclosure Power Requirements

Voltage: 90 to 132 Vac
(115 Vac nominal)
180 to 264 Vac (220 Vac nominal)

Frequency: 47 to 63 Hz (60 Hz nominal)

Current (operating): 1.5A @ 115 Vac; .7A @ 220 Vac

Monochrome Monitor Dimensions

Height: 11.5 in. (29.2 cm)
Width: 12.5 in. (31.8 cm)
Depth: 12.5 in. (31.8 cm)

Monochrome Monitor Weight

14 lb (6.36 kg)

Color Monitor Dimensions

Height: 13.5 in. (34.3 cm)
Width: 14 in. (35.6 cm)
Depth: 15.7 in. (39.9 cm)

Color Monitor Weight

34.5 lb (15.7 kg)

Keyboard Dimensions

Height: 1.65 in. (4.19 cm)
Width: 19.9 in. (50.5 cm)
Depth: 7.6 in. (19.3 cm)

Keyboard Weight

3.25 lb (1.48 kg)

System Environmental Requirements

Relative Humidity: 20% to 80% (noncondensing)

Ambient Temperature: 60°F to 90°F (15°C to 32°C)

Maximum Altitude: 6562 ft (2000 m)

Heat Dissipation (Electronics Enclosure): 870 Btu/hr

● END

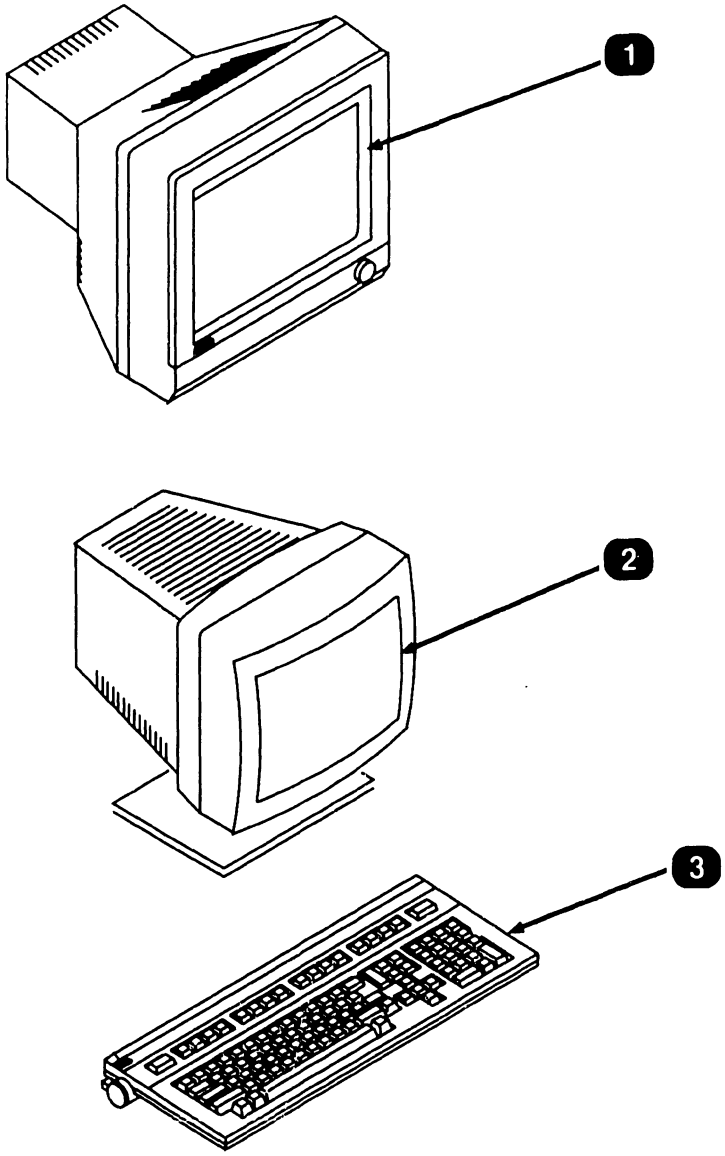
SECTION 12
ILLUSTRATED
PARTS

SECTION 12 CONTENTS

SECTION 12

ILLUSTRATED PARTS

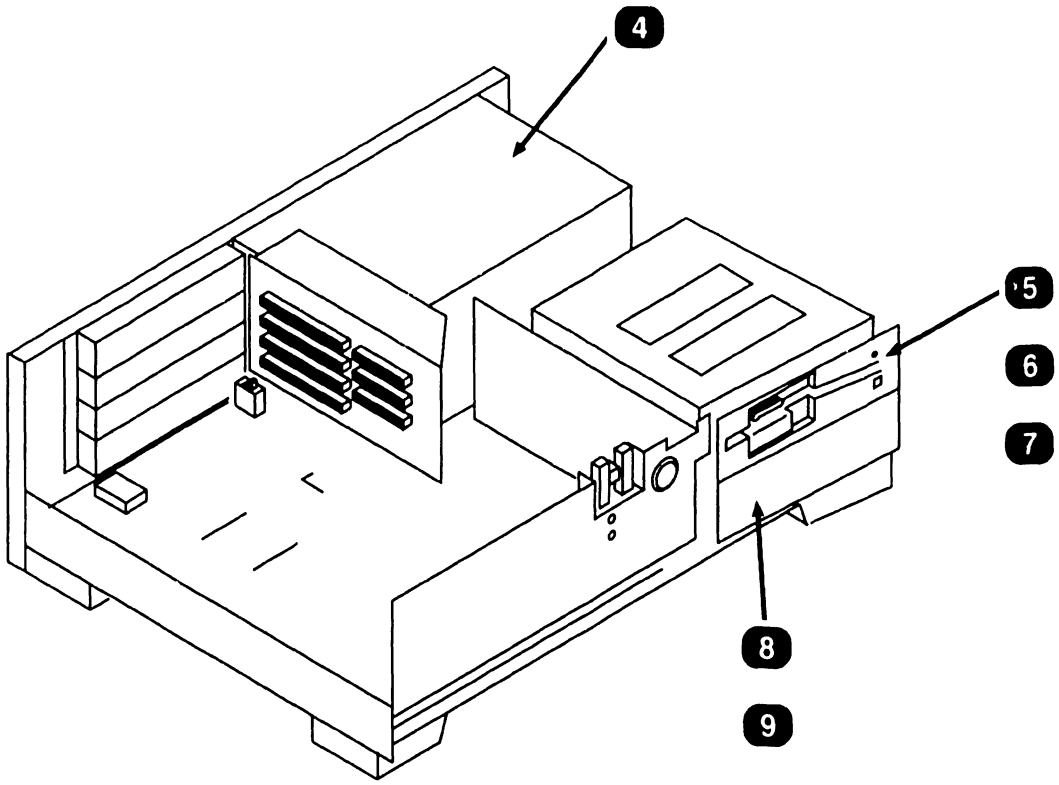
12.1 ILLUSTRATED PARTS
System Components (Sheet 1 of 5)



Item	*Part Number*	*Description*
1	279-0757	Monochrome monitor
2	725-3446	Color monitor
3	725-3401-US	Keyboard

➡NEXT

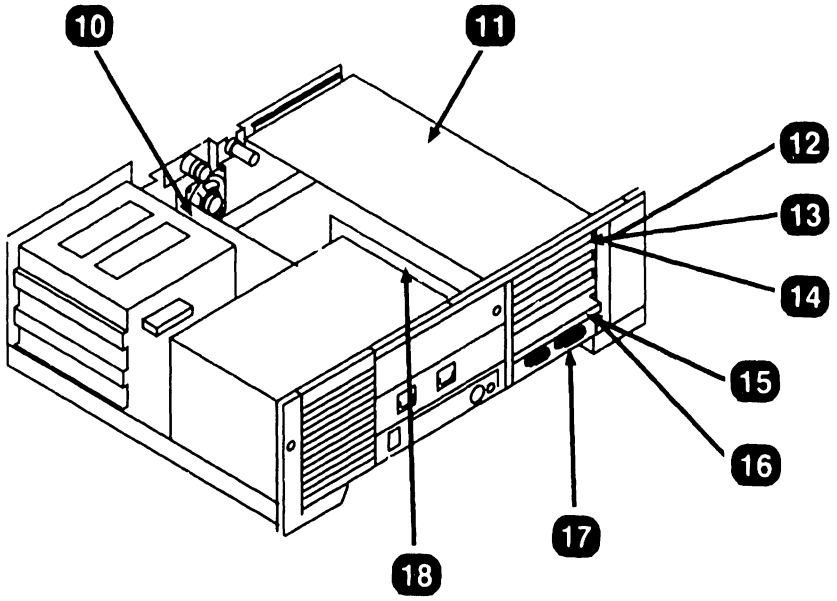
12.1 ILLUSTRATED PARTS
System Components (Sheet 2 of 5)



Item	*Part Number*	*Description*
4	270-1806	Power supply
5	279-0760	1.2MB diskette drive
6	279-0765	360KB diskette drive
7	279-0766	720KB diskette drive
8	279-0767	20MB H/HT Winchester disk drive
9	279-0773	40MB H/HT Winchester disk drive

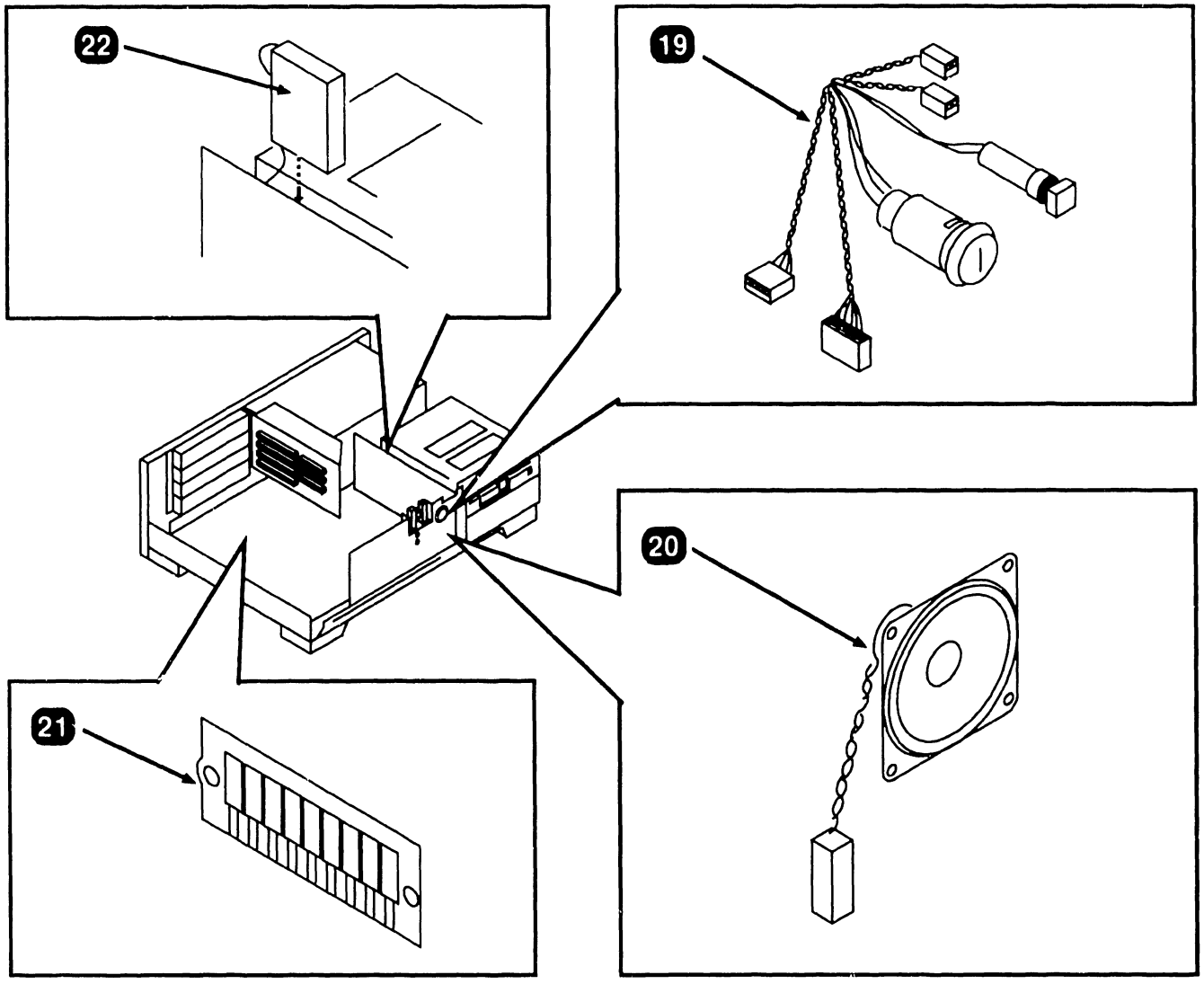
➡NEXT

12.1 ILLUSTRATED PARTS System Components (Sheet 3 of 5)



Item	*Part Number*	*Description*
10	210-8810	Floppy-Only Controller Board
11	210-8770-A	Winchester/floppy controller board (will replace Western Digital controller, P/N 725-3359)
12	210-9035	Monochrome video board
13	210-9454-A	Wang local office connection (WLOC) board
14	210-9453	Expanded memory board
15	210-9455	Synchronous/asynchronous communications board
16	210-8800-A	CPU board
17	210-8986	EGA/Monochrome/Color Video Controller Board
18	210-8801	Option Buss Board

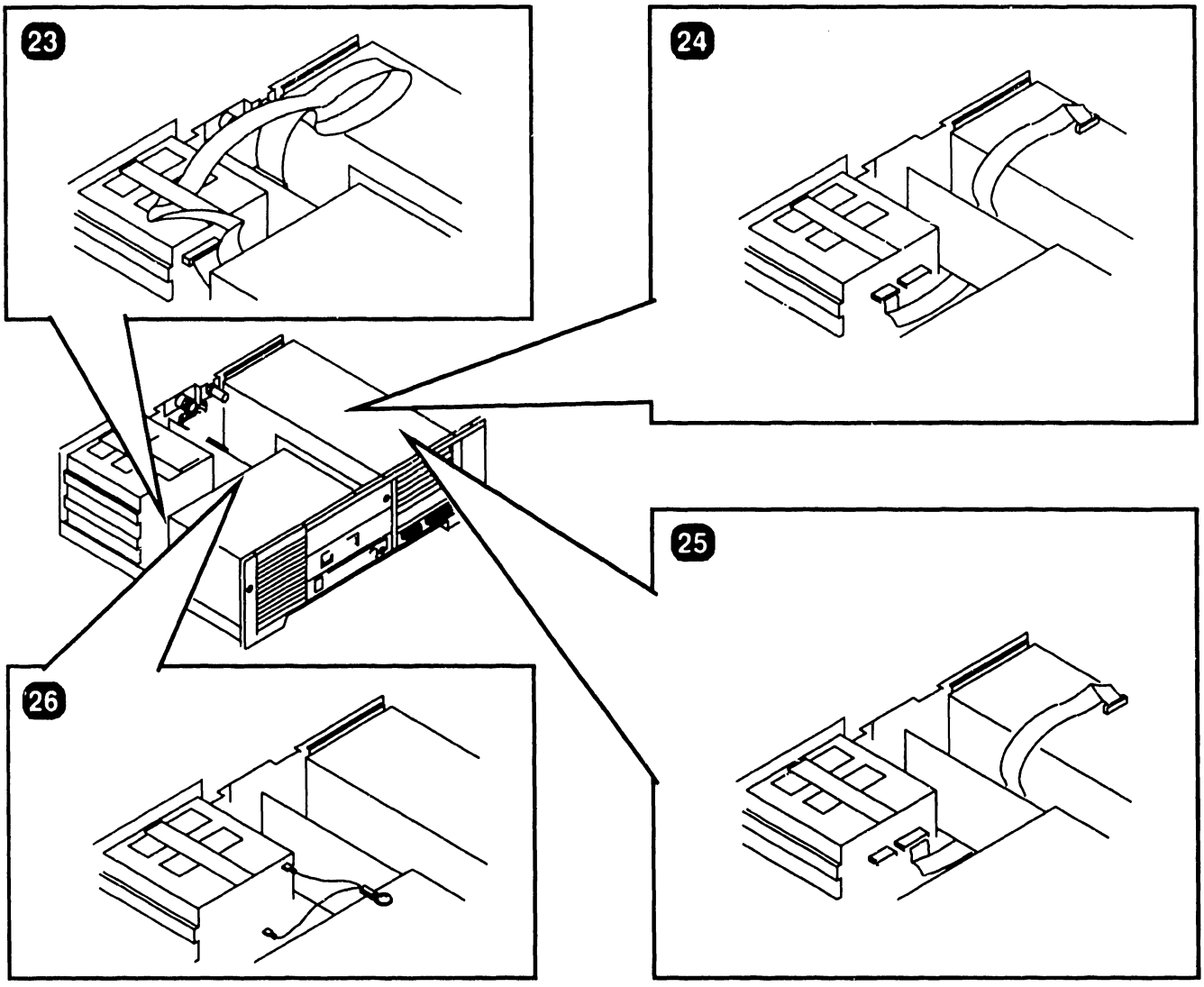
➡NEXT



Item	*Part Number*	*Description*
19	220-2562	Keylock cable assembly
20	220-2563	Speaker and cable
21	377-4508	Single In-Line Memory Module (SIMM)
22	666-1016	Lithium battery

➡NEXT

12.1 System Components (Sheet 5 of 5)



Item	*Part Number*	*Description*
23	220-3601	Floppy-Only cable
24	220-3603	Wini/Floppy cable
25	220-3604	Wini/Floppy cable
26	220-2564	Wini/Floppy ground cable

● END

WANG

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END