

WANG

3404

4230A Workstation

Model: 4230A

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**Customer Engineering
Product Maintenance Manual**

741-1709

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PREFACE

This document is the Product Maintenance Manual (PMM) for the Wang 4230A Workstation. The manual is organized in accordance with Customer Engineering Technical Documentation's approved PMM outline. The scope of this manual reflects the type of maintenance philosophy selected for this product.

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with sufficient instructions to operate, troubleshoot, and repair the 4230A Workstation. The manual will be updated on a regular schedule or as necessary. Such updates will be published either as Publication Update Bulletins (PUBs) or as full revisions.

First Edition (March, 1986)

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SECTION 1

INTRODUCTION

1.1 SCOPE AND PURPOSE

This Product Maintenance Manual contains specifications, unpacking and setup, installation, theory, operation, maintenance, adjustment, controls and indicators, repair, and troubleshooting information for the 4230A Workstation. This manual also contains an illustrated breakdown of replaceable parts.

The 4230A Workstation is a new low cost workstation that is intended to be used with the OIS and VS systems. The workstation will maintain all the attributes of the present 5536, 4230 and 2246 styled workstations, while providing for some additional enhancements.

The 4230A Workstation consists of a single Monitor type package, a 720 Keyboard, an electronics board and a power/video board. Connection to the master is via a standard 928 Data Link.

The purpose of the manual is to provide Customer Engineering personnel with the information necessary to install, troubleshoot, and repair the 4230A Workstation in the field. Familiarity with VS and OIS Workstations is recommended for the effective use of this manual.

1.2 ORGANIZATION AND LAYOUT

This manual is divided into 12 sections numbered 1 through 12. Each section describes a separate maintenance subject and is arranged to minimize references to other sections.

1.3 MICROFICHE ORGANIZATION

All or most information pertaining to a specific task is located on a single and/or double frame. Each frame contains illustrations, numbered steps, and/or text describing the individual steps required to accomplish each task. The steps within a frame are numbered around the various illustrations. Each section is preceded by the section number and a section table of contents. The sections, and corresponding frames, are arranged in numerical sequence from left-to-right and from top-to-bottom on the individual fiche cards. Referencing to other frames is made by use of the section number(s) contained in parenthesis ().

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2

**IDENTI-
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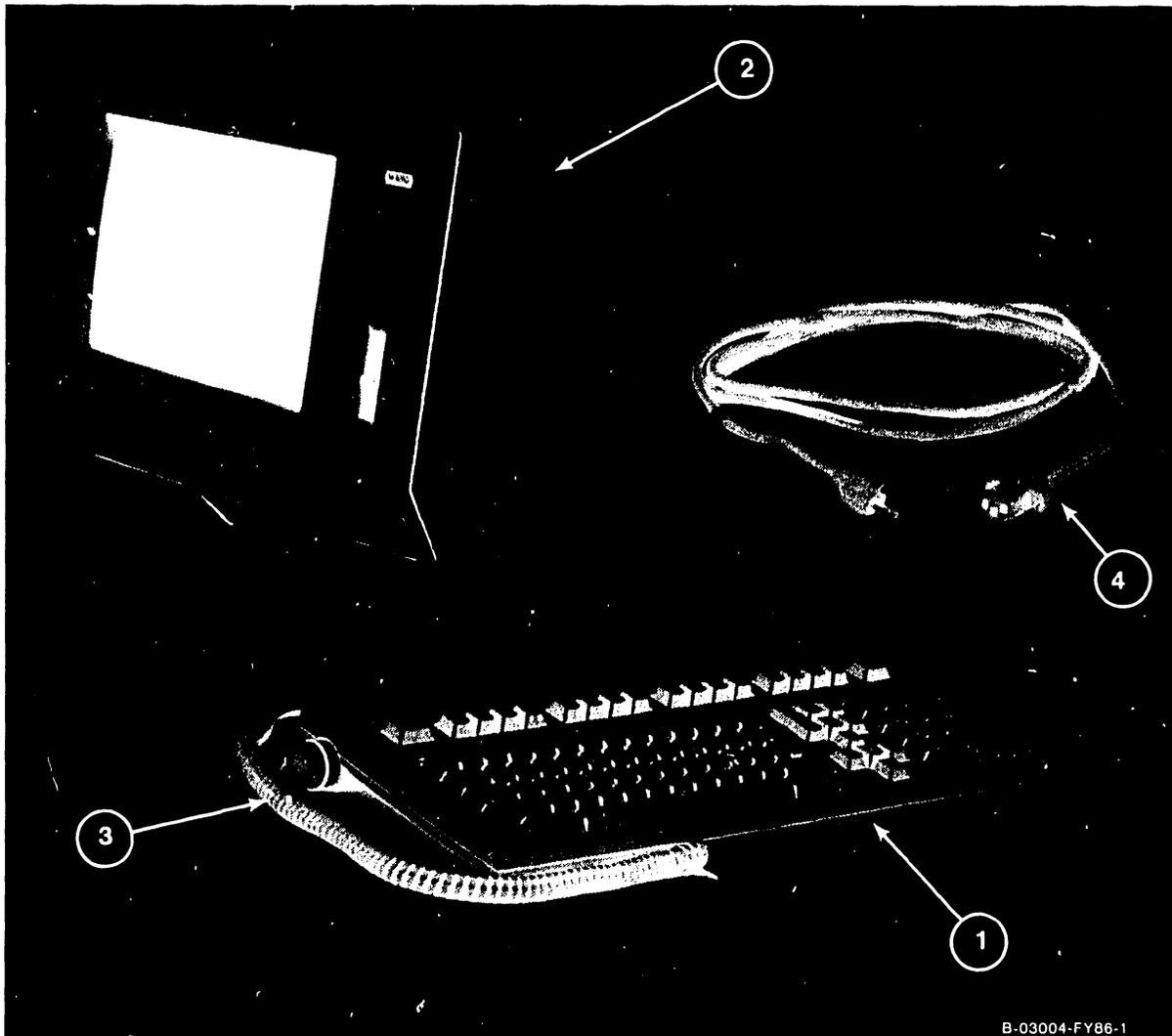
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IDENTIFICATION

2.1 4230A WORKSTATION MAJOR ASSEMBLIES

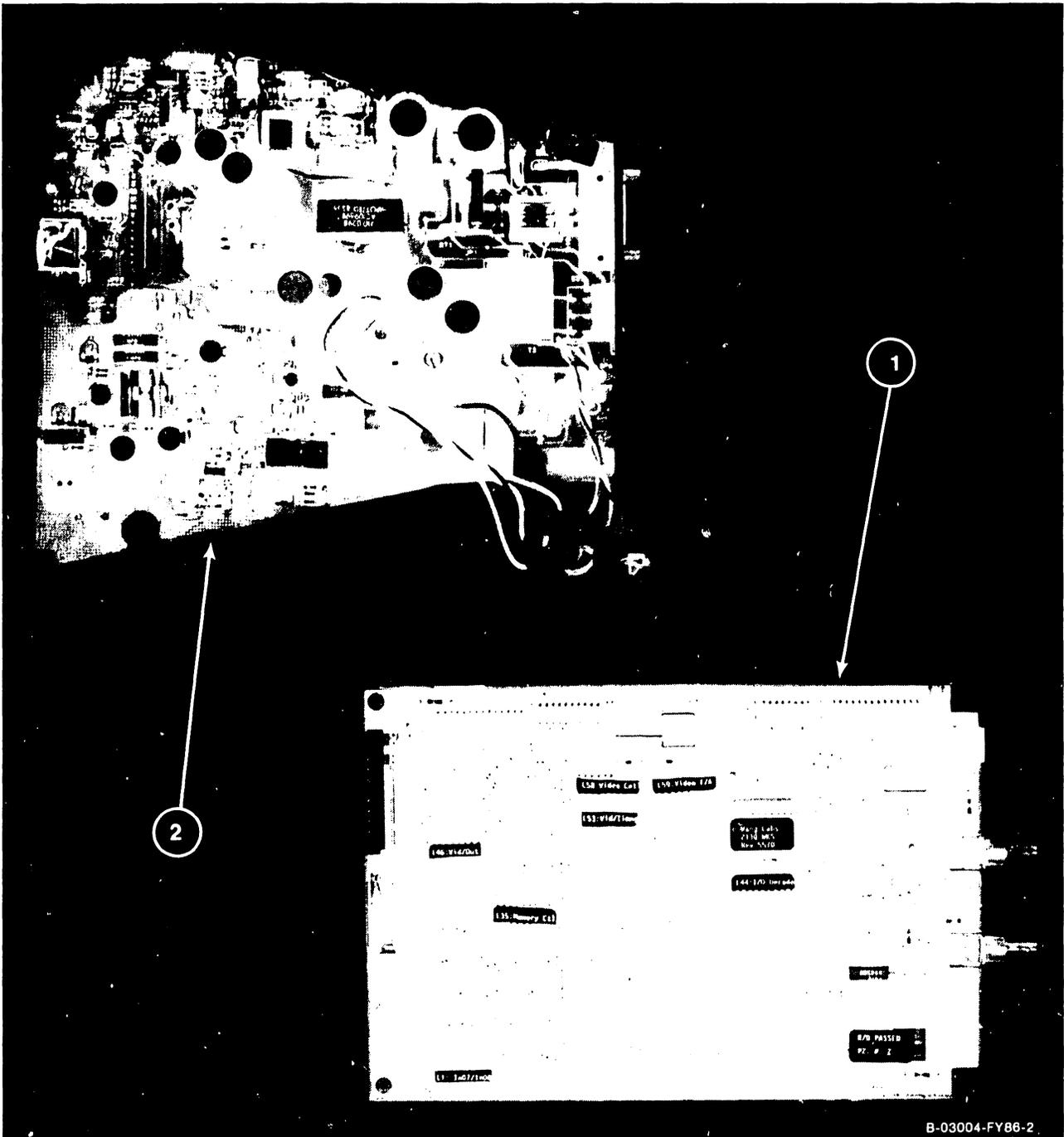


B-03004-FY86-1

ITEM	DESCRIPTION	USED WITH	PART NUMBER
1	720 Keyboard, 101 Key, Universal	4230A Workstation	725-3155-US
2	Monitor, 12 inch display	4230A Workstation	279-1051
3	Coil Cable, RJ-11 to RJ-11	4230A Workstation	420-1136
4	AC Power Cable	4230A Workstation	420-2040

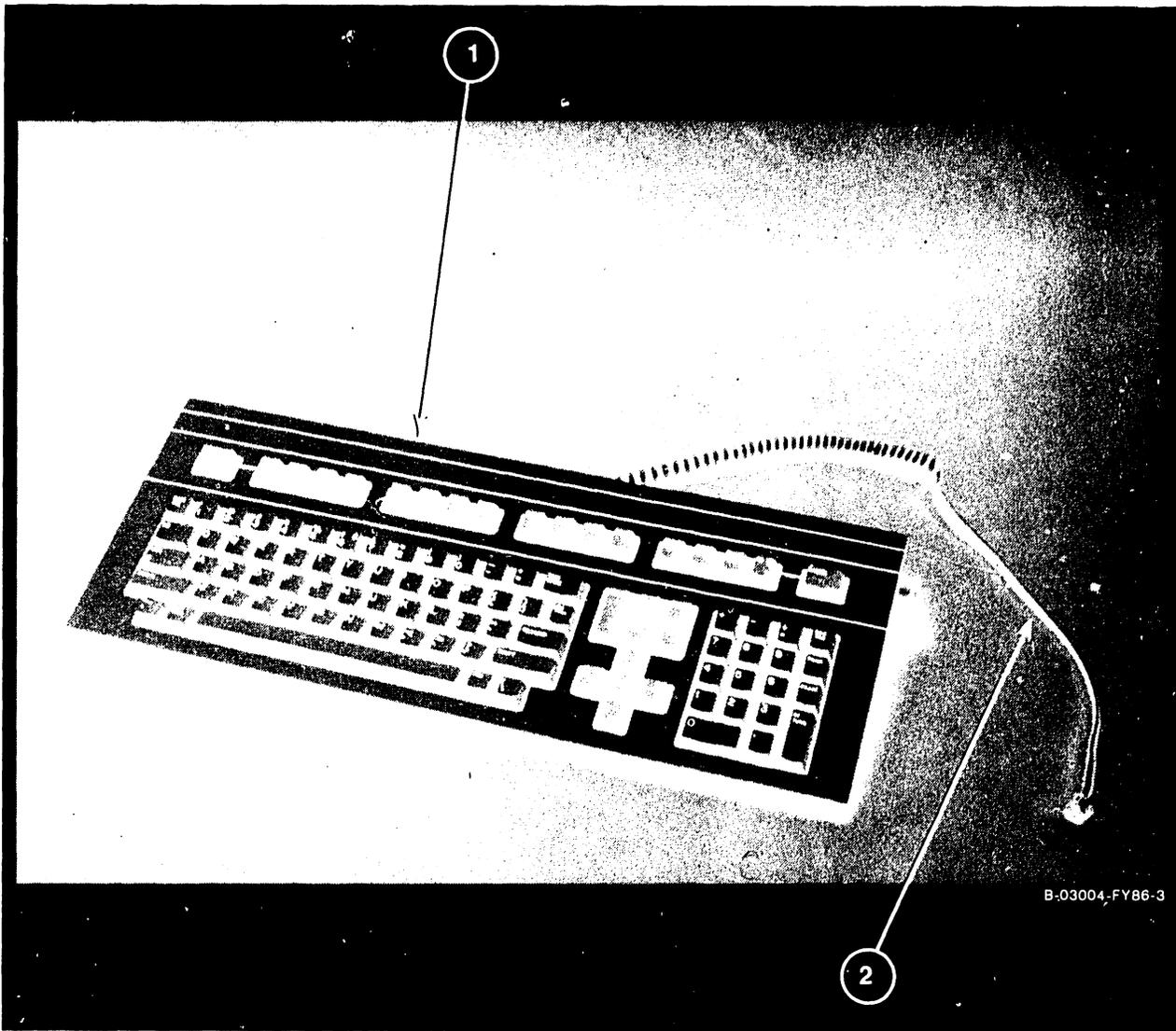
IDENTIFICATION

2.2 4230A WORKSTATION MONITOR MAJOR PARTS



ITEM	DESCRIPTION	USED WITH	PART NUMBER
1	Monitor Data Link PCA	4230A Workstation	210-8467
2	Power Supply/Monitor PCA	4230A Workstation	210-8466

2.3 4230A WORKSTATION KEYBOARD MAJOR PARTS



B-03004-FY86-3

ITEM	DESCRIPTION	USED WITH	PART NUMBER
1	720 Keyboard, 101 Key, Universal	4230A Workstation	725-3155-US
2	Coil Cable, RJ-11 to RJ-11	4230A Workstation	420-1136

SECTION

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CONTROLS

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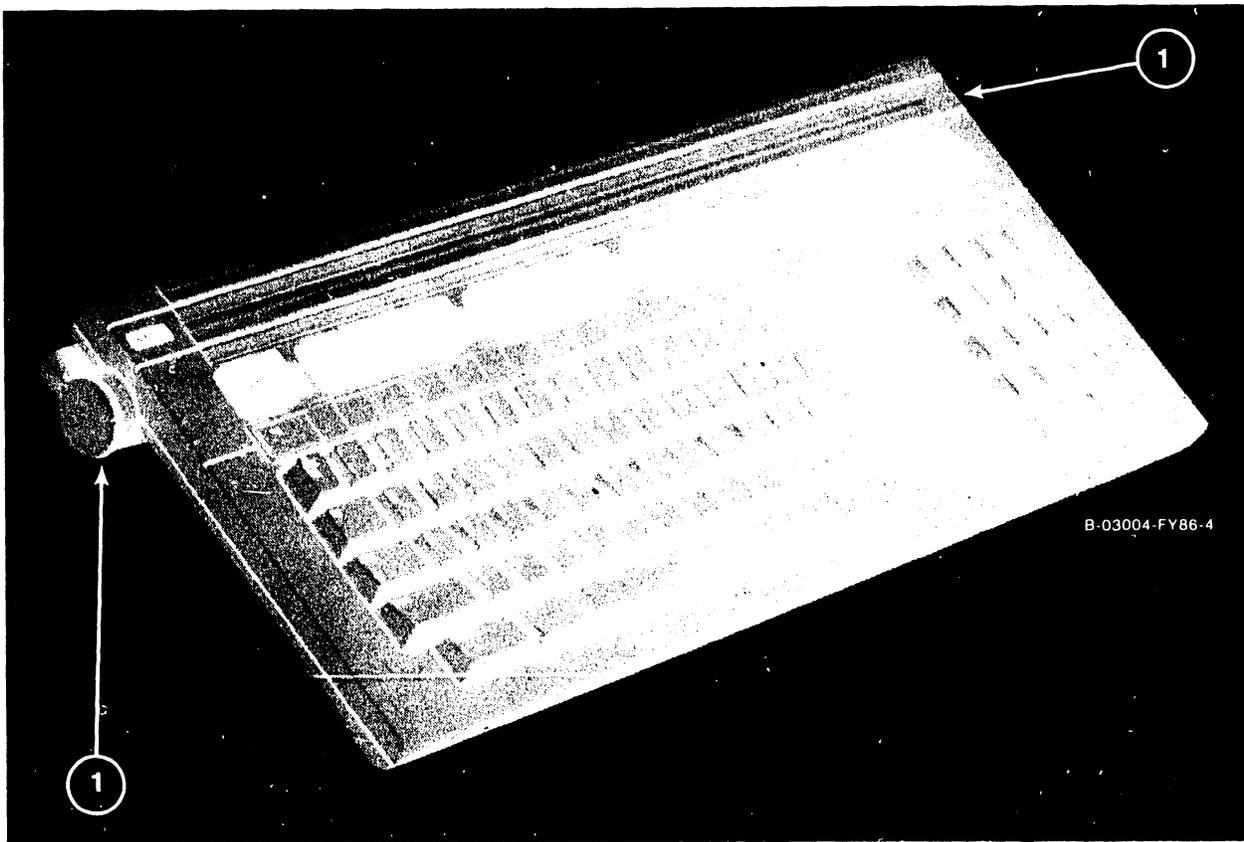
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CONTROLS

3.1 4230A WORKSTATION OPERATOR CONTROLS

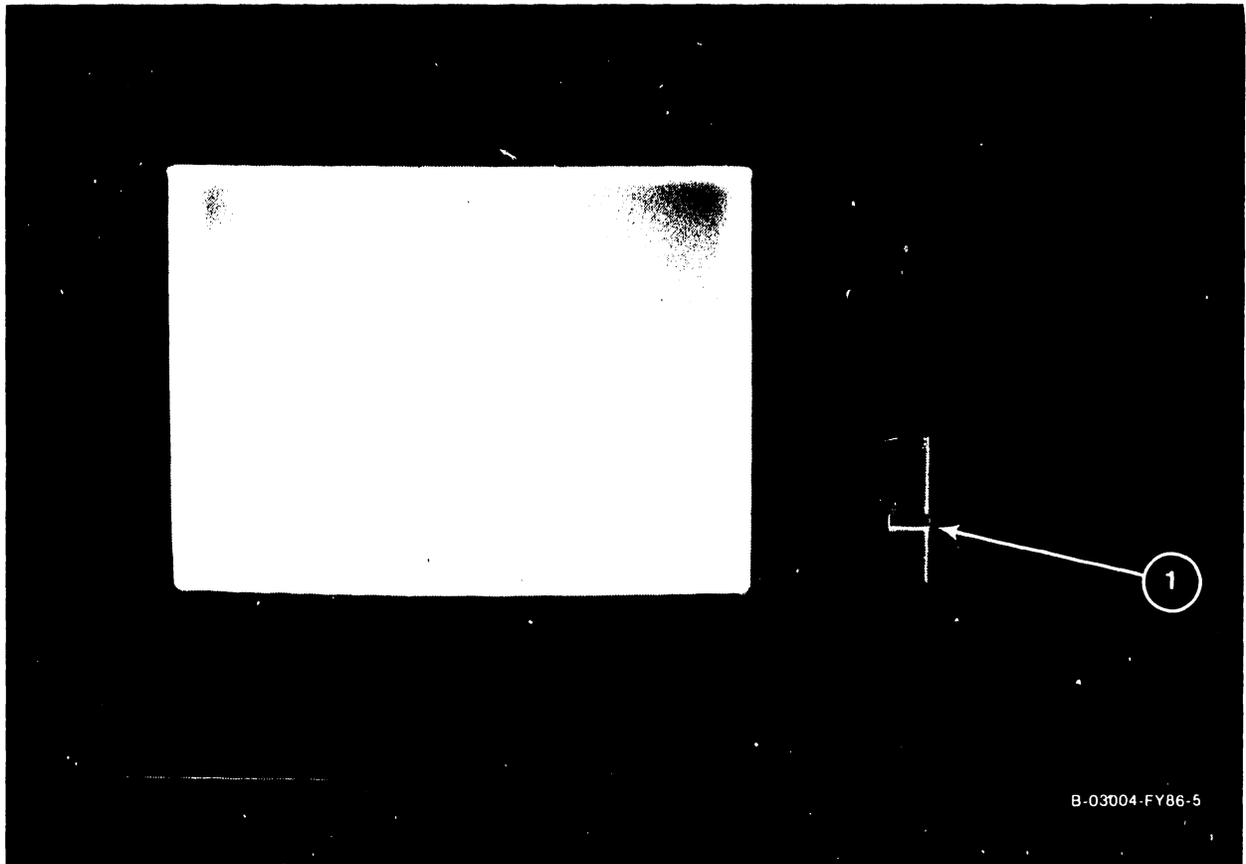
3.1.1 4230A WORKSTATION KEYBOARD OPERATOR CONTROLS



<u>ITEM</u>	<u>NAME</u>	<u>TYPE AND FUNCTION</u>
1	TILT ADJUST	3-position tilt adjustment; pull out and turn knob clockwise or counterclockwise to either raise or lower keyboard.

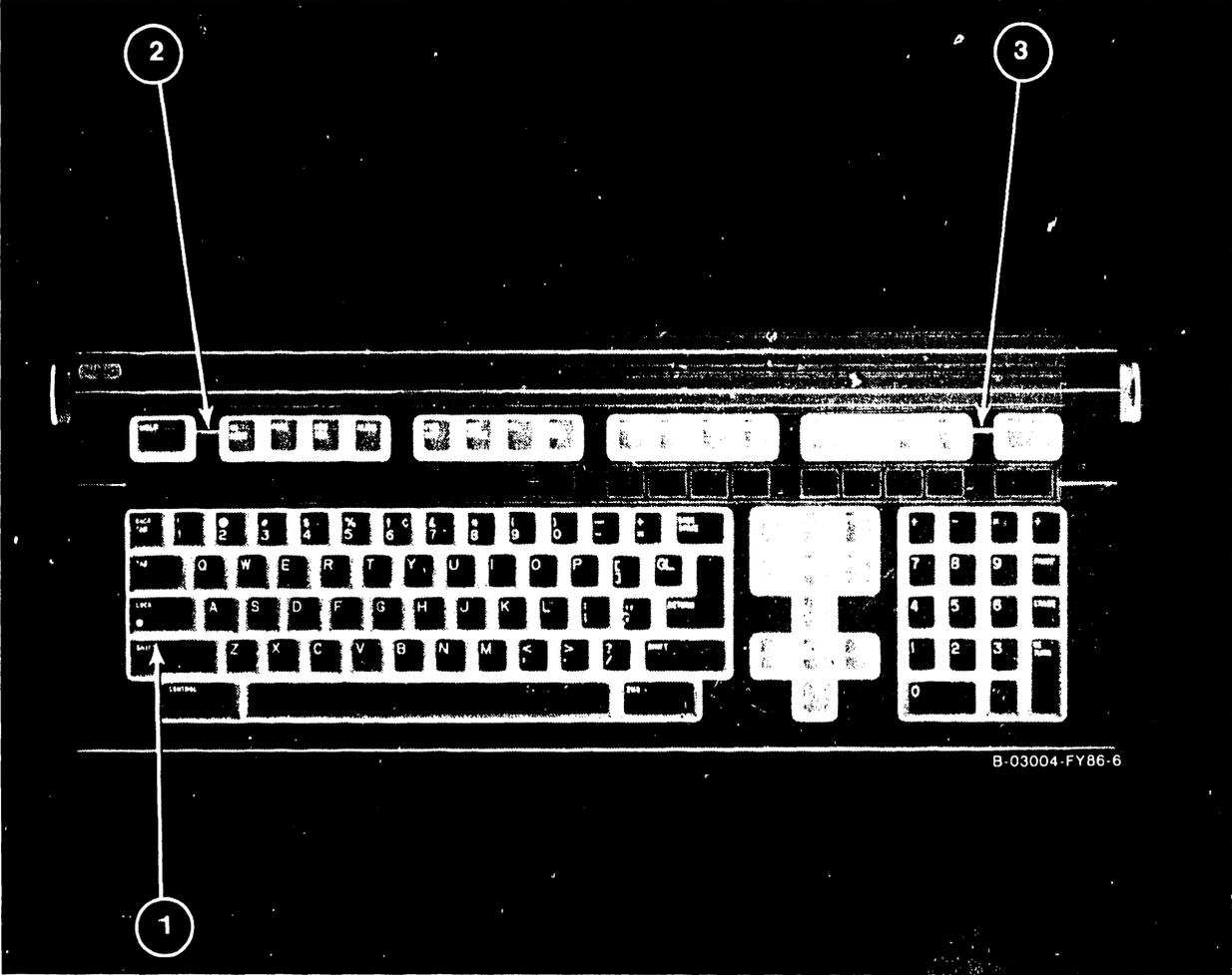
CONTROLS AND INDICATORS

3.1.2 4230A WORKSTATION MONITOR OPERATOR CONTROLS



<u>ITEM</u>	<u>NAME</u>	<u>TYPE AND FUNCTION</u>
1	POWER ON-OFF	Slide; Combination power On-Off and Brightness adjustment.

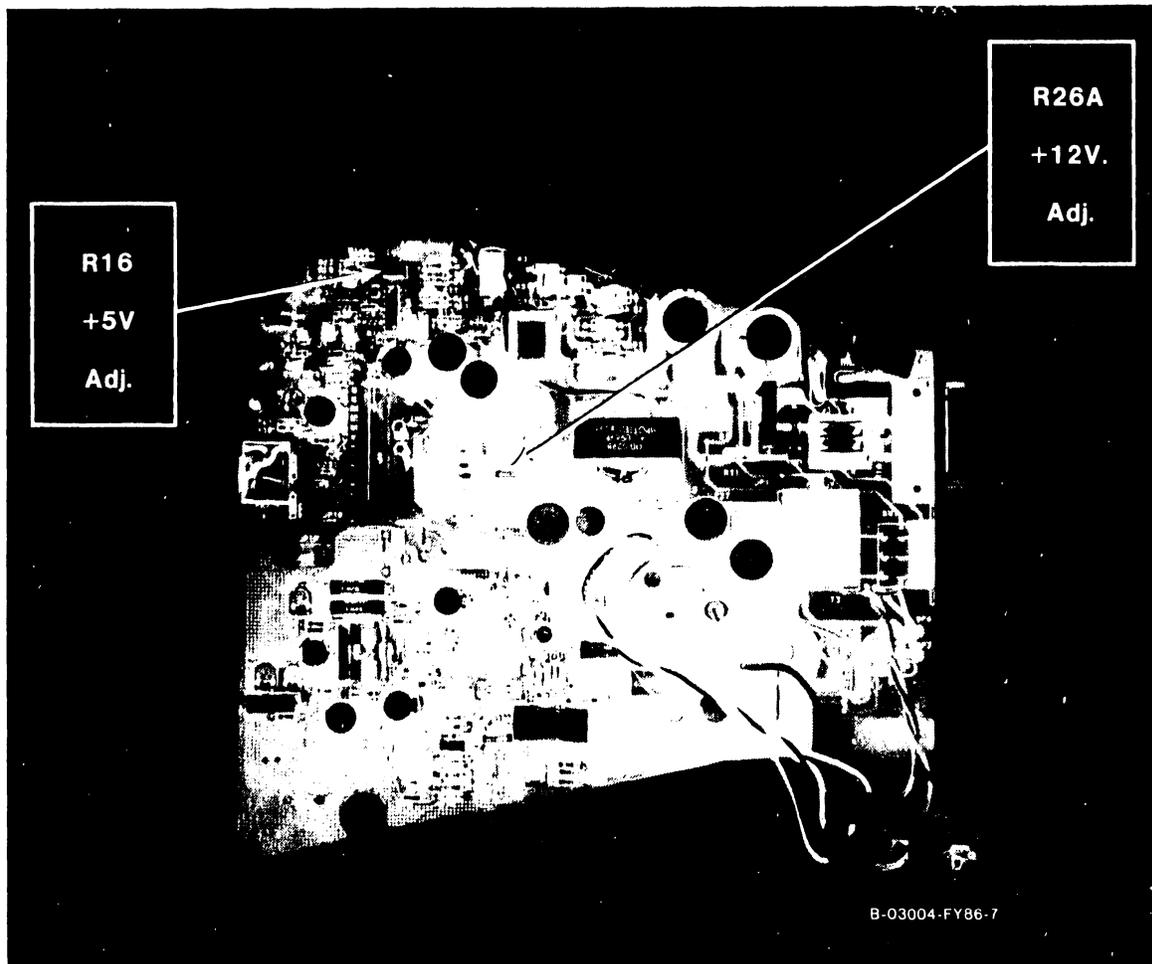
3.2 4230A WORKSTATION KEYBOARD INDICATORS



ITEM	NAME	TYPE AND FUNCTION
1	SHIFT (LOCK)	LED; Indicates keyboard is in shift or caps lock mode.
2	HELP	LED; Responds to a variety of the LED control commands for message signalling and general purpose applications.
3	NUM LOCK	LED; Indicates IBM 'NUM LOCK' condition.

CONTROLS AND INDICATORS

3.3 4230A WORKSTATION MONITOR ALIGNMENT CONTROLS (8466 PCA)



ITEM	NAME	TYPE AND FUNCTION
1	+5 Volt adjustment	R16, measure 5.15 V. to 5.20 V. between PCA pins 1 and 3.
2	+12 Volt adjustment	R26A, make adjustment only when Keyboard diagnostic screen is displayed on Monitor. Check voltage adjustment between PCA pins 3 and 6.

SECTION

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**OPERA-
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SECTION 4

OPERATION

4.1 4230A WORKSTATION POWER-UP PROCEDURE

Prior to powering-up the 4230A Workstation, perform the following steps:

1. Connect the ac power cable into a three-pronged electrical outlet.
2. Slide the front mounted, Monitor On/Off switch upwards to the On (1) position.
3. In a successful start-up procedure, the workstation will make a beep sound. This beep sound is followed by a loud click, which indicates that the Keyboard is functioning properly. If the Keyboard does not click, it is malfunctioning.
4. A test pattern appears on the screen for a few minutes and then disappears. If the test pattern remains after 5 to 10 minutes, contact the Service Technician.
5. Adjust the On/Off (1/0) switch upwards to increase screen brightness.
6. If there is not a successful start-up procedure, turn the Monitor off and check the following items:
 - a. The Keyboard cable is properly connected to the Monitor.
 - b. Make certain that all system cables are properly connected.
 - c. The ac power cable is properly attached to the Monitor.
 - d. The ac power cable is connected into a working electrical outlet.

If the host system screen still does not appear or if the Keyboard LOCK light blinks continuously, contact the Service Technician for assistance.

OPERATION

4.2 4230A WORKSTATION MONITOR BRIGHTNESS ADJUSTMENT

Adjust the Monitor brightness by performing the following:

1. Slide the On/Off (I/O) switch up and down to adjust the brightness of the screen. Sliding the On/Off switch up increases the brightness and sliding the On/Off switch down decreases brightness.

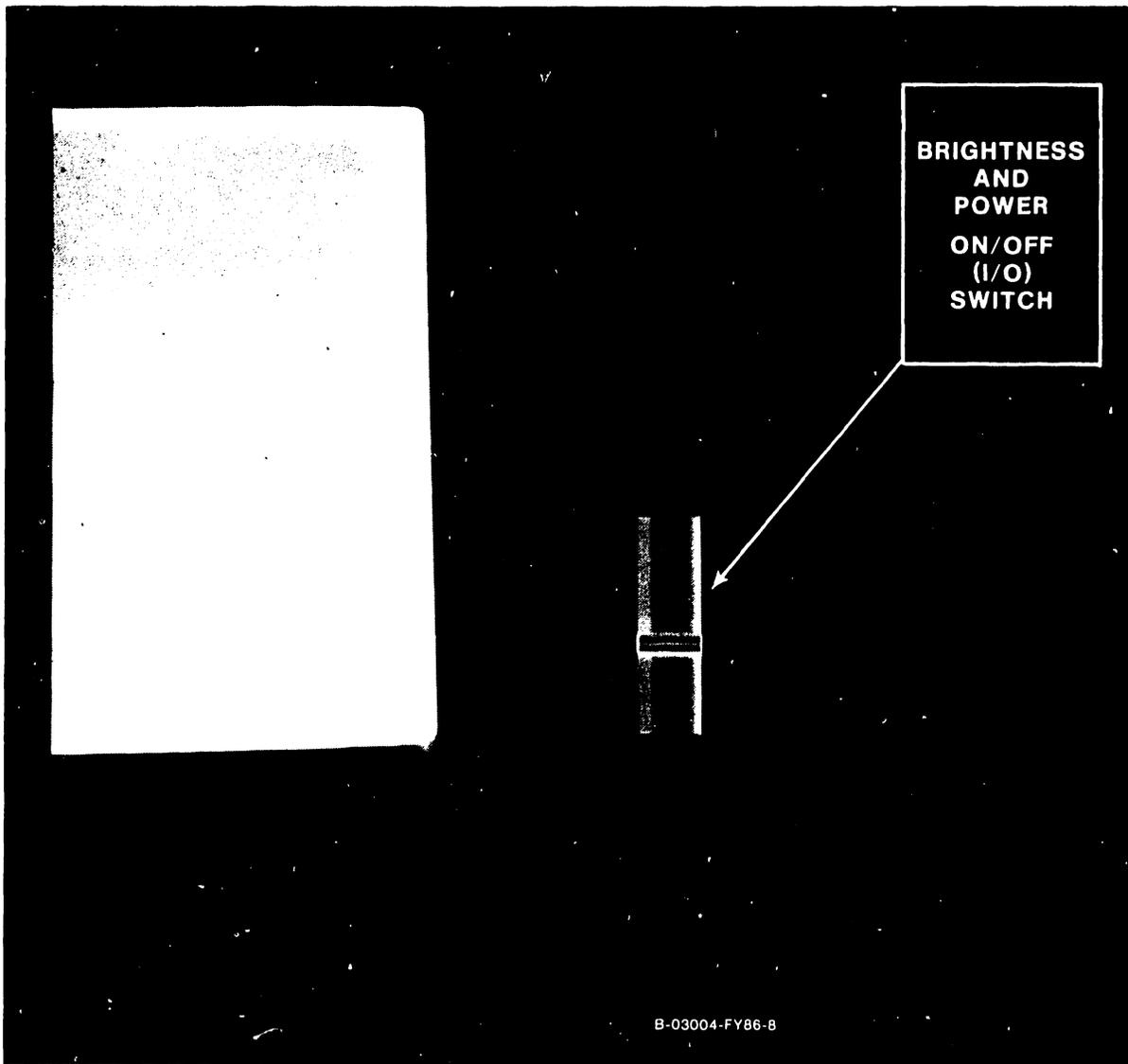


Figure 4-1. 4230A Workstation Brightness and Power-On/Off Slide Switch

4.3 POWERING-OFF THE 4230A WORKSTATION

1. Slide the On/Off switch to the Off position.

NOTE

After turning the Monitor power off, wait at least four (4) seconds before turning the power back on again. If you reapply power to the monitor without waiting a minimum of four (4) seconds, the host system screen will not be restored.

4.4 4230A WORKSTATION POWER-UP DIAGNOSTIC SCREENS

When the 4230A Workstation is first powered-on, the Power-up Diagnostic Tests will automatically run. Refer to Paragraph 6.8.2 for Diagnostic BIT Test Error Code listing. Following these tests, a visual test of the video and the attributes will be displayed to allow the operator to adjust the brightness. This display has lines of numbers 0 thru 7 with each line having an attribute corresponding to the number's bit position in the attribute byte (example: the line of 6's blink).

In addition, there are also random characters displayed on the last line of information, line 24. The characters on that line are there for comparison with other attributes such as Inverse Video, High Intensity, and Blinking. There is no other significance that should be attached to the information on line 24. Please disregard the information on this line.

OPERATION

While the visual test is displayed at normal intensity on the Monitor, additional diagnostic tests will be run. The Built-In Test will then query the Keyboard to determine if the CANCEL key has been depressed. If it has, the Keyboard will beep, and one of the special tests shown below may be selected. If no input from the keyboard is received, tests B will be run. If no errors are detected, the BIT will release control to the Data Link, which will load and run the operational software. If an error is found, testing stops with an error indication visible to the user. The IPL is then inhibited, unless overridden by depressing the SHIFT/HELP keys. The override allows the unit to be used if it has a non-fatal hardware fault.

The following is an example of the Normal Power-up display:

This line is displayed as inverse video:	<u>0000000</u>
This line underlined:	<u>4444444</u>
This line is underlined and only the underline blinks:	<u>5555555</u>
This line blinks, both numbers and underline:	<u>6666666</u>

NOTE

Please observe that the "6" line blinks continually with an underline above it.

Each display line has 10 number groups of 7 numbers in each group, plus 10 blanks equaling an 80 character line. The first group of zeros on the first line of the display, is composed of 1 blank and 7 zeros. All remaining line groups contain 80 characters and no spaces.

OPERATION

4.4.1 LOOP-ON BIT TEST

This mode is selected through a sequence of keystrokes (CANCEL, then PAGE). This mode will cause the tests in the BIT to be repeated until an error is detected. A loop count will be displayed. This mode may be exited by cycling the power off, then on again. In line 3 the test loop count is displayed and indicates an increasing numerical total of test cycles with each new cycle of the Loop-On Bit test.

Below is an example of the Loop-On Bit test display screen.

```
Rev 55A0      (C)  COPR  WANG LABORATORIES INC
IN07=4C      IN08=58
0001
```

4.4.2 KEYBOARD TEST

This test pattern is selected through a sequence of keystrokes (CANCEL, then SEARCH). Whenever a key is depressed, the keycode as received by the unit will be displayed in hexadecimal on the screen center.

NOTE

While in this test, pressing of the SHIFT/CANCEL key will release you to the BIT.

4.4.3 REFRESH TEST

This test is selected through a sequence of keystrokes (CANCEL, then DECTAB). The refresh test writes a 55 pattern in a section of memory, pauses 15 seconds, and then tests for data integrity. This test is run in the Loop-on Test mode with the loop counter updated each 15 seconds on the screen.

NOTE

While in this test, pressing of the CANCEL key will release you to the BIT.

REV 55AO (C) COPR WANG LABORATORIES INC

IN07=4C IN08=58

0001

REFRESH TEST WILL UPDATE COUNT EVERY 15 SECONDS

OPERATION

4.4.4 DIAGNOSTIC SCREEN ERROR MESSAGES

When an error is detected, the screen will be cleared, the ID field displayed and the error message displayed with the following format:

1. ERROR bb cc dd ee hhl1. Where ERROR is invariant and is meant to convey that an error has occurred and that the information on the rest of the line is error information.
2. bb cc dd ee hhl1. Where the contents of the Z80 are B, C, D, E and HL registers, respectively.
3. ee always represents error code. The first digit of error code represents the test number, and the second is the error number in the particular test.

If SHIFT/HELP key is depressed, the BIT will release control to the Data Link, which will load and run the operational software. This allows the unit to be used if it has a non-fatal hardware fault.

REV 55A0 (C) WANG LABORATORIES INC

IN07=4C IN08=58

ERROR FF FF ED FF 7EFF

4.5 4230A WORKSTATION OPERATING PRECAUTION

WARNING

Please note the need of a minimum of 1/8 inch clearance between the bottom rear of the workstation Monitor and the desk or table for normal operation. The elevation tube must be protruding a minimum of 1/8 inch for proper air flow (input/output) of the monitor.

SECTION

5

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SECTION 5

PREVENTIVE MAINTENANCE

5.1 MATERIALS REQUIRED

The CE tool kit is necessary for preventive maintenance of the 4230A Workstation. Additionally, soft cloths and warm soapy water are used to clean the workstation cabinet and CRT face. The 4230A Workstation does not require regular Preventive Maintenance.

5.2 CLEANING THE 4230A WORKSTATION

Make sure that the Monitor power is off and the Monitor power cable is unplugged from the electrical outlet prior to cleaning the workstation.

1. Dust the Keyboard with a soft-bristled brush.
2. To clean the Monitor cover and screen, perform the following:

NOTE

To clean the Monitor cover, use a slightly damp (mild soap and water solution), lint-free cloth to wipe down the outside case of the Monitor. Wipe dry with another clean dry cloth.

DO NOT USE CHEMICAL OR ABRASIVE CLEANERS.

To clean the Monitor screen, use a good quality glass cleaner or mild soap and water solution and a soft lint-free cloth. Use another lint-free cloth to dry the Monitor screen.

WARNING

If you clean the Monitor screen without removing the power cable, you could receive a dangerous electrical shock or a harmless static discharge.

SECTION

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**TROUBLE-
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SECTION 6

TROUBLESHOOTING

6.1 INTRODUCTION

Figure 6-1 and 6-2 are troubleshooting flowcharts for the 4230A Workstation. During the course of investigation, alignments or other procedures may be referred to as a means of verification or isolation of the problem. The repair philosophy for the 4230A Workstation is the field replacement of one or both of the PCA's. CRT replacement shall be accomplished at the FSC only.

6.2 RUNNING THE KEYBOARD DIAGNOSTIC

1. Insert the diagnostic into the Floppy Drive.
2. Load the diagnostic onto the system. Refer to the specific system user manual. For DOS Command Processor Operating Systems, type in the letters KYB720.EXEC to begin the diagnostic.

The initial screen will contain the following information:

WANG KEYBOARD TEST

Preliminary Version 1.0

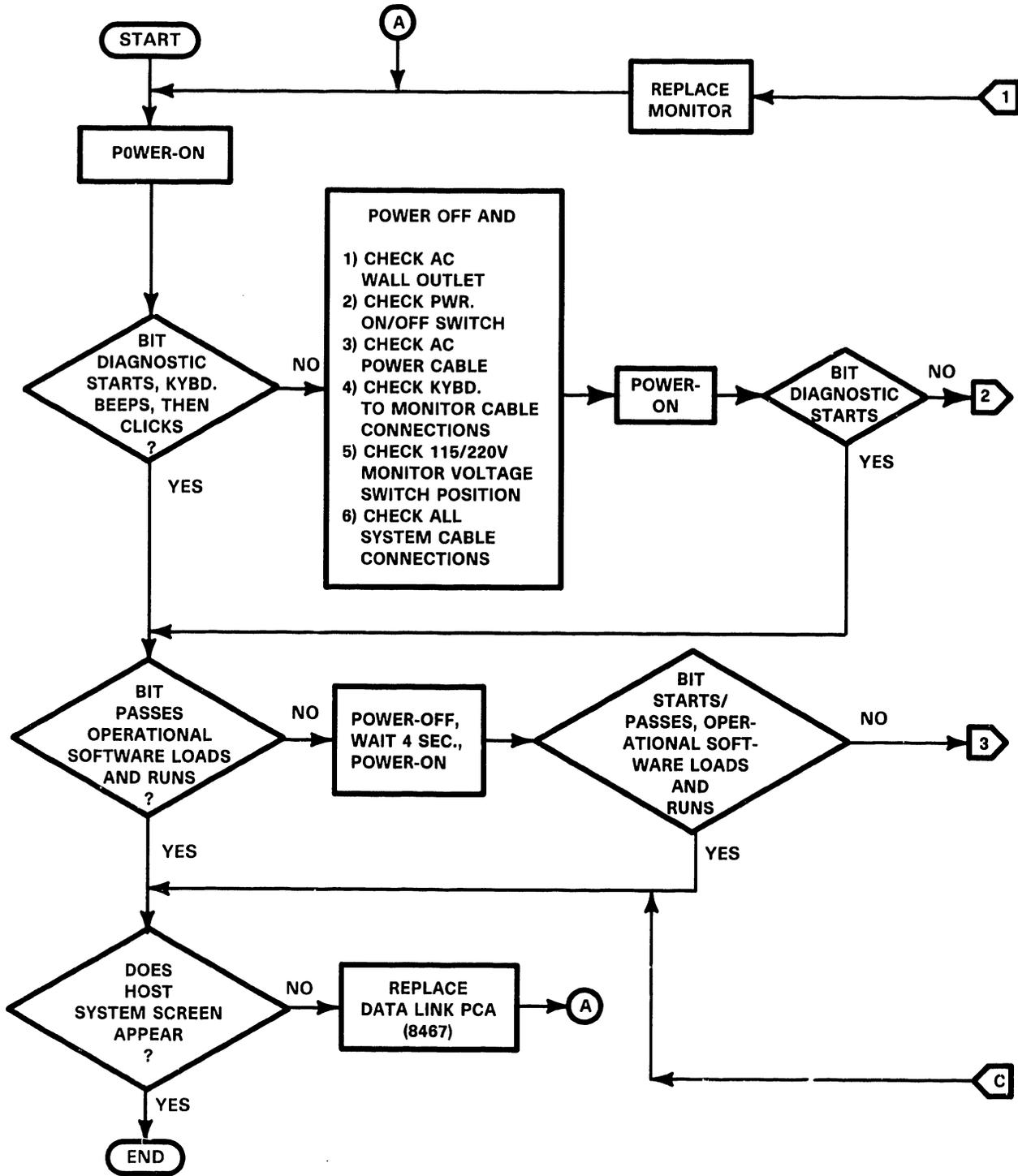
Hello. This program allows you to test your Wang Keyboard. A simulated keyboard layout will be displayed on the screen. Each key is automatically highlighted according to the key you press.

-- Keyboard Options--

■ : Test Make Only
___ : Test Make/Break
___ : Test Mouse Cursor Mode
___ : Test Mouse Data Mode
___ : Test Tones

Space Bar - Item Select
Execute - Proceed
Cancel - Exit
Help - Help Screen
E - Help Error Messages

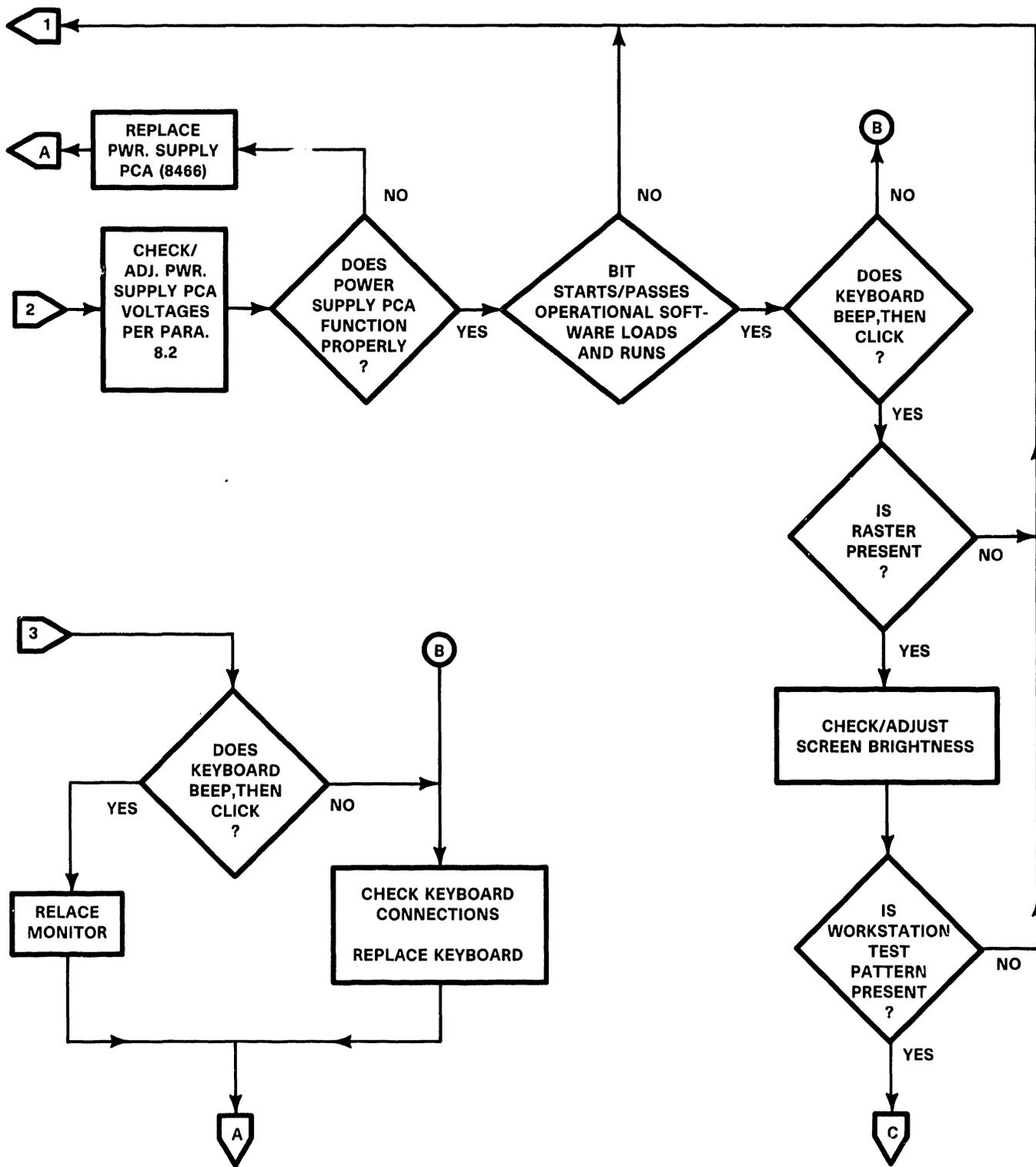
TROUBLESHOOTING



B-03025-FY86-1

Figure 6-1. 4230A Workstation Troubleshooting Flowchart

TROUBLESHOOTING



B-03025-FY86-3

Figure 6-2. 4230A Workstation Troubleshooting Flowchart

TROUBLESHOOTING

3. Move the cursor (using the space bar) to "Test Make Only".
4. Depress each of the keys on the Keyboard, making sure that all keys are highlighted on the screen.
5. Press the CANCEL key to end the test.
6. Move the cursor to "Test Make/Break" using the space bar.
7. Press each of the keys on the Keyboard. As the key is depressed, it should be highlighted on the screen. As the key is released, it should then become unhighlighted.

6.3 NORMAL POWER-UP DISPLAY SCREENS

When the 4230A Workstation is first powered-on, a series of internal diagnostic tests will be automatically run. Following these tests, a visual test of the video and the attributes will be displayed to allow the operator to adjust the brightness. This display has lines of numbers 0 thru 7 with each line having an attribute corresponding to the number's bit position in the attribute byte (example: the line of 6's blink).

In addition, there are also random characters displayed on the last line of information, line 24. The characters on that line are there for comparison with other attributes such as Inverse Video, High Intensity, and Blinking. There is no other significance that should be attached to the information on line 24. Please disregard the information on this line.

While the visual test is displayed at normal intensity on the Monitor, additional diagnostic tests will be run. The Built-In Test will then query the Keyboard to determine if the CANCEL key has been depressed. If it has, the Keyboard will beep, and one of the special tests shown below may be selected. If no input from the keyboard is received, test B will be run. If no errors are detected, the BIT will release control to the Data Link, which will load and run the operational software. If an error is found, testing stops with an error indication visible to the user. The IPL is then inhibited, unless overridden by depressing the SHIFT/HELP keys. The override allows the unit to be used if it has a non-fatal hardware fault.

The following is an example of the Normal Power-up display:

This line is displayed as inverse video:	<u>0000000</u>
This line underlined:	<u>4444444</u>
This line is underlined and only the underline blinks:	<u>5555555</u>
This line blinks, both numbers and underline:	<u>6666666</u>

TROUBLESHOOTING

6.4 LOOP-ON BIT TEST

This mode is selected through a sequence of keystrokes (CANCEL, then PAGE). This mode will cause the tests in the BIT to be repeated until an error is detected. A loop count will be displayed. This mode may be exited by cycling the power off, then on again. In line 3 the test loop count is displayed and indicates an increasing numerical total of test cycles with each new cycle of the Loop-On Bit test.

Below is an example of the Loop-On Bit test display screen.

Rev 55A0 (C) COPR WANG LABORATORIES INC

IN07=4C IN08=58

0001

TROUBLESHOOTING

6.5.1 ALIGNMENT "HO" TEST PATTERN

This HO test pattern is selected by depressing the CANCEL key followed by the CENTER key.

HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	HO	
O																						H	
H	!!!	!!!																			!!!	!!!	O
O	!!!	!!!																			!!!	!!!	H
H																							O
O																							H
H																							O
O																							H
H																							O
O																							H
H																							O
O																							H
H																							O
O																							H
H	!!!	!!!																			!!!	!!!	O
O	!!!	!!!																			!!!	!!!	H
H																							O
OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH	OH

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6.6 KEYBOARD TEST

This test pattern is selected through a sequence of keystrokes (CANCEL, then SEARCH). Whenever a key is depressed, the keycode as received by the unit will be displayed in hexadecimal on the screen center.

NOTE

While in this test, pressing of the SHIFT/CANCEL key will release you to the BIT.

6.7 REFRESH TEST

This test is selected through a sequence of keystrokes (CANCEL, then DECTAB). The refresh test writes a 55 pattern in a section of memory, pauses 15 seconds, and then tests for data integrity. This test is run in the Loop-on Test mode with the loop counter updated each 15 seconds on the screen.

NOTE

While in this test, pressing of the CANCEL key will release you to the BIT.

REV 55AO (C) COPR WANG LABORATORIES INC

IN07=4C IN08=58

0001

REFRESH TEST WILL UPDATE COUNT EVERY 15 SECONDS

TROUBLESHOOTING

6.8 SCREEN STANDARDS

6.8.1 ERROR MESSAGES

When an error is detected, the screen will be cleared, the ID field displayed and the error message displayed with the following format:

ERROR bb cc dd ee hhl1. Where ERROR is invariant and is meant to convey that an error has occurred and that the information on the rest of the line is error information.

bb cc dd ee hhl1. Where the contents of the Z80 are B, C, D, E and HL registers, respectively.

ee always represents error code. The first digit of error code represents the test number, and the second is the error number in the particular test.

If SHIFT/HELP key is depressed, the BIT will release control to the Data Link, which will load and run the operational software. This allows the unit to be used if it has a non-fatal hardware fault.

REV 55A0 (C) WANG LABORATORIES INC

IN07=4C IN08=58

ERROR FF FF ED FF 7EFF

6.8.2 4230A WORKSTATION BIT TEST/ERROR CODES

<u>TEST NUMBER</u>	<u>TEST NAME</u>	<u>ERROR CODE</u>	<u>FAILING MODULE OR DESCRIPTION</u>
01	Keystroke	None	Interrupt logic
20	Checksum test	21	Eprom
30	Force bad parity	31	Bad data with good parity set
		32	Could not force bad parity
		33	Bad parity, good parity set
40	Macho test	41	Data error, Main Memory
		42	Add error
		43	Parity error
50	Mem select	51	Bit 7 (IN07) is set
		52	Data error
		53	Could not select Main Memory
		54	Bit 7 (IN07) is set
		55	Could read Main Memory
		56	Main Memory still selected
		57	Bit 7 (IN07) is set
		58	Screen Memory selected
		59	Main Memory selected
		5A	Data error, font memory
		5B	Could read font
		5C	Could not verify font selected
		5D	128 font selected
		5E	128 font selected
		5F	256 font selected
60	Screen Memory test	61	Data error
		62	Add. error
70	Font Memory test	71	Data error
		72	Add. error
80	Keyboard test	B1	No returned data
		B2	Data error
		B4	No keyboard interrupt
90	Refresh test	91	Data error
		93	Parity error

TROUBLESHOOTING

6.9 4230A WORKSTATION POWER-UP FAILURE DIAGNOSIS

If the 4230A Workstation fails to provide the normal power-up indications as covered in Section 4, use the following general criteria to determine which PCA within the Workstation Monitor has failed.

- ** 1. If there is no response when the 4230A Workstation is powered-up, the Power Supply PCA (larger of the two) is suspect.
- ** 2. If the 4230A Workstation power-up is normal, but you can't communicate with the VS or OIS Systems, or when a much smaller than normal raster is present, then the Data Link Electronics PCA (smaller of the two) is suspect.

This paragraph does not attempt to cover all possible failures that may occur within the Workstation, therefore the Service Technician should use more in-depth component troubleshooting to accomplish a repair.

** Refer to sections 7 and 8 before attempting any Monitor cover or PCA removal. Specific WARNING, DANGER and CAUTION information should be read prior to any troubleshooting, removal, adjustment or repair of internal circuitry.

SECTION

7

REPAIR

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SECTION 7

REPAIR

7.1 TOOLS AND TEST EQUIPMENT

No special tools or test equipment are required to repair the 4230A Workstation. All necessary repair can be accomplished using the CE tool kit.

7.2 4230A WORKSTATION MONITOR DISASSEMBLY

All corrective maintenance procedures are performed with the 4230A Workstation Monitor disassembled. No adjustments other than Power-On/Off and Brightness are performed from the outside of the 4230A Workstation Monitor enclosure. No attempt should be made to repair the Power Supply PCA (8466); it is a field replaceable item only.

WARNING

Do not touch the Power Supply PCA while the Monitor is powered-up. Extremely dangerous voltages which exceed 300 Volts DC, and unlimited current, are present within the Power Supply PCA.

Prior to removing the Monitor cover for PCA replacement or adjustment, the Brightness/On-Off control must be completely off (0). In addition, the AC power plug must be removed from the wall socket.

Prior to removing the Power Supply PCA (8466), allow one minute before removing the Power Supply PCA. This will provide adequate time for any residual voltage to drain through the bleeder resistors.

7.2.1 4230A WORKSTATION MONITOR REAR COVER REMOVAL

Rear cover removal should be accomplished by performing the following steps:

1. Power-Off the 4230A Workstation Monitor and disconnect the ac power cord from the ac receptacle.
2. Using a slotted-head screwdriver, remove the ac power cord on the rear of the 4230A Workstation Monitor by removing two (2) slotted-head screws.

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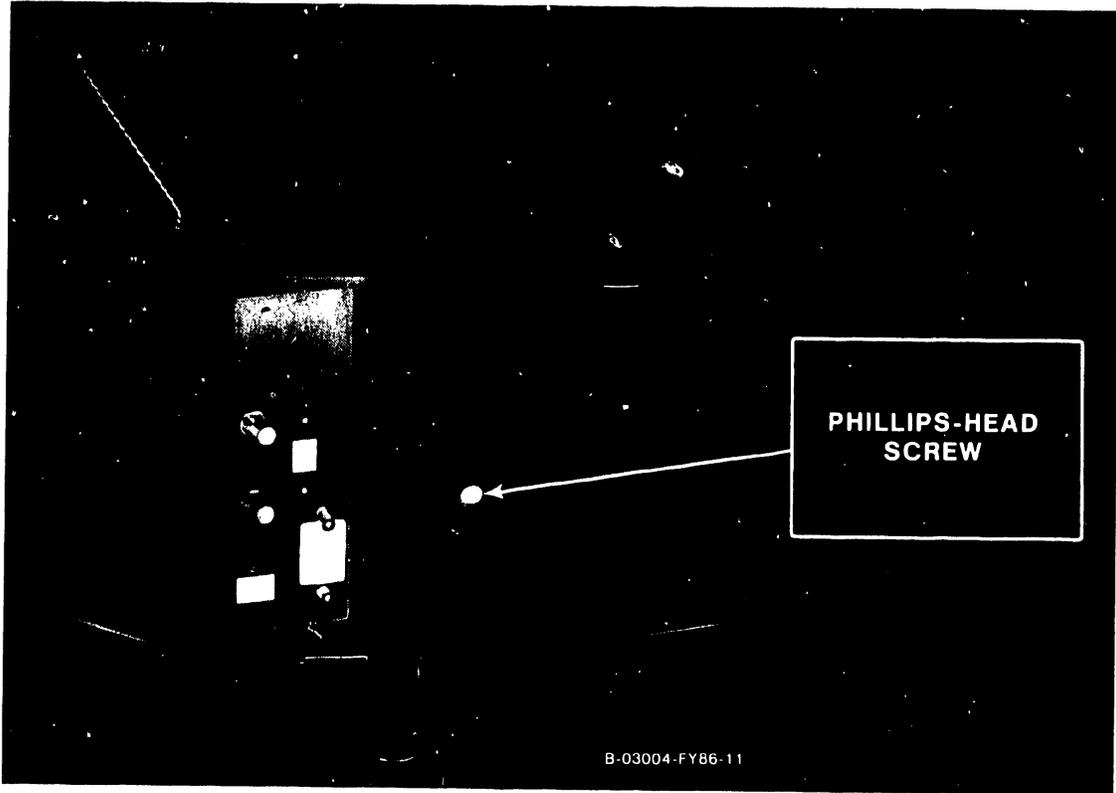


Figure 7-1. 4230A Workstation Monitor Cover Removal.

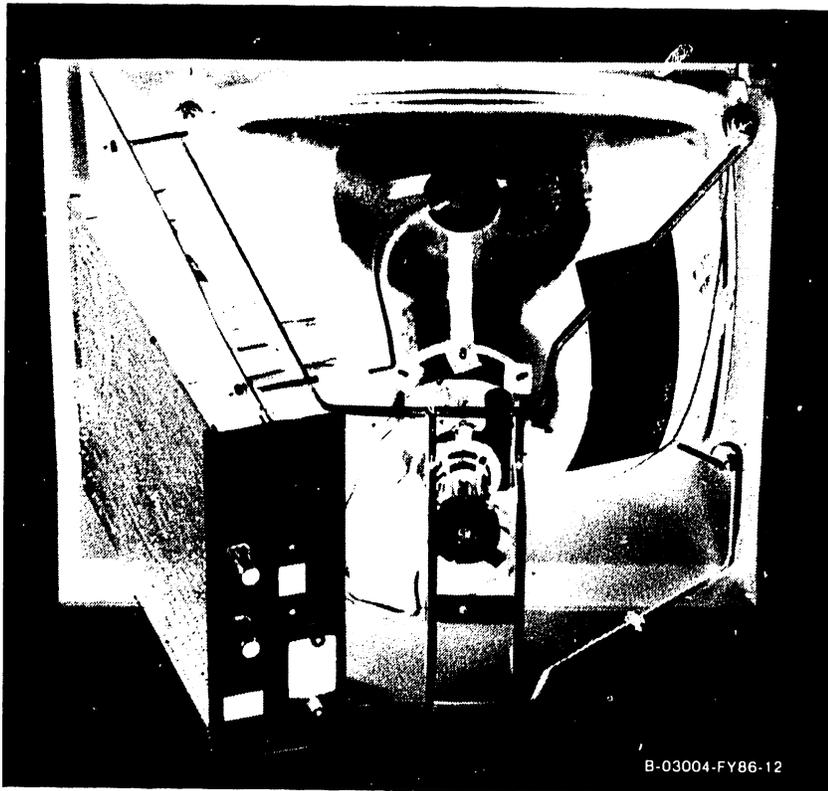


Figure 7-2. 4230A Workstation Monitor Cover Removed

REPAIR

3. Position the Monitor such that the back of the Monitor cover is facing you. Rest the Monitor on a soft cloth, and using a Phillips-head screwdriver, remove one (1) Phillips-head screw from the rear center of the Monitor (figure 7-1).
4. Tilt the Monitor forward and rest the Monitor bezel on the soft cloth. This will position the underside of the Monitor and the Monitor Tilt-mechanism towards you. Carefully lift the Monitor cover by grasping the sides of the cover and lifting straight upwards.

7.2.2 4230A WORKSTATION MONITOR CRT DISCHARGE PROCEDURE

DANGER

The CRT can hold a charge of several kilovolts. To prevent accidental discharge which could result in serious injury, discharge CRT anode as follows:

1. Using a non-conducting tool (plastic alignment tool) raise edge of rubber anode cap and insert screwdriver (figure 7-3).
2. Discharge CRT anode by touching anode clip with grounded screwdriver. (figure 7-3).
3. Disconnect high voltage connector from CRT.

WARNING

When reassembling Monitor CRT, ensure "Faston" clip ground lug is reconnected before powering-on Monitor.

7.2.3 4230A WORKSTATION MONITOR DATA LINK PCA REMOVAL

1. Turn the complete Monitor 1/4 turn to the left, and remove the four (4) Phillips-head screws that fasten the outermost board, the Data Link PCA.
2. Using a 1/2 inch open-end wrench or nut-driver, remove the two fastener nuts from the two (2) threaded connectors on the rear of the Monitor PCA connector panel.
3. Gently pull the lower portion of the Data Link PCA away (approximately 1/2 inch) from the connection on the Monitor Power Supply PCA underneath. Carefully remove the Data Link PCA by pulling down on the board.

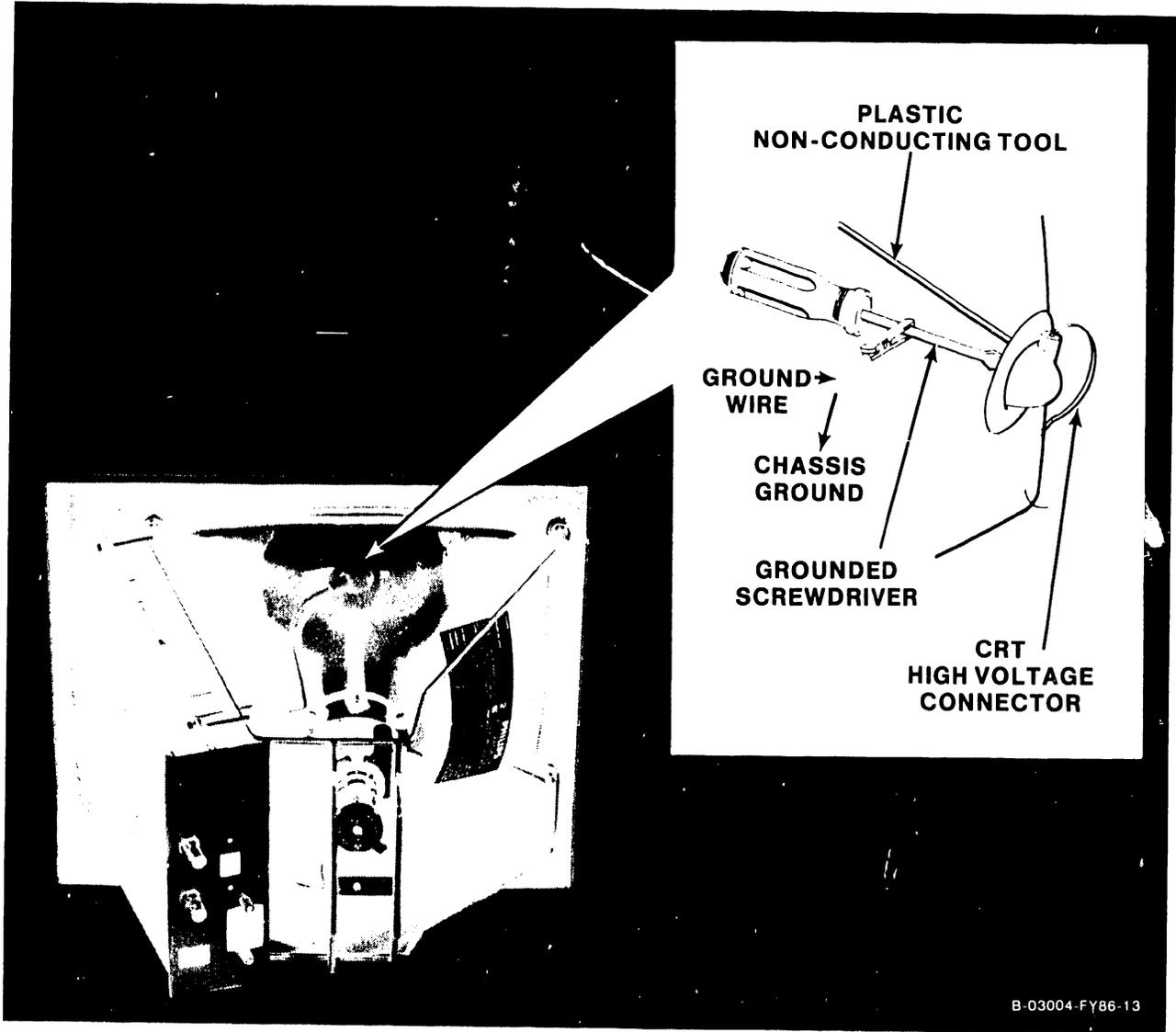


Figure 7-3. CRT Second Anode Discharge Procedure

REPAIR

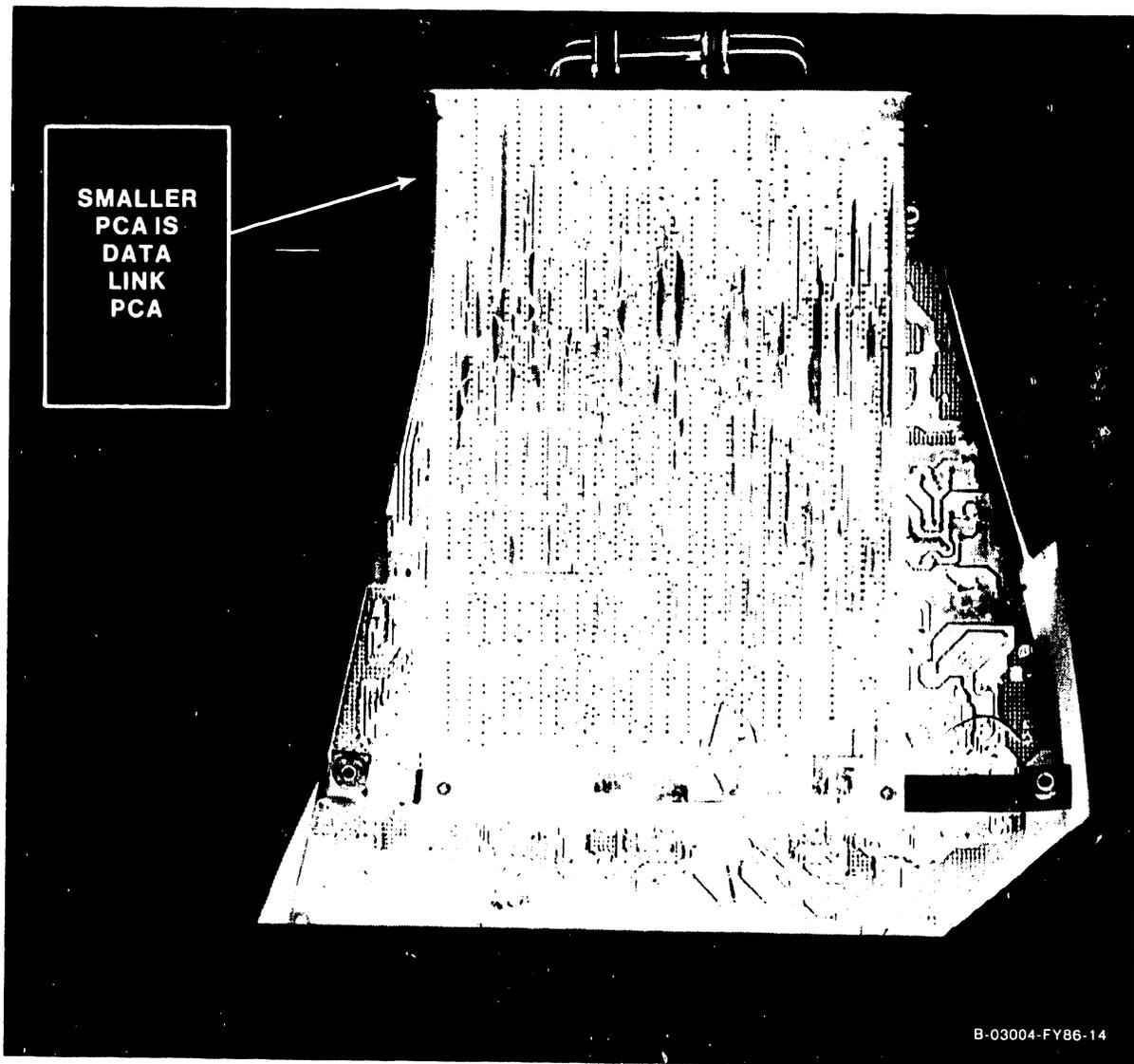


Figure 7-4. 4230A Workstation Monitor Data Link PCA Removal

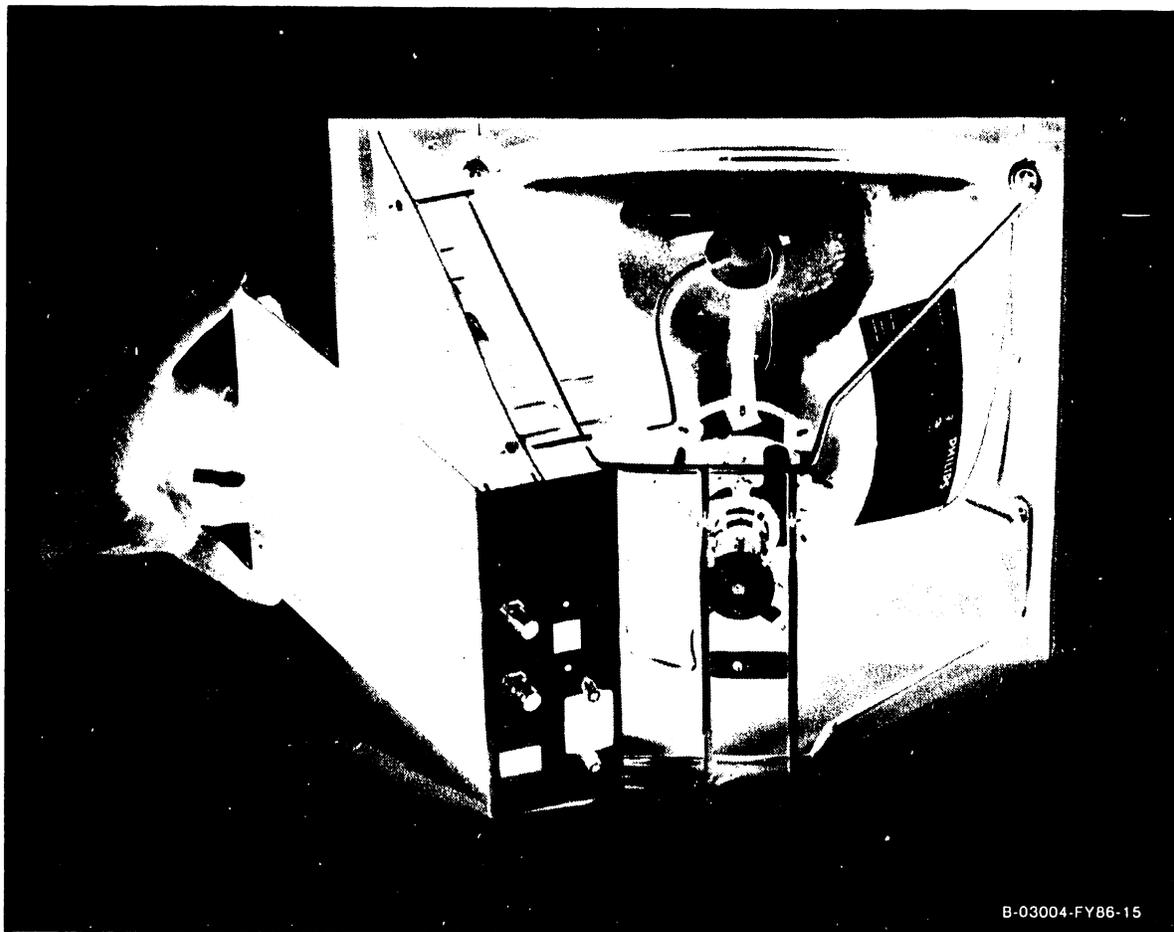


Figure 7-5. 4230A Workstation Monitor Data Link PCA Removal

REPAIR

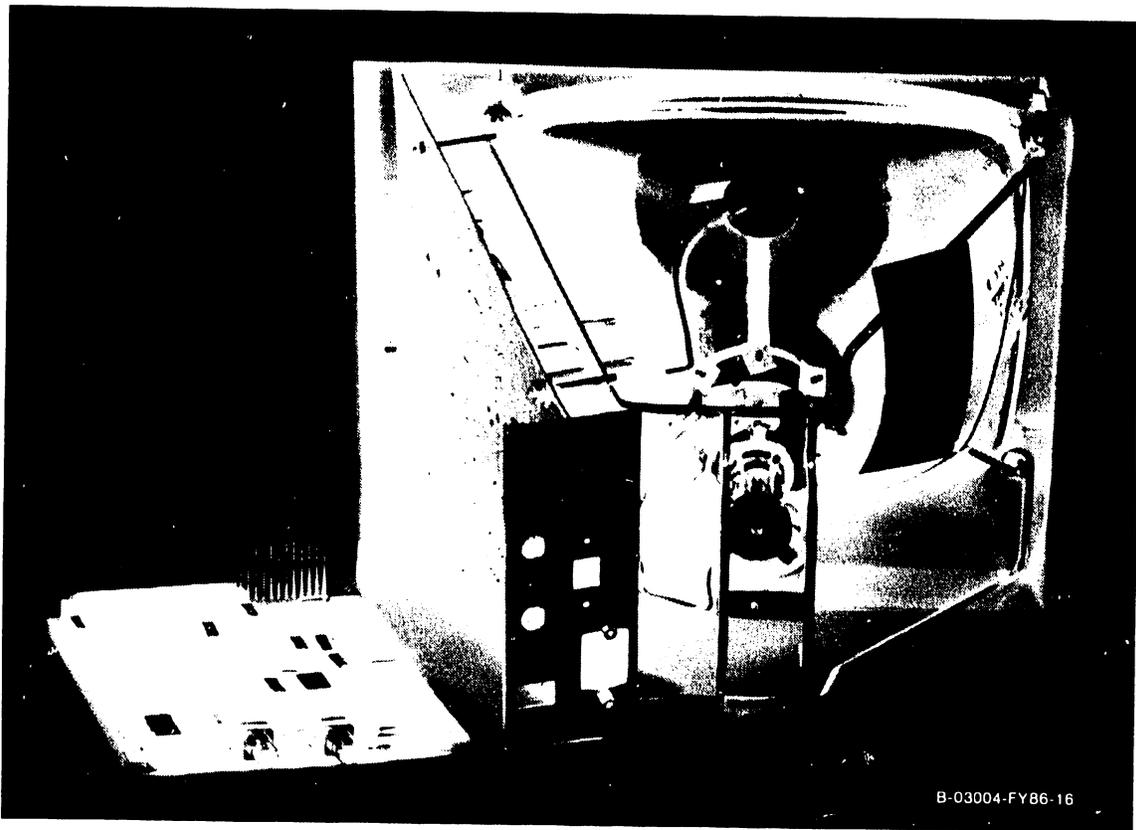


Figure 7-6. 4230A Workstation Monitor Data Link PCA Removed

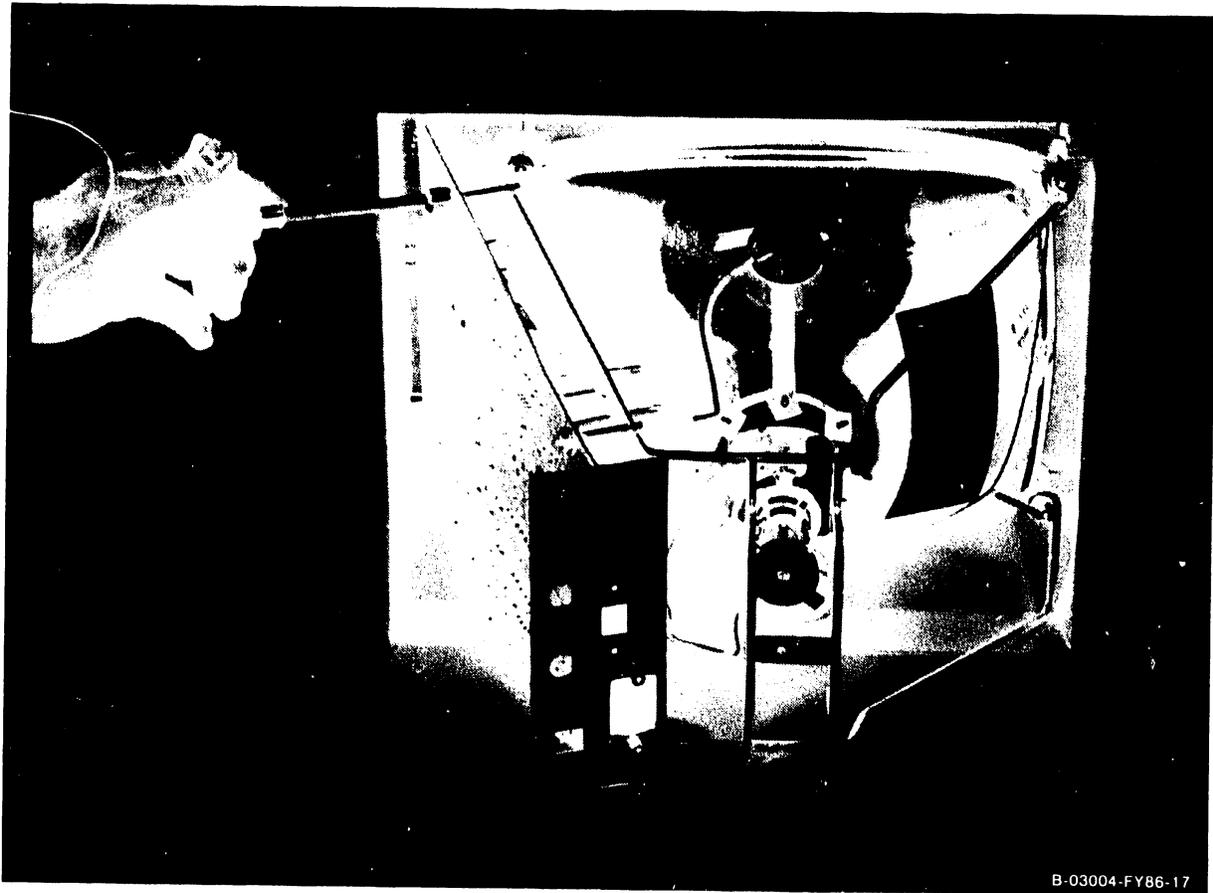
7.2.4 4230A WORKSTATION MONITOR POWER SUPPLY PCA REMOVAL**DANGER**

The CRT can hold a charge of several kilovolts. To prevent accidental discharge which could result in serious injury, discharge CRT anode as follows:

Refer to paragraph 7.2 for a WARNING regarding Power Supply PCA removal.

8. The Power Supply/Monitor PCA may be removed by using a 3/8 inch open-end wrench or nut-driver, and removing the four (4) fastener nuts from the four (4) mounting screws on the chassis mounting frame. Refer to Figure 7-3 for specific information regarding high voltage connection removal.
9. Remove the following wiring connections from the Power Supply/ Monitor PCA:
 - a. Chassis/CRT ground wire connector on the Power Supply/Monitor PCA.
 - b. CRT pin connector on the CRT neck (figure 7-3).
 - c. CRT second anode connector at the second anode connection on the CRT (figure 7-3).
 - d. Deflection yoke connector (J5) on Power Supply/Monitor PCA.
 - e. Power On-Off switch connector (J3) of Power Supply/Monitor PCA.
 - f. On-Off switch connector (J7) of Power Supply/Monitor PCA.

REPAIR



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Figure 7-7. 4230A Workstation Monitor Power Supply PCA Removal

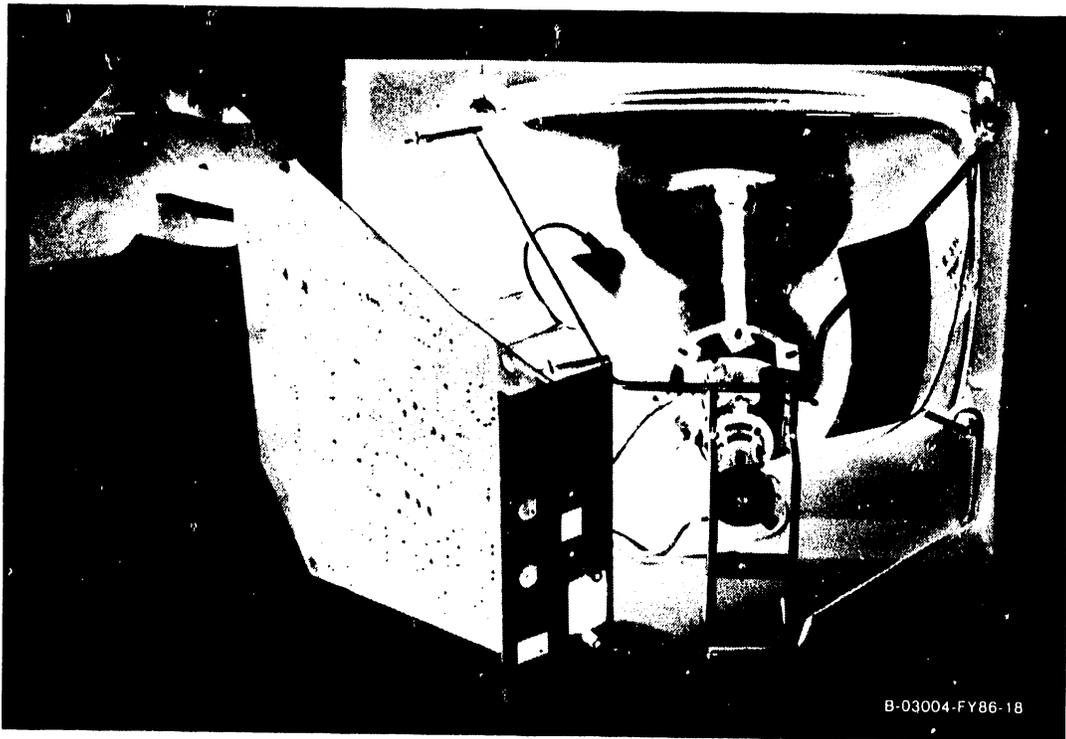


Figure 7-8. 4230A Workstation Monitor Power Supply PCA Removal

REPAIR

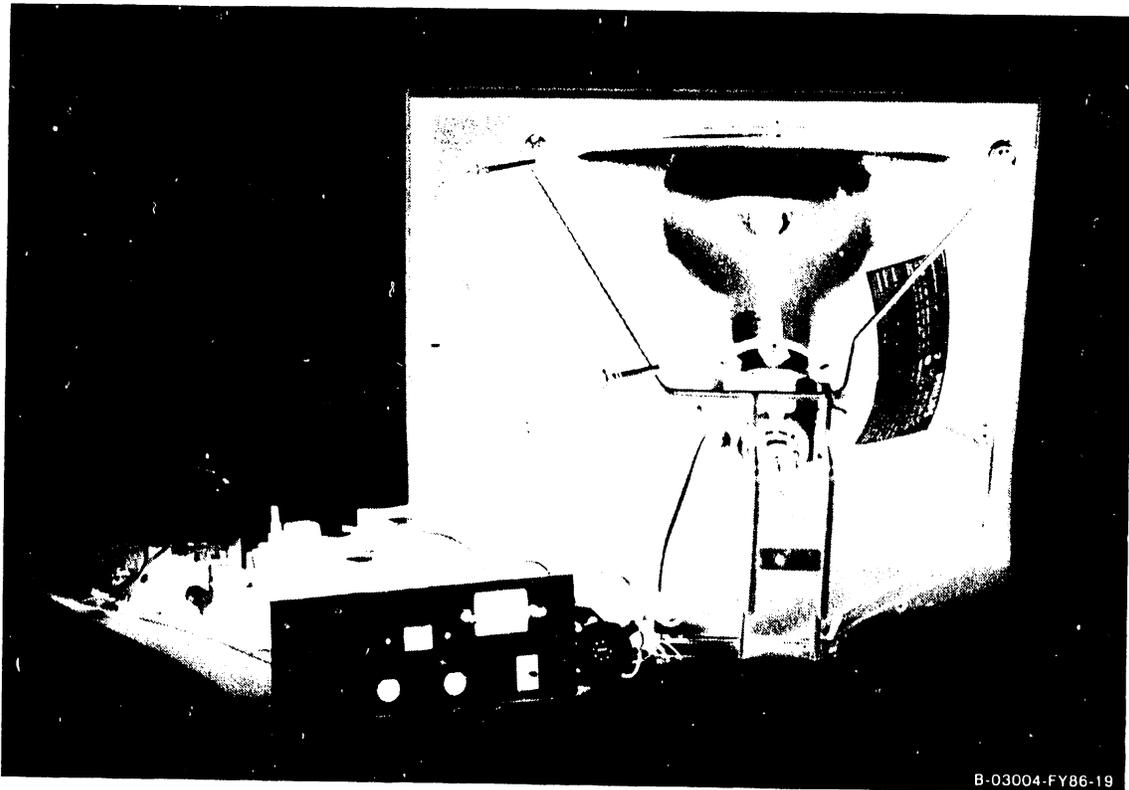


Figure 7-9. 4230A Workstation Monitor Power Supply PCA Removed

7.3 4230A WORKSTATION MONITOR REASSEMBLY

Prior to reassembly of the 4230A Workstation Monitor, observe the following CAUTIONS regarding the proper assembly of the Monitor Power Supply PCA and the Data Link PCA to the wire form chassis PCA mounting.

CAUTION

Prior to reassembling the 4230A Workstation Monitor PCA to the Monitor chassis wire form PCA mount, be certain that the AC power plug has been disconnected from the AC wall receptacle. The back plane of the Monitor Power Supply PCA is not protected from an AC short to ground. Damage can result if the Monitor Power Supply PCA is installed when the AC power is connected.

When reinstalling the Monitor Power Supply PCA and Data Link PCA, make sure that the ambient light detector housing located on the lower front of the Power Supply PCA does not touch the chassis. It is important that the PCA be properly aligned for correct detector response to produce proper CRT display brightness.

Power-up the 4230A Workstation Monitor with the Monitor cover removed and check for proper screen display. Locate and check the Power Supply PCA pins for proper voltages.

WARNING

When reassembling Monitor CRT, ensure "Faston" clip ground lug is reconnected before powering-on Monitor.

SECTION

8

ADJUST-

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SECTION 8

ADJUSTMENT

8.1 SPECIAL TOOLS

No special tools or equipment are required to perform adjustments and alignments on the 4230A Workstation. All adjustments and alignments on the 4230A Workstation can be performed using the standard CE tool kit.

8.2 4230A WORKSTATION MONITOR POWER SUPPLY ADJUSTMENTS

Remove the 4230A Workstation Cover (reference section 7), and power-up the 4230A Workstation (reference section 4) to accomplish the following Monitor power supply adjustment procedure.

1. Using the square alignment pattern of HOHO's on the screen (reference paragraph 8.5), adjust each power supply to the following parameters as referred to in figure 8-1. Reference figure 8-2 for J4 connector pin layout and section 7.2 for a Monitor disassembly WARNING.

a. 5 Volt adjustment:

Monitor this adjustment on pins 1 and 3 of J4 connector.

1. Adjust R16 to set the 5 Volts between 5.15 and 5.20 Volts.

b. 12 Volt adjustment:

Monitor this adjustment on pins 3 and 6 of J4 connector.

1. Adjust R26A to set 12 Volts between 11.95 and 12.00 Volts.

8.3 4230A WORKSTATION KEYBOARD ADJUSTMENTS

The Keyboard is a unit-swap item and therefore requires no field adjustment.

8.4 VIDEO TEST PATTERNS (ATTRIBUTES DISPLAY)

This mode is selected through a sequence of keystrokes (CANCEL, then CENTER). No internal testing will be performed. A pattern is presented on the screen of the Monitor for the purposes of verifying that the video controller logic is functional. This pattern changes and alternates from normal to inverse video continually until the CENTER key is depressed. Depressing the CENTER key will cause the alignment pattern to be displayed (paragraph 8.5).

ADJUSTMENT

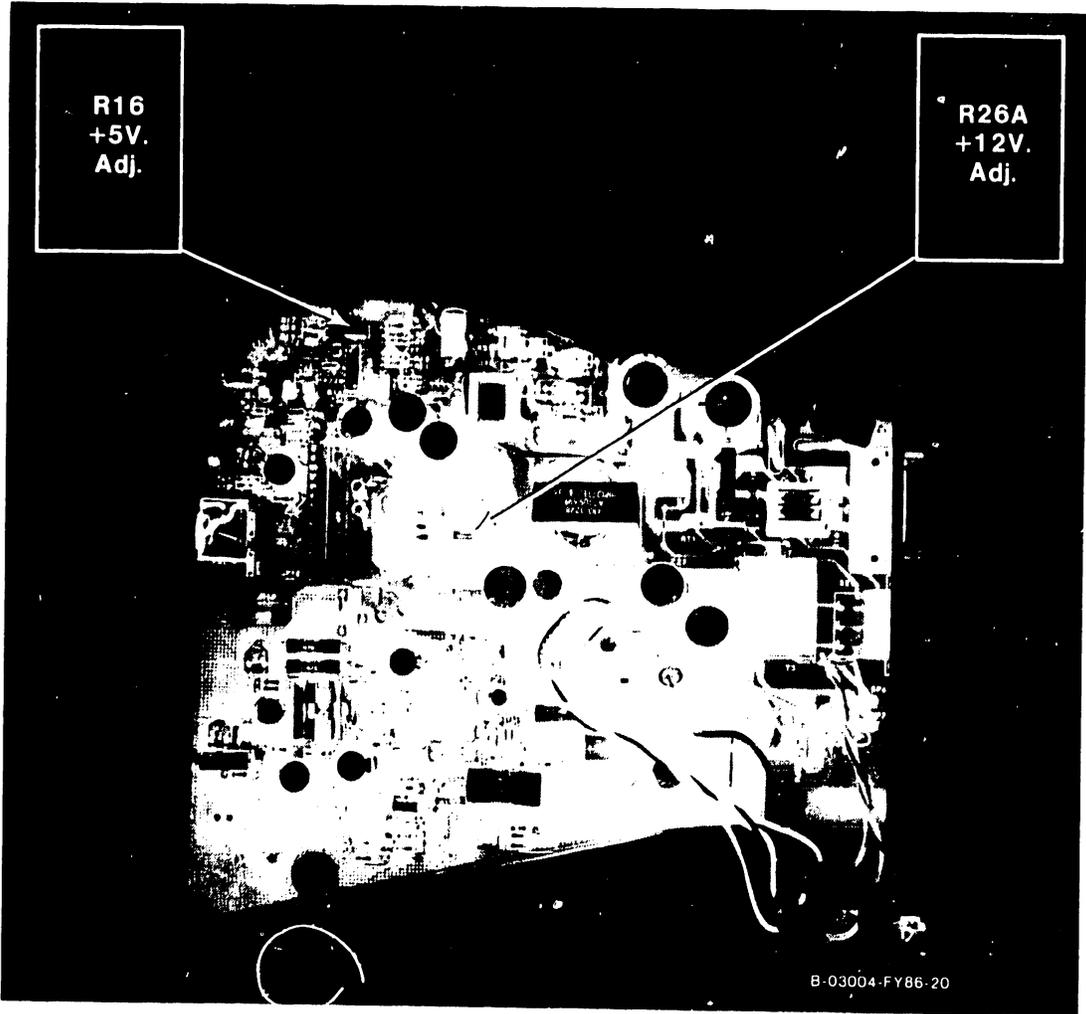
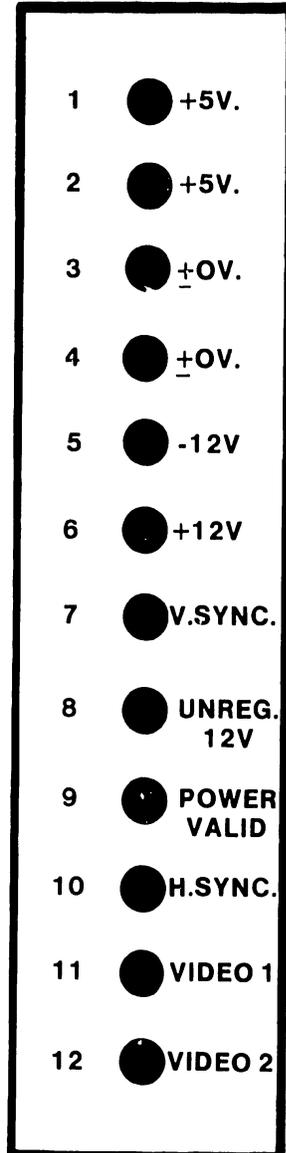


Figure 8-1. 4230A Workstation Power Supply PCA Adjustments

**J4 CONNECTOR
PIN ASSIGNMENT**

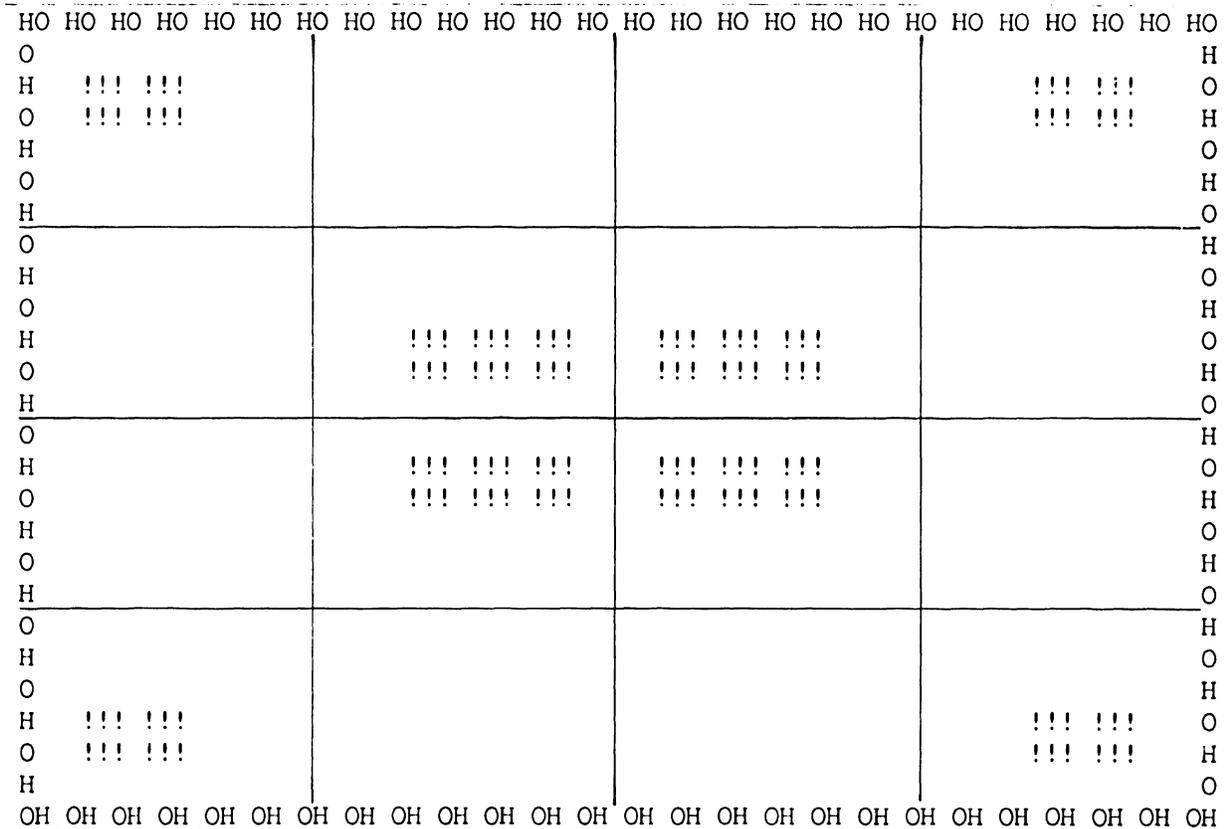


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Figure 8-2. 4230A Workstation Monitor Power Supply (J4) Connector

8.5 VIDEO ALIGNMENT TEST PATTERN

This test pattern is selected by depressing the CANCEL key followed by the CENTER key.



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SECTION

9

UNPACK-

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SETUP

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SECTION 9

UNPACKING AND SET-UP

9.1 UNPACKING THE 4230A WORKSTATION COMPONENTS

Prior to removing the 4230A Workstation Components from their two individual boxes, please note the condition of each box. The 4230A Workstation consists of a Monitor and a detached Keyboard.

9.1.1 UNPACKING THE 4230A WORKSTATION MONITOR

1. Remove the Monitor from the Monitor packing box. The ac power cable, the system power cable and the Monitor-tilt mechanism are shipped with the Monitor. Set the cables and the Monitor-tilt mechanism aside for future reference.

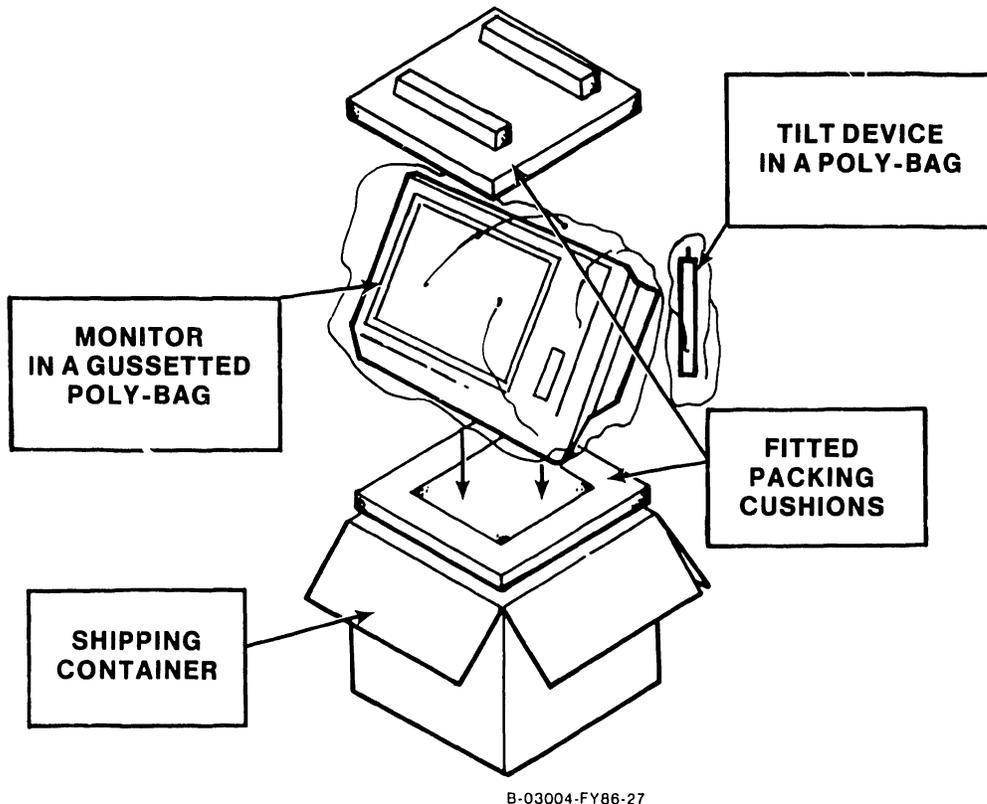


Figure 9-1. Unpacking the 4230A Workstation Monitor

UNPACKING AND SETUP

9.1.2. UNPACKING THE 4230A WORKSTATION KEYBOARD

2. Open the Keyboard carton and remove the Keyboard from the packing box. Remove the packing material from the ends of the Keyboard and visually inspect the unit and the attached coil cable for external damage.

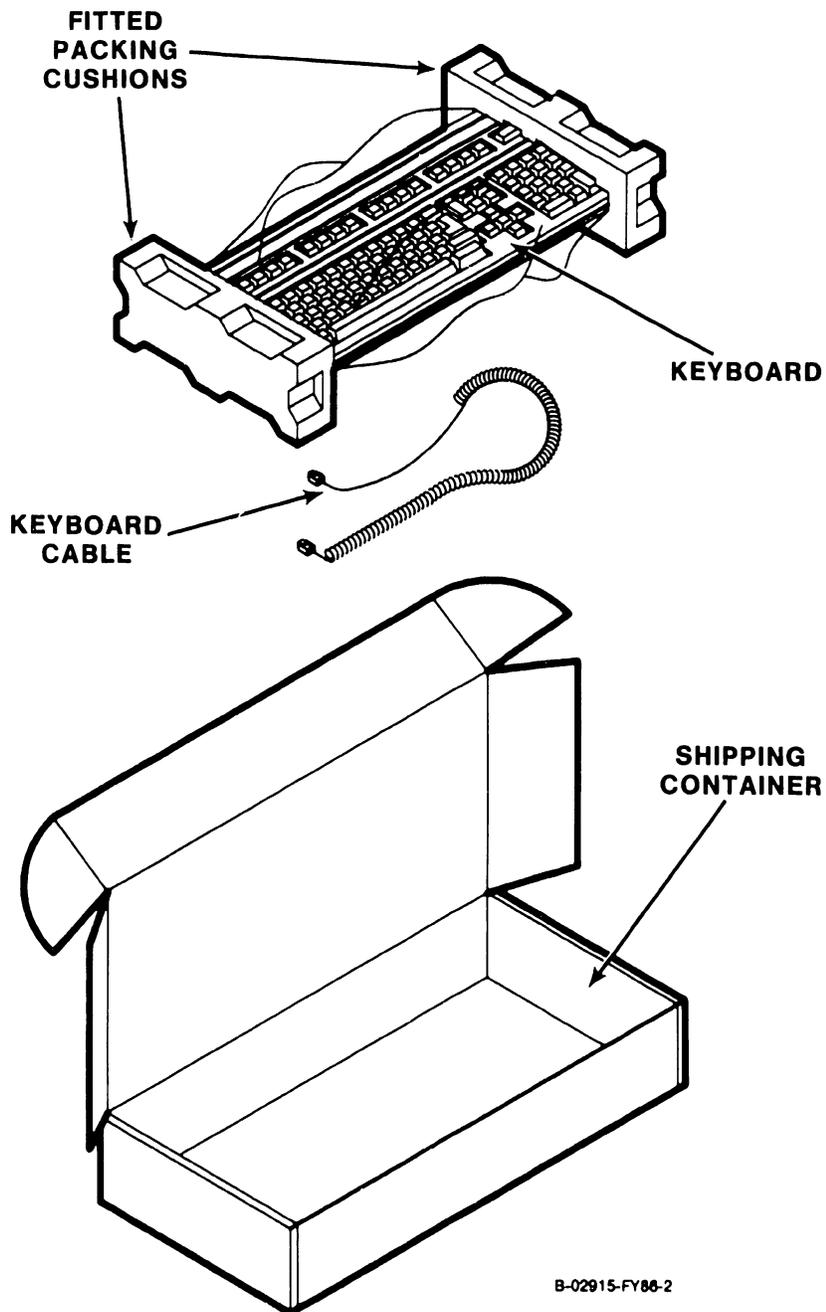


Figure 9-2. Unpacking the 4230A Workstation Keyboard

9.1.3 CLAIMS INFORMATION

If damage is discovered during inspection, the customer should file an appropriate claim promptly with the carrier involved, and notify your service manager.

9.2 MONITOR AND KEYBOARD CONNECTIONS

9.2.1 CONNECTING THE KEYBOARD TO THE MONITOR

Prior to connecting any equipment together, please make sure that the ac power On/Off (I/O) switch is in the Off (O) position and that the Monitor is not connected into any ac power source. Insert the end of the coiled Keyboard cable into the jack on the rear of the Monitor.

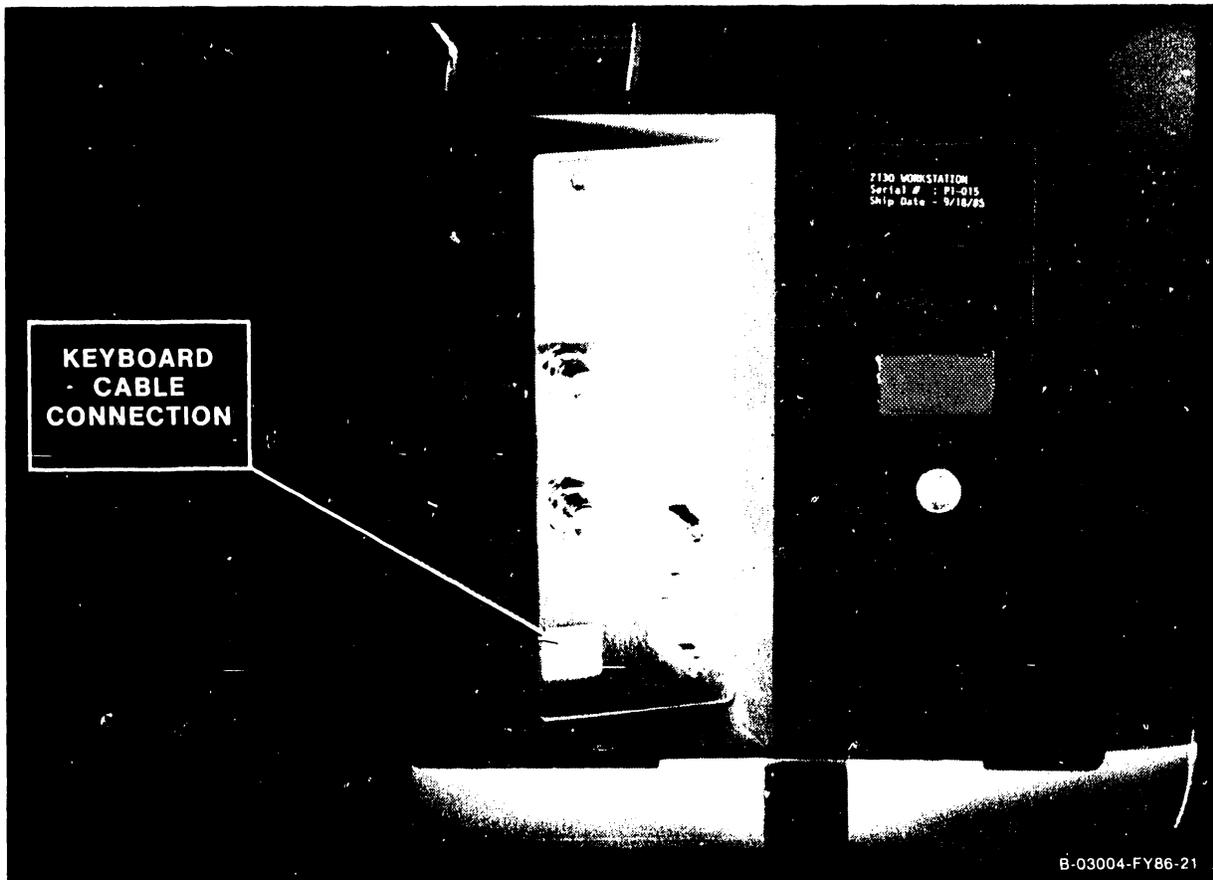


Figure 9-3. Monitor/Keyboard Connection

UNPACKING AND SETUP

9.2.2 CONNECTING THE SYSTEM CABLE

Locate the system cable that is shipped with the Monitor. Notice that at both cable ends there are connectors. While one connector locks into place, the other is threaded and screws into place.

9.2.3 SYSTEM CABLE CONNECTION TO THE REAR OF THE MONITOR

Connect the workstation Monitor and Keyboard as described below:

1. Connect the system cable to the rear of the Monitor by pushing the threaded connector gently over the threaded port on the rear of the monitor. Turn the collar clockwise until it screws on the connector.
2. Push the locking connector gently over the locking port on the rear of the Monitor. Rotate the collar until it locks into place.
3. Connect the other end of the system cable to the host system. Make sure that your system has been configured to accept the workstation.

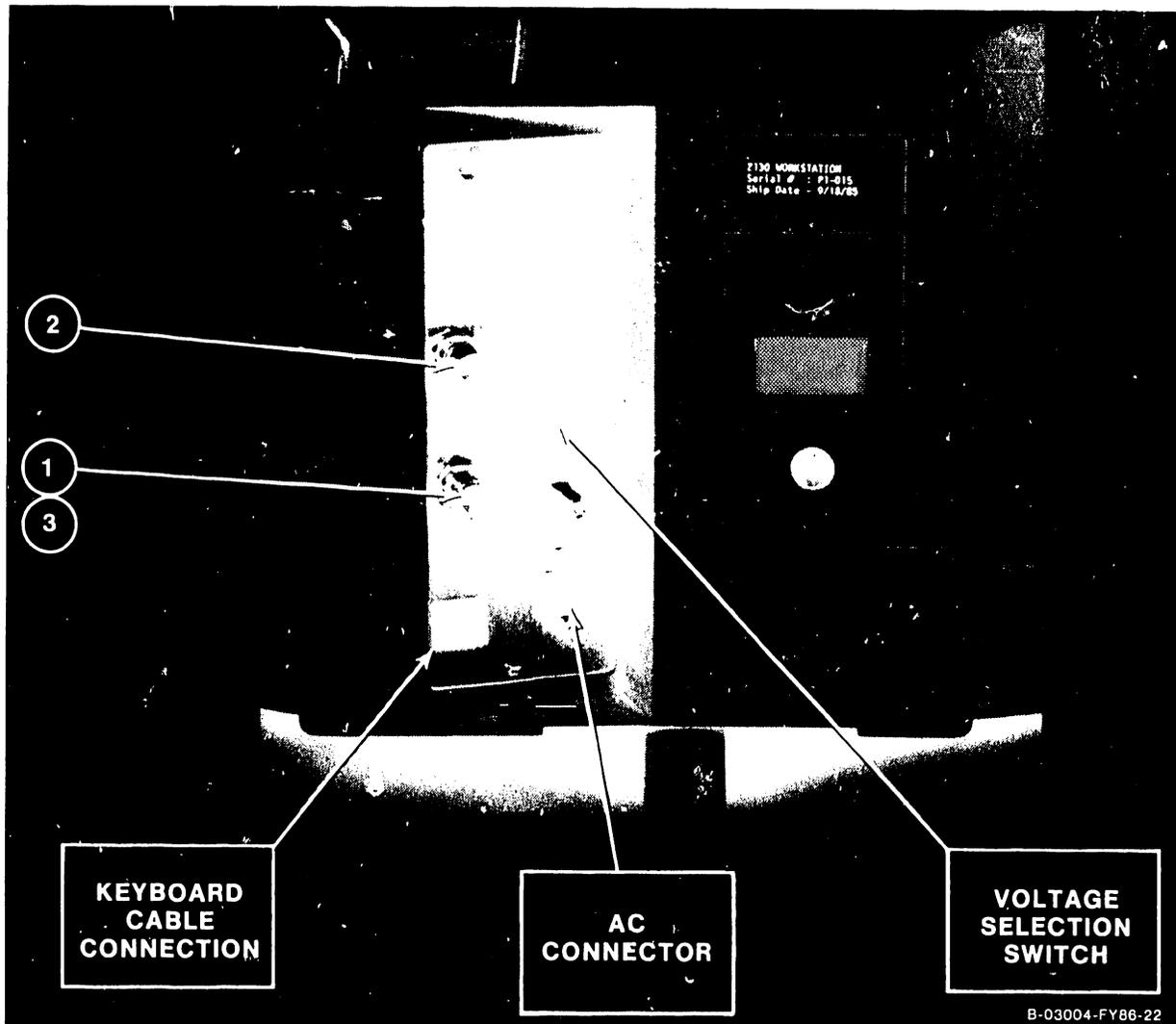


Figure 9-4. System Cable Connections

9.2.4 CONNECTING THE AC POWER CABLE

1. Make sure that the On/Off (1/0) switch on the front of the Monitor is in the Off (0) position.
2. Read the Warning Label that covers the ac power port on the rear of the Monitor. Remove the Warning Label.
3. Locate the ac power cable that was shipped with the Monitor. Plug the end of the ac power cable with the attached mounting screws into the ac power port on the rear of the Monitor.
4. Tighten the mounting screws on the ac power cable using a flat-blade screwdriver. This secures the power cable to the Monitor.

9.3 CHECKING THE VOLTAGE SETTING

The voltage switch mounted on the rear of the Monitor controls the ac power supplied to the 4230A Workstation. Make sure that the switch setting (either 115 Vac or 230 Vac) matches the power supplied to your work area. Adjust the switch for the proper operating voltage setting (115 Vac or 230 Vac), so that the voltage readable is the voltage set (when 230 Vac is readable, the switch is set for 230 Vac).

1. To change the switch setting from 115 Vac to 230 Vac, insert a flat-blade screwdriver into the slot and push up or down to select the proper operating voltage.

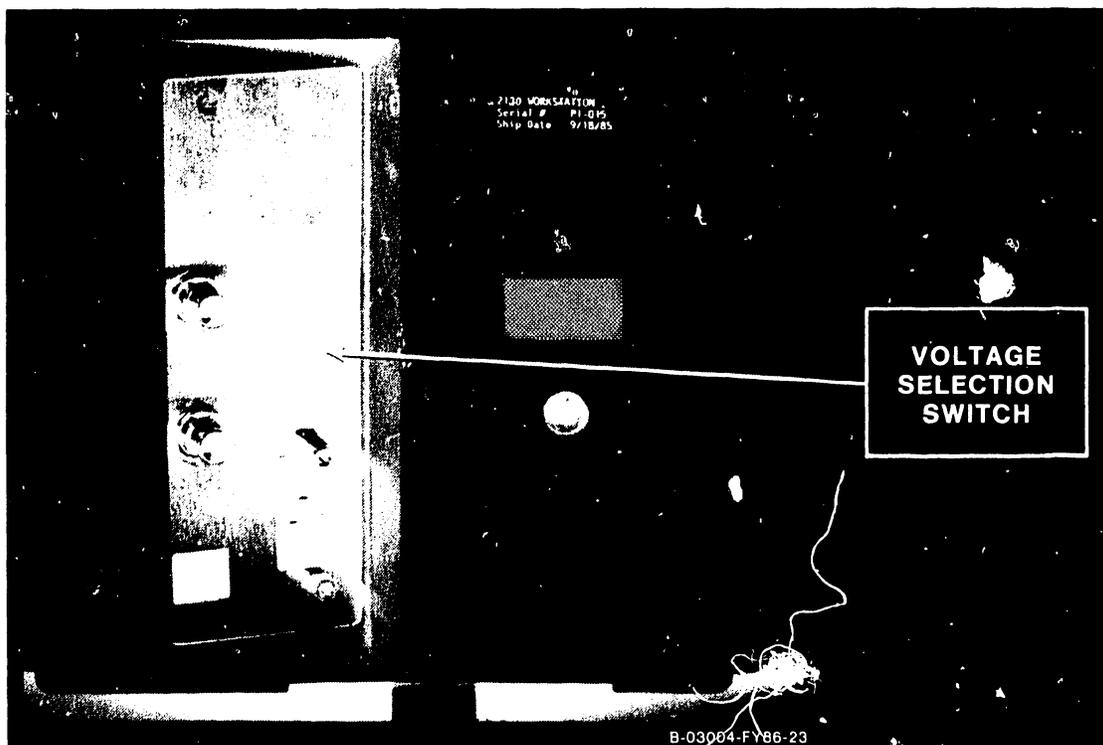


Figure 9-5. 4230A Workstation Monitor Voltage Select Switch

UNPACKING AND SETUP

9.4 INSTALLING THE MONITOR-TILT MECHANISM

1. Place the Monitor face down on the surface of the work area. Be careful not to disconnect the ac power cable, the Keyboard cable or the system cable.
2. Plug the long, thin end of the Monitor-tilt mechanism into the round receptacle on the bottom of the Monitor (figure 9-6).
3. Hold the Monitor-tilt mechanism with one hand, and slowly return the Monitor to its working position.
4. Adjust the Monitor viewing angle by pulling up or pushing down slowly on the Monitor.

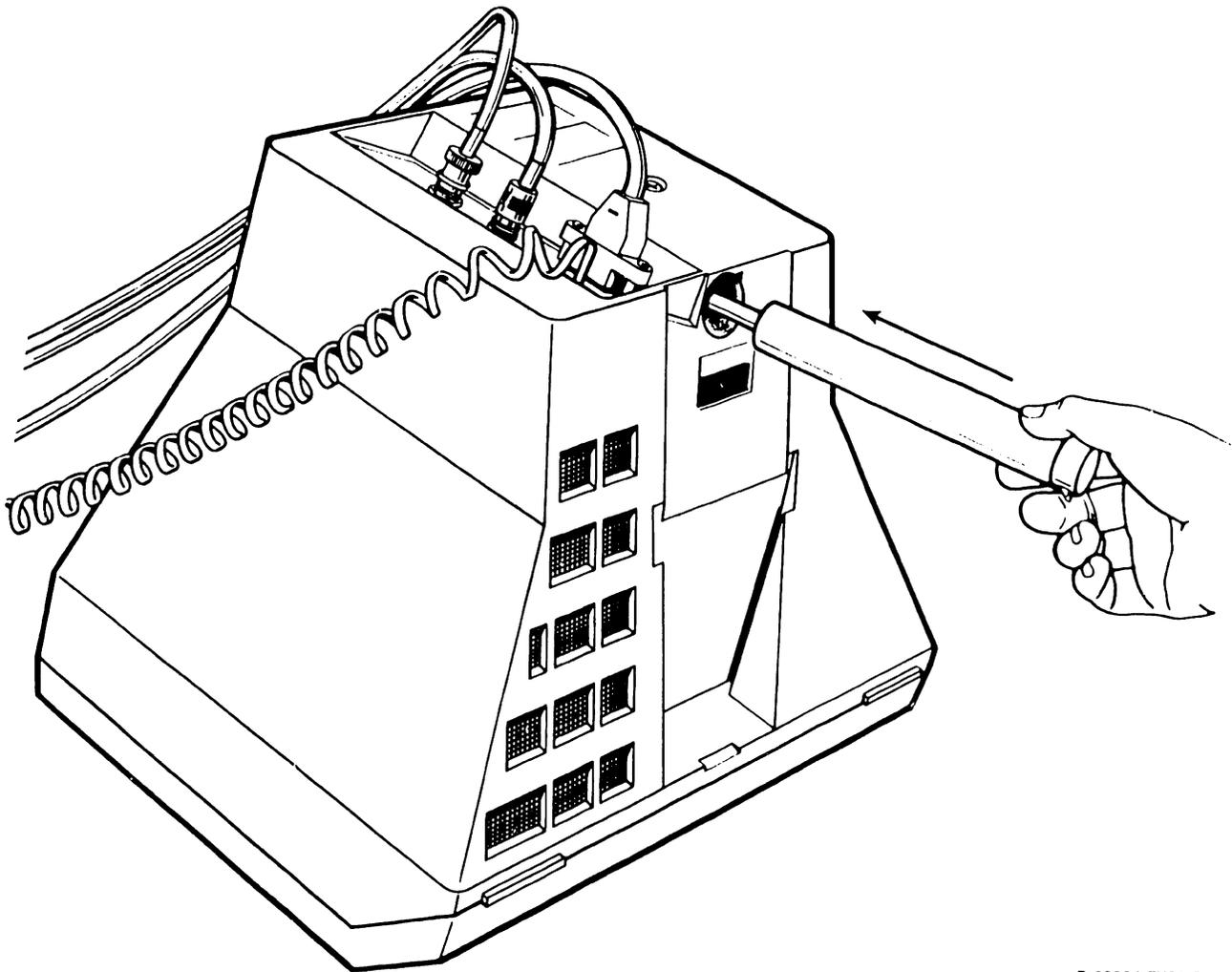
WARNING

Caution should be exercised to provide a minimum of 1/8 inch clearance between the bottom rear of the Monitor and the desk/table surface for normal operation. The elevation tube (Monitor-tilt mechanism) must protrude a minimum of 1/8 inch for proper input/output air flow of the Monitor chassis. The Monitor-tilt mechanism should not be removed from the bottom of the Monitor. Removal of this device will cause the Monitor to overheat and damage to the Monitor will result.

9.5 4230A WORKSTATION POWER-UP PROCEDURE

When powering-up the 4230A Workstation, perform the following steps:

1. Connect the ac power cable into a three-pronged electrical outlet.
2. Slide the front mounted, Monitor On/Off (1/0) switch upwards to the On (1) position.
3. In a successful start-up procedure, the workstation will make a beep sound. This beep sound is followed by a loud click, which indicates that the Keyboard is functioning properly. If the Keyboard does not click, it is malfunctioning.
4. A test pattern appears on the screen for a few minutes and then disappears. If the test pattern remains after 5 to 10 minutes, contact the Service Technician.
5. Adjust the On/Off (1/0) switch upwards to increase screen brightness.
6. If there is not a successful start-up procedure, turn the Monitor off and check the following items:



B-03004-FY86-24

Figure 9-6. Installing the Monitor-Tilt Mechanism

UNPACKING AND SETUP

- a. The Keyboard cable is properly connected to the Monitor.
- b. Make certain that all system cables are properly connected.
- c. The ac power cable is properly attached to the Monitor.
- d. The ac power cable is connected into a working electrical outlet.

If the host system screen still does not appear or if the Keyboard LOCK light blinks continuously, contact the Service Technician for assistance.

9.6 4230A WORKSTATION MONITOR BRIGHTNESS ADJUSTMENT

Adjust the Monitor brightness by performing the following:

1. Slide the On/Off (I/O) switch up and down to adjust the brightness of the screen. Sliding the On/Off switch up increases the brightness and sliding the On/Off switch down decreases brightness.

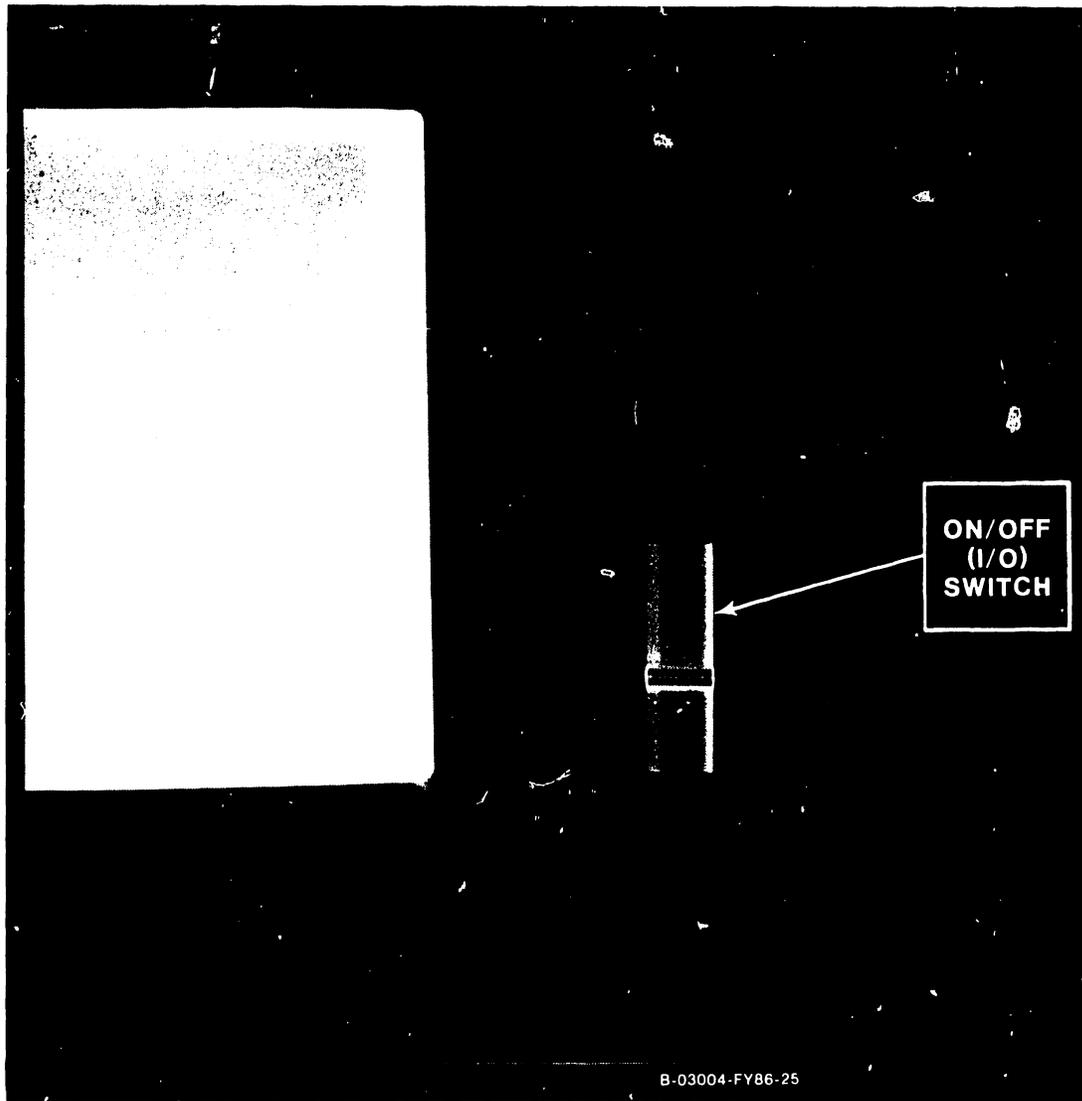


Figure 9-7. 4230A Workstation Brightness and Power-On/Off Slide Switch

9.7 POWERING-OFF THE 4230A WORKSTATION

1. Slide the On/Off (I/O) switch to the Off (0) position.

NOTE

After turning the Monitor power off, wait at least four (4) seconds before turning the power back on again. If you reapply power to the Monitor without waiting a minimum of four (4) seconds, the host system screen will not be restored.

9.8 4230A WORKSTATION POWER-UP DIAGNOSTIC SCREENS

When the 4230A Workstation is first powered-on, the Power-up Diagnostic Tests will automatically run. Refer to Paragraph 6.8.2 for Diagnostic BIT Test Error Code listing. Following these tests, a visual test of the video and the attributes will be displayed to allow the operator to adjust the brightness. This display has lines of numbers 0 thru 7 with each line having an attribute corresponding to the number's bit position in the attribute byte (example: the line of 6's blink).

In addition, there are also random characters displayed on the last line of information, line 24. The characters on that line are there for comparison with other attributes such as Inverse Video, High Intensity, and Blinking. There is no other significance that should be attached to the information on line 24. Please disregard the information on this line.

UNPACKING AND SETUP

While the visual test is displayed at normal intensity on the Monitor, additional diagnostic tests will be run. The Built-In Test will then query the Keyboard to determine if the CANCEL key has been depressed. If it has, the Keyboard will beep, and one of the special tests shown below may be selected. If no input from the Keyboard is received, test B will be run. If no errors are detected, the BIT will release control to the Data Link, which will load and run the operational software. If an error is found, testing stops with an error indication visible to the user. The IPL is then inhibited, unless overridden by depressing the SHIFT/HELP keys. The override allows the unit to be used if it has a non-fatal hardware fault.

The following is an example of the Normal Power-up display:

This line is displayed as inverse video:	<u>0000000</u>
This line underlined:	<u>4444444</u>
This line is underlined and only the underline blinks:	<u>5555555</u>
This line blinks, both numbers and underline:	<u>6666666</u>

NOTE

Please observe that the "6" line blinks continually with an underline above it.

Each display line has 10 number groups of 7 numbers in each group, plus 10 blanks equaling an 80 character line. The first group of zeros on the first line of the display, is composed of 1 blank and 7 zeros. All remaining line groups contain 80 characters and no spaces.

UNPACKING AND SETUP

9.8.1 LOOP-ON BIT TEST

This mode is selected through a sequence of keystrokes (CANCEL, then PAGE). This mode will cause the tests in the BIT to be repeated until an error is detected. A loop count will be displayed. This mode may be exited by cycling the power off, then on again. In line 3 the test loop count is displayed and indicates an increasing numerical total of test cycles with each new cycle of the Loop-On Bit test.

Below is an example of the Loop-On Bit test display screen.

Rev 55A0 (C) COPR WANG LABORATORIES INC

IN07=4C IN08=58

0001

9.8.2 KEYBOARD TEST

This test pattern is selected through a sequence of keystrokes (CANCEL, then SEARCH). Whenever a key is depressed, the keycode as received by the unit will be displayed in hexadecimal on the screen center.

NOTE

While in this test, pressing of the SHIFT/CANCEL key will release you to the BIT.

9.8.3 REFRESH TEST

This test is selected through a sequence of keystrokes (CANCEL, then DECTAB). The refresh test writes a 55 pattern in a section of memory, pauses 15 seconds, and then tests for data integrity. This test is run in the Loop-on Test mode with the loop counter updated each 15 seconds on the screen.

NOTE

While in this test, pressing of the CANCEL key will release you to the BIT.

REV 55A0 (C) COPR WANG LABORATORIES INC

IN07=4C IN08=58

0001

REFRESH TEST WILL UPDATE COUNT EVERY 15 SECONDS

UNPACKING AND SETUP

9.8.4 DIAGNOSTIC SCREEN ERROR MESSAGES

When an error is detected, the screen will be cleared, the ID field displayed and the error message displayed with the following format:

1. ERROR bb cc dd ee hhl1. Where ERROR is invariant and is meant to convey that an error has occurred and that the information on the rest of the line is error information.
2. bb cc dd ee hhl1. Where the contents of the Z80 are B, C, D, E and HL registers, respectively.
3. ee always represents error code. The first digit of error code represents the test number, and the second is the error number in the particular test.

If SHIFT/HELP key is depressed, the BIT will release control to the Data Link, which will load and run the operational software. This allows the unit to be used if it has a non-fatal hardware fault.

REV 55A0 (C) WANG LABORATORIES INC

IN07=4C IN08=58

ERROR FF FF ED FF 7EFF

9.9 4230A WORKSTATION OPERATING PRECAUTION

WARNING

Please note the need of a minimum of 1/8 inch clearance between the bottom rear of the workstation Monitor and the desk or table for normal operation. The elevation tube must be protruding a minimum of 1/8 inch for proper air flow (input/output) of the Monitor.

**SECTION
10
FUNC-
TIONAL
DESCRIP-
TION**

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SECTION 10

FUNCTIONAL DESCRIPTION

10.1 INTRODUCTION

The 4230A Workstation is a new low cost workstation that is intended to be used on the OIS and VS systems. The workstation will maintain all the attributes of the present 5536, 4230 and 2246 styled workstations, while providing for some additional enhancements.

The 4230A Workstation consists of a single Monitor type package, a 720 Keyboard, an electronics board and a power/video board. Connection to the master is via a standard 928 Data Link.

10.2 4230A WORKSTATION GENERAL FEATURES

- Two board workstation
- 4.275MHz Z-80B microprocessor
- 64K X 9 bit main DRAM (parity)
- 8K X 8 bit character/attribute mapped RAM
- 8K X 10 bit font RAM
- 25 lines of 80 characters displayed
- Character base⁷ (10 X 12 fully addressable font)
- 720 Serial Keyboard Interface
- Data Link Interface (2001 chip)
- Increased attribute functionality
- Arabic display capability
- Two 256 character sets (simultaneously accessible)
- Flicker free display
- Two piece package (Monitor and Keyboard)
- Built-in stand-alone test diagnostics

FUNCTIONAL DESCRIPTION

10.3 BASIC OPERATION

The heart of the 4230A Workstation is a Z-80B microprocessor. A block diagram of the workstation is shown in figure 10-1 and 10-2. The Z-80B is responsible for decoding and executing software that is down-loaded from the master via the data link communication channel. It is also responsible for performing various tasks in response to the keyboard. It controls all data transfers between various registers and memory locations.

10.4 POWER-UP SEQUENCE

When DC power is first supplied to the workstation, the power reset signal (RST) becomes active. This initializes various registers, flip flops, and the CPU. At this point, the following has occurred:

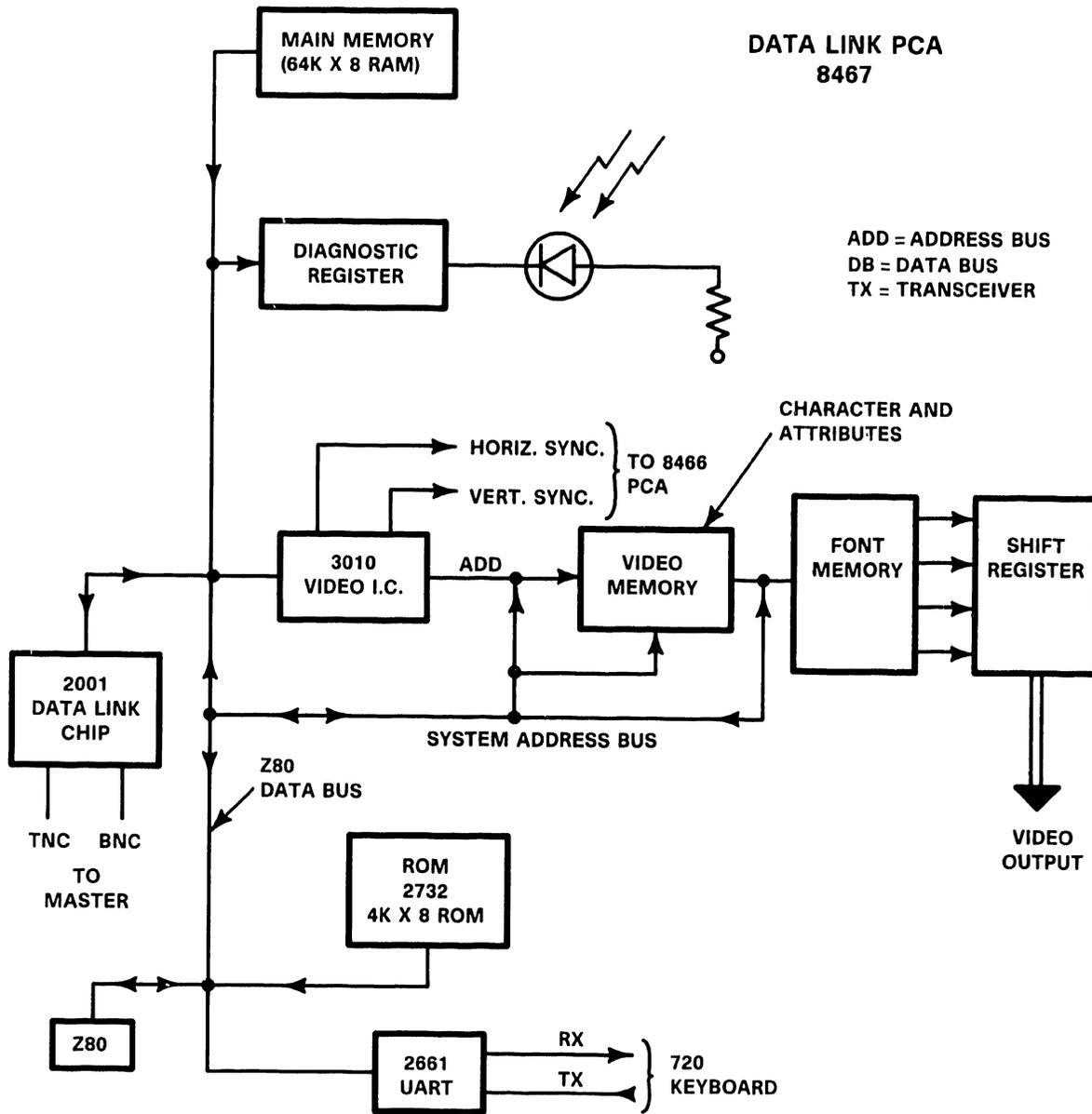
- 1) The page register contains a zero value
- 2) The diagnostic EPROM is enabled
- 3) The primary character set is selected
- 4) The workstation is in the 128 character set mode
- 5) The workstation is in the non-Arabic mode
- 6) The CRT will display normal video (not reverse video)
- 7) The LED is on
- 8) All main memory writes will be of correct parity
- 9) Parity errors will not disable the data link
- 10) The data link is set to not-ready (receive only)
- 11) The data link is reset
- 12) The data link is disabled
- 13) The CPU is reset (mode zero interrupts)

When the master reset signal becomes inactive, the CPU begins executing code at location zero from the diagnostic EPROM.

The EPROM contains code that runs the diagnostics on the workstation. The diagnostic code tests the workstation to ensure that it is functioning properly. Once all the tests have been passed, the diagnostic code loads a small routine in main memory and then instructs the CPU to jump to this routine. This routine disables the diagnostic EPROM and enables the data link. It then causes the CPU to go into a tight jump loop. The workstation will wait until the master sends an initial program load (IPL).

The master can now interrogate the data link and find that it is not ready and is in need of an initial program load. The master sends the appropriate code to the workstation (being careful not to write over the tight jump loop). The master then sends a data link restart command which resets the CPU (synchronized with M1). The CPU then begins executing the IPL code at location zero in main memory.

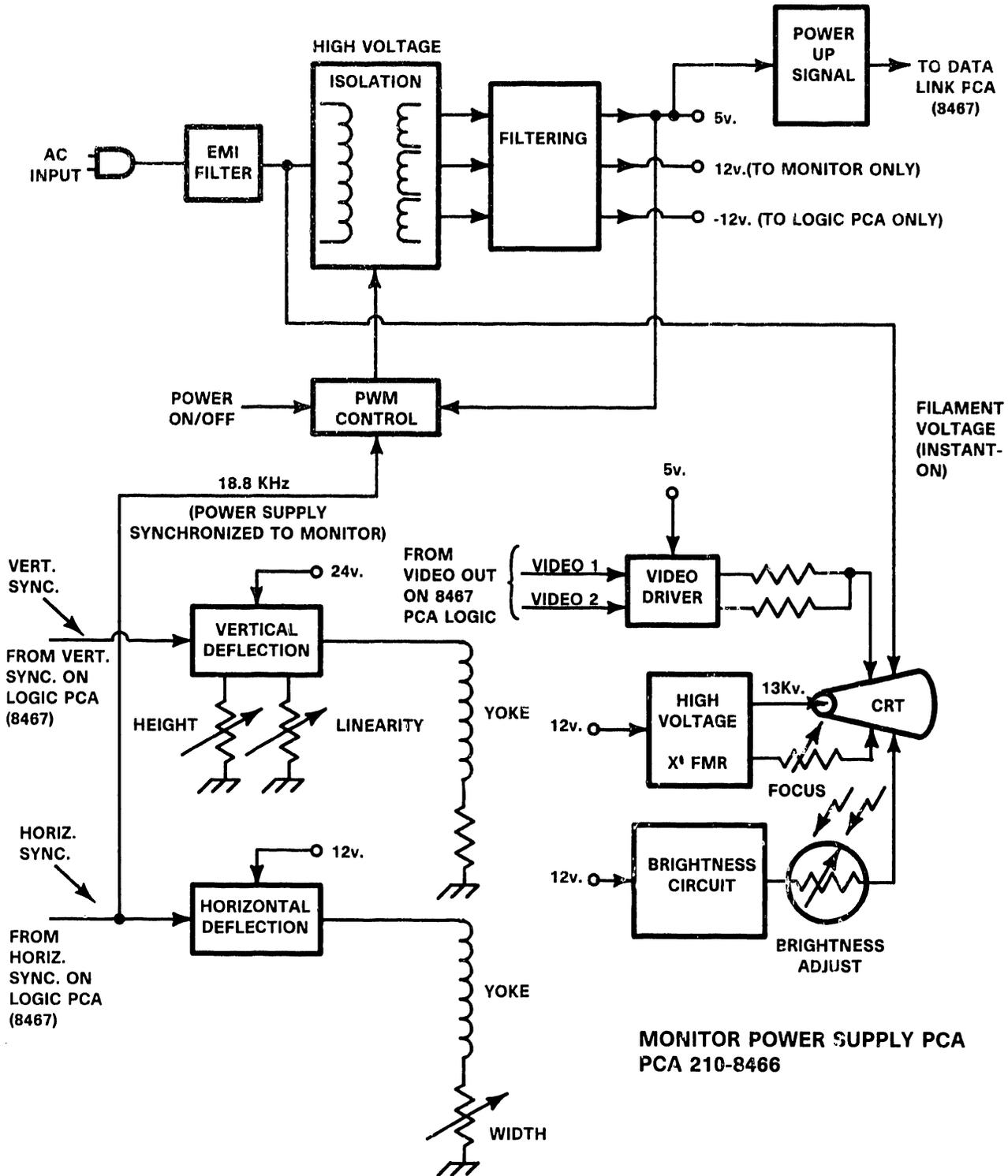
FUNCTIONAL DESCRIPTION



B-03025-FY86-4

Figure 10-1. 4230A Workstation Block Diagram - Data Link PCA (8467)

FUNCTIONAL DESCRIPTION



MONITOR POWER SUPPLY PCA
PCA 210-8466

B-03025-FY86-2

Figure 10-2. 4230A Workstation Block Diagram - Monitor Power Supply PCA (8466)

10.5 MEMORY ORGANIZATION

The Z-80 CPU has a 16 bit wide address bus. This limits the maximum amount of memory addressable by the CPU to 64K bytes. A page register has been implemented to overcome this limitation. There are three pages of memory resident in the workstation. The CPU may access any memory location within one of the three pages. The CPU must load a new value into the page register to access a different page. This is done by executing an OUT '05' command. A pictorial representation of the three pages available to the CPU is shown in figure 10-3. Notice that some parts of memory are common to all three pages.

There are five sets of input that are used to select a memory location. They are:

- 1) page register value (MP0,MP1)
- 2) enable eprom bit (EPROM)
- 3) 128 character set bit (128CS)
- 4) primary/secondary character set bit (PRI/SEC)
- 5) address bits 0-15 (A00-A15)

The page register value determines which page of memory the CPU may access (PAGE 0,1,2). The enable eprom bit (active low) disables the lower 32K of RAM from reads and enables the 4K of EPROM. Write memory cycles to the lower 32K will be directed to the main RAM and all read cycles to the lower 4K (repeating) will read data from the EPROM regardless of what value is in the page register. The 128 character set bit (active high) will inhibit all memory cycles to the upper 2K of the lower and upper font memory when active. The primary/secondary character set bit determines which lower and upper font is accessed when the page register value is two. The address bits determine which byte within the current page can be accessed. Table 10-1 shows how the blocks of memory are decoded.

10.6 MEMORY PARITY

The workstation has even parity included with the main memory. All other memories do not have parity. The parity generator/checker is used to verify that the data read from main memory is correct. If a memory parity error is detected, the entire CRT display screen is underlined. This indicates to the user that there is a problem with the main memory. The workstation does not have an error correction facility, and it normally performs a soft power down. The master is also informed of the problem. The master can restart the workstation to alleviate the problem or the user may have to turn the AC power off and then on.

A parity error can be forced for diagnostic purposes by issuing an OUT '0E' command (table 2). A parity error will send a non-maskable interrupt to the CPU and enable the diagnostic EPROM. The CPU will go to memory location 'X66' (hex) in the EPROM to look for the parity error routine. Where X is 0 when prom is enabled and F when prom is not enabled.

FUNCTIONAL DESCRIPTION

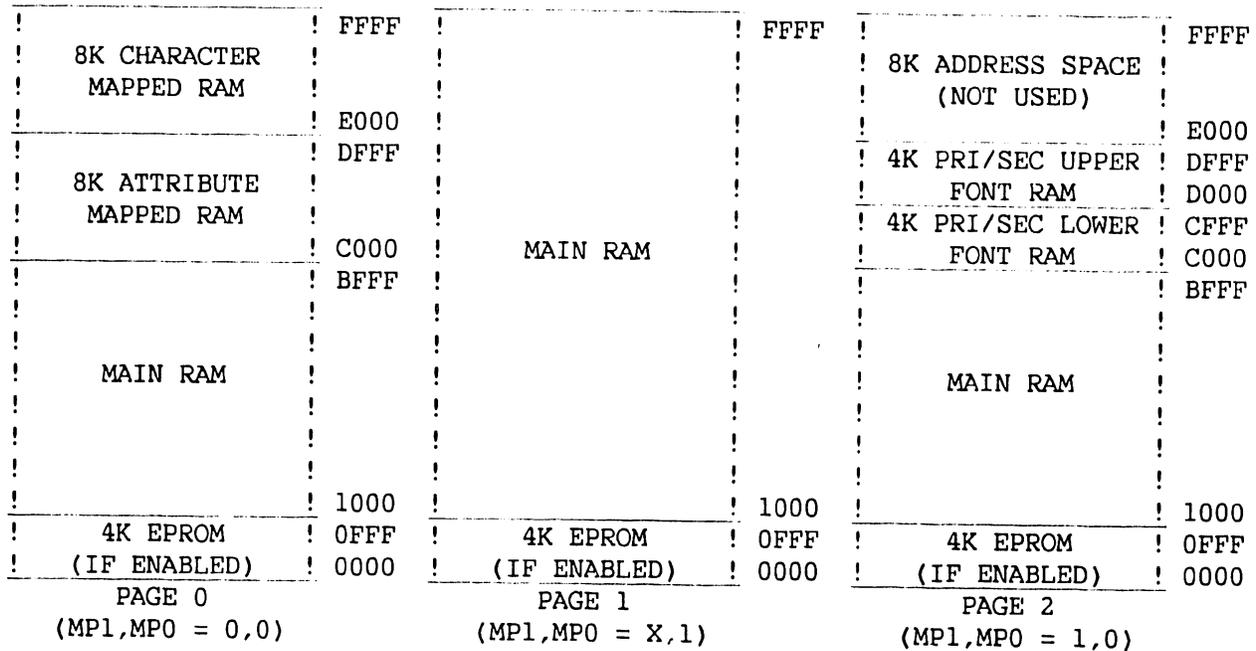


Figure 10-3. Pictorial Representation of Memory Organization

Table 10-1. Block Memory Decode

TYPE OF MEMORY	EPROM	MP1	MPO	128CS	ADDRESS	A15	A14	A13	A12	A11	A10-A00
EPROM	1	X	X	X	0K-32K	0	0	0	0	X	X
CHARACTER RAM	X	0	0	X	56K-64K	1	1	1	X	X	X
ATTRIBUTE RAM	X	0	0	X	48K-56K	1	1	0	X	X	X
LOWER FONT RAM	X	1	0	0	48K-52K	1	1	0	0	X	X
LOWER FONT RAM	X	1	0	1	48K-50K	1	1	0	0	0	X
UPPER FONT RAM	X	1	0	0	52K-56K	1	1	0	1	X	X
UPPER FONT RAM	X	1	0	1	52K-54K	1	1	0	1	0	X
MAIN RAM	0	X	X	X	0K- 4K	0	0	0	0	X	X
MAIN RAM	X	X	X	X	4K- 8K	0	0	0	1	X	X
MAIN RAM	X	X	X	X	8K-16K	0	0	1	X	X	X
MAIN RAM	X	X	X	X	16K-32K	0	1	X	X	X	X
MAIN RAM	X	X	X	X	32K-48K	1	0	X	X	X	X
MAIN RAM	X	X	1	X	48K-64K	1	1	X	X	X	X

10.7 CHARACTER MAPPED MEMORY

There is 8K of address space reserved for the character mapped memory. This address space is located at 56K through 64K. The 8K address is translated into a 4K address since the total memory required is less than 4K. This address translation is transparent to the software. The 4K of memory is capable of storing 25 lines (rows) of 160 characters (columns). The CRT however, displays only 25 lines of 80 characters at any time. The addressing and data format for the character mapped memory is shown below.

Z-80 ADDRESS	A15	A14	A13	A12	A11	A10	A09	A08
CRT ADDRESS	'1'	'1'	'1'	R04	R03	R02	R01	R00

Addresses row 0 through 24

Z-80 ADDRESS	A07	A06	A05	A04	A03	A02	A01	A00
CRT ADDRESS	C07	C06	C05	C04	C03	C02	C01	C00

Addresses column 0 through 159

Z-80 DATA	BD7	BD6	BD5	BD4	BD3	BD2	BD1	BD0
CHAR. DATA	CD7	CD6	CD5	CD4	CD3	CD2	CD1	CD0

10.8 ATTRIBUTE MAPPED MEMORY

There is 8K of address space reserved for the attribute mapped memory. This address space is located at 48K through 56K. The attribute and character mapped memories are mapped in exactly the same way. There is an attribute byte of memory for each character byte. Since the Z-80B can address only 8 bits at a time, the character and attribute memories must have a different address base.

The attribute memory stores information which controls how the character appears on the CRT. The addressing and data format for the attribute mapped memory and the control functions are listed below.

Z-80 ADDRESS	A15	A14	A13	A12	A11	A10	A09	A08
CRT ADDRESS	'1'	'1'	'0'	R04	R03	R02	R01	R00

Addresses row 0 through 24

Z-80 ADDRESS	A07	A06	A05	A04	A03	A02	A01	A00
CRT ADDRESS	C07	C06	C05	C04	C03	C02	C01	C00

Addresses column 0 through 159

Z-80 DATA	BD7	BD6	BD5	BD4	BD3	BD2	BD1	BD0
ATTR. DATA	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0

FUNCTIONAL DESCRIPTION

! AD7='1'	High Intensity On	! AD3='1'	Select Extended Char. Set	!
! AD7='0'	High Intensity Off	! AD3='0'	Select Normal Char. Set	!
! AD6='1'	Blink Character On	! AD2='1'	Superscript Character	!
! AD6='0'	Blink Character Off	! AD2='0'	Don't Superscript Char.	!
! AD5='1'	Blinking Cursor On	! AD1='1'	Subscript Character	!
! AD5='0'	Blinking Cursor Off	! AD1='0'	Don't Subscript Char.	!
! AD4='1'	Underline Char. On	! AD0='1'	Reverse Video Char.	!
! AD4='0'	Underline Char. Off	! AD0='0'	Normal Video Char.	!

10.9 FONT MEMORY

The font memory is used to store a pixel pattern for each character in the character set. A pixel pattern consists of sixteen lines of ten pixels for a total of 160 pixels per character. Each pixel within any character is addressable by the CPU thus enabling the font memory to be software loadable. The CRT however, displays only twelve lines of ten pixels per character as shown in figure 10-4.

The four lines of pixels within font memory that are not normally displayed are loaded with logic '0' (lines 12 to 15). These four blanked lines of pixels are used for superscript or subscript characters. When a superscript character is displayed, a value of two is added to the CRT line counter value. This causes the font data for scan line two to be presented to the CRT circuitry when scan line zero is normally displayed. The result is font data for scan lines two through thirteen are displayed for the current character.

A subscript character is displayed in a similar manner. A value of fourteen is added to the CRT line counter value. This causes font data for scan lines fourteen, fifteen, and zero through nine to be displayed for the current character. The vertical positions for the underline and cursor are fixed.

Since the CPU can address only 8 bits at a time, the lower font memory is used to store pixels zero through seven. The upper font memory is used to store pixels eight and nine. The lower font memory occupies address space 48K to 52K and the upper font memory occupies address space 52K to 56K.

FUNCTIONAL DESCRIPTION

		COLUMN 0										COLUMN 1										PIXEL
		9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	
SCAN LINE	0																					
	1																					
	2		*							*		*		*		*						
	3			*					*			*							*			
	4				*		*					*										
	5					*						*									ROW 0	
	6			*		*						*		*		*			*			
	7		*					*				*							*			
	8		*						*			*		*		*			*			
	9																				DESCENDER	
	10	*	*	*	*	*	*	*	*	*											CURSOR	
	11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	CURSOR, UNDERLINE	
SCAN LINE	0		*							*												
	1			*						*												
	2				*		*															
	3					*																
	4			*		*						*		*		*			*			
	5		*					*				*							*		ROW 1	
	6	*							*			*										
	7											*										
	8											*		*		*			*			
	9											*							*		DESCENDER	
	10	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	CURSOR	
	11	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	CURSOR, UNDERLINE	

SUPERSCRIPED CHAR. SUBSCRIPED CHAR.

Figure 10-4. Superscripted/Subscripted Font Memory Pixel Pattern

! Z-80 ADDRESS ! A15 ! A14 ! A13 ! A12 ! A11 ! A10 ! A09 ! A08 !
 ! FONT ADDRESS ! '1' ! '1' ! '0' ! '0' ! CD7 ! CD6 ! CD5 ! CD4 !
 Primary and secondary lower font ram addresses pixels 0 through 7

! Z-80 ADDRESS ! A07 ! A06 ! A05 ! A04 ! A03 ! A02 ! A01 ! A00 !
 ! FONT ADDRESS ! CD3 ! CD2 ! CD1 ! CD0 ! L03 ! L02 ! L01 ! L00 !
 Primary and secondary lower font ram addresses pixels 0 through 7

! Z-80 ADDRESS ! A15 ! A14 ! A13 ! A12 ! A11 ! A10 ! A09 ! A08 !
 ! FONT ADDRESS ! '1' ! '1' ! '0' ! '1' ! CD7 ! CD6 ! CD5 ! CD4 !
 Primary and secondary upper font ram addresses pixels 8 through 11

! Z-80 ADDRESS ! A07 ! A06 ! A05 ! A04 ! A03 ! A02 ! A01 ! A00 !
 ! FONT ADDRESS ! CD3 ! CD2 ! CD1 ! CD0 ! L03 ! L02 ! L01 ! L00 !
 Primary and secondary upper font ram addresses pixels 8 through 11

! Z-80 DATA ! BD7 ! BD6 ! BD5 ! BD4 ! BD3 ! BD2 ! BD1 ! BD0 !
 ! PIXEL ! 7 ! 6 ! 5 ! 4 ! 11,3 ! 10,2 ! 9,1 ! 8,0 !

FUNCTIONAL DESCRIPTION

NOTE

CD7 to CD0 selects the pixel pattern and L03 to L00 selects 1 of 16 scan lines within the pixel pattern.

10.10 CHARACTER SET CONTROL

There are two 256 character sets which occupy the same address space (48K to 56K). The selection of the primary or secondary character set is controlled by an OUT '06' or OUT '07' command (table 10-2).

The selection of a character set can also be controlled on a character by character basis. Attribute bit three selects the extended character set when it is a logic '1'. When the primary character set is selected, the secondary character set becomes the extended character set. If the secondary character set is selected, the primary character set becomes the extended character set. By utilizing attribute bit three, both the primary and secondary character sets can be used as a single 512 character set.

The software may instruct the hardware to appear as though there are two 128 character sets by executing an OUT '20' command (table 10-3). The hardware will inhibit all font memory accesses outside of the two 128 character sets. In this mode a maximum of 256 characters may be accessed.

10.11 UNDERLINE CONTROL

Attribute bit four is used for the underline control. If the software instructs the workstation to go into the 128 character set mode, character bit seven is also used for the underline control.

10.12 HORIZONTAL AND VERTICAL SCROLLING

Vertical scrolling of information on the CRT is controlled by software. The character and attribute data is read one screen location at a time and it is rewritten to the screen location one row above the original position. This is repeated until the entire screen has been vertically scrolled upward by one row.

Horizontal scrolling is controlled by hardware. A start column value is loaded into the start column register by an OUT '02' command (table 10-2). The start column value can range from 0 to 80 (decimal) inclusive. The CRT will display the first character corresponding to the start column value on the left edge. The next 79 characters will follow from left to right. For example, if the start column value is 29 then the 29th to the 108th character will be displayed on each line. The only exception is that row 0, 23, and 24 will always display characters zero to 79 (unless overruled by OUT '21').

10.13 ARABIC MODE

The software may instruct the workstation to go into an Arabic mode by executing an OUT '21' command (refer to table 10-3). This will reverse the horizontal order of all characters on the CRT. The start column value functions in exactly the same way as in the non-Arabic mode. If a start column value of 29 is loaded into the start column register, the 108th to the 29th character will be displayed left to right on the CRT. In addition, OUT '21' controls lines 1, 24 and 25 horizontal scrolling.

10.14 720 KEYBOARD

The 720 Keyboard has 101 keys and is connected to the 4230A Workstation by a removable 4 pin cable. The cable connectors at both the workstation and the keyboard are RS-11 telephone type connectors. The Keyboard is detachable, and incorporates a low profile design with an adjustable tilting mechanism to allow for user comfort. A coil cord, terminated at each end with RJ-11 Modjack connectors, is used to connect the Keyboard to the host system. The Keyboard communicates with the workstation via a full duplex asynchronous serial link that operates at a 62.5K baud rate. Other features include a local 'click' which is enabled or disabled by the host system. This key 'click' sound is generated for all key depressions except repeating keys, shift, lock, control, and 2nd keys. In addition, three LED indicators are available on the Keyboard; the first LED indicates caps or shift lock. A second LED, located near the 'Help' key responds to all LED control commands. The third LED, is a 'Num Lock' LED that operates in a local mode, although the host has the ability to change the state of this LED at any time. The 'Num Lock' LED is controlled only by the host.

10.15 720 KEYBOARD INTERFACE

The serial keyboard interfaces to the CPU by utilizing a 2661 UART. The interface makes the serial keyboard appear like a parallel keyboard. This is necessary in order to use the existing software from previous workstations.

Upon power up, the Z80B initializes the UART. When a serial character is received, a mode 0 interrupt will then be sent to the CPU indicating a pending keystroke. The CPU will execute an interrupt acknowledge cycle which will fetch the restart instruction inserted by hardware. The CPU executes the restart instruction which loads the program counter inside the CPU with a zero. The CPU executes the jump instruction at location zero from main memory. The jump instruction tells the CPU to go to the keyboard service routine. This routine will cause the CPU to execute an IN '00' instruction which reads the key code provided by the 2661. The key code is normally read only once for each keystroke interrupt. If the same keystroke is read a second time the same key code will be given. Once the CPU has the key code, it can determine what action should take place. A common action would be to translate the key code into a WISCII code, and store the code in character memory. The keyboard service routine is also responsible for controlling the keyboard beeper and clicker.

The CPU has the facility to transfer one byte of data at a time to the serial keyboard interface by issuing an OUT '25' command. There must be at least a 400us delay between any two consecutive executions of an OUT '25' command. This delay is required to synchronize the system to the keyboard.

FUNCTIONAL DESCRIPTION

The serial output data stream of the 2661 can be looped back to the serial input. This allows testing of the 2661 and the surrounding support circuitry without using a keyboard. This function is employed by installing a loop back connector (RJ11). The built in test EPROM senses if the loop back connector is present and then loops on the built-in test (normally for burn-in).

10.16 DMA TRANSFERS

All DMA transfers are done by utilizing the 2001 Data Link chip. No external device may gain direct control of the bus from the CPU. Data may be transferred to or from any memory location in main memory. The data link is used by the master to provide for a DMA path to main memory.

The master sends serial data and commands to the data link. This serial bit stream is converted to parallel bytes. The data link will be instructed to request bus control from the CPU. Bus control is relinquished by the CPU, and the data link performs a single byte or a block move DMA operation to or from the correct location(s) in main memory.

The hardware reconfigures the memory so that all memory accesses will occur between the data link and main memory.

If the CPU is executing code when a bus request is presented, the CPU will finish the current machine cycle and then temporarily suspend its operations. The data, address, and control buses will float. The DMA transfer takes place and then the data link will relinquish the bus. The CPU senses the bus request termination and then continues processing where it left off.

10.17 MASTER COMMUNICATION

The master is used to transfer code to and from the workstation's main memory and to invoke other commands such as status requests and restarts. The master may perform the following:

- 1) Device Status Read
- 2) Restart
- 3) One Byte Read
- 4) One Byte Write
- 5) 256 Byte Read (Block Read)
- 6) 256 Byte Write (Block Write)

10.18 SWITCH SETTINGS

The two eight bit switch values are buried in the PROM. They are used to identify what type of device is connected to the master. Two of the bits represent the current value of MP0 and l28 char. The switch settings at IPL time for the slave IN '07' and IN '08' are shown below:

SWITCH:	1	2	3	4	5	6	7	8	HEX						
(SW2) IN '07'	!	0	!	1	!	0	!	0	!	0	!	!	4C	!	0 = ON
(SW1) IN '08'	!	0	!	1	!	0	!	1	!	1	!	!	58	!	1 = OFF

FUNCTIONAL DESCRIPTION

10.19 READ/WRITE CONTROL FOR CHARACTER, ATTRIBUTE, AND FONT RAM

The character, attribute, and font RAMs are shared by the CPU and the CRT timing logic. The CPU generates the image in memory and the CRT timing logic displays the image on the CRT.

The CRT logic has the highest priority when accessing character, attribute, or font memory. If the CPU needs to access any of these memories, it must wait until the CRT logic is finished with them. The transfer to or from the CPU is then given 208ns to take place. A temporary storage register holds the data during a read operation because the CPU is too slow. This "interleaving" ensures that the CRT display will remain flicker free by allowing the CRT logic to access the character, attribute, and font memories when new data is required.

The read/write control timing originates from a 19.2MHz crystal oscillator. A modulo ten counter (inside a PAL) and some various gates are used to generate the necessary control signals to read and write the RAMs.

10.20 WL-3010 VIDEO CONTROLLER CHIP

The WL-3010 Video Controller Chip was designed for use in the 4230A Workstation. General features of this chip are:

- Generation of video control signals VSYNC and HSYNC
- Generation of the video memory character address
- Alteration of raster row signals to enable superscripting and subscripting of characters
- Generation of CURSOR, UNDERLINE and BLINK signals which can be used to enable these attributes
- Assists in horizontal scrolling capability
- Enables workstation Arabic Mode (characters appear from right to left on display)

10.21 GENERATION OF CRT DISPLAY

The data displayed on the CRT originates from the address generated by the row, column, and line counters in the WL-3010. The row counter value (R0-R4) and the column counter value (C0-C7) address the character and attribute RAM. The character RAM stores the WISCII code (CD0-CD7) of the character to be displayed and the attribute RAM stores the attribute data (AD0-AD7) associated with the character. The WISCII code along with the line counter value (L0-L3) serve as the address to the font memory. The font memory supplies the pixel pattern of the character to a shift register. The shift register sends a serial stream of pixels to the video modification logic which modifies the pixel stream according to the attribute data.

Two bit streams exit the video modification logic. Two bits are necessary in order to provide three different combinations (the fourth is an illegal condition). This allows a pixel on the CRT to be black, normal intensity, or high intensity. These two bit streams are joined by the horizontal and vertical synchronization signals. All four of the signals are then driven to the CRT.

FUNCTIONAL DESCRIPTION

10.22 CRT TIMING

The WL-3010 controls the horizontal and vertical beam position for the CRT. It also supplies an address to the character, attribute, and font RAMs corresponding to the pixel data that is to be displayed on the CRT for the current beam position.

Table 10-2. Data Input Commands

<u>COMMAND</u>	<u>HEX DATA</u>	<u>FUNCTION</u>
OUT 00	--	SOUNDS KEYBOARD CLICKER
OUT 01	--	SOUNDS KEYBOARD SPEAKER
OUT 02	'00' to '50'	LOADS DATA INTO START COLUMN REGISTER
OUT 05	'00' to '02'	LOADS DATA INTO PAGE REGISTER
OUT 06	--	SELECTS PRIMARY CHARACTER SET
OUT 07	--	SELECTS SECONDARY CHARACTER SET
OUT 09	'00' or '80'	'00' SELECTS NORMAL VIDEO; '80' SELECTS INVERSE VIDEO
*OUT 0E	--	D0 = '0' SETS ALL MEMORY WRITES TO CORRECT PARITY D0 = '1' SETS ALL MEMORY WRITES TO INCORRECT PARITY D1 = '0' WILL NOT DISABLE DATA LINK UPON PARITY ERROR D1 = '1' WILL DISABLE DATA LINK UPON PARITY ERROR D2 = '0' TURNS LED ON D2 = '1' TURNS LED OFF D3 = '0' ENABLES DIAG. EPROM (IF DATA LINK DISABLED) D3 = '1' DISABLES DIAG. EPROM * D4 = '0' DISABLES CRT DISPLAY * D4 = '1' ENABLES CRT DISPLAY D6 = '0' DISABLES DATA LINK D6 = '1' ENABLES DATA LINK * D7 = '0' ENABLES COMMAND RESET (UART, WL-2001) * D7 = '1' DISABLES COMMAND RESET

FUNCTIONAL DESCRIPTION

Table 10-3. Data Input Commands

<u>COMMAND</u>	<u>HEX DATA</u>	<u>FUNCTION</u>
OUT 20	'00' or '01'	'00' 256 CHARACTER SET; '01' 128 CHARACTER SET
*OUT 21	'00' to '03'	D0- '0' NON ARABIC MODE '1' ARABIC MODE * D1- '0' lines 1, 24 and 25 always characters 0-79 * D1- '1' lines 1, 24 and 25 shifted with other lines
OUT 25	'00' to 'FF'	SERIAL KEYBOARD FUNCTION CONTROL (refer to HM - 126)
*OUT 26	--	WRITE COMMAND OR CONTROL INFO. TO KEYBOARD UART
*OUT 29	--	WRITE COMMAND OR CONTROL INFO. TO KEYBOARD UART
*OUT 2A	--	WRITE COMMAND OR CONTROL INFO. TO KEYBOARD UART
IN 00	--	READS SERIAL KEYBOARD KEYSTROKE DATA
IN 07	--	READS DEVICE TYPE DEFINITION (refer to HM - 04)
IN 08	--	READS DEVICE TYPE DEFINITION (refer to HM - 04)

* THIS IN OR OUT COMMAND IS DIFFERENT THAN THE 4230 WORKSTATION.

SECTION

11

**SPECIFI-
CATIONS**

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11.2	Applicable Documentation.....	11-1
11.3	System Specifications.....	11-1

SECTION 11

SPECIFICATIONS

11.1 SCOPE AND PURPOSE OF MANUAL

This Product Maintenance Manual contains specifications, unpacking and setup, installation, theory, operation, maintenance, adjustment, controls and indicators, repair, and troubleshooting information for the 4230A Workstation. The 4230A Workstation is supported in the field on a unit-swap basis for the Monitor, both PCA's within the Monitor, and the Keyboard. This section contains information on applicable documentation, system specifications and a general description of the 4230A Workstation.

11.2 APPLICABLE DOCUMENTATION

A complete listing of all technical documentation is contained in the Technical Documentation Catalog/Index P/N 742-0000. Other product documentation is identified in the Corporate Resource Catalog P/N 700-7647.

11.3 SYSTEM SPECIFICATIONS

The 4230A Workstation power supply and Monitor meets FCC Class A requirements, and uses switching regulated power supply technology as part of the design. The switching power supply is capable of supplying three DC output voltages as specified herein. The power supply's operating frequency is synchronised to the Monitor horizontal scan rate. This eliminates any interference caused by two different operating frequencies within the same chassis.

4230A Monitor Dimensions and Weight:	Height:	11.5 inches (29.2 cm.)
	Width:	13.0 inches (33.0 cm.)
	Depth:	10.8 inches (27.0 cm.)
	Weight:	15.0 pounds (6.8 kg.)

4230A Keyboard Dimensions and Weight:	Height:	1.70 inches (4.3 cm.)
	Width:	18.3 inches (46.5 cm.)
	Depth:	7.8 inches (19.8 cm.)
	Weight:	4.5 pounds (2.0 kg.)

Environmental Requirements:	<u>Ambient Operating Temperature:</u>
	60°F. to 90°F. (16°C. to 32°C.)

<u>Relative Humidity:</u>
20% to 80% (non-condensing)

SPECIFICATIONS

CRT: 12 inch diagonal, green on black, 80 column by 25 row (24 rows supported by software).

Data Link: 4.275 Mbps, serial asynchronous

Keyboard Interface: 62.5 K baud, asynchronous

CPU: Z-80

Power Requirements: 100 Watts maximum, 60 Watts (AC line) typical

Input Power Line:

<u>Minimum</u>	<u>Nominal</u>	<u>Maximum</u>	<u>Frequency</u>
95 Vac	115 Vac	132 Vac	47 - 63 Hz
185 Vac	230 Vac	264 Vac	47 - 63 Hz

Power-On Surge Current: 20 Amperes maximum (5 Milliseconds) at 90 Vac

Voltage Selection: 115/230 Vac selection accomplished via switch accessible on rear of workstation.

Output Voltages: +5 Volt Output:

Output Voltage: 5 Volt +/- 0.20 Volt (adjustable)

Output Power: +5 Volts DC at 3.0 Amperes = 15.0 Watts

Set Point: 5.15 to 5.20 Volts at 2 Amperes

Output Current: 3.0 Amperes maximum, 2.0 Amperes minimum

Regulation: For any combination of line, load and cross regulation, the output voltage will not vary more than +/- 0.15 Volt.

Ripple and Noise:

0 to 120 Hz ripple:	50 millivolts maximum
120 to 100 KHz:	100 millivolts maximum
above 100 KHz:	200 millivolts maximum

Current Limit: Output will withstand a direct short circuit for a reasonable time period with no power supply damage.

Output Voltages: +12 Volt Output:

Output Voltage: +12 Volt +/- 0.1 Volt (adjustable)

SPECIFICATIONS

Output Power:	+12 Volts DC at 2.0 Amperes = 24.0 Watts
Set Point:	11.95 to 12.00 Volts at 1.5 Amperes
Output Current:	2.0 Amperes maximum
Regulation:	For any combination of line, load and cross regulation, the output voltage will not vary more than +/- 0.36 Volt.
Ripple and Noise:	0 to 120 Hz ripple: 50 millivolts maximum 120 to 100 KHz: 100 millivolts maximum above 100 KHz: 200 millivolts maximum
Current Limit:	Output will withstand a direct short circuit for a reasonable time period with no power supply damage.
Output Voltages:	<u>-12 Volt Output:</u>
Output Voltage	-12 Volt +/- 2.0 Volt
Output Power:	-12 Volts DC at 0.1 Amperes = 1.2 Watts
Output Current:	0.1 Amperes maximum
Regulation:	For any combination of line, load and cross regulation, the output voltage will not vary more than +/- 1.0 Volt.
Ripple and Noise:	0 to 120 Hz ripple: 50 millivolts maximum 120 to 100 KHz: 100 millivolts maximum above 100 KHz: 200 millivolts maximum
Current Limit:	Output will withstand a direct short circuit for a reasonable time period with no power supply damage.
Efficiency:	55% minimum at nominal continuous line voltage and maximum output power.
Overshoot/Undershoot:	The supply has no overshoot or undershoot at power turn-on or at power turn-off condition.
Short Circuit:	All outputs shall sustain a short circuit indefinitely without damage to the power supply.
Noise:	The supply is free of audible noise (0 to 20 KHz) over the specified load range.
No Load Operation:	The supply operates indefinitely without damage at no load condition. The outputs are not required to be in regulation during no load condition.

SECTION

12

**ILLUS-
TRATED
PARTS**

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SECTION 12

ILLUSTRATED PARTS

12.1 SCOPE

The following is an Illustrated Parts list which provides reference to assemblies that are identified for maintenance procedures. Use this IPL for part number identification when ordering Field Replaceable Units (FRU). FRU items are identified by double asterisk (**). The maintenance philosophy for the 4230A Workstation Monitor is as follows: one or both of the PCB's may be replaced in the field, CRT's to be replaced at the FSC only. The maintenance philosophy for the 4230A Workstation Keyboard is as follows: if a problem is indicated with the Keyboard, the defective Keyboard is unit-swapped for a direct field replacement.

The following IPL's are included in this section:

- Figure 12-1: 4230A Workstation Keyboard
- Figure 12-2: 4230A Workstation Monitor

ILLUSTRATED PARTS

12.2 4230A WORKSTATION KEYBOARD

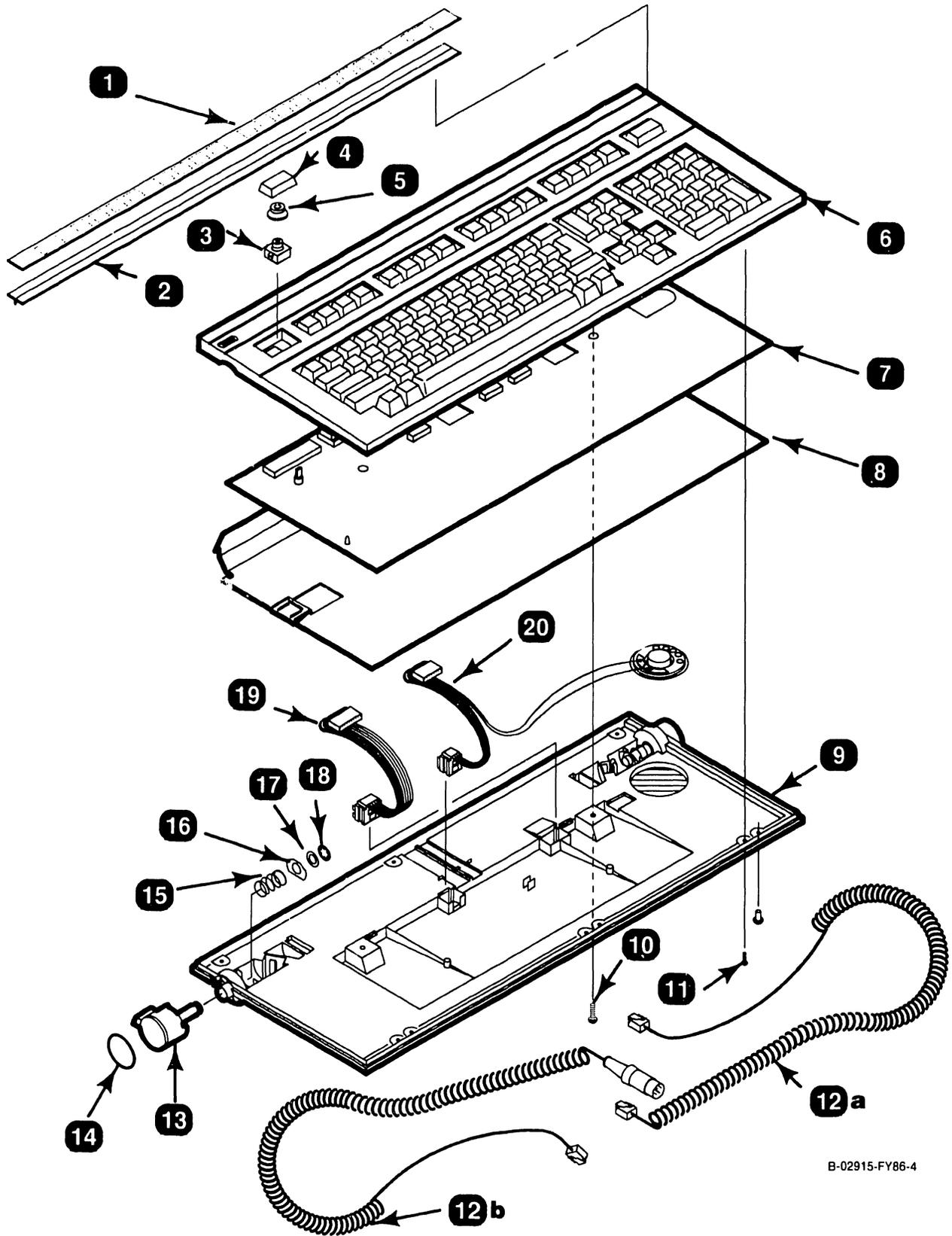
Domestic Keyboard (725-3155-US**)

International Keyboard (725-3156-GE**)

Item	Part Number	Description
1	615-2212	FUNCTION STRIP, BLANK
2	449-1137 (3)	FUNCTION STRIP, CARRIER
3	554-9986	TACTILE KEYSWITCHES, STANDARD, SINGLE
	554-9981	TACTILE KEYSWITCHES, MULTIWIDE
	554-9980	TACTILE KEYSWITCHES, MULTIWIDE, DUMMY
4	200-4121	101 KEYCAP SET
	200-4120	104 KEYCAP SET
	200-4122	107 KEYCAP SET
5	554-9984	2.5 OZ. TACTILE BOOT, BLUE, SINGLE CAP
	554-9985	1.25 OZ. TACTILE BOOT, GREY/PINK, DUAL SWITCH KEYCAP
	554-9983	3.0 OZ. TACTILE BOOT, SPACE BAR
6	449-1100	COVER, TOP, NON-EXPANDED
	449-1137	COVER, TOP, EXPANDED
7	65-03108-052	101 KEY, PRINTED CIRCUIT BOARD (Keytronic Part Number)
	65-03108-051	104 KEY, PRINTED CIRCUIT BOARD (Keytronic Part Number)
	65-03140-051	107 KEY, PRINTED CIRCUIT BOARD (Keytronic Part Number)
8	452-3167	SHIELD, KEYBOARD
9	449-1103	BASE, KEYBOARD
10	650-3181 (2)	SCREW, 6-19 x 1/16 PAN HEAD PHL.
11	650-2134 (6)	SCREW, 4-24 x 3/4 PAN HEAD PHL.
12a	420-1136	CABLE ASSY., 6P MOD., 6 FT. COIL
12b	420-1141	CABLE ASSY., 4P RJ11 to DIN, 6 FT. COIL
13	449-1101	KNOB, INDEX, LEFT HAND
	449-1102	KNOB, INDEX, RIGHT HAND
14	653-3009 (2)	O-RING, WANG BLUE
15	465-1848 (2)	SPRING, COMPRESSION
16	651-1777 (2)	RETAINER RING, CIRCULAR
17	458-1744 (2)	WASHER, BACK-UP
18	458-1630 (2)	WASHER, STOP
19	220-2377	CABLE ASSY., INTERNAL I/O
20	220-2376	CABLE ASSY., INTERNAL HOST WITH SPEAKER
21	651-0516 (2)	FASTENER, U-TYPE D

**Denotes RSL Item

ILLUSTRATED PARTS



B-02915-FY86-4

Figure 12-1. 4230A Workstation Keyboard

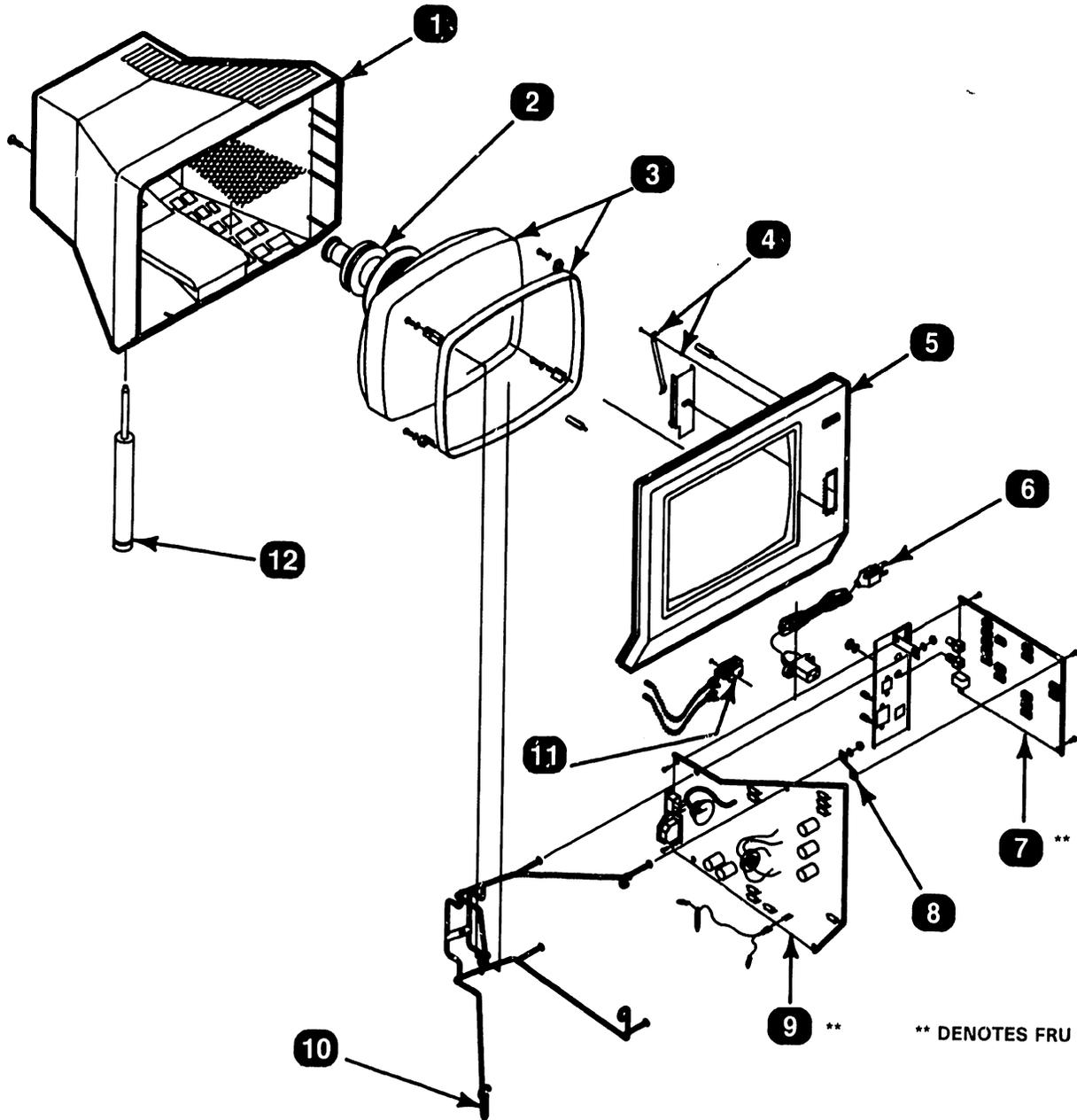
ILLUSTRATED PARTS

12.3 4230A WORKSTATION MONITOR

Item	Part Number	Description
1	449-1088	COVER, MONITOR
2	270-3387	ASSEMBLY, YOKE
3	340-0115	TUBE, CRT, 12 IN., 90 DEGREE, P42, 20 MM.
4	449-1115	SLIDE, ACTUATOR/REFLECTOR, TARGET AND SLIDE, SPRING
5	449-1107	BEZEL, MONITOR
6	420-2040	POWER CORD, AC
7**	210-8467	PRINTED CIRCUIT BOARD, LOGIC/DATA LINK (8467)
8	458-3610	BRACKET, PRINTED CIRCUIT BOARD
9**	210-8466	PRINTED CIRCUIT BOARD, POWER SUPPLY/VIDEO (8466)
10	458-3533	FORM, WIRE
11	325-2332	SWITCH, SUBMINIATURE WITH LEAF ACTUATOR
12	458-3150	SPRING ASSEMBLY, COUNTERBALANCE

** Denotes FRU

ILLUSTRATED PARTS



B-03025-FY86-5

Figure 12-2. 4230A Workstation Monitor

SCHE- MATICS

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SCHEMATICS

Schematics for 4230A Workstation

<u>PCA NUMBER</u>	<u>PCA NAME</u>	<u>PCA REVISION</u>
210-8466	POWER SUPPLY/MONITOR PCA	REVISION 2
210-8467	MONITOR DATA LINK PCA (6 of 6)	REVISION 0

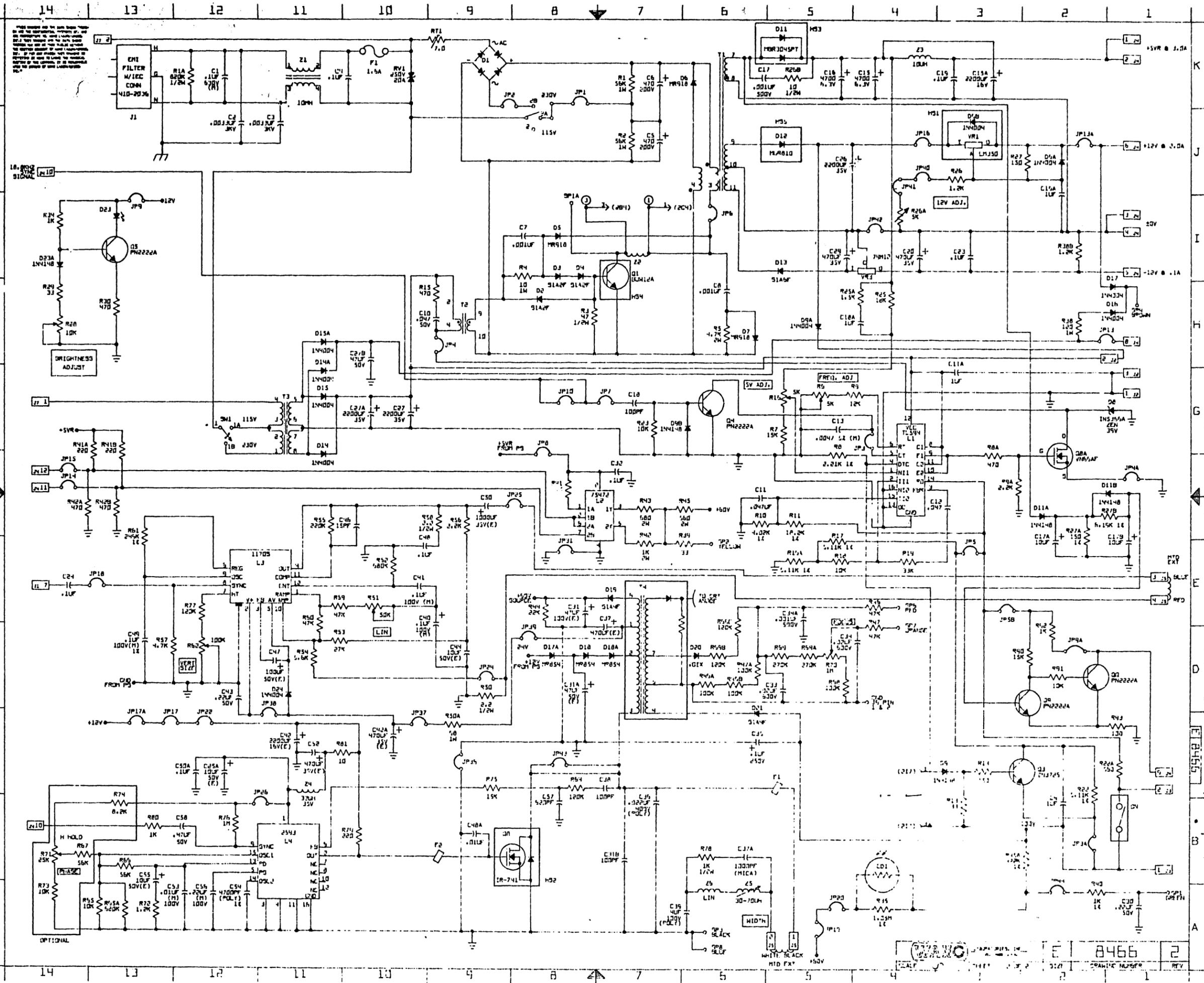
SCHEMATICS

Schematic diagrams for the component parts of the 4230A Workstation are included in this section of the manual. The schematics reflect the latest revisions at the time of printing.

14 13 12 11 10 9 8 7 6 5 4 3 2 1

K
J
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11"
17"

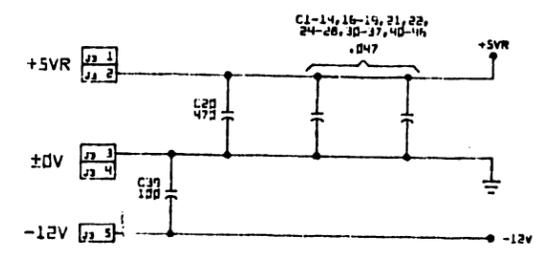
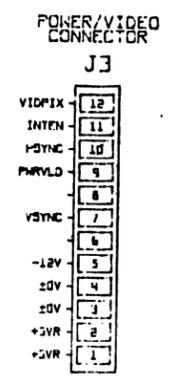
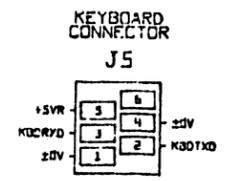


1. ALL RESISTOR VALUES IN OHMS.
 2. ALL CAPACITOR VALUES IN MICROFARADS
 UNLESS OTHERWISE INDICATED.
 3. ALL RESISTORS 1/4W 5%
 UNLESS OTHERWISE INDICATED.

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

IC TYPE	LOCATION	SPARES
74LS32	L57	1
74LS25	L51	1

MNEMONICS	COORD.
H SYNC	401
INTEN	401
KCORN	2A13
KDOTX	JF1
PARVLD	3E14
VICPIX	401
VSYNC	401
±0V	2G1
+5VR	2H1

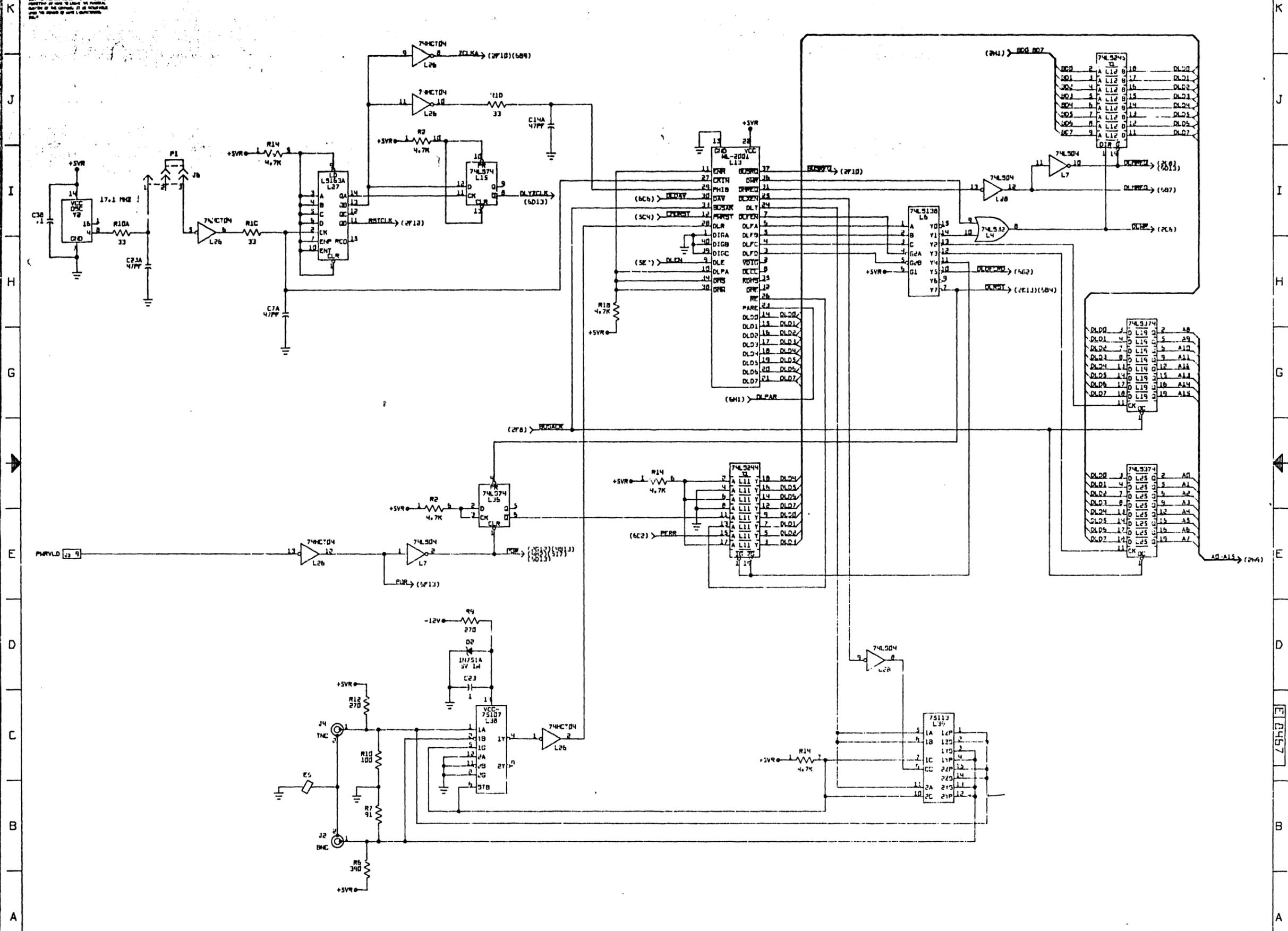


8.5"

11"

17"

SCHEMATIC DIAGRAM
 TITLE
 ALLIED WORK STATION
 DATE

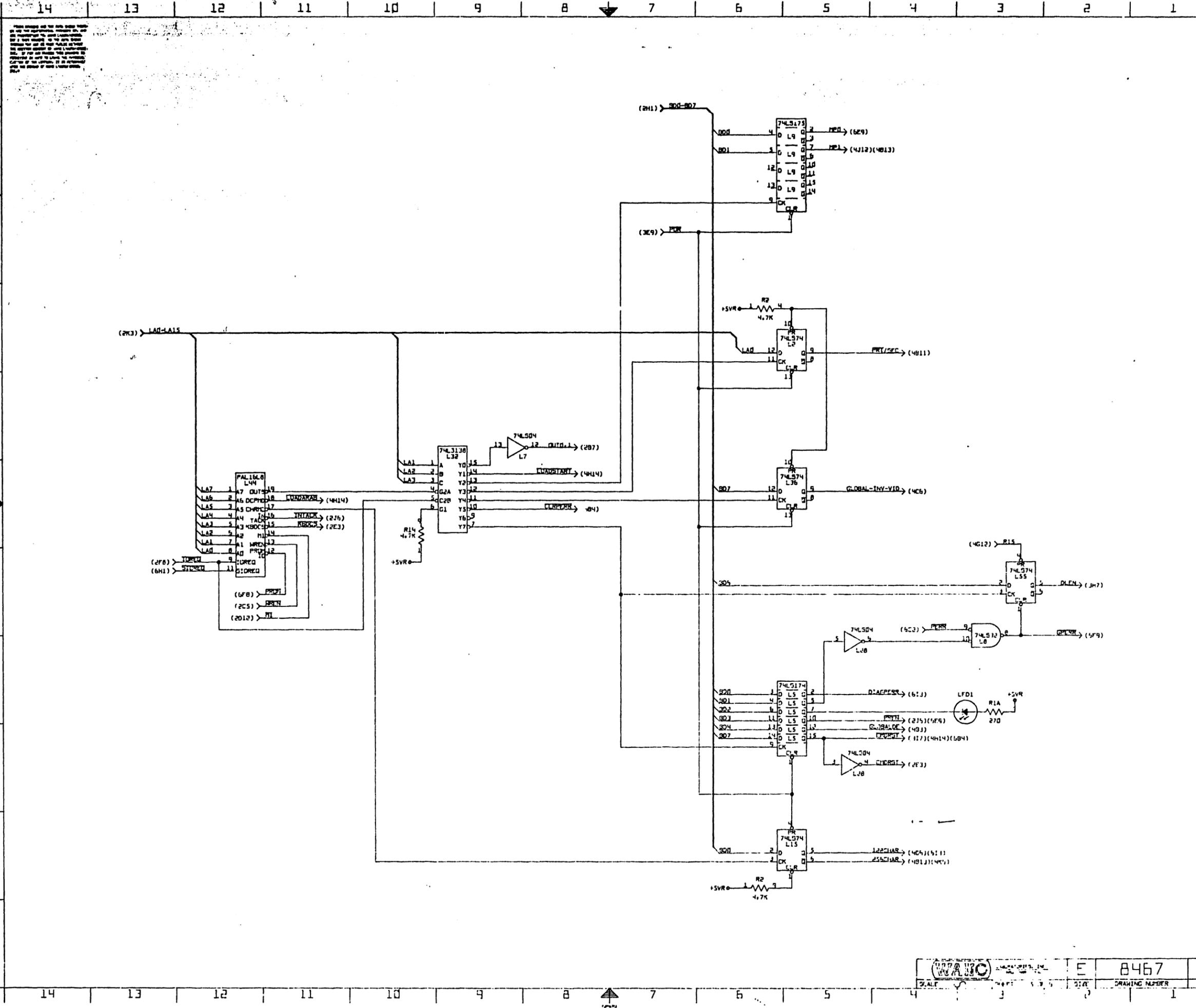


8.5"

8.5"

11"

17"





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