

E.3541

SERVICE MANUAL

**7220C/7220T and 7221C/7221T
GRAPHICS PLOTTERS**

SERIAL NUMBERS

This manual applies directly to plotters with serial numbers prefixed 2149A. With changes described in Section V, this manual also applies to plotters prefixed 2148A and 2036A.

For additional important information about serial numbers, see PLOTTERS COVERED BY MANUAL in Section I.

PLEASE RETURN TO -
ELECTRONIC STORE
DEPARTMENT OF
ELECTRICAL ENGINEERING
UNIVERSITY OF MELBOURNE

©1981 by HEWLETT-PACKARD COMPANY
16399 W. BERNARDO DRIVE, SAN DIEGO, CALIFORNIA 92127

MANUAL PART NO. 07220-90004
Microfiche Part No. 07220-90054

Printed: DECEMBER 1981

Table of Revised Pages

Serial Number Prefix 2148A

REVISION	REVISED PAGES				REASON
A December 1981	1-6*	3-4	3-6	4-2*	This change incorporates an improved Y-axis drive cable system.
	4-4*	4-5*	4-18	4-19/20*	
	4-21	4-24	4-25/26	4-27	
	5-1	6-16	6-18	6-20	
	6-21	6-22	6-23	6-61/62*	

Serial Number Prefix 2149A

REVISION	REVISED PAGES			REASON
B December 1981	A4-2	A4-4*	A4-5*	This change incorporates a more rugged relay on the Paper Advance Front Panel PCA, A1.
	A4-6*	A4-9/10	A4-11	
	A5-1	A6-2		

NOTE

PAGE NUMERS WITH AN * SUFFIX HAVE ERRATA CHANGES ONLY.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>	<u>Section</u>	<u>Page</u>
I GENERAL INFORMATION	1-1	4-8. Printed Circuit Assemblies	4-1
1-1. Introduction	1-1	4-10. Frame Mounted Parts	4-1
1-5. Description	1-1	4-12. Ordering Information	4-1
1-9. Safety Considerations	1-1	4-14. Code List of Manufacturers	4-1
1-12. Safety Symbols	1-1	4-16. Abbreviations and Reference Designations	4-1
1-14. Model 7220C/7221C Warnings	1-1	4-18. Check Digits	4-1
1-16. Line Voltage and Fuse Selection	1-2	V MANUAL CHANGES	5-1
1-19. Line Voltage Selection	1-3	5-1. Introduction	5-1
1-21. Plotters Covered by Manual	1-3	VI SERVICE	6-1
1-26. Specifications	1-3	6-1. Introduction	6-1
1-28. Accessories Supplied	1-3	6-3. Simplified Theory of Operation	6-1
1-30. Accessories Available	1-3	6-12. Functional Theory of Operation	6-1
1-32. Recommended Test Equipment	1-3	6-14. Interconnect PCA A1 Theory of Operation	6-1
II OPERATING AND PERFORMANCE TESTS	2-1	6-17. Main PCA A2 RS-232-C Circuits	6-3
2-1. Introduction	2-1	6-22. Main PCA A2 Processor Circuitry	6-5
2-3. Operating Tests	2-1	6-33. Main PCA A2 Internal I/O Circuitry	6-8
2-4. Confidence Test	2-1	6-35. Front Panel PCA A3	6-8
2-7. Performance Tests	2-1	6-37. Main PCA A2 Memory Circuit	6-8
2-8. Plotting Repeatability	2-1	6-42. Main PCA A2 Interpolator Circuitry	6-8
2-10. Plotting Accuracy	2-1	6-54. Main PCA A2 Motor Driver Circuitry	6-11
2-12. Diagnostic Tests	2-5	6-61. Power Supply Assembly	6-11
2-14. Opening the Plotter	2-5	6-77. Troubleshooting	6-14
2-16. Printed Circuit Identification	2-5	6-79. Maintenance	6-14
2-18. Self Test Controls and Indicators	2-5	6-80. Cleaning	6-14
2-21. Self Test	2-5	6-82. Repair	6-16
III ADJUSTMENTS	3-1	6-85. Opening the Plotter	6-16
3-1. Introduction	3-1	6-87. Cable Restringing	6-16
3-3. Safety Considerations	3-1	6-94. Pen Arm Adjustment	6-23
3-5. Electrical Adjustments	3-1	6-96. Printed Circuit Assembly Replacement	6-25
3-6. Test Equipment Required	3-1	6-102. Electrostatic Table (Platen) Removal and Replacement	6-31
3-8. Opening the Plotter	3-1	6-104. X- and Y-motor Replacement	6-31
3-10. X-axis Motor Driver Adjustments	3-1	6-106. X-limit Switch Assembly Replacement	6-31
3-12. Y-axis Motor Driver Adjustments	3-1	6-108. Y-limit Switch Assembly Replacement	6-32
3-14. Mechanical Adjustments	3-3	6-110. Side Panel Removal	6-32
3-15. Pen Solenoid Travel Adjustment	3-3	6-112. Logic Symbols and Notes	6-33
3-17. Pen Height Adjustment	3-3	6-114. Block Diagrams	6-33
3-19. Pen Force Adjustment	3-3	6-116. Schematic Diagrams	6-33
3-21. Pen Lift Adjustment	3-3	APPENDIX A — PAPER ADVANCE FEATURE	
3-23. Dashpot Adjustment	3-3	AI GENERAL INFORMATION	A1-1
3-25. X- and Y-drive Cable Tension Adjustment	3-4	A1-1. Introduction	A1-1
3-27. Pen Arm Adjustment	3-4	A1-4. Description	A1-1
3-29. X- and Y-limit Switch Adjustment	3-4	A1-13. Safety	A1-2
3-31. Non-horizontal Mounting Adjustment Procedure	3-6	A1-15. Specifications	A1-2
3-33. Pen Stable PCA Switch Adjustment	3-7	A1-17. Accessories Supplied	A1-2
IV REPLACEABLE PARTS	4-1	A1-19. Shipment	A1-2
4-1. Introduction	4-1	AII OPERATION	A2-1
4-3. Exchange Assemblies	4-1	A2-1. Introduction	A2-1
4-5. Accessories Supplied	4-1		
4-7. Replaceable Parts List	4-1		

TABLE OF CONTENTS (Continued)

<u>Section</u>	<u>Page</u>	<u>Section</u>	<u>Page</u>
AII OPERATION (Continued)		A4-10. Transmission Assembly	A4-1
A2-3. Panel Features	A2-1	A4-12. Ordering Information	A4-1
A2-5. Internal Control Features	A2-1	AV MANUAL CHANGES	A5-1
A2-7. Interface Instructions	A2-1	A5-1. Introduction	A5-1
A2-10. Paper Roll Loading	A2-1	AVI SERVICE	A6-1
A2-12. Operational Checks	A2-1	A6-1. Introduction	A6-1
AIII ADJUSTMENTS	A3-1	A6-4. Simplified Theory of Operation	A6-1
A3-1. Introduction	A3-1	A6-7. Functional Theory of Operation	A6-1
A3-3. Safety Requirements	A3-1	A6-9. Paper Advance Enable	A6-1
A3-5. Equipment Required	A3-1	A6-11. Paper Sensing Switches	A6-1
A3-7. Electrical Adjustments	A3-1	A6-13. Front Panel Control Switches	A6-1
A3-9. Paper Sensing Switch Adjustments	A3-1	A6-15. English/Metric Switch	A6-1
A3-11. Mechanical Adjustment	A3-1	A6-18. Cutter Lamp	A6-1
A3-12. Module Height and Position Adjustment	A3-1	A6-22. Paper Advance Motor Drive	A6-1
A3-14. Drum Sprocket Alignment	A3-2	A6-27. Paper Cutter	A6-4
A3-16. Drum Axis Perpendicularity Alignment	A3-2	A6-30. Troubleshooting	A6-4
A3-18. Drum Axial Alignment Procedure	A3-4	A6-32. Repair and Replacement of Parts ...	A6-4
A3-20. Brake Hub Alignment	A3-4	A6-34. Module Removal and Replacement	A6-4
A3-22. Drag Arm Adjustment	A3-4	A6-36. Drag Arm (Paper Supply Indicator) Replacement	A6-4
A3-24. Slip Clutch Adjustment	A3-4	A6-38. Paper Sensor Switch Replacement	A6-7
A3-26. Lower Cutter Blade Adjustment ...	A3-4	A6-40. Lower Cutting Blade Replacement	A6-8
AIV PARTS LISTS	A4-1	A6-42. Slip Clutch Replacement	A6-8
A4-1. Introduction	A4-1	A6-44. Drum Assembly/Sprocket Replacement	A6-8
A4-3. Replaceable Parts List	A4-1	A6-46. Drum Alignment Bushing Replacement	A6-9
A4-4. Printed Circuit Assembly	A4-1	A6-48. Schematic Diagrams	A6-9
A4-6. Mechanical Parts	A4-1		
A4-8. Interconnecting Cables	A4-1		

TABLES

<u>Table</u>	<u>Page</u>	<u>Table</u>	<u>Page</u>
1-1. Plotter Specifications	1-5	4-15. Check Digit Calculation	4-33
1-2. Supplemental Characteristics	1-5	6-1. RS-232-C/CCITT V.24 Wires/Signals Used in the Graphic Plotter	6-3
1-3. Accessories Supplied	1-6	6-2. Plotter Modes and Line States	6-7
1-4. Accessories Available	1-6	6-3. Microprocessor Definitions	6-6
1-5. Recommended Test Equipment	1-7	6-4. Register Functions	6-7
3-1. Pen Force Adjustment	3-7	6-5. ROM Functions	6-10
4-1. Exchange Assemblies	4-1	A1-1. Specifications	A1-3
4-2. Accessories Supplied	4-2	A1-2. Supplemental Characteristics	A1-3
4-3. Interconnect PCA A1 Parts List	4-2	A1-3. Page Lengths and Default Limits	A1-3
4-4. Main PCA A2 Parts List	4-3	A1-4. Accessories Supplied	A1-4
4-5. Front Panel PCA A3 Parts List	4-10	A2-1. Paper Advance Controls and Indicators Indicators	A2-1
4-6. Power Supply PCA A4 Parts List	4-12	A3-1. Equipment Required	A3-1
4-7. Primary PCA A5 Parts List	4-16	A4-1. Front Panel PCA (A1), Parts List	A4-2
4-8. Chart Hold PCA A6 Parts List	4-17	A4-2. Supply Module, Parts List	A4-4
4-9. Upper Deck Assembly Parts List	4-18	A4-3. Drive Module Housing/Bar Mount, Parts List	A4-6
4-10. Lower Case Assembly Parts List	4-22	A4-4. Drive Module, Parts List	A4-8
4-11. Pen Arm Assembly Parts List	4-24	A6-1. Alignment/Tension Problem Diagnosis	A6-6
4-12. Front Panel Assembly Parts List	4-28		
4-13. Code List of Manufacturers	4-30		
4-14. Reference Designations and Abbreviations	4-31		

ILLUSTRATIONS

<u>Figure</u>	<u>Page</u>	<u>Figure</u>	<u>Page</u>
1-1. HP Models 7220C and 7221C Graphics Plotters	1-0	6-25. Upper Right X Drive Cable Termination	6-23
1-2. Line Voltage Identification Plates	1-2	6-26. Lower Left X Drive Cable Termination	6-23
1-3. Opening the Plotter	1-4	6-27. X Motor and Pulley Windings	6-23
1-4. Line Voltage Selection Jumpers	1-5	6-28. X Drive Cable, Viewed from Underside of Upper Deck	6-24
2-1. Confidence Test Plot	2-2	6-29. Underside View of Upper Deck	6-25
2-2. 7220C Repeatability and Accuracy Test Program and Plot	2-3	6-30. Top View of Plotter with Platen Removed	6-26
2-3. 7221C Repeatability and Accuracy Test Program and Plot	2-4	6-31. X Cable Termination in Lower Pen Arm Bracket	6-26
2-4. PCA Identification	2-6	6-32. X Cable Stringing Diagram Viewed from Underside of Upper Deck	6-27
2-5. Self Test Controls	2-7	6-33. Front Panel Removal	6-28
2-6. Self Test	2-9	6-34. X Rear Track and Wheels	6-28
3-1. PCA Identification	3-2	6-35. Main PCA A2 Removal	6-29
3-2. Electrical Adjustment Location	3-2	6-36. Power Supply Assembly Removal	6-29
3-3. Electrical Adjustment Chart	3-3	6-37. Front Panel PCA A3 Removal	6-30
3-4. Pen Solenoid Travel Adjustment	3-4	6-38. Motor Removal	6-31
3-5. Pen Holder Adjustments	3-4	6-39. X-limit Switch Removal	6-32
3-6. Pen Damping Adjustments	3-5	6-40. Side Panel Removal	6-32
3-7. X-axis Cable Tension Adjustment	3-6	6-41. ANSI Y.32.14 Logic Symbols	6-34
3-8. Y-axis Cable Tension Adjustment	3-6	6-42. Schematic Diagram Notes	6-41
3-9. Alignment Position for Arm	3-6	6-43. HP Models 7220C/7221C Functional Block Diagram	6-43
3-10. Limit Switch Adjustment	3-7	6-44. Interconnecting Cable Diagram	6-44
3-11. Pen Stable Switch Identification	3-8	6-45. Interconnect PCA A1 Parts Location	6-45
3-12. Pretravel/Overtravel	3-8	6-46. Service Sheet 1 Interconnect PCA A1 Schematic Diagram	6-47
3-13. Front Panel PCA Adjustment	3-8	6-47. Main PCA A2 RS-232-C Circuit Parts Location	6-49
3-14. Pen Stable Switch Adjustment	3-9	6-48. Service Sheet 2 Main PCA A2 RS-232-C Schematic Diagram	6-51
4-1. Upper Deck Assembly	4-21	6-49. Main PCA A2 Processor Circuit Parts Location	6-53
4-2. Lower Case Assembly	4-23	6-50. Service Sheet 3 Main PCA A2 Processor Circuit Schematic Diagram	6-55
4-3. Pen Carriage and Arm Assembly	4-27	6-51. Front Panel PCA A3 Parts Location	6-57
4-4. Front Panel Assembly	4-29	6-52. Main PCA A2 Internal I/O Parts Location	6-59
6-1. HP Model 7220C/7221C Simplified Block Diagram	6-2	6-53. Service Sheet 4, Main PCA A2 Internal I/O and Front Panel Schematic	6-61
6-2. Typical Plotter Installation	6-2	6-54. Main PCA A2 Memory Circuit Parts Location	6-63
6-3. Plotter Modes	6-4	6-55. Service Sheet 5 Main PCA A2 Memory Circuit Schematic Diagram	6-65
6-4. Interrupt Request Timing	6-7	6-56. Main PCA A2 Motor Driver Circuit Parts Location	6-67
6-5. Read Write Timing	6-9	6-57. Motor Drive Waveforms	6-68
6-6. Register Selection Addressing	6-10	6-58. Service Sheet 6 Motor Driver Circuit Schematic Diagram	6-69
6-7. Simplified Accumulator Storage Location	6-10	6-59. Power Supply Assembly PCAs A4, A5, A6 Parts Location	6-71
6-8. Sine/Cosine ROM Values	6-11	6-60. Power Supply Waveforms	6-72
6-9. Interpolator Timing	6-13	6-61. Service Sheet 7 Power Supply Assembly Schematic Diagram	6-73
6-10. Drive Current Waveshapes	6-14	A1-1. HP Models 7220T/7221T Graphics Plotters with Paper Advance	A1-0
6-11. Motor Driver Current and Sequencing	6-15		
6-12. Power Supply Outputs	6-15		
6-13. Power Supply Indicator LEDs	6-16		
6-14. Opening the Plotter	6-17		
6-15. Underside View of Top Desk Assembly	6-18		
6-16. Pen Carriage with Cover Removed	6-18		
6-17. Y Trailing and Drive Cables	6-19		
6-18. Cables Termination Bracket	6-19		
6-19. Y Motor and Pulley Windings	6-19		
6-20. Upper Right Pulley Bracket	6-20		
6-21. Y Cable Feed Through to Pen Carriage Arm	6-20		
6-22. Y Cable Termination at Rocker Tension Arm	6-21		
6-23. Y Drive Cable Stringing Diagram	6-22		
6-24. X Tension Adjust Nut	6-23		

ILLUSTRATIONS (Continued)

<u>Figure</u>	<u>Page</u>	<u>Figure</u>	<u>Page</u>
A1-2. Paper Advance Modules	A1-1	A4-6. Transmission Assembly Detail	A4-13
A1-3. Paper Path Diagram	A1-2	A6-1. HP Models 7220T/7221T Simplified Functional Block Diagram	A6-2
A2-1. Controls and Indicators	A2-2	A6-2. Operational Flow Diagram	A6-3
A2-2. Paper Sensor Switch Locations	A2-3	A6-3. Troubleshooting Chart	A6-5
A2-3. Paper Loading	A2-4	A6-4. Removing the Paper Advance Modules	A6-7
A3-1. Paper Sensor Adjustment	A3-2	A6-5. Drag Arm Removal	A6-7
A3-2. Module Height Adjustment	A3-3	A6-6. Paper Sensor Switch Replacement	A6-8
A3-3. Sprocket Alignment	A3-3	A6-7. Lower Blade Replacement	A6-8
A3-4. Perpendicularity Alignment	A3-5	A6-8. Slip Clutch Replacement	A6-9
A3-5. Drum Axial Adjustment	A3-5	A6-9. Drum Assembly/Sprocket Replacement	A6-10
A3-6. Brake Hub Adjustment	A3-6	A6-10. Drum Bushing Replacement	A6-11
A3-7. Drag Arm Adjustment	A3-6	A6-11. Control Panel PCA Parts Location	A6-11
A3-8. Slip Clutch Adjustment	A3-6	A6-12. Control Panel PCA Schematic Diagram	A6-12
A3-9. Lower Cutter Blade Adjustment	A3-7	A6-13. HP Models 7220T/7221T Paper Advance Schematic Diagram	A6-13
A4-1. Front Panel PCA A1 Parts Location	A4-3		
A4-2. Supply Module	A4-5		
A4-3. Drive Module Housing	A4-7		
A4-4. Drive Module	A4-11		
A4-5. Interconnecting Cables	A4-12		

HP Computer Museum
www.hpmuseum.net

For research and education purposes only.

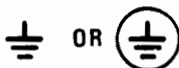
General Definitions of Safety Symbols Used On Equipment



International caution symbol (refer to manual): the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.



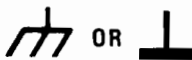
Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current



Direct current



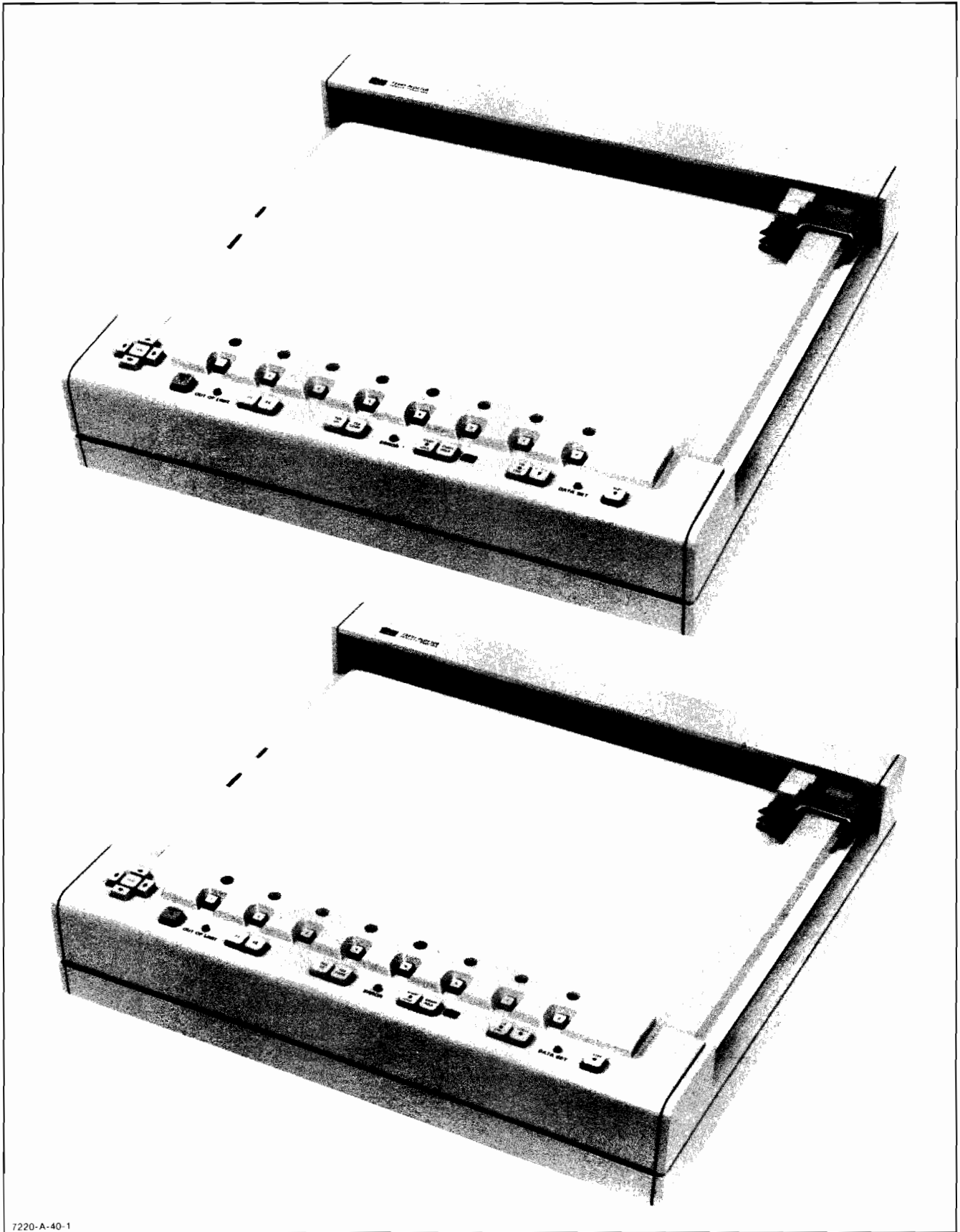
Alternating or direct current



The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury.



The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.



7220-A-40-1

Figure 1-1. HP Models 7220C and 7221C Graphics Plotters

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Service Manual contains the necessary information to test, adjust, and service the Hewlett-Packard Models 7220C and 7221C Graphics Plotters, which are shown in Figure 1-1. The appendix to this manual provides service information for the Paper Advance Feature. For ease of reference, this manual has been structured as follows:

SECTION I	GENERAL INFORMATION
SECTION II	OPERATING AND PERFORMANCE TESTS
SECTION III	ADJUSTMENTS
SECTION IV	REPLACEABLE PARTS
SECTION V	MANUAL CHANGES
SECTION VI	SERVICE
APPENDIX A	PAPER ADVANCE FEATURE

1-3. Information on interfacing and operating the plotters is contained in separate Operating and Programming Manuals, HP Part Numbers 07220-90003 and 07221-90024.

1-4. Listed on the title page of this manual is a microfiche part number. This number can be used to order 4- by 6-inch microfiche transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as any pertinent Service Notes.

1-5. DESCRIPTION

1-6. Both plotters are microprocessor-based, providing permanent graphic displays of problems solved by computer program output data. These plotters incorporate a stepper motor drive system to accomplish addressable moves as small as 0.025 mm. In addition to high resolution and improved line and character quality, 45 different instructions are built in to equip these plotters with such capabilities as point digitizing, labeling, and axes generation.

1-7. Automatic pen selection of eight pens via program control instructions or front panel switches is one of the exceptional features of the plotters. This allows multicolor plotting in locations where intersecting lines would be difficult to interpret. The plotter is connected in series between the host computer or modem and a terminal with data being exchanged between the equipment as defined in the Electronic Industries Association (EIA) Standard RS-232-C and the International Telegraph and Telephone Consultive Committee (CCITT) Recommendation V.24.

1-8. Both plotters generate final, draft-like plots of high quality for presentations, reports, and reproduction.

1-9. SAFETY CONSIDERATIONS

1-10. These are safety class I instruments (provided with a terminal for protective earthing) and have been manufactured and tested in accordance with international safety standards.

1-11. BEFORE APPLYING POWER, verify that the power transformer primary is matched to the available line voltage, that the correct value of fuse is installed, and that all safety precautions are observed (see the following warnings).

1-12. SAFETY SYMBOLS

1-13. Refer to page v for safety symbols used with the Model 7220C/7221C Plotters.

1-14. MODEL 7220C/7221C WARNINGS

1-15. The following warning statements should be observed when operating or maintaining the plotters.

WARNING

- a. Keep hands clear of the plotting arm when power is applied to the plotter.
- b. If it becomes necessary to replace the power cord, the replacement cord must have the same polarity as the original.
- c. Servicing instructions are for use by qualified personnel only. To avoid potential hazards, do not perform any servicing unless qualified to do so.
- d. Before switching on the plotter, the protective earth terminal of the plotter must be connected to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in an outlet with a protective earth contact. The protective action must not be negated by the use of an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor cable is not sufficient protection.
- e. If the plotter is to be energized through an auto-transformer (for voltage reduction), make sure that the common terminal is connected to the earth terminal of the power source.

- f. An interruption of the protective (grounding) conductor (inside or outside the plotter) or disconnecting the protective earth terminal may cause the plotter to become hazardous. Intentional interruption is prohibited.
- g. Make sure that only fuses with the required rated current and voltage and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short circuiting of fuse holders must be avoided.
- h. Adjustments described in the manual are performed with power supplied to the plotter while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.
- i. Any adjustment, maintenance, and repair of the opened plotter under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the potential electrical shock hazards involved.

1-16. LINE VOLTAGE AND FUSE SELECTION

1-17. The HP Models 7220C/7221C will operate with a voltage source of 100, 120, 220, or 240 Vac; -10%, +5%; 48 to 66 Hz single phase; 100 Watts maximum.



Applying 220/240 V line voltage when jumpers are set for 100/120 V operation will cause damage to the plotter circuits.

1-18. When shipped from the factory, the line voltage selectors and fuse rating are set according to the plotter destination.

VOLTAGE	FUSE	
100 Vac	1.5 A S-B	} HP Part Number 2110-0304
120 Vac	1.5 A S-B	
220 Vac	800 mA	} HP Part Number 2110-0567
240 Vac	800 mA	

The line voltage identification plate on the rear of the plotter indicates the voltage setting and fuse installed. See Figure 1-2.

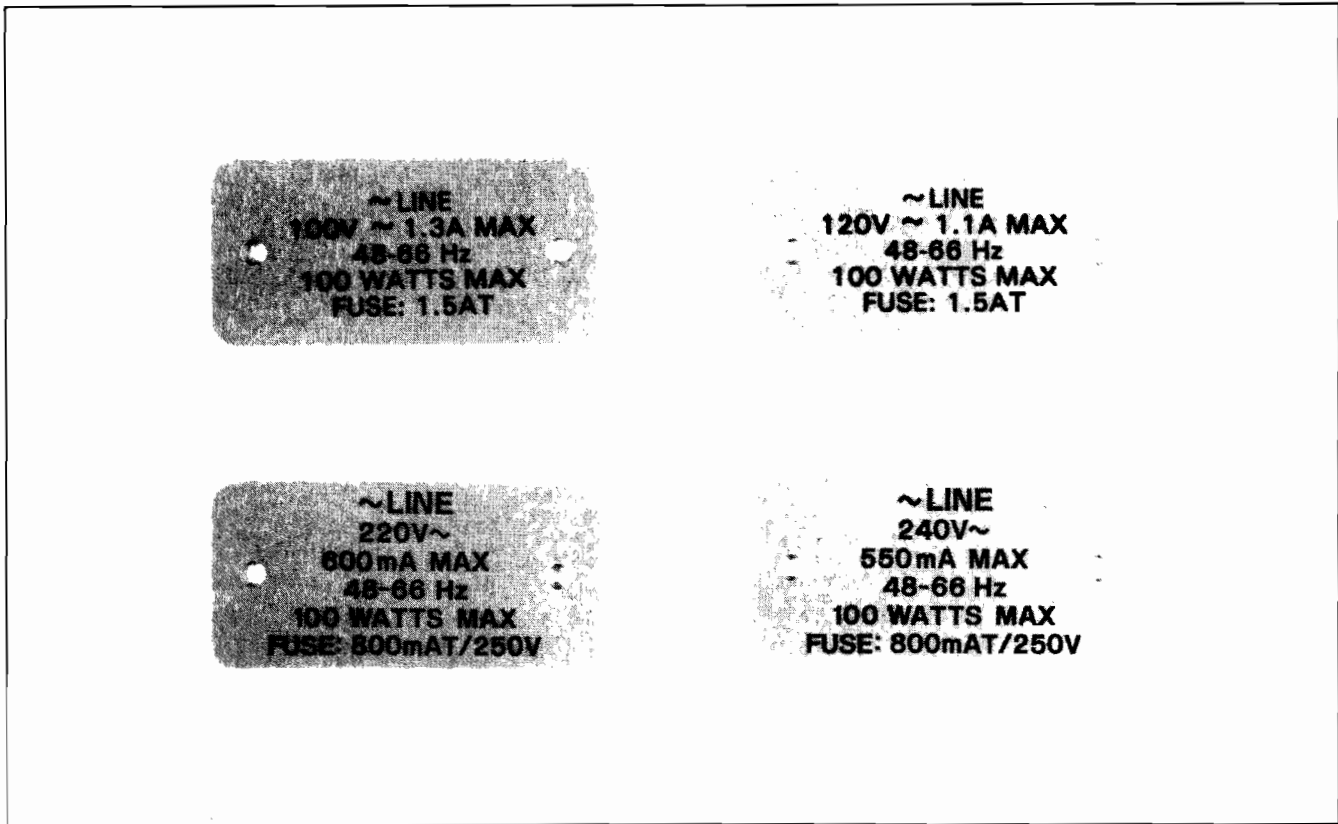


Figure 1-2. Line Voltage Identification Plates

1-19. LINE VOLTAGE SELECTION**WARNING**

The following service procedures should be performed only by service-trained personnel who are aware of the electrical shock hazards involved.

1-20. Three jumpers located on the Primary PCA A5 are set to match the plotter primary circuitry to the applied line voltage. Before operating the plotter with a different line voltage, change the jumpers as follows:

- a. Switch the plotter OFF (O) and disconnect all cables.
- b. To open the plotter, proceed as follows:
 1. Remove the two 6-32 trusshead screws, and lift off the rear hood. See Figure 1-3, Detail A.
 2. Unscrew the two upper deck locking screws. These screws are captive and should not be removed. See Figure 1-3, Detail B.
 3. Raise the upper deck, and place the latching bar in the slot provided. See Figure 1-3, Detail C.
- c. Remove the shield from the Primary PCA A5.
- d. Position the jumpers for the desired voltage according to the legend on the primary shield. Also see Figure 1-4.
- e. Install a line fuse of the correct type and rating for the new line voltage.
- f. Replace and secure the primary shield.
- g. Remove the line voltage plates from the rear of the plotter.
- h. Rearrange and install the line voltage identification plates so that the new line voltage setting is visible.
- i. Close the plotter, and secure the upper deck assembly and rear hood.
- j. Install the correct line cord set for the selected line voltage.

1-21. PLOTTERS COVERED BY MANUAL

1-22. The 7220C/7221C Plotters have a two-part serial number located on the rear panel. The serial number consists of a four-digit prefix and a five-digit suffix separated by a letter. The prefix number is the same

for all identical plotters and changes only when a modification is made that affects parts compatibility. The five digits in the suffix are assigned sequentially and are different for each plotter. This manual applies directly to plotters whose serial numbers have the same prefix as that printed on the title page of this manual.

1-23. If the serial number prefix of your plotter is higher than the one shown on the title page, one or more of the Update Packages supplied with the manual must be folded in. This will ensure that this manual applies directly to your plotter. Refer to the Manual Update Package for instructions.

1-24. If the serial number prefix of your plotter is lower than the one shown on the title page, information in the Manual Changes section, Section V, will adapt this manual to that plotter. To maintain this feature, it is necessary that, when revised pages are inserted in this manual from the Update Package, the old pages must be added to Section V.

1-25. In addition to plotter modification information, revised pages contained in the Update Package may correct errors in the manual or include improved procedures. To keep this manual as accurate as possible, Hewlett-Packard recommends that you periodically request all Update Packages with letter designations above any that you already have. A table of revised pages on the back of the title page will show you the revisions that you already have. When requesting revised pages, always refer to the manual by title, plotter model number, and the manual print date, which is shown on the title page.

1-26. SPECIFICATIONS

1-27. Plotter specifications are listed in Table 1-1. These specifications are the performance standards against which the plotter is tested. Table 1-2 lists supplemental characteristics. Supplemental characteristics are not specifications, but are included as additional information for the user.

1-28. ACCESSORIES SUPPLIED

1-29. Accessories supplied with the 7220C/7221C Plotters are listed in Table 1-3.

1-30. ACCESSORIES AVAILABLE

1-31. Accessories available for use with the 7220C/7221C Plotters are listed in Table 1-4.

1-32. RECOMMENDED TEST EQUIPMENT

1-33. Test equipment recommended to maintain and service the HP Model 7220C and 7221C Plotters are listed in Table 1-5.

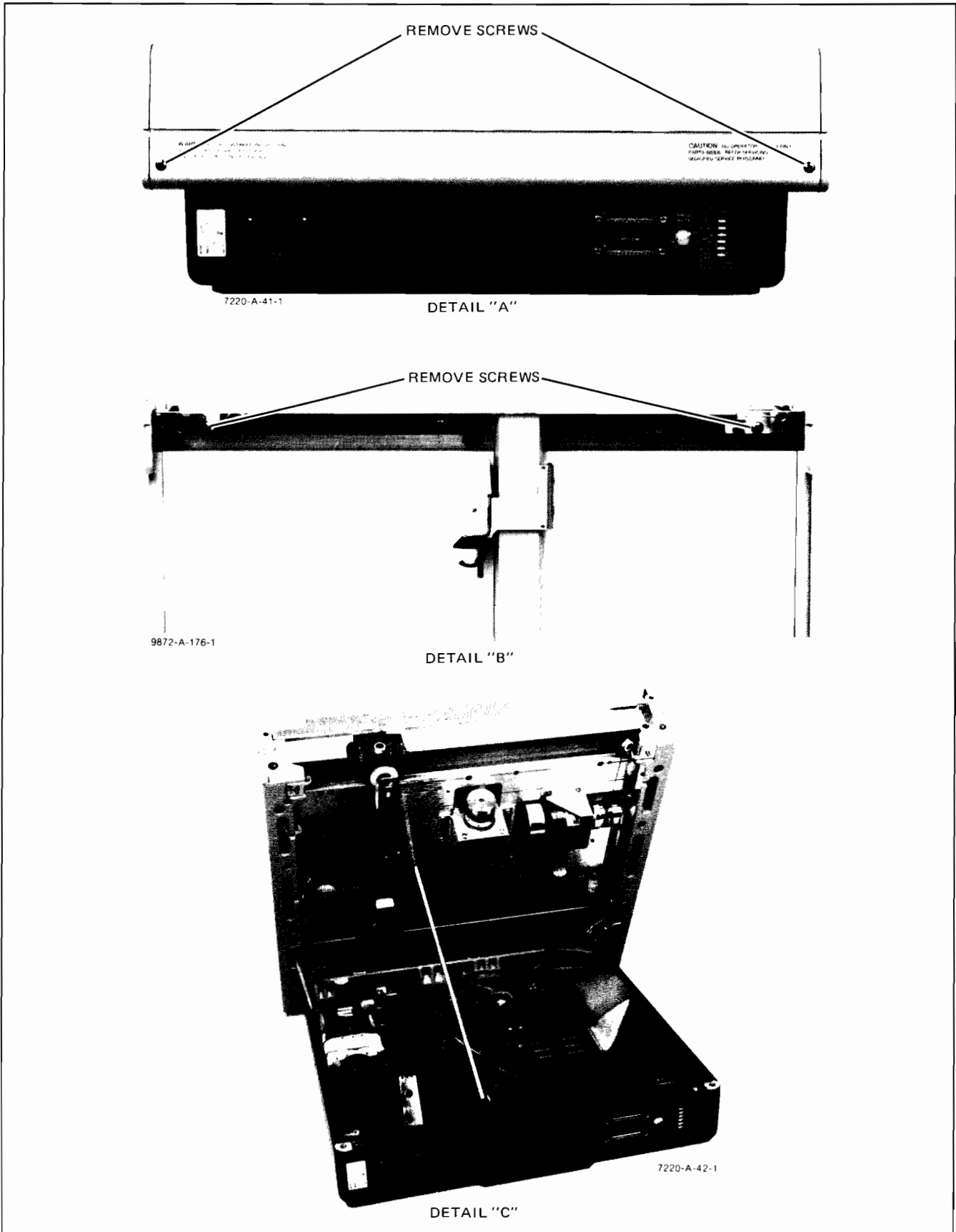


Figure 1-3. Opening the Plotter

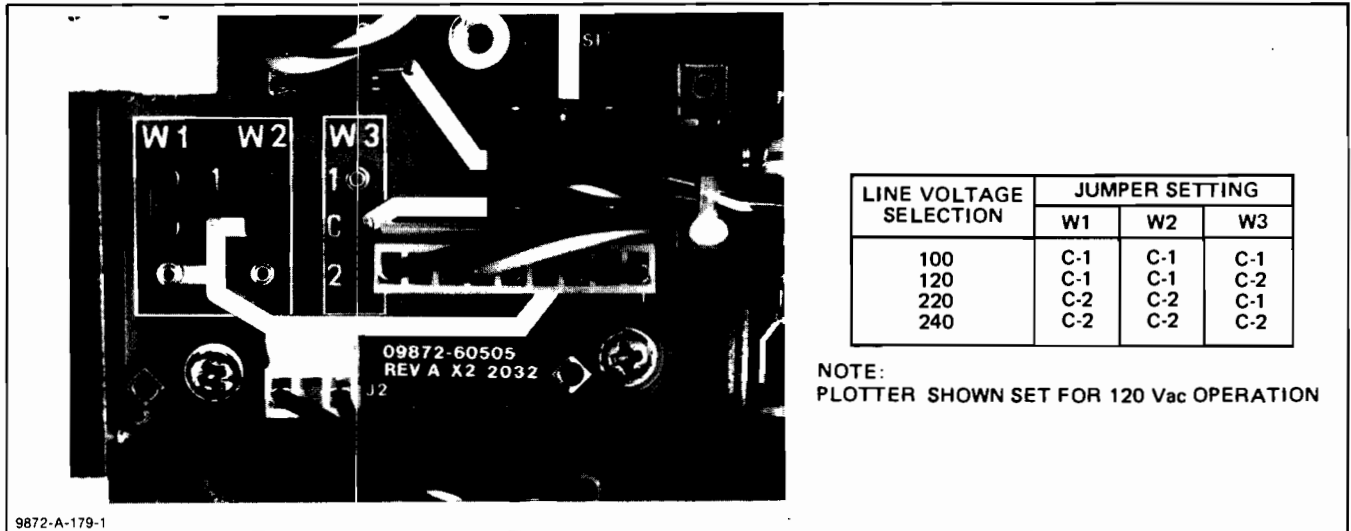


Figure 1-4. Line Voltage Selection Jumpers

Table 1-1. Plotter Specifications

PLOTTING AREA: 40 × 28 cm. Platen will accommodate 11 × 17 inch or ISO A3 chart paper.

PLOTTING ACCURACY: ±0.2% of deflection. ±0.2 mm (includes linearity and repeatability).

REPEATABILITY: Single Pen: ±0.1 mm from any given point approached from any direction.
Pen to Pen: ±0.2 mm without resetting zero coordinates.

ADDRESSABLE RESOLUTION: 0.025 mm is the smallest addressable move.

ENVIRONMENTAL LIMITS:

- Operating:
 - Temperature: 0° C to 55° C
 - Humidity: 5% to 95% relative (below 40° C)
 - Altitude: up to 4600 metres (15 000 feet).
- Storage:
 - Temperature: -40° C to +75° C
 - Humidity: 95% relative (below 40° C)
 - Altitude: up to 15 500 metres (50 000 feet).

POWER REQUIREMENTS: 100, 120, 220, 240 Vac; -10% +5%; 48-66 Hz; 100 Watts maximum.

Table 1-2. Supplemental Characteristics

MAXIMUM VELOCITY: 360 mm/s in each axis.

PROGRAMMABLE VELOCITY: 36 speeds from 10 mm/s to 360 mm/s.

VECTOR LENGTH: Any length within the plotter's mechanical limit.

CHARACTER PLOTTING: Typically 2 characters per second for 2.5 mm characters.

CHARACTER SETS: 6 resident sets: ASCII, 9825A compatible ASCII, European, Scandinavian, Spanish/Latin American, and graphics symbols sets.

PAPER HOLDDOWN: Electrostatic

WRITING MECHANISM: Disposable fiber tip ink pens.

WEIGHT: 18.2 kg net (40 lb).

DIMENSIONS: 189 mm high × 497 mm wide × 477 mm deep.

INTERFACE: RS-232-C/CCITT V.24 asynchronous serial ASCII, full duplex Bell 103A protocol, with switch selectable baud rates of 75, 110, 150, 200, 300, 600, 1200, or 2400 baud. Two port, female 25 pin EIA connectors.

The 7220C recognizes plot instructions in two-letter mnemonic HP Graphics Language.

The 7221C recognizes plot instructions in compacted binary.

INTERFACE CABLE: RS-232-C/CCITT V.24 male to male.

Table 1-3. Accessories Supplied

ITEM	HP PART NUMBER	C/D
Disposable Pens		
1 pack (5 black — 0.3 mm line width)	5060-6787	5
1 pack (5 black — 0.7 mm line width)	5060-6890	1
1 pack (1 each black, blue, red, green — 0.3 mm line width)	5060-6810	5
1 pack (1 each black, blue, red, green — 0.7 mm line width)	5060-6858	1
1 pack (1 each gold, burnt orange, brown, lime green, turquoise, violet — 0.3 mm line width)	5060-6894	5
1 pack (1 each gold, burnt orange, brown, lime green, turquoise, violet — 0.7 mm line width)	5060-6895	6
Digitizing Sight	09872-60066	2
Chart Paper		
300 sheets blank, 8.5 × 11 in.	9280-0517	7
(STD only) 300 sheets blank, 11 × 16.5 in.	9280-0518	8
(METRIC only) 300 sheets blank, A4 (210 × 297 mm)	9280-0519	9
Male-to-male Interface Cable	8120-3258	0
Operating and Programming Manual (1 only)		
7220C	07220-90003	8
7221C	07221-90024	4
Pocket Guide — 7220	07220-90005	0
Computer Supplies Catalog	5953-2450	4
Power Cord	as ordered	
Dust Cover	9222-0742	8

Table 1-4. Accessories Available

ITEM	HP PART NUMBER	C/D
Disposable Pens		
Red (pack of 5)		
0.3 mm line width	5060-6784	2
0.7 mm line width	5060-6893	4
Blue (pack of 5)		
0.3 mm line width	5060-6785	3
0.7 mm line width	5060-6891	2
Green (pack of 5)		
0.3 mm line width	5060-6786	4
0.7 mm line width	5060-6892	3
Black (pack of 5)		
0.3 mm line width	5060-6787	5
0.7 mm line width	5060-6890	1
4-color Pack (1 each red, blue, green, black)		
0.3 mm line width	5060-6810	5
0.7 mm line width	5060-6858	1
6-color pack (1 each brown, gold, burnt orange, lime green, turquoise, violet)		
0.3 mm line width	5060-6894	5
0.7 mm line width	5060-6895	6
Plotter Paper		
11 × 17 in., 10 lines/in., 10 × 15 in grid area, 100 sheets	9270-1004	8
8.5 × 11 in., 10 lines/in., 7 × 10 in grid area, 100 sheets	9270-1006	0
280 × 420 mm, 1 line/mm, 250 × 380 mm grid area, 100 sheets	9270-1024	2
216 × 280 mm, 1 line/mm, 180 × 250 mm grid area, 100 sheets	9270-1023	1
Blank 280 × 420 mm, 100 sheets	9280-0180	0
Blank 8.5 × 11 in., 300 sheets	9280-0517	7
Blank 210 × 297 mm, 300 sheets	9280-0519	9
Blank 11 × 16.5 in., 300 sheets	9280-0518	8

Table 1-4. Accessories Available (Continued)

ITEM	HP PART NUMBER	C/D
Overhead Transparency Kit:	17055A	
Pens (red, blue, green, black), 0.25 mm tip	5060-6818	3
Pens (red, blue, green, black), 0.7 mm tip	5060-6819	4
Pens (black, brown, orange, violet), 0.25 mm tip	5060-6834	3
Pens (black, brown, orange, violet), 0.7 mm tip	5060-6835	4
Solvent 29.6 ml (1 fl oz)	5060-6828	5
Transparency film, 100 sheets	9270-0639	3
Spectrum Graphics Kit	09872-60069	5
Pens (yellow, cyan, magenta, black)	5060-6855	8
Paper (box)	9280-0516	6
Instruction Sheet	09872-90010	9
Carrying Case (not suitable for shipping)	1540-0480	7
7220C/7221C Service Manual	07220-90004	1

Table 1-5. Recommended Test Equipment

INSTRUMENT	MODEL NUMBER
Oscilloscope	HP 184A
Vertical plug-in, 2 channel differential input	HP 1806A
Time Base plug-in, 10 ns to 1 s	HP 1820C
Digital Multimeter	HP 3465A
Logic Probe	HP 10525T
Logic Pulser	HP 10526T
Logic Clip	HP 548A
Optical Comparator	
Measuring Magnifier	Bausch and Lomb 81-34-35
Metric Scaler	
Microline Supergage	Bausch and Lomb



SECTION II

OPERATING AND PERFORMANCE TESTS

2-1. INTRODUCTION

2-2. The procedures in this section are designed to test the electrical performance of the HP Model 7220C/7221C Plotters. The Confidence Test allows a simple verification of plotter operation, while the performance tests are more complete and use the specifications in Table 1-1 as the performance standard.

2-3. OPERATING TESTS

2-4. CONFIDENCE TEST

2-5. In order for the user to easily verify that the essential functions of the plotter are operational, an automatic Confidence Test is built into the plotter. To perform the Confidence Test, proceed as follows:

- a. Turn the plotter LINE switch OFF (O).
- b. Connect the male-to-male interface cable (HP Part Number 8120-3258), provided with the plotter, between the TERMINAL and MODEM connectors on the plotter rear panel.
- c. Turn the LINE switch ON (I).
- d. Load a sheet of chart paper and a new pen.

WARNING

When performing the next step, keep hands and clothing away from the plotter arm.

- e. Place the Confidence Test switch in the (I) position. The Confidence Test begins immediately and runs automatically either to completion or a fault without operator intervention. Leave the Confidence Test switch in the (I) position throughout the test.
 - f. Upon completion of the Confidence Test, return the Confidence Test switch to the (O) position. The plotter will initialize.
- 2-6. The steps performed in the Confidence Test are as follows:
- a. The pen is raised and moved to the lower left-hand corner of the chart.
 - b. The internal electronic Self Test is performed. (The Self Test is described later in this section.)
 - c. The Plot Verification Test is run, producing the Confidence Test Plot shown in Figure 2-1.

- d. All front panel indicator lamps are turned on.
- e. The plotter waits until the Confidence Test switch is returned to the (O) position.
- f. The plotter reinitializes.

2-7. PERFORMANCE TESTS

NOTE

The REPEATABILITY and PLOTTING ACCURACY specifications can only be checked with the plotter under program control. Sample programs are provided to facilitate a check of these parameters. Refer to Table 1-5 for a list of the required test equipment.

2-8. PLOTTING REPEATABILITY

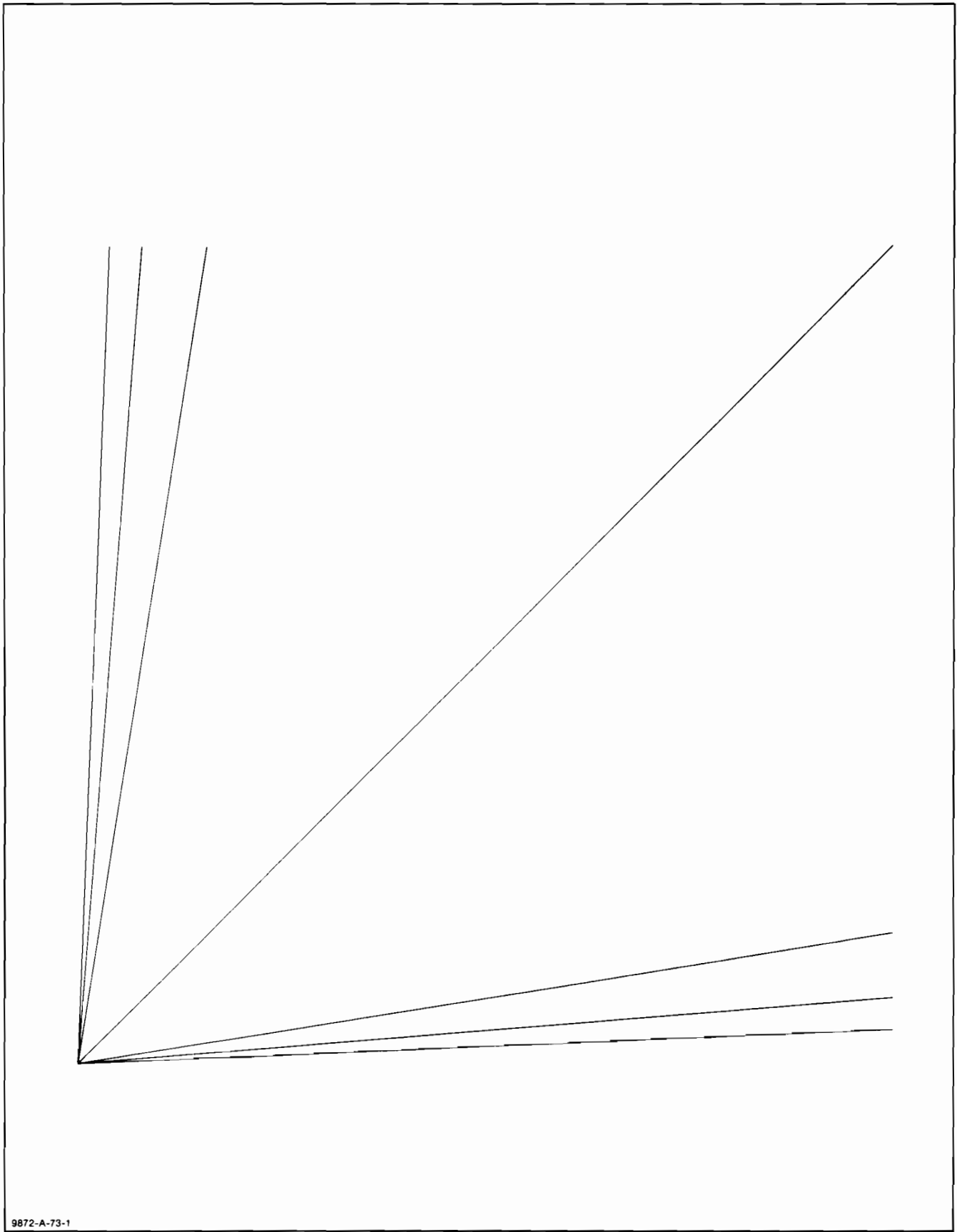
2-9. To verify plotter repeatability, proceed as follows:

- a. Load the plotter with a sheet of blank chart paper, and place a new pen in the plotter arm.
- b. Enter the applicable program from either Figure 2-2 or Figure 2-3 into the computer. Formatting of the program to a particular computer is the responsibility of the user.
- c. Run the program.
- d. Using an optical comparator, measure the difference in width between the single line segment and the retraced portion of the line segment. The difference should be within ± 0.1 mm. See Figure 2-2 or 2-3 for the sample plot.

2-10. PLOTTING ACCURACY

2-11. To verify plotting accuracy, proceed as follows:

- a. If the Repeatability Test has been run, proceed to step d. If the Repeatability Test has not been run, load the plotter with blank chart paper and a new pen.
- b. Enter the sample program into the computer.
- c. Run the program.
- d. Using a metric scaler, verify that the horizontal line measures 38 cm ± 0.96 mm and that the vertical line measures 25 cm ± 0.7 mm. See Figure 2-2 or 2-3.



9872-A-73-1

Figure 2-1. Confidence Test Plot

```

0: wrt 11,"ini
  sp1;"
1: wtb 11,27,46,
  40,27,46,64,"1
  2:"
2: wtb 11,27,46,
  73,"800;17;18:"
3: fxd 0
4: wrt 11,"pu;
  vs;pa15000,1000
  0,5000,5500;"
5: wrt 11,"vs1;
  pd;pr0,500;"
6: wrt 11,"pu;
  pa0,0,5000,6000
  ;"
7: asb "CHECK"
8: wrt 11,"pd;
  vs1;pr0,-250;
  vs;pu;pa0,0;"
9: wrt 11,"vs;
  pu;pa0,0,6000,
  5000;"
10: asb "CHECK"
11: wrt 11,"pd;
  vs1;pr500,0;"
12: wrt 11,"pu;
  pa15000,10000,
  6500,5000;"
13: wrt 11,"pd;
  vs1;pr-250,0;
  vs;pu;pa0,0;"
  
```

```

14: asb "CHECK"
15: wrt 11,"t11,
  1;pu;pa0,1000;"
16: for X=0 to
  15000 by 400
17: wrt 11,"pd;
  pa";X,";1000;
  xt;"
18: asb "CHECK"
19: next X
20: wrt 11,"pu;
  pa1000,0;"
21: for Y=0 to
  10000 by 400
22: wrt 11,"pd;
  pa1000,";Y,";
  yt;"
23: next Y
24: wrt 11,"pu;
  pa15000,10000;"
25: wtb 11,27,
  46,41
26: end
27: "CHECK":
28: wtb 11,17;
  rdb(11)+2
29: ret
*29754
  
```

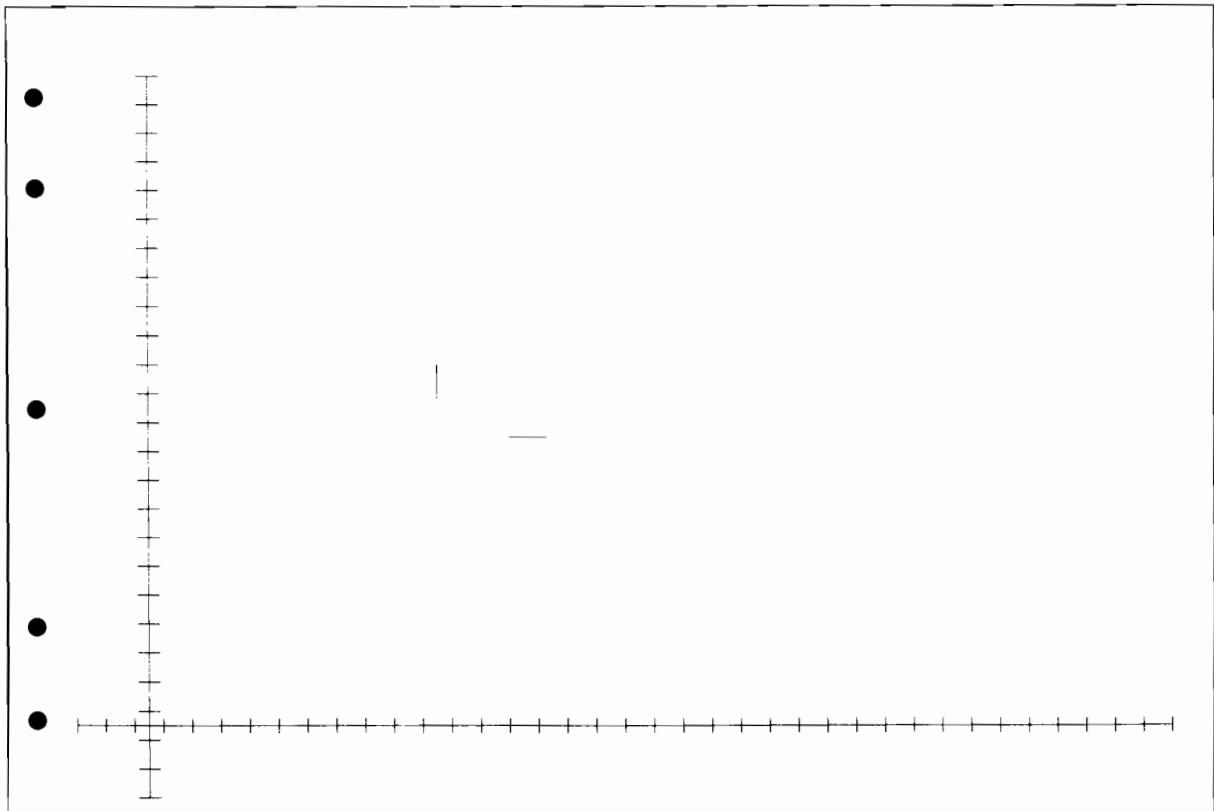


Figure 2-2. 7220C Repeatability and Accuracy Test Program and Plot

2-12. DIAGNOSTIC TESTS

2-13. The performance of the HP Model 7220C or 7221C Plotter may be checked by using a built-in Self Test program which is controlled by test switches located inside the plotter. The object of the Self Test feature is to prove plotter performance and as an aid in troubleshooting the plotter electronics. In most cases, the test will isolate a failure to a specific area of a printed circuit assembly (PCA) or to a group of components on the PCA. Instructions for the Self Test are given in paragraph 2-21.

WARNING

Servicing instructions are for use by qualified service personnel only. To avoid potential hazards, do not perform any procedures unless qualified to do so.

2-14. OPENING THE PLOTTER

2-15. To open the plotter, refer to the instructions in Section I of this manual.

2-16. PRINTED CIRCUIT IDENTIFICATION

2-17. Failures in the Self Test can be isolated to a stage or to a given area on a PCA. Refer to Figure 2-4 for PCA identification.

2-18. SELF TEST CONTROLS AND INDICATORS

2-19. The Self Test is controlled by three switches at the rear of the Main PCA A2. See Figure 2-5. Switch S4-2 is used to select the Self Test. The CONTINUE switch S3 (green) is used to continue the test after any error or halt. The RESET switch S5 (red) performs the same function as a power-up initialization.

2-20. Self Test indications are obtained from the four light emitting diodes (LEDs) beside the test switches. These indicate the binary number of the failed test step.

2-21. SELF TEST

2-22. The following is a brief description of the Self Test steps built into the 7220C/7221C. The test instructions and result interpretations are illustrated in Figure 2-6. The test steps are as follows:

- a. LED check — The Self Test LEDs flash sequentially
- b. ROM 0 LSB — A2U56
- c. ROM 0 MSB — A2U55
- d. 20 k ROM LSB — A2U209
- e. 20 k ROM MSB — A2U208
- f. RAM — A2U67, U66, U65, U64

- g. Interrupt Test — interrupt request, interrupt subroutine and stack pointer, and return to normal
- h. RS-232-C — DCE to DTE, DTE to DCE, and I/O Control
- i. Optional RAM — A2U215, U214, U213, and U212 (if installed)
- j. Front Panel — operator interactive test of the front panel switches
- k. Motor Vectors — operator interactive plotting test

2-23. To perform the Self Test, proceed as follows:

- a. Remove power from the plotter.
- b. Disconnect all interface cables from the plotter and install the jumper cable (HP Part Number 8120-3258) between the two rear panel I/O ports.
- c. Open the plotter.
- d. Apply power to the plotter.
- e. Set the SELF TEST switch S4-2 to the ON position. See Figure 2-5.
- f. Press the RESET switch S5 pushbutton (red).
- g. The Self Test LEDs will flash sequentially as a lamp test.
- h. Press the CONTINUE switch S3 pushbutton (green).
- i. The test will run to the end of the automatic test or to a fault indication. To continue after a fault, press the CONTINUE switch S3 (green). Certain RS-232 errors may not allow the test to continue.
- j. The Self Test LEDs will flash in unison when the automatic tests are complete or indicate the binary number of the failed step if one is found.
- k. To test the optional RAM and the front panel controls, proceed as follows:
 1. Remove all pens from the front panel.
 2. Press the Pen Select pushbutton #8.
 3. If no optional RAM is installed, the Self Test LEDs will indicate 8₂. Press the CONTINUE switch S3 pushbutton (green).
 4. If optional RAM is installed and passes, the Self Test will automatically step to the Front Panel Test.
 5. After either step 3 or 4, all front panel LEDs except DATA SET and STANDBY will be on. The Self Test LEDs will indicate 13₂.
 6. Press the CONTINUE switch S3 (green). All front panel LEDs except ERROR will be off.

7. Press the front panel switches in the order given in Figure 2-6.
 8. As each switch closes, the ERROR LED will go off and the OUT OF LIMIT LED will turn on momentarily. Go to the next switch when the ERROR LED comes on.
 9. Upon completion of the Front Panel test, the Self Test LEDs will flash sequentially.
- i. To perform the Motor Vector Tests, proceed as follows:
 1. Mute the X-motor at S1 on the Main PCA A2, and move the plotter arm to the left side of the platen (nearest pen stall #1). Turn on S1.
 2. Press Pen Select pushbutton #1. The plotter arm and pen holder will begin a diagonal pen up move. All Self Test LEDs will be off.
- An error is indicated by failure of the plotter to make the move.
3. Press and hold Pen Select pushbutton #2 until the arm movement stops. Release the pushbutton, and the plotter will begin the second vector.
 4. Repeat step 3. with Pen Select pushbuttons 3 through 6. Each button initiates a new vector.
- m. Upon completion of the Vector Test, set the SELF TEST switch S4-2 to the OFF position, and press the RESET switch S5 pushbutton (red). The plotter will complete a power-up initialization.
 - n. Turn off the plotter, remove the power cord and the jumper cable, and close the plotter, secure the upper deck locking screws, and replace the rear hood.

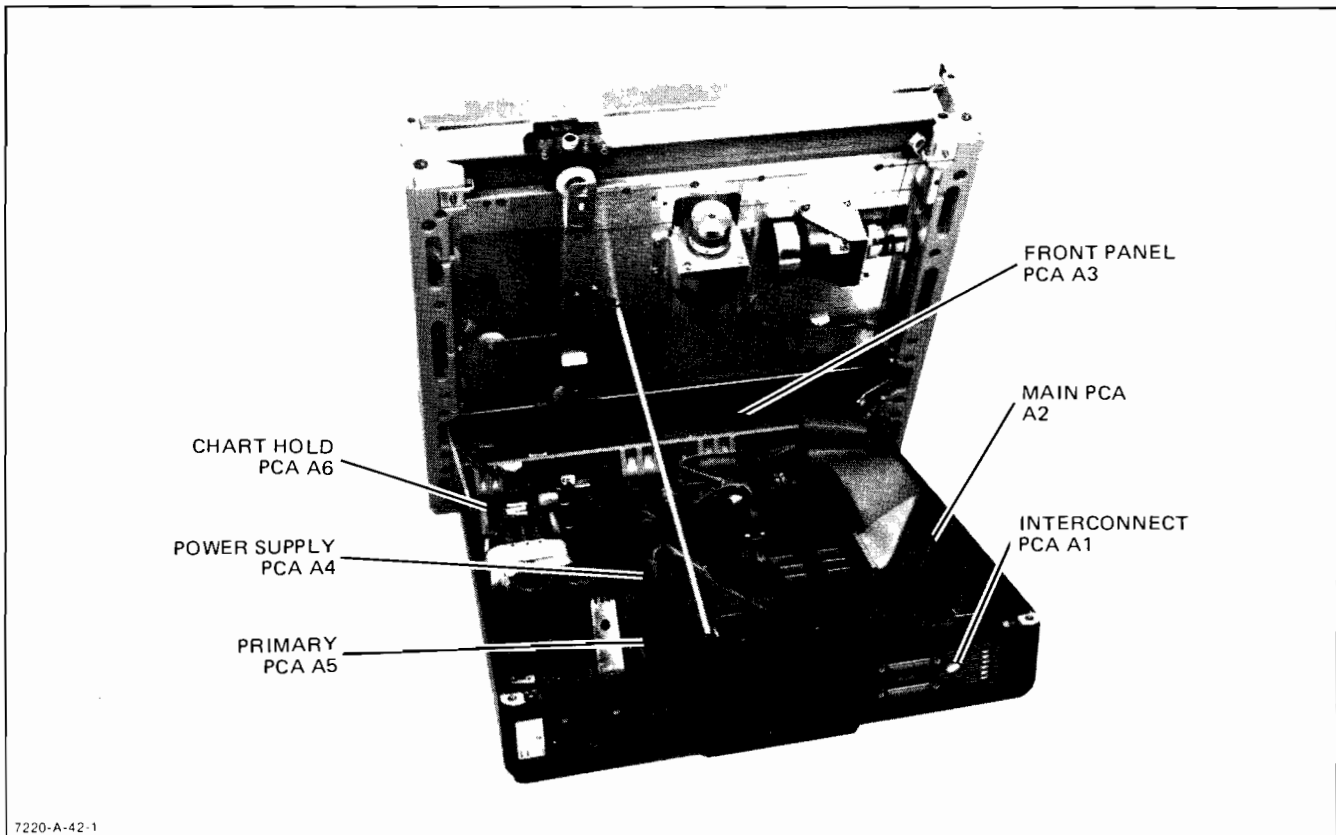


Figure 2-4. PCA Identification

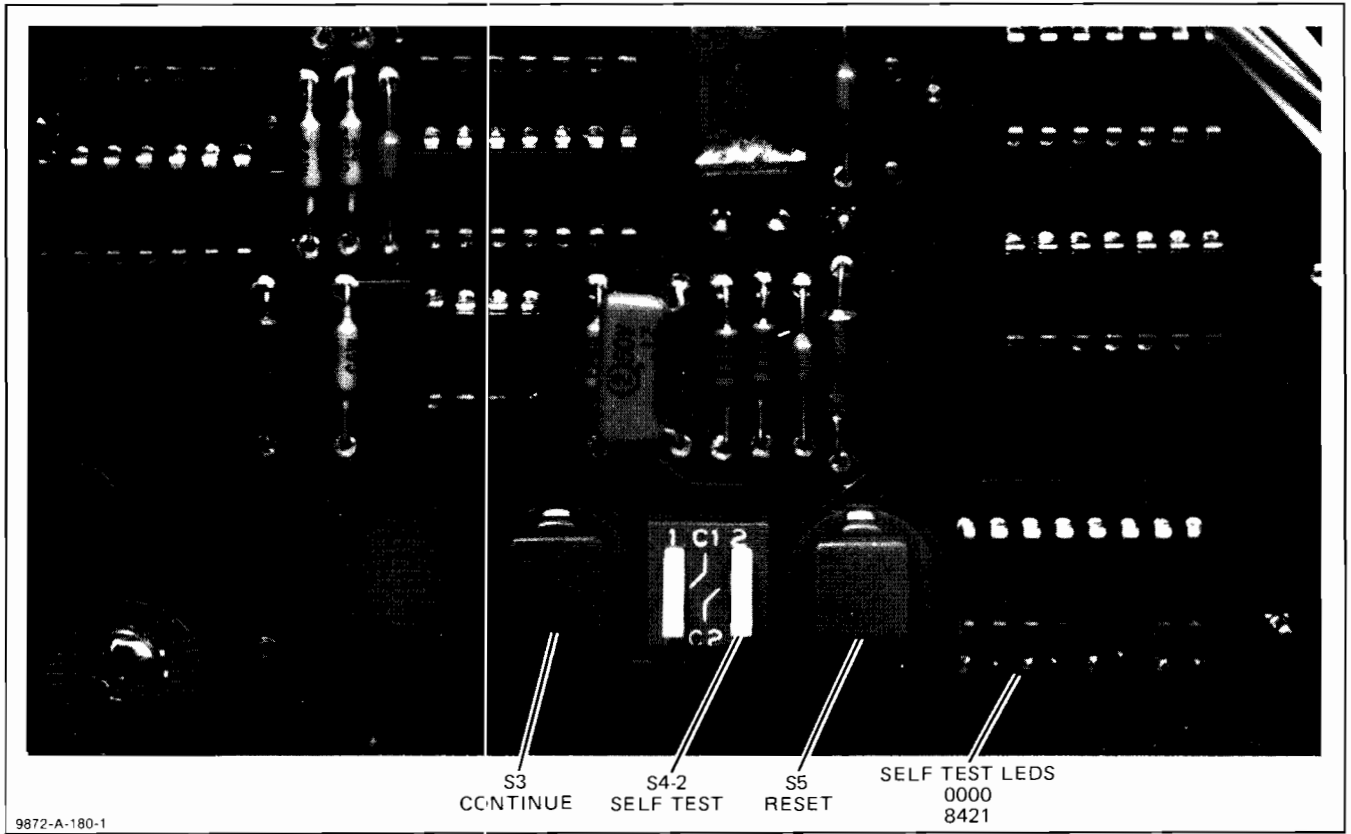


Figure 2-5. Self Test Controls





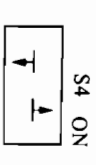
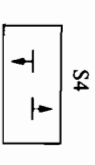
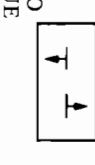
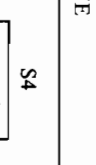
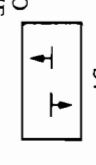
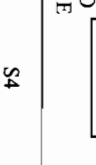
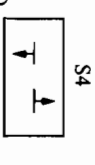


STEP	DESCRIPTION	SWITCH SETTING	SELF TEST LED INDICATION	DETAILS
a (CONT)	A2U214	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	A2U214 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE TEST
	A2U213	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	A2U213 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE TEST
	A2U212	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	A2U212 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE TEST
b	FRONT PANEL INTERACTIVE TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	THE FRONT PANEL LED'S, EXCEPT STBY AND DATA SET, WILL BE ON PRESS CONTINUE (S3) FRONT PANEL ERROR LED IS ON CLOSE EACH FRONT PANEL SWITCH IN THE ORDER INDICATED.
		S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	
c	FRONT PANEL TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	<ol style="list-style-type: none"> 1. CHART LOAD 2. LOWER LEFT (P1) 3. UPPER RIGHT (P2) 4. FAST 5. LEFT 6. RIGHT 7. UP 8. DOWN 9. PEN DOWN 10. PEN UP 11. CHART HOLD 12. ENTER 13. "X" LIMIT 14. "Y" LIMIT 15. SELECT PEN 1 16. SELECT PEN 2 17. SELECT PEN 3 18. SELECT PEN 4 19. SELECT PEN 5 20. SELECT PEN 6 21. SELECT PEN 7 22. SELECT PEN 8 23. PEN IN ARM 24. PEN PRESENT 8 25. PEN PRESENT 7 26. PEN PRESENT 6 27. PEN PRESENT 5 28. PEN PRESENT 4 29. PEN PRESENT 3 30. PEN PRESENT 2 31. PEN PRESENT 1 32. LOCAL 33. LINE 34. STANDBY <p>AS EACH SWITCH IS CLOSED, THE ERROR LED WILL TURN OFF, AND THE OUT OF LIMIT LED WILL TURN ON MOMENTARILY. WHEN THE ERROR LED TURNS ON AGAIN, PRESS THE NEXT SWITCH. AFTER ALL 34 SWITCHES ARE TESTED THE SELF TEST LED'S WILL FLASH SEQUENTIALLY. A SWITCH FAILURE IS INDICATED IF THE OUT OF LIMIT LED DOES NOT TURN ON.</p>
		S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	

7220-A-45-1

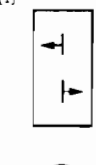
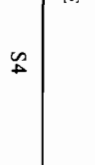
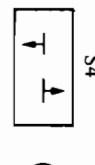

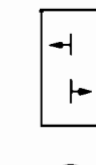
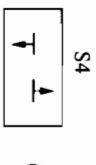
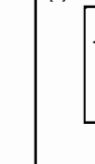

STEP D	DESCRIPTION	SWITCH SETTING	DETAILS
4	MOTOR DRIVER TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	THE FOLLOWING STEPS TEST MOTOR DRIVER PERFORMANCE AND ARE ALSO USED TO PERFORM ALIGNMENTS 1. PRESS CONTINUE (S3)
a	X 3RD HARMONIC	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #1 FOR APPROXIMATELY THREE SECONDS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
b	X GAIN	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #2 UNTIL THE PLOTTER ARM STOPS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
c	X OFFSET	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #3 UNTIL THE PLOTTER ARM STOPS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
d	Y 3RD HARMONIC	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #4 UNTIL THE PLOTTER ARM STOPS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
e	Y GAIN	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #5 UNTIL THE PLOTTER ARM STOPS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
f	Y OFFSET	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. PRESS AND HOLD PEN SELECT PUSHBUTTON #6 UNTIL THE PLOTTER ARM STOPS. RELEASE THE PLOTTER ARM WILL BEGIN A PEN-UP DIAGONAL MOVE. REFER TO SECTION III FOR ADJUSTMENT PROCEDURES
			SELF TEST LED'S ARE OFF. A FAILURE IS INDICATED BY FAILURE OF THE PLOTTER TO MAKE THE REQUIRED MOVE
5	END OF TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/> PRESS	1. SET SELF TEST SWITCH (S4-2) TO OFF AND PRESS RESET (S5). THE PLOTTER WILL INITIALIZE AND BE READY FOR NORMAL OPERATION

7220-A-46-1

Figure 2-6. Self Test

STEP	DESCRIPTION	SWITCH SETTING	DETAILS	
1	LED TEST	S3 <input type="radio"/> S4 ON <input type="checkbox"/> S5 <input type="radio"/>  PRESS	1. INSTALL A SHORTING CABLE BETWEEN THE TWO REAR PANEL CONNECTORS. 2. SET S4-2 TO ON. 3. PRESS RESET (S5) SELF TEST LEDS FLASH SEQUENTIALLY. CHECKS FOR DEFECTIVE LEDS.	
2	AUTOMATIC TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS	1. PRESS CONTINUE (S-3). AN AUTOMATIC TEST OF THE PLOTTER ELECTRONICS IS PERFORMED. THE TEST RUNS TO COMPLETION OR A FAILURE. SELF TEST LED'S WILL INDICATE A FAILURE NUMBER IF ONE IS FOUND, OR FLASH IN UNISON IF THE TEST IS PASSED. REFER TO THE SELF TEST LED INDICATIONS TO ISOLATE A FAILURE. REFER TO STEP 3 IF ALL TESTS ARE PASSED.	
a	ROM 0 LSB A2U56	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	SELF TEST LED INDICATION <input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	ROM 0 LSB A2U56 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
b	ROM 0 MSB A2U55	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	ROM 0 MSB A2U55 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
c	20K ROM LSB A2U209	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	20K ROM LSB A2U209 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
d	20K ROM MSB A2U208	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	20K ROM MSB A2U208 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
e	RAM A2U67	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	RAM A2U67 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
f	RAM A2U66	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	RAM A2U66 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
g	RAM A2U65	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	RAM A2U65 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST

7220-A-43-1

STEP	DESCRIPTION	SWITCH SETTING	SELF TEST LED INDICATION	DETAILS
h	RAM A2U64	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	RAM A2U64 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE THE SELF TEST
i	INTERRUPT TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	INTERRUPT REQUEST LOGIC, INTERRUPT SUBROUTINE, STACK POINTER, OR RETURN FAILED
j	RS-232-C TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	DCE TO DTE TRANSMISSION FAILURE
k	RS-232-C TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	DTE TO DCE TRANSMISSION FAILURE
l	RS-232-C TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	I/O CONTROL FAILURE END OF AUTOMATIC TEST
3	FRONT PANEL AND OPTIONAL RAM TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	1. REMOVE ALL PENS FROM THE PLOTTER 2. SET A2S1 (X MOTOR MUTE) TO OFF AND MOVE THE PLOTTER ARM TO THE LEFT END (NEAREST PEN STALL #1) OF THE PLATEN 3. SET A2S1 TO ON 4. PRESS PEN SELECT PUSHBUTTON IF NO OPTIONAL RAM IS INSTALLED GO TO 3b
a	RAM TEST	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input checked="" type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	IF NO OPTIONAL RAM IS INSTALLED THE FOLLOWING FAILURE INDICATIONS MAY BE SEEN. IF TEST PASSES, LED'S INDICATE 132. GO TO 3c
	A2U215	S3 <input type="radio"/> S4 <input type="checkbox"/> S5 <input type="radio"/>  PRESS TO CONTINUE	<input type="radio"/> 8 <input type="radio"/> 4 <input type="radio"/> 2 <input type="radio"/> 1	A2U215 OR ASSOCIATED CIRCUIT FAILED PRESS S3 TO CONTINUE TEST

NOTE:
CERTAIN RS-232-C FAILURES MAY NOT ALLOW THE SELF TEST TO CONTINUE WHEN S3 IS PRESSED.

7220-A-44-1

STEP	DESCRIPTION
a (CONT)	A2U214
	A2U213
	A2U212
b	FRONT PANEL INTERACTIVE TEST
c	FRONT PANEL TEST

7220-A-45-1

SECTION III

ADJUSTMENTS

3-1. INTRODUCTION

3-2. This section describes electrical and mechanical checks and adjustments required to return the HP Model 7220C or 7221C Plotter to peak operating capabilities when repairs have been made.

3-3. SAFETY CONSIDERATIONS

3-4. This section contains warnings and cautions that must be observed for personal protection and to avoid damage to the equipment.

WARNING

Maintenance described herein is performed with power supplied to the plotter and protective covers removed. Such maintenance should be performed only by service-trained personnel who are aware of the potential hazards involved. Where maintenance can be performed without power applied, the power should be removed.

3-5. ELECTRICAL ADJUSTMENTS

3-6. TEST EQUIPMENT REQUIRED

3-7. The test equipment required to perform the adjustment procedures is listed in Table 1-5, Recommended Test Equipment. If substitute equipment is used, the specifications must meet or exceed the specifications for the recommended equipment. See Figure 3-1 for PCA identification.

3-8. OPENING THE PLOTTER

3-9. For instructions to open the plotter, refer to Section I of this manual.

3-10. X-AXIS MOTOR DRIVER ADJUSTMENTS

3-11. To perform the X-axis adjustments, proceed as follows:

- a. Open the plotter.
- b. Place the SELF TEST switch S4-2 in the ON position. Press RESET S5 and then CONTINUE S3.
- c. Set the Y-MUTE S2 to the OFF position. See Figure 3-2 for switch and adjustment locations.
- d. Press and hold the #1 PEN SELECT pushbutton for approximately 5 seconds. Release.

- e. Adjust the X-3rd harmonic potentiometer R38 for minimum vibration of the pen holder.
- f. Press and hold the #2 PEN SELECT pushbutton until the plotter arm stops. Release.
- g. Adjust the X-gain potentiometer R22 for minimum vibration of the pen holder.
- h. Press and hold the #3 PEN SELECT pushbutton until the plotter arm stops. Release.
- i. Center the X-B Offset potentiometer R40 and adjust the X-A R43 for minimum vibration of the pen holder.
- j. Adjust the X-B Offset potentiometer R40 for minimum vibration of the pen holder.
- k. Return the Y-MUTE switch S2 to the ON position.

3-12. Y-AXIS MOTOR DRIVER ADJUSTMENTS

3-13. To perform the Y-axis motor driver adjustments, proceed as follows:

- a. Open the plotter as outlined in Section I.
- b. Place the SELF TEST switch S4-2 in the ON position. Press RESET S5 and then CONTINUE S3.
- c. Set the X-MUTE switch S1 to the OFF position.
- d. Press and hold the #4 PEN SELECT pushbutton for approximately 5 seconds. Release.
- e. Adjust the Y-3rd harmonic potentiometer R39 for minimum vibration of the pen holder.
- f. Press and hold the #5 PEN SELECT pushbutton until the plotter arm stops. Release.
- g. Adjust the Y-gain potentiometer R27 for minimum vibration of the pen holder.
- h. Press and hold the #6 PEN SELECT pushbutton until the plotter arm stops. Release.
- i. Center the Y-B OFFSET potentiometer R44 and adjust the Y-A R47 for minimum vibration of the pen holder.
- j. Adjust the Y-B OFFSET potentiometer R44 for minimum vibration of the pen holder.
- k. Return the X-MUTE switch S1 to the ON position. Also place the SELF TEST switch S4-2 to the OFF position. Figure 3-3 contains an overview of the electrical adjustment procedures.

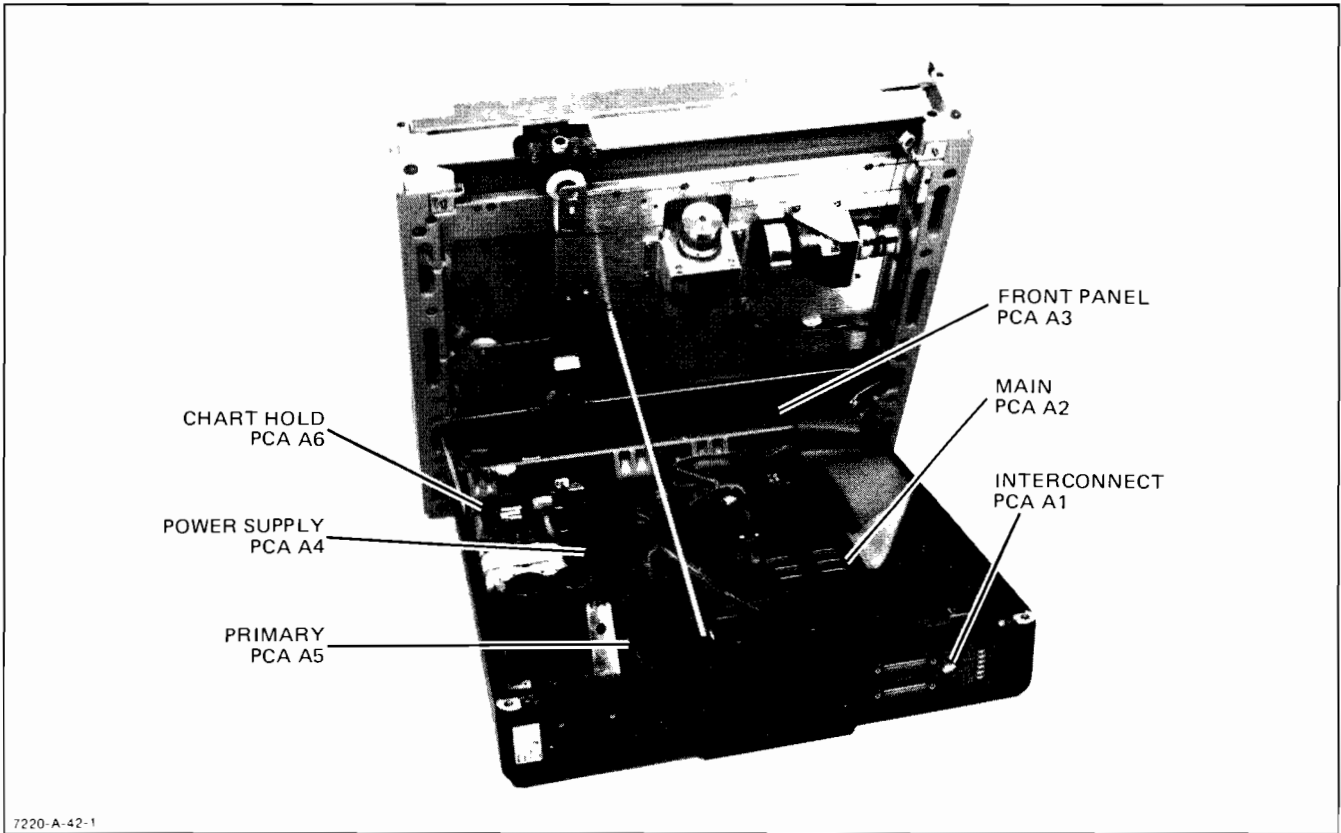


Figure 3-1. PCA Identification

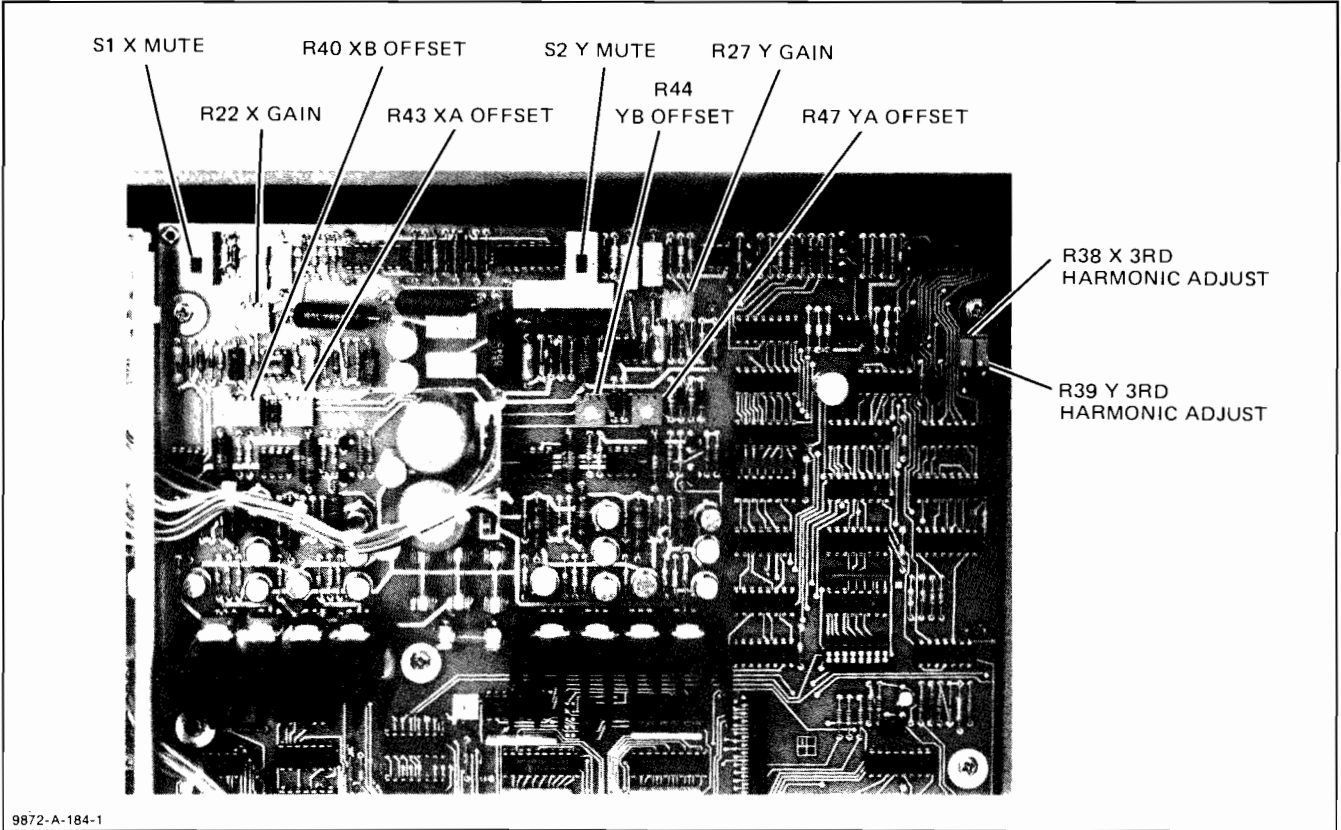


Figure 3-2. Electrical Adjustment Location

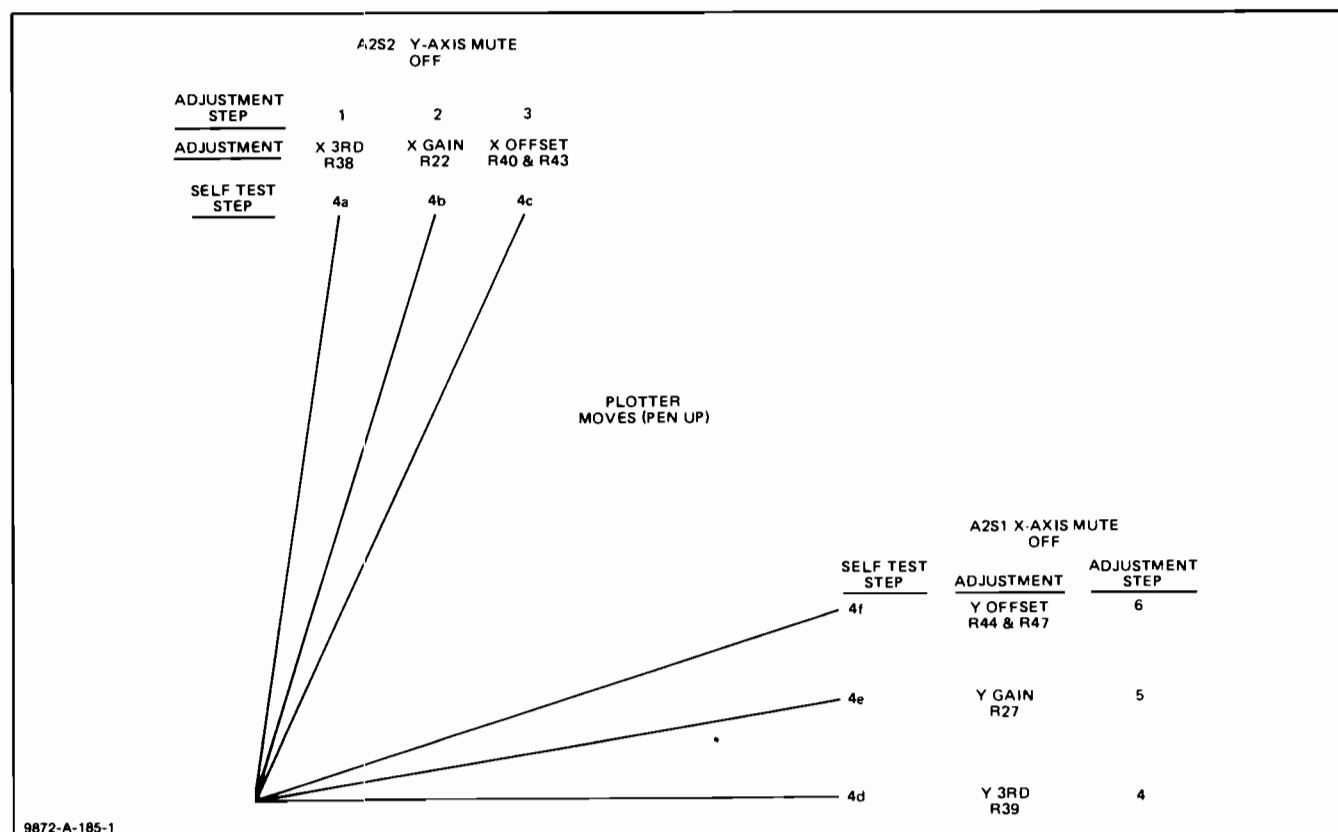


Figure 3-3. Electrical Adjustment Chart

3-14. MECHANICAL ADJUSTMENTS

3-15. PEN SOLENOID TRAVEL ADJUSTMENT

3-16. To adjust the pen solenoid travel, proceed as follows:

- Remove the pen cover with a Pozidrive screwdriver.
- Using a common screwdriver, set the pen solenoid travel adjustment screw to obtain a travel of 3.4 mm (0.133 in.). Refer to Figure 3-4.

3-17. PEN HEIGHT ADJUSTMENT

3-18. To adjust the pen height, proceed as follows:

- Remove the pen cover.
- Install a new pen in the pen holder, and move the holder to the lower left corner of the platen.
- Set the pen height adjustment screw until the pen tip is 2.3 mm (0.09 in.) above the platen. Refer to Figure 3-5 for the adjustment location.
- Check the pen height at the other three corners of the platen.

3-19. PEN FORCE ADJUSTMENT

3-20. To adjust the pen force, proceed as follows:

- Remove the pen cover.
- Load a new pen into the holder, and position the holder at the lower left corner of the platen.

- Using a 0-30 gram gauge, adjust the pen force adjustment screw until a force of 23 ± 3 grams is required to just lift the pen tip from the platen. Refer to Figure 3-5 for the adjustment location.

3-21. PEN LIFT ADJUSTMENT

3-22. The pen lift adjustment is designed to obtain proper deflection of the pen solenoid armature. To adjust the pen lift, proceed as follows:

- Using a 0-60 gram gauge, press down on the solenoid plate near the pen height adjustment screw.
- The plate should start to deflect downward with a pressure of 51 ± 2 grams.
- Adjustment is performed by bending the bottom pen solenoid plate spring tab either up or down to adjust as necessary. Refer to Figure 3-5 for adjustment locations.

3-23. DASHPOT ADJUSTMENT

3-24. The dashpot adjustment can be checked under program control. Sample programs using the HP Model 9825A Desktop Computer are shown in Figure 3-6. To perform the dashpot adjustment, proceed as follows:

- Load the plotter with a sheet of graph paper, and install a new pen in the holder.
- Enter the appropriate program into the 9825A Desktop Computer, and run the program.

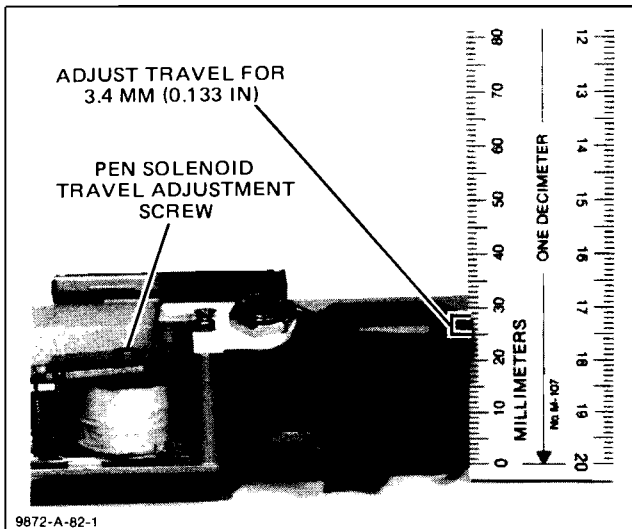


Figure 3-4. Pen Solenoid Travel Adjustment

- c. Adjust the dashpot adjustment screw until the pen is over damped. Refer to Figure 3-6 for an example of over damping.
- d. Turn the dashpot adjustment screw counterclockwise until the correct damping is just reached, and then continue turning the adjustment 1/4 turn counterclockwise. Refer to Figure 3-6.

3-25. X- AND Y-DRIVE CABLE TENSION ADJUSTMENT

3-26. To adjust the drive cable tension, proceed as follows:

- a. Open the plotter.
- b. Move the pen arm to the extreme right edge of the platen, and move the pen carriage to the top of the arm, as viewed from the front of the plotter.
- c. Locate the midpoint between pulleys on the cable.
- d. Using a 0-700 gram gauge, press against the cable at the midpoint until it just touches the rear track edge. Refer to Figures 3-7 and 3-8.
- e. To adjust the X-axis cable tension, rotate the tension adjustment nut to obtain a reading of 325 ± 25 grams on the gauge.
- f. To adjust the Y-axis cable tension, loosen the socket-head cap screw securing the cable tensioner and rotate the tensioner with a 3/8 in. open-end wrench to obtain a reading of 325 ± 25 grams on the gauge. Securely tighten the cap screw in the tensioner.

NOTE

After each adjustment, move the arm and carriage through its range several times and recheck the tension.

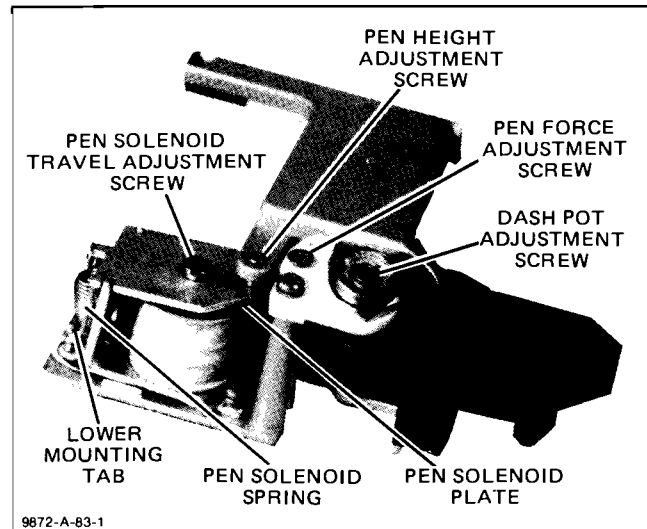


Figure 3-5. Pen Holder Adjustments

3-27. PEN ARM ADJUSTMENT

3-28. To set the plotter arm perpendicular to the X-axis, proceed as follows:

- a. Load the plotter with lined chart paper and a new pen.
- b. Draw one line in the Y-axis on a chart grid line.
- c. Check this drawn line for any offset from the grid line.
- d. Any offset can be corrected by resetting the pen arm adjustment nut. (See Figure 3-7 for the adjustment location.)

3-29. X- AND Y-LIMIT SWITCH ADJUSTMENT

3-30. To adjust the X- and Y-switches, proceed as follows:

- a. Open the plotter.
- b. Move the plotter arm assembly to the extreme right end of its travel, viewed from the front of the plotter (at pen stall #8).
- c. Position the pen claw so that it just touches the right end of the pen capper assembly of stall #8. See Figure 3-9.
- d. Loosen the adjusting screw on the switch bracket, and move the X-limit switch bracket until the switch just closes against the plotter arm assembly. This can be detected either by the sound of the switch closing, or by placing an ohmmeter, HP 427 or equivalent, across the X-limit switch connector and observing the meter for continuity.
- e. Tighten the adjustment screw, and recheck the setting.
- f. The Y-limit switch is adjusted by placing a pen in the holder and moving the holder into the Y-limit switch stall.

7220C	7221C
0: wtc 11,1;wtb 11,64,123,39; wtc 11,0;wti 0, 11;wti 6,1;wtb 11,27,46,40	0: "Setup interf ace":
1: 2000+X	1: wtc 11,1;wtb 11,64,123,39; wtc 11,0;wti 0, 11;wti 6,1
2: wrt 11,"si.5, .8;sp1;pa",X," 10000;"	2: "Setup plote r":
3: dsp "Insert allen, press CONTINUE";stp	3: wtb 11,27,46, 40,126,95,118, 65,126,37,100, 66,64
4: for I=1 to 5	4: "Columns":
5: wtb 11,"lbH", 13,10,3	5: for A=96 to 111
6: wait 2000; next I	6: if A=96;dsp "Insert allen, press CONTINUE"
7: dsp "Press CONTINUE for next column"; stp	7: wtb 11,112,A, 63,60,64
8: X+2000+X;sto 3	8: "Rows":
*24570	9: for B=1 to 5
	10: wtb 11,126, 39,72,13,10,3
	11: wait 2000
	12: next B
	13: dsp "For next column, press CONTINUE" ;stp
	14: next A
	15: end
	*6624

H Detail "A"
Not enough damping. Adjust Dashpot Screw clockwise.

H Detail "B"
Too much damping. Adjust Dash Pot Screw clockwise to obtain this condition, then slowly adjust the Dash Pot Screw counterclockwise to obtain correct damping as shown in Detail "C". Adjust screw an additional ¼ turn counterclockwise.

H Detail "C"
Correct damping adjustment.

Figure 3-6. Pen Damping Adjustments

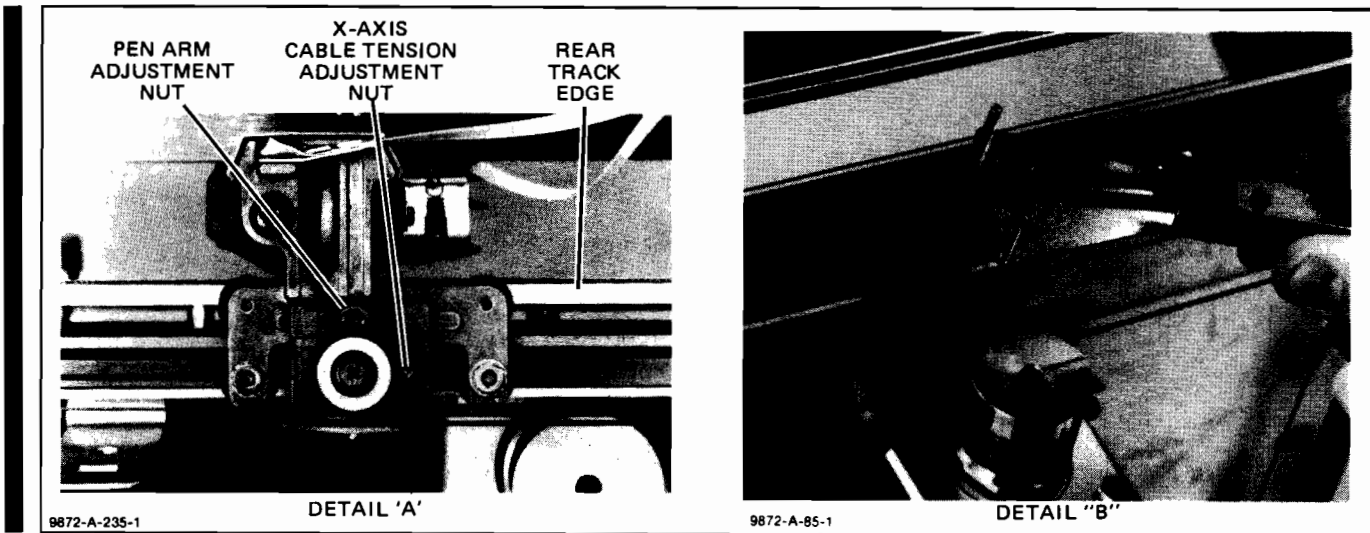


Figure 3-7. X-axis Cable Tension Adjustment

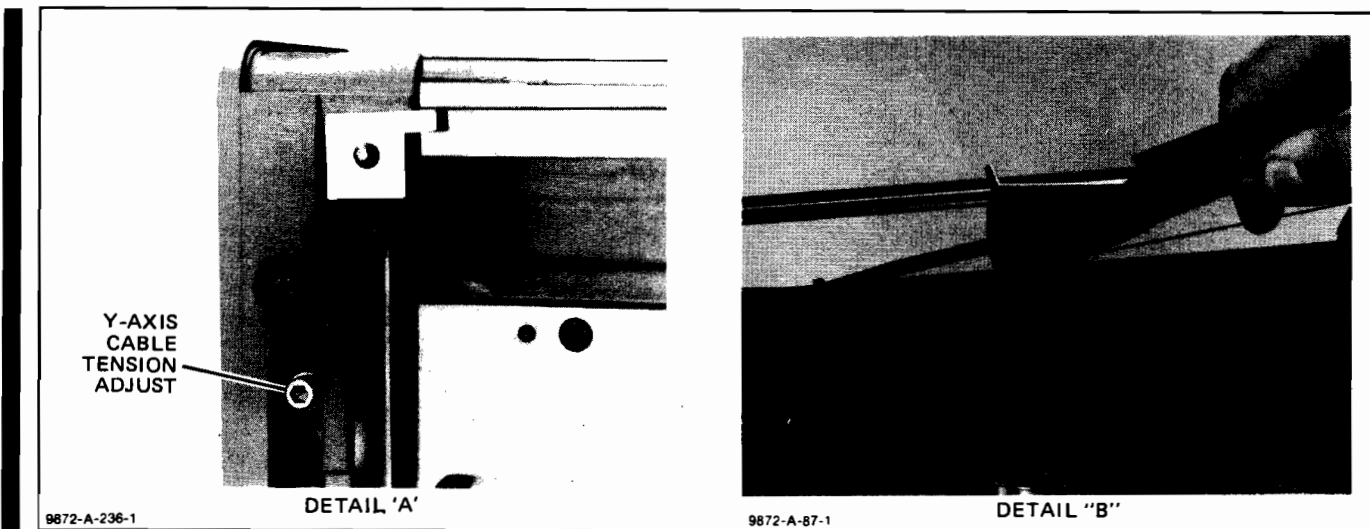


Figure 3-8. Y-axis Cable Tension Adjustment

- g. Listen for the sound of the pen-in-arm switch and then the Y-limit switch. If this sequence is not detected, adjust the Y-limit switch. (Refer to Figure 3-10.)

3-31. NON-HORIZONTAL MOUNTING ADJUSTMENT PROCEDURE

3-32. The plotter may be mounted in a non-horizontal position and function normally with only an adjustment of the pen force to compensate for gravity. To perform this adjustment, proceed as follows:

- Set the LINE switch to the OFF (O) position.
- Remove the pen cover.
- Reset the pen force adjustment screw according to Table 3-1 or compute the adjustment from the following formula:

$$\text{No. of turns CW} = 5.75(1 - \cos \theta)$$

θ = angle from horizontal

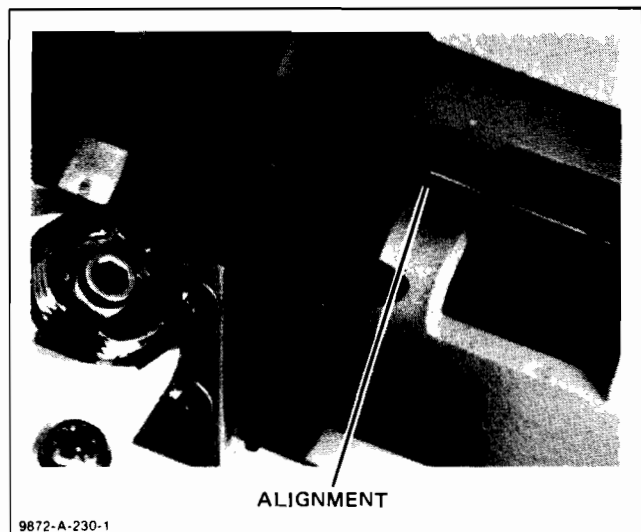


Figure 3-9. Alignment Position for Arm

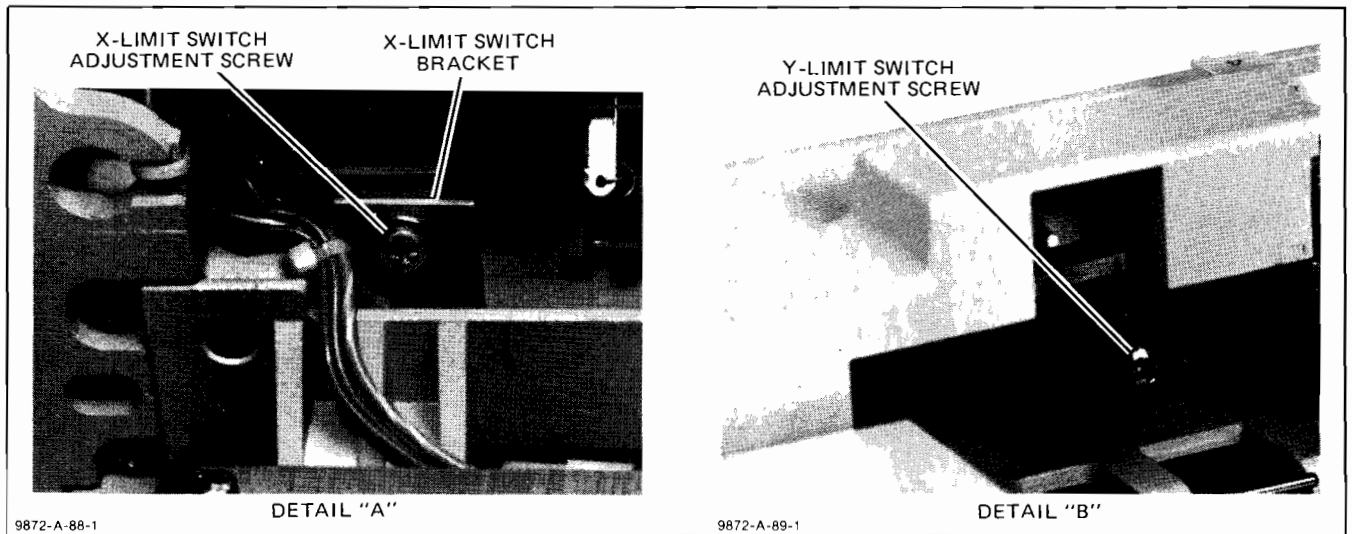


Figure 3-10. Limit Switch Adjustment

- d. To return the plotter to a horizontal position or to a lower angle, reverse the process.

3-33. PEN STABLE PCA SWITCH ADJUSTMENT

3-34. The eight pen stable switches and the pen-in-arm switch located on the Front Panel PCA A3 (see Figure 3-11) must be adjusted for a minimum pretravel and overtravel of 0.5 mm (0.02 in.) (see Figure 3-12). Pretravel is the distance that the plunger travels before the switch is activated, and overtravel is the distance that the plunger travels after the switch has activated. Normally, this adjustment is required only if the Front Panel PCA or an individual switch has been replaced. The procedure is performed before the front panel is replaced on the plotter. To perform this adjustment, proceed as follows:

- a. Loosen the Front Panel PCA mounting screws. See Figure 3-13.
- b. Move the PCA forward until the plungers press against each switch actuating arm just enough to activate the switches.
- c. Tighten the PCA mounting screws.
- d. While supporting the axle end of the actuator arm, place needlenose pliers or an alignment

tool on the switch arm at the notch in the PCA, and bend the arm away from the tip of the plunger to provide a minimum clearance of 0.5 mm (0.02 in.) (see Figure 3-14).

- e. Repeat this process for each switch, and verify the pretravel and overtravel for each switch.
- f. Refer to Section VI for plotter reassembly instructions.

Table 3-1. Pen Force Adjustment

PLATEN INCLINATION	NO. OF TURNS CW OF PEN FORCE ADJUSTMENT SCREW FROM FACTORY SETTING
0-15° (Horiz)	No readjustment necessary
30°	3/4
45°	1-3/4
60°	3
75°	4-1/4
90° (Vert)	5-3/4

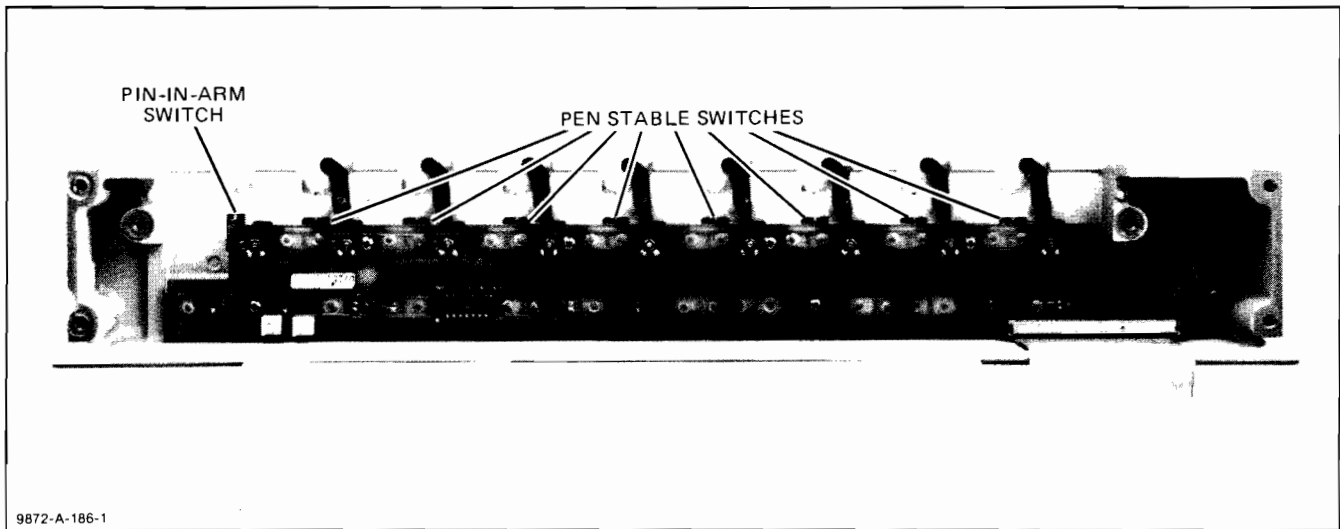


Figure 3-11. Pen Stable Switch Identification

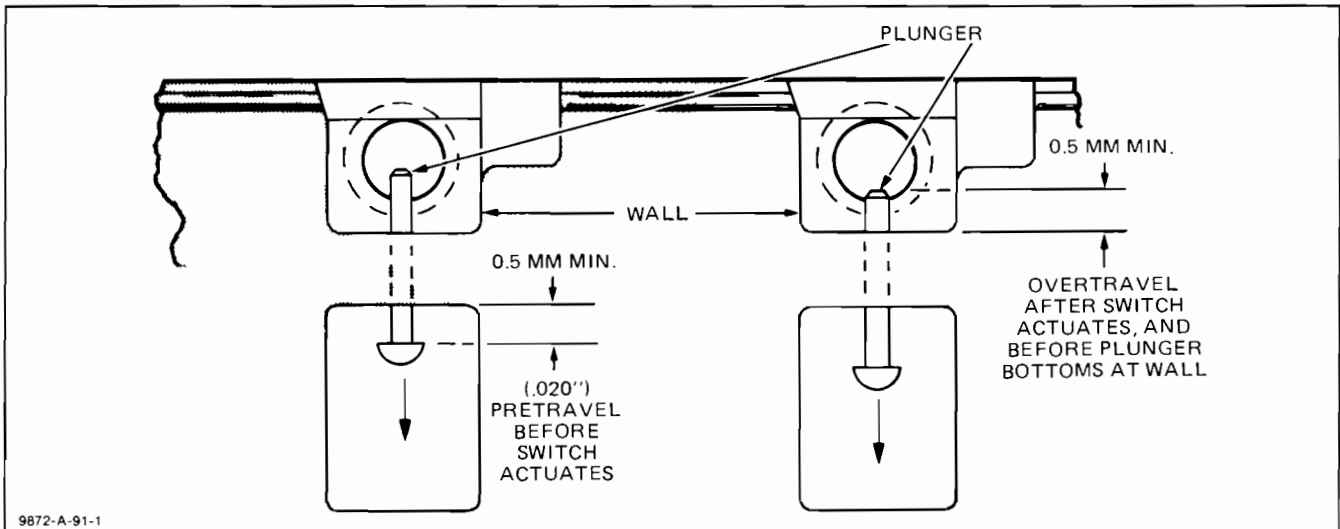


Figure 3-12. Pretravel/Overtravel

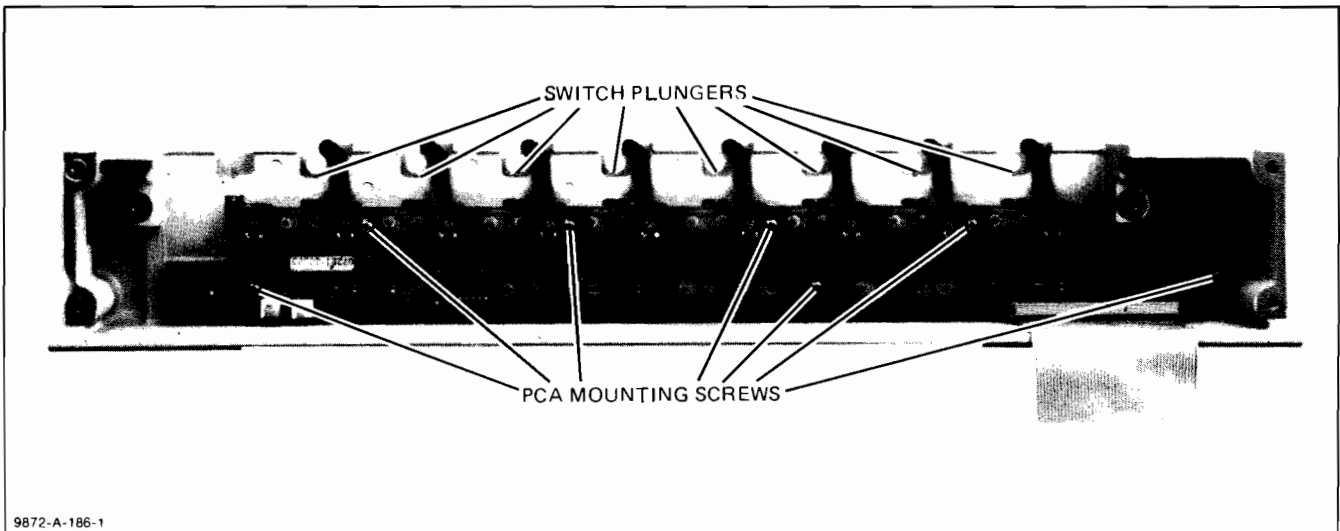


Figure 3-13. Front Panel PCA Adjustment

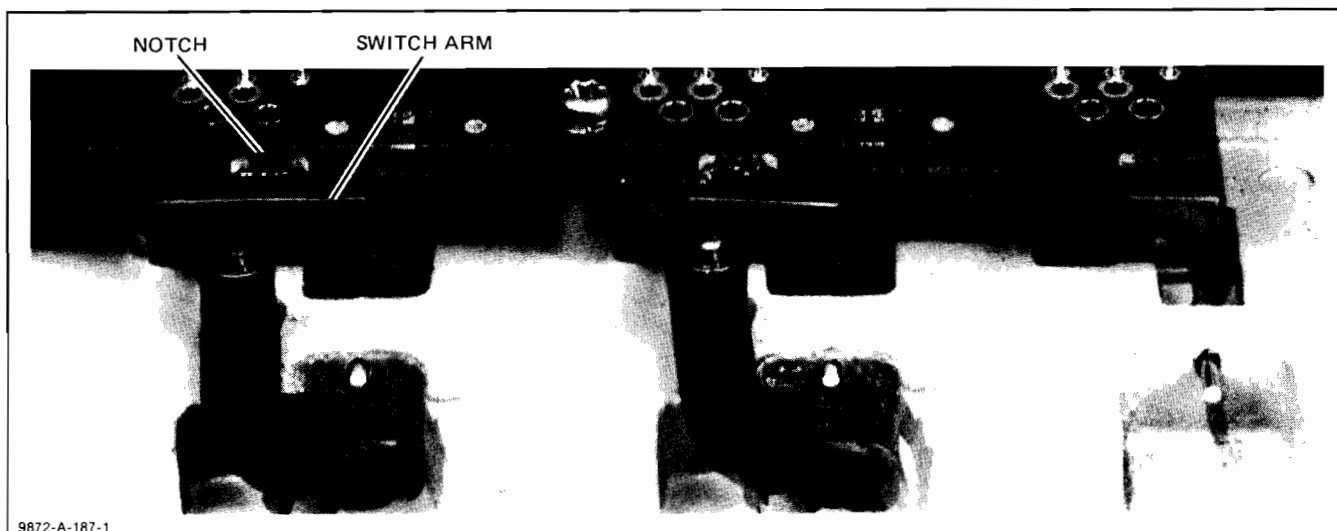


Figure 3-14. Pen Stable Switch Adjustment



SECTION IV

REPLACEABLE PARTS

4-1. INTRODUCTION

4-2. This section contains parts information for the HP Models 7220C and 7221C Graphics Plotters. Included herein are lists of assemblies, replaceable parts, and ordering information.

4-3. EXCHANGE ASSEMBLIES

4-4. Table 4-1 lists assemblies within the plotter that may be replaced on an exchange basis. Exchange, factory repaired and tested, assemblies are available only on a trade-in basis; therefore, the defective assemblies must be returned for credit.

4-5. ACCESSORIES SUPPLIED

4-6. A list of the accessories supplied is found in Table 4-2.

4-7. REPLACEABLE PARTS LIST

4-8. PRINTED CIRCUIT ASSEMBLIES

4-9. Parts located on the printed circuit assemblies (PCAs) are listed in tabular form in Tables 4-3 through 4-8.

4-10. FRAME MOUNTED PARTS

4-11. Parts located on the frame assembly are listed in Tables 4-9 through 4-12 and illustrated in Figures 4-1 through 4-4.

4-12. ORDERING INFORMATION

4-13. To obtain replacement parts or assemblies, address an order or inquiry to the nearest Hewlett-Packard Sales and Service Office. The order should include the part or assembly number, its description and location, the plotter model number and serial number.

4-14. CODE LIST OF MANUFACTURERS

4-15. Table 4-13 lists the five-digit code numbers assigned to the manufacturers of parts in the graphics plotters. These code numbers appear with the parts in Table 4-1 through 4-12 as an aid for ordering parts directly from the manufacturer.

4-16. ABBREVIATIONS AND REFERENCE DESIGNATIONS

4-17. Table 4-14 lists abbreviations and reference designations used through the manual. Abbreviations in the parts list are always all capital letters. In other parts of the manual both upper- and lowercase letter abbreviations are used.

4-18. CHECK DIGITS

4-19. When ordering parts through the HP Corporate Parts Center on the HEART system, a check digit is required. This number has been added to prevent any digits in the part number from being transposed, resulting in an incorrect order.

4-20. If the check digit is not included on the parts list, it may be calculated in the following manner (refer to Table 4-15):

- a. Copy the part number into column 1 of the table exactly as it appears in the parts list.
- b. Refer to the table of values, and enter the assigned value for each character into column 2. Values must also be assigned for blank spaces.
- c. Multiply each number in column 2 by the factor assigned. Enter the product of each in column 3.
- d. Total column 3. The check digit is the sum of the "ones" column.

Table 4-1. Exchange Assemblies

	HP PART NUMBER	C/D
Main PCA (rebuilt)		
7220	07220-66520	3
7221	07221-66520	4
Power Supply Assembly (rebuilt)	09872-66508	9
Power supply assembly does not include the power transformer, plastic safety cover, or grounding spring.		
Front Panel Assembly (rebuilt)	07220-66540	8

Table 4-2. Accessories Supplied

ITEM	HP PART NUMBER	C/D
Disposable Pens		
1 pack (5 black — 0.3 mm line width)	5060-6787	5
1 pack (5 black — 0.7 mm line width)	5060-6890	1
1 pack (1 each black, blue, red, green — 0.3 mm line width)	5060-6810	5
1 pack (1 each black, blue, red, green — 0.7 mm line width)	5060-6858	1
1 pack (1 each gold, burnt orange, brown, lime green, turquoise, violet — 0.3 mm line width)	5060-6894	5
1 pack (1 each gold, burnt orange, brown, lime green, turquoise, violet — 0.7 mm line width)	5060-6895	6
Digitizing Sight	09872-60066	2
Chart Paper		
300 sheets blank, 8.5 × 11 in.	9280-0517	7
(STD only) 300 sheets blank, 11 × 16.5 in.	9280-0518	8
(METRIC only) 300 sheets blank, A4 (210 × 297 mm)	9280-0519	9
Male-to-male Interface Cable	8120-3258	0
Operating and Programming Manual (1 only)		
7220C	07220-90003	8
7221C	07221-90024	4
Pocket Guide — 7220	07220-90005	0
Computer Supplies Catalog	5953-2450	4
Power Cord	as ordered	
Dust Cover	9222-0742	8

Table 4-3. Interconnect PCA A1 Parts List

Reference Designation	HP Part Number	C/D	Qty	Description	Mfr Code	Mfr Part Number
A1	07221-60506	4	1	INTERCONNECT, PCA	28400	07221-60506
A1J1	1251-4946	5	2	CONNECTOR 25-PIN F D SURMIN	28400	1251-4946
A1J2	1251-4946	5		CONNECTOR 25-PIN F D SURMTN	28400	1251-4946
A1J3	1251-6879	7	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	28400	1251-6879
A1S1	3101-2482	5	2	SWITCH-3 SPDT	28400	3101-2482
A1S2	3101-2482	5		SWITCH-3 SPDT	28400	3101-2482
A1S3	3100-3446	1	1	SWITCH-ROTARY 8 POS BCO; .75 IN DIA	28400	3100-3446

Table 4-4. Main PCA A2 Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2	07220-60520	1	1	MAIN - PCA (7220C)	28480	07220-60520
A2	07221-60520	2	1	MAIN - PCA (7221C)	28480	07221-60520
A2C1	0160-0164	7	4	CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A2C2	0160-0164	7		CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A2C3	0160-3847	9	46	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C4	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C5	0160-0153	4	8	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C6	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C7	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C8	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C9	0160-0164	7		CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A2C10	0160-0164	7		CAPACITOR-FXD .039UF +-10% 200VDC POLYE	28480	0160-0164
A2C11	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C12	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C13	0160-2150	5	2	CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A2C14	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C15	0160-2150	5		CAPACITOR-FXD 33PF +-5% 300VDC MICA	28480	0160-2150
A2C16	0160-0157	8	4	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A2C17	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C18	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C19	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C20	0160-0157	8		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A2C21	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C22	0180-2866	2	8	CAPACITOR-FXD 220UF+100-10% 50VDC AL	28480	0180-2866
A2C23	0180-2866	2		CAPACITOR-FXD 220UF+100-10% 50VDC AL	28480	0180-2866
A2C24	0160-0157	8		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A2C25	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C26	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C27	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C28	0160-0157	8		CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A2C29	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A2C30	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C31	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C32	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C33	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C34	0180-3533	0	1	CAPACITOR-FXD 470PF +-5% 300VDC MICA	28480	0180-3533
A2C35	0180-2866	2		CAPACITOR-FXD 220UF+100-10% 50VDC AL	28480	0180-2866
A2C36	0160-0199	6	1	CAPACITOR-FXD 220PF +-5% 300VDC MICA	72136	DM15F241J0300WV1CR
A2C37	0160-0194	3	4	CAPACITOR-FXD .0150UF +-10% 200VDC POLYE	28480	0160-0194
A2C38	0160-0194	3		CAPACITOR-FXD .0150UF +-10% 200VDC POLYE	28480	0160-0194
A2C39	0180-2866	2		CAPACITOR-FXD 220UF+100-10% 50VDC AL	28480	0180-2866
A2C40	0180-2675	1	2	CAPACITOR-FXD 330UF+75-10% 50VDC AL	00853	301HF331U050B
A2C41	0160-0194	3		CAPACITOR-FXD .0150UF +-10% 200VDC POLYE	28480	0160-0194
A2C42	0160-0194	3		CAPACITOR-FXD .0150UF +-10% 200VDC POLYE	28480	0160-0194
A2C43	0160-2204	0	7	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A2C44	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C45	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C46	0160-2204	0		CAPACITOR-FXD 100PF +-5% 300VDC MICA	28480	0160-2204
A2C47	0180-2866	2		CAPACITOR-FXD 220UF+100-10% 50VDC AL	28480	0180-2866
A2C48	0180-2675	1		CAPACITOR-FXD 330UF+75-10% 50VDC AL	00853	301HE331U050B
A2C49	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C50	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C51	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C52	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C53	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C54	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C55	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C56	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C57	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C58	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C59	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C60	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C61	0160-0127	2	2	CAPACITOR-FXD 100F +-20% 25VDC CER	28480	0160-0127
A2C62	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C63	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C64	0160-0127	2		CAPACITOR-FXD 100F +-20% 25VDC CER	28480	0160-0127
A2C65	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C66	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C67	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C68	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C69	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C70	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2C71	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C72	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C73	0150-0121	5		CAPACITOR-FXD .1UF +80-20% 50VDC CER	28480	0150-0121
A2C74	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C75	0180-0291	3		2	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289
A2C76	0180-2866	2	9	CAPACITOR-FXD 22UF+100-10% 50VDC AL	28480	0180-2866
A2C77	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C78	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C79	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C80	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C81	0180-2866	2	9	CAPACITOR-FXD 22UF+100-10% 50VDC AL	28480	0180-2866
A2C82	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C83	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C84	0180-2866	2		CAPACITOR-FXD 22UF+100-10% 50VDC AL	28480	0180-2866
A2C85	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C86	0160-3847	9	12	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A2C201	0180-0291	3		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A2C202	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C203	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C204	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C205	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C206	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C207	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C208	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C209	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C210	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C211	0160-4574	1		CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574
A2C212	0160-4574	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574	
A2C213	0160-4574	1	CAPACITOR-FXD 1000PF +-10% 100VDC CER	28480	0160-4574	
A2CR1	1901-0050	3	15	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR2	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR3	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR4	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR5	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR6	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR7	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR8	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR9	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR10	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A2CR11	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050	
A2CR12	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050	
A2CR13	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050	
A2CR201	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050	
A2CR202	1901-0050	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050	
A2DS1	1990-0486	6	4	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A2DS2	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A2DS3	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A2DS4	1990-0486	6		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4684
A2E1	0340-1005	9	8	INSULATOR-XSTR	28480	0340-1005
A2E2	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E3	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E4	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E5	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E6	0340-1005	9	8	INSULATOR-XSTR	28480	0340-1005
A2E7	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E8	0340-1005	9		INSULATOR-XSTR	28480	0340-1005
A2E9	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E10	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E11	2110-0597	7	7	FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E12	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E13	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E14	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E15	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E16	2110-0597	7	2	FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A2E17	09872-20481	1		HEAT SINK	28480	09872-20481
A2E18	09872-20481	1		HEAT SINK	28480	09872-20481
A2F1	2110-0495	4	4	FUSE 1.6A 250V IEC	28480	2110-0495
A2F2	2110-0495	4		FUSE 1.6A 250V IEC	28480	2110-0495
A2F3	2110-0495	4		FUSE 1.6A 250V IEC	28480	2110-0495
A2F4	2110-0495	4		FUSE 1.6A 250V IEC	28480	2110-0495
A2H1	0624-0341	6	8	SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A2H2	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A2H3	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A2H4	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A2H5	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION

E
—
E

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2H6	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H7	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H8	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H9	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H10	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H11	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2H12	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDG-HD-PHL	00000	ORDER BY DESCRIPTION
A2J1	1251-3195	4	2	CONNECTOR 4-PIN M POST TYPE	28480	1251-3195
A2J2	1251-3196	5	1	CONNECTOR 8-PIN M POST TYPE	28480	1251-3196
A2J3	1251-3195	4		CONNECTOR 4-PIN M POST TYPE	28480	1251-3195
A2J4	1251-3475	3	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-3475
A2J5	1251-3618	6	1	CONNECTOR 2-PIN M POST TYPE	28480	1251-3618
A2J6	1251-4904	5	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-4904
A2J7	1251-5722	7	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5722
A2J8	1251-3981	6	1	CONNECTOR 9-PIN M POST TYPE	28480	1251-3981
A2K201	0480-1307	1	2	RELAY-6PDT	28480	0480-1307
A2K202	0480-1307	1		RELAY-6PDT	28480	0480-1307
A2P1	1251-4787	2	1	SHUNT-DIP 8-POSITION	28480	1251-4787
A2Q1	1853-0264	8	5	TRANSISTOR PNP SI PD=310MW FT=100MHZ	04713	2N5401
A2Q2	1854-0215	1	7	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q3	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q4	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q5	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q6	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q7	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q8	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A2Q9	1853-0012	4	4	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A2Q10	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A2Q11	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A2Q12	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A2Q13	1854-0022	8	4	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A2Q14	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A2Q15	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A2Q16	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A2Q17	1854-0637	1	4	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A2Q18	1853-0264	8		TRANSISTOR PNP SI PD=310MW FT=100MHZ	04713	2N5401
A2Q19	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A2Q20	1853-0264	8		TRANSISTOR PNP SI PD=310MW FT=100MHZ	04713	2N5401
A2Q21	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A2Q22	1853-0264	8		TRANSISTOR PNP SI PD=310MW FT=100MHZ	04713	2N5401
A2Q23	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A2Q24	1853-0264	8		TRANSISTOR PNP SI PD=310MW FT=100MHZ	04713	2N5401
A2Q25	1855-0461	1	8	FET-POWER	28480	1855-0461
A2Q26	1855-0461	1		FET-POWER	28480	1855-0461
A2Q27	1855-0461	1		FET-POWER	28480	1855-0461
A2Q28	1855-0461	1		FET-POWER	28480	1855-0461
A2Q29	1855-0461	1		FET-POWER	28480	1855-0461
A2Q30	1855-0461	1		FET-POWER	28480	1855-0461
A2Q31	1855-0461	1		FET-POWER	28480	1855-0461
A2Q32	1855-0461	1		FET-POWER	28480	1855-0461
A2Q201	1855-0421	3	1	TRANSISTOR J-FET 2N5114 P-CHAN D-MODE	17856	2N5114
A2Q202	1854-0087	5	2	TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A2Q203	1854-0087	5		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A2R1	0698-8781	9	2	RESISTOR 5.36K .1% .125W F TC=0+-25	28480	0698-8781
A2R2	0698-8799	9	4	RESISTOR 21.5K .1% .125W F TC=0+-25	28480	0698-8799
A2R3	0698-8799	9		RESISTOR 21.5K .1% .125W F TC=0+-25	28480	0698-8799
A2R4	0699-0754	2	3	RESISTOR 4.99K .1% .125W F TC=0+-25	28480	0699-0754
A2R5	0698-8754	6	4	RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A2R6	0698-8754	6		RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A2R7	0698-8754	6		RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A2R8	0698-8754	6		RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A2R9	0698-8799	9		RESISTOR 21.5K .1% .125W F TC=0+-25	28480	0698-8799
A2R10	0698-8781	9		RESISTOR 5.36K .1% .125W F TC=0+-25	28480	0698-8781
A2R11	0698-8799	9		RESISTOR 21.5K .1% .125W F TC=0+-25	28480	0698-8799
A2R12	0699-0754	2		RESISTOR 4.99K .1% .125W F TC=0+-25	28480	0699-0754
A2R13	0699-0754	2		RESISTOR 4.99K .1% .125W F TC=0+-25	28480	0699-0754
A2R14	0757-0280	3	11	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R15	0699-0753	1	1	RESISTOR 2.74K .1% .125W F TC=0+-25	28480	0699-0753
A2R16	0699-0752	0	1	RESISTOR 1.78K .1% .125W F TC=0+-25	28480	0699-0752
A2R17	0698-8638	5	2	RESISTOR 3.16K .1% .125W F TC=0+-25	28480	0698-8638
A2R18	0698-8638	5		RESISTOR 3.16K .1% .125W F TC=0+-25	28480	0698-8638
A2R19	0698-3445	2	1	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A2R20	0698-3446	3	4	RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R21	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A2R22	2100-3211	7	2	RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	28480	2100-3211
A2R23	0811-0040	9	4	RESISTOR 1 1% 5W PW TC=0+-50	28480	0811-0040
A2R24	0811-0040	9		RESISTOR 1 1% 5W PW TC=0+-50	28480	0811-0040
A2R25	0811-0040	9		RESISTOR 1 1% 5W PW TC=0+-50	28480	0811-0040
A2R26	0811-0040	9		RESISTOR 1 1% 5W PW TC=0+-50	28480	0811-0040
A2R28	0698-3154	0	4	RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A2R29	0757-0461	2	4	RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A2R30	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A2R31	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A2R32	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A2R33	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A2R34	0698-3154	0		RESISTOR 4.22K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4221-F
A2R35	0757-0461	2		RESISTOR 68.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6812-F
A2R36	0699-0756	4	7	RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R37	0757-0442	9	4	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R38	2100-3089	7	2	RESISTOR-TRMR 5K 10% C TOP-ADJ 17-TRN	32997	3292W-1-502
A2R39	2100-3089	7		RESISTOR-TRMR 5K 10% C TOP-ADJ 17-TRN	32997	3292W-1-502
A2R40	2100-0558	9	4	RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A2R41	0698-3457	6	4	RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R42	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R43	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A2R44	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A2R45	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R46	0698-3457	6		RESISTOR 316K 1% .125W F TC=0+-100	28480	0698-3457
A2R47	2100-0558	9		RESISTOR-TRMR 20K 10% C TOP-ADJ 1-TRN	28480	2100-0558
A2R48	0757-0418	9	2	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A2R49	0757-0418	9		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A2R50	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A2R51	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R52	0698-3151	7	4	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A2R53	0699-0755	3	12	RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R54	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A2R55	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R56	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R57	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R58	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A2R59	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R60	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A2R61	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R62	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R63	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R64	0698-3403	2	8	RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R65	0757-0444	1	4	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A2R66	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R67	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R68	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A2R69	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R70	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R71	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A2R72	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R73	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R73	2100-3211	7		RESISTOR-TRMR 1K 10% C TOP-ADJ 1-TRN	28480	2100-3211
A2R74	0757-0444	1		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A2R75	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A2R76	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R77	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R78	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R79	0699-0757	5	4	RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A2R80	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R81	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R82	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A2R83	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R84	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R85	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A2R86	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R87	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R88	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A2R89	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A2R90	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A2R91	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A2R92	0757-0401	9	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R93	0698-0084	0	7	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R94	0757-0401	0		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A2R95	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2R96	0698-3446	3		RESISTOR 383 1% .125W F TC=0+-100	24546	C4-1/8-T0-383R-F
A2R97	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R98	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R99	0757-0419	0	1	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A2R100	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R101	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R102	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R103	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R104	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A2R105	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R106	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R201	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R202	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R203	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R204	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R205	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R206	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A2R207	0698-7332	4	1	RESISTOR 1M 1% .125W F TC=0+-100	28480	0698-7332
A2R208	0698-3132	4	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A2R209	0757-0438	3	1	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A2R210	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R211	0698-0084	9		RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A2R212	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A2R213	0683-1565	2	1	RESISTOR 15M 5% .25W FC TC=-900/+1200	01121	CB1565
A2RN1	1810-0231	9	2	NETWORK-RES 8-SIP2.2K OHM X 7	01121	208A222
A2RN2	1810-0231	9		NETWORK-RES 8-SIP2.2K OHM X 7	01121	208A222
A2RN3	1810-0376	3	10	NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN4	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN5	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN6	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN7	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN8	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN9	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN10	1810-0269	3	2	NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A2RN11	1810-0269	3		NETWORK-RES 9-SIP10.0K OHM X 8	28480	1810-0269
A2RN12	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN13	1810-0203	5	1	NETWORK-RES 8-SIP470.0 OHM X 7	01121	208A471
A2RN201	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2RN202	1810-0376	3		NETWORK-RES 9-SIP2.2K OHM X 8	28480	1810-0376
A2S1	3101-0860	9	2	SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-0860
A2S2	3101-0860	9		SWITCH-SL DPDT MINTR .5A 125VAC/DC PC	28480	3101-0860
A2S3	3101-2483	6	1	SWITCH-SPST, GREEN	28480	3101-2483
A2S4	3101-2283	4	1	SWITCH-TOGGLE SPDT	28480	3101-2283
A2S5	3101-2439	2	1	SWITCH-PB SPST-NQ MOM RED-BTN	28480	3101-2439
A2TP1-A2TP40	1251-0600	0	40	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A2U1	1826-0410	9	1	IC OP AMP LOW-BIAS-H-IMPD QUAD 14-DIP-P	01295	TL084CN
A2U2	1826-0416	5	2	IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A2U3	1826-0207	2	1	IC OP AMP WB 8-DIP-P PKG	27014	LM318N
A2U4	1826-0416	5		IC SWITCH ANLG QUAD 16-DIP-C PKG	27014	LF13331D
A2U5	1826-0139	9	2	IC OP AMP GP DUAL 8-DIP-P PKG	0192B	CA1458G
A2U6	1826-0139	9		IC OP AMP GP DUAL 8-DIP-P PKG	0192B	CA1458G
A2U7	1826-0550	8	1	IC CONV 8-B-D/A 16-DIP-P PKG	07263	UA0801EPC
A2U8	1826-0794	2	1	IC OP AMP LOW-BIAS-H-IMPD DUAL 8-DIP-P	0192B	CA3240E
A2U9	1816-0989	6	1	IC-82S131B LSB	18324	N82S131N PROGRAMMED
A2U10	1820-1425	6	1	IC SCHMITT-TRIG TTL LS NAND QUAD 2-INP	01295	SN74LS132N
A2U11	1820-0477	6	4	IC OP AMP GP 8-DIP-P PKG	0003J	UPC301AC
A2U12	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	0003J	UPC301AC
A2U13	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	0003J	UPC301AC
A2U14	1820-0477	6		IC OP AMP GP 8-DIP-P PKG	0003J	UPC301AC
A2U15	1816-0990	9	1	IC-82S131B MSB	18324	N82S131N PROGRAMMED
A2U16	1820-1436	9	3	IC TTL LS 16-BIT RAM STAT 45-NS 0-C	01295	SN74LS170N
A2U17	1820-1144	6	1	IC GATE TTL LS NOR QUAD 2-INP	01295	SN74LS02N
A2U18	1820-1444	9	1	IC MUXR/DATA-SEL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS298N
A2U19	1820-1436	9		IC TTL LS 16-BIT RAM STAT 45-NS 0-C	01295	SN74LS170N
A2U20	1816-0988	5	1	IC-82S123B	01295	T8P18S030N PROGRAMMED
A2U21	1820-1201	6	2	IC GATE TTL LS AND QUAD 2-INP	01295	SN74LS08N
A2U22	1820-1430	3	2	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A2U23	1820-1430	3		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	01295	SN74LS161AN
A2U24	1820-1441	6	1	IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS283N
A2U25	1820-1436	9		IC TTL LS 16-BIT RAM STAT 45-NS 0-C	01295	SN74LS170N
A2U26	1820-1470	1	1	IC MUXR/DATA-SFL TTL LS 2-TO-1-LINE QUAD	01295	SN74LS157N
A2U27	1820-1112	8	4	IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2U28	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2U29	1820-1195	7	1	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS175N
A2U30	1820-1917	1	4	IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2U31	1820-1201	6		IC GATE TTL LS AND QUAD 2-INP	01295	SN741S08N
A2U32	1820-1202	7	3	IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A2U33	1820-1216	3	2	IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A2U34	1820-2024	3	3	IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A2U35	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A2U36	1820-1204	9	1	IC GATE TTL LS NAND DUAL 4-INP	01295	SN74LS20N
A2U37	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A2U38	1820-1216	3		IC DCDR TTL LS 3-TO-8-LINE 3-INP	01295	SN74LS138N
A2U39	1820-2024	3		IC DRVR TTL LS LINE DRVR OCTL	01295	SN74LS244N
A2U40	1820-1196	8	3	IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A2U41	1820-1202	7		IC GATE TTL LS NAND TPL 3-INP	01295	SN74LS10N
A2U42	1820-1199	1	5	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2U43	1820-1641	8	3	IC DRVR TTL LS BUS DRVR HEX 1-INP	01295	SN74LS365AN
A2U44	1820-1641	8		IC DRVR TTL LS BUS DRVR HEX 1-INP	01295	SN74LS365AN
A2U45	1820-1641	8		IC DRVR TTL LS BUS DRVR HEX 1-INP	01295	SN74LS365AN
A2U46	1820-2075	4	2	IC MISC TTL LS	01295	SN74LS245N
A2U47	1820-2075	4		IC MISC TTL LS	01295	SN74LS245N
A2U48	1820-1199	1		IC INV TTL LS HFX 1-INP	01295	SN74LS04N
A2U49	1820-2206	3	2	IC MISC TTL LS	01295	SN74LS640N
A2U50	1820-2206	3		IC MISC TTL LS	01295	SN74LS640N
A2U51	1820-1197	9	4	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U52	1820-2102	8	2	IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A2U53	1820-2102	8		IC LCH TTL LS D-TYPE OCTL	01295	SN74LS373N
A2U54	1820-1991	1	1	IC CNTR TTL LS DECD DUAL 4-BIT	01295	SN74LS390N
A2U55	1818-1746	9	1	ROM 0 MSB (7220A ONLY)	28480	1818-1746
A2U55	1818-1744	7	1	ROM 0 MSB (7221A ONLY)	28480	1818-1744
A2U56	1818-1745	8	1	ROM 0 LSB (7220A ONLY)	28480	1818-1745
A2U56	1818-1743	6	1	ROM 0 LSB (7221A ONLY)	28480	1818-1743
A2U57	1820-1282	3	1	IC FF TTL LS J-K BAR POS-EDGE-TRIG	01295	SN74LS109AN
A2U58	1818-2500	5	1	IC NMOS	28480	1818-2500
A2U59	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2U60	1820-1112	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A2U61	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2U62	1820-0681	4	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U63	1820-1366	4	1	IC XLTR TTL CLOCK DRVR TTL-TO-MOS 1-INP	04713	MMH0026CP1
A2U64	1818-0443	1	4	IC NMOS 4096 (4K) RAM STAT 300-NS 3-S	0003J	UPD2114LC-1
A2U65	1818-0443	1		IC NMOS 4096 (4K) RAM STAT 300-NS 3-S	0003J	UPD2114LC-1
A2U66	1818-0443	1		IC NMOS 4096 (4K) RAM STAT 300-NS 3-S	0003J	UPD2114LC-1
A2U67	1818-0443	1		IC NMOS 4096 (4K) RAM STAT 300-NS 3-S	0003J	UPD2114LC-1
A2U68	1820-1194	6	1	IC CNTR TTL LS BIN UP/DOWN SYNCHRO	01295	SN74LS193N
A2U201	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A2U202	1820-1917	1		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N
A2U203	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2U204	1820-1917	1		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N
A2U205	1820-1199	1		IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A2U206	1820-1681	6	2	IC UART PMOS	52840	TR1602A
A2U207	1820-1681	6		IC UART PMOS	52840	TR1602A
A2U208	1818-1683	3	1	ROM- 20 MSB	28480	1818-1683
A2U209	1818-1682	2	1	ROM- 20 LSB	28480	1818-1682
A2U210	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U211	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U212-A2U215	1818-0443		4	IC 4K RAM (OPTION 001 ONLY)	0003J	UPD2114LC-1
A2U216	1820-1197	9		IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N
A2U217	1820-1196	8		IC FF TTL LS D-TYPE POS-EDGE-TRIG COM	01295	SN74LS174N
A2U218	1820-2065	2	1	IC MUXR/DATA-SEL CMOS 8-TO-1-LINE	27814	MM74C151N
A2U219	1820-0990	8	2	IC RCVR DTL NAND LINE QUAD	04713	MC1489AL
A2U220	1820-0990	8		IC RCVR DTL NAND LINE QUAD	04713	MC1489AL
A2U221	1820-1779	3	1	IC GEN CMOS	04713	MC14411P
A2U222	1820-0509	5	2	IC DRVR DTL LINE DRVR QUAD	04713	MC1488L
A2U223	1820-0509	5		IC DRVR DTL LINE DRVR QUAD	04713	MC1488L
A2U224	1820-1917	1		IC BFR TTL LS LINE DRVR OCTL	01295	SN74LS240N
A2VR1	1902-0761	5	3	DIODE-ZNR 1N821 6.2V 5% DO-7 PD=.4W	04713	1N821
A2VR2	1902-3077	2	1	DIODE-ZNR 4.42V 2% DO-35 PD=.4W	28480	1902-3077
A2VR3	1902-0761	5		DIODE-ZNR 1N821 6.2V 5% DO-7 PD=.4W	04713	1N821
A2VR4	1902-0761	5		DIODE-ZNR 1N821 6.2V 5% DO-7 PD=.4W	04713	1N821
A2VR5	1902-0202	9	8	DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR6	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR7	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR8	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR9	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR10	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR11	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR12	1902-0202	9		DIODE-ZNR 15V 5% DO-15 PD=1W TC=+.057%	28480	1902-0202
A2VR13	1902-0041	4	1	DIODE-ZNR 5.11V 5% DO-35 PD=.4W	28480	1902-0041
A2XK201	0490-0788	0	2	SOCKET-RLY 22-CONT R-10 DTP-SLDR	28480	0490-0788
A2XK202	0490-0788	0		SOCKET-RLY 22-CONT R-10 DTP-SLDR	28480	0490-0788

Table 4-4. Main PCA A2 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A2XP1	1200-0607	0	1	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0607
A2XU21	1200-0638	7		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0638
A2XU55	1200-0541	1	4	SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A2XU56	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A2XU58	1200-0654	7	3	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A2XU206	1200-0654	7		SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A2XU207	1200-0654	7		SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0654
A2XU208	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A2XU209	1200-0541	1		SOCKET-IC 24-CONT DIP DIP-SLDR	28480	1200-0541
A2XU212	1200-0539	7	4	SOCKET-IC 18-CONT DIP DIP-SLDR	28480	1200-0539
A2XU213	1200-0539	7		SOCKET-IC 18-CONT DIP DIP-SLDR	28480	1200-0539
A2XU214	1200-0539	7		SOCKET-IC 18-CONT DIP DIP-SLDR	28480	1200-0539
A2XU215	1200-0539	7		SOCKET-IC 18-CONT DIP DIP-SLDR	28480	1200-0539
A2Y1	0410-1020	7	1	CRYSTAL-QUARTZ	28480	0410-1020
A2Y201	0410-1004	7	1	CRYSTAL-QUARTZ	28480	0410-1004

Table 4-5. Front Panel PCA A3 Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3	07221-60530	4	1	FRONT PANEL- PCA	28480	07221-60530
A3C1	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A3DS1	1990-0487	7	5	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A3DS2	1990-0524	3	3	LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4550
A3DS3	1990-0524	3		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4550
A3DS4	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A3DS5	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A3DS6	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A3DS7	1990-0524	3		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4550
A3DS8	1990-0487	7		LED-VISIBLE LUM-INT=1MCD IF=20MA-MAX	28480	5082-4584
A3E1	09872-40006	8	3	SPACER-LED	28480	09872-40006
A3E2	09872-40006	8		SPACER-LED	28480	09872-40006
A3E3	09872-40006	8		SPACER-LED	28480	09872-40006
A3H1	0520-0130	1	9	SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H2	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H3	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H4	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H5	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H6	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H7	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H8	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H9	0520-0130	1		SCREW-MACH 2-56 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A3H10	0610-0001	6	9	NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H11	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H12	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H13	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H14	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H15	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H16	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H17	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H18	0610-0001	6		NUT-HEX-DBL-CHAM 2-56-THD .062-IN-THK	00000	ORDER BY DESCRIPTION
A3H19	2190-0112	0	9	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H20	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H21	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H22	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H23	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H24	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H25	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H26	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3H27	2190-0112	0		WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
A3J1	1251-5722	7	1	CONNECTOR 50-PIN M POST TYPE	28480	1251-5722
A3J2	1251-4245	7	2	CONNECTOR 2-PIN M POST TYPE	28480	1251-4245
A3J3	1251-4245	7		CONNECTOR 2-PIN M POST TYPE	28480	1251-4245
A3RN1	1810-0272	8	1	NETWORK-RES 10-SIP330.0 OHM X 9	01121	210A331
A3S1	5060-9436	7	23	PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S2	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S3	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S4	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S5	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S6	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S7	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S8	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S9	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S10	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S11	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S12	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S13	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S14	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S15	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S16	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S17	3101-2474	5	8	SWITCH	28480	3101-2474
A3S18	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S19	3101-2474	5		SWITCH	28480	3101-2474
A3S20	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S21	3101-2474	5		SWITCH	28480	3101-2474
A3S22	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S23	3101-2474	5		SWITCH	28480	3101-2474
A3S24	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S25	3101-2474	5		SWITCH	28480	3101-2474

Table 4-5. Front Panel PCA A3 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A3S26	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S27	3101-2474	5		SWITCH	28480	3101-2474
A3S28	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S29	3101-2474	5		SWITCH	28480	3101-2474
A3S30	5060-9436	7		PUSHBUTTON SWITCH P.C. MOUNT	28480	5060-9436
A3S31	3101-2474	5		SWITCH	28480	3101-2474
A3S32	3101-2475	6	1	SWITCH	28480	3101-2475
A3U1	1820-1202	7	1	IC GATE TTL LS NAND TPL 3-INP	01295	8N74LS10N

Table 4-6. Power Supply PCA A4 Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4	09872-60500	9	1	POWER SUPPLY-PCA	28480	09872-60500
A4C1	0180-0309	4	2	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56289	150D475X0010A2
A4C2	0180-0197	8	1	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A4C3	0160-0937	2	1	CAPACITOR-FXD 1000PF +-2% 300VDC MICA	28480	0160-0937
A4C4	0160-0155	6	2	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A4C5	0160-3847	9	10	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C6	0160-2208	4	1	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2208
A4C7	0160-0155	6	1	CAPACITOR-FXD 3300PF +-10% 200VDC POLYE	28480	0160-0155
A4C8	0180-0650	8	2	CAPACITOR-FXD 390UF+100-10% 20VDC AL	09023	UPC390-20-E2E
A4C9	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C10	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C11	0160-0161	4	3	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A4C12	0160-0127	2	3	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4C13	0180-2675	1	3	CAPACITOR-FXD 330UF+75-10% 50VDC AL	00853	301HE331U050B
A4C14	0180-0309	4	1	CAPACITOR-FXD 4.7UF+-20% 10VDC TA	56269	150D475X0010A2
A4C15	0180-0650	8	1	CAPACITOR-FXD 390UF+100-10% 20VDC AL	09023	UPC390-20-E2E
A4C16	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C17	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C18	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4C19	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C20	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C21	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C22	0160-0157	8	1	CAPACITOR-FXD 4700PF +-10% 200VDC POLYE	28480	0160-0157
A4C23	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C24	0180-2675	1	1	CAPACITOR-FXD 330UF+75-10% 50VDC AL	00853	301HE331U050B
A4C25	0180-2675	1	1	CAPACITOR-FXD 330UF+75-10% 50VDC AL	00853	301HE331U050B
A4C26	0160-3847	9	1	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A4C27	0160-4835	7	1	CAPACITOR-FXD .1UF +-10% 50VDC CER	28480	0160-4835
A4C28	0180-2679	5	2	CAPACITOR-FXD 4800UF+75-10% 50VDC AL	28480	0180-2679
A4C29	0180-2679	5	1	CAPACITOR-FXD 4800UF+75-10% 50VDC AL	28480	0180-2679
A4C30	0160-0194	3	1	CAPACITOR-FXD .015UF +-10% 200VDC POLYE	28480	0160-0194
A4C31	0170-0040	9	1	CAPACITOR-FXD .047UF +-10% 200VDC POLYE	56289	292P47392
A4C32	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A4C33	0160-4320	5	1	CAPACITOR-FXD .47UF +-10% 200VDC	14752	230B1C474K
A4C34	0160-0161	4	1	CAPACITOR-FXD .01UF +-10% 200VDC POLYE	28480	0160-0161
A4C35	0160-3980	1	1	CAPACITOR-FXD .47UF +-10% 50VDC	28480	0160-3980
A4C36	0160-0127	2	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A4C37	0180-2913	0	2	CAPACITOR-FXD 470UF+50-10% 50VDC AL	28480	0180-2913
A4C38	0180-2913	0	1	CAPACITOR-FXD 470UF+50-10% 50VDC AL	28480	0180-2913
A4CR1	1901-0050	3	4	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR2	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR3	1901-0691	8	1	DIODE-PWR RECT 100V 3A 200NS	03508	A115A
A4CR4	1901-1081	2	7	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR5	1901-1065	2	1	DIODE-PWR RECT 1N4936 400V 1A 200NS	14936	1N4936
A4CR6	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR7	1901-0685	0	1	DIODE-PWR RECT 250V 5A 200NS	04713	MR822
A4CR8	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR9	1901-0050	3	1	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A4CR10	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR11	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR12	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR13	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR14	1901-1081	2	1	DIODE-PWR RECT 100V 3A	04713	MR501
A4CR15	1901-0704	4	2	DIODE-PWR RECT 1N4002 100V 1A DO-41	01295	1N4002
A4CR16	1901-0704	4	1	DIODE-PWR RECT 1N4002 100V 1A DO-41	01295	1N4002
A4DS1	1990-0775	6	2	LED-VISIBLE LUM-INT=1MCD IF=50MA-MAX	28480	5082-4150(3-ELMNT)
A4DS2	1990-0775	6	1	LED-VISIBLE LUM-INT=1MCD IF=50MA-MAX	28480	5082-4150(3-ELMNT)
A4E1	0340-0950	1	12	INSULATOR-XSTR POLYI	28480	0340-0950
A4E2	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E3	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E4	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E5	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E6	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E7	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E8	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E9	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E10	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E11	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E12	0340-0950	1	1	INSULATOR-XSTR POLYI	28480	0340-0950
A4E13	09872-20481	1	3	HEAT SINK	28480	09872-20481
A4E14	09872-20481	1	1	HEAT SINK	28480	09872-20481
A4E15	09872-20481	1	1	HEAT SINK	28480	09872-20481

Table 4-6. Power Supply PCA A4 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4E16	2110-0597	7	6	FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4E17	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4E18	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4E19	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4E20	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4E21	2110-0597	7		FUSEHOLDER-CLIP TYPE 10A 250 V	28480	2110-0597
A4F1	2110-0495	4	2	FUSE 1.6A 250V IEC	28480	2110-0495
A4F2	2110-0495	4		FUSE 1.6A 250V IEC	28480	2110-0495
A4F3	2110-0489	6	1	FUSE .25A 250V IEC	28480	2110-0489
A4H1	0624-0341	6	6	SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H2	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H3	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H4	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H5	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H6	0624-0341	6		SCREW-TPG 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
A4H7	2360-0440	8	12	SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H8	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H9	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H10	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H11	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H12	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H13	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H14	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	03000	ORDER BY DESCRIPTION
A4H15	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H16	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H17	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H18	2360-0440	8		SCREW-MACH 6-32 .25-IN-LG BDC-HD-PHL	00000	ORDER BY DESCRIPTION
A4H19	2680-0051	5	4	SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A4H20	2680-0051	5		SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A4H21	2680-0051	5		SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A4H22	2680-0051	5		SCREW-MACH 10-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A4H23	0380-0081	3	2	SPACER-RVT-DN .875-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A4H24	0380-0081	3		SPACER-RVT-DN .875-IN-LG .152-IN-ID	00000	ORDER BY DESCRIPTION
A4H25	0380-0584	1	1	STANDOFF-RVT-DN .875-IN-LG 6-32THD	00000	ORDER BY DESCRIPTION
A4H26	2360-0117	6	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
A4J1	1251-7017	7	2	CONNECTOR 7-PIN	28480	1251-7017
A4J2	1251-3475	3	1	CONNECTOR 10-PIN M POST TYPE	28480	1251-3475
A4J3	1251-7017	7		CONNECTOR 7-PIN	28480	1251-7017
A4J4	1251-3981	6	1	CONNECTOR 9-PIN M POST TYPE	28480	1251-3981
A4J5	1251-3192	1	1	CONNECTOR 3-PIN M POST TYPE	28480	1251-3192
A4L1	9140-0615	0	2	INDUCTOR-500UH	28480	9140-0615
A4L2	9140-0615	0		INDUCTOR-500UH	28480	9140-0615
A4L3	9140-0613	8	1	INDUCTOR-800UH	28480	9140-0613
A4Q1	1853-0036	2	3	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q2	1853-0038	4	5	TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A4Q3	1854-0022	8	5	TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A4Q4	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A4Q5	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A4Q6	1853-0012	4	2	TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A4Q7	1854-0637	1	3	TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A4Q8	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A4Q9	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q10	1853-0491	3	2	TRANSISTOR PNP	28480	1853-0491
A4Q11	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A4Q12	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A4Q13	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A4Q14	1855-0461	1	4	FET-POWER	28480	1855-0461
A4Q15	1855-0461	1		FET-POWER	28480	1855-0461
A4Q16	1884-0281	4	3	THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A4Q17	1854-0215	1	3	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q18	1853-0038	4		TRANSISTOR PNP SI TO-39 PD=1W FT=100MHZ	28480	1853-0038
A4Q19	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A4Q20	1855-0461	1		FET-POWER	28480	1855-0461
A4Q21	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A4Q22	1855-0461	1		FET-POWER	28480	1855-0461
A4Q23	1854-0873	7	3	TRANSISTOR NPN	28480	1854-0873
A4Q24	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q25	1853-0036	2		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A4Q26	1853-0012	4		TRANSISTOR PNP 2N2904A SI TO-39 PD=600MW	01295	2N2904A
A4Q27	1854-0022	8		TRANSISTOR NPN SI TO-39 PD=700MW	07263	S17843
A4Q28	1854-0215	1		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A4Q29	1854-0873	7		TRANSISTOR NPN	28480	1854-0873
A4Q30	1853-0491	3		TRANSISTOR PNP	28480	1854-0873

Table 4-6. Power Supply PCA A4 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4Q31	1854-0637	1		TRANSISTOR NPN 2N2219A SI TO-5 PD=800MW	01295	2N2219A
A4Q32	1884-0281	4		THYRISTOR-SCR 2N6505 TO-220AB VRRM=100	04713	2N6505
A4Q33	1854-0873	7		TRANSISTOR NPN	20480	1854-0873
A4R1	0757-0289	2	2	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4R2	0757-0280	3	15	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R3	0698-3445	2	2	RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A4R4	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R5	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R6	0757-0420	3	3	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R7	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R8	0699-0757	5	5	RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A4R9	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R10	0698-3160	8	1	RESISTOR 31.6K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3162-F
A4R11	0757-0416	7	7	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R12	0698-3403	2	4	RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A4R13	0812-0017	2	2	RESISTOR .25 5% 3W PW TC=0+-90	28480	0812-0017
A4R14	0757-0794	4	2	RESISTOR 68.1 1% .5W F TC=0+-100	28480	0757-0794
A4R15	0698-0084	9	1	RESISTOR 2.15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2151-F
A4R16	0757-0198	2	1	RESISTOR 100 1% .5W F TC=0+-100	28480	0757-0198
A4R17	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R18	0757-0440	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4R19	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R20	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R21	0757-0442	9	5	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R22	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R23	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-42R2-F
A4R24	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4R25	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R26	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R27	0698-3428	1	2	RESISTOR 14.7 1% .125W F TC=0+-100	93888	PME55-1/8-T0-14R7-F
A4R28	0757-0458	7	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A4R29	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R30	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R31	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R32	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R33	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R34	0757-0394	0	4	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R35	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R36	0757-0289	2		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4R37	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A4R38	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A4R39	0757-0794	4		RESISTOR 68.1 1% .5W F TC=0+-100	28480	0757-0794
A4R40	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A4R41	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A4R42	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A4R43	0757-0424	7	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A4R44	0812-0017	2		RESISTOR .25 5% 3W PW TC=0+-90	28480	0812-0017
A4R45	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A4R46	0757-0346	2	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A4R47	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R48	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R49	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R50	0757-0278	9	2	RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R51	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A4R52	0699-0755	3	4	RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A4R53	0757-0278	9		RESISTOR 1.78K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1781-F
A4R54	0757-0444	1	1	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A4R55	0699-0756	4	3	RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A4R56	0698-3403	2		RESISTOR 348 1% .5W F TC=0+-100	28480	0698-3403
A4R57	0699-0757	5		RESISTOR 464 2% .25W F TC=0+-100	28480	0699-0757
A4R58	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R59	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R60	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R61	0811-1827	2	1	RESISTOR .1 10% 3W PW TC=0+-90	28480	0811-1827
A4R62	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R63	0698-3150	6	2	RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A4R64	0698-3150	6		RESISTOR 2.37K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2371-F
A4R65	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R66	0698-3162	0	2	RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A4R67	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R68	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R69	0698-3151	7	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A4R70	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F

Table 4-6. Power Supply PCA A4 Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A4R71	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A4R72	0757-0416	7		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R73	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A4R74	0698-3162	0		RESISTOR 46.4K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4642-F
A4R75	0757-0280	3		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R76	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A4R77	0698-3408	7	1	RESISTOR 2.15K 1% .5W F TC=0+-100	28480	0698-3408
A4R78	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A4R79	0757-0821	8	1	RESISTOR 1.21K 1% .5W F TC=0+-100	28480	0757-0821
A4R80	0699-0755	3		RESISTOR 51.1 2% .25W F TC=0+-100	28480	0699-0755
A4R81	0698-3445	2		RESISTOR 348 1% .125W F TC=0+-100	24546	C4-1/8-T0-348R-F
A4R82	0757-0394	0		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A4R83	0698-3428	1		RESISTOR 14.7 1% .125W F TC=0+-100	03838	PMC55-1/8-T0-14R7-F
A4R84	0699-0756	4		RESISTOR 215 2% .25W F TC=0+-100	28480	0699-0756
A4R85	0698-0024	7	1	RESISTOR 2.61K 1% .5W F TC=0+-100	28480	0698-0024
A4R86	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A4U1	1820-2466	7	1	IC-M75551PA	32293	1CM75551PA
A4U2	1820-1145	7	1	IC BFR CMOS INV HEX 1-INP	0192B	CD4049AF
A4U3	1826-0175	3	1	IC COMPARATOR GP DUAL 14-DIP-P PKG	27014	LM319N
A4U4	1820-0493	6	1	IC OP AMP GP 8-DIP-P PKG	27014	LM307N
A4U5	1820-0477	6	1	IC OP AMP GP 8-DIP-P PKG	0003J	UPC301AC
A4VR1	1902-0202	9	6	DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR2	1902-0202	9		DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR3	1902-3224	1	1	DIODE-ZNR 17.8V 5% D0-35 PD=.4W	28480	1902-3224
A4VR4	1902-0202	9		DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR5	1902-0533	9	1	DIODE-ZNR 4.99V 2% D0-15 PD=1W TC=-.012%	28480	1902-0533
A4VR6	1902-0202	9		DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR7	1902-0202	9		DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR8	1902-0761	5	2	DIODE-ZNR 1N821 6.2V 5% D0-7 PD=.4W	04713	1N821
A4VR9	1902-3191	1	3	DIODE-ZNR 13V 2% D0-35 PD=.4W TC=+.06%	28480	1902-3191
A4VR10	1902-0761	5		DIODE-ZNR 1N821 6.2V 5% D0-7 PD=.4W	04713	1N821
A4VR11	1902-3191	1		DIODE-ZNR 13V 2% D0-35 PD=.4W TC=+.06%	28480	1902-3191
A4VR12	1902-3092	1	1	DIODE-ZNR 4.99V 2% D0-35 PD=.4W	28480	1902-3092
A4VR13	1902-0202	9		DIODE-ZNR 15V 5% D0-15 PD=1W TC=+.057%	28480	1902-0202
A4VR14	1902-3191	1		DIODE-ZNR 13V 2% D0-35 PD=.4W TC=+.06%	28480	1902-3191

Table 4-7. Primary PCA A5 Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	09872-60505	4	1	PRIMARY PCA	28480	09872-60505
A5E1	1251-2118	9	9	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E2	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E3	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E4	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E5	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E6	1251-2118	9	9	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E7	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E8	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5E9	1251-2118	9		CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	28480	1251-2118
A5J1	1251-5565	6		1	CONNECTOR 5-PIN M POST TYPE	28480
A5J2	1251-7039	3	1	CONNECTOR 2-PIN M	28480	1251-7039
A5L1	9100-1788	6	2	CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/48
A5L2	9100-1788	6		CHOKE-WIDE BAND ZMAX=680 OHMS 180 MHZ	02114	VK200 20/48
A5S1	3101-0555	9	1	SWITCH-PB DPDT ALING 4A 250VAC	28480	3101-0555
A5TP1	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A5W1-A5W3	1258-0146	3	3	PLUG-SHORTING .04 DIA.	28480	1258-0146

Table 4-8. Chart Hold PCA A6 Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	09872-60580	5	1	CHART HOLD PCA	28480	09872-60580
A6C101	0160-4742	5	3	CAPACITOR - FXD 1000 PF 600 VDC	28480	0160-4742
A6C102	0160-4742	5		CAPACITOR - FXD 1000 PF 600 VDC	28480	0160-4742
A6C103	0160-4742	5		CAPACITOR - FXD 1000 PF 600 VDC	28480	0160-4742
A6C104	0160-3847	9	4	CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A6C105	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A6C106	0180-0291	9	1	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A6C107	0160-3847	3		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A6C108	0160-3847	9		CAPACITOR-FXD .01UF +100-0% 50VDC CER	28480	0160-3847
A6C109	0160-0153	4	3	CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A6C110	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A6C111	0160-0153	4		CAPACITOR-FXD 1000PF +-10% 200VDC POLYE	28480	0160-0153
A6CR101	1901-0831	8	3	DIODE-HV RECT 1N4937 600V 1A 200NS DO-41	04713	1N4937
A6CR102	1901-0831	8		DIODE-HV RECT 1N4937 600V 1A 200NS DO-41	04713	1N4937
A6CR103	1901-0831	8		DIODE-HV RECT 1N4937 600V 1A 200NS DO-41	04713	1N4937
A6CR104	1901-0050	3	3	DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR105	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6CR106	1901-0050	3		DIODE-SWITCHING 80V 200MA 2NS DO-35	28480	1901-0050
A6E101	1251-6939	0	2	CONNECTOR-SINGLE PIN	28480	1251-6939
A6E102	1251-6939	0		CONNECTOR-SINGLE PIN	28480	1251-6939
A6E103	1251-0600	0	2	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6E104	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6J101	1251-7114	5	1	CONNECTOR-2 PIN	28480	1251-7114
A6L101	9140-0131	5	1	INDUCTOR RF-CH-MLD 10MH 5% .25DX.75LG	28480	9140-0131
A6P101	1251-6998	1	2	CONNECTOR-7 PIN	28480	1251-6998
A6P102	1251-6998	1		CONNECTOR-7 PIN	28480	1251-6998
A6Q101	1854-0801	1	1	TRANSISTOR NPN SI TO-39 PD=1W FT=15MHZ	28480	1854-0801
A6Q102	1854-0215	1	1	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	2N3904
A6R101	0686-2265	9	2	RESISTOR 22M 5% .5W CC TC=0+1059	01121	E82265
A6R102	0686-1855	9	4	RESISTOR 1.8M 5% .5W CC TC=0+1000	01121	E81855
A6R103	0686-1855	9		RESISTOR 1.8M 5% .5W CC TC=0+1000	01121	E81855
A6R104	0686-2265	9		RESISTOR 22M 5% .5W CC TC=0+1059	01121	E82265
A6R105	0686-1855	9		RESISTOR 1.8M 5% .5W CC TC=0+1000	01121	E81855
A6R106	0686-1855	9		RESISTOR 1.8M 5% .5W CC TC=0+1000	01121	E81855
A6R107	0698-8754	5	3	RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A6R108	0698-8754	5		RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A6R109	0698-8754	5		RESISTOR 10M 1% .25W C TC=0+-150	01121	CC1005F
A6R110	0757-0477	1	2	RESISTOR 332K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3323-F
A6R111	0757-0279	0	1	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A6R112	0698-3155	1	1	RESISTOR 4.64K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4641-F
A6R113	0757-0458	7	1	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A6R114	0757-0401	0	1	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A6R115	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2611-F
A6R116	0757-0397	3	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A6R117	0757-0288	1	1	RESISTOR 9.09K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-9091-F
A6R118	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A6R119	0757-0477	0		RESISTOR 332K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-3323-F
A6R120	0757-0438	3	3	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R121	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R122	0699-0983	9	1	RESISTOR 3.6 1% 3W PW TC=0+-50	28480	0699-0983
A6R123	0698-3433	8	1	RESISTOR 28.7 1% .125W F TC=0+-100	03888	PME55-1/8-T0-28R7-F
A6R124	0757-0199	3	1	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A6R125	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A6R126	0757-1092	7	1	RESISTOR 287 1% .5W F TC=0+-100	28480	0757-1092
A6U101	1826-0412	1	1	IC COMPARATOR PRCN DUAL 8-DIP-P PKG	27014	LM393N
A6U102	1826-0706	6	1	IC OP AMP LOW-BIAS-H-IMPD 8-DIP-P PKG	28480	1826-0706
A6U103	1820-0471	0	1	IC INV TTL HEX 1-INP	01295	SN7406N



E

Table 4-9. Upper Deck Assembly Parts List

Reference Designation	HP Part Number	C	D	Qty	Description	Mfr Code	Mfr Part Number
1	07220-20524	1	1	1	COVER-REAR (7220C)	28480	07220-20524
	07220-20527	4	1	1	COVER-REAR (7220T)	28480	07220-20527
	07221-20532	2	1	1	COVER-REAR (7221C)	28480	07221-20532
	07221-20536	6	1	1	COVER-REAR (7221T)	28480	07221-20536
2	2360-0267	7	1	1	SCREW-MACH 6-32 1.625-IN-LG PAN-HD-SLT	00000	ORDER BY DESCRIPTION
3	2360-0200	8	1	1	SCREW-MACH 6-32 .5-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
4	09872-00554	7	1	1	TRAY-UPPER	28480	09872-00554
5	09872-60546	3	1	1	TRAILING CABLE ASSEMBLY	28480	09872-60546
6	0590-0381	1	1	1	NUT-HEX-W/LKWR 6-32-THD .12-IN-THK	00000	ORDER BY DESCRIPTION
7	09872-60485	9	1	1	SIDE (LEFT)	28480	09872-60485
8	2680-0111	8	1	1	SCREW-MACH 10-32 1-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
9	2510-0863	0	1	1	SCREW-MACH 8-32 1.5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	2200-0107	6	1	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
11	17072-20048	5	1	1	BUSHING	28480	17072-20048
12	17072-40012	5	1	1	PAPER STOP	28480	17072-40012
13	2510-0121	1	1	1	SCREW-MACH 8-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
14	09872-60486	0	1	1	HINGE	28480	09872-60486
15	5210-0067	1	1	1	SCREW	28480	5210-0067
16	09872-60484	8	1	1	SIDE (RIGHT)	28480	09872-60484
17	09872-00067	7	1	1	BRACKET (SIDE)	28480	09872-00067
18	0570-0595	7	1	1	SCREW-METRIC SPECIALTY 10-32 UNF-2A; 18	00000	ORDER BY DESCRIPTION
19	09872-60079	7	1	1	TABLE ASSEMBLY	28480	09872-60079
20	2360-0123	4	2	2	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI NOT ASSIGNED	00000	ORDER BY DESCRIPTION
22	09872-20032	8	1	1	TRACK (REAR)	28480	09872-20032
23	09872-60012	8	1	1	PULLEY ASSEMBLY, X-AXIS	28480	09872-60012
24	3050-0139	6	1	1	WASHER-FL MTLN NO. 8 .172-IN-ID NOT ASSIGNED	28480	3050-0139
26	2360-0123	4	1	1	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
27	2510-0103	9	1	1	SCREW-MACH 8-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
28	09872-00502	5	1	1	DECK ASSEMBLY	28480	09872-00502
29					NOT USED		
30	2200-0167	8	1	1	SCREW MACH 4-40 .375-IN-LG	00000	ORDER BY DESCRIPTION
31	09872-60528	1	1	1	PULLEY ASSEMBLY	28480	09872-60528
32	2190-0315	5	1	1	WASHER-FL MTLN NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
33	09872-60402	0	1	1	BRACKET (LEFT REAR) NOT USED	28480	09872-60402
34					NOT USED		
35	09872-20079	3	1	1	SLIDER ROD, X	28480	09872-20079
36	09872-00040	6	1	1	MOUNT, SHAFT	28480	09872-00040
37	09872-20014	6	1	1	BAR-SPACER	28480	09872-20014
38	2190-0105	1	1	1	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0105
39	2360-0205	3	1	1	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
40	09872-40039	7	1	1	BLOCK, TIE	28480	09872-40039
41	09872-40040	0	1	1	TENSIONER, Y CABLE	28480	09872-40040
42	09872-60405	3	1	1	BRACKET (RIGHT REAR)	28480	09872-60405
42A	3060-0692	6	1	1	WASHER FLAT NO. 10	00000	ORDER BY DESCRIPTION
42B	2190-0074	3	1	1	WASHER LOCK NO. 10	00000	ORDER BY DESCRIPTION
42C	3030-0040	6	1	1	SCREW CAP 10-32 .75-IN-LG	00000	ORDER BY DESCRIPTION
43	5001-0382	0	1	1	SHIM	28480	5001-0382
44	09872-20070	4	1	1	CABLE TIE	28480	09872-20070
45	2360-0195	0	1	1	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
46	2360-0196	1	1	1	SCREW-MACH 6-32 .375-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
47	1600-0599	7	1	1	CABLE MOUNT (RIGHT)	28480	1600-0599
48	3030-0017	7	1	1	SCREW-SKT HD CAP 8-32 .5-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
49	2190-0017	4	1	1	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
50	2190-0419	0	1	1	WASHER-FL MTLN NO. 8 .172-IN-ID	28480	2190-0419
51	09872-20033	9	1	1	BAR-ALIGNMENT	28480	09872-20033
52	2360-0114	3	1	1	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
53	4040-1784	9	1	1	INDEX-PAPER	28480	4040-1784
54	0520-0173	2	1	1	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI NOT ASSIGNED	00000	ORDER BY DESCRIPTION
56	09872-20034	0	1	1	SPACER	28480	09872-20034
57	2510-0123	3	1	1	SCREW-MACH 8-32 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
58	09872-60028	6	1	1	CABLE-X	28480	09872-60028
59	09872-20009	9	1	1	DRIVE PULLEY, X-AXIS	28480	09872-20009
60	09872-60573	6	1	1	CABLE, X-DRIVE	28480	09872-60573
61	0050-2064	7	1	1	CLAMP	28480	0050-2064
62	3030-0070	2	1	1	SCREW-SKT HD CAP 4-40 .625-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
63	09872-00083	7	1	1	MOTOR MOUNT, X	28480	09872-00083
64	2580-0006	8	1	1	NUT-HEX-W/LKWR 8-32-THD .125-IN-THK NOT ASSIGNED	00000	ORDER BY DESCRIPTION
65					NOT ASSIGNED		
66					NOT ASSIGNED		
67	2360-0197	2	1	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
68	2510-0049	2	1	1	SCREW MACH 8-32 .5-IN-LG	00000	ORDER BY DESCRIPTION
69	09872-60514	5	1	1	MOTOR ASSEMBLY	28480	09872-60514
70	09872-60008	2	1	1	DAMPER ASSEMBLY	28480	09872-60008
71	09872-00524	1	1	1	MOTOR MOUNT, Y	28480	09872-00524

Table 4-9. Upper Deck Assembly Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number	
E	72	09872-60566	7	1	CABLE, Y DRIVE	28480	09872-60566
	73	09872-20566	3	1	DRIVE PULLEY	28480	09872-20566
	74	1400-0584	6	1	MOUNT-CA TIE .122-DIA .75-WD ABS	28480	1400-0584
	75	2190-0152	8	1	WASHER-FL MTLC NO. 8 .188-IN-ID	28480	2190-0152
	76	2510-0108	4	1	SCREW-MACH 8-32 .625-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
	77	0380-1484	2	5	STANDOFF	28480	0380-1484



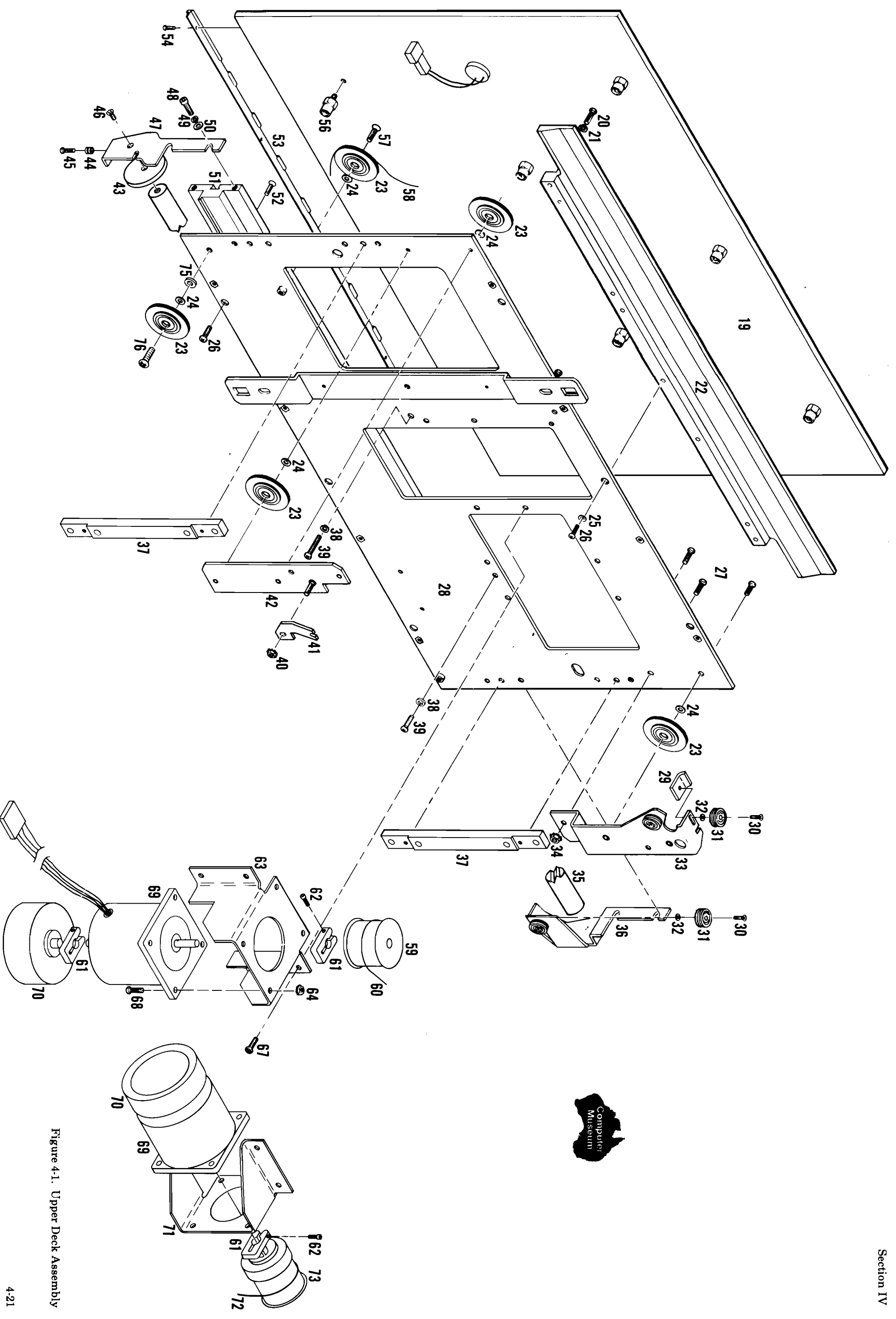
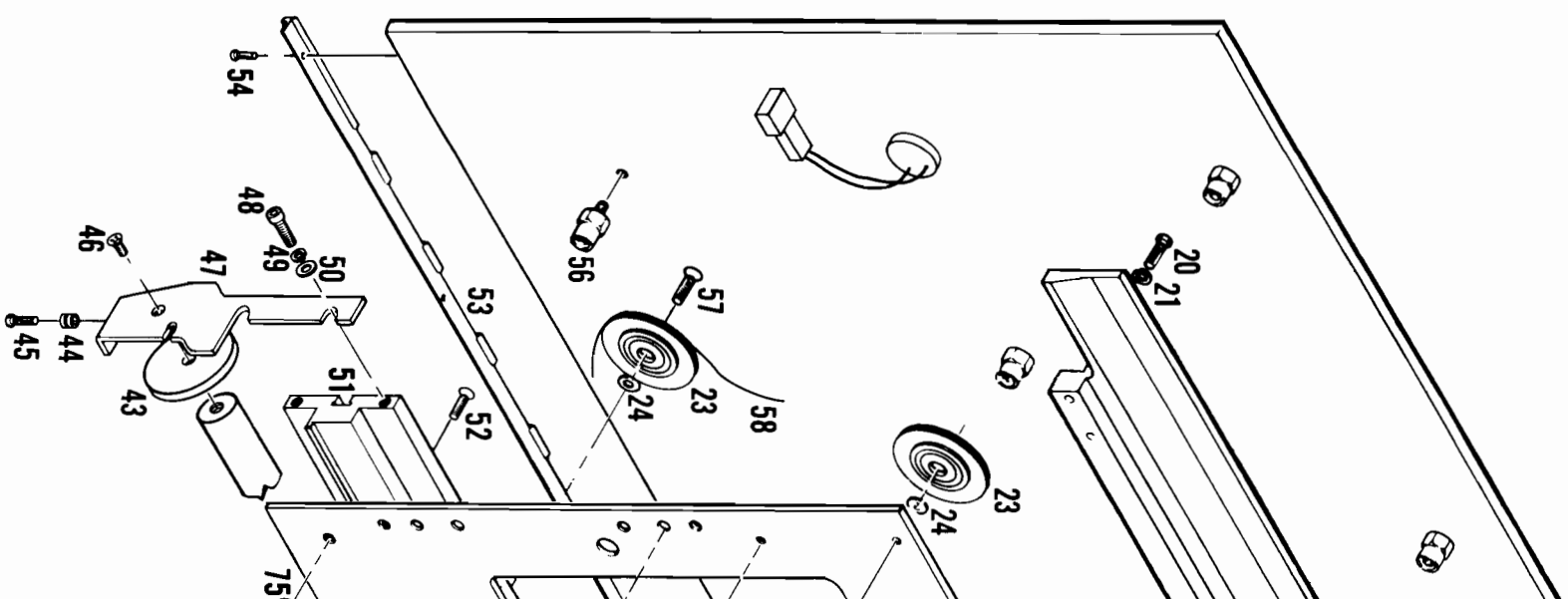
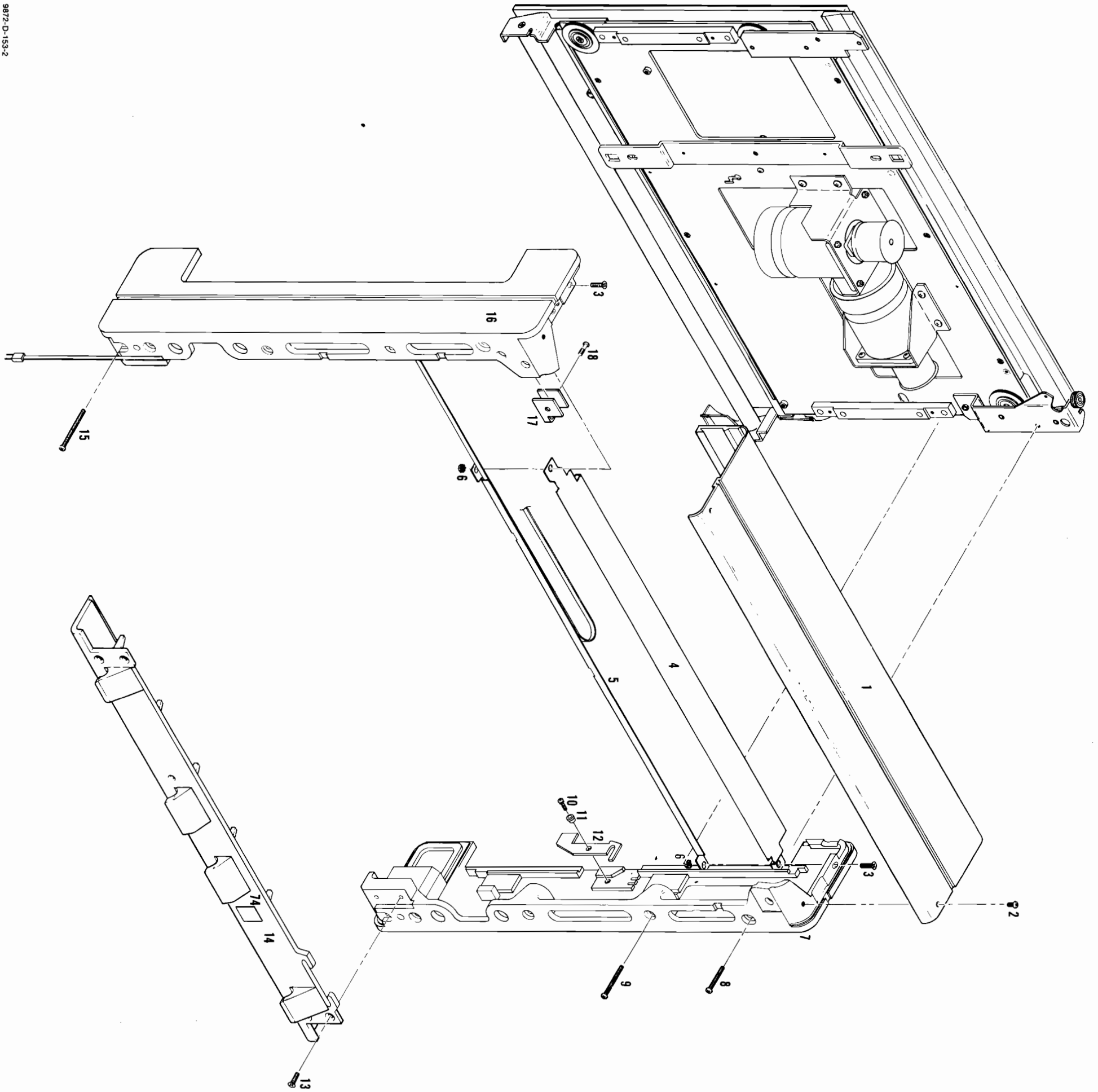


Figure 4-1. Upper Deck Assembly



Models 7220C/7221C

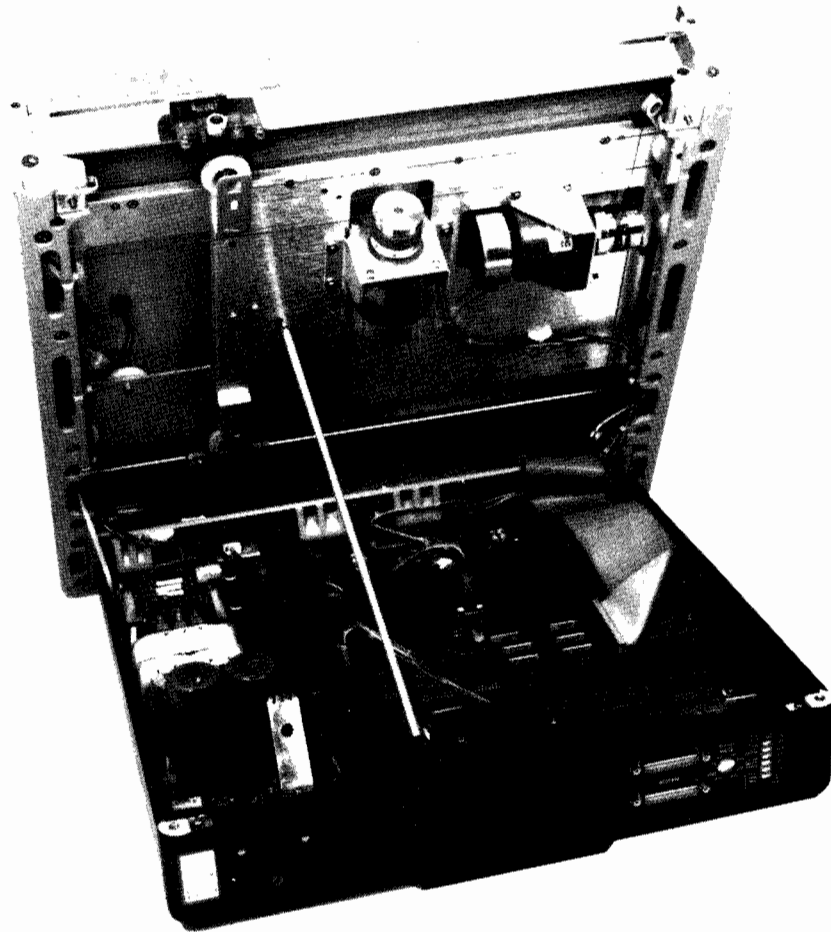


Table 4-10. Lower Case Assembly Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	09872-60596	3	1	LOWER CASE	28480	09872-60596
2	07221-00005	2	1	FRAME-FILTER	28480	07221-00005
3	4208-0165	4	1	FILTER	28480	4208-0165
4	09872-00006	4	1	SCREEN-FAN	28480	09872-00006
5	2360-0201	9	1	SCREW-MACH 6-32 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
6	2200-0107	6	1	SCREW-MACH 4-40 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
7	2190-0416	7	1	WASHER-FL HTLC NO. 4 .125-IN-ID	28480	2190-0416
8	09872-00073	5	1	ADAPTER-FAN	28480	09872-00073
9	2360-0197	2	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
10	0590-0381	1	1	NUT-HEX-W/LKWR 6-32-THD .12-IN-THK	00000	ORDER BY DESCRIPTION
11	09872-60061	7	1	FAN	28480	09872-60061
12	2190-0182	4	1	WASHER-FL NM NO. 3 .11-IN-ID .25-IN-OD	28480	2190-0182
13	2200-0149	6	1	SCREW-MACH 4-40 .625-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
14	09872-20515	2	1	SUPPORT-UPPER DECK	28480	09872-20515
15	9100-4141	1	1	TRANSFORMER ASSEMBLY	28480	9100-4141
16	2510-0065	2	1	SCREW-MACH 8-32 1.75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
17	2190-0017	4	1	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
18	09872-00508	1	1	PANEL-POWER SWITCH	28480	09872-00508
19	09872-60549	6	1	SHAFT-POWER SUPPLY SWITCH	28480	09872-60549
20	09872-60588	3	1	SHIELD-AC	28480	09872-60588
21	0403-0106	3	1	BUMPER FOOT-SCR 1-IN-OD .25-IN-THK BLK	28480	0403-0106
22	2360-0115	4	2	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
23	09872-60560	1	1	PANEL-POWER	28480	09872-60560
24	2110-0566	0	1	FUSEHOLDER-EXTR POST 12A 250 V	28480	2110-0566
25	2110-0569	3	1	NUT-HEX	28480	2110-0569
26	2360-0115	4	1	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
27	09872-60562	3	1	SPRING-GROUNDING	28480	09872-60562
28	2200-0103	2	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
29	07221-60546	2	1	PANEL-I/O RS-232-C	28480	07221-60546
30	1251-1198	3	1	LOCK-AMPH 17 CONN	28480	1251-1198
31	2200-0139	4	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
32	2360-0205	3	1	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
33	2360-0135	8	1	SCREW-MACH 6-32 1.5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
34	5041-0532	6	1	KEY 1/2	28480	5041-0532
35	0340-0136	5	1	GROMMET-RND .188-IN-ID .312-IN-GRV-OD	28480	0340-0136
36	2110-0565	9	1	CAP-FUSEHOLDER (100/120V)	28480	2110-0565
	2110-0567	1	1	CAP-FUSEHOLDER (220/240V)	28480	2110-0567

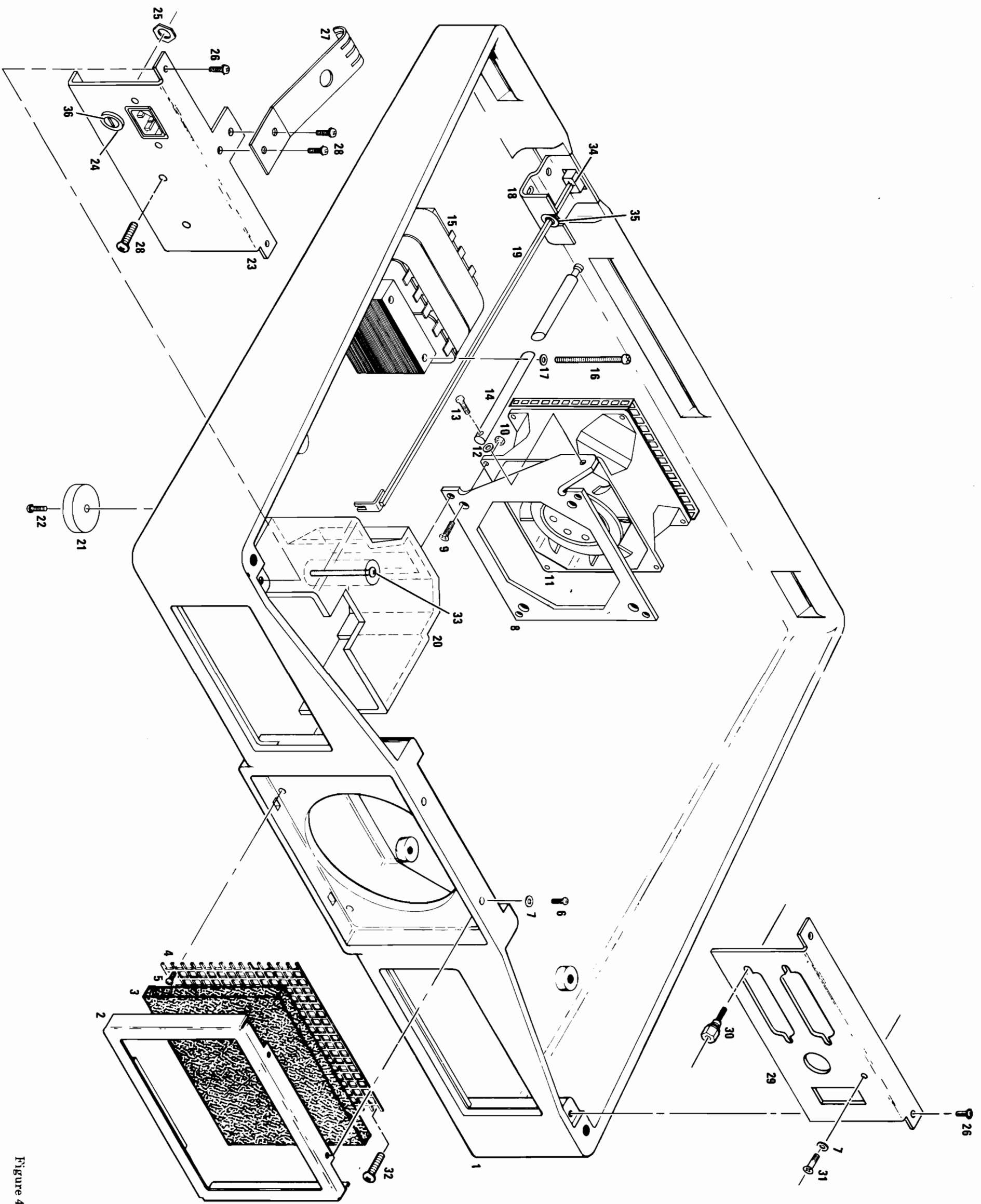


Figure 4-2. Lower Case Assembly

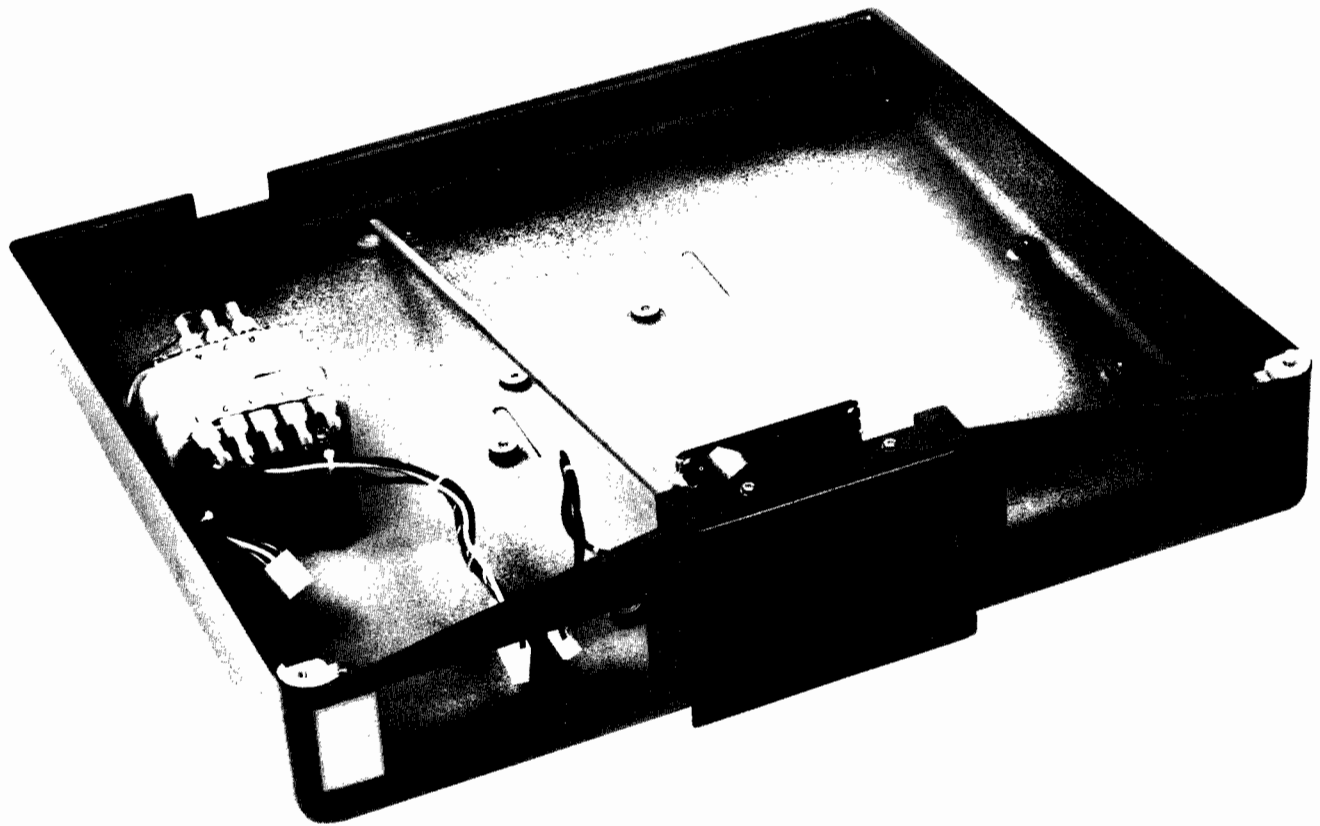


Table 4-11. Pen Arm Assembly Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0520-0167	4	2	SCREW-MACH 2-56 .438-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
2	09872-40001	3	1	COVER-PEN SOLENOID	28480	09872-40001
3	0520-0129	8	1	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	2190-0112	0	2	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
5	2950-0043	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
6	09872-20076	0	1	PIVOT-PEN	28480	09872-20076
7	09872-40003	5	1	BRACKET-DASHPOT	28480	09872-40003
8	3030-0668	4	1	SCREW-SET 6-32 .188-IN-LG FLAT-PT	00000	ORDER BY DESCRIPTION
9	09872-20051	1	1	PEN CARRIAGE (TOP)	28480	09872-20051
10	3030-0196	3	1	SCREW-SET 4-40 .188-IN-LG SMALL CUP-PT	00000	ORDER BY DESCRIPTION
11	1520-0099	2	1	DASHPOT .25-IN-STRK 1.4-LB-LOAD-CAP	28480	1520-0099
12	09872-20054	4	1	SCREW-PEN SPRING	28480	09872-20054
13	1460-1554	8	1	SPRING-CPRSN 4-MM-OD 12-MM-OA-LG SST	28480	1460-1554
14	0520-0163	0	3	SCREW-MACH 2-56 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
15	0516-0005	0	1	SCREW-MACH 0-80 .188-IN-LG PAN-HD-SLT	00000	ORDER BY DESCRIPTION
16	09872-60035	5	1	PEN HOLDER ASSY	28480	09872-60035
17	09872-20082	8	1	COVER-PEN ARM	28480	09872-20082
18	0520-0163	0	1	SCREW-MACH 2-56 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
19	09872-60546	3	1	TRAILING CABLE-ELECTRICAL	28480	09872-60546
20	0590-0199	9	2	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
21	2200-0179	2	1	SCREW-MACH 4-40 .125-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
22	09872-60526	9	2	PULLEY ASSEMBLY, Y-AXIS	28480	09872-60526
23	2190-0315	5	5	WASHER-FL MTLC NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
24	3030-0392	1	1	SCREW-SKT-HD 4-40 .375-IN-LG	00000	ORDER BY DESCRIPTION
25	09872-40002	4	1	SLIDER (TOP)	28480	09872-40002
26	2200-0169	0	3	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
27	0520-0285	7	1	SCREW-MACH 2-56 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
28	09872-40009	1	1	SLIDER-BASE	28480	09872-40009
29	09872-60535	0	1	SOLENOID ASSEMBLY-PEN (ITEMS 30-35)	28480	09872-60535
30	2200-0582	1	1	SCREW-MACH 4-40 .375-IN-LG TR-HD-SLT	00000	ORDER BY DESCRIPTION
31	1600-0611	4	1	ARMATURE	28480	1600-0611
32	09872-20055	5	1	BOBBIN	28480	09872-20055
33	1460-1763	1	1	SPRING-EXT 4.5-MM-OD SST PSVT	28480	1460-1763
34	1600-0612	5	1	BRACKET	28480	1600-0612
35	2200-0164	5	1	SCREW-MACH 4-40 .188-IN-LG UNCT 82 DEG	00000	ORDER BY DESCRIPTION
36	0520-0127	6	2	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
37	2190-0112	0	1	WASHER-LK HLCL NO. 2 .088-IN-ID	28480	2190-0112
38	09872-20093	1	1	NUT Y-AXIS ADJ	28480	09872-20093
39	2190-0108	4	3	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0108
40	2190-0315	5	1	WASHER-FL MTLC NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
41	2200-0169	0	1	SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
42	3050-0230	8	1	WASHER-FL MTLC NO. 2 .091-IN-ID	28480	3050-0230
43	09872-60527	0	1	PULLEY ASSY, OFFSET	28480	09872-60527
44	09872-20025	9	1	BUSHING-THREADED	28480	09872-20025
45	09872-20137	4	1	BLOCK-PULLEY	28480	09872-20137
46	0520-0167	4	1	SCREW-MACH 2-56 .438-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
47	09872-20128	3	1	BLOCK (REAR)	28480	09872-20128
48	2200-0167	8	1	SCREW-MACH 4-40 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
49	2190-0315	5	1	WASHER-FL MTLC NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
50	2200-0170	3	2	SCREW-MACH 4-40 X.63	00000	ORDER BY DESCRIPTION
51	09872-60014	0	1	WHEEL	28480	09872-60014
52				NOT USED		
53	0590-0199	9	1	NUT-HEX-W/LKWR 4-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
54	09872-20029	3	1	STANCHION	28480	09872-20029
55	2360-0181	4	1	SCREW-MACH 6-32 .25-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
56	09872-60012	8	1	PULLEY ASSEMBLY, X-AXIS	28480	09872-60012
57	09872-20040	8	1	WASHER- 9.5 MM	28480	09872-20040
58	09872-20106	7	1	STUD-Y	28480	09872-20106
59	2190-0315	5	1	WASHER-FL MTLC NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
60	2190-0157	3	1	WASHER-FL MTLC NO. 3 .109-IN-ID	28480	2190-0157
61	0520-0127	6	1	SCREW-MACH 2-56 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
62	09872-20135	2	1	TRACK, Y-AXIS	28480	09872-20135
63	2510-0101	7	2	SCREW-MACH 8-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
64	0520-0163	0	1	SCREW-MACH 2-56 .188-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
65	09872-20012	4	1	SLIDER ROD, Y-AXIS	28480	09872-20012
66	09872-40005	7	1	RETAINER	28480	09872-40005
67	3050-0867	7	1	WASHER-FL NM 8.0 MM 9.4-MM-ID	28480	3050-0867
68	09872-20127	2	1	BASE-PEN CARRIAGE	28480	09872-20127
69	09872-20024	8	1	SCREW-BEARING	28480	09872-20024
70	1460-1550	4	1	SPRING-CPRSN .12-IN-OD .312-IN-OA-LG MUM	28480	1460-1550
71	09872-20111	4	1	RETAINER-BEARING	28480	09872-20111
72	2190-0108	4	1	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0108
73	2200-0139	4	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
74	1410-0617	7	1	BEARING-LINEAR	28480	1410-0617

Table 4-11. Pen Arm Assembly Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
75	09872-60077	5	1	HOUSING, X-AXIS	28480	09872-60077
76	09872-00100	9	1	RETAINER-BEARING	28480	09872-00100
77	2190-0108	4		WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0108
78	2200-0137	2	1	SCREW-MACH 4-40 .188-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
79	1410-0621	3	1	BEARING	28480	1410-0621
80	3050-0852	0	1	WASHER-FL NM 12.2 MM 12.5-MM-ID 20-MM-OD	28480	3050-0852
81	09872-40004	6	1	RETAINER	28480	09872-40004
82	09872-20129	4	1	BLOCK (FRONT)	28480	09872-20129
83	2510-0101	7		SCREW-MACH 8-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
84	2190-0315	5		WASHER-FL MTLC NO. 5 .13-IN-ID .25-IN-OD	28480	2190-0315
85	2200-0169	0		SCREW-MACH 4-40 .5-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
86	09872-20026	0	1	SCREW	28480	09872-20026
87	1410-0620	2	1	BEARING	28480	1410-0620



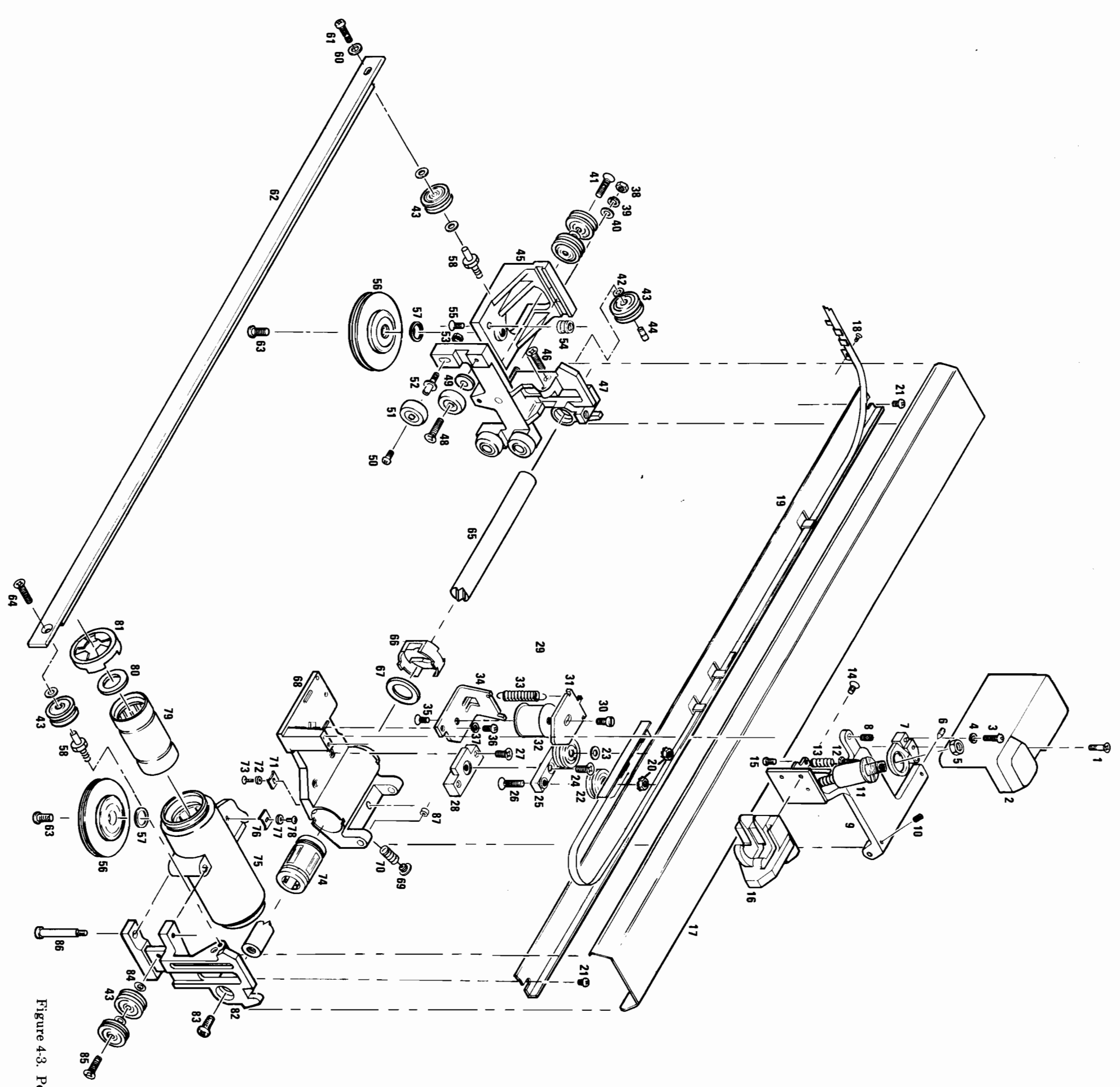


Figure 4-3. Pen Carriage and Arm Assembly

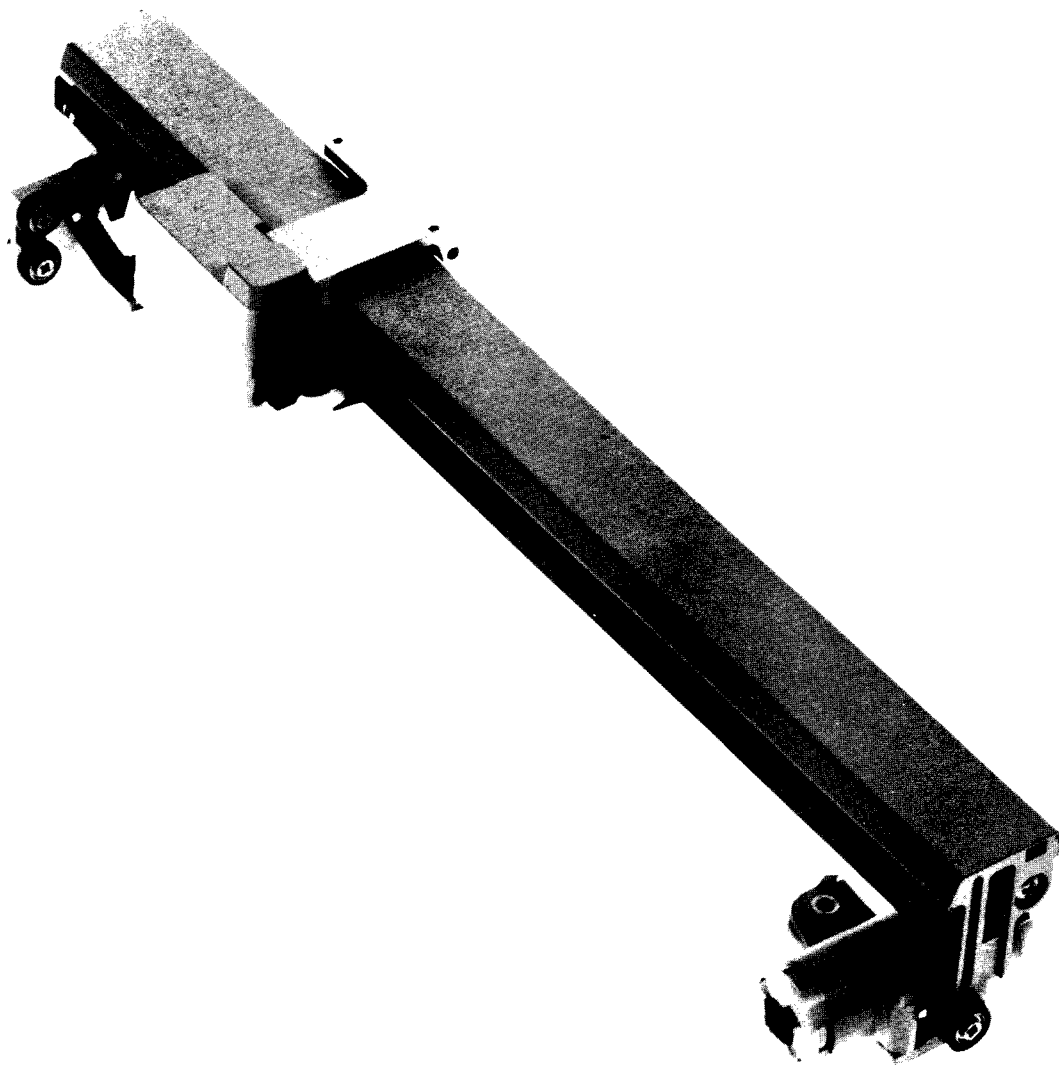


Table 4-12. Front Panel Assembly Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	07221-60521	3	1	CONTROL PANEL ASSEMBLY	28480	07221-60521
2	5041-0843	4	1	KEY-STBY	28480	5041-0843
3	5041-0843	2	1	KEY-LOCAL	28480	5041-0843
4	5041-0844	3	1	KEY ON-LINE	28480	5041-0844
5	5041-0066	1	1	KEY CHART-HOLD	28480	5041-0066
6	5041-0068	3	1	KEY CHART LOAD	28480	5041-0068
7	5041-0061	6	1	KFY PEN-DOWN	28480	5041-0061
8	5041-0062	7	1	KFY PEN-UP	28480	5041-0062
9	5041-0797	5	1	KEY P2 (7220)	28480	5041-0797
	5041-0067	2	1	KEY UR (7221)	28480	5041-0067
10	5041-0796	4	1	KEY P1 (7220)	28480	5041-0796
	5041-0064	9	1	KEY LL (7221)	28480	5041-0064
11	5041-0069	4	1	KEY ENTER	28480	5041-0069
12	5041-0059	2	1	KEY ARROW	28480	5041-0059
13	5041-0063	8	1	KEY FAST	28480	5041-0063
14	5041-0055	8	1	KEY 1	28480	5041-0055
15	5041-0056	9	1	KEY 2	28480	5041-0056
16	5041-0057	0	1	KEY 3	28480	5041-0057
17	5041-0058	1	1	KEY 4	28480	5041-0058
18	5041-1941	3	1	KEY 5	28480	5041-1941
19	5041-1942	4	1	KEY 6	28480	5041-1942
20	5041-1943	5	1	KEY 7	28480	5041-1943
21	5041-1944	6	1	KEY 8	28480	5041-1944
22	07221-60530	4	1	PCA FRONT PANEL (7221/7220)	28480	07221-60530
23	2190-0108	4	1	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0108
24	2200-0139	4	1	SCREW-MACH 4-40 .25-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
25	1460-1573	1	1	SPRING	28480	1460-1573
26	09872-40015	9	1	ARM-STABLE	28480	09872-40015
27	0510-0261	8	1	RETAINER-RING E-R EXT .094-IN-DIA STL	28480	0510-0261
28	0905-0713	2	1	O-RING .07-IN-ID .036-IN-X-SECT DIA FPR	28480	0905-0713
29	09872-20094	2	1	PLUNGER-PEN HOLDER	28480	09872-20094
30	09872-20087	3	1	PLUNGER-PEN SELECT	28480	09872-20087
31	2360-0195	0	1	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
32	2190-0105	1	1	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0105
33	3050-0066	8	1	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0066
34	09872-00518	3	1	BRACKET, X-LIMIT SWITCH	28480	09872-00518
35	09872-00094	0	1	ADJUST,X-LIMIT SWITCH	28480	09872-00094
36	3101-1082	9	1	ACTUATOR-SW STR LVR .72-IN-LG	28480	3101-1082
37	3101-2007	0	1	SWITCH-SENS SPDT SUBMIN 7A 250VAC	28480	3101-2007
38	2190-0014	1	1	WASHER-LK INTL T NO. 2 .069-IN-ID	28480	2190-0014
39	0520-0129	8	1	SCREW-MACH 2-56 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
40	09872-60577	0	1	WIRE ASSEMBLY	28480	09872-60577
41	09872-60376	7	1	LIMIT SWITCH ASSY INCLUDES 37 & 40	28480	09872-60376
42	1460-1558	2	1	SPRING-CPRSN .18-IN-OD .62-IN-DA-LG SST	28480	1460-1558
43	3050-0105	6	1	WASHER-FL MTLC NO. 4 .125-IN-ID	28480	3050-0105
44	2200-0757	2	1	SCREW-MACH 4-40 .688-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
45	09872-60482	6	1	STABLE BAR ASSEMBLY	28480	09872-60482
46	2190-0017	4	1	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
47	2510-0101	7	1	SCREW-MACH 8-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
48	09872-40482	4	1	BRACKET-CAPPER	28480	09872-40482
49	4320-0298	2	1	PEN CAP-RUBBER	28480	4320-0298
50	1460-0176	8	1	SPRING-EXT .25-IN-OD MUW CD	28480	1460-0176
51	1460-1315	9	1	SPRING-EXT .138-IN-OD SST PSWT	28480	1460-1315
52	09872-60377	8	1	CABLE X-LIMIT INCLUDES ITEMS 31 THROUGH 39	28480	09872-60377

PLEASE RETURN TO -
ELECTRONIC STORE
DEPARTMENT OF
ELECTRICAL ENGINEERING
UNIVERSITY OF MELBOURNE

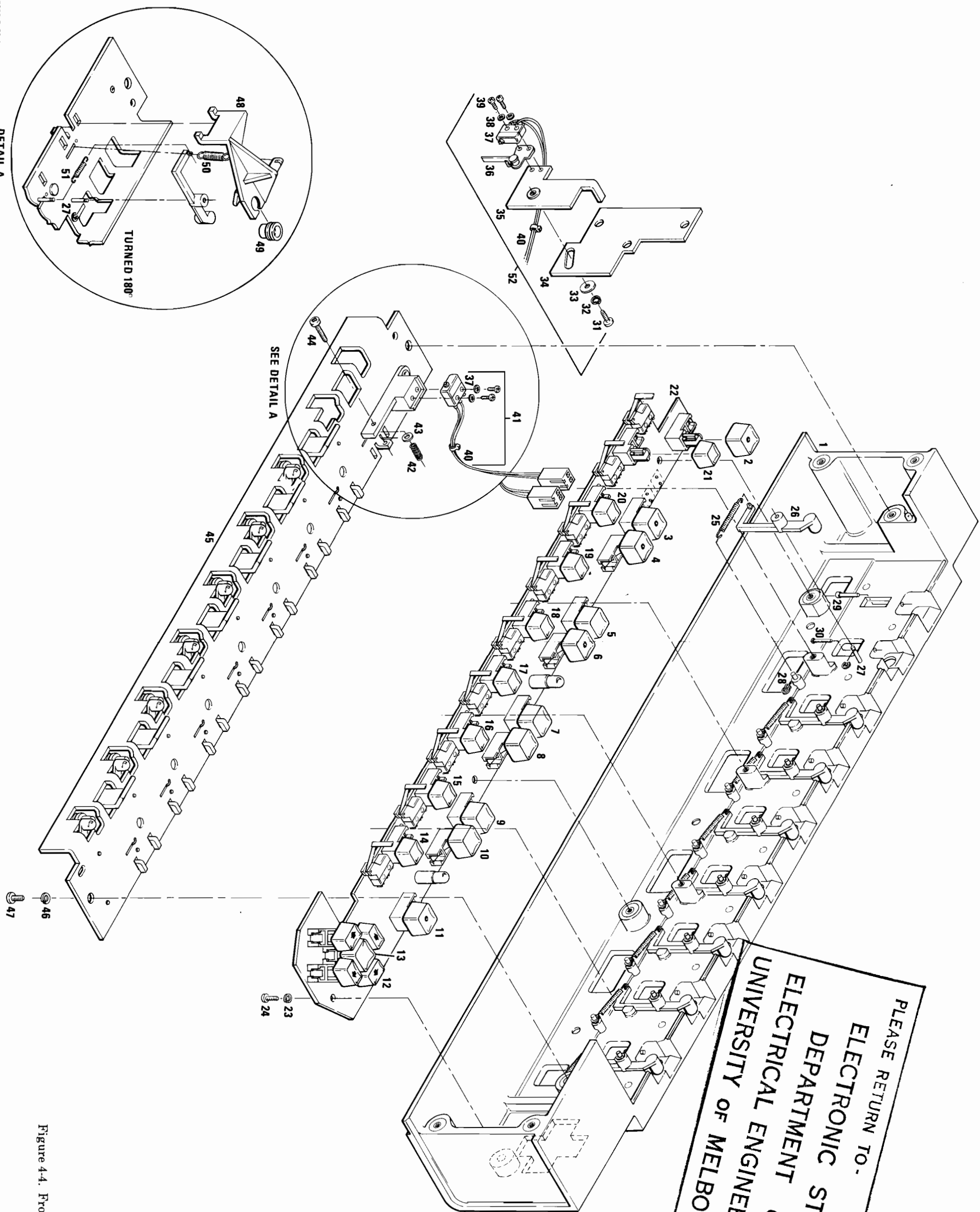


Figure 4.4. Front Panel Assembly

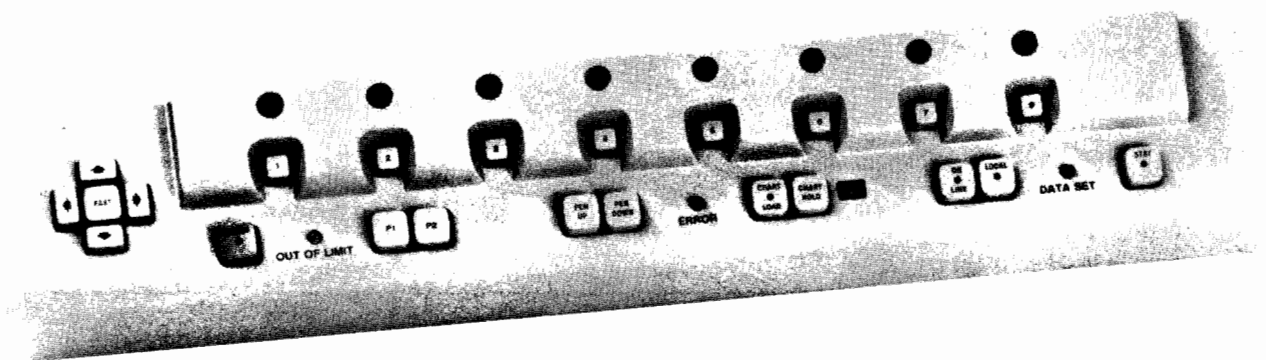


Table 4-13. Code List of Manufacturers

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
0003J	Nippon Electric Co.		
00853	Sangamo Electric Co., S. Carolina Div.	Pickens, SC	29671
01121	Allen-Bradley Co.	Milwaukee, WI	53204
01295	Texas Instruments Inc., Semiconductor Components Div.	Dallas, TX	75222
0192B	RCA Corp., Solid State Div.	Somerville, NJ	08876
04713	Motorola Semiconductor Products	Phoenix, AZ	85062
07263	Fairchild Semiconductor Div.	Mountain View, CA	94042
17856	Siliconix Inc.	Santa Clara, CA	95054
18324	Signetics Corp.	Sunnyvale, CA	94086
24546	Corning Glass Works (Bradford)	Bradford, PA	16701
27014	National Semiconductor Corp.	Santa Clara, CA	95051
28480	Hewlett-Packard Co., Corporate Headquarters	Palo Alto, CA	94304
32997	Bourns Inc., Trimpot Products Div.	Riverside, CA	92507
52840	Western Digital Corp.	Newport Beach, CA	92626
56289	Sprague Electric Co.	North Adams, MA	01247
72136	Electro Motive Corp., Sub. IEC	Williamantic, CT	06226

Table 4-14. Reference Designations and Abbreviations

REFERENCE DESIGNATIONS			
A..... assembly	E..... miscellaneous electrical part	P..... electrical connector (movable portion); plug	V..... electron tube
AT..... attenuator; isolator; termination	F..... fuse	Q..... transistor; SCR; triode thyristor	VR..... voltage regulator; breakdown diode
B..... fan; motor	FL..... filter	R..... resistor	W..... cable; transmission path; wire
BT..... battery	H..... hardware	RT..... thermistor	X..... socket
C..... capacitor	HY..... circulator	S..... switch	Y..... crystal unit (piezo-electric or quartz)
CP..... coupler	J..... electrical connector (stationary portion)	T..... transformer	Z..... tuned cavity; tuned circuit
CR..... diode; diode thyristor; varactor	K..... relay	TB..... terminal board	
DC..... directional coupler	L..... coil; inductor	TC..... thermocouple	
DL..... delay line	M..... meter	TP..... test point	
DS..... annunciator; signaling device (audible or visual); lamp; LED	MP..... miscellaneous mechanical part	U..... integrated circuit; microcircuit	

ABBREVIATIONS			
A..... ampere	COEF..... coefficient	ELECT..... electrolytic	kg..... kilogram
ac..... alternating current	COM..... common	ENCAP..... encapsulated	kHz..... kilohertz
ACCESS..... accessory	COMP..... composition	EXT..... external	kΩ..... kilohm
ADJ..... adjustment	COMPL..... complete	F..... farad	kV..... kilovolt
A/D..... analog-to-digital	CONN..... connector	FET..... field-effect transistor	lb..... pound
AF..... audio frequency	CP..... cadmium plate	F/F..... flip flop	LC..... inductance-capacitance
AFC..... automatic frequency control	CRT..... cathode-ray tube	FH..... flat head	LED..... light-emitting diode
AGC..... automatic gain control	CTL..... complementary transistor logic	FIL H..... fillister head	LF..... low frequency
AL..... aluminum	CW..... continuous wave	FM..... frequency modulation	LG..... long
ALC..... automatic level control	cw..... clockwise	FP..... front panel	LH..... left hand
AM..... amplitude modulation	D/A..... digital-to-analog	FREQ..... frequency	LIM..... limit
AMPL..... amplifier	dB..... decibel	FXD..... fixed	LIN..... linear taper (used in parts list)
APC..... automatic phase control	dBm..... decibel referred to 1 mW	g..... gram	lin..... linear
ASSY..... assembly	dc..... direct current	GE..... germanium	LK WASH..... lock washer
AUX..... auxiliary	deg..... degree (temperature interval) or difference	GHZ..... gigahertz	LO..... low; local oscillator
avg..... average	°..... degree (plane angle)	GL..... glass	LOG..... logarithmic taper (used in parts list)
AWG..... American wire gauge	°C..... degree Celsius (centigrade)	GRD..... ground(ed)	log..... logarithmic
BAL..... balance	°F..... degree Fahrenheit	H..... henry	LPF..... low pass filter
BCD..... binary coded decimal	°K..... degree Kelvin	h..... hour	LV..... low voltage
BD..... board	DEPC..... deposited carbon	HET..... heterodyne	m..... metre (distance)
BE CU..... beryllium copper	DET..... detector	HEX..... hexagonal	mA..... milliampere
BFO..... beat frequency oscillator	diam..... diameter	HD..... head	MAX..... maximum
BH..... binder head	DIA..... diameter (used in parts list)	HDW..... hardware	MΩ..... megohm
BKDN..... breakdown	DIFF AMPL..... differential amplifier	HF..... high frequency	MEG..... meg (10 ⁶) (used in parts list)
BP..... bandpass	div..... division	HG..... mercury	MET FLM..... metal film
BPF..... bandpass filter	DPDT..... double-pole, double-throw	HI..... high	MET OX..... metallic oxide
BRS..... brass	DR..... drive	HP..... Hewlett-Packard	MF..... medium frequency; microfarad (used in parts list)
BWO..... backward-wave oscillator	DSB..... double sideband	HPF..... high pass filter	MFR..... manufacturer
CAL..... calibrate	DTL..... diode transistor logic	HR..... hour (used in parts list)	mg..... milligram
ccw..... counterclockwise	DVM..... digital voltmeter	HV..... high voltage	MHz..... megahertz
CER..... ceramic	ECL..... emitter coupled logic	HZ..... Hertz	mH..... millihenry
CHAN..... channel	EMF..... electromotive force	IC..... integrated circuit	mho..... mho
cm..... centimetre	EDP..... electronic data processing	ID..... inside diameter	MIN..... minimum
CMO..... cabinet mount only		IF..... intermediate frequency	min..... minute (time)
COAX..... coaxial		IMPG..... impregnated	'..... minute (plane angle)
		in..... inch	MINAT..... miniature
		INCD..... incandescent	mm..... millimetre
		INCL..... include(s)	MOD..... modulator
		INP..... input	
		INS..... insulation	
		INT..... internal	

NOTE

All abbreviations in the parts list will be in uppercase.

Table 4-14. Reference Designations and Abbreviations (Continued)

MOM..... momentary	ns.....nanosecond	PWN pulse-width modulation	SSTstainless steel
MOS..... metal-oxide semiconductor	nW.....nanowatt	PWV.....peak working voltage	STLsteel
ms..... millisecond	OBD..... order by description	RCresistance-capacitance	SQsquare
MTG..... mounting	OD..... outside diameter	RECT.....rectifier	SWR...standing-wave ratio
MTR.....meter (indicating device)	OH..... oval head	REF.....reference	SYNC.....synchronize
mV millivolt	OP AMPL operational amplifier	REG.....regulated	T....timed (slow-blow fuse)
mVacmillivolt, ac	OPT..... option	REPL.....replaceable	TA tantalum
mVdcmillivolt, dc	OSC..... oscillator	RFradio frequency	TC temperature coefficient
mVpk..... millivolt, peak	OX..... oxide	RFI..... radio frequency interference	TD time delay
mVp-p..... millivolt, peak-to-peak	Ω..... ohm	RH.....round head; right hand	TERM..... terminal
mVrms..... millivolt, rms	P..peak (used in parts list)	RLC.....resistance-inductance-capacitance	TFT... thin-film transistor
mW..... milliwatt	PAM.....pulse-amplitude modulation	RMOrack mount only	TGLtoggle
MUX.....multiplex	PCprinted circuit	rms..... root-mean-square	THD thread
MYmylar	PCM.....pulse-code-modulation; pulse-count modulation	RND..... round	THRU through
μA.....microampere	PDM..... pulse-duration modulation	ROM ...read only memory	TItitanium
μF.....microfarad	pF.....picofarad	R & P rack and panel	TOLtolerance
μH..... microhenry	PIV.. peak inverse voltage	RWV reverse working voltage	TRIM..... trimmer
μmho.....micromho	pk peak	Sscattering parameter	TSTR..... transistor
μs.....microsecond	PNPpositive-negative-positive	s..... second (time)	TTL..... transistor logic
μV.....microvolt	P/Opart of	".....second (plane angle)	U..... micro (10 ⁻⁶) (used in parts list)
μVac.....microvolt, ac	POLY..... polystyrene	S-B.....slow-blow (fuse) (used in parts list)	UF..... microfarad (used in parts list)
μVdc.....microvolt, dc	PORC..... porcelain	SCR..... silicon controlled rectifier; screw	UHF.. ultrahigh frequency
μVpk..... microvolt, peak	POS... positive; position(s) (used in parts list)	SE.....selenium	UNREG..... unregulated
μVp-p..... microvolt, peak-to-peak	POSN..... position	SECT..... sections	V..... volt
μVrms..... microvolt, rms	POT..... potentiometer	SEMICON semiconductor	VA.....voltampere
μW.....microwatt	p-p..... peak-to-peak	SHF.. superhigh frequency	Vac..... volts, ac
nAnanoampere	PP..... peak-to-peak (used in parts list)	SI.....silicon	VAR..... variable
NC..... no connection	PPM..... pulse-position modulation; parts per million	SIL.....silver	Vdc..... volts, dc
N/C.....normally closed	PREAMPL.....preamplifier	SL..... slide	VDCW ..volts, dc, working (used in parts list)
NEG..... negative	PRF..... pulse-repetition frequency	SNR ..signal-to-noise ratio	Vpkvolts, peak
nF..... nanofarad	PRR ..pulse repetition rate	SPDTsingle-pole, double-throw	Vp-p... volts, peak-to-peak
NI PL..... nickel plate	ps..... picosecond	SPG..... spring	Vrms..... volts, rms
N/O..... normally open	PT..... point	SR..... split ring	VTVM..... vacuum-tube voltmeter
NOM..... nominal	PTM..... pulse-time modulation	SPST.....single-pole, single-throw	V(X)..... volts, switched
NORM..... normal		SSBsingle sideband	W watt
NPN.....negative-positive-negative			W/ with
NPO.....negative-positive zero (zero temperature coefficient)			WIV..... working inverse voltage
NRFR .. not recommended for field replacement			WW..... wirewound
NSR not separately replaceable			W/O..... without
			Z _o characteristic impedance

NOTE

All abbreviations in the parts list will be in uppercase.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10 ¹²
G	giga	10 ⁹
M	mega	10 ⁶
k	kilo	10 ³
da	deka	10
d	deci	10 ⁻¹
c	centi	10 ⁻²
m	milli	10 ⁻³
μ	micro	10 ⁻⁶
n	nano	10 ⁻⁹
p	pico	10 ⁻¹²
f	femto	10 ⁻¹⁵
a	atto	10 ⁻¹⁸

Table 4-15. Check Digit Calculation

Part No.	Value	Values for Column 2	
Col. 1	Col. 2	Part No.	Value
1		A	3
2		B	4
3		C	5
4		D	6
5		E	7
6		F	8
7		G	9
8		H	0
9		I	1
10		J	9
11		K	0
12		L	1
13		M	2
14		N	3
15		O	4
		P	5
		Q	6
		R	7
		S	6
		T	7
		U	8
		V	9
		W	0
		X	1
		Y	2
		Z	3
		.	5
		/	7
		-	6
		blank	4

Part No.	Value	Part No.	Value
1		0	0
2		1	1
3		2	2
4		3	3
5		4	4
6		5	5
7		6	6
8		7	7
9		8	8
10		9	9

EXAMPLE

Part No.	Col. 1	Col. 2	Col. 3
1	0	0	0
2	6	6	12
3	9	9	9
4	8	8	16
5	-	6	6
6	7	7	14
7	2	2	2
8	1	1	2
9	8	8	8
10		4	8
11		4	4
12		4	8
13		4	4
14		4	8
15		4	4
		7	5

Check Digit

Instructions:

- 1 - Write part number in column 1
- 2 - Fill in value squares (column 2), including blanks.
- 3 - Carry over number from odd numbered squares.
- 4 - Double number from even numbered squares. Use last digit.
- 5 - Total column 3. Last digit of answer is check digit.

9872-A-215-1



SECTION V

MANUAL CHANGES

5-1. INTRODUCTION

5-2. This section contains information needed to adapt this manual to plotters with serial prefixes lower than the one shown on the title page.

5-3. When revised pages are inserted in the manual, the old pages that are removed because of a modification to the plotter must be filed in Section V. This will provide a history of plotter modifications by serial prefix number. Insert the old pages after the CHANGE page (for this section) found in the Update Package. The CHANGE page identifies the modification and the serial prefix at which the modification occurred and lists the pages involved. The information on the old pages applies to plotters with serial prefixes lower than the one at which the modification occurred. Old pages that were revised because of errors may be discarded.

5-4. When applying this Manual Change information to a plotter with a serial prefix number lower than

the one at which the latest change occurred, begin with the latest change and work back to and including the change that lists the serial prefix number of the plotter on hand. Modifications which occurred before this prefix number have been incorporated into the plotter.

5-5. MANUAL CHANGES

5-6. CHANGE 1

5-7. Change 1 incorporates an improved Y-axis cable system.

5-8. CHANGE 2

5-9. Change 2 incorporates a more rugged relay on the Paper Advance Feature Front Panel PCA, A1. Refer to Appendix A of this manual for details.

CHANGE 1
COVER SHEET
Serial Number Prefixes Below 2148A

Change 1 modified the Y-axis pulleys, pulley brackets and tensioning system. For plotters with serial number prefixes below 2148A, refer to the following pages for procedures and part numbers associated with the Y-axis drive cable.

INSERT ALL PAGES REPLACED BY CHANGE 1 BEHIND THIS PAGE.

SECTION VI

SERVICE

6-1. INTRODUCTION

6-2. This section contains servicing information for the HP Model 7220C and 7221C Graphics Plotters. Included is a theory of operation, troubleshooting information, general repair and parts replacement information, and service sheets which include schematics, parts location illustrations, and waveforms.

6-3. SIMPLIFIED THEORY OF OPERATION

6-4. The simplified theory of operation is provided as an introduction to the plotter system at a simplified block diagram level. See Figure 6-1, HP Model 7220C/7221C Simplified Block Diagram. The plotter is designed to be hardwired between a host computer and a data terminal. Alternatively, the plotter may be interfaced to the host computer through a data set (modem). See Figure 6-2.

6-5. The Processor circuitry controls data transfer in the plotter. Timing signals are also generated in the Processor circuits.

6-6. In the Memory circuitry, the Read Only Memories (ROMs) store the instructions and data constants which the processor accesses and interprets. The Random Access Memories (RAMs) are used for temporary storage of processor calculations and for input/output data.

6-7. The Internal I/O circuitry provides an interface between the Front Panel PCA circuitry and the processor bus and also passes velocity information from the processor to the motor driver circuitry. If the paper advance feature is installed, the internal I/O also acts as the interface for these circuits.

6-8. The Interpolator circuits accept velocity information generated in the processor and convert this information from digital format to the stepping voltages required by the motor drivers for the X- and Y-axis motors.

6-9. The motor drivers provide both voltage and power amplification for the analog signals generated by the Interpolator circuits. These signals drive the X- and Y-axis plotter motors.

6-10. The Front Panel circuits provide a means of manually entering X- and Y-position data, reset, pen control, and chart hold data to the processor. The front panel indicators make certain status information available to the operator. Switches mounted in the pen stables provide information to the processor as to which stables contain pens and if a pen is present in the plotter arm pen holder. X- and Y-initialize switches are also connected through the Front Panel PCA.

6-11. The power supply assembly converts the input ac line voltage into the necessary dc voltages to operate the plotter. The power supply also contains the circuitry for the RESET pulse and for the electrostatic paper hold down circuits.

6-12. FUNCTIONAL THEORY OF OPERATION

6-13. The functional theory of operation is a detailed block diagram description (see Figure 6-43) which includes a functional description of each block of the Detailed Block Diagram.

6-14. INTERCONNECT PCA A1 THEORY OF OPERATION

6-15. The Interconnect PCA A1 houses the two EIA connectors to interface the plotter with the terminal and the computer or modem. See Service Sheet 1.

6-16. The Interconnect PCA also houses the function switches S1 and S2 and the baud rate switch S3. The function switches allow the operator to select the type of interface and to perform test functions. The six segments of the function switch are assigned as follows:

- a. Confidence Test Switch — When activated, this switch causes the plotter to execute its Self Test program which is used to verify that the plotter is operational.
- b. DTR Bypass Switch — With this switch in the DTR BYPASS position, the DATA TERMINAL READY (DTR) signal from the terminal is supplied directly to the DTR output to the modem. In the NORMAL position, the plotter supplies the DTR signal.
- c. Parity ON/OFF Switch — With this switch in the OFF position, no parity checking occurs in the plotter. If this switch is set to the ON position, parity checking takes place as determined by the ODD/EVEN switch.
- d. Parity ODD/EVEN Switch — With this switch in the ODD position, the plotter responds to odd check bits.
- e. Duplex HALF/FULL Switch — The duplex switch controls the echo feature at the TERMINAL connector. When set to FULL, the plotter provides an echo to the terminal. When set to HALF, the echo is suppressed.
- f. Hardwire Modem Switch — With this switch set to the hardwire position, CLEAR TO SEND

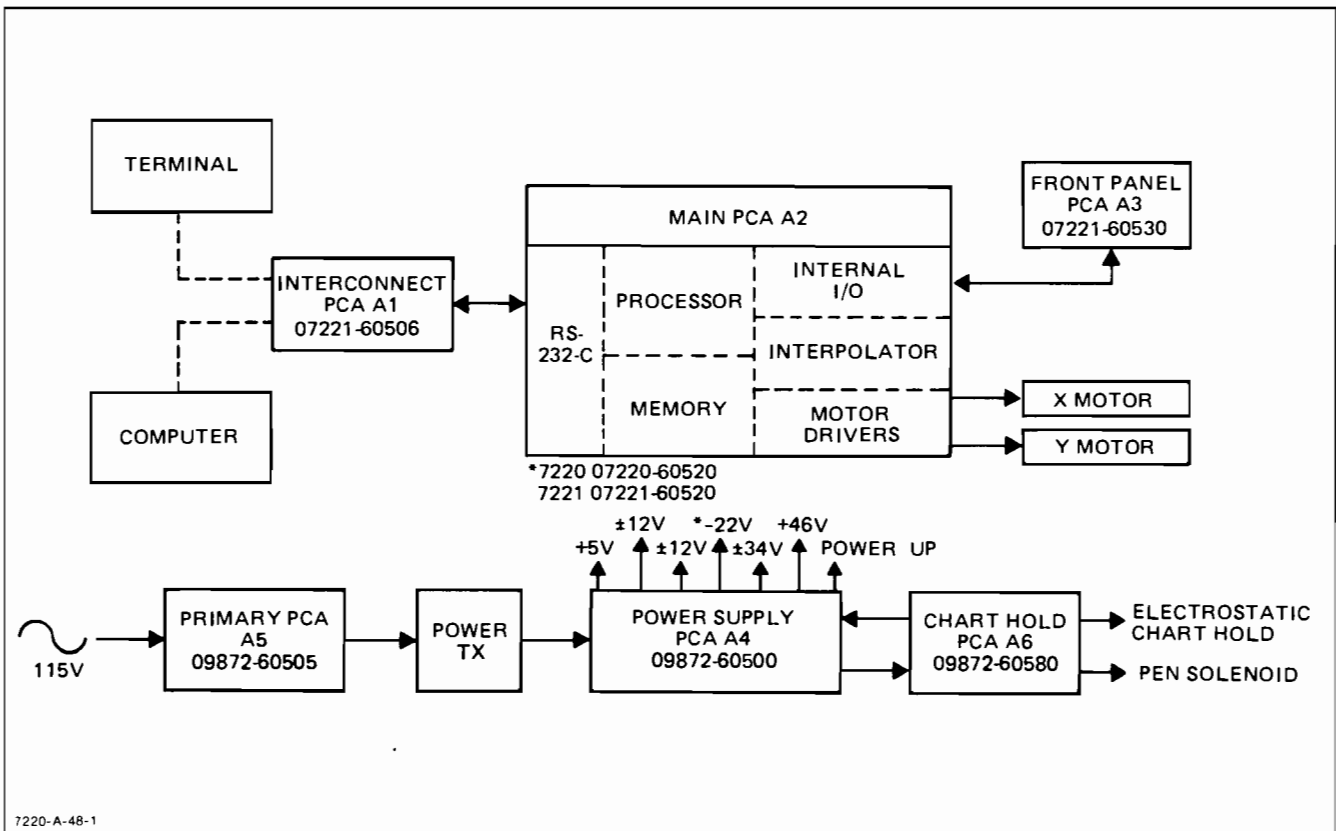


Figure 6-1. HP Model 7220C/7221C Simplified Block Diagram

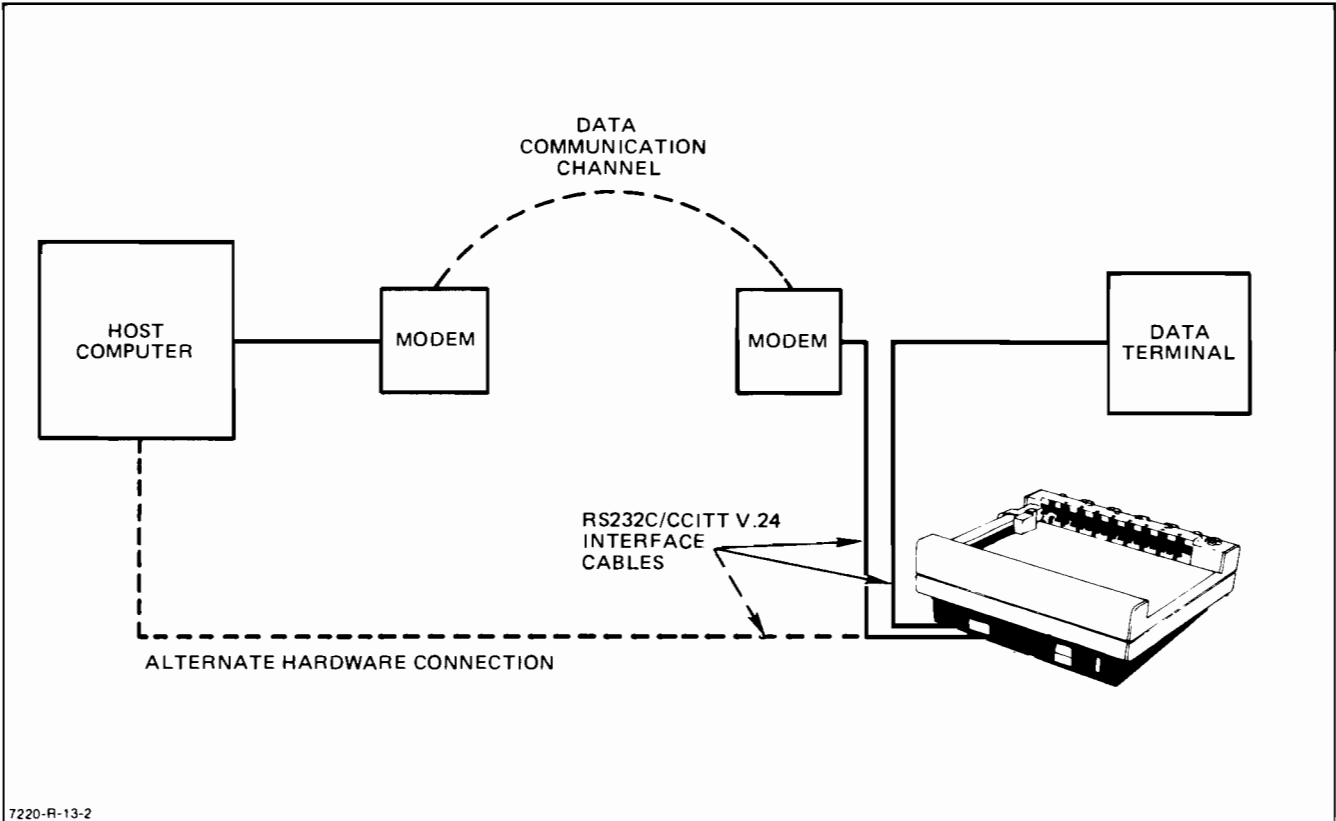


Figure 6-2. Typical Plotter Installation

and DATA SET READY are ignored. In the modem position, these lines are utilized in the usual manner.

The baud rate switch S3 selects one of eight internally generated baud rates to match the plotter to the baud rate of the system being used.

6-17. MAIN PCA A2 RS-232-C CIRCUITS

6-18. The RS-232-C/CCITT V.24 electronic circuits have been designed to comply with the specifications set forth in the Electronic Industries Association (EIA) Standard RS-232-C. See Service Sheet 2. This standard applies to the interconnection of data terminal equipment (DTE) and data communication equipment (DCE) using serial binary data interchange. The EIA RS-232-C/CCITT V.24 Standard defines the 25 wires, and their functions, that must be used in the connecting cables between the plotter and the data terminal/host computer. However, only seven basic wires are used in the plotter, and these are coupled through the Interconnect PCA A1 to the RS-232-C circuitry of the Main PCA A2. Refer to Table 6-1. The remaining wires bypass the plotter by being hardwired between the MODEM port (connector) and the TERMINAL port located on the rear panel.

6-19. The four major functions of the RS-232-C circuitry on the Main PCA are:

- a. Routing data according to the operating mode selected for the plotter, either LINE, LOCAL, or STANDBY mode (see Figure 6-3).
- b. Converting received data from its serial binary format to an eight-bit parallel, byte serial format for use in the internal circuits of the plotter.

- c. Converting data to be transmitted from the plotter into a serial binary format.
- d. Generating the clock signal for timing of the asynchronous type of data communication.

6-20. Data routing through the plotter is determined by the operating mode selected, as follows (refer to Table 6-2):

POWER OFF — TERMINAL port and MODEM port are connected in parallel through the deenergized relay switches. The plotter acts as a through connector in the communications channel between the data terminal and the host computer.

STANDBY — Data is routed between the MODEM connector and the TERMINAL connector through the Processor circuitry of the Main PCA A2.

LOCAL — Data from the terminal is routed to the plotter buffer. Plotter responses are routed to the terminal. Modem lines are set low (off).

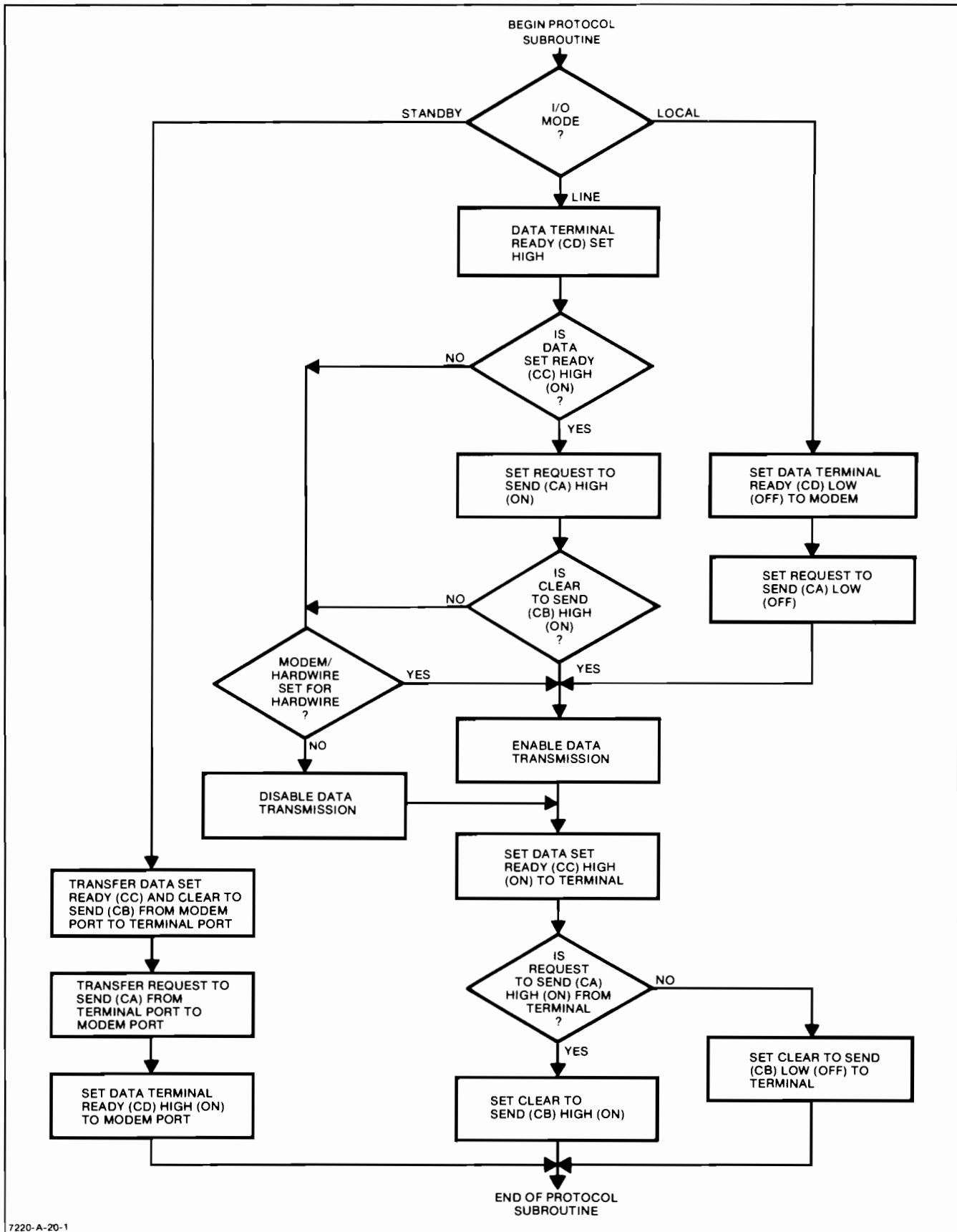
LINE — The plotter scans data received from the host computer for a PLOTTER ON or a PLOTTER OFF instruction. With a PLOTTER ON instruction, data from the host computer is routed to the plotter. With a PLOTTER OFF instruction, the data is routed to the terminal.

6-21. All data generated by the plotter is routed to the modem connector. Data generated by the terminal is routed through the plotter to the MODEM connector on a noninterference basis, so that data transmitted by the plotter will not be interrupted by the terminal data.

Table 6-1. RS-232-C/CCITT V.24 Wires/Signals Used in the Graphic Plotter

WIRE/SIGNAL NAME	MNEMONIC	FUNCTION
Transmitted data	BA	outgoing data from the plotter
Received data	BB	incoming data to the plotter
Request to send	CA	plotter activated to tell the modem to prepare to receive and retransmit data from the plotter
Clear to send	CB	activated by the modem to tell the plotter that it is ready to receive and retransmit data from the plotter
Data set ready	CC	activated by the modem to tell the plotter that the modem is operational
Data terminal ready	CD	plotter activated to tell the modem that the plotter is operational
Received line signal detector	CF	not monitored by the plotter — set high to the terminal from the plotter

The above table is true when the plotter is in the ON LINE mode, which causes it to be seen as a terminal by the modem.



7220-A-20-1

Figure 6-3. Plotter Modes

Table 6-2. Plotter Modes and Line States

PLOTTER MODE	DATA SET (MODEM) PORT SIGNAL LINES		TERMINAL PORT SIGNAL LINES	
	RECEIVE LINES	DRIVEN LINES	RECEIVE LINES	DRIVEN LINES
Standby	Data Set Ready (CC) turns front panel data lamp on.	With DTR Bypass/ Normal switch set to Normal, sets Data Terminal Ready (CD) high (ON) to modem.		Received Line Signal Detector (CF)
Local	Not monitored. Data Set Ready (CC) turns front panel data lamp on.	Sets to low (OFF) Data Terminal Ready (CD) Request to Send (CA) Transmitted Data (BA)	Request to Send (CA) is monitored.	Sets to high (ON) state: Data Set Ready (CC) Clear to Send (CB) if Request to Send (CA) is high. Received Line Signal Detector (CF).
Line	Data Set Ready (CC) turns front panel data lamp on. Clear to Send (CB) is monitored if Data Set Ready (CC) is high (ON). Received Data (BB) is routed to plotter if plotter is programmed ON and through plotter to terminal if OFF.	Data Terminal Ready (CD) is set high (ON). Request to Send (CA) is set high if Data Set Ready (CC) is high (ON). Transmitted Data (BA) is allowed to be set high if Data Set Ready (CC) and Clear to Send (CB) are high (ON).	Request to Send (CA) is monitored. If a Break Signal is received on transmitted data (BA), plotter generates a 200-millisecond break on modem Transmitted Data (BA) line. Data received is sent to host computer if no output from plotter is pending or in progress.	Sets to high state (ON): Data Set Ready (CC) Clear to Send (CB) if Request to Send (CA) is high (ON). Received Line Signal Detector (CF).

6-22. MAIN PCA A2 PROCESSOR CIRCUITRY

6-23. The plotter microprocessor is a 16-bit word controller which essentially accesses and processes instructions from memory. It also performs mathematical operations and controls the flow of data on the plotter bus. The microprocessor circuitry also contains a clock generator, memory timing and decoding circuits, bi-directional drivers, register decoders, and interrupt and self test registers. Refer to Table 6-3 for microprocessor definitions. See Service Sheet 3.

6-24. CLOCK GENERATOR. The output of the crystal controlled 10 MHz oscillator provides the clock input for the divide by two flip-flop U60A which in turn provides two 5 MHz pulsed inputs to the clock driver circuit. The clock driver U63 outputs are MOS level non-overlapping clock pulses referred to as

Phase 1 (PH1) and Phase 2 (PH2). These two signals provide all timing for the plotter and the clock drive to the microprocessor.

6-25. MICROPROCESSOR. Using the clock input, the microprocessor issues the appropriate timing signals to initiate and maintain the proper sequence of events required for processing data and instructions. The activities of the microprocessor are cyclical; fetching an instruction, performing the required operations, and then fetching the next instruction in an orderly, timed sequence.

6-26. The main timing signal from the microprocessor is Start Memory (STM), indicating the start of a memory read or write cycle. The falling edge of STM is used to latch the memory address into the 3-state Address Latches U52 and U53. The rising edge of Synchronous Memory Complete (SMC) indicates the

Table 6-3. Microprocessor Definitions

MNEMONIC	NAME	DEFINITION
SYNC	SYNCHRONOUS	A synchronizing signal generated by the microprocessor denotes when microprocessor is in an Instruction Fetch cycle.
$\overline{\text{STM}}$	$\overline{\text{START MEMORY}}$	A signal generated by the microprocessor which is essentially the system timing signal. The signal's leading edge indicates that there is a stable address on the bus. When the signal is true, it indicates a memory reference is in process.
$\overline{\text{UMC}}$	$\overline{\text{UNSYNCHRONOUS MEMORY COMPLETE}}$	A handshake signal indicating that a memory or a register is ready to process data.
SMC	SYNCHRONOUS MEMORY COMPLETE	A signal generated by the microprocessor when data, or an instruction, is on the bus. The trailing edge indicates that the microprocessor has accepted data. $\overline{\text{UMC}}$ must be present for the microprocessor to generate SMC.
$\overline{\text{PDR}}$	$\overline{\text{PROCESSOR DRIVING}}$	A signal generated by the microprocessor denotes when the microprocessor is driving the MOS bus.
RD	READ	A microprocessor generated signal indicating when memory is in a READ/WRITE state.
RAL	REGISTER ACCESS LINE	A microprocessor generated signal to decode registers 20-27.
$\overline{\text{PON}}$	$\overline{\text{POWER ON}}$	A power-up signal to the microprocessor. μp beings program execution at 40 μs .
$\overline{\text{INT}}$	$\overline{\text{INTERRUPT}}$	A signal from the Interpolator section signifying it is ready to receive new velocity data. The $\overline{\text{INT}}$ signal forces the microprocessor to execute, "JSM10,I" instruction.
$\overline{\text{FLG}}$	$\overline{\text{FLAG}}$	A Self-Test switch input which, when actuated, causes system to go to the next step.
$\overline{\text{STS}}$	$\overline{\text{STATUS}}$	Indicates on power-up whether the system is in normal operation or Self Test.
IFSTM	INSTRUCTION FETCH START MEMORY	A signal where the rising edge denotes address of an instruction.
$\overline{\text{IAK}}$	$\overline{\text{INTERRUPT (READ 10) ACKNOWLEDGE}}$	Acknowledges that an interrupt has been accepted.
XSMC	EXTENDED SYNCHRONOUS MEMORY COMPLETE	Extends the SMC to allow the time needed by MOS memories to stabilize data.

end of memory access cycle, with the data being latched into either the microprocessor (READ cycle) or into RAM (WRITE cycle). In order to satisfy the access time requirements of RAM and some of the Internal I/O circuitry, SMC is extended by the use of Unsynchro-nous Memory Complete $\overline{\text{UMC}}$ to generate Extended Synchronous Memory Complete (XSMC). The microprocessor bus is buffered by the use of the bidirectional drivers U46 and U47. The MOS (memory) bus is further isolated from the TTL bus by the use of bidirectional drivers U49 and U50.

6-27. The microprocessor uses a single level of interrupt to update the interpolator section. This Interrupt Request is synchronized to the microprocessor instruction fetch cycle by the latch U60B, gate U31A, and latch U28B. See Figure 6-4.

6-28. SELF TEST CIRCUITRY. The built-in Self Test provides a means of locating a defective stage or component and is an aid in performing certain alignments. The circuitry consists of the CONTINUE switch S3, the Self Test switch S4-2, RESET switch S5, U68, and the Self Test LEDs.

6-29. REGISTER DECODERS. Register selection is determined by the data bits A0-A4 and the states of the REGISTER ACCESS LINE (RAL), SYNCHRO-NOUS MEMORY COMPLETE (SMC), EXTENDED SYNCHRONOUS MEMORY COMPLETE (XSMC), and READ lines from the microprocessor. The functions of the Register lines are listed in Table 6-4.

6-30. MOS AND TTL BUS DRIVERS. The MOS and TTL bus drivers are 3-state bidirectional bus drivers

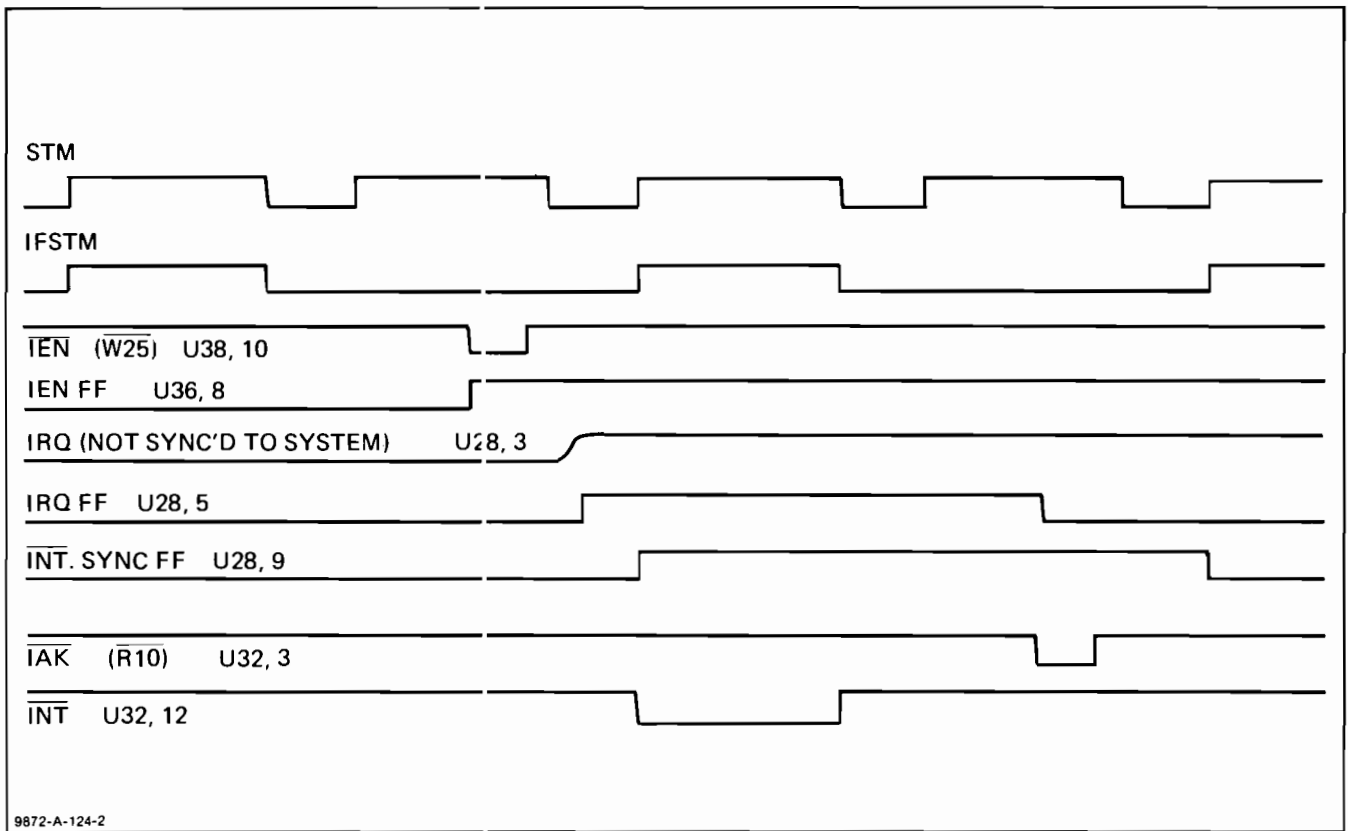


Figure 6-4. Interrupt Request Timing

Table 6-4. Register Functions

REGISTER	OPERATION	FUNCTION
20	R	Read Self Test
21	W	Write to Interface
	R	Read Interface
22	W	Write to Control
	R	Read Control.
23	W	Write to Paper Advance
	R	Read Front Panel & Paper Advance
24	W	Not Used
	R	
25	W	Inhibit Interrupt
	R	Enable Interrupt
26	W	Write Front Panel
	R	Read Front Panel
27	W	Write Front Panel
	R	Read Front Panel

(BIBs) which provide a two-way data transmission between the microprocessor and the various circuits of the plotter. BIBs U46 and U47 buffer the microprocessor bus from the MOS bus which interfaces with the Memory circuits and the TTL BIBs. These BIBs are enabled by DELAYED EXTENDED SYNCHRONOUS MEMORY COMPLETE (DXSMC). The direction that these BIBs are driving is controlled by the microproc-

essor generated PROCESSOR DRIVING (\overline{PDR}). When \overline{PDR} is low, the BIBs drive out to the bus, and with \overline{PDR} high, the BIBs drive toward the microprocessor. Further buffering is provided for the RS-232-C circuitry and the front panel by the BIBs U49 and U50. Direction control for these BIBs also comes from \overline{PDR} , while the enable signal is generated in the Memory Timing circuits.

6-31. **MEMORY TIMING.** The memory timing generates the necessary waveforms from the microprocessor control signals to insure proper timing for the memory and I/O data transfers. Figure 6-5 is a timing diagram of the memory control lines, while Table 6-1 defines the mnemonics.

6-32. A typical READ cycle begins when the microprocessor places an address on the bus. One clock period later, STM goes true indicating that the address is valid and that the address latches should store the information. One clock period after receipt of STM, the memory timing sends back UMC. At this time, the microprocessor removes the address from the bus. One half clock period later, XSMC goes high which allows the memory output drivers to be enabled. At the trailing edge of SMC, data must be stable in order for the microprocessor to store the data in its accumulator register. At the same time, the output drivers are disabled.

6-33. MAIN PCA A2 INTERNAL I/O CIRCUITRY

6-34. The Internal I/O circuitry provides buffered interconnection between the Front Panel PCA A3 and the Processor circuits. See Service Sheet 4. It also provides buffering for the signals to and from the paper advance feature, if one is installed. A front panel READ will put the status of the front panel switches on the plotter TTL bus. A front panel WRITE causes the selected front panel LEDs to light up. READ registers 23, 26, and 27 are used to put Front Panel PCA and paper advance data on the TTL bus, while WRITE registers 21, 23, and 27 are used to enable the LEDs on the front panel assembly and the paper advance control panel. These registers are stored in memory locations 20₈ through 27₈ and are decoded in the microprocessor circuitry by U33 and U38 using READ, RAL, and addresses A0-A2.

6-35. FRONT PANEL PCA A3

6-36. The Front Panel PCA A3 provides a means for the operator to set Chart Hold or Load, and to manually select a pen, control pen up and down, and to enter certain position data to the plotter. See Service Sheet 4. The operator may also receive status information concerning the plotter operation from the LEDs on the front panel. The Front Panel PCA circuits interface with the Main PCA A2 through the Internal I/O circuitry. The Front Panel PCA houses switches which indicate to the plotter which pen stables are loaded with pens, or if a pen is presently in the pen arm. The PCA also provides an interconnection for the X- and Y-limit switches.

6-37. MAIN PCA A2 MEMORY CIRCUIT

6-38. The memory capacity of the plotter is 9 k sixteen-bit words. See Service Sheet 5. The memory includes the following:

- a. **READ ONLY MEMORY (ROM)**
10 240 words of ROM. 10 k × 16
- b. **READ/WRITE RANDOM ACCESS MEMORY (RAM)**
1024 words of RAM. 1 k × 16
1024 words of optional RAM. 1 k × 16

6-39. **READ ONLY MEMORY.** The ROM consists of two 8 k by 8-bit wide mask programmable ROMs configured as 8 k of 16-bit wide memory and two 2 k by 8-bit ROMs configured as 2 k by 16. ROMs U55 and U56 are 8 k devices representing memory locations 0000₈ through 1777₈ and the ROMs U208 and U209 are 2 k devices representing locations 2000₈ through 2377₈. These ROMs contain the firmware instructions to drive the plotter and communicate with the controller through the I/O. Program execution begins at memory location 40₈ after the microprocessor receives the power-on pulse.

6-40. **RANDOM ACCESS MEMORY.** The RAM consists of four 1 k by 4 READ/WRITE MEMORIES U64, U65, U66, and U67 configured as 1 k by 16. The RAM is used as temporary storage for various plotter operations and as a buffer for incoming data. The RAM occupies memory locations 7600₈ through 7777₈. Sockets are provided for an additional 1 k of optional RAM, U212 through U215 representing memory locations 7400₈ through 7577₈.

6-41. **MEMORY CONTROL LOGIC.** The 15-bit memory address register consists of two 8-bit bistable latches which latch the address off the plotter bus on the rising edge of STM. The first 13 outputs are supplied to the 8 k ROMs to select specific memory locations, while the 2 k ROMs use address lines 0-11. The ROMs are enabled by addresses 13 and 14 along with STM, READ, AND R10 + RAL. The RAM address locations are accessed by the first 10 outputs of the address register. The devices are enabled by addresses 10 and 14 along with XSMC. The READ line determines if a READ or WRITE function is occurring.

6-42. MAIN PCA A2 INTERPOLATOR CIRCUITRY

NOTE

Due to the complexity of the Interpolator circuit, it will be described in somewhat more detail than the preceding circuits.

6-43. The Interpolator circuitry of the MAIN PCA receives the X- and Y-velocity data from the processor, integrates, and converts the data into analog signals for the Motor Driver circuits. See Service Sheet 6.

6-44. During the 1024 microsecond operating cycle, the motor position is updated eight times. This is accomplished by adding 1/8 of the input velocity word, which is an 8-bit, signed two's complement, with a maximum value of plus or minus decimal 90, to the position accumulator during each of the eight sub-cycles. The velocity word is added in these small increments to provide a smoother motor operation.

6-45. **OPERATING CYCLE.** The Interpolator operating cycle is begun with the positive transition of the Interrupt Request (IRQ) from U22. The microprocessor responds and the Interpolator Write (W26) latches the first half of the velocity word (bus 12-15) into one of four registers of the Input Data Register U25 as selected by the Address Bits (bus 0-1). See Figure 6-6. The latching of data into U25 is accomplished during the Y-axis portion of the eighth sub-cycle of the previous Interpolator cycle.

6-46. The first sub-cycle places the four Least Significant Bits (LSB) of the X-axis instruction on the inputs of the data selector U26. The data selector couples the

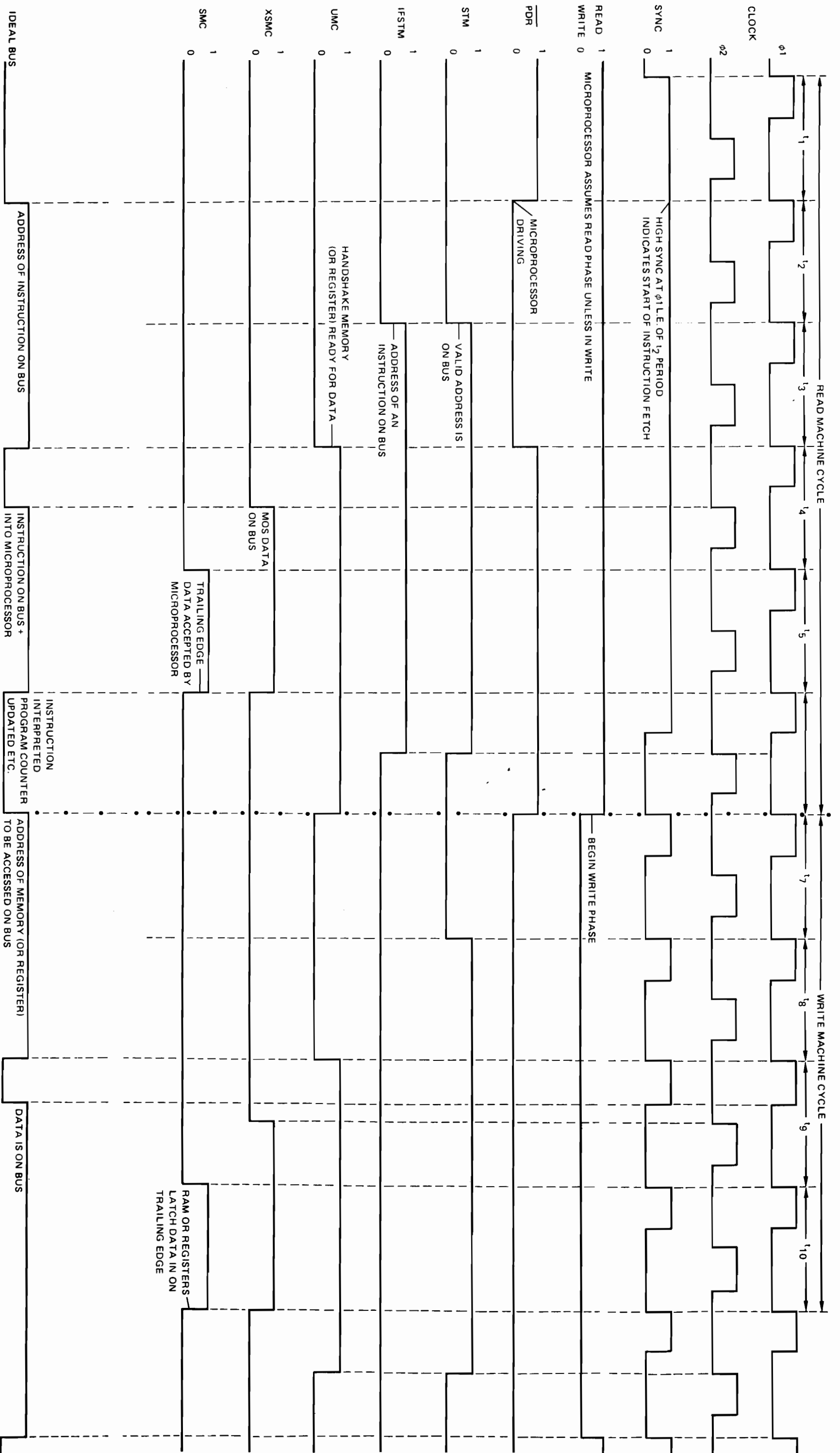


Figure 6

X LSB to the Y inputs of the adder U24. At this time, the Z inputs are the four LSB from the previous sub-cycle, input through U21. The output of U24 is the sum of the Y and Z inputs and the carry input (X) from the carry adder U27. If a carry-out from the previous summation in U24 exists, it is clocked through U27 and becomes a carry-in to U24 for the present sub-cycle. The carry input to U24 is set low every 16 clock pulses to assure that the carry is clear at the beginning of each new cycle.

6-47. The output from U24 is loaded into the four LSB registers of the X accumulator U19. The data transfer to U19 is accomplished when U19 is enabled by the write enable decoder U10. The decoder is enabled by the clock signal and a write signal from control ROM U20. See Figure 6-7.

6-48. Having stored the X-axis LSB in U19, the X-axis Most Significant Bits (MSB) are loaded into the adder U24. These are summed with the X MID SB from the preceding sub-cycle and stored in the MID SB

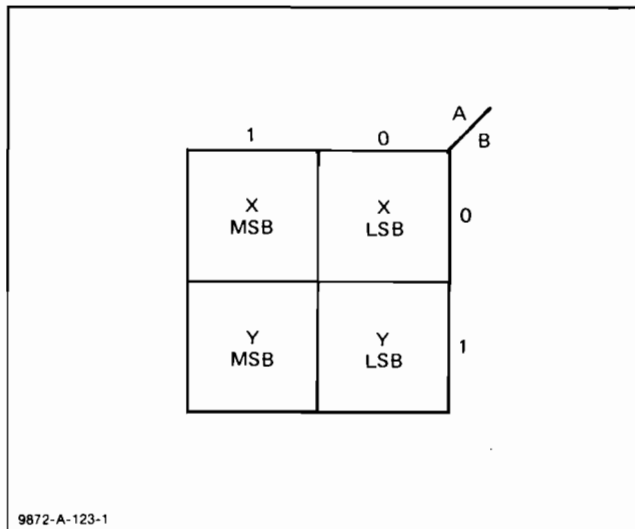


Figure 6-6. Register Selection Addressing

register of U19. With the next clock pulse, the output of the data register remains constant. The data selector U26 couples the sign bit of the MSB to the Y input of the adder U24, while the MSB from the previous sub-cycle is coupled to the Z input. These bits and the sign bit are summed and latched into the MSB register of U16 by the write enable decoder U10C. This completes the updating of the X-axis accumulator for this sub-cycle.

6-49. The output of the accumulators is used to address the sine/cosine ROMs U9 and U15. The four LSB and the sign bit of the MSB are not used to address the ROMs, but are retained for use in further computation. The output function of the ROMs is controlled by the inputs to pins 14 and 15. See Table 6-5. ROM U9 generates the four LSB inputs to the digital to analog converter (DAC) U7, while U15 outputs the four MSB to U7.

Table 6-5. ROM Functions

PIN 14	PIN 15	ROM OUTPUT
Low	Low	Cosine, 3rd Harmonic
High	Low	Cosine Fundamental
Low	High	Sine, 3rd Harmonic
High	High	Sine Fundamental

6-50. DIGITAL TO ANALOG CONVERTER. The DAC U7 produces differential output currents which are linear products of the digital input and the dc reference current at pin 14. The op amp U3 converts the differential currents to a voltage source for the analog switches U2 and U4. If the plotter motors are stationary, the power control U27 turns the transistor Q2 on, shunting the reference circuit, reducing the output current from U7.

6-51. INTERPOLATOR OUTPUT. During each sub-cycle, U3 must output four discrete signals in each axis. These are:

- a. cosine 3rd harmonic,
- b. cosine fundamental plus 3rd harmonic,

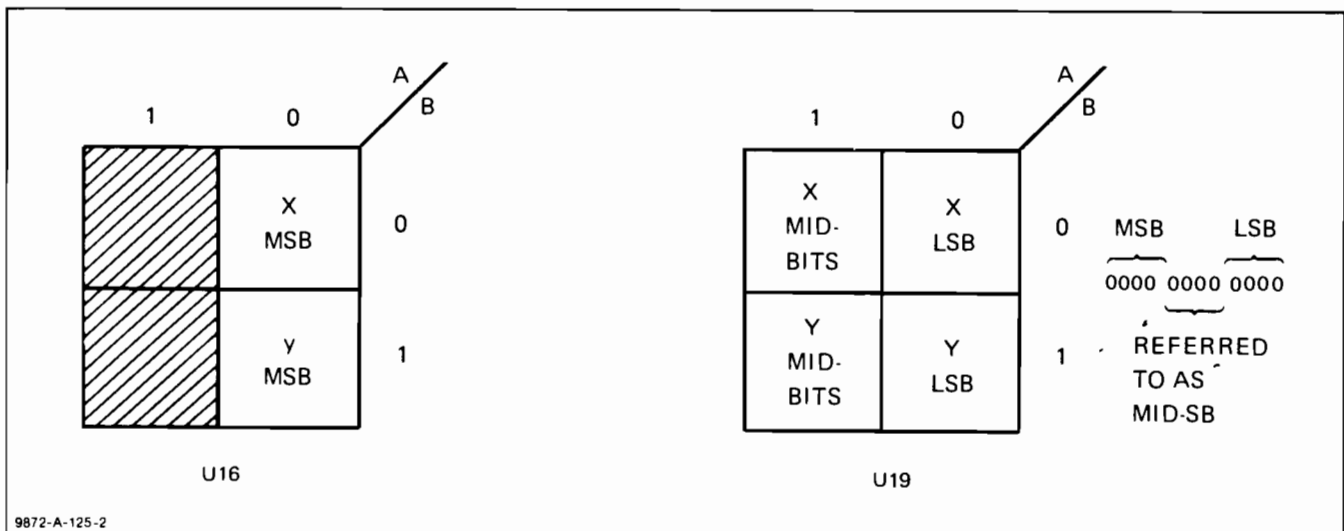


Figure 6-7. Simplified Accumulator Storage Location

- c. sine 3rd harmonic,
- d. sine fundamental plus 3rd harmonic.

Demultiplexers in the form of analog switches U2 and U4 with their associated buffers U1 and U8 combine the fundamental and harmonic pairs and then separate these pairs into the four analog signals for the motor drivers.

6-52. The fundamental plus 3rd harmonic consists of the fundamental frequency plus an in-phase quarter amplitude 3rd harmonic. See Figure 6-8 for equivalent sine/cosine ROM table values.

6-53. At the start of each sub-cycle, the X cosine 3rd harmonic is output by U7. U4-S1 is closed, and the value of the harmonic is stored on C34 and buffered by U8A to the X and Y 3rd harmonic adjustment potentiometers R38 and R39. At this time, the X cosine fundamental plus 3rd harmonic is output from U7. The analog switch U4-S2 and U4-S4 are closed as is U2-S4. A portion of the 3rd harmonic, selected by the setting of R38, is subtracted from the fundamental in U3. The result is stored in C8, buffered by U1C, and applied to the X phase-B motor driver. This same sequence is followed for the X sine, Y sine, and Y cosine in order. See Figure 6-9 for Interpolator Timing.

6-54. MAIN PCA A2 MOTOR DRIVER CIRCUITRY

6-55. The Motor Driver circuitry provides amplification of the Interpolator outputs required to drive the X- and Y-axis stepper motors and the paper advance motor, if installed. See Service Sheet 6.

6-56. Following the path of the X cosine signal, from the buffer U1C, the signal passes through the mute switch S1. This switch allows for muting of the X-axis motor during servicing or alignment procedures.

6-57. The first stage of the X cosine motor driver is U5 which functions as a high gain integrator to the signal. The 20 kHz oscillator signal from the power supply is

also input at this stage to develop the required triangular switching signal. Feedback from the motor is also sensed here for precision current control. The OFFSET potentiometer is used to establish the baseline reference for the drive signal. In the X- and Y-phase A amplifiers, the GAIN potentiometers allow matching of the relative gains of phases A and B. See Figure 6-10. Adjustment procedures for these potentiometers are found in Section III of this manual.

6-58. The triangular output of U5, plus the signal, is applied to the comparator U11 along with a feedback signal from the motor. The resulting squarewave output has an amplitude of approximately 25 volts.

6-59. During power-up and the paper advance switching sequence, the U11 output is disabled by the conduction of transistor Q5. The \overline{ZPWR} signal is used to turn on Q5. The resistor R23 in the feedback path acts as a current sensing resistor. This provides a convenient location for testing circuit action.

6-60. The squarewave output of U11 drives the grounded-base transistor pair Q9 on the positive half cycle and Q13 on the negative half cycle. The transistor Q17 provides the necessary current gain to gate the FET Q25. The transistor Q18 provides inversion as well as gain for the FET Q26. The FET switching action provides the current required to microstep the plotter motor. See Figure 6-11.

6-61. POWER SUPPLY ASSEMBLY

6-62. The power supply consists of three PCAs, a rear panel, and the power transformer, which is mounted in the lower case assembly. See Service Sheet 7.

6-63. PRIMARY CIRCUITS. The ac line input connection is through the receptacle mounted on the rear panel. The ac line fuse holder is also mounted here. From the rear panel, the ac input is wired to the Primary PCA A5. Mounted on this PCA are the broad band line filters L1 and L2, the LINE switch S1, and the voltage selection jumpers W1-W3. These jumpers are inserted in sockets to match the plotter primary

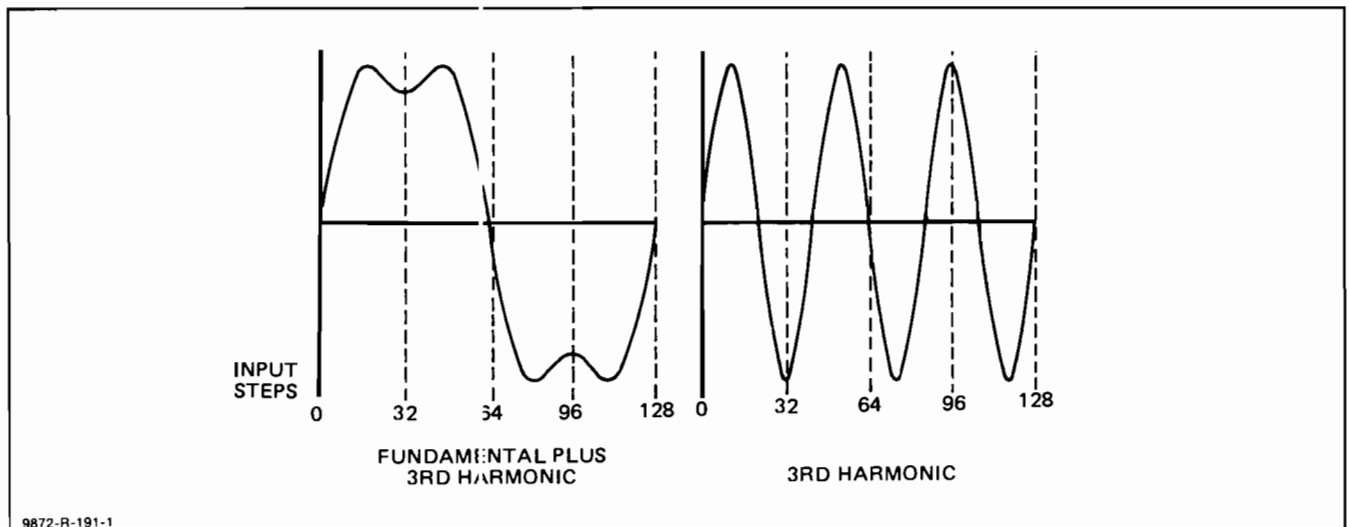


Figure 6-8. Sine/Cosine ROM Values

circuits to one of four ac line voltages. Jack J1 connects the Primary PCA with the primary side of the power transformer T1. The secondary of the transformer is connected through J5 to the Filter and Rectifier circuits of the Power Supply PCA A4. This Rectifier circuit supplies the plus and minus 34 volts which is the main power source for the power supply and for the X- and Y-motors. See Figure 6-12 for power supply outputs.

6-64. REFERENCE SUPPLY. The +34 volt main power is the source for the reference supply which controls all other power supply voltages. This zener-regulated supply produces a +5 volt reference and a +12 volt auxiliary supply. These voltages come up first and are used to control the switching supplies, balance circuit, and the 20 kHz Oscillator circuit.

6-65. VOLTAGE BALANCE CIRCUIT. The X- and Y-plotter motors form inductive loads across the ± 34 volt supplies. With the switching action of the motor drivers, it is possible to generate counter-induced voltages which would drive one or the other of the 34 volt supplies to a high level. To prevent the possibility of this happening, a balance circuit has been provided for the ± 34 volt supplies. Any imbalance created by the counter-induced voltages is sensed at the junction of resistors R66 and R74 in the balance circuit. With a balanced condition, this point is maintained at zero volts. Any voltage at the tie point is sensed at the inverting input of the comparator U5 along with the integrated signal from the 20 kHz oscillator. With the +34 volt high, during the negative half cycle output from U5, transistor Q27 will be conducting. This turns on transistor Q18, which in turn gates the FET Q20 on, drawing current from the +34 volt supply. The FET Q20 will pump current into inductor L3. During the positive half cycle out of U5, transistors Q26 and Q21 will be turned on, gating the FET Q22 on. The current established in L3 continues to flow during this half cycle through FET Q22, acting as a diode, in a direction opposite the normal flow. This current charges the -34 volt supply, and this action, combined with the loading of the +34 volt supply, brings the two supplies into balance. When the supplies are in balance, a null will again exist at the tie point of the resistors R66 and R74.

6-66. The comparator U4 and its associated components acts as a safety system by sensing the average current through the inductor L3 and the resistor R61. If this current tries to exceed 3 amps, Q24 and Q25 feeds back a signal to limit the current at 3 amps to prevent circuit damage.

6-67. During power-up or reset, the balance circuit is disabled by transistor Q28. This disabling action prevents any attempt at a balancing action before all voltages have had time to stabilize.

6-68. +5 VOLT SWITCHING SUPPLY. Switching circuitry is used to develop a regulated +5 volts from the unregulated +34 volt supply. The +34 volts is applied to the FET Q15. When the FET is conducting, a ramp of current is developed in the inductor L2, which

charges the capacitor C15 to the output voltage of +5 volts.

6-69. The 20 kHz oscillator output is integrated, and the sawtooth is applied to the comparator along with the 5 volt reference from the reference supply, and the +5 volt sense, which is the +5 volt output from the power supply. The output of U3 switches according to the relationship between the two 5 volt levels. If the +5 volt sense is low, the ON time of the FET Q15 will increase, increasing the current flow in L2, thus increasing the charge on C15. If the +5 volt sense is high in comparison with the reference, the ON time of Q15 will be reduced, allowing the charge on C15 to bleed down to the proper level. Additional circuitry in the +5 volt switching supply protects the circuit from voltage and current overload.

6-70. +12 VOLT SWITCHING SUPPLY. The functioning of the +12 volt switching supply is essentially identical to that of the +5 volt switching supply. The resistors R14 and R16 at the non-inverting input of U3 form a voltage divider. This divider drops the feedback voltage from the +12 volt output of the supply allowing the use of the +5 volt reference voltage as the reference in this supply as it is in the 5 volt switching supply.

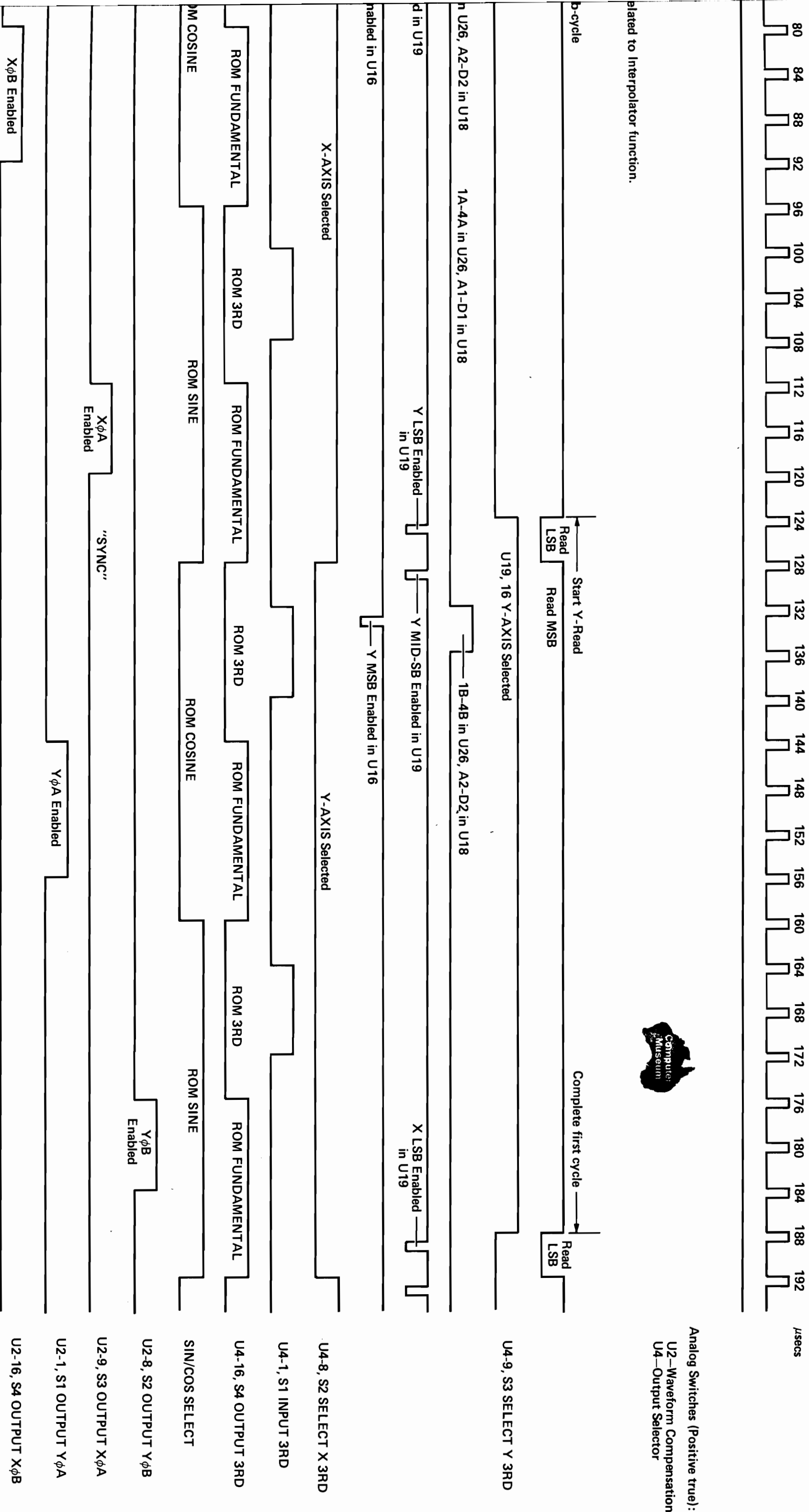
6-71. -12 VOLT SUPPLY. The -12 volt supply is a low current, zener-regulated emitter-follower circuit. The thyristor Q32 has been included for circuit overload protection.

6-72. FET GATE SUPPLIES. The positive FET gate supply is a doubler and regulator, producing an output which is maintained at a level 12 volts more positive than the +34 volt main supply. The nominal level is +46 volts.

6-73. The Negative FET Gate Supply is a zener-regulated supply producing a voltage which is 12 volts less negative than the -34 volt supply. The nominal level is -22 volts.

6-74. POWER-UP RESET CIRCUIT. The Reset circuit on the Chart Hold PCA A6 provides a negative pulse 70 milliseconds in duration at power-up. This pulse disables the Balance circuits, Motor Driver circuits, and provides a reset pulse to the Microprocessor circuits.

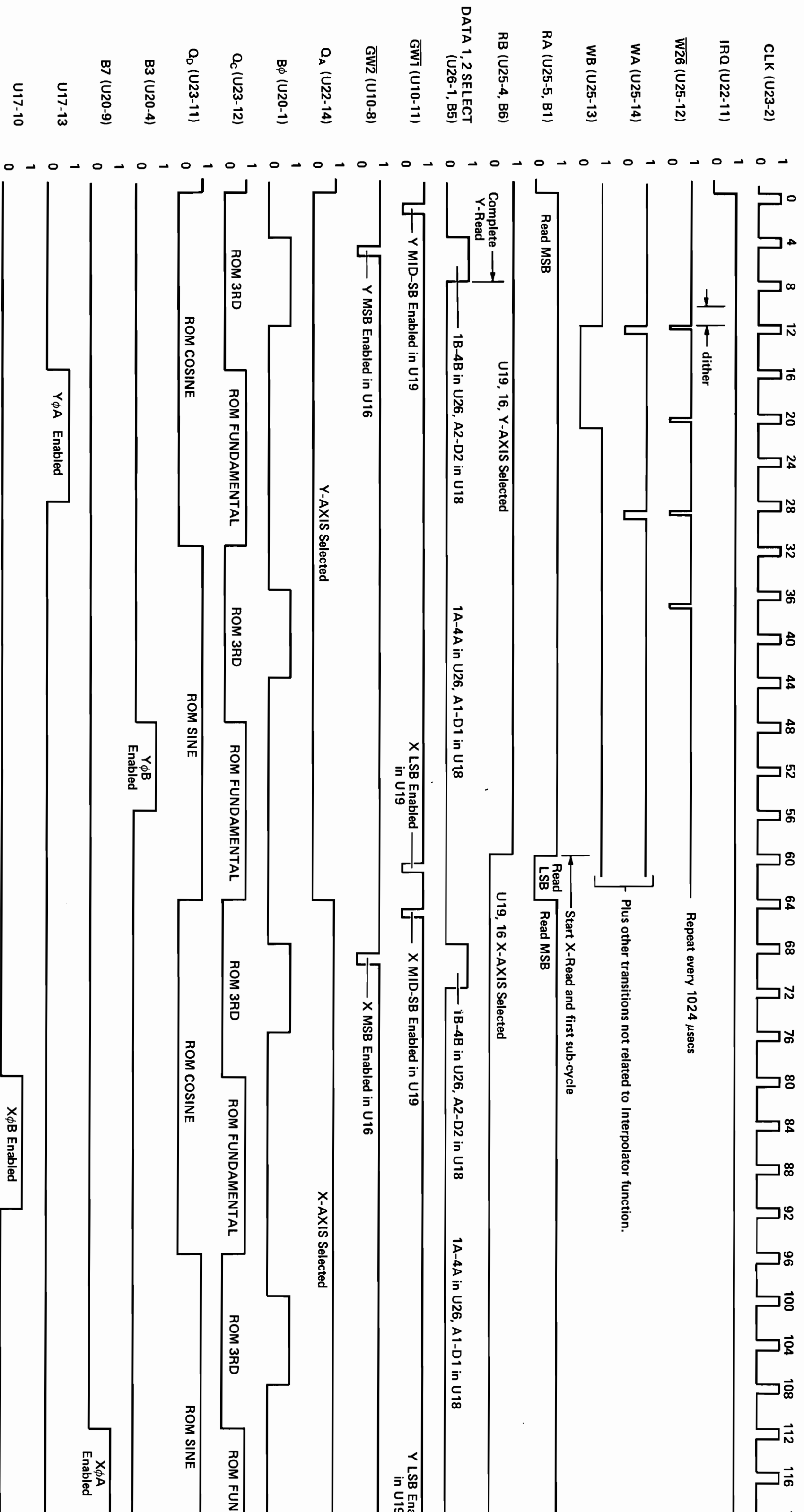
6-75. ELECTROSTATIC POWER SUPPLY. The Electrostatic Power Supply on PCA A6 develops a high voltage at very low current to hold the chart against the platen. This is a ringing circuit charging two parallel capacitor networks. Transistor Q101 is switched on and off by the 20 kHz oscillator signal. The transistor base voltage is controlled by U102 and Q102, while the emitter current is limited by resistor R114. While Q101 is switched on, a ramp of current is created in the inductor L101. When the transistor is turned off, current continues to flow, charging stray capacitance to a high level. When the charge on the inductor is equal to or greater than the charge on the capacitors C102 and C103, the diodes CR102 and CR103



related to Interpolator function.

INTERPOLATOR TIMING

Figure 6-9. Interpolator Timing



INTERPOLATOR TIMING

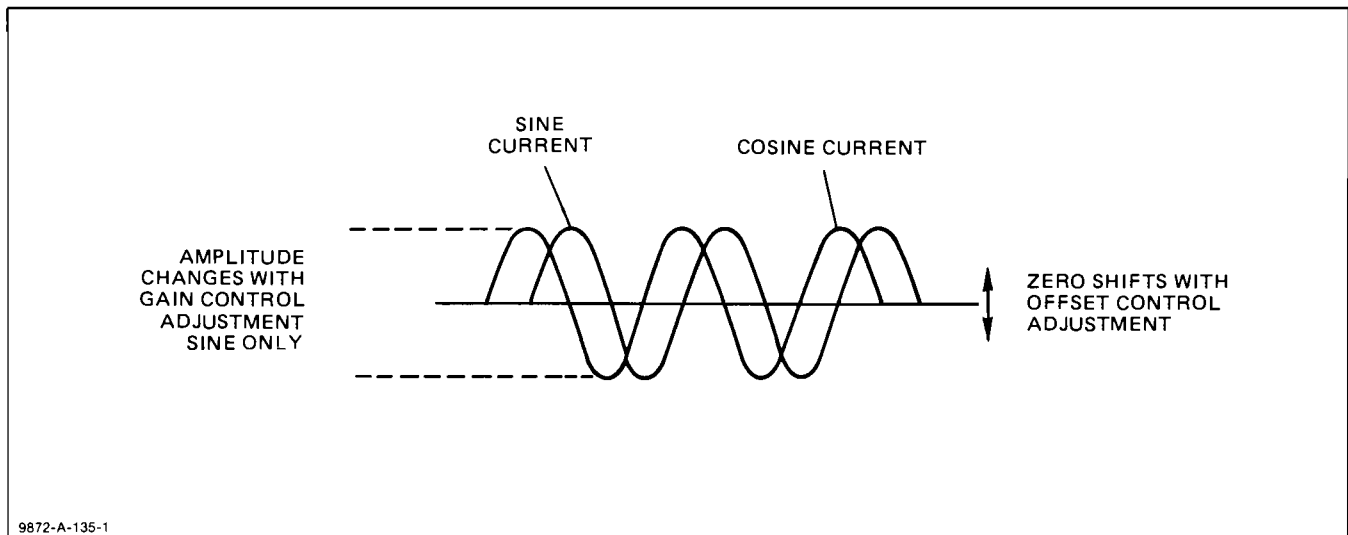


Figure 6-10. Drive Current Waveshapes

conduct, charging these capacitors. Resistors R102, 103, 105, and 106 current limit the high voltage to the platen. The open circuit voltage to the platen is approximately 900 volts.

6-76. **PEN LIFT DRIVE.** The pen lift drive is a switched current source providing approximately 250 mA to the pen solenoid. When Q10 is switched on, the voltage is applied to the solenoid, lowering the pen to the paper. When the transistor is switched off, the pen is raised by spring action.

6-77. TROUBLESHOOTING

6-78. The primary troubleshooting aid for the 7220C/7221C Graphics Plotters is the built-in Self Test. Refer to Section II of this manual for the Self Test procedures. This test in most cases can isolate a problem to a stage or to the component level. On the power supply assembly, a series of six LEDs have been provided to isolate failures to stages of the power supply. See Figure 6-13. When these LEDs are ON they indicate proper operation of the associated circuit.

NOTE

The power supply may be operated with the Chart Hold PCA A6 removed during troubleshooting procedures.

6-79. MAINTENANCE

6-80. CLEANING

6-81. A thorough cleaning of the plotter should be performed at regular intervals. These intervals are determined by the type of environment in which the plotter is operated. The cleaning should include the following:

- Remove any dust accumulation with a brush or air gun.

- Wash the fan filter in warm soapy water. Dry thoroughly before replacing.

WARNING

Never allow water to stand on the platen surface or to enter the electrical portion of the plotter. This could result in a shock hazard.

CAUTION

Do not use solvents or silicone-based cleaners on the platen surface.

- Clean the platen as follows:

- Set the plotter LINE switch OFF (O), and remove the line set (power cable) from the plotter.
- Dampen a soft cloth or disposable paper with a mixture of 50% isopropyl alcohol and 50% water by volume.
- Wipe the surface clean, and dry immediately.
- To remove heavier contamination, apply cleaner, HP Part Number 9310-0515, or use a commercial cleanser, such as Comet® or Ajax®, to the platen and wipe clean.
- Rinse out the cloth, and wipe all traces of cleaner from the platen.
- Wipe the platen dry thoroughly before use.
- Transparency ink may be removed with solvent, HP Part Number 5060-6828.

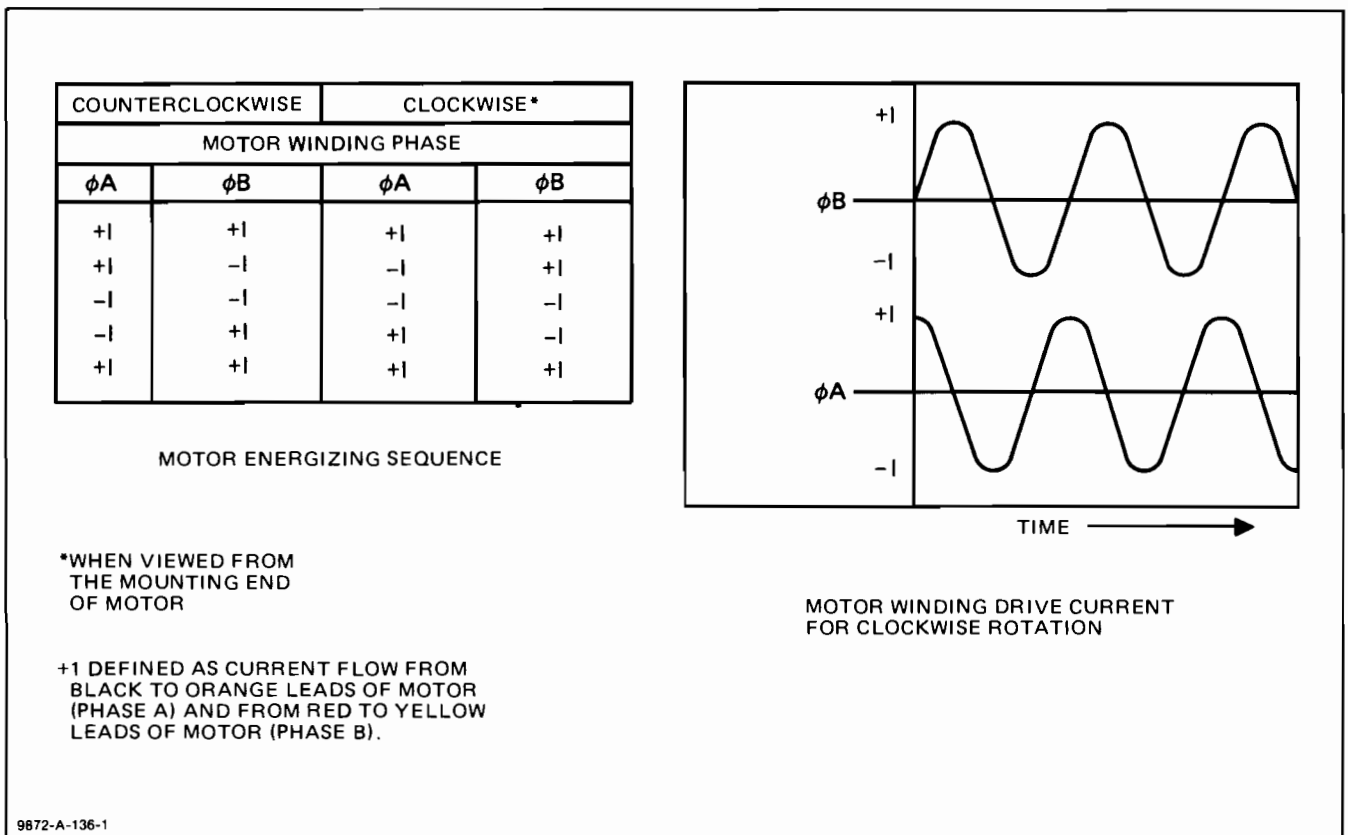


Figure 6-11. Motor Driver Current and Sequencing

SUPPLY	TYPE	USE
± 34 V	Zener Regulated and Balanced	Motor Driver and Power Supply Circuits
+5 V ref	Zener Regulated	Power Supply Reference, Reset, and Chart Hold
+12 V aux	Zener Regulated	Power Supply Operation
+5 V	Regulated Switching Supply	Plotter Operating Voltage
+12 V	Regulated Switching Supply	Plotter Operating Voltage
+46 V	Zener Regulated	+ FET Gate Supply
-22 V	Zener Regulated	- FET Gate Supply
-12 V	Zener Regulated	Plotter Operating Voltage
± 12 V*	Interlocked	Motor Driver and Balance Circuit Shutdown

Figure 6-12. Power Supply Outputs

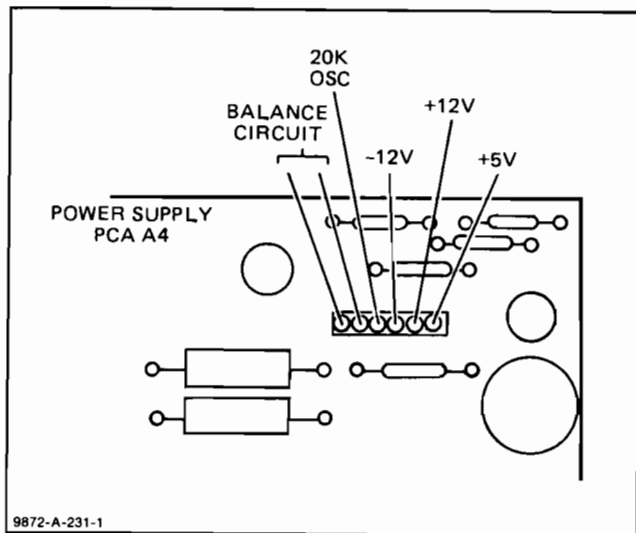


Figure 6-13. Power Supply Indicator LEDs

6-82. REPAIR

6-83. The following paragraphs contain information concerning the removal and replacement of mechanical parts and assemblies.

WARNING

Any adjustment, maintenance, and repair of the opened plotter under voltage should be avoided as much as possible and, if inevitable, should be carried out only by a skilled technician who is aware of the shock hazard involved. Capacitors inside the plotter may still hold a charge even if the plotter has been disconnected from the power source.

6-84. Before performing any of the following disassembly procedures, the following steps must be performed:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Remove the line set (power cable) from the plotter.
- c. Disconnect the interface cable.

6-85. OPENING THE PLOTTER

6-86. To open the plotter, proceed as follows:

- a. Unscrew the two 6-32 trusshead screws, and remove the rear hood. See Figure 6-14, Detail A.
- b. Unscrew the upper deck locking screws. These screws are captive and should not be removed from the upper deck. See Figure 6-14, Detail B.
- c. Raise the upper deck, and secure the latching bar into its bracket. See Figure 6-14, Detail C.

6-87. CABLE RESTRINGING

6-88. Y-DRIVE CABLE REMOVAL. To remove the Y-cable, proceed as follows:

- a. Place the pen carriage at the center of the arm, and position the arm over the deck locking assembly and fasten with two 6-32 screws. See Figure 6-15.
- b. Remove the pen cover by unscrewing the 2-56 × 3/8 in. flathead screw.
- c. Remove the 2-56 × .3 in. panhead screw from the dashpot assembly. See Figure 6-16.

CAUTION

While performing step d., use caution not to allow the dashpot piston to come free from the assembly.

- d. Carefully swing the dashpot assembly and pen carriage away from the pen arm.
 - e. Tape the pen carriage top assembly and dashpot assembly securely together to prevent any parts from becoming lost.
 - f. Pull the trailing cable cover free of the arm. This part is a snap fit.
 - g. Unplug the trailing cable from the solenoid leads, and move the leads away from the two nuts on the pen carriage. See Figure 6-17.
 - h. Remove the two #6 × 1/4 in. nuts from the top of the pen carriage assembly.
 - i. Lift the trailing cable terminator off the threaded studs.
 - j. Replace the two nuts over the pulleys finger tight.
 - k. Release the tension on the Y-axis cable by loosening the cap screw in the cable tensioner and remove the cable. See Figure 6-15.
 - l. Unhook the Y-drive cable loop from the lower left stud. See Figure 6-18.
 - m. Remove the Y-axis drive cable from the pulleys and the motor.
- 6-89. Y-DRIVE CABLE INSTALLATION. See Figure 6-23. To install a Y-drive cable, proceed as follows:
- a. Turn the Y-motor pulley so that the pin hole is directly up. See Figure 6-19.
 - b. Secure the motor with tape in this position.
 - c. Unwind the new Y-drive cable, using care not to kink it.

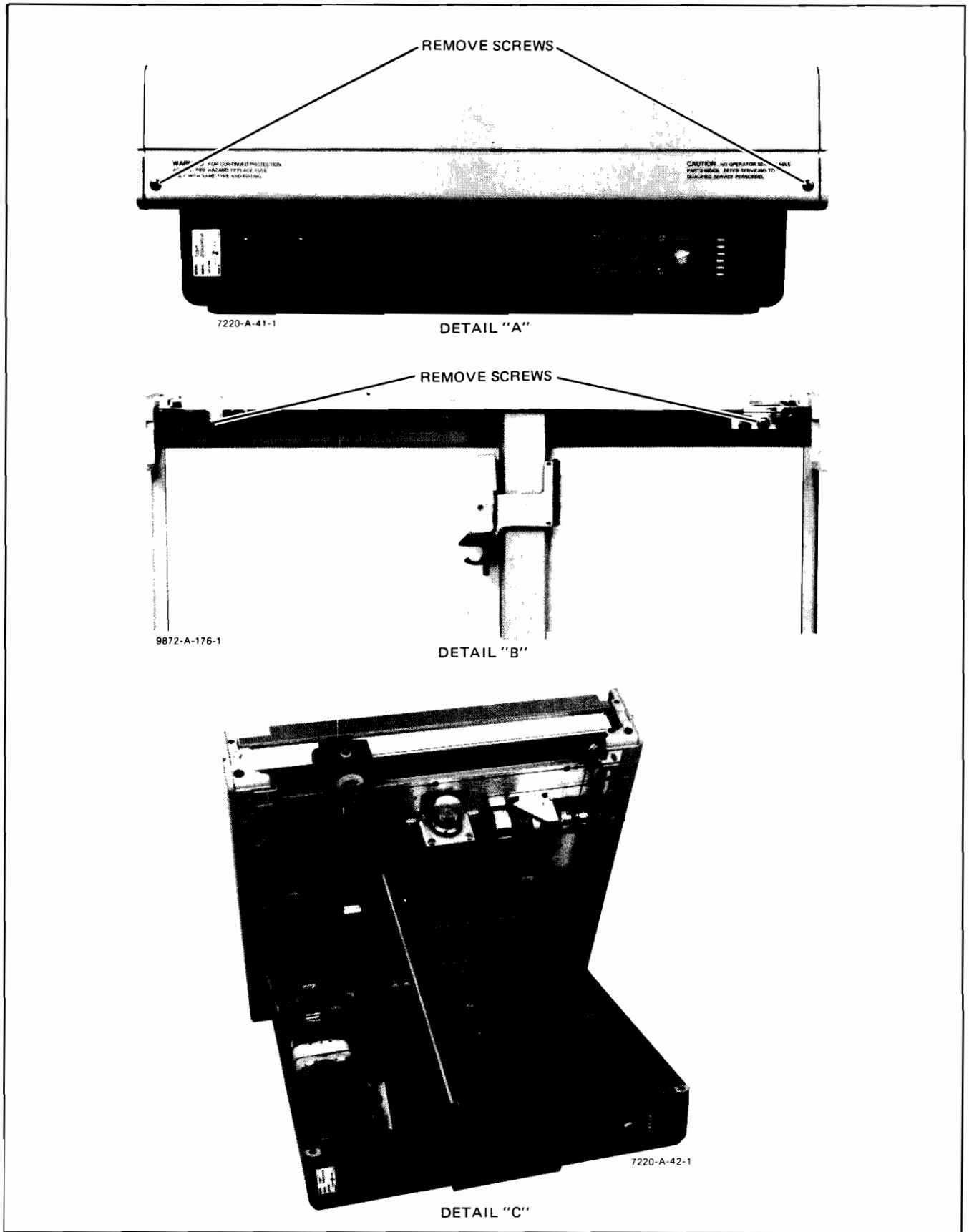


Figure 6-14. Opening the Plotter

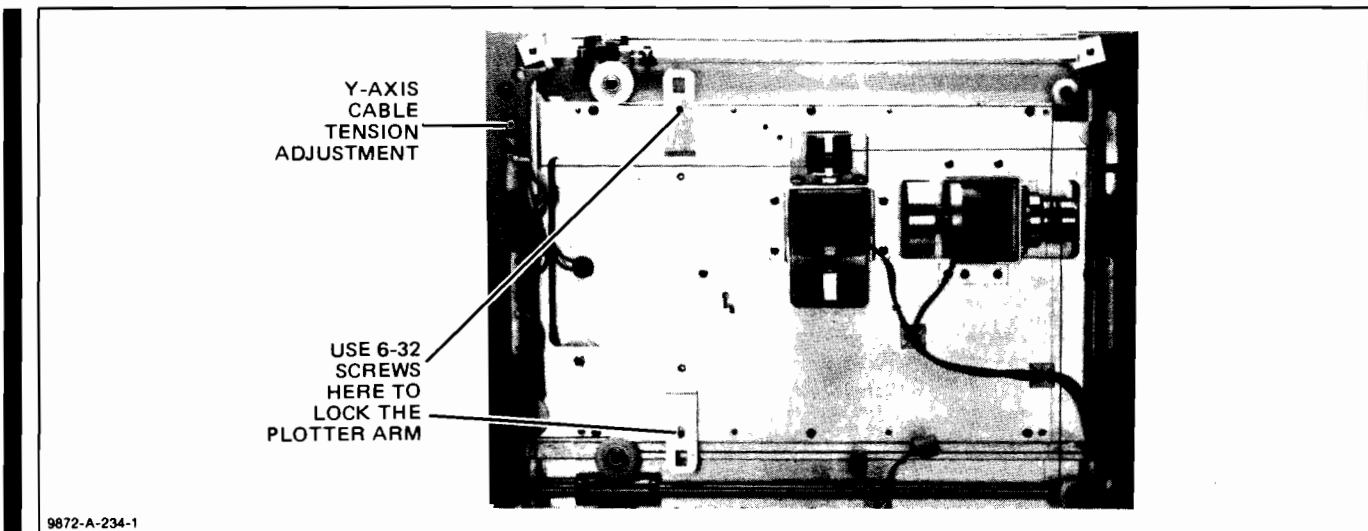


Figure 6-15. Underside View of Top Desk Assembly

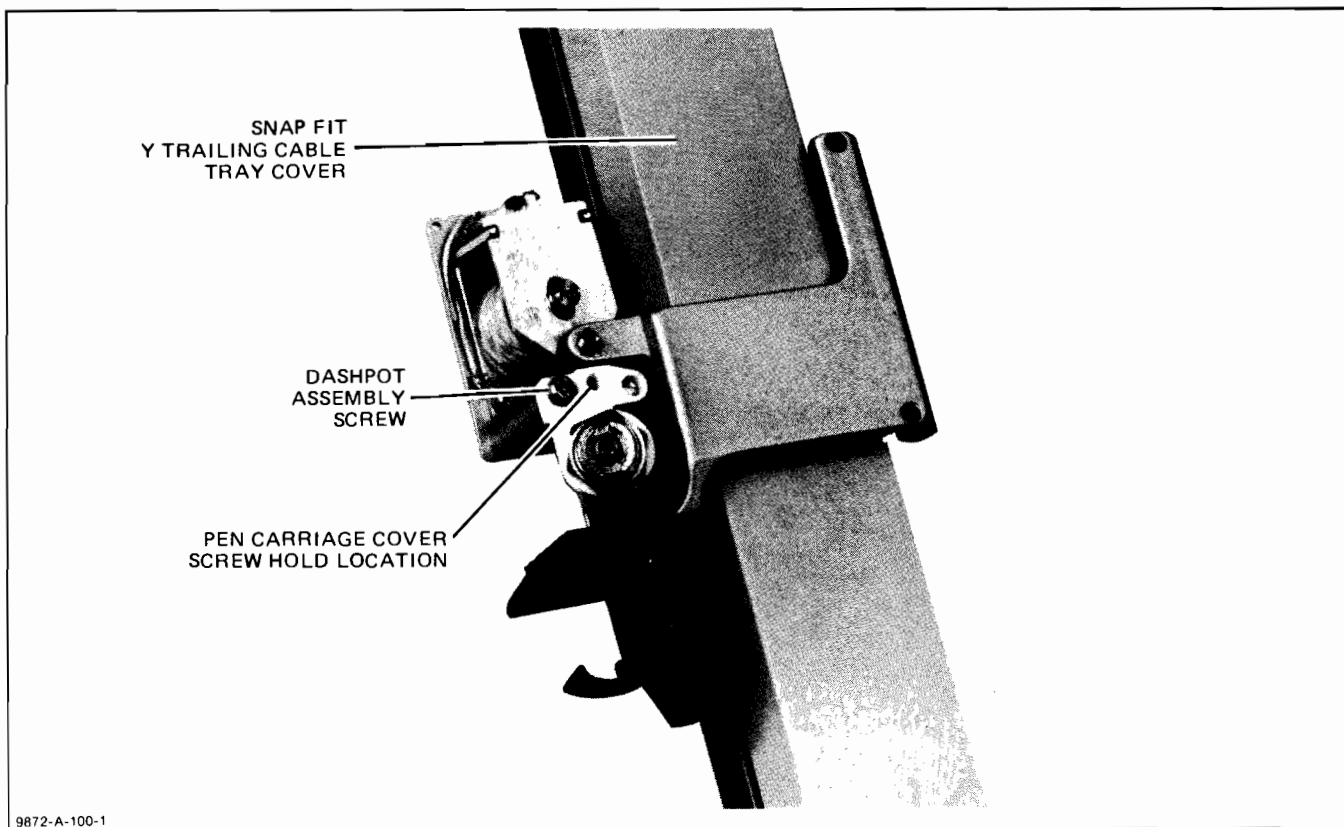


Figure 6-16. Pen Carriage with Cover Removed

- d. Insert the cable pin into the pulley hole so that the long end of the cable (crimped end) is draped out of the way over the top desk assembly.
- e. Wrap the short end (looped) of the cable four turns around the pulley wrapping away from the body and to the right of the pin.
- f. Holding the long end of the cable with one hand, pull the shorter end of the cable until four turns of the cable have been wrapped around the pulley to the left of the pin. Tape these four turns securely to the pulley.
- g. Thread the long end of the cable around pulleys #1, 2, and 3 as shown in Figures 6-20 and 6-21. From pulley #3, thread around under the trailing cable tray to pulley #4.
- h. Turn the plotter so that the platen is facing you, and thread the cable around pulleys #4, 5, and 6 and from #6 back under the tray to pulley #7.

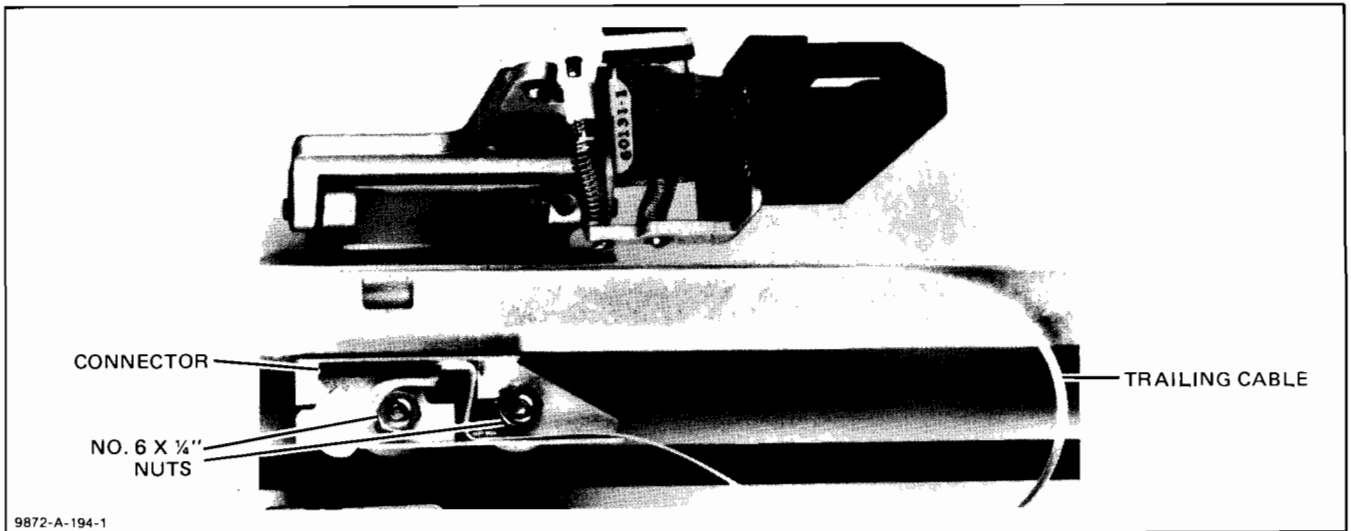


Figure 6-17. Y Trailing and Drive Cables

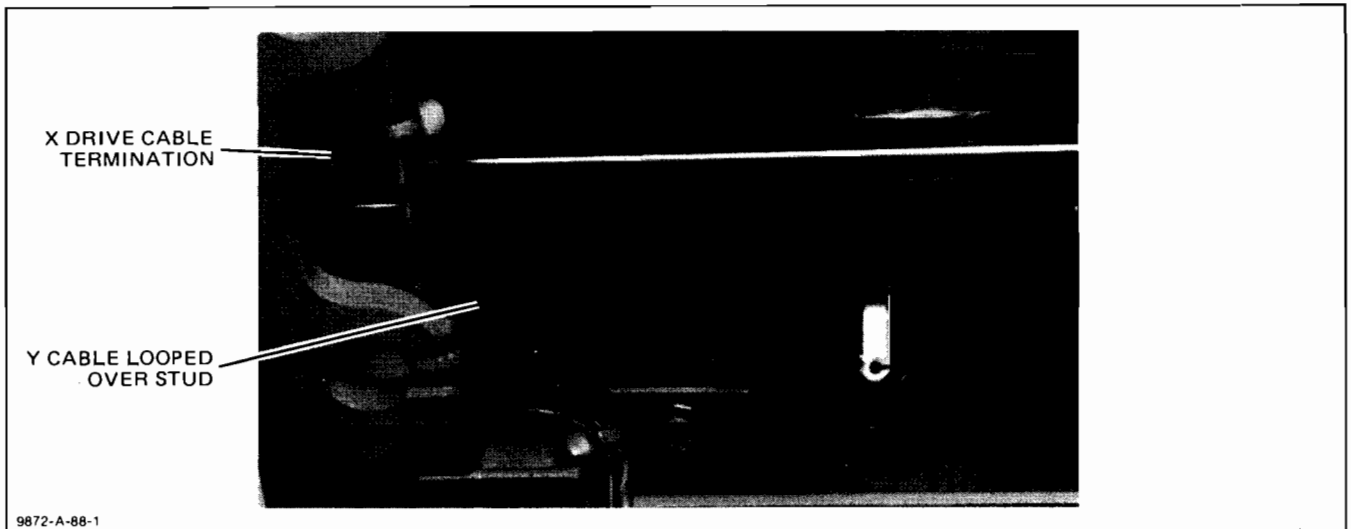


Figure 6-18. Cables Termination Bracket

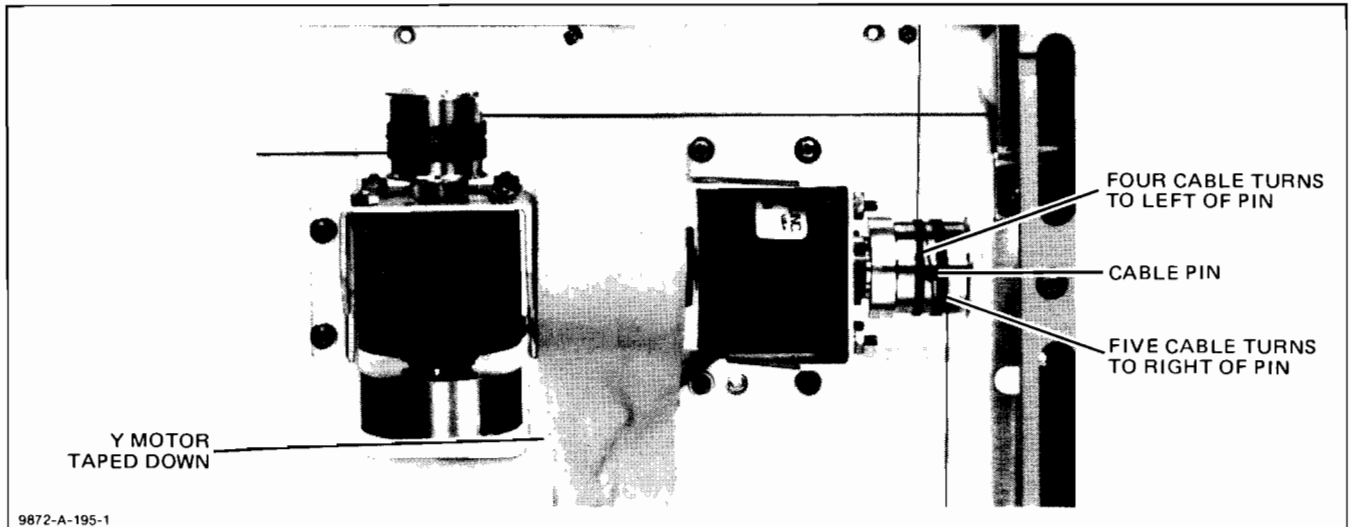


Figure 6-19. Y Motor and Pulley Windings

- i. Turn the plotter again, and thread the cable around pulley #7, through the tie block, and insert the crimped end into the hole in the tensioner. Tighten the tensioner cap screw. See Figure 6-21 and 6-22.
- j. Remove the tape from the windings on the motor pulley. Thread the short end of the cable around the motor pulley, forming five turns to the right of the pin. Tape these turns to the pulley.
- k. Thread the short end of the cable around pulleys #8, 9, and 10, and from pulley 10, thread the cable under the tray to pulley #11.
- l. Turn the plotter around, and thread the cable around pulleys #11, 12, 13, and from 13 back under the tray to pulley #14.
- m. Again turn the plotter, and thread the cable around pulley #14, and hook the looped end of the cable over the stud as shown.
- n. Assure that the cable is in its proper position over all the pulleys.
- o. While applying tension to the loose end of the cable, securely fasten the cable crimp.
- p. Remove all tape from the motor and pulleys.
- q. Remove the nuts from the pen holder assembly.
- r. Replace the trailing cable terminator, replace the nuts, and tighten.
- s. Plug in the pen solenoid, and position the solenoid wires where they will not rub on the pulleys.
- t. Replace the trailing cable tray cover. Make sure that both ends are flush.
- u. Swing the dashpot assembly and upper pen holder assembly into position.
- v. Secure with the 2-56 screw.

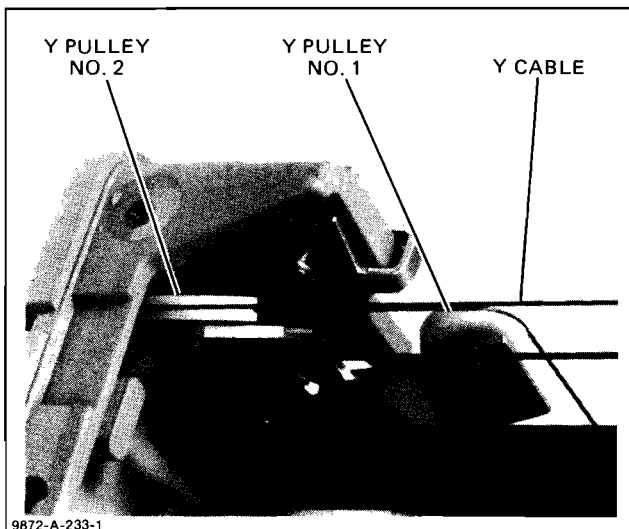


Figure 6-20. Upper Right Pulley Bracket

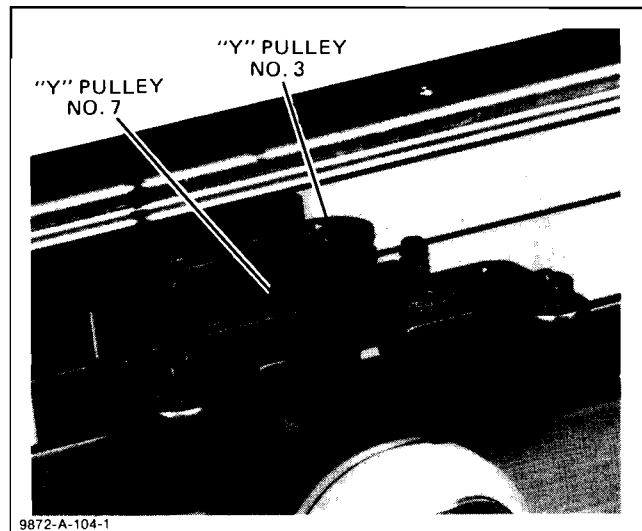


Figure 6-21. Y Cable Feed Through to Pen Carriage Arm

- w. Reinstall the pen holder cover and secure.
 - x. Remove the locking screws holding the plotter arm in position.
 - y. Position the plotter arm at the left end of the plotter as viewed from the rear and the pen carriage at the top corner of the platen.
 - z. Using a 0-700 gram gauge, adjust the cable tension as described in Section III of this manual. See Figure 6-22.
 - aa. Manually exercise the pen carriage along the plotter arm several times and recheck the tension. Adjust if necessary.
- 6-90. X-DRIVE CABLE REMOVAL. To remove the X-drive cable, proceed as follows:
- a. Remove power, and open the plotter as outlined in paragraph 6-85.
 - b. Secure the plotter arm over the locking assembly with the screws provided in the service kit.
 - c. Loosen, but do not remove, the X-tension adjusting nut. See Figure 6-24.
 - d. Unhook the X-drive cable from the two termination brackets, and remove the cable from the plotter. See Figures 6-25 and 6-26.
- 6-91. X-DRIVE CABLE INSTALLATION. To install the X-drive cable, proceed as follows:
- a. Turn the X-motor pulley so that the pin hole is directly up. See Figure 6-27.
 - b. Secure the motor with tape so that it will not turn.
 - c. Unwind the new X-cable, using care not to kink the cable.

- d. Wind the cable around the motor pulley so that there are three turns above the pin and six turns below the pin.
- e. Tape these cable turns securely to the motor pulley.
- f. Thread the shorter length of the cable around pulleys #1 and 2. See Figure 6-28.
- g. From pulley #2, thread the crimped end of the cable through the feed-through and back to the upper right bracket, and anchor the crimp. See Figure 6-25. Cut off excess cable.
- h. Thread the longer cable end around pulleys #3, 4, and 5, and anchor the crimp in the lower left bracket. See Figure 6-26.
- i. Remove the tape from the motor and motor pulley.
- j. Remove the screws securing the plotter arm.
- k. Move the plotter arm to the extreme right of the plotter as viewed from the back, and move the pen carriage to the top of the arm.
- l. Using a gram gauge, adjust the X-tension adjustment nut for 325 ± 25 grams. Refer to Section III of this manual if necessary. See Figure 6-24.
- m. Manually move the plotter arm back and forth several times, and recheck the cable tension. Readjust if necessary.

6-92. X-CABLE REMOVAL. To remove the X-cable, proceed as follows:

- a. Remove power from the plotter, remove the interface cable, and open the plotter.
- b. Unplug the electrostatic platen plug. See Figure 6-29.
- c. Move the plotter arm to the extreme right of the plotter as viewed from the rear.

- d. Remove the six 6-32 screws around the edge of the platen and the two 6-32 screws from the center area of the platen. See Figure 6-29.
- e. Lift the platen carefully out at the edge opposite the plotter arm.
- f. Position the plotter arm over the locking brackets, and install the 6-32 screws.
- g. Remove the X-tension adjustment nut, and push the threaded block out of the bracket. See Figure 6-24, Detail A.
- h. Remove the defective X-cable from the four pulleys, and remove the cleated end from the lower plotter arm bracket.

6-93. X-CABLE INSTALLATION. See Figure 6-32. To install the X-cable, proceed as follows:

- a. Remove pulley #4, being careful not to lose the washer located under the pulley. See Figure 6-30.
- b. Unwind the new X-cable, using care not to kink the cable.
- c. Thread the cleated end of the cable through the space normally occupied by pulley #4 and anchor to the lower plotter arm bracket. See Figures 6-30, 6-31, and 6-32.
- d. Replace pulley #4, making sure that the washer has been replaced under the pulley. The pulley will not rotate if the washer is omitted. See Figure 6-32.
- e. Bypass pulley #3, and thread the cable around pulley #2 to pulley #1.
- f. Thread the cable end block into the bracket above pulley #1, and install the adjusting nut finger tight. See Figure 6-24, Detail A.
- g. Assure that the cable is in place around pulley #1 and 2 and then complete the threading by placing the cable around pulley #3.

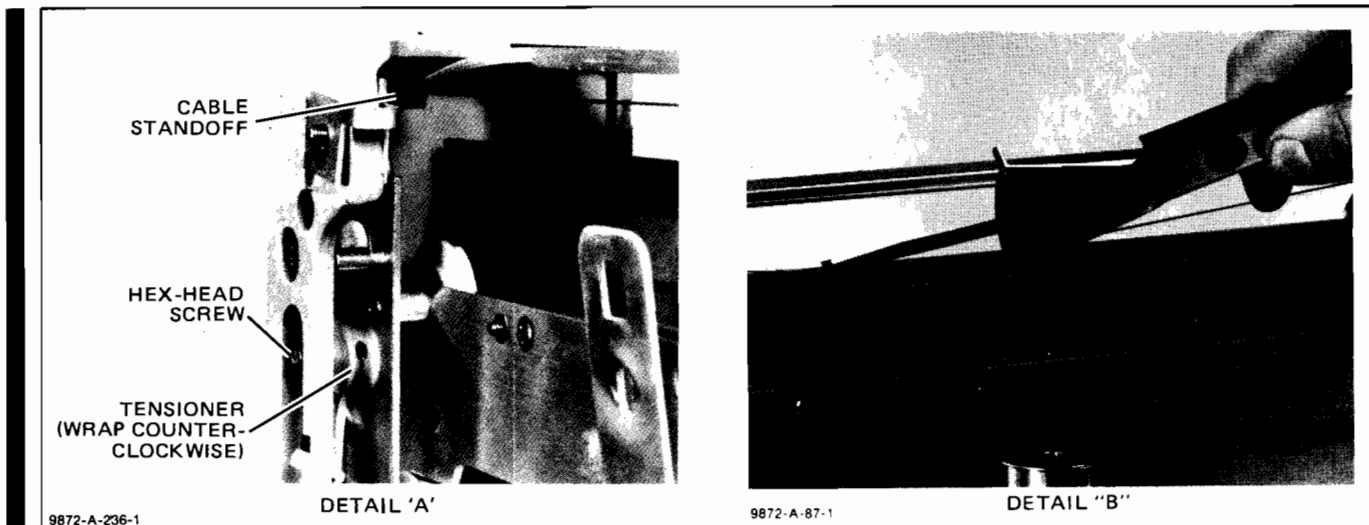


Figure 6-22. Y Cable Termination at Rocker Tension Arm

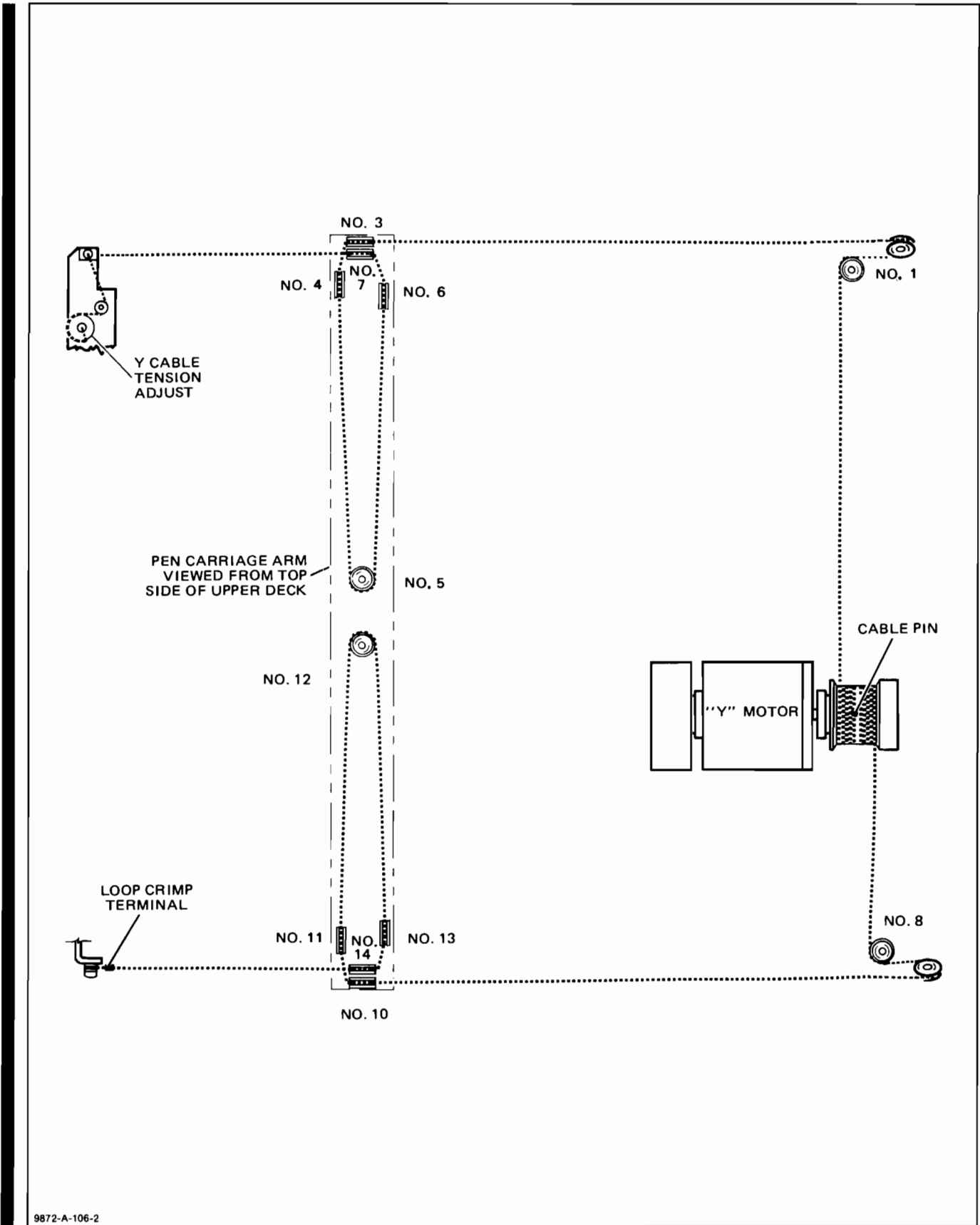


Figure 6-23. Y Drive Cable Stringing Diagram

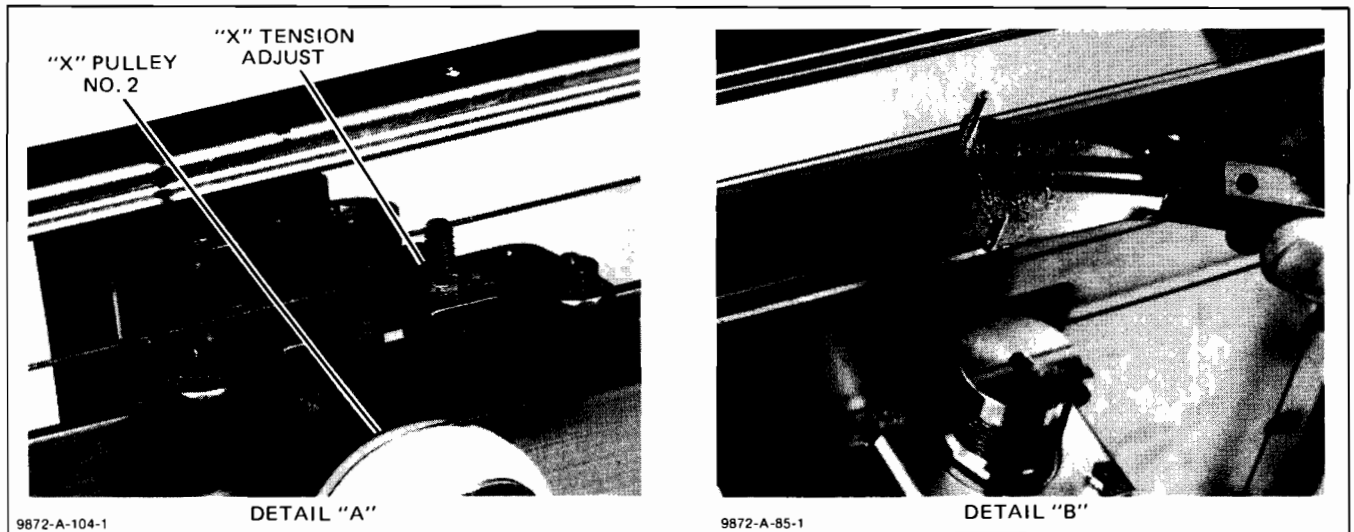


Figure 6-24. X Tension Adjust Nut

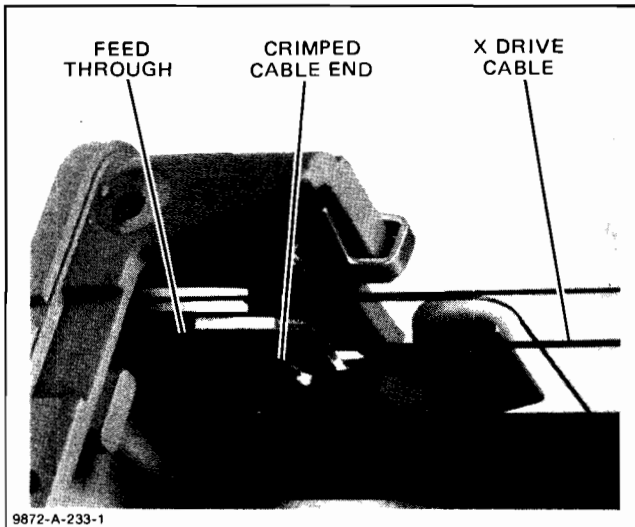


Figure 6-25. Upper Right X Drive Cable Termination

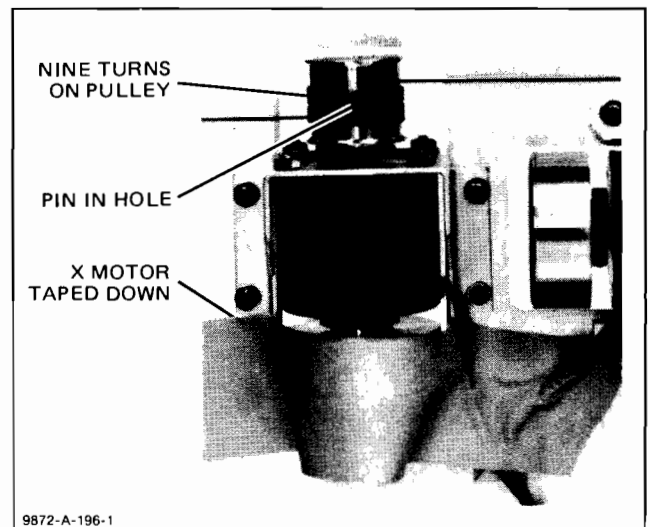


Figure 6-27. X Motor and Pulley Windings

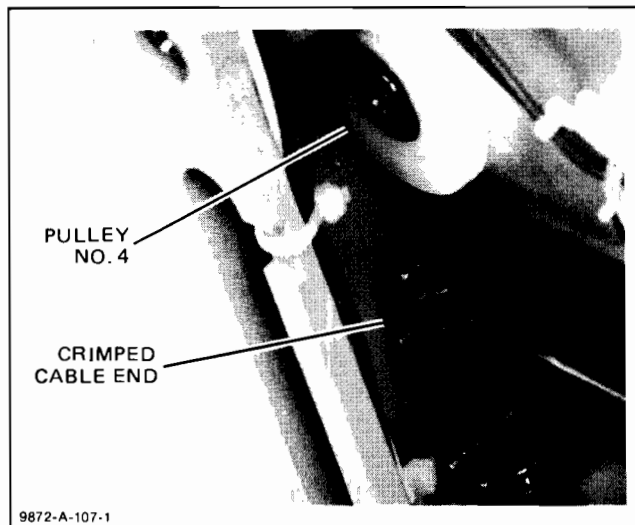
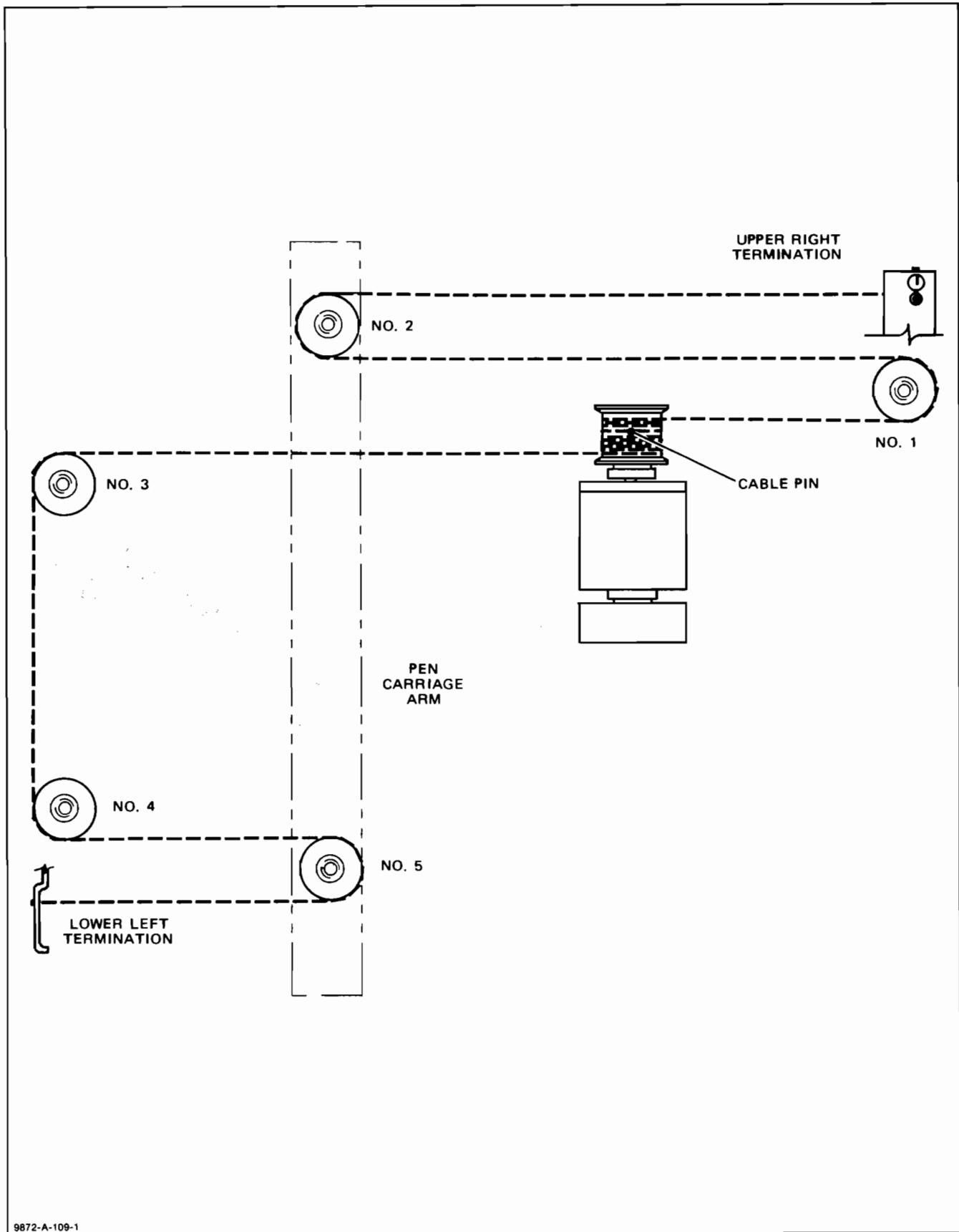


Figure 6-26. Lower Left X Drive Cable Termination

- h. With a 1/4 inch wrench, tighten the adjusting nut until approximately 5/16 inch of thread is exposed above the nut.
- i. Remove the 6-32 screws, and manually move the plotter arm through its full range.
- j. Position the plotter arm at the extreme left side of the plotter as viewed from the rear.
- k. Using a gram gauge, adjust the cable tension for 325 ±25 grams. Refer to Section III of this manual for adjustment procedures.
- l. Manually move the pen carriage several times, and recheck the tension. Adjust if necessary.

6-94. PEN ARM ADJUSTMENT

6-95. The following procedures adjust the gap between the plotter arm trolley rollers and the platen edge. Adjustment may be indicated if excessive X-liner



9872-A-109-1

Figure 6-28. X Drive Cable, Viewed from Underside of Upper Deck

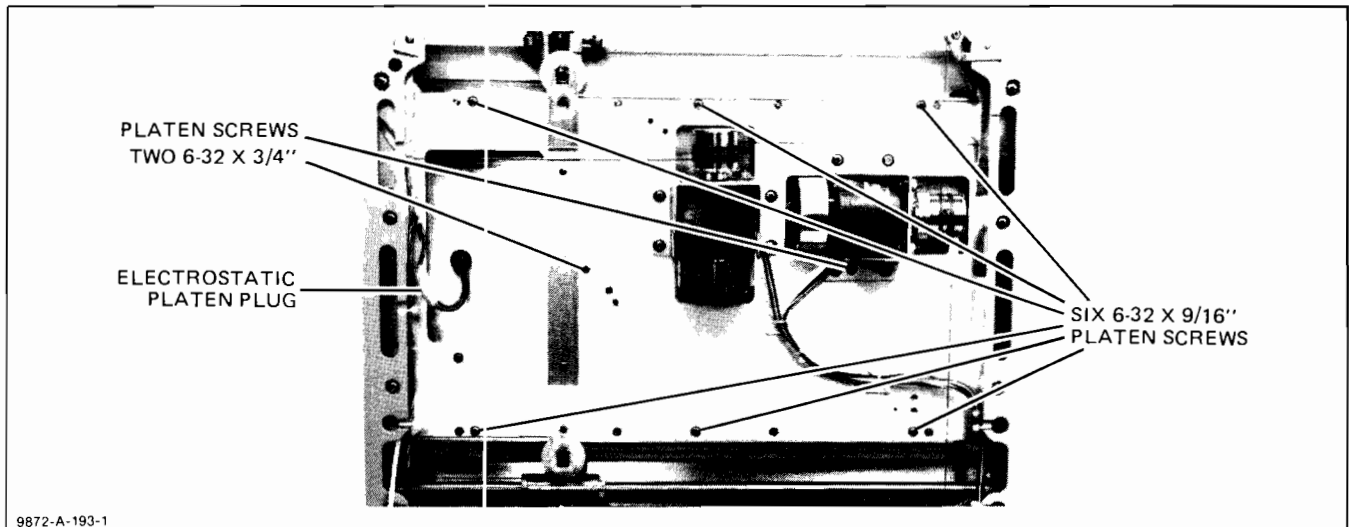


Figure 6-29. Underside View of Upper Deck

bearing noise is heard during short X-axis moves. To perform the adjustments, proceed as follows:

- a. Remove power, unplug the interface cable, and open the plotter.
- b. Unplug the front panel connectors, and remove the screws securing the front panel. See Figure 6-33.
- c. Remove the front panel to allow access to the screw located in the end of the Y-axis slider rod.
- d. Loosen the nuts securing the lower rollers to the trolley.
- e. Place a 0.3 mm (0.012 in.) shim between the upper right roller and the trolley track. See Figure 6-34.
- f. Loosen the screw in the end of the plotter arm, pressing down firmly on the casting so that both upper wheels are firmly in contact with either the track or shim. Securely tighten the screw in the end of the Y-axis slider rod.
- g. Remove the shim and verify that the 0.3 mm space exists.
- h. Place a 0.05 mm (0.002 in.) shim between the upper rollers and track.
- i. Squeeze each wheel pair (upper and lower) together against the track, and shim and tighten the nut securely on each pair.
- j. Remove the shim, and verify that the upper right and lower left rollers turn freely.
- k. Reassemble the plotter, and verify smooth operation.

NOTE

If precision shims are not available, the 0.3 mm shim may be approximated by three layers of HP chart paper (HP Part Number 9270-1004 or equivalent). The 0.05 mm shim may be approximated by one layer of lightweight note paper.

6-96. PRINTED CIRCUIT ASSEMBLY REPLACEMENT

6-97. INTERCONNECT PCA A1 REMOVAL AND REPLACEMENT. To remove the Interconnect PCA A1, proceed as follows:

- a. Open the plotter as outlined in paragraph 6-85.
- b. Unplug all interconnecting cables from the Main PCA A2.
- c. Remove the two 6-32 screws from the rear panel. See Figure 6-35.
- d. Remove the eight 6-32 screws from the Main PCA and lift the Main PCA and Interconnect PCA from the plotter.
- e. The Interconnect PCA may now be unplugged from the Main PCA.
- f. To replace, reverse the procedure.

6-98. MAIN PCA A2 REMOVAL AND REPLACEMENT. To remove and replace the Main PCA A2, follow the procedures listed for removal and replacement of the Interconnect PCA.

6-99. POWER SUPPLY ASSEMBLY REMOVAL AND REPLACEMENT. To remove and replace the power supply assembly, proceed as follows:

- a. Open the plotter as described in paragraph 6-85.
- b. Remove the 6-32 screw securing the safety cover over the Primary PCA A5. See Figure 6-36. Remove the cover.
- c. Unplug the fan connector, and plug P1 to the primary of the power transformer.
- d. Unplug the transformer secondary cable and the two power supply output cables from the Power Supply PCA A4.

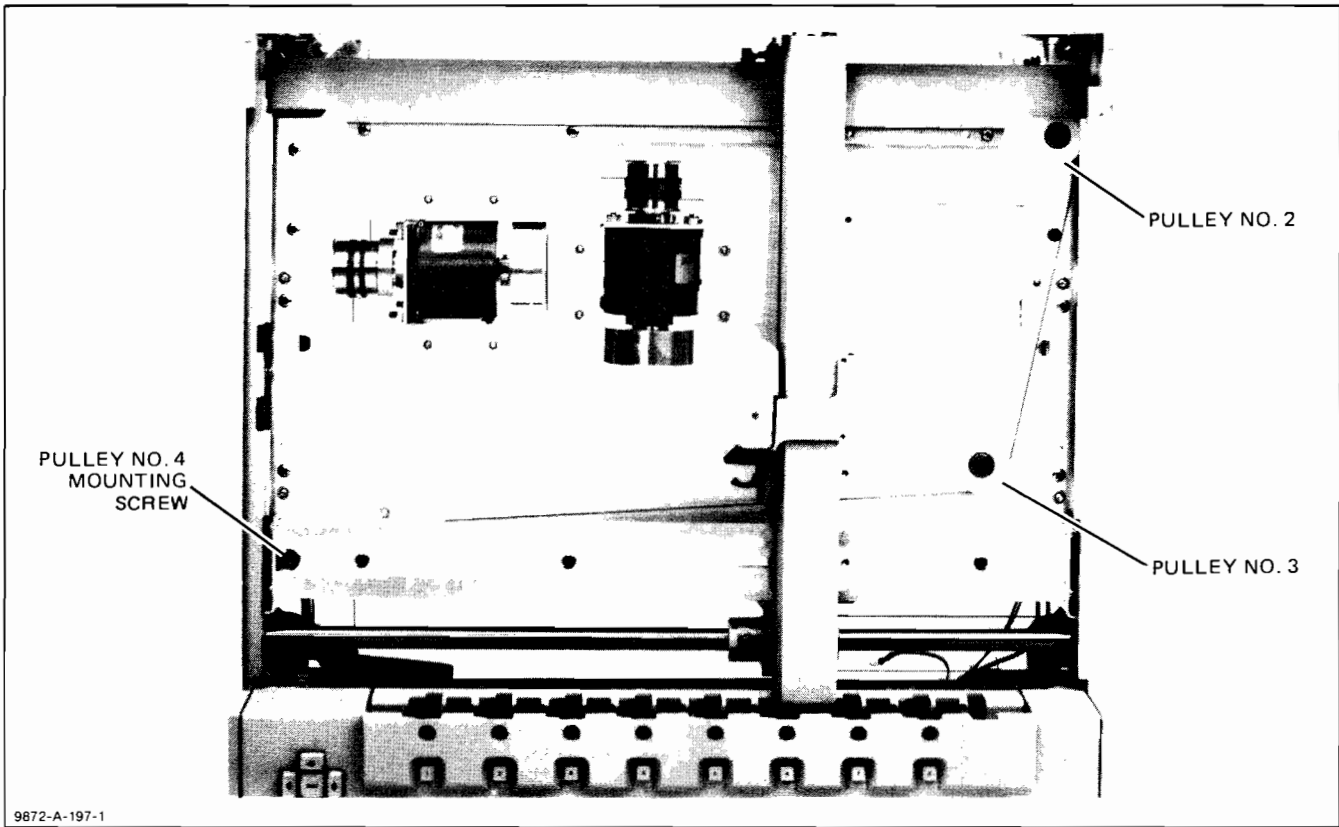


Figure 6-30. Top View of Plotter with Platen Removed

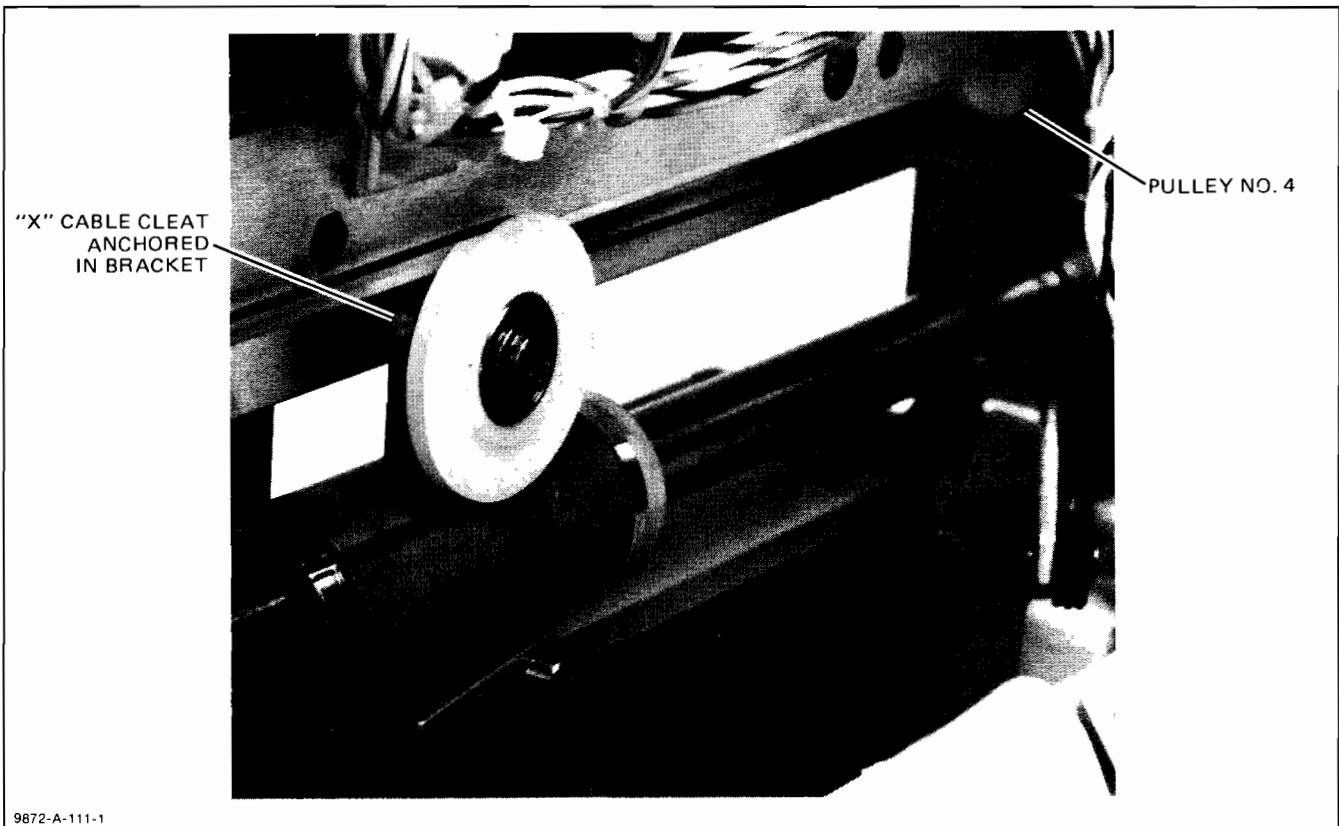


Figure 6-31. X Cable Termination in Lower Pen Arm Bracket

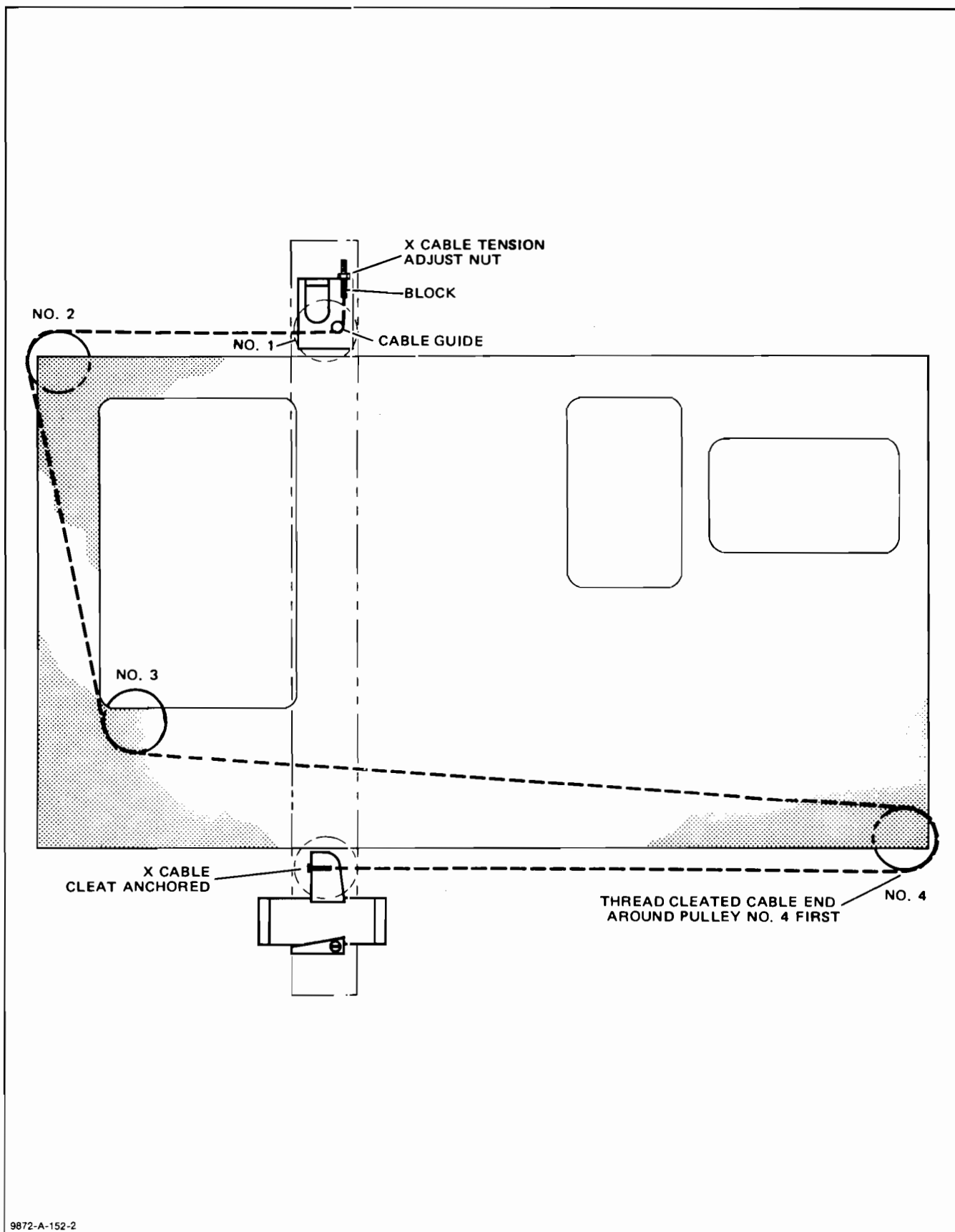


Figure 6-32. X Cable Stringing Diagram Viewed from Underside of Upper Deck

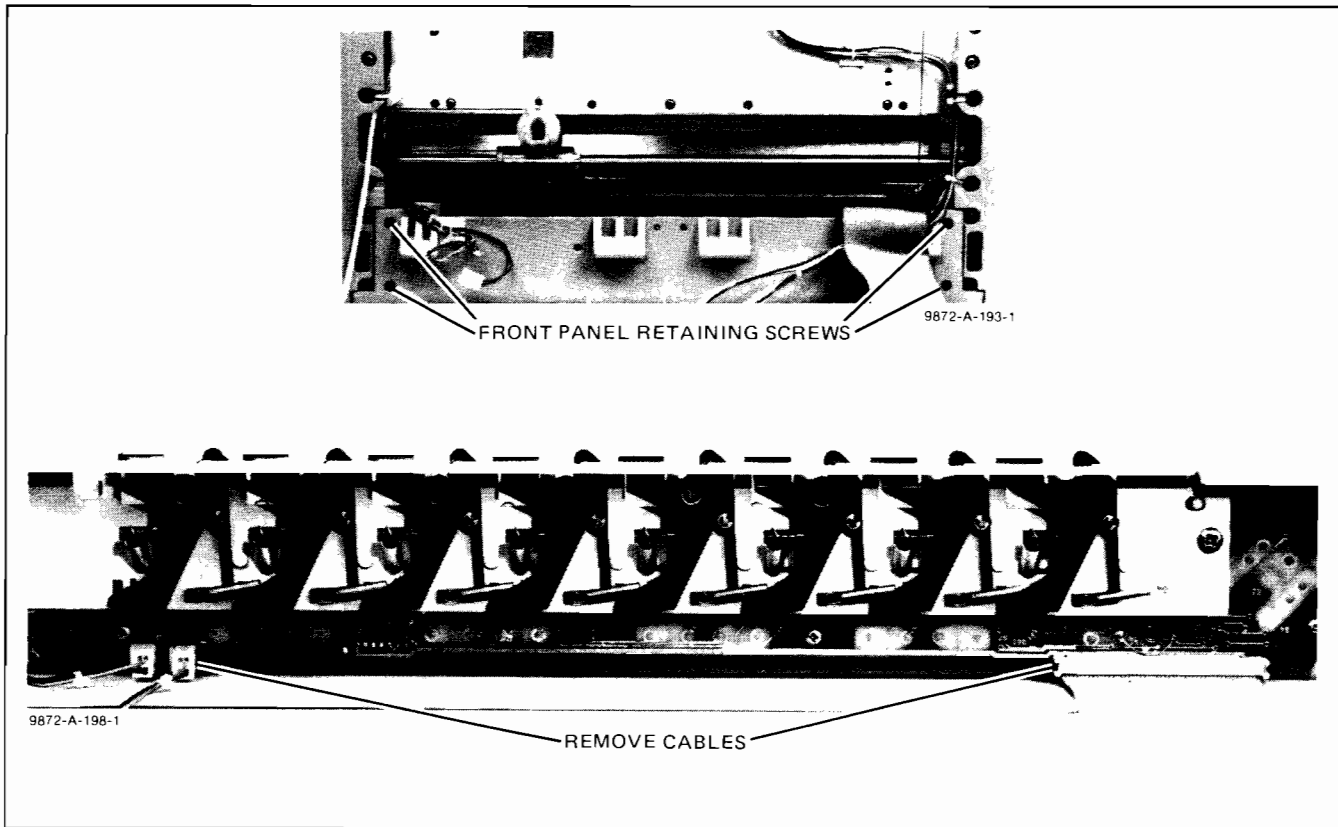


Figure 6-33. Front Panel Removal

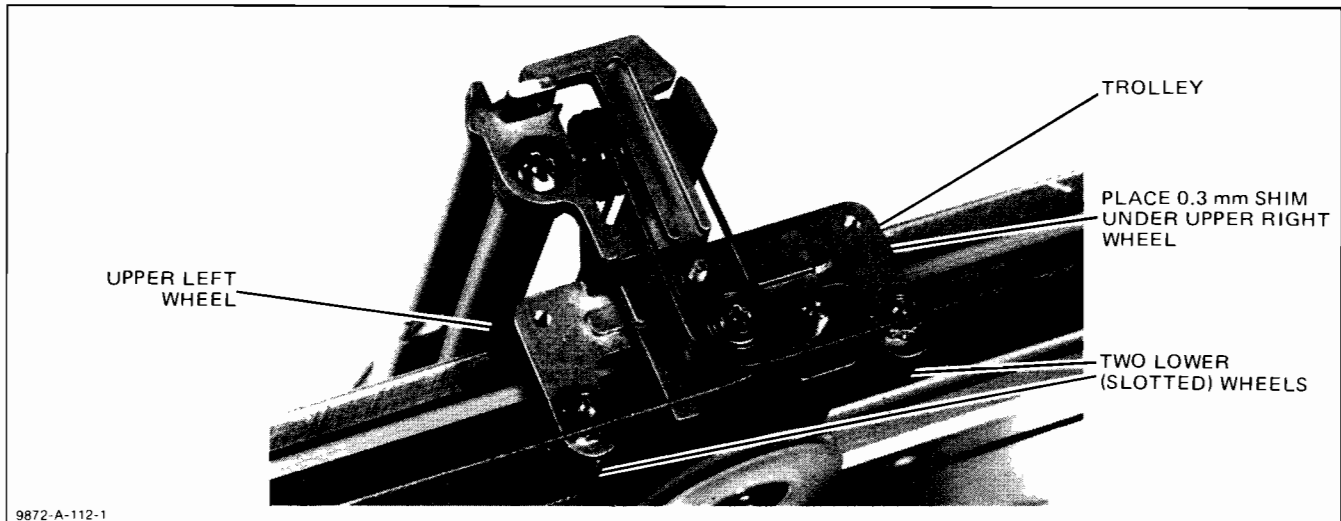


Figure 6-34. X Rear Track and Wheels

- e. Unplug the leads to the platen and to the pen solenoid at the Chart Hold PCA A6.
- f. Remove the two 6-32 screws from the power supply back panel. Remove the five 6-32 screws securing the power supply to the case assembly.
- g. Remove the two 6-32 \times 1 3/8 screws extending through the Chart Hold PCA into the lower case assembly. See Figure 6-36.
- h. Remove the 6-32 screw securing the ground cable to the forward switch bracket. See Figure 6-36.
- i. Remove the power supply assembly from the plotter.
- j. When replacing the power supply, assure that all ground cables are properly replaced.

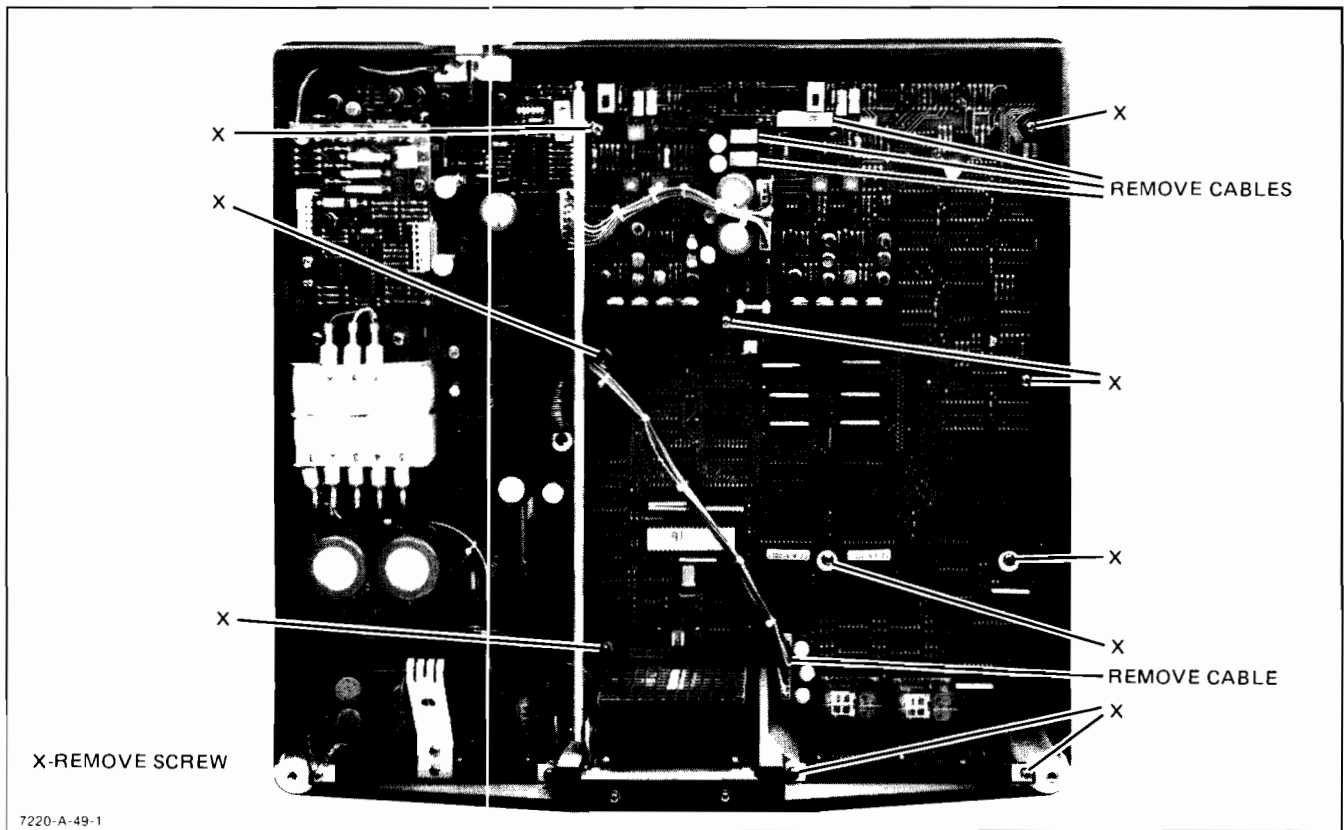


Figure 6-35. Main PCA A2 Removal

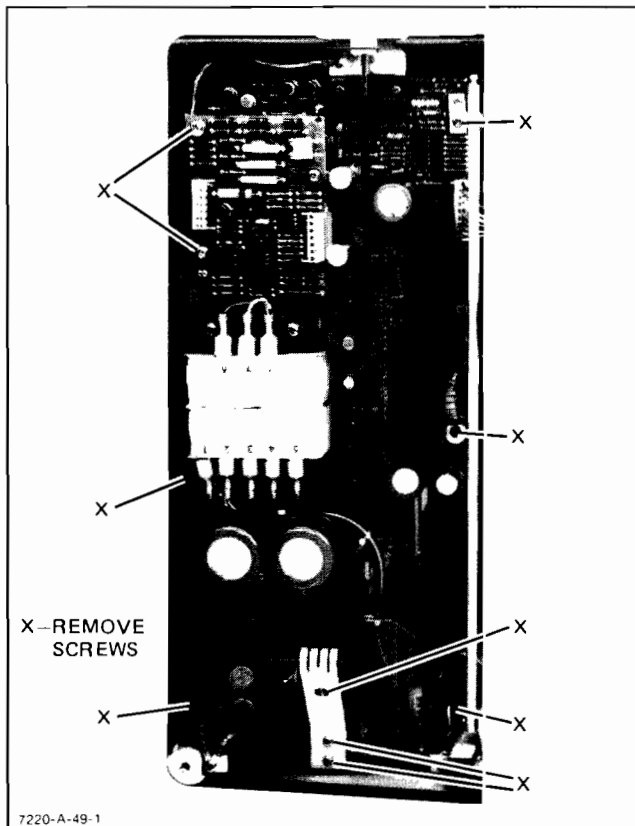


Figure 6-36. Power Supply Assembly Removal

6-100. FRONT PANEL PCA A3 REMOVAL AND REPLACEMENT. To remove and replace the Front Panel PCA A3, proceed as follows:

- a. Open the plotter as described in paragraph 6-85.
- b. Unplug the pen solenoid cable and platen cable from the Chart Hold PCA A6. See Figure 6-37.
- c. Unplug the motors and front panel cable from the Main PCA.
- d. Remove the screw holding the ground cable to the forward line switch bracket.
- e. Lift the upper deck assembly from the plotter.
- f. Remove the four 8-32 front panel retaining screws. Unplug the X-limit switch from the Front Panel PCA and remove the front panel from the upper deck.
- g. Remove the two 8-32 screws holding the copper assembly to the front panel. Unplug the Y-limit switch, and remove the copper assembly.
- h. Remove the seven 4-40 screws securing the PCA to the front panel assembly and remove the PCA. Use care not to lose any of the nine switch plungers located in the front panel assembly.

6-101. To replace the Front Panel PCA, proceed as follows:

- a. Place the front panel assembly on a flat surface, braced as shown in Figure 6-37. Assure that all switch plungers are fully seated in the panel.

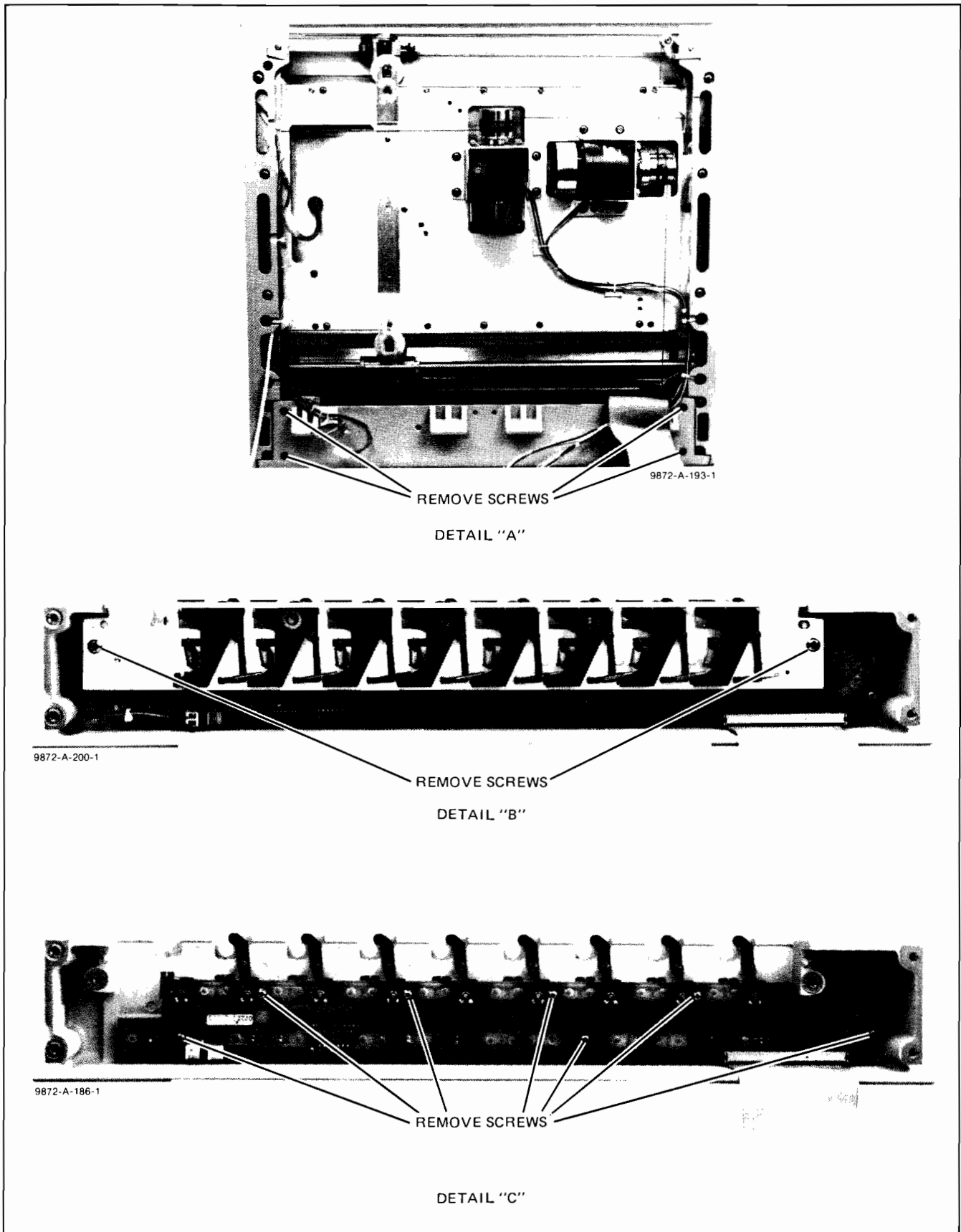


Figure 6-37. Front Panel PCA A3 Removal

- b. Carefully place the Front Panel PCA into the front panel assembly, assuring that the switch arms are properly seated behind the switch plungers. Carefully install the Front Panel PCA, assuring that each switch arm is seated.
- c. Insert two or three 4-40 screws into the PCA and double check switch actuator arms and plungers.
- d. Insert all front panel screws, but do not tighten.
- e. Refer to Section III of this manual for alignment procedures.

6-102. ELECTROSTATIC TABLE (PLATEN) REMOVAL AND REPLACEMENT

6-103. To remove and replace the electrostatic table, proceed as follows:

- a. Remove the six 6-32 \times 9/16 screws from around the edge of the platen. Remove the two 6-32 \times 3/4 screws from the center area of the plotter. See Figure 6-38.
- b. Unplug the electrostatic table.
- c. Move the Y-axis arm to one end of the plotter.
- d. Carefully lift the electrostatic table from the plotter.

6-104. X- AND Y-MOTOR REPLACEMENT

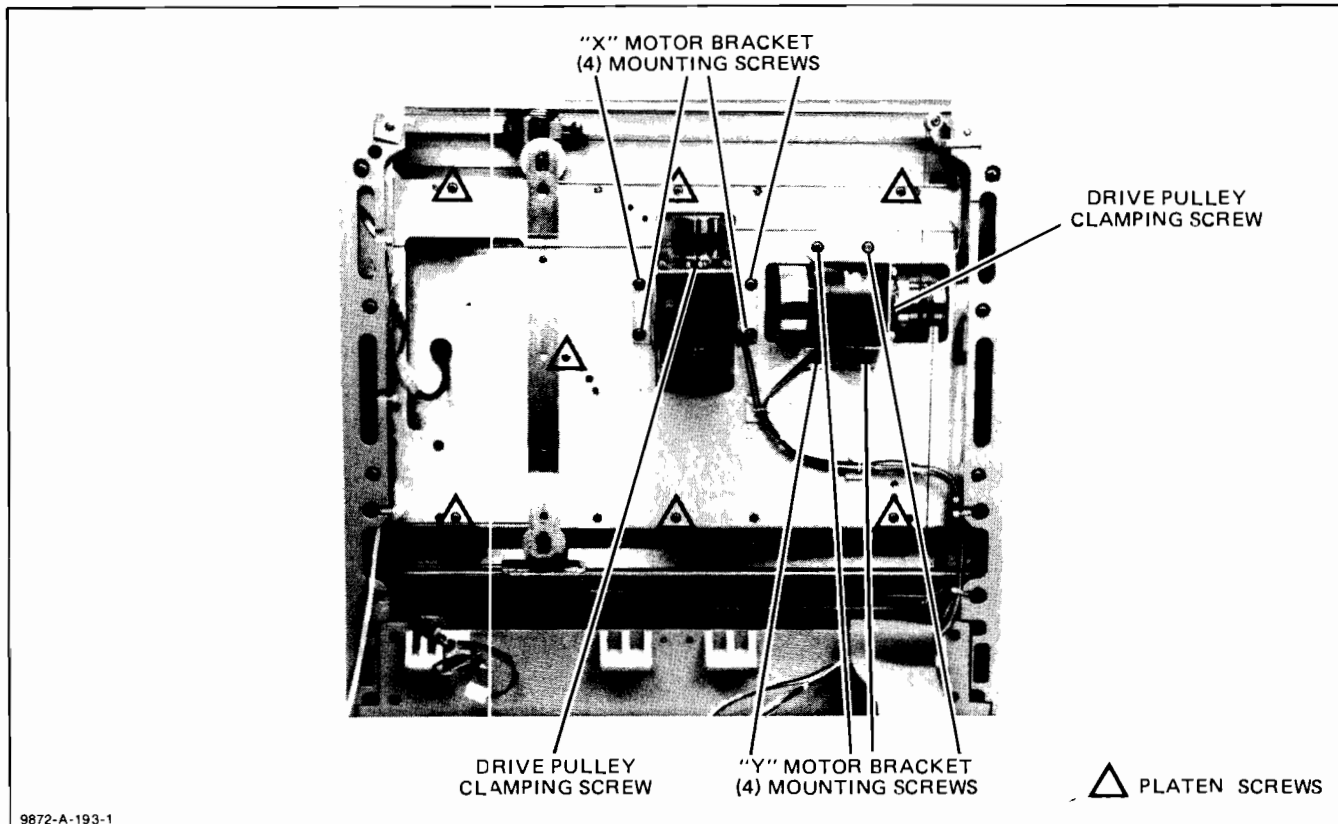
6-105. To remove or replace a drive motor, proceed as follows:

- a. Open the plotter as described in paragraph 6-85.
- b. Unplug the respective motor from the Main PCA A2. See Figure 6-35.
- c. Cut the cable ties on the upper deck assembly.
- d. Loosen the motor pulley clamp screw, and secure the pulley to prevent movement.
- e. Remove the four 6-32 motor bracket mounting screws.
- f. Carefully remove the motor and bracket. See Figure 6-38.
- g. Remove the four 8-32 screws and nuts securing the motor to the bracket.
- h. When replacing the motor, verify that the drive cable tension is within specifications.
- i. When a new motor is installed, refer to Section III of this manual for Motor Driver Alignment Procedures.

6-106. X-LIMIT SWITCH ASSEMBLY REPLACEMENT

6-107. To replace the X-limit switch assembly, proceed as follows:

- a. Open the plotter as described in paragraph 6-85.



9872-A-193-1

Figure 6-38. Motor Removal

- b. Unplug the X-limit switch connector from the Front Panel PCA A3.
- c. Remove the screw securing the switch to the switch bracket, and remove the switch. See Figure 6-39.
- d. Refer to the procedures in Section III of this manual to align the X-limit switch after installation.

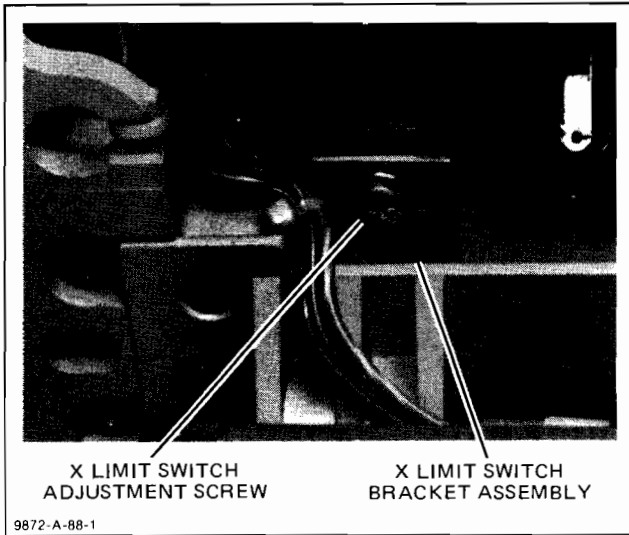


Figure 6-39. X-limit Switch Removal

6-108. Y-LIMIT SWITCH ASSEMBLY REPLACEMENT

- 6-109. To replace the Y-limit switch assembly, proceed as follows:
- a. Open the plotter as described in paragraph 6-85.
 - b. Remove the Front Panel PCA. Refer to paragraph 6-100.
 - c. Unplug the two leads from the Y-limit switch at the PCA.
 - d. Remove the two screws securing the micro-switch to the mounting block, and remove the switch.

6-110. SIDE PANEL REMOVAL

- 6-111. To remove the side panels from the plotter, proceed as follows:
- a. Remove power from the plotter, remove the interface cable, and open the plotter.
 - b. Remove the 6-32 screw and nut from the end of the trailing cable trough next to the side panel to be removed. Secure the cable trough to prevent damage by bending.
 - c. Remove the side panel retaining screws, the hinge screws, and the two front panel retaining screws from the side to be removed. See Figure 6-40.
 - d. Pull the side panel away from the upper deck assembly.

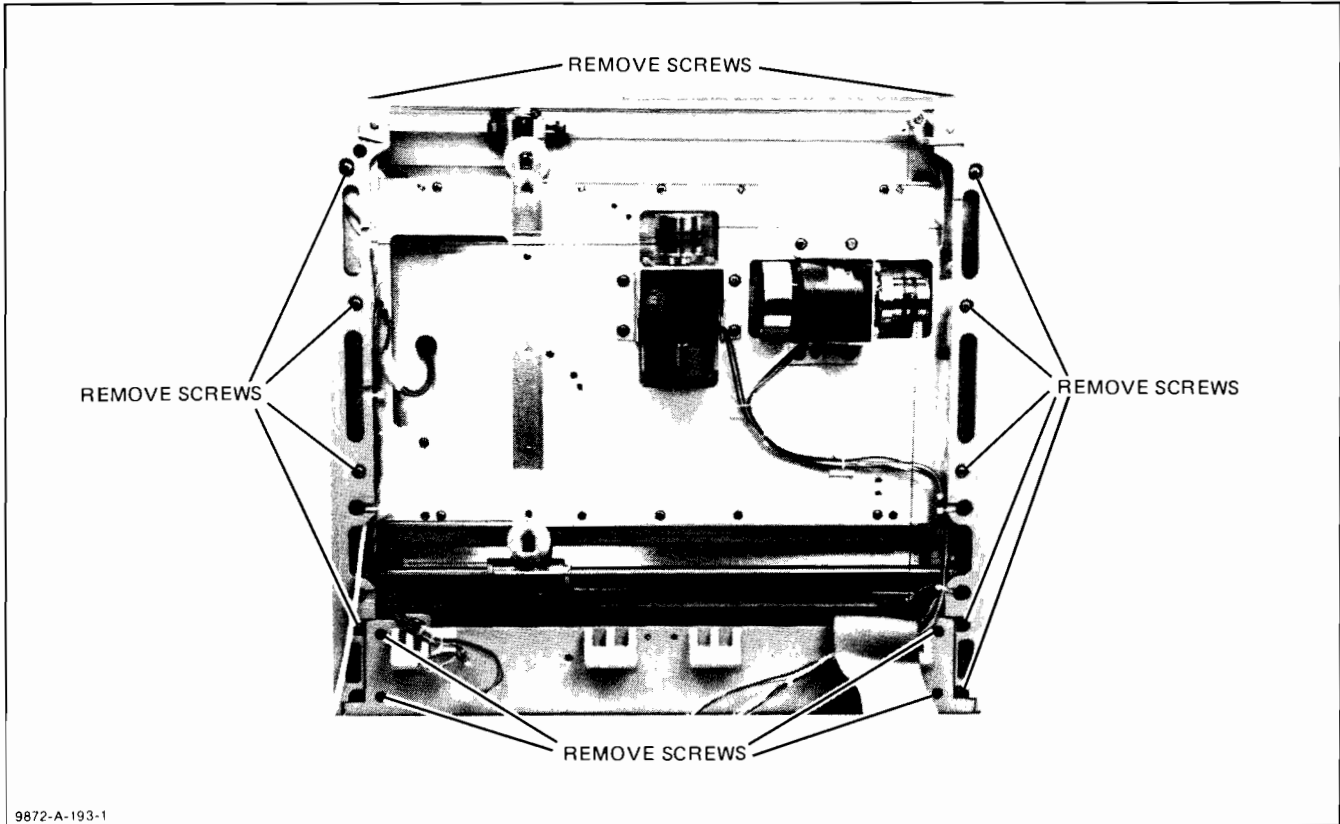


Figure 6-40. Side Panel Removal

6-112. LOGIC SYMBOLS AND NOTES

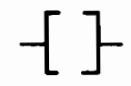

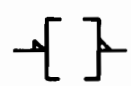
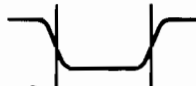
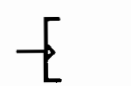
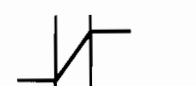
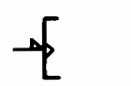


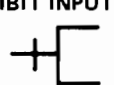
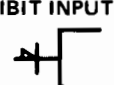
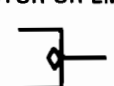
6-113. The logic symbols used in this manual comply with ANSI Standard Y32.14. Figure 6-41 gives explanatory data concerning this standard, along with some specific examples. Figure 6-42 provides notes for use with the schematic diagrams.

6-114. BLOCK DIAGRAMS

6-115. Figure 6-43 is the functional block diagram of the 7220C/7221C. A block diagram illustrating the interconnecting cables is provided in Figure 6-44.

6-116. SCHEMATIC DIAGRAMS

6-117. Figures 6-45 through 6-61 are the schematic diagrams and parts location diagrams for the printed circuit assemblies in the plotters. The Main PCA has been illustrated by functional areas due to the size and complexity of the PCA. Each schematic diagram has been given a service sheet number. This number is intended to facilitate referencing between schematic diagrams. Waveforms have been provided for the Motor Driver circuits (see Figure 6-57) and for the power supply assembly (Figure 6-60).

INDICATOR SYMBOLS		
 <p>HIGH LEVEL SENSITIVE</p>	 <p>ACTIVE PERIOD</p>	<p>ACTIVE HIGH inputs and outputs are indicated by the absence of the polarity indicator (Δ) or negation symbol (\circ).</p>
 <p>LOW LEVEL SENSITIVE</p>	 <p>ACTIVE PERIOD</p>	<p>ACTIVE LOW inputs and outputs are indicated by the presence of the polarity indicator (Δ) or negation symbol (\circ).</p>
 <p>LOW TO HIGH EDGE SENSITIVE</p>	 <p>ACTIVE PERIOD</p>	<p>EDGE SENSITIVE (Dynamic) inputs are indicated by the presence of the dynamic indicator symbol (\triangleright).</p>
 <p>HIGH TO LOW EDGE SENSITIVE</p>	 <p>ACTIVE PERIOD</p>	
<p>OUTPUT DELAY</p> 		<p>The output changes state only after the referenced input (m) returns to its inactive state. (m is replaced by appropriate dependency symbol.)</p>
<p>INHIBIT INPUT</p> 		<p>An active high state input prevents the output of that element from being active.</p>
<p>INHIBIT INPUT</p> 		<p>An active low state input prevents the output of that element from being active.</p>
<p>OPEN COLLECTOR OR EMITTER OUTPUT</p> 		<p>This output requires some external components to achieve logic state.</p>

1-A-3-1

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 1 of 7)

INDICATOR SYMBOLS (Continued)

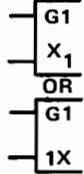


Schmitt Trigger- indicates that hysteresis exists in the device.

Dependency Notation



The input that controls or gates other inputs is labeled with a "C" or a "G", followed by an identifying number. The controlled or gated input or output is labeled with the same number. In this example, "1" is controlled by "G1".



When the controlled or gated input or output already has a functional label (X is used here), that label will be prefixed or subscripted by the identifying number.



If a particular device has only one gating or control input then the identifying number may be eliminated and the relationship shown with a subscript.



If the input or output is affected by more than one gate or control input, then the identifying numbers of each gate or control input will appear in the prefix or subscript, separated by commas. In this example "X" is controlled by "G1" and "G2".



GATE	IEEE STANDARD 91 ANSI Y32.14	TRUTH TABLE	FLIP FLOP	ANSI Y32.14 CONTROL DESIGNATIONS FOR F.F.	DESCRIPTION																																			
AND		<table border="1"> <tr> <td>A</td> <td>B</td> <td>C</td> </tr> <tr> <td>L</td> <td>L</td> <td>L</td> </tr> <tr> <td>H</td> <td>H</td> <td>H</td> </tr> <tr> <td>L</td> <td>H</td> <td>L</td> </tr> <tr> <td>H</td> <td>L</td> <td>L</td> </tr> </table>	A	B	C	L	L	L	H	H	H	L	H	L	H	L	L	R-S		<table border="1"> <tr> <td>R</td> <td>S</td> <td>Q</td> <td>Q̄</td> </tr> <tr> <td>L</td> <td>L</td> <td>N/C</td> <td>N/C</td> </tr> <tr> <td>L</td> <td>H</td> <td>H</td> <td>L</td> </tr> <tr> <td>H</td> <td>L</td> <td>L</td> <td>H</td> </tr> <tr> <td>H</td> <td>H</td> <td colspan="2">undetermined</td> </tr> </table>	R	S	Q	Q̄	L	L	N/C	N/C	L	H	H	L	H	L	L	H	H	H	undetermined	
A	B	C																																						
L	L	L																																						
H	H	H																																						
L	H	L																																						
H	L	L																																						
R	S	Q	Q̄																																					
L	L	N/C	N/C																																					
L	H	H	L																																					
H	L	L	H																																					
H	H	undetermined																																						

1-A-4-1

Figure 6-41 ANSI Y.32.14 Logic Symbols (Sheet 2 of 7)

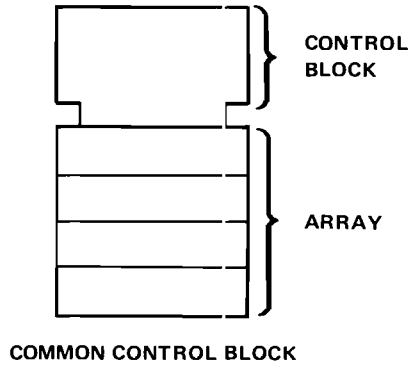
INDICATOR SYMBOLS (Continued)																						
OR		<table border="1"> <tr><th>A</th><th>B</th><th>C</th></tr> <tr><td>L</td><td>L</td><td>L</td></tr> <tr><td>H</td><td>H</td><td>H</td></tr> <tr><td>L</td><td>H</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td></tr> </table>	A	B	C	L	L	L	H	H	H	L	H	H	H	L	H					
A	B	C																				
L	L	L																				
H	H	H																				
L	H	H																				
H	L	H																				
NAND		<table border="1"> <tr><th>A</th><th>B</th><th>C</th></tr> <tr><td>L</td><td>L</td><td>H</td></tr> <tr><td>H</td><td>H</td><td>L</td></tr> <tr><td>L</td><td>H</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td></tr> </table>	A	B	C	L	L	H	H	H	L	L	H	H	H	L	H					
A	B	C																				
L	L	H																				
H	H	L																				
L	H	H																				
H	L	H																				
NOR		<table border="1"> <tr><th>A</th><th>B</th><th>C</th></tr> <tr><td>L</td><td>L</td><td>H</td></tr> <tr><td>H</td><td>H</td><td>L</td></tr> <tr><td>L</td><td>H</td><td>L</td></tr> <tr><td>H</td><td>L</td><td>L</td></tr> </table>	A	B	C	L	L	H	H	H	L	L	H	L	H	L	L					
A	B	C																				
L	L	H																				
H	H	L																				
L	H	L																				
H	L	L																				
XOR		<table border="1"> <tr><th>A</th><th>B</th><th>C</th></tr> <tr><td>L</td><td>L</td><td>L</td></tr> <tr><td>H</td><td>H</td><td>H</td></tr> <tr><td>L</td><td>H</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td></tr> </table>	A	B	C	L	L	L	H	H	H	L	H	H	H	L	H					
A	B	C																				
L	L	L																				
H	H	H																				
L	H	H																				
H	L	H																				
BUF-FER		<table border="1"> <tr><th>A</th><th>B</th></tr> <tr><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td></tr> </table>	A	B	1	1	0	0														
A	B																					
1	1																					
0	0																					
INVERT-ER		<table border="1"> <tr><th>A</th><th>B</th></tr> <tr><td>1</td><td>0</td></tr> <tr><td>0</td><td>1</td></tr> </table>	A	B	1	0	0	1														
A	B																					
1	0																					
0	1																					
T		<p>Toggles with every clock pulse</p>																				
D		<p>Data output follows data input. Input is gated by C.</p>																				
J-K		<table border="1"> <tr><th>J</th><th>K</th><th>Q</th><th>\bar{Q}</th></tr> <tr><td>L</td><td>L</td><td>N/C</td><td>N/C</td></tr> <tr><td>L</td><td>H</td><td>L</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td><td>L</td></tr> <tr><td>H</td><td>H</td><td colspan="2">toggles</td></tr> </table>	J	K	Q	\bar{Q}	L	L	N/C	N/C	L	H	L	H	H	L	H	L	H	H	toggles	
J	K	Q	\bar{Q}																			
L	L	N/C	N/C																			
L	H	L	H																			
H	L	H	L																			
H	H	toggles																				
J-K (gated)		<p>J and K inputs are gated by G.</p>																				
J-K (master slave)		<p>This output is dependent upon negative going edge of the signal.</p>																				

S Set input – when active causes the flip-flop to set (Asynchronous)
 R Reset input – when active causes the flip-flop to reset (Asynchronous)
 N/C No Change

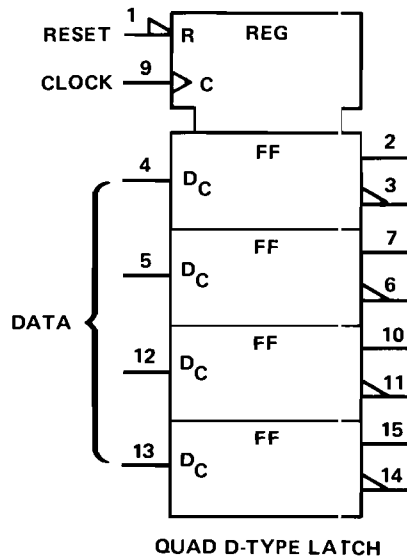
1-A-5-1

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 3 of 7)

INDICATOR SYMBOLS (Continued)



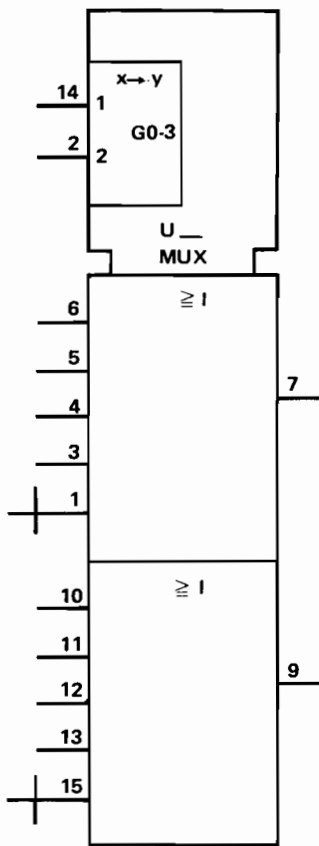
The Control Block is used to show when common control signals are applied to a group of mechanically connected, but functionally separate units.



Register control block used to illustrate a quad D-type latch. There is a common active-low reset (R), and a common edge-triggered control input (C). Since there is only one dependency relationship, the controlling input is not numbered and the controlled functions (D) are subscripted with a C.

1-A-6-1

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 4 of 7)

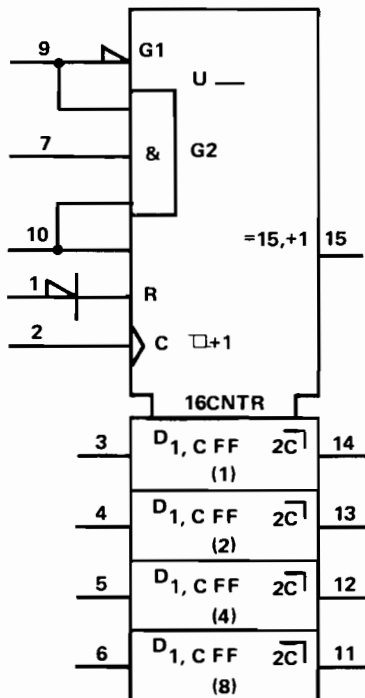


DUAL 4 TO 1 LINE DATA SELECTOR/MULTIPLEXER

Pins 14 and 2 in the control block gate both sections of the array simultaneously.

Each section of the array is essentially a four input OR with the output selected by the control block. Each section also has a STROBE input capable of disabling that section.

	CONTROL		INPUT				STROBE	OUTPUT
	1	2	0	1	2	3		
DISABLE	X	X	X	X	X	X	H	L
ENABLE	L	L	L	X	X	X	L	L
INPUT	0	L	L	H	X	X	X	L
	1	L	H	X	L	X	X	L
	2	L	H	X	H	X	X	L
	3	H	L	X	X	L	X	L
	2	H	L	X	X	H	X	L
	3	H	H	X	X	X	L	L
	3	H	H	X	X	X	H	L



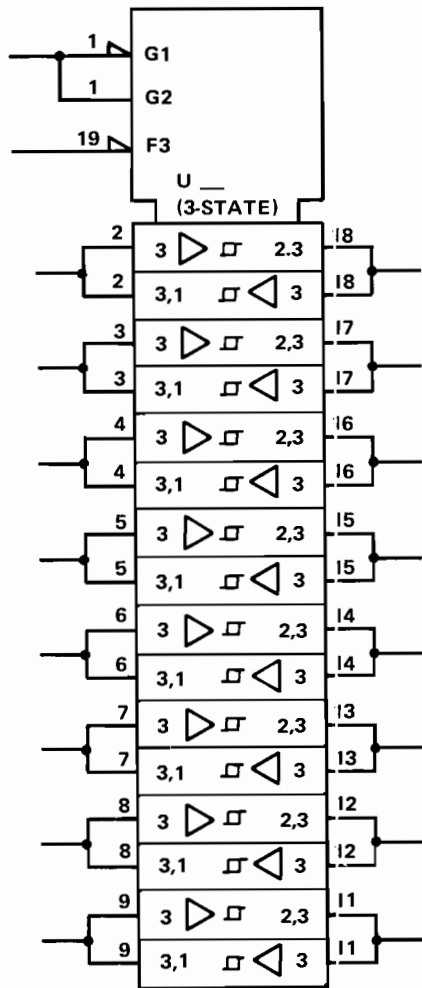
SYNCHRONOUS PRESETTABLE 4 BIT COUNTER

Pin 1(R) of the control block is an asynchronous CLEAR disabling and setting all outputs low when active (low). Pin 2 (C) is the positive edge triggered clock input. The input is buffered for noise immunity. Pins 7 and 10 are enable lines which must be high in order to enable the device. Pin 9 (G1) in the low state causes the inputs to be enabled and to be loaded on the next rising edge of the clock input. When high, Pin 9 forms the third enable to the counter.

The array consists of four flip-flops with binary weighting. The inputs are enabled by G1 and loaded by the rising edge of the clock. The outputs are enabled by the active G2 and stepped by the clock (C) input. At count 15 a pulse is output at Pin 15 Ripple Carry Output.

17603-A-28-1

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 5 of 7)

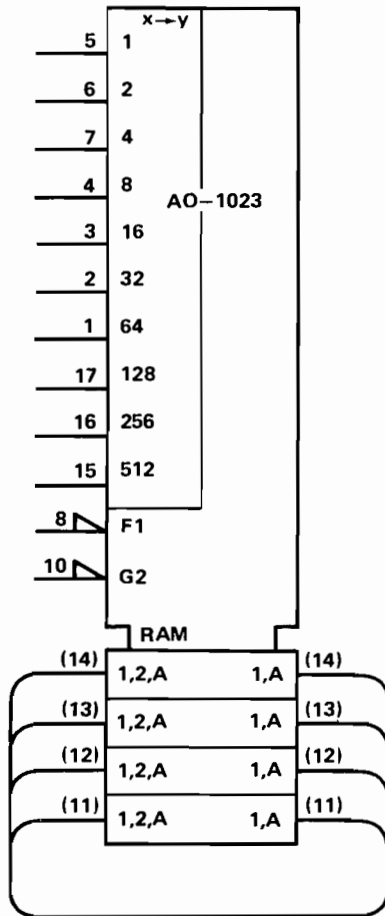


OCTAL BUS TRANSCEIVER with identical input/output lines

Pin 1 is the transmit/receive enable. A low at G1 enables the left to right flow of information, while a high at G2 will enable the right to left flow. F3 is the three state enable. A low at Pin 19 is required to enable the chip.

Each pin of the array is shown twice, once as a receiver and again as a transmitter, with the numbers of the enabling inputs of the control block given at each pin. The triangle indicates each section as a buffer, while the hysteresis symbol shows noise immunity.

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 6 of 7)



RAM (with identical input/output pins)

Random Access Memory with access to 1024 locations. Address selection is determined by the 10 address input codes in the upper left corner of the control block. These lines are weighted to correspond to the possible address (AO-1023).

G2 is the read/write enable. A low at Pin 10 will enable the write function. A high at Pin 10 will enable the read function. F1 is the chip enable line. A low at Pin 8 will enable data to be read and written.

The input lines are noted in the lower left portion of the symbol. "1" indicates that these inputs are enabled when there is a low on pin F1. "2,A" indicates that information will be written into the chip when G2 is low at the memory location addressed (A).

The output lines are noted in the lower right portion of the symbol. "1" indicates that these outputs are enabled by the low on F1, and that the information will be read from the location addressed by "A".

Note: The input/output pins are identical. This is indicated by the signal line bundling.

Figure 6-41. ANSI Y.32.14 Logic Symbols (Sheet 7 of 7)

SCHMATIC DIAGRAM NOTES

Resistance in ohms, capacitance in microfarads, inductance in millihenries unless otherwise noted.



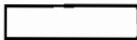
Indicates a NOTE on the schematic diagram.



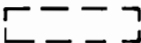
Tool-aided adjustment.



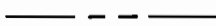
Manual control.



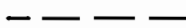
Encloses a front-panel or circuit assembly silkscreened designator.



Encloses a rear-panel silkscreened designator.



Circuit assembly borderline.



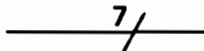
Other assembly borderline. Also used to indicate mechanical interconnection (ganging) and RF shielding



Heavy line with arrows indicates path and direction of main signal.



Heavy dashed line with arrows indicates path and direction of main feedback.



Indicates cable run with seven lines.



Wiper moves toward CW with clockwise rotation of control (as viewed from shaft or knob).



Numbered Test point. Measurement aid (metal post, circuit pad, etc.) provided.



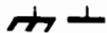
Lettered Test point. No measurement aid provided.



Encloses wire color code. Code used is the same as the resistor color code. First number identifies the base color, second number identifies the wider stripe, third number identifies the narrower stripe (e.g., (947) denotes white base, yellow wide stripe, violet narrow stripe).



A direct conducting connection to the earth, or a conducting connection to a structure that has a similar function (e.g., the frame of an air, sea, or land vehicle).



A conducting connection to a chassis or frame.



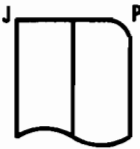
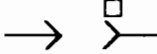
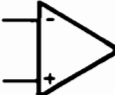





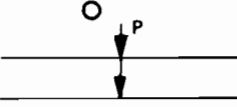





Common connections. All like-designated points are connected. When accompanied by a letter, indicates the type common (i.e., A = Analog, D = Digital, F = Floating).

1-A-1-1

Figure 6-42. Schematic Diagram Notes

SCHMATIC DIAGRAM NOTES (Continued)

	Light Emitting Diode (LED).
	Photo-Transistor.
	Cable and circuit assembly connectors. J – Fixed Portion P – Moveable Portion
	Circuit assembly square-pin connectors.
	Operational Amplifier (integrated circuit).
	Voltage regulator (breakdown diode).
	Denotes Field Effect transistor (FET) with N-type base.
	Denotes FET with P-type base.
	Denotes Silicon Controlled Rectifier (SCR).
	Denotes spring-loaded switch.
	Indicates twisted pair.
	Identifies service sheet for quick reference.
	Signal line identification.
	Combined service sheet and signal line identification.

1-A-2-1

Figure 6-42. Schematic Diagram Notes (Continued)

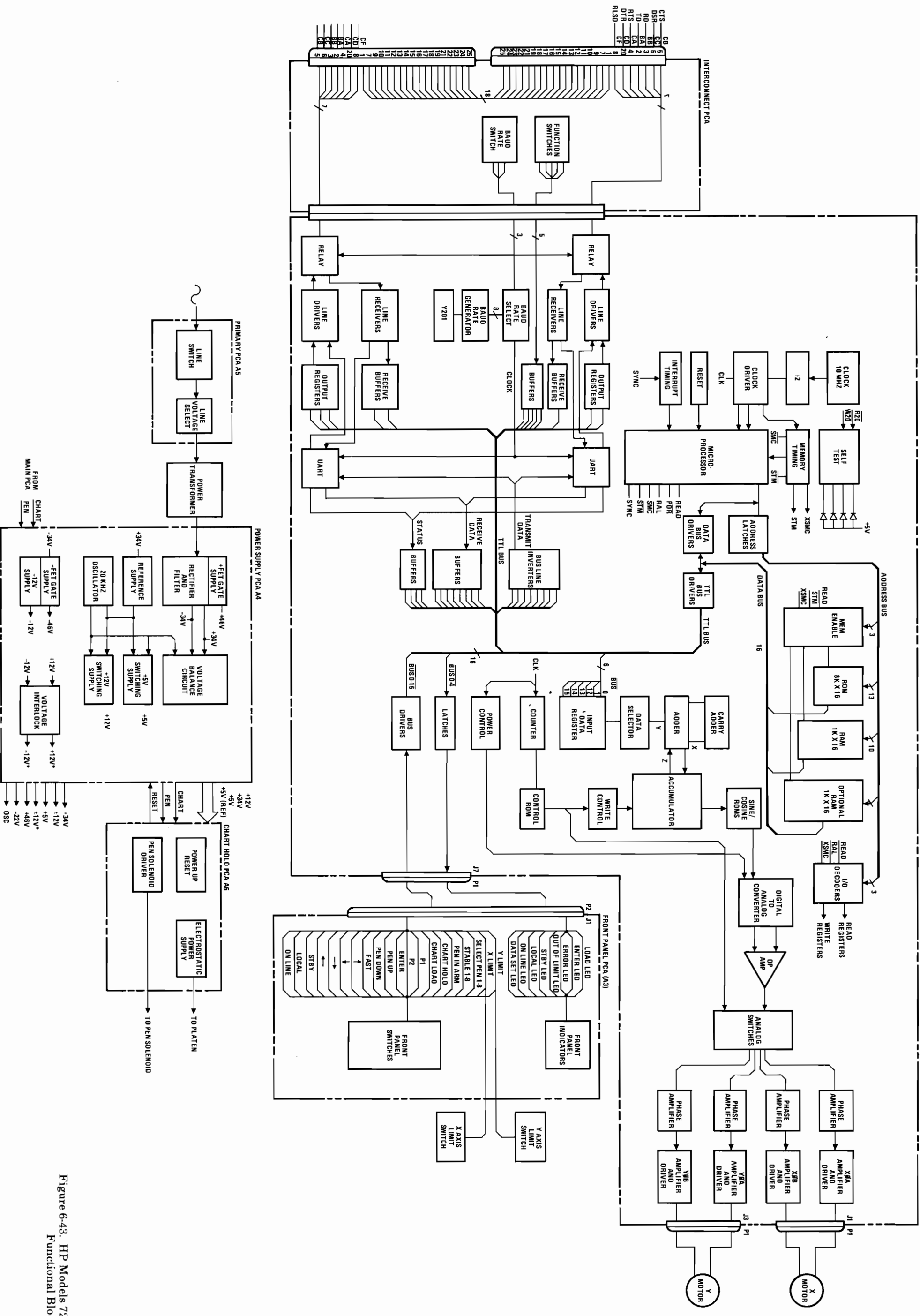
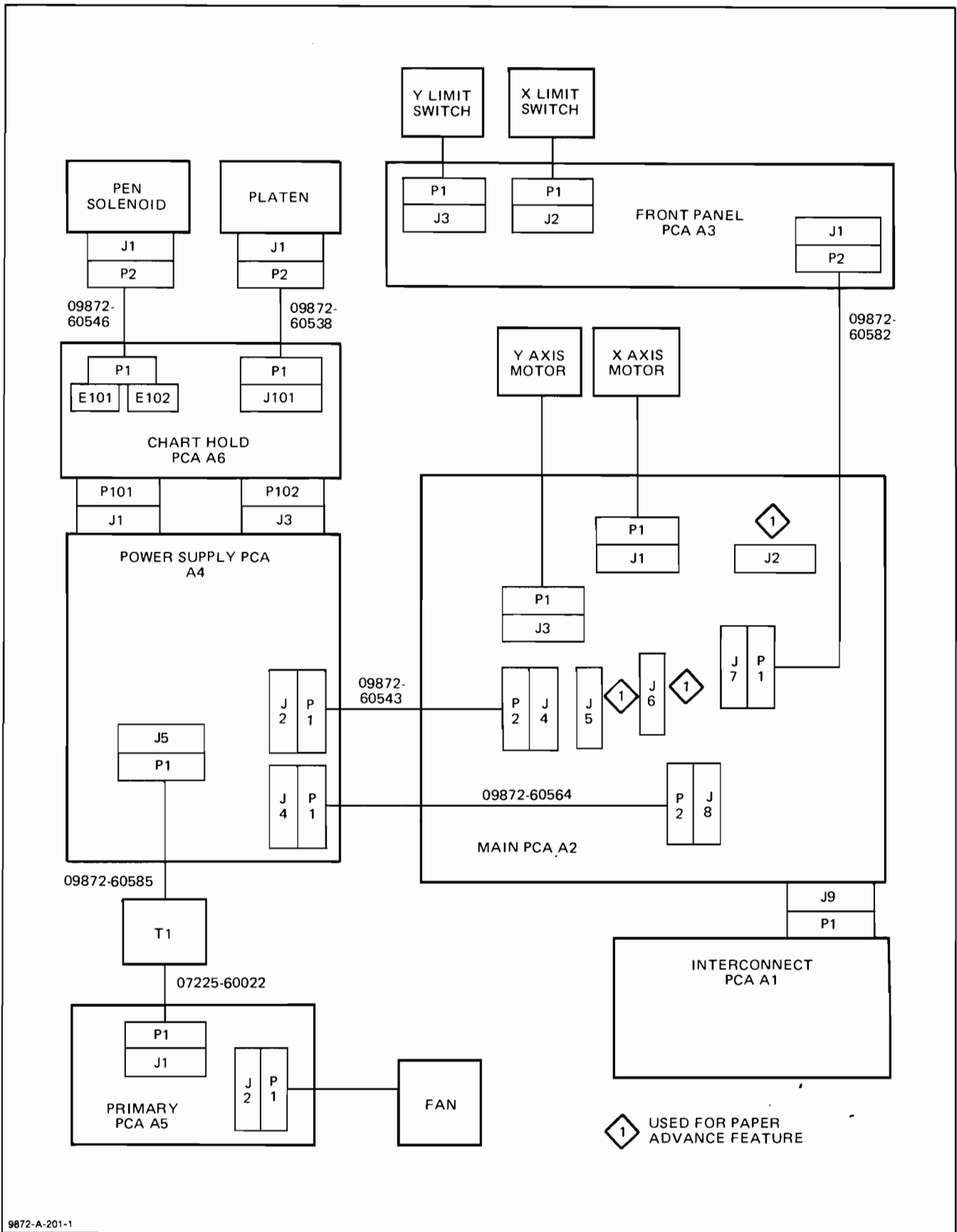
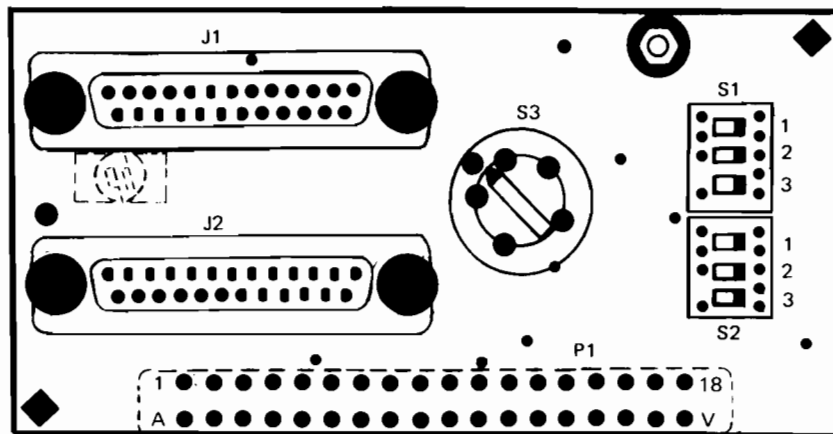


Figure 6-43. HP Models 7220C/7221C Functional Block Diagram



9872-A-201-1

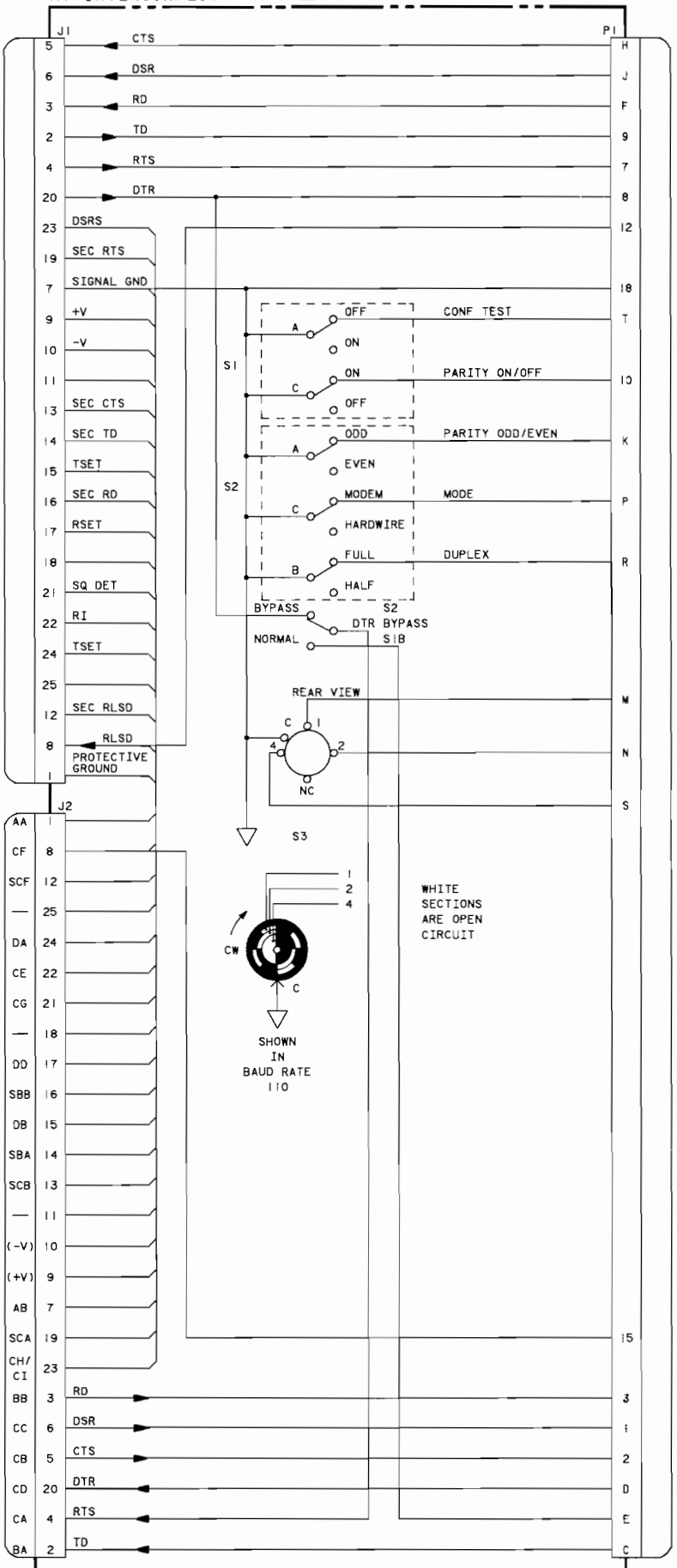
Figure 6-44. Interconnecting Cable Diagram



7220-A-65-1

Figure 6-45. Interconnect PCA A1 Parts Location

DTE
TERMINAL



TO MAIN PCA
A2 J9 SEE
SERVICE SHEET 2

PLEASE RETURN TO -
ELECTRONIC STORE
DEPARTMENT OF
ELECTRICAL ENGINEERING
UNIVERSITY OF MELBOURNE

DCE
MODEM



SERVICE SHEET

Figure 6-46. Service Sheet 1 Interconnect PCA (07221-60506) Schematic

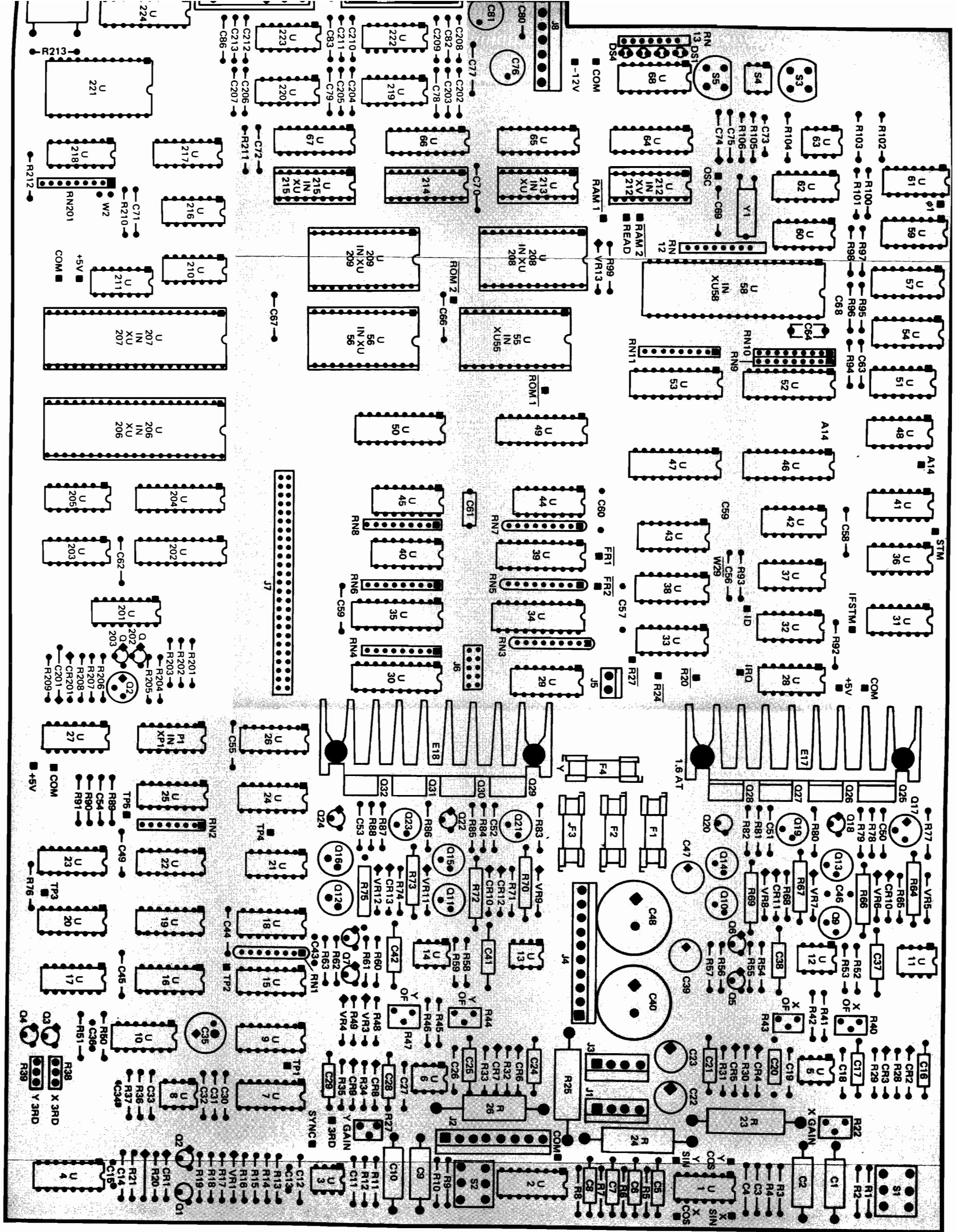
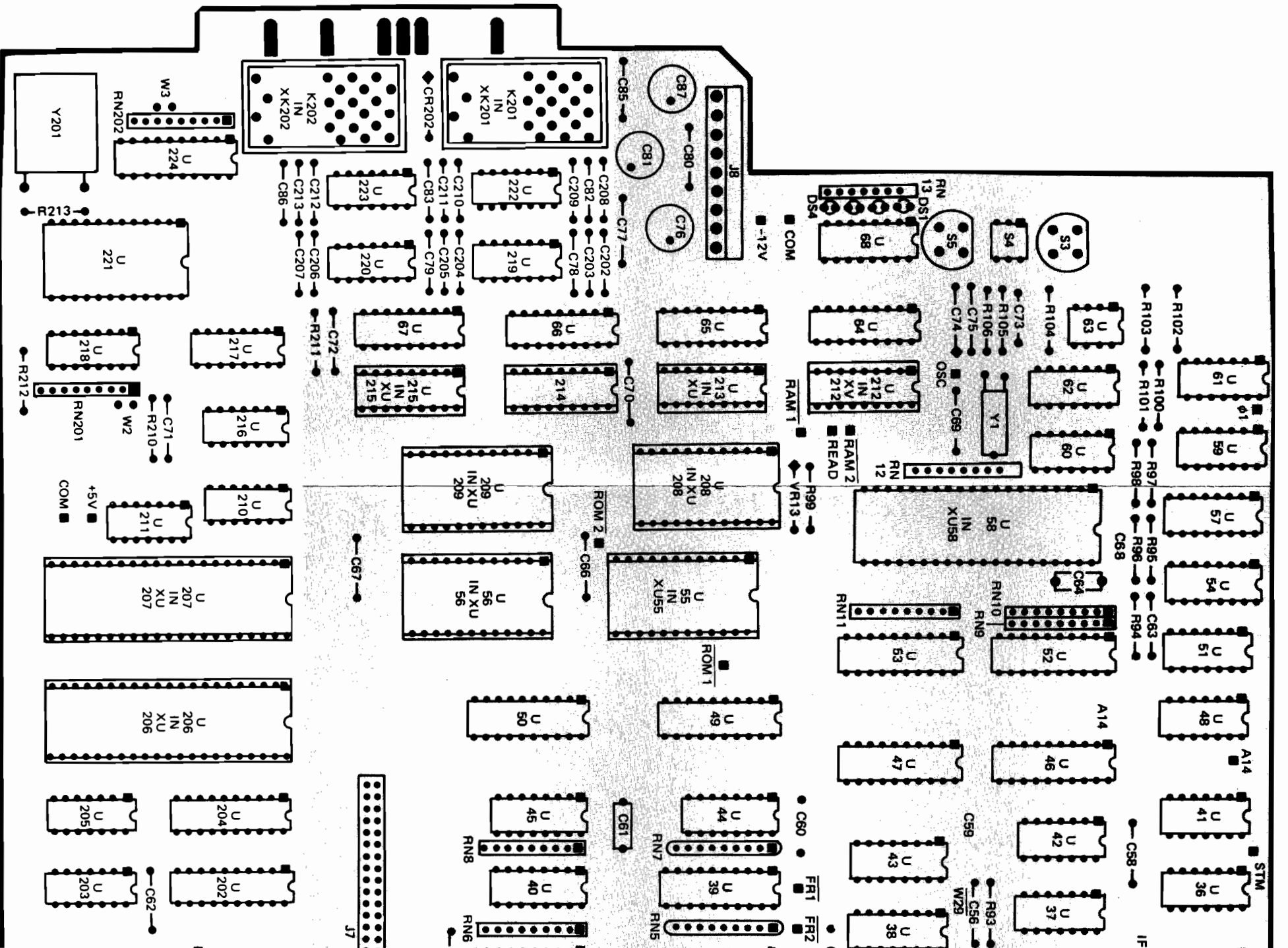
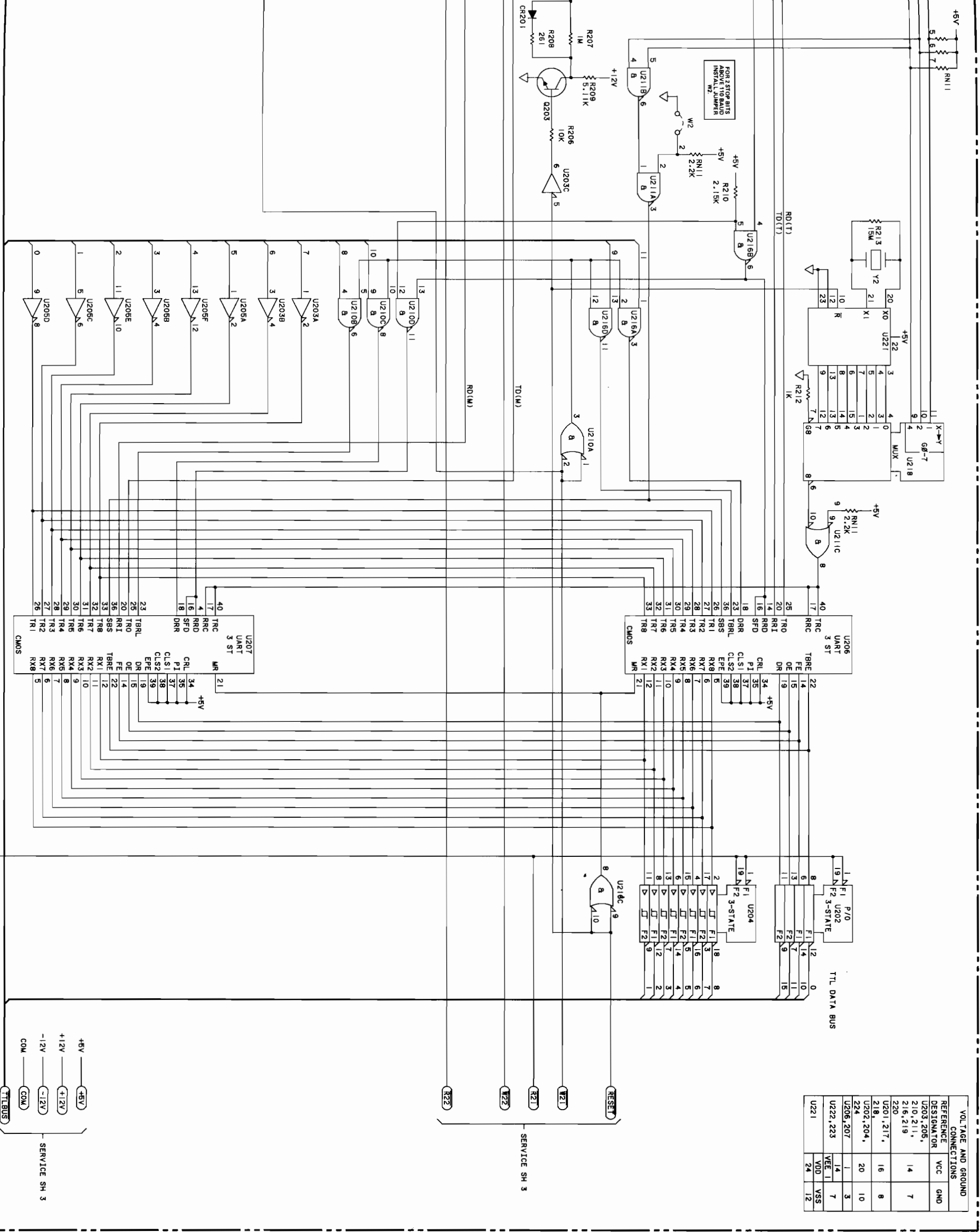


Figure 6-47. Main PCA A2 RS-232-C Circuit Parts Location



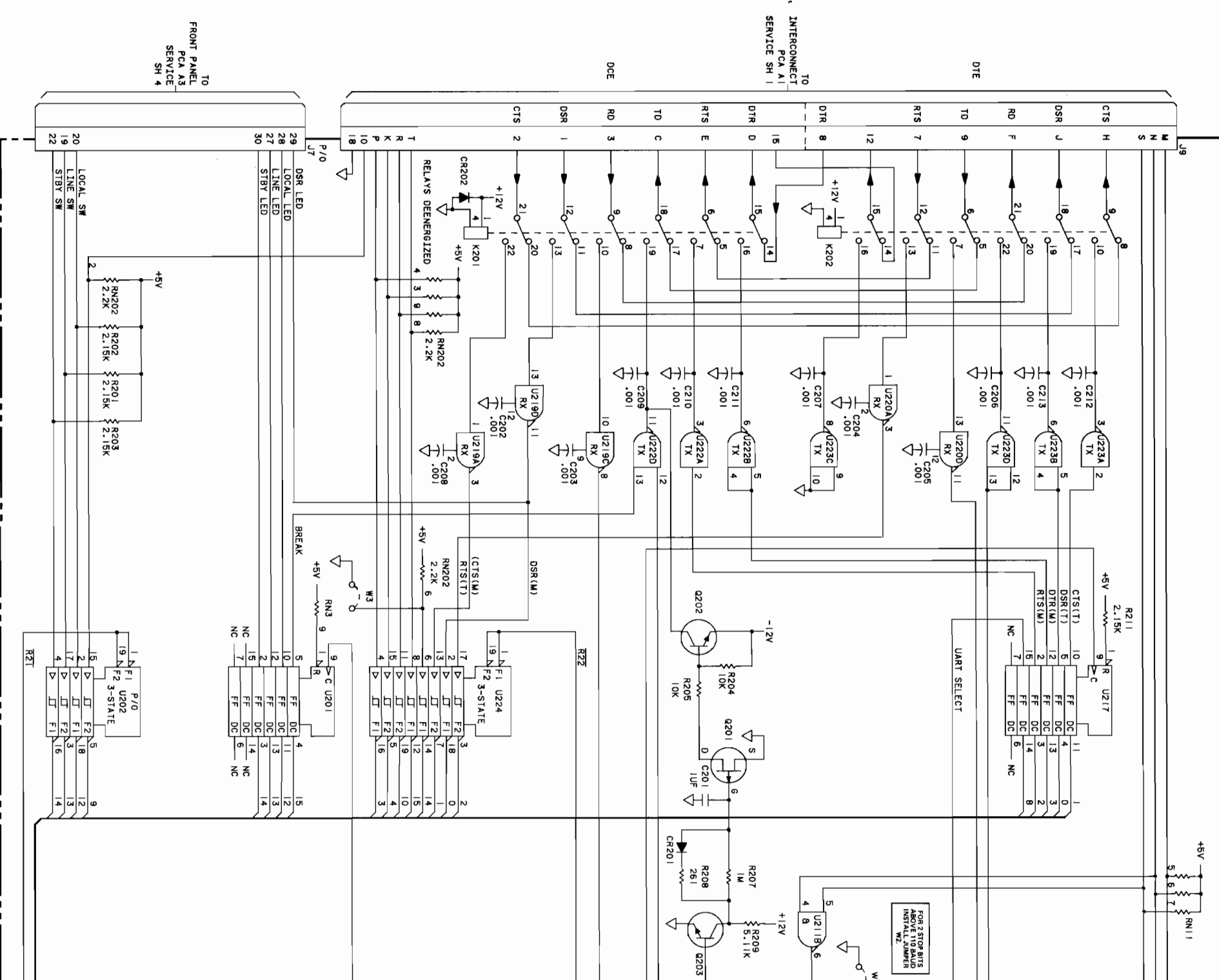


VOLTAGE AND GROUND CONNECTIONS			
REFERENCE DESIGNATOR	VCC	GND	
U203, 205, 210, 211, 216, 219	14	7	
U201, 217, 218, 219	16	8	
U202, 204, 224	20	10	
U206, 207	1	3	
U222, 223	14	7	
U221	VEE 1	VDD 7	VSS 24

2

SERVICE SHEET

Figure 6-48. Service Sheet 2 Main PCA A2 RS-232-C Circuit Schematic Diagram



TO FRONT PANEL
PCA A3
SERVICE
SH 4

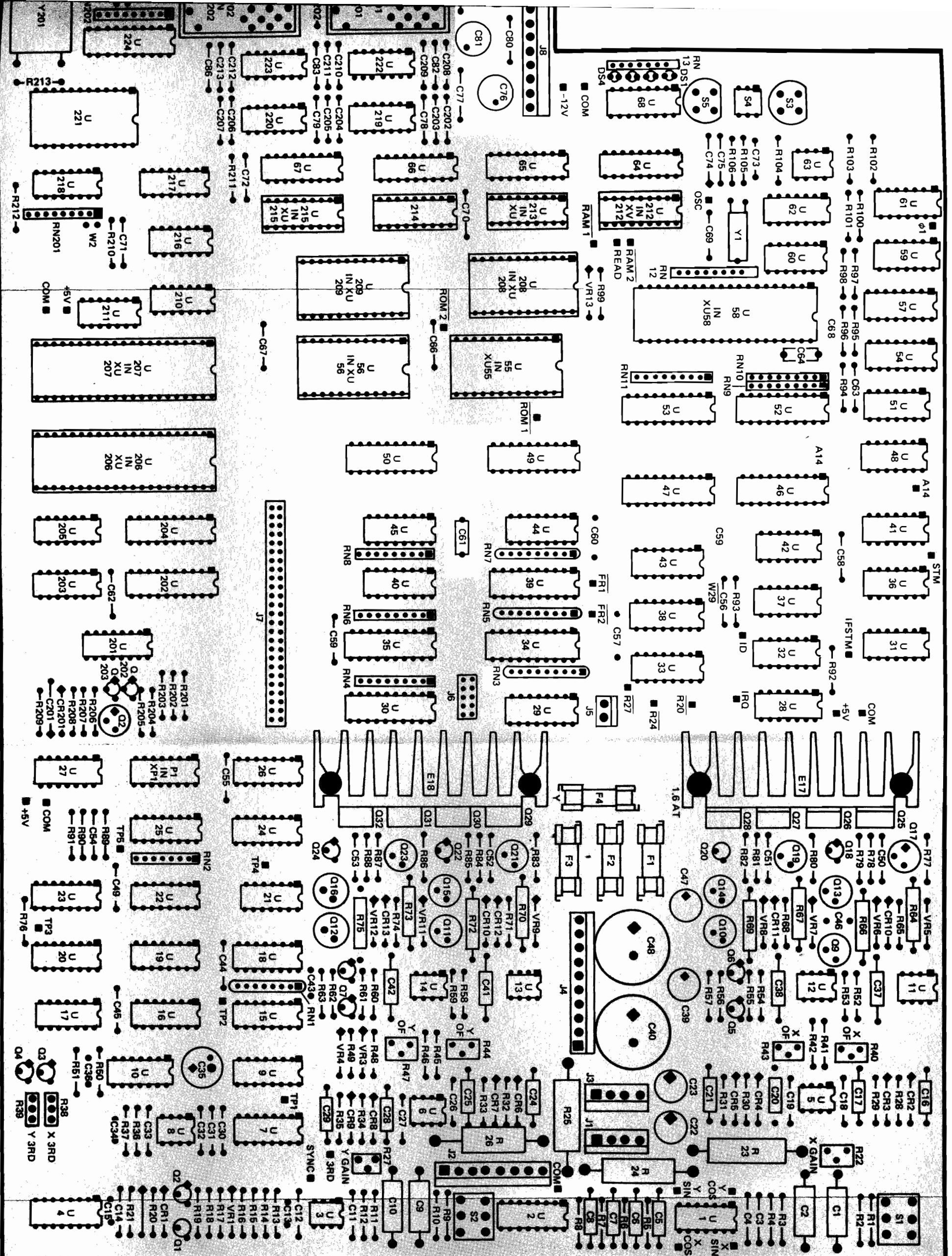
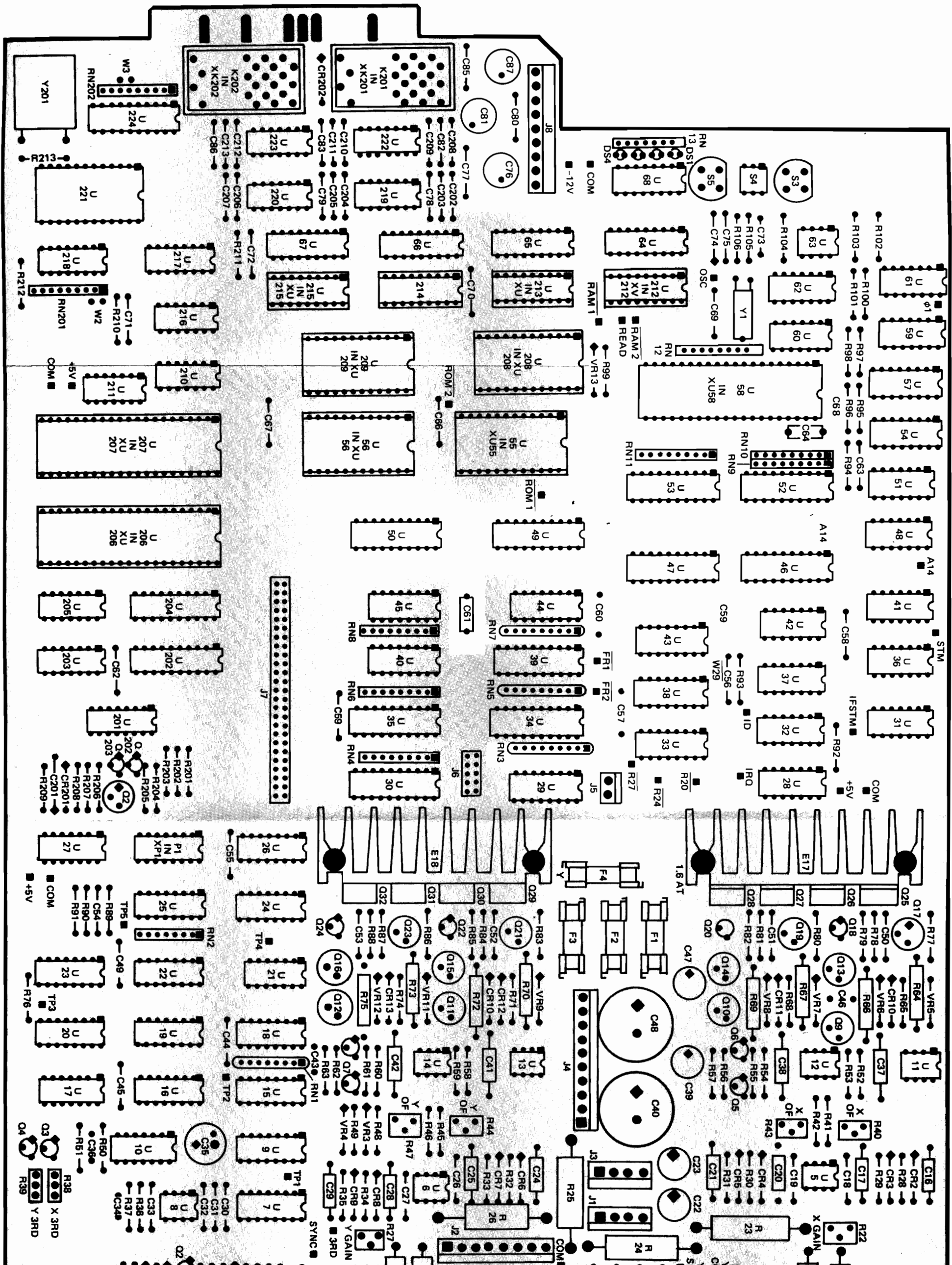


Figure 6-49. Main PCA A2 Processor Circuit Parts Location

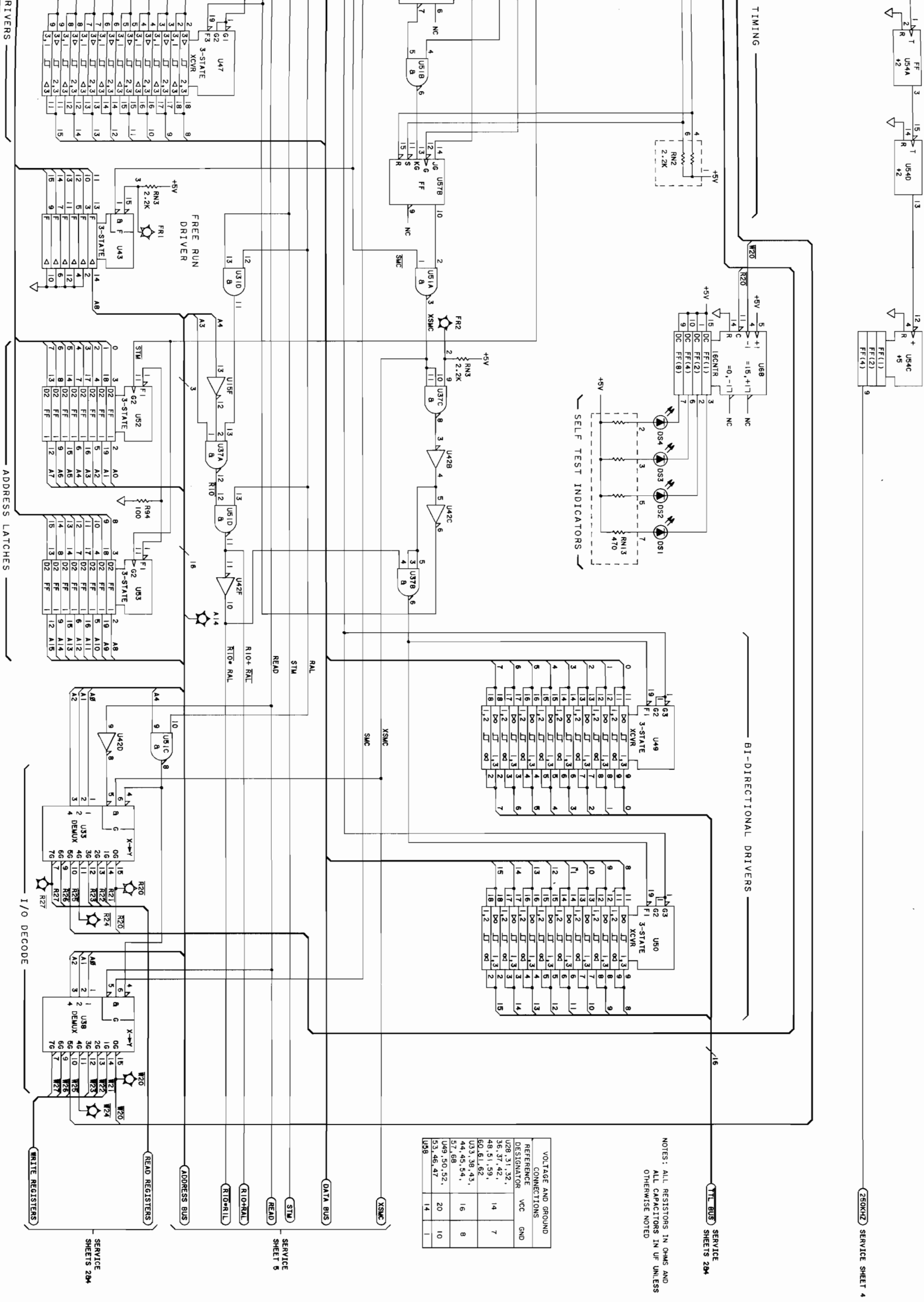


250KHZ SERVICE SHEET 4

TTL BUS SERVICE SHEETS 204

NOTES: ALL RESISTORS IN OHMS AND ALL CAPACITORS IN UF UNLESS OTHERWISE NOTED

VOLTAGE AND GROUND CONNECTIONS	REFERENCE DESIGNATOR	VCC	GND
U28	31, 32	14	7
U49	37, 42	14	7
U49	51, 59	14	7
U33	38, 43	16	8
U49	45, 54	16	8
U49	50, 52	20	10
U58	46, 47	14	7



3

SERVICE SHEET

Figure 6-50 Service Sheet 3 Main PCA A2 Processor Circuit Schematic Diagram



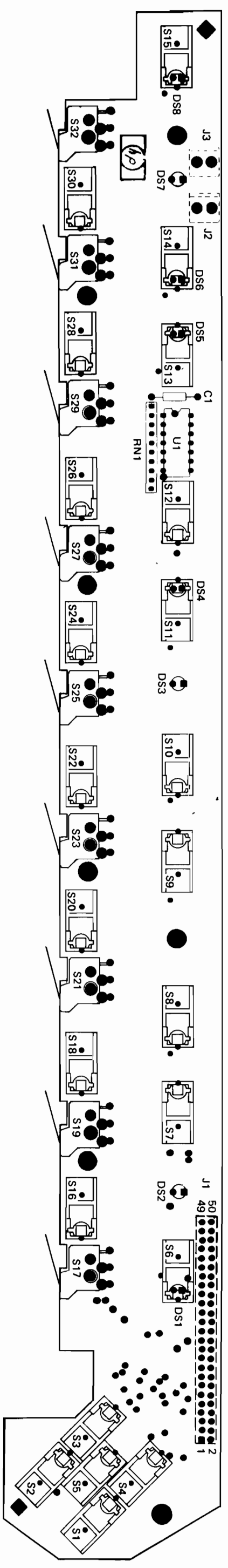


Figure 6-51. Front Panel PCA A3 Parts Location

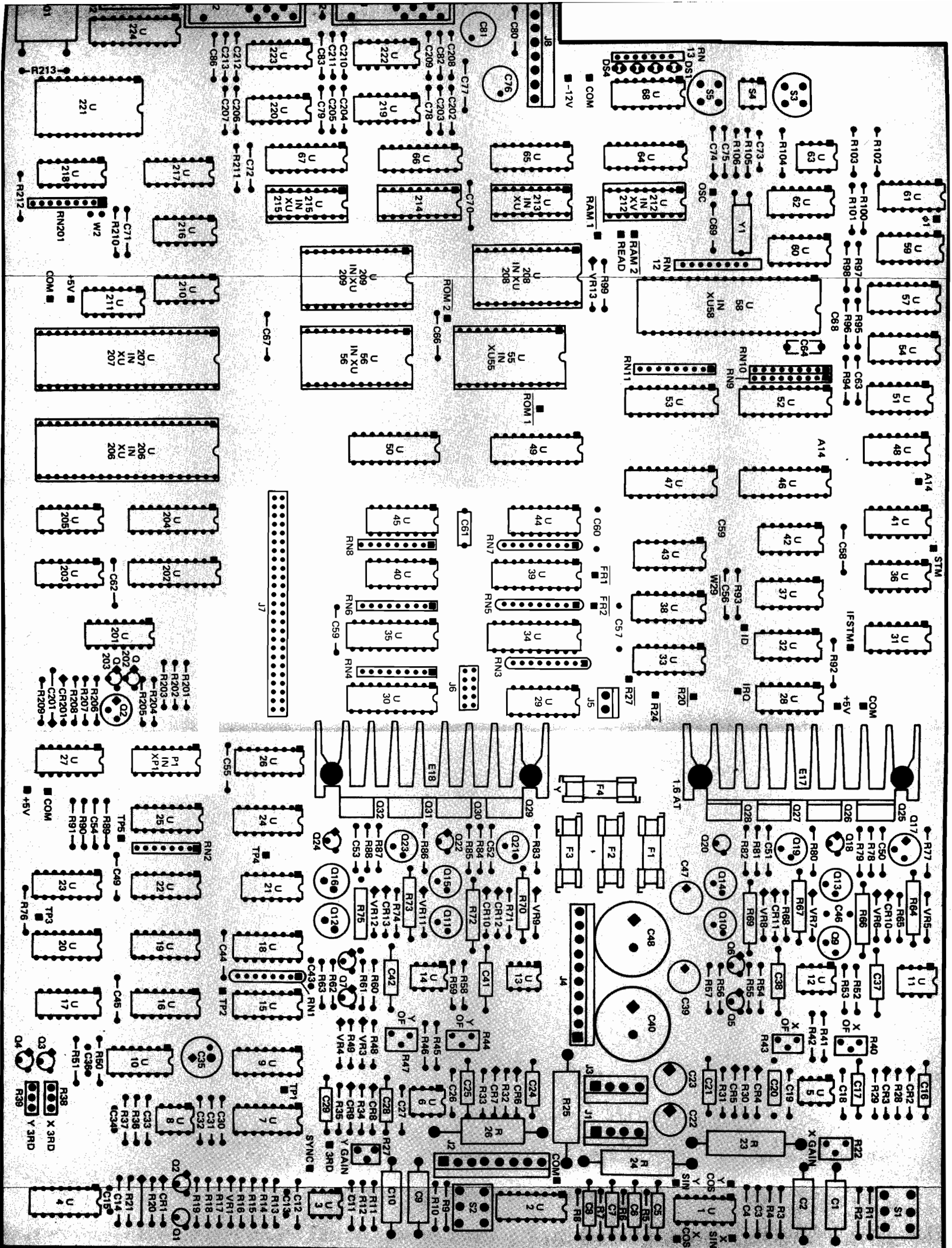
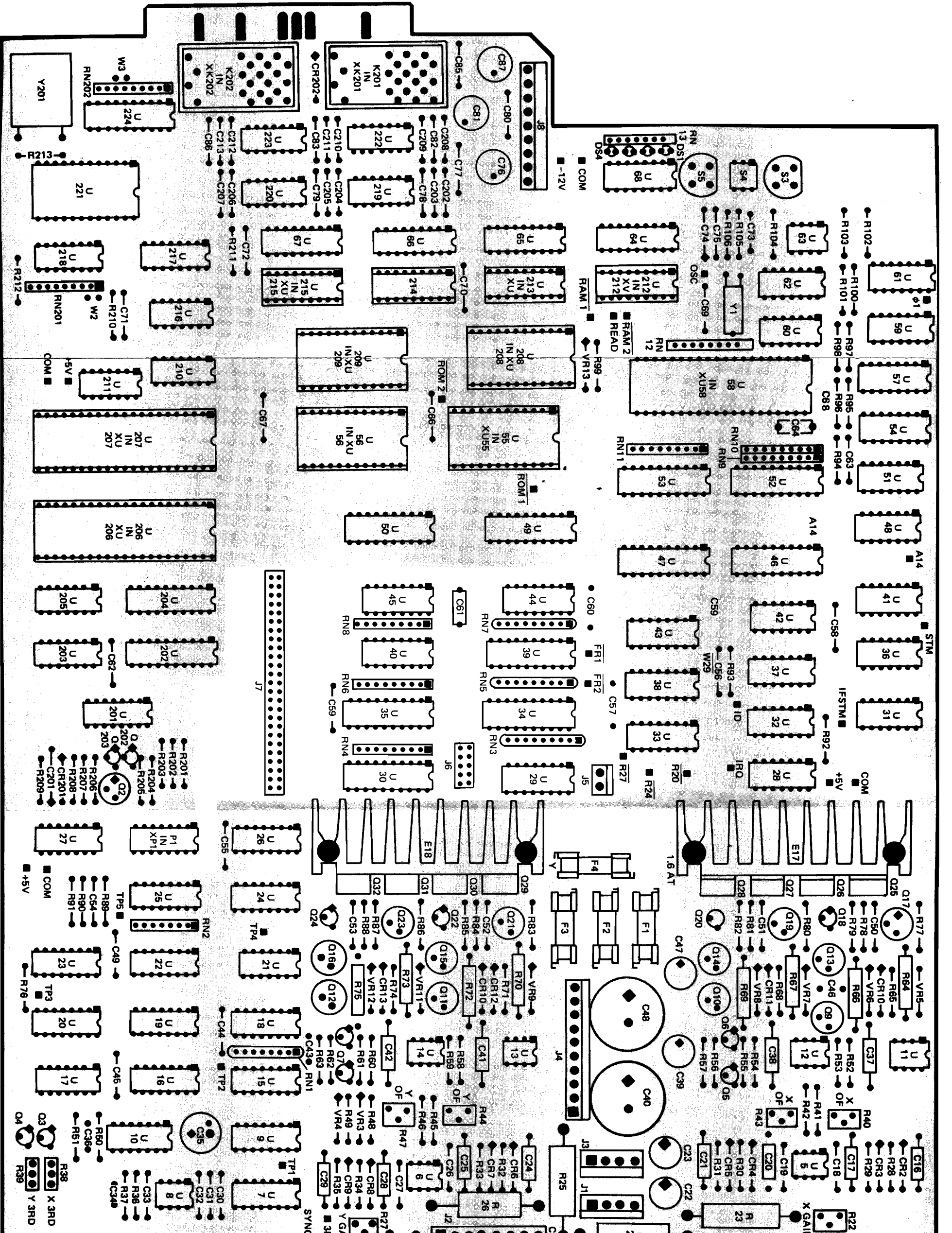
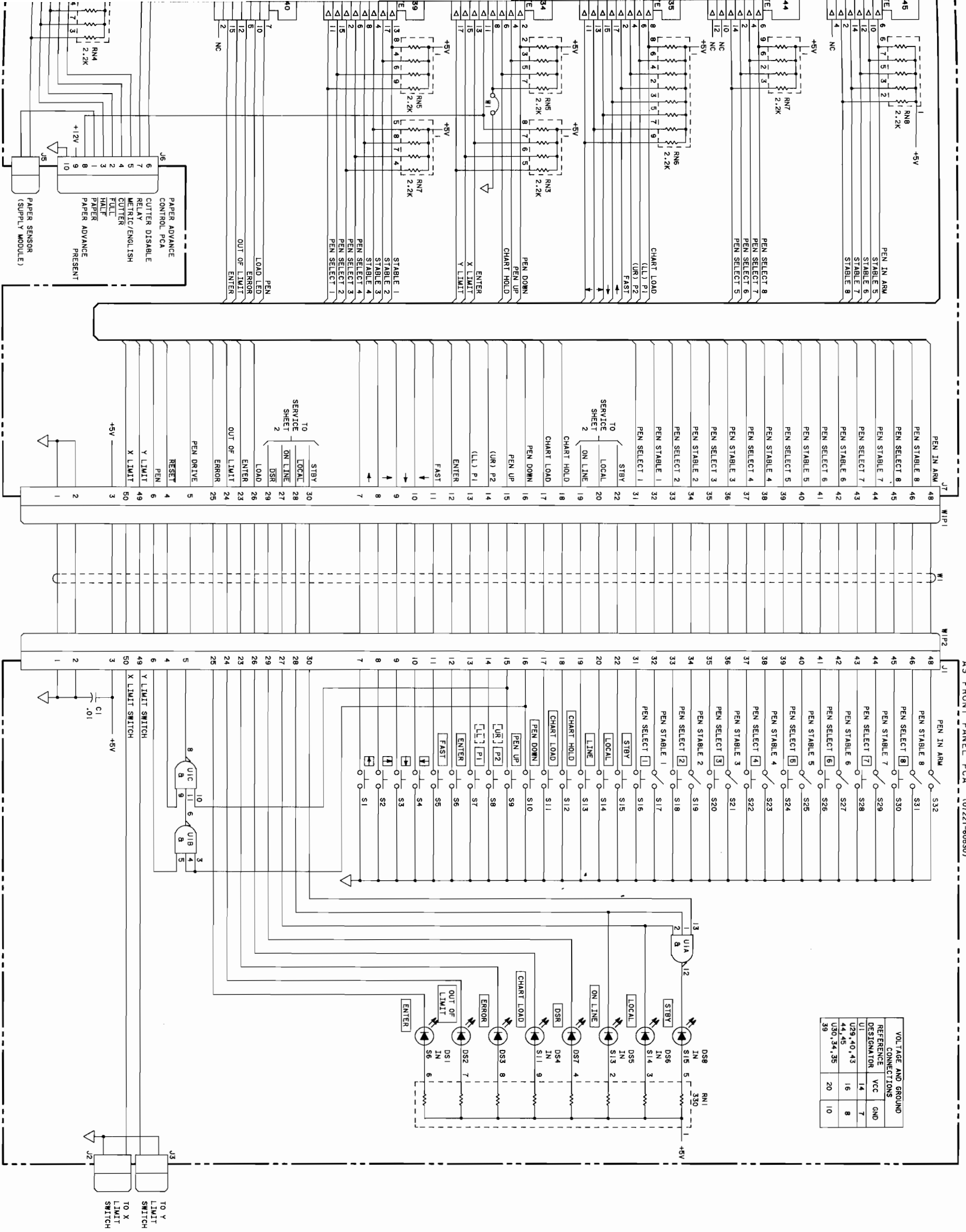


Figure 6-52. Main PCA A2 Internal I/O Parts Location

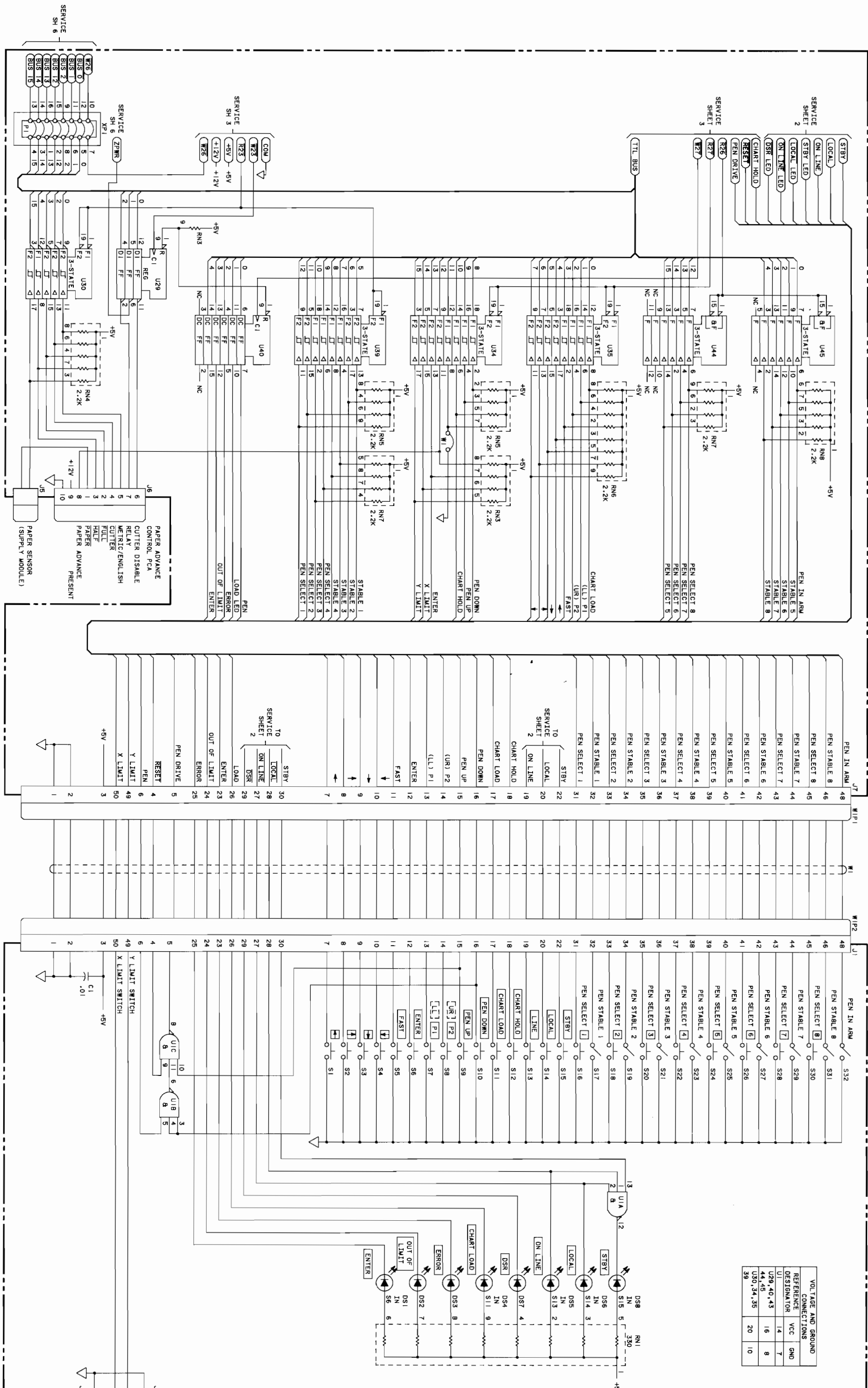




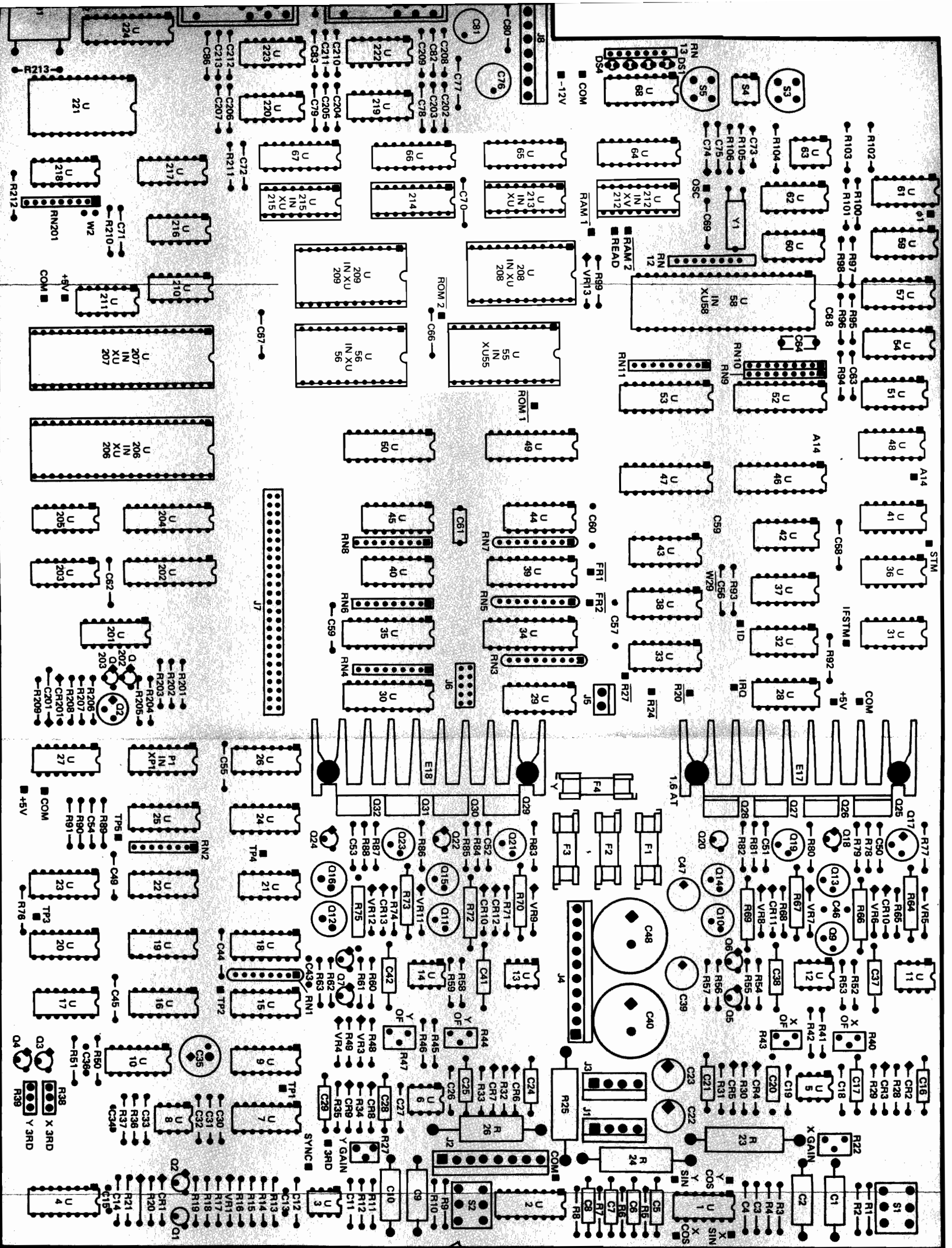
SERVICE SHEET



Figure 6-53. Service Sheet 4, Main PCA A2 Internal I/O and Front Panel Schematic



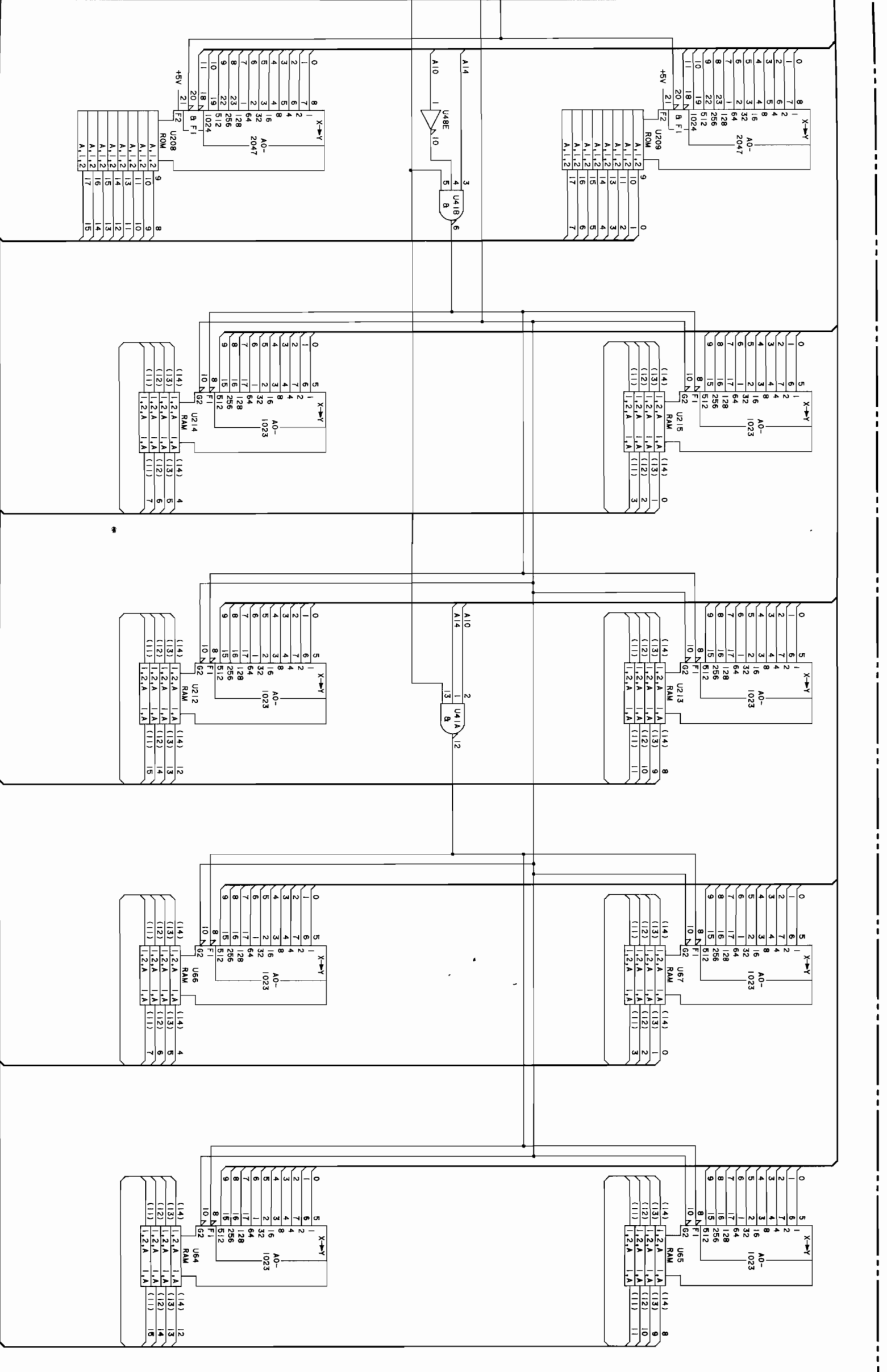
VOLTAGE AND GROUND	REFERENCE	VCC	SND
U29,40,43	14	7	8
44,45	16	7	8
U30,34,35	20	10	39



PLEASE RETURN TO -
 ELECTRONIC STORE
 DEPARTMENT OF
 ELECTRICAL ENGINEERING
 UNIVERSITY OF MELBOURNE



Figure 6-54. Main PCA A2 Memory Circuit Parts Location

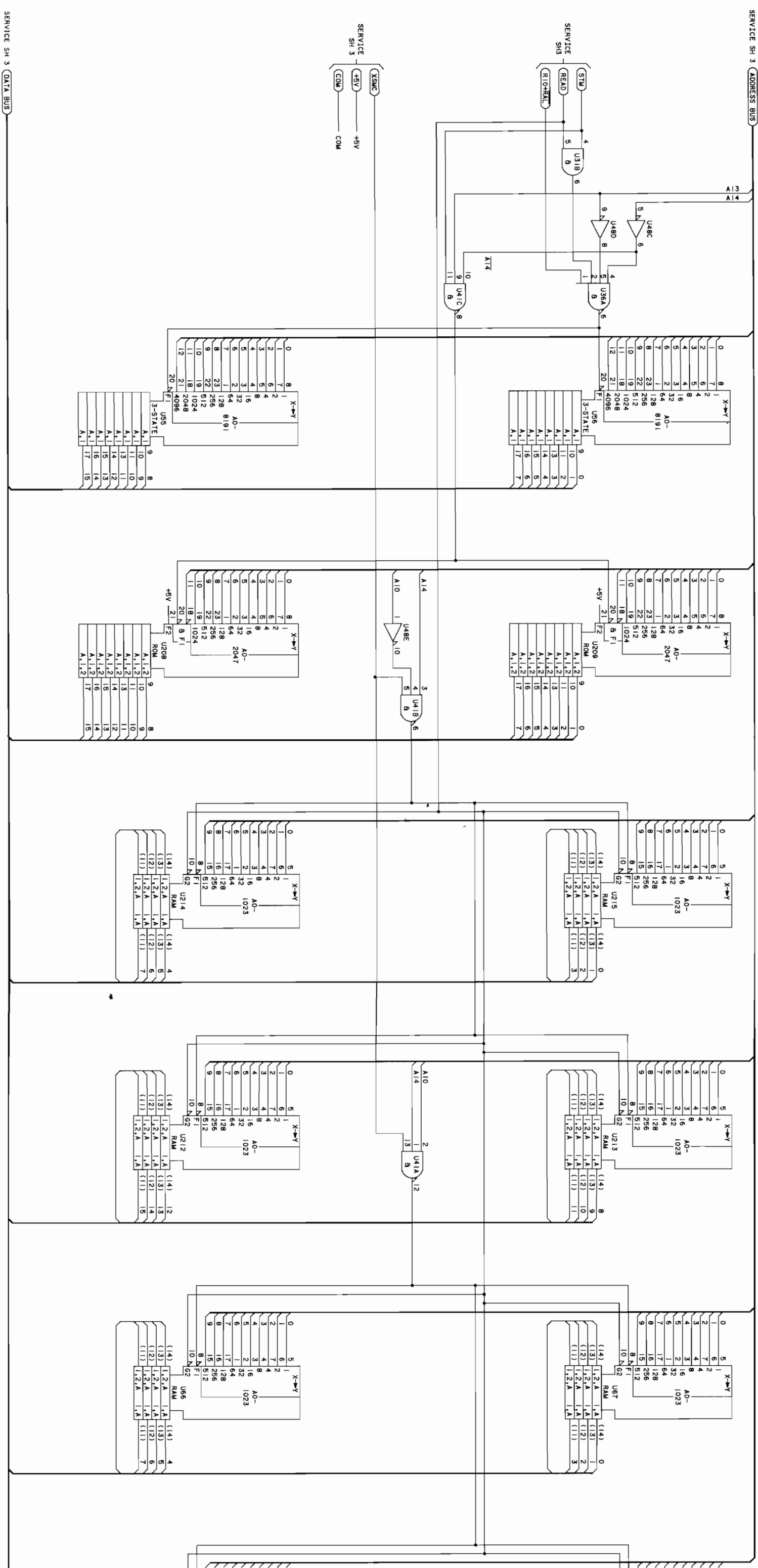


2K OPTIONAL RAM
(OPTION 0011)

VOLTAGE AND GROUND CONNECTIONS			
REFERENCE	VCC	GND	
DESIGNATOR	U31, 36, 41,	14	7
	U212-215,	18	9
	U64-67		
	U65, 56, 208,	24	12
	209		

SERVICE SHEET

Figure 6-55. Service Sheet 5 Main PCA A2 Memory Circuit Schematic Diagram



2K OPTIONAL RAM
(OPTION 001)

VOL 1	REFER
DESIGN	U212-2
U318,36	U64-61
U65,56	209

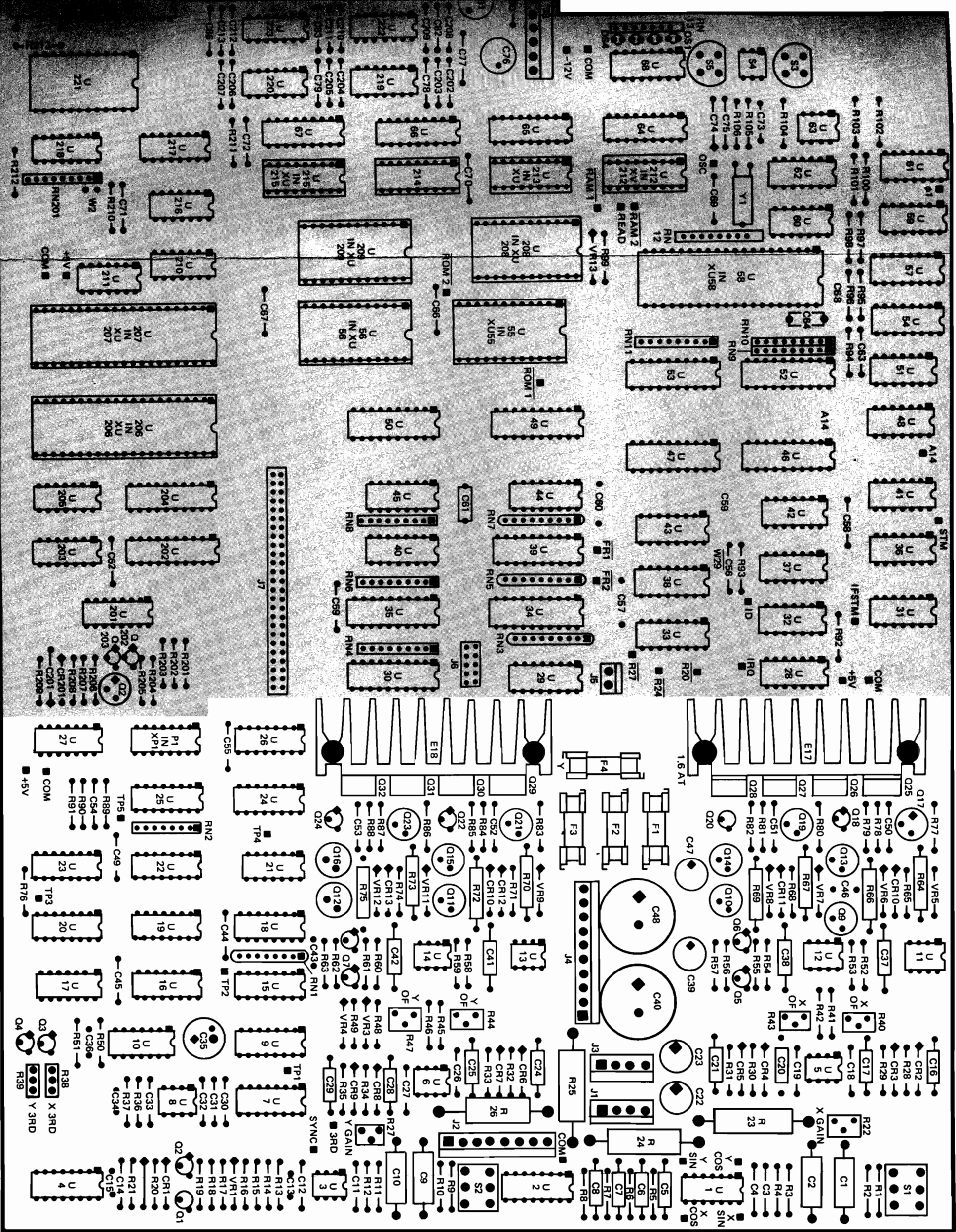
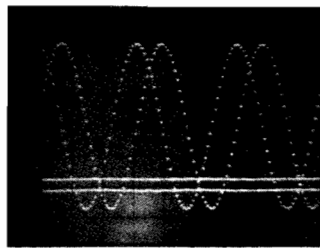
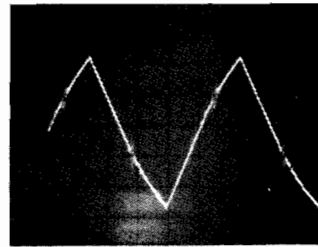


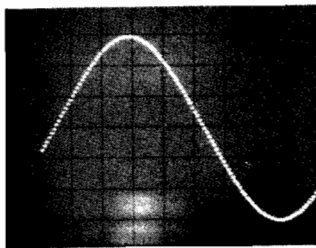
Figure 6-56. Main PCA A2 Motor Driver Circuit Parts Location



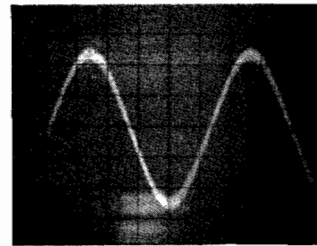
3rd TP TO ∇
 2V/cm
 30 mS/cm Approx
 Press Front
 Panel Switch
 ↑ or →
 11V P-P Approx



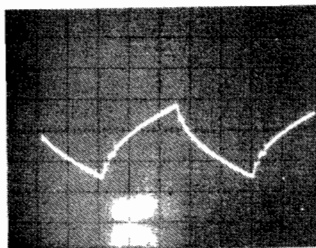
U11, 12, 13 or 14
 Pin 2 to ∇
 0.1V/cm
 10 μs/cm
 0.5V P-P Approx



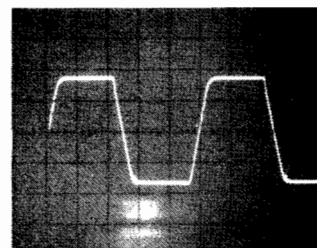
X sin, X cos,
 Y sin, or Y cos TP to ∇
 2V/cm
 30 mS/cm (Approx)
 Press Front Panel
 Switch ↑ or →
 12V P-P Approx



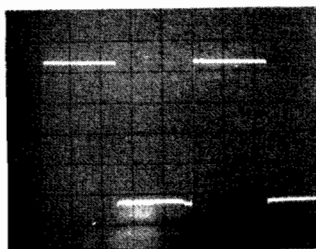
U11, 12, 13 or 14
 Pin 3 to ∇
 0.5V/cm
 50 mS/cm
 Press Front
 Panel Switch
 → or ↑
 2.4V P-P
 Approx



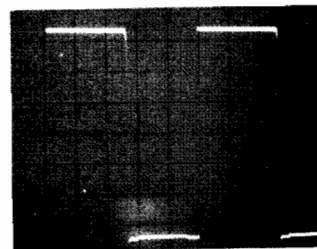
U11, 12, 13 or 14
 Pin 3 to ∇
 0.1V/cm
 10 μs/cm
 0.3V P-P
 Approx



Q9, 10, 11 or 12
 Emitter to ∇
 0.5V/cm
 10 μs/cm
 1.5V P-P
 Approx



U11, 12, 13 or 14
 Pin 6 to ∇
 5V/cm
 10 μs/cm
 22V P-P
 Approx



Y Phase B
 #3 to ∇
 10V/cm
 10 μs/cm
 ±34V P-P

Figure 6-57. Motor Drive Waveforms

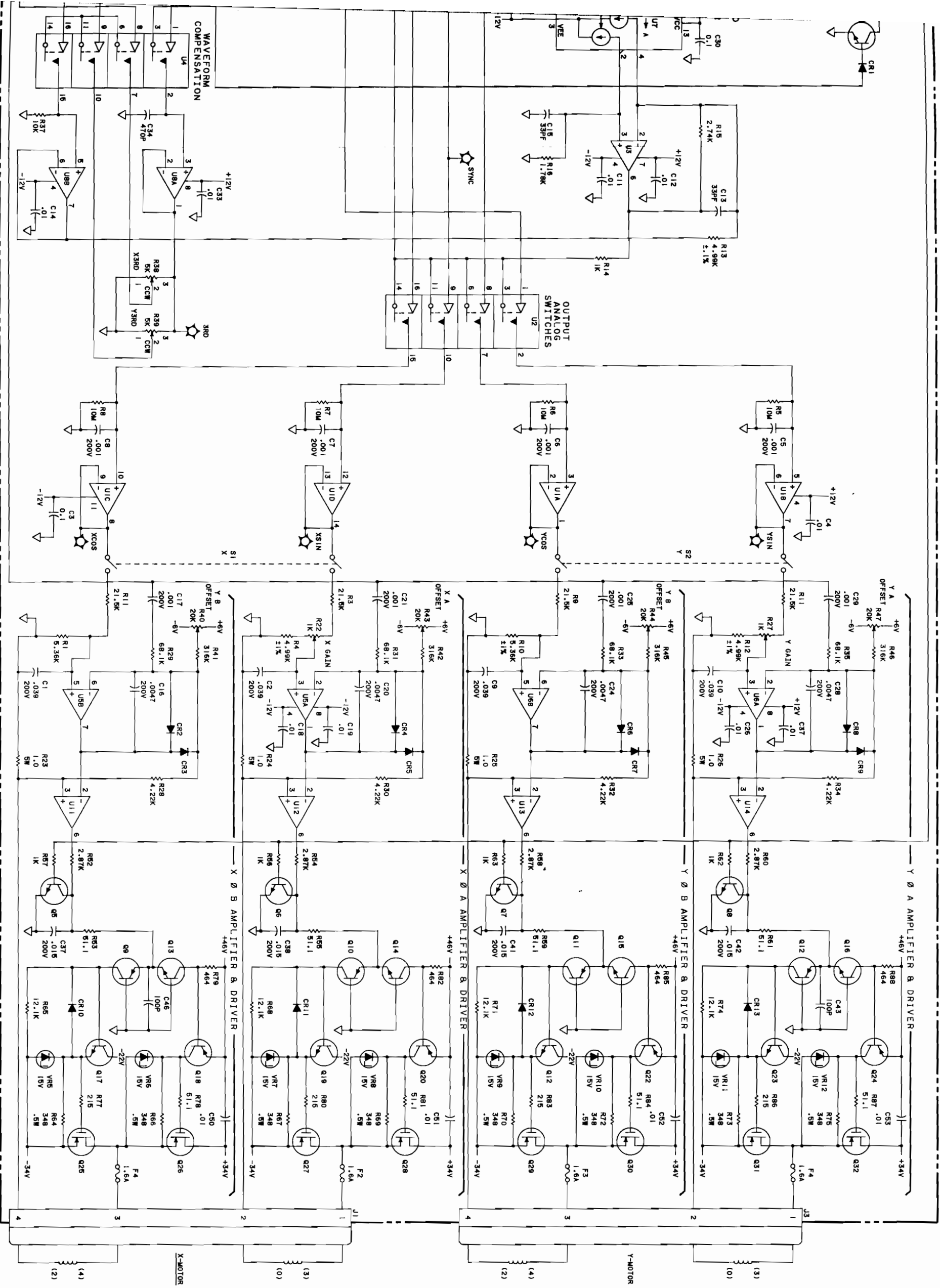


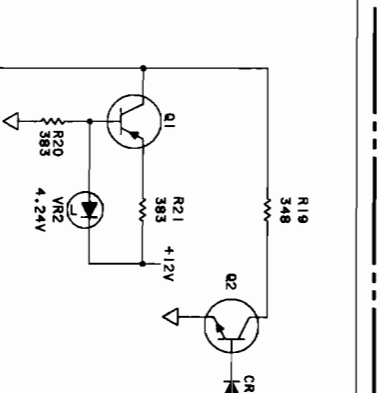
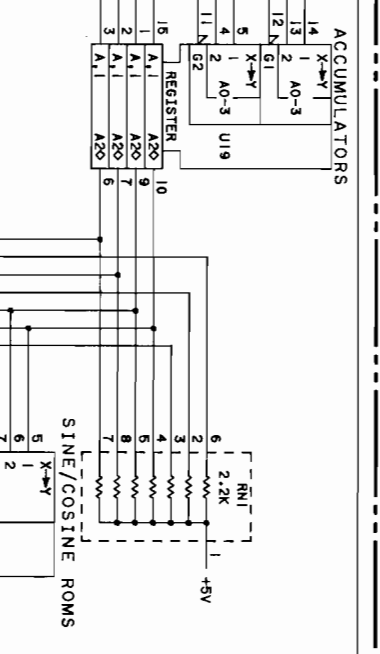
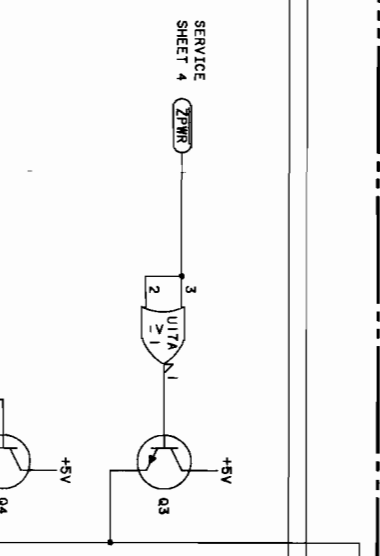
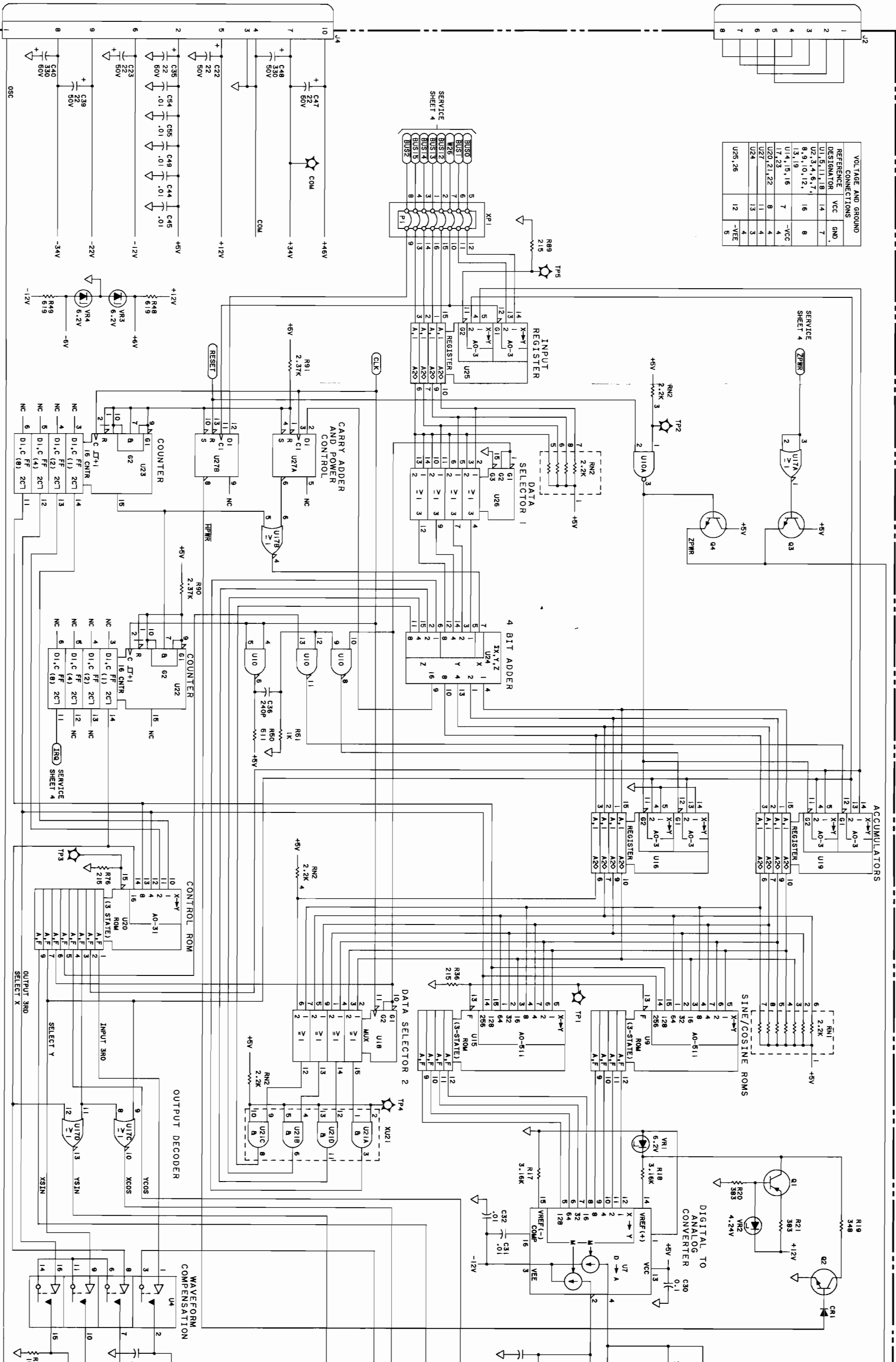
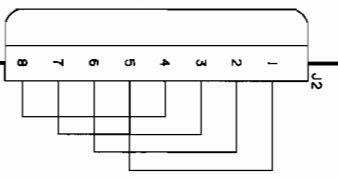
Figure 6-58. Service Sheet 6 Motor Driver Circuit Schematic Diagram

SERVICE SHEET



VOLTAGE AND GROUND CONNECTIONS

REFERENCE DESIGNATOR	VCC	GND	-VCC	-VEE
U1, 5, 11, 18	14	7		
U2, 3, 4, 6, 7, 8, 9, 10, 12, 13, 19	16	8		
U1, 4, 15, 16	7	4		
U17, 23	8	4		
U20, 21, 22	11	4		
U24	13	3		
U25, 26	12	5		



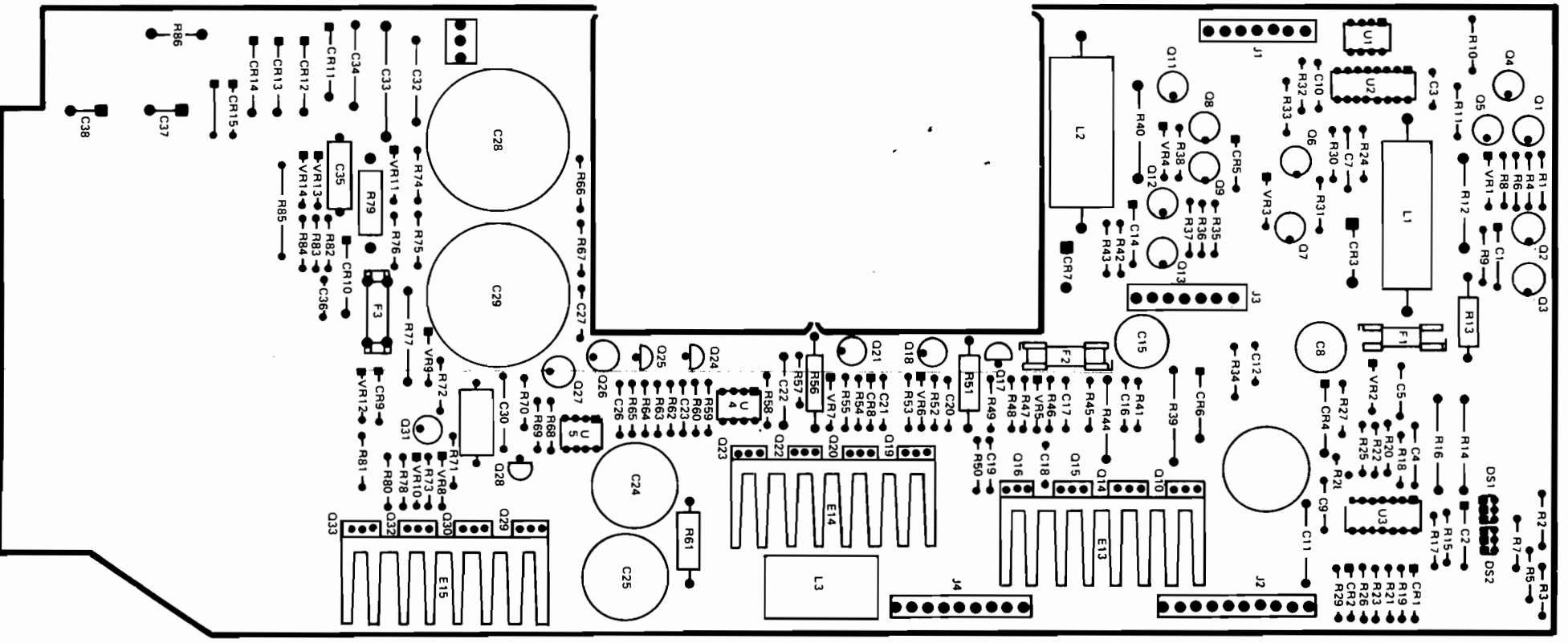
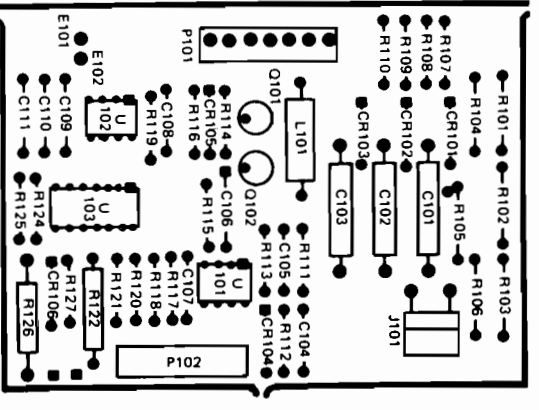
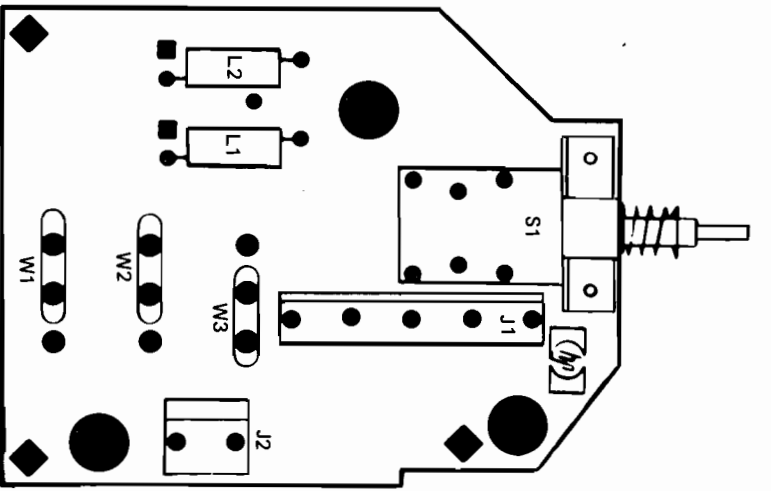
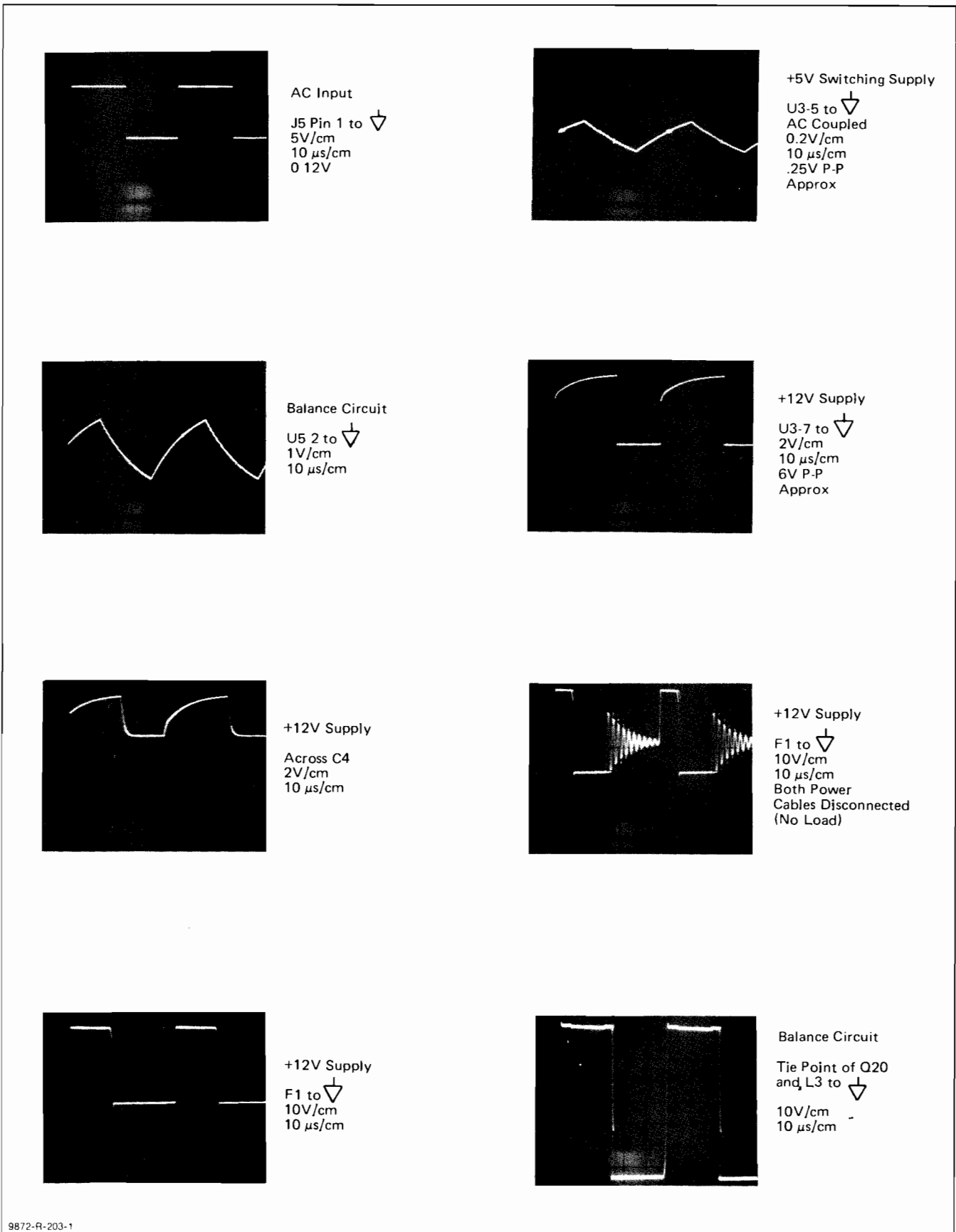


Figure 6-59. Power Supply Assembly PCAs A4, A5, A6 Parts Location



9872-R-203-1

Figure 6-60. Power Supply Waveforms

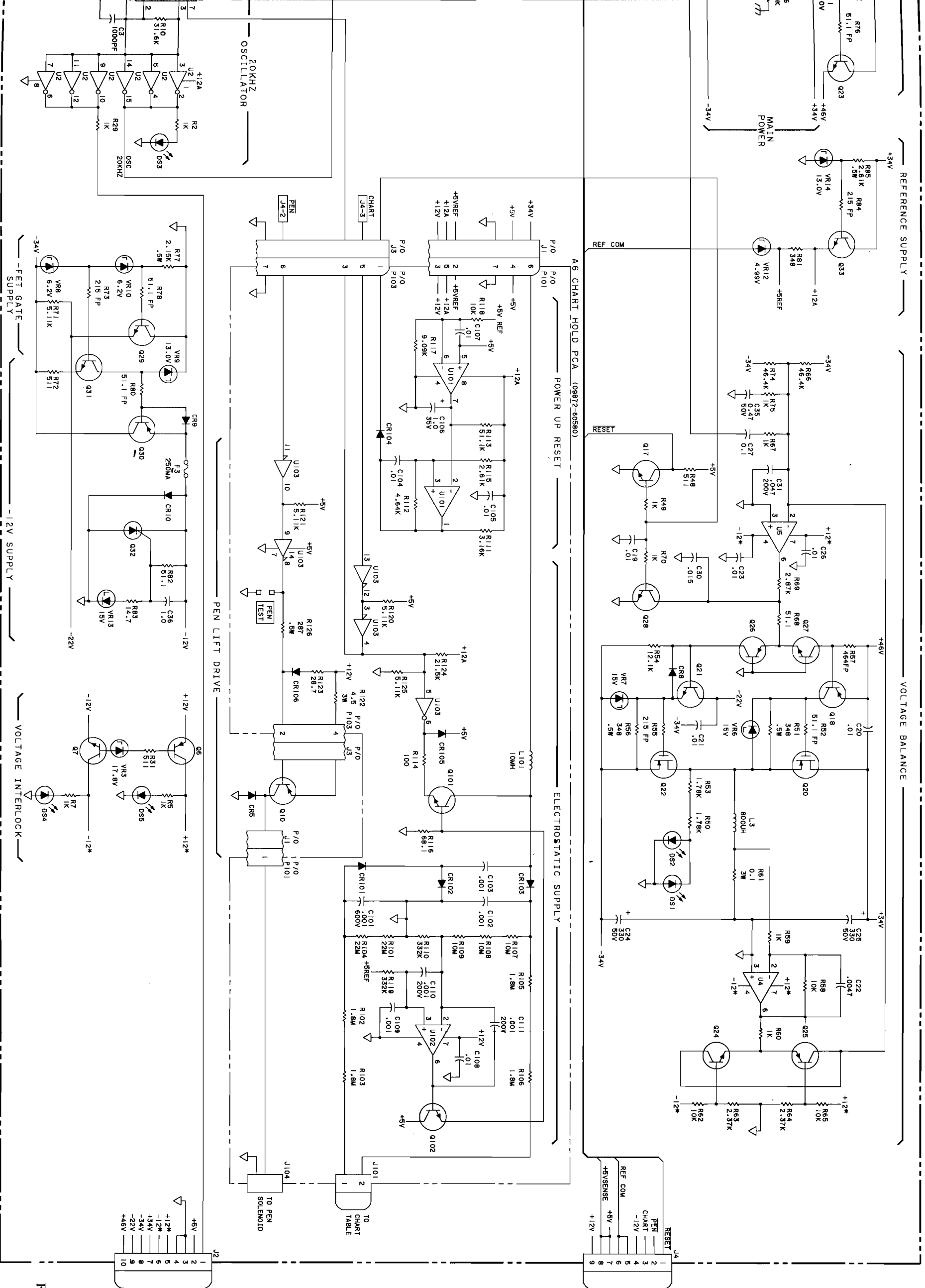
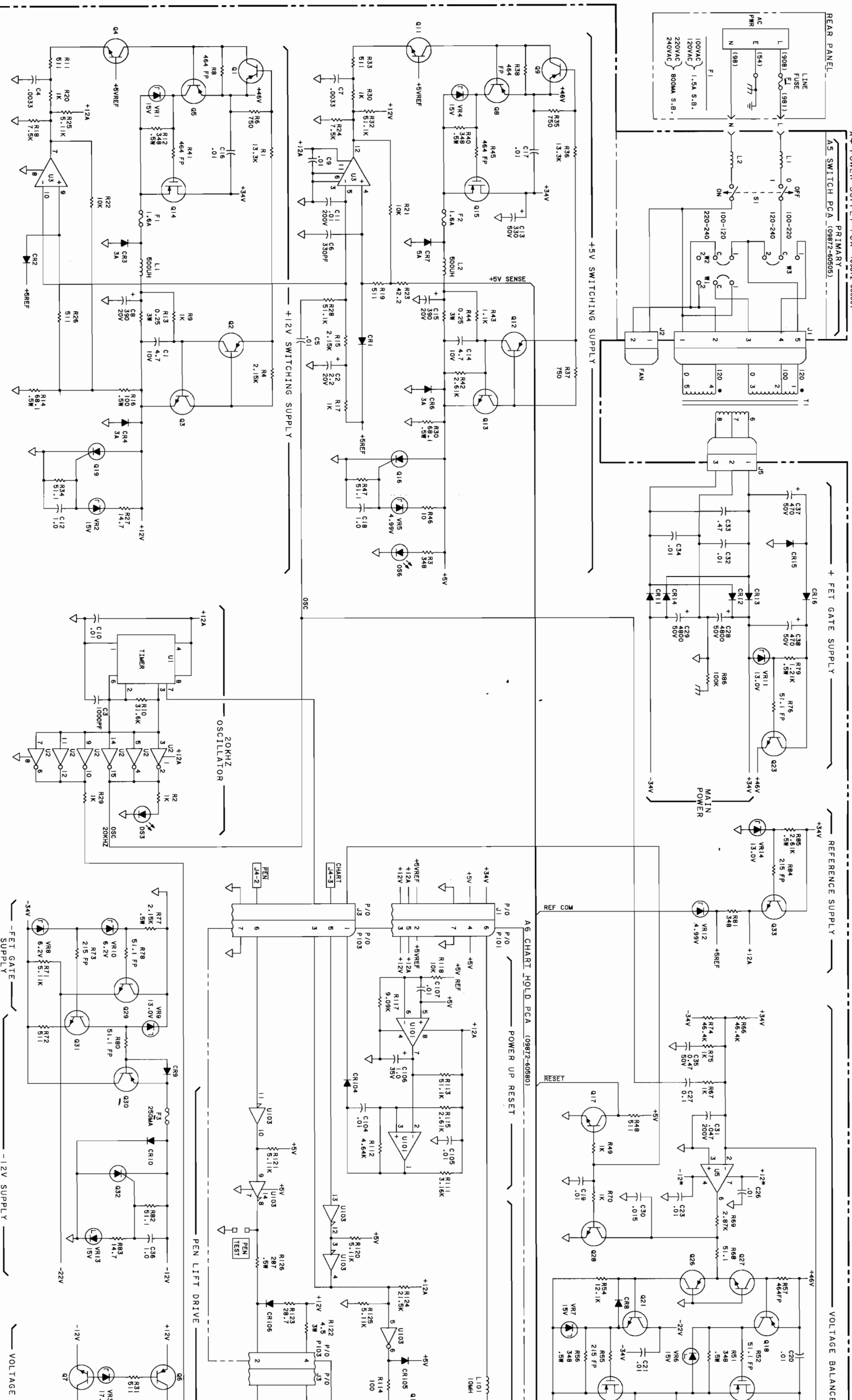


Figure 6-61. Service Sheet 7 Power Supply Assembly Schematic Diagram

SERVICE SHEET



A4. POWER SUPPLY PCA (09872-60500)



APPENDIX A

Paper Advance Feature

PLEASE RETURN TO -
ELECTRONIC STORE
DEPARTMENT OF
ELECTRICAL ENGINEERING
UNIVERSITY OF MELBOURNE



7220-A-50-1

Figure A1-1. HP Models 7220T/7221T Graphics Plotters with Paper Advance

SECTION AI

GENERAL INFORMATION

A1-1. INTRODUCTION

A1-2. This appendix contains the necessary information to test, adjust, and service the Hewlett-Packard Models 7220T and 7221T Graphics Plotters with the paper advance feature, as shown in Figure A1-1. For ease of reference, this appendix has been divided into six sections similar to the main manual

SECTION AI	GENERAL INFORMATION
SECTION AII	OPERATION
SECTION AIII	ADJUSTMENTS
SECTION AIV	REPLACEABLE PARTS
SECTION AV	MANUAL CHANGES
SECTION AVI	SERVICE

A1-3. This appendix pertains only to the paper advance feature. For information concerning the plotter, refer to the main body of this manual.

A1-4. DESCRIPTION

A1-5. The paper advance feature provides unattended plotting capability on the Graphics Plotter by using a continuous roll of paper. The paper is advanced, cut to either half or full pages of either English or metric dimensions, and stacked.

A1-6. Manual control of the paper advance is provided by front panel pushbutton switches. Program control of the paper advance is made possible by the addition of four instructions.

A1-7. The paper advance mechanism consists of two electro-mechanical modules as shown in Figure A1-2. The paper supply module is located on the right side of the main body of the plotter, and the paper drive module is located to the left. The modules are mounted on two factory-aligned support bars which are attached to the main body of the plotter.

A1-8. Two paper sensor switches located under the paper path detect the presence of a properly loaded roll

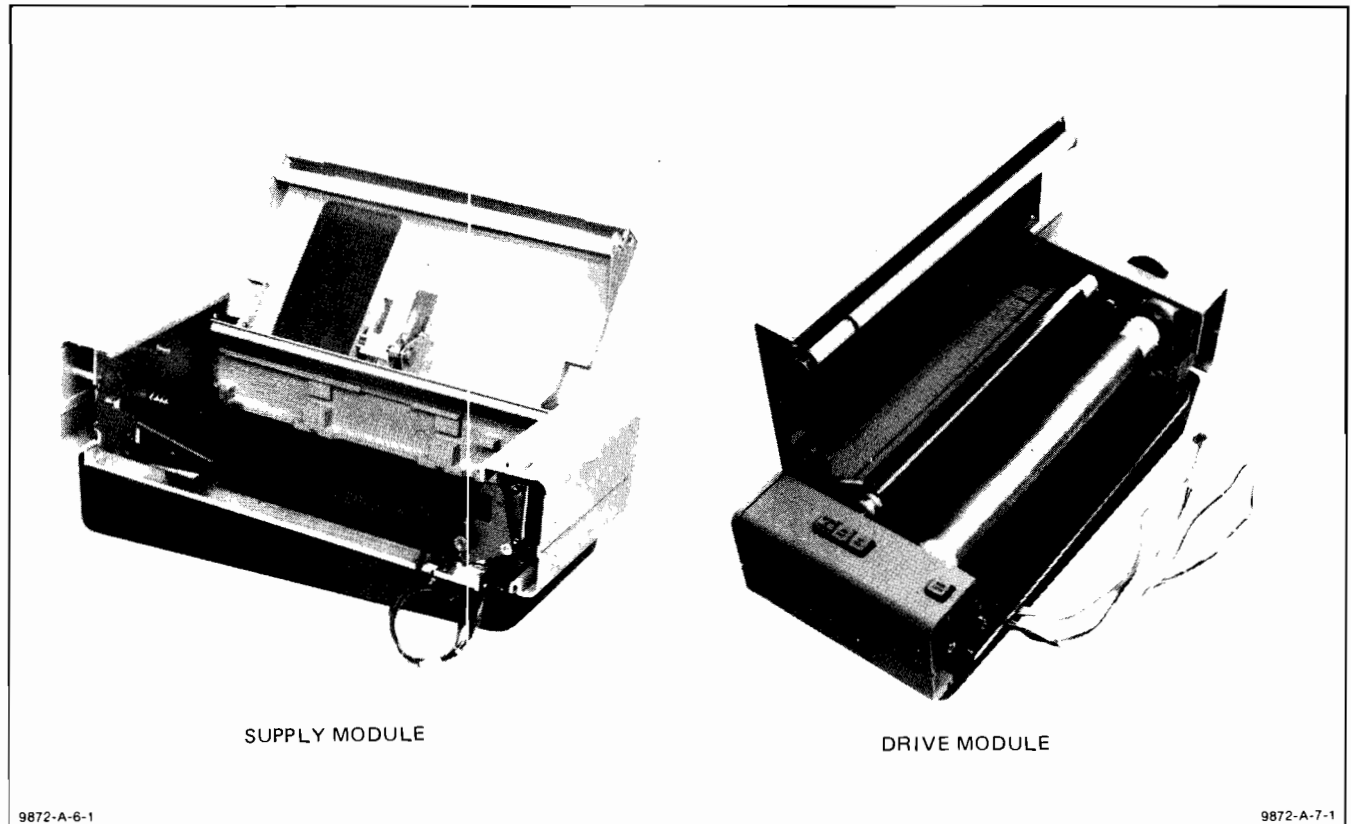


Figure A1-2. Paper Advance Modules

of paper. Activation of these switches automatically disables the electrostatic chart hold circuit while enabling the paper advance circuitry.

A1-9. The supply module holds a 61 metre (200 foot) roll of sprocket-punched paper. During operation of the paper advance feature, the paper is drawn across the platen by a sprocketed drum in the drive module. See Figure A1-3. Tension to hold the paper flat against the platen is provided by nylon rollers mounted in the module doors and by a paper brake in the supply module.

A1-10. When an advance operation is initiated, the paper is advanced through cutter blades located in the drive module. If the cutter is enabled, the paper is cut and stacked in the paper tray. Note that the last plot completed is not the one cut. The last plot completed remains in the drive module until the next advance and cut instructions are executed.

A1-11. A single stepper motor, which is identical to the plotter drive motors, provides the mechanical drive for both advancing and cutting the paper. During paper advance operation, the microprocessor in the plotter controls all paper advance functions. The outputs from the plotter motor drive circuits are switched from the Y-axis motor to the paper advance motor.

A1-12. The possibility of cumulative errors in page length is eliminated by the use of a ratchet assembly in the drive module. Any gear backlash is eliminated by a slip clutch assembly.

A1-13. SAFETY

A1-14. Carefully review the safety precautions in Section I of the main manual before servicing the paper advance modules.

A1-15. SPECIFICATIONS

A1-16. The specifications for the Models 7220T/7221T Graphics Plotters with paper advance are listed in

Table A1-1. These specifications will supplement the Model 7220C/7221C specifications. Table A1-2 lists supplemental characteristics. These are not specifications, but are included as additional information for the user. Page lengths and default limits are listed for reference in Table A1-3.

A1-17. ACCESSORIES SUPPLIED

A1-18. Accessories supplied with the Models 7220T/7221T are listed in Table A1-4. This table adds to and modifies the list of accessories supplied with the standard plotter.

A1-19. SHIPMENT

A1-20. If the plotter must be shipped, it is absolutely essential to use only the original packing materials and carton. If the original material is not available, proper packing materials may be ordered from Hewlett-Packard Sales and Service Offices.



Before shipping, remove the paper roll.

A1-21. If the plotter is to be returned to Hewlett-Packard, contact the nearest Sales and Service Office for shipping instructions. Attach a tag to the plotter including the model number of the plotter, full serial number, type of service required, and a return address.

NOTE

When returning the plotter to Hewlett-Packard, do not send the power cord, accessory kit, or other operating accessories.

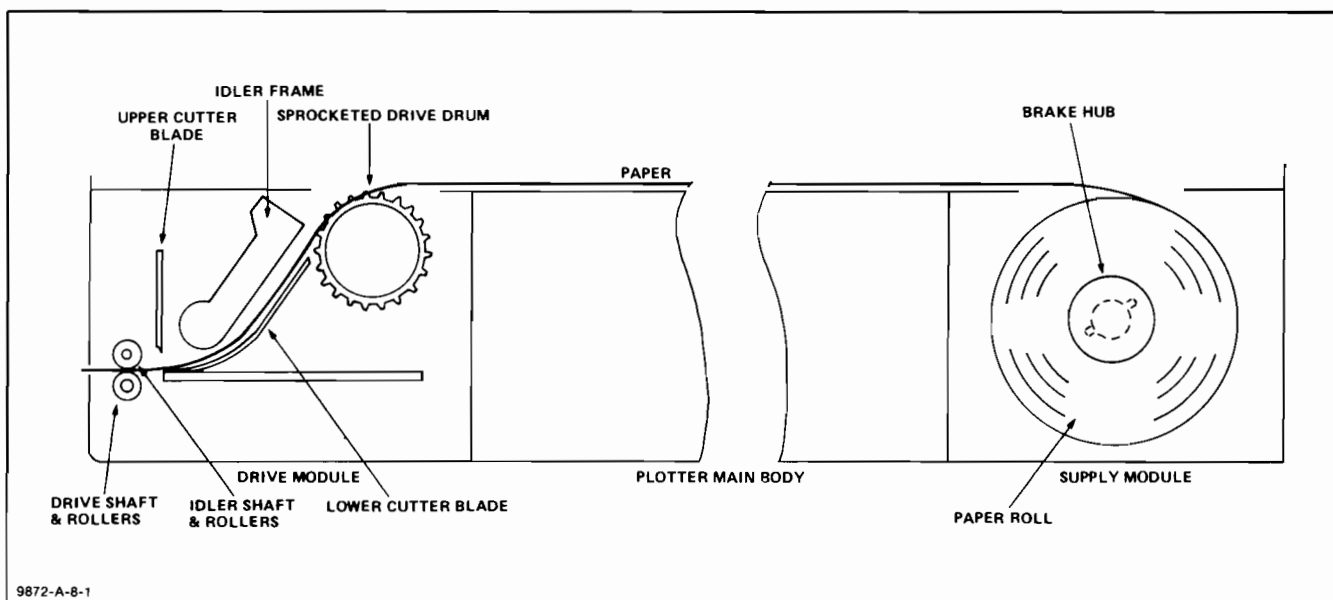


Figure A1-3. Paper Path Diagram

Table A1-1. Specifications

<p>HORIZONTAL PAPER ALIGNMENT ACCURACY (relative to the lower left corner): page to page accuracy ± 0.4 mm (0.016 in.)</p> <p>VERTICAL PAPER ALIGNMENT ACCURACY: total accuracy ± 2 mm (0.08 in.)</p> <p>PAPER CUTTER ACCURACY (excluding paper dimensional changes): Orthogonality $90^\circ \pm 0.2^\circ$ Cut Distance A, B size — ± 1 mm (0.04 in.) A3 size — +1, -2 mm (0.08 in.) A4 size — +0.5 mm, -1.5 mm (+0.02 in., -0.06 in.)</p> <p>ACCURACY OF CUT TO TRUE LEFT EDGE OF PLATEN: ± 1.6 mm (0.063 in.)</p>
--

Table A1-2. Supplemental Characteristics

<p>FRAME ADVANCE TIME (nominal): Cutter Enabled Half Frame — 11 s. Full Frame — 13 s.</p> <p>Cutter Disabled Half Frame — 8 s. Full Frame — 11 s.</p> <p>HORIZONTAL PAPER ALIGNMENT: Position adjustable manual thumbwheel in 3.175 mm (0.125 in.) steps.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Page Lengths</th> <th>(Full Advance)</th> <th>(Half Advance)</th> </tr> </thead> <tbody> <tr> <td>English</td> <td>17 inches</td> <td>8.5 inches</td> </tr> <tr> <td>Metric</td> <td>420 mm</td> <td>210 mm</td> </tr> </tbody> </table> <p>PAPER DIMENSIONAL CHANGES: Dimensions can change $\pm 1\%$ under extreme range of environmental conditions.</p> <p>PAPER TRAY: Holds up to 280 sheets (half or full size).</p> <p>CHARACTER PLOTTING SPEED: Character plotting speed averages 2.2 characters per second.</p> <p>DIMENSIONS: 858 mm wide, 477 mm deep, 210 mm high (33.8 in., 18 in., 8.3 in.).</p> <p>WEIGHT: Net — 29.6 kg (65 lbs) Shipping — 42.5 kg (93.5 lbs).</p>	Page Lengths	(Full Advance)	(Half Advance)	English	17 inches	8.5 inches	Metric	420 mm	210 mm
Page Lengths	(Full Advance)	(Half Advance)							
English	17 inches	8.5 inches							
Metric	420 mm	210 mm							

Table A1-3. Page Lengths and Default Limits

OPERATING MODE		PAGE LENGTHS		DEFAULT LIMIT COORDINATES IN MACHINE UNITS			
				LOWER LEFT (P1)		UPPER RIGHT (P2)	
PAPER SENSOR SWITCHES	ENGLISH/ METRIC SWITCH	FULL PAGE	HALF PAGE	X	Y	X	Y
Either Switch Open	N/A	N/A	N/A	520	380	15720	10380
Both Switches Closed	English	17 inches	8.5 inches	520	1020	15760	11180
	Metric	420 mm	210 mm	520	1140	15120	11140

Table A1-4. Accessories Supplied

DESCRIPTION	HP PART NUMBER
Paper, roll, blank	
Metric 280 mm × 61 m	9280-0494
English 11 in. × 200 ft	9280-0493
Paper Stacking Tray	17072-60023
Dust Cover	9222-0681

SECTION AII

OPERATION

A2-1. INTRODUCTION

A2-2. This operating section explains the controls and indicators of the paper advance modules and lists the additional instructions required for the paper advance feature. Also included in this section are instructions for performing the operational checks of the paper advance modules and paper loading instructions.

A2-3. PANEL FEATURES

A2-4. The controls and indicators on the paper advance modules are described in Table A2-1 and illustrated in Figure A2-1.

A2-5. INTERNAL CONTROL FEATURES

A2-6. Each module contains a microswitch which detects the presence of a properly loaded roll of paper. Figure A2-2 illustrates the location of these switches. When both are activated, the paper advance is enabled and the chart hold is disabled.

A2-7. INTERFACE INSTRUCTIONS

A2-8. The following HP-GL instructions are used in conjunction with the paper advance feature.

EC	Cutter Enable
EC0	Cutter Disable
AF/PG/PG1	Advance Full Page
AH	Advance Half Page

A2-9. The following additional output instruction is used also.

OO Output Options

This instruction outputs numbers representing plotter options. Refer to the 7220/7221 Operating and Programming Manual for details concerning these instructions.

A2-10. PAPER ROLL LOADING

A2-11. Instructions for loading a roll of paper are found inside the supply module door and illustrated in Figure A2-3.

A2-12. OPERATIONAL CHECKS

A2-13. To check the paper advance feature for proper operation, proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Load a roll of paper into the paper advance modules; close and latch the lids. Advance the paper a few inches using the thumbwheel. This will ensure proper tension and assure that the paper is threaded properly.
- c. Apply power to the plotter.

Table A2-1. Paper Advance Controls and Indicators

Item 1. Thumbwheel — manual position thumbwheel allows the user to manually advance the paper any desired incremental distance, and is used in threading the paper and achieving the proper initial tension when paper is installed.

Item 2. Cutter Enable Pushbutton — enables the cutter circuitry to activate the cutter mechanism after the page advance. The indicator LED is on when the cutter is enabled. Disabling the cutter allows the user to obtain a continuous roll of plots from the plotter.

Item 3. Advance Half Pushbutton — allows the user to advance the paper in half-page increments from the front panel.

Item 4. Advance Full Pushbutton — allows the user to advance the paper in full-page increments from the front panel.

Items 5 & 6. Door Latch Pushbutton — releases the mechanical door latch.

Item 7. Paper Supply Indicator — provides a visual indication of the paper remaining in the supply module.

Item 8. English/Metric Switch — allows the user to select either English or metric page length. A full page English advance is 17 in. and a full page metric advance is 420 mm. A half page English advance is 8.5 in. and a half page metric advance is 210 mm.

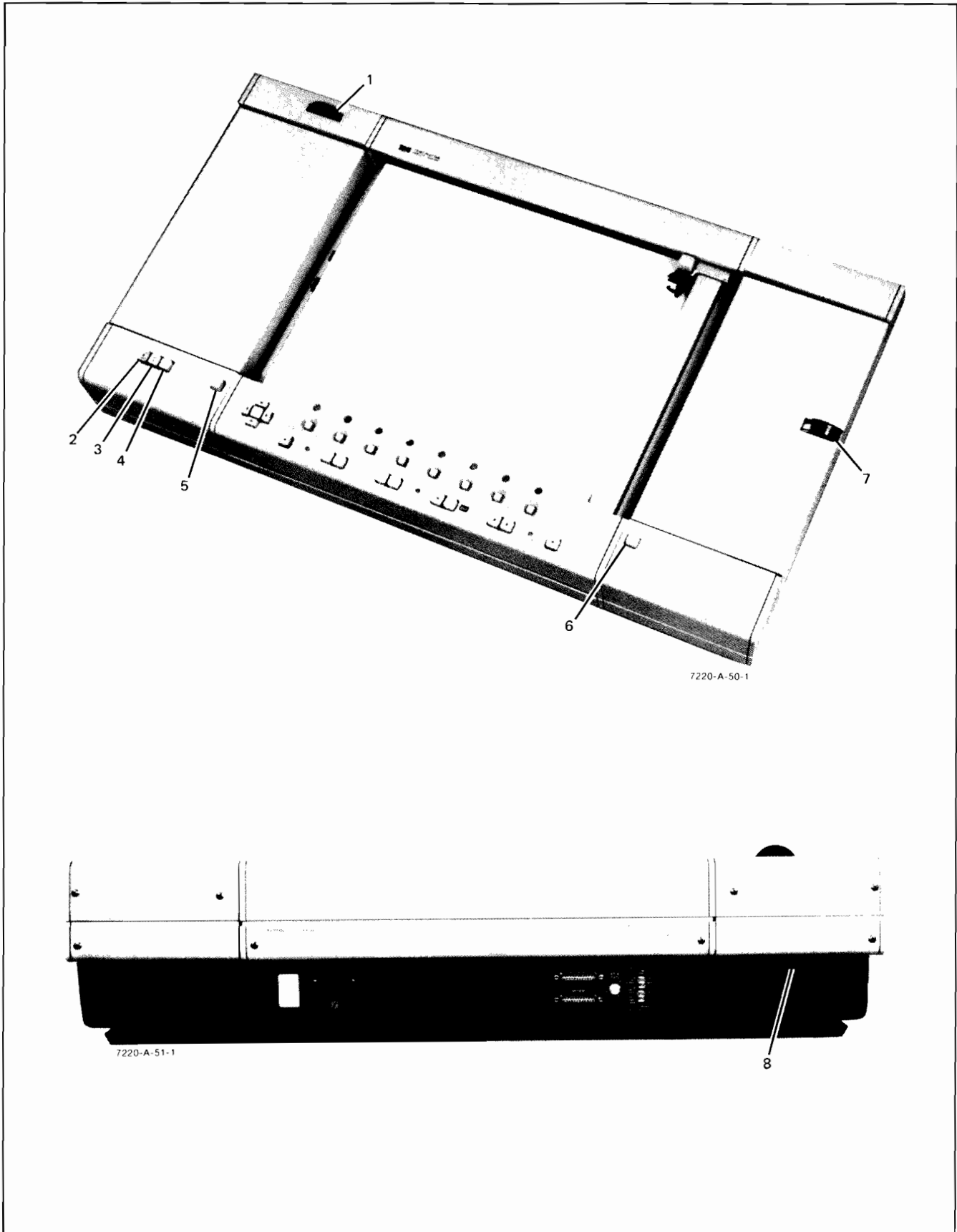


Figure A2-1. Controls and Indicators

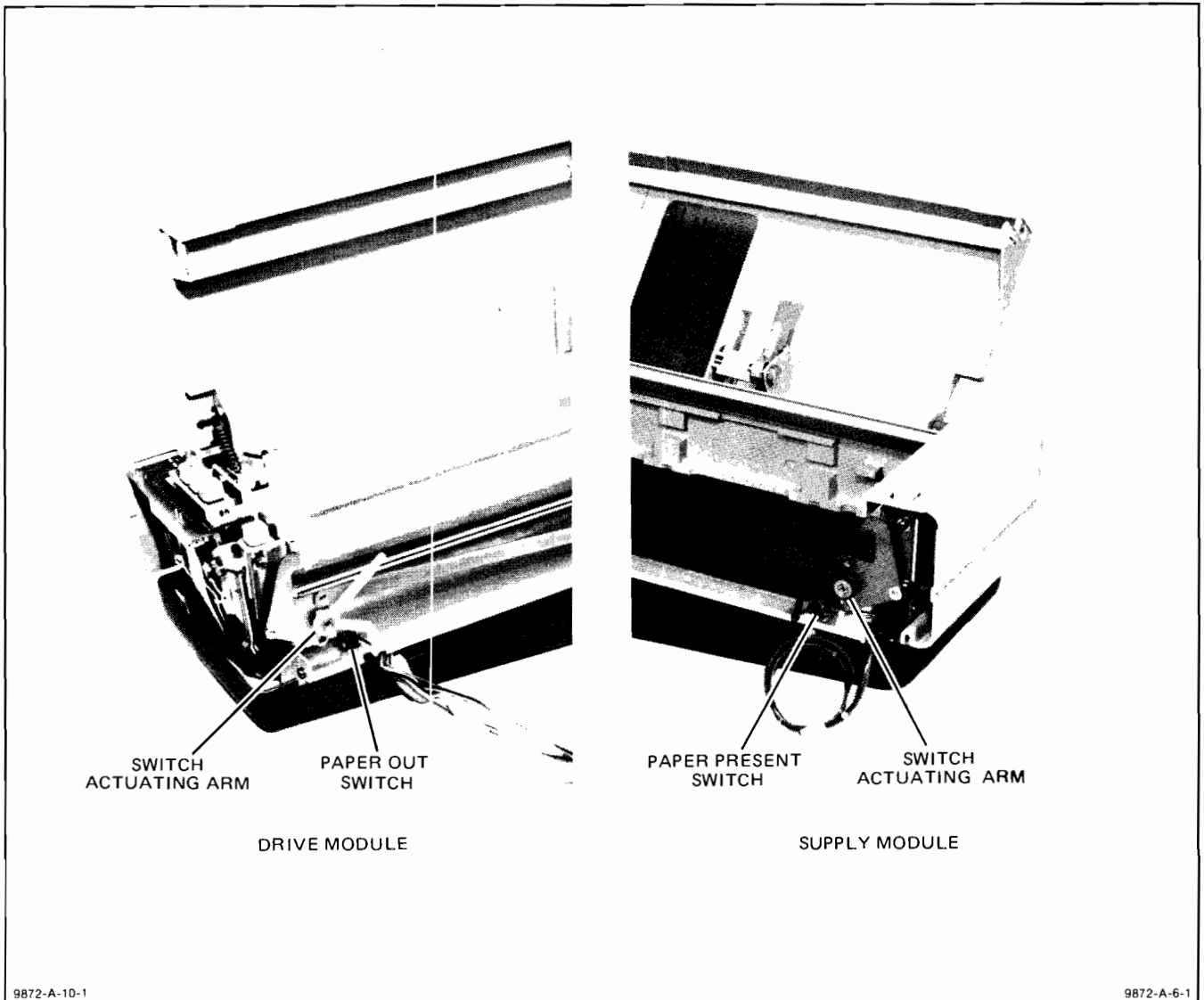
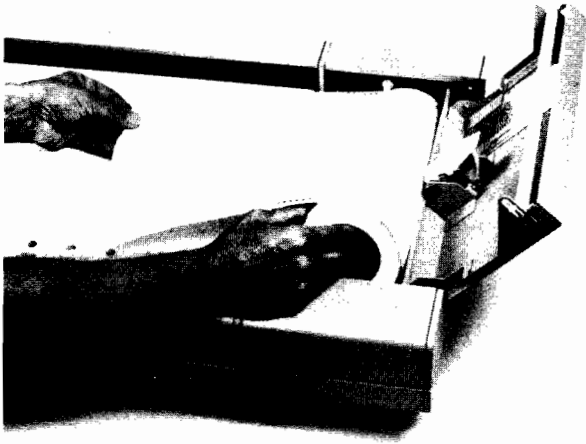


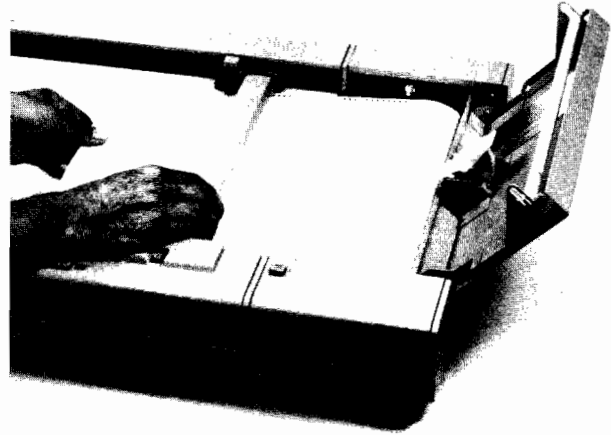
Figure A2-2. Paper Sensor Switch Locations

- d. Assure that the paper sensor switches have been activated. If both are activated, the CHART LOAD light will remain on even when the CHART HOLD switch is pressed.
- e. Assure that the cutter is enabled.
- f. Press and release the Half Advance pushbutton.
- g. Note that the plotter goes through an initialize sequence and then advances and cuts a half page.
- h. Completion of this sequence verifies the paper advance feature operation. If any step fails, refer to the troubleshooting portion of this appendix.



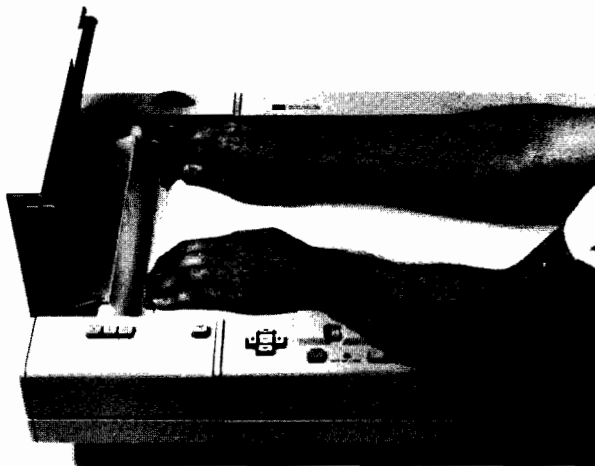
9872-A-206-1

PLACE PAPER ROLE IN SUPPLY MODULE
DETAIL "A"



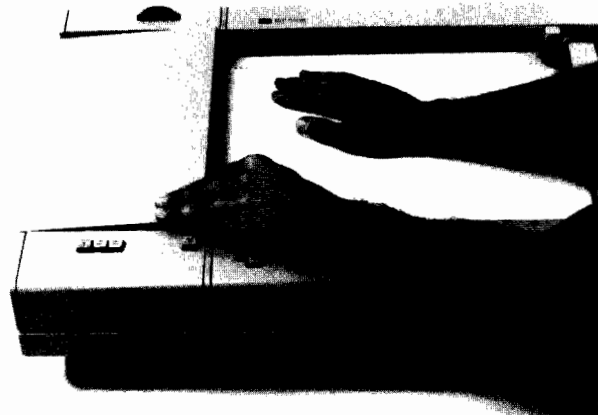
9872-A-207-1

FEED PAPER ACROSS PLATEN
DETAIL "B"



9872-A-208-1

ENGAGE PAPER HOLES IN SPROCKET TEETH
DETAIL "C"



9872-A-209-1

CLOSE MODULE DOORS
DETAIL "D"

Figure A2-3. Paper Loading



SECTION AIII

ADJUSTMENTS

A3-1. INTRODUCTION

A3-2. This section describes the checks and adjustments required to maintain the paper advance modules, or to return them to peak operating condition after repairs have been made.

A3-3. SAFETY REQUIREMENTS

A3-4. The following warnings must be followed for your safety and to prevent damage to the plotter or modules.



The following service procedures should be performed only by service-trained personnel who are aware of the electrical shock hazard or mechanical hazard which may be involved.

Certain procedures described in this section are performed with power supplied to the modules while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

A3-5. EQUIPMENT REQUIRED

A3-6. Table A3-1 lists the equipment required to perform the adjustment procedures contained in this section.

Table A3-1. Equipment Required

	HP PART NUMBER
Paper Sensor Adjustment Plate	17072-20074
P.K. Neuses 0-150 gram gauge or equivalent	—
Mylar Alignment Sheet	17072-00042
Drum Alignment Tool	17072-20073
Bruning 450 mm drafting scale or equivalent	—
Pozidrive screwdriver	—
3/8 in. nut driver XCELITE HS-12 or equivalent	—
1/2 in. nut driver XCELITE HS-16 or equivalent	—
7/64 in. allen or hex wrench	—

A3-7. ELECTRICAL ADJUSTMENTS

A3-8. Under normal operating circumstances, no electrical adjustments of the paper advance modules are necessary. Should either of the paper sensor switches fail to activate properly, adjustment of the appropriate switch may be necessary.

A3-9. PAPER SENSING SWITCH ADJUSTMENTS

A3-10. To adjust either of the paper sensing switches, proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Raise the module lids, and remove the paper.
- c. Loosen, but do not remove, the two switch plate mounting screws. See Figure A3-1.
- d. Place the paper sensor adjustment plate as shown in Figure A3-1 for the appropriate switch, and move the switch plate toward the actuator arm until a click is heard. (If the adjustment plate is not available, the switch actuator may be held in the position shown in Figure A3-1.)
- e. Tighten the switch plate mounting screws, load paper, and check for proper operation. Assure that the switch overtravel is not exceeded, or switch damage will occur.

A3-11. MECHANICAL ADJUSTMENT

NOTE

All mechanical adjustments are performed with the plotter upper deck assembly secured in the closed position.

A3-12. MODULE HEIGHT AND POSITION ADJUSTMENT

A3-13. Each module is provided with four adjusting nuts and lock nuts to raise or lower the module with respect to the plotter platen surface. The adjustments can be made from the bottom of the module. See Figure A3-2. To make this adjustment, proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position and remove the line cord.
- b. Loosen the 3/8 in. locking nuts located beneath the support bars.

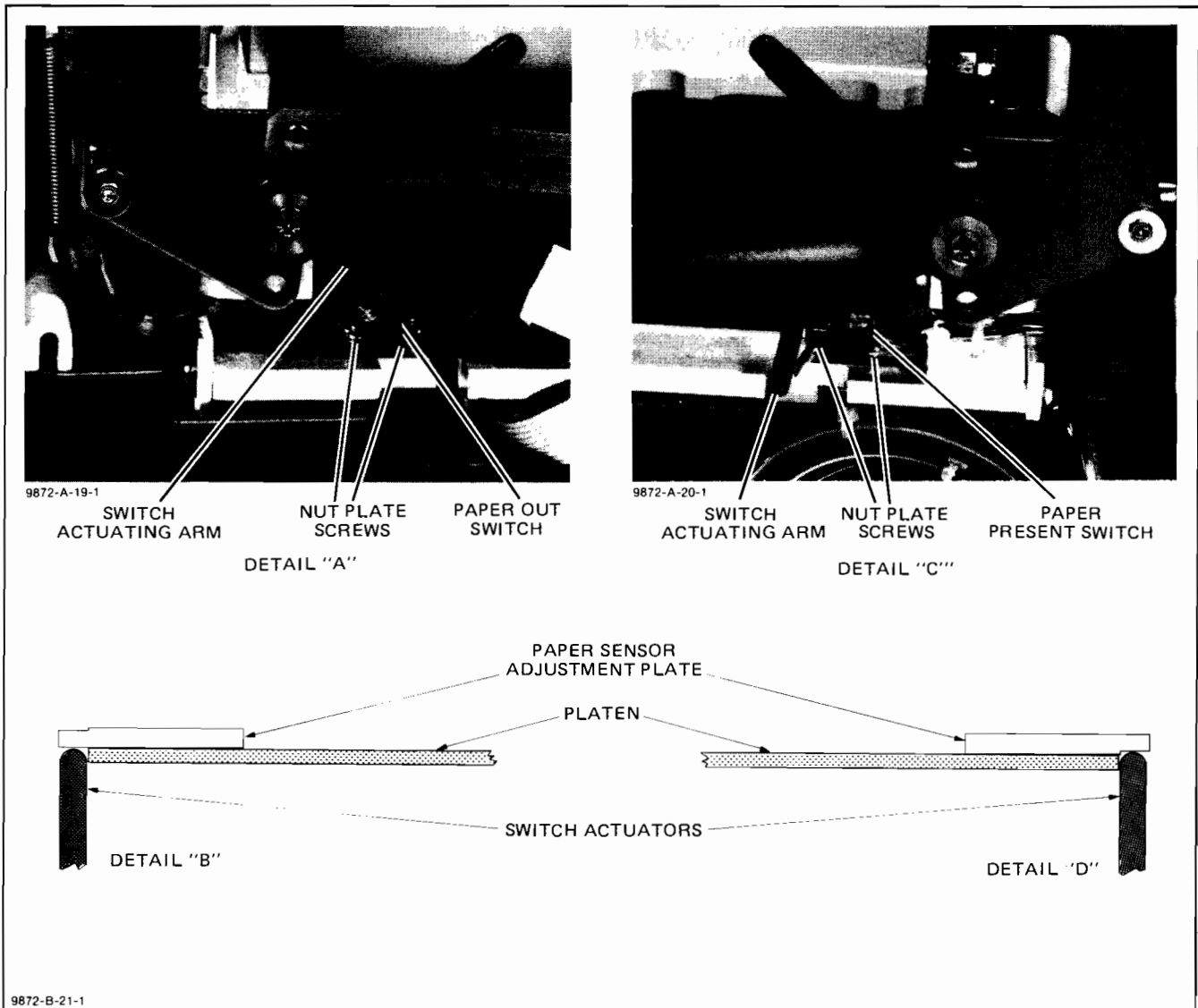


Figure A3-1. Paper Sensor Adjustment

- c. Turn the 1/2 in. adjusting nuts to raise or lower the module as necessary. The top cover of the plotter and module should be flush.
- d. Tighten the locking nuts securely.

- d. Place the drum sprocket alignment tool on the drum, concave side down. See Figure A3-3. The two triangular tabs should extend into the space between the teeth on both sprockets.
- e. Holding the tool firmly against the drum, rotate the tool or the drum until the rear sprocket tooth to the right of the tool (on the platen side) contacts the tab of the tool.
- f. Maintaining the contact developed in step e., rotate the front sprocket until the front sprocket tooth to the right of the tool (on the platen side) contacts the front tab of the alignment tool.
- g. Tighten the front sprocket clamp screw to secure the front sprocket in position on the shaft.

A3-14. DRUM SPROCKET ALIGNMENT

A3-15. This adjustment assures that the teeth on the front and rear sprocket are correctly aligned with each other. This alignment is vital because future alignment procedures are based on this. Proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position, and remove the line cord.
- b. Open the drive module, and remove the paper.
- c. Loosen the clamp screw on the front drive sprocket so that the sprocket turns freely on the shaft.

A3-16. DRUM AXIS PERPENDICULARITY ALIGNMENT

A3-17. This adjustment assures that the axis of the drive drum is perpendicular to the front paper guide of

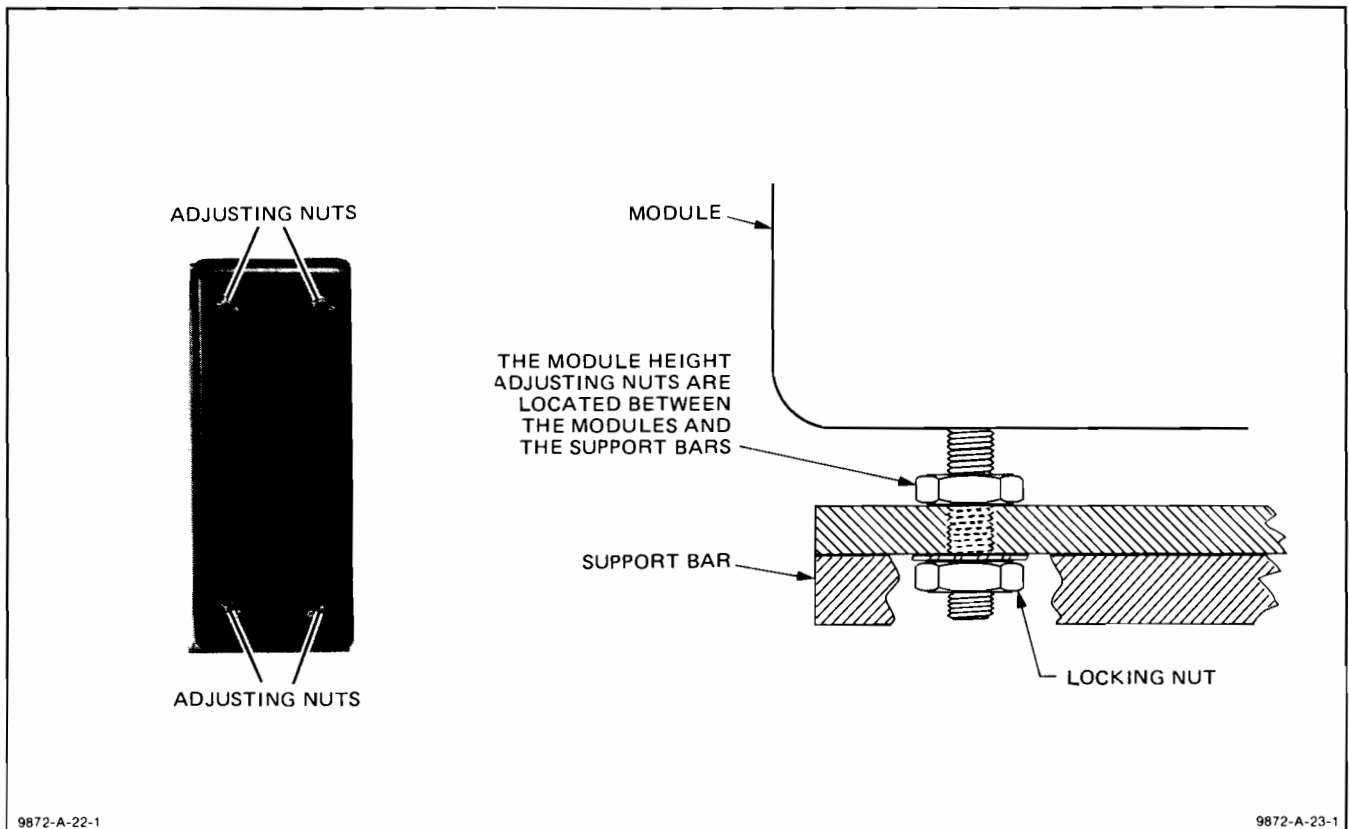


Figure A3-2. Module Height Adjustment

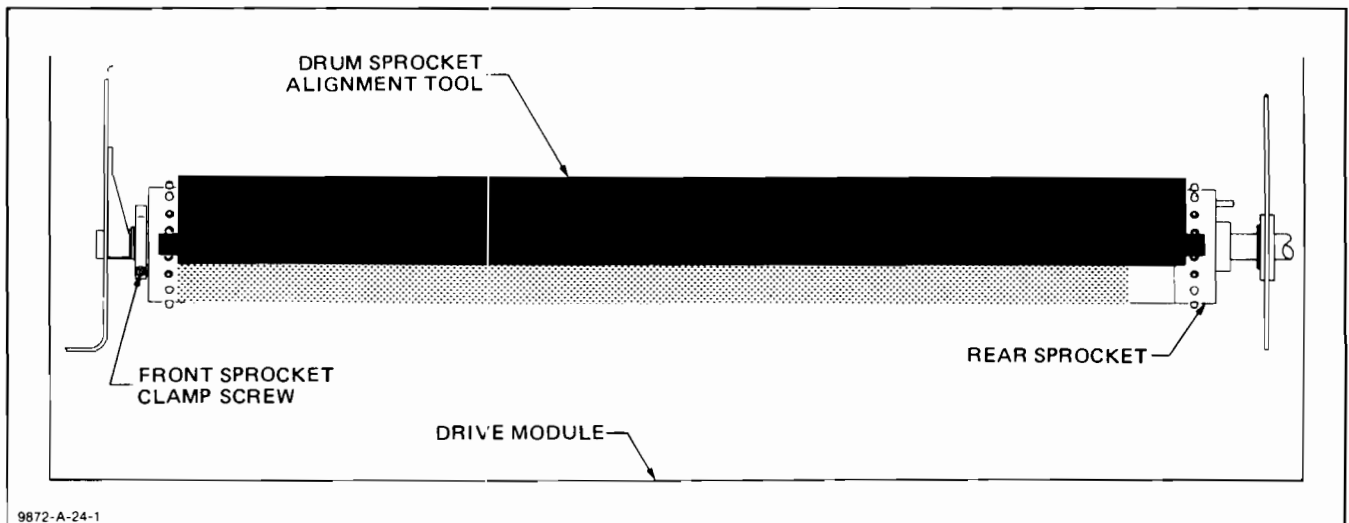


Figure A3-3. Sprocket Alignment

the plotter. To perform this adjustment, proceed as follows:

- a. Set the plotter LINE switch to the Off (O) position, and remove the line cord.
- b. Check for correct drum sprocket alignment. (Refer to paragraph A3-14.)
- c. Install the mylar alignment sheet with the clipped corner to the upper right. The holes in the sheet are engaged on the drive drum sprockets. Close the drive module lid, and thread the mylar sheet under the plotting arm. Manually apply firm, even tension on the sheet so that the roller shaft in the module lid is raised as far as it will go in the slot.
- d. See that the mylar sheet is parallel with the front paper guide on the plotter platen.

- e. If adjustment is required, open the drive module lid and loosen the screw in the drum alignment bushing. See Figure A3-4.
- f. Rotate the drum alignment screw either clockwise or counterclockwise until the front edge of the mylar sheet is parallel with the plotter front paper guide.
- g. Tighten the bushing lock screw.

A3-18. DRUM AXIAL ALIGNMENT PROCEDURE

A3-19. This adjustment assures that the front edge of the paper does not interfere with the edge of the front paper guide on the platen. Adjustment will not normally be required but should be checked as follows:

- a. Set the plotter LINE switch to the OFF (O) position, and remove the line cord.
- b. Check for correct drum sprocket alignment and drum axis perpendicularity. Refer to paragraphs A3-14 through A3-17.
- c. Remove the front and rear covers from the drive module.
- d. Loosen the drive pulley clamp screw on the front of the drum shaft and the ratchet clamp screw on the transmission assembly. See Figure A3-5.
- e. Install the mylar alignment sheet as described in paragraph A3-16.
- f. Gently tap the front or rear of the drum shaft until the front edge of the mylar sheet is touching but not under the lip of the front paper guide on the platen.
- g. Tighten the two clamp screws, and replace the drive module covers.

A3-20. BRAKE HUB ALIGNMENT

A3-21. This procedure aligns the supply module drum with the plotter platen. Proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Check for correct mechanical alignment of the drive module.
- c. Check for correct location of the supply module on the support bars.
- d. Remove the paper from the supply module.
- e. Remove the front cover from the supply module.
- f. Loosen the brake hub clamp screw. See Figure A3-6.
- g. Using a 7/64 in. hex wrench, turn the brake hub adjusting screw a few turns clockwise, and

push the brake hub forward until it contacts the end of the adjustment screw. See Figure A3-6.

- h. Install the mylar sheet as described in paragraph 3-17.
- i. Turn the brake hub adjustment screw clockwise until the inner edge of the brake hub flange contacts the front edge of the sheet.
- j. Remove the mylar sheet, and tighten the brake hub clamp screw.
- k. Replace the front cover.

A3-22. DRAG ARM ADJUSTMENT

A3-23. The drag arm should be adjusted to provide a pressure from 82 to 142 grams against the paper roll. To adjust this, proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Open the supply module lid.
- c. Press down on the tip of the drag arm with a gram gauge. See Figure A3-7.
- d. The arm should begin to move with a pressure of 82 to 142 grams indicated on the gauge.
- e. To adjust the pressure, turn the link adjust nut clockwise to increase the pressure or counterclockwise to decrease.

A3-24. SLIP CLUTCH ADJUSTMENT

A3-25. The slip clutch reduces any backlash effect from the paper advance mechanics. To adjust the clutch, proceed as follows:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Remove the front cover from the drive module.
- c. Manually turn the thumbwheel until the clutch arm contacts the support stud.
- d. The clutch should slip back to its original position upon release of the thumbwheel.
- e. If adjustment is necessary, turn the clutch adjustment screw clockwise to tighten or counterclockwise to increase slippage. See Figure A3-8.
- f. Check and readjust as necessary.
- g. Replace the front cover.

A3-26. LOWER CUTTER BLADE ADJUSTMENT

A3-27. The lower cutter blade may be adjusted to provide a cut which is perpendicular to the front edge of the paper. To check and adjust the lower cutter blade, proceed as follows:

- a. Advance and cut a sheet of paper.

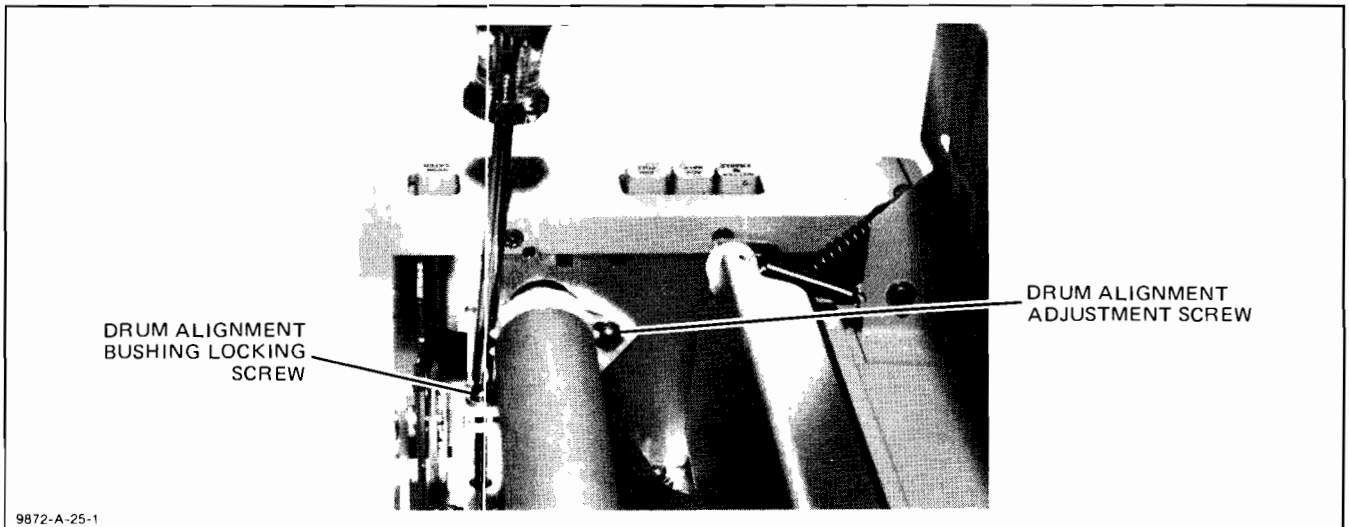


Figure A3-4. Perpendicularity Alignment

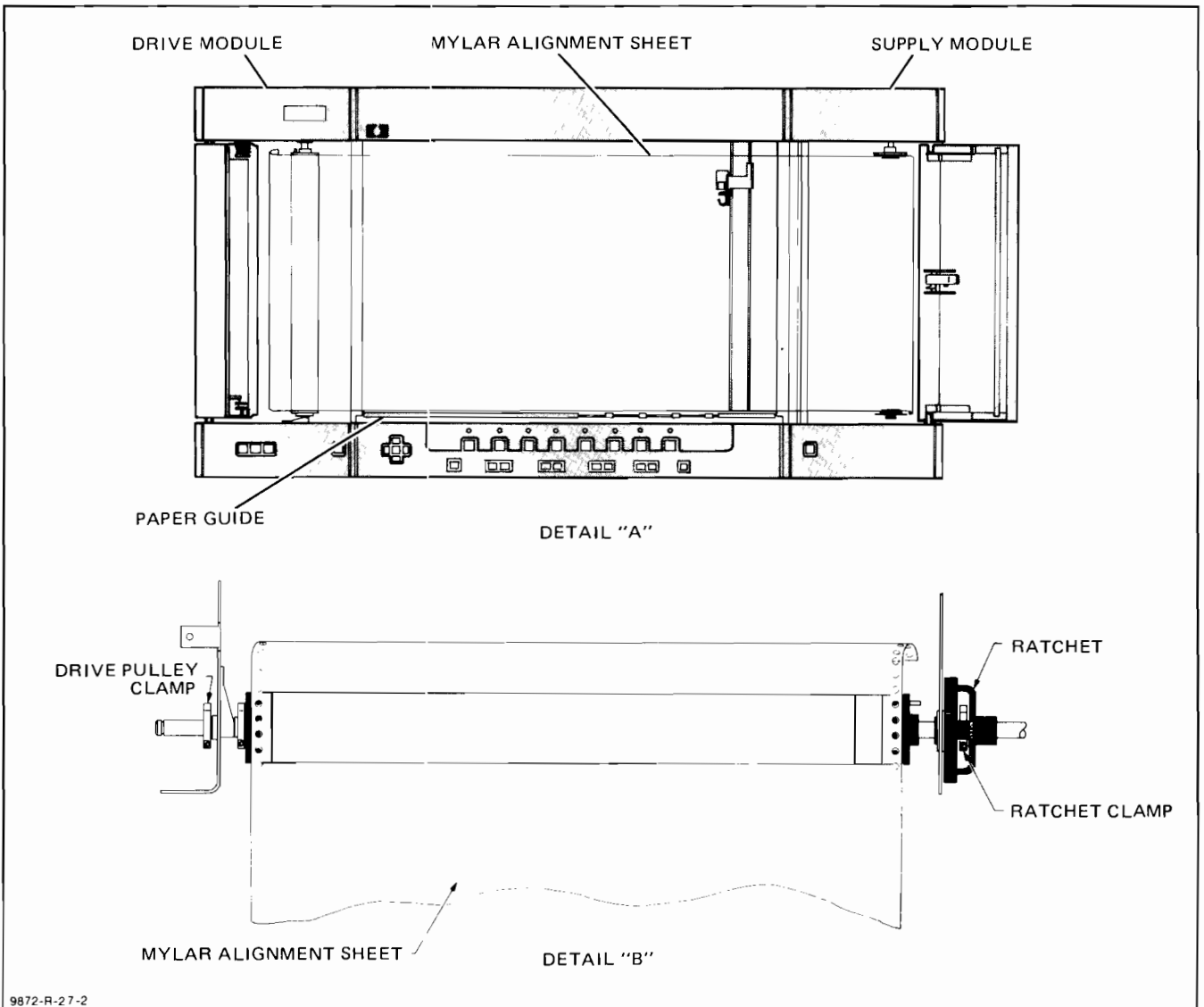


Figure A3-5. Drum Axial Adjustment

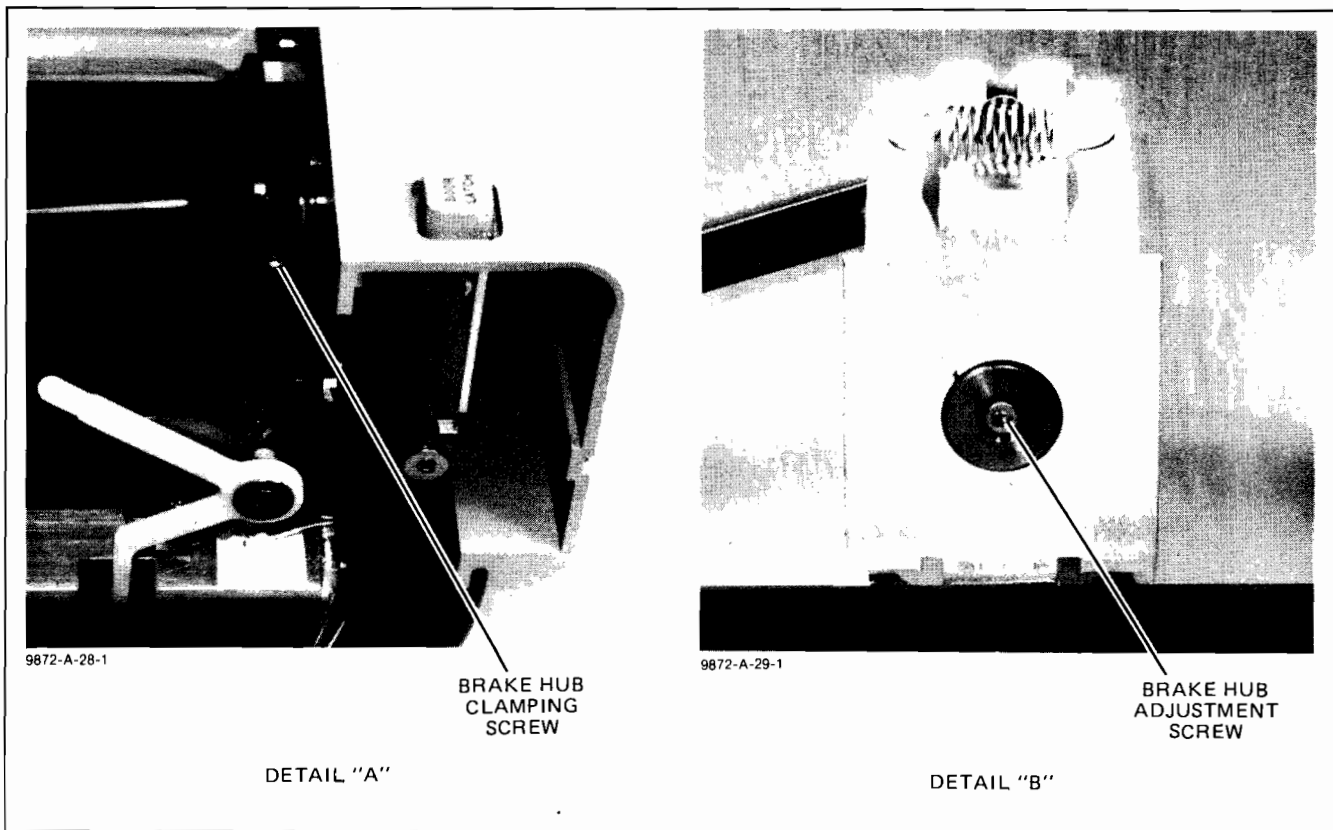


Figure A3-6. Brake Hub Adjustment

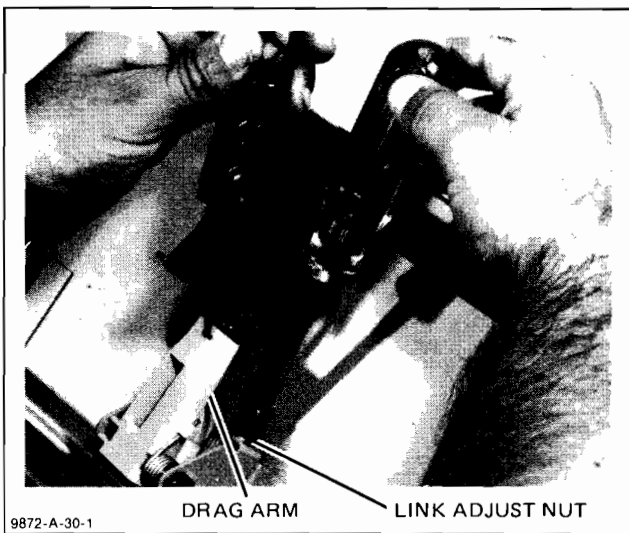


Figure A3-7. Drag Arm Adjustment

- b. Measure from the cut edge to the first sprocket hole at the front and back edge of the paper. The difference between these measurements should be within 1 mm (0.04 in.).
- c. Set the plotter LINE switch to OFF (O).
- d. Remove the drive module covers and lid.
- e. Loosen the rear and center lower blade mounting screws. See Figure A3-9.

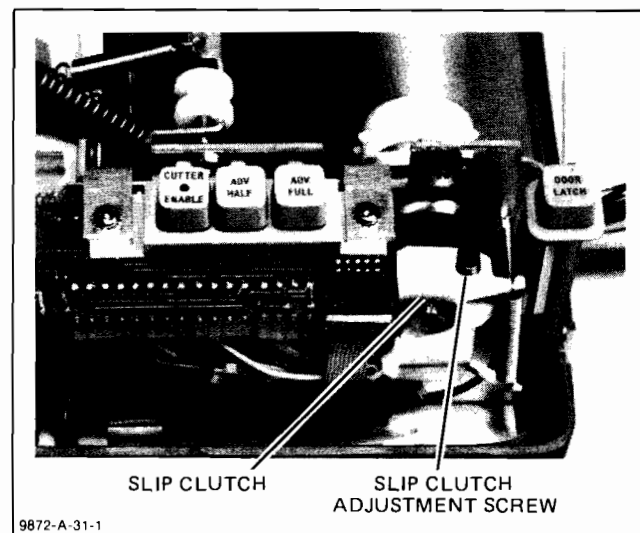


Figure A3-8. Slip Clutch Adjustment

- f. Loosen the eccentric nut locking screw, and rotate the eccentric to move the front edge of the lower blade.
- g. Tighten the eccentric nut locking screw, and check for a square cut.
- h. Readjust if necessary, and tighten the lower blade mounting screws.
- i. Replace the covers.

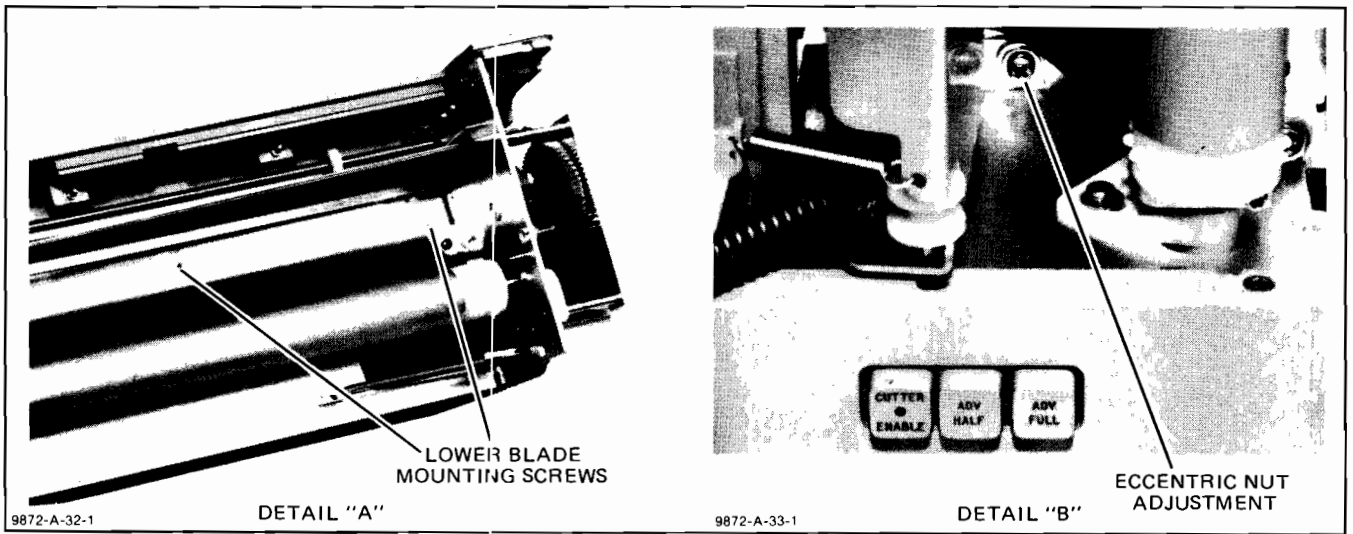


Figure A3-9. Lower Cutter Blade Adjustment



SECTION AIV

PARTS LISTS

A4-1. INTRODUCTION

A4-2. This section contains parts information for the Hewlett-Packard Models 7220T and 7221T Graphics Plotters. Included are parts lists and illustrated parts breakdowns.

A4-3. REPLACEABLE PARTS LIST

A4-4. PRINTED CIRCUIT ASSEMBLY

A4-5. Parts located on the printed circuit assembly (PCA) are listed in Table A4-1 and illustrated in Figure A4-1.

A4-6. MECHANICAL PARTS

A4-7. Parts and assemblies for the paper advance feature are listed in Tables A4-2 through A4-4 and illustrated in Figures A4-2 through A4-4.

A4-8. INTERCONNECTING CABLES

A4-9. Interconnecting cables for the paper advance are illustrated and identified in Figure A4-5.

A4-10. TRANSMISSION ASSEMBLY

A4-11. The transmission parts are illustrated and identified in Figure A4-6.

A4-12. ORDERING INFORMATION

A4-13. Refer to Section IV of the main manual for information concerning ordering replacement parts.

Table A4-1. Front Panel PCA (A1), Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	17072-60105		1	PCA, FRONT PANEL	28480	17072-60105
A1C1	0160-3847		1	CAPACITOR FXD .01UF +100-0% 50 VDC CER	28480	0160-3847
A1CR1	1901-0022		1	DIODE - STABISTOR 10V 250 MA	01698	PG1572
A1DS1	1990-0487		1	DIODE LED YELLOW SM	28480	1990-0487
A1J1	1251-3751		1	CONNECTOR PT 8M	28480	1251-3751
A1J2	1251-3305		2	CONNECTOR PT 4	28480	1251-3305
A1J3	1251-3305			CONNECTOR PT 4	28480	1251-3305
A1J4	1251-4582		1	CONNECTOR PT 10M	28480	1251-4582
A1K1	0490-0705		1	RELAY 2C 12VDC .05A	04776	R10-E1 Z2-S800
A1Q1	1854-0039		1	TRANSISTOR NPN SI PD=1W FT=100 MHZ	01921	2N3053
A1Q2	1854-0215		1	TRANSISTOR NPN SI PD=350 MHZ FT=250 MHZ	04713	2N3904
A1R1	0757-0442		1	RESISTOR 10K 1% .125W	24546	C4-1/8-TO-1002-F
A1R2	0757-0418		1	RESISTOR 619 Ω 1% .125W	24546	C4-1/8-TO-6190-F
A1R3	0698-3444		1	RESISTOR 316 Ω 1% .125W	24546	C4-1/8-TO-3160-F
A1S1	5060-9436		3	SWITCH PB ASSY	28480	5060-9436
A1S2	5060-9436			SWITCH PB ASSY	28480	5060-9436
A1S3	5060-9436			SWITCH PB ASSY	28480	5060-9436
				MISCELLANEOUS		
E1-5	0360-1514		5	STUD, TERMINAL	28480	0360-1514
E6	1200-0718		1	SOCKET - RELAY	28480	1200-0718

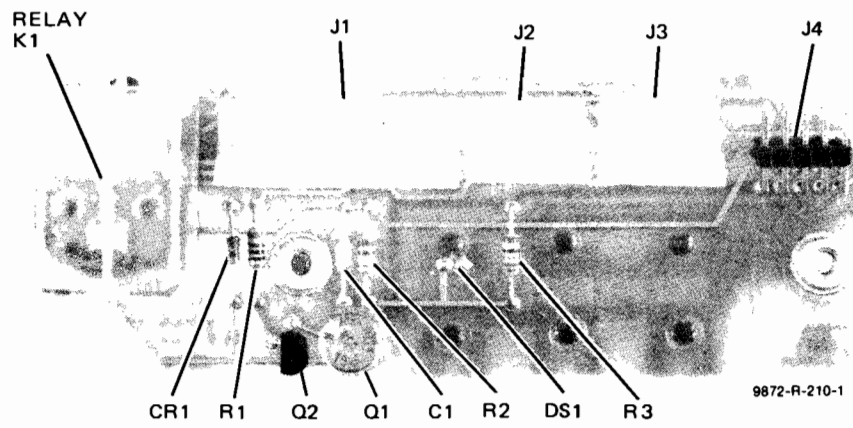
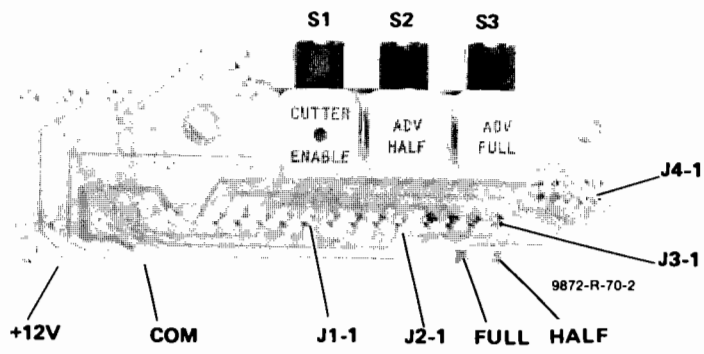


Figure A4-1. Front Panel PCA A1 Parts Location

Table A4-2. Supply Module, Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	2360-0045	7	3	SCREW-MACH 6-32 .562-IN-LG TR-HD-PHL	00000	ORDER BY DESCRIPTION
2	17072-20040	7	1	COVER, RIGHT REAR	28480	17072-20040
3	2360-0115	4	7	SCREW-MACH 6-32 .312-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
4	17072-00007	4	1	BRACKET, RIGHT REAR	28480	17072-00007
5	17072-20034	9	1	SPACER, RIGHT REAR	28480	17072-20034
6	17072-00017	6	1	SUPPORT, RIGHT REAR	28480	17072-00017
7	17072-20060	1	1	STOP, DOOR	28480	17072-20060
8	17072-40021	6	1	BUMPER, DOOR	28480	17072-40021
9	2190-0194	8	1	WASHER-SHLDR 3/8 IN .385-IN-ID .75-IN-OD	28480	2190-0194
10	1460-0849	2	1	SPRING-CPRSN .61-IN-OD 2-IN-OA-LG MUA CD	28480	1460-0849
11	17072-40010	3	1	SUPPORT CORE	28480	17072-40010
12	0510-0235	6	2	RETAINER-RING E-R EXT .375-IN-DIA STL	28480	0510-0235
13	17072-20062	3	1	SPACER, RIGHT	28480	17072-20062
14	2360-0205	3	3	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
15	2190-0105	1	3	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0105
16	3050-0066	8	11	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0066
17	2190-0152	8	1	WASHER-FL MTLC NO. 8 .148-IN-ID	28480	2190-0152
18	17072-20010	1	1	SPACER-HINGE, RIGHT	28480	17072-20010
19	17072-20081	0	1	SIDE, RIGHT	28480	17072-20081
20	17072-20011	2	1	HINGE-REAR	28480	17072-20011
21	17072-20072	5	1	ROLLER	28480	17072-20072
22	17072-40015	8	2	BUSHING, LINEAR	28480	17072-40015
23	17072-60003	6	1	DOOR ASSEMBLY, RIGHT	28480	17072-60003
24	0590-0076	1	1	NUT, HEX - PLSTC LKG 4-40	28480	0590-0076
25	17072-20067	8	1	LINK ADJUST	28480	17072-20067
26	17072-20038	3	1	SHAFT, ROLLER-RIGHT	28480	17072-20038
27	17072-40011	4	1	WINDON	28480	17072-40011
28	3030-0844	9	2	SCREW 6-32 .375-IN-LG ALY	28480	3030-0844
29	2260-0009	3	1	NUT-HEX-W/LKWR 6-40-THD .094-IN-THK	00000	ORDER BY DESCRIPTION
30	17072-40009	0	1	ARM, DRAG	28480	17072-40009
31	1460-1784	6	1	SPRING, TORSION-DRAG ARM	28480	1460-1784
32	17072-20047	4	1	AXLE, DRAG ARM	28480	17072-20047
33	17072-20013	4	1	HINGE, FRONT	28480	17072-20013
34	17072-20061	2	1	BUSHING-HINGE	28480	17072-20061
35	0510-0015	0	1	RETAINER-RING E-R EXT .125-IN-DIA STL	28480	0510-0015
36	17072-40003	4	1	HUB, PAPER BRAKE	28480	17072-40003
37	0510-0195	7	1	NUT-HEX-W/LKWR LKG 6-32-THD .172-IN-THK	28480	0510-0195
38	2360-0183	6	2	SCREW-MACH 6-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
39	17072-00014	3	1	SUPPORT, RIGHT FRONT	28480	17072-00014
40	1460-1764	2	1	SPRING-EXT .188-IN-OD SST PSVT	28480	1460-1764
41	17072-20016	7	1	BUSHING ACTUATOR	28480	17072-20016
42	17072-00036	9	1	ARM-STOP	28480	17072-00036
43	1410-0606	4	2	BEARING-SLEEVE .751-ID 844-OD NYL	28480	1410-0606
44	2360-0119	4	5	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
45	17072-20032	7	1	SHAFT, BRAKE	28480	17072-20032
46	1460-1765	3	1	SPRING-EXT .375-IN-OD MUA CD	28480	1460-1765
47	17072-40007	8	2	BRAKE BLOCK	28480	17072-40007
48	17072-00018	7	1	BRACKET, BRAKE ASSEMBLY	28480	17072-00018
49	3030-0158	1	1	SCREW, SKT HD CAP 6-32 1.00 IN LG SST	28480	3030-0158
50	17072-20078	4	1	PANEL, RIGHT FRONT	28480	17072-20078
51	0624-0208	4	4	SCREW-TPG 6-32 .5-IN-LG PAN-HD-POZI STL	28480	0624-0208
52	1400-0704	4	1	CLAMP, SPRING	28480	1400-0704
53	17072-20008	7	2	BUSHING, LATCH	28480	17072-20008
54	0520-0129	4	4	SCREW, 2-56 .250 PAN-HD-POZI	00000	ORDER BY DESCRIPTION
55	2190-0014	1	2	WASHER-LK INTL T NO. 2 .089-IN-ID	28480	2190-0014
56	3101-10A2	9	1	SWITCH ACTUATOR	28480	3101-10A2
57	3101-2007	0	1	SWITCH, SPDT-NS	28480	3101-2007
58				NOT ASSIGNED		
59	17072-00041	2	1	NUT PLATE	28480	17072-00041
60	5041-1825	2	1	KEY CAP, DOOR LATCH	28480	5041-1825
61	17072-40016	1	1	SHIELD, BUTTON	28480	17072-40016
62	17072-20001	0	1	BASE, RIGHT	28480	17072-20001
63	17072-40020	5	1	ACTUATOR, SWITCH	28480	17072-40020
64	17072-20033	8	1	BUSHING, SWITCH	28480	17072-20033
65	2360-0210	0	1	SCREW-MACH 6-32 .625-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
66	17072-60014	9	1	HOUSING, RIGHT	28480	17072-60014
67	2740-0003	5	4	NUT-HEX-W/LKWR 10-32-THD .125-IN-THK	00000	ORDER BY DESCRIPTION
68	17072-60002	5	1	LATCH ASSEMBLY, RIGHT	28480	17072-60002
69	1460-1768	6	1	SPRING-EXT .25-IN-OD SST PSVT	28480	1460-1768
70	2360-0199	6	1	SCREW 6-32 X .43	28480	2360-0199
71	2420-0001	3	1	NUT, HEX W/LKWR 6-32-THD .109-IN-THK	28480	2420-0001
72	2360-0276	8	4	SCREW-MACH 6-32 .375-IN-LG TR-HD-PHL	00000	ORDER BY DESCRIPTION
73	3030-0013	3	1	SCREW-SKT HD CAP 6-32 .75-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
74	17072-60009	2	1	CABLE, SENSOR RIGHT	28480	17072-60009
75				NOT ASSIGNED		
76	2190-0112	2	2	WASHER-LOCK HLCL #2	28480	2190-0112
77	2190-0417	2	2	WASHER-FLAT #2	28480	2190-0417
78				NOT ASSIGNED		
79	3050-0399	2	2	WASHER-FLAT #6	28480	3050-0399
80	7120-8776	1	1	LABEL - INFO	28480	7120-8776

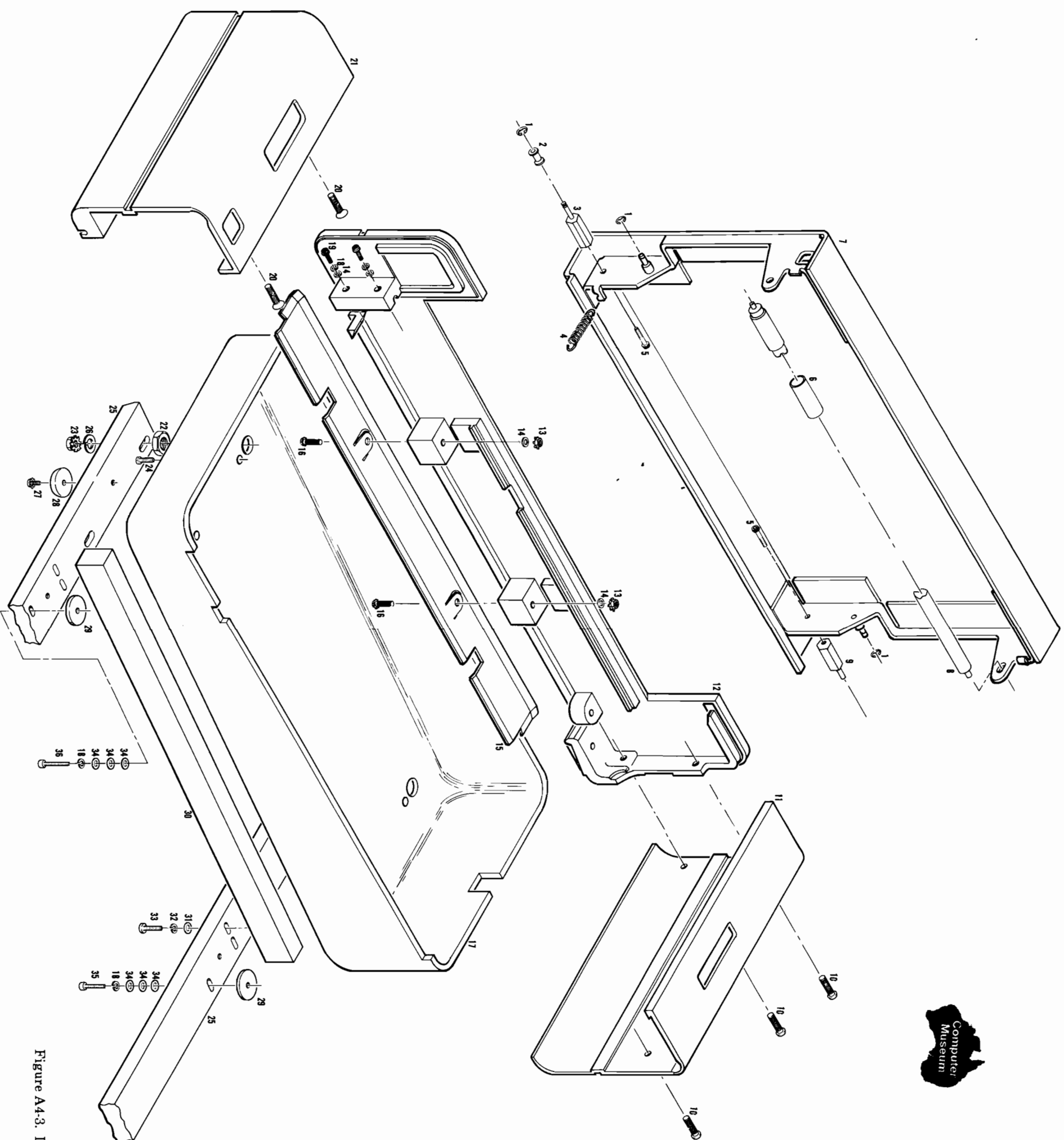


Figure A4-3. Drive Module Housing

Table A4-3. Drive Module Housing/Bar Mount, Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0510-0015	0	3	RETAINER-RING E-R EXT .125-IN-DIA STL	28480	0510-0015
2	17072-20061	2	1	RUSHING, HINGE	28480	17072-20061
3	17072-20013	4	1	HINGE-FRONT	28480	17072-20013
4	1460-1769	7	1	SPRING, EXTENSION .250-OD, DOOR HOLD	28480	1460-1769
5	3030-0844	0	2	SCREW 6-32 .375-IN-LG ALY	28480	3030-0844
6	17072-20015	6	1	ROLLER	28480	17072-20015
7	17072-60010	5	1	DOOR ASSEMBLY, LEFT	28480	17072-60010
8	17072-20003	2	1	SHAFT, ROLLER-LEFT	28480	17072-20003
9	17072-20011	2	1	HINGE-REAR	28480	17072-20011
10	2360-0045	7	3	SCREW-MACH 6-32 .562-IN-LG TR=HD=PHL	00000	ORDER BY DESCRIPTION
11	17072-20041	8	1	COVER, LEFT REAR	28480	17072-20041
12	17072-20082	1	1	SIDE-LEFT	28480	17072-20082
13	0590-0361	1	2	NUT-MEX=H/LK=H 6-32-TMD .12-IN-TMK	00000	ORDER BY DESCRIPTION
14	3050-0066	1	4	WASHER=FL MTLCL NO. 6 .147-IN-ID	28480	3050-0066
15	17072-00021	2	1	DEFLECTOR	28480	17072-00021
16	2360-0209	7	2	SCREW-MACH 6-32 1-IN-LG PAN=HD=POZI	00000	ORDER BY DESCRIPTION
17	17072-60013	8	1	HOUSING, LEFT	28480	17072-60013
18	2190-0105	1	6	WASHER=LK MTLCL NO. 6 .141-IN-ID	28480	2190-0105
19	2360-0205	3	2	SCREW-MACH 6-32 .75-IN-LG PAN=HD=POZI	00000	ORDER BY DESCRIPTION
20	2360-0183	6	2	SCREW-MACH 6-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
21	17072-20077	9	1	FRONT PANEL, LEFT	28480	17072-20077
22	17072-20065	6	8	NUT, LOCK HEIGHT ADJUST	28480	17072-20065
23	2740-0003	5	8	NUT-MEX=H/LK=H 10-32-TMD .125-IN-TMK	00000	ORDER BY DESCRIPTION
24	2360-0276	8	8	SCREW-MACH 6-32 .375-IN-LG TR=HD=PHL	00000	ORDER BY DESCRIPTION
25	17072-20053		2	BAR ALIGNMENT	28480	17072-20053
26	2190-0028		8	WASHER LOCK	28480	17072-20071
27	2360-0115		4	SCREW, MACH. 6 32 x .312 PAN HD POZI	00000	ORDER BY DESCRIPTION
28	0403-0106		4	FOOT RUBBER	04041	R-10 REDCO
29	17072-00040		4	WASHER	28480	17072-00040
30	17072-20075		2	BAR CROSS	28480	17072-20075
31	3050-0393		8	WASHER FLAT #5	00000	ORDER BY DESCRIPTION
32	2190-0017		8	WASHER LOCK #5	00000	ORDER BY DESCRIPTION
33	3030-0015		8	SCREW, 8 32 x 750	00000	ORDER BY DESCRIPTION
34	3050-0016		12	WASHER, FLAT #6	00000	ORDER BY DESCRIPTION
35	3030-0013		3	SCREW, 6 32 x 750	00000	ORDER BY DESCRIPTION
36	3030-0158		1	SCREW, 6 32 x 1.00	00000	ORDER BY DESCRIPTION

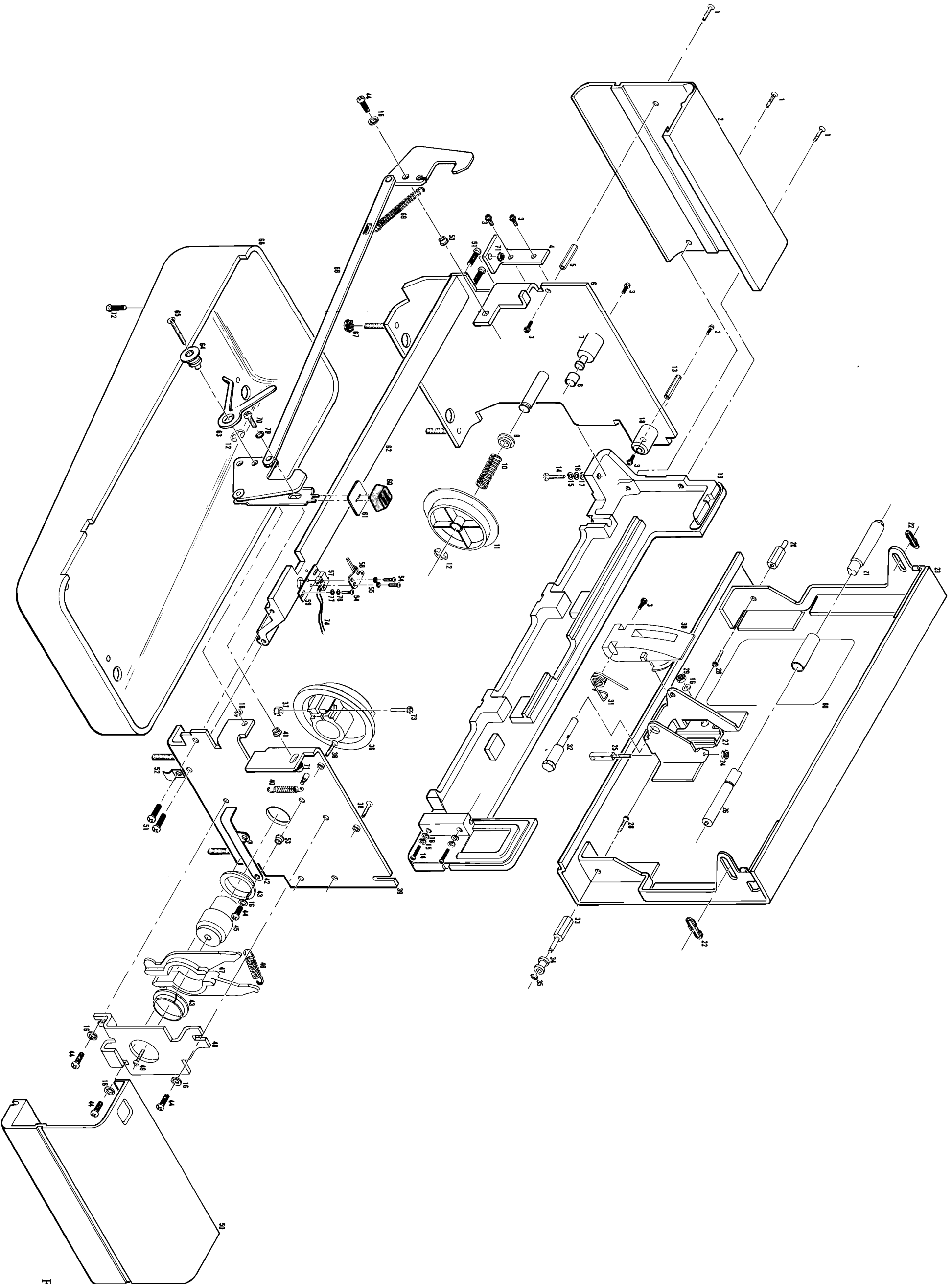


Figure A4-2. Supply Module

Table A4-4. Drive Module, Parts List

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	07245-20016	5	1	IDLER, LEFT UPPER	28480	07245-20016
2	17072-20014	5	1	AXLE-IDLER	28480	17072-20014
3	17072-00027	8	1	BLADE-UPPER	28480	17072-00027
4	0340-0920	5	2	INSULATOR	28480	0340-0920
5	1460-1807	0	1	SPRING-EXT .375-IN-OD MUX CD	28480	1460-1807
6	1460-1105	5	1	SPRING, EXTENSION .250-OD	28480	1460-1105
7	1460-1766	4	2	SPRING, EXTENSION	28480	1460-1766
8	17072-20021	4	1	IDLER-FLDATING	28480	17072-20021
9	3050-0139	6	1	WASHER-FL MTLG NO. 8 .172-IN-ID	28480	3050-0139
10	0510-0166	2	1	RETAINER-RING E-R EXT .156-IN-DIA STL	23480	0510-0166
11	17072-00030	3	2	GUIDE, SPRING	28480	17072-00030
12	1460-1770	0	1	SPRING, COMPRESSION .360-OD	28480	1460-1770
13	0510-0015	0	2	RETAINER-RING E-R EXT .125-IN-DIA STL	28480	0510-0015
14	2190-0198	2	4	WASHER-BHLDR NO. 4 .123-IN-ID .312-IN-OD	28480	2190-0198
15	17072-00002	9	1	FRAME, IDLER	28480	17072-00002
16	2360-0183	6	1	SCREW-MACH 6-32 .375-IN-LG 82 DEG	00000	ORDER BY DESCRIPTION
17	17072-20070	3	1	BUSHING-ECCENTRIC	28480	17072-20070
18	17072-00026	7	1	BLADE-LOWER	28480	17072-00026
19	2200-0140	7	4	SCREW-MACH 4-40 .25-IN-LG 100 DEG	00000	ORDER BY DESCRIPTION
20	2190-0152	8	2	WASHER-FL MTLG NO. 8 .168-IN-ID	28480	2190-0152
21	3050-0066	8	6	WASHER-FL MTLG NO. 6 .147-IN-ID	28480	3050-0066
22	2190-0105	1	3	WASHER-LK HLCL NO. 6 .141-IN-ID	28480	2190-0105
23	2360-0197	2	1	SCREW-MACH 6-32 .375-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
24	1460-1772	2	1	SPRING, COMPRESSION .360-OD	28480	1460-1772
25	0510-0235	6	12	RETAINER-RING E-R EXT .375-IN-DIA STL	28480	0510-0235
26	3030-0013	2	7	SCREW 6-32 X .75-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
27	07245-20028	9	3	CLAMP	28480	07245-20028
28	17072-20018	9	1	SHAFT-DRUM	28480	17072-20018
29	17072-20046	3	2	SPROCKET	28480	17072-20046
30	17072-20019	0	1	DRUM	28480	17072-20019
31	17072-60018	3	1	DRUM GUIDE	28480	17072-60018
32	2260-0002	1	1	NUT-MEX-OBL-CHAM 4-40-THD .094-IN-TMK	00000	ORDER BY DESCRIPTION
33	2200-0147	4	1	SCREW-MACH 4-40 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
34	1410-0170	7	1	BRG-PDL BA .375-IN-OD .875-IN-DD	28480	1410-0170
35	2360-0119	8	6	SCREW-MACH 6-32 .438-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
36	0340-0442	6	2	INSULATOR-FLG-8SMG NYLON	28480	0340-0442
37	0510-0083	2	7	RETAINER-RING E-R EXT .25-IN-DIA STL	28480	0510-0083
38	17072-20027	0	2	WHEEL-IDLER	28480	17072-20027
39	17072-20023	6	1	SHAFT-IDLER	28480	17072-20023
40	0905-0806	4	2	O-RING .484-IN-ID .139-IN-XSECT-DIA EPR	83259	D8A 2-206 E751-65
41	17072-60019	4	1	DRIVE SHAFT	28480	17072-60019
42	1410-0745	2	3	BEARING-SLEEVE .251-ID .344-OD NYL	28480	1410-0745
43	2190-0190	4	3	WASHER-FL NM NO. 12 .25-IN-ID .5-IN-OD	28480	2190-0190
44	2360-0119	4	13	SCREW-MACH 6-32 .44-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
45	17072-00016	5	1	SUPPORT, LEFT REAR	28480	17072-00016
46	17072-20063	4	1	SPACER, SIDE L.H.	28480	17072-20063
47	17072-20024	7	3	STANDOFF, XSMN	28480	17072-20024
48	17072-00010	9	1	BRACKET, LEFT REAR	28480	17072-00010
49	2360-0205	3	1	SCREW-MACH 6-32 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
50	1410-0929	4	2	BEARING-SLEEVE .376-ID .469-OD NYL	28480	1410-0929
51	17072-20030	5	1	SHAFT, TRANSMISSION	28480	17072-20030
52	17072-20045	2	1	LEVER-CUTTER	28480	17072-20045
53	2190-0199	3	1	WASHER-FL NM NO. 4 .125-IN-ID .312-IN-OD	28480	2190-0199
54	17072-00025	6	1	LINK-CUTTER	28480	17072-00025
55	0510-0052	5	1	RETAINER-RING GRPR EXT .125-IN-DIA STL	28480	0510-0052
56	17072-60016	1	1	THUMBWHEEL	28480	17072-60016
57	2190-0200	7	9	WASHER-FL NM 3/8 IN .378-IN-ID	28480	2190-0200
58	17072-60015	0	1	GEAR-CLUTCH	28480	17072-60015
59	1410-0746	3	2	BEARING-SLEEVE .376-ID .469-OD NYL	28480	1410-0746
60	1410-0744	1	1	BEARING-SLEEVE .126-ID .188-OD NYL	28480	1410-0744
61	17072-00020	1	1	PLATE-TRANSMISSION	28480	17072-00020
62	17072-40004	5	1	PAWL	28480	17072-40004
63	17072-20068	9	1	SHAFT-THUMBWHEEL	28480	17072-20068
64	17072-40002	3	2	GEAR-CLUSTER	28480	17072-40002
65	17072-40005	6	1	GEAR-PINION	28480	17072-40005
66	17072-40001	2	1	RATCHET	28480	17072-40001
67	07245-20075	8	1	CLAMP	28480	07245-20075
68	17072-60005	8	1	ARM-CUTTER, REAR	28480	17072-60005
69	2200-0151	0	2	SCREW-MACH 4-40 .75-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
70	2190-0108	4	2	WASHER-LK HLCL NO. 4 .115-IN-ID	28480	2190-0108
71	17072-20050	9	2	STOP-CUTTER	28480	17072-20050
72	0590-0381	1	1	NUT-MEX-W/LKWR 6-32-THD .12-IN-TMK	00000	ORDER BY DESCRIPTION
73	17072-00005	2	1	BRACKET, SWITCH	28480	17072-00005
74	3101-1235	4	1	SWITCH-SL DPTD STD 1.5A 125VAC SLDR=LUG	28480	3101-1235

Table A4-4. Drive Module, Parts List (Continued)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
75	17072-20036	1	1	SPACER, L.H.	28480	17072-20036
76	2260-0009	3	2	NUT-HEX-W/LKWR 4-40-TMD .094-IN-TMK	00000	ORDER BY DESCRIPTION
77	2580-0006	8	3	NUT-HEX-W/LKWR 8-32-TMD .125-IN-TMK	00000	ORDER BY DESCRIPTION
78	17072-20049	6	1	PIVOT-REAR	28480	17072-20049
79	07035-20090	1	1	HOUSING CLAMP	28480	07035-20090
80	09872-60042	4	1	Y-MOTOR ASSEMBLY	28480	09872-60042
81	1251-5832	0	1	CONNECTOR 4-PIN W POST TYPE	28480	1251-5832
82	17072-20004	3	1	SHAFT-CUTTER	28480	17072-20004
83	17072-20002	1	1	BASE-LEFT	28480	17072-20002
84	17072-20016	7	1	BUSHING, ACTUATOR	28480	17072-20016
85	1460-1768	6	1	SPRING-EXT .25-IN-OD SST PSVT	28480	1460-1768
86	17072-60001	4	1	LATCH ASSEMBLY, L.H.	28480	17072-60001
87	2360-0210	0	1	SCREW-MACH 6-32 .625-IN-LG #2 DEG	00000	ORDER BY DESCRIPTION
88	17072-20033	8	1	BUSHING-SWITCH	28480	17072-20033
89	17072-40020	5	1	ACTUATOR-SWITCH	28480	17072-40020
90	17072-40016	9	1	SHIELD, BUTTON	28480	17072-40016
91	5041-1825	2	1	KEY CAP-ODDR LATCH	28480	5041-1825
92	17072-00041	2	1	NUT PLATE	28480	17072-00041
93	3101-1082	9	1	SWITCH ACTUATOR	28480	3101-1082
94	3101-2007	0	1	SWITCH, SPDT-N3	28480	3101-2007
95	2190-0112	1	2	WASHER-LK INTLT NO. 2.088-IN-ID	28480	2190-0112
96	0520-0129	4	4	SCREW-MACH 2-56 .250-IN LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
97	2510-0067	4	1	SCREW-MACH 8-32 2-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
98	2360-0131	4	1	SCREW-MACH 6-32 1.125-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
99	17072-40018	1	1	BUSHING-DRUM ALIGNMENT	28480	17072-40018
100	17072-00015	4	1	SUPPORT-LEFT FRONT	28480	17072-00015
101	2740-0003	5	4	NUT-HEX-W/LKWR 10-32-TMD .125-IN-TMK	00000	ORDER BY DESCRIPTION
102	17072-40006	7	1	PULLEY-DRIVE	28480	17072-40006
103	0905-0805	3	1	O-RING RELT	A3259	OBA 2-236 E751-65
104	3030-0072	4	1	SCREW-SKT HD CAP 4-40 1-IN-LG ALY STL	00000	ORDER BY DESCRIPTION
105	3050-0105	6	1	WASHER-FL MTLR ND, 4 .125-IN-ID	28480	3050-0105
106	1460-1771	1	1	SPRING, COMPRESSION .240-OD	28480	1460-1771
107	17072-60022	9	1	SLIP CLUTCH ASSEMBLY	28480	17072-60022
108	2260-0003	7	1	NUT-HEX-PLSTC LKG 4-40-TMD .141-IN-TMK	00000	ORDER BY DESCRIPTION
109	1460-1769	7	1	SPRING, EXTENSION .250-OD	28480	1460-1769
110	17072-20005	4	1	ARM-CUTTER, FRONT	28480	17072-20005
111	17072-00029	0	1	GUARD, CABLES	28480	17072-00029
112	1400-0584	0	2	PAD MNTG	28480	1400-0584
113	17072-60031	1	1	CABLE-ADVANCE DRIVE	28480	17072-60031
114	17072-60021	8	1	CABLE-MOTOR	28480	17072-60021
115	17072-60032	9	1	CABLE-PAPER ADVANCE	28480	17072-60032
116	17072-60004	7	1	CABLE-ADVANCE PANEL	28480	17072-60004
117	17072-60105	4	1	PCA- PANEL, FRONT	28480	17072-60105
118	17072-40013	6	1	COVER, SWITCH	28480	17072-40013
119	5041-1823	0	1	KEY CAP-ADVANCE, FULL	28480	5041-1823
120	5041-1824	1	1	KEY CAP-ADVANCE, HALF	28480	5041-1824
121	5041-1826	1	1	KEY CAP-CUTTER ENABLE	28480	5041-1826
122	2510-0109	3	1	SCREW-MACH, 8-32 .62-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
123	17072-20008	1	3	BUSHING, LATCH	28480	17072-20008
124	2420-0001	1	1	NUT, HEX W/LKWR 6-32 THD .109 IN THK	28480	2420-0001
125	2190-0112	2	2	WASHER-LOCK HLCL #2	28480	2190-0112
126	2190-0417	2	2	WASHER-FLAT #2	28480	2190-0417
127	2360-0199	1	1	SCREW, 6-32 .438 IN PAN-HD-POZI	00000	ORDER BY DESC.
128	3050-0399	2	2	WASHER-FLAT #6	28480	3050-0399
129	17072-20076	1	1	PIVOT-IDLER	28480	17072-20076
130	3050-0016	1	1	WASHER .147 ID	28480	3050-0016
131	2360-0199	1	1	SCREW 6-32 X .43	28480	2360-0199

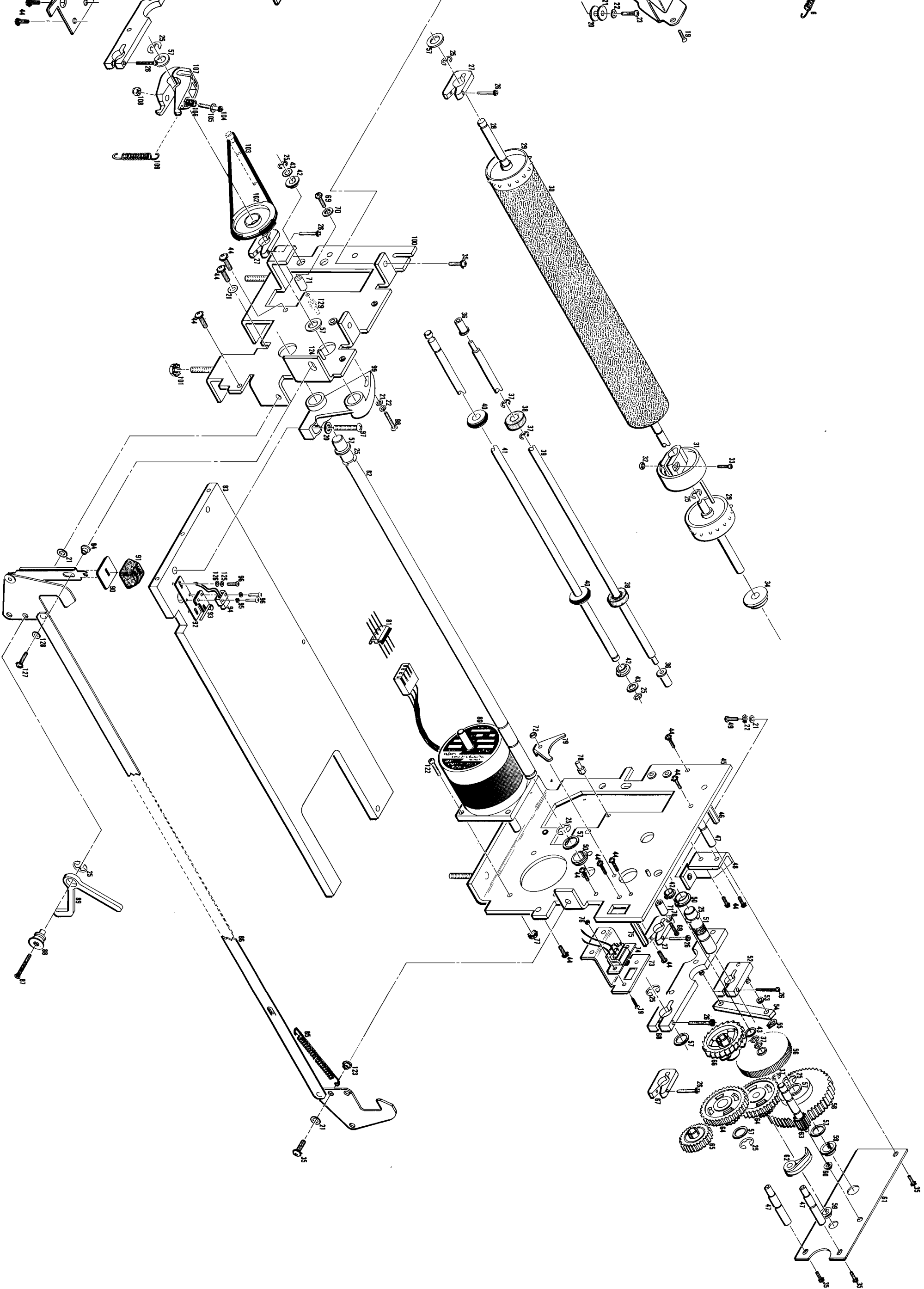
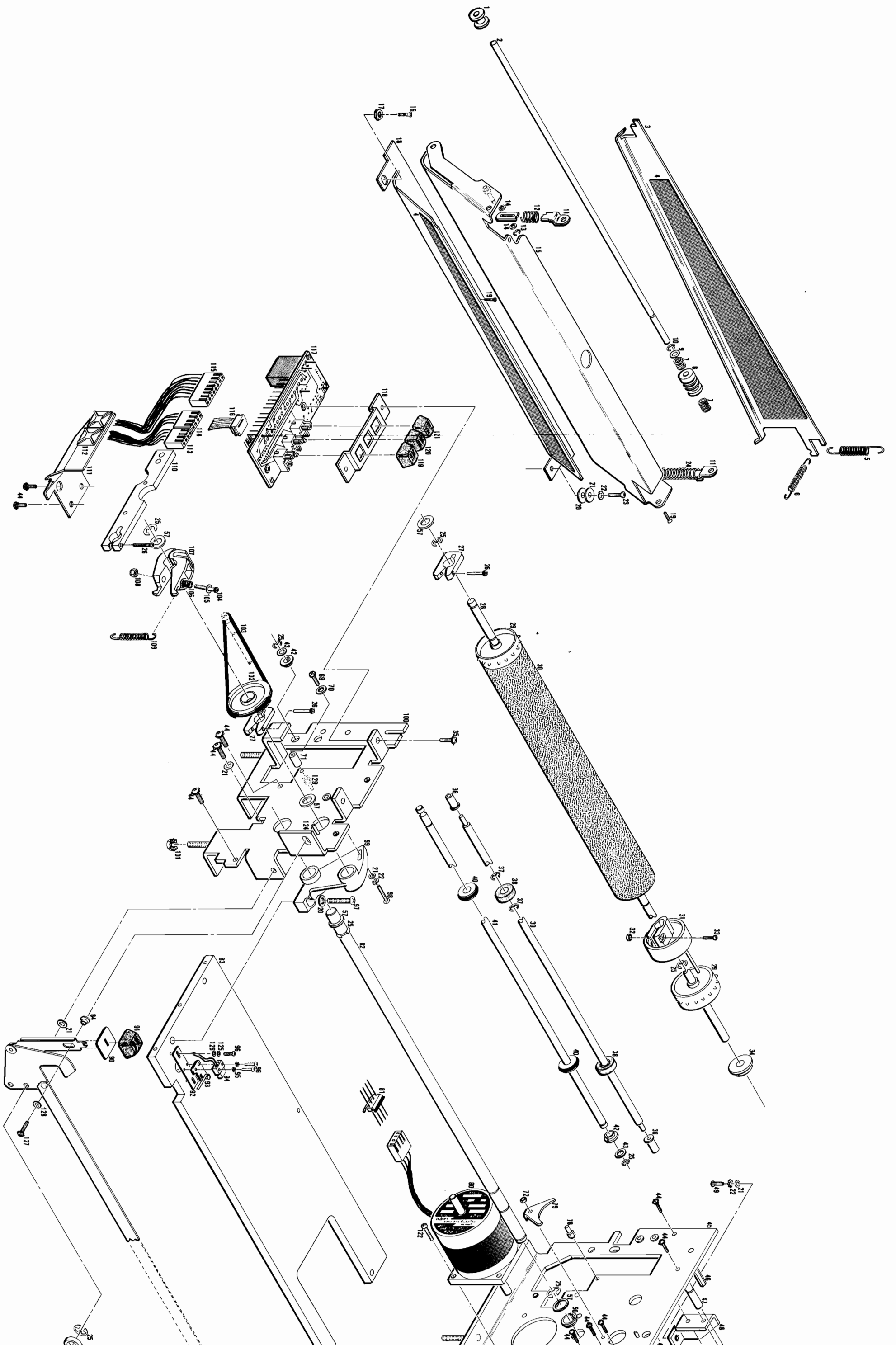
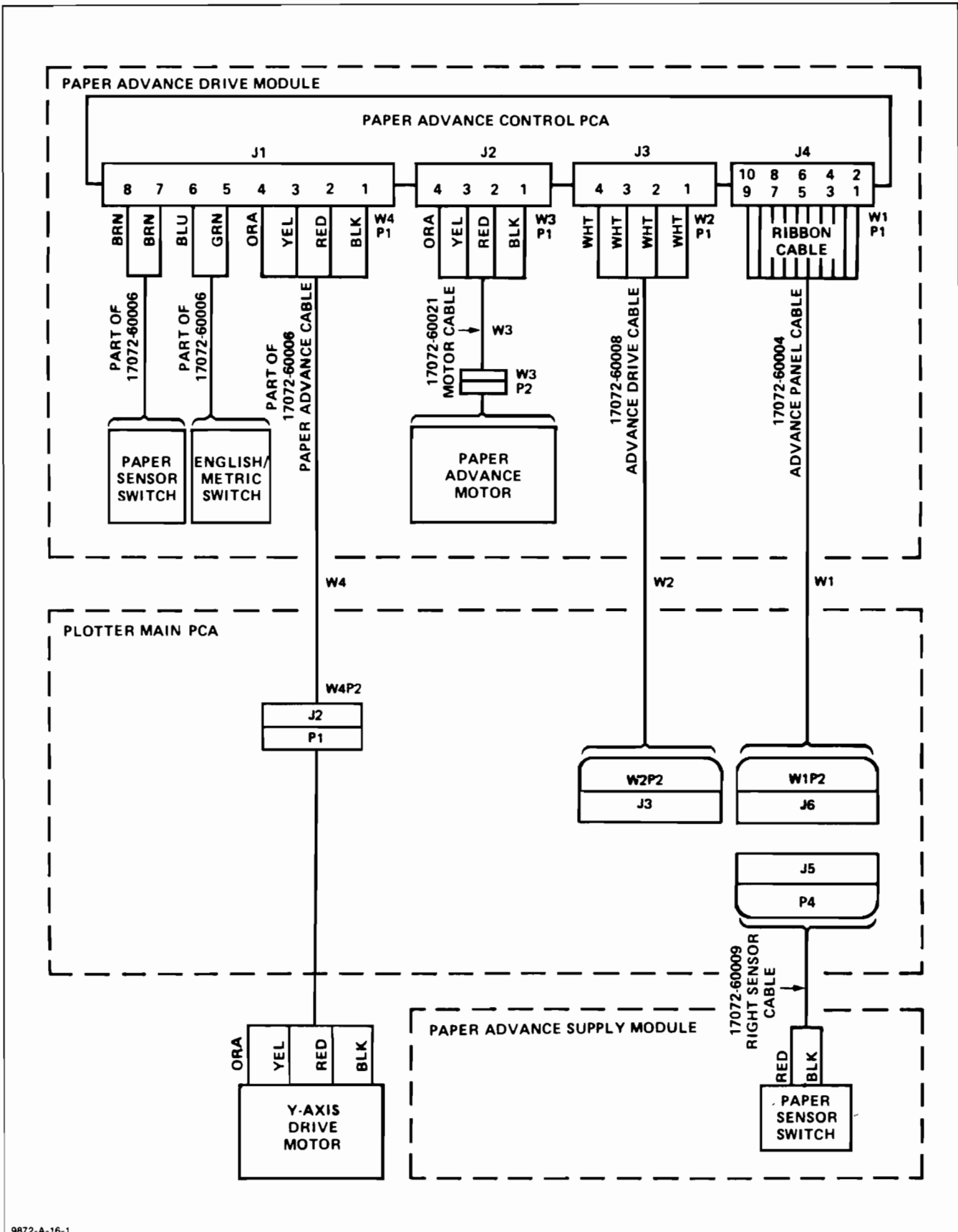


Figure A4-4. Drive Module





9872-A-16-1

Figure A4-5. Interconnecting Cables

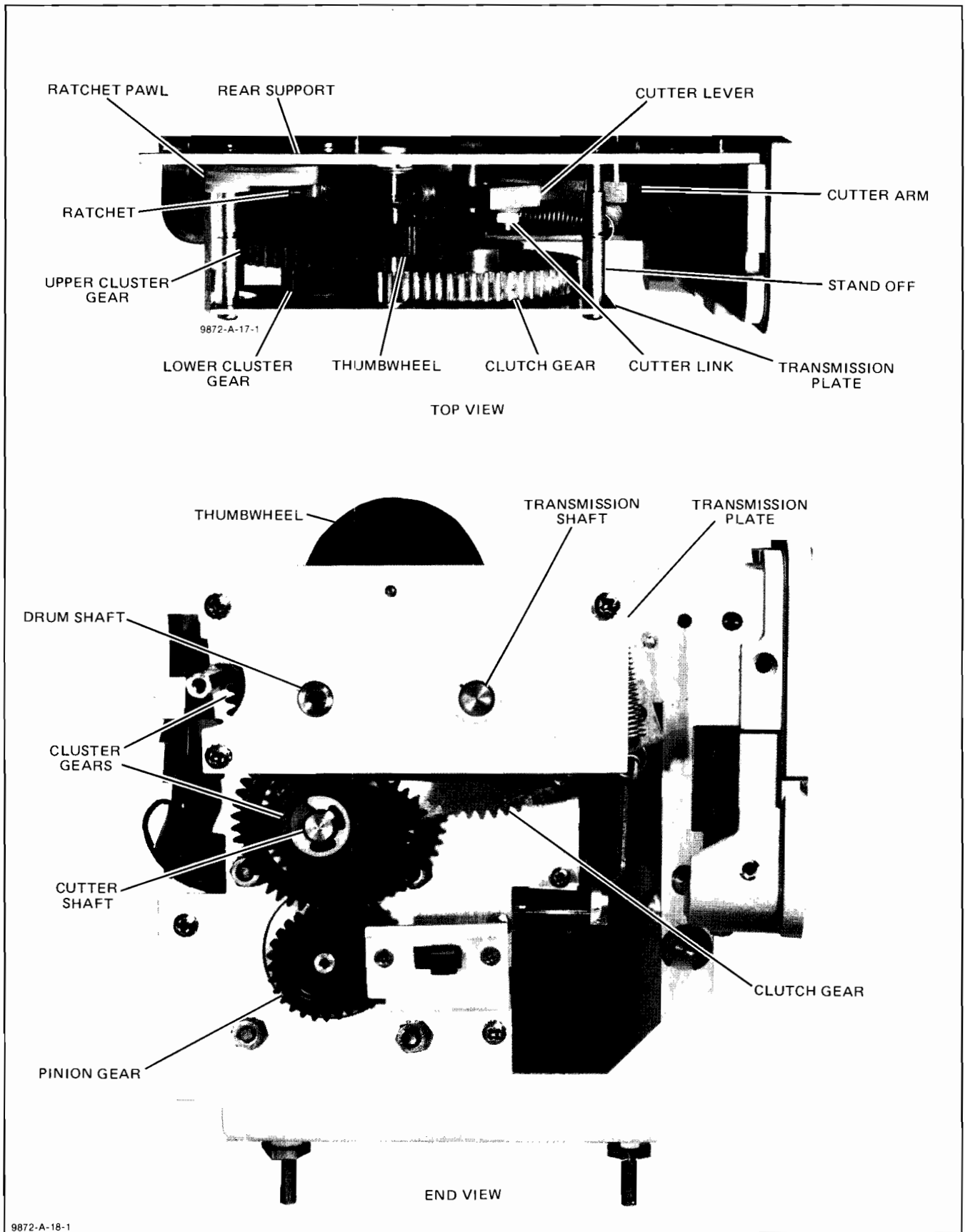


Figure A4-6. Transmission Assembly Detail



SECTION AV

MANUAL CHANGES

A5-1. INTRODUCTION

A5-2. Refer to Section V of the main manual for information concerning manual changes.



SECTION AVI

SERVICE

A6-1. INTRODUCTION

A6-2. This section contains information for servicing the paper advance feature. Included is the theory of operation, troubleshooting, repair, and schematic diagrams.

A6-3. The schematic diagram includes the plotter circuitry which directly interacts with the paper advance circuits. The Control Panel PCA parts location and schematic diagram are also included.

A6-4. SIMPLIFIED THEORY OF OPERATION

A6-5. A properly loaded roll of paper in the paper advance modules closes the two paper sensing switches which automatically activate the paper advance circuitry. With the circuitry activated, the paper is advanced and cut, if required, under program or front panel pushbutton control.

A6-6. During the paper advance operation, the plotter power drive to the Y-axis motor is switched to the motor in the drive module. This motor, under microprocessor control, drives the paper advance mechanism and the cutter blade assembly.

A6-7. FUNCTIONAL THEORY OF OPERATION

A6-8. The following description is written to the Simplified Functional Block Diagram, Figure A6-1, and the Paper Advance Schematic Diagram, Figure A6-13, located at the end of this section. An operational flow diagram for the paper advance feature is illustrated in Figure A6-2.

A6-9. PAPER ADVANCE ENABLE

A6-10. The plotter microprocessor controls all functions of the paper advance feature. During initialization of the plotter and during subsequent cycles, the microprocessor reads register 23 which has as its inputs all of the paper advance controls. If the paper sensing switches are both closed, the paper advance feature will be enabled.

A6-11. PAPER SENSING SWITCHES

A6-12. With a roll of paper properly loaded and tensioned, the two series-wired, paper-sensing switches, one in the supply module and one in the drive module, will be closed, pulling their input line to register 23 low. The low input is buffered and loaded on to BUS 15 when the register is enabled. The microprocessor is reading register 23, therefore the bidirectional buffer

(BIB) is driving to the microprocessor. The BIB loads the low signal on the processor 15 bus line. With processor bus 15 low, the paper advance is enabled.

A6-13. FRONT PANEL CONTROL SWITCHES

A6-14. The CUTTER ENABLE, ADV HALF, and ADV FULL switches each function in a manner similar to the paper sensing switches. When pressed, each pulls its respective line to register 23 low. When the microprocessor enables and reads register 23, it interprets each low and sets up the required cycles.

A6-15. ENGLISH/METRIC SWITCH

A6-16. Setting the rear panel English/Metric switch to the metric position closes the switch pulling the line to register 23 low. This low is read by the microprocessor on the processor 0 bus line and enables the drive circuits for metric page sizing.

A6-17. Placing the switch in the English position opens the switch which allows the register 23 input to be pulled high. A high at the processor 0 input enables the circuits for an English page.

A6-18. CUTTER LAMP

A6-19. The state of the cutter circuitry is indicated by the light emitting diode (LED) located in the CUTTER ENABLE switch pushbutton. When the LED is on, the cutter is enabled and will cut the page following the next paper advance.

A6-20. With BUS 2 high, due either to a program instruction or a front panel switch input during a READ register 23, the microprocessor enables the circuitry for a cut after the next advance.

A6-21. With the cutter circuitry enabled, the microprocessor pulls the processor 0 line low during a WRITE register 23. This causes a low output at the flip-flop at the cathode side of the LED. With 5 volts on the anode, the LED is turned on.

A6-22. PAPER ADVANCE MOTOR DRIVE

A6-23. In the paper advance mode, the drive signal to the Y-axis motor is switched to the paper advance motor. This motor provides the drive for both the paper advance and the cutter mechanism.

A6-24. In enabling the paper advance, the microprocessor initiates the following sequence of events:

- a. The motor drive circuits are disabled.
- b. The motor switching relay is energized, switching to the paper advance motor.

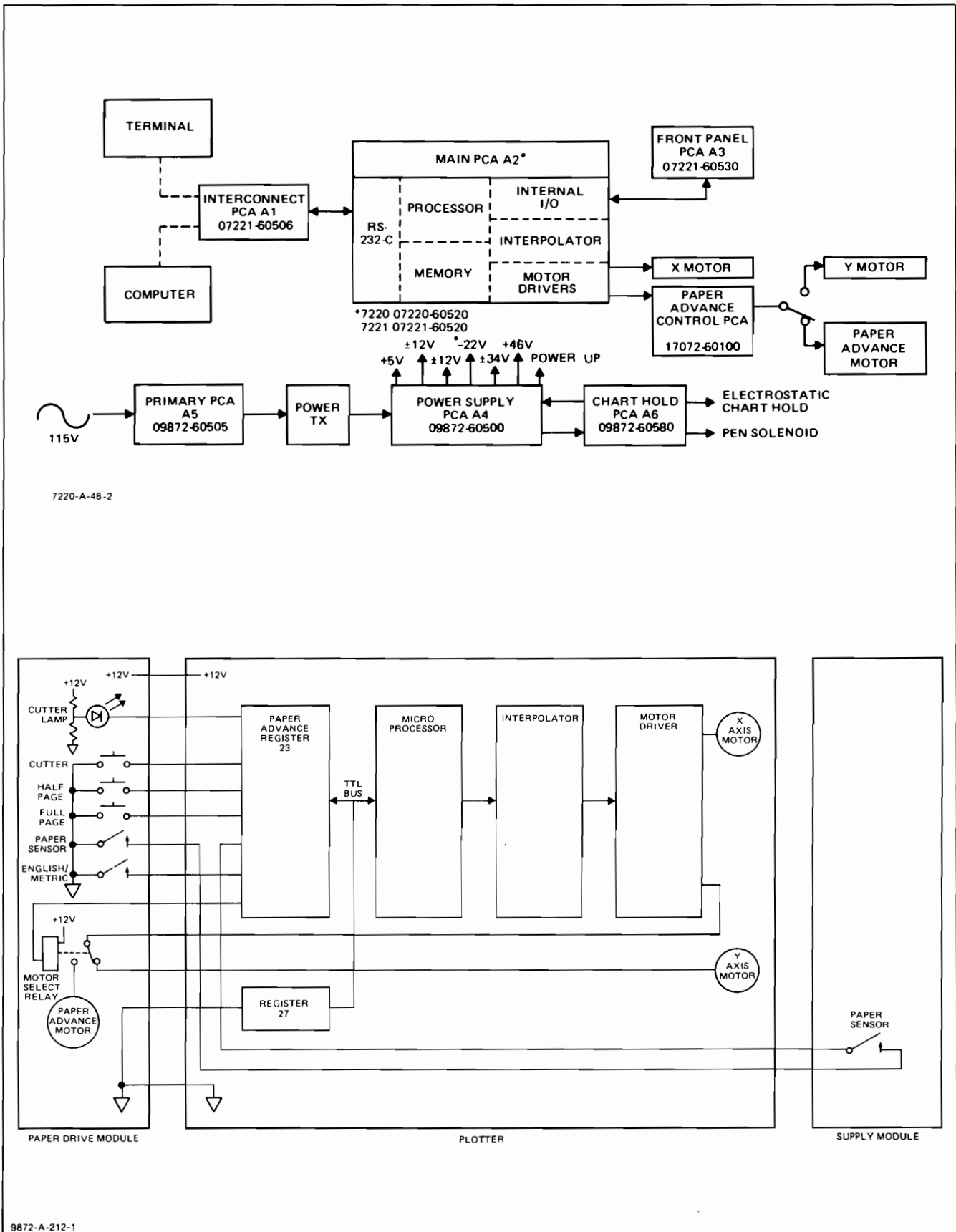
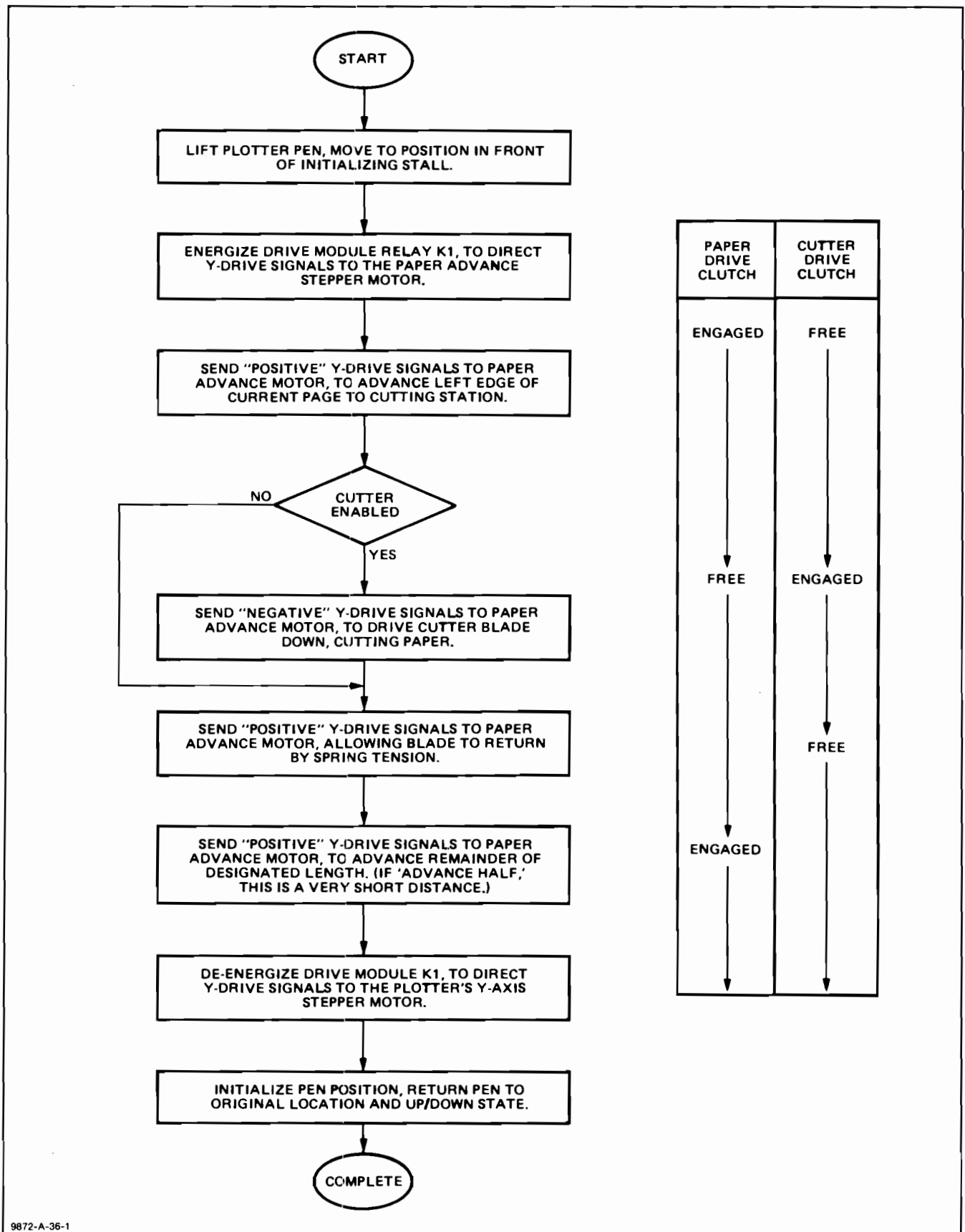


Figure A6-1. HP Models 7220T/7221T Simplified Functional Block Diagram



9872-A-36-1

Figure A6-2. Operational Flow Diagram

- c. The motor circuits are enabled.
- d. The required paper advance functions are performed.
- e. The motor drive circuits are again disabled.
- f. The motor switching relay is deenergized, switching to the plotter Y-axis motor.
- g. The drive circuits are enabled.

A6-25. To disable the motor drive circuits, the microprocessor pulls the processor BUS 1 line low during a WRITE register 23. This signal is latched through U29 by the WRITE register 23 and causes the transistors Q5, 6, 7, and 8 to conduct, shutting off the motor driver circuits.

A6-26. With the motor drive turned off, the microprocessor pulls BUS 2 low. This is clocked through U29 on a WRITE register 23 sequence, turning on the Darlington pair Q1 and Q2 on the Paper Advance Control PCA, activating the relay K1. Once the relay has switched, the microprocessor sets BUS 1 high to reactivate the Motor Drive circuits. The cycle is repeated to switch the motor drive back to the Y-axis motor.

A6-27. PAPER CUTTER

A6-28. Drive for the paper cutter mechanism is supplied by reversing the rotation of the paper advance motor. After receiving either a program instruction or a front panel switch input to cut the paper, the paper is first advanced, and then the motor drive is reversed and the paper is cut.

A6-29. During an interpolator WRITE cycle, the microprocessor supplies velocity data to the interpolator. This velocity information is converted to an analog waveform by the waveform function generator to the motor drive. In order to activate the cutter, the microprocessor causes the motor function generator to shift the signal by 180°. This phase-shifted motor drive signal causes the motor to reverse its rotation, activating the cutter blade.

A6-30. TROUBLESHOOTING

A6-31. A troubleshooting chart is given in Figure A6-3. This chart may be used as an aid in locating a defective stage in the Paper Advance circuitry. Locate the block related to the problem being experienced, and take the suggested corrective action. Table A6-1 is provided as an easy reference for tension or paper alignment problems. Refer to Section AIII of this appendix for alignment procedures.

A6-32. REPAIR AND REPLACEMENT OF PARTS

WARNING

Any adjustment, maintenance, or repair of the opened instrument with power applied should be avoided as

much as possible and, if inevitable, should be carried out only by a skilled person who is aware of the shock or mechanical hazards involved. Capacitors inside the plotter may still be charged even if the plotter has been disconnected from the supply.

A6-33. Before performing any of the following repair procedures, the following steps must be performed:

- a. Set the plotter LINE switch to the OFF (O) position.
- b. Remove the line power cord from the plotter.

NOTE

Many of the photographs in this section show the module removed from the plotter. This has been done for picture clarity and parts identification. DO NOT remove the module from the plotter unless called for in the instructions. Any time a module is removed, an alignment procedure must be completed.

A6-34. MODULE REMOVAL AND REPLACEMENT

A6-35. To remove either of the paper advance modules, proceed as follows:

- a. Set the plotter LINE switch OFF (O), and remove the line cord.
- b. Remove the paper from the plotter.
- c. Open the plotter. Refer to Section II of the main manual if necessary.
- d. Disconnect the cables to the paper advance module. See Figure A6-4.
- e. Remove the four 3/8 in. lock nuts accessible from the under side of the module to be removed.
- f. Install in the reverse order. Refer to Section AIII of this appendix for alignment procedures.

A6-36. DRAG ARM (PAPER SUPPLY INDICATOR) REPLACEMENT

A6-37. To remove the drag arm, proceed as follows:

WARNING

The drag arm has a high-tension spring which could cause injury if not handled carefully.

- a. Remove power from the plotter.
- b. Raise the supply module door fully.
- c. Carefully unhook the spring end from the drag arm tab. See Figure A6-5.

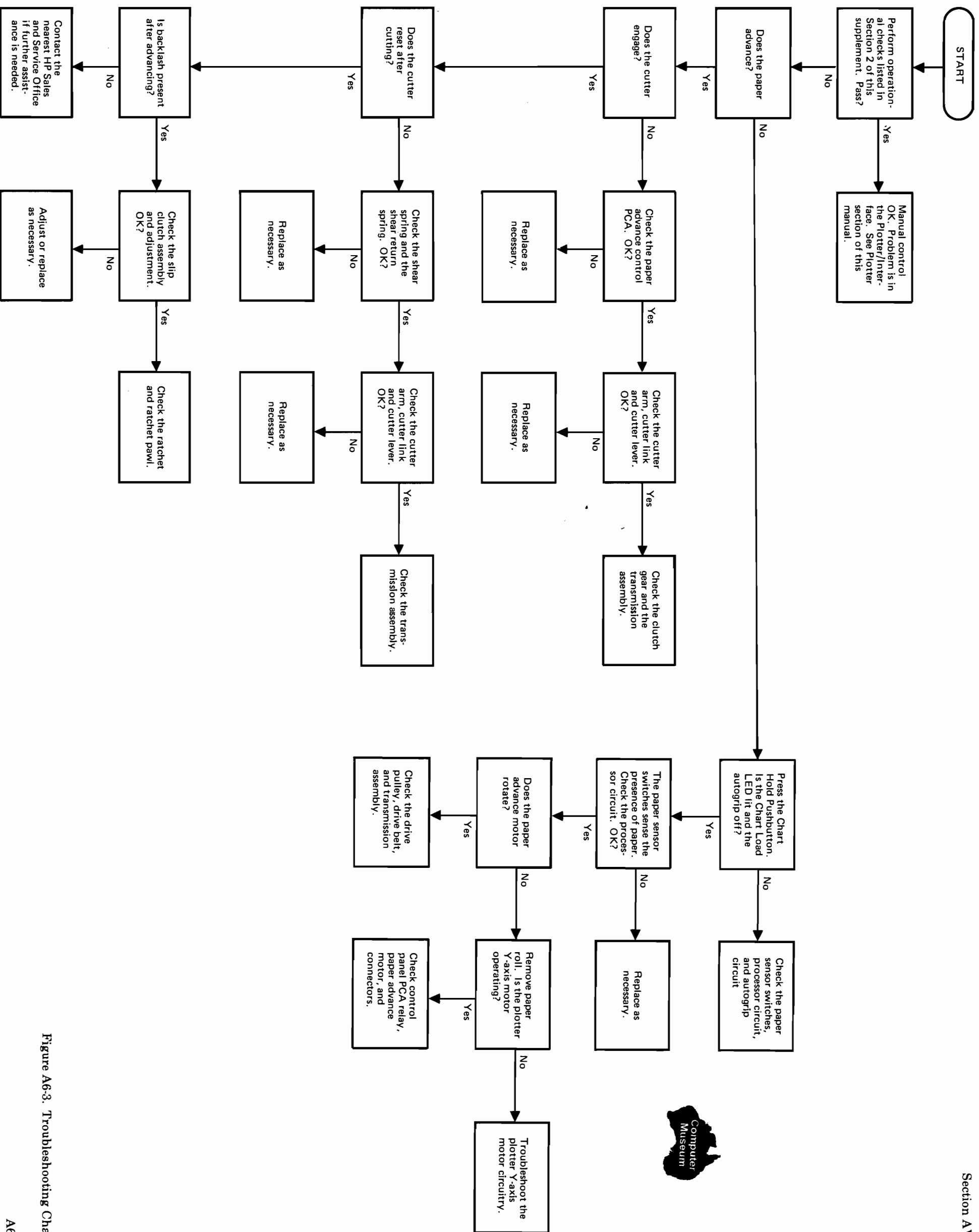


Figure A6-3. Troubleshooting Chart

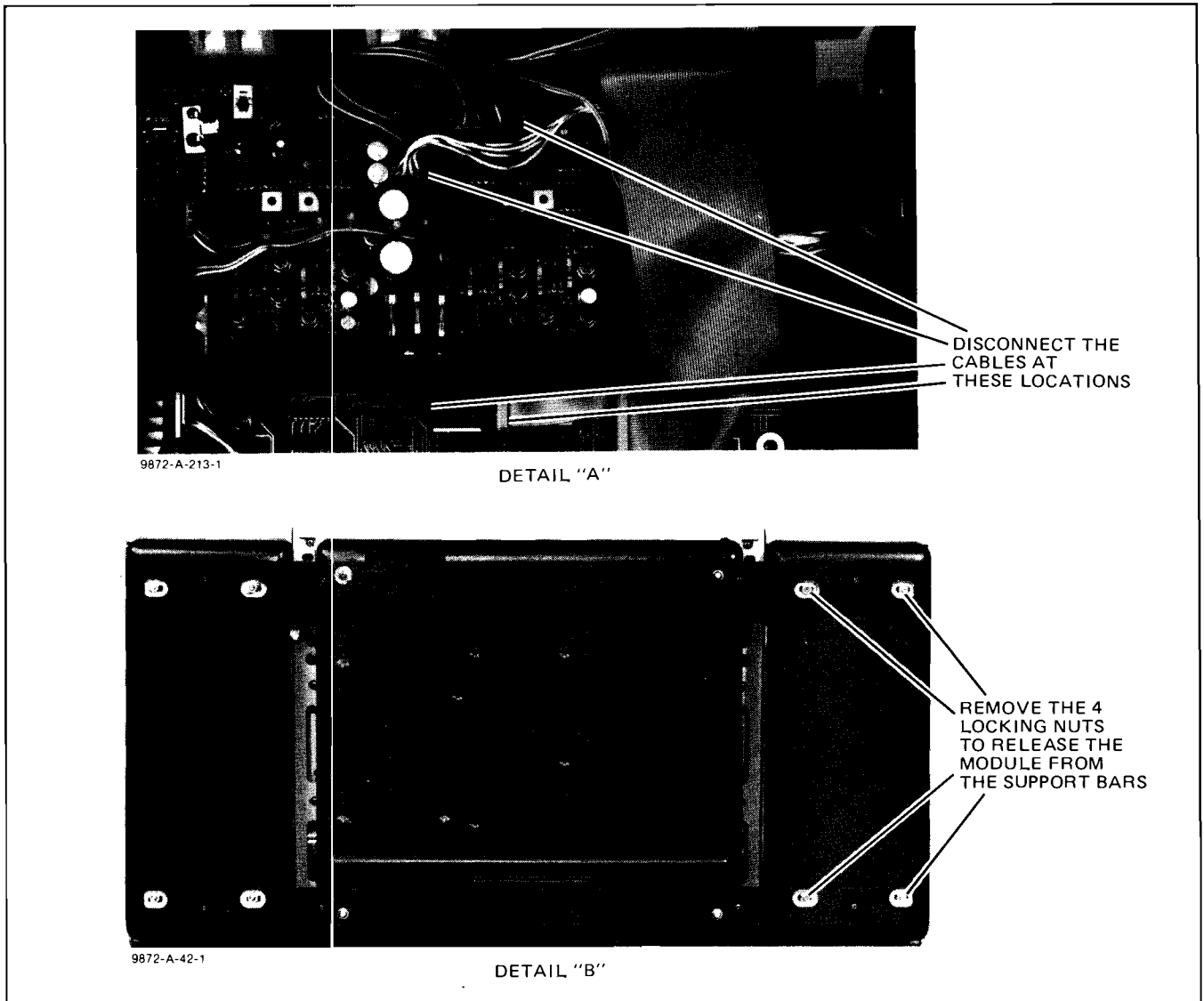


Figure A6-4. Removing the Paper Advance Modules

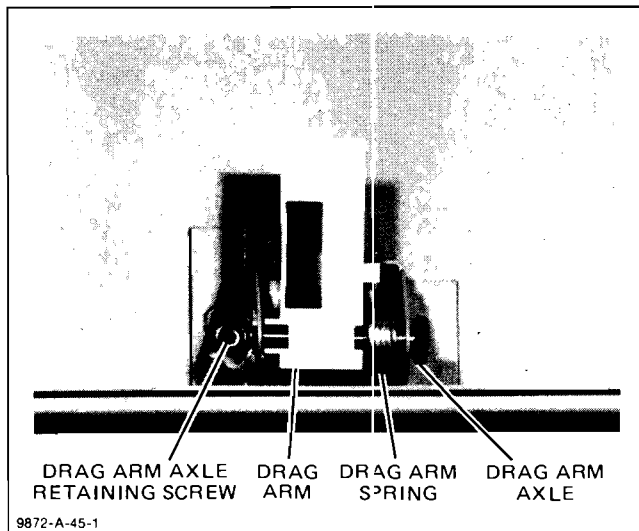


Figure A6-5. Drag Arm Removal

- d. Remove the axle retaining screw.
- e. Remove the axle from the mounting flange.
- f. Replace in the reverse order.
- g. Refer to the drag arm tension adjust in Section AIII of the appendix.

A6-38. PAPER SENSOR SWITCH REPLACEMENT

A6-39. To replace the paper sensor switch, proceed as follows:

- a. Remove power from the plotter.
- b. Raise the module door, and remove paper from the plotter.
- c. Remove the sensor switch plate mounting screws. See Figure A6-6.

- d. Unsolder the wires, and remove the switch. If it is necessary to remove the switch harness, remove the tie-down, open the plotter, and unplug the switch connector.
- e. Install in reverse order.
- f. Perform the sensor alignment procedures in Section AIII of the appendix.

A6-40. LOWER CUTTING BLADE REPLACEMENT

A6-41. To replace the lower cutting blade, proceed as follows:

- a. Remove the drive module door.
- b. Remove the idler frame.
- c. Remove the lower blade mounting screws. See Figure A6-7.
- d. Remove the eccentric nut adjustment.
- e. Remove the lower blade from the module.
- f. Install in the reverse order.
- g. Perform the lower cutter blade adjustment listed in Section AIII of the appendix.

A6-42. SLIP CLUTCH REPLACEMENT

A6-43. To replace the slip clutch assembly, proceed as follows:

- a. Remove the drive module front panel.
- b. Loosen the slip clutch adjusting screw, and release the slip clutch spring. See Figure A6-8.
- c. Remove the slip clutch retaining clip, and slide the slip clutch assembly off the drum shaft.
- d. Install in the reverse order.

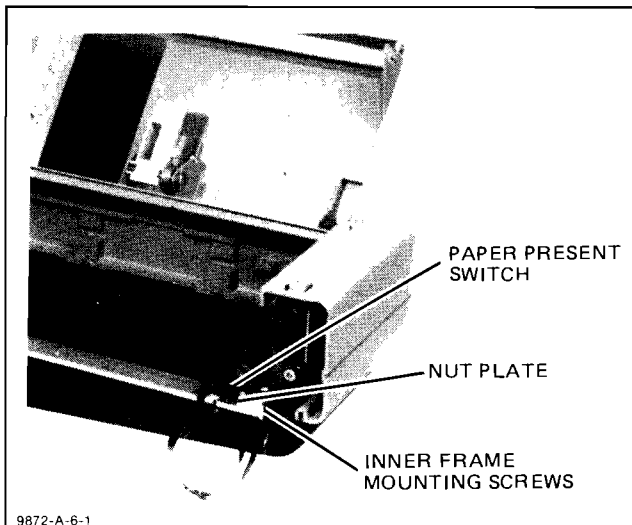


Figure A6-6. Paper Sensor Switch Replacement

- e. Perform the slip clutch adjustment procedure as listed in Section AIII of the appendix.

A6-44. DRUM ASSEMBLY/SPROCKET REPLACEMENT

A6-45. To replace the drum assembly or a drum sprocket, proceed as follows:

- a. Remove power from the plotter.
- b. Remove the drive module from the support bars.
- c. Remove the module from the housing.
- d. Remove the front panel and rear cover.
- e. Remove the slip clutch assembly. See Figure A6-9.
- f. Remove the drive pulley.
- g. Remove the front cutter arm.
- h. Remove the front cutter shaft retaining clip.
- i. Disconnect the shear spring from the upper blade.
- j. Disconnect the shear return spring from the upper blade.
- k. Remove the left side frame.
- l. Release the door latch mechanism from the rear support.
- m. Remove the front drive shaft retaining clip.
- n. Remove the two rear support-to-base mounting screws.
- o. Slide the entire rear support assembly from the base. Check the motor cable for adequate slack.
- p. Remove the front drum shaft retaining clip.

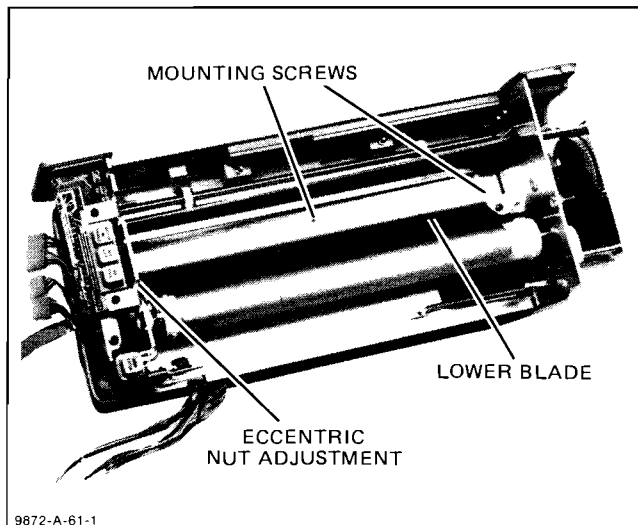
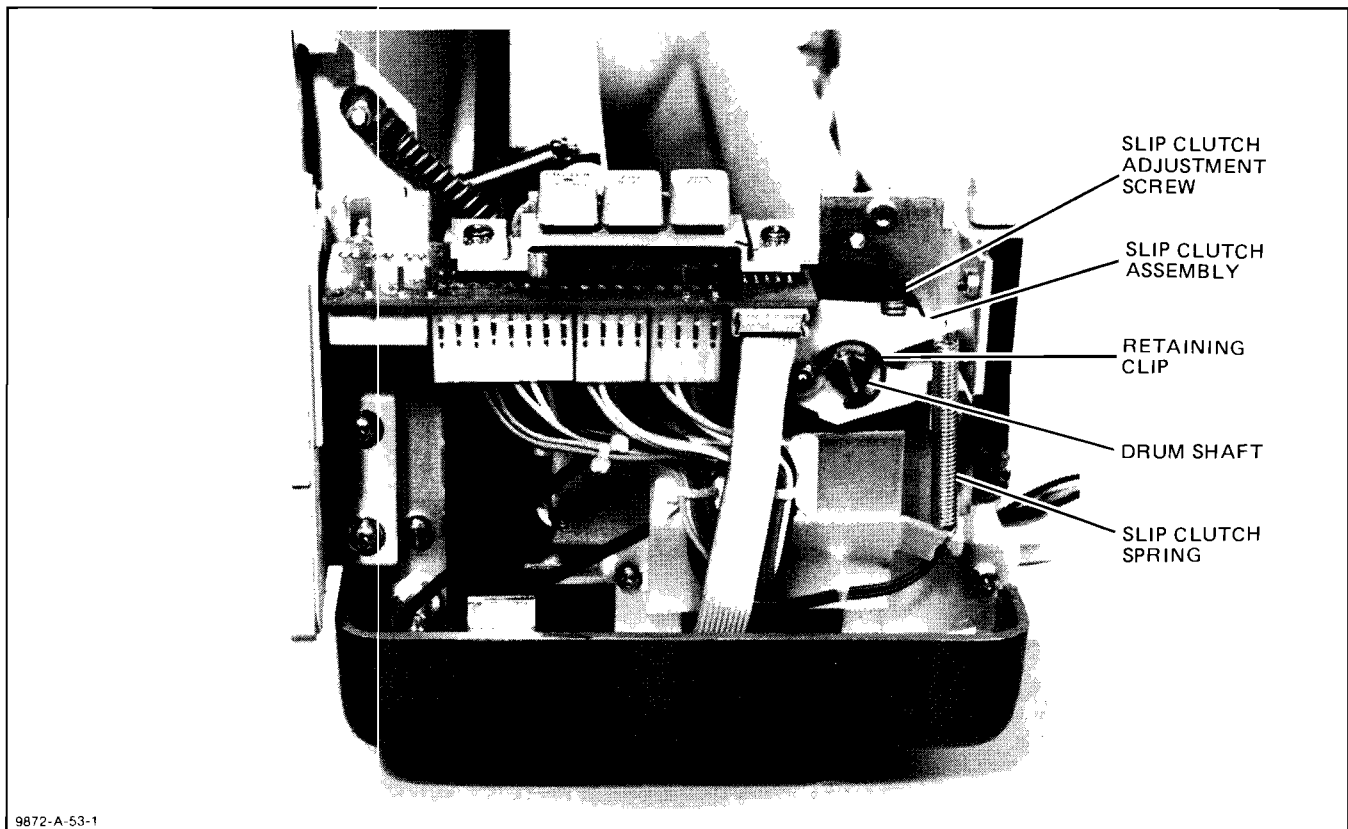


Figure A6-7. Lower Blade Replacement



9872-A-53-1

Figure A6-8. Slip Clutch Replacement

- q. Loosen the front sprocket clamp screw, and slide the clamp and sprocket from the drum shaft.
- r. Slide the drum off the shaft.
- s. Loosen the drum guide clamp screw, and slide the drum guide off the shaft.
- t. Remove the clip from between the drum guide and the rear sprocket.
- u. Slide the rear sprocket off the shaft.
- v. Reassemble in the reverse order. Make sure to properly align all shafts with support holes and to install all clips and washers where appropriate.
- w. Manually advance the gear train and cutter mechanism to check for proper movement.
- x. Perform ALL module alignment procedures listed in Section AIII of this appendix.

A6-46. DRUM ALIGNMENT BUSHING REPLACEMENT

A6-47. To replace the alignment bushing, proceed as follows:

- a. Remove the drum assembly. Refer to paragraph A6-45.
- b. Remove the drum alignment bushing adjustment and locking screws. See Figure A6-10.
- c. Remove the alignment bushing.
- d. Reassemble in the reverse order.
- e. Perform ALL alignment procedures listed in Section AIII of this appendix.

A6-48. SCHEMATIC DIAGRAMS

A6-49. A parts placement diagram of the Paper Advance Control Panel PCA is illustrated in Figure A6-11 along with the schematic diagram, Figure A6-12. The schematic for the complete paper advance, including plotter interconnecting circuits, is provided in Figure A6-13.

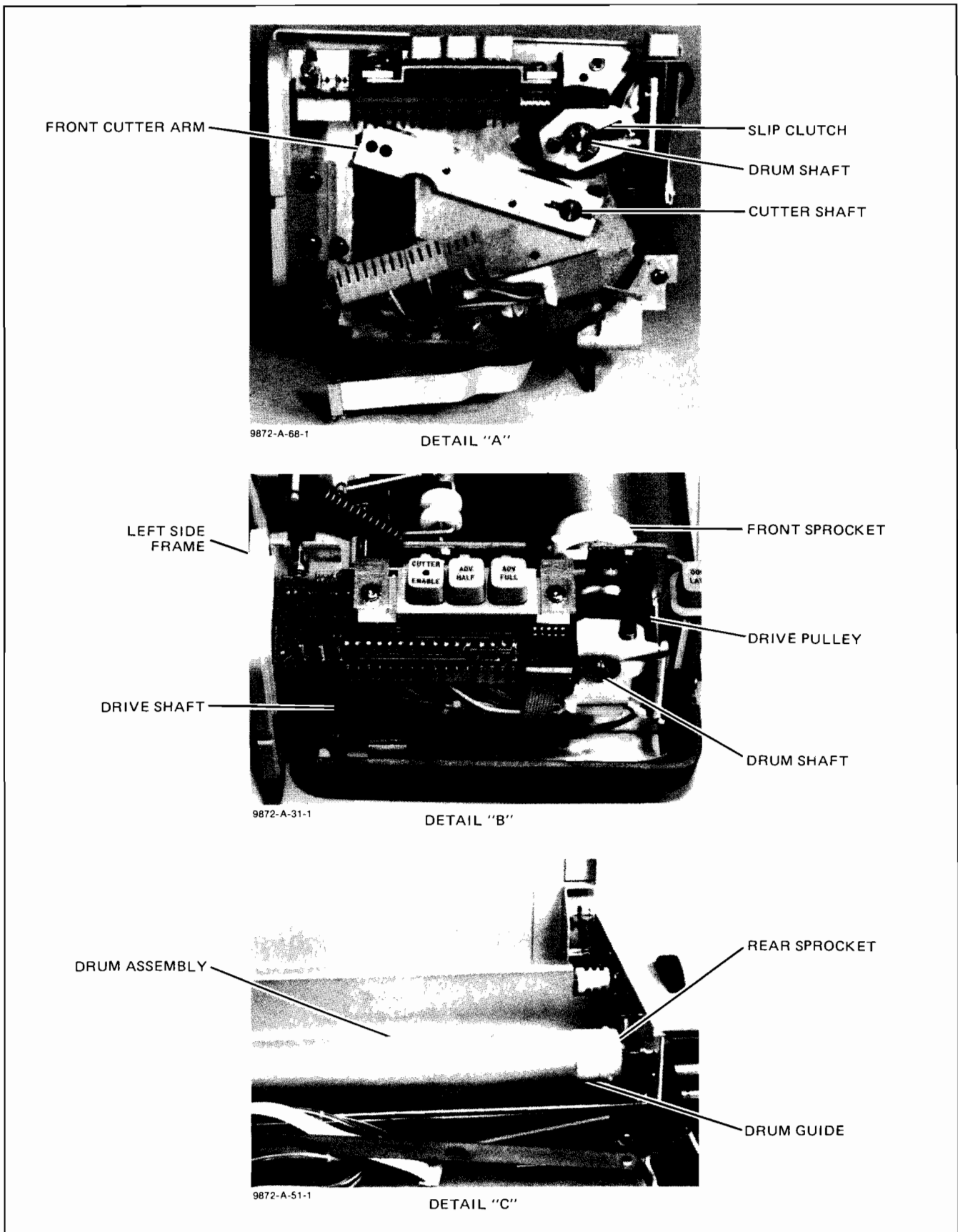


Figure A6-9. Drum Assembly/Sprocket Replacement

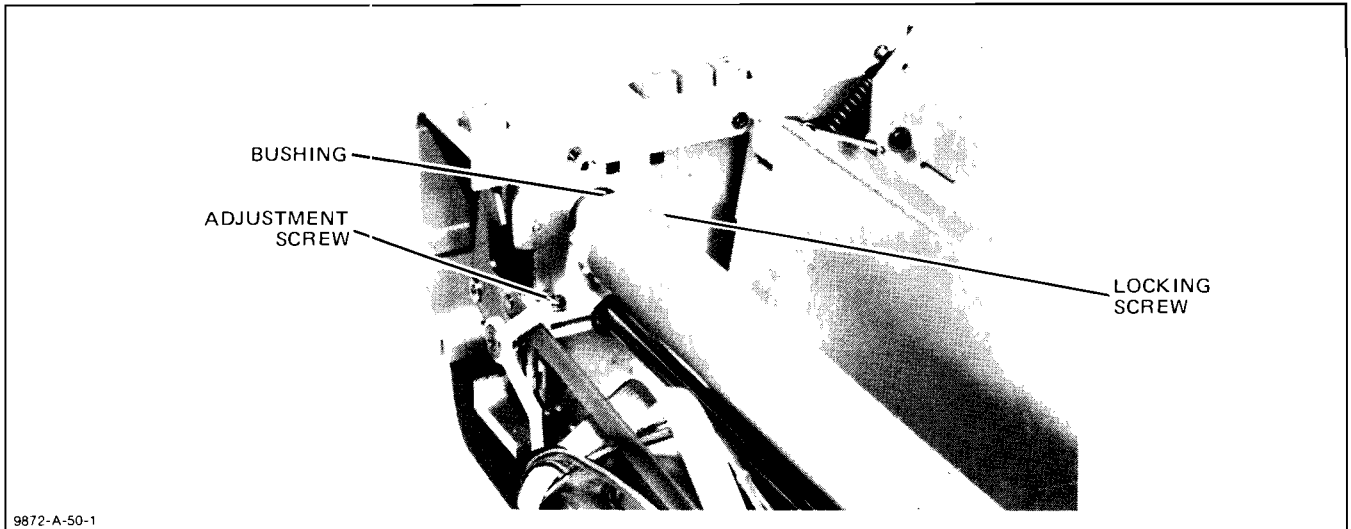


Figure A6-10. Drum Bushing Replacement

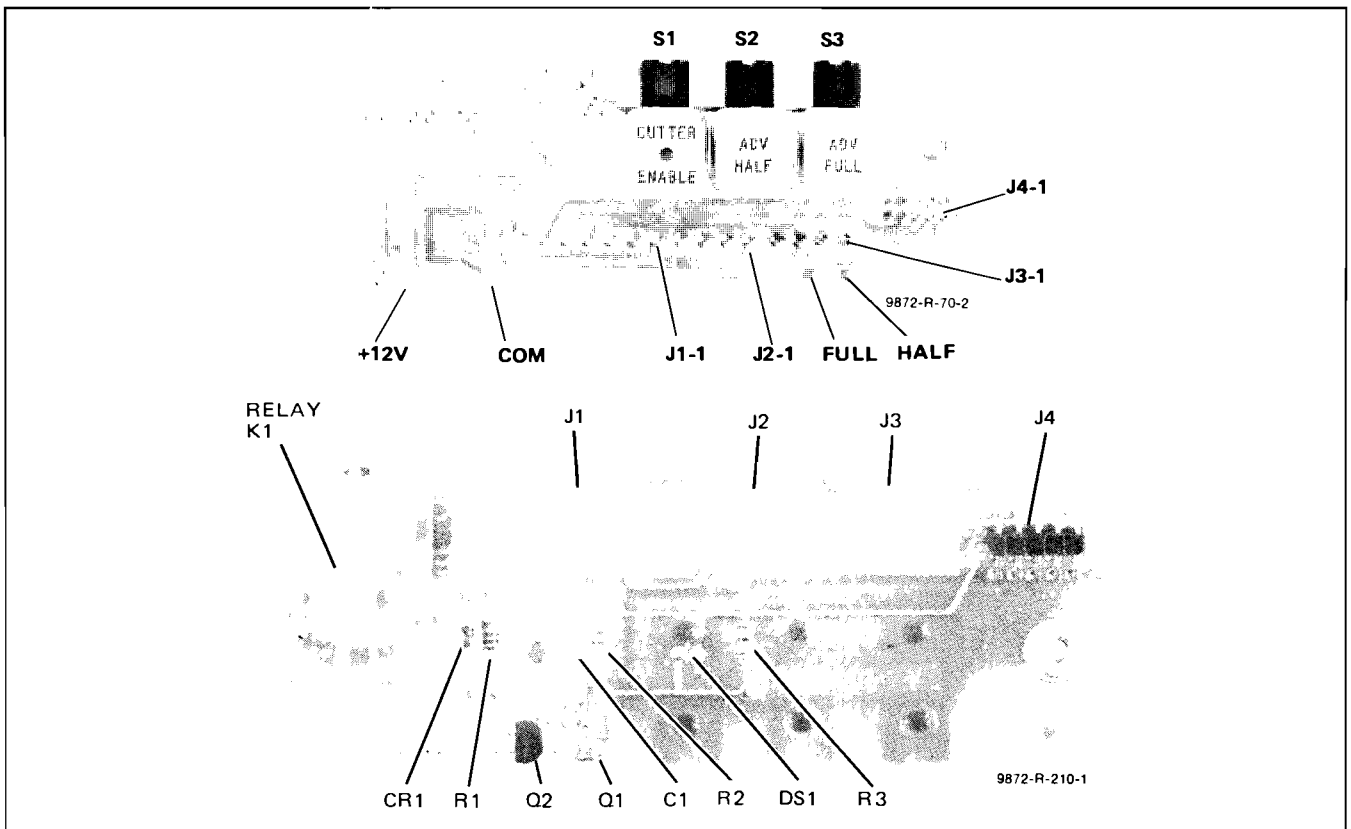
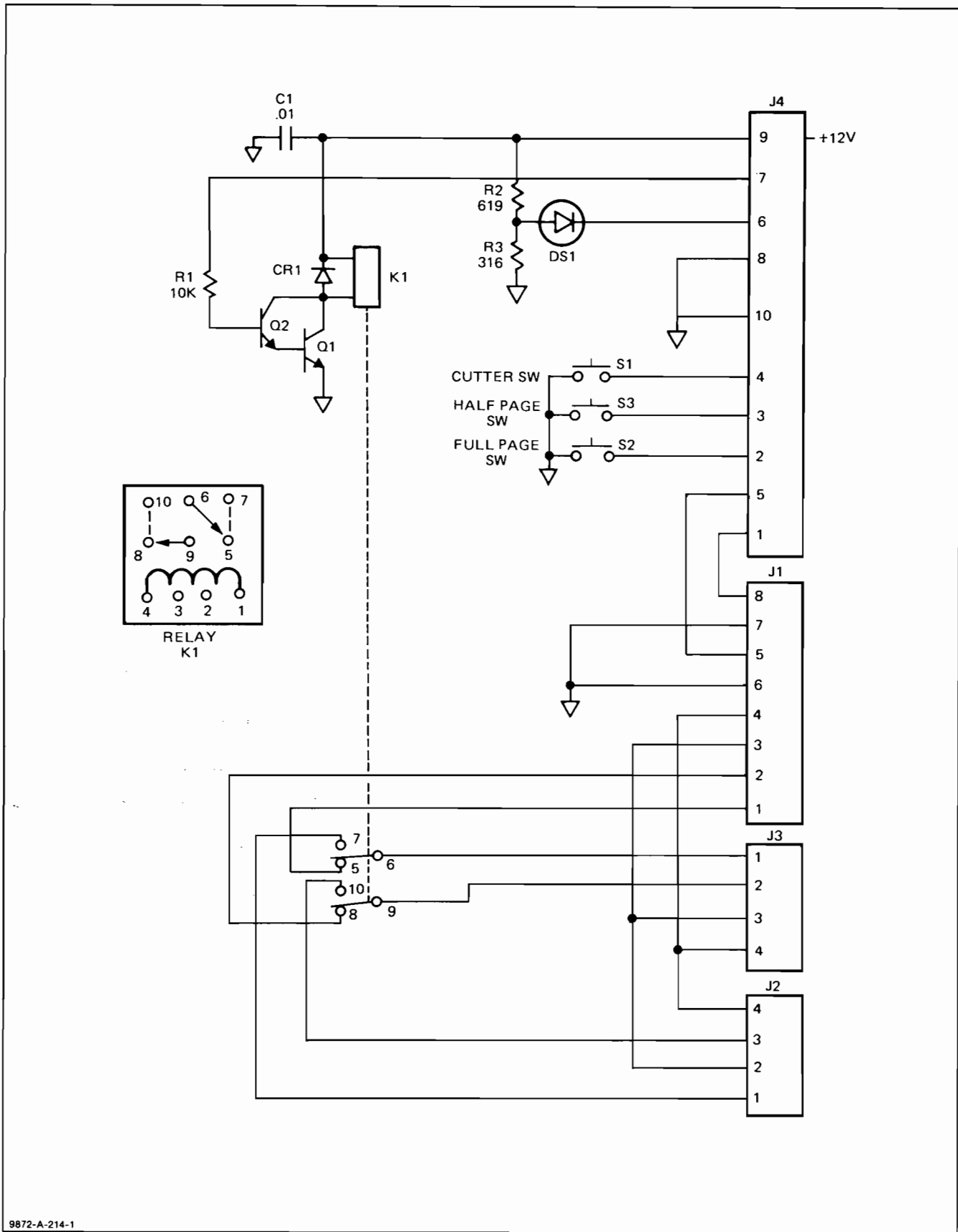
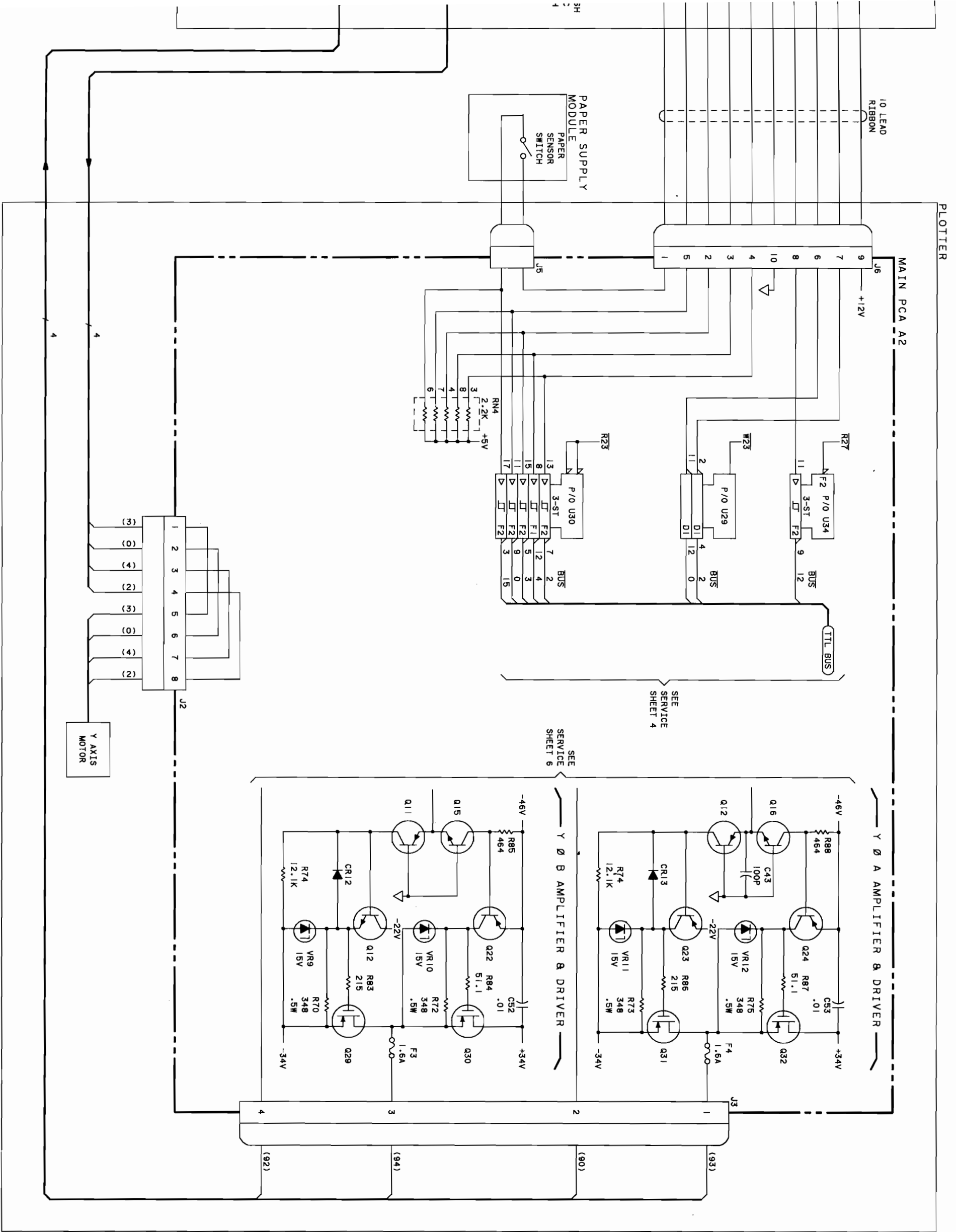


Figure A6-11. Control Panel PCA Parts Location



9872-A-214-1

Figure A6-12. Control Panel PCA Schematic Diagram



PLEASE RETURN TO -
ELECTRONIC STORE
DEPARTMENT OF
ELECTRICAL ENGINEERING
UNIVERSITY OF MELBOURNE

Figure A6-13. HP Models 7220T/7221T Paper Advance Schematic Diagram

