HEWLETT PACKARD

HARDWARE SUPPORT MANUAL

HP7440A
ColorPro PLOTTER

SERIAL NUMBERS

This manual applies directly to Plotters with serial numbers prefixed 2539.

Product History for plotters with serial number prefixes below 2539 is provided in Chapter 11.

For Additional information about serial numbers see SERIAL NUMBER INFORMATION in Chapter 1.

16399 W. BERNARDO DRIVE, SAN DIEGO, CALIFORNIA 92127-1899

MANUAL PART NO. 07440-90000

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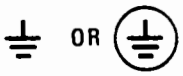
General Definitions of Safety Symbols Used On Equipment

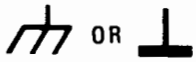
International caution symbol (refer to manual): the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument.

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.

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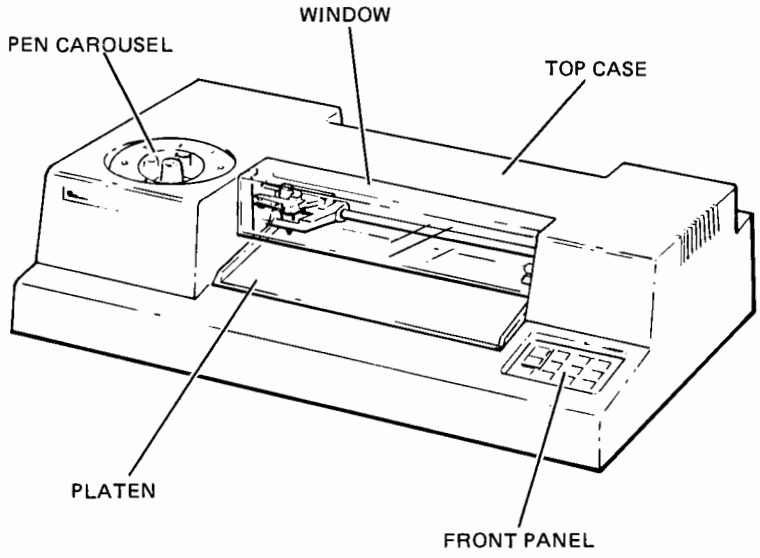


Figure 1-1. HP 7440 ColorPro Plotter, Front View

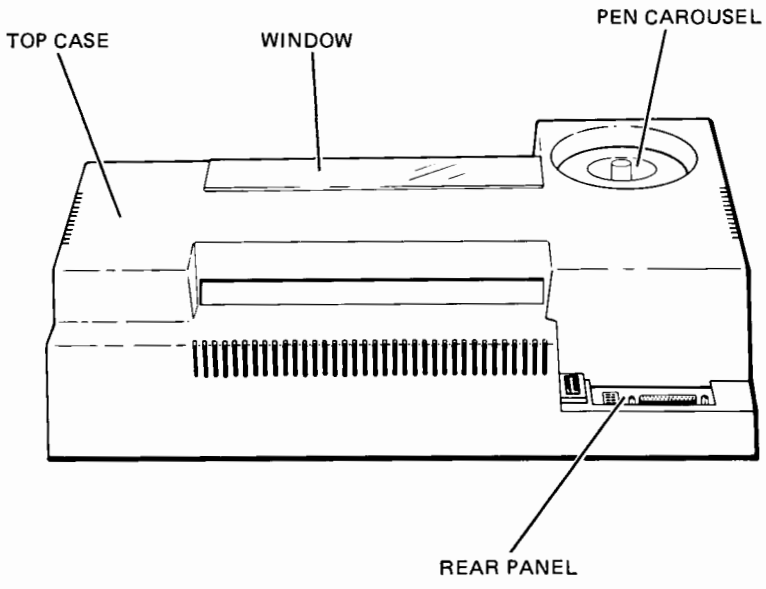


Figure 1-2. HP 7440 ColorPro Plotter, Rear View

CHAPTER 1

PRODUCT INFORMATION

1-1. INTRODUCTION

1-2. This hardware support manual contains information necessary to test and service the HP 7440 ColorPro plotter. It is divided into twelve chapters as follows:

1 Product Information
2 Site Planning and Requirements
3 Installation and Configuration
4 Preventive Maintenance
5 Functional Description
6 Removal and Replacement
7 Adjustments
8 Troubleshooting and Diagnostics
9 Replaceable Parts
10 Reference
11 Product History
12 Diagrams

1-3. Information for interfacing, operating, and programming the HP 7440 plotter is contained in the following publications:

TITLE	HP PART NUMBER
Programming Manual	07440-90001
Operating Manual	07440-90002
Pocket Guide	07440-90003

1-4. This chapter also includes a description of the plotter, options available, accessories supplied, plotter specifications, operating characteristics, and a list of the tools and equipment required for maintenance and repair.

1-5. Also listed on the title page of this manual is a microfiche part number. This number can be used to order 4 × 6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Updates as well as pertinent Service Notes.

1-6. DESCRIPTION

1-7. See Figures 1-1 and 1-2 for the physical appearance of the HP 7440 plotter.

1-8. The HP 7440 plotter is a microprocessor controlled plotter providing graphic displays of computer program output data. The HP 7440 operates with a number of HP computer systems, graphics terminals, and desktop computer systems to produce printed and graphic copy. The HP 7440 can be used with controllers having either HP-IB or RS-232-C interfaces.

1-9. The HP 7440 accepts digital information to produce graphic plots on ANSI A (8½ × 11 in.) or ISO A4 (210 × 297 mm) paper or special transparency plastic. Disposable pens are available in various ink colors.

1-10. The HP 7440 is equipped with such capabilities as point digitizing, labeling, axes generation, and automatic pen selection. Multicolor plots of high resolution and quality in sizes ANSI A or ISO A4 for reports, reproduction, or graphic presentations are generated by the HP Model 7440.

1-11. A Graphics Enhancement Cartridge (GEC) (HP Model 17440A) may be supplied with or field installed in the HP 7440. Installing a GEC provides additional graphics capabilities; such as, the circle command, arc commands, and area fill commands.

1-12. The eight-pen carousel permits pen changes under program control. Pens are automatically capped while they are stored in the pen carousel.

1-13. Seven different dashed-line fonts are available. Labeling can be done in five character sets (including three European sets) plus user-defined characters. Text (labeling) can be written in any direction, upright or slanted. Character size is also variable.

1-14. The HP 7440 incorporates a low inertia dc servo motor drive system for pen positioning and media transport.

1-15. OPTIONS

1-16. The HP 7440 is available with one of two types of interface, designated as the following options:

Option 001 (RS-232-C/CCITT V.24 serial interface)
Option 002 (HP-IB parallel interface)

1-17. ACCESSORIES

1-18. The items listed in Table 1-1 are supplied with each plotter.

1-19. The item listed in Table 1-2 is supplied with the Graphics Enhancement Cartridge.

1-20. SPECIFICATIONS

1-21. Table 1-3 lists the specifications and characteristics for the HP 7440 including performance specifications against which the plotter is tested. Also included in Table 1-3 are supplemental characteristics. Supplemental characteristics are not specifications, but are typical characteristics included as additional information for the user.

Table 1-1. Accessories Supplied, Plotter

DESCRIPTION	QUANTITY	CHECK DIGIT	HP PART NUMBER
Operating Manual	1	3	07440-90002
Plotter Sampler*	1	2	07440-60400
20 sheets blank plotter paper			
ISO A4 (210 × 297 mm)		3	9280-0588
ANSI A (8½ × 11 in.)		3	9280-0589
10 sheets glossy presentation paper			
Transparency Sampler	1	9	07440-60415
5 sheets of overhead transparency film			
Packs of Paper Plotter Pens	2		
5 color pack — 0.3 mm, blue, black, green, aqua, violet		3	17847P
5 color pack — 0.3 mm, brown, yellow, orange, red, red-violet		2	17849P
Packs of Transparency Plotter Pens	2		
5 color pack — 0.3 mm, black, green, aqua, blue, violet		3	17747T
5 color pack — 0.3 mm, brown, yellow, orange, red, red-violet		5	17749T
8-Pen Carousel	1	8	07440-60085
Power Module ac	1		Table 3-1

*Paper size supplied is based on the destination of the plotter.

Table 1-2. Accessories Supplied, Graphics Enhancement Cartridge

DESCRIPTION	QUANTITY	CHECK DIGIT	HP PART NUMBER
Installation Instructions	1	1	17440-90000

Table 1-3. Specifications and Supplemental Characteristics

PERFORMANCE SPECIFICATIONS

Repeatability

Single pen: 100 micrometres
Pen to pen: 200 micrometres

Note: Specifications apply only when using Hewlett-Packard authorized supplies.

SUPPLEMENTAL CHARACTERISTICS

Plotting area

Media size:
ISO A4: 210 × 297 mm
ANSI A: 8½ × 11 in.

Maximum plotting area: Dependent on media size as follows:
ISO A4: 191 mm × 272 mm (7.5 in. × 10.7 in.) metric
ANSI A: 191 mm × 257 mm (7.5 in. × 10.1 in.) English

Table 1-3. Specifications and Supplemental Characteristics (Continued)

Pen speed
Pen down: maximum, 40 cm/s (15.7 in./s) programmable, 1 to 40 cm/s (0.4 to 15.7 in./s)
Pen up: 52 cm/s (20.5 in./s)

Smallest addressable step size
0.025 mm (0.001 in.)

Acceleration
Approximately 1225 cm/s/s (1.2 g)

Force
Pen force: 10 g to 26 g

Pens
Number of pens: 8/carousel
Pen types: fiber-tip, transparency

Buffer size
Without the Graphics Enhancement Cartridge: 60 bytes
With the Graphics Enhancement Cartridge: 1024 bytes, programmable to 1974 bytes

Character plotting speed
Approximately 2 characters/s

Power requirements
Source: 100, 120, 220, or 240 Vac (+5% −10%)
Frequency: 48 to 66 Hz
Consumption: 20 W maximum

Size
Height: 125 mm (4.9 in.)
Width: 460 mm (18.1 in.)
Depth: 308 mm (12.1 in.)

Environmental range
Operating temperature: 0°C to 55°C
Relative humidity: 5% to 95% (at 40°C)
Non-operating temperature: −40°C to 75°C

Weight
Net weight: 5.5 kg (12 lbs)
Shipping weight: 8.6 kg (19 lbs)

1-22. SERIAL NUMBER INFORMATION

NOTE

Remove the pen carousel before turning the plotter upside down to look at the serial number.

1-23. The plotter serial number is located on bottom of the plotter. See Figure 1-3. Hewlett-Packard uses a two-part serial number consisting of a four-digit prefix and a five-digit suffix separated by a letter (e.g., 0000A00000). The prefix is the same for all identical plotters and changes only when a modification is made that affects parts compatibility. The suffix is assigned sequentially and is different for each plotter. This manual applies directly to plotters with the serial prefix shown on the title page.

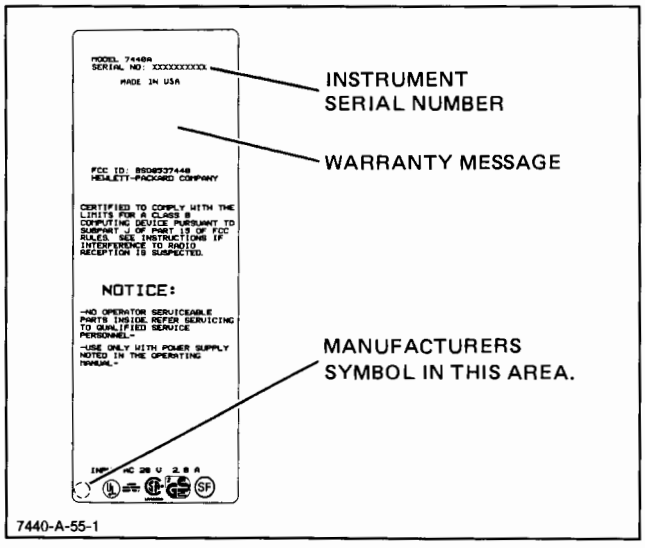


Figure 1-3. HP 7440 Serial Number Label

1-24. TEST EQUIPMENT AND SPECIAL TOOLS

1-25. The tools and equipment required to maintain the HP 7440 are listed in Table 1-4.

Table 1-4. Required Tools and Test Equipment

TOOL	TYPE OR P/N
Screwdriver	Pozidriv #1
Screwdriver	Pozidriv #2
Pliers	Long Nose
RS-232-C Test Plug	07440-60302
Optical Comparator	BL 81-34-35

1-26. SAFETY

1-27. Safety information relevant to the service procedure being described is provided in the appropriate sections of this manual. Review your HP 7440 plotter and this manual for safety markings and instructions before beginning service work.

WARNING

To protect operating personnel, the plotter must be properly grounded. The plotter is supplied with a three-conductor power cable which, when connected to an appropriate power outlet, grounds the plotter. To preserve this protective feature, do not operate the plotter from a power outlet which has no grounded connection.

CHAPTER 2

SITE PLANNING AND REQUIREMENTS

2-1. INTRODUCTION

2-2. This chapter contains information about the requirements for proper operation of the HP Model 7440 plotter. A figure showing the plotter's physical dimensions is included.

2-3. ELECTRICAL SPECIFICATIONS

2-4. POWER REQUIREMENTS

2-5. The HP 7440 requires a power source of 100, 120, 220, or 240 Vac (+5% −10%).

2-6. AC POWER MODULE

2-7. The ac power module required for use with the HP 7440 is determined by the destination of the plotter. Refer to Chapter 3 for the available ac power modules.

2-8. ENVIRONMENTAL SPECIFICATIONS

2-9. The HP 7440 plotter complies with HP requirements for Class B products. The environmental limits are as follows:

OPERATING

Temperature:	0°C to 55°C
Humidity:	5% to 95% RH at 40°C
Altitude:	to 4575 m (15000 ft) at 0°C

STORAGE

Temperature:	−55°C to +75°C
Humidity:	to 90% RH at 65°C
Altitude:	to 15250 m (50000 ft) at 0°C

2-10. PHYSICAL SPECIFICATIONS

2-11. See Figure 2-1 for the physical dimensions of the plotter.

2-12. CABLE RESTRICTIONS

2-13. Interface cable length restrictions for the plotter are determined by the type of interface installed.

RS-232-C 15.24 m (50 ft)

HP-IB 20 m (65.6 ft) total or 2 m (6.6 ft) per device, whichever is less

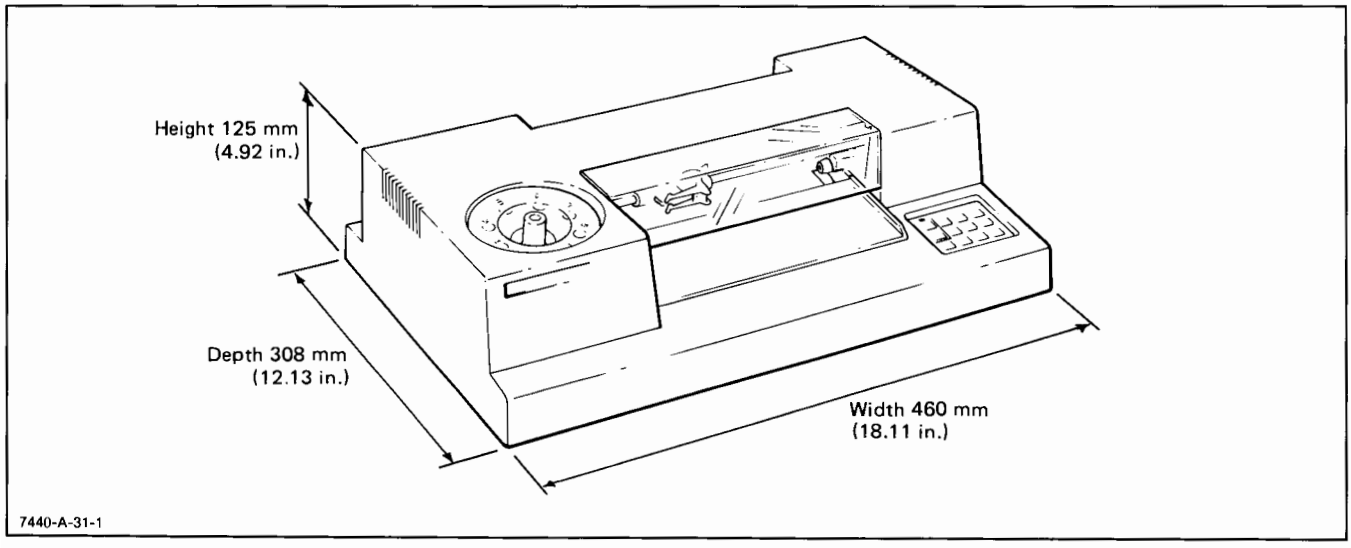


Figure 2-1. Physical Dimensions

CHAPTER 3

INSTALLATION AND CONFIGURATION

3-1. INTRODUCTION

3-2. This chapter contains information about the unpacking, inspection, repacking, storage, and shipping of your HP 7440 plotter. It also contains descriptions of:

- Plotter installation
- Line voltage and fusing used
- Switches related to each plotter option
- Interconnection of the plotter with a controller
- Plotter self test procedures
- System verification

In addition, the chapter includes user information on how to operate the plotter.

3-3. UNPACKING AND INSPECTION

NOTE

Open the carton carefully to preserve the shipping materials.

3-4. Check the carton and shipping materials as you unpack the plotter.

3-5. Save the box and materials. Store them in a dry place. You may need them again if you ship the plotter.

3-6. Check your plotter and accompanying components for damage that may have occurred during shipping. If you discover any damage, contact your local HP Sales and Service Office. You'll find the offices listed at the back of this hardware support manual.

3-7. Remove any pen carriage restraint or pen carousel retainer before switching the plotter on.

3-8. REPACKING, STORAGE, AND SHIPPING

3-9. If the original packaging material has been retained, repack the plotter in the same manner as it was received. The following general instructions should be used for packing with commercially available materials:

a. Wrap the plotter in heavy paper or plastic.

b. Use a strong container.

c. Use a layer of shock-absorbing material at least 70 to 100 mm (3 to 4 in.) thick around all sides of the plotter to provide firm cushioning and prevent movement inside the container.

d. Before storing the plotter for any considerable length of time, remove all pens from the pen carousel. Repack the plotter in the shipping carton using the original packing materials.

CAUTION

Ensure that the pen carriage and pen carousel are held firmly in place to prevent possible damage to the plotter.

e. Store the plotter on a flat, level surface, and ensure that the temperature of the storage space will not fall below or rise above the allowable, non-operating environmental range of −40°C to 75°C. The relative humidity of the storage space should be between 20% and 80%.

3-10. When shipping the plotter, observe the following rules:

CAUTION

Ensure that the pen carriage and pen carousel are held firmly in place to prevent possible damage to the plotter.

a. Seal container securely. Mark container FRAGILE to ensure careful handling.

b. In any correspondence, refer to the plotter by model number and full serial number.

3-11. If the plotter is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, model number, full serial number, and your return address. Also include this information in any correspondence.

3-12. INSTALLATION

3-13. To install the plotter, perform the following steps:

a. Place the plotter on a flat surface.

b. Lift the pen carousel clear of the plotter, and load pens into the carousel. Set carousel off to the side.

CAUTION

To prevent damage to the plotter, make sure you are using the correct ac power module and power plug configuration before connecting line power. Installing the wrong ac power module can cause damage to the power module, the plotter, or both. Refer to Table 3-1 for a list of the power modules that are available.

Table 3-1. Available ac Power Modules

DESCRIPTION	COUNTRY	MODEL NO.	VOLT/PLUG TYPE
Power Mod — VDE	Italy	17222A	220/902
Power Mod — British	Britain	17422B	240/900
Power Mod — VDE	France	17222A	220/902
Power Mod — VDE	Finland	17222A	220/902
Power Mod — UL	N/A	17122B	120/903
Power Mod — USA	USA	17122A	120/903
Power Mod — Swiss	Switzerland	17522B	220/906
Power Mod — Argentinian	S. America	17222B	220/902
Power Mod — Japanese	Japan	17322B	100/903
Power Mod — VDE	Germany	17222A	220/902
Power Mod — Australian	Australia	17722B	240/901
Power Mod — United Kingdom	United Kingdom	17422A	240/900
Power Mod — Denmark	Denmark	17822B	240/912
Power Mod — S. African	Rep. of S. Africa	17622B	220/917
Power Mod — Chinese	China	17922B	220/901
Power Mod — Spanish	Spain	17122A	120/903
Power Mod — English	Hong Kong	17322A	100/903

WARNING

The line power cord and power outlet must have a protective earth (ground) terminal. Use of the plotter in the absence of proper grounding can cause injury or death.

c. Check the Graphics Enhancement Cartridge (GEC), by turning the plotter bottom side up and removing and reinstalling the GEC following the directions shown in picture form on the GEC label. Ensure the GEC is firmly seated before proceeding.

d. Turn the plotter top side up and install the pen carousel.

e. Connect the four pin connector of the ac power module to J2 of the plotter.

f. Connect the three prong plug of the ac power module to an ac power source.

g. Press the logic ON/OFF (I/O) key on the plotter front panel. See Figure 3-1. The front panel LED will light.

h. Place a sheet of ANSI A (8½ × 11) paper against the left-hand rail of the platen, and align the rear edge of the sheet with the white line.

i. Press the PAPER LOAD key. See Figure 3-1.

j. Select a pen by pressing the PEN SELECT key, and then operate each of the front panel key switches. Vertical, horizontal, and diagonal lines (using the directional controls with a pen down) should be smooth.

k. Connect the plotter to a controller. Information about cables is given under the heading, INTERCONNECTION, later in this chapter. Set the plotter rear panel switches to configure the plotter to the controller. Information about switch settings appears under the heading, REAR PANEL SWITCHES, later in this chapter.

3-14. LINE VOLTAGE AND FUSING

WARNING

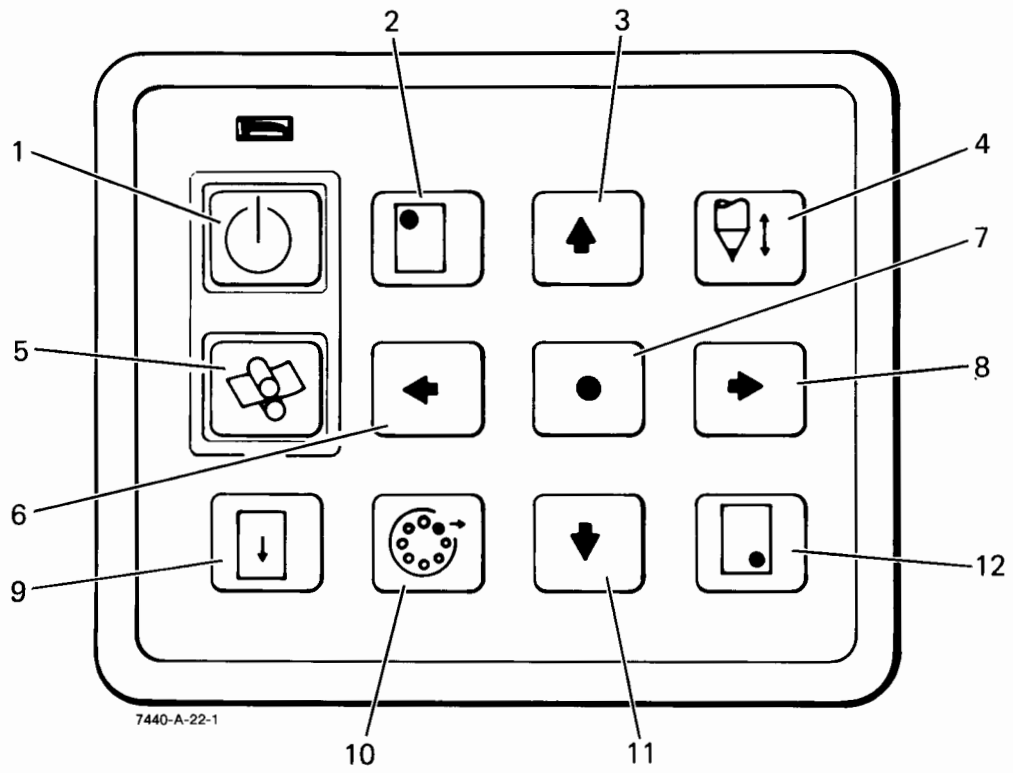
Disconnect the power module from the ac wall outlet before working on the plotter. Even though the front panel ON/OFF (I/O) key switch is in the OFF (O) condition, it will only stop the machine program, and dangerous voltages will still be applied to the Main PCA.

3-15. Table 3-1 lists the available ac power modules for use with the HP 7440 plotter.

3-16. The underside of each ac power module is labeled with the appropriate input voltage, frequency, and current followed by the output voltage and power.

CAUTION

Applying a line voltage of 220 V or 240 V to the plotter while using a 100 V or 120 Vac power module may damage the power module, the plotter, or both.



1 = ON/OFF (I/O) (logic only)
2 = P1
3 = Cursor Movement (toward top margin of paper)
4 = Pen Up/Pen Down
5 = Paper Load
6 = Cursor Movement (toward left margin of paper)
7 = Enter
8 = Cursor Movement (toward right margin of paper)
9 = View
10 = Pick Pen
11 = Cursor Movement (toward bottom margin of paper)
12 = P2

Figure 3-1. Front Panel Key Switches

3-17. The input voltage to the power module is stepped down to 20/30 Vac by a transformer before being applied to the HP 7440 plotter. The primary and secondary windings of the power module transformer are protected by fuses. The +20/30 V line on the plotter Main PCA is protected by a 2.0 A fuse (F1) to avoid having to replace the power module in case of a short in a plotter dc power supply or in the load of one of the supplies.

3-18. SWITCH SETTINGS

3-19. Switches on the HP 7440 plotter consist of front panel key switches and rear panel switches. Switch functions are described in the following paragraphs.

3-20. FRONT PANEL KEY SWITCHES

3-21. There are twelve key switches on the front panel. See Figure 3-1 for a drawing of the front panel key switches with a brief description of switch functions. Refer to Table 3-2 for a more detailed description of the switch functions.

3-22. REAR PANEL SWITCHES

3-23. Options 001 and 002 each have a rear panel switch assembly with seven switches, but the switches have different functions depending on the option. The paragraphs below describe the functions of the rear panel assembly switches for each option and tell how to set the switches.

3-24. REAR PANEL SWITCHES (RS-232-C/ CCITT V.24 Serial Interface) (Option 001)

3-25. BAUD RATE. See Figure 3-2 for the function of each rear panel assembly switch. Refer to Table 3-3 for the switch settings required to set the baud rate of the plotter.

Table 3-2. Front Panel Key Switch Functions

ICON	INDICATOR OR CONTROL	FUNCTION
	1. ON/OFF (Light)	Shows the plotter's power status
	2. ON/OFF (Button)	Turns the plotter on and off
	3. P1	Moves the pen and medium to the plot's lower-left corner
	4. Up Cursor	Moves the plotting medium up on the platen
	5. Pen Up/Down	Raises and lowers the pen
	6. Load	Holds and releases the plotting medium; puts the pen away
	7. Left Cursor	Moves the pen to the user's left
	8. Enter	Enter+P1 inputs the current pen position as the plot's lower-left corner; Enter+P2 inputs the current pen position as the plot's upper-right corner
	9. Right Cursor	Moves the pen to the user's right
	10. View	Moves the plot to the front of the platen for viewing; returns the plot to its original position
	11. Pen Select	Selects the pen used for plotting
	12. Down Cursor	Moves the plotting medium down on the platen
	13. P2	Moves the pen and medium to the plot's upper-right corner

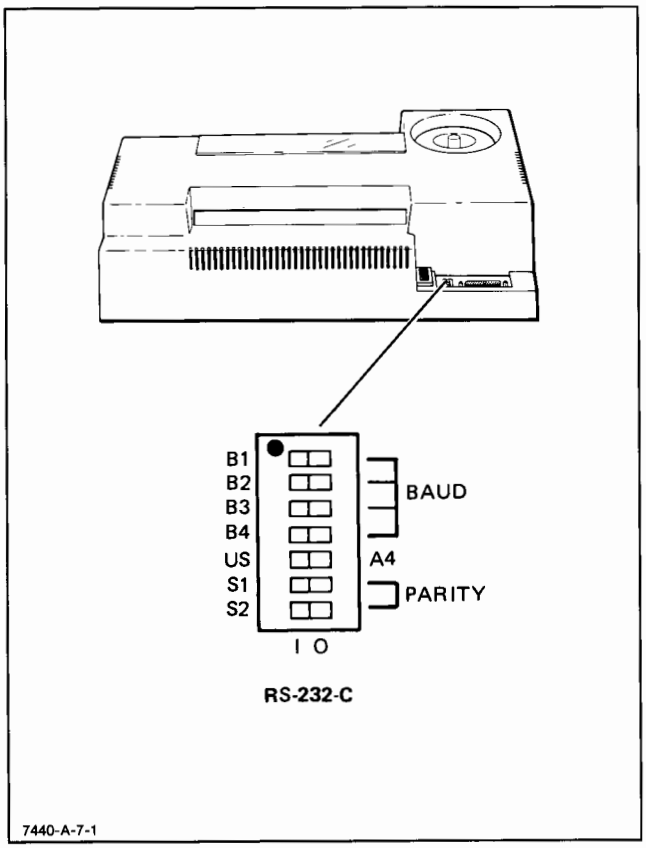


Figure 3-2. RS-232-C/CCITT V.24 (Option 001) Rear Panel Switch Functions

Table 3-3. HP 7440 Plotter Baud Rate Settings

REAR PANEL SWITCHES								
BAUD RATE	ONE STOP BITS B4	B3	B2	B1	TWO STOP BITS B4	B3	B2	B2
Auto Baud	0	0	0	0	.....			
75	.....				0	0	0	1
110	.....				0	0	1	0
150	0	0	1	1	.....			
200	0	1	0	0	.....			
300	0	1	0	1	1	0	1	1
600	0	1	1	0	1	1	0	0
1200	0	1	1	1	1	1	0	1
2400	1	0	0	0	1	1	1	0
4800	1	0	0	1	1	1	1	1
9600	1	0	1	0	0	0	0	0

3-26. PARITY. Two rear panel switches are used for parity selection. When the S1/PARITY switch is set to I, the S2/PARITY switch selects odd (I) or even (O) parity.

3-27. MET/US. This switch is used to program the plotting area for two paper sizes:

Paper Size	Switch Position	Maximum Plotting Area
ISO A4	MET	190 × 273 mm
ANSI A	US	7.5 × 10.2 in.

3-28. REAR PANEL SWITCHES (HP-IB Parallel Interface) (Option 002)

3-29. FUNCTIONS. See Figure 3-3 for the functions reserved to each rear panel assembly switch on the Option 002 plotter.

3-30. ADDRESS. The plotter's HP-IB address is set by five of the seven switches on the rear panel. Refer to Table 3-4 for the switch settings of each address.

3-31. MET/US. This switch is used to program the plotting area for two paper sizes:

Paper Size	Switch Position	Maximum Plotting Area
ISO A4	MET	190 × 273 mm
ANSI A	US	7.5 × 10.2 in.

3-32. INTERCONNECTION

3-33. To apply power to the plotter, connect the four pin, power module plug (female) to J2 of the plotter. Then connect the three prong, power module plug to the ac power source.

3-34. When used with Hewlett-Packard equipment, one of the following cables is required:

	Cable P/N
Option 001 (RS-232-C)	13242G
Option 002 (HP-IB)	10833A, B, C or D

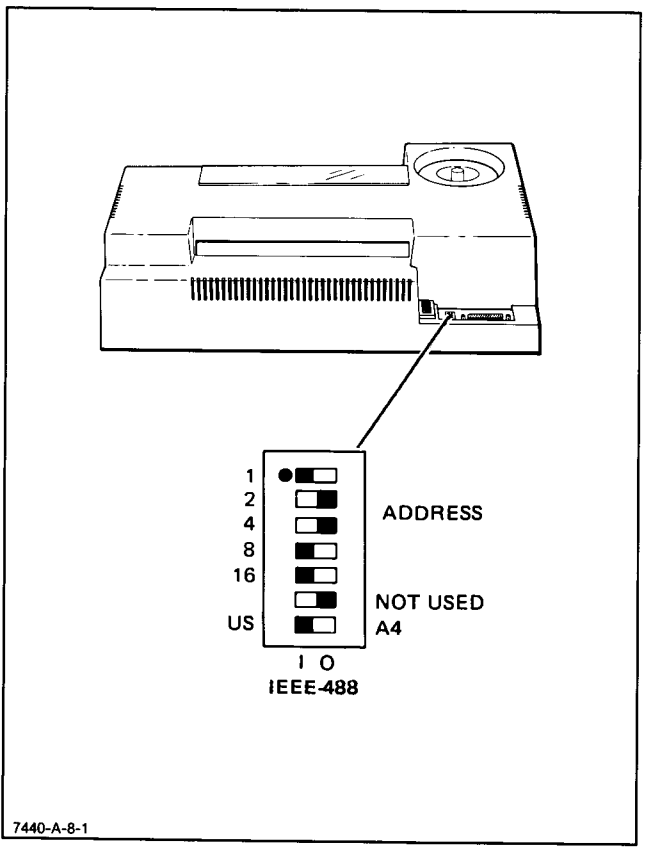


Figure 3-3. HP-IB Parallel Interface (Option 002) Rear Panel Switch Functions

Table 3-4. HP-IB Address Selection

HP-IB ADDRESS	SWITCH SETTINGS MSB ◄ ► LSB				
00	0	0	0	0	0
01	0	0	0	0	1
02	0	0	0	1	0
03	0	0	0	1	1
04	0	0	1	0	0
05	0	0	1	0	1
06	0	0	1	1	0
07	0	0	1	1	1
08	0	1	0	0	0
09	0	1	0	0	1
10	0	1	0	1	0
11	0	1	0	1	1
12	0	1	1	0	0
13	0	1	1	0	1
14	0	1	1	1	0
15	0	1	1	1	1
16	1	0	0	0	0
17	1	0	0	0	1
18	1	0	0	1	0
19	1	0	0	1	1
20	1	0	1	0	0
21	1	0	1	0	1
22	1	0	1	1	0
23	1	0	1	1	1
24	1	1	0	0	0
25	1	1	0	0	1
26	1	1	0	1	0
27	1	1	0	1	1
28	1	1	1	0	0
29	1	1	1	0	1
30	1	1	1	1	0
31	1	1	1	1	1

MSB = Most Significant Bit
LSB = Least Significant Bit
Address 31 = LISTEN ONLY

NOTE

The 10833 HP-IB cables will replace and are identical to the 31389 and 45529 series HP-IB cables.

3-35. When other manufacturer's equipment is used, refer to the Hewlett-Packard Computer Users Catalog to find out what cable is required.

3-36. SELF TEST PROCEDURES

3-37. PRELIMINARY TEST

3-38. Operation of all plotter circuitry can be verified by the use of the front panel keys except for the input/output (I/O) circuits.

3-39. To verify plotter operation, perform the following steps.

a. Make sure eight pens are installed in pen carousel.

CAUTION

Before applying power to the plotter, check that the proper ac power module is available for installation. Installing the wrong ac power module can damage the module, the plotter, or both.

b. Apply power to the plotter by installing the ac power module and pressing the logical ON/OFF key at the front panel. See Figure 3-1.

c. After the plotter initializes, place a sheet of paper (ANSI A or ISO A4) against the left-hand rail and the rear edge of the sheet against the white line. Make sure that the plotter is set for the proper paper size.

d. Press the PAPER LOAD key. See Figure 3-1.

e. Select a pen by pressing the PEN SELECT key, and then operate each of the front panel key switches. Vertical, horizontal, and diagonal lines (using the directional controls with a pen down) should be smooth.

NOTES

If the pen is down, it will lift when either P1 or P2 is pressed. The VIEW switch is a latching control. After the VIEW key is pressed once, the other controls will not operate until the VIEW key is pressed a second time. If the plotter is loaded, pressing the LOAD key will cause the media to be unloaded and the plotter pen carriage to go to the initialized position.

3-40. DEMONSTRATION PLOTS

3-41. Each HP 7440 contains a demonstration plot stored in read only memory (ROM). Running this plot will verify proper operation of most of the logic circuits as well as the operation of the paper and pen drive mechanisms; however, it does not test the I/O circuitry. To run the demonstration plot, proceed as follows:

a. Make sure eight pens are installed in the carousel.

b. Apply power to the plotter by installing the ac power module in the plotter, inserting the power plug into a receptacle, and pressing the logical ON/OFF (I/O) key. See Figure 3-1.

c. Place a sheet of paper (ANSI A or ISO A4) on the platen so that the rear edge of the sheet lines up with the white line. Press the LOAD key. See Figure 3-1.

d. Press the ENTER and LOAD keys simultaneously. See Figure 3-1. Release the keys after the demonstration plots begins.

e. If the plotter does not have a Graphics Enhancement Cartridge (GEC) installed, compare the demonstration plot to the plot in Figure 3-4. The

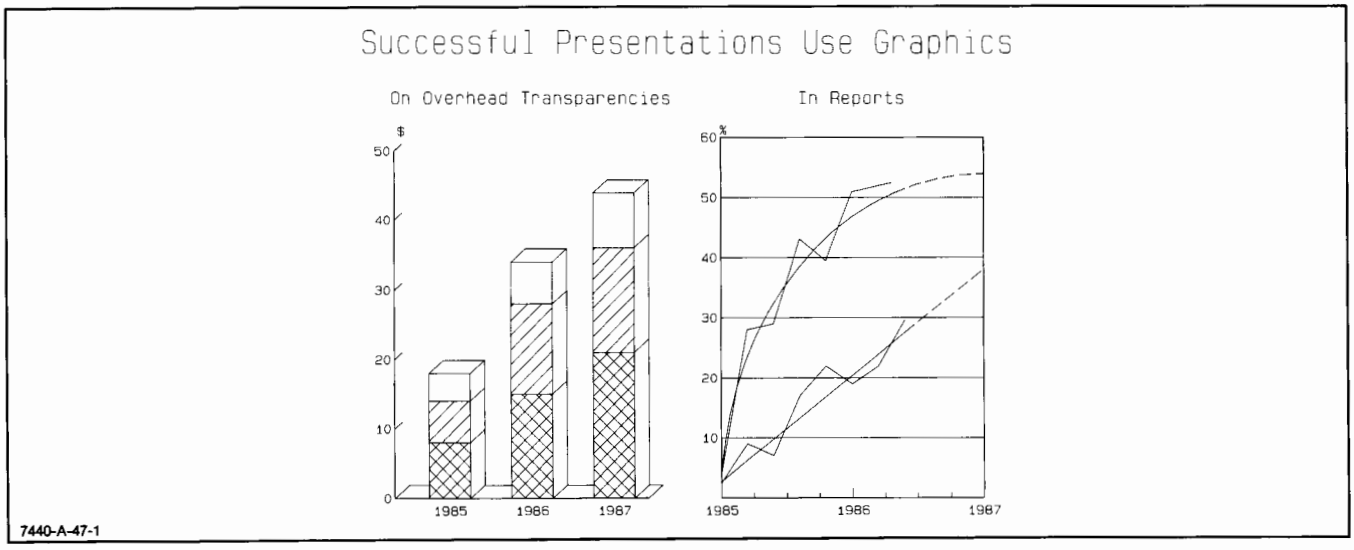


Figure 3-4. Demonstration Plot, without GEC

two plots should be the same except that the plot in Figure 3-4 has been reduced in size.

f. If the plotter has a GEC installed, compare the demonstration plot to the plot in Figure 3-5. The two plots should be the same except that the plot in Figure 3-5 has been reduced in size.

3-42. REPEATABILITY

3-43. To verify single pen plotter repeatability, proceed as follows:

a. Load a new 0.3 mm pen into stable 1 of the pen carousel.

b. Apply power to the plotter by installing the ac power module in the plotter, inserting the power plug into a receptacle, and pressing the logical ON/OFF (I/O) key. See Figure 3-1.

c. Press the ENTER and LOAD keys simultaneously. See Figure 3-1. The plotter will produce a demonstration plot. Release the keys after the demonstration plot begins.

d. Using an optical comparator, inspect the point on the line graph under the label, In Reports, where the axis labeled % and the axis labeled with the years 1985 through 1987 intersect.

e. Ensure that the offset does not exceed 0.2 mm.

3-44. PEN-TO-PEN REPEATABILITY

3-45. To verify plotter pen-to-pen repeatability, proceed as follows:

a. Load new 0.3 mm pens into the pen carousel.

b. Apply power to the plotter by installing the ac power module in the plotter, inserting the power plug into a receptacle, and pressing the logical ON/OFF (I/O) key. See Figure 3-1.

c. Press the ENTER and LOAD keys simultaneously. See Figure 3-1. The plotter will produce a demonstration plot. Release the keys after the demonstration plot begins.

d. Using an optical comparator, inspect the line graph under the label, In Reports, where the straight-line function intersects with the first segment of its dashed-line continuation.

e. Ensure that the offset does not exceed 0.2 mm.

3-46. LOOPBACK TEST

3-47. The RS-232-C version of the HP 7440 has a loopback test that is a part of the demonstration plot. The loopback test will add a + to the demonstration plot (see Figure 3-6) when the loopback test plug (RS-232-C Test Plug) is installed and the RS-232-C interface is working properly. If the RS-232-C Test Plug is not installed or there is a problem with the RS-232-C interface, the + will not appear on the demonstration plot.

3-48. In doing the loopback test, the microprocessor sends a byte via the transmit data line. The byte is routed back to the receive data line by the RS-232-C test plug. The byte sent is compared to the byte received in order to detect signal loss or distortion.

3-49. SYSTEM VERIFICATION

3-50. The program in Figure 3-7 is written in BASIC language specifically for the HP Model 85 Personal Computer, but may be adapted to other controllers. This program tests the I/O circuits of the HP 7440, and the operation of the paper and pen drive mechanisms. The resultant plot is illustrated in Figure 3-8.

3-51. The system verification plot in Figure 3-8 verifies that the controller and the plotter can communicate using the HP-IB interface.

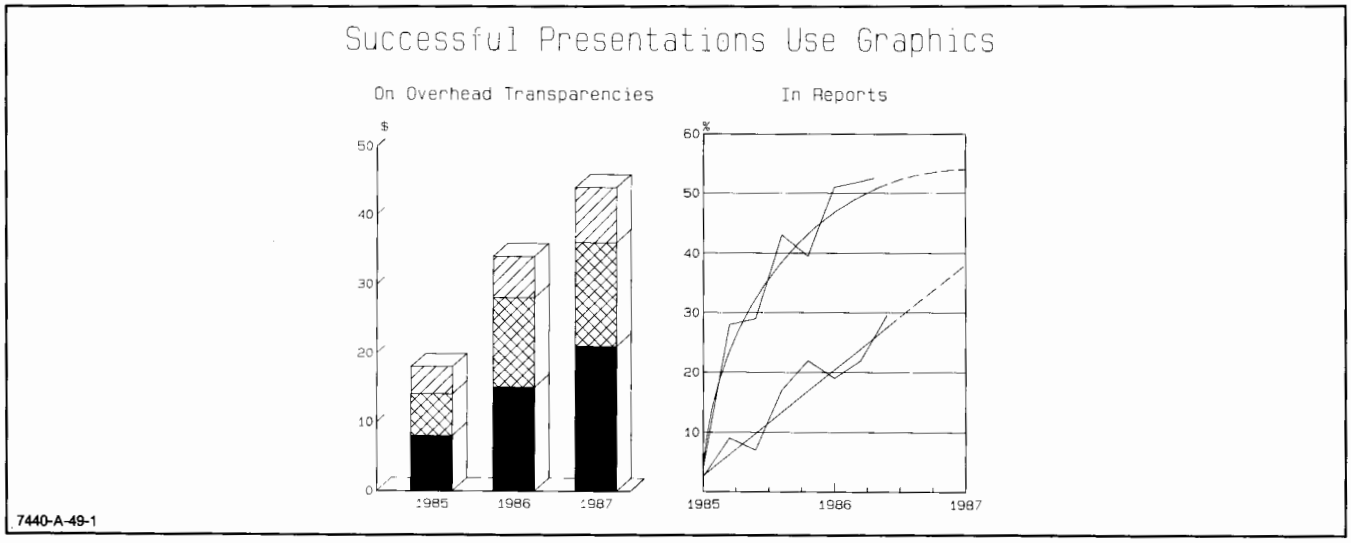


Figure 3-5. Demonstration Plot, GEC Installed

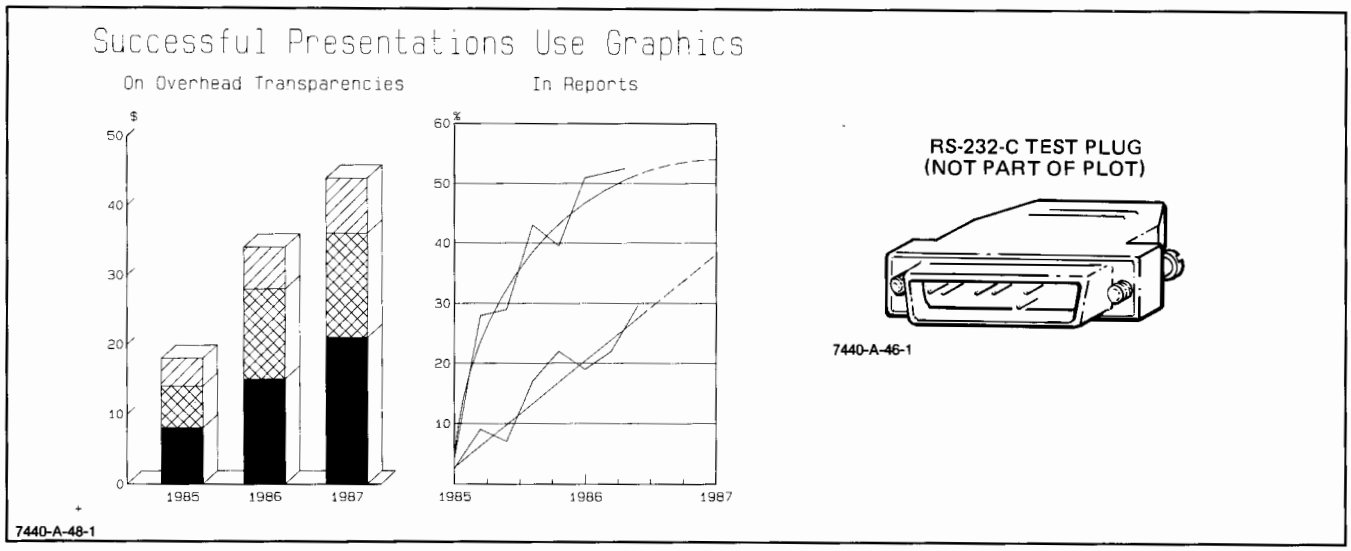


Figure 3-6. Demonstration Plot (with Valid Loopback Test)

```
10 OUTPUT 705 ;"IN;SP1;"
20 OUTPUT 705 ;"PA5000,5000;OE;
   "
30 ENTER 705 ; E
40 OUTPUT 705 ;"LBHP-IB COMMUNI
   CATIONS OK",CHR$(3)
50 OUTPUT 705 ;"PA0,0;SP0;"
60 END
```

7440-A-32-1

Figure 3-7. System Verification Test Program

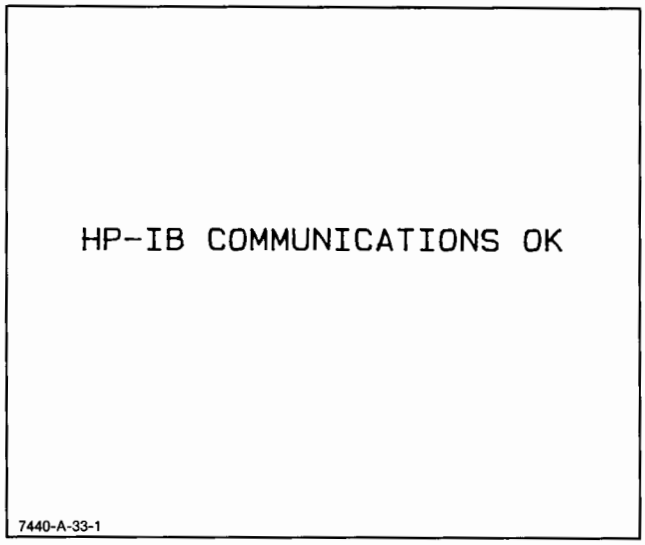


Figure 3-8. System Verification Plot

3-52. HEWLETT-PACKARD GRAPHICS LANGUAGE

3-53. The HP 7440 without the Graphics Enhancement Cartridge recognizes the Hewlett-Packard Graphic Language (HP-GL) instructions listed in Table 3-5.

3-54. The HP 7440 with the Graphics Enhancement Cartridge recognizes the HP-GL instructions listed in Table 3-6 as well as those listed in Table 3-5.

3-55. USER INFORMATION

WARNING

Disconnect the power module from the ac wall outlet before working on the plotter. Even though the front panel ON/OFF (I/O) key switch is in the OFF (O) condition, it will only stop the machine program, and dangerous voltages will still be applied to the Main PCA.

Table 3-5. HP 7440 HP-GL Minimal Instruction Set

INSTRUCTION	DEFINITION
Vector Group:	
PA x,y(,x,y(,...))	Plot absolute (integer format, −32 768 to +32 767
PR x,y(,x,y(,...))	Plot relative (integer format, −32 768 to +32 767
PU	Pen up
PD	Pen down

Table 3-5. HP 7440 HP-GL Minimal Instruction Set (Continued)

INSTRUCTION		DEFINITION
Character Group:		
CA	n	Designate alternate character set (n = integer 0 to 4, 6 to 9, or 30 to 39)
CP	spaces,lines	Character plot (decimal format, −128 to +127.9999)
CS	n	Designate standard character set (n = integer, 0 to 4, 6 to 9, or 30 to 39)
DI	run,rise	Absolute direction (decimal format −128 to +127.9999)
DR	run,rise	Relative direction (decimal format −128 to +127.9999)
LB	c (c (. . .))	Label ASCII string (c = ASCII characters)
SA		Select alternate character set
SI	wide,high	Absolute character size (decimal format in centimetres)
SL	tan angle (+ or −)	Absolute character slant from vertical format (tangent of angle from vertical)
SM		Turn off symbol mode.
SM	c	Invoke symbol mode. The character will be drawn with its center point at the locus of following co-ordinate pairs.
SP	0	Put away current pen.
SP	n	Put away current pen and fetch pen n.
SR	wide,high	Relative character size (decimal format, of $P2_x - P1_x$ and $P2_y - P1y$)
SS		Select standard character set
UC	(pen,)vector [,(pen,)vector]	User-defined character
Line and Fill Type Group:		
LT	type(,1)	Designate line type t and length 1
SM		Turn off symbol mode
SP	0	Put away current pen
SP	n	Put away current pen and fetch pen n
TL	tp(,tn)	Tick length (tp = positive length, tn = negative length)
VS	v	Select pen velocity v (increments of 0.31 cm/s)
XT		Draws X-axis ticks the size defined by TL
YT		Draws Y-axis ticks the size defined by TL
Configuration and Status Group:		
DF		Set default values except P1 and P2
DT	c	Define label terminator
IM	e(,s),p))	Input e, s, and p masks
IN		Initialize
SC	X_1,X_2,Y_1,Y_2	Scale (integer format −32 768 to 32 767)
Digitize Group:		
DC		Digitize clear
DP		Digitize point
OA		Output actual x, y, and pen position
OC		Output last valid x, y, and pen position input from I/O or front panel
OD		Output digitized point and pen status
OE		Output error
OF		Output factors
OH		Output current hardclip limits
OI		Output identification
OO		Output options
OP		Output P1 and P2
OS		Output status
OW		Output window corner coordinates (lower left and upper right)
Setup Group:		
IP	$P1x,P1_y,P2_x,P2_y$	Input P1 and P2 (integer format −32 768)
IW	$X_{lo},Y_{lo},X_{hi},Y_{hi}$	Input window (integer format −32 768 to output P1 and P2)

Table 3-6. HP 7440 HP-GL Instruction Set Extension (with Graphics Enhancement Cartridge)

INSTRUCTION		DEFINITION
Arc and Circle Group:		
AA	X-center, Y-center arc angle(,chord angle)	Draw arc starting with current position
AR	X-center, Y-center arc angle(,chord angle)	Draw arc with center relative to current position
CI	radius(,chord angle)	Draw circle around current position
Polygon Mode:		
PM*		Polygon definition
PM0		Enable polygon definition mode
PM1		Close current subpolygon
PM2		Close current subpolygon and disable polygon definition mode
Area Fill Group:		
EA	x,y	Edge rectangle, absolute
EP		Edge polygon
ER	x,y	Edge rectangle, relative
EW	radius, start angle, stop angle	Edge wedge
FP		Fill polygon
FT	type, spacing, angle	Fill type
PT	thickness	Pen thickness
RA	x,y	Shade rectangle, absolute
RR	x,y	Shade rectangle, relative
WG	radius, start angle, stop angle (,chord angle) (,chord angle)	Shade wedge
Configuration and Status Group:		
DF		Set default values
DT	c	Define label terminator (c = ASCII character)
IM	e(,s(,p))	Input e, s, and p masks
SC	X_1,X_2,Y_1,Y_2	Scale (integer format −32 768 to +32 767)

*Vector Group instructions in Table 3-5 and IN are available.

CHAPTER 4

PREVENTIVE MAINTENANCE

4-1. INTRODUCTION

4-2. This chapter contains information on keeping the HP 7440 in the best operating condition. Included are:

- Instructions for operator maintenance
- Cleaning procedures
- Service procedures for mechanical and electrical adjustments

4-3. EFFECT ON PRODUCT RELIABILITY

4-4. To maintain the plotter in the best operating condition, keep it free of dust accumulation, ink and other contamination. Clean the plotter as often as is required by the local conditions where the plotter is operated. While accumulations of dust or ink on the plotter will probably not degrade the performance, dust or lint on the grit wheels will affect plotter operation. A build-up of lint or paper fibers on the grit wheels will allow the media to slip and to degrade the accuracy of the plot. As with any precision electronics equipment, proper maintenance will help to prolong the product life.

4-5. CLEANING

WARNING

To prevent possible electrical shock or physical injury from moving mechanical parts, always turn the plotter OFF (O). Remove the ac line cord and the interface cable before performing any maintenance procedures.

4-6. USER CLEANING PROCEDURES

4-7. The following cleaning procedures may be performed by the plotter user. Follow normal safety precautions, and prevent water or other cleaning materials from entering the electronics enclosure of the plotter. If in doubt about any procedure, contact your local Hewlett-Packard sales representative or service personnel.

4-8. Clean the exterior surfaces of the plotter with a soft clean cloth, dampened with warm water. Use a bit of mild soap if necessary. Wipe the surface dry after cleaning.

4-9. Clean the plotter grit wheels by brushing the surface with a clean dry brush. Use the brush from the service kit or a tooth brush to remove the paper fibers from the grit wheels.

4-10. Clean the ink from the pen cappers in the carousel with a cotton swab dampened with warm water and mild soap. Use isopropyl alcohol to remove heavier contamination. Take care not to tear the soft rubber pen cappers. Cleaning the cappers will prevent ink colors from being transferred when pens are changed.

CAUTION

The following cleaning procedures should be performed only by trained service personnel.

4-11. SERVICE PERSONNEL CLEANING PROCEDURES

4-12. Remove accumulations of dust or contamination inside of the electronics enclosure by opening the enclosure and blowing the dust away with compressed air, or vacuuming the dust away with a small, hand-held vacuum.

4-13. Wipe the moving parts of the plotter with a soft dry cloth to remove any accumulated contamination.

4-14. MECHANICAL ALIGNMENT

4-15. No mechanical alignment procedures are required on the HP 7440.

4-16. ELECTRICAL ALIGNMENT

4-17. No electrical alignment procedures are required on the HP 7440.

CHAPTER 5

FUNCTIONAL DESCRIPTION

5-1. INTRODUCTION

5-2. This chapter contains information needed for maintenance and repair of the HP Model 7440, including:

- Simplified Description of Circuits
- Functional Description of Circuits
- Detailed Description of Main PCA Circuitry
- Functional Description of Options
- Detailed Description of Option Circuitry

5-3. SIMPLIFIED DESCRIPTION OF CIRCUITS

5-4. See Figure 5-1, HP 7440 Simplified Block Diagram, while reading the simplified circuit description below.

5-5. The HP 7440 uses microprocessor-based logic to convert digital instructions into a graphic plot. The microprocessor receives instructions from an external controller through its interface circuitry (either HP-IB or RS-232-C) or from the plotter front panel. It then issues data to the Support IC which sends signals to the pen lift drive, paper drive motor, and the pen carriage drive motor to produce the plot.

5-6. The pen carriage (Y-axis) and paper drive (X-axis) motors are reversible dc motors. Encoders on each motor transmit data representing pen carriage and paper position back to the Support IC. The paper drive motor rotates grit wheels which move the plotting medium in the X-axis. The grit wheels also rotate the pen carousel during initialization and pen pick operations. The pen drive motor moves the pen across the plotting surface in the Y-axis.

5-7. There are two HP 7440 interface options. Option 001 has an RS-232-C/CCITT V.24 serial interface. Option 002 has an HP-IB (Hewlett-Packard Interface Bus) parallel data interface which is defined by IEEE standard 488-1978.

5-8. Main memory provides the program instructions and data required for most plotter functions.

5-9. The Graphics Enhancement Cartridge extends the capabilities of the plotter to provide more commands; such as circle, arc, and fill commands.

5-10. The rear panel switches are used to configure the plotter interface.

5-11. The plotter power supply converts 20/30 Vac supplied by a detachable ac power module (not shown on the diagram) into 5 dc voltages used within the plotter.

5-12. FUNCTIONAL DESCRIPTION OF CIRCUITS

5-13. See Figure 12-2. Functional Block Diagram — HP Model 7440 while reading the descriptions below.

5-14. FRONT PANEL

5-15. The plotter may be controlled by pressing function keys at the front panel. The function keys are inscribed with symbols designed to be internationally understood.

5-16. The front panel key symbols, their meanings, and switch functions are described in Chapter 3 of this manual under the heading, SWITCH SETTINGS.

5-17. INTERFACES

5-18. The controller communicates with the plotter via one of two interfaces, HP-IB or RS-232-C depending on the option installed. With either interface, two way communication between the controller and the plotter is possible.

5-19. MICROPROCESSOR

5-20. All plotter operations are directed by the microprocessor. The microprocessor used in the HP 7440 has a built-in serial port and 256 bytes of internal random access memory (RAM). In Option 001 (RS-232-C/CCITT V.24) plotters the serial port is used to communicate with the controller. In Option 002 (HP-IB) plotters the microprocessor communicates with the controller via multiplexed address/data bus lines AD0-7. Lines AD0-7 are bidirectional lines used to carry either data or addresses. Lines A8-A15 are used to address other memory locations.

5-21. SUPPORT IC

5-22. The Support IC is a very large scale integrated circuit (VLSI) that issues drive signals to the Motor Driver ICs and the pen lift drive circuits. The motor drive signals are amplified by the Motor Driver ICs to move the pen carriage, the grit wheels, and the pen carousel. The Support IC monitors the +20/30 V power supply (using the comparator and feedback line PSCOMP) and keeps a number representing the power supply level in an internal counter. When paper has been loaded, and every 5 seconds while the plotter is inactive, the microprocessor accesses the number in the internal counter and adjusts one of the factors used to compute the gain of its output drive signals (X-drive, Y-drive, and pen lift drive). This process compensates for large power supply variations that may occur between uses of the plotter or between plots. The Support IC

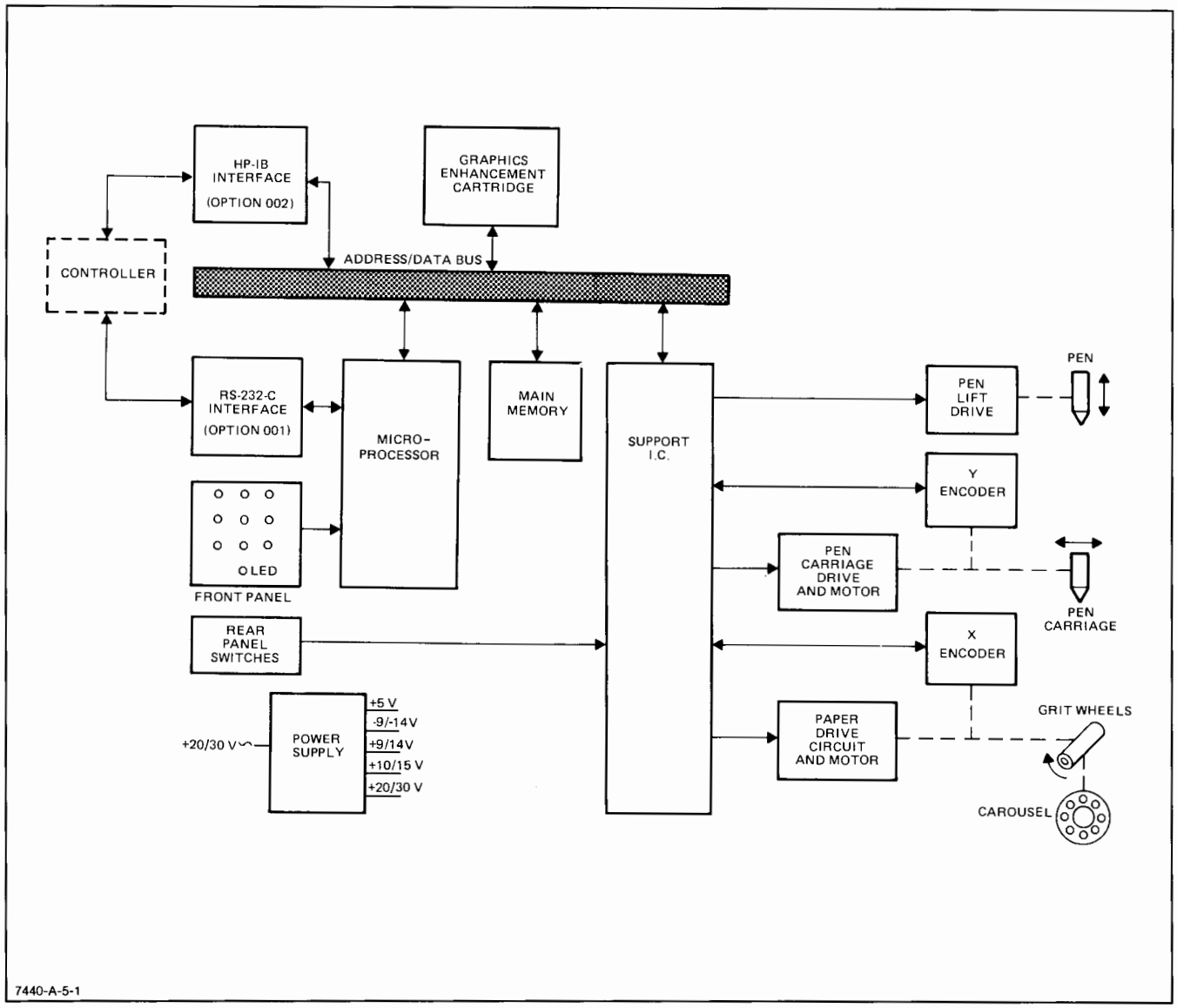


Figure 5-1. HP 7440 Simplified Block Diagram

receives position feedback from X- and Y-encoders mounted on the paper drive and pen carriage drive motors. It makes this position information available to the microprocessor via address/data lines AD0–7.

5-23. GRAPHICS ENHANCEMENT CARTRIDGE (GEC)

5-24. The Graphics Enhancement Cartridge, HP Model 17440A, is a plug-in assembly that extends the graphics capabilities of the HP 7440 so as to provide more commands; such as the circle command, arc commands, and area fill commands. It contains 16K bytes of read only memory (ROM), 2K bytes of random access memory (RAM), and a latch. The ROM holds the HP-GL instructions needed to extend the plotting capability of the HP 7440. The RAM provides additional temporary memory space. The additional temporary memory space provided by the RAM may be used as a graphics buffer, an RS-232-C buffer, and for variables storage. The latch aids in accessing the available ROM and RAM storage locations.

5-25. MEMORY

5-26. The Main PCA ROM holds instructions required for the plotter to perform its normal graphics operations. The Main PCA ROM is a 16K ROM IC. In addition, the microprocessor has 256 bytes of internal RAM, and the Support IC contains 128 bytes of internal RAM.

5-27. POWER SUPPLY

5-28. Six voltages are provided by the HP 7440 power supply circuitry. They are:

1. −9/−14 V regulated
2. +5 V(A) regulated
3. +5 V(B) regulated
4. +9/14 V regulated
5. +10/15 V unregulated
6. +20/30 V unregulated

5-29. The −9/−14 V supply is used in conjunction with one or more of the +5 V supplies to operate the X-axis and Y-axis encoders. In the RS-232-C/CCITT V.24 (Option 001) version, the −9/−14 V and +9/14 V are used to operate the interface output line driver.

5-30. The +10/15 V supply is regulated to obtain two +5 V supplies [+5 V(A) and +5 V(B)]. The two +5 V supplies provide power for the HP 7440 logic circuitry. For the Option 001, the +10/15 V supply is regulated to provide a +9/14 V supply.

5-31. The unregulated +20/30 V supplies the pen carriage and paper drive circuits, drive motors, and the pen coil.

5-32. COMPARATOR

5-33. The comparator is used to develop information about the level of the unregulated +20/30 V power supply. The information is in the form of an asymmetric square wave signal (PSCOMP) that controls a counter in the Support IC. The microprocessor accesses the number in that counter to monitor the level of the unregulated +20/30 V power supply.

5-34. GRIT WHEELS, PEN CARRIAGE, AND PEN CAROUSEL

5-35. The grit wheels move the paper toward the front or rear of the plotter. The pen carriage moves the pen across the paper from left to right. When the pen carriage is in its left limit (as viewed from the front of the plotter), it causes a clutch engaging lever to mechanically link the pen carousel to the grit wheel assembly via a worm gear assembly. While the pen carousel and the grit wheel assembly are linked, the paper drive motor will move both the grit wheels and the pen carousel. The clutch engaging lever is spring loaded; so that, when the pen carriage moves away from its left limit position, the linkage between the grit wheel assembly and the pen carousel is disengaged. Then, the paper drive motor will move only the grit wheels.

5-36. PEN CARRIAGE AND PAPER MOTOR DRIVER ICs, CIRCUITS, AND MOTORS

5-37. The Paper Drive Motor and Pen Drive Motor ICs amplify signals from the Support IC. The amplified signals are coupled through the paper and pen carriage drive circuits to the paper and pen carriage drive motors.

5-38. ENCODERS

5-39. There are two capacitive encoders in the HP 7440 plotter. A capacitive encoder is mounted on one end of the paper drive motor (X-axis), and one is mounted on the end of the pen carriage drive motor (Y-axis). Each encoder provides feedback signals to the Support IC. Movement of a drive motor shaft will cause a shift in the phase of the feedback signal for that axis (COMPX or COMPY). At zero-cross time for a feedback signal, the Support IC starts a counter. It stops the counter at the next zero-cross time for the feedback signal and loads the number from the counter into the X-axis or the Y-axis register as appropriate. The number in a register is used to calculate the present angular position of the motor shaft. The microprocessor accesses the number in each register during its program cycle. The difference between the present position of the shaft and the desired position is used in the microprocessor program to modify the signals sent to the motors.

5-40. PEN LIFT DRIVE CIRCUITS

5-41. The pen lift drive circuits supply power to the pen solenoid. When energized, the pen solenoid raises a pen lift bar, allowing the pen to be lowered to the paper by pen carriage spring tension. Pulse-width-modulated signals from the Support IC control the pen lift driver. Two types of control signals are supplied to the pen lift drive circuits. They are:

1. Solenoid-actuate signal (High power for pulling in the solenoid's center bar)

2. Solenoid-hold signal (Low power for maintaining solenoid's center bar "pulled in")

5-42. PEN SOLENOID

5-43. The pen solenoid is a coil with a movable metal bar in its core. The bar is offset toward the top of the core by spring tension. When current passes through the coil, a magnetic field is created that pulls the metal bar into the center of the core against the spring tension. As long as adequate holding current is passed through the coil the metal bar will remain at the center of the solenoid. When the current ceases to flow, spring tension will push the metal bar up toward the top of the core raising the plotter pen from the paper.

5-44. REAR PANEL

5-45. A switch assembly consisting of seven switches is mounted on the rear panel of RS-232-C and the HP-IB input/output option plotters. This assembly is for configuration of the HP-IB and RS-232-C/CCITT V.24 interfaces. Details about the function of each switch and instructions on how to set the switches are given in Chapter 3 of this manual.

5-46. PEN CAROUSEL

5-47. The pen carousel has eight pen stalls. Each stall contains a capping mechanism which prevents the pens from drying out.

5-48. DETAILED DESCRIPTION OF MAIN PCA CIRCUITRY

5-49. For the Option 001 plotter, see the following schematic diagrams in Chapter 12 while reading the detailed description of Main PCA circuitry:

- Figure 12-5. HP 7440 Main PCA, Option 001 (RS-232-C), Schematic Diagram

- Figure 12-7. HP 7440 Power Supply, Option 001 (RS-232-C), Schematic Diagram

5-50. For the Option 002 plotter, see the following schematic diagrams in Chapter 12 while reading the detailed description of Main PCA circuitry:

- Figure 12-9. HP 7440 Main PCA, Option 002 (HP-IB), Schematic Diagram
- Figure 12-11. HP 7440 Power Supply, Option 002 (HP-IB), Schematic Diagram

5-51. For the Graphics Enhancement Cartridge PCA, see:

- Figure 12-13. HP 17440 Graphics Enhancement Cartridge PCA, Schematic Diagram

5-52. For the Encoder PCA, see:

- Figure 12-15. HP 7440 Encoder PCA, Schematic Diagram

5-53. In the detailed circuit descriptions below, every reference to a part includes a reference designator and an additional reference designator in parentheses. The first reference designator refers to the part as it is labeled in the RS-232-C/CCITT V.24 serial interface Option 001. The reference designator in parentheses is for the HP-IB parallel interface, Option 002.

5-54. MICROPROCESSOR CIRCUITRY

5-55. The microprocessor U9 (U9) used in the HP 7440 has an internal clock circuit controlled by an external 12 MHz clock.

5-56. The microprocessor outputs a 16-bit address. The lower 8 bits (AD0-AD7) are multiplexed to serve as both address and data lines.

5-57. Power up reset (RST). An external RC circuit R26, R27, C31, C41, and C42 (R25, C16, C24, and C32) provides a reset delay signal to the microprocessor and the Support IC at the time power is switched on. Delaying the signal ensures that all other parts are supplied with power before the microprocessor begins its program and the Support IC sends any signals.

5-58. COMPARATOR

5-59. See Figure 5-2 for the signals into and out of the comparator.

5-60. The comparator circuitry compares the filtered output of the power supply pulse width modulator (PPWM) and one-tenth of the value of the +20/30 V power supply. (PPWM is converted to a triangular wave by the filter.) The output of the comparator is a square wave (PSCOMP). The Support IC samples the logic level of PSCOMP at regular intervals, and a counter inside of the Support IC counts up if PSCOMP is high and down if PSCOMP is low. Thus, when the output of the power supply and PPWM are stable, the number in the internal counter will vary slightly around a center value that is proportional to the output of the power supply. A shift in the +20/30 V power supply will change the relationship between the filtered value of PPWM and the part of the power supply voltage that is input to the comparator. Then, depending on the direction the power supply has

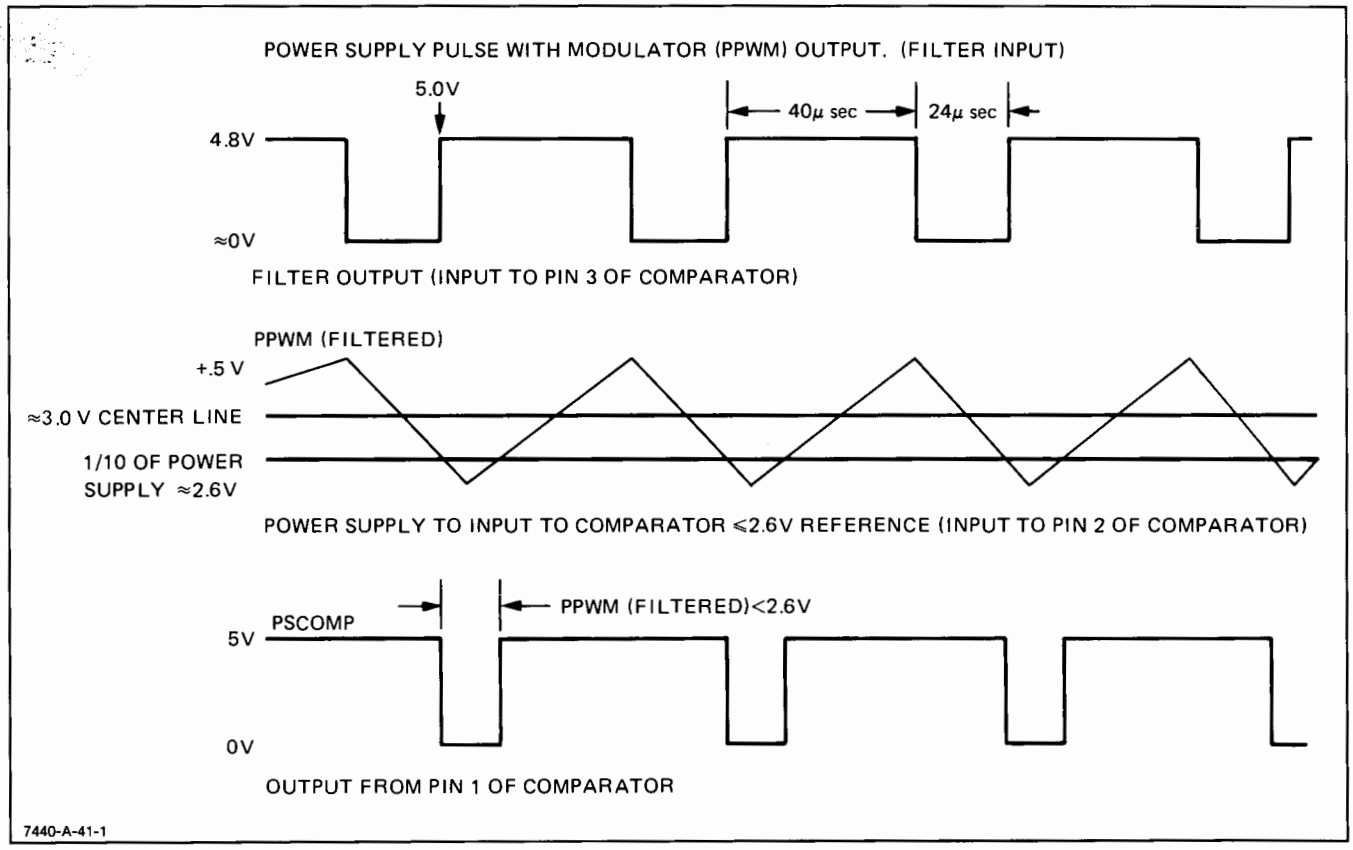


Figure 5-2. Comparator Input and Output Signals

moved, the counter will count up for a longer time or down for a longer time; so that the number in the counter will either increase or decrease. The changed number in the Support IC internal counter modifies PPWM in a direction to stabilize the counter so that it counts up and down around a new center value. Thus, the number in the counter tracks the level of the +20/30 V supply. The microprocessor uses that information, as described earlier in this chapter under the paragraph titled SUPPORT IC, to modify one of the factors involved in computing the desired gain of the plotter drive circuits.

5-61. SUPPORT IC CIRCUITRY

5-62. The Support IC U6 (U7) carries out many plotter functions. To accomplish those functions, it contains the following specialized circuits:

5-63. INTERNAL SUPPLY. The Support IC is an NMOS device that requires a −5 V supply. Since the HP 7440 plotter provides +5 V, the Support IC has an internal supply that uses the "charge pump" principle to convert the +5 V to −5 V. The "charge pump" principle is described in more detail under the heading, POWER SUPPLY CIRCUITRY, where the operation of the −9/−14 V supply is discussed.

5-64. INPUT BUFFER. The input buffer consists of a non-inverting latch and a transceiver. These components are used by the microprocessor to control the flow of information into and out of the Support IC. The microprocessor places a number indicating a desired Support IC function on the address/data (AD) bus, and on address line A13 (CS). If A13 is high the Support IC will be selected. The microprocessor pulls the address latch enable ALE line high. Pulling the ALE line high transmits the information on the AD bus to decoding circuitry inside the Support IC. As soon as it has decoded the information on the address bus, the Support IC will start the internal operations required to accomplish the indicated function.

5-65. ADDRESS DECODE. The address decode circuits read the value in the input buffer and access the section of the Support IC appropriate to the desired function.

5-66. SYNCHRONIZER. The synchronizer uses the 12 MHz clock signal to produce two, 4 MHz, phase-separated signals used to synchronize internal operations. In Option 002 plotters, one of the 4 MHz signals is also used externally as the clock signal for the HP-IB Interface IC.

5-67. POSITION COUNTER. The position counter performs the following functions:

- Generates addresses for the sine ROM in the sine generator. The addresses contain data applied to four output drivers to produce the signals that drive the capacitive encoders (DRIVE 1, DRIVE 2, DRIVE 3, and DRIVE 4).
- Provides a signal to start the pulse-width-modulators (PWMs) once every 64.1 ms.
- Provides a 977 Hz signal for use by the tracking analog-to-digital (TAD) converter.

5-68. POSITION ENCODER REGISTERS. There are two encoder registers in the Support IC, an X-encoder register and a Y-encoder register, that contain numbers representing the current position of the paper and the pen carriage.

5-69. SINE GENERATOR. The sine generator consists of a sine ROM and four output drivers. The sine ROM is addressed with a series of numbers from the position counter. The sine ROM addresses contain numbers that can be used to develop a pulse-width-modulated sine wave. The output of the sine ROM is fed to the output drivers whose outputs are four pulse-width-modulated sine waves, phase-separated by 90 degrees.

NOTE

The sine wave component cannot be observed with an oscilloscope unless the high frequency filter is switched ON (I).

5-70. The pulse-width-modulated sine wave outputs are applied to the X- and Y-encoders, each of which generates a single square wave feedback. The phase of the square wave feedback from the paper drive motor encoder (COMPX) is a function of the current position of the paper drive. The phase of the square wave feedback from the pen drive motor encoder (COMPY) is a function of the current position of the pen drive motor shaft.

5-71. PULSE WIDTH MODULATORS. There are three identical pulse-width-modulators (PWMs) in the Support IC. They are:

1. Paper drive axis PWM (X-PWM)
2. Pen carriage drive axis PWM (Y-PWM)
3. Pen PWM (pen lift drive PWM)

5-72. The X-PWM and the Y-PWM each have two output pins (labeled MOTXA, MOTXB, MOTYA, and MOTYB). Each PWM will put a pulse-modulated signal (square wave) on either the A or the B output pin depending on which direction the drive motor is to rotate. During each servo closure operation of the microprocessor, the control register of each PWM is loaded with a number. The magnitude of the number determines the period of the pulse train output, and the sign bit of the number selects the output pin. In the case of the pen PWM (pen lift drive), movement is in only one direction; therefore only the magnitude of the number input to the control register is significant.

5-73. TRACKING A/D CONVERTER. See Figure 5-3 while reading the following description.

5-74. The microprocessor modifies the numbers sent to the control registers of the PWMs to compensate for variations in the output of the main servo power supply (+20/30 V supply). To accomplish the modification, the microprocessor must receive information about the output of the power supply. It uses the tracking A/D converter (TAD) to find out whether the power supply has a normal output or not.

5-75. At initialization time, in a normally functioning plotter, a zero is clocked into the up/down counter, and

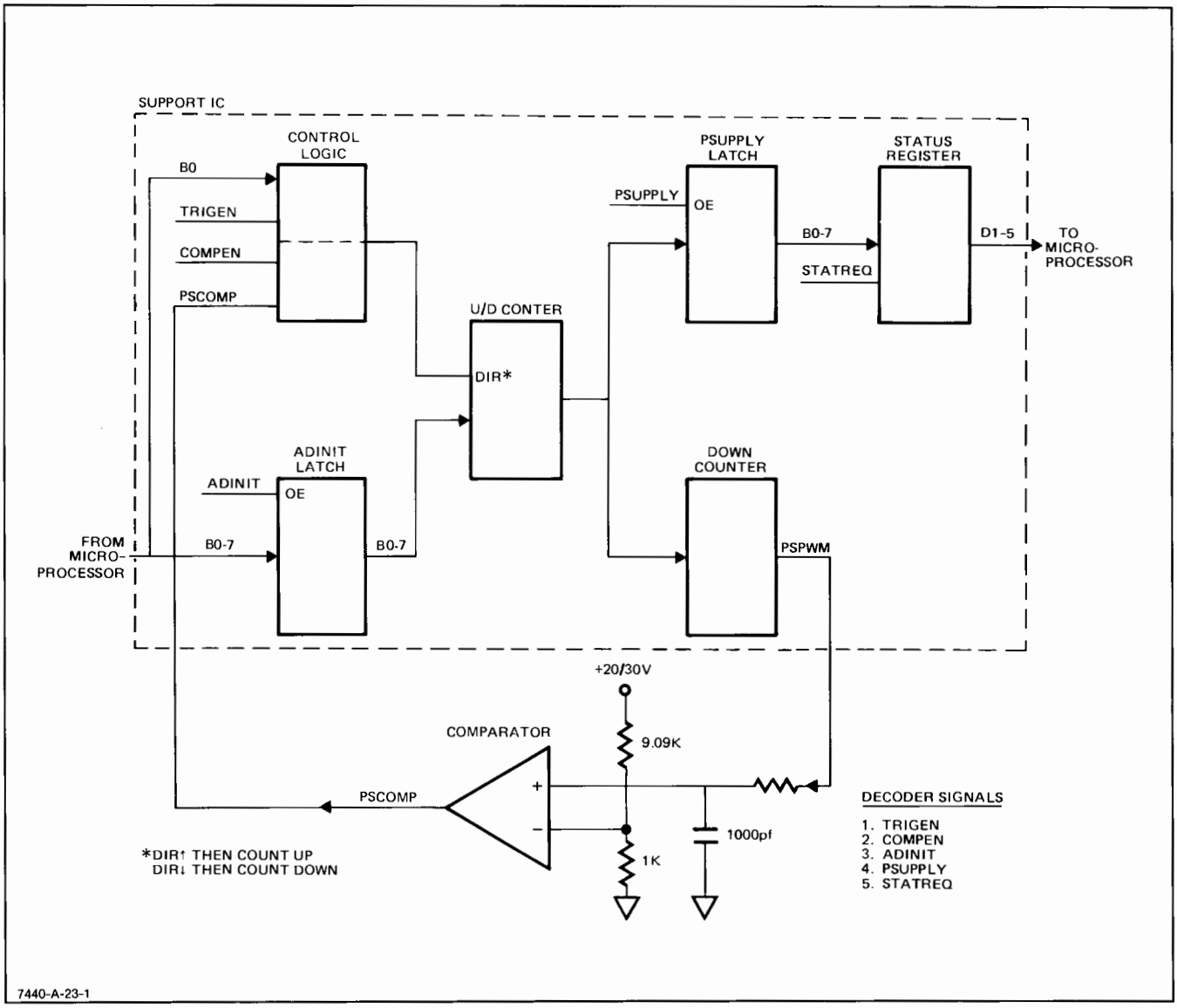


Figure 5-3. Tracking A/D Converter Block Diagram

the comparator enable (COMPEN) signal is high. The output of the control logic circuitry depends on whether PSCOMP is high or low. When PSCOMP is high, a "1" from the control logic circuitry will be clocked through a flip-flop to the up/down counter causing the counter to count up. When PSCMP is low, a "0" from the control logic circuitry will be clocked through the flip-flop and the counter will count down.

5-76. As described in an earlier paragraph of this chapter under the heading COMPARATOR, the number in the U/D counter will stabilize around a value that tracks the level of the +20/30 V power supply. If the plotter has just been switched on and initialized, or every 5 seconds while the plotter is inactive, the microprocessor will access the number in the U/D counter by using the PSUPPLY latch to send the number to the status register (via the B0-7 bus) and then accessing the status register to find out whether the +20/30 V supply is functioning normally. If the power supply level has changed beyond the allowable range, the microprocessor will adjust a gain factor involved in computing the gain of the plotter drive circuits. The result will be a change in the period of the X-, Y-, and pen PWM output pulses.

5-77. STATUS REGISTER. The status register will output the status of the following sections of the Support IC upon receiving a status request from the microprocessor:

- Paper drive PWM
- Pen carriage drive PWM
- Pen lift PWM
- Power supply PWM (PPWM)
- DSA bit
- A zero on the last bit of the register (B7)

5-78. REAR PANEL TRANSMITTER. The rear panel transmitter in the Support IC contains circuitry that allows the microprocessor to read the position of the rear panel switches. The position of these switches determines the configuration of the RS-232-C or the HP-IB interface.

5-79. STATIC RANDOM ACCESS MEMORY. The Support IC contains 128 words of 8-bit-wide, static, random-access memory (RAM) that can be read or written to like any other system RAM.

5-80. READ ONLY MEMORY CIRCUITRY

5-81. The Read Only Memory (ROM) U11 (U11) contains 16K bytes of fixed routines required for plotter operation.

NOTE

The ROM in some earlier models may be an EPROM or a standard ROM. Later versions have a latched ROM.

5-82. In the EPROM version of the circuit, the control signal, address latch enable (ALE), from the microprocessor, is applied to U10 (U10) to latch an address from lines AD0-AD7 onto lines A0-A7 (demultiplexing AD0-AD7).

5-83. In the latched ROM version of the circuit, U10 (U10) is not used and ALE will latch an address from lines A8-A13 to address lines A0-7 inside the ROM using an internal latch. Then, at a later time, the address on internal lines A0-7 and a new address placed on A8-13 will combine to produce address word A0-13.

5-84. Because the parallel data outputs of the ROM are 3-state, they are effectively disconnected from the data bus while the ROM is not enabled.

5-85. RANDOM ACCESS MEMORY CIRCUITRY

5-86. RAM on the main board consists of the 256 bytes available within the microprocessor and the 128 bytes available within the Support IC. If installed, the GEC provides 2K bytes more of RAM.

5-87. MOTOR DRIVE CIRCUITRY

5-88. Motor drive signals (MOTXA, MOTXB, MOTYA, & MOTYB) from the Support IC PWMs are applied to Motor Driver ICs U1 and U2 (U1 and U2). The signals will be amplified and sent to their appropriate motors if the output of Motor Driver Control IC U5B (U8B) is high. The microprocessor controls the output of the Motor Driver Control IC by controlling the output of port 1 pin 8 (P1.7). If P1.7 is pulled high, the base of Q3 (Q2) will temporarily go negative causing Q3 (Q2) to conduct. U5B (U8B) pin 5 will go high, and an amplified high will be output at pin 7. The high from U5B (U8B) pin 7 will enable the Motor Driver ICs U1 and U2 (U1 and U2).

5-89. Shottky diodes CR7-14 ensure that negative and positive spikes are not sent on to the motor fields causing oscillations in the motor circuits or high frequency electronic emissions from the motor drive lines.

5-90. MOTOR SUPPLY SENSOR CIRCUITRY

5-91. The motor supply sensor circuitry helps the comparator monitor the level of the unregulated +20/30 V power supply to the drive motors; so that the gain of the motor drive circuits can be adjusted to compensate for variations.

5-92. The sensor circuitry consists of a divider (R1 and R2 for Option 001 or R4 and R5 for Option 002) that places approximately one-tenth of the power supply voltage at the inverting input to the comparator and an input filter, R6 and C10 (R6 and C21). Pulses (PPWM) from the Support IC are applied to the filter at the noninverting input to the comparator. The filter converts the pulses to a triangular wave as discussed earlier in this chapter under the heading COMPARATOR, and the output of the comparator (PSCOMP) depends on the relation between the divider input to the comparator and the filtered input to the comparator.

5-93. CAPACITIVE ENCODER CIRCUITRY

5-94. The Support IC sine generator provides drive signals that are transmitted via separate cables to the X-and the Y-Motor Encoder PCAs that are mounted on the ends of the drive motors. The PCAs together with a conductive sense wheel and return plate for each encoder make up the capacitive encoder circuitry. The following description deals primarily with the X-encoder, but the same principles of operation are used in the Y-encoder.

5-95. Figure 5-4 shows the X-Encoder PCA with cover attached. If the four, hex-head screws that fasten the cover were removed and the cover were turned over, the motor armature grounding brush would become visible as shown in Figure 5-5. The sole purpose of the brush is to ground the armature of the motor. When the Encoder PCA cover is removed, the encoder appears as shown in Figure 5-6. Cable connector P1 is shown disconnected from J1 of the Encoder PCA and positioned directly above J1. The pins of P1 are aligned with the pins of J1. The top row of numbers on Figure 5-7 are P1 pin numbers. The second row of numbers on the figure are hybrid filter pin numbers. A single cable connects:

1. Motor drive signals to the X-motor armature (XMOTORA & XMOTORB).

2. Drive signals for the capacitive encoder (DRIVE 1, DRIVE 2, DRIVE 3, DRIVE 4).

3. Voltages necessary to power the Encoder PCA (−9/−14 V, +5 V, COM).

4. The COMPX feedback signal to the Support IC.

5-96. The drive signals for the capacitive encoder are routed through the PCA to copper segments on its inner side. There are 32 segments distributed evenly around a circle on the PCA inner surface. (See Figure 5-7.) The individual drive signals are connected to every fourth segment. For example, if the segments were numbered and DRIVE 1 were connected to segment 1, DRIVE 2 were connected to segment 2, etc., then DRIVE 1 would be connected to segments 1, 5, 9, 13, 17, 21, 25, and 29 and DRIVE 2 would be connected to segments 2, 6, 10, 14, 18, 22, 26, and 30. Thus, each signal would be applied to a segment in the same relative position in all 8 sectors of the circle.

5-97. When the Encoder PCA is installed, the 32 copper segments on its inner side are located directly above the sense wheel shown in Figure 5-8. The sense wheel is a solid piece of conductive material with eight radial,

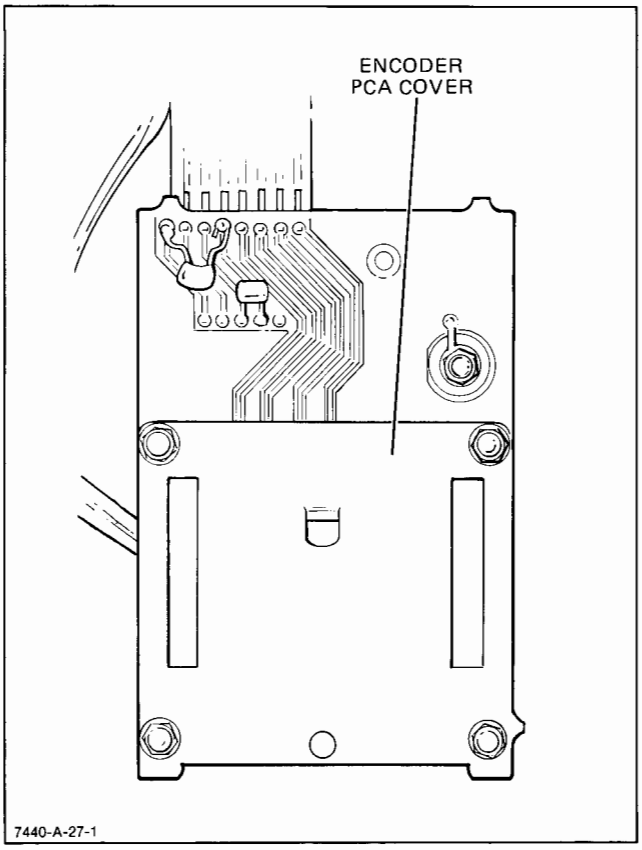


Figure 5-4. Encoder PCA Cover, Outer Side

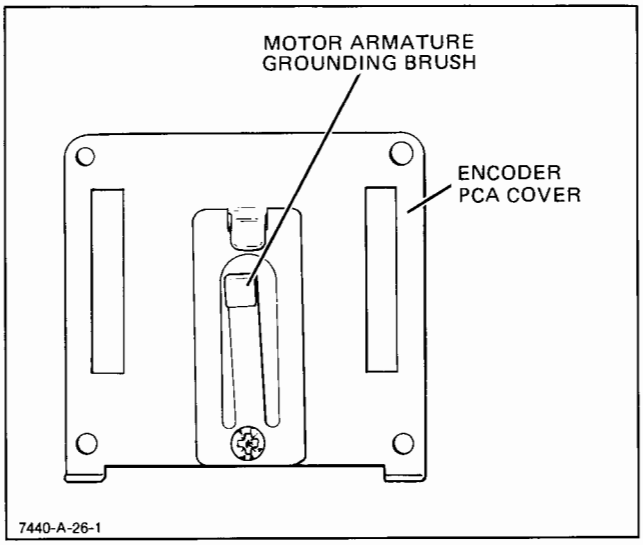


Figure 5-5. Encoder PCA Cover, Inner Side

raised vanes. The sense wheel is locked to the motor shaft. For any given position of the motor shaft each vane will be located in the same relative position within one of the 8 sectors of the circle. The sense wheel does not touch the Encoder PCA but rotates just below it. The voltage induced in the sense wheel at any instant across the gap between the sense wheel and the Encoder PCA will be slightly less than the vector sum of the drive signals applied to the Encoder PCA. The phase of the induced signal relative to DRIVE 1, or to a hypothetical sine wave originating at some arbitrary time designated as zero, depends on the position of the sense wheel vanes within the sectors of the circle.

5-98. The signal induced in the sense wheel is a single, phase-shifted, sine wave. This signal is converted to the feedback signal COMPX as follows; a fixed return plate made of conductive material is located just below the sense wheel (see Figure 5-8). The sine wave will be capacitively induced without phase shift from the sense wheel to the return plate. The signal on the return plate is input to a hybrid filter on the Encoder PCA (see Figure 5-6) where it is amplified, shaped and filtered to produce the feedback signal, COMPX. The feedback signal, COMPX, is the square wave used by the Support IC to create a number that represents to the microprocessor the present position of the paper drive (X) motor. The process just described is also used in the pen drive encoder to produce the feedback signal, COMPY.

5-99. PEN LIFT CIRCUITRY

5-100. The pen lift drive circuit consists of Q2 (Q4) and Q4 (Q1) and associated resistors. When the microprocessor receives a pen down instruction from either the controller or the front panel, it causes the Support IC to issue pulse width modulated signals to the pen lift drive circuit. Because more power is required to activate the pen solenoid than is needed to hold it after activation, the pulse is widened for a short period of time to provide this extra power. Numbers issued to the Support IC by the microprocessor control the duration of the pulse-width-modulated signals. The numbers that will be issued by the microprocessor depend on whether the pen is to be lowered or simply held down, and on the value of the +20/30 Vdc unregulated supply voltage.

5-101. POWER SUPPLY CIRCUITRY

5-102. Six major voltages are generated by the HP 7440 circuitry.

5-103. See supplies Service Sheet 4 (Option 001) or 6 (Option 002) while reading this description of the power supply circuitry.

NOTE

The decoupling capacitors for all ICs are shown at the far right side of the diagram. To relate each decoupling capacitor to its appropriate IC, refer to the table on the service diagram just to the right of the power supply schematic. For your convenience, the same table is also included on the Main PCA schematic diagrams.

5-104. The ac power module assembly provides 20/30 Vac to the four pin, input jack, J2. This ac voltage is full-wave rectified by a bridge rectifier consisting of diodes CR3, CR4, CR5, and CR6 (CR2, CR3, CR4, and CR5). C1, C3, and C11 (C1, C3, and C14) filter the 20/30 Vac input to the bridge rectifier. C33 (C18) smoothes the ripple in the unregulated +20/30 V output of the bridge rectifier. Decoupling capacitor C4 (C4) is associated with the Motor Driver ICs U1 and U2 (U1 and U2).

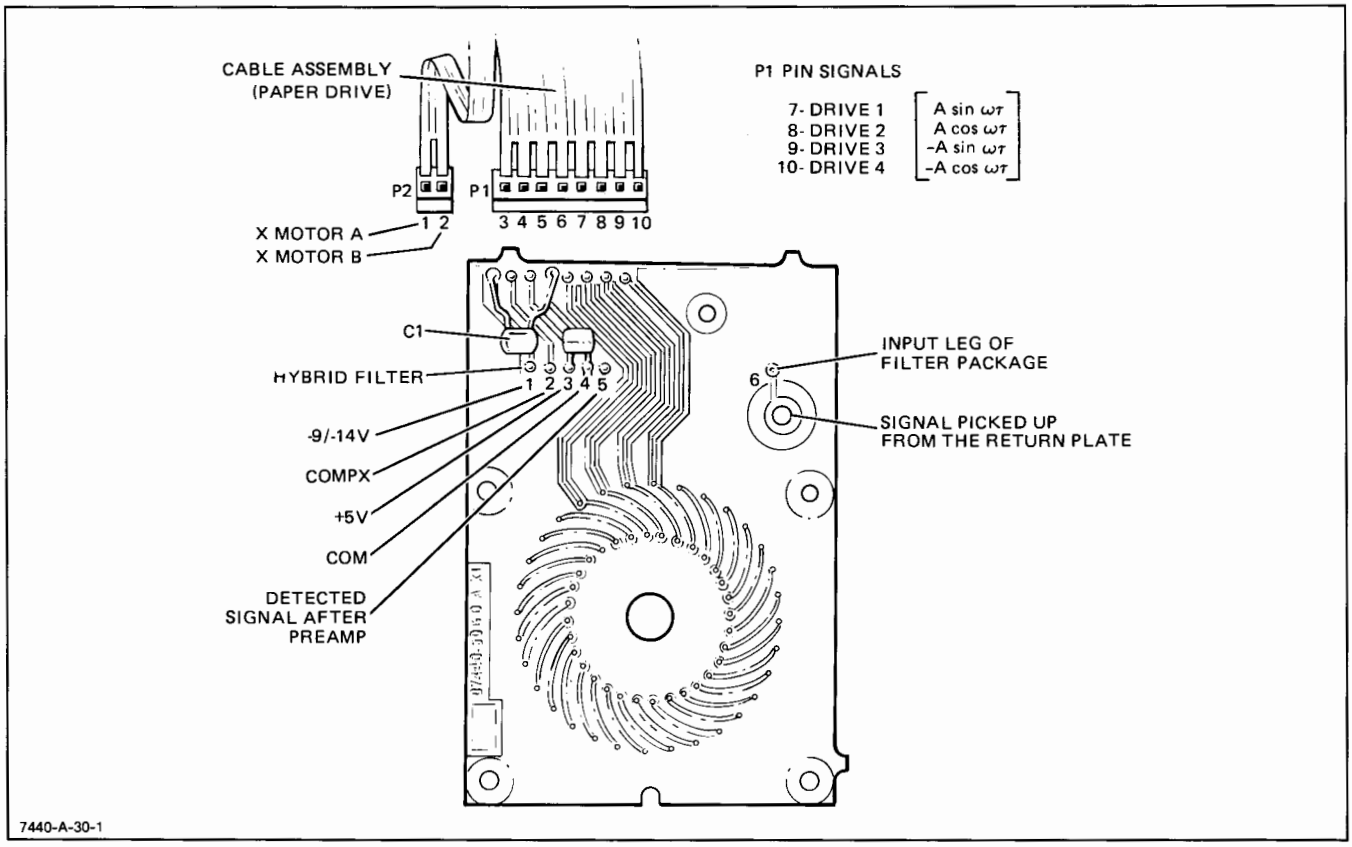


Figure 5-6. Encoder PCA, Outer Side

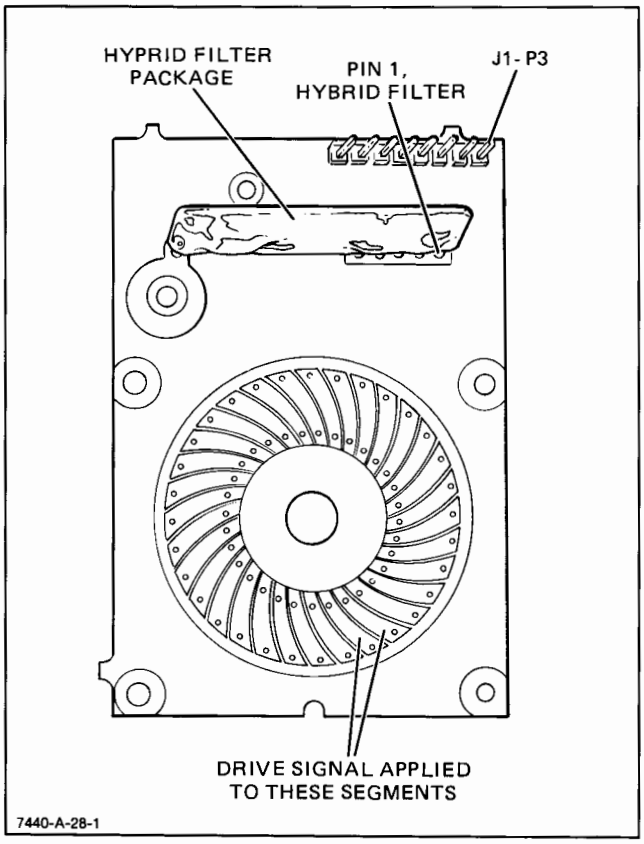


Figure 5-7. Encoder PCA, Inner Side

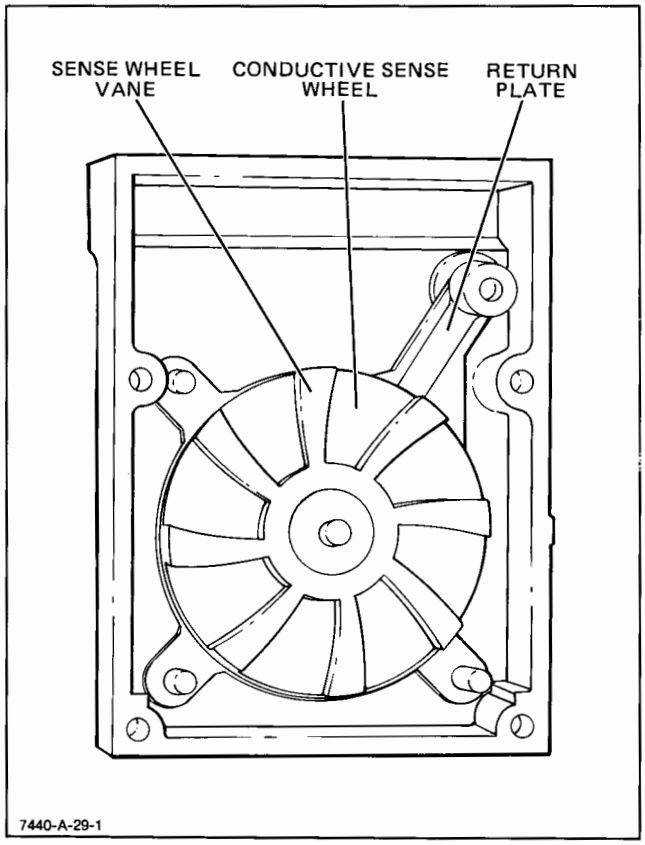


Figure 5-8. Encoder Sense Wheel and Return Plate

5-105. The unregulated +20/30 V is supplied to the Motor Driver ICs, motor driver circuits, motors, and the pen coil. The +20/30 V supply can be left unregulated because of the comparator and motor supply sensor circuitry.

5-106. In the RS-232-C, the unregulated +10/15 V is input to VR1 which produces a regulated, current limited +9/14 V. The 33 ohm resistor, R24, will open up if current drawn by the load is excessive.

5-107. Due to the load requirements of the HP 7440, two +5 V sources are supplied. They are +5 V(A) and +5 V(B). The +5 V supplies are produced by applying unregulated +10/15 V to voltage regulators, U3 and U4 (U3 and U4). The inputs to U3 and U4 are smoothed by C2, C6, C7, and C32 (C2, C6, C7 and C17). CR1 (CR1) routes any negative inputs to ground. The two +5 V supplies produced by U3 and U4 provide power for the plotter logic circuitry.

5-108. To produce the −9/−14 V supply, +20/30 V is applied to the collectors of Q5 and Q6. R19 (R15) reverse biases the collector of Q6. A 15.6 kHz signal from the Support IC is fed to the base of Q5 via R20 (R16). Each time this signal goes positive, it will draw electrons from the positive plate of capacitor C37 (C33) and cause electrons to pile up on the negative plate. C37 (C33) will continue charging during each pulse until CR20 (CR22) is reverse biased. Each time the signal drops to zero, C37 (C33) will discharge through CR21 (CR21) and R14 (R24) to ground charging C34 (C30) to approximately −14 V. When current is drawn from the −14 V supply, C34 (30) requires more time to become charged. Therefore, there can be some variation in the output of the −9/−14 V supply depending on its load.

5-109. The process of charging a capacitor to derive a negative supply from a positive voltage source is sometimes referred to as the "charge pump" principle.

5-110. GRAPHICS ENHANCEMENT CARTRIDGE CIRCUITRY

5-111. See the service sheet titled HP 17440 Graphics Enhancement Cartridge PCA, Schematic Diagram, while reading these paragraphs. The Graphics Enhancement Cartridge (GEC) plugs into connector J6 on either the Option 001 or the Option 002 plotter. To address the 2K RAM, U2, or the 16K ROM, U3, the lower half of the address will be placed on data lines AD0-AD7 and latched through U1 (as A0-A7) by pulling ALE control line high. The upper half of the address will be placed on address lines A8-A15. If A15 is low, the RAM will be selected. If A15 is high, the ROM will be selected. The states of RD' and WE' determine whether data will be written to or read out of RAM. Data on lines AD0-AD7 would be written into RAM. Data read out of RAM or ROM would also appear on lines AD0-AD7.

5-112. Clamping diodes prevent signal overshoots. The +5 V supply is prevented from rising above 6.2 V by voltage regulator VR1. Capacitors C1-C4 damp transient variations in the +5 V supply.

5-113. FUNCTIONAL AND DETAILED DESCRIPTIONS OF I/O OPTIONS

5-114. FUNCTIONAL DESCRIPTION OF THE RS-232-C/CCITT V.24 INTERFACE (OPTION 001)

5-115. See Figure 5-9, RS-232-C/CCITT V.24 Block Diagram, while reading the following description.

5-116. Serial data is passed from the external controller to the plotter on line RXD and data control signals for the microprocessor are passed on separate lines DSR, CTS, and RLSD. The data and control signals are amplified and inverted on their way to the microprocessor by a line receiver. The microprocessor indicates it is ready to transmit by pulling the DTR line low. Data is sent from the microprocessor on line TXD. The control signal and the serial data are transmitted in inverted form through a line driver to the external controller. The external controller may be either a terminal or a modem.

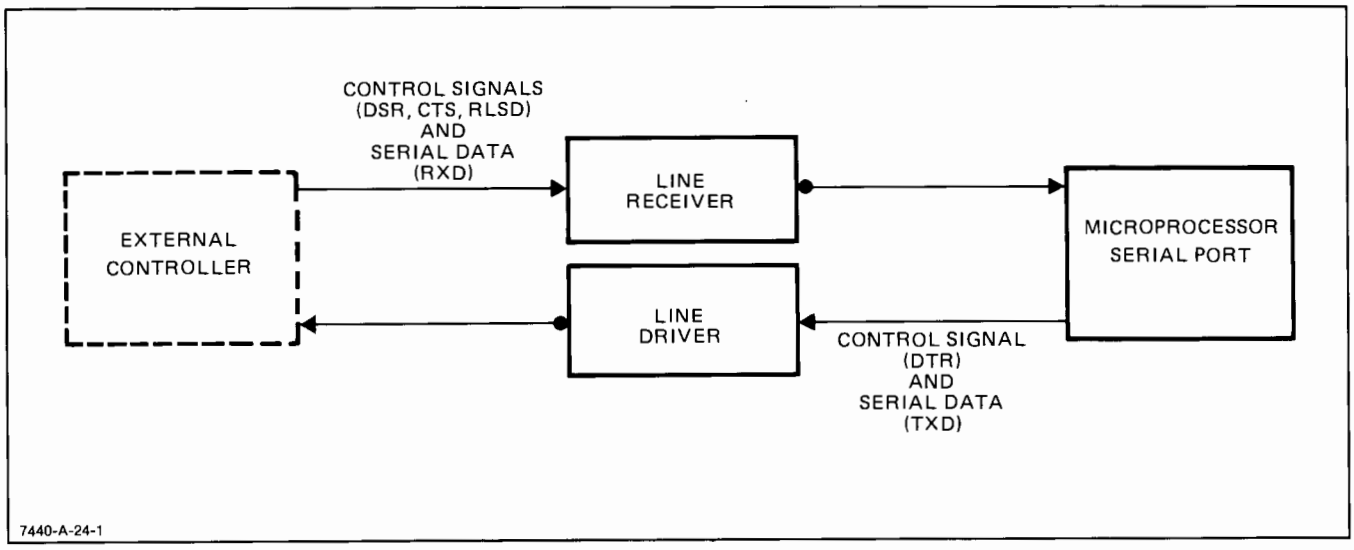


Figure 5-9. RS-232-C/CCITT V.24 Block Diagram

5-117. DETAILED DESCRIPTION OF THE RS-232-C/ CCITT V.24 INTERFACE (OPTION 001)

5-118. See the service sheet in Chapter 12 titled HP 7440 Main PCA, Option 001 (RS-232-C), Schematic Diagram for the signals discussed below.

5-119. OPERATION. The Option 001 I/O (Input/ Output) is an asynchronous, full-duplex, bit-serial interface for hardwired connection to a computer, modem, or terminal. Input and output are controlled in the HP 7440 by a serial port in the plotter microprocessor. This interface is compatible with EIA Standard RS-232-C and with CCITT V.24.

5-120. DATA INPUT AND OUTPUT CIRCUITS. Because signals within the HP 7440 are positive-true TTL levels, inverting line receivers and drivers, U7 and U8 are used to convert the logic and voltage between the levels required by the interface system.

5-121. The direction and timing of data flow through the data bus interface is established within the microprocessor.

5-122. The function of each RS-232-C I/O line is:

a. DATA SET READY (DSR) — Activated by the controller/modem to tell the plotter that the terminal/modem is operational.

b. CLEAR TO SEND (CTS) — Activated by the controller/modem to tell the plotter that it is ready to receive and retransmit data.

c. DATA TERMINAL READY (DTR) — Activated by the plotter to tell the controller/modem to come up on the communication line.

d. RECEIVED DATA (RXD) — Used to transmit data from the controller to the plotter microprocessor.

e. TRANSMITTED DATA (TXD) — Used to transmit data from the plotter microprocessor to the controller.

f. RECEIVED LINE SIGNAL DETECTOR (RLSD) — If the controller or modem stops sending a carrier signal, the RLSD level on the interface bus will go low. This signal will be inverted by U7. After inversion, the signal is designated RLS', and will cause the plotter microprocessor to shut down communications.

5-123. BAUD RATE. Baud rate is selected by means of the rear panel switches. The baud rate is transmitted to the microprocessor by the Support IC when the microprocessor requests it.

5-124. FUNCTIONAL DESCRIPTION OF THE HP-IB INTERFACE (OPTION 002)

5-125. See Figure 5-10, HP-IB Block Diagram, while reading the following description.

5-126. The HP-IB interface circuitry is defined by the IEEE 488 standard. It is more complex than the RS-232-C, but much faster at transmitting data because the data is transmitted at a byte per time unit along parallel lines rather than in bit-serial form along a single line. The passage of signals between the external controller and the plotter microprocessor along data lines DIO1-DIO8 and PIO1-PIO8 is managed by the HP-IB interface IC using the eight management lines and T/R (transmit/ receive) line 1.

5-127. The eight management lines can be broken down into three data transfer (handshake) control lines (DAV, NRFD, and NDAC) and five interface management lines (ATN, SRQ, IFC, EOI, and REN). The passage of each byte involves a set sequence of management steps using the three handshake lines.

5-128. The microprocessor addresses the HP-IB interface IC using address/data lines AD0-7 and communicates with the HP-IB interface IC along the same lines. WR' and RD' are used by the microprocessor to set the direction of signal flow along lines AD0-7. The RST line delays the operation of the HP-IB Interface IC until the plotter is fully powered.

5-129. The Support IC provides the HP-IB Interface IC with the 4 MHz clock pulse that drives it. The microprocessor selects the HP-IB Interface IC by causing the Support IC to pull the EXT line low.

5-130. DETAILED DESCRIPTION OF THE HP-IB INTERFACE (OPTION 002)

5-131. See Chapter 12, Service Sheet 5, Figure 12-9. HP 7440 Main PCA, Option 002 (HP-IB), Schematic Diagram for the signals discussed below.

5-132. Input/Output voltage levels must meet TTL requirements (low $\leqslant$ 0.8 V; high $\geqslant$ 2.0 V). All signals are active low (true).

5-133. All data and control signals to and from the HP-IB go through U5, the HP-IB bus transceiver, which is enabled to transmit or to receive by U6, the HP-IB Interface IC, in response to HP-IB commands and microprocessor input. The HP-IB Interface IC automatically handles all handshake requirements on the HP-IB bus. When the plotter power is on, the HP-IB bus transceiver inputs are set to the high impedance state to prevent loading the data lines. When the plotter power is off, the bus transceiver presents an open circuit to all data lines; consequently, the plotter does not interfere with other HP-IB operations.

5-134. A 16-line bus is used to carry data and control information and is divided into three sets of lines.

a. Data bus — eight signal lines — DIO1-DIO8.

b. Data transfer control — three signal lines — DAV, NRFD, and NDAC.

c. Interface management — five signal lines — ATN, SRQ, IFC, EOI, and REN.

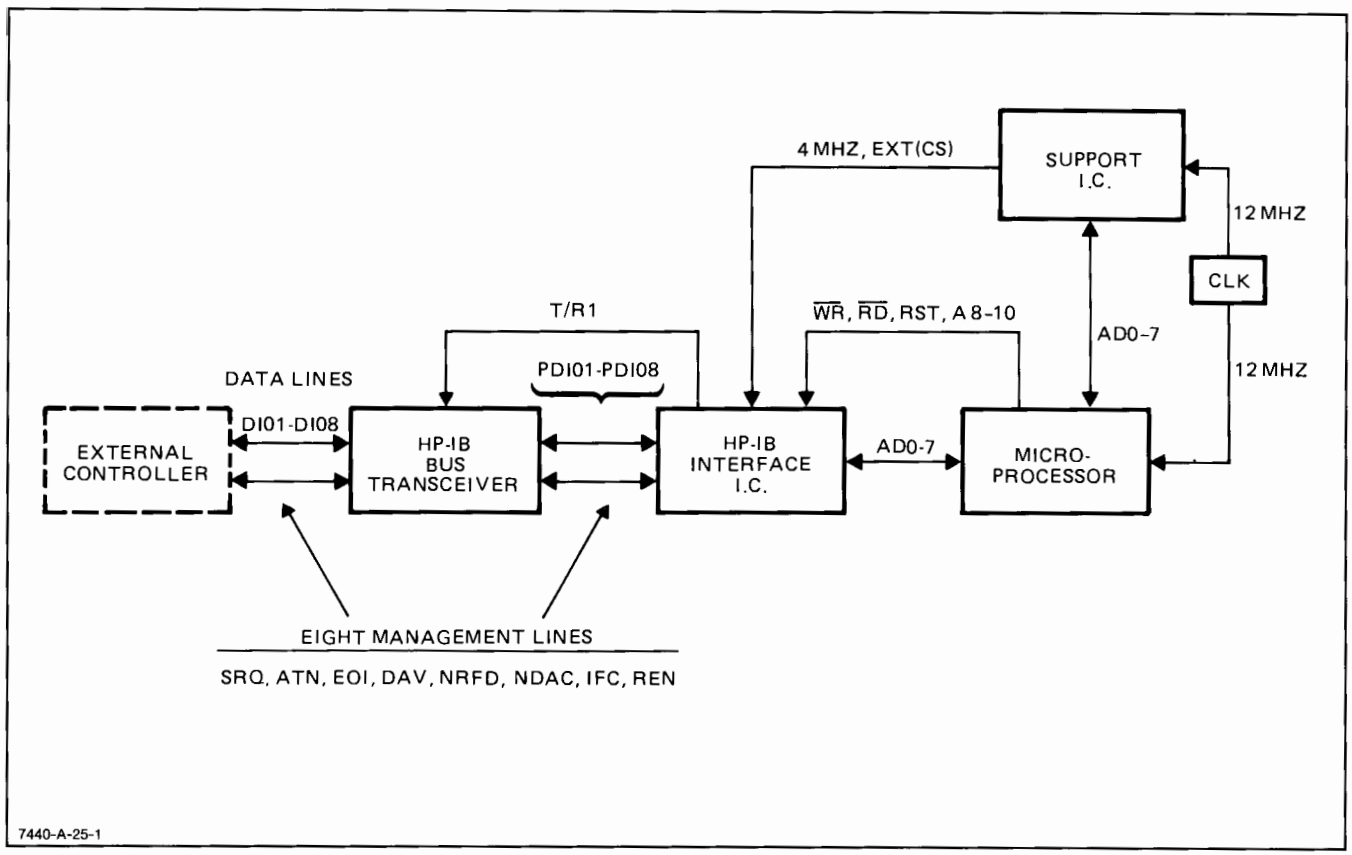


Figure 5-10. HP-IB Block Diagram

5-135. The data bus transfers 8-bit data between the controller and the plotter. The data are in bit-parallel, byte-serial form. The data are transferred bidirectionally and asynchronously.

5-136. The three data transfer control lines, or "handshake lines" are used to control the transfer of information on the data bus. These lines are identified as follows:

a. DATA VALID (DAV) — Used to indicate that valid information is available on the data lines.

b. NOT READY FOR DATA (NRFD) — Used to indicate the readiness of the plotter to accept information.

c. NOT DATA ACCEPTED (NDAC) — Used to indicate the acceptance of information by the plotter.

5-137. The five interface management lines are used to provide an orderly flow of information across the interface bus. The lines are identified as follows:

a. ATTENTION (ATN) — Used to identify information on the data bus. The information is a command, data, or parallel poll response.

b. SERVICE REQUEST (SRQ) — Used to indicate that the plotter needs attention.

c. INTERFACE CLEAR (IFC) — Used by the controller to place the bus in a known quiescent condition.

d. END OR IDENTIFY (EOI) — Used by a talker to indicate the end of a multiple byte transfer sequence or, in conjunction with ATN to execute a polling sequence.

e. REMOTE ENABLE (REN) — Used to enable a remote control mode.

5-138. Positive true logic is used within the plotter circuitry. Therefore a positive false NRFD (NRFD low) on the HP-IB bus will be converted to a positive true RFD (RFD high) within the plotter. That is, when the controller is ready for data, it will pull the NRFD line low. The low NRFD signal will be converted by U5 to a high RFD signal within the plotter.

5-139. When the HP-IB Interface IC, U6, receives a RESET pulse from the microprocessor, U9, it sets the NDAC and NRFD lines low, indicating the ready condition. (When power to the HP 7440 is first switched on, C16 and C32 will cause a fixed delay before the reset line goes high.) The controller will set ATN true indicating a bus message or address, and put the device address on data lines DIO1-DIO5. The HP-IB Interface IC compares the address on the bus with the setting of the HP-IB address switches on the rear panel switch assembly. (Read at power up.) If the address is valid, the HP-IB Interface IC will then decode lines DIO6 and DIO7, to determine if the HP 7440 is being addressed as an acceptor (listener) or source (talker). When the controller sends a valid address with DIO6 true and DIO7 false, the

plotter is being addressed as a listener. When the controller is ready to transfer data, the following sequence to transfer data is involved:

a. The plotter indicates that is ready to accept data by setting NRFD false and NDAC true.

b. After RFD has gone true, the controller places a data byte on the eight data lines and sets DAV true.

c. After the DAV line has gone true, the plotter sets RFD false, accepts the data, and sets DAC true.

d. After the DAC line has gone true, the controller can set DAV false again and take the data off the line. When DAV goes false, the plotter sets DAC false.

e. When the plotter can accept a new byte of data, it puts RFD true, and the sequence is ready to start from step a.

5-140. The HP-IB Interface IC is enabled by a low chip select not (CS') signal from Support IC U7. When the HP-IB Interface IC is enabled and its read not (RD') input is low, data can be read from the IC. When the write enable not (WE') input is low, data can be written by the microprocessor into the HP-IB Interface IC. The RD' and WE' inputs and the three register selection inputs, RS0-RS2 (A8-A10 from the microprocessor), select the proper register to handle the data in the HP-IB Interface IC.

CHAPTER 6

REMOVAL AND REPLACEMENT

6-1. INTRODUCTION

6-2. This chapter contains parts removal and replacement procedures. The procedures are summarized in matrix form at the end of the chapter.

6-3. SAFETY CONSIDERATIONS

6-4. Warning statements are included in these removal and replacement procedures to protect you from personal injury. Read and follow any instructions contained in the warning statements.

6-5. REQUIRED TOOLS/EQUIPMENT

6-6. The following tools are required for the disassembly and reassembly procedures:

1. Pozidriv #2 Screwdriver
2. Pozidriv #1 Screwdriver
3. Long Nose Pliers

6-7. DISASSEMBLY AND REASSEMBLY PROCEDURES

WARNING

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

WARNING

Procedures described in this chapter are performed with protective covers removed. If the plotter is not disconnected from the power source, voltage available at many many points can, if contacted, result in personal injury.

WARNING

Avoid contact with moving media. Long hair or ties and other clothing can get caught on the media and become entangled in the plotter mechanics resulting in personal injury. Lacerations can also occur due to contact with the edges of the moving media. Do NOT allow hair or clothing to contact the plotter mechanics while servicing the plotter. Personal injury and damage to the plotter may result.

6-8. OPENING UP THE PLOTTER

6-9. To open up the plotter, perform the following steps:

a. Disconnect the ac power module.

b. Lift the carousel from its receptacle.

c. Turn the plotter bottom side up.

d. Remove the two securing screws from the rear corners of the base assembly. See Figure 6-1, Detail A.

e. Holding the top case in contact with the base assembly, turn the plotter top side up.

f. Grasp the top case by its rear corners, raise it so that the retaining tabs clear their slots, and lift it clear of the base assembly. See Figure 6-1, Detail B and Detail C.

g. Reassemble the plotter by reversing the above procedure, taking care to seat the top case retaining tabs in the slots provided.

6-10. CHASSIS ASSEMBLY REMOVAL

6-11. To remove the chassis assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the mounting screw located at the base of the chassis assembly on the right side. See Figure 6-2, Detail A.

d. Disconnect the two motor encoder connectors and the pen solenoid cable connector from the main printed circuit assembly (PCA). See Figure 6-2, Detail B.

e. Grasp the chassis assembly by its right side and lift it clear of the base assembly until the left leg is disengaged from the base assembly slot. See Figure 6-2, Detail C.

f. Reassemble the plotter by reversing the above procedure.

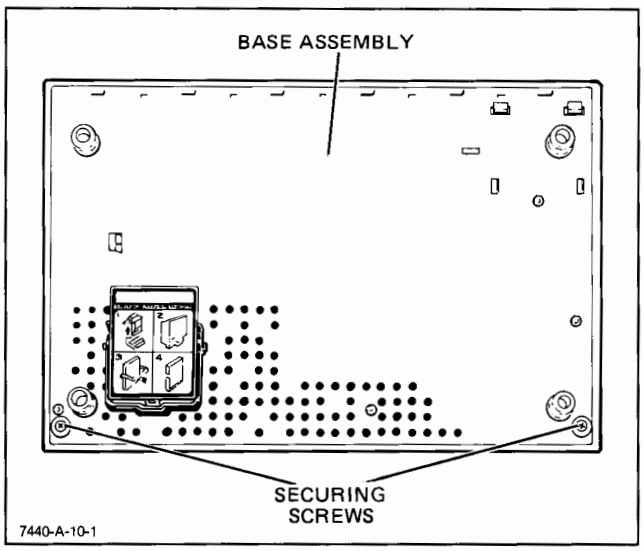


Figure 6-1. Opening up the Plotter, Detail A

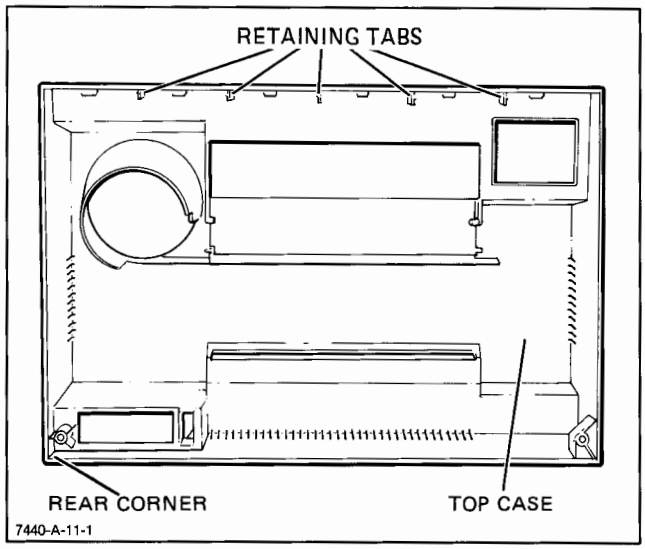


Figure 6-1. Opening up the Plotter, Detail B

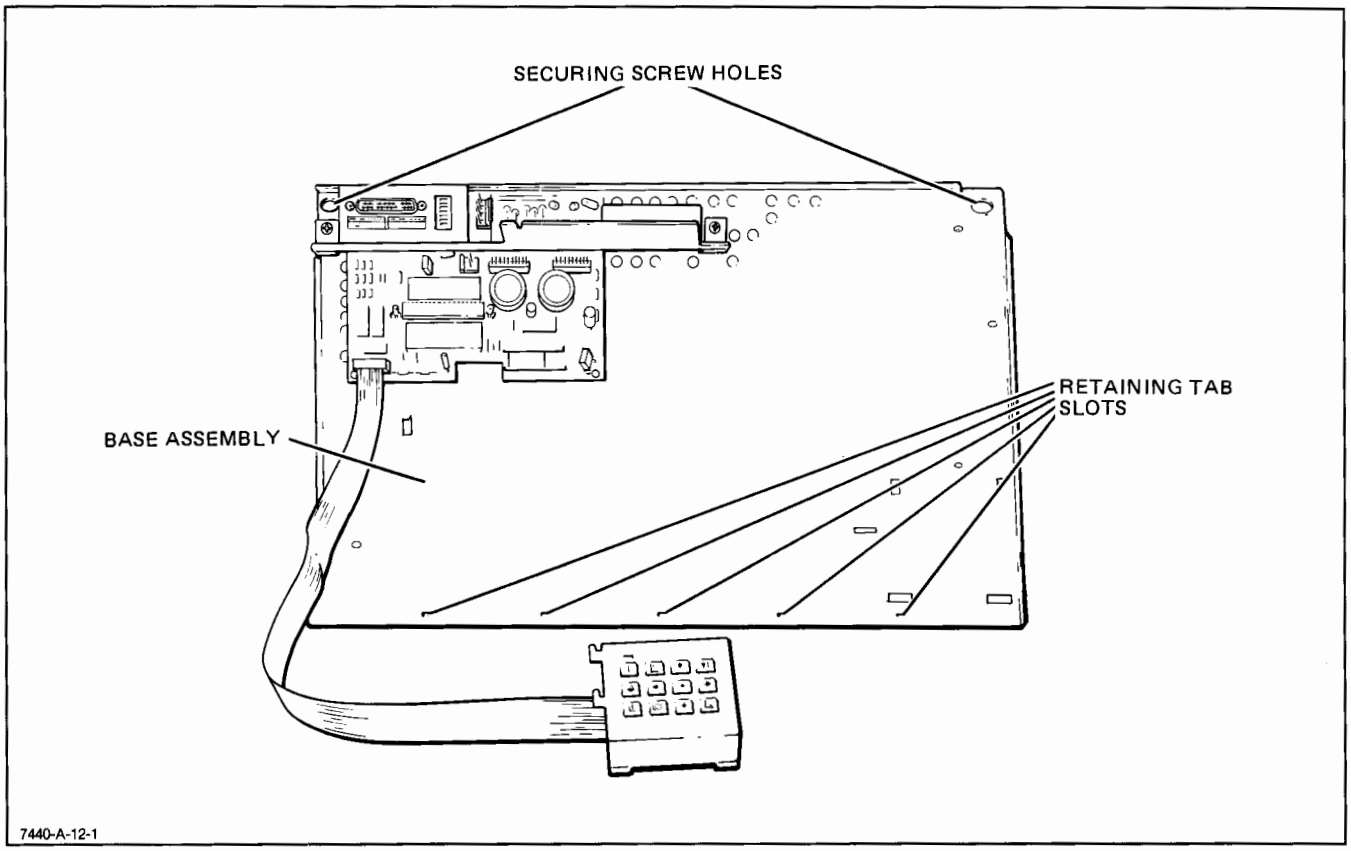


Figure 6-1. Opening up the Plotter, Detail C

6-12. MAIN PCA REMOVAL

6-13. To remove the Main PCA, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary, refer to the procedure CHASSIS ASSEMBLY REMOVAL.

d. Disconnect the front panel assembly ribbon cable connector from the left front side of the Main PCA. See Figure 6-3, Detail A.

e. Turn the base assembly bottom side up.

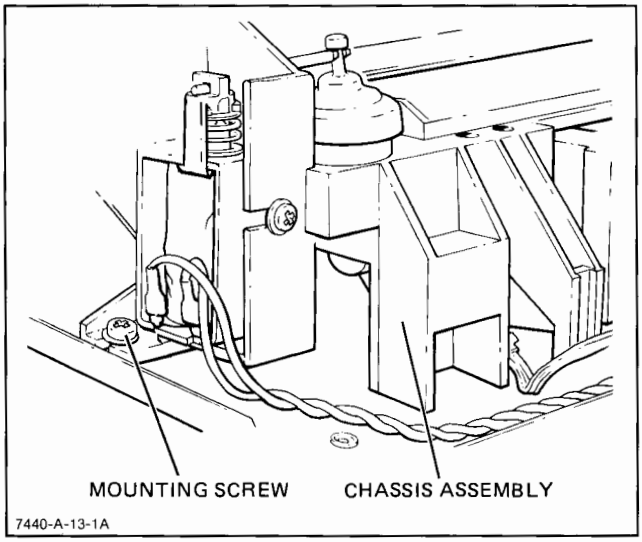


Figure 6-2. Chassis Assembly Removal, Detail A

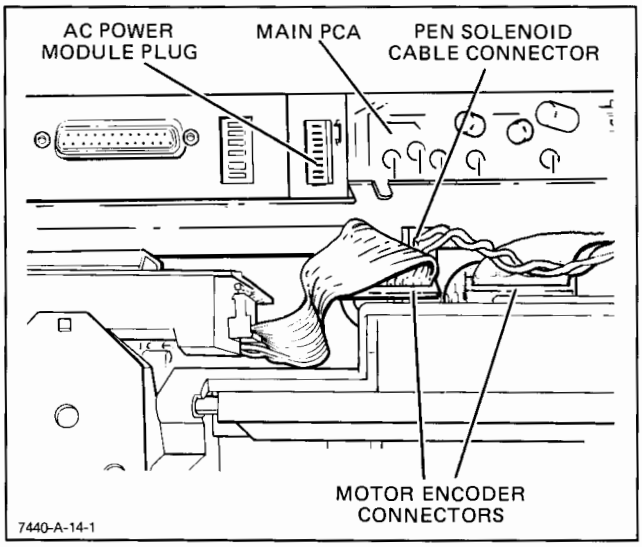


Figure 6-2. Chassis Assembly Removal, Detail B

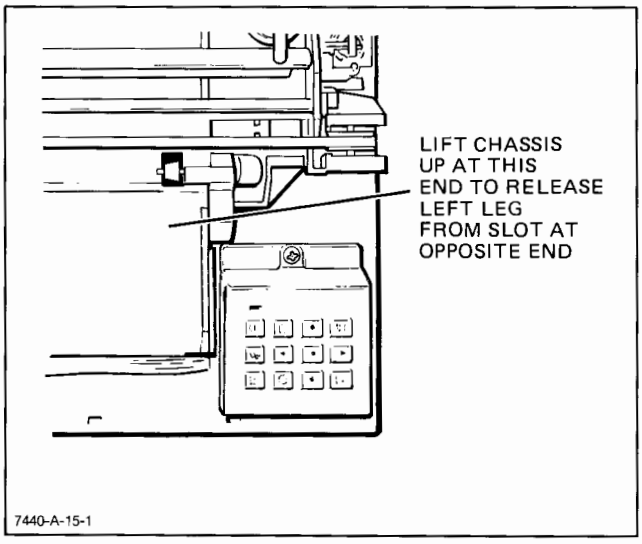


Figure 6-2. Chassis Assembly Removal, Detail C

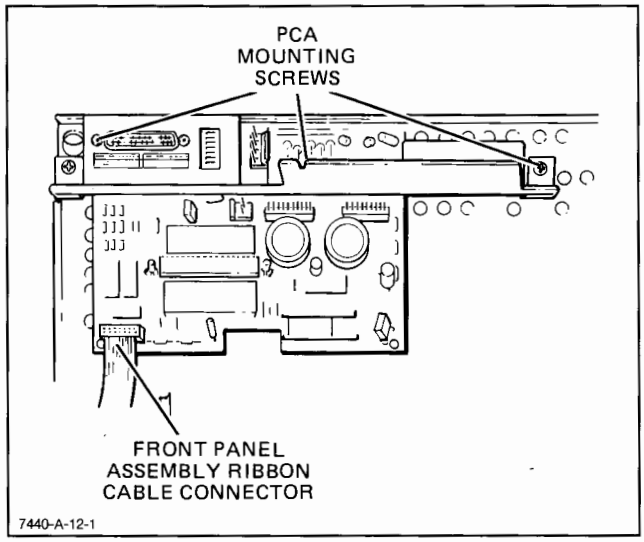


Figure 6-3. Main PCA Removal, Detail A

f. Remove the Graphics Enhancement Cartridge (GEC) by rotating the GEC release handle up and lifting the cartridge clear of the base assembly. See Figure 6-3, Detail B.

NOTE

Observe the alignment notch on the GEC plug. Use this alignment notch to guide the GEC into the base assembly during installation.

g. Turn the base assembly top side up.

h. Remove the Main PCA mounting screws shown in Figure 6-3, Detail A.

i. Install the Main PCA by reversing the above procedure and reassembling the plotter. If necessary reverse the procedure, OPENING UP THE PLOTTER to complete the assembly.

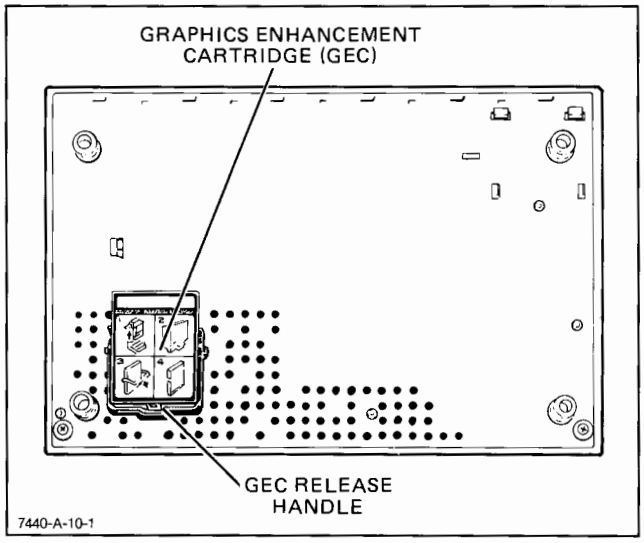


Figure 6-3. Main PCA Removal, Detail B

6-14. FRONT PANEL ASSEMBLY REMOVAL

6-15. To remove the front panel assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Disconnect the front panel assembly ribbon cable connector from the Main PCA. See Figure 6-4, Detail A.

NOTE

In Figure 6-4, Detail A, the chassis assembly was removed to show the complete ribbon cable and connector. Removal of the chassis assembly is not required for this procedure.

d. Remove the mounting screw located at the center rear of the front panel assembly. See Figure 6-4, Detail B.

e. Lift the rear of the front panel to disengage the front legs of the assembly from the base assembly slots.

f. Lift the front panel assembly clear of the base assembly.

g. Reassemble the plotter by reversing the above procedure, taking care that the front legs of the assembly are seated in their base assembly slots.

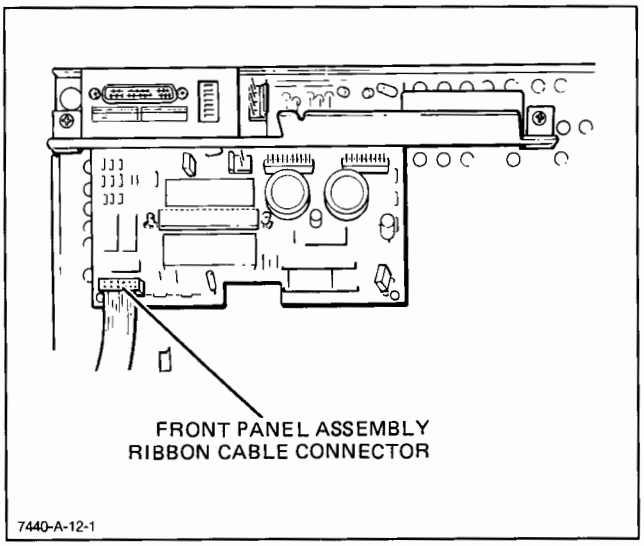


Figure 6-4. Front Panel Assembly Removal, Detail A

6-16. PEN SOLENOID ASSEMBLY REMOVAL

6-17. To remove the pen solenoid assembly, perform the following steps:

a. Disconnect the ac power module.

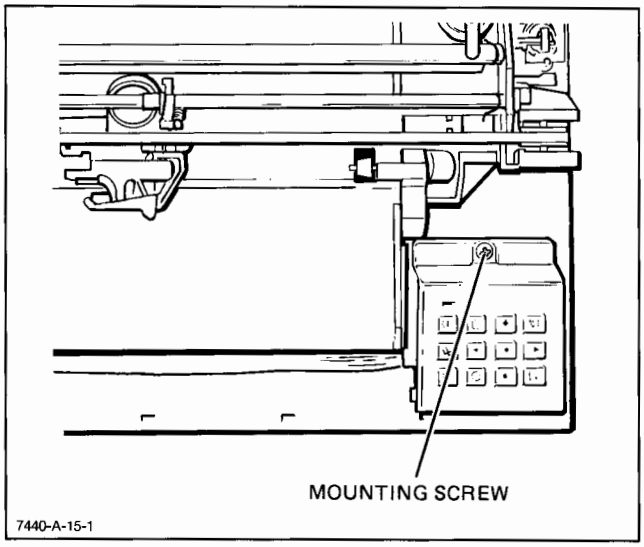


Figure 6-4. Front Panel Assembly Removal, Detail B

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Rotate the plotter to present a right-side view of the chassis assembly.

d. Disconnect the pen solenoid power connector from the Main PCA. See Figure 6-5, Detail A.

e. Loosen, but do not remove, the pen solenoid assembly mounting screw. See Figure 6-5, Detail B.

f. Slide the pen solenoid assembly clear of the chassis assembly.

g. Replace the pen solenoid assembly by reversing the above steps.

NOTE

When replacing the pen solenoid assembly ensure that the outer edge of the assembly is parallel to the vertical edge of the chassis assembly, that the tabs on the chassis fit inside the solenoid assembly, and that the end of the pen up/down bar is engaged in the plunger.

6-18. PEN CARRIAGE ASSEMBLY REMOVAL

6-19. To remove the pen carriage assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the plotter top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Rotate the plotter to present a right-side view of the chassis assembly.

d. Remove the pen carriage drive belt tensioner by grasping the bottom of the tensioner post with long nose pliers and sliding it along its slot until

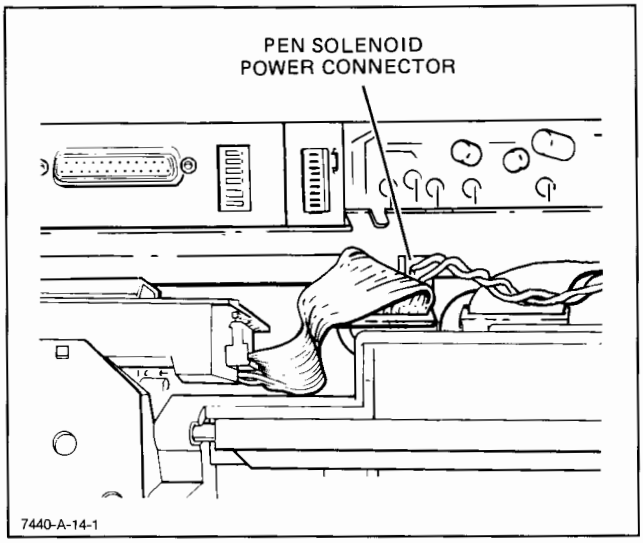


Figure 6-5. Pen Solenoid Assembly Removal, Detail A

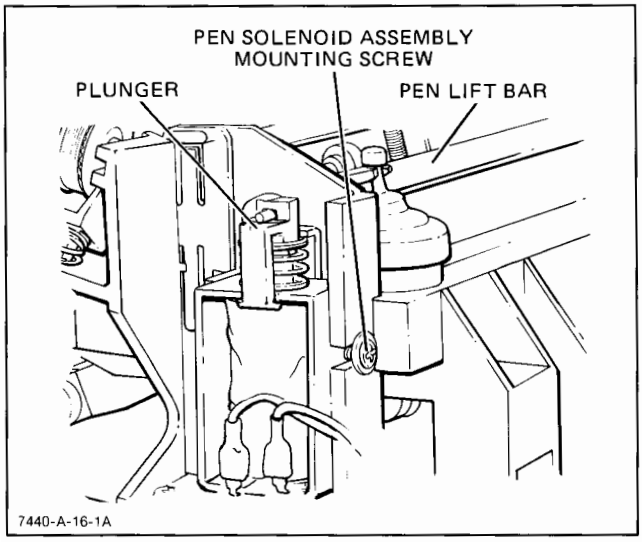


Figure 6-5. Pen Solenoid Assembly Removal, Detail B

it clears the chassis assembly. Note the orientation of the tensioner post for replacement. See Figure 6-6, Detail A.

WARNING

Ensure that the compression spring does not fly off of the post.

e. Remove the pen carriage drive belt from the gear on the shaft of the pen carriage drive motor (left end of belt). See Figure 6-6, Detail B.

f. Remove the drive belt pulley by sliding it to the right along its retaining grooves and clear of the chassis assembly. See Figure 6-6, Detail A.

g. Remove the drive belt from the pen carriage assembly.

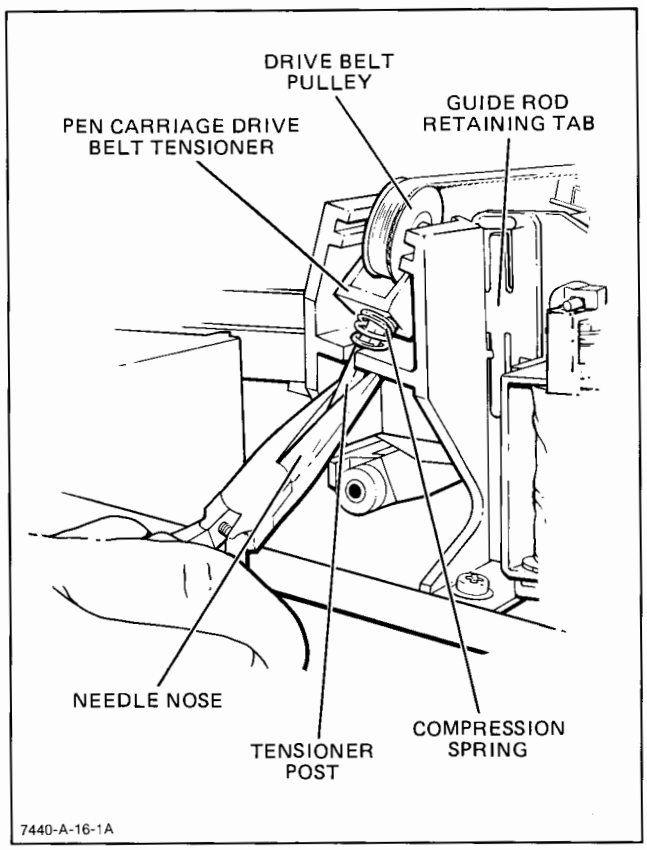


Figure 6-6. Pen Carriage Assembly Removal, Detail A

NOTE

Before performing step h., observe the orientation of the guide rod retaining tab shown in Figure 6-6, Detail A so you can easily reinstall it.

h. Using long nose pliers, press the bottom fingers of the removable guide rod retaining tab together and lift the tab clear of the chassis assembly. See Figure 6-6, Detail A.

i. Viewing the plotter from the front, remove the pen carriage guide rod by sliding it to the right and clear of the mechanical assembly.

j. Lift the pen carriage assembly clear of the chassis assembly.

k. Replace the pen carriage assembly by reversing the above steps, taking care that the pen carriage rear extension is under the vane that runs the length of the pen lift bar. See Figure 6-6, Detail B.

6-20. PEN LIFT BAR REMOVAL

6-21. To remove the pen lift bar, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the noise damper. See Figure 6-7, Detail A.

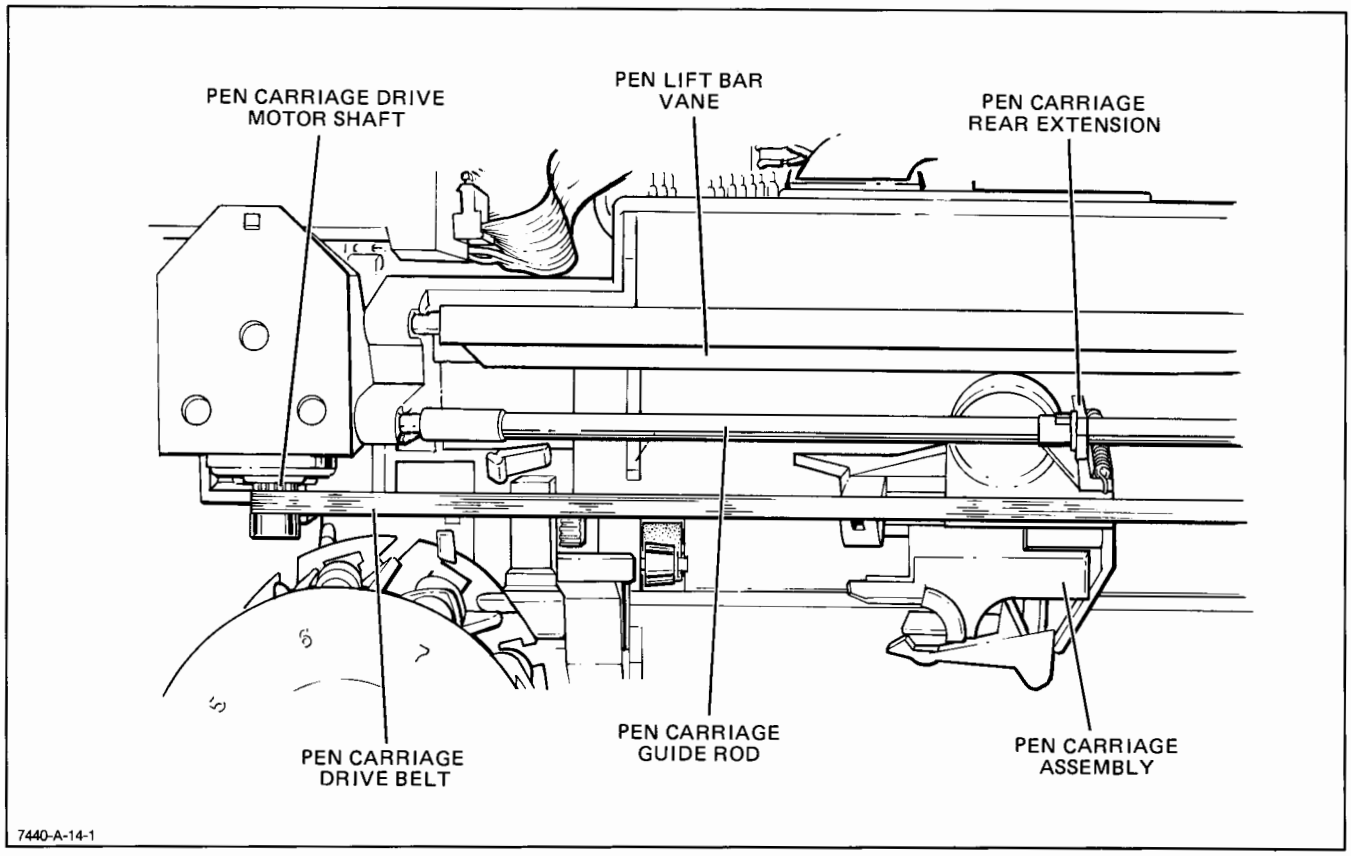


Figure 6-6. Pen Carriage Assembly Removal, Detail B

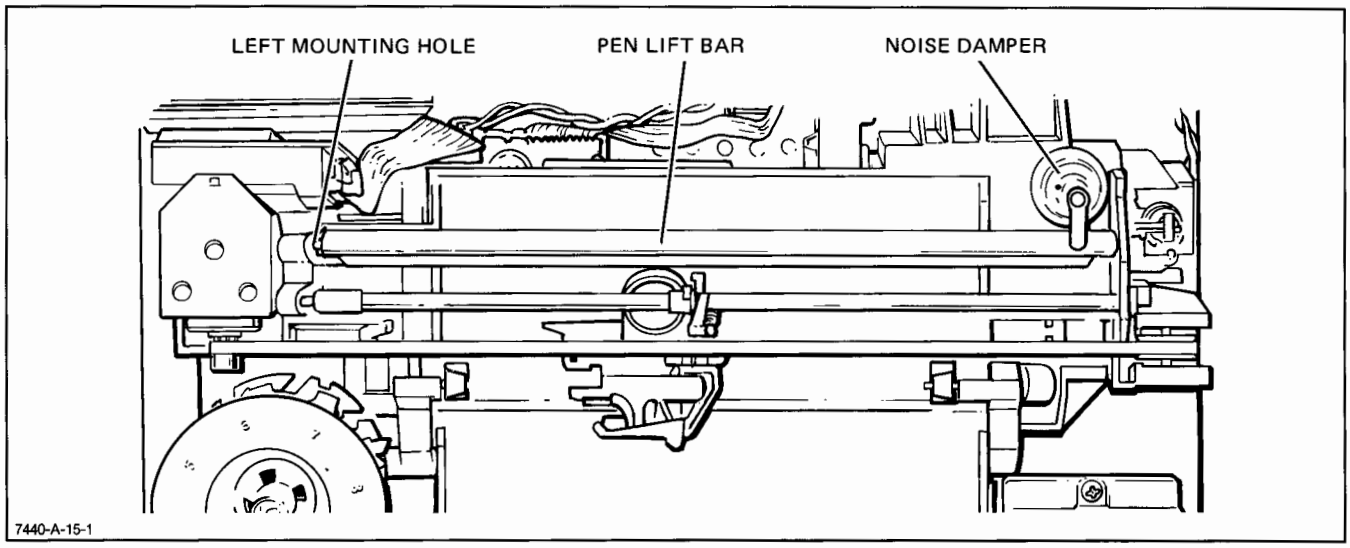


Figure 6-7. Pen Lift Bar Removal, Detail A

d. Remove the pen solenoid assembly. If necessary, refer to the procedure, PEN SOLENOID ASSEMBLY REMOVAL. See Figure 6-7, Detail B.

e. Pull the pen lift bar toward the right side of the plotter until it clears the left mounting hole. Swing the left end of the pen lift bar up and slightly toward the rear of the plotter. Rotate the pen lift bar approximately 180 degrees clockwise and remove it. See Figure 6-7, Detail C.

f. Replace the pen lift bar by reversing the above steps, taking care that the pen carriage rear extension fits under the vane that runs the length of the pen lift bar.

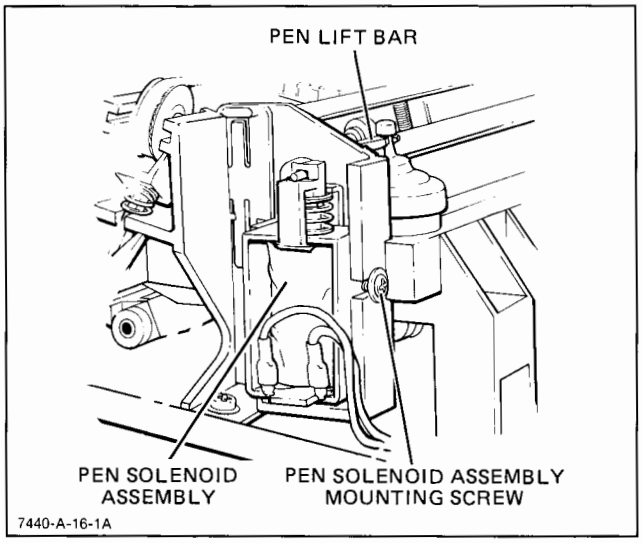


Figure 6-7. Pen Lift Bar Removal, Detail B

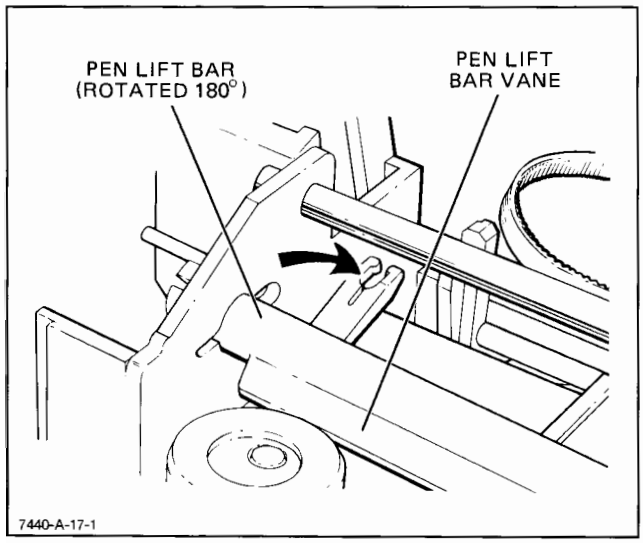


Figure 6-7. Pen Lift Bar Removal, Detail C

6-22. PEN CARRIAGE DRIVE MOTOR/ENCODER ASSEMBLY REMOVAL

6-23. To remove the pen carriage drive motor/encoder assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

d. Place the chassis assembly top side up on the work area with the platen toward your body.

e. Remove the pen carriage drive belt tensioner (right side of the mechanical assembly). To remove the belt tensioner, grasp its bottom post and slide it to the right. See Figure 6-8, Detail A.

f. Remove the pen carriage drive belt from of the gear on the shaft of the pen carriage drive motor/encoder assembly (left side of chassis assembly). See Figure 6-8, Detail B.

g. Remove the pen carriage drive belt pulley.

h. Turn the chassis assembly bottom side up (with the platen toward your body). The pen carriage drive motor/encoder assembly is on the right side of the chassis assembly. See Figure 6-8, Detail C.

i. Using a screwdriver, press down on the motor clamp extension located on the left end of the clamp and move it toward the rear of the assembly until it clears its retaining tab. See Figure 6-8, Detail C.

j. Remove the motor clamp.

k. Grasp the motor encoder housing and lift it up until the tab just clears its seating hole. When the motor/encoder assembly is installed, the tab must be seated securely in the seating hole.

l. Lift the motor/encoder assembly clear of the chassis assembly.

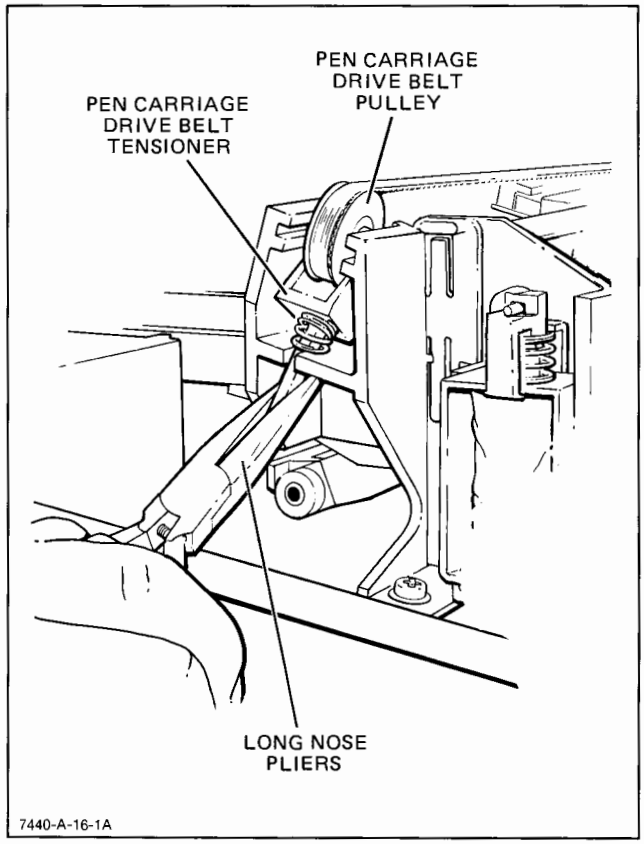


Figure 6-8. Pen Carriage Drive Motor/Encoder Assembly Removal, Detail A

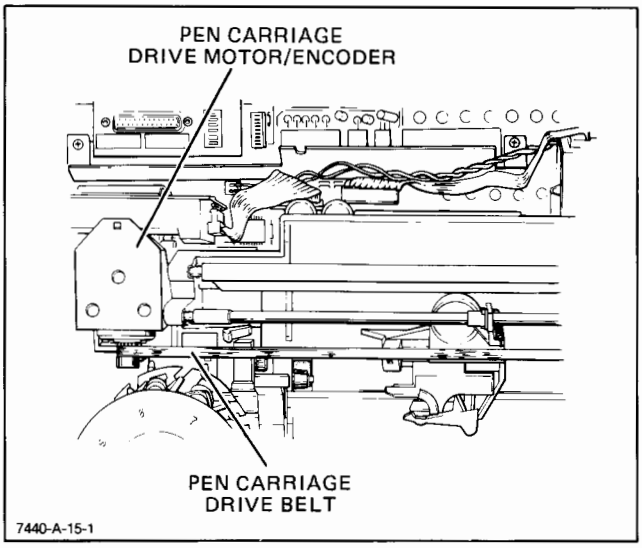


Figure 6-8. Pen Carriage Drive Motor/Encoder Assembly Removal, Detail B

NOTE

Observe the motor encoder ribbon cable connector orientation. The ribbon cable connects pin 10 of J5 on the Main PCA to pin 8 (top pin) of J1 on the Pen Carriage Drive Encoder PCA.

m. Reassemble the chassis assembly by reversing the above steps taking care that the motor field leads are connected properly and that the motor/encoder assembly tab is firmly seated in its seating hole before attempting to install the motor clamp.

6-24. PAPER DRIVE MOTOR/ENCODER ASSEMBLY REMOVAL

6-25. To remove the paper drive motor/encoder assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the plotter top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary, refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

d. Turn the chassis assembly bottom side up with the platen toward your body. The paper drive motor/encoder assembly is on the left side of the chassis assembly. See Figure 6-9.

e. Remove the tension spring from the paper drive motor belt tensioner.

f. Unhook the paper drive motor belt from the tensioner.

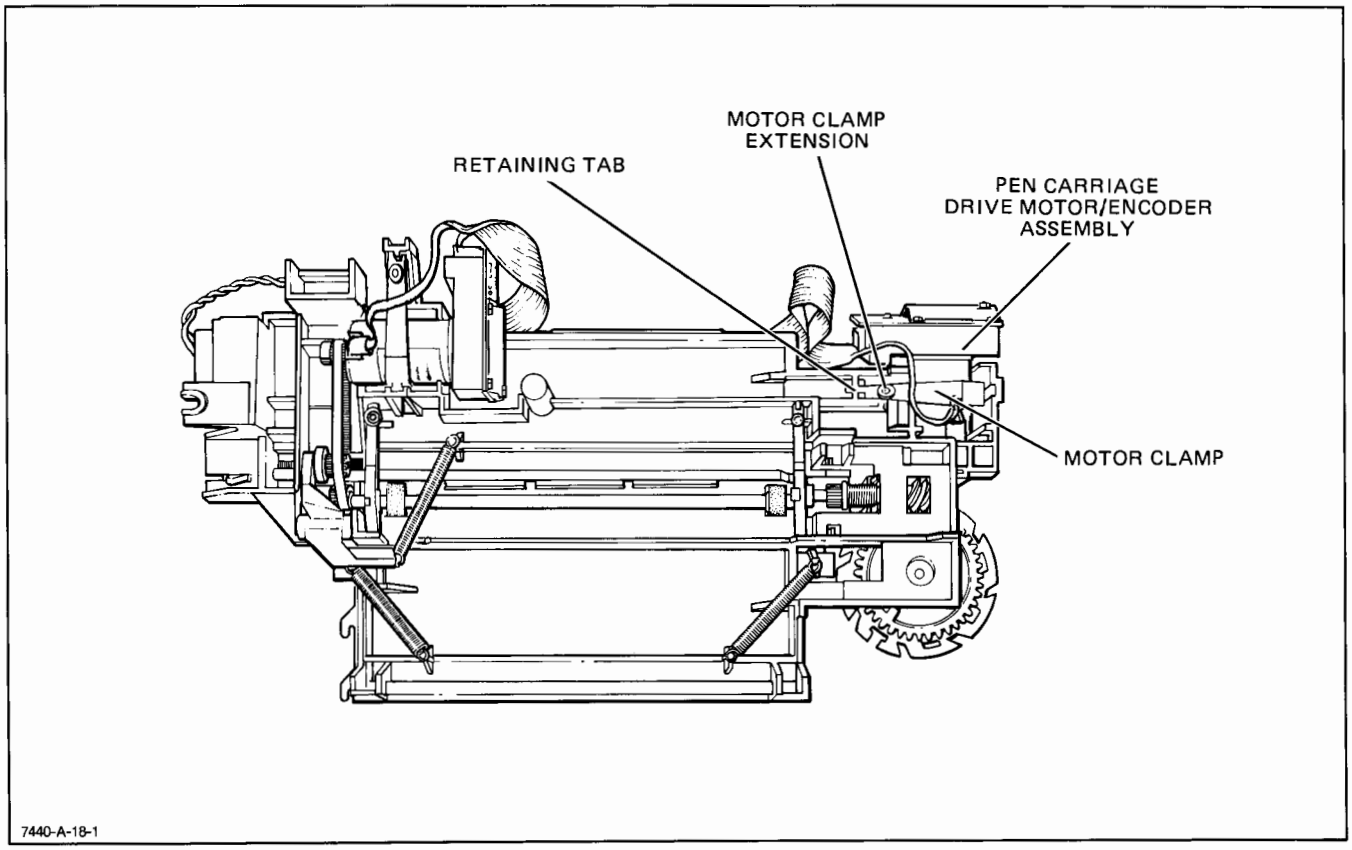


Figure 6-8. Pen Carriage Drive Motor/Encoder Assembly Removal, Detail C

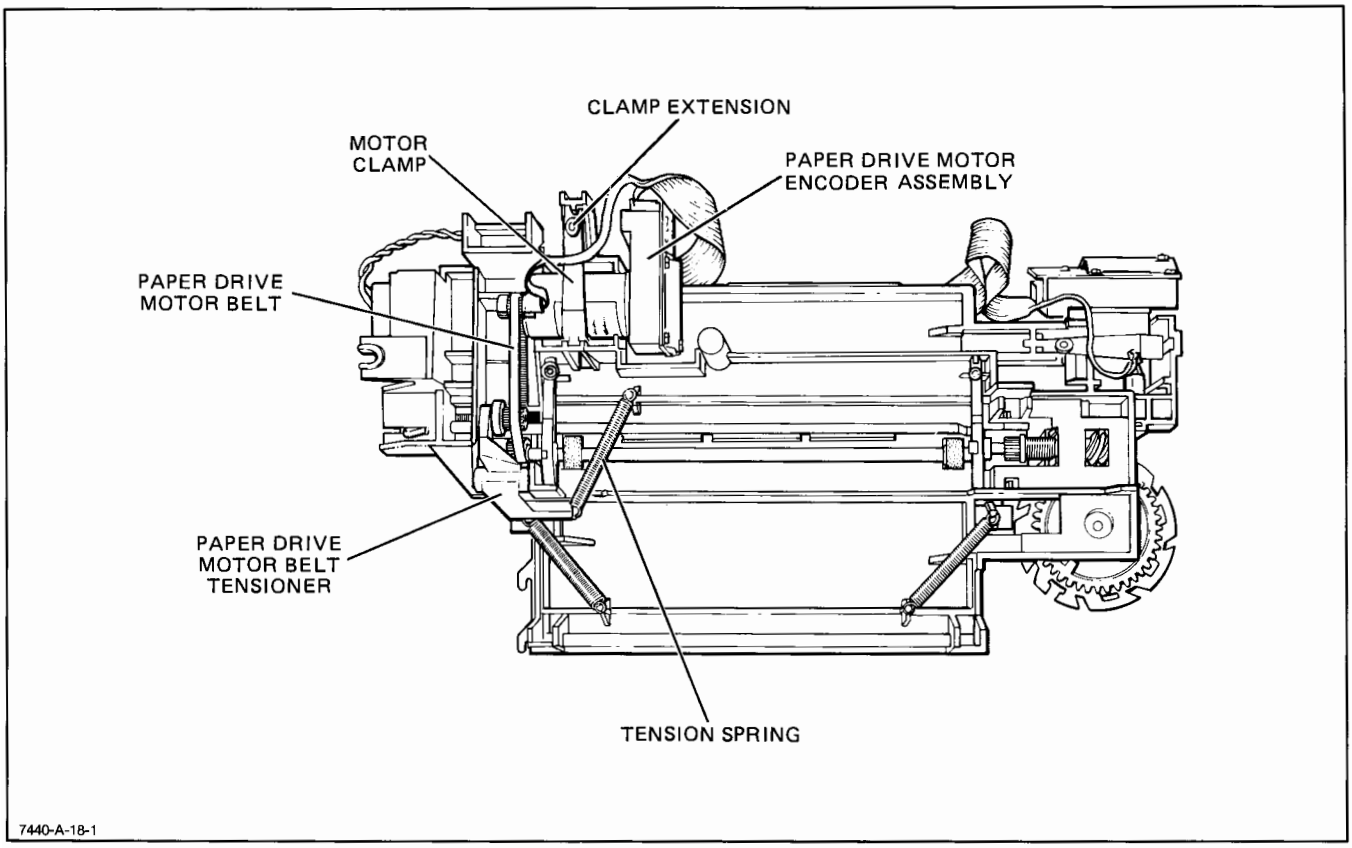


Figure 6-9. Paper Drive Motor/Encoder Assembly Removal

g. Move the belt tensioner to the left and clear of the chassis assembly.

h. Remove the paper drive belt from the gear on the shaft of the paper drive motor/encoder assembly.

i. To remove the motor clamp, use a screwdriver to press down on the clamp extension (far end of clamp) and slide the clamp clear of its retaining tab.

j. Lift the paper drive motor/encoder assembly clear by grasping the motor encoder housing (right end of motor) and moving it up to clear the chassis assembly. Note the square motor seating hole on the chassis assembly and the square retaining tab on the bottom side of the encoder housing. When the motor is installed, the retaining tab must be seated firmly in the seating hole.

NOTE

Observe the ribbon cable connector orientation. The ribbon cable connects pin 10 of J4 on the Main PCA to pin 8 (top pin) of J1 on the Paper Drive Encoder PCA.

k. Reassemble the chassis assembly by reversing the above steps, taking care that the motor field leads are properly connected and that retaining tab mentioned in step i. is firmly seated before attempting to install the motor/encoder clamp.

6-26. PINCH WHEEL REMOVAL

6-27. To remove a pinch wheel, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure OPENING UP THE PLOTTER.

c. Slide the pen carriage to the extreme right to raise the pinch wheels.

CAUTION

To prevent damage to the pinch wheel, lift the pinch wheel arm on which it is mounted and slide a thick piece of paper or plastic (e.g. credit card) between the pinch wheel and the grit wheel. See Figure 6-10.

d. Using long nose pliers, gently remove the "C" clip from the pinch wheel arm shaft. See Figure 6-10.

e. Lift the pinch wheel arm slightly and remove the pinch wheel from the pinch wheel arm shaft.

NOTE

When the pinch wheel is replaced, the replacement must be installed with the small-diameter end toward the center of the platen.

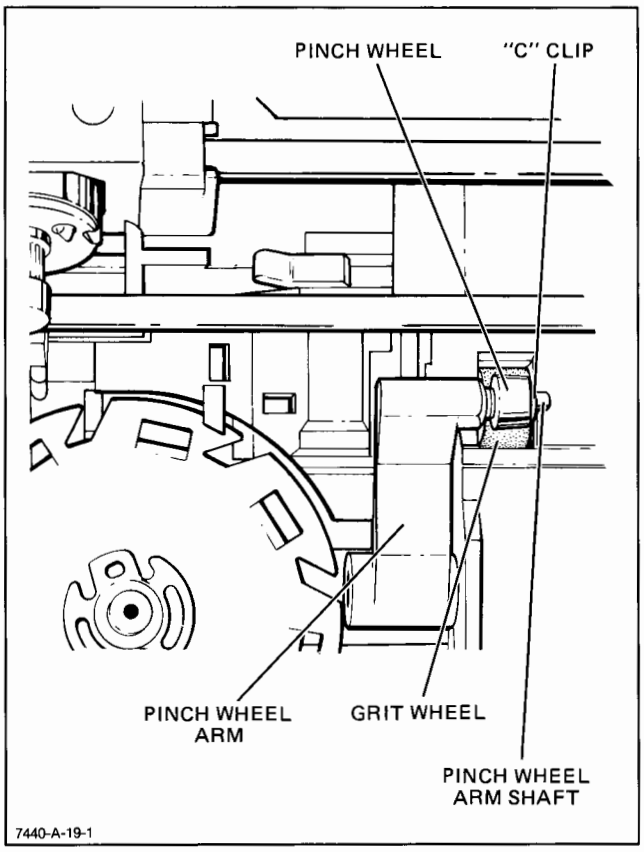


Figure 6-10. Pinch Wheel Removal

f. Replace the pinch wheel, taking care that it is properly oriented as indicated in the above NOTE and that the CAUTION between steps c. and d. is observed.

6-28. RIGHT PINCH WHEEL ARM REMOVAL

6-29. To remove the right pinch wheel arm, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary, refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

d. Turn the chassis assembly bottom side up.

e. Remove the right pinch wheel arm tension spring. See Figure 6-11.

f. Remove the right pinch wheel arm from the shaft.

g. Reinstall the right pinch wheel arm by reversing the above steps.

6-30. LEFT PINCH WHEEL ARM REMOVAL

6-31. To remove the left pinch wheel arm, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

d. Remove the pen carriage assembly. If necessary, refer to the procedure, PEN CARRIAGE ASSEMBLY REMOVAL.

e. Press the clutch engaging lever arm to the left. See Figure 6-12, Detail A.

f. Rotate the carousel base counterclockwise until the carousel base removal groove is directly under the clutch cover tab. See Figure 6-12, Detail A.

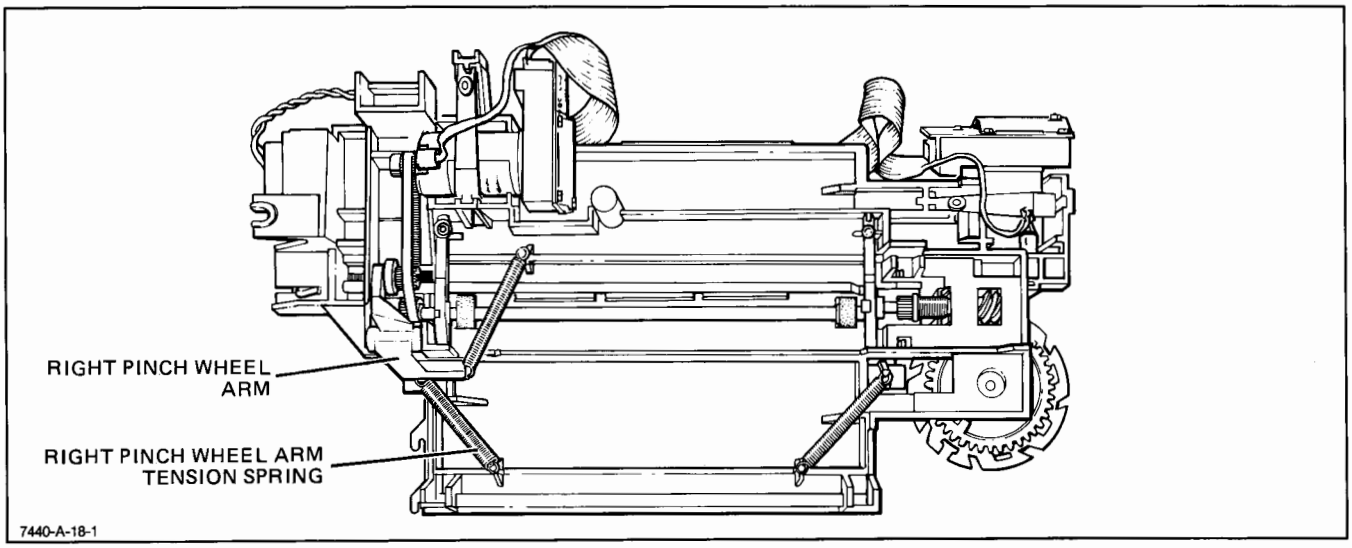


Figure 6-11. Right Pinch Wheel Arm Removal

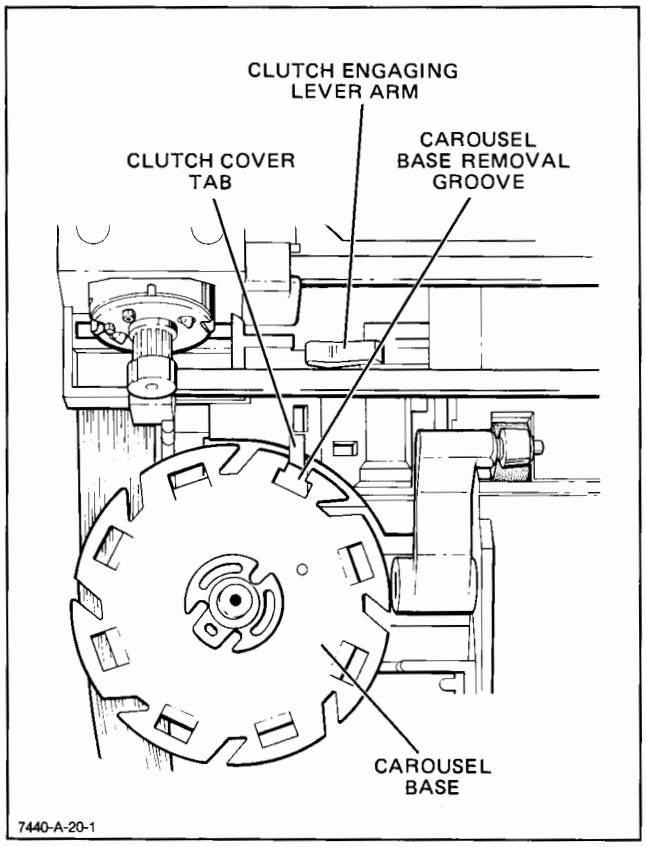


Figure 6-12. Left Pinch Wheel Arm Removal, Detail A

g. Lift the carousel base clear of the chassis assembly.

h. Turn the chassis assembly bottom-side up with the platen toward you.

i. Remove the left pinch wheel arm tension spring. See Figure 6-12, Detail B.

NOTE

To keep the clutch cover in the chassis assembly, hold the clutch cover from beneath with your right hand while performing step j. See Figure 6-12, Detail C.

j. Loosen, but do not remove, the clutch cover by pressing the two, right clutch cover retaining tabs toward the center of the clutch receptacle and then pressing down. See Figure 6-12, Detail D.

k. Turn the chassis assembly over to present a top front view.

l. Lift the clutch cover from the chassis assembly. Observe carefully the arrangement of the parts within the clutch receptacle. See Figure 6-12, Detail E.

m. Remove the left pinch wheel arm from the chassis assembly. See Figure 6-12, Detail E.

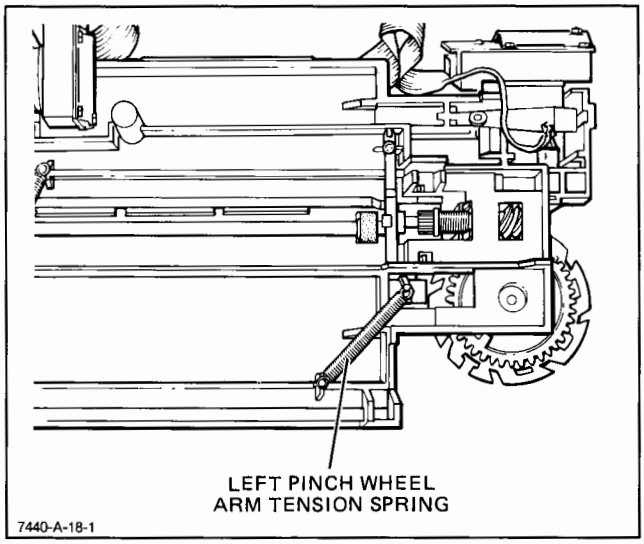


Figure 6-12. Left Pinch Wheel Arm Removal, Detail B

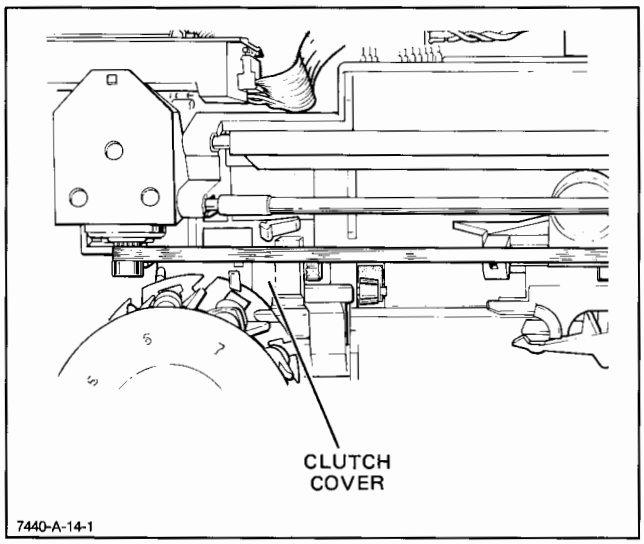


Figure 6-12. Left Pinch Wheel Arm Removal, Detail C

n. Reassemble the chassis assembly by installing the left pinch wheel arm, clutch cover, left pinch wheel arm tension spring, and carousel base.

o. Mount the chassis assembly on the base assembly.

p. Install the top case.

6-32. GRIT WHEEL ASSEMBLY REMOVAL

6-33. To remove the grit wheel assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary, refer to the procedure, OPENING UP THE PLOTTER.

c. Remove the chassis assembly. If necessary, refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

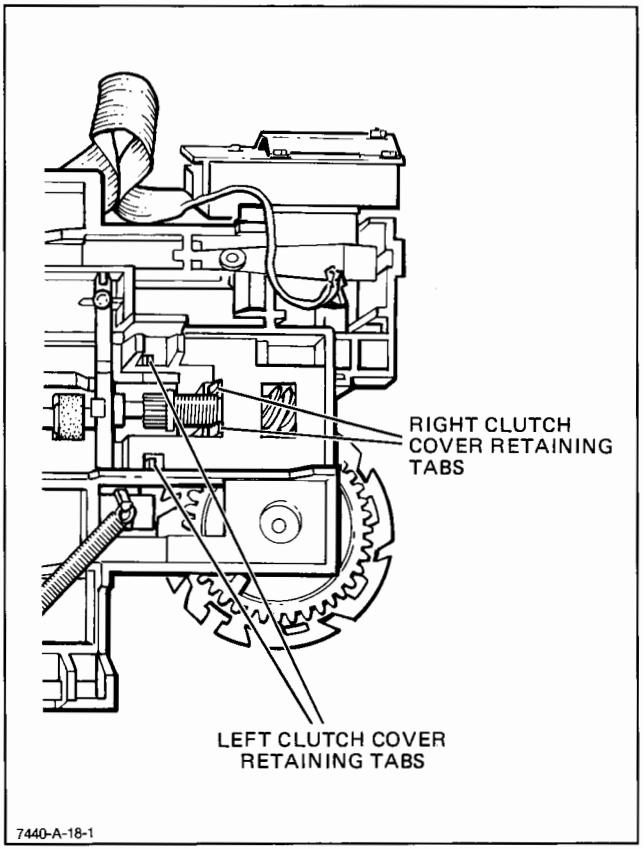


Figure 6-12. Left Pinch Wheel Arm Removal, Detail D

d. Turn the chassis assembly bottom side up with the platen toward you.

NOTE

As the plotter is now upside down, the left bearing clamp is on the right side of the chassis. See Figure 6-13, Detail A.

e. Press down on the left bearing clamp extension and slide the end of the clamp toward the center of the chassis assembly until it clears its retaining tab. See Figure 6-13, Detail A.

f. Remove the left bearing clamp. See Figure 6-13, Detail A.

g. Remove the paper drive belt tensioner spring. See Figure 6-13, Detail B.

h. Press down on the right bearing clamp extension and slide the end of the clamp toward the center of the chassis assembly until it clears its retaining tab. See Figure 6-13, Detail B.

i. Remove the right bearing clamp.

NOTE

The paper drive motor belt tensioner gear is loose on its shaft.

j. Remove the paper drive belt tensioner. See Figure 6-13, Detail B.

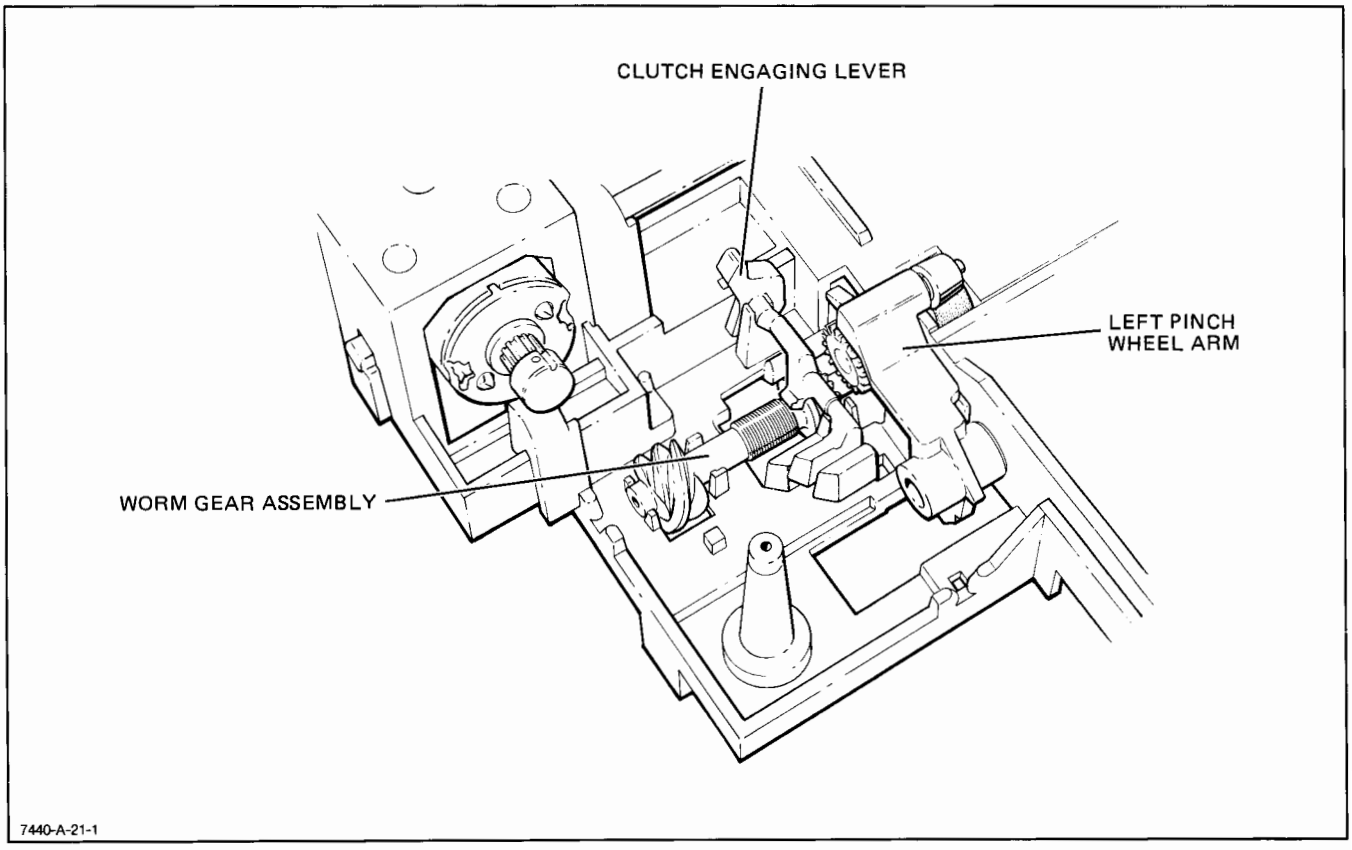


Figure 6-12. Left Pinch Wheel Arm Removal, Detail E

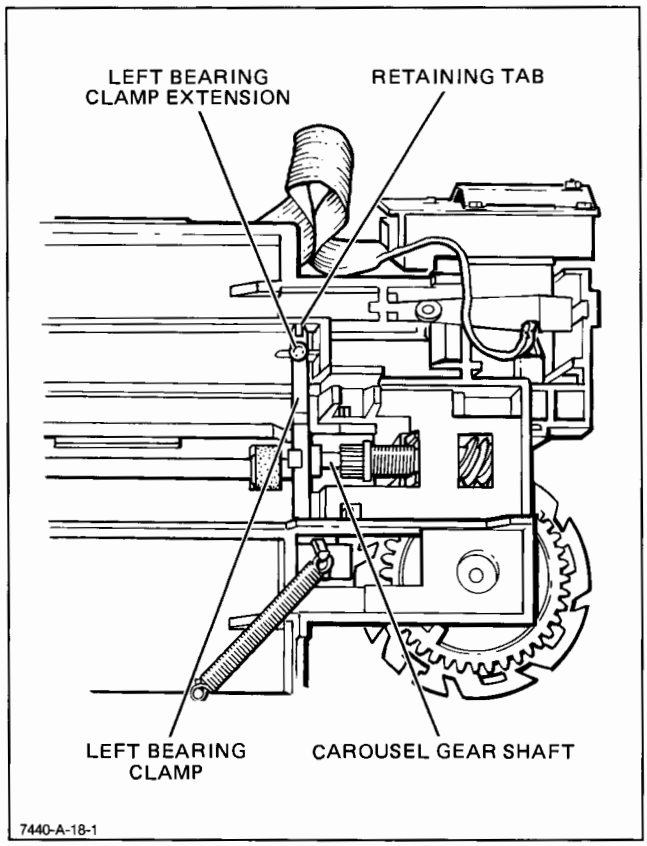


Figure 6-13. Grit Wheel Assembly Removal, Detail A

k. Remove the pinch wheel arm cam. See Figure 6-13, Detail B.

l. Remove the right pinch wheel arm tension spring. See Figure 6-11.

m. Remove the left pinch wheel arm tension spring. See Figure 6-12, Detail B.

n. Unhook the paper drive belt from the grit wheel assembly. (This can be accomplished by rotating the assembly while sliding the drive belt toward the end of the shaft.)

o. Pry the left end of the grit wheel assembly up and remove it by sliding the assembly clear of the carousel gear shaft. See Figure 6-13, Detail A.

p. Reassemble the plotter by reversing the above steps, taking care the grit wheel assembly bearings are properly seated before installing the bearing clamps.

6-34. CLUTCH ASSEMBLY REMOVAL

6-35. To remove the clutch assembly, perform the following steps:

a. Disconnect the ac power module.

b. Remove the top case. If necessary refer to the procedure, OPENING UP THE PLOTTER.

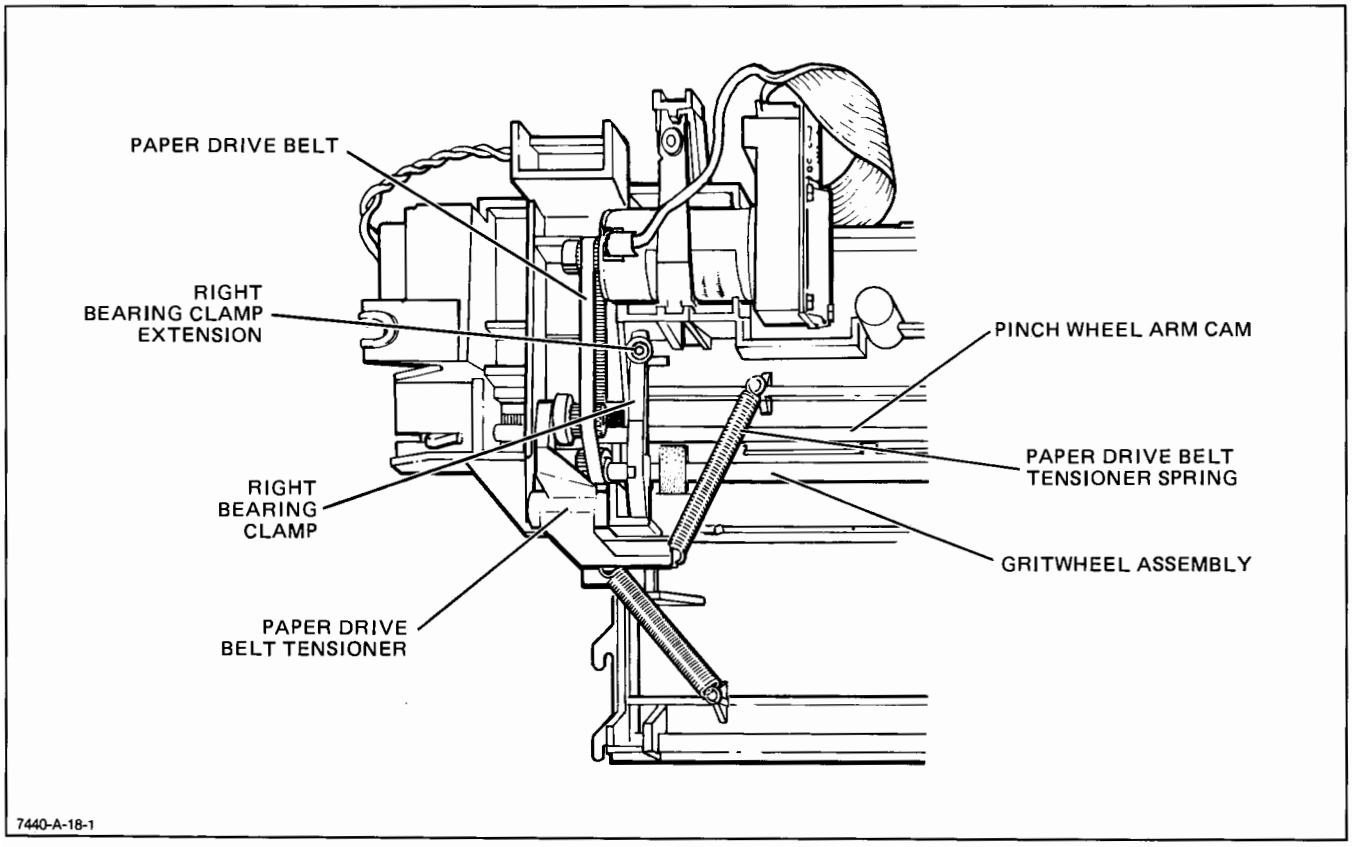


Figure 6-13. Grit Wheel Assembly Removal, Detail B

c. Remove the chassis assembly. If necessary refer to the procedure, CHASSIS ASSEMBLY REMOVAL.

d. To remove the clutch assembly press the clutch engaging lever arm to the left. See Figure 6-14, Detail A.

e. Rotate the carousel base counterclockwise until the base removal groove is directly under the clutch cover tab. See Figure 6-14, Detail A.

f. Lift the carousel base clear of the chassis assembly.

g. Rotate the chassis assembly to present a right side view of the chassis assembly.

h. Use needle nose pliers to remove the pen carriage drive belt tensioner. See Figure 6-14, Detail B.

i. Pull the pen carriage drive belt clear of the pen carriage drive motor/encoder shaft. See Figure 6-14, Detail C.

j. Remove the pen carriage drive belt pulley. See Figure 6-14, Detail B.

k. Using a pair of long nose pliers, press the bottom fingers of the removable guide rod retaining tab

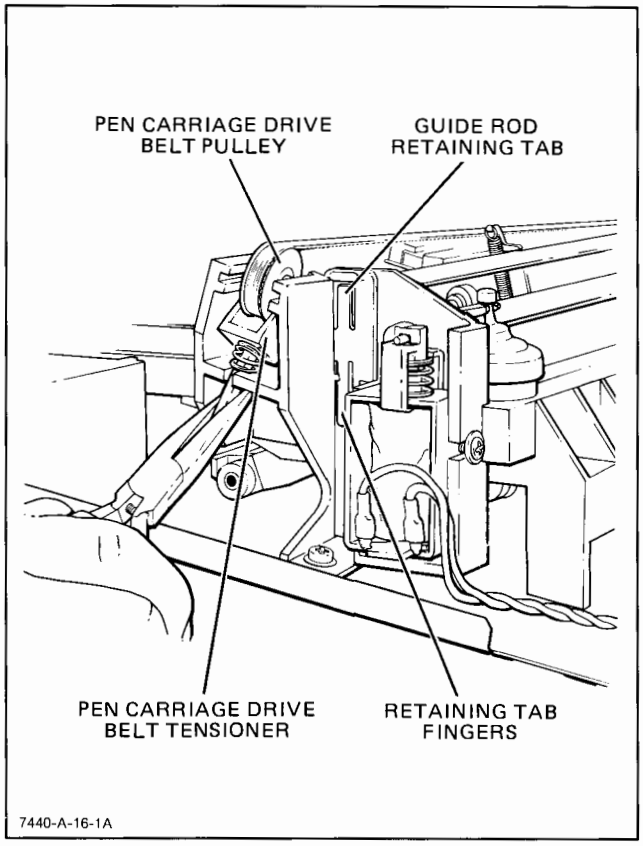


Figure 6-14. Clutch Assembly Removal, Detail B

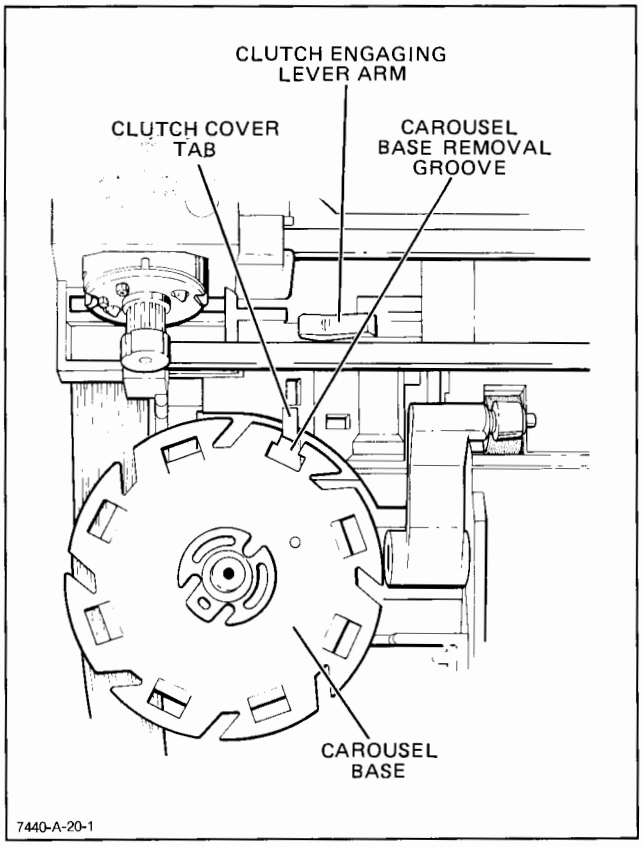


Figure 6-14. Clutch Assembly Removal, Detail A

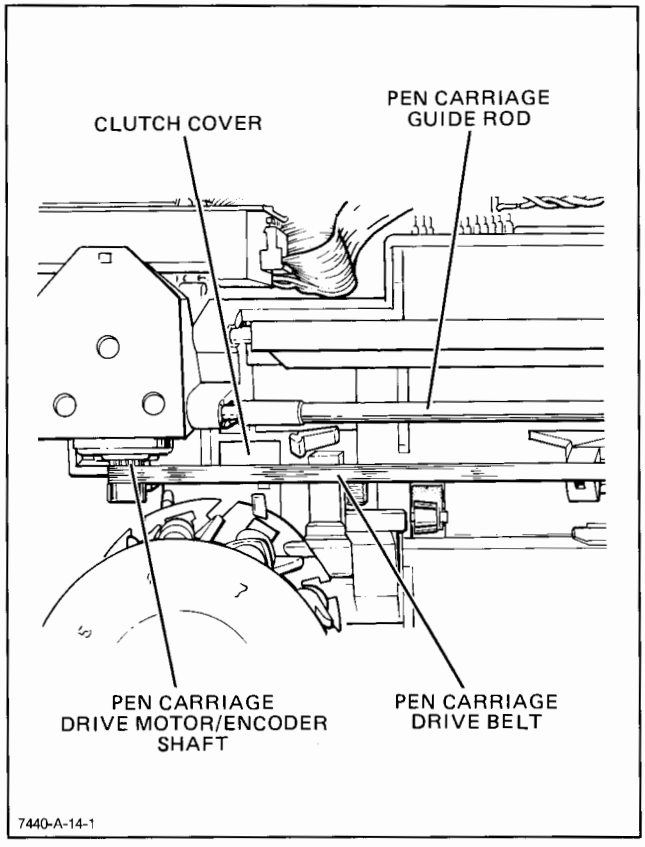


Figure 6-14. Clutch Assembly Removal, Detail C

together and lift the tab clear of the chassis assembly. Observe the orientation of the tab so you can easily reinstall it. See Figure 6-14, Detail B.

l. Slide the pen carriage guide rod toward you until it clears the clutch cover. See Figure 6-14, Detail C.

m. Turn the chassis assembly bottom side up with the platen toward you.

NOTE

To keep the clutch cover in the chassis assembly, hold it from beneath with your right hand while performing step n.

n. Loosen, but do not remove the clutch cover by pressing the two right clutch cover retaining tabs toward the center of the clutch receptacle. See Figure 6-14, Detail D.

o. Turn the chassis assembly over to present a top front view.

p. Carefully lift the clutch cover from the chassis assembly. Observe the arrangement of the parts within the clutch receptacle. See Figure 6-14, Detail E.

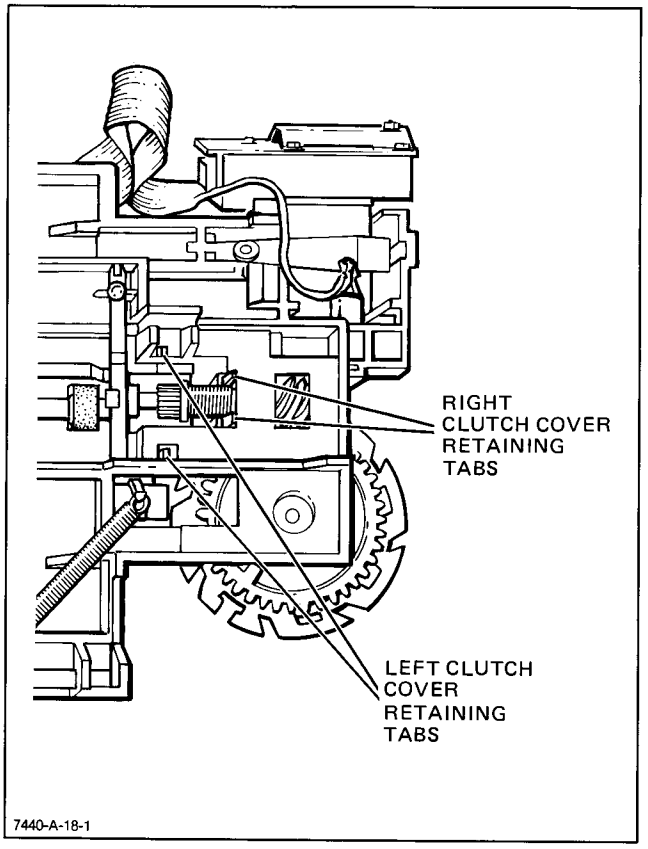


Figure 6-14. Clutch Assembly Removal, Detail D

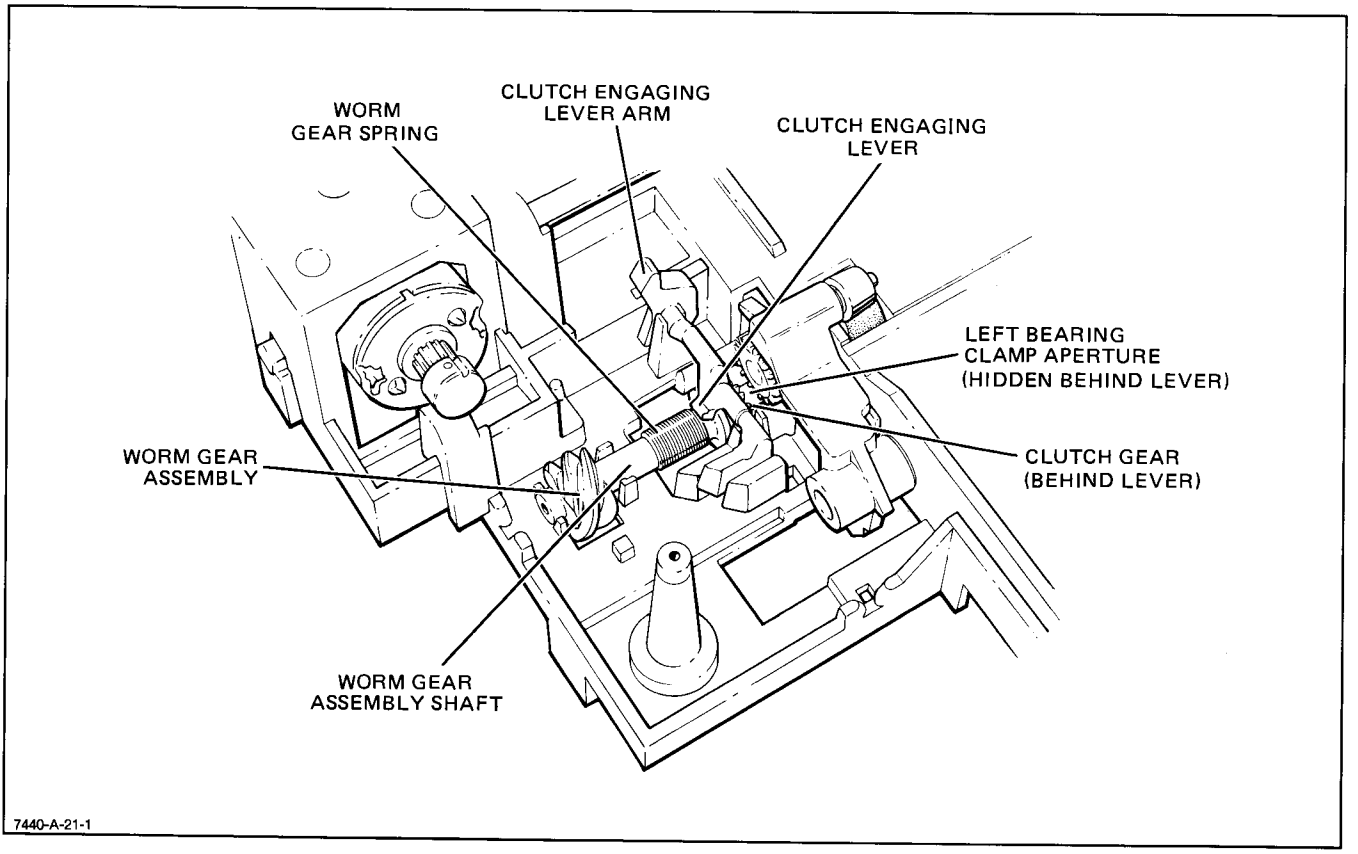


Figure 6-14. Clutch Assembly Removal, Detail E

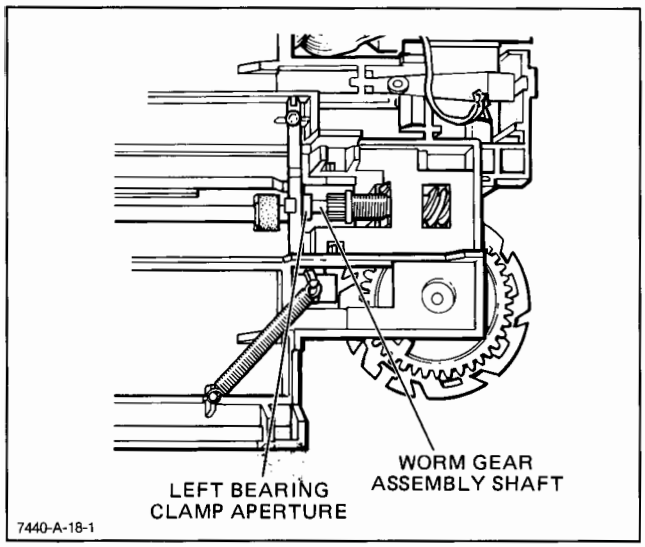


Figure 6-14. Clutch Assembly Removal, Detail F

q. Remove the clutch engaging lever and the worm gear assembly.

NOTE

The right end of the worm gear assembly shaft must be seated in the left bearing clamp aperture during installation. See Figure 6-14, Detail F.

r. Reassemble the clutch assembly and the chassis assembly by reversing the above steps. Ensure that the clutch cover is firmly against the left rear wall of the clutch cover receptacle during installation.

6-36. REMOVAL AND REPLACEMENT MATRIX

6-37. See Figure 6-15 for a summary, in matrix form, of the procedures described in this chapter.

	OPENING UP THE PLOTTER	CHASSIS ASSEMBLY	MAIN PCA	FRONT PANEL ASSEMBLY	PEN SOLENOID ASSEMBLY	PEN CARRIAGE ASSEMBLY	PEN LIFT BAR	PEN DRIVE MOTOR ASSEMBLY	PAPER DRIVE MOTOR ASSEMBLY	PINCH WHEEL	RIGHT PINCH WHEEL ARM	LEFT PINCH WHEEL ARM	GRIT WHEEL ASSEMBLY	CLUTCH ASSEMBLY
OPENING UP THE PLOTTER	1													
CHASSIS ASSEMBLY	1	2												
MAIN PCA	1	2	3											
FRONT PANEL ASSEMBLY	1			2										
PEN SOLENOID ASSEMBLY	1				2									
PEN CARRIAGE ASSEMBLY	1					2								
PEN LIFT BAR	1				2		3							
PEN DRIVE MOTOR ASSEMBLY	1	2						3						
PAPER DRIVE MOTOR ASSEMBLY	1	2							3					
PINCH WHEEL	1									2				
RIGHT PINCH WHEEL ARM	1	2									3			
LEFT PINCH WHEEL ARM	1	2				3						4		
GRIT WHEEL ASSEMBLY	1	2											3	
CLUTCH ASSEMBLY	1	2												3

7440-A-9-1

Figure 6-15. Disassembly and Reassembly Procedures Matrix

CHAPTER 7

ADJUSTMENTS

7-1. INTRODUCTION

7-2. This section normally contains electrical and mechanical adjustments. No adjustments are required on the HP 7440 ColorPro plotter.

CHAPTER 8

TROUBLESHOOTING AND DIAGNOSTICS

8-1. INTRODUCTION

8-2. This chapter contains safety information, troubleshooting strategy, and a reference to the troubleshooting flowchart used to isolate problems in the HP 7440 plotter.

8-3. SAFETY CONSIDERATIONS

8-4. Clear the immediate work area of liquids that could spill and create a shock hazard, or damage the plotter circuitry.

WARNING

Disconnect the power module from the ac wall outlet before opening up the plotter. Even though the front panel ON/OFF (I/O) key switch is in the OFF (O) condition, it only stops the machine program. Dangerous voltages are still applied to the Main PCA.

CAUTION

Applying a line voltage of 220 V or 240 V to the plotter while using a 100 V or 120 Vac power module may damage the power module, the plotter or both.

8-5. TROUBLESHOOTING STRATEGY

8-6. In carrying out the troubleshooting procedures below, the strategy is to isolate a problem to a defective assembly or mechanical part that can be replaced.

8-7. TROUBLESHOOTING PROCEDURES

8-8. Use the troubleshooting flowchart in Chapter 12 (Figure 12-1) to troubleshoot the HP 7440 plotter.

CHAPTER 9

REPLACEABLE PARTS

9-1. INTRODUCTION

9-2. This section contains information for ordering HP 7440 plotter parts. Included are:

- Lists of mechanical parts
- Illustrations of mechanical parts
- Lists of field replaceable assemblies and Main PCA electrical parts.
- A list of abbreviations and reference designators
- A code list of manufacturers

9-3. ORDERING INFORMATION

9-4. To obtain replacement parts or assemblies, address an order or inquiry to the nearest Hewlett-Packard Sales and Support Office. Include the HP Part Number, the check digit (listed under the heading, CD, in the parts list), the description, and the quantity required.

9-5. ILLUSTRATED PARTS BREAKOUTS

9-6. Table 9-1 is a list of the mechanical parts illustrated in Figure 9-1. Table 9-2 is a list of the chassis assembly parts illustrated in Figure 9-2. Table 9-3 is a list of the pen carriage assembly parts illustrated in Figure 9-3.

9-7. EXCHANGE PCAs

9-8. Part numbers for PCAs that are available on an exchange basis are listed in Table 9-4. These factory repaired and tested assemblies are available only on a trade-in basis; therefore, the defective assembly must be returned for credit.

9-9. FIELD REPLACEABLE PARTS LISTS

9-10. Parts for the HP 7440 Main PCA are listed in Tables 9-5 and 9-6. Parts for the Graphics Enhancement Cartridge are listed in Table 9-7. Parts for the Encoder PCAs are listed in Table 9-8.

9-11. ABBREVIATION LIST AND REFERENCE DESIGNATORS

9-12. Table 9-9 lists designators and abbreviations used throughout this manual. Abbreviations in the parts lists are always capital letters. In other parts of the manual, both upper and lower case abbreviations are used.

9-13. CODE LIST OF MANUFACTURERS

9-14. Table 9-10 lists the five-digit code numbers assigned to the manufacturers of parts in the HP 7440 plotter. These code numbers appear with the parts in Tables 9-1 through 9-8 as an aid for ordering replacement parts directly from the manufacturer.

Table 9-1. Parts List, Top Case, Front Panel, and Base Assemblies

REF. DES.	HP PART NUMBER	CD	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
1	07440-60085	8	1	PEN CAROUSEL (TURRET ASSY)	28480	07440-60085
2	07440-60090	4	1	ENCLOSURE, TOP CASE	28480	07440-60090
3	07440-40091	5	1	WINDOW	28480	07440-40091
4	0515-2063	2	2	SCREW-MACHINE ASSY. M4 X 0.7 14MM-LG	28480	0515-2063
5	0515-2065	4	3	SCREW-MACHINE ASSY. M4 x 0.7 8MM-LG	28480	0515-2065
6	07440-60101	0	1	PCA, RS-232-C	28480	07440-60101
6	07440-60102	1	1	PCA, IEEE-488	28480	07440-60102
7	07440-90272	9	1	BASE ASSEMBLY	28480	07440-90272
8	0515-2064	3	1	SCREW-MACH. M4 X 0.78MM-LG PAN-HEAD	28480	0515-2064
9	0515-1472	5	2	SCREW, TOP	28480	0515-1472
10	07440-60045	1	1	FRONT PANEL ASSEMBY (KEY MODULE)	28480	07440-60045
11	07440-60049	5	1	CABLE, FRONT PANEL (KEY MODULE)	28480	07440-60049
12				POWER MODULE (ORDER BY MODEL NO.)		
13	07440-40092	6	1	SOCKET, GEC (MODULE SOCKET)	28480	07440-40092
14	17440A	1		GRAPHICS ENHANCEMENT CARTRIDGE (GEC)	28480	17440A
15	07440-60014	4	1	GROUND STRAP	28480	07440-60014

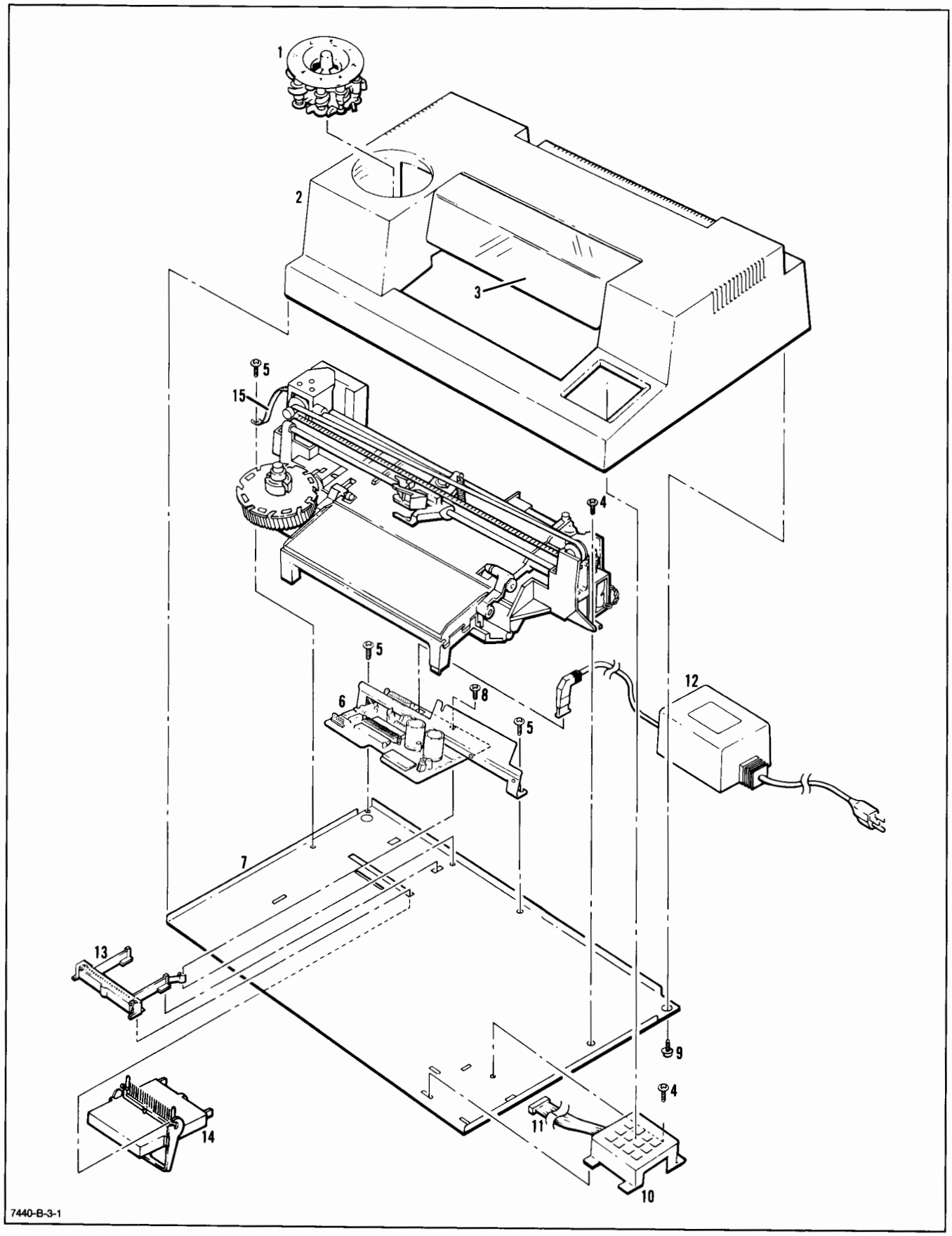


Figure 9-1. Top Case, Front Panel, and Base Assemblies, Illustrated Parts Breakdown

Table 9-2. Parts List, Chassis Assembly

REF. DES.	HP PART NUMBER	CD	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
1	07440-40051	7	1	PEN LIFT BAR	28480	07440-40051
2	07440-20051	5	1	PEN CARRIAGE GUIDE ROD	28480	07440-20051
3				NOT ASSIGNED		
4	07440-60040	6	1	PEN CARRIAGE ASSEMBLY	28480	07440-60040
5	07440-40065	3	1	RETAINER, GUIDE ROD	28480	07440-40065
6	1500-0649	6	1	BELT-GEAR .188-WD 392-T .082-P	28480	1500-0649
7	5020-6306	0	1	PULLEY, PEN CARRIAGE DRIVE BELT	28480	5020-6306
8	07440-40055	1	1	TENSIONER, PEN CARRIAGE DRIVE BELT	28480	07440-40055
9	07440-20014	0	1	SPRING-CPRSN .36-IN-OD .875-IN-OA-LG	28480	07440-20014
10	07440-40066	4	1	DAMPER, NOISE	28480	07440-40066
11	07440-20012	8	1	SPRING,NOISE (LEFT)	28480	07440-20012
12	07440-20011	7	1	CLIP, NOISE (RIGHT)	28480	07440-20011
13				NOT ASSIGNED		
14				NOT ASSIGNED		
15	07440-60014	4	2	GROUND STRAP (FOR MOTOR DRIVE ASSY.)	28480	07440-60014
16	07440-60025	7	1	SOLENOID ASSEMBLY	28480	07440-60025
17	07440-60011	1	1	CABLE, PAPER DRIVE	28480	07440-60011
18	07440-60008	6	2	MOTOR ASSEMBLY (WITH GND STRAP)	28480	07440-60008
19	07440-40061	9	1	PULLEY, IDLER-X	28480	07440-40061
20	07440-40056	2	1	TENSIONER, PAPER DRIVE BELT	28480	07440-40056
21	1500-0677	0	1	BELT, PAPER DRIVE	28480	1500-0677
22	07440-40063	1	2	CLAMP, MOTOR	28480	07440-40063
23	07440-40054	0	2	CLAMP, BEARING	28480	07440-40054
24	07440-40052	8	1	CAM, PINCH ARM	28480	07440-40052
25	1460-2100	2	3	SPRING, TENSION (LEFT PINCH WHEEL ARM)	28480	1460-2100
26	07440-60020	2	1	GRIT WHEEL ASSEMBLY	28480	07440-60020
27	07440-40035	7	1	PINCH WHEEL ARM (RIGHT)	28480	07440-40035
28	5040-8671	8	2	ROLLER, PINCH	28480	5040-8671
29	0510-1294	9	2	RETAINER-RING E-R EXT .125-IN-DIA STL	28480	0510-1294
30	07440-40050	6	1	CHASSIS ASSEMBLY	28480	07440-40050
31	07440-40030	2	1	PINCH WHEEL ARM (LEFT)	28480	07440-40030
32	07440-40060	8	1	LEVER, CLUTCH (WORM GEAR) ENGAGING	28480	07440-40060
33	07440-40058	4	1	WORM GEAR ASSEMBLY (WORM GEAR DRIVE)	28480	07440-40058
34	07440-40064	2	1	COVER, CLUTCH (CLAMP-WORM)	28480	07440-40064
35	07440-40057	3	1	BASE, CAROUSEL (SPINDLE TURRET)	28480	07440-40057
36	07440-60016	6	1	CABLE, PEN DRIVE	28480	07440-60016
37	07440-40059	5	1	GEAR, CLUTCH (SLIDING)	28480	07440-40059
38	07440-20010	6	1	SPRING-WORM	28480	07440-20010

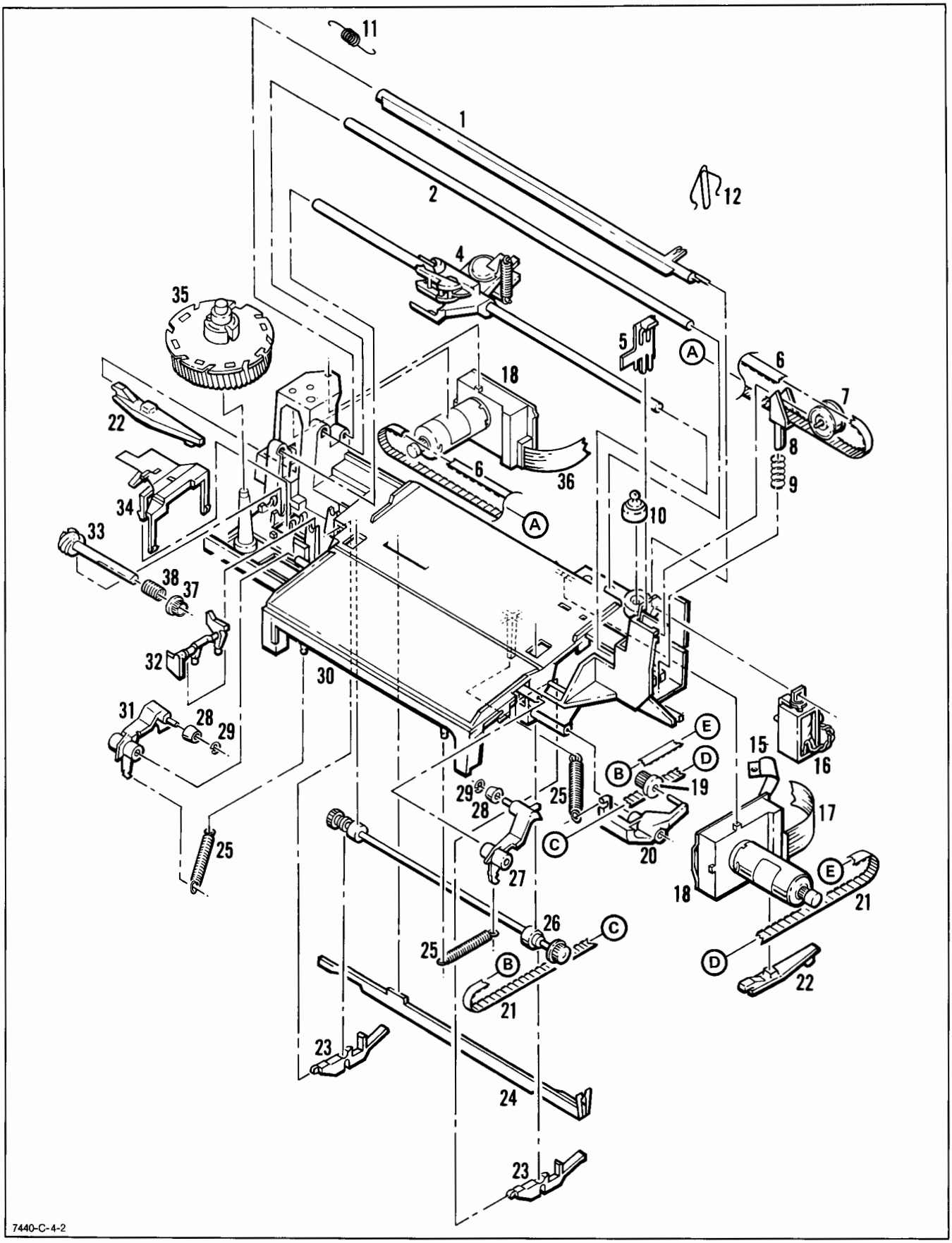


Figure 9-2. Chassis Assembly, Illustrated Parts Breakdown

Table 9-3. Parts List, Pen Carriage Assembly

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	07440-60040	6	1	PEN CARRIAGE ASSEMBLY (CONSISTS OF PARTS LISTED BELOW.)	28480	07440-60040
1	07440-40044	8	1	BUSHING, GUIDE ROD	28480	07440-40044
2	07440-40040	4	1	CARRIAGE	28480	07440-40040
3	1460-2107	9	1	SPRING, PRELOAD	28480	1460-2107
4	07440-20050	4	1	SLIDER ROD	28480	07440-20050
5	07440-40045	9	2	BUSHING, SLIDE ROD	28480	07440-40045
6	07440-40041	5	1	PEN HOLDER	28480	07440-40041
7	07440-40042	6	1	CLAW	28480	07440-40042
8	1460-2101	3	1	SPRING, CLAW	28480	1460-2101
9				NOT ASSIGNED		
10	1460-2105	7	1	SPRING, PEN DOWN	28480	1460-2105

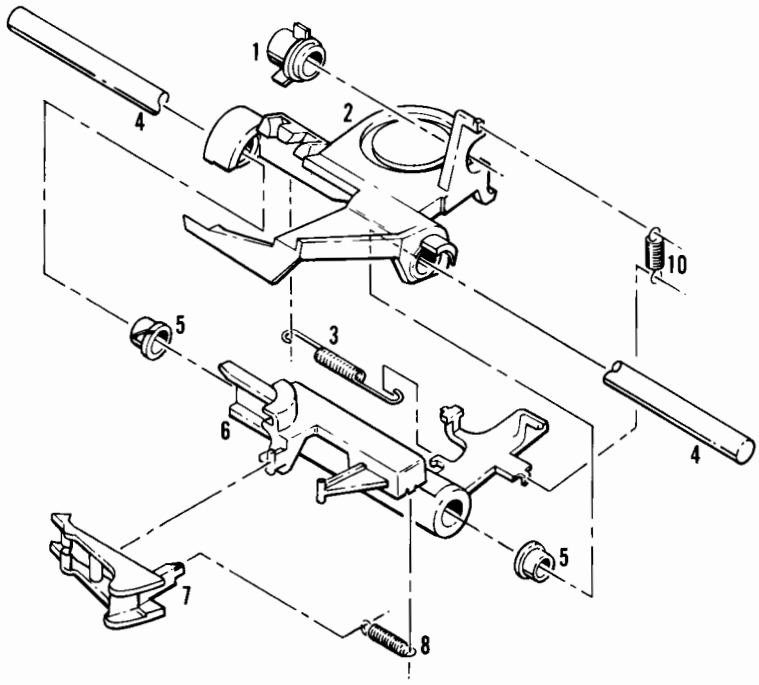


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Figure 9-3. Pen Carriage Assembly, Illustrated Parts Breakdown

Table 9-4. Parts List, Exchange Assemblies

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A1	07440-66101	2	1	MAIN PCA OPTION 001 (RS-232-C), REBUILT	28480	07440-66101
A1	07440-66102	3	1	MAIN PCA OPTION 002 (HP-IB), REBUILT	28480	07440-66102

Table 9-5. Parts List, RS-232-C Main PCA (A1) Option 001

REF. DES.	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
	07440-60101	0	1	PCA-MAIN RS232 (DATE CODE 2824-11)	28480	07440-60101
C1	0160-7016	7	4	CAPACITOR .01UF 100V	28480	0160-7016
C2	0160-7016	7		CAPACITOR .01UF 100V	28480	0160-7016
C3	0160-7016	7		CAPACITOR .01UF 100V	28480	0160-7016
C4	0160-6351	6	19	CAPACITOR .22UF 50V	28480	0160-6351
C5	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C6	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C7	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C8	0160-7016	7		CAPACITOR .01UF 100V	28480	0160-7016
C9	0160-6348	1	7	CAPACITOR .01UF 50V	28480	0160-6348
C10	0160-6349	2	2	CAPACITOR .001UF 100V	28480	0160-6349
C11	0160-6353	8	1	CAPACITOR .47UF 100V	28480	0160-6353
C12	0160-6352	7	6	CAPACITOR 470PF 50V	28480	0160-6352
C13	0160-6352	7		CAPACITOR 470PF 50V	28480	0160-6352
C14	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C15	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C16	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C17	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C18	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C19	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C20	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C22	0160-6352	7		CAPACITOR 470PF 50V	28480	0160-6352
C23	0160-6352	7		CAPACITOR 470PF 50V	28480	0160-6352
C24	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C25	0160-6349	2		CAPACITOR .001UF 100V	28480	0160-6349
C26	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C27	0160-6352	7		CAPACITOR 470PF 50V	28480	0160-6352
C28	0160-6352	7		CAPACITOR 470PF 50V	28480	0160-6352
C29	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C30	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C31	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C32	0180-3940	3	1	CAPACITOR 3300UF 25V	28480	0180-3940
C33	0180-3942	7	1	CAPACITOR 2200UF 40V	28480	0180-3942
C34	0180-3705	0	2	CAPACITOR 47UF 50V	28480	0180-3705
C35	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C36	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C37	0180-3705	0		CAPACITOR 47UF 50V	28480	0180-3705
C38	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-3651
C39	0160-6354	9	2	CAPACITOR 47PF 50V	28480	0160-6354
C40	0160-6354	9		CAPACITOR 47PF 50V	28480	0160-6354
C41	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C42	0180-3776	5	1	CAPACITOR 100UF 10V	28480	0180-3776
C43	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C44	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C45	0160-6351	6		CAPACITOR .22UF 100V	28480	0160-6351
C46	0160-6351	6		CAPACITOR .22UF 100V	28480	0160-6351
C47	0160-6351	6		CAPACITOR .22UF 100V	28480	0160-6351
CR1	1901-1190	4	5	DIODE 200V 1.5A 1N5393	28480	1901-1190
CR2	1901-1177	7	8	DIODE-SWITCHING, IN4606	28480	1901-1177
CR3	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR4	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR5	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR6	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR7	1901-1179	9	8	DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR8	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR9	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR10	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR11	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR12	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR13	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR14	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR15	1901-1178	8	1	DIODE 1N4934	28480	1901-1178
CR16	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR17	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR18	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR19	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR20	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177

Table 9-5. Parts List, RS-232-C Main PCA (A1) Option 001 (Continued)

REF. DES.	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
CR21	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR22	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR23	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
F1	2110-0725	3	1	FUSE 2A	28480	2110-0725
H1,H2	0570-1316	2	2	STANDOFF-HEX .327-IN-LG 6-32THD	28480	0570-1316
H3-H6	0515-1877	4	4	SCREW METRIC THD ROLL M3 X 0.5 8MM LG	28480	0515-1877
J1	1252-2094	2	1	CONN, RS232 25 PIN FEMALE	28480	1252-2094
J2	1252-0762	7	1	CONN 4 PIN MALE	28480	1252-0762
J3	1252-0761	6	1	CONN 2P MALE	28480	1252-0761
J4	1252-0922	1	3	PIN-CONTACT, 37 PIN-FEMALE	28480	1252-0922
J5	1252-0922	1		PIN-CONTACT, 37 PIN FEMALE	28480	1252-0922
J6	1252-1049	5	1	CONN-BACK 22 PIN FEMALE	28480	1252-1049
J7	1252-0922	1		PIN-CONTACT, 37 PIN FEMALE	28480	1252-0922
Q1	1854-1087	7	2	TSTR 2N3904	28480	1854-1087
Q2	1854-1087	7		TSTR 2N3904	28480	1854-1087
Q3	1853-0598	6	1	TSTR 2N3906	28480	1853-0598
Q4	1854-1105	0	2	TSTR TIP41A	28480	1854-1105
Q5	1854-1088	9	1	TSTR 2N4401 NPN	28480	1854-1088
Q6	1854-1105	0		TSTR TIP41A	28480	1854-1105
R1	0699-1755	7	1	R 1K 1% .12W	28480	0699-1755
R2	0699-1756	8	1	R 9.09K 1% .12W	28480	0699-1756
R3	0699-1753	6	1	R 1M 5% .25W	28480	0699-1753
R4	0699-1754	5	1	R 6.8K 5% .25W	28480	0699-1754
R5	0699-1663	4	5	RESISTOR 5.6K 5% .25W	28480	0699-1663
R6	0699-1661	2	1	RESISTOR 100K 5% .25W	28480	0699-1661
R7	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R8	0699-1662	3	2	RESISTOR 22K 5% .25W	28480	0699-1662
R9	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R10	0699-1665	6	2	RESISTOR 33 5% .50W	28480	0699-1665
R11	0699-1669	0	1	RESISTOR 220 5% 1W	28480	0699-1669
R12	0699-1660	1	3	RESISTOR 1K 5% .25W	28480	0699-1660
R13	0699-1660	1		RESISTOR 1K 5% .25W	28480	0699-1660
R14	0699-1662	3		RESISTOR 22K 5% .25WW	28480	0699-1662
R15	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R16	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R17	0699-1667	8	5	RESISTOR 100 5% .25W	28480	0699-1667
R19	0699-1668	9	1	RESISTOR 2.7K 5% .50W	28480	0699-1668
R20	0699-1660	1		RESISTOR 1K 5% .25W0W	28480	0699-1660
R21	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R22	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R23	0699-1666	7	2	RESISTOR 150 5% .25W	28480	0699-1666
R24	0699-1665	6		RESISTOR 33 5% .50W	28480	0699-1665
R25	0699-1666	7		RESISTOR 150 5% .25W	28480	0699-1666
R26	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R27	0699-1664	5	1	RESISTOR 8.2K 5% .25W	28480	0699-1664
RN1	1810-0867	7	1	R NET 7 X 1K 2%	28480	1810-0867
S1	3101-1973	7	1	SWITCH-SLIDE 7SPST	28480	3101-1973
U1	1820-4491	2	2	SG POWER SIP L298 MOTOR DRIVER	28480	1820-4491
U2	1820-4491	2		SG POWER SIP L298 MOTOR DRIVER	28480	1820-4491
U3	1826-1567	9	2	IC +5V REG LM340T-5	28480	1826-1567
U4	1826-1567	9		IC +5V REG LM340T-5	28480	1826-1567
U5	1826-1411	9	1	IC LM393	28480	1826-1411
U6	1SE1-0051	9		IC SUPPORT (JOEY)	28480	1SE1-0051
U7	1820-4253	4	1	DS1489A RECEIVER	28480	1820-4253
U8	1820-4254	6	1	DS1488 DRIVER	28480	1820-4254
U9	1820-4292	1	1	IC-8032 MPU	28480	1820-4292
U10	1820-4441	2	1	74HCT573	28480	1820-4441
U11	07440-18211	4	1	IC-ROM 128K	28480	07440-18211
VR1	1902-1496	5	1	DIODE 13V 5% 1.5W	28480	1902-1496
VR2	1902-1499	8	1	DIODE 16.2V 5% .4W	28480	1902-1499
Y1	0410-2096	9	1	RESONATOR 12MHZ	28480	0410-2096

Table 9-6. Parts List, HP-IB Main PCA (A1) Option 002

REF. DES.	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
	07440-60102	1	1	PCA-MAIN HPIB	28480	07440-60102
C1	0160-7016	7	3	CAPACITOR .01UF 100V	28480	0160-7016
C2	0160-7016	7		CAPACITOR .01UF 100V	28480	0160-7016
C3	0160-7016	7		CAPACITOR .01UF 100V	28480	0160-7016
C4	0160-6351	6	15	CAPACITOR .22UF 50V	28480	0160-6351
C5	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C6	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C7	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C8	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C9	0160-6350	5	3	CAPACITOR 6800PF 100V	28480	0160-6350
C10	0160-6351	6		CAPACITOR.22UF 50V	28480	0160-6351
C11	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C12	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C13	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C14	0160-6353	8	1	CAPACITOR .47UF 100V	28480	0160-6353
C15	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C16	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C17	0180-3940	3	1	CAPACITOR 3300UF 25V	28480	0180-3940
C18	0180-3942	7	1	CAPACITOR 2200UF 50V	28480	0180-3942
C19	0160-6348	1	2	CAPACITOR .01UF 50V	28480	0160-6348
C20	0160-6349	2	2	CAPACITOR .001UF 100V	28480	0160-6349
C21	0160-6349	2		CAPACITOR .001UF 100V	28480	0160-6349
C22	0160-6350	5		CAPACITOR 6800PF 100V	28480	0160-6350
C23	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C24	0180-3776	5	1	CAPACITOR 100UF 10V	28480	0180-3776
C25	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C26	0160-6354	9	2	CAPACITOR 47PF 50V	28480	0160-6354
C27	0160-6354	9		CAPACITOR 47PF 50V	28480	0160-6354
C28	0160-6348	1		CAPACITOR .01UF 50V	28480	0160-6348
C29	0160-6351	6		CAPACITOR .22UF 50V	28480	0160-6351
C30	0180-3705	0	2	CAPACITOR 47UF 50V	28480	0180-3705
C31	0160-6350	5		CAPACITOR 6800PF 100V	28480	0160-6350
C32	0160-6351	6		CAPACITOR .22UF 50VV	28480	0160-6351
C33	0180-3705	0		CAPACITOR 47UF 50V	28480	0180-3705
CR1	1901-1190	4	6	DIODE 200V 1.5A 1N5393	28480	1901-1190
CR2	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR3	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR4	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR5	1901-1190	4		DIODE 200V 1.5A 1N5393	28480	1901-1190
CR6	1901-1178	8	1	DIODE 1N4934	28480	1901-1178
CR7	1901-1179	9	8	DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR8	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR9	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR10	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR11	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR12	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR13	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR14	1901-1179	9		DIODE SCHOTTKY 40V 1A	28480	1901-1179
CR15	1901-1177	7	8	DIODE-SWITCHING, IN4606	28480	1901-1177
CR16	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR17	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR18	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR19	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR20	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR21	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
CR22	1901-1177	7		DIODE-SWITCHING, IN4606	28480	1901-1177
F1	2110-0725	3	1	FUSE 2.0A	28480	2110-0725
H1,H2	0380-0644	4	2	STANDOFF-HEX .327-IN-LG 6-32THD	28480	0380-0644
H3-H6	0515-1877	4	4	SCREW METRIC THD ROLL M3 X 0.5 8MM LG	28480	0515-1877

Table 9-6. Parts List, HP-IB Main PCA (A1) Option 002 (Continued)

REF. DES.	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
J1	1252-1323	8	1	CONN 24 PIN HP-IB	28480	1252-1323
J2	1252-0762	7	1	CONN 4 PIN MALE	28480	1252-0762
J3	1252-0761	6	1	CONN 2P MALE	28480	1252-0761
J4	1252-0922	1	3	PIN-CONTACT, 37 PIN-FEMALE	28480	1252-0922
J5	1252-0922	1		PIN-CONTACT, 37 PIN-FEMALE	28480	1252-0922
J6	1252-1049	5	1	CONN-BACK 22 PIN	28480	1252-1049
J7	1252-0922	1		PIN-CONTACT, 37 PIN-FEMALE	28480	1252-0922
Q1	1854-1105	0	2	TSTR TIP41A	28480	1854-1105
Q2	1853-0598	1	1	TSTR 2N3906	28480	1853-0598
Q3	1854-1087	7	2	TSTR 2N3904	28480	1854-1087
Q4	1854-1087	7		TSTR 2N3904	28480	1854-1087
Q5	1854-1105	0		TSTR TIP41A	28480	1854-1105
Q6	1854-1088	8	1	TSTR 2N4401-NPN	28480	1854-1088
R1	0699-1753	3	1	RESISTOR 1M 5% .25W	28480	0699-1753
R2	0699-1663	4	6	RESISTOR 5.6K 5% .25W	28480	0699-1663
R3	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R4	0699-1755	5	1	RESISTOR 1K 1% .12W	28480	0699-1755
R5	0699-1756	6	1	RESISTOR 9.09K 1% .12W	28480	0699-1756
R6	0699-1661	2	1	RESISTOR 100K 5% .25W	28480	0699-1661
R7	0699-1662	3	2	RESISTOR 22 K 5% .25W	28480	0699-1662
R8	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R9	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R10	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R11	0699-1665	6	1	RESISTOR 33 .50W	28480	0699-1665
R12	0699-1660	1	2	RESISTOR 1K 5% .25W	28480	0699-1660
R13	0699-1669	0	1	RESISTOR 220 5% 1W	28480	0699-1669
R14	0699-1754	4	1	RESISTOR 6.8K 5% .25W	28480	0699-1754
R15	0699-1668	9	1	RESISTOR 2.7K 5% .50W	28480	0699-1668
R16	0699-1660	1		RESISTOR 1K 5% .25W	28480	0699-1660
R17	0699-1666	7	2	RESISTOR 150 5% .25W	28480	0699-1666
R18	0699-1663	4		RESISTOR 5.6K 5% .25W	28480	0699-1663
R20	0699-1667	8	5	RESISTOR 100 5% .25W	28480	0699-1667
R21	0699-1664	5	1	RESISTOR 8.2 K 5% .25W	28480	0699-1664
R22	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R23	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R24	0699-1662	3		RESISTOR 22K 5% .25W	28480	0699-1662
R25	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
R26	0699-1666	7		RESISTOR 150 5% .25W	28480	0699-1666
R27	0699-1667	8		RESISTOR 100 5% .25W	28480	0699-1667
RN1	1810-0867	7	1	R NET 7 X 1K 2%	28480	1810-0867
S1	3101-1973	7	1	SWITCH-SLIDE 7 SPST	28480	3101-1973
U1	1820-4491	2	2	SG POWER SIP L298 MOTOR DRIVER	28480	1820-4491
U2	1820-4491	2		SG POWER SIP L298 MOTOR DRIVER	28480	1820-4491
U3	1826-1410	1	2	IC +5V REG LM340T	28480	1826-1567
U4	1826-1410	1		IC +5V REG LM340T	28480	1826-1567
U5	1LH4-0001	2	1	IC HPIB XCVR	28480	1LH4-0001
U6	1820-4442	3	1	IC 8291A	28480	1820-4442
U7	1SE1-0051	5	1	IC SUPPORT (JOEY)	28480	1SE1-0051
U8	1826-1411	2	1	IC LM393	28480	1826-1411
U9	1820-4292	1		IC-8032 MPU	28480	1820-4292
U10	1820-4441	2	1	IC 74HC573	28480	1820-4441
U11	07440-18212	5	1	IC-ROM 128K	28480	07440-18212
VR1	1902-1499	8	1	DIODE 16.2V 5% .4W	28480	1902-1499
Y1	0410-2096	9	1	RESONATOR 12MHZ	28480	0410-2096

Table 9-7. Reference Designators and Abbreviations

REFERENCE DESIGNATIONS

A.....assembly
AT ..... attenuator; isolator; termination
B.....fan; motor
BT .....battery
C.....capacitor
CR ..... diode; diode thyristor; varactor
DS ..... annunciator; signaling device (audible or visual); lamp; LED
E..... miscellaneous electrical part
F.....fuse
FL ..... filter
H ..... hardware
J ..... electrical connector (stationary portion) jack
K.....relay
L.....coil; inductor
M ..... meter
MP..... miscellaneous mechanical part
P..... electrical connector (movable portion); plug
Q.....transistor; SCR; thyristor
R.....resistor
RT .....thermistor
S ..... switch
T..... transformer
TP .....test point
U .....integrated circuit; microcircuit
VR ..... voltage regulator; breakdown diode
W ..... cable; transmission path; wire
X.....socket
Y.....crystal unit (piezo-electric or quartz)

ABBREVIATIONS

A.....ampere
ac .... alternating current
ADJ.....adjustment
A/D ..... analog-to-digital
AMPL..... amplifier
ASSY .....assembly
AWG .....American wire gauge
BCD ..... binary coded decimal
BKDN..... breakdown
CAL..... calibrate
ccw.....counterclockwise
CER..... ceramic
CHAN..... channel
cm .....centimetre
COAX.....coaxial
COEF ..... coefficient
COM ..... common
COMP..... composition
CONN..... connector
CTL..... complementary transistor logic
cw.....clockwise
D/A ..... digital-to-analog
dB ..... decibel
dBm..... decibel referred to 1 mW
dc ..... direct current
deg ..... degree (temperature interval) or difference
° .....degree (plane angle)
°C..... degree Celsius (centigrade)
°F ..... degree Fahrenheit
°K.....degree Kelvin
diam ..... diameter
DIA ..... diameter
DIFF AMPL .. differential amplifier
DPDT ..... double-pole, double-throw
DTL.....diode transistor logic
DVM .... digital voltmeter
ECL..... emitter coupled logic
EMF ..... electromotive force
EDP.....electronic data processing
ELECT..... electrolytic
EAROM..... electrically alterable read only memory
EEPROM..... electrically eraseable programmable read only memory
EXT.....external
F..... farad
FET.....field-effect transistor
F/F ..... flip flop
FH ..... flat head
FM..... frequency modulation
FP ..... front panel
FP .....flame proof
FREQ ..... frequency
FXD.....fixed
g ..... gram
GE .....germanium
GHz.....gigahertz
GL .....glass
GND ..... ground(ed)
H ..... henry
h..... hour
HEX .....hexagonal
HD..... head
HDW..... hardware
HI..... high
HP .....Hewlett-Packard
HPF..... high pass filter
HR..... hour
HV.....high voltage
Hz ..... Hertz
IC..... integrated circuit
ID..... inside diameter
in. ..... inch
INCD ..... incandescent
INCL..... include(s)
INP ..... input
INS .....insulation
INT ..... internal
kg .....kilogram
kHz ..... kilohertz
kΩ .....kilohm
kV ..... kilovolt
lb .....pound
LC .....inductance-capacitance
LED.....light-emitting diode
LF ..... low frequency
LG ..... long
LH ..... left hand
Lim ..... limit
LIN .....linear taper (used in parts list)
lin..... linear
LKWASH ... lock washer
LO .....low; local oscillator
LOG ... logarithmic taper
log ..... logarithm(ic)
LPF..... low pass filter
LV .....low voltage
m ..... metre (distance)
mA..... milliampere
MAX .....maximum
MΩ..... megohm
MEG .....meg (10^6) (used in parts list)
MET FLM .....metal film
MET OX... metallic oxide
MF....medium frequency; microfarad
MFR .....manufacturer
mg ..... milligram
MHz .....megahertz
mH.....millihenry
mho ..... mho
MIN..... minimum
min ..... minute (time)
'..... minute (plane angle)
mm .....millimetre
MOD.....modulator
MON.....momentary
MOS .....metal-oxide semiconductor
ms .....millisecond
MTG ..... mounting
MTR ..... meter (indicating device)
mV.....millivolt
mVac..... millivolt, ac
mVdc..... millivolt, dc
mVpk ..... millivolt, peak
mVp-p..... millivolt, peak-to-peak
mVrms ..... millivolt, rms
mW ..... milliwatt
MUX.....multiplex
MY..... mylar
μA ..... microampere
μF..... microfarad
μH .....microhenry
μs .....microsecond
μV .....microvolt
μVac ..... microvolt, ac
μVdc ..... microvolt, dc
μVpk ..... microvolt, peak
μVp-p ..... microvolt, peak-to-peak
μVrms..... microvolt, rms
μW ..... microwatt
nA .....nanoampere
N/C.....normally closed
NEG ..... negative
NI PL .....nickel plate
N/O.....normally open
NOM.....nominal
NORM .....normal
NPN ... negative-positive-negative
ns ..... nanosecond
nW ..... nanowatt
OBD .....order by description
OD ..... outside diameter
OP AMPL ....operational amplifier
OPT.....option
OSC.....oscillator
OX ..... oxide
oz ..... ounce
Ω..... ohm
P..... peak
PC ..... printed circuit
pF.....picofarad
PIV .....peak inverse voltage
pk..... peak

NOTE

All abbreviations in the parts list will be in uppercase.

Table 9-7. Reference Designators and Abbreviations (Continued)

ABBREVIATIONS (Continued)

PNP .... positive-negative-positive
P/O ..... part of
POLY .....polystyrene
PORC ..... porcelain
POS .....positive; position(s)
POSN ..... position
POT..... potentiometer
p-p .....peak-to-peak (used in parts list)
PPM .... parts per million
PREAMPL .. preamplifier
PRF..... pulse-repetition frequency
PRR..... pulse repetition rate
ps ..... picosecond
PT .....point
PWV .....peak working voltage
RAM .....random access memory
RC .....resistance-capacitance
RECT ..... rectifier
REF..... reference
REG .....regulated
REPL ..... replaceable
RF .....radio frequency
RFI .....radio frequency interference
RH ..... round head; right hand
RLC.....resistance-inductance-capacitance
rms .... root-mean-square
RND ..... round
ROM .. read only memory
s ..... second (time)
″ .... second (plane angle)
S-B .....slow-blow (fuse)
SCR.... silicon controlled rectifier; screw
SE ..... selenium
SECT ..... sections
SEMICON.....semi-conductor
SI ..... silicon
SIL..... silver
SL ..... slide
SNR..... signal-to-noise ratio
SPDT ..... single-pole, double-throw
SPG..... spring
SR ..... split ring
SPST..... single-pole, single-throw
SST ..... stainless steel
STL ..... steel
SQ ..... square
SYNC ..... synchronize
T...timed (slow-blow fuse)
TA .....tantalum
TC ..... temperature coefficient
TD .....time delay
TERM..... terminal
TGL.....toggle
THD ..... thread
THRU.....through
TI ..... titanium
TOL .....tolerance
TRIM .....trimmer
TSTR..... transistor
TTL .....transistor-transistor logic
U .....micro (10^{-6}) (used in parts list)
UNREG ..... unregulated
V..... volt
VA ..... voltampere
Vac .....volts, ac
VAR .....variable
Vdc .....volts, dc
VDCW ..... volts, dc, working
Vpk ..... volts, peak
Vp-p... volts, peak-to-peak
Vrms ..... volts, rms
VTVM..... vacuum-tube voltmeter
W ..... watt
WIV..... working inverse voltage
WW ..... wirewound
W/O ..... without

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 9-8. Code List of Manufacturers

MFR. NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	Any Satisfactory Supplier		
28480	Hewlett-Packard Company, Corporate Headquarters	Palo Alto, CA	94304

CHAPTER 10

REFERENCE

10-1. INTRODUCTION

10-2. This chapter contains a list of additional manuals with useful information about the HP 7440 plotter, a glossary of commonly used technical terms, a list of mnemonics used in this hardware support manual, and a list of organization abbreviations.

10-3. OTHER MANUALS

Manual	HP Part Number
Programming Manual	07440-90001
Operating Manual	07440-90002

10-4. GLOSSARY

10-5. Refer to Table 10-1 for an alphabetical listing of electronics and computer terms used in this manual.

10-6. MNEMONICS

10-7. Refer to Table 10-2 for an alphabetical listing of mnemonics used in this manual.

10-8. OTHER TECHNICAL DATA

10-9. Refer to Table 10-3 for abbreviations of organizations mentioned in this manual.

Table 10-1. Glossary

Accumulator: One or more registers associated with the ALU which temporarily store sums and other arithmetical and logical results of the ALU.

ALU (Arithmetic Logic Unit): The ALU performs various forms of addition and subtraction. The logic mode performs such logic operations as ANDing the contents of two registers or masking the contents of a register.

Asynchronous: Operation of a switching network by a free-running signal which signals successive instructions; the completion of one instruction triggering the next. There is no fixed time per cycle.

Baud Rate: A measure of data flow. The number of signal elements per second based on the duration of the shortest element.

Bidirectional: A term applied to a port or bus line that can be used to transfer data in either direction.

Buffer: A circuit inserted between other circuit elements to prevent interactions, match impedances, supply additional drive capability, or delay rate of information flow. Buffers may be inverting or non-inverting.

Bus Driver: An integrated circuit which is added to the data bus system to facilitate proper drive to the CPU when several memories are tied to the data bus line. These are necessary because of capacitive loading which slows down the data rate and prevents proper time sequencing of microprocessor operation.

Byte: Indicates a predetermined number of consecutive bits treated as an entity.

Clock: A generator of pulses which controls the timing of switching circuits in a microprocessor.

Control Block: This is the circuitry which performs the control functions of the CPU. It is responsible for decoding microprogrammed instructions and generating the internal control signals that perform the operations requested.

CPU (Central Processing Unit): The processing circuitry of the microprocessor which is made up of storage elements called registers, computational circuits in the ALU, the Control Block, and I/O.

DART (Dual Asynchronous Receiver Transmitter): A dual channel serial to parallel, parallel to serial converter/controller used in the asynchronous mode. It also provides modem control for both channels.

Data Bus: The microprocessor communicates internally and externally by means of the data bus. It is bidirectional and can transfer data to and from the CPU, memory storage, and peripheral devices.

Table 10-1. Glossary (Continued)

Decrement: A programming instruction which decreases the contents of a storage location.

Dedicated: To set apart for some special use. For example, a ROM is a dedicated memory.

DMA (Direct Memory Access): A method of gaining direct access to main storage to achieve data transfer without involving the CPU.

EAROM (Electrically Alterable ROM): Electrically alterable read-only memories are low-powered devices that are programmed much like ordinary RAMs.

EEROM (Electrically Eraseable ROM): A voltage is applied at an input pin to overcome the charge and bit designation at a particular gate.

EPROM (Electrically Programmable ROM): Manufactured with a transparent quartz lid covering the silicon die to facilitate erasure with an ultraviolet irradiation instrument. Programming will not degrade after exposure to other light sources.

Execution Time: Usually expressed in clock cycles necessary to carry out an instruction.

Firmware: Software instructions which have been permanently frozen into a ROM.

Flag Bit: An information bit which indicates some form of demarcation has been reached such as overflow or carry. Also an indicator of special conditions such as interrupts.

Flow Chart or Flow Diagram: A graphical representation for the definition, analysis, or solution of a problem, in which symbols are used to represent operations, data, flow, and equipment.

Hardware: Any piece of data processing equipment or the individual components of a circuit, both passive and active.

Hardwired Logic: The interconnection of numerous integrated circuits representing the logic elements.

Instruction Set: Constitutes the total list of instructions that can be executed by a given microprocessor and provides the basic information necessary to assemble a program.

Interface: A common boundary between adjacent components, circuits, or systems. The interface enables the devices to yield and acquire information from one another.

Interrupt: An interrupt involves the suspension of the normal programming routine of a microprocessor in order to handle a sudden request for service.

Interrupt Mask: Prevents the CPU from responding to further interrupt requests until cleared by execution of programmed instructions.

I/O (Input/Output): Package pins which are tied directly to the internal bus network to enable the I/O to interface the microprocessor with external elements.

Memory: The part of a system into which information can be inserted and held for future use.

Microprocessor: The semiconductor CPU is one of the principal components of the microcomputer. The elements of the microprocessor are frequently contained on a single chip but can be distributed over several separate chips.

Mnemonic Code: Groups of letters or symbols that suggest the definition of an instruction or the name of a signal.

MOS (Metal-Oxide Semiconductor): In MOS technology, amplification or switching is accomplished by applying a signal voltage to a gate electrode. The resulting electrostatic field creates a conduction channel between the two defused regions in the silicon crystal structure called the source and the drain.

Multiplexing: A process of transmitting more than one signal at a time over a single link, route, or channel.

Parallel Operation: Processing all the digits of a word or byte simultaneously by transmitting each digit on a separate channel or bus line.

Table 10-1. Glossary (Continued)

Parse: To divide a computer instruction into meaningful parts, interpret the meaning of the parts, and determine the sequence of the actions required to execute the instruction.

Parser: The sections of the software and firmware that parse computer instructions and generate appropriate machine code to carry out the actions indicated.

Polling: The method used to identify the source of interrupt requests.

Port: Device terminals that provide electrical access to a system or circuit.

Program: A procedure for solving a problem and frequently referred to as software.

Program Counter: One of the registers in the CPU which holds addresses necessary to step the machine through the program.

RAM (Random Access Memory): Provides rapid access to any storage location point in the memory immediately by means of vertical and horizontal coordinates. Information may be "written" in or "read" out in the same way.

Register: A register is a memory on a smaller scale. The words stored in it may involve arithmetical, logical, or transferral operations.

ROM (Read-Only Memory): Information is stored permanently and is read out, but not altered in operation.

Scratchpad: This term is applied to information that the processing unit stores or holds temporarily. It is a memory containing subtotals for various unknowns which are needed for final results.

Software: The programs, routines, and languages used by a programmer to communicate with the computer.

Storage: The word storage is used interchangeably with memory.

Subroutine: Part of a master routine which may be used at will in a variety of master routines.

Throughput: The speed with which problems or segments of problems are performed.

UART (Universal Asychronous Receiver Transmitter): Interfaces a word parallel controller or data terminal to a bit serial communication network. The HP 7440 does not contain a separate UART. The serial port of the microprocessor in the RS-232-C version of the plotter performs the functions of the UART.

Table 10-2. Mnemonics

MNEMONIC	DEFINITION
ALE	Address Latch Enable
APE	Automatic Poll Enable
ATN	Attention
CA	Controller Active
CLK	Clock
COMPEN	Comparator Enable
COMPX	Comparator X Feedback Signal
COMPY	Comparator Y Feedback Signal
CS	Chip Select
CTS	Clear to Send
DAC	Data Accepted
DAV	Data Available
DIO	Data Input/Output
DMAACK	Direct Memory Access Acknowledge
DMAREQ	Direct Memory Access Request
DSA	Digital Signature Analysis

Table 10-2. Mnemonics (Continued)

MNEMONIC	DEFINITION
DSR	Data Set Ready
DTR	Data Terminal Ready
EA	External Address
EOI	End Or Identify
EXT	External
FP	Front Panel
GEC	Graphic Enhancement Cartridge
HP-GL	Hewlett-Packard Graphics Language
HP-IB	Hewlett-Packard Interface Bus
IFC	Interface Clear
INT	Interrupt
MOTXA	Motor X-Axis A Drive Signal
MOTXB	Motor X-Axis B Drive Signal
MOTYA	Motor Y-Axis A Drive Signal
MOTYB	Motor Y-Axis B Drive Signal
NDAC	Not Data Accepted
NMOS	N-Channel Metal Oxide Semiconductor
NRFD	Not Ready For Data
PCA	Printed Circuit Assembly
PPL	Parallel Poll Latch
PPWM	Power Supply Pulse Width Modulator
PS	Power Supply
PSCOMP	Power Supply Comparator
PWM	Pulse Width Modulator
RD	Read
REN	Read Enable
RFD	Ready For Data
RLS	Received Line Signal
RLSD	Received Line Signal Detector
RPNL	Rear Panel
RS	Register Select
RST	Reset
RXD	Received Data
SC	System Controller
SRQ	Service Request
TAD	Tracking Analog to Ditigal
TE	Talker Enable
T/R	Transmit/Receive
TXD	Transmitted Data
VLSI	Very Large Scale Integration
WE	Write Enable
WR	Write
XTAL	Crystal

Table 10-3. Organization Abbreviations

ABBREVIATION	FULL NAME
ANSI	American National Standards Institute
CCITT	International Telegraph and Telephone Consultative Committee
EIA	Electronics Industries Association
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization

CHAPTER 11

PRODUCT HISTORY

11-1. INTRODUCTION

11-2. This chapter describes the differences between earlier versions of the HP7440 and the latest version documented in this manual. These earlier versions are identified by their serial number prefix on the title page of this manual. Printed circuit assembly (PCA) levels are identified by their date codes. For ease of reference, this section is divided into two major topics:

- History of Assemblies by Serial Number Prefix
- History of Printed Circuit Assemblies (PCAs)

11-3. HISTORY OF ASSEMBLIES BY SERIAL NUMBER PREFIX

11-4. Table 11-1 is a quick-reference table that lists, by serial number prefix, the assemblies that differ from those documented in this manual. Also referenced are Item Numbers under which these differences are described in this chapter. Table 11-2 lists the assemblies, other than PCAs that are described under each item.

11-5. Knowing the serial number prefix of a plotter, the user can see in Table 11-1 which assemblies are documented in this chapter. In Table 11-2 the user can see if more than one change has been made to a mechanical assembly.

Table 11-1. Assemblies by Product Serial Prefix Number

HP 7440 S/N PREFIX	ASSEMBLIES	ITEM
	No Change	

Table 11-2. Item Description

ITEM	ASSEMBLIES
	No Change

11-6. HISTORY OF PRINTED-CIRCUIT ASSEMBLIES (PCAs)

11-7. Hewlett-Packard's printed-circuit assemblies have three major identification features:

a. **Part Number.** All PCAs having the same part number are directly interchangeable. If a PCA is revised in any way that makes it non-interchangeable with previously issued PCAs of the same part number, a new part number is assigned to the revised PCA.

b. **Revision Letter.** This letter identifies the most recent revision to the etched circuit pattern. The original issue is identified with the letter "A". If the master artwork for a printed circuit board is revised in order to alter performance or manufacture, the revision letter is changed to the next letter in the alphabetical sequence.

c. **Assembly Date Code.** The date code on the PCA is a four-digit number which identifies the assembly level of the PCA. The first two digits represent the last two digits of the current year and are derived by subtracting 60 from the current year. The next two digits are the number of the week in that year. Any digits following a hyphen in the date code represent the division that manufactured the PCA; ie., 2501-11 = first week in 1985 and manufactured at division 11.

11-8. Table 11-3 is a quick-reference table that lists PCAs by part number and date code. Listed next to the part number and date code of the PCAs are the Items located in this section that describe the differences between the PCA in question and the level of that PCA described in the main body of this manual.

Table 11-3. PCA Date Codes

PRINTED CIRCUIT ASSEMBLY (PCA)	DATE CODE	REVISION	ITEMS
A1 Main PCA			
(07440-60101)	2539-11	A	1, 2, 3, 5, 6, 7, 9, 11, 12, 13, 15, 17
	2540-11	B	2, 3, 5, 6, 7, 9, 11, 12, 13, 15, 17
	2542-11	B	3, 5, 6, 7, 9, 11, 12, 13, 15, 17
	2620-11	B	5, 6, 7, 9, 11, 12, 13, 15, 17
	2632-11	B	6, 7, 9, 11, 12, 13, 15, 17
	2635-11	B	7, 9, 11, 12, 13, 15, 17
	2704-11	C	9, 11, 12, 13, 15, 17
	2709-11	C	11, 12, 13, 15, 17
	2715-11	C	12, 13, 15, 17
	2718-11	C	13, 15, 17
	2730-11	C	15, 17
	2816-11	C	17
A1 Main PCA			
(07440-60102)	2539-11	A	1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16
	2540-11	A	2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16
	2542-11	A	3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16
	2550-11	A	4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16
	2620-11	A	5, 6, 7, 8, 10, 12, 13, 14, 15, 16
	2632-11	A	6, 7, 8, 10, 12, 13, 14, 15, 16
	2635-11	A	7, 8, 10, 12, 13, 14, 15, 16
	2704-11	A	8, 10, 12, 13, 14, 15, 16
	2709-11	A	10, 12, 13, 14, 15, 16
	2718-11	A	13, 14, 15, 16
	2721-11	B	14, 15, 16
	2730-11	B	14, 15, 16
	2752-11	D	16

ITEM 1

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

No Date code label

ITEM 2

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 has the same components as the Main PCA 07440-60101 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1C33	0180-3655	7	1	CAPACITOR 2000UF 40V	28480	0180-3655
A1C42	0180-3706	1	1	CAPACITOR 100UF 50V	28480	0180-3706
A1R10	0699-1667	8	3	RESISTOR 100 5% .25W	28480	0699-1667
A1R26	0699-1660	1		RESISTOR 1K 5% .25W	28480	0699-1660

ITEM 3

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
28480	1810-0867	7	1	R NET 7 X 1K 2%	28480	1810-0867

ITEM 4

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60102 has the same components as the Main PCA 07440-60102 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1J1	1252-0826	4	1	CONN HP-IB 24PF	28480	1252-0826

ITEM 5

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1H3-H6	0515-1075	0	4	SCREW THD ROLL	28480	0515-1075

ITEM 6

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1Y1	0410-1592	8	1	RESONATOR 12MHZ	28480	0410-1592

ITEM 7

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1CR1,4,5	1901-1191	5	3	DIODE 100V 1N4002	28480	1901-1191
A1C1,2,3	0160-6433	5	3	CAPACITOR 6800PF 100V	28480	0160-6433

ITEM 8

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60102 has the same components as the Main PCA 07440-60102 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1C18	0180-3761	6	1	CAPACITOR 2200UF 40V	28480	0180-3761

ITEM 9

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 has the same components as the Main PCA 07440-60101 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1C33	0180-3761	6	1	CAPACITOR 2200UF 40V	28480	0180-3761

ITEM 10

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60102 has the same components as the Main PCA 07440-60102 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1C17	0180-3656	0	1	CAPACITOR 3300UF 25V	28480	0180-3656

ITEM 11

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 has the same components as the Main PCA 07440-60101 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1C32	0180-3656	8	1	CAPACITOR 3300UF 25V	28480	0180-3656

ITEM 12

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 has the same components as the Main PCA 07440-60101 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1J1	1252-1370	5	1	CONN, RS-232-C 25 PIN FEMALE	28480	1252-1370

ITEM 13

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCAs 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1RN1	0810-0487	7	1	R NET 7 X 1K 2%	28480	0810-0487

ITEM 14

Main PCA 07440-10102 changed to Rev. B. No part number changes.

ITEM 15

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 and 07440-60102 have the same components as the Main PCAs listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
A1U3	1826-1410	1	2	IC +5V REG	28480	1826-1410
A1U4	1826-1410	1		IC +5V REG	28480	1826-1410

ITEM 16

Main PCA 07440-60102 changed to Rev. d. (No Rev. C) Changes were made to PCB dimensions Some hole diameters on PCB were also altered.

ITEM 17

Except for the parts listed in this item and any parts listed in pertinent higher numbered items, Main PCA 07440-60101 has the same components as the Main PCA 07440-60101 listed in Chapter 9 of this manual.

REF DES	HP PART NUMBER	C D	QTY	DESCRIPTION	MFR CODE	MFR PART NUMBER
R28	0699-1663	4	1	RESISTOR 5.6K 5% 0.25W	28480	0699-1663
Y1	0410-1948	1	1	RESONATOR 12 MHz	28480	0410-1948

CHAPTER 12

DIAGRAMS

12-1. INTRODUCTION

12-2. This chapter contains a troubleshooting flowchart, a functional block diagram, an interconnecting cable diagram, and schematic diagrams for HP 7440 plotter circuitry.

12-3. TROUBLESHOOTING CHART

12-4. To troubleshoot the plotter, refer to Figure 12-1.

12-5. ENGINEERING DIAGRAMS

12-6. FUNCTIONAL BLOCK DIAGRAM

12-7. Service Sheet 1, Figure 12-2 is the functional block diagram for the HP 7440 plotter.

12-8. ELECTRICAL DIAGRAMS

12-9. Service Sheet 2 through Service Sheet 8 are the component location and schematic diagrams for the HP 7440 plotter.

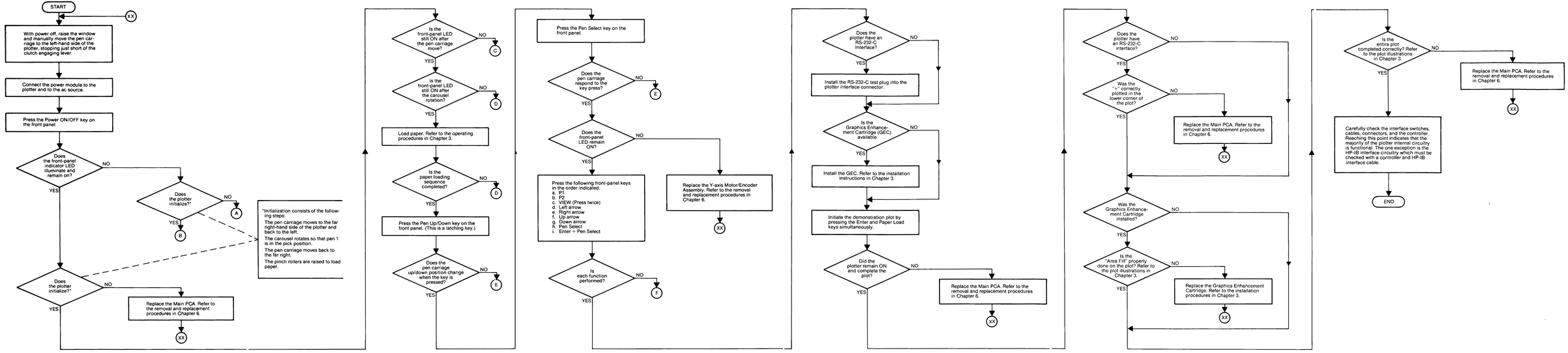


Figure 12-1. Troubleshooting Flowchart (Sheet 1 of 3)

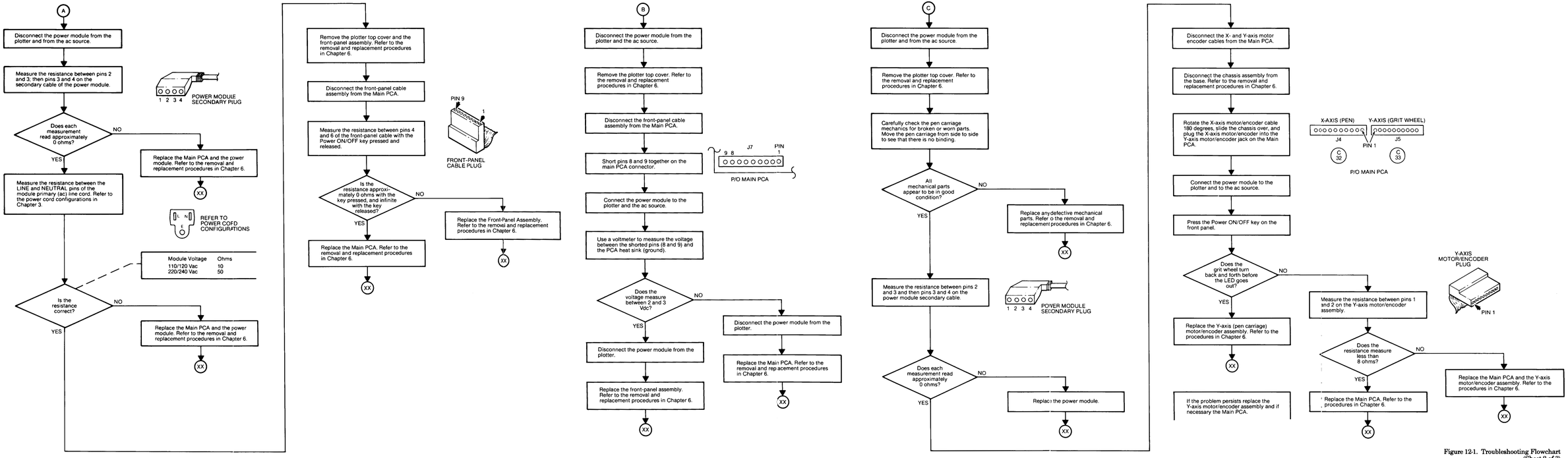
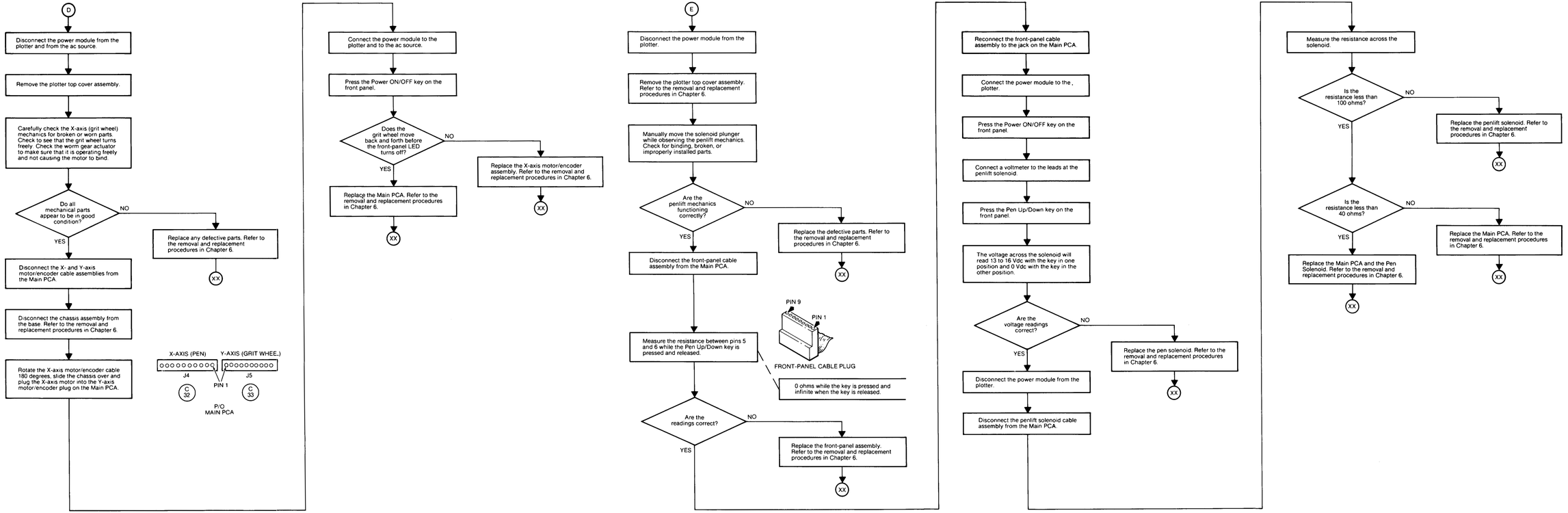
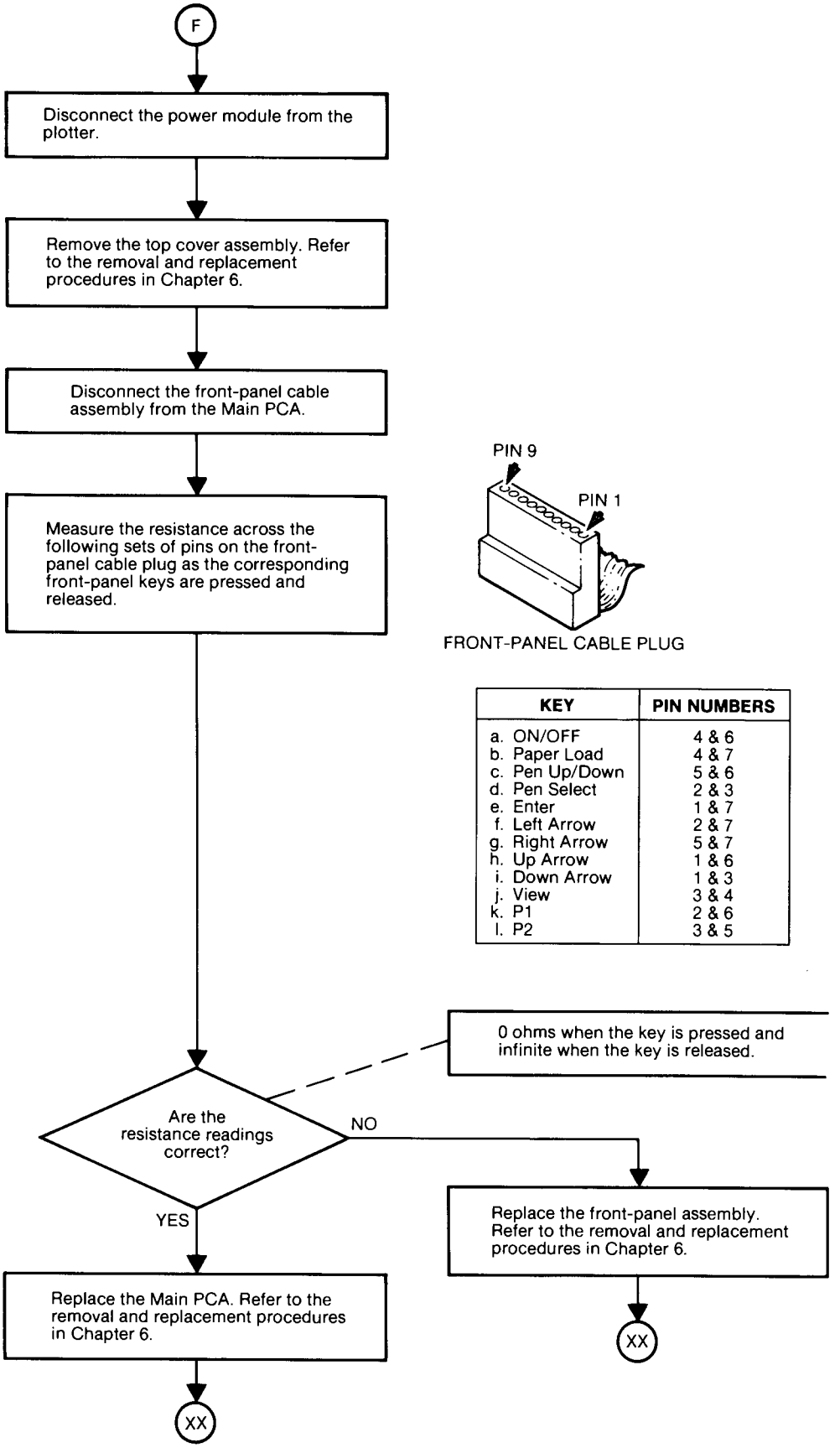


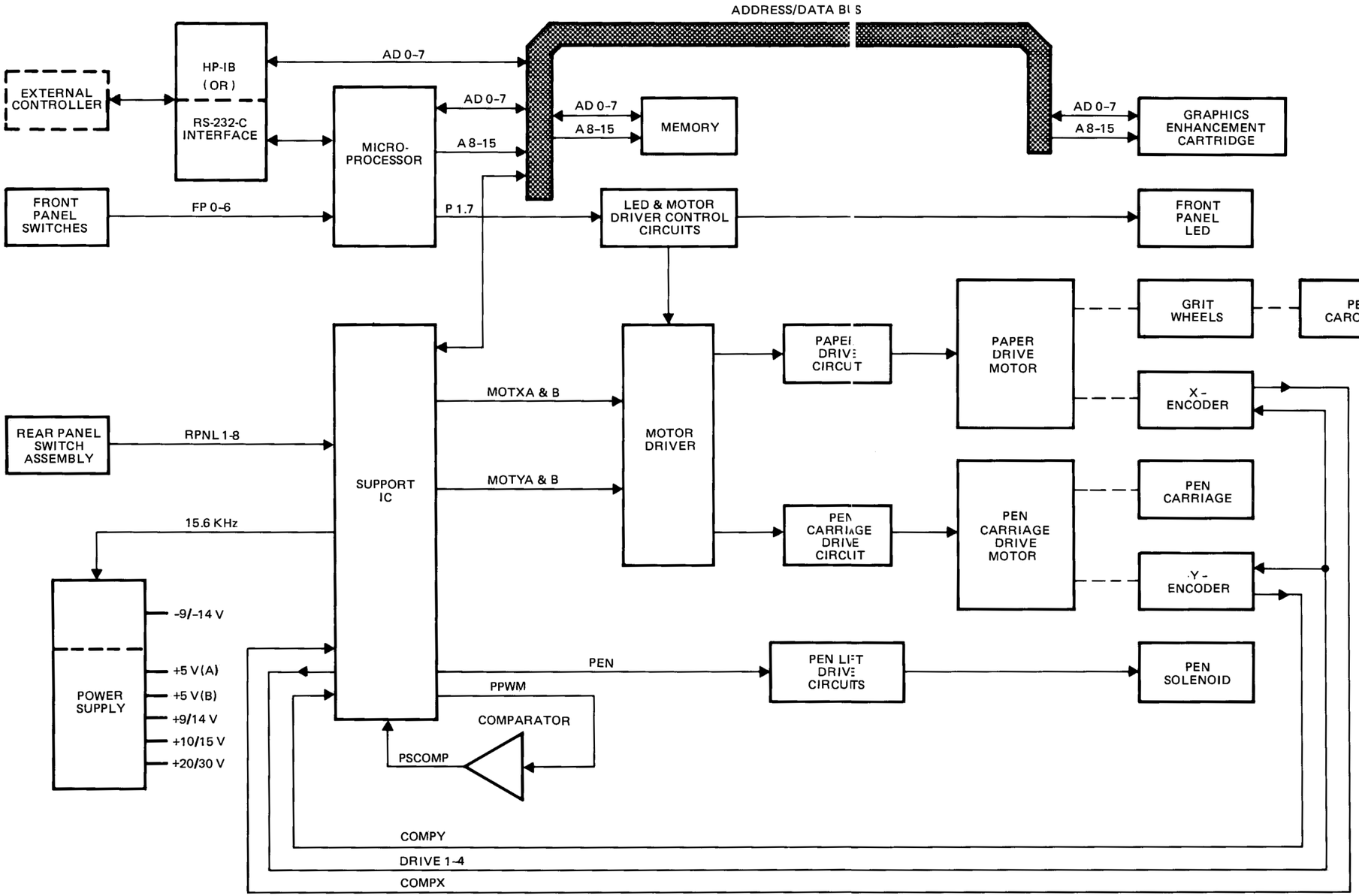
Figure 12-1. Troubleshooting Flowchart (Sheet 2 of 3)


D
Disconnect the power module from the plotter and from the ac source.
Remove the plotter top cover assembly.
Carefully check the X-axis (grit wheel) mechanics for broken or worn parts. Check to see that the grit wheel turns freely. Check the worm gear actuator to make sure that it is operating freely and not causing the motor to bind.
Do all mechanical parts appear to be in good condition?
NO
YES
Replace any defective parts. Refer to the removal and replacement procedures in Chapter 6.
XX
Disconnect the X- and Y-axis motor/encoder cable assemblies from the Main PCA.
Disconnect the chassis assembly from the base. Refer to the removal and replacement procedures in Chapter 6.
Rotate the X-axis motor/encoder cable 180 degrees, slide the chassis over and plug the X-axis motor into the Y-axis motor/encoder plug on the Main PCA.
X-AXIS (PEN)
Y-AXIS (GRIT WHEEL)
J4
J5
PIN 1
C 32
C 33
P/O MAIN PCA
Connect the power module to the plotter and to the ac source.
Press the Power ON/OFF key on the front panel.
Does the grit wheel move back and forth before the front-panel LED turns off?
NO
YES
Replace the X-axis motor/encoder assembly. Refer to the removal and replacement procedures in Chapter 6.
XX
Replace the Main PCA. Refer to the removal and replacement procedures in Chapter 6.
XX
E
Disconnect the power module from the plotter.
Remove the plotter top cover assembly. Refer to the removal and replacement procedures in Chapter 6.
Manually move the solenoid plunger while observing the penlift mechanics. Check for binding, broken, or improperly installed parts.
Are the penlift mechanics functioning correctly?
NO
YES
Replace the defective parts. Refer to the removal and replacement procedures in Chapter 6.
XX
Disconnect the front-panel cable assembly from the Main PCA.
Measure the resistance between pins 5 and 6 while the Pen Up/Down key is pressed and released.
PIN 9
PIN 1
FRONT-PANEL CABLE PLUG
0 ohms while the key is pressed and infinite when the key is released.
Are the readings correct?
NO
YES
Replace the front-panel assembly. Refer to the removal and replacement procedures in Chapter 6.
XX
Reconnect the front-panel cable assembly to the jack on the Main PCA.
Connect the power module to the plotter.
Press the Power ON/OFF key on the front panel.
Connect a voltmeter to the leads at the penlift solenoid.
Press the Pen Up/Down key on the front panel.
The voltage across the solenoid will read 13 to 16 Vdc with the key in one position and 0 Vdc with the key in the other position.
Are the voltage readings correct?
NO
YES
Replace the pen solenoid. Refer to the removal and replacement procedures in Chapter 6.
XX
Disconnect the power module from the plotter.
Disconnect the penlift solenoid cable assembly from the Main PCA.
Measure the resistance across the solenoid.
Is the resistance less than 100 ohms?
NO
YES
Replace the penlift solenoid. Refer to the removal and replacement procedures in Chapter 6.
XX
Is the resistance less than 40 ohms?
NO
YES
Replace the Main PCA. Refer to the removal and replacement procedures in Chapter 6.
XX
Replace the Main PCA and the Pen Solenoid. Refer to the removal and replacement procedures in Chapter 6.
XX



440-D-45-1

Figure 12-1. Troubleshooting Flowchart (Sheet 3 of 3)



1

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Figure 12-2. Functional Block Diagram - HP Model 744

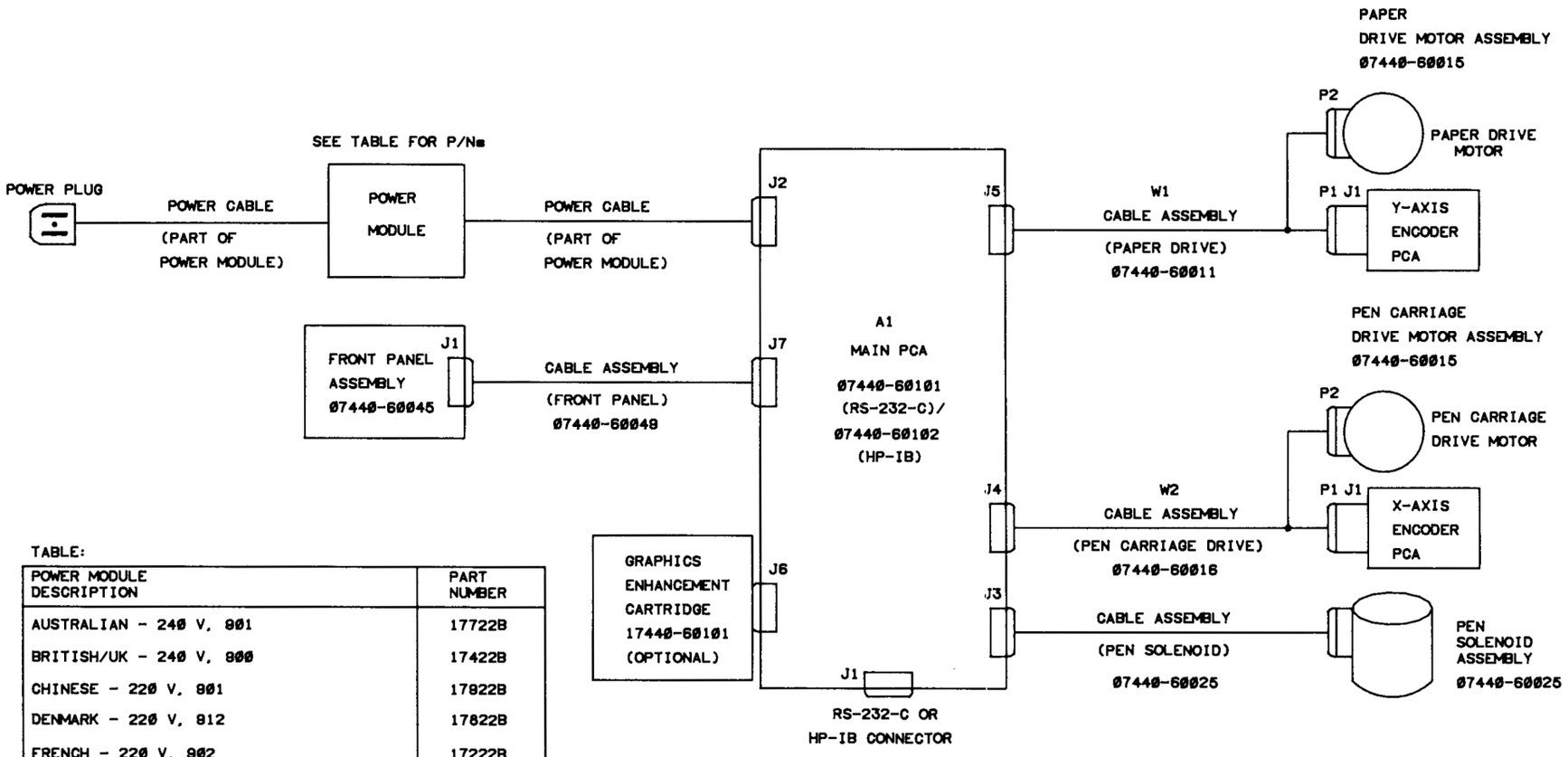

TABLE:

POWER MODULE DESCRIPTION	PART NUMBER
AUSTRALIAN - 240 V, 901	17722B
BRITISH/UK - 240 V, 900	17422B
CHINESE - 220 V, 901	17922B
DENMARK - 220 V, 912	17822B
FRENCH - 220 V, 902	17222B
ITALIAN - 220 V, 902	17222B
JAPANESE/ENGLISH - 100 V, 903	17322B
SOUTH AFRICAN - 220 V, 917	17822B
SOUTH AM./GERMAN/FINNISH - 220 V, 902	17222B
SWISS - 220 V, 906	17522B
USA/ENGLISH/SPANISH - 120 V, 903	17122B

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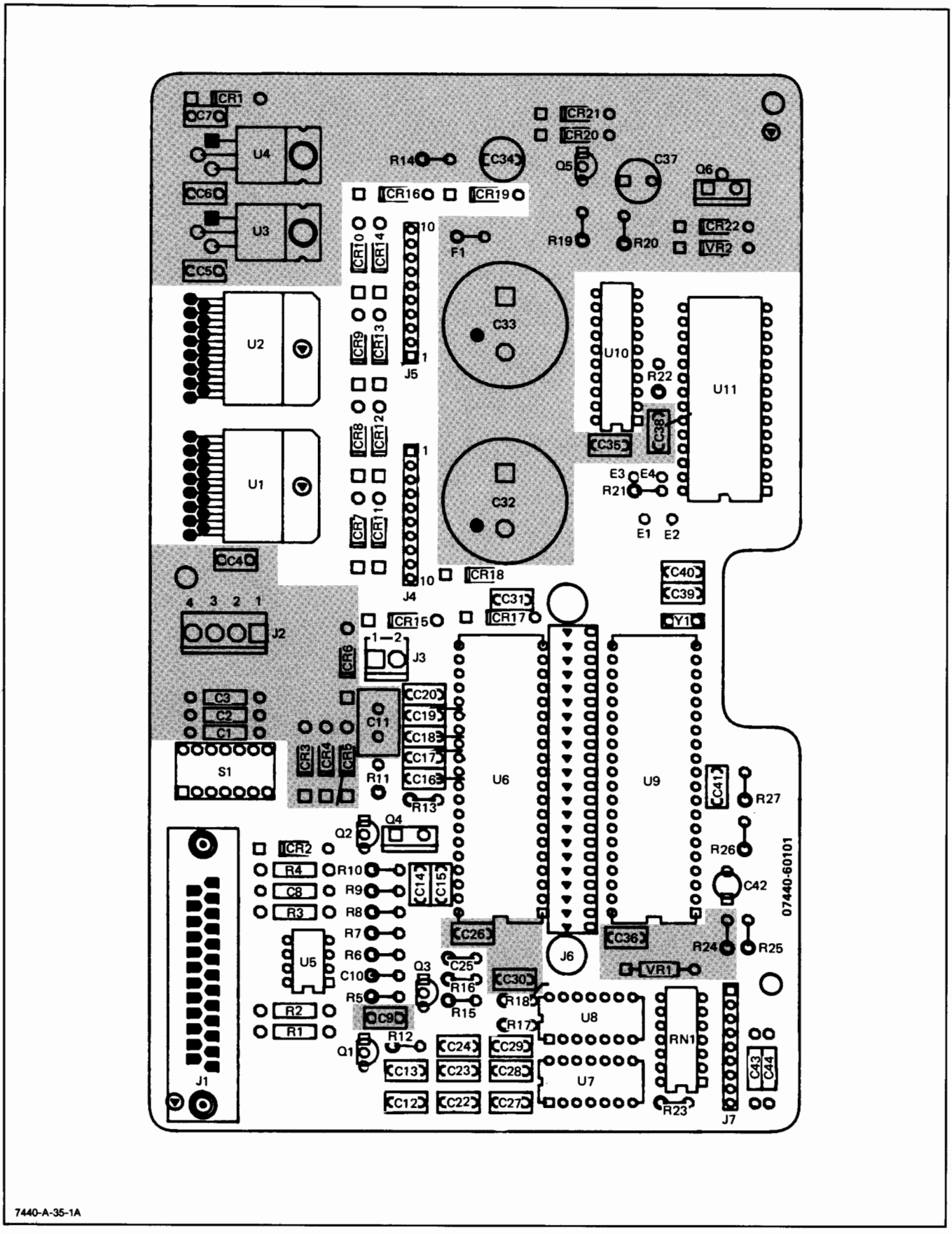
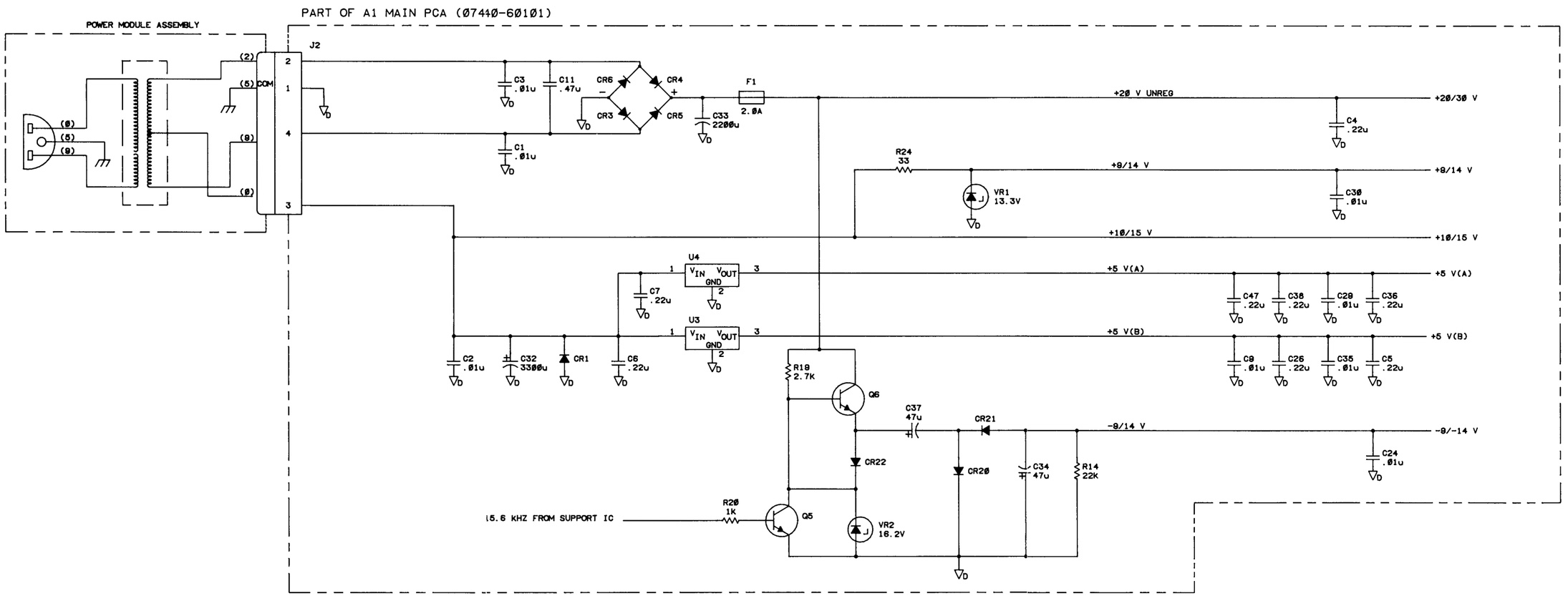
Figure 12-3. HP 7440 Interconnecting Cable Identification Diagram



7440-A-35-1A

Figure 12-4. HP 7440 Main PCA, Option 001 (RS-232-C), Component Location Diagram


POWER MODULE ASSEMBLY
PART OF A1 MAIN PCA (07440-60101)
J2
(2)
(5) COM
(0)
(5)
(9)
(9)
(0)
2
1
4
3
C3 .01u
C11 .47u
CR6
CR4
CR3
CR5
F1
2.0A
C33 2200u
C1 .01u
+20 V UNREG
+20/30 V
C4 .22u
R24 33
+9/14 V
+9/14 V
VR1 13.3V
C30 .01u
+10/15 V
+10/15 V
U4
VIN VOUT GND
+5 V(A)
+5 V(A)
C7 .22u
C47 .22u
C38 .22u
C29 .01u
C36 .22u
U3
+5 V(B)
+5 V(B)
C2 .01u
C32 3300u
CR1
C6 .22u
C8 .01u
C26 .22u
C35 .01u
C5 .22u
R18 2.7K
Q6
C37 47u
CR21
-9/14 V
-9/-14 V
C24 .01u
CR22
CR20
C34 47u
R14 22K
R20 1K
15.6 kHZ FROM SUPPORT IC
Q5
VR2 16.2V

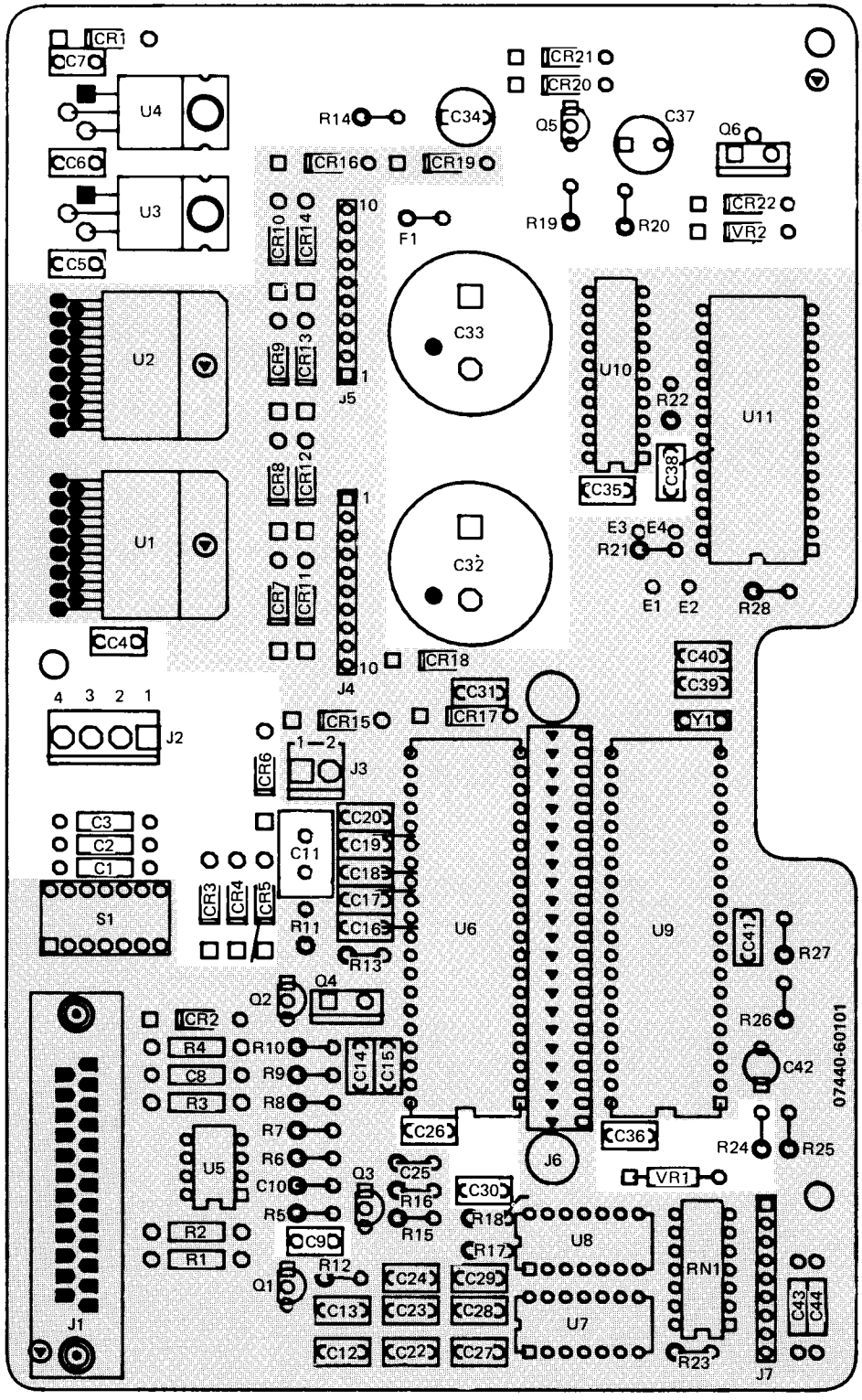
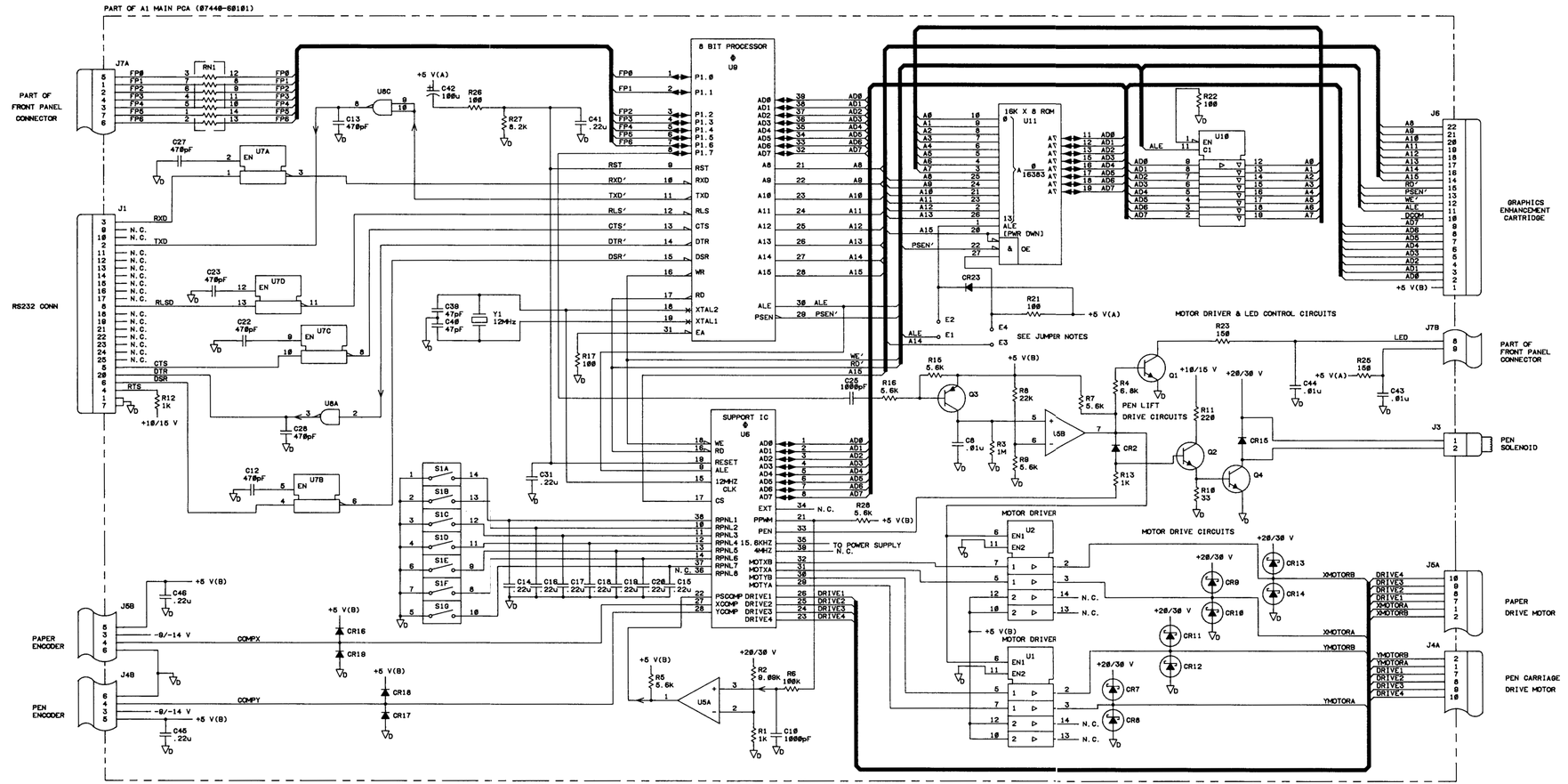


Figure 12-6. HP 7440 Power Supply, Option 001 (RS-232-C), Component Location Diagram



JUMPER NOTES:

1. AS SHOWN FOR STANDARD ROM OR EPROM, NO JUMPER BETWEEN E1 & E2. INSTALL R28 & R21. INSTALL U10.
2. FOR LATCHED ROM, REMOVE R28 AND USE R28 TO JUMPER E1 TO E2. INSTALL R21. REMOVE U10.
3. JUMPER BETWEEN E3 & E4 IS RESERVED FOR POSSIBLE USE OF 32K ROM.
4. THE STANDARD BAR SYMBOL FOR LOGICAL NEGATION HAS BEEN REPLACED WITH AN APOSTROPHE ON THIS SCHEMATIC (EG. PSEN' MEANS NOT PSEN).
5. REFERENCE DESIGNATOR C21 NOT USED; REFERENCE DESIGNATOR R18 NOT USED.
6. LAST USED REFERENCE DESIGNATORS ARE R28, C44, U11, Q6, CR22, VR2, F1, J7, S1, Y1, E4, RN1.
7. REFERENCE SCHEMATIC SOFTWARE S-07440-90101.

IC#	VOLTAGE	PIN	DESIG	DECOUPLING CAPACITORS
U1,U2	+5 V(B)	8	VCC	C5
	+20/30 V	4	VS	C4
	0 V	5	COM	
	0V	1	SENSE A (COM)	
	0V	15	SENSE B (COM)	
U3	POWER SUPPLY			
U4	POWER SUPPLY			
U5	+5 V(B)	8	VCC	C9
	0 V	4	COM	
U6	+5 V(B)	40	VCC	C26
	0 V	20	COM	
U7	+5 V(A)	14	VCC	C29
	0 V	7	COM	
U8	+8/14V	14	VSS	C38
	-8/-14V	1	VEE	C24
	0 V	7	COM	
U9	+5 V(A)	40	VCC	C36
	0 V	20	COM	
U10	+5 V(A)	28	VCC	C35
	0 V	14	COM	
U11	+5 V(A)	28	VCC	C36
	0 V	14	COM	

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Figure 12-5. HP 7440 Main PCA, Option 001 (RS-232-C), Schematic Diagram

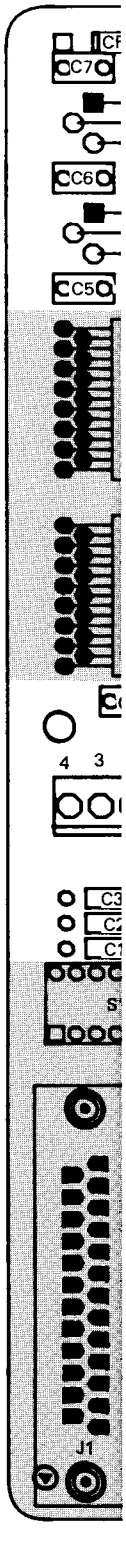

Figure 12-6.

IC#	VOLTAGE	PIN	DESIG	DECOUPLING CAPACITORS
U1, U2	+5 V(B)	8	VCC	C5
	+20/30 V	4	VS	C4
	0 V	6	COM	
	0V	1	SENSE A (COM)	
	0V	15	SENSE B (COM)	
U3	POWER SUPPLY			
U4	POWER SUPPLY			
U5	+5 V(B)	8	VCC	C9
	0 V	4	COM	
U6	+5 V(B)	40	VCC	C26
	0 V	20	COM	
U7	+5 V(A)	14	VCC	C29
	0 V	7	COM	
U8	+9/14V	14	VSS	C30
	-9/-14V	1	VEE	C24
	0 V	7	COM	
U9	+5 V(A)	40	VCC	C36
	0 V	20	COM	
U10	+5 V(A)	28	VCC	C35
	0 V	10	COM	
U11	+5 V(A)	28	VCC	C38
	0 V	14	COM	

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Figure 12-7. HP 7440 Power Supply, Option 001 (RS-232-C), Schematic Diagram

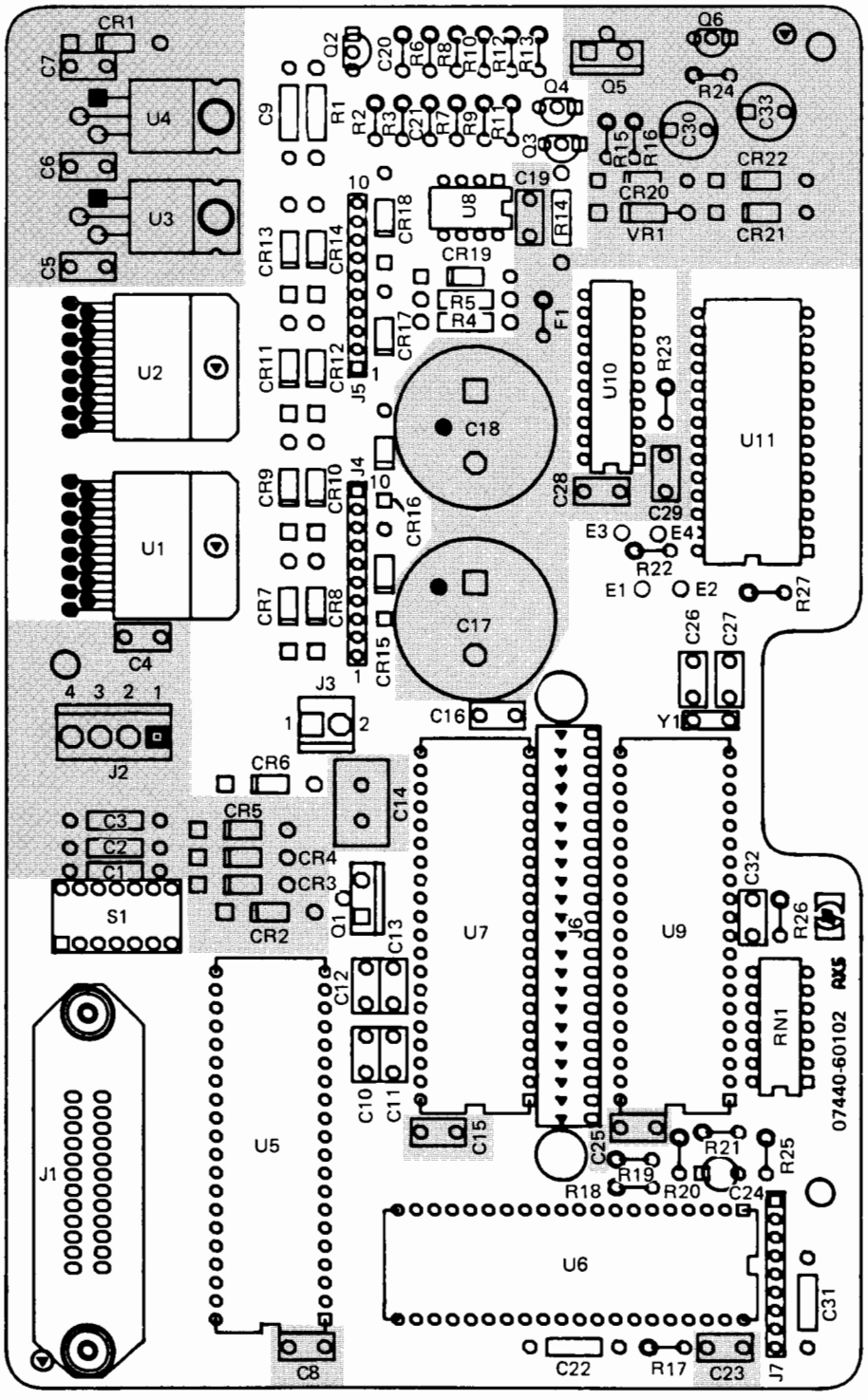
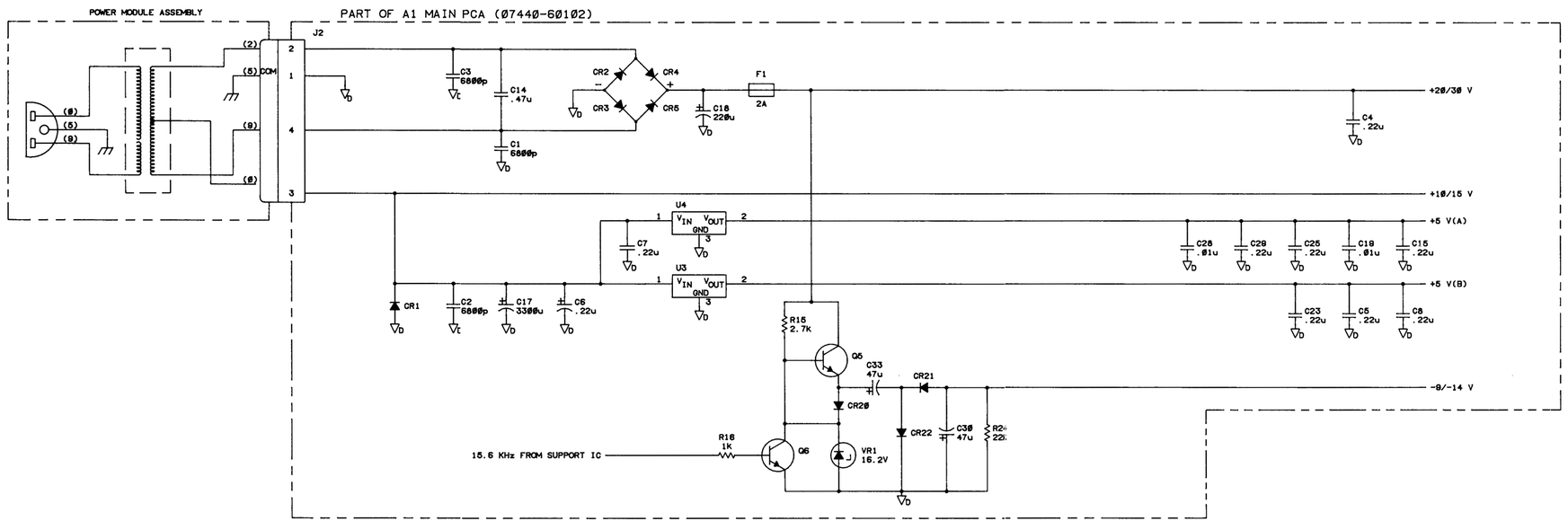


Figure 12-8. HP 7440 Main PCA, Option 002 (HP-IB), Component Location Diagram



IC#	VOLTAGE	PIN	DESIG	DECOUPLING CAPACITORS
U1, U2	+5 V(B)	9	VCC	C5
	+20/30 V	4	VS	C4
	0 V	8	COM	
	0 V	1	SENSE A (COM)	
	0 V	15	SENSE B (COM)	
U3	POWER SUPPLY			
U4	POWER SUPPLY			
U5	+5 V(B)	40	VCC	C6
	0 V	1,20	COM	
U6	+5 V(B)	40	VCC	C23
	0 V	20	COM	
U7	+5 V(A)	40	VCC	C15
	0 V	20	COM	
U8	+5 V(A)	8	VCC	C19
	0 V	4	COM	
U9	+5 V(A)	40	VCC	C25
	0 V	20	COM	
U10	+5 V(A)	20	VCC	C28
	0 V	10	COM	
U11	+5 V(A)	28	VCC	C29
	0 V	14	COM	

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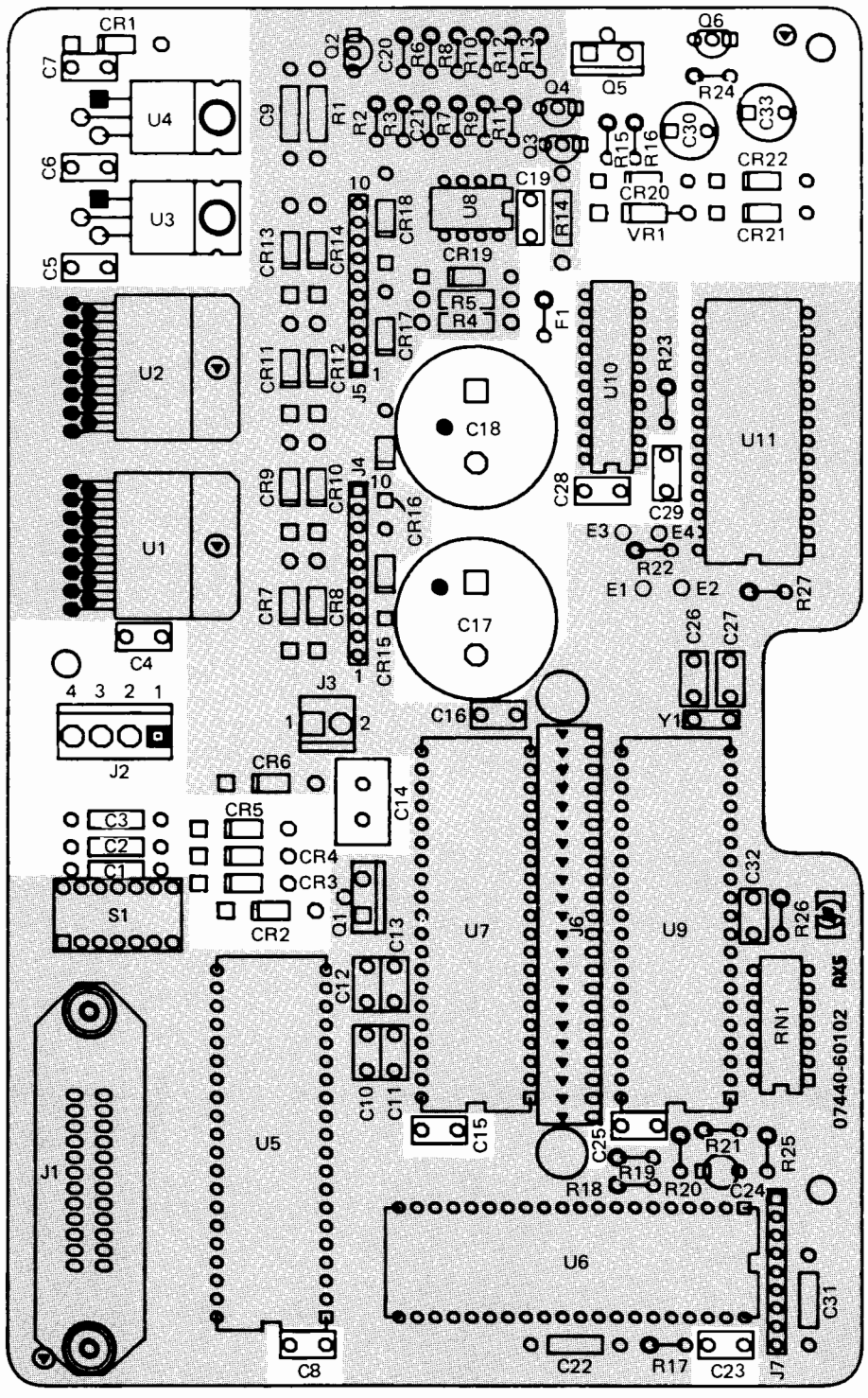
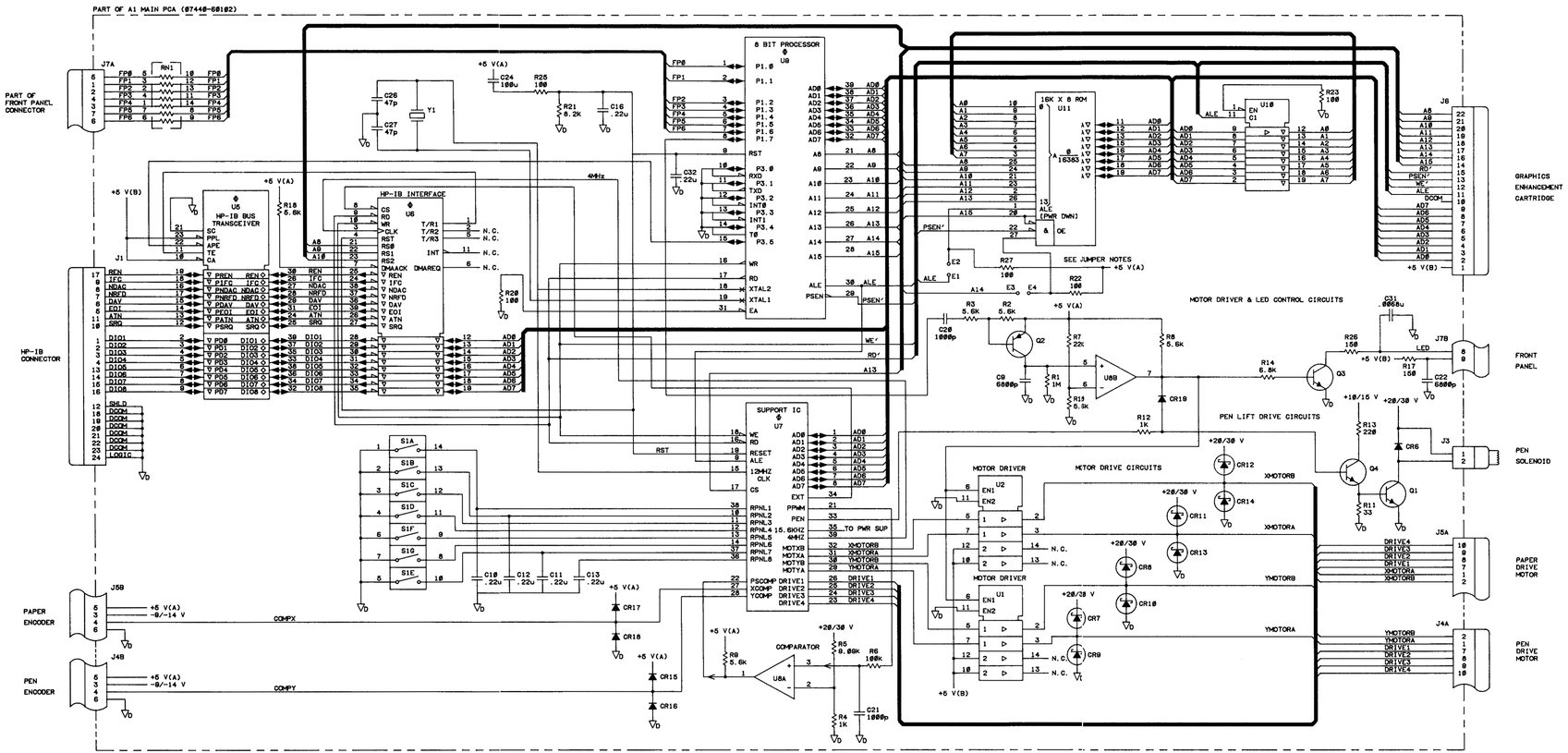
Figure 12-11. HP 7440 Power Supply, Option 002 (HP-IB), Schematic Diagram

7440-D-62-2A



7440-A-34-1

Figure 12-10. HP 7440 Power Supply, Option 002 (HP-IB), Component Location Diagram



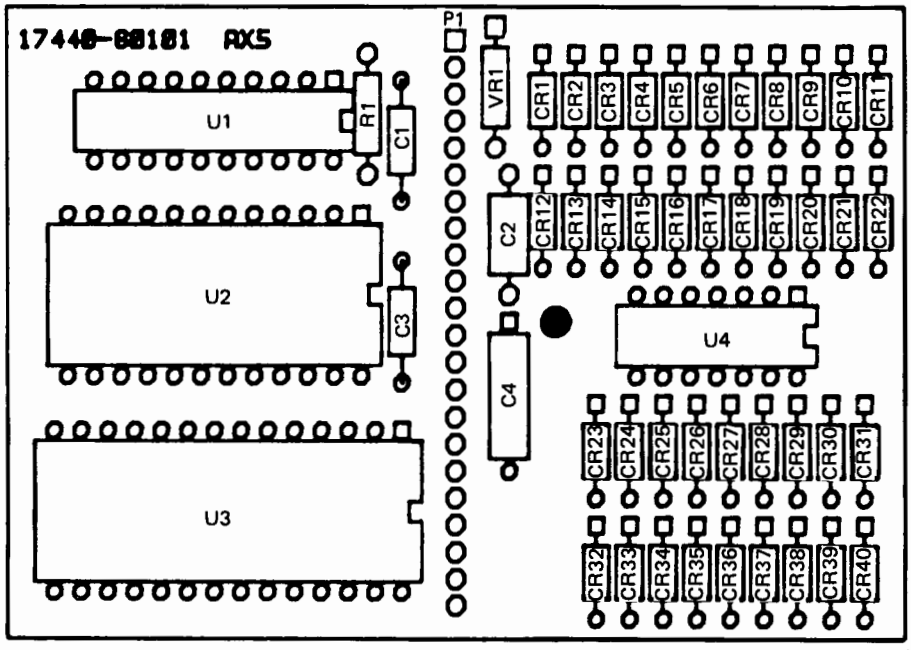
JUMPER NOTES:

1. AS SHOWN FOR STANDARD ROM OR EPROM. NO JUMPER BETWEEN E1 AND E2. INSTALL 427 & R22. INSTALL U10.
2. FOR LATCHED ROM, REMOVE R27 & USE R27 TO JUMPER E1 TO E2. INSTALL R22. REMOVE U10.
3. JUMPER BETWEEN E3 & E4 IS RESERVED FOR POSSIBLE USE OF 32K ROM.
4. THE STANDARD BAR SYMBOL FOR LOGICAL NEGATION HAS BEEN REPLACED WITH AN APOSTROPHE ON THIS SCHEMATIC (EG. PSEN' MEANS NOT PSEN).
5. REFERENCE SCHEMATIC SOFTWARE S-07440-60102.

IC#	VOLTAGE	PIN	DESIG	DECOUPLING CAPACITORS
U1,U2	+5 V(B)	8	VCC	C5
	+28/30 V	4	VS	C4
	0 V	5	COM	
	0 V	1	SENSE A (COM)	
	0 V	15	SENSE B (COM)	
U3	POWER SUPPLY			
U4	POWER SUPPLY			
U5	+5 V(B)	40	VCC	C6
	0 V	1,20	COM	
U6	+5 V(B)	40	VCC	C23
	0 V	20	COM	
U7	+5 V(A)	40	VCC	C15
	0 V	20	COM	
U8	+5 V(A)	5	VCC	C19
	0 V	4	COM	
U9	+5 V(A)	40	VCC	C25
	0 V	20	COM	
U10	+5 V(A)	20	VCC	C26
	0 V	10	COM	
U11	+5 V(A)	28	VCC	C28
	0 V	14	COM	

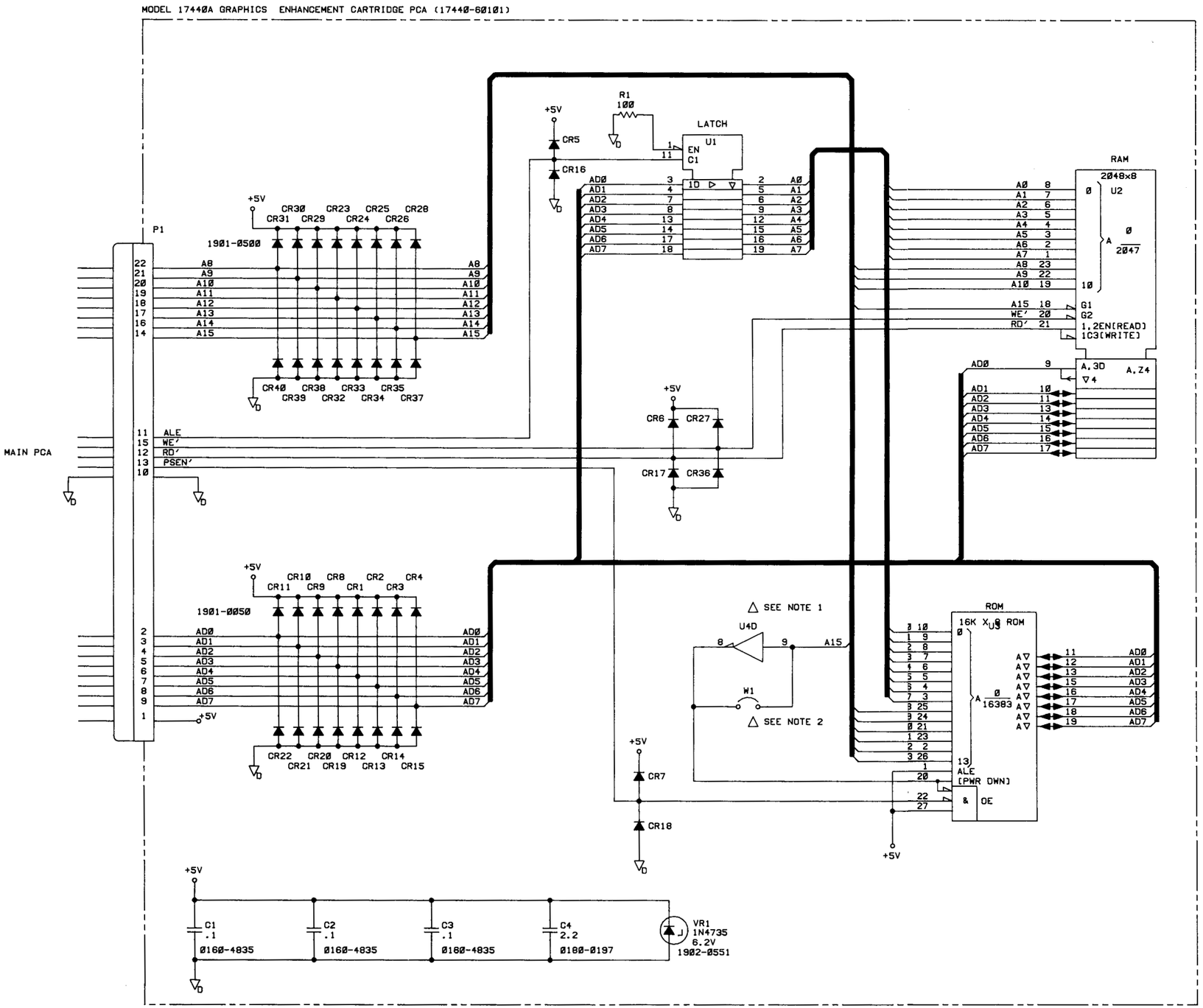
Figure 12-9. HP 7440 Main PCA, Option 002 (HP-IB), Schematic Diagram

7440-D-61-2A



7440-A-36-1

Figure 12-12. HP 17440 Graphics Enhancement Cartridge PCA, Component Location Diagram



IC	PIN	VOLTAGE	DESIG	DECOUPLING
U1	20 10	+5V 0V	VCC COM	C1 NA
U2	24 12	+5V 0V	VCC COM	C3 NA
U3	1,28 14	+5V 0V	VPP,VCC COM	NA NA
U4	14 1,3,5,7,11,13	+5V 0V	VCC COM	NA NA

△ NOTE 1

GATES U4A, B, AND C NOT USED.

△ NOTE 2

FOR:	LOAD:	DELETE:
EPROM	U4(HP#1820-1199)	W1
ROM	W1	U4

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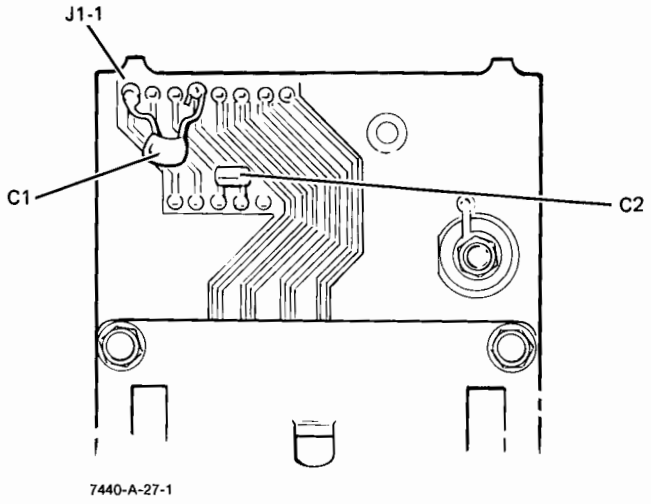
Figure 12-13. HP 17440 Graphics Enhancement Cartridge PCA, Schematic Diagram



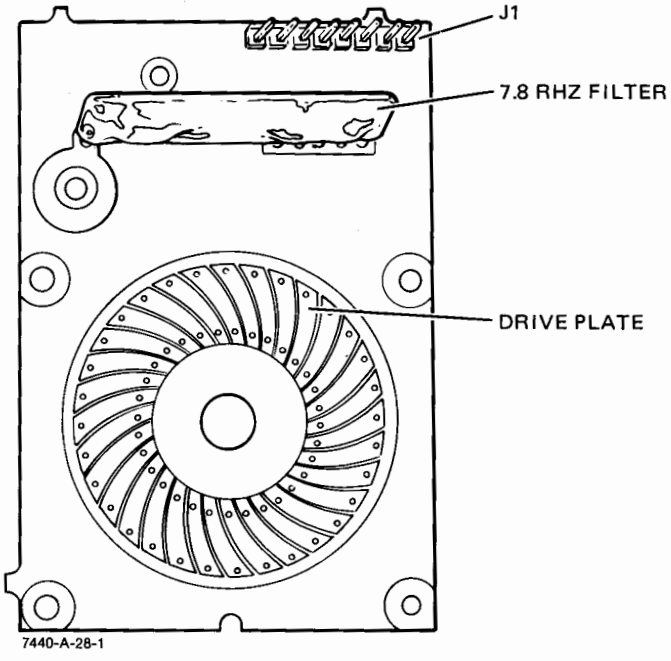
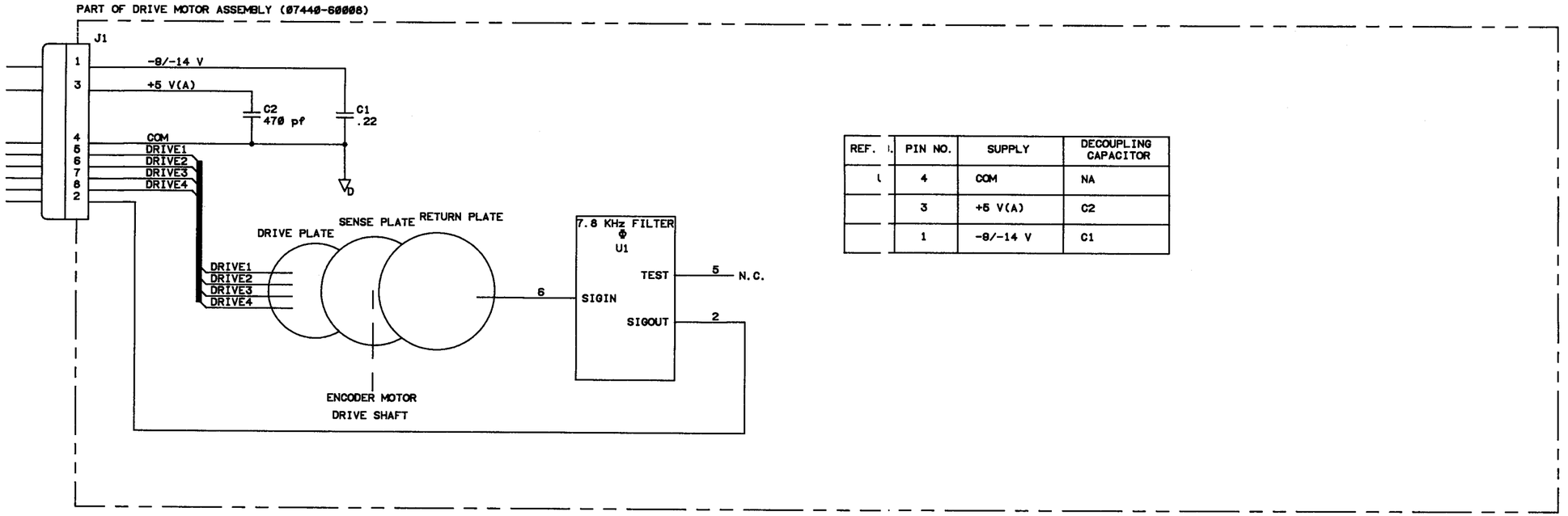
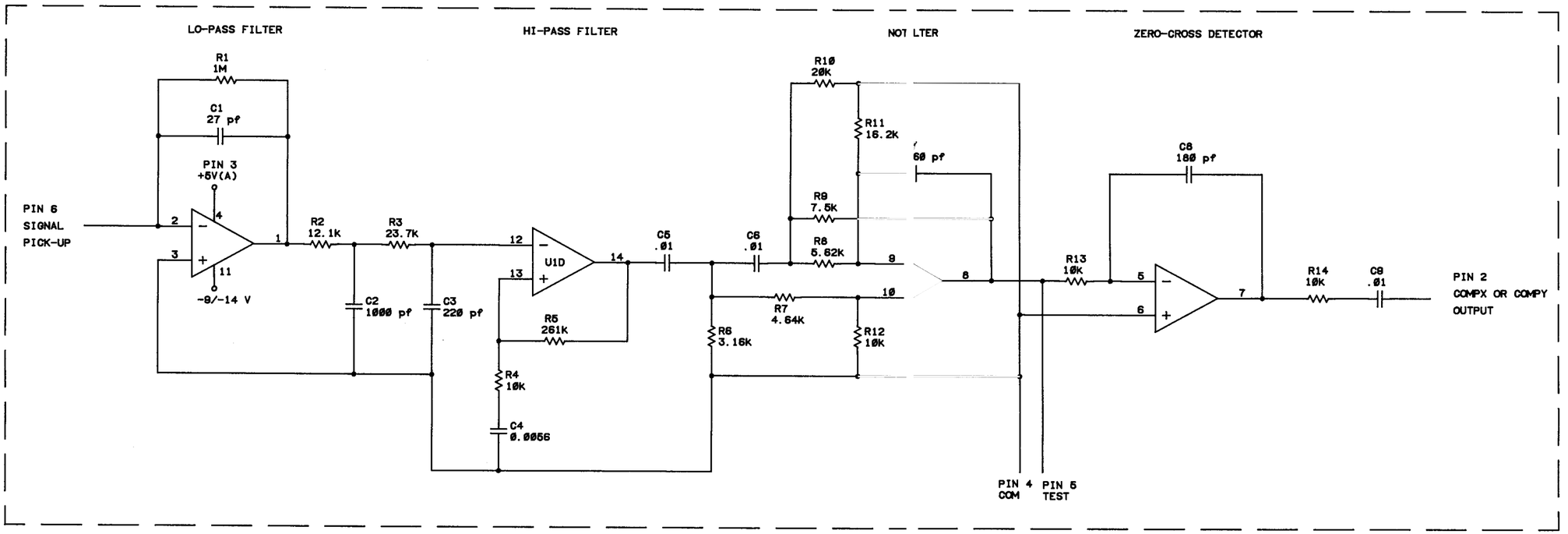


Figure 12-14. HP 7440 Encoder PCA, Component Location Diagram



REF.	PIN NO.	SUPPLY	DECOUPLING CAPACITOR
U	4	COM	NA
	3	+5 V(A)	C2
	1	-8/-14 V	C1



440-C-64-2

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Figure 12-15. HP 7440 Encoder PCA Schematic Diagram