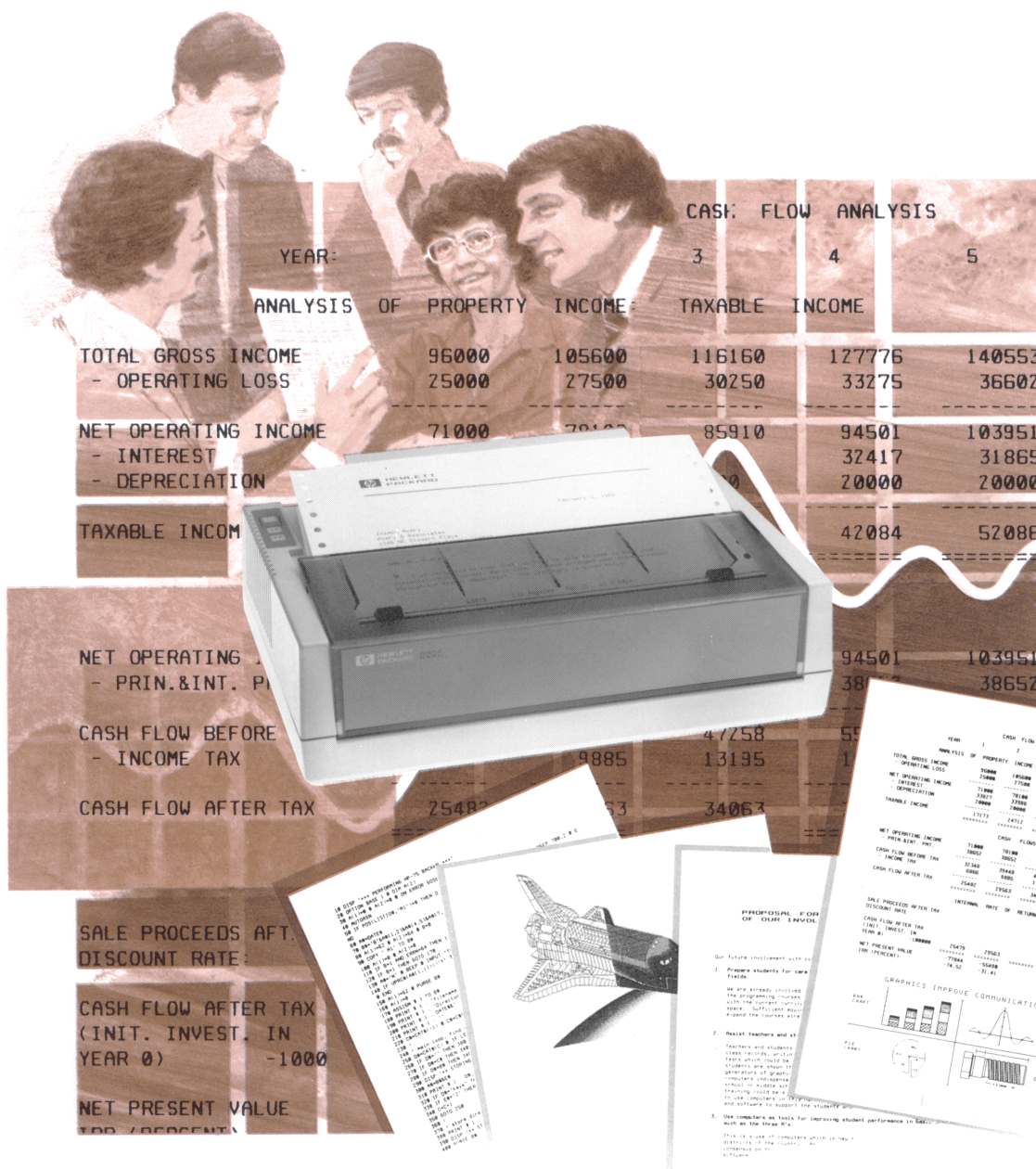


HP 2225 SERIES

ThinkJet

The Personal Printer from Hewlett-Packard

SERVICE MANUAL



HP 2225 SERIES

ThinkJet Printer

Service Manual

March 1985

02225-90046

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Section 1

General Information

Introduction

This manual contains information necessary for the maintenance and repair of the 2225 Series ThinkJet printers. Programming and printer interface information is contained in the respective ThinkJet Owner's Manuals:

Model Number	Interface	Owner's Manual Part Number
HP 2225A	HP-IB	02225-90031
HP 2225B	HP-IL	02225-90032
HP 2225C	Centronics-type	02225-90033
HP 2225D	RS-232	02225-90034

The 2225 Series of printers consists of the 2225A, 2225B, and 2225C, and 2225D printers. These printers offer quiet 150 cps printing, versatility, and convenience. The disposable print head cartridge contains enough ink to print approximately 500 pages.



HP 2225 Series ThinkJet Printer

Manual Overview

The service manual consists of the following sections:

Section 1: **General Information.** Provides a general overview of the service manual. Lists equipment provided, printer specifications, and briefly describes the options and accessories available.

Section 2: **Functional Description.** Provides a brief component description of the printer's operation.

Section 3: **Maintenance.** Provides procedures and illustrations to aid in removing and replacing assemblies and components.

Section 4: **Troubleshooting.** Contains self test information, describes how to isolate problems to the printer and offers troubleshooting hints.

Section 5: **Replaceable Parts.** Contains identification and part numbers of assemblies and components.

Section 6: **Schematic Diagrams.** Contains schematics of all logic board and I/O PCA's with locators.

Equipment Provided

The 2225 Series printers are shipped with the following accessories:

- one print head cartridge
- one packet of fanfold paper
- one paper separator
- one ThinkJet Owner's Manual
- one HP-IL interface cable (2225B only)
- one battery recharger (2225B only)
- one battery pack (2225B only)
- one power cord (2225A/2225C/2225D)

Specifications

2225A	HP-IB I/O, AC with selectable line voltage
2225B	HP-IL I/O, battery powered
2225C	Centronics-type I/O, AC with selectable line voltage
2225C	Centronics-type I/O, AC with 120 line volts only.
2225D	RS-232 I/O, AC with selectable line voltage

Product Features

Print rate:	150 cps (normal) 75 cps (expanded) 266 cps (compressed)
Carriage return rate:	.53 seconds (6.66 inches)
Linefeed rate:	.08 seconds @ 6 lpi; .06 seconds @ 8 lpi
Paper slew rate:	5.28 seconds (11" paper); 2.08 ips
Print modes:	Normal, bold, underline
Character spacing:	12 cpi (normal) 6 cpi (expanded) 21.3 cpi (compressed) 10.7 cpi (expanded-compressed)
Dot spacing:	96 or 192 dots per inch horizontal 96 dots per inch vertical
Dot size:	.007" on Mosinee
Character cell:	.083" H X .125" V, 7 X 11 dots
Line length:	80 normal 40 expanded 142 compressed 71 expanded-compressed
Paper type:	Single sheet (ink jet recommended) Z-fold pin feed
Page length:	11" 11.6" (European A4)
Paper width:	8.65" (219.71 mm) to 9.05" (229.87 mm)
Configuration:	Escape sequences and switches (2225A/2225C/2225D) Escape sequences and device dependent commands (2225B)

Buffer size:	1000 bytes
Print visibility:	Last line visible
Graphics copy:	2225A–raster (12 rows X 640 or 1280 col.) 2225B/C/D–raster (same as 2225A), column (8 high X 640 or 1280 wide)

Product Configuration

HP-IB I/O:	2225A
HP-IL I/O battery powered:	2225B
Centronics-type I/O:	2225C
RS-232 I/O:	2225D
Keypad Controls	
Blue Button:	Sets top-of-form Resets pen position Error recovery Remeasures carriage drive backlash
LF Button:	Dot row advance Line feed Continuous line advance Self test at power up
FF Button:	Form feed Self test at power up
Annunciators:	Power light Attention light

Physical Specifications

Physical dimensions:	29cm W X 21cm D X 9cm H
Weight:	2225A–7.4 lbs./3.36 kg. 2225B –4.7 lbs. (without battery) 5.5 lbs./2.5 kg. (with battery) 2225C–6.8 lbs./3.1 kg. 2225D–7.2 lbs./3.27 kg.

Electrical Specifications

Power requirements:	2225A–switch selectable 100, 120, 220, 240V + 5%, – 10% 2225B –<6.5V (NiCad) operates with low battery indication –<6.2V (NiCad) unit stops operation 2225C with US rear panel–120V + 5%, – 10% 2225C with international rear panel–same as 2225A 2225D–same as 2225A
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Power Consumption:	17 watts worst case
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Mechanical Specifications

Acoustic Performance:	< 50 dB sound pressure at 1 meter bystander position
Vibration–	
Cycle range:	5,55,5
Amplitude (p/p):	.38 mm
Sweep:	1 min/octave, 15 min. total
Dwell:	10 min. @ each resonance
Ventilation:	Convection cooling
Paper weight:	20 lb.

Environmental Specifications

Temperature–	
Nonoperating:	– 20 - 60 degrees Celsius
Operating survival:	10 - 55 degrees Celsius
Operating:	10 - 40 degrees Celsius
Relative Humidity–	
Operating:	10 - 90% RH @ 40 degrees Celsius
Nonoperating:	90% RH @ 60 degrees Celsius
Altitude (limited by print head cartridge)	
Operating:	0 to 4600 meters
Nonoperating:	0 to 15300 meters

Recommended Tools

TORX Kit:	HP P/N 8710-1426
Extended T9 Bit (Fits in TORX pouch):	HP P/N 130-T9-MOU
DVM:	HP 3435A or equivalent
Oscilloscope:	HP 1220A or equivalent
Logic Probe:	HP 545A or equivalent

ThinkJet Supplies and Accessories

The following supplies and accessories can be purchased through your HP dealer, or by contacting:

United States	800-538-8787
California	408-738-4133
United Kingdom	0734-792868 0734-792959
France	(6)928 32 64
Belgium/Luxembourg	(02)762 32 00
Switzerland	(057)31 22 54 or 31 22 59
West Germany	07031-142829 07031-223133
The Netherlands	020-470639
South Africa	802-5111 53-7954 28-4178
Canada:	
Toronto Local	416-671-8383
Ontario	1-800-268-6982
Quebec	1-800-387-3417
British Columbia	112-387-3154
Other Provinces	1-800-387-3154
Sweden	08-7502027 08-7502028

Part No's	Item(s)
92261M	ThinkJet paper–500 sheets, single sheets
92261N	ThinkJet paper–2500 sheets, z-fold
92261S	Printer stand–clear acrylic
2225A	
10833D	HP-IB cable–1/2 meter
10833A	HP-IB cable–1 meter
10833B	HP-IB cable–2 meter
10833C	HP-IB cable–4 meter
2225B	
82059D	Recharger–U.S.
82066B	Recharger–European 220V
82067B	Recharger–U.K.
82067B Option #001	Recharger–S. African
82068B	Recharger–Australian
82069B	Recharger–European 110V
82167A	HP-IL Cable–.5 meter
82167B	HP-IL Cable–1 meter
82167D	HP-IL Cable–5 meter
82199A	Battery pack
2225C	
82949A	HP Series 80 parallel printer interface
82957A	HP 86A printer cable
2225D	
13242G	HP 150 RS-232-C interface cable
2225A/B/C/D	
2110-0340	Fuse–US (120V) 400mA
2110-0489	Fuse–European (220V) 250mA
2110-0588	Fuse–UK (240V) 200mA
2110-0202	Fuse–Japan (100V) 500mA
2225A	
02225-90031	Owner's Manual
2225B	
02225-90032	Owner's Manual
2225C	
02225-90033	Owner's Manual
2225D	
02225-90034	Owner's Manual
2225A/B/C/D	
02225-90046	Service Manual

2225A/C/D

8120-1351	Power Cord – UK
8120-1369	Power Cord – Australian
8120-1689	Power Cord – European
8120-1378	Power Cord – US
8120-2956	Power Cord – Denmark
8120-2104	Power Cord – Switzerland

Getting Acquainted

This section introduces you to features of the HP 2225 Series printers. The keypad, installation information such as selecting and installing the fuse, and installing the print head, are briefly explained.

The Keypad

Line Feed Button (LF): The line feed button is used to advance the paper. Press the line feed button quickly to advance the paper a single dot row. Press the line feed button normally to advance the paper one line. If the line feed button is held down, the paper will advance one line, pause, then advance the paper rapidly until the button is released.

Form Feed Button (FF): The form feed button is used to advance the paper to the next top-of-form.

Note: If the printer is not correctly set for the length of paper being used the form feed button will not advance the paper to the next top-of-form.

Yellow Light: The yellow “attention” light turns on in a steady condition when the printer runs out of paper. The yellow light begins flashing when paper is loaded and remains flashing until the blue button is pressed. By pressing the blue button, the user indicates to the printer that paper is loaded correctly. The yellow light will also blink while paper is loaded if, 1) the printer is performing an internal self test (done immediately after the printer is turned on), or 2) a self test error is detected.

Note: Do not move the carriage manually. When the printer detects that the carriage has been moved, it will stop printing, the buffer will empty, all print features will return to their default settings, and the yellow attention light will begin flashing. To recover from this error condition, remove any obstruction (such as crumpled paper) and press the blue button.

Fuses and Voltage—2225A/2225C with International Rear Panel/2225D

The 2225A, 2225C with international rear panel, and 2225D are capable of operating from one of the following AC power sources:

- 100 volt AC, 50/60 Hz.
- 120 volt AC, 50/60 Hz.
- 220 volt AC, 50/60 Hz.
- 240 volt AC, 50/60 Hz.

The fuse box on the rear panel of the printer contains a voltage selector drum for selecting one of four line voltages. (Each printer is shipped with the voltage selector drum set to match local voltage requirements.)

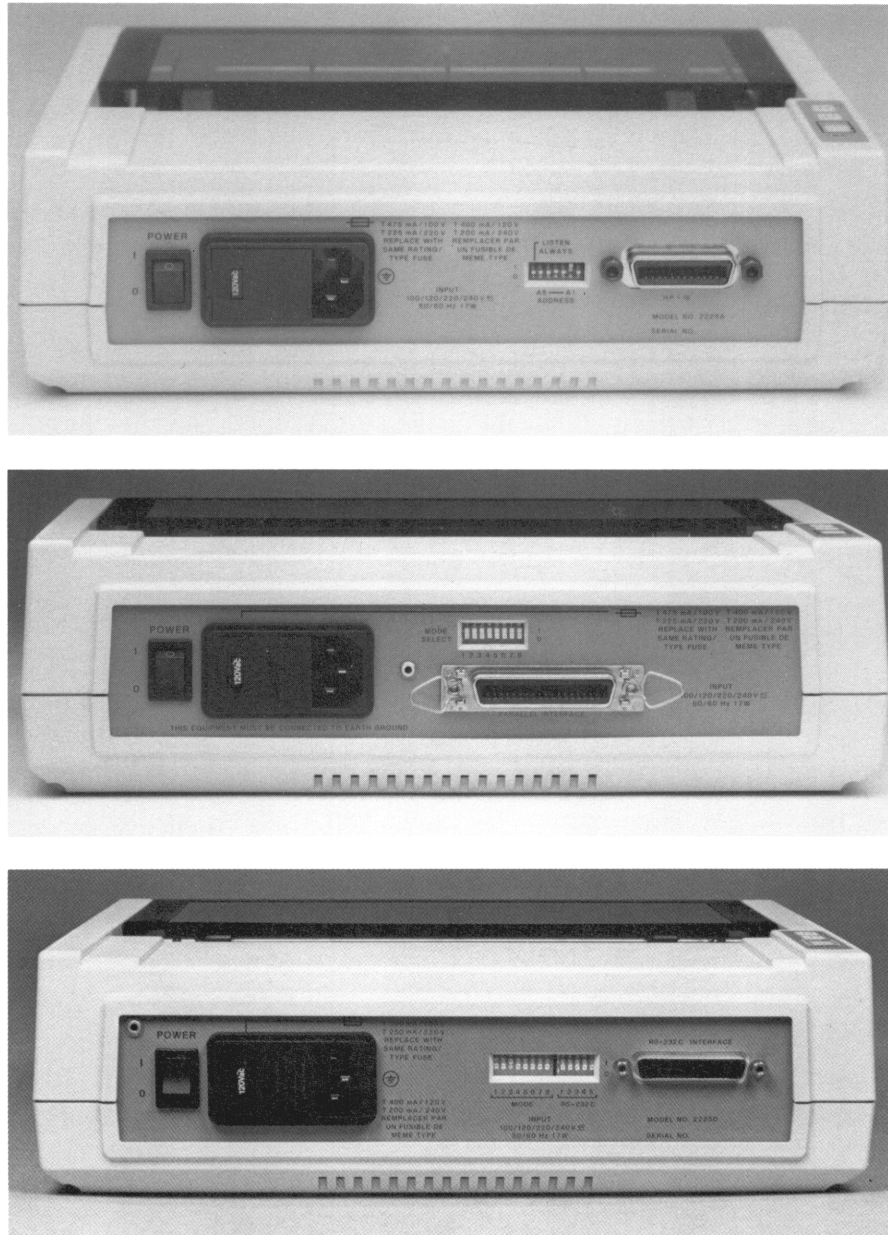


Figure 1-1, 2225A, 2225C with International Rear Panel, and 2225D

Selecting the Line Voltage:

- Remove the power cord from the printer.
- Open the cover of the fuse box with a small bit screwdriver. The cover closes tightly but will yield to firm pressure.
- **REMOVE** the voltage selector drum and rotate it to the setting that corresponds to the area's voltage requirements.
- Install the drum in the fuse box so that the selected voltage setting is visible through the window in the door when it is closed.

Installing the Fuse:

The 2225A, 2225C with international rear panel, and 2225D use one fuse. The fuse fits into a carrier which slides into a slot in the fuse box. The fuse box contains slots for two carriers. The proper fuse and its carrier must be installed in the top slot. The white arrows on the inside of the fuse box door point in the direction the fuse carrier is to be installed.

The correct fuse for the printer depends on the voltage requirements for your area. Each printer is shipped with the correct fuse installed for the location. Fuse rating requirements are printed on the product rating label on the back of the printer.

Replacing the Fuse:

- Remove the carrier from the slot, and the fuse from the carrier.
- Put the new fuse in the correct carrier and slide the carrier into the upper slot with the arrow on the end of the carrier facing out.
- Shut the fuse box door.

Fuses and Voltage—2225C with US Rear Panel

The 2225C printer with US rear panel must be operated from 120V AC, 50/60 hz, line voltage. Operating it from any other voltage may cause damage to your printer.

Installing the Fuse:

The 2225C with US rear panel uses one fuse which is inserted into the fuse holder on the printer's rear panel.

Replacing the Fuse:

- Push in the fuse holder cap with a wide-blade screwdriver and turn it counterclockwise.
- Put the fuse in the fuse holder, and push the fuse holder into the cavity with a wide-blade screwdriver. Replace the cap and turn it clockwise.

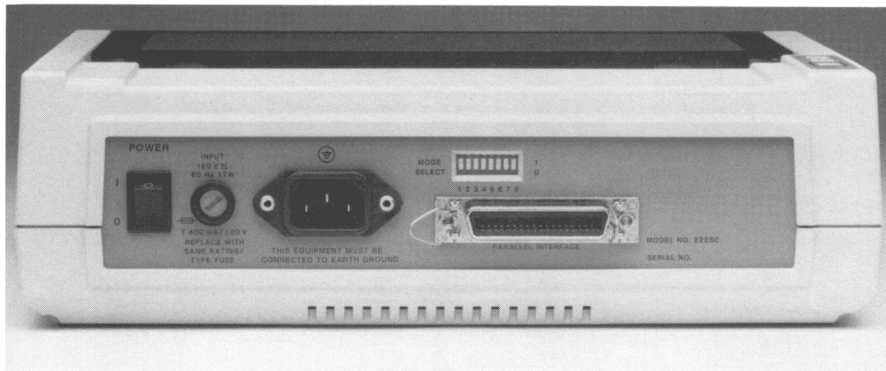


Figure 1-2, 2225C with US Rear Panel

Fuse Sizes and Ratings

(See ThinkJet Supplies and Accessories for part no.):

Line Voltage	Country	Fuse Rating	Fuse Size	Carrier
100 volt AC	Japan	500 mA TD	3 AG	white
120 volt AC	USA	400 mA TD	3 AG	white
220 volt AC	Europe	250 mA TD	5 X 20mm	black
240 volt AC	UK	200 mA TD	5 X 20mm	black

Installing the Print Head

Remove the print head cartridge and the absorber from their container, taking care not to touch the face of the cartridge.

Open the front cover of the printer and insert the absorber into the holder as shown below, making sure that the colored side of the absorber faces the back of the printer.

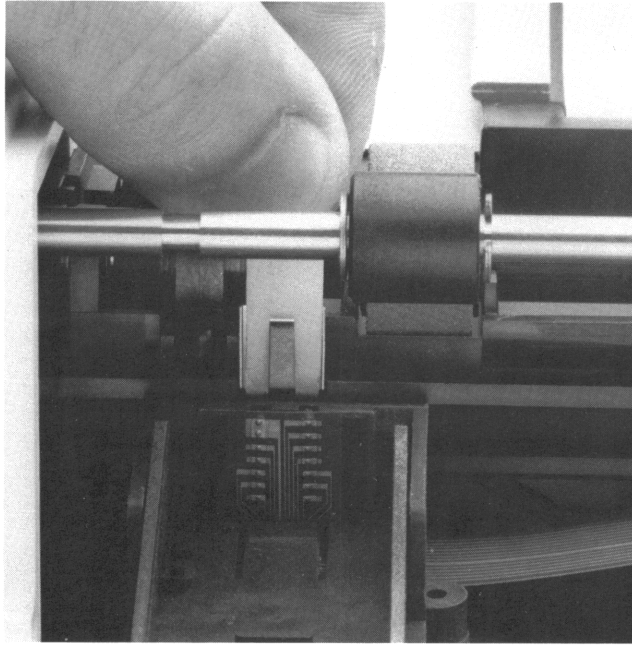


Figure 1-3, Inserting the Absorber

When the printer is turned on, a few drops of ink are sprayed onto the absorber to prepare the print head for operation. Absorbers are provided with each print head cartridge and should be replaced each time the cartridge is replaced. To remove a used absorber, insert the tip of a pencil into the hole at the top of the absorber, pull up, and discard.

Do not move the carriage manually. Doing so may damage the printer.

Installing the print head cartridge:

- Open the carriage latch by pushing it down.
- Insert the print head cartridge into the carriage.
- Close the carriage latch by lifting it up. Make sure that the carriage latch is fully closed.

Warning

The ink in the print head cartridge contains diethylene glycol and is HARMFUL IF SWALLOWED. Keep new or used cartridges OUT OF THE REACH OF CHILDREN. If ink is swallowed, induce vomiting and contact a physician.

Functional Description

2225 Component Level Operation

This section will cover the information necessary for understanding the component level operation of the 2225 family of printers. This is in no way intended to offer step-by-step detailed troubleshooting of component parts, but is instead a reference that can be utilized by experienced and knowledgeable “bench” repair personnel. A general step-by-step troubleshooting procedure is available elsewhere in this manual for board level error isolation and replacement. Component identification is per the schematics included in this manual. Should component location or identification be changed, updates will be available.

Block Level Operation

Because the five different products (2225A, 2225B, 2225C–US back panel, 2225C–International back panel, and 2225D) utilize different components for cost efficiency, some of the block level operation descriptions must be repeated for each product with different component designators. Each heading will indicate the product it represents. 2225 block operation is divided into the following parts:

Microprocessor

Power Supply:

- Rechargeable Ni-Cad Battery Pack

- Battery Control

- Boost Convertor

Print head Drive Logic

Stepper Motor Drive

Keypad

Home Switch

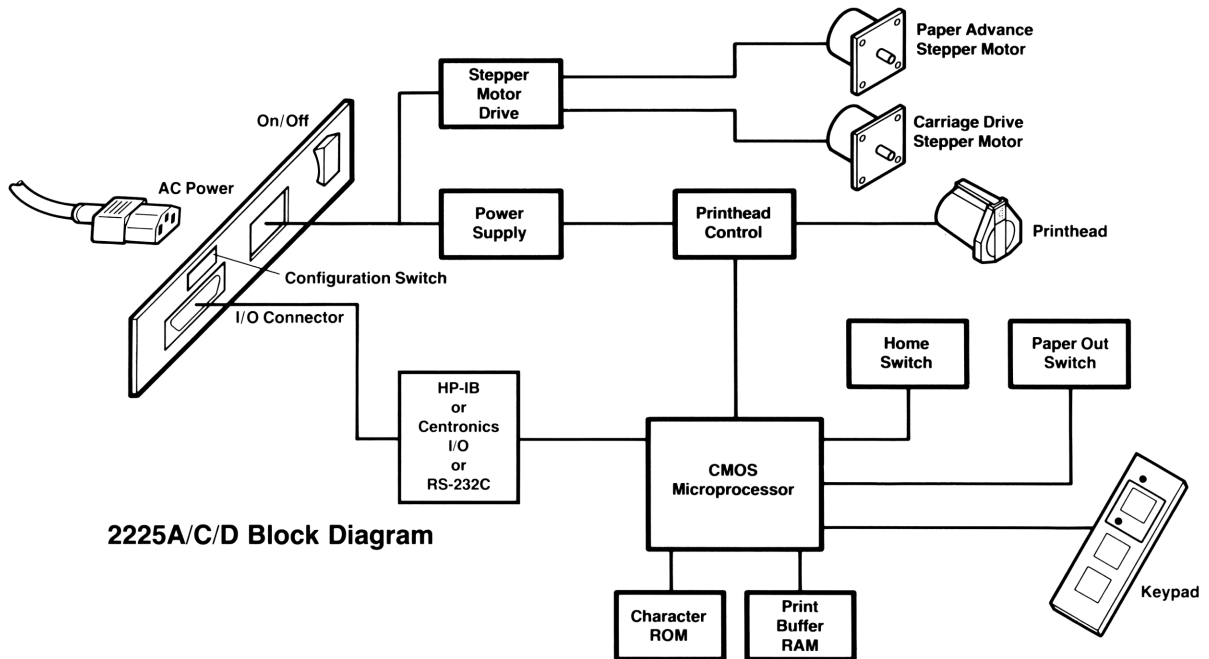
Rear Panel

Reset

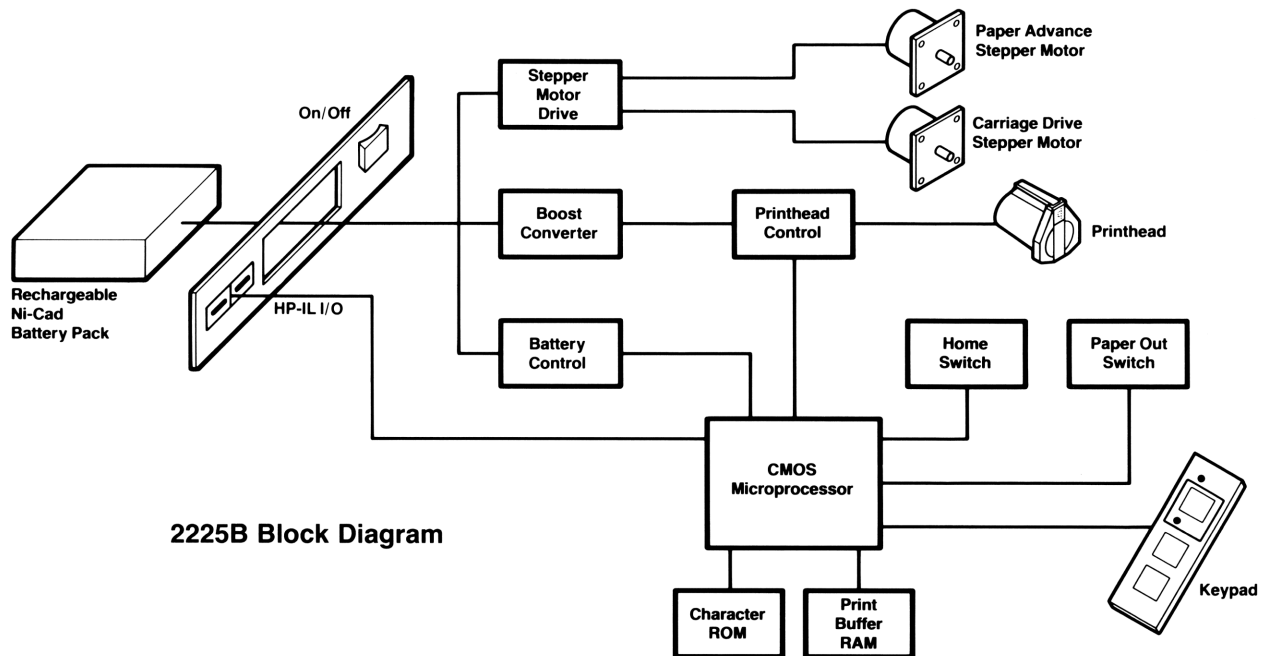
Interrupts and Timers

I/O's

Print Mechanism



2225A/C/D Block Diagram



2225B Block Diagram

Microprocessor:

The 2225A/B/C/D is controlled by a custom IC set designed and manufactured by Hewlett-Packard. Other IC's included in the family are a RAM and a ROM. The RAM is used as a graphics or text buffer, and the ROM contains the character patterns. In addition, many custom hardware features are incorporated into the microprocessor to ease the burden of controlling the printer and communicating with the outside world.

Power Supply—2225A/C/D:

The power supply's main purpose is to provide a high tolerance voltage level for the print head and logic circuit currents. To reduce costs the power supply components occupy the same logic Printed Circuit Board (PCB) as the logic components.

AC power comes through the line module which is drum selectable to 100, 120, 220, and 240 volts. The transformer is specially designed for these four primary voltages, plus safety and RFI requirements. There are two sets of secondary windings which are transient filtered by capacitors C6 and C7, full wave rectified by diodes CR1 through CR8 (CR1-CR4, CR7, and CR16 on the 2225D), and filtered by capacitors C1 and C2. C16 is a high frequency filter capacitor.

Regulator VR1 supplies the high tolerance voltage to the print head. The print head supply voltage must be 22.68 volts, plus or minus 0.8%. It is adjusted to fall into this range by removing combinations of resistors R14, R15, and R16 which are connected in parallel for exactness. The boards are loaded with all resistors in place for a target range of 22.52 to 22.86. If the voltage falls outside this range, various combinations of resistors are clipped out. If the voltage is less than 20.51 volts or greater than 22.86 volts, one of the components in the regulator circuit is bad. Resistors R1 and R2 provide the divider network for the regulator's unique output voltage. Two output voltages come from this circuit: VHD provides the high accuracy head voltage; unregulated voltage VMP, at about 30 volts, powers the paper motor, while the regulated VMC supply of 24V powers and carriage motors.

Regulator VR3 is the logic level +5 volt supply, plus or minus 5%. It is capable of delivering up to 100 milliamps. Two output voltages are also provided from this circuit: VDD which comes directly from the regulator for the logic, and VDRAW is the unregulated 10 volt filtered output from the transformer. Because VDRAW is unregulated, when the unit powers on VDRAW swings from 0 to 10 volts; VDD waits until VDRAW reaches something greater than 6 volts before it comes up. This is useful for power-on indication.

Capacitors C37 and C10 are current reservoirs for the regulators. Capacitor C37 is required to be a low "equivalent series resistance" (ESR) part. Capacitor C8 filters high frequencies. Diodes CR9 and CR10 provide protection to the regulators in case the voltage at the output terminal exceeds that at the input terminal, usually at power-off. Zener diode VR6 traps transients that may also harm the regulator.

Power Supply—2225B:

Rechargeable Ni-Cad Battery Pack—2225B:

The 2225B printer is totally powered by a battery pack, which contains six sub-C Ni-Cad cells of 1.2 amp-hour capacity, and the electronics necessary to recharge them. A fully charged battery pack can operate the printer continuously for approximately 2.0 hours (about 200 pages); with the charger plugged in, it will operate approximately 2.6 hours (about 275 pages), after which time it will slow to a 20% duty cycle, limited by the charger. Charge time for a fully discharged battery pack is about 14 hours. The two battery pack terminals are labeled VBATT and GROUND.

Diodes CR1—CR4 form a bridge rectifier for the incoming low voltage AC from the wall charging transformer. Resistor R3 controls the charging current to the battery. A fuse in the battery pack protects against high currents should the pack be inadvertently shorted.

Battery Control—2225B:

The low battery circuitry is divided into two sections: Low Battery Indicator Warning (LBIW) and Low Battery Indicator Cutoff (LBIC). Both sections indicate their status to the processor. A resistor network consisting of R8, R14, and R15 divides the battery voltage (VBATT) into voltages that are sampled by two comparators, U3A and U3B. The node at R8 and R15 is connected to the inverting input of U3C for LBIW, and the node at R14 and R15 is connected to the inverting input of U3B for LBIC; of course, each node is at a different voltage level. Capacitor C33 filters out high frequencies. The non-inverting input of both comparators are connected to a high precision reference voltage (VREF). Resistors R2, R3, R17, and R18 provide hysteresis. Resistors R22 and R24 are for pull-up.

When VBATT is above a preset threshold value (about 6.5 volts), both signals are low. When VBATT falls below 6.5 volts, LBIW goes high, indicating a low battery condition, but still allowing the unit to operate normally. The processor will blink the POWER LED to indicate that limited battery life remains. LBIW will return to a high level when VBATT recovers to 7.5 volts.

The Low Battery Indicator Cutoff operates similarly to the Low Battery Indicator Warning, the only differences being the threshold at which the comparator U3C toggles, and the action taken by the processor. When the battery drops to below a threshold value of 6.2 volts, the LBIC signal goes high (as does the LBIW). The processor responds by shutting off the POWER LED and disabling all printing activity. At this point the small amount of energy left in the batteries will maintain the HP-IL loop capability and information in the buffer for several hours.

VBATT is regulated to 5 volts by regulator U4 and reservoir capacitor C5. VREF of 1.235 volts is provided by zener diode VR10. Resistor R16 acts as a current limiter.

Boost Converter—2225B:

Because the 2225B printer is totally battery operated, its nominal voltage is far less than that required for the print head. A boost circuit is included to convert the 6-9 volts available to the 22 volts needed; it operates on the “switching” power supply principle. A monostable multivibrator, 555 timer IC U1, is biased by resistors R4 and R5, and capacitor C1, to produce a stable square wave. The output is current-limited by resistor R23 and used to drive transistor Q5. The rising edge of the square wave turns on the transistor and conducts current from the battery rail VBAT, through inductor L1 to ground. As the inductor charges, its magnetic field energizes. As the inductor discharges, its magnetic field collapses, and it acts as a current source for short periods of time. The transistor is off, so the current passes through diode CR2, and charges reservoir capacitor C4. The voltage on the capacitor increases, and is divided by network resistors R9 and the combination of R55, R56, R57, and R10 for feedback through U3D. The resistor combination is used to adjust the voltage output to a plus or minus 1% tolerance. At assembly, all four resistors are loaded, then the output voltage is measured and compared against a table. By clipping out some combination of R55, R56, or R57, the appropriate voltage tolerance can be obtained (this is in lieu of using a potentiometer which has assembly difficulties). Capacitor C3 helps maintain the voltage and prevent oscillation at the divider node. Capacitor C7 provides high frequency energy to the print head.

The voltage at the divider node is connected to the inverting input of comparator U3. The non-inverting input is connected to a voltage reference, VREF. Resistors R12 and R13 provide hysteresis to prevent oscillation. The voltage reference, 1.235 volts, is a very high-precision, temperature-compensated zener diode, VR10. When the voltage at the resistor network node exceeds this level, the comparator output goes low, inhibiting output from the 555 oscillator IC, and stopping current flow into the reservoir capacitor C4. When the voltage at the sample node falls below the reference, the comparator output goes high, again enabling the oscillator output. In this way the required print head voltage of 21 volts is generated from the 6 to 9 volt supply, with plus or minus 4.5% accuracy at the print head due to an accumulation of tolerances to the print head.

The supply can deliver an average current of 45 milliamps and a peak current of 950 milliamps for a maximum on-time of 36 microseconds. The switching circuitry of this supply is designed to operate with an input voltage ranging from 6.0 to 9.0 volts. In order to conserve power (the 555 vibrator consumes more power than the rest of the CMOS logic combined), the supply monitors PRT (the HPE or Print Head Power Enable). If PRT is low, the supply is turned off.

Print Head Drive Logic

The thermal ink jet print head requires precise control of the ON-time of the thermal resistors as well as the correct firing sequence required for formation of characters. The custom microprocessor contains a dedicated controller specifically for print head control and off-loading the CPU for data processing. The processor puts the dot information into transistor packs U8 and U9. The print head voltage VHD is supplied to all of the dots simultaneously, but a particular dot is only enabled when its drive transistor is on. Zener diode VR8 (VR5 on the 2225B) provides over-voltage protection from transients and electrostatic discharge (ESD). Because transistor pack U9 contains one of the drivers for the paper advance stepper motor, zener diode VR9 (VR6 on the 2225B) is needed for back-EMF and ESD protection.

Stepper Motor Drive—2225A/C/D

The paper advance motor has ample resolution for its purpose, so it requires a simple drive scheme. Three drive transistors in pack U10 and one in pack U9 are enabled in the proper half-stepping sequence via the processor bus. The unregulated voltage VMP is tied to the commons of both phase pairs. When one (or two) of the Darlington transistors are enabled, current from the common passes through the motor phase to ground. Protection diodes incorporated in the Darlington packs filter high voltage transients which are generated when the magnetic field around the enabled phase collapses, through zener diode VR18 to ground.

Because the carriage stepper motor demands exact accuracy and velocity, a regulated voltage is required. Regulator VR13 supplies 24.0 volts, plus or minus 5% from unregulated voltage VMP. The regulated voltage is labeled VMC. Zener diode VR15 protects the input of the regulator from transient spikes generated from the paper advance motor. Resistor R10 provides a load for the regulator when no phase is turned on (during paper advance or printer idle) to prevent oscillation. Capacitor C38 is a current reservoir for the regulator. Capacitor C9 is a high frequency filter. Zener diode VR14 provides overvoltage protection for the regulator. Diode CR13 protects the regulator should the voltage on the output exceed the voltage on the input, usually during power-down.

Diodes CR14 and CR15 isolate the phases so that the collapse of the magnetic field from one phase pair does not effect the other. C19 and C20 are filters, smoothing the resonating points at the speeds required during normal operation. All four Darlington drive transistors are in pack U10.

Stepper Motor Drive—2225B

Because the 2225B is battery operated, it must use low voltage stepper motors which are very sensitive to the saturation losses present in the drive transistors, and have high peak current requirements. For these reasons discrete bipolar power transistors are used. The motor phase information from the processor turns on buffers in packs U8 and U10, which in turn sink enough current from the base of the drive transistors for full saturation and minimum voltage drop. Resistors R37 - R44 are current limiters, and resistor pack R45 provides pull-up.

The drives are designed around the can-stack stepper motors. The low cost and high reliability of this type of motor justified their selection. Both the carriage and paper advance motor drives have identical supply requirements and are supplied directly by the batteries. The paper drive draws roughly twice the current of the carriage drive. For this reason the bias resistor network for the bipolar driver transistors is slightly different in value as compared to the carriage motor drive.

The paper drive is designed more for its torque than for speed to accommodate the variable paper drag. The motor is simply stepped in the proper sequence for the desired number of print rows and turned off. The motor is full-stepped with two coils energized at once to achieve maximum mechanical power output. The step rate is 200 full-steps per second.

Keypad

There are three keys and two indicator LEDs on the keypad: the form feed (FF), line feed (LF), and control (blue) keys; and the power (PWR) and attention (no label) LEDs. Because only two lines from the microprocessor are dedicated to the three keys, diodes CR11 and CR12 are needed to decode which key is being pushed (if any). In the 2225A/C/D, the power LED is simply connected to the logic voltage, VDD; the 2225B controls the power LED directly for indication of battery condition, (see BATTERY CONTROL). The attention LED connects directly to the Out-Of-Paper Sensor and an output line on the microprocessor. When there is an out of paper condition, VDD will pass through the LED to ground, as it will should the output line of the microprocessor go low.

Home Switch Assembly

The “home switch” is an infrared opto sensor. As the carriage transverses the platen, a blade passes between an LED source and a phototransistor, interrupting the light and turning off the transistor. An LED has a predetermined life expectancy in hours of emission, so the source is only enabled when the print head is moving. Current from regulated voltage VMC is limited by resistor R21 (R35 on the 2225B), passed through the LED, then to a Darlington in pack U9 to ground. The Darlington must be turned on to enable the opto interrupter. The phototransistor portion of the interrupter, when turned on, pulls the voltage at the collector to ground through pull-up resistor R22 (R36 on the 2225B). R22 (R36 on the 2225B) is also connected to the non-inverting input of comparator U7B (U5 on the 2225B); causing the output of the comparator to go low when the phototransistor is on (no interruption), and to go high when the transistor is off (carriage is passing through sensor). When enabled by the same Darlington that enables the LED, the inverting input of U7B (U5 on the 2225B) is tied to ground.

Resistors R25 (R48 on the 2225B) and R27 (R36 on the 2225B) provide the hysteresis biasing. The comparator corrects for sensor discrepancies by reducing hysteresis and minimizing ringing.

The microprocessor monitors the home switch for the presence of the carriage blade at selected times. The algorithm employed not only verifies the operation of the home switch, but also determines whether the carriage motor is stalled or has lost synchronization. In any event, a failure of the open loop control scheme is detected and further printer operations are suspended.

Rear Panel Features—2225A/C/D

The rear panels of the 2225A, 2225C (with international rear panel), and 2225D contain the power switch, power module, configuration switches, and the interface connector. The power module contains a receptacle for a power cord, and behind an access door, the AC fuse and line voltage selector.

The 2225A mode/address switch has seven rocker switches which control the mode of operation; Listen Always, Service Request Enable (SRQen), I/O diagnostic, and HP-IB address. The 2225A I/O connector is IEEE-488 compatible.

The 2225C mode switch has eight rocker positions for CR definition, LF definition, perforation skip, page length, control sequence mode, and character set selection. The rear panel of the 2225C (with US rear panel) differs from the international version by containing a separate power receptacle and fuse holder, rather than the selectable power module. Its eight rocker switch functions are identical to the international version 2225C.

The 2225D has two sets of switches. The set of eight rocker switches (MODE switches) perform the same function as the 2225C MODE switches. The second set of switches (RS-232C switches) are used for RS-232 interface control; baud rate, parity/word length, and handshake mode.

The 2225A, 2225C (with international rear panel), and 2225D will operate on either 100, 120, 220, or 240 volts AC at 50 to 60 hertz. The 2225C with US rear panel must be operated only from 120V, 50/60 Hz line voltage.

The tolerance on the input voltage is +5% and –10%. The frequency tolerance is plus or minus 5%. The total power consumption is as follows:

35 volt unregulated paper motor supply	200 mA	7.0 watts
24 volt carriage motor supply	120 mA	4.2 watts
24 volt thermal ink jet head supply	50 mA	1.75 watts
5 volt logic supply and I/O	80 mA	0.96 watts
12 volt input for 5 volt regulator	10 mA	0.30 watts

Total wattage (max) with paper motor and all logic running is about 8 watts.

Reset–2225A/C/D

A reset condition can be received from either the I/O or from the power-on sensor. The power-on sensor consists of comparator U7A, with zener diode VR7 connected to the inverting input. Resistor R11 acts as a voltage divider for VDRAW (the unregulated logic voltage) and the zener. The inverting input of the comparator is connected to the node of the voltage divider consisting of resistors R5 and R6; dividing VDD (the regulated logic voltage). Because the unregulated VDRAW voltage rises before the regulated VDD, and the voltage at the node of the zener is lower than the voltage at the node of the resistor divider, the output of the comparator remains low until VDD reaches the threshold voltage (5.4 volts) needed by the logic circuits. Resistor R7 (2225A and 2225D) or R17 (2225C) and capacitor C15 (2225A and 2225D) or C14 (2225C) smooth the comparator's output during transients, as required by the microprocessor. Resistor R12 (2225A and 2225D) or R13 (2225C) is for pull-up.

Reset–2225B

Because logic components have unknown operation until the voltage reaches a certain threshold, a RESET must be provided to halt the microprocessor during power-on. The node of the voltage divider consisting of resistors R19 and R20 is connected to the non-inverting input of comparator U3A; the inverting input is connected to the high precision voltage reference, VREF. VREF is connected to the input terminal of the regulator, while the resistor network is on the output. When the power is turned on, the reset line is not allowed to go high (allowing the processor to operate) until VDD exceeds 4.5 volts.

Resistor R21 is for pull-up, while capacitor C6 and resistor R11 act as a low-pass filter to prevent noise on the comparator's inputs from resetting the processor.

HP-IB I/O–2225A

The 2225A and the 2225B use the same system microprocessor, which means it uses the same HP-IL microcode I/O driver, even though the 2225A is HP-IB and the 2225B is HP-IL. The 2225A converts its HP-IB input to HP-IL; this is accomplished in the I/O board. The I/O board itself is basically the same product as the 82169A HP-IL/HP-IB Interface pod used with low cost Hewlett-Packard HP-IL products.

HP-IB has eight data lines, eight control lines, and six grounds. HP-IL has two transmit lines and two receive lines which go directly into the system microprocessor for interpretation. When the HP-IB printer is connected to the system bus, data on the bus is presented to the HP-IB transceiver IC U6 where it is buffered for the I/O microcomputer U4, (an 8048 with on-board ROM and RAM). The microcomputer handles data communications between the HP-IB IC and the HP-IL IC U1, which converts the parallel data from the I/O microcomputer into serial data needed by the 2225B microprocessor HP-IL circuits.

The HP-IB address switches, located on the rear panel, are buffered by IC pack U3. The output of the pack is enabled through quad latch U2 from the microcomputer, which also latches the register addresses used by the HP-IL chip U1. Quad latch U5 is similarly controlled from the microcomputer, and is used to hold the control line signals for the HP-IB chip. The rest of the discrete components perform other logic requirements.

HP-IL I/O–2225B

The majority of the HP-IL interface is contained within the custom microprocessor integrated circuit. The HP-IL interface does require a few added components not designed into the IC. These components are needed primarily for impedance matching and ESD protection. The HP-IL transformer T1 isolates the receiver and transmitter circuitry from the HP-IL interconnect wiring.

Zener diodes VR1 through VR4 clamp voltage spikes at a peak of 33 volts. Resistors R31 and R32, along with capacitors C11 and C12, control the rise time, filter out high frequencies, and provide impedance matching (100 ohm) to the microprocessor inputs.

Centronics-Type I/O–2225C

The 2225C microprocessor is different from that used in the 2225A and B because of the different microcode needed to drive the I/O. The microprocessor uses the same bus for the parallel I/O as is used for the stepper motor phase control. It multiplexes between the two requirements by loading stepper motor phase information into octal latch U4 on the processor board, and allowing the bus to be used for data communications the rest of the time.

Because of the limited number of control lines and I/O ports on the microprocessor, an ingenious method of reading the mode switch on the Centronics-type I/O board had to be devised. The “mode” switch, located on the backpanel, allows the operator to select printing features such as perforation skip and character set selection. When the unit is first turned on, the RESET line clears the output of flip-flop U4B. Pulsing HSE pulls the output of NAND-gate U3B low, and enables buffer U5. The buffer’s inputs are tied to the individual rockers on switch S1 and pull-up resistors in pack R3. The processor reads the sense of these switches immediately after control line HSE goes high. The NAND-gate is also used to clock the flip-flop, inverting the output, which brings the NAND-gate high and disables the switch buffer. Another NAND-gate, U3A, enables input latch U1 when HSE is pulsed from low to acknowledge (ACK) character acceptance. This sequence of reading the switches is only performed during a RESET, initiated by either the I/O or a “power-on”.

Data from the transmitting source is placed in the input latch U1 via the Strobe line (STR). The Strobe also clocks a flip-flop U4A which sets the BUSY line and signals the microprocessor on the HPD line that data is available. NAND-gate U3D keeps the I/O “busy” while the processor is reading the data. When the processor is ready for more data, it sets the HSE control line, which clears the flip-flop, clearing BUSY and ACK to allow for the next character.

Resistor pack R3 is for pull-up. All of IC pack U2 is used for buffering. NAND-gate U3C acts as inverter.

RS-232 I/O–2225D

The RS-232 serial I/O PCA contains a CPU (U1), UART (U2), two banks of switches (S1 and S2), a data buffer (U6 and U7), and some miscellaneous logic. The serial data from the host is converted to parallel and stored in the 104 byte buffer of the CPU. The CPU then transfers this data to the Logic PCA microprocessor through the data buffer and connector J2.

The 2225D Serial ThinkJet Printer supports both software (XON/XOFF) and hardware (DTR) modes of handshaking, selected by switch 1 of the RS-232C switches on the 2225D backpanel. Handshaking occurs when the 104 byte buffer is considered empty (room for 100 bytes of data) or full (room for 8 bytes of data).

With XON/XOFF handshaking, the printer will output an XOFF character when the buffer becomes full. The XOFF character is the ASCII DC3 character. When the buffer becomes empty, the printer will output the XON character, ASCII DC1. The DC1 character is also output whenever the printer is turned on with the XON/XOFF handshake mode selected.

When using DTR handshaking, the printer controls the DTR output at pin 20 of the RS-232 connector. The same signal also goes to pin 11 of the connector. When the buffer is full, these lines are turned to the OFF state (–10V or MARK or Logic 1). When the buffer becomes empty, the printer signals the controller that it can now accept more data by setting these two lines to the ON state (+10V or SPACE or Logic 0).

Print Mechanism

The print mechanism dimensions are 11 inches wide by 6.25 inches deep by 3 inches high, and can accommodate 80 character columns of print at 12 characters per inch, for a total printing width of 6.7 inches. Total weight is 1.8 pounds (0.82 kilograms). The mainframe is an injection molded plastic which accommodates the mounting scheme for the drive systems and sensing devices.

Paper Advance

Paper is advanced using a stepper motor with a 7.5 degree step angle at full step (48 steps per revolution). Rotational motion is translated through a 6:1 gear reduction train to the drive scheme which consists of both a grit wheel for single sheet feeding and a pin wheel for traditional fan fold tractor feed paper. Each full-step of the motor advances the paper one vertical dot row (0.010 inches). Twelve steps are required to advance the paper one line at 8 lines per inch. The right pin wheel is adjustable to accommodate variations of paper width from 8.65 inches to 9.05 inches.

Out-Of-Paper is detected by a magnetic reed switch. A lever with a magnet is positioned in the paper path above the switch. As the paper is inserted, the magnet is pushed away, opening the switch. When paper runs out, dropping the lever, the magnet again closes the switch indicating Out-Of-Paper; this occurs approximately 0.7 inches before the end of paper reaches the print region.

Paper slew rate is approximately 2 inches per second. There is no manual paper advance, nor backup capability.

Carriage Drive

The head carriage rides on a single guide rail in the back, and is guided in the front by a track molded into the mainframe. At the far left, the track is curved to tilt the head carriage away from the paper, allowing ease of paper loading; this is the “home” position. Tilting of the carriage also prevents the paper from contacting the print head while idle.

A stepper motor with a 9 degree half-step angle (400 half steps per revolution), translates rotational motion through a 5:1 gear reduction and a drum/ cable assembly for linear motion. This corresponds to one dot column of printing (0.010 inches). The velocity of the carriage is extremely constant, enough to allow for interpolation of position between the motor half-steps, for a total possible horizontal accuracy of 0.005 inches. Horizontal resolution is 640 dot columns on motor half-steps and 1280 dot-columns on motor quarter-steps.

The maximum speed of the motor is 1200 half-steps per second (150 characters per second). High speeds are achieved by “ramping” the motor steps. A “ramp” consists of 32 half-steps of the motor, each with an increasing step rate for acceleration. The step rate is increased from 200 half-steps per second to 1200 half-steps per second during this time. A similar “ramp” is needed to reduce the motor speed.

An optical switch is mounted in the mainframe in the carriage path to sense the carriage’s passing. The switch serves dual purposes, both of which occur at power-on or reset. First, because the system operates “open-loop” (there is no feedback of carriage position), there must be some initial indication of carriage location. At power-on the carriage sweeps approximately two inches to the right, then sweeps left until it encounters the switch, indicating location.

The printer prints characters bidirectionally. For proper line-to-line vertical alignment a 0.005 inch accuracy must be met.

Paper Path

Entry and exit of paper is from the top. A guide, molded into the case, ensures that single sheets are loaded correctly. The static-resistant platen frame mounts the grit and pin wheel drive, and acts to separate the entering and exiting paper.

Heat Dissipation

The carriage stepper motor dissipates 2.9 watts and the paper advance stepper motor 6.6 watts. Heat due to the print head is considered negligible. Since both motors are not operating simultaneously, the average power is 3.7 watts in text mode (based on a 22% duty cycle for the paper motor and a 78% duty cycle for the carriage motor). The most heat (6.6 watts) will be dissipated when the printer is performing form feeds. The mechanism is specified to operate in a maximum 70 degree celsius environment.

Acoustic Noise

In the package, the mechanism produces a maximum Sound Pressure Level of 50 dBA (slow response) at a distance of one meter. The total Sound Power Level from the unit is 60 dBA.

Mode Select Dip Switches—2225C and 2225D

The 2225C and 2225D have eight user-accessible DIP switches on the rear panel (these switches are labeled MODE on the 2225D). The state of these switches is read immediately after the power is turned on. To change the default settings, the 2225C or 2225D must be turned off and then on again.

Behavior consistent with the HP Printer Feature Set standard is guaranteed only if every switch is down.

Default Select DIP Switches:

		Up	Down
1	CR definition	CR-LF	CR only
2	LF definition	CR-LF	LF only
3	Perforation skip mode	1" perf area	no perf area
4	Page length	12"	11"
5	Control sequence mode	Alternate	HP
6-8	See table below		

Switch Settings			Character Set
6	7	8	
down	down	down	Roman8
up	down	down	United States ASCII
down	up	down	Swedish
up	up	down	IBM8*
down	down	up	French
up	down	up	German
down	up	up	United Kingdom
up	up	up	Spanish

*Some early version ThinkJet Printers have Italian, rather than IBM8.

Switch Configuration Guide:

The following switch settings can be used as a guide for configuring some computer systems:

Computer	Switch Settings							
	1	2	3	4	5	6	7	8
Hewlett-Packard	down	down	down	down	down	down	down	down
IBM PC*	down	up	down	down	up	up	up	down
Apple	down	up	down	down	up	up	down	down
Radio Shack	up	down	down	down	up	up	down	down
Epson MX80	down	up	down	down	up	down	down	down

*Early versions with Italian, rather than IBM8, should have switch 7 down. Switch positions 2 and 5 are software dependent.

HP-IB Address Select DIP Switches—2225A

The 2225A has seven HP-IB address select switches on the rear panel. The HP-IB address is a number from 0 to 30 which identifies each device connected to the interface. Using the HP-IB addresses, the controller can individually access the various devices on the interface. The 2225A printer is shipped from the factory with the address portion of the HP-IB configuration switch set to address 1. HP-IB is discussed in detail in the 2225A Reference Manual.

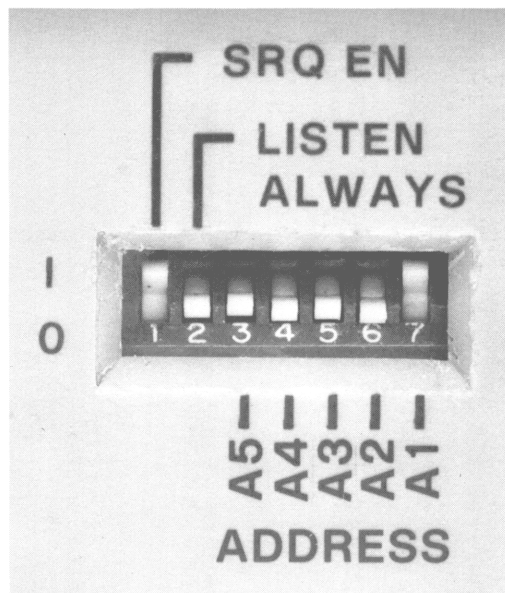


Figure 2-1, HP-IB Default Settings

RS-232 Control Dip Switches—2225D

The 2225D has a set of five DIP switches (labeled RS-232C) which control the RS-232 interface; baud rate, parity, and handshake mode. The printer is shipped from the factory with all five switches in the down position. See Figure 2-2 and Tables 2-1 and 2-2 for specific switch information.

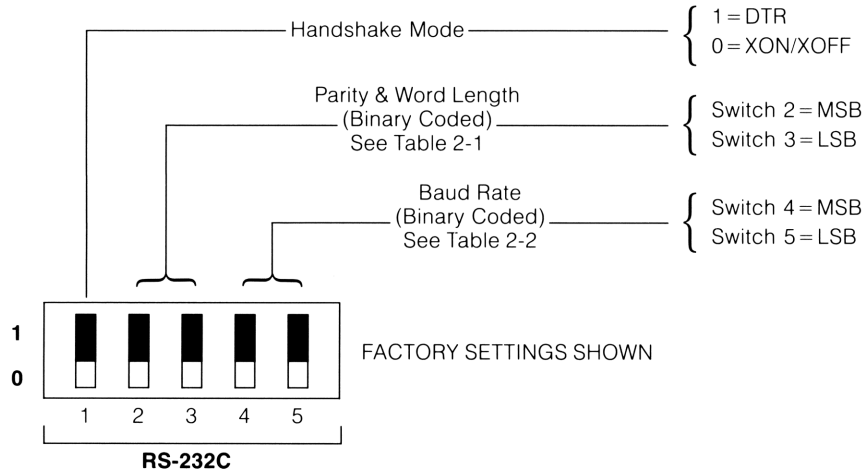


Table 2-1. Parity/Word Length

SWITCH 2	SWITCH 3	PARITY	WORD LENGTH
0	0	None	8
0	0	Zero	7
0	1	Odd	7
1	0	EVEN	7
1	1	One	7

Table 2-2. Baud Rate

SWITCH 4	SWITCH 5	BAUD RATE
0	0	9600
0	1	19200
1	0	2400
1	1	1200

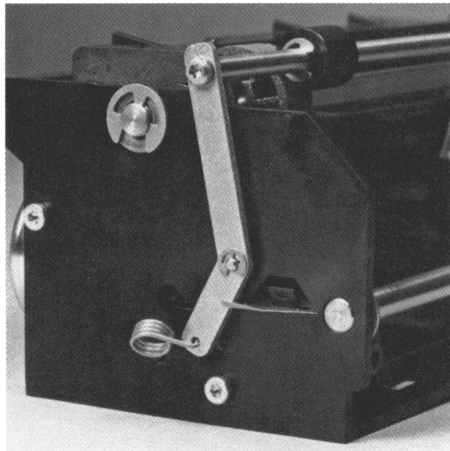
Maintenance

Adjustment Procedures

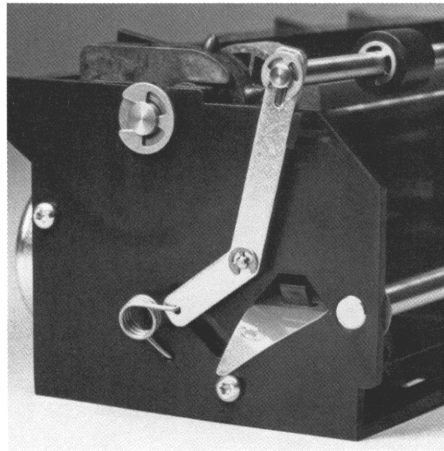
The following paragraphs contain the complete adjustments procedures for the HP 2225 series of printers.

Bail Arm Adjustment (early version ThinkJets, only)

The following bail arm adjustment is performed on early version ThinkJet printers only. If you don't have an early version printer, no bail arm adjustment is necessary. To determine if you have an early version ThinkJet printer, remove the top cover (Refer to Removal and Replacement in this section, if necessary) and look at the left side of your Bail Arm Assembly. If the ThinkJet bail is connected to the left bail arm with a screw, the following Bail Arm adjustment applies. Disregard the bail arm adjustment procedure if your ThinkJet printer bail is attached to the left bail arm with a retaining ring. See Figure 3-1.



EARLY VERSION



LATER VERSION

Figure 3-1, Bail Assembly Identification

The bail arm must be adjusted correctly to allow the pinch rollers to apply pressure evenly to the paper. If the pressures are uneven, the paper will skew as it moves through the mechanism. If necessary, refer to Removal and Replacement in this section for bail arm assembly and disassembly procedures.

1. Apply downward pressure on the left side of the bail arm assembly while lifting the right side of the bail. See Figure 3-2. The right pinch roller should lift a short distance ($\sim \frac{1}{8}$ to $\frac{1}{4}$ inch) off the grit wheel before meeting heavy resistance.
 - a. If there is no "play" in the right side, apply more outward pressure until the right side of the shaft loosens up.
 - b. If there is too much play, i.e., the right bail arm easily goes backward and hits the stop on the print frame, the screw on the left of the bail shaft is too loose.

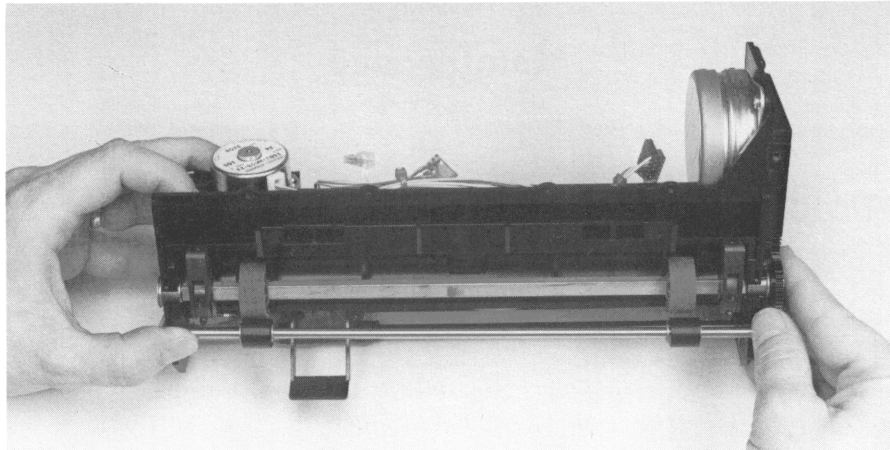


Figure 3-2, Bail Arm Adjustment, Right Side

2. Once the right side is adjusted properly, apply downward pressure on the right side of the bail arm assembly and lift the left side of the bail. See Figure 3-3. The left pinch roller should have the same amount of play. If not, use the same techniques outlined above to make the proper adjustment.

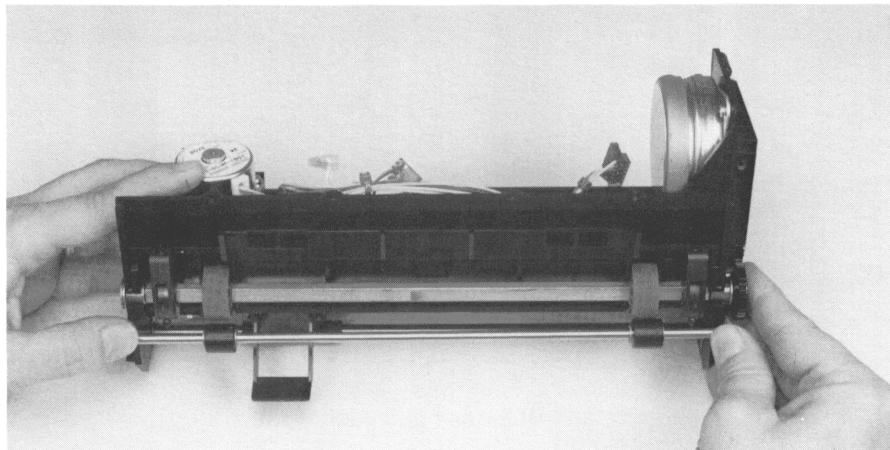


Figure 3-3, Bail Arm Adjustment, Left Side

3. Once both sides are set correctly, rotate the platen shaft either by hand or with the FF key and ensure that both pinch rollers are driven by the grit wheels.

Power Supply Adjustment—2225A/C/D

The power supply for the print head is specified as $22.682V \pm 0.18V$ at J2(6). It is adjusted into this range by removing combinations of resistors R14, R15, and R16. A new board is loaded with all resistors in place. In this condition, the voltage should be between 20.51 and 22.86 volts. If it is out of this range, one of the 6 components that determine this voltage is bad. Clipping the resistors will increase the voltage to bring it into range and is always done at the factory for replacement boards.

Initial Voltage	Action
<20.51	Defective part
20.51 to 20.65	Remove R14, R15, R16
20.66 to 20.95	Remove R15, R16
20.96 to 21.27	Remove R14, R16
21.28 to 21.58	Remove R16
21.59 to 21.89	Remove R14, R15
21.90 to 22.21	Remove R15
22.22 to 22.51	Remove R14
22.52 to 22.86	In Spec—no change required.
>22.86	Defective part

Power Supply Adjustment—2225B

The print head supply for the 2225B is specified as 22.73V \pm 0.21V at the cathode of CR 2. It is adjusted to fall into this range by removing combinations of resistors R55, R56, and R57. A new board is loaded with all resistors in place. In this condition, the voltage should be between 22.52 and 22.94 volts. If it is out of range, one of the loopback components that determine this voltage is bad. Clipping the resistors will decrease the voltage to bring it into range and is always done at the factory for replacement boards.

Initial Voltage	Action
>25.63	Defective part
25.63 to 25.18	Remove all resistors
25.17 to 24.75	R55, R56
24.74 to 24.33	R55, R57
24.32 to 24.00	R55
23.99 to 23.67	R56, R57
23.66 to 23.30	R56
23.29 to 22.94	R57
22.93 to 22.52	In spec—no change required.
<22.52	Defective Part

Removal and Replacement

The following paragraphs contain instructions for removing and replacing printer assemblies and components. Turn off power before performing any of the following replacements.

Top Cover Replacement

1. Turn printer upside down and remove the four corner screws with a T9 Torx driver.
2. Turn unit right side up and remove screws.
3. Lift top cover straight up to remove. Do not lift too far, since the keypad cable is connected to the logic PCA.
4. When replacing the cover, ensure the front edge of the window rests on the front edge of the base before the top cover is lowered into place.

HP-IB I/O PCA Replacement

Use the following steps to remove the HP-IB I/O PCA:

1. Remove top cover.
2. Remove flex cable from either the I/O board or the logic board.
3. Remove the two hex standoff screws on the rear panel HP-IB connector.
4. Remove the four nuts (4-40) that secure the HP-IB board to its mounting studs.
5. Lift the rear panel out of the base to free the HP-IB connector.
6. Lift the HP-IB I/O board free. Note that there is a ground cable attached to the bottom of the board that must be removed.

Parallel I/O PCA Replacement

Use the following steps to remove the Parallel I/O PCA:

1. Remove top cover.
2. Remove flex cable from either the I/O board or the logic board.
3. Lift the entire rear panel out of its slots in the base and rotate the panel away from the printer.
4. Remove the four T9 screws that hold the board to the rear panel. See Figure 3-4.

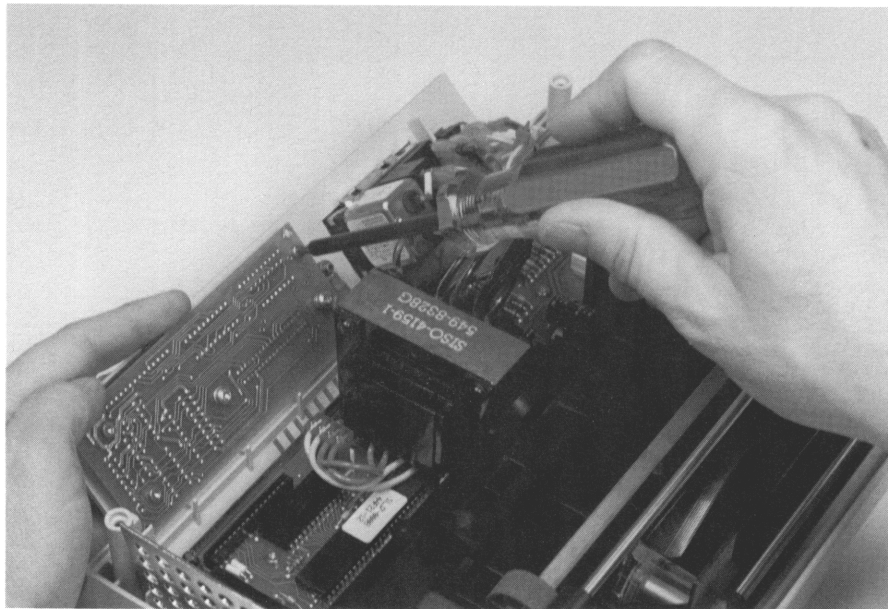


Figure 3-4, Parallel I/O Removal

5. Remove the two T10 screws that hold the connector housing to the board.
6. When installing the new board, ensure the ground wire is attached to the board.

RS-232 I/O PCA Replacement

Use the following steps to remove the RS-232-C I/O PCA:

1. Remove the top cover.
2. Remove flex cable from either the I/O board or the logic board.
3. Lift the entire rear panel out of its slots in the base and rotate the panel away from the printer.
4. Remove the two hex standoff screws on the rear panel RS-232-C connector.
5. Remove the ground wire from the I/O PCA.
6. Remove the two T9 screws that hold the board to the rear panel.
7. When installing the new board, be sure to attach the ground wire to the board.

Mechanism Replacement

Use the following steps to replace the mechanism:

1. Remove the top cover.
2. Remove the T9 screw on the bottom right side of the base.
3. Remove the two T9 screws on the inside of the mechanism that hold it to the base.
4. Remove the T10 screw holding the ground wire and magnetic shield to the mechanism.
5. Lift the mechanism slightly to remove the magnetic shield and then remove the T15 screw holding the ground wire to the paper motor.
6. Remove the four cable connectors and printhead ribbon that connect to the Logic board and lift the mechanism free.

Grit Wheel/Pin Wheel Replacement

Use the following procedure to replace either the grit wheel or pin wheel:

1. Remove the E-rings from both ends of the platen shaft.
2. Remove the output gear and dowel from the right side of the shaft. Be careful not to lose the dowel when the gear is removed.
3. Remove both sleeve bearings by pulling straight out from the sides.
4. Lift shaft free and remove wheels.
5. When installing the platen shaft, place both grit wheels on the shaft and temporarily set the shaft in the mechanism with the dowel hole positioned on the right side. Position the wheels so they fit between the flanges on the platen frame. See Figure 3-5.

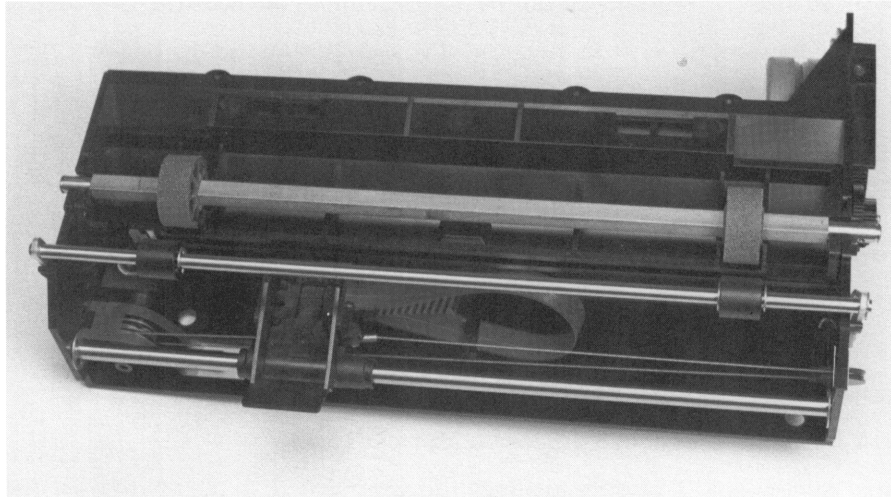


Figure 3-5, Grit Wheel Installation

6. Install the pin wheels on each side of the shaft. Ensure the pins are positioned the same on the shaft. See Figure 3-6.

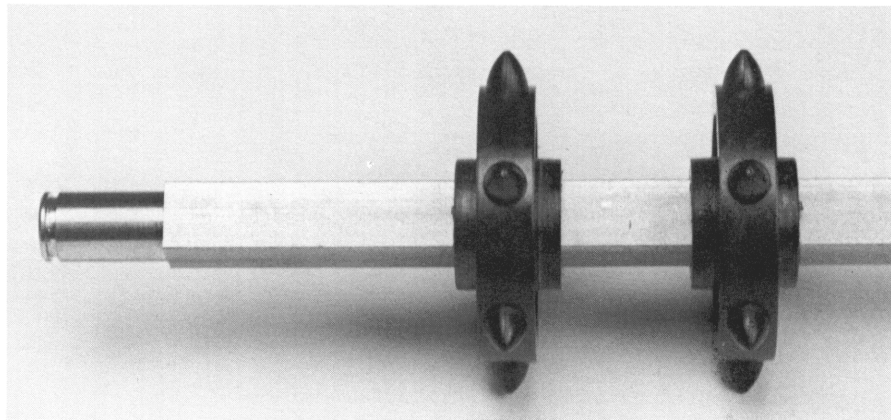


Figure 3-6, Pin Wheel Replacement – Correct

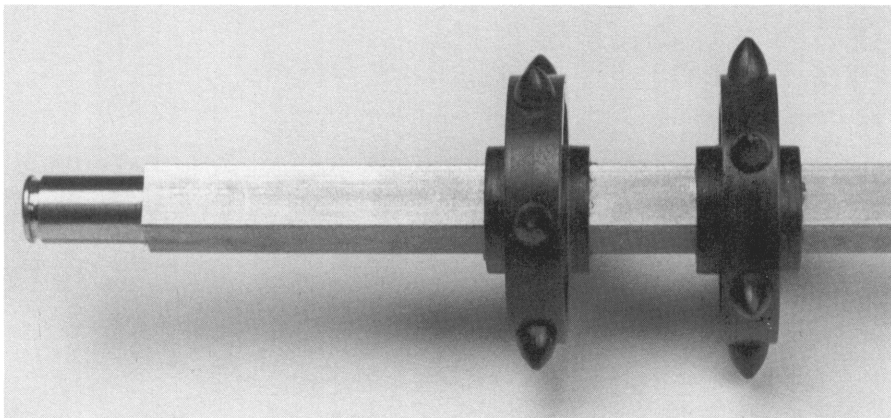


Figure 3-6, Pin Wheel Replacement – Incorrect

7. Place the guides over each pin wheel, and set the left guide into its slotted position on the platen frame. Seat the guides firmly into place. See Figure 3-7.

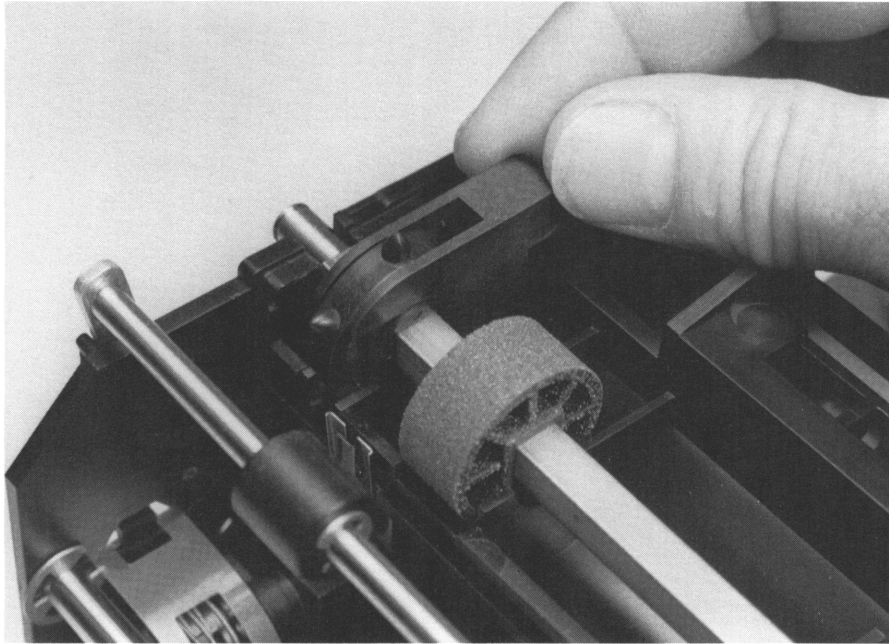


Figure 3-7, Pin Wheel Guide Placement

8. Install the sleeve bearings by pushing them onto the shaft with the shaft resting in place.
9. Rotate the shaft so that the dowel hole is horizontal and insert the dowel.
10. Install the output gear so that its recessed areas fit over the dowel.
11. Install the two E-rings on the ends of the shaft.

Carriage Assembly Replacement

Use the following procedure to replace the Carriage Assembly:

1. Remove the mechanism from the printer.
2. Lower the head latch lever and remove the printhead.
3. Move the carriage to the full left position and remove the T7 screw that secures the cable to the carriage. The screw can be accessed through the bottom cutout in the mechanism frame. See Figure 3-8.

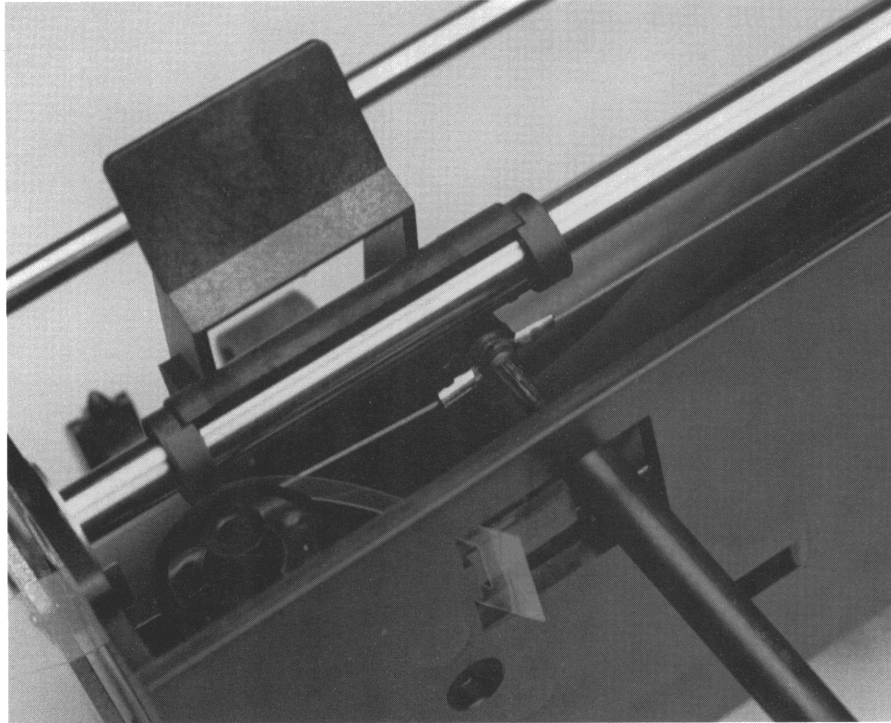


Figure 3-8, Carriage Screw Removal

NOTE

Use care to keep the two cable ends attached to the screw. The retaining washer will help secure these parts together once they have been removed from the carriage. If these parts are not kept intact, the cable could unwind and force the replacement of the print structure.

4. Remove the two E-rings from the inside of the carriage shaft. Remove the shaft and carriage assembly.

Pinch Roller Replacement

The following procedure is used to replace the pinch rollers from the bail arm:

1. Remove the ThinkJet top cover.
2. Remove the E-ring which connects the right bail arm to the right side of the bail. Be very careful not to lose the dowel in the bail arm slot, located behind the E-ring.
3. Pull the bail out of the right bail arm and remove the dowel from its hole in the bail..
4. Remove the E-ring to the right of the right pinch roller, then remove the right pinch roller. If the left pinch roller requires replacement, remove the next two E-rings and slide the left pinch roller off the right side of the bail.
5. Replace the E-rings and pinch rollers in the reverse order as removed. Connect the right bail arm to the bail shaft, remembering to install the dowel in the hole located on the bail shaft, and positioning the dowel in the slot of the bail arm.

Bail Assembly Replacement

There is an early and later version of bail assemblies. Perform Procedure A for early version or Procedure B for later version bail assembly replacement. To determine if you have an early version ThinkJet printer bail assembly, remove the top cover (Refer to Removal and Replacement in this section, if necessary) and look at the left side of your Bail Arm Assembly. If the ThinkJet bail is connected to the left bail arm with a screw, you have an early version bail assembly and follow Procedure A. Perform Procedure B if the bail is attached to both bail arms by retaining rings. See Figure 3-1.

Procedure A

Use the following procedure if the bail assembly requires more extensive maintenance than replacing the pinch rollers:

1. Lift both bail-arm springs to the outward position (see Figure 3-9), pinch legs together, and lift out.

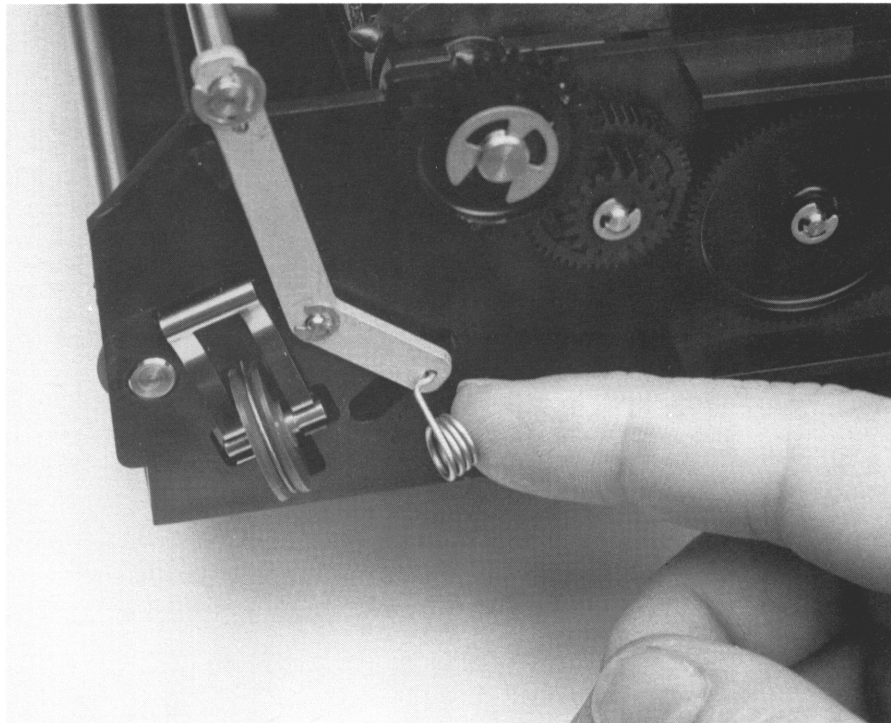


Figure 3-9, Bail Arm Removal

2. Remove the T10 screw on the left side of the bail shaft.
3. Remove the E-ring on the right side of the bail shaft. Be careful not to lose the dowel when removing the shaft from the right bail arm.
4. Remove the bail arms by removing the two E-rings.
5. When reassembling the bail assembly, it is important to note that the springs and bail arms are different for each side. Figure 3-10 identifies these parts.

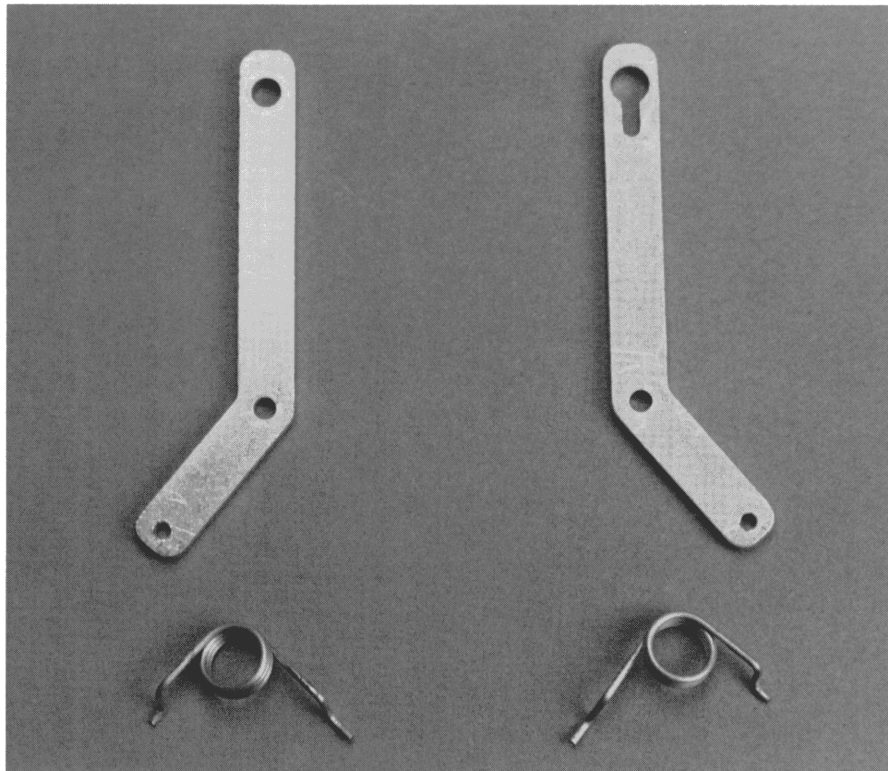


Figure 3-10, Bail Arm Identification

6. When installing the right bail arm, refer to Figure 3-11 for proper placement. The left bail arm is positioned in a similar manner.
7. To install the right spring, place the short side of the spring in the bail arm hole and the longer side in the printer frame hole. If the two legs are properly seated, the spring can be pushed down easily to its normal position. See Figure 3-11. If it does not position easily, the legs are not set in correctly.

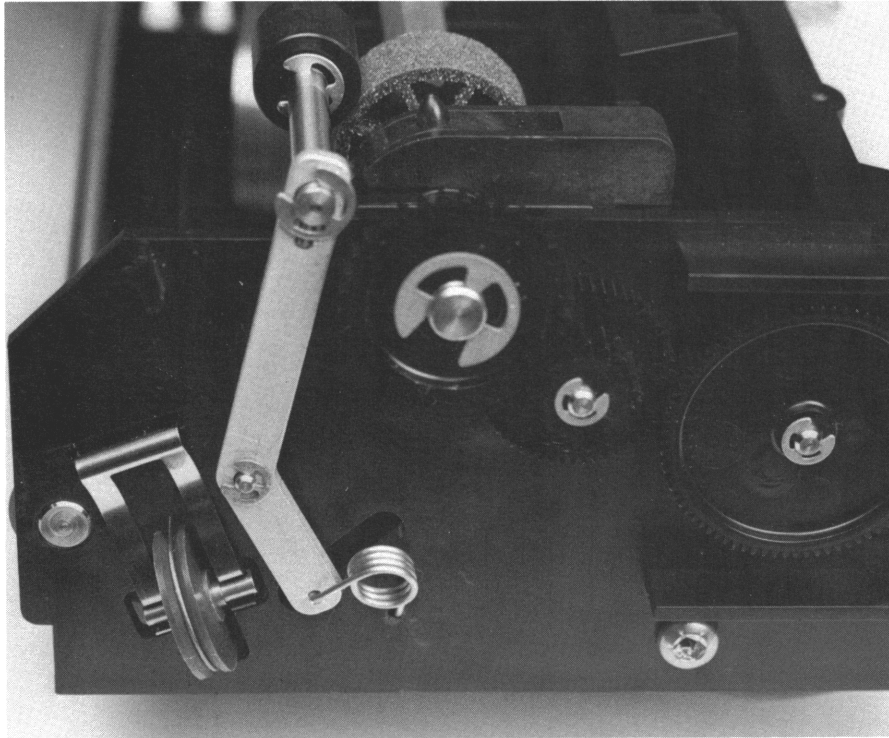


Figure 3-11, Correct Spring Position

8. Install the left spring in the same manner as the right spring.
9. To set the bail shaft into the right bail arm, position the shaft so that the dowel hole is horizontal. Place the dowel in the shaft and position the shaft into the right bail arm. Apply enough pressure on the shaft to hold the dowel in place; then turn the shaft so the dowel lines up with the slot in the arm. Push down on the dowel to set it in place; the shaft should then slip fully into the arm. Install the E-ring on the end of the shaft.
10. Secure the other end of the shaft to the left bail arm with the T10 screw.

NOTE

Once the bail shaft has been removed, its alignment should be checked. Refer to Adjustments in this section.

Procedure B

Use the following procedure to replace later version Bail Assemblies:

1. Lift both bail-arm springs to the outward position (see Figure 3-9), pinch legs together, and lift out.
2. Remove the E-ring on the left end of the bail shaft. Be careful not to lose the dowel in the bail arm, located behind the E-ring.
3. Remove the E-ring on the right end of the bail shaft, next to the right bail arm. Again, be careful not to lose the dowel when removing the shaft from the right bail arm.
4. Remove the bail arms by removing the two remaining E-rings on the bail arms.

5. When reassembling the Bail Assembly, it is important to note that both bail arms are identical (unlike early version bail assemblies, shown in Figure 3-10) but the right and left bail arm springs are different, as shown in Figure 3-10.
6. When installing the right bail arm, refer to Figure 3-11 for proper placement. The left bail arm is positioned in a similar manner.
7. To install the right spring, place the short side of the spring in the bail arm hole and the longer side in the printer frame hole. If the two legs are properly seated, the spring can be pushed down easily to its normal position. See Figure 3-11. If it does not position easily, the legs are not set in correctly.
8. Install the left spring in the same manner as the right spring.
9. To set the bail shaft into the right bail arm, position the shaft so that the dowel hole is horizontal. Place the dowel in the shaft and position the shaft into the right bail arm. Apply enough pressure on the shaft to hold the dowel in place; then turn the shaft so the dowel lines up with the slot in the arm. Push down on the dowel to set it in place; the shaft should then slip fully into the arm. Install the E-ring on the end of the shaft.
10. Secure the left end of the bail shaft to the left bail arm in the same manner as the right side.

Home Switch Replacement

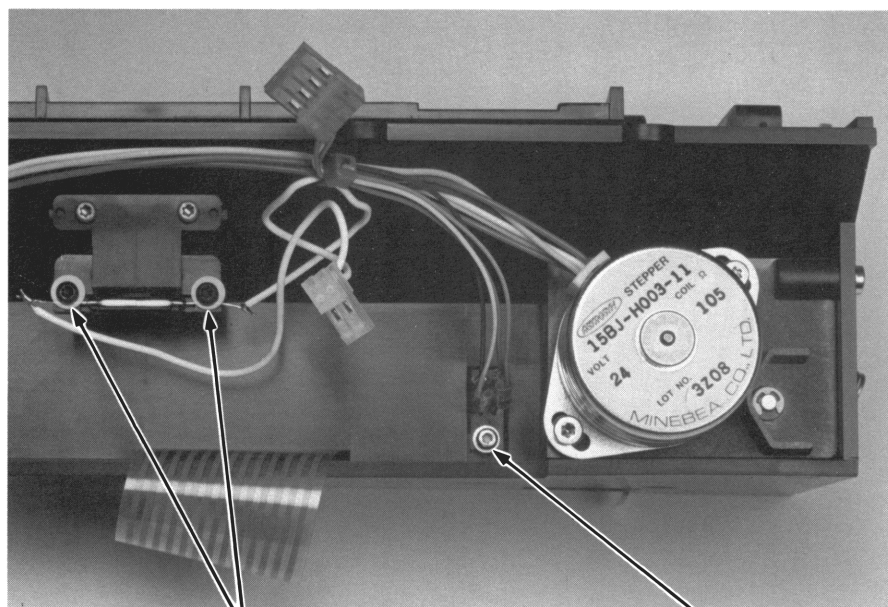
Use the following procedure to remove the home switch (this switch is also referred to as the opto sensor):

1. Remove the top cover.
2. Remove the mechanism (see Mechanism Replacement).
3. Locate the home switch shown in Figure 3-12 and remove the T6 screw that fastens the switch to the mechanism frame.
4. Pull the switch out of the back and cut the tie wrap holding it to the other cables.
5. Install a new home switch and replace the tie wrap.

Out-Of-Paper Switch Replacement

Use the procedure outlined below to replace the out-of-paper switch (this switch is also referred to as the reed switch):

1. Remove the top cover.
2. Remove the mechanism (see Mechanism Replacement).
3. Locate the reed switch shown in Figure 3-12 and loosen the two T6 screws that hold the switch to the bracket on the rear of the mechanism.
4. Slide the switch free of the loosened screws and cut the tie wrap holding it to the other cables.
5. Install a new home switch and replace the tie wrap.



OUT-OF-PAPER SWITCH SCREWS

HOME SWITCH SCREW

Figure 3-12, Home Switch and Out-of-Paper Switch Removal

Troubleshooting

Introduction

This section provides self test information and troubleshooting procedures for the ThinkJet printers to help isolate problems to the assembly or component level.

Self Test

ThinkJet printers have two forms of self test, printing and non-printing. The non-printing self test checks the CPU, timers, internal and external RAM, and internal and external ROM. The test occurs when the power is switched on, or as the first part of the printing self test. The yellow attention light blinks twice during the non-printing self test.

If the printer fails the non-printing self test, the processor pins that control dot firing are used to report the part of the test that failed. Power to the print head is turned off at this point; dots are not actually fired. See Logic Board Troubleshooting for further information.

The printing self test can be invoked in two ways. One way is to send an ESC z. All data in the buffer is printed, the non-printing self test is executed, and paper is advanced to the top of the form if it is not already there. ThinkJet printers execute the non-printing self test, and if the test is passed print a self test pattern. (The self test does not change any of the user-defined features.) See figure 4-1, self test pattern.

The other way of invoking the printing self test is to press the line feed button or the form feed button while switching on power.

1. Turn off the printer.
2. Depress and hold the line feed button while turning the printer on.
3. Release the line feed button to start the self test sequence which includes a set of printed examples.
4. The self test may be terminated at any time by turning off the printer.

The printing portion of the test is stopped if one of the following happens:

- the test fails because the carriage position is not known,
- a device clear command is received, in which case printing stops immediately and a device clear is executed, or
- the power is turned off.

The self test is suspended if the printer is out of paper, or, in the 2225B, the battery voltage is too low to run the motors. When either of these conditions is fixed the self test will resume.

The self-test-failed bit in the printer status byte is set only when the non-printing portion of the self test fails. (If the test failed because the carriage position cannot be determined, the carriage motion disabled bit is set. If the test is suspended because the printer is out of paper, the out of paper bit is set. If the test is suspended because the battery voltage is too low, the low battery bit is set.) The self test failed bit can be cleared by pulling pin 42 (FF) of the processor to ground.

Overall Troubleshooting

Use the following general procedure to troubleshoot the 2225 series of printers. This procedure ensures that the basic printer functions are working properly. If the printer has more subtle problems, refer to Table 4-1, Troubleshooting Hints.

1. With paper installed, does the printer power up correctly? At power on, the printer should do the following:

- a. The red PWR (power) LED should light.
- b. The yellow (attention) LED should blink twice and go out.
- c. The printhead should sweep through the home switch twice and then return to its left-most position.

If the unit powers up correctly, it indicates correct operation of the processor, ROM, RAM, carriage motor, home switch, and most of the power supply. Go to step 2.

If the printer does not power up correctly, see the following steps:

- a. If the red LED does not come on and the motors do not move, check the line fuse, power line module and transformer circuitry, and power supply. In the 2225B, check the battery pack: the red LED would be off or blink with low battery voltage.
 - b. Remove the cable to the I/O board (2225A/C/D), and power on again. If the printer then powers up correctly, replace the I/O board.
 - c. If the yellow LED fails to blink, check the keypad and logic board. See Logic Board Troubleshooting.
 - d. If the yellow LED stays on, it indicates a paper out condition. Check the out-of-paper switch and logic board.
 - e. If the yellow LED continues blinking after power on, it indicates a self test failure in the kernel of the logic PCA.
 - f. If the yellow LED blinks twice, stays off for several seconds, and then resumes blinking, it indicates one of the following:
 1. A failure in the logic board.
 2. A bad carriage motor. See Step g.
 3. A bad home switch.
 4. The mechanism will not allow the carriage to move.
 - g. If the carriage motor fails to move, disconnect the motor and plug another motor in its place. (There's no need to actually mount the motor in the mechanism.) If the new motor fails to rotate at power on, check the logic board circuitry (see Logic Board Troubleshooting). If the new motor rotates at power on, verify that it can work in the mechanism. If not, check the mechanism for any type of binding (gear housing, carriage cable, etc.).
 - h. If the printhead crashes to the left, check the home switch (opto sensor), logic board, and mechanism for binding. See Logic Board Troubleshooting.
2. Push the LF (line feed) button on the front panel a few times. Does the printer advance a line at a time? (Tapping the button should cause the mechanism to advance one dot row.) Does the paper drive operate smoothly? If the answer is yes, go to step 3.

If the printer fails to perform a line feed, do the following:

- a. Check the keypad to ensure the switch is functional. The easiest way to do this is by simply connecting a new keypad without actually mounting it to the top cover.
- b. Disconnect the paper motor and plug another motor in its place. (There's no need to actually mount the motor in the mechanism.)
- c. If the new motor fails to rotate when LF is pressed, check the logic board circuitry. See Logic Board Troubleshooting.
- d. If the new motor rotates at power on, verify that it can work in the mechanism. If not, check the mechanism for any type of binding (gears, bearings, etc.).

3. Push the FF (form feed) button on the front panel. Does the printer advance the paper several inches? If not, replace the keypad and check the print mechanism for binding that would prevent paper from freely moving through the unit.

4. Run the printer's self test (power off, hold down LF key, power on, release key). The printer should print a test pattern similar to Figure 4-1. If the pattern is printed correctly, go to Step 5.

If no printing occurs or dots are missing, check or replace the printhead, proper connection of the carriage ribbon cable, and the logic board. See Logic Board Troubleshooting.

5. Connect a host computer to the printer's I/O port and send data to the printer.

If the printer prints the data correctly, it is considered good.

If no printing occurs, recheck both units for proper configuration, then check or replace the following: the I/O board, the I/O cable that goes to the logic board, and the logic board. See Logic Board Troubleshooting.

Table 4-1, Troubleshooting Hints

Symptom	Cause
Missing dots.	<ol style="list-style-type: none"> 1. Print head needs cleaning. 2. Print head defective. 3. Print head flex cable/connector. 4. Logic PCA.
Print is too light.	<ol style="list-style-type: none"> 1. Unspecified paper. 2. Print head running out of ink. 3. Logic PCA.
Printer will not advance paper.	<ol style="list-style-type: none"> 1. Paper motor or connector. 2. Logic PCA. 3. I/O PCA (2225A/C/D). 4. Battery (2225B only). 5. Paper drive gears. 6. Paper path. 7. Keypad switch assy or connector.
Improper paper advance.	<ol style="list-style-type: none"> 1. Paper motor or connector. 2. Logic PCA. 3. I/O PCA (2225A/C/D). 4. Bail arm adjustment. 5. Pinwheels 6. Paper path.
Carriage slams into side plate when homing.	<ol style="list-style-type: none"> 1. Carriage motor or connector. 2. Home switch assembly. 3. Logic PCA. 4. I/O PCA (2225A/C/D).
Carriage stalls before done homing (yellow LED flashing).	<ol style="list-style-type: none"> 1. Drum cap on cable assembly. 2. Gear box for carriage drive. 3. Idler pulley. 4. Wear shoe on carriage.
Paper out condition indicated with paper installed.	<ol style="list-style-type: none"> 1. Out-of-paper switch. 2. Logic PCA. 3. I/O PCA (2225A/C/D).

Table 4-1, Troubleshooting Hints (Cont'd)

Symptom	Cause
Controller indicates loop time-out or errors (2225B only).	1. Logic PCA. 2. HPIL connector assembly. 3. Battery.
Locks up controller, nothing printed (2225A/C/D).	1. I/O PCA. 2. Logic PCA. 3. I/O to Logic flex cable.
Turns on, red light on (or flashing on 2225B), no homing, no yellow light.	1. Carriage motor or connector. 2. Battery (2225B only). 3. Keypad switch assembly. 4. I/O PCA (2225A/C/D). 5. Controller off or resetting printer.
Carriage stalls while printing.	1. Carriage motor. 2. Logic PCA. 3. Gear box for carriage drive. 4. Carriage binding.
Printer is noisy while printing.	1. Carriage motor. 2. Gear box for carriage drive.

Logic Board Troubleshooting–2225A

This procedure assumes the Logic PCA (HP P/N 02225-60010) has a known fault and no other fault exists outside of the board. For convenience, disconnect the HP-IB board and remove it from the printer. Use the following procedure as an aid in troubleshooting this board to the component level.

NOTE

All troubleshooting must be done with paper installed.

1. Always check the power supply voltages before attempting any other troubleshooting. Refer to Table 4-2 for voltage information.

Table 4-2, Power Supply Voltages

Supply	Nominal Voltage	Voltage Range	Test Point
VDRAW	11.6V	8.5 TO 12.7V	U7(8)
VDD	5.0V	4.75 TO 5.25V	U2(5)
VMC	24.0V	23.04 TO 24.96V	J4(5&6)*
VMP	34.7V	27.0 TO 40.0V	J3(5&6)*
VHD	22.68V	22.5 TO 22.86V	J2(6)
NRESET	4.5V	>4.5V	U1(10)

* Remove motor cable when measuring this voltage.

NOTE

If any parts are replaced in the power system, recheck the VHD (print head) voltage. Perform power supply adjustment if measurement is out of specification.

2. At power on with paper installed, does the yellow LED blink twice and go out? If it does, it indicates that the processor, ROM, RAM, carriage motor circuitry, and home switch circuitry are working correctly. In this case, go to Step 3. If not, continue within Step 2.

If the yellow LED is always on, it indicates a problem in the paper sense circuitry. With paper installed, U1(41) should be a logical high.

If the yellow LED continues blinking after power on, it indicates a self test failure in the kernel (ROM, RAM, processor). (See Troubleshooting the Kernel, below.)

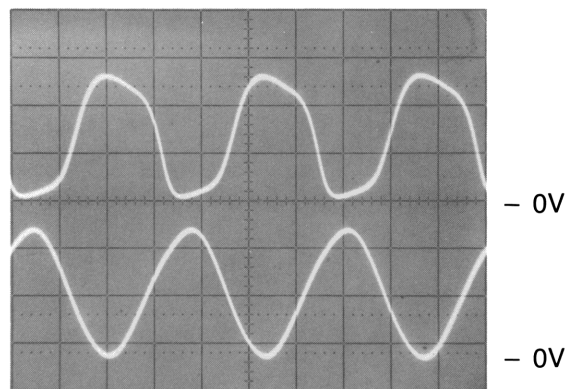
If the yellow LED blinks twice, stays off for several seconds, and then resumes blinking, it indicates one of the following:

- a. The logic board is not driving the carriage motor. (See Troubleshooting the Carriage Motor Circuitry, below.)
- b. The home switch circuitry is not sending signals to the processor. (See Troubleshooting the Home Switch Circuitry, below.)

If the carriage motor moves twice through the home switch, as in a normal power-up sequence, it indicates the kernel and carriage motor circuits are working correctly. A blinking yellow LED would then indicate a problem in the home switch circuitry. See the paragraph entitled Troubleshooting the Home Switch Circuitry. If this is not the case, continue on to the next paragraph.

Troubleshooting the Kernel

Check the 3MHz crystal for activity. Figure 4-2 shows the waveform on each leg of the crystal.



Crystal Leads
0.2V/DIV 10:1 probe
0.1us/DIV
DC coupled

Figure 4-2

The processor IC has a built-in self test that runs during a power-on cycle. To monitor the result of the self test, a logic probe must be placed on one of several pins of the processor IC (U1) while the unit is powered on. If the kernel fails the self test, one of the pins will pulse to indicate the failure mode. The pins and meanings are listed below.

NOTE

At power on, each pin listed below may pulse once as the processor is being reset. This first pulse occurs almost immediately and does not indicate an error message. Wait about one second for a second pulse, which will be a slightly longer pulse than the first.

U1 Pin Number	Name	Meaning
16	DOT 12	CPU (U1)
17	DOT 11	Internal ROM (U1)
18	DOT 10	Internal RAM (U1)
19	DOT 9	Either Timer (U1)
22	DOT 6	External RAM (U2)
23	DOT 5	External ROM (U3)

Check each pin sequentially:

- Place the logic probe on the first pin.
- Reset the processor by turning the line switch off and on.
- Continue checking the pins, resetting the processor each time.

If none of the pins indicate a failure, check the carriage motor circuitry next.

Troubleshooting the Carriage Motor Circuitry

The following procedure assumes that the kernel and power supplies have been checked, that a new carriage motor has been tried, and that both motors are connected to the logic board.

NOTE

For future reference, one way to have the carriage motor run is to unplug the reed switch connector, remove the print head, and enter the printing self test: power off, press LF button, power on, release button.

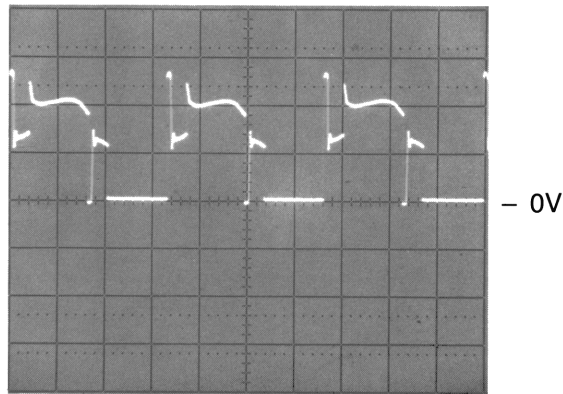
Procedure:

- First, ensure the blue key is functional. Place a logic probe on the cathode of CR11. The probe should indicate a high level as long as the key is held down.
- Check that U10(9) is about 34V. If not, suspect VR18 and U10.
- Check the motor driver input lines on U10 pins 1,2,3, and 4 by placing a logic probe on each pin and then pressing the blue key. Each pin should toggle several times. If not, replace U1. If all pins toggle, go to Step d.
- Unplug the carriage motor connector and check the driver outputs by placing an oscilloscope probe on U10(13-16) and then pressing the blue key. A low level square wave ($\sim 0.5V$ p-p) should be present if the driver is good. (This signal requires current flow through the probe, since the driver is open collector.) If not, suspect U10.
- If the waveform appears good, the problem is probably in the diode/capacitor circuit, CR14-15 and C19-20. A shorted diode or capacitor is very difficult to detect in normal operation. The result would be slight variations in the width of printed characters. With an open diode, the carriage would have difficulty moving and would stop after a few seconds.

NOTE

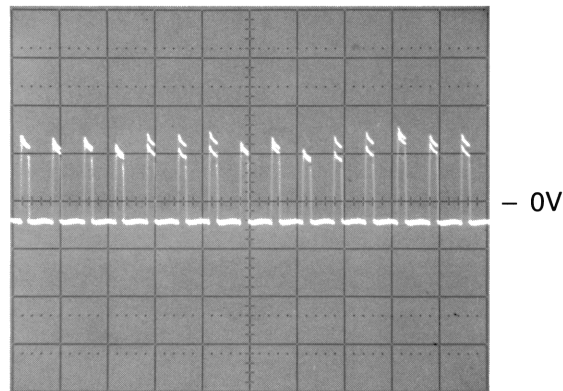
If one of these diodes is open, the corresponding capacitor must be replaced as well.

- Figure 4-3 shows a driver output under normal operating conditions as the carriage sweeps across the platen. Figure 4-4 shows the waveform on the cathode of CR14 under the same conditions. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



U10(13)
2V/DIV 10:1 probe
2ms/DIV
DC coupled

Figure 4-3



Cathode of CR14
0.2V/DIV 10:1 probe
5ms/DIV
AC coupled

Figure 4-4

Troubleshooting the Home Switch Circuitry

When the home switch circuitry is bad, the typical symptom is that the carriage will move initially to the right, reverse direction and crash into the left sideframe for a few seconds, and then come to rest. Do not attempt to troubleshoot this circuitry until the carriage is capable of moving through the home switch. Failure to move the carriage indicates the problem is located elsewhere.

Procedure:

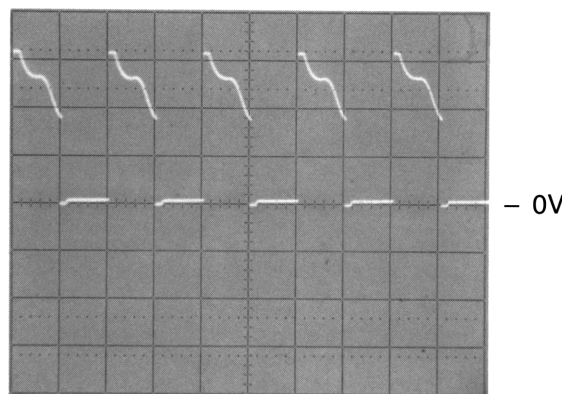
- Ensure the blue key is functional. Place a logic probe on the cathode of CR11 and press the blue key. The probe should indicate a high level as long as the key is held down.
- With power on and a known good home switch installed, place a logic probe on U1(46) and press the blue button on the keypad. This line from the processor is the LED enable signal; it should pulse high for about two seconds and then return low. If good, go to Step c. If not, replace U1.
- Place an oscilloscope probe on U7(6), and press the blue button again. The voltage level should go low for about two seconds and then return high ($\sim 22.5V$), indicating the LED enable signal passed through the driver. If good, go to Step d. If not, replace U9.
- Check that the voltage on U7(5) is about 5V. If good, go to Step e. If not, check U7 and the associated resistors.

- e. Check that U7(7) is a logical low. Pushing the blue button should cause it to pulse high several times, indicating the home switch circuitry is working properly. If good, suspect U1. If not, replace U7.
3. Check the paper advance circuitry by pressing the LF and FF keys. If paper advances normally, go to Step 4.
4. If not, use the following information to troubleshoot this portion of the logic board. This procedure assumes that a new paper motor has been tried.

Procedure:

- a. Ensure the FF switch is working properly. Place a logic probe on J7(3) and press the FF button. The pin should go high for as long as the button is held down and then return low.
- b. Ensure the LF switch is working properly. Place a logic probe on the cathode of CR11 and then CR12 and press the LF button. Each pin should go high for as long as the button is held down and then return low.
- c. Check the processor's paper motor port on U10(5,6,&7) and U9(7) by placing a logic probe on each pin and pressing the LF button for a few seconds. If any pin fails to toggle, replace U1.

If all pins toggle while the button is depressed, the problem is in U10 or U9 (or possibly VR9 or 18). With an oscilloscope, check the outputs (U9 pin 10 and U10 pins 10,11,&12) with the paper motor installed. Figure 4-5 shows the proper waveform when the circuit is working normally. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



U10(11)
2V/DIV 10:1 probe
10ms/DIV
DC coupled

Figure 4-5

4. The next step is to run the print mechanism self test to determine if the unit is capable of printing on its own. Turn off power to the printer, select the Roman8 character set, hold the LF button down, power the printer on, wait a few seconds and then release the LF button. The unit should begin printing a self test pattern like that shown in Figure 4-1. If the printout is correct, go to Step 5. If not, continue below.

Troubleshooting the Print Head Circuitry

In troubleshooting the print head circuitry, it is assumed the problem is not in the print head or carriage assembly.

Procedure:

- a. Run the print mechanism self test, as described above, while using a logic probe to check the print head driver inputs on U8(1 thru 7) and U9(1 thru 5). Each pin should toggle as the unit attempts to print.

NOTE

U8 pin 1, U9 pin 4, and U9 pin 5 are toggled in only a few characters during the printing self-test. Be sure the Roman8 character set is selected prior to running the self test.

- b. If any of the lines fail to toggle, replace U1.
 - c. If all lines toggle, the problem is in U8 or U9. Run the test again and use an oscilloscope to look for activity on the output pins of these IC's: U8(10 thru 16) and U9(12 thru 16). The waveform should appear as negative-going pulses from about 24 volts to logic ground. Replace the defective IC.
5. The last item to test in the printer is the I/O. Assuming the HP-IB I/O PCA and cable are good, the only thing left to cause an I/O problem is the processor IC.

LOGIC BOARD TROUBLESHOOTING—2225B

This procedure assumes the logic PCA (HP P/N 02225-60001) has a known fault and no other fault exists outside of the board. Use the following procedure as an aid in troubleshooting this board to the component level.

NOTE

All troubleshooting must be done with paper installed.

1. To access the logic board, remove the mechanism and rear panel. Place the rear panel upside down at the front of the printer and plug the power switch connector into J8 on the logic board. See Figure 4-6.

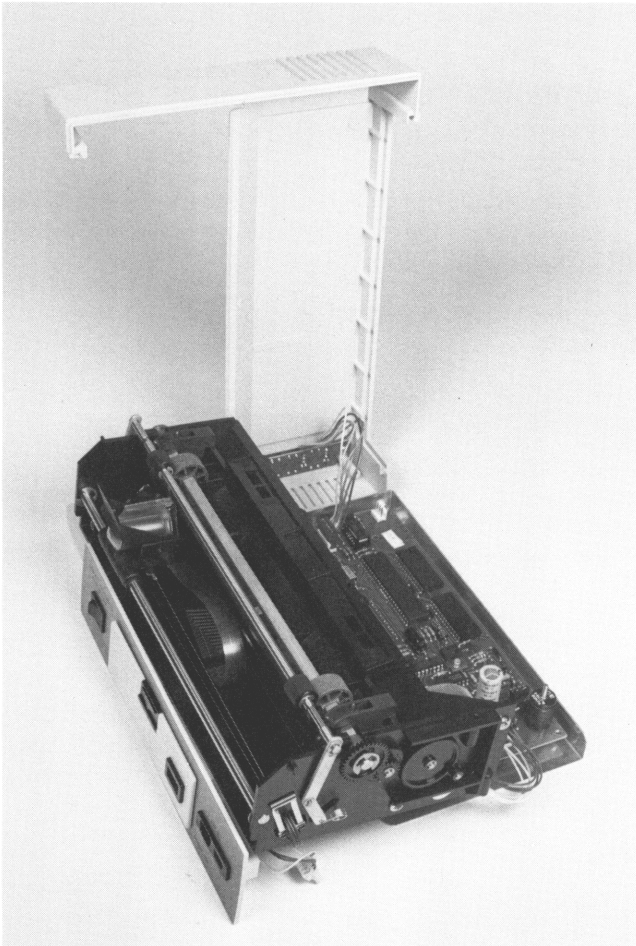


Figure 4-6

2. Check the points listed in Table 4-3 to ensure the battery voltage and power system circuits are performing correctly.

Table 4-3, Power System Measurements

Name	Nominal Voltage	Voltage Range	Test Point
VBATT	8.0V	7.2V to 8.5V	J8(2)
VDD	5.0V	4.75 to 5.25V	U6(11)
NRESET	>4.5V	–	U6(19)
PRT	High during printing	–	U6(46)
Vhead	22.7V during printing	22.5V to 22.93V	Cathode of CR2
LBIC	High	–	U6(40)
LBIW	High	–	U6(47)

NOTE

If any parts are replaced in the power system, recheck the Vhead voltage. Perform power supply adjustment if measurement is out of specification.

3. At power on with paper installed, does the yellow LED blink twice and go out? If it does, it indicates that the processor, ROM, RAM, carriage motor circuitry, and home switch circuitry are working correctly. In this case, go to Step 4. If not, continue within Step 3.

If the yellow LED is always on, it indicates a problem in the paper sense circuitry. With paper installed, U6(41) should be a logical high.

If the yellow LED continues blinking after power on, it indicates a self test failure in the kernel (ROM, RAM, or processor). (See Troubleshooting the Kernel, below.)

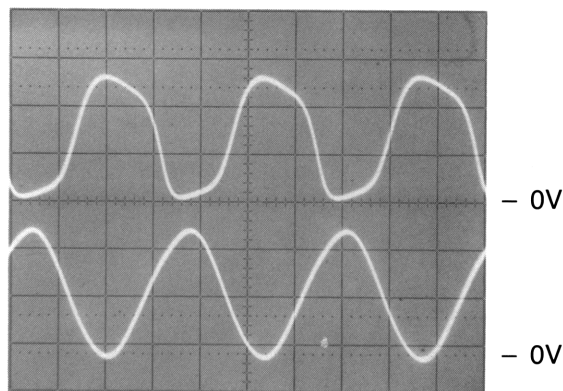
If the yellow LED blinks twice, stays off for several seconds, and then resumes blinking, it indicates one of the following:

- a. The logic board is not driving the carriage motor. (See Troubleshooting the Carriage Motor Circuitry, below.)
- b. The home switch circuitry is not sending signals to the processor. (See Troubleshooting the Home Switch Circuitry, below.)

If the carriage motor moves twice through the home switch, as in a normal power-up sequence, it indicates the kernel and carriage motor circuits are working correctly. A blinking yellow LED would then indicate a problem in the home switch circuitry. See the paragraph entitled Troubleshooting the Home Switch Circuitry. If this is not the case, continue on to the next paragraph.

Troubleshooting the Kernel

Check the 3MHz crystal for activity. Figure 4-7 shows the waveform on each leg of the crystal.



Crystal Leads
0.2V/DIV 10:1 probe
0.1us/DIV
DC coupled

Figure 4-7

The processor IC has a built-in self test that runs during the power-on cycle. To monitor the result of the self test, a logic probe must be placed on one of several pins of the processor IC (U6) while the unit is powered up. If the kernel has failed the self test, one of the pins will pulse to indicate the failure mode. The pins and meanings are listed below.

NOTE

At power on, each pin listed below **may** pulse once as the processor is being reset. This first pulse occurs almost immediately and does not indicate an error message. Wait about one second for a second pulse, which will be a slightly longer pulse than the first.

U6 Pin Number	Name	Meaning
16	DOT 12	CPU (U6)
17	DOT 11	Internal ROM (U6)
18	DOT 10	Internal RAM (U6)
19	DOT 9	Either Timer (U6)
22	DOT 6	External RAM (U7)
23	DOT 5	External ROM (U11)

Check each pin sequentially:

- Place the logic probe on the first pin.
- Reset the processor by turning the line switch off and on.
- Continue checking the pins, resetting the processor each time.

If none of the pins indicate a failure, check the carriage motor circuitry next.

Troubleshooting the Carriage Motor Circuitry

The following procedure assumes that the kernel and power supplies have been checked and that a new carriage motor has been tried.

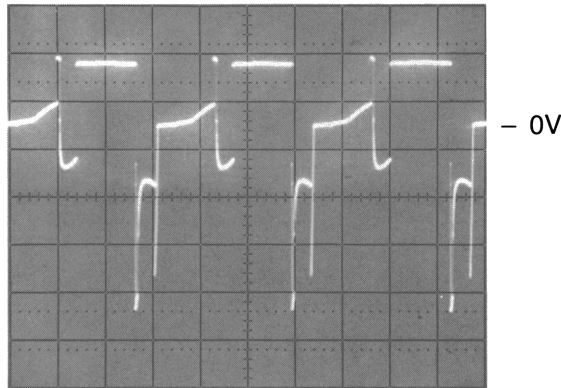
Procedure:

- First, ensure the blue key is functional. Place a logic probe on the cathode of CR11. The probe should indicate a high level as long as the key is held down.
- Check the processor's carriage-motor port on U10 pins 4,5,6, and 7 by placing a logic probe on each pin and then pressing the blue key. Each pin should toggle several times. If any pin fails to toggle, replace U6. If all pins toggle, go to Step c.
- Check the driver outputs on U10 pins 10,11,12, and 13 by placing an oscilloscope probe on each pin and then pressing the blue key. Each pin should toggle several times. If any pin fails to toggle, replace U10. If all pins toggle, go to Step d.
- Unplug the carriage motor connector and check each drive transistor circuit (Q11-14) by placing the oscilloscope probe on the anodes of CR7-10 and then pressing the blue key. The waveform should appear as a square wave about 8 volts high. (This requires current flow through the probe.) If not, replace the appropriate drive transistor or its associated flyback protection diode. (A shorted diode will force the node high; an open diode may cause the drive transistor to fail. Always check the diode when replacing a bad transistor.)
- If the waveform appears good, the problem is probably in the diode/capacitor circuit, VR12-13 and C34-35. A shorted diode or capacitor is very difficult to detect in normal operation. The result would be slight variations in the width of printed characters. With an open diode, the carriage would have difficulty moving and would stop after a few seconds.

NOTE

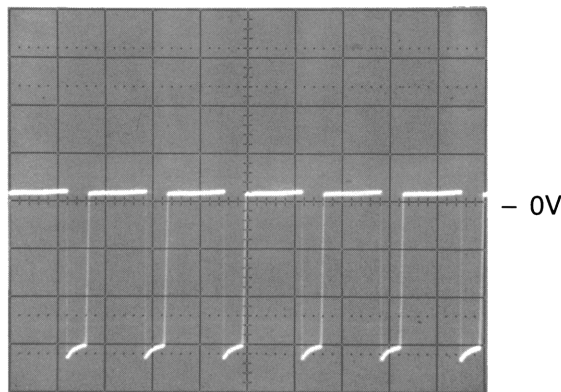
If one of these diodes is open, the corresponding capacitor must be replaced as well.

- f. Figure 4-8 shows the drive transistor output under normal operating conditions as the carriage sweeps across the platen. Figure 4-9 shows the waveform on the anode of VR13 under the same conditions. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



Anode of CR7
1V/DIV 10:1 probe
2ms/DIV
DC coupled

Figure 4-8



Anode of VR13
0.5V/DIV 10:1 probe
2ms/DIV
DC coupled

Figure 4-9

Troubleshooting the Home Switch Circuitry

When the home switch circuitry is bad, the typical symptom is that the carriage will move initially to the right, reverse direction and crash into the left sideframe for a few seconds, and then come to rest. Do not attempt to troubleshoot this circuitry until the carriage is capable of moving through the home switch. Failure to move the carriage indicates the problem is located elsewhere.

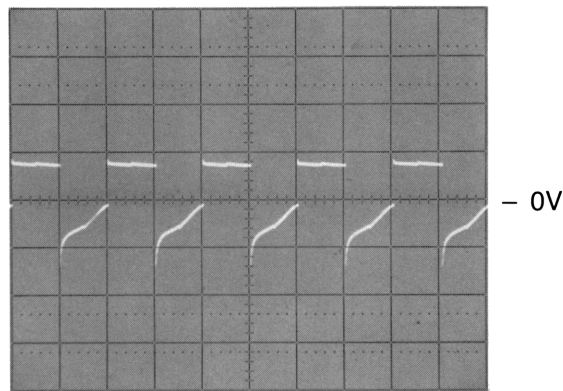
Procedure:

- First, ensure the blue key is functional. Place a logic probe on the cathode of CR11 and press the blue key. The probe should indicate a high level as long as the key is held down.
- With power on and a known good home switch installed, place a logic probe on U6(46) and press the blue button on the keypad. This line from the processor is the LED enable signal; it should pulse high for about two seconds and then return low. If good, go to Step c. If not, replace U6.
- Place an oscilloscope probe on U5(2) and press the blue button again. The voltage level should go low for about two seconds and then return high, indicating the LED enable signal passed through the driver. If good, go to Step d. If not, replace U9.

- d. Check that the voltage on U5(3) is about 5.0V. If good, go to Step e. If not, check U5 and associated resistors.
 - e. Check that U5(1) is a logical low. Pushing the blue button should cause it to pulse high several times, indicating the home switch circuitry is working properly. If good, suspect U6. If not, replace U5.
4. Check the paper advance circuitry by pressing the LF and FF keys. If paper advances normally, go to Step 5. If not, use the following information to troubleshoot this portion of the logic board. This procedure assumes that a new paper motor has been tried.

Procedure:

- a. Ensure the FF switch is working properly. Place a logic probe on J7(3) and press the FF button. The pin should go high for as long as the button is held down and then return low.
- b. Ensure the LF switch is working properly. Place a logic probe on the cathode of CR11 and then CR12 and press the LF button. Each pin should go high for as long as the button is held down and then return low.
- c. Check the processor's paper motor port on U10(1,2,&3) and U8(1) by placing a logic probe on each pin and then pressing the LF key. Each pin should toggle several times. If any pin fails to toggle, replace U6. If all pins toggle, go to Step d.
- d. Check the driver IC outputs on U10(14,15,&16) and U8(16) by placing an oscilloscope probe on each pin and pressing the LF button for a few seconds. Each pin should toggle several times. If any pin fails to toggle, replace the appropriate IC. If all pins toggle, go to Step e.
- e. Check each drive transistor circuit (Q7-10) by placing an oscilloscope probe on the anodes of CR3-6 and pressing the FF button. The waveform should appear as that shown in Figure 4-10. If any output fails to toggle, replace the appropriate drive transistor or its respective flyback protection diode. (A shorted diode would force the node high; an open diode may cause the driver transistor to fail. Always check the diode if a transistor is bad.) Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



Anode of CR3
1V/DIV 10:1 probe
10ms/DIV
DC coupled

Figure 4-10

5. The next step is to run the print mechanism self test to determine if the unit is capable of printing on its own. Turn off power to the printer, select Roman8 character set, hold the LF button down, power the printer on, wait a few seconds and then release the LF button. The unit should begin printing a self test pattern like that shown in Figure 4-10. If the printout is correct, go to Step 6. If not, continue below.

Troubleshooting The Print Head Circuitry

In troubleshooting the printhead circuitry, it is assumed the problem is not in the print head or carriage assembly.

Procedure:

Run the print mechanism self test, as described above, while using a logic probe to check U8(2 thru 7) and U9(2 thru 7). Each pin should toggle as the unit attempts to print.

NOTE

U9 pin 2, U8 pin 2, and U8 pin 3 will toggle only on a few of the printed lines. Be sure the Roman8 character set is selected prior to running the self test.

If any of the lines fail to toggle, replace U6.

If all lines toggle, the problem is in U8 or U9. Run the test again and use an oscilloscope to look for activity on the output pins of these IC's: U8(10 thru 15) and U9(10 thru 15). The waveform should appear as narrow, negative-going pulses from about 24 volts to logic ground. Replace the defective IC.

6. The last item to test in the printer is the I/O. This can be done with either an HP 75 or HP 71 Portable Computer. Use the appropriate program listed below.

HP 71: 10 STANDBY .001 @ ON ERROR GOTO 20
 20 ASSIGN IO ' '@ GOTO 20

HP 75: 10 STANDBY OFF @ ON ERROR GOTO 20
 20 ASSIGN IO ' '@ GOTO 20

NOTE

Line 20 contains two single apostrophies (' ') and not a single quote (') sign.

Either of these programs will allow the computer to send data to the printer without requiring the printer to return the data. Use an oscilloscope to check for activity at U6 pins 36 and 37. Although the waveform will appear somewhat erratic, the pulses should be fairly rectangular in shape. If the pulses are narrow or the edges fall off rapidly, it suggests that the torroid windings are shorted. If proper activity is present, it indicates at least a portion of the torroids and associated components are good. Place the oscilloscope probe on the processor's output pins: U6 pins 38 and 39. Activity here suggests the processor is working properly and that the problem exists in the other portion of the torroid circuitry.

LOGIC BOARD TROUBLESHOOTING—2225C

This procedure assumes the logic PCA (HP P/N 5061-4320) has a known fault and no other fault exists outside of the board. Use the following procedure as an aid in troubleshooting this board to the component level.

NOTE

All troubleshooting must be done with paper installed.

1. Always check the power supply voltages before attempting any other troubleshooting. Refer to Table 4-4 for voltage information.

Table 4-4. Power Supply Voltages

Supply	Nominal Voltage	Voltage Range	Test Point
VDRAW	11.6V	8.5 TO 12.7V	U7(8)
VDD	5.0V	4.75 TO 5.25V	U4(20)
VMC	24.0V	23.04 TO 24.96V	J4(5&6)*
VMP	34.7V	27.0 TO 40.0V	J3(5&6)*
VHD	22.68V	22.5 TO 22.86V	J2(6)
VIO	4.9V	4.75 TO 5.25V	J1(15)
NRESET	4.5V	>4.5V	U1(10)

* Remove motor cable when measuring this voltage.

NOTE

If any parts are replaced in the power system, recheck the VHD (print head) voltage. Perform power supply adjustment if measurement is out of specification.

2. At power on with paper installed, does the yellow LED blink twice and go out? If it does, it indicates that the processor, ROM, RAM, carriage motor circuitry, and home switch circuitry are working correctly. In this case, go to Step 3. If not, continue within Step 2.

If the yellow LED is always on, it indicates a problem in the paper sense circuitry. With paper installed J6(1) and U1(41) should be logical highs.

If the yellow LED continues blinking after power on, it indicates a self test failure in the kernel (ROM, RAM, processor). (See Troubleshooting the Kernel, below.)

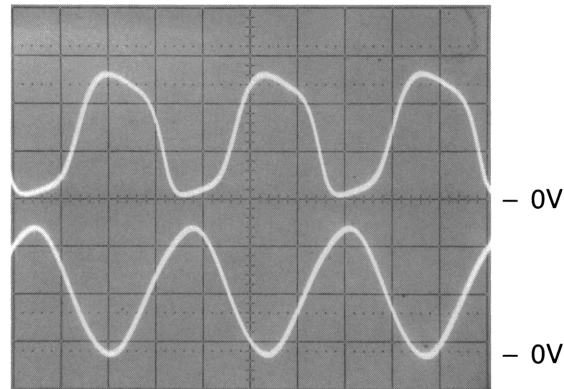
If the yellow LED blinks twice, stays off for several seconds, and then resumes blinking, it indicates one of the following:

- a. The logic board is not driving the carriage motor. (See Troubleshooting the Carriage Motor Circuitry, below.)
- b. The home switch circuitry is not sending signals to the processor. (See Troubleshooting the Home Switch Circuitry.)

If the carriage motor moves twice through the home switch, as in a normal power-up sequence, it indicates the kernel and carriage motor circuits are working correctly. A blinking yellow LED would then indicate a problem in the home switch circuitry. See the paragraph entitled Troubleshooting the Home Switch Circuitry. If this is not the case, continue on to the next paragraph.

Troubleshooting the Kernel

Check the 3MHZ crystal for activity. Figure 4-11 shows the waveform on each leg of the crystal.



Crystal Leads
0.2V/DIV 10:1 probe
0.1us/DIV
DC coupled

Figure 4-11

The processor IC has a built-in self test that runs during a power-on cycle. To monitor the result of the self test, a logic probe must be placed on one of several pins of the processor IC (U1) while the unit is powered on. If the kernel fails the self test, one of the pins will pulse to indicate the failure mode. The pins and meanings are listed below.

NOTE

At power on, each pin listed below **may** pulse once as the processor is being reset. This first pulse occurs almost immediately and does not indicate an error message. Wait about one second for a second pulse, which will be a longer pulse than the first.

U1 Pin Number	Name	Meaning
16	DOT 12	CPU (U1)
17	DOT 11	Internal ROM (U1)
18	DOT 10	Internal RAM (U1)
19	DOT 9	Either Timer (U1)
22	DOT 6	External RAM (U2)
23	DOT 5	External ROM (U3)

Check each pin sequentially:

- Place the logic probe on the first pin.
- Reset the processor by turning the line switch off and on.
- Continue checking the pins, resetting the processor each time.

If none of the pins indicate a failure, check the carriage motor circuitry next.

Troubleshooting the Carriage Motor Circuits

The following procedure assumes that the kernel and power supplies have been checked and that a new carriage motor has been tried.

NOTE

For future reference, one way to have the carriage motor run is to unplug the reed switch connector, remove the print head, and enter the printing self test: power off, press LF button, power on, release button.

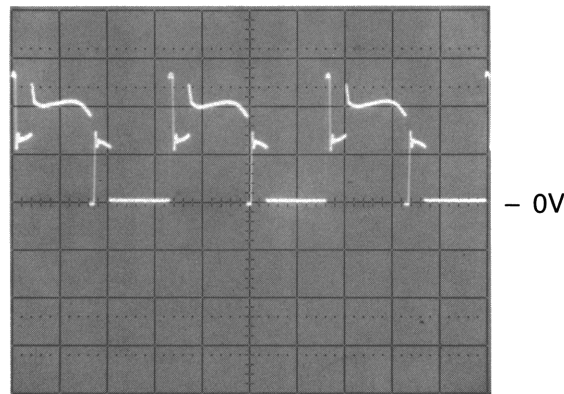
Procedure:

- a. First, ensure the blue key is functional. Place a logic probe on the cathode of CR11. The probe should indicate a high level as long as the key is held down.
- b. To check the enable line for the motor data latch, place a logic probe on U1(46) and press the blue key. The pin should pulse high for about two seconds and then return low. If good, go to Step c. If not, suspect U1.
- c. Check the processor's carriage-motor port on U4 pins 3,4,7, and 8 by placing a logic probe on each pin and then pressing the blue key. Each pin should toggle several times. If not, suspect U1. If all pins toggle, go to Step d.
- d. Check that U10(9) is about 34V. If not, suspect VR18 and U10.
- e. Check the motor driver input lines on U10 pins 1,2,3, and 4 by placing a logic probe on each pin and then pressing the blue key. Each pin should toggle several times. If not, replace U4. If all pins toggle, go to Step f.
- f. Unplug the carriage motor connector and check the driver outputs by placing an oscilloscope probe on U10(13-16) and then pressing the blue key. A low level square wave ($\sim 0.5V$ p-p) should be present if the driver is good. (This signal requires current flow through the probe, since the driver is open collector.) If not, suspect U10.
- g. If the waveform appears to be good, the problem is probably in the diode/capacitor circuit, CR14-15 and C19-20. A shorted diode or capacitor is very difficult to detect in normal operation. The result would be slight variations in the width of printed characters. With an open diode, the carriage would have difficulty moving and would stop after a few seconds.

NOTE

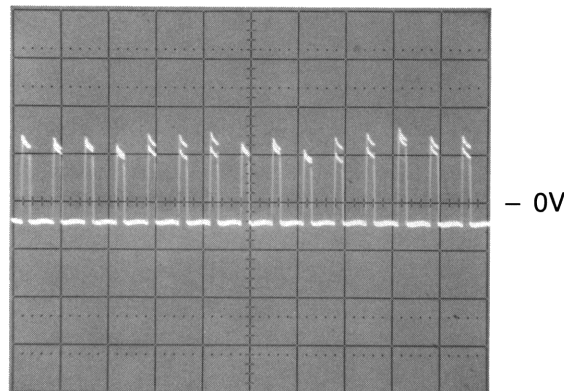
If one of these diodes is open, the corresponding capacitor must be replaced as well.

- h. Figure 4-12 shows a driver output under normal operating conditions as the carriage sweeps across the platen. Figure 4-13 shows the waveform on the cathode of CR14 under the same conditions. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



U10(13)
2V/DIV 10:1 probe
2ms/DIV
DC coupled

Figure 4-12



Cathode of CR14
0.2V/DIV 10:1 probe
5ms/DIV
AC coupled

Figure 4-13

Troubleshooting the Home Switch Circuitry

When the home switch circuitry is bad, the typical symptom is that the carriage will move initially to the right, reverse direction and crash into the left sideframe for a few seconds, and then come to rest. Do not attempt to troubleshoot this circuitry until the carriage is capable of moving through the home switch. Failure to move the carriage indicates the problem is located elsewhere.

Procedure:

- First, ensure the blue key is functional. Place a logic probe on the cathode of CR11 and press the blue key. The probe should indicate a high level as long as the key is held down.
- With power on and a known good home switch installed, place a logic probe on U1(46) and press the blue button on the keypad. This line from the processor is the LED enable signal; it should pulse high for about two seconds and then return low. If good, go to Step c. If not, suspect U1.
- Place an oscilloscope probe on U7(6), and press blue button again. The voltage level should go low for about two seconds and then return high ($\sim 22.5V$), indicating the LED enable signal passed through the driver. If good, go to Step d. If not, replace U9.
- Check that the voltage on U7(5) is about 5V. If good, go to Step e. If not, check U7 and associated resistors.

- e. Check that U7(7) is a logical low. Pushing the blue button should cause it to pulse high several times, indicating the home switch circuitry is working properly. If good, suspect U1. If not, replace U7.
3. Check the paper advance circuitry by pressing the LF and FF keys. If paper advances normally, go to Step 4. If not, use the following information to troubleshoot this portion of the logic board. This procedure assumes that a new paper motor has been tried.

Procedure:

- a. Ensure the FF switch is working properly. Place a logic probe on J7(3) and press the FF button. The pin should go high for as long as the button is held down and then return low.
- b. Ensure the LF switch is working properly. Place a logic probe on the cathode of CR11 and then CR12 and press the LF button. Each pin should go high for as long as the button is held down and then return low.
- c. Check the processor's paper motor port on U4(13, 14, 17, & 18) by placing a logic probe on each pin and pressing the LF button for a few seconds. If any pin fails to toggle, replace U1. If all pins toggle, go to Step d.
- d. Check the paper motor driver inputs on U10(5, 6, & 7) and U9(7) by placing a logic probe on each pin and pressing the LF button for a few seconds. If any pin fails to toggle, replace U4.

If all pins toggle while the button is depressed, the problem is in U10 or U9 (or possibly VR9, or VR18). Check the outputs (U9 pin 10 and U10 pins 10,11,&12) with the paper motor installed and with an oscilloscope. Figure 4-14 shows the proper waveform when the circuit is working normally. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.

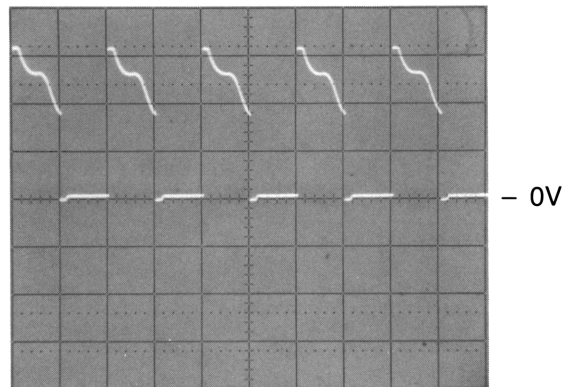


Figure 4-14

4. The next step is to run the print mechanism self test to determine if the unit is capable of printing on its own. Turn off power to the printer, select the Roman8 character set, hold the LF button down, power the printer on, wait a few seconds and then release the LF button. The unit should begin printing a self test pattern like that shown in Figure 4-1. If the printout is correct, go to Step 5. If not, continue below.

Troubleshooting the Print Head Circuitry

In troubleshooting the print head circuitry, it is assumed the problem is not in the print head or carriage assembly.

Procedure:

Run the print mechanism self test, as described above, while using a logic probe to check the print head driver inputs on U8(1 thru 7) and U9(1 thru 5). Each pin should toggle as the unit attempts to print.

NOTE

U8 pin 1, U9 pin 4, and U9 pin 5 will toggle only on a few of the printed lines. If any of the lines fail to toggle, replace U1. Be sure the Roman8 character set is selected prior to running the self test.

If all lines toggle, the problem is in U8 or U9. Run the test again and use an oscilloscope to look for activity on the output pins of these IC's: U8(10 thru 16) and U9(12 thru 16). The waveform should appear as negative-going pulses from about 24 volts to logic ground. Replace the defective IC.

- The last item to test in the printer is the I/O. Assuming the parallel I/O PCA and cable are good and the VIO supply has previously been checked, the only thing left to cause an I/O problem is the processor IC.

LOGIC BOARD TROUBLESHOOTING—2225D

This procedure assumes the Logic PCA (HP P/N 02225-60018) has a known fault and no other fault exists outside of the board. Use the following procedure as an aid in troubleshooting this board to the component level.

NOTE

All troubleshooting must be done with paper installed.

- Always check the power supply voltages before attempting any other troubleshooting. Refer to Table 4-5 for voltage information.

Table 4-5. Power Supply Voltages

Supply	Nominal Voltage	Voltage Range	Test Point
VDRAW	11.6V	8.5 to 12.7V	U7(8)
-VDRAW	-11.6V	-8.5 to -12.7V	J1(14)
VDD	5.0V	4.75 to 5.25V	U4(20)
VMC	24.0V	23.04 to 24.96V	J4(5&6)*
VMP	34.7V	27.0 to 40.0V	J3(5&6)*
VHD	22.68V	22.5 to 22.86V	J2(6)
NRESET	4.5V	>4.5V	U1(10)

* Remove motor cable when measuring this voltage.

NOTE

If any parts are replaced in the power system, recheck the VHD (print head) voltage. Perform power supply adjustment if measurement is out of specification.

- At power on with paper installed, does the yellow LED blink twice and go out? If it does, it indicates that the processor, ROM, RAM, carriage motor circuitry, and home switch circuitry are working correctly. In this case, go to Step 3. If not, continue within Step 2.

If the yellow LED is always on, it indicates a problem in the paper sense circuitry. With paper installed U1(41) should be a logical high.

If the yellow LED continues blinking after power on, it indicates a self test failure in the kernel (ROM, RAM, processor). (See Troubleshooting the Kernel, below.)

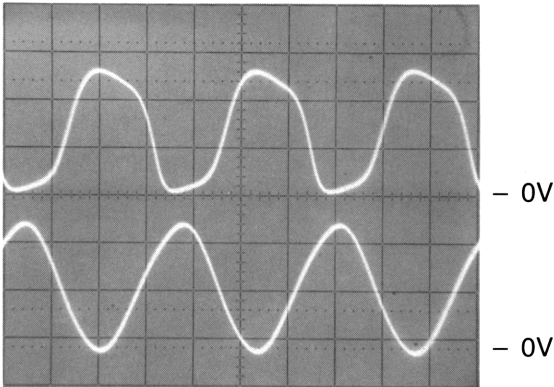
If the yellow LED blinks twice, stays off for several seconds, and then resumes blinking, it indicates one of the following:

- a. The logic board is not driving the carriage motor. (See Troubleshooting the Carriage Motor Circuitry, below.)
- b. The home switch circuitry is not sending signals to the processor. (See Troubleshooting the Home Switch Circuitry, below.)

If the carriage motor moves twice through the home switch, as in a normal power-up sequence, it indicates the kernel and carriage motor circuits are working correctly. A blinking yellow LED would then indicate a problem in the home switch circuitry. See the paragraph entitled Troubleshooting the Home Switch Circuitry. If this is not the case, continue on to the next paragraph.

Troubleshooting the Kernel

Check the 3MHZ crystal for activity. Figure 4-15 shows the waveform on each leg of the crystal.



Crystal Leads
0.2V/DIV 10:1 probe
0.1us/DIV
DC coupled

Figure 4-15

The processor IC has a built-in self test that runs during a power-on cycle. To monitor the result of the self test, a logic probe must be placed on one of several pins of the processor IC (U1) while the unit is powered on. If the kernel fails the self test, one of the pins will pulse to indicate the failure mode. The pins and meanings are listed below.

NOTE

At power on, each pin listed below **may** pulse once as the processor is being reset. This first pulse occurs almost immediately and does not indicate an error message. Wait about one second for a second pulse, which will be a slightly longer pulse than the first.

U1 Pin Number	Name	Meaning
16	DOT 12	CPU (U1)
17	DOT 11	Internal ROM (U1)
18	DOT 10	Internal RAM (U1)
19	DOT 9	Either Timer (U1)
22	DOT 6	External RAM (U2)
23	DOT 5	External ROM (U3)

Check each pin sequentially:

- a. Place the logic probe on the first pin.
- b. Reset the processor by turning the line switch off and on.
- c. Continue checking the pins, resetting the processor each time.

If none of the pins indicate a failure, check the carriage motor circuitry next.

Troubleshooting the Carriage Motor Circuitry

The following procedure assumes that the kernel and power supplies have been checked, that a new carriage motor has been tried, and that both motors are connected to the logic board.

NOTE

For future reference, one way to have the carriage motor run is to unplug the reed switch connector, remove the print head, and enter the printing self test: power off, press LF button, power on, release button.

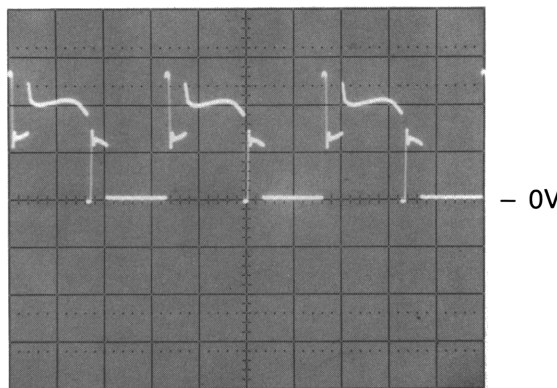
Procedure:

- First, ensure the blue key is functional. Place a logic probe on the cathode of CR11. The probe should indicate a high level as long as the key is held down.
- Check that U10(9) is about 34V. If not, suspect VR18 and U10.
- Check the motor driver input lines on U10 pins 1,2,3, and 4 by placing a logic probe on each pin and then pressing the blue key. Each pin should toggle several times. If not, replace U1. If all pins toggle, go to Step d.
- Unplug the carriage motor connector and check the driver outputs by placing an oscilloscope probe on U10(13-16) and then pressing the blue key. A low level square wave (approx. 0.5V p-p) should be present if the driver is good. (This signal requires current flow through the probe, since the driver is open collector.) If not, suspect U10.
- If the waveform appears good, the problem is probably in the diode/capacitor circuit, CR14-15 and C19-20. A shorted diode or capacitor is very difficult to detect in normal operation. The result would be slight variations in the width of printed characters. With an open diode, the carriage would have difficulty moving and would stop after a few seconds.

NOTE

If one of these diodes is open, the corresponding capacitor must be replaced as well.

- Figure 4-16 shows a driver output under normal operating conditions as the carriage sweeps across the platen. Figure 4-17 shows the waveform on the cathode of CR14 under the same conditions. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.



U10(13)
2V/DIV 10:1 probe
2ms/DIV
DC coupled

Figure 4-16

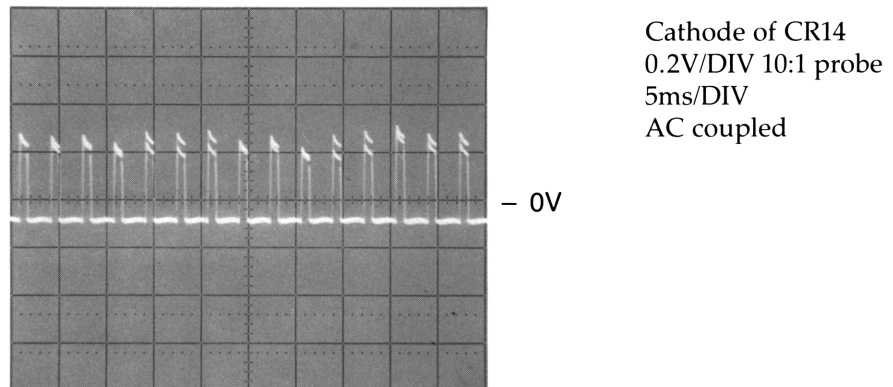


Figure 4-17

Troubleshooting the Home Switch Circuitry

When the home switch circuitry is bad, the typical symptom is that the carriage will move initially to the right, reverse direction and crash into the left sideframe for a few seconds, and then come to rest. Do not attempt to troubleshoot this circuitry until the carriage is capable of moving through the home switch. Failure to move the carriage indicates the problem is located elsewhere.

Procedure:

- a. First, ensure the blue key is functional. Place a logic probe on the cathode of CR11 and press the blue key. The probe should indicate a high level as long as the key is held down.
 - b. With power on and a known good home switch installed, place a logic probe on U1(46) and press the blue button on the keypad. This line from the processor is the LED enable signal; it should pulse high for about two seconds and then return low. If good, go to Step c. If not, replace U1.
 - c. Place an oscilloscope probe on U7(6), and press the blue button again. The voltage level should go low for about two seconds and then return high (approx. 22.5V), indicating the LED enable signal passed through the driver. If good, go to Step d. If not, replace U9.
 - d. Check that the voltage on U7(5) is about 5V. If good, go to Step e. If not, check U7 and associated resistors.
 - e. Check that U7(7) is a logical low. Pushing the blue button should cause it to pulse high several times, indicating the home switch circuitry is working properly. If good, suspect U1. If not, replace U7.
3. Check the paper advance circuitry by pressing the LF and FF keys. If paper advances normally, go to Step 4. If not, use the following information to troubleshoot this portion of the logic board. This procedure assumes that a new paper motor has been tried.

Procedure:

- a. Ensure the FF switch is working properly. Place a logic probe on J7(3) and press the FF button. The pin should go high for as long as the button is held down and then return low.
- b. Ensure the LF switch is working properly. Place a logic probe on the cathode of CR11 and then CR12 and press the LF button. Each pin should go high for as long as the button is held down and then return low.
- c. Check the processor's paper motor port on U10(4, 5, 6, & 7) and U9(7) by placing a logic probe on each pin and pressing the LF button for a few seconds. If any pin fails to toggle, replace U1.

If all pins toggle while the button is depressed, the problem is in U10 or U9 (or possibly VR9 or 18). With an oscilloscope, check the outputs (U9 pin 10 and U10 pins 10, 11, & 12) with the paper motor installed. Figure 4-18 shows the proper waveform when the circuit is working normally. Remember that under failed conditions, voltages will be induced back on the collector of a bad transistor because two motor phases are tied together.

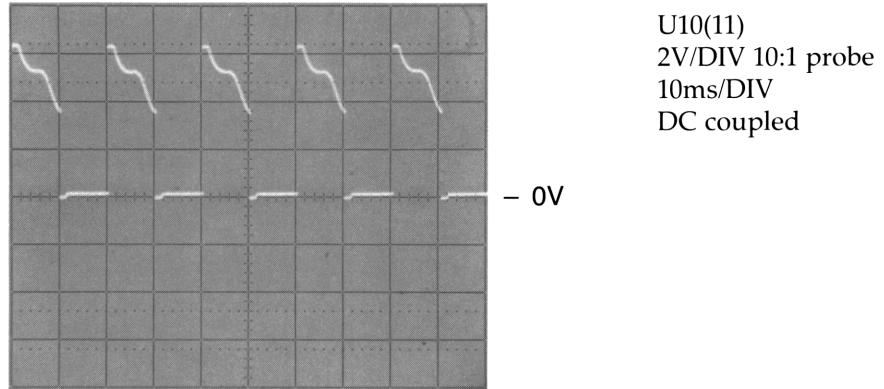


Figure 4-18

4. The next step is to run the print mechanism self test to determine if the unit is capable of printing on its own. Turn off power to the printer, select the Roman8 character set, hold the LF button down, power the printer on, wait a few seconds and then release the LF button. The unit should begin printing a self test pattern like that shown in Figure 4-1. If the printout is correct, go to Step 5. If not, continue below.

Troubleshooting the Print Head Circuitry

In troubleshooting the print head circuitry, it is assumed the problem is not in the print head or carriage assembly.

Procedure:

- a. Run the print mechanism self test, as described above, while using a logic probe to check the print head driver inputs on U8(1 thru 7) and U9(1 thru 5). Each pin should toggle as the unit attempts to print.

NOTE

U8 pin 1, U9 pin 4, and U pin 5 will toggle only on a few of the printed lines. Be sure the Roman8 character set is selected prior to running the self test.

- b. If any of the lines fail to toggle, replace U1.
 - c. If all lines toggle, the problem is in U8 or U9. Run the test again and use an oscilloscope to look for activity on the output pins of these IC's: U8(10 thru 16) and U9(12 thru 16). The waveform should appear as negative-going pulses from about 24 volts to logic ground. Replace the defective IC.
5. The last item to test in the printer is the I/O. Assuming the RS-232-C I/O PCA and cable are good, the only thing left to cause an I/O problem is the processor IC.

BATTERY PACK INFORMATION—2225B

Although the battery pack is not a serviceable part, the following paragraphs describe many of the symptoms that are associated with battery pack failures. After a general description of troubleshooting procedures, there follows a description of old age symptoms in Ni-Cad cells.

Troubleshooting

Insert the battery pack into a printer and observe the indicator lights. They should behave in one of the following ways.

1. **No lights turn on.** The battery pack probably has extremely low voltage. Remove the pack and measure the voltage from the middle (ground) to the positive (side) terminal. If the problem is in the battery pack, the voltage will probably be less than 6V. Attempt to recharge the pack with a standard recharger. If the pack is functional but badly discharged, the voltage will rise from the initial value to roughly 7.5 volts during the first 5 to 30 minutes. Note that this is initially a somewhat inflated voltage due to the presence of the recharger. If this initial surge of voltage slows or stops much before 7.5 volts, a shorted cell may be indicated. Since each cell has a voltage of about 1.25 volts, this will be indicated by a 6.2 or 5 volt final level.

If the battery has an open circuit failure such as a blown fuse or mechanical fault, the voltmeter will show the pure recharger voltage which is between 10 and 12 volts. This will drop to very near 0v when the recharger is disconnected. After the initial voltage rise, the voltage of a good battery pack will rise to a final "overcharge" voltage of about 8.5 volts. When the battery is fully charged, it stops storing the incoming energy and begins converting it all into heat. Thus, the most certain indication that the battery is fully charged is that it becomes slightly warm. The 8.5 volt "overcharge" voltage is partially a function of the charging process. After a small amount of discharge, the voltage will drop to the 7.2 to 7.6 volt range where it will remain for most of its charge life.

2. **The yellow indicator light flashes twice, the red light stays off, and the printer does not "seek and home."** This probably indicates that the battery is only partially charged, so the printer can perform its internal self test but does not have enough power for normal operation. The open-circuit voltage is probably between 5.7 and 7.2 volts. This may be due to a normal discharge condition after extended use.
3. **The yellow light flashes continuously, but the red indicator light stays off.** This indicates that the battery has enough voltage to start the printer but cannot maintain this voltage during the attempt to accelerate the motor. The printer is thus reset as soon as the attempt is made to "seek and home" and immediately launches into another self test, ad infinitum. This can be caused by a malfunctioning or extremely discharged battery that is capable of being falsely inflated to a high voltage, but which will not maintain high currents.
4. **The red indicator light is on and the yellow light is flashing.** This condition indicates that the printer has failed the internal self test.
5. **Red light flashes while 2225B is idle.** This is a warning that the battery level is low and needs charging. If the battery level drops below the cutoff state, the service request flag is set and the printer will cease printing in order to conserve power.

Nickel Cadmium Characteristics

Nickel Cadmium batteries exhibit behavior that is significantly different from other batteries. Instead of the usual steady decrease in voltage with discharge, Ni-Cads have a nearly constant voltage through most of their charge life. The exceptions to this are the initial 5% of "overcharge" when the voltage is about .2 volts per cell higher, and the final 3-5% of charge life when the voltage drops rapidly. For this reason, the 2225B senses battery voltage only during times of heavy load when the battery voltage is a better indicator of its state of charge. The battery-sense circuitry must then assume a fairly large voltage difference between high current loads and low current loads. For this reason, any attempt to run the printer from a DC power supply will fail unless the voltage is increased to nearly 8.0 volts and the supply can deliver a minimum of 4 amps during a surge.

Signs Of Old Age In Batteries

Batteries that have been heavily used and/or constantly overcharged for long periods of time will display weakening symptoms that will eventually cause the battery to become unusable. Often these batteries will show an abnormally short charge life: a battery that has a charge life of 50 pages or less is probably showing signs of old age. Another ailment is a consistent lowering of the battery voltage. A good battery will be fully charged at 8.5 volts, spend most of its charge life in the 7.2 to 7.6 volt range, and drop below that voltage when it is almost completely discharged. A battery that displays similar behavior, but at voltage levels consistently .5 or 1 volt lower, is showing signs of age.

Replaceable Parts

Introduction

This section includes listings of field replaceable parts. The 2225 series printers share many of the same mechanical assemblies and cabinet features.

Ordering Replaceable Parts

To order replaceable parts, options, or accessories, address the order to your local Hewlett-Packard Sales and Service office. Include the following information for each part ordered.

1. Complete printer model number (including options and accessories) and serial number.
2. Hewlett-Packard part number.
3. Complete part description as provided in the replacement parts lists.

Table 5-1, Overall Parts List

Description	P/N	Qty
Screw, Top Cover	0624-0616	4
Fuse, 400mA	2110-0340	1
Fuse, 250mA	2110-0489	1
Fuse, 200mA	2110-0588	1
Fuse, 100mA	2110-0202	1
Fuseholder, US	2110-0686	1
Fuseholder, EUR	2110-0687	1
Fuseholder Cap (2225C – U.S. only)	2110-0565	1
Switch, on-off	3101-2443	1
Cent I/O PCA (2225C)	5061-4316	1
Cent Logic PCA (2225C)	5061-4320	1
Cable, Cent I/O-16 pin (2225C/D)	8120-4434	1
Cable, HP-IB I/O-7 pin (2225A)	8120-4435	1
Power Receptacle, 100-240V (2225A/2225C-EUR/2225D)	9135-0238	1
Line Module–115V (2225C-U.S.)	9135-0176	1
Transformer–115/230V (2225A/2225C-EUR/2225D)	9100-4384	1
Transformer–115V (2225C-U.S.)	9100-4385	1
Foot	02225-00010	4
Plate, Gnd (2225B)	02225-00011	1
Plate, Gnd (2225A/C/D)	02225-00015	1
Shield, Magnetic	02225-00016	1
Window	02225-40025	1
Case, Bottom	02225-40027	1
Case, Top	02225-40028	1
Separator, Paper	02225-40032	1
Stand Off (2225B)	02225-40039	2
HP-IL Logic PCA (2225B)	02225-60001	1
Battery Pack (2225B)	02225-60005	1
HP-IB Logic PCA (2225A)	02225-60010	1
HP-IB I/O PCA (2225A)	02225-60011	1
HP-IL Back Pnl Ay (2225B)	02225-60012	1
HP-IB Back Pnl Ay (2225A)	02225-60013	1
Cent Back Pnl Ay-115/230V (2225C-EUR)	02225-60014	1
Cent Back Pnl Ay-115V (2225C-U.S.)	02225-60015	1
RS-232 Logic PCA (2225D)	02225-60018	1
RS-232 I/O PCA (2225D)	02225-60019	1
RS-232 Back Pnl Ay (2225D)	02225-60020	1
Service Mechanism Ay*	02225-60901	1
Print Structure Ay*	02225-60902	N/A
Keypad Switch Ay	02225-60904	1
Lbl, Window (2225B)	02225-80003	1
Lbl, Window (2225A/C/D)	02225-80038	1
Overlay, Switch	02225-80007	1
Lbl, Btm Window (2225A)	02225-80065	1
Lbl, Btm (2225B)	02225-80022	1
Lbl, Btm (2225C-U.S.)	02225-80024	1
Lbl, Btm (2225C-EUR)	02225-80059	1
Lbl, Btm (2225D)	02225-80053	1
Print Head	92261A	1

* The service mechanism assembly includes all mechanism parts, except the motors (see Figure 5-2). The print structure assembly is essentially a frame with gear box and cable (see Figure 5-1).

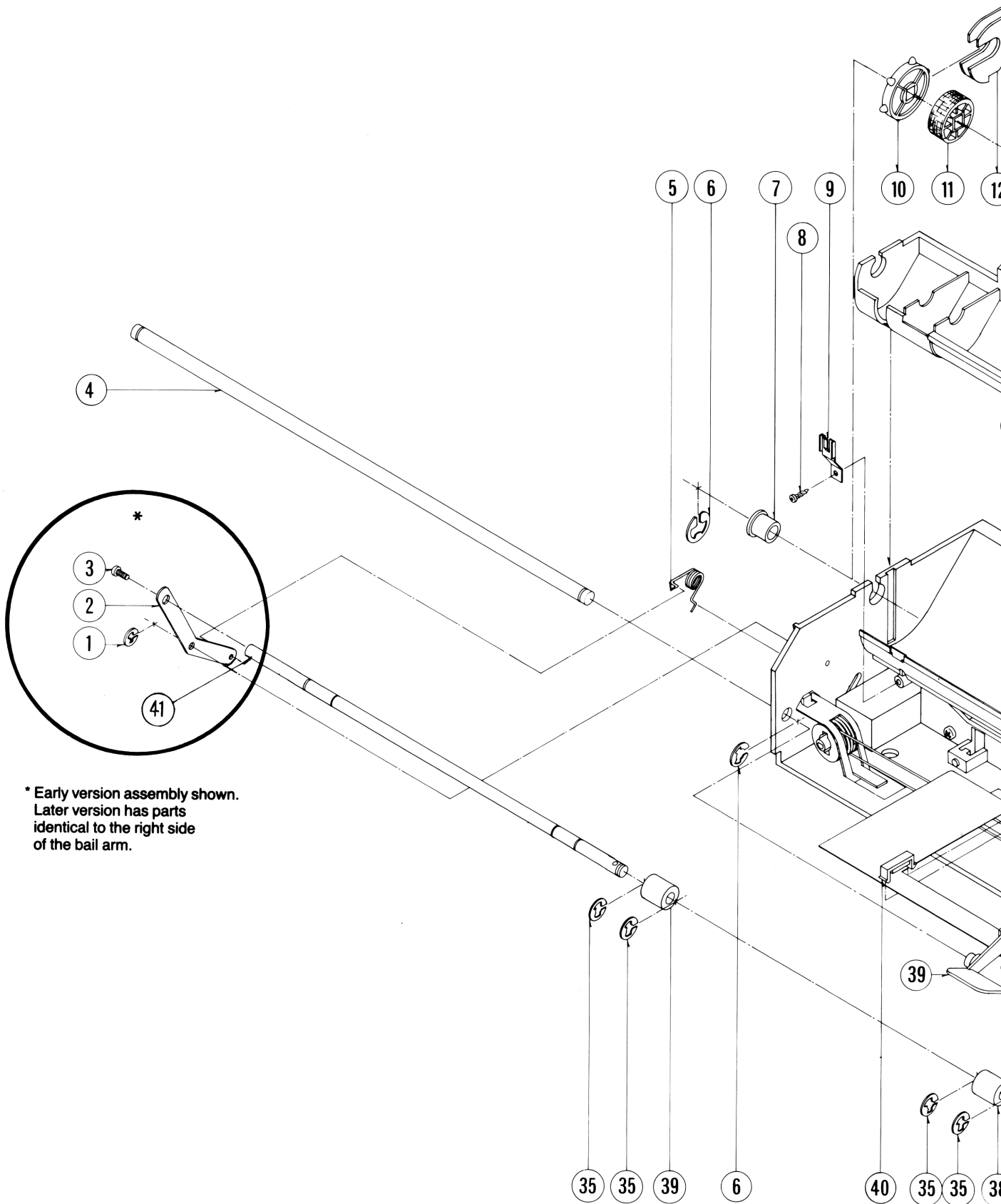


Figure 5-1, Print Structure Assembly

Table 5-2, Mechanism Parts List 02225-60901

Fig. & Index No.	Description	P/N	Qty
5-2-1	Retainer, E-Ring	0510-0952	2
5-2-2	Arm, Left Bail (early version, only)	02225-00005	1
5-2-3	Screw, M3.0x.5x8.0 (early version, only)	0515-1068	1
5-2-4	Shaft, Carriage	02225-20006	1
5-2-5	Spring, Left Side	02225-20011	1
5-2-6	Retainer, E-Ring	0510-0083	4
5-2-7	Bearing, Sleeve	1410-0251	2
5-2-8	Screw, 2-28x.250	0624-0614	2
5-2-9	Support, Absorber	02225-00012	1
5-2-10	Wheel, Pin	02225-40010	2
5-2-11	Wheel, Grit	02225-40030	2
5-2-12	Guide	02225-40009	2
5-2-13	Frame, Platen	02225-40018	1
5-2-14	Home Switch Ay	5061-4313	1
5-2-15	Screw w/washer, Home Switch	0624-0623	1
5-2-16	Shaft, Platen	02225-20009	1
5-2-17	Motor, Paper-2225 A/C/D	3140-0788	1
5-2-17	Motor, Paper-2225B	3140-0787	1
5-2-18	Screw, 4-20x.375	0624-0621	2
5-2-19	Motor, Carriage-2225A/C/D	3140-0786	1
5-2-19	Motor, Carriage-2225B	3140-0785	1
5-2-20	Switch, Reed	0490-1424	1
5-2-21	Screw w/washer, SEM 2-28x.250	0624-0611	2
5-2-22	Screw, 6-19x.50	N/A	1
5-2-23	Washer, Star #6-2225A/C/D	2190-0065	1
5-2-24	Wire-2225A/C/D	02225-80036	1
5-2-25	Shield, Magnetic	02225-00016	1
5-2-26	Wire-2225A/C/D	02225-80037	1
5-2-27	Washer, Star #8-2225A/C/D	2190-0009	1
5-2-28	Screw, 4x.7x10mm	0515-1268	2
5-2-29	Retainer, E-Ring	0510-0015	2
5-2-30	Gear, Idler	02225-40022	1
5-2-31	Gear, Cluster	02225-40021	1
5-2-32	Gear, Output P.D.	02225-40023	1
5-2-33	Dowel	02225-20017	1
5-2-34	Spring, Right Side	02225-20008	1
5-2-35	Retainer, E-Ring	0510-0045	6
5-2-36	Arm, Bail	02225-00004	2
5-2-37	Dowel, Bail Shaft	02225-20018	2
5-2-38	Roller, Pinch	02225-20001	2
5-2-39	Carriage Ay	02225-60903	1
5-2-40	Clip, Flex Circuit	02225-40005	1
5-2-41	Shaft, Bail (early version, only)	02225-20007	1
	Shaft, Bail	02225-20023	1
5-2-42	Print Structure Ay*	02225-60902	1

* See Figure 5-1.



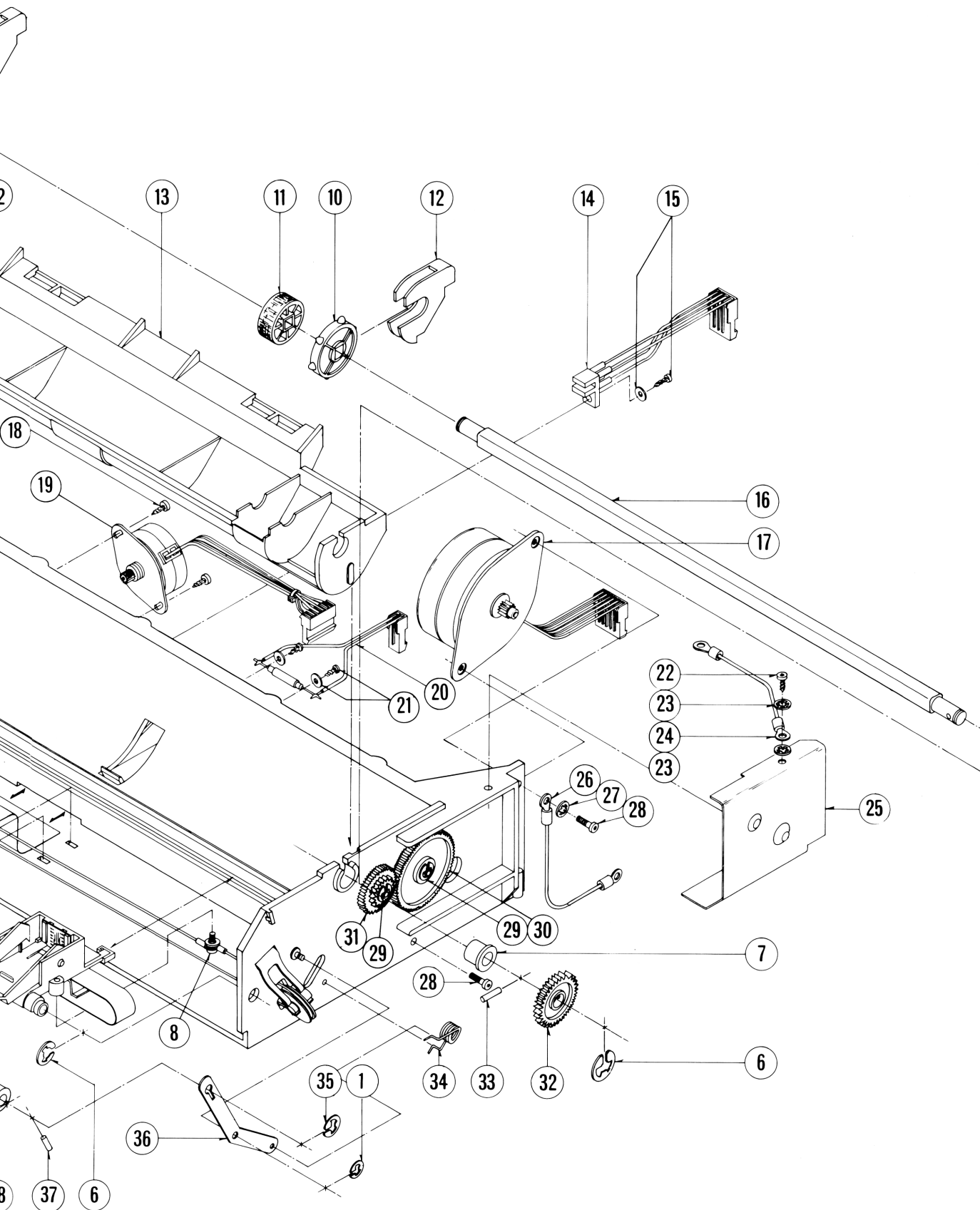


Figure 5-2, Print Mechanism Assembly with Motors

Table 5-3, HP-IL Logic PCA 02225-60001

Ref Des	Description	P/N	Qty
C1	CAP 320PF 1%	0140-0226	1
C2,27,28,30,33	CAP-0.01UF 50V	0160-4554	5
C26	CAP 10PF 5% 100V	0160-4791	1
C25	CAP 33PF 5% 100V	0160-4807	1
C11,12	CAP 220PF 5%	0160-4812	2
C9	CAP .1UF 50V	0160-4835	1
C3	CAP 1500PF 5%	0160-4846	1
C7	CAP .1UF 5% 50V	0160-5471	1
C5	C-F 100UF 10V AL	0180-3155	1
C6,8,34,35	CAP-1UF 50V	0180-3314	4
C4	CAP-330UF 38V	0180-3448	1
C31	CAP-33UF 16V	0180-3449	1
Y1	XTAL-3MHZ	0410-1496	1
R6,16,21	RES-10K 5% .25W	0683-1035	3
R33	RES 100K 5% .25W	0683-1045	1
R59,60	RES 1M 5% .25W	0683-1055	2
R48	RES 10M 5% .25W	0683-1065	1
R1	RES-12K 5% .25W	0683-1235	1
R31,32	RES-180 5% .25W	0683-1815	2
R35	RES-220 5% .25W	0683-2215	1
R36	RES 39K 5% .25W	0683-3935	1
R7	RES 470-5% .25W	0683-4715	1
R30,34	RES 820 5% .25W	0683-8215	2
R23	RES 47 5% .5W CC	0686-4705	1
R10	RES 2.87K 1%	0698-3151	1
R5	RES 38.3K 1%	0698-3161	1
R9	RES 46.4K 1% 1/8	0698-3162	1
R37-40	RES 46.4 1% .52	0698-3398	4
R13	RES 38.3 1%	0698-3435	1
R55	RES-42.2K 1% 1/8W	0698-3450	1
R3	RES 4.53K 1%	0698-4443	1
R15	RES 1.05K 1%	0698-4467	1
R56	RES-78.7KOHM	0698-4508	1
R57	RES 137K 1%	0698-4518	1
R20	RES 9.9K .1%	0698-6321	1
R19	RES 26.7K .1%	0698-6519	1
R8	RES 22.6K 1%	0757-0349	1
R11	RES 51.1 1%	0757-0394	1
R18	RES 4.32K 1%	0757-0436	1
R12	RESISTOR 6.81K	0757-0439	1
R22,24	RES 20K 1% .125W	0757-0449	2
R4	RES-90.9K	0757-0464	1
R2,14,17	RES 100K 1%	0757-0465	3
R41-44	RES 60 1% .25W	0757-1042	4
J6,8	CONN-2 PIN MALE	1251-6427	2
J1,5	CONN-POST-TP-HDR	1251-7018	2
J3,4,7	CONN-ML 6 PIN	1251-8089	3
J2	CONN-FLEX CKT 13	1251-8530	1
R45	NETWORK-RES SIP	1810-0275	1
U3	IC COMPARATOR	1826-0138	1
U1	IC 555	1826-0180	1

Table 5-3, HP-IL Logic PCA 02225-60001 (Cont.)

Ref Des	Description	P/N	Qty
U5	IC LM393	1826-0412	1
VR10	IC LM385BZ	1826-0774	1
U4	IC-LM330T	1826-0904	1
Q4	XSTOR PNP 2N4403	1853-0271	1
Q7-14	XSTR-PNP TIP32	1853-0537	8
Q3	XSTR NPN 2N3904	1854-0215	1
Q5	XSTR TIP 41A	1854-0456	1
U8-10	XSTR ARY 7NPN	1858-0099	3
CR3-10	DIO-IN4934	1901-0693	8
CR2	DIO-PWR RECT	1901-0789	1
CR11,12	DIODE-1N4150	1901-1098	2
VR12,13	DIO-ZNR 16V 5%	1902-0783	2
VR1-6	DIODE-ZNR 33V.4W	1902-0970	6
U11	IC-ROM	1LG7-0064	1
U7	SATURN RAM 1KBYT	1LG8-0001	1
U6	MICROPROCESSOR	1LJ7-0015	1
MP1	SCR 4-40X1.25	2280-0004	1
MP2	NUT 4-40	2340-0001	1
T1	XFMR-3V	9100-4334	1
L1	INDUCTOR 180UH	9140-0843	1

Table 5-4, HP-IB Logic PCA 02225-60010

Ref Des	Description	P/N	Qty
C6-9,16,33-35	CAP-0.01UF 50V	0160-4554	8
C18	CAP 10PF 5% 100V	0160-4791	1
C17	CAP 33PF 5% 100V	0160-4807	1
C10	C-F 33UF 16V AL	0180-2951	1
C2	CAP-4700UF 16V	0180-3162	1
C15,19,20	CAP-1UF 50V	0180-3314	3
C37	CAP-330UF 38V	0180-3448	1
C38	CAP 33OUF 35	0180-3450	1
C1	CAP-470UF 50V	0180-3451	1
Y1	XTAL-3MHZ	0410-1496	1
	TAPE	0460-1647	-
R12	RES 10K 5% .25W	0683-1035	1
R25,26 RES	100K 5% .25W	0683-1045	2
R3,4	RES 1M 5% .25W	0683-1055	2
R27	RES 10M 5% .25W	0683-1065	1
R21	RES-1.5K 5% .25W	0683-1525	1
R22	RES 39K 5% .25W	0683-3935	1
R7	RES 47 5% .25W	0683-4705	1
R10	RES-4.7K 5% .25W	0683-4725	1
R23,24	RES 680 OHM 5%	0683-6815	2
R1	RES 237 1% .125W	0698-3442	1
R14	RES 261K 1%	0698-3455	1
R16	RES-64.9K 1%	0698-4502	1
R2	RES 4.22K 1%	0698-4645	1
R6	RES 9.9K .1%	0698-6321	1
R5	RES 26.7K .1%	0698-6519	1
R11	RES 10K 1% 1/8W	0757-0442	1
R15	RES-130K	0757-0468	1
MP1,2	HEAT SINK	1205-0576	2
J6	POST HEADER	1251-6427	1
J5	CONN-POST-TP-HDR	1251-7018	1
J3,4,7	CONN-ML 6 PIN	1251-8089	3
J2	CONN-FLEX CKT 13	1251-8530	1
J9	CONN-7P-TP-ENTRY	1251-8842	1
J8	CONN-4P	1251-8958	1
VR3	IC-LM7805	1826-0122	1
VR1	IC-LM317T	1826-0393	1
U7	IC LM393	1826-0412	1
VR7	IC LM 385BZ	1826-0774	1
U8,9	XSTR ARY 7NPN	1858-0099	2
U10	IC-ULN 2023A	1858-0097	1
CR14,15	DIO-IN4934	1901-0693	2
CR1-8	DIO-PWR RECT	1901-0731	8
CR9-13	DIODE SWITCHING	1901-1098	5
VR9,15	DIO-ZNR 45.3V	1902-0038	2
VR18	DIO-ZNR 56V 5%	1902-0597	1
VR16	DIO-IN4754A 39V	1902-0656	1
VR6	DIO-ZNR 6.8V 5%	1902-0954	1
VR14	DIO-ZNR 27V	1902-0968	1
VR8	DIODE-ZNR 33V.4W	1902-0970	1

Table 5-4, HP-IB Logic PCA 02225-60010 (Cont.)

Ref Des	Description	P/N	Qty
U3	IC-ROM	1LG7-0064	1
U2	SATURN RAM 1KBYT	1LG8-0001	1
U1	MICROPROCESSOR	1LJ7-0015	1
MP4,5	FUSEHOLDER	2110-0589	2
F1	FUSE	2110-0621	1
MP6,7	SCR 6-32X.188	2360-0191	2
W3,4	JUMPER-0 OHMS	8159-0005	2
W5	JUMPER ASSY-HEAD	1258-0228	1
VR13	MC7824CT	1826-1218	1

Table 5-5, HP-IB I/O PCA 02225-60011

Ref Des	Description	P/N	Qty
C6,7	CAP 22PF 5% 200V	0160-3875	2
C1	CAP120PF 5% 100V	0160-4800	1
C2-5,9-13	CAP 100NF 50V	0160-4835	9
C8	C-F 33UF 16V AL	0180-2951	1
C14	C-F 220UF 16V AL	0180-2979	1
Y1	CRYSTAL 6MHZ	0410-1414	1
	TAPE-DBL CTD	0460-1802	1
R4	RES-FIX 6.19K	0757-0290	1
R2	RES 51.1K 1%	0757-0458	1
J1	CONN-HPIB	1251-7651	1
J2	CONN-7P-TP-ENTRY	1251-8842	1
R1	NETWORK-RES SIP	1810-0279	1
R3	NETWRK-RES SIP	1810-0367	1
U8	IC SN74LS03N	1820-1198	1
U2,5	IC MC74C175N	1820-1562	2
U7	IC MM74C04N	1820-2211	1
U3	IC-80C96	1820-3545	1
U1	HP-IL	1LB3-0003	1
U6	HP-IB DRIVER	1LH4-0001	1
	SCR-SKT ND CAP	3030-0252	2
S1	SW-RKR	3101-2215	1
W1-3	JUMPER-0 OHMS	8159-0005	3
L1	INDUCTOR 56UH 5%	9100-1631	1
U4	IC-8048L	1820-3636	1

Table 5-6, Centronics-Type I/O PCA 5061-4316

Ref Des	Description	P/N	Qty
C1	CAP-0.01UF 50V	0160-4554	1
MP1	SPACER-I/O	02225-40042	1
MP2	SPACER-PCA	02225-80012	1
J2	CONN-16P-RTANGL	1251-8841	1
R1,2	RES PK-10KX9	1810-0280	2
R3	RES-PK-100KX9	1810-0281	1
U2	IC-74C906	1820-1655	1
U4	IC 74C74	1820-1753	1
U1	IC SN74LS374N	1820-1997	1
U3	IC MM74C00N	1820-2210	1
U5	IC-74C240	1820-2566	1
S1	SWTCH 8 POS SPST	3101-2726	1
J1	CONN-36P CENTRON	1252-0142	1

Table 5-7, Centronics-Type Logic PCA 5061-4320

Ref Des	Description	P/N	Qty
C6-9,16,33-35,36	CAP-0.01UF 50V	0160-4554	9
C18	CAP 10PF 5% 100V	0160-4791	1
C17	CAP 33PF 5% 100V	0160-4807	1
C14	CAP-.047 UF	0160-4834	1
C10,11	C-F 33UF 16V AL	0180-2951	2
C2	CAP-4700UF 16V	0180-3162	1
C19,20	CAP-1UF 50V	0180-3314	2
C37	CAP-330UF 38V	0180-3448	1
C38	CAP 330UF 35V	0180-3450	1
C1	CAP-470UF 50V	0180-3451	1
Y1	XTAL-3MHZ	0410-1496	1
	TAPE	0460-1647	-
R17	RES-1K 5% .25W	0683-1025	1
R13,25,26	RES 100K 5% .25W	0683-1045	3
R3,4	RES 1M 5% .25W	0683-1055	2
R27	RES 10M 5% .25W	0683-1065	1
R21	RES-1.5K 5% .25W	0683-1525	1
R8,22	RES 39K 5% .25W	0683-3935	2
R10	RES-4.7K 5% .25W	0683-4725	1
R9,23,24	RES 680 OHM 5%	0683-6815	3
R1	RES 237 1% .125W	0698-3442	1
R14	RES 261K 1%	0698-3455	1
R16	RES-64.9K 1%	0698-4502	1
R2	RES 4.22K 1%	0698-4645	1
R6	RES 9.9K .1%	0698-6321	1
R5	RES 26.7K .1%	0698-6519	1
R11	RES 10K 1% 1/8W	0757-0442	1
R15	RES-130K	0757-0468	1
MP1,2	HEAT SINK	1205-0576	2
J6	POST HEADER	1251-6427	1
J5	CONN-POST-TP-HDR	1251-7018	1
J3,4,7	CONN-ML 6 PIN	1251-8089	3
J2	CONN-FLEX CKT 13	1251-8530	1
J1	CONN-16P-5P ENTR	1251-8840	1
J8	CONN-4P	1251-8958	1
U4	IC74 HC373	1820-2998	1
VR3	IC-LM7805	1826-0122	1
VR1	IC-LM317T	1826-0393	1
U7	IC LM393	1826-0412	1
VR7	IC LM385BZ	1826-0774	1
Q2	XSTOR PNP 2N4403	1853-0271	1
Q1	XXTR NPN 2N3904	1854-0215	1
U8,9	XSTR ARY 7NPN	1858-0099	2
U10	IC-ULN 2023A	1858-0097	1
CR14,15	DIO-IN4934	1901-0693	2
CR1-8	DIO-PWR RECT	1901-0731	8
CR9-13	DIODE-SWITCHING	1901-1098	5
VR9,15	DIO-ZNR 45.3V	1902-0038	2
VR18	DIO-ZNR 56V 5%	1902-0597	1
VR6	DIO-ZNR 6.8V 5%	1902-0954	1

Table 5-7, Centronics-Type Logic PCA 5061-4320 (Cont.)

Ref Des	Description	P/N	Qty
VR14	DIO-ZNR 27V	1902-0968	1
VR8	DIODE-ZNR 33V.4W	1902-0970	1
U3	IC-ROM	1LG7-0064	1
U2	SATURN RAM 1KBYT	1LG8-0001	1
U1	MICROPROCESSOR	1LJ7-0014	1
MP4,5	FUSEHOLDER	2110-0589	2
F1	FUSE, 500mA	2110-0621	1
MP6,7	SCR 6-32X.188	2360-0191	2
W1,2	JUMPER-0 OHMS	8159-0005	2
VR13	MC7824CT	1826-1218	1

Table 5-8, RS232 Logic PCA 02225-60018

Ref Des	Description	P/N	Qty
C1	CAP 470UF 50V	0180-3451	1
C2	CAP 4700UF 16V	0180-3162	1
C6-9,16,33-35	CAP 0.01UF 20% 50V	0160-4554	8
C10,11	CAP 33UF 20% 16V	0180-2951	2
C15,19,20	CAP 1UF 20% 50V	0180-3314	3
C17	CAP 33PF 5% 100V	0160-4807	1
C18	CAP 10PF 5% 100V	0160-4791	1
C37	CAP 330UF 100% 38V	0180-3448	1
C38	CAP 330UF 20% 35V	0180-3450	1
C39	CAP 330UF 25V	0180-3151	1
CR1-4,7,16	DIO PWR	1901-0731	5
CR9-13	DIO 1N4150	1901-1098	5
CR14,15	DIO 1N4934	1901-0693	2
F1	FUSE .5A 250V TD	2110-0621	1
J1	CONN-16P-TD ENTR	1251-8840	1
J2	CONN – FLEX CKT 13	1251-8530	1
J3,4,7	CONN-ML 6 PIN	1251-8089	3
J5	CONN-POST-TP-HDR	1251-7018	1
J6	POST HEADER	1251-6427	1
J8	CONN-4P	1251-8958	1
MP1,2	HEAT SINK	1205-0576	2
MP4,5	FUSEHOLDER-CLIP-10A	2110-0589	2
MP6,7	SCR 6-32X.375	2360-0495	2
R1	RES 237 1% .125W	0698-3442	1
R2	RES 4.22K 1%	0698-4645	1
R3,4	RES 1M 5% .25W	0683-1055	2
R5	RES 26.7K .1%	0698-6519	1
R6	RES 9.9K .1%	0698-6321	1
R7	RES 47 5% .25W	0683-4705	1
R10	RES 4.7K 5% .25W	0683-4725	1
R11	RES 10K 1% 1/8W	0757-0442	1
R12	RES 10K 5% .25W	0683-1035	1
R14	RES 261K 1%	0698-3455	1
R15	RES 130K 1%	0757-0468	1
R16	RES 64.9K 1%	0698-4502	1
R21	RES 1.5K 5% .25W	0683-1525	1
R22	RES 39K 5% .25W	0683-3935	1
R23,24	RES 680 5%	0683-6815	2
R25	RES 100K 5%	0683-1045	1
R26	RES 1.5K 5% .25W	0683-1525	1
R27	RES 10M 5% .25W	0683-1065	1
U1	MICROPROCESSOR	1LJ7-0014	1
U2	SATURN RAM 1KBYT	1LG8-0001	1
U3	ROM	1LG7-0064	1
U4	IC 74HC373	1820-2998	1
U7	IC LM393	1826-0412	1
U8,9	XSTR ARY 7NPN	1858-0099	2

Table 5-8, RS232 Logic PCA 02225-60018 (Cont.)

Ref Des	Description	P/N	Qty
U10	IC ULN 2023A	1858-0097	1
VR1	IC-LM317T	1826-0393	1
VR3	IC-LM7805	1826-0122	1
VR6	DIO ZENER 6.8V 5%	1902-0954	1
VR7	IC-LM385BZ	1826-0774	1
VR8	DIO ZENER 33V 5% .4W	1902-0970	1
VR9,15	DIO ZENER 45.3V 5%	1902-0038	2
VR13	MC7824CT	1826-1218	1
VR14	DIO ZENER 27V 5%	1902-0968	1
VR18	DIO ZENER 56V 5%	1902-0597	1
W1,2,4,8,9,10,11	JUMPER-0 OHMS	8159-0005	2
Y1	XTAL-3MHZ	0410-1496	1
	TAPE	0460-1647	

Table 5-9, RS232 I/O PCA 02225-60019

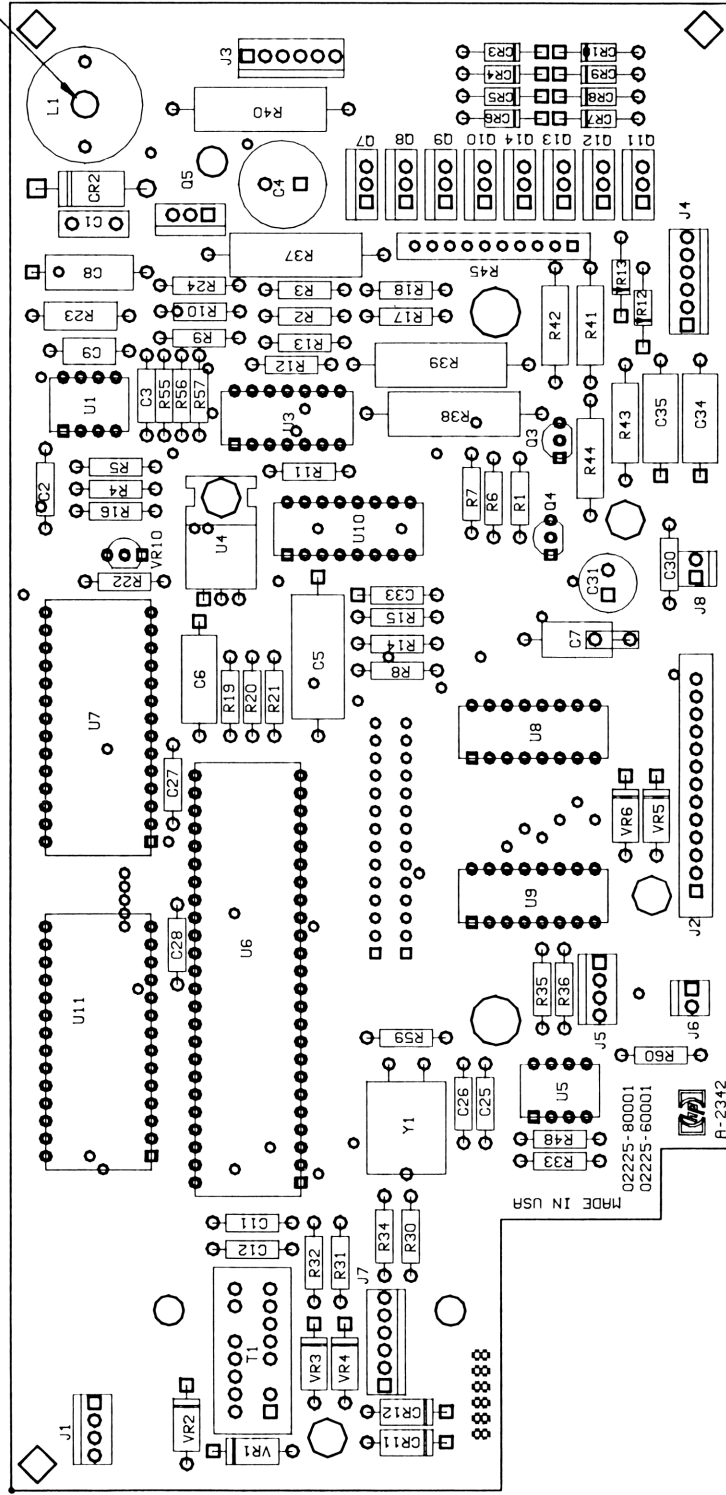
Ref Des	Description	P/N	Qty
C1,2	CAP 22PF 5%	0160-4787	2
C3,4	CAP 330PF 5%	0160-4810	2
C5,6,7,9,10	CAP .01UF 20%	0160-4554	5
C8	CAP .1UF 10% 50V	0160-4835	1
C11	CAP 1000PF 5%	0160-4822	1
J1	CONN DB25S	1252-0603	1
J2	CONN 16P RTANGL	1251-8841	1
R1,2	RES-NET 10K 2%	1810-0280	2
S1	SW 8 POS SPST	3101-2726	1
S2	SW 5 POS SPST	3101-2804	1
U1	IC-MCU	1820-3936	1
U2	IC-6551	1820-2577	1
U3	IC-80C96	1820-3545	1
U5	IC-MM74C00N	1820-2210	1
U6,7	IC-MC14076BCP	1820-2220	2
U8	IC-MC1489AL	1820-0990	1
U9	IC-MC1488L	1820-0509	1
VR1	DIO ZENER 14.5V 5W	1902-0976	1
Y1	6MHZ CRYSTAL	0410-1414	1
Y2	1.84MHZ CRYSTAL	0410-1485	1
	TAPE	0460-1802	2

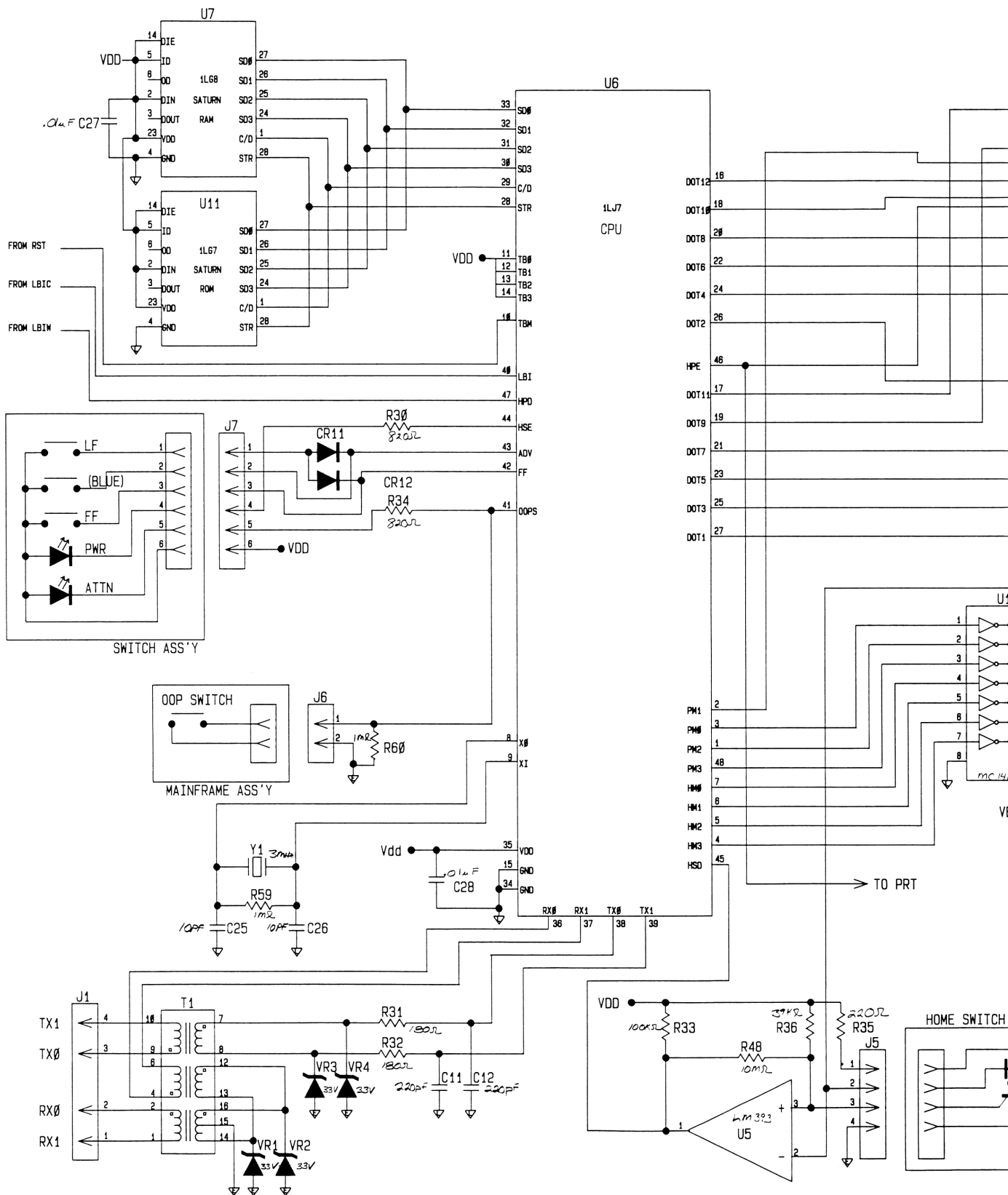
Section 6:

Schematic Diagrams

Schematics and Diagrams follow on the next page.

MP1 MP2





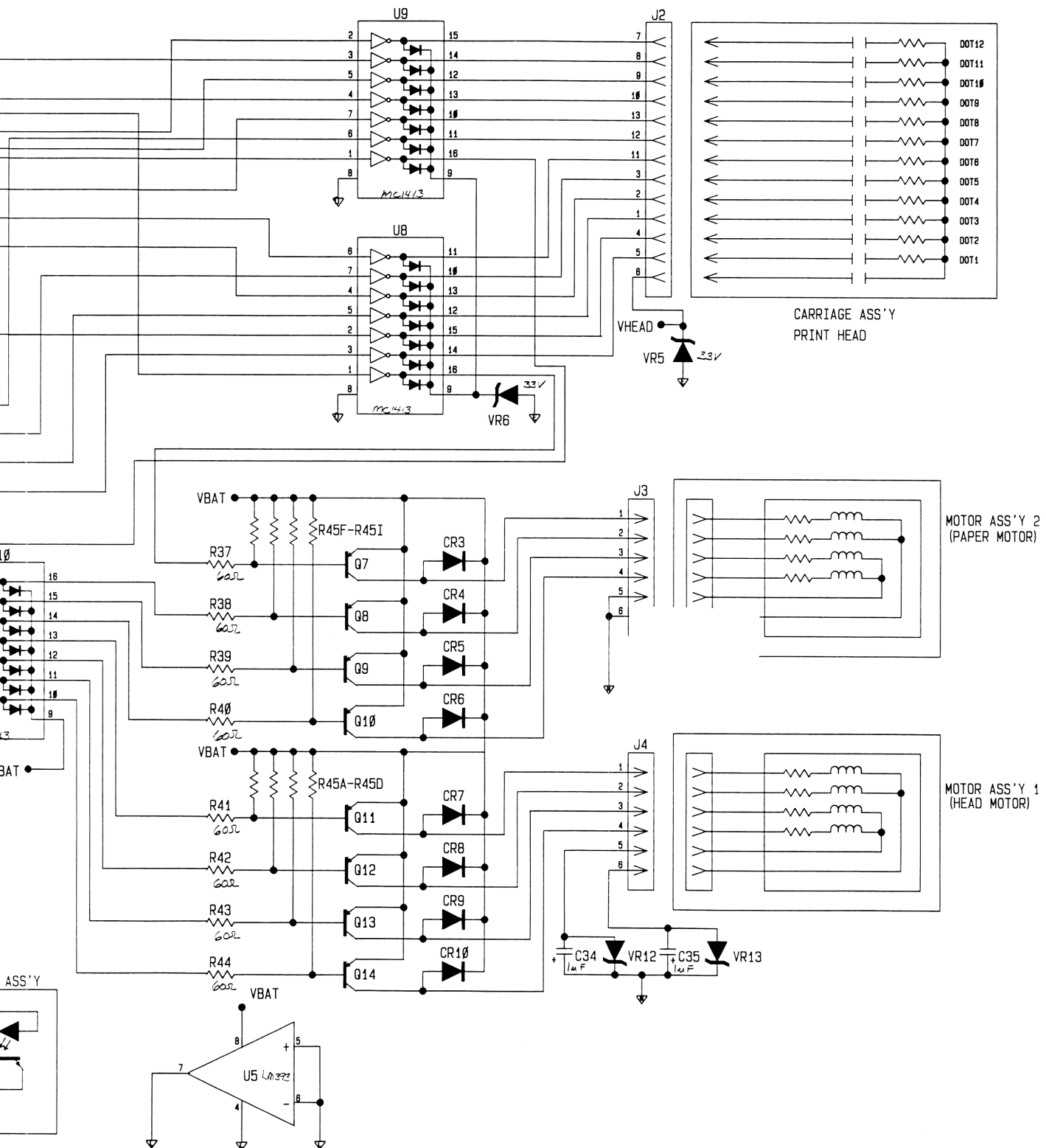
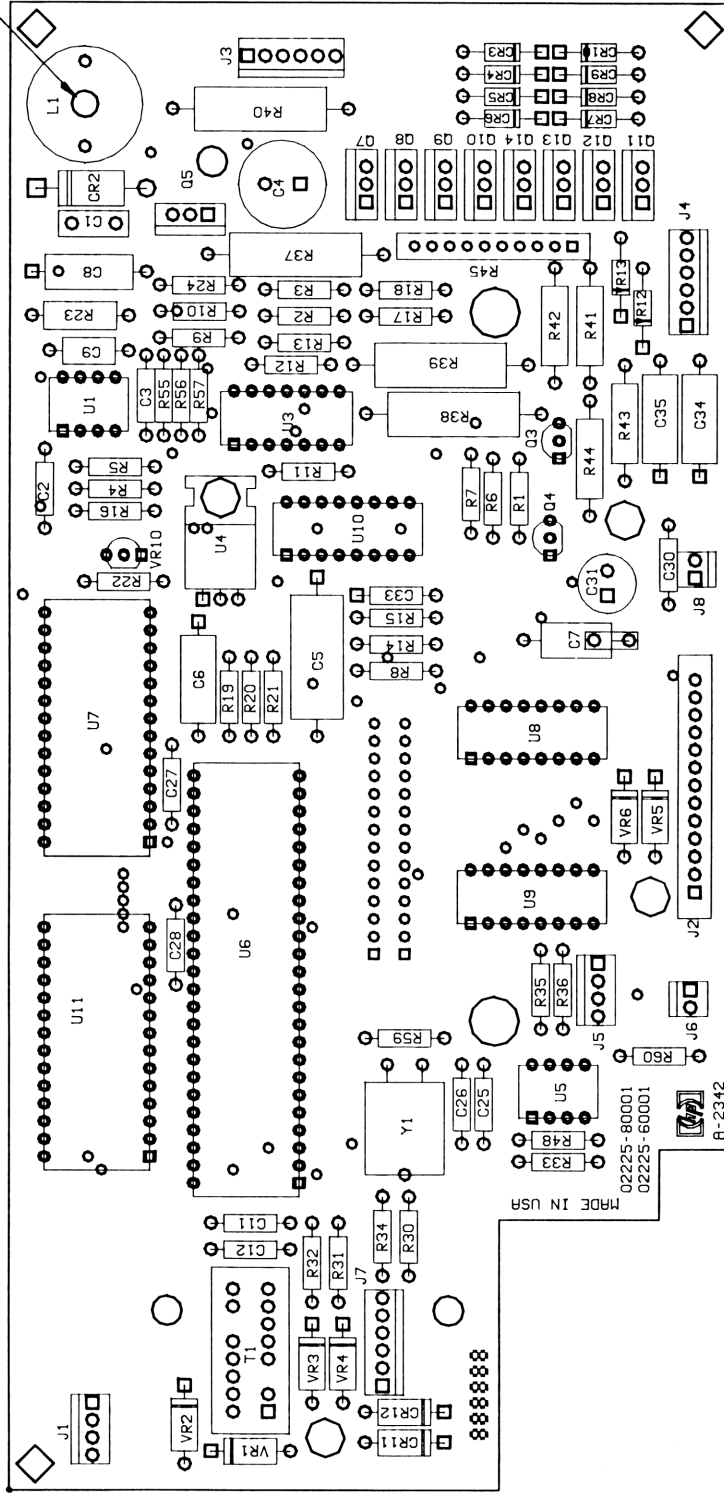
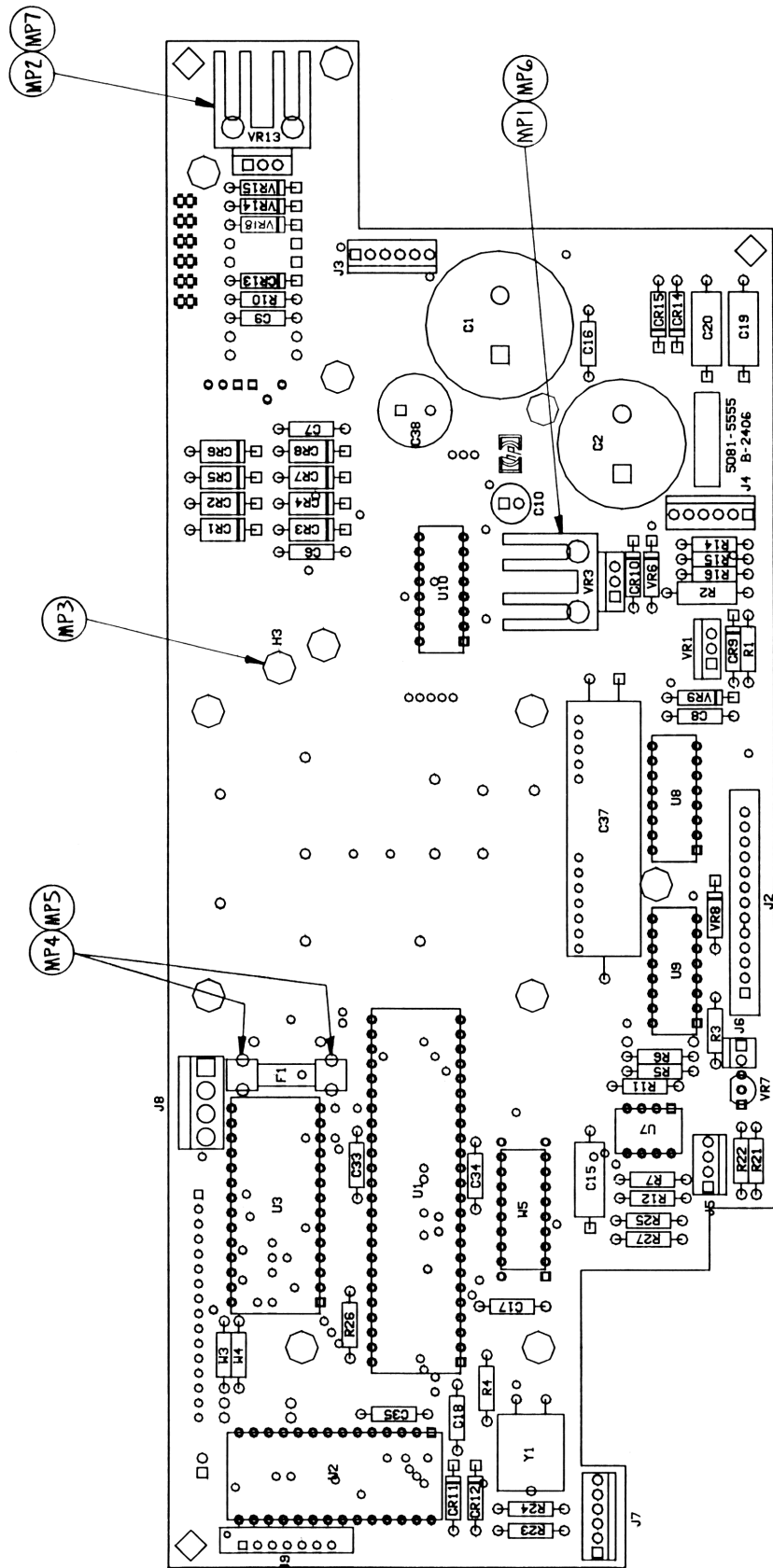
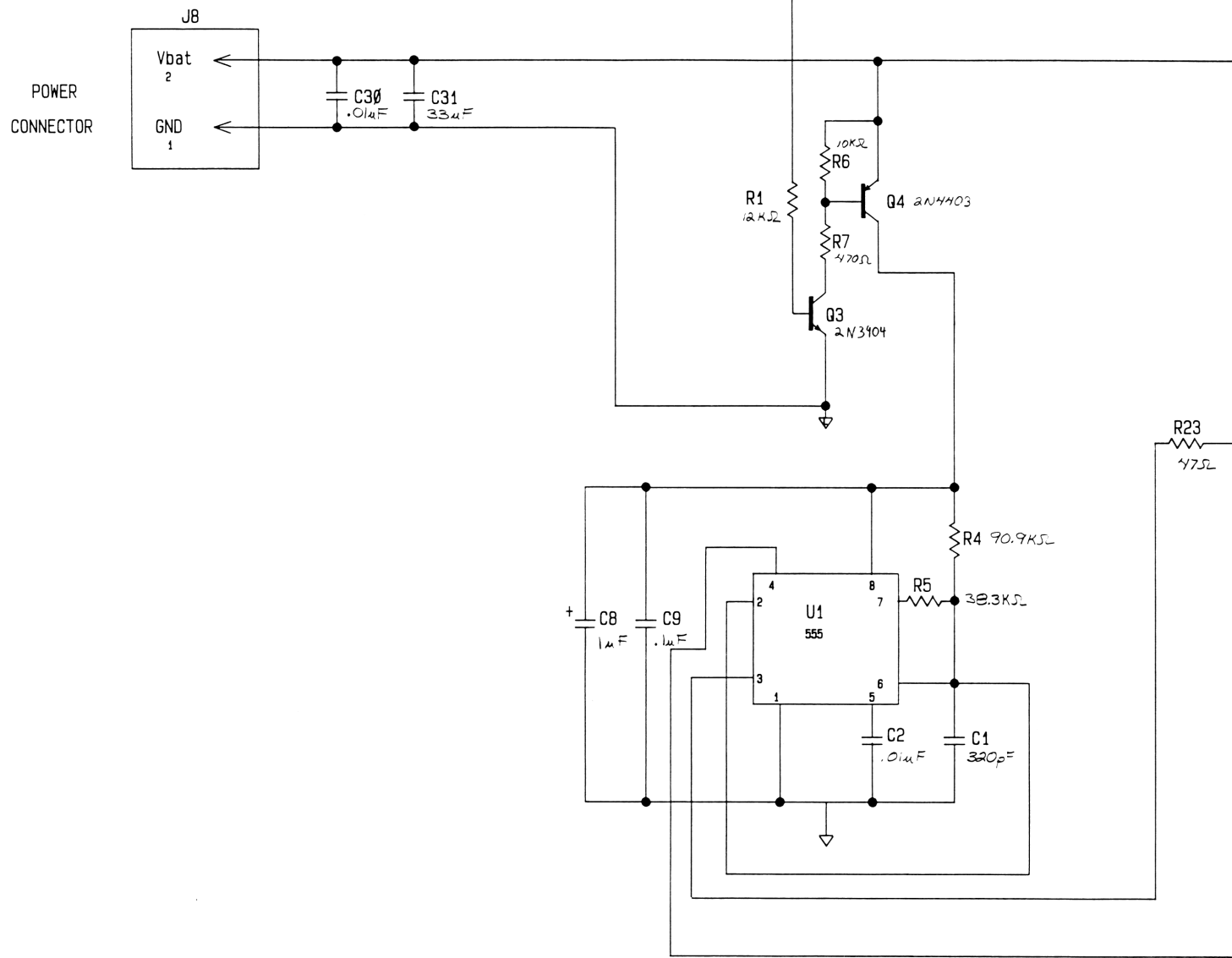


Figure 6-1, 2225B Logic Assembly, 02225-60001 (1 of 2)

MP1 MP2







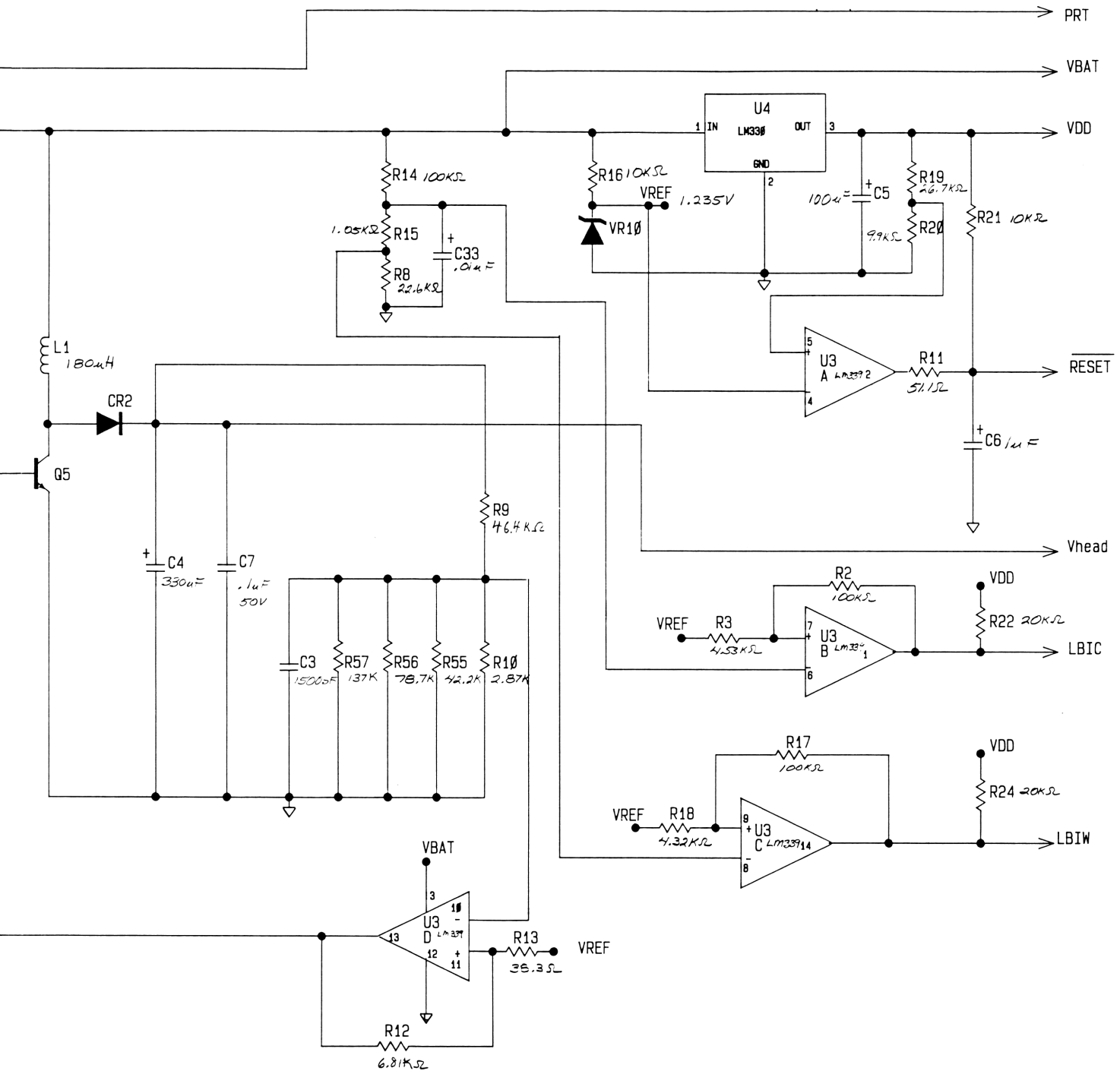
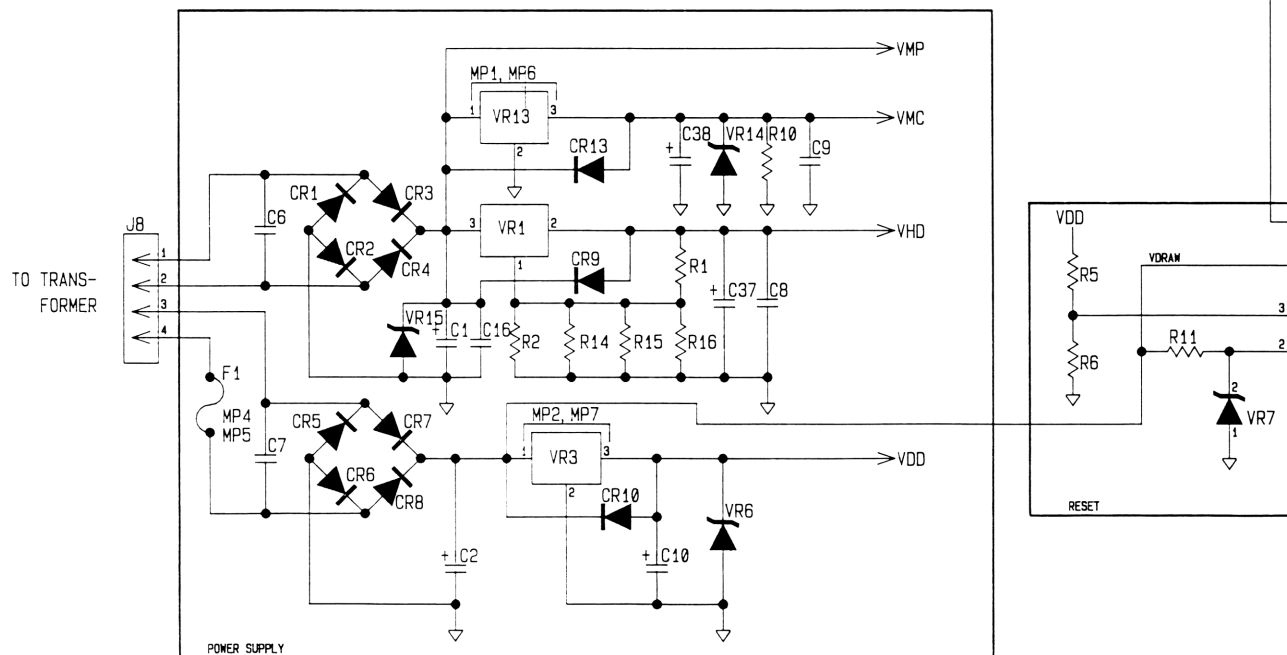
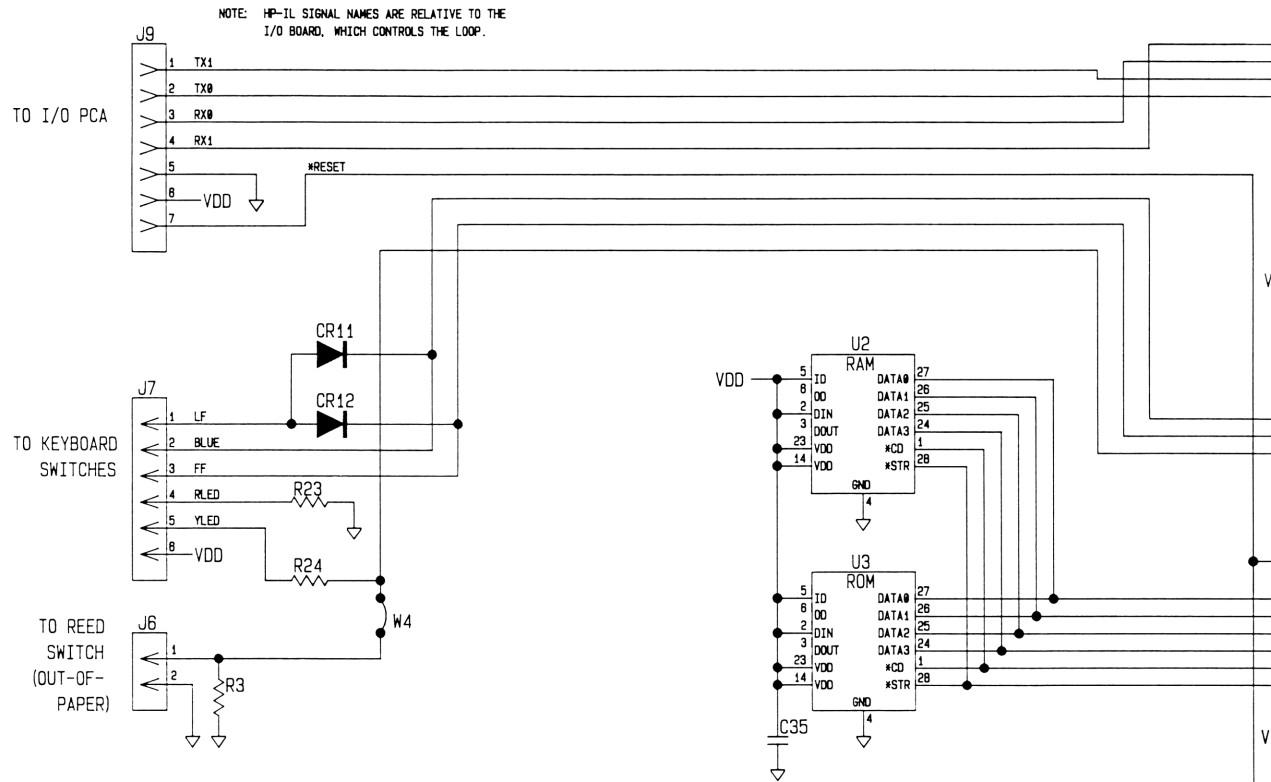
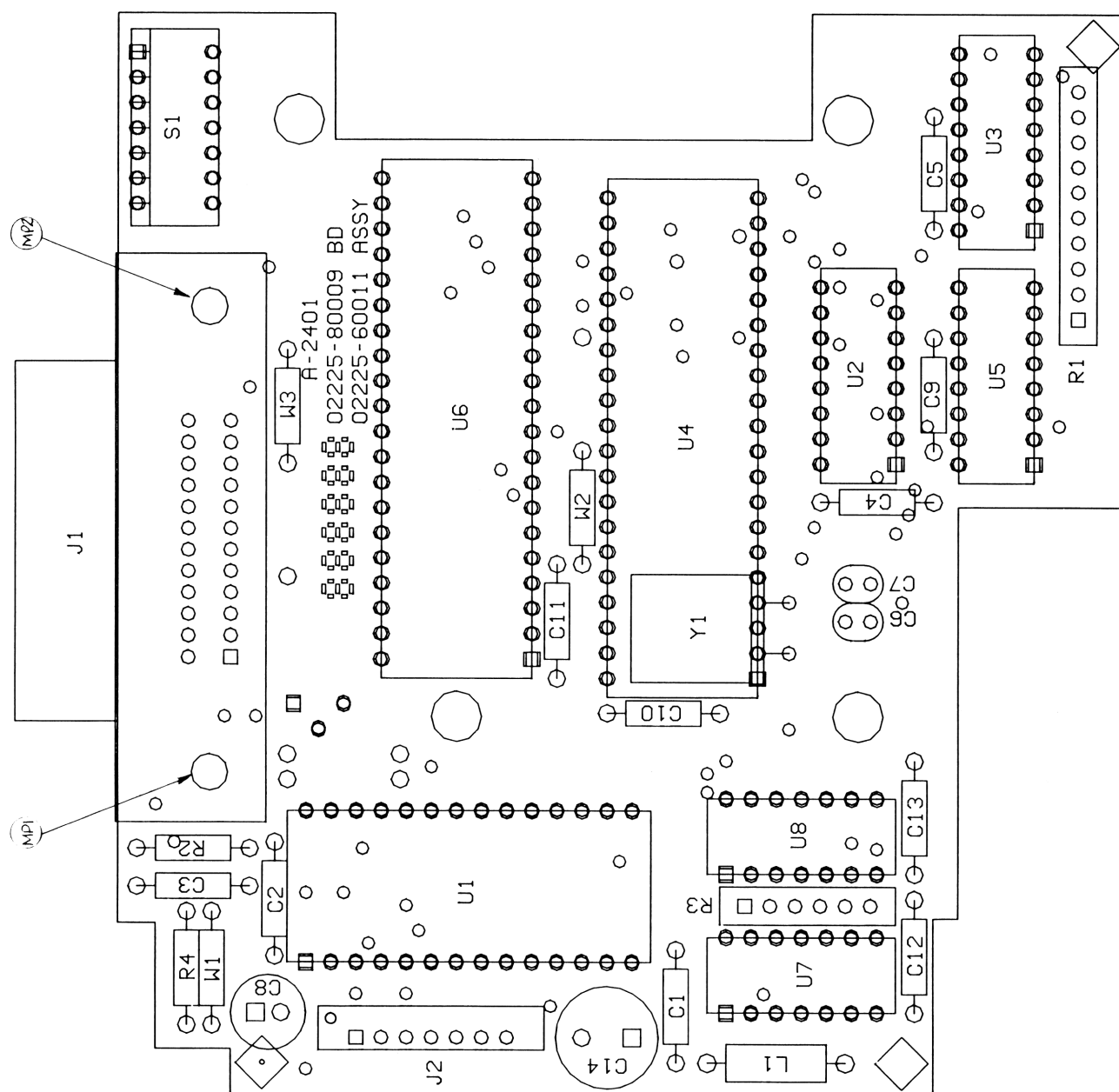
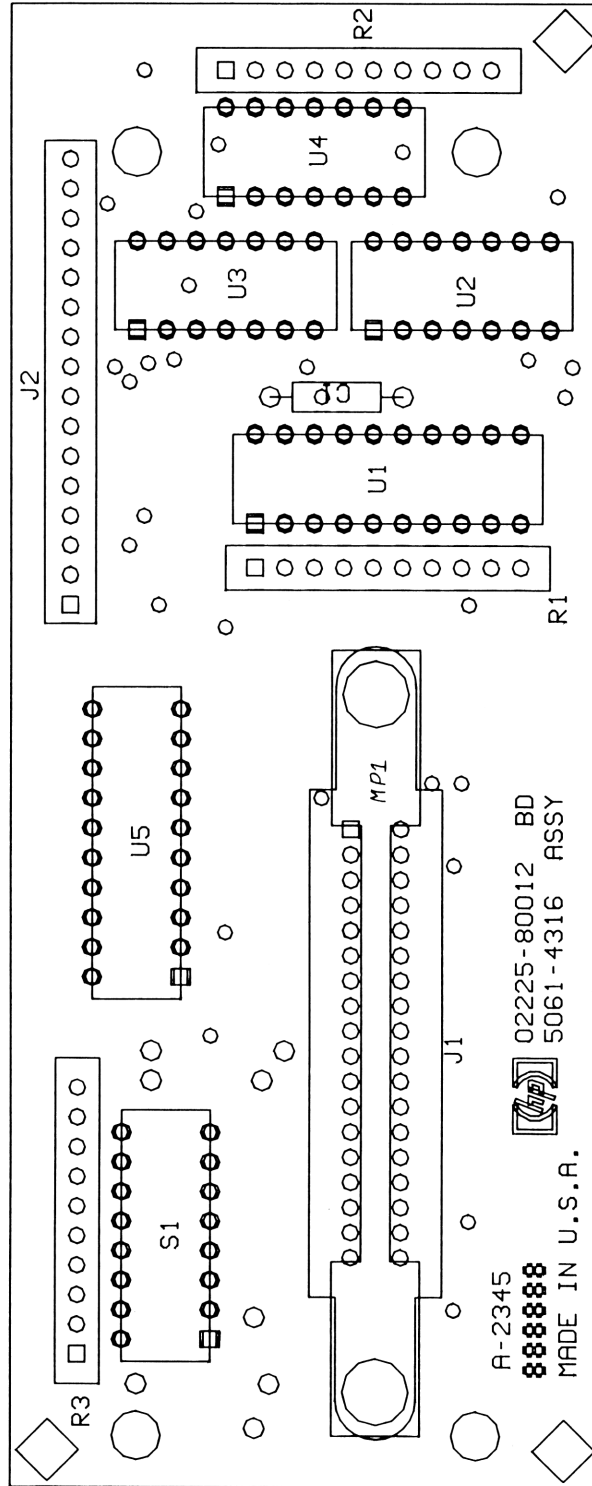


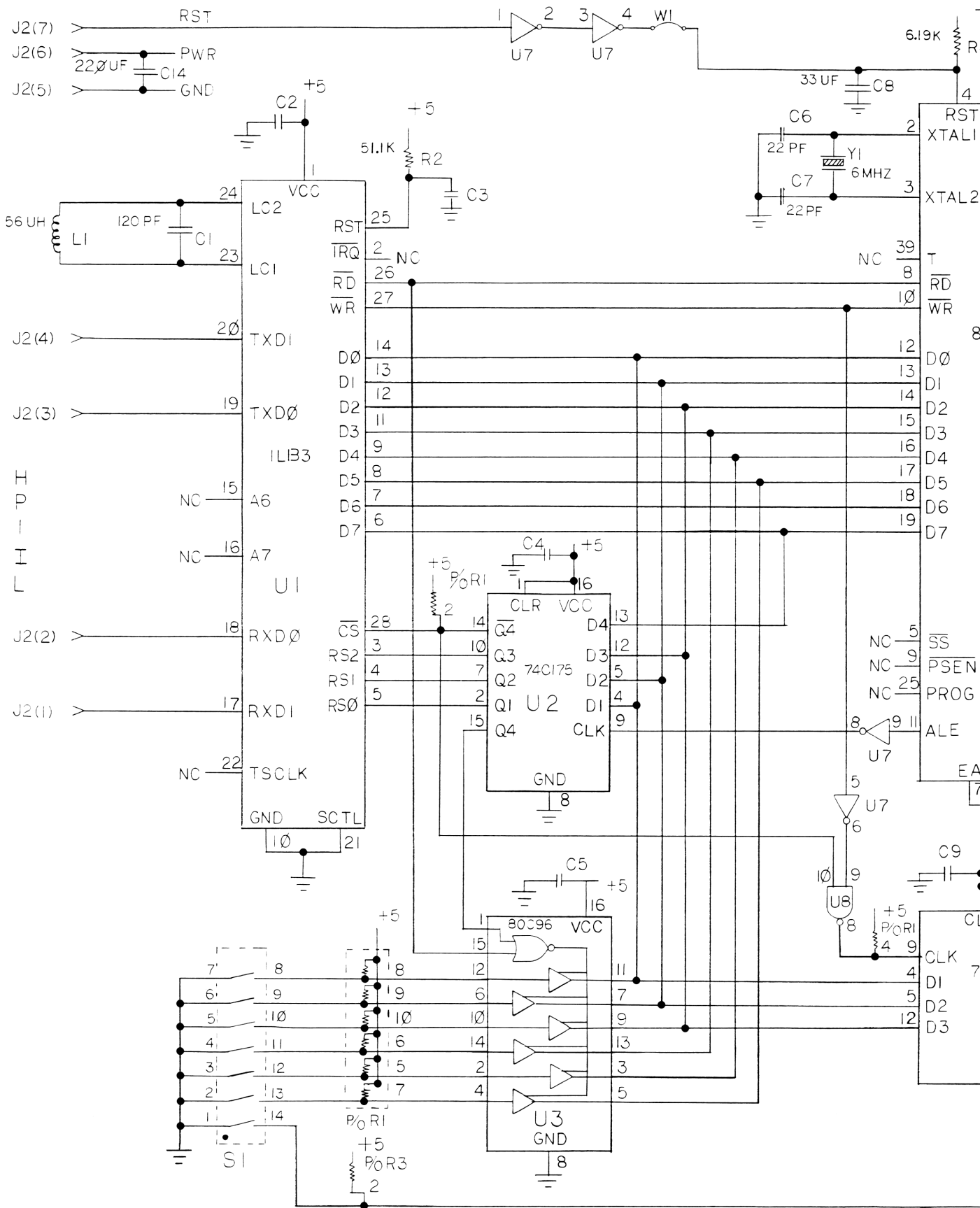
Figure 6-1, 2225B Logic Assembly, 02225-60001 (2 of 2)











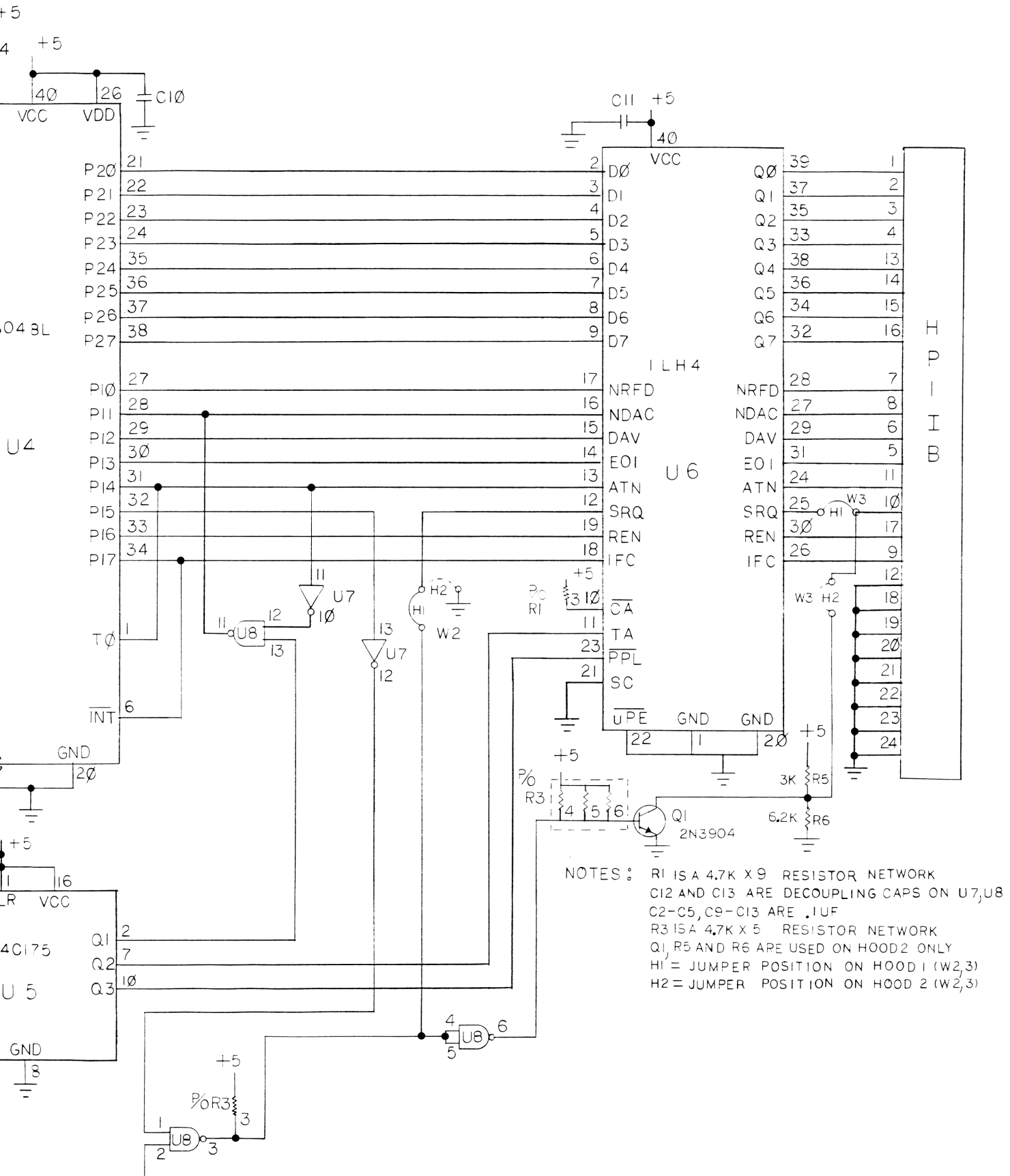
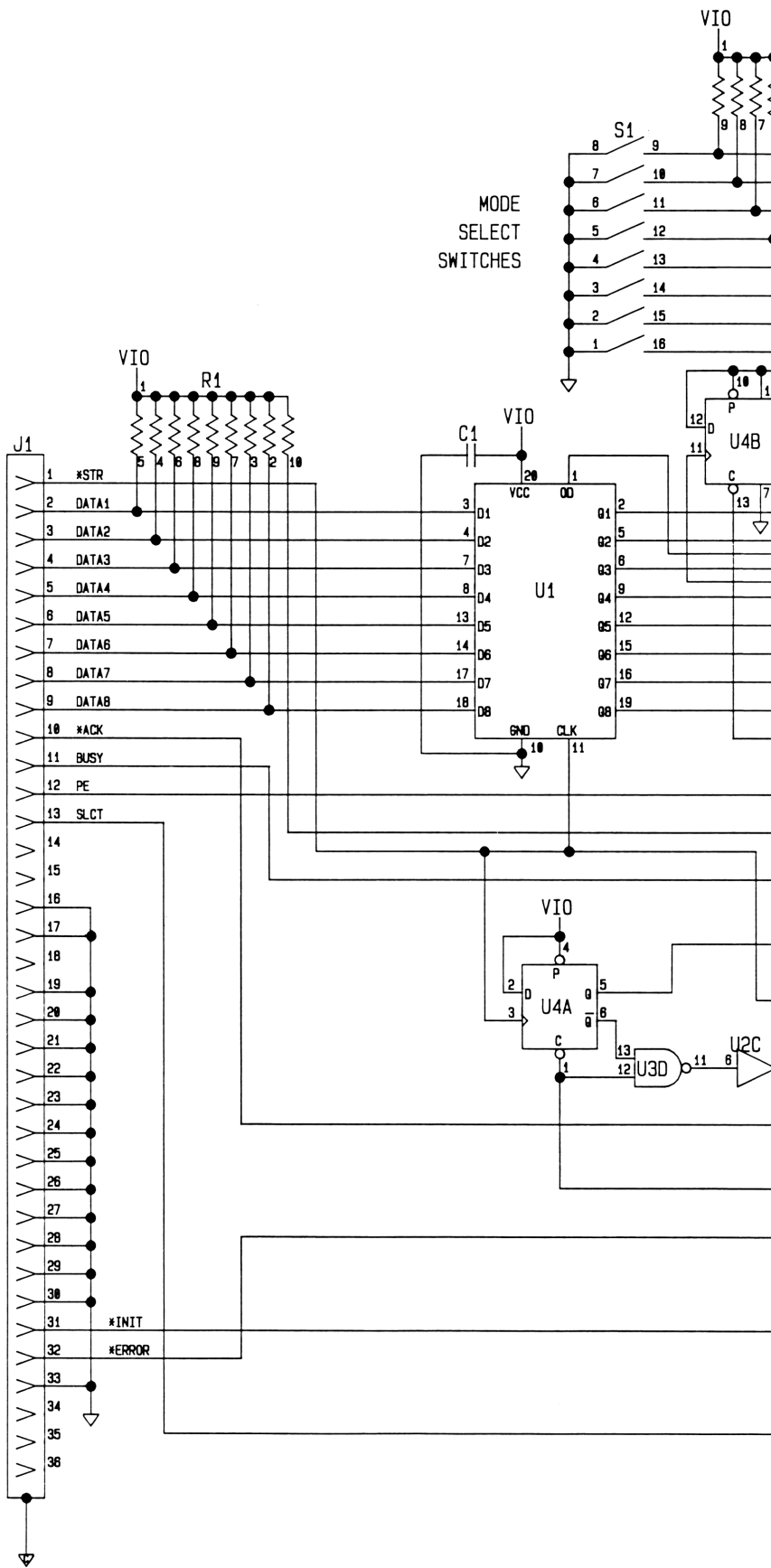


Figure 6-3, 2225A I/O Assembly, 02225-60011

CENTRONICS
INTERFACE



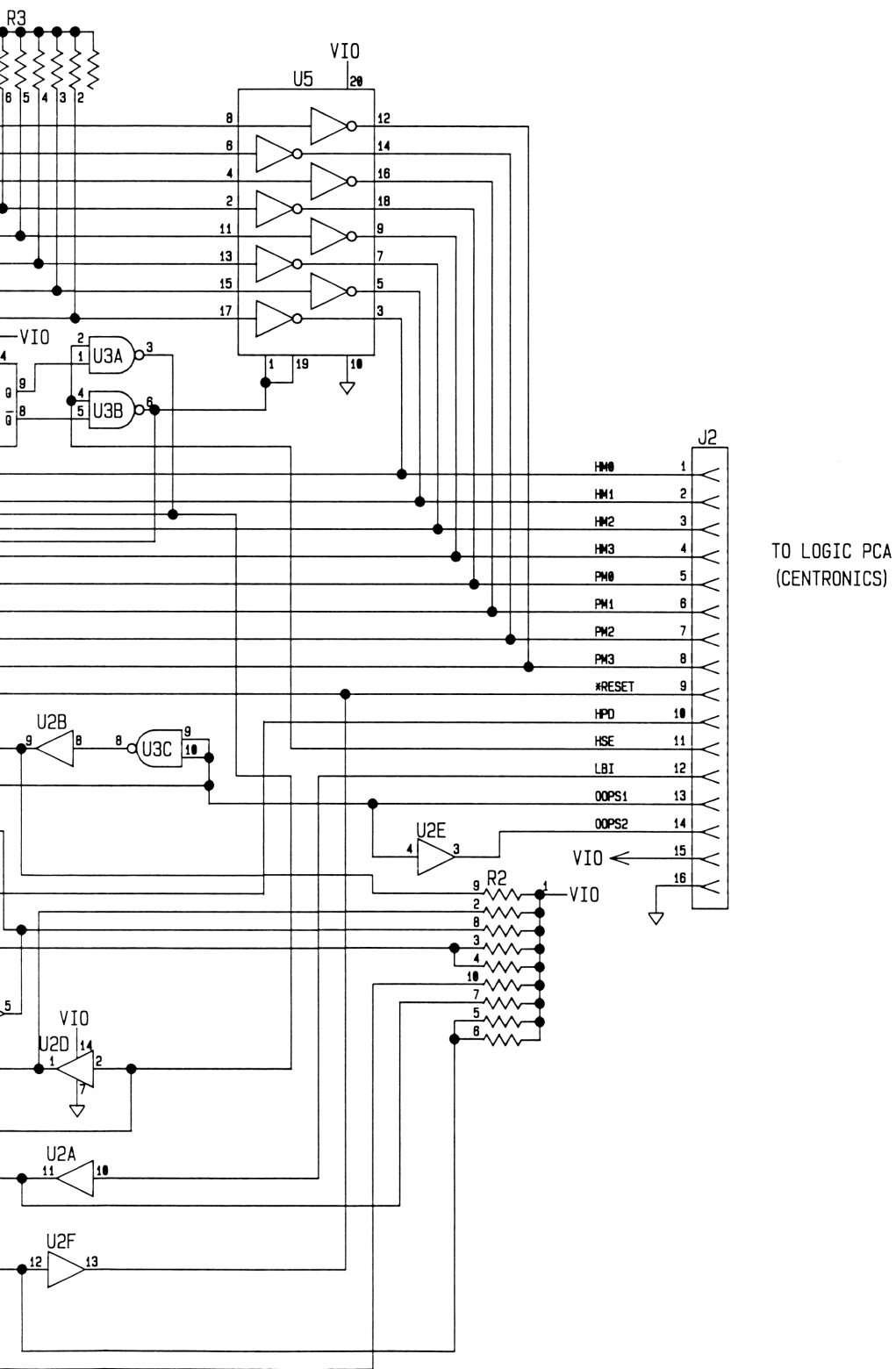
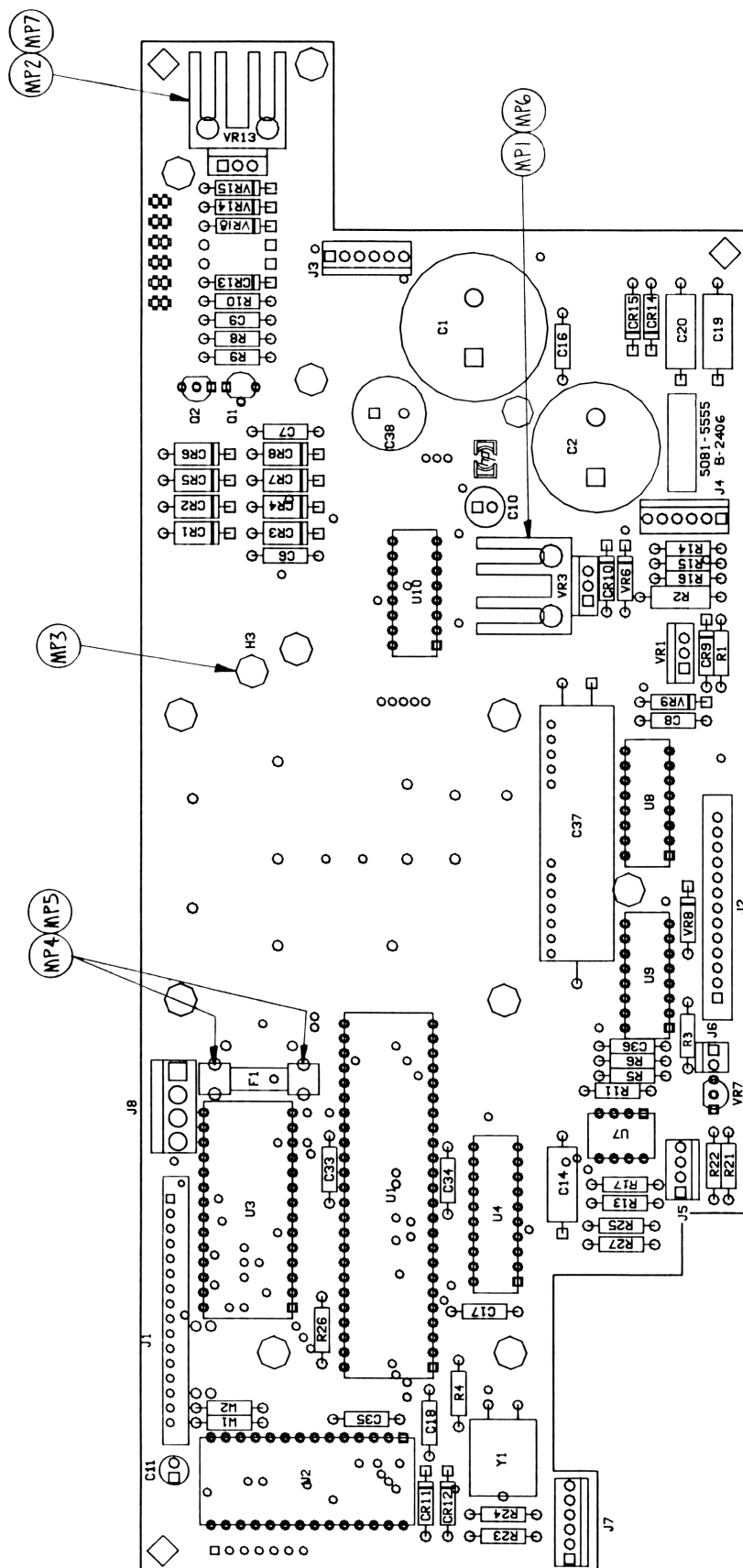
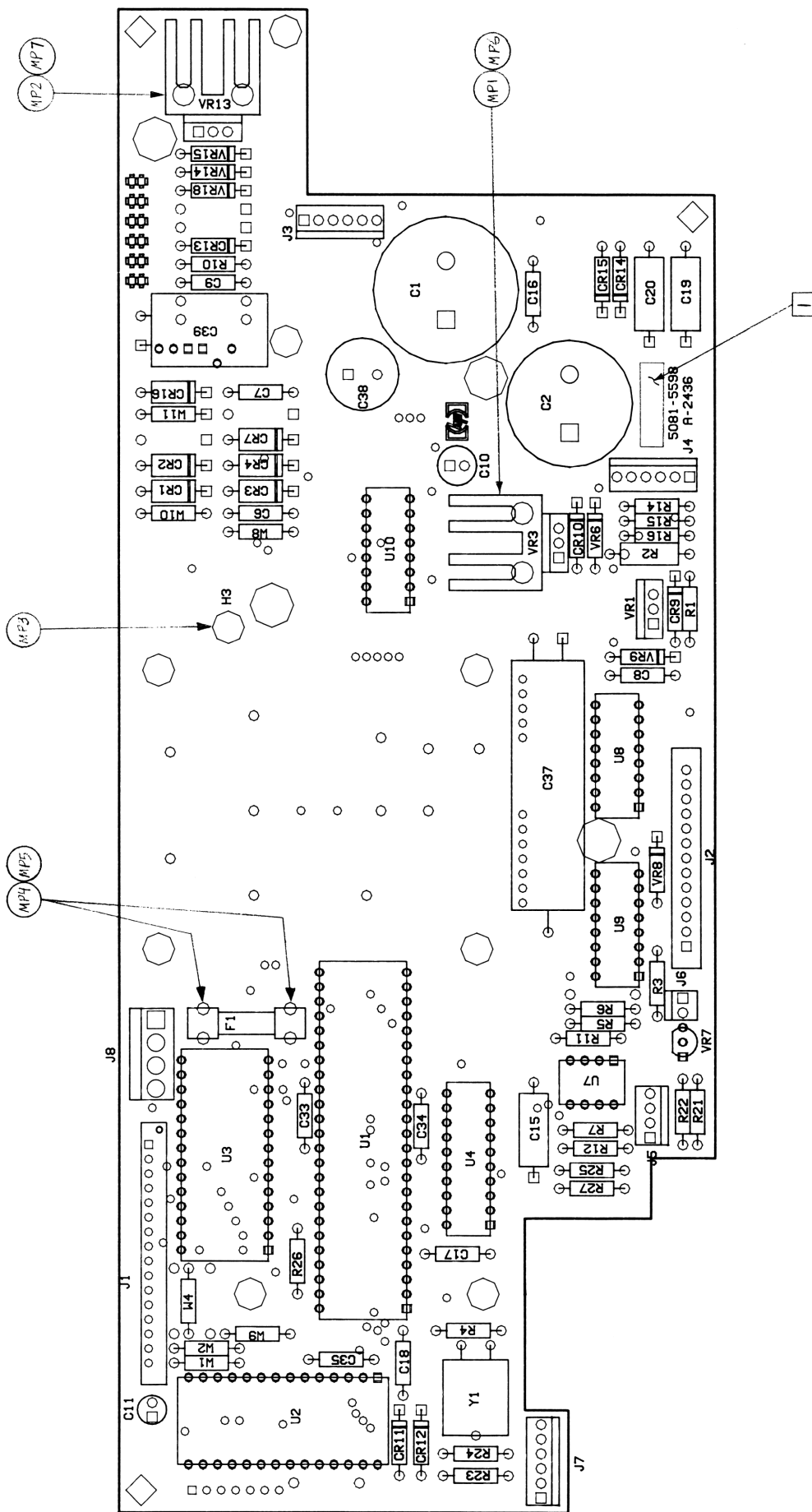
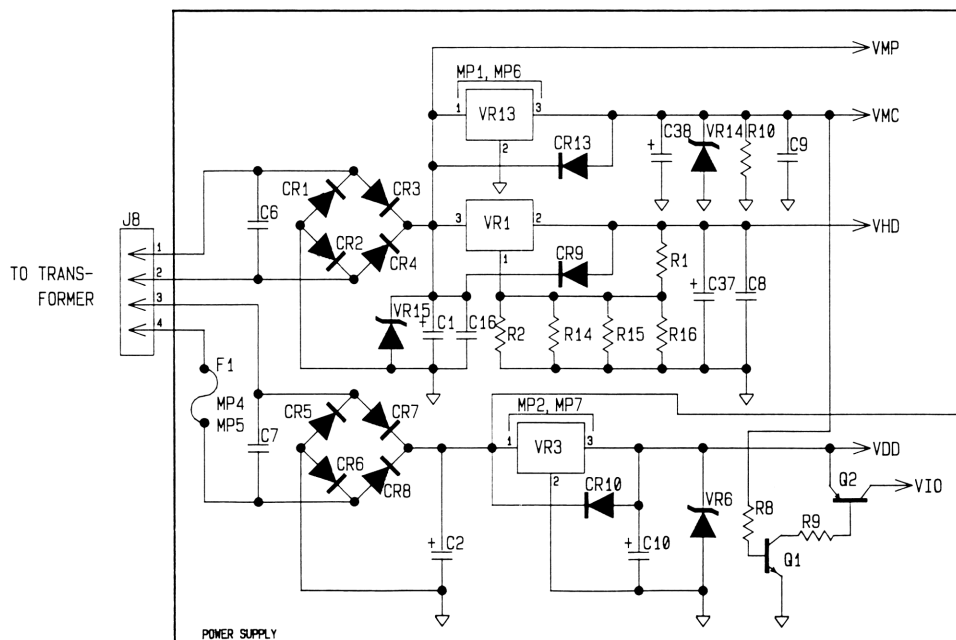
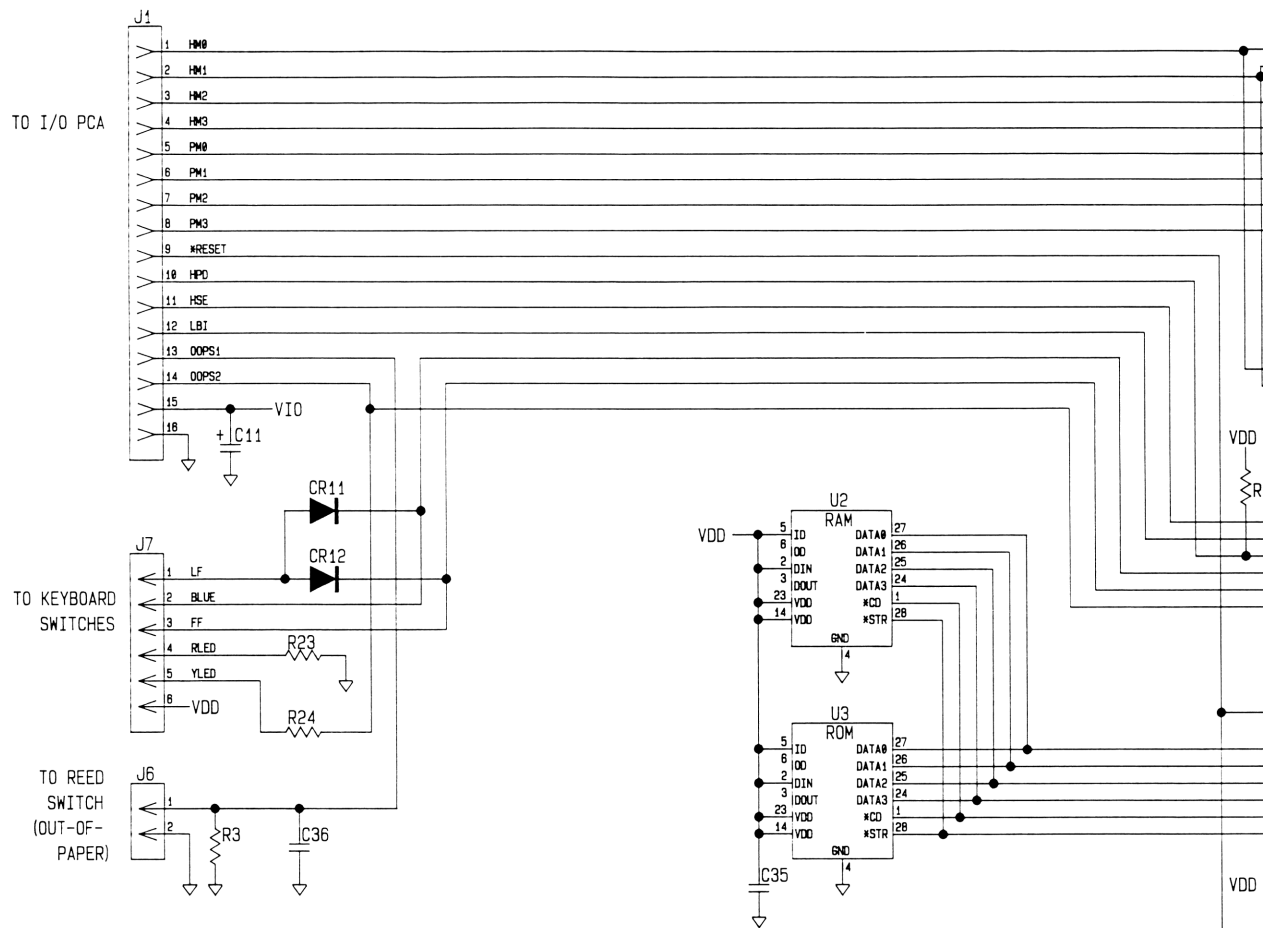


Figure 6-4, 2225C I/O Assembly, 5061-4316







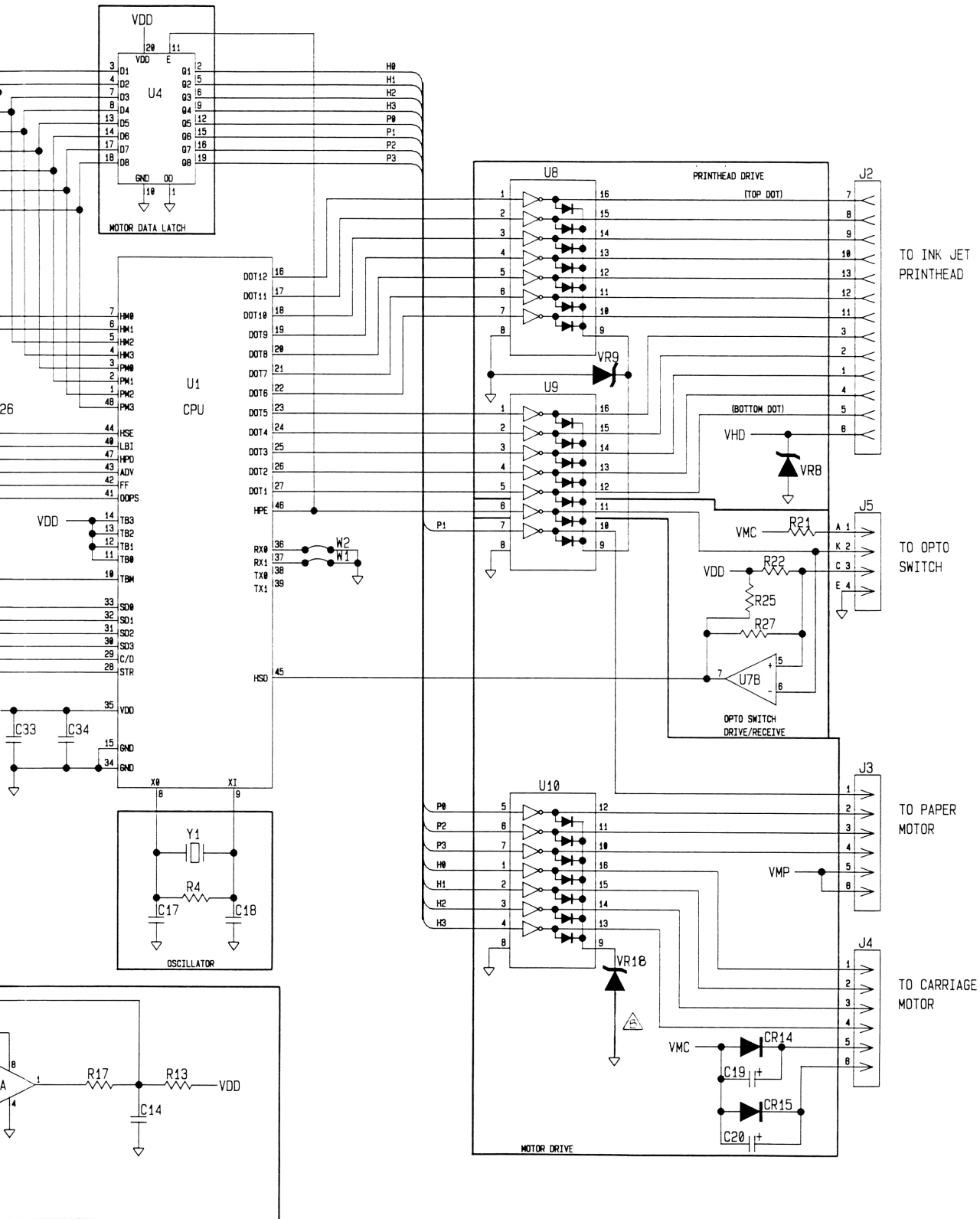
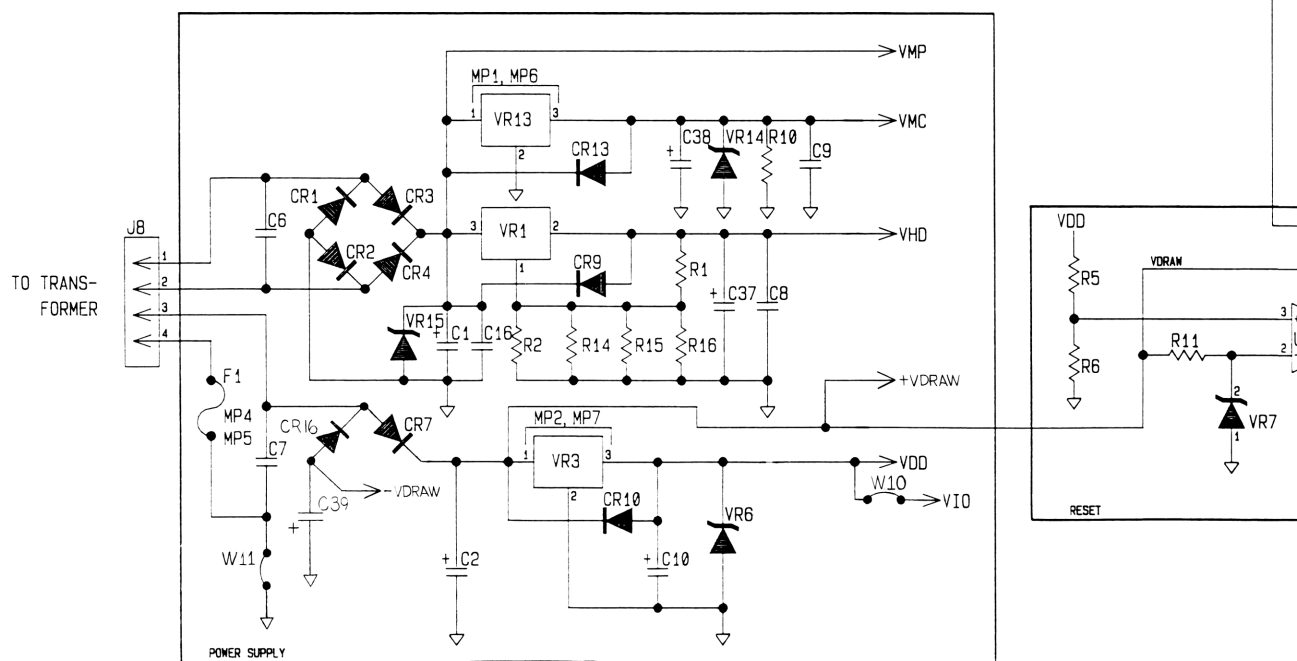
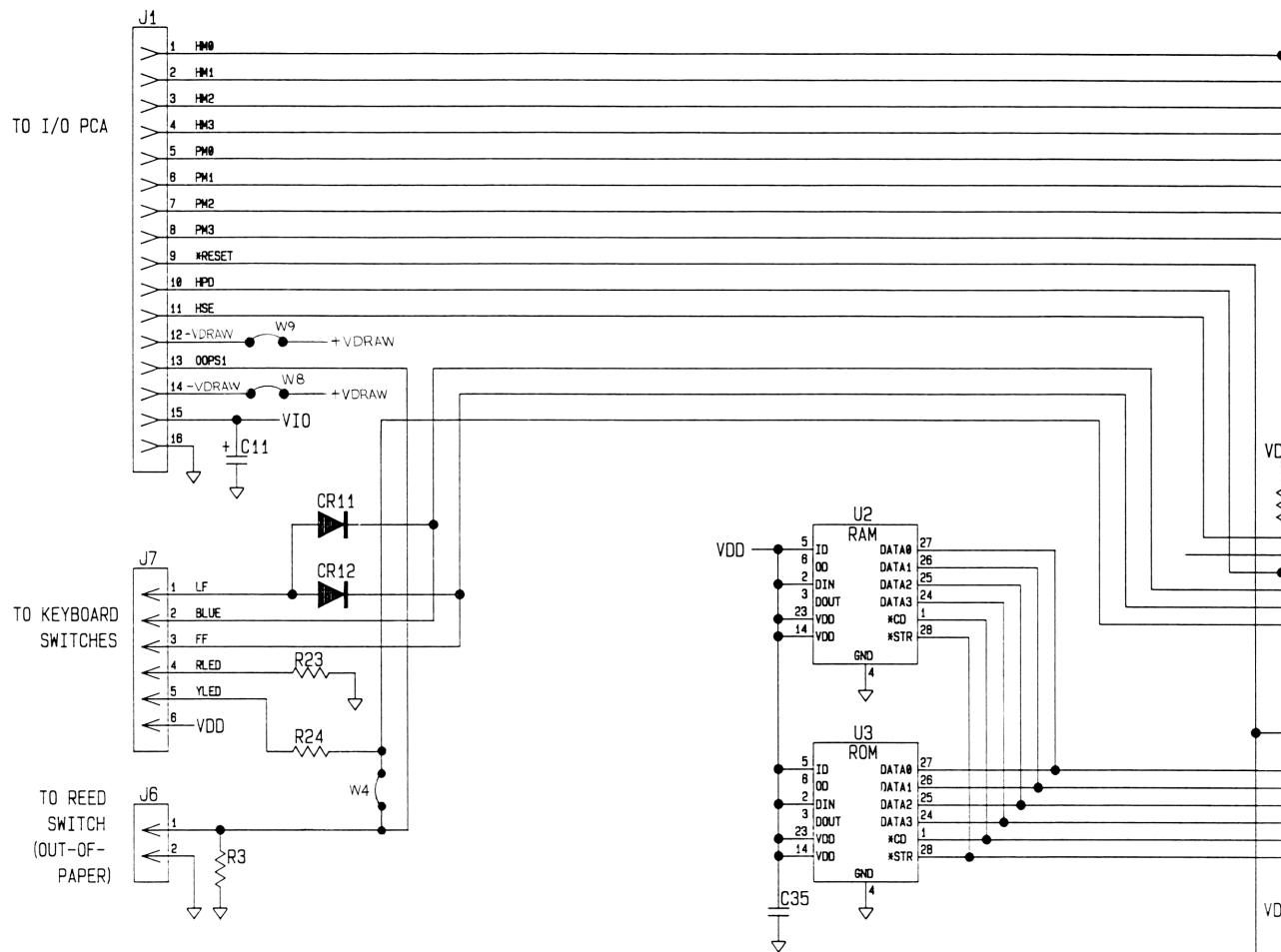


Figure 6-5, 2225C Logic Assembly, 5061-4318



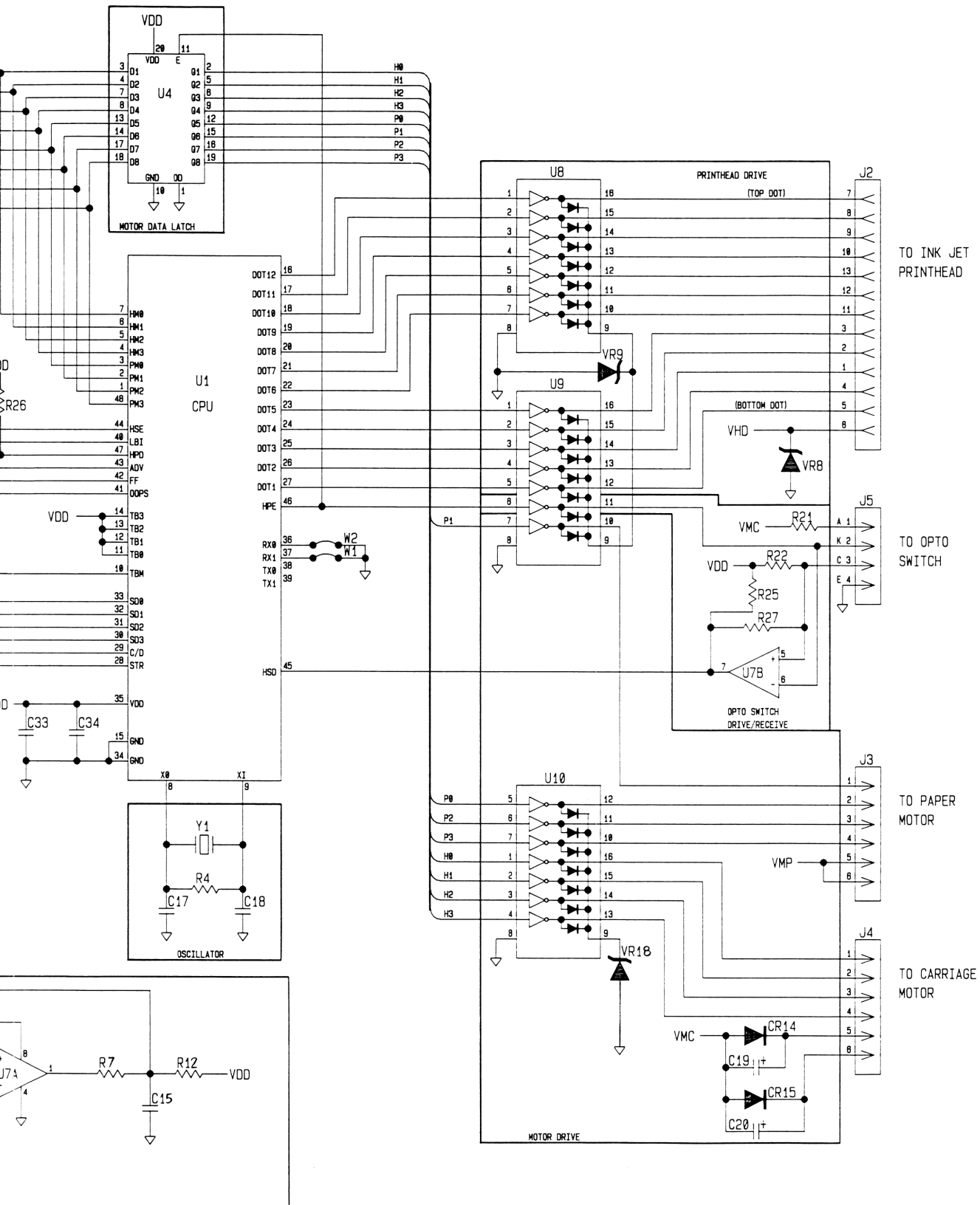
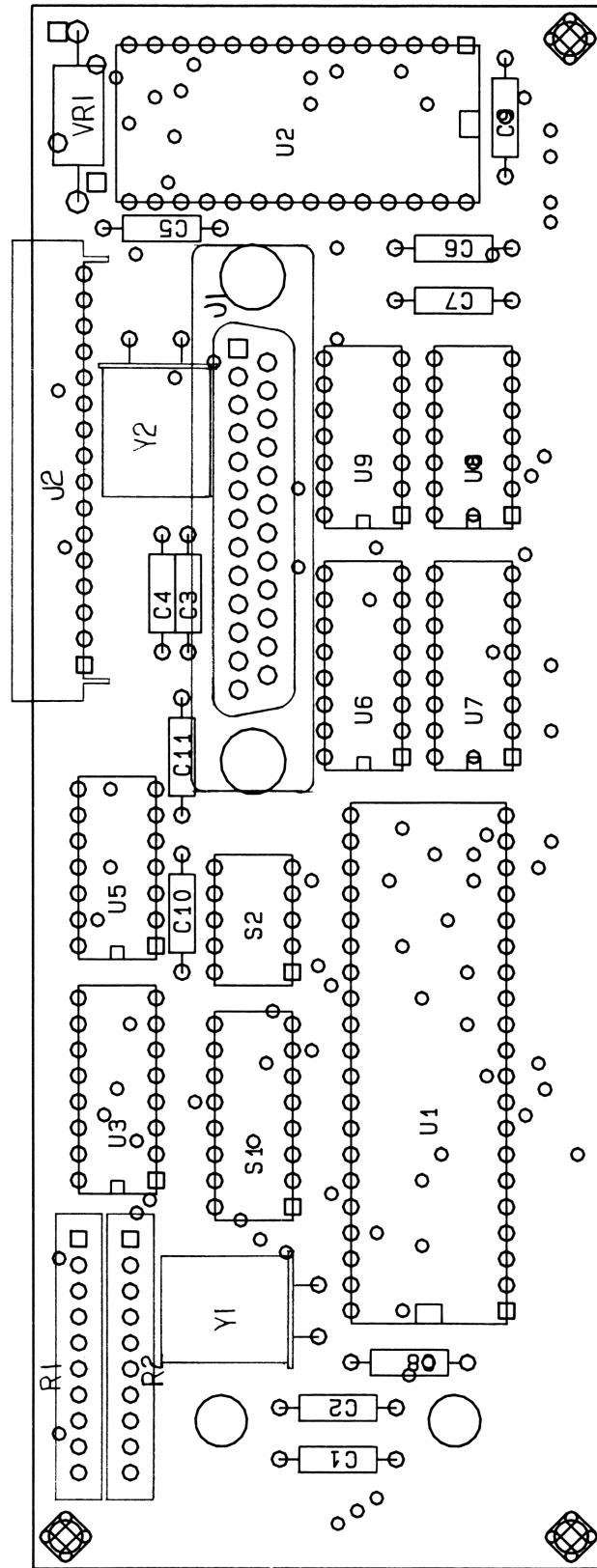
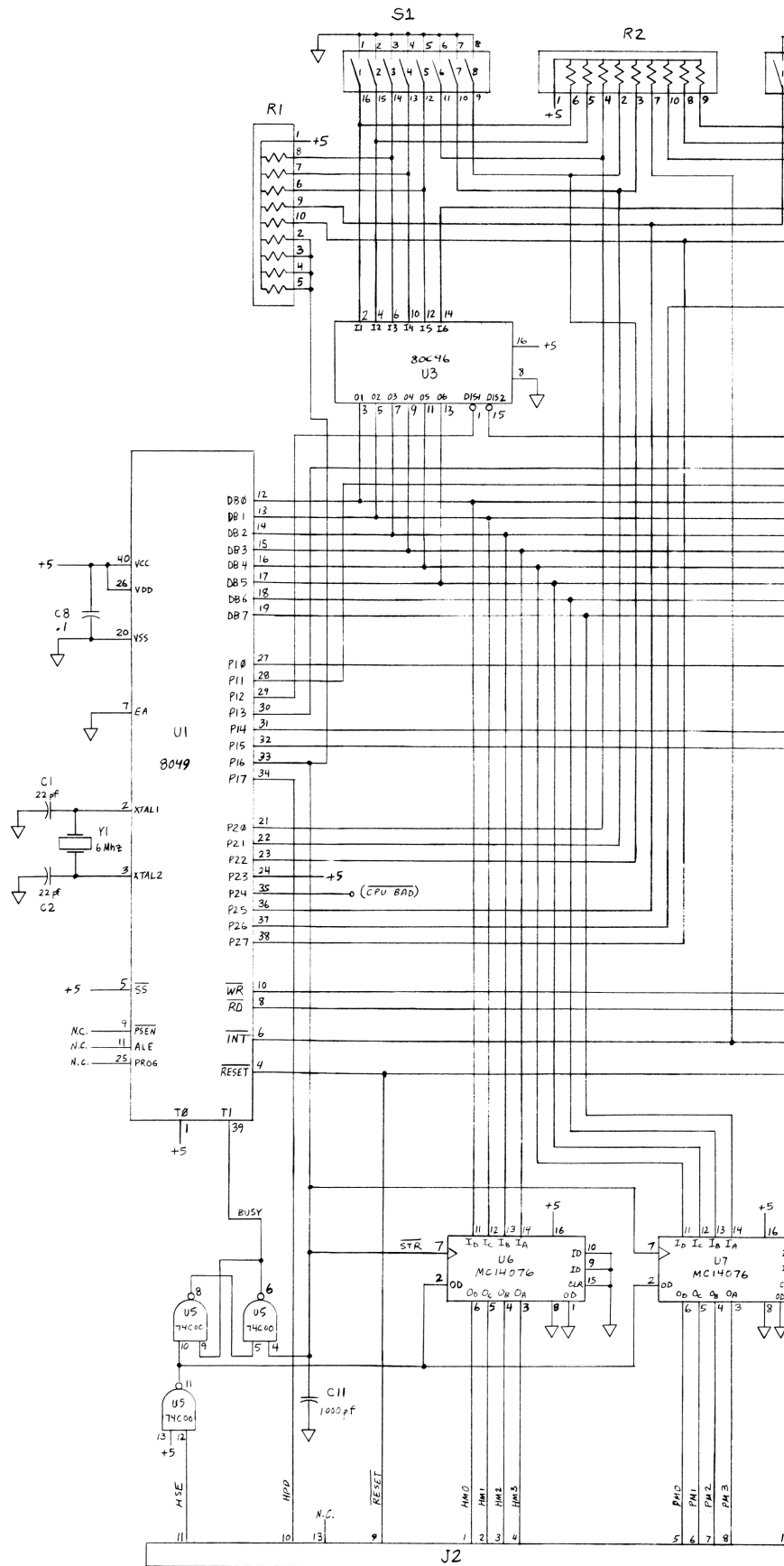


Figure 6-6, RS232 Logic Assembly, 02225-60018





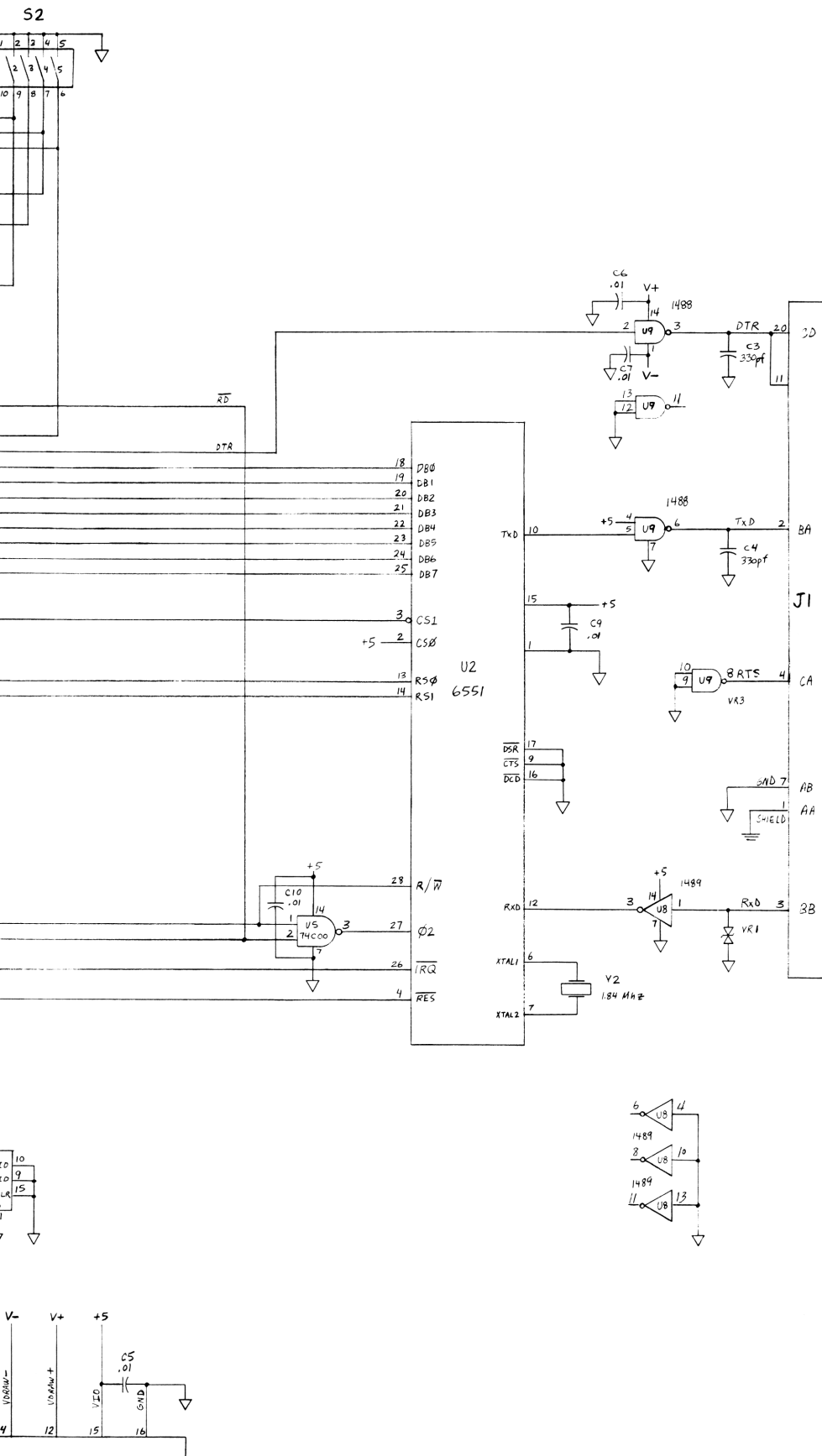
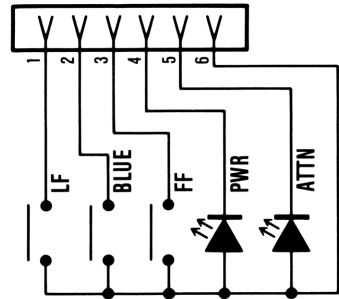
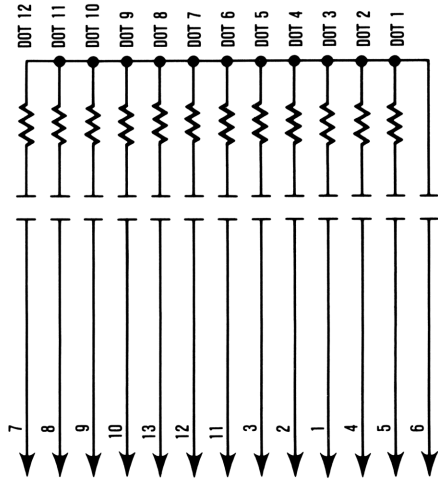


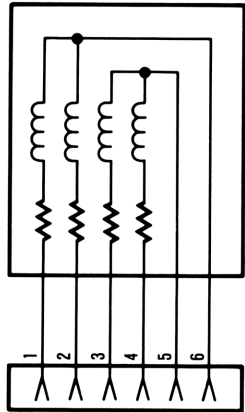
Figure 6-7, RS232 I/O Assembly, 02225-60019



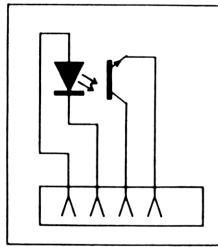
Switch Assembly



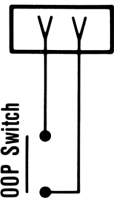
Carriage Assembly Print Head



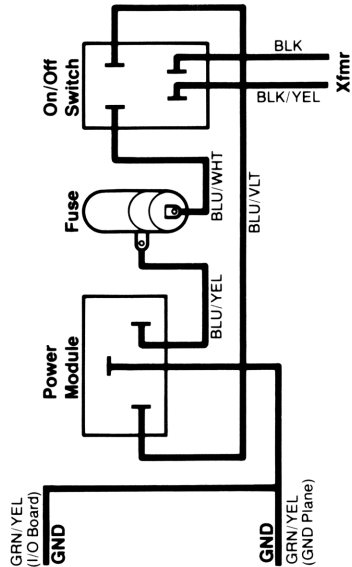
Motor Assembly



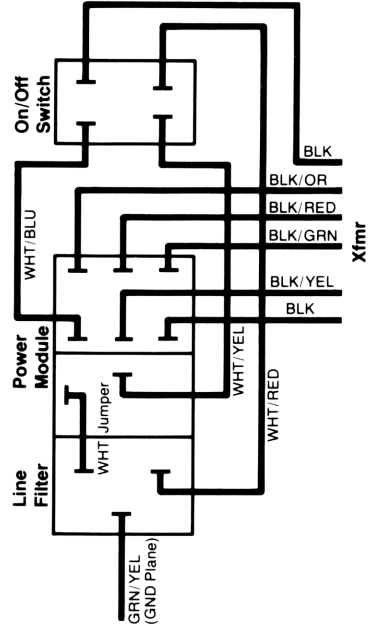
Home Switch Assembly



Mainframe Assembly



2225C with U.S. Rear Panel



2225A/2225C with
International Rear Panel/2225D

Figure 6-8, Miscellaneous Circuits

Sales and Support Offices

Product Line Sales/Support Key

Key Product Line

- A** Analytical
- CM** Components
- C** Computer Systems Sales only
- CH** Computer Systems Hardware Sales and Services
- CS** Computer Systems Software Sales and Services
- E** Electronic Instruments & Measurement Systems
- M** Medical Products
- P** Personal Computer Products
- * Sales only for specific product line
- ** Support only for specific product line

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August 1984

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**FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE
STATEMENT (U.S.A. ONLY)**

"This equipment generates and uses radio frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type-tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient the receiving antenna.
- Re-locate the computer with respect to the receiver.
- Move the computer away from the receiver.
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits."

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the FCC helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington D.C. 20042, Stock No. 004-000-00345-4.

