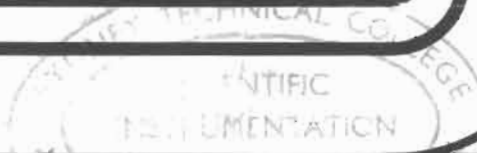# HEWLETT PACKARD

Display Terminals
2622A/D

Graphics Terminal
2623A

service manual

Preface

This manual provides field service information for the HP 2622A, 2622D, and 2623A Terminals. This manual is intended to be used by qualified service personnel to install and service the terminal. Because of product design, a modular repair philosophy has been implemented to minimize on-site repair time. There are three other manuals associated with this Service Manual: two *User Manuals*, and a *Reference Manual*. These manuals are listed below:

- *HP 2622A Display Terminal User's Manual*, part no. 02622-90001

- *HP 2623A Display Terminal User's Manual*, part no. 02623-90001

- *HP 2622A/2623A Display Terminal Reference Manual*, part no. 02622-90002

The User's Manual provides user information for operating the terminal from the keyboard. The Reference Manual provides information for installing and programming the terminal.

WARNING

Always remove AC power before opening the terminal or removing the top cover. If servicing requires that power be on while protective covers are removed, proceed only with extreme caution not to touch exposed areas. Failure to do so can result in serious injury. Heed all WARNING — HAZARDOUS VOLTAGE labels.

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Introduction _____1

INTRODUCTION ....   This section provides an overview of the service manual, lists terminal equipment pro-
vided, and briefly describes the options and accessories available.

MANUAL OVERVIEW ....   The Service Manual consists of the following sections:

Section I — *Introduction.* This section provides a general overview of the service manual,
lists terminal equipment provided and briefly describes the options and accessories
available.

Section II — *Installation.* This section provides procedures for installing the terminal.
Options, accessories, and cabling information are also included in this section.

Section III — *Configuration.* This section provides configuration procedures and status
information for the terminal.

Section IV — *Preventive Maintenance.* This section provides preventive maintenance
information for the terminal.

Section V — *Alignment.* This section provides procedures for adjusting the power supply
and display.

Section VI — *Troubleshooting.* This section provides procedures for isolating terminal
failures to a replaceable assembly or component.

Section VII — *Parts Lists/Repair.* This section provides parts list and repair information for
the terminal. This section also provides removal and replacement procedures for the
terminal's replaceable parts.

Section VIII — *Functional Operation.* This section provides a brief functional description
of the terminal.

EQUIPMENT PROVIDED . . . .   The following equipment and documentation are provided with the terminal:

1. HP 2622A, 2622D, or 2623A terminal with a standard 120V, 60Hz power source configuration.

2. HP 2622A User's Manual, part no. 02622-90001, or HP 2623A User's Manual, part no. 02623-90001.

3. HP 2622A/2623A Reference Manual, part no. 02622-90002.

4. Alignment Tool, part no. 8730-0016.

5. Thermal printer paper (provided only with terminals containing option 050; the integral printer option), part no. 92160A (blue) or 92160B (black).

OPTIONS AVAILABLE . . . .   Options are variations of the standard terminal that are requested by the customer. Available options for the terminal are listed in table 1-1.

Table 1-1.   Terminal Options

OPTION	DESCRIPTION
001	Finnish/Swedish character set and keyboard
002	Danish/Norwegian character set and keyboard
003	French character set and keyboard
004	German character set and keyboard
005	United Kingdom character set and keyboard
006	Spanish Language character set and keyboard
013	240V, 50Hz Power Source
014	100V, 60Hz Power Source
015	220V, 50Hz Power Source
016	100V, 50Hz Power Source
050	Integral Printer
202	Line Drawing Set
900	BS 1363/CEE Power Cable (part no. 8120-1351)
901	ASC112/CEE Power Cable (part no. 8120-1369)
902	GMBH/CEE Power Cable (cable no. 8120-1689)
906	SEV/CEE Power Cable (part no. 8120-2104)
912	SEV/CEE Power Cable (part no. 8120-2956)

ACCESSORIES AVAILABLE . . . . Accessories may be ordered with the terminal or separately from your local Hewlett-Packard Sales and Service Office. Sales and Service Offices are listed at the back of this manual. Terminal accessories are listed in table 1-2.

Table 1-2. Terminal Accessories

MODEL	HP PART NO.	DESCRIPTION
13222C	13222-60003	RS-232C DATACOMM CABLE (FEMALE) RS-232C 25-pin connector. Length: 6.6 ft. (2 m)
13222M	13222-60002	EUROPEAN MODEM CABLE (MALE) RS-232C 25-pin connector for interfacing the terminal to the European telephone system via 103- or 202C-type European modems.
13222N	13222-60001	U.S. MODEM CABLE (MALE) RS-232C 25-pin connector for interfacing the terminal to an HP 1000, 2000, or 3000 multiplexer; to a 103A, 202C/D/S/T, 212A, or VADIC 3400 modem; or to an acoustic coupler (signal compatible only).
13222Y	13222-60005	EMP PROTECT (MALE) RS-232C 25-pin connector for interfacing the terminal to an HP 1000, 2000, or 3000 multiplexer. Provides protection from lightning-induced transients. For use in hardwired configurations only. Length: 16.7 ft. (5 m)
13232U	5061-2403	MODEM BYPASS (FEMALE) RS-232C 25-pin connector on both ends. It crosses the signals so that two terminals (DTE devices) can communicate with one another. Length: 5 ft. (1.5 m)

Table 1-2. Terminal Accessories (Continued)

MODEL	HP PART NO.	DESCRIPTION
13242G	13242-60010	RS232 PRINTER CABLE (MALE) Male RS-232C 25-pin connector for interfacing the terminal to RS-232C compatible printers such as the HP 2631 and 2635. Length: 15 ft. (4.5 m)
13242H	13242-60011	RS232 PRINTER CABLE (FEMALE) Female RS-232C 25-pin connector for interfacing the terminal to RS-232C compatible printers such as the HP 2631 and 2635. Length: 15 ft. (4.5 m)

Notes: 1. EMP = Electromagnetic Pulse.
2. The gender of the cable refers to the computer or equipment end of the cable.
3. Although the terminal is equipped with a 50-pin datacomm connector, it is compatible with the 25-pin connector cables listed in this table.

SPECIFICATIONS ....
For terminal specifications, refer to the HP 2622A, 2622D, or 2623A Terminal Data Sheet, which is available from your local HP Sales and Service Office.

Installation

INTRODUCTION ....

In addition to procedures for installing the terminal, this section provides instructions for opening and closing the terminal, removing and replacing the mainframe on the support (figure 2-1), and interfacing information.
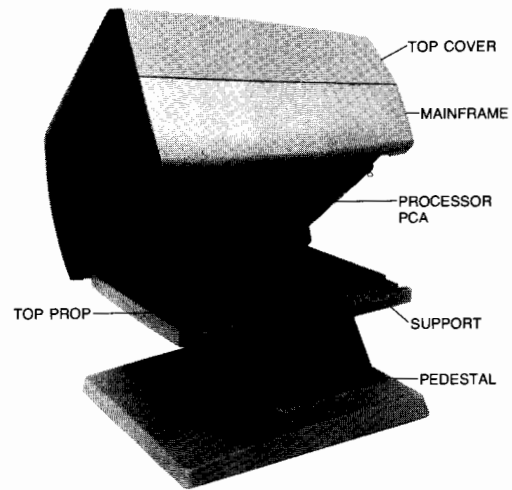
Figure 2-1. Terminal in Half-Open Position

Opening and Closing the Terminal

WARNING

Always remove AC power before opening the terminal or removing the top cover. If servicing requires that power be on while protective covers are removed, proceed only with extreme caution not to touch exposed areas. Failure to do so can result in serious injury. Heed all WARNING — HAZARDOUS VOLTAGE labels.

OPENING THE TERMINAL . . . .

1. Using a small Phillips-head screwdriver, loosen the quarter-turn fastener (figure 2-2) at the lower left rear of the terminal. Do not overturn the fastener more than a quarter-turn.

2. Hold the pedestal in place with one hand and push forward on the rear of the mainframe to slide the mainframe forward about ¼-inch on the support. While holding down the pedestal, lift the left side of the mainframe until it tilts approximately 45 degrees and the top prop locks the mainframe in the half-open (service) position.

POWER SOURCE LABEL

POWER SWITCH

POWER CONNECTOR

QUARTER-TURN FASTENER

DATA COMM CONNECTOR

BATTERY SUPPORT CLIPS

KEYBD CONNECTOR

OPTION LABEL

SERIAL TAG
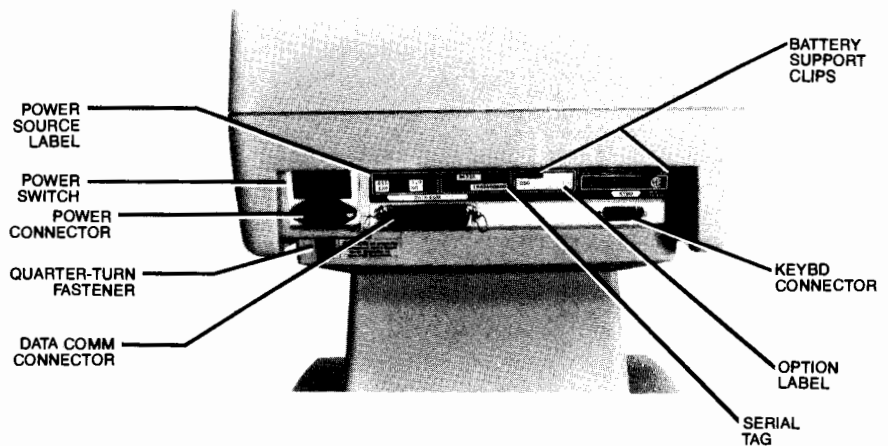
REMOVING THE MAINFRAME
FROM THE SUPPORT ....

To remove the mainframe from the support, proceed as follows:

1. Remove the top cover from the terminal by loosening the two quarter-turn fasteners at the top of the terminal. Do not overturn the fasteners.

2. Open the terminal to the half-open (service) position.

3. Disconnect the ground strap from the Processor PCA ground lug.

4. Lower the Processor PCA by unsnapping the four corner snap fasteners which hold it in place.

5. Disconnect the fan cable (if installed) from the FAN connector (J1) on the Power Supply PCA and pull it through the mainframe assembly so that it lies on the support.

CAUTION

When securing snap-in fasteners, always install each snap-in grommet into its respective fastening hole before pushing in on each snap-in plunger. Observe that each snap-in plunger clicks to ensure that the snap-in fastener is fully seated and secured. Failure to do so will result in an insecure assembly which may cause damage or failure to the assembly or terminal.

6. Reinstall the Processor PCA and reconnect the ground strap.

7. Free the mainframe from the top prop by squeezing the upper end of the top prop (figure 2-3) while exerting an upward force on the left side of the mainframe.

CAUTION

Use extreme care when freeing the mainframe from the top prop and pedestal. Failure to do so may result in damage to the terminal or injury to yourself.

8. With the mainframe free of the top prop, slide the mainframe forward an additional ¼-inch past the detents until the right side clears the fixed hinges (figure 2-3) on the right side of the support; then lift the mainframe free of the support.
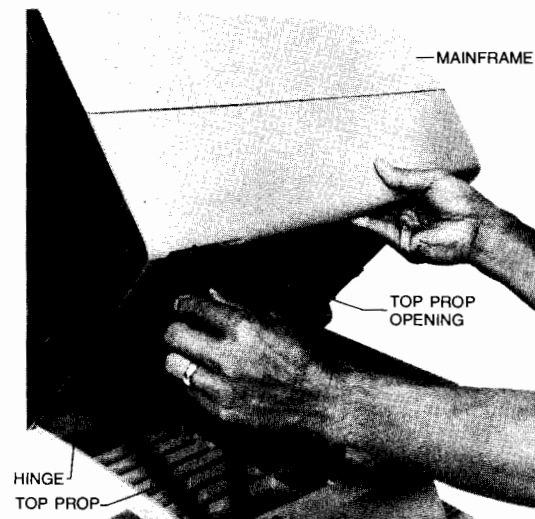
Figure 2-3. Freeing Mainframe from the Top Prop

REPLACING THE MAINFRAME ON THE SUPPORT ....

1. Hold the mainframe above the support in a tilted position with the left side up to clear the top prop, and the right side down so that the fixed hinges on the right side of the support enter the hinge openings (figure 2-4) along the right lower edge of the mainframe. Then slide the mainframe rearward past the detents approximately ¼-inch to lock the hinges.

2. While guiding the top prop so it enters the top prop opening (figure 2-3) in the lower left edge of the mainframe, lower the left side of the mainframe until the top prop locks the mainframe in the half-open (service) position.

3. On terminals equipped with a fan, make sure the fan cable is routed correctly and seated securely in the support slots and cable clip. Failure to do so may cause unusual cable wear which may cause possible shorts.
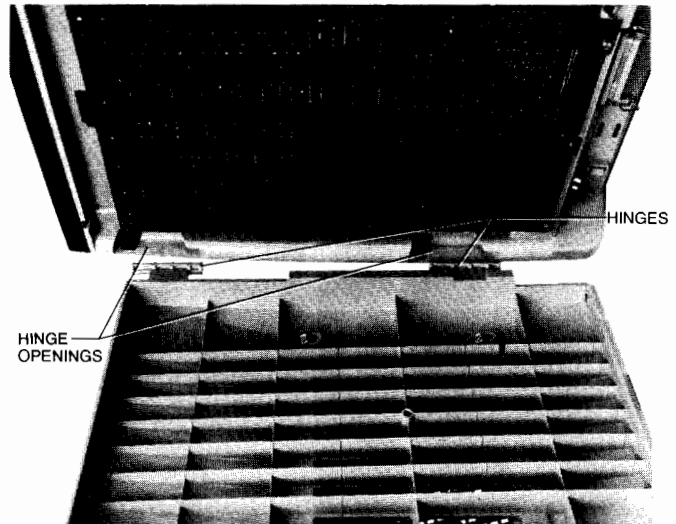
Figure 2-4. Mating the Hinges to the Hinge Openings

CLOSING THE TERMINAL ....

1. While holding the terminal mainframe with one hand to keep it from falling into the closed position, raise it slightly and squeeze the upper end of the top prop to release the catch. Then lower the mainframe to the closed position.

2. Push on the front of the mainframe to slide it rearward approximately ¼-inch or until it stops.

3. Use a small Phillips-head screwdriver to tighten the quarter-turn fastener at the left rear of the terminal. Do not overtighten the quarter-turn fastener.

Installing the Terminal

PROCEDURE ....

1. Check that the available power source matches the power source for which the power supply is designed, as marked on the power source and option labels at the rear of the terminal (figure 2-2).

2622A/D Terminal Power Supply (02620-60004)

OPTION	POWER SOURCE	FUSE PART NUMBER	FUSE SOCKET	FUSE SIZE
STD	120V, 60 Hz	2110-0002	120V, 2A	250V, 2.0A
013	240V, 50 Hz	2110-0001	240V, 1A	250V, 1.0A
014	100V, 60 Hz	2110-0083	100V, 2.5A	250V, 2.5A
015	220V, 50 Hz	2110-0001	220V, 1A	250V, 1.0A
016	100V, 50 Hz	2110-0083	100V, 2.5A	250V, 2.5A

2623A Terminal Power Supply (02620-60060)

OPTION	POWER SOURCE	FUSE PART NUMBER	FUSE SOCKET	FUSE SIZE
STD	120V, 60 Hz	2110-0002	120V, 2A	250V, 2.0A
013	240V, 50 Hz	2110-0001	240V, 1A	250V, 1.0A
014	100V, 60 Hz	2110-0083	100V, 2.5A	250V, 2.5A
015	220V, 50 Hz	2110-0001	220V, 1A	250V, 1.0A
016	100V, 50 Hz	2110-0083	100V, 2.5A	250V, 2.5A

Terminals Equipped with Option 050 Power Supply (02620-60019)

OPTION	POWER SOURCE	FUSE PART NUMBER	FUSE SOCKET	FUSE SIZE
STD	120V, 60 Hz	2110-0010	X1	250V, 5.0A
013	240V, 50 Hz	2110-0083	X1	250V, 2.5A
014	100V, 60 Hz	2110-0010	X2	250V, 5.0A
015	220V, 50 Hz	2110-0083	X1	250V, 2.5A
016	100V, 50 Hz	2110-0010	X2	250V, 5.0A

2. Remove the top cover by loosening the two quarter-turn fasteners at the top of the terminal. Do not overturn the fasteners.

3. Check that the fuse is inserted in the set of fuse holders which comes closest to matching the power source (figures 2-5 through 2-7). Also check that the amperage rating of the fuse is as indicated on the Power Supply PCA.
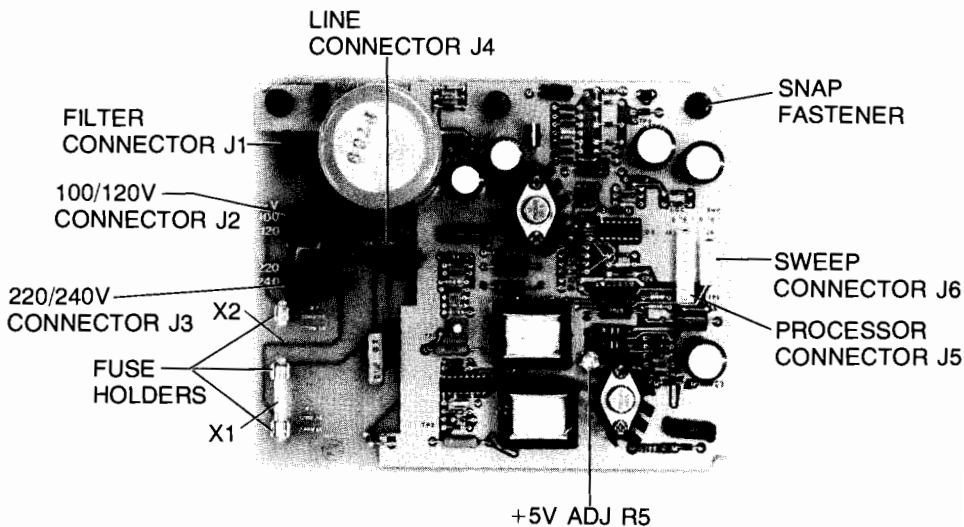
Figure 2-5.   2622A/D Power Supply PCA (02620-60004)
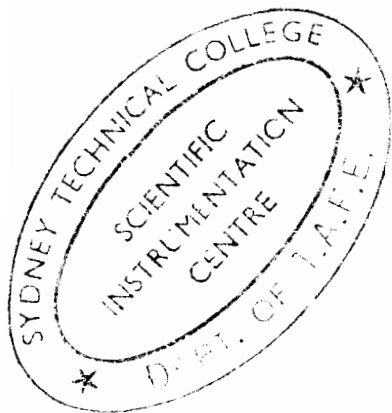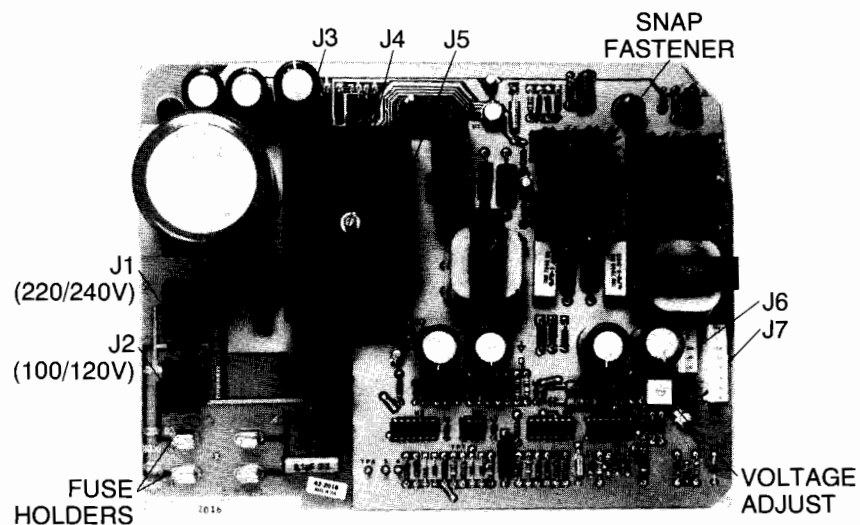
Figure 2-6. 2623A Power Supply PCA (02620-60060)
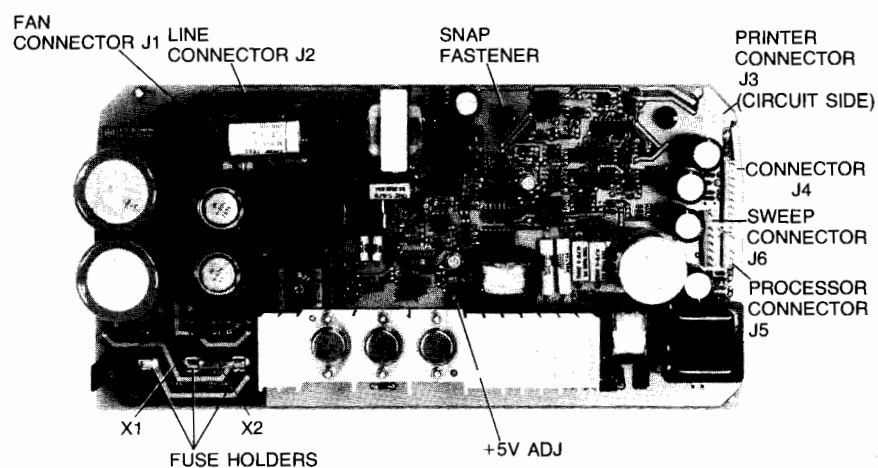
Figure 2-7. Option 050 Power Supply PCA (02620-60019)

4. Check that the power supply cables are properly connected.

5. Check that the battery is installed with the proper polarity as marked on the battery support.

6. Position the keyboard in front of the terminal and connect the keyboard cable to the KYBD connector at the lower right rear of the terminal (figure 2-2).

7. Slide the keyboard cable connector lock to the right (as viewed from the rear) to secure the keyboard cable to the KYBD connector.

8. If applicable, connect the data communications cable to the DATA COMM connector at terminal rear and latch the two securing latches at each side of the connector.

9. Connect the power cord to the power connector at the left rear of the terminal, then turn on the power switch and allow time for the terminal to warm up (about 15 seconds).

10. Perform the power supply adjustment procedures and check the raster alignment (refer to the Alignment Section for details).

11. Reinstall the top cover.

12. Perform terminal self-test (refer to the self-test procedure in the Troubleshooting Section).

13. Put the terminal in configuration mode and configure the straps as desired (refer to the Configuration Section).

14. Turn off terminal power, wait 2 to 5 minutes, then turn on terminal power and check that the strapping remains as it was configured.

Thermal Paper

INTRODUCTION .... The terminal printer uses thermal print paper for its thermal print mechanism (TPM). Hewlett-Packard thermal print paper is especially formulated for prolonged print head life. If Hewlett-Packard's thermal print paper is not used, the equipment warranty and service contract will be void. The part numbers for Hewlett-Packard's thermal print paper is as follows: blue printing 92160A (box of 24), black printing 92160B (box of 24).

PAPER LOADING .... To load a paper roll into the TPM, perform the following:

1. Raise the TPM door to gain access to the TPM.

2. Raise the door latch (figure 7-13) and remove the remaining paper and paper core (if any) and rod from the TPM mainframe.

3. Remove the rod from the old core and insert the rod through the core of a new paper roll.

Note

One side of the thermal paper is coated with printing material (the glossy side) and it must be installed correctly to produce the print image. See the embossed illustration on the underside of the TPM door for correct paper roll installation.

4. With the leading edge of the paper roll facing out (as viewed from the front), place the paper roll and rod into the slotted guides of the TPM housing. Press the paper roll down and toward the rear of the TPM until it clicks into place.

5. Feed the leading edge of the paper roll toward the front between the latching frame and the clear plastic tear window. Be careful not to sharply touch the print head because damage may result.

6. Lower the latching frame without locking it into place.

7. Align the paper roll sides with guide lines embossed on each side of the tear window.

8. Feed approximately 12 inches of paper through the latching frame so that the glue spot is beyond the print head and tear window. The glue spot, which holds the paper roll together, must not be allowed to come in contact with the print head during print operations.

9. Press down on the latching frame until it locks into place with an audible click.
10. Tear off the excess paper using the edge of the tear window as a cutting edge.
11. Close the TPM door securely.

Note

If subsequent print operations appear normal except that no print image appears, the paper may have been installed backwards. An image can be printed only on one side of the paper.

Interfacing Information

SIGNAL CHARACTERISTICS ....

DATA SIGNALS. The characteristics for data signals are as follows:

SPACE	MARK
Logic 0	Logic 1
>+3V but <+25V	<−3V but >−25V

CONTROL AND TIMING SIGNALS. The characteristics for control and timing signals are as follows:

ON (ACTIVE)	OFF (INACTIVE)
Logic 1	Logic 0
>+3V but <+25V	<−3V but >−25V

CABLING ....

Pin-to-pin wiring for data communication cables is shown in figures 2-8 to 2-13. Table 2-1 translates the RS232C/CCITT V.24 (European equivalent) signal identification code for each signal to the name of the signal. For additional information, refer to the *HP Cabling Manual*, part no. 5952-2047.
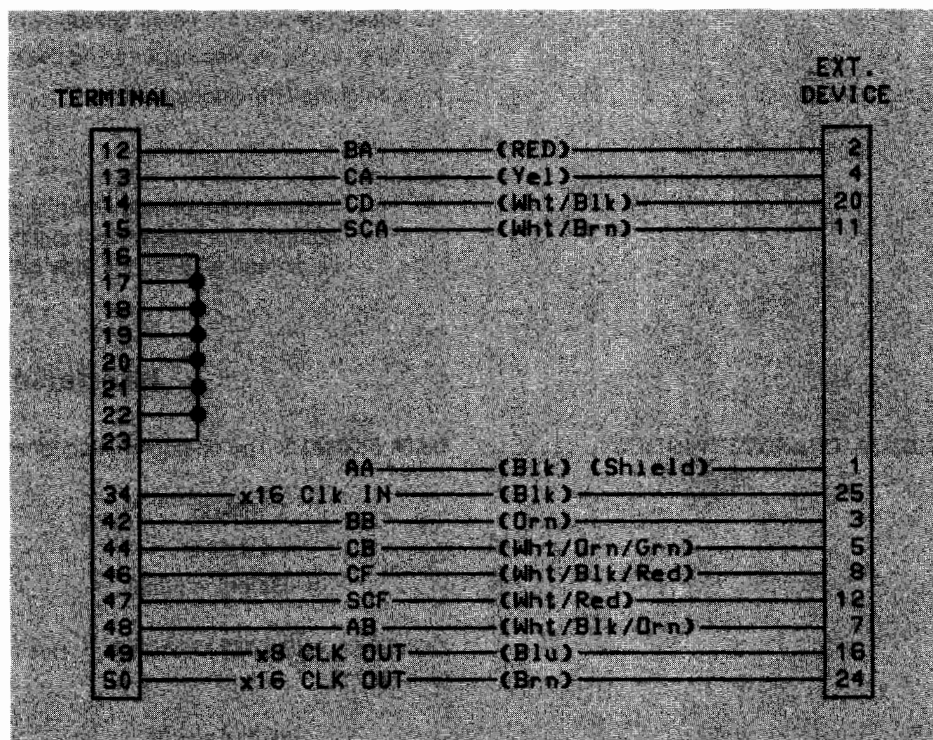
Figure 2-8.   13222C (RS232C) Cable Wiring
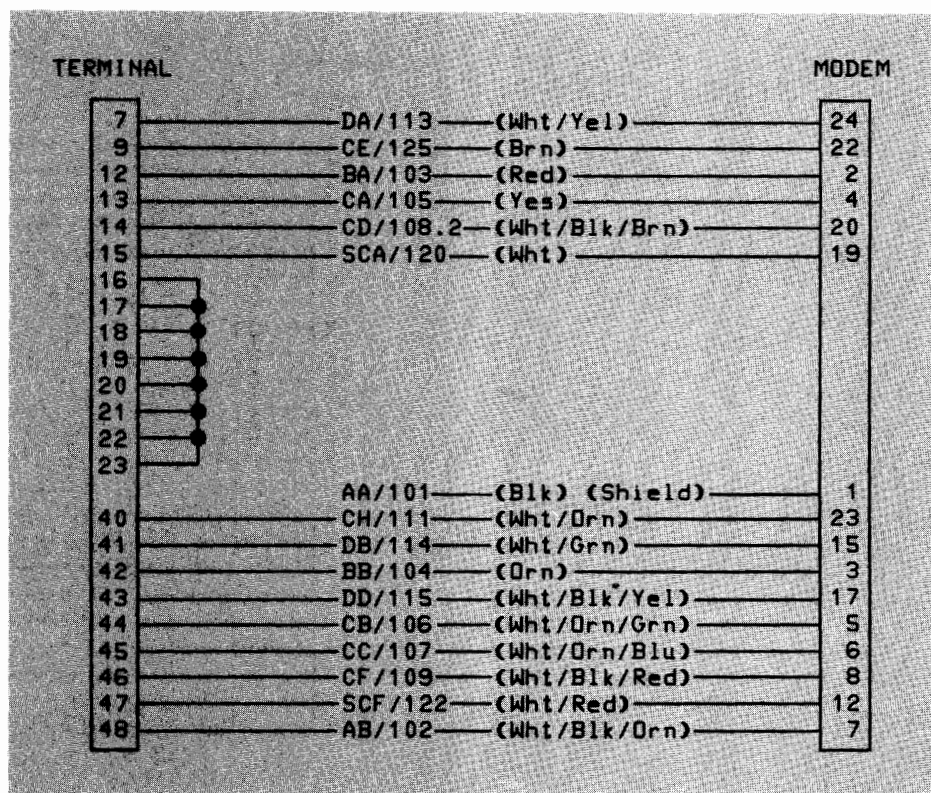
Figure 2-9. 13222M (European Modem) Cable Wiring
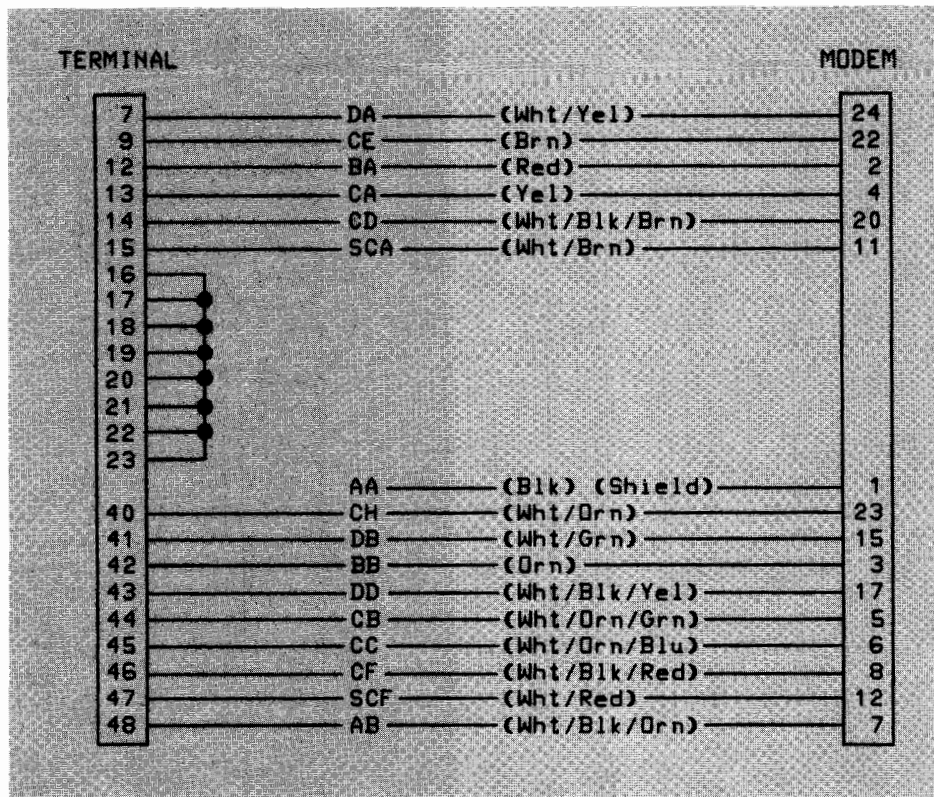
Figure 2-10. 13222N (U.S. Modem) Cable Wiring
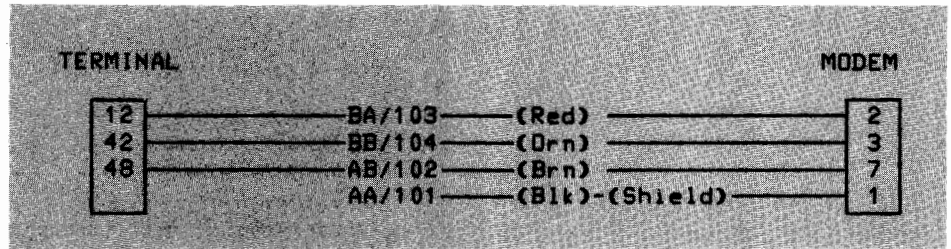
Figure 2-11. 13222Y (Three Wire/Male) Cable Wiring
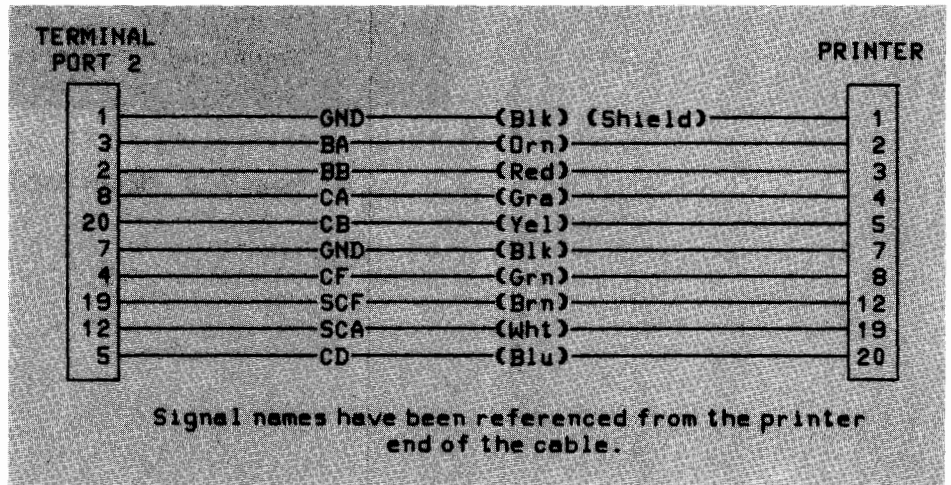
Figure 2-12. 13242G RS232C Printer Cable (Male) Wiring
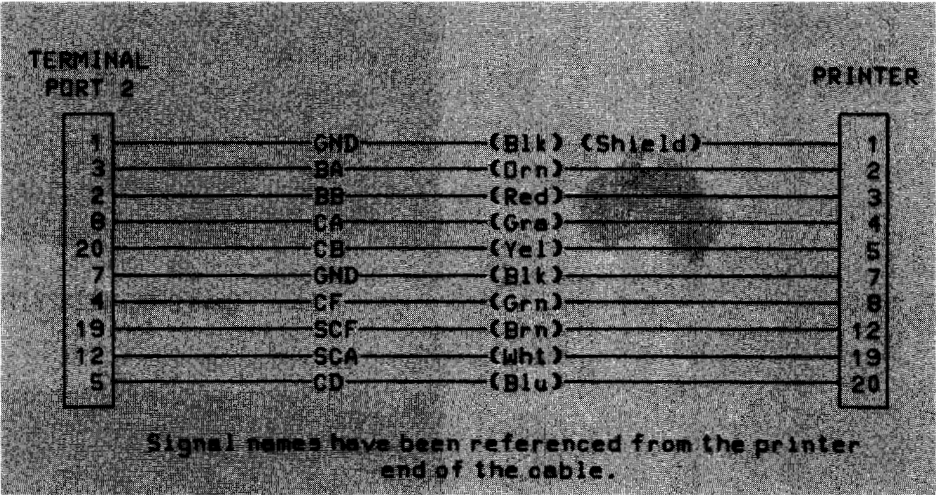
Figure 2-13. 13242H RS232C Printer Cable (Female) Wiring

Table 2-1. RS232C/CCITT V.24 Signal Code-to-Name Translation

CODE		NAME
RS232C	CCITT V.24	
AA	101	Protective Ground
BA	103	Transmitted Data (Data Out)
BB	104	Received Data (Data In)
CA	105	Request To Send
CB	106	Clear To Send
CC	107	Data Set Ready
AB	102	Signal Ground (Common Return)
CF†	109†	Received Line Signal Detector
SCF†	122†	Secondary Received Line Signal Detector
DB†	114†	Transmission Signal Element Timing
DD†	115†	Receiver Signal Element Timing
SCA†	120†	Secondary Request To Send
CD	108.2	Data Terminal Ready
CE	125	Ring Indicator
CH	111	Data Signal Rate Selector
DA†	113†	Transmit Signal Element Timing
x16 Clock In*†		Receive Timing
x16 Clock Out*†		Transmit Timing
x8 Clock Out*†		Transmit Timing

*These signals do not conform to the RS232C/CCITT V.24 voltage levels.
†The terminal does not use these signals.

CABLE FABRICATION .... Parts for cable fabrication are available from Hewlett-Packard if you should need to fabricate your own cable. The required parts are shown in figures 2-14 and 2-15.
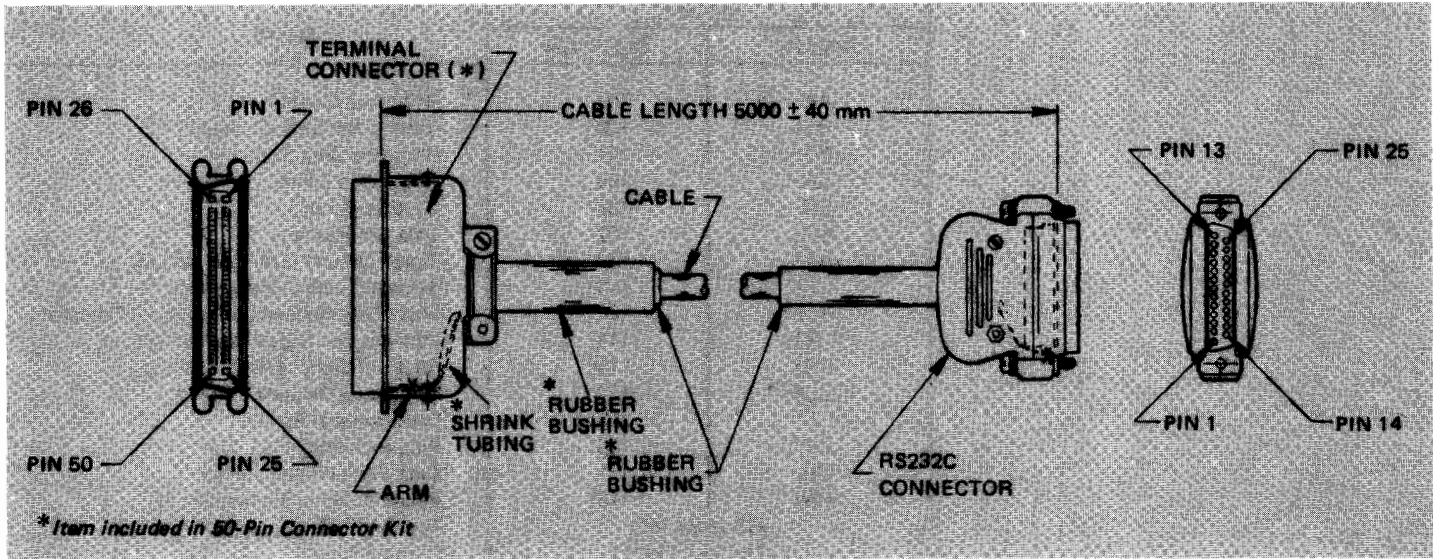
Figure 2-14. 13222 Series Cable Fabrication (Port 1)

ITEM	13222C (RS232C CABLE)	13222M EUROPEAN MODEM CABLE	13222N U.S. MODEM CABLE	13222Y 3-WIRE CABLE*
Cable	8120-1950	8120-2398	8120-2398	8120-2849
50-Pin Kit	5061-2412	5061-2412	5061-2412	5061-2412
Terminal Connector	1251-0086	1251-0086	1251-0086	1251-0086
Shrink Tubing	0890-0311	0890-0311	0890-0311	0890-0311
Rubber Bushing (11.1 mm)	1251-0171	1251-0171	1251-0171	1251-0171
Rubber Bushing (7.9 mm)	1251-0352	1251-0352	1251-0352	1251-0352
RS232C Connector (male/female)	5061-2405	5061-2405	5061-2405	5061-2405

*Cable 13222Y is male.

INSTRUCTIONS .... Instructions for fabricating an HP 13222 series cable (figure 2-14) are as follows:

1. Solder a bare wire, size 24 AWG, between the pins connected together in figures 2-8 though 2-11.

2. Solder a black wire, size 24 AWG, to the cable shielding at the RS232C connector end only. (This wire carries the RS232C signal code AA.)

3. At the terminal connector, place shrink tubing over the extended bare arm in the connector housing. Then solder the cable shield flat to the arm which extends from the pin portion of the connector.

4. At the RS232C connector, solder the cable shield flat to the inside of the connector shell.

5. Strip the ends of the cable wires and solder them to the connector pins at the terminal connector.

6. At the RS232C connector end of the cable, strip the ends of the wires, insert them in the pins, crimp the pins, and insert them into the connector shell.
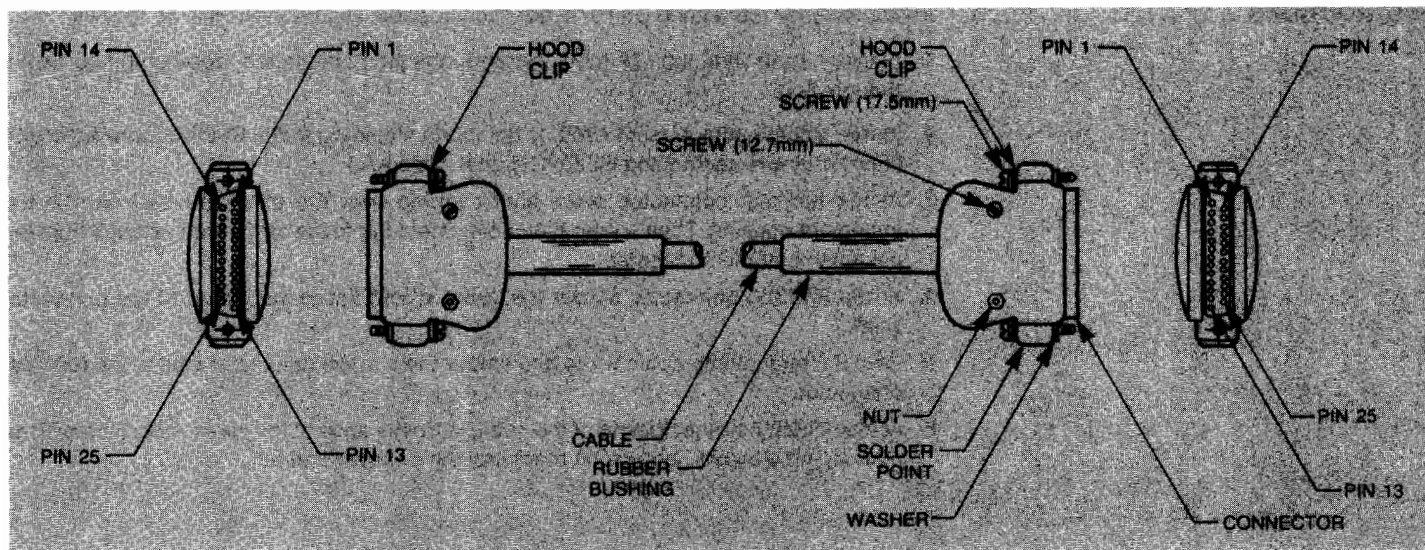
Figure 2-15. 13242 Series Cable Fabrication (Port 2)

ITEM	13242G (RS232C CABLE)	13242H (RS232C CABLE)
Cable	8120-1950	8120-1950
RS232C Connector Kit	5061-2405 (2)	5061-2405 (2)
Shrink Tubing	0890-0311	0890-0311
Rubber Bushing (7.9mm)	1251-0352 (2)	1251-0352 (2)

INSTRUCTIONS ....

Instructions for fabricating an HP 13242 series cable (figure 2-15) are as follows:

1. Strip the outer jacket from each end of the cable for distance of 30 mm. Separate the braided shield from the wires.

2. Strip the ends of the cable wires to be used (see figures 2-12 and 2-13) for insertion into pins and clip off all wires which will not be used at the termination of the outer jacket.

3. Insert each wire to be used into a pin, crimp the pin, and insert each pin into the correct hole in the connector (figure 2-15).

4. Strip one end of the 100 mm section of wire (part no. 8150-0447), insert it into a pin and insert the pin into pin hole 1 of the connector.

5. Solder the other end of the 100 mm section of wire to the braided shield at the point where the shield exits from the outer jacket of the cable.

6. Break off the cable guide pin to provide more room for the following operation. Then slide the 50 mm section of heat shrink tubing (part no. 0890-0732) over the shield, solder the end of the shield flat to the connector, and shrink the tubing.

7. After performing the above operations on each end of the cable, test the cable from the pins on one end to the pins on the other end for continuity and short circuits.

8. Lay the connector and cable end in place on a connector half shell, lay two of the longer (17.5 mm) 4-40 screws (each with a hood clip and lockwasher threaded on it) in place at each side of the half shell, then place another connector half shell over it, and secure them together with the two shorter (12.7 mm) 4-40 screws.

Configuration _____ 3

INTRODUCTION ....
This section provides both configuration and terminal status information. Hardware and software configuration are used; hardware configuration consists of ten switches located on the integral printer PCA. Software configuration is done on two menus; the Terminal Configuration menu and the Datacomm menu. Refer to the Reference Manual for a detailed explanation of each menu.

WHY ....
Configuration might be a source of seeming terminal malfunction. For example, if the terminal is in Remote mode and local echo is inhibited on the Terminal Configuration menu, no characters appear on the screen when keyboard keys are pressed. Also, for communication to occur between the terminal and the computer, the handshake selected on the terminal menus must be compatible with what the computer expects. For a detailed explanation of the terminal menus, refer to the Reference Manual.

The two sets (primary and secondary) of terminal status bits supply assorted information on the current configuration and condition of the terminal.

HOW ....
The hardware configuration selections are made by setting ten microswitches on the integral printer PCA. Software configuration is done by entering values in the two configuration menus.

WHEN ....
The software configuration is easily changed, requiring no more than keystrokes, and can be changed whenever desired. The hardware straps are set in one of two configurations, depending on the ROM(s) used on the integral printer PCA. The configuration should be set at installation time and should not be changed unless the ROM type is changed.

CONFIGURATION .... The following discussion covers software and hardware configuration.

SOFTWARE CONFIGURATION

Software configuration consists of changing entries on the Terminal, Datacomm, and External Printer (2623A only) Configuration menus (figures 3-1 through 3-5). The following discussion describes how to display a menu on the screen, how to change an entry on a menu, and lists the menu options and describes the function of each one.

TO DISPLAY A MENU. A menu is called to the screen by pressing 📟 , "**config keys**", and the key for the desired menu, in sequence.

TO CHANGE A MENU ENTRY. A menu entry is changed by positioning the cursor at the half-bright or full-bright/underlined portion of the entry to be changed and making the desired selection. The cursor can be positioned either by use of the 📟 or cursor control keys. Half-bright entries are changed from the keyboard. Full-bright/underlined entries must be changed by using the "**NEXT CHOICE**" or "**PREVIOUS CHOICE**" keys to cycle through a preselected list of selections contained in the firmware until the desired selection is displayed. After all menu entries are as desired, press the "**save config**" key to activate the selections.

TERMINAL CONFIGURATION. Figures 3-1 and 3-2 illustrate the terminal configuration and the default values. Refer to the Reference Manual for a description of the menu fields.

Figure 3-1. 2622A Terminal Configuration Menu

```
                         TERMINAL CONFIGURATION
                                      FrameRate 60
            Language [ USASCII ]
            ReturnDef [R]

       LocalEcho OFF     CapsLock OFF      Start Col 01     Ascii 8 Bit [NO]
     XmitFnctn(A) [NO]     SPOW(B) [NO]  InhEolWrp(C) [NO]  Line/Page(D) [LINE]
     InhHndShk(G) [NO]   Inh DC2(H) [NO]   Esc Xfer(N) [NO]   Compat(P,Q) [  OFF  ]

    FldSeparator [R]    BlkTermnator [R]
```

Figure 3-2. 2623A Terminal Configuration Menu

DATACOMM CONFIGURATION. The datacomm configuration menu is shown in figures 3-2. The values shown are the default values. Refer to the Reference Manual for a description of all menu fields.

```
                         DATACOMM CONFIGURATION
     BaudRate [ 2400 ]     Parity [0'S]
                                                        EnqAck [YES]
                       Chk Parity [NO]      SR(CH) [0]

     RecvPace [None  ]
     XmitPace [None  ]                               CS(CB)Xmit [NO]
```

Figure 3-3. 2622A Default Datacomm Configuration Menu

3-3

```
                    DATACOMM CONFIGURATION
    BaudRate [2400    Parity O'S]
                    Chk Parity [NO      SR(CH) [0             EnqAck YES

    RecvPace None    ]
    XmitPace None                                CS(CB)Xmit [NO
```

Figure 3-4. 2623A Default Datacomm Configuration Menu

EXTERNAL DEVICE CONFIGURATION. The 2623A is equipped with a second port which can be connected to an external printer. Figure 3-5 gives the default values for the external device configuration menu. Refer to the Reference Manual for a description of all menu fields.

```
                    EXTERNAL DEVICE CONFIGURATION
    BaudRate [2400     Parity O'S]   PrinterCode4 EXT   PrinterNulls 000

                                     SRRXmit  [NO
    XmitPace None    ]               SRRInvert [NO      CS(CB)Xmit [NO
```

Figure 3-5. External Device Configuration Menu

3-4

HARDWARE STRAPPING

Hardware strapping consists of setting ten microswitches on the integral printer PCA and, therefore, is done only on option 050 terminals. Two strapping configurations are used depending on the type of IC used in location U21 on the printer PCA. If an 1820-2432 or 1820-2561 type IC is used, switch 8 is the only switch closed. If an 1820-2271 type IC is used, switches 2 and 9 are the only closed switches. Figure 3-6 illustrates the location of the switches.

NOTE

There are two printer configurations. Set the printer switch block as follows:

U21 - 1820-2271
U11 - 1818-1160

Switch 2, 9 closed

```
1 2 3 4 5 6 7 8 9 10
    OPEN
```

U21 - 1820-2432 or 1820-2561
U11 = Not Present

Switch 8 closed

```
1 2 3 4 5 6 7 8 9 10
    OPEN
```

```
1 2 3 4 5 6 7 8 9 10
 ---- OPEN ----
```
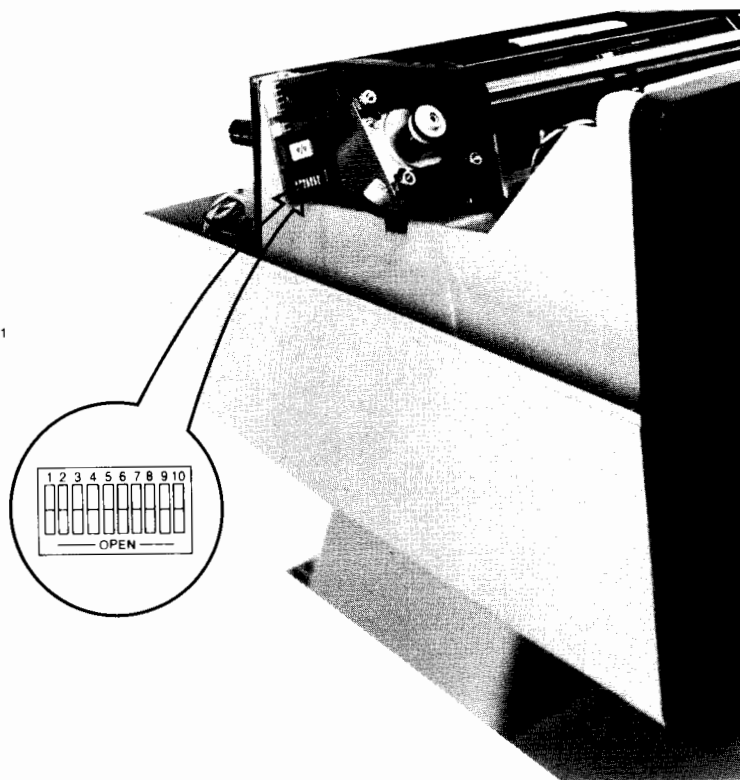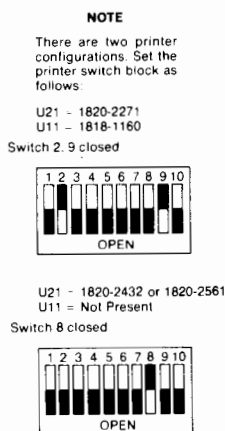
Figure 3-6. Printer PCA Microswitch Location

3-5

STATUS .... Terminal status provides a quick check of assorted terminal conditions including display memory size, data buffer size, various configuration selections, and whether or not the terminal and datacomm self-tests are inhibited. However, the readout is in code and requires interpretation.

Terminal status is obtained by performing a terminal self-test. It is supplied in two parts, primary and secondary (figure 3-7 or 3-8). Both are displayed after a terminal self-test and are made up of 14 status bytes (0-6 for primary and 7-13 for secondary). Each byte appears on the screen as an ASCII character. For each byte, the status information is contained in the lower four bits of each byte. The higher four bits are selected to form the ASCII character (which enables display and printout of the status information). Each byte can appear as one of 16 characters (table 3-1). Figures 3-9 through 3-12 illustrate interpretation of the status code.

Table 3-I. ASCII Status Characters

ASCII CHARACTER	BINARY
0	0011 0000
1	0011 0001
2	0011 0010
3	0011 0011
4	0011 0100
5	0011 0101
6	0011 0110
7	0011 0111
8	0011 1000
9	0011 1001
:	0011 1010
;	0011 1011
<	0011 1100
=	0011 1101
>	0011 1110
?	0011 1111
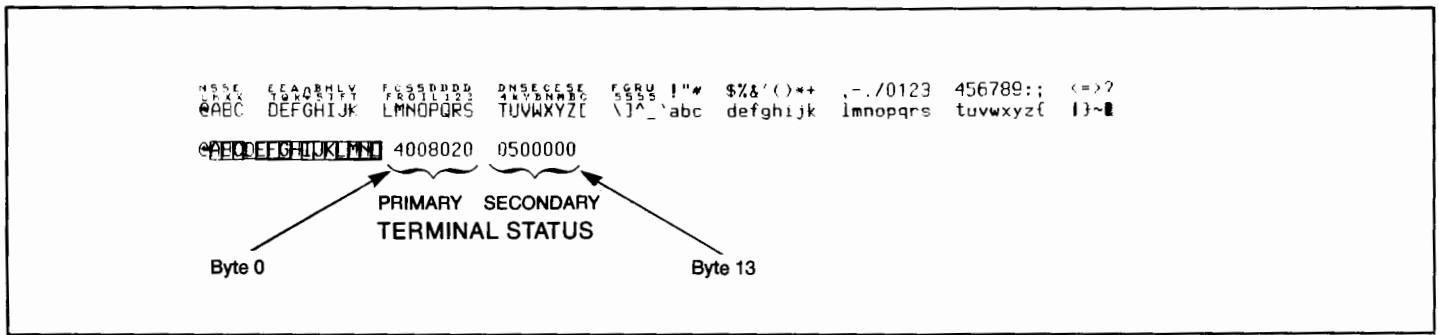
Figure 3-7. 2622A Terminal Self-Test
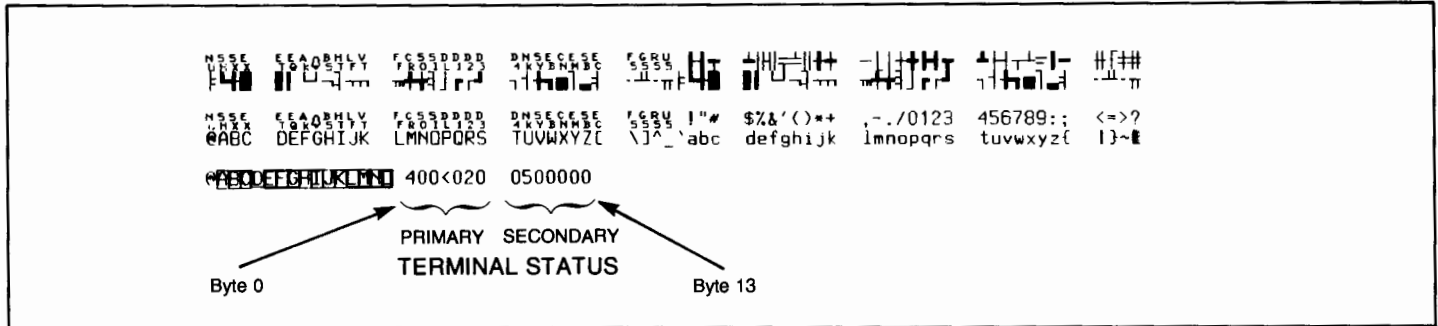
Figure 3-8. 2623A Terminal Self-Test

PRIMARY STATUS BYTES

BYTE 0   DISPLAY MEMORY SIZE

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

16K words

BYTE 2   CONFIGURATION STRAPS E–H

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

Strap H (Inhibit DC2)
1 = yes (Enabled)
0 = no (Disabled)

Strap G (DC2 Handshake)
1 = yes (Enabled)
0 = no (Disabled)

Strap E

Strap F

BYTE 1   CONFIGURATION STRAPS A–D

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

Strap D
Page/Line Transmission
1 = Page
0 = Line

Strap C
(End-of-Line Wraparound)
1 = yes (Disabled)
0 = no (Enabled)

Strap A
(Function Key Transmission)
1 = yes (Transmitted)
0 = no (Not transmitted)

Strap B
(Space Overwrite Latch)
1 = yes (Enabled)
0 = no (Disabled)

BYTE 3   LATCHING KEYS

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

Terminal sends
secondary status

AUTO LF Key
1 = auto LF
0 = no auto LF

CAPS LOCK Key
1 = upper case only
0 = upper and lower case

BLOCK MODE Key
1 = block mode
0 = character mode

Figure 3-9. Interpretation of Primary Terminal Status Code

PRIMARY STATUS BYTES (Continued)

BYTE 4 TRANSFER PENDING FLAGS

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

Secondary Status Pending
1 = yes
0 = no

ENTER Key Pending
1 = yes
0 = no

Cursor Sense Pending
1 = yes
0 = no

Function Key Pending
1 = yes
0 = no

BYTE 6 DEVICE TRANSFER PENDING FLAGS

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

Device Status Pending
1 = yes
0 = no

Device Operation Status
Pending
1 = yes
0 = no

BYTE 5 ERROR FLAGS

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

Device Error
1 = error
0 = no error

Loader Checksum
1 = no error
0 = error

Data Comm
1 = parity or buffer
overflow error
0 = no error

Self-Test
1 = no error
0 = error

Figure 3-9. Interpretation of Primary Terminal Status Code

SECONDARY STATUS BYTES

BYTE 7 BUFFER MEMORY
(always zero)

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

BYTE 9 CONFIGURATION STRAPS J–M
(always zero)

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

Strap M ——————————————— Strap J

Strap L ——————————————— Strap K

BYTE 8 TERMINAL FIRMWARE CONFIGURATION

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

0 = Non-programmable ————
terminal

1 = Terminal ————
identifies
self

———— 1 = I/O firmware installed,
integral printer
present
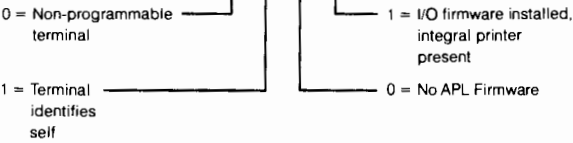
———— 0 = No APL Firmware

APL firmware does not apply.

BYTE 10 CONFIGURATION STRAPS N–R
(always zero)

8	7	6	5	4	3	2	1
0	0	1	1	0	0	0	0
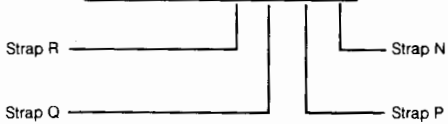
Strap R ——————————————— Strap N

Strap Q ——————————————— Strap P

Figure 3-10. Interpretation of Secondary Terminal Status Code

SECONDARY STATUS BYTES (Continued)

BYTE 11 **CONFIGURATION STRAPS S–V**
(always zero)

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

Strap V ─────────────┐
Strap U ─────────────┐
└───── Strap S
└───── Strap T

BYTE 13 **MEMORY LOCK MODE**

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

└── 1 = memory lock on
0 = memory lock off

BYTE 12 **CONFIGURATION STRAPS W–Z**
(always zero)

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

Strap Z ─────────────┐
Strap Y ─────────────┐
└───── Strap W
└───── Strap X
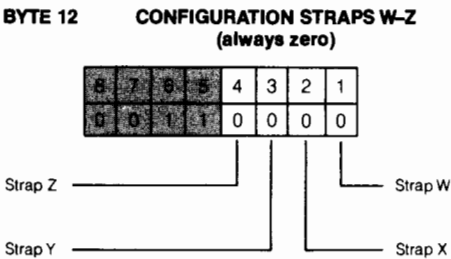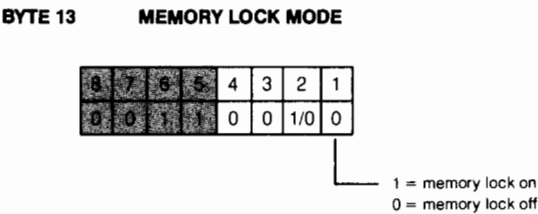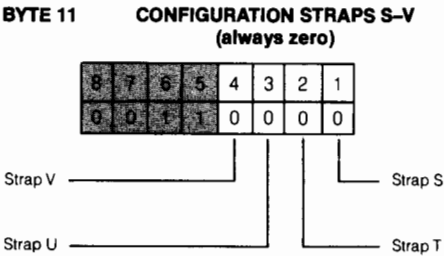
Note: Bytes 9–12 are always 0
(straps J–Z do not apply
to the terminal).

Figure 3-10.   Interpretation of Secondary Terminal Status Code

BYTE NO.	ASCII	BINARY	STATUS
0	4	0 0 1 1 <u>0 1 0 0</u>	4K bytes of display memory
1	0	0 0 1 1 0 0 0 0	Function key tramsmission disabled Space overwrite disabled End-of-line-wraparound enabled Set for line (not page) transmission
2	0	0 0 1 1 0 0 0 0	(Not used) Handshake disabled Inhibit DC2 disabled
3	8	0 0 1 1 1 0 0 0	Upper and lower case letters Character (not block) mode No auto line feed Terminal sends secondary status
4	0	0 0 1 1 0 0 0 0	Cursor sense not pending No function key pending ENTER key not pending Secondary status not pending
5	2	0 0 1 1 0 0 1 0	No datacomm error No self-test error (Not used) No device error
6	0	0 0 1 1 0 0 0 0	Device status not pending Device completion not pending (Not used) (Not used)

Figure 3-11. Primary Terminal Status Example

3-12

BYTE NO.	ASCII	BINARY	STATUS
7	0	0 0 1 1 <u>0 0 0 0</u>	└── No buffer memory
8	5	0 0 1 1 0 1 0 1	└── I/O firmware installed └── (Not used) └── Terminal identifies self └── Not a programmable terminal
9	0	0 0 1 1 <u>0 0 0 0</u>	└── (Not used)
10	0	0 0 1 1 <u>0 0 0 0</u>	└── (Not used)
11	0	0 0 1 1 <u>0 0 0 0</u>	└── (Not used)
12	0	0 0 1 1 <u>0 0 0 0</u>	└── (Not used)
13	0	0 0 1 1 0 0 0 0	└── Locked in row 0 (if memory lock is on) └── Memory lock mode off └── Display memory not full └── (Not used)

Figure 3-12. Secondary Terminal Status Example

Preventive Maintenance_____**INTRODUCTION** ....
This section provides preventive maintenance instructions for the terminal. Preventive maintenance is performed by the customer. It consists of replacing the non-volatile memory battery. In addition, for option 050, procedures for maintaining quality printing are provided.

```
CAUTION
```

Battery contains materials that may require special procedures to discard as dictated by local laws. Check local laws to determine such procedures. Observe battery manufacturer's caution labels.

Battery Replacement

WHY ....
To ensure the contents of the volatile memory are not deleted or distorted because of a weak battery when terminal power is off.

HOW ....
The battery support is removed from the terminal, the battery replaced, and the battery support reinstalled in the terminal.

WHEN ....
The battery should be replaced once a year or if it measures less than 3.2 volts.

Note

Since the shelf life of a battery is one year, stocking batteries is of little use.

EQUIPMENT REQUIRED ....
New battery (HP part no. 1420-0259 or Mallory Duracell TR133) and a voltmeter.

4-1

PROCEDURE .... The battery can be replaced with terminal power on or off. If it is to be done with the power off, the contents of the non-volatile memory (configuration menus) will be lost, making it necessary to copy the contents on paper before replacing the battery. Then, after the battery has been replaced, the contents must be reentered into non-volatile memory. The copy/reenter procedure can be avoided by replacing the battery with power on.

1. If the battery is to be replaced with power on, go to step 2. If not, copy the contents of non-volatile memory onto paper then turn off terminal power.

Note

With option 050, the configuration menus can be copied by the printer. Display the desired menu on the screen and press ▮▮▮▮▮ to copy the menu.

2. To remove the battery from the terminal, compress and pull down on the two battery support clips (figure 4-1) located above the KYBD connector at the rear of the terminal.
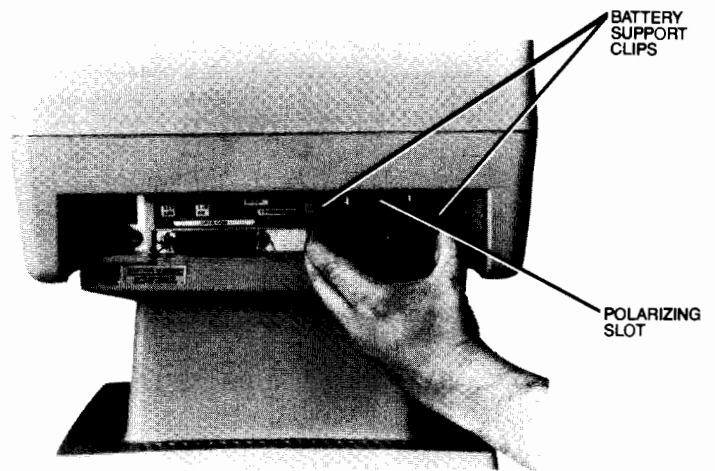
Figure 4-1. Battery Removal

3. Remove the battery from the battery support and measure the battery voltage with a voltmeter. If it measures less than 3.2 volts, replace the battery.

Note

Refer to previous caution in regard to discarding old battery.

4. Insert the new battery in the battery support with the correct polarity, as marked on the battery support.
5. Insert the battery support in the terminal, with the polarizing slot (figure 4-1) facing out, until each end of the battery support clicks into place.
6. If this procedure was performed with power off, reenter the former contents of the non-volatile memory into the non-volatile memory (refer to the Configuration Section).

TPM Preventive Maintenance

WHY .... To ensure quality printing and to prolong optimum performance of the TPM.

HOW .... Follow the preventive maintenance steps as described in the "PROCEDURE" paragraph below.

WHEN .... TPM preventive maintenance should be performed each time thermal paper is to be replaced.

PROCEDURE .... To maintain good print quality and to prolong TPM performance, observe the following:

1. Always replace thermal paper with HP thermal paper, product no. 92160A (blue printing) or product no. 92160B (black printing). If Hewlett-Packard's thermal paper is not used, the equipment warranty and service contract will be void.
2. Install thermal paper with printing (glossy) side facing thermal print head. (Refer to Installation Section.)
3. Be careful not to sharply touch the print head or damage may result.

4-4

Alignment_____5

Alignment procedures for the terminal consist of adjustment of the power supply output and raster alignment.

WARNING

Power Supply contains exposed high-voltage components. Use extreme caution not to touch these exposed parts when performing alignment procedures. Failure to do so can cause serious injury.

Power Supply Adjustment

WHY ....
To ensure that the power supply is generating the voltages required to enable correct operation of all terminal circuits.

HOW ....
Adjustment of the +5V power source also adjusts the +12V power source which uses the +5V source as a reference. The −12V source is not adjustable. On the option 050, the +5V adjustment also affects the +16.1V output.

WHEN ....
Power supply adjustment should be checked at installation and whenever any equipment is added or removed from the terminal.

EQUIPMENT REQUIRED..............
1. A 20,000 ohms/volt voltmeter with a fine voltage probe.
2. Alignment tool 8730-0016, or equivalent.
3. A small Phillips-head screwdriver.

PROCEDURE ....
1. Turn off terminal power.
2. Loosen the two quarter-turn fasteners securing top cover to mainframe. Remove top cover. Do not overturn fasteners.
3. Turn on terminal power.

CAUTION

Use care not to short together exposed Power Supply parts while checking the Power Supply voltages. To do so could result in damage to to the Power Supply.

4. Using a 20,000 ohms/volt voltmeter, check the Power Supply PCA voltages (table 5-1 and figure 5-1, 5-2, or 5-3) for accuracy. A fine-tipped voltage probe can be easily inserted through the holes in the cable connector (J5).

5. Adjust the +5V potentiometer (figure 5-1, 5-2, or 5-3) until the +5V and +12V (and 16.1V for option 050) sources are within tolerance. If they cannot be adjusted to be within tolerance or if the −12V source is out of tolerance, refer to the Troubleshooting Section.

Table 5-1. Power Supply Test Points

	TEST POINTS		SIGNAL	VOLTAGE
2622A/D	2623A	Opt 050		
J5-1	J7-1	J5-1	+5V	+5V(±0.2)VDC
NO PIN	NO PIN	NO PIN	—	—
J5-3	J7-3	J5-3	+5V	+5(±0.2)VDC
J5-4	J7-4	J5-4	+12V	+12(±0.3)VDC
J5-5	J7-5	J5-5	RETURN	—
J5-6	J7-6	J5-6	RETURN	—
J5-7	J7-7	J5-7	PWR ON/FAIL	+4.5(+0.5,−1)VDC
J5-8	J7-8	J5-8	−12V	−12V(±0.6)VDC
—	—	J4-1	+16.1V	+16.1)±0.5)VDC

6. Replace the top cover on the terminal and tighten the two quarter-turn fasteners. Do not overtighten the fasteners.
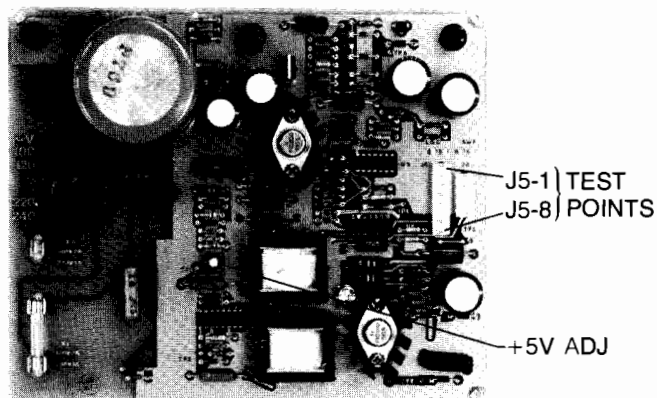
Figure 5-1. 2622A/D Power Supply PCA (02620-60004) Test Points and +5V Adjustment Locations
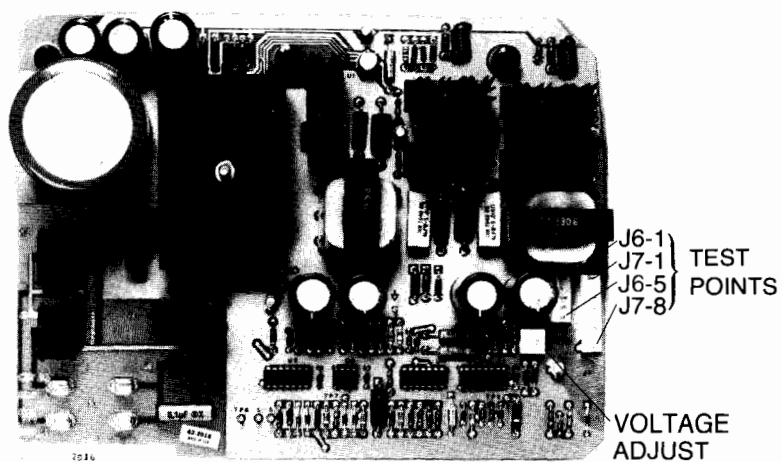
Figure 5-2. 2623A Power Supply PCA (02620-60060) Test Points and +5V Adjustment Locations

5-3
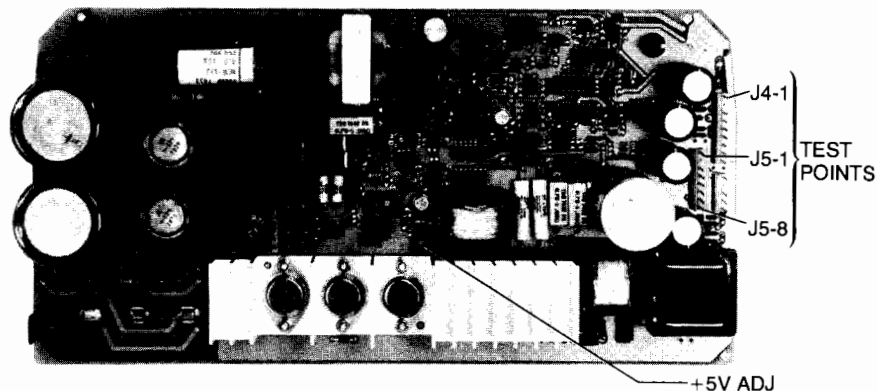
Figure 5-3. Option 050 Power Supply PCA (02620-60019) Test Points and +5V Adjustment Locations

Raster Alignment

WHY .... This procedure performs the following display adjustments:

1. Centers the display on the screen in the horizontal dimension.
2. Expands or contracts the display in the vertical dimension.
3. Focuses the beam for display clarity.
4. Adjusts for desired display brightness.
5. Expands or contracts the display in the horizontal dimension.
6. Adjusts tilt out of the display.

HOW .... With a display on the screen, the CENTER, HEIGHT, FOCUS, and BRIGHTNESS adjustments at the top of the terminal, the width adjustment on the Sweep PCA, and the CRT yoke assembly are adjusted for the desired effects.

WHEN .... Raster alignment can be performed anytime the display is considered unsatisfactory. It should be checked at installation and whenever the Sweep PCA is replaced.

EQUIPMENT REQUIRED . . . .   1. A small Phillips-head screwdriver.

                                                         2. Alignment tool 8730-0016.

PROCEDURE . . . .   1. Open the terminal to the half-open (service) position and lower the Processor PCA to expose the component side of the PCA by pulling on the four snap fasteners which hold it in place. Disconnect the ground strap from the Processor PCA ground lug.

2. Initiate a manufacturing test by pressing the ▦ key, service keys, and "**MANUF TEST**" key, in sequence. The screen should be filled with blank inverse video. (The video generator can also be used to obtain this display.)

3. Using the hex end of the alignment tool, adjust the CENTER adjustment at the top of the terminal (figure 5-4) to center the display on the screen in the horizontal dimension.
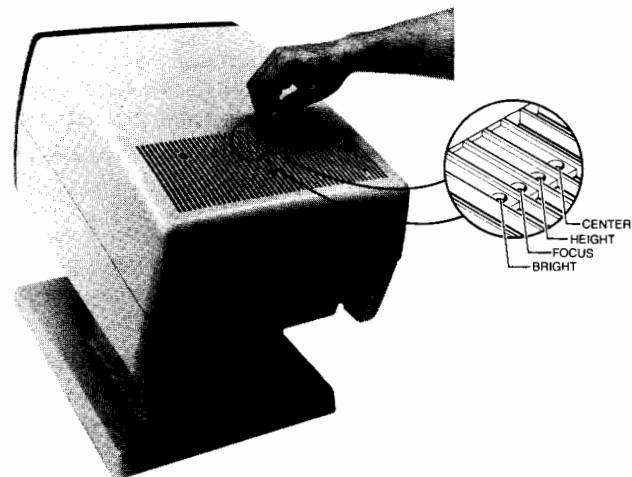
Figure 5-4. Location of Four Raster Adjustments (CENTER, HEIGHT, FOCUS, and BRIGHTNESS)

4. Adjust the HEIGHT adjustment to expand or contract the display in the vertical dimension, as desired.

5. Use the alignment tool to adjust the width adjustment on the Sweep PCA (figure 5-4) to expand or contract the display in the horizontal dimension.

WARNING

Use care in performing the following step; high voltages, sufficient to cause serious injury are present on exposed portions of the yoke assembly. Grasp the yoke only by its plastic donut-shaped body.

6. To adjust a tilted display, the yoke assembly must be rotated on the CRT neck by its plastic donut-shaped body, but first the yoke collar screw (figure 5-5) must be loosened. After the adjustment has been made, retighten the yoke collar screw.

7. Fill the screen with @ signs. If the manfacturing test is being used to control the display (step 2), this can be done by pressing the ▮RETURN▮ key. If the video generator is being used, refer to the discussion in Section 6 on using the video generator.

8. Adjust the FOCUS adjustment for uniform clarity across the screen.

9. Adjust the BRIGHT adjustment for the desired brightness.

10. Replace the Processor PCA by holding it in position (the metal I/O panel on one end of the PCA fits into a groove in the chassis). Install each of the four snap-in grommets into its respective fastening hole and press on each of the four snap-in plungers until they click into place.

11. Reconnect the ground strap to the ground lug on the Processor PCA.

12. Perform a hard reset (press ▮CTRL▮, ▮SHIFT▮, and ▮RESET▮ keys, simultaneously) to end the manufacturing test.
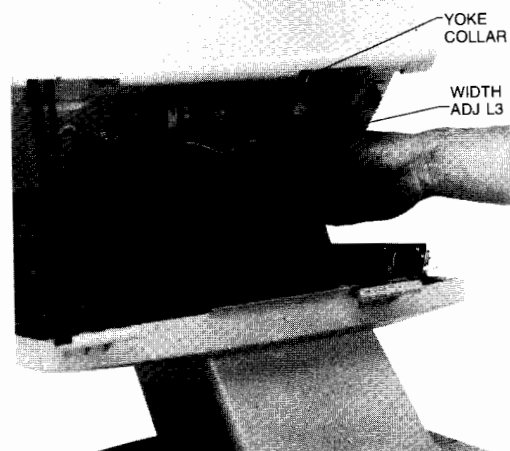
Figure 5-5. Location of Raster Width Adjustment and Yoke Collar

Troubleshooting

INTRODUCTION ....
This section provides troubleshooting information for isolating terminal malfunctions to a replaceable assembly or component, and instructions for using the Video Generator.

WARNING

Power Supply and CRT area contain exposed high-voltage components. Use caution not to touch these exposed parts when working in these areas. Failure to do so can result in serious injury.

Preliminary Troubleshooting

WHY ....
To determine if terminal malfunctions truly exist before attempting any detailed trouble isolation procedures, since most malfunctions are caused by incorrect operation.

HOW ....
Checking terminal installation and any recent servicing for workmanship.

WHEN ....
Preliminary troubleshooting should be performed whenever the terminal is not operating correctly.

PROCEDURE ....

1. Check that the terminal is properly installed (power cord connected and fuse properly installed) and is set to the correct operating mode. Refer to the Installation Section for installation procedures.

2. Determine whether or not any recent service routines (accessory installation, cables removed or installed, power supply or raster adjustments performed) have been performed on the terminal. If so, check for workmanship. Refer to the Alignment Section for alignment procedures.

3. Check to see if battery is within specs. Refer to the Preventive Maintenance Section for details.

4. Check that strapping is properly configured for the terminal. Refer to the Configuration Section for configuring terminal strapping.

Troubleshooting

WHY .... To minimize terminal downtime and to ensure optimum terminal performance.

HOW .... Malfunctions are isolated by performing one or more of the self-tests listed below. Test results are reported using messages printed on the screen. The tests are as follows:

1. Power-on test.
2. Terminal test.
3. Manufacturing test.
4. Datacomm test.
5. Integral printer test.
6. Identify ROMs.

Although the datacomm and printer tests are included in some of the other three tests, they are also individually selectable.

WHEN .... Whenever the terminal is not operating properly after preliminary troubleshooting.

TEST COVERAGE .... Areas covered by the power-on, terminal, and manufacturing tests are listed below. Note that the datacomm test is included in the manufacturing test and the integral printer test is included in the terminal and manufacturing tests. The tests are listed in sequence in which they are performed.

ITEM	TEST		
	PWR-ON	TERM	MANUF
Display memory RAM marching 1's and 0's test.	X		
Display memory contents read, its complement written, verified, and repeated.		X	X
Test of each firmware ROM: 　1. Presence check for each firmware ROM. 　2. Check of identification byte. 　3. Check of configuration address. 　4. Verify ROM by cyclic redundancy check (CRC) on it.	X X X X	X X X X	X X X X
Character ROM test.		X	X
Initialize the terminal.	X		
Perform an integral printer test.		X	X
Non-volatile memory RAM contents read, its complement written, verified, and repeated.		X	X
Bell (beep) test.	X	X	
Datacomm test.			X

ERROR REPORTING .... Results of the self-tests are monitored by messages displayed at the bottom of the screen. Table 6-1 supplies the meaning for the displayed messages. Messages can be cleared by pressing the ▮RETURN▮ key.

Table 6-1. Error Messages

MESSAGE	MEANING
CMOS ERR	Non-volatile memory is failing.
DC ERR#x	Datacomm error where x = 1 thru 8. Refer to table 6-2 for details.
EXT PRNTR ERR#x	External printer error where x = 1 thru 8. Refer to table 6-2 for details.
G RAM ERR	Graphics RAM error test pattern. Refer to figure 6-4 for details.
INTEGRAL PRINTER ERROR	Printer test failed.
RAM ERR#	Failing RAM where x = 1 thru 8 which represents the location of the RAM.

x	RAM	
	2622A	2623A
1	U41	U717
2	U42	U718
3	U43	U719
4	U44	U720
5	U51	U817
6	U52	U818
7	U53	U819
8	U54	U820

Table 6-1. Error Messages (Continued)

MESSAGE	MEANING
ROM ERR#x	Failing ROM where x = 1 thru 6 which represents the location of the ROM.

x	ROM	
	2622A	2623A
1	U63	U912
2	U64	U913
3	U65	U915
4	U66	U916
5	U67	U917
6	U68	U918

MESSAGE	MEANING
Press RETURN to clear	Current test has failed, pressing [RETURN] clears the error and continues the test.

Note: If battery is not working when terminal power is turned on, invalid errors may be displayed. Press [RETURN] to clear errors.

POWER-ON TEST ....

DESCRIPTION. The power-on test (figure 6-1) checks the following items on the Processor PCA:

1. Display memory RAMs.
2. Firmware ROMs.
3. Bell operation.

TO INITIATE THE TEST. The power-on test is initialized automatically each time terminal power is turned on. If the integral printer option is present, the print head moves across and back. The terminal beeps once at the beginning of the test and again once at the end of the test (about 15 seconds later). No message will be displayed if the test is successful. The cursor should be blinking in the upper left corner of the screen.

IF AN ERROR OCCURS. Any error occurring before the terminal is initialized, during the power-on test, is reported by a series of beeps (1–8 beeps = RAM 1–8 and 9–14 beeps = ROM 1–6). The test is halted when an error occurs.

If there are no character ROMs present on the Processor PCA when the test is performed, the terminal will display a series of blank half-bright inverse video blocks at the bottom of the screen.
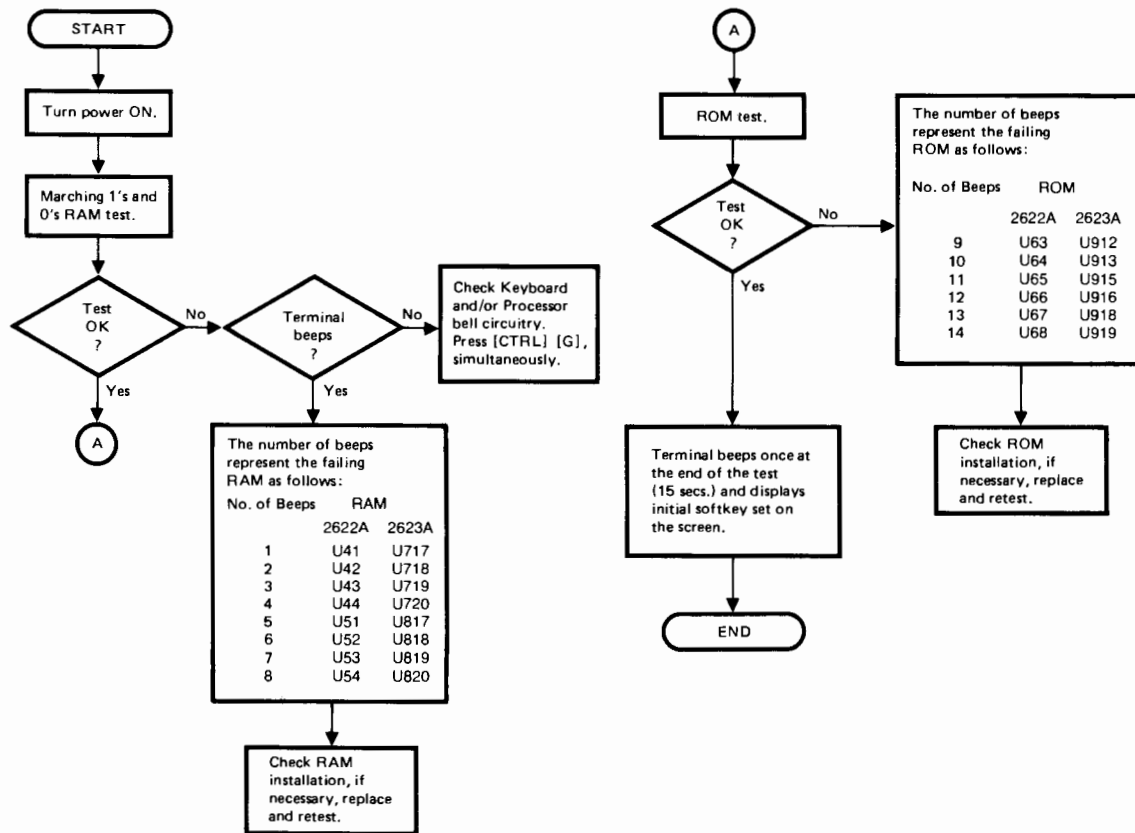
Figure 6-1. Power-On Test Flowchart

TERMINAL TEST ....

DESCRIPTION. During the graphics test (2623A only), the screen is blanked and a graphics raster pattern (full-bright inverse video) is swept from left to right and then right to left before leaving the screen blank. The graphics raster then is swept from bottom to top and then top to bottom leaving the screen blank again.

Following the graphics test, the softkeys are blanked and the message " TESTING!" will be displayed. When the test is completed, the function key labels and cursor are returned to the screen, the test pattern (figure 6-2 or 6-3) is displayed, and the bell is sounded. The test consists of the following checks, performed in the sequence listed below:

1. A graphics display test for each graphics RAM (2623A only).
2. A non-destructive RAM test for each firmware RAM.
3. A non-destructive CMOS RAM (non-volatile memory) test.
4. ROM test on all firmware ROMs checks the following:
   a. Is ROM size correct?
   b. The ID byte of each ROM is checked to see that the ROM is installed in the correct socket.
   c. A cyclic redundancy check (CRC) is performed to check for code integrity.
5. Character ROM test checks and displays all characters configured for the terminal (see figure 6-2 or 6-3).
6. Beep test checks the operation of the bell circuitry.
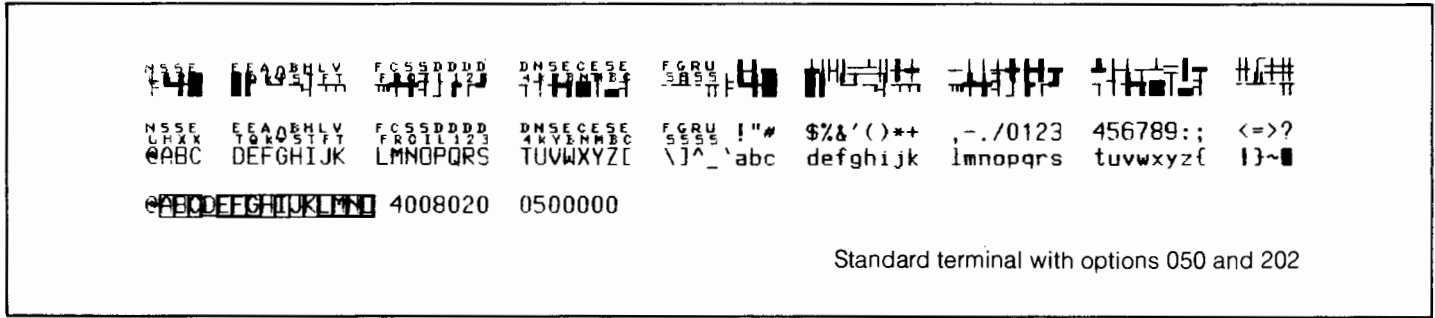
Figure 6-2. 2622A Terminal Test Pattern
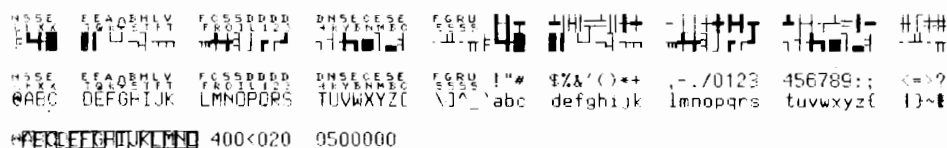
Figure 6-3. 2623A Terminal Test Pattern

TO INITIATE THE TEST. The terminal test can be started by any of the following methods: pressing ▮ESC▮ and ▮Z▮ keys in sequence; pressing the ▮AIDS▮, **service keys**, and **TERMINAL TEST** keys, in sequence; or by pressing the ▮MODES▮ and **TERMINAL TEST** keys, in sequence.

IF AN ERROR OCCURS. If an error occurs, the test is halted and the error is identified by an error message on the screen. To resume the test and erase the error message after an error occurs, press the ▮RETURN▮ key. The flowchart in figure 6-4 can be used as a guide in troubleshooting errors.

START

Press [MODES]
and TERMINAL
TEST keys in
sequence

Graphics display
test (2623A only).

Test
OK
?
— No →

An error report
format is displayed:

G RAM ERR 0000 1000 1000
0000
        ↑   ↑
      (LSB)   (MSB)

Press RETURN to clear

Where 0 indicates a good
RAM and 1 indicates a bad
RAM. The example above
is as follows:

	BIT	RAM		BIT	RAM
LSB	0	U217		1	U117
	0	U216		0	U116
	0	U215		0	U115
	0	U214		0	U114
	1	U213		0	U113
	0	U212		0	U112
	0	U211		0	U111
	0	U210	MSB	0	U110

Yes

Non-destructive
RAM test.

Display message:

RAM ERR #X
Press RETURN to clear

Where X is the failing RAM.

X	RAM	
	2622A	2623A
1	U41	U717
2	U42	U718
3	U43	U719
4	U44	U720
5	U51	U817
6	U52	U818
7	U53	U819
8	U54	U820

Test
OK
?
— No →

Replace failing
RAM and retest.

Replace failing
RAM(s) and retest.

Yes

Non-destructive
CMOS RAM (non-
volatile memory)
test.

Test
OK
?
— No →

Display message:

CMOS ERR
Press RETURN to clear

Replace U73
and retest.

YES

A

Figure 6-4. Terminal Test Flowchart (Sheet 1 of 2)

Figure 6-4. Terminal Test Flowchart (Sheet 2 of 2)

MANUFACTURING TEST ....

DESCRIPTION. Since the datacomm test is performed as a part of manufacturing test, it is necessary to install a loopback test hood on the datacomm port before performing the test to avoid datacomm errors. The datacomm baud rate test performed during manufacturing is performed on all possible baud rates as opposed to the datacomm test performed separately which performs the baud rate test only on the currently selected baud rate.

Manufacturing test (figure 6-5) consists of the following items performed in sequence:

1. On the 2623A terminal, the screen is filled with full-bright inverse video (graphics raster). The pattern outlines the display area boundaries enabling adjustment of display area width and height, tilt, and centering. The test is then halted until the **RETURN** key is pressed. This step is not used on the 2622A/D terminal.

2. On both the 2622A/D and 2623A terminals, the screen is filled with half-bright inverse video (alpha raster). Although this pattern is similar to the one in step 1, it is narrower. The display area may be used for adjustments. The test is then halted until the **RETURN** key is pressed.

3. A screenful of @ signs is displayed to enable a focus alignment, if necessary. Again, a carriage return is necessary to continue the test.

4. Errors detected in previous terminal or manufacturing tests will be displayed. The terminal will halt after each error. To continue, press the **RETURN** key.

5. The sequence of subtests listed for manufacturing test under the heading "Test Coverage" is performed endlessly until the test is stopped by a "soft or hard reset". Each time the list of subtests is completed, the character sets, enhancements, and terminal status is displayed on the screen just as for terminal test. At the beginning of the test and every 30 minutes, three printer test patterns are printed on the integral printer.

```
   ( START )                    ( A )                          ( B )
      |                          |                              |
      v                          v                              v
 +-------------+         +----------------+          +---------------------------+
 | Install DC  |         | Screen is      |          | The following seven tests |
 | test        |         | filled with    |          | are performed and         |
 | connector to|         | @ characters   |          | repeated 31 times:        |
 | datacomm    |         | which permits  |          |                           |
 | port.       |         | focus          |          |                           |
 +-------------+         | adjustment.    |          |   1. Non-destructive RAM  |
      |                  | Press [RETURN] |          |      test                 |
      v                  | to continue    |          |   2. Non-destructive CMOS |
 +-------------+         | test.          |          |      test                 |
 | Initialize  |         +----------------+          |   3. ROM test             |
 | test by     |              |                      |   4. Character ROM test   |
 | pressing    |              v                      |   5. Identify ROMs        |
 | [CTRL]      |         +----------------+          |   6. Toggle screen (ages  |
 | left [SHIFT]|         | If errors      |          |      CRT screen evenly)   |
 | right       |         | occurred, they |          |   7. Extended datacomm    |
 | [SHIFT],    |         | are shown one  |          |      test (Checks         |
 | and [ENTER] |         | at a time.     |          |      datacomm at 13       |
 | in sequence.|         | Press [RETURN] |          |      baud rates)          |
 +-------------+         | to clear and   |          |                           |
      |                  | to resume test.|          | Each pass takes about 55  |
      v                  +----------------+          | seconds. If a printer is  |
 +-------------+              |                      | present, errors are       |
 | Configures  |              v                      | continuously logged on.   |
 | terminal to |         +----------------+          | Extended testing can be   |
 | default     |         | Test loop      |          | done by wedging some      |
 | state.      |         | counter is     |          | paper between the         |
 | Initiates   |         | incremented    |          | keyboard and [RETURN] key.|
 | loop counter|         | and the screen |          +---------------------------+
 | (monitors   |         | is refreshed.  |               |
 | test length)|         +----------------+               v
 +-------------+              |                      +---------------------------+
      |                       v                      | Press [CTRL],             |
      v                  +----------------+          | [SHIFT], [RESET],         |
 +-------------+         | Integral       |          | simultaneously to end     |
 | Inverse     |         | printer (if    |          | test.                     |
 | video is    |         | present) is    |          +---------------------------+
 | displayed   |         | tested every   |               |
 | which       |         | 30 minutes,    |               v
 | permits     |         | and if working,|           (  END  )
 | screen      |         | prints printer |
 | alignment.  |         | pattern three  |
 | Press       |         | times.         |
 | [RETURN] to |         +----------------+
 | continue    |              |
 | test.       |              v
 +-------------+             ( B )
      |
      v
     ( A )
```
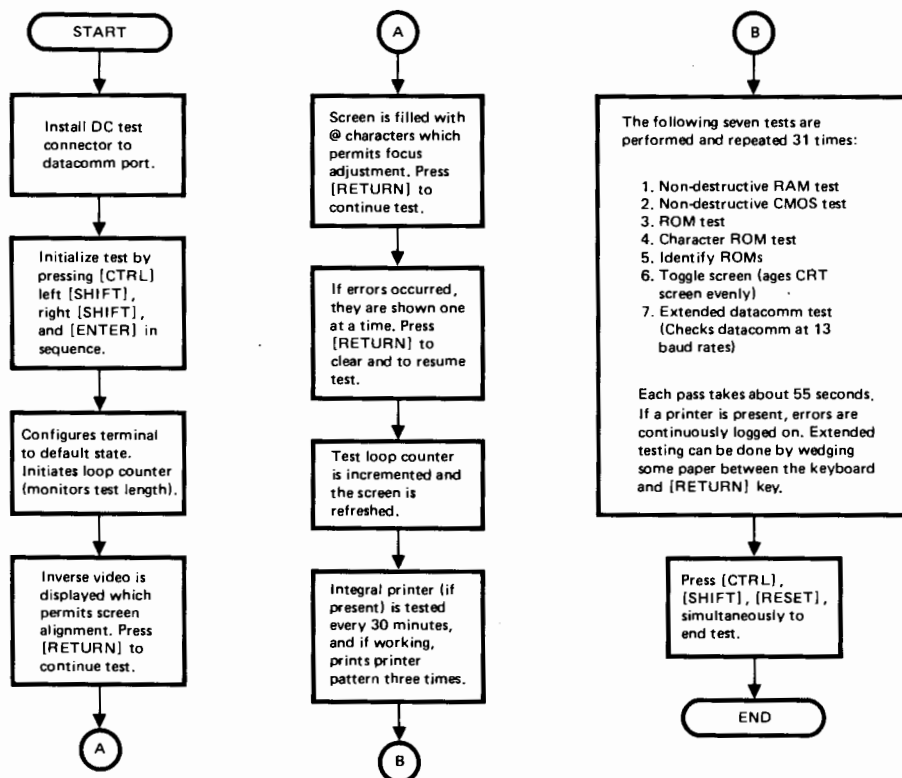
Figure 6-5. Manufacturing Test Flowchart

TO INITIATE THE TEST. The manufacturing test is initiated by pressing [CNTL], left [SHIFT], right [SHIFT], and [ENTER] keys all at once.

IF AN ERROR OCCURS. When an error occurs during the test, the test is stopped and the error is displayed on the screen and saved in non-volatile memory RAM. If the terminal power is cut off and then reapplied or a reset is performed, the test will be returned in the halted condition and the error will be displayed on the screen. Pressing the [RETURN] key, under these circumstances will erase the error message from the screen and cause the test to resume.

TO STOP THE TEST. The test cannot be ended by turning off terminal power and then turning it back on again. The test can be ended by performing a hard reset but the screen contents will not be saved. A soft reset will return the test to the beginning and display a full-bright inverse video on the screen followed by a series of @ characters. To end the test, press [CTRL], [SHIFT], [RESET], simultaneously.

DATACOMM TEST ....

DESCRIPTION. To perform this test, the signals generated by the terminal datacomm circuits are looped back through a test connector or a modem and returned to the terminal to simulate responses to themselves. The means of signal loopback can be a test connector connected directly to the datacomm port or a cable connected to the datacomm port with a test connector on the other end.

PORT	TEST HOOD CONNECTOR	
	2622A/D	2623A
Terminal (Port 1)	02620-60056 (50-pin)	02620-60056
External Printer (Port 2)	——	02620-60062 (25-pin)

If there is a test connector or a cable with test connector connected to the terminal port, the following tests are performed:

1. Control line test.
2. Baud rate test (which verifies that the baud rate generator is functioning properly within ±2% of the configured baud rate.
3. Data loopback test.

All three tests are performed using an asynchronous configuration. The baud rate test is performed at the currently configured baud rate. If a modem is being used in local loopback mode, the modem should be setup in in local loopback test mode, if present.

TEST SETUPS. Several tests can be used depending on the item(s) to be tested. Figure 6-6 illustrates test setups for testing the terminal and the cable(s).

Before the test can be initiated, it must be enabled on the Terminal Configuration menu. To initiate the datacomm test, press the ▓▓, **service keys**, and **DATACOMM TEST** keys, in sequence.

TEST CONNECTOR
02620-60056
OR
02620-60062

TERMINAL TEST SETUP

TEST CONNECTOR
02620-60062 (MALE)
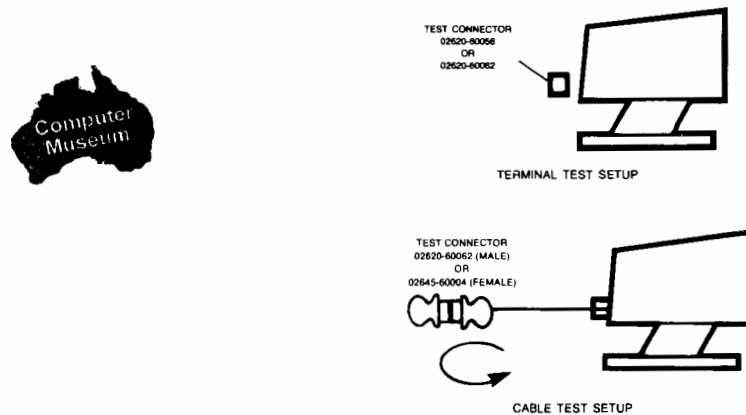OR
02645-60004 (FEMALE)

CABLE TEST SETUP

Figure 6-6. Datacomm Test Setups

IF AN ERROR OCCURS. During execution of the test, the screen is blanked and the message " **TESTING!** " is displayed until either the test has completed or an error occurs. If the test passes, the terminal beeps once, brings up the previous set of softkey labels, and then exits. If an error occurs, then the error message "**DC ERR#x**" or "**EXT PRNTR ERR#x**" is displayed. The "**x**" indicates the type of error that occurred as listed in table 6-2.

Table 6-2. Datacomm Self Test Errors

DC ERR#x or EXT PRNTR ERR#x	MEANING
1	Test connector not present. If a modem is used, disregard this error.
2	Baud rate too fast.
3	Baud rate too slow.
4	Error in control lines.
5	Character did not loop back.
6	Received character not the same as one transmitted.
7	Framing error in character.
8	A character was overrun.

PRINTER TEST ....

DESCRIPTION. This test exercises the integral printer. A self-test of the printer is performed and then a pattern of characters, print types, and display enhancements are printed on the paper (figure 6-7).

TO INITIATE THE TEST. The printer test is initiated by pressing the [AIDS], **service keys**, and **INT PRT TEST** keys, in sequence.

@ABC DEFGHIJK LMNOPQRS TUVWXYZ[\]^_`abc defghijk lmnopqrs tuvwxyz{ |}~
@ABC   DEFGHIJK   LMNOPQRS   TUVWXYZ[\]^_
@ABC DEFGHIJK LMNOPQRS TUVWXYZ[\]^   `abc defghijk lmnopqrs tuvwxyz{ |}~   !"#$ %&'()*+, -./01234 56789:;< =>?@
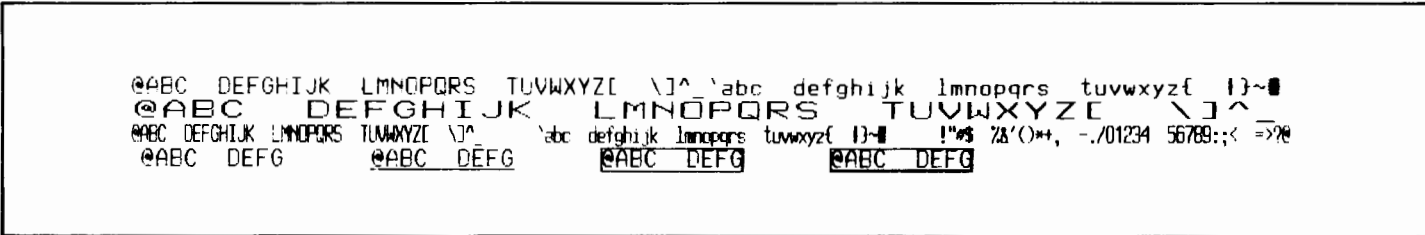@ABC DEFG   @ABC DEFG   @ABC DEFG   @ABC DEFG

Figure 6-7. Integral Printer Test Pattern

IF AN ERROR OCCURS. If an error occurs during the printer test, the following message is displayed:

INTEGRAL PRINTER ERROR
Press RETURN to clear

The error may indicate one of the following malfunctions:

1. Printer is out of paper.
2. Printer latch is not locked (not pressed down securely).
3. Printer self-test has failed.
4. TPM power and logic cables not properly connected.

IDENTIFY ROMS .... The Identify ROMs feature lists the identification labels stored in the firmware ROMs. This includes the HP part numbers and date code for each of the ROMs. This feature is accessed by ▇▇, **service keys**, **IDENTIFY ROMS** key, pressed in sequence. A typical display is shown in figure 6-8.

```
   Firmware ROMs              Firmware ROMs              Firmware ROMs
   ────────────               ────────────               ────────────
1818-1456 2049             1818-1694 2049             1818-1456 2049
1818-1458 2049             1818-1693 2049             1818-1458 2049
1818-1569 2049             1818-1695 2049             1818-1617 2049
1818-1617 2049 (Opt.050)   1818-1696 2049             1818-1454 2049
                                                      1818-1455 2049

      (A) 2622A                 (B) 2622D                 (C) 2623A
```

Figure 6-8. Typical Identify ROMs Display

Using the Video Generator

PURPOSE .... The Video Generator (part no. 02620-60029) is used (as an alternative to the manufacturing test) for alignment and troubleshooting. It can be used to produce dot and cross-hatch displays in either full- or half-bright intensity, inverse video dot and cross-hatch patterns, full- or half-bright displays with no video, a half-bright display with inverse video, or a blank display.

INSTALLATION .... To use the Video Generator the Processor PCA must be removed from the terminal and the Video Generator installed in its place. Install the Video Generator as follows:

Note

When the Processor PCA is removed, all information is deleted from the non-volatile memory which stores the strapping selections. Therefore, the strapping data should be copied on paper before removing the Processor PCA.

After the Processor PCA is reinstalled, be sure to reenter the information previously copied on paper into the non-volatile memory.

1. Display the contents of the non-volatile memory and copy the contents on paper.
2. Turn off terminal power and remove the Processor PCA from the terminal as described in the Parts Lists/Repair Section.
3. Install the Video Generator in place of the Processor PCA (figure 6-9) and connect the power and sweep cables to J1 and J2, respectively, on the Video Generator.
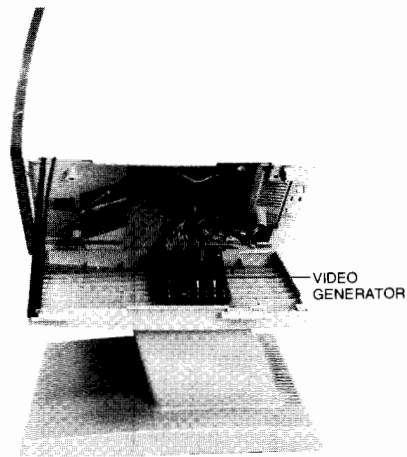4. Perform the various display patterns as described in table 6-3.

Figure 6-9. Video Generator Installed in Place of the Processor PCA

CONTROLS .... Displays are produceable using the Video Generator (figure 6-10) and the switch positions listed in table 6-3.
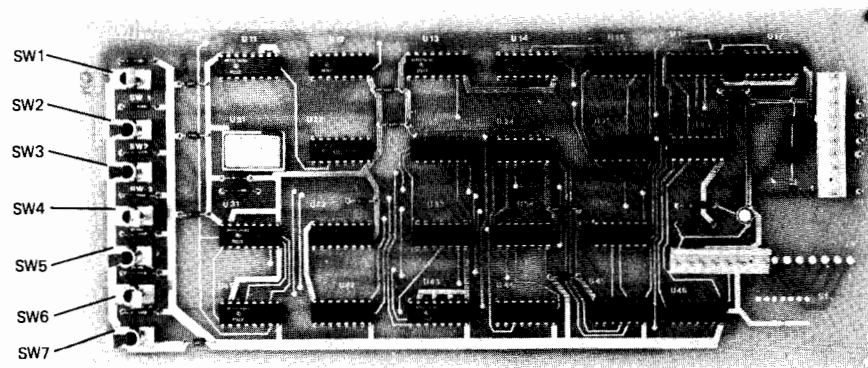

Figure 6-10. Video Generator

6-19

Table 6-3. Video Generator Controls

DESIRED EFFECT	SWITCH						
	HOR SW 1	CROSS-HATCH SW 2	DOT SW 3	BRIGHT RASTER SW 4	NORMAL SW 5	HALF-BRIGHT SW 6	60 Hz SW 7
Blank display	OFF	—	—	—	—	—	—
Blank full-bright display	ON	—	—	1	1	—	Note 3
Blank half-bright display	ON	0	0	0	—	1	Note 3
Full-bright cross-hatch on dark background	ON	1	—	0	1	0	Note 3
Full-bright cross-hatch on half-bright background	ON	1	—	0	1	1	Note 3
Full-bright dot pattern on dark background	ON	0	1	0	1	0	Note 3
Full-bright dot pattern on half-bright background	ON	0	1	0	1	1	Note 3
Dark cross-hatch on half-bright background	ON	1	—	0	0	1	Note 3
Dark dots on half-bright background	ON	0	1	0	0	1	Note 3

Notes: 1. 1 = switch set to the labeled position.
          0 = switch set to the unlabeled position.

2. — = don't care.

3. Set at 50 or 60 Hz, as required.

Using the Head Load Assembly

PURPOSE .... The Head Load Assembly (part no. 02670-60029) is used in place of the TPM print head to help determine if the TPM PCA is defective. The Head Load Assembly checks the status of the print mechanism's dot matrix scheme.

┌─────────────┐
│ CAUTION │
└─────────────┘

A defective TPM PCA may cause a print head replacement to become defective. Before replacing the print head, use the Head Load Assembly to determine if the TPM PCA is defective.

PROCEDURE .... To use the Head Load Assembly, the print head cable must be removed and the Head Load Assembly installed in its place. Install the Head Load Assembly in the TPM as follows:

1. Turn off terminal power and remove TPM top cover.

2. Raise door latch and remove paper roll.

3. Carefully disconnect the flex end of the print head cable from the TPM PCA connector. A print head removal tool (02620-00012) is available as an aid in removing the cable.

4. With component side up, plug the long connector side of the Head Load Assembly (figure 6-11) into TPM PCA connector (slot in TPM mainframe). Ensure that the Head Load Assembly is seated fully into TPM mainframe.

5. Place a small piece of paper over the paper detector (microswitch) located inside the TPM mainframe on the right side.

6. Lower and close door latch.

7. Locate TPM PCA test connector J1 in the upper left-hand corner (as viewed from the front). Using a jumper wire, connect pins J1-1 (GND) and J1-2 (TEST) together.

8. Turn on terminal power and allow this test (TPM local self-test) to run several times.

9. Observe operation of LEDs on Head Load Assembly. If LEDs stay on or off continuously during the test, then TPM PCA defective. Normal operation is random blinking of LEDs 2 thru 14 while the print head travels from left to right and all LEDs are off as the print head retraces (linefeed and carriage return). LEDs 1 and 15 may flicker slightly but have no effect in determining PCA status.
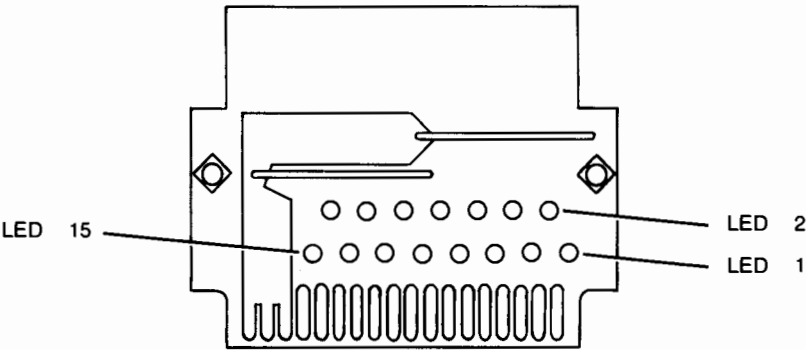
LED 15
LED 2
LED 1

Figure 6-11. Head Load Assembly

Parts Lists/Repair

INTRODUCTION .... This section provides instructions for removing and replacing terminal assemblies and components designated field replaceable. Included also is a listing of field-replaceable parts, procedures for ordering replaceable parts, and a listing of exchange modules.

REMOVAL AND
REPLACEMENT PROCEDURES .... The terminal's modular design facilitates the removal and replacement procedures for the various field-replaceable parts. The following paragraphs describe removal and replacement procedures for the terminal. Differences in option 050 (printer option) will be noted in each procedure.

WARNING

Hazardous voltages are present inside the terminal. Always remove AC power when working inside the terminal. Removal and replacement procedures contained in this section shall be performed only by qualified service personnel.

TOP COVER .... REMOVAL. Set terminal power to the off position, disconnect the power cord, and proceed as follows:

1. Using a small Phillips-head screwdriver, loosen the two quarter-turn fasteners securing top cover to mainframe (see figure 7-1). Do not overtighten the fasteners.
2. Slide top cover toward the rear slightly and remove.

REPLACEMENT. Replace the top cover as follows:

1. Position top cover onto the mainframe and slide it forward into the groove of the bezel.
2. Secure top cover to mainframe by tightening the two quarter-turn fasteners. Do not overtighten the fasteners.
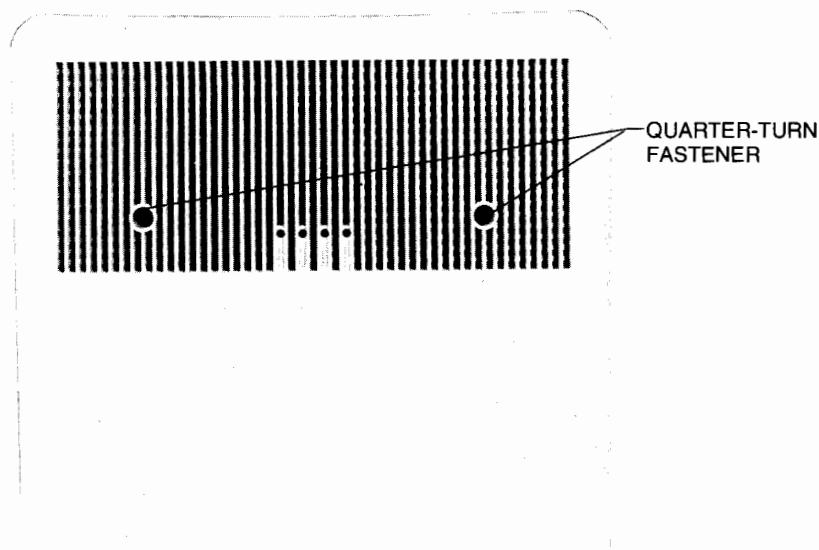
QUARTER-TURN FASTENER

Figure 7-1. Terminal Top View

MAINFRAME ....

REMOVAL. Set terminal power to the off position, disconnect the power cord and keyboard cable assembly, disconnect the datacomm cable assembly (if present), and proceed as follows:

1. Remove the top cover to disconnect the fan cable assembly from Power Supply PCA connector J4 (J1 for option 050).

2. Loosen the quarter-turn fastener at the left rear of the terminal (as viewed from the rear). See figure 7-2.

3. Hold pedestal in place and slide mainframe forward about ¼-inch.

| CAUTION |

Use extreme care when placing the terminal in the half-open (service) position. Failure to do so may cause terminal to tip over causing personal injury or damage to the terminal.

4. Grasp left side of mainframe and lift it upward until the top prop locks the mainframe in the half-open (service) position.

5. Lower Processor PCA onto the support, pull fan cable assembly through opening in mainframe, and reattach Processor PCA to mainframe.

6. Squeeze the upper end of the top prop and lift the mainframe upward (see figure 7-3). Then slide the mainframe forward until it is free from the support hinge and remove.

QUARTER-TURN FASTENER
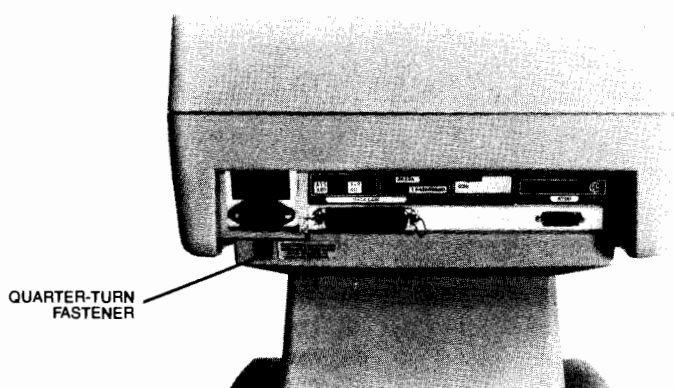
Figure 7-2. Terminal Rear View

7-3
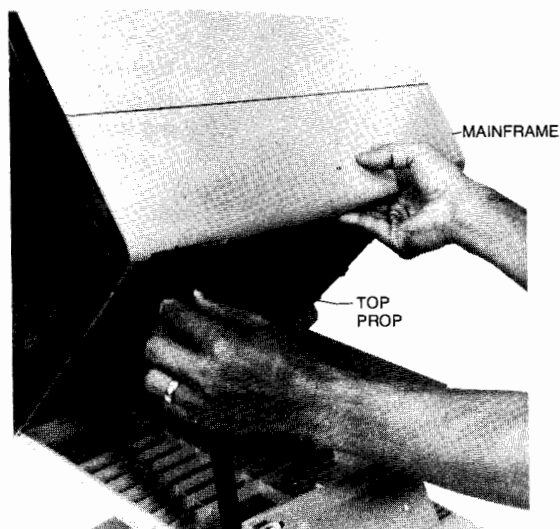
Figure 7-3. Terminal Set to the Half-Open Position

REPLACEMENT. Replace mainframe as follows:

1. Position mainframe onto support hinge (figure 7-4). Slide mainframe and support together until they are hinged.

2. Lower Processor PCA onto support, route fan cable assembly through opening in mainframe and connect it to Power Supply PCA connector J4 (J1 for option 050). Re-attach Processor PCA to mainframe and reconnect ground strap.

3. Lower mainframe onto top prop.

4. Make sure that the fan cable is resting in support slots and cable clip.

5. Squeeze upper end of the top prop and lower the mainframe to its closed position.

6. Slide mainframe toward the rear and secure in place by tightening the quarter-turn fastener at the left rear of terminal. Do not overtighten the fastener.

7. Replace top cover.

8. Reconnect power cord, keyboard cable assembly, and data comm cable assembly (if required).

SUPPORT ....

REMOVAL. Set terminal power to the off position, disconnect the power cord, disconnect keyboard cable assembly and datacomm cable assembly (if present), remove mainframe, and proceed as follows:

1. Remove the four screws and washers securing support to pedestal (figure 7-4).

2. Remove support from pedestal.

3. Pull fan cable assembly through opening in support.

REPLACEMENT. Replace support as follows:

1. Position support onto pedestal.

2. Route fan cable assembly through support opening, two slots, and cable clip.

3. Secure support in place with the four screws and washers.

4. Attach mainframe to support and secure in place by tightening the quarter-turn fastener. Do not overtighten the fastener.

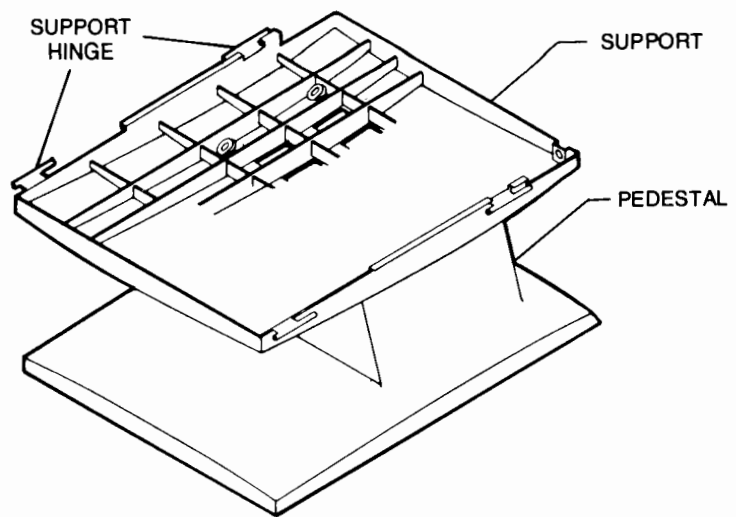5. Reconnect keyboard cable assembly, data comm cable assembly (if required), and power cord.

Figure 7-4. Support and Pedestal

PEDESTAL ....

REMOVAL. Set terminal power to the off position, disconnect the power cord, disconnect the keyboard cable assembly and data comm cable assembly (if present), and proceed as follows:

1. Position mainframe to the half-open (service) position.
2. Remove mainframe from support.
3. Remove the four screws and washers to pedestal. Remove pedestal.
4. Remove the two screws and washers securing fan assembly to pedestal.

REPLACEMENT. Replace pedestal as follows:

1. Reinstall fan assembly onto pedestal (refer to "VENTILATING FAN"). Route fan cable assembly through support opening, two slots, and cable clip.
2. Position support over pedestal and align the four holes.
3. Secure support to pedestal with the four screws and washers.
4. Position mainframe onto support and lower it onto the top prop.
5. Connect fan cable to Power Supply PCA connector J4 (J1 for option 050).
6. Lower mainframe onto support, slide it rearward, and secure in place by tightening the quarter-turn fastener. Do not overtighten the fastener.
7. Reconnect keyboard cable assembly, data comm cable assembly (if required), and power cord.

VENTILATING FAN ....   Procedures for removing and replacing the fan follow.

REMOVAL. Set terminal power to the off position, disconnect the keyboard cable assembly and datacomm cable assembly (if installed), disconnect the power cord, and proceed as follows:

1. Remove top cover and disconnect fan cable assembly from Power Supply PCA connector J4 (J1 for option 050).
2. Remove mainframe from support (refer to "MAINFRAME").
3. Remove support from pedestal.
4. Remove the two screws and washers securing fan to pedestal cavity (figure 7-5) and remove fan.
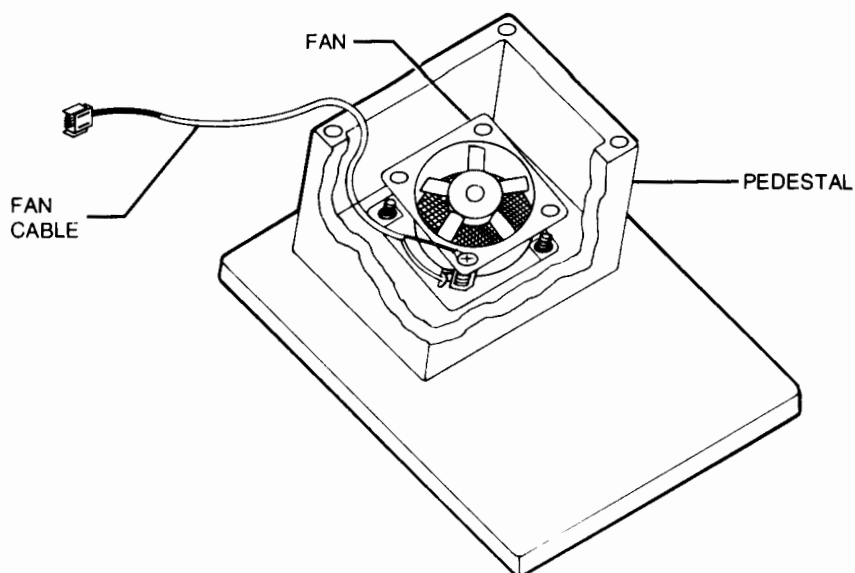
7-7

Figure 7-5. Fan Removal

REPLACEMENT. Replace ventilating fan as follows:

1. Position fan into pedestal cavity with the air flow direction of the fan facing upward.
2. Route fan cable asembly through support opening, two slots, and cable clip.
3. Reinstall support onto pedestal and secure in place with the four screws and washers.
4. Reinstall mainframe onto support hinges in the half-open (service) position.
5. Lower Processor PCA and route fan cable through mainframe opening. Connect fan cable to Supply PCA connector J4 (J1 for option 050).
6. Reinstall Processor PCA and reconnect ground strap to Processor PCA ground lug.
7. Close mainframe and secure in place by tightening the quarter-turn fastener. Do not overtighten the fastener.
8. Replace top cover, reconnect the keyboard cable assembly, datacomm cable assembly (if required), and the power cord.

**PRINTED-CIRCUIT
ASSEMBLIES** ....

Printed-circuit assemblies (PCAs) are easily removed and replaced. The following paragraphs provide removal and replacement procedures for each PCA installed in the terminal.

PROCESSOR PCA ....

REMOVAL. Set terminal power to the off position, disconnect the power cord, keyboard cable assembly, and datacomm cable assembly (if present), set mainframe to the half-open position, and proceed as follows:

1. Disconnect the ground strap from Processor PCA ground lug at terminal left rear.
2. Pull outwardly on each of the four snap fasteners securing Processor PCA to mainframe bottom. Lower Processor PCA until it rests on the support (figure 7-6).
3. Disconnect the two cable assemblies from their respective connectors (J2 and J3).
4. For option 050, disconnect the thermal print cable assembly from connector J1.
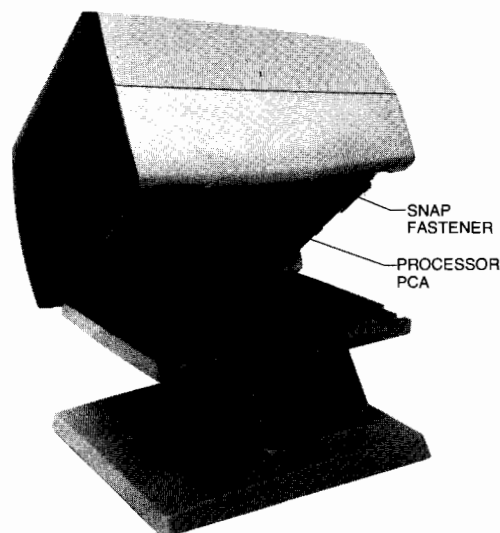5. Carefully remove the Processor PCA.

SNAP
FASTENER

PROCESSOR
PCA

Figure 7-6. Processor PCA Removal

7-9

REPLACEMENT. Replace Processor PCA as follows:

1. If replacement PCA requires an I/O Panel, remove the I/O Panel from the just-removed Processor PCA. Disconnect the Datacomm and interconnecting cable assemblies from the Processor PCA. Remove the ground lug, three screws and washers securing I/O Panel to Processor PCA.

2. Install I/O Panel onto new Processor PCA and secure in place with the three screws and washers and ground lug. Reconnect the Datacomm and Keyboard interconnecting cable assemblies to the Processor PCA.

3. If replacement PCA requires RAMs, ROMs, or ICs, remove them from the just-removed PCA. Using care and IC removal tool (part no. 7710-0585), remove RAMs, ROMs, and ICs from their IC sockets.

CAUTION

Integrated circuits can be damaged by electrostatic discharge. Use the following precautions:

DO NOT wear clothing subject to static charge buildup, such as wool or synthetic materials.

DO NOT handle integrated circuits in carpeted areas.

DO NOT remove IC from its conductive foam pad until you are ready to install it.

AVOID touching circuit leads. Handle by the plastic package only.

ENSURE that IC, work surface (table, desk, etc.) and PCA are all at the same ground potential. This can be done by touching the foam pad to the PCA and then touch the foam pad, circuit, and PCA to the work surface. A portable static-safe work station is available, HP part no. 9300-0794.

4. Connect the two cable assemblies to their respective connectors (J2 and J3). For option 050, connect the thermal print cable assembly to connector J1.

5. Position Processor PCA onto mainframe bottom and align I/O panel into mainframe groove. Install each of the four snap-in grommets into their respective fastening holes and then push inwardly on each of the four snap-in plungers until they click in place.

6. Reconnect the ground strap to the Processor PCA ground lug.

7. Lower mainframe onto support and secure in place by tightening the quarter-turn fastener. Do not overtighten the fastener.

8. Reconnect keyboard and datacomm cable assemblies and power cord.

SWEEP PCA ....

REMOVAL. Set terminal power to the off position, disconnect the power cord, set mainframe to the half-open position, lower Processor PCA, and proceed as follows:

CAUTION

High voltages are present within the Sweep PCA and CRT area. Use caution when working near these assemblies.

1. Disconnect the four cable assemblies from their respective connectors (J1 thru J4).

2. Use caution and carefully disconnect the high voltage cable assembly from the CRT high voltage connector (hole in CRT) by squeezing the insulated connector. Ground the high voltage cable assembly before removing the Sweep PCA.

3. Remove the Sweep PCA (figure 7-7) from the mainframe by pulling outwardly on each of the two snap fasteners. Use care and remove the Sweep PCA.

7-11

REPLACEMENT. Replace the Sweep PCA as follows:

1. Carefully position Sweep PCA into mainframe and secure in place by pushing inward on each of the two snap-in grommets and then the two snap-in plungers. Ensure that wiring and cabling are not pinched.

2. Reconnect the four cable assemblies to their respective connectors (J1 thru J4) and the high-voltage cable to the CRT connector (hole in CRT). Hook the high-voltage cable onto tie-down tab in mainframe.

3. Replace Processor PCA.

4. Lower mainframe and secure in place by tightening the quarter-turn fastener.

5. Reconnect the power cord.
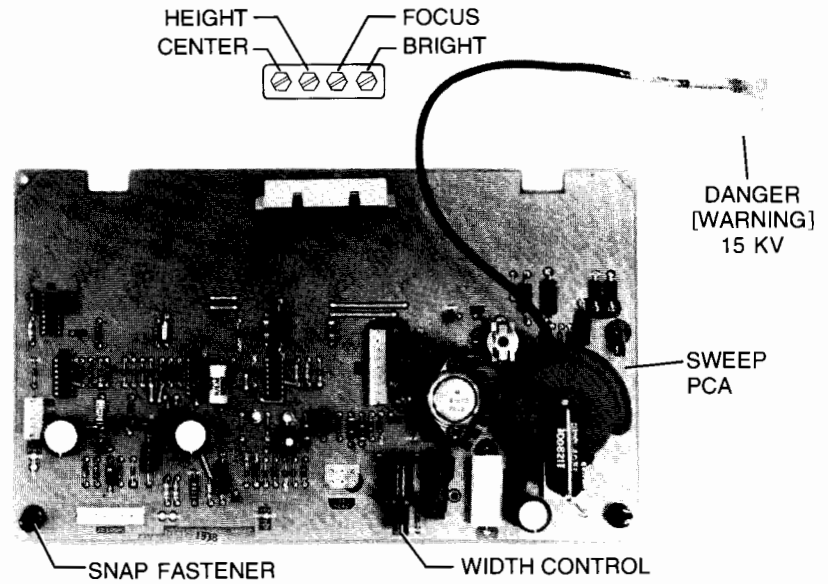
Figure 7-7. Sweep PCA

POWER SUPPLY PCA . . . .   REMOVAL: Set terminal power to the off position, disconnect the power cord, remove the top cover, and proceed as follows:

1. At top of the Power Supply PCA, pull outwardly on each of the three snap fasteners securing PCA to mainframe (see figure 7-8 or 7-9).
2. Disconnect the five cable assemblies from their respective connectors.

Note

For option 050, there are four snap fasteners securing Power Supply PCA to mainframe (see figure 7-10).

3. Remove Power Supply PCA by pulling it upward from the mainframe cavity.

REPLACEMENT. Replace Power Supply PCA as follows:

1. Slide Power Supply PCA into mainframe cavity.
2. Reconnect the five cable assemblies to their respective connectors J1 or J2 and J3 through J7. For option 050, these connectors are J1 through J3, J5 and J6.
3. Secure PCA in place by pushing inwardly on each of the three snap-in grommets and then the three snap-in plungers. For option 050, there are four snap fasteners.

Note

For option 050, connector J2 is for 100–120V and connector J3 is for 220–240V. For others, connector J2 is for 100–120V and J1 is for 220–240V.

4. Check that the line fuse is correct for the configured line voltage. Refer to "Installing the Terminal" in Section 2 for a description of fuse placement.
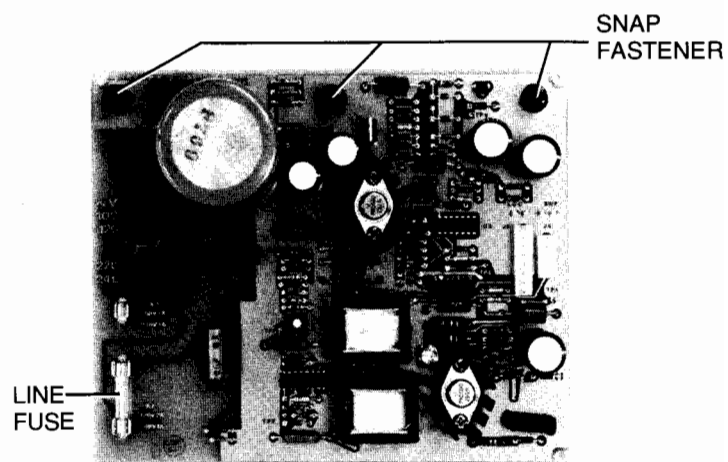5. Replace top cover and reconnect the power cord.

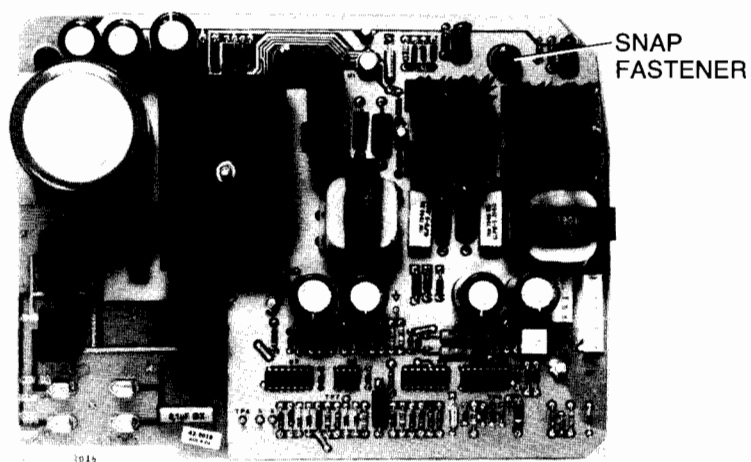Figure 7-8. 2622A/D Power Supply PCA (02620-60004)

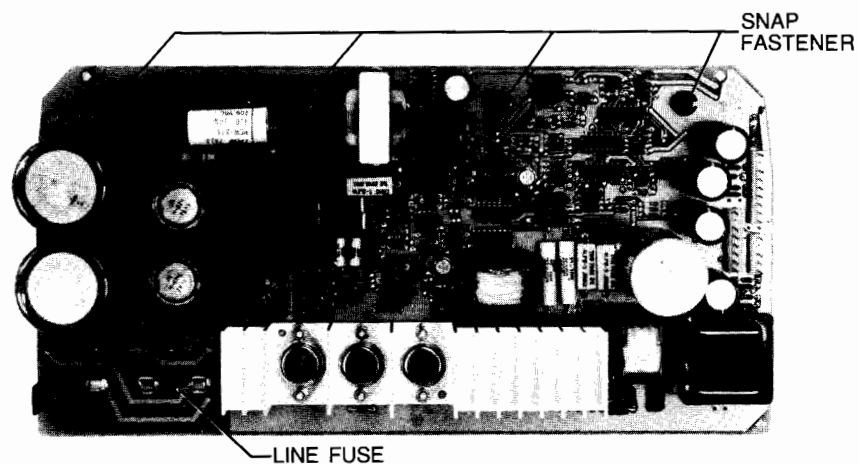Figure 7-9. 2623A Power Supply PCA (02620-60060)

Figure 7-10. Option 050 Power Supply PCA (02620-60019)

KEYBOARD ASSEMBLY ....

REMOVAL. Turn off terminal power, disconnect the power cord and keyboard cable, and remove Keyboard Assembly.

REPLACEMENT. Replace Keyboard Assembly as follows:

1. Connect keyboard cable to KYBD connector at terminal rear. Secure in place by sliding connector lock to the right.

2. Reconnect the power cord.

KEYBOARD PCA . . . .

REMOVAL. Remove the Keyboard PCA as follows:

1. Turn off terminal power and disconnect the power cord.

2. Disconnect the keyboard cable assembly.

3. Remove the four screws securing keyboard to keyboard base (figure 7-25).

4. Remove keyboard top, disconnect keyboard and speaker cables from the Keyboard PCA, and then remove the Keyboard PCA.

REPLACEMENT. Replace Keyboard PCA as follows:

1. Place Keyboard PCA over keyboard base standoffs.

2. Route keyboard and speaker cables into their respective grooves on the keyboard base. Reconnect keyboard and speaker cables to their respective Keyboard PCA connectors.

3. Place keyboard top over Keyboard PCA and secure in place with the four screws.

4. Reconnect keyboard cable to KYBD connector at terminal rear and secure cable in place by sliding the connector lock to the right.

5. Reconnect the power cord.

KEYCAPS ....

REMOVAL. Using the keycap disassembly tool (part no. 5040-7433), carefully hook keycap bottom edge and lift keycap from the Keyboard Assembly (see figure 7-11).

REPLACEMENT. Install new keycap over vacated switch on Keyboard Assembly as follows:

CAUTION

Switch Contacts can be damaged if keycap is not installed at its designed angle. Use care when installing keycaps.

1. Position replacement keycap over vacated switch at its designed angle.
2. Push down on the keycap at its designed angle until the keycap is fully seated.

KEYCAP DISASSEMBLY TOOL

Figure 7-11. Keycap Removal

BATTERY . . . .   REMOVAL. The battery can be replaced with terminal power on or off. Remove battery as follows:

<div align="center">

┌─────────────┐
│ CAUTION │
└─────────────┘

</div>

Configuration will be lost from memory when removing the battery from the terminal and power is turned off. Before removing battery, ensure that configuration is recorded so that original strapping can be duplicated.

1. If battery is to be replaced with power on, go to step 2. If not, record configuration and then turn power off.
2. Locate battery support at rear of terminal.
3. Grasp and squeeze battery support clips and pull it downward for removal. (See figure 7-12).
4. Remove battery from battery support.

REPLACEMENT. Replace battery as follows:

1. Install new battery in battery support. Observe polarity markings on battery for correct battery orientation.
2. Install battery support into battery receptacle at rear of terminal. Make sure that battery clips are seated fully. To ensure correct installation, both the battery support and receptacle are keyed.
3. If battery was replaced with power off, restore terminal power and restrap configuration (refer to Configuration Section).
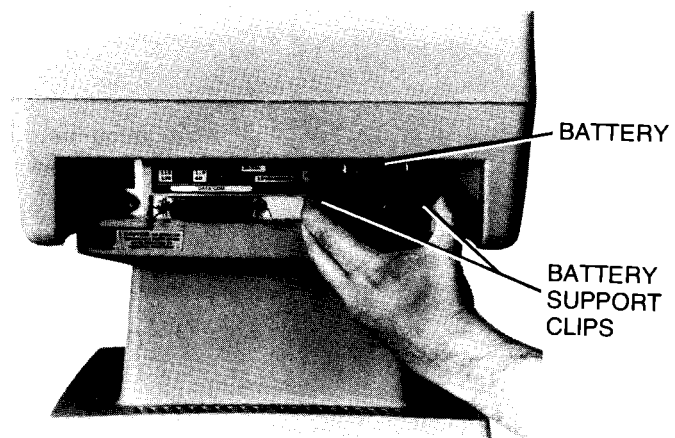
Figure 7-12. Battery Removal

INTEGRATED CIRCUIT ....

REMOVAL. If a defective integrated circuit (IC), such as a Read-Only-Memory (ROM) or Random-Access-Memory (RAM), is to be replaced, set terminal power to the off position, disconnect the power cord, remove defective PCA, and proceed as follows:

CAUTION

Integrated circuits can be damaged by electrostatic discharge. Use the following precautions:

DO NOT wear clothing subject to static charge buildup, such as wool or synthetic materials.

DO NOT handle integrated circuits in carpeted areas.

DO NOT remove IC from its conductive foam pad until you are ready to install it.

AVOID touching circuit leads. Handle by the plastic package only.

ENSURE that IC, work surface (table, desk, etc.) and PCA are all at the same ground potential. This can be done by touching the foam pad to the PCA and then touch the foam pad, circuit, and PCA to the work surface. A portable static-safe work station is available, HP part no. 9300-0794.

1. Locate defective IC.
2. Using an IC removal tool (part no. 7110-0585), remove defective IC from its socket.

REPLACEMENT. When replacing a defective IC, be aware that each IC must be oriented and aligned in its socket, i.e., pin 1 of the IC matches pin 1 of the PCA. All ICs on a PCA are usually installed in the same direction, i.e., the notched ends of the ICs are facing in one direction for correct orientation. Pin 1 is marked on the PCA by a square hole, and pin 1 on the IC is marked by a dot or notch. These markings help to ensure that both the IC socket and IC are installed correctly (figure 7-13). Install new IC as follows:

1. Observe correct IC orientation and install replacement IC into IC socket.
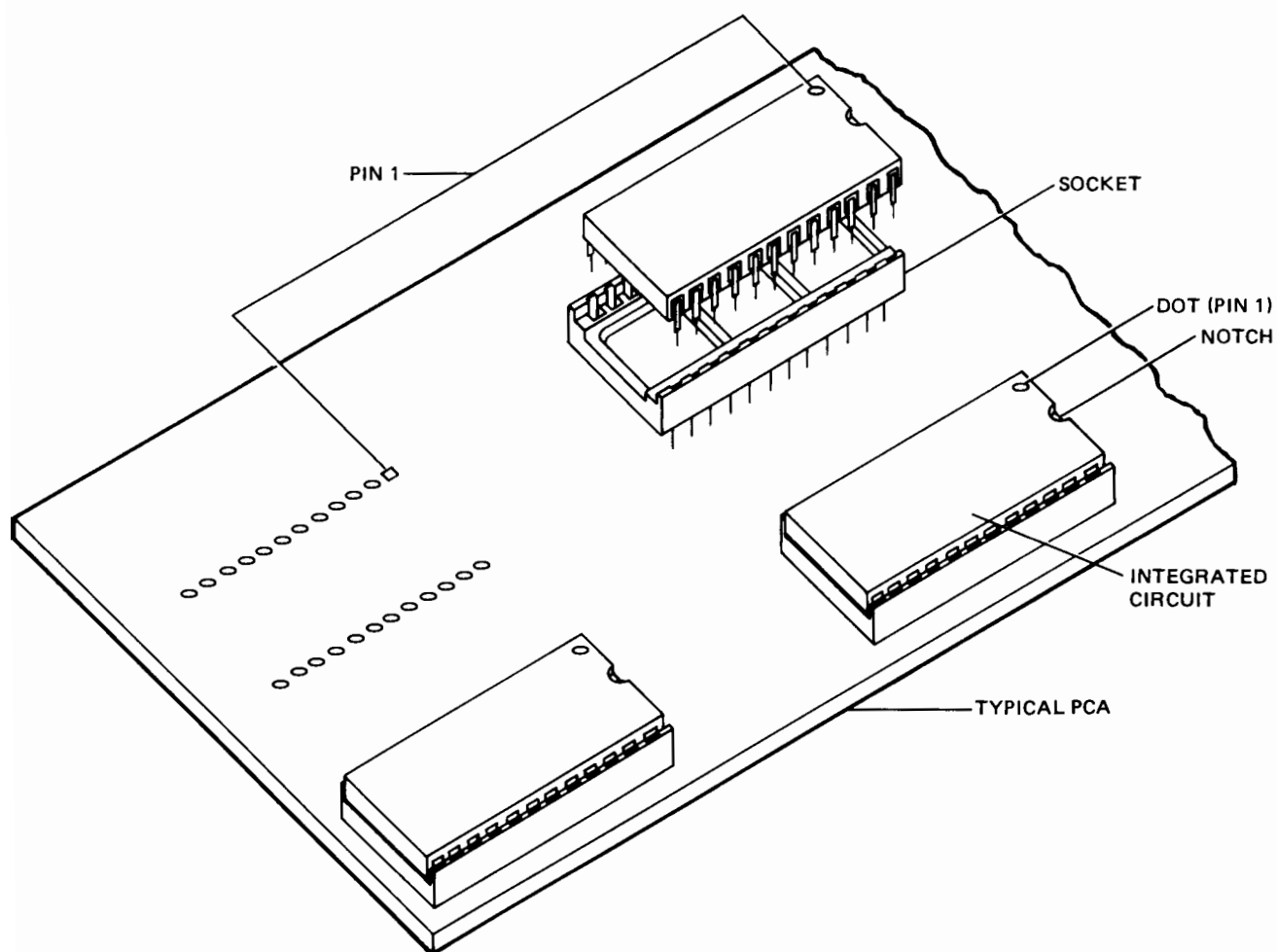2. Reinstall PCA.

Figure 7-13. Installing an IC

THERMAL PRINT
MECHANISM ....

The thermal print mechanism (TPM) is replaceable as an assembly, however, several subassemblies have been designated as field replaceable: the TPM PCA, and print head. Procedures for removing and replacing these subassemblies follow.

REMOVAL. Set terminal to the off position, disconnect the power cord, remove top cover, and proceed as follows:

1. Raise door latch and remove paper roll rod from TPM.
2. Use an IC removal tool and unsnap the two snap fasteners securing TPM to mainframe (see figure 7-14).
3. Lift back of TPM mainframe and slide TPM forward slightly. Do not grasp TPM motors when handling TPM.
4. Disconnect the two cable assemblies from their respective connectors (J2 and J3). Also, disconnect the ground cable at the quick-disconnect point which separates cable 02670-60052 from cable 02670-60081. Then remove TPM.
5. Loosen the three screws securing magnetic shield to TPM. Slide magnetic shield outward for removal.

REPLACEMENT. Replace TPM as follows:

1. Slide the just-removed magnetic shield onto TPM replacement and secure in place with the three screws.
2. Reconnect the two cable assemblies to their respective connectors (J2 and J3) and position TPM onto mainframe.
3. Slide TPM forward to hook front hooks onto mainframe. Be sure that TPM is properly positioned at the front hooks and snap-fastener holes in mainframe.
4. Raise door latch and secure TPM in place by pushing inward on the two snap-in grommets and then the two snap-in plungers.
5. Replace paper roll and lower door latch.
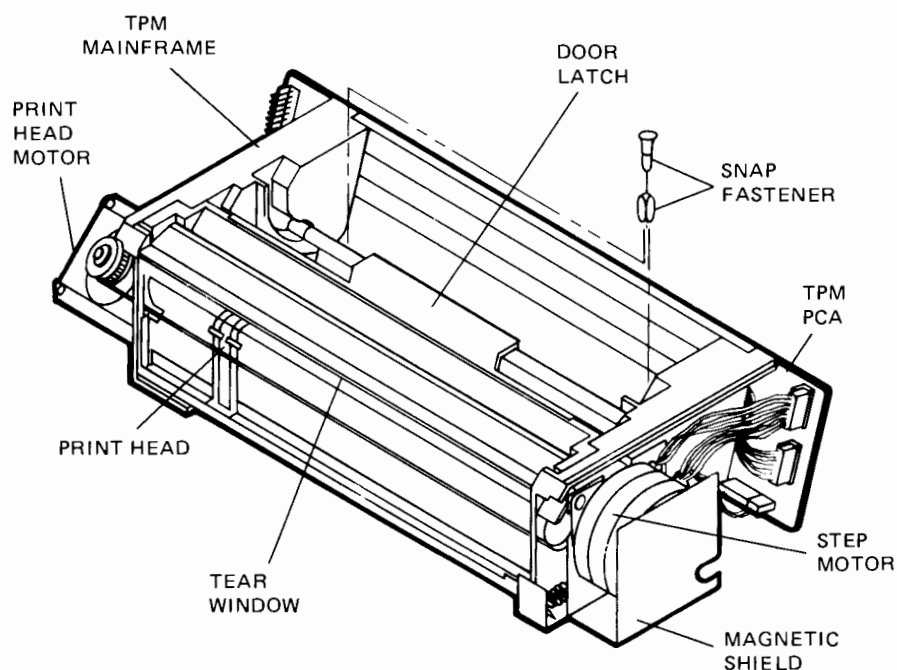6. Replace top cover and reconnect the power cord.

TPM
MAINFRAME

DOOR
LATCH

PRINT
HEAD
MOTOR

SNAP
FASTENER

TPM
PCA

PRINT HEAD

STEP
MOTOR

TEAR
WINDOW

MAGNETIC
SHIELD

Figure 7-14. TPM Removal

TPM PCA ....

REMOVAL. Set terminal power to the off position, disconnect the power cord, remove top cover and proceed as follows:

1. Remove the three screws securing TPM PCA from TPM mainframe.

2. Disconnect the remaining five cable assemblies from their respective connectors.

3. Remove TPM PCA from TPM mainframe.

REPLACEMENT. Replace the TPM PCA as follows:

1. If replacement PCA requires ROMs, remove the just removed PCA. Reinstall these ROMs in their respective IC sockets. Refer to "INTEGRATED CIRCUIT" and see figure 7-13.

2. Position TPM PCA onto TPM mainframe hooks and secure in place with the three screws.

3. Install print head (flex) cable into connector J4 (slot in TPM mainframe).

4. Reconnect the remaining cable assemblies to their respective connectors.

5. Reinstall TPM.

6. Replace top cover and reconnect power cord.

7. Reconfigure TPM strapping (refer to Configuration Section).

PRINT HEAD ....

Removal of the print head is made up of two major parts. First the thermal print mechanism must be removed from the terminal. Second the print head assembly (which includes the print head) must be removed.

To remove thermal print mechanism (TPM) from the terminal, proceed as follows:

1. Set terminal to the off position, disconnect the power cord, and remove the top cover.
2. Raise door latch and remove paper and paper roll rod from TPM.
3. Use an IC removal tool and unsnap the two snap fasteners securing TPM to mainframe (see figure 7-14).
4. Lift back of TPM mainframe and slide TPM forward slightly. Do not grasp TPM motors when handling TPM.
5. Disconnect the two cable assemblies from their respective connectors (J2 and J3) and remove TPM.

To remove print head assembly from TPM proceed as follows:
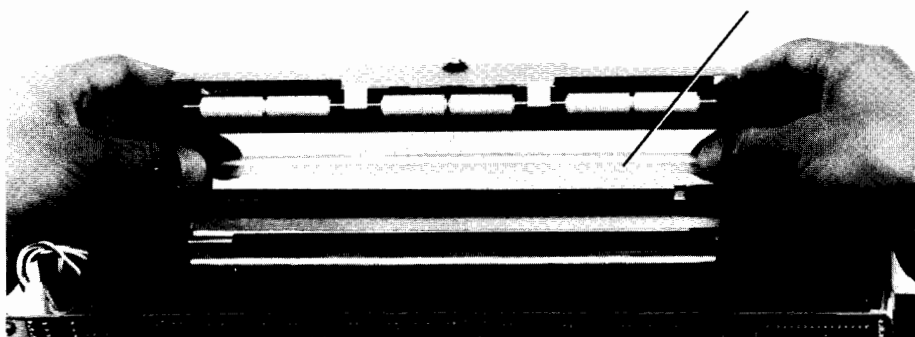
1. Raise door latch.

Figure 7-15. Tear Window

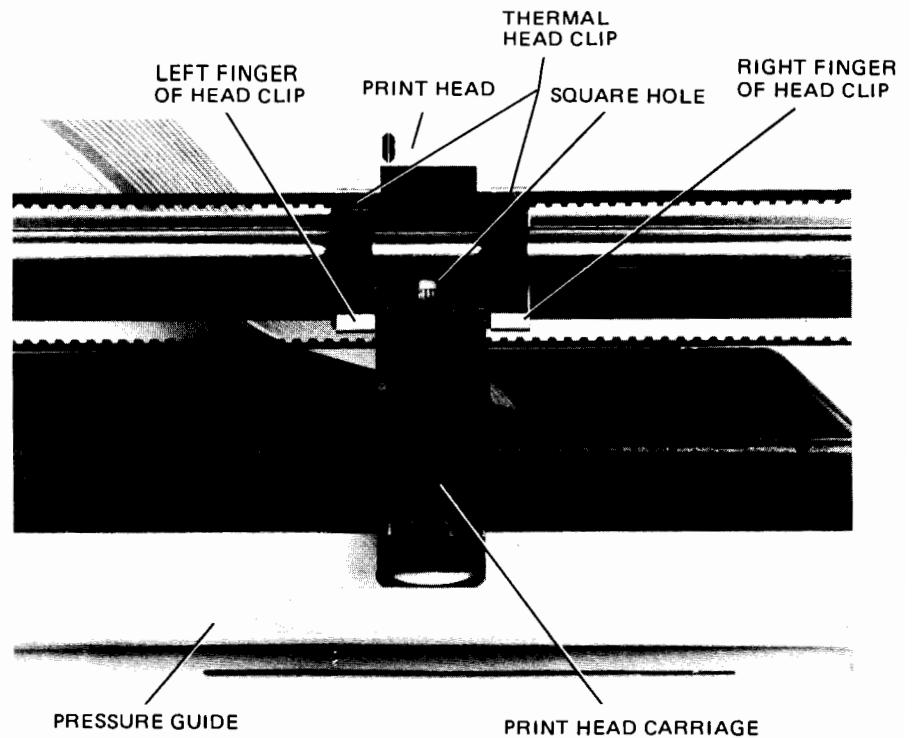2. Remove tear window. (See figure 7-15.)
3. Remove removable rod.

Figure 7-16. TPM Front View

4. Slide print head carriage down to the middle of the TPM. (See figure 7-16.)
5. Loosen right and left fingers of the thermal head clip which secures the print head in place.
6. Push the print head out from the print head carriage and down.
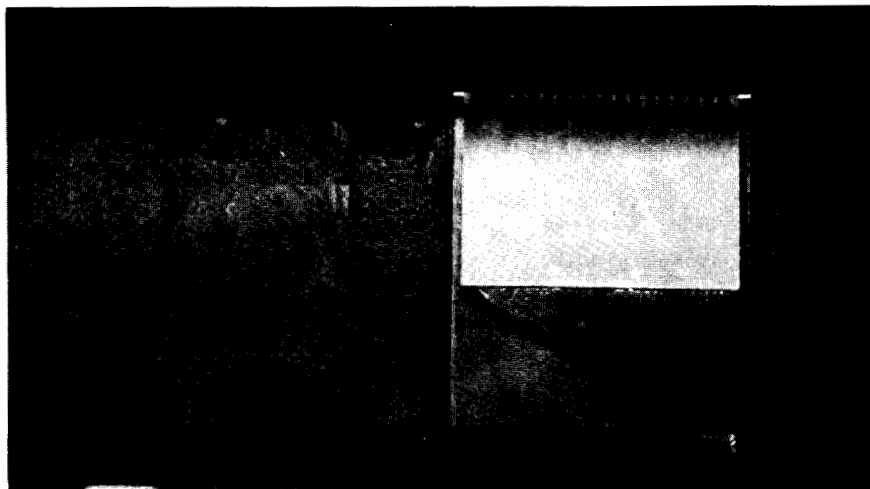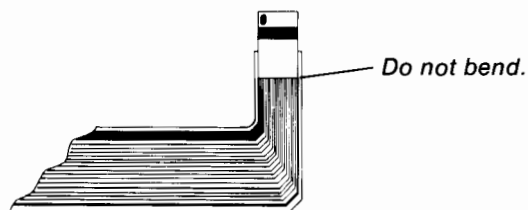7. Pull the print head out of the print head carriage.

Figure 7-17. Print Head Assembly Connector

8. Slide the print head removal tool (part no. 02620-00012) under the print head assembly connector and then insert it into the TPM PCA connector.

9. Unplug the connector end of the print head assembly. (See figure 7-17.)

10. Pull the print head assembly out of the thermal print mechanism.

CAUTION

— *Do not bend.*

When replacing the print head assembly do not bend the flex cable where it connects to the print head.

7-27

Replace print head as follows:

1. Put the TPM on the edge of a table top with the pressure guide and print head carriage facing you. The pressure guide needs to hang over the edge of the table. (See figure 7-16.)

2. Hold the print head so that the side which is one-half silver and one-half black is facing you. Thread print head under pressure guide between pressure guide and black portion of TPM.

3. Slide the print head up between the print head carriage and the thermal head clip. (See figure 7-16.) Do not bend flex cable where it connects to the print head because the wires will break.
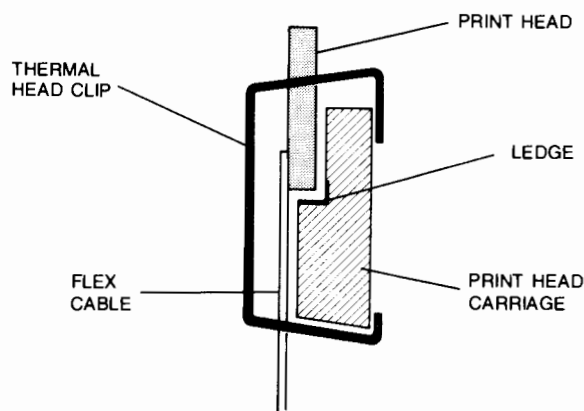

Figure 7-18. Ledge Inside Print Head Cartridge

4. Pull the print head up until you can see some of the flex cable through the square hole in the front of the print carriage. Then push the print head back down until it rests on the ledge which exists on the inside of the print head carriage. (See figure 7-18.)

5. Look through the square hole of the print head carriage. Be sure that print head ceramic is seen in half of the square hole, and that flex cable is seen in the other half of the square hole. (See figure 7-16.)

6. Latch the left and right fingers of the thermal head clip. (See figure 7-16.)
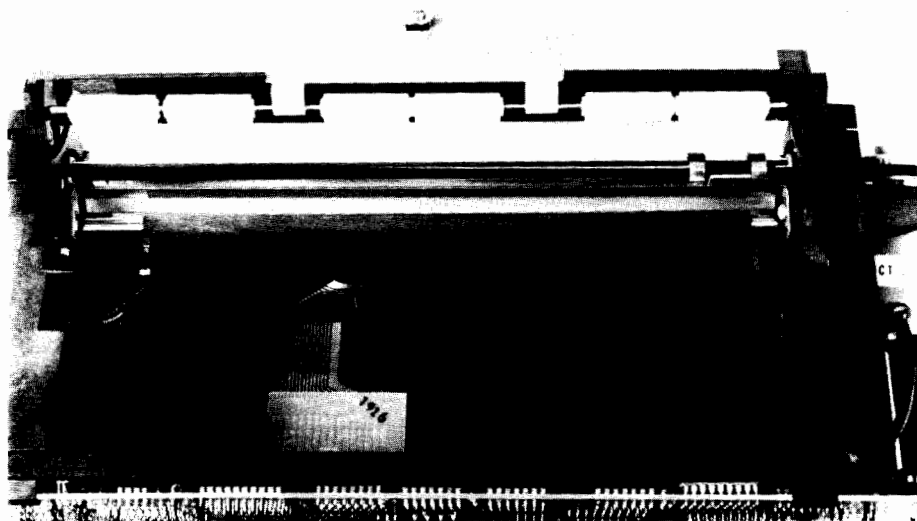7. Press the flex cable back inside of the TPM.

Figure 7-19. Print Head Assembly in Place

8. Make similar fold in flex cable as in defective flex cable and route along TPM trough. (See figure 7-19.)

Note

To ensure correct folding of flex cable, the replacement cable has been previously creased.

9. With insulated side up, install flex cable into TPM PCA connector (slot in TPM main-frame). Ensure that flex cable is seated fully into TPM PCA connector and that the contacts of the print head cable assembly are aligned with the contacts of the TPM PCA. To be sure of a perfect alignment, turn the TPM upside down to view the connection pin assignment. (See figure 7-17.)

7-29

Replace the TPM complete with new print head back into the terminal as follows:

1. Reconnect the two cable assemblies to their respective connectors (J2 and J3) and position TPM onto mainframe.
2. Slide TPM forward to hook front hooks onto mainframe. Be sure that TPM is properly positioned at the front hooks and snap-fastener holes in mainframe.
3. Raise door latch and secure TPM in place by pushing inward on the two snap-in grommets and then the two snap-in plungers.
4. Replace removable rod.
5. Replace paper and paper roll rod.
6. Replace tear window.
7. Lower and secure door latch.
8. Replace cover and reconnect power cord.

REMOVABLE PARTS ....

Removable parts for the terminal are listed in tables 7-1 through 7-8. The removable parts in tables 7-1 through 7-4 are referenced to the exploded views (figures 7-20 through 7-25) of the terminal by index numbers which are in disassembly order, except attaching parts are listed immediately after the parts they attach. Table 7-5 gives the part numbers for keycaps shown in figures 7-26 through 7-31. Table 7-6 gives the 2622D keycap kit part numbers for the keyboards shown in figures 7-32 through 7-40. Table 7-7 gives the part numbers for the replaceable parts shown in figures 7-41 through 7-43. Items in the DESCRIPTION column of tables 7-1 through 7-4 are indented to indicate item relationship. In addition, the symbol "— — — X — — —" follows the last one or more attaching parts. Indention is as follows:

> *MAJOR ASSEMBLY*
>
> *Removable Assembly
> *Attaching Parts for Removable Assembly
> **Subassembly Parts
> **Attaching Parts for Subassembly Parts

Tables 7-1 through 7-4 provide the following information for each part:

a. *FIG. & INDEX NO.* The figure and index number where the removable parts are shown in the exploded view.

b. *HP PART NO.* The Hewlett-Packard part number for each removable part.

c. *DESCRIPTION.* The description and any special application (accesories and options) for each removable part.

d. *UNITS PER ASSY.* The total quantity of each part used in the major assembly.

ORDERING REMOVABLE PARTS ....

To order removable parts for the terminal or options and accessories, address the order to your local Hewlett-Packard Sales and Service Office listed at the end of this manual. The following information should be included in the order for each part.

a. Complete terminal model number (including options and accessories) and serial number.

b. Hewlett-Packard part number.

c. Complete part description as provided in the removable parts list.

EXCHANGE MODULES ....

Exchange modules are replacement modules less some removable components. Table 7-8 lists the available exchange modules and the components that must be removed before a module is sent to Hewlett-Packard's Customer Service Division (CSD). These exchange modules are available from CSD under the "Blue Stripe Program." The Customer Service Engineer can exchange a defective module for a replacement module at the prevailing exchange rate. Contact your local HP Sales and Service Office for details.
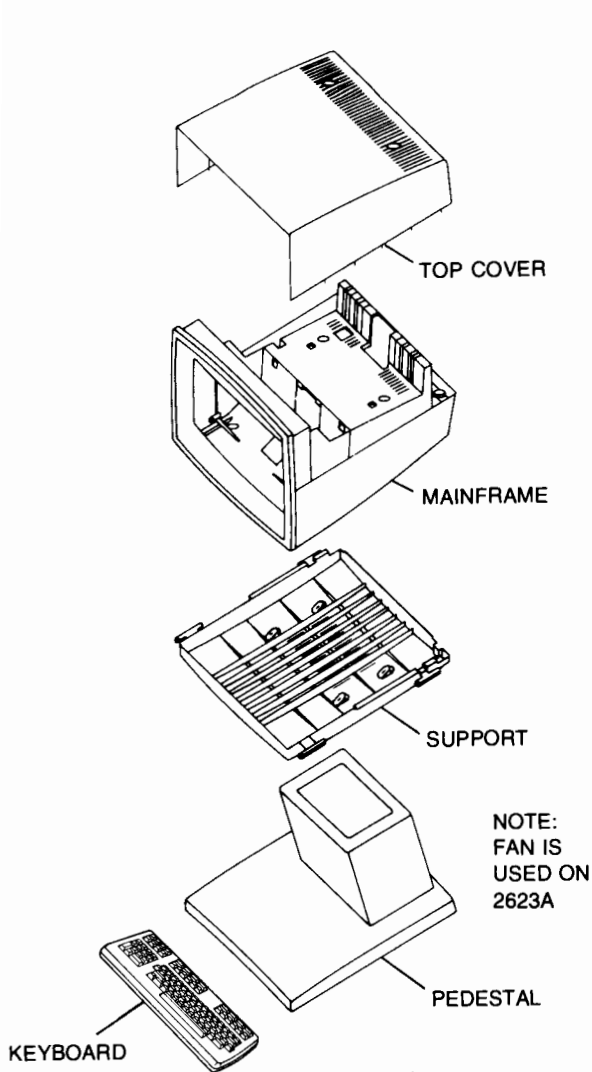
TOP COVER

MAINFRAME

SUPPORT

NOTE:
FAN IS
USED ON
2623A

PEDESTAL

KEYBOARD

Figure 7-20. Standard Terminal

TPM
DOOR

TPM TOP COVER

TPM

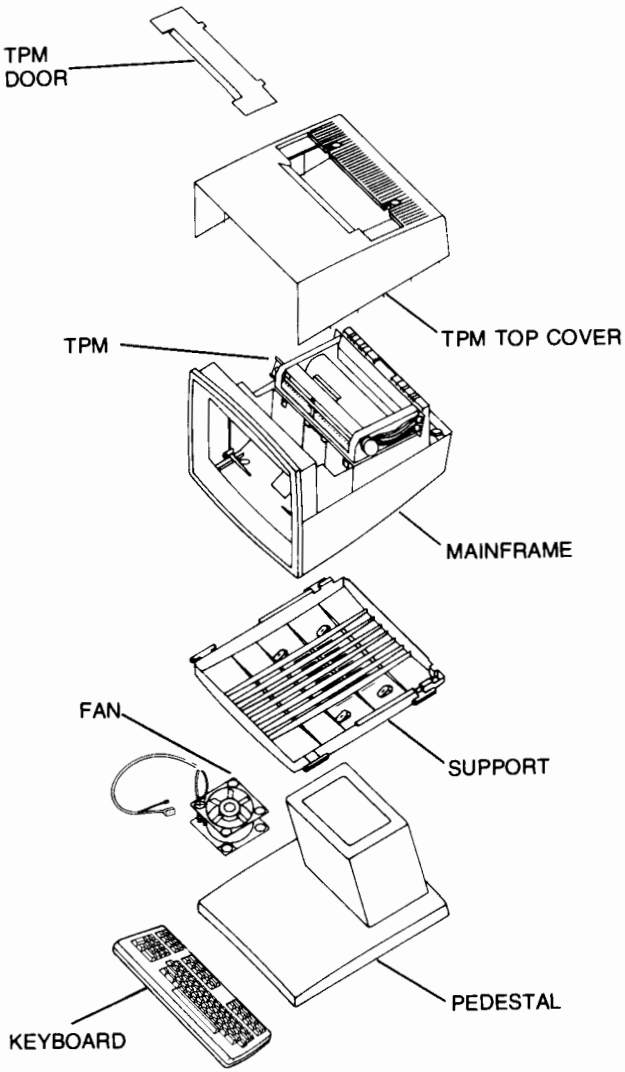MAINFRAME

FAN

SUPPORT

PEDESTAL

KEYBOARD

Figure 7-21. Option 050 Terminal

Table 7-1. Top Cover, Support, and Pedestal

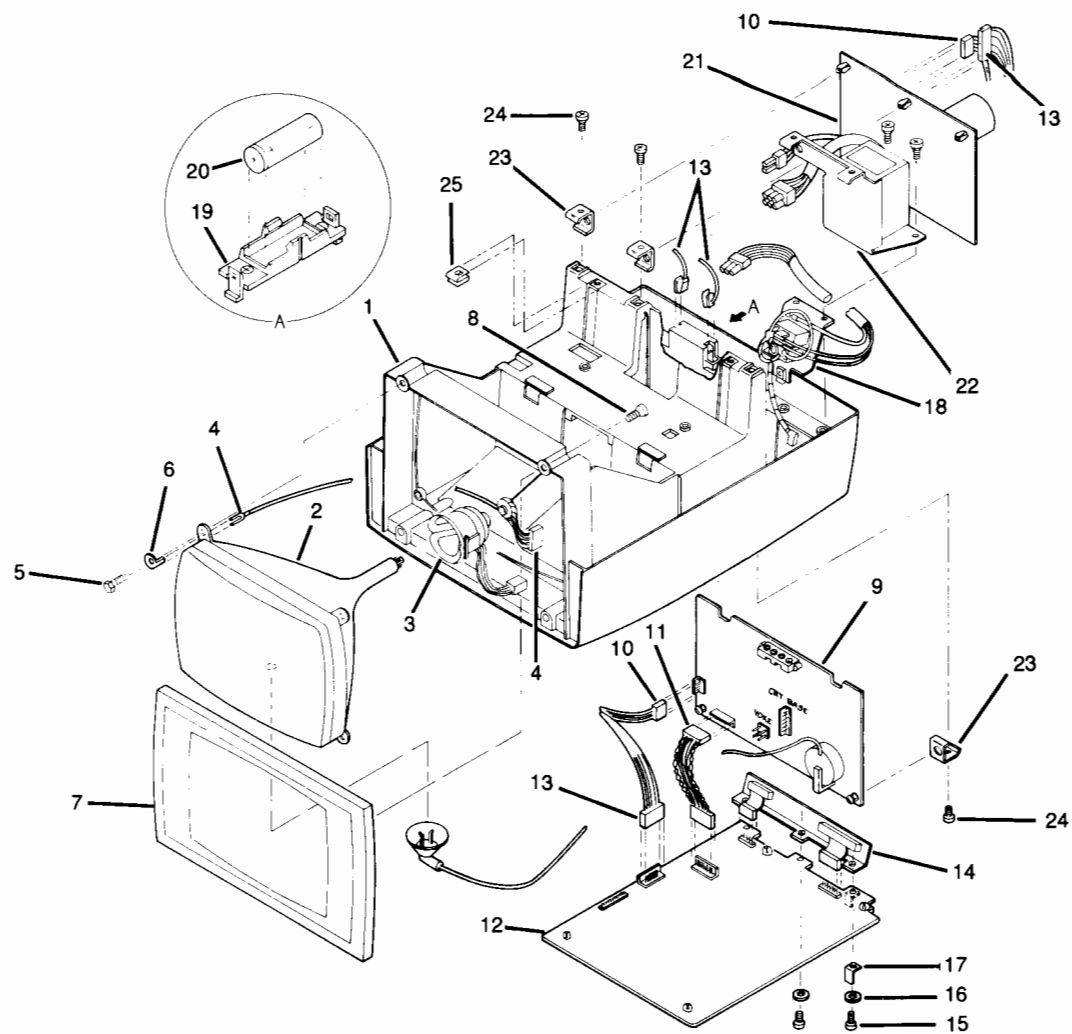| FIG. & INDEX NO.	2 6 2 2 A	2 6 2 2 D	2 6 2 3 A	OPT. 050	HP PART NO.	DESCRIPTION
7-20	1	1	1		4040-1479	*Top Cover
7-21				1	4040-1481	*TPM Top Cover
						(Attaching Parts)
	2	2	2	2	1390-0475	*Quarter-Turn Fastener
	2	2	2	2	1390-0293	*Quarter-Turn Spring
	2	2	2	2	1390-0257	*Quarter-Turn Retainer
	2	2	2	2	1390-0071	*Quarter-Turn Washer
						— — — X — — —
7-21				1	4040-1482	*TPM Door
						— — — X — — —
7-20, 21	1	1	1	1	4040-1484	*Support
						(Attaching Parts)
	1	1	1	1	1390-0475	*Quarter-Turn Fastener
	1	1	1	1	1390-0293	*Quarter-Turn Spring
	1	1	1	1	1390-0257	*Quarter-Turn Retainer
	1	1	1	1	1390-0071	*Quarter-Turn Washer
						— — — X — — —
	1	1	1	1	4040-1447	*Top Prop
						— — — X — — —
7-20, 21	1	1	1	1	4040-1480	*Pedestal
						(Attaching Parts)
	4	4	4	4	0624-0439	*Screw, tapping
	4	4	4	4	3050-0099	*Washer, flat
	6	6	6	6	0403-0284	*Foot, press-in
7-20, 21			1	1	3160-0208	*Fan
						(Attaching Parts)
			1	1	02620-60172	*Fan Cable Assembly
			3	3	0590-0653	*Nut, no. 6
			1	1	2190-0008	*Washer, lock, no. 6

Mainframes

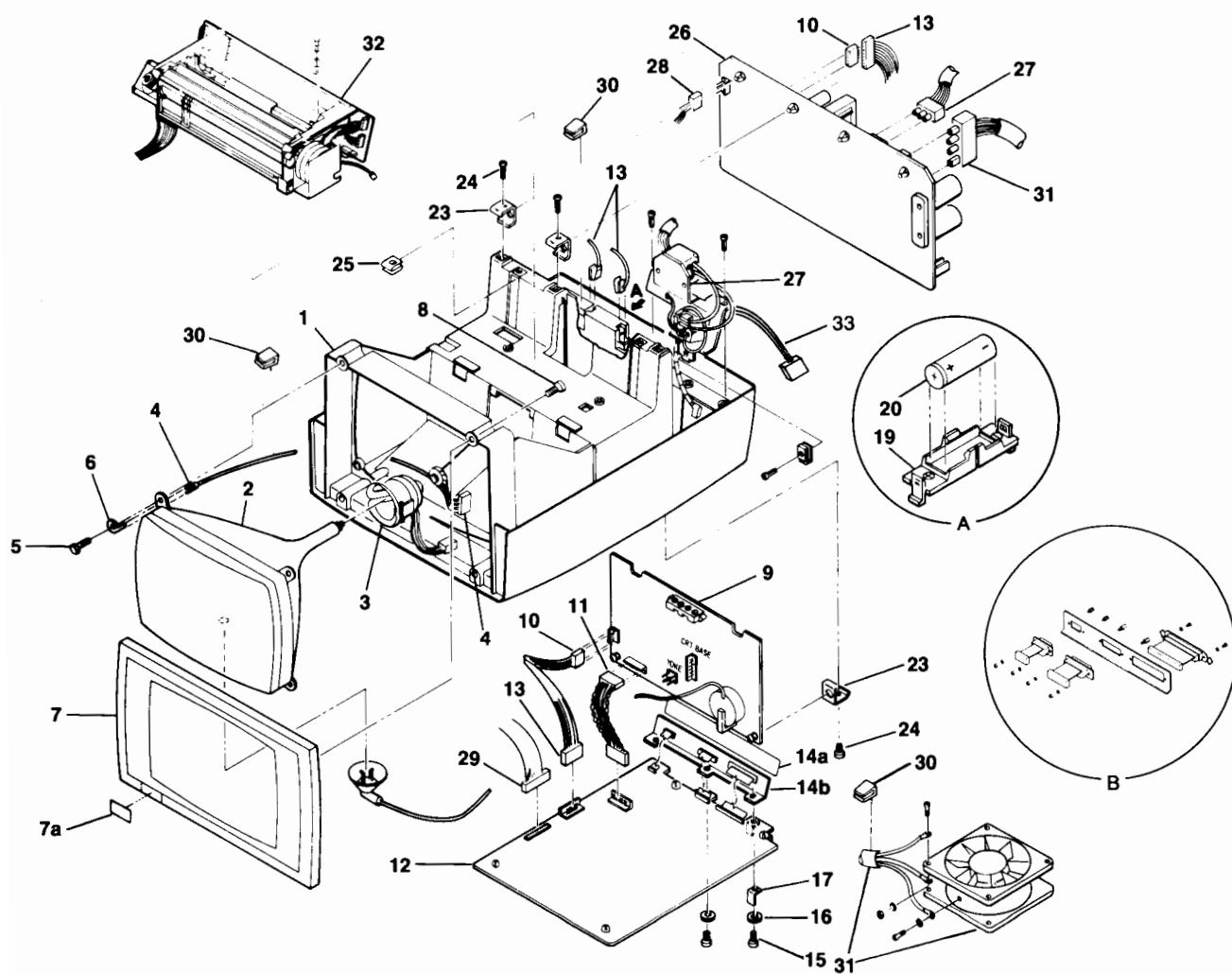Figure 7-22. Mainframe, Exploded View (Standard)

Figure 7-23. Mainframe, Exploded View (Option 050)

Table 7-2. Mainframe Module Assembly

FIG. & INDEX NO.	2622A	2622D	2623A	OPT. 050	HP PART NO.	DESCRIPTION
7-22-						
7-23-						
1	1	1	1	1	4040-1486	*Chassis
						(Attaching Parts)
2	1	1	1	1	2090-0042	*Cathode Ray Tube (CRT)
3	1	1	1	1	9100-4159	*Yoke, Deflection
4	1	1	1	1	02620-60009	*CRT Base Cable Assembly
5	4	4	4	4	0264-0440	*Screw, tapping, 10-14×⅝
6	1	1	1	1	0360-1934	*Lug, quick disconnect
7	1	1	1	1	4040-1478	*Bezel
7a	1			1	7120-7454	*Bezel Insert
7a		1		1	7120-1927	*Bezel Insert
7a			1	1	7120-8631	*Bezel Insert
8	4	4	4	4	0624-0413	*Screw, tapping, 8-16×½
						— — — X — — —
9	1	1	1	1	02620-60002	*Sweep PCA
10	1	1	1	1	02620-60022	*Sweep Power Cable Assembly
11	1	1	1	1	02620-60010	*Video Cable Assembly
						— — — X — — —
12	1	1	1	1	02620-60087	*Processor PCA (also used on 2622A/D-050)
12			1	1	02620-60088	*Processor PCA (also used on 2623A-050)
						(Attaching Parts)
12a	7	7	7	10	1390-0104	*Snap Fastener Insert
12b	7	7	7	10	1390-0281	*Tall Snap Fastener
13	1	1	1	1	02620-60021	*Logic Power Cable Assembly
14	1	1		1	02620-60025	*I/O Panel Assembly (also used on 2622A/D-050)
14			1	1	02620-60109	*Dual Panel Assembly (also used on 2623A-050)

Table 7-2. Mainframe Module Assembly (Continued)

FIG. & INDEX NO.	2622A	2622D	2623A	OPT. 050	HP PART NO.	DESCRIPTION
15	3	3	3	3	0515-0066	*Screw, machine
16	3	3	3	3	2190-0007	*Lockwasher
17	1	1	1	1	0360-1263	*Lug, quick discon, rt. angle
						———X———
18	1	1	1		02620-60006	*Power Panel Assembly
						———X———
19	1	1	1	1	1400-0965	*Battery Support
20	1	1	1	1	1420-0259	*Battery, 4.2V
						———X———
21	1	1			02620-60004	*Power Supply PCA (2622A/D)
	1	1			2110-0043	*Fuse, 1.5A, 250V (Standard)
	1	1			2110-0063	*Fuse, 0.75A, 250V (opt. 013)
	1	1			2110-0002	*Fuse, 2A, 250V (opt. 014)
	1	1			2110-0001	*Fuse, 1A, 250V (opt. 015)
	1	1			2110-0002	*Fuse, 2A, 250V (opt. 016)
21			1		02620-60060	*Power Supply PCA (2623A)
			1		2110-0002	*Fuse, 2A, 250V (Standard)
			1		2110-0001	*Fuse, 1A, 250V (opt. 013)
			1		2110-0083	*Fuse, 2.5A, 250V (opt. 014)
			1		2110-0001	*Fuse, 1A, 250V (opt. 015)
			1		2110-0002	*Fuse, 2A, 250V (opt. 016)
						———X———
22	1	1			02620-60015	*Transformer Assembly
22			1		02620-60079	*Transformer Assembly
						———X———
23	4	4	4	6	1600-0776	*Bracket, PC Board
24	8	8	8	8	0624-0413	*Screw, tapping, 8-16× ½
25	2	2	2	2	1390-0464	*Quarter-Turn Receptacle
						———X———

Table 7-2. Mainframe Module Assembly (Continued)

FIG. & INDEX NO.	2 6 2 2 A	2 6 2 2 D	2 6 2 3 A	OPT. 050	HP PART NO.	DESCRIPTION
26				1	02620-60019	*Power Supply PCA (opt. 050)
				1	2110-0010	*Fuse, 5A, 250V (Standard)
				1	2110-0083	*Fuse, 2.5A, 250V (opt. 013)
				1	2110-0010	*Fuse, 5A, 250V (opt. 014)
				1	2110-0083	*Fuse, 2.5A, 250V (opt. 015)
				1	2110-0010	*Fuse, 5A, 250V (opt. 016)
						— — — X — — —
27				1	02620-60027	*Power Panel Assembly
28				1	02620-60013	*TPM Power Cable
29				1	8120-2805	*TPM Cable
30				3	1400-0611	*Cable Clamp
31				1	3160-0208	*Fan
31				1	02620-60172	*Fan Cable Assembly
32				1	02670-60046	*TPM Mainframe
						— — — X — — —
	1	1	1	1	8120-1378	*Power Cord Set, NEMA/5CEE (Standard)
	1	1	1	1	8120-1351	*Power Cord Set, BS1363/CEE (option 900)
	1	1	1	1	8120-1369	*Power Cord Set, ASCII2/CEE (option 901)
	1	1	1	1	8120-1689	*Power Cord Set, GMEH/CEE (option 902)
	1	1	1	1	8120-2104	*Power Cord Set, SEV/CEE (option 906)
33				1	02620-60081	*Ground Strap Assembly

Thermal Print Mechanism
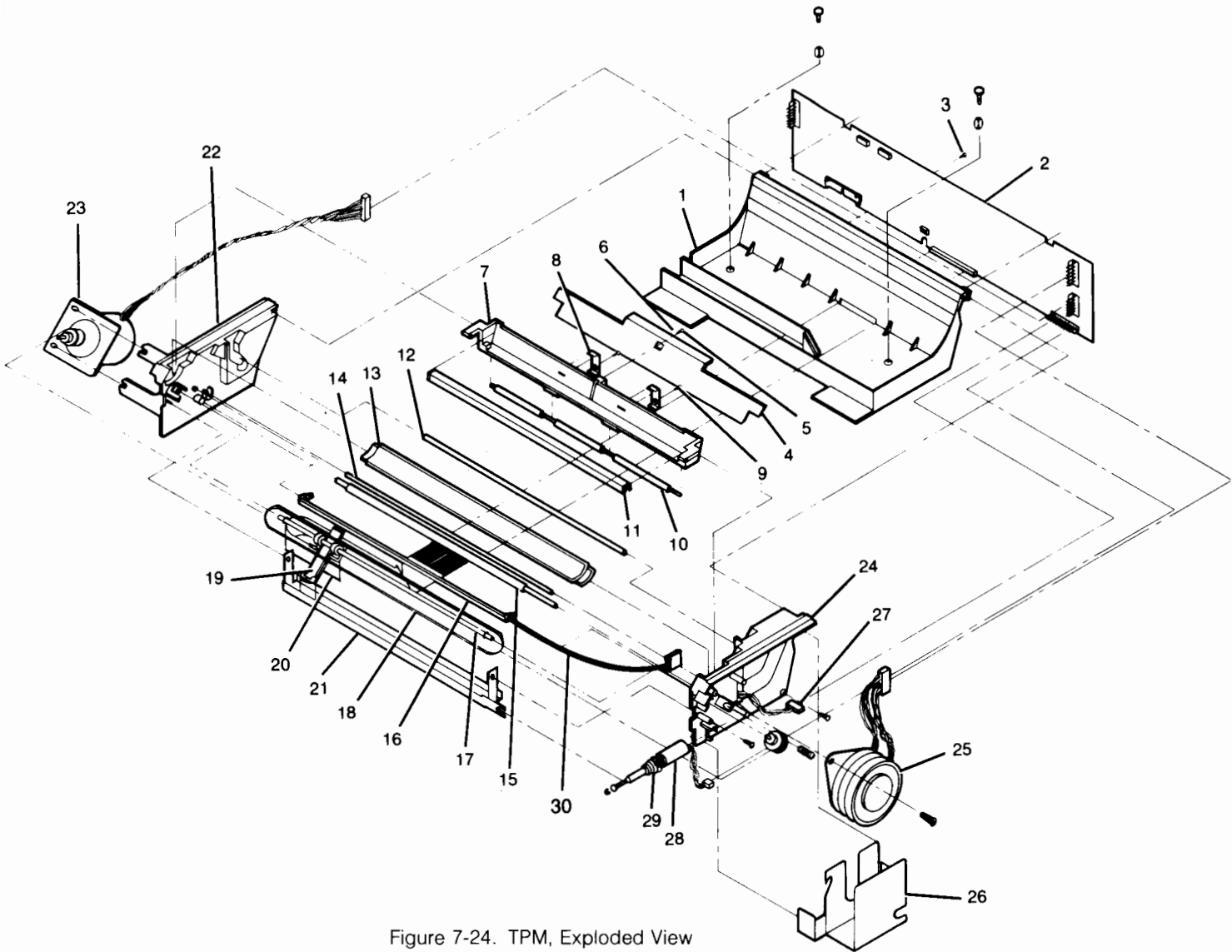
Figure 7-24. TPM, Exploded View

Table 7-3. Thermal Print Mechanism

FIG. & INDEX NO.	UNITS PER ASSY.	HP PART NO.	DESCRIPTION
7-24-			
		02670-60015	Mechanical Assembly less Items 2, 19, 26
1	1	02670-40003	*Mainframe (Attaching Parts)
1a	2	1390-0450	*Short Fastener
1b	2	1390-0104	*Snap Fastener Insert
2	1	02670-60050	*TPM PCA (Exchange Module)
3	3	2360-0125	*Screw, machine
4	1	1600-0758	*Door Latch
5	1	0624-0364	*Screw, no. 4-20 x .25 in.
6	1	3050-0100	*Washer, flat, no. 4
7	1	02670-40005	*Latching Frame
8	2	1600-0757	*Clip, platen holder
9	2	0624-0364	*Screw, tapping, no. 2-28
10	1	1531-0021	*Shaft, idle roller
11	1	02670-60007	*Platen Assembly
12	1	02670-60055	*Rod, paper roll
13	1	02670-40007	*Tear Window
14	1	1531-0022	*Rod, removable
15	1	1530-2154	*Shaft, rubber drive
16	1	02670-60052	*Paper Guide & Ground Strap Assembly
	1	9270-0638	*Paper, Thermal
17	1	1531-0071	*Shaft, head carriage
18	1	1500-0520	*Belt, timing
19	1	02670-60014	*Print Head Cable Assembly
20	1	1600-0761	*Clip, head
21	1	1600-0755	*Guide, pressure
22	1	02670-40001	*Plate, left end
23	1	02670-60002	*Motor, Print Head Assembly
24	1	02670-40002	*Plate, right end
25	1	3140-0613	*Motor, Paper Step
26	1	8160-0309	*Shield, Magnetic (Not used on 2622D)
27	1	02670-60005	*Microswitch Assembly
28	1	02670-60004	*Solenoid Assembly
29	1	1460-1683	*Spring, Solenoid
30	1	02670-60052	*Paper Guide Ground Strap

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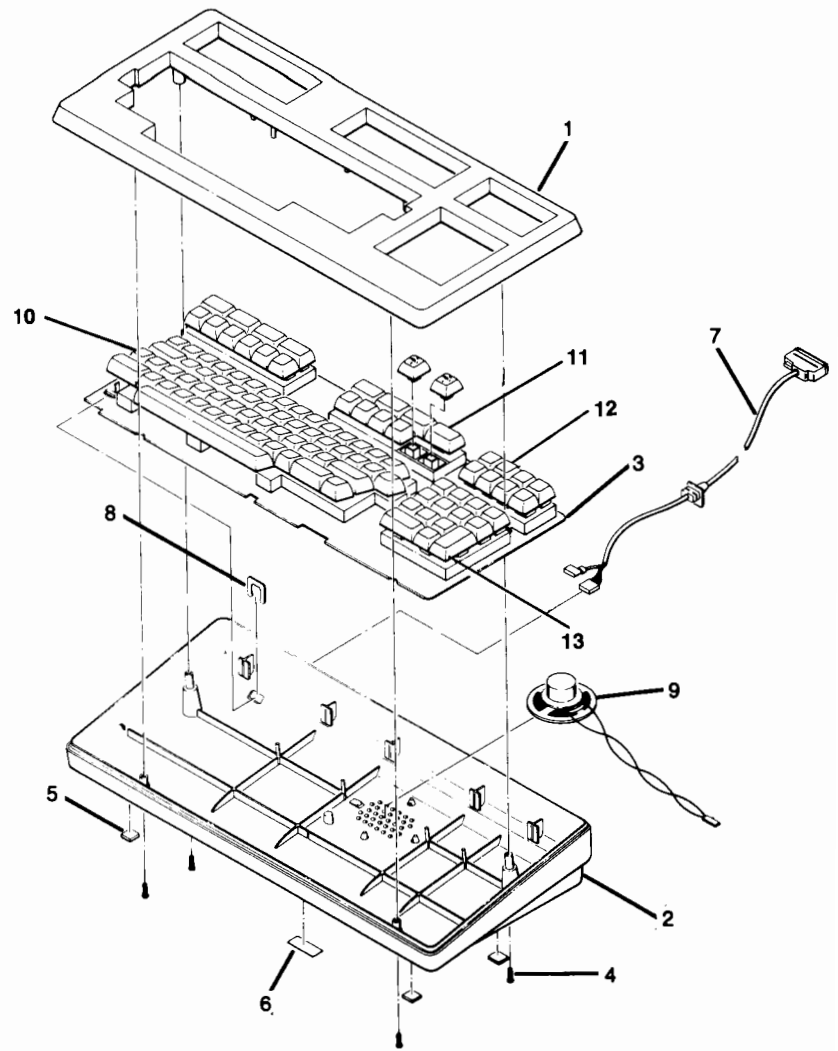
Keyboards

Figure 7-25. Keyboard Assembly

Table 7-4. Keyboard Assembly

INDEX NO.	UNITS PER ASSY. (Figure 7-25)	HP PART NO.	DESCRIPTION
1	1	02620-40011	**Keyboard Top, Extended
2	1	02620-40012	**Keyboard Base, Extended
3	1	02620-60061	**Keyboard PCA, Extended
4	4	0624-0400	**Screw, Tapping, no. 6-19
5	4	0403-0324	**Rubber Bumper
6	1	7120-1927	**Serial Tag
7	1	02620-60028	**Keyboard Cable Assembly
8	1	1600-0767	**Retainer, Cable
9	1	02620-60016	**Loudspeaker Assembly
10	1	3101-2337	**Switch Array (61 Switches)
11	2	3101-0464	**Switch Array (10 Switches)
12	1	3101-0465	**Switch Array (8 Switches)
13	1	3101-0466	**Switch Array (14 Switches)

Table 7-5. Keycaps

HP PART NO.	KEYCAP DESCRIPTION	UNITS PER ASSEMBLY							
		2622A	2623A	Swd./Fn. 001	Dan./Nr. 002	Fr. 003	Ger. 004	UK 005	Sp. 006
0371-1219	A	1	1	1	1	1	1	1	1
0371-1220	B	1	1	1	1	1	1	1	1
0371-1221	C	1	1	1	1	1	1	1	1
0371-1222	D	1	1	1	1	1	1	1	1
0371-1223	E	1	1	1	1	1	1	1	1
0371-1224	F	1	1	1	1	1	1	1	1
0371-1225	G	1	1	1	1	1	1	1	1
0371-1226	H	1	1	1	1	1	1	1	1
0371-1232	N	1	1	1	1	1	1	1	1
0371-1234	P	1	1	1	1	1	1	1	1
0371-1235	Q	1	1	1	1	1	1	1	1
0371-1236	R	1	1	1	1	1	1	1	1
0371-1237	S	1	1	1	1	1	1	1	1
0371-1238	T	1	1	1	1	1	1	1	1
0371-1240	V	1	1	1	1	1	1	1	1
0371-1241	W	1	1	1	1	1	1	1	1
0371-1242	X	1	1	1	1	1	1	1	1
0371-1243	Y	1	1	1	1	1	1	1	1
0371-1244	Z	1	1	1	1	1	1	1	1
0371-1245	1!	1	1	1	1	1	1	1	1
0371-1246	2@	1	1						
0371-1247	3#	1	1	1	1				
0371-1248	4$	1	1	1	1	1	1	1	1
0371-1249	5%	1	1	1	1	1	1	1	1
0371-1250	6^	1	1						
0371-1251	7&	1	1						
0371-1252	8*	1	1						
0371-1253	9(	1	1						
0371-1254	0)	1	1						
0371-1255	_-	1	1	1	1	1	1	1	1
0371-1256	=+	1	1						
0371-1257	`~	1			1			1	1

Table 7-5. Keycaps (Continued)

HP PART NO.	KEYCAP DESCRIPTION	UNITS PER ASSEMBLY							
		2622A	2623A	Swd./Fn. 001	Dan./Nr. 002	Fr. 003	Ger. 004	UK 005	Sp. 006
0371-1258	[{	1	1					1	
0371-1259	]}	1	1					1	
0371-1260	\ I	1	1					1	
0371-1261	;:	1	1						
0371-1262	' "	1	1						
0371-1263	,<	1	1						
0371-1264	. >	1	1						
0371-1265	/?	1	1						
0371-1267	BACKSPACE	1	1	1	1	1	1	1	1
0371-1268	CAPS	1	1	1	1	1	1	1	1
0371-1269	CTRL	1	1	1	1	1	1	1	1
0371-1270	ENTER	1	1	1	1	1	1	1	1
0371-1273	TAB/BACKTAB	1	1	1	1	1	1	1	1
0371-1274	SHIFT	2	2	2	2	2	2	2	2
0371-1275	RETURN	1	1	1	1	1	1	1	1
0371-1277	(SPACEBAR)	1	1	1	1	1	1	1	1
0371-1864	2"			1	1	1	1	1	1
0371-1865	8(			1	1	1	1	1	1
0371-1866	9)			1	1	1	1	1	1
0371-1867	0=			1	1	1	1	1	1
0371-1868	,;			1	1	1	1	1	1
0371-1869	.:			1	1	1	1	1	1
0371-1870	6&			1	1	1	1	1	1
0371-1871	7/			1	1	1	1		
0371-1872	+?			1	1			1	1
0371-1873	' E			1					
0371-1874	< >			1	1	1	1	1	1
0371-1875	A			1	1				
0371-1876	U			1			1		
0371-1877	' *			1	1				
0371-1878	Ö			1			1		
0371-1879	Ä			1			1		
0371-1880	@^				1				
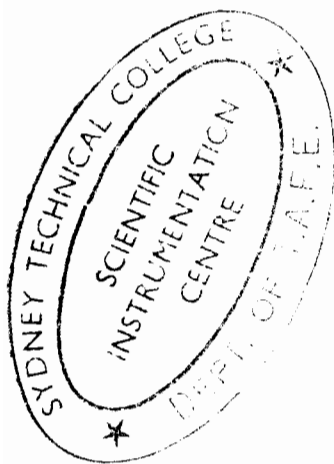
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Table 7-5. Keycaps (Continued)

HP PART NO.	KEYCAP DESCRIPTION	UNITS PER ASSEMBLY							
		2622A	2623A	Swd./Fn. 001	Dan./Nr. 002	Fr. 003	Ger. 004	UK 005	Sp. 006
0371-1881	Æ				1	1			
0371-1882	Ø				1				
0371-1883	3§					1	1		
0371-1884	6+					1			
0371-1885	'?					1			
0371-1886	^..					1			
0371-1887	`£					1			
0371-1888	à ç					1			
0371-1889	& *					1			
0371-1890	é è								
0371-1891	ù o					1			
0371-1892	β?						1		
0371-1893	..						1		
0371-1894	£ ^						1		
0371-1895	+*						1		
0371-1896	3£							1	
0371-1897	7^							1	
0371-1898	'/							1	1
0371-1899	*@							1	1
0371-1900	3¿								1
0371-1901	7i								1
0371-1902	o {								1
0371-1903	# }						4		1
0371-1904	ñ						1		1
0371-1970	(CURSOR)	4	4	4	4	4	1	4	4
0371-1971	(HOME UP)	1	1	1	1	1	1	1	1
0371-1973	F1	1	1	1	1	1	1	1	1
0371-1974	F2	1	1	1	1	1	1	1	1
0371-1975	F3	1	1	1	1	1		1	1
0371-1976	F4	1	1	1	1	1		1	1
0371-1977	F5	1	1	1	1	1		1	1
0371-1978	F6	1	1	1	1	1		1	1

Table 7-5. Keycaps (Continued)

HP PART NO.	KEYCAP DESCRIPTION	UNITS PER ASSEMBLY							
		2622A	2623A	Swd./Fn. 001	Dan./Nr. 002	Fr. 003	Ger. 004	UK 005	Sp. 006
0371-1979	F7	1	1	1	1	1	1	1	1
0371-1980	F8	1	1	1	1	1	1	1	1
0371-1981	ESC	1	1	1	1	1	1	1	1
0371-1982	DEL	1	1	1	1	1	1	1	1
0371-1983	(TAB LEFT)	1	1	1	1	1	1	1	1
0371-1984	(TAB RIGHT)	1	1	1	1	1	1	1	1
0371-1985	0	1		1	1	1	1	1	1
0371-1986	NEXT PAGE	1	1	1	1	1	1	1	1
0371-1987	PREV PAGE	1	1	1	1	1	1	1	1
0371-1990	INS LINE	1	1	1	1	1	1	1	1
0371-1991	DEL LINE	1	1	1	1	1	1	1	1
0371-1992	INS CHAR	1	1	1	1	1	1	1	1
0371-1993	DEL CHAR	1	1	1	1	1	1	1	1
0371-1994	CLEAR DSPLY	1	1	1	1	1	1	1	1
0371-1995	BREAK	1	1	1	1	1	1	1	1
0371-1996	RESET	1	1	1	1	1	1	1	1
0371-1997	1	1		1	1	1	1	1	1
0371-1998	2	1		1	1	1	1	1	1
0371-1999	3	1		1	1	1	1	1	1
0371-2000	4	1		1	1	1	1	1	1
0371-2001	5	1		1	1	1	1	1	1
0371-2003	7	1		1	1	1	1	1	1
0371-2004	8	1		1	1	1	1	1	1
0371-2006	– (MINUS)	1	1	1	1	1	1	1	1
0371-2007	. (PERIOD)	1	1	1	1	1	1	1	1
0371-2013	AIDS	1	1	1	1	1	1	1	1
0371-2015	CLEAR LINE	1	1	1	1	1	1	1	1
0371-2016	I	1	1	1	1	1	1	1	1
0371-2017	J	1	1	1	1	1	1	1	1
0371-2018	K	1	1	1	1	1	1	1	1
0371-2019	L	1	1	1	1	1	1	1	1
0371-2020	M	1	1	1	1	1	1	1	1

Table 7-5. Keycaps (Continued)

HP PART NO.	KEYCAP DESCRIPTION	UNITS PER ASSEMBLY							
		2622A	2623A	Swd./Fn. 001	Dan./Nr. 002	Fr. 003	Ger. 004	UK 005	Sp. 006
0371-2021	O	1	1	1	1	1	1	1	1
0371-2022	U	1		1	1	1	1	1	1
0371-2029	MODES	1	1	1	1	1	1	1	1
0371-2030	USER KEYS	1	1	1	1	1	1	1	1
0371-2081	6 and 9	2		2	2	2	2	2	2
0371-1988	ROLL UP		1						
0371-1989	ROLL DOWN		1						
0371-2355	GRAPHICS COPY		1						
0371-2356	ALPHA DSPLY		1						
0371-2357	GRAPHICS DSPLY		1						
0371-2358	GRAPHICS CRSR		1						
0371-2359	> (Arrow Right)		1						
0371-2360	< (Arrow Left)		1						
0371-2361	▲ (Arrow Up)		1						
0371-2362	▼ (Arrow Down)		1						
0371-2363	CURSOR FAST		1						
0371-2365	GRAPHICS CLEAR		1						
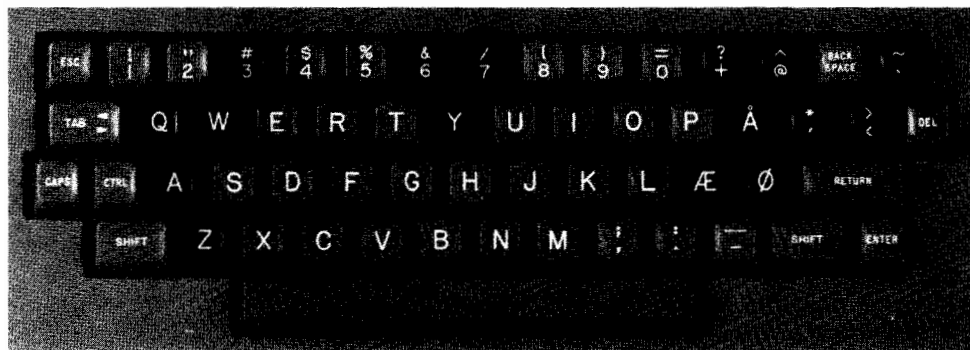
Figure 7-26. Swedish/Finnish Keyboard (Opt. 001), Unique Keys
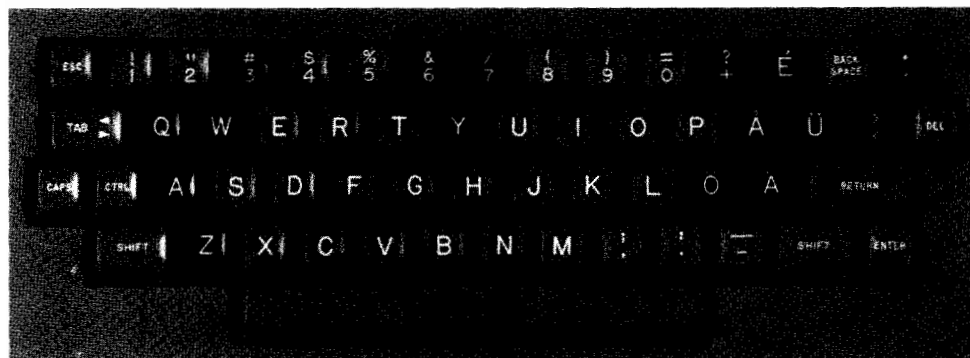
Figure 7-27. Danish/Norwegian Keyboard (Opt. 002), Unique Keys

The French keyboard can be
configured to the following
layout:

Q W E R T Y
A S D
Z X

When this optional key layout is
used, "qw" must be selected
during the language configura-
tion process. (Refer to the User
and Reference manuals for addi-
tional configuration information.)
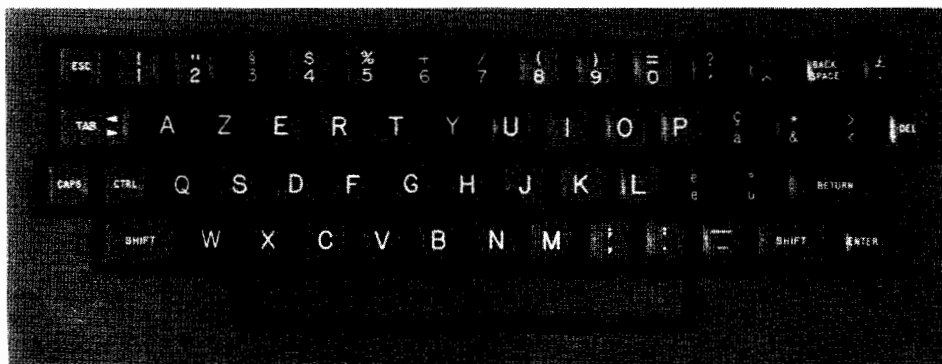
Figure 7-28. French Keyboard (Opt. 003), Unique Keys
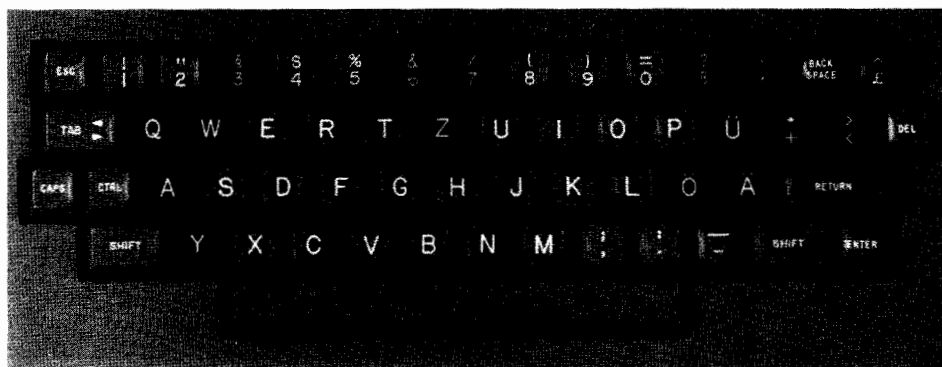
Figure 7-29. German Keyboard (Opt. 004), Unique Keys
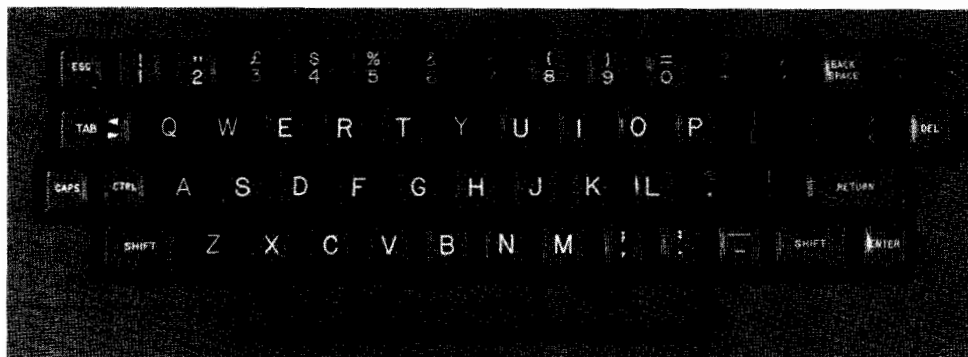
Figure 7-30. United Kingdom Keyboard (Opt. 005), Unique Keys
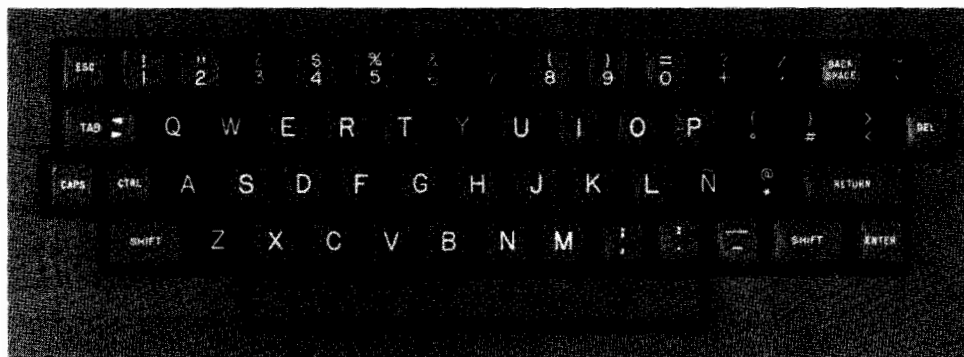
Figure 7-31. Spanish Keyboard (Opt. 006), Unique Keys

Figures 7-32 through 7-40 show the various keyboard options for the HP 2622D. Table 7-6 lists the keycap kit for each language.

Table 7-6. 2622D Keycap Kits

HP PART NO.	KEYBOARD DESCRIPTION								
	2622D Std.	Fr. 252	Ger. 253	U.K. 254	Swd. 255	Span. 256	Ital. 257	Kat. 258	Dan. 500
02620-60110	1								
02620-60117		1							
02620-60118			1						
02620-60115				1					
02620-60116					1				
02620-60113						1			
02620-60114							1		
02620-60111								1	
02620-60112									1
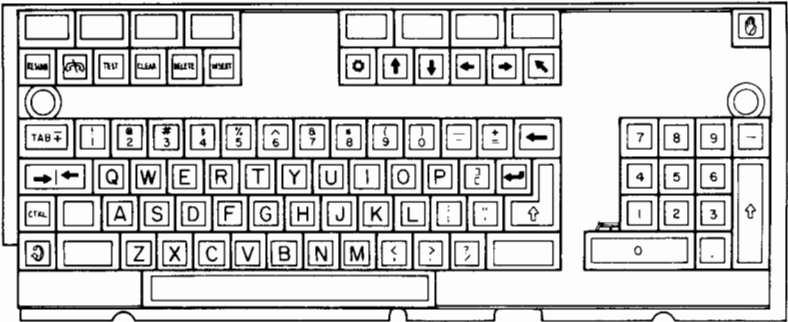
Figure 7-32. 2622D Standard Keyboard
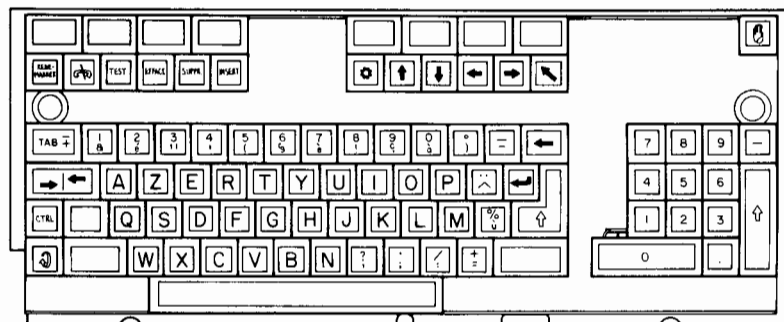
Figure 7-33. 2622D French Keyboard (Opt. 252)
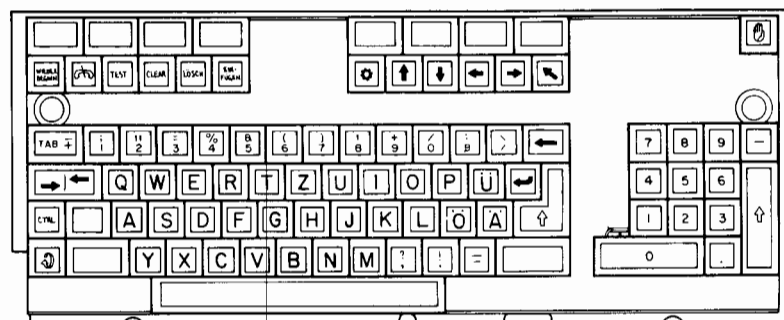
Figure 7-34. 2622D German Keyboard (Opt. 253)
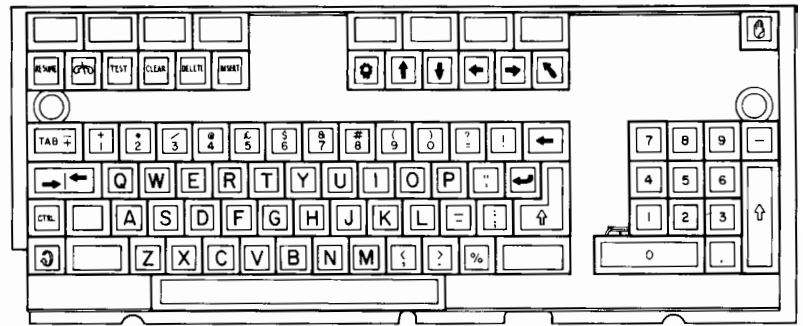
Figure 7-35. 2622D United Kingdom Keyboard (Opt. 254)
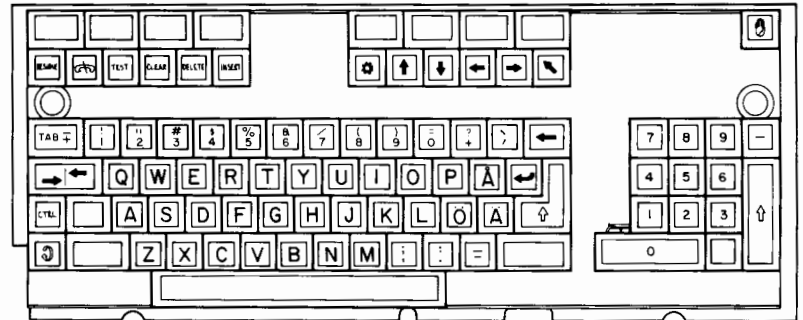
Figure 7-36. 2622D Swedish Keyboard (Opt. 255)
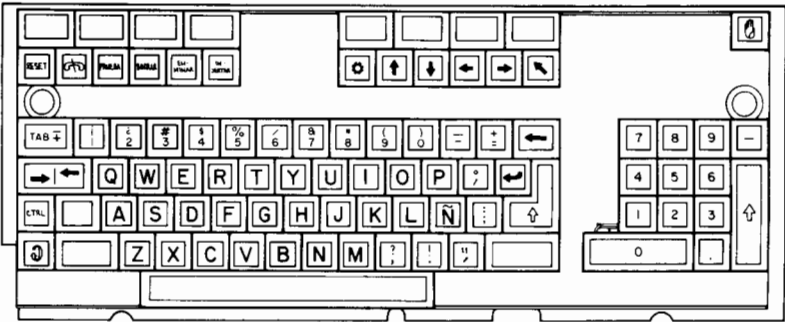
Figure 7-37. 2622D Spanish Keyboard (Opt. 256)
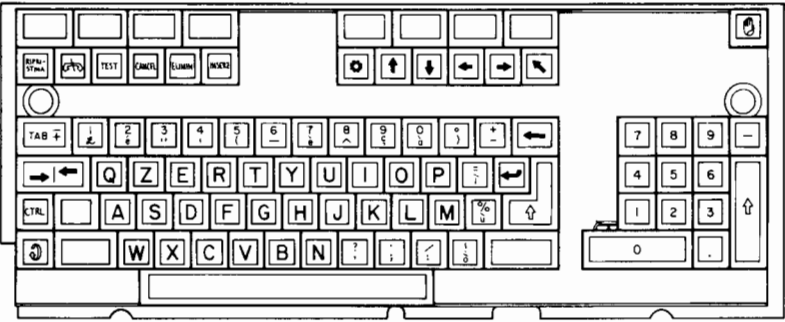
Figure 7-38. 2622D Italian Keyboard (Opt. 257)
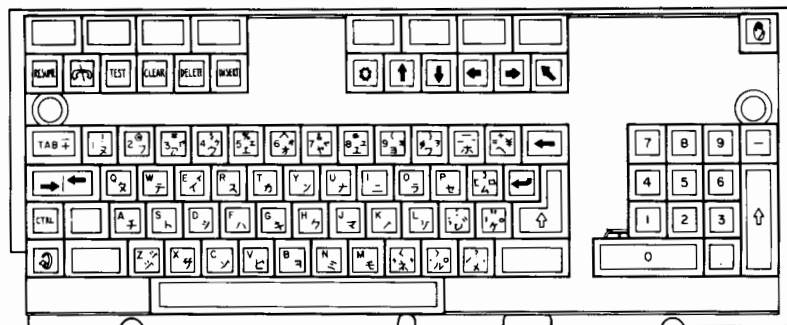
Figure 7-39. 2622D Katakana Keyboard (Opt. 258)
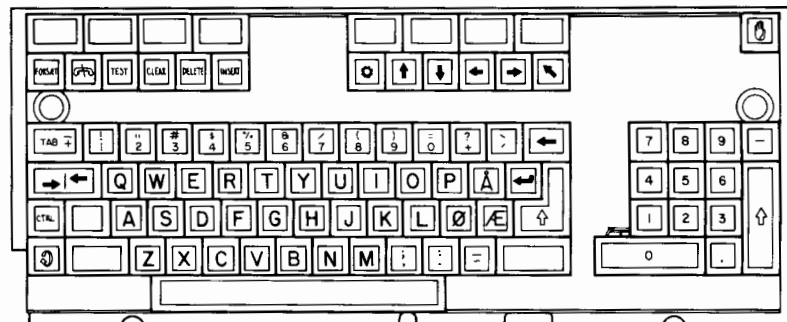
Figure 7-40. 2622D Danish Keyboard (Opt. 500)

Replaceable
Components
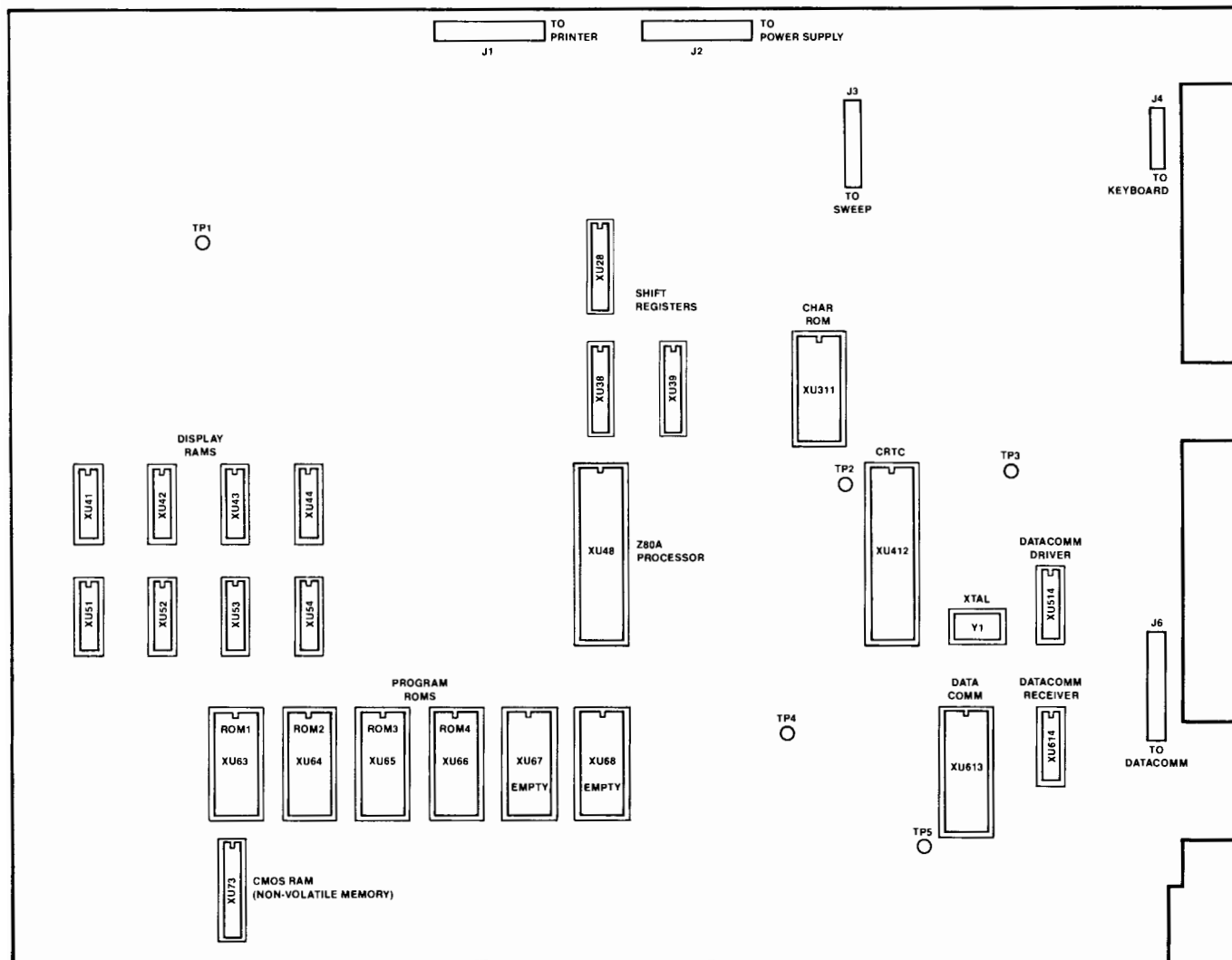
Figure 7-41. 2622A/D Processor PCA
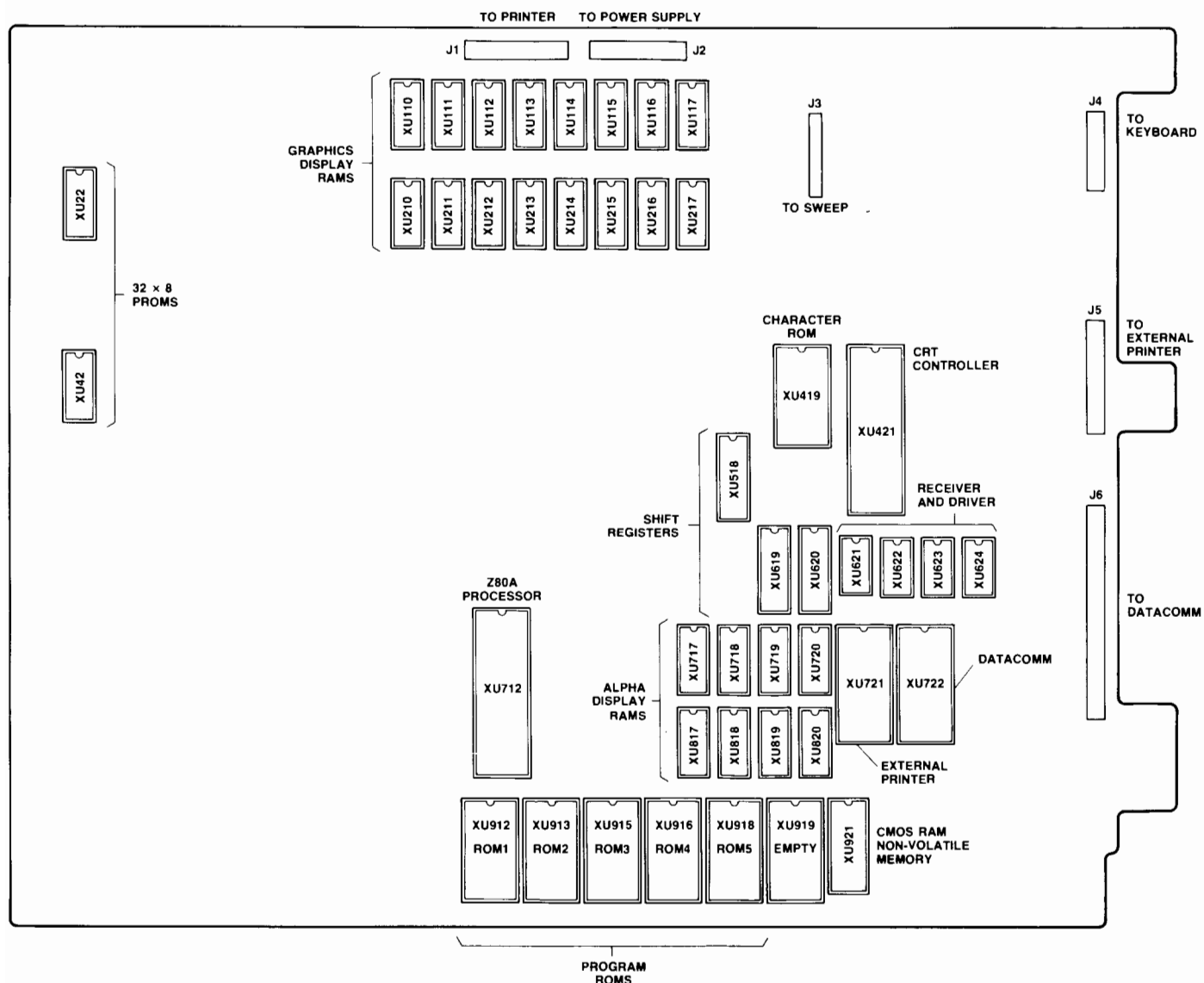
Figure 7-42. 2623A Processor PCA

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TPM CHARACTER
ROM (U11)

TPM CPU
ROM (U21)

STRAPPING
SWITCH

CRYSTAL
(Y1)
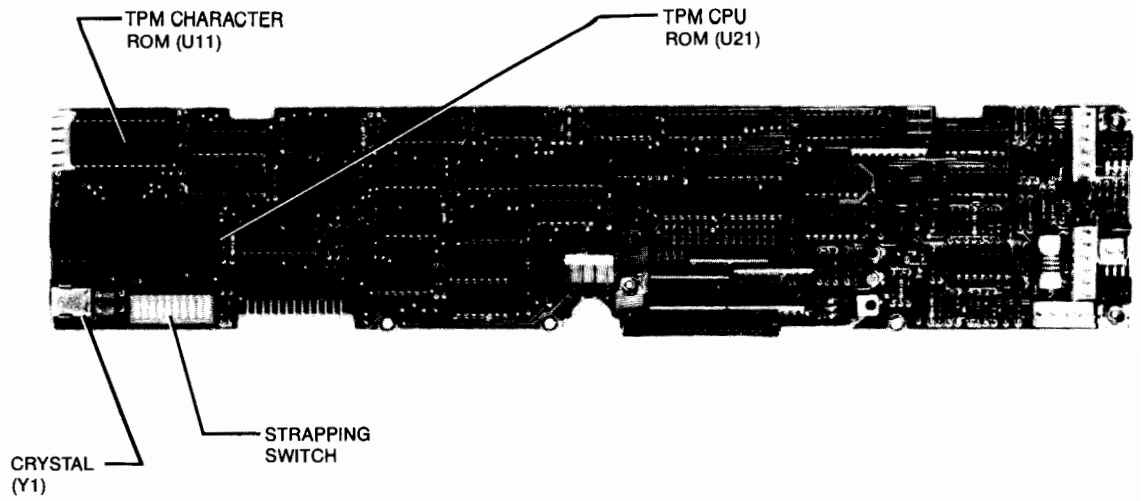
Figure 7-43. Integral Printer PCA

Table 7-7. Replaceable Components

REFERENCE DESIGNATOR	UNITS PER ASSY.	HP PART NO.	DESCRIPTION
Figure 7-41	1	02620-60087	*Processor PCA (2622A/D)
U28, U38, U39	3	1820-2416	IC, Shift Register
U41-U44,	8	5081-2705	IC, RAM, Display Memory
U51-U54			(Note: 5090-0581 can be used
			in place of 5081-2705)
U311	1	1818-1489	**IC, ROM, Character, (Std.)
U311	1	1818-1547	**IC, ROM, Character, (Line Drawing)
			(option 202)
U311	1	1818-1695	**IC, ROM, Character (2622D)
U311	1	1818-1696	**IC, ROM, Character (2622D)
U412	1	1820-2373	IC, CRT Controller
U73	1	1818-0708	IC, RAM, Non-volatile Mem.
U48	1	1820-2298	IC, Microprocessor, Z80A
U514	1	1820-0509	IC, Line Driver
U614	1	1820-0990	IC, Line Receiver
U613	1	1820-2577	IC, Datacomm
U63	1	1818-1456	**IC, Program ROM 1
U63	1	1818-1694	**IC, Firmware ROM 1 (2622D)
U64	1	1818-1458	**IC, Program ROM 2
U64	1	1818-1693	**IC, Firmware ROM 2 (2622D)
U65	1	1818-1569	**IC, Program ROM 3
U66	1	1818-1617	**IC, Program ROM 4 (opt. 050)
Figure 7-42	1	02620-60088	*Processor PCA (2623A)
U518, 619, 620	3	1820-2416	IC, Shift Register
U10-17, 210-217	16	5081-2705	IC, RAM, Graphics Display Memory
U717-720, 817-820	8	5081-2705	IC, RAM, Alphanumeric Display Memory
U419	1	1818-1489	**IC, ROM, Character, (Std.)
U419	1	1818-1547	**IC, ROM, Character, (Line Drawing) (option 202)
U622, 623	2	1820-0509	IC, Line Driver
U621, 624	2	1820-0990	IC, Line Receiver
U22	1	1816-1472	IC, PROM, 32 × 8

Table 7-7. Replaceable Components (Continued)

REFERENCE DESIGNATOR	UNITS PER ASSY.	HP PART NO.	DESCRIPTION
U42	1	1816-1471	IC, PROM, 32 × 8
U421	1	1820-2373	IC, CRT Controller
U921	1	1818-0708	IC, RAM, Non-volatile Mem.
U712	1	1820-2298	IC, Microprocessor, Z80A
U722	1	1820-2577	IC, Datacomm
U721	1	1820-2577	IC, Datacomm (External Printer)
U912	1	1818-1640	**IC, Program ROM 1 (0-8K)
U913	1	1818-1642	**IC, Program ROM 2 (8-16K)
U915	1	1818-1455	**IC, Program ROM 3 (16-24K)
U916	1	1818-1454	**IC, Program ROM 4 (24-32K)
U918	1	1818-1641	**IC, 4K × 8 ROM 5 (opt. 050)
Figure 7-43	1	02670-60050	*Integral Printer PCA
U11 (Used with set 1)	1 (Option 050)	1818-1160	**IC, TPM Character ROM
U21 (Used with set 1)	1 (Option 050)	1820-2271	**IC, 8039 Microprocessor
U21 (Used with set 2)	1 (Option 050)	1820-2432	**IC, Microprocessor ROM
U21 (Used with set 2)	1 (Option 050)	1820-2561	**IC, Microprocessor ROM (may be used in place of 1820-2432)

Table 7-8. Exchange Modules

HP PART NO.	DESCRIPTION	2622A	2622D	2623A	OPT. 050
02620-69002	*Sweep PCA	1	1	1	1
	— — — X — — —				
02620-69087	*Processor PCA (2622A/D)	1	1		1
	(Less Assembly and Components Listed Below)				
02620-60025	**I/O Panel Assembly	1	1		1
1818-1489	**Character ROM (or Line Drawing ROM 1818-1547)	1			1
1818-1695	**Character ROM (or Alternate Character ROM 1818-1696)		1		1
1818-1456	**Program ROM Code 1	1			1
1818-1458	**Program ROM Code 2	1			1
1818-1569	**Program ROM Code 3	1			1
1818-1617	**Program ROM Code 4 (opt. 050)	1			1
1818-1694	**Firmware ROM 1		1		1
1818-1693	**Firmware ROM 2		1		1
	— — — X — — —				
02620-69088	*Processor PCA (2623A)			1	1
	(Less Assembly and Components Listed Below)				
02620-60109	**Dual I/O Panel Assembly			1	1
1818-1489	**Character ROM			1	1
1818-1640	**Program ROM 1 (0-8K)			1	1
1818-1642	**Program ROM 2 (8-16K)			1	1
1818-1455	**Program ROM 3 (16-24K)			1	1
1818-1454	**Program ROM 4 (24-32K)			1	1
1818-1641	**Program ROM 5 (4K × 8 (opt. 050)				1
	— — — X — — —				
02620-69004	*Power Supply PCA (2622A/D)	1	1		
	**(Less Fuse)	1	1		
	— — — X — — —				
02620-69060	*Power Supply PCA (2623A)			1	
	**(Less Fuse)			1	
	— — — X — — —				

Table 7-8. Exchange Modules (Continued)

HP PART NO.	DESCRIPTION	2622A	2622D	2623A	OPT. 050
02620-69019	*Power Supply PCA (opt. 050)				1
	**(Less Fuse)				1
	— — — X — — —				
02620-69061	*Keyboard PCA (Less ROLL UP, 0371-1988 and ROLL DOWN, 0371-1989 Keycaps)	1	1	1	1
	— — — X — — —				
02670-69050	*TPM PCA				1
0410-1190	**Crystal, 11 MHz				1
1818-1160	**Character ROM (U11)				1
1820-2271	**Processor 8048 (U21)				1
1820-2432	**Processor 8049 (U21) (this version does not use U11)				1
1820-2561	**Processor (U21) (this version does not use U11) Note: May be used in place of 1820-2432.				1
	— — — X — — —				
02670-69015	*TPM Mechanical Assembly (Less Assemblies and Components Listed Below)				1
02670-60050	**TPM PCA				1
02670-60014	**Print Head Cable Assembly				1
8160-0309	**Magnetic Shield (not used on 2622D-050)				1
*Exchange Module **These components or assemblies must be removed.					

Functional Operation _____8

INTRODUCTION ....   The following discussion is concerned primarily with the Processor PCA, although information on the keyboard and internal printer is included. The Processor PCA has four major functions; keyboard control, datacomm control, display control, and internal printer control. (Control of any external printer is done through the datacomm channel.) Since a knowledge of the display subsystem is useful for understanding operation of the rest of the PCA, the display subsystem is discussed first. Figure 8-1 is a block diagram of the Processor PCA.

DISPLAY SUBSYSTEM ....   The display subsystem consists of a CRT controller (CRTC), display memory, three recirculating line buffers (RLBs), a character ROM, a delay circuit, a parallel-to-serial converter, and a multiplexer. It operates automatically to display any data present in portions of display memory selected by the Z80A and firmware. As input it receives from the Z80A four addresses: top-of-page, row-start for a character row, row-start for the enhancements for a row, and the cursor address. Its output is a serial stream of dots which is supplied to the Sweep PCA to produce the display.

The display screen is divided into 26 rows of 80 character cells each. Each character cell is a rectangle, 15 dots vertical by nine dots horizontal (figure 8-2). For normal (not inverse) video, if a character cell is occupied by a character, the dots used to shape the character are lighted, the others remaining blank. The display is produced by sweeping an electron beam horizontally across the screen for 390 sweeps (scan lines) from top to bottom. To produce a row of 80 characters, 15 scan lines are required. As the electron beam sweeps a scan line, it lights the appropriate dots in each character cell required to produce the character. The dots to be lighted are determined by a stream of logic 1's and 0's (referred to hereafter as a dot stream) applied to the cathode of the CRT as the scan line is swept. After the screen has been swept by 390 scan lines, the beam is diverted from the bottom to the top of the screen and the sweep of the screen is repeated.
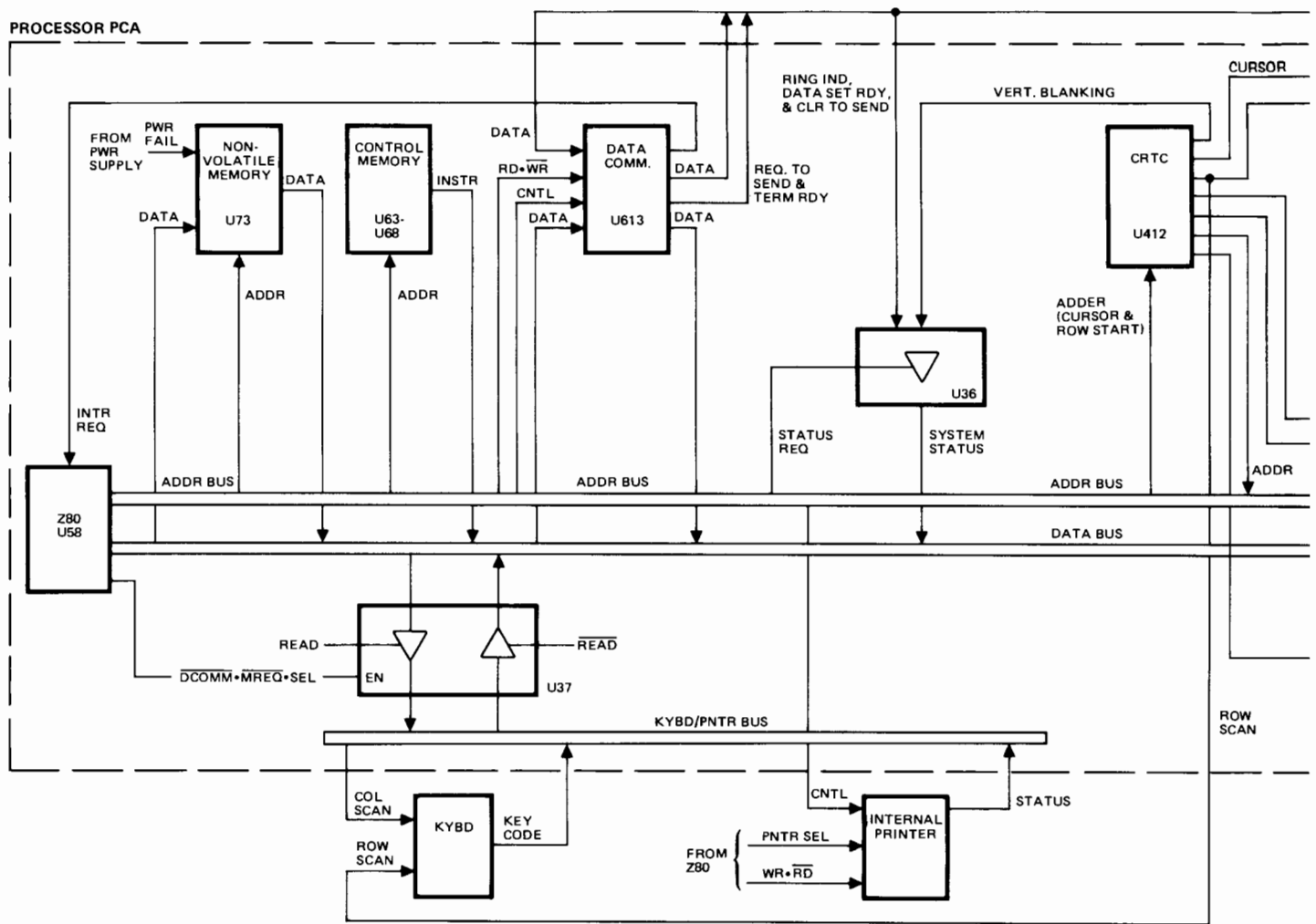
Figure 8-1. Processor PCA Block Diagram (Sheet 1 of 2)
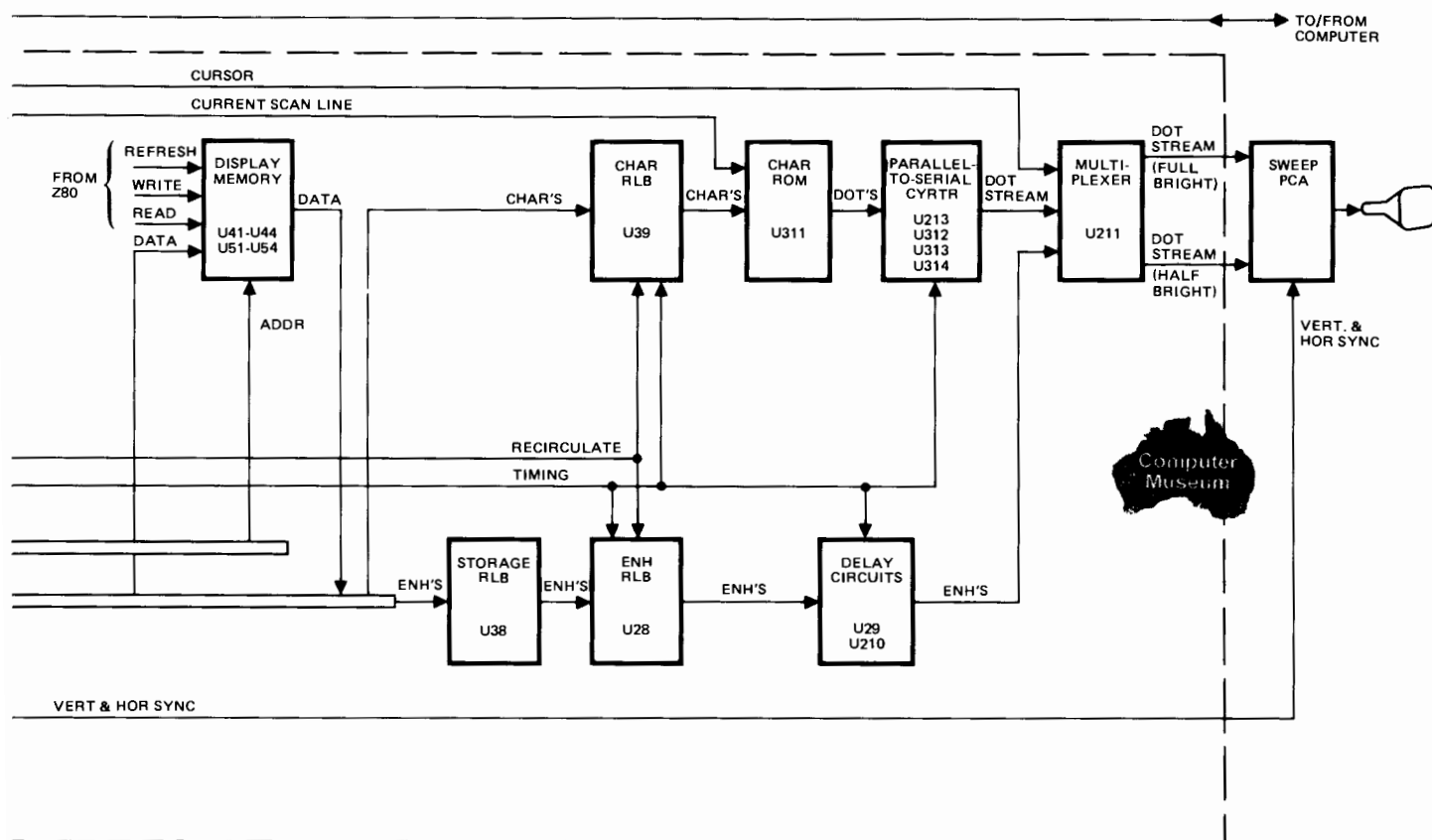
Figure 8-1. Processor PCA Block Diagram (Sheet 2 of 2)
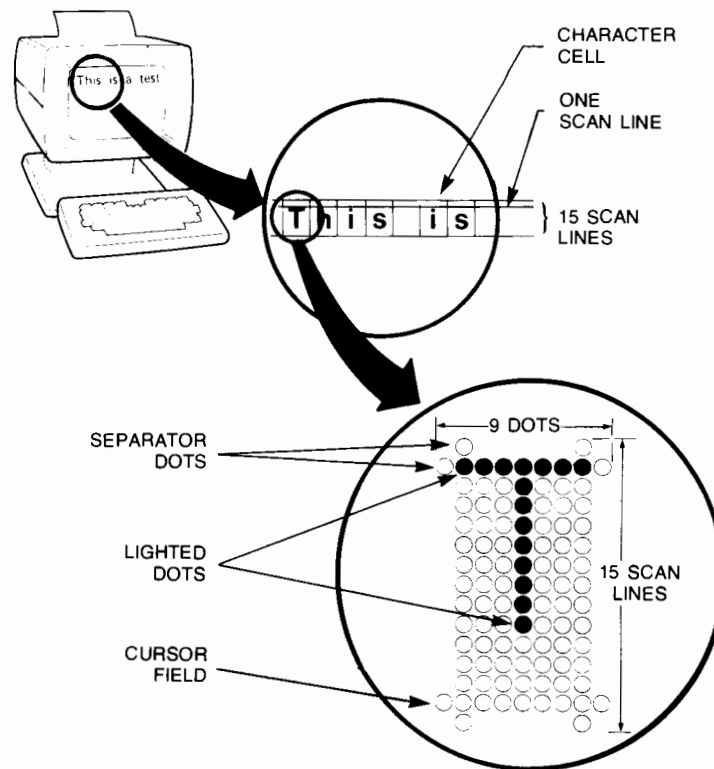
Figure 8-2. Character Formation

CRTC. Each character row to be displayed on the screen is represented in display memory by one block of not more than 8 ASCII characters and one block of not more than 80 enhancement bytes. To select a row of characters for display on the screen, the Z80A sends to the CRTC the addresses, in display memory, of the first byte of the character block and the first byte of the enhancement block. This is done while the previous row is being traced on the screen.

The CRTC is supplied, by the Z80A, with two row-start addresses, one for the characters to appear in the next character row and one for the enhancements which apply to the characters. The row-start addresses for each character row are updated for each character row while the previous character row is being displayed. A third address, the cursor address, is supplied to the CRTC by the Z80A while the row in which the cursor is located is being scanned.

DISPLAY MEMORY. Display memory contains the characters and enhancement bytes for display on the screen. It has sufficient memory to contain two screens (pages) of data. The data for one display row is contained in three blocks of sequential addresses. One contains the characters to be displayed, another contains the enhancement(s) for each character, and the third contains software enhancements (used in Format mode) which are used only by the firmware and are ignored by the display subsystem. Each of the three blocks is the length of a display row (80 bytes).

The character and enhancement data is written into display memory by the Z80A. To do a write operation, the Z80A supplies the address on the address bus and the data to be written on the data bus and indicates the operation is to be a write operation. For a read operation, the data present at the address is output on the data bus while the Read signal is active.

When addresses are supplied by the CRTC, as is done for display of a page of data, the data is written into either intermediate recirculating line buffer (RLB) U38 or RLB U39 from the data bus.

To be retained, the data stored in display memory must be refreshed frequently. Refreshment of one display memory address is done after each instruction fetch. The Z80A contains a refresh register in which a refresh address is stored. After an instruction fetch, the Z80A outputs the address to display memory on the address bus while it activates the Refresh signal. Then it increments the refresh register to enable refreshing of the next sequential display memory address after the next instruction fetch.

CURRENT CHARACTER ROW EVENTS. The display subsystem contains three recirculating line buffers (RLBs): one for temporary storage of the enhancement bytes (U38), one for characters (U39) and one for enhancements (U28) (see figure 8-1). Each RLB is a shift register consisting of 80 sets of eight parallel flip-flops. Each set of flip-flops is capable of storing one data byte so that each RLB can store one row (80 bytes) of display information. While the Recirculate signal is applied to the RLBs (U39 and U28) by the CRTC, their contents are recirculated continuously. When the Recirculate signal is inactive, new data can be shifted into the RLBs (U38, U39, and U28). To produce a row of characters on the screen, the characters and enhancements for the current row are stored in RLBs (U39 and U28), then they are recirculated 15 times, once for each scan line of the row.

As the character bytes are recirculated in U39, they are sent, one at a time, to the character ROM U311. The character ROM, which is kept informed of the current scan line by the CRTC, generates the seven-bit dot pattern needed to form the portion of the character for the current scan line (figure 8-2). When output from the character ROM, this dot pattern is in parallel form. It is converted to serial form by the parallel-to-serial converter and becomes part of the dot stream.

While the current scan-line portion of the dot stream is being formed by the character ROM and parallel-to-serial converter, the enhancement applicable to the scan line segment is held in delay circuits. Then the scan line segment of the dot stream and the associated enhancement are combined in the multiplexer and sent to the sweep PCA. The cursor is also injected into the dot stream at the multiplexer when the next to last scan line of the cursor row and column is scanned.

NEXT CHARACTER ROW PREPARATION. While the current character row is being displayed, the display subsystem makes preparations to display the next character row. While the current character row is being recirculated in the character and enhancement RLBs U39 and U28, the enhancements for the next character row are stored in RLB U38. Then, during the last scan line (14) of the current character row, the enhancements are shifted into RLB U28 from RLB U38 and the characters for the next row are shifted into RLB U39. The events are as follows (the scan lines are numbered 0–14):

SCAN LINE	EVENT
4	The CRTC requests, from the Z80A, the address of the first byte of the enhancement block applicable to the next character row and stores it as the row-start address.
5*	The bus request logic requests control of the address and data busses for use by the display subsystem.
6	The CRTC sends the addresses of the enhancements for the next character row, in sequence, to the display memory on the address bus. Each enhancement byte is read into enhancement shift register U38, via the data bus, as its address is selected.
12	The CRTC requests the address of the first character of the next character row from the Z80A and stores it as the row-start address.
13	The cursor is generated into the dot stream while the cursor column is being scanned.
13*	Again the bus request logic requests control of the address and data buses for use by the CRTC.
14	The CRTC sends the addresses of the characters for the next row, in sequence starting with the row-start address, to display memory. The character stored at each address is read into character RLB U39, via the data bus, as its address is accessed.
	Also, the enhancement bytes stored in RLB U38 are shifted into RLB U28 during scan line 14.
	When scan line 14 ends, the characters for the next character row have been stored in RLB U39 and the enhancement bytes for the next row have been stored in RLB U28.

*The event occurs during horizontal blanking after the indicated line has been scanned.

**TERMINAL CONTROL
SUBSYSTEM** .... The terminal control subsystem, which consists of the Z80A microprocessor U48, the control memory ROMs (U63, U64, U65, and U66), and non-volatile memory RAM U73, exercises supervisory control over all terminal operations. In the case of the display subsystem, control is minimal because operation of the display subsystem is largely automatic. The Z80A extracts firmware instructions from the control memory ROMs and executes them by sending appropriate signals to the other Processor PCA components. The data in display memory RAMs U41, U42, U43, U44, U51, U52, U53, and U54 is refreshed as a part of each fetch cycle. Figure 8-3 is a map of the terminal's ROM and RAM memory.
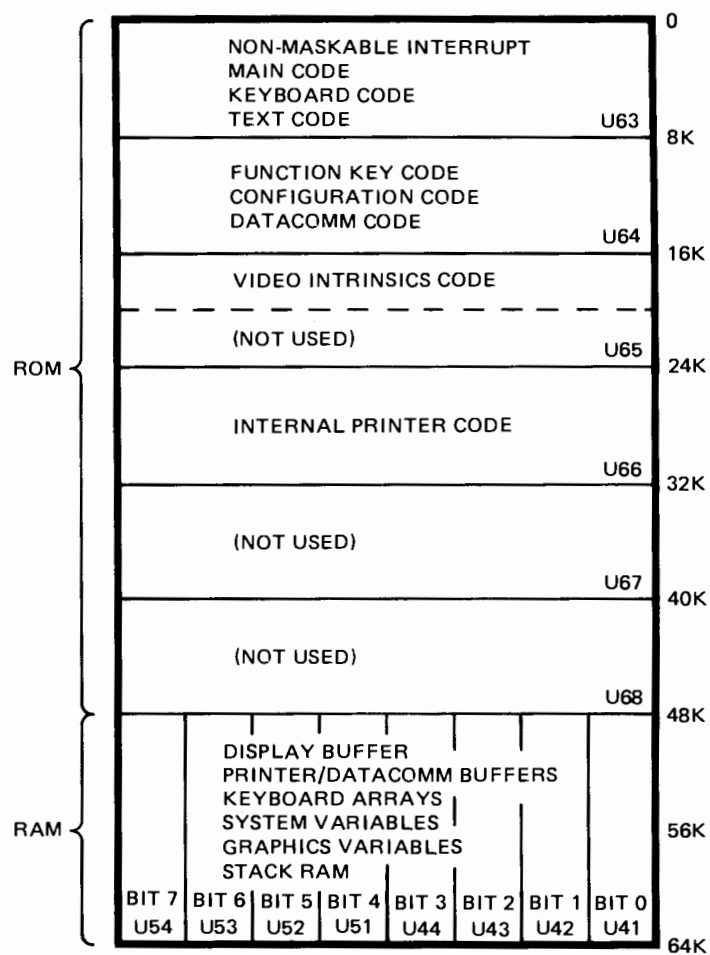
Figure 8-3. Terminal Memory Map

DISPLAY SUBSYSTEM CONTROL. Operations performed by the Z80A in controlling the display subsystem are listed below.

1. Stores data (characters and enhancements) from the keyboard or computer in display memory for display. It also updates this data on command from the keyboard or computer.

2. Retrieves data from display memory for transfer to the computer or printer on command from the keyboard or computer.

3. Refreshes the data in display memory as part of every instruction fetch cycle in which it fetches an instruction from control memory.

4. On request from the display subsystem, it sends the row-start address (address of the first byte of the display row) to the CRT controller (CRTC) for both character and enhancement rows. (The request must be enabled by the Z80A.)

5. Sends the cursor address to the CRTC whenever the position of the cursor is changed.

6. On request from the display subsystem, frees the address and data busses for display subsystem use when the display subsystem extracts data from display memory for transfer to the CRT.

KEYBOARD CONTROL. The keyboard is controlled by the Z80A and firmware code. The keyboard keys are arranged, by wiring, into a matrix. Any key can be identified by identifying the row and column at which it is situated in the matrix. One column of the matrix is scanned for any pressed key each time a row of characters is reproduced on the screen. The results are returned to the Z80A. The keycode from the keyboard is converted to an ASCII character by the PCA hardware and the firmware.

Although part of the display subsystem, the CRTC is closely involved in keyboard scanning. The first eight numbers of the 15-number scan line count (which is generated by the CRTC) is used to scan the eight rows of the keyboard. Also, the register on the Processor PCA which stores the result of the row and column scans is clocked by the scan line clock (which is also generated by the CRTC). The column count, used to scan the keyboard columns, is generated by the Z80A on the data and keyboard/printer busses.

The keyboard bell is also controlled by the Z80A and firmware. When the Z80A senses that the bell key has been pressed, it causes a signal to be sent to the speaker on the keyboard. This signal is also dependent on a clock signal from the CRTC.

DATACOMM CONTROL. Most of the datacomm functions are performed by the data-comm chip U613 under control of the Z80A. The incoming signals Data Set Ready, Clear To Send, and Ring Indicator go directly to the Z80A, bypassing the datacomm chip. However, the incoming data from the computer is received by the datacomm chip which generates an interrupt to the Z80A for each byte received to indicate a byte is ready for transfer to the Z80A.

The outgoing signals Request To Send and Data Terminal Ready and data for transmission to the external device (computer or external printer) are transmitted by the datacomm chip. The Data Signal Rate Selector signal is transmitted by the Z80A.

Data for transmission is extracted by the Z80A from display memory and sent to the datacomm chip one byte at a time. When the datacomm chip transmit register has been emptied, it sets bit in a datacomm status word which is supplied, on request, to the Z80A. When the Z80A is ready to send the next byte, it requests the datacomm status on the data bus. On finding the transmit-register-empty-bit set, it sends the next byte to the datacomm chip.

The three datacomm signals incoming from the computer (not including the data) are applied to gate IC U36. These signals are Clear To Send, Data Set Ready, and Ring Indicator signals. If the Z80A has the Status Request signal active, the three signals are made available to the Z80A on the data bus, along with the Vertical Blanking signal from the CRTC and the Printer Interrupt signal from the internal printer.

The Z80A controls the datacomm chip using commands sent on two of the address lines and the Read/Write signal line. Following is a list of commands used:

1. Transmit the data currently on the data bus.
2. Put the received data byte on the data bus.
3. Reset registers (this reset local to the datacomm chip).
4. Put the datacomm status on the data bus.
5. Parity selections.
6. Enable or disable the receive interrupt.
7. Activate the Ready To Send signal.
8. Transmit the Break signal.
9. Activate the Data Terminal Ready signal.

INTERNAL PRINTER CONTROL. The internal printer is controlled entirely by the Z80A with printer firmware code and dot data stored in control memory ROM U66. The printer can print normal, compressed, or expanded characters. Like the display subsystem, it forms characters using dots in a 9 by 15 character cell (for normal characters).

Each character is formed of 15 bytes of dot data. Each byte is made up of the dot data needed to form the character if the character cell is scanned horizontally (see figure 8-2). Thus, 15 bytes (15 scans), stacked vertically, are used to compose the character. To print a character, the Z80A extracts the 15 bytes of dot data from ROM U66 and sends it to the printer, one byte at a time. The printer character buffer has a capacity of two characters (30 bytes). In the printer, the 15 bytes are stacked to form the character. Compression or expansion of the character is done in the printer.

The Z80A communicates with the printer using five signal lines and an 8-bit bus. The 8-bit bus is used to send commands and character dot data. The signals are a Printer Select signal, a Write/Read signal, a Power-On Reset signal, and two lines from the address bus used for control. The Write signal indicates to the printer that there is either data or a command currently on the bus. The commands are as follows:

1. Print.

    Direction (left/right), character type (ASCII/graphics), and format (expanded/compressed).

2. Move print head.

    Direction (left/right) and magnitude (0 to 18 dot widths).

3. Carriage movement.

    Type (linefeed/formfeed).

4. Self-test.

5. Clear.

6. Mask.

    (Interrupt mask used to inhibit printer interrupts to the Z80A).

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The printer uses one signal line to send a printer interrupt to the Z80A through status gate chip U36. (The Z80A must enable the Status Request signal to enable U36 and read the status.) An interrupt indicates the printer is ready for a command or data. When the Write/Read signal indicates a read operation, the printer uses the bus to transmit four status bits as listed below:

1. Interrupt pending.   The printer has generated an interrupt to the Z80A which will remain active until it receives a byte to write.

2. Write ready.   The printer is ready to receive a Write signal.

3. Power on.   Active as long as power is applied to the printer.

4. Printer ready.   Active as long as the printer has paper and the printer door is not open.

In a typical print cycle, the Z80A checks the printer status bits to determine if the printer is ready to receive data. If so the Z80A sends it a series of 30 bytes (15 bytes per character) of character dot data with the Write signal active. It follows the dot data with a Print command. When the printer has begun to process the data, it activates the printer interrupt signal line and sets the status bits to indicate it is ready to receive more data.

In the data transfer operation, the Z80A fetches an ASCII byte from display memory, converts it to 15 bytes of dot data by accessing code in U66, and sends the 15 bytes directly to the printer from U66. It then repeats this operation for the second character. Then it samples the printer status bits to determine when the printer is ready for two more characters.

If the data to be printed comes from the computer, the Z80A stores it in display memory, then sends it to the printer as described above.

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