Introduction

Introduction 1

GENERAL .... This section provides an overview of the service manual contents.

MANUAL OVERVIEW .... This manual consists of the following sections:

Section 1 — *Introduction*. Section 1 provides an overview of the manual.

Section 2 — *Installation*. Section 2 provides installation information for the 264X-series terminals and their accessories.

Section 3 — *Strapping*. Section 3 provides instructions for configuring the printed circuit assemblies (PCAs) used with the terminals and accessories.

Section 4 — *User Maintenance*. Section 4 provides maintenance instructions to be performed by the user.

Section 5 — *Alignment*. Section 5 provides alignment and adjustment instructions for the terminals.

Section 6 — *Troubleshooting*. Section 6 provides procedures for isolating malfunctions to a replaceable unit.

Section 7 — *Parts List/Repair*. Section 7 provides a list of replaceable parts for the terminals and accessories and instructions for removal and replacement of parts.

Section 8 — *Functional Operation*. Section 8 provides a brief description of terminal operation.

TERMINALS COVERED .... Terminals covered in this manual are as follows:

2640A/B/C/N/S.	2645A/K/N/R/S.
2641A.	2647A.
2642A.	2648A.
2644A.	2649A/B/C/D/E/G/I

ACCESSORIES COVERED .... Accessories covered in this manual are as follows:

13231A — Display Enhancements.
13234A — 4K RAM Memory.
13236A/B — Cartridge Tape Units.
13238A — Terminal Duplex Register.
13240A — Backplane Extension.
13245A — PROM Character Set.
13246A/B — Printer Subsystem (9866A).
13250B — Asynchronous Data Communications/Serial Printer Interface
13254A — Video Interface.
13260A — Standard Asynchronous Communications Interface.
13260B — Extended Asynchronous Communications Interface.
13260C — Asynchronous Multipoint Communications Interface.
13260D — Synchronous Multipoint Communications Interface.
13261A — Firmware for support of Cartridge Tape Units/Printers.
13272A — Mini Disc Drive
13291A — 4K UV PROM PCA.
13292A — Writeable Control Store PCA.
13295A — Keycap Kit.
13296A — HP-IB Interface.
13297A — Universal RAM Memory PCA.
13298A — PROM Memory Accessory (and 32K ROM Memory PCA).

PCAs COVERED .... Strapping information is supplied on several PCAs which are supplied as standard equipment with the terminals. These are as follows:

1. Keyboard Interface PCA.
2. Control Store PCA.
3. ROM PCA.
4. Control Memory PCA.
5. 32K ROM Memory PCA (included with Accessory 13298A).
6. Processor PCA.

Installation

2

Installation 2

This section contains installation instructions for the terminal. Also included are instructions for selecting optional ac operating voltages (115 or 230V), selecting optional operating functions, and installing terminal add-on accessories.

Standard 2640 terminals contain a backplane assembly which allows installation of only two accessory PCAs. If more than two PCAs are to be added, it is first necessary to install accessory 13240A, the Option Slot Extender.

Note

> After installing or removing any accessory, check the power supply voltage output (refer to Section 5) and perform the terminal self test (refer to Section 6).

WARNING

Hazardous voltages are present inside equipment. The procedures contained in this section shall be performed only by qualified personnel.

Terminal Access

OPENING THE TERMINAL ....

To gain access to the terminal internal components, open the terminal as follows (also see figure 2-1):

1. Set mainframe rear panel ~ LINE switch to OFF.

Note

Mainframe top cover is unlocked by inserting access key supplied with terminal in each of the keyways located on right and left sides of top cover. Inserting keys into keyways unlock top cover. No key rotation is required.

2. From front of terminal, insert access key into right keyway and unlock right side of terminal by slightly raising right side of display top (figure 2-1, A and B).
3. While maintaining upward pressure to keep right side of terminal unlocked, insert access key into left keyway and raise display top until both right and left sides of terminal are unlocked (figure 2-1, C).
4. Using both hands, carefully swing display top up until it latches into the half open position (figure 2-1, D).

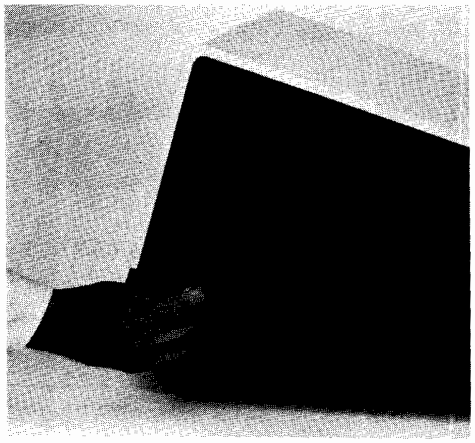
Note

The half open position provides adequate room for performing most. service routines. However, if extensive repairs are to be made or if components contained in the top cover are to be serviced, fully open mainframe in according with step 5.

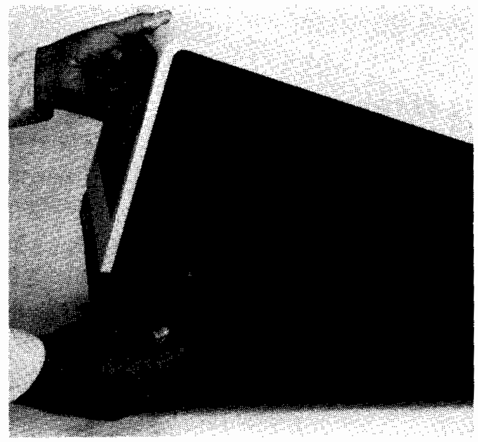
CAUTION

Mainframe top hinges are open hinge type. When fully opening terminals do not allow top hinges to slip off hinge pins.

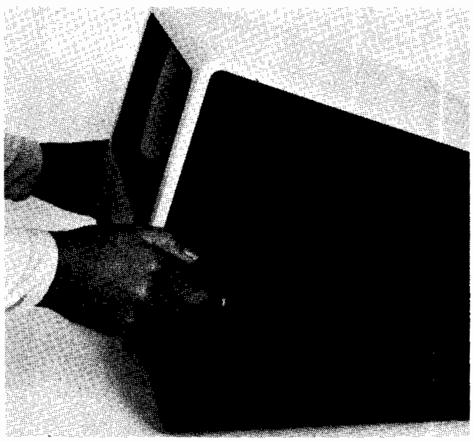
5. Firmly grasp display top in one hand and release support (see figure 2-1, D) by pressing it inboard with other hand. Then, using both hands, swing display top up and over to a full open position (resting on its top). (The hinges will disengage when the display top is approximately in the vertical position.)



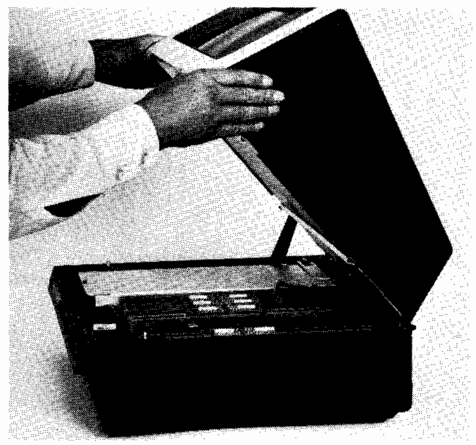
A. INSERTING ACCESS KEY INTO KEYWAY



B. UNLOCKING RIGHT SIDE OF TERMINAL



C. INSERTING ACCESS KEY INTO LEFT KEYWAY WHILE HOLDING RIGHT SIDE OPEN



D. OPENING TOP COVER TO HALF-OPEN POSITION

Figure 2-1. Opening the Terminal

CLOSING THE TERMINAL FROM ..... THE HALF-OPEN POSITION

1. Hold the display top to keep it from falling closed when support of the display top support is removed. Press inboard on the support and slowly lower the display top into place resting on the mainframe.

CLOSING THE TERMINAL FROM ..... THE FULL OPEN POSITION

1. Lift the display top and position it so that the hinges engage the hinges on the display mainframe.
2. Raise the display top, rotating it forward on its hinges, until it approaches the half open position.
3. Press inboard on the support to allow it to enter the slot designed for it in the CRT shield (figure 2-2).
4. When the support has cleared the CRT shield, lower the display top into place resting on the mainframe.

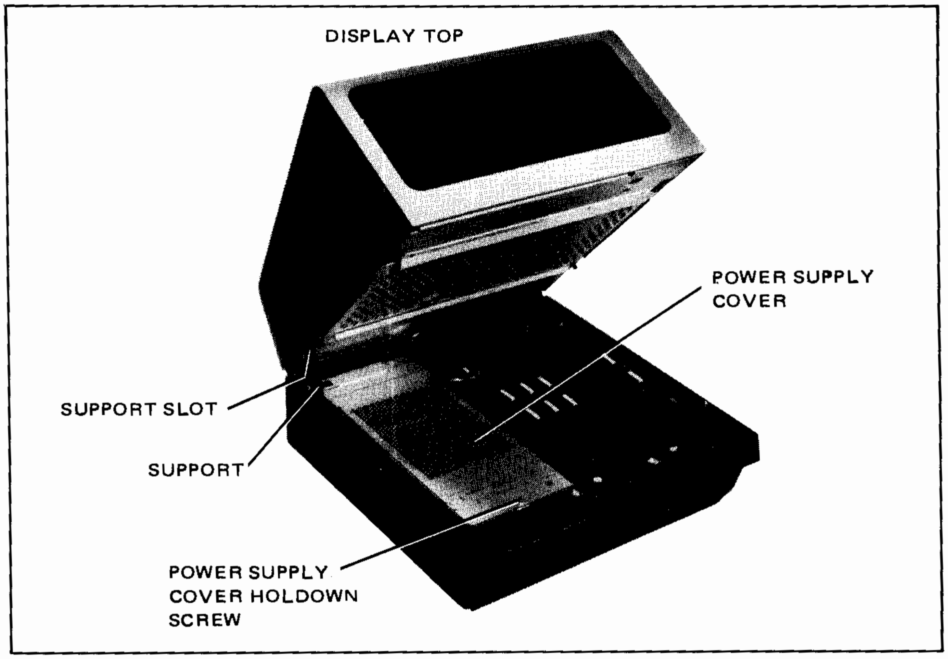


Figure 2-2. Terminal in Half-Open Position

REMOVING A TOP PLANE CONNECTOR

1. Insert Connector Extractor 1600-0676 under the top plane connector (figure 2-3).
2. Press down on the connector extractor handle. This will loosen the top plane connector for easy removal.

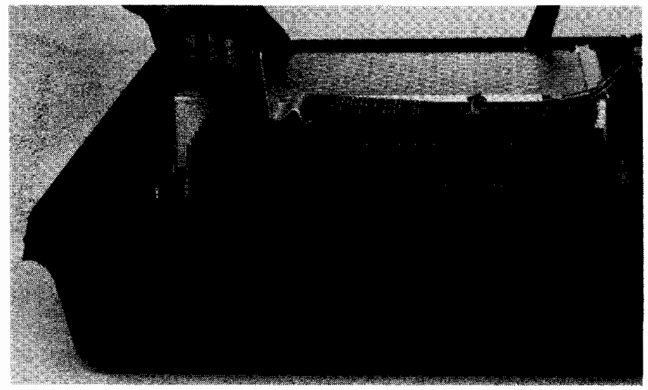


Figure 2-3. TOP Plane Assembly Removal

Installing The Terminal

GROUNDING REQUIREMENTS

To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the terminal's frame be grounded. The terminal is equipped with a three-conductor power cable which, when connected to an appropriate power receptacle, grounds the frame of the terminal. To preserve this protection feature, do not operate the terminal from an ac power outlet with no ground connection.

TERMINAL INSTALLATION PROCEDURES

1. Place the terminal on any convenient surface, except plush or spongy surfaces that might restrict air flow through the bottom vents; for example, do not use typewriter pads (figure 2-4).

2. Raise the unit's hinged rear access cover (two rotating latches hold it in place) and connect the keyboard cable hood connector to the printed circuit card. The printed circuit card has been notched to match the cable connector (figure 2-5).

   Note

   Card connectors have been notch-keyed to prevent erroneous connection. Minimal pressure is needed to make the connection.

3. This step is only required when the terminal is to be used with a computer.

   Connect the proper interface cable hood connector to the Communication Interface PCA. The card connector has been notched to match the hood connector. Connect the other end of the interface cable to your modem or computer (figure 2-6).

4. Select the line voltage and frequency of the power source as described in this section.

CAUTION

MAKE SURE THAT YOUR VOLTAGE MATCHES THE TERMINAL'S REQUIREMENTS (either 115V or 230V, see the rear panel label). Plug the 3-prong power connector into your power outlet.

5. Set the power switch to the OFF position. Connect the power cord to the terminal power connector (figure 2-7).

6. Select the optional terminal operating characteristics as described in this section.

7. Perform a terminal self test as described in Section 6.

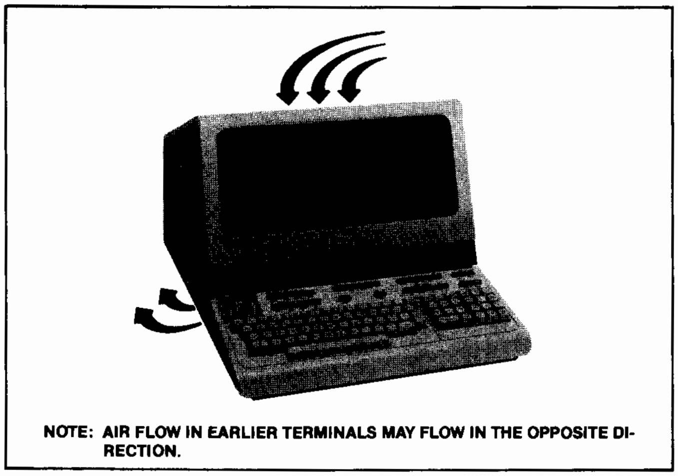


Figure 2-4. Terminal Cooling Air Flow

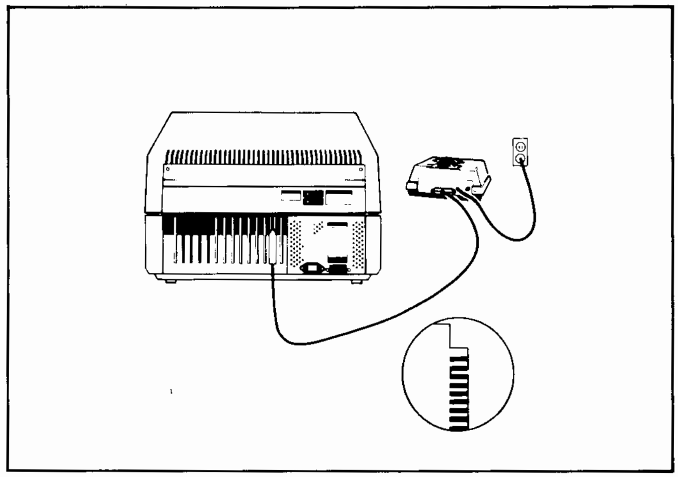


Figure 2-6. Connection of the Terminal to a Modem or Computer

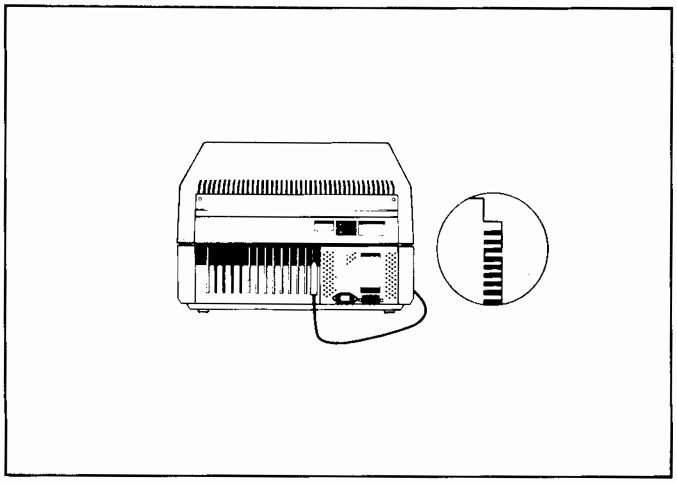


Figure 2-5. Keyboard Interface Cable Connection

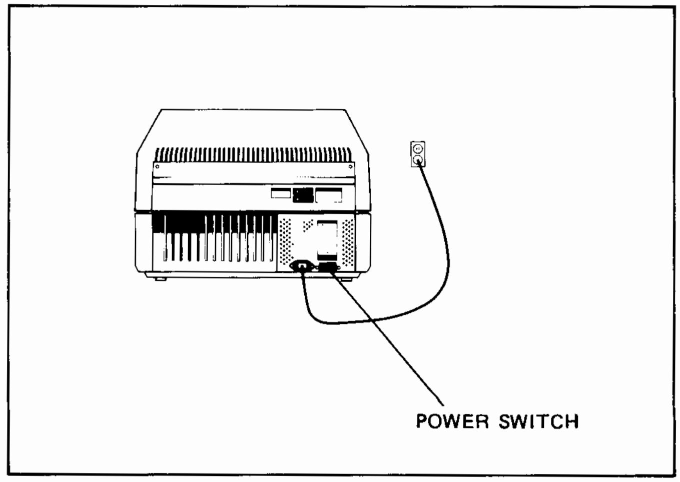


Figure 2-7. Terminal Connection to Power Source

Selecting Line Voltage and Frequency

SELECTABLE VOLTAGES AND FREQUENCIES .... 115V or 230V at either 60 Hz or 50 Hz.

WHY .... To configure the terminal to the voltage and frequency of the power source from which it is to be operated.

HOW .... **VOLTAGE.** The line voltage is changed from 115V to 230V or vice versa by changing fuses in the power supply.

FREQUENCY. The line frequency is changed by installing a crystal (Y1) of a different frequency on the Display Timing PCA.

WHEN .... This procedure should be performed whenever the terminal is to be operated from a power source of different voltage or frequency from that for which it is configured. When shipped from the factory, the line voltage and frequency for which the terminal is configured is stamped on a label which is accessible by raising the rear door of the terminal.

EQUIPMENT REQUIRED .... To change to 230V:

1. A Phillips-head screwdriver.
2. A 0.20A, SB, 250V fuse, 2110-0235 or 2110-0588.
3. A 2A, SB, 250V fuse, 2110-0303 or 2110-0587

To change to 115V:

1. A Phillips-head screwdriver.
2. A 0.5A, SB, 250V fuse, 2110-0202.
3. A 4A, SB, 250V fuse, 2110-0365.

To change to 50 Hz:

1. A 17.55 MHz crystal, 0410-0646.

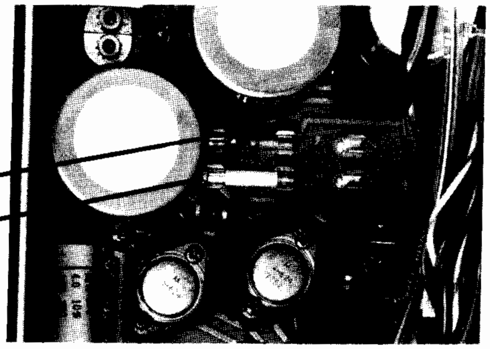
To change to 60 Hz:

1. A 21.06 MHz crystal, 0410-0647.

PROCEDURE ....

1. Turn off terminal power and disconnect power cord.
2. Open terminal to its half open position as described in the "Opening The Terminal" paragraph in this section.
3. Remove power supply cover by removing the hold-down screw at the front of the cover (figure 2-2) and pulling the cover up and out of the mainframe.
4. Select the operating voltage by inserting the proper fuses into the appropriate locations shown in figure 2-8. For 115 volts, use a 0.5A, SB, 250V fuse and a 4A, SB, 250V guse. For 230 volts, use a 0.20A, SB, 250V fuse and a 2A, SB, 250V fuse.
5. On some early model terminals a voltage select switch is located in the power supply (figure 2-9). If the terminal has such a switch, set it for the new power source voltage.
6. If changing from 60 Hz to 50 Hz operation or vice versa, ensure that crystal Y1 on the Display Timing PCA (figure 2-10) is changed. For 60 Hz operation, use a 21.06 MHz crystal (part no. 0410-0647) and for 50 Hz operation, use a 17.55 MHz crystal (part no. 0410-0646).
7. Check the power supply output voltage and adjust it if necessary (refer to Power Supply Voltage Adjustment in Section 5).
8. Replace the power supply cover and secure in place with the hold-down screw.

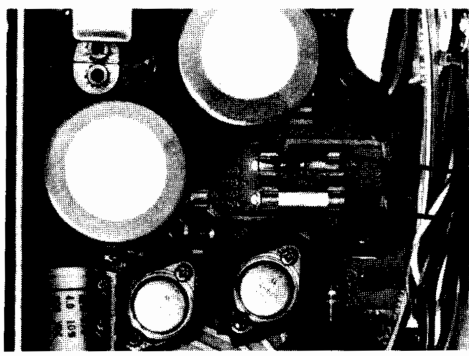
EARLIER VERSION



0.5A, SB, 250V

4A, SB, 250 V

115 VAC FUSE POSITION

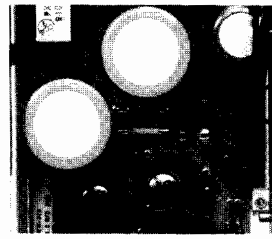


0.2A, SB, 250V

2A, SB, 250V

230 VAC FUSE POSITION

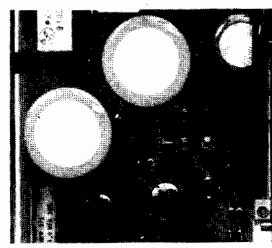
LATER VERSION



0.5A, SB, 250 V

4A, SB, 250V

115 VAC FUSE POSITION



0.20A, SB, 250V

2A, SB, 250V

NOTE: THESE TWO FUSES ARE SHORT

230 VAC FUSE POSITION

Figure 2-8. Fuse Positions for 115 VAC and 230 VAC Line Voltage

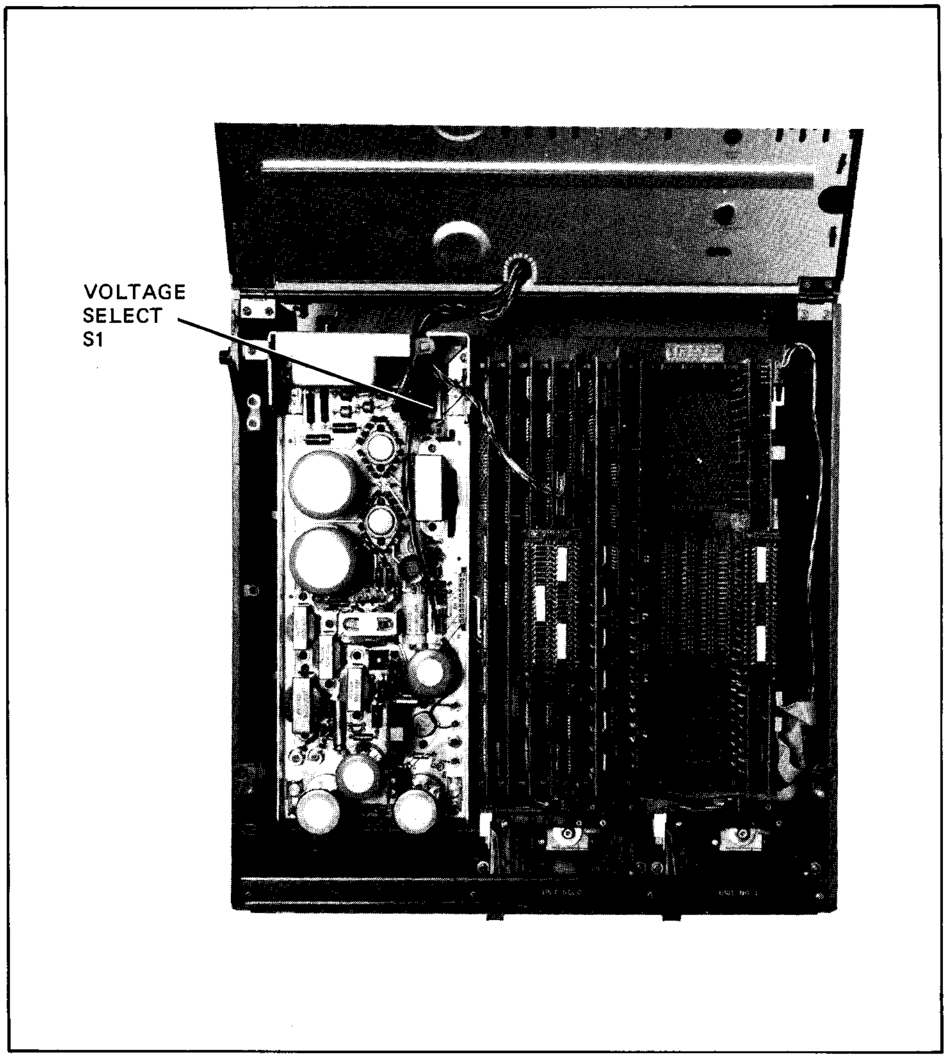


Figure 2-9. Location of Voltage Select Switch (Early Model 2640 Terminals)

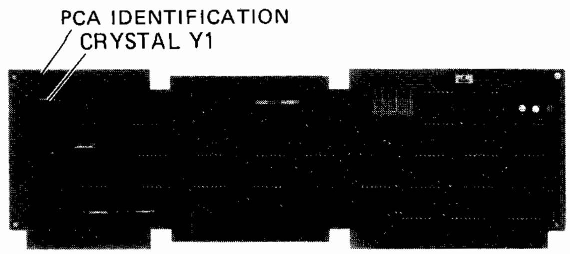


Figure 2-10. Location of Crystal Y1 on Display Timing PCA

Selecting Optional Operating Characteristics For The Terminal

Selection of the optional operating characteristics is done by making strapping selections on the Keyboard Interface PCA. Refer to strapping instructions for the Keyboard Interface PCA in Section 3.

PCA Location Constraints

1. The Keyboard Interface PCA should be located in one of the slots nearest the power supply (figure 2-11) to accommodate the ground cable connection between the supply and PCA.
2. The Display Timing PCA should be located within five slots of the power supply to accommodate the cable which connects it to the Sweep PCA.
3. The CTU Interface PCA and CTU Read/Write PCA should be located in the two slots most distant from the power supply to keep the three cables which connect the Read/Write PCA to the CTU transport assembly out of the way.
4. Certain PCAs must be located in groups so they can be connected together with a top or end plane connector. These PCAs are shown in groups in the illustration.
5. Most PCAs may be installed anywhere in the backplane; however, there must be no empty slots between the DMA and Processor PCAs.

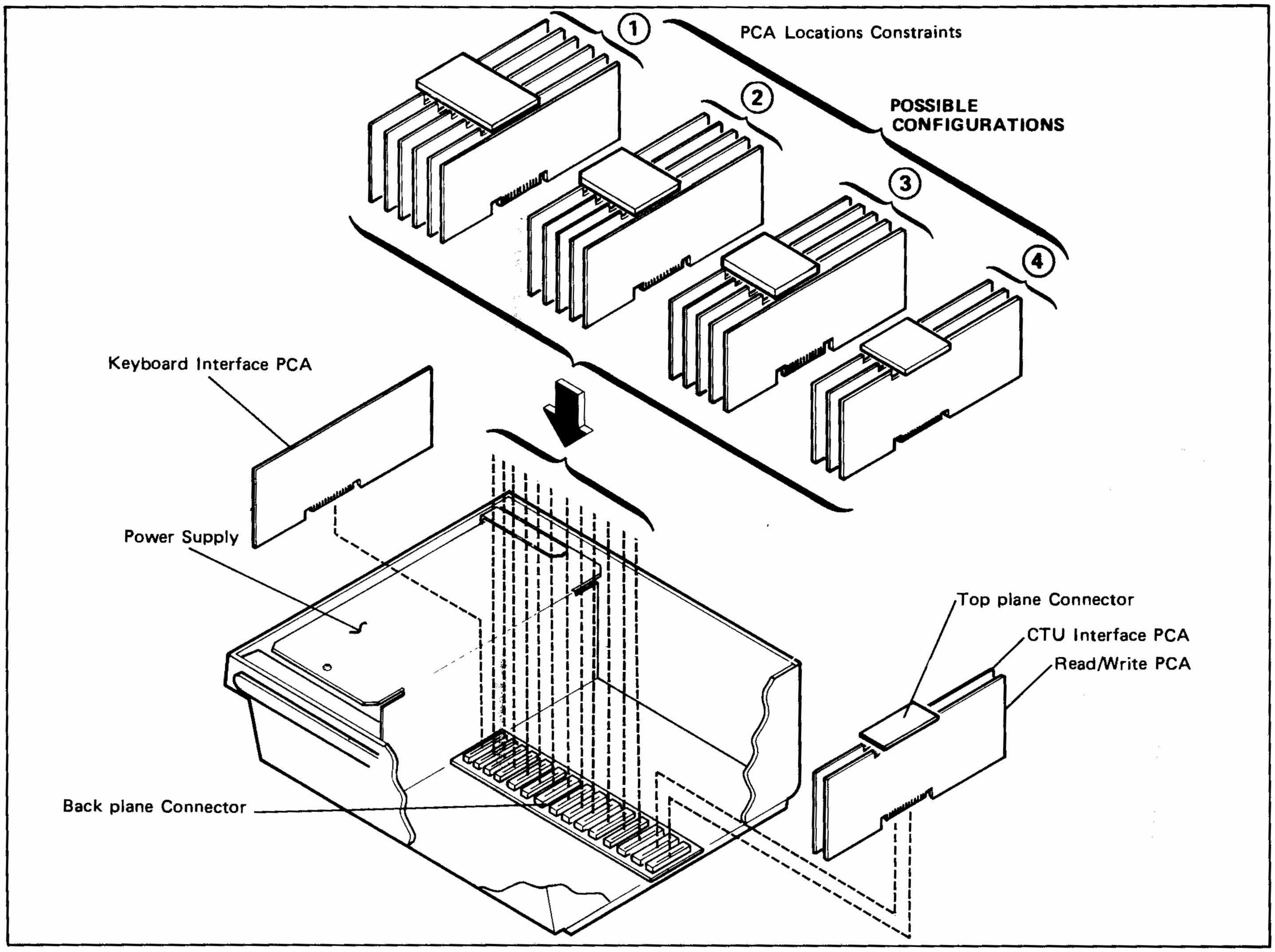


Figure 2-11. Constraints Which Apply to Location of PCAs on Backplane (Sheet 1 of 2)

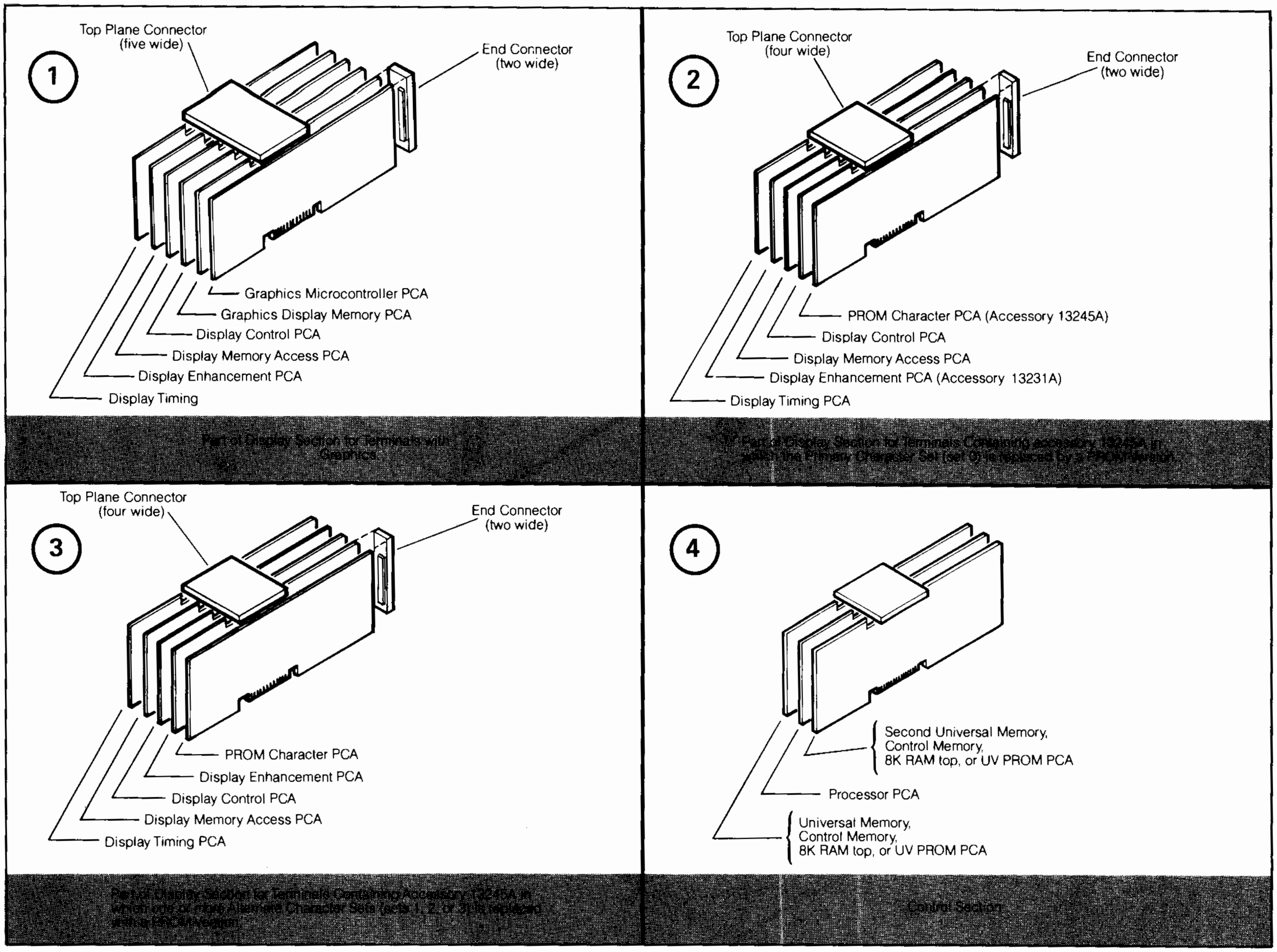


Figure 2-11. Constraints Which Apply to Location of PCAs on Backplane (Sheet 2 of 2)

Accessory Installation Procedures

The following text consists of procedures for installing accessories which were not included in the terminal as it was shipped from the factory.

Standard 264X series terminals contain a backplane assembly which allows installation of only two accessory PCAs. If more than two PCAs are to be added, it is first necessary to install accessory 13240A, the Option Slot Extender.

Note

After installing or removing any accessory, check the power supply voltage output (refer to Section 6) and perform the terminal self test (refer to Section 7).

64-Character Lower Case ROM

OPTIONS .... None

WHY .... The 64-Character Lower Case ROM, part no. 1816-0613, is used to upgrade standard 64 character set 2640 terminals to 128 Roman characters. (Do not confuse this with the character sets which are part of Accessory 13231A.)

HOW .... To incorporate the lower case capability in the terminal, the lower case ROM is installed on the Display Control PCA and a jumper is installed in the 128 character strapping position on the PCA.

USEABLE ON .... 264X series terminals

ITEMS SUPPLIED .... One 64-character lower case ROM, part number 1816-0613.

EQUIPMENT REQUIRED ....

1. A Connector Extractor, 1600-0676.
2. A 20K ohm/volt voltmeter.

PROCEDURE ....

CAUTION

MOS 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 MOS circuits in carpeted areas.

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

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

ENSURE that the circuit 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, circuits, and PCA to the work surface.

1. Open terminal to its half open position (refer to "Opening The Terminal" in this section).
2. Use connector extractor to remove the top plane connector from the Display Control PCA (refer to Removing a Top Plane Connector in this section).
3. Remove Display Control PCA from backplane assembly.
4. Using figure 2-12 as a guide, locate the 128 CH jumper W1 position and solder in a jumper. (If the board uses a jumper socket or switch, insert a jumper or make the proper setting.)
5. Locate the vacant lower case ROM socket XU28 (figure 2-12).
6. Carefully insert 64 characters lower case ROM in socket XU28 so that ROM pin 1 is at upper right corner of XU28.
7. Reinstall Display Control PCA in backplane assembly connector from which it was removed.
8. Reinstall top plane assembly on DMA, Display Timing, and Display Control PCAs top connectors.

PROCEDURE (Continued) ....

9. Check and, if necessary, adjust power supply as described in the power supply portion of Section 5.

10. Perform a terminal self test as described in Section 6.

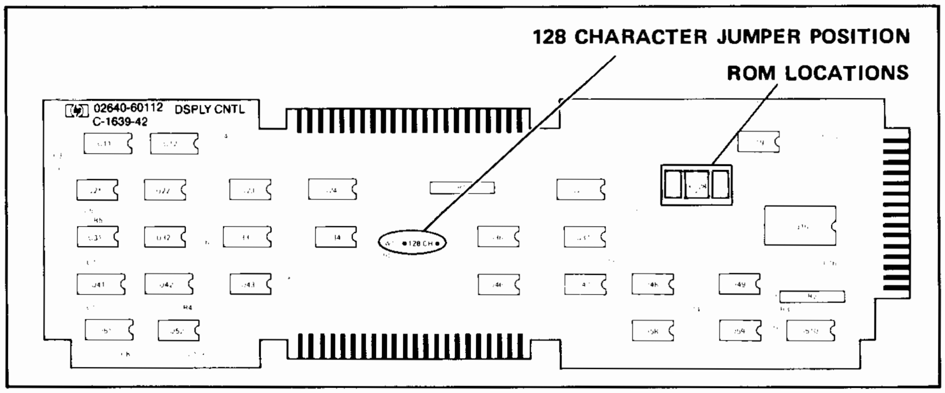


Figure 2-12. Display Control PCA Jumper and ROM Locations

13231A Display Enhancements

OPTIONS ....

STANDARD. Adds the capability to display blinking, underlined, and half-bright characters and to draw simple line drawings.

OPTION 201. Math Symbol Character Set (Set A or Set 1).

OPTION 202. Line Drawing Character Set (Set B or Set 2). (*Note: Option 202 has been incorporated into the standard set.)*

OPTION 203. Large Character Set (Set C or Set 3).

WHY ....

STANDARD. The standard 13231A accessory adds the capability to select for each display character blinking, underlined, half-bright, or any combination of these characteristics (figure 2-13). (The terminal, without the 13231A accessory, has only the inverse video capability.) It also includes the capability to draw simple line drawings and data entry forms (figure 2-14). Most keyboard keys produce a line segment (figure 2-15).

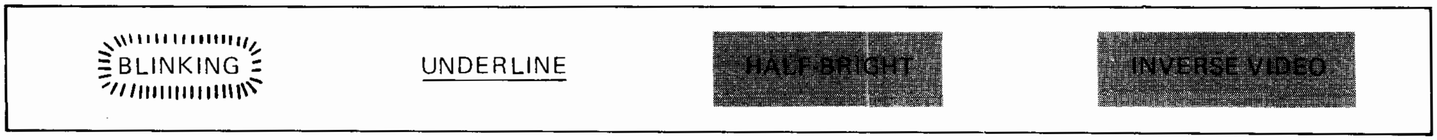


Figure 2-13. Standard 13231A Character Display Selections

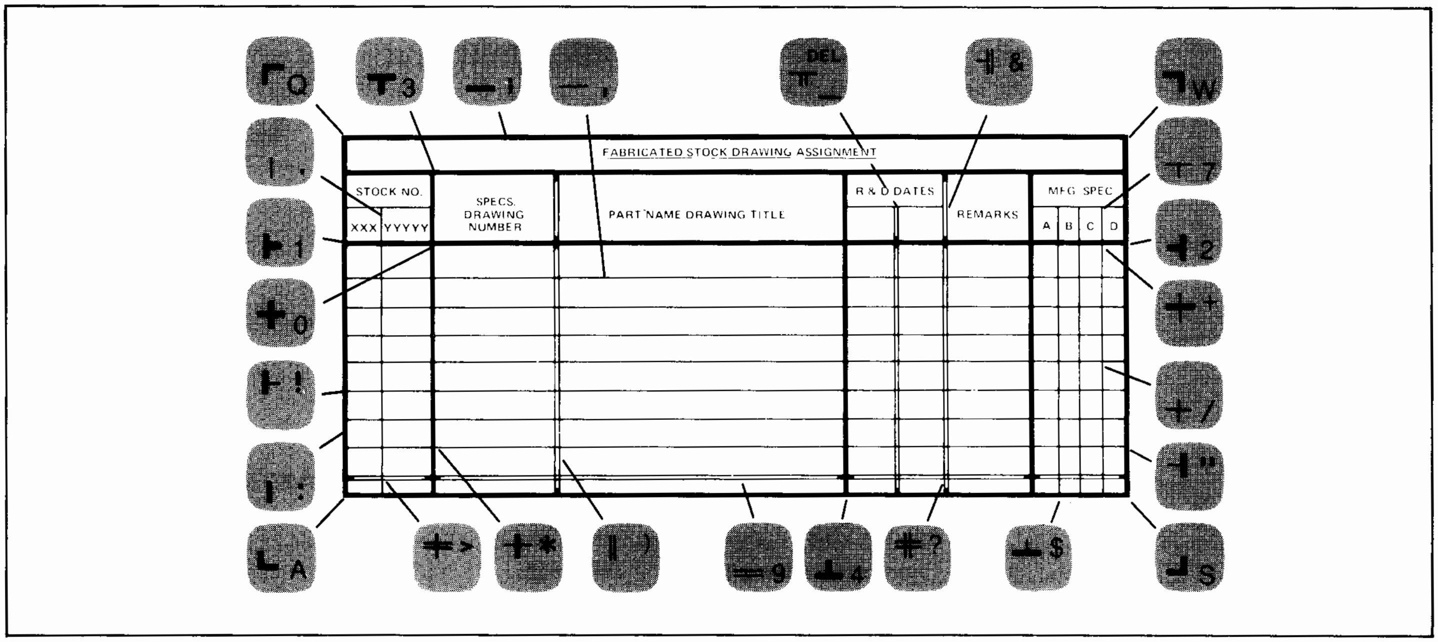


Figure 2-14. Example of Line Drawing Character Set Use

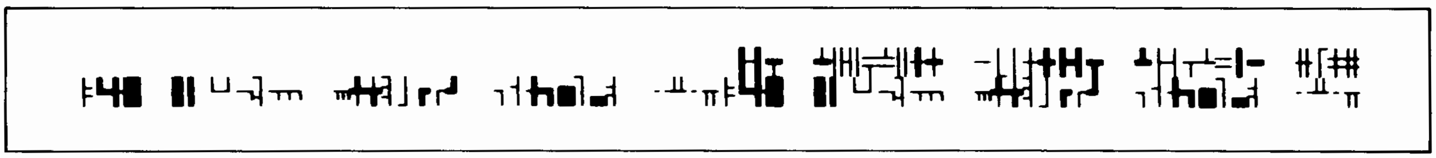


Figure 2-15. Line Drawing Character Set Line Segments

OPTION 201. Option 201 adds math symbols to the terminal's character set (figures 2-16 and 2-17).

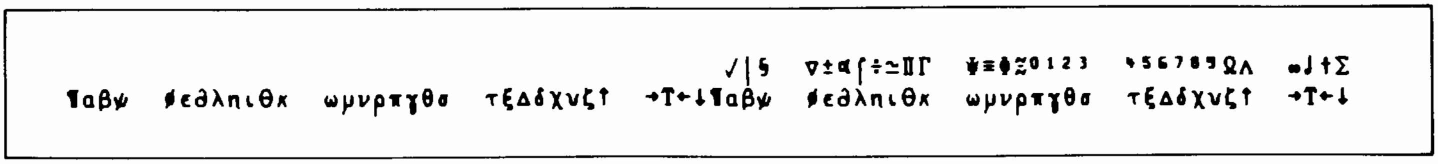


Figure 2-16. Math Symbols

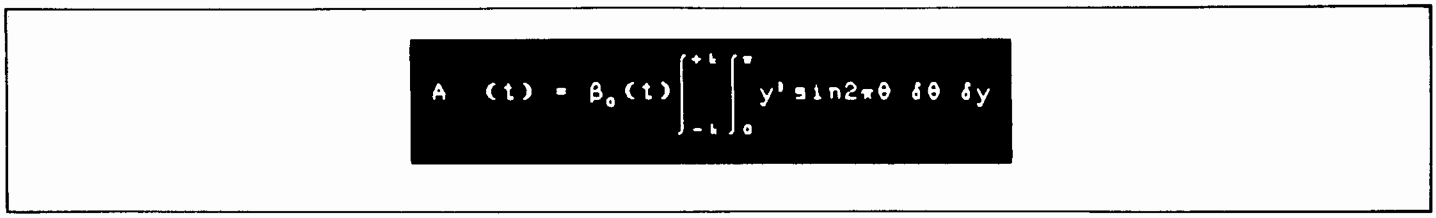


Figure 2-17. Example of Math Symbol Set Use

OPTION 203. Option 203 adds a large character set (figures 2-18 and 2-19).

Figure 2-18. Character Segments of Large Character Set

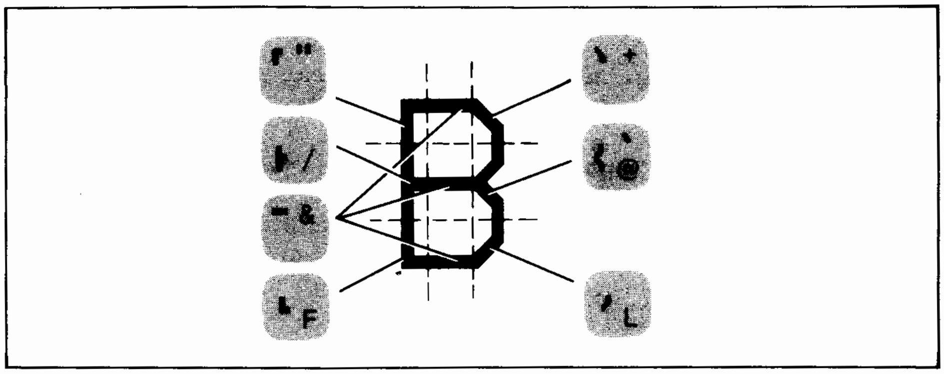


Figure 2-19. Example of Large Character Set Use

HOW .... Installation of the 13231A consists of strapping and installing the Display Enhancement PCA, then connecting it to the Display Control, Display Memory, and Display Timing PCAs with a top connector. The Display Enhancement PCA comes with the appropriate ROM(s) for the character set ordered already installed.

USEABLE ON .... Accessory 13231A can be installed on any 264X terminal. However, the 2641 terminal can accommodate only one of the three character sets.

ITEMS SUPPLIED .... STANDARD. The standard 13231A (without options) consists of:

1. One Display Enhancement PCA, 02640-60024.
2. One 4-wide Top Plane Connector, 02640-60022.
3. One 5-wide Top Plane Connector, 02640-60016.
4. One ROM, 1816-1417 (Line Drawing Character Set) mounted on the Display Enhancement PCA. Earlier version PCAs may require ROM 1816-0641.
5. One Symbol Template, 9320-3172 (for line drawing segments.).

OPTION 201

1. One ROM, 1816-0642, (Math Symbol Character Set) mounted on the Display Enhancement PCA.
2. One Symbol Template, 9320-3173 (for math symbols).

OPTION 202

1. One ROM, 1816-1417 (Line Drawing Character Set) mounted on the Display Enhancement PCA. Earlier version PCAs may require ROM 1816-0641.
2. One Symbol Template, 9320-3172, (for line drawing segments).

OPTION 203

1. One ROM, 1816-1425 (Large Character Set) mounted on the Display Enhancement PCA. Earlier version PCAs may require ROM 1816-0641.

EQUIPMENT REQUIRED .... A 20K ohms/volt voltmeter.

PROCEDURE .... 1. If any option was ordered, check the Display Enhancement PCA to see that the ROM(s) are installed in the correct locations (figure 2-20).

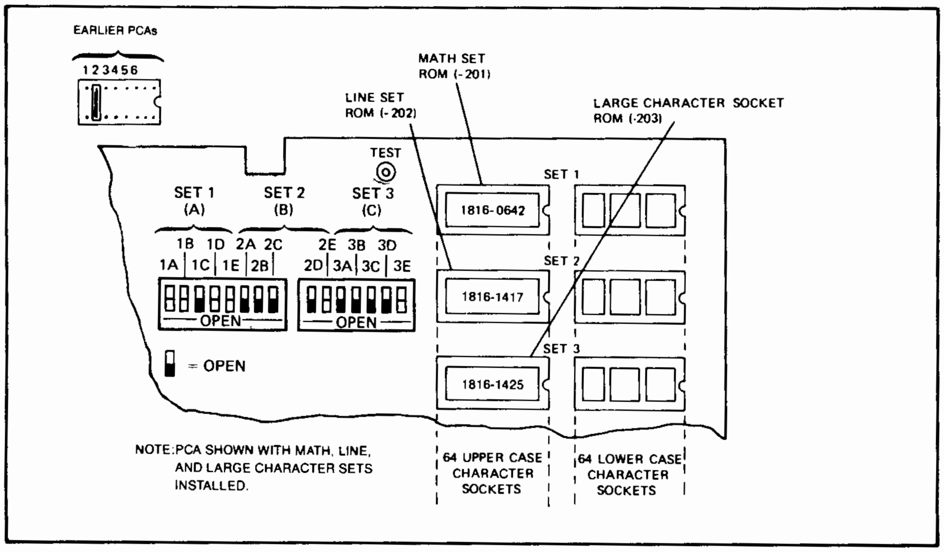


Figure 2-20. Display Enhancement PCA ROM Socket Locations

PROCEDURE (Continued) ....

Note

Only one alternate character set (one ROM) is allowed in the 2641A terminal. Therefore, if one of the option ROMs is to be installed, it replaces the line drawing set ROM (figure 2-21).

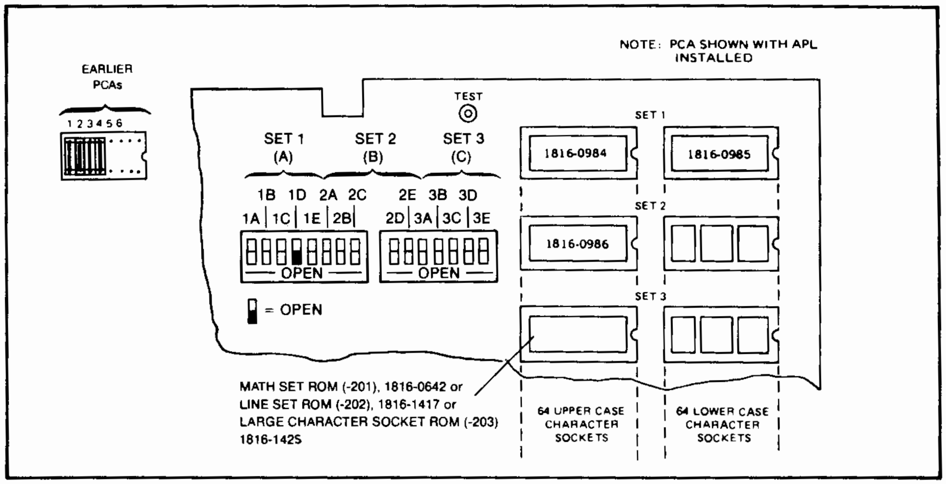


Figure 2-21. Display Enhancement PCA Rom Socket Location (HP 2641A)

2. Check the Display Enhancement PCA to see that it is correctly configured (refer to Section 5, Strapping).
3. Open terminal to its half open position (refer to "Opening The Terminal").
4. Use the connector extractor to remove the top plane connector from the Display Control, Display Memory Access (DMA), and Display Timing PCAs.
5. If necessary, rearrange PCAs in backplane assembly so that an unused connector is available for the Display Enhancement PCA adjacent to the Display Memory Access (DMA), Display Control and Display Timing PCAs (see figure 2-11) and install the Display Enhancement PCA.

PROCEDURE (Continued)

6. Install one of the top plane connectors on the following PCAs (see figure 2-11):
   a. Display Enhancement PCA.
   b. Display Timing PCA.
   c. Display Memory Access PCA.
   d. Display Control PCA.
   e. Graphics Display Memory PCA (if no such PCA is installed in the terminal, use the 4-wide top plane connector to connect the preceding four PCAs).
7. Check and, if necessary, adjust the power supply output voltage (refer to Section 5 for instructions).
8. Perform the primary self test (refer to the troubleshooting section) and check that any alternate character set installed is present on the display and that the blinking, half-bright, and underline characteristics are present. If the half-bright portion of the display is unsatisfactory, adjust it as desired according to instructions in Section 5 (Brightness, Half-Bright, and Focus Adjustment).

13234A 4K RAM Memory

OPTIONS None

WHY The 13234A adds 4K of RAM memory to the terminal's memory. This enables more information to be stored without "rolling off the end" of terminal memory.

HOW The 13234A accessory is installed by making strapping selections on the 4K RAM Memory and Control Memory PCAs, then installing the 4K RAM Memory PCA in a vacant slot in the terminal.

USEABLE ON All 264X-series terminals except 2642A and 2647A.

ITEMS SUPPLIED One 4K RAM Memory PCA, 02640-60065.

EQUIPMENT REQUIRED

1. A Connector Extractor, 1600-0676.
2. A 20K ohms/volt voltmeter.

PROCEDURE ....

1. Open the terminal to the half-open position (refer to Opening The Terminal at the start of this section).
2. Set the strapping on the 4K RAM Memory and Control Memory PCAs according to instructions in the 13234A portion of the Strapping section.
3. Install the 4K RAM Memory in any vacant slot but within the constraints listed in figure 2-11.
4. Check and, if necessary, adjust the power supply output voltage.
5. Perform a terminal self test as described in the Troubleshooting section.

13236A/B Cartridge Tape Unit

OPTIONS .... None

WHY .... The cartridge tape unit (CTU) accessory provides the terminal with a mass storage capability.

HOW .... The cartridge tape unit is installed by:

1. Installing two PCAs in the terminal and connecting them with a top plane connector.
2. Installing two CTU cushions.
3. Installing two CTU transport assemblies.
4. Connecting the two transport assemblies to the two PCAs with three cables.
5. Replacing the old bezel with one compatible with the transport assemblies.

USEABLE ON .... The 13236A is for 2644A terminals. The 13236B is for all other terminals except the 2647A which comes with CTUs installed.

ITEMS SUPPLIED .... Items supplied are listed below:

Quantity		Description	HP Part Number
13236A	13236B		
2	2	CTU Cushion	0403-0345
1	1	Head Cleaner	8500-1251
2	2	Data Cartridge (blank)	9162-0061
25	25	Head Cleaning Swab	9300-0468
1	1	Top Plane Connector	02640-60021
1	1	Read/Write PCA	02640-60032
1	—	CTU Interface Assembly	02640-60033
2	2	CTU Transport Assembly	02640-60050
1	1	Motor Cable	02640-60085
1	1	CTU Bezel	02640-60177
—	1	CTU Interface PCA	02640-60137
1	—	Bezel Insert (2644)	02644-00001
1	—	User Inst. Tape (2644)	02644-13301
—	1	Bezel Insert (2645)	02645-00010
—	1	User Inst. Tape (2645)	02645-13301
1	1	Installation Manual	13236-90004

EQUIPMENT REQUIRED ....

1. CTU Tester 02640-60082.
2. CTU Checkout Tape Cartridge 02640-60096.
3. Phillips-head screwdriver.

PROCEDURE ....

1. Perform a terminal self test to verify correct operation. Any malfunction must be corrected before proceeding. Refer to Section 6 for self test instructions.
2. Turn off terminal power and disconnect the power cord.
3. Open the terminal to the half-open position (refer to Opening The Terminal in this section).
4. Remove four screws and lockwashers securing existing front bezel to mainframe shell. Remove and discard front bezel.
5. Remove backing paper from CTU cushions supplied in accessory package. Press cushions into place on mainframe shell as shown in figure 2-22.

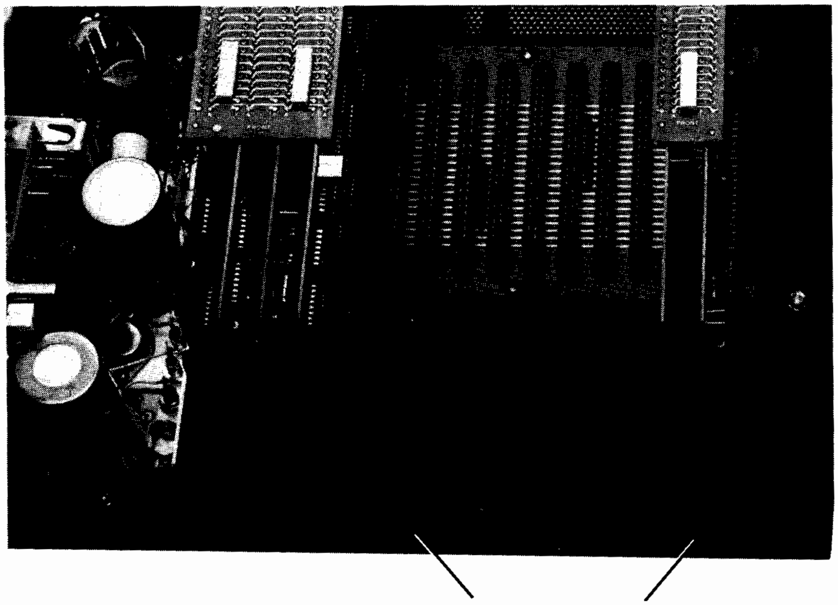


Figure 2-22. CTU Cushion Location

PROCEDURE (Continued) ....

6. Ensure that CTU Interface PCA jumper configuration is as shown in the 13236A/B portion of Section 3. Install PCA in the second from the right-most backplane connector.
7. Install Read/Write PCA in the right-most backplane connector between CTU Interface PCA and right side of mainframe shell. The two PCAs must be installed in adjacent connectors with the Read/Write PCA nearest the right side of mainframe.

CAUTION

It is imperative that the following cable connections be made exactly as stated. Double check each connection. Incorrect connections will result in improper terminal operation and may cause damage to tape cartridges.

PROCEDURE (Continued) ....

Note

Each CTU cable assembly is color coded with a red stripe that extends visibly through the bottom of the assembly's 14-pin connector. When the cable assembly is properly connected to its associated connector socket on the Read/Write PCA, the red stripe is at the bottom of the PCA's connector socket.

8. Connect motor cable four-pin connector to Read/Write PCA connector J6 as shown in figure 2-23.
9. Route motor cable to front of mainframe shell as shown in figure 2-23.

Note

The CTU Transport Assemblies are identical. Either assembly can be used for the following procedure. When installing the CTU Transport Assemblies, ensure that all cables are routed under and to the right of the assemblies along the bottom of the mainframe shell as shown in figure 2-24.

10. Mount CTU Transport Assembly in space provided for UNIT 0 (left-hand unit) by seating both shock mounts in the two mainframe shell mounting wells. Ensure assembly is seated on cushion attached to mainframe shell in step 5 above.
11. Tighten two mounting screws into shock mounts seated in mounting wells until CTU Transport Assembly is secured firmly in place. Do not overtighten mounting screws; overtightening may cause misalignment between CTU Transport Assembly and front bezel.
12. Connect Motor Cable Assembly two-pin connector with red-white and black-white wires to UNIT 0 Transport Assembly motor connector.
13. Route UNIT 0 cabling as shown in figure 2-24. Ensure that cables do not interfere with free movement of CTU Transport Assembly motor when a cartridge is inserted or ejected.
14. Fold ribbon cable attached to remaining CTU Transport Assembly (UNIT 1) as shown in figure 2-25.
15. Connect remaining Motor Cable two-pin connector to UNIT 1 motor connector.

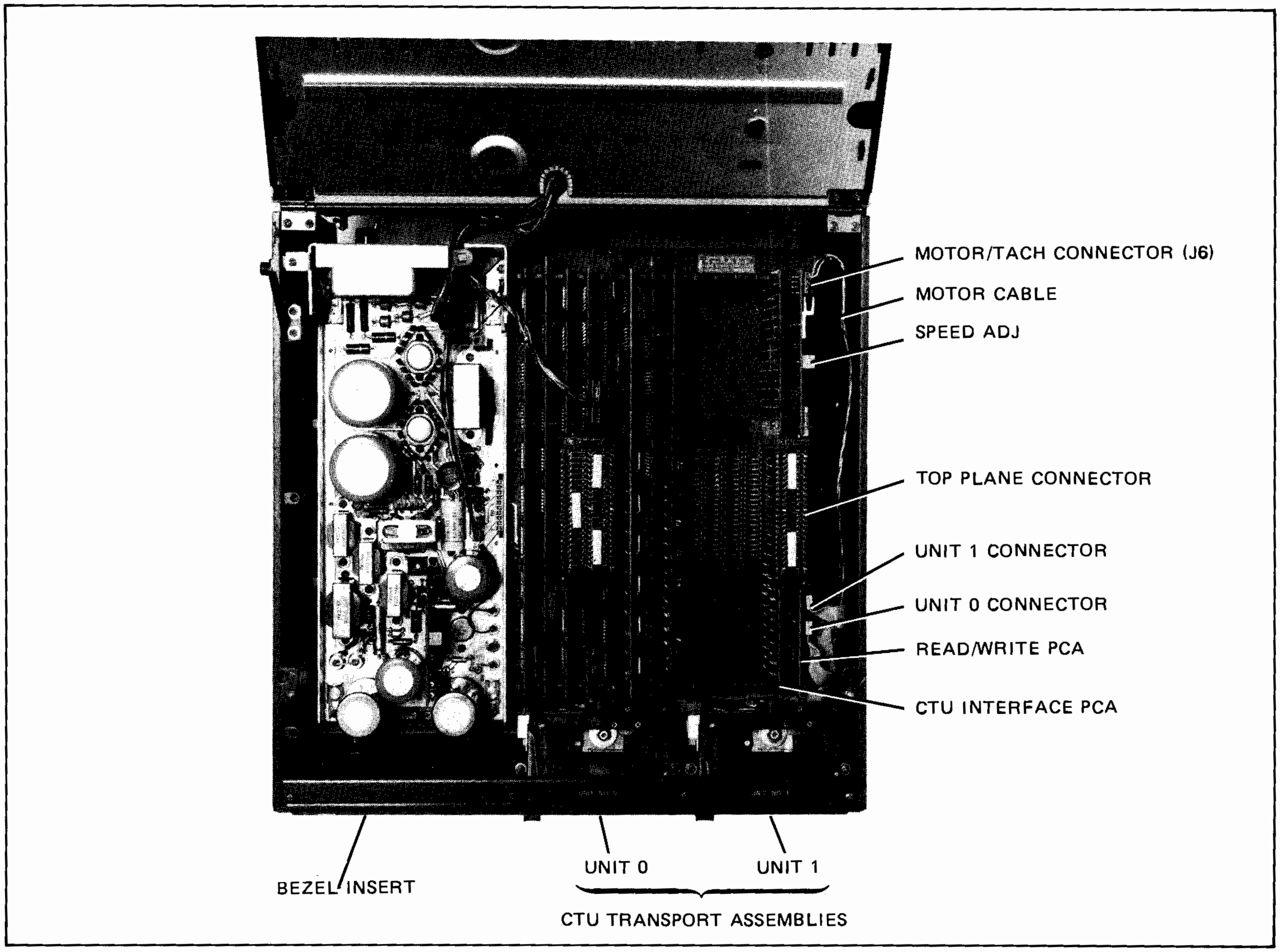
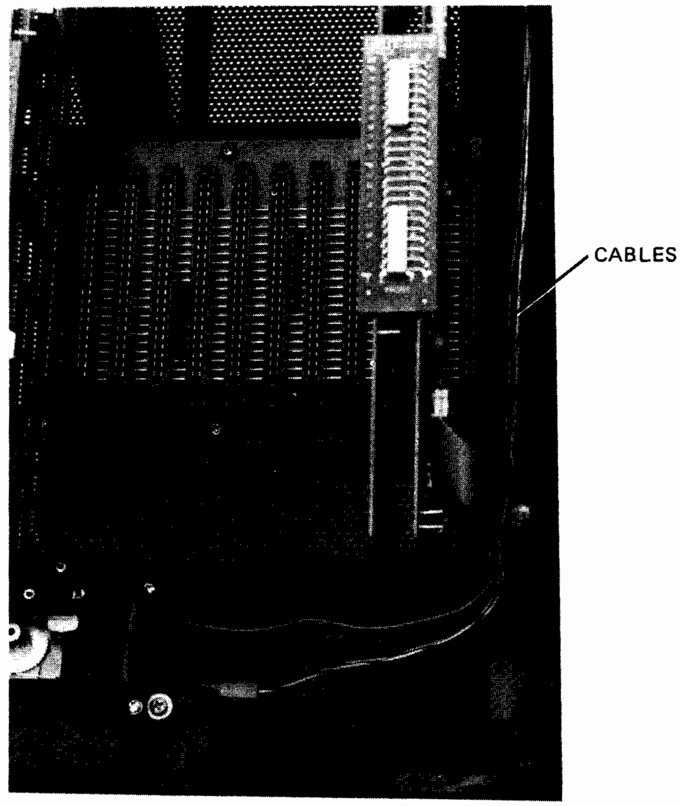


Figure 2-23. Accessory Component Locations



NOTE: PCAS ARE NORMALLY INSTALLED IN THE LAST TWO SLOTS. THEYARE SHOWN POSITIONED ONE SLOT TO THE LEFT TO ILLUSTRATE CABLE CONNECTIONS.

Figure 2-24. Cable Routing

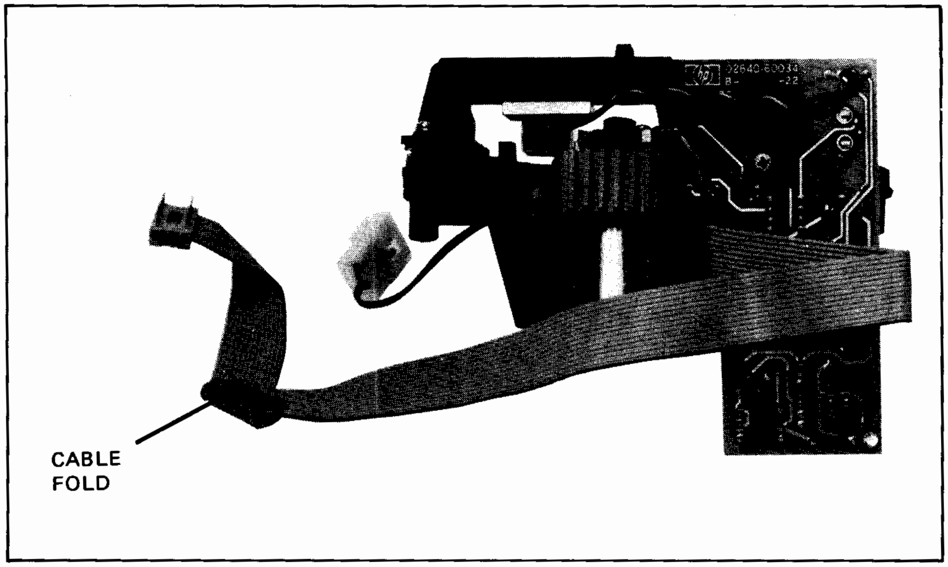


Figure 2-25. Unit 1 Cable Fold

PROCEDURE (Continued) ....

16. Mount UNIT 1 CTU Transport Assembly in right-hand mounting wells. Tighten shock mount screws to secure assembly in mainframe shell.
17. Connect UNIT 0 ribbon cable to Read/Write PCA socket labeled "U0". Refer to figure 2-23.
18. Connect UNIT 1 ribbon cable to Read/Write PCA socket labeled "U1"
19. Carefully mount front bezel on mainframe shell so that both CTU Transport Assembly eject buttons protrude through bezel holes.
20. Align four mounting screws with threaded holes in mainframe shell and secure bezel in place by tightening four screws. Ensure that no space exists between bezel ends and mainframe shell.
21. Check for correct bezel and CTU Transport Assembly alignment by ensuring that both CTU eject buttons move freely within the bezel holes and that both bezel doors open and close without interference.

PROCEDURE (Continued) ....

22. If bezel and CTU Transport Assemblies are properly aligned, proceed to step 23. If additional alignment is required, proceed as follows:

    a. Loosen misaligned CTU Transport Assembly mounting screws until shock mounts are loosely seated in their respective mounting wells. When loose, the CTU Transport Assembly can be moved slightly in both its lateral and vertical planes.

    b. Manually move CTU Transport Assembly until properly aligned as stated in step 21.

    c. While holding CTU Transport Assembly in properly aligned position, tighten two mounting screws until shock mounts firmly secure CTU Transport Assembly in place.

    d. Repeat substeps "a" through "c" as required until both CTU Transport Assemblies are properly aligned.

23. Remove backing paper from bezel insert. Press insert into place in recess at left side of bezel front.

24. Close the terminal.

25. Turn terminal power on and perform self-test.

13238A Terminal Duplex Register

OPTIONS .... None

WHY .... The Terminal Duplex Register PCA is used to interface between the terminal and a peripheral device such as a printer. (It is not used to interface to a computer or another terminal; the 13260A, B, C, or D accessory is used for that purpose.)

HOW .... Accessory 13238A is installed by:

1. Setting the strapping configuration of the Terminal Duplex Register PCA.
2. Installing the Terminal Duplex Register PCA in the terminal.
3. Connecting the peripheral device cable to the Terminal Duplex Register PCA.
4. Checking, and, if necessary, adjusting the power supply output.
5. Performing a terminal self test.

USEABLE ON .... All 264X terminals.

ITEMS SUPPLIED ....

1. A Terminal Duplex Register PCA 02640-60031.
2. Ten strapping jumpers 1258-0124.

EQUIPMENT REQUIRED .... A 20K ohms/volt voltmeter.

PROCEDURE ....

1. Turn off terminal power and open the terminal to the half-open position.
2. Install the strapping jumpers on the Terminal Duplex Register PCA according to instructions in the 13238A portion of Section 3.
3. Install the Terminal Duplex Register PCA in the vacant slot nearest the power supply.
4. Open the rear door and connect the peripheral device cable to connector P2 (rear connector) on the Terminal Duplex Register PCA.

Note

The hood connector and PCA connector P2 are identically keyed to prevent inadvertent erroneous connections. Connecting the two together requires minimal hand pressure. If excessive resistance is encountered, an incorrect connection is probably being attempted.

PROCEDURE (Continued) ....

5. Turn on terminal power. Check the power supply output voltage and, if necessary, adjust it as described under Power Supply Voltage Adjustment in Section 5.
6. Perform the terminal self test as described in the Troubleshooting section.
7. Check operation of peripheral device.

13240A Backplane Extender

OPTIONS .... None

WHY .... The backplane extender, when installed in a 2640 terminal, increases the number of PCA slots in the backplane by six slots to enable installation of additional options.

HOW .... The primary tasks involved in installing Accessory 13240A are:

1. Remove the Sweep PCA from the terminal.
2. Install the backplane extender as an extension of the backplane.
3. Install a fan and fan cable in the terminal.
4. Remove the power supply housing and connect the fan cable to the Power Supply PCA.
5. Reinstall the Sweep PCA.
6. Test and, if necessary, adjust the power supply as described in the power supply portion of Section 5.
7. Perform a terminal self test as described in the Troubleshooting section.

USEABLE ON .... 2640- terminals only.

ITEMS SUPPLIED ....

1. Backplane Extender 02640-60002.
2. Fan 3160-0208.
3. Fan Cable 02640-60138.
4. Attaching hardware.

EQUIPMENT REQUIRED ....

1. A set of Allen wrenches.
2. A Phillips-head screwdriver.
3. A 20K ohms/volt voltmeter.

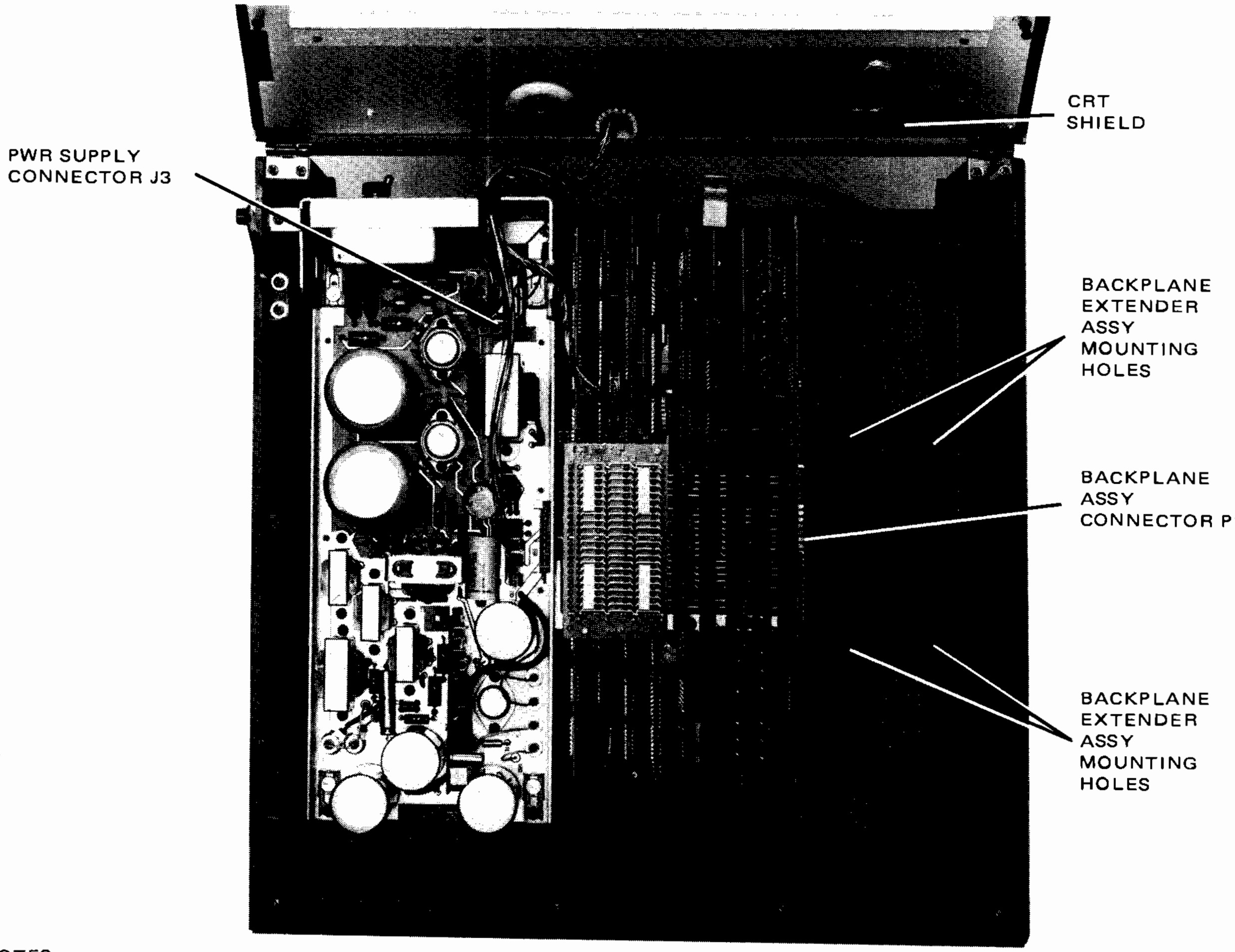
PROCEDURE ....

1. Turn off terminal power and open terminal to its full open position (refer to Opening The Terminal in this section).
2. The CRT shield (see figure 2-26) is secured in place with snap fasteners. Remove CRT shield by pulling fasteners out of top cover mounting holes (see figure 2-27) and sliding toward the front of the CRT.
3. Disconnect High Voltage Cable from CRT.
4. Disconnect Yoke Cable from Sweep Printed Circuit Assembly (PCA) connector P3.
5. Disconnect Sweep Cable from Sweep PCA connector P1.
6. Unlatch two snap locks, raise Sweep PCA from mainframe, disconnect CRT Cable from Sweep PCA connectors P2 and P4, and remove Sweep PCA.
7. Remove two Phillips-head screws and lockwashers securing two cable clamps and wire harness to mainframe top cover. Retain mounting hardware for installing the fan. Do not remove cable clamps from wire harness. (Vacated cable clamp holes will be used to mount fan.)
8. Carefully connect connector J16 of backplane extender, part no. 02640-60002, to backplane connector P1 (see figure 2-26).
9. Visually align backplane extender mounting holes with the four mounting holes in bottom of mainframe and secure in place with four lockwashers and four Phillips-head screws.

Note

Fan and cable Assembly must be mounted so that cables from fan are closest to back of top cover and CRT. Fan AIRFLOW arrow must point inward for correct terminal cooling action.

10. Visually align mounting holes with the four mounting holes (see figure 2-27) in mainframe top cover.



NOTES:

1. POWER SUPPLY IS SHOWN WITH HOUSING REMOVED.

Figure 2-26. Mainframe Bottom Part Locations (2640A/B/N/S)

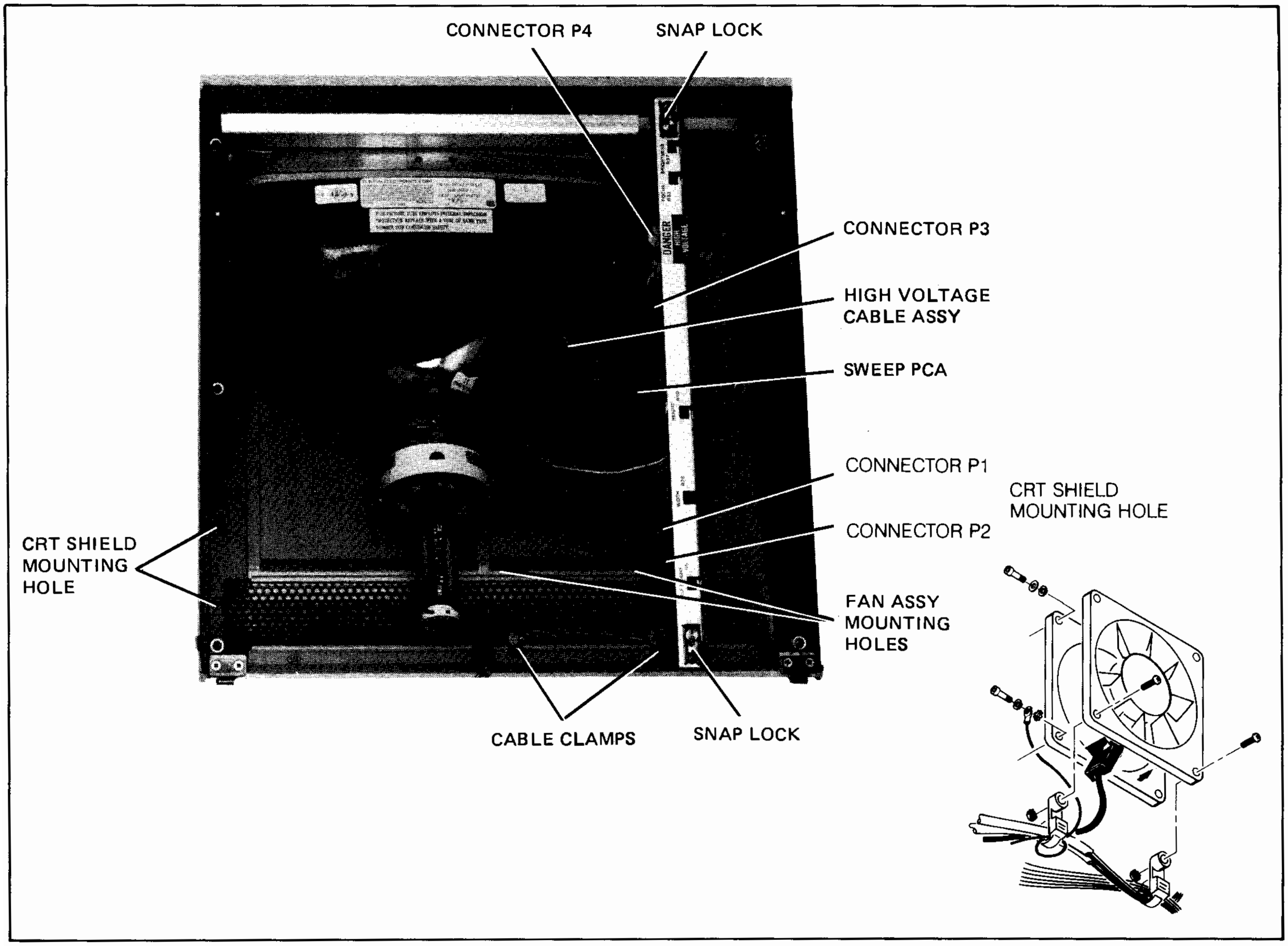


Figure 2-27. Mainframe Top Part Locations (2640A/B/N/S)

PROCEDURE (Continued) ....

Note

Fan cable ground lug must be attached to one of the fan Allen-head mounting screws.

11. Secure fan in place with four lockwashers and four Allen-head screws.
12. Remove power supply housing (bottom left side of mainframe) by removing the screw securing the housing to the power supply. Then pull the housing up and out toward front of mainframe.
13. Connect fan cable connector to Power Supply PCA connector J3 (see figure 2-26) and route cables back to fan with existing wire harness. The cable should be placed inside the first (left) cable clamp along with the existing harness. See figure 2-27.
14. Replace power supply housing and secure in place with the screw.
15. Using two Phillips-head screws, two lockwashers, and two nuts, secure two cable clamps and the wire harness to mounting holes in top of fan frame closest to back of mainframe.
16. Connect CRT cable to Sweep PCA connectors P2 and P4.
17. Connect yoke cable to Sweep PCA connector P3.
18. Connect sweep cable to Sweep PCA connector P1.
19. Install Sweep PCA in mainframe top cover and secure in place with the two snap locks.
20. Connect high voltage cable to CRT.
21. Secure CRT shield in place by sliding the front of the shield over the CRT mounting bracket and pressing the snap fasteners into the mounting holes.
22. Turn terminal power on. Check and, if necessary, adjust power supply as described in Power Supply Voltage adjustment in Section 5.
23. Close the terminal.
24. Perform the terminal self test as described in Section 6.

13245A Character Set Generation Kit

OPTIONS .... None

WHY .... Accessory 13245A enables the user to design his own character set(s). It has a capacity of two 128-character sets which can be used to replace the primary character set (the one the terminal normally displays without special selection) or to replace either one or two of the three alternate character sets (math symbol set, line drawing set, and large character set) available as options with Accessory 13231A. ROMs for the character set being replaced must be removed from the terminal when the new set is installed.

HOW ....

1. Remove the ROMs for the character set to be replaced from the Display Control PCA (if the primary character set is to be replaced) or the Display Enhancement PCA (if one or more alternate character sets are to be replaced).
2. Install the ROMs for the new character set(s) on the PROM Character PCA.
3. Strap the PROM Character PCA and either the Display Control or Display Enhancement PCA.
4. Install the PROM Character PCA in the terminal. To do so, it may be necessary to relocate the PCAs presently in the terminal.
5. Install the end connector provided on the PROM Character PCA and either the Display Control or Display Enhancement PCA, depending on whether the primary or an alternate character set is being replaced.
6. Check the power supply output and adjust it if necessary.
7. Test the terminal.

USEABLE ON .... All 264X terminals.

ITEMS SUPPLIED ....

1. A PROM Character PCA, 02640-60053.
2. An end connector, 02640-60070.
3. An applications note manual, 13245-90001, (2640 Series Character Set Generation).

EQUIPMENT REQUIRED .... A 20K ohm/volt voltmeter.

PROCEDURE ....

1. Turn off terminal power and open terminal to the half-open position.
2. Use Connector Extractor 1600-0676 to remove the top plane connector from the Display Control, Display Memory Access and Display Timing PCAs.

Note

A character set represented in PROM cannot simultaneously be represented in ROM on the Display Control or Enhancement PCA. However, mixing of different sets is permitted. Thus alternate set 1 may be a Math Symbol Set or Line Drawing Set ROM while alternate set 2 is a custom PROM set on the PROM Character Board.

3. If the primary character set is to be replaced, remove the Display Control PCA from the terminal. If one or two alternate character sets are to be replaced, remove the Display Enhancement PCA.
4. Remove the ROMs containing the character set(s) to be replaced. If the primary character set is to be replaced, remove both the upper case and lower case ROMs from the Display Control PCA (figure 2-28). If one or two alternate character sets are to be replaced, remove the upper case and lower case ROMs for the character set(s) to be replaced from the Display Enhancement PCA (figure 2-29).

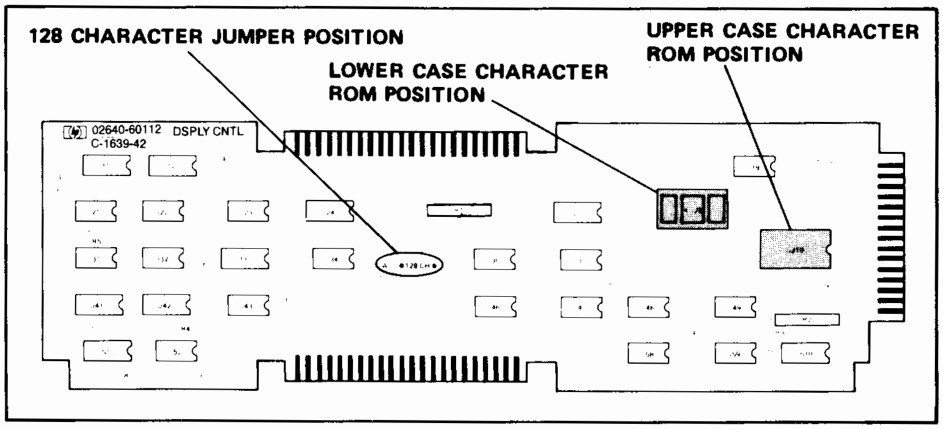


Figure 2-28. Display Control PCA ROM and Jumper Locations

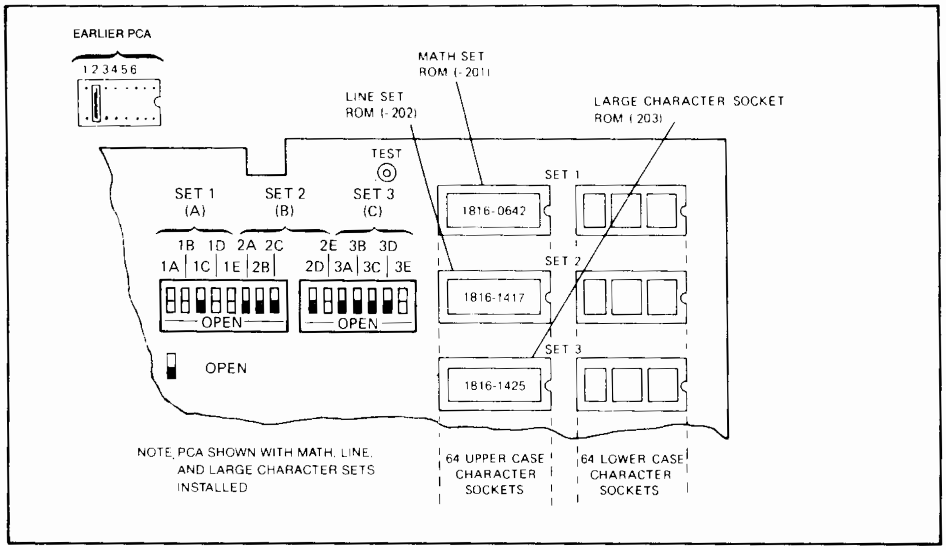


Figure 2-29. Display Enhancement PCA ROM Locations

PROCEDURE (Continued) ....

5. Install the ROMs for the new character set(s) on the PROM Character PCA and strap the PROM Character PCA. Also, strap the Display Control PCA (if the primary character set is being replaced) or the Display Enhancement PCA (if one or two alternate character sets are being replaced). Instructions for locating the ROMs on the PROM Character PCA and for strapping the PROM Character PCA, Display Control PCA, and Display Enhancement PCA are available in the 13245A portion of Section 3.

6. If necessary, rearrange PCAs in the backplane assembly so that an unused connector is available for the PROM Character PCA adjacent to either the Display Control PCA or Display Enhancement PCA depending on the character set(s) to be replaced. If the primary character set is to be replaced, vacate a connector adjacent to the Display Control PCA. If an alternate character set(s) is to be replaced, vacate a connector adjacent to the Display Enhancement PCA. See figure 2-11 for constraints on PCA location.

7. Install either the Display Control PCA or Display Enhancement PCA and the PROM Character PCA in the terminal.

PROCEDURE (Continued) ....

8. Open the terminal rear door and install the end connector 02640-60070 on the PROM Character PCA (if the primary character set is being replaced) or the Display Enhancement PCA (if one or two alternate character sets are being replaced (figures 2-30 and 2-31).

9. Reconnect the top plane connector to the Display Control, Display Memory Access, Display Timing, and Display Enhancement (if present) PCAs.

10. Turn on terminal power. Check and, if necessary, adjust the power supply according to instructions in the power supply portion of Section 5.

11. Perform the terminal self test according to instructions in Section 6.

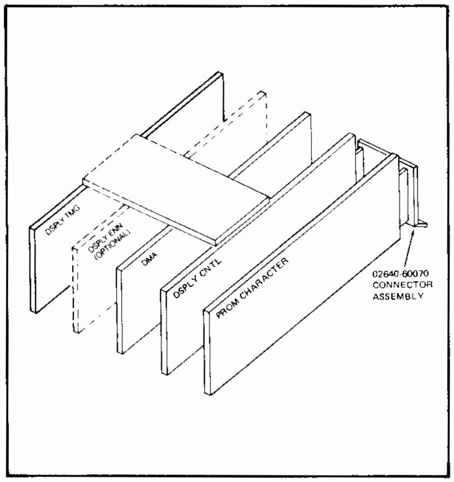


Figure 2-30. PCA Configuration If The Primary Character Set Is To Be Replaced

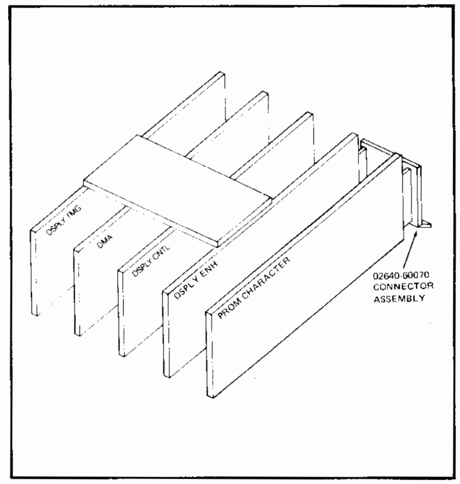


Figure 2-31. PCA Configuration If An Alternate Character Set Is To Be Replaced

13246A/B Printer (9866) Subsystem

OPTIONS .... None.

WHY .... This accessory adds a line printing capability to the terminal. Accessory 13246A is supplied with an HP 9866A printer; Accessory 13246B has an HP 9866B printer. (The 9866B printer prints lower and upper case characters while the 9866A prints only upper case characters.)

Note

This accessory requires Device Support Firmware to be installed.

HOW ....

1. Install the Terminal Duplex Register PCA (Accessory 13238A) in the terminal.
2. Install the printer.
3. Check the power supply output and adjust it if necessary.
4. Perform a terminal self test.

USEABLE ON .... All 264X terminals.

ITEMS SUPPLIED ....

1. An Accessory 13238A (Terminal Duplex Register PCA).
2. An Accessory 13232S (printer cable).
3. An Operator's manual (13246-90901).

EQUIPMENT REQUIRED .... A 20K ohm/volt voltmeters.

PROCEDURE ....

1. Install the Accessory 13238A (Terminal Duplex Register PCA) according to procedures listed under 13238A in this section.
2. Install the printer according to instructions in Operator's manual 13246-90901 supplied with this accessory.
3. Check and, if necessary, adjust the power supply output according to instructions in Section 5.
4. Perform a terminal self test according to instructions in Section 6.
5. Verify correct printer operation.

13250B Serial Printer Interface

OPTIONS .... None

WHY .... Accessory 13250B can be used either as:

1. An interface between the terminal and a serial printer.
2. An asynchronous data communications interface with more (extended) capabilities than the standard data comm PCA. These additional capabilities are:
   a. Switch-selectable speeds.
   b. Standard baud rates (110, 150, 300, 1200, 2400, 4800, or 9600).
   c. Custom baud rates (from 37.5 to 9600, within 1.0 percent).
   d. Supports split baud rates (data can be transmitted at one baud rate and received at another).
   e. Supports both transmit and receive hardware handshake protocols.
   f. Switch-selectable parity (odd, even, or none).
   g. Switch-selectable number of stop bits (one or two).
   h. Provide either a standard RS232C link or an asynchronous 20mA current loop communications link instead of the RS232C link.

Note

If the 13250B is to be used as an interface to a serial printer, the Device Support Firmware must be included in the terminal's firmware.

HOW ....

1. Configure the strapping switches on the 02640-60143 PCA provided.
2. Install the PCA in the terminal.
3. Connect the cable between the terminal and the printer, modem, or computer.
4. Test and, if necessary, adjust the power supply output.
5. Test the terminal.

USEABLE ON .... All 264X terminals.

13250B

ITEMS SUPPLIED ....

1. An Asynchronous Data Communications PCA
2. An Interface Cable 02640-60083.
3. An Operating Manual 13250-90004.

EQUIPMENT REQUIRED ....

A 20,000 ohms/volt voltmeter.

PROCEDURE ....

1. Configure the strapping switches on the 02640-60143 PCA (refer to the 13250A/B portion of the strapping section).
2. Turn off terminal power, open the terminal to the half-open position, and insert the PCA in the vacant slot nearest to the power supply.
3. Unlock and raise the rear door of terminal to allow access to the PCAs and connect the cable hood connector to the 02640-60143 PCA. The hood connector and the back edge of the 13250B are identically keyed to prevent a wrong connection. Connecting the cable to the PCA should require minimal hand pressure. If excessive resistance is encountered, you either have the wrong cable or you are trying to connect it to the wrong board.
4. Close the rear door of the terminal.
5. Connect the other end of the cable to the printer, modem, or computer system.
6. Test the power supply output (refer to the Power Supply Voltage Adjustment procedures in the Alignment section) and, if necessary, adjust the power supply output.
7. Perform a terminal self test to ensure correct terminal operation (refer to Section 6).

13254A Video Interface

OPTIONS .... None

WHY .... This accessory connects the terminal to either video hard copy devices or television monitors or both. A maximum of 10 such devices can be daisy chained to the terminal to enable display or hard copying (or both) of whatever is displayed on the terminal.

The source of the information displayed on the terminal can be either the terminal keyboard, a tape, or a computer.

HOW ....

1. Configure the strapping on the Video Interface PCA.
2. Install the Video Interface PCA in the terminal next to the Display Timing PCA. (It may be necessary to rearrange the PCA locations in the terminal. If so, refer to figure 2-11.)
3. Disconnect the sweep cable from the Display Timing PCA and connect it to the Video Interface PCA.
4. Connect the extended sweep cable provided with this accessory between the Display Timing PCA and the Video Interface PCA.
5. Check and, if necessary, adjust the power supply output.
6. Perform a terminal self test to verify proper terminal operation.
7. Use accessory 13232K and/or 13232L cable(s) to connect the hard copy unit(s) and/or the TV monitor(s) to the terminal.

USED WITH .... **HARDCOPY UNIT** — Tektronix 4632 Video Hardcopy unit which has had option 007 installed at the factory.

TELEVISION MONITOR — Conrac Television Monitor (QQA series) ordered with reference to drawing 503-451.

USEABLE ON .... All 264X terminals.

ITEMS SUPPLIED ....

1. Video Interface PCA, 02640-60119.
2. Sweep Extender Cable, 02640-60122.
3. Operating and Service manual, part number 13254-90001.

EQUIPMENT REQUIRED ....

1. Accessory 13232K. (Cable for connecting terminal directly to a Tektronix 4632 Hardcopy Unit.)
2. Accessory 13232L. (Cable for connecting terminal directly to a Conrac TV Monitor.)
3. A 20K ohm/volt voltmeter.

PROCEDURE ....

1. Strap the Video Interface PCA according to instructions in the 13254A portion of Section 3.
2. Turn off terminal power and disconnect the primary power cord.
3. Open the terminal to the half-open position. Make sure that the support bracket has snapped into place to lock the terminal in the open position.
4. Remove the existing Sweep Cable assembly from connector P4 of the Display Timing PCA. Make sure that the Display Timing PCA is installed to the left of the other display PCAs. This is to accommodate the Sweep Extender Cable. Adjust the board positions as necessary.
5. Install Video Interface PCA in the Backplane Assembly connector adjacent and to the left of the Display Timing PCA. It may be necessary to move existing PCAs to create a vacant slot. If so, refer to figure 2-11 for PCA location restraints.
6. Connect the Sweep Extender Cable (02640-60122) supplied with the Video Interface from connector P4 of the Display Timing PCA to connector P4 of the Video Interface PCA.
7. Connect the free end of the old Sweep Cable to connector P5 of the Video Interface PCA.
8. Reconnect AC power.
9. Check and, if necessary, adjust the terminal power supply in accordance with instructions contained in the installation and service manual supplied with the terminal.
10. Perform a terminal self test in accordance with instructions in Section 6.
11. Close the terminal.
12. Use an Accessory 13232K cable to connect the hardcopy device to the terminal and an Accessory 13232L cable to connect the TV monitor to the terminal. Refer to the 13254A Operating and Service manual, 13254-90001, for instructions and verify proper operation.

13260A Standard Asynchronous Communications Accessory (Point-to-Point)

13260B Extended Asynchronous Communications Accessory (Point-to-Point)

13260C Asynchronous Multipoint Communications Accessory

13260D Synchronous Multipoint Communications Accessory

NOTE

Only one data communications interface accessory (13260A, B, C, or D) can be installed in a terminal at any time.

OPTIONS ....

13260A STANDARD.
A standard RS232-C asynchronous communications interface suitable for connection to only one external device (point-to-point).

13260B STANDARD.
Same as the 13260A except with added (extended) features. To identify the extended features, see the table in the WHY paragraph.

13260C STANDARD.
Asynchronous Multipoint Communications Interface. Allows several terminals to share the same communication line.

13260D STANDARD.
Similar to 13260C except that 13260D is synchronous rather than asynchronous.

OPTION 001 (13260C, D only)
Adds monitor mode capability which allows a terminal to monitor data transfers between the computer or driver terminal and other terminals on the communications line.

OPTION 002 (13260A, B, C, D)
Supplies only the data communications PCA without a data communications ROM, keyboard overlay, or baud rate label.

OPTION 003 (13260A, B only)
To be used with 2648A terminals. Same as the standard except that a graphics-type ROM is supplied in place of the standard ROM.

OPTION 004 (13260A, B only)
To be used with a 2645K terminal. Same as the standard except that a Katakana-type ROM is supplied in place of the standard ROM.

OPTION 006 (13260A, B, C, D)
To be used with 2647A terminals. Same as the standard except that a keyboard overlay compatible with 2647A terminals is supplied in place of the standard keyboard overlay.

WHY .... The 13260A, B, C, D Data Communications Accessories provide various types of data communications from teletypewriter compatible data communications to asynchronous or synchronous multipoint polling. The capabilities of each accessory are listed below.

DATA COMMUNICATIONS FEATURES	13260 A	13260 B	13260 C	13260 D
Transfer Rate:				
110, 150, 300, 1200, 2400, 4800, 9600 bits per second and external clocking (110-9600)	X	X		
300, 600, 1200, 1800, 3600, 4800, 7200, 9600 bits per second			X	
2400, 4800, 9600 bits per second and external clocking (300-9600)				X
Custom transfer rates within 1% from 37.5 to 2400 bits per second		X		
Split speed transmit/receive capability		X		
EIA RS232-C	X	X	X	X
Teletypewriter compatible	X	X		
ASCII	X	X	X	X
EBCDIC			X	X
20mA DC Current Loop		X		
Transmission Modes:				
Character Transfer	X	X		
Block Transfer	X	X	X	X
Half-duplex	X	X	X	X
Full-duplex	X	X		
Asynchronous	X	X	X	
Synchronous				X

DATA COMMUNICATIONS FEATURES	13260 A	13260 B	13260 C	13260 D
Hardwired to computer; dialed (switched) or leased line	X	X	X	X
Modem Compatibility:				
Bell 103A, 202D, 202C, 202S, 202T (Asynchronous)	X	X	X	
Vadic 3400 (Asynchronous/Synchronous)	X	X	X	X
Bell 201A, 201B, 201C, 208A, 208B, 209A (Synchronous)				X
Choice of main channel or reverse channel line turnaround for 202 modems	X	X		
Auto-Answer/Disconnect		X	X	X
Transparency (send and receive 8-bit binary data)	X	X	X	X
Data Comm Self-Test	X	X	X	X
Error Checking:				
VRC, choice of parity generation/checking	X	X	X	X
LRC			X	X
CRC-16			X	X
Additional polling protocol features:				
Daisy-chained/multipoint line and modem sharing (up to 32 terminals/line)			X	X
Synchronous polling (IBM Binary Synchronous Multipoint Communication, Bisync)				X
Asynchronous polling (modeled after IBM Bisync)			X	
Group and device addressing; group poll; broadcast			X	X
Variable I/O buffer sizes			X	X
Concurrent or completed block input processing			X	X
Configuration status			X	X
Monitor Mode	X	X	X	X
Driver Mode (option)			X	X

HOW ....

1. Perform a terminal self test to ensure proper terminal operation.
2. Install the ROM(s) supplied with the accessory on the Control Memory PCA.
3. Select the data communications operating characteristics by strapping the Keyboard Interface PCA.
4. Install the Data Communications PCA in the terminal.
5. Perform a Data Communications Self Test.
6. Connect the cable between the Data Communications PCA and the external device.
7. Check, and if necessary, adjust the power supply output as described in Section 5.

USEABLE ON ....

Accessories 13260A, B, C, and D are not applicable to 2640X, 2641A, and 2644 terminals. Applicability of the accessories to other terminals is illustrated in the following table.

		2645					2642A	2647A	2648A	13290A/B
		A	K	N	R	S				
13260A	STD	X		X	X	X	X			X
	002	X	X	X	X	X		X	X	X
	003								X	
	004		X							
	006							X		
13260B	STD	X		X		X	X			X
	002	X	X	X	X	X		X	X	X
	003								X	
	004		X							
	006							X		
13260C	STD	X		X		X	X		X	X
	001						X			
	002									
	006							X		
13260D	STD	X		X		X	X		X	X
	001	X		X		X	X	X	X	X
	002	X		X		X		X	X	X
	006							X		

ITEMS SUPPLIED .... Items supplied are listed in the following table.

ACCESSORY AND OPTIONS	DATA COMM PCA	DATA COMM FIRMWARE ROM(s)	KEYBOARD OVERLAY	BAUD RATE LABEL	GND CABLE
13260A—STD	02640-60086	1818-0513	02644-00002	7120-6388	None
—002	02640-60086	None	None	None	None
—003	02640-60086	1818-0547	02644-00002	7120-6388	None
—004	02640-60086	1818-0371	02644-00002	7120-6388	None
—006	02640-60086	1818-0600 1818-0601	02646-00001	7120-6388	None
13260A—STD	02640-60239	1818-1046	02644-00002	7120-6388	02640-60083
13260B—STD	02640-60143	1818-0513	02644-00002	7120-6388	02640-60083
—002	02640-60143	None	None	None	02640-60083
—003	02640-60143	1818-0547	02644-00002	7120-6388	02640-60083
—004	02640-60143	1818-0371	02644-00002	7120-6388	02640-60083
—006	02640-60143	1818-0600 1818-0601	02646-00001	7120-6388	02640-60083
13260C—STD	02640-60106	1818-0584 1818-0585	7120-6925	7120-6386	02640-60083
—001	02640-60106	1818-0583 1818-0585 1818-1047	7120-6925	7120-6386	02640-60083
—002	02640-60106	None	None	None	02640-60083
—006	02640-60106	1818-0628 1818-0629	None	7120-6386	02640-60083
13260D—STD	02640-60107	1818-0584 1818-0585	7120-6925	7120-6386	02640-60083
—001	02640-60107	1818-0583 1818-0585 1818-1047	7120-6925	7120-6386	02640-60083
—002	02640-60107	None	None	None	02640-60083
—006	02640-60107	1818-0628 1818-0629	None	7120-6386	02640-60083

Note: The 02640-60239 data comunications PCA is a later version.

EQUIPMENT REQUIRED ....

1. Connector Extractor 1600-0676.
2. Data Communication Self Test Connector, 02645-60004 (supplied with the 13232 accessory interface cable).
3. 20K ohms/volt voltmeter.

PROCEDURE ....

CAUTION

MOS 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 MOS circuits in carpeted area.

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

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

ENSURE that the circuit, 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.

1. Perform a terminal self test to verify proper terminal operation.
2. Turn off terminal power and open terminal to half-open position.
3. Use the connector extractor to remove the top plane connector from the Control Memory and Processor PCAs.
4. On 2642A, 2645X, and 13290B terminals, remove the Control Memory PCA from the terminal. On 2647A and 2648A terminals, locate the first Control Memory PCA and remove it from the terminal (these terminals have two Control Memory PCAs). On 2648A terminals, the first Control Memory PCA is identifiable as the one on which the +24 strapping switch is open.

Note

ROMs removed from PCAs should never be returned to the factory.

PROCEDURE (Continued) ....

5. Remove any ICs present in the data communications sockets of the Control Memory PCA. On 2642A terminals, the data communications socket is X4. On 2645A, 2648A, and 13290B terminals, the data communications sockets are 20 and 22. On 2647A terminals, the data communications sockets are 28 and 30.

6. Observing the caution notes at the start of this procedure, insert the ROM(s) in the Control Memory PCA data communication ROM sockets (see figures 2-32, 2-32A, and 2-33). If only one ROM is supplied, install it in the lowest-numbered socket, leaving the highest-numbered socket empty. If two ROMs are supplied, install the ROM with the lowest part number in the lowest-numbered ROM socket and the ROM with the highest part number in the highest-numbered ROM socket.

7. Reinstall Control Memory PCA into backplane assembly connector from which it was removed.

8. Reinstall top plane assembly on Processor and Control Memory PCAs.

9. Configure the 13260B, C, or D Interface PCAs for your particular application by setting the switches on the keyboard and Keyboard Interface PCA according to instructions in Section 3.

10. Install the data communications PCA in the first vacant backplane assembly connector adjacent to existing PCAs. For 13260C/D installation, connect ground cable assembly (part no. 02640-60083) between power supply chassis ground and PCA ground connector lug.

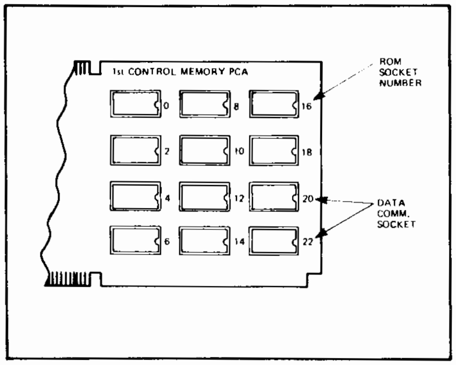


Figure 2-32. Data Communication ROM Locations for 2645A, 2648A, and 13290B Terminals.

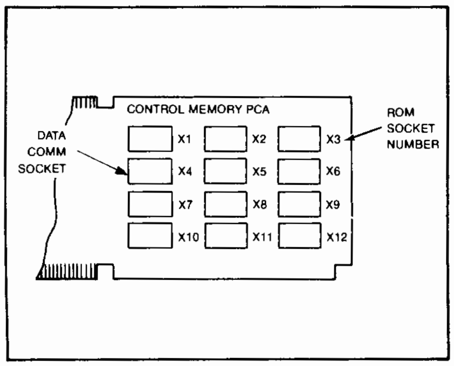


Figure 2-32A. Data Communication ROM Location for 2642A Terminal.

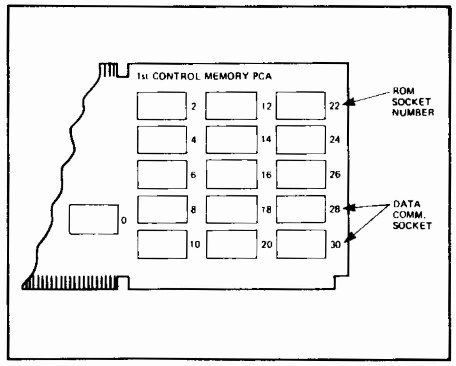


Figure 2-33. Data Communication ROM Location for 2647A Terminal.

PROCEDURE (Continued) ....

Note

To ensure proper terminal operation, all PCAs must be installed in adjacent backplane assembly connectors. There should never be vacant connectors between PCAs except for the two CTU PCAs (Read/Write PCA and CTU Interface PCA) which can be separated from the others.

11. Open the terminal rear door and connect the Data Communications Self Test Connector to the end connector on the Data Communications PCA.
12. Perform the Data Communication Self Test according to instructions in Section 6. When the self test is completed, remove the self test connector from the Data Communications PCA.
13. Connect the interface cable (a 13232C, F, N, P, Q, or T cable assembly — not part of this accessory) to the end connector of the Data Communications PCA. Connect the other end of the cable to the device to which the terminal is to be connected.
14. Install the baud rate switch overlay and keyboard overlay on the terminal (see figures 2-34, 2-35, and 2-36).
15. Check and, if necessary, adjust the power supply output as described in Section 5.

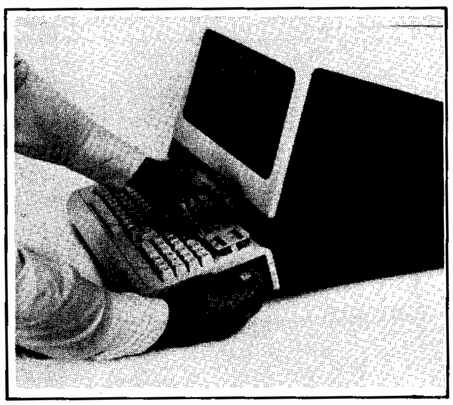


Figure 2-34. Removing a Keyboard Overlay

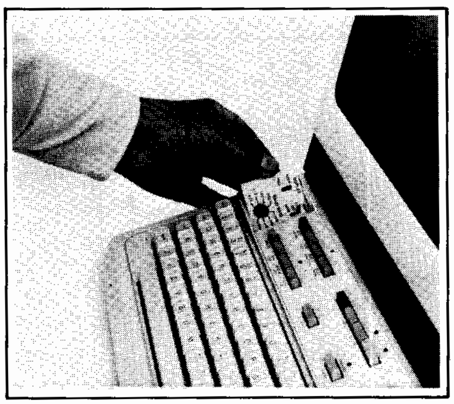


Figure 2-35. Installing Baudrate Overlay

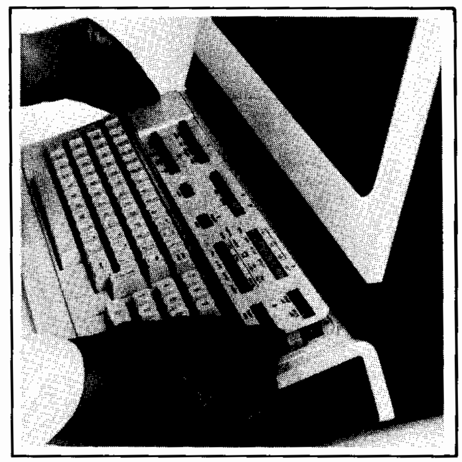


Figure 2-36. Installing Keyboard Overlay

13261A Device Support Firmware

OPTIONS

STANDARD. Input/output firmware for 2645A, N, S terminals.

OPTION 001. Input/output firmware for 2641A terminals.

OPTION 002. Input/output firmware for 2645R terminals.

OPTION 003. Input/output firmware for 2648A terminals.

OPTION 004. Input/output firmware for 2645K terminals.

WHY

This accessory supplies the necessary firmware to support the CTUs and any printers connected to the terminal. If a terminal was shipped from the factory with CTUs installed, the firmware supplied by this accessory was incorporated in the terminal at the factory. However, if CTUs were not installed at the factory and this accessory was not ordered, it will be necessary to install this accessory in the terminal before CTUs or printers can be used with the terminal.

HOW

1. Remove the Control Memory PCA from the terminal.
2. Install the ROMs provided on the Control Memory PCA.
3. Reinstall the Control Memory PCA in the terminal.
4. Check and, if necessary, adjust the power supply output.
5. Perform a terminal self test.

USEABLE ON

2641A, 2645A, K, N, R, S, and 2648A terminals.

ITEMS SUPPLIED

Four ROM ICs are supplied for the standard accessory and each of the options. The ROM part numbers are listed below.

OPTION	ROMs				
STD	1818-0208	1818-0209	1818-0210	1818-0426	—
001	1818-0208	1818-0209	1818-0210	1818-0274	—
002	1818-0208	1818-0209	1818-0303	1818-0310	—
003	1818-0406	1818-0407	1818-0408	1818-0409	1818-1388
004	1818-0208	1818-0209	1818-0210	1818-0369	—

EQUIPMENT REQUIRED ....

1. A Connector Extractor, 1600-0676.
2. A 20K ohms/volt voltmeter.

PROCEDURE ....

CAUTION

MOS integrated circuit devices can be internally damaged by excessive electrostatic discharge. The following handling precautions should be taken to prevent circuit damage:

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

DO NOT handle devices in carpeted areas.

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

Avoid touching IC leads. Handle by plastic package only.

Ensure that IC device, work surface (table, desk, etc.) and PCA are all at the same earth 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.

1. Turn off terminal power.
2. Open the terminal to the half-open position.
3. Use the connector extractor to remove the top plane connector from the Control Memory PCA(s).
4. Remove the Control Memory PCA from the terminal. (The 2641A and 2648A terminals contain two Control Memory PCAs.) For the 2641A, remove the PCA which contains more than one ROM. For the 2648A, remove the PCA which has no ROMs in locations 10, 12, 14, and 16.
5. Insert the ROMs in the appropriate locations on the Control Memory PCA(s) (see figure 2-37 for the location of each ROM).

LOCATION	ROM				
	2641A	2645A/N/S	2645K	2645R	2648A
10	1818-0208	1818-0208	1818-0208	1818-0208	1818-0406
12	1818-0209	1818-0209	1818-0209	1818-0209	1818-0407
14	1818-0210	1818-0210	1818-0210	1818-0303	1818-0408
16	1818-0274	1818-0426	1818-0369	1818-0310	1818-0409
*12					1818-1388

*Location on 2nd Control Memory PCA

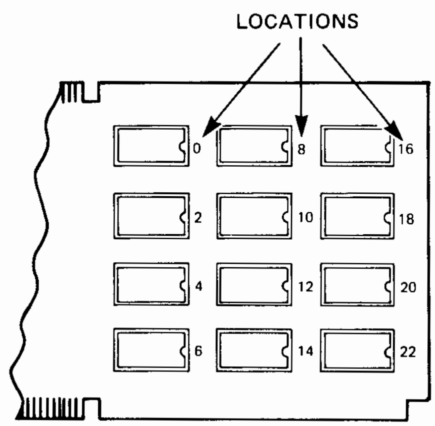


Figure 2-37. I-O ROM Locations for 2641A, 2645, and 2648A Terminals

PROCEDURE (Continued) ....

6. Reinstall the PCA in the terminal in the slot from which it was removed and replace the top plane connector on the Processor and Control Memory PCAs.
7. Check and, if necessary, adjust the power supply output.
8. Perform a terminal self test to verify proper terminal operation.

13272A Mini Disc Drive

OPTIONS .... **STANDARD.** One mini disc drive for 2642A.

OPTION 072. Adds second mini disc drive to 2642A.

WHY .... The mini disc drive provides the terminal with mass storage capability.

HOW .... The disc drive unit is installed by:

1. Installing the Disc Controller PCA into the terminal.
2. Connecting an interconnecting cable from the drive to the Disc Controller PCA.

WHERE USED .... The 13272A is standard on the 2642A.

ITEMS SUPPLIED .... Items supplied are listed below:

QUANTITY	DESCRIPTION	HP PART NUMBER
1	Disc Drive Unit	13270-60011
1	Disc Controller PCA	02640-60223
1	Controller Cable	13270-60003
1	Cable Retainer	1400-1039
4	Diskette	9164-0128
1	Diskette Box	9164-0135
1	User Instruction Diskette	02642-13302

PROCEDURE ....

1. Turn off terminal power and open the terminal to the half-open position.
2. Install the Disc Controller PCA in slot 1 (slot nearest the power supply) and move the other PCAs to the right.
3. Place the Disc Drive Unit on a table or desk next to the terminal.
4. Connect one end of the Controller Cable onto the Disc Controller PCA edge connector at the rear of the terminal and connect the other end of the cable to the connector at the rear of the drive.
5. Secure the cable connection to the drive with the cable retainer and secure the cable connection to the terminal by tightening the two door latch screws.
6. Turn on terminal power and perform the disc self-test.

13291A 4K PROM PCA (without PROMs)

OPTIONS .... **STANDARD.** Consists of a UV PROM PCA, part number 02640-60007, without PROMs.

OPTION 001. Consists of a UV PROM PCA, part number 02640-60149, equipped with zero insertion force PROM sockets; also without PROMs.

WHY .... Provides a PCA for installation of up to 16 256-byte PROMs (1702A) to be used for storage of programs or data. The PROMs are divided into two blocks of 2K bytes each and are addressed sequentially in each block. The starting address of the first PROM of each block is selectable in 2K increments from 0 to 62K.

HOW ....

1. Select the desired strapping options on the UV PROM PCA.
2. Install the PCA in the terminal.
3. Check and, if necessary, adjust the power supply output to accommodate the added load.
4. Perform a terminal self test.

USEABLE ON .... All 264X terminals.

ITEMS SUPPLIED .... **STANDARD.** A UV PROM PCA, part number 02640-60007 (without PROMs).

OPTION 001. A UV PROM PCA, part number 02640-60149, equipped with zero insertion force PROM sockets (also without PROMs).

EQUIPMENT REQUIRED .... A 20K ohm/volt voltmeter.

PROCEDURE ....

1. Turn off terminal power.
2. Open the terminal to half-open position.
3. Install the PROMs on the UV PROM PCA.
4. Strap the UV PROM PCA as described in Section 3.
5. Install the PCA in the terminal in the empty slot nearest the power supply.

13292A Writeable Control Store

OPTIONS .... STANDARD. Consists of an 8K RAM Top PCA, 02640-60118.

OPTION 001. Consists of a five-wide top plane connector for use in connecting the 8K RAM Top PCA to the Processor PCA and Control Memory PCAs if it is to be used as additional control memory.

WHY .... Provides 8K bytes of RAM memory for storage of programs and data. (It cannot be used as display memory.) The starting address of the first byte is selectable in 8K increments from 0 to 56K. A maximum of four Writeable Control Store PCAs are allowed in a terminal.

HOW ....

1. Select the desired strapping options on the 8K RAM Top PCA.
2. Install the PCA in the terminal.
3. Check and, if necessary, adjust the power supply output.
4. Perform a terminal self test.

USEABLE ON .... 13290A.

ITEMS SUPPLIED .... STANDARD. An 8K RAM Top PCA, 02640-60118.

OPTION 001. A five-wide top plane connector, 02640-60016.

EQUIPMENT REQUIRED .... A 20K ohm/volt voltmeter.

PROCEDURE ....

1. Turn off terminal power.
2. Open the terminal to the half-open position.
3. Strap the 8K RAM Top PCA according to instructions in Section 3.

Note

If the 8K RAM Top PCA is used as a Control Memory PCA, programs which are executed using code contained on the 4K PROM PCA will execute faster if the PCA is connected to the other Control Memory PCAs by a top plane connector.

PROCEDURE (Continued) ....

4. Install the PCA in the terminal. If the PCA is not to be used as control memory or is not to be connected to other control memory PCAs by a top plane connector, it should be installed in the vacant slot nearest the power supply. If it is to be used as control memory and is to be connected to other control memory PCAs by a top plane connector, it must be located next to another control memory PCA. To accomplish this, it may be necessary to rearrange the PCAs in the terminal. (See figure 2-11 for restraints on location of PCAs in the terminal.)
5. Check and, if necessary, adjust the power supply output as described in Section 5.
6. Perform a terminal self test as described in Section 6.

13293A Diagnostic/Loader

OPTIONS .... None

WHY .... The 13293 is a control memory board that contains a single ROM chip: the binary loader. As with the standard control memory board, it must be connected to the processor board by way of the top plane bus. It is referred to as a "diagnostic" board because it is meant to be used for loading standard firmware into 2649 terminals in the field so as to create a known firmware environment within which terminal malfunctions can more quickly and easily be diagnosed.

HOW ....

1. Remove the Control Memory PCA from the terminal and install the 13293A Accessory PCA in its place.
2. Use a top plane connector to connect the 13293A Accessory PCA to the Processor PCA.

USEABLE ON .... 13290A/B terminals.

ITEMS SUPPLIED ....

1. A Control Memory PCA (without ROMs), 02640-60192.
2. One ROM, 1818-0278.
3. A two-wide top plane connector.

EQUIPMENT REQUIRED .... A Connector Extractor, 1600-0676.

PROCEDURE ....

1. Turn off terminal power and open the terminal to the half-open position.
2. Use the connector extractor to remove the top plane connector from the Control Memory PCA and the Processor PCA.
3. Remove the Control Memory PCA from the terminal and install the Accessory 13293A PCA (with ROM installed) in its place.
4. Install the top plane connector on the Accessory 13293A PCA and the Processor PCA.

13295A Keycap Kit

OPTIONS .... None

WHY .... The 13295 is a kit containing 50 keycaps (with clear plastic covers and blank keycap inserts) and a blank keyboard overlay. The keyboard overlay is painted and properly punched but contains no lettering. With the 13295, users can relabel individual keys and silkscreen their own lettering on the keyboard overlay to create prototype keyboards for specialized applications.

HOW ....

1. Label a blank keycap.
2. Remove the keycap to be replaced and install the new keycap in its place.
3. The above steps are repeated for each keycap to be replaced.

USEABLE ON .... 13290A/B and 2649A terminals.

ITEMS SUPPLIED ....

1. 50 blank keycaps, 5040-7846.
2. 50 keycap inserts, 5040-7431.
3. 75 blank inserts, 13295-80001.
4. A keycap extractor, 5040-7433.
5. Two blank keyboard overlays.

EQUIPMENT REQUIRED .... None

PROCEDURE ....

1. Label a blank insert with the desired keycap label and place it in the recess in the top of a blank keycap.
2. Press one of the clear plastic keycap inserts into the recessed top of the blank keycap to hold the insert in place.
3. Use the keycap extractor to remove the existing keycap from the key which is to receive the new keycap.
4. Press the new keycap into place on the key.
5. Repeat the preceding steps for each new keycap to be installed.

13296A HP-IB Interface

OPTIONS .... **OPTION 048.** Adds raster dump capability to the existing device support firmware in earlier version terminals.

WHY .... Connects up to nine HP-IB-compatible devices (such as computers, terminals, calculators, printers, plotters, or measuring devices) in parallel so that any connected device can communicate with any other connected device. One device (a computer, terminal, or calculator) is selected, by strapping, as the controller of the network.

Note

2648 terminals must be equipped with Raster Dump and Device Support Firmware.

HOW ....

1. Select the desired strapping options on the HP-IB Interface PCA.
2. Install the PCA in the terminal.
3. Connect the HP-IB Interface Adapter and HP-IB Interface cable between the HP-IB Interface PCA and the other network devices.
4. Check and, if necessary, adjust the power supply output.
5. Perform a terminal self-test.
6. Perform an HP-IB self-test.

USEABLE ON .... 2642A, 2647A, and 2648A terminals.

ITEMS SUPPLIED .... **STANDARD.** The standard 13296A consists of:

1. An HP-IB Interface PCA, 02640-60128.
2. An HP-IB Interface Adapter (Load Box), 02640-60215. The interface adapter is an end connector that provides the link between the HP-IB Interface PCA and multiple cabling capability.
3. An HP 10631B Interface Cable, 8120-1834.

OPTION 048. ROM IC, 1818-1388.

EQUIPMENT REQUIRED .... A 20K ohms/volt voltmeter.

PROCEDURE

1. Turn off terminal power and open the terminal to the half-open position.
2. Select the desired strapping options on the HP-IB Interface PCA using instructions in Section 3.
3. Install the HP-IB Interface PCA in the terminal in the vacant slot nearest the power supply. (The PCA must be installed in a slot which allows room to connect the HP-IB Interface Adapter.)
4. Open the terminal rear door and connect the HP-IB Interface Adapter, 02640-60215, to the end connector of the HP-IB Interface PCA.
5. Connect an HP-IB Interface Cable, HP 10631A, B, or C, between the HP-IB Interface Adapter and any of the devices connected into the network.
6. Turn on terminal power and check and, if necessary, adjust the power supply output as described in Section 5.
7. Perform a terminal self-test.
8. Perform an HP-IB self-test on 2642A and 2647A terminals by holding down the f3 key and then pressing the test key. There is no HP-IB self-test on the 2648A.

13297A Universal RAM Memory PCA

OPTIONS ....

STANDARD. Supplies a Universal RAM Memory PCA with 8K bytes of RAM memory.

OPTION 002. Supplies eight 16K bit RAM ICs to provide 16K bytes of memory. (No PCA supplied.)

OPTION 003. Supplies sixteen 16K bit RAM ICs to provide 32K bytes of memory. (No PCA supplied.)

WHY ....

Provides 8, 16, or 32K bytes of additional memory depending on the option selected. Following choices selectable by strapping:

1. If 8K of memory is used, it can be separated into two separately addressable 4K byte blocks. If 32K of memory is used, it can be separated into two separately addressable 16K byte blocks. (If 16K bytes is used, it comes as only one block.)
2. Each block is selectable for use as either RAM or ROM.
3. Enable or disable for both read and write access.
4. Enable or disable write access only.
5. Select either unconditional read access or read access to be enabled or disabled programmatically (the latter selection not available to 2640 and 2644 terminals).

HOW ....

1. Select the strapping options on the Universal RAM Memory PCA.
2. Install the Universal RAM Memory PCA in the terminal.
3. Check and, if necessary, adjust power supply.
4. Perform terminal self test.

USEABLE ON ....

All 264X terminals except 2640X series terminals.

ITEMS SUPPLIED ....

STANDARD

1. A Universal RAM Memory PCA, 02640-60171.
2. 16 4K-bit RAM ICs, 5090-0109.
3. An Accessory Manual, 13297-90001.

002 (ordered with Standard) — 16 4K-bit RAM ICs replaced with eight 16K-bit RAM ICs, 5090-0114.

003 (ordered with Standard) — 16 4K-bit RAM ICs replaced with sixteen 16K-bit RAM ICs, 5090-0114.

EQUIPMENT REQUIRED ....

A 20K ohms/volt voltmeter.

PROCEDURE ....

1. Turn off terminal power and open the terminal to the half-open position.
2. Select the desired strapping options on the Universal RAM Memory PCA using instructions in Section 3.
3. Install the Universal RAM Memory PCA in the terminal. If a top plane connector is to be used to connect the Universal RAM Memory PCA to other PCAs it may be necessary to relocate some of the PCAs. If so, see figure 2-11 for PCA location constraints and relocate the PCAs. Then install the top plane connector on the PCAs.

   If the PCA is to be used as display memory, a top plane connector must not be used on it and it can be located in the vacant slot nearest the power supply.
4. Turn on terminal power and check the power supply output according to instructions in Section 5. Adjust the power supply output if necessary.
5. Perform a terminal self test.

13298A 32K PROM Memory
(Applicable also to the 32K ROM Memory PCA 02640-60221)

OPTIONS .... None.

WHY .... Provides 32K of top-plane PROM (Accessory 13298A) or ROM (ROM PCA) memory and 256-bytes of RAM memory. The bank select capability and the RAM memory can both be disabled.

HOW ....

1. Select the strapping options on the PCA.
2. Install the PCA in the terminal.
3. Check and, if necessary, adjust power supply.
4. Perform terminal self test.

USEABLE ON .... All 2641A, 2645X, 2647A, 2648A and 2649A/B terminals.

ITEMS SUPPLIED .... A PROM Memory PCA 02640-60216 (Accessory 13298A) or a 32K ROM Memory PCA. (No ROMs or PROMs are supplied.)

EQUIPMENT REQUIRED .... A 20K ohms/volt voltmeter.

PROCEDURE ....

1. Insert the PROMs or ROMs in the sockets on the PCA.
2. Select the desired strapping options on the PCA.
3. Turn off terminal power and open the terminal to the half-open position.
4. Remove the top plane connector from the Processor and memory PCAs, rearrange the PCAs in the terminal so that the memory PCA to be added is located next to the Processor PCA or another top plane memory PCA. Then connect the top plane connector to the processor PCA and all top plane memory PCAs, including the 32K PROM or ROM Memory PCA.
5. Turn on terminal power and check the power supply output as described in the Alignment section. Adjust the power supply output, if necessary.
6. Perform a terminal self test.

INTERFACING WITH EXTERNAL DEVICES

Interfacing with devices external to the terminal is done through the four data communications accessories (13260A/B/C/D), the Terminal Duplex Register Accessory (13238A), the Serial Printer/Extended Asynchronous Data Communications Interface Accessory (13250A/B), Composite Video Interface Accessory (13254A), and the HP-IB Interface Accessory (13296A). Accessories 13250A/B and 13260A/B/C/D provide an RS232C data communications capability and Accessories 13250A/B and 13260B also provide a current loop communications capability.

INTERFACE STANDARDS

The International Telegraph and Telephone Consultative Committee (CCITT) is an international consultative body for setting international communication standards. Their interface standard is CCITT V24, which closely resembles EIA RS232C, and is the standard in common European use. The following table summarizes the interface data and control signals as defined by both the CCITT V24 and EIA RS232C standards.

EIA RS232C INTERFACE STANDARD

Most voltage interfaces in North America conform to the Electronic Industries Association (EIA) standard RS232C. This standard specifies a 25-pin connector as the standard interface in datacomm networks, with lettered pin assignments for ground, data, control and timing circuits. It also specifies the mechanical and electrical requirements of an interface, within an operating range of 0 to 20,000 bps in bit serial operation, synchronous and asynchronous.

MECHANICAL SPECIFICATIONS.

The signal interface between the Data Communications Equipment (DCE) and the Data Terminal Equipment (DTE) is located at the RS232C-specified connector between the two pieces of equipment. The female is connected to the DCE and the male to the DTE. Short cables of less than 50 feet (15 meters) are recommended, but longer cables may be used if the load capacitance is suitable. The pin assignments shown in the table under "Interface Standards" must be used, and unassigned pins may carry additional circuits determined by mutual agreement between the communicating parties.

EIA RS232C and CCITT V24 Interface Data and Control Signals

CONNECTOR RS232	CONNECTOR P2 13260 A	B	C	D	CIRCUIT RS232	CIRCUIT CCITT V24	DESCRIPTION	MODEM TO	MODEM FROM	GND	DATA	CON-TROL	TIMING
1	A	A	A	A	AA	101	Protective Ground			X			
7	H	H	H	H	AB	102	Signal Ground/Common Return			X			
2	B	B	B	B	BA	103	Transmitted Data	X			X		
3	C	C	C	C	BB	104	Received Data		X		X		
4	D	D	D	D	CA	105	Request to Send	X				X	
5	E	E	E	E	CB	106	Clear to Send		X			X	
6	F	F	F	F	CC	107	Data Set Ready		X			X	
20	P	P	P	P	CD	108.2	Data Terminal Ready	X				X	
22	—	—	14	14	CE	125	Ring Indicator		X			X	
8	J	J	J	J	CF	109	Received Line Signal Detector		X			X	
21	—	—	—	—	CG	110	Signal Quality Detector		X			X	
23	—	R	R	R	CH	111	Data Rate Selector (DTE Source)	X				X	
23	—	—	—	—	CI	112	Data Rate Selector (DCE Source)		X			X	
24	—	—	S	S	DA	113	Transmitter Timing (DTE Source)	X					X
15	—	—	—	12	DB	114	Transmitter Timing (DCE Source)		X				X
17	—	—	—	13	DD	115	Receiver Timing		X				X
14	—	—	—	—	SBA	118	Secondary Transmitted Data	X			X		
16	—	—	—	—	SBB	119	Secondary Received Data		X		X		
19	M	M	M	M	SCA	120	Secondary Request to Send	X				X	
13	—	—	—	—	SCB	121	Secondary Clear to Send		X			X	
12	N	N	N	N	SCF	122	Secondary Received Line Detector		X			X	

ELECTRICAL SPECIFICATIONS

Except for protective and signal grounds, all circuits carry bi-polar low-voltage signals that are suitable for electronic circuits. All signals are measured at the connector with respect to Signal Ground (AB) and cannot exceed ±25V. The significance of the bi-polar signals is summarized as follows, with the region between ±3V defined as the transition region:

Data Communications Signal Levels

DATA:		
Name	Space	Mark
Logic	0	1
Voltage	>+3V but <+25V	<−3V but >+25V
CONTROL:	ON (true)	OFF (false)
CLOCK SIGNALS:	0 = ground	1 = +5V

While RS232C designates 23 circuit signals, the number actually in use depends upon the type of devices being connected to one another.

ACCESSORY 13238A-TERMINAL DUPLEX REGISTER (02640-60031)

The HP 13238A Terminal Duplex Register accessory (PCA part no. 02640-60031) is a general purpose parallel input/output module for use in the HP 264X family of terminals. The interface PCA provides TTL levels (+5 volts and ground) for eight input data bits, eight output data bits, and eight input status bits. It also has two command flip-flops (In and Out) for controlling data flow.

The HP 13238A accessory is very flexible and with proper jumper selection can provide many functions. It can be configured to perform output only, input only, or input/output. It can also be configured for either positive or negative logic (with processor inversion of data). If a minimum amount of status is needed, the status lines can be used for data input if desired. If DATA OUT and DATA IN lines are tied together, a birdirectional bus can be implemented.

The HP 13238A accessory is most often used for connecting the HP 2631A Dot Matrix Printer, the HP 9866A/B Thermal Printer or the HP 9871A Impact Printer to the terminal. The interfacing requirements for those three devices are as follows:

DEVICE	CABLE	STRAPPING
2631A/9871A	13232J	B,C,F,K,P installed;
9866A	13232S	all others removed.

The jumpers on the 02640-60031 PCA are defined under "13238A" in Section 3, Strapping.

The pin-to-pin wiring and signal directions for the 13232J and 13232S cables are illustrated under "Cabling" later in this section.

ACCESSORIES 13250A/B, 13260B .... GENERAL PURPOSE ASYNCHRONOUS DATA COMMUNICATIONS ACCESSORIES (02640-60089 or 02640-60143)

The HP 13250A, 13250B, and 13260B General Purpose Asynchronous Data Communications accessories provide an EIA RS232C or 20 mA current loop link from the terminal to an external device. The interface PCA transmits and receives bit serial data to and from the external device through an interface cable assembly. It also provides parallel-to-serial and serial-to-parallel conversion, and transmits and receives bit parallel data to and from the terminal's internal PCAs through the Backplane Assembly (data bus).

The General Purpose Asynchronous Data Communications interface PCA is very flexible and with proper jumper and cable selection can be used to connect the terminal to a variety of RS232C devices (such as serial printers, modems, acoustic couplers, or asynchronous data communication computer ports) or to 20 mA current loop computer ports.

The following table summarizes the interfacing requirements for those types of devices and computers with which the HP 13250A, 13250B, and 13260B accessories are most often used. Note that the column labeled "Strapping" only specifies the required settings for the jumpers A4, A11, A10, and A9 which specify the module's address on the terminal's data bus. The settings of the other jumpers are dependent upon the particular configuration parameters that you select (such as baud rate, handshake enabling, and so forth). In a few cases you must also set some jumpers on the Keyboard Interface PCA; when that is necessary, the particular jumpers are also called in the column labeled "Strapping". Strap definitions for the 02640-60089, 02640-60143, and Keyboard Interface PCAs are presented under "13250A/B" and "13260B" in Section 3, Strapping.

Note

If a 13250A/B or 13260B is being used as a serial printer interface and the terminal also contains the HP 13254A Video Interface, the PCA address of the video interface must be disabled to avoid a conflict on the terminal's data bus.

EXTERNAL INTERFACE/DEVICE	CABLE	STRAPPING
HP 1000, 2000, and 3000 Computer I/O Multiplexers; 103A, 202C/D/S/T modems; acoustic couplers (signal compatible only).	13232A	A4 must be open; A11, A10, and A9 must be closed. You must also set strap U on the Keyboard Interface PCA.
HP 12532D HP 12880A	13232B	A4 must be open; A11, A10, and A9 must be closed.
HP computers requiring female RS232C connector from terminal.	13232C	A4 must be open; A11, A10, and A9 must be closed. Strap U on Keyboard Interface PCA must be set open when terminal is hardwired to the computer. If your Keyboard Interface PCA does not have a U strap, then disconnect the wire from pin N of the hood connector on the 13232C cable assembly.
20 mA current loop serial printers.	13232F	A4 and A10 must be open; A11 and A9 must be closed.
20 mA current loop computer ports.	13232F	A4 must be open; A11, A10, and A9 must be closed.
Serial printers requiring male RS232C connector from terminal.	13232G	A4 and A10 must be open; A11 and A9 must be closed.

EXTERNAL INTERFACE/DEVICE	CABLE	STRAPPING
Serial printers requiring female RS232C connector from terminal.	13232H	A4 and A10 must be open; A11 and A9 must be closed.
European telephone connections via 202C type European modems (male connector).	13232M	A4 must be open; A11, A10, and A9 must be closed. You must also set straps S and T on the Keyboard Interface PCA.
HP 2100 or 21MX computer via 12966A interface.	12966A-Opt. 001	A4 must be open; A11, A10, and A9 must be closed.

The pin-to-pin wiring and signal directions for the above cables are illustrated under "Cabling" later in this section.

CURRENT LOOP INTERFACING

RS232C interfacing uses voltage levels to represent marks and spaces on the line. Current loop interfacing, on the other hand, uses the presence or absence of current to represent marks and spaces. Unlike EIA RS232C and CCITT V24, current loop interfacing is not standardized within the industry.

As illustrated in figure 2-38, the device on each end of a current loop interface has both a transmitter and a receiver. The transmitter manipulates the current (opens and closes the current loop) to generate marks and spaces. The receiver monitors the state of the current loop to determine if data is being received.

There are two types of transmitters and two types of receivers. A sourcing transmitter supplies the current for the loop; a sinking transmitter does not. A non-floating active receiver supplies current for the loop; a floating passive receiver does not. Schematic representations of these four types of transmitters and receivers are illustrated in figure 2-39. The electrical characteristics for each are listed in table 2-1.

Table 2-1. Hewlett-Packard Current Loop Specifications

FLOATING PASSIVE RECEIVER Loop Current: 15 mA (min); 25 mA (max) No Loop Current: 0mA (min); 5 mA (max) Voltage Drop (Loop Current Flowing): 1.4V (min); 1.8V (max)	Loop current is interpreted as a MARK if INI (Invert Input) is open; if INI is grounded, loop current is interpreted as a SPACE.
NON-FLOATING ACTIVE RECEIVER Loop Current: 20 mA (min); 25 mA (max) No Loop Current: 0 mA (min); 10 mA (max) Voltage Drop (Loop Current Flowing): 1.4V (min); 1.8V (max)	Loop current is interpreted as a SPACE if INI (Invert Input) is open; if INI is grounded, loop current is interpreted as a MARK.
SOURCING TRANSMITTER Loop Current: 17 mA (min); 25 mA (max) No Loop Current: 0 mA (min); 0.01 mA (max) Receiver Voltage: +7.5V to −12V	A MARK is transmitted as a loop current if INO (Invert Output) is open; a SPACE is transmitted as loop current if INO is grounded.
SINKING TRANSMITTER Loop Current: 25 mA (min); 35 mA (max) No Loop Current: 0 mA (min); 0.01 mA (max) Receiver Voltage: +15V to −7.5V	A MARK is transmitted as loop current if INO (Invert Output) is open; a SPACE is transmitted as loop current if INO is grounded.

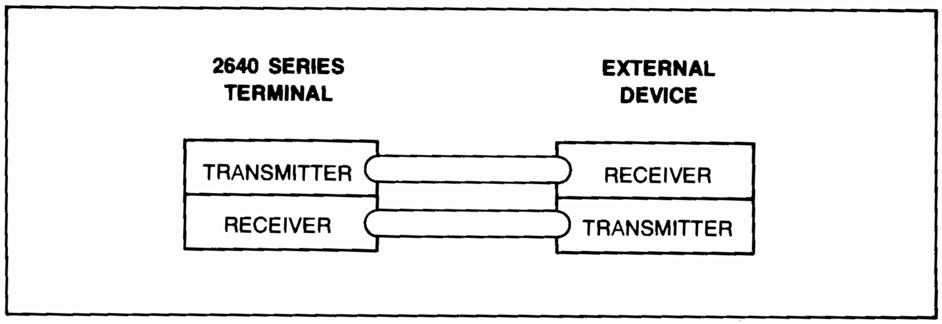


Figure 2-38. Current Loop Block Diagram

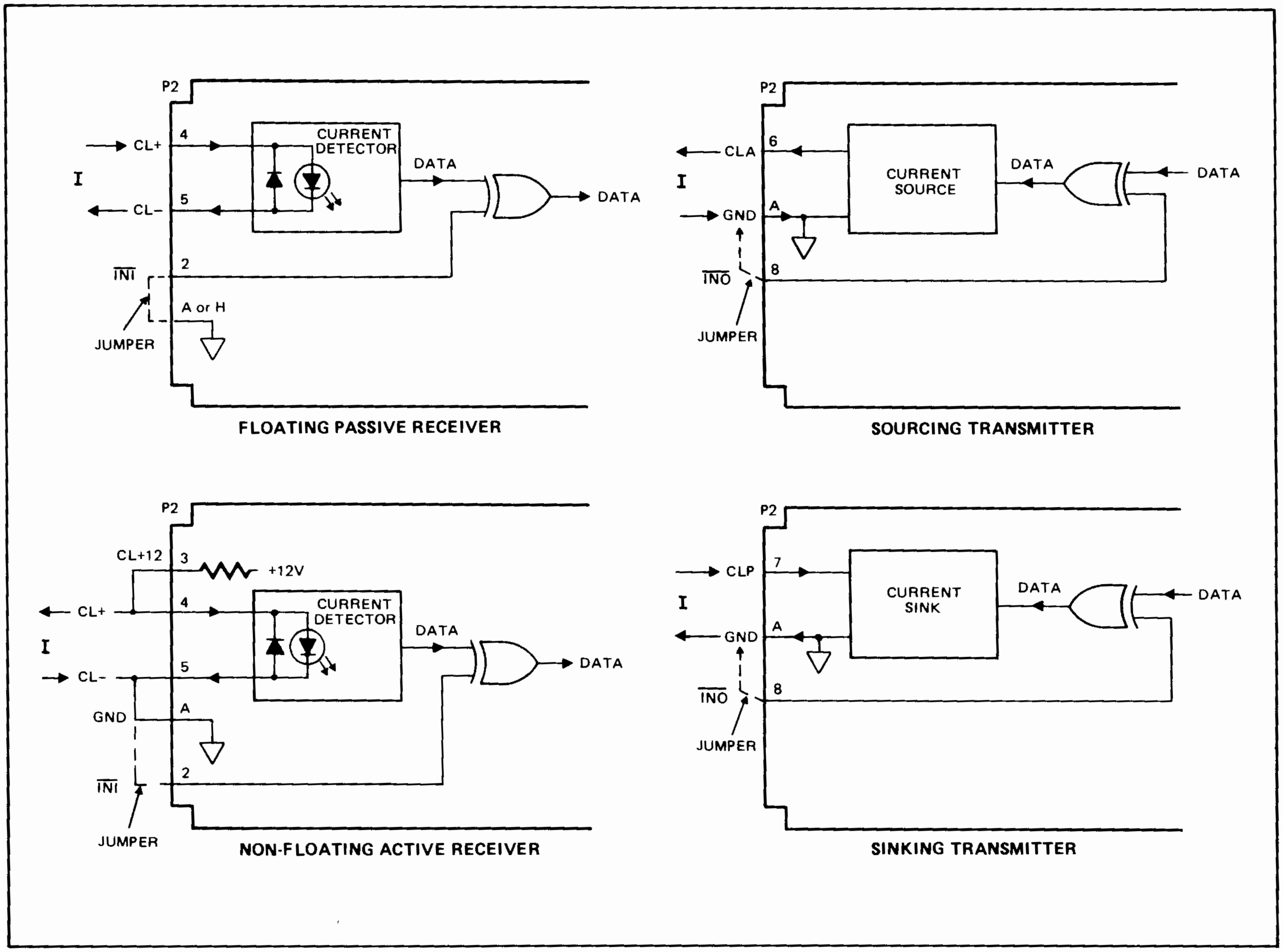


Figure 2-39. Current Loop Configurations

If one device has a sourcing transmitter, the other must have a passive receiver. Conversely, if one device has a sinking transmitter, the other must have an active receiver.

You can connect an HP 264X terminal to another device (usually a computer mainframe) via a current loop interface by using an HP 13232F cable assembly and any of the following three accessories:

1. HP 13250A General Purpose Asynchronous Data Communications Accessory
2. HP 13250B General Purpose Asynchronous Data Communications Accessory
3. HP 13260B Extended Asynchronous Data Communications Accessory

The characteristics of the current loop are determined by the manner in which the 13232F cable is wired to the hood connector. In its standard configuration, the 13232F cable defines the following characteristics:

Current = Mark (for both transmitting and receiving)
Terminal = Sourcing Transmitter
Terminal = Floating Passive Receiver

You can change these characteristics by rewiring the hood connector of the 13232F cable as follows:

Desired Characteristic	Required Hood Connector Alteration
Current = Space for transmitting)	Install a jumper between pins 8 and ground (A or H).
Current = Space (for receiving)	Install a jumper between pins 2 and ground (A or H).
Terminal = Sinking Transmitter	Disconnect the wire from pin 6 and connect it instead to pin 7.
Terminal = Non-floating Active Receiver	Connect a jumper between pins 3 and 4 and between pin 5 and ground (A or H).

Replacing A Decwriter. To replace a Decwriter with an HP 264X terminal in current loop mode on a PDP 11/20, all you need to do is change the terminal from a sourcing transmitter to a sinking transmitter. As described above, you do this by disconnecting the wire from pin 6 in the hood connector of the 13232F cable assembly and connect it instead to pin 7.

3-Wire Extension Cabling. If your terminal is connected to another device via a current loop and you need to install an extension cable between the two devices, you can save money by running a 3-wire cable (or a shielded 2-wire cable) between the lug end of the 13232F cable assembly and the other device. To connect the 13232F cable to the extension cable, join the lugs for the brown (C.L.–) and yellow (ground) wires and fasten them to the ground wire of the extension cable (or to the shield if you are using a shielded 2-wire extension cable). The lugs for the red (C.L.+) and green (C.L. Output) wires connect to the remaining two wires of the extension cable.

ACCESSORY 13254A VIDEO INTERFACE (02640-60119)

The HP 13254A Video Interface accessory (PCA part no. 02640-60119) provides a link between your HP 264X terminal and a video hard copy device or a video monitor. In addition to the interface PCA, the HP 13254A accessory includes a Sweep Extender Cable (part no. 02640-60122).

The Video Interface PCA is installed in the terminal in a slot adjacent to the Display Timing PCA. In doing so it may be necessary to move existing PCAs in order to create a vacant slot.

Note

In the HP 2648A Graphics Terminal the Display Timing PCA is one of four PCAs which are connected to one another by a top plane connector. To reposition the Display Timing PCA for use with the Video Interface PCA you will have to remove the top plane connector, rearrange the three left PCAs so that the Display Timing PCA is at the left of the group, and then reinstall the PCAs (and the top plane connector) so that there is a vacant slot next to the Display Timing PCA for the Video Interface PCA.

When the Video Interface PCA is installed in the proper slot, remove the existing Sweep Cable assembly from connector P4 of the Display Timing PCA and install the Sweep Extender Cable so that it is connected to connector P4 of both the Video Interface and Display Timing PCAs. Then connect the free end of the old Sweep Cable assembly to connector P5 of the Video Interface PCA.

If the 13254A is being used as a video hard copy interface, configure switches A, A9, A10, A11, A4, and ADD DISAB on the Video Interface PCA as follows:

A: Setting this switch to the open position "freezes" the display while a copy is being made. If the terminal must be free to accept data or perform other tasks while the copy is being made, then set switch A to the closed position. If switch A is closed, you must be careful not to change the display during the copy process.

A9: Closed.
A10: Open.
A11: Open.
A4: Open.
ADD DISAB: Open.

If the 13254A is being used as a video monitor interface, set the A and ADD DISABLE switches to their closed positions. When closed, the ADD DISABLE switch disables the address logic of the PCA, thus preventing an addressing conflict if the 13238A, 13250A/B, or 13260B serial printer interfaces are also installed in the terminal.

The positions of the switches and connectors on the Video Interface PCA are illustrated in figure 2-40.

To connect the 13254A to a Tektronix 4632 Option 007 Video Hardcopy Unit, use the HP 13232K cable assembly.

Versatec makes the cable to connect the 13254A to their Model 1640 Hard Copy System.

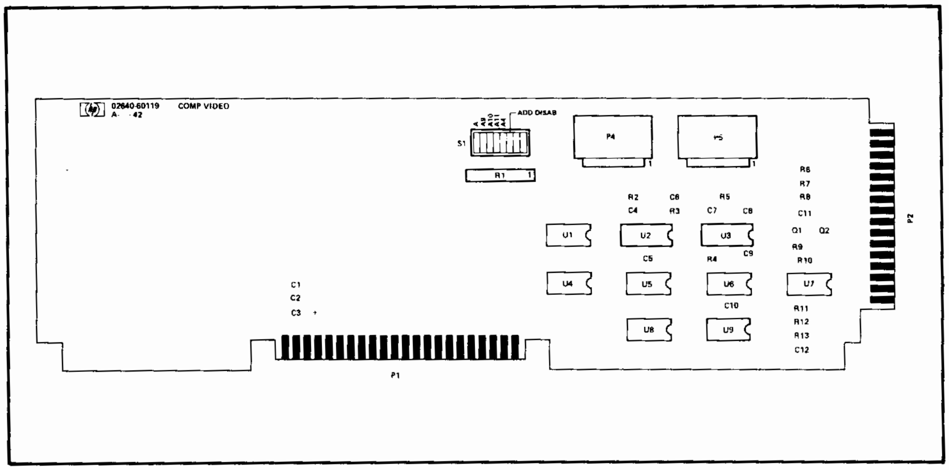


Figure 2-40. Composite Video Interface PCA Strapping Switch Locations

Note

To generate a copy on either the Tektronix or Versatec unit using the keystrokes [illegible] . f6 . f8 at the terminal or the escape sequence Ec&p4u5C sent from a computer requires the presence of the device support firmware in the terminal. This firmware also supports cartridge tape units and printer applications without a video interface. The device support firmware has the product number 13261A.

To connect the 13254A to a Conrac Television Monitor (QQA Series) or equivalent, use the HP 13232L cable assembly.

If you need to construct a cable for connecting the 13254A to a video hard copy unit, the hood connector pin and signal definitions are as follows:

CONNECTOR P2 PIN NO.	MNEMONIC	FUNCTION
10	GND	Return for command and status lines
11	BUSY	Goes low to indicate copy unit is making a copy
12	REMOTE COPY	Goes low to initiate a copy
14	COMPOSITE VIDEO OUT	Video output to copy unit
15	GND	Return for video

If you need to construct a cable for connecting the 13254A to a video monitor unit, the hood connector pin and signal definitions are as follows:

CONNECTOR P2 PIN NO.	MNEMONIC	FUNCTION
14	COMPOSITE VIDEO OUT	Video output to monitor
15	GND	Return for video

ACCESSORY 13260A STANDARD ..... ASYNCHRONOUS COMMUNICATIONS (02640-60086 and 02640-60239)

The HP 13260A Standard Asynchronous Communications Accessory (PCA part no. 02640-60086) is the primary interface between an HP 264X terminal and external data processing equipment. It provides character parallel data, status, and control information to the terminal microprocessor by way of firmware control. Individual characters are sent and received bit-serial and character-serial using an EIA RS232C electrical interface. The 02640-60086 PCA can be connected to external data processing equipment either directly or by modem, depending upon the particular HP 13232 cable assembly used.

When installing the HP 13260A accessory, you must configure the terminal by setting straps on the Keyboard Interface (02640-60123) PCA as described under "13260A/B" in Section 3, Strapping.

The following four HP 13232 cable assemblies apply to point-to-point configurations:

13232A This cable has a hood connector on one end and a male RS232C connector on the other. It is used for connecting the HP 13260A PCA to any of the following:

- HP 1000, 2000, 3000, RTE MUX panel
- 103A, 202C/D/S/T modems
- Acoustic couplers (signal compatible only)

13232B This cable has hood connectors on both ends. It is used for connecting the HP 13260A PCA to the HP 12531D or HP 12880A computer interfaces.

13232C This cable has a hood connector on one end and a female RS232C connector on the other. It is used for connecting the HP 13260A PCA to non-HP computers that require a female RS232C connector from the terminal.

13232U This cable has an RS232C connector on both ends. It is used for bypassing the modem connector so that the point-to-point communications configuration can more easily be tested (by eliminating the modem connection you can isolate those problems which pertain strictly to the communications interfaces). When the point-to-point link works properly in that simplified configuration, you then replace the 13232U cable with the modem connection and test the link in its "target" configuration (problems at this point probably pertain to the modem connection).

ACCESSORIES 13260C/D MULTI- ..... POINT COMMUNICATIONS (02640-60106 and 02640-60107)

The HP 13260C Asynchronous Multipoint Communications accessory, PCA part no. 02640-60106, and the HP 13260D Synchronous Multipoint Communications accessory, PCA part no. 02640-60107, provide an RS232C-compatible multipoint data communications interface (patterned after IBM Bisynch) which allows up to 36 HP 264X terminals to share the same communications line.

With both accessories, non-RS232C hardware is provided to permit multipoint daisy-chaining of terminals. The daisy-chain can be connected to the computer either directly or through a modem.

Each terminal in a multipoint configuration must:

1. Include the HP 13260C or 13260D accessory (depending upon whether you want asynchronous or synchronous operation);
2. Be properly configured by setting straps on the multipoint and Keyboard Interface (02640-60123) PCAs as described under "13260C/D" in Section 3, Strapping.
3. Include the proper firmware ROMs in sockets 20 and 22 on earlier Control Memory PCAs or in socket X4 on later Control Memory PCAs. These ROMs, which are included with the HP 13260C/D accessories, contain firmware which provides the interface between the terminal's maincode and the 13206C or 13260D multipoint data communications PCA. The ROM for socket 20 replaces the standard asynchronous data communications ROM which normally resides in that socket (either of two multipoint ROMs will be installed in socket 20, depending upon whether you have selected standard or monitor mode).

The following five HP 13232 cable assemblies apply to multipoint configurations:

13232P — This is a 3-connector cable assembly. It has a hood connector for attaching to the 13260C/D interface PCA; a female multipoint connector for attaching to the next terminal in the daisy-chain (via a 13232Q cable); and a male RS232C connector for attaching to the modem or computer system.

13232Q — This is a 3-connector cable assembly. It has a hood connector for attaching to the 13260C/D interface PCA and both a male and female multipoint connector for attaching to the preceding and following terminals in the daisy-chain.

13232R — This is a 30 meter (100 foot) multipoint extension cable which has a male connector on one end and a female on the other. It can be used for extending the distance between two terminals in the daisy-chain.

13232T — This is the same as the 13232Q cable assembly described above except that it is equipped with terminal power-down rerouting relays. If the power is lost for the terminal attached to the hood connector of this cable assembly, the other terminals in the daisy-chain will not be affected.

13232U This cable has a female RS232C connector on each end. It is most often used in the multipoint environment for bypassing the modem connection so that the daisy-chain can more easily be tested (by eliminating the modem connection you can isolate those problems which pertain strictly to the daisy-chain). When the multipoint daisy-chain works properly in that simplified configuration, you then replace the 13232U cable with the modem connection and test the daisy-chain in its "target" configuration (problems at this point probably pertain to the modem connection).

The pin-to-pin wiring and signal directions for the above cables are illustrated under "Cabling" later in this section.

Cabling

The following paragraphs supply pertinent information on the cables used with the terminals.

CABLE ASSEMBLIES .... Figure 2-40 lists the cables used with the 264X terminals and also lists the function, length, and types of connectors for each cable. Figures 2-41 through 2-60 show the wiring for each cable, the signal carried by each wire, and the identification of the pins on which each wire terminates.

POINT-TO-POINT COMMUNICATIONS CABLING .... Figure 2-61 illustrates the cabling between the data communications interface PCA (13260A, B, C, or D) in a terminal and a modem. Figure 2-62 illustrates the cabling for a current loop connection. Figure 2-63 illustrates use of the 13232U cable to connect direct to the remote device by bypassing the modem.

MULTIPOINT COMMUNICATIONS CABLING .... Figures 2-64 and 2-65 show the cable connections used by the multipoint communications accessories 13260C/D. Figures 2-66 and 2-67 show the power-down-protect cabling for accessories 13260C/D.

FABRICATING CABLES .... PCA hood connectors, RS232C connectors, multipoint connectors, and cables are available should you need to fabricate your own data communications cable. Part numbers of the items are given in the following table.

Parts for Fabricating Your Custom Data Communications Cable

ITEM	HP PART NO.	ALTERNATE SOURCE	DESCRIPTION
RS232 Connector	5061-2405		(See figure 2-69).
PCA Hood Connector	5061-1340		(See figure 2-70).
Multipoint Connector	5061-2401		(See figure 2-71).
PCA Hood to RS232 Connector Cable	8120-1903 or 8120-1930		26 AWG (or greater) Low Voltage Computer Cable.
Multipoint Cable	8120-2305	Brand Rex POSS4P22	22 AWG, 4 twisted pairs, overall shield, 75 ohm differential mode characteristic impedance.
Note: All connectors include contacts.			

Figures 2-69 through 2-71 show the details of assembling each type of connector. Also, the illustrations of the HP cables (figures 2-41 through 2-61) may be used as a guide.

There are maximum length limitations on each type of cable. The following may be used as a guide for length considerations.

MAXIMUM DISTANCES

- 13260A Standard Asynchronous

  Modem/Computer to first terminal: 50 feet (RS232C standard)

- 13260B Extended Asynchronous

  Modem/Computer to first terminal: 50 feet (RS232C standard)

  Computer to terminal: 1000 feet (current loop)

- 13260C Asynchronous Multipoint

  Modem/Computer to first terminal: 50 feet (RS232C standard)

  Terminal to terminal: @ 300 to 9600 bits per second, up to 2000 feet between terminals with up to 32 terminals per line.

- 13260D Synchronous Multipoint

  Modem/Computer to first terminal: 50 feet (RS232C standard)

  Terminal to terminal: The following table shows the average distances allowed between terminals.

Terminals/Line	BIT/SECOND 2400	4800	9600
4	2000 ft.	2000 ft.	2000 ft.
8	2000 ft.	2000 ft.	2000 ft.
16	2000 ft.	1200 ft.	480 ft.
32	1200 ft.	480 ft.	120 ft.

Average Distances Between Terminals

NOTE: The maximum total line length is 16,000 feet. Beyond 16,000 feet contact the factory for ordering information.

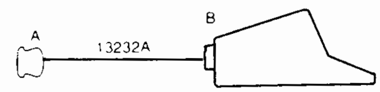
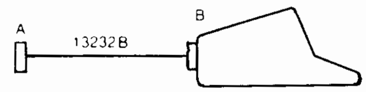
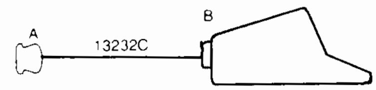
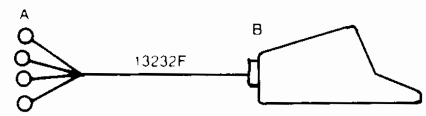
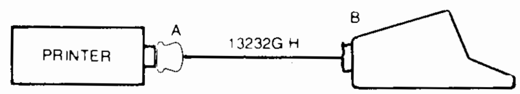
CABLE	FUNCTION	CONNECTORS A	CONNECTORS B	CONNECTORS C	LENGTH	HOOKUP
13232A	Connects data communications interface PCA to modem 103 202. (Cable part no. 02640-60043.)	RS232 (male)	Hood	—	4.57 Metres 15 feet	
13232B	Connects 12531 12880 teleprinter interface PCA to terminal. (Cable part no. 02640-60058.)	Hood	Hood	—	15.25 Metres 50 feet	
13232C	Connects data communications interface PCA to RS232 connector. (Cable part no. 02640-60059.)	RS232C (female)	Hood	—	1.52 Metres 5 feet	
13232F	Provides current loop connections for 13260B data communications interface. (Cable part no. 02640-60097.)	4 terminal lugs	Hood	—	1.52 Metres 5 feet	
13232G	Connects 13250A Serial Printer Interface to RS232 compatible printers. (Cable part no. 02640-60098.	RS232C (male)	Hood	—	4.57 Metres 15 feet	
13232H	Same as 13232G. (Cable part no. 02640-60099.)	RS232C (female)	Hood	—	4.57 Metres 15 feet	

Figure 2-41. 13232 Cable Assemblies (Sheet 1 of 3)

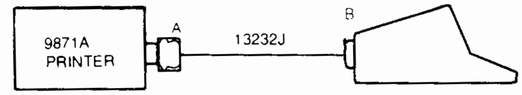
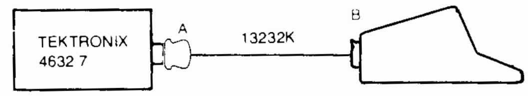
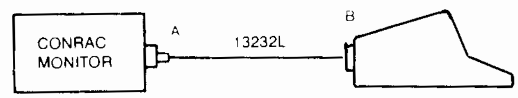
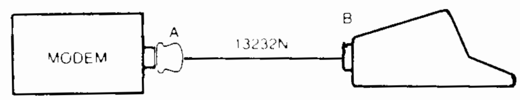
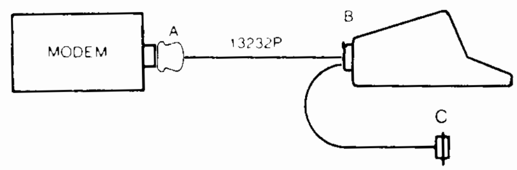
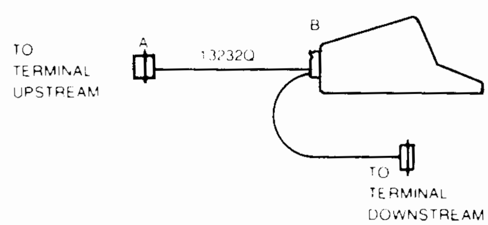
CABLE	FUNCTION	CONNECTORS A	CONNECTORS B	CONNECTORS C	LENGTH	HOOKUP
13232J	Connects 13238A Duplex Register PCA to 9871A Printer. (Cable part no. 02640-60116.)	9871A printer (female)	Hood	—	1.83 Metres 6 feet	
13232K	Connects 13254A Video Interface PCA to Tektronix 4632/7 Video Copier. (Cable part no. 02640-60120.)	RS232 (male)	Hood	—	4.57 Metres 15 feet	
13232L	Connects 13254A Video Interface PCA to Conrac Monitor. (Cable part no. 02640-60121.)	BNC	Hood	—	7.61 Metres 2.5 feet	
13232N	Connects data communications interface PCA to modem. (Cable part no. 02640-60131.)	RS232C (male)	Hood	—	4.57 Metres 15 feet	
13232P	Connects 13260C or 13260D data communication interface PCA to modem in multipoint configurations. (Cable part no. 02640-60132.)	RS232C (male)	Hood	Multipoint (female)	4.57 Metres 15 feet (each leg)	
13232Q	Connects 13260C or 13260D data communications interface PCA to other terminals in downstream multipoint configuration. (Cable part no. 02640-60133.)	Multipoint (male)	Hood	Multipoint (female)	4.57 Metres 15 feet (each leg)	

Figure 2-41. 13232 Cable Assemblies (Sheet 2 of 3)

Table 7-2. 13232 Cable Assemblies (Continued)

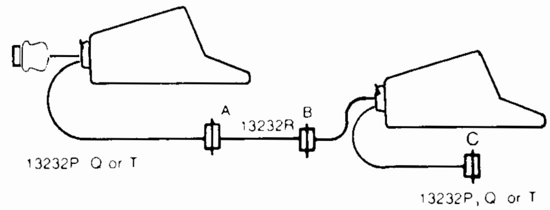
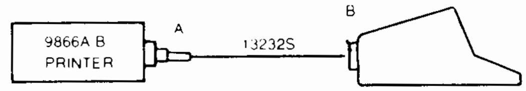
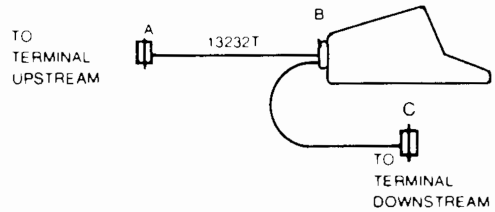
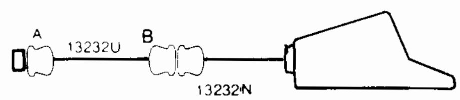
CABLE	FUNCTION	CONNECTORS A	CONNECTORS B	CONNECTORS C	LENGTH	HOOKUP
13232R	Provides 100-foot extension to 13232P, Q, T, multipoint cables. (Cable part no. 02640-60134.)	Multipoint (male)	Multipoint (female)	Multipoint (female)	30.5 Metres 100 feet	
13232S	Connects 13238A Duplex Register PCA to 9866A/B Printer. (Cable part no. 02640-60135.)	9866 printer (female)	Hood	—	1.83 Metres 6 feet	
13232T	Provides power-down protection for a terminal in multipoint configuration. (Cable part no. 02640-60151.)	Multipoint (male)	Hood	Multipoint (female)	4.57 Metres 15 feet (each leg)	
13232U	Provides direct connection to a computer by replacing the modem connections. (Cable part no. 5060-2403.)	RS232C (female)	RS232C (female)	—	1.52 Metres 5 feet	

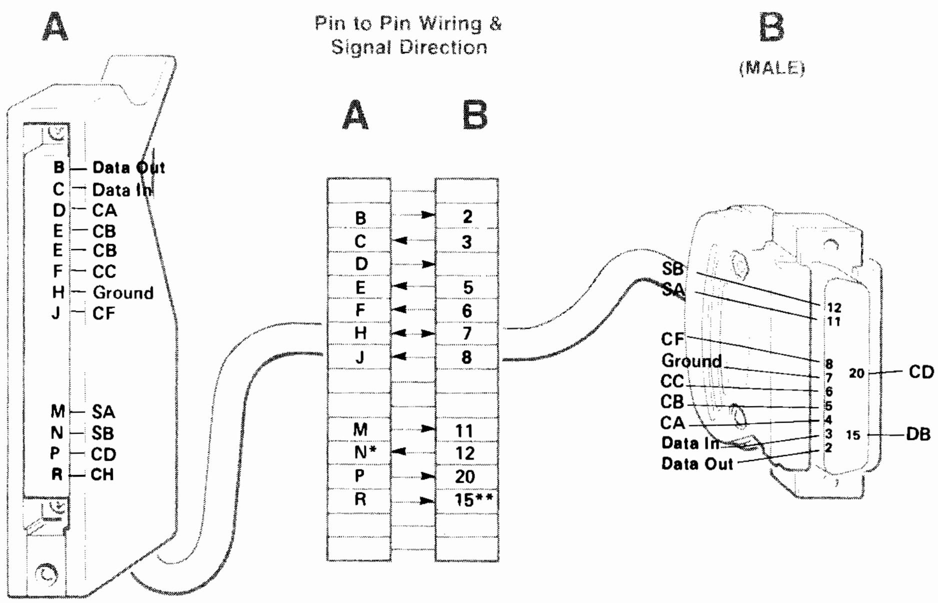
Figure 2-41. 13232 Cable Assemblies (Sheet 3 of 3)

13232A

Name on Hood: **103/202 MODEM CBL**

Cable Length: **4.5 meters 15 feet**

Uses: **264X Terminal standard Async D.C. or 13260A (02640-60086); 13250B (02640-60143) to HP1000, 2000, 3000 Computer I/O Multiplexers; 103A, 202 C, D, S, T Modems; Acoustic Couplers (Signal compatible only).**



A	Direction	B
B	→	2
C	←	3
D	→	
E	←	5
F	←	6
H	↔	7
J	←	8
M	→	11
N*	←	12
P	→	20
R	→	15**

Special Notes: *Switch rocker switch "U" on Keyboard Interface to the open position when hardwired to computer. If keyboard interface does not have a "U" switch, then disconnect the wire on pin N. Five different versions of this cable exist.

**CH and DB signals are miswired. Rewire these lines if CH or DB are to be used.

Figure 2-42. Cable 13232A Wiring

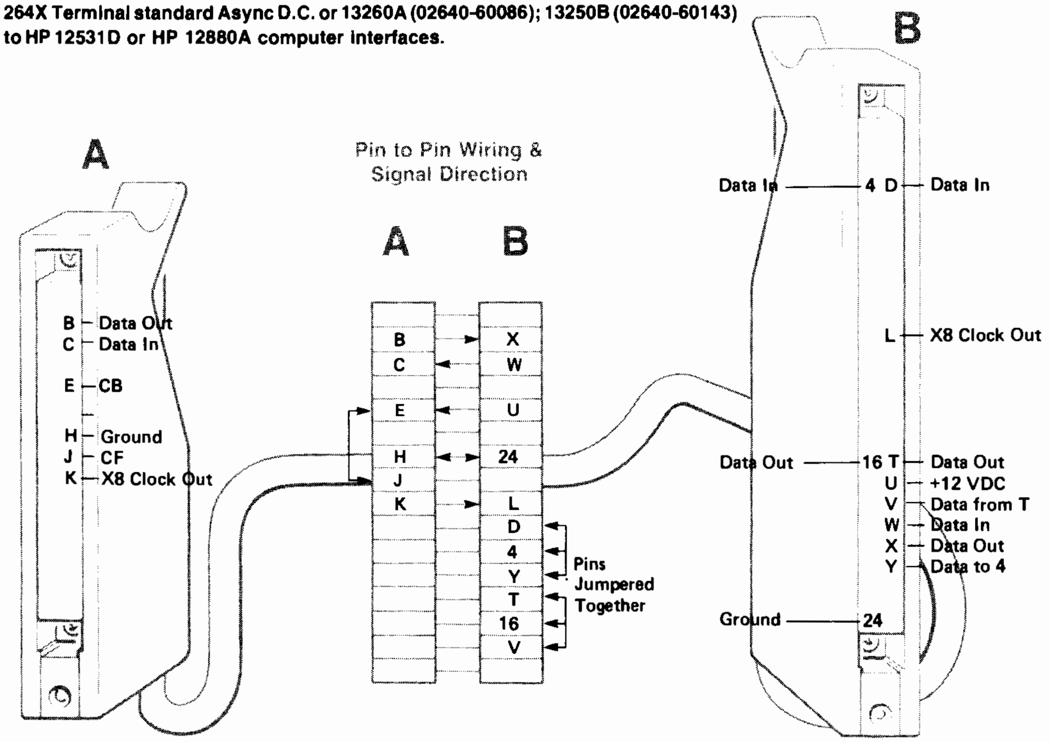
13232 B

(02640-60058)

Name on Hood: **12531/12880 CBL**

Cable Length: **15.0 meters**
50 feet

Uses: **264X Terminal standard Async D.C. or 13260A (02640-60086); 13250B (02640-60143) to HP 12531D or HP 12880A computer interfaces.**



Special Notes: Can also be ordered as 12880A option 001; 12531D option 004. Some standard 12531D computer interface cables are missing external clock.

Figure 2-43. Cable 13232B Wiring

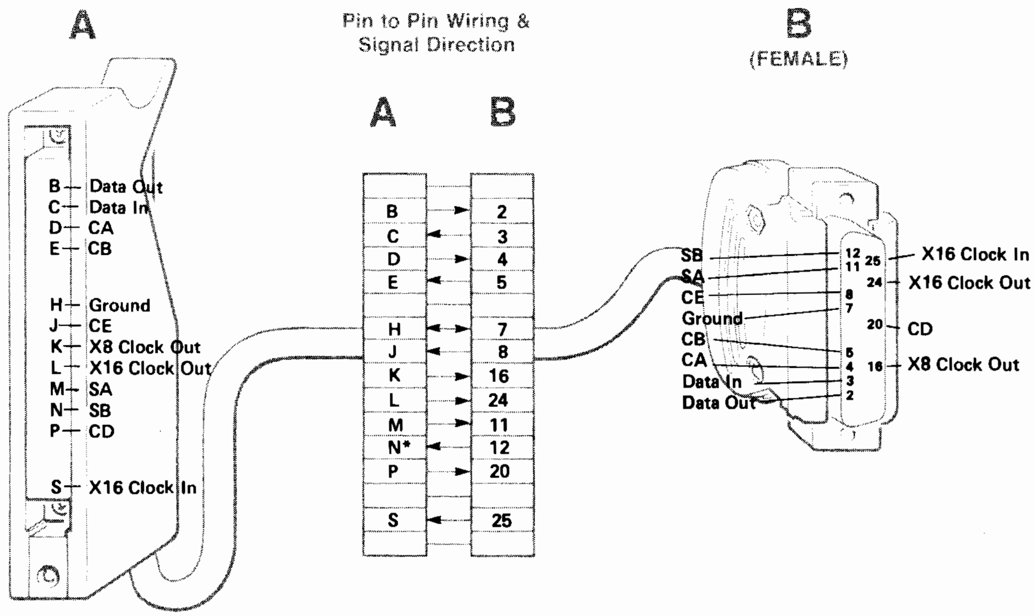
13232 C

(02640-60089)

Name on Hood: **RS232CBL**

Cable Length: **1.5 meters**
5 feet

Uses: **264X Terminal standard Async D.C. or 13260A (02640-60086); 13250B (02640-60143) to non HP computers requiring female RS232 connector on terminal side of cable.**



Special Notes: *Switch rocker switch "U" on Keyboard Interface to the open position when hardwired to computer. If keyboard interface does not have a "U" switch, then disconnect the wire on pin N.

Figure 2-44. Cable 13232C Wiring

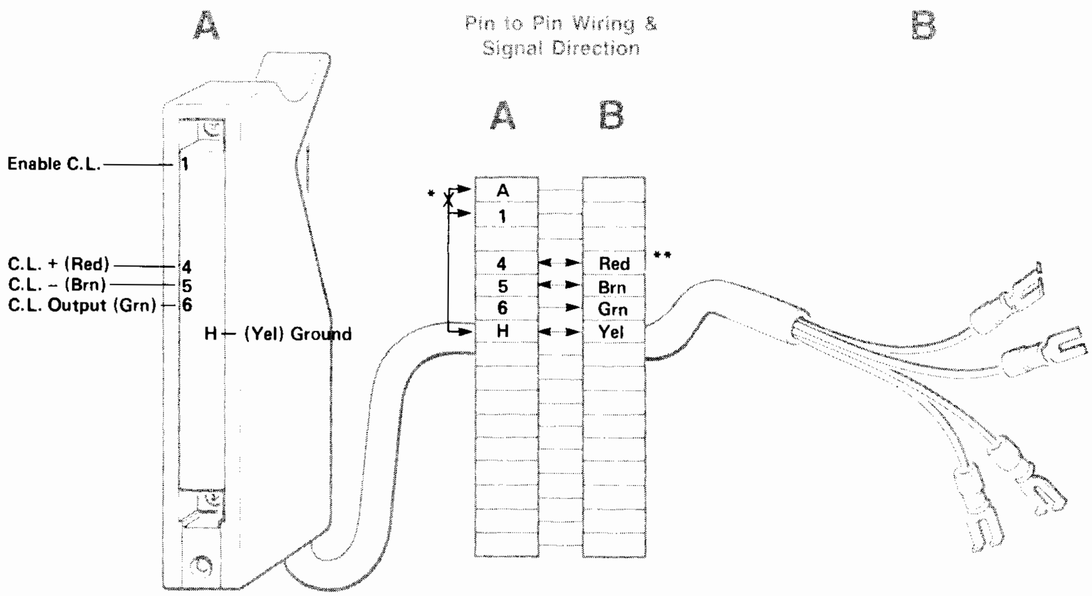
13232 F

(5061-2408 or 02640-60097)

Name on Hood: CURRENT LOOP CBL

Cable Length: 1.5 meters
5 feet

Uses: For 264X terminal 13250B or 13260B G.P. Async D.C. Interface to 20 milli-ampere current loop serial printers or 20 milli-ampere current loop data communication.



Special Notes: *Early cables had pin A to pin 1. Pin 1 should now be wired to pin H.

**This is the color of the wires. C.L. = Current Loop (5061-2408 replaces 02640-60097).

Figure 2-45. Cable 13232F Wiring

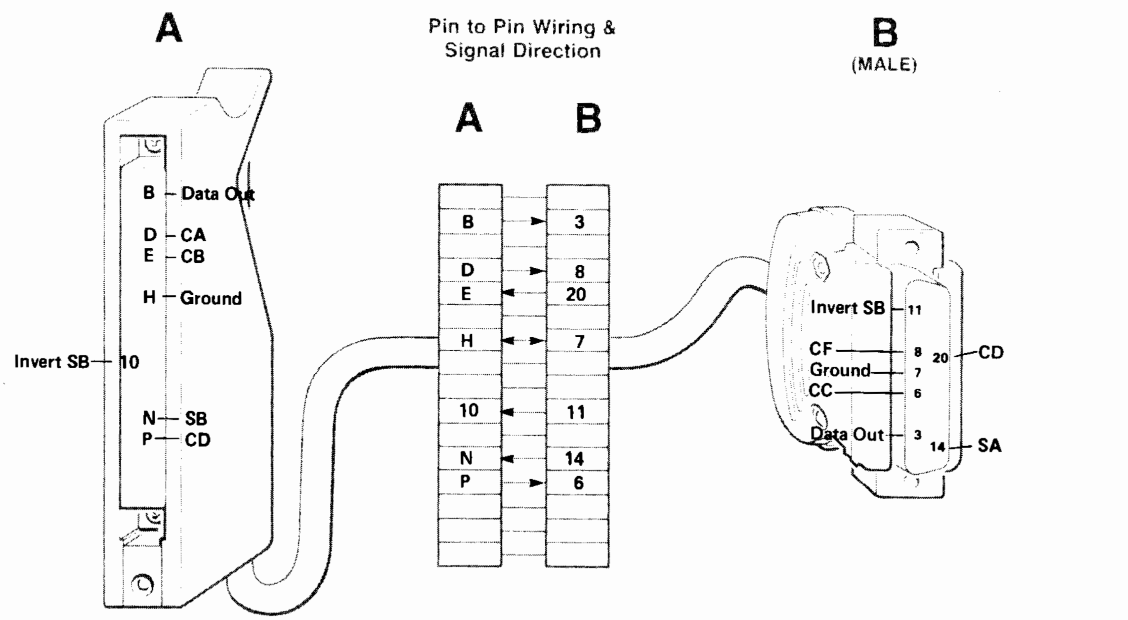
13232 G

(02640-60098)

Name
on Hood: **RS232 PRINTER CBL (MALE)**

Cable
Length: **4.5 meters**
15 feet

Uses: **264X Terminal G.P. Async D.C./Serial Printer Interface 13250B or 13260B (02640-60143) with device support firmware to RS232 compatible serial printers such as 2631/2635.**



Special Notes: Terminal G..P. module rocker switches must be set to match the requirements of the Printer used. See Section IV, Strapping.

Figure 2-46. Cable 13232G Wiring

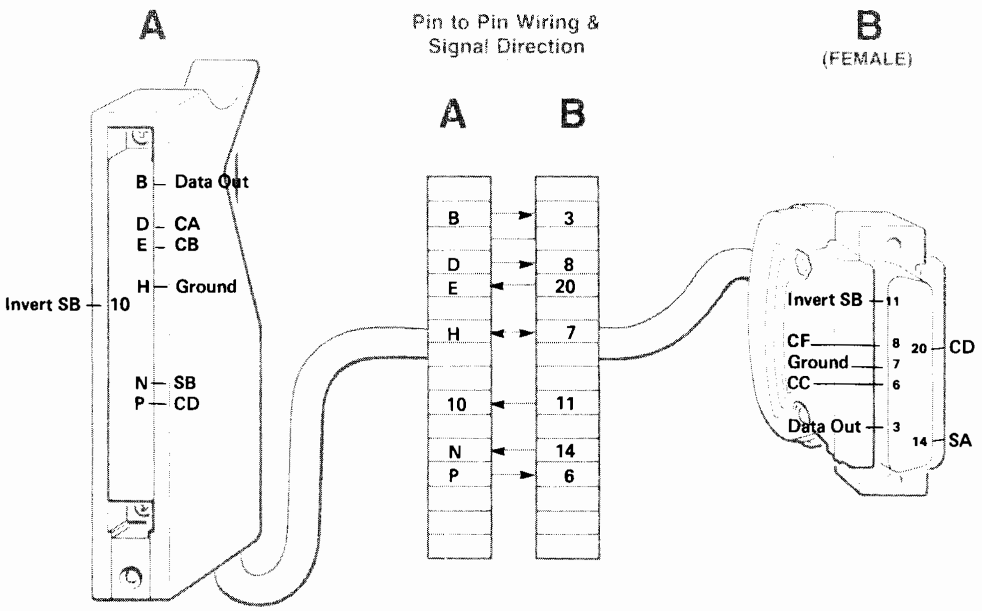
13232 H

(02640-6099)

Name
on Hood: **RS232 PRINTER CBL (FEMALE)**

Cable
Length: **4.5 meters**
15 feet

Uses: **264X terminal G.P. Async D.C./Serial Printer Interface 13250B or 13260B (02640-60143) to RS232 compatible serial printers.**



Special Notes: Terminal G.P. module rocker switches must be set to match the requirements of the Printer used. See Section IV, Strapping.

Figure 2-47. Cable 13232H Wiring

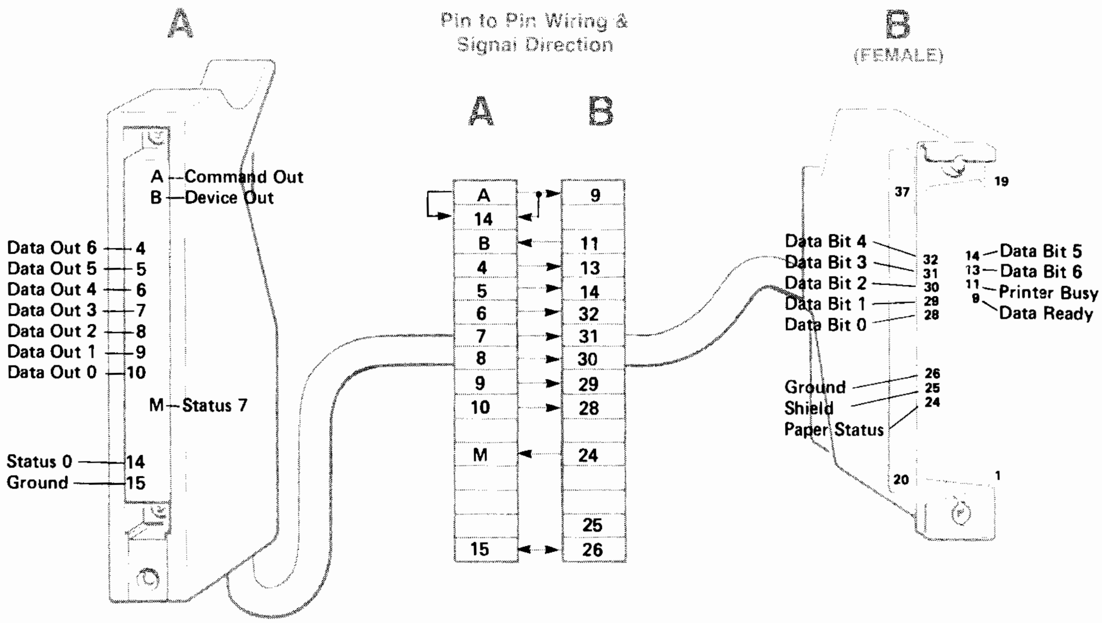
13232 J

(02640-60116)

Name on Hood: **9871 PRINTER CBL**

Cable Length: **1.8 meters 6 feet**

Uses: **264X Terminal 13238A Duplex Register module (02640-60031) with device support firmware to HP 9871A Impact Printer or to 2631A-240 Datamation Printer. Used in 13349A Impact Printer Subsystem (2631/2635 with 13238 Duplex Register)**



Special Notes: All jumpers on 13238A are removed except jumpers B, C, F, K and P. Parallel data transferring is done on this interfacing. 2640A Terminals need Firmware Upgrade Kit (02640-60117) if Firmware ROM's are not 1818-017X series.

Figure 2-48. Cable 13232J Wiring

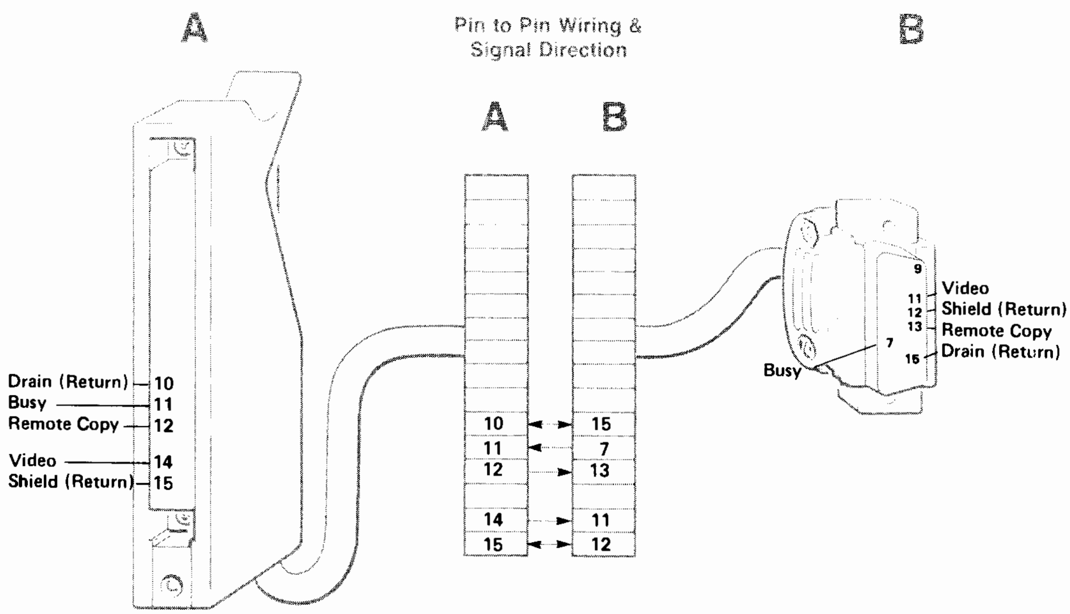
13232 K

(02640-60120)

Name on Hood: **VIDEO CABLE**

Cable Length: **4.5 meters**
15 feet

Uses: **264X Terminal 13254A Video Interface (02640-60119) with device support firmware to Tektronix 4632 Video Hardcopy Unit.**



Special Notes: For use with the Tektronic 4632 option 007.

Figure 2-49. Cable 13232K Wiring

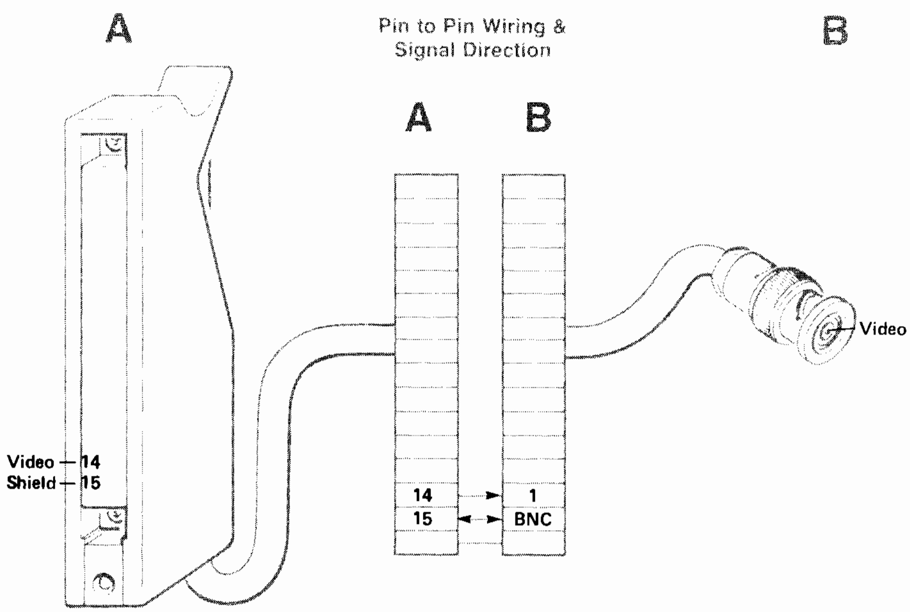
13232 L

(02640-60121)

Name
on Hood: **COMPOSITE VIDEO**

Cable
Length: **7.5 meters**
25 feet

Uses: **264X Terminal 13254A Video Interface (02640-60119) to Conrac Television Monitor (QQA Series) or equivalent. VERSATEC 1640 if copy is initiated at the copier.**



Special Notes: **Refer to "Interfacing" earlier in this section for specifics on signal requirements.**

Figure 2-50. Cable 13232L Wiring

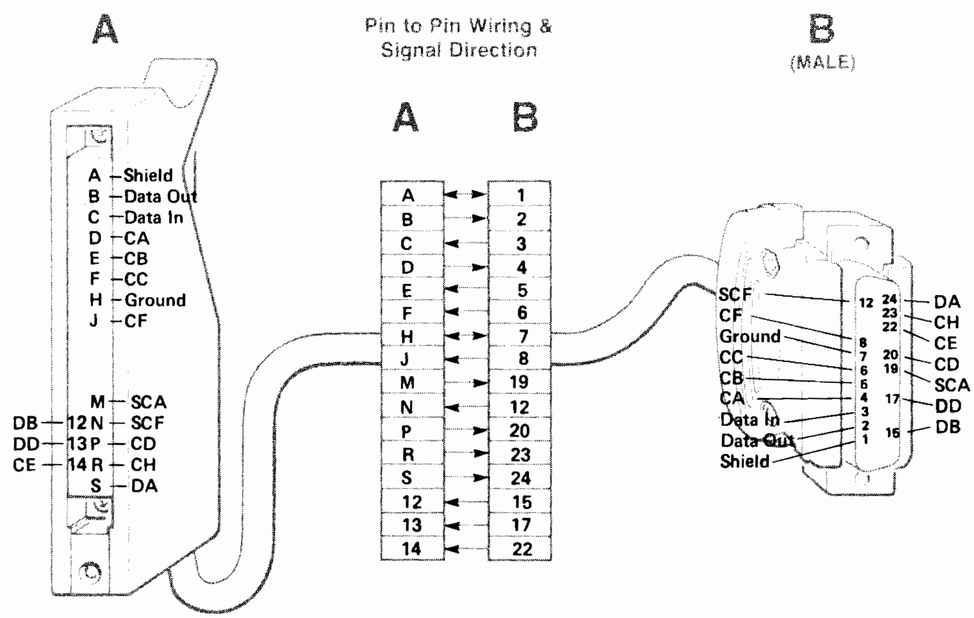
13232 M

(5061-2409)

Name on Hood: **EUROPEAN MODEM CBL**

Cable Length: **4.5 meters**
15 feet

Uses: **264X Terminal 13250B, 13260B G.P. Async D.C. Interface modules to European telephone connections via 202C type European modems.**



A	Direction	B
A	↔	1
B	→	2
C	←	3
D	→	4
E	←	5
F	←	6
H	↔	7
J	←	8
M	→	19
N	←	12
P	→	20
R	→	23
S	→	24
12	←	15
13	←	17
14	←	22

Special Notes: Will work with one terminal connected to 13260C or 13260D Multipoint Async D.C. or Multipoint Sync D.C. Configure Keyboard Interface module (02640-60123) when using cable in Europe. Refer to the discussion of Main Channel Protocol in Section V of your terminal's reference manual.

Figure 2-51. Cable 13232M Wiring

13232 N

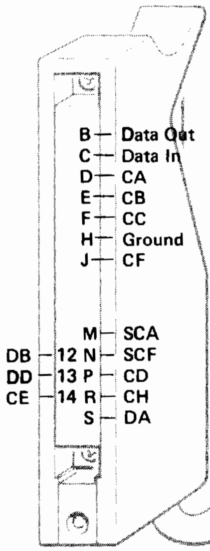
(02640-60131)

Name on Hood: **U.S. MODEM CABLE**

Cable Length: **4.5 meters**
15 feet

Uses: **264X Terminal 13250B, 13260A, 13260B or standard Async D.C. (02640-60086) to HP 1000, 2000, 3000 Computer I/O Multiplexers; 103A, 202C, D, S, T 212A, VADIC 3400 Modems; Acoustic Couplers (Signal Compatible only).**

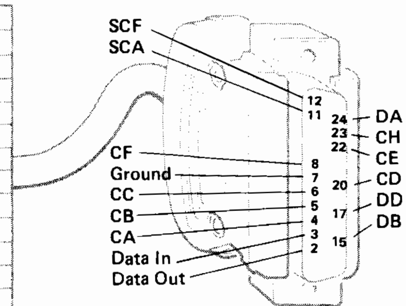
A



Pin to Pin Wiring & Signal Direction

A		B
B	→	2
C	←	3
D	→	4
E	←	5
F	←	6
H	↔	7
J	←	8
M	→	11
N*	←	12
P	→	20
R	→	23
12	←	15
13	←	17
14	←	22
S	→	24

B (MALE)



Special Notes: *Switch rocker switch "U" on Keyboard Interface to the open position when hardwired to computer. If keyboard interface does not have a "U" switch, then disconnect the wire on pin N.

Figure 2-52. Cable 13232N Wiring

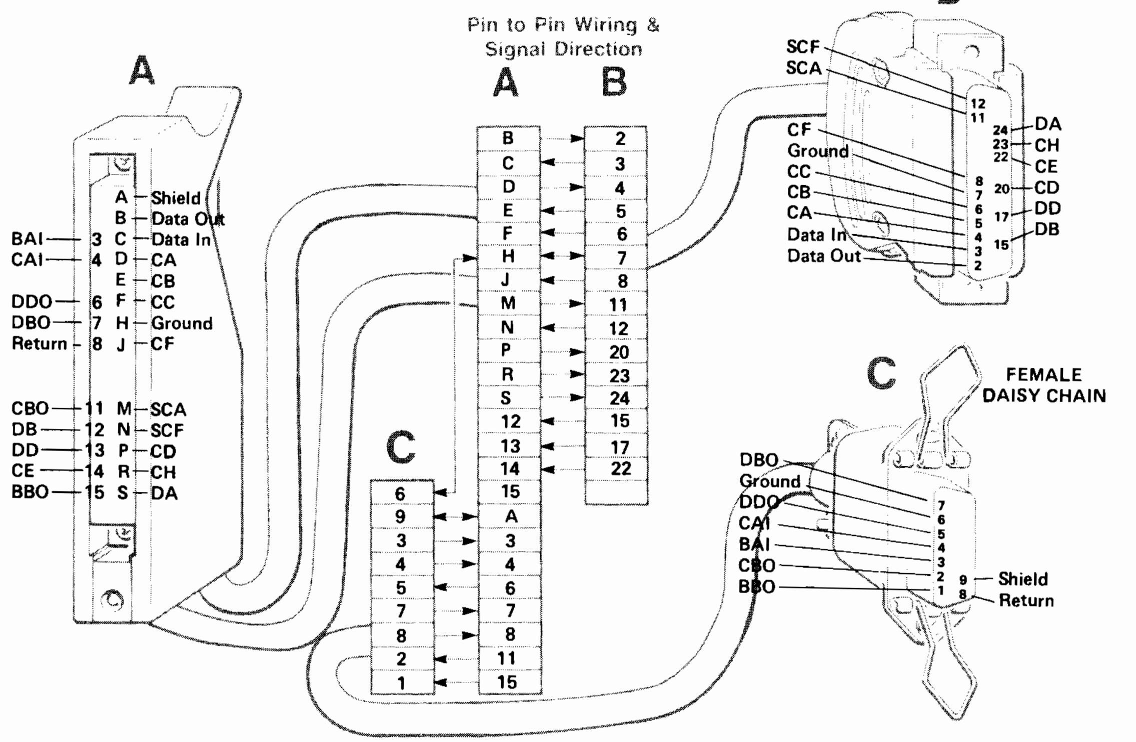
Name
on Hood: **MODEM/MULTIPOINT**

13232 P

(02640-60132)

Cable
Length: **4.5 meters**
15 feet

Uses: **264X Terminal 13260C or 13260D to 103A; 202C, D, S, T Modems; Acoustic Couplers (Signal Compatible only) and to second Terminal is daisy chain multi-point multiple terminal network.**



Special Notes: May also use 13250A, 13250B, 13260A, 13260B, for single terminal operation.

Figure 2-53. Cable 13232P Wiring

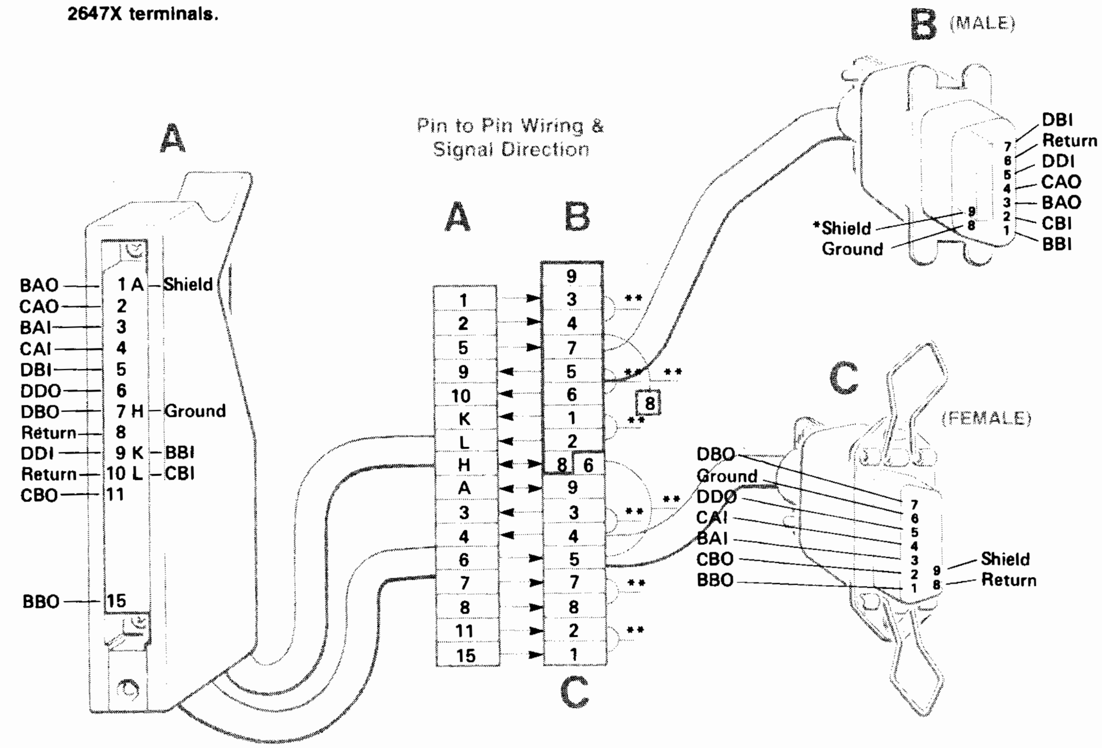
13232 Q

(02640-60133)

Name on Hood: **MULTIPOINT CBL**

Cable Length: **4.5 meters**
15 feet

Uses: **264X Terminal 13260C or 13260D Multipoint Interface to up to 32 daisy-chained 2645X 2647X terminals.**



Special Notes: *Shield not connected on "A" hood connector side.

**Same twisted pair.

Figure 2-54. Cable 13232Q Wiring

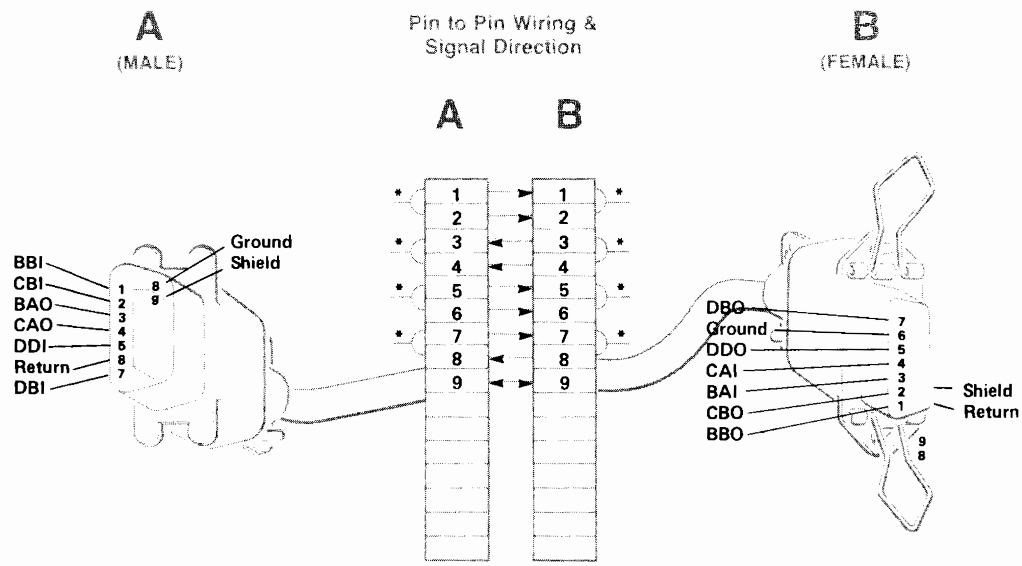
13232 R

(02640-60134)

Name on Hood: **NO HOOD**

Cable Length: **30 meters**
100 feet

Uses: **Multi-point Extension cable. Connects to 13232Q cable.**



Special Notes: *See "Fabricating Cables" later in this section for cable length maximum distance.

**Same twisted pair.

Figure 2-55. Cable 13232R Wiring

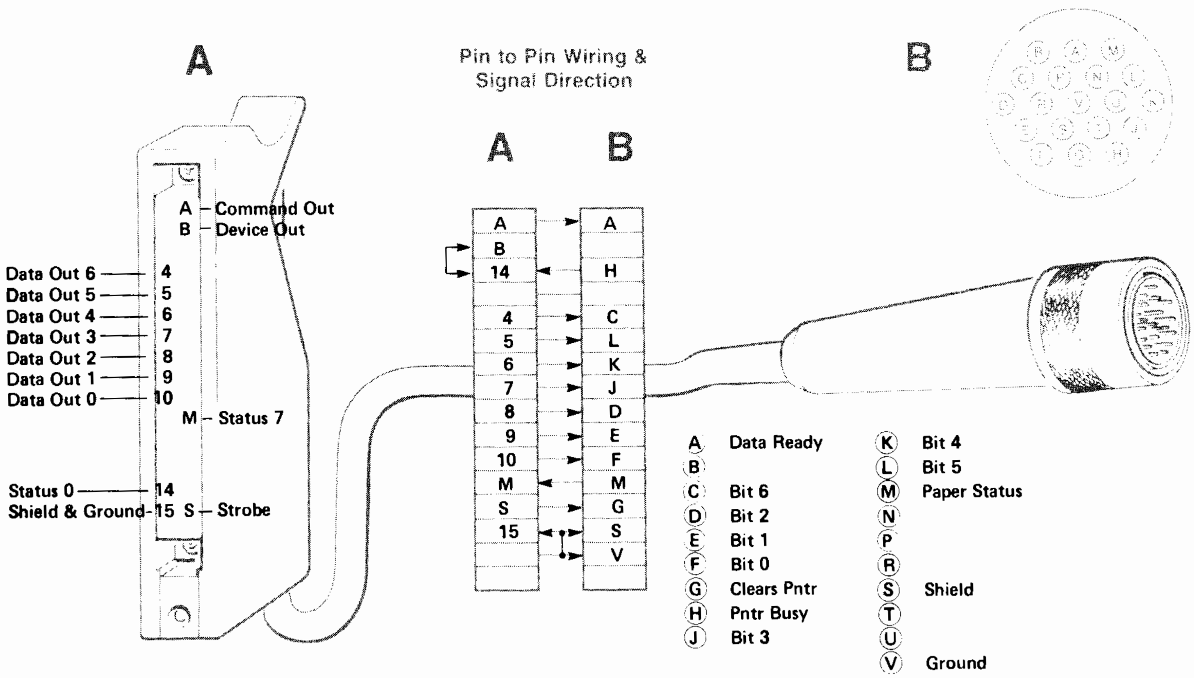
13232 S

(02640-60135)

Name
on Hood: **9866 PNTR CBL**

Cable
Length: **1.8 meters**
6 feet

Uses: **264X Terminal 13238A Duplex Register (02640-60031) to HP 9866A or 9866B Thermo Printer. Cannon plug is non RS232. Used in 13246A/B Thermo Printer Subsystem.**



Special Notes: HP 9866B and 2640A connections require updated firmware in terminal. (1818-017X series firmware ROMs required). Replaces 13238-60001 cable.

Figure 2-56. Cable 13232S Wiring

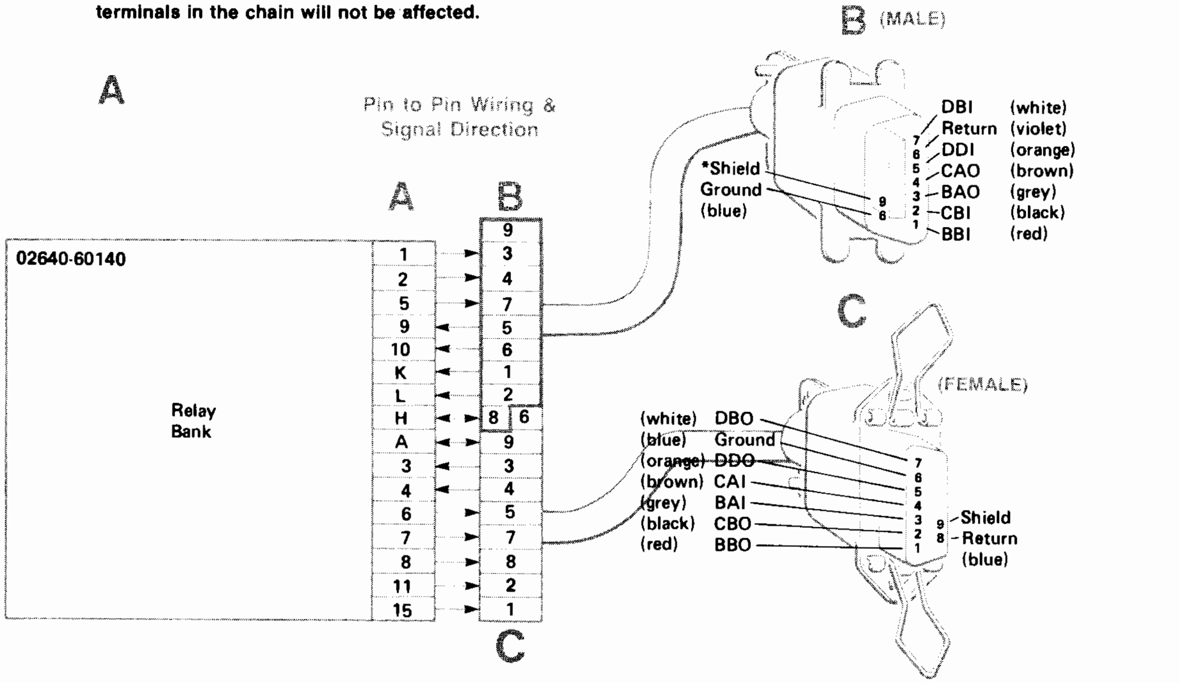
13232 T

(02640-60151)

Name on Hood: **POWER PROTECT MULTIPT CABLE**

Cable Length: **9 meters 30 feet**

Uses: **Same as 13232Q except this cable is equipped with terminal power down rerouting relays. If one terminal uses this cable and its power is lost, the other terminals in the chain will not be affected.**



Special Notes: Refer to your terminal's reference manual for details on Relay Module. Same twisted pairs as 13232R cable.

Figure 2-57. Cable 13232T Wiring

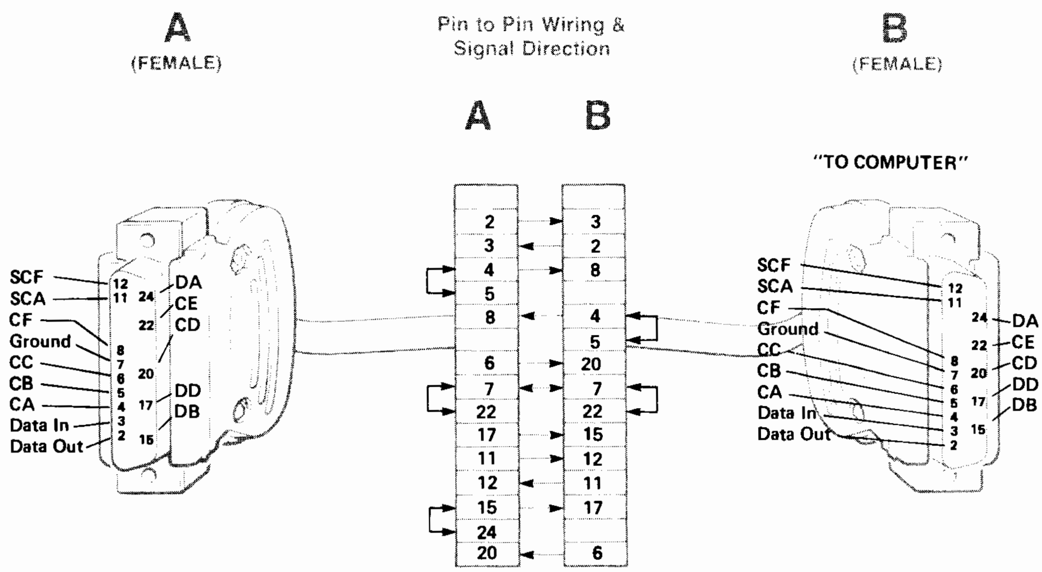
13232 U

(5061-2403)

Name on Hood: "5061-2403"
"TO COMPUTER"

Cable Length: **1.5 meters**
5 feet

Uses: **13232P cable to this 13232U modem bypass cable to another terminal or a computer with EIA RS232 connectors.**



Special Notes: Usually used for Diagnostic testing of multi-point daisy chained terminals.

Figure 2-58. Cable 13232U Wiring

13232 W

(5061-2410)

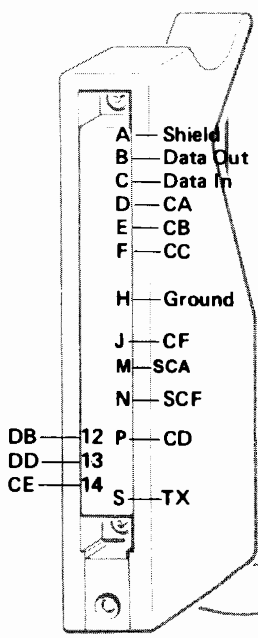
Name on Hood:

Cable Length: **6.2 meters**
20 feet

Uses: **264X Terminal connection to HP300 System; shielded**

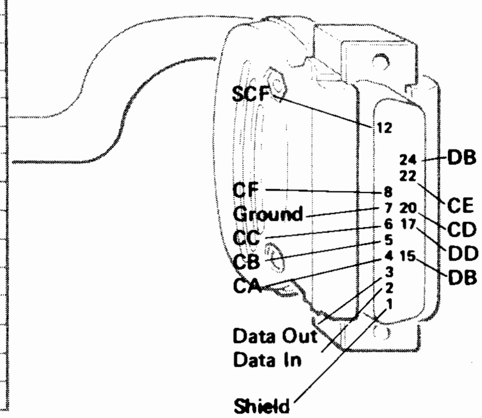
A

B
(FEMALE)



Shield

A		B
A	—	1
B	→	3
C	←	2
D, E	→	8
F	←	20
H,N,14	↔	7,22
J	←	4, 5
12, S	→	17
13	←	15
P	→	6
M	↔	12



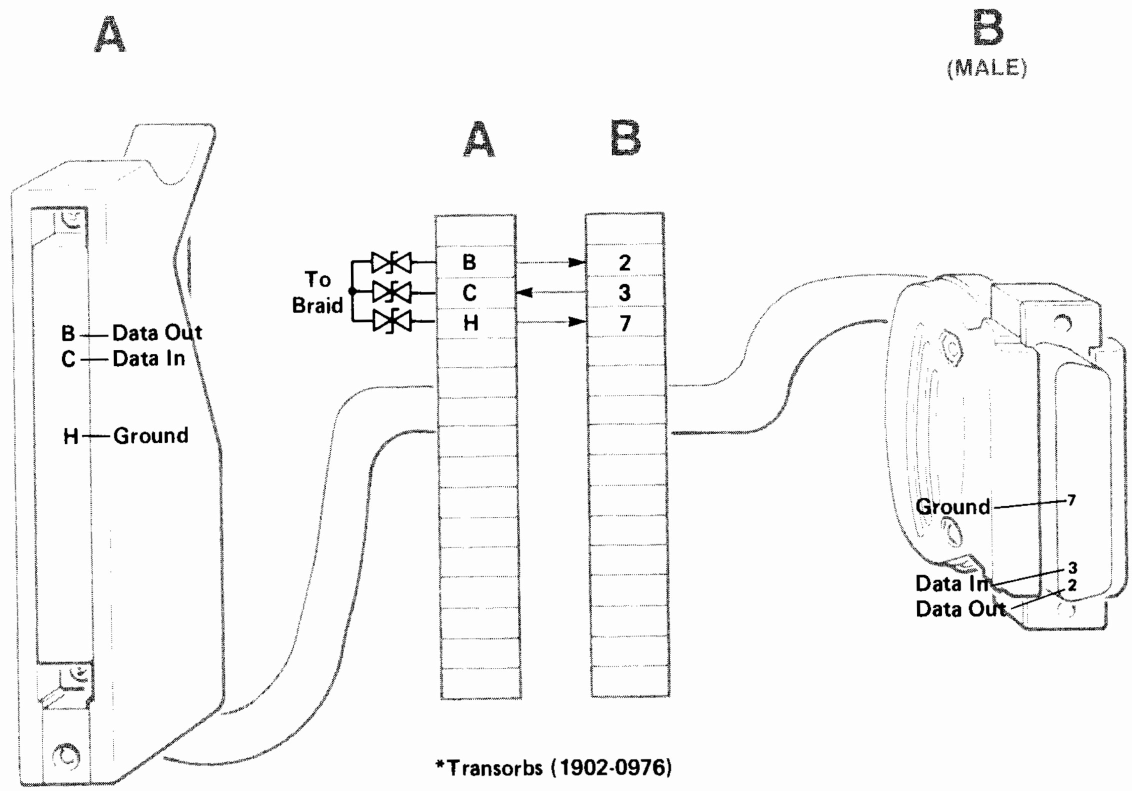
13232 Y

(02640-60218)

Name on Hood: **EMP PROTECT MALE**

Cable Length: **4.5 meters 15 feet**

Uses: **264X Terminal protection from lightning-induced transients on data comm line. For Hardwired Applications only. Works on HP 1000, 2000, 3000 MUX.**



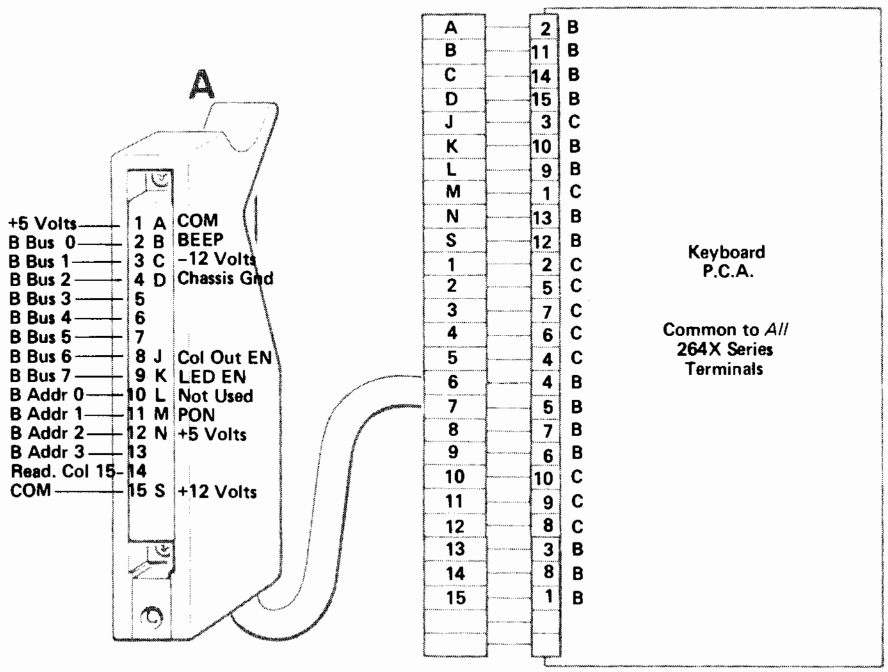
*Transorbs (1902-0976)

264X Keyboard Cable

(02640-60081)

Cable Length: **1.5 meters**
5 feet

Uses: **To connect 264X keyboard (02640-60018) to the terminal mainframe keyboard interface (02640-60029) or (02640-60123). This cable is the same for all 264X series Terminal Keyboards.**



Logic Function

1B Ground
2B Ground
3B B Addr 3
4B B Bus 4
5B B Bus 5
6B B Bus 7
7B B Bus 6
8B Col 15
9B Not Used
10B LED EN
11B Beep
12B + 12V
13B + 5V
14B + 12V
15B Ground (Chassis)
1C PON
2C + 5V
3C Col Out EN
4C B Bus 3
5C B Bus 0
6C B Bus 2
7C B Bus 1
8C B Addr 2
9C B Addr 1
10C B Addr 0

Special Notes: This cable is the same for all 2640 series Terminal Keyboards.

Figure 2-59. Keyboard Cable Wiring

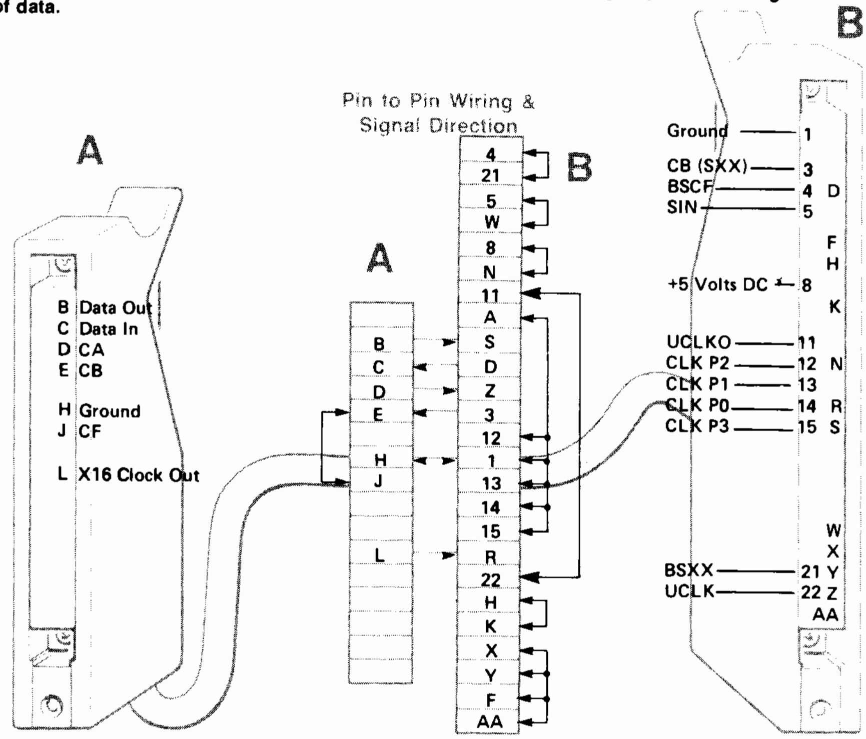
12966 A Option 001

Name on Hood: "ASYNC 2640/2644" "ASYNC DATA"

(12966-60008)

Cable Length: 15 meters 50 feet

Uses: 264X Terminal 13250B and 13260B to HP 2100 or 21MX computer interface 12966A. Main purpose is for block mode transfers typical of 2644A or 2645A cartridge tape transferring of data.



Special Notes: Order 12966A Option 001 or cable part number 12966-60008.

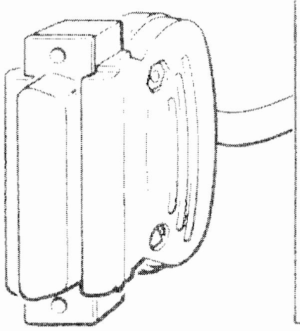
Figure 2-60. DSD Cable Wiring

Extension Cables

30062C (30062-60006) 25 feet
30062C-001 (30062-60009) 50 feet
30062C-002 (30062-60012) 100 feet

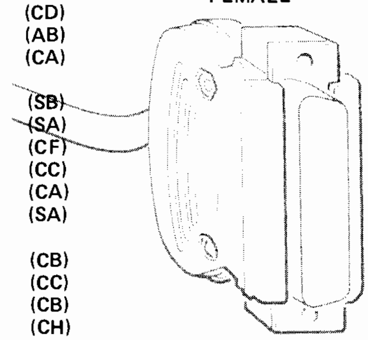
Cable modification required. (See footnote.)

MALE CONNECTOR



2	CHANNEL NO.	O	TRANSMITTED DATA	(BB)
3	CHANNEL NO.	O	RECEIVED DATA	(BA)
4	CHANNEL NO.	O	STATUS 2	(CF)
5	CHANNEL NO.	O	STATUS 2	(CF)
6	CHANNEL NO.	O	COMMAND 1	(CD)
7	COMM RET			(AB)
8	CHANNEL NO.	O	COMMAND 2	(CA)
9	+12V			
11	CHANNEL NO.	O	STATUS 1*	(SB)
12	CHANNEL NO.	O	COMMAND 1*	(SA)
13	CHANNEL NO.	N	STATUS 2	(CF)
14	CHANNEL NO.	N	STATUS 1	(CC)
15	CHANNEL NO.	N	COMMAND 2	(CA)
16	CHANNEL NO.	N	COMMAND 1*	(SA)
17	−12V			
18	CHANNEL NO.	N	STATUS 2*	(CB)
20	CHANNEL NO.	O	STATUS 1	(CC)
22	CHANNEL NO.	O	STATUS 2*	(CB)
23	CHANNEL NO.	O	COMMAND 2*	(CH)

FEMALE



25 pins wired pin 1 to pin 1, pin 2 to pin 2, pin 3 to pin 3, etc.

Special Notes: Very noisy, cross talk cable. If cable must be used, disconnect all wires except pin 2, 3, and 7.

NOTES:

1. The asynchronous multiplexer interface kit is shown connected in its maximum configuration with two asynchronous multiplexer control PCAs. For installations that require only one asynchronous multiplexer control PCA, the PCA is connected through its cable assembly to connector panel receptacles J16 and J20.
2. The asterisk indicates signals that are available only when two asynchronous multiplexer control PCAs are used.

Figure 2-61. GSD Extension Cable Wiring

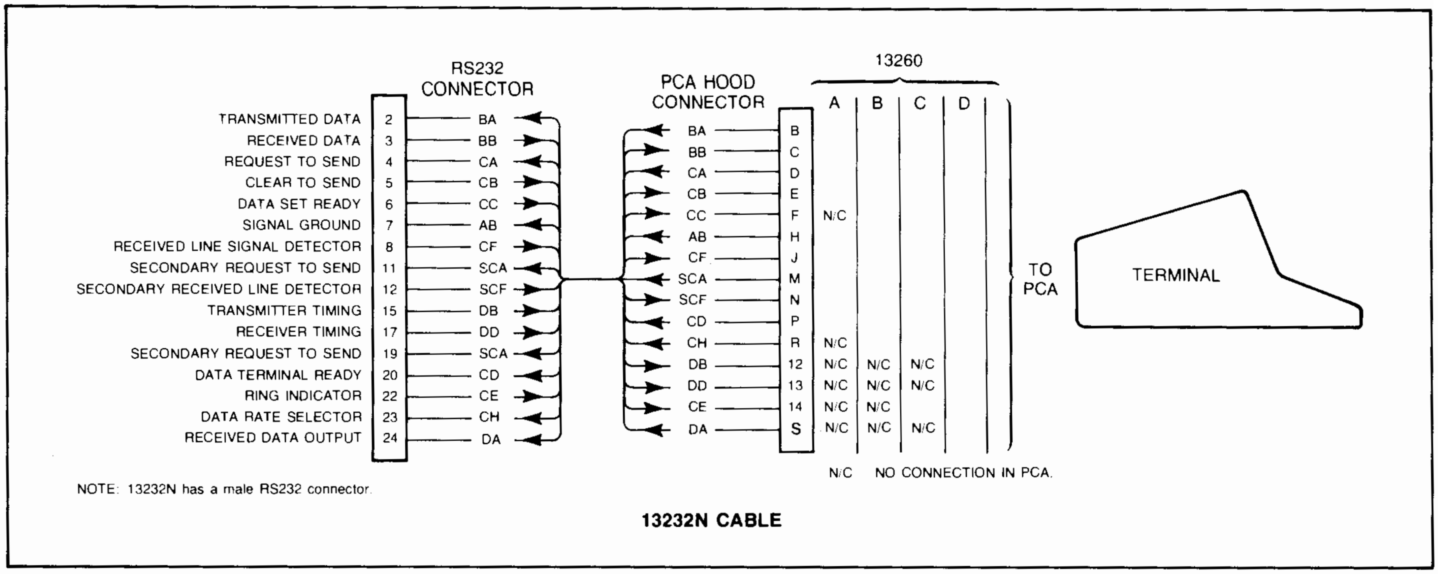


Figure 2-62. Point-to-Point Communications Cabling

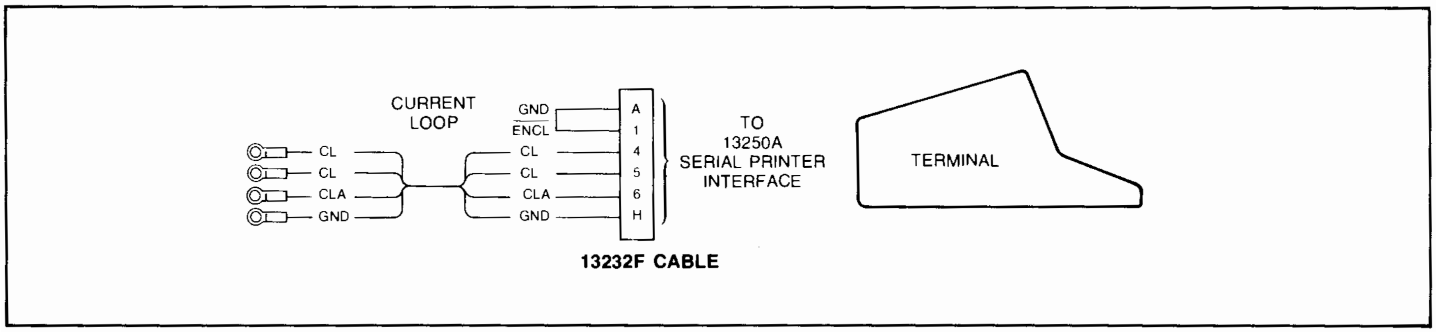


Figure 2-63. Current Loop Cabling

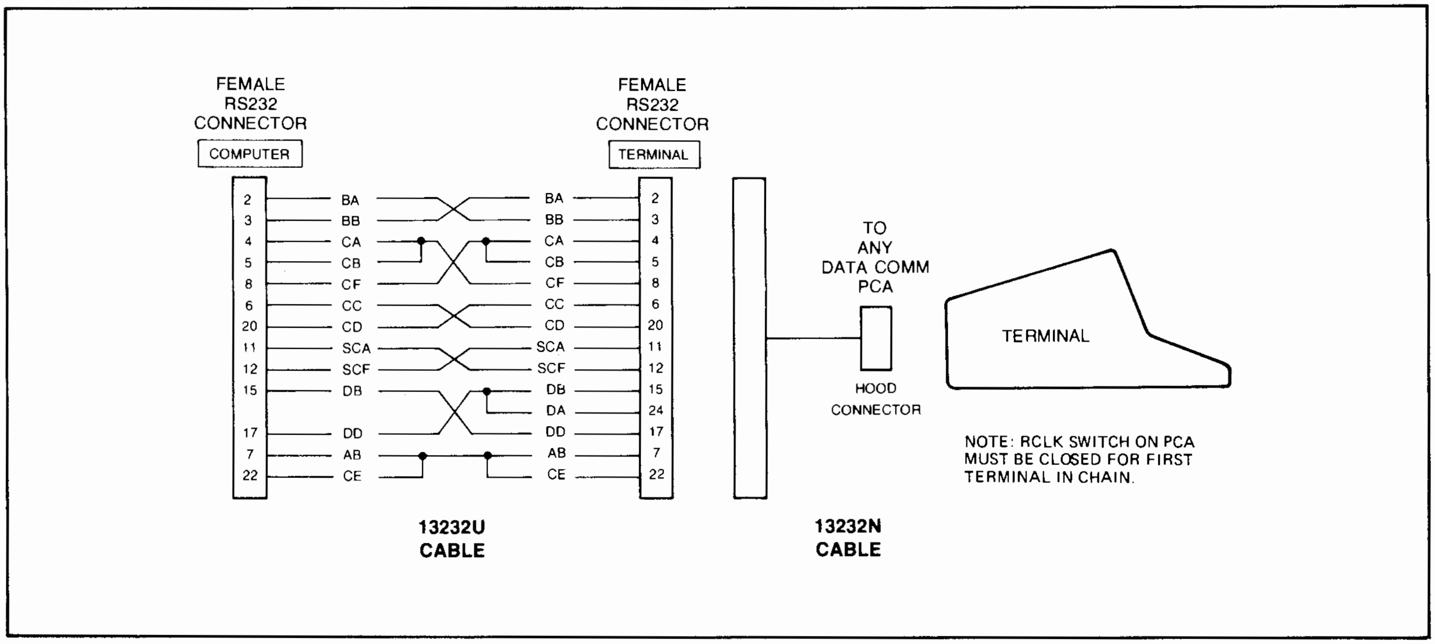


Figure 2-64. Modem By-Pass Cabling

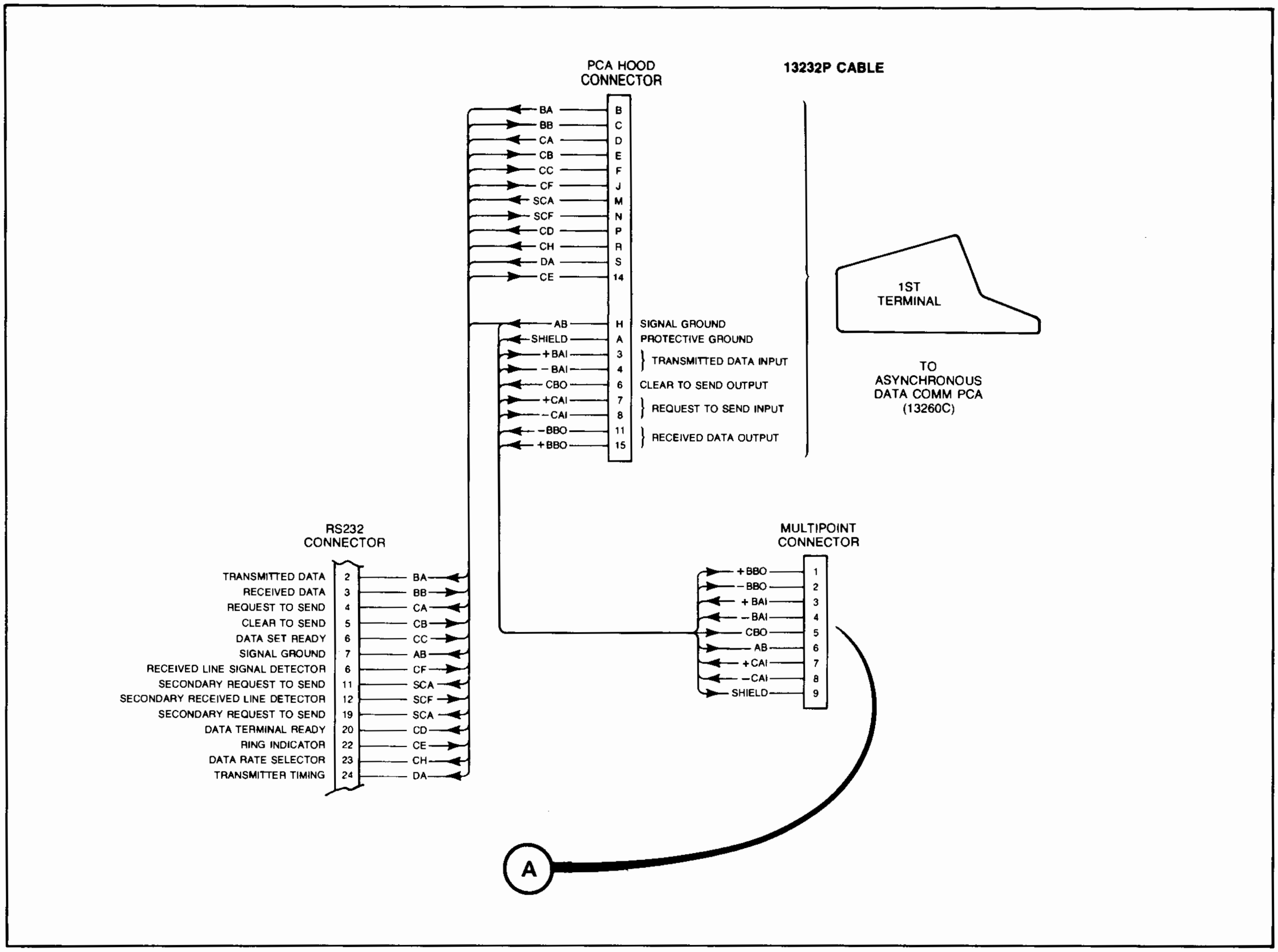


Figure 2-65. Asynchronous Multipoint Cabling (Sheet 1 of 2)

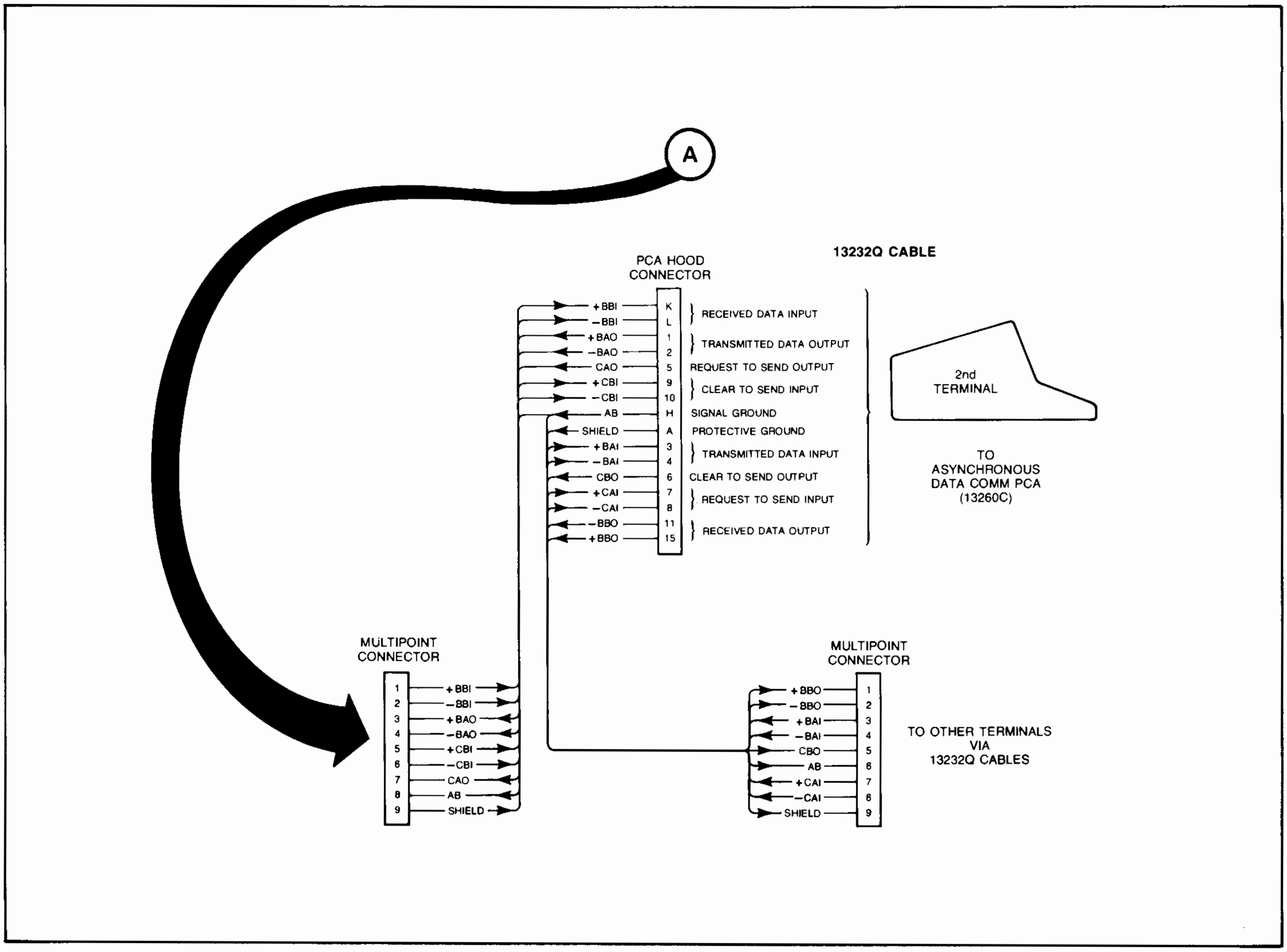


Figure 2-65. Asynchronous Multipoint Cabling (Sheet 2 of 2)

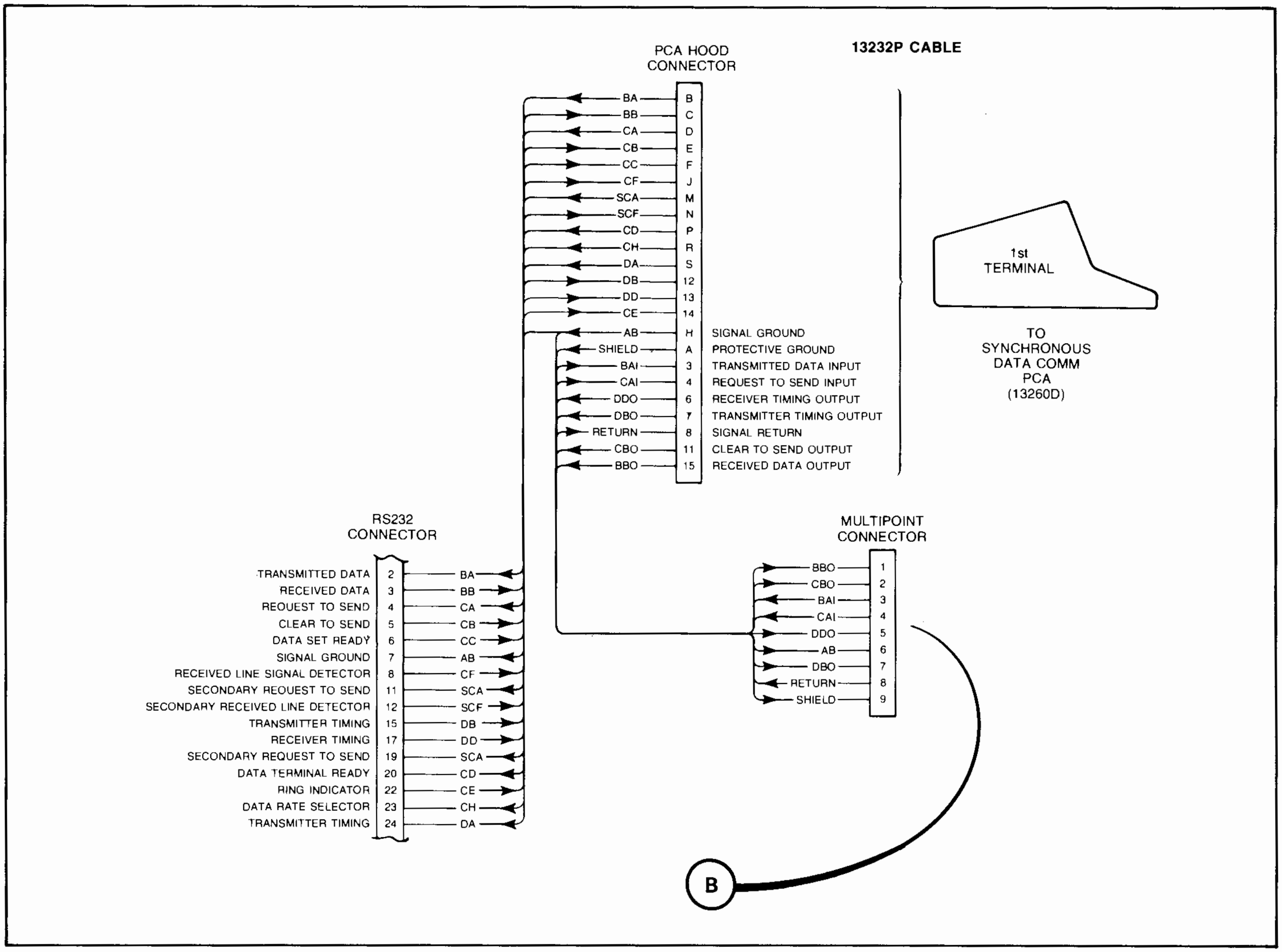


Figure 2-66. Synchronous Multipoint Cabling (Sheet 1 of 2)

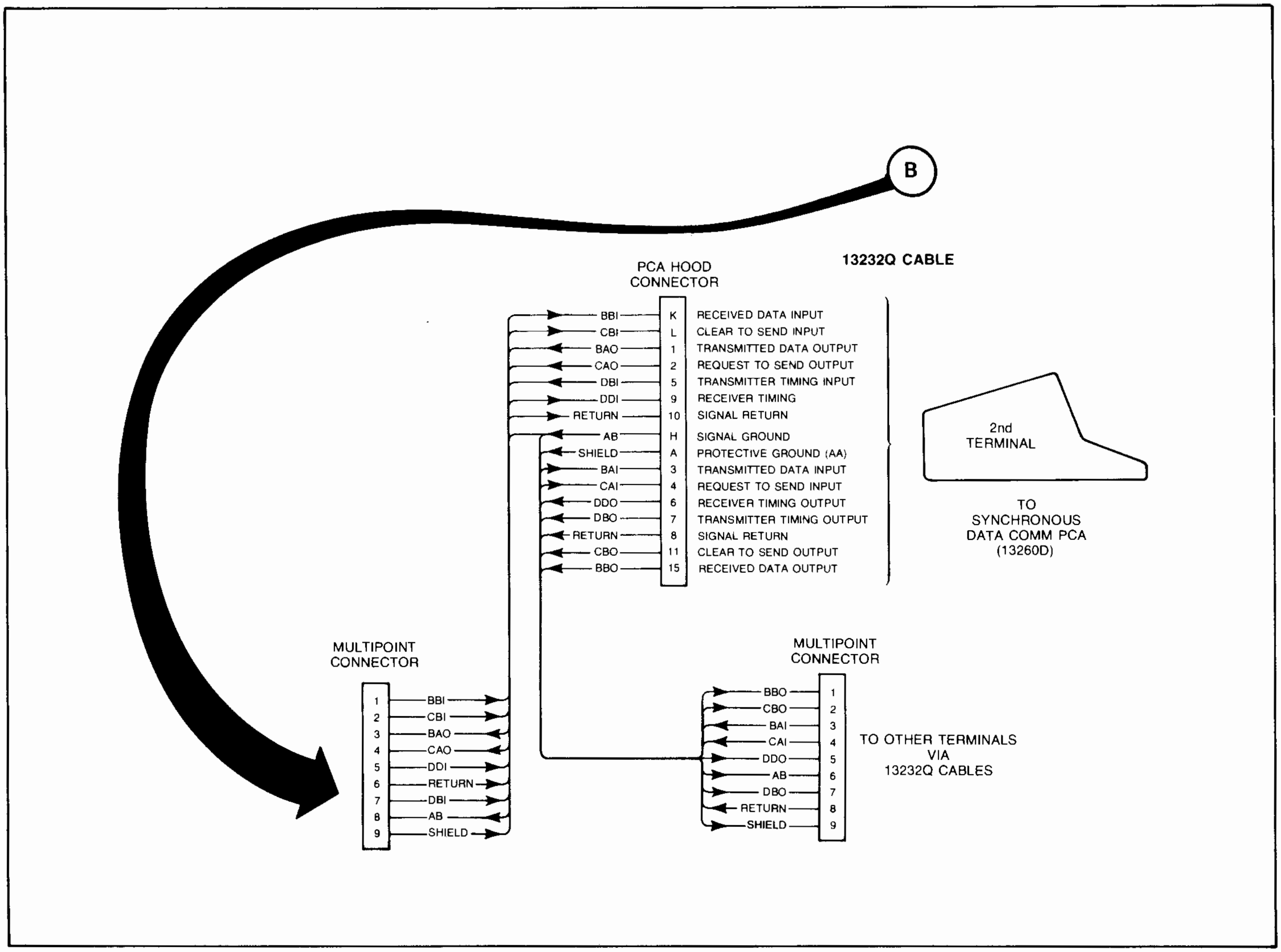


Figure 2-66. Synchronous Multipoint Cabling (Sheet 2 of 2)

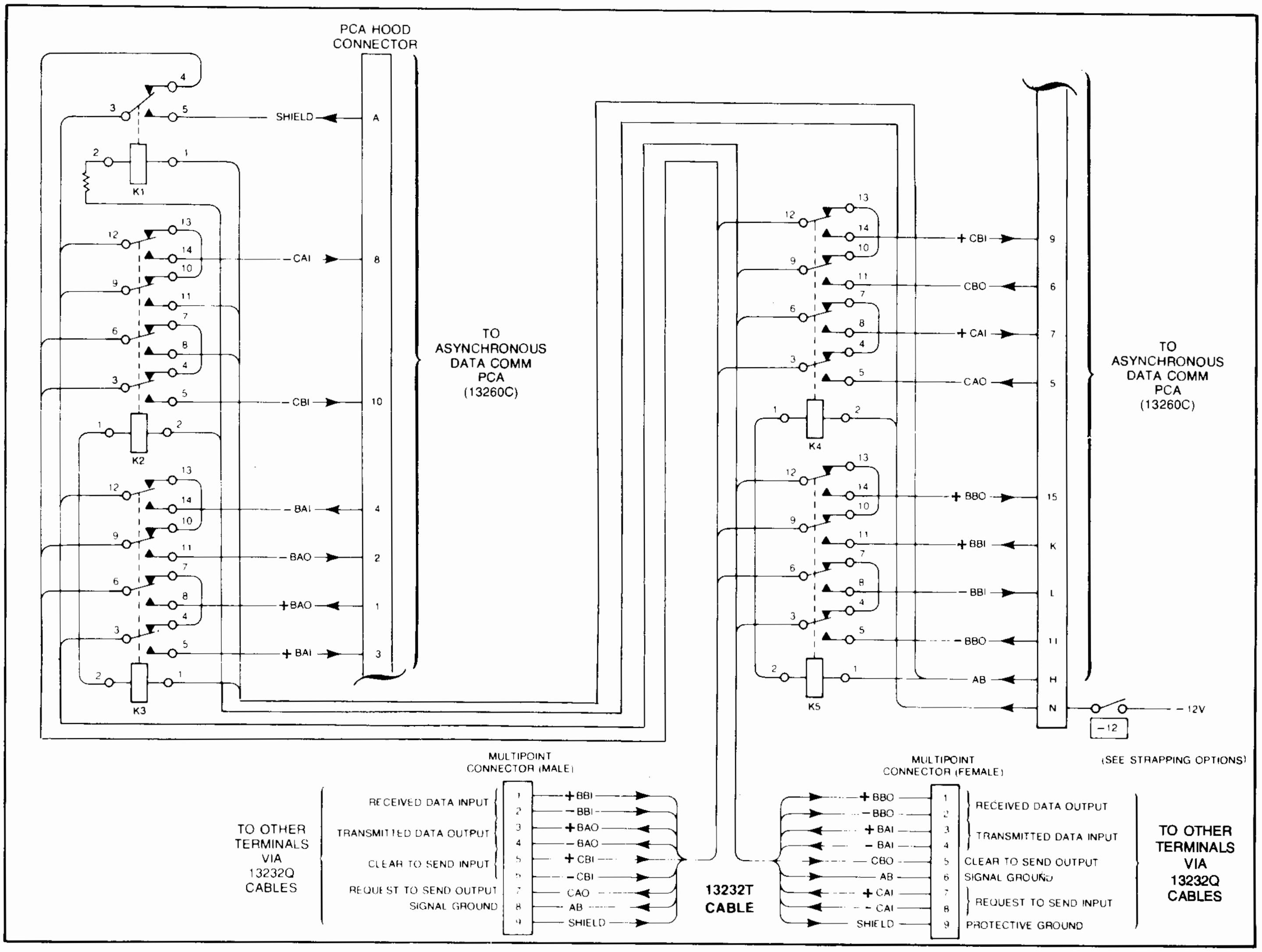


Figure 2-67. Power-Down-Protect Cabling for Asynchronous Multipoint Configuration

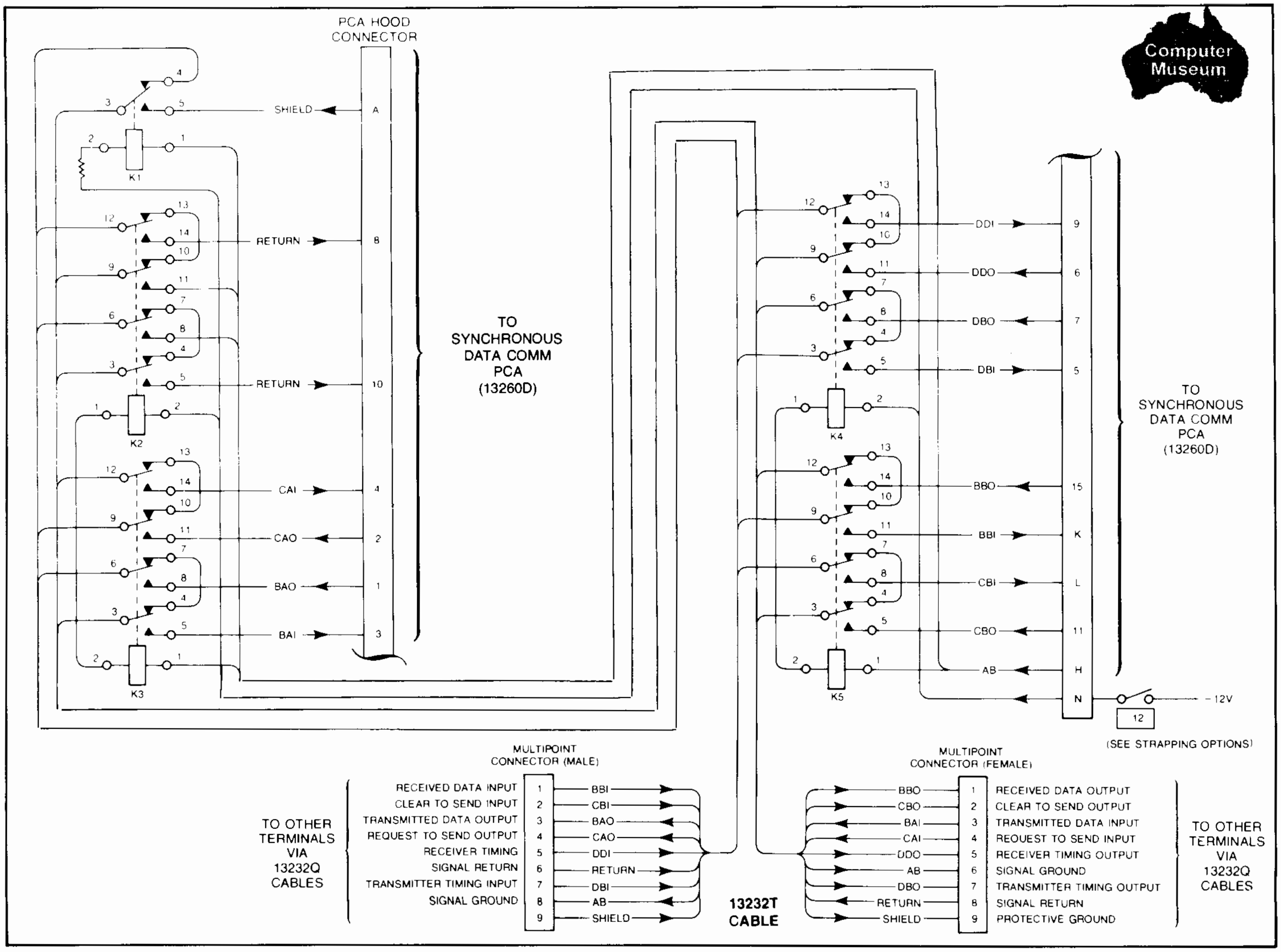
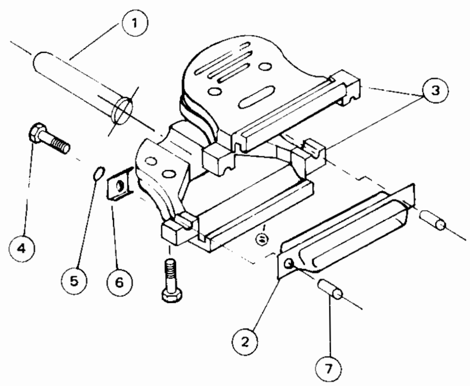
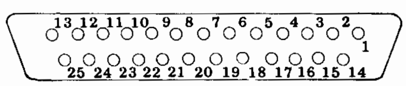


Figure 2-68. Power-Down-Protect Cabling for Synchronous Multipoint Configuration





VIEWED FROM SOLDER SIDE

RS232 Connector Kit, 5061-2405

Assembly Procedure:

1. ( ) Slide rubber bushing (item 1) over end of cable, leaving about 6 inches of cable end exposed for wire stripping, etc.

2. ( ) Strip back the cable jacket 1-inch.

3. ( ) Clip the unused conductor wires to the edge of the cable jacket.

4. ( ) Remove 1/4-inch of insulation from the ends of the conductor wires to be used.

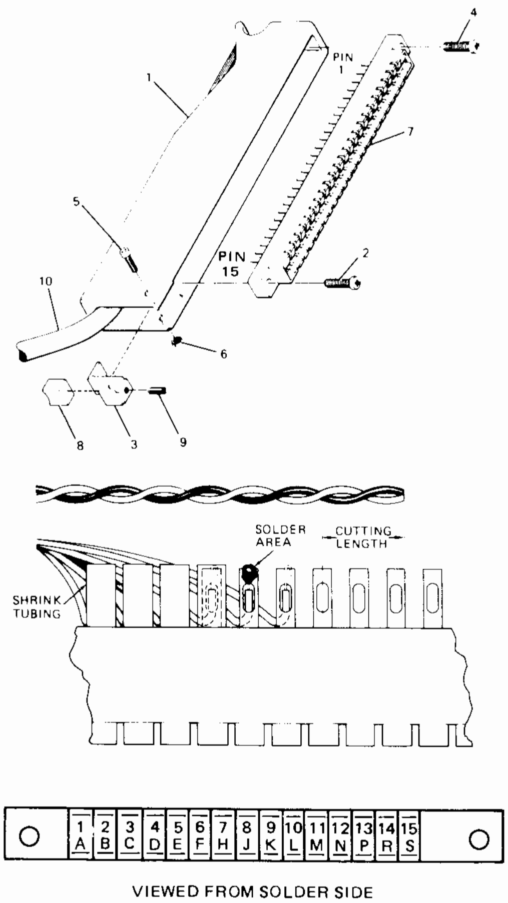
5. ( ) Solder the conductor wires onto the contacts of the contact assembly (item 2). (Select either the male or female contact assembly provided for your particular application.)

6. ( ) Slide the rubber bushing to the end of the cable such that the rubber bushing flange is flush with the stripped end of the cable jacket.

7. ( ) Assemble the two halves of the connector (item 3) onto the contact assembly (item 2). (Use the screws and nuts provided.)

8. ( ) Mount the two screws, threaded spacers, and other hardware (items 4 thru 7) onto the contact assembly.

Figure 2-69. Assembling the RS232C Connector



PCA Hood Connector Kit, 5061-1340

Assembly Procedure:

1. ( ) Insert approximately 10 inches of cable (item 10) into the connector hood (item 1).

2. ( ) Strip the outer jacket of the cable back 5 inches.

3. ( ) Remove approximately 1/4-inch of insulation from each signal wire.

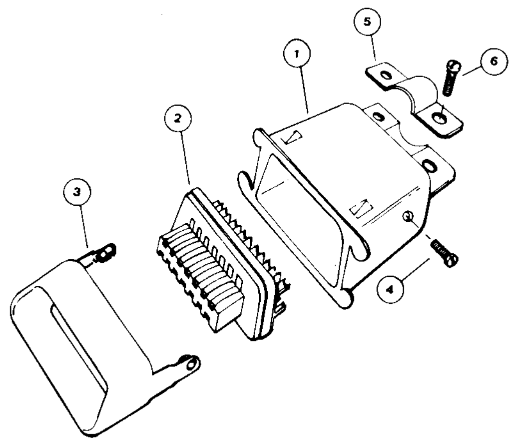
4. ( ) Starting at the end of the 30-pin connector (item 7) nearest pins S and 15, solder the signal wires to the appropriate pins on the connector, and insulate each pin with tubing as shown at left.

5. ( ) Install the 30-pin connector in the connector hood using the two self-tapping screws (items 2 and 4).

6. ( ) Install the cable clamp (items 3 and 8), and tighten it in place with the screw and nut (items 5 and 6).

7. ( ) Tighten the cable clamp on the cable with the setscrew (item 9).

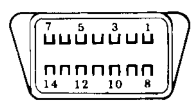
Figure 2-70. Assembling the PCA Hood Connector



Multipoint Connector Kit, 5061-2401

Assembly Procedure:

1. ( ) Insert cable through the outer housing (item 1).
2. ( ) Strip back the cable jacket 1-inch.
3. ( ) Clip any unused conductor wires to the edge of the cable jacket.
4. ( ) Remove 1/4-inch of insulation from the ends of the conductor wires to be used.
5. ( ) Solder the conductor wires onto the contacts of the contact assembly (item 2).
6. ( ) Assemble the multipoint connector by sliding the inner housing (item 3) over the contact assembly (item 2). Slide the outer housing over items 2 and 3 until the screw holes are aligned. Secure the entire assembly with the two screws (item 4).
7. ( ) Mount the cable clamp (item 5), and secure with the two screws (item 6).



MULTIPOINT CONNECTOR P2
(VIEWED FROM SOLDER SIDE)

MULTIPOINT CONNECTOR CABLING

ASYNCHRONOUS	P2			SYNCHRONOUS P2	
BBO	1	*	*	1	BBO
-BBO	2			2	CBO
BAI	3	*	*	3	BAI
-BAI	4			4	CAI
CBO	5	*	*	5	DDO
AB (GND)	6			6	AB (GND)
CAI	7	*	*	7	DBO
-CAI	8			8	RETURN
SHIELD	9			9	SHIELD

Asynchronous: TO PCA HOOD CONNECTOR (SEE FIG. 2-67)

Synchronous: TO PCA HOOD CONNECTOR (SEE FIG. 2-68)

* TWISTED PAIR

Figure 2-71. Assembling the Multipoint Connector

3

Strapping

Strapping 3

INTRODUCTION ....

This section provides instructions for configuring PCAs which contain configuration switches or jumpers. Those PCAs supplied with accessories are presented first in numerical order by accessory number. These are followed by any PCAs not supplied with accessories but containing configuration devices arranged in numerical order by PCA part number.

13231A Display Enhancements

USED WITH TERMINALS ....

All 264X-series terminals.

SELECTABLE CHARACTERISTICS ....

The following listed character sets are selectable for all terminals except the 2641A. For the 2641A, any one (but only one) of the three sets can be used. Character sets consist of one ROM for a 64 character set or two ROMs for a 128 character set.

1. Mathematics symbol character set (set 1 or A).
2. Line drawing character set (set 2 or B).
3. Large character set (set 3 or C).

PCA(s) TO BE STRAPPED ....

Display Enhancement PCA.

HOW ....

Strapping consists of setting switches (or inserting or removing jumpers on earlier PCAs). For each of the character sets to be used, at least one ROM must be inserted in the appropriate socket on the Display Enhancement PCA.

PROCEDURE ....

The Display Enhancement PCA contains 15 switches, five for each character set (or, on earlier PCAs, six jumpers, two for each character set). (See figure 3-1.) One ROM IC must be inserted in the appropriate socket on the PCA for the 64 upper-case characters of each character set and one ROM for the 64 lower-case characters of each set. Descriptions of the strapping options are given in tables 3-1 and 3-1A.

PROCEDURE (Continued) .... On earlier version PCAs having jumpers instead of switches, there are two selectable characteristics.

Note

Do not confuse the 128/64 character jumpers for *alternate character sets* with the 128 character jumper (located on the Display Control PCA) for the *standard character set.*

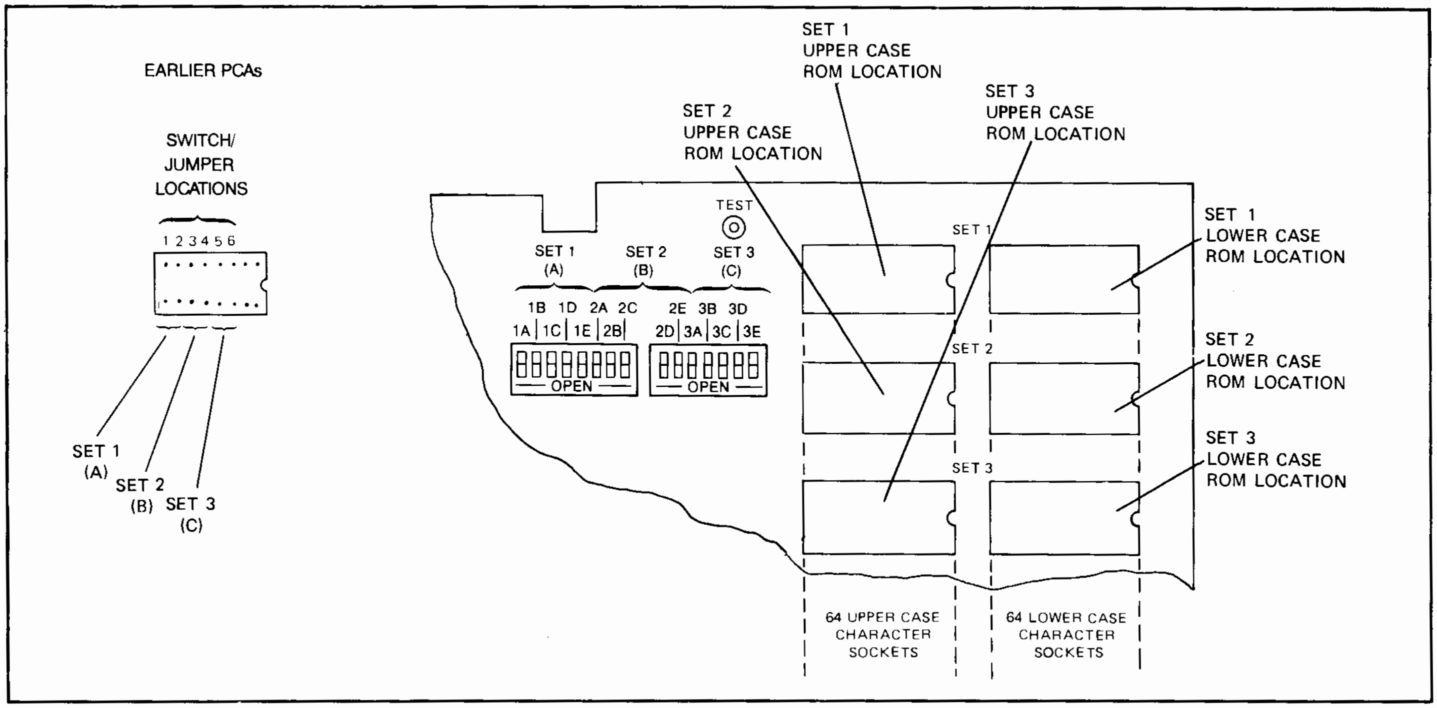


Figure 3-1. Display Enhancement PCA Switch/Jumper and ROM Socket Locations

Table 3-1. Display Enhancement PCA Strapping Options (on earlier PCAs)

STRAP	STRAPPING OPTION	JUMPER IN PLACE	NO JUMPER
1	Character Set 1 (set A) — 128 or 64 characters.	Alternate character set 1 (set A) is composed of 128 characters.	Alternate character set 1 (set A) is composed of 64 characters.
2	Character Set 1 (set A) — alphanumeric or microvector type.	Alternate character set 1 (set A) is of the alphanumeric type.	Alternate character set 1 (set A) is of the microvector type.
3	Character Set 2 (set B) — 128 or 64 characters	Alternate character set 2 (set B) is composed of 128 characters.	Alternate character set 2 (set B) is composed of 64 characters.
4	Character set 2 (set B) — alphanumeric or microvector type	Alternate character set 2 (set B) is of the alphanumeric type.	Alternate character set 2 (set B) is of the microvector type.
5	Character set 3 (set C) — 128 or 64 characters	Alternate character set 3 (set C) is composed of 128 characters.	Alternate character set 3 (set C) is composed of 64 characters.
6	Character set 3 (set C) — alphanumeric or microvector	Alternate character set 3 (set C) is of the alphanumeric type.	Alternate character set 3 (set C) is of the microvector type.

STRAPPING NON-2641A TERMINALS

Configuring the PCA consists of performing the following steps for character sets 1, 2, and 3:

1. If the lower-case characters for the set are to be used and the associated ROM is present, install a jumper in the first jumper location for the set (location 1, 3, or 5). If the lower-case ROM is missing or the set is not to be used, remove any jumper from the first location for the set.
2. If the characters for a set are in the alphanumeric format (refer to the paragraph on Supplemental Information), install a jumper in the second location for the set (location 2, 4, or 6). If the characters are in the microvector format, remove any jumper from the second location for the set.

Table 3-1A. Display Enhancement PCA Strapping Options (on later PCAs)

SWITCH			DESCRIPTION	
			CLOSED	OPEN
1A	2A	3A	Alphanumeric Sets	Microvector Sets
1B	2B	3B	Enables half-shift (for Alphanumeric Sets)	Disables half-shift (for Microvector Sets)
1C	2C	3C	128 Character Sets (2 ROMs)	64 Character Sets (1 ROM)
1D	2D	3D	Alphanumeric or 9-bit Microvector Sets	8-bit Microvector Set
1E	2E	3E	Both upper and lower case are 8-bit Microvector Sets	Lower case characters are 8-bit Microvector Characters and upper case are 9-bit Microvector Characters

Notes:
1. Switch E is only effective on 128 character, 8-bit Microvector Character Sets.
2. Set 1 consists of switches1A through 1E, set 2 consists of switches 2A through 2E, and set 3 consists of switches 3A through 3E.

PROCEDURE (Continued) .... STRAPPING 2641A TERMINALS

On 2641A terminals only one alternate character set is allowed because ROM ICs for APL characters occupy the ROM locations for character sets 1 and 2 on the Display Enhancement PCA (figure 3-2). This leaves room for only one alternate character set (set 3). Any one of the three alternate character sets can be used. Jumpers must be located in strapping positions 1 through 4 as shown in the accompanying illustration. Strapping positions 5 and 6 (for set 3) are strapped according to the rules listed in the table on Display Enhancement PCA Strapping Options.

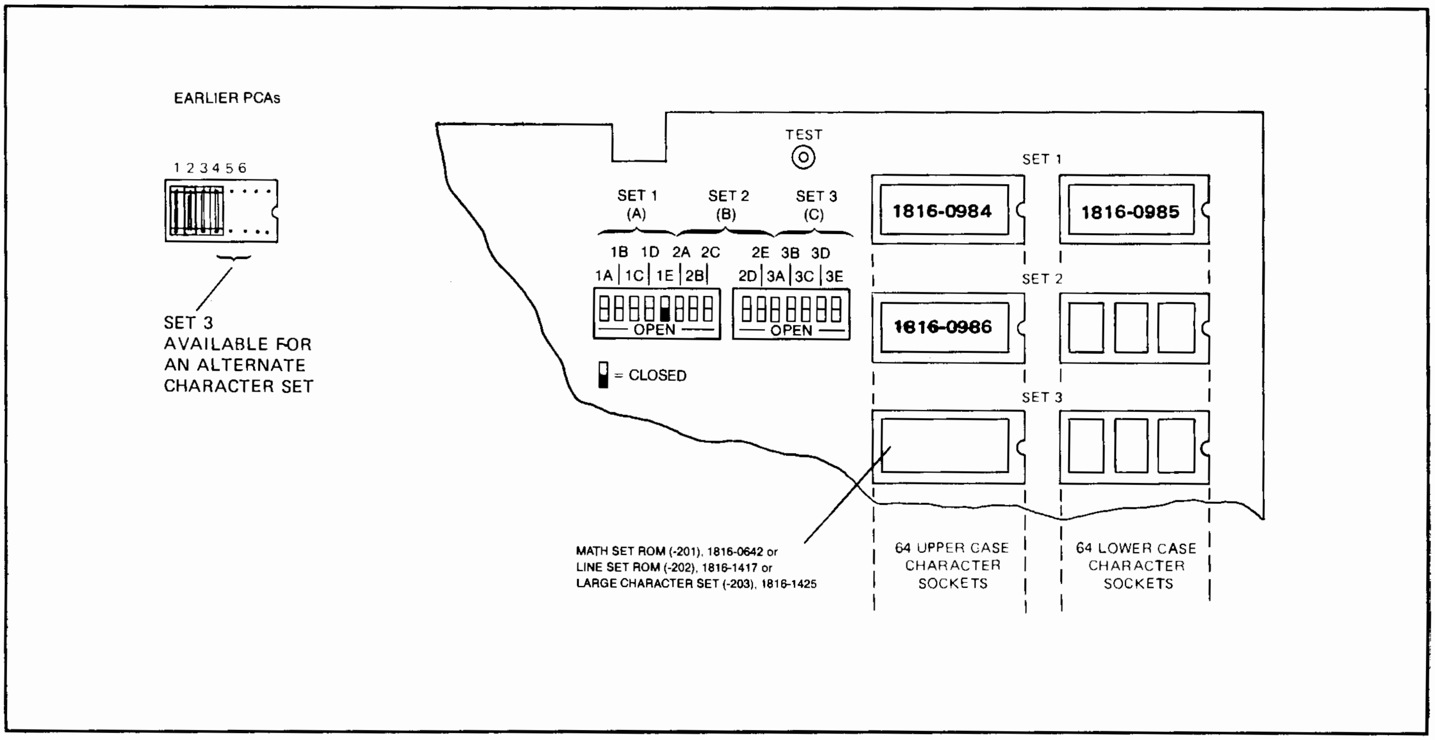


Figure 3-2. Display Enhancement PCA ROM Location and Strapping for 2641A Terminals

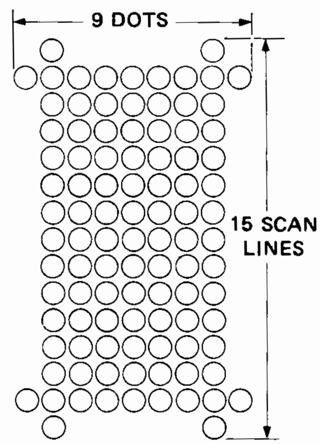
SUPPLEMENTARY INFORMATION .... Two types of character sets can be used in the terminal; alphanumeric and microvector.

ALPHANUMERIC CHARACTER SETS.

Alphanumeric sets are characterized by having a rectangle of 7 dots by 13 scan lines which are used for upper case, lower case, and control characters (figure 3-3). Two of the dot columns, one on either side of the character, are used for horizontal character to character spacing. Similarly, two scan lines are used for vertical row to row spacing.

MICROVECTOR CHARACTER SETS

Microvector sets use the entire 9 dot by 15 scan line rectangle without the half-shift or spacer columns and scan lines. As a result, all of the encoded dots appear and the characters can be concatenated horizontally and vertically for contiguous lines. The primary purpose of the microvector sets is to generate special symbols and line segments for limited graphic display applications, forms, or histogram plots.



Basic Character Cell of 9 Dots x 15 Scan Lines with Spacers Between Characters and Rows

Figure 3-3. Basic Character Cell of 9 Dots × 15 Scan Lines With Spacers Between Characters and Rows

EFFECT OF IMPROPER STRAPPING

128 CHARACTERS STRAPPED FOR 64

When a 128 character set is used and is strapped for 64 characters, only the first 64 characters in the set will be accessed. This will cause the "q" character, for example, to access the same display character as the "Q" character.

64 CHARACTERS STRAPPED FOR 128

Any attempt to access one of the lower case 64 characters ("a", "q", etc.) will result in a blank being displayed.

ALPHANUMERIC SET STRAPPED AS MICROVECTOR

Alphanumeric data strapped as microvector will normally result in characters that are skewed or fuzzy.

MICROVECTOR SET STRAPPED AS ALPHANUMERIC

Microvector data strapped as alphanumeric will display blanks for the microvector characters.

EXAMPLE

If the three standard alternate character sets (Math Set, Line Drawing Set, and Large Character Set) are used, the configuration may be as follows:

Math Set (placed in the first socket of set ROM 1816-0642) (figure 3-4)

Switch 1A = Closed, since character data is in alphanumeric format.

Switch 1B = Closed, since alphanumeric format used half-dot shifting.

Switch 1C = Open, since only 64 characters are used.

Switch 1D = Closed, since alphanumeric character set is used.

Switch 1E = Closed or open, has no effect on alphanumeric character sets.

On earlier PCAs, jumper 1 = Out, jumper 2 = In.

Line Set (placed in the first socket of set ROM 1816-1417)

Switch 2A = Open, since data is in microvector format.

Switch 2B = Open, since data is in microvector format.

Switch 2C = Open, since there are only 64 characters.

EXAMPLE CONTINUED ....

Switch 2D = Open, since 8-bit microvector character set is used.

Switch 2E = Closed or open, has no effect on 64 microvector character sets.

On earlier PCAs, jumpers 3 and 4 = Out.

Large Character Set (placed in the first socket of set ROM 1818-1425).

Switch 3A = Open, since the data is in microvector format.

Switch 3B = Open, since the data is in microvector format.

Switch 3C = Open, since there are only 64 characters.

Switch 3D = Open, since 8-bit microvector character set is used.

Switch 3E = Closed or open, has no effect on 64 microvector character sets.

On earlier PCAs, jumpers 5 and 6 = Out.

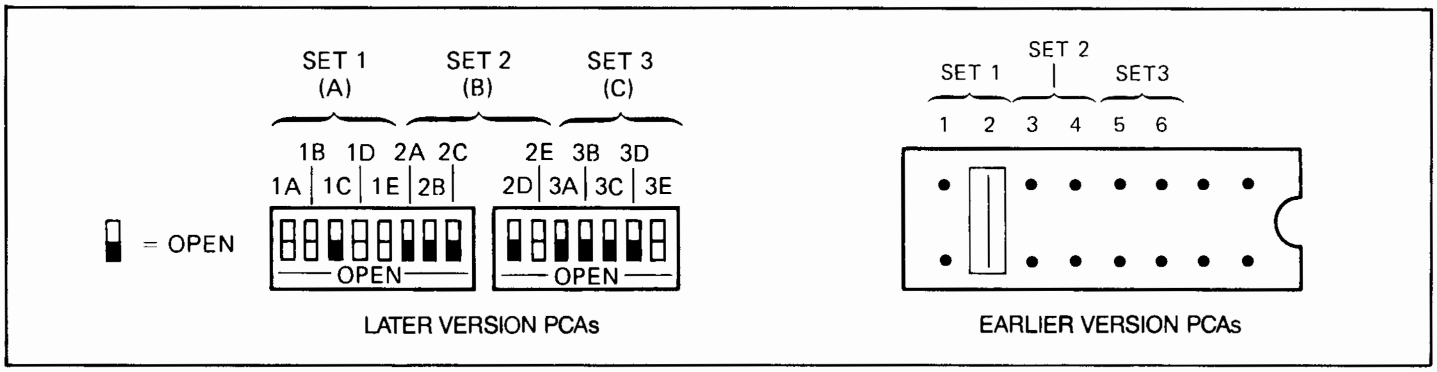


Figure 3-4. Example of Strapping Configuration for Set 1 = Math Set, Set 2 = Line Drawing Set, and Set 3 = Large Character Set

Keyboard Interface PCA (02640-60019, -60123, -60246)

USED WITH TERMINALS .... Three Keyboard Interface PCAs are used in the 264X terminals; 02640-60019, 02640-60123 and 02640-60246. PCA 02640-60019 is an early model with eight straps; PCA 02640-60123 is a later version with 24 straps; PCA 02640-60246 is the newest version with 24 straps. Usage is as follows:

02640-60019	02640-60123, -60246
2640A/C 2644A	2640B/N/S 2641A 2642A All 2645 terminals 2647A 2648A All 2649 terminals

SELECTABLE CHARACTERISTICS .... The operating characteristics for the terminal are selected using switches on the Keyboard Interface PCA and the keyboard. These switches affect both local operation and operation with a computer or peripheral device. Refer to the strapping instructions for accessories 13260A/B/C/D for a list of the operating characteristics selectable on the Keyboard Interface PCA.

PCA(s) TO BE STRAPPED .... Keyboard Interface PCA (02640-60019, 02640-60123 or 02640-60246)

HOW .... Strapping consists of setting 24 configuration switches on the 02640-60123 or 02640-60246 Keyboard Interface PCA and inserting or removing jumpers from eight jumper locations on the 02640-60019 PCA. The functions of the eight jumpers on the 02640-60019 PCA are identical to the functions of the first eight switches on the 02640-60123 and 02640-60246 PCAs.

PROCEDURE .... For standard operation, set all switches on the PCA to the closed position (or insert jumpers in all jumper positions). If non-standard operation is desired or to check any switch selection, refer to table 3-6 or table 3-9 located with the strapping instructions for accessories 13260A/B/C/D.

13234A 4K RAM Memory PCA

SELECTABLE CHARACTERISTICS ...

The starting address of the block of memory being added is the only characteristic selectable on the 4K RAM Memory PCA.

PCA(S) TO BE STRAPPED ....

1. 4K RAM Memory PCA.
2. On 2640 A, B, N, and S terminals, the Control Memory (Control Store) PCA contains 1K of RAM memory. For these terminals, the Control Memory PCA must be strapped to indicate the starting address of this 1K of memory.

HOW ....

1. Check for presence of the unlabeled jumper near the "−5" test point on the 4K RAM Memory PCA.
2. Determine the starting address of the block of memory to be added.
3. Strap the 4K RAM Memory PCA to indicate the starting address of the block of memory it contains.
4. For 2640 A, B, N, and S terminals, strap the control Memory PCA to indicate the starting address of the 1K of RAM memory contained on it.

HOW TO DETERMINE THE STARTING ADDRESS FOR A BLOCK OF MEMORY

For all terminals, memory blocks are added to the terminal memory by starting at the maximum amount of memory recognized by the terminal and working backward, from higher- to lower-numbered memory, in memory-block steps (figure 3-5).

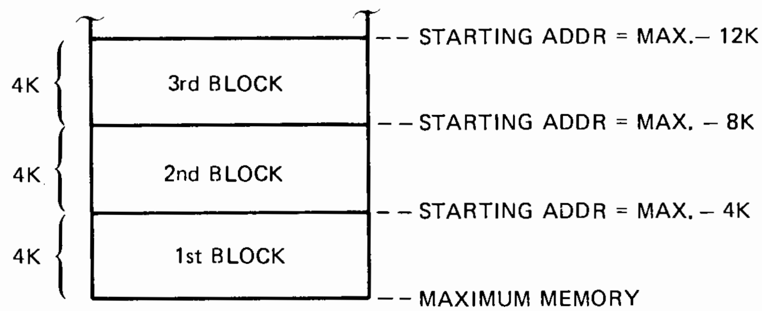


Figure 3-5. 4K RAM Memory PCA Starting Addresses

The starting address of the first block of memory is determined by subtracting the amount of memory in the block to be added from the maximum memory recognized by the terminal.

The starting address for the second and subsequent blocks is determined by subtracting the amount to be added from the starting address of the last block added.

MAXIMUM MEMORY

2640	16K
2644	16K
2641	64K
2645	64K
2648	64K

The following equations summarize the foregoing information:

STARTING ADDR FOR FIRST BLOCK	=	MAX. MEMORY	—	AMOUNT OF MEMORY IN FIRST BLOCK
STARTING ADDR FOR SUBSEQUENT BLOCKS	=	STARTING ADDR FOR LAST BLOCK	—	AMOUNT OF MEMORY IN BLOCK BEING ADDED

Equations for Determining the Starting Address of a Block of RAM Memory

The following table lists the lower limit for the starting address of RAM memory for each terminal in which the 4K RAM Memory PCA might be used.

Lower Limits for Starting Address of RAM Memory

TERMINAL	LOWER LIMIT
2640A,B,N,S	8K
2640C, 2644	12K
2641	48K*
2645	48K*
2648	48K*

*Note

The 4K block of memory between 48K and 52K, if used, is restricted to use as data communications buffer space.

PROCEDURE ....

1. Ensure that a jumper is installed in the unlabeled jumper location near the "−5" test point in the lower center of the PCA(figure 3-6).

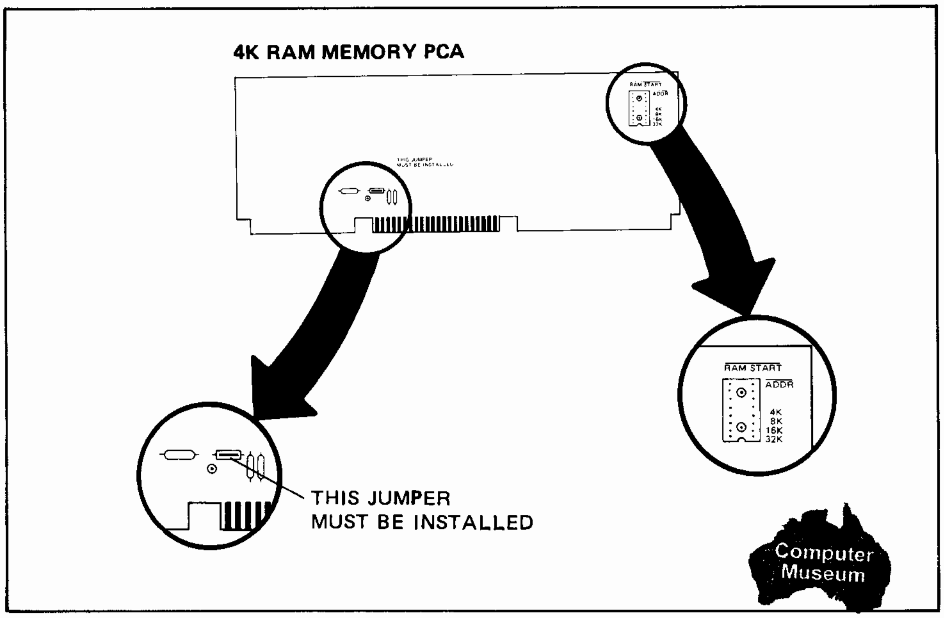


Figure 3-6. 4K RAM Memory PCA Jumper Locations

2. Determine the starting address of the block of memory to be added (refer to the preceding paragraph for instructions).

3. Strap the 4K RAM Memory PCA to indicate the starting address of the block of memory on the PCA. See figure 3-6 for the jumper locations. Terminals 2640C and 2644A must be strapped as shown in figure 3-7. See the examples for further clarification on strapping of the other terminals.

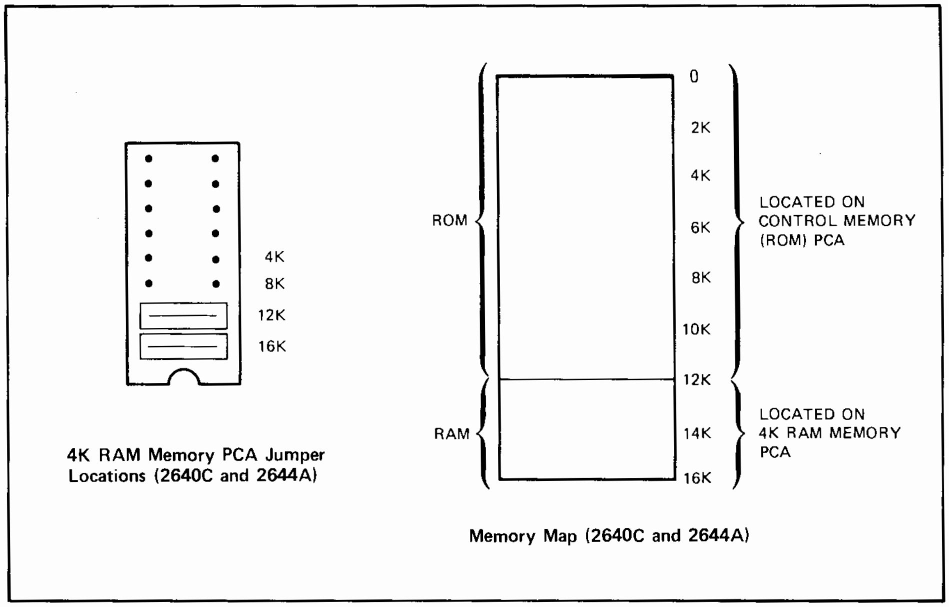


Figure 3-7. +4K Memory PCA Strapping for 2640C and 2644A Terminals

Note

The starting address for the block of memory on a 4K RAM Memory PCA is indicated by two methods, depending on the terminal in which the PCA is to be used. For 2640 and 2644 terminals, the starting address is indicated by summing the labels (4K, 8K, 16K, and 32K) of the empty jumper locations.

For 2641, 2645, and 2648 terminals, the starting address is indicated by summing the labels of the jumper locations occupied by jumpers. (The unlabeled jumper locations are not used and should be empty of jumpers.)

4. For 2640A, B, N, and S terminals, strap the Control Memory (Control Store) PCA to indicate the starting address of the 1K of RAM memory contained on it. The starting address is indicated by summing the labels (4K, 8K, 16K, and 32K) of the empty jumper locations (figure 3-8). Note that the lower limit of RAM memory for these terminals is 8K. Therefore, if all the memory space between the lower (8K) and upper limit (16K) is occupied, the 1K of RAM on the Control Memory cannot be used and the strapping locations for it must be empty of jumpers.

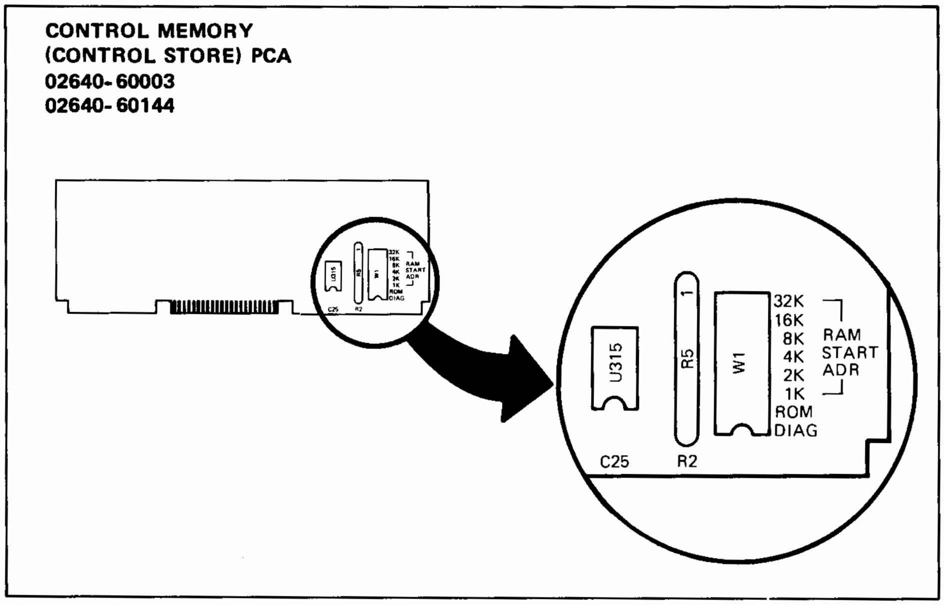


Figure 3-8. Control Memory (Control Store) PCA Strapping Locations (2640A, B, N, and S Terminals)

EXAMPLES .... The following figures (3-9 through 3-11) illustrate several RAM memory strapping configurations for each type of terminal.

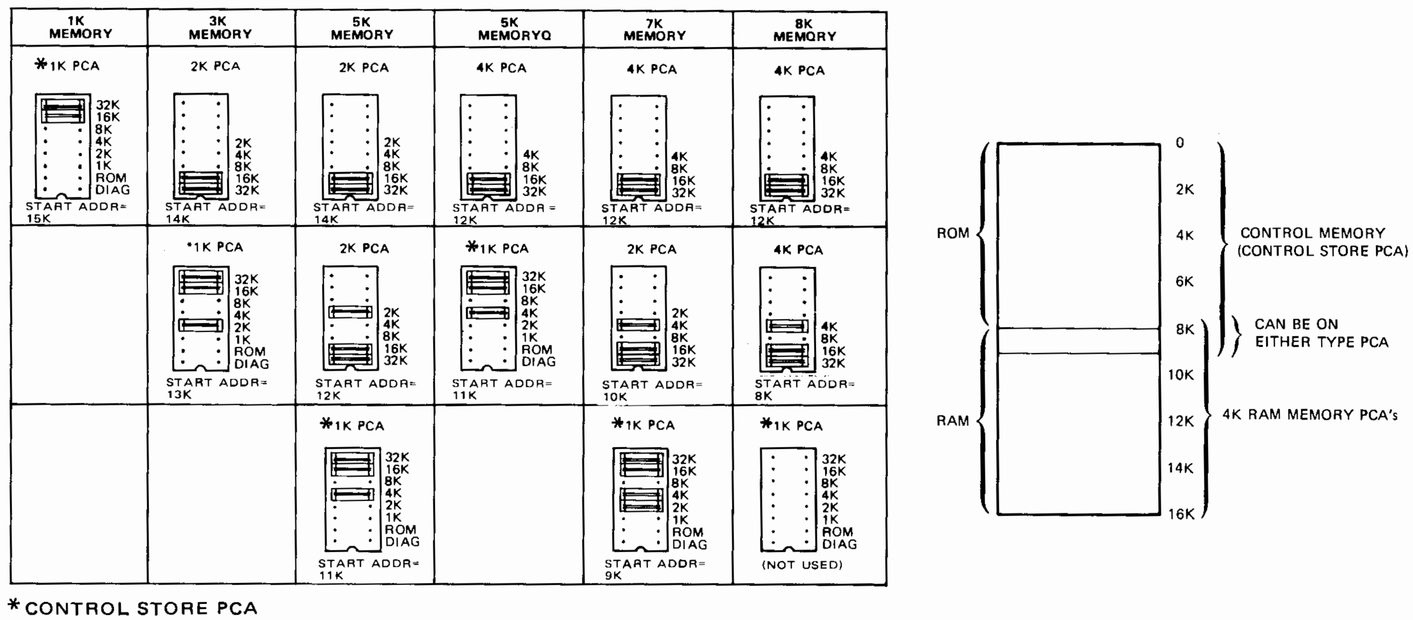


Figure 3-9. +4K Memory PCA Strapping Examples for 2640A, B, N, and S Terminals

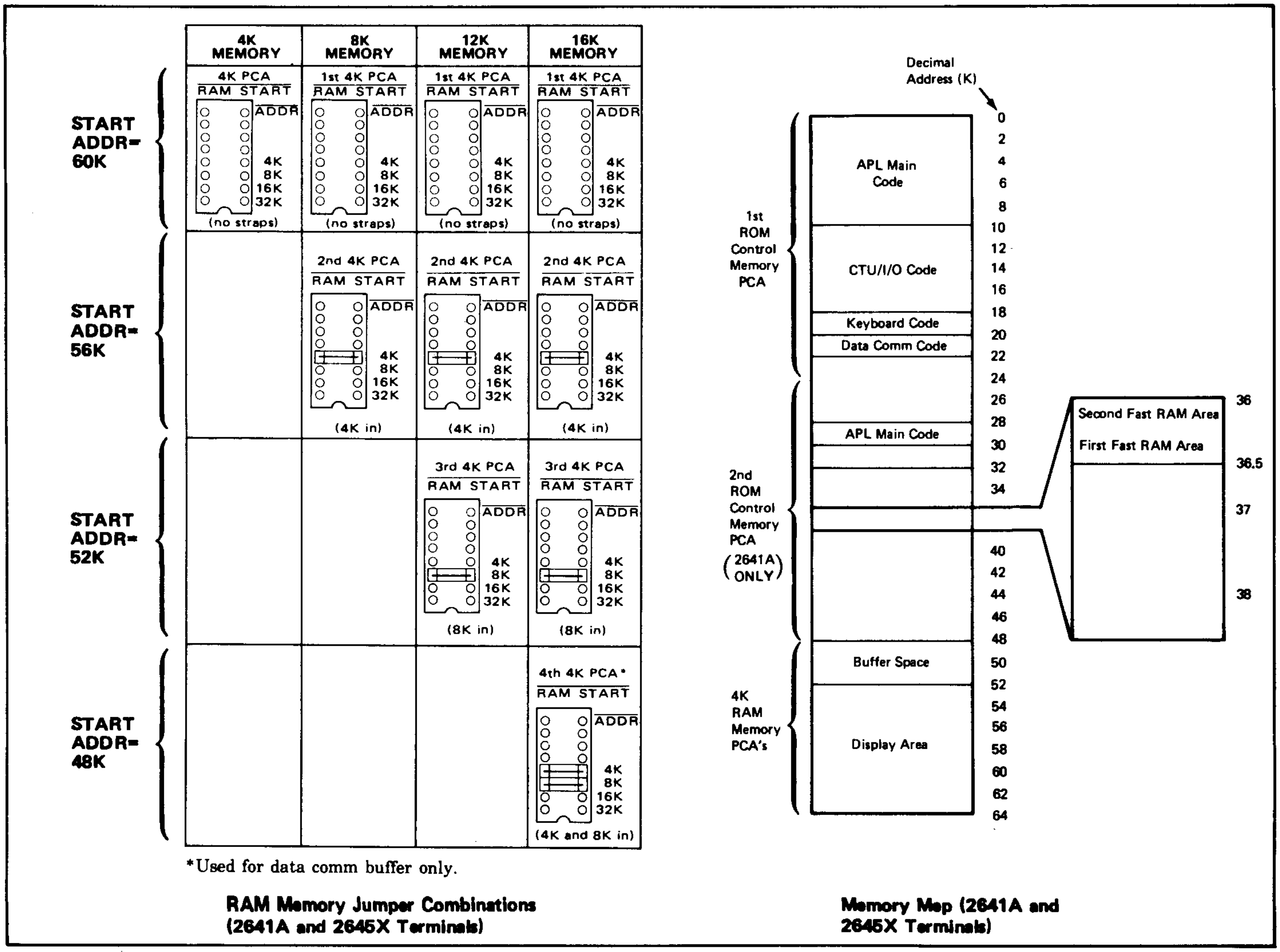


Figure 3-10. +4K Memory PCA Strapping Examples for 2641A and 2645X Terminals

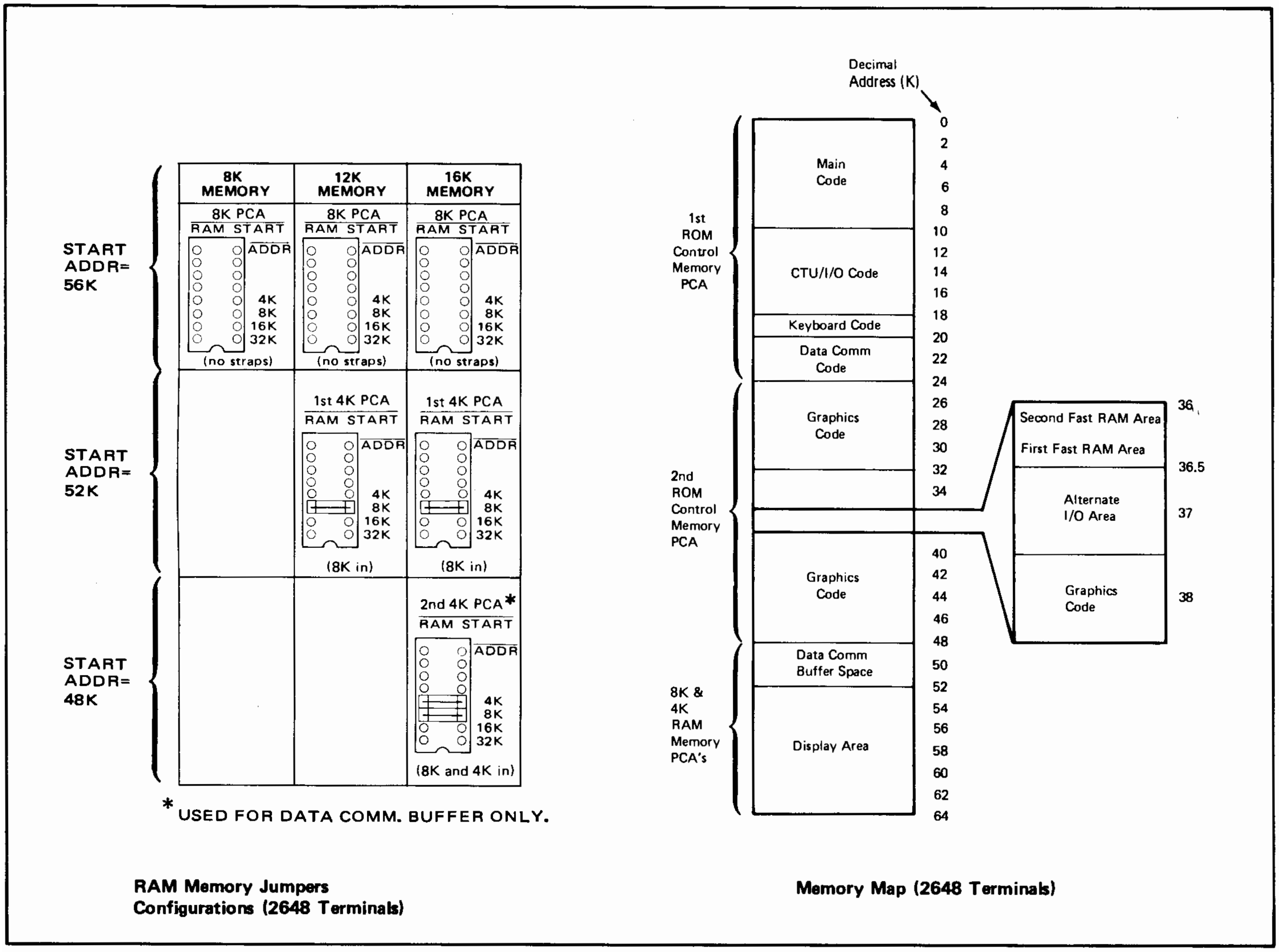


Figure 3-11. +4K Memory PCA Strapping Examples for 2648 Terminals

13236A Cartridge Tape Unit

SELECTABLE CHARACTERISTICS ... One version (02640-60033) of the CTU Interface PCA requires selection, by strapping, of the address (0 through 14) by which it is known to the processor.

PCA TO BE STRAPPED .... The 02640-60033 version of the CTU Interface PCA is the only version which requires strapping.

PROCEDURE .... Strap the jumper locations to select, in binary code, the PCA address (figure 3-12). If a jumper location is occupied by a jumper, the associated binary bit is one. If unoccupied, the associated binary bit is a 0. For example, address 13 is represented as follows:

W0 (2^0)	W1(2^1)	W2 (2^2)	W3 (2^3)
1	0	1	1

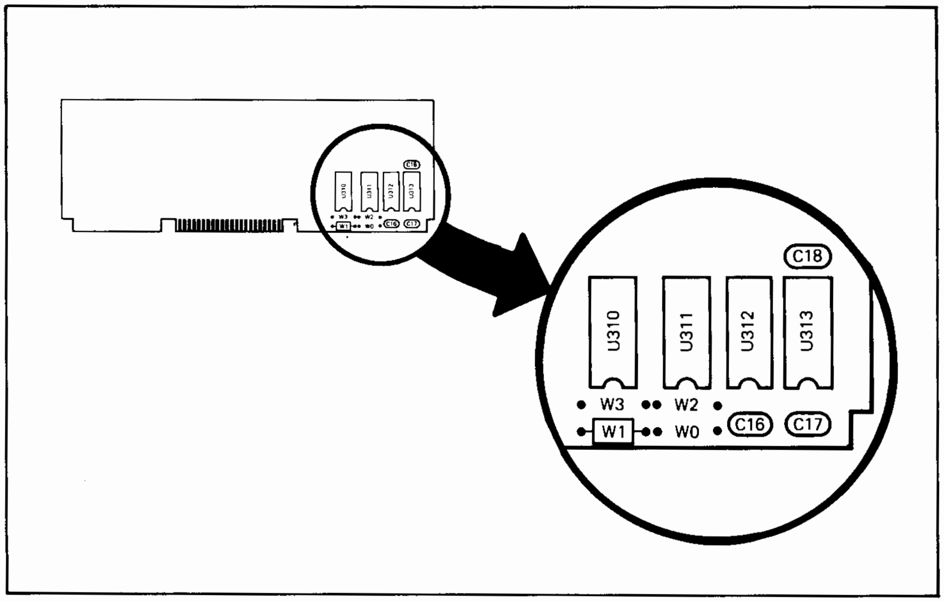


Figure 3-12. Jumpers Locations (Address 13 Selected)

13238A Terminal Duplex Register

USED WITH TERMINALS .... All 264X-series terminals.

SELECTABLE CHARACTERISTICS ...

1. Apply a high or low voltage level at the inputs to the input data register as the inactive level of the input data signals.
2. Enable or disable setting the Out flag and activating the Command Out signal when the program supplies an output command (STA if memory-mapped I/O is used).
3. Select the address for the Terminal Duplex Register (TDR) PCA by which it will be addressed by the processor.
4. Select the voltage levels of the Device In and Device Out signals which will set the In flag and Clear the Out flag, respectively.
5. Select the active levels of the Command In and Command Out signals.
6. Select whether the contents of the output register will be supplied to the external device constantly or only when the Out flag is set.
7. Select the type of Strobe signal supplied to the external device.

PCA TO BE STRAPPED .... Terminal Duplex Register PCA.

PROCEDURE ....

1. If the TDR PCA is to be used with a 9866A/B or 9867A printer the jumper configuration is standardized as shown in figure 3-13.
2. Remove all jumpers from the TDR PCA.
3. Strap jumper locations E, F, G, and H to reflect the PCA address (refer to table 3-2 for jumper configuration).
4. Using the strapping options table which follows as a reference, place jumpers in the remaining jumper locations to select the desired characteristics.

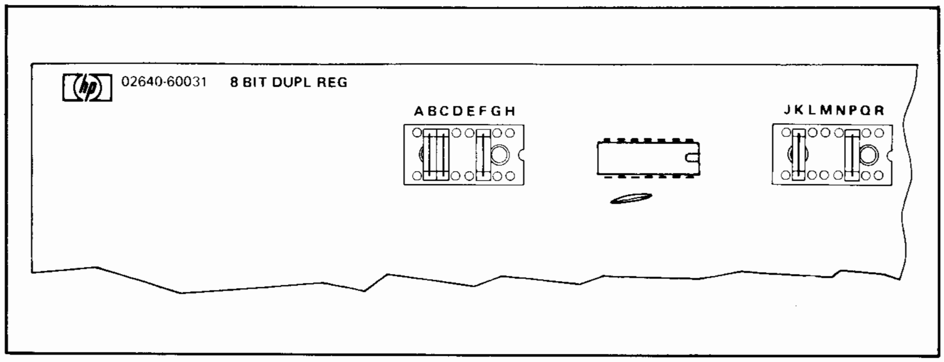


Figure 3-13. Terminal Duplex Register PCA Jumper Configuration for Use with 9866A/B or 9867A Printers

Table 3-2. Terminal Duplex Register (TDR) PCA Strapping Options

STRAP	STRAPPING OPTION	JUMPER IN PLACE (NORMAL OPERATION)	NO JUMPER
A, B	Jumper A or B is selected to apply the inactive voltage level of DATA IN signals 0 through 7 to the input of the input data register.	**CAUTION** Jumper locations A and B must not both contain jumpers. If this condition exists, the power supply output will be shorted to ground. If the active level of the DATA IN signals from the external device is high, a jumper should be placed in location A to supply a low (ground) voltage at the inputs to the input register while the input signals are inactive. If the active level of the DATA IN signals is low, a jumper should be placed in B to apply a high to the input register while the input signals are inactive.	A jumper should be located in either A or B to avoid entry of false data into the input register.
C	Enables or disables setting the Out flag and activating the Command Out signal when the TDR PCA is selected and the I/O, WRITE, and REQ signals are active.	When the PCA is selected on address lines ADDR4, ADDR9, ADDR10, and ADDR11, and the I/O, WRITE, and REQ signals are active (if memory-mapped I/O is used, these conditions occur when a STA command is executed), the Out flag is set and the Command Out signal to the external device becomes active. Also, if a jumper is present in location N, the contents of the output register are supplied to the external device. (Storing the data from the processor into the output register also occurs as a result of a STA command but this event is not dependent on strapping at location C.)	Storing of data from the processor in the output register is the only event that occurs when the PCA is selected on the address lines and the I/O, WRITE, and REQ signals are active.
D	Not used.		
E thru H	These jumpers correspond to address lines ADDR4, ADDR9, ADDR10, and ADDR11 and are used to assign a unique address to the PCA by which it will be known to the processor. ADDR4 . . .E. . .2^0 ADDR9 . . .F. . .2^1 ADDR10. . .G. . .2^2 ADDR11. . .H. . .2^3	The corresponding address line must be high to select the PCA.	The corresponding address line must be low to select the PCA.

Table 3-2. Terminal Duplex Register (TDR) PCA Strapping Options (Continued)

STRAP	STRAPPING OPTION	JUMPER IN PLACE (NORMAL OPERATION)	NO JUMPER
J	Selects active level of the DEVICE IN signal from the external device. (This signal from the external device sets the IN flag; indicating the external device has supplied input data to the TDR PCA.)	The high level of the DEVICE IN signal is selected as the active level.	The low level of the DEVICE IN signal is selected as the active level.
K	Selects the active level of the DEVICE OUT signal from the external device. (This signal from the external device clears the OUT flag.)	The high level of the DEVICE OUT signal is selected as the active level.	The low level of the DEVICE OUT signal is selected as the active level.
L	Selects the active level of the COMMAND IN signal which signals the external device the TDR PCA is ready to receive input.	The high level of the COMMAND IN signal is selected as the active level.	The low level of the COMMAND IN signal is selected as the active level.
M	Selects the active level of the COMMAND OUT signal which signals the external device the TDR PCA is ready to send output.	The high level of the COMMAND OUT signal is selected as the active level.	The low level of the COMMAND OUT signal is selected as the active level.
N	Selects whether the contents of the output register will be supplied to the external device constantly or only when the Out flag is set and the Command Out signal is active.	The contents of the output regster are supplied to to the external device only while the Out flag is set and the Command Out signal is active.	The contents of the output register are supplied to the external device constantly.
P,Q, R	Select the type of Strobe signal generated to the external device.	**CAUTION** Only one jumper is allowed in locations P, Q, and R. If one of these locations is occupied by a jumper, the other two must be empty or the strobe circuits may be damaged. P — The Strobe signal is a 0V, negative-going, 1-microsecond pulse. Q — The Strobe signal is a +5V, positive-going, 1-microsecond pulse. R — The Strobe signal is a steady +5VC voltage level.	If no jumper is present in any of these three locations, the Strobe line is open-circuited on the TDR PCA end.

13245A PROM Character Sets

SELECTABLE CHARACTERISTICS ...

Selection of the character set to be replaced by the PROM character set(s) is done by strapping the PROM character PCA. The character sets which can be replaced are:

1. The primary character set (the set normally used by the terminal).
2. Any one or two of the three alternate sets available with Display Enhancement Accessory 13231A, as follows:
   a. Math symbol set.
   b. Line drawing set.
   c. Large character set.

PCA'S TO BE STRAPPED............

PROM CHARACTER PCA. The PROM Character PCA must be strapped to select the existing character set to be replaced by the PROM character set.

DISPLAY ENHANCEMENT PCA. If any of the Accessory 13231A (Display Enhancement) character sets is to be replaced, the Display Enhancement PCA must be restrapped.

DISPLAY CONTROL PCA. If the terminal primary character set is to be replaced, the strap on the Display Control PCA must be checked.

PROCEDURE........................

CAUTION

MOS integrated circuits can be demaged 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 MOS circuits in carpeted areas.

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

PROCEDURE (Continued) ....

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

ENSURE that the circuit, 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.

1. Using table 3-3 as a guide, strap jumper locations W1 and W2 (figure 3-14) on the PROM character PCA to select the character set(s) to be replaced.

2. Insert the PROMs in the sockets indicated in table 3-3 for the character set(s) to be replaced (figures 3-14 and 3-15).

3. If any display enhancement character set is to be replaced, strap Display Enhancement PCA 02640-60024 as indicated in table 3-3.

4. If the primary character set is to be replaced, install a jumper in the "128 CH" jumper location W1 on Display Control PCA 02640-60112.

Table 3-3. PROM Character Set Strapping

CHARACTER SET TO BE REPLACED	PROM CHARACTER BOARD				DISPLAY BOARD AFFECTED	
	JUMPER W1 POSITION	PROM SOCKETS USED	JUMPER W2 POSITION	PROM SOCKETS USED	BOARD NAME	JUMPER POSITION
SET 0 (PRIMARY SET)	0,1	XU11—XU14	Not Used	Not Used	DSPY CNTL	In
ALT SET 1	0,1	XU11—XU14 (Also XU15 if Set 1 is microvector)	Not Used	Not Used	DSPY ENH	W1,W2 In (W2 Out if Set 1 is microvector)
ALT SET 2	2	XU11—XU14 (Also XU15 if Set 2 is microvector)	Not Used	Not Used	DSPY ENH	W3, W4 In (W4 Out if Set 2 is microvector)
ALT SET 3	Not Used	Not Used	3	XU1—XU4 (Also XU5 if Set 3 is microvector)	DSPY ENH	W5, W6 In (W6 Out if Set 3 is microvector)
ALT SETS 1,2	0,1	Set 1 In XU11—XU14 (Also XU15 if Set 1 is microvector)	2	Set 2 In XU1—XU4 (Also XU15 if Set 2 is microvector)	DSPY ENH	W1, W2, W3, W4 In (W2, W4 Out if Sets 1 and/or 2 respectively are microvector)
ALT SETS 1,3	0,1	Set 1 In XU11—XU14 (Also XU15 if Set 1 is microvector)	3	Set 3 In XU1—XU4 (Also XU5 if Set 3 is microvector)	DSPY ENH	W1, W2, W5, W6 In (W2, W6 Out if Sets 1 and/or 3 respectively are microvector)
ALT SETS 2,3	2	Set 2 In XU11—XU14 (Also XU15 if Set 2 is microvector)	3	Set 3 In XU1—XU4 (Also XU5 if Set 3 is microvector)	DSPY ENH	W3, W4, W5, W6 In (W4, W6 Out if Sets 2 and/or 3 respectively are microvector)

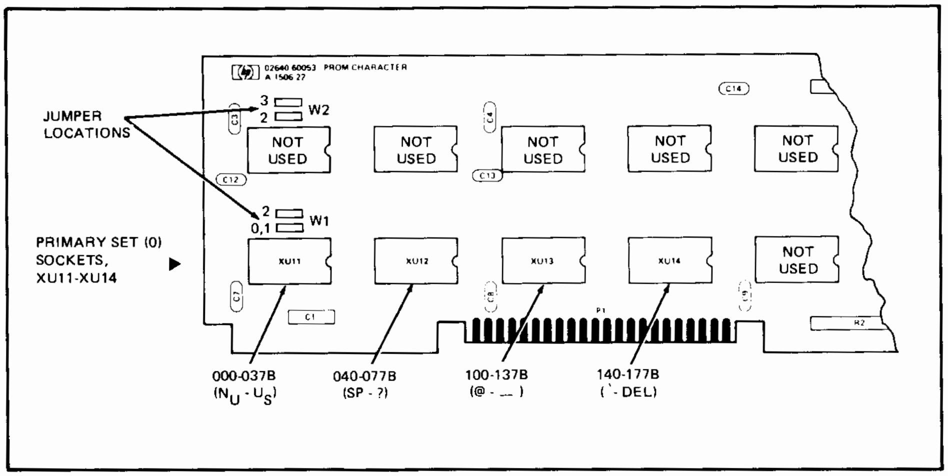


Figure 3-14. Location of PROMs If Primary Character Set Is To Be Replaced

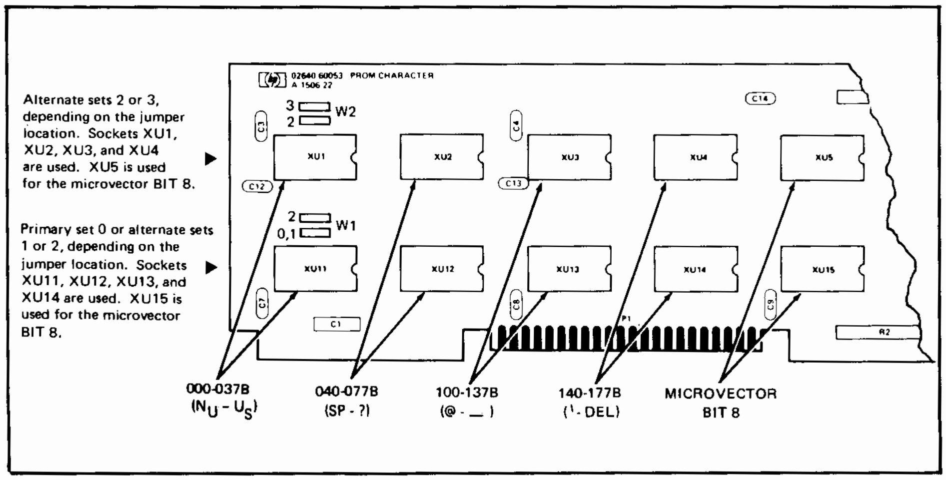


Figure 3-15. Location of PROMs If An Alternate Character Set Is To Be Replaced

13250A/B (Used as a Serial Printer Interface)

Accessory 13250A/B can be used either as an interface between the terminal and a serial printer or as an asynchronous data communications interface between the terminal and computer. The 13250B Accessory PCA is the same one used with Accessory 13260B. For information on strapping Accessory 13250A/B for use as a data communications interface, refer to the Accessory 13260B portion of this section. The following discussion describes strapping of Accessory 13250A/B for use with a serial printer only.

SELECTABLE CHARACTERISTICS ...

1. PCA address. This address identifies to the processor the function performed by the PCA (serial printer interface or asynchronous data communications interface).
2. Baud rate:
   a. External clock (custom baud rate — 37.5 to 2400).
   b. Strap selectable — 110, 150, 300, 1200, 2400, 4800, or 9600.
3. Parity (none, even, or odd).
4. Number of null characters sent to printer following an ASCII control character (1 or 8 through 56, in steps of 8).
5. Number of stop bits (1 or 2).
6. Transmit handshake (use or not).

PCA(S) TO BE STRAPPED ....

Two PCA's are associated with Accessory 13250A/B. An earlier version, 02640-60089, has been replaced by 02640-60143 (figures 3-16 and 3-17). Both contain four banks of rocker switches for strapping. When either PCA is used as a serial printer interface, only the leftmost and rightmost banks are used. Before starting strapping procedures, set all switches on these two banks to the open position.

PROCEDURE ....

PCA ADDRESS. The PCA address switches are A4, A9, A10, and A11. To identify the function of the PCA as a serial printer interface, they must be set as follows:

A11	A10	A9	A4
Closed	Open	Closed	Open
1	0	1	0

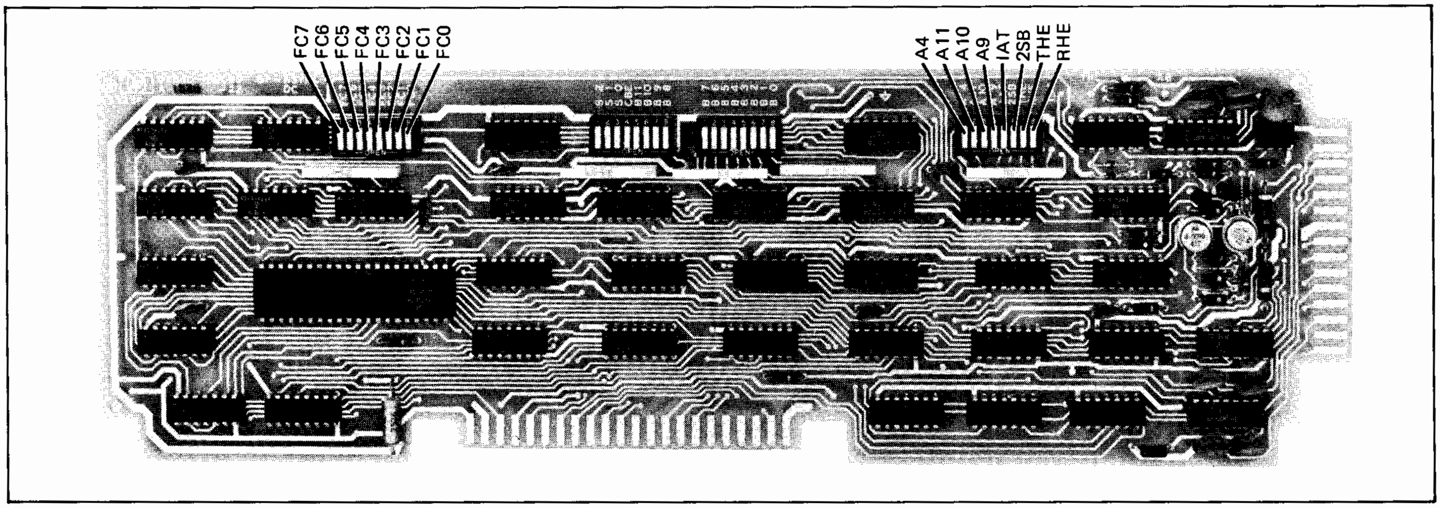


Figure 3-16. 02640-60089 PCA Switch Locations

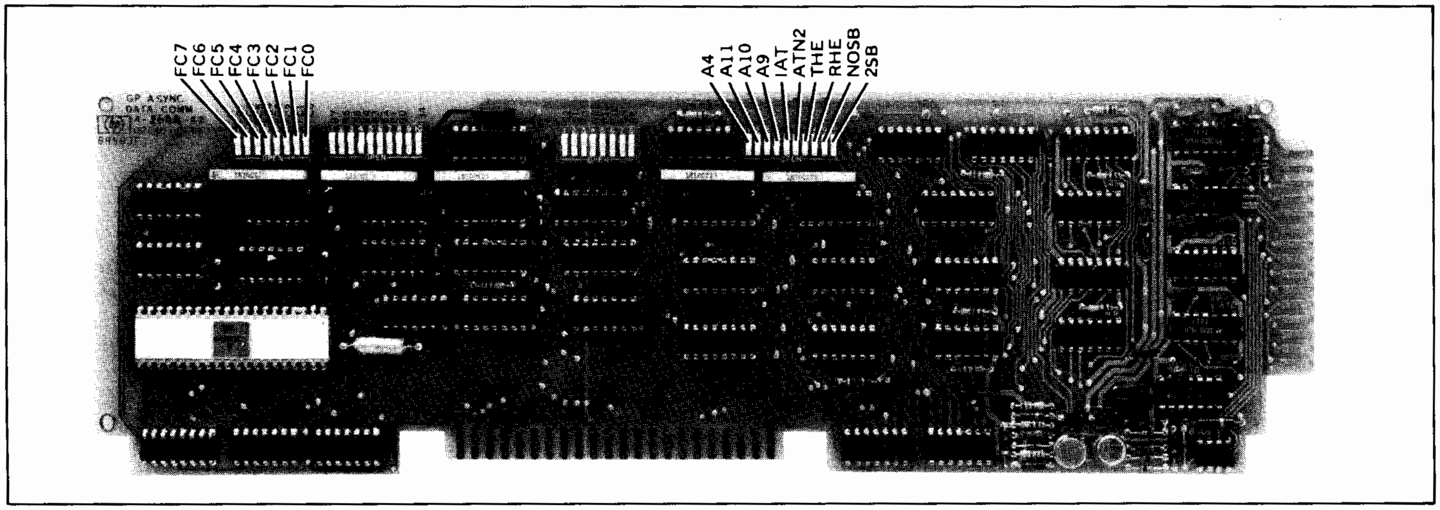


Figure 3-17. 02640-60143 PCA Switch Locations

BAUD RATE. Switches F0, F1, and F2 are used for baud rate selection. Use the following table for selection of the baud rate.

BAUD RATE	FC2	FC1	FC0
External Clock	1	1	1
110	1	1	0
150	1	0	1
300	1	0	0
1200	0	1	1
2400	0	1	0
4800	0	0	1
9600	0	0	0
1 = Switch closed. 0 = Switch open.			

PARITY. Parity is set with switches FC3 and FC4. Use the following table to set parity.

PARITY	FC4	FC3
Odd	1	1
Even	1	0
None	0	—
1 = Switch closed. 0 = Switch open.		

NULL CHARACTERS. The number of null characters following an ASCII control character is selected using switches FC5, FC6, and FC7. The null characters are inserted after every control character except a CR followed by a LF. The amount of time delay produced by the null characters is calculated as follows.

If the number of stop bits selected is one:

$$\text{Time delay (sec.)} = \frac{10 \text{ x no. of nulls}}{\text{baud rate}}$$

If the number of stop bits selected is two:

$$\text{Time delay (sec.)} = \frac{11 \text{ x no. of nulls}}{\text{baud rate}}$$

Select the number of null characters as follows:

1. Set the THE switch to the open position.
2. Use the following table to select the nulls.

NO. NULLS	FC7	FC6	F5
8	1	1	0
16	1	0	1
24	1	0	0
32	0	1	1
40	0	1	0
48	0	0	1
*56 or 0	0	0	0

1 = Switch closed.
0 = Switch open.

*If all three switches are open, 56 nulls will be transmitted when a 2645 terminal is used and 0 nulls will be transmitted when a 2648 terminal is used.

STOP BITS. The number of stop bits is selected using switch 2SB as follows.

NUMBER OF STOP BITS	SWITCH 2SB
1	Open
2	Closed

TRANSMIT HANDSHAKE. Transmit handshake is selected with the THE switch. Closing the THE switch selects the transmit handshake protocol. Opening the switch disables transmit handshake. If the terminal is to be connected to a printer which requires null (delay) characters after ASCII control characters, the THE switch must be open.

13254A Video Interface

SELECTABLE CHARACTERISTICS ...

1. Select the PCA address.
2. Enable or disable the hard copy function. (The hard copy function can be disabled without affecting the video interface function.)
3. Enable or disable the capability for the hard copy device to disable the terminal processor (to freeze the display) while it copies the display.

PROCEDURE ....

Note

If a printer accessory (either accessory 13238A or accessory 13250B used as a printer interface) is used in the terminal, set switch SIF to the closed position. (This is necessary because the video interface PCA and the priner interface PCA's use the same PCA address. If both are present in the terminal without switch SIF on the video interface PCA closed, an addressing conflict will result.) Closing SIF disables the hard copy function of the video interface PCA so that hard copies of the display must be made using the COPY button on the hard copy unit. The video display function of the video interface PCA is not affected by closing switch SIF.

1. If a printer accessory is present in the terminal, close switch SIF (figure 3-18). If no printer accessory is used in the terminal, set switches SIB, SIC, SID, and SIF to select the video interface PCA address (1101) as shown below (this address is shared with the parallel printer interface).

A11	open
A10	open
A 9	closed
A 4	open

2. Use the strapping options (table 3-4) to set the remaining strapping switches (SIA and SIF).

Table 3-4. Video Interface PCA Strapping Options

STRAP	STRAPPING OPTION	CLOSED	OPEN
A	Enables or disables the capability for the hard copy device to disable the processor (disabling terminal operations and freezing the display) while it copies the display.	Disables the hard copy devices capability to disable the processor (freezing the display while it copies the display.	Enables the hard copy device to disable the processor (freezing the display) while it copies the display.
A4 A9 A10 A11	Used to select the PCA address. The switches correspond to address lines ADDR4, ADDR9, ADDR10, and ADDR11, as follows: ADDR4 2^0 ADDR9 2^1 ADDR10 2^2 ADDR11 2^3	The corresponding address line must be high to select the PCA.	The corresponding address line must be low to select the PCA.
ADD DISAB	Disables the PCA address logic on the Video Interface PCA so that the PCA cannot be selected by the processor for copying. Video output from the PCA is not affected by strap F.	Disables the copying function of the PCA.	Enables the copying function.

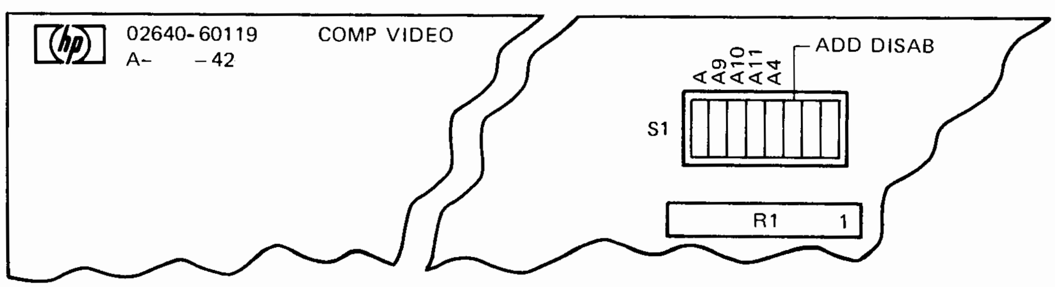


Figure 3-18. Video Interface PCA Jumper Locations

13260A Asynchronous Data Communications PCA
and
13260B Extended Asynchronous Data Communications PCA

SELECTABLE CHARACTERISTICS ...

Means for configuring accessory 13260B are located in three places; the keyboard, the Keyboard Interface PCA, and the data communications PCA itself. Accessory 13260A contains no configuration switches or straps. For it, all configuration is done on the keyboard and the Keyboard Interface PCA.

KEYBOARD. Characteristics selectable using three switches on the keyboard are listed below:

1. Full or half duplex.
2. Parity (even, odd, or none).
3. Baud rate.

KEYBOARD INTERFACE PCA. Characteristics selectable on the Keyboard Interface PCA are listed below:

1. Function key transmission
2. Space overwrite latch
3. Cursor end-of-line wraparound
4. Line-Page mode
5. Paper tape mode
6. Fast binary read
7. Block transfer handshake
8. Inhibit DC2
9. Auto terminate
10. Clear terminator
11. Self-test inhibit
12. Reverse action of CNTL key with INSERT CHAR and,
13. DELETE CHAR keys (wrap function)
14. Escape code transfer to printer

15. Compatibility Mode (scaled)
16. Compatibility Mode (unscaled)
17. Circuit Assurance
18. Main/Reverse Channel configuration. (Switches S and T cannot be modified programmatically.
19. CPU break
20. Carrier detect
21. Data Comm self-test enable
22. Data speed select
23. Transmit LED
24. Force Parity

13260B DATA COMMUNICATIONS PCA. Characteristics selectable on the 13260B PCA are listed below. (The 13260A PCA has no strapping facilities.)

1. PCA address.
2. Standard or custom baud rate.
3. Rate of custom baud rate.
4. Whether transmit baud rate is the same or different from receive baud rate.
5. Rate of transmit baud rate (if transmit and receive baud rates are different, receive baud rate is selected on the keyboard.)
6. Number of stop bits (1 or 2).
7. Inhibit transmit handshake.
8. Inhibit receive handshake.
9. Inhibit RS232 SCF (Secondary Carrier control line).

WHICH PCA(S) ....

ACCESSORY 13260A. The Keyboard Interface PCA is the only PCA containing configuration means for Accessory 13260A with earlier PCAs (02640-60086). However, on later PCAs (02640-60239), strapping must be configured (see figure 3-19).

ACCESSORY 13260B. For Accessory 13260B, both the Keyboard Interface PCA and the data communication PCA (02640-60089 or 02640-60143, whichever is used) (see figure 3-19A) must be configured.

HOW .... Accessory 13260A strapped by setting the configuration switches on the Keyboard Interface PCA and the DUPLEX, PARITY, and BAUD RATE switches on the keyboard. Strapping for Accessory 13260B is the same as for 13260A except that configuration switches on the data communication PCA must also be set.

PROCEDURE .... Figure 3-20 supplies the strapping procedures for Accessory 13260A for earlier PCAs (02640-60086) and both PCAs (02640-60089 and 02640-60143) of Accessory 13260B in flowchart form. Although PCA 02640-60089 is not mentioned in the flowchart, the flowchart is applicable to it also. To use the flowchart with PCA 02640-60089, ignore reference to any switch not contained on the PCA. Use figure 3-19 to configure 13260A with later version PCAs (02640-60239).

SWITCH	DESCRIPTION
$\overline{\text{THE}}$	Open — Enables Transmit Handshake Closed — Disables Transmit Handshake
$\overline{\text{600}}$	Open — Enables 600 Baud Rate Closed — Disables 600 Baud Rate
$\overline{\text{EBE}}$	Open — Enables External Baud Rate Closed — Disables External Baud Rate
$\overline{\text{200}}$	Open — Enables 200 Baud Rate Closed — Disables 200 Baud Rate

Note: Switches $\overline{\text{200}}$, $\overline{\text{600}}$, and $\overline{\text{EBE}}$ work only when the baud rate selector is set to EXT on the terminal. Only one of these three switches may be enabled (open) at any one time.

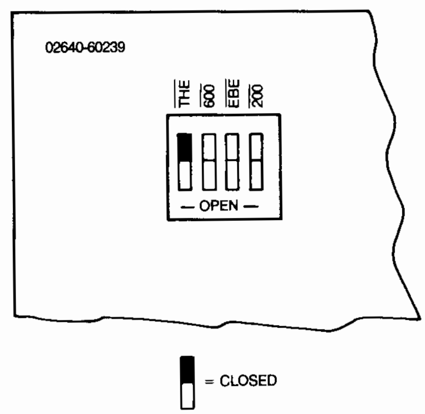


Figure 3-19. 13260A Strapping Options on Later PCAs (02640-60239)

PROCEDURE CONTINUED ....

Table 3-5 supplies a description of the function of the configuration switches on PCAs 02640-60089 and 02640-60143. Table 3-6 lists the function for each of the configuration switches on the Keyboard Interface PCA as applied to Accessories 13260A and 13260B.

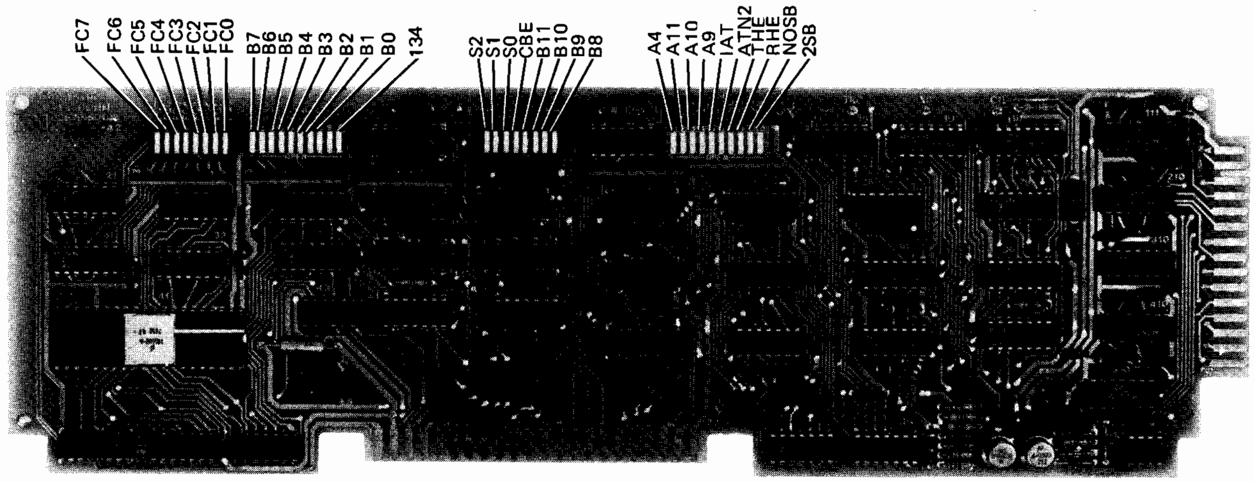


Figure 3-19A. Extended Asynchronous Data Communications PCA Strapping Option

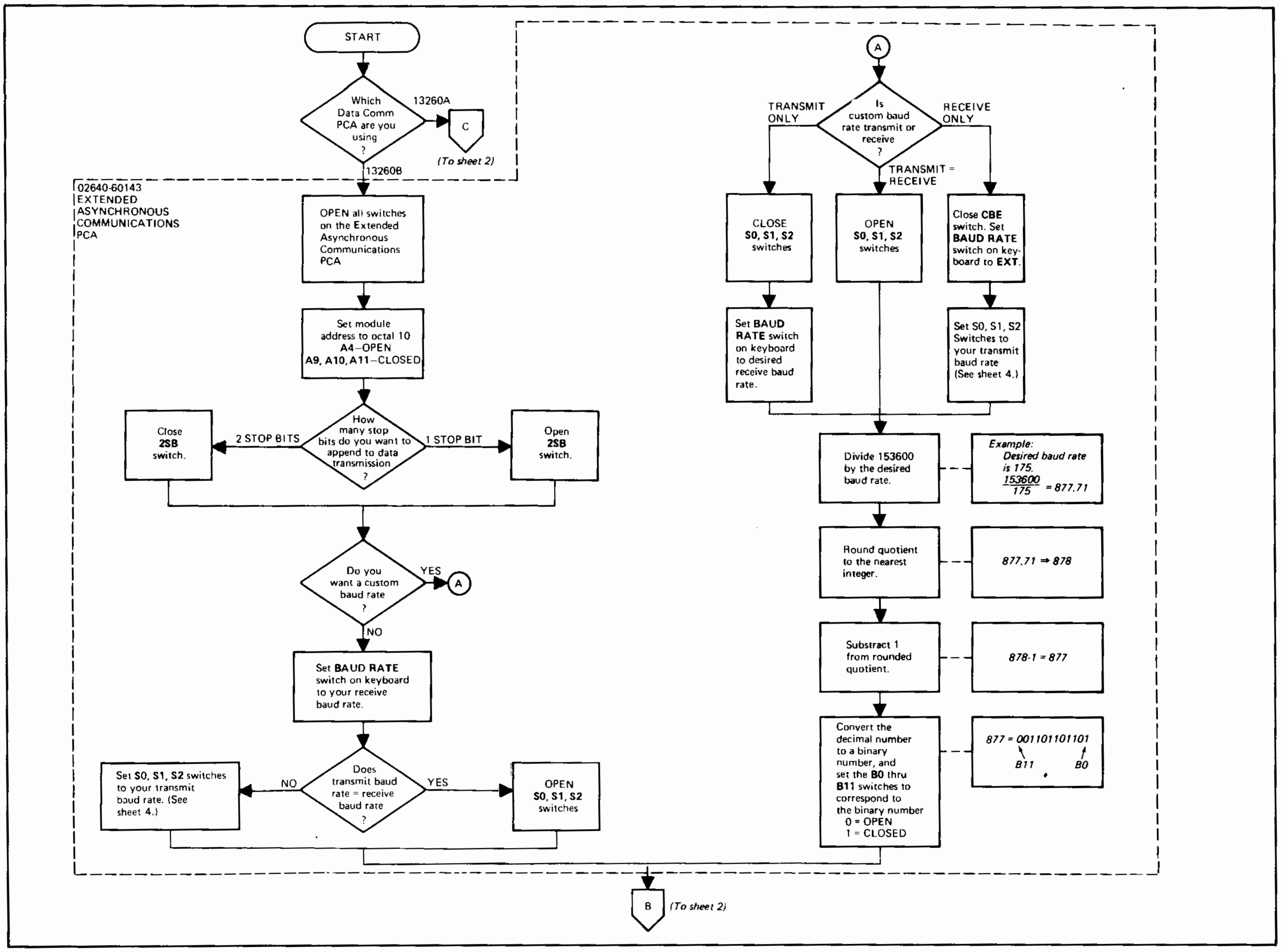


Figure 3-20. Point-to-Point Data Communications Configuration Flowchart (Sheet 1 of 5)

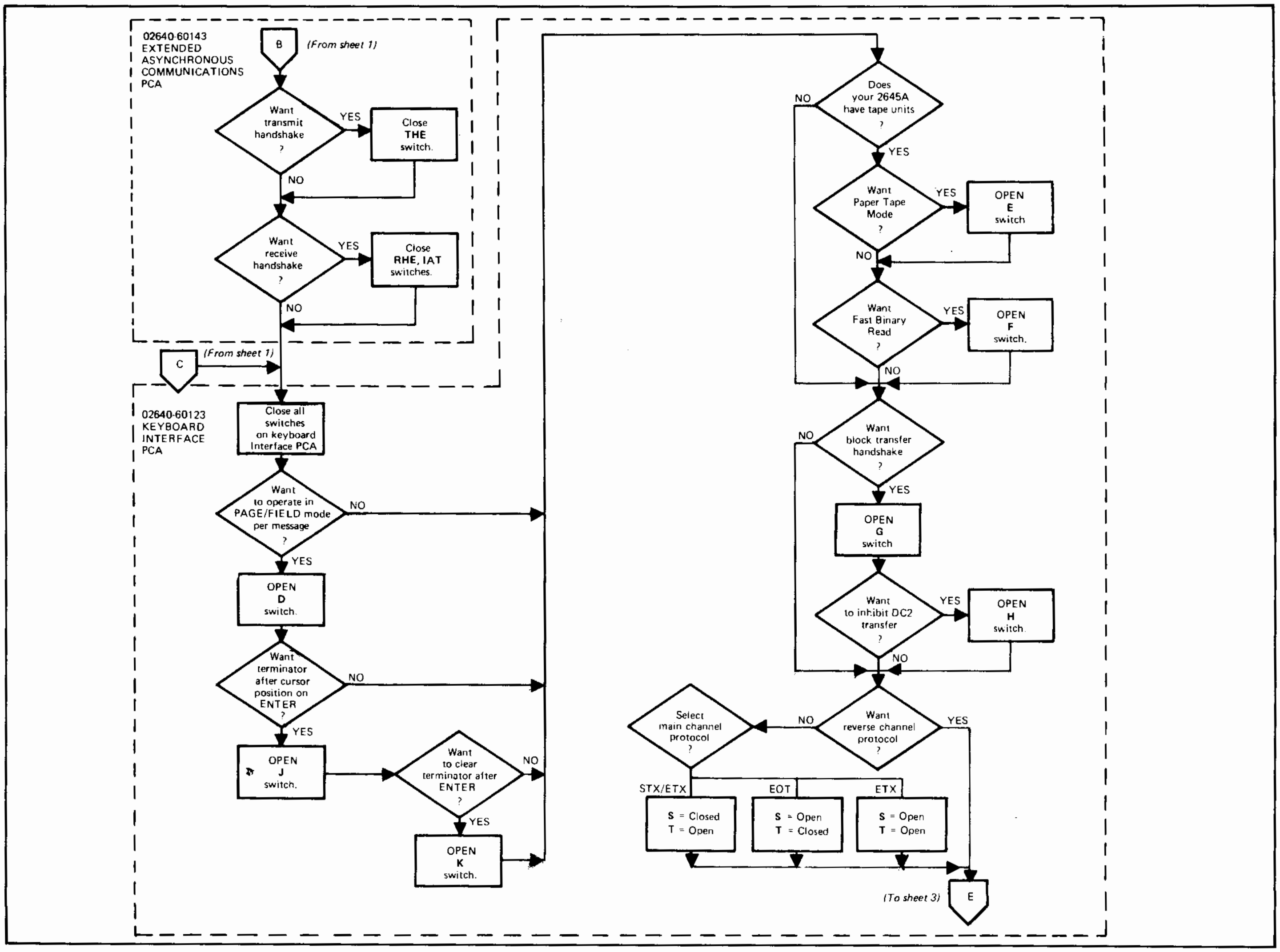


Figure 3-20. Point-to-Point Data Communications Configuration Flowchart (Sheet 2 of 5)

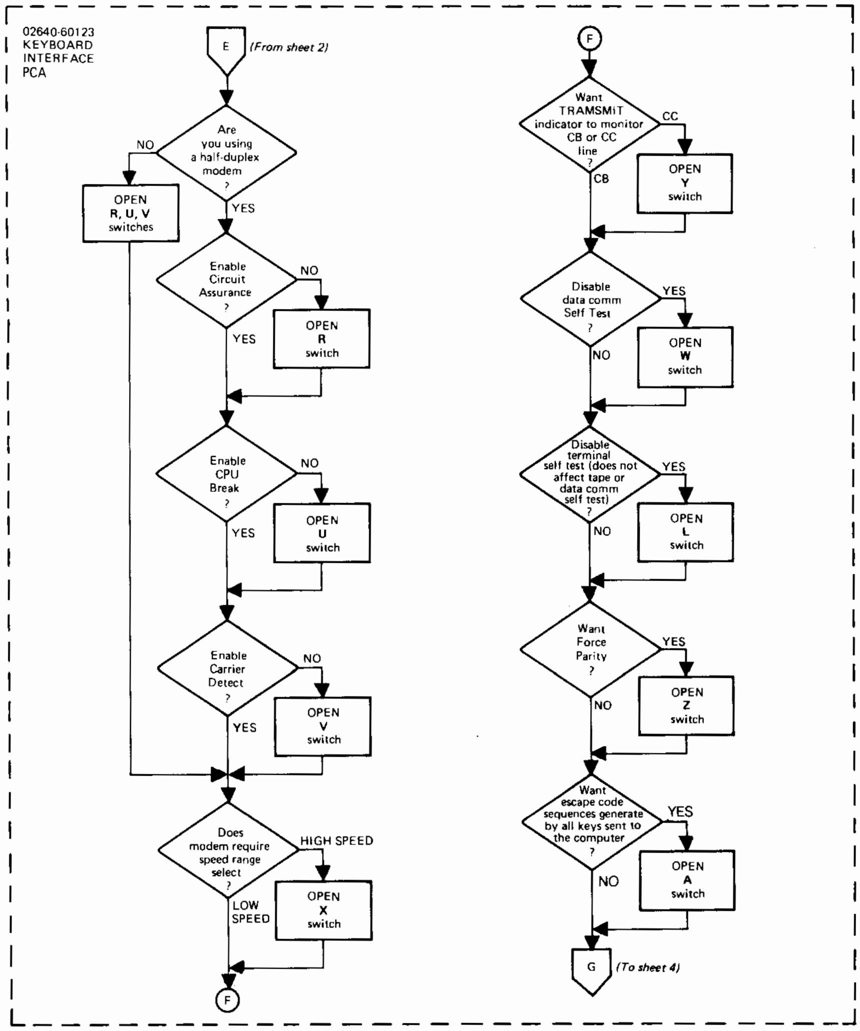


Figure 3-20. Point-to-Point Data Communications Configuration Flowchart (Sheet 3 of 5)

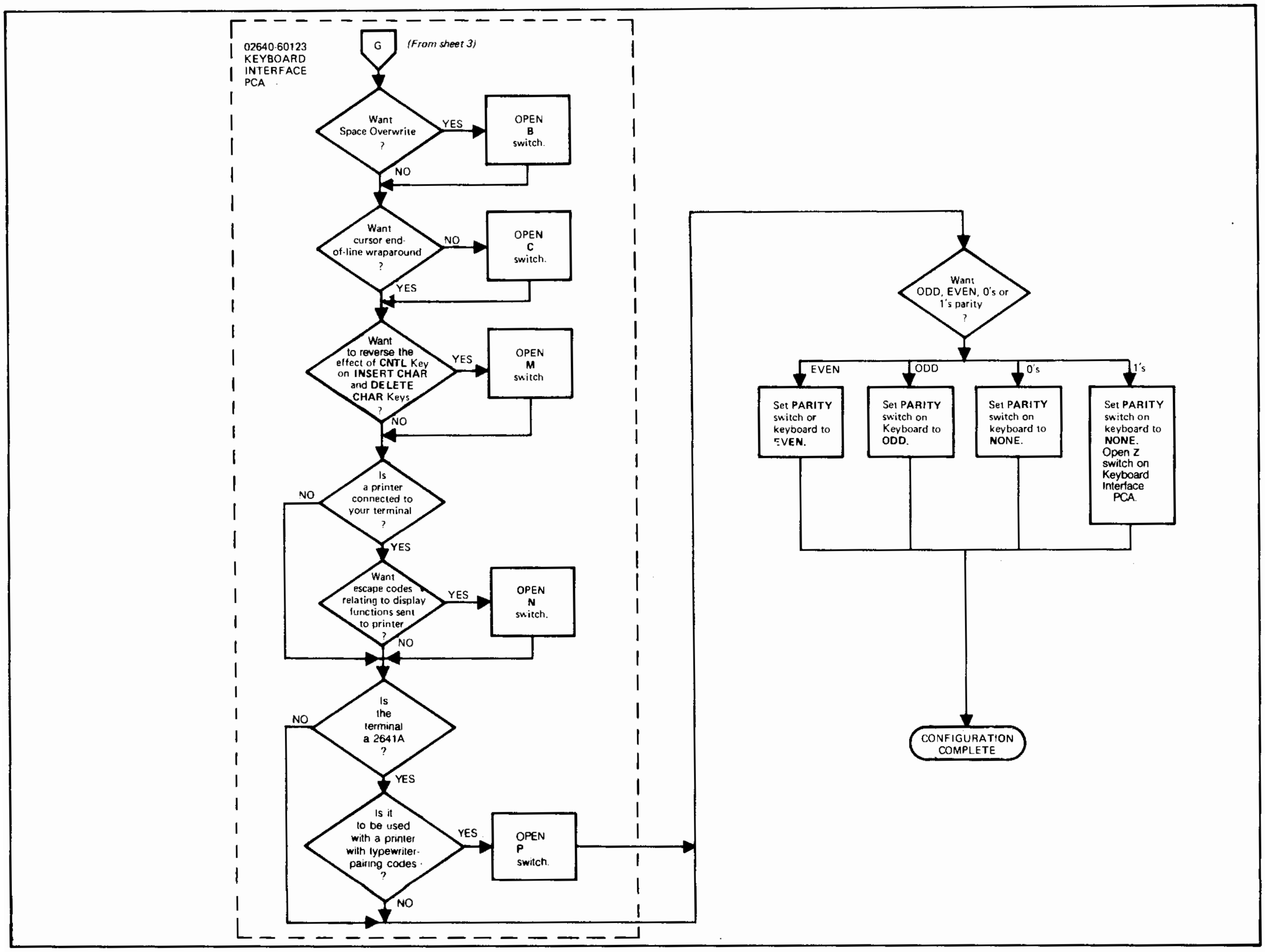


Figure 3-20. Point-to-Point Data Communications Configuration Flowchart (Sheet 4 of 5)

BAUD RATE SELECTIONS

X = Available Split Rate C = Switch Closed O = Switch Open		TRANSMIT BAUD RATE EXT	CUSTOM	110	150	300	1200	2400	4800	9600	134.5	BAUD RATE SWITCH SETTING
Receive Baud Rate	EXT	X	X	X	X	X	X	X	X	X		EXT
	CUSTOM		X		X				X	X		EXT (See Notes)
	110		X	X								110
	150		X		X				X	X		150
	300		X		X				X	X		300
	1200		X		X				X	C		1200
	2400		X		X				X	X		2400
	4800		X		X	X	X	X	X	X		4800
	9600		X		X	X	X	X	X	X		9600
	134.5		X								X	134.5
S2S0 Setting		O	C	O	C	C	O	O				
S2S1 Setting		O	C	O	O	O	C	C				
S2S2 Setting		O	C	O	C	O	C	O				

NOTES

The S2CBE switch must be set to its closed position for custom receive baud rates and keyboard BAUD RATE switch must be set to EXT.

When switches S2S0, S2S1, and S2S2 are all set to their open positions, the transmit baud rate will equal the receive baud rate.

Figure 3-20. Point-to-Point Data Communications Configuration Flowchart (Sheet 5 of 5)

Table 3-5. Extended Asynchronous Data Communications Interface Strapping Options

STRAP	STRAPPING OPTION	DESCRIPTION
FC0 thru FC7	(Not Used)	(This switch should always be open.)
B0 thru B11	Custom Baud Rate Select	The switches are set to the binary equivalent of a number determined by the following steps: 1. Solve the following equation: $\left(\frac{15360}{\text{baud rate}}\right) - 1$ 2. Round off the result to the nearest integer.
134	134.5 Baud	(This switch should always be open.)
S0 thru S2	Transmit Baud Rate	**SWITCH SETTING** (S0 S1 S2) — **TRANSMIT BAUD RATE**: O O O — Transmit baud rate = receive baud rate O C C — 110 C O C — 150 O O C — 300 C C O — 1200 O C O — 2400 C C C — Custom O = open, C = closed
CBE	Custom Baud	**Closed:** Enables custom receive baud rates. (The keyboard BAUD RATE switch must be set to EXT.) **Open:** Receive baud rate is set by keyboard BAUD RATE switch.
B8 thru B11	Custom Baud Rate Select	See B0 thru B11 (above.)
A4, A9 thru A11	Module Address	Provides PCA address so that firmware can address the PCA. These switches should always be set to 10, (A4 open, A9 thru A11 closed.)
IAT	Inhibit Attention	(This switch must be closed when receive handshake is used.)
ATN2	Enable Attention Two	(This switch should always be open.)
THE	Transmit Handshake Enable	**Closed:** Permits the associated external device (a or computer) to signal a "busy" condition on CB (Clear to Send) or SCF (Secondary Carrier) control lines and temporarily stop data transmission from the terminal. **Open:** Transmit Handshake disabled.
RHE	Receive Handshake Enable	**Closed:** Permits the terminal to signal a "busy" condition on the CD (Data Terminal Ready) control line and temporarily stop data transmission from the associated external device (a computer). **Open:** Receive Handshake Disabled.
NOSB	SCF Inhibit	**Closed:** Inhibits RS232 SCF (Secondary Carrier) control line.
2SB	Stop Bit Select	Selects the number of stop bits to be appended to the data bits during transmission. **Closed:** Selects 2 stop bits. **Open:** Selects 1 stop bit. NOTE: Selecting 110 baud automatically appends 2 stop bits.

Table 3-6. Keyboard Interface PCA Strapping Options for Accessories 13260A and 13260B

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
A	Function Key Transmission	The escape code sequence generated by the major function keys (such as ROLL UP, ROLL DOWN, etc.) are executed locally, but not transmitted to the computer.	The escape code sequences generated by all keys are transmitted to the computer. If operating in half duplex, the function is also executed locally.
B	Space Overwrite (SPOW) Latch Enable	Spaces typed will overwrite existing characters.	When the SPOW latch is off, overwriting occurs as normal. When the SPOW latch is on, spaces cause the cursor to forward but not overwrite any existing characters. The SPOW latch is turned on by a Carriage Return, and off by a Line Feed, Home or Tab.
C	Cursor End-of-Line Wraparound	At the end of each line a local Carriage Return and Line Feed are generated; the cursor moves to the beginning of the next line.	A Carriage Return and Line Feed are not generated at the end of each line. The cursor remains in and overwrites column 80.
D	Line/Page	The terminal is set to transfer a line at a time in Block Mode.	Entire pages of information are transferred in Block Mode.
E	Paper Tape Mode	When the READ key is pressed with AUTO LF key latched down, each tape record begins with an LF and is terminated by a CR.	Each tape record is terminated by CR LF.
F	Fast Binary Read	The transmission rate is determined by the BAUD RATE switch on the keyboard.	When an ESC e (Fast Binary Read) is issued by the computer, the baud rate is switched automatically to 9600 baud (if the terminal is equipped with cartridge tape units).
G	Block Transfer Handshake	In Block Mode, all data transfers to the computer are sent upon receipt of a DC1 from the computer.	All Block Mode transfers (i.e., cursor sense, terminal and device status, device I/O responses, display memory, and function keys) are preceded by a DC2. The terminal sends the DC2 upon receipt of a DC1 from the computer. After the CPU receives the DC2 from the terminal, another DC1 is required to trigger transmission of data from the terminal.
H	Inhibit DC2	During Block Mode Handshake transfers, the terminal sends a DC2 in response to a DC1 prior to sending data. (See Block Transfer Handshake strapping above.)	A DC1 from the computer is not required to trigger data transfers to the computer. Also, the DC2 from the terminal is not sent during Block Mode Transfer handshakes. (See Block Transfer Handshake strapping above.) Additionally, when the ENTER key is pressed in Block Mode the cursor will be placed in the first column before transmission occurs if operating in Line Mode (switch D closed) or Home'd if operating in Page Mode (switch D open). Opening both switches G and H eliminate the terminal's use of the Handshake protocol entirely.
J	Auto Terminate	No effect.	When in Block Mode and the ENTER key is pressed, places a non-displaying terminator before the cursor position.

Table 3-6. Keyboard Interface PCA Strapping Options for Accessories 13260A and 13260B (Continued)

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
K	Clear Terminator	No effect.	Clear terminator caused by Strapping Option J or ESC —.
L	Self Test Inhibit	No effect.	Self Test function is inhibited. Pressing TEST key or issuing ESC z displays the NO TEST message. TAPE TEST and DATA COMM SELF TEST functions are not affected.
M	INSERT and DELETE CHAR with Wrap (Reverse Sense)	No effect.	Reverses effect of CNTL key on INSERT CHAR and DELETE CHAR keys (i.e., when key is pressed, line wrap around is in effect without having to press CONTROL key. When either key is pressed while pressing CNTL, normal insert character and delete character functions are in effect.)
N	Escape Code Transfer to Printer	No effect.	Escape codes relating to the display (e.g., display enhancements, alternate character sets, format mode, fields, etc.) are sent to printer if it is selected as a destination device.
P, Q	Compatibility Mode	These switches set the terminal to be compatible with Tektronix control commands when initialized (power on or full reset).	
		P = closed, Q = closed	Normal operation.
		P = closed, Q = open	Unscaled Compatibility Mode and 2048 byte data comm buffer.
		P = open, Q = closed	Scaled Compatibility Mode and 2048 byte data comm buffer.
		P = open, Q = open	2048 byte data comm buffer.
R	Circuit Assurance	The transition from receive state to transmit state occurs after both CB (106) (Clear to Send) and SB (122) (Secondary Receive Data) go on within 2.6 seconds. Otherwise, the terminal returns to the receive state.	The transition from receive state to transmit state occurs after CB (106) (Clear to Send) goes on.
S, T	Main Channel Protocol	Reverse Channel protocol (both switches closed).	**S-closed, T-open:** Main channel with STX/ETX as Start of Data and End of Data. **S-open, T-closed:** Main channel with EOT as End of Data. **S-open, T-open:** Main channel with ETX as End of Data.
U	CPU Break	The CPU can interrupt the terminal while it is in the transmit state. The CPU initiates an ON to OFF transition of the SB (122) (Secondary Receive Data) line. The terminal responds by turning off CA (106) (Request to Send) and going to the receive state.	The terminal ignores all transitions on the SB (122) (Secondary Receive Data) line from the modem in the transmit state.
V	Carrier Detect	When the terminal is in the receive state, an ON to OFF transition of CF (109) (Carrier Detect) line from the modem causes the terminal to go into the transmit state. Transitions of CF have no effect while the terminal is in the transmit state.	Transitions of CF (109) (Carrier Detect) line have no effect on the terminal.

Table 3-6. Keyboard Interface PCA Strapping Options for Accessories 13260A and 13260B

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
W	Data Comm Self Test	Enables DATA COMM SELF TEST from either the keyboard or escape sequence.	Disables DATA COMM SELF TEST. If self test is attempted (by either the keyboard or escape sequence), the test will be aborted and ERROR 0 will appear on the display.
X	Data Speed Select	Holds data speed signal low (CH (111) = 0).	Sets data speed signal high (CH (111) = 1).
Y	Transmit LED	The TRANSMIT light on the keyboard is turned on when CB (106) (Clear to Send) line from the modem is high. It is turned off when the CB (106) line goes low.	The TRANSMIT light on the keyboard is turned on when the CC (107) (Data Set Ready) line from the modem is high and the 13260B Extended Asynchronous Communications Interface PCA is used. It is turned off when the CC line goes low.
Z	Parity	The PARITY switch on the terminal keyboard is affected as follows:	
		No Parity: Send 8 data bits and receive 8 data bits. Force bit 8 to zero. Check for parity error. **Odd Parity:** Send 7 data bits + odd parity. Receive 7 data bits + odd parity. Check for parity error. **Even Parity:** Send 7 data bits + even parity. Receive 7 data bits + even parity. Check for parity error.	**No Parity:** Send 8 data bits and receive 8 data bits. Force bit 8 to one on send. No check for parity error. **Odd Parity:** Send 7 data bits + odd parity. Receive 7 data bits. No check for parity error. **Even Parity:** Send 7 data bits + even parity. Receive 7 data bits. No check for parity error.

13260C Asynchronous Multipoint Data Communications PCA and 13260D Synchronous Multipoint Data Communications PCA

SELECTABLE CHARACTERISTICS ...

Means for configuring Accessories 13260C and 13260D are located in three places; the keyboard, the Keyboard Interface PCA, and the data communications PCA.

KEYBOARD. Characteristics selectable using three switches on the keyboard are listed below:

1. Baud rate range (high or low).
2. Baud rate.
3. Parity (even, odd, or none).

KEYBOARD INTERFACE PCA. Characteristics selectable on the Keyboard Interface PCA are listed below:

1. Function key transmission
2. Space overwrite latch
3. Cursor end-of-line wraparound
4. Block mode (Line/Page)
5. Paper tape mode
6. Auto terminate
7. Clear terminator
8. Self-test inhibit
9. Reverse CNTL key effect on INSERT
10. CHAR and DELETE CHAR keys
11. Escape code transfer to printer
12. Compatibility Mode (scaled)
13. Compatibility Mode (unscaled)
14. Set trailing PAD
15. Input block size
16. Output block size
17. Continuous carrier
18. Data Comm self-test enable
19. Data speed select
20. Transmit LED
21. Parity

DATA COMMUNICATIONS PCA. selectable on the 13260C and 13260D data communications PCA's are listed below:

13260C	13260D
• Number of stop bits.	• Transmit clock rate.
• Sync mode.	• Receive clock rate.
	• IBM 3270 text mode.

In addition to the PCA-peculiar characteristics listed above, other characteristics, common to both PCA's, are listed below:

- PCA address.
- Group identification.
- Device identification.
- ASCII or EBCDIC code.
- Block check or none.
- Type of block check character (LRC or CRC).
- Buffer size.
- Block or character mode.
- Power for Accessory 13232T cable.

WHICH PCA(S) ....

ACCESSORY 13260C. The Keyboard Interface PCA and data communications PCA 02640-60106 (figure 3-21) must be configured for Accessory 13260C.

ACCESSORY 13260D. The Keyboard Interface PCA and data communications PCA 02640-60107 (figure 3-22) must be configured for Accessory 13260D.

HOW ....

Both accessories are strapped by setting the configuration switches on the Keyboard Interface PCA and the appropriate data communication PCA and setting the RANGE PARITY, and BAUD RATE switches on the keyboard.

PROCEDURE ....

Figure 3-23 supplies the strapping procedures for both Accessory 13260C and Accessory 13260D in flowchart form.

Table 3-7 supplies a description of the function of the configuration switches on the data communication PCA (02640-60106) used with Accessory 13260C and table 3-8 supplies the same information for PCA 02640-60107 which is used with Accessory 13260D. Table 3-9 lists the function of each of the configuration switches on the Keyboard Interface PCA as applied to accessories 13260C and 13260D.

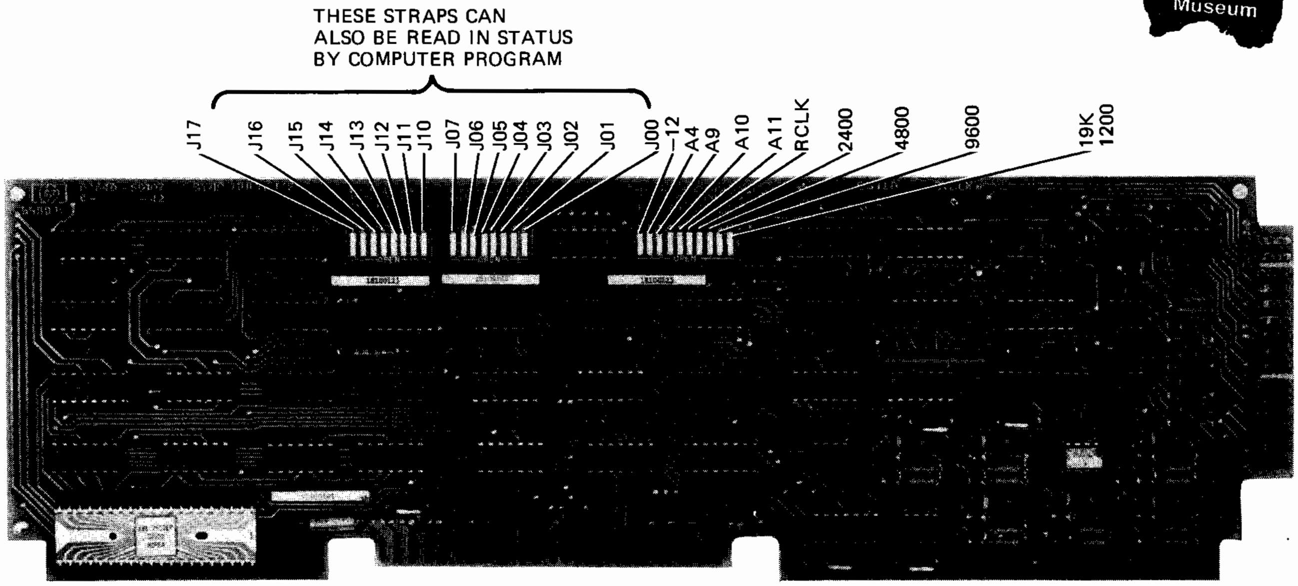


Figure 3-21. Asynchronous Multipoint Data Communications PCA Strapping Switch Locations

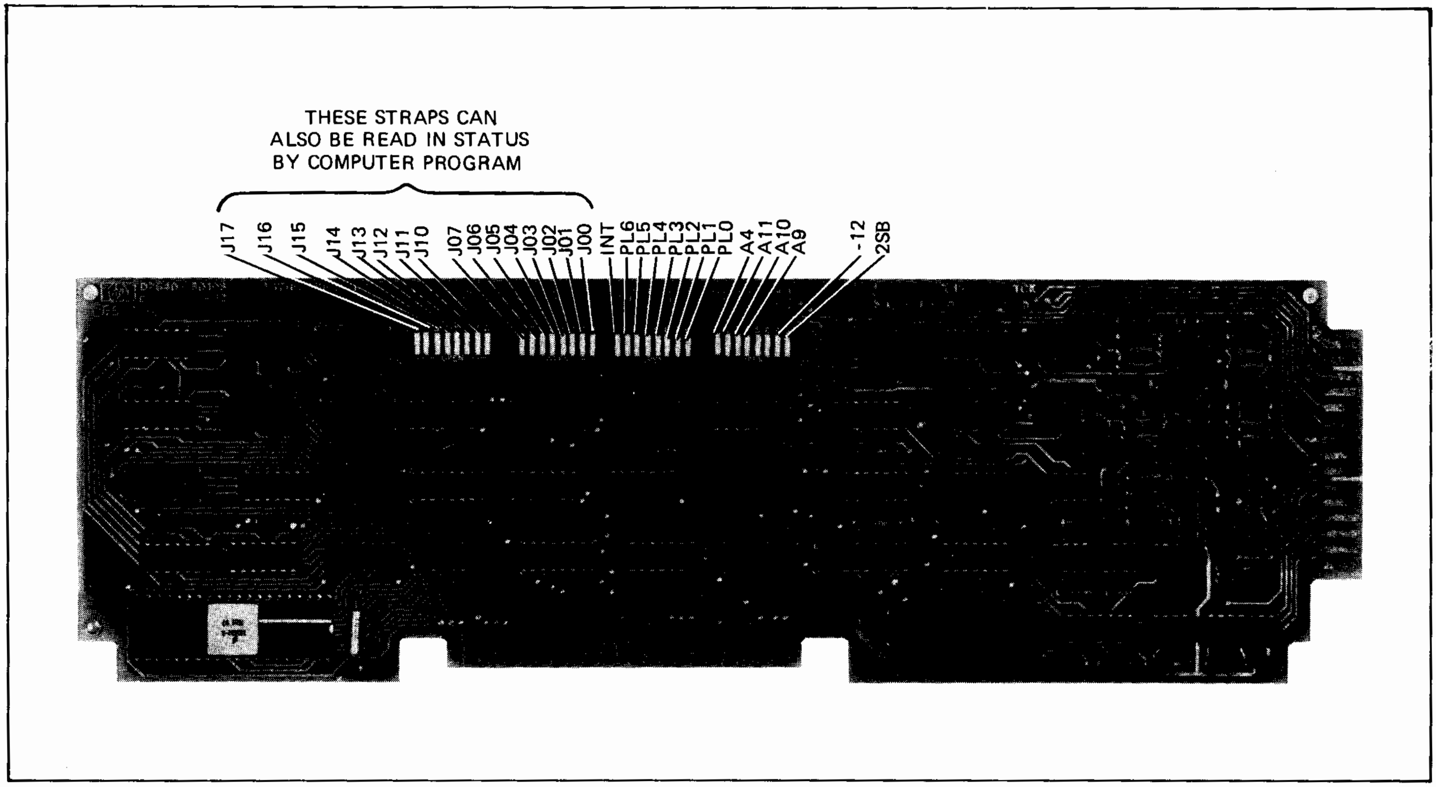
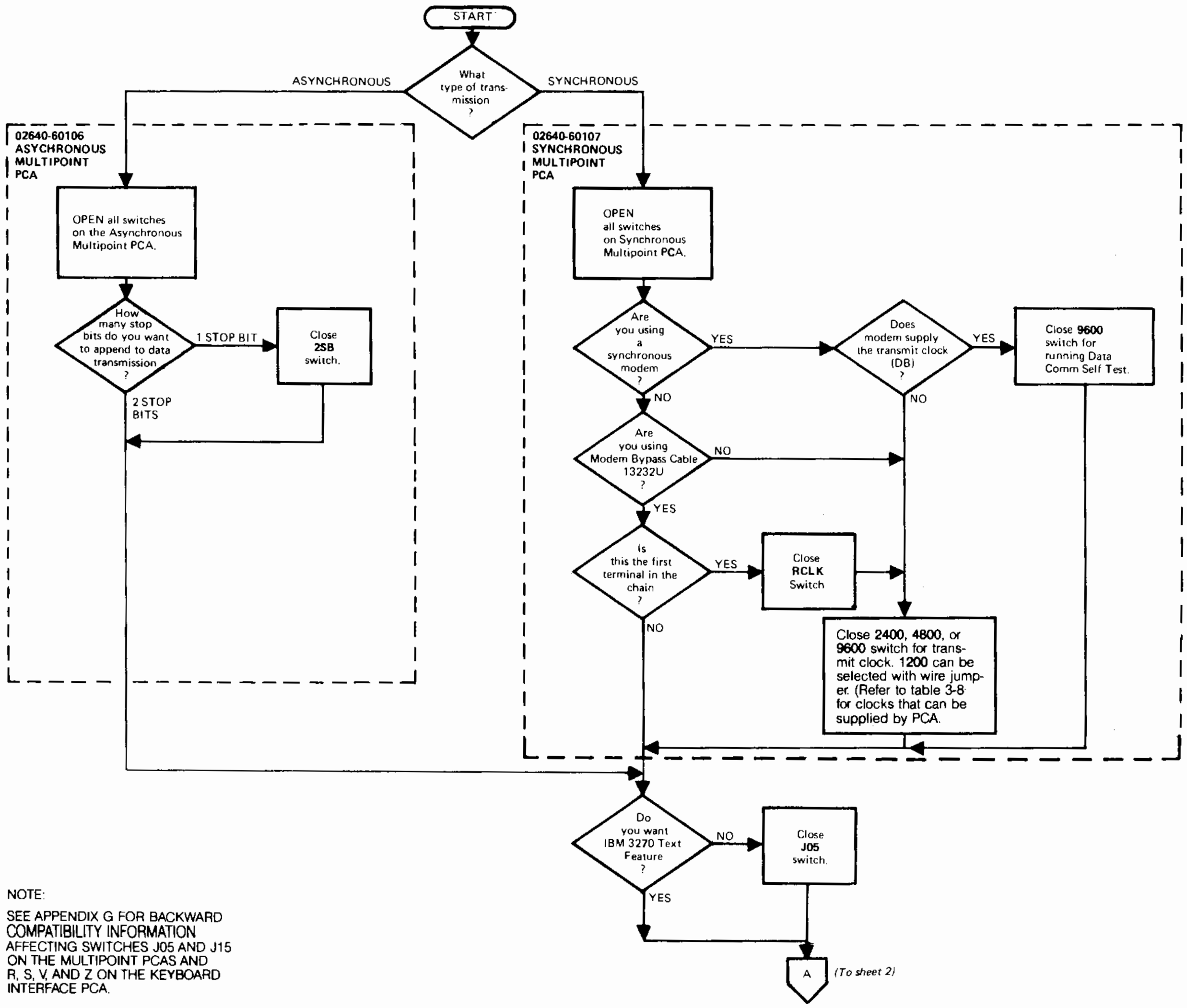


Figure 3-22. Asynchronous Multipoint Data Communications PCA Strapping Switch Locations



NOTE:

SEE APPENDIX G FOR BACKWARD COMPATIBILITY INFORMATION AFFECTING SWITCHES J05 AND J15 ON THE MULTIPOINT PCAS AND R, S, V, AND Z ON THE KEYBOARD INTERFACE PCA.

Figure 3-23. Multipoint Data Communications Configuration (Sheet 1 of 4)

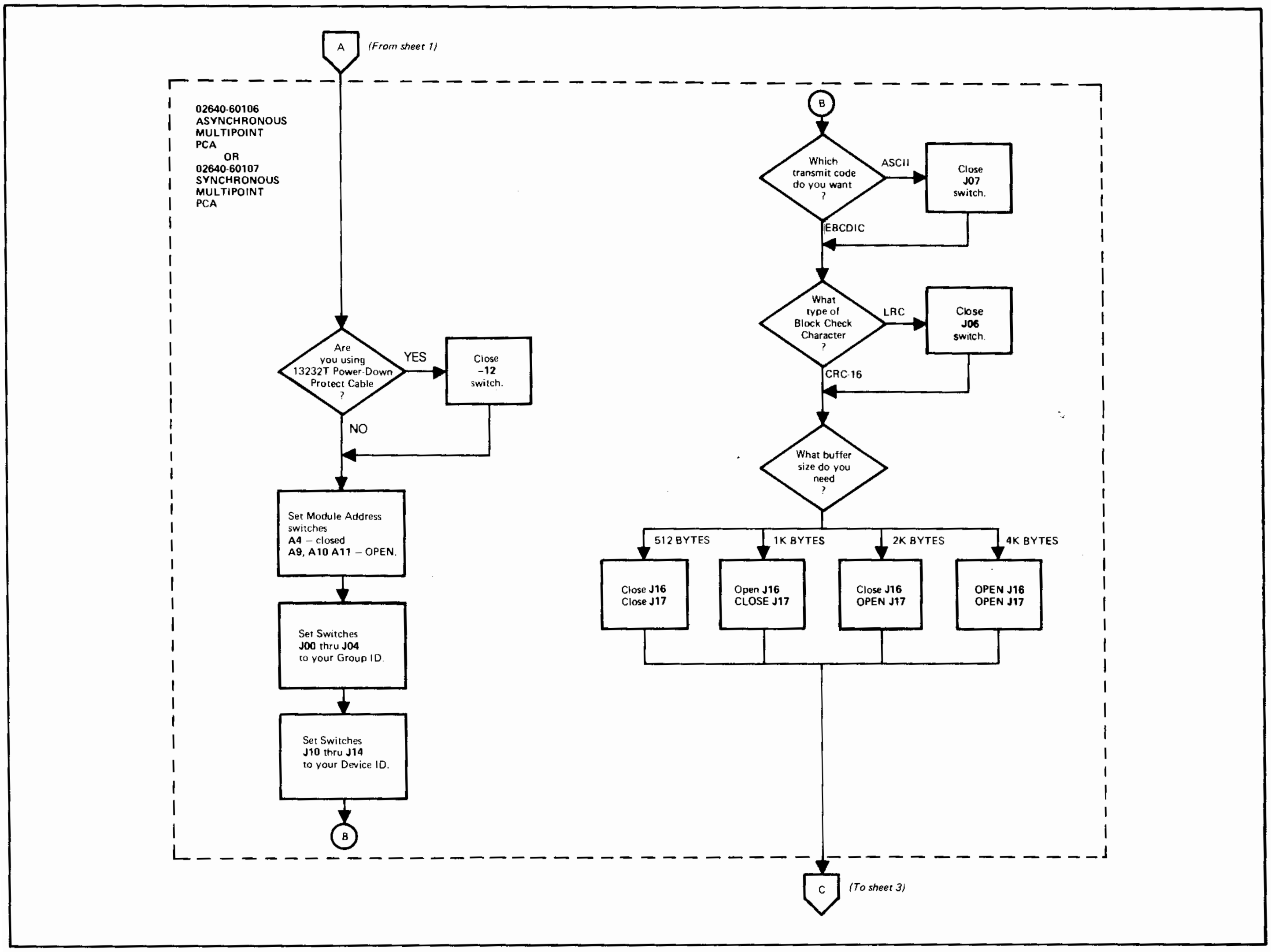


Figure 3-23. Multipoint Data Communications Configuration (Sheet 2 of 4)

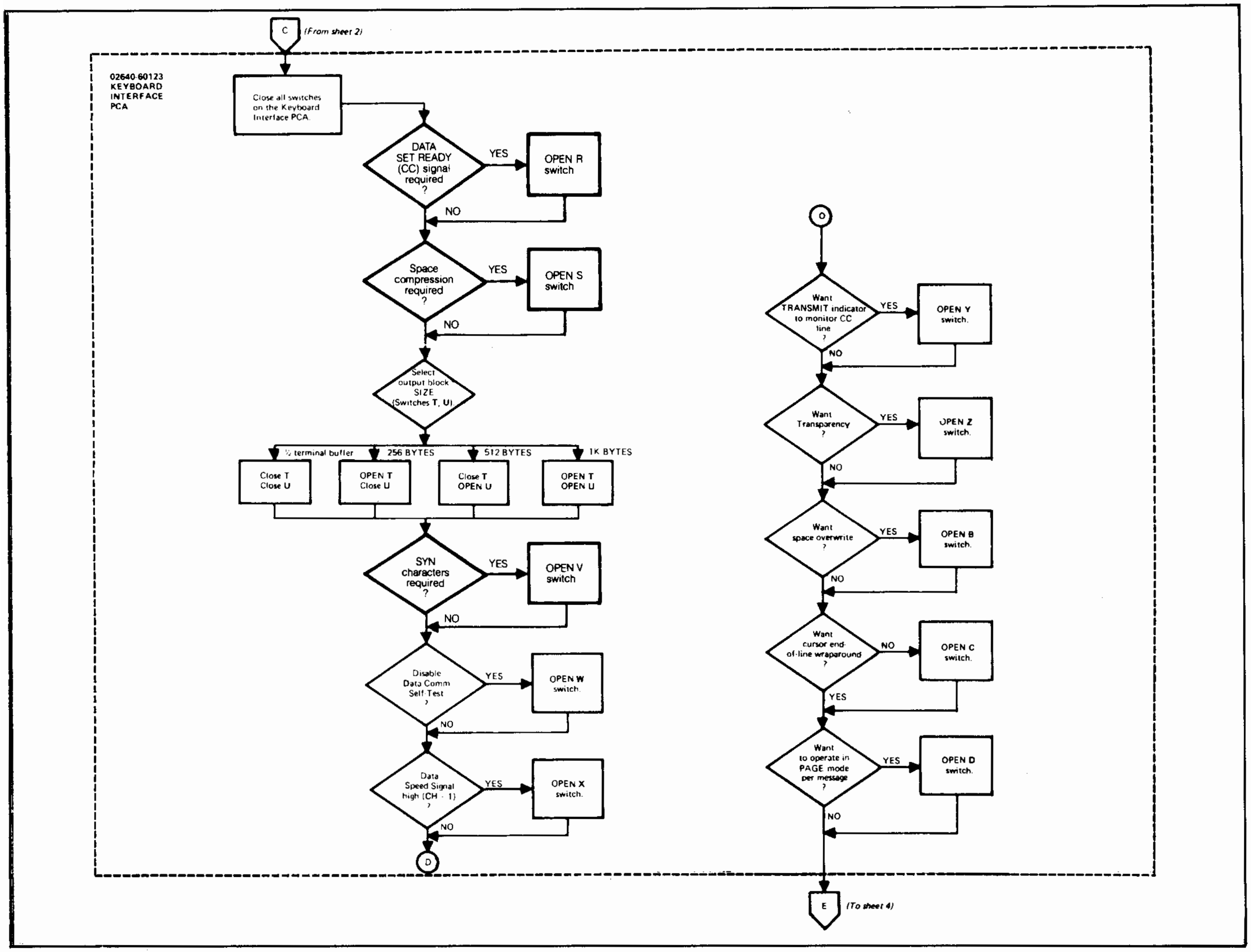


Figure 3-23. Multipoint Data Communications Configuration (Sheet 3 of 4)

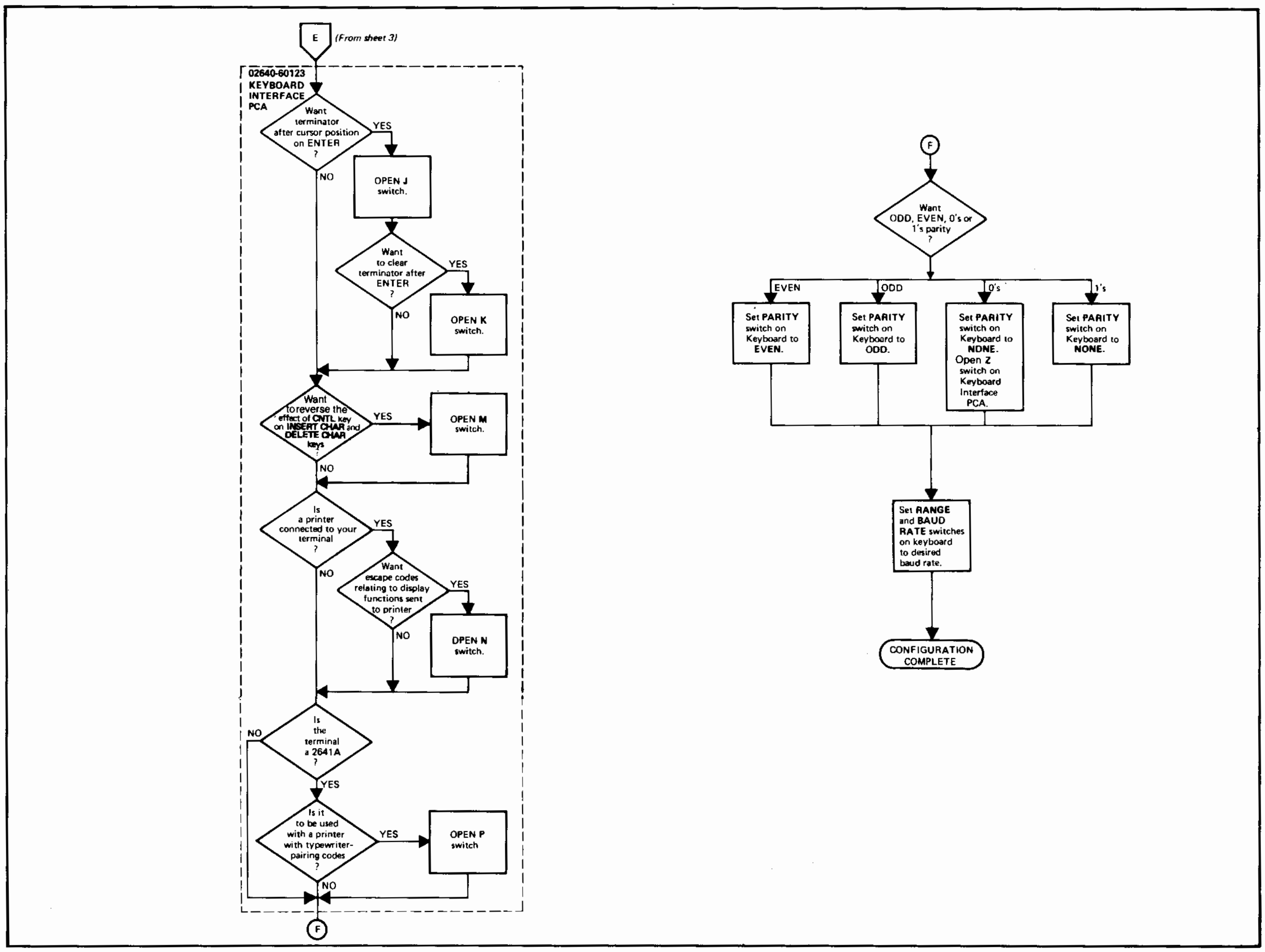


Figure 3-23. Multipoint Data Communications Configuration (Sheet 4 of 4)

Table 3-7. Asynchronous Multipoint Data Communications Interface Strapping Options

STRAP	STRAPPING OPTION	DESCRIPTION
J10 thru J14	Device ID	Selects device ID code (0-27) which identifies one terminal from another on a particular communication line. For example: to set an ID code of 6, set switches J14 through J10 to 00110 respectively. 0 = closed, 1 = open
J15 (NOTE 1)	(Not Used)	Set to open.
J16, J17	Buffer Size Select	**J17 J16 BUFFER SIZE** C C 512 bytes C O 1024 bytes O C 2048 bytes O O 4096 bytes C = closed, O = open
J00 thru J04	Group ID	Selects group ID code (0-27) which identifies the communications line that the terminal is on. For example: to set an ID code of 20, set switches J04 thru J00 to 10100 respectively. 0 = closed, 1 = open
J05	Sync Mode	**Open:** Enables the insertion and deletion of sync characters to be compatible with a single, generalized data communications driver. **Closed:** Sync Mode disabled.
J06	BCC (Block Check Character)	Determines which type of parity check will be used for an entire block of data in Block Mode. **Closed = 0:** LRC (longitudinal redundancy check.) **Open = 1:** CRC — 16 (cyclic redundancy check.)
J07	Code Select	Selects data character and control character code format. **Open = 1:** EBCDIC **Closed = 0:** ASCII
INT	Firmware Interrupt	This switch should always be open.
PL0 thru PL6	Poll Bits	These switches should always be open.
A4, A9 thru A11	Module Address	Provides PCA address so that the firmware can address the PCA. These switches should always be set to 7 (A4 closed, A9 thru A11 open).
−12	13232T Accessory Power	**Closed:** Provides −12 volts for operation of relays in the 13232T Power Protect Multipoint Cable. **Open:** No power supplied.
2SB	Stop Bit Select	Selects the number of stop bits to be appended to the data bits during transmission. **Open:** Selects 2 stop bits. **Closed:** Selects 1 stop bit (normal position).

NOTE 1. For backward compatibility strapping (2645A and 2648A only), refer to Appendix G.

Table 3-8. Synchronous Multipoint Data Communications Interface Strapping Options

STRAP	STRAPPING OPTION	DESCRIPTION
J10 thru J14	Device ID	Selects device ID code (0-27) which identifies one terminal from another on a particular communication line. For example: to set an ID code of 6, set switches J14 through J10 to 00110 respectively. 0 = closed, 1 = open
J15 (NOTE 1)	(Not Used)	Set to open.
J16, J17	Buffer Size Select	**J17 J16 BUFFER SIZE** C C 512 bytes C O 1024 bytes O C 2048 bytes O O 4096 bytes C = closed, O = open
J00 thru J04	Group ID	Selects group ID code (0-27) which identifies the communications line that the terminal is on. For example: to set an ID code of 20, set switches J04 thru J00 to 10100 respectively. 0 = closed, 1 = open
J05 (NOTE 1)	IBM 3270	**Open:** 3270 Text Mode enabled. **Closed:** 3270 Text Mode disabled.
J06	BCC (Block Check Character)	Determines which type of parity check will be used for an entire block of data in Block Mode. **Closed** = **0:** LRC (longitudinal redundancy check.) **Open** = 1: CRC — 16 (cyclic redundancy check.)
J07	Code Select	Selects data character and control character code format. **Open** = 1: EBCDIC **Closed** = **0:** ASCII
−12	13232T Accessory Power	**Closed:** Provides −12 volts for operation of relays in the 13232T Power Protect Multipoint Cable. **Open:** No power supplied.
A4, A9 thru A11	Module Address	Provides PCA address so that the firmware can address the PCA. These switches should always be set to 7 (A4 closed, A9 thru A11 open).
RCLK	Receive Data Clock	When the terminal is directly connected to a computer (no modem) by using the 13232U Modem Bypass cable, the PCA can provide the receive data clock (DD) by closing this switch. (This applies only to the first terminal in the multipoint chain.) Normally, this switch is open. One of the transmit data clock switches (see below) must be selected for this function.
2400 4800 9600	Transmit Data Clock	Usually, the modem or computer provides both the receive (DD) and transmit (DB) data clocks for timing the data transfers. If the modem requires a terminal-supplied transmit clock (DA), select the appropriate rate for that modem. If using the 13232U Modem Bypass cable, select the desired rate. **CAUTION** Close only one switch, otherwise damage to the PCA may result.

NOTE 1. For backward compatibility strapping (2645A and 2648A only), refer to Appendix G.

Table 3-9. Keyboard Interface PCA Strapping Options for Accessories 13260C and 13260D

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
A	Function Key Transmission	The escape code sequence generated by the major function keys (such as, ROLL UP, ROLL DOWN, etc.) are executed locally, but not transmitted to the computer.	(Same as switch closed.)
B	Space Overwrite (SPOW)	Spaces typed will overwrite existing characters.	When the SPOW latch is off, overwriting occurs as normal. When the SPOW latch is on, spaces cause the cursor to forward but not overwrite any existing characters. The SPOW latch is turned on by a Carriage Return, and turned off by a Line Feed, Home, or Tab.
C	Cursor End-of-Line Wrap	At the end of each line, a local Carriage Return and Line Feed are generated; the cursor moves to the beginning of the next line.	A Carriage Return and Line Feed are not generated at the end of each line. The cursor remains in and overwrites column 80.
D	Line/Page Mode	The terminal is set to transfer a line at a time from display memory, an unprotected field in format mode, or a record from the tape cartridge.	Transfers the entire contents of display memory (a "page"), all unprotected fields in format mode, or a file from the tape cartridge.
E	Paper Tape Mode	When the READ key is pressed with the AUTO LF down, each tape record begins with a LF and terminates with a CR.	Each tape record is terminated by CR(LF).
F	(Not used)		
G	Block Transfer Handshake	No effect.	No effect.
H	Inhibit DC2	No effect.	No effect.
J	Auto Terminate	No effect.	When the ENTER key is pressed place a non-displayable terminator after the cursor position.
K	Clear Terminator	No effect.	Clear terminator caused by Strapping Option J.
L	Self Test Inhibit	No effect.	Self Test function is inhibited. Pressing TEST key or issuing ESC z has no effect. TAPE TEST and DATA COMM SELF TEST functions are not affected.
M	INSERT and DELETE CHAR Reverse Sense	No effect.	Reverses control function of INSERT CHAR and DELETE CHAR keys (i.e., when key is pressed, line wrap around is in effect without having to press CNTL key. When either key is pressed while pressing CNTL, normal insert character and delete character functions are in effect.)
N	Escape Code Transfer	No effect.	Escape codes relating to the display (e.g., display enhancements, alternate character sets, format mode, fields, etc.), are sent to printer if it is selected as a destination device.

Table 3-9. Keyboard Interface PCA Strapping Options for Accessories 13260C and 13260D (Continued)

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
P (2641A only)	APL Printer Pairing Code	Makes terminal compatible with APL Printers with bit-pairing codes.	Makes terminal compatible with APL Printers with typewriter-pairing codes.
Q (2641A only)	(Not Used)		
P, Q (2648A only)	Compatibility Mode	P-closed, Q-closed P-open, Q-closed P-closed, Q-open P-open, Q-open	Normal operation. Scaled Compatibility Unscaled Compatibility Mode Normal operation with expanded data comm buffers.
P, Q (all other terminals)	(Not Used)		
R	Data Set Ready	No effect.	Provides an internal Data Set Ready (CC) signal to the terminal. (Used in applications with the HP 30037A Asynchronous Repeater, and the Group Poll feature.)
S	(Not Used)		
T, U	Output Block Size	 T-closed, U-closed T-open, U-closed T-closed, U-open T-open, U-open	**Block Size (Bytes)** 1/2 Data Comm Buffer (refer to switches J16, J17 on multi-point PCA). 256 512 1024
V	Synch Characters	Asynchronous operation without SYN characters.	SYN characters are inserted during Asynchronous operation.
W	Data Comm Self Test	Enables DATA COMM SELF TEST from either the key board or escape sequence.	Disables DATA COMM SELF TEST. If self test is attempted (by either the keyboard or escape sequence), the test will be aborted and ERROR 0 will appear on the display.
X	Data Speed Select	Holds data speed signal low (CH = off).	Sets data speed signal high (CH =on).
Y	Transmit Indicator	Lights TRANSMIT indicator on keyboard when terminal is communicating with the computer.	Lights TRANSMIT indicator on keyboard when Data Set Ready (CC) is on, and it goes out when CC goes off.

Table 3-9. Keyboard Interface PCA Strapping Options for Accessories 13260C and 13260D (Continued)

STRAP	STRAPPING OPTION	SWITCH CLOSED (NORMAL OPERATION)	SWITCH OPEN
Z	Transparency	No effect.	Causes all data sent from the terminal to be transparent.

13291A 4K UV PROM PCA (without PROMS)

USED WITH TERMINALS .... All 264x series terminals.

SELECTABLE CHARACTERISTICS ... Selectable characteristics are as follows:

1. Disable one or both of two 2K PROM blocks.
2. Select the starting address for each block (from 0 to 62K in 2K increments).

HOW .... Strapping accessory 13291A consists of configuring the switches on the 4K UV PROM PCA.

PROCEDURE .... Use the information in table 3-10 to configure the 4K UV PROM PCA.

Table 3-10. 4K UV PROM PCA Strapping Options

STRAP	STRAPPING OPTION	SWITCH OPEN	SWITCH CLOSED
DISABLE	Enables or disables the associated 2K bank (A or B) of PROM memory.	Enables access to the data in the associated bank of memory.	Disables access to the data in the associated bank of memory.
2K	Adds 2K to the starting address of the associated 2K block.	Adds 2K to the starting address of the associated 2K block.	Adds zero to the starting address for the associated 2K block.
4K	Adds 4K to the starting address of the associated 2K block.	Adds 4K to the starting address of the associated 2K block.	Adds zero to the starting address of the associated 2K block.
8K	Adds 8K to the starting address of the associated 2K block.	Adds 8K to the starting address of the associated 2K block.	Adds zero to the starting address of the associated 2K block.
16K	Adds 16K to the starting address of the associated 2K block.	Adds 16K to the starting address of the associated 2K block.	Adds zero to the starting address of the associated 2K block.
32K	Adds 32K to the starting address of the associated 2K block.	Adds 32K to the starting address of the associated 2K block.	Adds zero to the starting address of the associated 2K block.

13292A Writeable Control Store PCA

USED WITH TERMINALS .... 13290A.

SELECTABLE CHARACTERISTICS .... Selectable characteristics are as follows:

1. Enable or disable all memory on the PCA.
2. Select the starting address for the memory on the PCA in 8K increments from 0 to 56K.

WHICH PCA(S) .... The Writeable Control Store PCA is the only one to be configured.

HOW .... Configuring the Writeable Control Store PCA consists of inserting or removing jumpers in five jumper positions.

PROCEDURE .... Use table 3-11 to configure the PCA.

Table 3-11. Writeable Control Store PCA Strapping Options

STRAP	STRAPPING OPTION	JUMPER IN PLACE	JUMPER REMOVED
8K	Adds 8K or 0 to the PCA memory starting address.	Adds 0 to the PCA memory starting address.	Adds 8K to the PCA memory starting address.
16K	Adds 16K or 0 to the PCA memory starting address.	Adds 0 to the PCA memory starting address.	Adds 16K to the PCA memory starting address.
32K	Adds 32K or 0 to the PCA memory starting address.	Adds 0 to the PCA memory starting address.	Adds 32K to the PCA memory starting address.
RAM ENABLE	Enables RAM or ROM on PCA.	Enables RAM and disables ROM.	Enables ROM and disables RAM.
GO SLOW	Selects slower or faster memory operation.	Selects slower memory operation.	Selects faster memory operation.

13296A HP-IB

USED ON TERMINALS .... 2647A and 2648A.

PROCEDURE .... Configuration of the HP-IB Interface PCA is standardized as listed in table 3-12.

Table 3-12. HP-IB Interface Switch Settings

SWITCH(ES)	SETTING(S)
A4, A11, A10, A9	These four switches specify the PCA module address and must be set as follows: A4 Closed; A11 Open; A10 Closed; A9 Closed
PL6 through PL0	These seven switches are reserved for future use. PL6 should be set to the closed position and switches PL5 through PL0 should be set to the open position.
ATN, ATN2	These switches are reserved for future use and should be set to the open position.
FC, and TA	These two switches are reserved for future use and should be set to the closed position.
LA	This switch should be set to the open position to indicate the presence of the HP-IB Interface PCA in 2647 (2648 — closed).
B4 through B0	These five switches specify the HP-IB address of your terminal. The device addresses 0-7 are reserved for peripheral devices (plotters and printers) while the device addresses 8-29 may be assigned to terminals. To achieve the most efficient operation, it is recommended that the addresses for a terminal cluster start at 29 and work their way down sequentially. The terminal which is assigned as the System Controller of the HP-IB (see switch SC below) must, however, be assigned the lowest device address of all the terminals in the shared peripheral configuration. The switch settings for the various terminal HP-IB addresses are as follows: (2648 — address 29)

Table 3-12. HP-IB Interface Switch Settings (Continued)

SWITCH(ES)	SETTING(S)
	Decimal Address / B4 / B3 / B2 / B1 / B0 (see table below) where: 0 = Open switch. 1 = Closed switch.
SC	This switch determines whether or not your terminal will be the System Controller of the HP-IB (remember that the System Controller must have the lowest device address of all the terminals in the shared peripheral configuration). One, and only one, terminal in the shared peripheral configuration must be assigned as the System Controller. (2648 must be System Controller — set to open.) Open = System Controller

Decimal Address	B4	B3	B2	B1	B0
8	1	0	1	1	1
9	1	0	1	1	0
10	1	0	1	0	1
11	1	0	1	0	0
12	1	0	0	1	1
13	1	0	0	1	0
14	1	0	0	0	1
15	1	0	0	0	0
16	0	1	1	1	1
17	0	1	1	1	0
18	0	1	1	0	1
19	0	1	1	0	0
20	0	1	0	1	1
21	0	1	0	1	0
22	0	1	0	0	1
23	0	1	0	0	0
24	0	0	1	1	1
25	0	0	1	1	0
26	0	0	1	0	1
27	0	0	1	0	0
28	0	0	0	1	1
29	0	0	0	1	0

13297A Universal RAM Memory PCA

USED WITH TERMINALS .... The Universal RAM Memory PCA can be used as top plane or bottom plane memory on the terminals listed below.

USED AS EITHER TOP OR BOTTOM PLANE MEMORY

1. 2641A.
2. 2642A.
3. 2645A,S.
4. 2647A.
5. 2648A.
6. 2649.

SELECTABLE CHARACTERISTICS .... PCA characteristics selectable by strapping are as follows:

1. Whether the PCA is to communicate with the processor on the top plane bus or bottom plane bus.
2. Inhibit operation of one or both modules on the PCA.
3. Time required for a memory cycle (400 or 500 nanoseconds) (provided the top plane bus is used).
4. Identify the IC's used in each module as either 4K or 16K IC's.
5. Whether bank selection will be used.
6. Assign the memory on the PCA to one of up to four banks of memory (provided the top plane connector is used). Each bank contains up to 64K bytes.
7. Add up to 60K to the starting address of either module in 4K increments (provided bank selection is not used). If bank selection is used, a maximum of 48K can be added in increments of 32K and 16K.
8. Inhibit reading and/or writing on the top plane bus.

HOW .... Configuring the Universal Memory PCA consists of positioning the two "B" (bank select) jumpers and setting the strapping switches for each of the two modules on the PCA.

PROCEDURE .... To configure the Universal Memory PCA refer to figure 3-24. For reference, table 3-13 lists the function of each configuration switch.

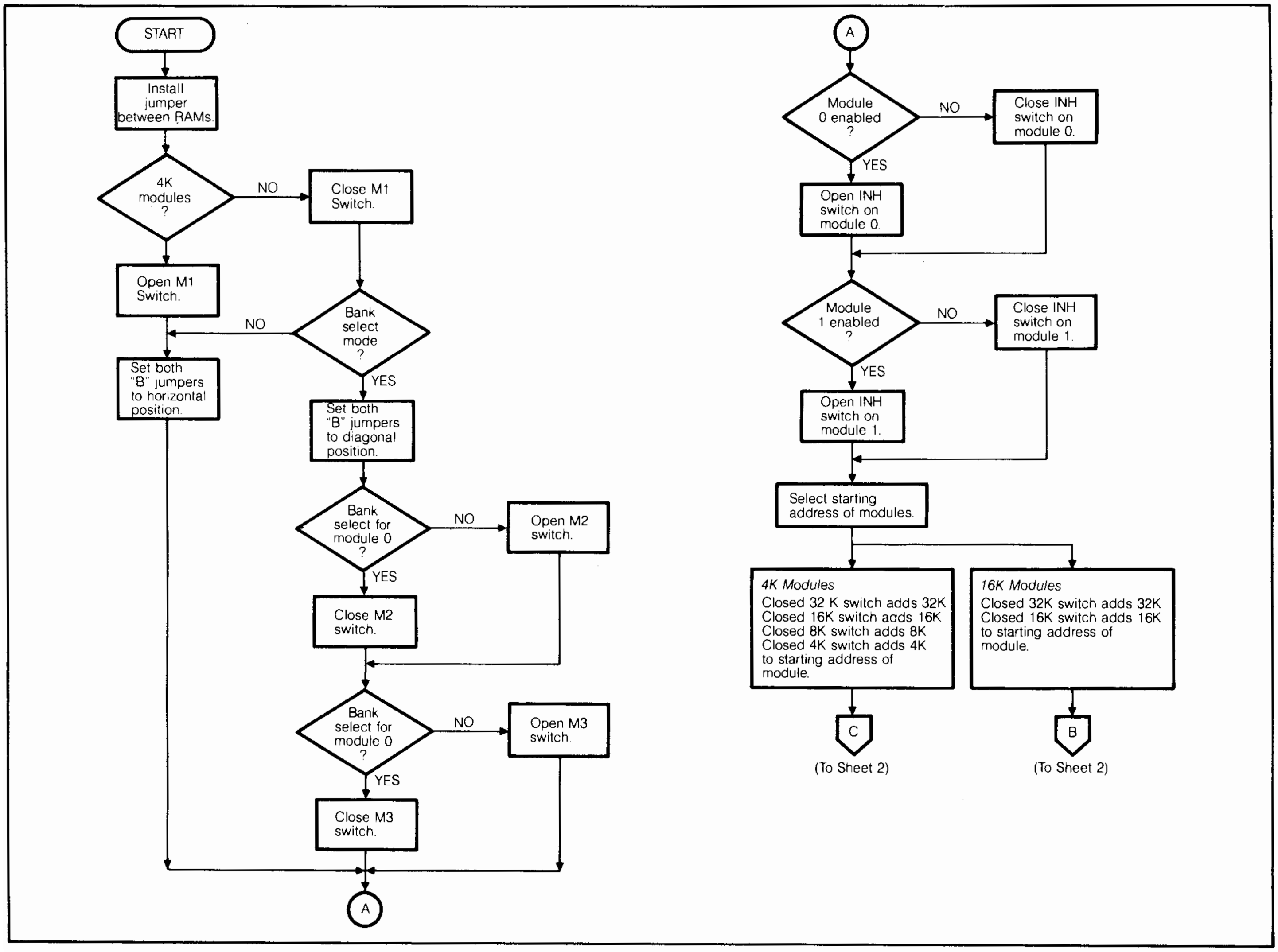


Figure 3-24. Universal Memory PCA Strapping Flowchart (Sheet 1 of 2)

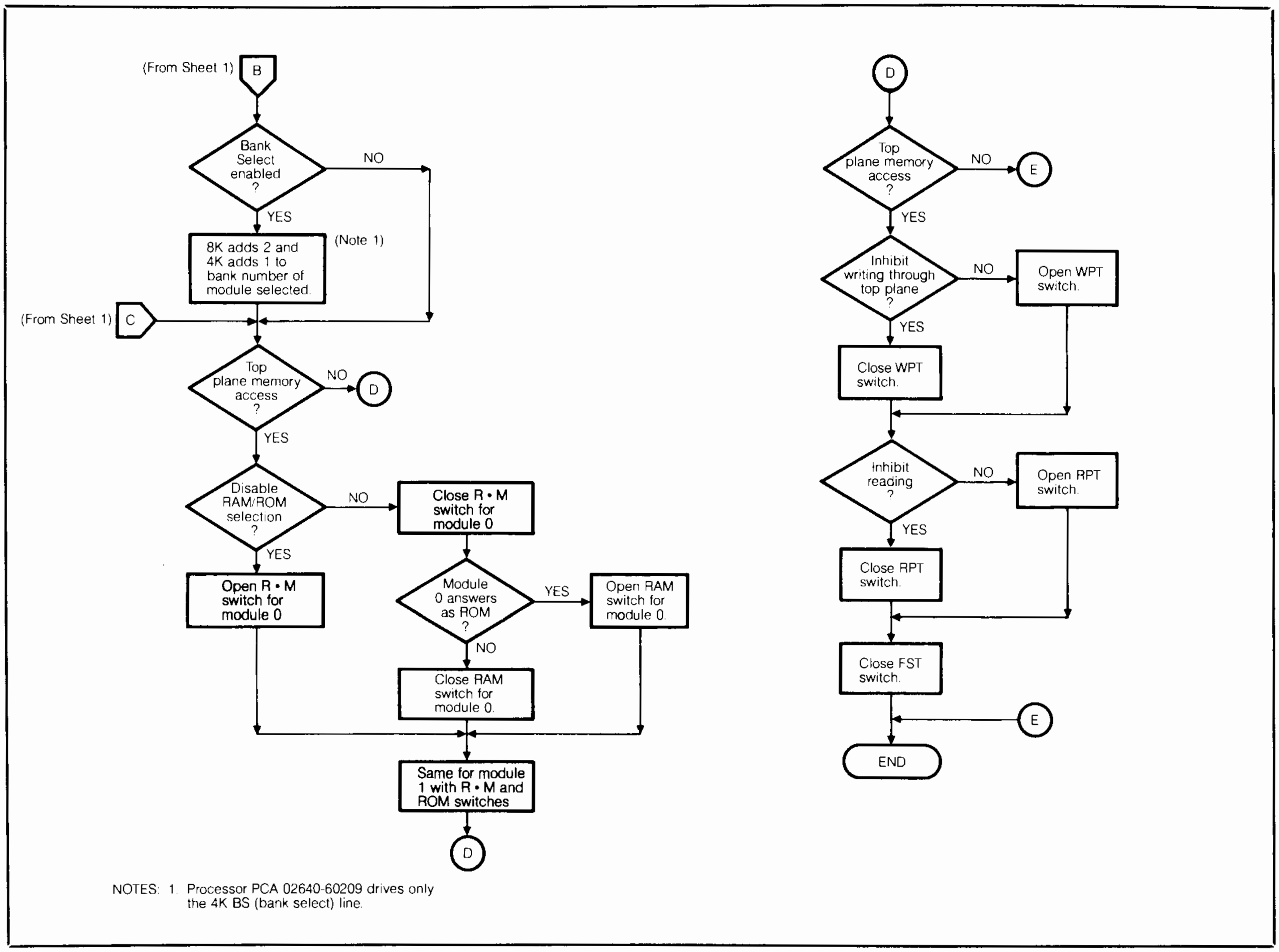


Figure 3-24. Universal RAM Memory PCA Strapping Flowchart (Continued) (Sheet 2 of 2)

Table 3-13. Universal RAM Memory PCA Strapping Options

STRAP	STRAPPING OPTION	SWITCH OPEN	SWITCH CLOSED
INH	Inhibit or enable the corresponding module.	The corresponding module is enabled.	The corresponding module is inhibited.
32K	Add 32K or 0 to the starting address of the corresponding module.	Adds 0 to the address selected by address bits 0 thru 13.	Adds 32K to the address selected by address bits 0 thru 13.
16K	Add 16K or 0 to the starting address of the corresponding module.	Adds 0 to the address selected by address bits 0 thru 13.	Adds 16K to the address selected by address bits 0 thru 13.
8K	If Bank Select is selected and the corresponding enabling switch, M2 or M3, is closed, selects either the high or low level of the BANK SELECT signal for selecting the most significant of the two bank select bits. If Bank Select is not selected, add either 8K or 0 to the starting address of the corresponding module, provided the corresponding enabling switch, M2 or M3, is closed.	If Bank Select is selected and the M2 (or M3) switch is closed the most significant bank select bit is selected when the BANK SELECT signal is low (not compatible with standard firmware code). If Bank Select is not selected, 0 is added to the starting address of the corresponding module.	If Bank Select is selected and the M2 (or M3) switch is closed, the most significant bank select bit is selected when the BANK SELECT signal is high (compatible with standard firmware code). If Bank Select is not selected, 8K is added to the starting address of the corresponding module.
4K	If Bank Select is not selected, add 4K or 0 to the starting address of the corresponding module provided switch M2 or M3 (whichever is applicable) is closed. If Bank Select is selected, this switch must be closed.	If Bank Select is not selected, adds 0 to the address selected by address bits 0 thru 13 provided switch M2 or M3 (whichever is applicable) is closed. If Bank Select is selected, this switch must be closed.	If Bank Select is not selected, adds 4K to the address selected by address bits 0 thru 13 provided switch M2 or M3 (whichever is applicable) is closed. If Bank Select is selected, this switch must be closed.
M2	If Bank Select is selected, enables or disables the most significant of the two bank select bits (8K switch) for module 0. If Bank Select is not selected, enables or disables the capability for adding 4K or 8K or both to the starting address of the memory in module 0.	If Bank Select is selected, disables selection of the most significant bank select bit for module 0. If Bank Select is not selected, disables the capability for adding 8K to the starting address of module 0.	If Bank Select is selected, enables selection of the most significant bank select bit for module 0 using the BANK SELECT signal. If Bank Select is not selected, enables the capability for adding 4K or 8K or both to the starting address of the memory in module 0.
M3	If Bank Select is selected, enables or disables the most significant of the two bank select bits (8K switch) for module 1. If Bank Select is not selected, enables or disables the capability for adding 4K or 8K or both to the starting address of the memory in module 1.	If Bank Select is selected, disables selection of the most significant bank select bit for module 1. If Bank Select is not selected, disables the capability for adding 8K to the starting address of module 1.	If Bank Select is selected, enables selection of the most significant bank select bit for module 1 using the BANK SELECT signal. If Bank Select is not selected, enables the capability for adding 4K or 8K or both to the starting address of the memory in module 1.
FST	Select 400 or 500 nanosecond memory cycle time. (The top plane connector must be in place to enable this switch.)	500 nanosecond memory cycle time selected.	400 nanosecond memory cycle time selected.

Table 3-13. Universal RAM Memory PCA Strapping Options (Continued)

STRAP	STRAPPING OPTION	SWITCH OPEN	SWITCH CLOSED
"B" Jumpers	Enable or disable selection of the most significant of the two bank select bits (to enable selection of banks 2 and 3) using the BANK SELECT signal. (To enable selection of bank 2 or 3, the M2 and M3 switches must be closed.)	Both jumpers in horizontal position. Selection of bank 2 and 3 disabled. (The 4K, 8K, M2, and M3 switches are used to add 0, 4K, 8K, or 12K to the starting address of the corresponding module.)	Both jumpers in diagonal position. Selection of banks 2 and 3 enabled provided the 4K, 8K, and M2 (or M3) switches are closed. (To enable selection of bank 3, the R•M and RAM switches must also be closed.)
R•M	Provided the RAM switch is closed, enables or disables selection of the least significant of the two bank select bits using the DISABLE ROM signal.	Selection of the least significant of the two bank select bits is disabled.	Provided the RAM switch is closed, selection of the least significant of the two bank select bits is enabled.
RAM	If the R•M switch is closed, selects either the high or low level of the DISABLE ROM signal to select the least significant of the two bank select bits. If the R•M switch is open, the RAM switch has no effect and selection of the least significant bank select bit is disabled.	Providing the R•M switch is closed, the least significant bank select bit is selected when the DISABLE ROM signal is low (not compatible with standard firmware code).	Providing the R•M switch is closed, the least significant bank select bit is selected when the DISABLE ROM signal is high (compatible with standard firmware code).
RPT	Enable or disable use of the DISABLE ROM signal for disabling data output on the top plane bus for either banks 0 and 2 or banks 1 and 3, depending on the position of the RAM switch.	The top plane bus is enabled for readout of data from all banks in use independent of the DISABLE ROM signal.	If the R•M switch is open, disabling selection of the least significant bank select bit, the top plane bus is enabled for readout of data from any bank in use when the DISABLE ROM signal is high and disabled for readout from any bank when the signal is low. If the R•M and RAM switches are closed, readout of data over the top plane bus is disabled only for banks 0 and 2 by a low DISABLE ROM signal. If the R•M switch is closed and the RAM switch is open, readout is disabled only for banks 1 and 3 when the DISABLE ROM signal is low. (Readout is enabled for all banks used when the DISABLE ROM signal is high.)
WPT	Enable or disable writing into both memory modules.	Enables writing into both memory modules.	Disables writing into both memory modules.
M1	Selects a maximum of 4K or 16K addressable addresses per IC chip.	Selects a maximum of 4K addressable addresses per IC chip.	Selects a maximum of 16K addressable addresses per IC chip.

13298A 32K PROM Memory (Applicable also to the 32K ROM PCA 02640-60221)

USED WITH TERMINALS .... 2641A; 2645A, K, N, R, S; 2647A; 2648A.

SELECTABLE CHARACTERISTICS ... Characteristics selectable are:

1. Select the PCA for use with either ROMs or PROMs (this is normally done at the factory).
2. Select the block of addresses for the 32K bytes of memory on the PCA to be any 32K block in the range 0 to 256K (provided the processor PCA supplies the DISABLE ROM and BANK SELECT signals).
3. Disable the ROM/PROM memory on the PCA in 2K-byte blocks.
4. Enable or disable the 256 bytes of fast RAM on the PCA.
5. Select the starting address for the 256 bytes of RAM on the PCA to be one of the following:
   a. 36,864
   b. 37,120
   c. 64,000
   d. 64,256

RESTRICTIONS .... The ROM/PROM Memory PCA cannot be used for any memory which must be accessed on the bottom plane bus (this includes display memory). If the terminal display is to be used, a memory PCA which can be accessed on the bottom plane bus must be used to contain the display memory because the Display Memory Access (DMA) PCA can access only bottom plane memory.

PROCEDURE .... The flowchart in figure 3-25 supplies configuration procedures for the ROM/PROM Memory PCA. Functions of the strapping switches are supplied in table 3-14. If more information is needed, refer to the background information paragraphs following these procedures.

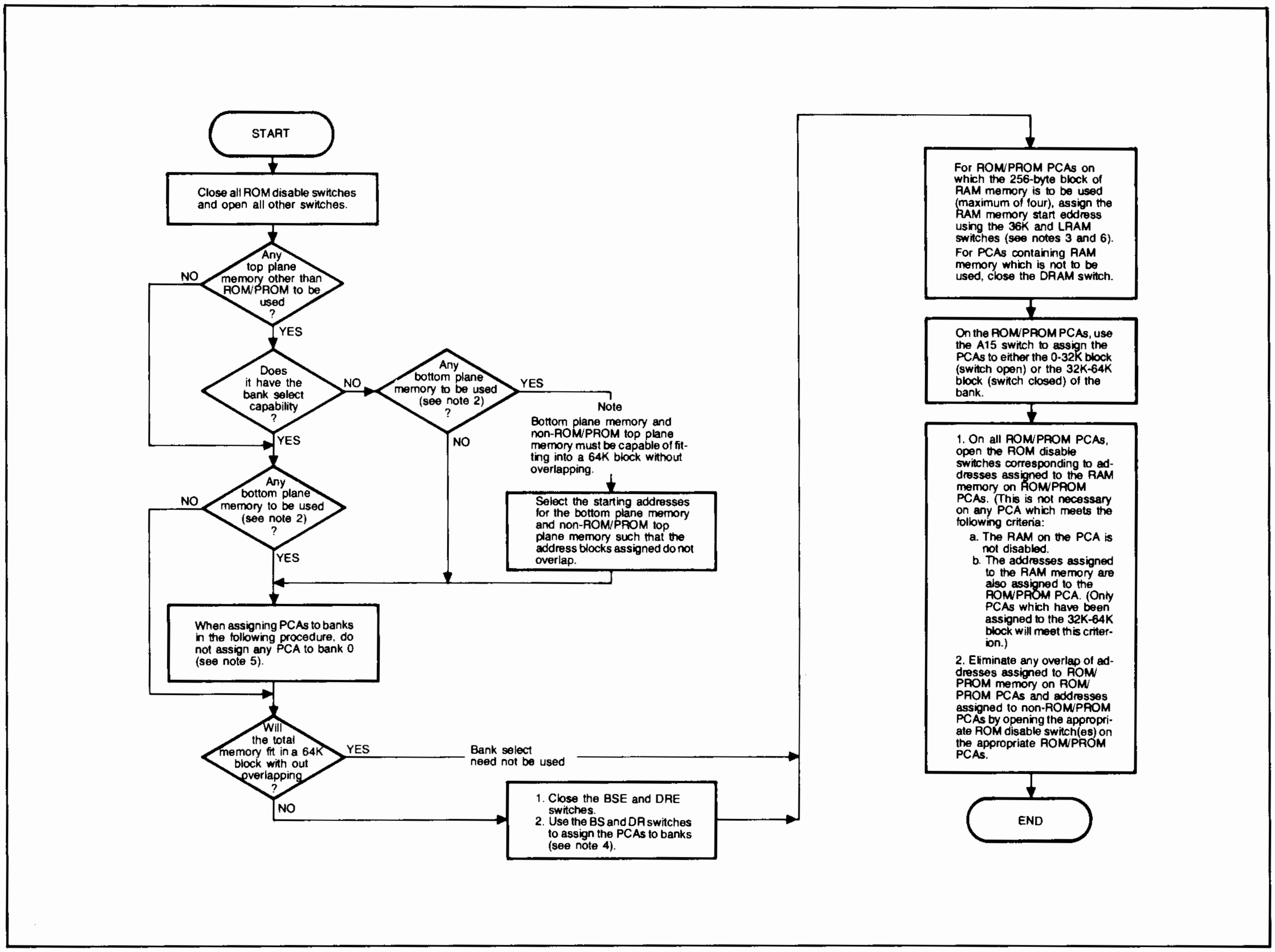


Figure 3-25. 32K ROM/PROM PCA Strapping Flowchart (Sheet 1 of 2)

1. Addresses 32,769 through 36,867 (32K—36K) are reserved by the PCA hardware for "memory-mapped I/O".

2. Display memory and any memory which must be accessible from any bank (for example, a bridge routine for accessing memory in one bank from another bank) must be assigned to the bottom plane.

3. Addresses assigned to RAM memory on ROM/PROM PCAs are exclusive and cannot be assigned to any other top plane memory. Although these addresses can be assigned to bottom plane memory without harm, the bottom plane addresses can never be accessed when this is done.

4. Memory on the ROM/PROM is assigned to banks using the BS and DR switches which must be enabled by closing the BSE and DRE switches. Banks are selected as follows (1 = switch closed, 0 = switch open):

BANK	BS	DR
0	0	0
1	0	1
2	1	0
3	1	1

5. Under certain circumstances, it is desirable to assign all top plane memory to banks 1, 2, and 3, leaving bank 0 for bottom plane memory, or for top plane memory which has no bank select capability, or for both. Although bank 0 is not selected using switches on the PCAs assigned to it, the memory assigned to it is accessed, by default, when no such address is found on the top plane.

   Note that the program instructions used to access an address in bank 0 must always include selection of bank 0 to ensure that the same address on bank 1, 2, or 3 is not accessed.

6. Each ROM/PROM PCA contains one 256-byte block of RAM memory. The starting address for the RAM block is restricted to four addresses which are selected using the 36K and LRAM switches as indicated below (1 = switch closed; 0 = switch open):

STARTING ADDRESS	SWITCH	
	36K	LRAM
36,864	1	1
37,120	1	0
64,000	0	1
64,256	0	0

Figure 3-25. 32K ROM/PROM PCA Strapping Flowchart (Sheet 2 of 2)

Table 3-14. 32K ROM/PROM Memory PCA Strapping Options

SWITCH	STRAPPING OPTION	SWITCH CLOSED	SWITCH OPEN
ROM disable switches 0-30	Each switch disables 2K of ROM/PROM memory.	Each switch, when closed, enables the corresponding 2K byte block of ROM memory.	Each switch, when open, disables the corresponding 2K byte block of ROM memory.
A15	Used to designate the addresses on this PCA as being in the range from 0 to 32K or 32K to 64K.	The ADDR 15 signal from the processor (bit 15 of the address selection word) must be low (logic 0) to enable selection of an address on this PCA.	The ADDR 15 signal from the processor (bit 15 of the address selection word) must be high (logic 1) to enable selection of an address on this PCA.
		NOTE The DISABLE ROM and BANK SELECT signals from the processor act as two additional address selection signals. The total address selection word consists of signals ADDR 0 through ADDR 15, DISABLE ROM, and BANK SELECT enabling selection of 2^{17} addressess through the top plane connector.	
DR	Used to designate the addresses on this PCA as being either in the range 0 to 64K or 64K to 128K.	The DISABLE ROM signal from the processor must be low (logic 0) to enable selection of an address on this PCA. (The DRE configuration switch must be closed to enable the DR switch.)	The DISABLE ROM signal from the processor must be high (logic 1) to enable selection of an address on this PCA. (The DRE configuration switch must be closed to enable the DR switch.)
BS	Used to designate the addresses on this PCA as being either in the range 0 to 128K or 128K to 256K.	The BANK SELECT signal from the processor must be low (logic 0) to enable selection of an address on this PCA. (The BSE configuration switch must be closed to enable the BS switch.)	The BANK SELECT signal from the processor must be high (logic 1) to enable selection of an address on this PCA. (The BSE configuration switch must be closed to enable the BS switch.)
DRE	Enables or disables the DR switch.	Enables the DR configuration switch.	Disables the DR configuration switch.
BSE	Enables or disables the BS switch.	Enables the BS configuration switch.	Disables the BS configuration switch.
DRAM	Enables or disables the 256 byte RAM memory.	Disables the 256 byte fast RAM memory.	Enables the 256-byte fast RAM memory.

SWITCH	STRAPPING OPTION	SWITCH CLOSED	SWITCH OPEN
LRAM	Increases the starting address for RAM memory by 256.	The starting address for fast RAM memory is as selected by the "36K" configuration switch.	The starting address for fast RAM memory is equal to the value selected by the "36K" configuration switch plus 256 (decimal).
36K	Selects the starting address for RAM memory as 36K or 62.5K	The selected start address for fast RAM memory is 36,864. (This address is subject to change by the LRAM configuration switch.)	The selected start address for fast RAM memory is 62,500. (This address is subject to change by the LRAM configuration switch.)
SLOW	Selects 400 or 500 nanoseconds as the time for a memory cycle.	The time required for a ROM or PROM memory cycle is 500 nanoseconds. The switch must be closed if slow (>400 ns) PROMs are used on the PCA in place of ROMs.	The time required for a ROM memory cycle is 400 nanoseconds. The switch should be closed if ROMs are used on the PCA.
W1	Used in selection of ROMs or PROMs.	Connects the ADDR 10 signal to pin 21 on the test socket. This jumper must be installed to use ROMs.	Disconnects the ADDR 10 signal from pin 21 on the test socket. This jumper must be removed to use PROMs.
W2	Used in selection of ROMs or PROMs.	Connects +5V to pin 21 on the test socket. This jumper must be installed to use PROMs.	Disconnects +5V from pin 21 on the test socket. This jumper must be removed to use ROMs.
W3	Used in selection of ROMs or PROMs.	Connects the ADDR 10 signal to pin 19 on the test socket. This jumper must be installed to use PROMs.	Disconnects the ADDR 10 signal from pin 19 on the test socket. This jumper must be removed to use ROMs.
W4	Used in selection of ROMs or PROMs.	Connects +12V to pin 19 on the test socket. This jumper must be installed to use ROMs.	Disconnects +12V from pin 19 on the test socket. This jumper must be removed to use PROMs.

BACKGROUND INFORMATION .... The following paragraphs consist of background information to supplement the strapping procedures.

RAM ADDRESS ASSIGNMENT

If the 256 bytes of RAM memory on the ROM/PROM Memory PCA is to be used, the block of addresses assigned to it is exclusive and cannot be shared with any other memory in the terminal. This requires that ROM/PROM memory (and all other top plane memory) be disabled for any block of addresses assigned to RAM. (A hardware signal on the PCA disables all ROM/PROM memory on any Control Memory PCA to which a block of RAM addresses is assigned which includes the address selected by the processor.)

DISABLING ROM/PROM MEMORY WHICH SHARES ADDRESSES WITH RAM MEMORY

To avoid response from ROM/PROM memory when RAM memory is accessed by the processor, it is necessary, on some top plane memory PCA's, to disable the block of ROM/PROM memory which shares addresses with RAM memory. This can be done by closing ROM disable switch 4 and/or 30. Each switch disables 2K of ROM/PROM memory. This must be done on any top plane memory PCA to which addresses 32K to 64K are assigned with the following two exceptions. If the RAM memory starting addresses are correctly assigned, it is not necessary to close ROM disable switch 4 on any PCA which contains RAM memory to which addresses in the address block 36,864 — 37,375 are assigned. Closing the switch is unnecessary because the ROM/PROM memory is automatically disabled by a hardware signal on the PCA when the RAM memory on the PCA is enabled by selection of one of its addresses. Also, for the same reason, it is not necessary to close ROM disable switch 30 on any PCA which contains RAM memory to which addresses in the address block 64,000—64,512 are assigned.

RAM STARTING ADDRESSES

Four starting addresses are available for RAM memory. They are fixed, by the hardware, at the values listed below:

a. 36,864
b. 37,120
c. 64,000
d. 64,256

Table 3-15 lists the switch settings for selecting the starting address for the 256-byte block of RAM on a PCA. It also lists the addresses at which RAM is enabled and disabled for each of the starting addresses and the addresses at which ROM/PROM memory is disabled and enabled again. Note that the address at which ROM/PROM memory is enabled is not necessarily the same as the one at which RAM is disabled.

Table 3-15. RAM Memory Start Address Selection

SWITCHES						AMOUNT	
36K	LRAM	RAM ENABLED	ROM/PROM DISABLED	RAM DISABLED	ROM/PROM ENABLED	RAM ON	ROM/PROM OFF
Closed	Closed	36864	36864				
Closed	Closed			37120		256	
Closed	Closed				37376		512
Closed	Open		36864				
Closed	Open	37120					
Closed	Open			37376	37376	256	512
Open	Closed	64000	64000				
Open	Closed			64256		256	
Open	Closed				64512		512
Open	Open		64000				
Open	Open	64256					
Open	Open			64512	64512	256	512

For all of the starting addresses, ROM/PROM memory is disabled for a block of 512 addresses; twice the number required for the 256-byte block of RAM on the PCA. However, the extra addresses can be assigned to RAM memory on another PCA as shown in figure 3-26.

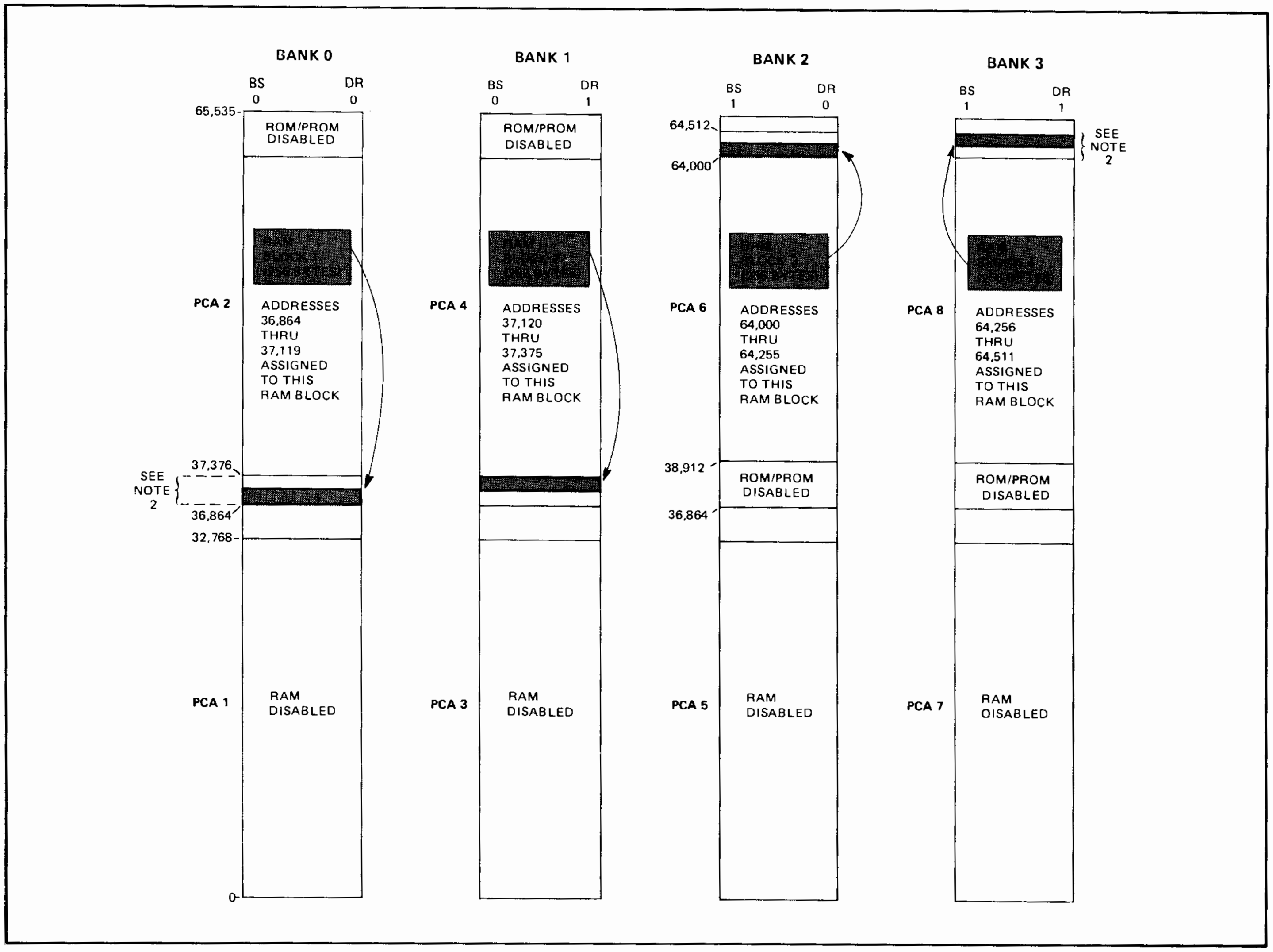


Figure 3-26. Example of RAM Address Assignment (Sheet 1 of 2)

SWITCH		PCA 1	2	3	4	5	6	7	8
	DRAM	Closed	Open	Closed	Open	Closed	Open	Closed	Open
	36K	Closed	Open	Closed	Open	Closed	Open	Closed	Open
	LRAM	–	Closed	–	Open	–	Open	–	Closed
	BS	Closed	Closed	Closed	Closed	Open	Open	Open	Open
	DR	Closed	Closed	Open	Open	Closed	Closed	Open	Open
	A15	Closed	Open	Closed	Open	Closed	Open	Closed	Open
	BSE	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
	DRE	Closed	Closed	Closed	Closed	Closed	Closed	Closed	Closed
DISABLE ROM SWITCHES	4	Open	Open	Open	Open	Open	Closed	Open	Closed
DISABLE ROM SWITCHES	30	Open	Closed	Open	Closed	Open	Open	Open	Open

NOTES:

1. RAM memory is not assigned to any bank.

2. ROM/PROM memory with these addresses is disabled by the RAM DISABLED-ROM SELECT signal.

Figure 3-26. Example of RAM Address Assignment (Sheet 2 of 2)

INTERFACING WITH OTHER MEMORY PCAs

In cases where it is desirable to use already existing bottom-plane memory or add more RAM memory than exclusive use of ROM/PROM Memory PCA's allows, gaps can be left in the addresses assigned to Control Memory PCA memory using the A15, DR, and BS switches. Then these gaps are filled with bottom-plane memory. Figure 3-26 illustrates how a 32K-byte gap can be left in top-plane memory and filled in with bottom plane memory. The addresses assigned to the bottom-plane memory must be selected to fall within the gap left in top-plane memory or they cannot be accessed.

To leave a gap in memory composed of ROM/PROM Memory PCA's it is necessary to either remove the applicable ROM/PROM Memory PCA or use the ROM disable switches to disable ROM/PROM memory on the PCA in 2K blocks. Figure 3-27 shows two examples of gap creation in top plane memory; a 32K gap is shown created by removing a whole PCA and a 4K gap is created at the top 4K of bank 3 memory by closing ROM disable switches 28 and 30.

If the terminal display is to be used, a gap must be left for it in top plane memory because the Display Memory PCA can access display memory only on the bottom plane bus. With this arrangement, the processor will first try to access any address which falls within the gap on the top plane bus. When the attempt is unsuccessful within the top plane access time, it will automatically access the selected address on the bottom plane bus. It should be kept in mind that bottom plane memory requires more access time than top plane memory.

EXAMPLES .... See figure 3-27 for examples of ROM/PROM PCA memory allocation.

Note

The examples supplied are not necessarily practical. They have been selected to illustrate the rules for memory allocation rather than actual usage.

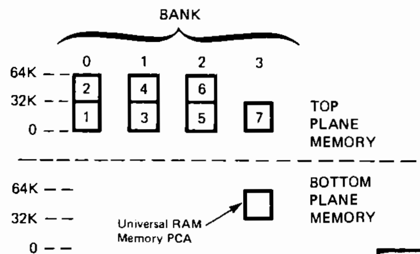
Example 1 illustrates use of the maximum amount of memory (256K), of which 32K is bottom plane memory. When an address in the range 32K to 64K in bank 3 is addressed, the processor automatically attempts to access the address on the top plane first. When it does not find the address in top plane memory, it tries bottom plane memory where the address is actually located.

In example 2, only banks 0 and 1 are used with only 4K of bottom plane memory. As in example 1, the bottom plane memory is accessed by addressing the top 4K of bank 1 memory (which has been disabled). When the attempt to access top plane memory is unsuccessful, the processor automatically checks bottom plane memory for the address.

In example 3, banks 1, 2, and 3 are used for top plane memory with bank 0 left blank so that when an address in the 32K to 64K range in bank 0 is addressed, the address will be found in bottom plane memory.

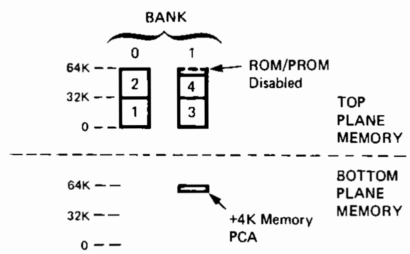
Example 4 shows two ROM/PROM PCA's used in bank 1 with two Writable Control Store PCA's of 8K each assigned addresses 16K through 32K in bank 0. When an address in the block 32K to 64K in bank 0 is accessed by the processor, it will be found on the Universal RAM Memory PCA assigned to bottom plane memory.

Banks 0 and 1 are used, in example 5, with one ROM/PROM PCA containing addresses 0 to 32K in bank 0 and two ROM/PROM PCA's containing addresses 0 to 64K in bank 1. Two Universal Memory PCA's are used for bottom plane memory with one containing only one ROM. A gap is left in top plane, bank 0 memory by disabling addresses 26K to 28K. These addresses are assigned to the single ROM on the PCA in bottom plane memory. When the processor attempts to access an address in the 26K to 28K block in bank 0, the 26K to 28K ROM in bottom plane memory will be accessed, by default, when the address is not found in top plane memory.



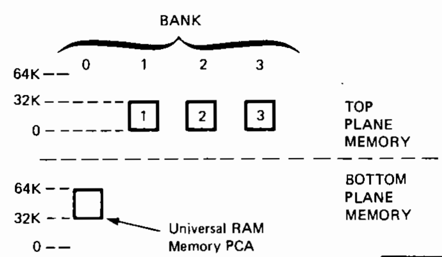
PCA	SWITCH BSE	DRE	$\overline{BS}$	$\overline{DR}$	$\overline{A15}$	OPEN DISABLE ROM SWITCHES
1	1	1	1	1	1	NONE
2	1	1	1	1	0	NONE
3	1	1	1	0	1	NONE
4	1	1	1	0	0	NONE
5	1	1	0	1	1	NONE
6	1	1	0	1	0	NONE
7	1	1	0	0	1	NONE

EXAMPLE 1



PCA	SWITCH BSE	DRE	$\overline{BS}$	$\overline{DR}$	$\overline{A15}$	OPEN DISABLE ROM SWITCHES
1	1	1	1	1	1	NONE
2	1	1	1	1	0	NONE
3	1	1	1	0	1	NONE
4	1	1	1	0	0	28,30

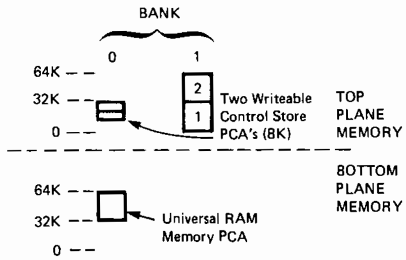
EXAMPLE 2



PCA	SWITCH BSE	DRE	$\overline{BS}$	$\overline{DR}$	$\overline{A15}$	OPEN DISABLE ROM SWITCHES
1	1	1	1	0	1	NONE
2	1	1	0	1	1	NONE
3	1	1	0	0	1	NONE

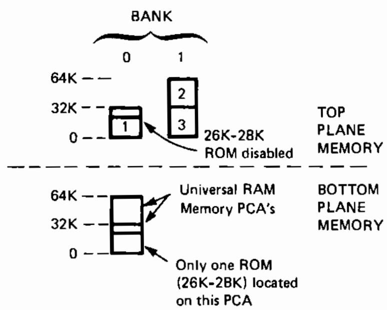
EXAMPLE 3

Figure 3-27. Examples Illustrating Interfacing of Top and Bottom Plane Memory (Sheet 1 of 2)



PCA	SWITCH					OPEN DISABLE ROM SWITCHES
	BSE	DRE	$\overline{BS}$	$\overline{DR}$	$\overline{A15}$	
1	1	1	1	0	1	NONE
2	1	1	1	0	0	NONE

EXAMPLE 4



PCA	SWITCH					OPEN DISABLE ROM SWITCHES
	BSE	DRE	$\overline{BS}$	$\overline{DR}$	$\overline{A15}$	
1	1	1	1	1	1	26
2	1	1	1	0	1	NONE
3	1	1	1	0	0	NONE

EXAMPLE 5

Figure 3-27. Examples Illustrating Interfacing of Top and Bottom Plane Memory (Sheet 2 of 2)

02640-60003, -60144 Control Memory (Control Store) PCA

USED WITH TERMINALS .... 2640A,B,N, and S

SELECTABLE CHARACTERISTICS .... The Control Memory (Control Store) PCA contains 1K of RAM memory in addition to the complete ROM memory for the terminal. Strapping the PCA consists of selecting the starting address for the 1K of RAM memory.

HOW ....

1. Determine the starting address for the 1K of RAM memory.
2. Strap the Control Memory PCA to indicate the starting address.

HOW TO DETERMINE THE STARTING ADDRESS .... For all terminals, memory blocks are added to the terminal memory by starting at the maximum amount of memory recognized by the terminal and working backward, from higher- to lower-numbered memory, in memory-block steps (figure 3-28).

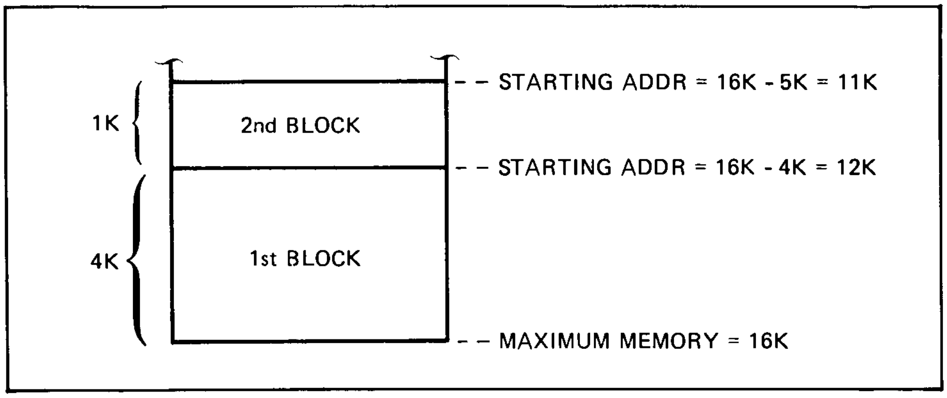


Figure 3-28. Determination of Starting Address for a Memory Block

The starting address of the first block of memory is determined by subtracting the amount of memory in the block to be added (1K) from the maximum memory recognized by the terminal. For terminals using the 02640-60003 Control Memory PCA (2640A, B, N, and S) the upper memory limit is 16K. The lower limit for RAM memory is 8K.

The starting address for the second and subsequent blocks is determined by subtracting the amount to be added from the starting address of the last block added.

The following equations summarize the foregoing information:

STARTING ADDR FOR FIRST BLOCK	=	MAX. MEMORY (16K)	—	AMOUNT OF MEMORY IN FIRST BLOCK
STARTING ADDR FOR SUBSEQUENT BLOCKS	=	STARTING ADDR FOR LAST BLOCK	—	AMOUNT OF MEMORY IN BLOCK BEING ADDED

PROCEDURE

1. Determine the starting address of the RAM memory on the Control Memory PCA using the rules described in the preceding paragraph. If the 1K of RAM is to be the only RAM memory used in the terminal, its starting address must be 15K (derived using the equation from the preceding paragraph for determining the starting address of the first block of memory). If other blocks of RAM memory are to be used, use the equation for the starting address of subsequent blocks of memory to determine the starting address of the 1K RAM block.

   Note

   The 1K block of RAM on the control memory should be the last-added and, therefore, the lowest-numbered block of RAM memory.

2. Remove all jumpers from the Control Memory PCA, then place jumpers in the locations labeled RAM START ADR (1K, 2K, 4K, 8K, 16K, and 32K) such that the sum of the labels of locations without jumpers is equal to the starting address of the 1K of RAM memory. (The DIAG and ROM jumper locations are not used.) (See figures 3-29 and 3-30.)

   If the 1K of RAM memory on the Control Memory is not to be used, remove all jumpers from the Control Memory PCA.

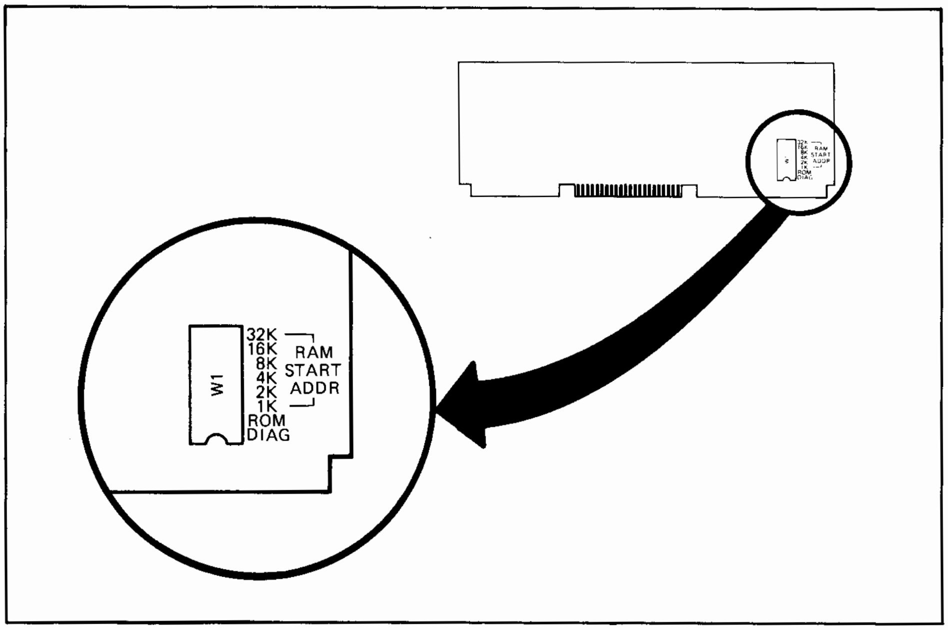


Figure 3-29. Control Store PCA Locations

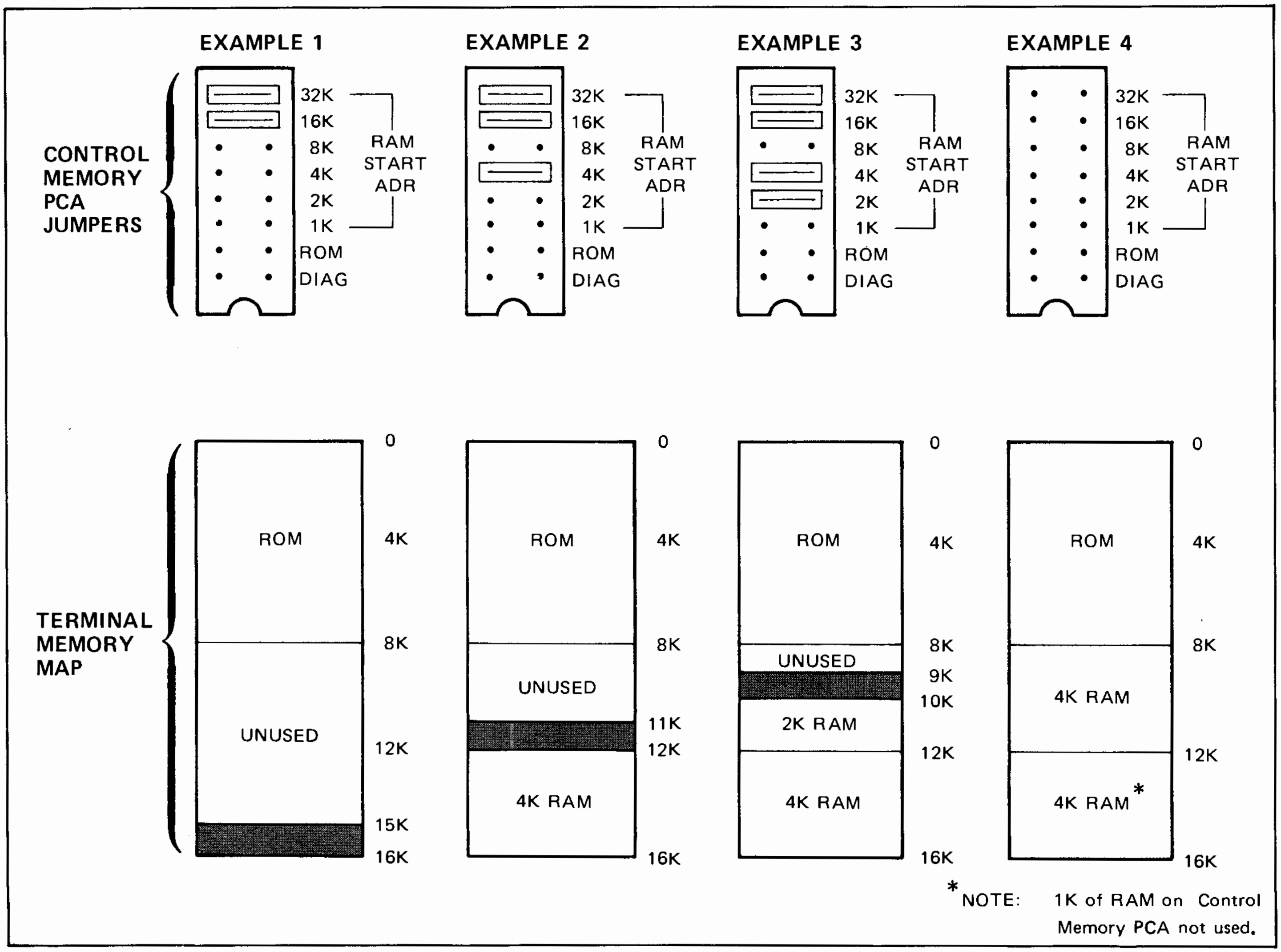


Figure 3-30. Control Memory (Control Store) PCA 02640-60003 (02640-60144) Jumpering Examples

Keyboard Interface PCA
02640-60019, -60123, -60246

Note

Most switches on the Keyboard Interface PCA are associated with data communications accessories 13260A, B, C, and D. For strapping information on a Keyboard Interface PCA used in a terminal which contains accessory 13260A or B, refer to the strapping information for accessories 13260A and B. For information on a PCA used with a 13260C or D accessory, refer to the strapping information for accessories 13260C and D.

02640-60047, -60111 Control Memory (ROM) PCA

USED WITH TERMINALS .... 2640C and 2644A.

SELECTABLE CHARACTERISTICS .... This PCA contains two sets of jumpers; ENABLE ROM and START ADDRESS. Each ENABLE ROM jumper enables one 2K ROM IC located on the PCA. For a ROM to be accessible to the processor, the associated ENABLE ROM jumper location must be occupied by a jumper. The START ADDRESS 16K and 32K jumper locations are not used but must be occupied by jumpers.

PROCEDURE ....

1. Place jumpers in all ENABLE ROM jumper locations except 12-14 and 14-16 (figure 3-31).
2. Place jumpers in the 16K and 32K START ADDRESS jumper locations. No other jumper locations should contain jumpers.

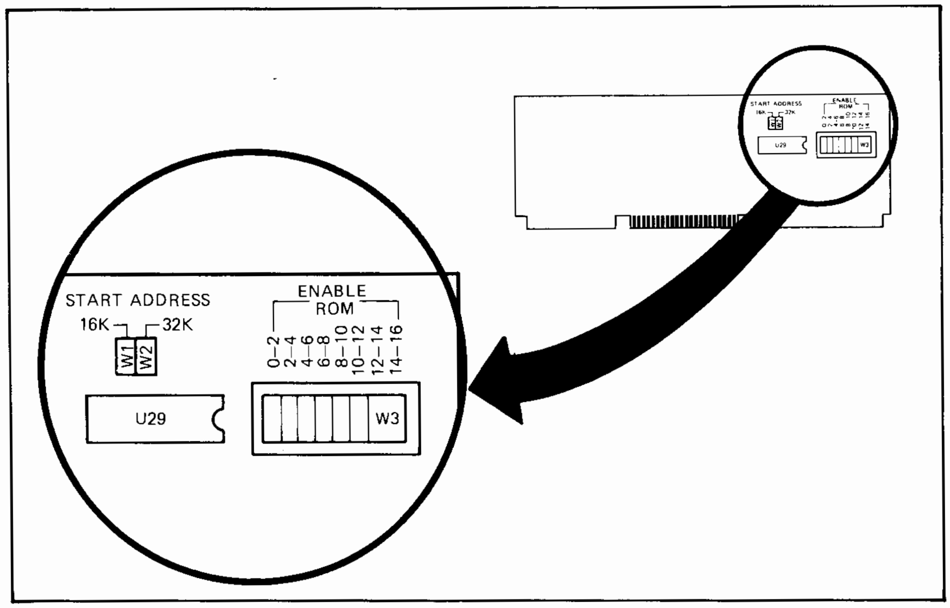


Figure 3-31. ROM PCA Jumper Locations

02640-60136 and 02640-60192 Control Memory PCAs

USED WITH TERMINALS .... The terminals with which each PCA is used is shown below.

TERMINAL	1ST CONTROL MEMORY PCA	2ND CONTROL MEMORY PCA
2641A	02640-60192	02640-60136
2645A,K,R,S	02640-60192	None
2648A	02640-60192	02640-60192

SELECTABLE CHARACTERISTICS .... Selectable characteristics are listed below (see figure 3-32).

JUMPER/SWITCH LOCATION	JUMPER IN (CLOSED)	JUMPER OUT (OPEN)
0 thru 22	Each jumper enables the ROM IC with the same starting address.	Disables the ROM IC with the same starting address.
+24	Add 0 to each ROM starting address on the PCA.	Add 24 to each ROM starting address label on the PCA.
RAM	Enables the 250-byte fast RAM IC located on the PCA.	Disables the 250-byte fast RAM IC located on the PCA.

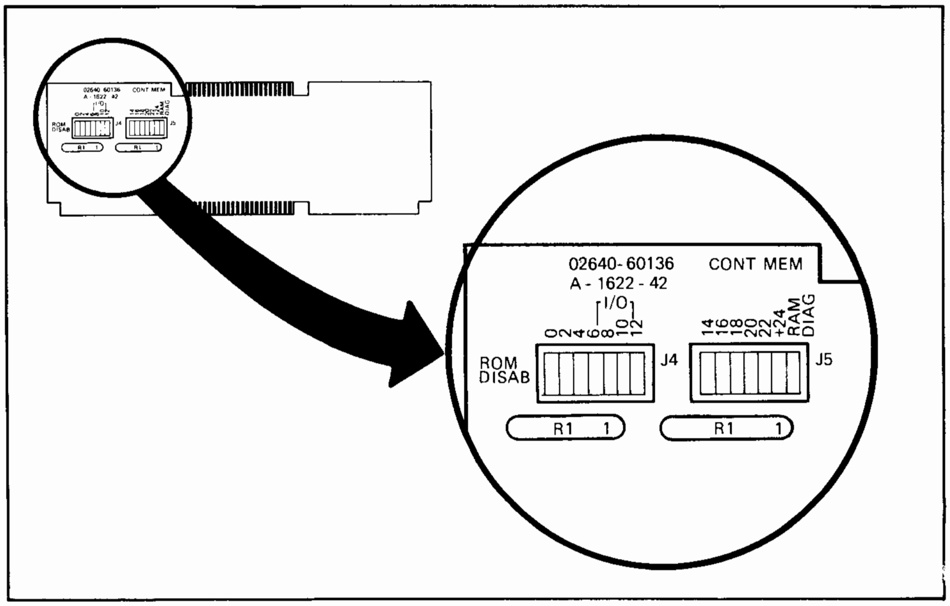


Figure 3-32. Control Memory PCA Jumper Locations

PROCEDURE .... Strapping for the Control Memory PCAs is standardized as shown in figure 3-33.

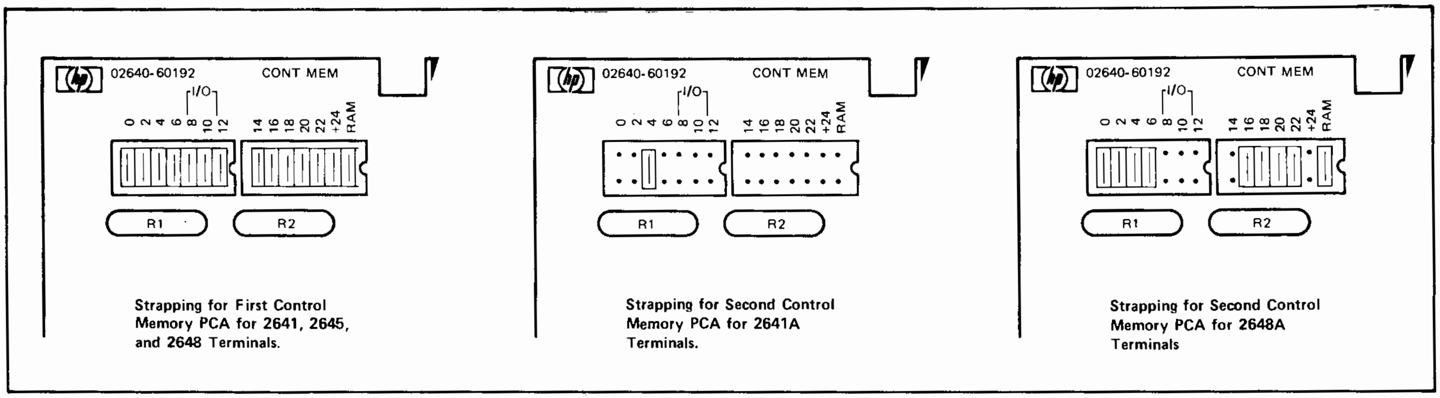


Figure 3-33. Control Memory PCAs Strapping

02640-60243 Control Memory PCA

USED WITH TERMINALS 2642A

PROCEDURE .... Strapping the Control Memory PCA consists of configuring the switches as shown in figure 3-34.

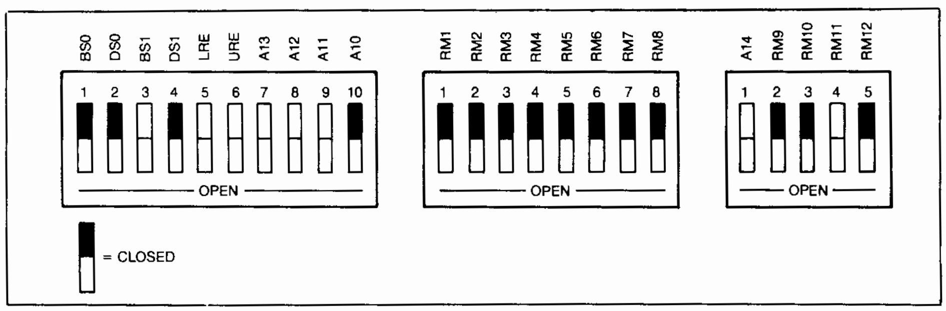


Figure 3-34. Control Memory PCA Strapping for 2642A

Processor PCAs (All Types)

USED WITH TERMINALS .... All 264X terminals.

HOW .... Strapping any Processor PCA consists of configuring the switches on the Processor PCA.

PROCEDURE .... Configuration of the strapping switches on all types of Processor PCA is standardized with all switches set to the closed position.

32K ROM PCA
02640-60221

Note

Strapping procedures for the 32K ROM PCA are the same as for accessory 13298A (32K PROM PCA). Refer to the strapping instructions for accessory 13298A.

User Maintenance

4

User Maintenance 4

INTRODUCTION Preventive maintenance procedures are required only for the cartridge tape unit and tape.

CAUTION

DO NOT use petroleum-based cleaners such as lighter fluid or cleaners containing benezene, tricholoretylene, dilute ammonia, ammonia, or acetone on the terminal. These could harm the plastic surfaces. Avoid spraying between the keys.

The screen and keyboard can be cleaned to remove dust or grease. First, lightly dust using a damp, lint-free cloth. The cloth should be just damp enough to pick up dust, not wet. Paper towels are fine. Avoid wiping dust or lint into the keyboard area.

Smudges and fingerprints can be removed using most conventional spray cleaners (such as "SNAP" glass and plastic cleaner manufactured by Mist Products Inc., 16 Watch Hill Road, Croton-on-Hudson, N.Y. 10520).

Magnetic Head Cleaning

WHY To reduce the possibility of data errors.

HOW With a swab and cleaning solvent.

WHEN Fifty operating hours after the last cleaning or if dirt or oxide is present on heads.

EQUIPMENT NEEDED Cleaning swab
Cleaning solvent (Freon or alcohol)

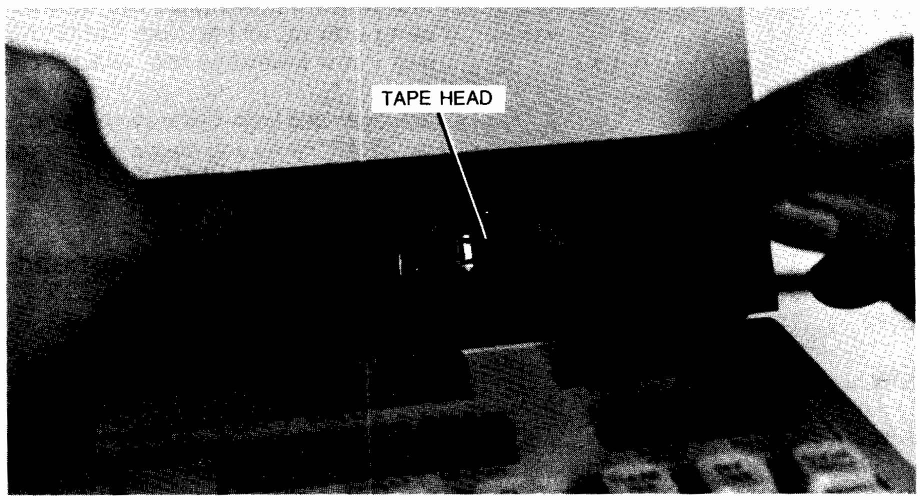
PROCEDURE

1. Open the terminal. (Refer to Section 2 for procedures.) (Refer to Section 7 to locate magnetic heads.)

CAUTION

Do not attempt to clean magnetic heads with any cleaning materials other than those provided. Use of solvents other than Freon or alcohol may damage heads. Use of abrasive type cleaners may scratch head surfaces.

2. Saturate cleaning swab with cleaning solvent.
3. Using right-to-left and left-to-right motion, carefully wipe magnetic head surface clean with saturated swab. Do not clean head surface with an up and down motion.
4. Using a clean, dry, cleaning swab, carefully wipe magnetic head surface dry. Do not dry head surface with an up and down motion.



Magnetic Head Degaussing

WHY .... To restore full read/write capability of CTU.

HOW .... With a hand-held degaussing tool.

WHEN .... Whenever the head has been exposed to a powerful magnetic field.

EQUIPMENT NEEDED .... HP Handheld Degausser, 9160-0023, or equivalent.

PROCEDURE .... 1. Open the terminal. (Refer to Section 7 to locate magnetic heads.)

CAUTION

Remove all tape cartridges from vicinity of degausser.

CAUTION

The degausser should not be left energized for more than five minutes at a time to prevent permanent damage to degausser. Also, ensure that tip of degausser is clean and free of any small bits of metal that might scratch the magnetic head surface.

2. Connect the degausser to an ac power source.
3. Starting from at least three feet away, point tip of degausser toward magnetic head front center surface and slowly approach magnetic head until tip of degausser touches head front center surface.
4. Slowly retract tip of degausser from magnetic head to a distance of at least three feet and disconnect degausser.
5. Firmly grasp mainframe top cover in one hand and release safety latch by pressing it inboard with other hand. Then, using both hands, carefully lower top cover to its closed position.

Tape Conditioning

WHY .... Conditioning a tape restores proper tape tension.

HOW .... By winding the tape forward to end-of-tape at 60 ips and then rewinding it back to beginning-of-tape at 60 ips.

WHEN .... A tape should be conditioned whenever a tape cartridge has been rethreaded, been subjected to sudden environmental changes, or whenever improper tape tension is suspected.

PROCEDURE ....

1. Insert the tape in the left slot for 2644A terminals. For all terminals, the tape can be inserted in either slot.
2. For most terminals, press the TEST key while holding down the CNTL key. For 2642A and 2647A terminals, press the COMMAND key, press the NEXT key two times in succession, then press the CONDTN L TAPE or R TAPE, and then RETURN.
3. When the SEARCHING message is replaced by the cursor (2640A and 2644A) or the EJECT button light goes out (all other terminals), tape conditioning is complete.

Usually, one tape conditioning sequence is sufficient to restore proper tape tension. The sequence can, however, be repeated as many times as desired. If three conditioning sequences fail to restore proper tape tension, replace tape cartridge.

5

Alignment

Alignment and Adjustment 5

Note

All alignment and adjustment procedures for the terminal and its add-on accessories are contained in this section. Unless otherwise specified, these procedures can be performed individually or in any desired sequence.

Power Supply Voltage Adjustment

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

HOW .... Since the +5V power source serves as a reference for the +5V, +12V, −12V, and −42V power sources, adjustment of the +5V potentiometer adjusts all other power sources.

WHEN .... The power supply voltage adjustment should be made whenever any equipment is added or removed from the terminal.

EQUIPMENT REQUIRED .... A 20,000 ohms/volt voltmeter and a screwdriver.

PROCEDURE ....

1. Open the terminal, and remove power supply cover by loosening the cover holddown screw (figure 5-1).
2. Turn on ac power to terminal, and ensure that neither cartridge tape transport motor is running (if installed).
3. Check the voltages at the following points with the multimeter. (See figure 5-1.)

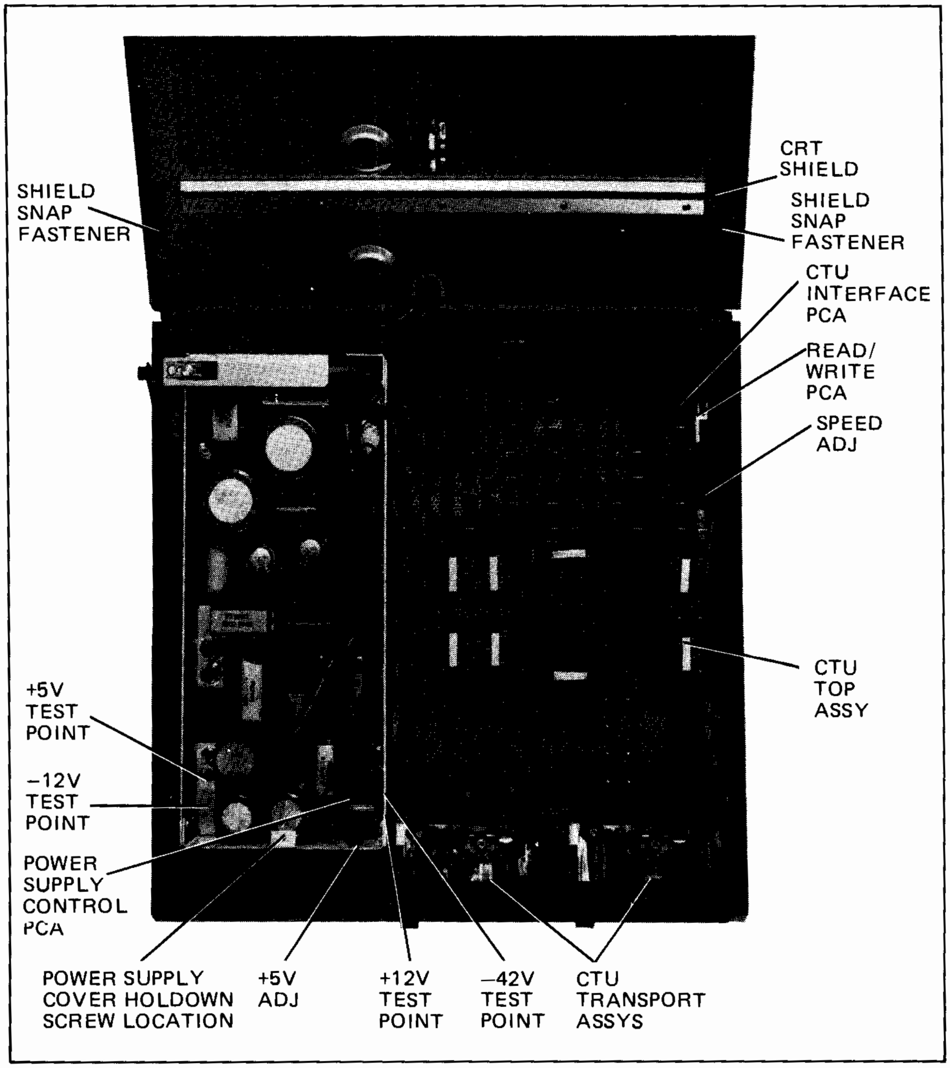


Figure 5-1. Mainframe Bottom Test Point and Adjustment Locations

PROCEDURE (Continued) ....

TEST POINT	VOLTAGE TOLERANCE
+ 5V diode	+4.85V to +5.25V
−42V diode	−40V to −46V
+12V diode	+11.8V to +12.6V
−12V diode	−11.8V to −12.6V

4. Adjust +5V potentiometer until all voltages are within tolerance.
5. When all voltages are within tolerance, replace power supply cover.
6. Perform a terminal self test as described in Section 6.

Brightness, Half Bright, and Focus Adjustments

WHY .... Due to product design, these adjustments seldom need be performed. However, minor adjustment can be made to each potentiometer to suit individual preferences for brightness and focus.

HOW .... Brightness, half-bright, and focus adjustments are made by adjusting three potentiometers on the Sweep PCA. The adjustments are interactive and the procedure is to repeat a cycle in which all three potentiometers are adjusted until brightness, half-bright, and focus are all satisfactory.

WHEN .... These adjustments can be made whenever the appearance of the display is unsatisfactory.

EQUIPMENT REQUIRED ....

1. HP Display Test Module 02640-60063.
2. Screwdriver or alignment tool.

PROCEDURE ....

1. Turn off terminal power and open the terminal.
2. Remove the top connector from the Display Control, Display Memory Access, and Display Timing PCAs (figure 5-2).

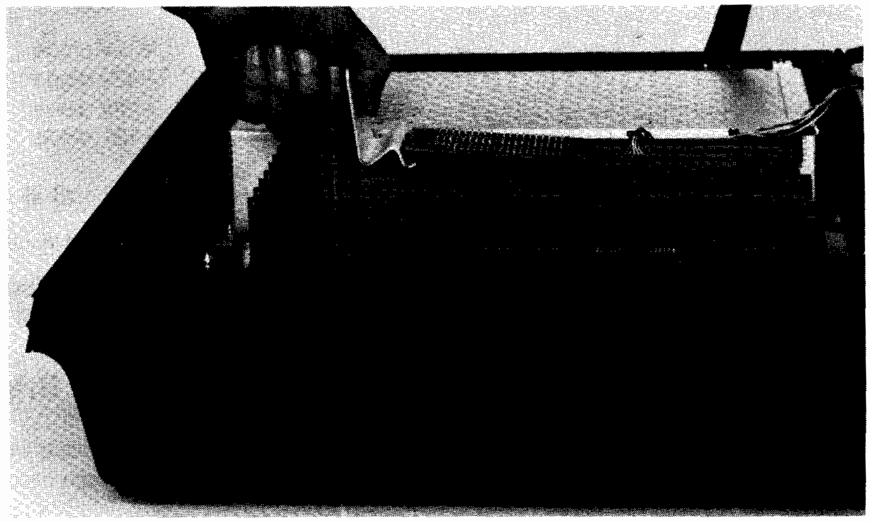


Figure 5-2. Top Plane Connector Removal

PROCEDURE (Continued) ....

3. Remove Display Memory Access (DMA) PCA from terminal.
4. If necessary, rearrange backplane PCA configuration to perform step 5.
5. Install Display Test Module on top connectors of Display Timing and Display Control PCAs so that test module cable is toward front of mainframe (figure 5-3).
6. Connect test module cable plug to Display Timing PCA +5V red test jack located on top front of PCA (figure 5-4).
7. Set rear panel ~LINE switch to ON position.
8. Set test module HALF BRIGHT switch to off position, INVERSE VIDEO switch to off position, and DOTS/CROSSHATCH switch to DOTS.
9. Adjust BRIGHTNESS R37 (see figure 5-5) for desired display brightness.

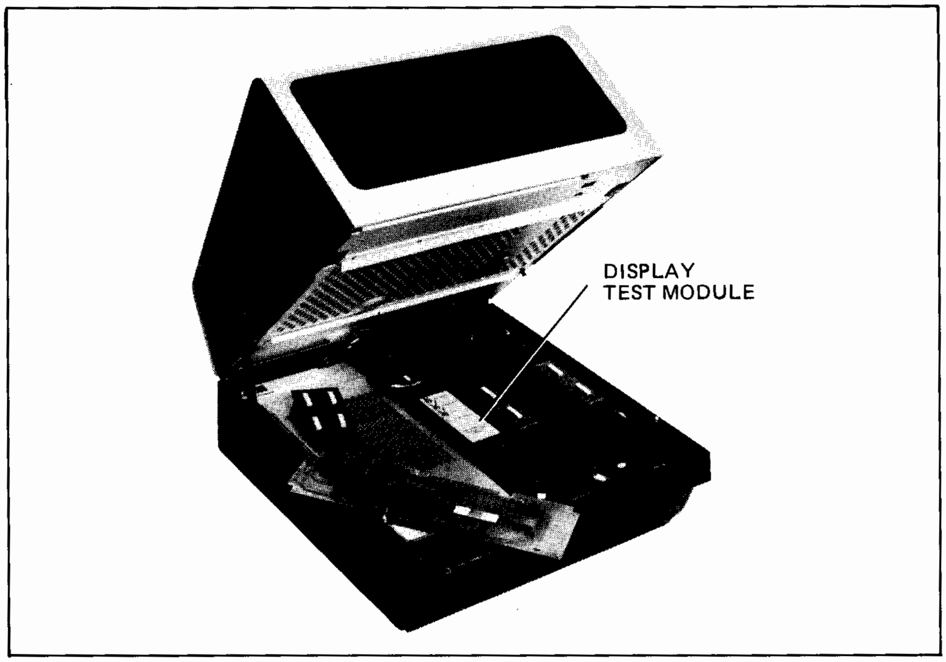


Figure 5-3. Installation of Display Test Module

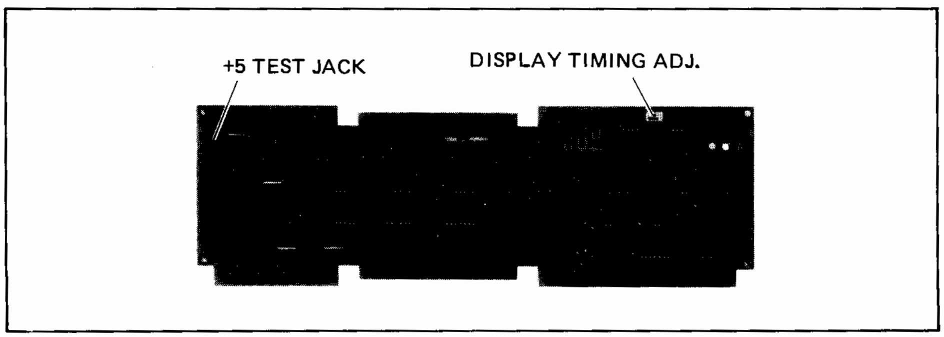


Figure 5-4. Display Timing PCA Test Jack and Timing Adjustment Locations

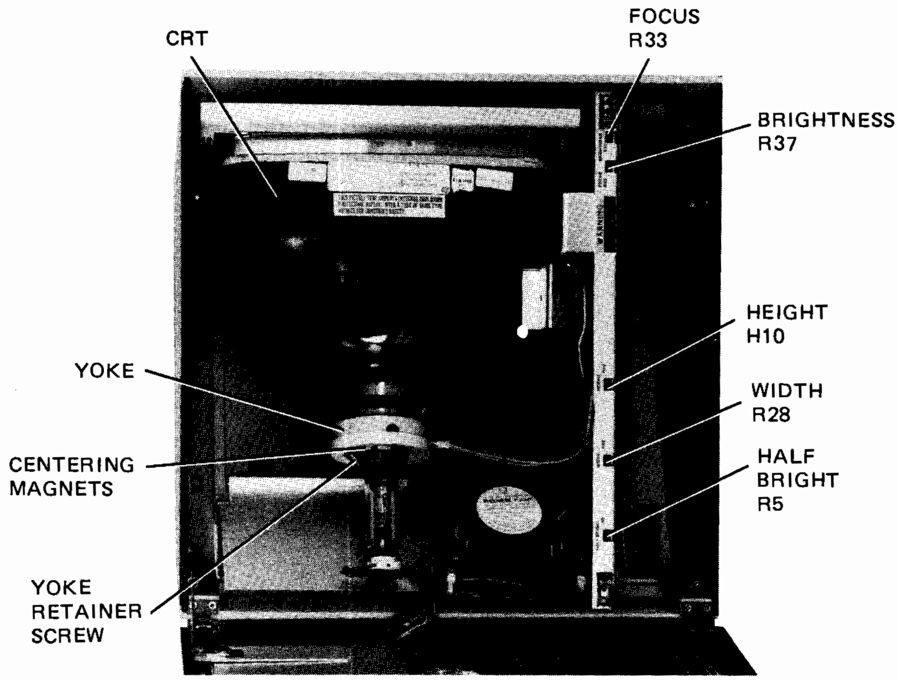


Figure 5-5. Mainframe Top Adjustment Locations

PROCEDURE (Continued) ....

10. Set test module HALF BRIGHT switch to on position, remove button covering CRT shield HALF BRIGHT adjustment access hole, and adjust HALF BRIGHT R5 for desired display half brightness.
11. Repeat steps 8, 9, 10 until desired display contrast is obtained between full bright and half bright.
12. Set test module HALF BRIGHT switch to off position.
13. Adjust FOCUS R33 (see figure 6-5) for best overall display sharpness.
14. If desired focus cannot be obtained, adjust display brightness slightly lower and repeat steps 8 through 13.
15. Set rear panel ~LINE switch to OFF and reinstall button to cover HALF BRIGHT adjustment access hole.
16. Secure CRT shield in place by pressing the two nylon snap fasteners into mounting holes.
17. Disconnect test module cable plug from Display Timing PCA and disconnect test module from Display Timing and Display Control PCAs.
18. Reinstall DMA PCA into vacated backplane assembly connector and reinstall top plane connector on DMA, Display timing, and Display Control PCAs.
19. Perform a terminal self test as described in Section 6.

Display Enhancements Adjustment

WHY .... This procedure is used to correctly locate the full and half bright inverse video fields in the horizontal dimension of the display.

HOW .... The adjustment is made by adjusting the FIELD potentiometer on the Display Enhancements PCA.

WHEN .... This procedure should be performed as a check after initial installation or replacement of the Display Enhancements PCA.

EQUIPMENT REQUIRED .... A screwdriver or alignment tool.

PROCEDURE ....

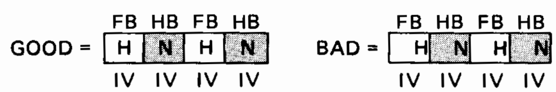
1. Open the terminal (figure 2-1).
2. Turn on terminal power.
3. Set the terminal for local operation (REMOTE key up) and press each of the keys listed in the following four lines. Compare the resulting display with the illustration below.

NOTE

A similar pattern can be obtained from the last line of the self test pattern.

ESC,&,d,B,H
ESC,&,d,J,N
ESC,&,d,B,H
ESC,&,d,J,N

where: FB = full bright enhancement
HB = half bright enhancement
IV = inverse video enhancement



4. If necessary, adjust Display Enhancement PCA FIELD potentiometer R10 to center full bright and half bright inverse video fields over characters displayed on monitor (figure 5-6).
5. Perform the terminal self test as described in Section 6.

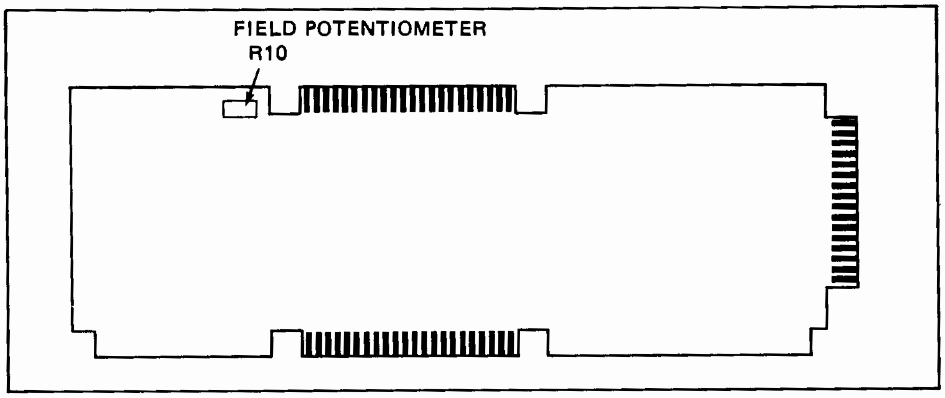


Figure 5-6. Location of Field Potentiometer R10 on Display Enhancement PCA

Display Raster Alignment and Adjustment

WHY .... This procedure is performed to correct tilt (rotation of the displayed area), adjust the width or height of the display area, or center the displayed area on the screen.

HOW .... Tilt of the displayed area is corrected by adjusting the CRT yoke, width and height of the display are changed by adjustment of the WIDTH and HEIGHT potentiometers of the Sweep PCA, and the centering magnets on the CRT yoke are used to center the display on the screen.

WHEN .... This procedure should be performed:

1. After the Sweep PCA or CRT/yoke assembly has been replaced.
2. If the displayed area is tilted or not centered on the screen.
3. If the width or height of the displayed area is unsatisfactory.

EQUIPMENT REQUIRED ....

1. HP Display Test Module 02640-60063.
2. Connector Extractor, 1600-0676.
3. Screwdriver or alignment tool.

PROCEDURE ....

1. Turn off terminal power, open the terminal, and remove CRT shield as follows:
   a. Pull out on the two nylon snap fasteners on each side of the shield (figure 5-1).
   b. Slide the shield toward the front of the mainframe to release it from the sheet metal lip on the monitor assembly. (The rear of the shield should be allowed to drop far enough to allow it to slide forward without binding.)
2. Use the connector extractor to remove the top plane connector from the Display Control, Display Timing, and Display Memory Access (DMA) PCAs (figure 5-2).
3. Remove DMA PCA from backplane assembly.
4. If necessary, rearrange backplane PCA configuration to perform step 5.
5. Install display test module on top connectors of Display Timing and Display Control PCAs so that test module cable is toward front of mainframe (figure 5-3).
6. Connect test module cable plug to Display Timing PCA red +5V test jack located on top front of PCA (figure 5-4).
7. Turn on terminal power.
8. Set test module HALF BRIGHT switch to off position, INVERSE VIDEO switch to on position, and DOTS/CROSSHATCH switch to center off position.
9. The monitor should display an inverse video rectangular pattern. If no pattern is displayed, adjust BRIGHTNESS potentiometer R37 (see figure 5-4) until pattern is displayed. If this step is required, perform brightness, half-brightness, and focus adjustments after completing raster alignment and adjustment procedures.

WARNING

Hazardous voltages are present inside equipment. The procedures contained in this section shall be performed only by qualified service personnel.

AVVISO

Pericolo: Alta tensione presente in questa apparecchiatura. Le procedure contenute in questa sezione debbono essere effettuate soltanto da qualificato personale di servizio.

VORSICHT

Innerhalb des Geräts bestehen gefährliche Spannungen. Die in diesem Abschnitt enthaltenen Arbeiten dürfen nur durch Betriebsfachpersonal durchgeführt werden.

ADVERTENCIA

Hay voltaje peligroso en el interior de este equipo. Los procedimientos expuestos en esta sección sólo deberá llevarlos a cabo el personal de servicio calificado.

ATTENTION

Des tensions dangereuses sont présentes à l'intérieur du matériel. Les opérations décrites dans cette section ne devront être effectuées que par un personnel qualifié.

高圧危険

内部装置に危険な高電圧かきています　この章にある処置や手続に関しては、専門のサービスマンによってのみ行なって下さい

PROCEDURE (Continued) ....

10. Loosen yoke retainer screw and rotate (see figure 6-4) until displayed rectangle is horizontal and parallel to monitor frame.

CAUTION

Do not tighten yoke retainer screw any more than necessary to keep yoke from sliding on the neck of the CRT (finger tight). Overtightening can damage CRT.

11. Secure yoke in place by tightening yoke retainer screw.
12. Rotate centering magnets (black tabs) until displayed rectangle is centered on monitor screen.
13. Adjust WIDTH potentiometer R28 until displayed rectangle is 9.50 in. (24.13 cm) wide.
14. Adjust HEIGHT potentiometer R10 until displayed rectangle is 4.75 in. (12.065 cm) high.
15. Set rear ~LINE switch to OFF and secure CRT shield in place with fasteners.
16. Disconnect test module cable plug from Display Timing PCA and disconnect test module from Display Timing and Display Control PCAs.
17. Reinstall DMA PCA into vacated Backplane Assembly connector and reinstall top plane connector on DMA, Display Timing, and Display Control PCAs.
18. Close terminal mainframe, turn on terminal power, and check for correct raster alignment.
19. Perform a terminal self test as described in Section 6.

Display Timing Adjustment

WHY .... This procedure ensures equal brightness of vertical and horizontal lines on the display.

HOW .... Brightness of the vertical and horizontal lines is equalized by adjustment of the DOT potentiometer on the Display Timing PCA.

WHEN .... This procedure should be performed whenever the difference in brightness between the vertical and horizontal lines is considered unacceptable.

EQUIPMENT REQUIRED .... A screwdriver or alignment tool.

PROCEDURE ....

Note

Before and after performing the adjustment, check that BRIGHTNESS, HALF BRIGHT, and FOCUS are adjusted properly (refer to the Brightness, Half-Bright, and Focus adjustment procedure).

1. With the terminal mainframe in its half open position and power applied to the terminal, locate the display timing adjustment (DOT potentiometer) (figure 5-7).

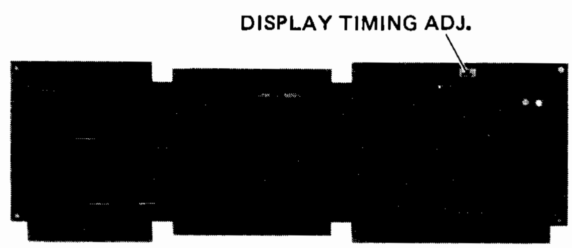
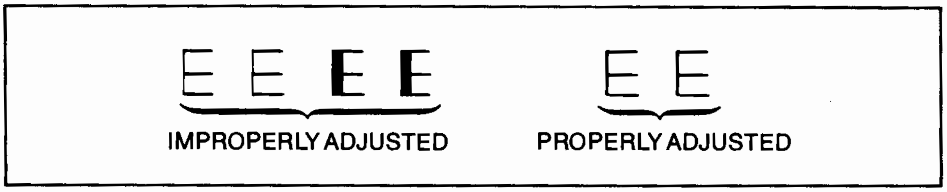


Figure 5-7. Display Timing PCA Timing Adjustment Location

PROCEDURE (Continued) ....

2. Press and hold the "E" key to produce a row of uppercase E's on the display.
3. Adjust display timing so that the vertical and horizontal lines of the E's are of equal brightness (see figure below).



4. Perform a terminal self test as described in Section 6.

CTU Transport Assembly Speed Adjustment

WHY ....

Tape transport speed adjustment reduces the possibility of data errors during read or write tape operations.

HOW ....

The tape speed for each cartridge tape unit (CTU) is tested. If either is out of adjustment, it is corrected to 10 ips by adjusting the SPEED potentiometer on the Read/Write PCA. Then the other CTU is rechecked and adjusted if necessary.

WHEN ....

This procedure should be performed whenever the CTU Interface or CTU Read/Write PCA or the CTU Transport assembly has been replaced or if the tape speed is considered a possible source of data errors.

EQUIPMENT REQUIRED ....

1. One HP CTU Tester 02640-60082.
2. One HP Checkout Cartridge 02640-60096.

NOTE

The checkout cartridge is an endless loop. The speed test does not test for end-of-tape. If an ordinary tape cartridge is used, the speed adjustment procedure may cause tape runoff.

PROCEDURE ....

1. Turn off terminal power and open the terminal.
2. Insert connector extractor under CTU top plane assembly and remove assembly by pressing down on the extractor handle. Use of the extractor is illustrated in figure 5-2.
3. Install CTU Tester (figure 5-9) on top connectors of CTU Interface and Read/Write PCAs so that tester indicator lamps are closest to rear of terminal's mainframe (figure 5-8).
4. Set CTU Tester's UNIT switch to 0, ON LINE/OFF LINE switch to OFF, RVS/FWD switch to FWD, and IPS switch to 10.
5. Remove any tape cartridges inserted in terminal.
6. Turn on terminal power.
7. Insert Checkout Cartridge in UNIT 0 CTU Transport Assembly. (Unit 0 is the left CTU, the right CTU is unit 1).

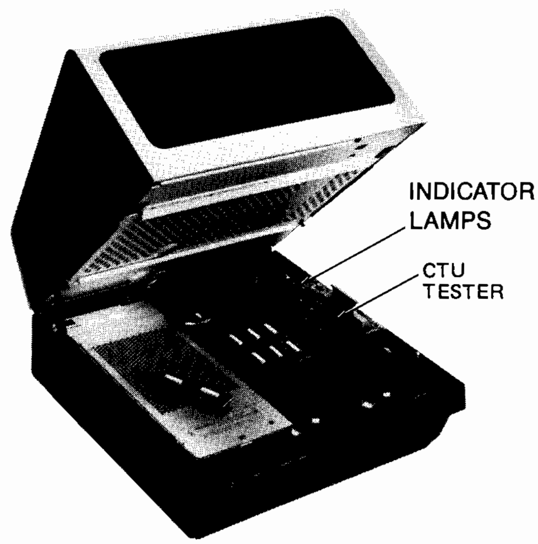


Figure 5-8. CTU Tester Installation

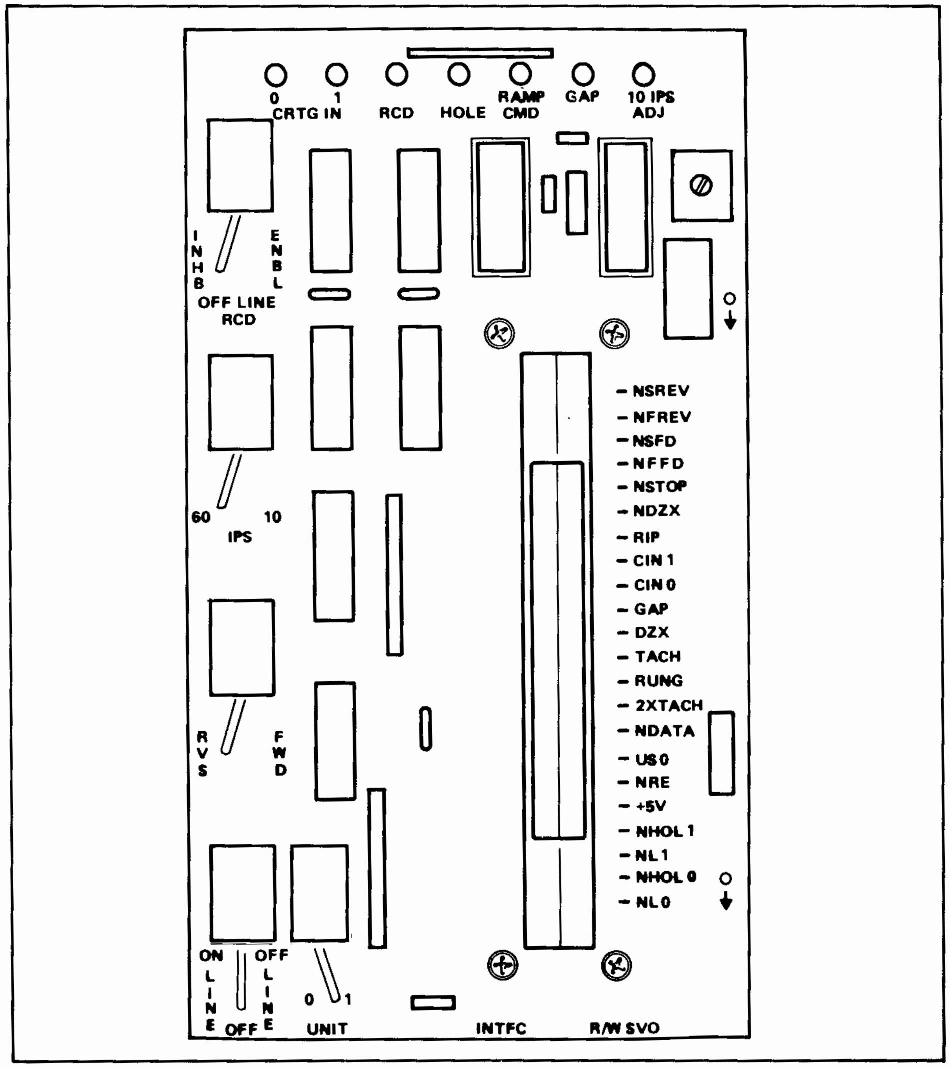


Figure 5-9. CTU Tester

Note

Maximum brilliance of tester 10 IPS ADJ indicator lamp indicates that CTU Transport Assembly motor is rotating at a speed as close as possible to drive tape at exactly 10 ips. Lesser brilliance indicates that tape motion will be faster or slower than 10 ips, but still within allowable tolerances.

8. Set test ON LINE/OFF LINE switch to OFF LINE and check that tester 10 IPS ADJ indicator lamp is blinking. Indicator lamp should be on more than 50% of the time. If not proceed to step 14.
9. Set tester ON LINE/OFF LINE switch to OFF.
10. Remove Checkout Cartridge from UNIT 0 CTU Transport Assembly and insert it in UNIT 1.
11. Set tester UNIT switch to 1.
12. Set tester ON LINE/OFF LINE switch to OFF LINE and check that tester 10 IPS ADJ indicator lamp is blinking. Indicator lamp should be on more than 50% of the time. If not proceed to step 14.
13. If 10 IPS ADJ indicator lamp indications are as stated in steps 8 and 12, no further adjustment is required. Skip to step 16.
14. If tester 10 IPS ADJ indicator lamp indication is erroneous for either CTU Transport Assembly, insert Checkout Cartridge in defective CTU Transport Assembly, set tester UNIT switch to applicable unit number (0 or 1), and slowly adjust Read/Write PCA SPEED potentiometer R55 until tester 10 IPS ADJ indicator lamp is blinking on for more than 50% of the time.
15. Reinsert Checkout Cartridge in remaining CTU Transport Assembly, set tester UNIT switch to applicable unit number, and check that tester 10 IPS ADJ indicator lamp is blinking on for more than 50% of the time. If not, repeat steps 14 and 15 until tester 10 IPS ADJ indicator lamp indications are correct. If 10 IPS ADJ indicator lamp indications are correct, no further adjustment is required.
16. Turn off terminal power.
17. Remove CTU Tester from CTU Interface and Read/Write PCAs and reinstall CTU top plane connector on CTU Interface and Read/Write PCAs.
18. Close terminal mainframe.

Servo Motor Speed Adjustment

WHY .... To ensure that the spindle speed of the mini disc drive is operating at the correct frequency.

HOW .... Adjusting the motor speed potentiometer on the motor control PCA to 200ms ±1.5% (197 to 203ms).

WHEN .... This speed adjustment should be made whenever the motor control PCA, drive belt, or motor is replaced.

EQUIPMENT REQUIRED .... An HP 5345A Electronic Counter or equivalent and an alignment tool.

PROCEDURE ....

1. Turn off terminal power.
2. Remove cable retainer from rear of mini disc drive.
3. Disconnect controller cable from disc drive.
4. Separate the rear panel from the drive and disconnect the ribbon cable from the motor control PCA.
5. Separate the bottom cover from the top cover by pulling them apart.
6. Remove the four screws securing the top cover to the drive unit. Remove the top cover.
7. Reconnect the ribbon cable to the motor control PCA. Reconnect the controller cable to the ribbon edge connector.
8. Open the terminal and remove the disc controller PCA. Check the ROM located in socket U14 (figure 5-10). Determine if the ROM is an earlier one (1818-1005) or a later one (1818-1497). For earlier ROMs, an electronic frequency counter is used to check the frequency (motor speed). For later ROMs, the five LEDs on the disc controller PCA are used to check the frequency.
9. Reinstall the disc controller PCA in the terminal and reconnect the controller cable to the PCA.
10. If your disc controller PCA is furnished with an earlier ROM (1818-1005), connect electronic counter's probe to U15, pin 2 and the ground cable to the ground side of the capacitor adjacent to U15 on the drive PCA (figure 5-11).

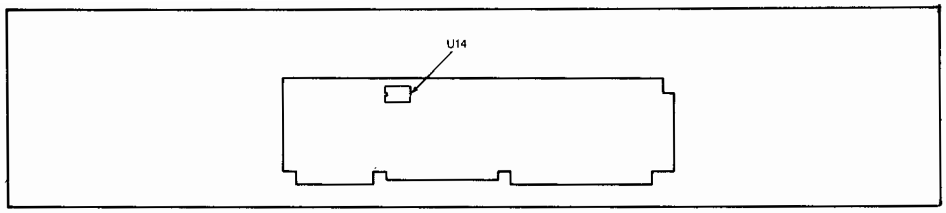


Figure 5-10. Location of ROM on Disc Controller PCA.

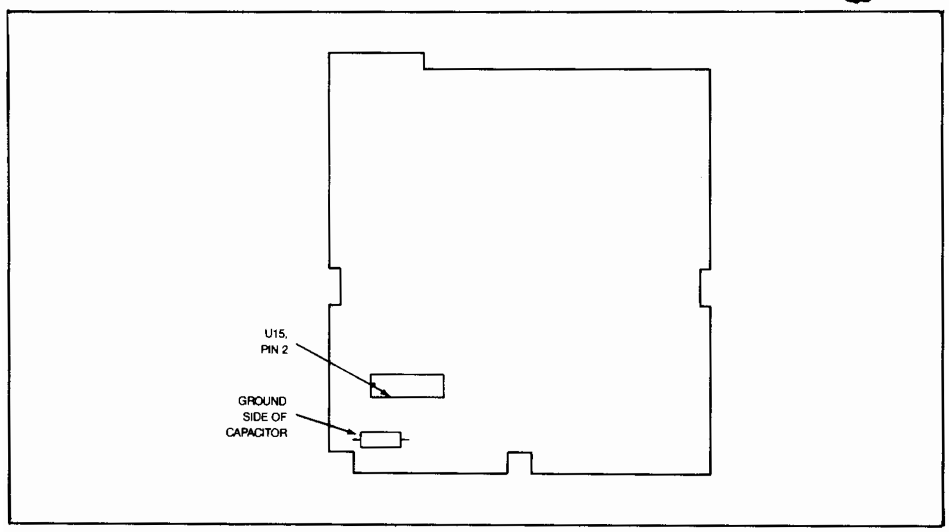


Figure 5-11. Location of Test Probe Connection on Drive PCA.

PROCEDURE (Continued) ....

11. Turn terminal power on. Install a diskette in the drive. Press the [COMMAND] key, type "Enable Diagnostic" and press the [RETURN] key. The following message will appear: "DISC DIAGNOSTIC COMMANDS ENABLED"
12. Enter on the command line:
    "Pseek 16 1 1" and then press [RETURN].
    A physical seek of track 16, head 1, unit 1 is being tested.
13. Check the frequency for 200ms and if necessary, adjust the potentiometer on the motor control PCA (figure 5-12).
14. For disc controller PCAs with later ROMs (1818-1497), check the five LEDs (figure 5-13) and if the middle LED is lighted, the frequency is correct. If necessary, adjust the potentiometer on the motor control PCA until the middle LED is lighted.
15. Turn off terminal power and remove the probe and ground cable from the drive PCA.
16. Reassemble the mini disc drive and reconnect the drive to the terminal.
17. Restore terminal power and perform a disc self-test as described in Section 6.

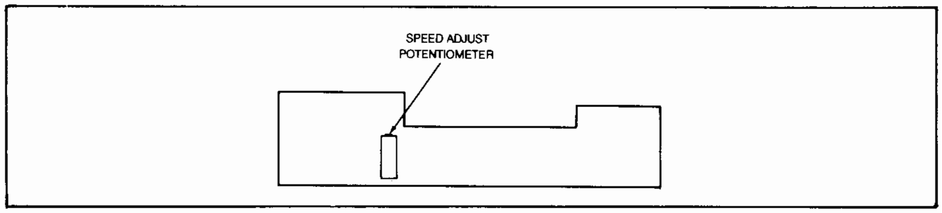


Figure 5-12. Location of Speed Adjust Potentiometer on Motor Control PCA.

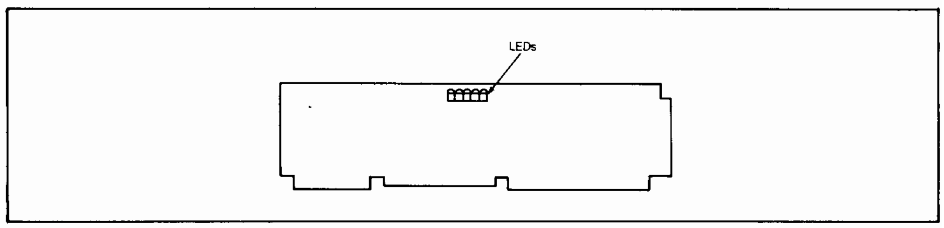


Figure 5-13. Location of LEDs on the Disc Controller PCA.

Troubleshooting

6

Troubleshooting 6

INTRODUCTION

This section contains troubleshooting information for isolating a malfunction to a replaceable unit. It consists of the following information:

1. Error messages.
2. Preliminary checks.
3. Self-tests:
   a. Basic terminal self-test.
   b. Data communications self-test.
   c. Cartridge tape system self-test.
   d. Disc self-test.
   e. HP-IB system self-test.
4. Detailed troubleshooting procedures.
5. Information on special test equipment.

Listed below is a suggested approach to troubleshooting:

1. If the malfunction appears to be localized to the data communications, cartridge tape, or HP-IB system, perform the test for that system (refer to "Self Tests").
2. Perform the basic terminal self test (refer to "Self Tests"). If the terminal self test isolates the problem, correct the problem and check for proper operation with another terminal self test.
3. If the terminal self test doesn't isolate the malfunction or if the trouble symptom is intermittent, refer to "Detailed Troubleshooting".
4. If the self test can't be run, refer to "Preliminary Checks". If the preliminary checks reveal no problem, refer to "Detailed Troubleshooting".

   If the preliminary checks do reveal a problem correct the condition and perform a terminal self test to check for proper operation.

WARNING

Hazardous voltages are present inside equipment. The procedures contained in this section shall be performed only by qualified service personnel.

VORSICHT

Innerhalb des Geräts bestehen gefährliche Spannungen. Die in diesem Abschnitt enthaltenen Arbeiten dürfen nur durch Betriebsfachpersonal durchgeführt werden.

ATTENTION

Des tensions dangereuses sont présentes à l'intérieur du matériel. Les opérations décrites dans cette section ne devront être effectuées que par un personnel qualifié.

AVVISO

Pericolo: Alta tensione presente in questa apparecchiatura. Le procedure contenute in questa sezione debbono essere effettuate soltanto da qualificato personale di servizio.

ADVERTENCIA

Hay voltaje peligroso en el interior de este equipo. Los procedimientos expuestos en esta sección sólo deberá llevarlos a cabo el personal de servicio calificado.

高圧危険

内部装置に危険な高電圧がきています　この章にある処置や手続に関しては、専門のサービスマンによってのみ行なって下さい

Error Messages

Two types of error messages are displayed by the 264X terminals; self test errors and operating-time errors.

SELF TEST ERRORS .... Self test errors and their meanings can be found in the paragraph titled "Basic Terminal Self Test."

OPERATING-TIME ERRORS .... The errors which might occur during operation are listed in the table below.

MESSAGE	MEANING
BUFFER OVERFLOW	There is insufficient RAM memory available for data communications buffer space.
NO DEVICE DRIVER	An I/O operation has been attempted for which the necessary accessory is not installed.
I/O ERROR X	An invalid device interrupt has occurred. Specific meanings are listed below. (Most I/O error messages imply execution of bad code being attempted or bad code or data being addressed.) X=0 Undefined interrupt. Probably a bad Processor PCA. or ROM error or bad CTU. X=A ROM containing CTU code missing or bad. X=B ROM which should contain code for the alternate I/O device missing. X=1 Probably malfunctioning Processor PCA or ROM or RAM error. X=2 Same as X=1. X=3 Timer error. X=4 Data communications error. X=6 Probable ROM or RAM error. (All 1's, except for bit 0, in word being analyzed.) X=7 Probable ROM or RAM error. (All 1's in word being analyzed.)

Preliminary Checks

WHY .... To ensure that an apparent malfunction isn't caused by incorrect operation, loose electrical connectors, or wrong configuration.

HOW .... Checks are provided for operator errors, loose connectors, proper PCA strapping, and duplicated I/O addresses.

WHEN .... These checks should be performed prior to troubleshooting and after the terminal self test whenever an apparent malfunction occurs.

INSTRUCTIONS .... Preliminary checks are detailed below:

SWITCH CONFIGURATION ERRORS

Some apparent terminal malfunctions are caused by incorrect switch configuration. Common errors which might appear to an inexperienced user to be a malfunction are listed below:

1. Attempting to communicate with the computer with the REMOTE key in the up position.
2. Attempting to use the terminal in local mode with the REMOTE key in the down position.
3. Attempting to communicate with the computer with the AUTO LF key in the down position.
4. Attempting to communicate with the computer with the BLOCK key unintentionally in the down position.
5. Using the terminal with the DISPLAY FUNCTIONS key unintentionally in the down position.
6. DUPLEX, PARITY or BAUD RATE switch on the keyboard incorrectly set.

CONNECTION INSPECTION

Following is a list of inspection procedures which should be performed before more complex troubleshooting procedures:

1. Check that all PCAs are firmly seated in the backplane connectors.
2. Check that all top plane and end connectors are firmly seated on the PCAs.
3. Check that all internal cables and wires are firmly seated in the appropriate connectors.
4. Check that each cable, top plane, and end connector is connected to the right PCAs.

STRAPPING CHECK

A check of PCA strapping consists of looking for two types of errors; wrong strapping for a PCA and two PCAs strapped for the same I/O address.

Wrong Strapping Check. Refer to Section 3 for the strapping configuration for each PCA. PCAs which contain strapping switches or jumpers are listed below.

PART NO.	ACCESSORY	NAME
02640-60024	13231A	Display Enhancements
02640-60123	None	Keyboard Interface PCA
02640-60124	None	Display Memory Access
02640-60065	13234A	+4K RAM Memory PCA
02640-60101	None	8K Memory PCA
02640-60031	13238A	Terminal Duplex Register PCA
02640-60053	13245A	PROM Character PCA
02640-60112	None	Display Control PCA
02640-60089	13250A	Serial Printer Interface/Extended Asynchronous Data Communications PCA
02640-60143	13250A	Serial Printer Interface/Extended Asynchronous Data Communications PCA
02640-60119	13254A	Video Interface PCA

PART NO.	ACCESSORY	NAME
02640-60239	13260A	Asynchronous Data Communications PCA
02640-60089	13260B	GP Asynchronous Data Communications PCA
02640-60106	13260C	Asynchronous Multipoint Data Communications PCA.
02640-60107	13260D	Synchronous Multipoint Data Communications PCA
02640-60007	13291A	4K UV PROM PCA
02640-60118	13292A	Writeable Control Store PCA
02640-60128	13296A	HP-IB Interface PCA
02640-60171	13297A	Universal RAM Memory PCA
02640-60216	13298A	32K PROM Memory PCA
02640-60221	None	32K ROM Memory PCA
02640-60003	None	Control Store PCA
02640-60144	None	Control Store PCA
02640-60047	None	ROM PCA
02640-60111	None	ROM PCA
02640-60136	None	Control Memory PCA
02640-60192	None	Control Memory PCA
02640-60243	None	Control Memory PCA
02640-60093	None	Processor PCA
02640-60209	None	Processor PCA

Duplicated I/O Address Check. Each PCA in the terminal concerned with I/O operations (such as communications with a computer, a peripheral, the cartridge tapes, the keyboard, or the terminal display) is assigned an address, from 0 to 15, by which it is known to the firmware (refer to table 6-1).

To identify a PCA with which it intends to communicate, the processor generates the address of the PCA on address lines ADDR11, ADDR10, ADDR9, and ADDR4. It is established convention, in 264X terminal documentation, to show A4 as the most significant of the four address bits although, in both hardware and firmware code, it is the least signficant bit. To be consistent with existing documentation, references to PCA addresses in this manual also show A4 as the most significant bit.

For proper operation of the terminal, it is required that the same address is not shared by two or more PCAs present in the terminal. As shown in table 6-1, several PCAs can share addresses 7, 8, and 14. If one is present in the terminal and is strapped for the common address, the other PCAs which share the same address must not be present in the terminal if they are strapped for the same address. For example, if the Terminal Duplex Register PCA is strapped for address 7 and is present in the terminal, the PCA for either Accessory 13260C or 13260D (multipoint data communications accessories) must not also be present. The one exception to this rule is the Video Interface PCA which can share its I/O address with another PCA provided the ADDRESS DISABLE switch on the PCA is set to the address disabling position.

Table 6-1. I/O PCA Addresses

ADDRESS					PCA	I/O FUNCTION SUPPORTED BY FIRMWARE
DEC	BINARY					
	A4	A11	A10	A9		
15	1	1	1	1	Not assigned.	Not assigned.
14	1	1	1	0	Terminal Duplex Register 02640-60031. (Accessory 13238A).	8-bit parallel printer (HP 9866A, HP 9871A, HP 2631, and Okidata 110).
					Video Interface 02640-60119. (Accessory 13254A.)	Video hardcopy device.
13	1	1	0	1	Cartridge Tape Interface 02640-60137.	Cartridge tapes.
12	1	1	0	0	Graphics Controller 02640-60125.	Graphics display.
11	1	0	1	1	Display Control 02640-60112.	Terminal display.
10	1	0	1	0	Serial Printer Interface 02640-60089. (Accessory 13250A.)	Communication with a serial printer.
9	1	0	0	1	Keyboard Interface 02640-60019, -60123.	User input to terminal thru keyboard.
8	1	0	0	0	Asynchronous Data Comm 02640-60086, -60239 (Accessory 13260A.)	Standard asynchronous data comm interface.
					Extended Asynchronous Data Comm 02640-60089. (Accessory 13250A.)	Extended asynchronous data comm interface.
					Extended Asynchronous Data Comm 02640-60143. (Accessories 13250B and 13260B.)	Extended asynchronous data comm interface.

Table 6-1. I/O PCA Addresses (Continued)

ADDRESS					PCA	I/O FUNCTION SUPPORTED BY FIRMWARE
DEC	BINARY					
	A4	A11	A10	A9		
7	0	1	1	1	Asynchronous Multipoint Data Comm 02640-60106. (Accessory 13260C.)	Asynchronous multipoint data comm interface.
					Synchronous Multipoint Data Comm 02640-60107. (Accessory 13260D.)	Synchronous multipoint data comm interface.
					Terminal Duplex Register 02640-60031.	Paper tape reader/punch.
6	0	1	1	0	High Speed Parallel Interface 02640-60146.	Direct communication between memory and an external device.
5	0	1	0	1	Not assigned.	Not assigned.
4	0	1	0	0	HP-IB Interface 02640-60128. (Accessory 13296A.)	HP-IB.
3	0	0	1	1	HP-IB Interface 02640-60128. (Accessory 13296A.)	HP-IB.
2	0	0	1	0	HP-IB Interface 02640-60128. (Accessory 13296A.)	HP-IB.
1	0	0	0	1	HP-IB Interface 02640-60128. (Accessory 13296A.)	HP-IB.
0	0	0	0	0	HP-IB Interface 02640-60128. (Accessory 13296A.)	HP-IB.

NOTES:
1. Although address bit A4 is shown as the most significant of the four address bits, it is actually the least significant bit in both firmware and hardware. It is shown in the most significant position to be consistent with existing terminal documentation.
2. For strapping purposes:
   1 = switch open (or jumper removed)
   0 = switch closed (or jumper in place)

Basic Terminal Self Test

WHY .... This test checks out the basic terminal for proper operation making it possible to isolate most terminal malfunctions quickly and easily.

HOW .... The test is initiated by pressing the TEST pushbutton on the keyboard. After that, the test proceeds automatically.

WHEN .... A terminal self test can be performed any time. Because it is so easily performed, it is the first troubleshooting step to be performed when a malfunction occurs.

PROCEDURE .... To run self test, press the TEST pushbutton. If self test can't be performed or if the normal indications don't occur, refer to "Preliminary Checks", then attempt another self test. If the terminal self test still can't be performed after doing the preliminary checks, refer to "Detailed Troubleshooting".

If error messages occur during self test, refer to figure 6-1 for troubleshooting procedures. To resume self test after an error message occurs, press the RESET TERMINAL pushbutton. The normal sequence of events is illustrated in figures 6-2 through 6-4 and described below.

1. All keyboard indicators (LEDs) light.

2. Each ROM on the Control Memory PCA(s) is checked to see if it is in the correct socket and a checksum test is run on it. If the ROM is found to be in the wrong socket, the following error message is displayed:

   ROM ERROR aa bbb ccc

   where: **aa** is the ROM number.

   bbb is the expected most significant byte (in octal) of the ROM start address. (This address is recorded in the ROM.)

   ccc is the most significant byte (in octal) of the ROM start address actually found in the ROM.

PROCEDURE (Continued) ....

Example:

[illegible]

The above message indicates the most significant byte of the starting address of the ROM in location 10 is 060 octal (12K decimal). It should be 050 octal (10K decimal). This means the ROM which belongs in location 12 is presently occupying location 10.

If the checksum is incorrect for 2641A, 2645, or 2648A terminals, the following message is displayed:

[illegible]

where: **aa** is the ROM number.

If the checksum is incorrect for 2647A terminals, the following message is displayed:

[illegible]

where: **aa** is the ROM number

OPEN / **CLOSED** identifies the Control Memory PCA on which the failed ROM is located. **OPEN** indicates it is on the PCA on which the Bank Select (BS) switch is open. **CLOSED** indicates it is on the PCA on which the BS switch is closed.

Example:

[illegible]

The above message indicates the Control Memory PCA on which the **BS** switch is closed has a failed ROM in location 12.

3. The display is blanked.
4. Each 4K block of RAM memory is tested. If an error is found one of two error messages will be displayed:

[illegible]

[illegible]

where: **aaaaaa** is the RAM start address (in decimal).

bbb is the expected test value (in octal).

ccc is the test value (in octal) actually found.

PROCEDURE (Continued) ....

Example:

`RAM ERROR 62208 373 333`

where: **62208** is the RAM start address, in decimal.
373 is the expected value, in octal.
333 is the value found, in octal.

If the PCA to which the address is assigned is not a Universal RAM Memory PCA, the PCA must be replaced. If the PCA is a Universal RAM Memory PCA, refer to Appendix D for instructions for identifying the faulty IC chip so it can be replaced.

5. If the terminal under test is a 2647 or 2648 terminal, the RAMs on the Graphics Display Memory PCA are tested. (This step is not performed, of course, for terminals without the graphics capability.) If an error is found, the following message is displayed:

   `MEMORY CHIP Uxy`

   where: **Uxy** is the identity of the failed RAM on the Graphics Display Memory PCA.

6. The keyboard bell is sounded.
7. The entire character set contained in the terminal is displayed on the screen (figures 6-5 through 6-9).
8. If the terminal under test is a 2647A and the BASIC Interpreter was active when the TAPE TEST key was pressed, a checksum routine is performed on the BASIC code. If an error is found, the following error is displayed:

   `CHECKSUM ERROR IN BASIC`

9. A line of characters, **@ABCDEFGHIJKLMNO**, is displayed. If the Display Enhancement option is installed, then the Display Enhancement features (Underline, Half bright, and Blnking), along with Inverse Video, will be imposed on this line of characters.
10. The 7 bytes of status information are displayed.

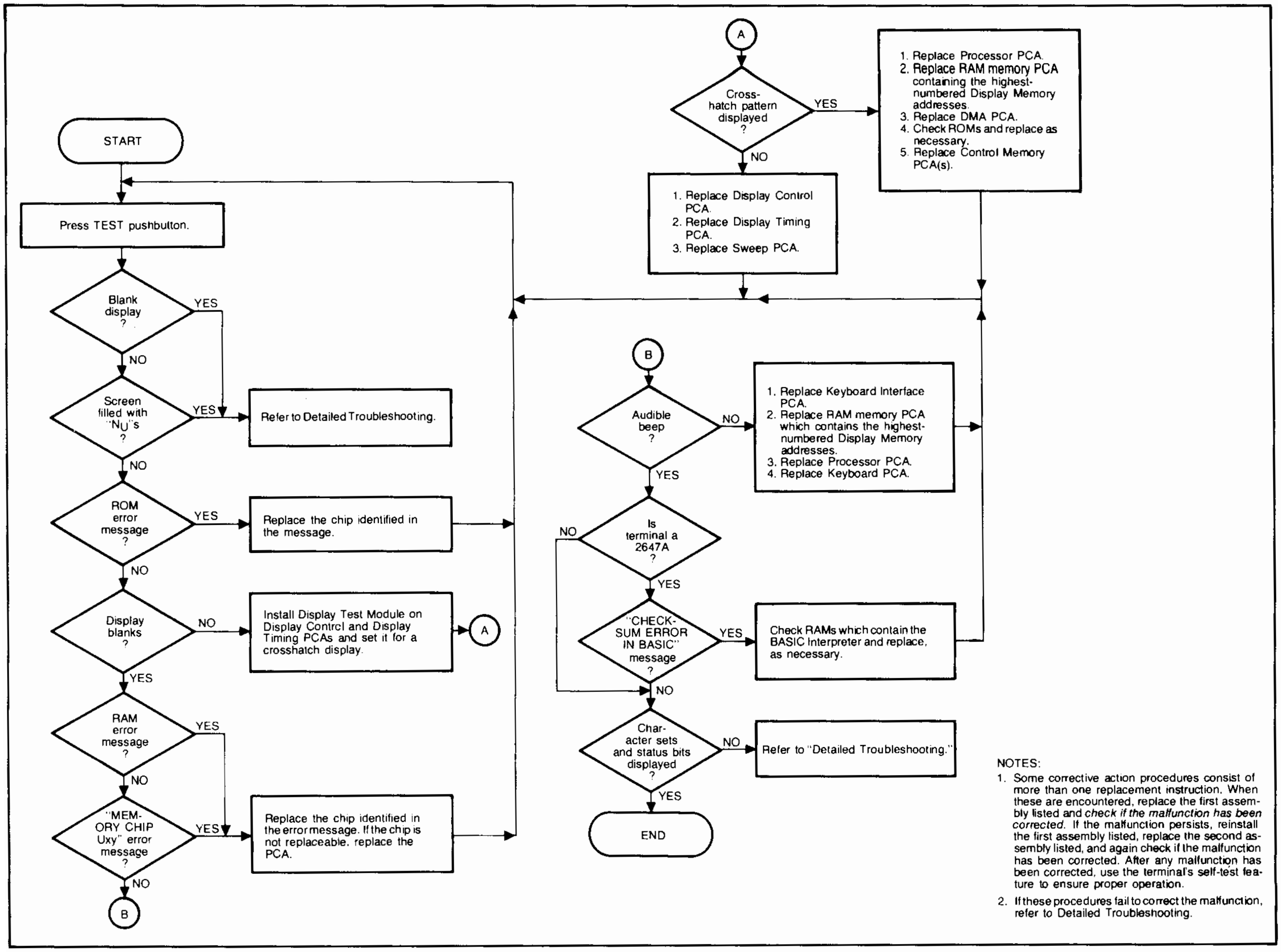


Figure 6-1. Error Message Flowchart

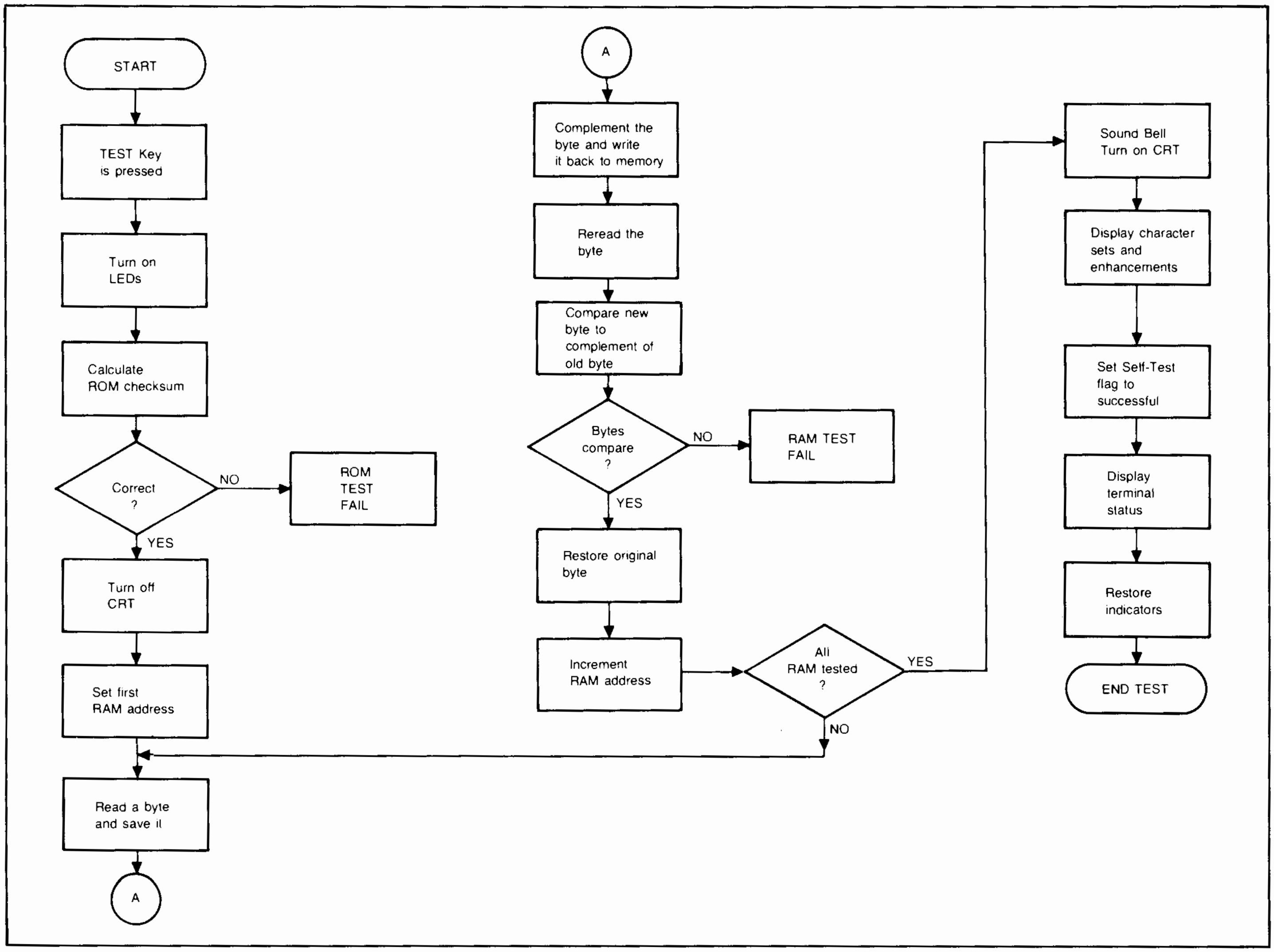


Figure 6-2. Terminal Self Test Flowchart (2640)

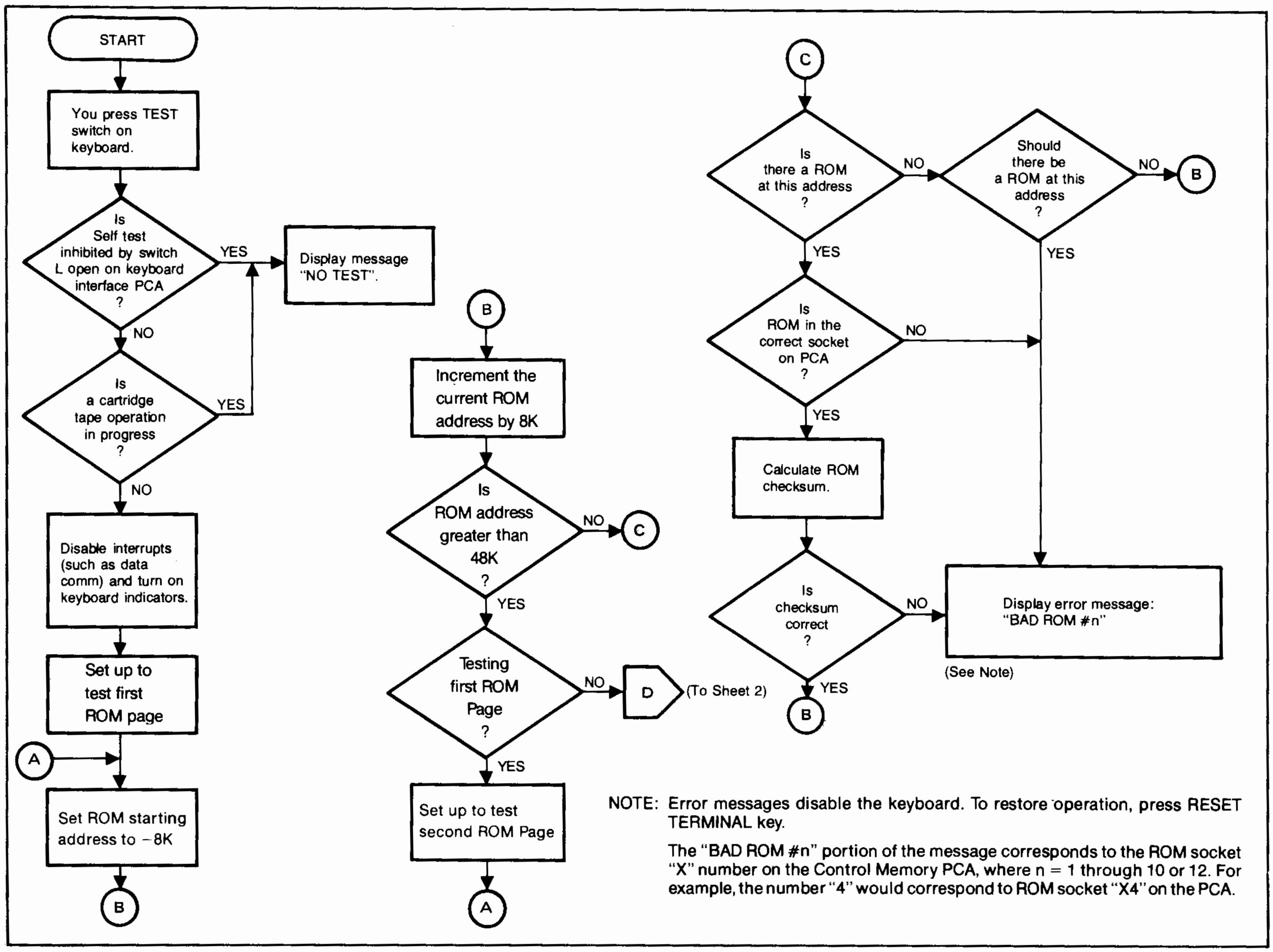


Figure 6-2A. Basic Terminal Self-Test Flowchart (2642) (Sheet 1 of 3)

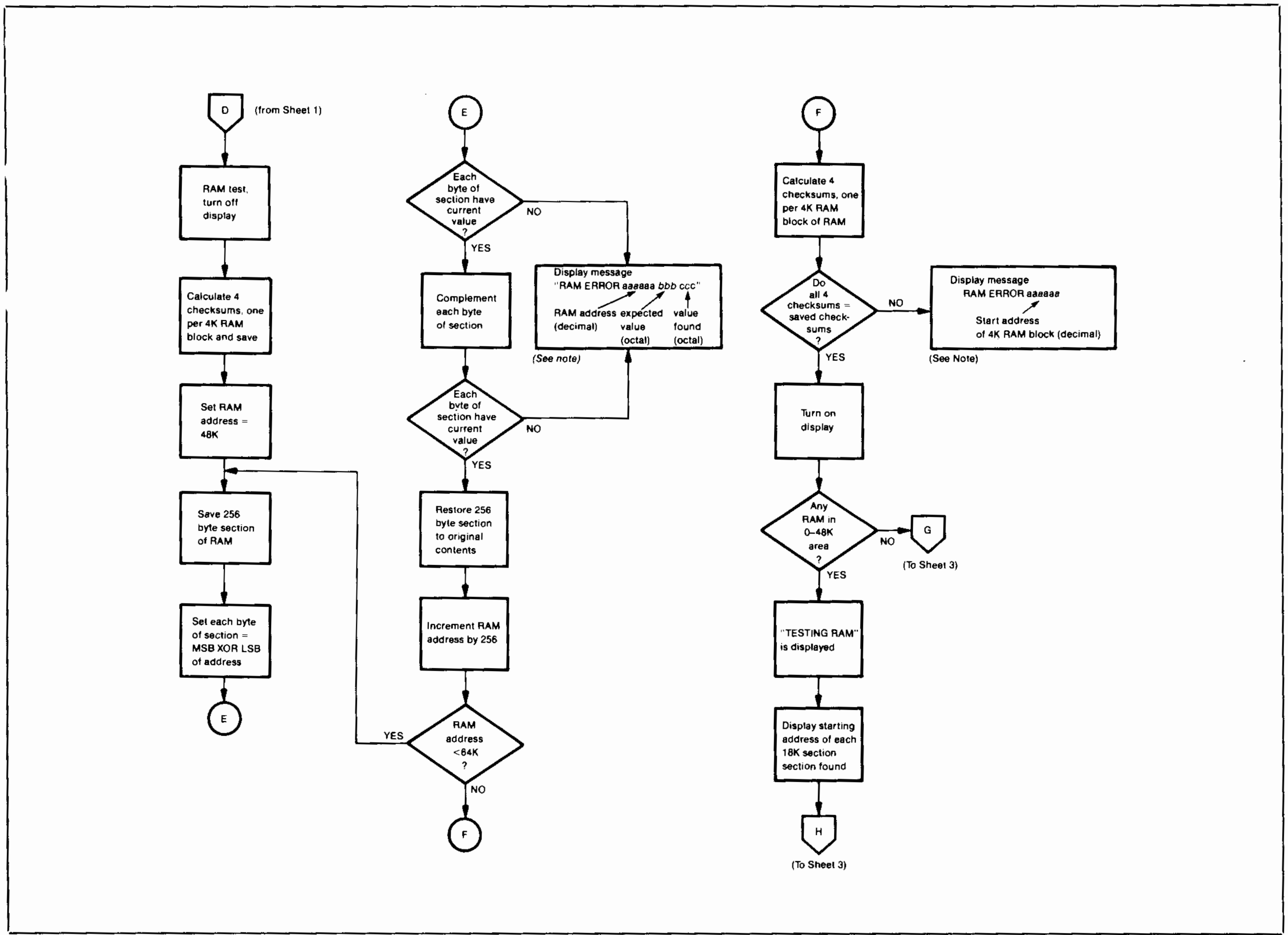


Figure 6-2A. Basic Terminal Self-Test Flowchart (2642) (Sheet 2 of 3)

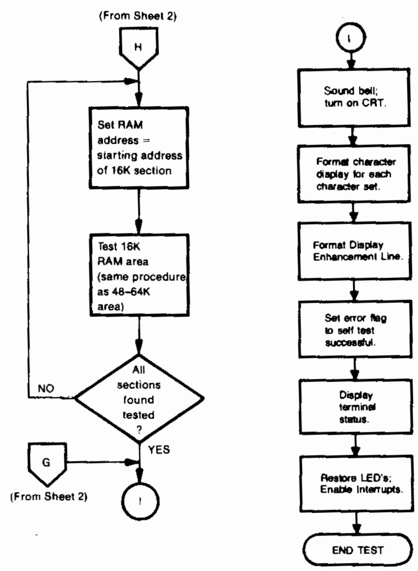


Figure 6-2A. Basic Terminal Self-Test Flowchart (2642) (Sheet 3 of 3)

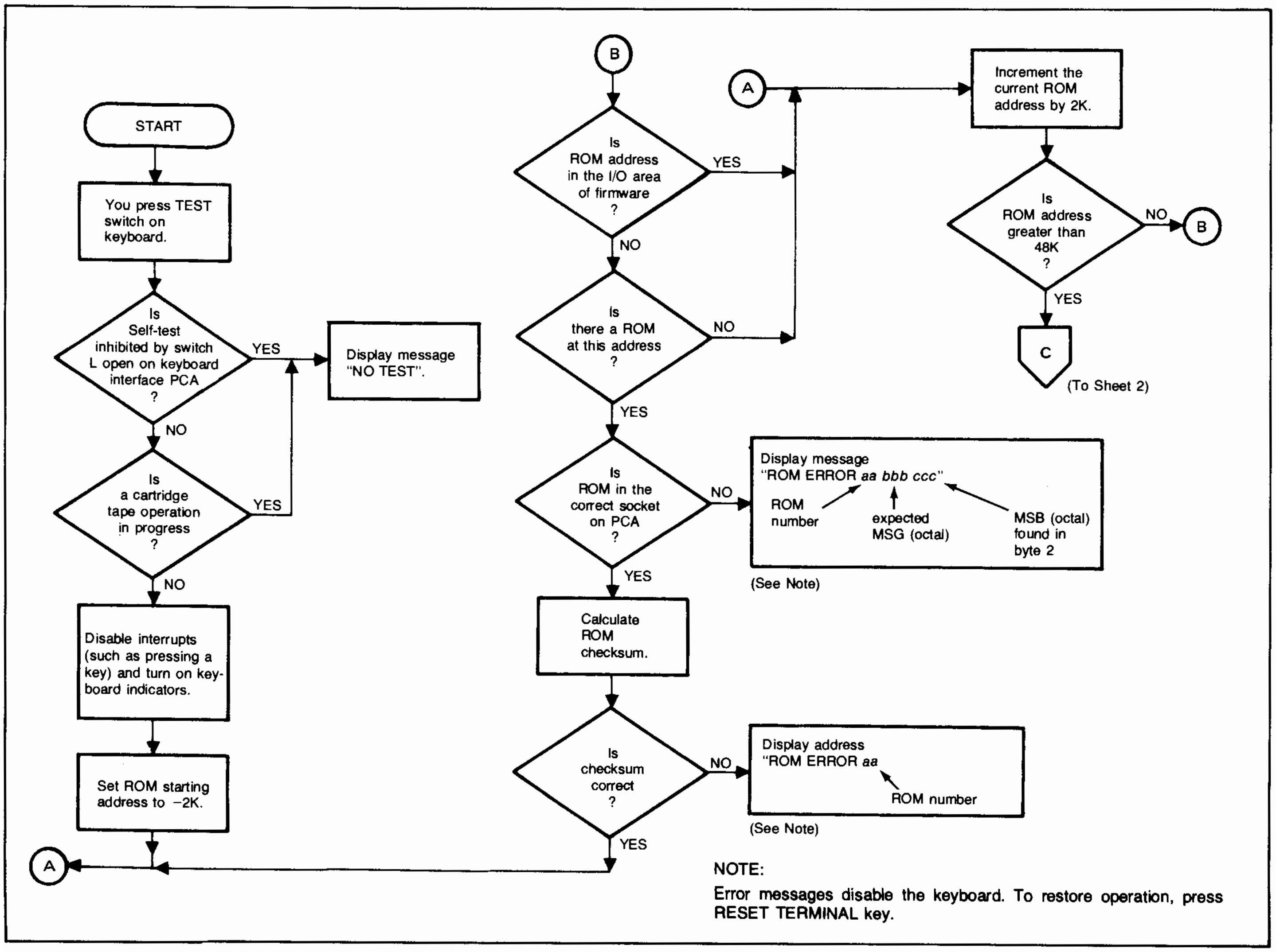


Figure 6-3. Terminal Self Test Flowchart (2645 and 2648) (Sheet 1 of 3)

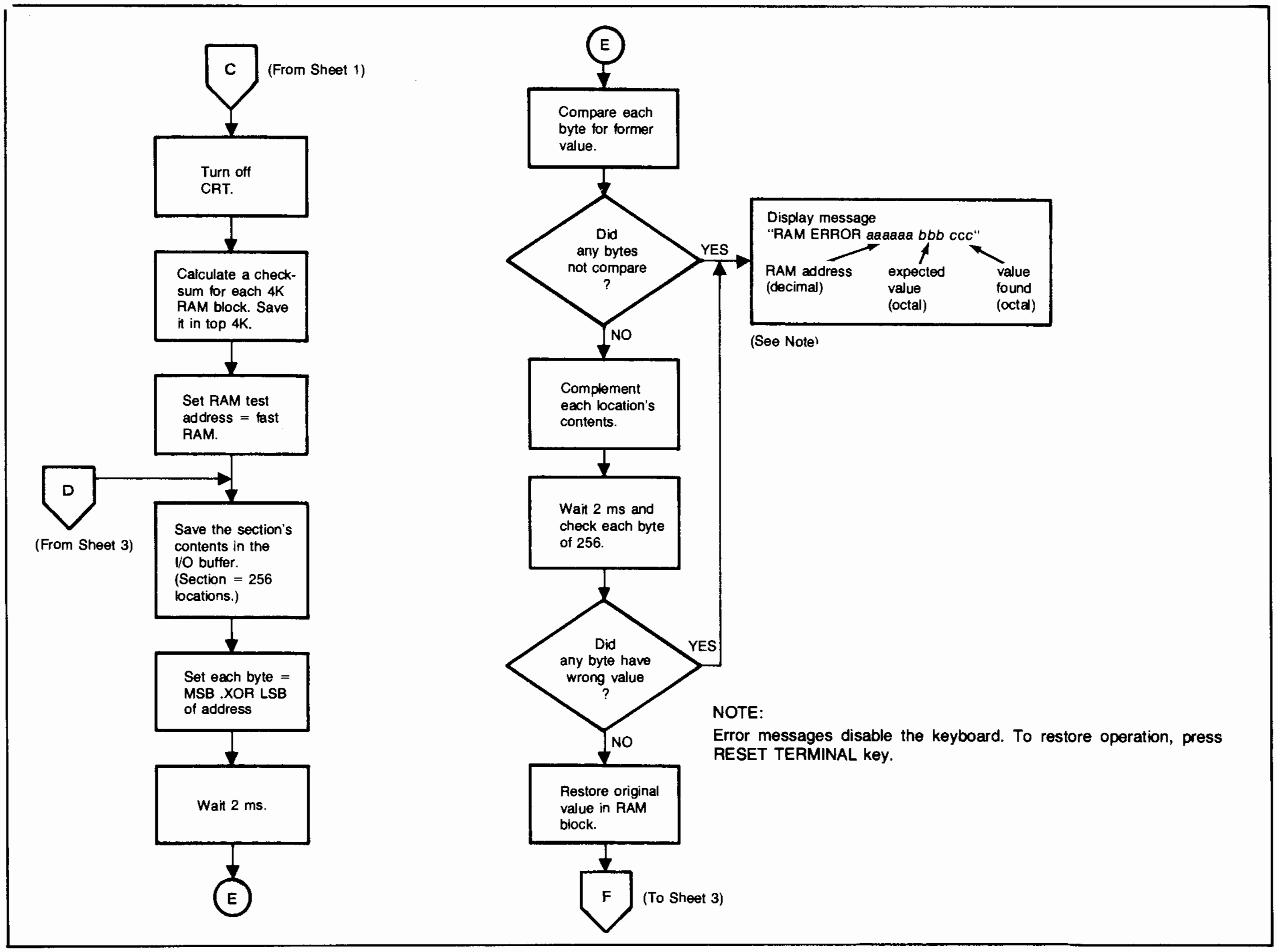


Figure 6-3. Terminal Self Test Flowchart (2645 and 2648) (Sheet 2 of 3)

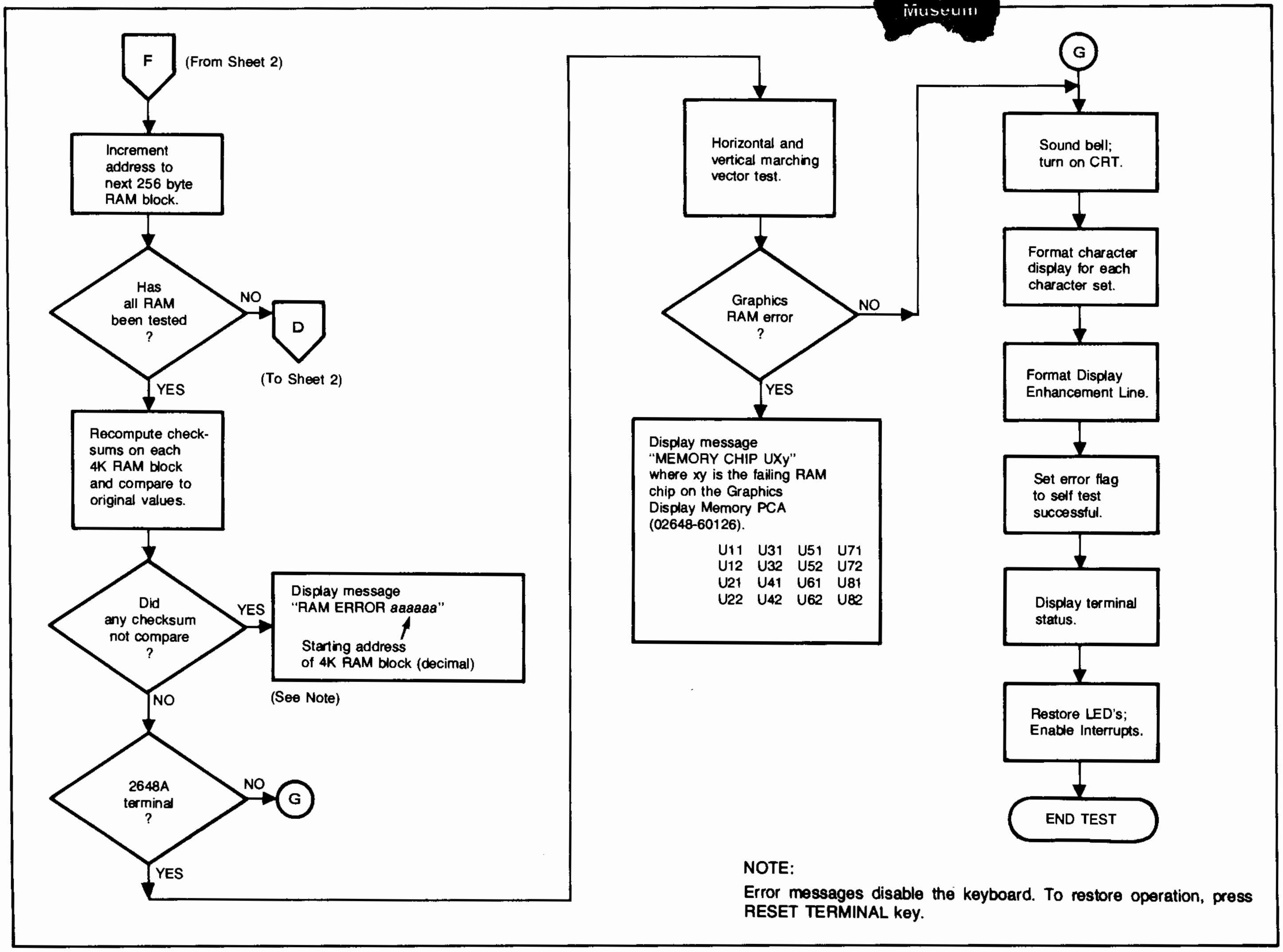
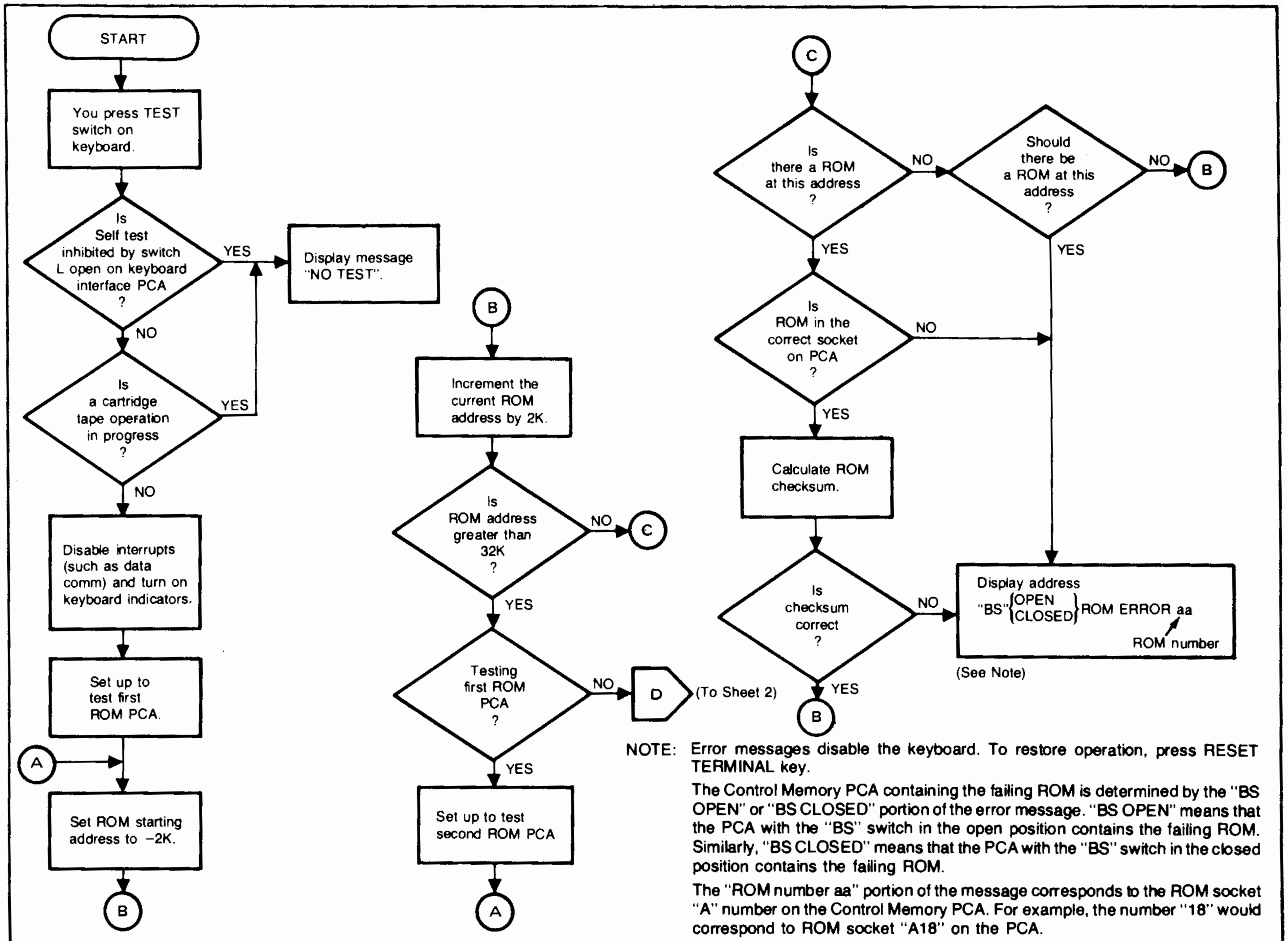


Figure 6-3. Terminal Self Test Flowchart (2645 and 2648) (Sheet 3 of 3)



NOTE: Error messages disable the keyboard. To restore operation, press RESET TERMINAL key.

The Control Memory PCA containing the failing ROM is determined by the "BS OPEN" or "BS CLOSED" portion of the error message. "BS OPEN" means that the PCA with the "BS" switch in the open position contains the failing ROM. Similarly, "BS CLOSED" means that the PCA with the "BS" switch in the closed position contains the failing ROM.

The "ROM number aa" portion of the message corresponds to the ROM socket "A" number on the Control Memory PCA. For example, the number "18" would correspond to ROM socket "A18" on the PCA.

Figure 6-4. Basic Terminal Self-Test Flowchart (2647) (Sheet 1 of 3)

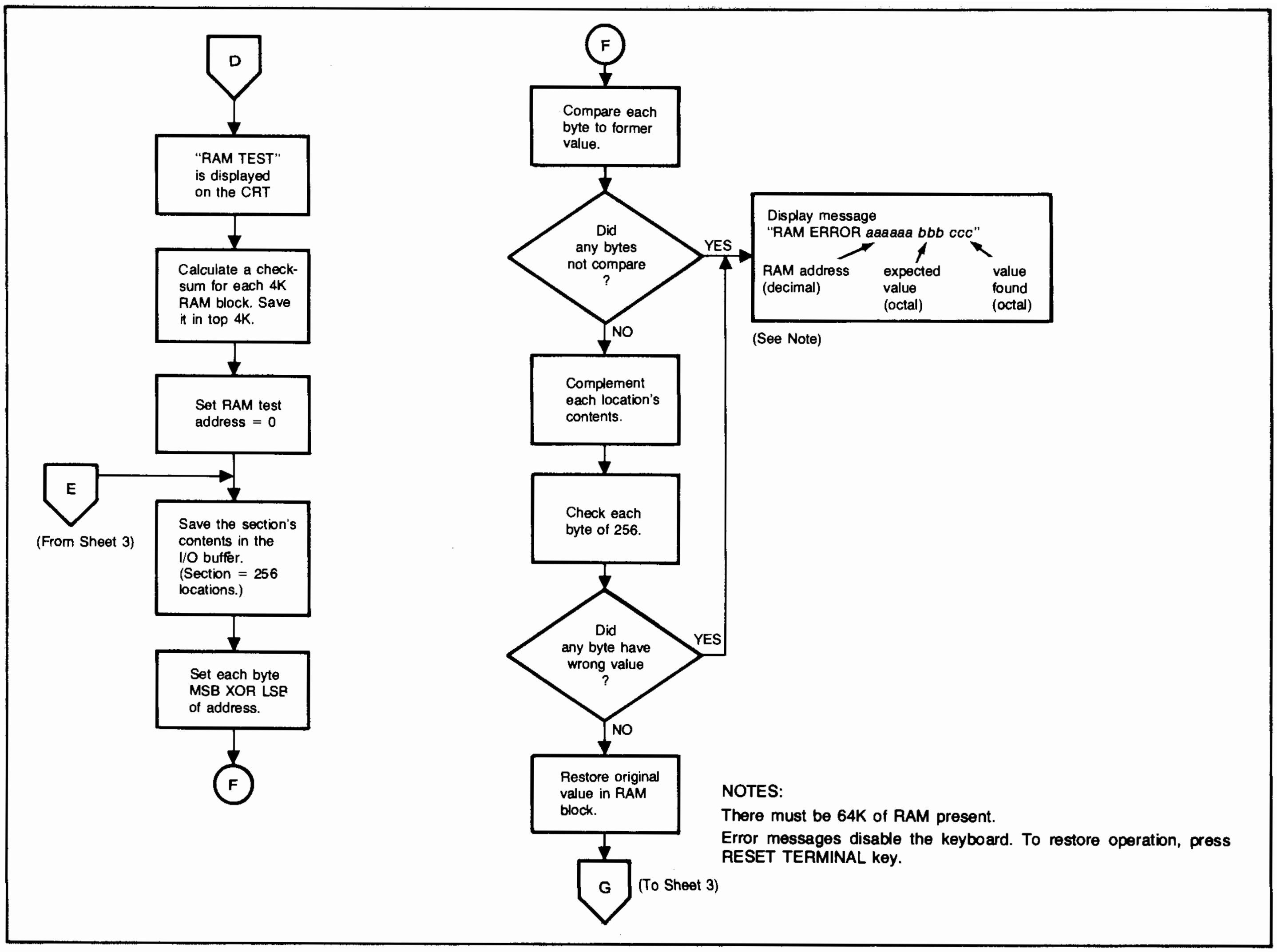


Figure 6-4. Basic Terminal Self-Test Flowchart (2647) (Sheet 2 of 3)

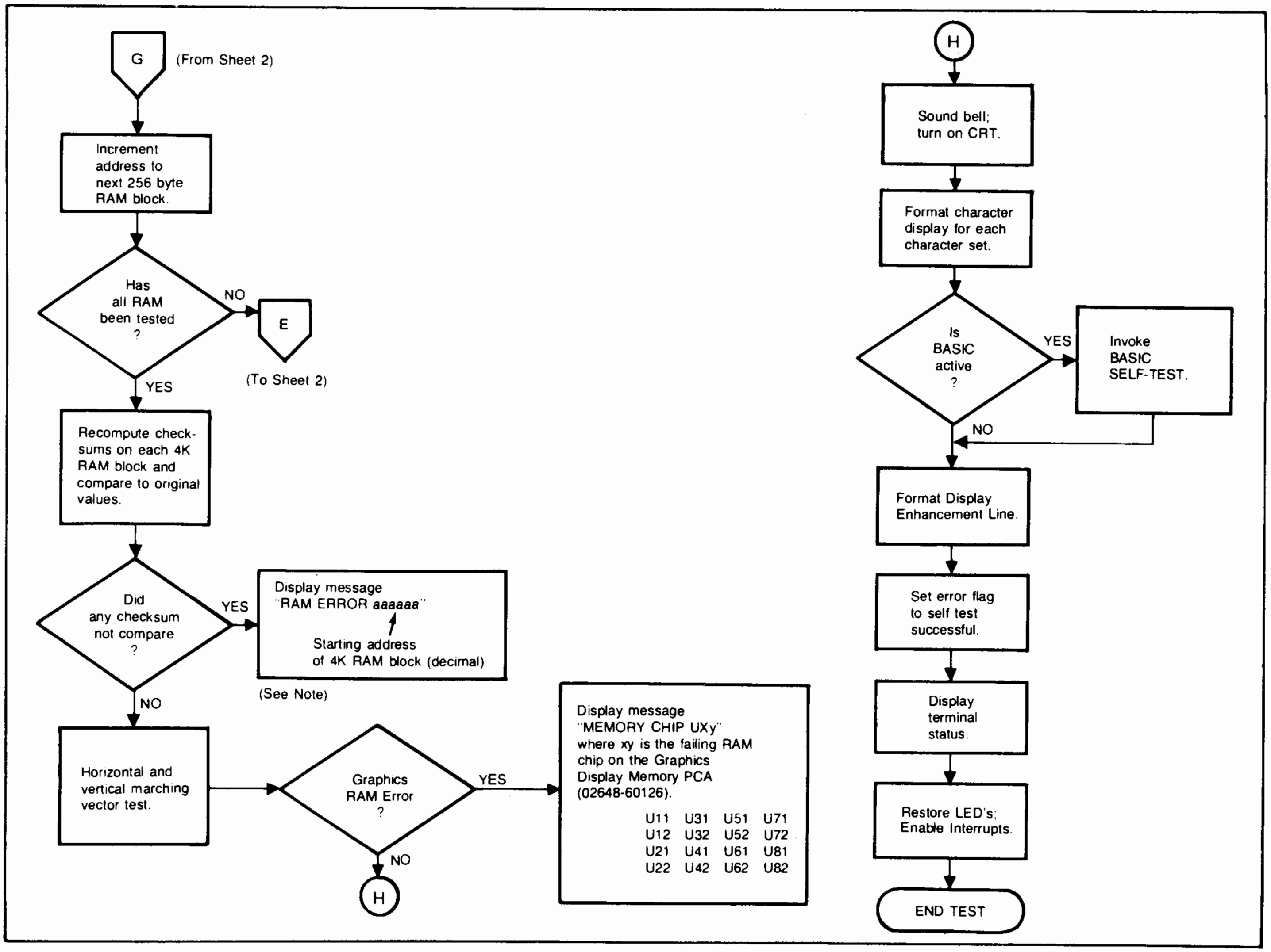
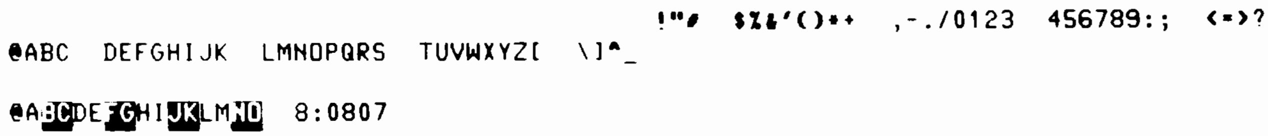
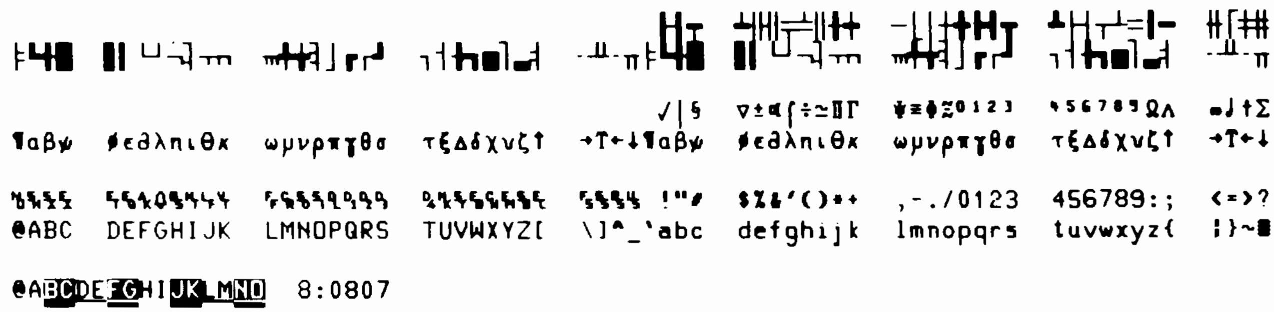


Figure 6-4. Basic Terminal Self-Test Flowchart (2647) (Sheet 3 of 3)

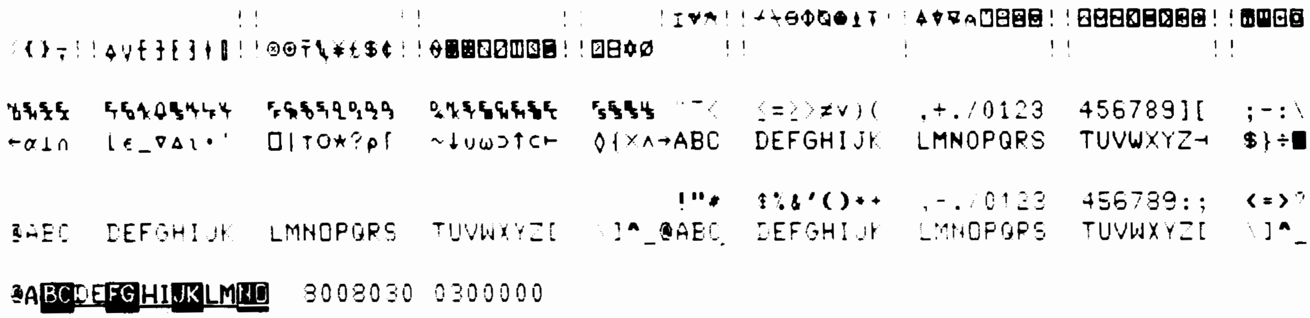


A. Test Pattern for the standard terminal.



B. Test Pattern for terminals containing Display Enhancements, 128 Roman Character Set, Display Enhancements, Math Symbol Set, and Line Drawing Set.

Figure 6-5. Self Test Patterns (2640B)



A. Test Pattern for the standard terminal.

B. Test Pattern for terminals containing 128 Roman Character Set, and Line Drawing Set.

Figure 6-6. Basic Self Test Patterns (2641A)

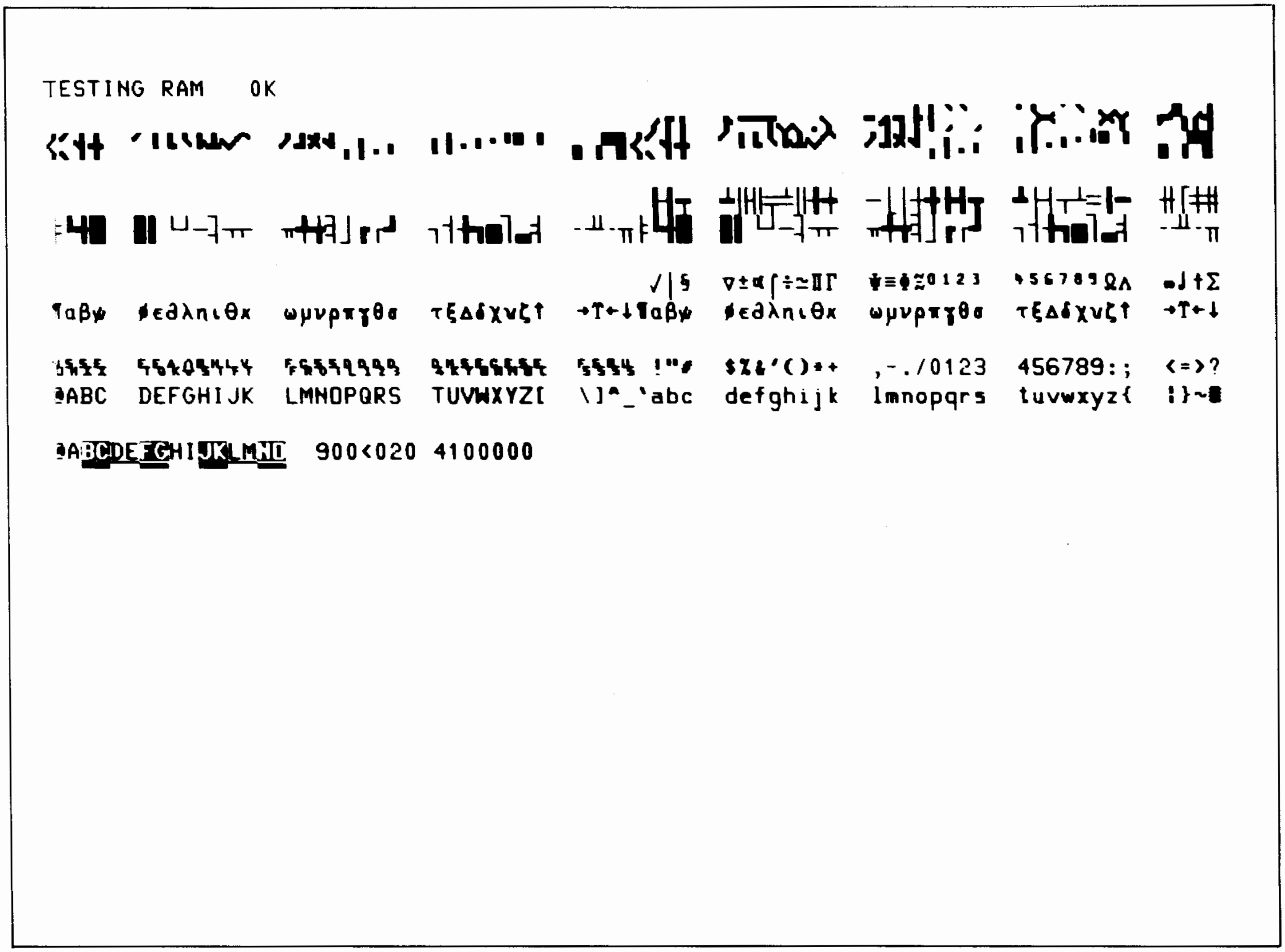
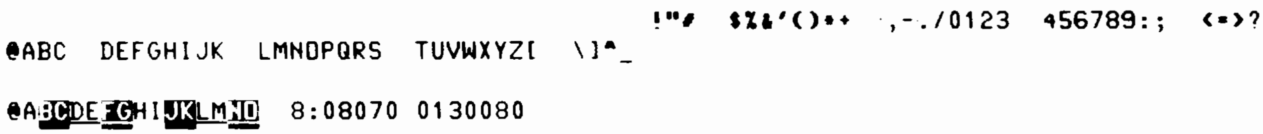
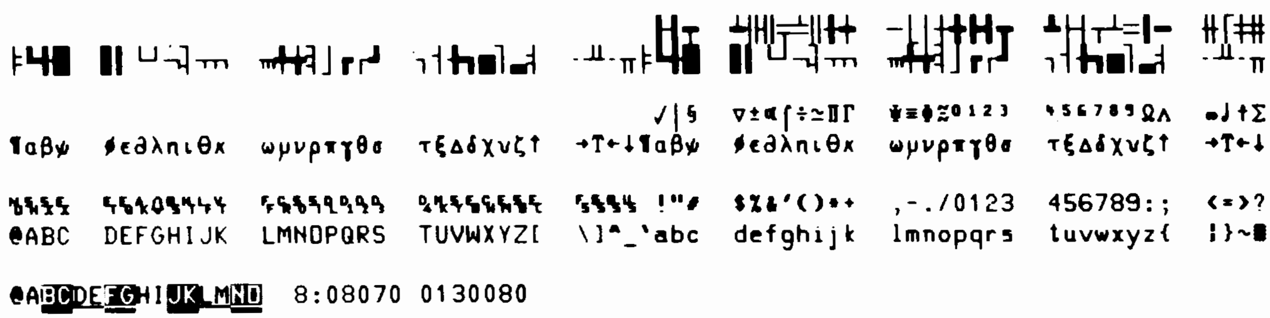


Figure 6-6A. Basic Self-Test Patterns (2642A)

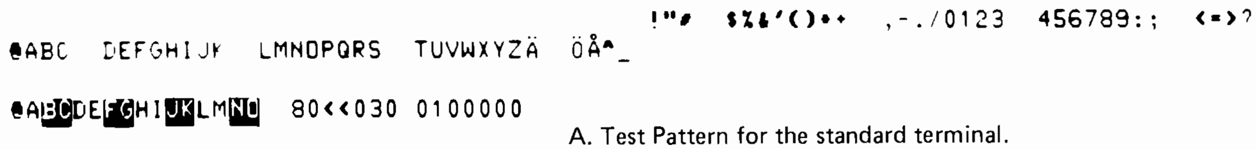


A. Test Pattern for the standard terminal.

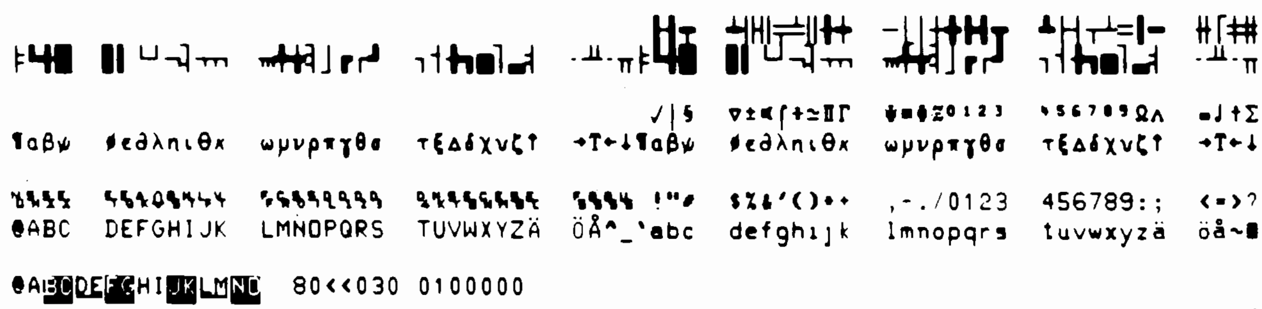


B. Test Pattern for terminals containing Display Enhancements, 128 Roman Character Set, Math Symbol Set, and Line Drawing Set.

Figure 6-7. Basic Self Test Patterns (2645A)

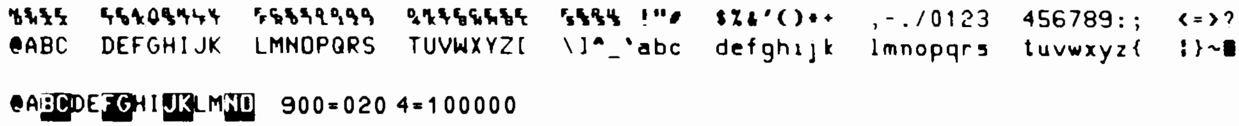


A. Test Pattern for the standard terminal.

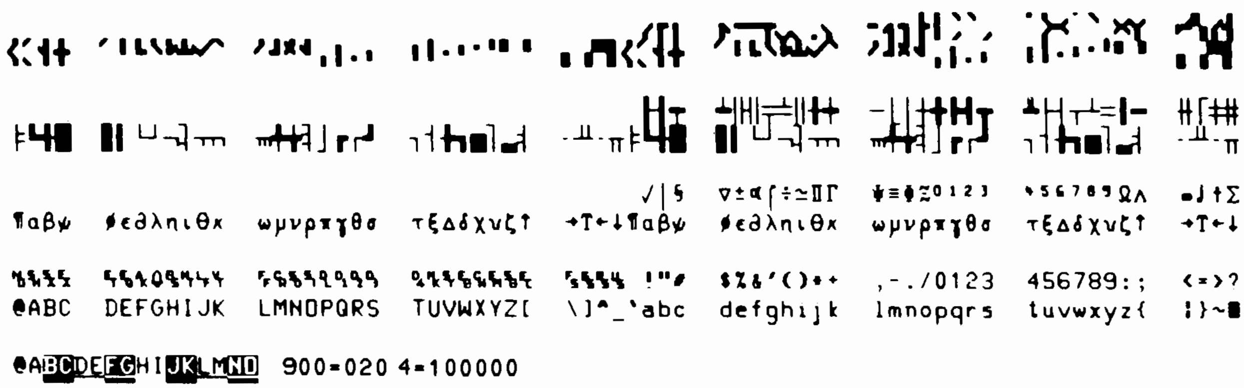


B. Test Pattern for terminals containing Display Enhancements, 128 Roman Character Set, Math Symbol Set, and Line Drawing Set.

Figure 6-8. Basic Self Test Patterns (2645S)



A. Test Pattern for the standard terminal.



B. Test Pattern for terminals containing Display Enhancements, Math Symbol Set, Line Drawing Set, and Large Character Set.

Figure 6-9. Basic Self Test Patterns (2647A and 2648A)

Data Communications Self Test

WHY .... The data communications self test is used to isolate a malfunction to one of the following items:

1. Data communications PCA (either point-to-point or multipoint).
2. Data communications cable (either point-to-point or multipoint).
3. Modem (either near-end or remote).

HOW .... A data communications test, resident in firmware, is run to exercise the data communications equipment. Using one of three test connectors, signals output from the item under test are looped back to simulate signals occurring as a response to the output signals. The firmware test instructions check for return of the response signals.

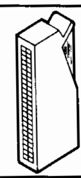
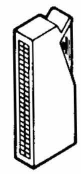
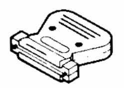
The terminal must be in good operating condition before testing the data communications equipment. First the data communications PCA is checked, then the cable(s), the near-end modem, and then the remote modem.

WHEN .... The data communications self test can be performed anytime and should be performed whenever a malfunction appears to be isolated to the data communications equipment.

PROCEDURE .... For valid test results, each of the following tests depends on proper operation of other equipment. All tests depend on correct operation of all terminals used in the test. Also, some tests depend on successful completion of the test on other data communications equipment. The prerequisites for each test are listed preceding the test.

Test connectors are used for some tests to provide signal loopback while the test is being run. A description of the test connectors is provided in the following table.

Table 6-2. Data Communications Self-Test Connectors

SELF-TEST CONNECTORS	HP PART NO.	USED FOR
	02645-60002	Checks RS232 circuits on 13260A, B, C, D accessory PCAs. (Does not check multipoint circuits on PCA; use 02645-60004 test connector below.)
	02645-60035	Checks current loop circuits on 13260B accessoy PCA.
	02645-60004	Provides loop-back of RS232 signals at RS232 connector end of cable. Used during self-test of point-to-point configurations.

DATA COMMUNICATIONS PCA TEST

This procedure tests the data communications PCA. To ensure that the terminal *is not* malfunctioning, perform the basic terminal self test before performing this test. Perform this test as follows:

1. Ensure power is off, and disconnect cable from data communications PCA.
2. Connect PCA Test Connector, part no. 02645-60002, to data communications PCA. (If operating in current loop, use test connector part no. 02645-60035 to connect to 13260B Data Communications PCA.) (See figure 6-10.)
3. Turn on terminal power and press the REMOTE key to lock it in the down (REMOTE) position.
4. Press the ESC key, then the x key to start the test. See figure 6-11 or 6-12 for the test events and error messages. Table 6-3 contains error messages for the non-multipoint data communications test. If the test fails and no corrective action is suggested in the flowchart (such as resetting a strapping switch), replace the data communications PCA.

NOTE
This test doesn't work on 2640B/C/N/S terminals.

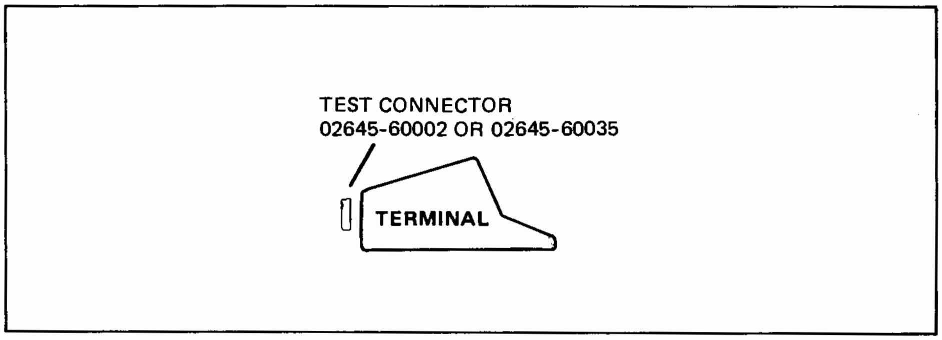


Figure 6-10. PCA Test Setup

Table 6-3. Basic Data Communications Self Test Error Messages

ERROR MESSAGE	MEANING
BASIC DATA COMM SELF-TEST OK	Test successful.
BASIC DATA COMM SELF-TEST ERROR 0 (DISABLED)	Switch W on Keyboard Interface PCA is set to inhibit Data Comm Self Test.
BASIC DATA COMM SELF-TEST ERROR 1 (NO CB)	CB signal, which should have been received when the CA signal was sent, was not received.
BASIC DATA COMM SELF-TEST ERROR 2 (PARITY)	Character sent out was returned but with a parity error.
BASIC DATA COMM SELF-TEST ERROR 3 (OVERRUN)	More bits were returned than were transmitted or a pad was sent out without being returned.
BASIC DATA COMM SELF-TEST ERROR 3 (LOST CHAR)	Character returned is not the character sent out.
BASIC DATA COMM SELF-TEST ERROR 4 (CB)	Either received a CB without sending a CA or didn't receive a CB after sending a CA.
BASIC DATA COMM SELF-TEST ERROR 4 (CF)	Either a CF signal was received when no SA signal was sent and no CB signal was received or didn't receive a CF signal after sending a CA signal and receiving a CB signal.
BASIC DATA COMM SELF-TEST ERROR 5 (SB)	One of the following conditions occurred: 1. Received an SB signal without sending either a CA signal or a SA signal and without receiving either a CB or CF signal. 2. Received an SB signal after sending a CA signal and receiving both a CB signal and a CF signal. 3. Didn't receive an SB signal after sending a CA signal and an SA signal and receiving both a CB signal and a CF signal.

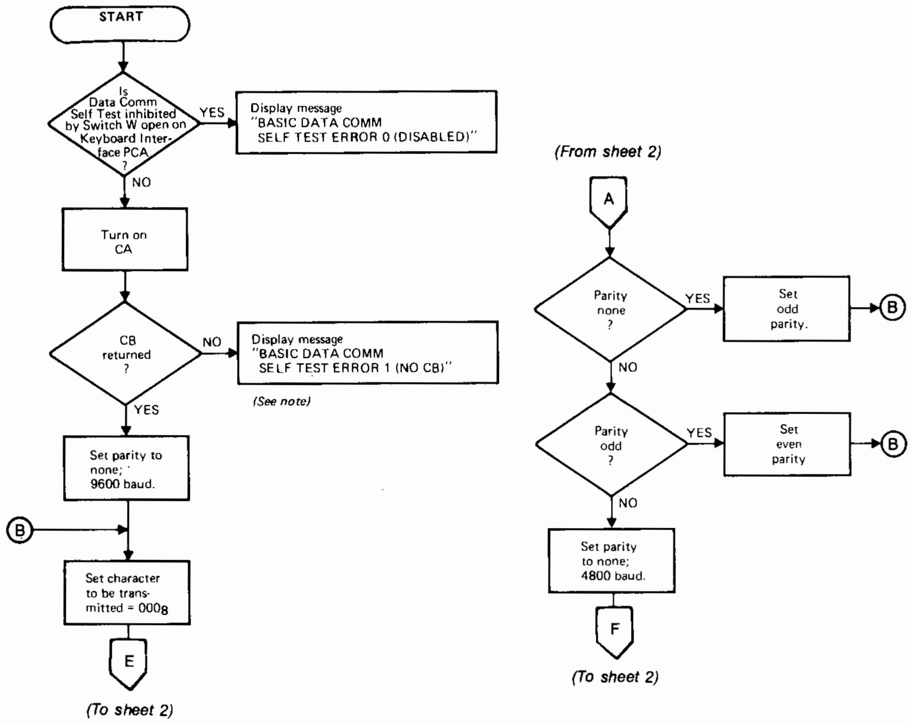


Figure 6-11. Basic Data Comm Self Test Flowchart (Sheet 1 of 3)

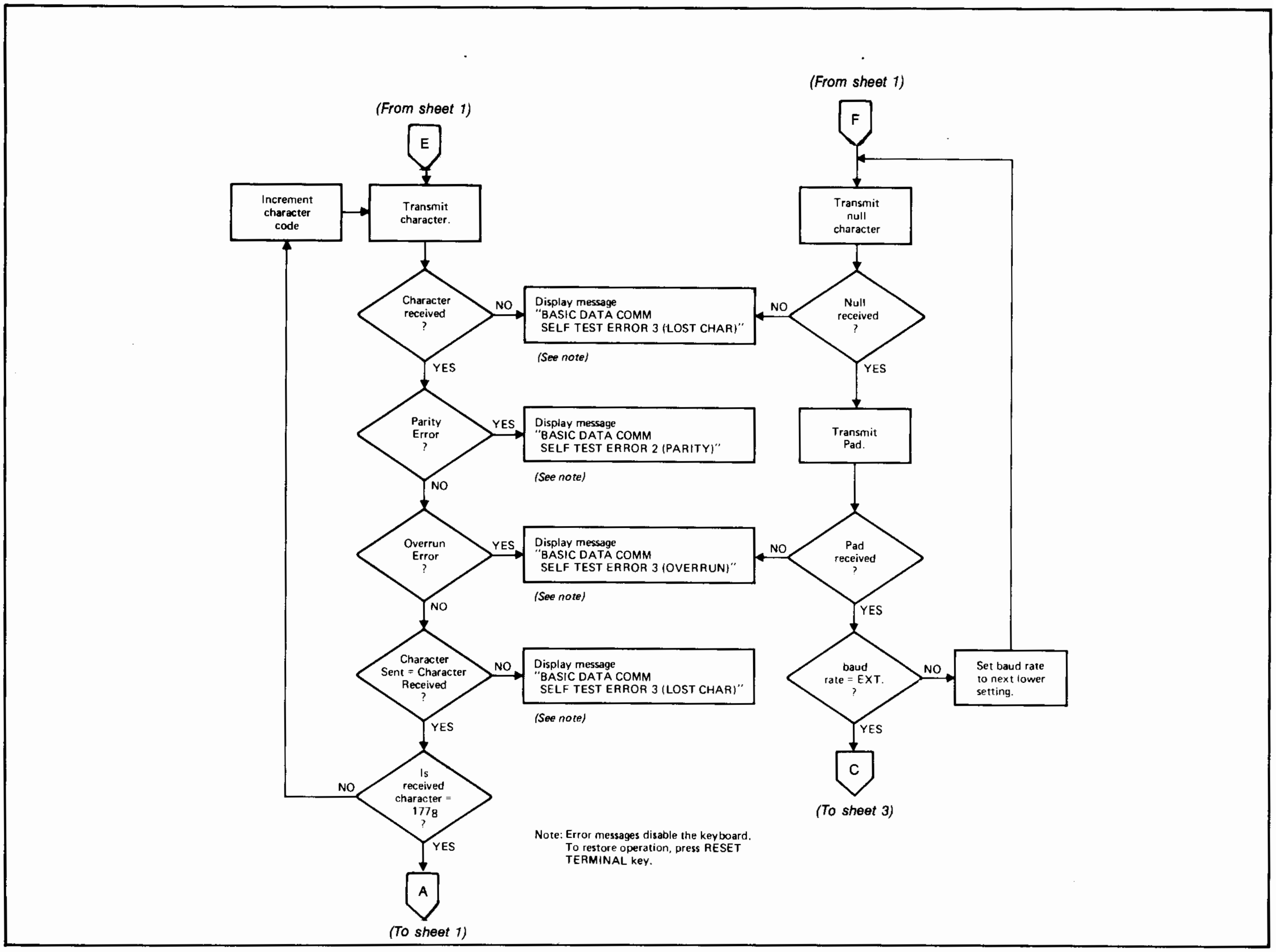


Figure 6-11. Basic Data Comm Self Test Flowchart (Sheet 2 of 3)

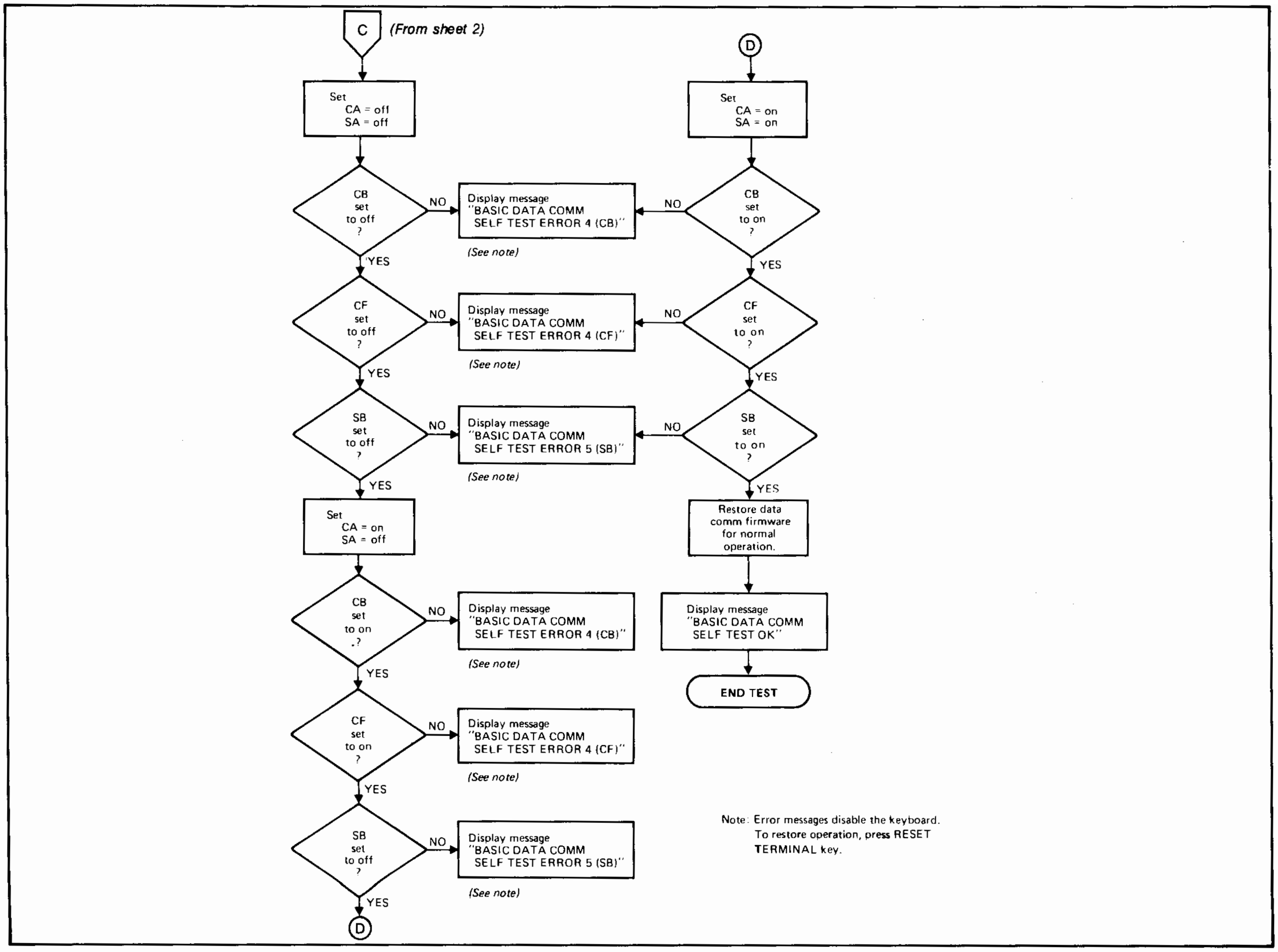


Figure 6-11. Basic Data Comm Self Test Flowchart (Sheet 3 of 3)

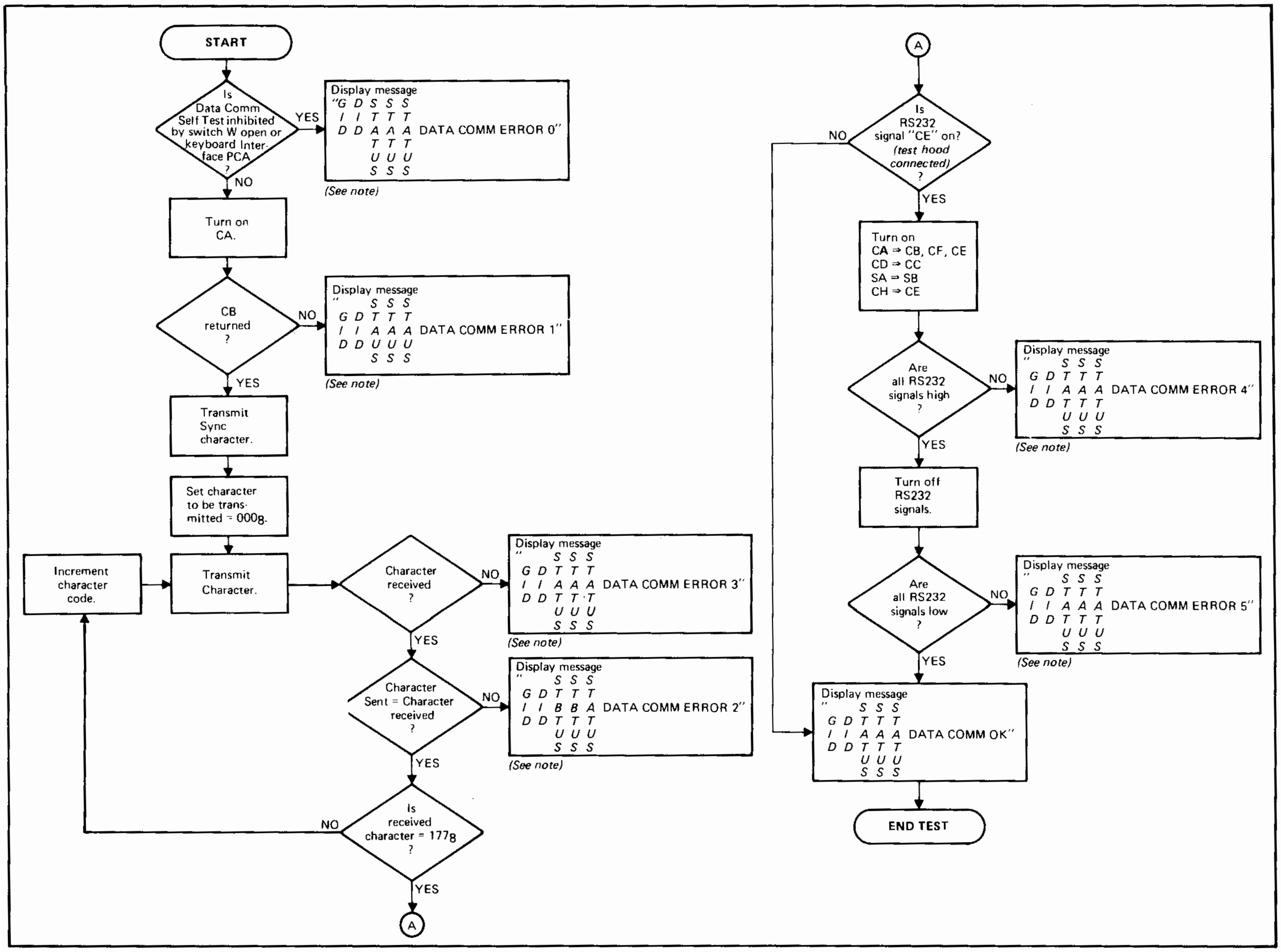


Figure 6-12. Multipoint Data Comm Self Test Flowchart (Sheet 1 of 2)

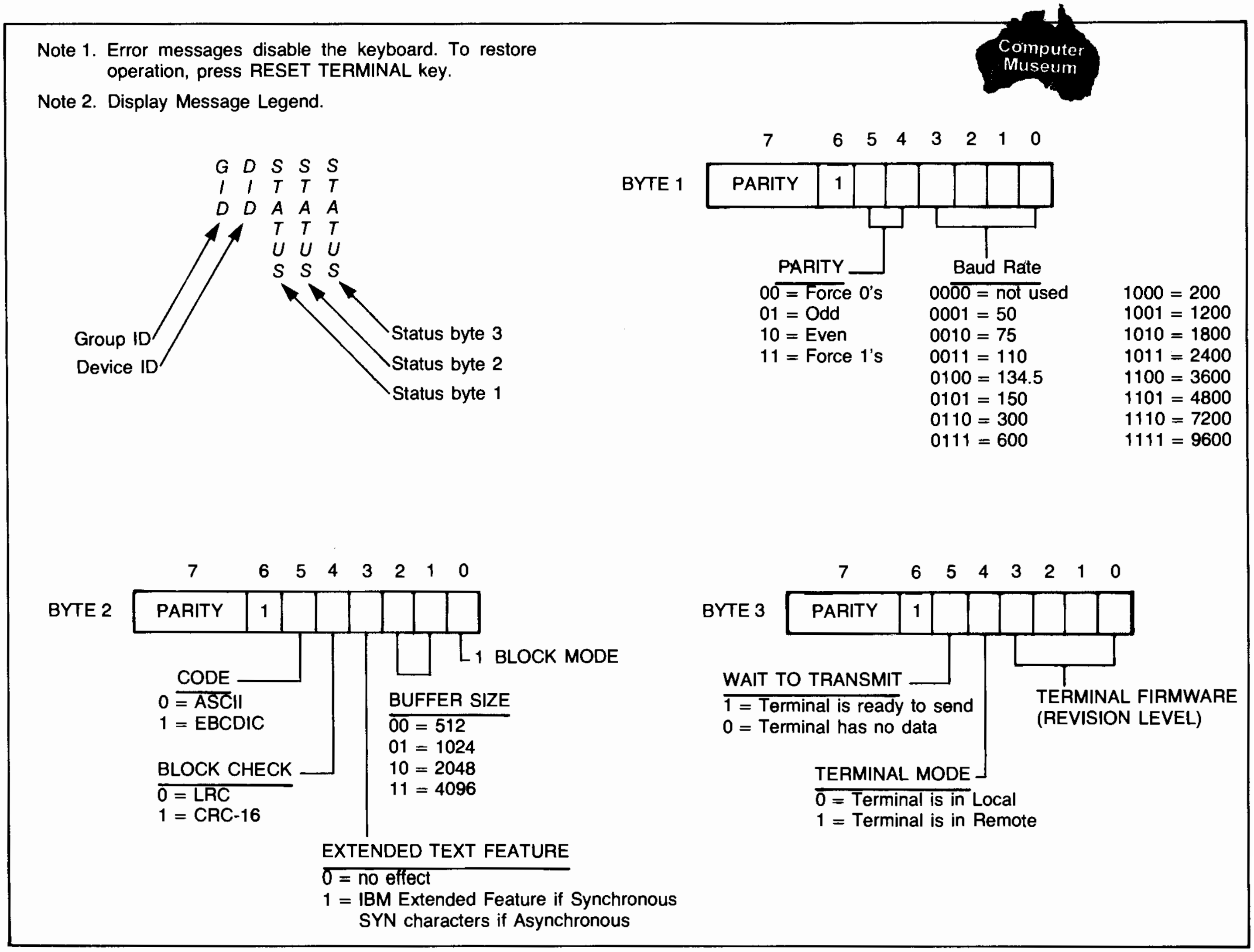


Figure 6-12. Multipoint Data Comm Self Test Flowchart (Sheet 2 of 2)

CABLE TEST

This procedure tests the cable(s) used to connect the terminal(s) to the modem (or direct to the computer). For valid test results, the terminal and the data communications PCA must be operating correctly. To ensure this condition, perform a basic terminal self test and a data communications PCA test before performing this test. Perform this test as follows:

1. Turn off power and connect the equipment as shown in figure 6-13 or 6-14.
2. Connect RS232 Test Connector, part no. 02645-60004, to RS232 connector on 13232C or N cable.
3. Turn on terminal power and press the REMOTE key to lock it in the down (REMOTE) position.
4. Press the ESC key, then the x key to start the test. See figure 6-11 or 6-12 for the test events and error messages. If the test fails and no corrective action is suggested in the flowchart, replace the cable.

MODEM TEST

This test is applicable only to modems with a loopback capability. It can be used to test either the modem to which the terminal(s) are connected or the remote modem. To ensure valid test results, perform the basic terminal test, the multipoint data communications PCA test, and the multipoint cable test before performing this test. Test the near modem before testing the remote modem. Perform the test as follows:

1. With the system connected for operation (figure 6-15 or 6-16) set the modem for loopback operation.
2. Press the REMOTE key to lock it in the down (remote) position.
3. Press the ESC key; then the x key to start the test. See figure 6-11 or 6-12 for test events and error messages. If the test fails and no corrective action (such as resetting a switch) is suggested by the flowchart, replace the modem.

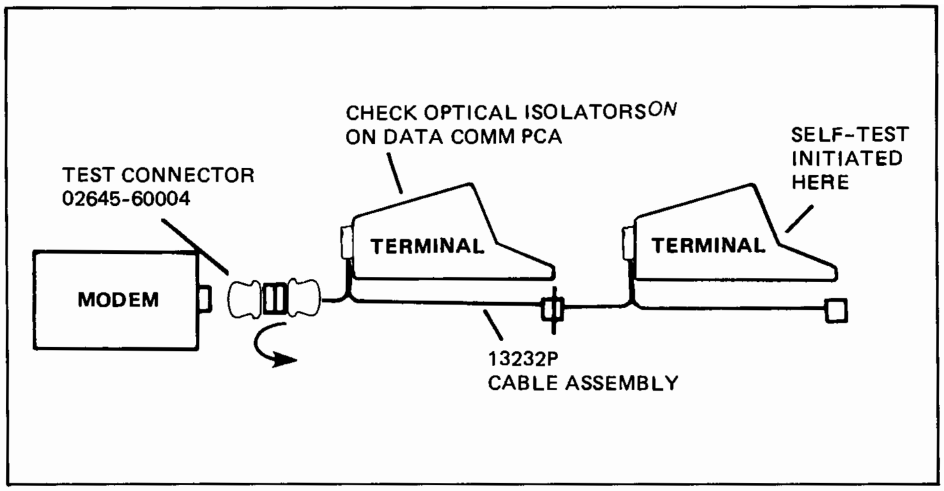


Figure 6-13. Multipoint Cable Test Setup

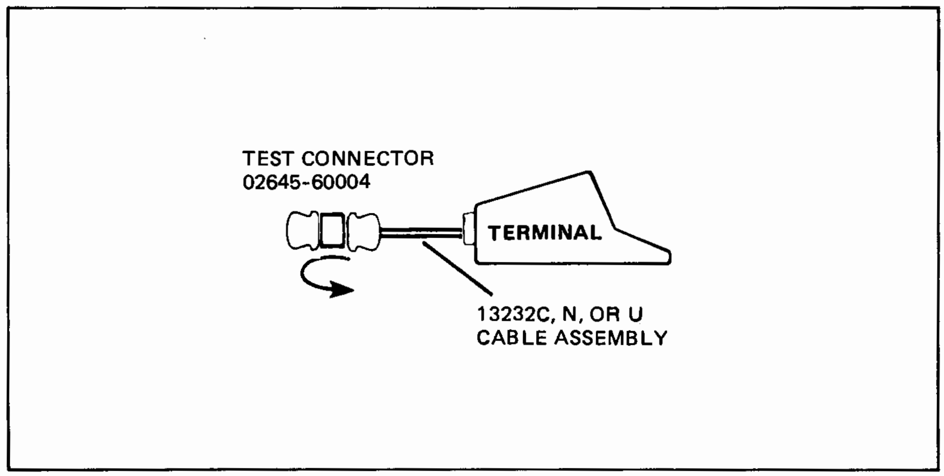


Figure 6-14. Point-to-Point Cable Test Setup

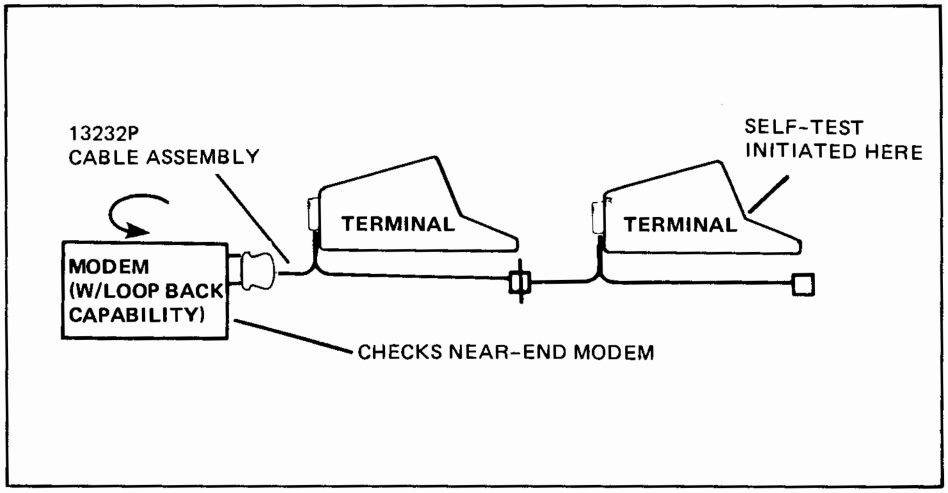


Figure 6-15. Near Modem Test Setup

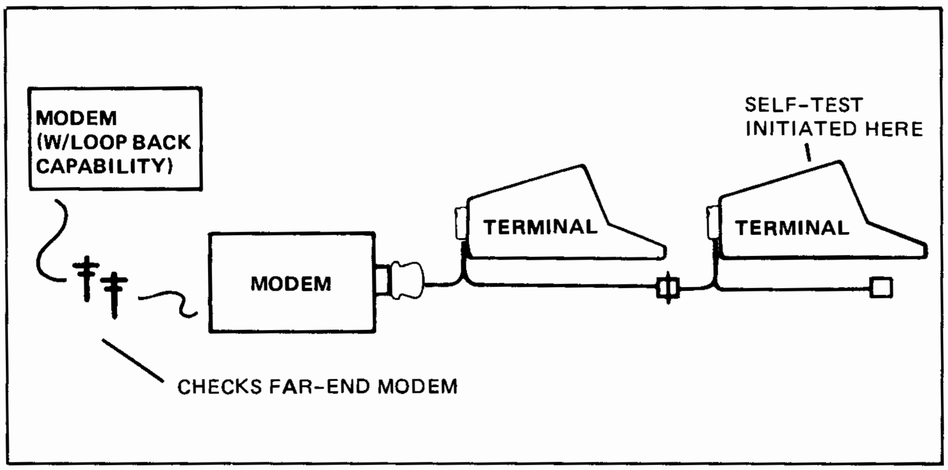


Figure 6-16. Remote Modem Test Setup

Tape System Test

WHY .... The tape system test checks the cartridge tape system for correct operation. Troubleshooting procedures are supplied for use if a malfunction is encountered during the test.

HOW .... A tape test, resident in the terminal firmware, is run to exercise the tape system when the test is initiated from the keyboard. Both CTU transport assemblies are tested while the user monitors progress of the test visually.

WHEN .... The tape test can be performed at any time and should be performed whenever the tape system is suspected of malfunctioning. The terminal itself must be operating properly for the results of the tape test to be valid.

PROCEDURE .... If a malfunction occurs during the test, note the checkout step number and refer to table 6-4. Table 6-4 is keyed to the checkout by step number and contains a list of malfunctions (SYMPTOM) that could occur for each step and associated lists of PROBABLE CAUSE and CORRECTIVE ACTION procedures. If more than one probable cause is listed for a specific symptom, check the probable causes in the order listed. If more than one corrective action is listed for a specific probable cause, perform the corrective actions in the order listed. After any corrective action has been performed, *check if the malfunction has been corrected*. If the malfunction persists, check the next probable cause, perform the corrective action(s), and again check if the malfunction has been corrected. After any malfunction has been corrected, repeat this entire checkout procedure to ensure proper terminal operation. Perform the test as follows:

1. Open terminal to its half open position.
2. Using at least two tape cartridges, check that cartridges can be easily inserted and ejected for both UNIT 0 and UNIT 1 (left and right tape drives, respectively).
3. Perform terminal self test.
4. Press RESET TERMINAL key twice within 0.5 second and check that display clears and blinking cursor appears in upper-left corner of display.

CAUTION

Do not use tape cartridges containing data you wish to save when performing the following checkout procedures. Data previously stored on tape will be overwritten with test data.

Note

Many of the following test sequences can be individually duplicated using the HP CTU Tester. Whenever it is desired to perform such a test sequence more than once, it is recommended that the CTU Tester be used rather than to repeat the entire checkout procedure.

5. Set cartridge protect tab on both tape cartridges to RECORD position, insert tape cartridges in UNIT 0 and UNIT 1, and observe the following sequence of events.

   a. The tape cartridges sequentially rewind to beginning-of-tape (BOT) and then search forward to load point (LP). (Tape motion; fast reverse then slow forward.)

   b. When both tapes are at LP, both eject buttons light.

6. For 2642A and 2647A terminals, press the COMMAND key to display the command functions along the bottom of the display; then press the following keys in the following sequence: NEXT (f1) three times, TEST (f4), TAPES (f4), and the RETURN key.

   For other terminals, press GREEN key and then TEST key. The following sequence of events should occur.

   Note

   If a malfunction occurs while testing either CTU Transport Assembly, test will halt and the eject button on the CTU Transport Assembly under test when the malfunction occurred will be lighted.

   a. UNIT 0 eject button light starts blinking indicating start of a complete test for UNIT 0. Test sequence is as follows:

      (1) Worst case test pattern (one record of 128 "%Z" characters) is recorded on tape. (Tape motion; slow forward.)

      (2) Tape is backspaced over recorded test pattern. (Tape motion; slow reverse.)

      (3) Recorded test pattern is read and verified and an end-of-file mark recorded. (Tape motion; slow forward.)

   b. UNIT 0 eject button light stops blinking and remains on indicating successful completion of UNIT 0 test.

   c. Two self-test patterns appear on display indicating the successful completion of two basic terminal self-test sequences.

PROCEDURE (Continued) ....

d. UNIT 1 eject button starts blinking indicating start of complete test for UNIT 1. Sequence of events for UNIT 1 test is identical to sequence of events for UNIT 0 test described in substeps a(1) through a(3) above.

e. Another self-test pattern appears and remains on display and both eject buttons remain lighted indicating the successful completion of UNIT 1 test.

7. For 2642A and 2647A terminals, press the COMMAND key to display the command functions along the bottom of the display; then press the following keys in the following sequence: REWIND (f5), LTAPE (f5), and the RETURN key. For other terminals, press GREEN, REWIND, and LTAPE keys.

   Check that UNIT 0 tape cartridge rewinds to BOT (tape motion; fast reverse) and, after tape stops at BOT, check the UNIT 0 eject button is no longer lighted.

8. For 2642A and 2647A terminals, repeat step 7 for UNIT 1 except press the RTAPE (f6) key in place of the LTAPE (f5) key.

   For other terminals, press GREEN, REWIND, and R. TAPE keys.

   Check that UNIT 1 performs the same as UNIT 0 in step 7 above.

9. Swap tape cartridges between UNIT 0 and UNIT 1.

10. Press RESET TERMINAL key within 0.5 second and, after cartridges have rewound and both eject button lights are on, press READ key. Check that a line of "%Z" characters are read from UNIT 0 and appear on display. (Tape motion; slow forward.)

11. For 2642A and 2647A terminals, press the COMMAND key to display the command functions along the bottom of the display, then press the following keys in the following sequence: COPY (f2), LINE (f1), RTAPE (f2), DISPLAY (f3), then press the RETURN key.

    For other terminals, press GOLD, FROM: R. TAPE, and READ keys.

    Check that a line of "%Z" characters are read from UNIT 1 and appear on display. (Tape motion; slow forward.)

12. Rewind both tape cartridges (steps 7 and 8 above) and remove cartridges from terminal.

13. Lower top cover to closed position.

Table 6-4. Tape System Troubleshooting Guide

STEP	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
	Some of the listed PROBABLE CAUSE malfunctions are preceded by an asterisk (*). The asterisk denotes that the malfunction can be further checked or verified using the HP CTU Tester. Whenever such a malfunction is encountered, it is recommended that the tester be used to verify the malfunction before performing any CORRECTIVE ACTION instructions.		
1	Not applicable.		
2	Tape cartridge does not insert easily or does not seat properly.	1. Defective tape cartridge.	Replace tape cartridge.
		2. CTU Transport Assy and mainframe front bezel not properly aligned.	Align transport and bezel.
		3. Defective CTU Base Assy.	Replace CTU Transport Assy.
	Tape cartridge does not fully eject.	Same as causes 1 through 3 above.	Same as above.
	Tape cartridge ejects from terminal.	Defective CTU Base Assy.	Replace CTU Transport Assy.
3	Not applicable.		
4	Display does not clear and/or cursor does not appear.	1. Operator error.	Press RESET TERMINAL key.
		2. Basic terminal malfunction.	Perform terminal self test.
5a	No message appears and neither tape cartridge rewinds.	1. CTU Top Plane not properly connected.	Reinstall top plane on CTU Interface and Read/Write PCA top connectors.
		2. CTU Interface and/or Read/Write PCA not properly connected.	Reinstall PCAs in Backplane Assy.
		*3. Defective top plane or PCA top con nectors.	Use CTU Tester in its ON LINE mode. Verify malfunction and, if necessary, replace top plane and/or PCAs.
		*4. Defective bus decoder and timing logic, or tape motion decoder.	Replace CTU Interface PCA.
		*5. Defective amplifier select logic or CTU drive circuits.	Replace Read/Write PCA.

Table 6-4. Tape System Troubleshooting Guide

STEP	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
5a (cont.)	NO TAPE message appears on display and only one tape cartridge rewinds.	1. Tape cartridge not seated properly in CTU Transport Assy with lighted eject button.	Eject and reinsert tape cartridge in Transport Assy.
		2. Defective tape cartridge.	Replace tape cartridge.
		*3. Defective Head Bridge Assy in CTU Transport Assy with lighted eject button.	Replace CTU Transport Assy.
		*4. Defective cartridge detect circuit, amplifier select circuit, or CTU drive circuits.	Replace Read/Write PCA.
		*5. Defective command logic, hole detect logic, or status bus drivers.	Replace CTU Interface PCA.
	NO TAPE message appears on display and neither tape cartridge rewinds.	*1. Defective bus decoder and timing logic, command logic, hole detect logic, or tape motion decoder.	Replace CTU Interface PCA.
		*2. Defective amplifier select logic or CTU drive circuits.	Replace Read/Write PCA.
	RUNOFF message appears on display.	1. Defective tape cartridge in CTU Transport Assy with lighted eject button.	If tape has run off either tape hub, either rethread or replace tape cartridge. If tape is attached to both hubs, rewind approximately 1/2 inch of tape by manually rotating cartridge belt drive puck.
		*2. Defective Head Bridge Assy in CTU Transport Assy with lighted eject button.	Replace CTU Transport Assy.
		*3. Defective hole detect logic or hole detect flip-flop.	Replace CTU Interface PCA.
	Both tape cartridges rewind, but neither searches forward to LP.	*1. Defective command logic or tape motion decoder.	Replace CTU Interface PCA.
		*2. Defective CTU drive circuits or feedback circuits.	Replace Read/Write PCA.
	One tape cartridge rewinds and stops at LP, but no tape motion on other tape cartridge.	*1. Defective Motor/Tachometer Assy on CTU Transport Assy with lighted eject button.	Replace CTU Transport Assy.

Table 6-4. Tape System Troubleshooting Guide (Continued)

STEP	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
5a (cont.)		*2. Defective amplifier select logic or CTU CTU drive circuits.	Replace Read/Write PCA.
		*3. Defective Head Bridge Assy on CTU Transport Assy with lighted eject button.	Replace CTU Transport Assy.
5b	Cursor appears on display but neither eject button is lighted.	Defective bus decoder and timing logic or command logic.	Replace CTU Interface PCA.
	Cursor appears on display, but only one eject button is lighted.	1. Defective indicator lamp DS1 on unlighted eject button.	Replace DS1.
		2. Defective Head Bridge Assy on unlighted CTU Transport Assy.	Replace CTU Transport Assy.
		*3. Defective command logic.	Replace CTU Interface PCA.
6a	PROTECTED TAPE message appears on display.	1. Operator error.	Eject tape cartridge, set cartridge protect tab to RECORD position, and reinsert tape cartridge in UNIT 0.
		*2. Defective Head Bridge Assy.	Replace UNIT 0 CTU Transport Assy.
		*3. Defective unit/function decoder or write current circuit.	Replace Read/Write PCA.
		*4. Defective command logic.	Replace CTU Interface PCA.
	RUNOFF message appears on display.	Same as STEP 5a RUNOFF message SYMPTOM.	
	READ FAIL message appears on display.	1. Defective tape cartridge.	Condition UNIT 0 tape or, if malfunction persists, replace tape cartridge.
		*2. Defective magnetic head.	Clean and degauss UNIT 0 magnetic head or, if malfunction persists, replace UNIT 0 CTU Transport Assy.
		*3. Defective data I/O buffer, shift register, or encoder/decoder logic.	Replace CTU Interface PCA.
		*4. Defective unit/function decoder, write current circuit, read select switch, read amplifier circuit, or gap detect circuit.	Replace Read/Write PCA.
		*5. Defective Motor/Tachometer Assy.	Replace UNIT 0 CTU Transport Assy.

Table 6-4. Tape System Troubleshooting Guide (Continued)

STEP	SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
6b	Not applicable.		
6c	ROM or RAM ERROR messages appear on display, test patterns do not appear, or incorrect test patterns appear.	Basic terminal malfunction.	Perform terminal self test.
6d	Same as 6a except use UNIT 1 in lieu of UNIT 0.		
7	Tape cartridge does not rewind.	1. Operator error. *2. Defective command logic or tape motion decoder.	Repeat key stroke sequence. Replace CTU Interface PCA.
8	Same as step 7.		
9	Not applicable.		
10	No characters appear on display.	1. Operator error. *2. Defective bus decoder and timing logic, data I/O logic, shift register, or encoder/decoder logic.	Repeat key stroke sequence. Replace CTU Interface PCA.
	Blanks appear between displayed characters.	1. Defective tape cartridges. *2. CTU Transport speeds not balanced.	Condition tapes or replace tape cartridges. Perform speed adjustment.
	READ FAIL message appears on display.	*1. CTU Transport speeds not balanced. *2. Defective magnetic head.	Perform speed adjustment. Clean and degauss UNIT 0 magnetic head or, if malfunction persists, replace UNIT 0 CTU Transport Assy.
11	Same as step 10 except use UNIT 1 in lieu of UNIT 0.		
12, 13	Not applicable.		

Disc Self-Test

WHY .... The disc self-test checks the disc drive system for correct operation.

HOW .... A disc self-test, resident in terminal firmware, is run to exercise the disc drive system when the test is initiated from the keyboard.

WHEN .... The disc self-test can be performed at any time and should be performed whenever the disc drive system is suspected of malfunctioning. The terminal must be operating properly for the results of the disc self-test to be valid.

PROCEDURE .... The disc self-test is performed with a diskette installed in each disc drive. Make sure t any data on the diskette need not be saved. Perform this test as follows:

1. Install the diskette(s) into the drives(s). Make sure the door is closed.
2. Press the [COMMAND] key to display the command functions along the bottom of the display.
3. Press softkeys [next], [next], [next], [TEST], [DISCS], and then the [RETURN] key to initiate the test. The test checks the disc controller and drive PCAs, disc drive unit, and the disc system's reading and writing operations.
4. Following the execution of the test, the terminal will display a message on the screen to indicate if the disc has successfully completed the test or if an error occurred. Messages that may appear are:
   a. Disc self-test OK
   b. No disc controller attached
   c. Disc self-test Fail, Unit is <u>, Test is <t>, Subtest is <s>, Head is <h>

      where:

      <u> is the selected disc drive unit when the test failed.

      <t> indicates which test failed.

      <s> indicates which subtest of the current test failed.

      <h> indicates which head the test failed on.

If a failure occurred, try a new diskette and repeat the test. If the failure occurs again, table 6-4A as a guide to troubleshooting down to a replaceable assembly. Section 7 provides replacement procedures.

Table 6-4A. Disc Self-Test Description

TESTED ITEM	TEST NO.	SUBTEST NO.	TEST	EXPLANATION
Disc Controller PCA	15	—	Power-On	Controller cannot be initialized.
	15	—	LED Test	LEDs did not change from on to off.
	4	—	ROM Test	CRC Check.
	5	—	RAM 1 Test	Data Pattern LSB.
	6	—	RAM 2 Test	Data Pattern MSB.
	7	—	RAM 3 Test	Address Line Error.
	2	0	FDC Test1	Disc Controller Time-Out Error.
	9	4	FDC Test2	Disc Controller Interrupt Error.
	8	6	Write Circuit Test	(1) Data pulse width = 0 or > 9μs. (2) 9μs one-shot multivibrator circuit is defective. (3) Controller cable is broken or not connected to drive.
	10	7	I/O Test	I/O and/or Handshake Registers may be defective.
Drive PCA Test (Note 1)	11	3	Seek Test1	(1) After recalibration, track 0 indicator was not detected. (2) Track 0 indicator circuit is defective. (3) Stepper motor did not move the actuator toward track 0. (4) Controller cable is broken or not connected.
	11	5	Seek Test2	(1) Track 0 indicator circuit is defective. (2) Stepper motor did not move the actuator toward track 34.
	11	6	Seek Test3	(1) Track 0 indicator circuit is defective. (2) Stepper motor did not move the actuator toward track 0.
	11	7	No Drive	(1) Drive ID circuit is defective. (2) Controller cable is not connected to drive or is broken.

Table 6-4A. Disc Self-Test Description (Continued)

TESTED ITEM	TEST NO.	SUBTEST NO.	TEST	EXPLANATION
Drive PCA Test (Note 1)	11	8	Write/Read	(1) Data pulse width = 0 or > 9µs. (2) Defective write/read circuit. (3) Defective 9µs one-shot multivibrator circuit. (4) Controller cable is not connected to drive or is broken.
	11	9	9µs Test	(1) Defective 9µs one-shot multivibrator circuit. (2) Controller cable is not connected to drive or is broken.
Drive Test (Note 2)	12	0	No Index Mark	(1) Defective index circuit. (2) Defective photo detector circuit or LED indicator. (3) Motor is not spinning. (4) Door is not closed.
	12	1	Speed Test1	Disc spinning faster than specified limits.
	12	2	Speed test2	Disc spinning slower than specified limits.
	12	6	Missing Pulse	(1) Defective missing one-shot circuit. (2) Defective index circuit.
Write Test (Note 3)	13	1	No Diskette	(1) No diskette inserted in drive or door not closed on drive. (2) Defective missing pulse one-shot circuit.
	13	2	Write Protected	(1) Defective write protect circuit. (2) Diskette is write protected.
	13	3	Underrun	(1) Controller PCA did not receive data before 30µs. (2) Defective timing circuit.
Read Test (Note 4)	14	0	Not Ready	(1) Defective disc change circuit. (2) Diskette is missing from drive.
	14	2	No ID Field	(1) Diskette is defective. (2) Unable to formate diskette due to defective write circuit.
	14	3	Wrong ID	Seek failure caused by wrong track.

Table 6-4A. Disc Self-Test Description (Continued)

TESTED ITEM	TEST NO.	SUBTEST NO.	TEST	EXPLANATION
Read Test (Note 4)	14	5	CRC Error	(1) Defective controller PCA. (2) Phase lock loop error caused by defective read circuit.
	14	6	Overrun	(1) Overrun occurred from lost data in the current read attempt. (2) Timing circuit is defective.

Notes:
1. A failure in the Drive PCA Test indicates a problem associated with the Drive PCA, or controller/drive logic.
2. A failure in the Drive Test indicates a problem with the motor speed, stepper motor, or the photo detection circuit on the disc drive unit.
3. A failure in the Write Test indicates a problem with recording data or formatting the diskette in the indicated drive.
4. A failure in the Read Test indicates a problem in reading data from the diskette. This may result from a failure to write or read correctly or from bad media.

HP-IB Self Test

WHY .... This test either tests the PHI chip on the HP-IB Interface PCA or indicates that the test was not attempted with supplementary information which might suggest why it was not attempted.

If the test is successful or if it was not attempted, the following information is displayed:

1. The HP-IB address for which the HP-IB Interface PCA is strapped.
2. Whether the terminal is the system controller.
3. Whether the terminal is the controller-in-charge.

If the test fails, one of two reasons is indicated, as follows:

1. No HP-IB Interface PCA installed in the terminal.
2. PHI chip error.

HOW .... A test, resident in terminal firmware, is run resulting in display of one of three messages to indicate if the test was not attempted, if it failed, or if it was successful.

NOTE

The HP-IB self test is not available in the 2648A.

WHEN .... The HP-IB test can be run anytime desired, either to check the PHI chip or to get information described above.

PROCEDURE .... To initiate the HP-IB self test, press and hold f3, then press TEST, or press COMMAND, next softkey three times in succession, TEST, HP-IB, and then RETURN.

TEST NOT ATTEMPTED

If the test is not attempted, the following message will be displayed:

```
                                                  YES         YES
HP-IB TEST NOT ATTEMPTED, ADDR=xx,SYSCTL =     ,  CIC=
                                                  NO          NO
```

The test will not be attempted if the terminal from which the test is initiated does not meet one of the following requirements:

1. It is both the System Controller and the Controller In Charge (CIC).
2. It is neither the System Controller nor the CIC.

PROCEDURE (Continued) ....

To be the System Controller, the SC strapping switch on the HP-IB Interface PCA must be set to the open position. CIC only means the terminal was the one which most recently issued a command on the HP-IB bus.

When the above message is displayed, it is most convenient to manipulate the CIC function (manipulating whether or not your terminal is the System Controller requires reconfiguring the entire HP-IB configuration). To make your terminal the CIC, type **SHOW TIME** in the command channel and then press the RETURN key. To make it so that your terminal is not the CIC, type **SHOWTIME** in the command channel (followed by the RETURN key) of another terminal in the configuration. Then retry the HP-IB self test.

TEST FAILS

If the test fails, the following message will be displayed:

```
HP-IB TEST FAIL, ERROR=x
```

where **x** is a number from 0 to 2 whose meaning is as follows:

- 0 indicates no HP-IB interface PCA is installed (or the PCA, if present, is strapped incorrectly)
- 1 or 2 indicates a PHI IC chip error.

TEST SUCCESSFUL

If the test is successful, the following message will be displayed:

```
                                  YES      YES
HP-IB TEST OK,ADDR=xx,SYSCTL=     ,CIC=
                                  NO       NO
```

where **xx** is the HP-IB address of the HP-IB PCA. This address, from 8 to 29, is set by strapping on the PCA and uniquely identifies the PCA within the HP-IB system. SYSCTL indicates whether or not the terminal is the system controller. CIC indicates whether or not the terminal is the Controller In Charge of the HP-IB bus.

HP-IB Terminal-to-Terminal Loop-Back Test

WHY .... This test tests communication between two terminals in an HP-IB configuration.

HOW .... A 256-byte data block is sent, from the terminal on which the test command is entered, to the target terminal; then it is returned, by the target terminal, for a comparison with the data block sent.

WHEN .... This test can be performed anytime communications between two terminals is suspected to be substandard.

PROCEDURE .... Perform the test as follows:

1. Enter **TEST TERMINAL#x** into the command channel; where **x** is the HP-IB device address of the target terminal. Then press the RETURN key.
2. If the test fails, then the following message is displayed:

[redacted]

where: **x** is the HP-IB device address of your terminal

y is the HP-IB device address of the target terminal

z is the error number, as follows:

1 indicates no HP-IB interface PCA
2 indicates no control of HP-IB
3 indicates target terminal did not receive entire data block
4 indicates target terminal did not send back entire data block
5 indicates returned data block did not match the one originally transmitted

WHY .... Terminal self test is useful primarily to identify faulty ROM and RAM chips and to give a "go/no go" indication whether the rest of the basic terminal is operating correctly. (Refer to the Functional Operation section for the components of a basic terminal.) Detailed troubleshooting isolates a malfunction to a replaceable unit after the terminal self test has indicated a "no go" condition. It is also used if the terminal self test can't be performed.

HOW .... Detailed troubleshooting is focused on the basic terminal; that is, a terminal containing only those elements required to enter data at the keyboard and have it displayed on the CRT (refer to Section VIII for a detailed discussion of the basic terminal). Problems associated with accessories or graphics elements can be isolated using self tests or parts replacement when the basic terminal is operating correctly.

Two easily-performed checks are used to provide a preliminary indication of the problem cause:

1. Checking for a TERMINAL READY display when the terminal is turned on. 2640A/B terminals display a blinking cursor.
2. Listening for an audible "beep" when a "Control G" (bell) is entered on the keyboard.

Table 6-5 lists tentative assumptions based on occurrence or non-occurrence of these two check signals.

If checkout procedures based on the assumptions listed in the table fail to isolate the problem, two elementary procedures are used to diagnose the problem:

1. With all PCAs removed from the backplane except those listed below, a terminal self test is initiated by pressing the TEST key. If all four PCAs are healthy, all self test indications will occur (except, of course, for display of the test patterns).
   a. Keyboard Interface PCA.
   b. Processor PCA.
   c. Control Memory PCA(s).
   d. The RAM memory PCA containing the highest-numbered 4K block of Display Memory. 2647A terminal requires all of its memory.

2. With all PCAs removed from the backplane except those listed below, TERMINAL READY should be displayed when the power switch is turned on.
   a. Processor PCA.
   b. Control Memory PCA.
   c. The RAM memory PCA containing the highest-numbered 4K of Display Memory.
   d. DMA PCA.
   e. Display Control PCA.
   f. Display Timing PCA.

If either of the two above procedures fail, the PCAs used can be replaced, one at a time, until the procedure works. If it still doesn't work, continuity checks can be performed. With both the procedures working, other PCAs are reinstalled, one at a time, and self test initiated until the problem PCA is isolated.

Table 6-5. Tentative Assumptions Based on Two Basic Signals

SIGNAL	INDICATION
TERMINAL READY occurs in all 264X terminals except 2640A/B where cursor is blinking.	The Processor PCA, the portion of RAM memory which contains Display memory, the portion of ROM memory which controls Display Memory, and the DMA, Control Memory, Display Timing, and Sweep PCAs are probably operating correctly.
Beep occurs	The Keyboard, Keyboard Interface, and Processor PCAs and the portions of ROM and RAM memory required to operate the keyboard are probably OK.
Neither TERMINAL READY nor beep	Power distribution to the PCAs may be faulty. If not, a signal with the power to inhibit operation of one or more critical PCAs (such as Power On) may be clamped in the inhibiting state or the Processor PCA may have failed.
Beep without TERMINAL READY	The problem probably lies in the Display section, starting with the portion of RAM memory which contains Display Memory and ending with the CRT.
TERMINAL READY without beep	The problem probably lies in the keyboard, Keyboard PCA, or Keyboard Interface PCA, or keyboard cable.

WHEN .... Detailed troubleshooting should be performed whenever performance of the Preliminary Checks and terminal self test fail to isolate the malfunction or if terminal self test can't be performed.

EQUIPMENT REQUIRED ....

1. A multimeter may be required to check power supply output voltages and make continuity checks.
2. A spare memory PCA containing the full complement of ROMs for the malfunctioning terminal type is useful for isolating a problem to a ROM chip. Two such PCAs are required for 2641A, 2647A, and 2648A terminals, since these terminals use two ROM memory PCAs.

BACKPLANE MULTIMETER CHECKS .... During performance of the procedures, it may be necessary to take multimeter measurements on a vacant backplane connector. Figure 6-17 identifies the backplane connector pins.

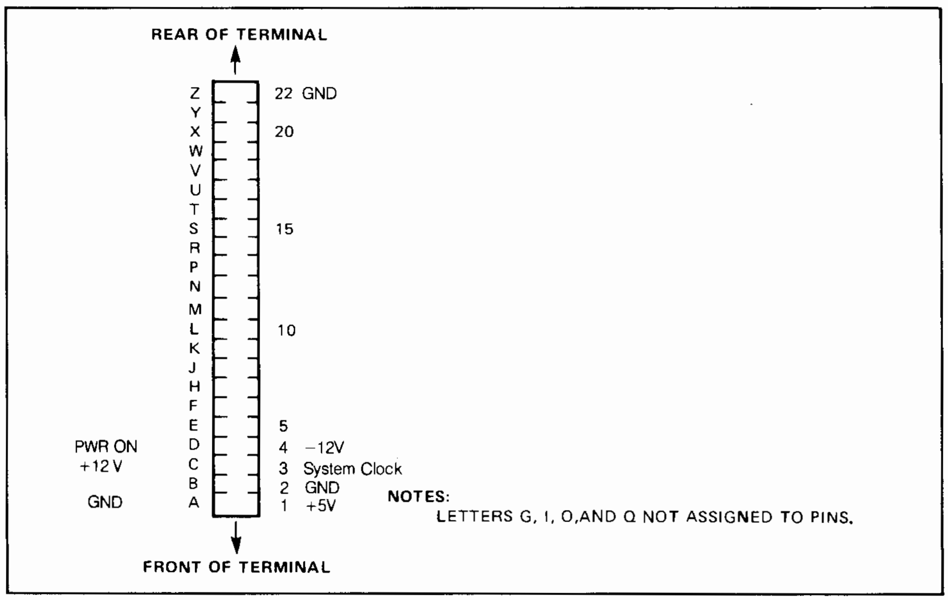


Figure 6-17. Top View of a Typical Backplane Connector

ROM CHECK

Control Memory ROMs can be checked provided a Control Memory PCA containing a full complement of ROMs, which is known to be good, is available. Check the suspected ROMs as follows:

NOTE
The ROM check does not apply to 2640 series and 2644A terminals.

1. Replace the Control Memory PCA containing the suspected ROM(s) with the "known good" PCA and run self test to ensure that all terminal components except those on the suspected PCA are good.
2. Use the ROM disable switches or jumpers on both PCAs to enable a single ROM on the suspected PCA and disable the corresponding ROM on the "known good" PCA.
3. Reinstall the suspected PCA in the terminal, leaving the "known good" PCA in place so that the terminal contains both PCAs. To make room, it may be necessary to remove an accessory PCA.
4. Run self test. If self test fails, replace the ROM presently enabled on the suspected PCA.
5. Perform steps 2 through 4 for each suspected ROM.

PROCEDURE

Figure 6-18 is a flowchart of the detailed troubleshooting procedures.

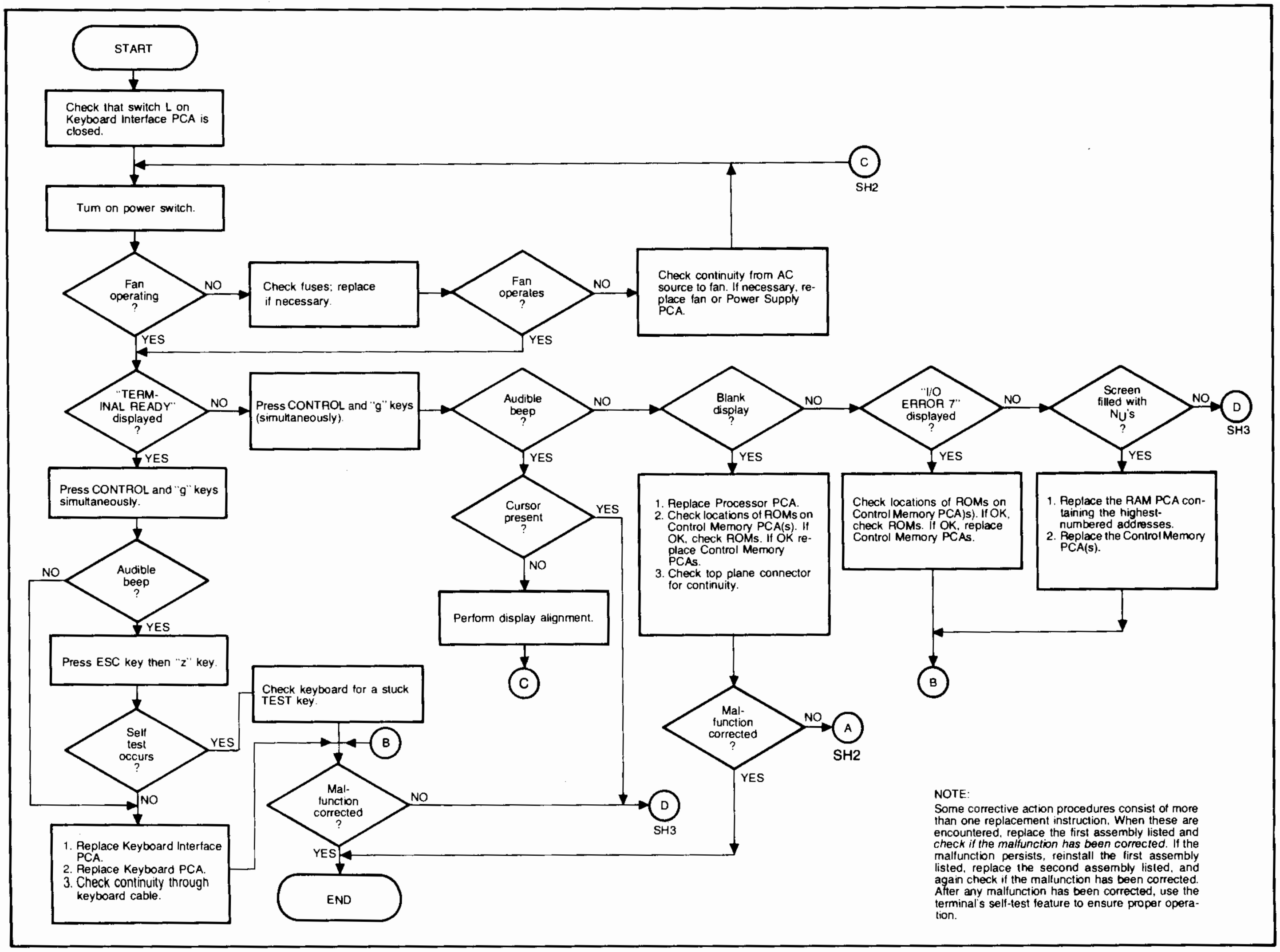


Figure 6-18. Detailed Troubleshooting Flowchart (Sheet 1 of 3)

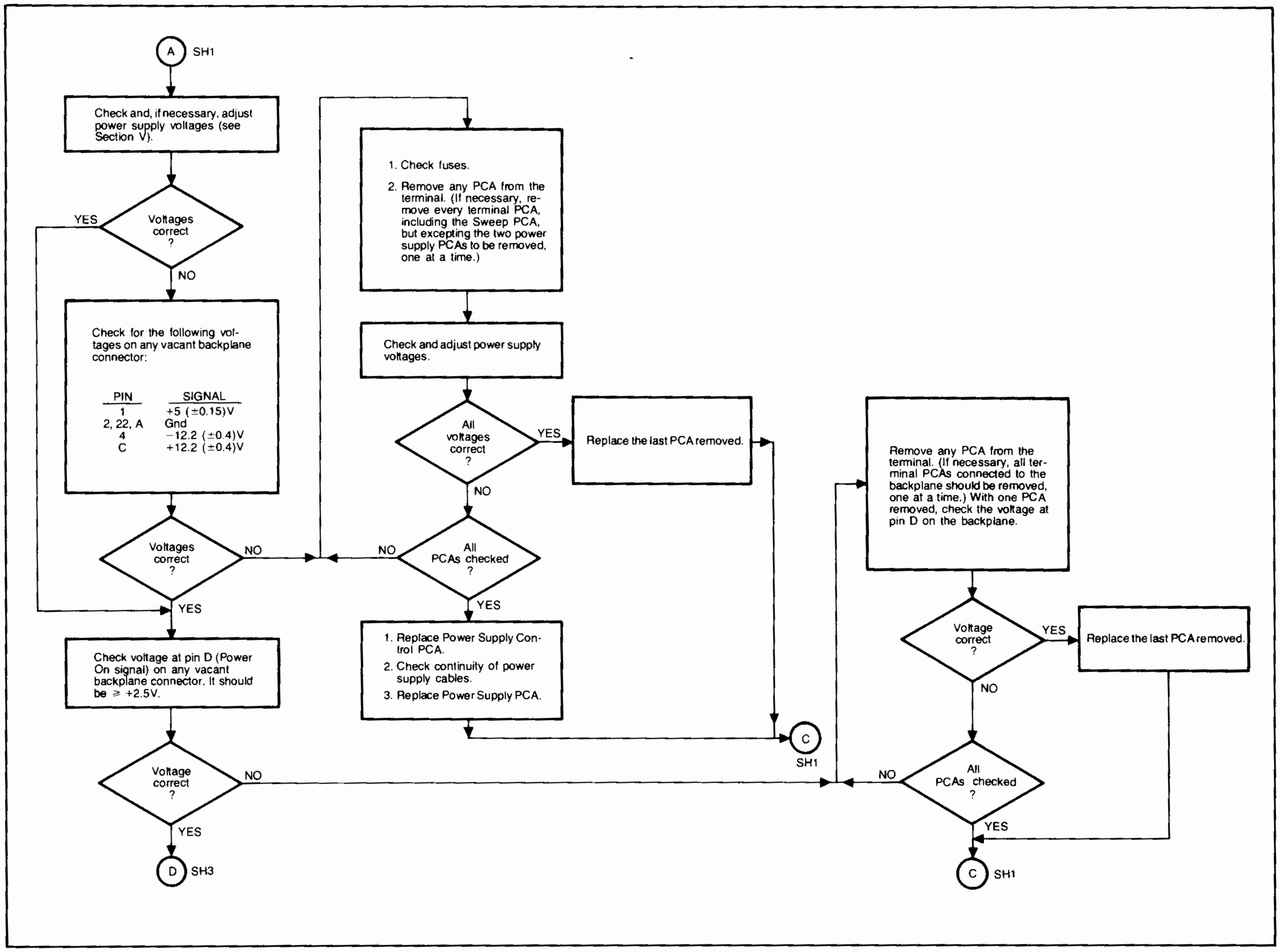


Figure 6-18. Detailed Troubleshooting Flowchart (Sheet 2 of 3)

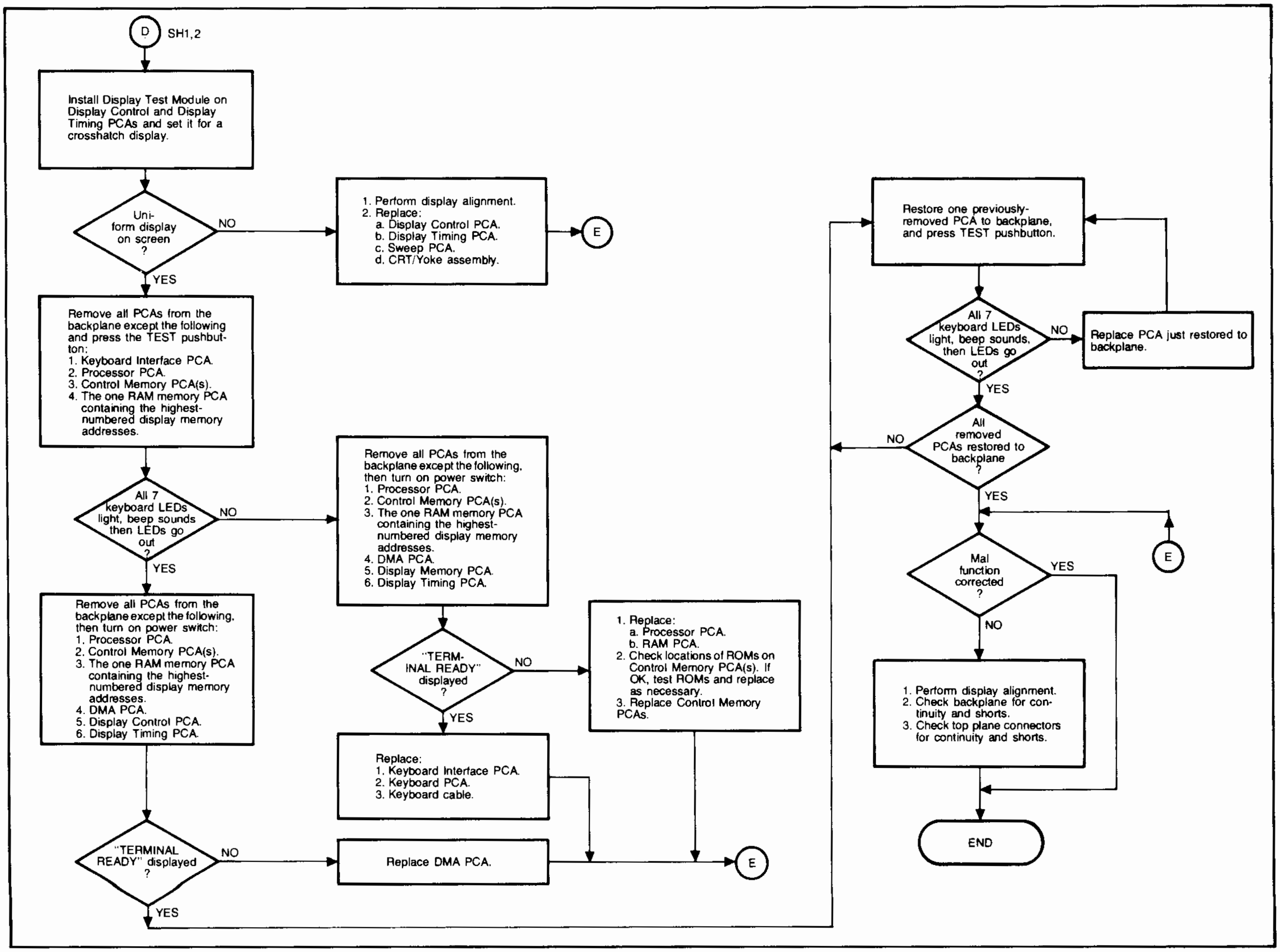


Figure 6-18. Detailed Troubleshooting Flowchart (Sheet 3 of 3)

Display Test Module

PURPOSE .... Display Test Module 02640-60063 is used for alignment and troubleshooting of the display portion of the terminal. It can be used to produce various combinations of half-bright and full-bright dot and cross hatch patterns on half-bright and full-bright backgrounds. It can also be used to blank the display or produce a half-bright or full-bright background without a pattern.

For troubleshooting, it can be used to check whether the display system, starting with the Display Control PCA is functioning properly. This includes the Display Control, Display Timing, and Sweep PCAs and the CRT.

INSTALLATION .... To use the Display Test Module, remove the top plane connector from the display PCAs and install the Display Test Module on the Display Control and Display Timing PCAs. Then connect the Display Test Module power lead to the +5V connector at the upper left corner of the Display Timing PCA.

CONTROLS .... All displays produceable using the Display Test Module are listed in table 6-6 along with the switch settings required to produce them.

Troubleshooting Your Terminal by Simplifying Configuration

WHY .... This troubleshooting technique is used when other troubleshooting procedures have failed to detect the faulty component (PCA or assembly).

HOW .... By reconfiguring the terminal down to a simplified state and checking its operation. Then gradually building the terminal up from a simple terminal to a complete terminal, each time checking the terminal's operation.

WHEN .... Whenever the terminal's screen doesn't light up or display "TERMINAL READY" or when other troubleshooting techniques have failed to detect the faulty component.

PROCEDURE .... The following procedure uses a 2647A terminal, however, any 264X terminal may be used. To troubleshoot the terminal using the simplified configuration method, perform the following:

1. Turn terminal power off and open the terminal to the half-open position.
2. Using a connector extractor, remove the top plane connectors from all of the PCAs in the terminal.
3. Remove all of the PCAs from the terminal except the following:

   a. Sweep PCA
   b. DMA PCA
   c. Display Control PCA
   d. Display Timing PCA

   The DMA, Display Timing, and Display Control PCAs must be connected by a top plane connector.

4. Turn terminal power on, the screen should remain dark. Proceed with the following:

   a. At the top plane connector, short pins X and B (ground). The entire screen should fill with nulls. This proves that the display group is working OK. (Note that this is a simple way of testing the Sweep PCA without removing it).

   b. Now short pins 22 and B on the top plane connector. The entire screen should be in inverse video, which means that the path for the video signal from the Display Enhancement PCA is OK.

c. Short pins 20 and B on the top plane connector. An inverse video screen should appear. This indicates that the graphics video stream can go through the Display Timing PCA.

d. Further tests can be made by shorting pins E, F, H, J, K, L, M, or N on the backplane bus to pin A (ground). This shows that the DMA PCA can display all characters. characters.

If the expected display doesn't appear, move the PCAs a few slots on the backplane to detect a possible bad contact in one of the slots. PCAs can be placed anywhere on the backplane bus with this exception: there can be no empty slots between the DMA and Processor PCAs. (There may be empty slots between other PCAs.)

5. Install the Processor PCA and repeat step 4. The results should be the same.

   The Processor PCA is now making requests on the bottom plane bus, this shows that it does not interfere with the DMA PCA.

6. On the first Control Memory PCA (02640-60221), close the BS switch and install the PCA in the terminal. Do not use a top plane connector for the processor group yet. Repeat Step 4, the results should be the same.

7. Connect the Processor and first Control Memory PCAs with a top plane connector. Install a "Known Good" RAM PCA. This may be a 4K RAM PCA starting at address 60K or an 8K RAM PCA starting at address 56K. After Power On, you should get the message "BS OPEN ROM ERROR 0."

The reason for this is as follows: the first ROM chip (1818-0590 at address 0) contains a built-in test. At Power On, the ROMs in the space 0-32K on the first Control Memory PCA (switch BS open) will be tested in the order of increasing addresses. In this example, the second Control Memory PCA is not installed, thus the error message returned is "BS OPEN ROM ERROR 0" to indicate that the test failed on the second Control Memory PCA (switch BS open) at ROM location 0. If no ROM other than the 1818-0590 was installed on the first Control Memory PCA, the following message would be displayed "BS CLOSED ROM ERROR 2."

If the message "BS OPEN ROM ERROR 0" does not appear, take the following actions:

a. Change the Processor PCA.
b. Change the ROM chip 1818-0590.

If the above did not help, there is a good chance that the Control Memory PCA is defective. But before you needlessly start swapping ROMs, make sure that the problem is in the Control Memory PCA by:

a. Replace the Control Memory PCA in the terminal with a spare Control Memory PCA (02640-60221) having only the 1818-0590 ROM.

b. If no improvement is observed, install a 02640-60192 Control Memory PCA (all switches closed) having only the 1818-0590 ROM installed in socket 0.

In both cases, you must get "BS CLOSED ROM ERROR 2," then install the ROMs step by step until you get "BS OPEN ROM ERROR 0."

8. Now install the second Control Memory PCA (02640-60221) with the top plane connector. The second Control Memory PCA has switch BS open. You will get the message "TERMINAL READY" or "BS OPEN ROM ERROR XX." The error message tells you to change the ROM at address XX. If that does not help, change the second Control Memory PCA. Again, you can swap the ROMs step by step if necessary.

NOTE

Control Memory PCA 02640-60192 cannot be used for the second Control Memory PCA in a 2647A.

9. Once you get "TERMINAL READY," install the Keyboard Interface, connect the keyboard and run terminal self-test. RAM ERROR 49407 XXX YYY will appear because there is a RAM between 60K (or 56K) and 64K only. The RAM is tested by blocks of 16K. You will now add RAM, knowing that the RAM between 60K and 64K must be good to get "TERMINAL READY."

10. Remove the 4K or 8K RAM installed in Step 7. Install the BOTTOM plane 32K Universal RAM PCA strapped to occupy the space 32-64K, i.e., switches 2, 3, 7 or 2, 7, 8 are closed on the first bank and switch 5 closed on the second bank. You should get "TERMINAL READY." Pressing TEST will give RAM ERROR 255 XXX YYY because there is no RAM between 0 and 32K, but this message also means that the RAM between 32 and 64K has been found good. If you do not get "TERMINAL READY," swap the starting addresses of the two 16K modules with switches 2, 3, 7, and 8. Change the RAM PCA if no improvement is observed.

11. When you get RAM ERROR XXX YYY, install the second Universal RAM PCA (switch 8 or 3 on the first bank and 1, 2, 3, 4, 5, 8 on the second bank, closed). If no "TERMINAL

READY" comes up, change the PCA; otherwise, press TEST and change the defective ROM and then the PCA if you get an error message.

12. Reinstall the graphics and CTU PCAs.

If your terminal is a 2648A, test the Control Memory PCA (02640-60221) as follows:

a. On the 02640-60221, close all switches except DRAM, LRAM, SLOW and install the following ROMs:

SOCKET	ROM	SOCKET	ROM
A0	1818-0401	A16	1818-0409
A2	1818-0548	A18	1818-0410
A4	1818-0954	A20	1818-0547
A6	1818-0446	A22	None
A8	1818-0405	A24	1818-0412
A10	1818-0406	A26	1818-0747
A12	1818-0407	A28	1818-0748
A14	1818-0408	A30	1818-0749

b. On the second Control Memory PCA (02640-60192), open all switches except 12, 14, 16, 18, 20, 22, and RAM DIS. Install the following ROMs:

SOCKET	ROM
12 (optional)	1818-1388
14	1818-0755
16	1818-0417
20	1818-0419
22	1818-0420

After Power On, "TERMINAL READY" will appear and the self-test will pass if the 02640-60221 is good. The same type of test can be made in a 2645A, but the addressing logic between 24K and 32K will not be tested. As mentioned earlier, the 1818-0590 ROM may be installed in a 2645A or 2648A to check a problem with a Control Memory PCA or a ROM.

SUMMARY .... The following points summarize the above procedures in troubleshooting the terminal through simplified configuration.

1. Good RAM is required at the top of memory (near 64K) to have a message on the screen.
2. The 1818-0590 ROM plus some RAM is enough to tell you something on the screen.
3. The LEDs on the keyboard can also indicate that the terminal has come up properly or passed self-test. This allows you to bring up the terminal without the display group.
4. The above procedure may be followed in reverse.

Table 6-6. Display Test Module Use

DISPLAY	HALF BRIGHT	INVERSE VIDEO	DOTS/ CROSS-HATCH
Full-bright dots on a blank background.	0	0	DOTS
Full-bright background without pattern.	0	1	N
Half-bright cross hatch on a blank background.	1	0	CH
Dots on a half-bright background.	1	1	DOTS
Blank display.	0	0	N
Cross hatch on a full-bright background.	0	1	CH
Half-bright dots on a blank background.	1	0	DOTS
Half-bright background without pattern.	1	1	N
Full-bright cross hatch on a blank background.	0	0	CH
Dots on a full-bright background.	0	1	DOTS
Blank display.	1	0	N
Cross hatch on a half-bright background.	1	1	CH

NOTES:
0 = Switch set to the unlabeled position.
1 = Switch set to the labeled position.
DOTS = DOTS/CROSSHATCH switch set to the DOTS position.
N = DOTS/CROSSHATCH switch set to the central or neutral position.
CH = DOTS/CROSSHATCH switch set to the CROSSHATCH position.

CTU Tester

PURPOSE .... The CTU tester contains controls and indicators for alignment and troubleshooting of the tape system. It can be used to provide local control of the CTU for any purpose.

INSTALLATION .... Install the CTU tester as follows:

1. Remove the top plane connector from the CTU Interface and Read/Write PCA.
2. Install the CTU tester on the two PCA's with the indicators on the tester toward the rear of the terminal.

CONTROLS AND INDICATORS .... The CTU tester controls and indicators are shown in figure 6-19 and described in table 6-7.

Table 6-7. CTU Tester Controls and Indicators

INDEX NO.	NOMENCLATURE	DESCRIPTION
1	CRTG IN 0 indicator	When lighted, indicates that a tape cartridge is inserted in UNIT 0 CTU Transport Assy. Also verifies proper operation of UNIT 0 Head Bridge Assy switch circuit and Read/Write PCA cartridge detect circuit.
2	CRTG IN 1 indicator	When lighted, indicates that a tape cartridge is inserted in UNIT 1 CTU Transport Assy. Also verifies proper operation of UNIT 1 Head Bridge Assy switch circuit and Read/Write PCA cartridge detect circuit.
3	RCD indicator	When lighted, indicates that data is being recorded on selected CTU Transport Assy tape. Also verifies proper operation of Read/Write PCA write current circuit when tester is in ON LINE mode.
4	HOLE indicator	When lighted, indicates that a hole is being detected in selected CTU Transport Assy tape. Also verifies proper operation of Head Bridge Assy hole detection circuit.
5	RAMP CMD indicator	When lighted, indicates that a tape motion signal is being generated. Also verifies proper operation of Read/Write PCA CTU drive circuits. Also verifies CTU Interface PCA tape motion decoder and command logic when tester is used in ON LINE mode.
6	GAP indicator	When blinking, indicates that tape containing recorded data is moving past selected CTU Transport Assy magnetic head. Also verifies proper operation of Head Bridge Asy magnetic head and Read/Write PCA unit/function decoder, read select switch, read amplifier circuits, and gap detect circuit. Lamp on indicates presence of inter-record gap.

INDEX NO.	NOMENCLATURE	DESCRIPTION
7	10 IPS ADJ indicator	When on, indicates that selected CTU Transport Assy is driving tape at 10 ips ±1.0%. Also verifies proper operation of CTU Transport Assy Motor/Tachometer Assy; Read/Write PCA amplifier select logic, CTU drive circuits, tachometer feedback select and conditioning circuits, and feedback circuit; and CTU Interface PCA command logic and tape motion decoder.
8	UNIT switch	When operating OFF LINE, selects either UNIT 0 or UNIT 1 CTU Transport Assy and ejects button of selected unit. Also verifies proper operation of Head Bridge Assy indicator lamp circuit and Read/Write PCA amplifier select logic and unit/function decoder.
9	ON LINE/OFF/OFF LINE switch	When set to ON LINE, CTU Tester performs as a CTU Top Plane Assy with visual displays. Storage subsection is controlled by terminal keyboard and CTU Interface PCA. When set to OFF LINE, storage subsection is controlled by CTU Tester, CTU Interface PCA is disabled, and tape motion is determined by RVS/FWD and IPS switches. Tape motion will stop when a hole is detected. When set to OFF, all tape motion and control is inhibited; CTU Tester and CTU Interface PCA are both disabled.

INDEX NO.	NOMENCLATURE	DESCRIPTION
10	RVS/FWD switch	When operating OFF LINE, controls tape motion direction (reverse or forward) for CTU Transport Assy selected by UNIT switch. Verifies proper operation of Read/Write PCA CTU drive circuits, for both tape directions.
11	IPS switch	When operating OFF LINE, controls tape speed (60 or 10 ips) for CTU Transport Assy selected by UNIT switch. Also verifies proper operation of same circuits as RVS/FWD switch.
12	OFF LINE RCD switch	When operating OFF LINE and set to INHB, enables read mode circuits. When operating OFF LINE and set to ENBL, enables write mode circuits. Also verifies proper operation of Head Bridge Assy magnetic head and Read/Write PCA unit/function decoder, read select switch, read amplifier circuit, and gap detect circuit.

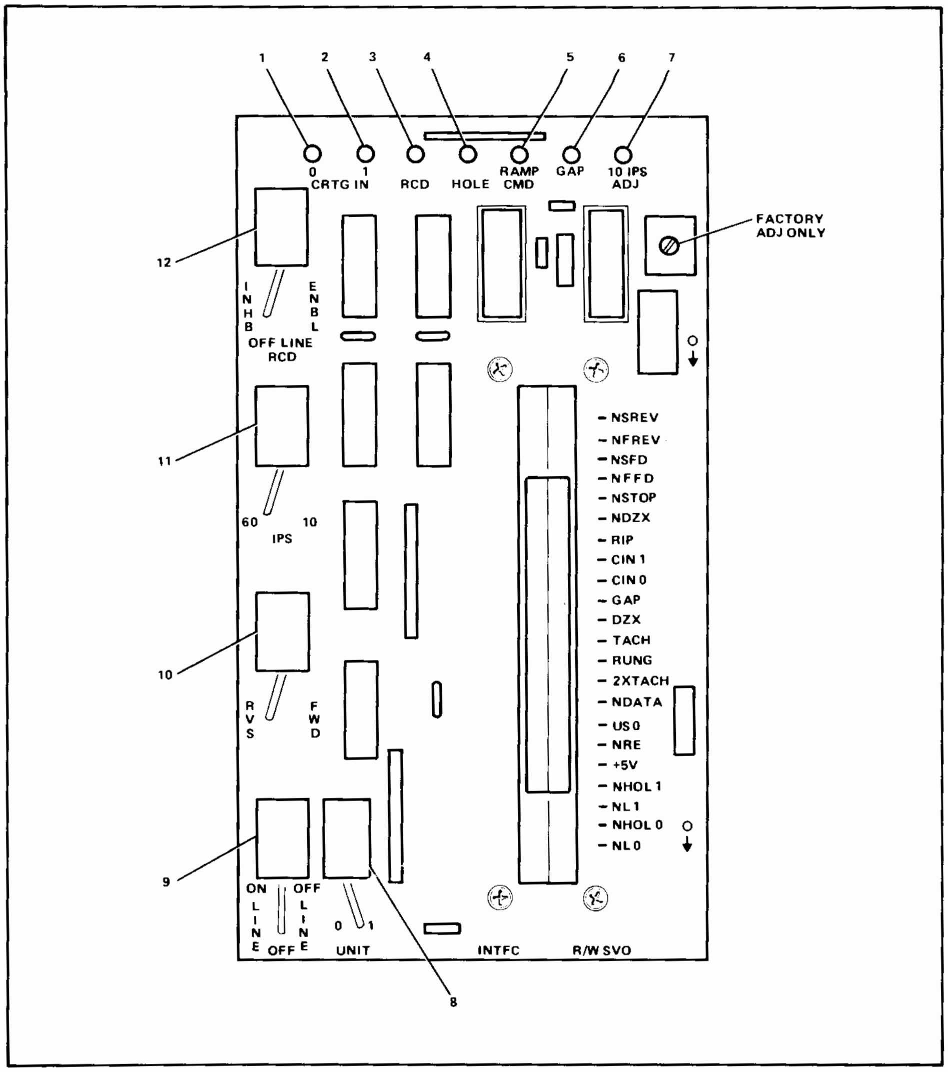


Figure 6-19. CTU Tester Controls and Indicators

TROUBLESHOOTING WITH THE CTU TESTER

The following discussion describes the troubleshooting philosophy and lists the procedural steps for troubleshooting with the CTU tester.

PHILOSOPHY

Once familiar with the tester displays and storage subsection circuits, two other important facts must be understood:

1. When using the tester on line, the display indicator lamps are monitoring the signal paths between the CTU Interface PCA and Read/Write PCA just as though the CTU Top Plane Assembly was installed, and
2. When using the tester off line, the CTU Interface PCA is isolated from the rest of the subsection and the tester indicator lamps are monitoring the signal paths between the tester and Read/Write PCA.

If a specific malfunction is indicated during on line testing, but is not indicated during off line testing, it is most probable that the trouble exists in the CTU Interface PCA circuits, assuming that the basic terminal is operating properly. Conversely, if the same malfunction is indicated during both on line and off line testing, it is most probable that the trouble exists in either the Read/Write PCA or the CTU Transport Assemblies.

Once a trouble is isolated to either the Read/Write PCA or the CTU Transport Assemblies, it should be remembered that the CTU Transport Assemblies share common read, write, and tape motion circuits on the Read/Write PCA. Therefore, if a specific malfunction is indicated for UNIT 0, but is not indicated for UNIT 1, it is most probable that the trouble exists in the UNIT 0 CTU Transport Assembly. Conversely, if the same malfunction is indicated for both UNIT 0 and UNIT 1, it is most probable that the trouble exists in the Read/Write PCA circuits.

PROCEDURE

When a malfunction has occurred that cannot be quickly isolated using the checkout procedures (listed with the tape system self test procedures), continue to troubleshoot with the tester as follows:

1. Install the tester and set tester ON LINE/OFF/OFF LINE switch to ON LINE.
2. Repeat the tape system self test procedure while observing tester display indicator lamps.
3. When the malfunction occurs, compare its symptoms against the tester display indicator lamps. In some cases, the malfunction can be isolated at this point. For example; if a NO TAPE message is displayed and the tester CRTG IN indicator lamp is lighted for the selected CTU Transport Assembly, it is most probable that the trouble exists in the CTU Interface PCA because the lighted CRTG IN indicator lamp verifies that the CTU Transport Assembly and Read/Write PCA cartridge detect circuits are operating properly.
4. If the malfunction cannot be isolated by performing the previous step, set tester ON LINE/OFF/OFF LINE switch to OFF, determine how to duplicate the operation where the malfunction occurred with the tester, set tester control switches to required positions, set ON LINE/OFF/OFF LINE switch to OFF LINE, and again check the malfunction symptoms against the tester display indicator lamps. If the malfunction no longer exists, it is most probable that the trouble exists in the CTU Interface PCA circuits. If the malfunction still exists, it is most probable that the trouble exists in either the Read/Write PCA or selected CTU Transport Assembly circuits. For example; if READ FAIL or END OF DATA message is repeatedly displayed and the malfunction cannot be isolated by performing step 3, set tester ON LINE/OFF/OFF LINE switch to OFF and duplicate a read operation as follows:
   a. Insert a prerecorded tape in CTU Transport Assembly that was being tested when the malfunction occurred.
   b. Set tester UNIT switch to corresponding number of CTU Transport Assembly under test.
   c. Set tester OFF LINE RCD switch to INHB, IPS switch to 10, and RVS/FWD switch to FWD.

CAUTION

The tester does contain "stop on hole detect" circuitry. However, to ensure prevention of tape run-off, it is recommended to discontinue tape motion commands once a "hole detect" has stopped the tape.

CAUTION

To restart tape motion, ON LINE/OFF/OFF LINE switch must first be set to OFF and then back to OFF LINE. However, care should be taken to change direction of tape motion to prevent tape run-off.

d. Set tester ON LINE/OFF/OFF LINE switch to OFF LINE and observe GAP indicator lamp. If GAP indicator lamp is blinking, it is most probable that the trouble exists in the CTU Interface PCA because the blinking GAP indicator lamp verifies that the CTU Transport Assembly and most of the Read/Write PCA read circuits are operating properly. If the GAP indicator lamp is not blinking, it is most probable that the trouble exists in either the CTU Transport Assembly or the Read/Write PCA. Set tester ON LINE/OFF/OFF LINE switch to OFF, insert prerecorded tape in other CTU Transport Assembly, set ON LINE/OFF/OFF LINE switch to OFF LINE, and again observe the GAP indicator lamp. If the GAP indicator lamp is blinking, it is most probable that the trouble exists in the CTU Transport Assembly originally under test. If the GAP indicator is not blinking, it is most probable that the trouble exists in the Read/Write PCA read circuits commonly shared by both CTU Transport Assemblies.

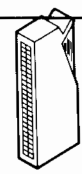
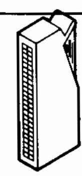
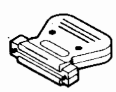
5. Once the malfunction has been isolated, perform the necessary repair procedures and repeat steps 1 and 2 to ensure that the tape system is now operating properly.
6. Remove tester from terminal and reinstall CTU Top Plane Assembly on CTU Interface PCA and Read/Write PCA top connectors.

Data Communications Test Connectors

PURPOSE ....

Three cable connectors are used for testing data communications equipment. Their function is to loop back each signal output from the data communications PCA so that it simulates the input signal which normally occurs as a response to the output signal. A test program, resident in terminal firmware, checks for the presence of the returned signal. The table below specifies the part number and use for each connector.

Table 6-8. Data Communications Self-Test Connectors

SELF-TEST CONNECTORS	HP PART NO.	USED FOR
	02645-60002	Checks RS232 circuits on 13260A, B, C, D accessory PCAs. (Does not check multipoint circuits on PCA; use 02645-60004 test connector below.)
	02645-60035	Checks current loop circuits on 13260B accessoy PCA.
	02645-60004	Provides loop-back of RS232 signals at RS232 connector end of cable. Used during self-test of multipoint configurations.

INSTALLATION ....

Connectors 02645-60002 and 02645-60003 are connected to the data communications PCA after the cable connector has been removed. Connector 02645-60004 is connected to the far end (from the terminal) of the cable to be tested. Refer to the Data Communications Self Tests for specific installation details.

Terminal Status

WHY .... Terminal status provides an easy way to determine display memory size, switch settings, keyboard interface configuration, and terminal errors.

HOW .... Terminal status is obtained by performing terminal self-test or by sending an escape code sequence from the computer to the terminal. In response to status requests the terminal returns an escape code sequence followed by one or more bytes. The status bytes are followed by a terminator.

Terminal status is made up of 14 status bytes which are displayed below the self-test pattern (figure 6-20). There are two terminal status requests, primary (bytes 0-6) and secondary (bytes 7-13). Each request returns a set of 7 status bytes.

Each byte consists of eight bits, the status information is contained in the lower four bits of each byte and the upper four bits of each byte are set so that the byte will have a value of an ASCII character. Each byte can be interpreted as 32 characters (table 6-9).

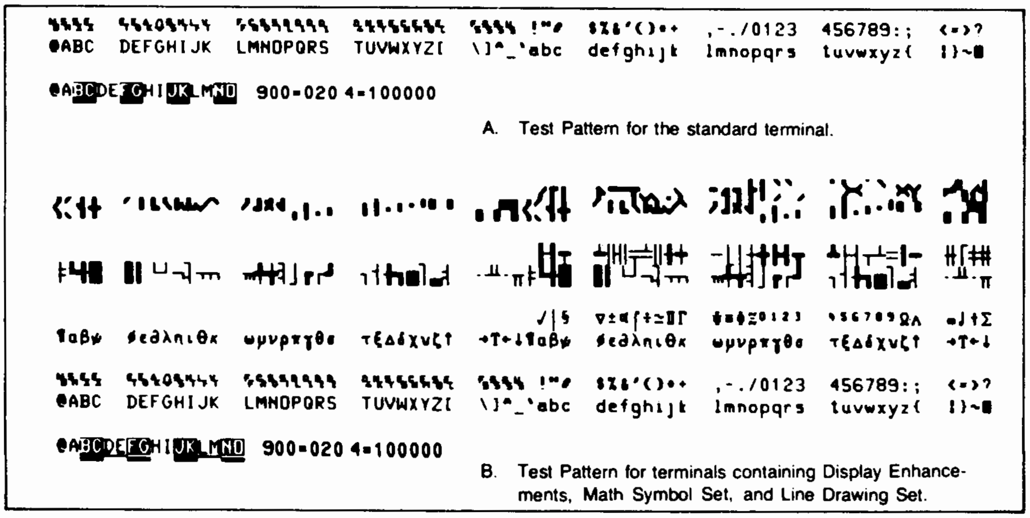


Figure 6-20. Typical 264X Test Pattern

Table 6-9. ASCII Status Characters

ASCII CHARACTER	BINARY	ASCII CHARACTER	BINARY
SPACE	0010 0000	0	0011 0000
!	0010 0001	1	0011 0001
"	0010 0010	2	0011 0010
#	0010 0011	3	0011 0011
$	0010 0100	4	0011 0100
%	0010 0101	5	0011 0101
&	0010 0110	6	0011 0110
'	0010 0111	7	0011 0111
(	0010 1000	8	0011 1000
)	0010 1001	9	0011 1001
*	0010 1010	:	0011 1010
+	0010 1011	;	0011 1011
,	0010 1100	<	0011 1100
–	0010 1101	=	0011 1101
.	0010 1110	>	0011 1110
/	0010 1111	?	0011 1111

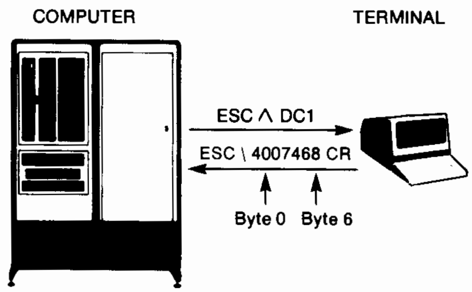
WHEN .... Interpreting terminal status may be performed whenever the terminal is reconfigured.

PROCEDURE .... To interpret terminal status, perform the following:

1. Perform self-test by pressing the [TEST] key.
2. If the terminal is connected to a computer, the first block of terminal status is requested by sending the following escape sequence:

   Primary Terminal
   Status Request — ESC ^

The terminal will respond with an Esc \ and 7 status bytes followed by a terminator. A typical primary terminal status request and response is shown in figure 6-21. The example is for configuration requiring the DC1 character to initiate block transfers.



BYTE	ASCII	BINARY	STATUS	
0	8	0011 1000	8142 bytes of display memory	
1	0	0011 0000	Function key transmission disabled Space overwrite latch disabled Cursor wrap around Strapped for line	Switches A-H on Keyboard Interface PCA
2	0	0011 0000	Tape mode enabled Send at previous baud rate Disable handshake Inhibit DC2 disabled	
3	7	0011 0111	Upper case only Block mode Auto line feed	
4	4	0011 0100	ENTER key has been hit (DC2 has been sent and a data transfer has been enabled—bytes 2 and 3)	
5	6	0011 0110	No data comm errors Last Self Test ok No loader checksum errors No device errors	
6	8	0011 1000	Data part of byte count read pending	

Figure 6-21. Primary Terminal Status Example

PRIMARY TERMINAL STATUS

BYTE 0 DISPLAY MEMORY SIZE

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

- Bit 1 — 1024
- Bit 2 — 2048
- Bit 3 — 4096
- Bit 4 — 8192

The amount of display memory (blocks of 1K) available in the terminal is returned. The amount can range from 1K to 9K bytes. The actual number of displayable characters is less than the returned figure by at least 12% minus another 500 bytes for system use.

BYTE 1 KEYBOARD INTERFACE SWITCHES (A-D)

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

Switch D
Page/Line
1 = open (Page)
0 = closed (Line)

Switch C
(End-of-Line Wraparound)
1 = open (Disabled)
0 = closed (Enabled)

Switch B
(Space Overwrite Latch)
1 = open (Enabled)
0 = closed (Disabled)

Switch A
(Function Key Transmission)
1 = open (Transmitted)
0 = closed (Not transmitted)

BYTE 2 KEYBOARD INTERFACE SWITCHES (E-H)

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

Switch H (Inhibit DC2)
1 = open (Enabled)
0 = closed (Disabled)

Switch G (DC2 Handshake)
1 = open (Enabled)
0 = closed (Disabled)

Switch F (Fast Binary Read)
1 = open (Switch to 9600 baud)
0 = closed (Retain speed)

Switch E (Tape Mode)
1 = open (Disabled)
0 = closed (Enabled)

BYTE 3 LATCHING KEYS

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

Terminal Type

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

BLOCK MODE Key
1 = block mode
0 = character mode

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

PRIMARY TERMINAL STATUS

BYTE 4 **TRANSFER PENDING FLAGS**

4	3	2	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 5 **ERROR FLAGS**

4	3	2	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

BYTE 6 **DEVICE TRANSFER PENDING FLAGS**

4	3	2	1
1/0	1/0	1/0	1/0

Data Portion of Byte Count Read Pending
1 = yes
0 = no

I/O Read Pending
1 = yes
0= no

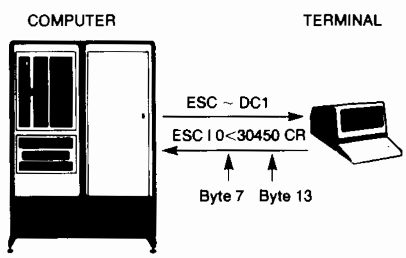
Device Status Pending
1 = yes
0 = no

Device Completion Pending
1 = yes
0 = no

3. If the terminal is connected to a computer, the second block of terminal status is requested by sending the following escape sequence:

   Secondary Terminal Status Request — ESC ~

   The terminal will respond with an Esc | and 7 status bytes followed by a terminator. A typical secondary terminal status request and response is shown in figure 6-22.



BYTE	ASCII	BINARY	STATUS
7	0	[redacted] 0000	No buffer memory installed
8	<	[redacted] 1100	I/O firmware not installed APL firmware not installed Graphics firmware installed Programmable terminal
9	3	[redacted] 0011	Auto terminate enabled Clear terminator enabled Data Comm Self Test enabled Normal operation of INSERT/DELETE CHAR — Switches J-M on Keyboard Interface PCA
10	0	[redacted] 0000	Switches N-R closed
11	4	[redacted] 0100	Switch S closed Switch T closed Switch U open Switch V closed
12	5	[redacted] 0101	Switch W open Switch X closed Switch Y open Switch Z closed
13	0	[redacted] 0000	Memory not locked

Figure 6-22. Secondary Terminal Status Example

SECONDARY STATUS BYTES

BYTE 7 BUFFER MEMORY

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

1 = 4096 bytes
0 = none

Memory installed in addition to display memory that is available for use as data buffers.

BYTE 8 TERMINAL FIRMWARE CONFIGURATION

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

1 = Programmable terminal

1 = Graphics firmware installed
0 = No Graphics firmware

1 = APL Firmware
0 = No APL Firmware

1 = I/O firmware installed
0 = not installed

The device support firmware is required before tape units or printers can be used with the terminal.

BYTE 9 KEYBOARD INTERFACE SWITCHES (J-M)

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

Switch M (Alternate Operation—INSERT and DELETE CHARACTER Keys)
1 = open (invert wrap sense)
0 = closed (normal)

Switch L (Self Test Inhibit)
1 = open (inhibit test)
0 = closed (Allow test)

Switch K (Clear Terminator)
1 = open (Enabled)
0 = closed (Disabled)

Switch J (Auto Terminate)
1 = open (Enabled)
0 = closed (Disabled)

BYTE 10 KEYBOARD INTERFACE SWITCHES (N-R)

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

Switch R (varies with communications protocol)
1 = open
0 = closed

Switch Q Compatibility Mode (Unscaled)
1 = Enabled
0 = Disabled

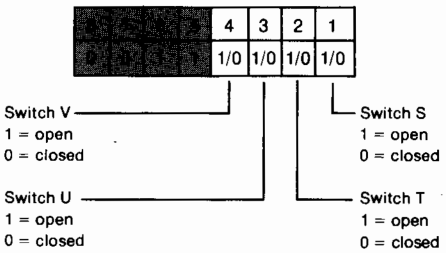
Switch P Compatibility Mode (Scaled)
1 = Enabled
0 = Disabled

Switch N Printer (Escape Code Transfer)
1 = open (Send ESC code)
0 = closed (Do not send code)

Note that if either or both of the P or Q switches is enabled an extended data comm buffer is selected.

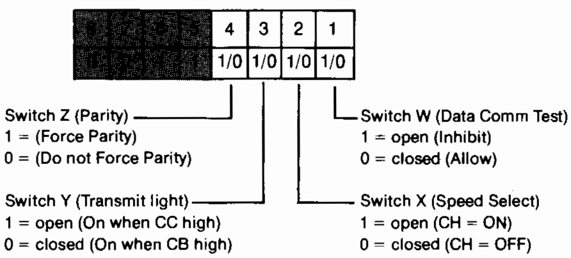
SECONDARY STATUS BYTES

BYTE 11 KEYBOARD INTERFACE SWITCHES (S-V)



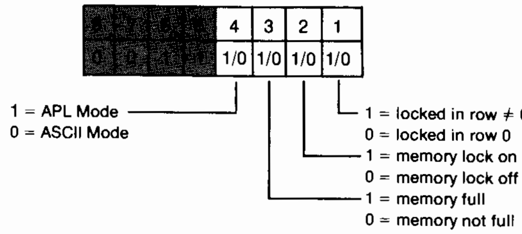
The use switches S to V varies depending on the communication protocol used.

BYTE 12 KEYBOARD INTERFACE SWITCHES (W-Z)



The use switches W to Z varies depending on the communication protocol used.

BYTE 13 MEMORY LOCK/BI-LINGUAL MODE



TERMINAL STATUS SUMMARY .... The bottom line in each 264X basic test pattern (figures 6-1 through 6-9) gives the typical terminal status of each. Table 6-10 provides a description of the status bytes and how they are applied to each 264X terminal.

Table 6-10. Terminal Status Description

Status Type	**Byte**	**Terminal**															**Byte Description**
		2640					**41**	**42**	**44**	**2645**					**47**	**48**	
		A	B	C	N	S	A	A	A	A	K	N	R	S	A	A	
Primary	0	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Display Memory Size
Terminal	1	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Keyboard Interface
Status																	Switches (A-D)
	2	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Keyboard Interface
																	Switches (E-H)
	3	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Latching Keys
	4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Transfer Pending Flags
	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	Error Flags
	6						x	x		x	x	x	x	x	x	x	Device Transfer
																	Pending Flags

Table 6-10. Terminal Status Description (Continued)

Status Type	Byte	Terminal															Byte Description
		2640					41	42	44	2645					47	48	
		A	B	C	N	S	A	A	A	A	K	N	R	S	A	A	
Secondary Terminal Status	7						x	x		x	x	x	x	x	x	x	Buffer Memory
	8						x	x		x	x	x	x	x	x	x	Terminal Firmware Configuration
	9						x	x		x	x	x	x	x	x	x	Keyboard Interface Switches (J-M)
	10						x	x		x	x	x	x	x	x	x	Keyboard Interface Switches (N-R)
	11						x	x		x	x	x	x	x	x	x	Keyboard Interface Switches (S-V)
	12						x	x		x	x	x	x	x	x	x	Keyboard Interface Switches (W-Z)
	13						x	x		x	x	x	x	x	x	x	Memory Lock/Bilingual Mode

DEVICE STATUS

The status of a tape unit or printer can be obtained by a device status request. This request would typically be made following an input/output operation or as a result of testing bytes 5 and 6 of the terminal status. The device status bytes are shown on the following page.

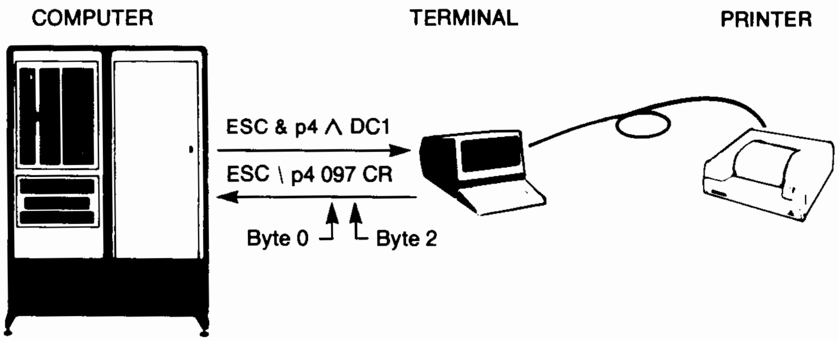
Device status is requested by sending the following escape sequence:

Device Status
Request: ESC & p <device code> ^

where: <device> is 1, 2, or 4 and
1 = left tape
2 = right tape
4 = external printer

Note: The printer designated by device code 4 is an 8-bit duplex or serial printer (NOT an HP-IB printer connected by way of an HP 13296A Shared Peripheral Interface).

The terminal will return an ESC/P (device code) and 3 bytes of device status followed by a terminator. A typical device status request and response are shown in figure 6-23. A status request from device 3 (display) will be ignored.



BYTE	ASCII	BINARY	STATUS
0	0	0011 0000	No print error Paper present
1	9	0011 1001	Printer busy Last print command executed properly
2	7	0011 0111	Printer is on-line Baud rate is 300 characters per second

Figure 6-23. Device Status Example

DEVICE STATUS

TAPE UNITS

BYTE 0

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

End of File (bit 4)
1 = at end of file
(tape positioned afer the file mark)
0 = not at end of file

Load Point (bit 3)
1 = at load point
0 = not at load point

End of Tape (bit 2)
1 = at end of tape
0 = not at end of tape

Write Error (Write/Backspace/Read Mode only) (bit 1)
1 = error
0 = no error

BYTE 1

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

Command Execution (bit 4)
1 = last command performed
0 = last command aborted

Write Protect (bit 3)
1 = protected
0 = not protected

Read Error (bit 2)
1 = error during last read
0 = no error

Tape Busy (bit 1)
1 = busy*
0 = not busy

*A "busy" indication is returned when the terminal is:

- conditioning the tape
- rewinding the tape
- finding a file (keyboard or cartridge tape initiated)
- skipping lines (keyboard or cartridge tape initiated)
- no tape present

Since the terminal cannot process a status request while performing a normal read or write operation, these functions will not result in a "busy" indication.

BYTE 2

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

Soft Error (read/write error-recovered) (bit 4)
1 = yes
0 = no

Hard Error (10 read/write failures) (bit 3)
1 = yes
0 = no

End of Valid Data (bit 2)
1 = yes
0 = no

Tape Inserted (bit 1)
1 = yes
0 = no

DEVICE STATUS

PRINTERS

BYTE 0

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

Paper Out (varies with printer) (bit 2)
1 = yes
0 = no

Print Error (varies with printer) (bit 1)
1 = yes
0 = no

BYTE 1

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

Command Execution (bit 4)
1 = last command performed
0 = last command aborted

Printer Busy (bit 1)
1 = yes
0 = no

BYTE 2

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

Printer Baud Rate (bits 4–2)

Printer Connected (bit 1)
1 = yes
0 = no

rate	bit 4 3 2
external	0 0 0
110	0 0 1
150	0 1 0
300	0 1 1
1200	1 0 0
2400	1 0 1
4800	1 1 0
9600	1 1 1

Parts Lists/Repair

(continued on back side)

Parts Lists/Repair 7

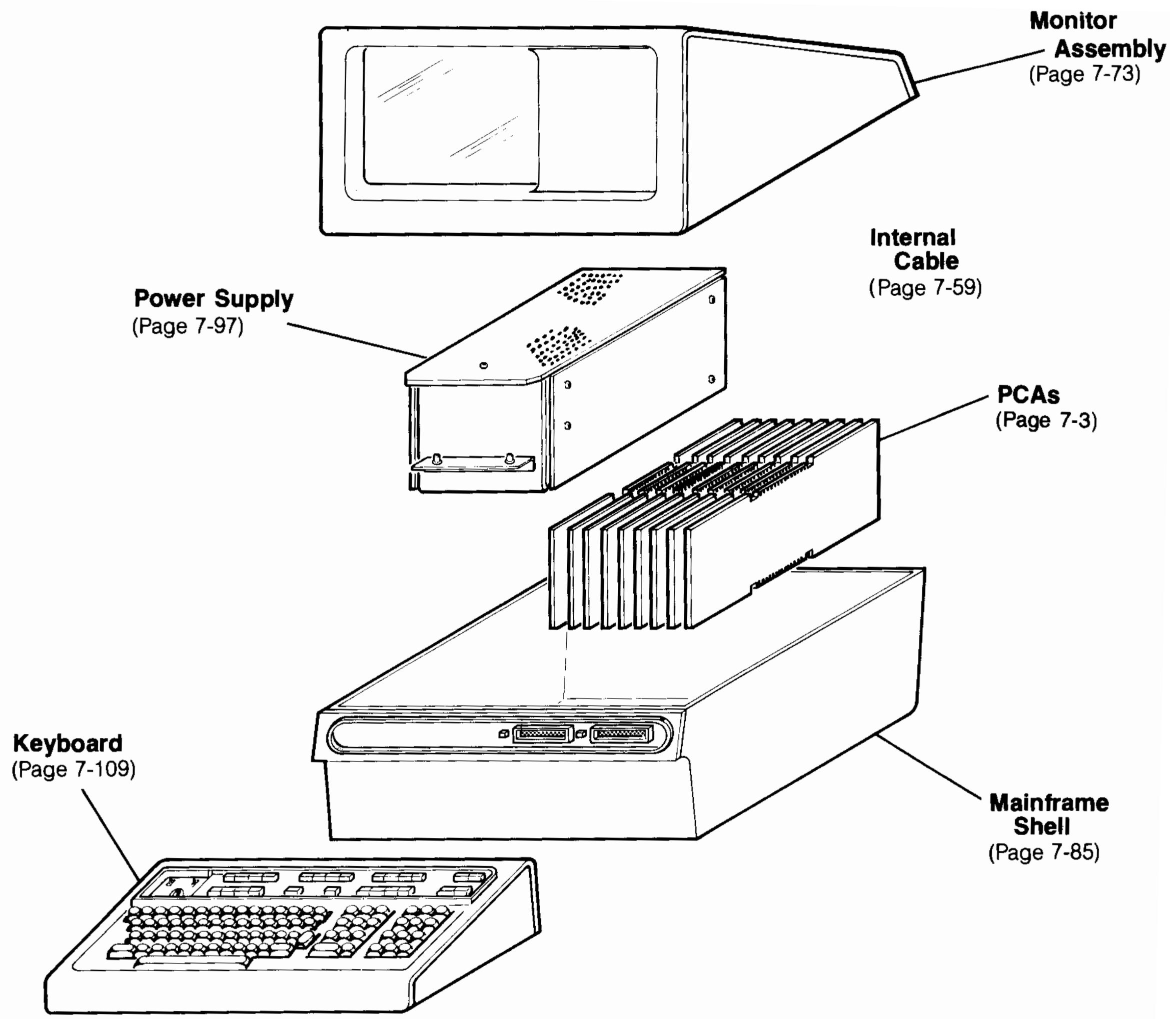
INTRODUCTION

This section provides parts lists and repair/replacement procedures for the terminals. The section is divided into the major areas of the terminal:

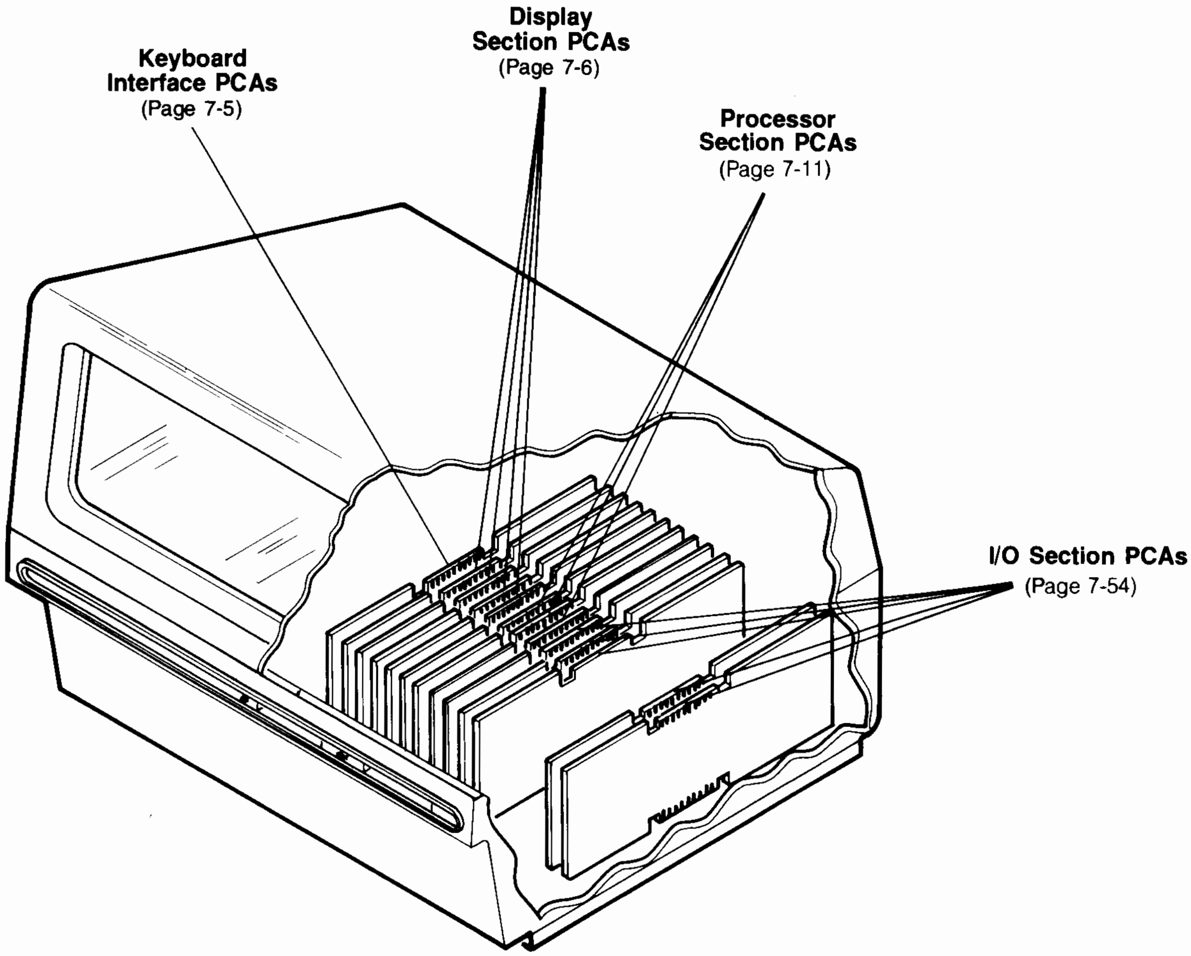
- PCAs
- Internal Cables
- Monitor Assembly
- Mainframe
- Power Supplies
- Keyboards
- External Accessories

Within each of these major areas, the information is presented in the following order:

- Exploded view of the major area
- Parts List
- Pertinent strapping or ROM information, as applicable
- Repair/Replacement procedures


Monitor Assembly
(Page 7-73)
Internal Cable
(Page 7-59)
Power Supply
(Page 7-97)
PCAs
(Page 7-3)
Keyboard
(Page 7-109)
Mainframe Shell
(Page 7-85)

PCA's

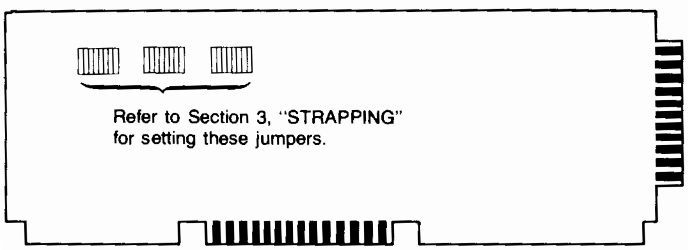


Note: PCA arrangement may vary from terminal to terminal.

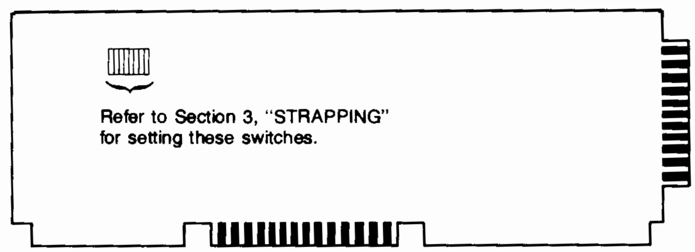
FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	S	—	—	—	—	—	—	S	—	—	—	—	—	—	—	02640-60019	Keyboard Interface PCA
	—	S	S	S	S	S	S	—	S	S	S	S	S	S	S	02640-60123	Keyboard Interface PCA
	—	S	S	S	S	S	S	—	S	S	S	S	S	S	S	02640-60246	Keyboard Interface PCA

S = standard, O = optional, A = accessory

KEYBOARD INTERFACE PCA
(02640-60123, -60246)



KEYBOARD INTERFACE PCA
(02640-60019)



NOTE:

Unless re-strapping is required, set the jumpers or switches the same as on the PCA that you are replacing.

The functions of jumpers/switches A thru H are same on both PCAs.

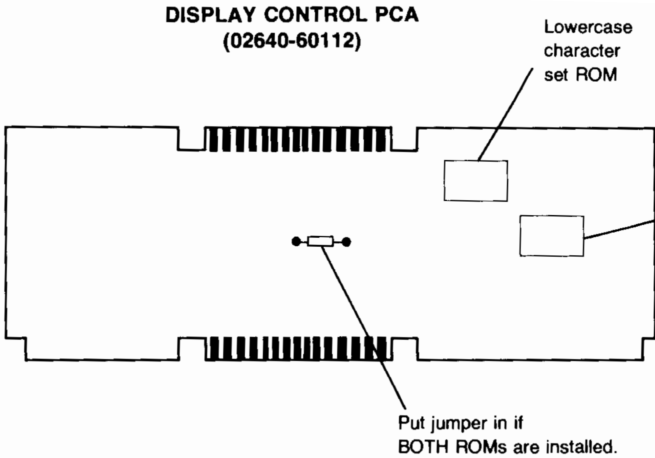
DISPLAY SECTION PCA's

FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	2649D	PART NO.	DESCRIPTION
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	02640-60112	Display Control PCA
	S	S	S	—	—	S	S	S	S	—	—	S	—	S	S	S	1816-0612	*IC, ROM (64-char uppercase Roman)
	O	O	O	—	—	O	S	O	O	S	—	—	—	S	S	S	1818-0613	*IC, ROM (128-char lowercase Roman)
	—	—	—	—	S	—	—	—	—	—	—	—	S	—	—	—	1816-0864	*IC, ROM (64-char uppercase Swedish)
	—	—	—	—	O	—	—	—	—	—	—	—	O	—	—	—	1816-0865	*IC, ROM (128-char lowercase Swedish)
	—	—	—	S	—	—	—	—	—	—	S	—	—	—	—	—	1816-0866	*IC, ROM (uppercase Norwegian)
	—	—	—	O	—	—	—	—	—	—	S	—	—	—	—	—	1816-0867	*IC, ROM (lowercase Norwegian)
	—	—	—	—	—	—	—	—	—	S	—	—	—	—	—	—	1816-0743	*IC, ROM (64-char uppercase Roman w/Katakana)
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	—	02640-60119	Video Interface Accessory PCA
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	—	02640-60122	Cable, Jumper
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	02640-60088	Display Timing PCA
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	0410-0647	*Crystal, 21.06 MHz (60 Hz pwr)
	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	0410-0646	*Crystal, 17.55 MHz (50 Hz pwr)
	S	S	S	S	S	—	—	S	—	—	—	—	—	—	—	—	02640-60009	Display Memory Access PCA
	—	—	—	—	—	S	S	—	S	S	S	S	S	S	S	S	02640-60124	Display Memory Access PCA
	A	A	S	A	A	S	S	A	A	S	A	S	A	A	A	S	02640-60024	Display Enhancement PCA
	A	A	A	A	A	A	O	A	A	A	A	A	A	A	A	—	1816-0642	*IC, ROM (Math Character Set)
	A	A	A	A	A	A	—	A	A	A	A	A	A	A	A	—	1816-0641	*IC, ROM (Line Drawing Set)
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S	1816-1315	*IC, ROM (Extended Line Drawing Set)
	A	A	A	A	A	A	S	A	A	A	A	A	A	A	A	—	1816-1417	*IC, ROM (Line Drawing Set) (Note 1)
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	S	1816-1463	*IC, ROM (Extended Line Drawing Set) (Note 1)
	A	A	A	A	A	A	—	A	A	A	A	A	A	A	A	—	1816-0947	*IC, ROM (Large Character Set)
	A	A	A	A	A	A	O	A	A	A	A	A	A	A	A	—	1816-1425	*IC, ROM (Large Character Set) (Note 1)
	—	—	—	—	—	S	—	—	—	—	—	—	—	—	—	—	1816-0984	*IC, ROM (Uppercase APL)
	—	—	—	—	—	S	—	—	—	—	—	—	—	—	—	—	1816-0985	*IC, ROM (Lowercase APL)
	—	—	—	—	—	S	—	—	—	—	—	—	—	—	—	—	1816-0986	*IC, ROM (Overstrike APL)
	—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	O	1816-0744	*IC, ROM (Katakana)
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	1816-1314	*IC, ROM (International)
	—	—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	1816-1013	*IC, ROM (Arabic)
	—	—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	1816-1426	*IC, ROM (Arabic 8-bit) (Note 1)
	—	—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	1816-1014	*IC, ROM (Arabic)
	—	—	—	—	—	—	—	—	—	—	—	S	—	—	—	—	1816-1427	*IC, ROM (Arabic 8-bit) (Note 1)
	—	—	S	—	—	—	—	—	—	—	—	—	—	—	—	—	1816-0788	*IC, ROM (Cyrillic)
	—	—	S	—	—	—	—	—	—	—	—	—	—	—	—	—	1816-0789	*IC, ROM (Cyrillic)
	—	—	—	—	—	—	—	—	—	—	—	—	—	S	S	—	02640-60125	Graphics Controller PCA
	—	—	—	—	—	—	—	—	—	—	—	—	—	S	S	—	02640-60126	Graphics Display PCA
	—	—	—	—	—	—	—	—	—	—	—	—	—	S	S	—	5090-0114	*IC, RAM, 16 each
	—	—	—	—	—	—	—	—	—	—	—	—	—	S	S	—	02640-60194	Connector Assembly
	S	S	—	S	S	—	—	S	S	—	S	—	S	—	—	—	02640-60012	3-Connector Assembly

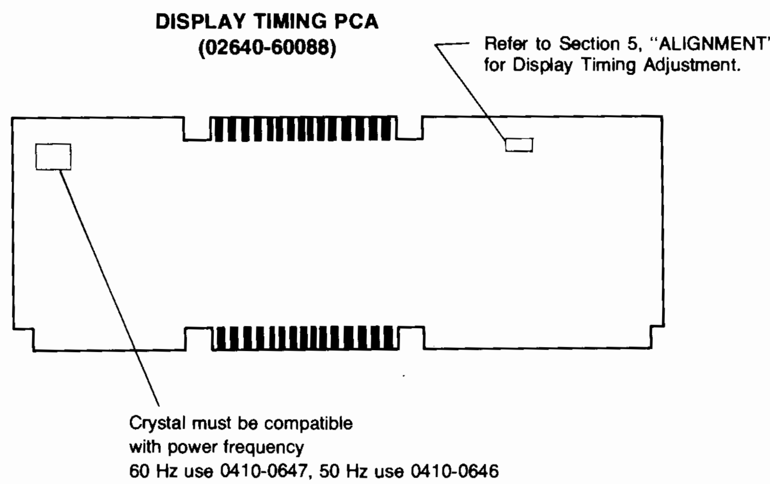
S=standard, O=optional, A=accessory

Note: 1. These ROMs can only be used on Display Enhancement PCAs with data code C-1942 or later

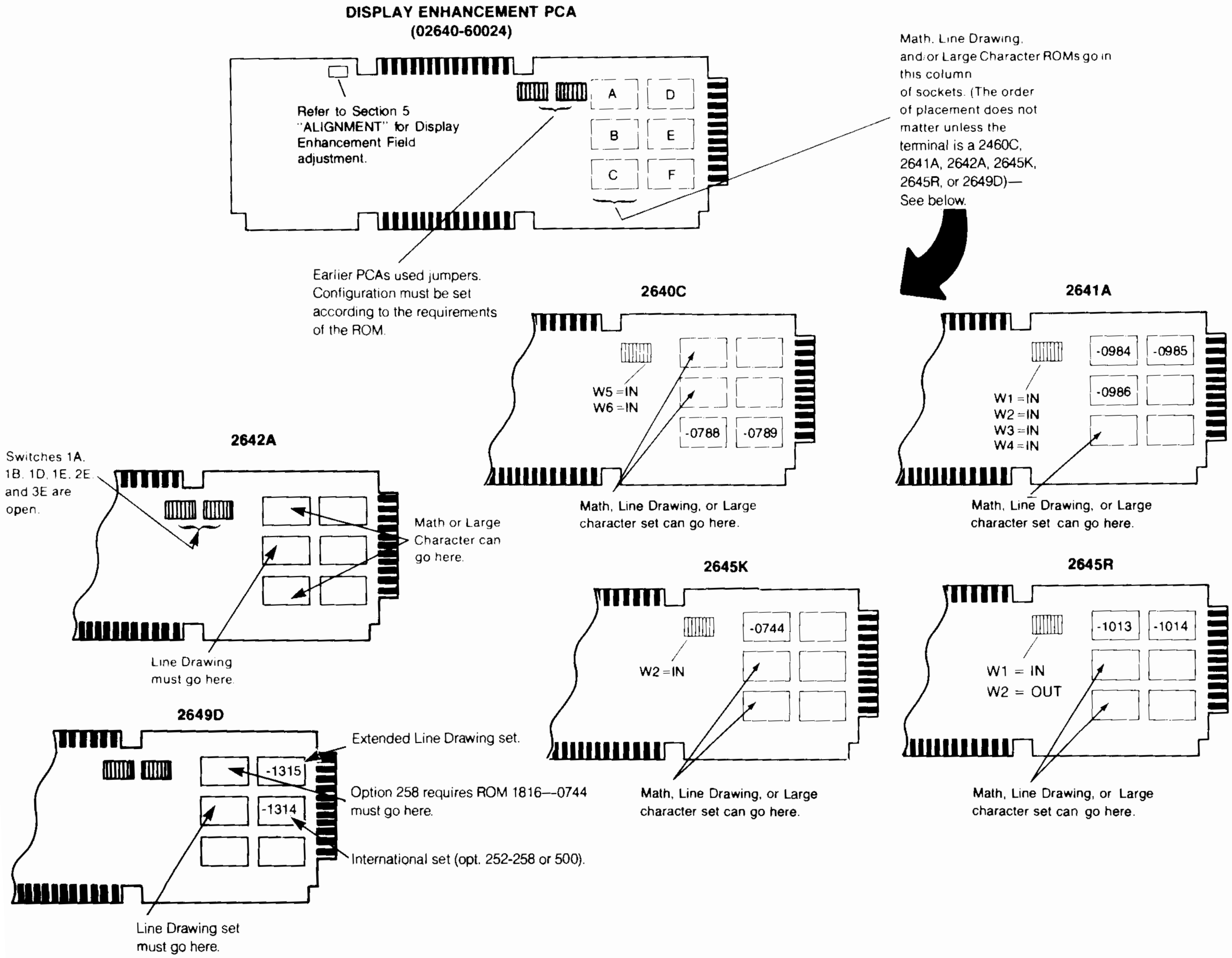
FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	O	O	S	O	O	S	S	O	O	S	O	S	O	S	S	02640-60022	4-Connector Assembly
	—	—	—	—	—	—	—	—	—	—	—	—	—	O	O	02640-60016	5-Connector Assembly
	A	A	A	A	A	A	—	A	A	A	A	A	A	—	A	02640-60053	PROM Character PCA
	A	A	A	A	A	A	—	A	A	A	A	A	A	—	A	02640-60070	Connector Assembly (Used with PROM PCA)



DISPLAY CONTROL PCA
(02640-60112)
Lowercase character set ROM
Uppercase character set ROM
Put jumper in if BOTH ROMs are installed.

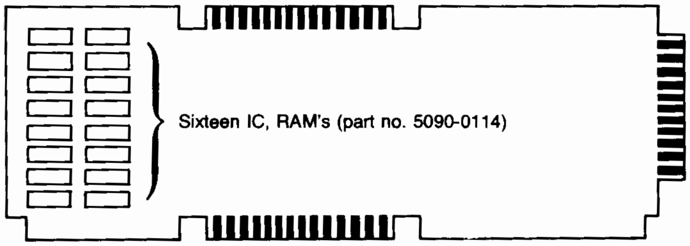


DISPLAY TIMING PCA
(02640-60088)
Refer to Section 5, "ALIGNMENT" for Display Timing Adjustment.
Crystal must be compatible with power frequency
60 Hz use 0410-0647, 50 Hz use 0410-0646

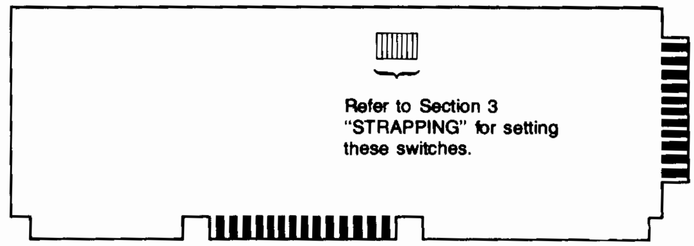


DISPLAY ENHANCEMENT PCA
(02640-60024)
Refer to Section 5 "ALIGNMENT" for Display Enhancement Field adjustment.
A
B
C
D
E
F
Math, Line Drawing, and/or Large Character ROMs go in this column of sockets. (The order of placement does not matter unless the terminal is a 2460C, 2641A, 2642A, 2645K, 2645R, or 2649D)—See below.
Earlier PCAs used jumpers. Configuration must be set according to the requirements of the ROM.
2640C
W5 = IN
W6 = IN
-0788
-0789
Math, Line Drawing, or Large character set can go here.
2641A
-0984
-0985
-0986
W1 = IN
W2 = IN
W3 = IN
W4 = IN
Math, Line Drawing, or Large character set can go here.
2642A
Switches 1A, 1B, 1D, 1E, 2E and 3E are open.
Math or Large Character can go here.
Line Drawing must go here.
2645K
-0744
W2 = IN
Math, Line Drawing, or Large character set can go here.
2645R
-1013
-1014
W1 = IN
W2 = OUT
Math, Line Drawing, or Large character set can go here.
2649D
-1315
-1314
Extended Line Drawing set.
Option 258 requires ROM 1816—0744 must go here.
International set (opt. 252-258 or 500).
Line Drawing set must go here.

GRAPHICS DISPLAY PCA
(02640-60126)



VIDEO INTERFACE ACCESSORY
(02640-60119)



WHEN REPLACING PCA's, BE SURE TO REMOVE ANY RAM's, ROM's, or PROM's FROM SOCKETS and INSTALL THEM ON THE REPLACEMENT PCA. DOES NOT APPLY TO PCA 02640-60126.

PROM CHARACTER PCA
(02640-60053)

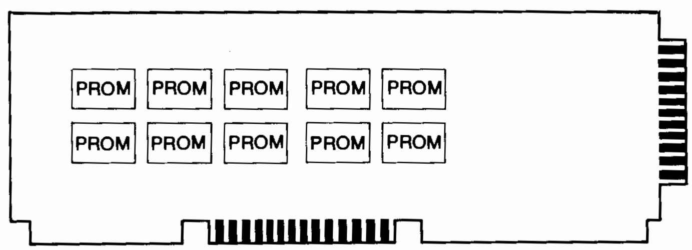
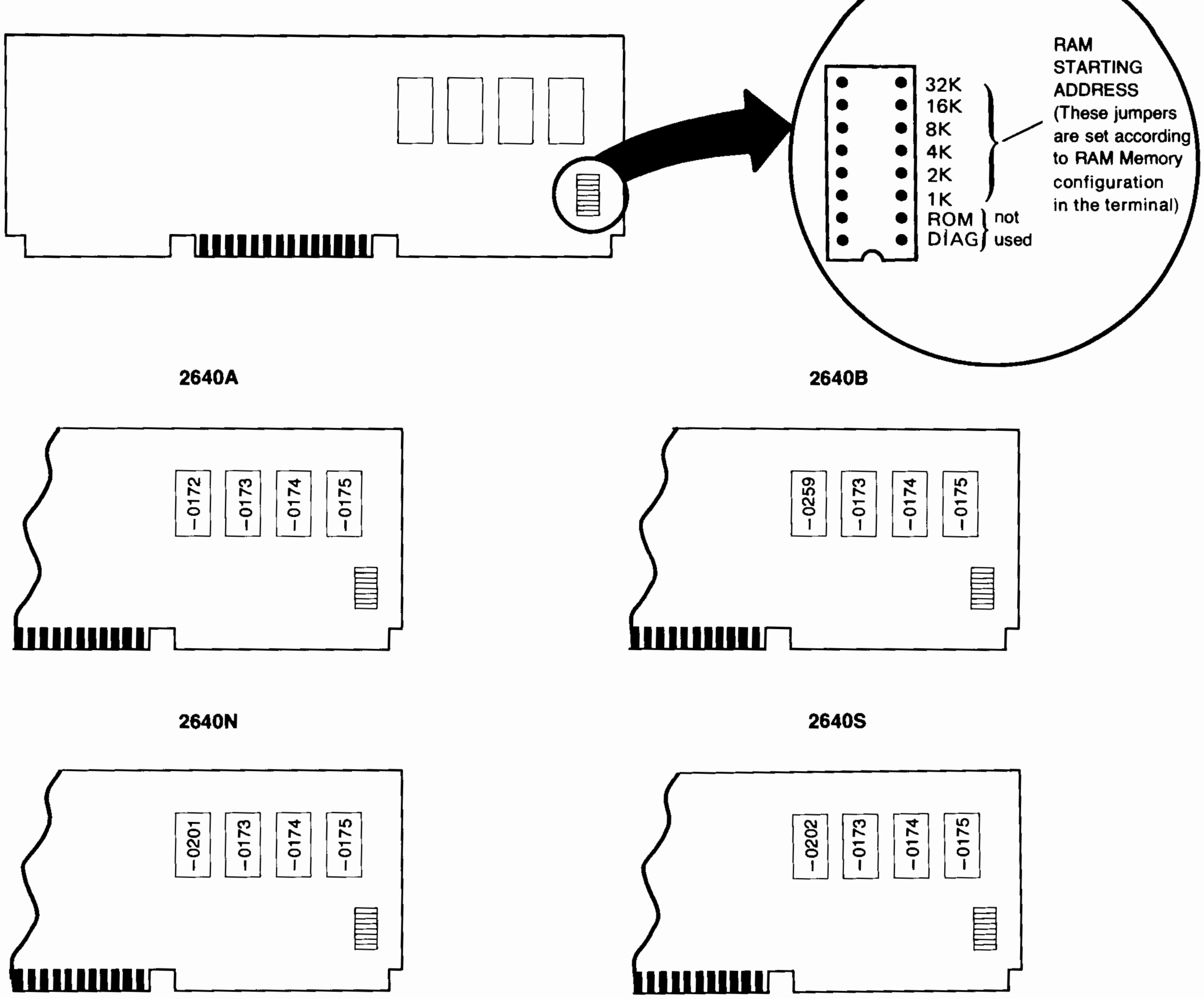


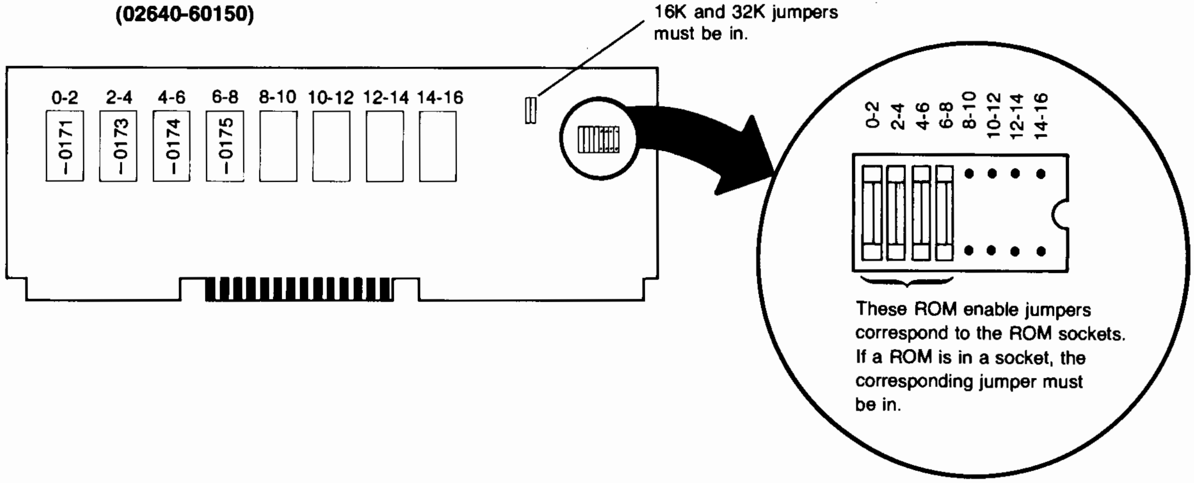
FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
	1	1	—	—	—	—	—	02640-60144	Basic Memory PCA (ROM)
	—	—	—	—	—	—	—	02640-60150	Control Store PCA (ROM)
	—	—	—	1	—	—	—	02640-60047	ROM Memory PCA (ROM)
	—	—	2	—	2	2	—	02640-60192	Control Memory PCA (ROM)
	—	—	—	—	—	—	2	02640-60221	32K B/S Control Memory PCA (ROM)
	—	—	—	—	—	—	2	02640-60243	96K Control Memory PCA
	1	1	—	1	—	—	—	02640-60008	Processor PCA
	—	—	1	—	—	—	—	02640-60093	Processor PCA (See Note)
	—	—	—	—	1	1	1	02640-60~~209~~256	Processor PCA
	—	—	—	—	—	—	—	02640-60021	2-Connector Assembly
	—	—	1	—	1	1	—	02640-60012	3-Connector Assembly
	—	—	—	—	—	—	1	02640-60022	4-Connector Assembly
	1	1	1	1	1	1	—	02640-60065	+4K Memory PCA (RAM)
	—	—	—	—	—	—	—	02640-60101	8K Memory PCA (RAM)
	—	—	—	—	—	—	2	02640-60171	Universal Memory PCA (RAM)

NOTE: The 02640—60093 Processor PCA has been replaced by the 02640—60209 Processor PCA.

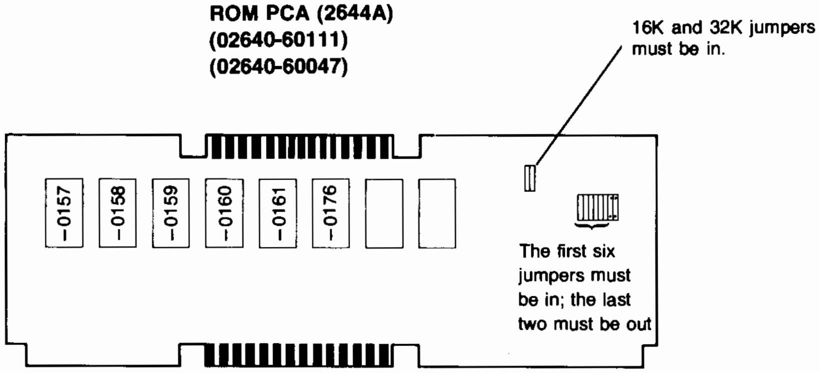
BASIC MEMORY PCA (2640A, B, N, S)
(02640-60144)



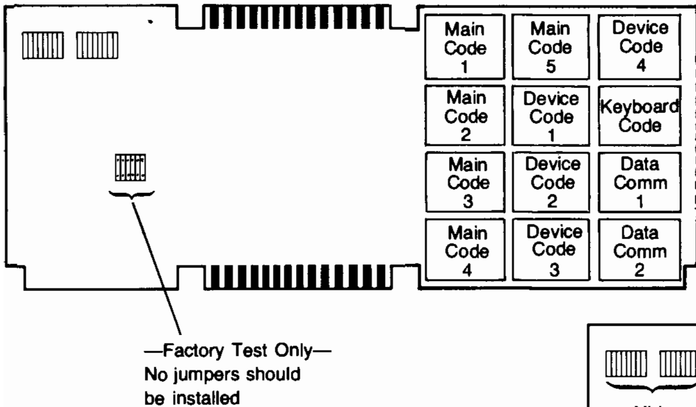
CONTROL STORE PCA (2640C Only)
(02640-60150)



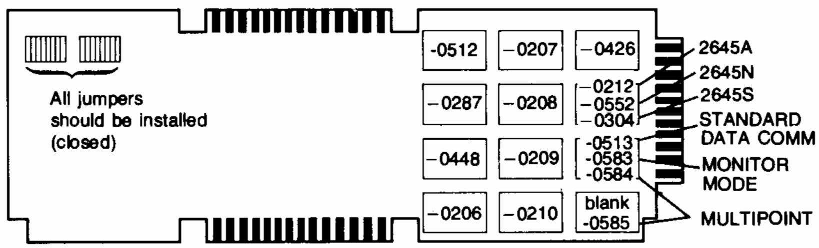
ROM PCA (2644A)
(02640-60111)
(02640-60047)



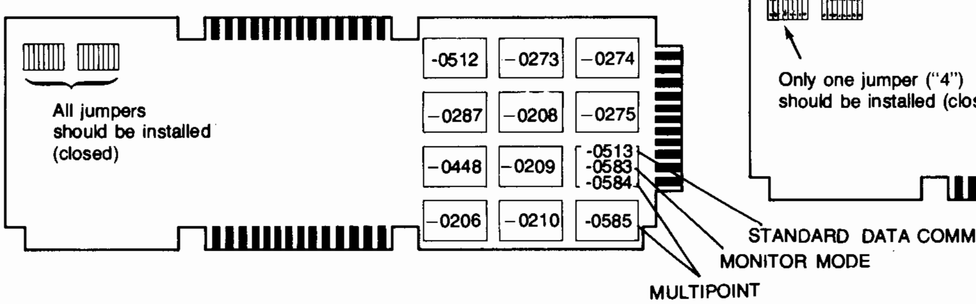
CONTROL MEMORY PCA (02640-60192)



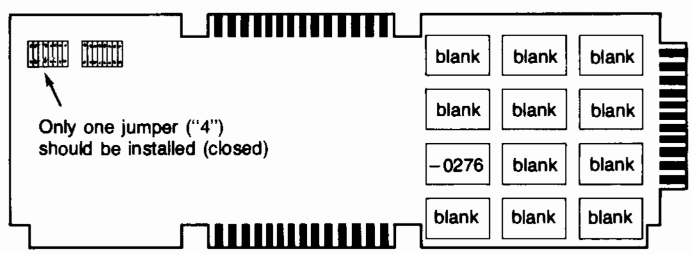
2645A/N/S

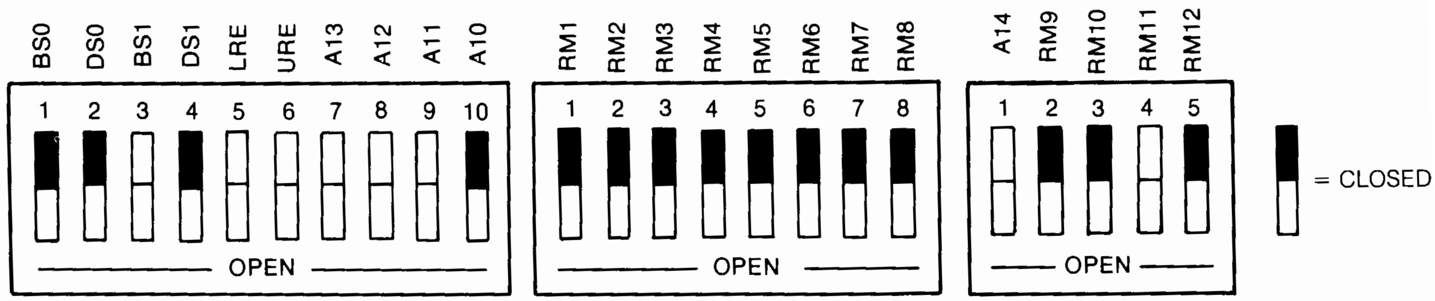


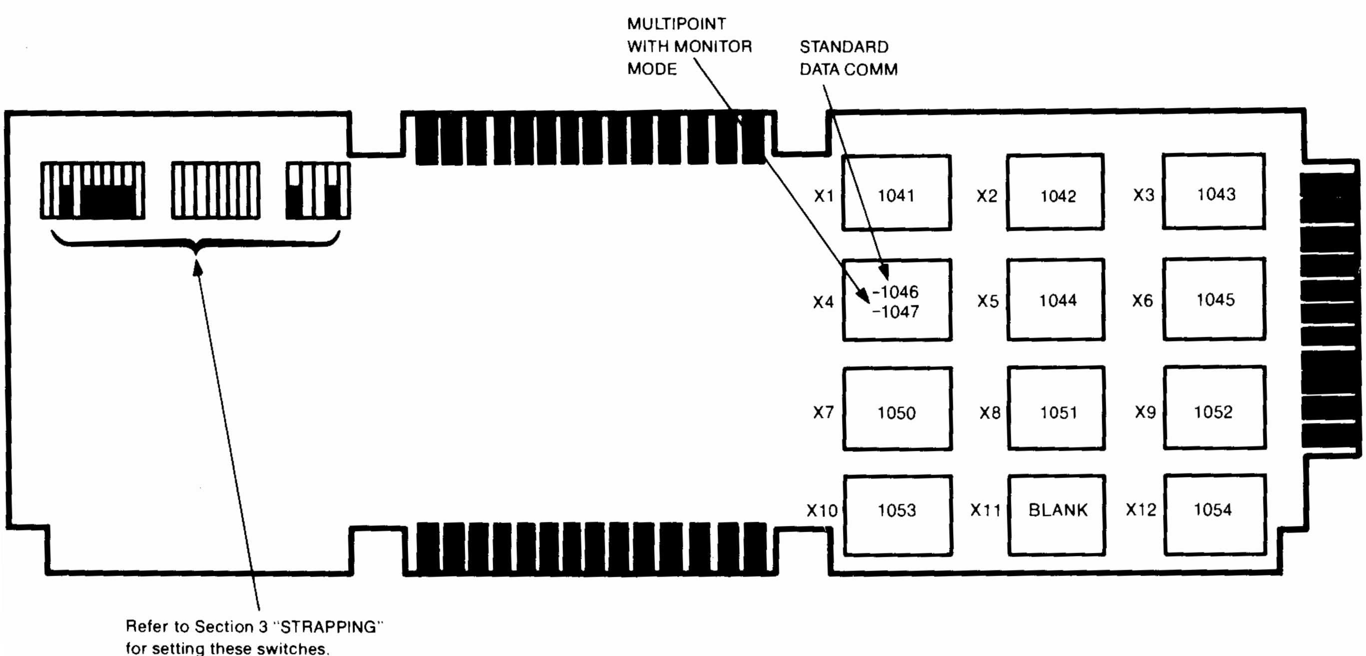
2641A (1st PCA)



2641A (2nd PCA)

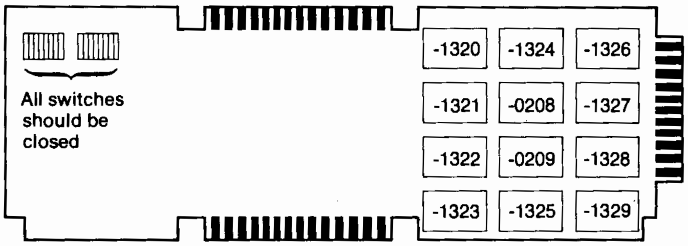




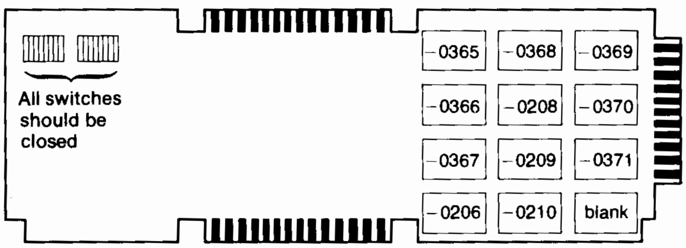


2642A CONTROL MEMORY PCA
(02640-60243)

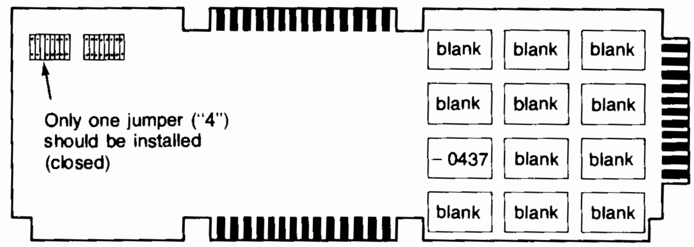
2645J



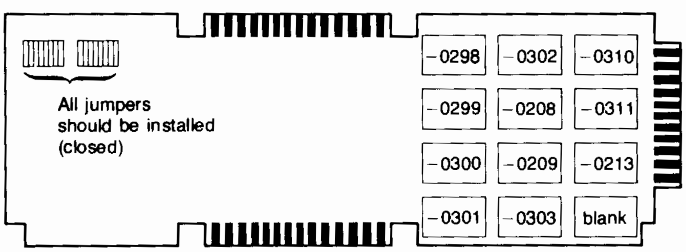
2645K (1st PCA)



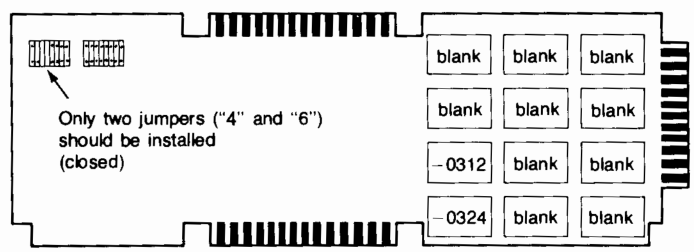
2645K (2nd PCA)



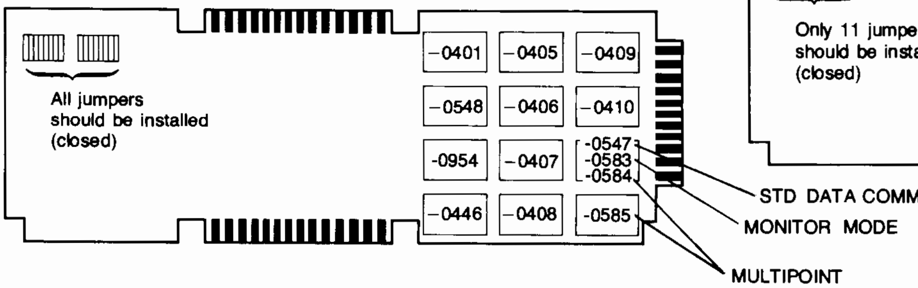
2645R (1st PCA)



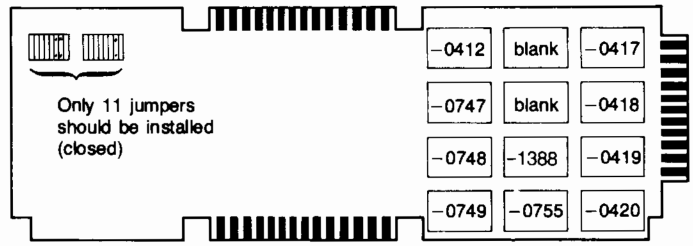
2645R (2nd PCA)



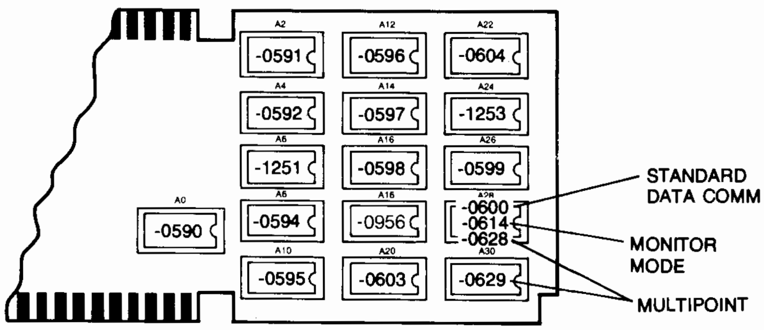
2648A (1st PCA) (+24 Closed)



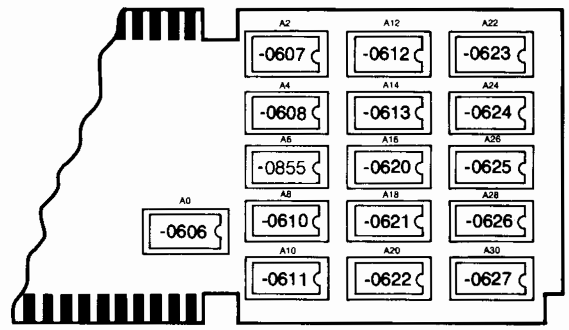
2648A (2nd PCA) (+24 Open)



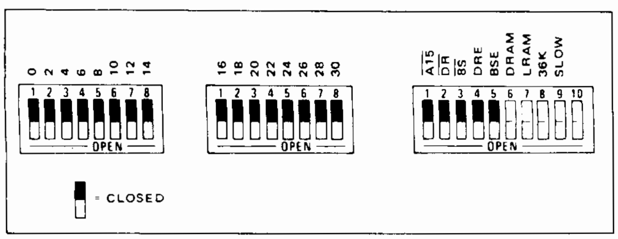
2647A (1st PCA) (BS Switch Closed)
(02640-60221)



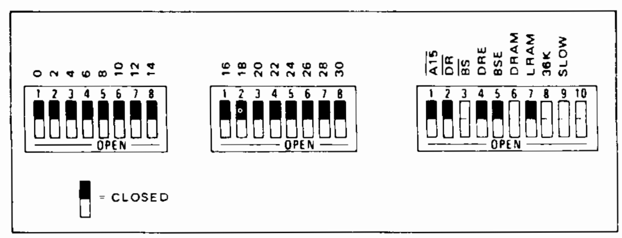
2647A (2nd PCA) (BS Switch Open)
(02640-60221)



First Control Memory PCA:
(contains data comm ROMs)



Second Control Memory PCA:



2640A INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0130	Main Code	April 76	Serial Printer Operation	1818-0172			
2	1818-0131	Main Code	April 76	Cursor Positioning Screen	1818-0173			
4	1818-0132	Main Code	April 76	Relative	1818-0174			
6	1818-0133	Main Code	April 76	Cursor Home Down	1818-0175			

2640B INSTRUCTION ROMS

0	1818-0259	Main Code						
2	1818-0173	Main Code						
4	1818-0174	Main Code						
6	1818-0175	Main Code						

2640C INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0171	Main Code						
2	1818-0173	Main Code						
4	1818-0174	Main Code						
6	1818-0175	Main Code						

2640N INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0201	Main Code						
2	1818-0173	Main Code						
4	1818-0174	Main Code						
6	1818-0175	Main Code						

2640S INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0202	Main Code						
2	1818-0173	Main Code						
4	1818-0174	Main Code						
6	1818-0175	Main Code						

2644A INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0157	Main Code						
2	1818-0158	Main Code						
4	1818-0159	Main Code						
6	1818-0160	Main Code						
8	1818-0161	Main Code						
10	1818-0162	Main Code	April 76	Upgrade 202 S&C Modem	1818-0176			

2641A INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code	March 78	Pt to pt main channel RTE sys. hlf. duplex	1818-0512 ①			
2	1818-0287	Main Code						
4	1818-0205	Main Code	Nov. 77	3000 II Multipoint	1818-0448 ②③			
6	1818-0206	Main Code						
8	1818-0273	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0274	Device Support Code						
18	1818-0275	Keyboard Code						
20	1818-0213	Main Data Comm Code	March 78	Pt to pt main channel RTE sys. hlf. duplex	1818-0513 ①			
20	1818-0214	Standard Multipoint Code	Nov. 77	3000 II Multipoint	1818-0434 ②	Oct. 78	CTU Operation	1818-0584 ③
20	1818-0261	Monitor Multipoint Code	Nov. 77	3000 II Multipoint	1818-0433 ②	Oct. 78	CTU Operation	1818-0583 ③
22	1818-0288	Second Multipoint Code	Nov. 77	3000 II Multipoint	1818-0435 ②	Oct. 78	CTU Operation	1818-0585 ③

Note 1: These ROMs must be installed together

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together.

2641A SECOND ROM BOARD

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
4	1818-0276	Main Code	second board +24 out or disable RAM out or disable					

Note 1: These ROMs must be installed together

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together.

2642A INSTRUCTION ROMs (Bank 0)

SOCKET NO.	START ADDR	ROM #	FUNCTION	REV DATE	REASON FOR REVISION	ROM #	REV DATE	REASON FOR REVISION	ROM #
X1	0	1816-1041	Main Code						
X2	8K	1816-1042	Main Code and Keyboard Code						
X3	16K	1816-1457	I/O Code						
X4	24K	1816-1046	Data Comm Code						
X5	32K	1816-1044	Main Code, Text Preparation, and Forms Design Code						
X6	40K	1816-1045	Text Preparation and Forms Design Code						
X4	24K	1816-1047	Multipoint with Monitor Mode						

2642A INSTRUCTION ROMs (Bank 1)

SOCKET NO.	START ADDR	ROM #	FUNCTION	REV DATE	REASON FOR REVISION	ROM #	REV DATE	REASON FOR REVISION	ROM #
X7	0	1816-1050	File System Code						
X8	8K	1816-1051	File System Code						
X9	16K	1816-1052	Mini Disc Code						
X10	24K	1816-1053	Mini Disc Code						
X11	32K	—	Not Used						
X12	40K	1816-1366	Mini Disc Code						

2645A INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code	March 78	Pt to pt main channel RTE sys. hlf. duplex	1818-0512 ①			
2	1818-0287	Main Code						
4	1818-0205	Main Code	Nov. 77	3000 II Multipoint	1818-0448 ② ③			
6	1818-0206	Main Code						
8	1818-0207	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0211	Device Support Code	Oct. 77	Line feed Line feed in record mode format mode	1818-0426			
18	1818-0212	Keyboard Code						
20	1818-0213	Main Data Comm Code	March 78	Pt to pt main channel RTE sys. hlf. duplex	1818-0513 ①			
20	1818-0214	Standard Multipoint Code	Nov. 77	3000 II Multipoint	1818-0434 ②	Oct. 78	CTU Operation	1818-0584 ③

Note 1: These ROMs must be installed together

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together.

2645A INSTRUCTION ROMS (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
20	1818-0261	Monitor Multipoint Code	Nov. 77	3000 II Multipoint	1818-0433②	Oct. 78	CTU Operation	1818-0583③
22	1818-0288	Second Multipoint Code	Nov. 77	3000 II Multipoint	1818-0435②	Oct. 78	CTU Operation	1818-0585③
20	1818-0421	Data Com Dec Compat E35 Special						

Note 1: These ROMs must be installed together

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together.

2645J INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-1320	Katakana Main Code						
2	1818-1321	Katakana Main Code						
4	1818-1322	Katakana Main Code						
6	1818-1323	Katakana Main Code						
8	1818-1324	Katakana Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-1325	Device Support Code						
16	1818-1326	Device Support Code						
18	1818-1327	Keyboard Code						
20	1818-1328	Data Comm Code						
22	1818-1329	Data Comm Code						

2645K INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0365	Katakana Main Code						
2	1818-0366	Katakana Main Code						
4	1818-0367	Katakana Main Code						
6	1818-0206	Main Code						
8	1818-0368	Katakana Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0369	Device Support Code						
18	1818-0370	Keyboard Code						
20	1818-0371	Data Comm Code						

2645K INSTRUCTION ROMS (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
20	1818-0434	Multipoint Code	Oct. 78	CTU Operation	1818-0584[1]			
20	1818-0433	Monitor Multipoint Code	Oct. 78	CTU Operation	1818-0583[1]			
22	1818-0435	Second Multipoint Code	Oct. 78	CTU Operation	1818-0585[1]			

2645K SECOND ROM BOARD

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
4	1818-0437	Katakana Main Code						

Note 1: These ROMs must be installed together.

2645N INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code	March 78	Pt. to pt. main channel RTE sys. hlf. duplex	1818-0512[1]			
2	1818-0287	Main Code						
4	1818-0205	Main Code	Nov. 77	3000 II Multipoint	1818-0448[2,3]			
6	1818-0206	Main Code						
8	1818-0207	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0211	Device Support Code	Oct. 77	Line Feed	1818-0426			
18	1818-0552	Keyboard Code						

2645N INSTRUCTION ROMS (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
20	1818-0213	Main Data Comm Code	March 78	Pt. to pt. main channel RTE sys. hlf. duplex	1818-0513[1]			
20	1818-0214	Standard Multipoint Code	Nov. 77	3000 II Multipoint	1818-0434[2]	Oct. 78	CTU Operation	1818-0584[3]
20	1818-0261	Monitor Multipoint Code	Nov. 77	3000 II Multipoint	1818-0433[2]	Oct. 78	CTU Operation	1818-0583[3]
22	1818-0288	Second Multipoint Code	Nov. 77	3000 II Multipoint	1818-0435[2]	Oct. 78	CTU Operation	1818-0585[3]

Note 1: These ROMs must be installed together

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together

2645R INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0298	Main Code						
2	1818-0299	Main Code						
4	1818-0300	Main Code						
6	1818-0301	Main Code						
8	1818-0302	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0303	Device Support Code						
16	1818-0310	Device Support Code						
18	1818-0311	Keyboard Code						
20	1818-0213	Data Comm Code						
20	1818-0513	Extended Data Comm Code						

2645R INSTRUCTION ROMS (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
20	1818-0434	Multipoint Code	Oct. 78	CTU Operation	1818-0584[1]			
20	1818-0433	Monitor Multipoint Code	Oct. 78	CTU Operation	1818-0583[1]			
22	1818-0435	Second Multipoint Code	Oct. 78	CTU Operation	1818-0585[1]			

2645R SECOND ROM BOARD

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
4	1818-0312	Main Code						
6	1818-0324	Main Code						

Note 1: These ROMs must be installed together

2645S INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code	March 78	Pt. to pt. main channel RTE sys. hlf. duplex	1818-0512[1]			
2	1818-0287	Main Code						
4	1818-0205	Main Code	Nov. 77	3000 II Multipoint	1818-0448[2,3]			
6	1818-0206	Main Code						
8	1818-0207	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0211	Device Support Code	Oct. 77	Line Feed	1818-0426			
18	1818-0304	Keyboard Code						
20	1818-0213	Main Data Comm Code	March 78	Pt. to pt. main channel RTE sys. hlf. duplex	1818-0513[1]			

2645S INSTRUCTION ROMS (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
20	1818-0214	Standard Multipoint Code	Nov. 77	3000 II Multipoint	1818-0434[2]	Oct. 78	CTU Operation	1818-0584[3]
20	1818-0261	Monitor Multipoint Code	Nov. 77	3000 II Multipoint	1818-0433[2]	Oct. 78	CTU Operation	1818-0583[3]
22	1818-0288	Second Multipoint Code	Nov. 77	3000 II Multipoint	1818-0435[2]	Oct. 78	CTU Operation	1818-0585[3]

Note 1: These ROMs must be installed together
Note 2: These ROMs must be installed together
Note 3: These ROMs must be installed together

13290B INSTRUCTION ROMS

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code						
2	1818-0287	Main Code						
4	1818-0205	Main Code						
6	1818-0206	Main Code						
8	1818-0207	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0211	Device Support Code						
18	1818-0212	Keyboard Code						
20	1818-0213	Main Data Comm Code						

2647A INSTRUCTION ROMS
1ST CONTROL MEMORY BOARD BS CLOSED

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0590	Main Code						
2	1818-0591	Main Code						
4	1818-0592	Main Code						
6	1818-0593	Main Code	Nov. 80		1818-1253			
8	1818-0594	Main Code						
10	1818-0595	Main Code						
12	1818-0596	Main Code						
14	1818-0597	Main Code						
16	1818-0598	Main Code						
18	1818-0602	File System Code	June 79		1818-0956[5] [6]			
20	1818-0603	File System Code						
22	1818-0604	File System Code						

Note 5: These ROMs must be installed together.
Note 6: These ROMs must be installed together.

2647A INSTRUCTION ROMS
1ST CONTROL MEMORY BOARD BS CLOSED (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
24	1818-0605	File System Code	June 79		1818-0854[5]	Jan. 81	Duplicate Record	1818-1251[6]
26	1818-0599	Keyboard Code						
28	1818-0600	Standard Data Comm						
28	1818-0614	Multi-Pt w/ Monitor Mode						
28	1818-0628	Multi-Pt w/o Monitor Mode						
30	1818-0629	Multi-Pt						

Note 5: These ROMs must be installed together.

Note 6: These ROMs must be installed together.

2647A INSTRUCTION ROMS
2ND CONTROL MEMORY BOARD BS OPEN

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0606	File System Code						
2	1818-0607	File System Code						
4	1818-0608	File System Code						
6	1818-0609	File System Code		June 79	1818-0855[5,6]			
8	1818-0610	File System Code						
10	1818-0611	File System Code						
12	1818-0612	File System Code						
14	1818-0613	File System Code						
16	1818-0620	Graphics Code						
18	1818-0621	Graphics Code						
20	1818-0622	Graphics Code						
22	1818-0623	Graphics Code						

Note 5: These ROMs must be installed together.

Note 6: These ROMs must be installed together.

2647A INSTRUCTION ROMS
2ND CONTROL MEMORY BOARD BS OPEN (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
24	1818-0624	Graphics Code						
26	1818-0625	Graphics Code						
28	1818-0626	Graphics Code						
30	1818-0627	Graphics Code						

2648A INSTRUCTION ROMS
1ST CONTROL MEMORY BOARD +24 CLOSED

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0401	Main Code						
2	1818-0402	Main Code	Jan. 79	Data Comm Related	1818-0548[5]			
4	1818-0403	Main Code	June 79	Soft Reset Graphics	1818-0954			
6	1818-0404	Main Code	Nov. 77	3000 II Multipoint	1818-0446[2,3]			
8	1818-0405	Main Code						
10	1818-0406	Device Support Code						
12	1818-0407	Device Support Code						
14	1818-0408	Device Support Code						
16	1818-0409	Device Support Code						
18	1818-0410	Main Keyboard						
20	1818-0411	Main Data Comm Code	Jan. 79	Data Comm Related	1818-0547[5]			
20	1818-0214	Standard Multipoint Code	Nov. 77	3000 II Multipoint	1818-0434[2]	Oct. 78	CTU Operation	1818-0584[3]
20	1818-0261	Monitor Multipoint Code	Nov. 77	3000 II Multipoint	1818-0433[2]	Oct. 78	CTU Operation	1818-0583[3]
22	1818-0288	Second Multipoint Code	Nov. 77	3000 II Multipoint	1818-0435[2]	Oct. 78	CTU Operation	1818-0585[3]

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together

Note 5: These ROMs must be installed together.

2648A INSTRUCTION ROMS
2ND CONTROL MEMORY BOARD +24 OPEN

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
24	1818-0412	Graphics Code						
26	1818-0413	Graphics Code	Jan. 79	Graphics Related	1818-0747④			
28	1818-0414	Graphics Code	Jan. 79	Graphics Related	1818-0748④			
30	1818-0415	Graphics Code	Jan. 79	Graphics Related	1818-0749④			
32								
34								
36	1818-0746	Raster Dump HPIB	Aug 80	Alternate Character Set Related	1818-1388			
38	1818-0416	Graphics Code	Jan. 79	Graphics Related	1818-0755④			
40	1818-0417	Graphics Auto Plot Code						
42	1818-0418	Graphics Auto Plot Code						
44	1818-0419	Graphics Auto Plot Code						
46	1818-0420	Graphics Auto Plot Code						

Note 2: These ROMs must be installed together

Note 3: These ROMs must be installed together

Note 4: These ROMs must be installed together

2649D INSTRUCTION ROMS (Remote 250 Terminal)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0764	Main Code						
2	1818-0765	Main Code						
4	1818-0766	Main Code						
6	1818-0767	Main Code						
8	1818-0768	HP-IB Driver	Feb. 1981	2631B Compatibility	1818-1551			
10								
12								
14								
16								
18	1818-0769	Keyboard Code						
20	1818-0213	Data Comm Code						

2649E INSTRUCTION ROMS 1st CONTROL MEMORY BOARD (HP 3000 Series 30 System Console)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0203	Main Code						
2	1818-0501	Main Code						
4	1818-0205	Main Code						
6	1818-0206	Main Code						
8	1818-0207	Main Code						
10	1818-0208	Device Support Code						
12	1818-0209	Device Support Code						
14	1818-0210	Device Support Code						
16	1818-0211	Device Support Code						
18	1818-0212	Keyboard Code						
20	1818-0213	Main Data Comm Code						

2649E 2nd CONTROL MEMORY BOARD

0	1818-0502	HP-IB Driver						
2	1818-0503	HP-IB Driver						

2649I INSTRUCTION ROMS
1st CONTROL MEMORY BOARD BS CLOSED

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0590	Main Code						
2	1818-0591	Main Code						
4	1818-0592	Main Code						
6	1818-0593	Main Code						
8	1818-0594	Main Code						
10	1818-0595	Main Code						
12	1818-0596	Main Code						
14	1818-0597	Main Code						
16	1818-0598	Main Code						
18	1818-0602	File System Code	June 79		1818-0956[5]			
20	1818-0603	File System Code						
22	1818-0604	File System Code						
24	1818-0605	File System Code	June 79		1818-0854[5]			

2649I INSTRUCTION ROMS
1st CONTROL MEMORY BOARD BS CLOSED (Continued)

START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
26	1818-0599	Keyboard Code						
28	1818-0600	Standard Data Comm						
28	1818-0614	Multi-Pt. w/ Monitor Mode						
28	1818-0628	Multi-Pt. w/o Monitor Mode						
30	1818-0629	Multi-Pt.						

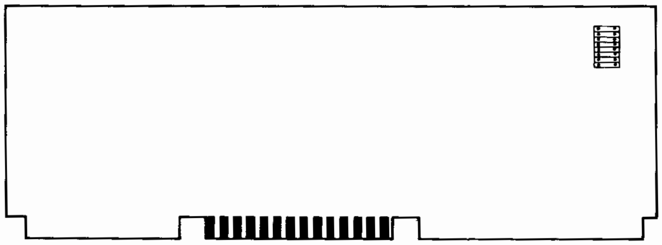
Note 5: These ROMs must be installed together.

2649I INSTRUCTION ROMS
2nd CONTROL MEMORY BOARD BS OPEN

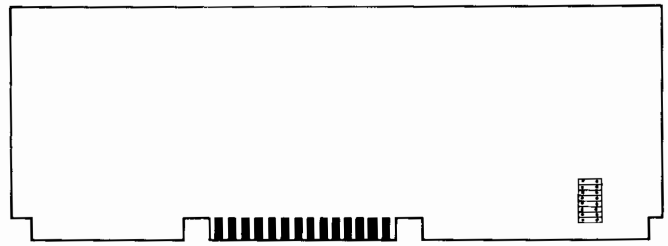
START ADDR.	ROM#	FUNCTION	REV. DATE	REASON FOR REVISION	ROM#	REV. DATE	REASON FOR REVISION	ROM#
0	1818-0606	File System Code						
2	1818-0607	File System Code						
4	1818-0608	File System Code						
6	1818-0609	File System Code	June 79		1818-0855[5]			
8	1818-0610	File System Code						
10	1818-0611	File System Code						
12	1818-0612	File System Code						
14	1818-0613	File System Code						
16	1818-0979	File System Code						

Note 5: These ROMs must be installed together.

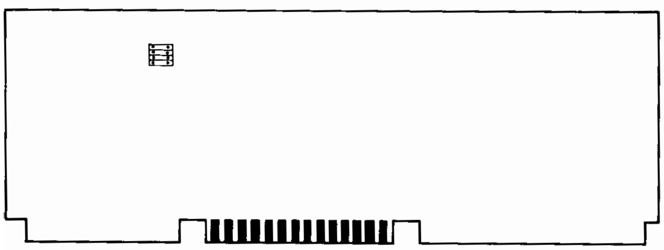
+4K MEMORY PCA
(02640-60065)



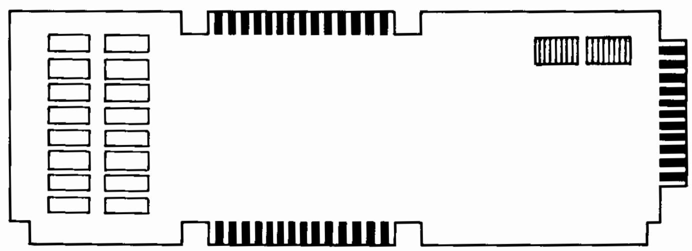
2K MEMORY PCA
(02640-60064)



8K MEMORY PCA
(02640-60101)

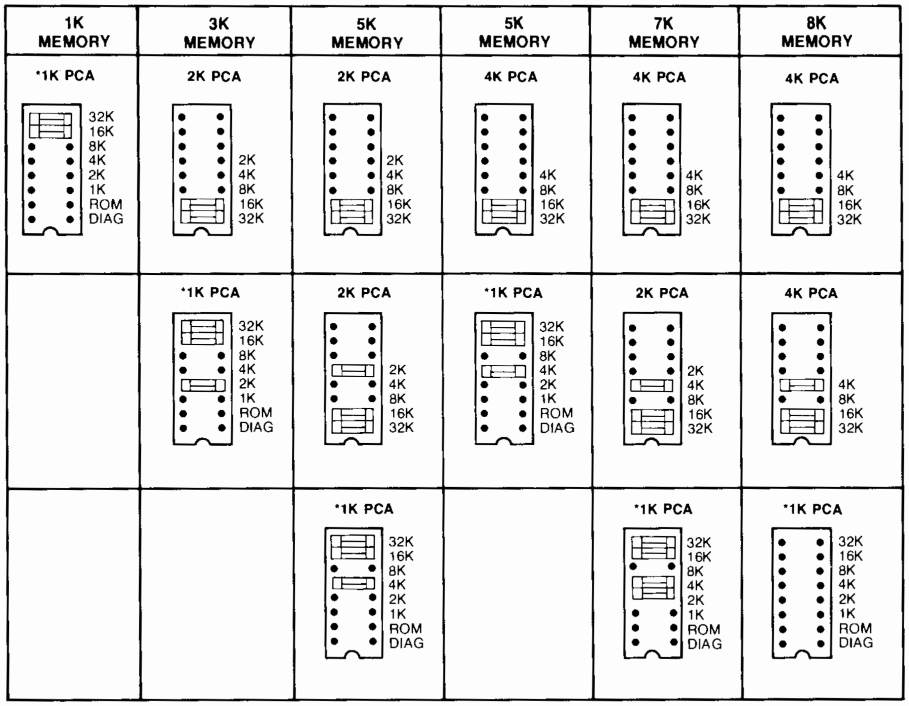


UNIVERSAL MEMORY PCA
(02640-60171)



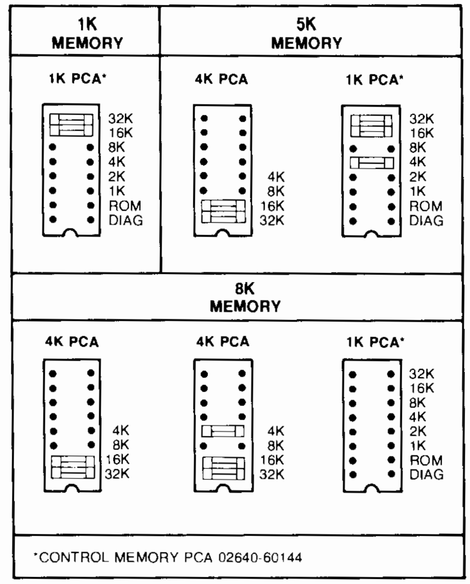
POSSIBLE RAM MEMORY CONFIGURATIONS

2640A



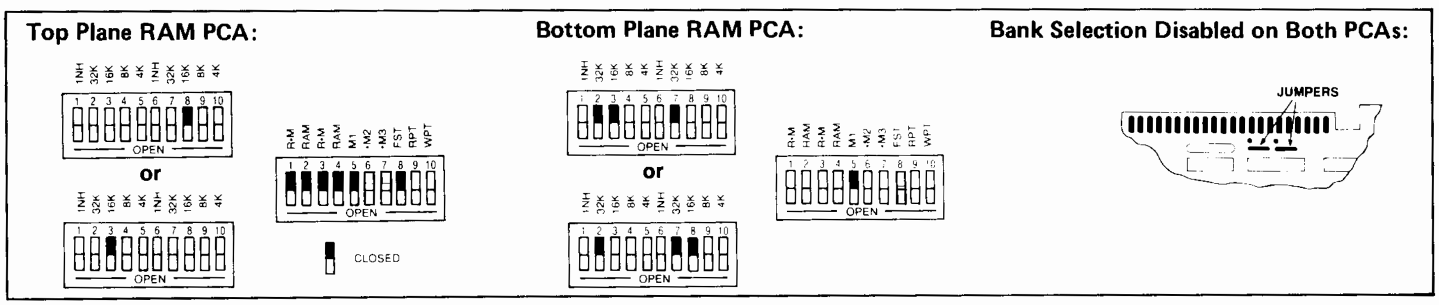
*CONTROL STORE PCA OR 02640-60144

2640B,C,N,S



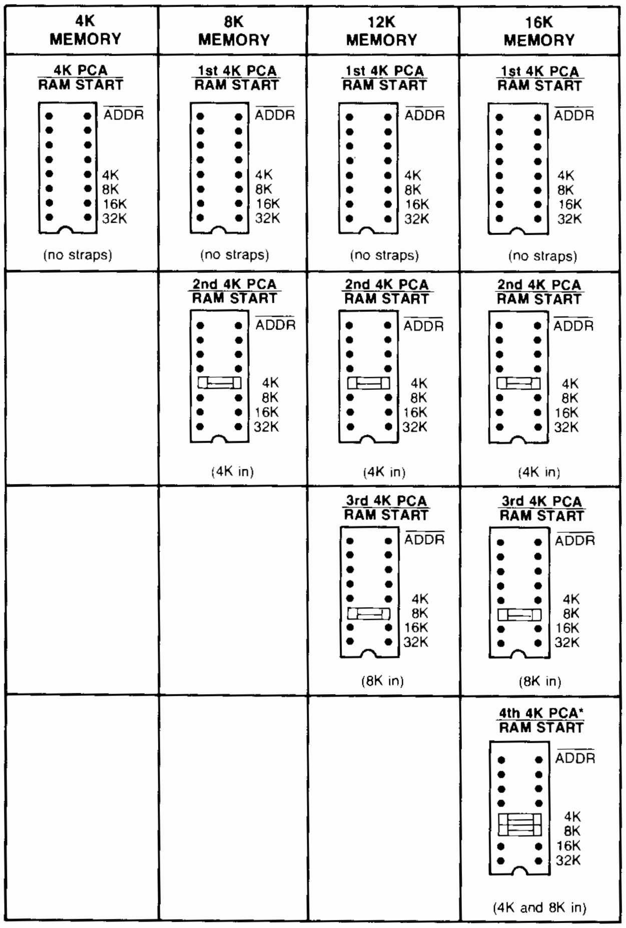
*CONTROL MEMORY PCA 02640-60144

2647A



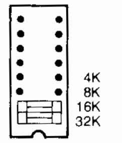
POSSIBLE RAM MEMORY CONFIGURATIONS (Continued)

2645A,K,N,R,S & 2641A

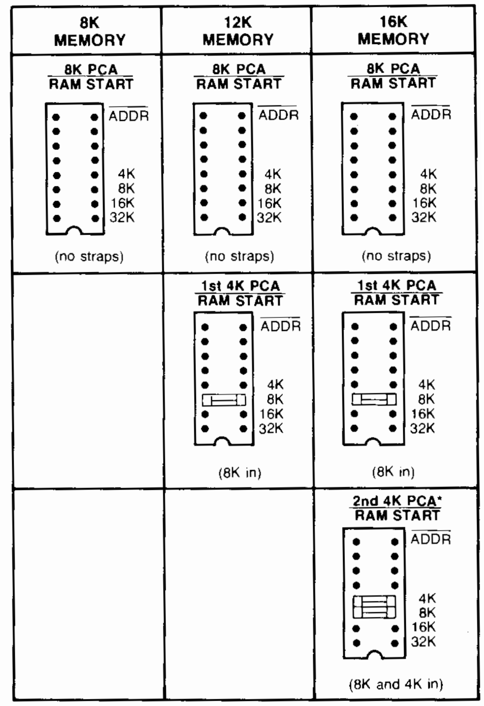


*Used for data comm buffer only.

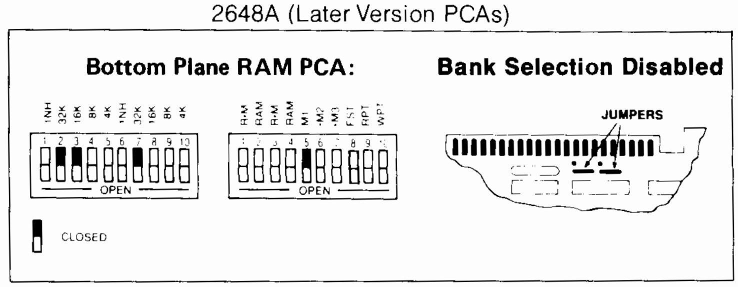
2644A



2648A (Earlier Version PCAs)

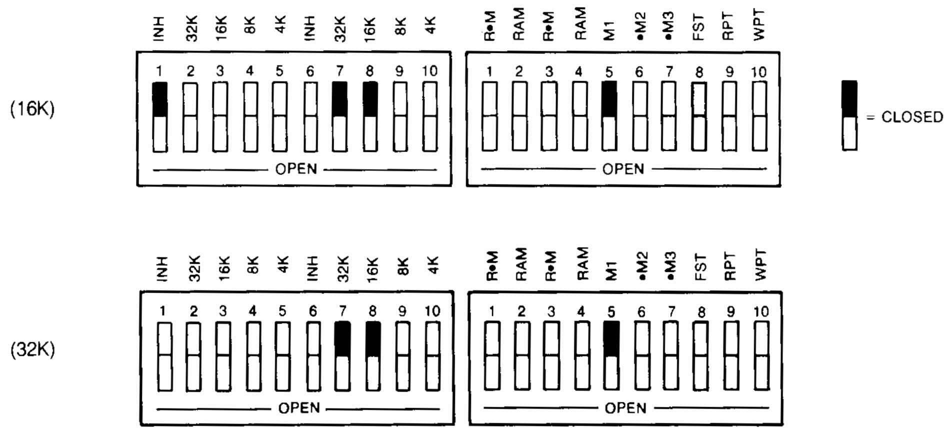


2648A (Later Version PCAs)

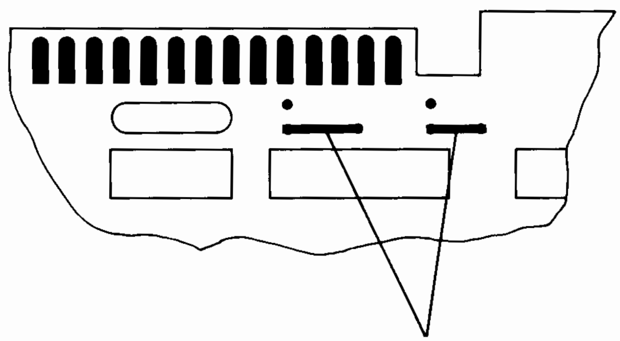


2642A

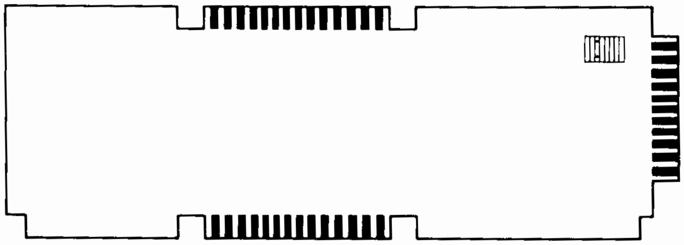
BOTTOM PLANE MEMORY PCA



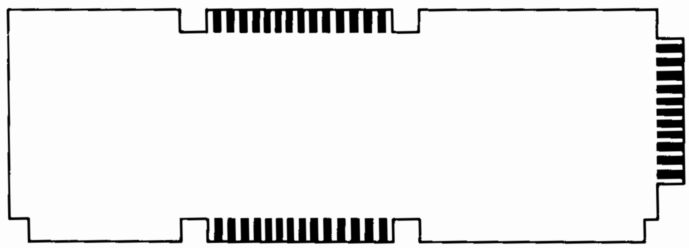
BANK SELECTION DISABLED



PROCESSOR PCA
(02640-60093)



PROCESSOR PCA
(02640-60008)



PROCESSOR PCA
(02640-60209)

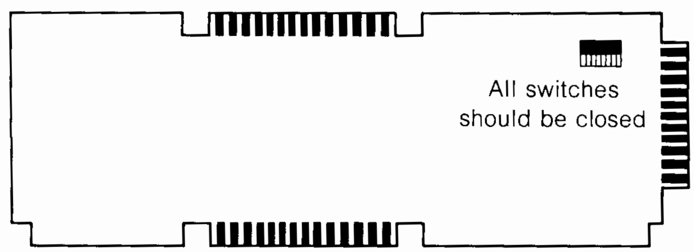
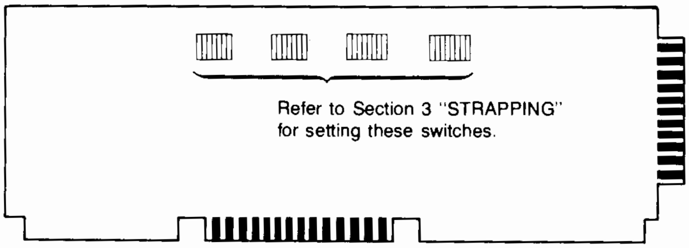


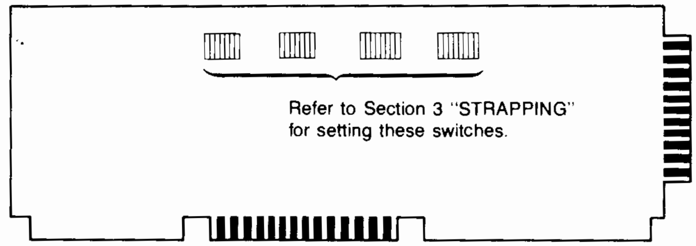
FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	S	S	S	S	S	S	—	S	S	S	S	S	S	S	S	02640-60086	Asynch Data Comm PCA (Std) (Earlier Version)
	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	02640-60239	Asynch Data Comm PCA (Std) (Later Version)
	A	A	A	A	A	A	O	A	A	A	A	A	A	A	A	02640-60143	General Purpose Asynch Data Comm PCA
	—	—	—	—	—	A	O	—	A	—	A	A	A	A	A	02640-60106	Asynch Multipoint PCA
	—	—	—	—	—	A	O	—	A	—	A	A	A	A	A	02640-60107	Synch Multipoint PCA
	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	02640-60031	Terminal Duplex Register PCA
	—	—	—	—	—	O	O	—	O	O	O	O	O	S	O	02640-60137	CTU I/F PCA
	—	—	—	—	—	O	O	S	O	O	O	O	O	S	O	02640-60032	Read/Write PCA
	—	—	—	—	—	—	—	S	—	—	—	—	—	—	—	02640-60033	CTU I/F PCA
	—	—	—	—	—	O	O	S	O	O	O	O	O	S	O	02640-60021	2-Connector Assembly (used with CTU I/F and Read/Write PCAs)
	—	—	—	—	—	—	S	—	—	—	—	—	—	O	—	02640-60223	Disc Controller PCA
	—	—	—	—	—	—	O	—	—	—	—	—	—	O	O	02640-60128	HP-IB Interface PCA
	—	—	—	—	—	—	O	—	—	—	—	—	—	O	O	02640-60215	HP-IB Interface Adapter
	—	—	—	—	—	—	O	—	—	—	—	—	—	O	O	1810-0408	*1-LOAD IC Resistor
	—	—	—	—	—	—	O	—	—	—	—	—	—	O	O	1810-0410	*2-LOAD IC Resistor
	—	—	—	—	—	—	O	—	—	—	—	—	—	O	O	1810-0409	*4-LOAD IC Resistor

S=standard, O=optional, A=accessory

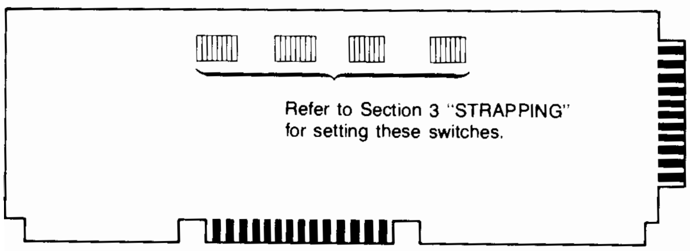
GENERAL PURPOSE ASYNCHRONOUS DATA COMM PCA
(02640-60143)



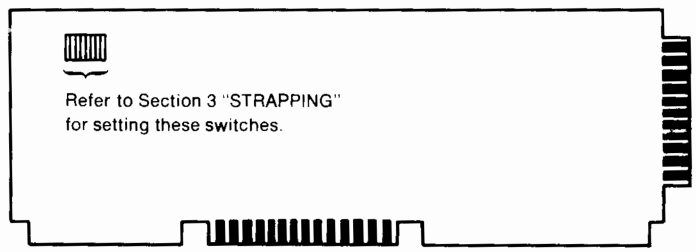
ASYNCHRONOUS MULTIPOINT PCA
(02640-60106)



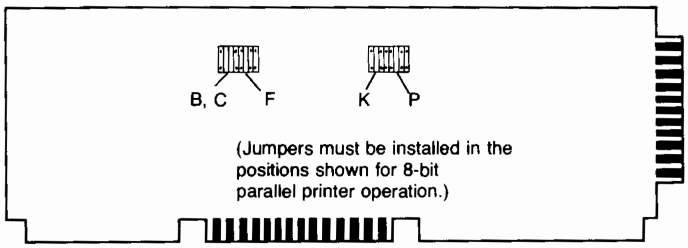
SYNCHRONOUS MULTIPOINT PCA
(02640-60107)



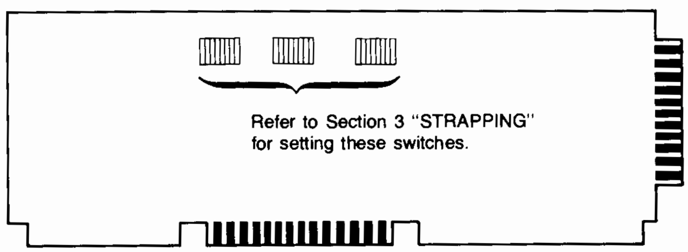
ASYNCHRONOUS DATA COMM PCA
(02640-60239)



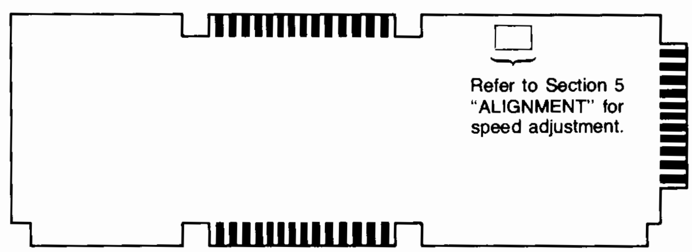
TERMINAL DUPLEX REGISTER PCA
(02640-60031)



HP-IB INTERFACE PCA
(02640-60128)



READ/WRITE PCA
(02640-60032)

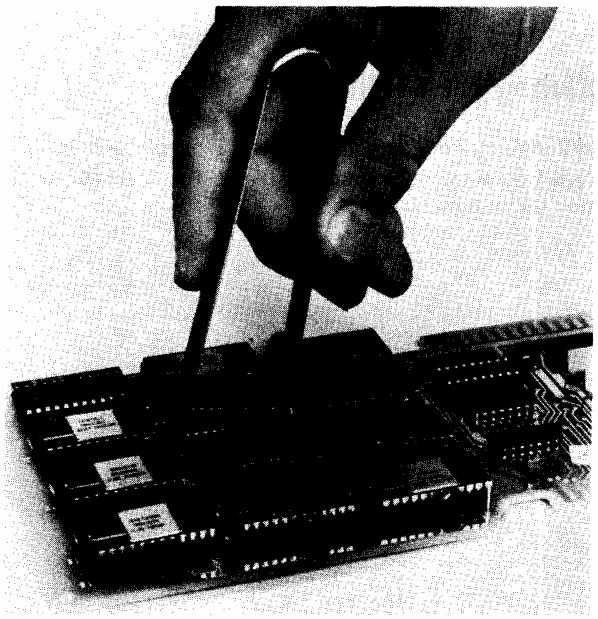


Replacing PCAs

1. Be sure to remove any ROMs on old PCA, and install them on new PCA.
2. Be sure to place jumpers, straps, or switches in their correct position on new PCA. (Use old PCA as a guide, or refer to Section 3, "Strapping".

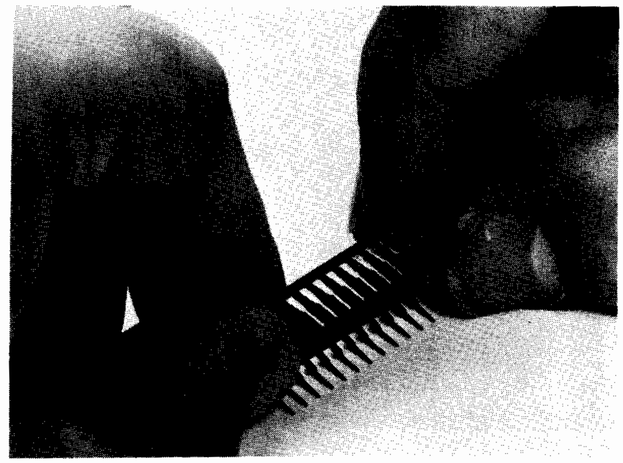
Replacing ROMs

1. Use IC Removal Tool, part no. 8710-0585, for removing the ROMs. With the tool over the ends of the ROM, gently rock the tool side-to-side, and the ROM will lift out of its socket.

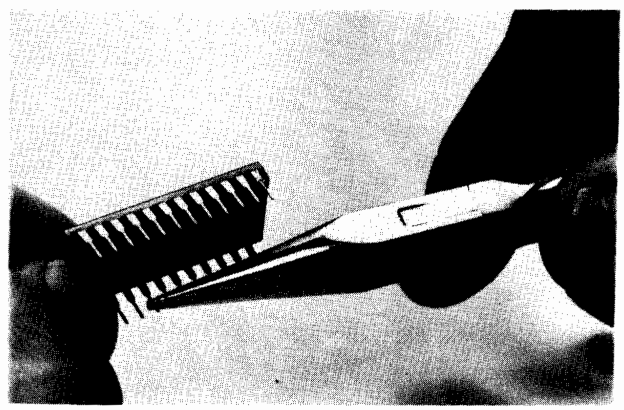


Removing ROMs with IC Removal Tool

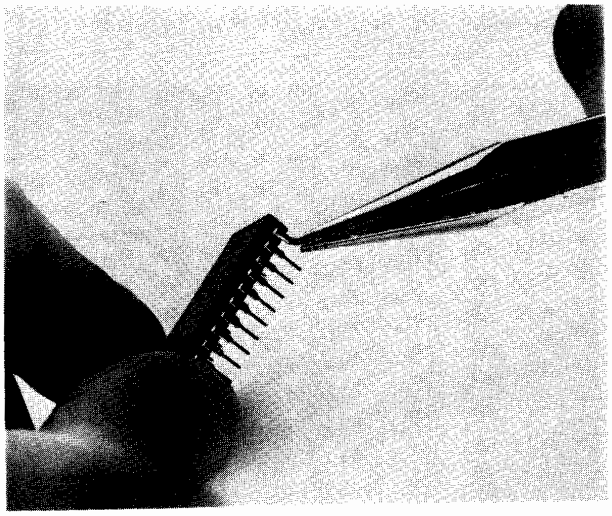
2. Bent pins may be straightened with your fingers or a pair of needlenose pliers. Be careful; the pins are soft.



Straightening Bent Pins by Pressing on Work Surface



Straightening Bent Pins with Pliers



Straightening Bent Pins

3. Place the removed ROM on a conductive foam pad. These ROMs are susceptible to static discharge, so be sure to observe the following precautions:

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

   DO NOT handle ICs in carpeted areas.

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

   ENSURE that the IC, work surface (table, desk, etc.), PCA, and you are all at the same ground potential. This can be done by touching the foam pad, IC leads, PCA, and your hands to the work surface.

Installing New ROMs

When installing the ROMs, be sure that pin 1 of the ROM (which is indicated by a dot at the corner of the IC) is positioned at the upper-right corner of the socket.

Internal Cables

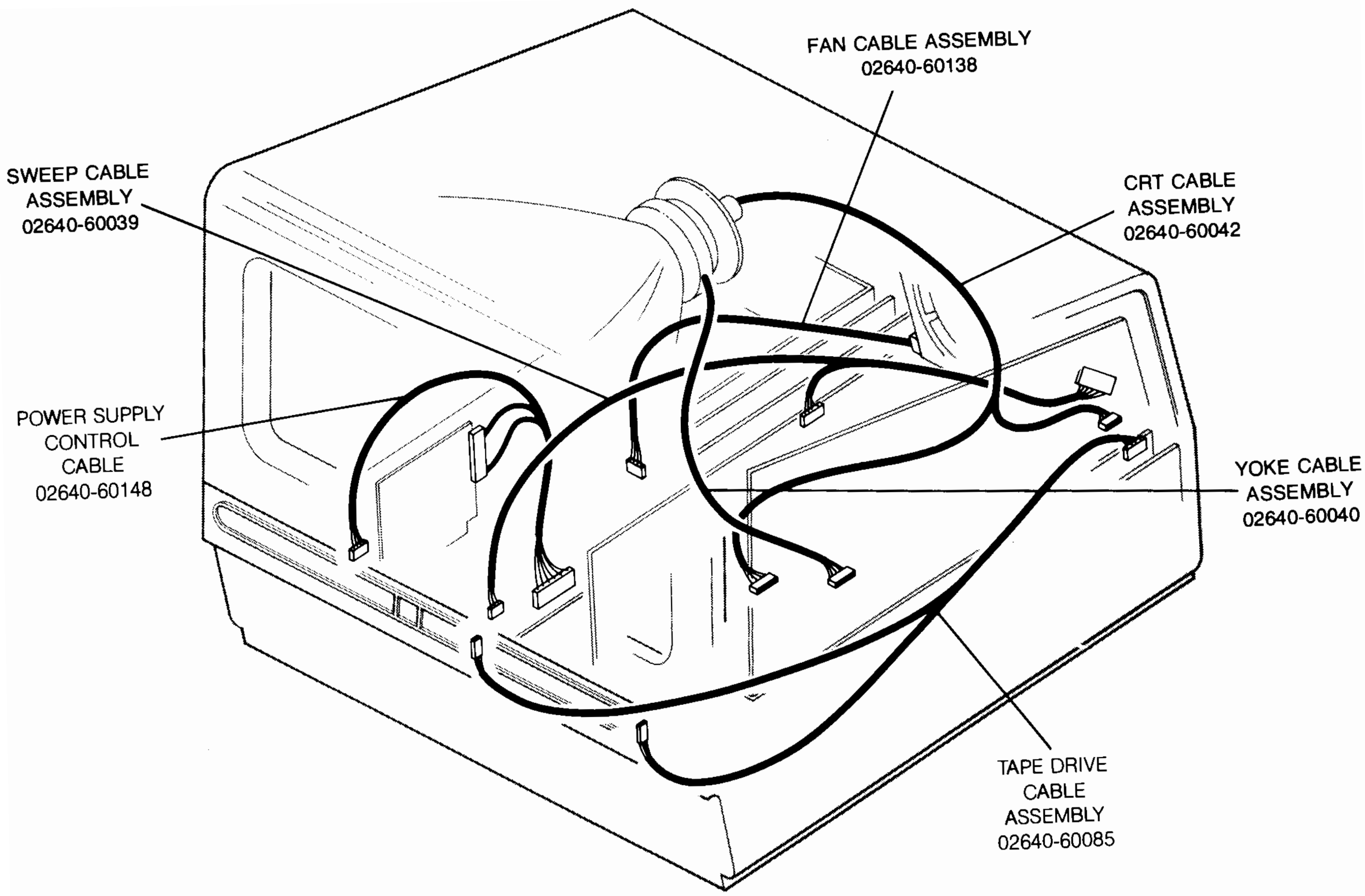
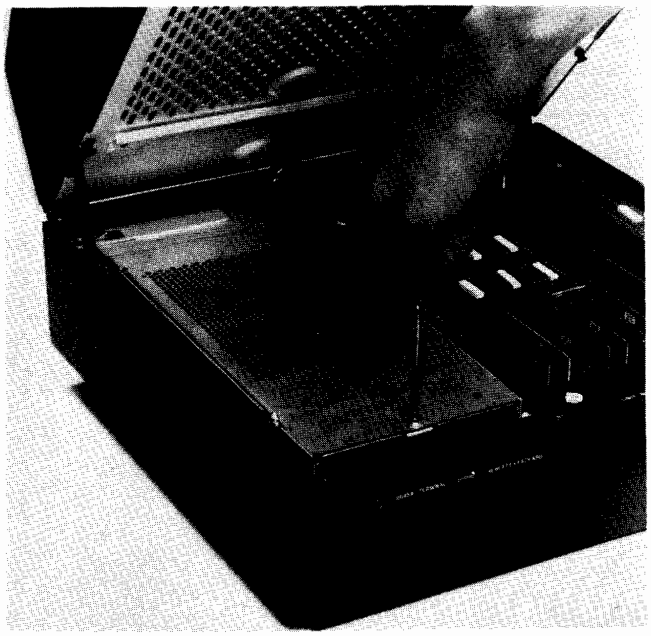

FAN CABLE ASSEMBLY
02640-60138
SWEEP CABLE
ASSEMBLY
02640-60039
CRT CABLE
ASSEMBLY
02640-60042
POWER SUPPLY
CONTROL
CABLE
02640-60148
YOKE CABLE
ASSEMBLY
02640-60040
TAPE DRIVE
CABLE
ASSEMBLY
02640-60085

FIG & INDEX NO.	2640A	2640C	2640S	2642A	2645A	2645N	2645S	2648A	PART NO.	DESCRIPTION
1	1	1	1	1	1	1	1	1	02640-60148	Power Supply Control Cable
2	1	1	1	1	1	1	1	1	02640-60039	Sweep Cable Assembly
3	1	1	1	1	1	1	1	1	02640-60138	Fan Cable Assembly
4	1	1	1	1	1	1	1	1	02640-60042	CRT Cable Assembly
5	1	1	1	1	1	1	1	1	02640-60040	Yoke Cable Assembly
6	1	1	1	1	1	1	1	1	02640-60085	Tape Drive Cable Assembly
7	1	1	1	1	1	1	1	1	02640-60081	Keyboard Cable Assembly

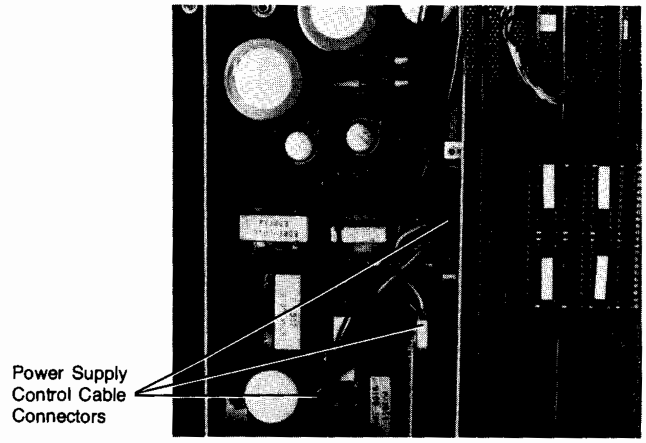
Internal Cables Repair and Replacement

REPLACING THE POWER SUPPLY CONTROL CABLE

1. Remove the power supply cover; one screw holds it on.



2. Remove each of the three connectors of the power supply control cable from its mating connector by gently rocking the connector while pulling it away from the mating connector.

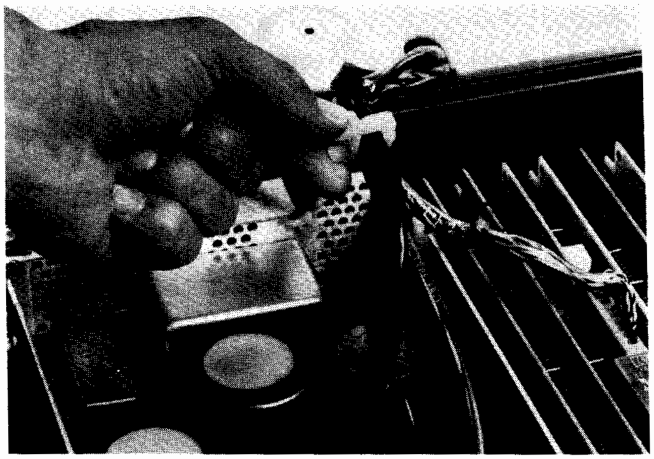


Power Supply Control Cable Connectors

3. Install the new cable connectors onto their mating connectors.

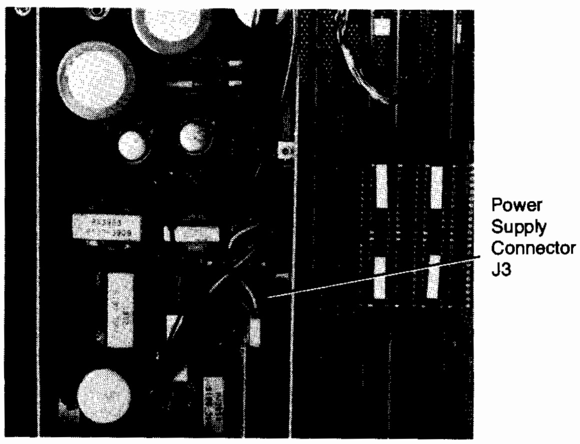
REPLACING THE SWEEP CABLE ASSEMBLY

1. Remove the CRT shield (see paragraph "Removing The Shield").
2. Remove the power supply cover; one screw holds it on.
3. Grasp the nylon cable bundler by the ends, and slip off its retainer.



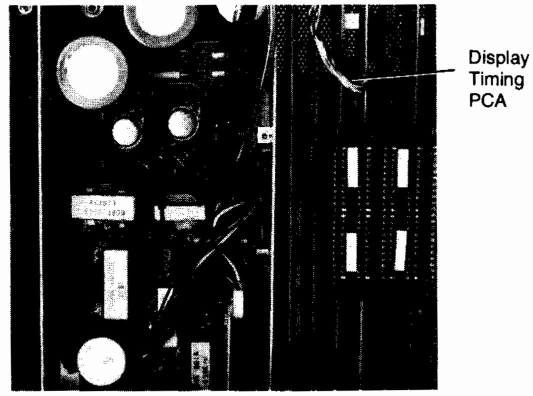
Removing the Cable Bundler

4. Disconnect the cable connector from the power supply board (J3).



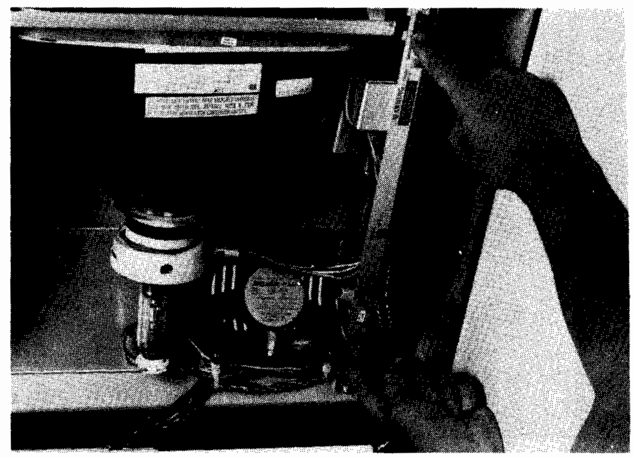
Power Supply Connector J3

5. Disconnect cable connector on DSPLY TMG PCA (part no. 02640-60088).



Sweep Cable Connector on DSPLY TMG PCA

6. Unlatch Sweep PCA to gain better access to sweep cable connector and for replacing the white nylon cable clamps.

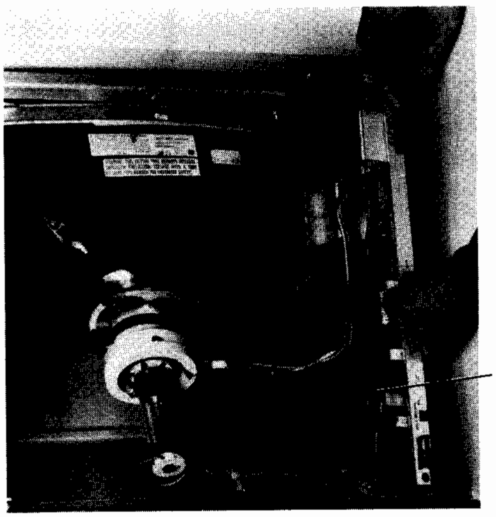


Unlatching the Sweep PCA

7. Remove the two white nylon cable clamps from the fan, and cut their cable ties.

Cutting the Cable Ties

8. Disconnect the cable connector that connects to the Sweep PCA.



Sweep Cable Connection on Sweep PCA

9. The Sweep Cable Assembly should now be free to be removed from the terminal.

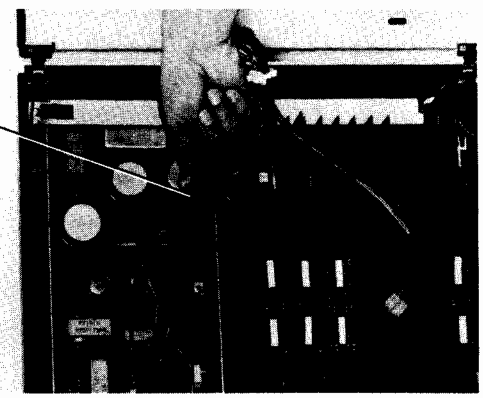
10. Install the new cable assembly. First, connect the three cable connectors to their mating connectors on the Sweep PCA, DSPLY TMG PCA, and power supply. Next, dress the cable next to the other cables near the fan.

11. Finally, mount two new cable clamps (part no. 1400-0400) to the fan, and tie the cables to the clamps with the clamp's ties. Omit yellow, brown, and black wires on CRT cable from the left cable clamp.

REPLACING THE FAN CABLE ASSEMBLY

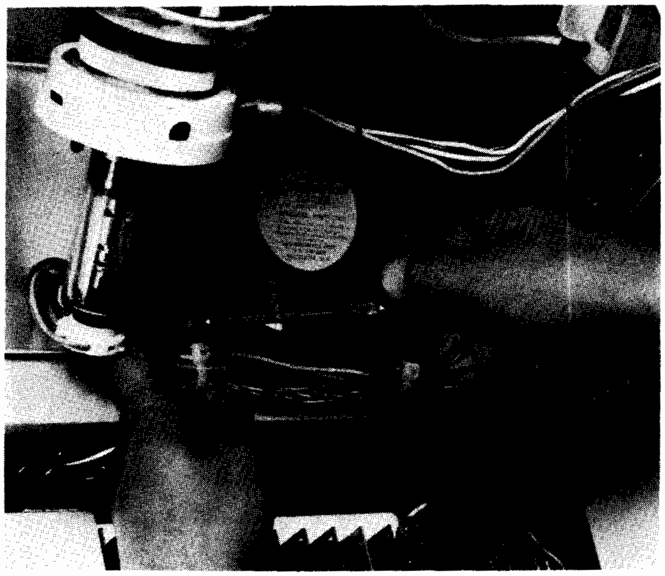
1. Remove the power supply cover; one screw holds it on.

2. Disconnect the cable connector from the power supply by squeezing the ears of the connector while pulling it up.



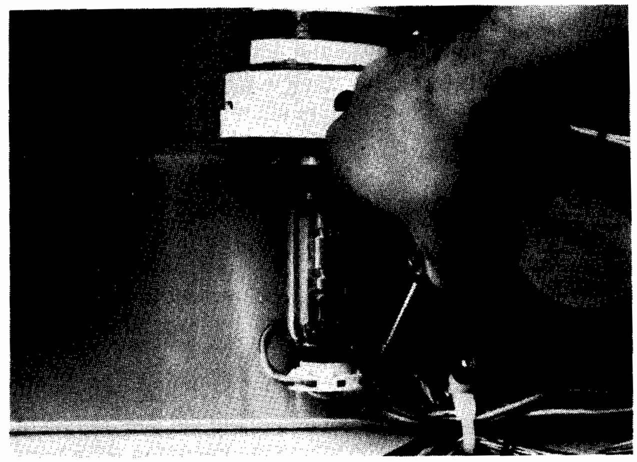
Disconnecting the Fan Cable Connector on the Power Supply

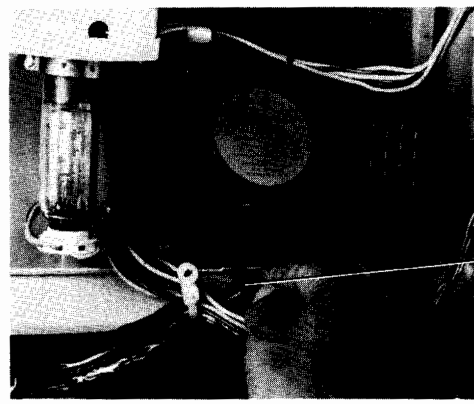
3. Remove the left while nylon cable clamp from the fan, and carefully cut the cable tie to release the cables.



Removing the Left Cable Clamp

4. Remove the ground lug screw from the fan plenum, and disconnect the cable connector from the fan.





Fan Cable Ground Lug and Connector

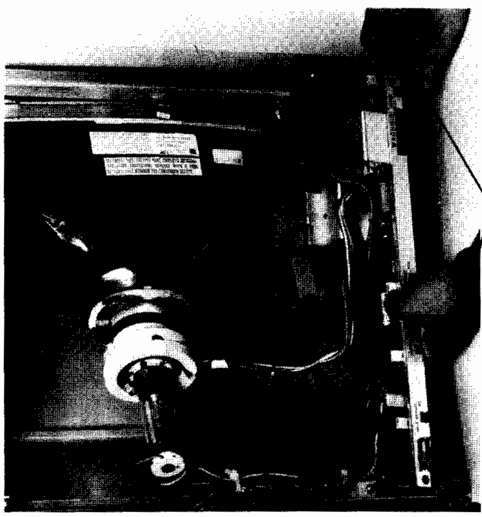
5. Install the new fan cable assembly. First, connect the cable connectors to the power supply and fan. Next, connect the ground lug to the fan plenum with the screw and split lockwasher. Dress the cable next to the other cables near the fan.

6. Finally, mount a new cable clamp (part no. 1400-0440) to the fan, and tie the cables to the clamp with the clamp's ties. (Omit yellow, brown, and black wires on CRT cable from the cable clamp.)

REPLACING THE CRT CABLE ASSEMBLY

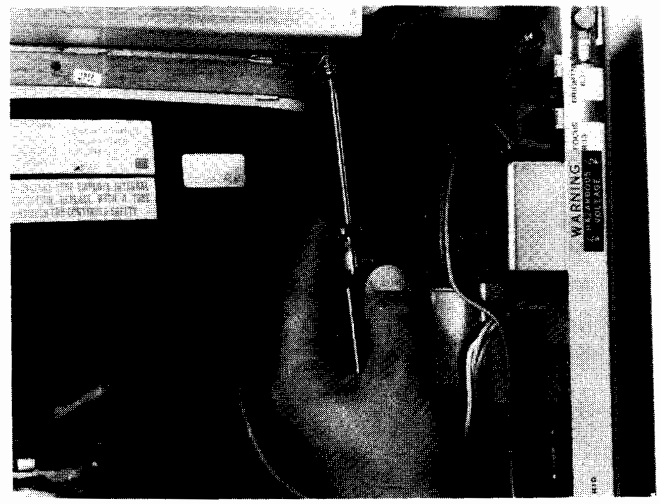
NOTE
The CRT and yoke must be replaced as a matched pair.

1. Remove the CRT shield.
2. Remove the Sweep PCA by unlatching the two latches at the front and rear of the PCA. Carefully lower the PCA from the Monitor Assembly; the cable connectors are now accessible.



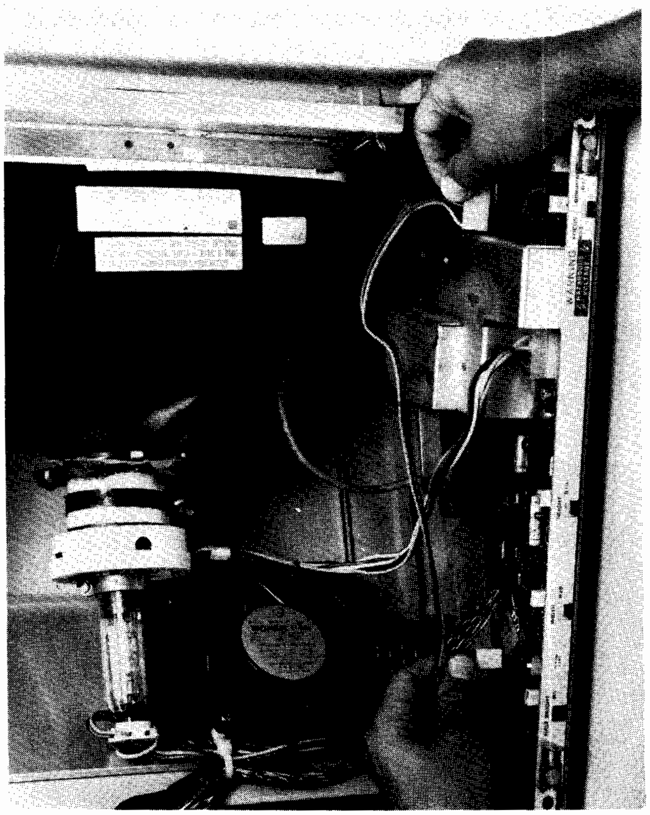
Removing the Sweep PCA

3. Remove the ground lug screw from the front CRT bracket.



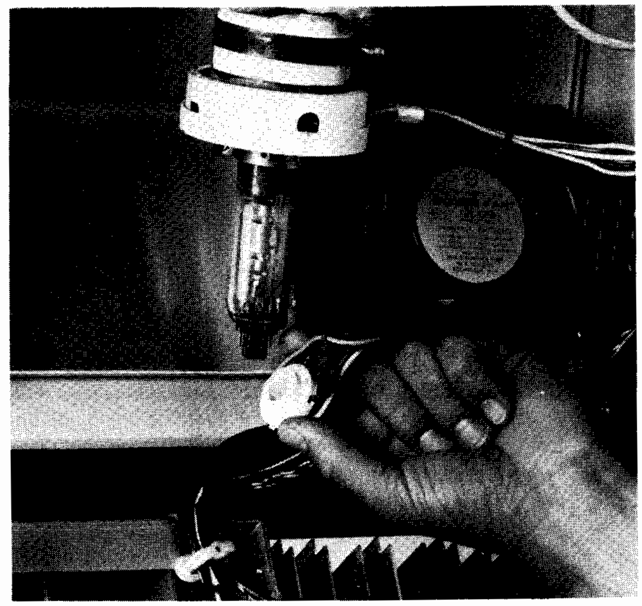
CRT Cable Ground Lug

4. Disconnect the two cable connectors from the Sweep PCA.



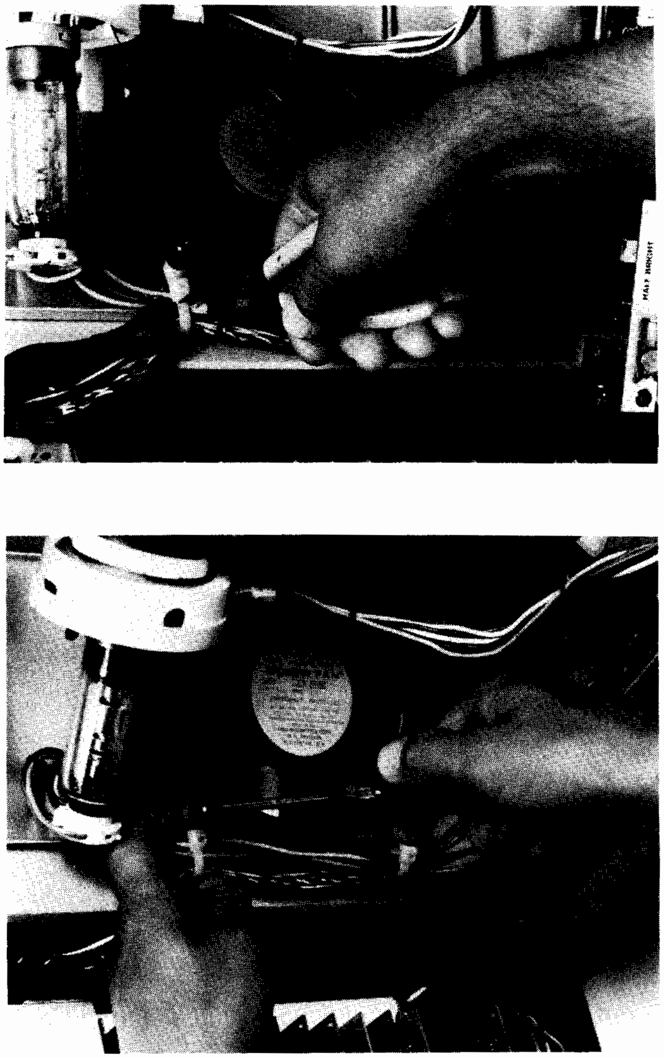
CRT Cable Connections on Sweep PCA

5. Disconnect the CRT connector from the neck of the CRT.



Disconnecting the CRT Cable Connector at the CRT

6. Remove the two white nylon cable clamps from the fan, and cut their cable ties.



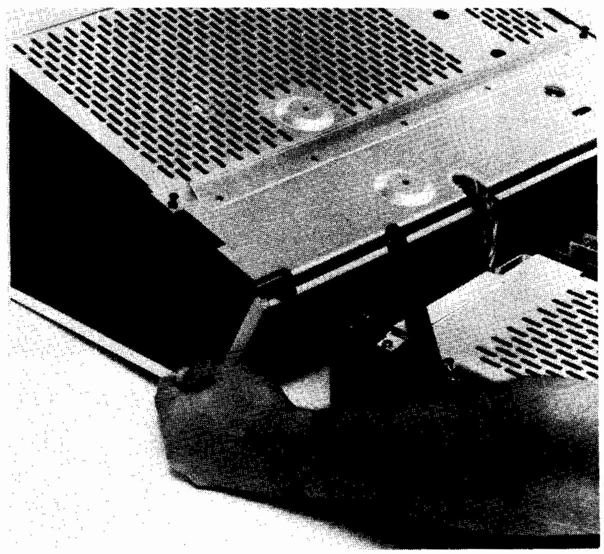
Cutting and Removing the CRT Cable Ties

7. The CRT cable assembly should now be free to remove from the terminal.
8. Install the new cable assembly. First, connect the three cable connectors to their mating connectors on the Sweep PCA and CRT. Mount the ground lug with screw, spring washer, flat-washer, and external lockwasher removed in step 3. Position the Sweep PCA up into the Monitor Assembly and close the two latches. Next, dress the cable next to the other cables near the fan. Finally, mount two new cable clamps (part no. 1400-0440) to the fan, and tie the cables to the clamps with the clamp's ties. (Omit yellow, brown, and black wires on CRT cable from the left cable clamp.)

REPLACING THE YOKE CABLE ASSEMBLY

NOTE

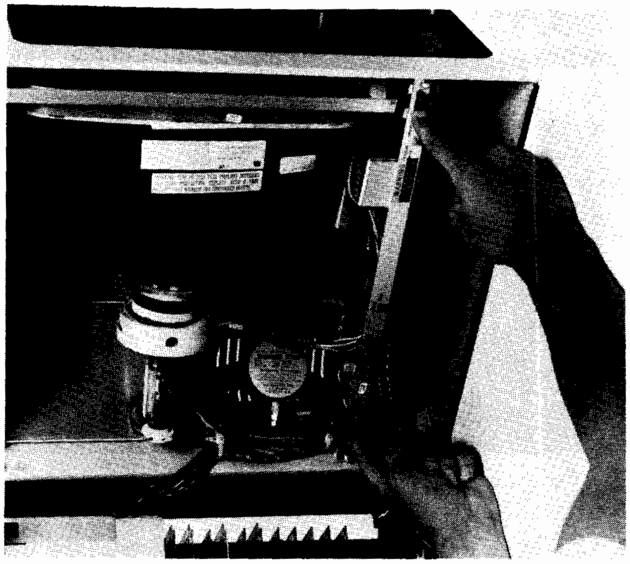
The CRT and yoke must be replaced as a matched pair.



Opening the Terminal

1. Open the terminal until the top of the monitor assembly rests on the work surface.

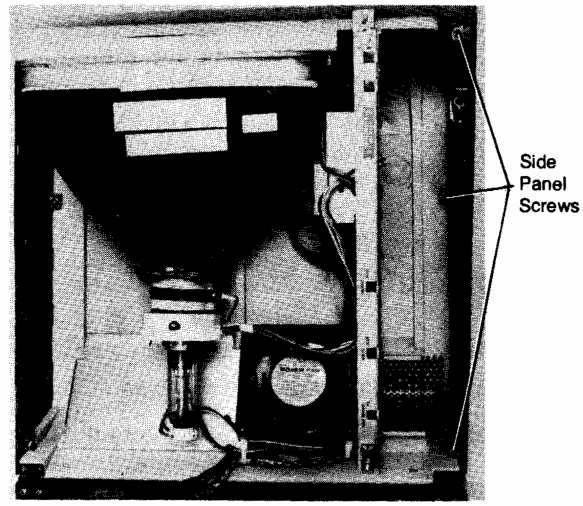
2. Remove the CRT shield.



Unlatching the Sweep PCA

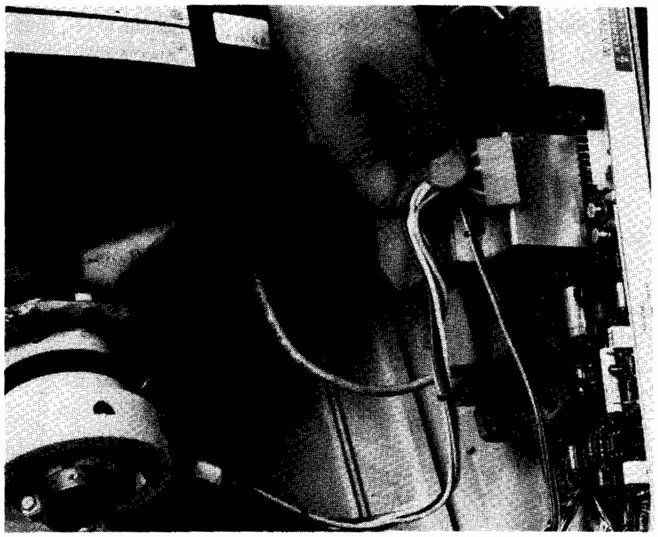
3. Unlatch the two latches that secure the Sweep PCA, and pull out the Sweep PCA as far as the cables will permit.

4. Remove the side panels (3 screws each side) to allow access to the CRT.



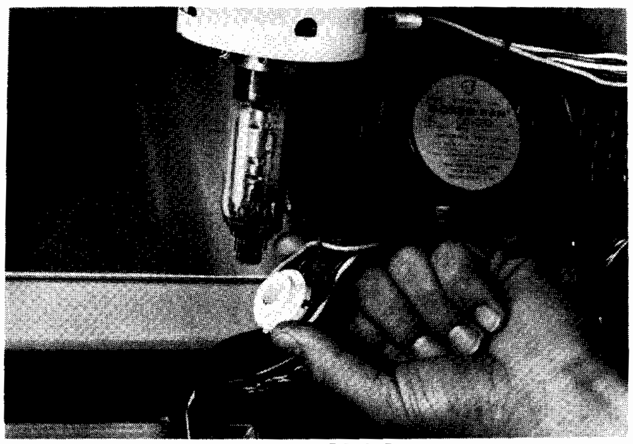
Removing the Side Panel

5. Disconnect the yoke cable assembly connector from the Sweep PCA.



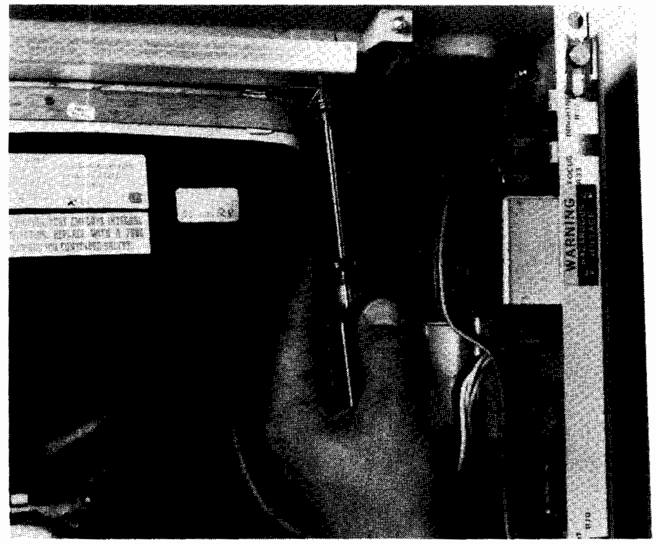
Yoke Cable Connector on Sweep PCA

6. Disconnect the CRT connector from the neck of the CRT.



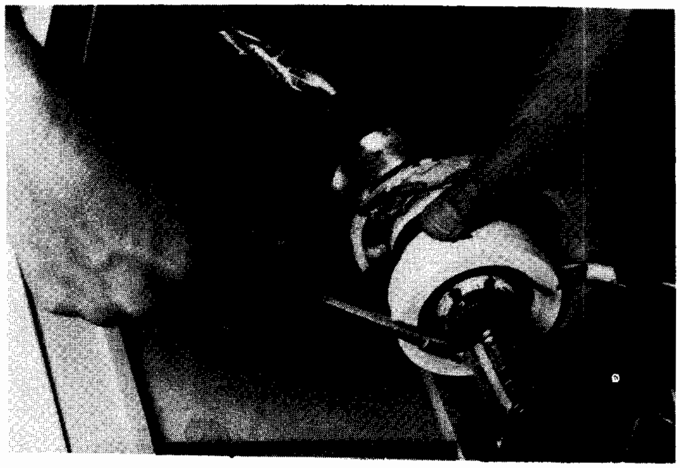
Disconnecting the CRT Connector

7. Remove the four screws that secure the CRT to the monitor top. Now, you should be able to tilt the CRT into a position to allow removal of the yoke.

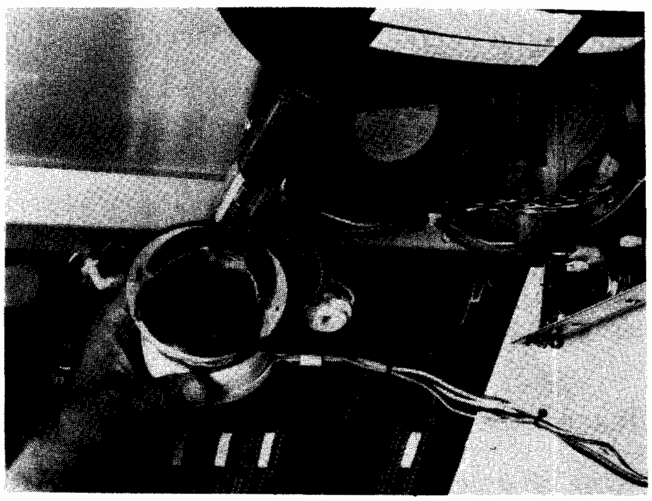


CRT Securing Screws

8. Carefully rotate the yoke until you can unscrew the yoke clamp sufficiently to allow removal of the yoke. Slide the yoke over the neck of the CRT.



Loosening the Yoke



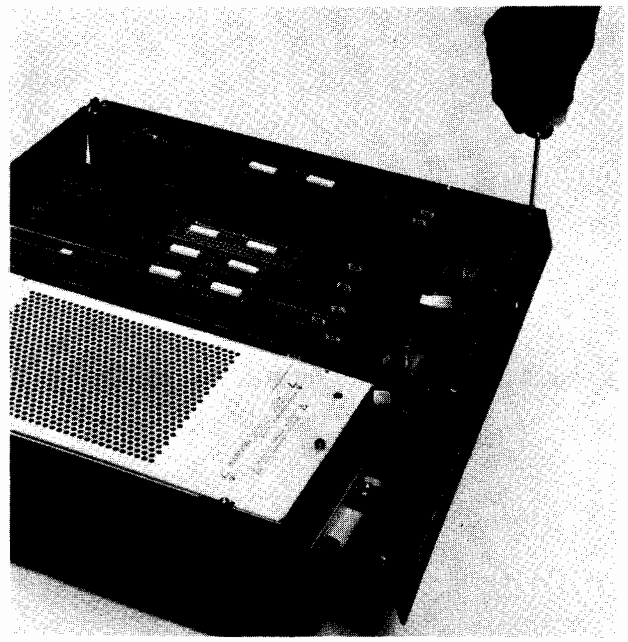
Removing the Yoke

9. The CRT cable assembly should now be free to remove from the terminal.

10. Install the new yoke cable assembly by following the above steps in the reverse order. Be sure to slide the yoke fully against the CRT. (Alignment procedures for positioning the yoke are contained in the "ALIGNMENT" section of this manual.)

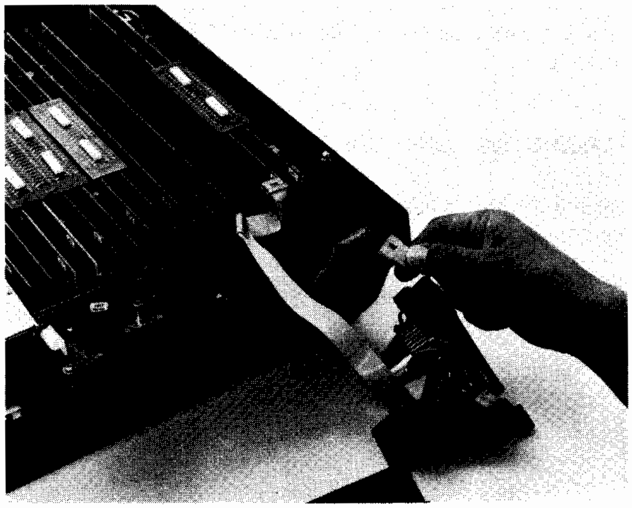
REPLACING THE TAPE DRIVE CABLE ASSEMBLY

1. Loosen the four screws that secure the front tape bezel to the mainframe, and remove the bezel.



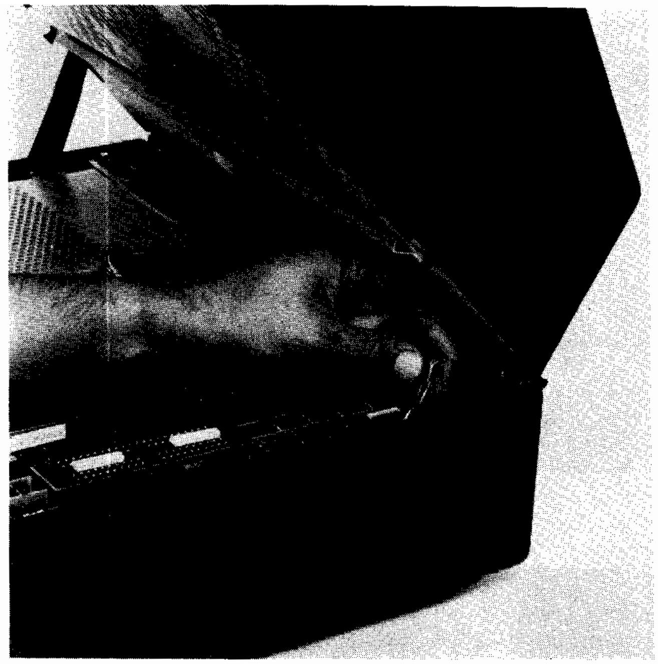
Removing the Front Bezel

2. Remove the two screws that secure each tape drive to the mainframe, and pull up each drive to gain access to the tape drive connector. Disconnect each connector from its tape drive.



Disconnecting the Tape Drive Cable Connectors

3. Disconnect the cable connector from the Read/Write PCA.



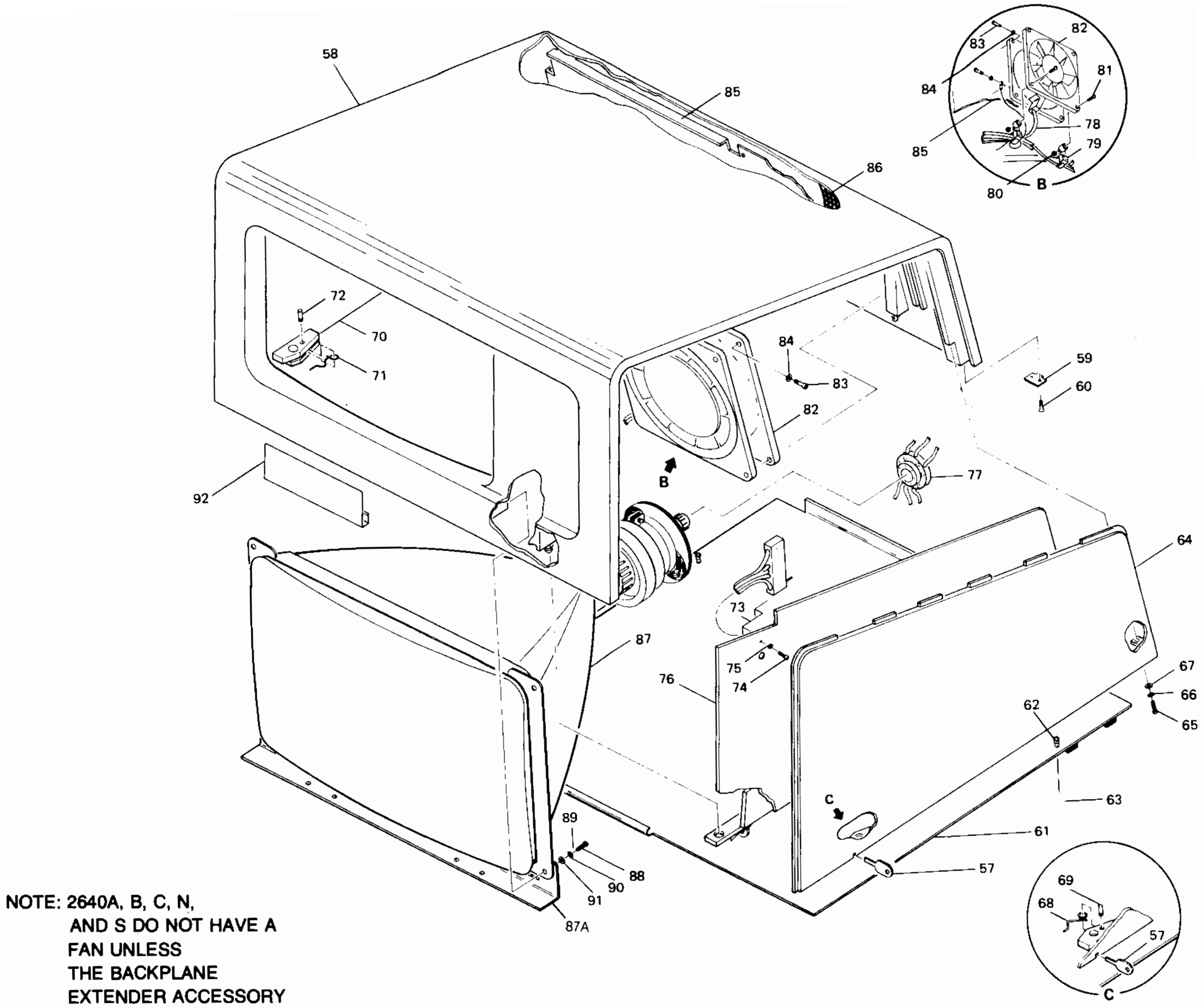
Disconnecting the Read/Write PCA Cable Connector

4. Install the new cable in the reverse order. When tightening the four screws that secure the front bezel, be sure to open and close the tape doors so that they do not bind. If the screws are tightened too much, the tape doors will bind.

REPLACING THE KEYBOARD CABLE ASSEMBLY

1. Follow the procedures for removing the keyboard PCA on page 7-122.

Monitor Assembly



NOTE: 2640A, B, C, N, AND S DO NOT HAVE A FAN UNLESS THE BACKPLANE EXTENDER ACCESSORY 13240A IS INSTALLED.

MONITOR ASSEMBLY

FIG & INDEX NO.	[redacted]	2640B	[redacted]	2640N	[redacted]	2641A	[redacted]	2644A	[redacted]	2645K	[redacted]	2645R	[redacted]	2647A	[redacted]	PART NO.	DESCRIPTION
57		1		1		1		1		1		1		1		02640-00021	*Access Key
58		1		1		1		1		1		1		1		02640-40044	*Display Top (see Notes 1,6)
		1		1		1		1		1		1		1		02640-40045	*Display Top, RFI option -017 (see Notes 1,6)
		1		1		1		1		1		1		1		02640-40042	*Display Top, (see Notes 2, 6)
		1		1		1		1		1		1		1		02640-40043	*Display Top, RFI option -017 (see Notes 2, 6)
		1		1		1		1		1		1		1		02640-40046	*Display Top (see notes 2, 6) (later version)
		1		1		1		1		1		1		1		02640-40047	*Display Top, RFI option -017 (see notes 2, 6) (later version)
		1		1		1		1		1		1		1		02640-60268	*Assembly Kit (used with Display Tops 02640-40046, -40047)
59		2		2		2		2		2		2		2		3110-0099	*Hinge Top
																	(Attaching Parts)
60		4		4		4		4		4		4		4		2360-0196	*Screw, Machine, flh, no. 6-32, 3/8 in.
																	———X———
61		1		1		1		1		1		1		1		02640-00112	*CRT Shield (see Note 5)
																	(Attaching Parts)
62		2		2		2		2		2		2		2		1390-0365	*Plunger, Snap-in
63		2		2		2		2		2		2		2		1390-0366	*Grommet, Snap-in
																	———X———
64		1		1		1		1		1		1		1		02640-40022	*Right Side (see Note 1)
		1		1		1		1		1		1		1		02640-40026	*Right Side, RFI option -017 (see Note 1)
		1		1		1		1		1		1		1		02640-40033	*Right Side (see Note 2)
		1		1		1		1		1		1		1		02640-40037	*Right Side, RFI option -017 (see Note 2)
																	(Attaching Parts)
65		3		3		3		3		3		3		3		2360-0201	*Screw, Machine, ph, no. 6-32, 0.5 in. pozi
66		3		3		3		3		3		3		3		2190-0918	*Washer, Lock, helical, spring-type
67		3		3		3		3		3		3		3		3050-0066	*Washer, Flat, no. 6
																	———X———
68		1		1		1		1		1		1		1		1460-0687	*Spring, wireform, right (earlier version)
		1		1		1		1		1		1		1		1460-1580	*Spring, wireform, right (later version, see Note 3)
		1		1		1		1		1		1		1		1600-0655	*Plate, latching (later version, see Note 3)
																	(Attaching Parts)
69		1		1		1		1		1		1		1		1480-0069	*Pin, 0.125 in., 0.5 in.
																	———X———
70		1		1		1		1		1		1		1		02640-40023	*Left Side (see Note 1)
		1		1		1		1		1		1		1		02640-40027	*Left Side, RFI option -017 (See Note 1)
		1		1		1		1		1		1		1		02640-40034	*Left Side (see Note 2)
		1		1		1		1		1		1		1		02640-40038	*Left Side, RFI option -017 (see Note 2)
																	(Attaching Parts)
		3		3		3		3		3		3		3		2360-0201	*Screw, Machine, ph, no. 6-32, 0.5 in. pozi
		3		3		3		3		3		3		3		2190-0918	*Washer, Lock, helical, spring-type

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
	3	3	3	3	3	3	3	3050-0066	*Washer, Flat, no. 6
									———X———
71	1	1	1	1	1	1	1	02640-60039	*Sweep Cable Assembly (not shown)
	1	1	1	1	1	1	1	1460-0688	*Spring, wireform, left (earlier version)
	1	1	1	1	1	1	1	1460-1579	*Spring, wireform, left (later version, see Note 3)
	1	1	1	1	1	1	1	1600-0711	*Plate, latching (later version, see Note 3)
									(Attaching Parts)
72	1	1	1	1	1	1	1	1480-0069	*Pin, 0.125 in., 0.5 in.
73	—	—	1	1	1	1	1	02640-00034	*Shield, Transformer
									(Attaching Parts)
74	—	—	2	2	2	2	2	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
75	—	—	2	2	2	2	2	2190-0918	*Washer, Lock, Split, no. 6
									———X———
76	1	1	1	1	1	1	1	02640-60095	*Sweep Assembly
77	1	1	1	1	1	1	1	02640-60042	*CRT Cable Assembly
78	—	—	1	1	1	1	1	02640-60138	*Fan Cable Assembly
79	2	2	2	2	2	2	2	1400-0249	*Cable Tie
									(Attaching Parts)
80	2	2	2	2	2	2	2	2420-0001	*Nut, hex, no. 6-32
81	2	2	2	2	2	2	2	2360-0205	*Screw, no. 6-32, 3/4 in.
									———X———
82	1	1	1	1	1	1	1	3160-0208	*Fan (see Note 4)
									(Attaching Parts)
83	4	4	4	4	4	4	4	3030-0064	*Screw, Cap, no. 6-32, 5/8 in.
84	4	4	4	4	4	4	4	2190-0918	*Washer, Lock, spring, no. 6
									———X———
85	—	—	1	1	1	1	1	02640-00074	*Fan Shroud (see Note 6)
86	1	1	1	1	1	1	1	02640-00046	*Screen, 2.5 inch (see Note 7)
	1	1	—	—	—	—	—	02640-00044	*Screen, 13.5 inch
87	1	1	1	1	1	1	1	02640-60084	*CRT/Yoke Assembly
	1	1	1	1	1	1	1	02640-60040	*Yoke
	1	1	1	1	1	1	1	2090-0028	*CRT
87A	1	1	1	1	1	1	1	02640-00055	*Support Retainer
88	4	4	4	4	4	4	4	2510-0107	*Screw, Machine, ph, no. 8-32, 0.5 in.
89	4	4	4	4	4	4	4	2190-0017	*Washer, spring, no. 8
90	1	1	1	1	1	1	1	2190-0010	*Washer, Lock, ext-tooth, no. 8

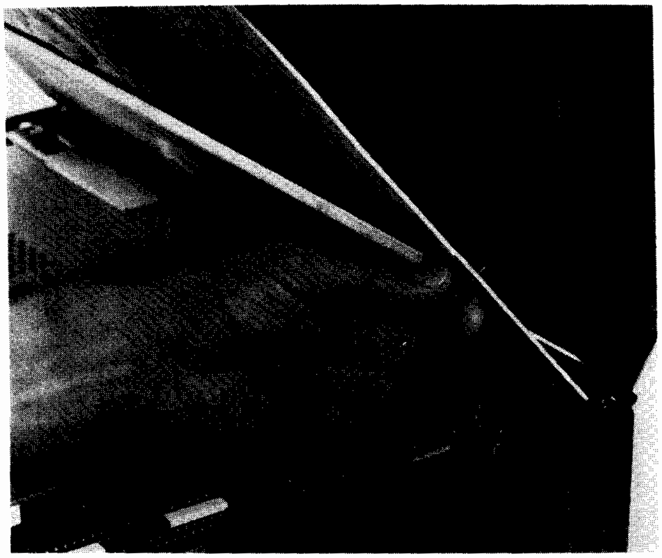
FIG & INDEX NO.	[redacted]	2640B	[redacted]	2640N	[redacted]	2641A	[redacted]	2644A	[redacted]	2645K	[redacted]	2645R	[redacted]	2647A	[redacted]	PART NO.	DESCRIPTION
91	[redacted]	4	[redacted]	4	[redacted]	4	[redacted]	4	[redacted]	4	[redacted]	4	[redacted]	4	[redacted]	3050-0001	*Washer, flat, no. 8
																	———X———
92	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	9320-3173	*Symbol Template (Mathematics) (used in Accessory 13231A-201)
	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	1	[redacted]	9320-3172	*Symbol Template (Line Drawing)

Notes:
1. For olive black terminals.
2. For cocoa brown terminals.
3. Item 61, CRT Shield, part no. 02640-00107, must be used with the later version latching plate and spring.
4. 2640A,B,C,N,S Terminals have fan only if 13240A Backplane Extender accessory is installed.
5. CRT Shield, 02640-00107, is replaced by 02640-00112.
6. Display Top and Fan Shroud must be replaced as a unit.
7. On newer terminals, the screen is part of the display top.

Monitor Assembly Repair and Replacement

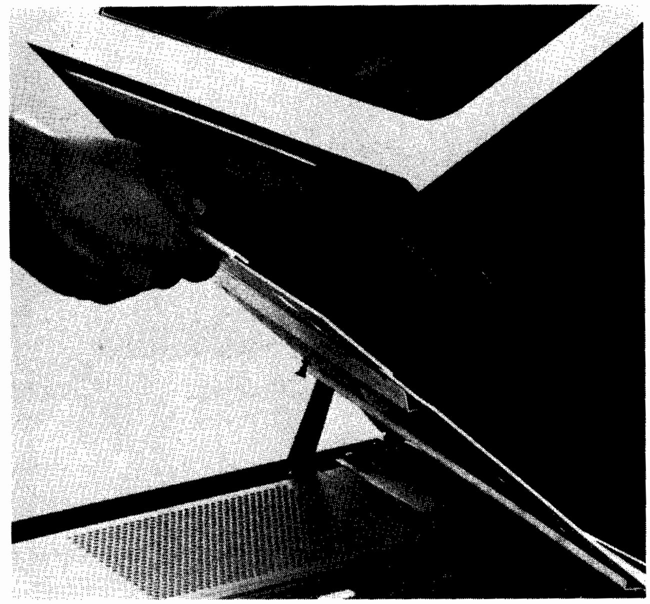
REMOVING THE SHIELD

1. Pull down on the two plungers which retain the CRT shield in place.



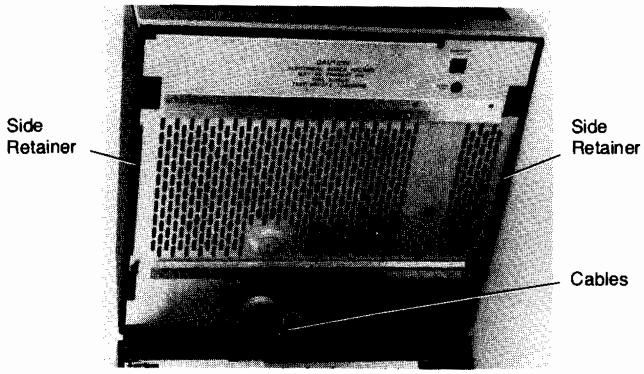
Unlatching the CRT Shield

2. Slide the shield toward the front of the monitor assembly so that the lip of the shield clears the front of the CRT retainer. The shield should now drop out of the monitor assembly.



Removing the CRT Shield

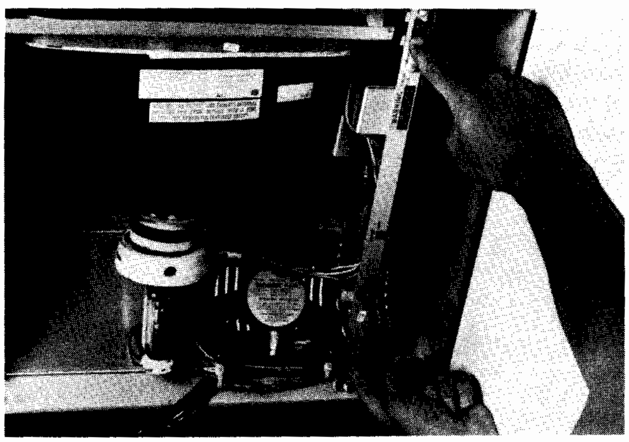
3. When installing the shield, be sure that the cables at the rear of the monitor assembly fit into the recess of the shield. Also, be sure that the lip of the shield is in place before pushing in the two retainers.



Installing the CRT Shield

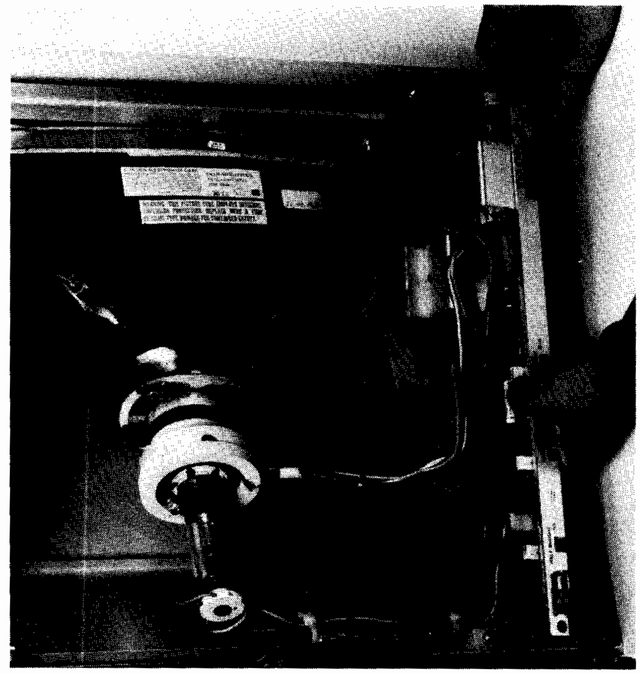
REPLACING THE SWEEP PCA

1. Remove the CRT shield as described above.
2. Unlatch the two retaining latches at the front and rear of the PCA.



Unlatching the Sweep PCA

3. Pull the Sweep PCA out of the monitor assembly as far as the cable connections permit.

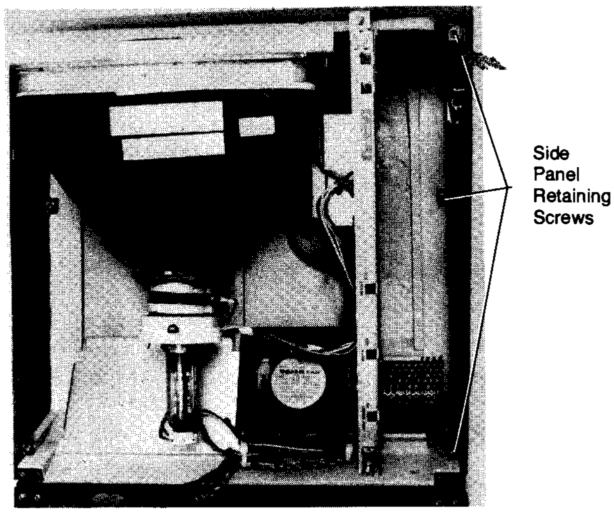


Removing the Sweep PCA

4. Disconnect the cable connections to the Sweep PCA.
5. Install the new Sweep PCA by following the above steps in reverse order.

REPLACING SIDE PANELS

1. Remove the CRT shield.
2. Remove the three screws securing the side panel to the monitor top.

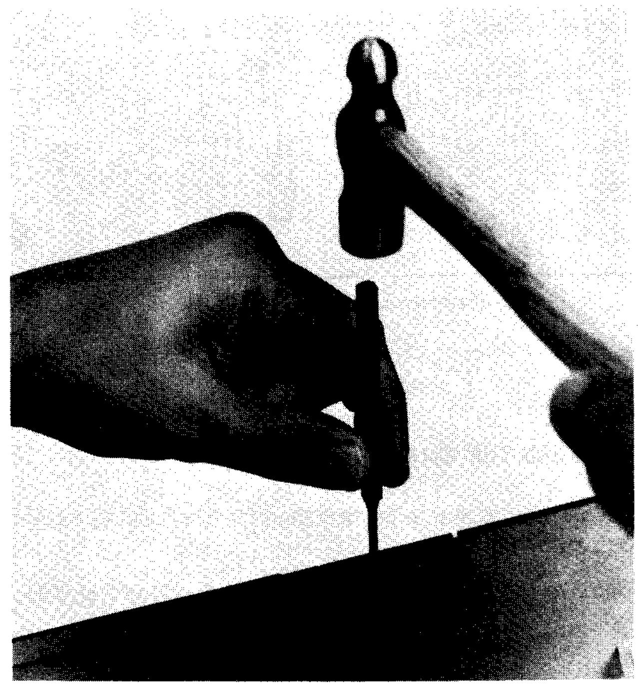


Removing the Side Panel

3. Install the side panel with the hardware removed in step 2.

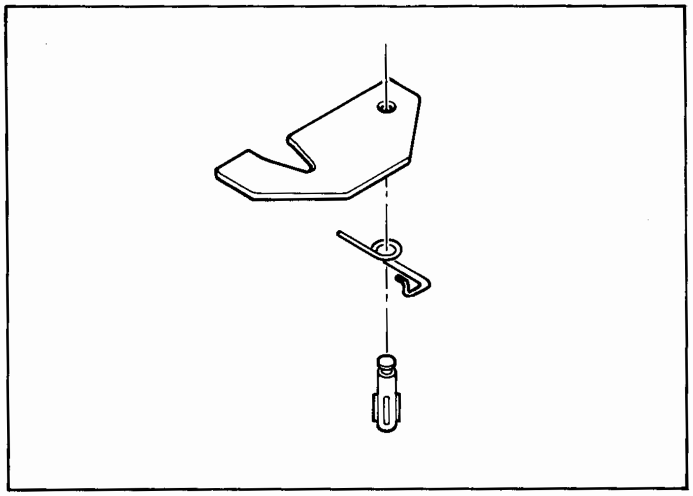
REPAIRING THE LATCHES

1. Remove the side panel containing the defective latch.
2. With a drift and small hammer, drive the pin from the side panel as shown.

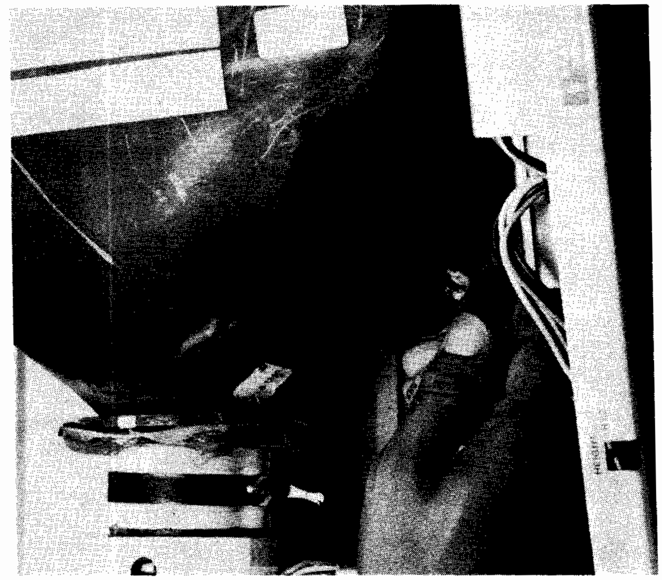


Driving Latch Pin from Side Panel

3. Assemble the appropriate spring and latch (left or right) for the side being repaired.



Assembling Latch and Spring



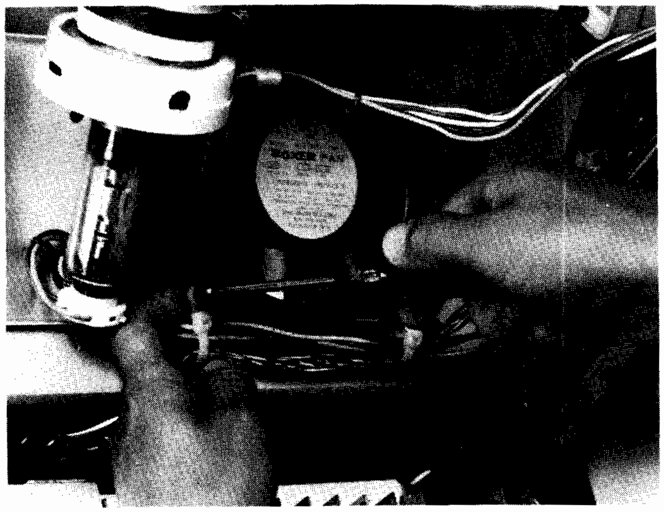
Removing the High Voltage Lead from the CRT

REPLACING THE CRT

1. Follow the procedure for removing the Yoke Cable Assembly on page 7-68.
2. Remove the high voltage lead from the side of the CRT.
3. The CRT should be free to remove from the monitor assembly.
4. Install the CRT by following the above steps in reverse order. The yoke alignment procedure is contained in Section 5, "ALIGNMENT".

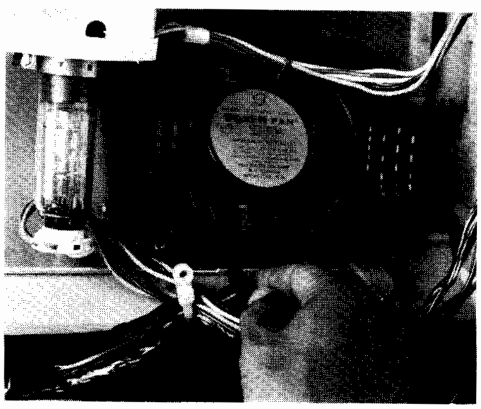
REPLACING THE FAN

1. Remove the CRT shield as described above.
2. Unlatch the two latches securing the Sweep PCA to the monitor top; remove the PCA as far as the cables will allow as described above.
3. Remove the screws securing the two white nylon cable clamps to the fan.



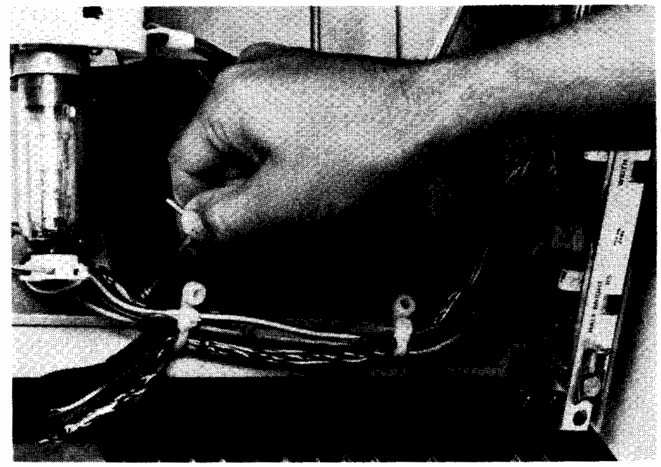
Removing the Fan Cable Clamps

4. Disconnect the fan cable from the fan.



Disconnecting the Fan Cable Connector

5. Using a 7/64 allen wrench, remove the four allen head cap screws securing the fan; the fan should be free to remove from the monitor assembly.



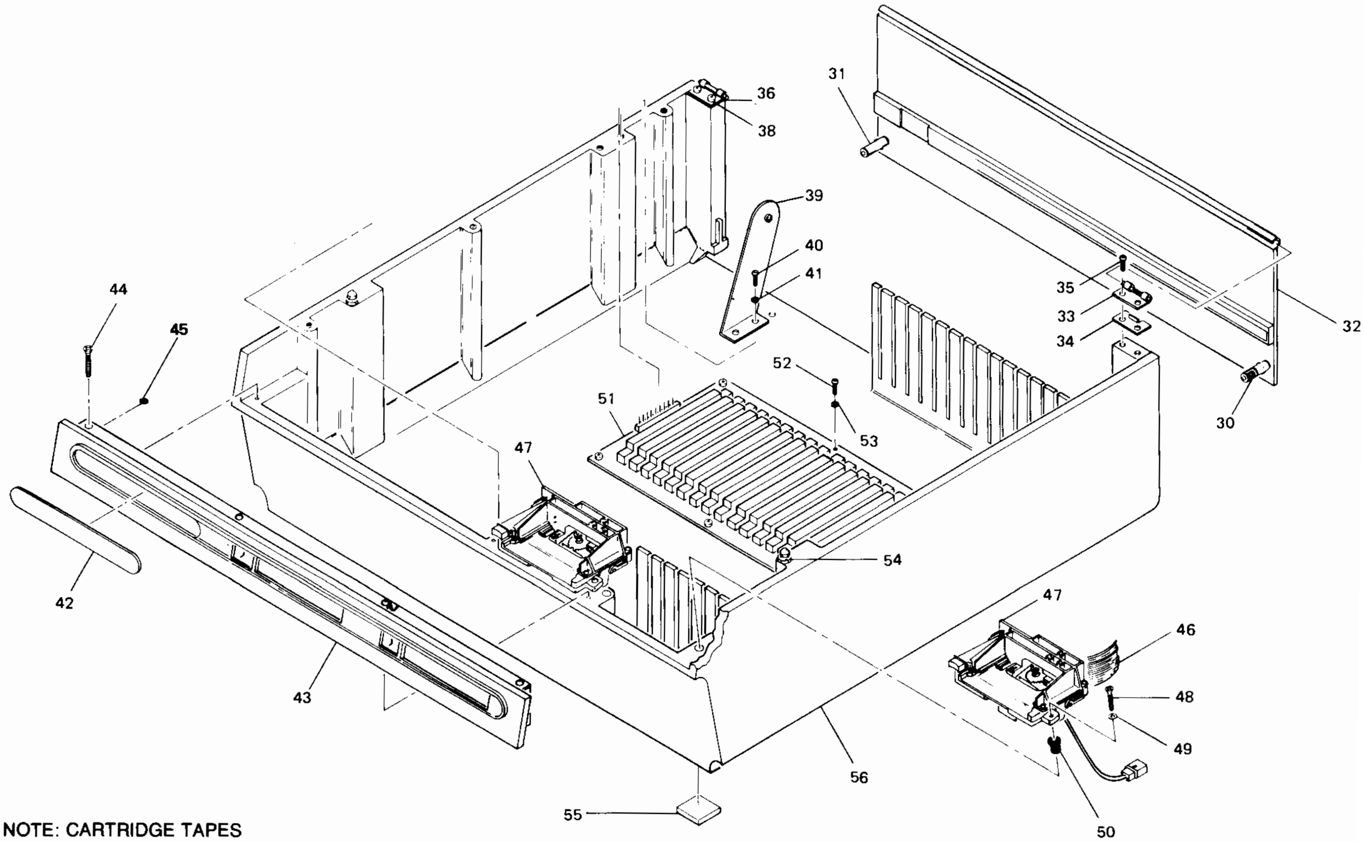
Removing the Four Allen Head Screws Securing the Fan

6. Install the fan by following the above steps in reverse order. Be sure that the air flow arrow on the fan points toward the vents in the monitor shell.

Mainframe

Computer Museum

7-85



NOTE: CARTRIDGE TAPES
ARE NOT USED ON
2640A/B/C/N/S.
ON OTHER TERMINALS
THEY MAY BE OPTIONAL.

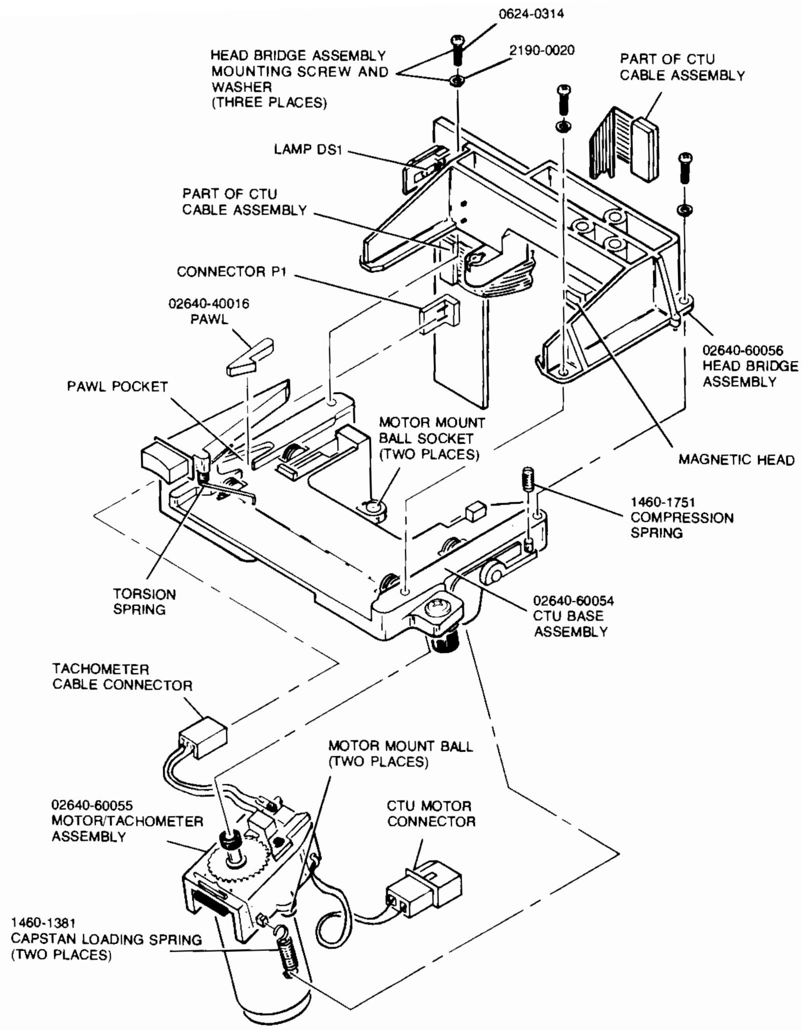
MAINFRAME SHELL AND TAPE UNITS

FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1390-0327	*Latch, door, right
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1390-0326	*Latch, door, left
32	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	02640-20007	*Rear Door (see Note 1)
	—	1	1	1	1	1	1	—	1	1	1	1	1	1	1	02640-20020	*Rear Door (see Note 2)
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3110-0100	*Right Hinge
																	(Attaching Parts)
34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	02640-00025	*Hinge Support
35	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
																	———X———
36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3110-0101	*Left Hinge
																	(Attaching Parts)
37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	02640-00025	*Hinge Support
38	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
																	———X———
39	1	1	1	1	1	1	—	1	1	1	—	1	1	1	1	02640-00010	*Support (see Note 1)
	—	1	1	1	1	1	1	—	1	1	1	1	1	1	1	02640-00091	*Support (see Note 2)
																	(Attaching Parts)
40	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
41	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2190-0851	*Washer, Lock, split, no. 6
																	———X———
42	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-00047	*Front Bezel Insert
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-00068	*Front Bezel Insert (see Note 1)
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-00097	*Front Bezel Insert (see Note 2)
	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	02640-00103	*Front Bezel Insert (see Note 2)
	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	02640-00057	*Front Bezel Insert (see Note 1)
	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	02640-00096	*Front Bezel Insert (see Note 2)
	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	02640-00056	*Front Bezel Insert (see Note 1)
	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	02640-00095	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	02640-00052	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	02640-00104	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	02642-00001	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	02644-00001	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02645-00001	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02645-00010	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	02645-00006	*Front Bezel Insert (see Note 1)

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
	—	—	—	—	1	—	—	02645-00013	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	—	02645-00020	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	1	—	02645-00004	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	1	—	02645-00011	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	—	02645-00005	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	—	—	02645-00012	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	1	02647-00001	*Front Bezel Insert (see Note 2)
	—	—	—	—	—	—	—	02648-00001	*Front Bezel Insert (see Note 1)
	—	—	—	—	—	—	—	02648-00002	*Front Bezel Insert (see Note 2)
43	1	1	1	1	1	1	—	4040-1023	*Front Bezel (see Note 1)
	1	1	1	—	1	1	—	4040-1249	*Front Bezel (see Note 2)
	—	—	1	1	1	1	—	02640-60102	*Front Bezel (option -007 and Accessory 13236B) (see Note 1)
	—	—	1	—	1	1	1	02640-60177	*Front Bezel (option -007 and Accessory 13236B) (see Note 2)
									(Attaching Parts)
44	4	4	4	4	4	4	4	2360-0219	*Screw, Machine, ph, no. 6-32, 1-3/8 in.
45	4	4	4	4	4	4	4	2190-0918	*Washer, Lock, helical, no. 6
									———X———
	—	—	2	2	2	2	2	9162-0061	Mini Cartridge (not shown) (option -007 and Accessory 13236B)
46	—	—	2	2	2	2	2	02640-60066	Ribbon Cable, CTU (used for option -007 and Accessory 13236A/B)
47	—	—	2	2	2	2	2	02640-60050	*CTU Transport Assy (option -007 and Accessory 13236A/B) (Earlier Version)
	—	—	2	—	2	2	2	02640-60254	*CTU Transport Assy (option -007 and Accessory 13236A/B) (Later Version)
									(Attaching Parts)
48	—	—	2	2	2	2	2	2360-0205	*Screw, Machine, ph, no. 6-32, 3/4 in.
49	—	—	2	2	2	2	2	3050-0227	*Washer, Flat, no. 6
50	—	—	2	2	2	2	2	1520-0067	*Shock Mount
									———X———
	—	—	2	2	2	2	2	1460-1381	**Spring, Capstan Loading
	—	—	1	1	1	1	1	02640-40016	**Pawl
	—	—	1	1	1	1	1	1460-1751	**Spring, Compression
	—	—	1	1	1	1	1	02640-60056	**Head Bridge Assembly
									(Attaching Parts)
	—	—	3	3	3	3	3	0624-0314	**Screw, Tapping, no. 6-40
	—	—	3	3	3	3	3	2190-0020	**Washer, Lock, splint, no. 4
									———X———

FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	2140-0450	***Indicator Lamp DS1
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	4040-1017	***Shield, Light
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	02640-60055	**Motor/Tachometer Assembly
																	(Attaching Parts)
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	1460-1381	**Extension Spring
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	1600-1014	**CTU Cage
																	———X———
	—	—	—	—	—	1	1	1	1	1	1	1	1	1	1	02640-60054	**CTU Base Assembly (see Note 1)
51	1	1	1	1	1	—	—	—	—	—	—	—	—	—	—	02640-60153	*Backplane Assembly, 9-Connector (Earlier version)
	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	02640-60075	*Backplane Assembly
	—	—	—	—	—	1	1	—	1	1	1	1	1	1	1	02640-60158	*Backplane Assembly, 15-Connector (Earlier version)
	—	—	—	—	—	1	1	—	1	1	1	1	1	1	1	02640-60245	*Backplane Assembly, 15-Connector (Later Version)
																	(Attaching Parts)
52	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
53	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	2190-0851	*Washer, Lock, split, no. 6
																	———X———
54	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0570-0528	*Stud, retainer
55	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0430-0285	*Bumper, rubber
56	1	1	1	1	1	1	[illegible]	1	1	1	1	1	1	1	1	02640-40001	*Mainframe Shell (see Note 1)
57	—	1	1	1	1	1	1	—	1	1	—	1	1	1	1	02640-40035	*Mainframe Shell (see Note 2)
	—	1	—	1	1	1	1	—	1	—	1	—	1	1	1	02640-40039	*Mainframe Shell (used with RFI option -017) (see Note 2)

Notes: 1. For olive black terminals.
2. For cocoa brown terminals.
3. Option -007 and Accessory 13236A/B add cartridge tapes to some terminals.

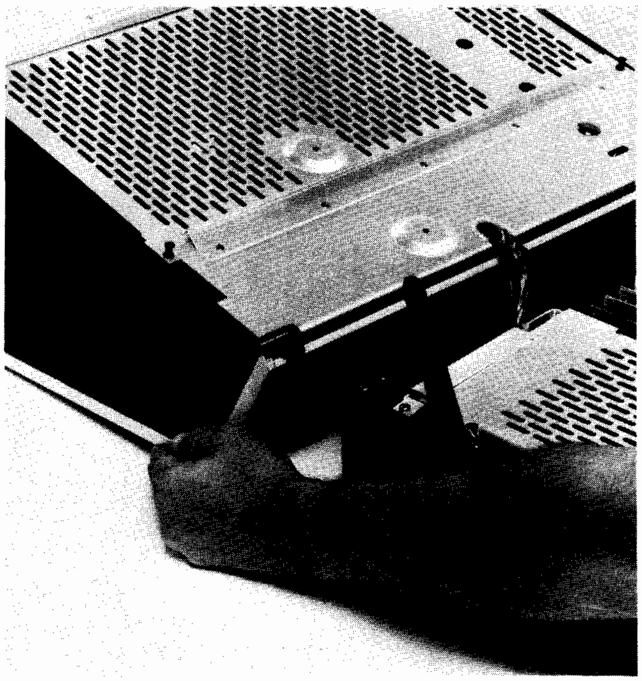


CTU TRANSPORT ASSEMBLY

Mainframe Shell Repair and Replacement

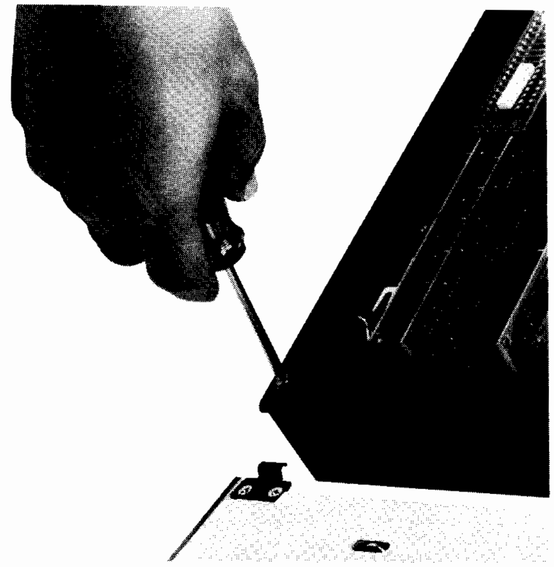
REPLACING THE REAR DOOR

1. Open the terminal until the monitor assembly rests on its top on the work surface. Carefully lift the monitor assembly until the two hinges separate from the mainframe.



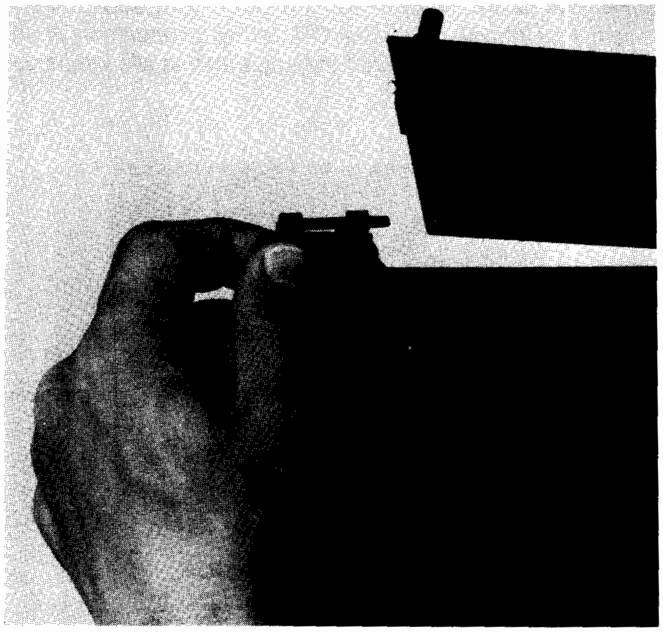
Removing the Monitor Assembly from the Mainframe

2. Remove the two screws that secure one of the hinge halves to the mainframe.



Removing the Mainframe Door Hinges

3. Slide the half-hinge out from the side of the rear mainframe until the hinge clears the pin on the door. The rear door should now be free to slide out of the other hinge.



Removing the Rear Door

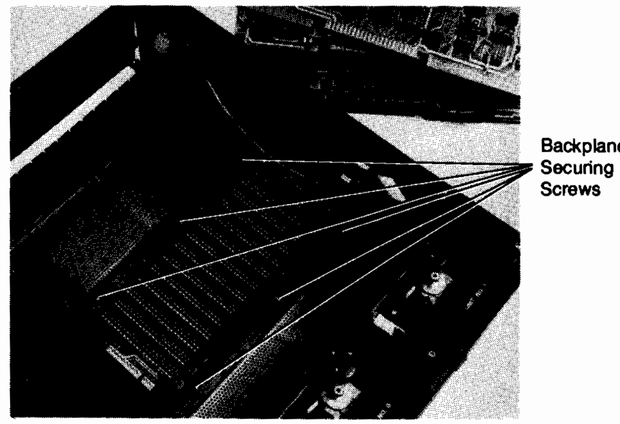
4. Install the rear door by performing the above steps in reverse order.

REPLACING FOOT PADS

1. The foot pads (rubber bumpers), part no. 0403-0285, are glued to the mainframe using the self-adhesive back on the pads.

REPLACING THE BACKPLANE

1. Remove top cover of power supply; one screw holds it on.
2. Remove the power supply (refer to procedures on pages 7-103 and 7-106.
3. Remove all PCAs from the backplane connectors. If your terminal has cartridge tapes, disconnect the tape drive cable connector and the two ribbon cable connectors from the Read/Write PCA before removing the PCA.

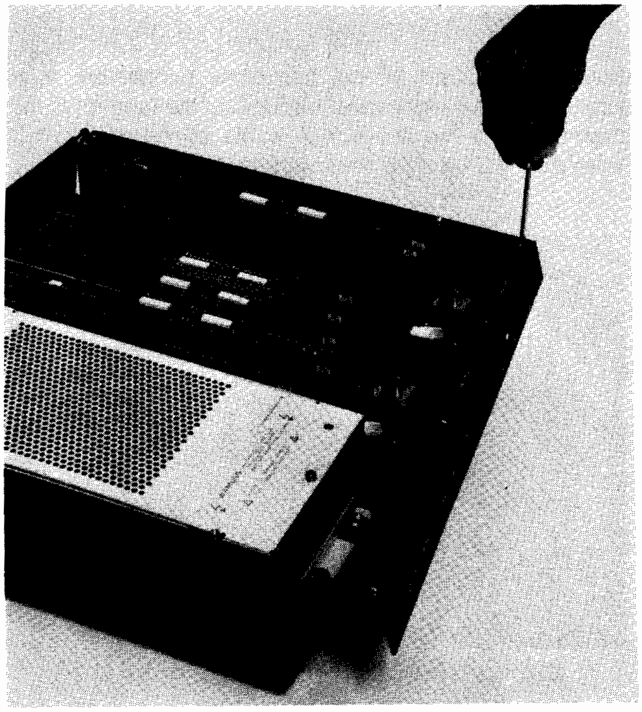


Preparing for Backplane Removal

4. Remove the six screws (2640's have four) securing the backplane to the mainframe. The backplane should be free to remove from the mainframe.
5. Install the backplane by following the above steps in reverse order.

REPLACING THE FRONT BEZEL

1. Loosen the four screws securing the front bezel to the mainframe.

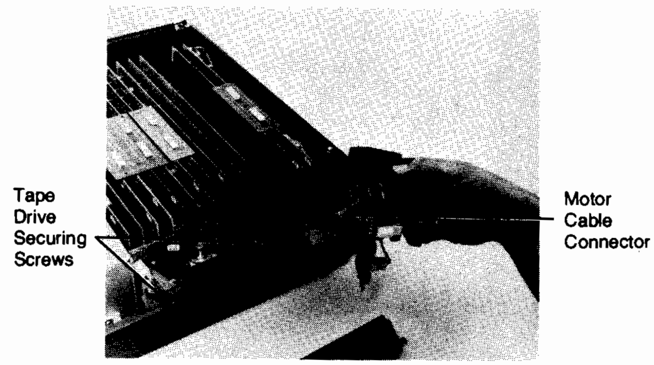


Removing the Front Bezel

2. Install the bezel by positioning it over the four screw holes in the mainframe, and tightening the screws until the bezel is held in place. Don't tighten the screws too much because you may distort the bezel. If the terminal has tapes, check that the tape doors do not bind while you tighten the screws.

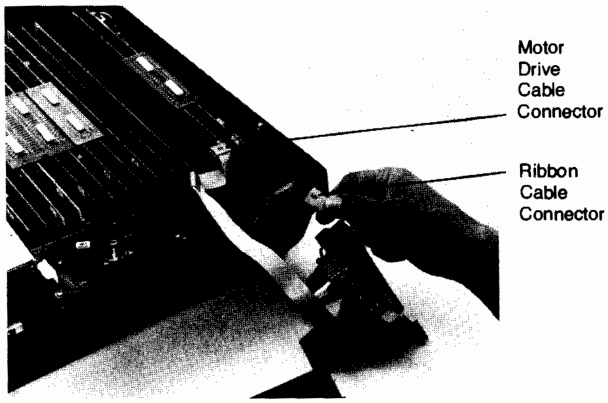
REPLACING THE CTU TRANSPORT ASSEMBLY

1. Remove the front bezel (see procedure above.)
2. Remove the two screws securing the CTU transport assembly to the mainframe. (If the left CTU transport assembly is being replaced, remove the right transport also to allow removal of the ribbon cable.)



Removing the CTU Transport

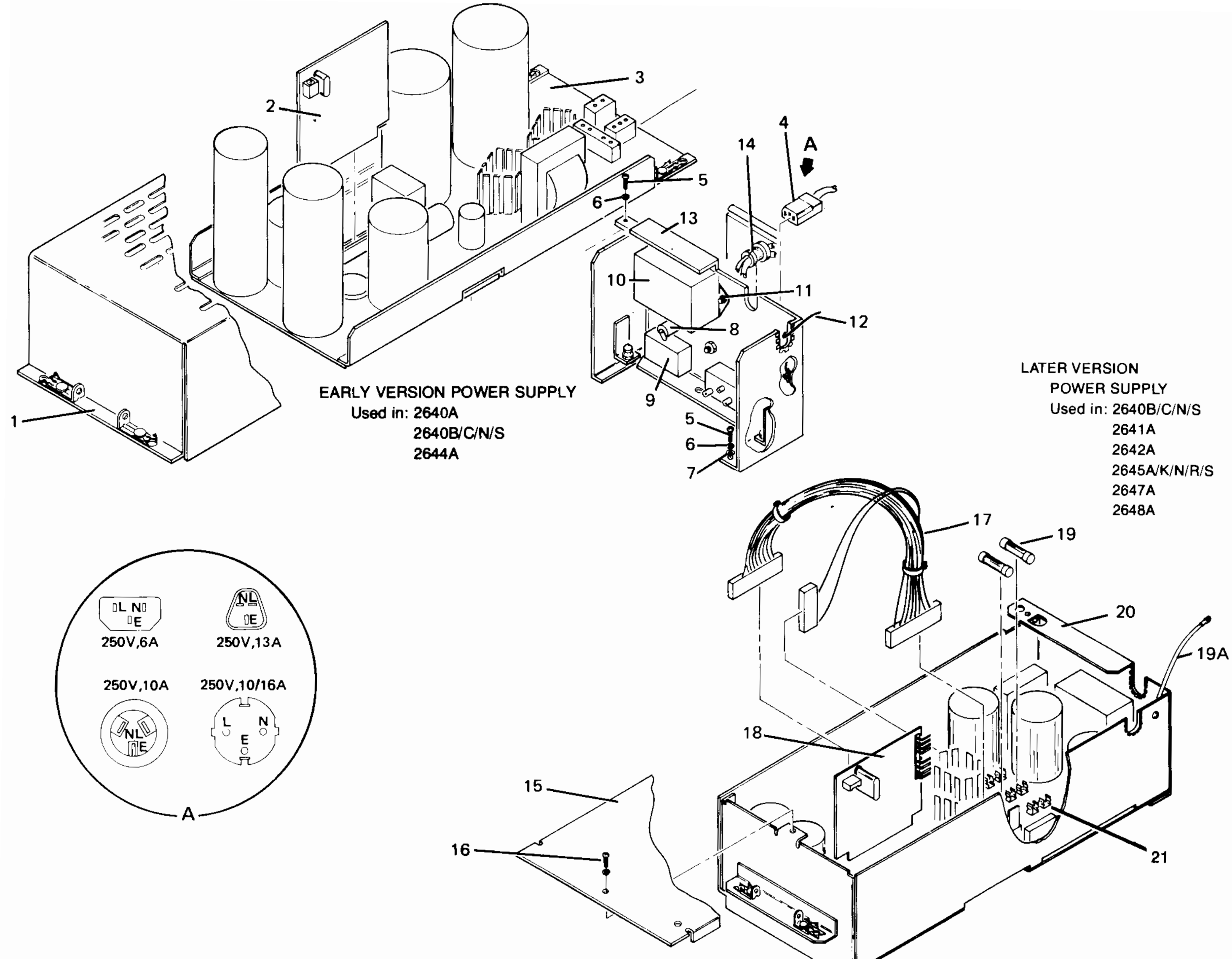
3. Disconnect the motor drive cable connector, and disconnect the ribbon cable connector at the Read/Write PCA.



Removing the CTU Transport After Disconnecting the Cables

4. The transport is now free from the mainframe.
5. Install the transport following the above steps in reverse order. Be sure to dress the cables below the transports before securing them in place.

Power Supplies



POWER SUPPLY

FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	02640-60030	*Keyboard and Cable Assembly
1	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	02640-00001	*Housing
2	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	02640-60029	*Power Supply Control Assembly
3	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	02640-60004	*Power Supply Assembly
4	1	1	1	1	1	—	1	1	1	1	1	1	1	1	1	8120-1378	*Power Cord Set, 250V, 6A (standard)
	1	1	1	1	1	—	1	1	1	1	1	1	1	1	1	8120-1351	*Power Cord Set, 250V, 13A (used on option 900)
	1	1	1	1	1	—	1	1	1	1	1	1	1	1	1	8120-1369	*Power Cord Set, 250V, 10A (used on option 901)
	1	1	1	1	1	—	1	1	1	1	1	1	1	1	1	8120-1689	*Power Cord Set, 250V, 10/16A (used on option 902)
	—	—	—	—	—	—	1	1	1	1	1	1	1	1	1	8120-2104	*Power Cord Set, 250V, 6A (used on option 906)
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	02640-60027	*Rear Panel Assembly
																	(Attaching Parts)
5	2	2	2	2	2	—	—	2	—	—	—	—	—	—	—	2360-0197	*Screw, Machine, ph, no. 6-32, 3/8 in.
6	2	2	2	2	2	—	—	2	—	—	—	—	—	—	—	2190-0918	*Washer, Lock, split, no. 6
7	2	2	2	2	2	—	—	2	—	—	—	—	—	—	—	3050-0066	*Washer, Flat, no. 6
																	———X———
8	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2110-0464	**Fuseholder Body
																	(Attaching Parts)
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	1400-0090	**Washer, Neoprene, 5/8 in. OD
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2190-0037	**Washer, Lock, int-tooth
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2950-0054	**Nut, Hex, 1/2-28
																	———X———
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2110-0465	**Fuseholder Cap
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2110-0365	**Fuse, 4A, SB, 250V (F1)
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2110-0303	**Fuse, 24, SB, 250V (F1) (used for option 015)
9	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	3101-0646	**Power Switch
																	(Attaching Parts)
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	0590-0012	**Nut, Self-Locking, knurled, no. 15/32-32
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2190-0102	**Washer, Lock, int-tooth, 7/16 in. ID
	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	2950-0035	**Nut, Hex, 15/32-32
																	———X———
10	1	1	1	1	1	—	—	1	—	—	—	—	—	—	—	9135-0028	**Line Filter
																	(Attaching Parts)
11	2	2	2	2	2	—	—	2	—	—	—	—	—	—	—	2420-0003	**Nut, Plain, no. 6
																	———X———

EARLY VERSION POWER SUPPLY (Continued)

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
12	1	1	—	1	—	—	—	02640-60083	**Ground Wire
	1	1	—	1	—	—	—	0890-0006	**4 inches Hi-Shrink Tubing
									(Attaching Parts)
	1	1	—	1	—	—	—	0362-0332	**Ring Lug
	1	1	—	1	—	—	—	2190-0008	**Washer, Lock, ext-tooth
									———X———
13	1	1	—	1	—	—	—	02640-00042	**Rear Panel and Connector Housing
14	1	1	—	1	—	—	—	0400-0082	*Channel Grommet

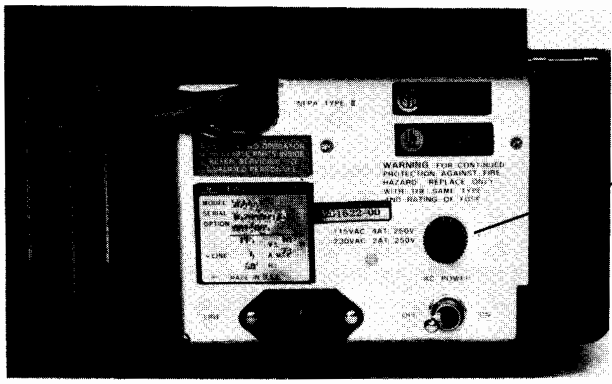
LATER VERSION POWER SUPPLY

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
15	1	1	1	—	1	1	1	02640-00064	*Cover, power supply
									(Attaching Parts)
16	1	1	1	—	1	1	1	2360-0115	*Screw, Machine, ph, no. 6-32, 0.312 in., with lock washer
									— — — X — — —
17	1	1	1	—	1	1	1	02640-60148	*Cable Assembly
	—	—	—	1	1	1	—	02640-60225	*Power Supply Control PCA (4 BVDC) (also used in 2649A/B/C)
18	1	1	1	—	1	1	1	02640-60169	*Power Supply Control Assembly
19	1	1	1	—	1	1	1	2110-0202	*Fuse, 0.5A, 250V (not used for option 015)
	1	1	1	—	1	1	1	2110-0365	*Fuse, 4A, SB, 250V (not used for option 015)
	1	1	1	—	1	1	1	2110-0235	*Fuse, 0.2A, 250V (used in option 015) (long fuse)
	1	1	1	—	1	1	1	2110-0303	*Fuse, 2A, SB, 250V (used in option 015) (long fuse)
	1	1	1	—	1	1	1	2110-0588	*Fuse, 200 mA, SB, 250V (used in option 015) (short fuse)
	1	1	1	—	1	1	1	2110-0587	*Fuse, 2A, SB, 250V (used in option 015) (short fuse)
19A	1	1	1	—	1	1	1	02640-60083	Cable Assembly
20	1	1	1	—	1	1	1	02640-60202	*Power Assembly
	—	—	—	1	1	1	—	02640-60230	*Power Supply Assembly (48 VDC) (also used in 2649A/B/C)
21	—	—	—	1	1	1	—	02640-60226	*Power Supply Main PCA (48 VDC) (also used in 2649A/B/C)

Power Supply Repair and Replacement

REPLACING FUSES

A. Earlier Version Supply — one fuse in back, under door.

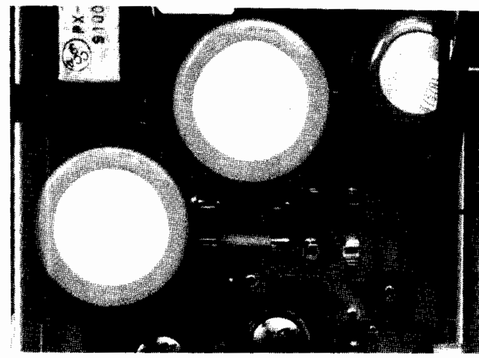


Earlier Version Power Supply Fuse Location

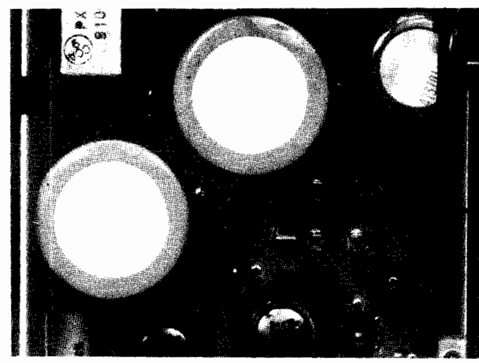
1. Lift rear door, remove fuse by turning fuse holder counter-clockwise.
2. Replace fuse with correct rating (for 115-volt, use 4A, slo-blo, 250V; for 230-volt, use 2A, slo-blo, 250V).

B. Later Version Supply — two fuses under power supply cover.

1. Remove power supply cover; one screw holds it on.
2. Replace fuse(s) with correct rating and in proper position. (see figure 2-8 for fuse location and positioning).



(115-volt)

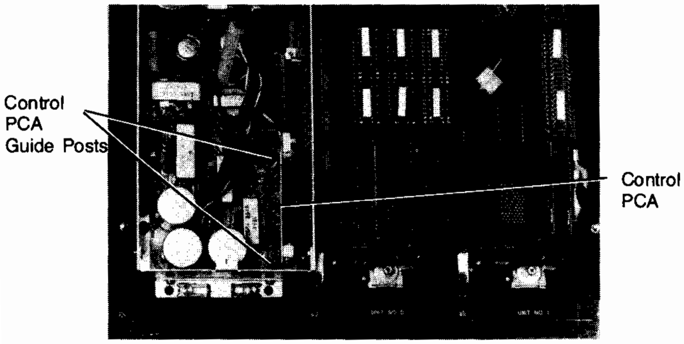


(230-volt)

Later Version Power Supply Fuse Locations

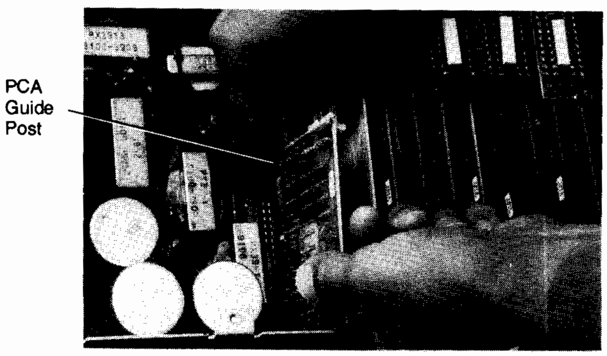
REPLACING POWER SUPPLY CONTROL PCA

1. The power supply control PCA is held in place by its mating connector on the power supply and two slotted guide posts that contain detents to lock the PCA in place.



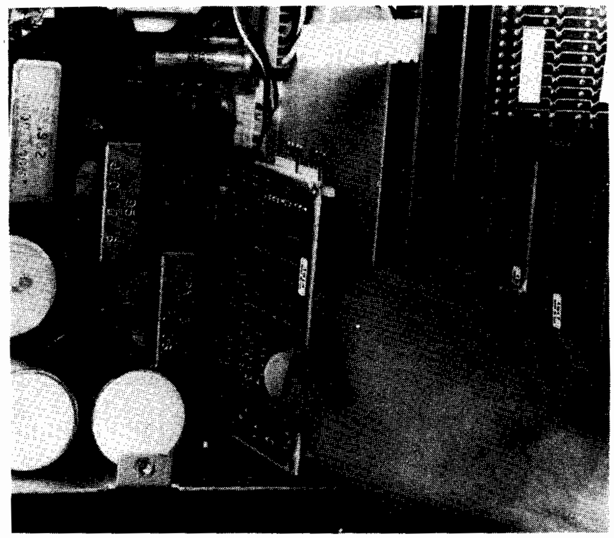
Power Supply Control PCA and Guide Posts

2. To remove the PCA, pull one of the guide posts slightly away from the PCA's edge to free the detent, then carefully rock the PCA up and out of its mating connector on the power supply.



Removing the Power Supply Control PCA

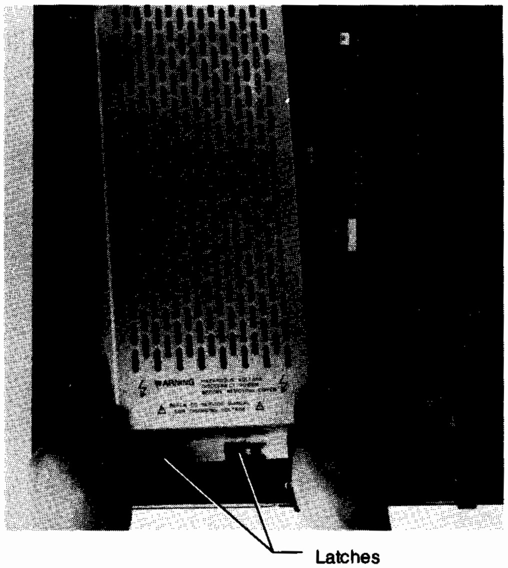
3. To replace the PCA, align the PCA's edges with the guide post slots, and press down firmly on the PCA until it is seated in its mating connector on the power supply and locked in place by the guide post detents.



Replacing the Power Supply Control PCA

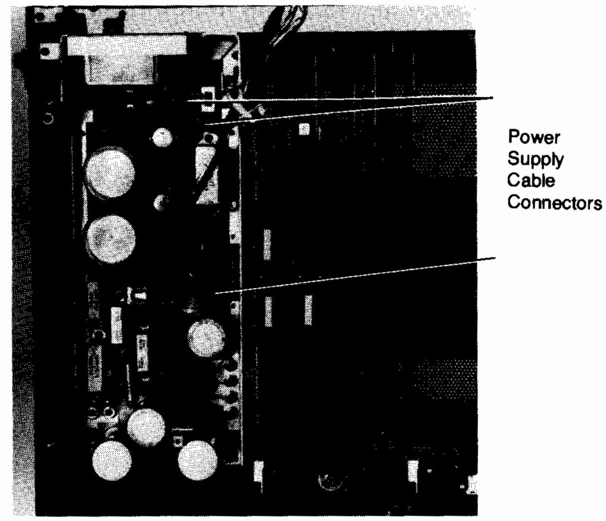
REPLACING EARLIER VERSION POWER SUPPLY

1. Unlatch the power supply top cover; two latches at the bottom front of the power supply secure it in place. After unlatching it, lift off the top cover.



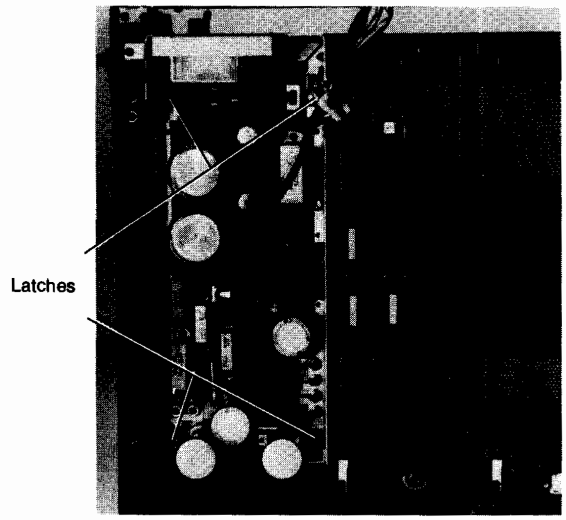
Removing the Top Cover on Earlier Version Power Supply

2. Disconnect the three cable assemblies from their mating connectors on the power supply.

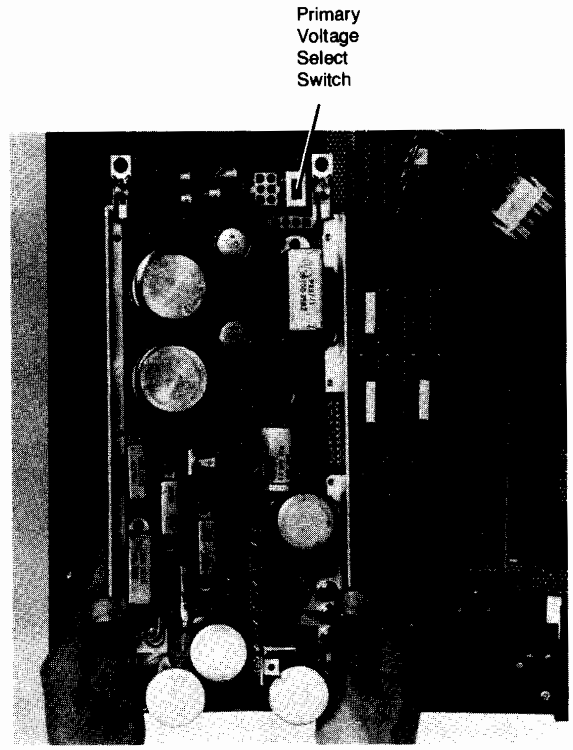


Cable Connections in Earlier Version Power Supply

3. Unlatch the four latches (one at each corner) securing the power supply to the mainframe. Now, lift the power supply out of the mainframe; the rear panel of the supply will remain in place.



The Four Latches that Secure the Earlier Version Power Supply

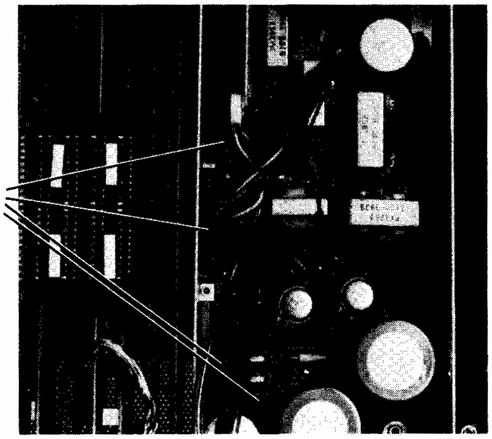


Removing Earlier Version Power Supply

4. Install the power supply by performing the above steps in reverse order. Be careful not to damage the backplane connector pins lowering the power supply into the mainframe. Be sure to set the primary voltage select switch to match the primary power voltage at the power cord (115 VAC or 230 VAC).

REPLACING LATER VERSION POWER SUPPLY

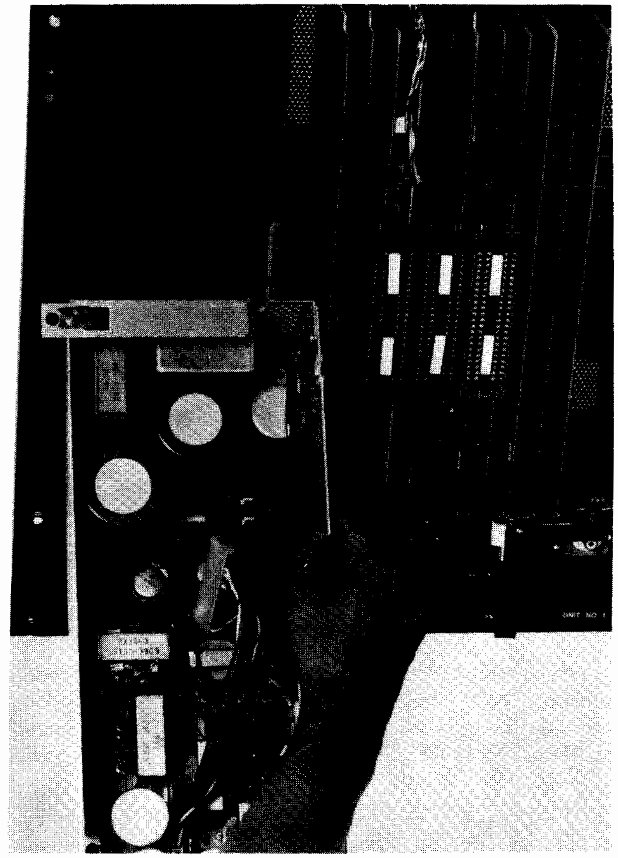
1. Lift off the top cover to the power supply; one screw holds it on.
2. Disconnect the cable connectors shown in the figure below.



Power Control Connectors

Cable Connections in Later Version Power Supply

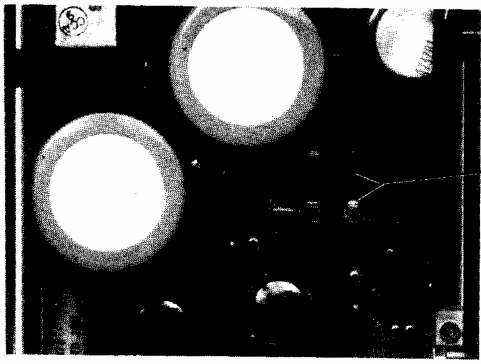
3. Unlatch the three latches that hold the power supply in place.
4. Lift the power supply out of the mainframe.



Lifting Power Supply Out of Mainframe

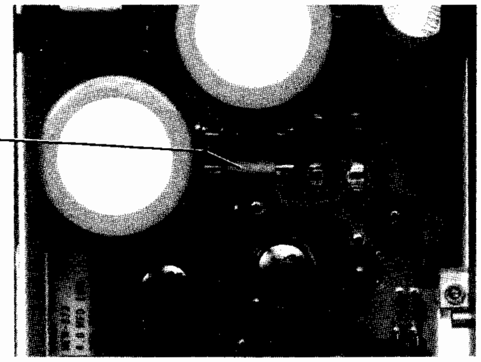
5. Install the power supply by following the above steps in reverse order.

SETTING POWER SUPPLY FOR 230-VOLT OPERATION



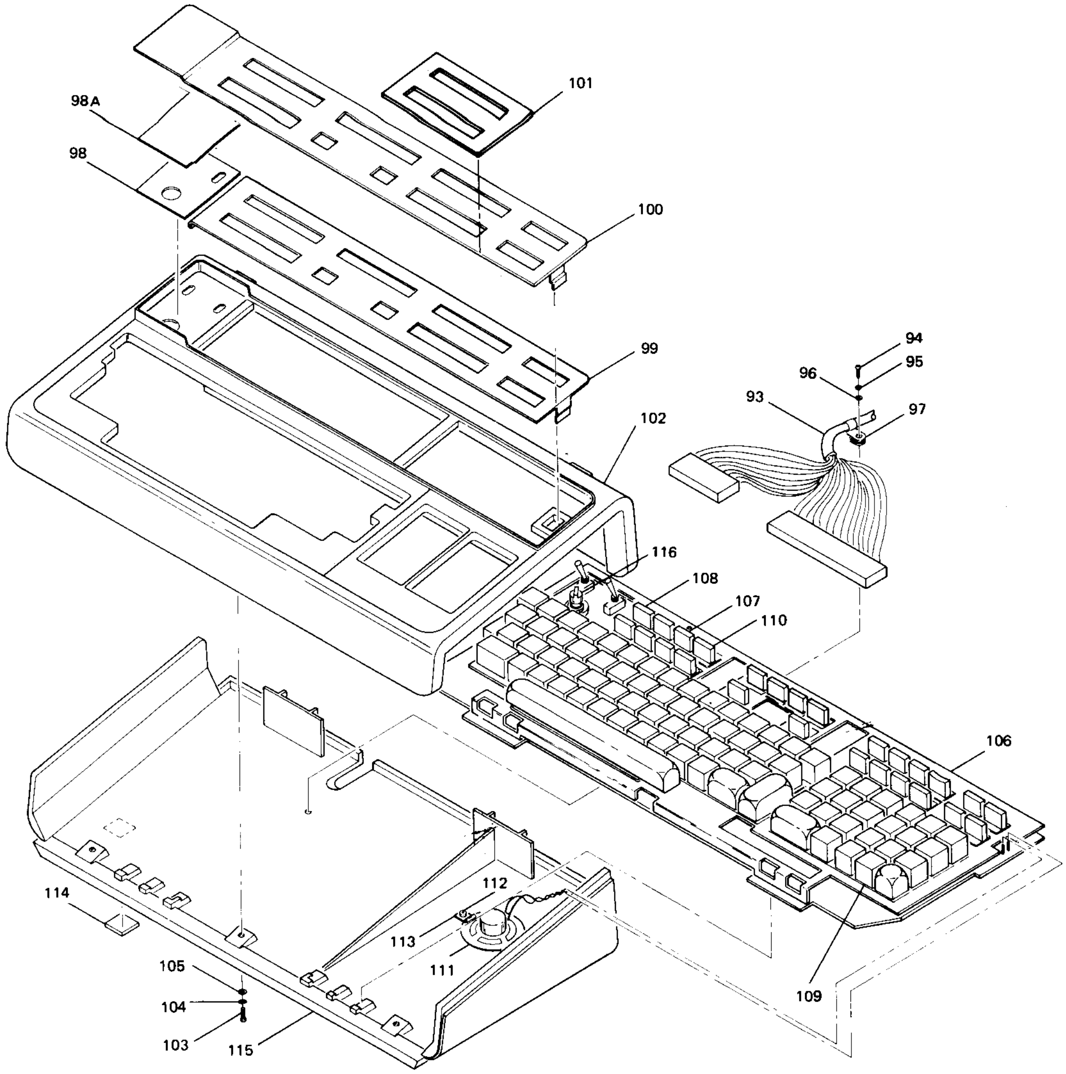
Setting 230-Volt Operation in Later Version Power Supply

SETTING POWER SUPPLY FOR 115-VOLT OPERATION



Setting 115-Volt Operation in Later Version Power Supply

Keyboards



KEYBOARD ASSEMBLY

FIG & INDEX NO.	2640A	2640B	2640C	2640N	2640S	2641A	2642A	2644A	2645A	2645K	2645N	2645R	2645S	2647A	2648A	PART NO.	DESCRIPTION
	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-60030	*Keyboard and Cable Assy
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-60145	*Keyboard and Cable Assy (see Note 1)
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-60180	*Keyboard and Cable Assy (see Note 2)
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-60187	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	02640-60206	*Keyboard and Cable Assy (UK opt -005) (see Note 2)
	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	02640-60175	*Keyboard and Cable Assy (See Note 2)
	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	02640-60113	*Keyboard and Cable Assy, Norwegian (see Note 1)
	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	02640-60179	*Keyboard and Cable Assy, Norwegian (see Note 2)
	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	02640-60188	*Keyboard and Cable Assy, Norwegian (RFI opt -017) (see Note 2)
	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	02640-60178	*Keyboard and Cable Assy, Swedish (see Note 2)
	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	02640-60189	*Keyboard and Cable Assy, Swedish (RFI opt -017) (see Note 2)
	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	02640-60092	*Keyboard and Cable Assy (see Note 1)
	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	02640-60176	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	02640-60207	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	02640-60002	*Keyboard and Cable Assy
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02640-60001	*Keyboard and Cable Assy (see Note 1)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02640-60015	*Keyboard and Cable Assy (RFI opt -017) (see Note 1)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02640-60023	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02640-60026	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	02640-60031	*Keyboard and Cable Assy
	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	02640-60028	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	02640-60033	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	02640-60007	*Keyboard and Cable Assy (see Note 1)
	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	02640-60020	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	02640-60022	*Keyboard and Cable Assy (see Note 2)

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
	—	—	—	—	—	—	—	02645-60027	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	—	02646-60002	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	1	02647-60002	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	—	1	02647-60003	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
	—	—	—	—	—	—	—	02648-60001	*Keyboard and Cable Assy (see Note 1)
	—	—	—	—	—	—	—	02648-60005	*Keyboard and Cable Assy (see Note 2)
	—	—	—	—	—	—	—	02648-60006	*Keyboard and Cable Assy (RFI opt -017) (see Note 2)
93	1	1	1	1	1	1	1	02640-60160	*Keyboard and Cable Assembly
									(Attaching Parts)
94	1	1	1	1	1	1	1	2360-0201	**Screw, Machine, ph, no. 6-32, 0.5 in.
95	1	1	1	1	1	1	1	2190-0918	**Washer, Lock, spring, no. 6
96	1	1	1	1	1	1	1	3050-0066	**Washer, Flat, 0.147 ID, 0.375 in. OD
97	1	1	1	1	1	1	1	1400-0440	**Cable Clamp
									———X———
98	1	1	—	1	—	—	—	7120-4403	**Baudrate Label (standard) (see Note 1)
98	1	1	—	1	—	—	—	7120-6387	**Baudrate Label (standard) (see Note 2)
98	—	—	1	—	1	1	—	7120-5486	**Baudrate Label (standard) (see Note 1)
98	—	—	1	—	1	1	—	7120-6388	**Baudrate Label (standard) (see Note 2)
98	—	—	1	—	—	—	—	7120-5485	**Baudrate Label (accessories 13260C/D) (see Note 1)
98	—	—	1	—	—	—	—	7120-6386	**Baudrate Label (accessories 13260C/D) (see Note 2)
98A	1	1	1	—	1	1	1	4040-1356	**Cover, Baudrate Label
99	—	—	—	—	—	—	—	02640-00004	**Keyboard Overlay (standard)
99	1	1	—	—	—	—	—	02640-00059	**Keyboard Overlay (standard) (see Note 1)
99	1	1	—	—	—	—	—	02640-00099	**Keyboard Overlay (standard) (see Note 2)
99	—	—	—	—	—	—	—	02640-00051	**Keyboard Overlay (standard) (see Note 1)
	—	—	1	—	—	—	—	02641-00002	**Keyboard Overlay (standard) (see Note 1)
	—	—	1	—	—	—	—	7120-7569	**Keyboard Overlay (standard) (see Note 2)
99	—	—	—	—	—	—	—	02644-00002	**Keyboard Overlay (standard) (see Note 1)
99	—	—	—	—	—	—	—	02644-00005	**Keyboard Overlay (standard) (see Note 2)
	—	—	—	—	1	—	—	7120-7568	**Keyboard Overlay (standard) (see Note 2)
	—	—	—	—	—	1	—	02640-00071	**Keyboard Overlay (standard) (see Note 1)
	—	—	—	—	—	1	—	7120-7570	**Keyboard Overlay (standard) (see Note 2)
	—	—	—	—	—	—	1	7120-7484	**Keyboard Overlay (standard) (see Note 2)

FIG & INDEX NO.	2640B	2640N	2641A	2644A	2645K	2645R	2647A	PART NO.	DESCRIPTION
100	—	—	—	—	—	—	—	02644-00003	**Keyboard Overlay (accessories 13260C/D) (see Note 1)
100	—	—	—	—	—	—	—	7120-6925	**Keyboard Overlay (accessories 13260C/D) (see Note 2)
100	—	—	1	—	—	—	—	7120-7569	**Keyboard Overlay (accessories 13260C/D) (see Note 2)
101	—	—	5	—	5	5	—	7120-5525	**Function Key Overlay
102	1	1	1	1	1	1	—	02640-40008	**Keyboard Top (see Note 1)
102	1	1	—	—	—	—	1	02640-40030	**Keyboard Top (see Note 2)
									(Attaching Parts)
103	5	5	5	5	5	5	5	2360-0203	**Screw, Machine, ph, no. 6-32, 0.625 in.
104	5	5	5	5	5	5	5	2190-0918	**Washer, Lock, spring, no. 6
105	5	5	5	5	5	5	5	3050-0066	**Washer, Flat, 0.147 in. ID, 0.375 in. OD
									———X———
106	1	1	1	1	1	1	1	02640-60018	**Keyboard Printed Circuit Assembly
107	5	5	5	5	5	5	—	1990-0486	***Light-Emitting Diode, red
	—	—	—	—	—	—	7	1990-0719	***Light-Emitting Diode, red
	—	—	1	1	1	1	—	1990-0487	***Light-Emitting Diode, yellow
	—	—	1	1	1	1	—	1990-0485	***Light-Emitting Diode, green
108	1	1	1	1	1	1	—	3101-1745	***RESET TERMINAL Pushbutton Switch (under keycap)
109	99	99	99	99	99	99	99	3101-2137	***Pushbutton Switch, Momentary Contact (under keycap)
110	5	5	5	5	5	5	5	3101-2136	***Pushbutton Switch, Locking (under keycap)
111	1	1	1	1	1	1	1	9160-0233	**Loudspeaker Assembly
	1	1	1	1	1	1	1	02640-60041	**Cable, Loudspeaker
									(Attaching Parts)
112	2	2	2	2	2	2	2	2360-0193	**Screw, Machine, ph, no. 6-32, 0.25 in.
	2	2	2	2	2	2	2	2190-0918	**Washer, Lock, spring, no. 6
113	2	2	2	2	2	2	2	1400-0054	**Mounting Clamp
									———X———
114	4	4	4	4	4	4	4	0403-0285	**Rubber Bumper
115	1	1	1	1	1	1	—	02640-40007	**Keyboard Bottom (see Note 1)
115	1	1	1	1	1	1	1	02640-40029	**Keyboard Bottom (see Note 2)
116	1	1	1	1	1	1	1	0370-2991	**BAUD RATE Knob
									(Attaching Parts)
	1	1	1	1	1	1	1	3030-0609	**Set Screw, knurled
									———X———
	1	1	1	1	—	—	1	02640-00072	**Shield (RFI option -017 only)
									(Attaching Parts)
	4	4	4	4	—	—	4	2360-0201	**Screw, Machine, ph, no. 6-32, 0.500 in.
	4	4	4	4	—	—	4	2190-0918	**Washer, Lock, spring, no. 6

Notes: 1. For olive black terminals 2. For cocoa brown terminals

2640A/B/N/S, 2644A, 2645A/N/S KEYCAPS

UNITS PER ASSY 2640A/B 2644A 2645A	2640N 2645N	2640S 2645S	HP PART NO.	DESCRIPTION
1	1	1	0370-2646	***ESC Keycap
1	1	1	0370-2260	***1 ! Keycap
1	1	1	0370-2261	***2 " Keycap
1	1	1	0370-2262	***3 # Keycap
1	1	1	0370-2263	***4 $ Keycap
1	1	1	0370-2264	***5 % Keycap
1	1	1	0370-2265	***6 & Keycap
1			0370-2266	***7 ' Keycap
1	1	1	0370-2267	***8 (Keycap
1	1	1	0370-2268	***9) Keycap
1	1	1	0370-2641	***0 Keycap
1			0370-2648	***- = Keycap
1			0370-2654	***^ ~ Keycap
1			0370-2651	***\	Keycap
1	1	1	0370-2637	***CNTL Keycap
1	1	1	0370-2286	***Q Keycap
1	1	1	0370-2292	***W Keycap
1	1	1	0370-2274	***E Keycap
1	1	1	0370-2287	***R Keycap
1	1	1	0370-2289	***T Keycap
1	1	1	0370-2294	***Y Keycap
1	1	1	0370-2290	***U Keycap
1	1	1	0370-2278	***I Keycap
1	1	1	0370-2284	***O Keycap
1	1	1	0370-2285	***P Keycap
1	1	1	0370-2655	***@ ` Keycap
1			0370-2653	***[{ Keycap
1			0370-2650	***_ DEL Keycap
1	1	1	0370-2270	***A Keycap
1	1	1	0370-2288	***S Keycap
1	1	1	0370-2273	***D Keycap
1	1	1	0370-2275	***F Keycap
1	1	1	0370-2276	***G Keycap
1	1	1	0370-2277	***H Keycap
1	1	1	0370-2279	***J Keycap
1	1	1	0370-2280	***K Keycap
1			0370-2281	***L Keycap
1			0370-2324	***; + Keycap
1			0370-2325	***: * Keycap
1			0370-2652	***] } Keycap
1	1	1	0370-2635	***RETURN Keycap
1	1	1	0370-2636	***SHIFT Keycap
1	1	1	0370-2295	***Z Keycap
1	1	1	0370-2293	***X Keycap
1	1	1	0370-2272	***C Keycap
1	1	1	0370-2291	***V Keycap
1	1	1	0370-2271	***B Keycap
1	1	1	0370-2283	***N Keycap
1	1	1	0370-2282	***M Keycap
1			0370-2296	***, < Keycap
1			0370-2297	***. > Keycap

UNITS PER ASSY 2640A/B 2644A 2645A	2640N 2645N	2640S 2645S	HP PART NO.	DESCRIPTION
1			0370-2298	***/ ? Keycap
1	1	1	02640-60170	***Space Bar Keycap
1	1	1	0370-0620	***0 Keycap (Numeric Pad)
1	1	1	0370-2312	***1 Keycap (Numeric Pad)
1	1	1	0370-2313	***2 Keycap (Numeric Pad)
1	1	1	0370-2314	***3 Keycap (Numeric Pad)
1	1	1	0370-2315	***4 Keycap (Numeric Pad)
1	1	1	0370-2316	***5 Keycap (Numeric Pad)
1	1	1	0370-2317	***6 Keycap (Numeric Pad)
1	1	1	0370-2318	***7 Keycap (Numeric Pad)
1	1	1	0370-2319	***8 Keycap (Numeric Pad)
1	1	1	0370-2320	***9 Keycap (Numeric Pad)
1	1	1	0370-2322	***. Keycap (Numeric Pad)
1	1	1	0370-2982	***CLEAR TAB Keycap
1	1	1	0370-2657	***SET TAB Keycap
1	1	1	0370-2643	***CLEAR DSPLY Keycap
1	1	1	0370-2658	***ROLL UP Keycap
1	1	1	0370-2659	***ROLL DOWN Keycap
1	1	1	0370-2638	***NEXT PAGE Keycap
1	1	1	0370-2639	***PREV PAGE Keycap
1	1	1	0370-2642	***(Home) Keycap
4	1	1	0370-2640	***Arrow Keycap
13	1	1	0370-2644	**Operating Function Keycap
1	1	1	0370-2877	***Backspace Keycap
1	1	1	0370-2878	***TAB Keycap
1	1	1	0370-2898	***Olive Black Keycap
		1	0370-2957	***Ö Keycap
	1		0370-2958	***Ø Keycap
	1	1	0370-2959	***DEL Keycap
		1	0370-2960	***_ ^ Keycap
	1	1	0370-2961	***- _ Keycap
	1	1	0370-2962	***0 = Keycap
	1	1	0370-2963	***. : Keycap
	1	1	0370-2964	***, ; Keycap
	1	1	0370-2965	***' * Keycap
	1	1	0370-2966	***+ ? Keycap
	1	1	0370-2967	***7 / Keycap
	1	1	0370-2968	***> < Keycap
	1	1	0370-2969	***Å Keycap
		1	0370-2970	***Ä Keycap
	1		0370-2971	***Ü Keycap
	1		0370-2972	***Æ Keycap
1	1	1	0370-2765	***f1 Keycap
1	1	1	0370-2766	***f2 Keycap
1	1	1	0370-2767	***f3 Keycap
1	1	1	0370-2768	***f4 Keycap
1	1	1	0370-2769	***f5 Keycap
1	1	1	0370-2770	***f6 Keycap
1	1	1	0370-2771	***f7 Keycap
1	1	1	0370-2772	***f8 Keycap

2640C KEYCAPS

QTY	PART NO.	DESCRIPTION
1	0370–2641	··· 0 Keycap (Numeric Pad)
1	0370–2312	··· 1 Keycap (Numeric Pad)
1	0370–2313	··· 2 Keycap (Numeric Pad)
1	0370–2314	··· 3 Keycap (Numeric Pad)
1	0370–2315	··· 4 Keycap (Numeric Pad)
1	0370–2316	··· 5 Keycap (Numeric Pad)
1	0370–2317	··· 6 Keycap (Numeric Pad)
1	0370–2318	··· 7 Keycap (Numeric Pad)
1	0370–2319	··· 8 Keycap (Numeric Pad)
1	0370–2320	··· 9 Keycap (Numeric Pad)
1	0370–2322	··· . Keycap (Numeric Pad)
1	0370–2656	··· CLEAR TAB Keycap
1	0370–2657	··· SET TAB Keycap
1	0370–2982	··· CLEAR DISPLAY Keycap
1	0370–2658	··· ROLL UP Keycap
1	0370–2659	··· ROLL DOWN Keycap
1	0370–2638	··· NEXT PAGE Keycap
1	0370–2639	··· PREV PAGE Keycap
1	0370–2642	··· \ (home) Keycap
1	0370–2640	··· Arrow Keycap
1	0370–2646	··· ESC Keycap
1	0370–2877	··· BACK SPACE Keycap
1	0370–2878	··· TAB Keycap
1	0370–2365	··· RETURN Keycap
2	0370–2636	··· SHIFT Keycap
1	0370–2637	··· CNTL Keycap
1	0370–0213	··· Space Bar Keycap
48	5040–7431	··· Insert, Keycap
48	5040–7846	··· Keycap
1	02640–80108	··· Cyrillic Keycap Label Set 1
1	02640–80109	··· Cyrillic Keycap Label Set 2
1	0370–2765	··· f1 Keycap
1	0370–2766	··· f2 Keycap
1	0370–2767	··· f3 Keycap
1	0370–2768	··· f4 Keycap
1	0370–2769	··· f5 Keycap
1	0370–2770	··· f6 Keycap
1	0370–2771	··· f7 Keycap
1	0370–2772	··· f8 Keycap
1	0370–2898	··· OLIVE BLACK Keycap
14	0370–2644	··· Operating Function Keycap
1	0370–2991	··· BAUD RATE Knob

2641A KEYCAPS

UNITS PER ASSY	HP PART NO.	DESCRIPTION	UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2637	***CNTL Keycap	1	0371-0419	***C ∩ Keycap
1	0370-2635	***RETURN Keycap	1	0371-0420	***V U Keycap
2	0370-2636	***SHIFT Keycap	1	0371-0421	***B ⊥ Keycap
1	0370-2649	***LINE FEED Keycap	1	0371-0422	***N ⊤ Keycap
1	0371-0212	***0 Keycap	1	0371-0423	***M I Keycap
1	0371-0380	***1. Keycap	1	0371-0424	***. : Keycap
1	0371-0381	***2 − Keycap	1	0371-0425	***, ; Keycap
1	0371-0382	***3 < Keycap	1	0371-0426	***/ \ Keycap
1	0371-0383	***4 ≤ Keycap	1	02641-60170	***Space Bar Keycap
1	0371-0384	***5 = Keycap	1	0370-0620	***0 Keycap (Numeric Pad)
1	0371-0385	***6 ≥ Keycap	1	0370-2312	***1 Keycap
1	0371-0386	***7 > Keycap	1	0370-2313	***2 Keycap
1	0371-0387	***8 / Keycap	1	0370-2314	***3 Keycap
1	0371-0388	***9 v Keycap	1	0370-2315	***4 Keycap
1	0371-0389	***+ − Keycap	1	0370-2316	***5 Keycap
1	0371-0390	***× + Keycap	1	0370-2317	***6 Keycap
1	0371-0391	***◇ $ Keycap	1	0370-2318	***7 Keycap
1	0371-0392	***Q ? Keycap	1	0370-2319	***8 Keycap
1	0371-0393	***E ε Keycap	1	0370-2320	***9 Keycap
1	0371-0394	***W ω Keycap	1	0370-2322	*** . Keycap (Numeric Pad)
1	0371-0395	***R ρ Keycap	1	0370-2656	***CLEAR TAB Keycap
1	0371-0396	***T ~ Keycap	1	0370-2657	***SET TAB Keycap
1	0371-0397	***Y ↑ Keycap	1	0370-2982	***CLEAR DSPLY Keycap
1	0371-0398	***U ↓ Keycap	1	0370-2658	***ROLL UP Keycap
1	0371-0399	***I ∿ Keycap	1	0370-2659	***ROLL DOWN Keycap
1	0371-0400	***O o Keycap	1	0370-2638	***NEXT PAGE Keycap
1	0371-0401	***P * Keycap	1	0370-2639	***PREV PAGE Keycap
1	0371-0402	***← → Keycap	1	0370-2642	*** ↖ (Home) Keycap
1	0371-0403	***⊢ ⊣ Keycap	4	0370-2640	***Arrow Keycap
1	0371-0404	***∧ DEL Keycap	15	0370-2644	***Operating Function Keycap
1	0371-0405	***A α Keycap	1	0370-2765	***f1 Keycap
1	0371-0406	***S ⌜ Keycap	1	0370-2766	***f2 Keycap
1	0371-0407	***D ⌞ Keycap	1	0370-2767	***f3 Keycap
1	0371-0408	***F _ Keycap	1	0370-2768	***f4 Keycap
1	0371-0409	***G ∇ Keycap	1	0370-2769	***f5 Keycap
1	0371-0410	***H Δ Keycap	1	0370-2770	***f6 Keycap
1	0371-0411	***J • Keycap	1	0370-2771	***f7 Keycap
1	0371-0412	***K ' Keycap	1	0370-2272	***f8 Keycap
1	0371-0413	***L □ Keycap	1	0370-2877	***BACKSPACE Keycap
1	0371-0414	***[(Keycap	1	0370-2878	***TAB Keycap
1	0371-0415	***]) Keycap	1	0370-2895	***Gold Keycap
1	0371-0416	***( ) Keycap	1	0370-2894	***Green Keycap
1	0371-0417	***Z ⊂ Keycap	1	0370-2898	***Olive Black Keycap
1	0371-0418	***X ⊃ Keycap			

2642A KEYCAPS

UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2646	***ESC Key
1	0370-2260	***1 ! Key
1	0370-2261	***2 " Key
1	0370-2262	***3 # Keycap
1	0370-2263	***4 $ Keycap
1	0370-2264	***5 % Keycap
1	0370-2265	***6 & Keycap
1	0370-2266	***7 ' Keycap
1	0370-2267	***8 (Keycap
1	0370-2268	***9) Keycap
1	0370-2641	***0 Keycap
1	0370-2648	***– = Keycap
1	0370-2654	*** ^ ~ Keycap
1	0370-2651	***\ | Keycap
1	0370-2637	***CNTL Keycap
1	0370-2286	***Q Keycap
1	0370-2292	***W Keycap
1	0370-2274	***E Keycap
1	0370-2287	***R Keycap
1	0370-2289	***T Keycap
1	0370-2294	***Y Keycap
1	0370-2290	***U Keycap
1	0370-2278	***I Keycap
1	0370-2284	***O Keycap
1	0370-2285	***P Keycap
1	0370-2655	***@ Keycap
1	0370-2652	***[{ Keycap
1	0370-2650	***_ DEL Keycap
1	0370-2270	***A Keycap
1	0370-2288	***S Keycap
1	0370-2273	***D Keycap
1	0370-2275	***F Keycap
1	0370-2276	***G Keycap
1	0370-2277	***H Keycap
1	0370-2279	***J Keycap
1	0370-2280	***K Keycap
1	0370-2281	***L Keycap
1	0370-2324	***; + Keycap
1	0370-2325	***: * Keycap
1	0370-2653	***] } Keycap
1	0370-2635	***RETURN Keycap
2	0370-2636	***SHIFT Keycap
1	0370-2295	***Z Keycap
1	0370-2293	***X Keycap
1	0370-2272	***C Keycap

UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2291	***V Keycap
1	0370-2271	***B Keycap
1	0370-2283	***N Keycap
1	0370-2282	***M Keycap
1	0370-2296	***, < Keycap
1	0370-2297	***. > Keycap
1	0370-2298	***/ ? Keycap
1	02640-60170	***Space Bar Keycap
1	0370-0620	***0 Keycap (Numeric Pad)
1	0370-2312	***1 Keycap (Numeric Pad)
1	0370-2313	***2 Keycap (Numeric Pad)
1	0370-2314	***3 Keycap (Numeric Pad)
1	0370-2315	***4 Keycap (Numeric Pad)
1	0370-2316	***5 Keycap (Numeric Pad)
1	0370-2317	***6 Keycap (Numeric Pad)
1	0370-2318	***7 Keycap (Numeric Pad)
1	0370-2319	***8 Keycap (Numeric Pad)
1	0370-2320	***9 Keycap (Numeric Pad)
1	0370-2322	*** Keycap (Numeric Pad)
1	0370-2656	***CLEAR TAB Keycap
1	0370-2657	***SET TAB Keycap
1	0370-2982	***CLEAR DSPLY Keycap
1	0370-2658	***ROLL UP Keycap
1	0370-2659	***ROLL DOWN Keycap
1	0370-2638	***NEXT PAGE Keycap
1	0370-2639	***PREV PAGE Keycap
1	0370-2642	*** ↖ (Home) Keycap
4	0370-2640	***Arrow Keycap
17	0370-2644	***Operating Function Keycap
1	0370-2765	***f1 Keycap
1	0370-2766	***f2 Keycap
1	0370-2767	***f3 Keycap
1	0370-2768	***f4 Keycap
1	0370-2769	***f5 Keycap
1	0370-2770	***f6 Keycap
1	0370-2771	***f7 Keycap
1	0370-2772	***f8 Keycap
1	0370-2877	***BACKSPACE Keycap
1	0370-2878	***TAB Keycap
1	0370-2898	***Olive Black Keycap

2645J/K KEYCAPS

UNITS PER ASSY	HP PART NO.	DESCRIPTION	UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2646	***ESC Key	1	02640-60115	***C ソ Keycap
1	02640-60115	***1 ! ヌ Keycap	1	02640-60115	***V ヒ Keycap
1	02640-60115	***2 " フ Keycap	1	02640-60115	***B コ Keycap
1	02640-60115	***3 # ア Keycap	1	02640-60115	***N ミ Keycap
1	02640-60115	***4 $ ウ Keycap	1	02640-60115	***M モ Keycap
1	02640-60115	***5 % エ Keycap	1	02640-60115	***, < ネ Keycap
1	02645-60115	***6 & オ Keycap	1	02640-60115	***. > ル Keycap
1	02645-60115	***7 ' ヤ Keycap	1	02640-60115	***/ ? メ Keycap
1	02645-60115	***8 (ユ Keycap	1	02640-60115	*** シフト(SHIFT) Keycap
1	02645-60115	***9) ヨ Keycap	1	02640-60170	***Space Bar Keycap
1	02645-60115	***0 ワ Keycap	1	0370-0620	***0 Keycap (Numeric Pad)
1	02645-60115	***- = ホ Keycap	1	0370-2312	***1 Keycap
1	02645-60115	***^ ~ ヘ Keycap	1	0370-2313	***2 Keycap
1	02645-60115	***¥ | ロ Keycap	1	0370-2314	***3 Keycap
1	0370-2637	***CNTL Keycap	1	0370-2315	***4 Keycap
1	02640-60115	***Q タ Keycap	1	0370-2316	***5 Keycap
1	02640-60115	***W テ Keycap	1	0370-2317	***6 Keycap
1	02640-60115	***E イ Keycap	1	0370-2318	***7 Keycap
1	02640-60115	***R ス Keycap	1	0370-2319	***8 Keycap
1	02640-60115	***T カ Keycap	1	0370-2320	***9 Keycap
1	02640-60115	***Y ン Keycap	1	0370-2322	***. Keycap (Numeric Pad)
1	02640-60115	***U ナ Keycap	1	0370-2656	***CLEAR TAB Keycap
1	02640-60115	***I ニ Keycap	1	0370-2657	***SET TAB Keycap
1	02640-60115	***O ラ Keycap	1	0370-2982	***CLEAR DSPLY Keycap
1	02640-60115	***P セ Keycap	1	0370-2658	***ROLL UP Keycap
1	02640-60115	***@ ` ゛ Keycap	1	0370-2659	***ROLL DOWN Keycap
1	02640-60115	***[{ ゜ Keycap	1	0370-2638	***NEXT PAGE Keycap
1	0370-2650	***_ DEL Keycap	1	0370-2639	***PREV PAGE Keycap
1	02640-60115	***A チ Keycap	1	0370-2642	*** ↖ (Home) Keycap
1	02640-60115	***S ト Keycap	4	0370-2640	***Arrow Keycap
1	02640-60115	***D シ Keycap	15	0370-2644	***Operating Function Keycap
1	02640-60115	***F ハ Keycap	1	0370-2765	***f1 Keycap
1	02640-60115	***G キ Keycap	1	0370-2766	***f2 Keycap
1	02640-60115	***H ク Keycap	1	0370-2767	***f3 Keycap
1	02640-60115	***J マ Keycap	1	0370-2768	***f4 Keycap
1	02640-60115	***K ノ Keycap	1	0370-2769	***f5 Keycap
1	02640-60115	***L リ Keycap	1	0370-2770	***f6 Keycap
1	02640-60115	***; + レ Keycap	1	0370-2771	***f7 Keycap
1	02640-60115	***: * ケ Keycap	1	0370-2772	***f8 Keycap
1	02640-60115	***] } ム Keycap	1	0370-2877	***BACKSPACE Keycap
1	0370-2635	***RETURN Keycap	1	0370-2878	***TAB Keycap
1	0370-2636	***SHIFT Keycap	1	0370-2895	***Gold Keycap
1	02640-60115	***Z ツ Keycap	1	0370-2894	***Green Keycap
1	02640-60115	***X サ Keycap	1	0370-2898	***Olive Black Keycap
			1	0371-1834	***Blue Keycap (2645J)

2645R KEYCAPS

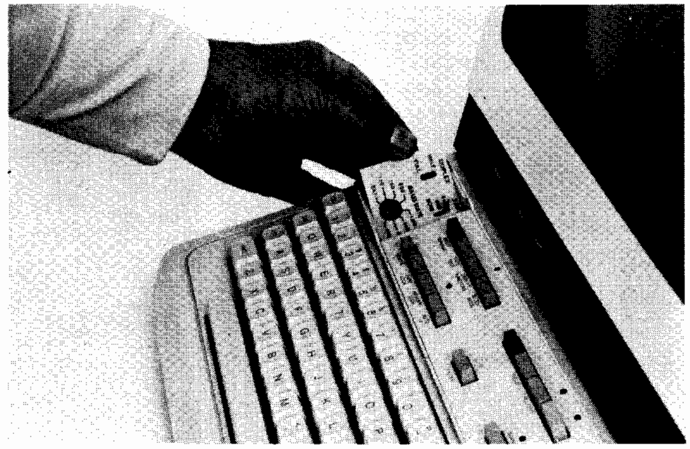
UNITS PER ASSY	HP PART NO.	DESCRIPTION	UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2646	***ESC Key	1	02645-60009	*** ئ Z Keycap
1	0370-2260	***1 ! Keycap	1	02645-60009	*** ذ X Keycap
1	0370-2261	***2 " Keycap	1	02645-60009	*** د C Keycap
1	0370-2262	***3 # Keycap	1	02645-60009	*** ر V Keycap
1	0370-2263	***4 $ Keycap	1	02645-60009	*** ر B Keycap
1	0370-2264	***5 % Keycap	1	02645-60009	*** ظ N Keycap
1	0370-2265	***6 & Keycap	1	02645-60009	*** ط M Keycap
1	0370-2266	***7 ' Keycap	1	0370-2296	***, < Keycap
1	0370-2267	***8 (Keycap	1	0370-2297	***. > Keycap
1	0370-2268	***9) Keycap	1	0370-2298	***/ ? Keycap
1	0370-2641	***0 Keycap	1	02640-60170	***Space Bar Keycap
1	0370-2648	***- = Keycap	1	0370-0620	***0 Keycap (Numeric Pad)
1	0370-2324	***; + Keycap	1	0370-2312	***1 Keycap (Numeric Pad)
1	0370-2651	***: ! Keycap	1	0370-2313	***2 Keycap (Numeric Pad)
1	0370-2637	***CNTL Keycap	1	0370-2314	***3 Keycap (Numeric Pad)
1	02645-60009	*** ض Q Keycap	1	0370-2315	***4 Keycap (Numeric Pad)
1	02645-60009	*** ص W Keycap	1	0370-2316	***5 Keycap (Numeric Pad)
1	02645-60009	*** ث Keycap	1	0370-2317	***6 Keycap (Numeric Pad)
1	02645-60009	*** ق Keycap	1	0370-2318	***7 Keycap (Numeric Pad)
1	02645-60009	*** ف Keycap	1	0370-2319	***8 Keycap (Numeric Pad)
1	02645-60009	*** غ Keycap	1	0370-2320	***9 Keycap (Numeric Pad)
1	02645-60009	*** ع U Keycap	1	0370-2322	*** . Keycap (Numeric Pad)
1	02645-60009	*** ه I Keycap	1	0370-2656	***CLEAR TAB Keycap
1	02645-60009	*** خ O Keycap	1	0370-2657	***SET TAB Keycap
1	02645-60009	*** ح P Keycap	1	0370-2982	***CLEAR DSPLY Keycap
1	02645-60009	*** ج @ Keycap	1	0370-2658	***ROLL UP Keycap
1	02645-60009	*** ـ — Keycap	1	0370-2659	***ROLL DOWN Keycap
1	02645-60009	*** ة DEL Keycap	1	0370-2638	***NEXT PAGE Keycap
1	02645-60009	*** ش A Keycap	1	0370-2639	***PREV PAGE Keycap
1	02645-60009	*** س S Keycap	1	0370-2642	*** ↖(Home) Keycap
1	02645-60009	*** ي D Keycap	4	0370-2640	***Arrow Keycap
1	02645-60009	*** ب F Keycap	15	0370-2644	***Operating Function Keycap
1	02645-60009	*** ل G Keycap	1	0370-2765	***f1 Keycap
1	02645-60009	*** ا H Keycap	1	0370-2766	***f2 Keycap
1	02645-60009	*** ت J Keycap	1	0370-2767	***f3 Keycap
1	02645-60009	*** ن K Keycap	1	0370-2768	***f4 Keycap
1	02645-60009	*** م L Keycap	1	0370-2769	***f5 Keycap
1	02645-60009	*** ك [Keycap	1	0370-2770	***f6 Keycap
1	02645-60009	*** و] Keycap	1	0370-2771	***f7 Keycap
1	0370-2625	***: * Keycap	1	0370-2772	***f8 Keycap
1	0370-2635	***RETURN Keycap	1	0370-2877	***BACKSPACE Keycap
2	0370-2636	***SHIFT Keycap	1	0370-2878	***TAB Keycap
			1	0370-2895	***Gold Keycap
			1	0370-2894	***Green Keycap
			1	0370-2898	***Olive Black Keycap

2647A AND 2648A KEYCAPS

UNITS PER ASSY	HP PART NO.	DESCRIPTION
1	0370-2646	***ESC Key
1	0370-2260	***1 ! Key
1	0370-2261	***2 " Key
1	0370-2262	*** # Keycap
1	0370-2263	***4 $ Keycap
1	0370-2264	***5 % Keycap
1	0370-2265	***6 & Keycap
1	0370-2266	***7 ' Keycap
1	0370-2267	***8 (Keycap
1	0370-2268	***9) Keycap
1	0370-2641	***0 Keycap
1	0370-2648	***– = Keycap
1	0370-2654	***^ ~ Keycap
1	0370-2651	***\ | Keycap
1	0370-2637	***CNTL Keycap
1	0370-2286	***Q Keycap
1	0370-2292	***W Keycap
1	0370-2274	***E Keycap
1	0370-2287	***R Keycap
1	0370-2289	***T Keycap
1	0370-2294	***Y Keycap
1	0370-2290	***U Keycap
1	0370-2278	***I Keycap
1	0370-2284	***O Keycap
1	0370-2285	***P Keycap
1	0370-2655	***@ Keycap
1	0370-2652	***[{ Keycap
1	0370-2650	***_ DEL Keycap
1	0370-2270	***A Keycap
1	0370-2288	***S Keycap
1	0370-2273	***D Keycap
1	0370-2275	***F Keycap
1	0370-2276	***G Keycap
1	0370-2277	***H Keycap
1	0370-2279	***J Keycap
1	0370-2280	***K Keycap
1	0370-2281	***L Keycap
1	0370-2324	***; + Keycap
1	0370-2325	***: * Keycap
1	0370-2653	***] } Keycap
1	0370-2635	***RETURN Keycap
2	0370-2636	***SHIFT Keycap
1	0370-2295	***Z Keycap
1	0370-2293	***X Keycap
1	0370-2272	***C Keycap
1	0370-2291	***V Keycap
1	0370-2271	***B Keycap
1	0370-2283	***N Keycap
1	0370-2282	***M Keycap
1	0370-2296	***, < Keycap
1	0370-2297	***. > Keycap
1	0370-2298	***/ ? Keycap
1	02640-60170	***Space Bar Keycap
1	0371-0644	***◀ Keycap
1	0371-0645	***STOP Keycap
1	0371-0646	***▶ Keycap
1	0371-0647	***ZOOM IN Keycap
1	0371-0648	***▼ Keycap
1	0371-0649	***ZOOM OUT Keycap
1	0371-0650	***ZOOM Keycap
1	0371-0651	***CURSOR FAST Keycap (2648A only)
1	0371-1070	***CURSOR FAST Keycap (2647A only)
1	0371-0652	***AUTO PLOT Keycap (2648A only)
1	0371-1069	***MULTIPLOT Keycap (2647A only)
1	0371-0653	*** ▲ Keycap
1	0371-0654	***G CURSOR Keycap
1	0370-2656	***CLEAR TAB Keycap
1	0370-2657	***SET TAB Keycap
1	0370-2982	***CLEAR DSPLY Keycap
1	0370-2658	***ROLL UP Keycap
1	0370-2659	***ROLL DOWN Keycap
1	0370-2638	***NEXT PAGE Keycap
1	0370-2639	***PREV PAGE Keycap
1	0370-2642	*** ↖ (Home) Keycap
4	0370-2640	***Arrow Keycap
17	0370-2644	***Operating Function Keycap
1	0370-2765	***f1 Keycap
1	0370-2766	***f2 Keycap
1	0370-2767	***f3 Keycap
1	0370-2768	***f4 Keycap
1	0370-2769	***f5 Keycap
1	0370-2770	***f6 Keycap
1	0370-2771	***f7 Keycap
1	0370-2772	***f8 Keycap
1	0370-2877	***BACKSPACE Keycap
1	0370-2878	***TAB Keycap
1	0370-2895	***Gold Keycap
1	0370-2894	***Green Keycap
1	0370-2898	***Olive Black Keycap

REMOVING AND INSTALLING KEYBOARD OVERLAYS

A. REMOVING A KEYBOARD OVERLAY

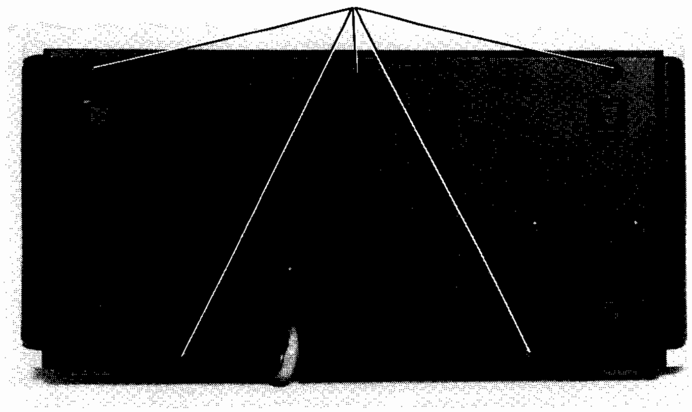


B. INSTALLING BAUDRATE OVERLAY

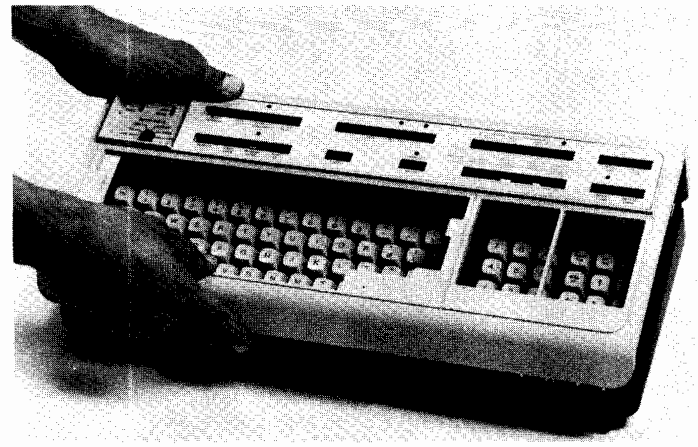
C. INSTALLING KEYBOARD OVERLAY

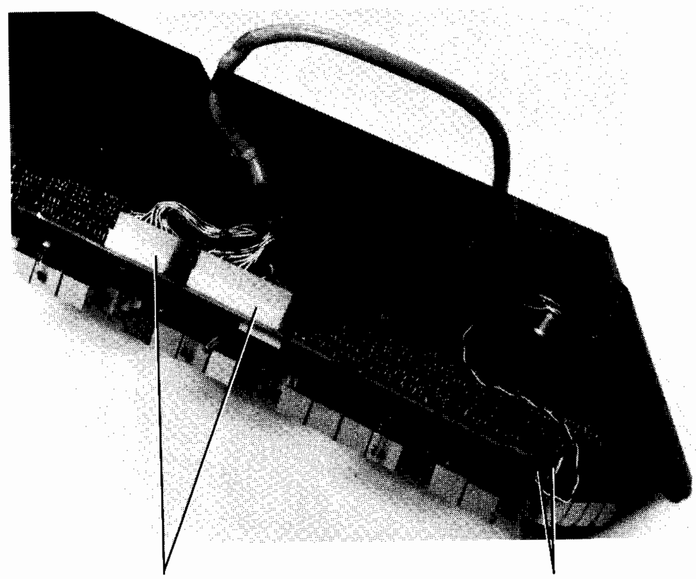
REMOVING KEYBOARD PCA

A. Remove these 5 screws.



B. Lift off top.





C. Disconnect cable connectors.

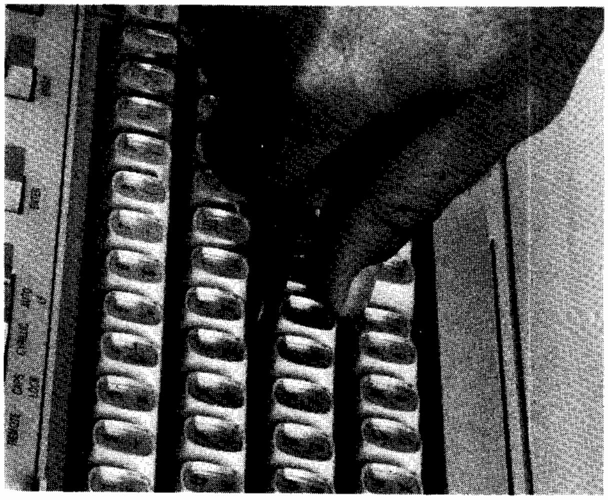
D. Disconnect buzzer wires.

INSTALLING LEDs

1. Remove Keyboard Top as described in "REMOVING KEYBOARD PCA".

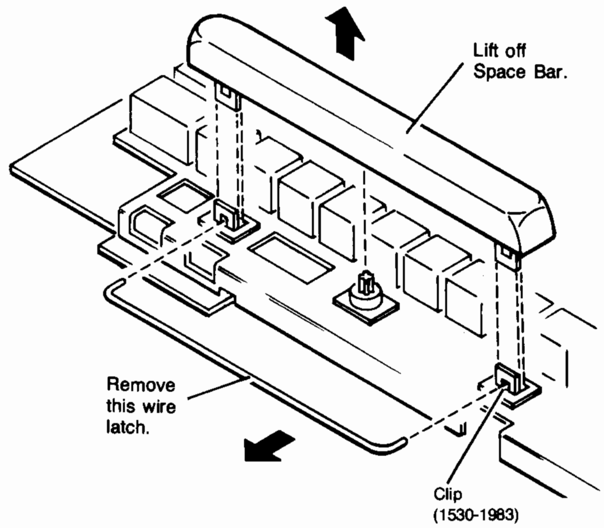
2. Turn-on power, and press the SELF-TEST key to light LEDs. If LED does not light, reverse the leads into the LED socket. Press SELF-TEST key again to verify it lights.

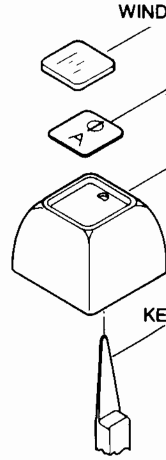
REMOVING AND INSTALLING KEYCAPS



REMOVING AND REPLACING THE SPACE BAR

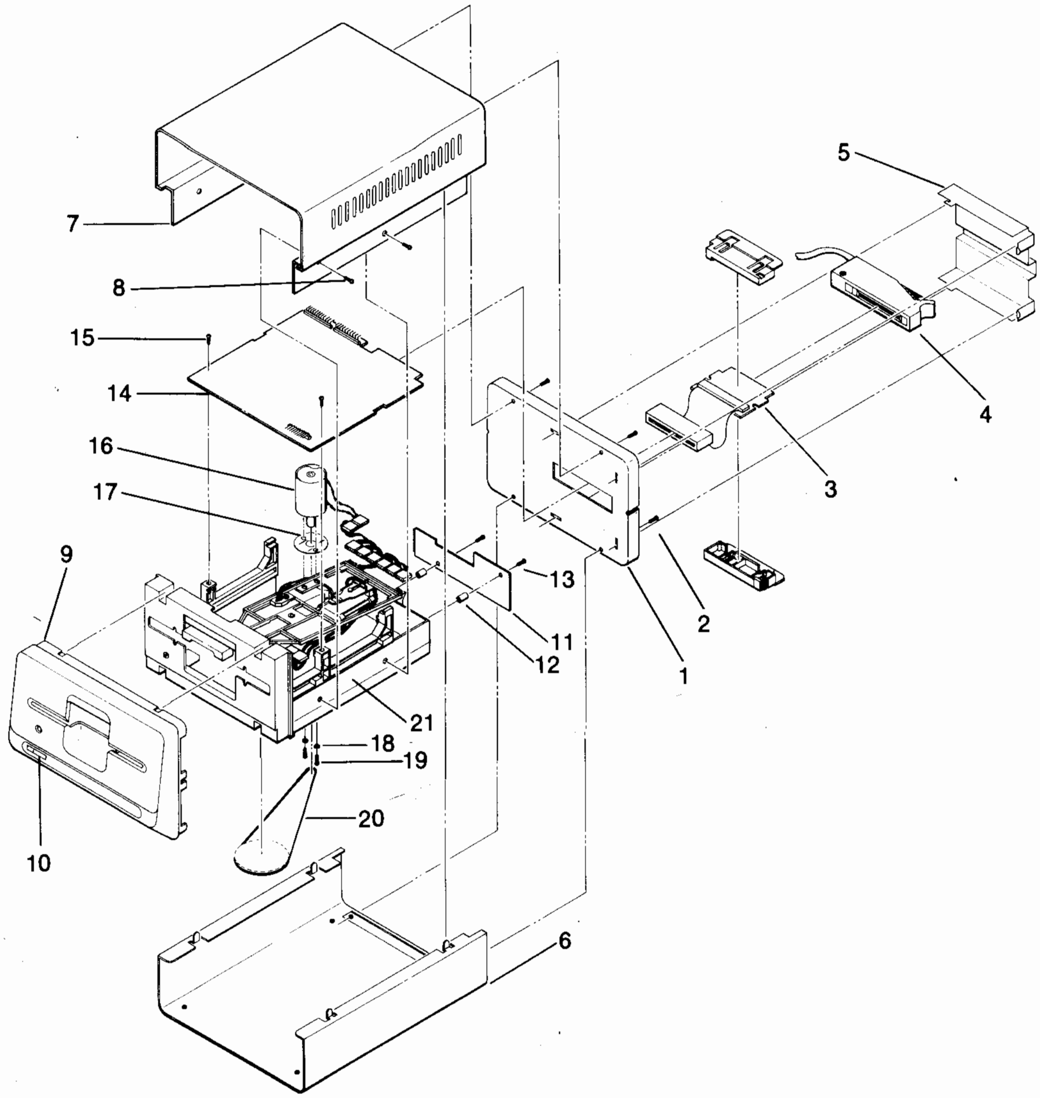
1. Remove Keyboard Top as described in "REMOVING KEYBOARD PCA".





These keycaps are used on:
2640C
2645K
2645R

External Accessories



MINI DISC DRIVE

INDEX NO.	HP PART NO.	DESCRIPTION	QTY.
	13270-60011	Mini Disc Drive Unit	1
1	1600-0954	*Rear Panel	1
		(Attaching Parts)	
2	2360-0115	**Screw, Machine, ph, 6-32, 0.375 in.	4
3	13270-60006	**Printed Circuit Edge Connector	1
4	13270-60003	**Controller Cable, 1.2 meters	1
	13270-60004	**Next Drive Cable, 0.7 meters (used on option 072)	1
	13270-60005	**T-Block Connector (used on option 072)	1
5	1400-1039	**Cable Retainer	1
		———X———	
6	7101-0526	*Bottom Cover	1
		(Attaching Parts)	
	4320-0027	**Foot, Screw, .5 x .3H	4
		———X———	
7	7101-0525	*Top Cover	1
		(Attaching Parts)	
8	2360-0115	**Screw, Machine, ph, 6-32, 0.375 in.	4
		———X———	
9	4040-1638	*Front Panel	1
		(Attaching Parts)	
10	7121-0269	**Label, 1st Mini Drive	1
	7121-0268	**Label, 2nd Mini Drive (used on option 072)	1
		———X———	
11	0950-0449	*Motor Control PCA	1
		(Attaching Parts)	
12	0380-0340	**Standoff, Fiber, no. 6	2
13	2360-0115	**Screw, Machine, ph, 6-32, 0.375 in.	2
		———X———	
14	13270-60002	*Drive PCA	1
		(Attaching Parts)	
15	2200-0521	**Screw, Machine, ph, 4-40, 0.250 in.	2
		———X———	
16	0950-0443	*Drive Motor	1
		(Attaching Parts)	
17		**Insulator, Mica	1
18		**Washer, Nylon, no. 6	2
19	2360-0332	**Screw, Machine, ph, 6-32, 0.375 in.	2
20	0950-0448	**Drive Belt	1
		———X———	

MINI DISC DRIVE (CONTINUED)

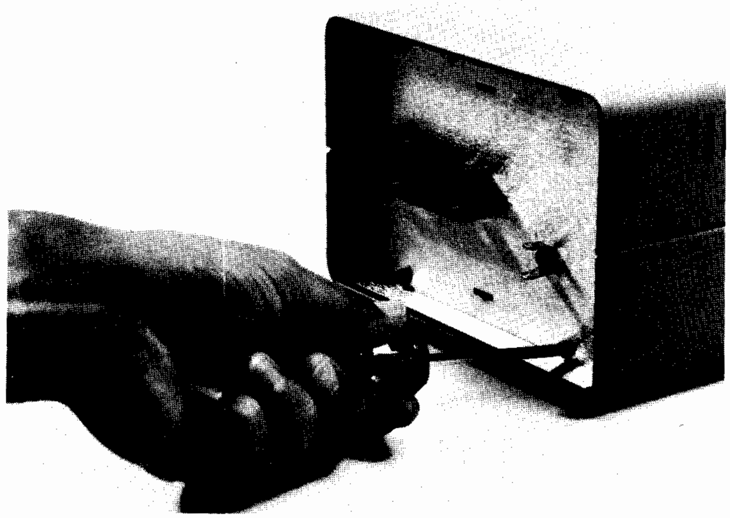
INDEX NO.	HP PART NO.	DESCRIPTION	QTY.
21	0950-0461	*Mini Drive Mechanics	1
		———X———	
	13270-60223	*Disc Controller PCA	1
	9164-0128	*Diskette, 2-sided, 133mm (5-1/4 in.)	4
	9164-0135	*Diskette Box	1
	02642-13302	*User Instruction Diskette	1

Mini Disc Drive Repair and Replacement

1. Set terminal power to the OFF position.
2. Remove the cable retainer securing the controller cable to the drive.
3. Disconnect the controller cable from the PC edge connector at the rear of the drive.
4. Install the new mini disc drive following the above steps in the reverse order.

REMOVING THE REAR PANEL ....

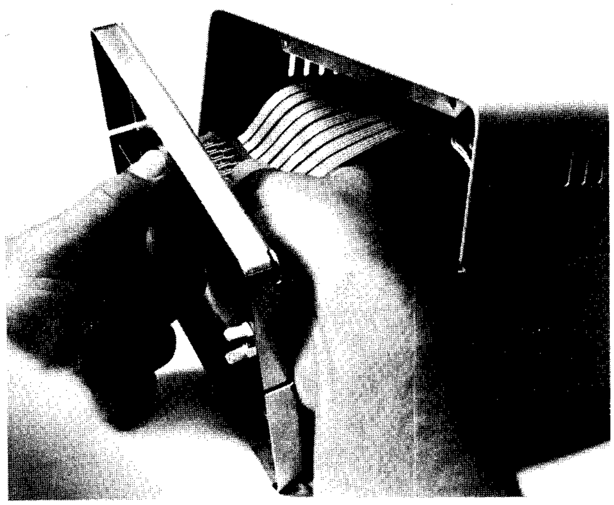
1. Grasp the cable retainer, move it slightly left and pull it outward to disengage the tabs securing the cable retainer to the rear panel. The cable retainer should be free for removal.
2. Disconnect the controller cable from its connector at the rear of the drive.
3. Remove the four screws securing the rear panel to the drive.
4. To aid in removing the rear panel, insert the cable retainer into the rear panel slots. First, insert the left tabs into the vertical slots and lastly, insert the right tabs into the horizontal slots of the rear panel.
5. Grasp the cable retainer and pull the rear panel outward. Disconnect the ribbon cable from the drive PCA and remove the rear panel.
6. When replacing the rear panel, be sure to connect the ribbon cable to the drive PCA before securing the rear panel to the drive unit with the four screws.



Removing the Rear Panel

CONNECTOR ASSEMBLY REPLACEMENT

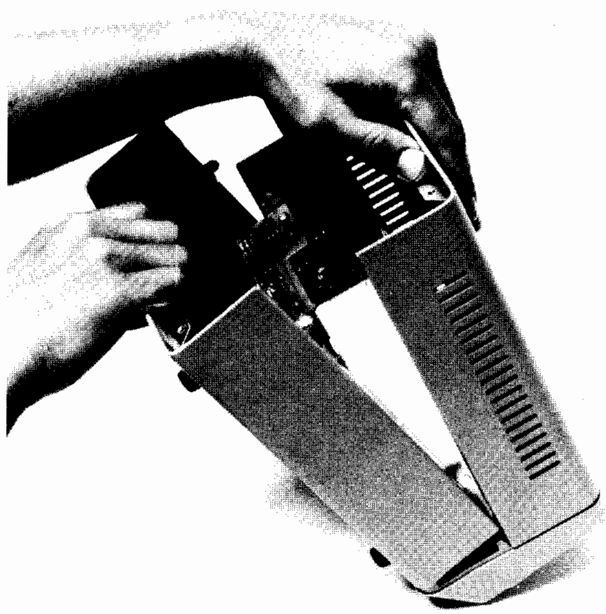
1. Remove the rear panel as described in "Removing the Rear Panel."
2. On the connector assembly, squeeze the snap latches and slide the connector assembly through the opening in the rear panel.
3. Separate the connector insulator in half by unhooking the two retaining hooks that secure the connector insulator halves together.
4. Remove the ribbon cable assembly.
5. When replacing the connector assembly, align the ribbon cable's PCA on one half of the connector insulator. Snap the other half on to secure the PCA.
6. With the solder side of the ribbon cable PCA facing down, route the connector assembly through the opening in the rear panel from the outside to the inside. The connector will snap against the rear panel to secure it in place.
7. Reconnect the ribbon cable to the drive PCA and reinstall the rear panel.



Squeezing the Snap Latches on the Connector Assembly

BOTTOM COVER REPLACEMENT .....

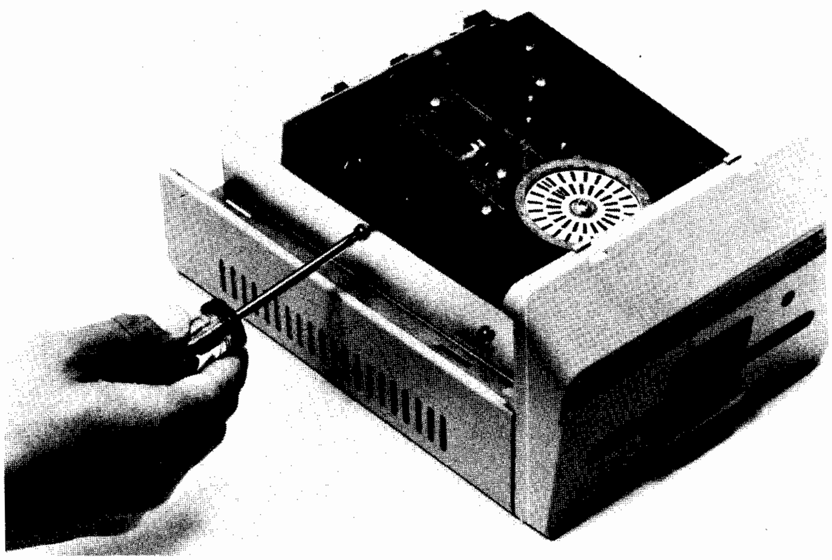
1. With the rear panel removed, place the disc drive unit on a paper pad or a piece of cardboard to protect it from getting scratched.
2. Grasp the bottom cover with one hand and the top cover with the other hand, then separate the two covers by pulling them apart.
3. Remove the bottom cover by pulling it up and away from the front panel.
4. When replacing the bottom cover, slide the bottom cover from the rear, clearing the drive mounting screws. Simultaneously, engage the bottom cover's (1) front end with the front panel's plastic lugs, (2) flanges with the front panel's retainers, (3) metal tabs with the top cover's slots. Rotate the top cover down and push firmly until the covers snap together.



Separating the Bottom Cover from the Top Cover

TOP COVER REPLACEMENT ....

1. With the rear panel and bottom cover removed, place the disc drive on a piece of protective material.
2. Remove the four screws securing the top cover to the drive unit.
3. Grasp the rear of the top ncover and the plastic front, then pull the cover away from the drive unit.
4. When replacing the top cover, be sure that the front end of the top cover is seated into the recessed area of the front panel before securing it in place with the four screws.



Removing the Top Cover

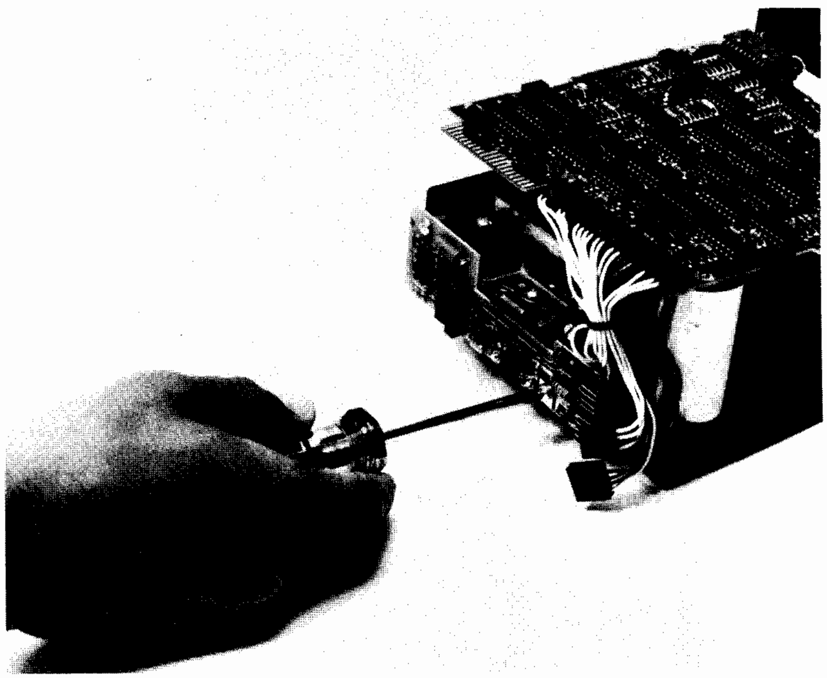
FRONT PANEL REPLACEMENT ....

1. With the rear panel, top and bottom covers removed, place the drive unit on its front panel.
2. Using a flat blade screwdriver, unlatch the two bottom hooks securing the front panel to the drive's front bezel.
3. Grasp the bottom of the front panel and firmly pull it up and away until it unsnaps from the front bezel.
4. When replacing the front panel, make sure that the top hooks on the front panel are positioned properly at the top and backside of the front bezel before snapping the bottom hooks into place at the bottom and backside of the front bezel.

Unlatching the Front Panel

MOTOR CONTROL PCA REPLACEMENT ....

1. With the top cover and rear panel removed, disconnect cables 20 and 21 from connectors J20 and J21 on the motor control PCA.
2. Remove the two screws and insulated standoffs from the motor control PCA.
3. When replacing the motor control PCA, make sure that the insulated standoffs are used before securing the PCA to the drive unit with the two screws.
4. Check and if necessary, adjust the drive motor speed. Refer to the alignment procedures in Section 5 for details.



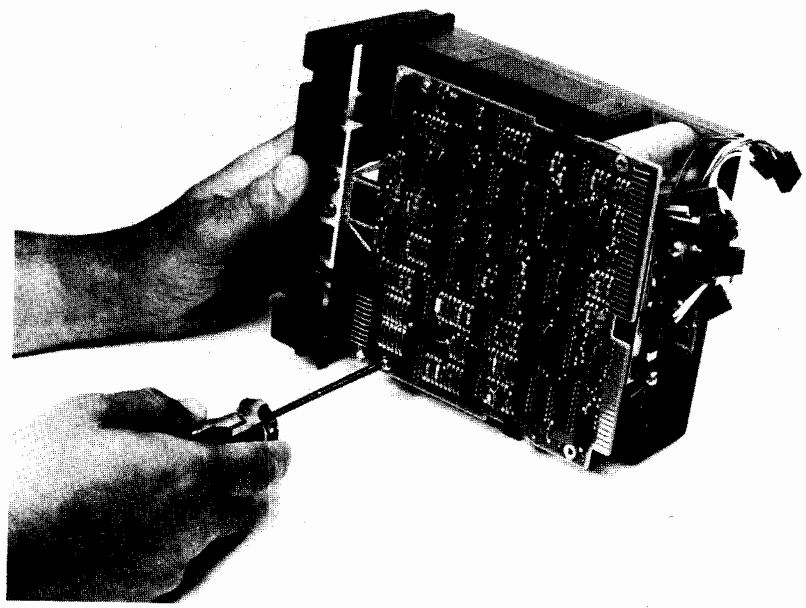
Removing the Motor Control PCA

DRIVE PCA REPLACEMENT ....

1. With the drive unit removed from its covers, disconnect cables 5 and 6 from connectors J5 and J6 at the front of the drive PCA and cables 8 through 13 from connectors J8 through J13, respectively, at the rear of the PCA.
2. Remove the two screws securing the drive PCA to the drive unit. Remove the drive PCA.
3. When replacing the drive PCA, make sure that the PCA notches are aligned with the tabs on the drive unit before sliding the PCA forward until it is aligned over the holes. Secure the drive PCA in place with the two screws.
4. Reconnect the two cables at the front of the PCA to connectors J5 and J6 and the six cables 8 through 13 at the rear of the PCA to connectors J8 through J13, respectively.

Note

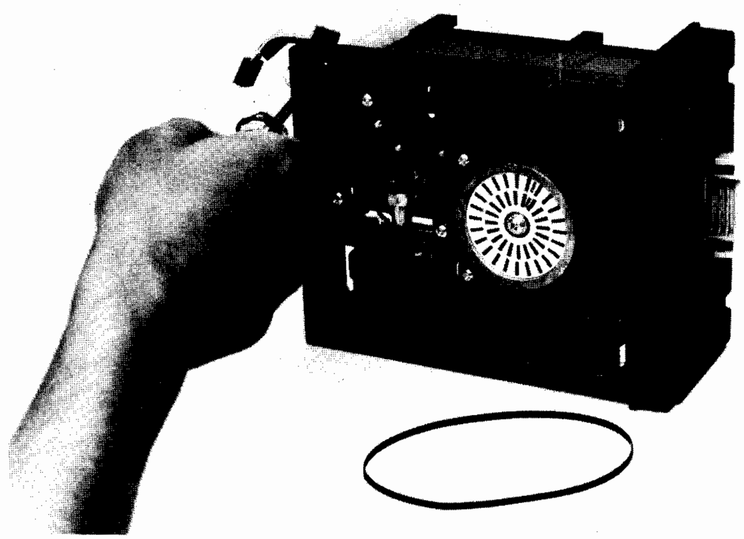
The drive PCA and drive unit are replaced together as an assembly.



Removing the Drive PCA

DRIVE MOTOR AND DRIVE BELT REPLACEMENT ....

1. With the drive unit removed from its covers and the drive PCA removed, place the drive unit on its side.
2. Remove the drive belt from the drive wheels.
3. Remove the two screws and nylon washers securing the drive motor to the drive unit.
4. When replacing the drive motor, make sure that the holes in both the drive motor, mica insulator, nylon washers, and drive unit are properly aligned before securing the drive motor in place with the two screws and washers.
5. With the shiny side of the belt facing inside, place the belt over the drive wheels. Rotate the large drive wheel to ensure that the belt will not come off when operating. The smooth side of the belt should be over the wheel.



Removing the Drive Motor

8

Functional Operation

Functional Operation 8

INTRODUCTION

This section describes briefly the functional operation of a skeleton or basic terminal. Included is an overview of terminal operation, a description of the functional operation of the basic terminal, and two examples of signal flow through the terminal. The signal flow examples are meant to summarize the description of terminal operation which precedes them.

Overview

The terminal is controlled by the firmware code which is stored in ROM memory and implemented by the Processor PCA. Terminal operation is a repeated process in which the Processor PCA fetches an instruction from ROM memory and executes it. This involves transfer of control instructions and data between the Processor PCA and I/O devices such as the keyboard, the cartridge tape units, a printer, a computer, etc.

Memory space for temporary storage of variables and input/output data is provided by RAM memory.

The Basic Terminal

Any 264X-series terminal consists of a basic terminal, usually with some accessories appended to it. It is made up, primarily, of the Processor and memory PCAs with a keyboard for input and a CRT for display. Several additional PCAs are used for transfer of keystrokes from the keyboard to the processor and data transfer from the processor to the CRT.

The basic terminal is a limited but complete terminal. When an accessory such as data communications, the cartridge tapes, or display enhancement is added, it increases the terminal's capabilities but does not change its operation. The accessory is only appended to the basic terminal. This is also true of the graphics capability of the 2647A and 2648A terminals and the BASIC language capability of the 2647A terminals. The hardware items which compose a basic terminal are as follows:

INPUT/OUTPUT SECTION

1. Keyboard assembly (includes the Keyboard PCA).
2. Keyboard interface PCA.

CONTROL SECTION

1. Processor PCA.
2. ROM PCA(s) (several types, known by different names).
3. RAM PCA(s) (several types, known by different names).

DISPLAY SECTION

1. Display Memory Access (DMA) PCA.
2. Display Control PCA.
3. Display Timing PCA.
4. Sweep PCA.
5. CRT/Yoke assembly.

Input/Output Section

For a basic terminal, the Input/Output section consists of the Keyboard, the Keyboard PCA (located in the Keyboard assembly), and the Keyboard Interface PCA. It enables the user to control the cursor, enter keystrokes, set margins and tabs, and select operating modes, such as Memory Lock and Display Functions.

Additional Input/Output equipment, not a part of the basic terminal, is listed below:

1. Read/Write PCA.
2. The two CTU Transport Assemblies.
3. Data Communications PCA (Accessory 13260A, B, C, or D).
4. Terminal Duplex Register PCA (Accessory 13238A).
5. Video Interface PCA (Accessory 13254A).
6. Serial Printer Interface PCA (Accessory 13250A).
7. HP-IB Interface PCA (Accessory 13296A).

KEYBOARD .... The keyboard converts the user's keystroke into an electrical signal and stores it as an eight-bit key code until it is accessed by the processor through the Keyboard Interface PCA.

KEYBOARD INTERFACE PCA

The Keyboard Interface PCA interfaces between the Processor PCA and the Keyboard for both reading and writing. It also contains 24 jumpers for configuring data communications and local terminal operation. In read mode, keystrokes are transferred from the Keyboard to the Processor PCA. In write mode, commands to light keyboard LEDs or sound the beeper are passed from the Processor PCA to the Keyboard PCA. These signals are transferred between the Processor PCA and Keyboard Interface PCA in the form of multiple parallel bits on the bottom plane bus.

The jumpers on the Keyboard Interface PCA have no direct relationship to the function of the Keyboard Interface PCA. When the firmware calls for reading the configuration of these jumpers, the Processor PCA does so by addressing the Keyboard Interface PCA in read mode over the bottom plane bus.

Control Section

The Control section controls terminal operation. It consists of the Processor PCA, one or more Control Memory (ROM) PCAs, and one or more RAM PCAs.

PROCESSOR PCA

The Processor PCA fetches and executes firmware instructions from ROM memory. It translates the instructions into hardware signals which it distributes to the appropriate circuits, either on the Processor PCA or other PCAs. These circuits perform, on the hardware level, the actions required to implement the instructions.

The Processor PCA interfaces with other PCAs on two busses; a top plane bus and the bottom plane bus. Since use of the bottom plane bus, which must be shared with other PCAs, may require a wait period for the bus to be released by another PCA, the top plane bus is usually used for accessing ROM and RAM memory. The bottom plane bus is used for interfacing with other PCAs such as the Keyboard Interface, data communications, and display PCAs.

While idle, the processor cycles constantly through a sequence of firmware instructions called the monitor loop (figure 8-1) in which all I/O devices are checked to see if they require input or output. The needs of any I/O device are attended to, then the monitor loop is resumed.

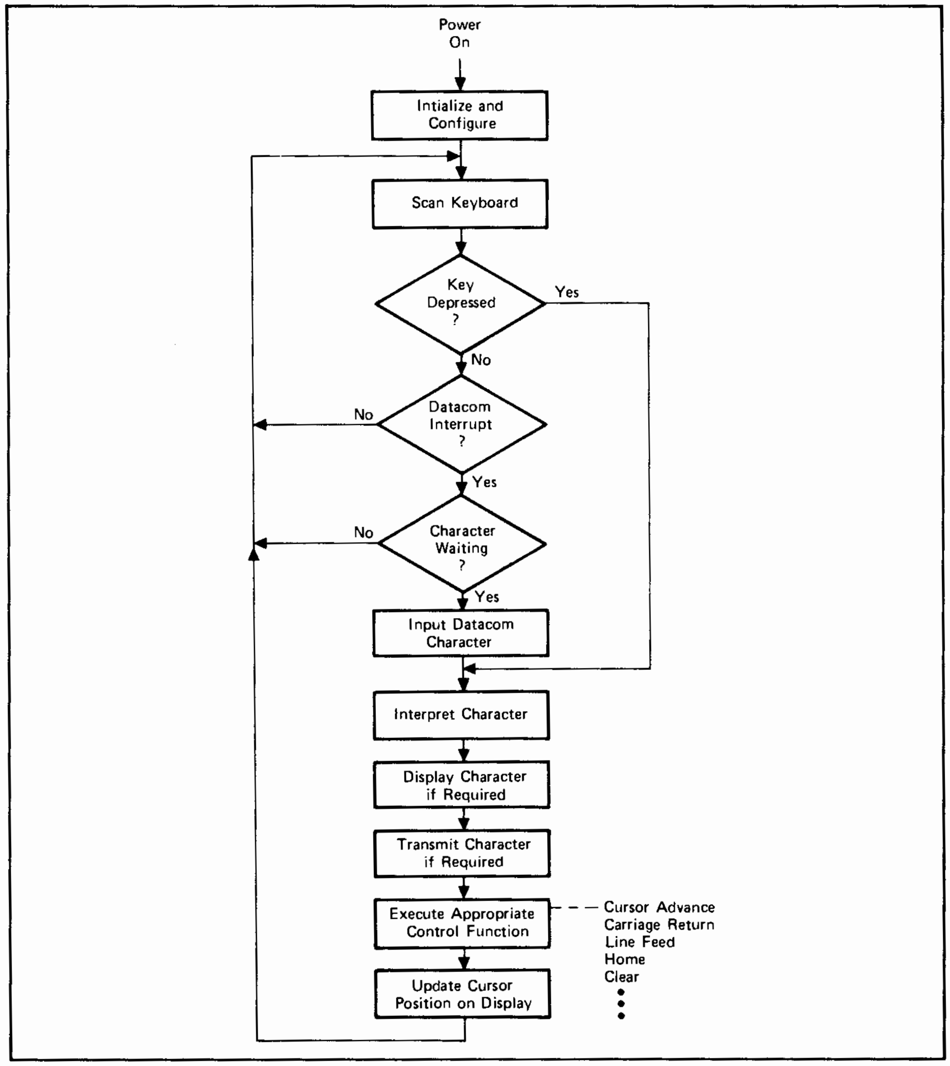


Figure 8-1. System Monitor Basic Loop

ROM PCA(s)

The ROM (Control Memory) PCA(s) contain the ROMs in which the firmware code is stored. The terminal is controlled by the firmware code as executed by the Processor PCA. Figures 8-2 through 8-5 are memory maps of ROM and RAM memory for typical terminals. Functions performed by the firmware code include the following:

1. Initialize the terminal at power on and reset.
2. Implement terminal control functions initiated from the keyboard or any other I/O device.
3. Service interrupts from I/O devices.
4. Keep Display Memory current with input from the I/O device currently selected for input; this includes cursor positioning.
5. Perform self tests.

Each ROM PCA also contains 256 bytes of RAM memory (fast RAM) which is used as scratch pad memory.

RAM PCA(s)

RAM memory is used for temporary storage of variables and pointers, buffer storage for data during data communication operations, and for Display Memory. If a data communications accessory PCA is installed in the terminal, 4K of RAM memory is required for data communications buffer space. Display Memory occupies the space remaining after the pointers, variables, and buffer storage is assigned.

Display Memory consists of a linked list. (Refer to the Reference manual for a description of the linked-list nature of Display Memory.) The 24 lines selected for display on the screen are taken from this list. Any rearrangement of Display Memory, such as inserting or deleting characters or lines, scrolling up or down, selecting the next or previous page for display, etc., is done by changing pointers in the linked list.

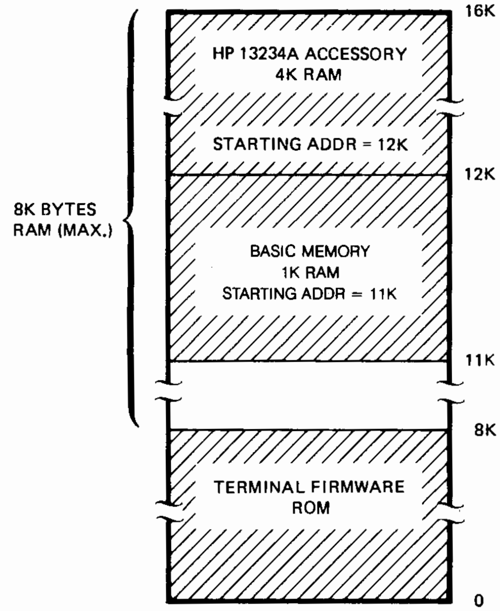


Figure 8-2. 2640X Terminal Memory Map

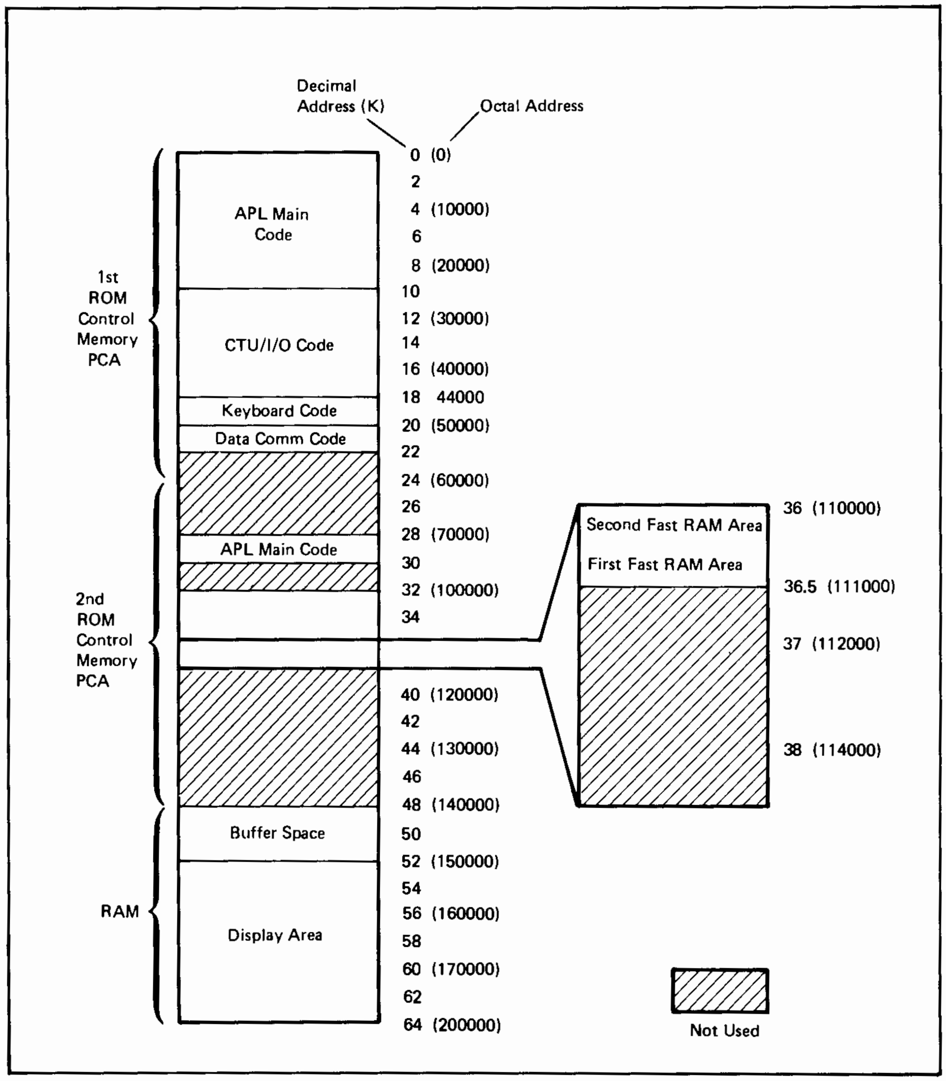


Figure 8-3. 2641A Terminal Memory Map

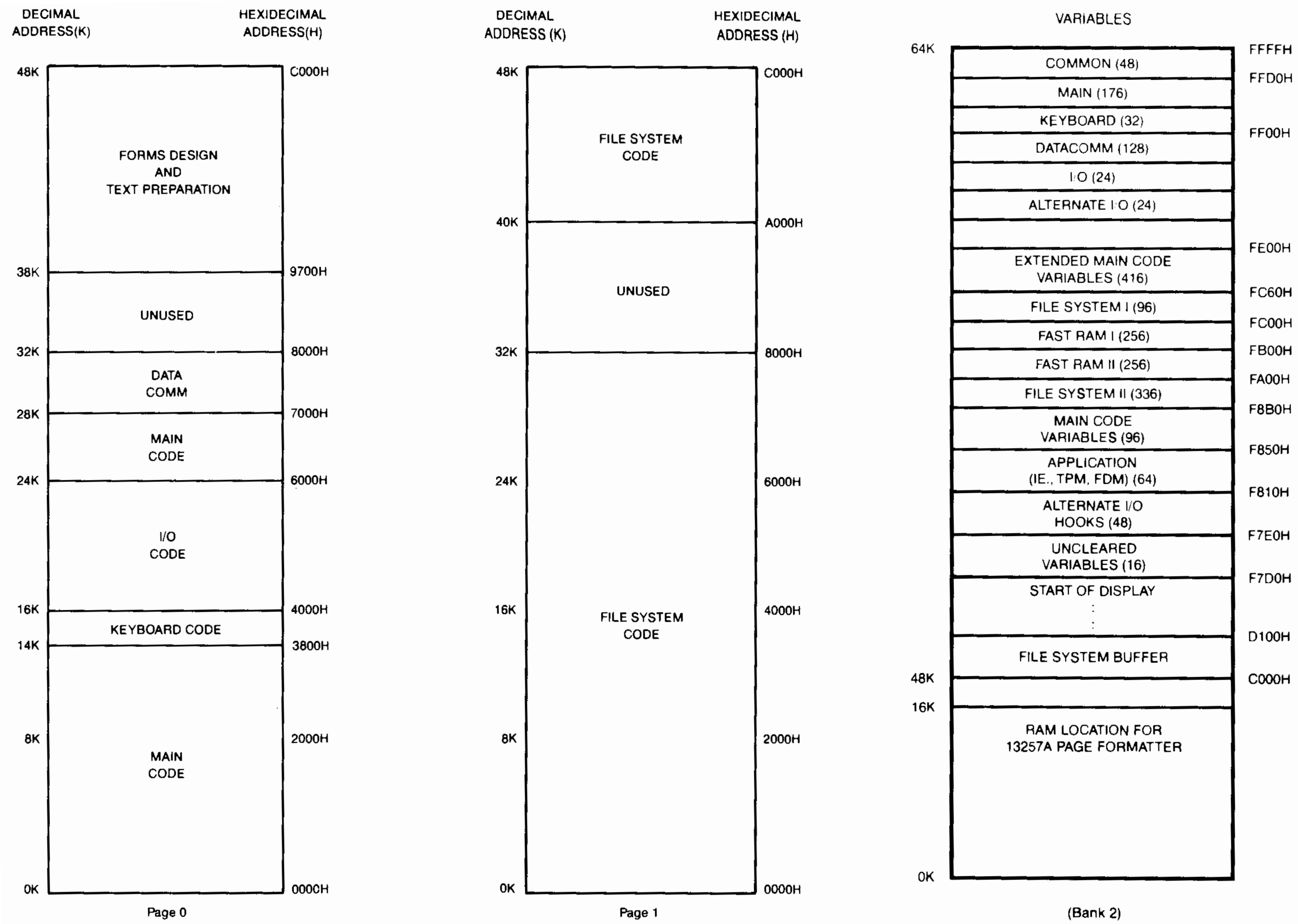


Figure 8-3A. 2642A Terminal Memory Map

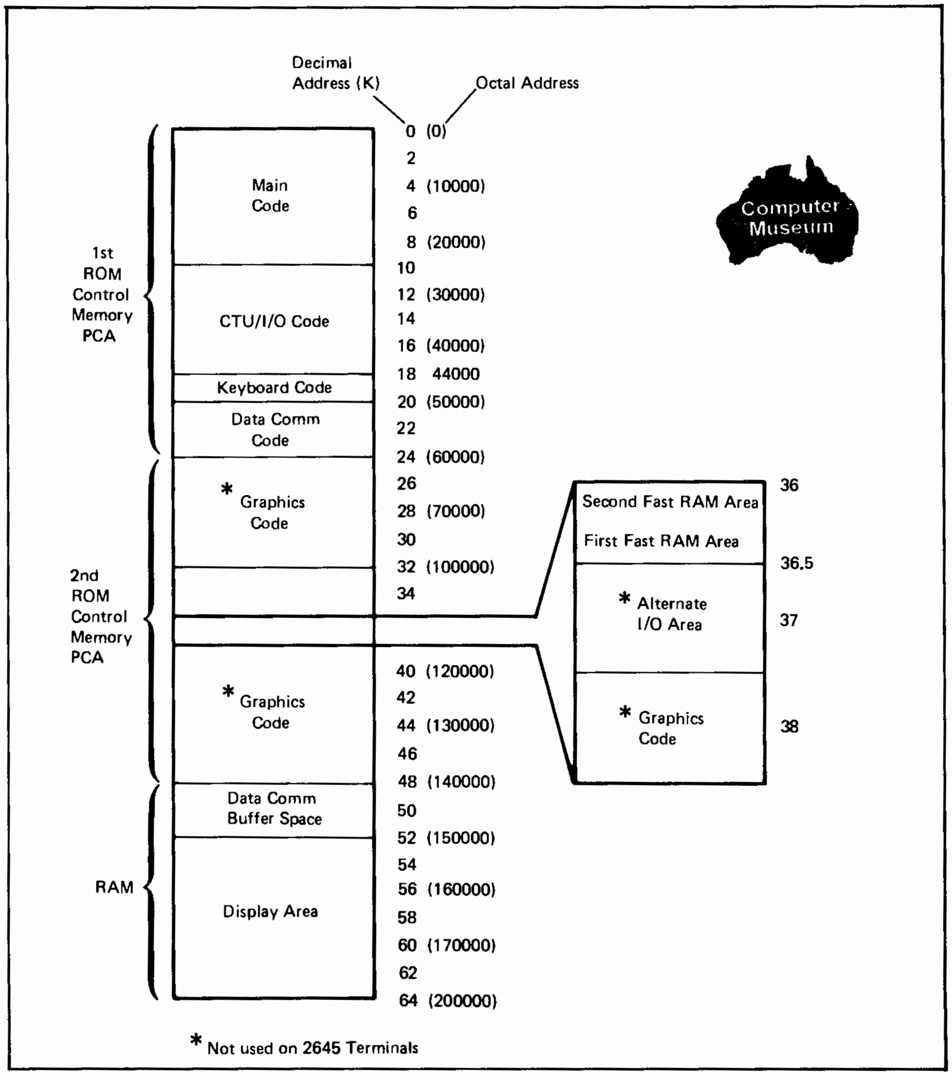


Figure 8-4. 2645 and 2648 Terminals Memory Map

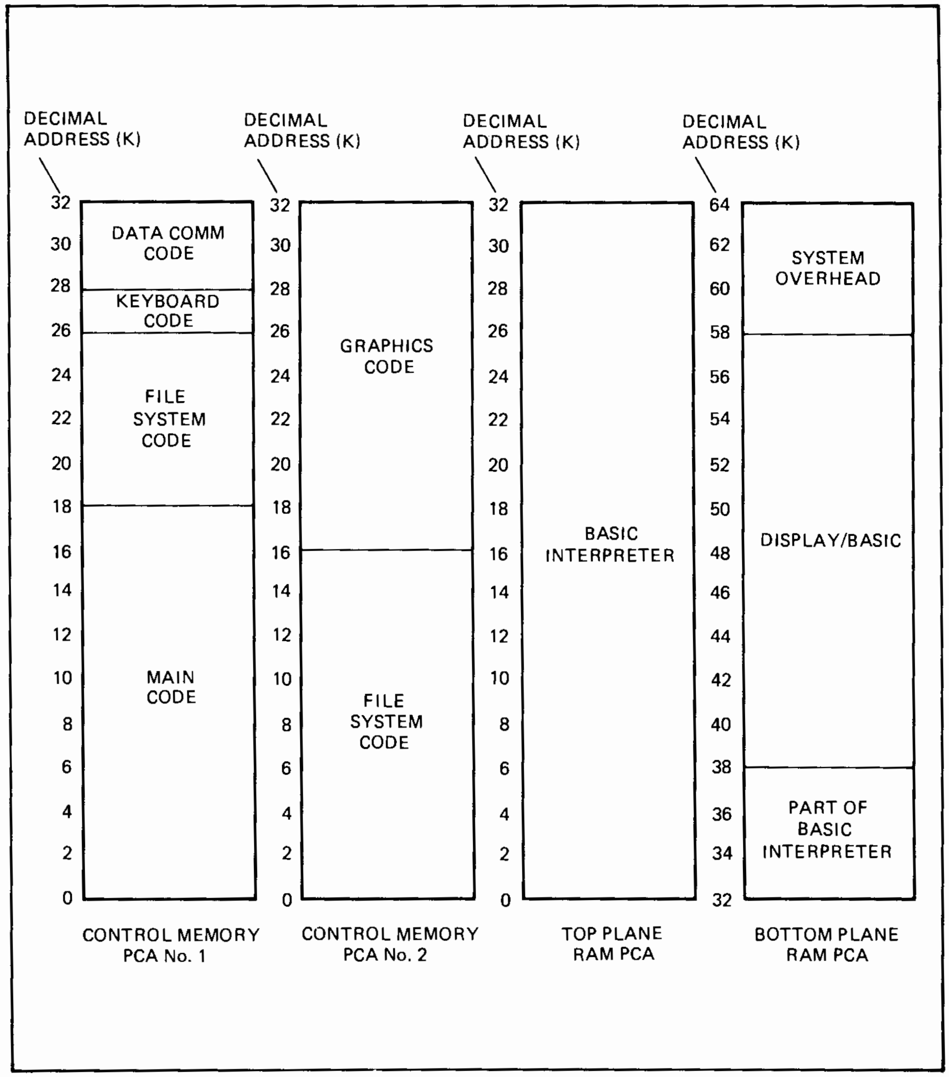


Figure 8-5. 2647A Terminal Memory Map

Display Section

The Display section constantly refreshes the screen with whatever data is stored in Display Memory. Its action is entirely automatic and independent of the firmware. It consists of the DMA, Display Control, Display Timing, and Sweep PCAs and the CRT.

DISPLAY SCREEN ....

The display screen is divided into 24 rows of 80 character cells each. Each character cell is a rectangle, 15 dots (vertical) by nine dots (horizontal) (figure 8-6). If a character cell is occupied by a character, the appropriate dots are lighted, the others remaining blank. The display is produced by sweeping an electron beam horizontally across the screen for 360 sweeps (scan lines) from top to bottom. To produce a row of 80 characters, 15 scan lines are required. Each scan line lights the appropriate dots in each character cells to produce the character to be displayed in the cell. If the character cell is not to contain a character or if the dots on the scan line where it crosses the cell are not to be lighted, the dots remain blank. After the screen has been swept by 360 scan lines, the beam is diverted from the bottom to the top of the screen and the sweep of the screen is repeated.

DISPLAY MEMORY ....

Display Memory may consist of a minimum of 4K to a maximum of 12K of RAM memory. The starting address depends on the amount of memory used. If 4K of memory is used, the starting address is 60K; if 8K is used, the starting address is 56K; and if 12K is used, the starting address is 52K. The highest-numbered addresses are reserved for variables storage and I/O device buffers. The remainder is left for display data.

The portion of display memory for display (24 lines) is scanned constantly by the DMA PCA and the contents are displayed on the screen. It is the responsibility of the firmware to change the contents of Display Memory and to select the 24 lines to be displayed.

DMA PCA ....

The DMA PCA constantly scans the 24 lines of Display Memory selected for display by the firmware. This action, which is automatic and independent of the firmware, occurs constantly while power is applied to the terminal. Its output is supplied to the Display Control PCA as ASCII characters. If the Display Enhancements accessory PCA is installed in the terminal, the DMA PCA informs the Display Timing PCA whether the character currently output from the DMA PCA is to be displayed as inverse video.

The action of the DMA PCA is synchronized to the vertical retrace of the CRT electron beam by a vertical synchronization signal from the Display Control PCA. When it receives this signal, the DMA PCA's Display Memory address pointer, which selects the next byte to be read from Display Memory, is reset to the starting address of Display Memory. This ensures that the first of the 24 lines to be displayed will be displayed at the top of the screen.

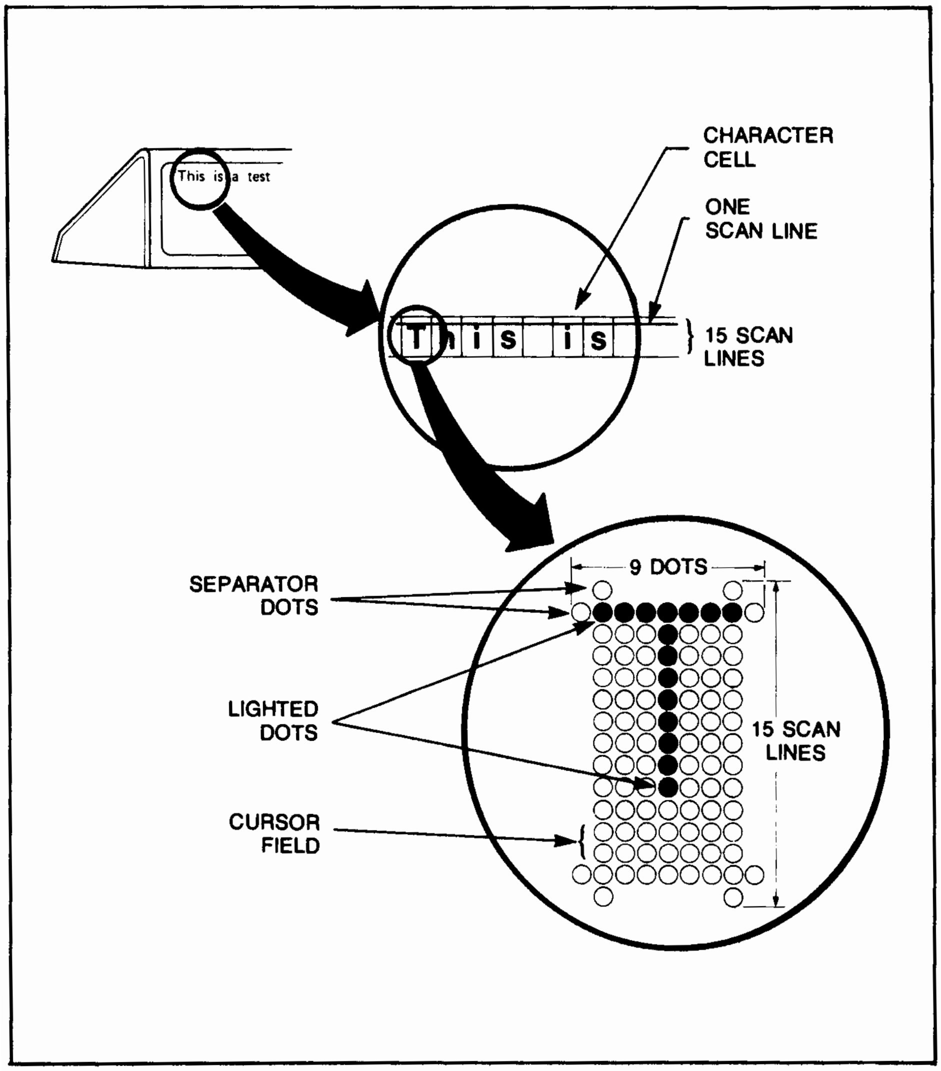


Figure 8-6. Formation of a Character in a Character Cell

DISPLAY CONTROL PCA . . . .

The Display Control PCA converts ASCII characters from the DMA PCA to the appropriate dot pattern and outputs them, as a serial stream of dots, to the Display Timing PCA. Also, it is responsible for vertical control of the display. It generates the vertical drive signal which retraces the CRT electron beam to the top of the screen after it has swept the last scan line of the display. It also generates the vertical synchronization signal to the DMA PCA to ensure that the DMA PCA starts its scan of Display Memory at the same time as the CRT beam starts to sweep the first scan line of the screen.

A row of 80 ASCII characters, as displayed on the screen, consists of 15 scan lines which are output from the Display Control PCA as a continuous stream of dots. The dots, which exist at this stage as 1's or 0's, will be lighted (1) or unlighted (0) when displayed.

The character ROMs, located on the Display Control PCA, contain the dot images of each ASCII character stored as 15 segments of eight dots each. The 15 segments, when stacked vertically, form the character. A modulo 15 counter, also located on the Display Control PCA, is used to count the scan lines, 1 to 15, which form a row on the display screen. The ASCII character code and the current scan line are converted to an address in the character ROM to access the eight-dot segment of a character to be displayed on the current scan line.

The DMA PCA contains two buffers, each with a capacity of 80 characters (one row). While one row of characters is being supplied to the Display Control PCA from one buffer, the other buffer is being filled from Display Memory. Since 15 scan lines are required to produce a row of 80 characters, a row of characters is shifted out of one buffer serially to the Control Memory PCA 15 times in succession, once for each scan line. The first scan line is produced by the Control Memory PCA when the 80 characters are shifted out of the DMA PCA for the first time; the second scan line is produced on the second shift out, etc., until the row of characters is completed with the 15th shift out.

If PROM characters are used (Accessory 13245A) the ASCII character bits are diverted to PROMs on the PROM Character PCA, instead of the ROMs on the Display Control PCA, for conversion to dot patterns which represent the PROM characters before being converted to a dot stream.

The Processor PCA keeps the Display Control PCA informed of the line on which the cursor is positioned. When the Display Control PCA is generating the dot stream for the lowest scan line of the row on which the cursor is located it supplies a cursor enabling signal to the Display Timing PCA.

DISPLAY TIMING PCA ....

The Display Timing PCA composes the dot stream from the Display Control PCA, the Inverse Video signal from the DMA PCA, display enhancement features from the Display Enhancement PCA (if installed), and the cursor into the video dot stream which it supplies to the Sweep PCA. To produce the cursor, it receives the identity of the column in which the cursor is located from the Processor PCA and a cursor enabling signal from the Display Control PCA. When the column in which the cursor is to appear is being traversed while the cursor enabling signal is present (indicating this is the column in which the cursor is to be positioned), the cursor is generated into the video stream.

The Display Timing PCA also produces the horizontal synchronization signal which synchronizes the horizontal sweep of the CRT electron beam with the characters embedded in the dot stream it receives from the Display Control PCA. This signal is also sent to the Sweep PCA.

SWEEP PCA ....

The Sweep PCA converts the horizontal and vertical timing signals, which it receives from the Display Timing and Display Control PCAs, to horizontal and vertical drive signals which it supplies to the CRT yoke. The dot stream, which it receives from the Display Timing PCA, is supplied to the CRT to become the scan beam. The horizontal drive signal moves the beam from left to right across the screen and the vertical drive signal moves it to the top of the screen when the last line has been swept.

Examples of Signal Flow

Two examples of signal flow between replaceable modules are supplied in the following discussion; signal flow occurring when a character key is pressed on the keyboard and signal flow occurring when the cursor is repositioned.

CHARACTER TRANSFER FROM ...... THE KEYBOARD TO THE CRT

The keypunch, entered by the user at the keyboard, is stored in the Keyboard assembly (figure 8-7). When the Processor PCA reaches the point in the monitor loop which requires that it check the keyboard for input, it accesses the keypunch through the Keyboard Interface PCA. When accessed, the keypunch is sent to the Processor PCA through the Keyboard Interface PCA in the form of an eight-bit code. The Processor PCA converts the keyboard code to ASCII code by accessing a conversion table in the keyboard code section of the ROM memory. Then the ASCII code is stored in Display Memory.

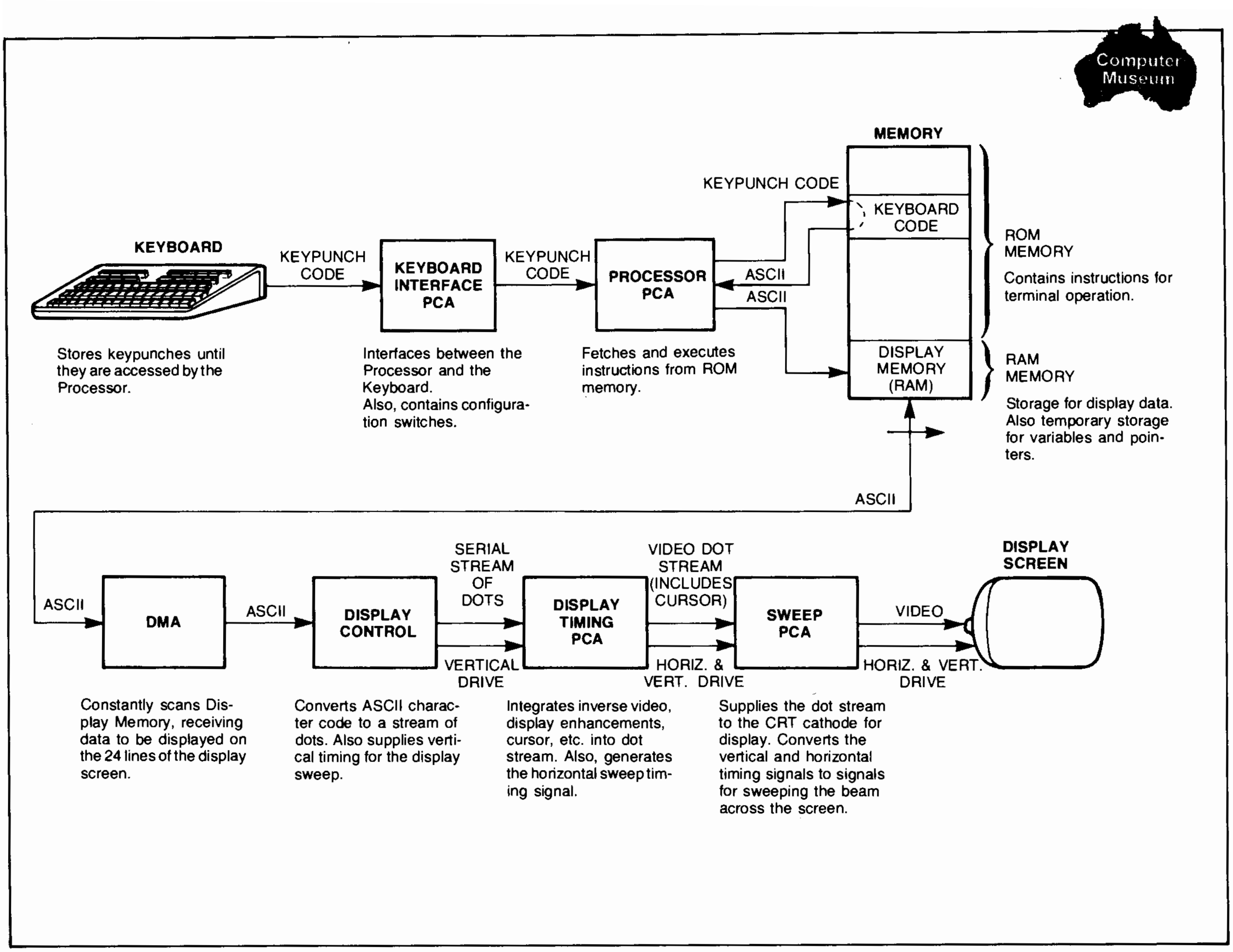


Figure 8-7. Signal Flow of a Character from the Keyboard to the Display Screen

With the character stored in Display Memory, the remaining actions in the character transfer are automatic. The ASCII character is transferred from Display Memory to the Display Control PCA when the DMA PCA makes its next sweep of the 24 lines of Display Memory selected for display. (The DMA PCA constantly sweeps these 24 lines, transferring the data to the Control Memory PCA. This keeps the CRT refreshed with the latest display data.)

The Display Control PCA converts the ASCII character to 15 line segments consisting of nine dots each (the width of a character cell). These line segments are incorporated into the serial dot stream, one segment per horizontal sweep of the CRT beam, so that they will be displayed, stacked vertically, in the row and column of the screen allotted as the character cell for this character.

As the dot stream, containing the 15 line segments, passes through the Display Timing PCA, inverse video (if selected) and display enhancement features (if the Display Enhancements PCA is installed) are incorporated into the character line segments.

CURSOR POSITIONING ....

When the cursor is repositioned during terminal operation, the firmware, with the Processor PCA as agent, determines the row and column in which the cursor is presently located (figure 8-8). This information is stored in the display variables portion of RAM memory. The row and column identities are modified, as required by the firmware; then the row identity is supplied to the Display Control PCA and the column identity is supplied to the Display Timing PCA. The Display Control PCA controls vertical timing of the display sweep and the Display Timing PCA controls sweep horizontal timing.

During the time the CRT beam is sweeping the row in which the cursor is to be positioned, the Display Control PCA activates the Cursor Enable signal to the Display Timing PCA. When the beam is sweeping the column in which the cursor is to be positioned while the Cursor Enable signal is active, the Display Timing PCA injects the cursor into the dot stream. The cursor then passes through the Sweep PCA to the CRT cathode with the dot stream and is displayed on the screen.

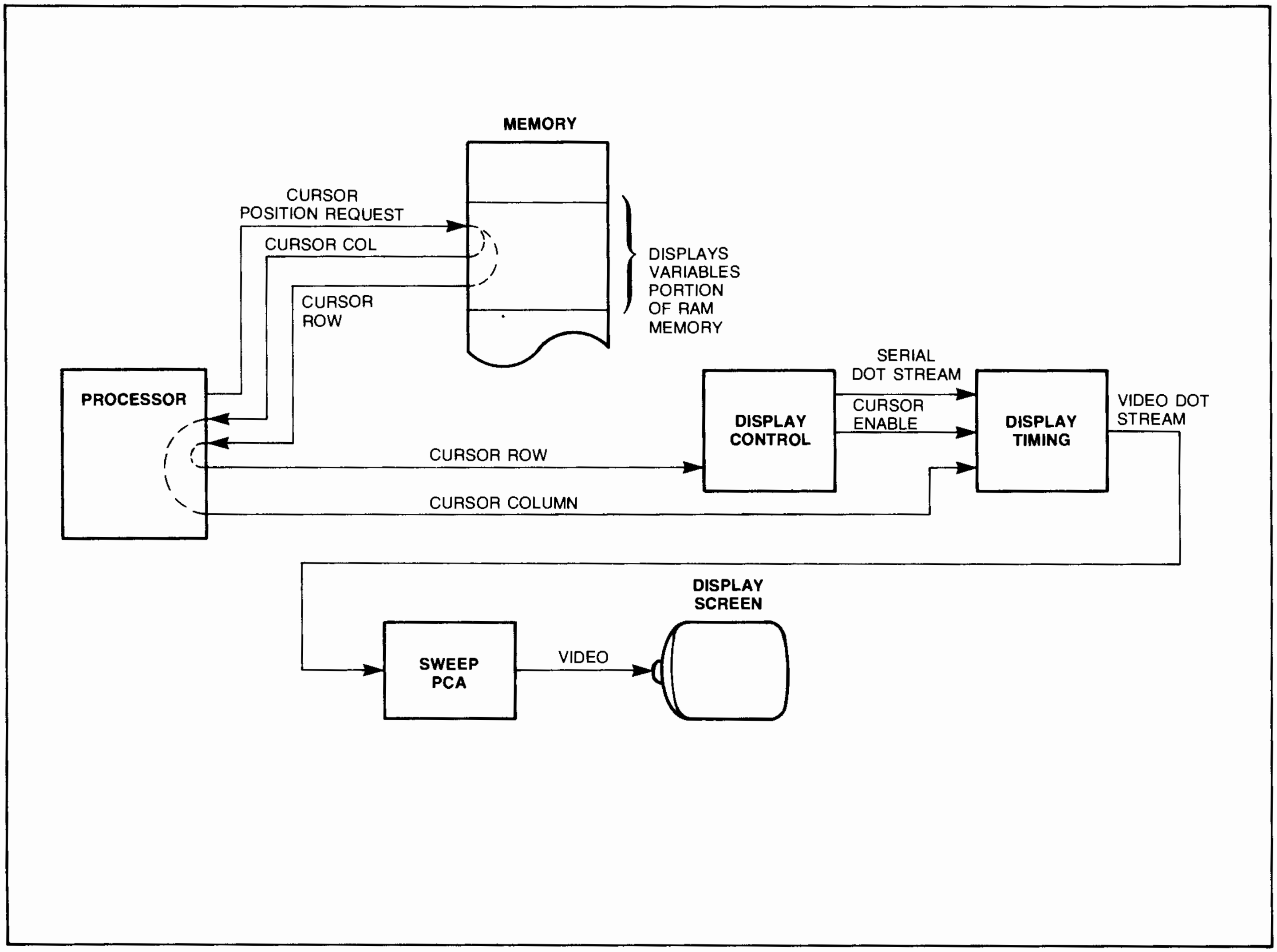


Figure 8-8. Signal Flow Illustrating Cursor Positioning

Appendices

A

Appendix A

How to Handle Service Calls

Before visiting a customer's site, it is desirable to get as much specific information as possible. Following is a list of items on which to question the customer before making a trip:

1. Have customer lift the rear cover of the terminal and read the following information off the under side of the cover:
   a. Model.
   b. Serial number.
   c. Options.
2. Is the terminal connected to:
   a. A computer.
   b. A peripheral device such as a printer or plotter.
   c. In an HP-IB configuration.
3. If connected to a computer, find out the following:
   a. Kind of computer.
   b. Is the computer up and operating correctly.
   c. Is the terminal connected to the computer through a modem.
   d. Does the malfunction occur in local or remote mode or both.
   e. If in local mode, check that the MEMORY LOCK and DISPLAY FUNCTIONS indicators aren't lighted and the REMOTE key is in the up (off) position.
   f. If in remote mode, check the following:
      (1) The REMOTE key is locked in the down (on) position and the DISPLAY FUNCTIONS and MEMORY LOCK indicators aren't lighted.
      (2) The BLOCK MODE key is locked in the down (on) position only if the customer is intentionally operating in block mode.
      (3) The DUPLEX, PARITY, and BAUD RATE switches are correctly set.
      (4) Determine the following about the data comm configuration:
         (a) Point-to-point or multipoint.
         (b) Asynchronous or synchronous.

4. Determine malfunction symptoms.
5. Make sure you have the correct kit for the model of terminal to be serviced.
6. Make sure the kit contents are complete and correct. This can be verified by checking the Product Support Plan for the terminal.

Appendix B

Reference Tables

INTRODUCTION

This appendix contains the following reference information for each model terminal covered by this manual:

- Character Code Chart
- Large Character Set coding table for forming large characters.

Table B-1. Character Code Chart Reference Tables

BIT 7 6 5 / 4321	CONTROL (CNTL) CHARACTERS		DISPLAYABLE CHARACTERS						ESCAPE SENT FIRST					
	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0000	@ 0 NUL	P 16 DLE	SP	0	@	P	`	p	SP	0	@ DELAY 1 SEC	P DELETE CHAR	` CURSOR RELATIVE SENSE	p f_1
0001	A 1 SOH	Q 17 DC1	!	1	A	Q	a	q	!	1 SET TAB	A ↑ CURSOR UP	Q INSERT CHAR ON	a CURSOR ABSOLUTE SENSE	q f_2
0010	B 2 STX	R 18 DC2	"	2	B	R	b	r	"	2 CLEAR TAB	B ↓ CURSOR DOWN	R INSERT CHAR OFF	b KEYBOARD ENABLE	r f_3
0011	C 3 ETX	S 19 DC3	#	3	C	S	c	s	#	3 CLEAR ALL TABS	C → CURSOR RIGHT	S ROLL UP	c KEYBOARD DISABLE	s f_4
0100	D 4 EOT	T 20 DC4	$	4	D	T	d	t	$	4 SET LEFT MARGIN	D ← CURSOR LEFT	T ROLL DOWN	d ENTER	t f_5
0101	E 5 ENQ	U 21 NAK	%	5	E	U	e	u	%	5 SET RIGHT MARGIN	E RESET TERMINAL	U NEXT PAGE	e BINARY READ	u f_6
0110	F 6 ACK	V 22 SYN	&	6	F	V	f	v	& PARA METER SEQUENCE	6 START ALPHA FIELD	F CURSOR HOME DOWN	V PREV PAGE	f MODEM DIS CONNECT	v f_7
0111	G 7 BEL	W 23 ETB	'	7	G	W	g	w	'	7 START NUMERIC FIELD	G CURSOR RETURN	W FORMAT MODE ON	g SOFT RESET	w f_8
1000	H 8 BS	X 24 CAN	(	8	H	X	h	x	(	8 START ALPHNUM FIELD	H HOME CURSOR (SEE NOTE 3)	X FORMAT MODE OFF	h HOME CURSOR (SEE NOTE 3)	x DATA COM SELF TEST
1001	I 9 HT	Y 25 EM	)	9	I	Y	i	y	) DEFINE CHAR SET	9	I HORI-ZONTAL TAB	Y DISPLAY FUNCTIONS ON	i BACK TAB	y MONITOR MODE ON
1010	J 10 LF	Z 26 SUB	*	:	J	Z	j	z	* GRAPHICS SEQUENCE	:	J CLEAR DSPLY	Z DISPLAY FUNCTIONS OFF	j SOFT KEY DISPLAY ON	z TERMINAL SELF TEST
1011	K 11 VT	[27 ESC	+	;	K	[	k	{	+	;	K ERASE TO END OF LINE	[START UNPROTECT FIELD	k SOFT KEY DISPLAY OFF	{ START XMIT ONLY FIELD
1100	L 12 FF	\ 28 FS	,	<	L	\	l	|	, COMMAND SEQUENCE	<	L INSERT LINE	\	l MEMORY LOCK ON	|
1101	M 13 CR	] 29 GS	–	=	M	]	m	}	–	=	M DELETE LINE	] END UNPROTECT FIELD	m MEMORY LOCK OFF	}
1110	N 14 SO	^ 30 RS		>	N	^	n	~		>	N INSERT CHAR W/WRAP ON	^ TERM PRIMARY STATUS	n	~ SEND SECOND-ARY STATUS
1111	O 15 SI	_ 31 US	/	?	O	_	o	▮	/	?	O DELETE CHAR W/WRAP	_ INSERT NON-DISP TERMINATR	o	DEL

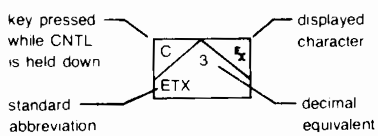
Example: J is bits 1001010; Control J is LF line feed; Escape (ESC) followed by J is CLEAR DISPLAY

LEGEND

NOTES:

1. LOWER CASE LETTER, LOWER CASE SYMBOL, AND CONTROL CHARACTER CODES ARE GENERATED BY STANDARD TERMINAL, BUT ASSOCIATED CHARACTERS ARE NOT DISPLAYED ON THE SCREEN. PRESS TAPE TEST KEY FOR DISPLAYABLE CHARACTER SET.
2. SINGLE CHARACTER ESCAPE SEQUENCES AND CONTROL CODES NOT LISTED WITH A FUNCTION ARE NEITHER ACTED UPON NOR DISPLAYED.
3. ESC H HOMES CURSOR INCLUDING TRANSMIT-ONLY FIELDS. ESC h HOMES CURSOR EXCLUDING TRANSMIT-ONLY FIELDS.

Control Character Legend:



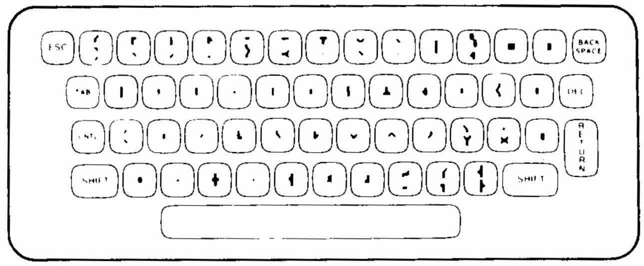
AK — ACKNOWLEDGE
BL — BELL
BS — BACKSPACE
CS — CANCEL LINE
CR — CARRIAGE RETURN
DL — DATA LINK ESCAPE
D1 — DEVICE CONTROL 1
D2 — DEVICE CONTROL 2
D3 — DEVICE CONTROL 3
D4 — DEVICE CONTROL 4
— DELETE
EM — END OF MEDIUM
EQ — ENQUIRY
ET — END OF TRANSMISSION
EC — ESCAPE
EB — END OF TRANSMISSION BLOCK
EX — END OF TEXT
FF — FORM FEED
FS — FILE SEPARATOR
GS — GROUP SEPARATOR
HT — HORIZONTAL TABULATION
LF — LINE FEED
NK — NEGATIVE ACKNOWLEDGE
RS — RECORD SEPARATOR
SI — SHIFT IN
SO — SHIFT OUT
SP — SPACE
SH — START OF HEADING
SX — START OF TEXT
SB — SUBSTITUTE
SY — SYNCHRONOUS IDLE
US — UNIT SEPARATOR
VT — VERTICAL TABULATION

Table B-2. Coding the Large Character Set

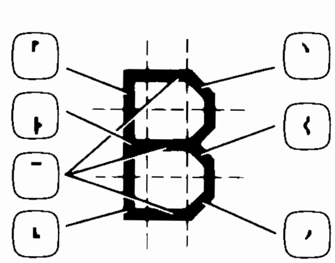
! ' 0 S	— %&,	9 !&+ G&? G&L	E "&, /& F&,	Q !&+ 0 0 G&N	] %. 0 %M	i • ' E	u '' FM
" ''	. Z	: Z Z	F "&, /& E	R "&+ /&@ E E	^ 9 K	j • ' GL	v '' GL
# CC CC	÷ • %&, 4	; Y L	G !&+ 0 . G&L	S !&+ G&+ G&L	_ ^^^	k ' /@ EE	w '' HD
$!C+ GC+ GCL	0 !&+ 0 0 G&L	< 3 2	H ' ' /&? E E	T %', 0 E	` +	l ' 0 E	x 5@ EE
% P P 3<D Y Y	1 - 0 E	= %&, %&,	I ' 0 I	U ' ' 0 0 G&L	a !. GM	m $- EE	y '' G?
& !+ 5IC G&L	2 !&+ !&L F&,	>) D	J ' 0 L	V ' ' 0 0 2JD	b ' /+ FL	n "+ EE	z %. F,
' '	3 !&+ &@ G&L	? !&+ >D S	K ' ' /6A E E	W ' ' 090 HKD	c !, G,	o !+ GL	{ !, @ G,
(!, 0 G,	4 ' ' F&C E	@ !&+ !.0 GIL	L ' 0 F&,	X ' ' 1:A E E	d ' !? GM	p "+ /L	¦ Q U
) %+ 0 %L	5 "&, F&+ G&L	A !&+ /&? E E	M $(- 070 E E	Y ' ' 2;D E	e !+ G,	q !. G?	} %+ 5 %L
× 1:A	6 !&+ /&+ G&L	B "&+ /&@ F&L	N $)' 08B E E	Z "&. 3<D F&M	f !+ C E	r !, E	~ !&L
+ • %C, 4	7 %&. >D E	C !&+ 0 G&L	O "&. 0 0 F&M	[", 0 F,	g !. G?	s !, %L	▒ --- --- ---
, L	8 !&+ 5&@ G&L	D "&+ 0 0 F&L	P "&+ /&L E	\ ' 2:) E	h ' /+ EE	t • C GL	

Table B-2. Coding the Large Character Set (Continued)

The elements of the Large Character Set are associated with the keyboard as pictured below:



Each large character is actually made up of nine character segments. An example of constructing the letter "B" using the Large Character Set follows:



Appendix C

Communications Flowcharts

This appendix contains reference information on terminal communication functions. This material consists of the following flowcharts and tables:

- ASCII code table.
- ASCII to EBCDIC code conversion tables.
- Overall point-to-point communications flowchart.
- Keyboard communication switches.

Table C-1 is a list of the ASCII characters and their decimal equivalents. Tables C-2 and C-3 contain information for converting data between the ASCII and EBCDIC character sets.

The flowchart in figure C-1 illustrates the overall point-to-point communication function. The various configuration parameters (switches) are included in the diagram. Figure C-2 illustrates the way the terminal responds to various Keyboard Interface PCA switches.

Table C-1. ASCII Character Set

DECIMAL VALUE	GRAPHIC	COMMENTS	ALTERNATE CHARACTER
0	␀	Null	$@^c$
1	␁	Start of heading	A^c
2	␂	Start of text	B^c
3	␃	End of text	C^c
4	␄	End of transmission	D^c
5	␅	Enquiry	E^c
6	␆	Acknowledge	F^c
7	␇	Bell	G^c
8	␈	Backspace	H^c
9	␉	Horizontal tabulation	I^c
10	␊	Line feed	J^c
11	␋	Vertical tabulation	K^c
12	␌	Form feed	L^c
13	␍	Carriage return	M^c
14	␎	Shift out	N^c
15	␏	Shift in	O^c
16	␐	Data link escape	P^c
17	␑	Device control 1 (X-ON)	Q^c
18	␒	Device control 2	R^c
19	␓	Device control 3 (X-OFF)	S^c
20	␔	Device control 4	T^c
21	␕	Negative acknowledge	U^c
22	␖	Synchronous idle	V^c
23	␗	End of transmission block	W^c
24	␘	Cancel	X^c
25	␙	End of medium	Y^c
26	␚	Substitute	Z^c
27	␛	Escape	$[^c$
28	␜	File separator	$\backslash^c$
29	␝	Group separator	$]^c$
30	␞	Record separator	$\wedge^c$
31	␟	Unit separator	
32		Space (Blank)	
33	!	Exclamation point	
34	"	Quotation mark	
35	#	Number sign	
36	$	Dollar sign	
37	%	Percent sign	
38	&	Ampersand	
39	'	Apostrophe	
40	(	Opening parenthesis	
41	)	Closing parenthesis	
42	*	Asterisk	
43	+	Plus	
44	,	Comma	
45	-	Hyphen (Minus)	
46	.	Period (Decimal)	
47	/	Slant	
48	0	Zero	
49	1	One	
50	2	Two	
51	3	Three	
52	4	Four	
53	5	Five	
54	6	Six	
55	7	Seven	
56	8	Eight	
57	9	Nine	
58	:	Colon	
59	;	Semicolon	
60	<	Less than	
61	=	Equals	
62	>	Greater than	
63	?	Question mark	
64	@	Commercial at	
65	A	Uppercase A	
66	B	Uppercase B	
67	C	Uppercase C	
68	D	Uppercase D	
69	E	Uppercase E	
70	F	Uppercase F	
71	G	Uppercase G	
72	H	Uppercase H	
73	I	Uppercase I	

Table C-1. ASCII Character Set (Continued)

DECIMAL VALUE	GRAPHIC	COMMENTS	ALTERNATE CHARACTER
74	J	Uppercase J	
75	K	Uppercase K	
76	L	Uppercase L	
77	M	Uppercase M	
78	N	Uppercase N	
79	O	Uppercase O	
80	P	Uppercase P	
81	Q	Uppercase Q	
82	R	Uppercase R	
83	S	Uppercase S	
84	T	Uppercase T	
85	U	Uppercase U	
86	V	Uppercase V	
87	W	Uppercase W	
88	X	Uppercase X	
89	Y	Uppercase Y	
90	Z	Uppercase Z	
[1] 91	[	Opening bracket	
[2] 92	\	Reverse slant	
[1] 93	]	Closing bracket	
[1] 94	^	Circumflex	
[2] 95	_	Underscore	
96	`	Grave accent	
97	a	Lowercase a	
98	b	Lowercase b	
99	c	Lowercase c	
100	d	Lowercase d	
101	e	Lowercase e	
102	f	Lowercase f	
103	g	Lowercase g	
104	h	Lowercase h	
105	i	Lowercase i	
106	j	Lowercase j	
107	k	Lowercase k	
108	l	Lowercase l	
109	m	Lowercase m	
110	n	Lowercase n	
111	o	Lowercase o	
112	p	Lowercase p	
113	q	Lowercase q	
114	r	Lowercase r	
115	s	Lowercase s	
116	t	Lowercase t	
117	u	Lowercase u	
118	v	Lowercase v	
119	w	Lowercase w	
120	x	Lowercase x	
121	y	Lowercase y	
122	z	Lowercase z	
[2] 123	{	Opening (left) brace	
[2] 124	|	Vertical line	
[2] 125	}	Closing (right) brace	
[2] 126	~	Tilde	
127		Delete	

Notes:
1. The equivalent EBCDIC character uses a different graphic.
2. No equivalent character exists in EBCDIC.

Table C-2. ASCII (7-Bit) Character Codes

GRAPHIC	DEC	OCT	HEX
NUL	0	0	0
SOH	1	1	1
STX	2	2	2
ETX	3	3	3
EOT	4	4	4
ENQ	5	5	5
ACK	6	6	6
BEL	7	7	7
BS	8	10	8
HT	9	11	9
LF	10	12	A
VT	11	13	B
FF	12	14	C
CR	13	15	D
SO	14	16	E
SI	15	17	F
DLE	16	20	10
DC1	17	21	11
DC2	18	22	12
DC3	19	23	13
DC4	20	24	14
NAK	21	25	15
SYN	22	26	16
ETB	23	27	17
CAN	24	30	18
EM	25	31	19
SUB	26	32	1A
ESC	27	33	1B
FS	28	34	1C
GS	29	35	1D
RS	30	36	1E
US	31	37	1F
SP	32	40	20

GRAPHIC	DEC	OCT	HEX
!	33	41	21
"	34	42	22
#	35	43	23
$	36	44	24
%	37	45	25
&	38	46	26
'	39	47	27
(	40	50	28
)	41	51	29
*	42	52	2A
+	43	53	2B
,	44	54	2C
-	45	55	2D
.	46	56	2E
/	47	57	2F
0	48	60	30
1	49	61	31
2	50	62	32
3	51	63	33
4	52	64	34
5	53	65	35
6	54	66	36
7	55	67	37
8	56	70	38
9	57	71	39
:	58	72	3A
;	59	73	3B
<	60	74	3C
=	61	75	3D
>	62	76	3E
?	63	77	3F
@	64	100	40

Table C-2. ASCII (7-Bit) Character Codes (Continued)

GRAPHIC	DEC	OCT	HEX
A	65	101	41
B	66	102	42
C	67	103	43
D	68	104	44
E	69	105	45
F	70	106	46
G	71	107	47
H	72	110	48
I	73	111	49
J	74	112	4A
K	75	113	4B
L	76	114	4C
M	77	115	4D
N	78	116	4E
O	79	117	4F
P	80	120	50
Q	81	121	51
R	82	122	52
S	83	123	53
T	84	124	54
U	85	125	55
V	86	126	56
W	87	127	57
X	88	130	58
Y	89	131	59
Z	90	132	5A
[	91	133	5B
\	92	134	5C
]	93	135	5D
^	94	136	5E
_	95	137	5F
`	96	140	60

GRAPHIC	DEC	OCT	HEX
a	97	141	61
b	98	142	62
c	99	143	63
d	100	144	64
e	101	145	65
f	102	146	66
g	103	147	67
h	104	150	68
i	105	151	69
j	106	152	6A
k	107	153	6B
l	108	154	6C
m	109	155	6D
n	110	156	6E
o	111	157	6F
p	112	160	70
q	113	161	71
r	114	162	72
s	115	163	73
t	116	164	74
u	117	165	75
v	118	166	76
w	119	167	77
x	120	170	78
y	121	171	79
z	122	172	7A
{	123	173	7B
¦	124	174	7C
}	125	175	7D
~	126	176	7E
█	127	177	7F

Table C-3. EBCDIC Character Codes

GRAPHIC	DEC	OCT	HEX
NUL	0	0	0
SOH	1	1	1
STX	2	2	2
ETX	3	3	3
PF	4	4	4
HT	5	5	5
	6	6	6
DEL	7	7	7
	8	10	8
	9	11	9
	10	12	A
VT	11	13	B
FF	12	14	C
CR	13	15	D
SO	14	16	E
SI	15	17	F
DLE	16	20	10
DC1	17	21	11
DC2	18	22	12
TM	19	23	13
RES	20	24	14
NL	21	25	15
BS	22	26	16
IL	23	27	17
CAN	24	30	18
EM	25	31	19
CC	26	32	1A
CU1	27	33	1B
IFS	28	34	1C
IGS	29	35	1D
IRS	30	36	1E
IUS	31	37	1F
DS	32	40	20
SOS	33	41	21
FS	34	42	22

GRAPHIC	DEC	OCT	HEX
	35	43	23
BYP	36	44	24
LF	37	45	25
ETB	38	46	26
ESC	39	47	27
	40	50	28
	41	51	29
SM	42	52	2A
CU2	43	53	2B
	44	54	2C
ENQ	45	55	2D
ACK	46	56	2E
BEL	47	57	2F
	48	60	30
	49	61	31
SYN	50	62	32
	51	63	33
PN	52	64	34
RS	53	65	35
UC	54	66	36
EOT	55	67	37
	56	70	38
	57	71	39
	58	72	3A
CU3	59	73	3B
DC4	60	74	3C
NAK	61	75	3D
	62	76	3E
SUB	63	77	3F
SP	64	100	40
	65	101	41
	66	102	42
	67	103	43
	68	104	44
	69	105	45

Table C-3. EBCDIC Character Codes (Continued)

GRAPHIC	DEC	OCT	HEX
	70	106	46
	71	107	47
	72	110	48
	73	111	49
	74	112	4A
.	75	113	4B
<	76	114	4C
(	77	115	4D
+	78	116	4E
ББ	79	117	4F
&	80	120	50
	81	121	51
	82	122	52
	83	123	53
	84	124	54
	85	125	55
	86	126	56
	87	127	57
	88	130	58
	89	131	59
!	90	132	5A
$	91	133	5B
*	92	134	5C
)	93	135	5D
;	94	136	5E
¬	95	137	5F
-	96	140	60
/	97	141	61
	98	142	62
	99	143	63
	100	144	64
	101	145	65
	102	146	66
	103	147	67
	104	150	68

GRAPHIC	DEC	OCT	HEX
	105	151	69
¦	106	152	6A
,	107	153	6B
%	108	154	6C
_	109	155	6D
>	110	156	6E
?	111	157	6F
	112	160	70
	113	161	71
	114	162	72
	115	163	73
	116	164	74
	117	165	75
	118	166	76
	119	167	77
	120	170	78
	121	171	79
:	122	172	7A
#	123	173	7B
@	124	174	7C
'	125	175	7D
=	126	176	7E
"	127	177	7F
	128	200	80
a	129	201	81
b	130	202	82
c	131	203	83
d	132	204	84
e	133	205	85
f	134	206	86
g	135	207	87
h	136	210	88
i	137	211	89
	138	212	8A
	139	213	8B

Table C-3. EBCDIC Character Codes (Continued)

GRAPHIC	DEC	OCT	HEX
	140	214	8C
	141	215	8D
	142	216	8E
	143	217	8F
	144	220	90
j	145	221	91
k	146	222	92
l	147	223	93
m	148	224	94
n	149	225	95
o	150	226	96
p	151	227	97
q	152	230	98
r	153	231	99
	154	232	9A
	155	233	9B
	156	234	9C
	157	235	9D
	158	236	9E
	159	237	9F
	160	240	A0
~	161	241	A1
s	162	242	A2
t	163	243	A3
u	164	244	A4
v	165	245	A5
w	166	246	A6
x	167	247	A7
y	168	250	A8
z	169	251	A9
	170	252	AA
	171	253	AB
	172	254	AC
[	173	255	AD
	174	256	AE

GRAPHIC	DEC	OCT	HEX
	175	257	AF
	176	260	B0
	177	261	B1
	178	262	B2
	179	263	B3
	180	264	B4
	181	265	B5
	182	266	B6
	183	267	B7
	184	270	B8
	185	271	B9
	186	272	BA
	187	273	BB
	188	274	BC
]	189	275	BD
	190	276	BE
	191	277	BF
{	192	300	C0
A	193	301	C1
B	194	302	C2
C	195	303	C3
D	196	304	C4
E	197	305	C5
F	198	306	C6
G	199	307	C7
H	200	310	C8
I	201	311	C9
	202	312	CA
	203	313	CB
	204	314	CC
	205	315	CD
	206	316	CE
	207	317	CF
}	208	320	D0
J	209	321	D1

Table C-3. EBCDIC Character Codes (Continued)

GRAPHIC	DEC	OCT	HEX
K	210	322	D2
L	211	323	D3
M	212	324	D4
N	213	325	D5
O	214	326	D6
P	215	327	D7
Q	216	330	D8
R	217	331	D9
	218	332	DA
	219	333	DB
	220	334	DC
	221	335	DD
	222	336	DE
	223	337	DF
\	224	340	E0
	225	341	E1
S	226	342	E2
T	227	343	E3
U	228	344	E4
V	229	345	E5
W	230	346	E6
X	231	347	E7
Y	232	350	E8
Z	233	351	E9
	234	352	EA
	235	353	EB
	236	354	EC
	237	355	ED
	238	356	EE
	239	357	EF

GRAPHIC	DEC	OCT	HEX
0	240	360	F0
1	241	361	F1
2	242	362	F2
3	243	363	F3
4	244	364	F4
5	245	365	F5
6	246	366	F6
7	247	367	F7
8	248	370	F8
9	249	371	F9
	250	372	FA
	251	373	FB
	252	374	FC
	253	375	FD
	254	376	FE
	255	377	FF

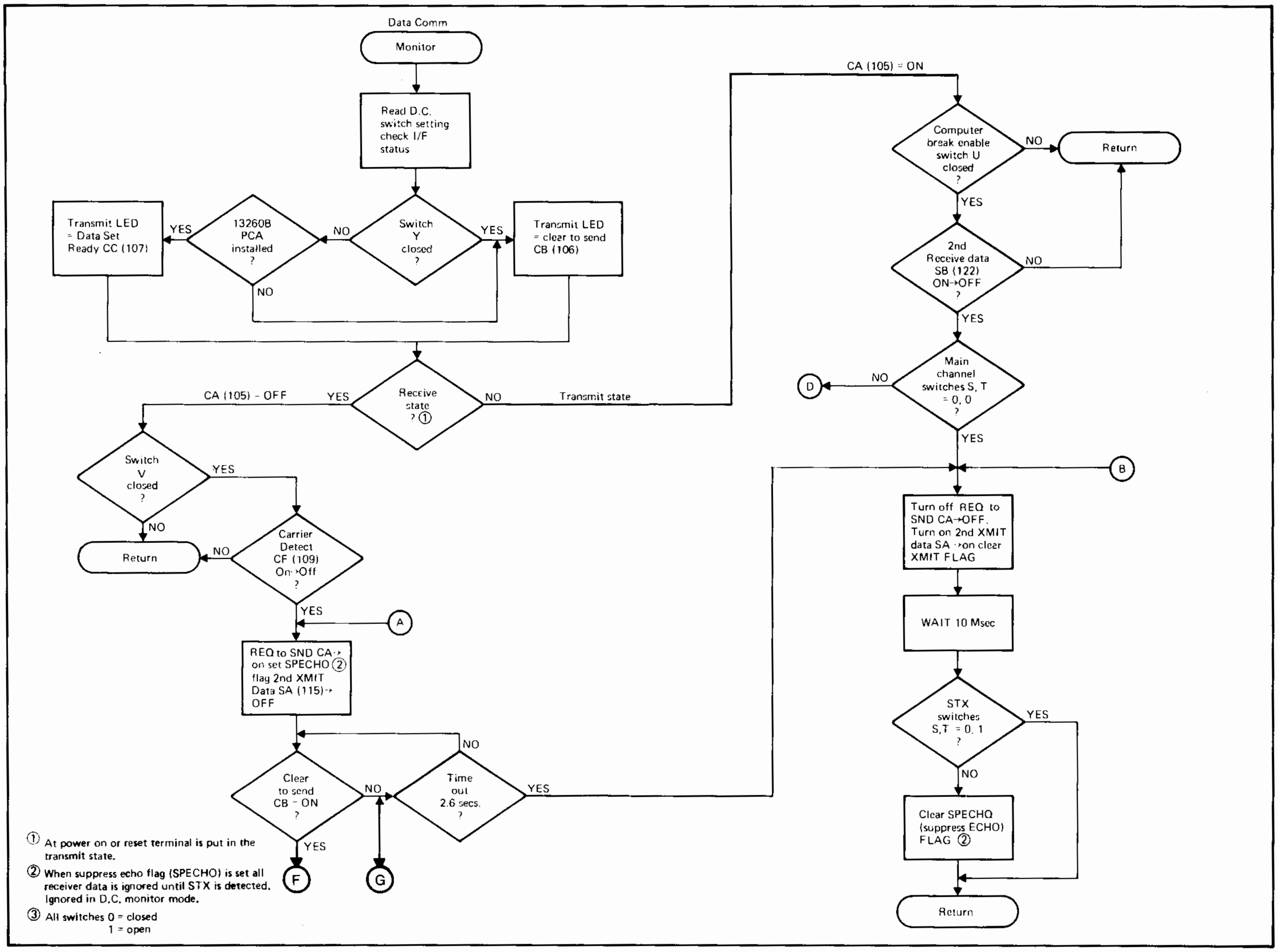


Figure C-1. Point-to-Point Communication Flowcharts (Sheet 1 of 3)

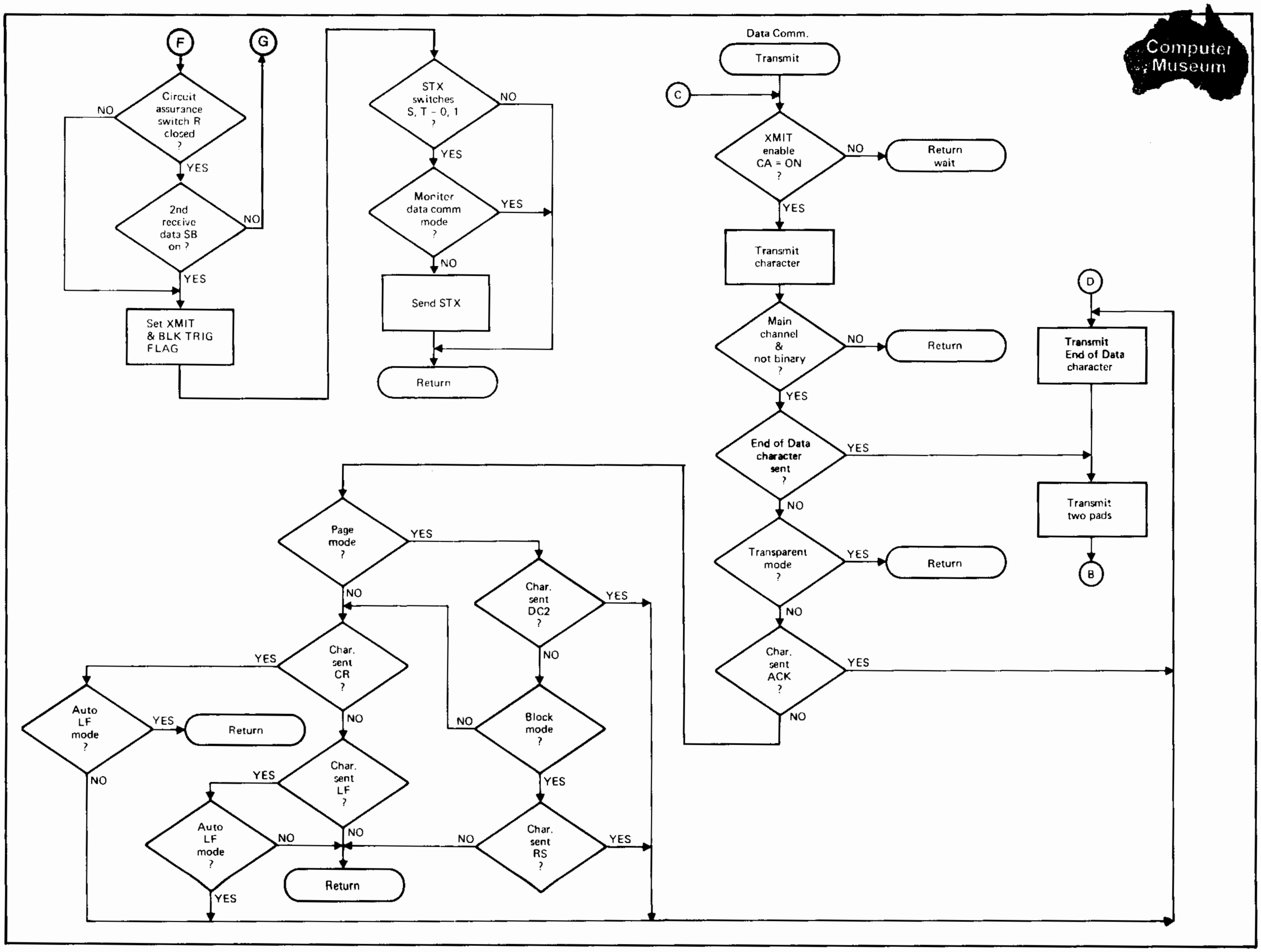


Figure C-1. Point-to-Point Communication Flowcharts (Sheet 2 of 3)

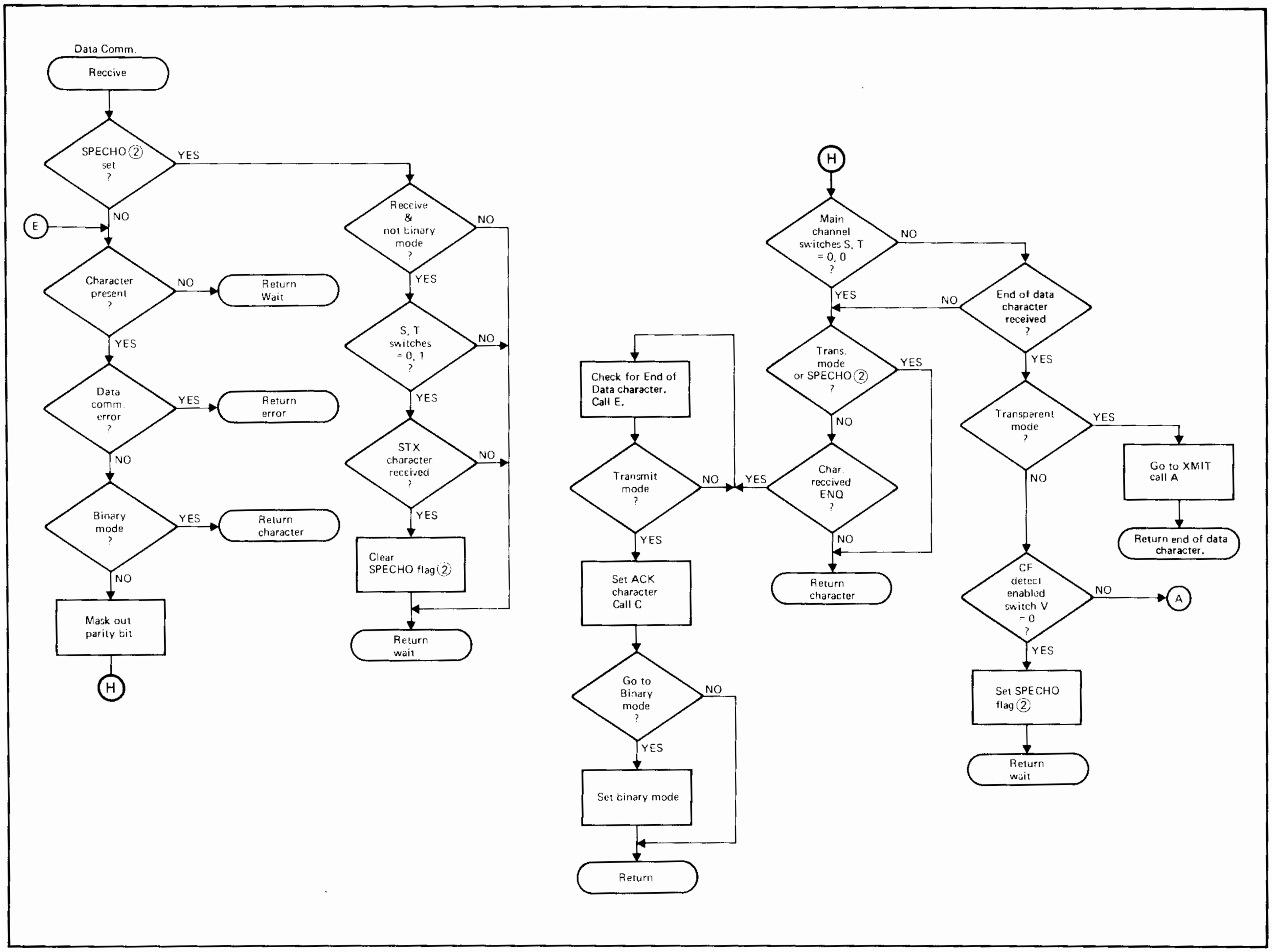


Figure C-1. Point-to-Point Communication Flowcharts (Sheet 3 of 3)

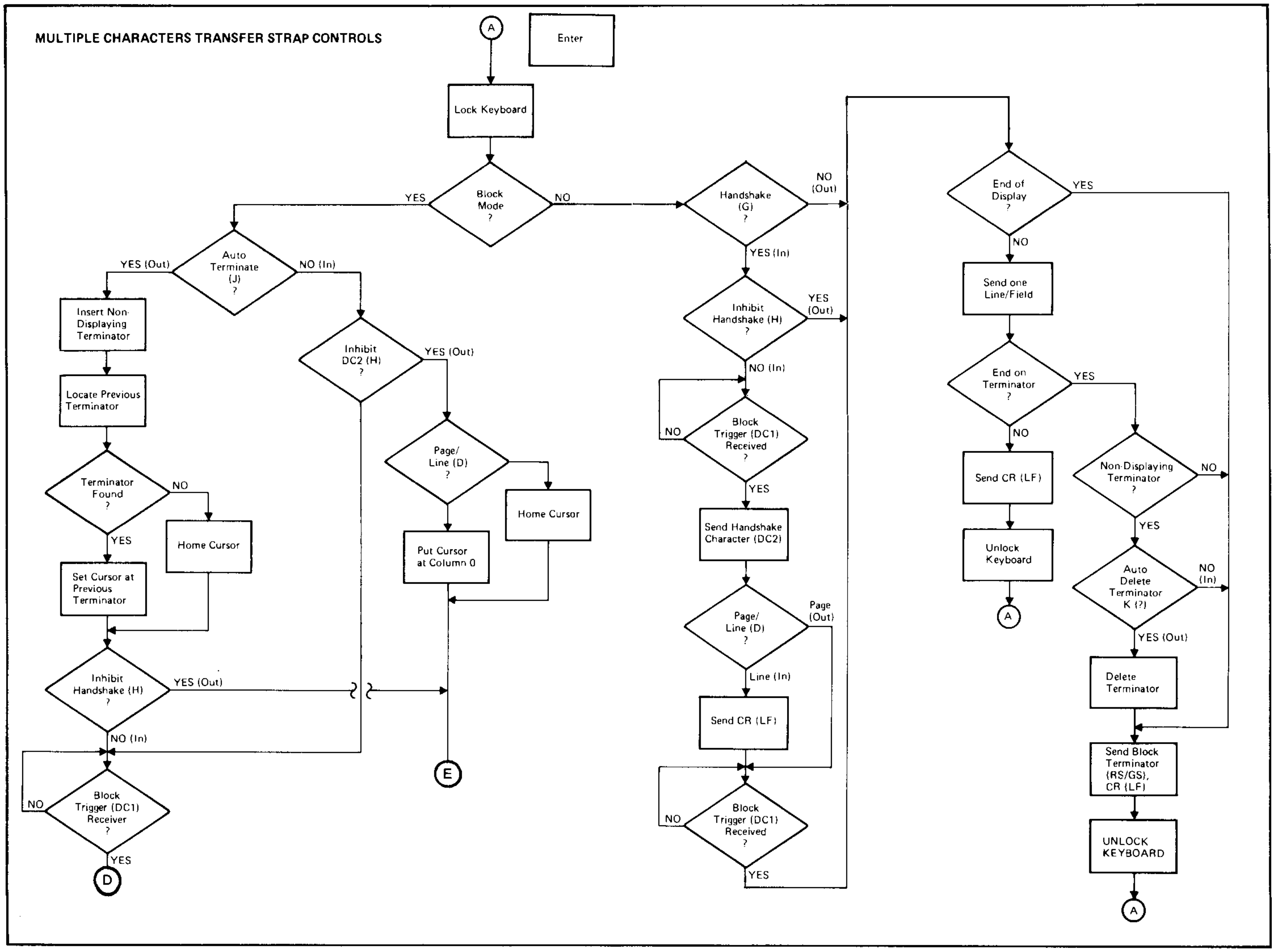


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 1 of 6)

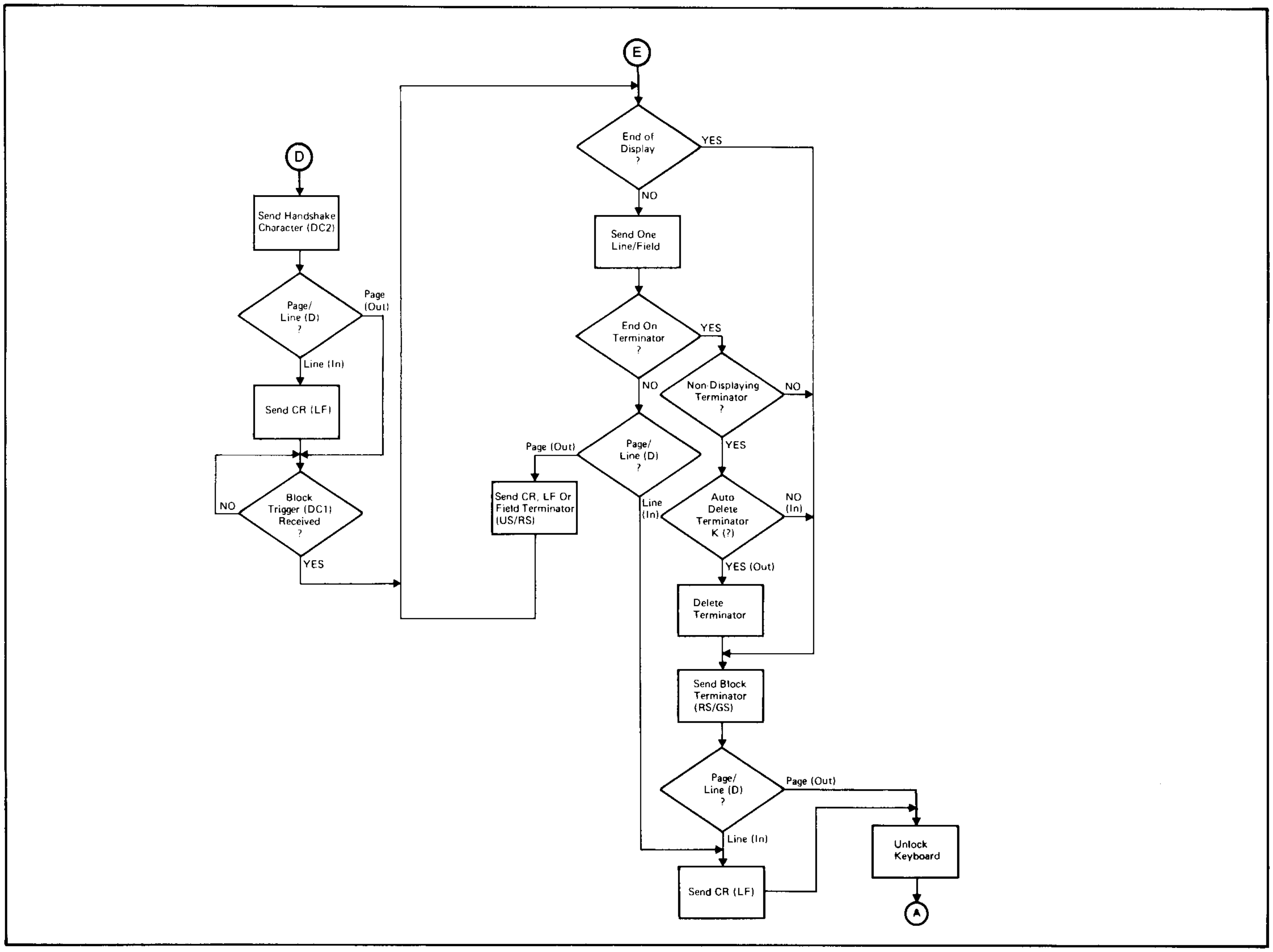


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 2 of 6)

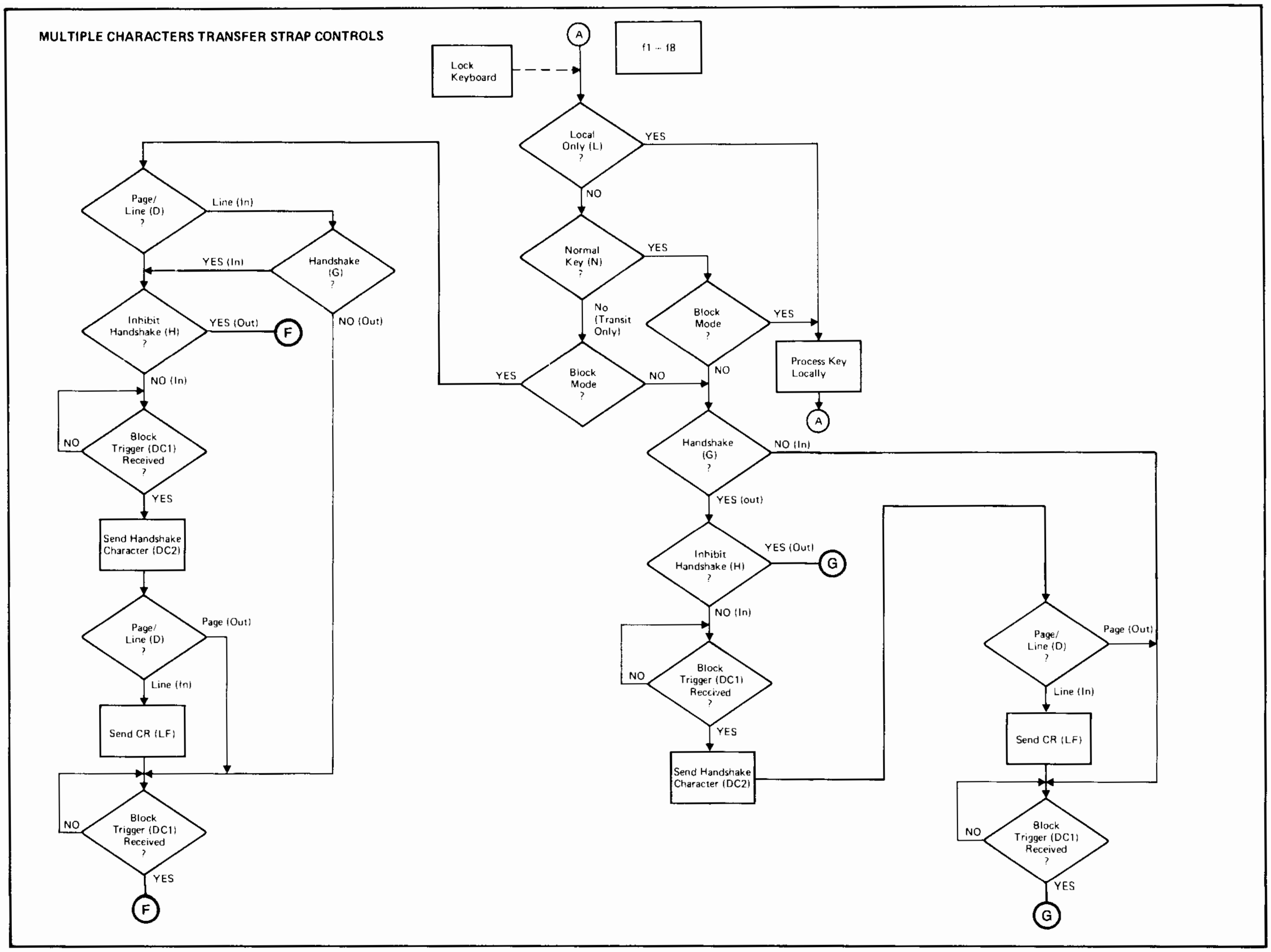


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 3 of 6)

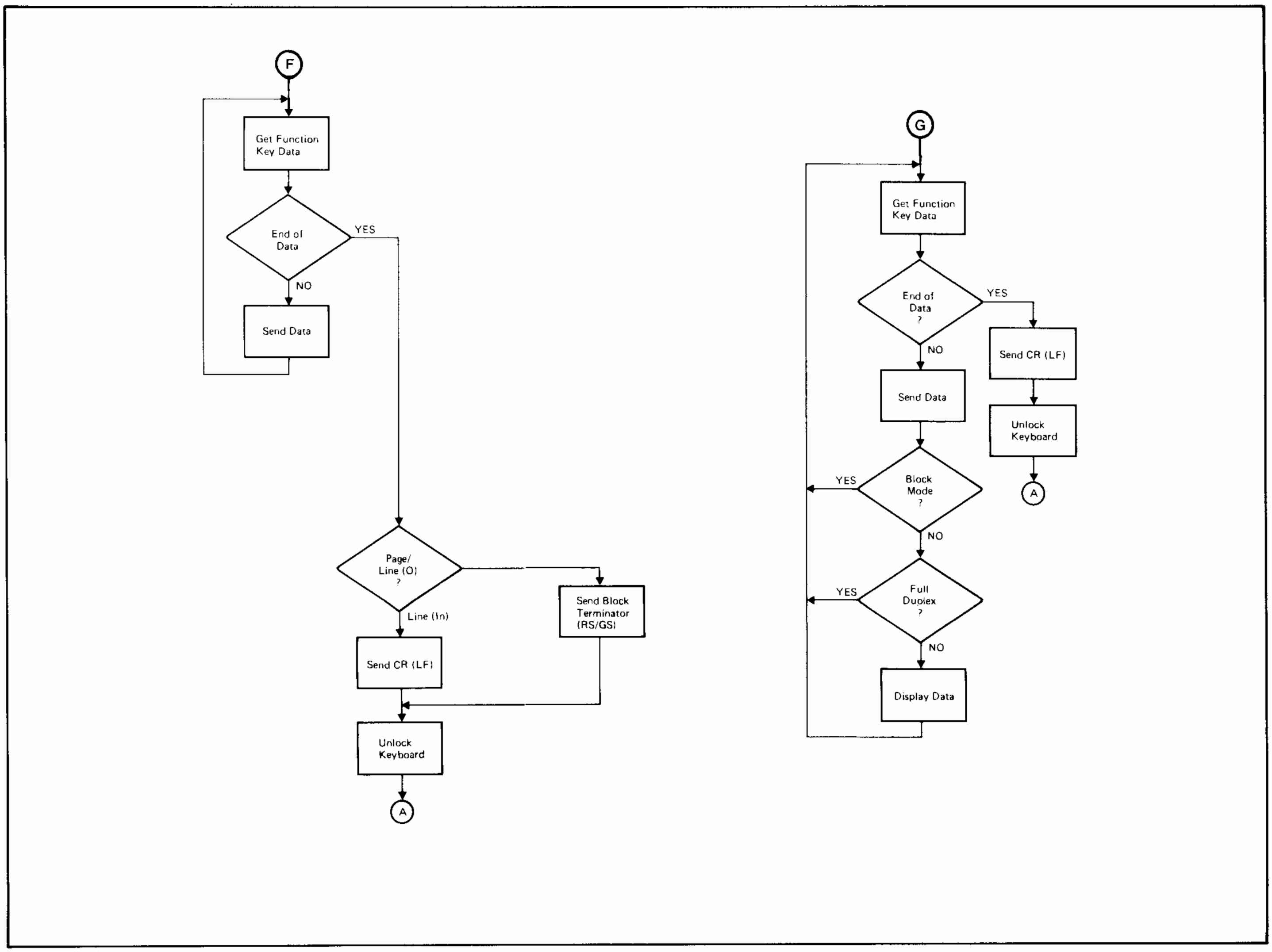


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 4 of 6)

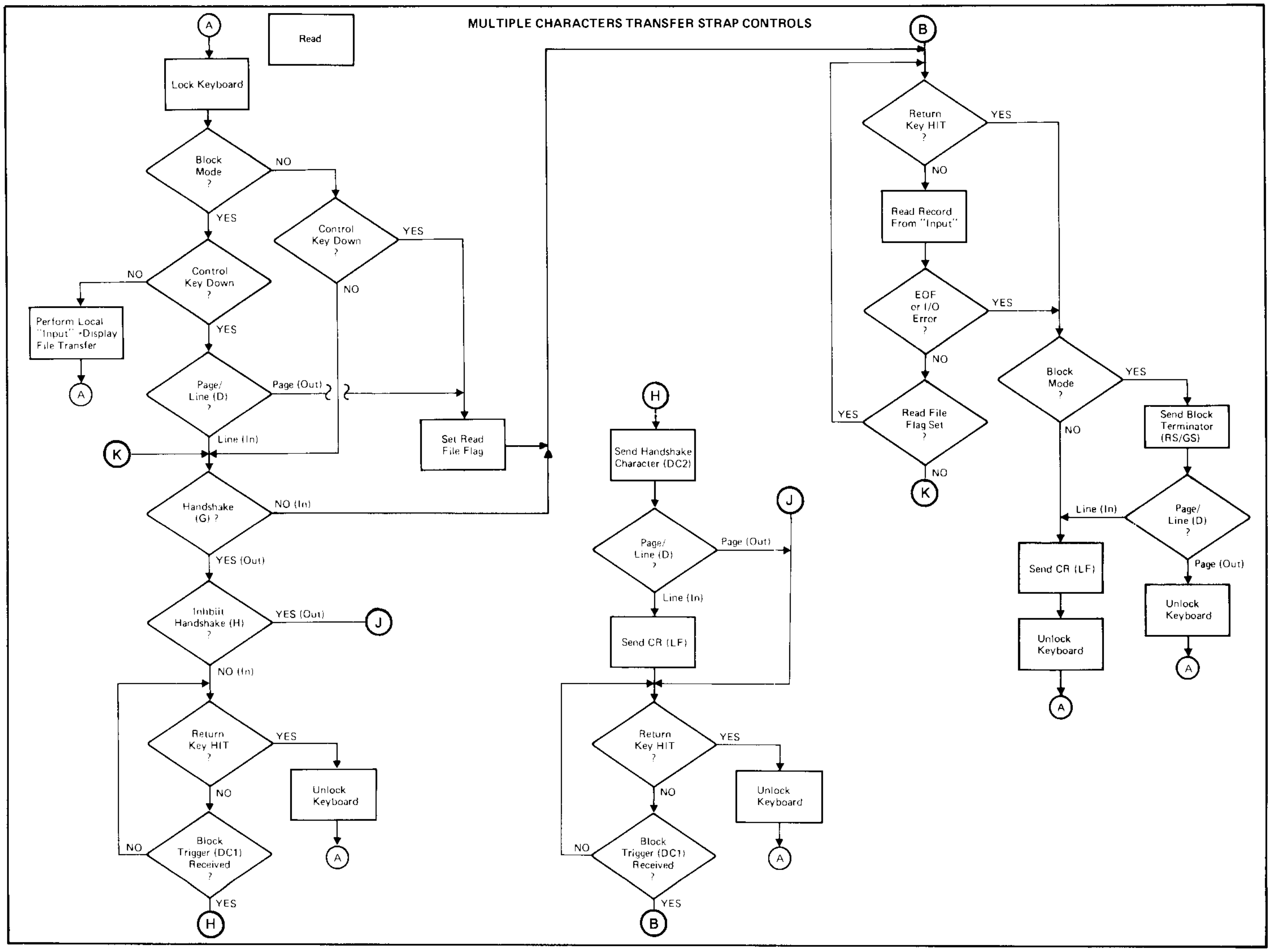


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 5 of 6)

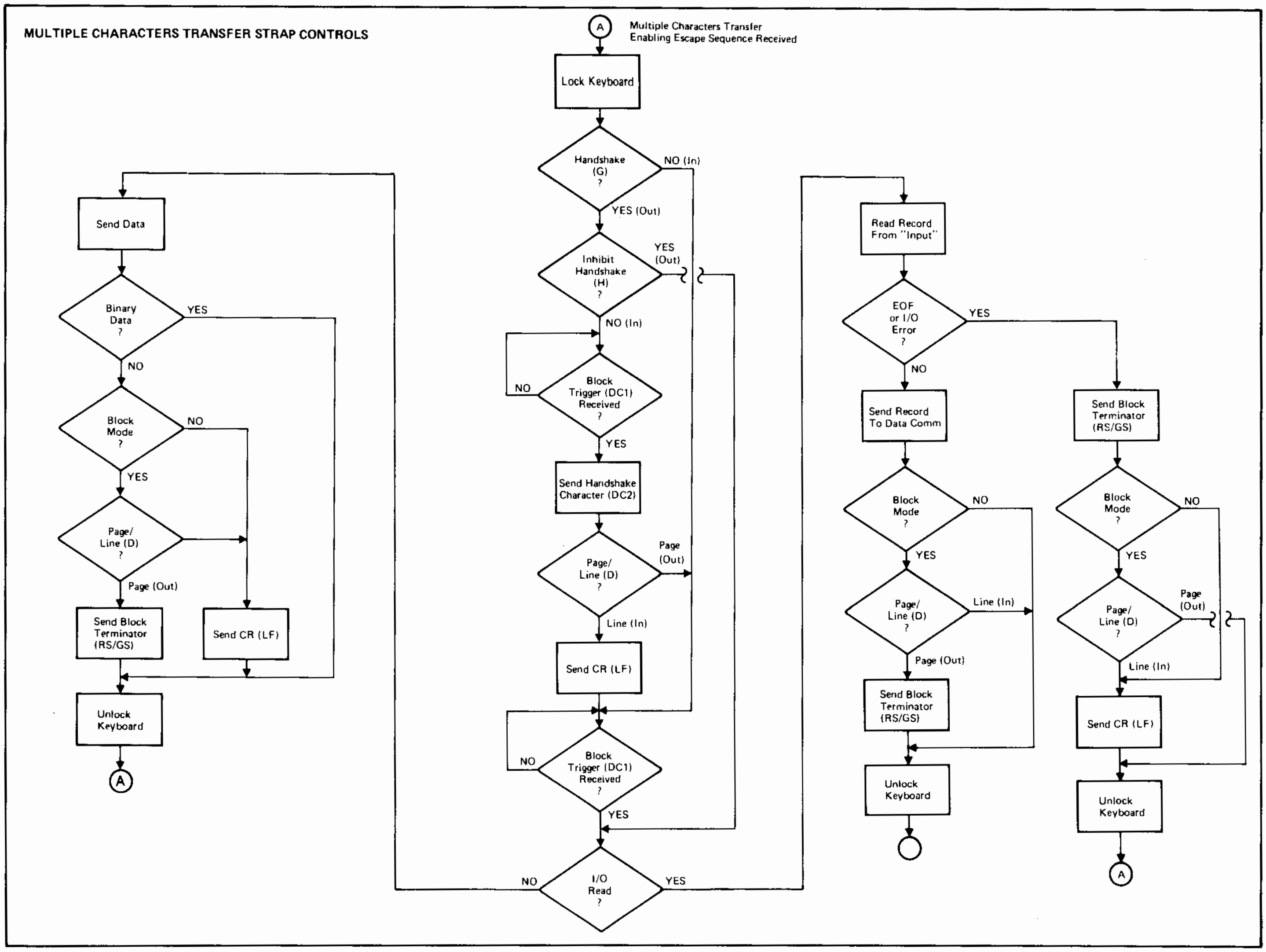


Figure C-2. Keyboard Communication Switches Flowcharts (Sheet 6 of 6)

Appendix D

TERMINAL SELF-TEST RAM ERROR MESSAGE INTERPRETATION

This discussion describes how to translate a RAM error message, displayed during terminal self test, into a RAM IC chip location on the Universal RAM Memory PCA to enable replacement of the faulty IC.

The Universal RAM Memory PCA can contain either 8K, 16K, or 32K bytes of memory. The amount of memory on the PCA can be determined from the number of IC chips contained on the PCA and the part number of the ICs (figure D-1). In the 8K configuration, each IC chip contains 512 bytes; in the 16K and 32K configurations, each IC chip contains 2,048 bytes.

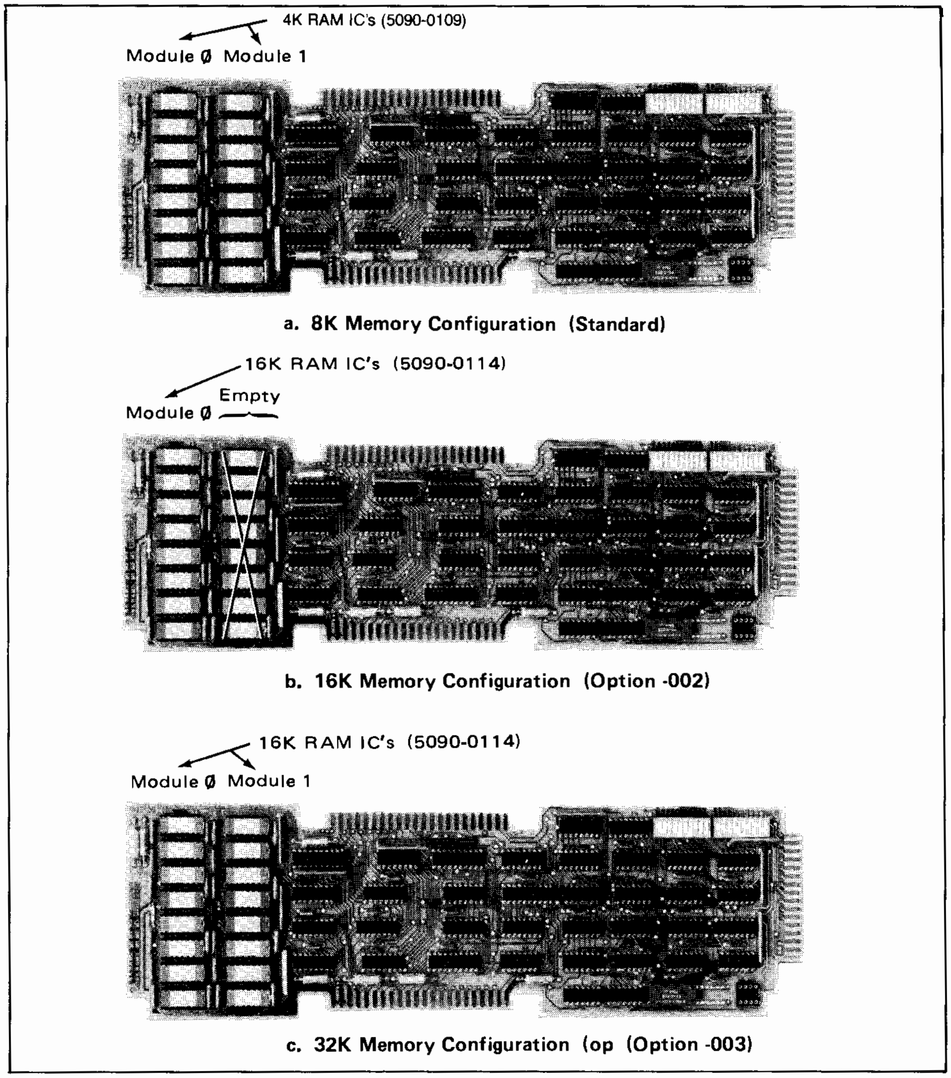
Below is a message such as might be displayed to indicate a faulty RAM IC when the terminal self test is run.

```
RAM ERROR 62208 373 333
```

where: **62,208** is the address which contains the bad data,
373 (octal) is the expected value, and
333 (octal) is the value found.

The address switches (4K, 8K, 16K, and 32K) on the PCA are used to set the starting address for the associated module. The leftmost set of switches correspond to module 0 (figure D-2) and the rightmost set to module 1. The starting address for a module is the sum of the values assigned to the closed address switches assigned to the module. For example, if the 32K and 16K switches of the left set of switches are closed, the starting address for module 0 is 48K (49,152). Determine, from the two starting addresses, which module contains the address (identified in the error message) with the bad data.

To identify the faulty IC, the data bit in which the error occurred must be identified. This can be done by converting the expected data value and the value returned, as identified in the error message, to binary. The bit in the returned value which doesn't match the corresponding bit in the expected value is the faulty bit, as shown below.



a. 8K Memory Configuration (Standard)

b. 16K Memory Configuration (Option -002)

c. 32K Memory Configuration (op (Option -003)

Figure D-1. HP 13297A Universal RAM Memory Loadings

	Bits							
	7	6	5	4	3	2	1	0
Expected value = 373	1	1	1	1	1	0	1	1
Returned value = 333	1	1	0	1	1	0	1	1

Refer to figure D-2 to locate the faulty IC by associating the faulty bit with an IC location.

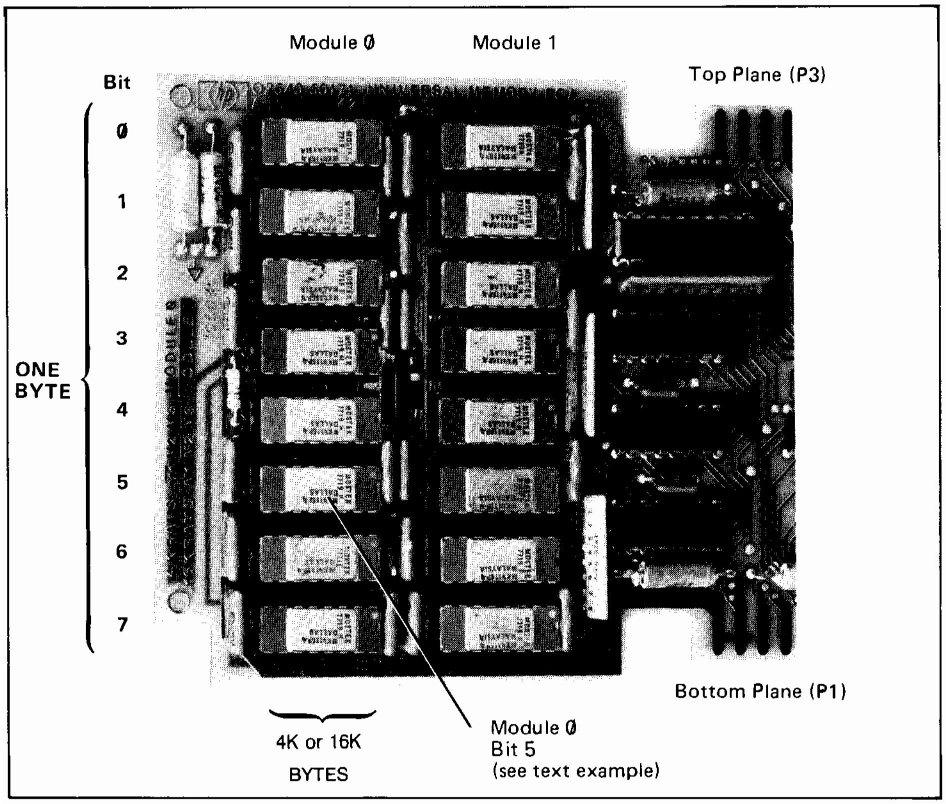


Figure D-2. Universal RAM Memory PCA Module Location and Data Bit/IC Chip Association

Appendix E

Trouble Symptoms

Following is a list of malfunction symptoms, probable causes, and the suggested action. It is not represented as complete; rather it is only a digest of field reports gathered over a six-month period of time.

SYMPTOM	PROBABLE CAUSE	ACTION
60 cycle hum	Sweep PCA	Replace
Arcing	Display Control	Replace
Backspace operation fails	CTU Transport	Replace
Bad data when cold	Processor PCA	Replace
CTUs inoperative	Read/Write PCA	Replace
Characters added	DMA PCA	Replace
Characters added to display	Processor PCA	Replace
Characters change value	DMA PCA	Replace
Characters lost	Display Control	Replace
Cursor improper	Display Control	Replace
Data comm does not respond	GP Asynch PCA	Replace
Display vanishes	Sweep PCA	Replace
Dots on display	Display Control/ROMs	Replace
Drive runs continuously	Read/Write PCA	Replace
Drops line of characters (2647)	ROM 1818-0612	Replace
End of Data message	Read/Write PCA	Replace
Enhancements illegible	Display Enhancements PCA	Replace
Erratic display	DMA PCA	Replace
Erratic display	ROM 1818-0205	Replace
Error 10 (2641 or 2645)	ROM 1818-0208	Replace
Every 2nd line garbled	DMA PCA	Replace
F1—F8 keys cause lockup	Keyboard Interface PCA	Replace
First 2 characters lost	ROMs	Replace
First 2 characters lost	Display Control	Replace
First 2 characters lost (2647)	Check ROM 1818-0612	Replace

SYMPTOM	PROBABLE CAUSE	ACTION
Flashing	DMA PCA	Replace
Flashing/intermittent	Display Timing PCA	Replace
Garbage/bad characters	DMA PCA	Replace
Garbled characters	4K RAM Memory PCA	Replace
High frequency noise	Sweep PCA	Replace
High voltage supply noisy	Sweep PCA	Replace
Horizontal line/no vertical	Sweep PCA	Replace
I/O Error 7	Control Memory PCA	Replace
I/O Error 7	Check for I/O ROMs	Install
I/O Error 7 (2641 or 2645)	ROM 1818-0213 missing	Install
I/O Error 7 (2645)	Check ROM 1818-0207	Replace
I/O Error 7 (2648)	ROM 1818-0411	Replace
I/O Error 7, bad lower case (2647)	ROM 1818-0613	Replace
I/O Errors (2645)	ROMs 1818-0207/0213	Replace
I/O Errors (2648)	Check ROM 1818-0405	Replace
I/O Errors (2648)	ROMs 1818-0415/0417	Replace
Improper BAUD rate	Keyboard Assembly	Replace
Inverse video bad	Sweep PCA	Replace
Jitter	Display Timing PCA	Replace
Jitter	DMA PCA	Replace
Jitter	Display Control	Replace
Jitter	Display Enhancements PCA	Replace
Jittery cursor	Sweep PCA	Replace
Keyboard dead	Keyboard PCA/Cable	Replace
Keyboard locked, bad data	Check ROM 1818-0420	Replace
Keys intermittent	Keyboard PCA/Cable	Replace
LEDs on, no cursor (2645)	Check ROM 1818-0205	Replace
Misses EOT	CTU Transport	Replace
NOT READY message	Control Memory PCA	Replace
No TERMINAL READY message (2645)	Check ROM 1818-0207	Replace
No TERMINAL READY message	ROMs	Replace
No cursor	Sweep PCA	Replace
No cursor	ROMs	Replace
No display	Display Timing PCA	Replace
No display	DMA PCA	Replace
No display	Sweep PCA	Replace

SYMPTOM	PROBABLE CAUSE	ACTION
No display	Display Control	Replace
No display	ROMs	Replace
No display	Control Memory PCA	Replace
No display	Processor PCA	Replace
No display, loading supply	Keyboard Interface PCA	Replace
No display, no self-test	ROMs	Replace
Only vertical bar in center	Sweep PCA	Replace
PCA switches broken	PCA	Replace
Power but no functions (2645)	Check ROM 1818-0213	Replace
Printer characters lost	Duplex Register PCA	Replace
Printer hangs up	Duplex Register PCA	Replace
Printer hangs up	GP Asynchronous PCA	Replace
Random characters (2641, 2645)	ROMs 1818-0434/0435	Replace
Random characters displayed	DMA PCA	Replace
Random characters on screen	Control Memory PCA	Replace
Random characters on power up	ROMs	Replace
Random screen characters	DMA PCA	Replace
Read error	CTU Transport	Replace
Record error	CTU Transport	Replace
Repeating characters	Control Memory PCA	Replace
Shrinking display	Sweep PCA	Replace
Sticky keys	Keyboard Assembly	Replace
Tape errors	CTU Transport	Replace
Tape run-off	CTU Interface PCA	Replace
Tape run-off	Read/Write PCA	Replace
Tape run-off	CTU Transport	Replace
Tape stalls	Read/Write PCA	Replace
Tape stalls	CTU Transport	Replace
Turn-on doesn't clear screen	DMA PCA	Replace
Undefined character	DMA PCA	Replace
Underline always on	Display Enhancements PCA	Replace
Uneven characters (2647)	ROM 1818-0612	Replace
Unstable display	Display Timing PCA	Replace
Unstable display (Jitter)	Display Timing PCA	Replace
Vertical bars	Display Control	Replace

Appendix F

Data Communications Connection Information

The following pages contain information on interface PCAs, strapping, switch settings, modems, and cabling for connection to five HP computers.

SYSTEM 3000, SERIES 33

1. Interface PCA (in computer)	ADCC	
2. Data comm PCA (in terminal)	Asynchronous Data Comm 02640-60086 (13260A).	
3. Strapping	Keyboard Interface PCA: All switches closed.	
4. Switches:	DUPLEX:	FULL
	BAUD RATE*:	<=2400
	PARITY:	NONE
	AUTO LF:	UP (OFF)
	BLOCK MODE:	UP (OFF) or DOWN (ON)
5. Modem:	Bell 103 or 212 or equivalent.	
6. Cables:	See figure F-1.	

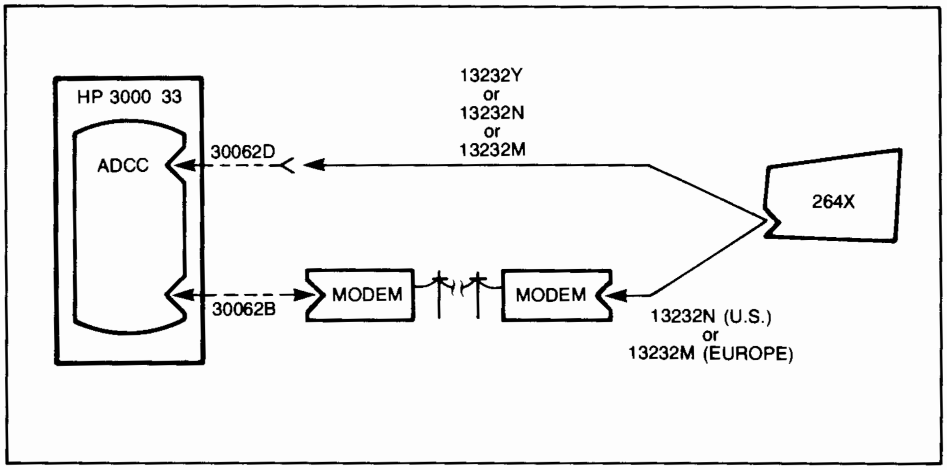


Figure F-1

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

SYSTEM 1000 (RTE M/II/IV)

1. Interface PCA (in computer)	12531D or 12880A
2. Data comm PCA (in terminal)	Asynchronous Data Comm 02640-60086
3. Strapping	Keyboard Interface PCA: All switches closed. Ext. Asynch. Data Comm PCA: All switches open except A9, A10, and A11.
4. Switches:	DUPLEX: FULL BAUD RATE: <=2400 PARITY: NONE AUTO LF: UP (OFF) BLOCK MODE: UP (OFF)
5. Modem:	Bell 103 or 212 or equivalent.
6. Cables:	See figure F-2.

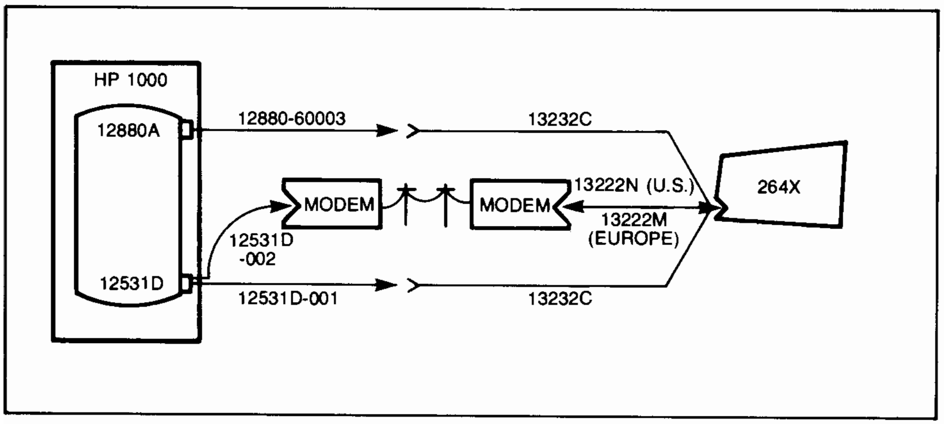


Figure F-2

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

SYSTEM 1000 (RTE M/II/IV)

1. Interface PCA: (in computer) — 12966A
2. Data comm PCA: (in terminal) — Extended Asynchronous Data Comm 02640-60143 (13260B).
3. Strapping: — Keyboard Interface PCA: All switches closed.
   Ext. Asynch. Data Comm PCA: All switches open except A9, A10, A11, and THE.
4. Switches:

DUPLEX:	FULL
BAUD RATE:	<=9600*
PARITY:	NONE
AUTO LF:	UP (OFF)
BLOCK MODE:	UP (OFF) or DOWN (ON)

5. Modem — Bell 103 or 212 or equivalent
6. Cables: — See figure F-3.

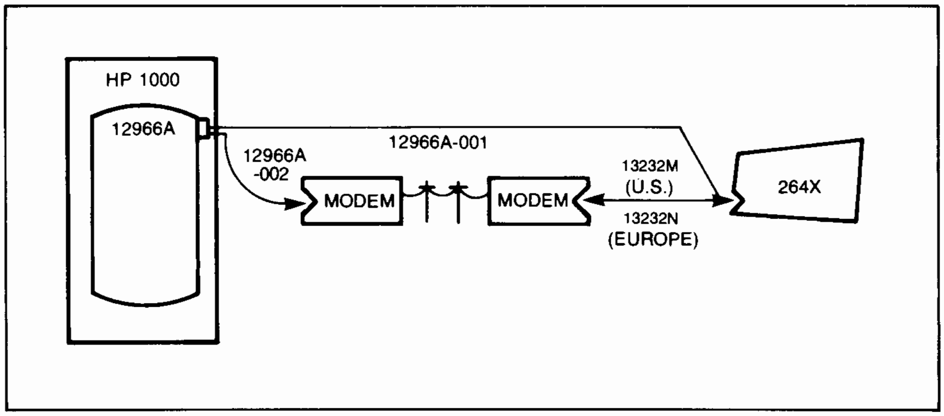


Figure F-3

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

1. Interface PCA: (in computer) — ATC
2. Data comm PCA: (in terminal) — Asynchronous Data Comm 02640-60086 (13260A)
3. Strapping: — Keyboard Interface PCA: All switches closed.
4. Switches:

DUPLEX:	FULL
BAUD RATE:	<=2400*
PARITY:	EVEN
AUTO LF:	UP (OFF)
BLOCK MODE:	UP (OFF) or DOWN (ON)

5. Modem: — Bell 103 or 212 or equivalent
6. Cables: — See figure F-4.

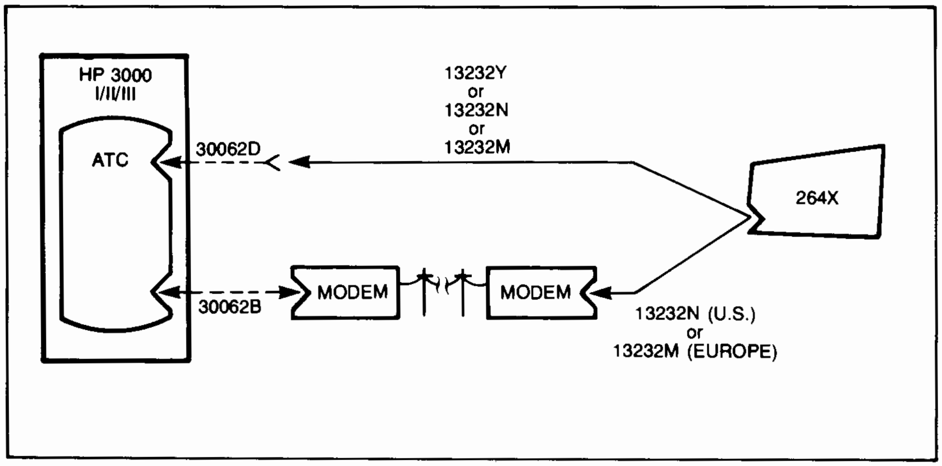


Figure F-4

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

SYSTEM 250

1. Interface PCA: (in computer) — 45120 ASI
2. Data comm PCA: (in terminal) — Asynchronous Data Comm (02640-60086 (13260A)
3. Strapping: — Keyboard Interface PCA: All switches closed.
4. Switches:

DUPLEX:	FULL
BAUD RATE:	<=9600*
PARITY:	ODD
AUTO LF:	UP (OFF)
BLOCK MODE:	UP (OFF) or DOWN (ON)

5. Modem: — Bell 103 or 212 or equivalent.
6. Cables: — See figure F-5.

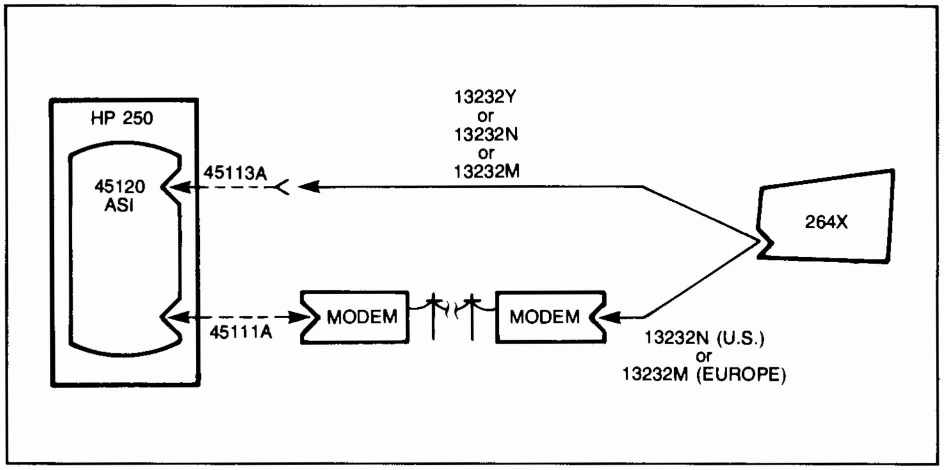


Figure F-5

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

SYSTEM 300

1. Interface PCA: (in computer) — ADCC
2. Data comm PCA: (in terminal) — Asynchronous Data Comm 02640-60086 (13260A)
3. Strapping: — Keyboard Interface PCA: All switches closed.
4. Switches:

DUPLEX:	FULL
BAUD RATE:	<=9600*
PARITY:	NONE
AUTO LF:	UP (OFF)
BLOCK MODE:	UP (OFF) or DOWN (ON)

5. Modem: — None
6. Cables: — See figure F-6.

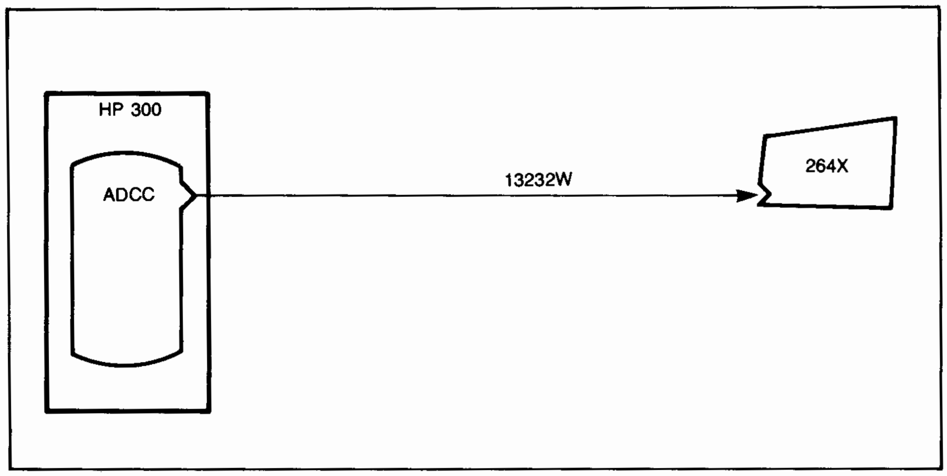


Figure F-6

*Note: For the 2647A terminal, operations above 1200 baud may require the use of nulls or handshake protocol to ensure data integrity.

Appendix G

Backward Compatibility Information for Early Model 2645A and 2648A Terminals Containing Accessory 13260C or 13260D

For early model 2645A and 2648A terminals containing Accessory 13260C or 13260D, strapping for the J05 switch on the accessory PCA and for switches R, S, V, and Z on the Keyboard Interface PCA will be different from later models. The following information applies to terminals with ROM 1818-0434 (standard multipoint) or 1818-0433 (monitor mode) in ROM location 20 on the Control Memory PCA and ROM 1818-0435 in location 22. (For 2648A terminals, this applies to the Control Memory PCA with the closed +24 switch closed.) Tables G-1 and G-2 and figure G-1 supply the strapping information for earlier model multipoint firmware code.

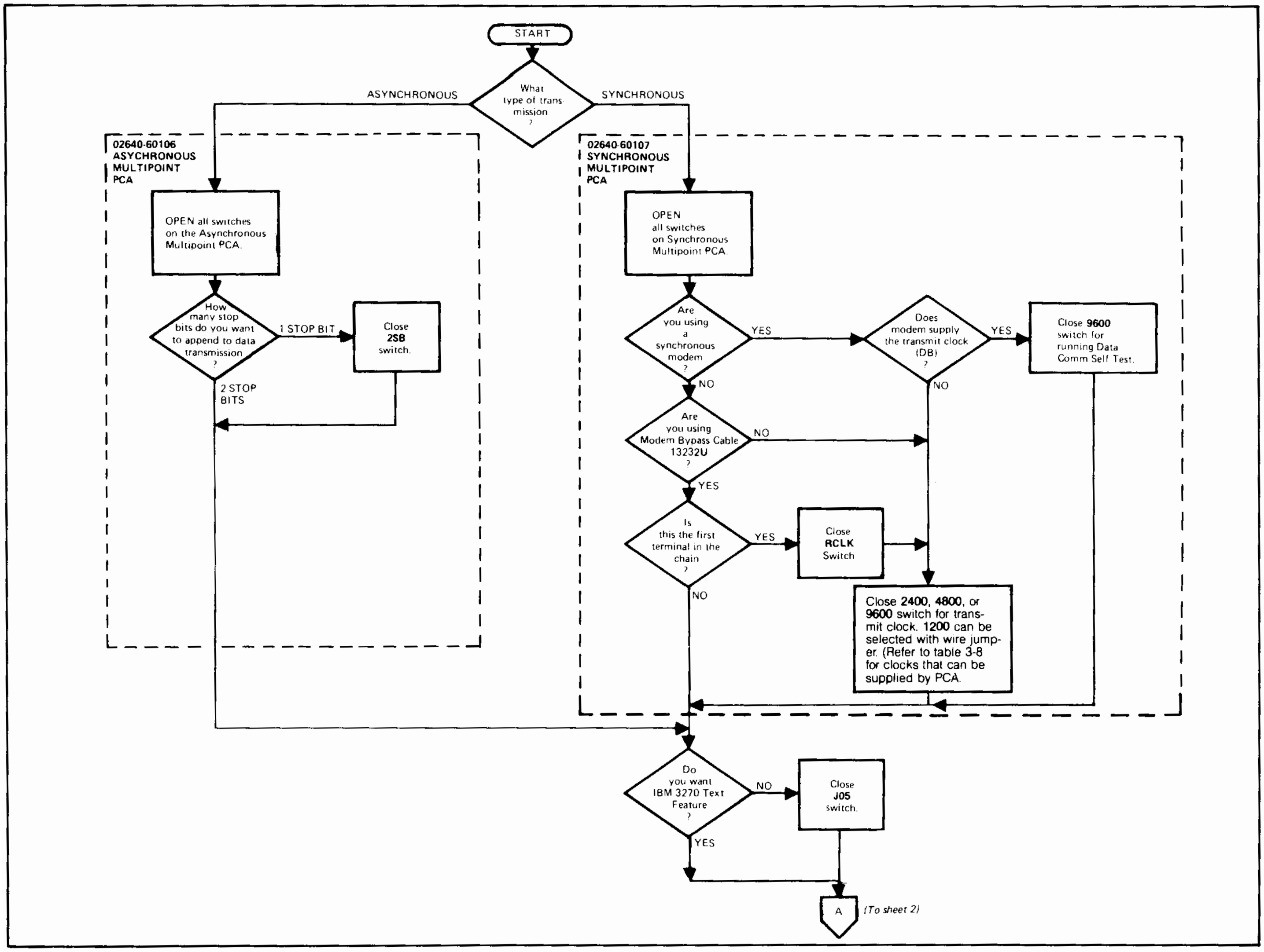


Figure G-1. Multipoint Data Communications Configuration for Earlier Multipoint Code (Sheet 1 of 4)

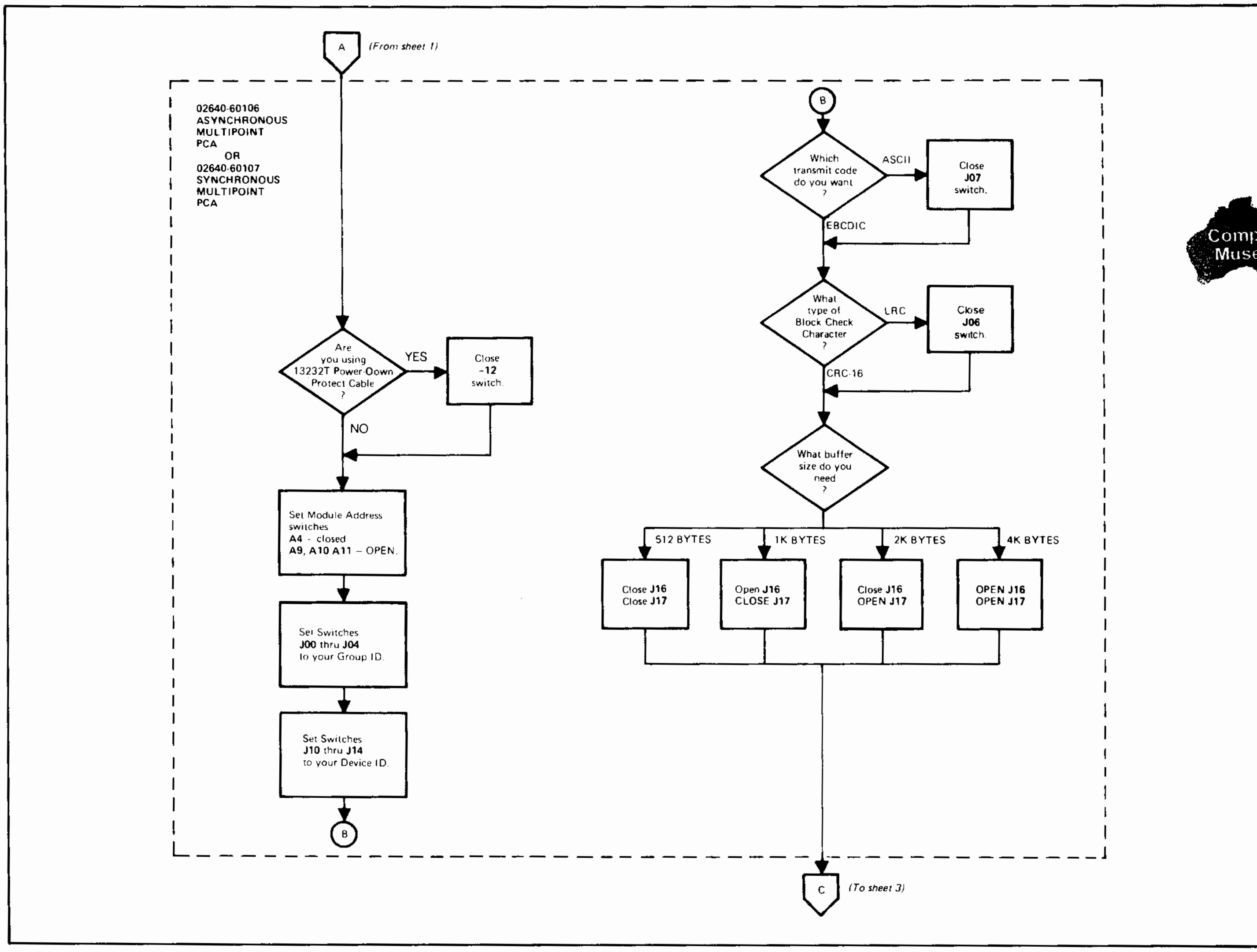


Figure G-1. Multipoint Data Communications Configuration for Earlier Multipoint Code (Sheet 2 of 4)

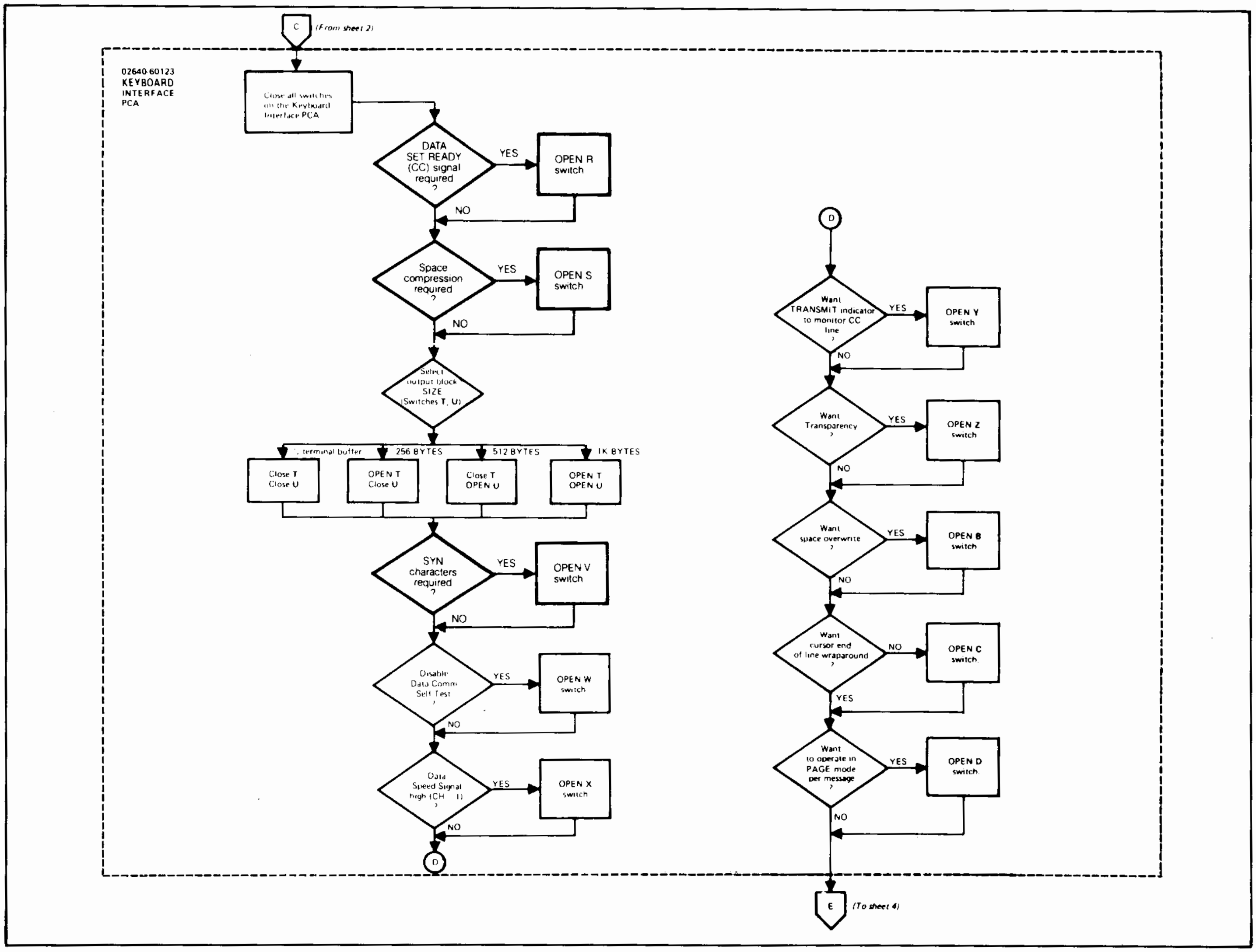


Figure G-1. Multipoint Data Communications Configuration for Earlier Multipoint Code (Sheet 3 of 4)

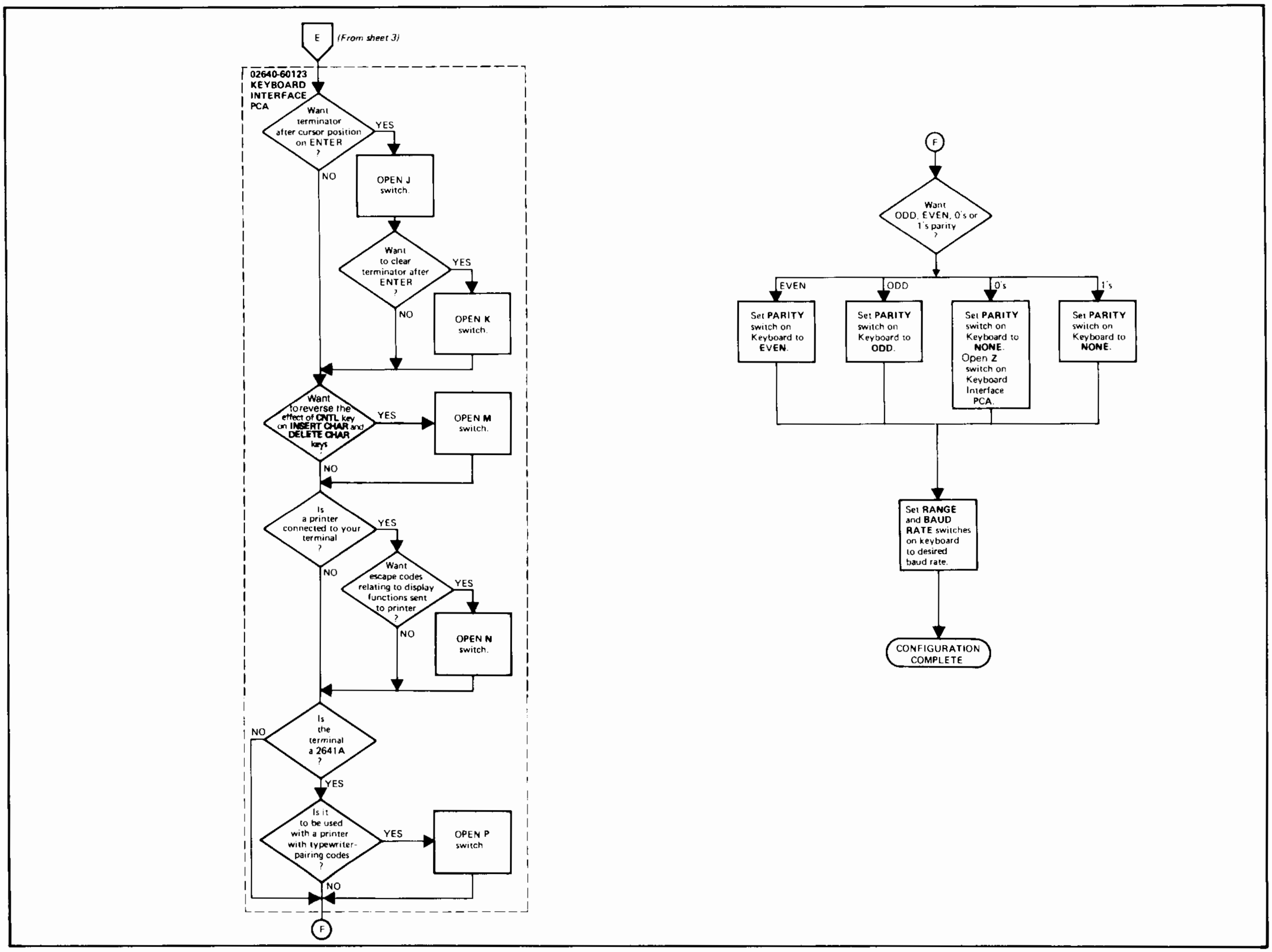


Figure G-1. Multipoint Data Communications Configuration for Earlier Multipoint Code (Sheet 4 of 4)

Table G-1. Keyboard Interface Switch Definitions for Earlier Multipoint Code

STRAP	STRAPPING OPTION	NORMAL OPERATION (SWITCH CLOSED)	OPERATION WITH STRAPPING OPTION (SWITCH OPEN)
R	Set Trailing Pad	If in ASCII mode (switch J07 closed on multipoint PCA), sets pad to 177 (octal) + parity. If in EBCDIC mode (switch J07 open on multipoint PCA), sets pad to 377 (octal).	Sets pad to 377 (octal) if any of the following conditions are present: (1) PARITY switch on keyboard is set to NONE (2) Switch Z on this PCA is open (3) CRC-16 is selected (switch J06 on multipoint PCA is closed).
S	(not used)		
V	Continuous Carrier	Continuous carrier off indicates that the modem does not have continuous carrier.	Continuous carrier on indicates that the modem does have continuous carrier. Allows firmware to abort operation.
Z	Parity	The PARITY switch on the terminal keyboard is affected as follows: **None:** (Force 0). Send 8 bits and receive 8 bits. Force bit 8 to zero. Check for parity error.† **Odd Parity:** Send 7 bits + odd parity. Receive 7 bits + odd parity. Check for parity error. **Even Parity:** Send 7 bits + even parity. Receive 7 bits + even parity. Check for parity error. †Allows Transparency Mode.	**None:** (Force 1). Send 8 bits and receive 8 bits. Force bit 8 to one. Check for parity error.† **Odd Parity:** Send 7 bits + odd parity. Receive 7 bits + odd parity. Check for parity error.† **Even Parity:** Send 7 bits + even parity. Receive 7 bits + even parity. Check for parity error.†

Table G-2. Multipoint Communications Interface Switch Definitions for Earlier Multipoint Code

STRAP	STRAPPING OPTION	DESCRIPTION
J05	Sync Mode (Asynchronous Interface Only)	**Open:** Enables the insertion and deletion of sync characters to be compatible with a single, generalized data communications driver. **Closed:** Sync Mode disabled.

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