IBM 3101 Display Terminal
Repair Center
Maintenance Information

11/10/79 R

PREFACE

This manual is designed mainly for use by the IBM Repair Center Customer Engineer who will service the 3101. The Maintenance Analysis Procedures (MAPs) section, which are in Chapter 2 supply pointers to the test, removals/replacements, and locations sections.

Other useful publications are:

° IBM 3101 DISPLAY TERMINAL DESCRIPTION (GA 18-2033).

° IBM 3101 DISPLAY TERMINAL CPAR (GA 18-2036).

rst Edition (Oct, 1979)

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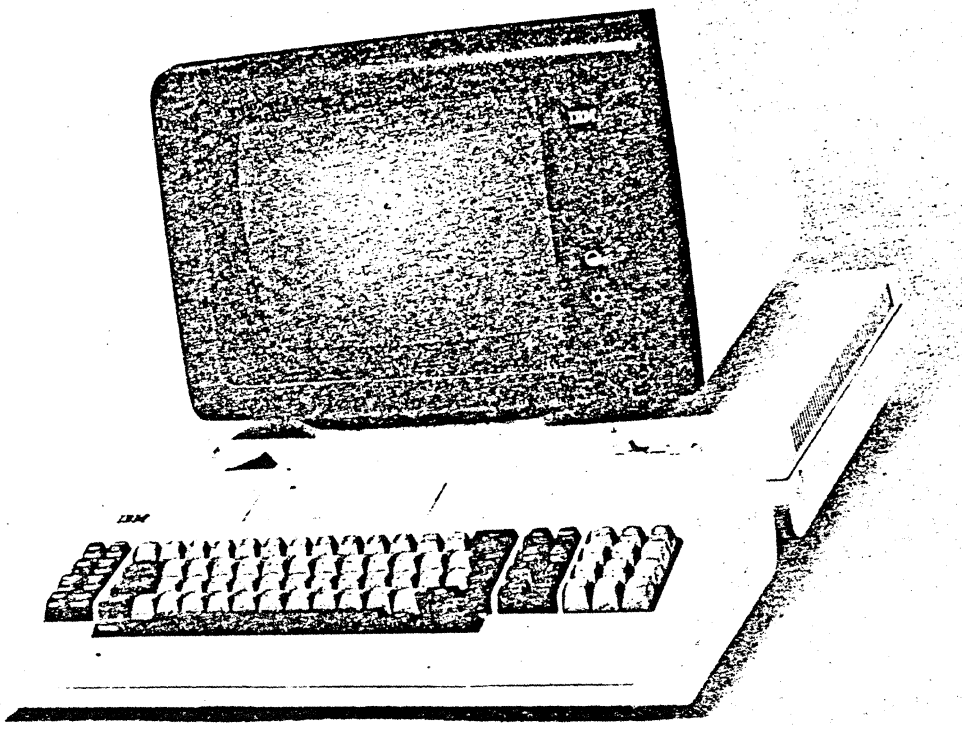

Frontispiece (Design Model)

CHAPTER 1. PRODUCT DESCRIPTION

The IBM 3101 is a compact Keyboard display terminal that has a typewriter-like ASCII Keyboard and a monochrome cathode ray tube (CRT) display screen. It uses start-stop line protocol and communicates with other systems through the EIA RS-232C, EIA RS-422, or 20-mA current-loop interfaces.

The display screen can contain up to 1920 characters.

The 3101 is compatible with the Teletype* 33/35.

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* Teletype is a trademark of The Teletype Corporation.

1.1 MODELS

The 3101 is available in eight models. The major differences between Models 1X and 2X are as follows:

Model 1X: Character-by-character transmission

Model 2X: Same as Model 1X, but with the following enhancements:

- Block transmission (using the Send keys)
- Format Operation (Protect/Unprotect, Modified Data Tag, Field Highlighting)
- Insert/Delete a line of data
- Insert/Delete a data character
- Buffer Print operation, if a printer is attached

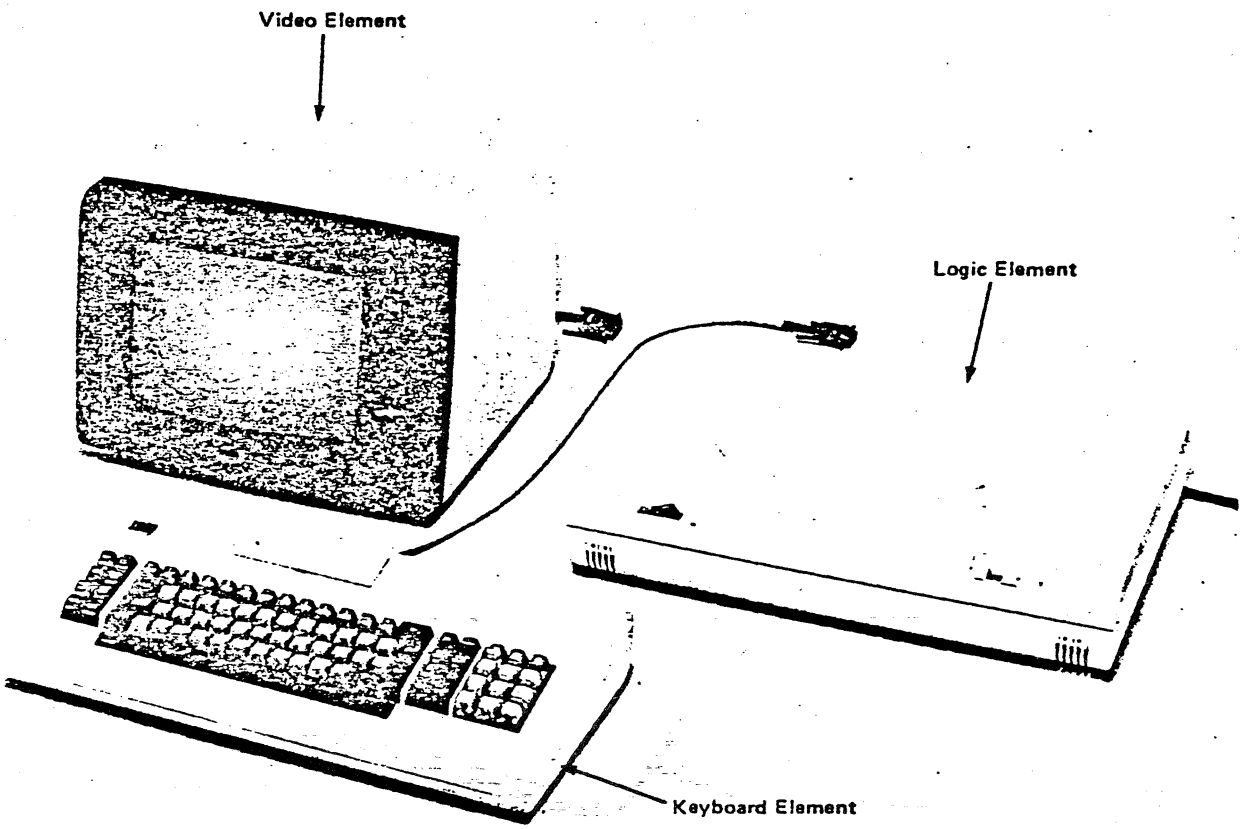


Figure 1-1. Work Station Elements

1.2 WORK STATION ELEMENTS DESCRIPTION

The 3101 consists of three work station Elements: the Video Element, the Logic Element, and the Keyboard Element (see Figure 1-1).

1.2.1 VIDEO ELEMENT

The Video Element comprises a 305-mm (12-inch) diagonal monochrome CRT display screen with a display screen filter, a deflection yoke, an analog circuit, a high voltage control circuit, and brightness and contrast potentiometers. Conventional solid-state television technology is used.

The display screen has the following characteristics:

- A presentation of 1920 characters (24 lines of 80 characters)
- A line for operator information (Line 25)
- A block or blinking cursor
- Normal and reverse Video

The Video Element can be tilted vertically 10 or 15 degrees for ease of viewing, and can also be swivelled left or right up to 25 degrees in either direction.

1.2.2 KEYBOARD ELEMENT

The 3101 Keyboard Element consists of:

- 87 keys including a numeric key pad (12 keys)
- A Keyboard Logic card
- A clicker
- Setup switches
- A cable
- A documentation storage space in the cover.

The Keyboard Element can generate all 128 ASCII character codes and has a four-character buffer for storing data until the Logic Element is ready to receive it.

The 3101 has many integrated functions. Setup switches in the customer access area at the top of the Keyboard allow the customer to select the functions required at setup time, or when his requirements change. The functions that can be selected are:

- Block (Model 2X only)/Character Transmission modes
- Half/Full Duplex
- EIA RS-232C/Current Loop or EIA RS-232C/EIA RS-422
- Permanent-Request-to-Send/Controlled-Request-to-Send
- Reverse Channel
- ETX/CR/ECT/XOFF
- Dual/Mono case
- 1 or 2 Stop Bits
- Parity (Space/Mark/Odd/Even)
- Send Line Option (Model 2X only)
- Null Suppress (Model 2X only)
- Number of time-fill characters (Model 2X only)
- Auto New Line
- Auto Line Feed
- Carrier Return/Carrier Return Line Feed
- Scroll
- Reverse Video
- Blinking Cursor
- Main I/O Baud Rate (110, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600 BPS)
- Aux I/O Baud Rate (same as above)

KEYBOARD ELEMENT

Caution: Turn power off when replacing any FRU.

Record positions of setup switches to restore after repairing.

Physical Check

If the Keyboard has any mechanical damage, replace the damaged part.

Short-Circuit Check

Check the resistance at cable connector pins 2 and 7, and 6 and 7 (see Figure 5-2).

Result	Action
Less than 3 ohms	Replace either: -Keyboard card -Keyboard cable
Over 3 ohms	Go to next check

Symptom Check

1. Connect known good Video and Logic Elements.
2. Set TEST/NORMAL switch on the Logic Element to TEST.
3. Turn power on (run the offline test - refer to "OFFLINE TEST PROCEDURE" in Chapter 3). Verify the symptom reported by the customer.

Symptom	Failing FRU
'LOGIC OR KEYBOARD' or 'KEYBOARD' is displayed	- Keyboard card - Keyboard cable
Clicker does not work	- Clicker assembly - Keyboard card - Keyboard cable
One key does not work	- Key module - Keyboard card
Setup switch is not functioning	- Setup switch assembly - Keyboard card
Other Keyboard problems	- Keyboard card

Restore setup switches to same positions as when received.

LOGIC ELEMENT

Caution: 1. Turn power off when replacing any FRU.
2. Disconnect power plug when replacing the power assembly.

Power Check

1. Connect the power plug to an outlet and turn power on.
2. Set TEST/NORMAL switch to TEST.
3. Observe the Power-On light and the Light 1.

Symptom	Action
Both lights are off	Replace either - AC fuse - Power assembly - Power cord
Power-On light is on, and Light 1 is off	Replace either - DC fuse - (Refer to Figure 5-1) - Logic board - Power assembly
Both lights stay on	Replace - Logic board
Power-On light is on, and Light 1 is blinking	Go to next check

Logic Check

1. Turn power off.
2. Connect known good Video and Keyboard Elements.
3. Set TEST/NORMAL switch to TEST.
4. Turn power on (run the offline test - refer to "OFFLINE TEST PROCEDURE" in Chapter 3.) Verify the symptom reported by the customer.

Result	Action
Test failed	Replace either - Logic board - Power assembly
Good	Go to next check

External Ports Check

Port 2 ..... Video Element port
Port 3 ..... AUX Device port
Port 4 ..... EIA/C-Loop Communication port
Port 5 ..... Keyboard Element port

1. Set the setup switches on the Keyboard Element as indicated in each Test table and Figure 2-1.
2. Connect the Test Set (jumpered) to the port 4 as indicated in each Test table and Figure 2-1.
3. Turn TEST/NORMAL switch to TEST and then return to NORMAL prior to doing each action (to reset to initial condition).
4. Do each action and verify expected result.
   - If the results are NOT as expected, replace the Logic board.
   - If the results are good, go to the next check.

- Communication (EIA) Port Test

Notes: 1. The test 1 can be skipped if online test is done with Series/1.
2. The tests 1, 3, 4, and 5 can be skipped if online test is done with Maintenance Device.

TST	Setup switch / Test set	Action	Expected result	Tested function
1	Setup 1 / Test set 1	Press character key Check display	Character is displayed	FDX
2	Setup 1 / Test set 1	Press alphabetic P and D with ALT key held down	Light 20 (DTR) is off briefly	
3	Setup 1 / Test set 2	Press character key Check display	Character is not displayed	
4	Setup 1 / Test set 3	Press character key Check display	LOCK-LINE CHECK 1 is displayed	
5	Setup 2 / Test set 2	Observe Test Set light	Light 4 (RTS) is off	HDX

- Communication (EIA) Port Additional Test

TST	Setup switch / Test set	Action	Expected result
6	Setup 2 / Test set 2	Press character key Check display	LOCK-SYSTEM NOT READY is not displayed
7	Setup 2 / Test set 4	Press character key Check display	LOCK-SYSTEM NOT READY is not displayed
8	Setup 2 / Test set 4	Observe Test set light	Light '+' is Off
9	Setup 2 / Test set 5	Observe Test set light	Light '+' is On

- Auxiliary Port Test

  Note: This test can be skipped if online test with Series/1 is done in AUX mode. See section 3.3.2.

  1. Connect a Test Set to port 3 for monitoring the lines.
  2. Do the following at port 4.

Setup switch / Test set	Action	Expected result (at port 3)
Setup 1 / Test set 1	Press AUX key with ALT key held down Press character keys	Lights 6 (DSR) and 8 (CD) are on, 3 (RD) blinks

- Current Loop Feature (Optional) Test - for Model 12/22 only

  Do the following at port 4.

Setup switch / Test set	Action	Expected result
Setup 3 / Test set 6	Press character key Check display	Character is displayed

- RS-422 Feature (Optional) Test - for Model 13/23 only

  Do the following at port 4.

Setup switch / Test set	Action	Expected result
Setup 3 / Test set 7	Press character key Check display	Character is displayed

Additional Checks for Intermittent Problems

DC voltage check

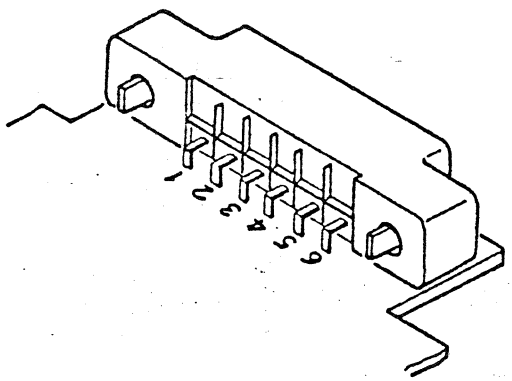
1. Turn power off.
2. Remove the Logic Element cover and the power assembly safety cover.

DANGER: Primary voltage is present on power assembly.

3. Turn power on and measure the voltage at the output connector pins of the power assembly (Known good Keyboard and Video Elements should be connected to the Logic Element). Voltage should be as follows:

Meter leads (+)	Meter leads (-)	Voltage
Pin 3	Pin 6	4.5 - 5.5 Vdc
Pin 2	Pin 6	11.4 - 12.6 Vdc
Pin 6	Pin 4	10.9 - 13.2 Vdc

If any voltage does not meet the above specification, exchange the power assembly.



2) Power ripple check

1. Turn power off.
2. Remove the Logic Element cover and the power assembly safety cover.

DANGER: Primary voltage is present on power assembly.

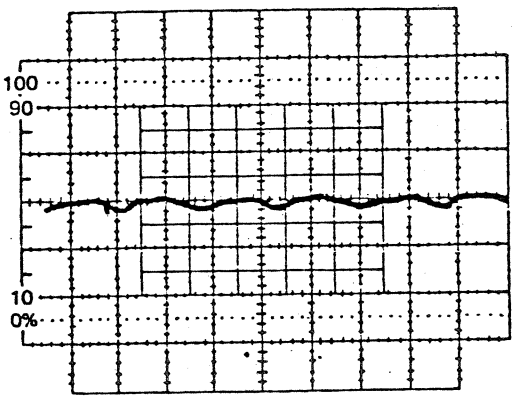
3. Turn power on and measure the ripple using oscilloscope at the output connector pins of the power assembly (Known good Keyboard and Video Elements should be connected to the Logic Element). Ripple should be as follows:

Voltages	Scope Probe	Maximum Limit
+ 5 Vdc	Pin 3	200 mV P-P
-12 Vdc	Pin 4	240 mV P-P
+12 Vdc	Pin 2	See note 1

Note 1: Ripple for +12 Vdc line is hard to be measured. Instead of measuring of this line observe the displayed pattern. Ripple problem of this line will cause the jittering of display.

If any ripple does not meet the above specification, exchange the power assembly.

- Scoping Procedure for Ripple



Displayed Voltage scale: 50 mV per cm

Turn scope power on.

Connect a 10:1(10X) probe to CH 1 INPUT.
Set A Triggering Source to INT.
Set A Triggering Coupling to DC.
Set SWEEP MODE to AUTO TRIG.
Set TIME BASE to 5 MSEC/DIV.
Set MODE to CH 1.
Set CH 1 AC/GND/DC switch to GND.
Set CH 1 VOLTS/DIV to 5 MV.
Set POSITION, INTENSITY, and FOCUS for sharp trace in the center of display.
Connect the probe ground to Pin 6 of the output connector pins of the power assembly. (Use the short ground wire.)
Set CH 1 AC/GND/DC switch to AC.

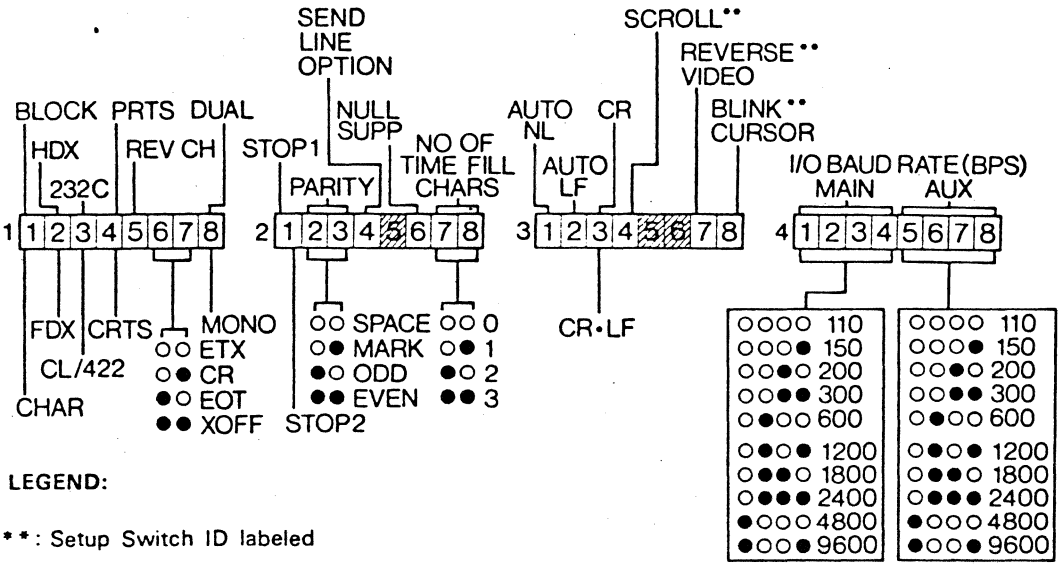
Connect the probe to the voltage pin to be tested.

FAILURE SYMPTOMS TO FRU LIST

- Use this list as a quick reference and for the intermittent problem.
- The FRUs in each work station element are as follows:
  - Logic element ..... Logic, Power
  - Keyboard element ..... KBD-card, cable, Clicker, Setup-switches, Key-module
  - Video element ..... Analog, CRT

Failure Symptom	Suspected FRU
• MACHINE CHECK message appears with:	
LOGIC	Logic/Power
LOGIC OR KEYBOARD	Logic/KBD-card/cable
KEYBOARD	KBD-card/cable/Logic
• Light 1 stays off in TEST mode	Logic/Power/Analog
• Light 1 stays on in TEST mode	Logic
• TEST/NORMAL switch operation failure	Logic
• Display blank or green background (No cursor, no divider line, and no characters)	Analog/Logic
• Display dim at maximum contrast/brightness	Analog/CRT
• Display is tilted or shifted	CRT
• Raster visible at minimum brightness	Analog
• Display overflows screen at maximum brightness	Analog
• Brightness or contrast control problem	Analog/Logic
• Dual intensity function failure	Analog/Logic
• Display is out of focus	Analog/Logic/CRT
• Display is out of synchronization (Moving)	Analog/Logic
• Display is not stable	Analog/Logic/Power
• Size of display area is not correct	Analog/Power/Logic (or voltage source)
• Wrong horizontal position	Logic/Analog/CRT
• Extra/missing dot or test pattern failure	Logic
• Cursor error (missing, random location)	Logic
• Other display failure	Logic/Analog/CRT
• Setup switch failure	Setup-switches/ KBD-card/cable/Logic
• One key failure	Key-module/KBD-card
• Keyboard is not working at all	KBD-card/cable/Logic
• Displayed character is different from keyed-in	KBD-card/Logic (Logic/KBD mismatch)
• Keyboard clicker failure	Clicker/KBD-card
• Printer failure (See the printer RCMI)	Logic

Setup-Switch Settings



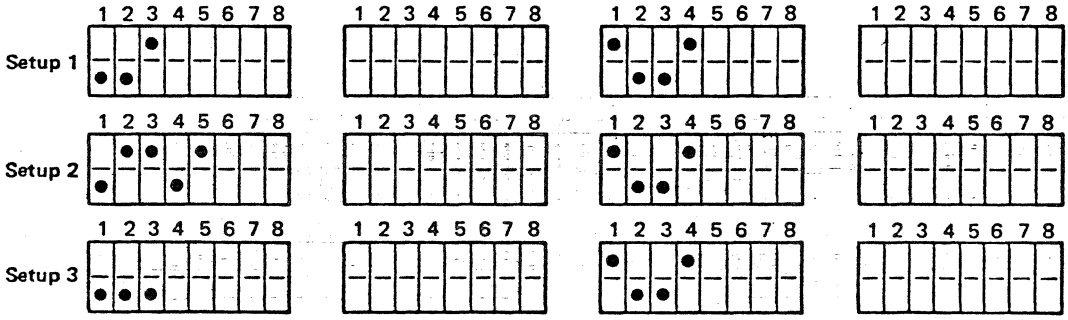
LEGEND:

**: Setup Switch ID labeled

● : Setup Switch On

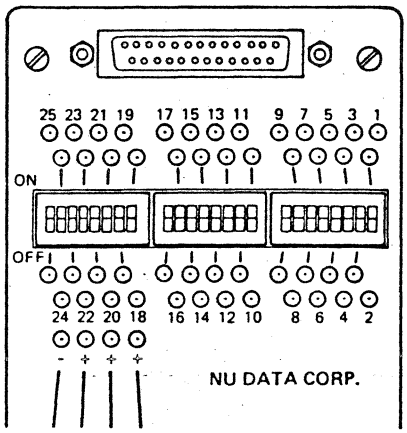
○ : Setup Switch Off

▨ : Not Used



Note: The non-indicated switch settings are not important.

Test Set Jumpering



Test Set - PN 453637

Test Set 1	Test Set 2	Test Set 3	Test Set 4	Test Set 5	Test Set 6	Test Set 7
2 - 3	2 - 3	2 - 3	2 - 3	2 - 3	17 - 18	15 - 19
4 - 5	4 - 5		4 - 5	4 - 5	23 - 24	17 - 25
5 - 12	5 - 12	5 - 12			15 - 25	
8 - 12				8 - 20		
6 - 12	6 - 20	6 - 20	6 - 20	6 - 20		
			11 - +	11 - +		

Notes:

1. Jumpers for Test Set 1, 2, and 3 can use plug type connectors instead of jumpers on Test Set.
2. Test Set 6 can be combined with Test Set 1.
3. Put all rocker switches ON.

Figure 2-1. Setup-Switch Settings and Test Set Jumpering

CHAPTER 3. DATA FLOW AND TEST PROCEDURE

3.1 DATA FLOW

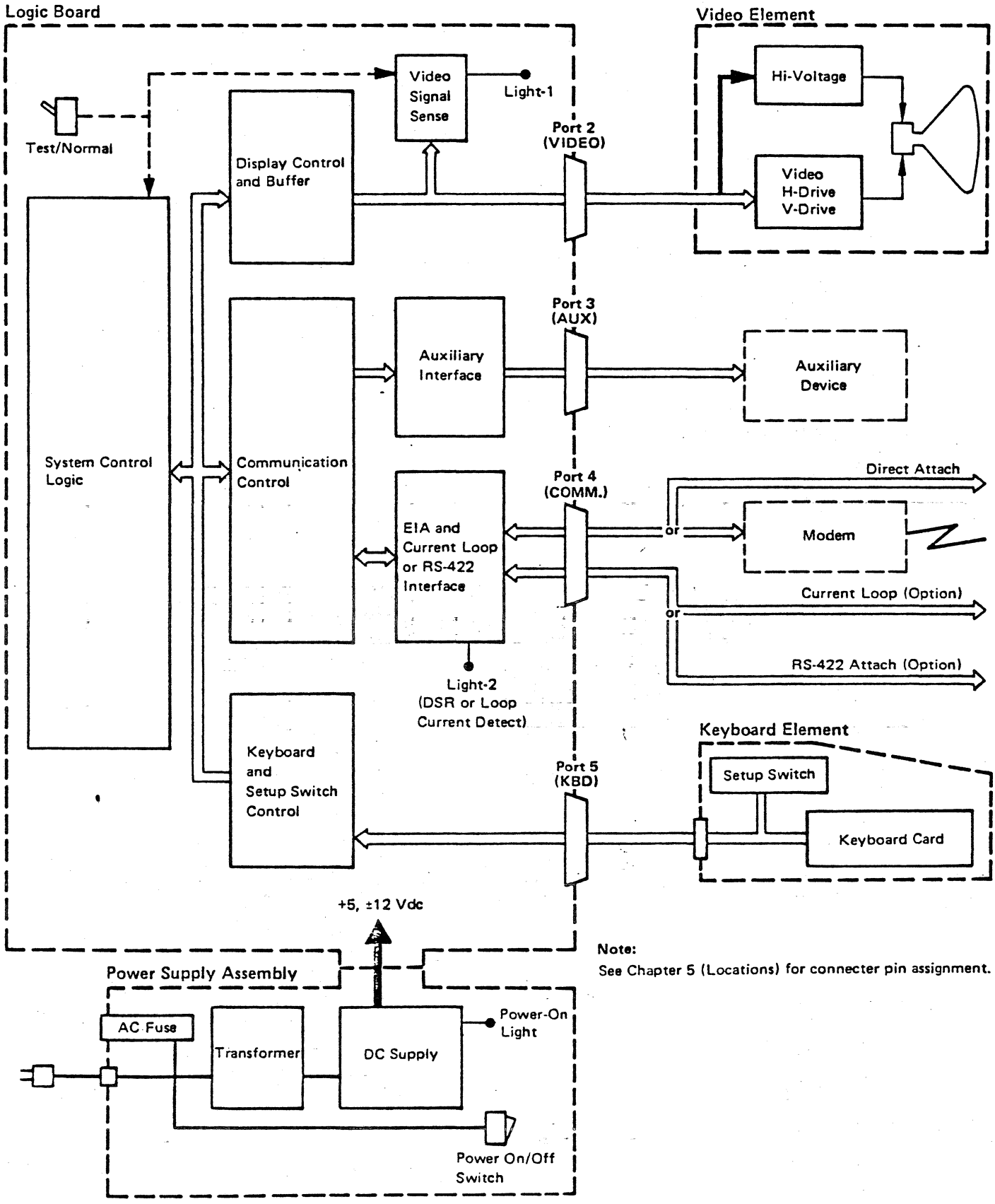
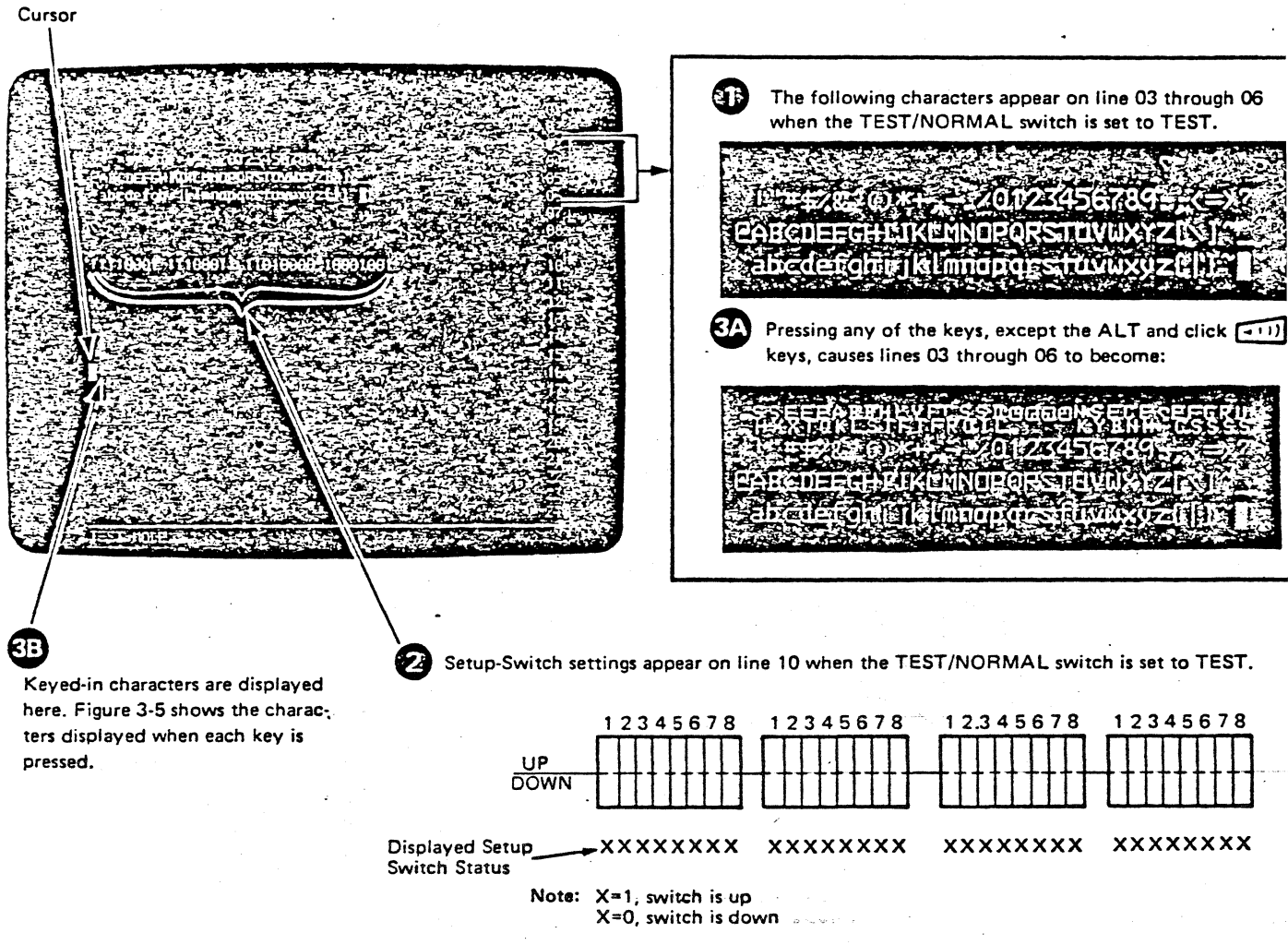


Figure 3-1. IBM 3101 Data flow

3.2 OFFLINE TEST PROCEDURE

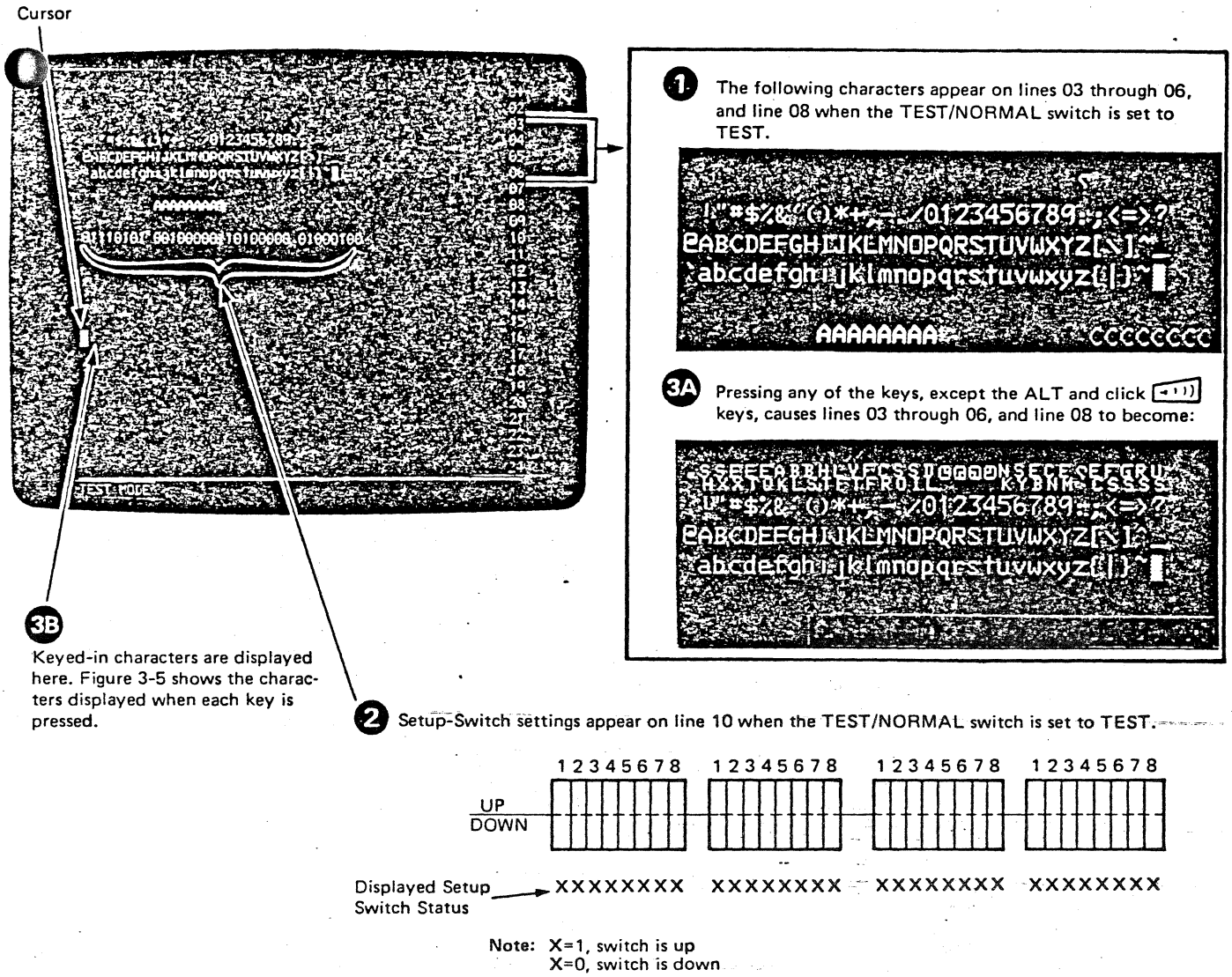
Test Start/Stop	Diagnostic Activity	Visible/Audible Activity	CE Action
Entry: Set Test/Normal switch to Test.	Basic Assurance Test starts:	Alarm sounds once. TEST MODE is displayed.	
	Routine 1: Control 2: R/W storage 3: ROS	Displays MACHINE CHECK-LOGIC if error is detected.	
	4: Communication Wrap. 5: Display Adapter 6: Keyboard	Machine stops. Only Normal/Test switch is effective.	☐ Note error condition and return to MAPs.
	OR	Displays MACHINE CHECK-KEYBOARD	☐ Note error condition and return to MAPs.
	OR	Displays MACHINE CHECK-LOGIC OR KEYBOARD if error is detected. Machine stops. Only Normal/Test switch is effective.	☐ Remove keyboard cable from Logic Element and run test again. If same message, problem is Logic Element. If message is now MACHINE CHECK-KEYBOARD, keyboard Element has the problem. ☐ Return to MAPs.
	Terminal Test starts: Routine 7: All Characters Display	ASCII character set is displayed-for check of character generator.	
		Blinking cursor also is displayed.	☐ Compare characters with those in Figure 3-3, ❶, or 3-4, ❶. Note cursor: it should be blinking.
	8: Attribute Check (Model 2X only)	'AAAAAAAA' should be high intensity.	☐ Adjust screen contrast by the knob.
		'BBBBBBBB' should not be displayed.	☐ Note error condition and return to MAPs.
		'CCCCCCCC' should be blinking.	
	9: Setup Switches Display	Status of setup switches is displayed in binary.	☐ Compare displayed status (as shown by ❷ in Figure 3-3 or 3-4.) with actual switch settings: 1 = switch is up 0 = switch is down Change position of each switch: status should change accordingly.
	10: Key Operation	First keystroke causes graphic characters displayed in Routine 7 to change.	☐ Compare changed characters with those in Figure 3-3, 3A, or 3-4, 3A.
		First keystroke also changes blinking cursor to normal cursor.	☐ Note if cursor is normal and positioning correctly.
		Symbols corresponding to the first and all subsequent characters keyed in are displayed.	☐ Compare keyed-in symbols (located at 3B, Figure 3-3 or 3-4) with keys that you pressed; see Figure 3-5 for symbols that should be displayed.
Exit: Set Normal/Test switch to Normal.	None (POR is initiated)	TEST MODE and the test pattern are cleared and CHAR MODE/BLOCK MODE appears in the Operator Information Area.	☐ Return to MAPs if it does not change.

Figure 3-2. Offline Test Procedure



Note: Figure 3-2 describes how to display the test characters at 1, 2, 3A and 3B above.

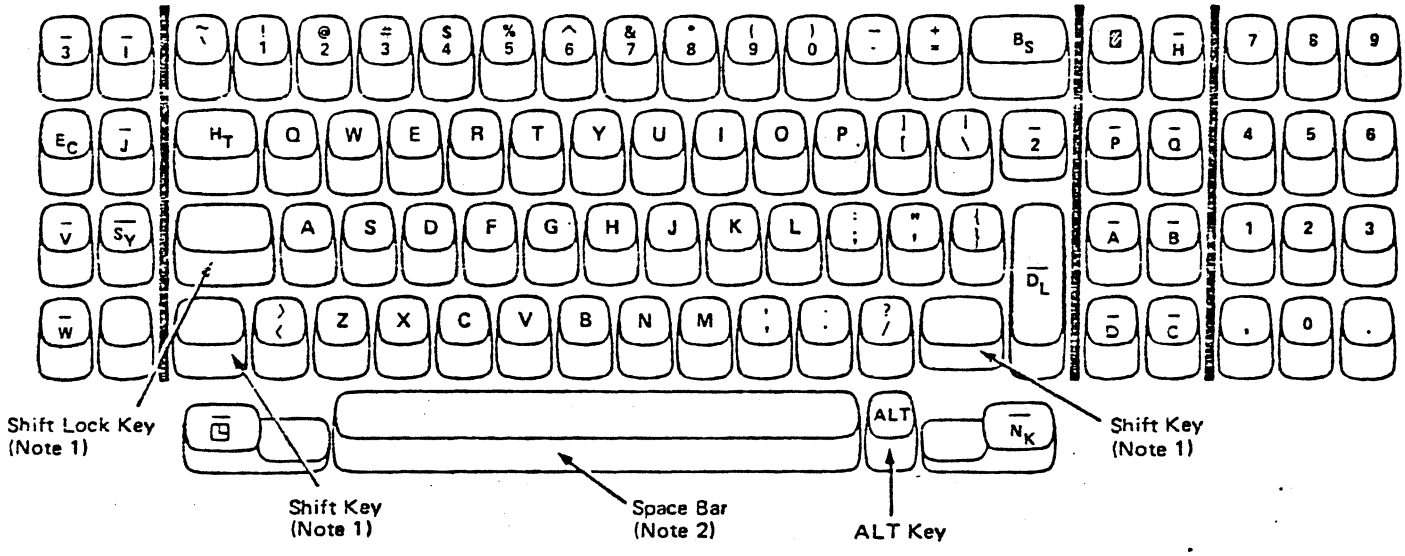
Figure 3-3. Offline-Test Display Characters (Model 1X)



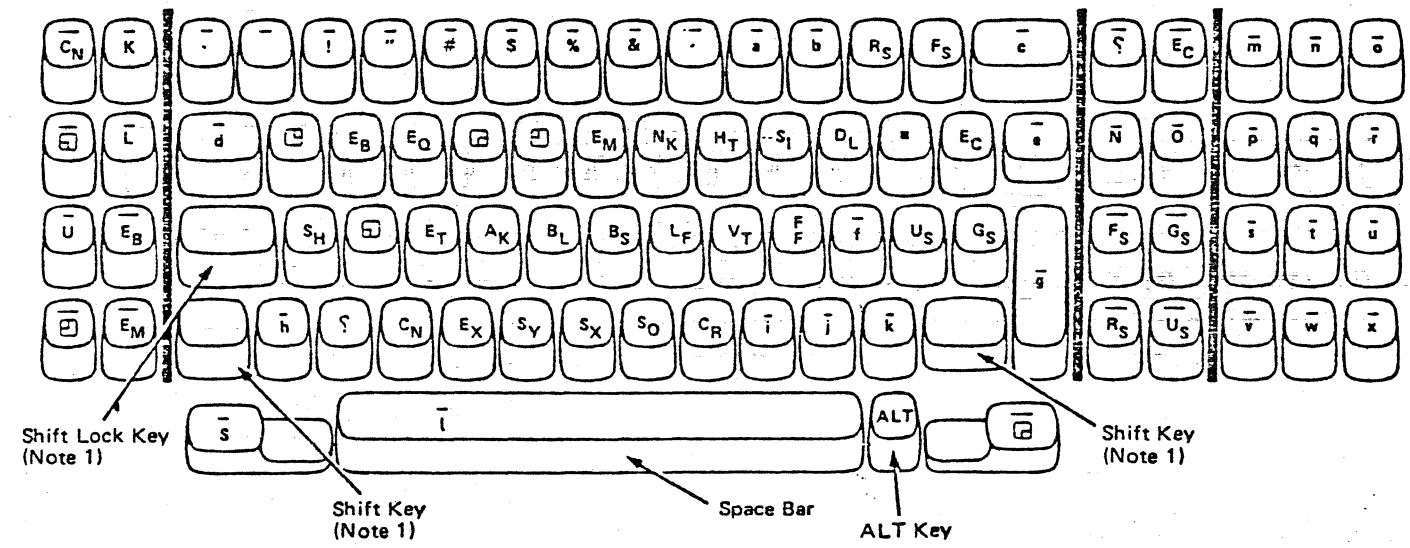
Note: Figure 3-2 describes how to display the test characters at 1, 2, 3A and 3B above.

Figure 3-4. Offline-Test Display Characters (Model 2X)

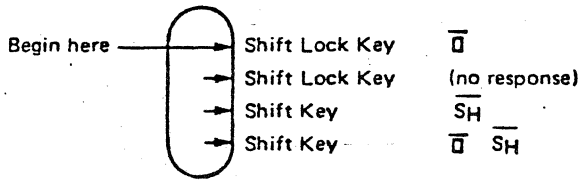
Characters Displayed--Not Using ALT
This diagram shows the character that will be displayed for each key pressed, provided the ALT Key has not been pressed and held.



Characters Displayed--Using ALT
This diagram shows the character that will be displayed for each key pressed, provided the ALT Key has been pressed and held.



Notes: 1. The following characters are displayed when the keys are pressed in the sequence given:



2. Pressing Space Bar produces no character, but the Cursor moves one character position (and erases any character previously in that position)

Figure 3-5. Characters Displayed

3.3 ONLINE TEST PROCEDURE

3.3.1 DESCRIPTION OF TEST MODE

The following three test modes are available.

TEST MODE 1 : All Characters Display
TEST MODE 2 : H Characters Display
TEST MODE 3 : Echo Test

Note: Refer to "Run Procedure (3.3.2)" for actual procedure.

3.3.1.1 Test Mode 1

This mode displays all ASCII charcters (code x'20'-x'7e') as follows.

The display format

```
                    **** TEST MODE 1 ****
  !"#$%&'()*+       .       .       .       .    hijklmno
 !"#$%&'()*+,                                    ijklmnop
     .                                              .
     .                                              .
     .                                              .
 0123456789:;                                       xyz
 123456789:;<      .       .       .       .      yz     !
```

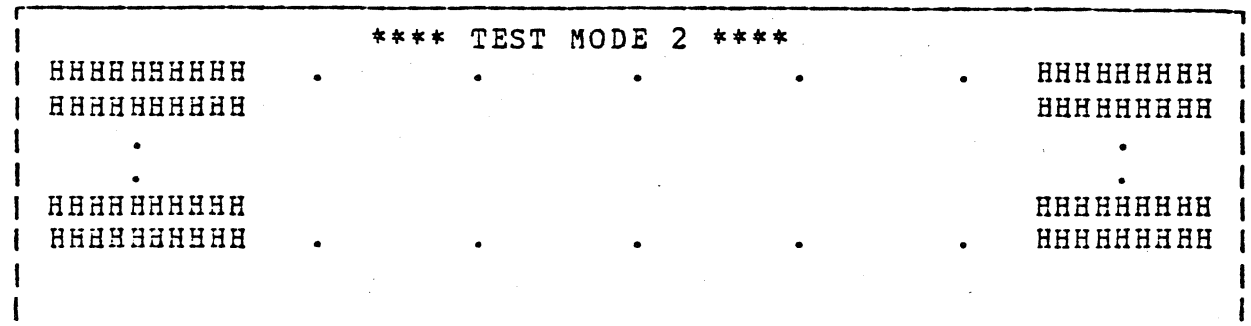
The number of lines to be displayed can be specified. If more than 23 lines are specified, the screen scrolls up and the title (TEST MODE 1) is replaced by graphic characters.

If both EIA/C-Loop and AUX ports (ports 4 and 3) are connected with EIA (or C-Loop) and AUX ports of Series/1, and AUX mode of 3101 is on, the transmitted data from Series/1 are wrapped back and compared automatically. After the specified number of lines are transmitted, the result of test is displayed on the 4979. Refer to section 3.3.3. (Press AUX+ALT on 3101 keyboard to set AUX mode on.)

3.3.1.2 Test Mode 2

This mode displays character 'H' throughout the screen as follows.

The display format



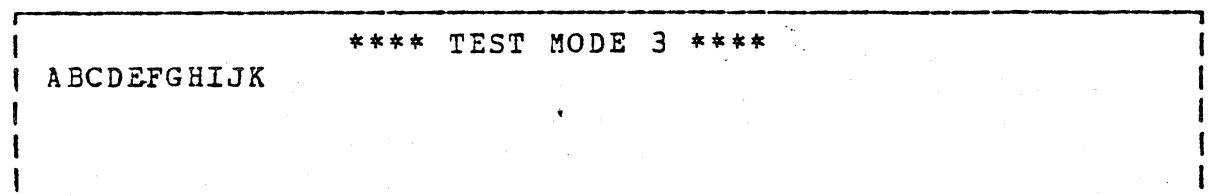
The number of lines to be displayed can be specified. If more than 23 lines are specified, the screen scrolls up and the title (TEST MODE 2) is replaced by H characters.

If EIA/C-Loop and AUX ports (ports 4 and 3) of 3101 are connected with EIA (or C-Loop) and AUX ports of Series/1, and AUX mode of 3101 is on, the transmitted data from Series/1 are wrapped back and compared automatically. After the specified number of lines are transmitted, the result of test is displayed on the 4979. Refer to section 3.3.3. (Press AUX+ALT on 3101 keyboard to set AUX mode on.)

3.3.1.3 Test Mode 3

In this mode, the data entered from the tested terminal is displayed to the screen, character by character as follows.

The display format



The available keys are only graphic keys.
CLEAR, BREAK, and so on are not available.

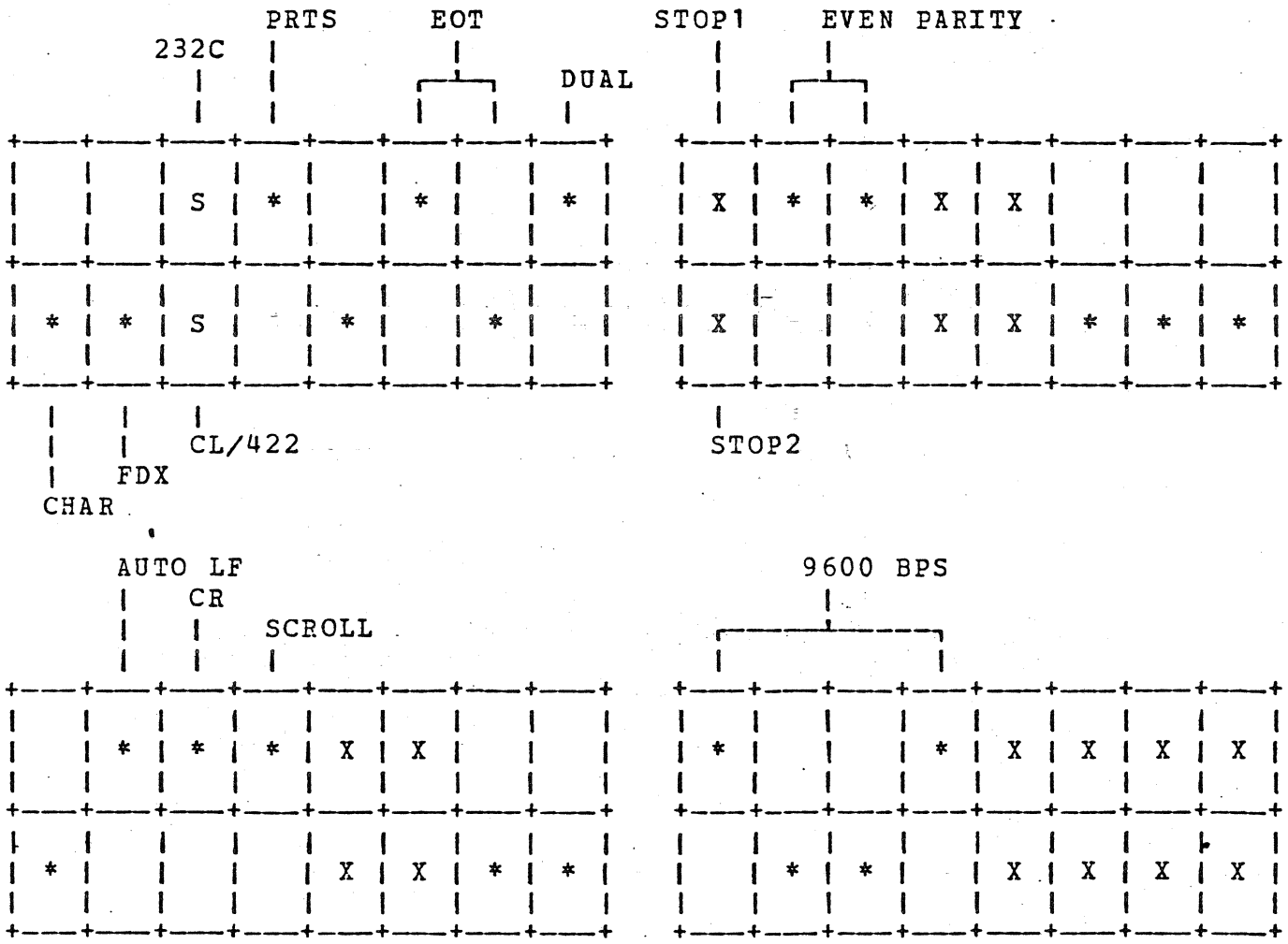
3.3.2 RUN PROCEDURE

3.3.2.1 3101 Setup (Tested Terminal)

1) Set up the setup switches of 3101 as follows.
2) Connect the Series/1 EIA (or C-Loop) cable to the 3101 port 4.
3) Connect the Series/1 AUX cable to the 3101 port 3.
4) Press AUX+ALT on 3101 keyboard to set AUX mode on.

- Setup Switch Setting

'*' : Set to indicated position
'S' : Select for port 4 testing (EIA232C or C-Loop)
'X' : Do not care



3.3.2.2 Series/1 Setup

1) Power up the Series/1.
2) Press STOP, RESET and LOAD keys on Series/1.
   (The test program in the disk becomes ready for use.)

3.3.2.3 Testing from 4979 (Series/1 display terminal)

* Test Initiation

1) Press ATTN key.
   '>' is displayed.
2) Key-in and enter $L T3101.
   'T3101', time and address are displayed.
   'T3101A', time and address for AUX port are displayed.
   'T3101X', time and address for EIA port are displayed.
   'T3101X', time and address for C-LOOP port are displayed.
   '3101 ON-LINE TEST STARTED' is displayed.
   Test Mode 3 is running on the 3101.

* Test Mode Selection

1) Press ATTN key.
   '>' is displayed.
2) Key-in and enter T3101x m (nnnn).
   x: 'E' for EIA port, 'C' for C-Loop port.
   m: Test mode number (1, 2, or 3)
   nnnn: Number of display lines
   (Default is 23. nnnn=0 means loop.)

* Test Termination

1) Press ATTN key.
   '>'is displayed.
2) Key-in and enter EN.
3) Press ATTN key.
   '>'is displayed.
4) Key-in and enter T3101A.
5) Press ATTN key.
   '>'is displayed.
6) Key-in and enter T3101E.
7) Press ATTN key.
   '>'is displayed.
8) Key-in and enter T3101C.

3.3.3 INDICATION

The following messages are displayed on the 4979 when test mode 1 or 2 has completed.

- T3101x: RECEIVE BUFFER OVERRUN
  T3101x: LINE PARITY ERROR

  Receive Buffer Overrun (or Line Parity Error) is detected.

- T3101x: AUX TIMEOUT ERROR

  AUX port does not receive data.
  If AUX port (port 3) of 3101 is not connected with AUX port of Series/1, or AUX mode of 3101 is not on, this error occurs.

- 3101x: AUX DATA ERROR

  AUX port received unexpected data when data was wrapped back.

- T3101x: AUX GOOD COMPLETION

  Test mode 1 or 2 has completed successfully.

Note
x : 'E' for EIA port
'C' for C-Loop port

CHAPTER 4. REMOVAL AND REPLACEMENT PROCEDURES

4.1 LOGIC ELEMENT COVER

1. Turn power off and disconnect the power-cord plug from the outlet.
2. Remove all plugs (1) connected to the Logic Element, then lift the Video Element (2) from the top of the Logic Element (see Figure 4-1).
3. Invert the Logic Element, remove Warning Label and remove the single screw from the recessed hole in the base (The screw is under the label).
4. Return the Logic Element to its normal position.
5. Through an opening in the right front ventilator, press the plastic tab (3) inward with a screwdriver and push the top cover (4) upward just far enough to unlatch the tab.
6. Repeat Step 5 at the left front ventilator, then raise the top cover (5) from the base.
7. Reinstall the cover in reverse sequence.
8. Paste the Warning Label (PN5640566) over the single screw.

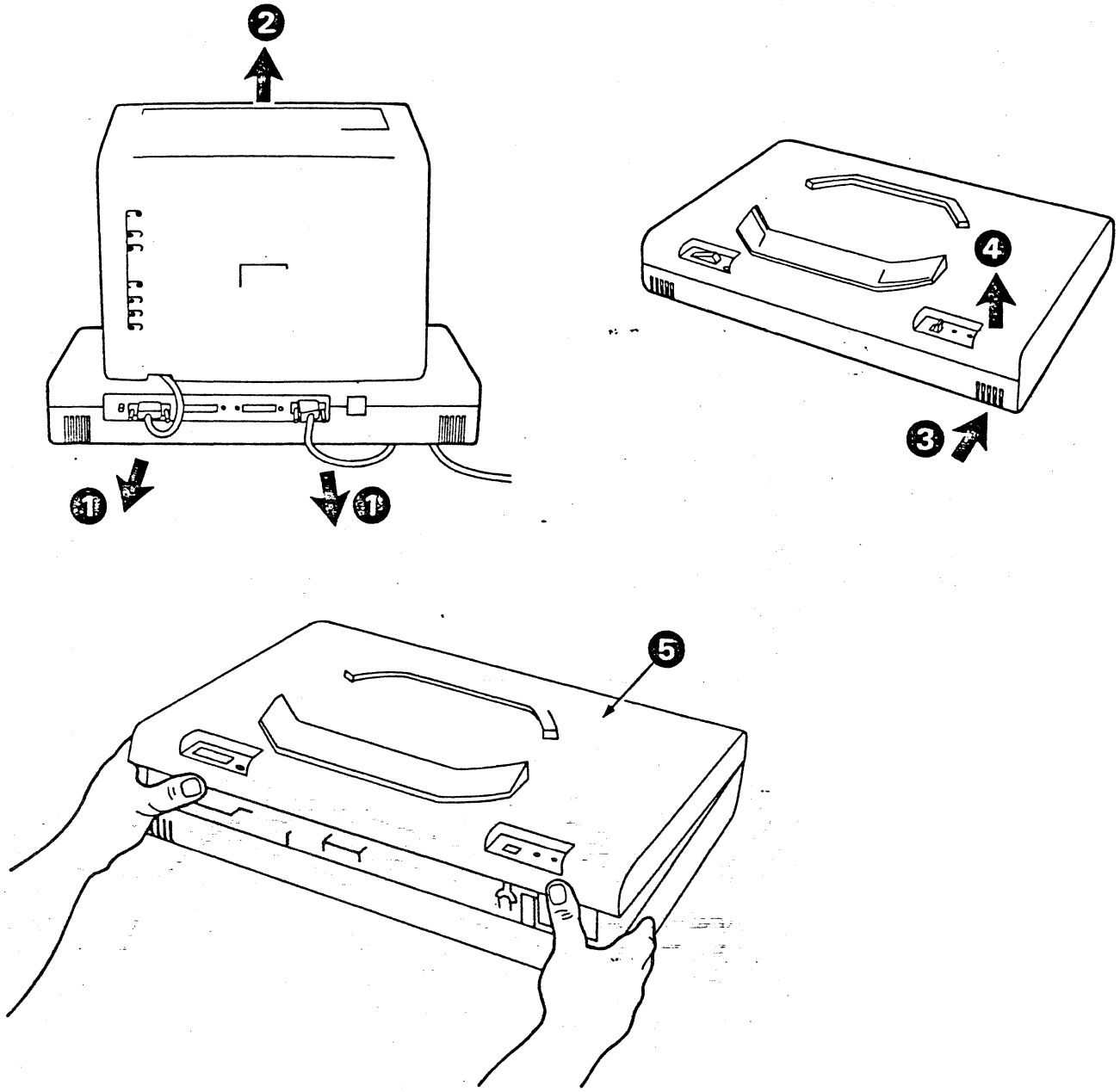


Figure 4-1. Logic element Cover

4.2 LOGIC ELEMENT LOGIC BOARD ASSEMBLY

1. Remove the Logic Element cover as described under "Logic Element Cover."
2. Remove the screw (1) connecting the Logic board and power supply frame (see Figure 4-2).
3. Disengage the plastic tabs (2) and (3) and raise the Logic board just clear of the tabs.
4. Pull the Logic board (4) from the connector (5), then lift it clear of the unit.
5. Reinstall in reverse sequence.

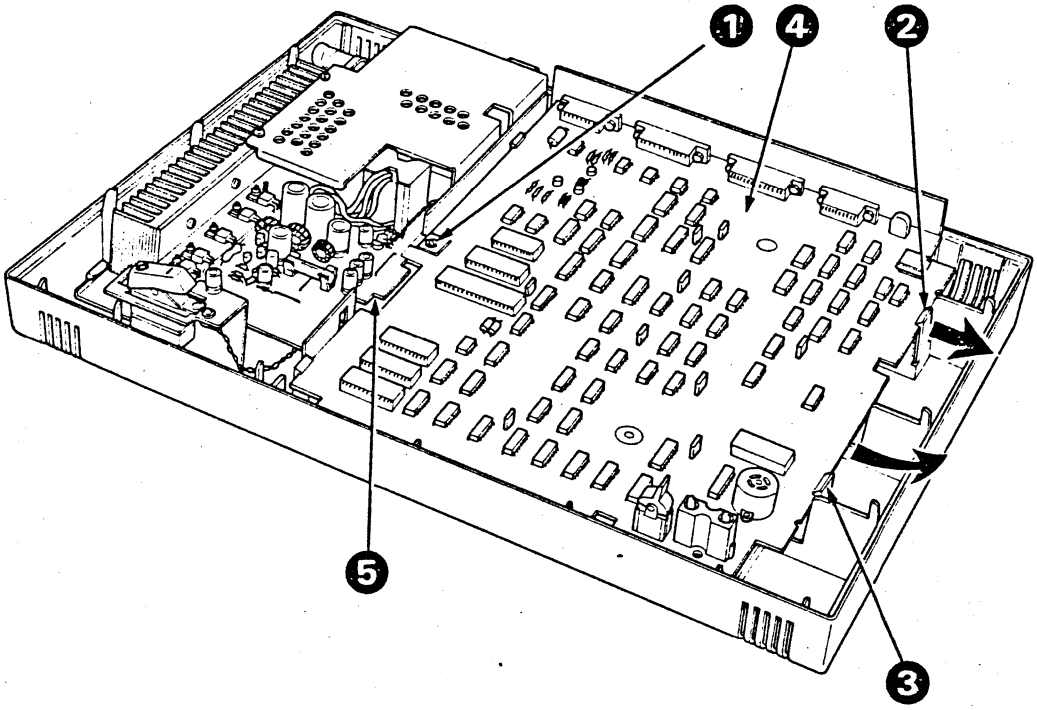


Figure 4-2. Logic Board Assembly

4.3 LOGIC ELEMENT POWER SUPPLY

1. Remove the Logic Element cover, as described under "Logic Elemer Cover," and the Logic board assembly, as described under "Logi Element Logic Board Assembly."

2. Disconnect the power-cord plug ① from the power supply (se Figure 4-3).

3. Disengage the two plastic tabs ② (the closer tab cannot be see in the drawing), pivot the supply upward ③ and pull it out (from the two tabs on the opposite side.

4. Reinstall in reverse sequence.

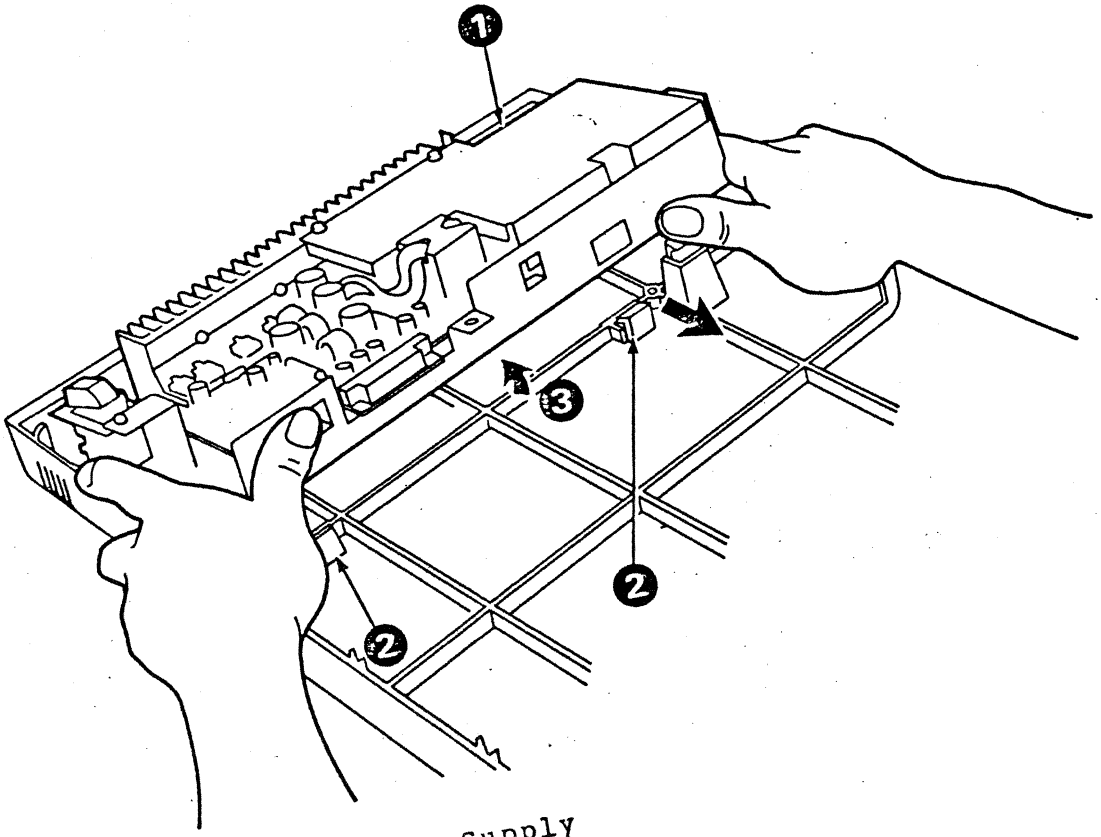


Figure 4-3. Power Supply

4.4 KEYBOARD ELEMENT COVER

1. Unplug the Keyboard cable from the Logic Element.

2. Invert the Keyboard Element and remove the four screws from th corners of the base.

3. Return the Keyboard Element to its normal position and lift th cover from the base.

4. Reinstall in reverse sequence, but first ensure that th Keyboard's protective plastic cover is not folded.

   Note: Check for cover clearance around the keys after the cove is reinstalled. Adjust the cover if necessary.

4.5 KEYBOARD ELEMENT SETUP SWITCHES ASSEMBLY

1. Remove the Keyboard Element cover, as described under "Keyboard Element Cover."

2. Remove two screws, one at each end (1) of the switch assembly (see Figure 4-4).

3. Lift the switch assembly from the Keyboard assembly pins, which protrude into the switch-assembly connectors (2) from the underside.

4. When reinstalling, ensure that the pins on the Keyboard assembly properly align with the connectors on the switch assembly; the switch assembly easily fits into place when the pins are aligned.

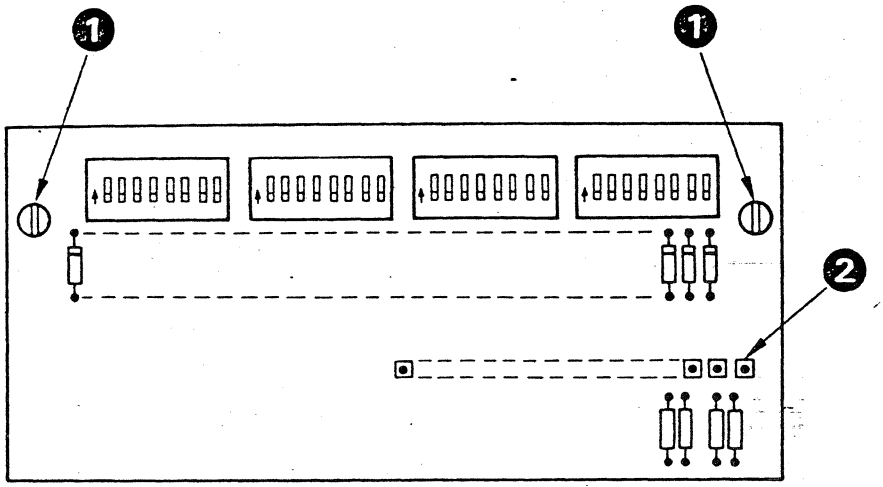


Figure 4-4. Setup Switch Assembly

4.6 KEYBOARD ELEMENT CLICKER ASSEMBLY

1. Remove the Keyboard Element cover, as described under "Keyboard Element Cover," and the Keyboard assembly, as described under "Keyboard Element Keyboard Assembly."

2. Push the clicker-assembly bail fastener (shown in Figure 4-5), toward the rear of the Keyboard Element, then raise the fastener over the cast tab as you let it move forward slowly.

3. Disconnect the clicker-cable slide connector and lift the clicker assembly.

4. Reinstall in reverse sequence.

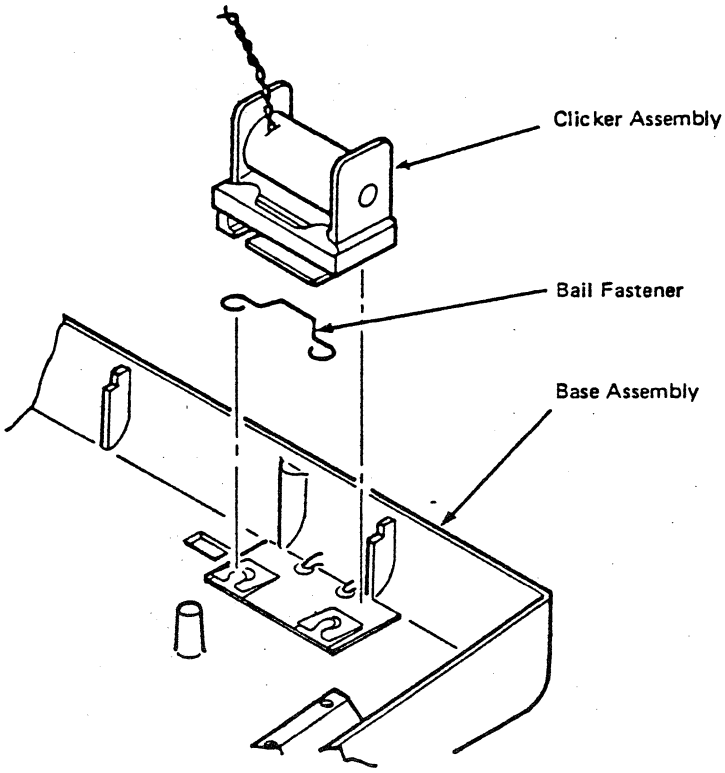


Figure 4-5. Clicker Assembly Removal

4.7 KEYBOARD ELEMENT KEYBOARD ASSEMBLY

1. Remove the Keyboard Element cover, as described under "Keyboard Element Cover."

2. Disconnect the clicker cable connector, shown in Figure 4-6, from the Keyboard Logic card assembly.

3. Disconnect the Keyboard cable connector and grounding wire from the Keyboard assembly.

4. Remove the two screws holding the Keyboard assembly to the base, and lift the assembly from the base.

5. Reinstall in reverse sequence, being careful to spread the Keyboard's protective plastic cover before putting the Keyboard Element cover in place.

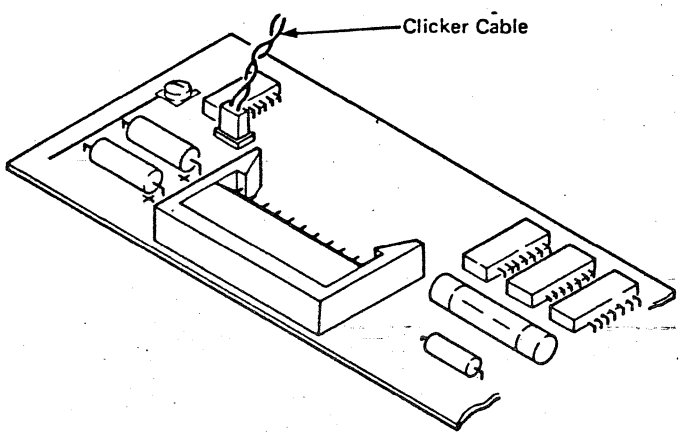


Figure 4-6. Clicker Cable

4.8 KEYBOARD ELEMENT KEYBOARD ASSEMBLY COMPONENTS

A keytop puller (PN 9900373-preferred, 75475, or 627953), isopropyl alcohol (PN 2200200), and lint-free cloth (PN 2108930) may be needed to remove and replace keyboard components.

4.8.1 KEYBUTTON

Keybuttons are removed by sliding the keytop puller tool over the keytop and pulling straight up.

4.8.2 KEY MODULE

The work area must be clean. Any particle between the key module flyplate, shown in Figure 4-7, and the printed circuit must be cleared.

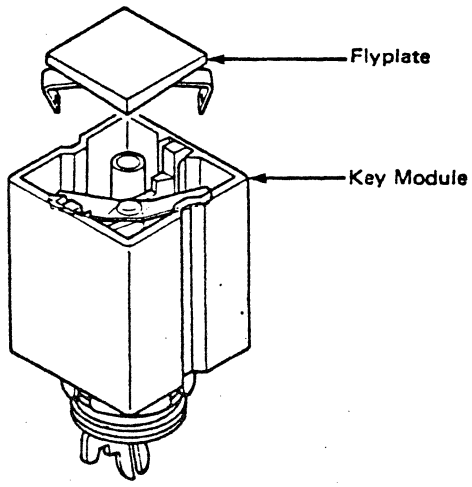


Figure 4-7. Key Module/Flyplate

4.8.2.1 Preparation for Removal

1. Turn power off.
2. Disconnect the Keyboard cable from the Logic Element.
3. Remove the Keyboard Element cover (see "Keyboard Element Cover").
4. Remove the keybutton from the module to be replaced (see "Keybutton").
5. Remove the Keyboard assembly from the base (see "Keyboard Element Keyboard Assembly").
6. Invert the Keyboard assembly and place it on the guide tabs located on the left and right sides.

4.8.2.2 Key Module Removal (Including Spacebar Module)

Note: See "Spacebar," if the spacebar module is to be replaced.

1. Remove the eight screws holding the base plate and circuit board to the key assembly (see Figure 4-8).
2. Lift the circuit board and the base plate from the key assembly, and place them on their bases in a clean area.
3. Handle the key assembly by its sides. Be careful not to press any keys. Lift the key assembly off the base, turn it over, and place it back on the base.

   Note: Replace the key module if the flyplate comes off. Do not attempt to repair the module. Repaired modules can cause intermittent failures.
4. Press down on the key module until it is free of the holding plate.
5. Lift the edge of the key assembly that is nearest the key module that has just been removed. Remove the defective module.
6. Lift the key assembly by the edges, and invert it on its base.

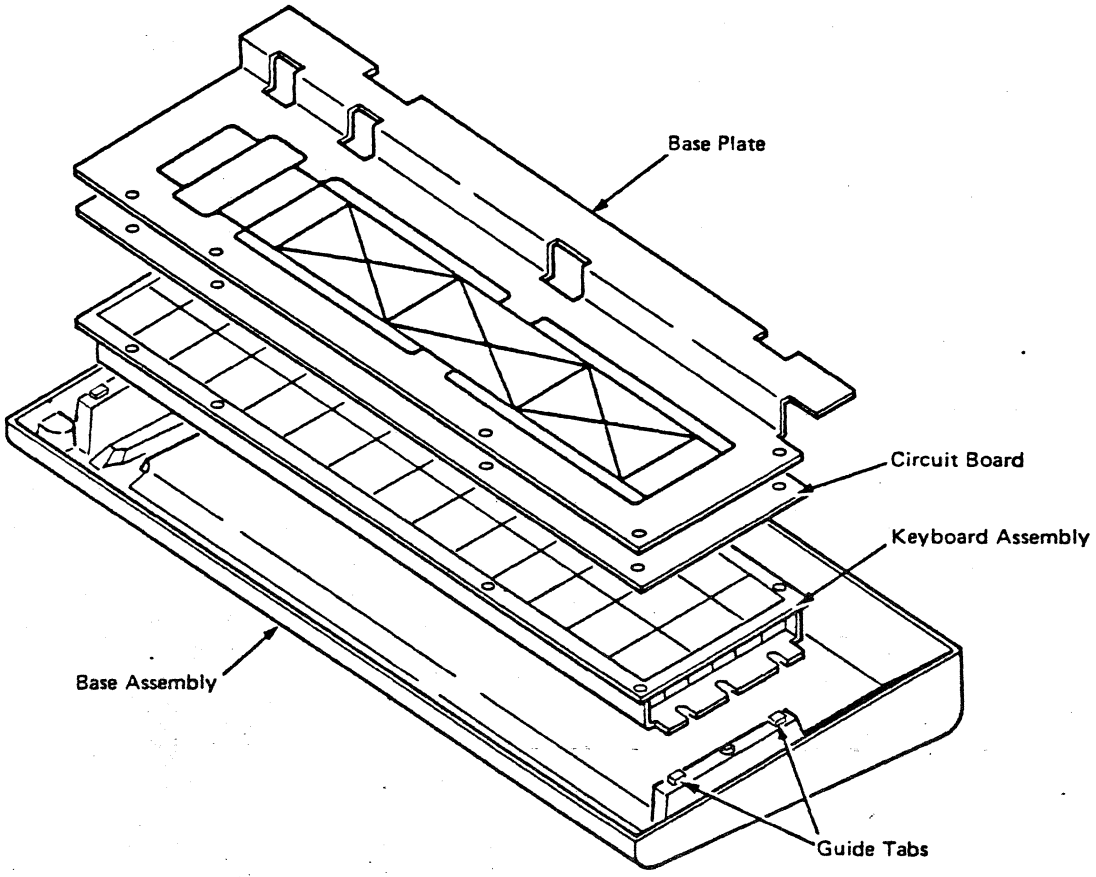


Figure 4-8. Key Module Removal

4.8.2.3 Key Module Replacement

1. Position the key module so that the alignment tab will engage the keybutton as shown in Figure 4-9.

2. Press the new key module (PN 1748131) by hand into the holding plate.

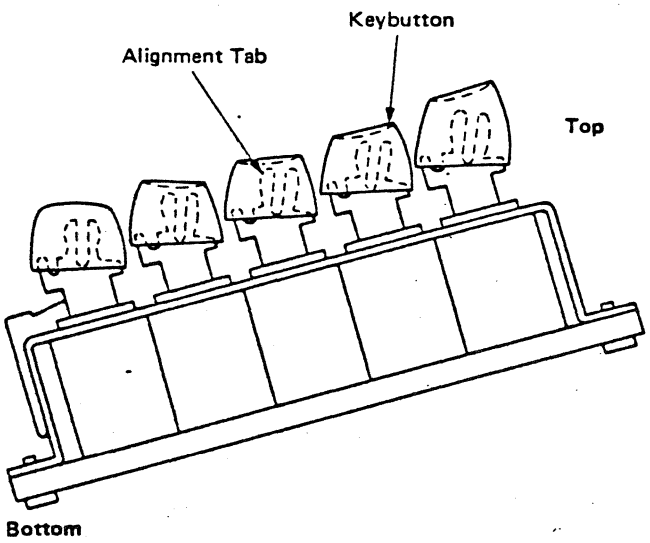


Figure 4-9. Key Module Replacement

3. Carefully wipe the printed circuit board with a lint-free cloth (PN 2108930) moistened with isopropyl alcohol (PN 2200200). Inspect all key module flyplates for any particles, and carefully clean if needed.

4. Align the holding-screw holes through the base plate, circuit board, insulator, and top insulator (if used). Lower the circuit board to the key assembly. Secure the circuit board to the key assembly with the holding screws.

5. Reinstall the Keyboard assembly on the base, ensuring correct alignment.

6. Reinstall the keybutton in the correct location.

7. Reconnect the Keyboard cable connector and clicker cable to the Logic card. Reinstall the Keyboard Element cover, and reconnect the Keyboard cable to the Logic Element.

8. Perform the Offline Test Procedure to check for correct Keyboard operation.

4.8.3 SPACEBAR

Disconnect the Keyboard cable from the Logic Element and remove the Keyboard Element cover (see "Keyboard Element Cover") for access to the Keyboard assembly.

4.8.3.1 Removal

1. Hold the spacebar at the ends and push upward with even pressure.
2. Remove the pivots (if required) using the tip of a screwdriver in the molded slot in the side of the pivot.

4.8.3.2 Replacement

1. Press any pivots removed into the mounting frame.
2. Place the spacebar button over its modules, and lower it into position while engaging the bar in the two pivots.
3. Press down on the spacebar at the spacebar modules to seat the spacebar button.
4. Check spacebar operation for binding. If the spacebar binds, the probable cause is a bent right module stem. This stem can be shaped to free the bind.
5. Install the Keyboard Element cover and reconnect the Keyboard cable to the Logic Element.

4.8.4 KEYBOARD LOGIC CARD ASSEMBLY

1. Disconnect the Keyboard cable from the Logic Element.
2. Remove the Keyboard Element cover (see "Keyboard Element Cover").
3. Remove the setup switch assembly as described under "Keyboard Element Setup Switches Assembly."

4. Disconnect the Keyboard cable connector and clicker connector at the Keyboard Logic card.

5. Remove the two retaining screws from each end of the Keyboard Logic card, as shown in Figure 4-10.

6. Remove the Keyboard Logic card.

7. Reinstall in reverse sequence.

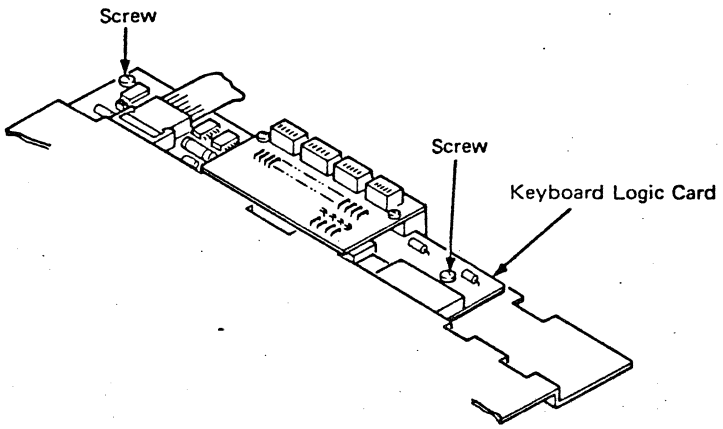


Figure 4-10. Keyboard Logic Card Removal

4.9 KEYBOARD CABLE REPLACEMENT

1. Turn power off
2. Disconnect the Keyboard cable from the Logic Element.
3. Remove the Keyboard Element cover, as described under "Keyboard Element Cover," and the Keyboard assembly, as described under "Keyboard Element Keyboard Assembly."
4. Remove the screw and the strain relief from the base assembly.
5. Disconnect the Keyboard cable connector from the Keyboard assembly.
6. Install in reverse sequence.

4.10 VIDEO ELEMENT FILTER REPLACEMENT

1. Push the left and right upper corners so that the bottom edge comes out.
2. Grasp the left and right bottom edges and pull forward slightly.
3. Grasp both side edges and pull to remove.
4. Install a new filter in the reverse sequence making sure the protruding edge is at the bottom.

4.11 VIDEO ELEMENT CONTRAST AND BRIGHTNESS CONTROL KNOBS REPLACEMENT

1. Hold the knob and pull it out.
2. Replace with the new knob.

4.12 VIDEO REAR COVER REMOVAL/REPLACEMENT

SAFETY NOTE: Static charge may be present at the anode lead; using an insulated jumper wire, momentarily ground the CRT anode terminal to the CRT mounting screw.

1. Turn power off, and disconnect the video cable.
2. Place the Video element with the screen face down.
3. Remove two plugs and two screws from top of Video element.
4. Remove two white seals and two screws from bottom of element.
5. Release the cable frcm rear cover.
6. Slide the rear cover off.
7. Discharge the static charge (see SAFETY NOTE).
8. Reinstall the rear cover in reverse sequence.
   (Align the inside guide to the analog card.)

Note: Put new white seals over screws on bottom, if required. Left side or right side plug is indicated inside the plug.

4.13 VIDEO ANALOG CARD REPLACEMENT

1. Remove two knobs (Brightness and Contrast knobs).
2. Remove the rear cover.
   (Discharge the static charge; see SAFETY NOTE in 4.12).
3. Remove the anode lead.
4. Remove carefully the small card connected to CRT socket.
   (Do not break glass extension in center of the socket.)
5. Disconnect the four wires from the CRT yoke coil.
   (Record or mark the wire color for later soldering.)
6. Remove the cable clamp.
7. Remove two Analog card holding screws.
8. Reinstall the Analog card in reverse sequence.
   (Do "Final check and adjustment".)
9. Reinstall the rear cover.
   (Align the inside guide to the analog card.)

4.14 VIDEO CRT ASSEMBLY REPLACEMENT

1. Remove the rear cover.
   (Discharge static charge; see SAFETY NOTE in 4.12.)

2. Remove the Analog card.

3. Replace the CRT and front panel assembly.

4. Reinstall the Analog card.
   (Do "Final check and adjustment".)

5. Reinstall the rear cover.

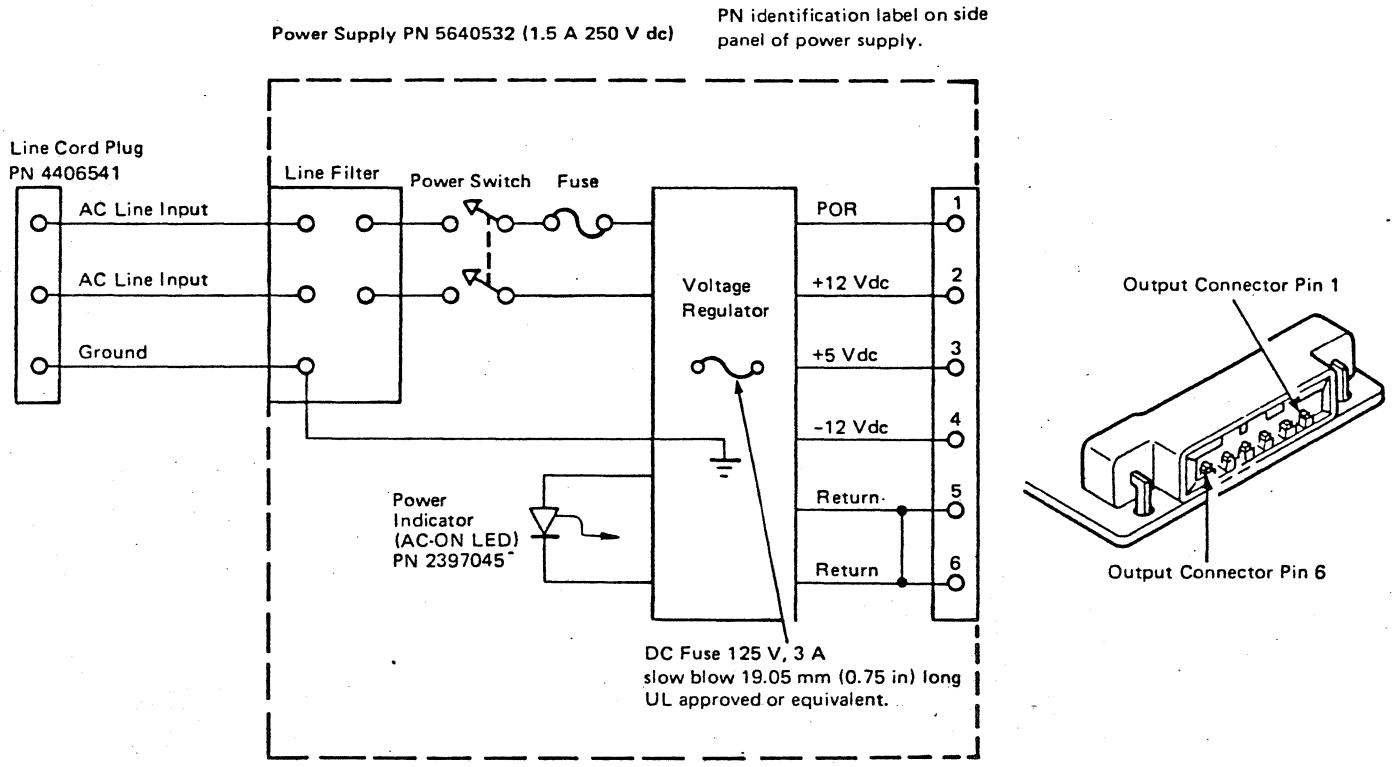
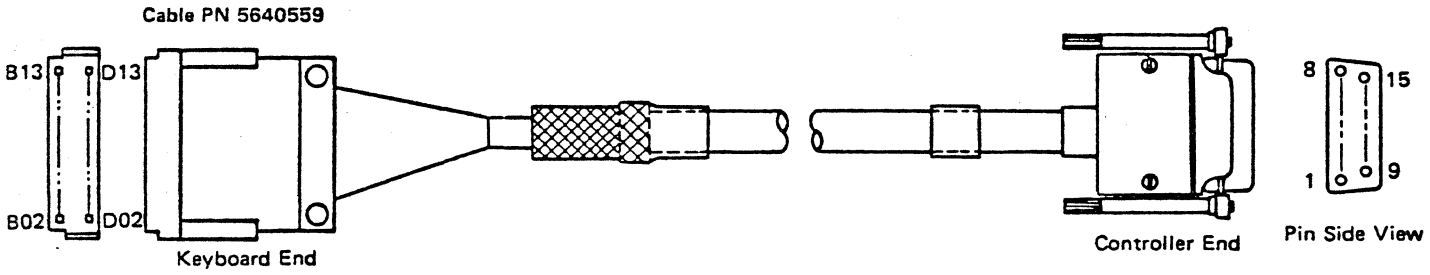


Figure 5-1. Power Components



Wire Color	Keyboard End	Controller End	Line Title
Pink	D03	2	+5 Vdc
WHT/BLK/ORG	B11	6	+12 Vdc
White	D12	11	Command Strobe
Black	GND Bus	7	Ground
Aquamarine	B02	8	Cable Check
White/Black	B10	9	Serial Data Clock
White/Brown	B13	5	Serial Data
White/Red	D04	12	Command 0
White/Orange	D05	13	Command 1
White/Yellow	D09	14	Command 2
White/Green	B07	4	Keyboard Data Available
White/Blue	D07	3	Power On Reset
White/Gray	D02	10	Acknowledge
WHT/BLK/BRN	GND Bus	7	Ground
Red	GND Bus	7	GroundID
(Shield)	—	1, 15	Ground

Figure 5-2. Keyboard Cable

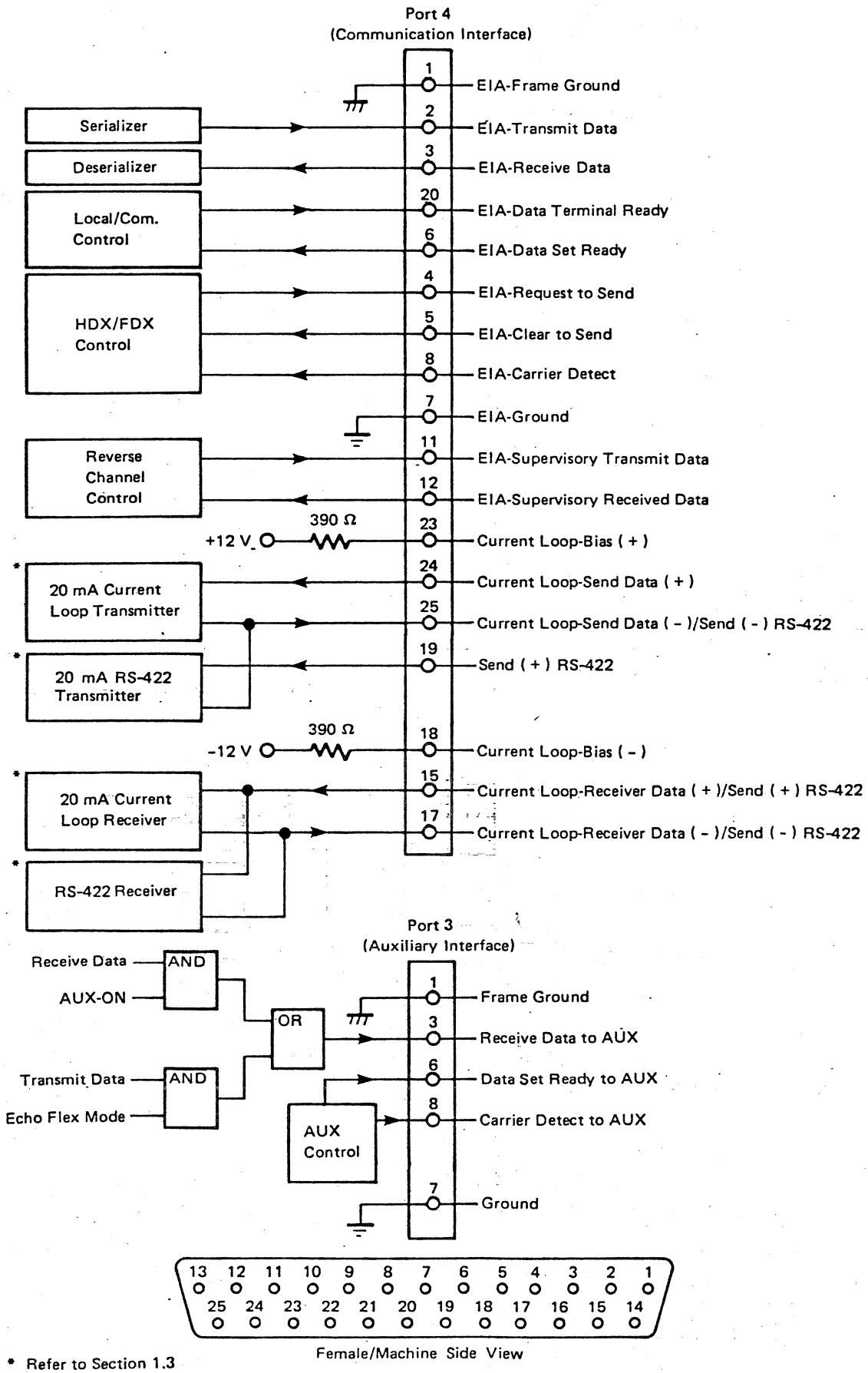


Figure 5-3. Communication and Auxiliary Interface

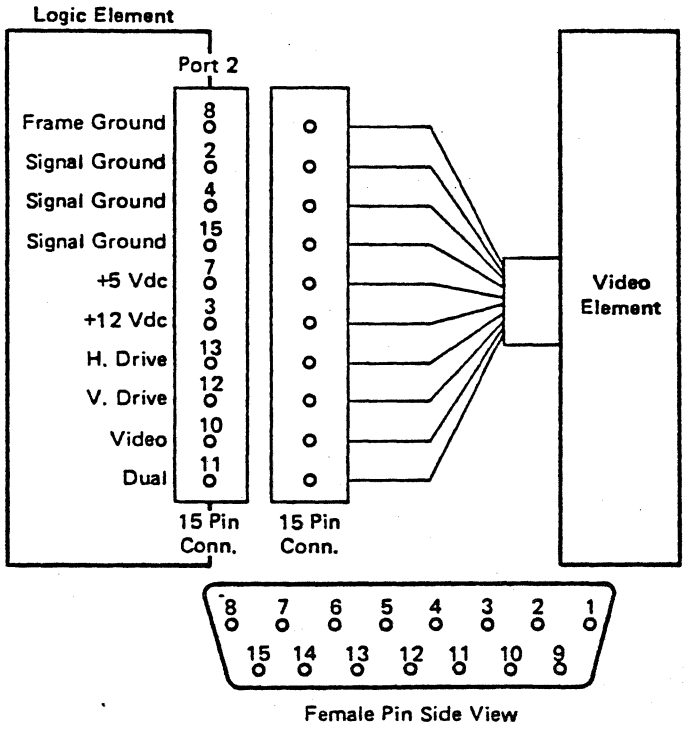


Figure 5-4. Video Cable

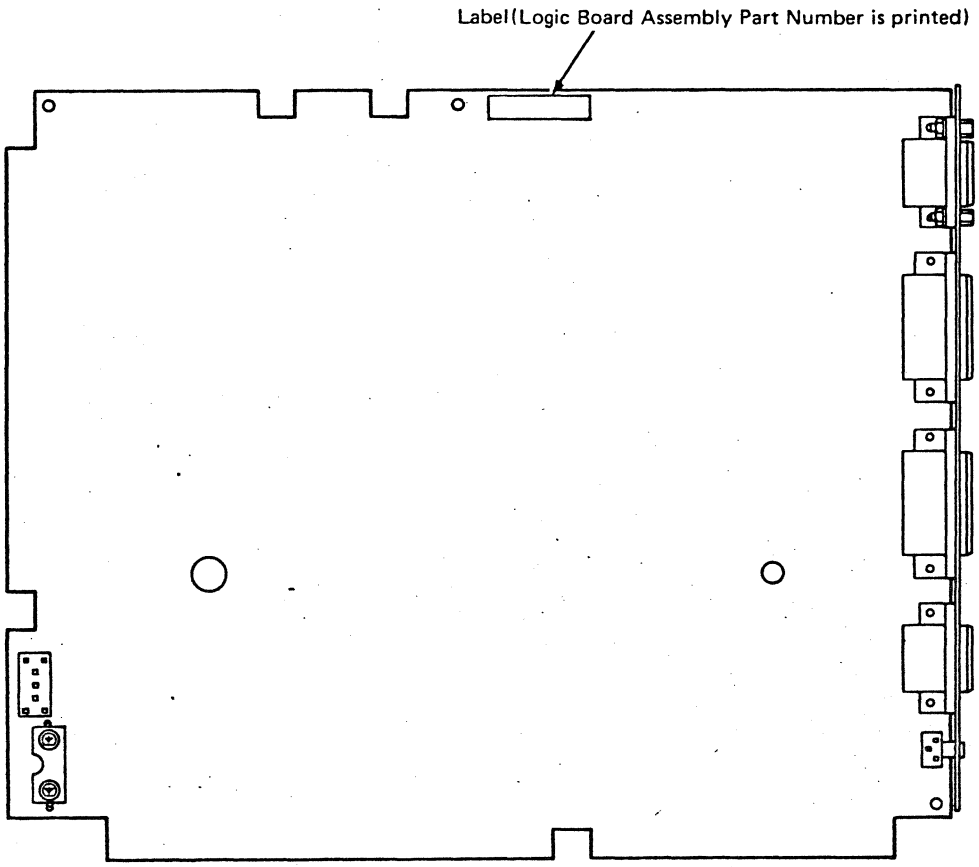


Figure 5-5. Logic Board ID

Modem Interface Test Set (PN 453637)

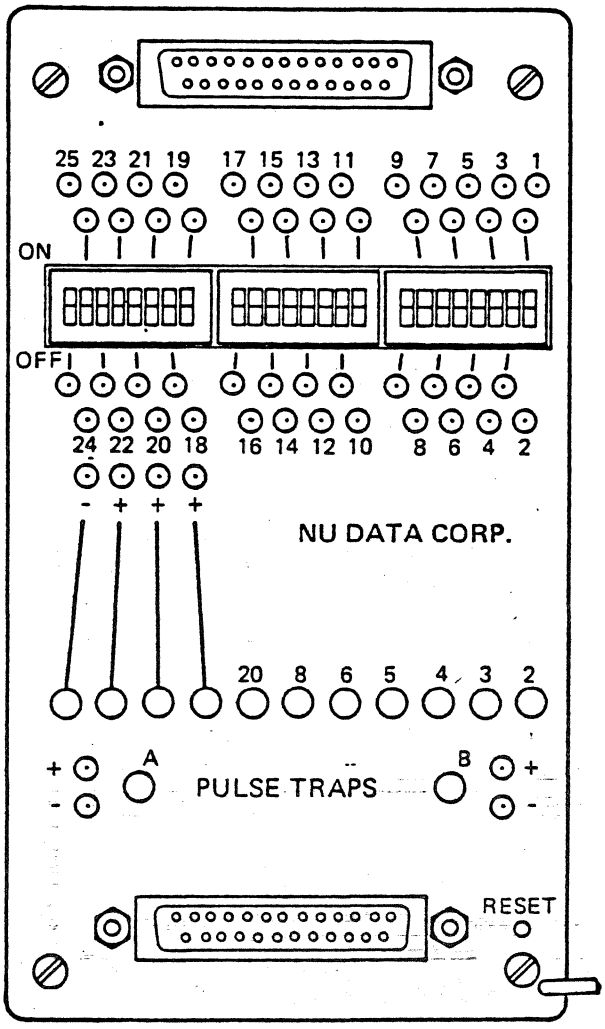


Figure 6-1. Modem Interface Test Set (PN 453637)

The NU DATA test set connects in series with the CCITT/EIA data se cable and the 25-pin data set connector. This enables the CE t monitor, measure, or control the 24 leads of a data set interfac cable. Non-standard inter connections and signal generation can b performed using patch cords provided with the tool. This too contains seven LED indicators for quick display of the significan CCITT/EIA lines.

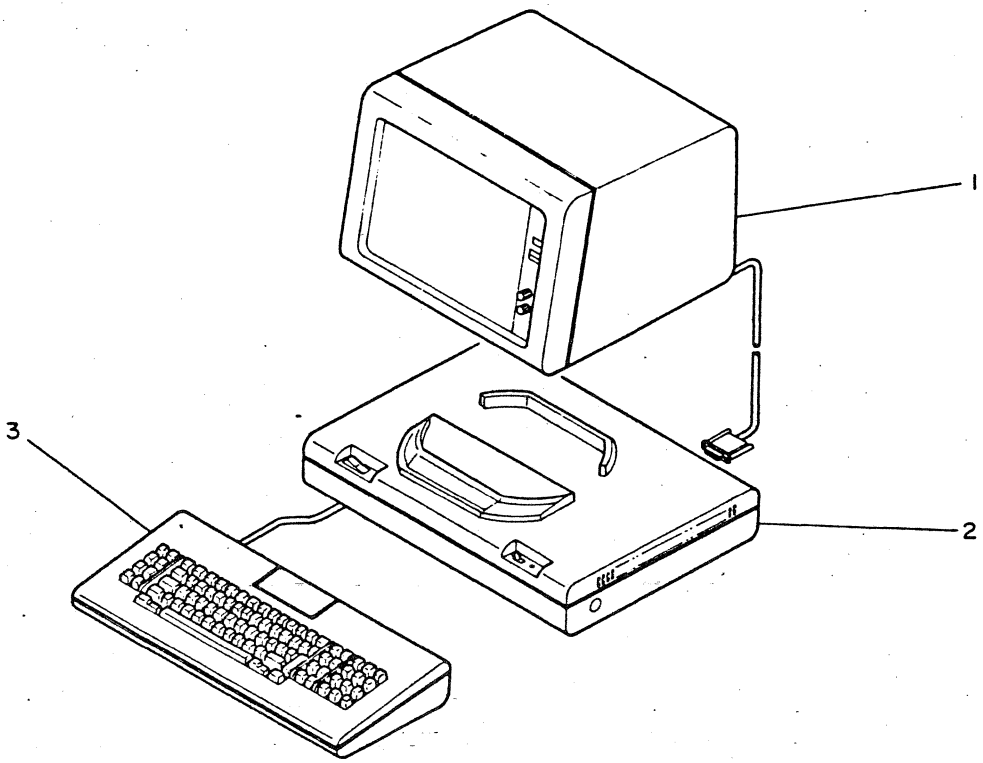


Figure A-1. Final Assembly, See List A-1

List A-1 Final Assembly

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	1 2 3 4 DESCRIPTION
1-1	5640540	REF.	VIDEO ELEMENT FOR DETAIL BREAKDOWN, SEE FIGURE A-2
-2	5640410		LOGIC ELEMENT-MODEL 10, RS-232C FEATURE, FOR US
-2	5640428		LOGIC ELEMENT-MODEL 11, RS-232C FEATURE, W/ EIA CABLE
-2	5640412		LOGIC ELEMENT-MODEL 12, RS-232C AND C-LOOP FEATURE FOR US
-2	5640414		LOGIC ELEMENT-MODEL 13, RS-232C AND RS-422 FEATURE FOR US
-2	5640411		LOGIC ELEMENT-MODEL 20, RS-232C FEATURE, FOR US
-2	5640429		LOGIC ELEMENT-MODEL 21, RS-232C FEATURE, W/ EIA CABLE
-2	5640413		LOGIC ELEMENT-MODEL 22, RS-232C AND C-LOOP FEATURE FOR US
-2	5640415		LOGIC ELEMENT-MODEL 23, RS-232C AND RS-422 FEATURE FOR US
-2	5640710		LOGIC ELEMENT-MODEL 10, RS-232C FEATURE FOR CANADA (US ASCII)
-2	5640712		LOGIC ELEMENT-MODEL 11, RS-232C FEATURE, W/ EIA CABLE FOR CANADA (US ASCII)
-2	5640714		LOGIC ELEMENT-MODEL 12, RS-232C AND C-LOOP FEATURE FOR CANADA (US ASCII)
-2	5640716		LOGIC ELEMENT-MODEL 13, RS-232C AND RS-422 FEATURE FOR CANADA (US ASCII)
-2	5640711		LOGIC ELEMENT-MODEL 20, RS-232C FEATURE FOR CANADA (US ASCII)
-2	5640713		LOGIC ELEMENT-MODEL 21, RS-232C FEATURE, W/ EIA CABLE FOR CANADA (US ASCII)
-2	5640715		LOGIC ELEMENT-MODEL 22, RS-232C AND C-LOOP FEATURE FOR CANADA (US ASCII)
-2	5640717		LOGIC ELEMENT-MODEL 23, RS-232C AND RS-422 FEATURE FOR CANADA (US ASCII) FOR DETAIL BREAKDOWN, SEE FIGURE A-3
-3	5640534		KEYBOARD ASSEMBLY, ASCII-US FOR DETAIL BREAKDOWN, SEE FIGURE A-4

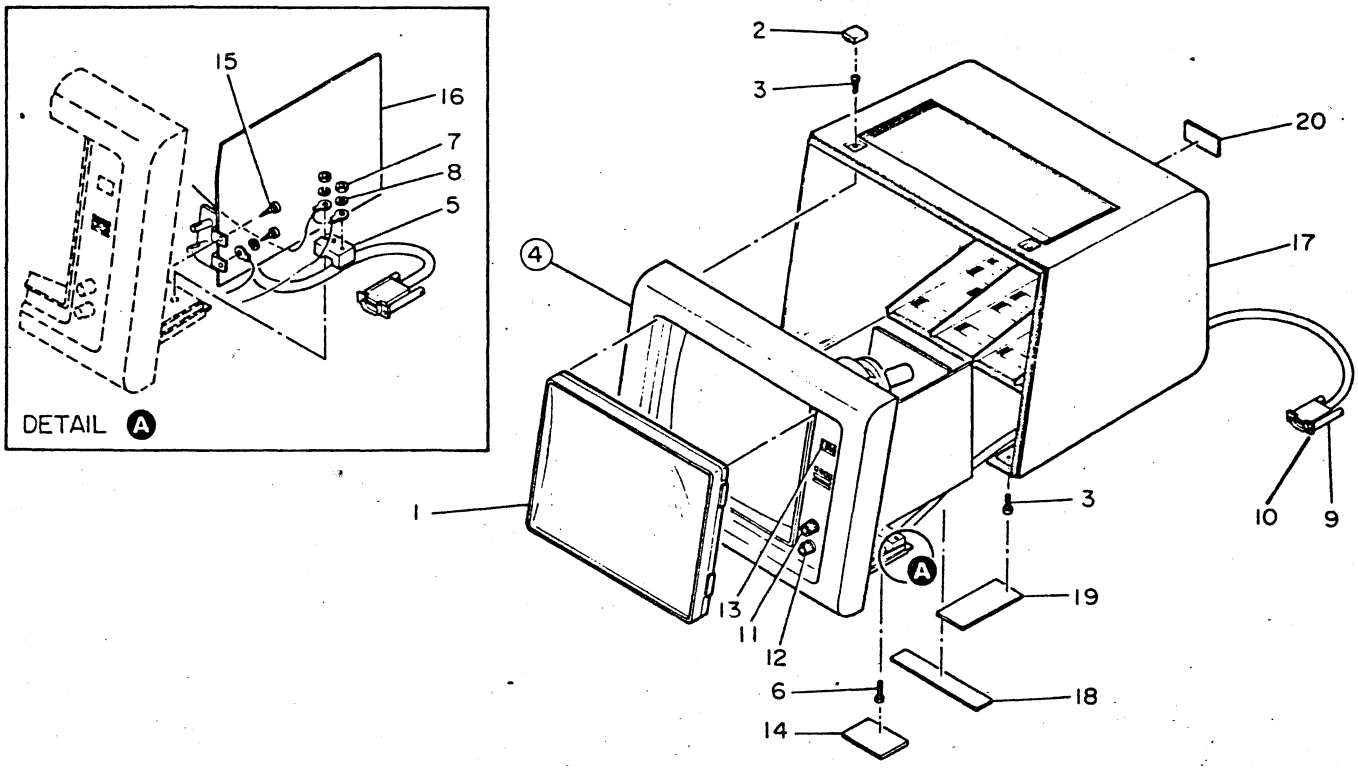


Figure A-2. Video Element, See List A-2

List A-2. Video Elrment

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
2-	5640540	REF	VIDEO ELEMENT FOR NEXT HIGHER ASM, SEE FIGURE A-1-1 AND FOR DETAIL BREAKDOWN, SEE FIGURE A-2
- 1	5640517	1	. COVER ASSEMBLY, FILTER
- 2	5640452	1	. PLUG, LEFT
- 2	5640585	1	. PLUG, RIGHT
- 3	5640459	4	. SCREW, PAN HD, PLUS-M4 X 12 LG, FOR US, AFE, EMEA
- 4	5640598	1	. FRONT ASSEMBLY, WITHOUT ANALOG CARD FOR US (REFERENCE ONLY)
- 5	5640460	1	. . CLAMP, CABLE
- 6	5640524	1	. . SCREW, PAN HD, PLUS-M4 X 30 LG
- 7	1622403	2	. . NUT, HEX, DOUBLE CHAMFERED-M4
- 8	1622318	2	. . WASHER, LOCK SPLIT-4.1 ID X 7.6 X 0.9 THK
- 9	5640560	2	. . STUD
-10	5640735	2	. . RETAINER
-11	5640737	1	. . KNOB ASSEMBLY, CONTRAST
-12	5640738	1	. . KNOB ASSEMBLY, BRIGHTNESS
-13	5640583	1	. . MARK, LOGO
-14	5640689	2	. . LABEL, BLACK
-15	5640574	2	. . SCREW, WOOD, PAN HD, PLUS-M4 X 15 LG
-16	5640572	1	. ANALOG CARD - CRT ASSEMBLY
-17	5640582	1	. COVER, REAR
-18	5640497	1	. LABEL, CAUTION
-19	5640688	1	. LABEL, WHITE
-20	5640519	1	. LABEL

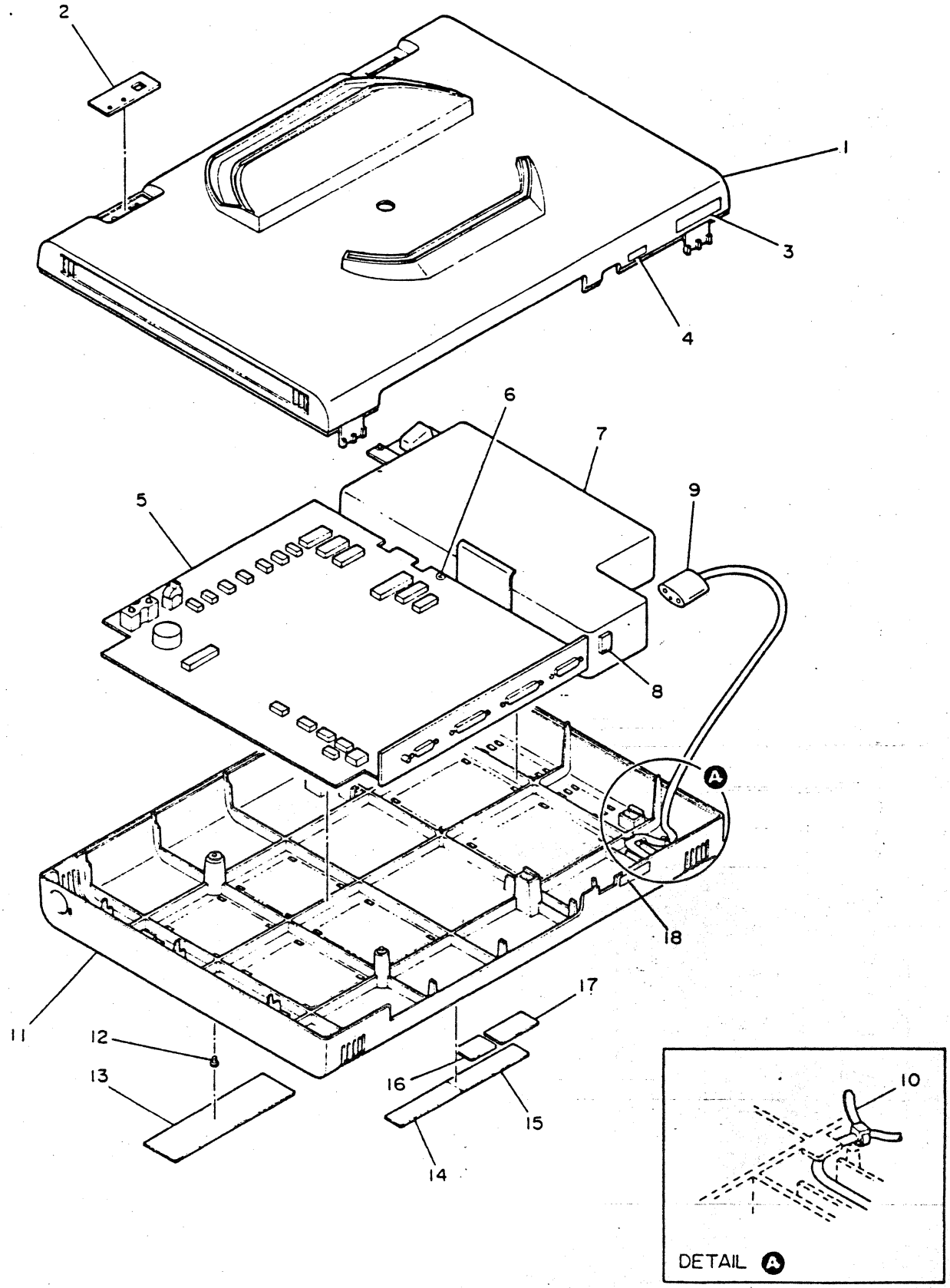


Figure A-3. Logic Element, See List A-3

List A-3. Logic Element

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
3-	5640410	REF	LOGIC ELEMENT, MODEL 10, RS-232C FEATURE
	5640428	REF	LOGIC ELEMENT, MODEL 11, RS-232C FEATURE, W/ EIA CABLE
	5640412	REF	LOGIC ELEMENT, MODEL 12, RS-232C AND C-LOOP FEATURE
	5640414	REF	LOGIC ELEMENT, MODEL 13, RS-232C AND RS-422 FEATURE
	5640411	REF	LOGIC ELEMENT, MODEL 20, RS-232C FEATURE
	5640429	REF	LOGIC ELEMENT, MODEL 21, RS-232C FEATURE, W/ EIA CABLE
	5640413	REF	LOGIC ELEMENT, MODEL 22, RS-232C AND C-LOOP FEATURE
	5640415	REF	LOGIC ELEMENT, MODEL 23, RS-232C AND RS-422 FEATURE
	5640710	REF	LOGIC ELEMENT-MODEL 10, RS-232C FEATURE FOR CANADA (US ASCII)
	5640712	REF	LOGIC ELEMENT-MODEL 11, RS-232C FEATURE FOR CANADA (US ASCII), W/ EIA CABLE
	5640714	REF	LOGIC ELEMENT-MODEL 12, RS-232C AND C-LOOP FEATURE FOR CANADA (US ASCII)
	5640716	REF	LOGIC ELEMENT-MODEL 13, RS-232C AND RS-422 FEATURE FOR CANADA (US ASCII)
	5640711	REF	LOGIC ELEMENT-MODEL 20, RS-232C FEATURE FOR CANADA (US ASCII)
	5640713	REF	LOGIC ELEMENT-MODEL 21, RS-232C FEATURE FOR CANADA (US ASCII), W/ EIA CABLE
	5640715	REF	LOGIC ELEMENT-MODEL 22, RS-232C AND C-LOOP FEATURE FOR CANADA (US ASCII)
	5640717	REF	LOGIC ELEMENT-MODEL 23, RS-232C AND RS-422 FEATURE FOR CANADA (US ASCII)
			FOR NEXT HIGHER ASM, SEE FIGURE A-1-2 AND FOR DETAIL BREAKDOWN, SEE FIGURE A-3
- 1	5640548	1	. COVER ASSEMBLY
- 2	5640567	1	. PLATE, TEST SWITCH
- 3	5640541	1	. PLATE, NAME, MODEL 10
- 3	5640680	1	. PLATE, NAME, MODEL 12
- 3	5640542	1	. PLATE, NAME, MODEL 13
- 3	5640677	1	. PLATE, NAME, MODEL 20
- 3	5640681	1	. PLATE, NAME, MODEL 22
- 3	5640678	1	. PLATE, NAME, MODEL 23
- 4	5640528	1	. LABEL, FUSE RATING-1.5 A
- 5	NO NO.	1	. BOARD ASSEMBLY, LOGIC REPLACE WITH PART NUMBER ON DEFECTIVE BOARD
- 6	2549561	1	. SCREW
- 7	5640532	1	. SUPPLY ASSEMBLY, POWER
- 8	1176668	1	. FUSE, AC
- 9	1655377	1	. CORD ASSEMBLY, LINE-1.8 M
-10	5420242	1	. TIE, CABLE
-11	5640658	1	. BASE ASSEMBLY
-12	5728576	1	. SCREW
-13	5640497	1	. LABEL, WARNING FOR CANADA
-13	5640659	1	. LABEL, WARNING FOR US
-14	5640695	1	. LABEL, SERIAL NUMBER
-15	5640512	1	. LABEL, POWER RATING
-16	960766	1	. LABEL, CSA
-17	855286	1	. LABEL, UL
-18	5640656	1	. LABEL, WARNING FOR US
-18	5640640	1	. LABEL, WARNING FOR CANADA

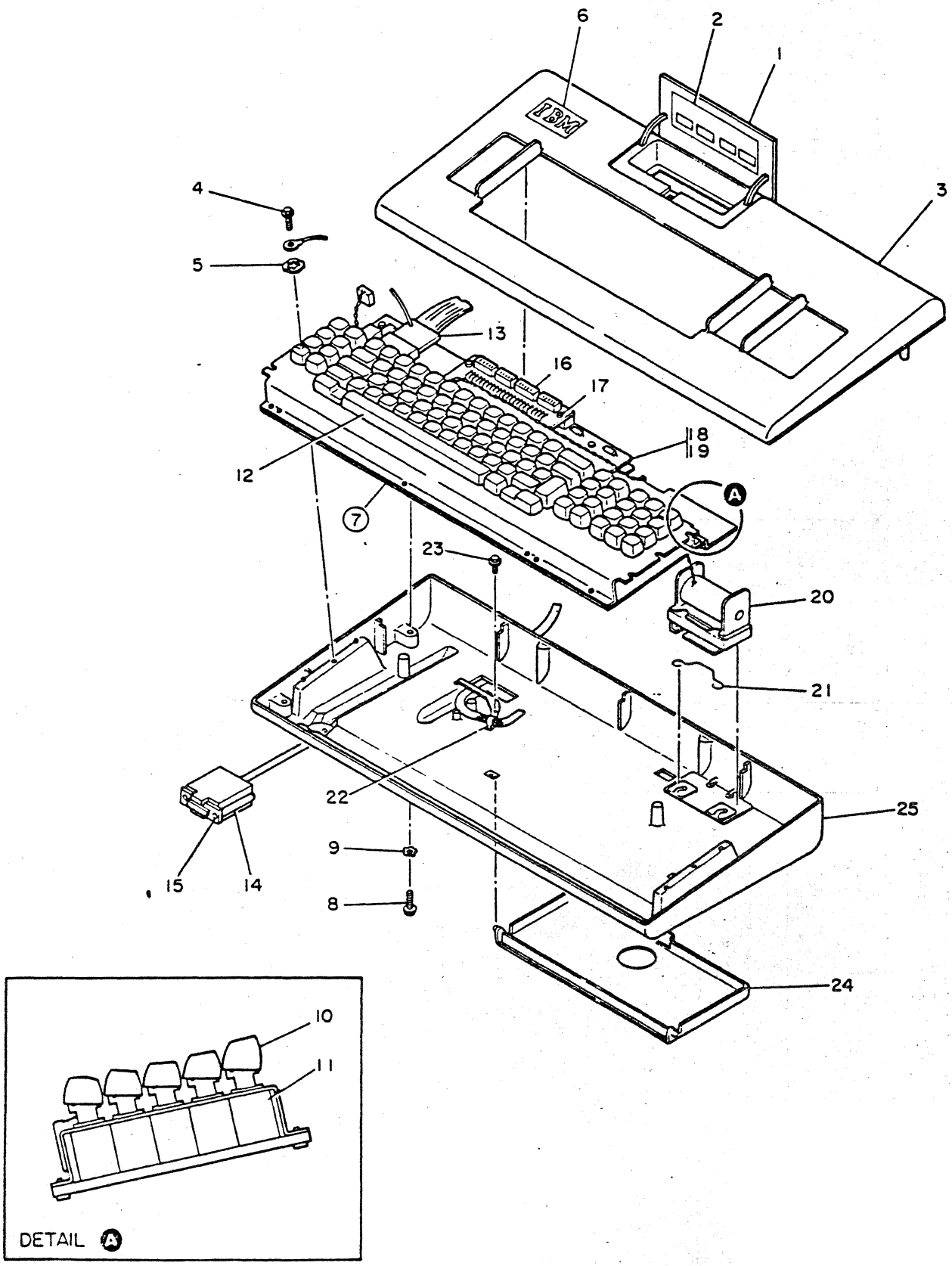


Figure A-4. Keyboard Element, See List A-4

List A-4. Keyboard Element

FIGURE-INDEX NUMBER	PART NUMBER	UNITS PER ASM.	DESCRIPTION 1 2 3 4
4-	5640534	REF	KEYBOARD ELEMENT, ASCII, US FOR NEXT HIGHER ASM, SEE FIGURE A-1-3 AND FOR DETAIL BREAKDOWN, SEE FIGURE A-4
- 1	5640565	1	. COVER
- 2	5640860	1	. LABEL, CSU FOR US-ASCII
- 3	5640562	1	. COVER, CAST
- 4	4796654	2	. SCREW
- 5	2125963	2	. WASHER
- 6	5640520	1	. PLATE, LOGO
- 7	8627075	1	. KEYBOARD ASSEMBLY, CSA
- 8	4796654	4	. SCREW
- 9	1622346	4	. WASHER, LOCK, STAR, EXTERNAL- 4.3 ID
-10	NO NO.		. . KEYBUTTON SEE LIST 4
-11	1748131	AR	. . MODULE, KEY, SENSING
-11	1748132	AR	. . MODULE, KEY, NON-SENSING
-12	1854442	1	. . BAR, SPACE
-13	5640559	1	. . CABLE ASSEMBLY
-14	5640560	2	. . STUD
-15	5640735	1	. . RETAINER
-16	8627246	1	. . CARD ASSEMBLY, CSU
-17	10170	1	. . SCREW, PAN HD- 6-32 X .25 LG
-18	8627245	1	. . CARD ASSEMBLY, LOGIC
-19	438551	1	. . SCREW
-20	1742661	1	. CLICKER ASSEMBLY
-21	1742658	1	. BAIL
-22	1742689	1	. RELIEF, STRAIN
-23	5640705	1	. SCREW
-24	1742635	1	. CADDY, DOCUMENTATION
-25	5640550	1	. BASE ASSEMBLY

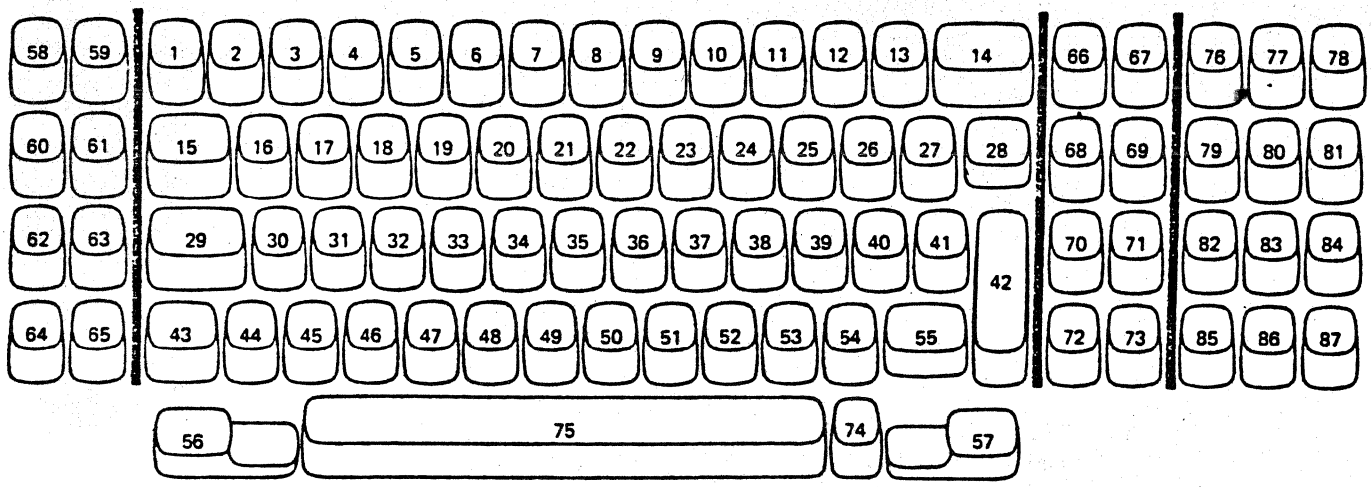


Chart A-1. Keybuttons and Nomenclature

Pos. No.	Nomenclature	Part Number	Pos. No.	Nomenclature	Part Number	Pos. No.	Nomenclature	Part Number
1	~ `	1755816	30	A	1853521	59	ERASE EOL/EOF ERASE INPUT	8627418
2	! 1	8627403	31	S	1853522	60	ESC	8627420
3	@ 2	8627404	32	D	1853523	61	ERASE EOF CLEAR	8627422
4	# 3	8627405	33	F	1853524	62	PRINT MSG PRINT LINE	8627424
5	$ 4	8627406	34	G	1853525	63	SEND MSG SEND LINE	8627426
6	% 5	8627407	35	H	1853526	64	PRINT AUX	8627428
7	^ 6	8627408	36	J	1853527	65	LOCAL	5194152
8	& 7	8627409	37	K	1853528	66	DEL	1853559
9	* 8	8627410	38	L	1853529	67	BREAK	8627430
10	(9	1853506	39	: ;	1853530	68	INS CHAR INS LINE	8627431
11	) 0	1853507	40	" '	1853531	69	DEL CHAR DEL LINE	8627432
12	_ -	1853508	41	} {	1756166	70	↑	1853560
13	+ =	1853509	42	↵	1648530	71	↓	1853561
14	←	1643648	43	⇧	1643637	72	←	1853547
15	→	1643646	44	> <	1756170	73	→	1853562
16	Q	1853510	45	Z	1853532	74	ALT	1643610
17	W	1853511	46	X	1853533	75	(SPACE BAR)	1854442
18	E	1853512	47	C	1853534	76	7 PF7	1854026
19	R	1853513	48	V	1853535	77	8 PF8	1854027
20	T	1853514	49	B	1853536	78	9	1854028
21	Y	1853515	50	N	1853537	79	4 PF4	1854033
22	U	1853516	51	M	1853538	80	5 PF5	1854034
23	I	1853517	52	' ,	1650484	81	6 PF6	1854035
24	O	1853518	53	. .	1853644	82	1 PF1	1854038
25	P	1853519	54	? /	1853541	83	2 PF2	1854039
26	] [	1853585	55	⇧	1643644	84	3 PF3	1854040
27	| \	8627411	56	RESET CANCEL	8627412	85		8627433
28	←	1650752	57	SEND	8627414	86	0	8627434
29		5194147	58	ATTR PRGM MODE	8627416	87	.	8627435