



Maintenance Library

**3279**

Color Display Terminal  
Models 2A, 2B, 3A, and 3B  
Maintenance Information



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**PREFACE**

This publication contains the information needed to service and maintain the IBM 3279 Display Station.

Part 1 comprises the Maintenance Information and Parts Catalog.

Part 2 comprises the Maintenance Analysis Procedures.

If this machine is fitted with any RPQ features, any extra RPQ documentation can be found in a tray under the keyboard.

**Third Edition, February 1981**

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## Cathode Ray Tube Safety

The CRT consists of a highly-evacuated glass envelope which must be handled with extreme CAUTION. Unsafe and careless handling of CRT's can cause the tubes to implode. Some tubes, when broken, merely fill with air and otherwise remain intact, while other tubes of exact design and construction implode violently under the same test conditions. Tests have indicated that an implosion is more likely to occur if the "bell" of the tube is impacted rather than the neck.

The primary hazard of CRT's is flying glass as a result of an implosion. Methods for protecting against flying glass are:

1. Eliminate the Hazard — Improve tube envelope design.
2. Isolate the Hazard — Service the CRT remotely.
3. Confine the Hazard — Guard the tube to shield it from potential impacts and such so that all glass would be contained if an implosion occurred.
4. Guard the Person — Provide protective equipment for the serviceman so that flying glass will not cause injury.

A combination of these methods is required to provide a safe environment.

### IMPLOSION PROTECTED TUBES

Several processes are commercially available which, according to the vendor, render the Cathode Ray Tubes less likely to implode. Full protective equipment is not necessary when handling these tubes. If the tube is to be disarmed, full safety equipment will be worn. These tubes will be specifically identified to the Customer Engineer in the affected units CEM's.

The following sections will deal with different phases of CRT Safety. All phases are equally important and negligence in any area could result in possible injury to an employee or customer.

Additional information or variations from this information on specific units will be included under the affected units — Service Aid CEM's.

### STORAGE OF CATHODE RAY TUBES

1. It is required that Cathode Ray Tubes be enclosed when received, transported, or otherwise moved from area to area. If they are shipped in a carton, they must be in the original carton or one of equivalent strength and securely sealed to prevent accidental opening. Also, original or equivalent packing materials and/or forms must be placed inside the carton to give the tube the proper support and protection. If tubes are transported in a unit or piece of equipment, the equipment must be able to contain the glass fragments should an implosion occur.
2. CRT's should be stocked as per directions on manufacturer's carton. When in doubt, stock with faceplate (viewing surface) down. Cartons should not be stacked more than two high.
3. CRT storage areas will be away from normal flow of material handling equipment and pedestrian traffic. Also, storage areas must be dry to ensure that cartons will not absorb moisture and collapse.

### MAINTENANCE AND INSTALLATION

1. No one shall be permitted to install, adjust, maintain, replace or handle high vacuum tubes until he has reviewed this CEM.
2. Cathode Ray Tubes when received, transported, or otherwise moved from area to area should be completely enclosed in their original shipping cartons and sealed.
3. When handling CRT's, personnel will wear Safety equipment at all times. The required Safety equipment is:
  - a. Safety Glasses — P/N 5715010
  - b. Long Sleeve Garment
4. Tubes under vacuum will not be permitted to remain out of

their carton unless they are under test or inspection.

5. No person shall handle a tube larger than 40.64 cms (16 inches) on the longest viewing surface dimension unless there is at least one other person in the immediate area. All personnel exposed to the implosion hazard should wear protective equipment.
6. Avoid scratching or bumping any part of the tube because this may weaken the glass and possibly cause it to implode.
7. Prior to removal of any high vacuum tube, discharge all stored potential which may exist on the tube's anode button or base socket pins and the capacitors in the high voltage supply. (Note: Some Cathode Ray Tubes contain a conductive coating on both the inside and outside surfaces to form a capacitor. Within some tubes, a second capacitive charge builds up following the original discharge. It is, therefore, important to discharge each tube a second time immediately before removal.)
8. Do not handle Cathode Ray Tubes by the neck alone. The neck is the weakest part of the tube and is easily broken. Always handle tubes with two hands.
9. When inserting or removing tubes from equipment, they must be supported by the large end while carefully guiding the neck in or out of position.
10. Avoid placing the tubes on a table or bench when there is any possibility of the tube rolling. If it is necessary to place a tube anywhere except in its special carton, a piece of felt or other soft material should be placed under it to prevent scratching the glass. Place larger tubes vertically on their faces, and not on their sides to prevent the possibility of rolling.
11. When removing a tube from equipment, it should be enclosed in its shipping container as soon as possible to reduce the chances of breaking. Cathode Ray Tubes should be placed in the carton with the large face end up and the neck down. Be sure that the weight of the tube is not resting on the neck. The container should be sealed securely with strong tape and, to prevent tipping, turned over so the tube is positioned face down.

### DISARMING CATHODE RAY TUBES

#### Procedures for Breaking Vacuum Seal

1. Only authorized persons will be permitted to break vacuum seals.
2. This operation shall never be performed when customer's employees or the public are present.
3. The protective equipment listed must be worn by employees letting tube to air:

a. Cape, welder's rawhide	P/N 5715008
b. Apron, synthetic rubber	P/N 5715009
c. Gloves, welder's	P/N 5715011
d. Face shield	P/N 5715010
4. Enclose tube in an approved tube shipping carton with a short section of the neck (approx. 2 inches of the base) exposed through a hole in the end.
5. Adjust a pair of vice pliers so that the closed jaw clearance is less than the outside diameter of the bakelite locating pin on the base of the tube. Then, holding a piece of heavy canvas or some other firm protective material over the carton, crush the locating pin with the pliers, similar to a nut cracking operation. This exposes the glass tip at the base of the tube. Still holding the canvas over the carton, release the vacuum seal by crushing glass tip.

The procedures below will be used on tubes which do not have a glass protrusion in the center of the base pin assembly:

1. The tube must be encased in a shield, carrier or carton with a hole directly in front of the high voltage anode.
2. Drill through the anode connection with a 5/64" (.078) drill, thus letting the tube to air.



## 1.0 CHAPTER 1. GENERAL DESCRIPTION AND LOCATIONS

### 1.1 INTRODUCTION

The IBM 3279 Color Display Station is connected by a coaxial cable to either the IBM 3274 Control Unit or the IBM 3276 Control Unit/Display Station. The 3279 Display Station consists of a color display unit and an alphanumeric keyboard.

Four models of 3279 are available: 2A, 2B, 3A and 3B. Model 2 has 24 lines, each of 80 characters; Model 3 has 32 lines, each of 80 characters.

Models with an A-suffix can display four colors. Models with a B-suffix have highlighting and 7-color capability (ECS) and an additional font for

APL/Text. Note that the 3276 Control Unit does not support 7-color, programmed symbols, or highlighting.

Optional features include a selector light pen, a security keylock, and magnetic reader control (for slot reader or hand scanner). Programmed symbols (PS2—two fonts, and PS4—four additional fonts) is an optional feature on models with a B-suffix. Note that the 3276 control unit does not support either ECS functions or PS.

Machines are available to operate from an ac supply of either 100 to 127 V (50 or 60 Hz) or 200 to 240 V (50 or 60 Hz).

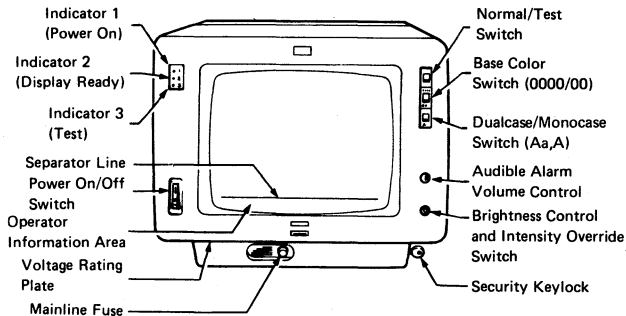


Figure 1-1. Controls and Indicators

**1.1.1 CONTROLS**

full rasters of red, blue, and green. See section 2.4 for details.

**1.1.1.1 Power On/Off Switch**

Switches line voltage. Wait approximately 10 seconds after switching off before switching on again. This allows any stored fault conditions to reset.

**1.1.1.6 Audible Alarm Volume Control**

This control sets the volume of the alarm.

**1.1.1.2 Normal/Test Switch**

Switches the machine offline and into Test Mode.

**1.1.1.7 Brightness Control**

This control sets the brightness of the display.

**1.1.1.3 Base Color Switch**

In the '00' position, the base colors blue and red are replaced by green and white respectively. The separator line and the operator information area remain blue. Green and white fields are not affected, nor are any fields controlled, by ECS.

**1.1.1.8 Security Keylock**

A feature that blanks the data area of the screen to prevent unauthorized access to the machine.

**1.1.1.4 Dualcase/Monocase Switch**

In the 'A' position, all alphabetic characters are displayed in uppercase.

**1.1.2 INDICATORS****1.1.2.1 Indicator 1 (Power On)**

Indicates line supply and +5 V supply available. It does not confirm the availability of other voltages generated within the machine.

**1.1.1.5 Intensity Override Switch**

This switch operates when the brightness control is turned fully counterclockwise. It sets the brightness circuits to maximum and the screen shows

**1.1.2.2 Indicator 2 (Display Ready)**

Lit when the display is unblanked, thus confirming that most of the analog circuits are operational.

This condition occurs about 40 seconds after both deflection circuits are activated. The delay allows the CRT cathode time to warm up.

See Figure 6-5 for a complete grounding diagram.

### 1.1.2.3 Indicator 3 (Test)

Lit when Test Mode is selected.

### 1.1.2.4 Operator Information Area

The row below the separator line displays characters that indicate the status of the 3279.

## 1.2.2 EQUIPMENT LIGHTNING PROTECTION

The 3279 is designed to provide a low-impedance energy path from the external coaxial cable shield to frame (ac) ground for potentials above 36 V.

Additional information on lightning protection requirements for the customer coaxial cable (customer responsibility) is provided in IBM 3270 Information Display Station Installation Manual - Physical Planning, GA27-2787.

## 1.2 DISPLAY UNIT

The display unit comprises a main enclosure assembly, a logic gate, and a bezel as shown in Figure 1-5. Field Replaceable Units (FRUs) are listed in the Parts Catalog.

The weight of the unit is approximately 27 kg (58 lb) without keyboard.

## 1.2.3 VIDEO OUTPUT RPQ (7J0039)

This RPQ allows suitable monitors to display the contents of the 3279 screen (except for the separator line and Operator Information Area).

Red Video, Green Video, Blue Video and Sync signals are fed to individual coaxial sockets in the customer access area.

A sync polarity indicator and two switches (video control switch and sync polarity switch) are also provided in the customer access area.

## 1.2.1 ELECTRICAL GROUNDING

The ac ground and dc returns are electrically connected in the 3279 display unit. The coaxial cable return (shield) is isolated from the dc return at the 3279.

With the ac power cord disconnected, a correctly-wired unit should indicate continuity between ac and dc ground, and an open circuit between ground and the shield of the device coaxial cable.

### 1.2.3.1 Video Control Switch

This switch has three positions:

- Central position: The monitor receives the same balance of color signals as the 3279 CRT.

- **ENHANCE position:** The blue signal fed to the monitor is brightened by the addition of some green.
- **TEST position:** The color signals to the monitor are internally connected to the 3279 CRT, thus allowing direct comparison of the two displays (except for the separator line and Operator Information Area).

#### **1.2.3.2 Sync Polarity Switch**

This switch is used to select either positive or negative sync pulses at the sync output socket.

#### **1.2.3.3 Signal Test Indicator**

This indicator is lit when either

- the synchronizing signal is faulty,  
or
- the Video Control Switch is set to TEST.

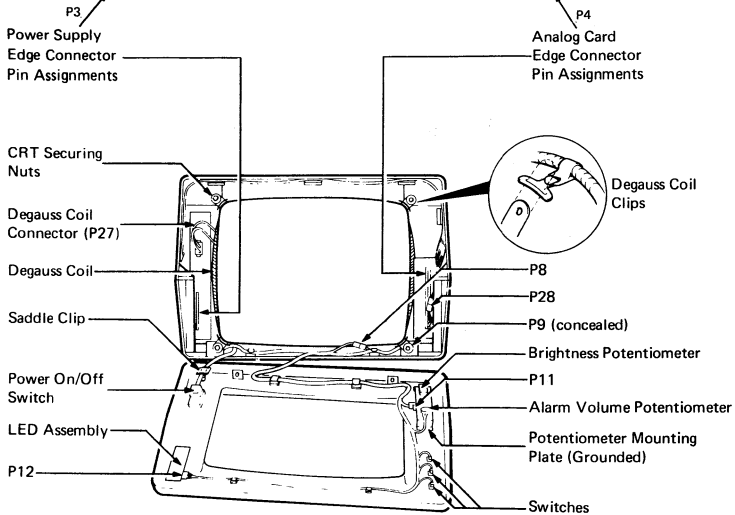
**\* DANGER**

Pins may be up to 250V above ground potential  
Use probe, Part 1749249/1749250.

1	+12V
2	+12V Return
3	-12V
4	+103V Return
5	+103V
6	Ground
7	Ground
8	LOPT
9	LOPT return
10	Line Input
11	• Line Test Point
12	Degauss
13	Degauss Return
14	• Neutral Test Point
15	Neutral Input
16	Ground

Test Points are shown as bullets ( • ).

Skip	26	1	Horizontal Sync
Skip •	27	2	• Horiz Sync
Vertical Sync	28	3	• Vert Sync
-5V	29	4	0V from A3
Gnd from A3	30	5	• -5V
+12V LOPT	31	6	0V to security keylock
- Display Ready	32	7	0V To Color SW
- Display Ready	33	8	/
+5V	34	9	0V To Aa/A Switch
+8.5V	35	10	0V To LED Card
+8.5V •	36	11	/
+5V •	37	12	"Power Good" (+5V)
/	38	13	Input Prohibit
Gnd •	39	14	+103V Return
+103V •	40	15	+103V
Brightness Pot	41	16	Brightness 3
Intensity Override SW4	42	17	Brightness 1
Intensity Override SW1	43	18	Intensity Override SW2
Brightness 2 To Color Balance	44	19	Brightness 2
-135V •	45	20	Balance Pots Ret (-150V/39kΩ)
/	46	21	/
+6.3V Return •	47	22	Heater (6.3V) Return
+70V •	48	23	+70V To Video
/	49	24	+70V Return
+6.3V •	50	25	Heater (+6.3V)



**Figure 1-2. Display Unit - Front View with Bezel Removed**



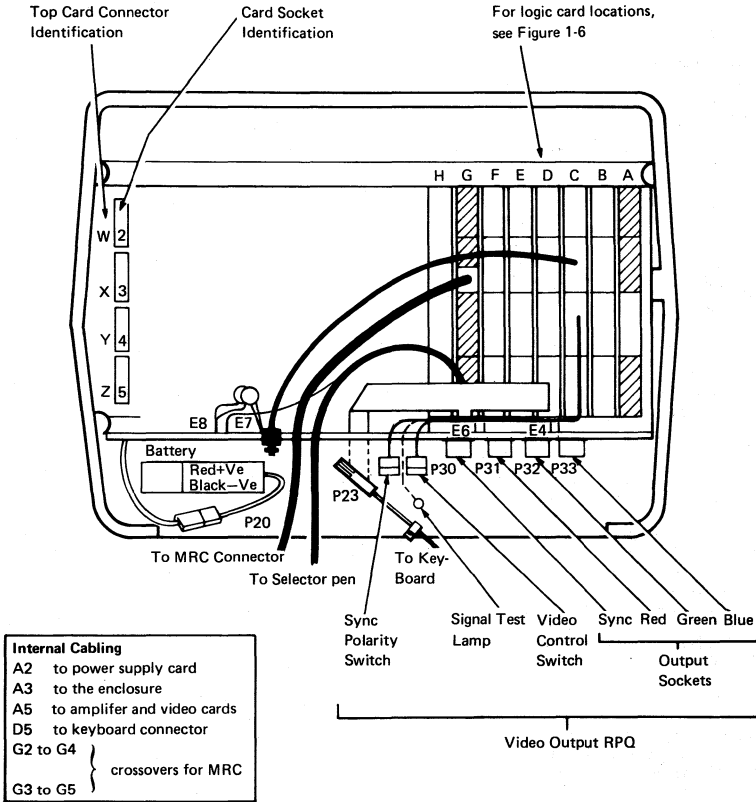


Figure 1-3. Display Unit - Rear View

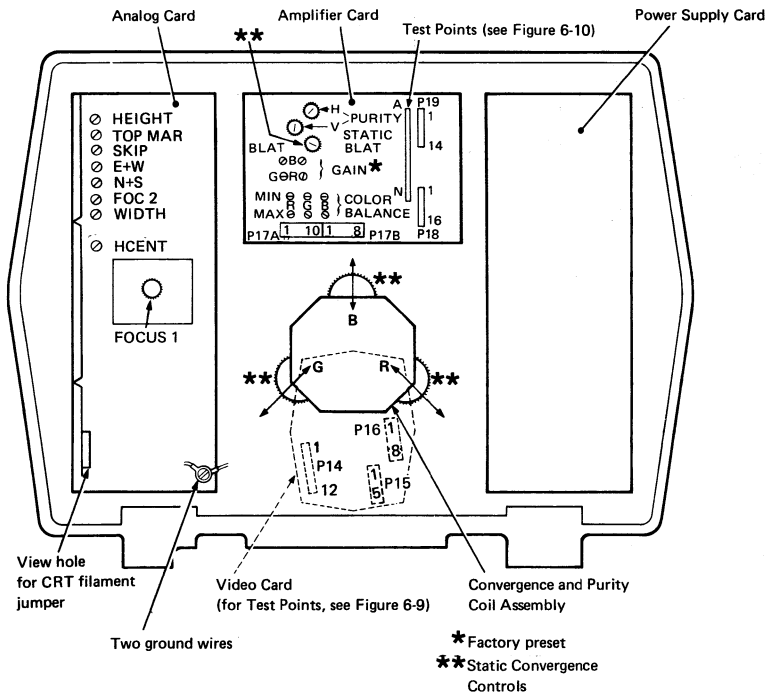


Figure 1-4. Display Unit - Rear View, Open

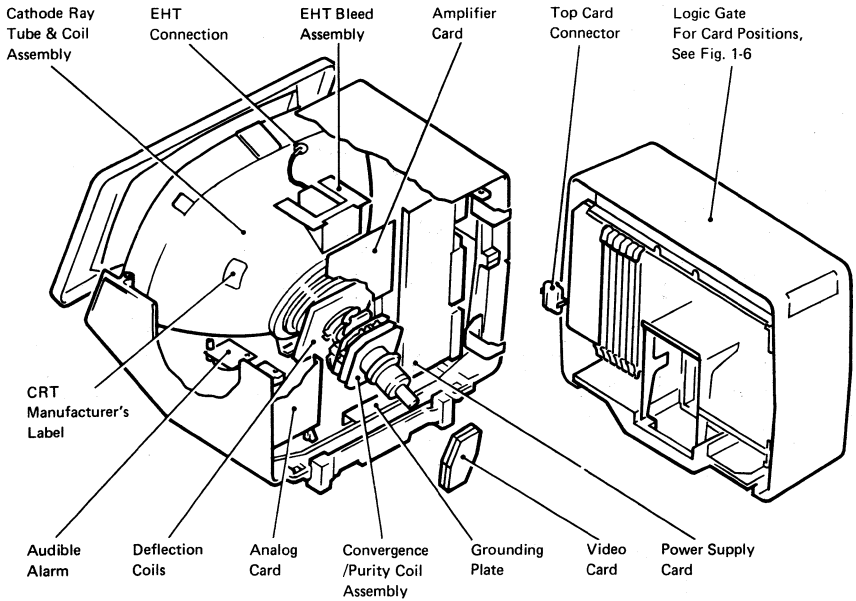
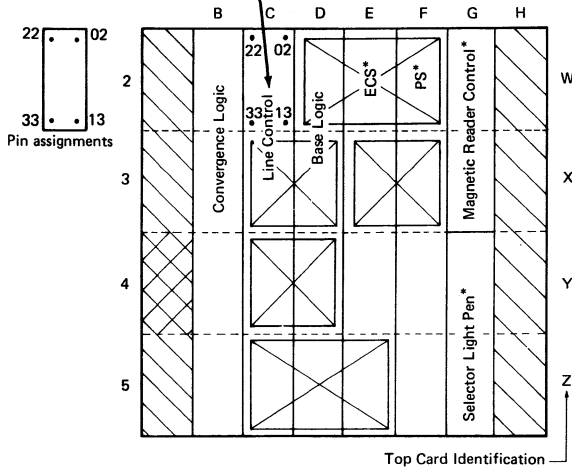


Figure 1-5. Display Unit - Interior View

For jumpers, use SLT pins, PIN 453443,  
inserted in SLT jumper, PIN 452655



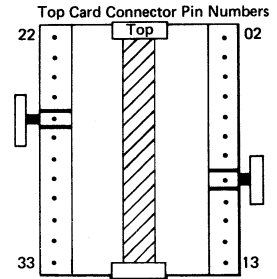
\*Feature  
\*\*Model 8 only

Note: If RPQ 7J0039 is installed, line control card is replaced by video output card.

Figure 1-6. Logic Card and Top Card Connector Locations (card side)

TOP CARD CONNECTOR LAYOUT SHOWN  
BY MODEL AND FEATURE

Model A	Model B	Model B with PS
	D2-E2	D2-E2-F2
C3-D3	C3-D3	C3-D3
		E3-F3
C4-D4	C4-D4	C4-D4
C5-D5	C5-D5-E5	C5-D5-E5



### 1.3 KEYBOARDS

#### 1.3.1 SCAN CODES

Pressing a key generates a 7-bit scan code that is presented in parallel-by-bit form to the control unit. The scan code for a specific key position is always the same. The control unit translates each scan code into the appropriate character or function.

#### 1.3.2 BREAK CODES

Several keys, including the reset key, produce a second scan code (called a 'break code') as the key is released. The break code for the reset key is ignored by the control unit.

#### 1.3.3 KEYBOARD CABLE

This cable carries the control and data signals between the keyboard and the display unit. It also provides the +5V supply for the keyboard. See Figure 6-12 for details.

#### 1.3.4 SYSTEM UPSHIFT

System upshift cannot be selected from the keyboard; it is controlled by the application program and applies to all keyboard types. When the system is in upshift mode, the control unit (3274 or 3276) processes only specified characters. Characters other than those specified may be entered by an operator using the override capability.

#### 1.3.5 KEYBOARD TYPE IDENTIFICATION

The keyboard logic card contains four pairs of pins that must be jumpered to indicate the type of keyboard (see Figure 6-11).

#### 1.3.6 KEYBOARD LOCK

The keyboard can be 'locked' (that is, keyed characters are ignored by the control unit). Specific data, for example a 'reset' scan code, may still be accepted.

The operator is made aware of keyboard lock by a change in the action of the keyboard clicker. The clicker normally clicks once for each key depression, but stops clicking after keyboard lock. If the operator has chosen to turn off the clicker for normal operation, then keyboard lock will cause it to click at each key depression.

An X is displayed in the Operator Information Area when the keyboard is locked.

#### 1.3.7 NUMERIC LOCK (FEATURE)

The numeric lock feature is selected by installing a keyboard jumper in position 1 of the keyboard ID jumper block. This feature limits the characters that can be entered into a numeric field to:

0 through 9  
period (.) or comma (,)  
minus (-)

The DUP key remains active. Depression of any other key while the cursor is in a numeric field causes the keyboard to lock with the symbol X ANUM in the Operator Information Area. Press RESET to clear the locked condition.

#### 1.4.1 GENERAL LOGIC PROBE

To use the General Logic Probe (GLP), IBM Part 453212, set the switches as follows:

Technology	MULTI
Latch	NONE
Gate Ref.	GND

Power the probe from any D03 pin (red wire +5 V) and any D08 pin (black wire, ground). The ground lead on the probe tip must also be connected to a nearby ground.

Test GLP operation by probing on D03 and then D08.

#### 1.4 TOOLS AND TEST EQUIPMENT

The following tools and test equipment are required for maintenance of the 3279.

<u>Item</u>	<u>IBM Part Number</u>
Insulated probes*	1749249 and 1749250
General logic probe	453212
Miniprobe**	453718
GLP extension cable	453605
Keytop puller	9900373
Keylock retaining nut wrench	4418787
MSR test card	1742659
SLT jumper (3)	452655
SLT pins***	453443
Adjusting tool	1864853
Metric tools	1749235
Alignment mask	4423472
Isopropyl Alcohol	2200200
Lint-free cloth	2108930

\* For use with standard CE meter

\*\* This probe is for use on low voltage (up to 15 volts)

\*\*\* For use with jumpers on some top card connectors



## 2.0 CHAPTER 2. MAINTENANCE AIDS

### 2.1 MAINTENANCE PLAN

The maintenance plan for the 3279 assumes the use of:

1. Problem determination procedures (performed by the customer using the Problem Determination Guide, which is located under keyboard handrest).
2. The General Failure Index (GFI) (section 2.2) for simple symptoms.
3. The Maintenance Analysis Procedures (MAPs) (referred to in section 2.3) comprise Part 2.
4. Intensity override (section 2.4).
5. Offline test modes (section 2.5).
6. Online tests (section 2.6).
7. Adjustment procedures (see Chapter 5).

8. FRU removal and replacement (see Chapter 4). FRU locations and part numbers can be found in the Parts Catalog at the back of this manual.

#### DANGER

Do not attempt to service FRUs under power outside the machine frame.

### 2.2 GENERAL FAILURE INDEX

#### CAUTION:

The display must be powered off before cards and cables are reseated or swapped. Be careful not to loosen other cards or cables as this could cause intermittent failures.

Symptoms for faults that can be attributed to the Video Output RPQ are listed at the end of the GFI.

#### Symptom

#### Action

- |   |  |
|---|--|
| 1. Display blank. No cursor, separator line, or glow on screen and... |  |
| a. ... indicators 1 and 2 both off.                                   | Ensure that the mainline power cable is plugged into an active outlet. Check ON/OFF switch is set to ON. If problem persists, go to MAP 0200, Entry Point A. |
| b. ... indicators 1 and 2 both on.                                    | Turn brightness control clockwise. If nothing displays, go to MAP 0100, Entry Point A.   |
| c. ... indicator 1 on, indicator 2 off.                               | Go to MAP 0400, Entry Point A.   |



<u>Symptom</u>	<u>Action</u>
2. a. Screen bright all over and indicators 1 and 2 are on.	Vary the brightness control. Use Figure 6-8 to check the connections to the brightness control. If no fault is found, go to MAP 0100, Entry Point A.
<u>or</u>	
b. Brightness low or not adjustable, very faint picture, very bright, badly focussed characters.	
<b>Note:</b> For symptoms 3 and 4, note the position of the relevant control before attempting adjustments. If correct adjustment cannot be achieved, reset the controls to their original positions before continuing.	
3. Excessive brightness of one primary color (red, blue, or green).	Try to adjust color balance, but do NOT move the RED MAX control (see preceding Note and sections 5.2.1 and 5.3.6). If problem remains, go to MAP 0100 Entry Point A.
4. Display wrong size or not 'square'.	Try adjusting raster controls (see preceding Note and section 5.2.2 and Figure 1-4). If problem persists, go to MAP 0100, Entry Point A.
5. Character jitter	Disconnect the degauss coil (P27). If jitter is reduced, check position of degauss coil. If coil position is correct, exchange the power supply card. If jitter still persists, the probable cause is interference from adjacent electrical equipment. Try relocating the display unit. Horizontal jitter only: Try small adjustment of the H CENT potentiometer.
6. All characters, cursor, and separator line are green.	Inspect other 3279s on same control unit. If they have same symptom, verify system diskette. If all OK, go to MAP 0100, Entry Point A.
7. All characters are either green, or white (no red, or blue).	Set the base color (0000/00) switch to 0000. Use Figure 6-8 to check switch connections if fault persists, go to MAP 0100, Entry Point A.
8. Convergence poor, convergence routine (Test 7) has no obvious effect. One or more primary color(s) displaced.	Go to MAP 0600, Entry Point A.

Symptom

Action

- |  |   |
|--|---|
| 9. Display has to be converged each time power is turned on. | Check battery date (stamped on battery: month/year). If it is over 3 years old, ask customer to install new battery. If problem persists, go to MAP 0600, Entry Point A.  |
| 10. Indicator 3 is always on.                                | Set NORMAL/TEST switch to NORMAL. Use Figure 6-8 to check connections to switch and lamp panel.   |
| 11. NORMAL/TEST switch operation failure.                    | Check switch and cable (see Figure 6-8). If problem persists, exchange card D2, then C2.  |
| 12. Base color switch fails.                                 | Check switch and cable (see Figure 6-8). If problem persists, exchange card C2, then D2.  |
| 13. Dualcase/monocase switch fails.                          | Check switch and cable (see Figure 6-8). If problem persists, exchange card D2.   |
| 14. One or more keyboard key fails.                          | Set NORMAL/TEST switch to TEST. Use Test Mode 2 and Figure 2-3 to test the failing key. Reseat the keyboard cable plug, P23. If no character enters, exchange key module. If wrong character enters, exchange keyboard logic card. If character is correct, check keyboard ID jumpers. Go to MAP 0700, Entry Point A. |
| 15. Security key fails.                                      | Go to MAP 0800, Entry Point GG.   |
| 16. X ~ always on in OIA.                                    | Go to MAP 0800, Entry Point GG.   |
| 17. NO APL   | Ensure that KB ID response is correct (see section 2.5.3 and Figure 6-11) and that the APL module is installed in card E2.  |
| 18. Incorrect APL characters                                 | Exchange the APL module on card E2.   |

SymptomAction

The following symptoms refer to faults that are associated with the Video Output RPQ. The switches, indicator, and BNC coaxial connectors are in the customer access area (see Figure 1-3). If the index does not find the fault, refer to MAP 1000, Entry Point A.

- |  |  |
|--|--|
| 19. Cursor visible, but no separator line and no symbols in the Operator Information Area. | Check that the wrap switch (Figure 1-3) is set to NORMAL. If problem persists, go to MAP 1000, Entry Point A.  |
| 20. Monitor display is missing or unstable.  | Loss of sync. Ensure that the PDG procedure for this symptom has been done. Check the sync polarity switch, the sync BNC connector, and the internal cable (see Figure 6-13). If the fault persists, exchange card C2.                         |
| 21. Monitor display has one or more colors missing or incorrect.                           | Loss of video. Ensure that the PDG procedure for this symptom has been done. Check the video BNC connections and the internal cable (see Figure 6-13). If the fault persists, exchange card C2.  |
| 22. Blue too light or too dark on monitor.   | Enhance (half-intensity green with blue) failure. Check Video Control switch setting and wiring (see Figure 6-13). If fault persists, exchange card C2.  |
| 23. OIA and separator line missing from 3279 display.                                      | Permanent video wrap. Check the Video Control switch and wiring (Figure 6-13). The OIA and separator line should NOT display when the Video Control switch is set to TEST.   |
| 24. OIA and separator line missing from monitor.   | No fault. This is normal operation.  |
| 25. Monitor display has excessive flicker.   | Ask customer to check brightness and contrast adjustments on the affected monitor: some monitors are prone to flicker at high brightness levels. The problem is unlikely to be in the 3279, but if the fault persists, try exchanging card C2. |

2.3 MAPS

- |   |  |
|---|--|
| 1. Before using the MAPs, try the General Failure Index (section 2.2). If the symptoms are not listed, go to MAP 0000, Entry Point A.   | second pass through the MAPs the trouble is not repaired, call for assistance.   |
| 2. If you go through the MAPs once without repairing the problem, go back to MAP 0000 and go through the MAPs a second time. If after a | 3. To use the MAPs, start with the 3279 online to its control unit, otherwise some of the symptoms may differ from those for which the MAPs were designed. |
|   | 4. The MAPs instruct you to reseat/exchange cards in a specific  |

sequence. Always switch power off before exchanging cards. The first card is the most probable cause of the failure, the second card is the next most probable cause, and so on.

5. Always reseal the cards, top card connectors, and their associated cables, and test before exchanging parts.
6. Always reinstall the original part when the new part did not repair the problem.
7. Where the new part did not repair the problem, check the continuity of its associated cables, connectors, and planar strips.

**CAUTION:**

Correct ground connections and cable positions are essential for effective lightning and flashover protection. See Figure 6-5 for grounding details.

8. When the analog card, the amplifier card, or any major FRU is exchanged, the new card may need adjustment (see Chapter 5).
9. If the failure is intermittent, check cards and cable connectors for correct seating. Check that the supply voltages are within tolerance as described in section 5.1.

## 2.4 INTENSITY OVERRIDE

To engage intensity override, turn and hold the brightness control fully

counterclockwise. Intensity override turns on the red, green, and blue guns at maximum brightness.

When the TEST/NORMAL switch is set to TEST, the three rasters will be unconverged (see Figure 2-1) unless the Test Mode 3 jumper (D2Y08 to D2Y09) is installed. TEST mode checks analog and associated circuits.

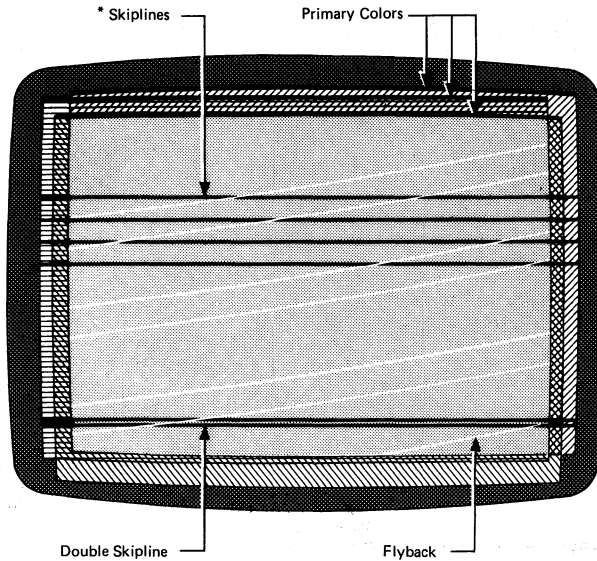
When the TEST/NORMAL switch is set to NORMAL and the 3279 is connected to an active control unit, the red, green, and blue rasters should be converged. Skip and display geometry can be inspected.

## 2.5 TEST MODES (OFFLINE)

**Note:** When the display terminal is offline, the convergence correction circuits are not active. This will be obvious when more than one color is displayed.

### **2.5.1 TEST MODE 1: TEST PATTERN**

1. Set the Dualcase/Monocase (A,a/A) switch to A,a.
2. Set the TEST/NORMAL switch to NORMAL and back to TEST. The Test Mode 1 pattern is displayed.
3. Verify operation of Test Mode 1 by checking the displayed pattern carefully against the pattern shown in Figure 2-2. If the test fails, go to MAP 0100, Entry Point BB.



\* At regular intervals across the screen on Model 2. Only the double skipline appears on Model 3. Each skipline appears as a dark line when converged.

**Figure 2-1. Intensity Override (Test Mode)**



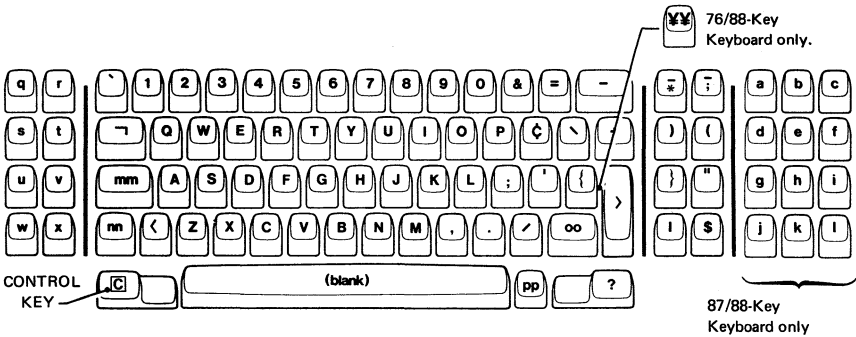


Figure 2-3. Keyboard Character Interpretation for Test Mode 2

### 2.5.3 TEST MODE 3: TEST OF COMMANDS

is shown only when the result is important.

#### Notes:

1. Use the keyboard diagram (Figure 2-3) to identify the keys listed below. Do not identify by keytop symbol (although the two may be identical).
2. **C** refers to the CONTROL key (see Figure 2-3).
3. When a single character is shown in the 'Results' column it will appear on the screen in the first position of the Operator Information Area (OIA) (bottom left hand corner). It

4. The display will be green unless specified otherwise.

5. If any action fails, recheck the test sequence and then exchange logic card C2, then D2, then go to MAP 0100.

Perform the test in sequence (or the results are unpredictable) as follows:

Enter Test Mode 3 from Test Mode 1 or 2 by pressing the CONTROL key (Figure 2-3), or directly using a jumper - see section 2.7.

Step (See Notes 1 & 2 above)	Press Keys	Result (See Notes 3 & 4 above)
1	<input type="checkbox"/> B	$\bar{2}$
2	B B B	$\bar{0}$
3	C	Test Mode 1 pattern is restored
4	<input type="checkbox"/> J	See Table in Figure 6-11
5	<input type="checkbox"/> N	

Monocase Sw.		Security Keylock
A, a	A	
0	A	Not installed
‡	Q	On (clockwise)
1	B	Off (counterclockwise)

6	<input type="checkbox"/> M A B C...	A B C... appear over cursor; cursor advances
7	<input type="checkbox"/> D D D...	Character over cursor is displayed at OIA first position and cursor advances
8	<input type="checkbox"/> C	
9	<input type="checkbox"/> B W $\bar{x}$	
10	<input type="checkbox"/> G A	Line 1 displays $\bar{0}$ as far as 'a' two-thirds of the way along the line.
11	<input type="checkbox"/> B O I	Display turns red.
12	<input type="checkbox"/> B O Q	Display mainly blue, some red remains.
13	<u>Set the TEST/NORMAL switch to NORMAL and back to TEST</u>	
		Display turns green.
14	<input type="checkbox"/> K 1	Cursor blinks.
15	4	Cursor is inhibited.
16	8	Cursor returns but display is inhibited.
17	0	Pattern returns to normal.
18	3	Cursor is blinking and reverse video.
19	2	Cursor is reverse video
20	<input type="checkbox"/> G G	Display contains all $\bar{0}$ ; reverse video cursor moves to OIA first position.



Step (See Notes <u>1 &amp; 2 above</u> )	Press Keys	Result (See Notes <u>3 &amp; 4 above</u> )
21	<input type="checkbox"/> G G	OIA fills with 0.
22	<input type="checkbox"/> B U A	Cursor moves to start of line 2.
23	<input type="checkbox"/> E 5	Cursor moves to start of line 18.
24	<input type="checkbox"/> V	A
25	F	5
26	<input type="checkbox"/> M 3 3 3 3 3 } 5 5 5 5 9 9 }	333335555599 appears on line 18.
27	<input type="checkbox"/> B W $\bar{x}$	
28	<input type="checkbox"/> S 3	Cursor moves to last 3 in line 18.
29	<input type="checkbox"/> B Q 9	Cursor moves to first 9 in line 18.
30	<u>Set TEST/NORMAL switch to NORMAL</u>	

## 2.6 ONLINE TESTS (CONTROL UNIT TO DISPLAY STATION)

Test	Description	Refer to
0	4-color test pattern	Section 2.6.1 and Figure 2-4
1	Error log for 3278/9	Section 2.6.2
2*	Control unit configuration data	MCM for the control unit
3	Status of attached devices	Section 2.6.3
4	Reset error log for 3278/9	Section 2.6.2
5*	Display control unit storage	MCM/MIM for the control unit
6*	Display key DCB information	MCM/MIM for the control unit
7	Operator convergence utility	See section 5.3.3
8*	7-color ECS/PS test pattern	See section 2.6.4 and Figure 2-6

\* Not 3276 control unit.

### 2.6.1 TEST 0: 4-COLOR INTERACTIVE TEST PATTERN

The Test 0 test pattern can be displayed either on the requesting display or on any other specified display. Perform the following steps in sequence.

#### 2.6.1.1 To Run Test 0

To run Test 0 to the requesting display:

1. Set the TEST/NORMAL switch to TEST and back to NORMAL.
2. Set the A,a/A switch to A,a and set the 0000/00 switch to 0000.
3. Hold down ALT, press TEST, release both. Key in /0 (or just /) and press ENTER. The test pattern (Figure 2-4) should be displayed. Go to section 2.6.1.2.

To run Test 0 from another display:

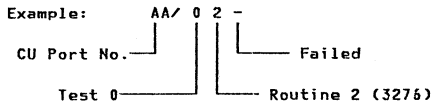
1. Set the TEST/NORMAL switch to TEST and back to NORMAL.
2. Set the TEST/NORMAL switch on the display to be tested to NORMAL.
3. Set the A,a/A switch to A,a and set the 0000/00 switch to 0000.
4. Hold down ALT, press TEST, release both. Key in AA/0 (or just AA/) and press ENTER. (AA is the port number of the display to be tested.)
5. When the test pattern (Figure 2-4) is initiated from another display unit,

the pattern should appear on display AA. Check the test pattern for correct colors and characters.

The results of the test are passed back to the requesting display by suffixing the invoking message with +, -, or 0 where:

- + = successful
- = CU or coaxial cable failure
- 0 = display power off

3276: +, -, or 0 is also prefixed by a routine number 1, 2, or 3 (see Section 2.6.1.2).



6. Perform the interactive test procedure, see section 2.6.1.3.

An error indicator may appear when you try to enter Test 0. Interpret as follows:

- 1) X-f (Do not enter, Function not available) ... you tried to select an in-session terminal for Test 0.
- 2) X t#? (Do not enter, 0p check, What number) ... you used an invalid test number, or address, or wrong test format. (Begin test format at position 0 and use only one slash / and no spaces).

2.6.1.2 Breakdown by Routine

**Note:** Before going to a specific MAP reference, read the caution notice at the start of MAP 0000.

Test 0 - Routine 1 (3276 only)

Checks basic TA (Terminal Adapter) card functions - register, SERDES, command decode, and so on. Driver/receiver operations are not tested. If an error occurs, the test stops. Go to MAP 0100, Entry Point CC.

Test 0 - Routine 2 (3276 only)

Link test - checks the communications link by issuing reset and receiving POR response. If an error occurs, the test stops. Go to MAP 0100, Entry Point CC.

Test 0 - Routine 3 (3274 and 3276)

Interactive test - permits visual check of display operation and testing of keyboard, MRC and selector pen. Audible alarm sounds, and test 0 pattern (Figure 2-4) displays.

If an error occurs, the test stops.

Failure in	Go to MAP
Keyboard	0700, Entry Point A
SLP	0800, Entry Point DD
MRC	0800, Entry Point EE

See Figures 6-17 and 6-18 for attribute bits.

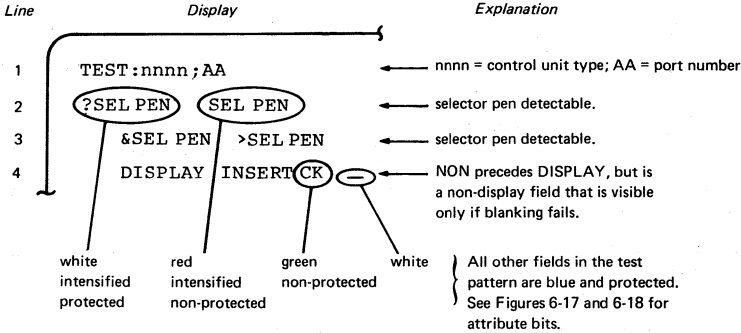


Figure 2-4. Online Test 0 Pattern

2.6.1.3 Interactive Test Procedure

## Action

## Results

1. Move the cursor under the C of the CK field.
2. Press the insert ( $\hat{a}$ ) key.
3. Press keys A B C.
4. Press RESET.
5. Test the SLP feature. (You may simulate the SLP by using the cursor and the cursor select key):
  - a. Touch the pen on ?SEL PEN field on the second line. (If X appears in OIA, press RESET and retry, with increased brightness.)
  - b. Repeat step a.
  - c. Touch the pen on >SEL PEN field on the third line.
  - d. Repeat step c.
6. To test the MRC feature:
  - a. Move the cursor to the first position in the fifth line (line below the test pattern).
  - b. Read the MSR test card.
7. Hold down ALT, press TEST, release both.

^ appears in the Operator Information Area.

DISPLAY INSERT abCK (fourth line) X f appears in OIA.

X f and ^ are erased.

The second line becomes: >SEL PEN SEL PEN

The second line becomes: ?SEL PEN SEL PEN

The third line becomes: &SEL PEN ?SEL PEN

The third line becomes: &SEL PEN >SEL PEN

If the read operation is successful, the cursor moves a number of positions equal to the number of characters on the MSR test card; the green light on reader turns on, and x-f is displayed in the OIA.

If the read operation is unsuccessful, the red light on the reader turns on; press the reset key and repeat the test from Step 6a.

Test pattern and 'TEST' are erased.

2.6.2 TEST 1: ERROR LOG

Online Test 1 allows the error log for any device attached to the control unit to be inspected. It may be useful to reset the error using Online Test 4 before testing, but note the contents of the log before doing this.

To run Test 1:

1. Set the TEST/NORMAL switch to NORMAL.
2. Hold down ALT, press TEST, release both.
3. Press keys /1 ENTER (for error log of requesting display) or press keys AA / 1 ENTER (for error log of display on port AA). Both displays are described below.

2.6.2.1 Online Test 1 Display: 3274 Control Unit

```
AA/1
05XX   XXXX
XXXX   XXXX   XXXX
```

The most recent 3279 display error code appears in the first two digits on line 2. This code is prefixed by '2' when it appears in the operator information area.

For example, an error code of 205 (X 205) is logged as '05'.

3274 error codes for the 3279 display are listed in Figure 2-7.

2.6.2.2 Online Test 1 Display: 3276 Control Unit

The pattern shown below is displayed. This is different from the 3274 because ALL errors are recorded and a count is kept.

Note that the 3276 error log is exactly the same as the OIA. For example: (X 42) is logged as 42.

```
*** YY ***
   X0 X1 X2 X3 X4 X5 ...
0X xx _ xx _ xx _ ...
1X _ xx _ _ _ _ ...
2X _ _ _ _ xx ...
3X xx _ _ xx _ _ ...
4X _ _ 03 _ _ _ ...
5X _ _ _ _ _ _ ...
6X _ _ _ _ _ _ ...
7X _ _ _ _ _ _ ...
8X _ _ _ _ _ _ ...
9X _ _ _ _ _ _ ...
```

The above example shows that error code 42 (keyboard overrun) has occurred 3 times. For error code interpretation, see Figure 2-8.

### 2.6.3 TEST 3: STATUS SUMMARY

<i>Line</i>	<i>Display</i>	<i>Explanation</i>
1	01234567 . . . .	← Configured port numbers on C.U.
2	11101-11 . . . .	← See Note, below.
3	xxxx xxxx xxxx xxxx	← 4 error summary counters (see C.U. MIM or MCM)

**Note:** *Line 2 symbols refer to line 1 port numbers, as follows:*

- 1 attached device has power on
- TA card failed *or* device is disabled because of C.U. — detected error.
- 0 No TA card installed (3276) *or* device has power off *or* no device attached to this port.

**Figure 2-5. Test 3 Test Pattern**

Test 3 indicates the status (Active, Inactive, Disabled) of each display unit attached to the control unit.

To run Test 3, hold down ALT and press TEST, then release both. Type /3 and press ENTER. The Test 3 pattern is shown in Figure 2-5.

#### 2.6.4 TEST 4: ERROR LOG RESET

Test 4 resets the error log. To run Test 4 do the following:

1. Set the TEST/NORMAL switch to NORMAL.
2. Hold down ALT, press TEST, release both.

3. Press keys /4 ENTER.

#### 2.6.5 TEST 8: 7-COLOR AND PROGRAMMED SYMBOLS (PS)

To run Test 8, hold down ALT and press TEST, then release both. Type /8 and press ENTER. The pattern shown in Figure 2-6 is displayed.



If Extended Character Set (ECS) (Models 2A and 3A) is not installed, the symbol **X** **?** appears in the operator information area and the test will not run.

If Test 8 fails, go to MAP 0800, Entry Point CC.

Line							
1	PS	AND	COLOR	TEST	:		
3	PS	A	B	C	D	E	F
5		A	B	C	D	E	F
7	COLOR	1	2	3	4	5	6
8		1	2	3	4	5	6
10		A					
11		B					
12		A					

Line		
1	AND (C) & TEST (F) are reverse video	
	PS (C) & COLOR (F) blink	
3 (F)	are red	
5 (C)	are red with white centers	
7 (F)	1 is blue, 2 is red, 3 is pink, 4 is green	
8 (C)	5 is turquoise, 6 is yellow, 7 is white	
10	is red from font A	
11	is red from font B (skip suppressed)	
12	is red from font A	

**Notes:**

1. If PS fonts are not installed, the  &  is replaced by a green period and omitted on lines 10, 11 and 12.
2. Feature PS2 gives fonts A and B. Feature PS4 gives 4 extra fonts, C through F.
3. Color is green unless stated. Control is by (C) Character Attribute or (F) Extended Field Attribute.

**Figure 2-6. Test 8 Test Pattern**

**2.6.6 ERROR CODES**

Try to reset the error by either pressing the RESET key or by setting the TEST/NORMAL switch to TEST then back to NORMAL. If the failure persists, or recurs, consult the appropriate table below.

In the following error code tables, FRU's are listed in order of probability of failure. Check the following before exchanging any FRU:

- Seating of cards and cables.

- Dirty or bent board pins or card/top card connector contacts.
- Voltages on board pins.

See Figures 6-4 and 3-1 for voltage pin locations and section 5.1 for voltage tolerances.

Exchange or repair suspected FRUs one at a time, and verify correct operation each time. If the suggested actions do not cure the problem, investigate seating and continuity of associated cables and board wiring, then go to MAP 0100 Entry Point A.



3274 Code	Repair Action (3279 logic card)	Error Code Explanation
202	D2.	Control unit keystroke/status buffer overflow
203	D2, then features then B2.	Feature Bus error
204	D2, or C2.	Storage error (Device Check)
205 *	D2, then C2, then features.	Unsupported feature attached
206	D2, then B2, then features.	Incorrect feature response on initialization
207 *	D2, then C2.	Lost Operation Complete this display
208	D2, then C2.	Invalid (unexpected) Operation Complete
209	D2, then C2.	Command queue failure
210 *	Keyboard ID jumpers, then cable, then D2.	Invalid keyboard attached (not configured)
211	D2, then features.	Invalid status received
212	Keyboard logic, then cable, then D2.	Invalid scan code received
222	G4, (selector pen), then D2, then C2.	Invalid selector pen status or command queue failure
223	E2, then D2.	ECS buffer parity error
224	G2 (MRC), then D2.	Invalid MRC status or command queue failure
225	E2, then D2.	ECS status/initialization failure
226	E2, then D2.	ECS command queue failure
227	E2, then D2.	ECS write alternate command queue failure
228	B2, then D2, then C2.	Storage parity error
229	B2, or D2, or C2.	FSU storage parity error
234	E2.	Switches not set to include APL
295	D2, then C2.	Invalid type A adapter status
299	D2, then C2.	Non-command queue cycle sharing machine check
2x%	-	Not customized for attached features

\* Do the control unit and the customization support the 3279 features?  
Check ECS card switches, P5 jumper, and keyboard jumpers (see Figure 6-14).

**Note:** For other error codes, see control unit documentation and installed RPQ documentation.

Figure 2-7. Error Codes From 3274

3276 Code	Repair Action (3279 logic card)	Error Code Explanation
41	Keyboard logic, then cable, then D2.	Invalid scan code received
42	Keyboard logic, then D2.	Keyboard overrun
43	G2 (MRC), then D2.	MRC data parity error
44	G4 (selector pen), then D2, then C2.	Selector pen data parity error
45	G2 (MRC), then D2.	No response from MRC
55	B2, then D2, then C2.	Storage parity error
56	B2, then D2, then C2.	FSU storage parity error
60	G2 (MRC), then D2.	MRC timeout
61	G4 (selector pen), then D2, then C2.	Selector pen timeout
70	C2, then coaxial cable, then D2.	No response from terminal (timeout)
71	C2, then coax, then D2.	Adapter receive parity error
72	C2, then D2.	Data parity error
73 *	D2.	Lost Operation Complete this display
74	D2, then features.	Feature timeout
77	D2, then C2.	Device check (buffer parity)
78	D2, then C2.	POR signal error

\* Do the control unit and its features support the 3279 features?  
 Check ECS card switches, PS jumper, and keyboard jumpers (see Figure 6-14).

**Note:** For other error codes, see control unit or RPQ documentation.

Figure 2-8. Error Codes From 3276

## 2.7 JUMPER POSITIONS

A number of jumper positions are available to aid display adjustments and fault-finding.

The positions and their uses are listed below. Note that every jumper position is activated when grounded. A recommended ground pin is listed.

<u>Name</u>	<u>Pin</u>	<u>Ground</u>	<u>Use/Description</u>
Reverse Video	D2Y02*	D2Y08	All characters are reversed. Used to check purity.
Disable Skip	C2J04	D2J08	Inter-row skip (Mod 2 only) is disabled. Separator line moves up. Used when adjusting image height.
Color Balance Bars	C2W09*	C2W28	A number of colored bars, 2 characters high, are displayed. (must be characters on screen). Color balance.
Force White	C2W07*	C2W28	All characters on the screen become white. Good test of convergence over whole screen, used to set up static convergence (at screen center).
Force Characters	C2G06	D2J08	Easy method of filling screen with characters when online to check overall convergence.
Force Green	C2S11	C2U08	Green video is forced permanently on. Used to check green video amplifier and gun.
Force Red	C2U11	C2U08	Red video is forced permanently on. Used to check red video amplifier and gun.
Force Blue	C2S12	C2U08	Blue video is forced permanently on. Used to check blue video amplifier and gun.
Storage Power	B2B08	B2D08	Removes power from storage to force a convergence check. Used in setting up convergence.
CE Jumper	D2Y09*	D2Y08	Allows entry on TEST switch directly to Test Mode 3 without resetting refresh buffer. Nulls display 0, attributes are blank. Red and white are interchanged when this jumper is connected.
Pen Detect Lines	D2Y10*	D2Y08	Displays selector pen detect lines.

\*See Figures 1-6 and 6-3 for top card connector pin numbering.

### 3.0 CHAPTER 3. FUNCTIONAL COMPONENTS

#### 3.1 POWER SUPPLY

The power supply switches the line voltage at high frequency using pulse width modulation (See Figure 3-1). The modulated voltage is fed to the primary windings of a power transformer. The outputs from the secondary windings are rectified to produce the following voltages:

<u>Voltage</u> <u>(V)</u>	<u>Tolerance</u> <u>(±%)</u>	<u>Max. Ripple</u> <u>(V pk-pk)</u>
+103	6	0.7
+12	10	0.4
-12	10	0.4
+8.5	10	0.26
+5	10	0.15
-5	10	0.15

The transformer incorporates a feedback winding to control the pulse width and hence the output voltages.

A signal from the analog card (LOPT sense) locks the power supply oscillator to the line timebase frequency, to eliminate interference on the display caused by the high frequency modulation. This signal also indicates to the power supply an overvoltage condition on the analog card.

If either the overvoltage or the overcurrent protection mechanism shuts down the power supply, it retries up to seven times, approximately once per second and the 'POWER GOOD' indicator light 1 flashes at this rate, provided that the failure is not on the +5 V line. An audible click may be heard from the supply at each retry by listening near the ventilation slots above the power supply card.

A 1-amp fuse is located on the power supply card. If this fuse fails, the power supply card must be exchanged.

#### 3.2 ANALOG CARD

The analog card generates horizontal and vertical drives for the CRT scan coils and includes the high voltage power supply. When the logic is supplying horizontal and vertical synchronizing signals, the timebases on the analog card lock to the imposed frequency.

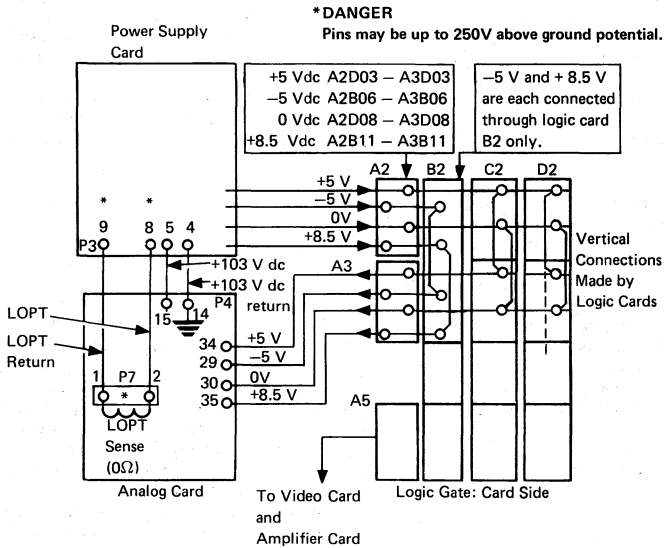
The line output transformer (LOPT), in the horizontal drive circuit, provides the following supplies:

- +25 V dc - On-card use, deflection amplifiers
- 25 V dc - On-card use, deflection amplifiers
- +12 V dc - On-card use and card B2
- +70 V dc - To video card
- 150 V dc - Through brightness control amplifier card and color balance controls to CRT grid
- +250 V dc - Focus circuits and CRT to anode
- +450 V dc
- +6k V - Focus circuits
- +6.3 V dc - CRT filament (see Fig. 6-7)
- +25k V - EHT supply to CRT

The analog card receives a further signal ('skip'), which forces the raster to move vertically a defined amount (see Figure 2-1).

To start up, the analog card requires  $\pm 5$  V dc,  $+8.5$  V dc, and  $+103$  V dc. When the power is turned on the horizontal drive circuit starts and produces the additional supplies. These enable the vertical drive circuit to start and this

initiates a delay. After 40 seconds DISPLAY READY (indicator 2) turns on and a change in CRT grid voltage unblanks the screen.



See Figure 6-4 for voltage pins on logic strips

Figure 3-1. Power Supplies to Logic Gate and Analog Card

### 3.3 AMPLIFIER CARD AND INPUTS

#### 3.3.1 CONVERGENCE CIRCUITS

The convergence amplifiers drive the convergence coils, which provide the necessary correction for all points on the screen to the three beams (see Figure 3-2).

The current in the convergence coils is controlled by data in a store which is read in step with the scanning of the screen. The data in this store may be altered by the operator to compensate for CRT ageing.

As data in the convergence store in the display is lost when power is turned off, the convergence store is supported by battery-maintained storage. When the 3279 display is switched on, the convergence logic card B2 generates a 'power on reset' to the logic. This resets most registers and sets the status to 'power on rest'. The next poll from the control unit to which the 3279 is connected detects the status and then

reads the data from the battery-maintained storage and processes it to set up the correct data in the convergence store. This is normally complete before the screen unblanks. The power on procedure also occurs when the TEST/NORMAL switch is returned to NORMAL.

When the operator uses the convergence procedure in the online tests, the data in the battery-maintained storage is modified and the convergence store is updated.

Note that the convergence control circuits are packaged on two cards (see Figure 3-2):

- Logic card B2, (4Wx3H) carries the volatile and non-volatile stores and the logic.
- The amplifier card receives four convergence analog signals from the logic card and amplifies these to drive the convergence correction coils.
- The amplifier also contains gain controls that are factory-preset.

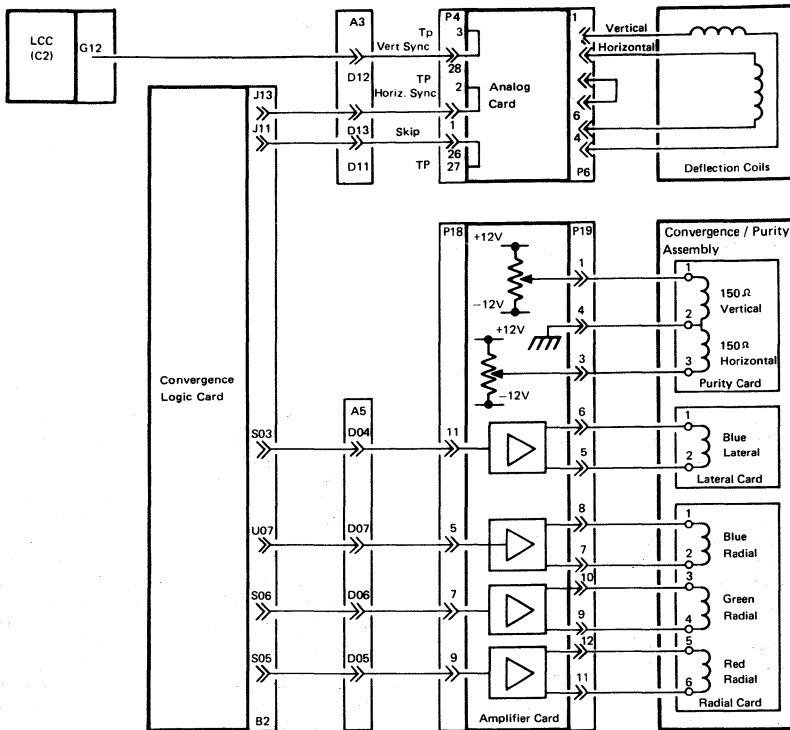


Figure 3-2. Synchronization, Convergence, Purity, and Deflection Coil Connections

### 3.3.2 COLOR CONTROLS

Also located on the amplifier card are the six color balance potentiometers. These receive a voltage of between -150 V dc and 0 V from the brightness control and work in pairs to set the minimum and maximum brightness levels for each color.

Two more potentiometers allow color purity adjustments.

### 3.4 VIDEO CARD

The video (tube neck) card receives the three video signals and amplifies them to

drive the CRT cathodes (see Figure 6-4). The CRT filament supplies, the anode supply, and the grid (brightness) voltages go through this card to the CRT pins. The focus supply is wired directly to the CRT socket.

### 3.5 CATHODE RAY TUBE AND COIL ASSEMBLY

The human eye contains detectors for red, green, and blue light. These are the 3 primary colors. Other colors (and white) are seen as mixtures of these. The screens of color CRTs are made of dots of 3 phosphors which emit red, green, and blue light when they are hit by electrons.

The red and green phosphor dots in the 3279 are pure, that is, they emit only red or green light. The blue dots are impure, that is, the blue light is mixed with a little green and red to improve the overall balance of the colors. This is done because pure blue is too dark. This means that any mixed colors that include blue will be changed. If the brightness of the primary colors is not balanced, the mixed colors will not be correct and the white will be colored.

Phosphor Dots <u>Illuminated</u>	Color seen on 3279 <u>Screen</u>
Red	Red
Green	Green
Blue	Blue
Red and Green	Yellow
Red and Blue	Pink (Violet, Magenta)
Green and Blue	Turquoise (Light Blue, Cyan)
Red, Green, Blue	White

Each primary color has a separate electron gun, with a separate grid to

control its brightness. The three electron beams are accelerated and focused by a single anode assembly and deflected across the screen by a single set of deflection coils. The three beams arrive at the screen at slightly different angles. A mask (see Figure 3-3) which is at EHT voltage is located a few millimeters from the screen phosphor. The small holes in the mask break each beam into six or seven smaller beams before they hit the screen phosphor. The angle of the beam at the mask directs the beam to the correctly-colored phosphor dots.

Another group of coils is arranged around the neck of the CRT between the cathodes and the common anode. These are used to improve purity and convergence.

1. Purity - These coils move the three beams under horizontal and vertical controls to strike the shadow mask at the correct angles.
2. Static Convergence - Three thumbwheels (mounted on an assembly on the CRT neck) and the blue lateral static convergence potentiometer (mounted on the convergence amplifier card) allow the three color beams to be aligned at the center of the screen.
3. Dynamic Convergence - The overall deflection distortion is corrected by the normal pincushion correction controls. The distortion of each beam is however slightly different. These differences are corrected by the dynamic convergence circuits. Voltage waveforms are generated on the convergence logic card B2 and fed to the coils via the amplifier card. Thus the 3 primary color images lie on top of one another all over the screen. Observe the difference in quality of multi-colored images in Test Mode 3 compared with concurrent test 0.



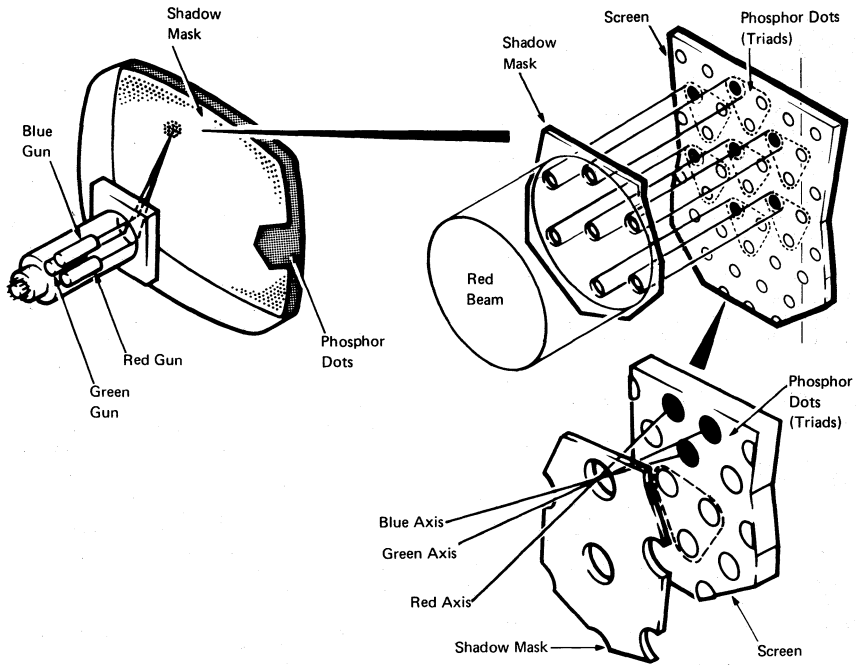


Figure 3-3. Shadow Mask

**3.6 CONVERGENCE LOGIC CARD (LOCATION B2)**

The convergence logic card (see Figure 3-4) provides digitally-controlled analog signals for convergence of the display unit. The card has two stores that hold the definitions of the currents

required in the convergence coils. The digital information is converted to analog signals and fed to the amplifier card in the main enclosure assembly.

The card is connected to the base logic card through the feature bus so that the stores can be accessed and updated.

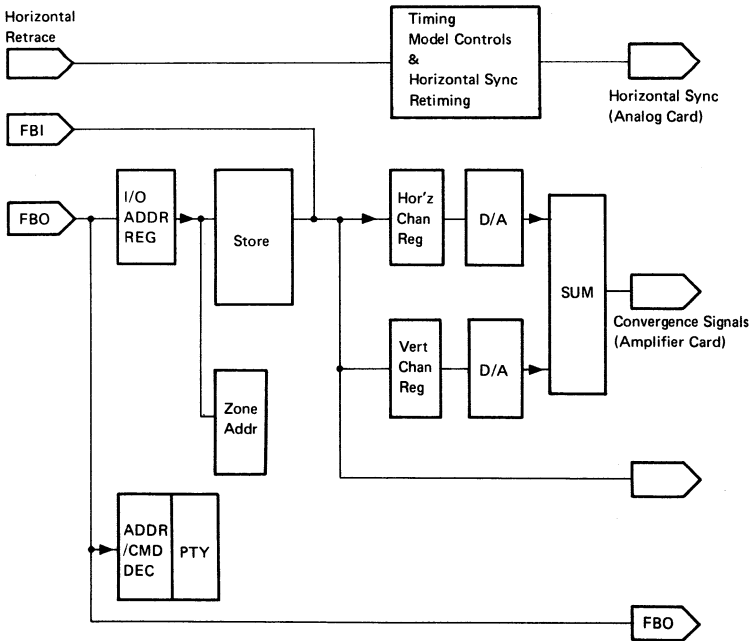


Figure 3-4. Convergence Logic Card

### 3.7 LINE CONTROL CARD (LOCATION C2)

The Line control card (see Figure 3-5) contains:

- Circuits to handle transmission and reception of data down the coaxial line to the control unit.
- Main oscillator (14 MHz), dot counter and feature clock.

- A serializer that converts the ROS outputs from the base logic card to drive the three video outputs.
- Test circuits that force colored bar patterns on the screen adjustments.
- (Video Output RPQ only) Circuits that produce red, blue, green, and sync signals for external monitors.

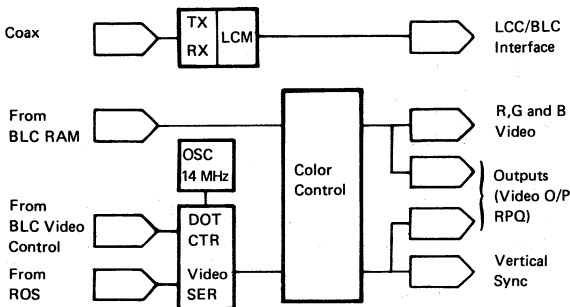


Figure 3-5. Line Control Card

### 3.8 BASE LOGIC CARD (LOCATION D2)

The base logic card (see Figure 3-6) contains:

- The display buffer, which holds the character code for each position on the screen.
- Attribute control circuits. The base attribute byte defines the characteristics of the field (for example, color).
- The ROS which stores the character shapes. It is addressed by the display buffer and the outputs are fed to the line control card.

- Keyboard control circuits for keystrokes and responses.
- Logic for handling I/O operations with the display buffer. This involves the base I/O address counter which is also used by the features as an address for I/O operations.
- The character counters.
- Feature bus controls. The feature bus is the main path for transmitting data around the machine.

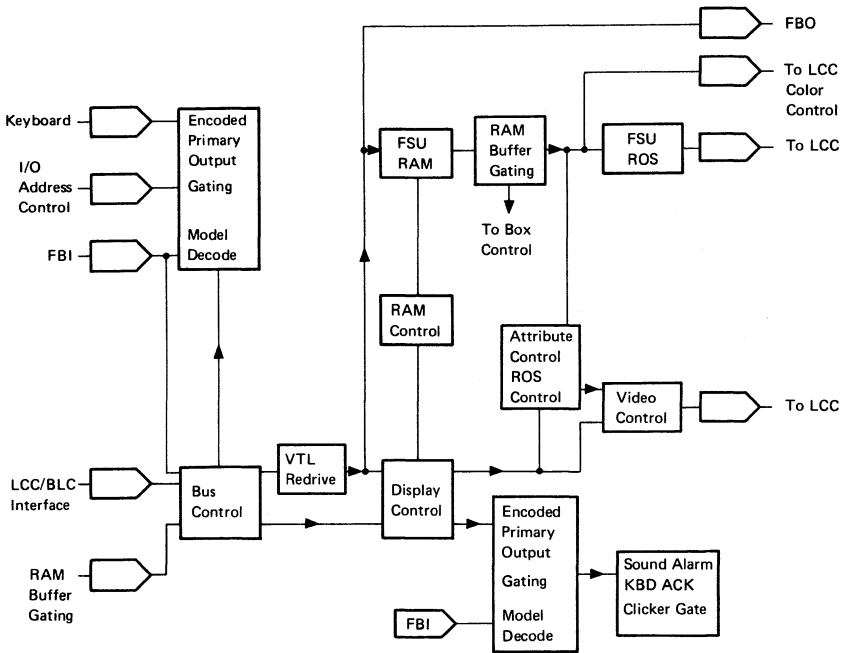


Figure 3-6. Base Logic Card

**3.9 APL/EXTENDED CHARACTER SET (ECS) CARD (LOCATION E2)**

The ECS card (see Figure 3-7) allows the user to define the color of characters on a character basis by providing a shadow buffer with a byte of information for each character position in the display buffer. This shadow buffer (see Figure 6-19) can select characters from the APL ROS (or several programmable fonts if the

Programmed Symbols feature is installed). It can cause the characters to appear in any of seven colors and can highlight the characters. The APL ROS is pluggable, although it is standard with the ECS/APL card in the 3279. The switches are set as shown in Figure 6-14. These return the correct response when the control unit addresses a 'Read ID' command to the ECS feature.

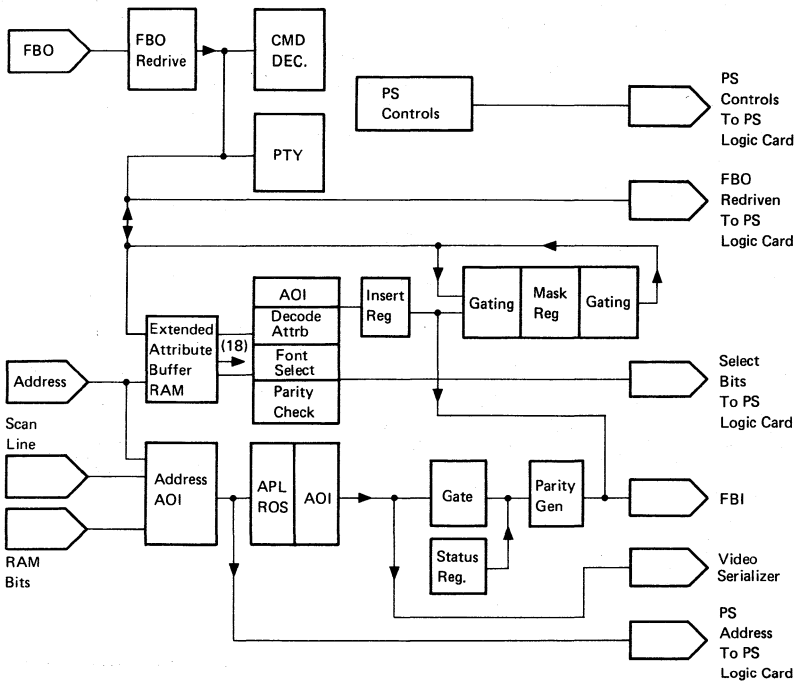


Figure 3-7. APL/ECS Card

**3.10 PROGRAMMED SYMBOLS (PS) CARD  
(FEATURE) (LOCATION F2)**

The PS (Programmed Symbols) card (see Figure 3-8) allows the host, or the user through the host, to program the shapes of characters for display on the screen. Special character sets and graphic characters may be programmed. Two fonts

(A and B, PS2 feature) or six fonts (A through F, PS2 and PS4 feature) may be installed. Each font is used in the same manner as the APL R05, selection being by ECS. When PS2 only is included the jumper is installed. This rearranges the addressing to bring the second programmed font within the storage module, see Figure 6-14.

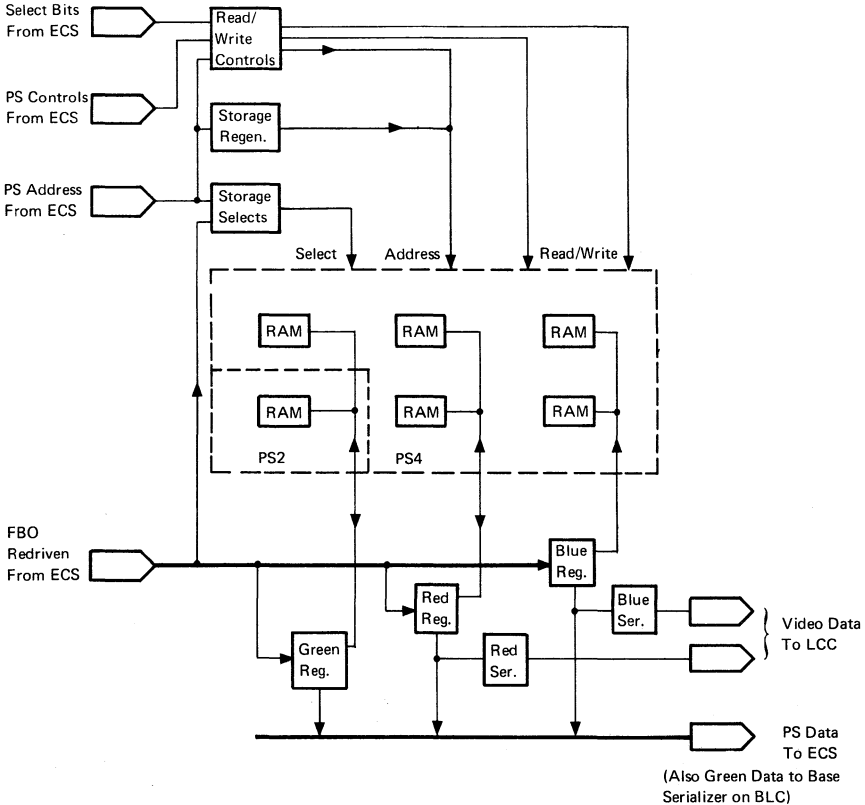


Figure 3-8. Programmed Symbols Card

Each PS font contains 190 programmable characters. The user can program each pel in the 9 x 12 matrix of each character. The color of the character is defined by the base or ECS attribute (see section 6.12).

For the triple fonts C, D, and F only, the user can program the color of each pel separately when the ECS byte color field is 111. For other combinations of the color field bits, the color of the complete character is defined by the ECS attribute, as for the other fonts.

### 3.11 SELECTOR LIGHT PEN (LP) CARD (FEATURE) (LOCATION G4)

This card contains the logic for the operation of the selector light pen (see Figure 6-13).

### 3.12 MAGNETIC READER CONTROL (MRC) CARD (FEATURE) (LOCATION G2)

This card contains the logic for the operation of the magnetic slot reader (MSR) or magnetic hand scanner (MHS) (see Figure 6-13).

## 4.0 CHAPTER 4. CHECKS, ADJUSTMENTS, AND REMOVALS

### 4.1 GENERAL

It is recommended that the display be positioned near the corner of a table with the right-hand side of the bezel nearest the corner, leaving sufficient clearance for the bezel to be placed face down on the table in front of the display.

### 4.2 LOGIC GATE

To open the logic gate, insert an allen wrench in each of the two slots on the right-hand side of the display and turn the wrench a quarter turn in each slot. The rear enclosure assembly can then be swung open on the hinges.

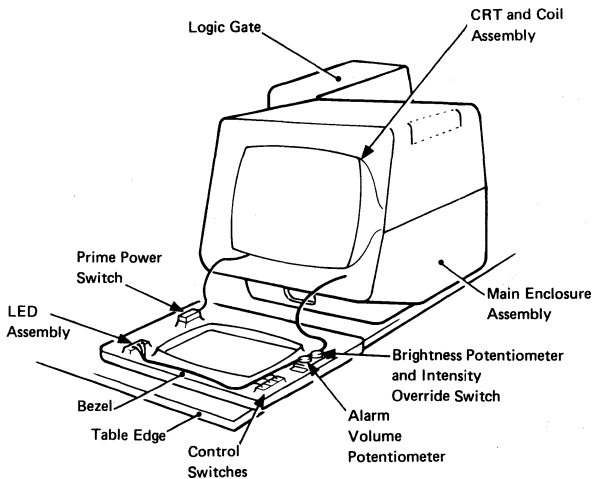


Figure 4-1. General View - Bezel Removed



### 4.3 REAR COVER

To remove the rear cover, open the customer access panel by pressing up on the two clips. Remove the three screws located along the hinged section of the cover.

### 4.4 BEZEL

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the two allen screws from the under side of the bezel and lift the bezel up and away from the enclosure assembly.

#### 4.4.1 ON/OFF SWITCH

1. Remove the bezel (see section 4.4).
2. Release the internal power cable from the clamp near the ON/OFF switch.
3. Press to one side the plastic catch at the side of the switch, and pull the switch out. Remove the power supply (see section 4.5.2).
4. Unplug connector P2 from the prime power box.
5. Reinstall in reverse sequence.

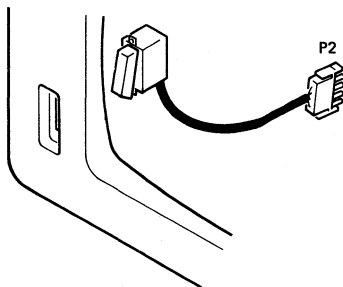


Figure 4-2. ON/OFF Switch

#### 4.4.2 BRIGHTNESS AND AUDIBLE ALARM VOLUME CONTROLS

1. Remove the bezel (see section 4.4).
2. Pull off the two knobs.
3. Remove the tape from around P11 and unplug it. Release the mounting bracket from the inside of the bezel.
4. Reinstall in reverse sequence.
5. Wrap two turns of adhesive tape around P11 to insulate the contacts (150 V) and hold the plug and socket together.

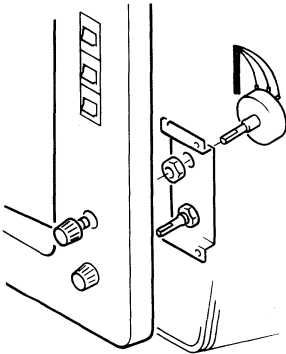


Figure 4-3. Brightness and Audible Alarm  
Volume Control Assembly

#### 4.4.3 NORMAL/TEST, BASE COLOR, AND DUALCASE/MONOCASE SWITCHES

Three switches on the upper right of the bezel are removed as follows:

1. Remove the bezel (see section 4.4).
2. Disconnect the wiring to the switch.
3. Pinch the spring clips together and push the switch and clip out through the front of the bezel.
4. Reinstall in reverse sequence.

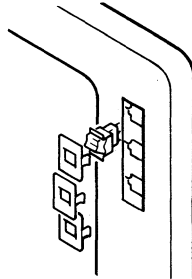


Figure 4-4. Switches

#### 4.4.4 INDICATOR LEDS

Before removing the LED assembly, switch off power and remove the mainline power cable from the power socket. The indicator LEDs are contained on a PCB as shown in Figure 4-5.

#### 4.4.5 SECURITY KEYLOCK

1. Remove the analog card (see section 4.5.4).
2. Disconnect P9 and remove the retaining nut (use wrench, IBM Part 4418787).
3. Withdraw the keylock assembly.
4. Replacement is the reverse of removal, but ensure that the keylock is inserted the right way up so that the key can be turned without hitting the side of the display unit.

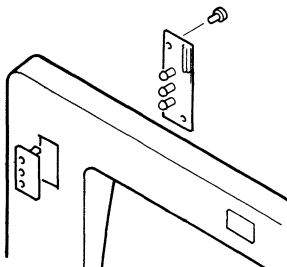


Figure 4-5. Indicator LED Assembly

#### 4.5 POWER UNITS

##### DANGER

Before any power unit replacement procedures are performed, the display must be powered off and the mainline power cable disconnected at the power socket.

##### 4.5.1 FUSE

##### DANGER

Switch power off and remove the mainline power cable from the power socket before changing the fuse.

The main supply fuse is located in the front enclosure assembly below the bezel. Push the fuse cover and turn it counterclockwise to release the fuse.

##### 4.5.2 POWER SUPPLY

The power supply is located to the right of the CRT as viewed from behind.

##### DANGER

Components on this card are hot. Before handling the card, allow it to cool for 5 minutes with power turned off.

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the rear cover (see section 4.3).
3. Unplug the A2 cable connector.
4. Remove the retaining clip that holds the cable to the inside of the logic gate.
5. Pull the flat cable through the gap (it is easier if the connector shroud is removed).
6. Remove the two screws and pull out the power supply card.
7. Reinstall in reverse sequence, ensuring that the card is correctly located in the bottom guide and both top guides.
8. See Chapter 5 for adjustments.

##### 4.5.3 PRIME POWER SUPPLY

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the power supply as described in Section 4.5.2.
3. Remove connectors P1 and P2 from the prime power assembly.
4. Disconnect the ground wires from the assembly.

5. Remove the two screws that secure the assembly to the base of the enclosure.
6. Remove the assembly from the display.
7. Reinstall in reverse sequence.
8. **DANGER**  
**Ensure that all ground connections to the prime power assembly are reconnected.**
9. Insert the EHT cable fully into the LOPT socket, P21 and screw down the cable clamp.
10. Continue installation in reverse sequence. Ensure that the card is correctly located in the top and bottom guides.
11. Reconnect 2 ground wires and screw down.

#### 4.5.4 ANALOG CARD

The analog card is located to the left of the CRT as viewed from behind.

1. Switch power off and remove the mainline power cord from the power outlet.
2. Disconnect the two ground wires from the ground screw at the bottom of the card assembly.
3. Remove the two screws at the top and bottom of the analog card assembly and the center clamp.
4. Withdraw the assembly toward the rear of the machine taking care not to damage the cables connected to the card.
5. Unplug P5, P7, and P26 (see Figure 4-7) from the analog card.
6. Unscrew the clamp that holds the red EHT red wire at the Line Output Transformer (LOPT) connector, P21. Pull out the wire and discharge it to the frame.
7. Remove the analog card.
8. To reinstall, first check that the jumper matches the CRT (see Figure 4-7).

**DANGER**  
**Verify that all ground wires are reconnected securely. Refer to Figure 6-6 for grounding details.**

12. See Chapter 5 for adjustments.

#### **4.6 LOGIC CARDS**

##### **4.6.1 REMOVAL**

Switch power off. Remove any attached top card connectors. Operate the levers in the directions shown by the arrows in Figure 4-6 and withdraw the card.

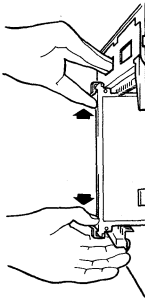
##### **4.6.2 REPLACEMENT**

Push the card firmly into its socket and then operate the levers as shown in Figure 4-6. Replace the top card connectors.

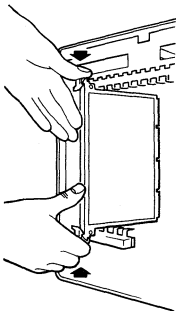
**CAUTION:**  
**Always use a card shroud when reinstalling a card, to prevent contact with adjacent cards.**

For ECS and PS feature cards (E2, F2) see Figure 6-14 for details of switch settings and module and jumper positions.

**Note:** 3279s with the Video Output RPQ have a video output card instead of a line control card in location C2. The video output card has two extra modules. When this card is installed in location C2, the resistance between each video output socket and ground falls to less than 10 kilohms.



Removal



Replacement

Figure 4-6. Logic Card Removal and Replacement

#### **4.7 CONNECTORS**

Most internal connectors have mechanical locking devices.

##### **4.7.1 MULTI-PIN CONNECTIONS**

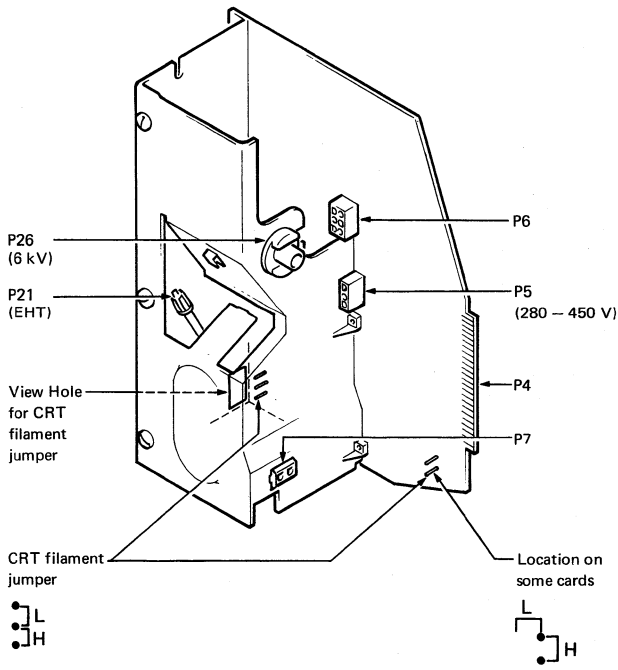
**Removal** - Pinch the latch tabs together and pull the connector free from the pins.

**Replacement** - Reseat the connector ensuring that the tabs are latched.

##### **4.7.2 INTERNAL COAXIAL CONNECTION**

**Removal** - Press and hold the latch button and pull the connector free.

**Replacement** - Reseat the connector ensuring that it is latched, (see Figure 6-13 for location).



**DANGER:** Dangerous voltages exist at all these connectors.

*Note: When exchanging a CRT or Analog Card, match the jumper position to the CRT. This sets the filament voltage to 6.3 V dc. Incorrect setting may reduce CRT life or the display brightness.*

Jumper Position Symbol	L	H
CRT Manufacturer — See label on bell of CRT behind analog card.	Matsushita Electronics Corporation	Mitsubishi Electric Corporation
CRT filament current	Low (715 mA)	High (800 mA)
Filament configuration	Three in parallel	Three in series
Filament resistance (Cold)	1.9 $\Omega$	1.4 $\Omega$

Figure 4-7. Analog Card

## 4.8 VIDEO COMPONENTS

### 4.8.1 AMPLIFIER CARD

#### DANGER

Components on this card are hot. Before handling the card, allow it to cool for 5 minutes with power turned off.

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the four push-in multi-wire connectors P17A, P17B, P18 and P19 from the amplifier card (see Figure 6-10).
3. Remove the screws that secure the safety cover and remove the cover.
4. Pull the amplifier card off its four locating lugs.
5. Reinstall the amplifier card in reverse sequence. The multi-wire connectors cannot be mixed up because they are different sizes. Do not finally tighten the safety cover securing screws until these connectors have been reconnected.
6. Go to Chapter 5 for adjustments.

### 4.8.2 VIDEO CARD

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the analog card (see section 4.5.4, steps 1 through 4 only).

3. Unplug P5 and P26 from the analog card (see Figure 4-7).
4. Disconnect the three ground wires from the video card. Note the connection points and routing of the wires (see Figure 6-9).
5. Pull the video card off the CRT base.
6. Disconnect P14, P15 and P16 from the video card (see Figure 1-4).
7. Reinstall in reverse sequence.
8. See Chapter 5 for adjustments.

### 4.8.3 CRT AND COIL ASSEMBLY

#### DANGER

Wear safety equipment (see 'Cathode Ray Tube Safety' at the front of this manual) when handling CRTs.

#### 4.8.3.1 Removal

#### **CAUTION:**

**Support the logic gate to prevent the display from falling backwards when the CRT and coil assembly is removed.**

1. Remove the mainline power cable from the power socket.
2. Position the display as described in section 4.1, with logic gate open.
3. Remove the bezel (see section 4.4) and place it face down in front of the display. Release the internal power cable from the rubber clamp near the ON/OFF switch.

4. Remove:
  - The power supply (see section 4.5.2)
  - The analog card (see section 4.5.4)
  - The amplifier card (see section 4.8.1)
  - The EHT bleed assembly (see Section 4.8.4, but do not remove the bleed assembly from the bracket)
5. Pull the video card from the CRT base and place it on the table.
6. Loosen the clamp and pull the convergence coil assembly from the CRT neck.
7. Disconnect P27 (front left of the CRT screen - see Figure 1-2).
8. Disconnect the ground braid clamp and its jumper link (Figure 6-9). Ensure that the braid can move forward freely.

**CAUTION:**

The following steps free the CRT from its mounting. The CRT weighs approximately 7.5 kg; support it and protect it from excessive pressure that could damage it or other units. Handle the CRT by the bell only, NOT by the neck.

9. Remove the four hexagonal nuts and washers from the corners of the CRT face.
10. Check that the logic gate is supported.
11. Observing normal CRT safety precautions (see page 3), remove the CRT from the display unit and put it face down on the bezel.
12. Remove the wrap tie that secures the degauss coil.
13. Remove the degauss coil, ground braid and securing clips from the CRT.
14. Prepare a surface for the CRT and remove the CRT to that surface.

**4.8.3.2 Replacement**

1. Ensure that the case that contains the new CRT is the correct way up.
2. Remove the new CRT from its case and set it on the bezel with the EHT connector to the front.
3. If you do not have a new piece of plastic foam (acoustic shield) to fit around the deflection coils, transfer the plastic foam from the old CRT.
4. Pack the old CRT in the case provided with the new CRT.
5. Install the degauss coil, ground braid and securing clips on the new CRT. Keep the ground braid between the tube and the degauss coil.
6. Secure the degauss coil in position with the wrap.
7. Observing normal CRT safety precautions, install the CRT in the display unit, taking care to avoid trapping or fouling any cables.
8. Insert the washers and nuts but do not tighten the nuts.
9. Check that all cables and connectors within the display unit are free and accessible.
10. Connect the degauss coil (P27).



11. Center the CRT in the display and tighten the nuts.
  - The video card (see section 4.8.2)
12. Check that the CRT is centered by replacing the bezel and repeat Step 10 as necessary.
  - The analog card (see section 4.5.4)
  - The power supply (see section 4.5.2)
13. Remove the pin protector from the CRT and insert it on the failed CRT.
14. Slide the convergence coil assembly onto the CRT neck and position the assembly over the interelectrode gap as shown in Figure 4-8. Adjust the angular alignment to the stated tolerance. Use the machine base as a reference.
15. Secure the convergence coil assembly by the clamp but do not over-tighten the screw.
16. Check that the jumper on the analog card matches the CRT type (see Figure 4-7).
17. Reconnect the ground braid clamp (see Figure 6-90) and replace the jumper link.
18. Install:
  - The EHT bleed assembly (see section 4.8.4.2. steps 2 through 4)
  - The amplifier card (see section 4.8.1)
19. Reconnect all plugs that were disconnected during the removal procedure.
20. Ensure that all ground connections are reconnected securely, including the two on the analog card heatsink.
21. Check that all cards and connectors are correctly seated.
22. Replace the rubber clamp on the internal power cable near the ON/OFF switch.
23. Secure the bezel to the front of the display unit (see section 4.4).
24. Carry out Display Setup as detailed in Chapter 5.
25. On completion of the initial checks and the setting up procedures, replace all the safety covers and close the logic gate.

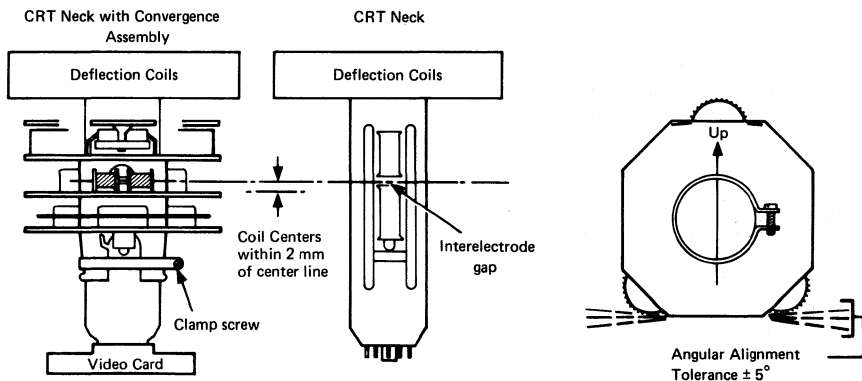


Figure 4-8. Convergence/Purity Coil Assembly

#### 4.8.4 EHT BLEED ASSEMBLY

##### 4.8.4.1 Removal

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the power supply card (section 4.5.2), analog card (section 4.5.4) and amplifier card (section 4.8.1)

**DANGER**

**Do not let anything fall on the tube neck.**

3. Loosen the two screws holding the bleed assembly/amplifier card bracket in the top of the box, and remove the assembly.

**DANGER**

**The CRT retains a capacitive charge after the EHT lead has been disconnected (step 4). It must be discharged to ground with a suitably**

**installed lead before the CRT is handled or the EHT lead is reconnected. Ensure that the discharge lead is connected to ground BEFORE touching it onto the CRT connector.**

4. Supporting the bleed assembly, unplug the EHT cable from the top of the CRT. Lift the rubber cap at the edge to break the airlock, grasp the cap firmly, rock it to one side, and lift.
5. Disconnect the ground connector at the prime power box (see Figure 6-5).
6. Withdraw the bleed assembly/bracket, remove two securing screws, and take the bleed assembly from the bracket.

##### 4.8.4.2 Replacement

1. Mount the bleed assembly on the bleed assembly/amplifier card bracket and secure it using the two screws

- removed in step 6 of Section 4.8.4.1.
2. Remove the rear cover (see section 4.3)
  3. Disconnect all connectors and note their locations.
  4. Remove the logic cards.
  5. Remove the two diagonally opposite screws (top right and bottom left) that attach each rear planar strip holder to the logic gate.
  6. Remove the rear holders and planar strips.
- CAUTION:**  
Verify that all ground wires are reconnected securely. Refer to Figure 6-5 for grounding details.

6. Reinstall the power supply card and the amplifier card and make all connections.
7. Ensure that all ground connections are replaced.

#### 4.8.5 DEGAUSS COIL

To remove and replace the degauss coil, go to section 4.8.3 CRT and Coil Assembly. For removal, follow 'Removal' steps 1 through 13. For replacement, follow 'Replacement', steps 5 through 23.

Display adjustments should not be affected, but refer to Chapter 5 if necessary. Reinstall all safety covers and close the logic gate.

### 4.9 LOGIC BOARD PLANAR STRIPS

#### 4.9.1 REMOVAL

1. Switch power off and remove the mainline cable from the power socket.

#### 4.9.2 REPLACEMENT

1. Feed the cables that plug into the strips through the gap at the right-hand side of the logic gate (as viewed from the rear). It is easier if the shrouds are removed; replace them afterwards.
2. Ensure that the card-locating shoulders on the strip holders are positioned the correct way round (see Figure 4-9).
3. Insert the planar strips and rear holders in approximately their correct positions. Insert, but do not tighten, the strip-securing screws.
4. Plug all the logic cards into the gate and clip them in position.
5. Close the logic gate so that the enclosure positions it at the correct height, then tighten the strip-securing screws.
6. Open the logic gate. Reinstall all connectors (pass the keyboard cable through the gap at the right-hand side of the logic gate as viewed from the rear).

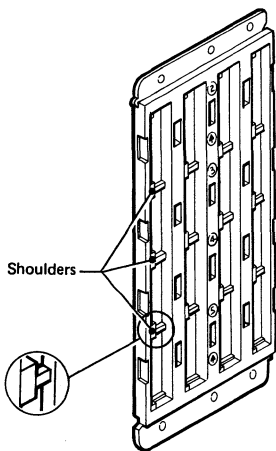


Figure 4-9. Planar Strip Holders

#### 4.10 AUDIBLE ALARM

1. Switch power off and remove the mainline power cable from the power socket.
2. Remove the analog card as detailed in section 4.5.4.
3. Remove the two screws that secure the audible alarm assembly to the base of the enclosure (see Figure 4-10).
4. Note the position of the five wires connected to the audible alarm assembly by push-in connectors (see Figure 4-10).

5. Lift the audible alarm assembly, remove the five connectors and withdraw the alarm from the display.
6. Reinstall the audible alarm assembly in the reverse sequence.

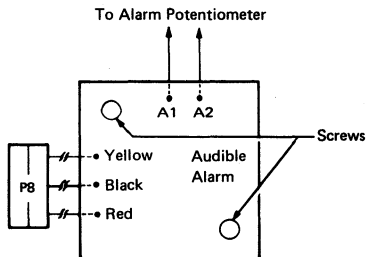


Figure 4-10. Audible Alarm Assembly.

#### 4.11 KEYBOARD UNITS

##### 4.11.1 KEYBOARD FROM DISPLAY STATION

1. Turn power off.
2. Open the customer access panel at the rear of the display.
3. Remove the wing nut that holds the keyboard cable to the frame.
4. Free the cable clamp, and remove the keyboard cable connector from its socket.
5. Reinstall in the reverse sequence.

6. Ensure that all cable connectors are tightly seated in the sockets and that the ground straps are attached.

#### 4.11.2 KEYBOARD TOP COVER

1. Invert the keyboard.
2. Remove the four screws in the corners of the keyboard base.
3. Place the keyboard base on a flat surface.
4. Lift the top cover off the keyboard.
5. Reinstall in the reverse sequence.

**Note:** Check for cover clearance around the keys after the cover has been reinstalled. Adjust if required.

#### 4.11.3 KEYBOARD ASSEMBLY FROM BASE

1. Disconnect the keyboard from the display station (see section 4.11.1).
2. Remove the keyboard top cover (see section 4.11.2).
3. Disconnect the keyboard cable connector and clicker connector at the logic card.
4. Remove the two screws that hold the keyboard assembly to the mounting (mark for alignment reference).
5. Lift the keyboard assembly off the mounting.
6. Reinstall in the reverse sequence.
7. Ensure that the cable connector is tightly seated.

#### 4.11.4 CLICKER ASSEMBLY

1. Disconnect the keyboard from the display station (see section 4.11.1).
2. Remove the keyboard top cover (see section 4.11.2).
3. Disconnect the clicker connector.
4. Remove the clicker assembly by sliding the bail fastener from under the cast tabs.
5. Reinstall in the reverse sequence.

#### 4.11.5 KEYBUTTON

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

#### 4.11.6 KEY MODULES

1. Disconnect the keyboard from the display station (see section 4.11.1).
2. Remove the keyboard top cover (see section 4.11.2).
3. Remove the keybutton from the module that will be swapped (see section 4.11.5).
4. Remove the keyboard assembly from the base (see section 4.11.3).
5. Invert the keyboard, and place it on the base pins located on the left and right sides.

#### 4.11.6.1 Removal (Including Spacebar Module)

**Note:** See section 4.11.7 if the spacebar module is to be swapped.

1. Remove the screws that hold the base plate and circuit board to the all-keys assembly.
2. Lift the circuit board from the all-keys assembly, and place the circuit board on its base in a clean area.
3. Handle the all-keys assembly by the sides. Be careful not to press any keys. Lift the all-keys assembly off the base, turn it over, and place it on the base.

**Note:** Swap 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 all-keys assembly nearest the key module that has just been removed. Remove the module.
6. Lift the all-keys assembly by the edges, and invert it on its base. Remove the bad module.

#### 4.11.6.2 Replacement

1. Ensure that the alignment tab and the angled keystem are in the same position as those of the other modules in the all-keys assembly.
2. Install the new module by pressing the key module into the holding plate by hand.

3. Clean the printed circuit board by carefully wiping it with a lint-free cloth moistened with isopropyl alcohol. Inspect every key module fly-plate for any foreign matter, and carefully clean if needed.
4. Align the holding screw holes through the baseplate, circuit board, insulator, and top insulator (if used). Lower the circuit board assembly on the all-keys assembly. Secure the circuit board to the all-keys assembly with the holding screws.
5. Reinstall the keyboard assembly on the base, maintaining its original alignment.
6. Reinstall the keybutton in the correct location.
7. Reinstall the keyboard cable connector and clicker cable to the logic card. Reinstall the keyboard top cover, and reconnect the keyboard to the display if it was removed.
8. Use Test Mode 2 to check for correct operation of the keyboard.

#### 4.11.7 SPACEBAR

Perform the removals described in sections 4.11.1 through 4.11.3 for access to the keyboard assembly.

##### 4.11.7.1 Removal

1. Hold the spacebar at each end (beyond the modules), and remove by pushing upward evenly.

2. Pivots can be removed (if necessary) by pushing with a screwdriver in the slot in the side of the pivot.

#### 4.11.7.2 Replacement

1. Press any pivots removed in step 2 (above) into the mounting frame.
2. Place the spacebar button on 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 it.
4. Check the spacebar operation for binds. If it binds, the probable cause is a bent right module stem. This stem can be shaped to free the bind.
5. Install the keyboard top cover, and reconnect the keyboard to the display station if it was previously removed.

#### 4.11.8 LOGIC CARD ASSEMBLY

1. Remove the keyboard top cover (see section 4.11.2).
2. Disconnect the keyboard cable connector and clicker connector at the logic card.
3. Remove the two holding screws from each end of the logic card.
4. Remove the logic card.
5. Reinstall in the reverse sequence.

**Note:** Check that the KB ID jumpers on the new logic card are in the same position as on the old logic card. See Figure 6-11 if necessary.

## 5.0 CHAPTER 5. DISPLAY SET-UP

The complete adjustment procedure shown overleaf and detailed in this chapter is sufficient to set up a display from a totally unadjusted condition.

After a single FRU change, however, there is no need to go through the complete procedure. The necessary adjustments are listed below.

1. Power Supply Card: Perform the initial checks (section 5.1), then go to static convergence (section 5.3.1) and work forward to make minor adjustments.
2. Analog Card: Perform the initial checks (section 5.1), then go to coarse adjustments (section 5.2) and work forward. Ignore color balance (sections 5.2.1, 5.3.6).
3. Logic Card B2: Perform the initial checks (section 5.1), then adjust static convergence (section 5.3.1) and dynamic convergence (section 5.3.3) only.
4. Amplifier Card: Perform the initial checks (section 5.1). Do not adjust the four controls marked GAIN; these

are preset during manufacture. Go to coarse adjustments (section 5.2) and carry on to adjust color balance, purity, static convergence, and dynamic convergence only.

5. Video Card: Perform the initial checks (section 5.1), then if necessary, adjust color balance (section 5.3.6).
6. CRT: Perform the initial checks (section 5.1), then go to coarse adjustments (section 5.2) and work through all adjustments.
7. Convergence/Purity Coil Assembly: Perform the initial checks (section 5.1), then go to coarse adjustments (section 5.2) and carry on to adjust purity, static convergence, and dynamic convergence only.
8. Planar Strips: Perform the initial checks (section 5.1), then check dynamic convergence (section 5.3.3).

**Warning: Use adjusting tool, IBM Part 1864853, to adjust potentiometers; screwdriver blades will damage them.**



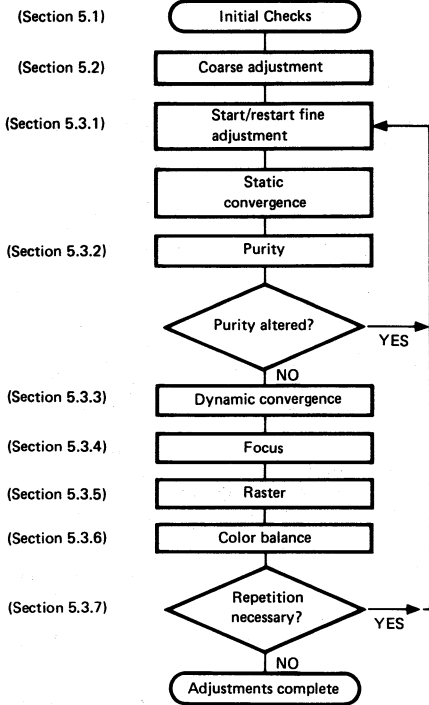
2. Plug the mainline power cable into the customer's outlet.
3. Switch power on and check that indicator 1 (Power Good) is on.
4. Check that indicator 2 (Display Ready) turns on after approximately 45 seconds.

**Note:** The screen will probably brighten when the Display Ready indicator is on.

**CAUTION:**  
Use insulated probes, IBM Part 1749249 or similar, during the next step.

5. Measure the voltages in the following table and ensure they are correct. Go to MAP 0200 if you are unable to obtain the correct voltages. Use the potentiometer mounting plate on the bezel as a ground.

ADJUSTMENT PROCEDURE



ANALOG CARD (P4) PIN	VOLTS (dc)	TOLERANCE (V dc)	RIPPLE (V pk-pk)
20	-135V*	±20	
43	-150	±20	
31	+12	±1.5	
48	+70	+10, -5	
37	+5.0	±0.5	0.25
5	-5.0	±0.5	0.25
30	0	.....	
36	+8.5	±0.9	0.3
POWER SUPPLY CARD (P3) PIN	VOLTS (dc)	TOLERANCE (V dc)	RIPPLE (V pk-pk)
1	+12.0	±1.0	0.4
3	-12.0	±1.0	0.4
2	0	.....	.....
5	+103	±8	3.0
4	0	.....	.....

**5.1 INITIAL CHECKS**

1. Make ready the control unit (see control unit PDG).

\* -150 V through 39 kΩ

6. Turn the BRIGHTNESS potentiometer counterclockwise until the Intensity Override switch operates - a white

raster may appear. (The raster will probably be tinted due to purity/color brightness imbalances.) Now set the potentiometer to its mid-point.

7. Set the TEST/NORMAL switch to TEST. A full screen of characters may appear.

**Note:** The Control Key is used extensively by TEST MODE 3 but is not labelled CONTROL. Refer to the keyboard overlay in Figure 2-3 where the key is shown labelled CONTROL. On most keyboards this will be the RESET key.

**Note:** During the set-up procedure. If X-f appears in the operator information area, press the RESET key and retry the action.

If any action does not produce the expected results, repeat the action and then try repeating the whole section.

If the results are still not as expected you have a failure; go to MAP 0000, Entry Point A.

## 5.2 COARSE ADJUSTMENTS

Start here to completely set up the display after replacing the CRT. See Page 5-1 for the adjustments that are required after other FRU replacements.

Note that these coarse adjustments are intended to give a display that is an acceptable starting point for subsequent fine adjustments (see section 5.3). If any step fails, go to MAP 0000, Entry Point A.

Try to adjust the display without altering the RED MAX potentiometer (except after a CRT or amplifier card change).

Ready the display unit as follows:

1. Switch power on.
2. Turn the operator's brightness control fully clockwise.
3. Wait 45 seconds until Indicator 2 turns on.

### 5.2.1 COARSE COLOR BALANCE

**Note:** See Figure 1-4 for locations of controls.

1. Set the TEST/NORMAL switch to NORMAL.
2. If the display is reasonably bright and the three primary colors are approximately balanced (look at the cursor), then go to section 5.2.2.

#### 5.2.1.1 Green Gun

1. Set the TEST/NORMAL switch to NORMAL then back to TEST.
2. If the screen is completely blank, set the HEIGHT control fully counterclockwise.
3. If the screen is either still blank or is very dim, turn GREEN MAX (and, if necessary, GREEN MIN) clockwise until a reasonably bright image appears. The image will be green unless the static convergence or purity controls are badly out of adjustment.
4. If the HEIGHT control was altered in Step 2, adjust it to give a normal display height.

### 5.2.1.2 Blue Gun

1. Set the TEST/NORMAL switch to NORMAL, then back to TEST.
2. Press keys CONTROL O Q (alpha).
3. If the screen is blank or very dim, turn BLUE MAX (and, if necessary, BLUE MIN) clockwise until a reasonably bright image appears.

### 5.2.1.3 Red Gun

1. Set the TEST/NORMAL switch to NORMAL then back to TEST.
2. Press keys CONTROL O I (alpha).
3. It is better not to move the RED MAX potentiometer if you can continue the adjustments at the existing brightness level. If, however, the screen is blank or very dim, mark the current position of the RED MAX potentiometer. Turn RED MAX (and, if necessary, RED MIN) clockwise until a reasonably bright image appears. If an acceptable image cannot be obtained, set the RED MAX potentiometer back to its marked position and go to MAP 0000, Entry Point A.

### 5.2.2 COARSE RASTER ADJUSTMENT

1. Set the TEST/NORMAL switch to NORMAL and back to TEST to display the test pattern.
2. If the four edges of the pattern are within 3 to 35 mm (0.1 to 1.4 inches) of the sides of the screen, then go to section 5.2.3. Otherwise, adjust the WIDTH and horizontal centering (H

CENT) potentiometers until the vertical edges of the pattern are within 3 to 35 mm (0.1 to 1.4 inches) of the sides of the screen.

3. Adjust the top margin (TOP MAR) potentiometer until the top line is within 3 to 35 mm (0.1 to 1.4 inches) of the top of the screen.
4. Adjust the HEIGHT potentiometer (and if necessary the SKIP potentiometer) until the pattern is within 3 to 35 mm (0.1 to 1.4 inches) of the bottom of the screen.

**Note:** The picture will blank if the Height control is set too low.

### 5.2.3 COARSE FOCUS

1. Set the TEST/NORMAL switch to NORMAL and back to TEST.
2. See Figure 1-4. Adjust the static focus finger control (FOCUS 1) for best focus at screen center.

### 5.2.4 COARSE STATIC CONVERGENCE

At this point the raster may still be badly adjusted and any characters on the screen may be distorted. The color of the screen may still not be correct or uniform.

Note that a control unit that can support the 3279 color display must be available for the following procedures.

1. Display the convergence pattern as follows:
  - a. Set TEST/NORMAL switch to NORMAL.
  - b. Hold down the ALT key and F TEST then release both ke

c. Press keys '/' and '7' and 'ENTER'.

2. If the patterns are within 5 mm (0.2 inches) of each other, go to section 5.2.5.
3. If necessary, adjust the red and green (R and G) 'STATIC CONV CONTROLS' (see Figure 1-4) until the two patterns align vertically and horizontally.
4. Press the R key.
5. Adjust the blue and blue lateral (B and BL) controls until the two patterns align horizontally and vertically.

**Note:** The static blue lateral control is a potentiometer on the amplifier card.

6. Press the R key. If the two patterns have moved apart, return to step 2.

### 5.2.5 COARSE COLOR PURITY

1. Set the TEST/NORMAL switch to NORMAL and back to TEST.
2. Press the following keys to fill the screen with red characters:  
  
CONTROL 0 I (alpha)
3. If necessary, adjust the two (H and V) 'PURITY' potentiometers (see Figure 1-4) until the characters appear RED over all the screen.

## 5.3 FINE ADJUSTMENTS

**Note:** Do not attempt any fine adjustments until the 3279 has been powered on for at least 20 minutes.

### 5.3.1 STATIC CONVERGENCE

This procedure will result in the three colors being correctly converged at the CENTER of the screen.

1. The display must be connected to a control unit that can support the 3279 color display. Step (b) removes the power supply to the convergence store. The control unit will detect a parity error and the default values will be written to the store.
  - a. Switch power off.
  - b. Connect a jumper from B2B08 to B2D08 (short circuit).
  - c. Remove the jumper after 5 seconds.
  - d. Switch power on and wait 45 seconds.
  - e. Set TEST/NORMAL switch to NORMAL. An error code '228' or '55' appears on the screen. Ignore it.
  - f. Hold down 'ALT' key and press 'TEST', then release both keys.
  - g. Press keys '/' and '7' and 'ENTER'.

The pattern '-|-|-' appears at the screen center.

2. The pattern displays in yellow (or green and red if misconverged).
3. Adjust red and green (R and G) 'STATIC CONV CONTROLS' until the two patterns align horizontally and vertically (see Figure 1-4).
4. Press R key. The pattern displays in pink (or red and blue if misconverged).
5. Adjust blue (B) 'STATIC CONV CONTROL' until the patterns align vertically.
6. Adjust blue lateral 'STATIC CONV CONTROL' (see Figure 1-4) until the patterns align horizontally.
7. Go back to step 5 if necessary.
8. Press R key.
9. If the patterns diverge, return to Step 3 and work forward again.
10. Hold down 'ALT' key and press 'TEST', then release both keys. The screen clears.

### 5.3.2 PURITY

1. Jumper D2Y02 to D2Y08. (Force Reverse Video see Figure 1-6).

#### CAUTION:

This jumper must not be left on for more than 30 seconds at a time, otherwise the shadow mask may distort. Remove and replace at each step.

2. Set the TEST/NORMAL switch to NORMAL and then to TEST. Press the following keys:
 

CONTROL 0 I (alpha)
3. Unless the raster is uniformly red, adjust horizontal and vertical (H and

V) 'PURITY' potentiometers (see Figure 1-4) until the red area covers the screen. Pay close attention to the four corners.

**Note:** That as the color becomes pure it also becomes brighter and the adjustment should thus be made to leave the color both as pure and as bright as possible.

4. Set the TEST/NORMAL switch to NORMAL and back to TEST. Check that the raster is uniformly green.

5. Press the following keys:

CONTROL 0 Q (alpha)

Check that the raster is uniformly blue.

6. If the green and blue rasters are not uniform, readjust the two purity potentiometers.
7. If any readjustment was necessary, return to step 1. If raster colors are not acceptable on the second time through the sequence, go to MAP 0000, Entry Point A.
8. Remove jumper D2Y02 to D2Y08.

### 5.3.3 DYNAMIC CONVERGENCE (ONLINE TEST 7)

This procedure converges the screen. The convergence pattern is stepped through 13 areas and each is converged in turn.

**Note:** If, after executing step 1.c, X-f appears in the operator information area, another operator is probably using the convergence routine. Wait a few minutes before trying again. If X-f or any other symbol appears in the operator information area at any other time, press the RESET key and retry the action.

1. Display the convergence pattern as follows:
  - a. Set the TEST/NORMAL switch to NORMAL.
  - b. Hold down the 'ALT' key and press 'TEST', then release both keys. 'TEST' appears in the operator information area.
  - c. Press keys '/' and '7' and ENTER.
9. On the second pass through the complete fine adjustment, when all 13 patterns appear, check the convergence of each pattern. If any need further adjustment, press the spacebar once and return to step 2.

The pattern '-|-|-' appears at the center of the screen. Adjust the brightness control if necessary.

2. Use cursor control control keys to move the green pattern until the red and green images are superimposed (as closely as possible) to give a yellow pattern.
3. Press the R key.
4. Use the cursor keys again to move the blue pattern until the blue and red images are superimposed (as well as possible) and give a pink pattern.
5. Press the R key and go back to step 2 at least once to check.
6. Press the spacebar once or twice until the pattern appears in the next position.
7. When you press the spacebar after converging the 13th area, the (white) pattern appears simultaneously in all 13 positions. Until this happens go back to step 2 to continue converging.
8. On the first pass through the complete fine adjustment, when all 13 patterns appear, hold down ALT and press TEST, then release both. The screen will clear. Go to section 5.3.4.
10. If, on the second pass, you cannot converge the screen, then there is a fault. If you have exchanged the amplifier card go to section 5.3.8; otherwise, go to MAP 0600, Entry Point A.
11. Hold down the 'ALT' key and press 'TEST', then release both keys. The screen will clear.

#### 5.3.4 FOCUS ADJUSTMENTS

1. Set the TEST/NORMAL switch to NORMAL and then to TEST.
2. Set the 'FOC 2' potentiometer fully counterclockwise.
3. Adjust the 'FOCUS 1' potentiometer for sharpest image in the FOCUS area on the alignment mask (see Figure 5-1).
4. Adjust the 'FOC 2' potentiometer if necessary, then go back to step 3.
5. Change the color of the characters on the screen and verify that an optimum focus setting has been achieved.
  - a. Green: Set TEST/NORMAL switch to NORMAL and back to TEST.
  - b. Blue: Press keys CONTROL C CONTROL BB CONTROL O Q (alpha).
  - c. Red: Press keys CONTROL C CONTROL BB CONTROL O I (alpha).

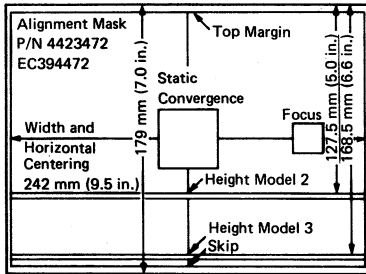


Figure 5-1. CRT Alignment Mask

1. Adjust the top margin (TOP MAR) potentiometer until the top character row is centered in the top space on the alignment mask.
2. Adjust the WIDTH and horizontal centering (H CENT) potentiometers until the vertical edges of the images are correctly aligned.
3. Model 2 only Jumper C2J04 to D2D08 (ground). (Disable interrow skip.)
4. Adjust the HEIGHT potentiometer until the bottom trace of the last character row above the divider line centers on the HEIGHT space (for the correct model) on the alignment mask.
5. Model 2 only Remove jumper C2J04 to D2D08.

### 5.3.5 RASTER CONTROLS

**Note:** The raster controls may be set accurately only when the display is online, that is, converged, and viewed from a normal operating position.

1. Set the TEST/NORMAL switch to NORMAL.
2. Hold down the ALT key, press TEST, release both.
3. Jumper C2G06 to D2J08 (ground). Characters will fill the screen.
4. Attach the alignment mask (Figure 5-1) to the CRT face.
5. Adjust the top margin (TOP MAR) potentiometer until the top character row is centered in the top space on the alignment mask.
6. Adjust the WIDTH and horizontal centering (H CENT) potentiometers until the vertical edges of the images are correctly aligned.
7. Repeat steps 5 through 10 until the picture height and interrow gaps are correct.
8. Remove the alignment mask.

#### 5.3.5.2 Pincushion

1. Adjust the East and West (E + W) pincushion potentiometer on the analog card (Figure 1-4) until the vertical edges of the image are straight.
2. Adjust the North and South (N + S) pincushion potentiometer so that the top and bottom edges of the image are straight.
3. Repeat steps 1 and 2 if necessary.
4. Remove the jumper C2G06 to D2J08.

#### 5.3.5.1 Raster Centering/Size Controls

Figure 1-4 shows the location of the controls referred to in the following steps. If any of the following controls has insufficient range to produce the desired adjustment, set it as nearly as possible and continue.

### 5.3.6 COLOR BALANCE

This procedure also sets the maximum brightness. If this is too high, the life of the CRT will be shortened. If possible, avoid altering the setting of the R MAX and R MIN potentiometers. The 3279 must be connected to an active control unit, otherwise misconvergence will cause problems.

1. Set the TEST/NORMAL switch to NORMAL then back to TEST.
2. Press keys CONTROL [B] O (alpha) I.
3. Turn the brightness control fully clockwise.
4. If you have exchanged the CRT or the amplifier card, go to step 6.
5. The brightness of the red character should be correct; if possible, compare it with another 3279 of the same model. If the brightness is correct, go to step 11.
6. Ensure that the focus adjustments have been done (see section 5.3.4).
7. Turn the R MIN potentiometer to its mid position.
8. Find an '@' near the right-hand side of the fifteenth row. Adjust the R MAX potentiometer until the center of the '@' is just filled in. View the display from directly in front of the screen and turn back the potentiometer until the '@' is clear.  
**Note:** CRT life will be shortened if the brightness is too high.
9. Turn the BRIGHTNESS control fully counterclockwise (but not past the intensity override switch). Adjust the RED MIN potentiometer until the characters are just visible (move the screen away from direct light if necessary).
10. Turn the BRIGHTNESS control fully clockwise. Check step 8.
11. Set the TEST/NORMAL switch to NORMAL.
12. Connect the CE jumper D2Y09 to D2Y08 (ground). This will maintain convergence in Test Mode.
13. Set the TEST/NORMAL switch to TEST and press keys [C]. The screen fills with a pattern of characters.
14. Jumper C2W09 to C2W28 (color bars).
15. Set the B MIN and G MIN color balance potentiometers to their mid positions.
16. Ensure that the brightness control is turned fully clockwise.
17. Adjust the G MAX potentiometer until the green areas are as bright as the red, and the yellow is good.
18. Adjust the B MAX potentiometer until the blue areas are as bright as the red, and the turquoise, pink, and white areas are good.
19. Jumper D2Y02 to D2Z04 (reverse video); use E2Z04 if D2Z04 is not available.
20. Turn the BRIGHTNESS control to MINIMUM (counterclockwise) but not past the switch into intensity override.
21. Adjust the G MIN and B MIN potentiometers so that the green and blue areas are as dim as the red; and the yellow, turquoise, pink and white areas are good.
22. Remove the jumper from D2Y02 and D2Z04 (or E2Z04).
23. Turn the brightness control to MAXIMUM and back again to check that the color balance is good over the



whole range of the control. Pay special attention to the white areas. Make small adjustments if necessary (but not to R MAX or R MIN).

24. Remove the jumpers.

### 5.3.7 REPETITION

1. If necessary repeat the sequence of fine adjustments. Only small changes in the settings should be necessary and the repetition steps within the procedure can be omitted. Go to section 5.3.
2. If you have been through the complete procedure three times, and the display is still not satisfactory, go to MAP 0100, Entry Point A.
3. Return the brightness control to a normal setting. Set the TEST/NORMAL switch to NORMAL. Replace the MIM and close the covers.

### 5.3.8 CONVERGENCE AMPLIFIER GAIN CONTROLS

The amplifier card has gain controls for the four convergence amplifiers. These are preset at the manufacturing plant and should NOT need adjustment. However, if you fail to achieve dynamic convergence after exchanging this card, readjustment may be necessary. When the gain is too low, the patterns have too little movement to converge; when too high, the patterns move in large steps with insufficient control to align precisely.

Before making any adjustments:

1. Use Online Test 7 to confirm that you can move the pattern in the correct direction. See MAP 0600.

2. Check that the convergence coil assembly is correctly aligned on the neck of the CRF (see Figure 4-8).
3. Measure the supplies to the amplifier card:

Amplifier Card Test Point (see Figure 6-10)	Voltage and Tolerance
K	+12 V dc $\pm 1.5$ V
N	-12 V dc $\pm 1.5$ V

4. If any of these checks fail, go to MAP 0600 (Entry Point A).
5. Write down the settings of the gain controls.
6. Normally controls R, G, and B (Red, Green and Blue) are set 3/4 clockwise, and B LAT (Blue Lateral) is set fully clockwise (Maximum Gain).
7. If any are set to a position that is not normal, set them to normal and try the convergence routine again. (section 5.3.3). If you know which gain is set wrongly adjust only that control.
8. If convergence still fails, set all controls to maximum gain and try again (see section 5.3.3).
9. If convergence still fails, put the gain controls back to the settings you wrote down. Go to MAP 0600 Entry Point A.

If convergence is now working return to Section 5.3.3.

6.0 CHAPTER 6. SUPPORT INFORMATION

6.1 BLOCK DIAGRAM

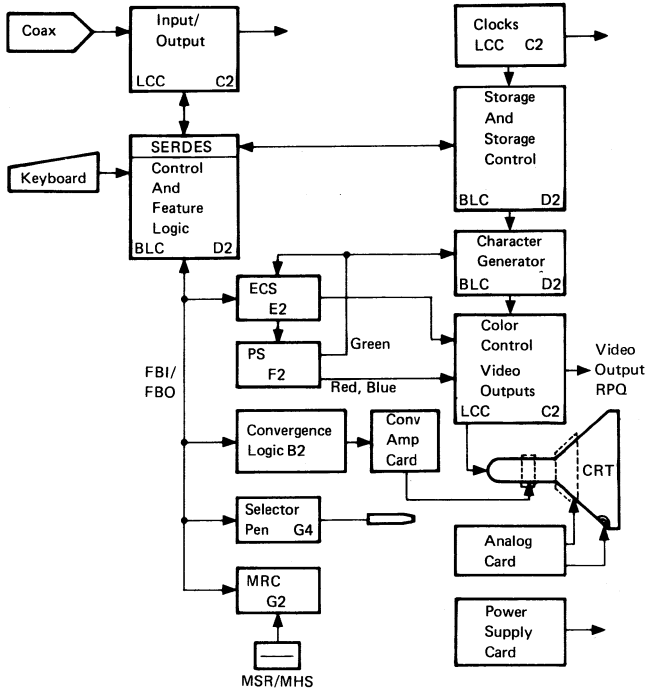
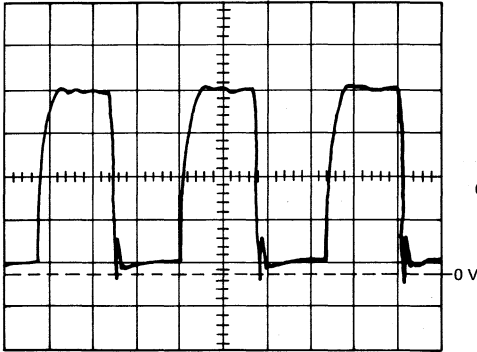


Figure 6-1. 3729 Block Diagram

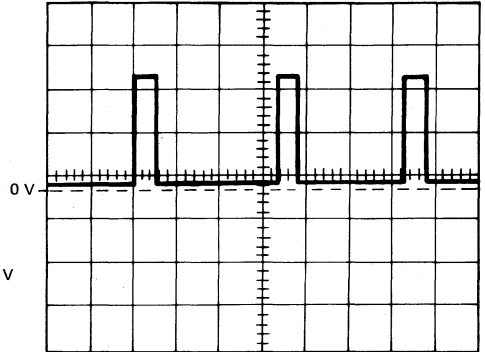
**6.2 3279 CONTROL SIGNALS**

**6.2.1 WAVEFORMS**



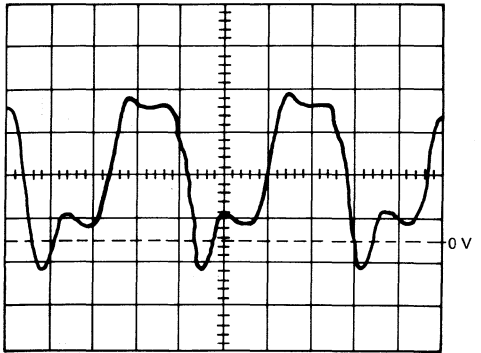
**Feature Clock**

Scopepoint C2 M08 Sync. Internal  $0.2 \mu\text{s}/\text{cm}$ ,  $1\text{V}/\text{cm}$  x 10 probe. If bad, change card C2 then B2, D2, E2.



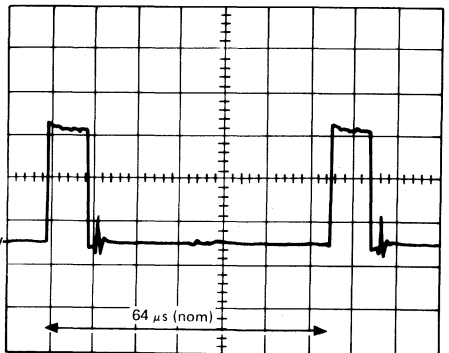
**Horizontal Retrace**

Scopepoint B2 G13 Sync. Internal  $20 \mu\text{s}/\text{cm}$ ,  $2\text{V}/\text{cm}$  x 10 probe. If bad, change card D2 then B2.



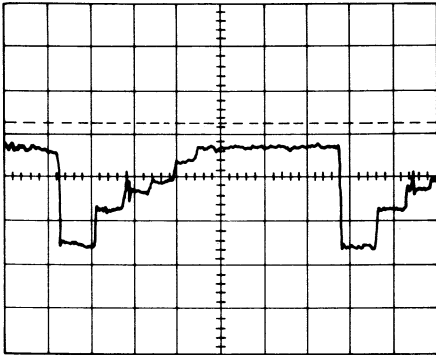
**14 MHz Clock**

Scopepoint C2 P13 Sync. Internal  $20 \text{ns}/\text{cm}$ ,  $1\text{V}/\text{cm}$  x 10 probe. If bad, change card C2.



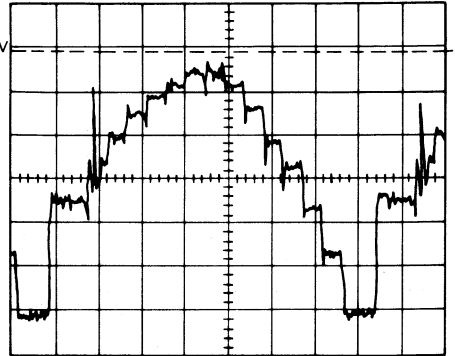
**Horizontal Sync.**

Scopepoint B2 J13 Sync. Internal  $10 \mu\text{s}/\text{cm}$ ,  $1\text{V}/\text{cm}$  x 10 probe. If bad, change card B2 then analog.



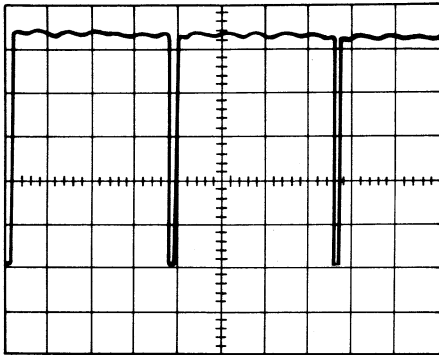
Example of Convergence Parabola for Badly Converged Screen

Scopepoint B2 S06 Sync. etc. as for Convergence Parabola  
If unable to converge, change card B2 then analog.



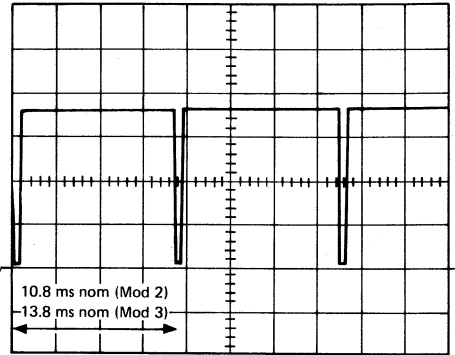
Convergence Parabola

Scopepoint B2 S06 Sync C2 Z08 (Indicator Row) Use  
delayed sweep 2 ms/cm, Main sweep 10  $\mu$ s/cm, Delayed  
sweep 0.2V/cm x 10 probe  
If bad, change card B2 then analog



— Skip (Model 2 only)

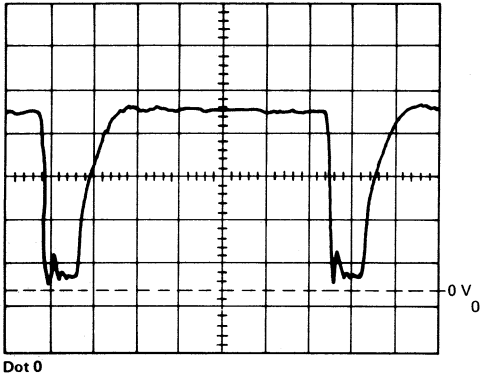
Scopepoint B2 G10 Sync. Internal 1V/cm, 0.1 ms/cm x 10 probe.  
If bad, change card C2 then D2.



— Skip Out (Model 2 only)

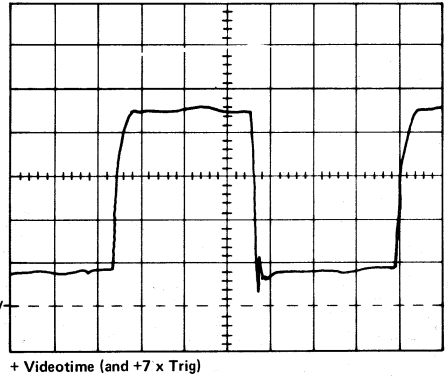
Scopepoint B2 J11 Sync. Internal 1V/cm x 10 probe.  
If bad, change card B2 then analog.

Figure 6-2 (Part 1 of 2). Waveforms



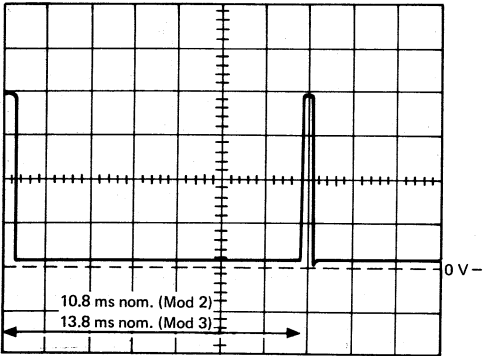
Dot 0

Scopepoint C2 B04 Sync. Internal  $0.1 \mu\text{s}/\text{cm}$ ,  $1\text{V}/\text{cm} \times 10$  probe. If bad, change card C2 then D2, E2, F2.



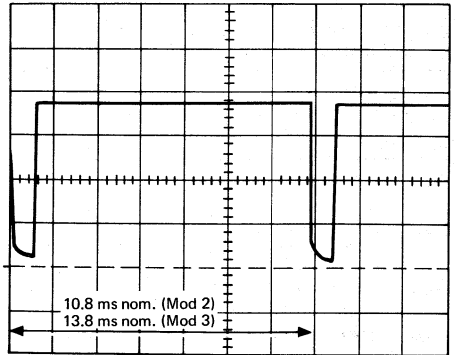
+ Videotime (and +7 x Trig)

Scopepoints C2 D02 C2 J10 Sync. Internal  $0.2 \mu\text{s}/\text{cm}$ ,  $1 \text{V}/\text{cm} \times 10$  probe. If bad, change card D2, then C2, E2, F2.



+ Indicator Row

Scopepoint C2 Z08 Sync. Internal  $1\text{V}/\text{cm} \times 10$  probe. If bad, change card D2 then C2, E2.

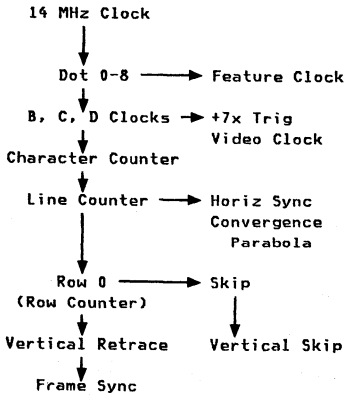


Frame Sync.

Scopepoint C2 G12 Sync. Internal  $1\text{V}/\text{cm} \times 10$  probe. If bad, change card B2 then analog

Figure 6-2 (Part 2 of 2). Waveforms

### 6.2.2 ACTIVATION SEQUENCE



This diagram is a representation of some of the main control signals in the 3279, and the sequence in which they are developed.

The following connector strip diagrams show how these signals are distributed around the machine.

### 6.3 TOP CARD CONNECTOR AND PLANAR STRIP WIRING

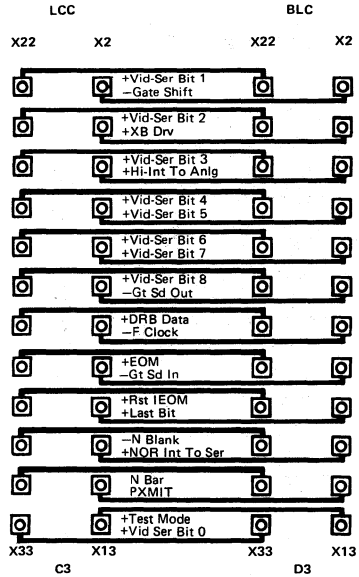


Figure 6-3 (Part 1 of 4). Top Card Connectors

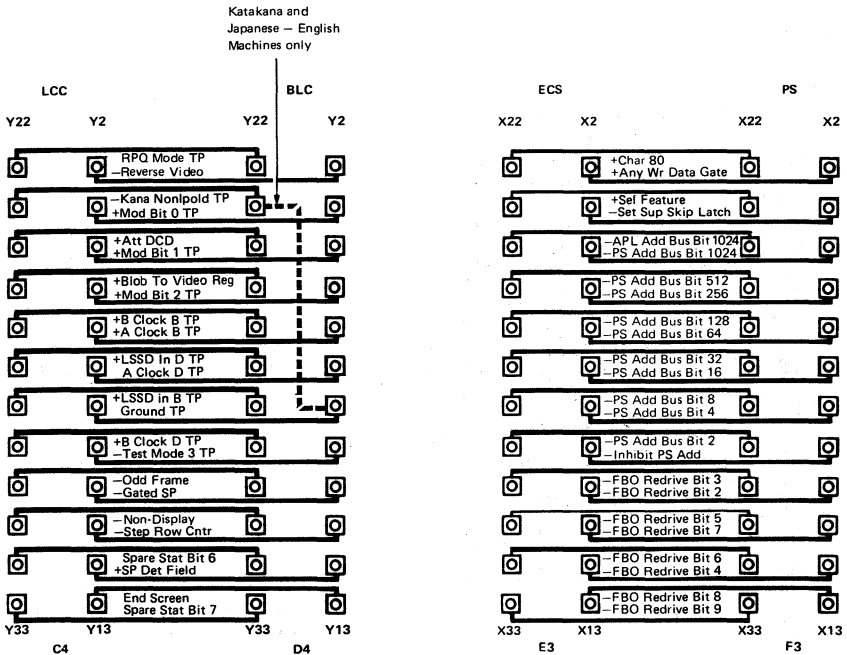


Figure 6-3 (Part 2 of 4). Top Card Connectors

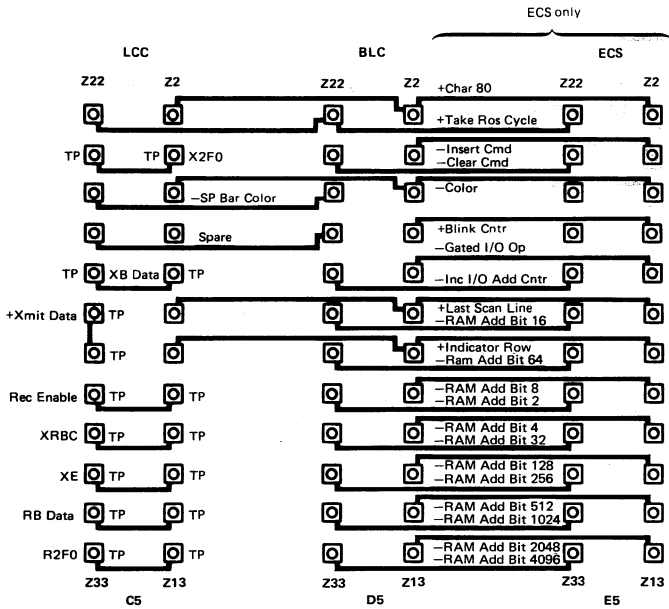


Figure 6-3 (Part 3 of 4). Top Card Connectors



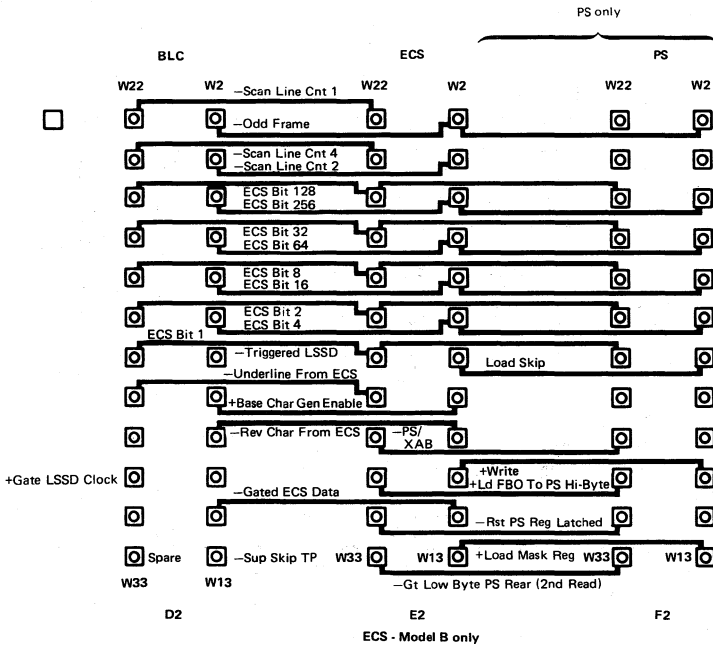
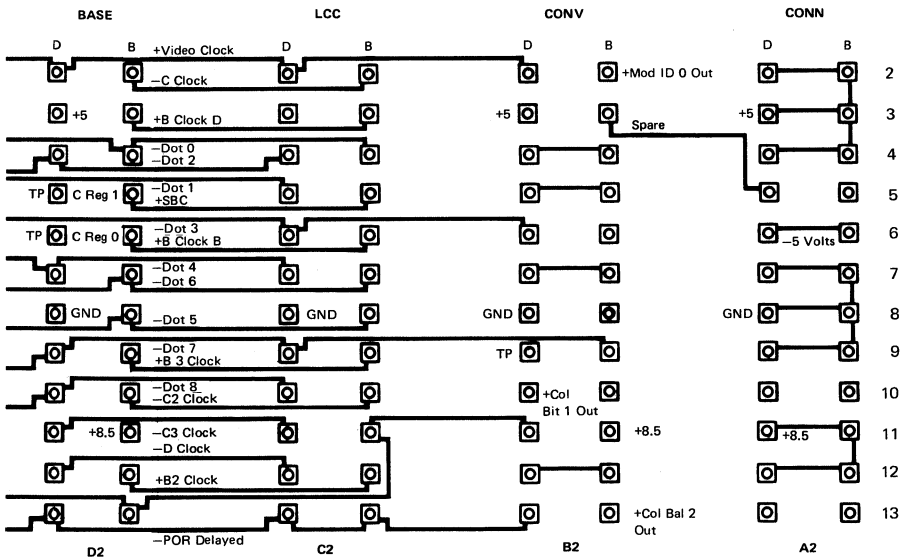
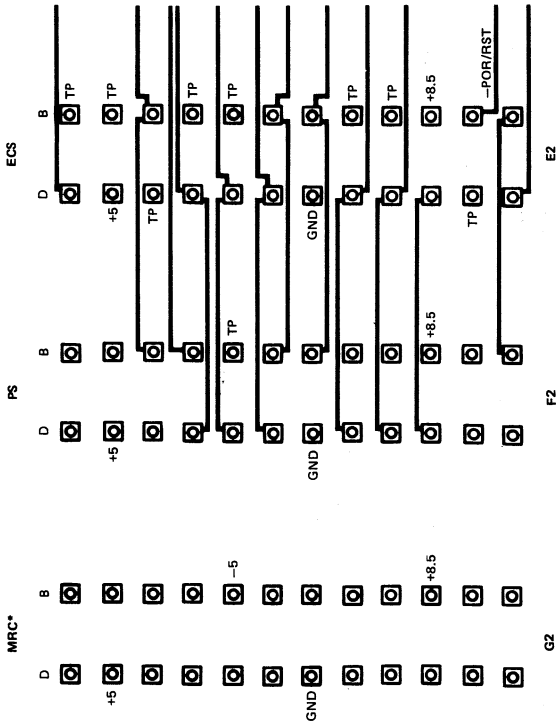


Figure 6-3 (Part 4 of 4). Top Card Connectors

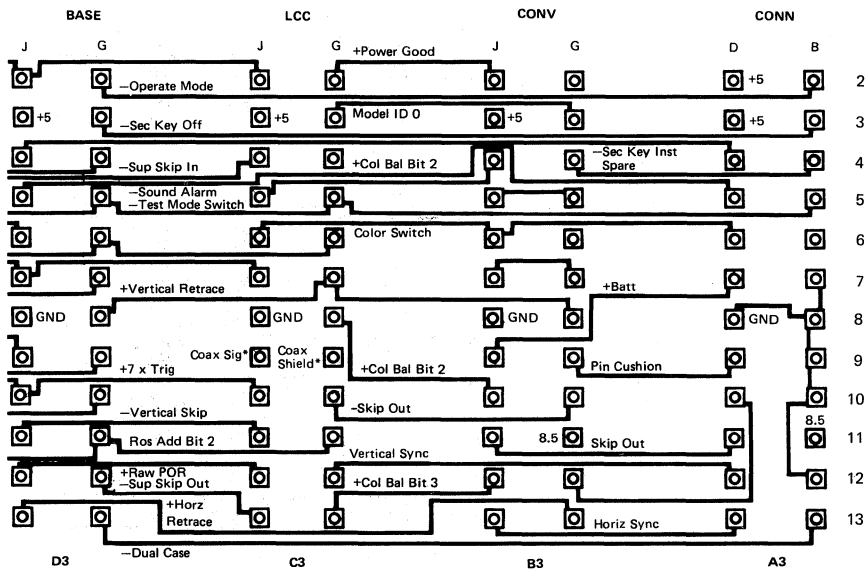
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\*Note that there is also a cable between G2 and G4 when MRC is installed.

Figure 6-4 (Part 1 of 2). Planar Strips - BD



\*Coaxial cable

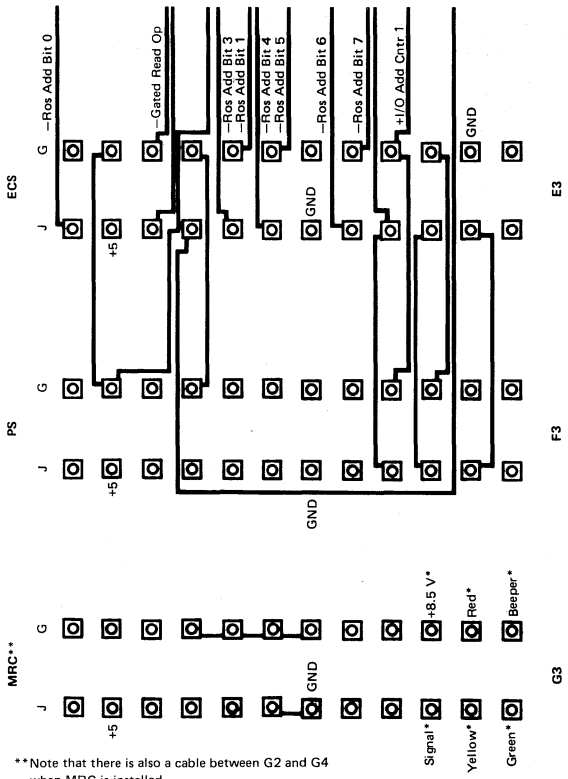
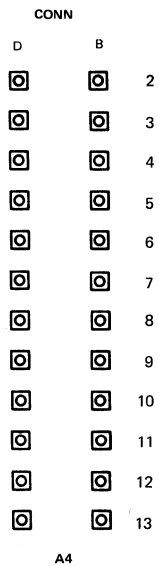
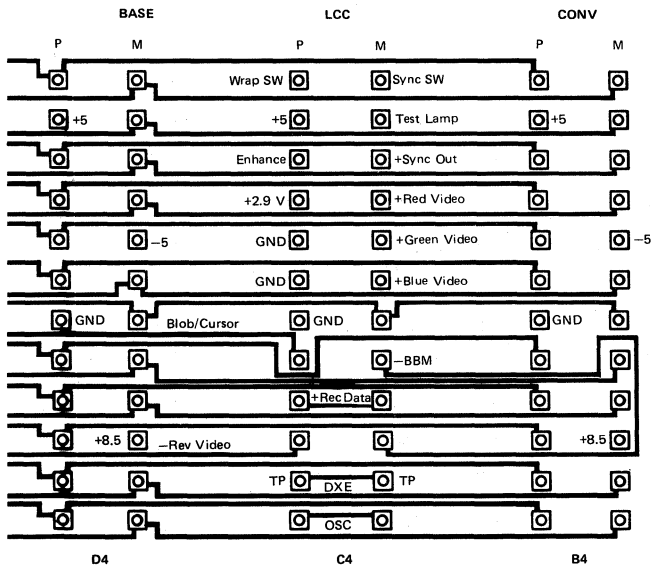


Figure 6-4 (Part 2 of 4). Planar Strips - BD



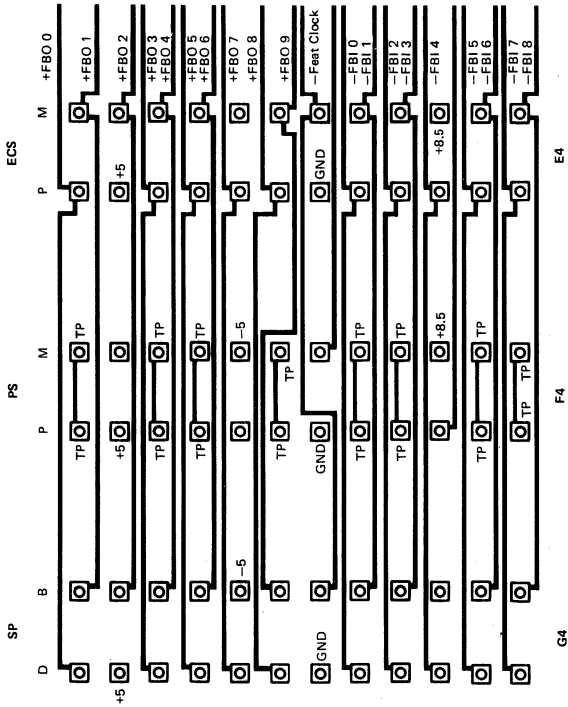
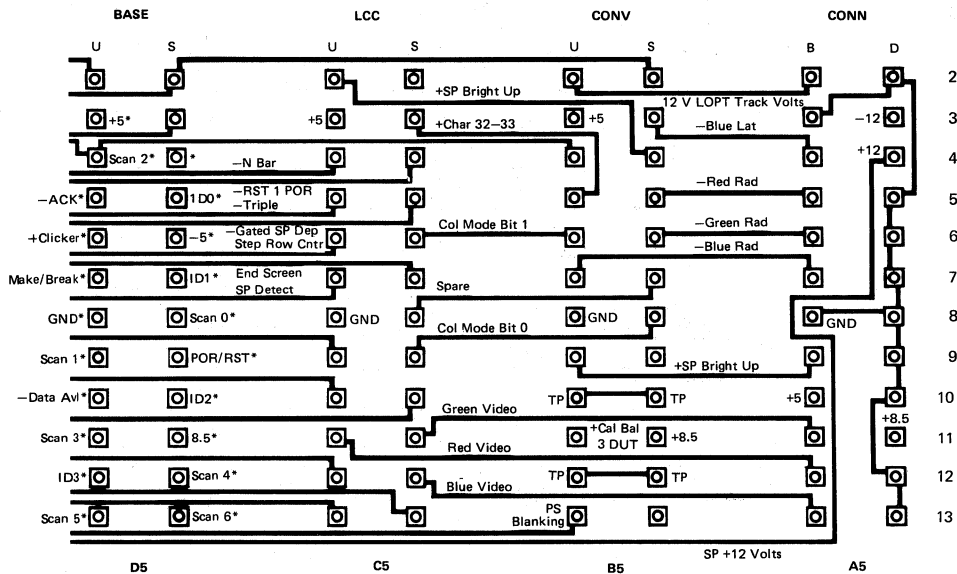
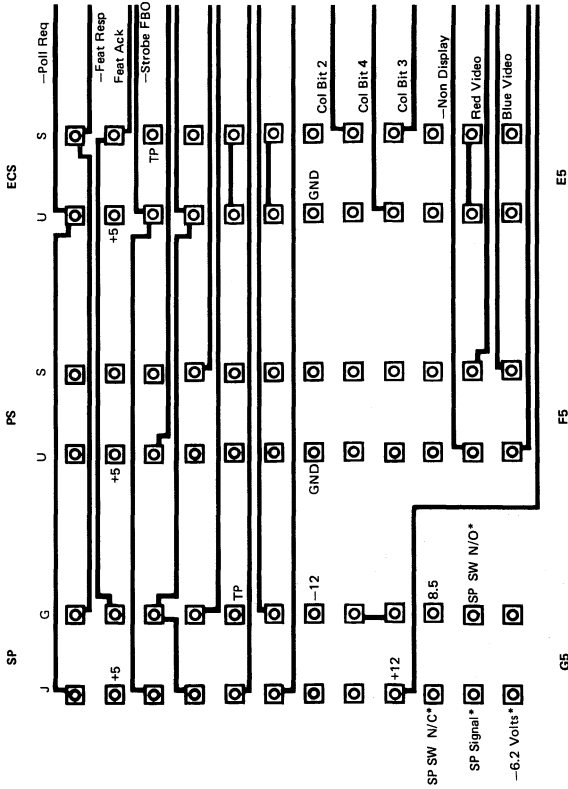


Figure 6-4 (Part 3 of 4). Planar Strips - MP





\*Keyboard cable



\*Selector Light Pen Cable

Figure 6-4 (Part 4 of 4). Planar Strips - MP



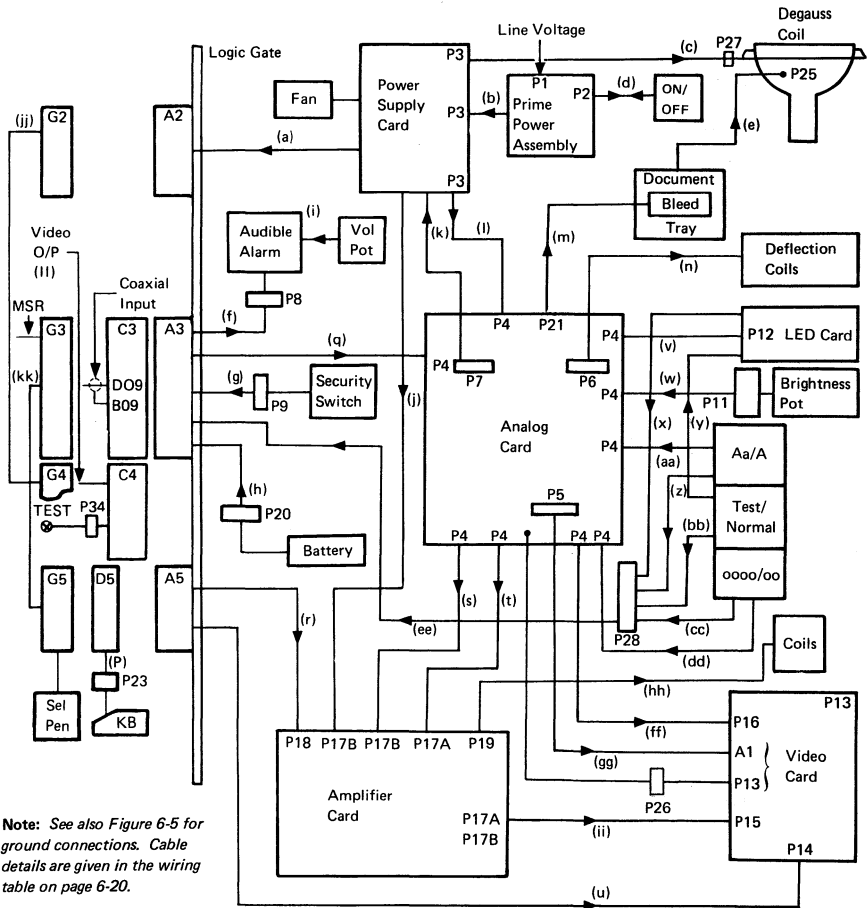


Figure 6-6. Cabling Diagram

Wiring Table (see Figure 6-6)

Cable	Description	From	To
a	+5 V dc		A2D02
	+5 V dc		A2B02
	+5 V dc		A2D03
	+5 V dc		A2B03
	+5 V dc		A2D04
	+5 V dc		A2B04
	+12 V dc	Hard-Wired	A2B05
	-5 V dc		A2D06
	-5 V dc	at	A2B06
	0 V dc		A2D07
	0 V dc	Power Supply	A2B07
	0 V dc		A2D08
	0 V dc		A2B08
	0 V dc		A2D09
	0 V dc		A2B09
	-12 V dc		A2B10
+8.5 V dc		A2D11	
+8.5 V dc		A2B11	
+8.5 V dc		A2D12	
+8.5 V dc		A2B12	
b	Line	Hard-wired to fuseholder	P3-10
	Neutral	P2-2	P3-15
	Ground	Screw #6	P3-7
	Ground	Screw #6	P3-16
c	Degauss	P3-12	P27-2
	Neutral	P3-13	P27-1
d	Line (Switched)	P2-1	6 hard-wired
	Neutral (Switched)	P2-2	3 at power
	Neutral	P2-3	2 switch
	Line	P2-4	5
e	EHT Anode	Bleed Asm 2	P25
f	+5 V dc (red)	A3D02	P8-1
	0 V dc (black)	A3D08	P8-3
	Sound Alarm (yellow)	A3D05	P8-4
g	Security Key Op	P9-1	A3B03
	Security Key Ins	P9-4	A3D04
	Security Key Gnd	P9-3	P4-6
h	Battery +ve	P20-4	A3D07
	Battery -ve	P20-1	A3B07

Wiring Table (continued)

Cable	Description	From	To
i	Vol Pot 1	3 (cw)	Alarm A1
	Vol Pot 2	1 (ccw) + 2	Alarm A3
j	+12 V dc	P3-1	P17B-4
	+12 V dc return	P3-2	P17B-6
	-12 V dc	P3-3	
k	LOPT Return	P7-1	P3-9
	LOPT Sense	P7-2	P3-8
l	103 V dc Return	P3-4	P4-14
	103 V dc	P3-5	P4-15
m	EHT P21		Bleed 1
n	Horiz Drive	P6-6	Hard-wired at yoke
	Horiz Return	P6-3	
	Vert Drive	P6-1	
	Vert Return	P6-4	
	Horiz Supply Voltage	P6-2	
p	+5 V dc	P23-16	D5D03
	Scan Bit 2	P23-3	D5B04
	KB Ack	P23-4	D5D05
	KB Ident Bit 0	P23-17	D5B05
	Clicker	P23-5	D5D06
	-5 V dc	P23-19	D5B06
	Make/Break	P23-6	D5D07
	KB Ident Bit 1	P23-18	D5B07
	DC Return	P23-11	D5D08
	Scan Bit 0	P23-23	D5B08
	Scan Bit 1	P23-8	D5D09
	POR	P23-21	D5B09
	Data Available	P23-9	D5D10
	KB Ident Bit 2	P23-22	D5B10
	Scan Bit 3	P23-10	D5D11
	+8.5 V dc	P23-20	D5B11
	KB Ident Bit 3	P23-7	D5D12
Scan Bit 4	P23-14	D5B12	
Scan Bit 5	P23-12	D5D13	
Scan Bit 6	P23-2	D5B13	
q	+5 V dc	A3D03	P4-34
	-5 V dc	A3B06	P4-29
	+8.5 V dc	A3B11	P4-35
	Skip	A3D11	P4-26

## Wiring Table (continued)

Cable	Description	From	To
q	Vert Sync	A3D12	P4-28
	Horiz Sync	A3D13	P4-1
	0 V	A3B09	P4-30
	Ground	A3B10	P4-4
	Ground Separator	A3B04	-
	Ground Separator	A3B12	-
r	12 V dc LOPT	A5D02	P18-13
	12 V dc LOPT Return	A5B02	P18-12
	Ground Separator	A5D03	P18-10
	-12 V dc	A5B03	P18-15
	Lateral Blue	A5D04	P18-11
	+12 V dc	A5B04	P18-14
	Radial Red	A5D05	P18-9
	Ground Separator	A5B05	P18-8
	Radial Green	A5D06	P18-7
	Ground Separator	A5B06	P18-6
	Radial Blue	A5D07	P18-5
	Ground Separator	A5B07	P18-4
	Blue Bright-Up	A5D09	P18-3
Ground Separator	A5D09	P18-1	
s	Display Ready	P4-32	P17B-7
	12 V dc LOPT	P4-31	P17B-8
t	Bri Pot Wiper	P4-44	P17A-1
	Bri Pot	P4-41	P17A-3
	Bri Pot Return (-150 V)	P4-20	P17A-5
u	0 V dc	A5D08	P14-4
	Ground Separator	A5B08	P14-6
	+5 V dc	A5D10	P14-1
	Ground Separator	A5B10	P14-8
	Green Video	A5D11	P14-5
	+8.5 V dc	A5B11	P14-3
	Red Video	A5D12	P14-7
	Ground Separator	A5B12	P14-10
	Blue Video	A5D13	P14-9
Ground Separator	A5B13	P14-11	
v	0 V dc	P12-6	P4-10
	+5 V dc	P12-7	P4-12
	Display Ready	P12-8	P4-33

Wiring Table (continued)

Cable	Description	From	To
w	BRI1	P11-6	P4-17
	BRI2	P11-7	P4-19
	BRI3	P11-8	P4-16
	Intensity Override Sw. 4	P11-3	P4-42
	Intensity Override Sw. 2	P11-4	P4-18
	Intensity Override Sw. 1+3	P11-5	P4-43
x	Test	P12-3	P28-3
y	Test	Test Sw. Top	P12-4
	0 V dc	Test Sw. Center	P12-5
z	Dualcase	A,a/A Sw. Bottom	P28-5
aa	0 V dc	A,a/A Sw. Center	P4-9
bb	Operate	Test Sw. Bottom	P28-4
cc	Base Col Supp	oooo/oo Sw. Bottom	P28-1
dd	0 V dc	oooo/oo Sw. Center	P4-7
ee	Test	P28-3	A3B05
	Operate	P28-4	A3B02
	Color Switch	P28-1	A3D06
	Monocase Switch	P28-5	A3B13
ff	70 V dc	P4-23	P16-1
	70 V dc Return	P4-24	P16-7
	+6.3 V dc	P4-25	P16-3
	+6.3 V dc Return	P4-22	P16-4
	Intensity Override	P4-13	P16-5
gg	A1 (+280 to +450 V dc)	P5-3	hard-wired
	Focus (6 k V)	P26	hard-wired
hh	Blue Radial Return	P19-8	Radial Card 1
	Blue Radial Drive	P19-7	Radial Card 2
	Green Radial Return	P19-10	Radial Card 3
	Green Radial Drive	P19-9	Radial Card 4
	Red Radial Return	P19-12	Radial Card 5
	Red Radial Drive	P19-11	Radial Card 6
	Vertical Purity Drive	P19-1	Purity Card 1
	Purity Return	P19-4	Purity Card 2
	Horizontal Purity Drive	P19-3	Purity Card 3
	Lateral Drive	P19-5	Lateral Card 2
	Lateral Return	P19-6	Lateral Card 1



## Wiring Table (continued)

Cable	Description	From	To
ii	Red Grid	P17B-7	P15-1
	Green Grid	P17B-9	P15-5
	Blue Grid	P17B-1	P15-3
jj		G2B02	G4B02
		G2D02	G4D02
		G2B03	G4B03
		G2B04	G4B04
		G2D04	G4D04
		G2B05	G4B05
		G2D05	G4D05
		G2D06	G4D06
		G2B07	G4B07
		G2D07	G4D07
		G2B08	G4B08
		G2B09	G4B09
		G2D09	G4D09
		G2B10	G4B10
		G2D10	G4D10
	G2D11	G4D11	
	G2B12	G4B12	
	G2D12	G4D12	
	G2B13	G4B13	
	G2D13	G4D13	
kk		G2G02	G4G02
		G2J02	G4J02
		G2G03	G4G03
		G2G04	G4G04
		G2J04	G4J04
		G2J05	G4J05
ll	Sync Out	C4B04	J30
	Red Video	C4B05	J31
	Green Video	C4B06	J32
	Blue Video	C4B07	J33
	Wrap Test	C4D02	Video Ctl Sw. - Top
	Sync Polarity	C4B02	Sync Pol Sw. - Bot
	Ground	C4D08	Video Ctl Sw. - Ctr
	Ground	C4D08	Sync Pol Sw. - Ctr
	+5 V dc	C4D03	P34-1
	Signal Test Lamp	C4B03	P34-4
	Blue Enhance	C4D04	Video Ctl Sw. - Bot

## 6.5 CRT DRIVE CIRCUITS

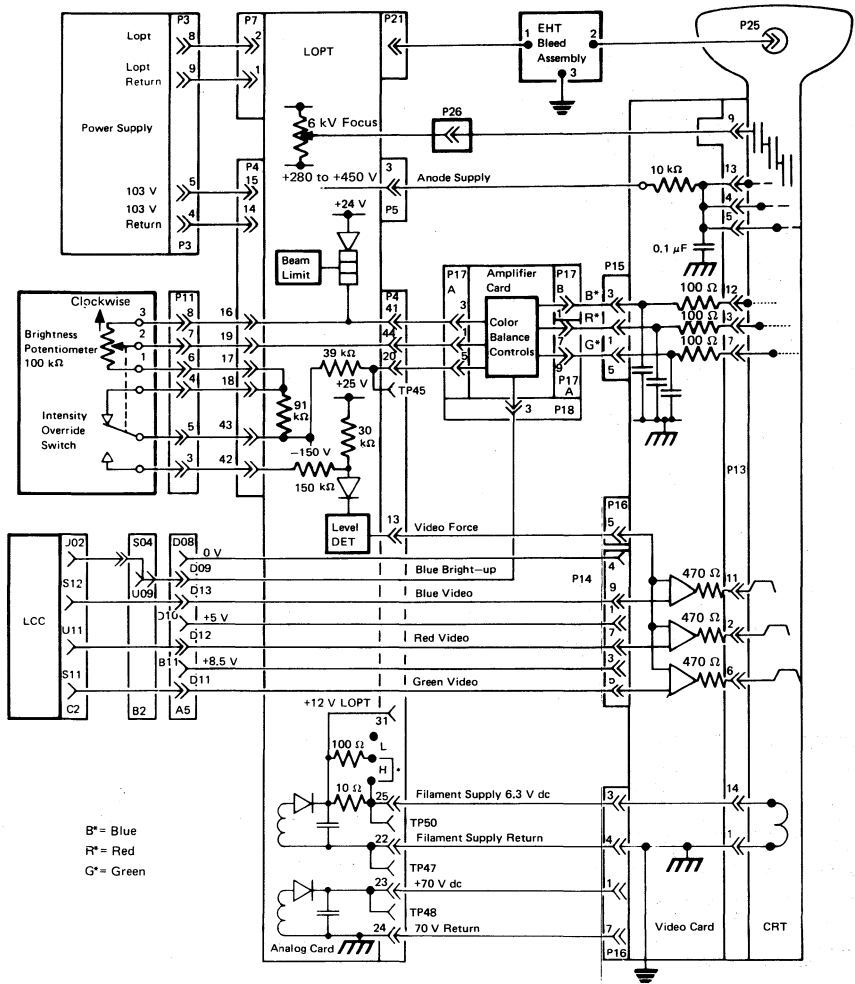
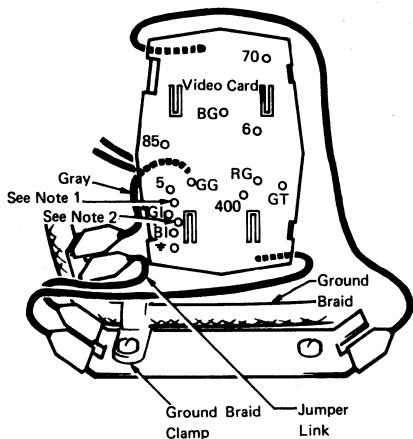


Figure 6-7. CRT Drive Circuits





Video Card – Rear View

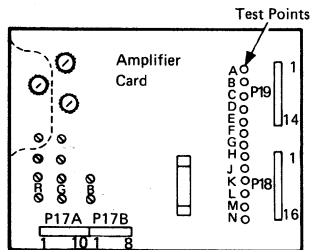
Figure 6-9. Video Card Test Points

Test Point	Description
5	+5 V dc
8.5	+8.5 V dc
70	+70 V dc (video amps)
⊖	Return 0 V
6	+6.3 V dc (Heater)
RI	Red } Video Amp.
GI	Green } Inputs
BI	Blue } (0.5 V)
400	Anode Voltage (+280 to +450 V dc)
GT	Intensity Override (0.5 V)
RG	Red } Grid
GG	Green } Voltages
BG	Blue } (0 to -150 V)

Notes:

1. RI (all cards except p/n 5148396)
2. RI (card p/n 5148396)

**CAUTION:** Probing the wrong RI point may short-circuit land patterns and damage cards.



A	Blue Lateral	Convergence	J	Blue Bright-up
B	Blue		K	+12 V dc (Fused)
C	Green		L	-150 V dc
D	Red	Drive	M	+12 V dc
E	Red		N	-12 V dc
F	Green	Analog Inputs from B2 card		
G	Blue			
H	Blue Lateral			

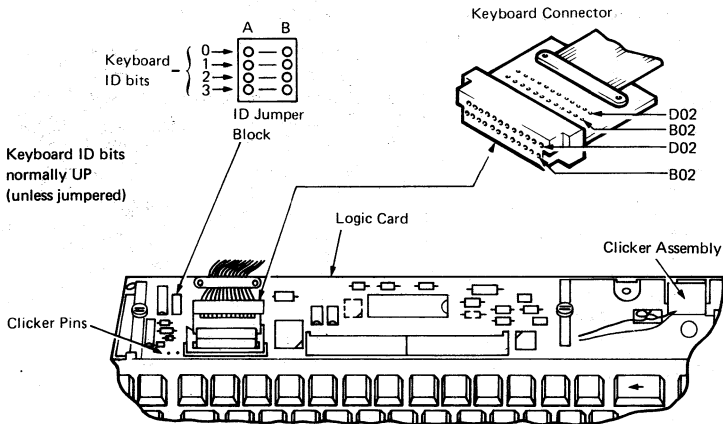
Figure 6-10. Amplifier Card Test Points

**6.7 KEYBOARD JUMPERS AND CABLES**

	Jumper Positions	Keyboard ID response (See Test Mode 3) Ensure that the A,a/A switch is set to A,a.	
		Model 2	Model 3
Reserved	-	Q	X
Reserved	1	U	W
Typewriter	3	C	S
Typewriter with Numeric Lock	1, 3	E	G
Data Entry	2	B	▶
Data Entry with Numeric Lock	1, 2	u	w
Data Entry, Keypunch	2, 3	é	Z
Data Entry, Keypunch with Numeric Lock	1, 2, 3	e	g
APL with PSHICO	0	Ü	È
RPO	0, 1	:	┘
Text	0, 3	Û	Ö
Text with Numeric Lock	0, 1, 3	4	6
APL	0, 2	ü	è
APL with Numeric Lock	0, 1, 2	/	ı
Typewriter with PSHICO	} 0, 2, 3	û	ö
Overlay with PSHICO			
Reserved	0, 1, 2, 3	4	6

If PSHICO present, Numeric lock is specified at CU customization and not by the keyboard I/D

PSHICO = PS, Highlighting and Color select on PF Keys (not valid on 3276 CU)



**Figure 6-11. Keyboard Logic and Connector**

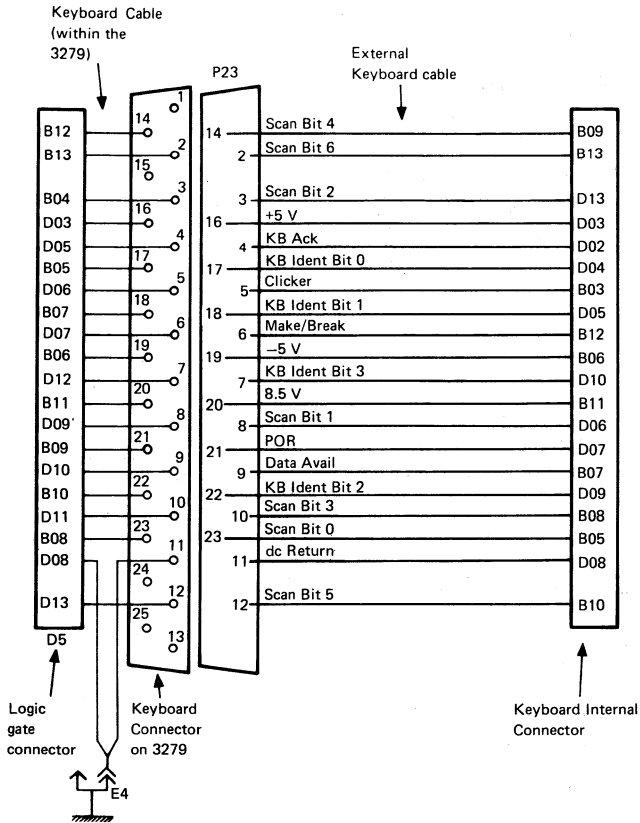


Figure 6-12. Logic Gate to Keyboard Cable

6.8 ATTACHMENT CABLING

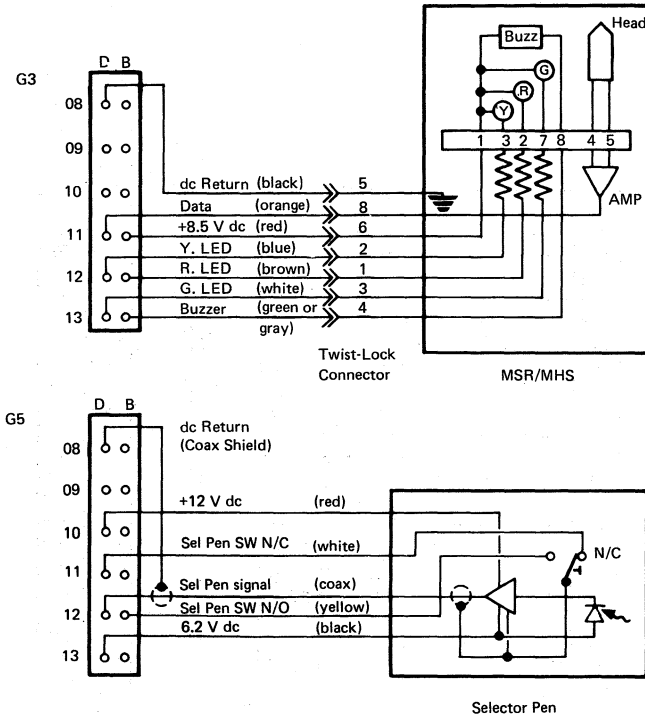


Figure 6-13 (Part 1 of 2). Attachment Cabling

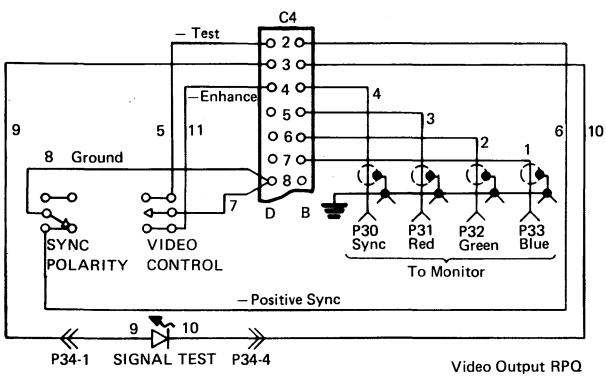
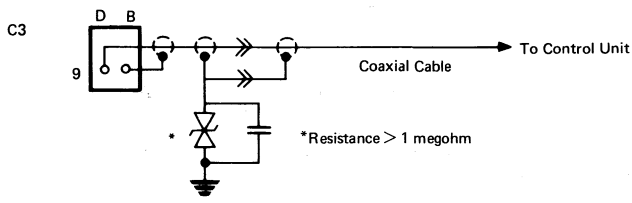
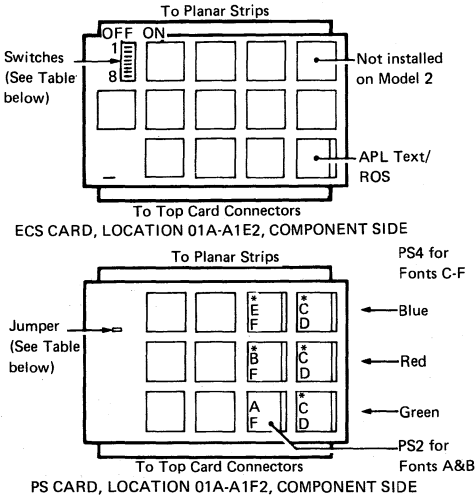


Figure 6-13 (Part 2 of 2). Attachment Cabling



**6.9 ECS AND PS CARD LAYOUTS**



\* PS4 only, install with bevel as shown

Feature	ECS Card Switches				PS Card **
	SW 2	SW 3	SW 1 & 4	SW 5-8	Jumper
No PS	OFF	OFF	ON	NOT USED	NO CARD
PS 2 **	OFF	ON	ON	USED	INSTALL
PS 2 PS 4 **	ON	ON	ON		NO

\*\* These features are only supported in the 3279 by certain control units (for example, 3274). If the feature is not supported by the control unit (including its features and customization), set switches SW2 and SW3 OFF. See Figures 2-6 and 2-7 for relevant error codes.

**Figure 6-14. ECS and PS Card Layouts**

## 6.10 POWER SUPPLIES

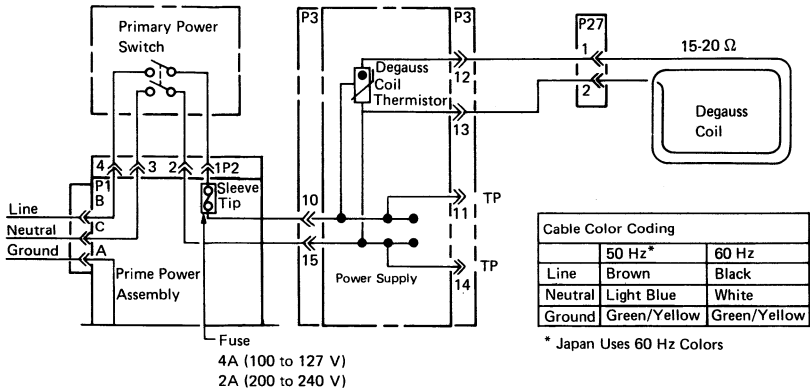


Figure 6-15. Mainline Supply

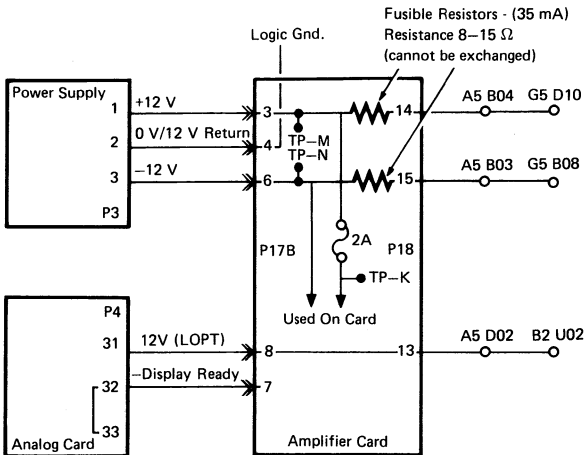


Figure 6-16. Supplies to Amplifier Card

**6.11 DISPLAY ATTRIBUTES AND MODIFIED DATA TAGS**

Data in the refresh buffer (not the ECS buffer) may be examined for proper attributes and the setting or resetting of modified data tags (MDTs).

The procedure is as follows:

1. Jumper D2Y09 to D2Y08 (see section 2.5).
2. Position the cursor at the location of the attribute to be displayed.
3. Set the TEST/NORMAL switch to TEST. Nulls will display as  $\bar{O}$  and attributes are blank.

Note that the colors of white and red fields (base) change to red and white respectively.

4. Press CONTROL D. The character, or attribute, at the cursor position is copied into the first position of the Operator Information Area and the cursor advances (see Test Mode 3, section 2.5.3).
5. Use the attribute bit definition figure and the attributes character tables (Figures 6-17 and 6-18) to determine if the attributes are being correctly interpreted by the hardware.

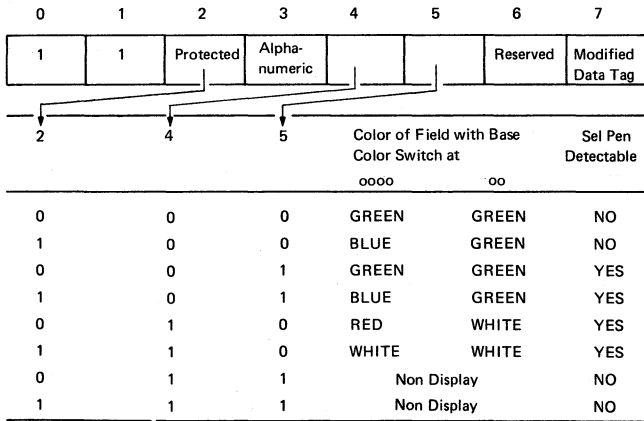


Figure 6-17. Base Field Attribute Byte

C	D	E	F	
ç	P	Č	✈	0
ĝ	S	Ĉ	—	1
ŝ	A	Š	Z	2
ž	▶	Ž	—	3
ĉ	B	Ć	⊙	4
ĵ	◻	Ć	⊙	5
ŝ	▶	Š	✕	6
ý	◻	Ý	■	7
À	➡	É	➡	8
Š	⚡	Š	⚡	9
d	↑	Đ	○	A
P	⚡	P	┌	B
L	⚡	I	Ⓜ	C
l	↓	i	Ⓜ	D
i	Ⓜ	℥	Ⓜ	E
z	■	½	Ⓜ	F

English

C	D	E	F	
ä	P	Ä	✈	0
σ	S	Ö	—	1
ü	A	Ü	Z	2
ã	▶	Ä	—	3
ñ	B	Ñ	⊙	4
õ	◻	Ö	⊙	5
á	▶	Á	✕	6
é	◻	É	■	7
í	➡	Í	➡	8
ó	⚡	Ó	⚡	9
ú	↑	Ú	○	A
à	⚡	â	┌	B
è	⚡	ê	Ⓜ	C
ì	↓	î	Ⓜ	D
ò	Ⓜ	ô	Ⓜ	E
ù	■	û	Ⓜ	F

Katakana and Japanese English

Figure 6-18. Attribute Characters

### 6.12 EXTENDED CHARACTER SET BUFFER

The ECS buffer contains the Character Attribute (CA) bytes (defined in Figure 6-19). If the corresponding byte in the refresh buffer is itself an attribute, then the ECS byte becomes an extended field attribute (EFA).

Normally, the character attribute controls the displaying of the corresponding character; however, if the

character attribute contains blank fields then attribute control defaults to the EFA. If the EFA also contains a blank color field, then color control defaults to the attribute byte in the refresh buffer.

The hardware is tested by Online Test 8, but no test exists to display the contents of the ECS buffer. (The DIA symbols can be used to determine the contents of the ECS buffer.)

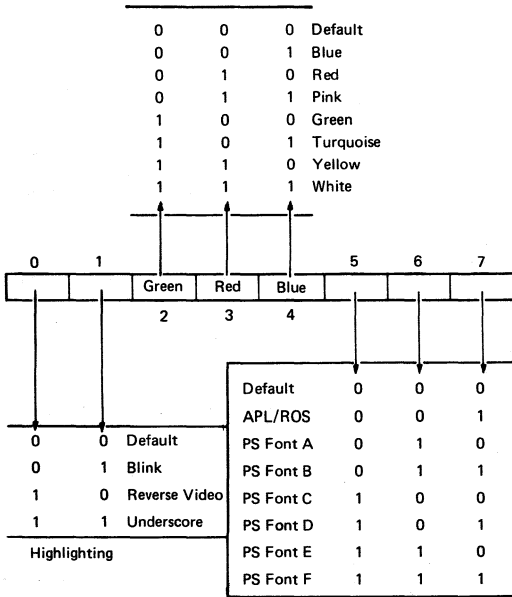
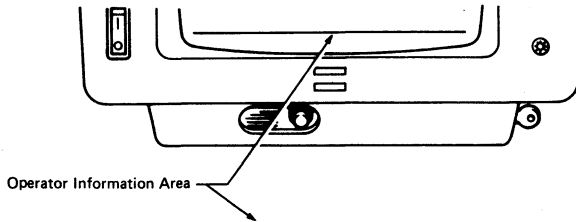


Figure 6-19. ECS Byte

**A.0 APPENDIX A. INDICATORS IN OPERATOR INFORMATION AREA**






























Col.	Readiness and System Connection	Do Not Enter (Input Inhibited)	Reminders	PS	Shift and Modes	High-lighting	Color	Insert Mode	Printer Status
	1 6	9 17	21 27	31 34	36 44	46 47	49 50	52	60 64

**Note:** The column numbers (0 - 64) of the indicator row do not appear on the screen.

**Figure A-1. Layout of Operator Information Area**

The following describes the symbols that may appear in the Operator Information Area.

	3274 control unit is ready.
	3276 control unit is ready.
	Control unit is connected to system under 'a' rules.
	Control unit is connected to system under 'b' rules (SNA).
	3279 is connected to application.
	3279 is connected to system operator (control program).
	3279 is connected to host but not to application or control program. Use SYS REQ to LOGON.
TEST	3279 is in online test mode (to control unit).
	Wait for system to complete.
	Keyboard overrun - RESET and retry.
	System has locked keyboard while busy - wait for complete.
	Action must be taken elsewhere on the screen - RESET.
	Too many characters attempted to insert - RESET.
	Only numerals can be entered in numeric field - RESET.
	Wrong or invalid number entered - RESET.
	Requested function is unavailable - RESET.
	3279 logic failure - see Error Codes in Section 2.6.6.
	As above.
	Communication check - see Control Unit MIM.
	As above.
	Host data stream programming error - see control unit MCM.
	As above.
	Assigned printer is busy. If  is displayed at right, the printer is busy on your work. Wait for printer to complete or use DEV CNCL. (Print in progress cannot be stopped by DEV CNCL.)
	Longer wait time expected than for  .
	Assigned printer is not working. If  is displayed in printer status area, printer stopped while printing your work - use DEV CNCL.

✕ 天 ✕	Function not allowed on this 3279.
✕ 〇	Security keylock is off - key is needed to unlock.
✕ 天 田 ?	Questionable card - but usable in this operation.
✕ 天+ ?	An invalid key was entered after the dead key accent.
✕ 天+ ?	
✕ 天+ ?	
✕ 天+ ?	
✕ 天+ ?	
✕ - S	The symbol that was keyed is not available.
✕ 田 田	A message from the operator was received and rejected.
↔	Errors are occurring on the link to the host.
—	Host link established.
天	Operator Selectable.
▶	Field Inherit.
S 〇	Base symbols are selected.
PSA	Program Symbols Set A is selected.
田	Reverse Video.
⦿	Blink.
Ⓐ	Underscore.
a	Normal.
■	Color in effect is shown by colored blob.
○ ▶	Color is green or white by default.
NUM	Keyboard is in numeric mode (0123456789 -. and DUP only).
APL	The keyboard is in APL mode.
TEXT	The keyboard is in text mode.
↑	The keyboard is in upshift.
^	The 3279 is in insert mode. (This symbol appears in position 41 on Model A or position 42 on Model B.)
〇 〇 _ _	When printer ID/class is changed, two keyed-in numerals appear here.



□ □ nn

Authorization to use printer nn.

□ ■ nn

Selected printer is printing your work.

□ → nn

Selected printer stopped while printing for this 3279.

□ □ ??

Printer assignment for this 3279 has changed.

## ABBREVIATIONS AND GLOSSARY

### ABBREVIATIONS

<b>ac</b>	alternating current	<b>ECS</b>	extended character set
<b>ack</b>	acknowledge	<b>EFA</b>	extended field attribute
<b>addr</b>	address	<b>EHT</b>	extra high tension (3279 = 25 kV)
<b>alt</b>	alternate	<b>EOM</b>	end of message
<b>APL</b>	a programming language	<b>E + W</b>	east and west
<b>b</b>	bottom	<b>FBI</b>	feature bus in
<b>bal</b>	balance	<b>FBO</b>	feature bus out
<b>BLC</b>	base logic card	<b>foC</b>	focus
<b>c</b>	center	<b>FRU</b>	field replaceable unit
<b>CA</b>	character attribute	<b>FSU</b>	functional storage unit
<b>char</b>	character	<b>GLP</b>	general logic probe
<b>cm</b>	centimeters	<b>H CENT</b>	horizontal centering
<b>cmd</b>	command	<b>Hz</b>	hertz
<b>cntr</b>	counter	<b>ID</b>	identification
<b>coax</b>	coaxial	<b>ident</b>	identification
<b>col</b>	color	<b>int</b>	internal
<b>CRT</b>	cathode ray tube	<b>I/O</b>	input/output
<b>ctr</b>	counter	<b>KB</b>	keyboard
<b>CU</b>	control unit	<b>kg</b>	kilograms
<b>D/A</b>	digital to analog	<b>kV</b>	kilovolts
<b>DEC</b>	decoder	<b>k<math>\Omega</math></b>	kilohms
<b>EBCDIC</b>	extended binary-coded decimal interchange code	<b>lb</b>	pounds
		<b>LCC</b>	line control card

<b>LCH</b>	line control module	<b>PSHICO</b>	PS, highlighting and color select
<b>LED</b>	light emitting diode	<b>pty</b>	parity
<b>LOPT</b>	line output transformer	<b>RA</b>	read address
<b>LP</b>	light pen	<b>RAM</b>	random access memory
<b>MAP</b>	maintenance analysis procedure	<b>reg</b>	register
<b>MAX</b>	maximum	<b>ret</b>	return
<b>MCM</b>	Maintenance Concepts Manual	<b>ROS</b>	read-only storage
<b>MHS</b>	Magnetic Hand Scanner	<b>RPQ</b>	request for price quotation
<b>MHZ</b>	megahertz	<b>rx</b>	receiver
<b>MIN</b>	minimum	<b>sec</b>	second
<b>MIM</b>	Maintenance Information Manual	<b>sel</b>	selector
<b>mm</b>	millimeters	<b>SER</b>	serializer
<b>Mod</b>	model	<b>SERDES</b>	serializer/deserializer
<b>MRC</b>	Magnetic Reader Control	<b>SUP</b>	suppress
<b>MSR</b>	magnetic slot reader	<b>SW.</b>	switch
<b>No.</b>	number	<b>sync</b>	synchronization
<b>ns</b>	nanoseconds	<b>t</b>	top
<b>NUM</b>	numeric	<b>TA</b>	terminal adapter
<b>N + S</b>	north and south	<b>T/C</b>	timing and control
<b>OIA</b>	Operator Information Area	<b>TOP MAR</b>	top margin
<b>OP</b>	operation	<b>TP</b>	test point
<b>O/P</b>	output	<b>trig</b>	trigger
<b>PDG</b>	problem determination guide	<b>V</b>	volts
<b>pk-pk</b>	peak-to-peak	<b>vert</b>	vertical
<b>POR</b>	power-on reset	<b>vid</b>	video
<b>pot</b>	potentiometer	<b>VTL</b>	vendor transistor logic
<b>PS</b>	programmed symbols		

WA write address

$\mu$ F microfarads

W/O without

$\mu$ S microseconds

NR write

**GLOSSARY**

**bezel.** The front panel that surrounds the display screen.

**coaxial cable.** A cable consisting of one conductor, usually a small copper tube or wire, within and insulated from another conductor of larger diameter, usually copper tubing or copper braid.

**converged, convergence.** Ideally, the condition in which the red, blue, and green electron beams together produce a white display with no colored fringes.

**feature bus.** The logical data bus in the 3279, along which the base machine communicates with added features.

**misconvergence.** Opposite in meaning to "convergence" (see above).

**pel.** Picture element.

**monochrome.** Single color.

**phosphors.** The coatings on the inner surface of the screen that emit light when hit by an electron beam.

**pincushion.** (distortion). The appearance of the display when the sides of the raster are curved.

**raster.** The pattern of lines on the display screen that is traced out by the scanning electron beams. The raster may be visible when the brightness control is turned up or when intensity override is engaged.

**retimed.** With improved timing.

**ripple.** An ac signal on a dc level.

## Abbreviations

A	Amp	MM	Millimetre
A/R	As Required	No No	No Number
ASM	Assembly	NOS	Numbers
BM	Bill of Material	OD	Outside Diameter
CAN/FR	Canadian French	P HD	Pan Head
COL	Column	P/N	Part Number
CONN	Connector	POSN	Position
CRT	Cathode Ray Tube	POT	Potentiometer
CSK	Countersunk	PT. NO.	Part Number
DIST	Distribution	PWR	Power
EX TH	External Tooth	QTY	Quantity
GAPL	Group Assembly Parts List	REF	Reference
GN	Green	RES	Resistor
GND	Ground	RH	Right Hand
HD	Head	SHLDR	Shoulder
HEX	Hexagon	STD	Standard
ID	Inside Diameter	SW	Switch
LCK W	Lock Washer	TEMP	Temperature
L.E.D.	Light Emitting Diode	THK	Thick
LG	Long	UNC	Unified National Coarse
LH	Left Hand	V	Volt
LOCN	Location	W.O.	Without
M	Metre	WSHR	Washer
MANUF	Manufacturing	WTC	World Trade Corporation
MFI	Machine Feature Index	YEL	Yellow

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## HOW TO USE THIS PARTS CATALOG

This catalog is divided into three major sections:

The **Visual Index** contains small overall views of the machine, and gives references for all the major assemblies which are broken down in the Group Assembly Parts List (GAPL).

The **Group Assembly Parts List** contains exploded illustrations of the assemblies, subassemblies, and detail parts of the machine. Parts are cross-referenced by index number to the list of part numbers that accompanies each figure.

The **Numerical Index** follows the GAPL. It contains all of the part numbers on the GAPL in numerical order, and cross-references them by figure and index number.

### Finding a Part

Turn to the visual index and find the general area of the machine in which the part is located. An arrow from that area will point to one or more reduced GAPL figures. Find the figure or figures containing the part required; there is a cross reference to indicate which GAPL figure contains the part.

Turn to the referenced figure in the GAPL to find the index number of the part required and locate the index number on the accompanying list. The list contains the following details:

- **Part Number**
- **Description**  
(Trailer lines after the description are used for clarification or to indicate usage or obtainability of parts.)
- **Units per Assembly**  
(This refers to the number of units used in the area indexed, or the number used for a similar purpose in the assembly.)

### Circled Index Numbers

A circled index number indicates that the assembly is broken down within the figure.

### Example for Ordering Parts

4	5726422	REF	FAN ASM. POWER SUPPLY ENCLOSURE FOR NEXT HIGHER ASSEMBLY. SEE FIGURE 1 184 FOR ILLUSTRATION. SEE FIGURE 4	
1	334921	2	● TERMINAL. RING. 18-22 AWG. 6 HOLE. INS	
2	187854	1	● SHIELD. TERMINAL BLOCK. 2 POS	ATT PT
3	210984	1	● SCREW. RD. HD. 6-32 x 0.250 LG	
4	5357050	1	● FAN ASM. NO. CONN. OR	
5	52042	2	● SCREW. BIND. HD. 10-22 x 0.375 LG	ATT PT
6	5357066	1	● BLADE	
7	5357067	1	● MOTOR. 208 V. 230 V. 60 HZ. 220 V. 50 HZ	
8	130434	2	● SCREW. SLOTTED HEX. HD. 10-32 x 0.375 LG	ATT PT
9	58079	2	● LOCKWASHER. EXT. TH. 0.195 ID x 0.410 OD	ATT PT
10	5726436	1	● HEADER. POWER SUPPLY FAN	

If the entire fan assembly is to be replaced, order part number 5726422; all of the items on that list will be supplied. If only the subassembly is required, order part number 5357050; it will include all of the two-dot items that immediately follow its attaching parts. Attaching parts must be ordered separately.

All parts may be ordered individually.

# GLOSSARY

## 1 NO NO.

When this appears in the part number column, it denotes a group of parts for which no assembly part number has been assigned. The detail parts must be ordered separately.

## 2 AR

As Required (AR) in the units per assembly column denotes that the quantity is used as required.

## 3 ATT PT

Attaching Parts: These parts are used to attach a subassembly to an assembly. The attaching parts are listed immediately following the part to be attached.

## 4 REF

This entry in the units per assembly column denotes a part or assembly included for reference only. It is not part of the assembly breakdown and is also included elsewhere in the catalog.

## 5 INDENTURE

The relationship of a part to its next higher assembly is indicated by indentures. For example:

1 2 3 4

Unit

- Assemblies and Detail Parts of Unit
- Attaching Parts for Assemblies & Detail Parts
- Subassemblies
- Attaching Parts for Subassemblies
- Detail Parts for Subassemblies, etc.

## 6 NR

NR in the part number column denotes the part is procurable but not recommended for field replacement, and that the next higher assembly should be ordered.

## 7 NP

The entry NP in the part number column denotes that the part is non-procurable. Order detail parts or next higher assembly, as applicable.

FIGURE- INDEX NUMBER	PART NUMBER	UNITS				DESCRIPTION
		PER ASM	1	2	3 4	
2 -						DRIVE MOTOR ASSEMBLY
-	2199386	NP	REF			MOTOR ASM, DRIVE-220 VOLTS, 50 HZ FOR NEXT HIGHER ASM, SEE FIGURE 1-92 FOR ILLUSTRATION, SEE FIGURE 2
- 1	2199255		1			PULLEY
- 2	79842		AR			• SETSCREW, SPLINE DR CUP PT- 8-32 x 0.375 LG
- 3	2204116		1			• MOTOR ASM, 220 V AC 60 HZ
- 4	NO NO		1			• MOTOR ASM, 220 V AC, 50 HZ
- 5	5526		4			• SCREW, BIND HD-8-32 x 0.625 LG
- 6	2204082		1			• FERRULE, OUTER
- 7	2204033		1			• FERRULE, INNER
- 8	2199258		1			• MOTOR, DRIVE - 220 V, 50 HZ
- 9	2199402	NR	1			• PLATE, MOTOR MY-220 V, 50 HZ



# GROUP ASSEMBLY PARTS LIST

3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	1 2 3 4				DESCRIPTION
			COVER ASSEMBLY				
1 -	4423162	REF					COVER ASM
- 1	4423377	1					CABINET, LOWER
- 2	4420421	4					SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 3	1622346	4					LCK W, EX TH, 4.3 MM ID
- 4	4420449	1					SPRING
- 5	4420448	1					SPRING
- 6	4423378	1					CABINET, UPPER
- 7	4423381	4					STUD
- 8	4423364	2					CLIP
- 9	4420395	1					HINGE, BRACKET
- 10	1673725	2					SCREW, P HD, M4, 12 MM LG
- 11	1622346	2					LCK W, EX TH, 4.3 MM ID
- 12	4420424	2					SCREW, HEX WSHR HD, 6-19, 16 MM LG, THD FORMING
- 13	1188748	2					WSHR, 0.172 IN ID, 0.5 IN, OD
- 14	4420348	1					CABLE CLAMP
- 15	4420394	1					HINGE BRACKET
- 16	1673725	2					SCREW, P HD, M4, 12 MM LG
- 17	1622346	2					LCK W, EX TH, 4.3 MM ID
- 18	4422079	2					LATCH ASM
- 19	4420481	2					CAM
- 20	4423376	1					COVER, REAR
- 21	4420398	1					HINGE, LOWER
- 22	1621190	2					SCREW, P HD, M4, 8 MM LG
- 23	1622346	2					LCK W, EX TH, 4.3 MM ID
- 24	1622304	2					WSHR, 4.3 MM ID, 9 MM OD
- 25	4420397	1					HINGE, UPPER
- 26	1621190	2					SCREW, P HD, M4, 8 MM LG
- 27	1622346	2					LCK W, EX TH, 4.3 MM ID
- 28	1622304	2					WSHR, 4.3 MM ID, 9 MM OD
- 29	4420401	1					PANEL, REAR
- 30	4420422	2					SCREW, HEX WSHR HD, 6-19, 10 MM LG, THD FORMING
- 30A	1621509	1					SCREW, SCK HD, M4, 8 MM LG FOR DETAILS SEE FIG 3 ITEM 3
- 31	4420441	1					LATCH, BRACKET
- 32	1621190	2					SCREW, P HD, M4, 8 MM LG
- 33	1622346	2					LCK W, EX TH, 4.3 MM ID
- 34	1622304	2					WSHR, 4.3 MM ID, 9 MM OD
- 35	4420400	1					PANEL, HINGE
- 36	4420442	1					LATCH, BRACKET
- 37	1621190	1					SCREW, P HD, M4, 8 MM LG
- 38	1622346	2					LCK W, EX TH, 4.3 MM ID
- 39	1622304	2					WSHR, 4.3 MM ID, 9 MM OD
- 40	4418777	1					LATCH, R.H.
- 41	4418778	1					LATCH, L.H.

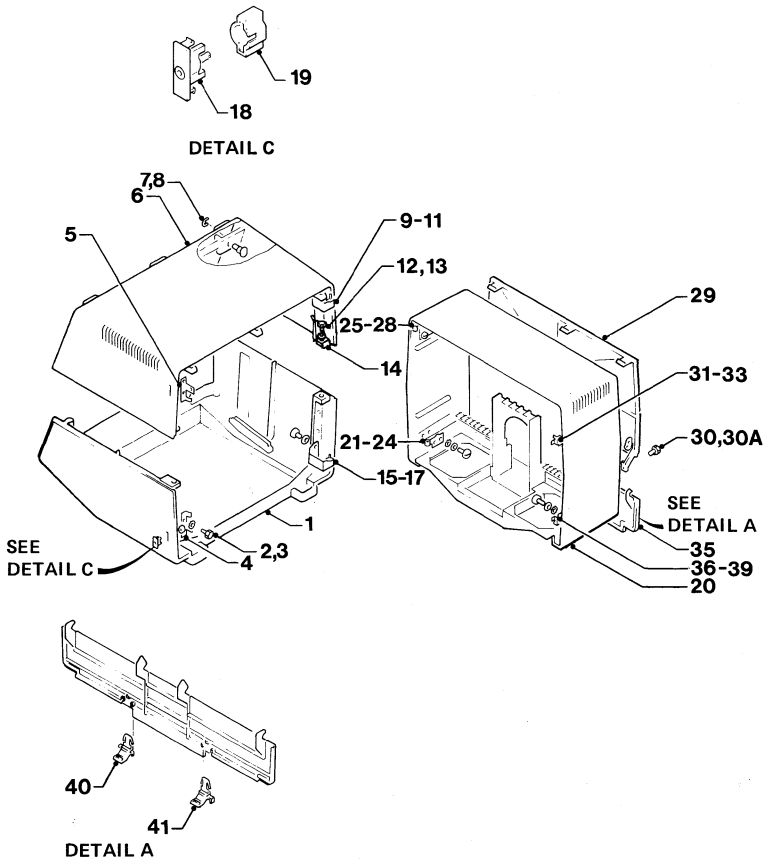


Figure 1. Cover Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	REF				DESCRIPTION
			1	2	3	4	
							FRONT ENCLOSURE ASSEMBLY
2 -	NO NO	REF					FRONT ENCLOSURE
- 1	4423252	1	.	.	.	.	BEZEL ASM
- 2	4423408	1	.	.	.	.	BEZEL
- 3	4423410	1	.	.	.	.	INSERT, L.E.D.
- 4	5830579	1	.	.	.	.	CARD ASM, L.E.D.
- 5	4420426	2	.	.	.	.	SCREW, HEX WSHR HD, 4-20, 8 MM LG, THD FORMING
- 6	1743194	1	.	.	.	.	LOGO
- 7	1655357	3	.	.	.	.	SWITCH
- 8	4423231	1	.	.	.	.	INSERT, NORMAL TEST
- 9	4423232	1	.	.	.	.	INSERT, COLOR DEFAULT
- 10	4423336	1	.	.	.	.	INSERT, MONO DUAL
- 11	4423406	1	.	.	.	.	POTENTIOMETER ASM, BRIGHTNESS
- 12	4420426	2	.	.	.	.	SCREW, HEX WSHR HD, 4-20, 8 MM LG, THD FORMING
- 13	4423405	1	.	.	.	.	KNOB, BRIGHTNESS
- 14	1743174	1	.	.	.	.	CUP
- 15	2114043	1	.	.	.	.	CRADLE
- 16	4420422	1	.	.	.	.	SCREW, HEX WSHR HD, 6-19, 10 MM LG, THD FORMING
- 17	1743178	1	.	.	.	.	SWITCH, ON/OFF
- 18	2114044	1	.	.	.	.	CLIP
- 19	4423479	1	.	.	.	.	POTENTIOMETER ASM
- 20	4423403	1	.	.	.	.	KNOB
- 21	1743174	1	.	.	.	.	CLIP
- 22	4420281	2	.	.	.	.	CAPSCREW, HEX SOC HD, M3, 8 MM LG
- 23	615683	1	.	.	.	.	FUSE, 2 AMP (220 V)
- 23	1143492	1	.	.	.	.	FUSE, 4 AMP (110 V)
- 24	811427	1	.	.	.	.	RETAINER
- 24A	2596291		.	.	.	.	CLIP, UPPER
- 24B	2596275		.	.	.	.	CLIP, LOWER

ITEMS 24A AND 24B MAY BE  
FOUND ON OLDER MACHINES.  
THEY ARE NOT SHOWN ON THE DRAWING

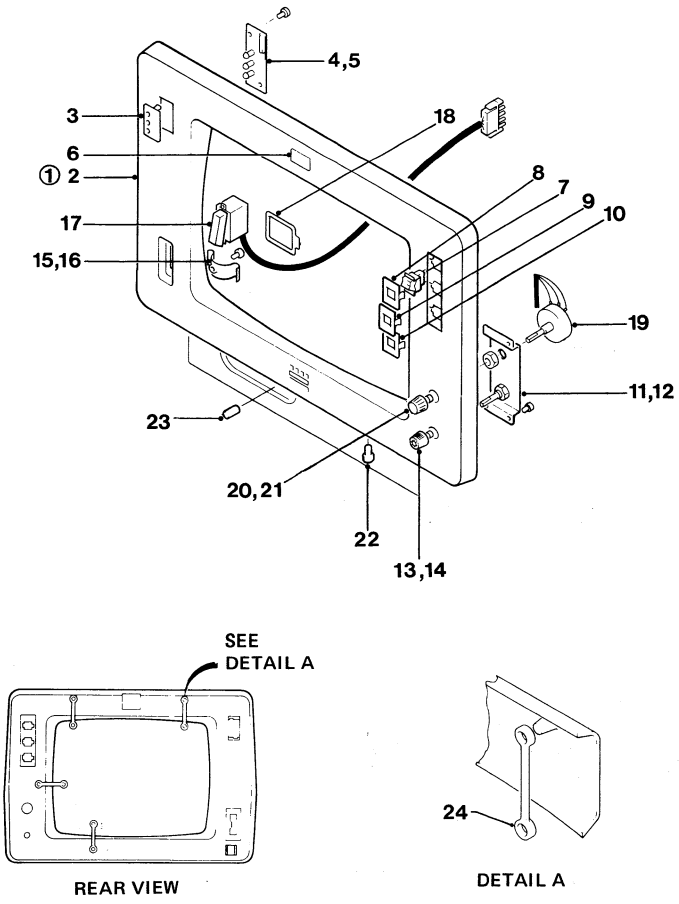


Figure 2 (Sheet 1 of 4). Front Enclosure Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	FRONT ENCLOSURE ASSEMBLY (CONT)				DESCRIPTION
			1	2	3	4	
2 -							FRONT ENCLOSURE
- 25	SEE NOTE	1	.				AMPLIFIER CARD ASM
- 25A	855231	1	.				FUSE, 2 AMP
- 26	4423028	1	.				COVER
- 27	1621195	2	.				SCREW, P HD, M4, 25 MM LG
- 28	SEE NOTE	1	.				POWER SUPPLY CARD
- 28	SEE NOTE	1	.				USED ON MACHINE 100-127 V
- 29	4420423	2	.				POWER SUPPLY CARD
							USED ON MACHINE 200-240 V
- 30	4423344	1	.				SCREW, HEX WSHR HD, 6-19, 12 MM LG,
- 31	SEE NOTE	1	.				THD FORMING
- 32	4423029	1	.				HOUSING
- 33	SEE NOTE	1	.				CARD-VIDEO
- 34	4420423	2	.				COVER
- 35	4420437	1	.				ANALOG CARD ASM
- 36	4420423	1	.				SCREW, HEX WSHR HD, 6-19, 12 MM LG,
							THD FORMING
- 37	4420772	1	.				CLIP
							SCREW, HEX WSHR HD, 6-19, 12 MM LG,
							THD FORMING
							JUMPER

NOTE: WHEN REORDERING CARDS USE THE PART NUMBER ON THE FAILED CARD

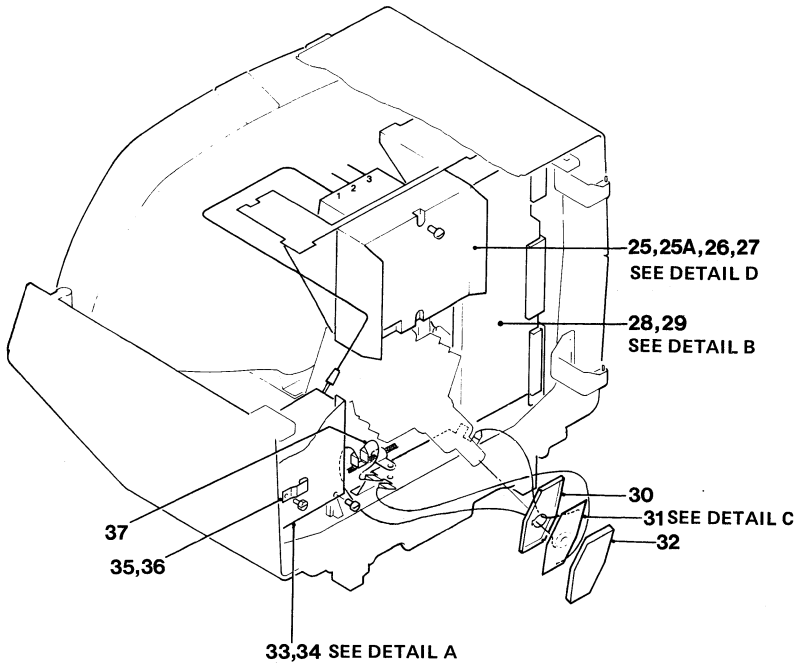
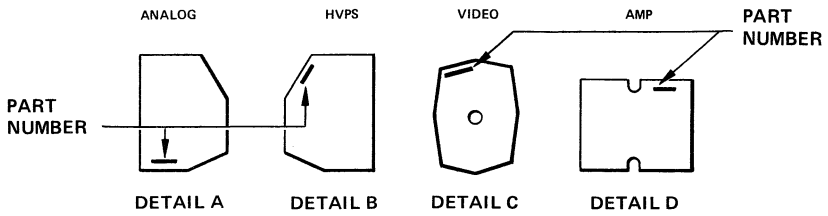


Figure 2 (Sheet 2 of 4). Front Enclosure Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			FRONT ENCLOSURE ASSEMBLY (CONT)			
2 -						FRONT ENCLOSURE
- 38	4423140	1	.			ENCLOSURE ASM
- 39	4423397	1	.			CONVERGENCE ASM
- 39A	4423462	1	.			CLAMP
- 39B	1621193	1	.			SCREW, P HD, M4, 16 MM LG
- 40	4423385	1	.			SCREEN
- 41	219615	4	.			CLIP
- 42	4420770	1	.			PLATE
- 43	4420422	1	.			SCREW, HEX WSHR HD, 6-19, 10 MM LG, THD FORMING
- 44	2102365	1	.			CLIP
- 45	4420422	1	.			SCREW, HEX WSHR HD, 6-19, 10 MM LG, THD FORMING
- 46	SEE NOTE	1	.			CARD ASM, AUDIBLE ALARM
- 47	4423373	2	.			THUMBSCREW, M3, 6 MM LG
- 48	4423357	2	.			INSERT
- 49	4423048	1	.			KEYSWITCH
- 50	4420359	1	.			GROUND STRAP
- 51	4423317	4	.			CLIP
- 52	4418776	4	.			NUT
- 53	6814363	1	.			COIL CBM
- 54	5213306	4	.			CLIP
- 55	5405736	1	.			TIE
- 56	4423392	1	.			TUBE AND YOKE ASM, MODEL 2
						ORDER ITEM 57 WHEN ORDERING THIS ITEM
- 56	4423393	1	.			TUBE AND YOKE ASM, MODEL 3
						ORDER ITEM 57 WHEN ORDERING THIS ITEM
- 57	4420274	1	.			ACOUSTIC SHIELD
- 58	4423146	1	.			BLEEDER ASM
- 59	4423318	1	.			BRACKET
- 60	2568709	4	.			STAND-OFF
- 61	1621191	2	.			SCREW, P HD, M4, 10 MM LG

NOTE: WHEN REORDERING CARDS, USE  
THE PART NUMBER ON THE FAILED CARD

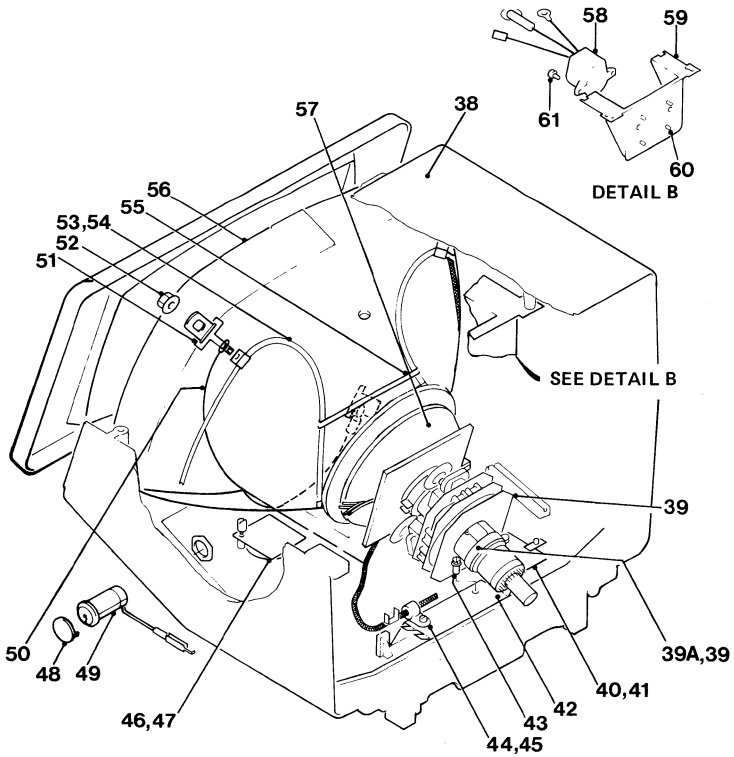


Figure 2 (Sheet 3 of 4). Front Enclosure Assembly



## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			FRONT ENCLOSURE ASSEMBLY (CONT)			
2 -			FRONT ENCLOSURE			
- 62	4423490	1	.	.	.	DOCUMENT TRAY
- 63	4420421	4	.	.	.	SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 64	4423353	1	.	.	.	BRACKET
- 65	4420425	1	.	.	.	SCREW, HEX WSHR HD, 6-19, 12 MM LG, THD FORMING
- 66	4420283	1	.	.	.	SPRING
- 67	4423244	1	.	.	.	FOOT
- 68	4423354	1	.	.	.	BRACKET
- 69	4420425	1	.	.	.	SCREW, HEX WSHR HD, 6-19, 12 MM LG, THD FORMING
- 70	219615	4	.	.	.	CLIP
- 71	4423385	1	.	.	.	SCREEN
- 72	4423494	1	.	.	.	BRACKET
- 73	1621190	2	.	.	.	SCREW, P HD, M4, 8 MM LG
- 74	1622346	2	.	.	.	LCK W, EX TH, 4.3 MM ID
- 75	1622304	2	.	.	.	WSHR, 4.3 MM ID, 9 MM OD
- 76	1621190	2	.	.	.	SCREW, P HD, M4, 8 MM LG
- 77	1622346	2	.	.	.	LCK W, EX TH, 4.3 MM ID
- 78	1622304	2	.	.	.	WSHR, 4.3 MM ID, 9 MM OD
- 79	4423493	1	.	.	.	BRACKET

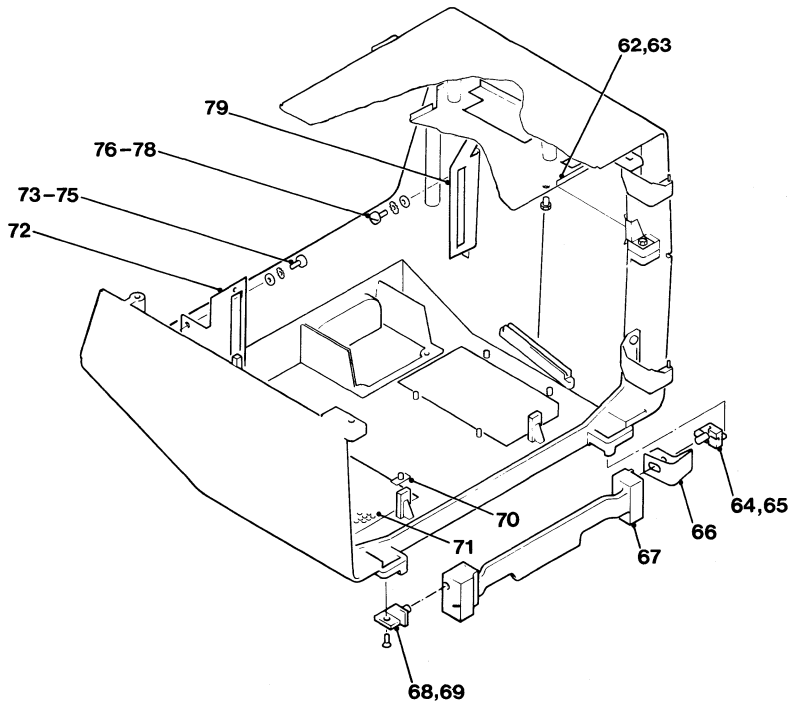


Figure 2 (Sheet 4 of 4). Front Enclosure Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM				DESCRIPTION
		1	2	3	4	
REAR ENCLOSURE ASSEMBLY						
3 -	NO NO	REF				REAR ENCLOSURE
- 1	4420421	3	.			SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 2	4423374	1	.			THUMBSCREW, M4, 9 MM LG
- 3	1621509	1	.			SCREW, SCK HD, M4, 8 MM LG
- 4	4418790	1	.			GUARD
- 5	1621844	1	.			SCREW, P HD, M3, 6 MM LG, THD FORMING
- 6	1743456	1	.			BATTERY
- 7	1743455	1	.			CLIP
- 8	4420350	1	.			PLATE
- 9	473442	1	.			GROMMET, 27 MM LG
- 9A	4423374	3	.			THUMBSCREW, M4, 9 MM LG (MODEL 2)
- 9B	4422107	1	.			PLATE (MODEL 2)
- 9C	4422106	1	.			STRAP (MODEL 2)
- 9D	4423312	3	.			CLAMP (MODEL 2)

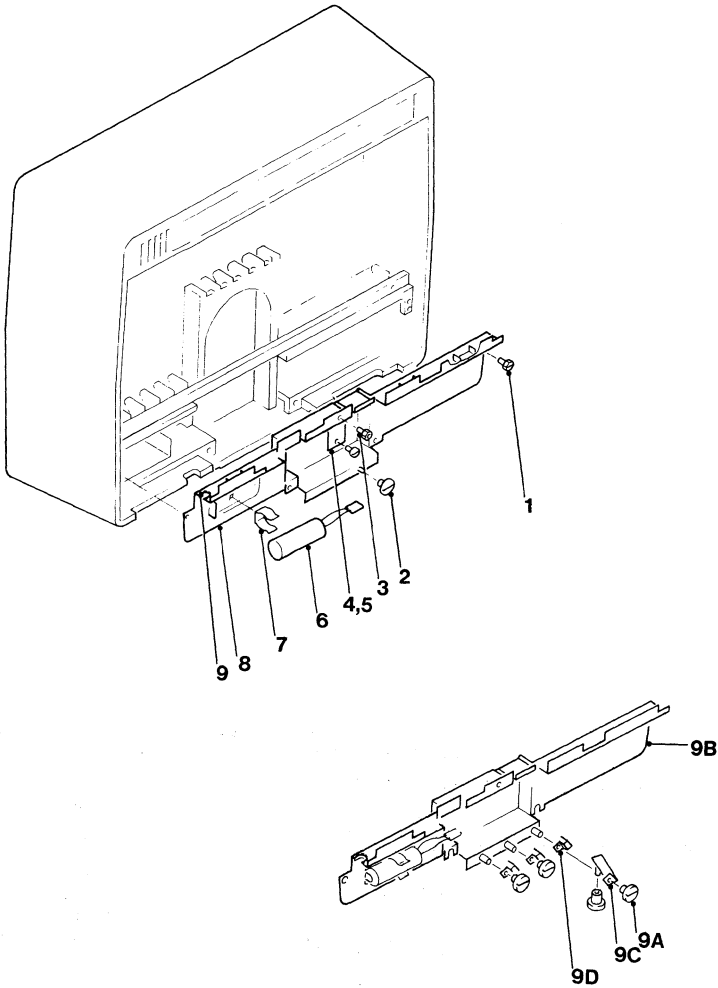


Figure 3 (Sheet 1 of 4). Rear Enclosure Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM				DESCRIPTION
		1	2	3	4	
						REAR ENCLOSURE ASSEMBLY (CONT)
3 -						REAR ENCLOSURE
- 10	4423162	1	.	.	.	COVER ASM
- 11	4420368	1	.	.	.	GUARD
- 12	219615	6	.	.	.	CLIP
- 13	1621191	2	.	.	.	SCREW, P HD, M4, 10 MM LG
- 14	1622346	1	.	.	.	LCK W, EX TH, 4.3 MM ID
- 15	4423483	1	.	.	.	SUPPORT
- 16	4420421	4	.	.	.	SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 17	4423365	8	.	.	.	GROMMET
- 18	4423233	1	.	.	.	PLATE, STOP
- 19	1621197	1	.	.	.	SCREW, P HD, M4, 6 MM LG
- 20	4420421	4	.	.	.	SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 21	4423485	1	.	.	.	BRIDGE
- 22	1621197	2	.	.	.	SCREW, P HD, M4, 6 MM LG
- 23	811427	14	.	.	.	RETAINER

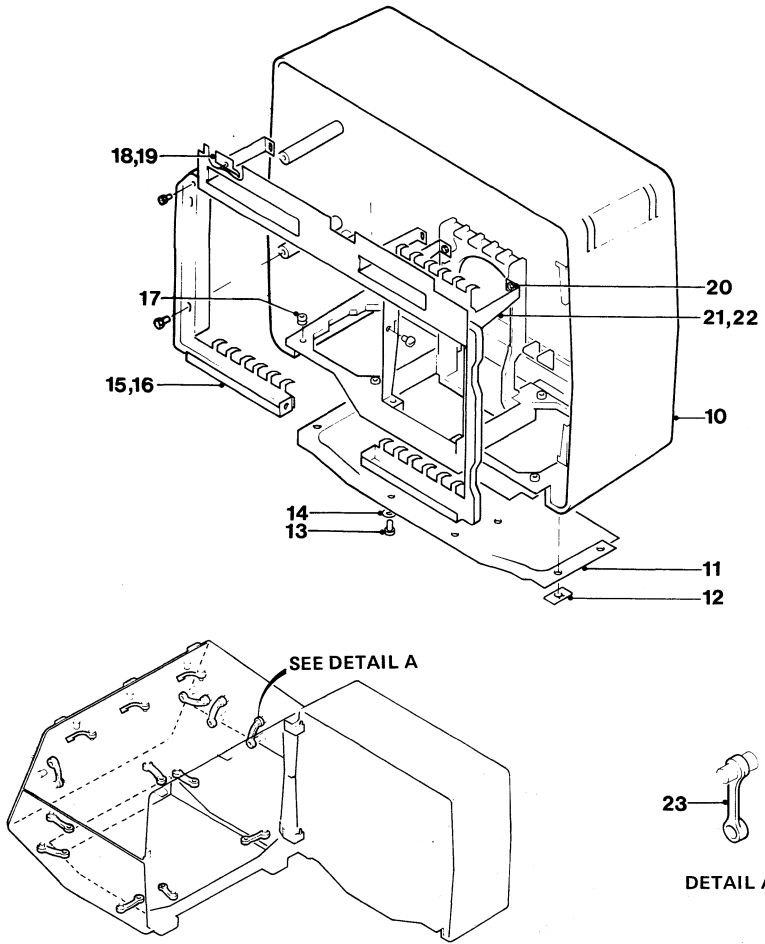
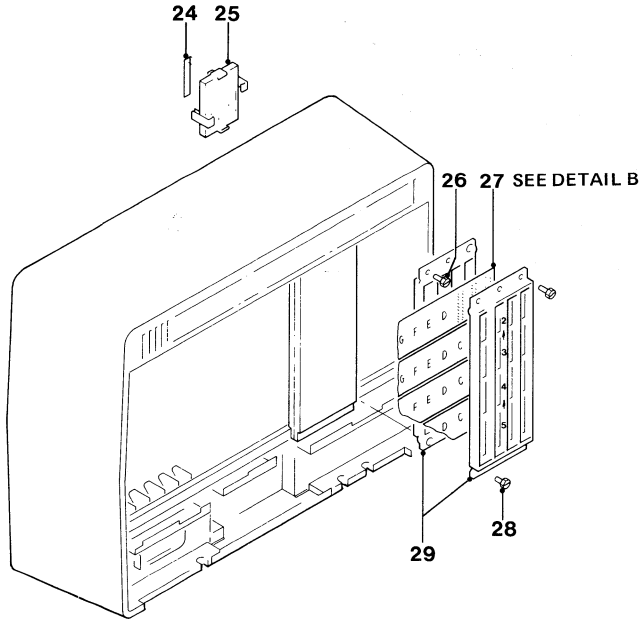
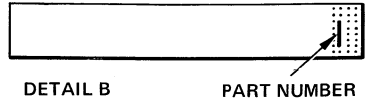


Figure 3 (Sheet 2 of 4). Rear Enclosure Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			REAR ENCLOSURE ASSEMBLY (CONT)			
3 -						REAR ENCLOSURE
- 24	NO NO	REF	.			LABEL
						FOR DETAILS SEE CHART Y
- 25	NO NO	REF	.			CONNECTOR, TOP CARD
						FOR DETAILS SEE CHART Y
- 26	4420426	4	.			SCREW, HEX WSHR HD, 4-20, 8 MM LG, THD FORMING
- 27	NO NO	REF	.			PLANAR STRIPS
						FOR DETAILS SEE CHART X
- 28	4420427	4	.			SCREW, HEX WSHR HD, 4-20, 16 MM LG, THD FORMING
- 29	4134800	4	.			STIFFENER



**CHART X**

ROW	FROM COL	TO COL	BM	PLANAR STRIP PART NUMBER				
				EC 393807	EC394427	EC	EC	EC
2	A	G	A	5148164	5148932			
3	A	G	A	5148165	5148706			
4	A	G	A	5148166	5148707			
5	A	G	A	5148167	5148933			

**CHART Y**

LOCATION	TCC Asm Part No.	LABEL
C3 - D3	2766726	4423095
C4 - D4	2766726	4423089
C5 - D5	4423325	4423090
D2 - E2	4423324	4423093
C5 - E5	4420450	4423091
D2 - F2	4423323	4423092
E3 - F3	2766726	4423094
C4 - D4	4420718	4423089

**NOTE:** PLANAR STRIP, PART NO. 5148707, MAY HAVE BEEN REPLACED BY PART 5147535 IF RPQ 7J0039 IS INSTALLED



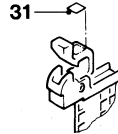
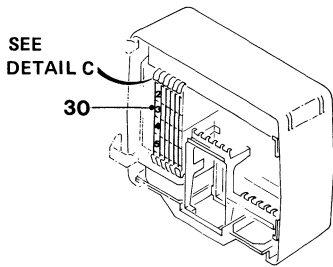
## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	1 2 3 4				DESCRIPTION REAR ENCLOSURE ASSEMBLY (CONT)
			REF	.	.	.	
3 -							REAR ENCLOSURE
- 30	NO NO		REF	.	.	.	CARD AND HOLDER FOR DETAILS SEE CHART A
- 31	1743002	1	.	.	.	.	LABEL, 'B'
- 31	1743003	1	.	.	.	.	LABEL, 'C'
- 31	1743004	1	.	.	.	.	LABEL, 'D'
- 31	1743005	A/R	.	.	.	.	LABEL, 'E'
- 31	1743006	A/R	.	.	.	.	LABEL, 'F'
- 31	1743007	A/R	.	.	.	.	LABEL, 'G'
- 32	815924	A/R	.	.	.	.	FOR DETAILS SEE CHART A CONNECTOR, DISCRETE SEE DETAIL D
- 33	815923	2	.	.	.	.	CONNECTOR, HOUSING SEE DETAIL D
- 34	1599501	5	.	.	.	.	MODULE, CONC-T, PLUGGABLE SEE DETAIL H
- 35	5645546	1	.	.	.	.	MODULE, ROS, PLUGGABLE SEE DETAIL G NOTE: USE THE PART NUMBER ON THE CARD TO REORDER

## CHART A

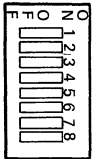
CARD DESCRIPTION	CARD HOLDER PART NUMBER	CARD LOCN	LABEL P/N	CARD DESCRIPTION	CARD HOLDER PART NUMBER	CARD LOCN	LABEL P/N
CONVERGENCE CARD	1743142	B2	1743002	ECS CARD MOD 2B LATIN	1743142	E2	1743005
LINE CONTROL CARD *	1743142	C2	1743003	ECS CARD MOD 3B LATIN	1743142	E2	1743005
BLC CARD MOD 2A LATIN	1743142	D2	1743004	ECS CARD MOD 2B KATAKANA	1743142	E2	1743005
BLC CARD MOD 3A LATIN	1743142	D2	1743004	ECS CARD MOD 3B KATAKANA	1743142	E2	1743005
BLC CARD MOD 2A KATAKANA	1743142	D2	1743004	PS2 CARD MOD 2B	1743142	F2	1743006
BLC CARD MOD 3A KATAKANA	1743142	D2	1743004	PS2 CARD MOD 3B	1743142	F2	1743006
BLC CARD MOD 2A LATIN	1743142	D2	1743004	PS4 CARD MOD 2B	1743142	F2	1743006
BLC CARD MOD 3A LATIN	1743142	D2	1743004	PS4 CARD MOD 3B	1743142	F2	1743006
BLC CARD MOD 2A KATAKANA	1743142	D2	1743004	SELECTOR PEN	1743141	G4	1743007
BLC CARD MOD 3A KATAKANA	1743142	D2	1743004	MAG READ CONTROL	1743141	G2	1743007
				SELECTOR PEN AND MAG READ CONTROL	1743141	G4	1743007

\* IF RPQ 7J0039 IS INSTALLED, LINE CONTROL CARD IS REPLACED BY VIDEO OUTPUT CARD.



**DETAIL C**

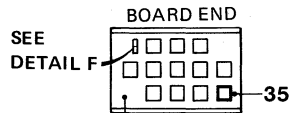
**SWITCH POSITIONS  
FOR MODEL B**



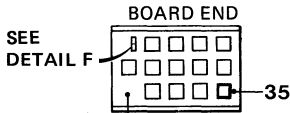
- 1 ON
- 2 } SEE BELOW
- 3 }
- 4 ON
- 5 OFF
- 6 OFF
- 7 OFF
- 8 OFF

**DETAIL F**  
ECS CARD SWITCH  
SETTINGS

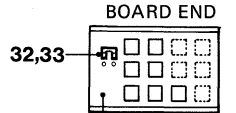
FOR PS		2	3
NO PS	SWITCH BIT	OFF	OFF
PS2		OFF	ON
PS4		ON	ON



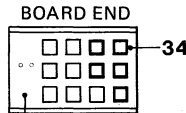
**DETAIL E**  
COMPONENT FACE  
DETAIL E  
(ECS CARD FOR MODEL 2B)



**DETAIL G**  
COMPONENT FACE  
DETAIL G  
(ECS CARD FOR MODEL 3B)



**DETAIL D**  
COMPONENT FACE  
DETAIL D  
(PS 2 CARD ASM)



**DETAIL H**  
COMPONENT FACE  
DETAIL H  
(PS 4 CARD ASM)

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			KEYBOARD ASSEMBLY 87/88 KEY			
4 -	4418901	REF				KEYBOARD FINAL ASM, 87 KEY FOR DETAILS SEE FIGURE 5
-	4418903	REF				KEYBOARD FINAL ASM, 88 KEY FOR DETAILS SEE FIGURE 5
-	4422623	REF				KEYBOARD FINAL ASM, 87 KEY FOR DETAILS SEE FIGURE 5
- 1	1742683	1	.			BASE ASM, 87 KEY
- 1	1742653	1	.			BASE ASM, 88 KEY
- 1	1742771	1	.			BASE ASM, 87 KEY
- 2	4406233	1	.			LABEL USED IN US/CANADA ONLY
- 3	1742689	1	.			STRAIN RELIEF
- 4	2181012	1	.			SCREW, HEX WSHR HD, 8-32, 11 MM (0.437) LG
- 5	1742668	1	.			CABLE ASM, 0.90 MM (3 FT) FOR COMPONENT PARTS SEE FIGURE 12 ITEMS 45-48
- 6	1742662	1	.			CLICKER ASM
- 7	1742643	1	.			CLICKER ASM
- 8	1742663	1	.			CUSHION
- 9	1742664	1	.			CRADLE
- 10	1742658	1	.			BAIL SPRING
- 11	NO NO	1	.			KEYBOARD ASM FOR FURTHER INFORMATION SEE FIGURE 5
- 11A	1809895	1	.			PAD CARD, 87 POSITION
- 11A	1752330	1	.			PAD CARD, 88 POSITION
- 12	1748131	REF	.			KEYMODULE, ACTIVE
- 13	NO NO	REF	.			KEYBUTTON FOR DETAILS, SEE FIGURE 9
- 14	2181005	2	.			SCREW, HEX WSHR HD, 6-32, 9.5 MM (0.375) LG
- 15	2125765	2	.			LCK W, IN TH, 14.27 MM (0.562) OD, SHAKEPROOF
- 16	1854442	1	.			SPACE BAR ASM
- 17	5183361	1	.			STABILIZER
- 18	1854443	1	.			SPACEBAR
- 19	5183362	2	.			PIVOT
- 20	1742779	1	.			COVER ASM, 87 KEY
- 20	1742657	1	.			COVER ASM, 88 KEY
- 21	4942245	4	.			SCREW, HEX WSHR HD, 8-32, 12.7 MM (0.50) LG
- 22	NO NO	1	.			PROBLEM DETERMINATION GUIDE FOR DETAILS SEE FIGURE 10
- 23	1742688	1	.			LATCH
- 24	1742686	1	.			ROD, HINGE
- 25	1742687	1	.			SPRING
- 26	1742685	1	.			REST, PALM
- 27	1650667	1	.			JUMPER
- 28	SEE NOTE	1	.			KEYBOARD LOGIC CARD, 87/88 KEY
- 29	1742635	1	.			CADDY, CE

NOTE: ORDER ITEM 28 USING THE PART NUMBER  
ON THE FAILED CARD

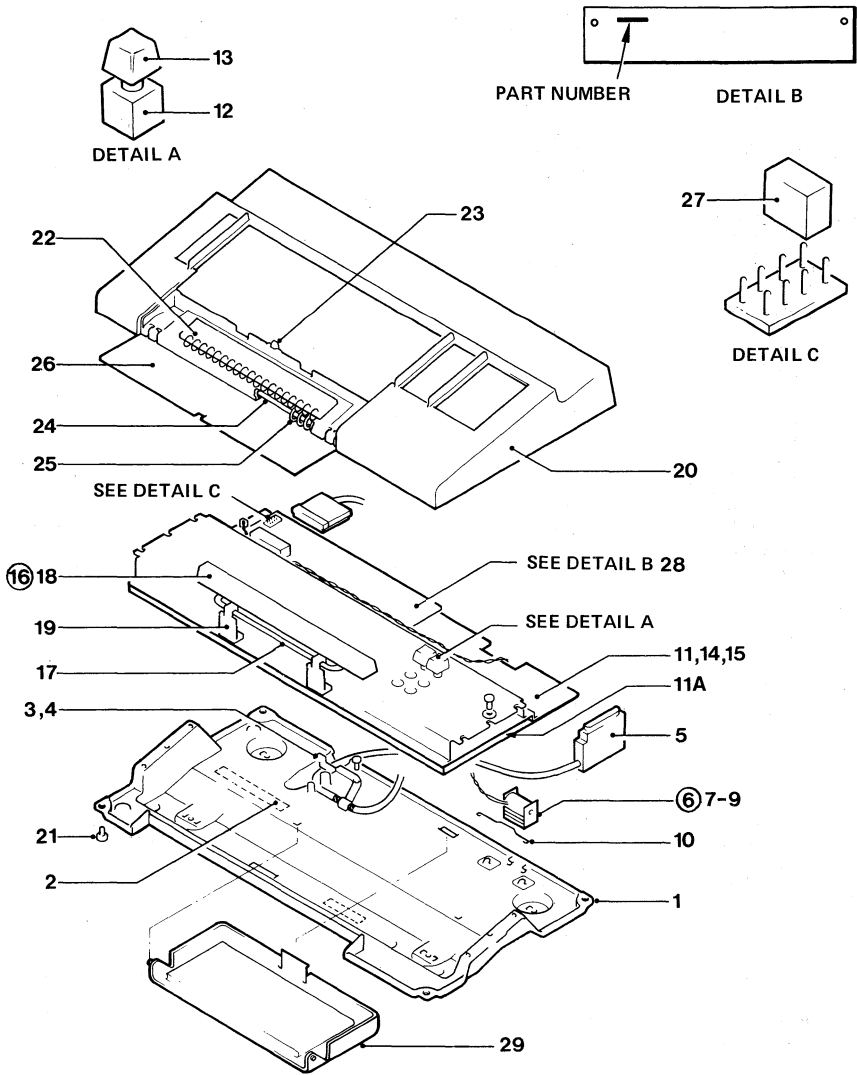


Figure 4. Keyboard Assembly 87/88 Key

- Notes: 1. All keyboards are 87 key unless otherwise stated.  
2. All keyboard types are with color.

LANGUAGE	KEYBOARD TYPE	FINAL ASM*	COMMON SUB-ASM
AUSTRIAN/GERMAN	TYPEWRITER	4419263	8627026
	APL	4419191	8627046
BELGIUM	TYPEWRITER	4419267	8627027
	APL	4419195	8627047
BRAZIL	TYPEWRITER	4419271	8627028
	APL	4419199	8627048
CANADIAN-FRENCH	TYPEWRITER	4419311	8627039
	APL	4419239	8627059
DENMARK	TYPEWRITER	4419275	8627029
	APL	4419203	8627049
EBCDIC	TYPEWRITER	4419259	8627025
	APL	4419187	8627045
FINLAND	TYPEWRITER	4419279	8627030
	APL	4419207	8627050
FRENCH AZERTY	TYPEWRITER	4419283	8627032
	APL	4419211	8627052
FRENCH QWERTY	TYPEWRITER	4419287	8627031
	APL	4419215	8627051
INTERNATIONAL	TYPEWRITER	4419291	8627033
	APL	4419219	8627053
ITALY	TYPEWRITER	4419295	8627034
	APL	4419223	8627054
JAPAN-ENGLISH 88 KEY	TYPEWRITER	4419331	8627062
	APL	4419323	8627042
JAPAN-KATAKANA 88 KEY	TYPEWRITER	4419335	8627063
	APL	4419327	8627043
NORWAY	TYPEWRITER	4419315	8627040
	APL	4419243	8627060
PORTUGAL	TYPEWRITER	4419299	8627035
	APL	4419227	8627055
SPAIN	TYPEWRITER	4419303	8627036
	APL	4419231	8627056
SPANISH SPEAKING	TYPEWRITER	4419307	8627037
	APL	4419235	8627057
SWEDEN	TYPEWRITER	4419319	8627041
	APL	4419247	8627061
U.K. ENGLISH	TYPEWRITER	4419255	8627038
	APL	4419183	8627058
U.S. ENGLISH	TYPEWRITER	4419251	8627024
	APL	4419179	8627044

\* PART NUMBERS LISTED IN THIS COLUMN ARE KEYBOARDS ONLY.  
FINAL ASSEMBLY NUMBERS (IN NEXT COLUMN) INCLUDES COVERS; CABLES, ETC.

LANGUAGE	KEYBOARD TYPE	FINAL ASM*	COMMON SUB-ASM
SWISS/ GERMAN (RPQ SU0122)	TYPEWRITER OVERLAY	5881072 5881073	8115467 8115469
SWISS/ FRENCH (RPQ SU0123)	TYPEWRITER OVERLAY	5881074 5881075	8115468 8115470

\* PART NUMBERS LISTED IN THIS COLUMN ARE KEYBOARDS ONLY.  
FINAL ASSEMBLY NUMBERS (IN NEXT COLUMN) INCLUDES COVERS; CABLES, ETC.

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			KEYBOARD ASSEMBLY 75/76 KEY			
6 -	NO NO	REF				KEYBOARD ASM, 75 KEY FOR DETAILS SEE FIGURE 7
-	NO NO	REF	.			KEYBOARD ASM, 76 KEY FOR DETAILS SEE FIGURE 7
- 1	1742678	1	.			BASE ASM, 75/76 KEY
- 2	4406233	1	.			LABEL USED IN US/CANADA ONLY
- 3	1742689	1	.			STRAIN RELIEF
- 4	2181012	1	.			SCREW, HEX WSHR HD, 8-32, 11 MM (0.437) LG
- 5	1742668	1	.			CABLE ASM, 0.9 M (3 FT) FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 45-48
- 5	1742661	1	.			CABLE ASM, 1.8 M (6 FT) FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 45-48
- 6	1742662	1	.			CLICKER ASM
- 7	1742643	1	.			CLICKER ASM
- 8	1742663	1	.			CUSHION
- 9	1742664	1	.			CRADLE
- 10	1742658	1	.			BAIL SPRING
- 11	NO NO	1	.			KEYBOARD ASM FOR FURTHER INFORMATION SEE FIGURE 7
- 12	7388944	1	.			PAD CARD, 75 POSITION
- 12	1752366	1	.			PAD CARD, 76 POSITION
- 13	1748131	REF	.			KEY MODULE, ACTIVE
- 14	NO NO	REF	.			KEY BUTTON FOR DETAILS SEE FIGURE 9
- 15	2181012	2	.			SCREW, HEX WSHR HD, 8-32, 11 MM (0.437) LG
- 16	4942270	2	.			WSHR
- 17	1854442	1	.			SPACE BAR ASM
- 18	5183361	1	.			STABILIZER
- 19	1854443	1	.			SPACE BAR
- 20	5183362	2	.			PIVOT
- 21	1742773	1	.			COVER ASM, 75 KEY
- 21	1742637	1	.			COVER ASM, 76 KEY
- 21	1742672	1	.			COVER ASM, 75 KEY
- 22	2181012	4	.			SCREW, HEX WSHR HD, 8-32, 8-32, 11 MM (0.437)
- 23	NO NO	1	.			PROBLEM DETERMINATION GUIDE FOR DETAILS SEE FIGURE 10
24	742688	1	.			LATCH
- 25	1742686	1	.			ROD, HINGE
- 26	1742687	1	.			SPRING
- 27	1742085	1	.			REST, PALM
- 28	1650667	1	.			JUMPER
- 29	1742635	1	.			CADDY, CE
- 30	SEE NOTE	1	.			KEYBOARD LOGIC CARD, 75/76 KEY NOTE: ORDER ITEM 30 USING THE PART NUMBER ON THE FAILED CARD

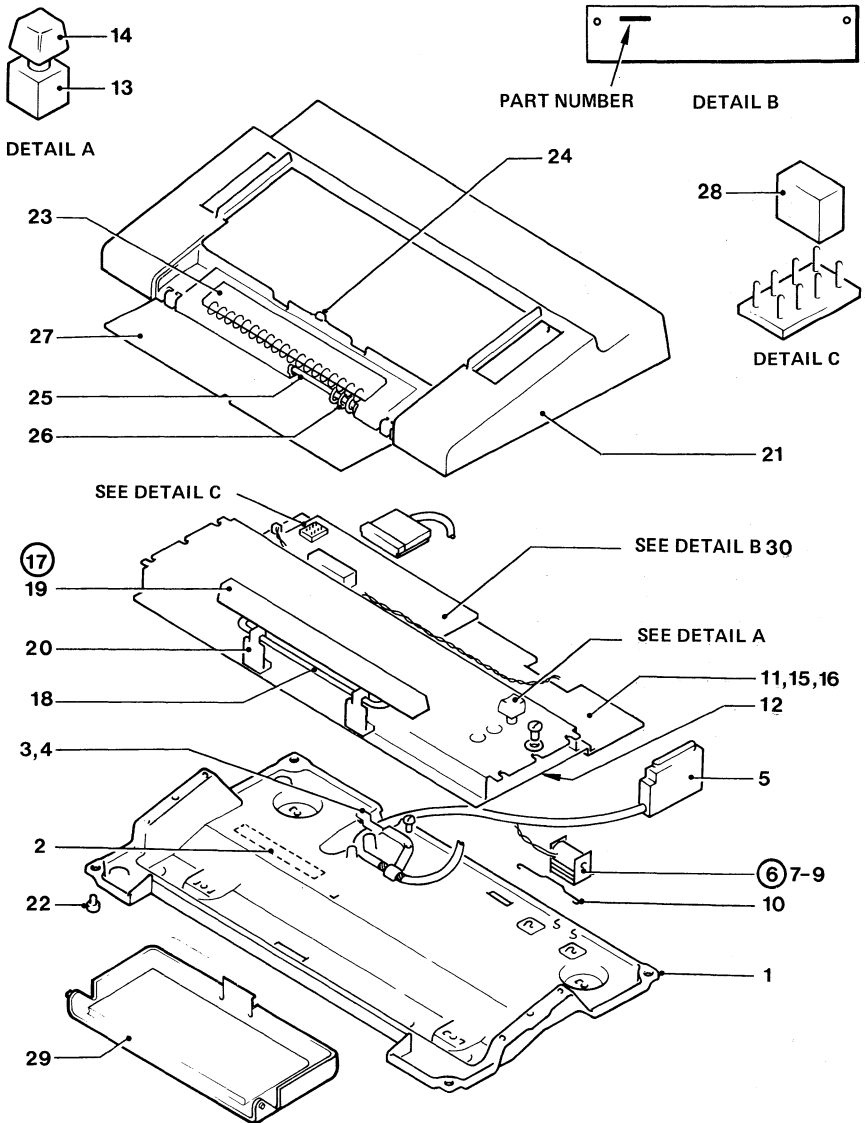


Figure 6. Keyboard Assembly 75/76 Key



**Notes:**

1. All keyboards are 75 key unless otherwise stated.
2. All keyboard types are without color.

Key: WO = without Numeric Lock  
 W = with Numeric Lock

LANGUAGE	KEYBOARD TYPE	FINAL ASM *	COMMON SUB-ASM
AUSTRIAN/GERMAN	TYPEWRITER	4941813	WO 1650674
	TYPEWRITER	4941954	W 1650674
	DATA ENTRY 1	4941814	WO 1650691
	DATA ENTRY 1	4941917	W 1650691
	DATA ENTRY 2	4941815	WO 1752430
	DATA ENTRY 2	4941918	W 1752430
BELGIUM	TYPEWRITER	4941771	WO 1650668
	TYPEWRITER	4941940	W 1650668
	DATA ENTRY 1	4941772	WO 1650685
	DATA ENTRY 1	4941903	W 1650585
	DATA ENTRY 2	4941773	WO 1752424
BRAZIL	DATA ENTRY 2	4941904	W 1752424
	TYPEWRITER	4941777	WO 1650669
	TYPEWRITER	4941942	W 1650669
	DATA ENTRY 1	4941778	WO 1650686
	DATA ENTRY 1	4941905	W 1650686
DENMARK	DATA ENTRY 2	4941779	WO 1752425
	DATA ENTRY 2	4941906	W 1752425
	TYPEWRITER	4941789	WO 1650670
	TYPEWRITER	4941946	W 1650670
	DATA ENTRY 1	4941790	WO 1650687
EBCDIC	DATA ENTRY 1	4941909	W 1650687
	DATA ENTRY 2	4941791	WO 1752426
	DATA ENTRY 2	4941910	W 1752426
	TYPEWRITER	4941795	WO 1650671
	TYPEWRITER	4941948	W 1650671
FINLAND	DATA ENTRY 1	1742701	WO 1645102
	DATA ENTRY 1	1742710	W 1645102
	DATA ENTRY 2	1742702	WO 1762694
	DATA ENTRY 2	1742711	W 1762694
	TYPEWRITER	4941801	WO 1650672
	TYPEWRITER	4941950	W 1650672
	DATA ENTRY 1	4941802	WO 1650689
	DATA ENTRY 1	4941913	W 1650689
DATA ENTRY 2	4941803	WO 1752428	
DATA ENTRY 2	4941914	W 1752428	

\* PART NUMBERS LISTED IN THIS COLUMN ARE KEYBOARDS ONLY.

FINAL ASSEMBLY NUMBERS (IN NEXT COLUMN) INCLUDES COVERS; CABLES, ETC.

LANGUAGE	KEYBOARD TYPE	FINAL ASM	*	COMMON SUB-ASM
FRENCH AZERTY	TYPEWRITER	4941877	WO	1752427
	TYPEWRITER	4941974	W	1752427
	DATA ENTRY 1	4941878	WO	1650688
	DATA ENTRY 1	4941937	W	1650688
	DATA ENTRY 2	4941879	WO	1752897
FRENCH QWERTY	DATA ENTRY 2	4941938	W	1752897
	TYPEWRITER	4941807	WO	1650673
	TYPEWRITER	4941952	W	1650673
	DATA ENTRY 1	4941808	WO	1650690
	DATA ENTRY 1	4941915	W	1650690
INTERNATIONAL	DATA ENTRY 2	4941809	WO	1752429
	DATA ENTRY 2	4941916	W	1752429
	TYPEWRITER	4941825	WO	1650675
	TYPEWRITER	4941958	W	1650675
	DATA ENTRY 1	4941826	WO	1650692
PORTUGAL	DATA ENTRY 1	4941921	W	1650692
	DATA ENTRY 2	4941872	WO	1752431
	DATA ENTRY 2	4941922	W	1752431
	TYPEWRITER	4941847	WO	1650678
	TYPEWRITER	4941964	W	1650678
SPAIN	DATA ENTRY 1	4941848	WO	1650696
	DATA ENTRY 1	4941927	W	1650696
	DATA ENTRY 2	4941849	WO	1752435
	DATA ENTRY 2	4941928	W	1752435
	TYPEWRITER	4941853	WO	1650679
SPANISH-SPEAKING	TYPEWRITER	4941966	W	1650679
	DATA ENTRY 1	4941854	WO	1650697
	DATA ENTRY 1	4941929	W	1650697
	DATA ENTRY 2	4941855	WO	1752436
	DATA ENTRY 2	4941930	W	1752436
SWEDEN	TYPEWRITER	4941859	WO	1650680
	TYPEWRITER	4941968	W	1650680
	DATA ENTRY 1	4941860	WO	1650698
	DATA ENTRY 1	4941931	W	1650698
	DATA ENTRY 2	4941861	WO	1752437
SWEDEN	DATA ENTRY 2	4941932	W	1752437
	TYPEWRITER	4941865	WO	1650681
	TYPEWRITER	4941970	W	1650681
	DATA ENTRY 1	4941866	WO	1650699
	DATA ENTRY 1	4941933	W	1650699
	DATA ENTRY 2	4941867	WO	1752438
	DATA ENTRY 2	4941934	W	1752438

★PART NUMBERS LISTED IN THIS COLUMN ARE KEYBOARDS ONLY.  
FINAL ASSEMBLY NUMBERS (IN NEXT COLUMN) INCLUDES COVERS; CABLES, ETC.

LANGUAGE	KEYBOARD TYPE	FINAL ASM *	COMMON SUB-ASM
U.K. ENGLISH	TYPEWRITER	4941871	WO 1650682
	TYPEWRITER	4941972	W 1650682
	DATA ENTRY 1	4941872	WO 1650700
	DATA ENTRY 1	4941935	W 1650700
	DATA ENTRY 2	4941873	WO 1752439
	DATA ENTRY 2	4941936	W 1752439
U.S. ENGLISH	TYPEWRITER	1742700	WO 1645100
	TYPEWRITER	1742720	W 1645100
	DATA ENTRY 1	1742701	WO 1645102
	DATA ENTRY 1	1742710	W 1645102
	DATA ENTRY 2	1742702	WO 1762694
	DATA ENTRY 2	1742711	W 1762694
	ASCII	1742704	WO 1648531
	ASCII	4941978	W 1648531
CANADIAN FRENCH	TYPEWRITER	4941783	WO 1650684
	TYPEWRITER	4941944	W 1650684
	DATA ENTRY 1	4941784	WO 1650702
	DATA ENTRY 1	4941907	W 1650702
	DATA ENTRY 2	4941785	WO 1752441
	DATA ENTRY 2	4941908	W 1752441
JAPAN KATAKANA 76 KEY	TYPEWRITER	4941835	WO 1648549
	TYPEWRITER	4941976	W 1648549
	DATA ENTRY 1	4941836	WO 1648550
JAPAN-ENGLISH	DATA ENTRY 1	4941939	W 1648550
	TYPEWRITER	4941831	WO 1650737
	TYPEWRITER	4941960	W 1650737
	DATA ENTRY 1	4941832	WO 1650694
	DATA ENTRY 1	4941923	W 1650694
	DATA ENTRY 2	4941833	WO 1752433
NORWAY	DATA ENTRY 2	4941924	W 1752433
	TYPEWRITER	4941841	WO 1650677
	TYPEWRITER	4941962	W 1650677
	DATA ENTRY 1	4941842	WO 1650695
	DATA ENTRY 1	4941925	W 1650695
ITALY	DATA ENTRY 2	4941843	WO 1752434
	DATA ENTRY 2	4941926	W 1752434
	TYPEWRITER	4941819	WO 1650676
	TYPEWRITER	4941956	W 1650676
	DATA ENTRY 1	4941820	WO 1650693
	DATA ENTRY 1	4941919	W 1650693
	DATA ENTRY 2	4941821	WO 1752432
	DATA ENTRY 2	4941920	W 1752432

\*PART NUMBERS LISTED IN THIS COLUMN ARE KEYBOARDS ONLY.  
FINAL ASSEMBLY NUMBERS (IN NEXT COLUMN) INCLUDES COVERS; CABLES, ETC.

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## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM				DESCRIPTION
		1	2	3	4	
						CONTROLLER SWITCH ASSEMBLY
8 -	4420277	REF				CONTROLLER SWITCH ASM
- 1	4422020	1	.			CONTROLLER SWITCH ASM
- 2	1743316	1	.			LABEL, ENGLISH
- 2	1743317	1	.			LABEL, FRENCH
- 2	1743318	1	.			LABEL, ITALIAN
- 2	1743319	1	.			LABEL, SPANISH
- 2	1743320	1	.			LABEL, GERMAN
- 2	1743313	1	.			LABEL, CANADIAN FRENCH
- 2	1743314	1	.			LABEL, PORTUGUESE
- 2	1743315	1	.			LABEL, JAPANESE

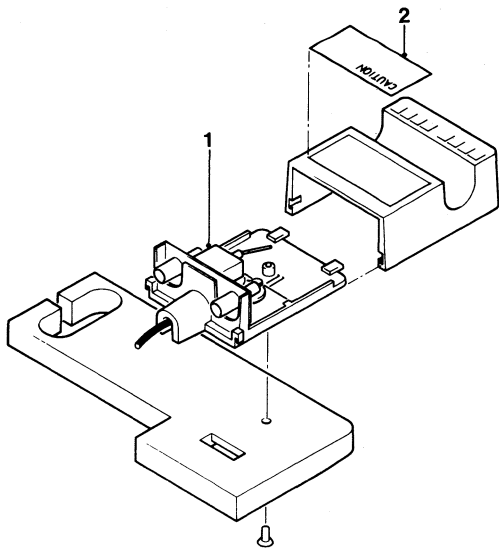
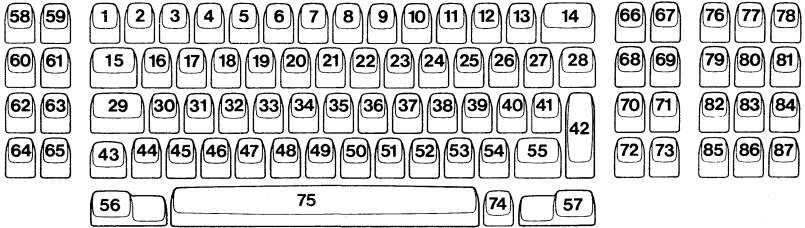
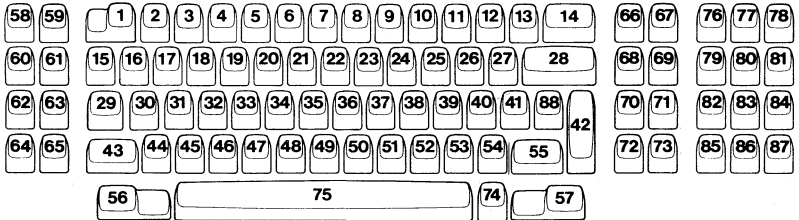


Figure 8. Controller Switch Assembly



Keybutton Positions for 87 Key Keyboard



Keybutton Positions for 88 Key Keyboard

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
1		1853775	2		1757481	3		8326284	3		1853547
		1854578			8326283			8626901			1855131
		5192898			8626900			1854857	4		1643628
		1752539			1853571			1853572			1752523
		8542644			1757230			1855131			1757145
		1643611			1757308			1854265			1757303
		1757229			1855167			1855149			1756271
		5587644			1853547			1855336			1757485
		5588068	3		1643633			1854098			1756278
2		1643634			1752521			1855164			5587610
		1752520			1756286			1752818			8326285
		1756284			1757483			1855169			8626914
		5587735			5587609			1854858			8626937

Figure 9 (Sheet 2 of 17). Keypoint Group



Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
4		8626952	5		1854859	7		1756266	7		1751185
		8626954			1855139			1752525			1757269
		1854858			1757301			1757146			5587622
		1855169			1855170			1757491			5588070
5		1643623			1854858			5587612	8		1643625
		1752532	6		1643624			8326288			1752526
		1756290			1756292			8626910			1756296
		5587736			1757489			8626902			1757493
		1757487			8326287			8627073			1756279
		1752532			1854860			1853606			5587613
		8326286			1855137			1757091			8326289
		8626909			5588069			5188362			8626903
		8626955	7		1643632			1757151			8626957

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
8		1853607	10		1752528	11		8542588	11		1757186
		1757148			1756300			5587616			5587646
		1855173			1757497			8326292	12		1643630
9		1643626			5587615			8626906			1752530
		1752527			8326291			8626958			1757125
		1756298			8626905			1853572			1752533
		1757495			1854864			1853573			1756304
		5587614			1756276			1757231			1756281
		8326290			5588071			1757309			5587617
		8626904	11		1643629			5588072			8326293
		1854863			1752529			1854071			8626907
		1855174			1756302			1757092			8626933
10		1643627			1757499			1757243			8626912

Figure 9 (Sheet 4 of 17). Keybutton Group

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
12		8626959	13		1757126	13		8626934	13		5588074
		1853573			1752531			8626908			1853572
		1853574			1752534			8626911			1757232
		1757232			1757147			8626915			1757310
		1757310			1756313			8626935	14		1643648
		5588073			5587653			8626938			8326295
		1853572			1756272			8626953			8626936
		1853571			1757306			8626956			8626932
		1757231			1761423			8626960			8626951
		1757309			5587618			1853574			8627074
		1761422			1752524			1853575			1752485
13		1643631			8326294			1757233			1756321
		1752517			8626913			1757311			1756316

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
14		1757174	17		5189788	19		1855120	20		1752819
		5587737			1854871			1855143			1855154
15		1643646			1855136			1855150			1855183
16		1853743			1855180			5194238	21		1853748
		1854104	18		1853745			1762676			1854105
		1752565			1752567			1855153			1752570
		5189786			1854872			1855182			5189906
		1854870			1855181	20		1853747			1854875
		1855132	19		1853746			1752569			1855126
		1855170			1752568			1854874			1854921
17		1853744			1854873			1855125			1855184
		1854105			1855124			1855133	22		1853749
		1752566			1854920			1855138			1752571

Figure 9 (Sheet 6 of 17). Keybutton Group

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
22		1854876	25		1853752	26		1854285	26		5189761
		5182751			1752574			1854244			5189819
		1855185			1853814			1854266			5189851
23		1853750			1854879			1752575			1643612
		1752572			1855188			5189835			1855127
		1854877	26		1854107			5189909			185510
		5182752			1854108			5189791			1855141
		1855186			1855354			5189851			1855145
24		1853751			1854256			5189925			1757236
		1752573			1854283			5189965			1757312
		1854878			1854269			5189881			5588075
		5182753			1854289			5189917			1854076
		1855187			1854277			5189891			1757245

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
26		5194240	27		5189871	27		1757312	31		1752579
		1757296			5189793	28		5194148			1854894
		5188352			5189853			5194344			1855193
		5587649			8542655	29		5194147	32		1853755
27		1854579			5189821			5588077			1752580
		1855036			1643613	30		1853753			1854895
		1854107			1643612			1854110			1855194
		1855025			1757237			1752578	33		1853756
		5194235			1757313			5189794			1752581
		5192899			5588076			1854893			1854896
		5188378			5188377			1855134			1855198
		5189739			1854076			1855192	34		1853757
		5189942			1757236	31		1853754			1752582

Figure 9 (Sheet 8 of 17). Keybutton Group

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
34		1854897	37		1752585	39		1854279	39		5189967
		8627065			1854900			1854271			5189863
		1854922			1855199			1854290			5189883
		1855196	38		1853761			1854114			5189919
35		1853758			1752586			1854111			5189873
		1752583			1854901			1854259			5189765
		1854898			1855200			1854148			5189937
		1855197	39		1853762			1752587			5189855
36		1853759			1752515			5189837			1853632
		1752584			1854113			5189855			1855128
		1854899			1854245			5189797			1757238
		1855198			1854258			5189899			1757197
37		1853760			1854294			5189927			5588078

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
40		1853763	40		1854149	40		5189767	40		1757180
		1752514			1854279			5189823			5587733
		1854118			1752589			5189939	41		1854580
		1855356			5189839			1643614			1855037
		1854259			5189857			1855129			5188335
		1854295			5189799			1855142			1855018
		1855030			5189901			1855144			1855024
		1854248			5189929			1757239			1855026
		1854291			5189969			1757197			1855027
		5194236			5189865			1645044			1855029
		1854116			5189885			1757314			5194237
		5587633			5189921			5588079			5192900
		1854258			5189893			1752522			5587634

Figure 9 (Sheet 10 of 17). Keybutton Group



Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
41		1855030	41	PF7	1643614	42	PF8	1752487	43		1643637
		1752591		TAB	1645044						5588001
		5189840		SKIP	1853632				44		1854581
		5189910		PF6	1752522		DAT FREIG	1757101			1855039
		5189800		P8	1757240						5194319
		5189858		FP7	1757314		PF5	1756325			1752592
		5189970		FP8	5587836						8542649
		5189886		PF8	5588080		PF6	1756320			1643616
		5189795		PF4	1756315						1756270
		5189894		P7	1757239		P8	1757246			1756268
		2542648		FP6	5587733						1756269
		5189824	42		8326350		FP8	5587845	44		1757241
	PF8	1643615									1757316
							FP7	1757297			

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
44		1757315	46		1752594	49		1854909	51		1752599
		1854317			1854906			1853902			1854911
45		1853764			1855209			1854923			5182756
		1854129	47		1853766			1855151			1855214
		1854128			1752595			1855337	52		1853804
		1752593			1854907			5194239			1853868
		5189803			1855210			1762677			1853771
		5189802	48		1853767			1855212			5587637
		1854905			1752596	50		1853769			1854109
		1855130			1854908			1752598			1752600
		1855135			1855211			1854910			5189804
		1855200	49		1853768			1855213			8626917
46		1853765			1752597	51		1853770			5189771

Figure 9 (Sheet 12 of 17). Keybutton Group





















































Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
52		5189831	53		5189827	54		5189829	56	RESET	1853554
		1854912			5189805		PF10	1643617		GRDSTG	1757122
		1855146			1854913		SPRG	1757113		RESTAUR	1757244
		5182757			1855148		PF7	1756269		RIPRIST	1757207
		1855215			5182758		PF8	1756270		REST	5188348
53		1853805	54		5588083		PF8	1855147		PF10	1752489
		1853869			1853773		PF10	5587734		PF8	1756317
		1853772			1854241		FP9	1757316		PF7	1756324
		5587638			5188364		PF10	5588084		P10	1757247
		1854115			1854119		←	1854143		PF10	5587651
		1752602			1752604	55	↑	1643644		FP9	1757299
		8626919			5189807		↓	5194149	57	ENTER	1853555
		5189773			5189935		カナ	5588085		DAT FREIG	1757124










































Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
57		1757178	59		1757089	62		5188817	63		5188342
		5188780			1757143			5194131	64		5194150
		1757295			1757184			5194135	65		5194153
		5587643									
		5188375			1757266			5194127			5194158
		8326351									5194159
58		1643618			5587607			5194129			5194157
											5194160
		1757806	60		5188360	63		5194133			5194166
		1757140	61		8326349			1853544			5194156
					8326353			1757099	66		1643635
		1757181			8326354			1757163			1757149
		1756294			8326356			1757195			1757211
		5188358			8326357			1757279			5587620
					8326358			5188638			1853594
59		1648441			6326355						

Figure 9 (Sheet 14 of 17). Keybutton Group

Figure 9 (Sheet 15 of 17). Keybutton Group

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
66		1757234	70		8326360	76		8326365	77		8627367
		5287647			8326360			8326364			8627320
67		1648432	71		8326361			8627066			8627378
		8626966			8326361			8326426			8627356
		1757152	72		5194190			8627067			8326367
		1757212	73		5194191			8326363			8326371
		1757270	74		1643610			8326365			8326369
		5587623			1757177			8326364			8326428
		1853610			1757209			8627066			8626988
		1757235			1757294			8326426			8326430
		5587648			5587642			8627067	78		8326372
68		5194154	75	Spacebar	1854442	77		8627331			8326374
69		5194155	76		8326363			8627389			8326373

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
78		8626989	79		8326414	80		8326419	82		8326387
		8626991			8326348	81		8326384			8326389
		8626990			8627334			8326386			8326388
		8627333	80		8627392			8326385			8326423
		8627391			8627370			8626992			8326425
		8627369			8627323			8626994			8326424
		8627322			8627381			8626993	83		8627337
		8627380			8627359			8627336			8627395
		8627358			8326379			8627394			8627373
79		8326375			8326383			8627372			8627326
		8326377			8326381			8627325			8627384
		8326376			8326417			8627383			8627362
		8326432			8326421			8627361			8326391

Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N	Loc.	Character	P/N
83		8326395	84		8627375	86		8626983	87		8627388
		8326393			8627328			8626987			8627366
		8626971			8627386			8626985			
		8626975			8627364	87		8326411			
		8626973	85		8326400			8326413			
84		8326396			8326404			8326412			
		8326398			8326402			8626998			
		8326397			8626977			8627000			
		8626995			8626981			8626999			
		8626997			8626979			8627341			
		8626996	86		8326406			8627399			
		8627339			8326410			8627377			
		8627397			8326408			8627330			

PROBLEM DETERMINATION GUIDE	
COUNTRY	FORM NUMBER
Brazil	GA17-0029
Canada	GA09-0090
Denmark	GA19-6031
Finland	GB11-6145
France	GA11-0118
Germany	GA12-2409
Italy	GA13-0158
Japan (English/Katakana)	NGA18-2067*
Japan (English/Katakana)	GA18-2067
Japan (WT)	NGA33-3051*
Netherlands	GA14-5193
Norway	GA15-3062
Spain	GA10-8174
Sweden	GA14-0526
US English	GA33-3051

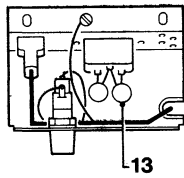
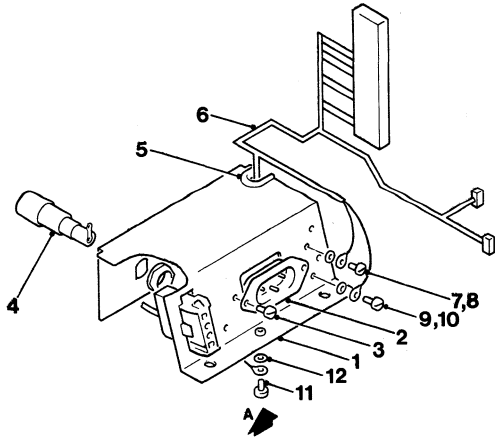
\*Printed in Japanese



## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			AC BOX (POWER PLATE) ASSEMBLY (EMEA*)			
11 -	4420492	REF				AC BOX (POWER PLATE) ASM
- 1	4420460	1	.			PLATE
- 2	5640669	1	.			RECEPTACLE
- 3	1621286	2	.			SCREW, P HD, M3, 20 MM LG
- 4	6814322	1	.			FUSE HOLDER ASM
- 5	473442	1	.			GROMMET, 24 MM LG
- 6	4420488	REF	.			CABLE ASM, AC DISTRIBUTION FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 29,30
- 7	1621190	1	.			SCREW, P HD, M4, 8 MM LG
- 8	1622346	1	.			LCK W, EX TH, 4.3 MM ID
- 9	1621190	1	.			SCREW, P HD, M4, 8MM LG
- 10	1622346	1	.			LCK W, EX TH, 4.3 MM ID
- 11	1621197	1	.			SCREW, P HD, M4, 6 MM LG
- 12	1622346	1	.			LCK W, EX TH, 4.3 MM ID
- 13	4409572	2	.			CAPACITOR

\* FOR COUNTRIES SERVICED BY IBM WORLD TRADE  
EUROPE/MIDDLE EAST/AFRICA CORPORATION

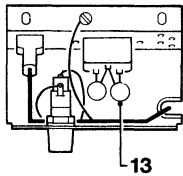
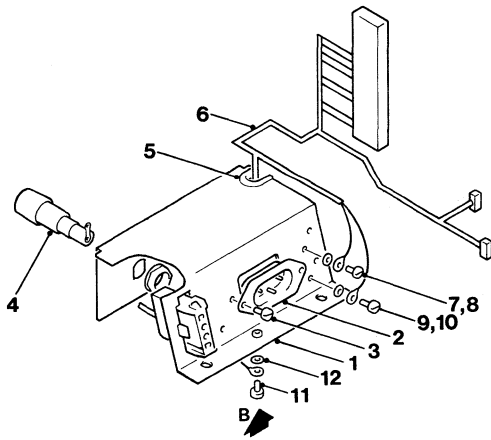


VIEW A

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			AC BOX (POWER PLATE) ASSEMBLY (US/AFE*)			
12 -	4420491	REF				AC BOX (POWER PLATE) ASM
- 1	4420461	1				PLATE
- 2	4406541	1				RECEPTACLE
- 3	1621844	2				SCREW, P HD, M3, 6 MM LG
- 4	6814322	1				FUSE HOLDER ASM
- 5	473442	1				GROMMET, 24 MM LG
- 6	4420488	REF				CABLE ASM, AC DISTRIBUTION FOR COMPONENT PARTS SEE FIGURE 15, ITEMS, 29, 30
- 7	1621190	1				SCREW, P HD, M4, 8 MM LG
- 8	1622346	1				LCK W, EX TH, 4.3 MM ID
- 9	1621190	1				SCREW, P HD, M4, 8 MM ID
- 10	1622346	1				LCK W, EX TH, 4.3 MM ID
- 11	1621197	1				SCREW, P HD, M4, 6 MM LG
- 12	1622346	1				LCK W, EX TH, 4.3 MM ID
- 13	4409572	2				CAPACITOR

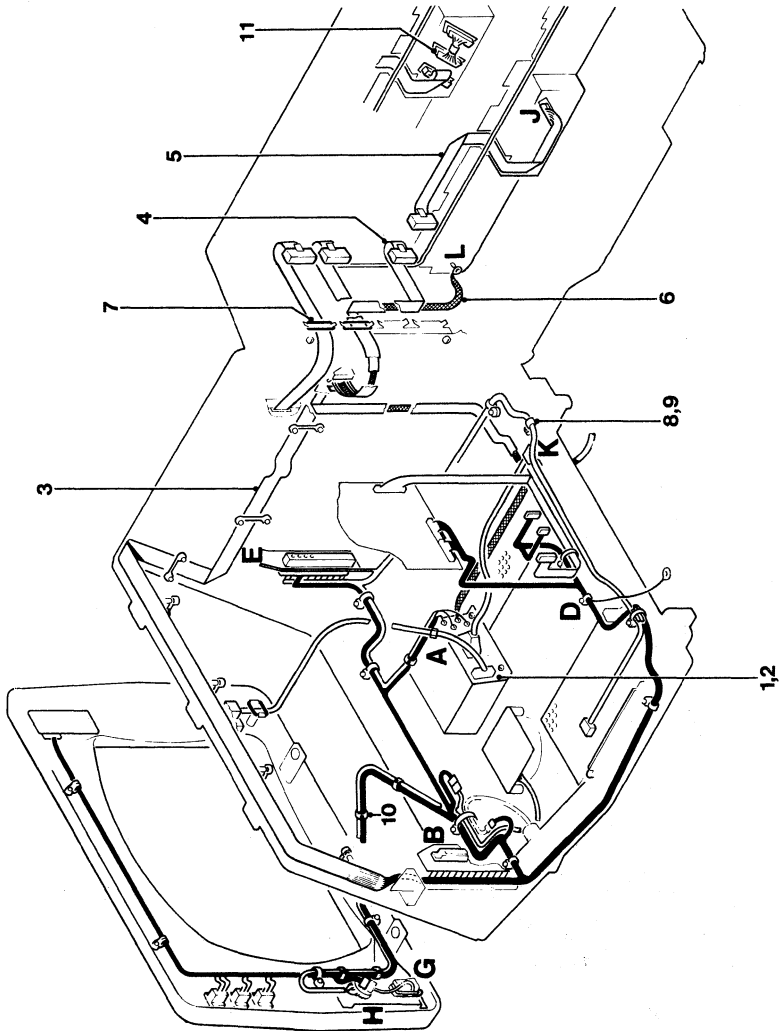
\* FOR COUNTRIES SERVICED BY IBM WORLD  
TRADE AMERICAS/FAR EAST CORPORATION



**VIEW B**

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			CABLE ASSEMBLY			
13 -		REF				CABLE ASM
- 1	4420491	1	.			POWER PLATE ASM (US/AFE)
- 1	4420492	1	.			POWER PLATE ASM (EMEA)
- 2	4420421	2	.			SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 3	4423437	1	.			CABLE ASM, DISTRIBUTION FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 1-6, 9, 10, 12-14, 18, 20-22, 25, 27, 29, 30
- 4	4423237	1	.			CABLE ASM, LOGIC TO VIDEO AND AN 2 FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 7, 8, 12, 13, 18, 20
- 5	4423475	1	.			CABLE ASM, KEYBOARD INT FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 12, 13, 15, 18, 19, 32
- 6	4420793	1	.			GROUND JUMPER ASM FOR COMPONENT PARTS SEE FIGURE 15, ITEM 30
- 7	2114044	3	.			CABLE STRAP
- 8	472707	1	.			CABLE CLAMP
- 9	4420421	1	.			SCREW, HEX WSHR HD, 6-19, 8 MM LG, THD FORMING
- 10	5420242	4	.			CABLE TIE
- 11	1743057	1	.			CABLE ASM FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 15, 23, 45, 46

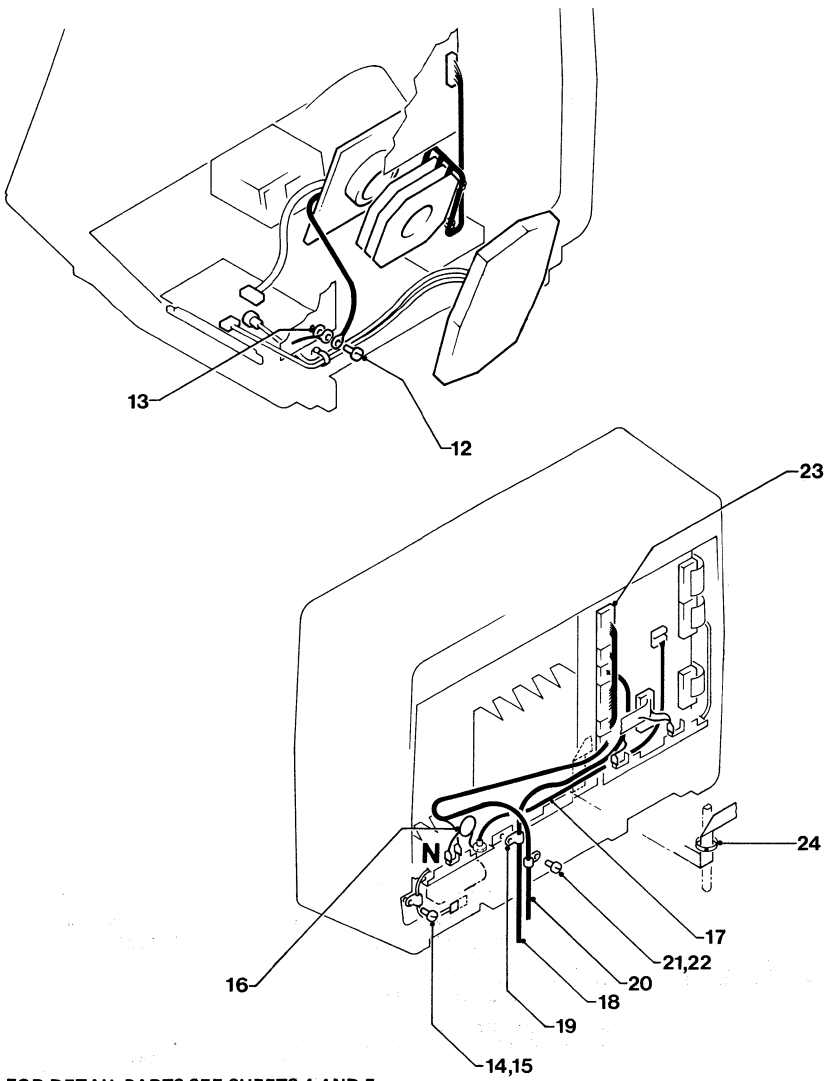


FOR DETAIL PARTS SEE SHEETS 4 AND 5

Figure 13 (Sheet 1 of 5). Cable Assembly

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			CABLE ASSEMBLY (CONT)			
13 - 12	1621191	1	.			SCREW, PHD, M4, 10 MM LG
- 13	1622346	1	.			LCK W, EX TH, 4.3 MM ID
- 14	5213276	1	.			CABLE CLAMP
- 15	4420424	1	.			SCREW, HEX WSHR HD, 6-19, 10 MM LG, THD FORMING
- 16	4418786	1	.			FILTER ASM
- 17	4423481	1	.			CABLE ASM, COAX INT FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 16, 17, 26, 38, 39
- 18	4423250	1	.			CABLE ASM, MSR FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 11, 13, 18, 19, 24, 33, 35-37
- 19	2102364	1	.			CABLE CLIP
- 20	4423097	1	.			SEL PEN ASM, (OLD MODEL 3) SMALL LENS
- 20	4420407	1	.			SEL PEN ASM, (OLD MODEL 2) LARGE LENS
- 20	4422183	1	.			SEL PEN ASM, (NEW MODEL 3) SMALL LENS
- 20	4421284	1	.			SEL PEN ASM, (NEW MODEL 2) LARGE LENS
- 21	5213276	1	.			CABLE CLIP
- 22	1621852	1	.			SCREW, P HD, M4, 10 MM LG, THD FORMING
- 23	4423112	1	.			CABLE ASM, GATE CROSSOVER FOR COMPONENT PARTS SEE FIGURE 15, ITEMS 12, 13, 23
- 24	5420242	1	.			CABLE TIE



FOR DETAIL PARTS SEE SHEETS 4 AND 5

Figure 13 (Sheet 2 of 5). Cable Assembly

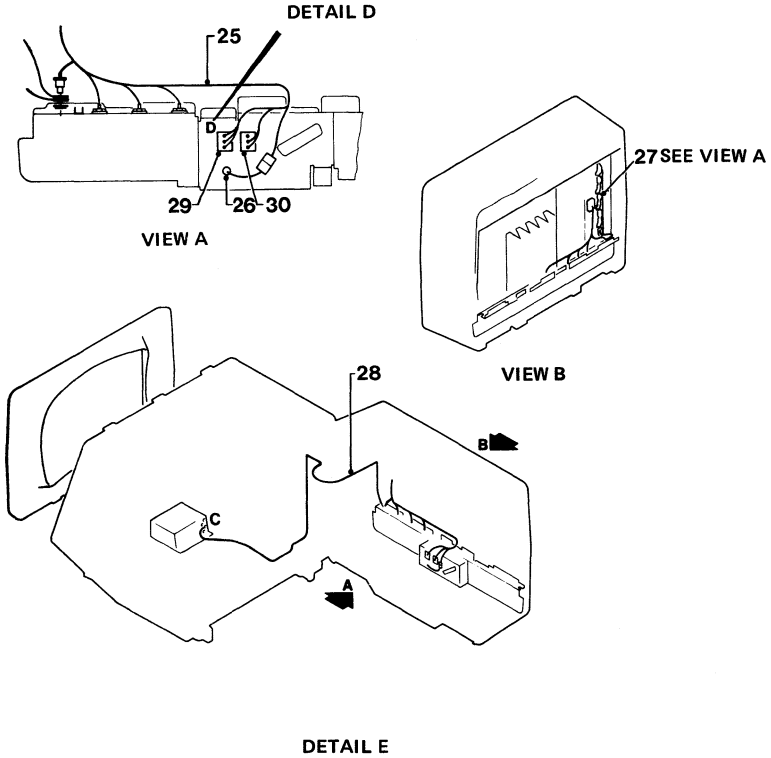


## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	CABLE ASSEMBLY (CONT)				DESCRIPTION
			1	2	3	4	
13 - 25	4418779	1	.	.	.	.	CABLE ASM, MON ATTACH FOR COMPONENT PARTS SEE FIGURE 15, ITEMS ITEMS 2, 10, 12, 13, 16, 18, 21, 27
- 26	4420428	1	.	.	.	.	L.E.D. ASM
- 27	5881129	1	.	.	.	.	BUS STRIP ASM
- 28	5881272	1	.	.	.	.	EARTH STRAP ASM
- 29	5881268	1	.	.	.	.	SWITCH, SP DT
- 30	1655357	1	.	.	.	.	SWITCH, SP DT



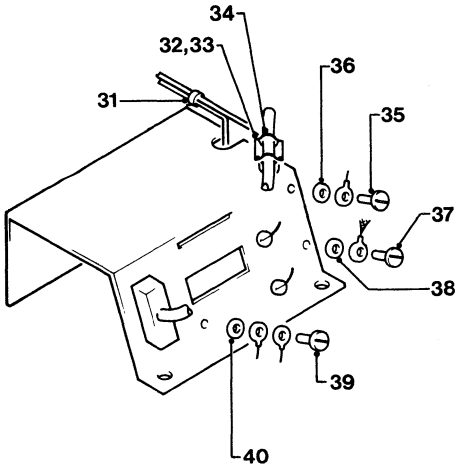
FIGURES DENOTE WIRE NUMBERS TO DETAIL D



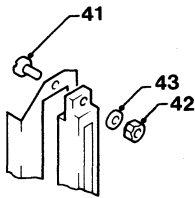
NOTE: THIS DRAWING SHOWS ADDITIONAL CABLES FOR RPQ 7J0039

## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			CABLE ASSEMBLY (CONT)			
13 - 31	5420242	1	.	.	.	CABLE TIE
- 32	2114043	1	.	.	.	CRADLE
- 33	1621197	1	.	.	.	SCREW, P HD, M4, 6 MM LG
- 34	2114044	1	.	.	.	CLIP
- 35	1621190	1	.	.	.	SCREW, P HD, M4, 8 MM LG
- 36	1622346	1	.	.	.	LCK W, EX TH, 4.3 MM ID
- 37	1621190	1	.	.	.	SCREW, P HD, M4, 8 MM LG
- 38	1622346	1	.	.	.	LCK W, EX TH, 4.3 MM ID
- 39	1621190	1	.	.	.	SCREW, P HD, M4, 8 MM LG
- 40	1622346	1	.	.	.	LCK W, EX TH, 4.3 MM ID
- 41	1621173	2	.	.	.	SCREW, P HD, M3, 12 MM LG
- 42	1622401	2	.	.	.	NUT

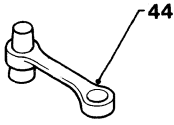


DETAIL A (SHEET 1)

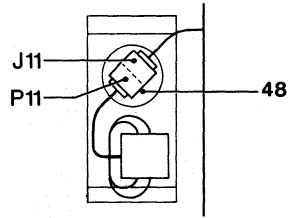


## 3279

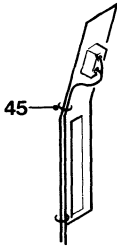
FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			CABLE ASSEMBLY (CONT)			
13 - 43	1622344	2	.	LCK W, EX TH, 3.2 MM ID		
- 44	811427	2	.	RETAINER		
- 45	5420242	2	.	CABLE TIE		
- 46	1621852	1	.	SCREW, P HD, M4, 10 MM LG, THD FORMING		
- 47	1622346	1	.	LCK W, EX TH, 4.3 MM ID		
- 48	450692	A/R	.	TAPE, 110 MM LG		
- 49	2565092	2	.	SCREW, HEX HD, 4-40, 6.3 MM (0.248) LG, THD FORMING		
- 49	2565092	4	.	SCREW, HEX HD, 4-40, 6.3 MM (0.248) LG, THD FORMING, USED ON MODEL 2		
- 50	4420457	1	.	STRAIN RELIEF		
- 51	4420423	2	.	SCREW, HEX WSHR HD, 6-19, 12 MM LG, THD FORMING		
- 52	1622403	1	.	NUT		
- 53	1622346	1	.	LCK W, EX TH, 4.3 MM ID		



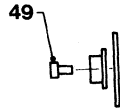
DETAIL D



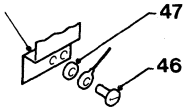
DETAIL H



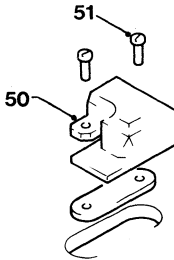
DETAIL E



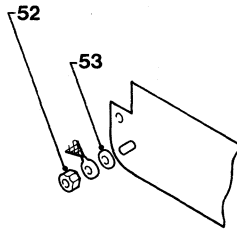
DETAIL J



DETAIL G



DETAIL K



DETAIL L

AFE (WITH UL M/C PLUG)								
COUNTRIES	VOLTAGE	FREQ (HZ)	CSU PLUG TYPE	WIRE COLOURS	PART NUMBERS			
					1.8M	2.8M	3.7M	4.6M
BAHAMAS	120	60	TYPE 'DD'	BLACK		1655379		1655424
BERMUDA	120	60	FIG 6	WHITE				
BOLIVIA	115	60	NON-LOCK	GN/YEL				
BRAZIL	120-127	60	↓	↓				
COLOMBIA	120	60						
COSTA RICA	120	60						
DOMINICAN REP	120	60						
ECUADOR	110	60						
EL SALVADOR	120	60						
GUATEMALA	120	60						
HONDURAS	110	60						
JAPAN	100	50/60						
MEXICO	127	60						
NETH. ANTILLES	120-127	60						
NICARAGUA	120	60						
PANAMA	120	60						
PHILIPPINES	110	60						
TAIWAN	110	60						
TRINIDAD	115	60						
VENEZUELA	120	60						
ARGENTINA	220	50	TYPE 'EE'	BROWN		1655392		4406528
CHILE	220	50	FIG 5	LIGHT BLUE				
PARAGUAY	220	50	NON-LOCK	GN/YEL				
URUGUAY	220	50	↓	↓				
AUSTRALIA	240	50						
NEW ZEALAND	230	50						
INDONESIA	220	50	TYPE 'MA'	BROWN		1655391		4406536
			FIG 15	LIGHT BLUE				
			NON-LOCK	GN/YEL				
JAPAN	200	50/60	TYPE 'MG'	BLACK		1743137		1743139
			FIG 20	WHITE				
			TWIST-LOCK	GN/YEL				
MALAYSIA	240	50	TYPE 'MJ'	BROWN		1655390		1655430
SINGAPORE	230	50	FIG 23	LIGHT BLUE				
			NON-LOCK	GN/YEL				
HONG KONG	200	50	TYPE 'MH'	BROWN	1743381	1743382	1743383	1743384
			FIG 21	LIGHT BLUE				
			NON-LOCK	GN/YEL				
BRAZIL	220	60	TYPE 'EE'	BLACK				
PERU	220	60	FIG 5	WHITE				
COLOMBIA	208/240	60	NON-LOCK	GN/YEL				
TRINIDAD	230	60	↓	↓				
VENEZUELA	208/240	60						
BARBADOS	120	50	TYPE 'DD'	BROWN				
CHILE	110	50	FIG 4	LIGHT BLUE				
JAMAICA	110	50	NON-LOCK	GN/YEL				

VERSION WITH NO CSU PLUG							
COUNTRIES	M/C PLUG TYPE	FREQ (HZ)	WIRE COLOURS	PART NUMBERS			
				1.8M	2.8M	3.7M	4.6M
US/AFE	UL	60	BLACK WHITE GN/YEL	4406504	4406505	4406506	4406507
AFE	UL	50	BROWN LIGHT BLUE GN/YEL	1655425	1655378	1655426	1655427
EMEA	CEE 22	50	BROWN LIGHT BLUE GN/YEL		5640660		4420410
EMEA	CEE 22	60	BLACK WHITE GN/YEL	5640673	5640687		4420418

EMEA (WITH CEE 22 M/C PLUG)								
COUNTRIES	VOLTAGE	FREQ (HZ)	CSU PLUG TYPE	WIRE COLOURS	PART NUMBERS			
					1.8M	2.8M	3.7M	4.6M
AUSTRIA	220	50	TYPE 'MA'	BROWN		5640663		4420411
BULGARIA	220	50	FIG 15	LIGHT BLUE		↓		↓
FINLAND	220	50	NON-LOCK	GRN/YEL		↓		↓
GERMANY	220	50				↓		↓
ICELAND	220	50				↓		↓
IRAN	220	50				↓		↓
NORWAY	220	50				↓		↓
POLAND	220	50				↓		↓
PORTUGAL	220	50				↓		↓
ROMANIA	220	50				↓		↓
SPAIN	220	50				↓		↓
SWEDEN	220	50				↓		↓
TURKEY	220	50				↓		↓
YUGOSLAVIA	220	50				↓		↓
ALGERIA	220	50	TYPE 'MC'	BROWN		5640661		4420412
BELGIUM	220	50	FIG 18	LIGHT BLUE		↓		↓
FRANCE	220	50	NON-LOCK	GN/YEL		↓		↓
GREECE	220	50				↓		↓
HUNGARY	220	50				↓		↓
ITALY	220	50				↓		↓
SWITZERLAND	220	50				↓		↓
DENMARK	220	50	TYPE 'MF'	BROWN		5640667		4420415
			FIG 19	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
ISRAEL	230	50	TYPE 'XX'	BROWN		5640672		4420419
			FIG 32	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
ITALY	220	50	TYPE 'ML'	BROWN		5640668		4420417
			FIG 25	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
SAUDI ARABIA	127	60	TYPE 'GG'	BLACK		4420362		4420363
			FIG 7 (15A)	WHITE		↓		↓
			TW-LOCK	GN/YEL		↓		↓
SAUDI ARABIA	220	60		BLACK				
				WHITE				
				GN/YEL				
SOUTH AFRICA	230	50	TYPE 'MI'	BROWN		5640666		4420414
			FIG 22	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
SWITZERLAND	220	50	TYPE 'MK'	BROWN		5640665		4420416
			FIG 24	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
UNITED KINGDOM	240	50	TYPE 'MJ'	BROWN		5640662		4420413
IRELAND	240	50	FIG 23	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓
NETHERLANDS	220	50	TYPE 'MA'	BROWN		5641082		4420337
			FIG 15	LIGHT BLUE		↓		↓
			NON-LOCK	GN/YEL		↓		↓

DOMESTIC (WITH UL M/C PLUG)								
COUNTRIES	VOLTAGE	FREQ (HZ)	CSU PLUG TYPE	WIRE COLOURS	PART NUMBERS			
					1.8M	2.8M	3.7M	4.6M
USA	208/240	60	TYPE 'CC'	BLACK				
			FIG 2	WHITE				
			NON-LOCK	GN/YEL				
USA	120	60	TYPE 'GG'	BLACK				
			FIG 8 (20A)	WHITE				
			TWIST-LOCK	GN/YEL				
USA/CANADA	120	60	TYPE 'GG'	BLACK	1655402	1655401	1655431	1655432
			FIG 7 (15A)	WHITE				
			TWIST-LOCK	GN/YEL				
USA/CANADA	120	60	TYPE 'DD'	BLACK	1655377	1655379	1655423	1655424
			FIG 4	WHITE				
			NON-LOCK	GN/YEL				



## 3279

FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			JUMPER & CABLE COMPONENT ASM			
15 -			JUMPER & CABLE COMPONENT			
- 1	2731835	.				HOUSING
- 2	2731850	.				HOUSING
- 3	2732354	.				HOUSING
- 4	2731851	.				HOUSING
- 5	2731836	.				HOUSING
- 6	2731852	.				HOUSING
- 7	2731838	.				HOUSING
- 8	2731839	.				HOUSING
- 9	2637689	.				INSERT
- 10	1743055	.				STRAIN RELIEF
- 11	2732337	.				HOUSING
- 12	2732338	.				HOUSING
- 13	2732342	.				SHROUD
- 14	6814383	.				HOUSING
- 15	1655336	.				CONNECTOR
- 16	5252661	.				CONNECTOR
- 17	1743169	.				HOUSING
- 18	2637691	.				CONTACT
- 19	2637690	.				CONTACT
- 20	1661528	.				CONTACT
- 21	2731384	.				CONTACT
- 22	2122259	.				CONTACT
- 23	1655337	.				CONTACT
- 24	1655358	.				CONTACT

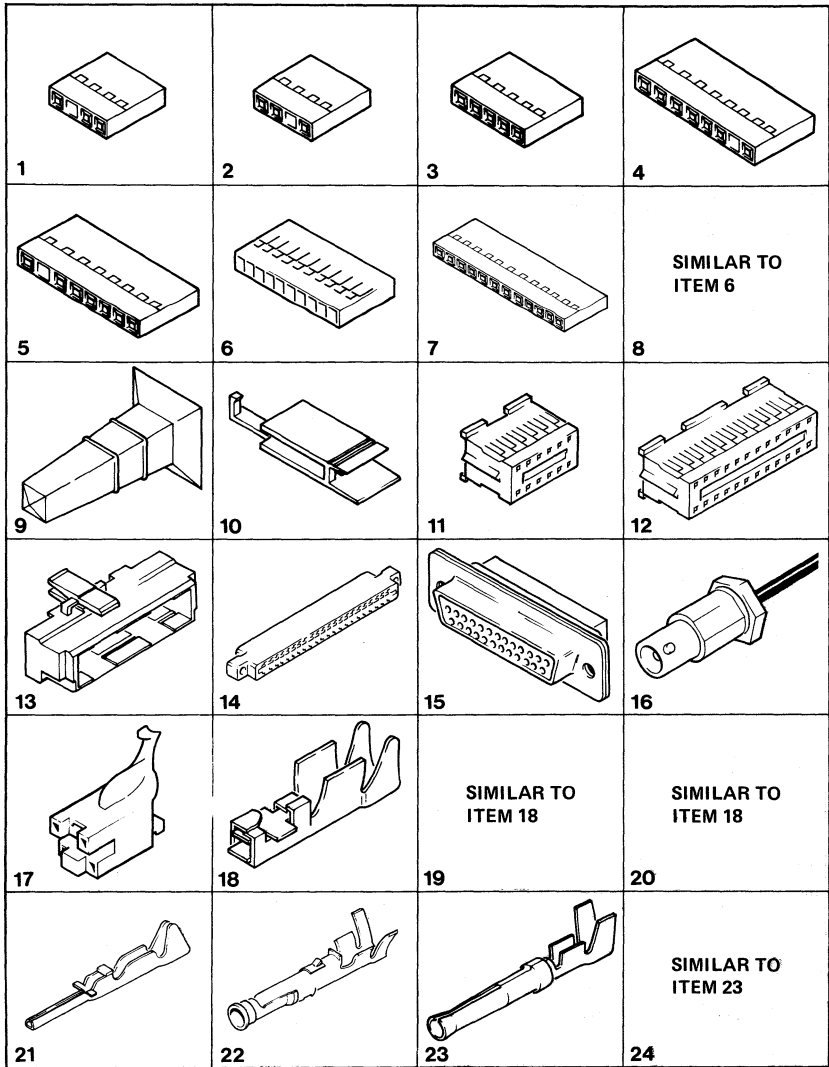


Figure 15 (Sheet 1 of 2). Jumper and Cable Component Assembly

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FIGURE- INDEX NUMBER	PART NUMBER	UNITS PER ASM	DESCRIPTION			
			1	2	3	4
			JUMPER & CABLE COMPONENT ASM (CONT)			
15 -			JUMPER & CABLE COMPONENT			
- 25	6814354	.				CONTACT
- 26	816884	.				CONTACT
- 27	1608893	.				TERMINAL
- 28	6814371	.				HOUSING
- 29	483681	.				TERMINAL
- 30	483682	.				TERMINAL
- 31	1847525	.				HOUSING
- 32	523267	.				TERMINAL
- 33	430799	.				TERMINAL
- 34	1847529	.				HOUSING
- 35	4832993	.				RECEPTACLE
- 36	5576593	.				SEAL
- 37	4832957	.				CABLE CRIMP
- 38	2577718	.				BUSH
- 39	442458	.				WASHER
- 40	1847524	.				HOUSING
- 41	1847520	.				CONTACT
- 42	1847521	.				CONTACT
- 43	2122261	.				CONTACT
- 44	5275481	.				STRAIN RELIEF
- 45	1655338	.				CONNECTOR
- 46	1655339	.				CONTACT
- 47	1655359	.				CONTACT

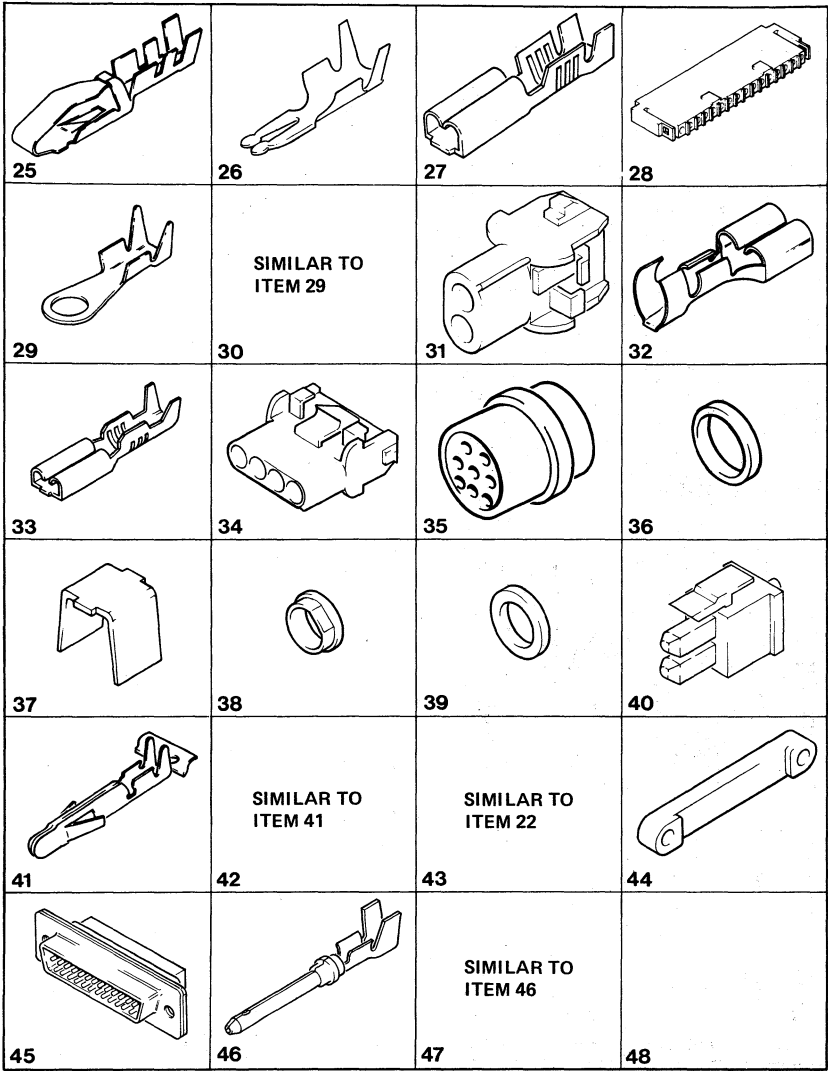


Figure 15 (Sheet 2 of 2). Jumper and Cable  
Component Assembly

# NUMERICAL INDEX

PART NO.	LIST AND INDEX NO.	PART NO.	LIST AND INDEX NO.	PART NO.	LIST AND INDEX NO.	PART NO.	LIST AND INDEX NO.
219615	2 - 41	1621852	13 - 22	1742668	4 - 5	2181012	4 - 4
	2 - 70		13 - 46		6 - 5		6 - 4
	3 - 12	1622304	1 - 24	1742672	6 - 21		6 - 15
430799	15 - 33		1 - 28	1742678	6 - 1		6 - 22
442458	15 - 39		1 - 34	1742683	4 - 1	2565092	13 - 49
450692	13 - 48		1 - 39	1742685	4 - 26	2565092	13 - 49
472707	13 - 8		2 - 75	1742686	4 - 24	2568709	2 - 60
473442	3 - 9		2 - 78		6 - 25	2577718	15 - 38
	11 - 5	1622344	13 - 43	1742687	4 - 25	2596275	2 - 24B
	12 - 5	1622346	1 - 3		6 - 26	2596291	2 - 24A
483681	15 - 29		1 - 11	1742688	4 - 23	2637689	15 - 9
483682	15 - 30		1 - 17	1742689	4 - 3	2637690	15 - 19
523267	15 - 32		1 - 23		6 - 3	2637691	15 - 18
615683	2 - 23		1 - 27	1742771	4 - 1	2731384	15 - 21
742688	6 - 24		1 - 33	1742773	6 - 21	2731835	15 - 1
811427	2 - 24		1 - 38	1742779	4 - 20	2731836	15 - 5
	3 - 23		2 - 74	1743002	3 - 31	2731838	15 - 7
	13 - 44		2 - 77	1743003	3 - 31	2731839	15 - 8
815923	3 - 33		3 - 14	1743004	3 - 31	2731850	15 - 2
815924	3 - 32		11 - 8	1743005	3 - 31	2731851	15 - 4
816884	15 - 26		11 - 10	1743006	3 - 31	2731852	15 - 6
855231	2 - 25A		11 - 12	1743007	3 - 31	2732337	15 - 11
SEE NOTE	2 - 25		12 - 8	1743055	15 - 10	2732338	15 - 12
	2 - 28		12 - 10	1743057	13 - 11	2732342	15 - 13
	2 - 28		12 - 12	1743169	15 - 17	2732354	15 - 3
	2 - 31		13 - 13	1743174	2 - 14	4134800	3 - 29
	2 - 33		13 - 36		2 - 21	4406233	4 - 2
	2 - 46		13 - 40	1743178	2 - 17		6 - 2
	4 - 28		13 - 48	1743194	2 - 6	4406541	12 - 2
	6 - 30		13 - 47	1743313	8 - 2	4409572	11 - 13
	2 - 23		13 - 53	1743314	8 - 2		12 - 13
1143492	1 - 13	1622401	13 - 42	1743315	8 - 2		2 - 52
1188748	1 - 13	1622403	13 - 52	1743316	8 - 2	4418777	1 - 40
1599501	3 - 34	1650667	4 - 27	1743317	8 - 2	4418778	1 - 41
1608893	15 - 27	1650667	6 - 28	1743318	8 - 2	4418779	13 - 25
1621173	13 - 41	1655336	15 - 15	1743319	8 - 2	4418786	13 - 16
1621190	1 - 22	1655337	15 - 23	1743320	8 - 2	4418790	3 - 4
	1 - 26	1655338	15 - 45	1743455	3 - 7	4418901	4 - REF
	1 - 32	1655339	15 - 46	1743456	3 - 6	4418903	4 - REF
	1 - 37	1655357	2 - 7	1748131	4 - 12	4420274	2 - 57
	2 - 73		13 - 30		6 - 13	4420277	8 - REF
	2 - 76	1655358	15 - 24	1752330	4 - 11A	4420281	2 - 22
	11 - 7	1655359	15 - 47	1752366	6 - 12	4420283	2 - 66
	11 - 9	1661528	15 - 20	1809895	4 - 11A	4420348	1 - 14
	12 - 7	1673725	1 - 10	1847520	15 - 41	4420350	3 - 8
	12 - 9		1 - 16	1847521	15 - 42	4420359	2 - 50
	13 - 35	1742085	6 - 27	1847524	15 - 40	4420368	3 - 11
	13 - 37	1742635	4 - 29	1847525	15 - 31	4420394	1 - 15
	13 - 39		6 - 29	1847529	15 - 34	4420395	1 - 9
1621191	2 - 61	1742637	6 - 21	1854442	4 - 16	4420397	1 - 25
1621191	3 - 13	1742643	4 - 7		6 - 17	4420398	1 - 21
	13 - 12		6 - 7	1854443	4 - 18	4420400	1 - 35
1621193	2 - 39B	1742653	4 - 1		6 - 19	4420401	1 - 20
1621195	2 - 27	1742657	4 - 20	2102364	13 - 19	4420407	13 - 20
1621197	3 - 19	1742658	4 - 10	2102365	2 - 44	4420421	1 - 2
	3 - 22		6 - 10	2114043	2 - 15		2 - 63
	11 - 11	1742661	6 - 5		13 - 32	4420421	2 - 3
	12 - 11	1742662	4 - 6	2114044	2 - 18		3 - 1
	13 - 33		4 - 6		13 - 7		3 - 16
1621286	11 - 3	1742663	4 - 8		13 - 34		3 - 20
1621509	1 - 30A		6 - 8	2122259	15 - 22		13 - 2
	3 - 3	1742664	4 - 9	2122261	15 - 43		13 - 9
	3 - 5		6 - 9	2125765	4 - 15		
1621844	3 - 5		6 - 9	2181005	4 - 14		
	12 - 3						

PART NO.	LIST AND INDEX NO.
4420422	1 - 30
	2 - 16
	2 - 43
	2 - 45
4420423	2 - 29
	2 - 34
	2 - 36
	13 - 51
4420424	1 - 12
	13 - 15
4420425	2 - 65
	2 - 69
4420426	2 - 5
	2 - 12
	3 - 26
	3 - 28
4420427	3 - 28
4420428	13 - 26
4420437	2 - 35
4420441	1 - 31
4420442	1 - 36
4420448	1 - 5
4420449	1 - 4
4420457	13 - 50
4420460	11 - 1
4420461	12 - 1
4420481	1 - 19
4420488	11 - 6
	12 - 6
4420491	12 - REF
	13 - 1
4420492	11 - REF
	13 - 1
4420770	2 - 42
4420772	2 - 37
4420793	13 - 6
4422020	8 - 1
4422079	1 - 18
4422106	3 - 9C
4422107	3 - 9B
4422183	13 - 20
4422184	13 - 20
4422623	- REF
4423028	2 - 26
4423029	2 - 32
4423048	2 - 49
4423097	13 - 20
4423112	13 - 23
4423140	2 - 38
4423146	2 - 58
4423162	1 - REF
	3 - 10
4423231	2 - 8
4423232	2 - 9
4423233	3 - 18
4423237	13 - 4
4423244	2 - 67
4423250	13 - 18
4423252	2 - 1
4423312	3 - 9D
4423317	2 - 51
4423518	2 - 59
4423336	2 - 10
4423344	2 - 30
4423353	2 - 64

PART NO.	LIST AND INDEX NO.
4423354	2 - 68
4423357	2 - 48
4423364	1 - 8
4423365	3 - 17
4423373	2 - 47
4423374	3 - 2
	3 - 9A
4423376	1 - 20
4423377	1 - 1
4423378	1 - 6
4423381	1 - 7
4423385	2 - 40
	2 - 71
4423392	2 - 56
4423393	2 - 56
4423397	2 - 39
4423403	2 - 20
4423405	2 - 13
4423406	2 - 11
4423408	2 - 2
4423410	2 - 3
4423437	13 - 3
4423462	2 - 39A
4423475	13 - 5
4423479	2 - 19
4423481	13 - 17
4423483	3 - 15
4423485	3 - 21
4423490	2 - 62
4423493	2 - 79
4423494	2 - 72
4832957	15 - 37
4832993	15 - 35
4942245	4 - 21
4942270	6 - 16
5183361	4 - 17
	6 - 18
5183362	4 - 19
	6 - 20
5213276	13 - 14
	13 - 21
5213306	2 - 54
5252661	15 - 16
5275481	15 - 44
5405736	2 - 55
5420242	13 - 10
	13 - 24
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