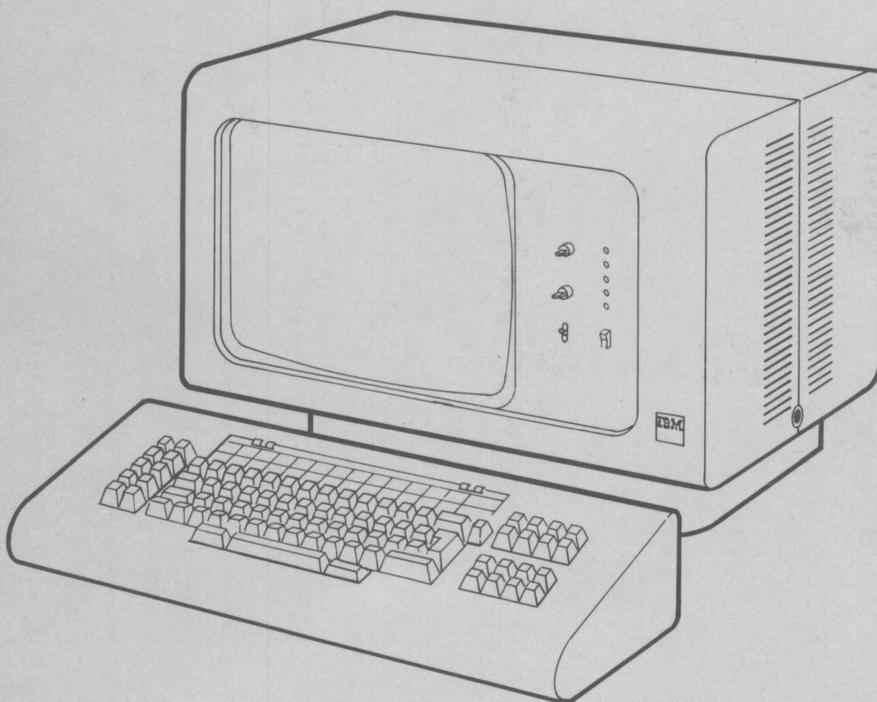
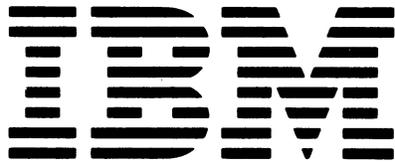


SY31-0587-2

**IBM 5253 Display Station
Maintenance Information and
Maintenance Analysis Procedures Manual**





SY31-0587-2

IBM 5253 Display Station Maintenance Information and Maintenance Analysis Procedures Manual

Glossary
Legend
Using Manual

MAP
Introduction

Start of Call
MAP

MAP 2

MAP 3

Locations
Covers
Control Panel
and Keylock

Keyboard
Display
Extended
Storage

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Third Edition (November 1983)

This major revision makes obsolete SY31-0587-1. Changes or additions were made to show the table 259 displayable extended character set (ECS).

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Preface

This manual is to be used for servicing the IBM 5253 Display Station. Customer Engineers using this manual are assumed to have completed the IBM 5253 Display Station education course.

This manual has two parts: *Part 1. MAPs* and *Part 2. Maintenance Information*. *MAPs* contains two major sections: *MAP Introduction* and *Display Station MAPs*. *Maintenance Information* contains three major sections: *Maintenance Procedures*, *Theory*, and *Features*.

Definitions of terms and abbreviations that are not common, but are used in the MIM, are in the *Glossary of Terms and Abbreviations*.

There are several DANGER and CAUTION notices in this manual. You can use the blank lines below each notice to translate it into your own words. The locations of these notices are listed in the Safety section.

Related Publications

Related information can be found in the following manuals:

- *IBM 5520 Administrative System Installation Manual-Physical Planning*, GA23-1002
- *IBM 5250 Information Display System Planning and Site Preparation Guide*, GA21-9337
- *IBM 5253 Display Station Setup Procedures*, GA21-9385
- *IBM 5253 Display Station Parts Catalog*, S131-0628
- *IBM 5253 Display Station I/PAR Code Guide and CE Log*, ZY31-0606
- *IBM 5520 Administrative System Operator's Guide*, SC23-0715
- *IBM 5520 Administrative System Messages and Recovery Aids*, SC23-0733
- *IBM 5525 System Unit Error Analysis Procedures*, SY20-8509-1

DANGER AND CAUTION NOTICES

Throughout this manual, the word **DANGER** is used to inform the CE of an action that could cause a personal injury. The word **CAUTION** is used to inform the CE of an action that could damage the machine, or affect the running of a customer program.

Danger Notices

Danger notices appear in the following maintenance procedures:

- 151 Display assembly removal and replacement
- 152 Video adjustments
- 153 Vertical and horizontal adjustments
- 154 Yoke adjustment
- 155 Centering adjustment
- 173 Station protector
- 182 Voltage level checks
- 187 Power supply fan removal and replacement
- 188 Power isolation mini-MAP

Caution Notices

Caution notices appear in the following maintenance procedures:

- 104 Main planar
- 106 Cable routing removal and replacement aids
- 108 Display station covers
- 110 Control panel and keylock
- 131 Keyboard removal and disassembly
- 132 Cleaning
- 133 Key module
- 156 Raster
- 157 Display signal/planar power cable mini-MAP
- 181 Power supply removal and replacement
- 213 Probe and probing information

The IBM 5253 Display Station has the following specific **DANGERS**:

- Line voltage is present at the power supply and the display assembly.
-
-

- High voltage is present at the cathode-ray tube.
-
-

- The cathode-ray tube could implode if it is hit or if it falls.
-
-

- The green wire on the display assembly may not be at ground voltage.
-
-

CE SAFETY PRACTICES

All Customer Engineers are expected to take every safety precaution possible and observe the following safety practices while maintaining IBM equipment:

1. You should not work alone under hazardous conditions or around equipment with dangerous voltage. Always advise your manager if you **MUST** work alone.
2. Remove all power, ac and dc, when removing or assembling major components, working in immediate areas of power supplies, performing mechanical inspection of power supplies, or installing changes in machine circuitry.
3. After turning off wall box power switch, lock it in the Off position or tag it with a "Do Not Operate" tag, Form 229-1266. Pull power supply cord whenever possible.
4. When it is absolutely necessary to work on equipment having exposed operating mechanical parts or exposed live electrical circuitry anywhere in the machine, observe the following precautions:
 - a. Another person familiar with power off controls must be in immediate vicinity.
 - b. Do not wear rings, wrist watches, chains, bracelets, or metal cuff links.
 - c. Use only insulated pliers and screwdrivers.
 - d. Keep one hand in pocket.
 - e. When using test instruments, be certain that controls are set correctly and that insulated probes of proper capacity are used.
 - f. Avoid contacting ground potential (metal floor strips, machine frames, etc.). Use suitable rubber mats, purchased locally if necessary.
5. Wear safety glasses when:
 - a. Using a hammer to drive pins, riveting, staking, etc.
 - b. Power or hand drilling, reaming, grinding, etc.
 - c. Using spring hooks, attaching springs.
 - d. Soldering, wire cutting, removing steel bands.
 - e. Cleaning parts with solvents, sprays, cleaners, chemicals, etc.
 - f. Performing any other work that may be hazardous to your eyes. **REMEMBER—THEY ARE YOUR EYES.**
6. Follow special safety instructions when performing specialized tasks, such as handling cathode ray tubes and extremely high voltages. These instructions are outlined in CEMs and the safety portion of the maintenance manuals.
7. Do not use solvents, chemicals, greases, or oils that have not been approved by IBM.
8. Avoid using tools or test equipment that have not been approved by IBM.
9. Replace worn or broken tools and test equipment.
10. Lift by standing or pushing up with stronger leg muscles—this takes strain off back muscles. Do not lift any equipment or parts weighing over 60 pounds.
11. After maintenance, restore all safety devices, such as guards, shields, signs, and grounding wires.
12. Each Customer Engineer is responsible to be certain that no action on his part renders products unsafe or exposes customer personnel to hazards.
13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
14. Ensure that all machine covers are in place before returning machine to customer.

15. Always place CE tool kit away from walk areas where no one can trip over it; for example, under desk or table.
16. Avoid touching moving mechanical parts when lubricating, checking for play, etc.
17. When using stroboscope, do not touch **ANYTHING**—it may be moving.
18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.
19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.
20. Before starting equipment, make certain fellow CEs and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in area of machine while performing and after completing maintenance.

**Knowing safety rules is not enough.
An unsafe act will inevitably lead to an accident.
Use good judgment—eliminate unsafe acts.**

ARTIFICIAL RESPIRATION

General Considerations

1. **Start Immediately—Seconds Count**
Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim, or apply stimulants.
2. **Check Mouth for Obstructions**
Remove foreign objects. Pull tongue forward.
3. **Loosen Clothing—Keep Victim Warm**
Take care of these items after victim is breathing by himself or when help is available.
4. **Remain in Position**
After victim revives, be ready to resume respiration if necessary.
5. **Call a Doctor**
Have someone summon medical aid.
6. **Don't Give Up**
Continue without interruption until victim is breathing without help or is certainly dead.

Rescue Breathing for Adults

1. Place victim on his back immediately.
2. Clear throat of water, food, or foreign matter.
3. Tilt head back to open air passage.
4. Lift jaw up to keep tongue out of air passage.
5. Pinch nostrils to prevent air leakage when you blow.
6. Blow until you see chest rise.
7. Remove your lips and allow lungs to empty.
8. Listen for snoring and gurglings—signs of throat obstruction.
9. Repeat mouth to mouth breathing 10-20 times a minute. Continue rescue breathing until victim breathes for himself.



Thumb and
finger positions



Final mouth-to-
mouth position

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Glossary of Terms and Abbreviations

μf: Microfarad.

addr: Address.

ALU: Arithmetic and logic unit.

attribute: Controls how data is displayed on the display screen. For example, attributes of a display character include blinking, high intensity, and reverse image.

blink: An attribute of a display character that causes the character to flash.

brightness limiter: A video adjustment control on the display assembly. See *Display Assembly Locations* (150).

Cable Thru feature: A special feature that permits multiple display stations or printers to be attached serially to a system cable.

char: Character.

character attribute: The control character that describes how a character is displayed. (For example, a displayed character can be intensified, reversed, or underscored.)

character matrix: A part of the display screen character window. The character matrix is 16 dots high by eight dots wide.

character null: A character attribute that causes a null to be displayed instead of the character.

character window: A part of the display screen that is 24 dots high by 10 dots wide and includes the character matrix.

cont: Controller.

contrast control: The device that changes the contrast between intensified characters and the other areas of the display screen. See *Locations, Front View* (100).

controller: A device that controls the operation of one or more input or output devices.

core: Center part of the twinaxial cable.

dash overstrike: A character attribute that causes a dash to be displayed in the same position and time as a character.

data stream: A continuing flow of data.

diag: Diagnostic.

double underscore: A character attribute that causes a double underscore to be displayed in the same position and time as a character.

D/R: Driver/receiver.

driver: A source that sends (drives) a signal from one location to another. See *Troubleshooting Aids—Mini-MAP Example* (212).

end-of-message delimiter: A 111 in the station ID location that indicates the last frame of a message block.

flyplate: The bottom of a key module. See *Flyplate Replacement* (135).

FPL: Feature program load.

FRU: Field-replaceable unit.

Function Extension feature: A special feature card required for extended functions (3270 emulation).

hex: Hexadecimal.

HHMMSS: Hours, minutes, and seconds.

ID: Identification.

implode: To burst inward.

IPL: Initial program load.

jacket: The covering on a cable.

KBD: Keyboard.

key stem: The connecting part between the keytop and the key module. See *Flyplate Replacement* (135).

keylock: A feature with a lock and key to restrict the use of the display station.

keystroke: The action of pressing a key on the keyboard.

LED: Light emitting diode.

linearity: Pertains to the size of displayed characters being of equal width.

LRC: Longitudinal redundancy check.

main planar: The basic printed circuit electronic board used in the display station.

make/break key: A key that generates an 8-bit scan code with the first bit variable. The first bit is a 0 when the key is pressed and a 1 when the key is released.

margin indicator: A sound, used when typing, to indicate the right margin area has been entered.

menu: A list of options that can be selected to request display station tests.

mfd: Microfarad.

microprocessing: An operation of the MPU.

microprocessing unit (MPU): A processing unit that is microprogram controlled and performs internal machine operations. The MPU receives data, controls the display of data, and controls the flow of information to and from the controller.

microprogram: A program that uses microinstructions to carry out system operations.

mini-MAP: A maintenance analysis procedure that is located in the maintenance information manual. A mini-MAP continues the failure analysis after one of the other MAPs has located the area that is failing.

MPU: Microprocessing unit.

mm: Millimeter.

ms: Millisecond.

msg: Message.

multiframe response: Pertains to more than one frame or multiple frames of data being sent.

N/C: Pertains to a switch setting; normally closed.

N/O: Pertains to a switch setting; normally open.

null: A character of all zeros that occupies a position in the buffer and is displayed as a blank.

online test: A series of tests that can be requested from the system after power-on and sign-on. See *Online Tests (206)*.

option: The selection listed on a display screen menu for test requests.

P-P Peak-to-peak.

PC: Printed circuit.

planar: See *main planar*.

PM: Preventive maintenance.

poll: A technique the controller uses to determine if a display station is ready to send or receive data.

POR: Power-on reset.

power off: Power down the display station.

quadrant: One part of something divided into four parts.

raster: The image on the cathode-ray tube that is made by the action of the electron beam as it scans across the area where data is displayed. See *Raster (156)*.

read-only storage (ROS): A device in the MPU from which data can be read but in which data cannot be changed.

read/write storage: A device in the MPU from which data can be read and in which the stored data can be changed by an MPU.

refresh: To repeatedly display data on the display screen to prevent the data from becoming dim.

regen buffer: An area in read/write storage where data is stored before it is displayed.

register: A storage device or circuit that stores those limited parts of data needed for executing input/output, storage, processing, and control operations.

resolution: The visual quality of display screen data.

retaining ears: Projections on the bottom of a key module that hold the key module to the frame. See *Key Module* (133).

retrace lines: The lines that appear on the display screen when the display adapter returns the sweep (electron beam) to the upper left corner of the display screen. Retrace lines are normally not visible. See *Raster* (156).

retry: To send frames of information a number of times until the frames are received by the display station without an error. The controller sends the frames.

ripple level: A measurement of the amount of ac voltage that is superimposed on a dc voltage.

rolling: Pertains to movement of a display screen; either horizontally, vertically, or a combination of both.

ROS: Read-only storage.

rt adj: Right adjust.

serdes: Serializer/deserializer.

serializer/deserializer (serdes): A register that is used 1) to change data from parallel-by-byte to serial-by-bit for output from a machine, and 2) to change data from serial-by-bit to parallel-by-byte for input to a machine.

setup: To prepare a device for operation.

sign-on: The procedure performed at a display station; it can include entering the sign-on command, a password, or other user-specified security information.

sleeve: A circular spacer.

slot: A narrow opening or groove.

speaker: A device used to produce sound.

slash overstrike: An attribute character that causes a slash (/) to be displayed in the same space and time as the character.

stabilizer: A rod used on the Spacebar. See *Spacebar* (134).

stat addr: Station address

stem: See *key stem*.

SVCS: Services.

TB: Terminal block.

Terminator switch: A switch used to terminate the system cable at the last display station or printer in a series. This switch is a part of the Cable Thru feature on the display station.

theory: The material in a section of this manual that includes data flow, functional units, and features.

twinaxial cable: A shielded twisted-pair cable that connects a display station or printer to a controller or another work station.

typamatic key: A repeat-action key on the keyboard.

underscore: An attribute character that places a line under the character to which the attribute applies.

US: United States.

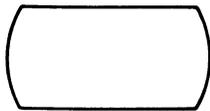
Vac: Volts alternating current.

Vdc: Volts direct current.

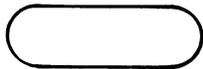
video: Pertains to the display screen image.

YYMMDD: Year, month, and day.

The following symbols may be used in flowcharts and figures throughout this manual.



Display Screen



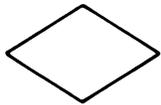
Start and End of Flowchart



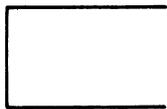
Off-Page Connector



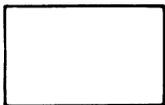
On-Page Connector



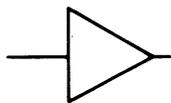
Decision Block



Comment Block

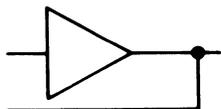


Information Block



Logic (indicates signal direction)

Driver



Logic

Driver/Receiver



Relay Driver



Detector



Zener Diode



Diode



Capacitor



Ground



Transformer



Normally Closed (N/C) Contact



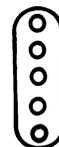
Contact (relay energized)



Resistor



Jumper



Control Panel Lights

Use the information in this manual as reference material when you are diagnosing machine failures. This manual contains MAPs, maintenance procedures, diagnostic aids, theory, and features information.

No scheduled preventive maintenance or special tools and test equipment are required for this display station.

The format for page numbering is XXX-YYY.Z. XXX is the section number, YYY is the page number, and Z is the expansion number used when it is not practical to renumber all the pages.

Three-digit reference numbers are assigned to location drawings and maintenance procedures that are referred to in the MAPs. For example, 130 indicates the keyboard locations of the display station.

MAPS SECTION

The *MAPs* section contains questions that you answer to guide you to the possible cause of the machine failure or the failing FRU.

MAINTENANCE PROCEDURES SECTION

The *Maintenance Procedures* section contains location drawings, maintenance procedures with mini-MAPs, and diagnostic aids, for repairing, installing, or diagnosing the failing FRUs (field replaceable units).

Location Drawings

The location drawings show the position of the parts in the display station.

Maintenance Procedures

The maintenance procedures include removal, replacement, and adjustment procedures. All procedures and drawings have three-digit reference numbers assigned so that they can be referenced from the MAPs.

You are sent to the mini-MAPs after one of the other MAPs has located the failing area. The mini-MAPs continue the failure analysis to locate the failing field-replaceable unit.

In general, mini-MAPs provide you with the following levels of information:

1. A figure showing the circuit line names and pin numbers.
2. A description of the circuit and how it can be tested.
3. A detailed guide that uses the yes and no path of questions to enable you to isolate the failure.

You can select the level of information you need to locate the failing field-replaceable unit.

Diagnostic Aids

The diagnostics aids section includes information about diagnostic programs, how to use them, and what is available when they are in control. A list of error conditions is included to aid in diagnosing machine failures in more detail.

THEORY SECTION

The *Theory* section describes the functional units and features. These descriptions are preceded by a view of the system that gives you a general idea of the complete operation and where each function or feature is used.

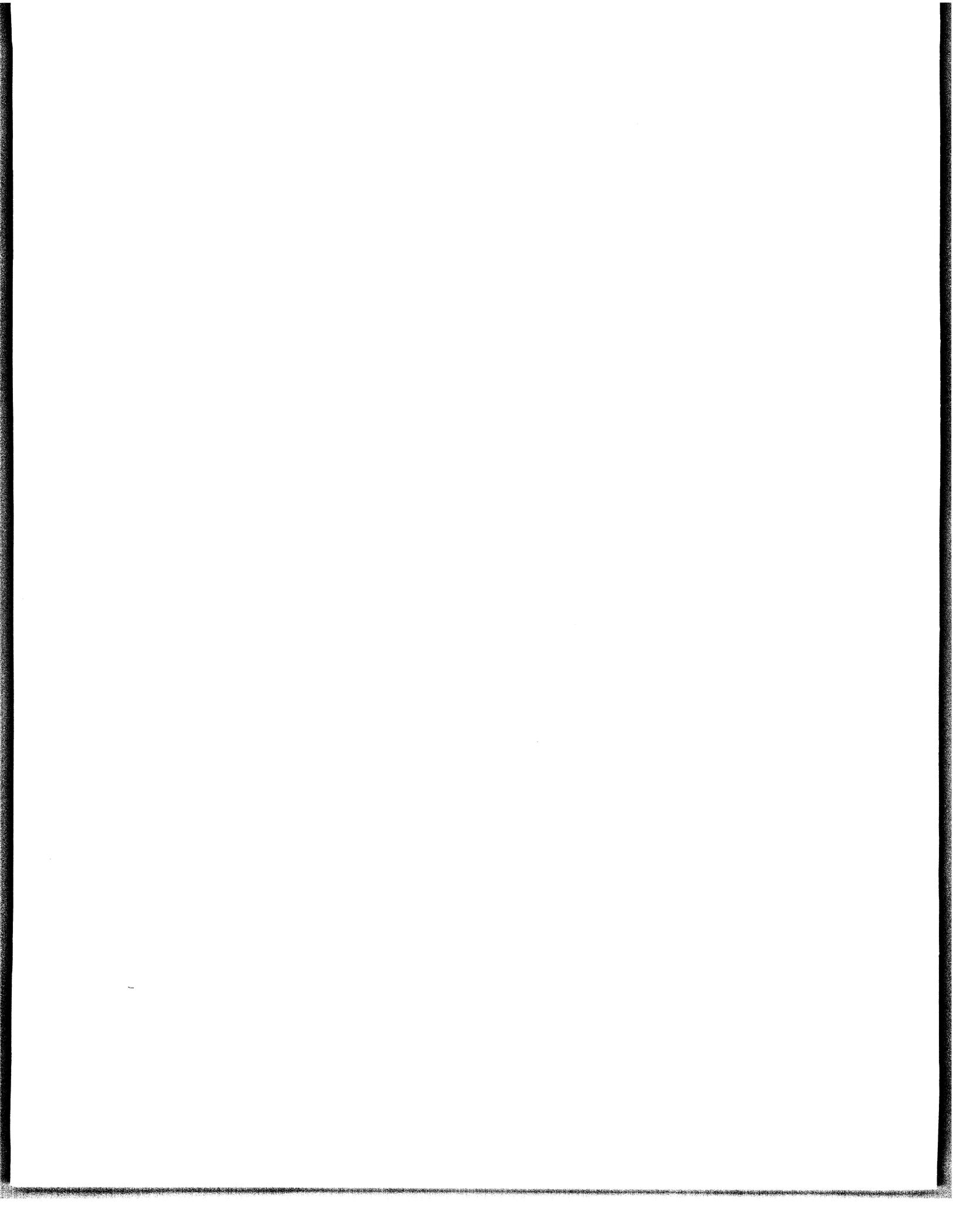
FEATURES SECTION

The *Features* section describes the features that are available with the 5253 Display Station.

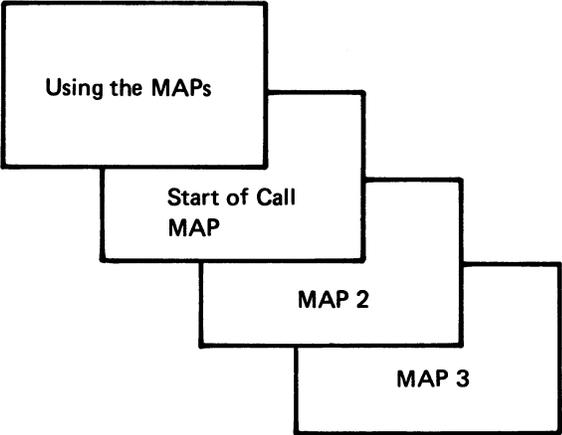
INDEX

The index is a detailed list of all material in this manual.

Part 1. MAPs



MAP ORGANIZATION



Start of Call MAP

The *Start of Call MAP* is the starting point for each service call. This MAP contains a symptom index, which is a list of single indications that are grouped by major units. These single indications lead either directly to a repair action in the MIM, or, if the indication is not contained in this list, lead to *MAP 2*.

MAP 2

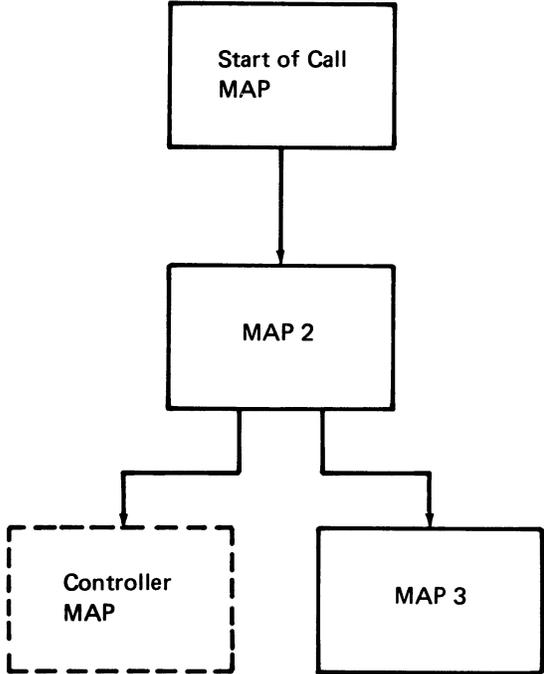
MAP 2 develops symptoms from several indications. This MAP selects one indication at a time, with the most important and least complex indication first, resulting in the quickest path to a repair action.

MAP 3

MAP 3 develops symptoms from indications the same as *MAP 2* but uses fewer indications. As a result, *MAP 3* does not isolate the failure as close to the failing FRU as *MAP 2*.

MAP 3 relies on either the indication reports from the customer, or the indications of intermittent failures (failures that were present but might not be present now).

MAP FLOW



USING THE MAPS

When using the MAPs, you must:

READ CAREFULLY. The MAPs can aid you in finding the failure only if you follow instructions and answer questions accurately.

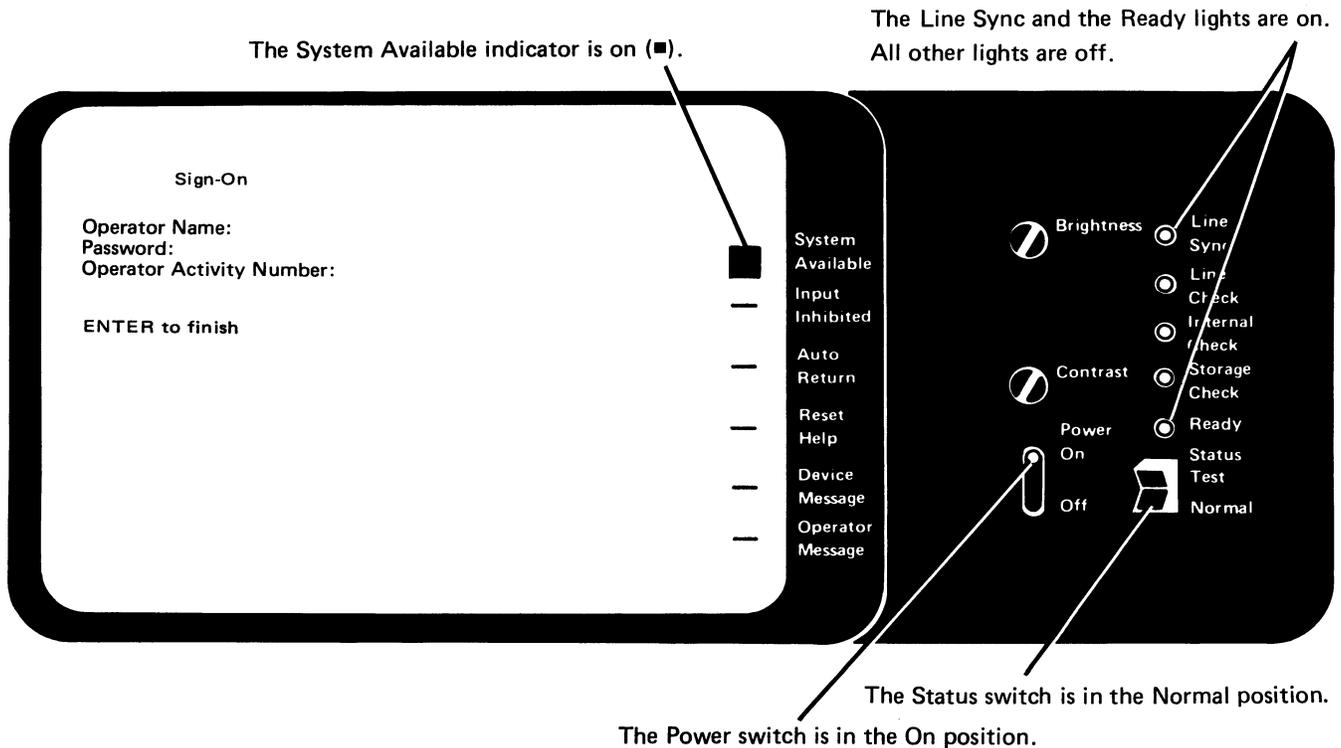
FOLLOW THE SEQUENCE. Always do the procedure one step at a time. Some steps have additional information that pertains to that step. This information precedes the question and is an aid in describing why questions or an action is needed in determining the correct failing part.

FOLLOW INSTRUCTIONS. Instructions must be carried out exactly and in the order given. Do not change the conditions prepared by the instructions before answering the questions.

NORMAL CONDITIONS AFTER POWER-ON

The following illustration shows the normal conditions of the display station after power-on. The system is communicating with the display station.

Note: When a key is pressed, the clicker (speaker) operates and the characters are displayed.



5253 DISPLAY STATION

START OF CALL MAP

PAGE 1 OF 5

001

Start of Call

DISPLAY STATION COVER REMOVAL (108)

KEYBOARD COVER REMOVAL (109)

(Entry Point A)

SYMPTOM INDEX

Symptom	Comments	Repair Action
***** * D I S P L A Y ******		
Display changes size	Display is stable	Replace the display assembly (151)
Display lines missing	Some lines are correctly displayed	Replace the planar (103, 104, 105)
Lines not straight	Display is stable	Replace the display assembly (151)
Out of focus (fuzzy)	Display is stable Brightness control operates correctly	Replace the display assembly (151)
Displayed characters not readable	Characters are smudged	Replace the display assembly (151)
Only a horizontal line is displayed	Line may be solid or broken/may occur only after keying	Replace the display assembly (151)

(Step 001 continues)

START OF CALL MAP

PAGE 2 OF 5

(Step 001 continued)

Only a vertical line is displayed	Line may be solid or broken	Replace the display assembly (151)
Dots for cursor and indicators	Displays partial characters - loss of brightness	+Video signal line failing, Use MIM 157
Vertical line of double cursors on the right * See Note 2 at the end of this index	Not stable Display operates OK	Replace the planar (103, 104, 105)
Vertical line of cursors on the left * See Note 2 at the end of this index	Keyboard goes dead after pressing some keys	Replace the planar (103, 104, 105)
Dots for cursor and indicators	Only displays cursor with missing dots (no characters)	Replace the planar (103, 104, 105)
Loss of Brightness (Not intermittent)	Keyboard is OK. Only Line Sync Light and Ready Light on	Check display fuse. If the 120 Vac to the display is missing, replace power supply (181). Otherwise use MIM 157

* KEY LOCK *

Machine operates with keylock set (locked)	Machine still operates	MIM 114
--	------------------------	---------

(Step 001 continues)

B
3

START OF CALL MAP

PAGE 4 OF 5

002

Do you have the Function Extension feature (3270 emulation) on this machine?

Y N

003

-Go to MAP 0200, Entry Point A.

004

The following are the correct operations of a basic machine:

Line Sync and Ready LEDs on, SA on, Cursor in E (210) or a menu displayed and keyboard characters display correctly as G, O, L and M keys are pressed.

Does the basic machine operate correctly?

Y N

005

- Power off.
- Remove the Function Extension feature by removing cross-connectors 2N and 2P (191). Disconnect the feature interface cable at planar location G (191).
- Power on.

Does the basic machine operate correctly now?

Y N

006

-Go to MAP 0200, Entry Point A.

007

- Use MIM 192, Entry Point A to isolate the failure.

008

- Get the error log (206).

Do you have a current error code of 0172 (208, 209)?

Y N

5
C D

D

009

Do you have a current error code of 0170 (208, 209)?

Y N

010

Do you have a current error code of 0171 or 0173 (208, 209)?

Y N

011

Do you have a current error code with the 'Feature Program Load in Progress' bit on (bit 2=1) in the Feature Mode Flag byte (208)?

Y N

012

Do you have a current error code with the '3270 Feature Application Active' bit on (bit 1=1) in the Feature Mode Flag byte (208)?

Y N

013

-Go to MAP 0200, Entry Point A.

014

- Go to MAP 0300, Entry Point C. Use TABLE B only to isolate the failure.

015

- Use MIM 194 to isolate the failure.

016

- Replace the feature card (196).
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

017

- Use MIM 193 to isolate the failure.

A C
3 4

START OF CALL MAP

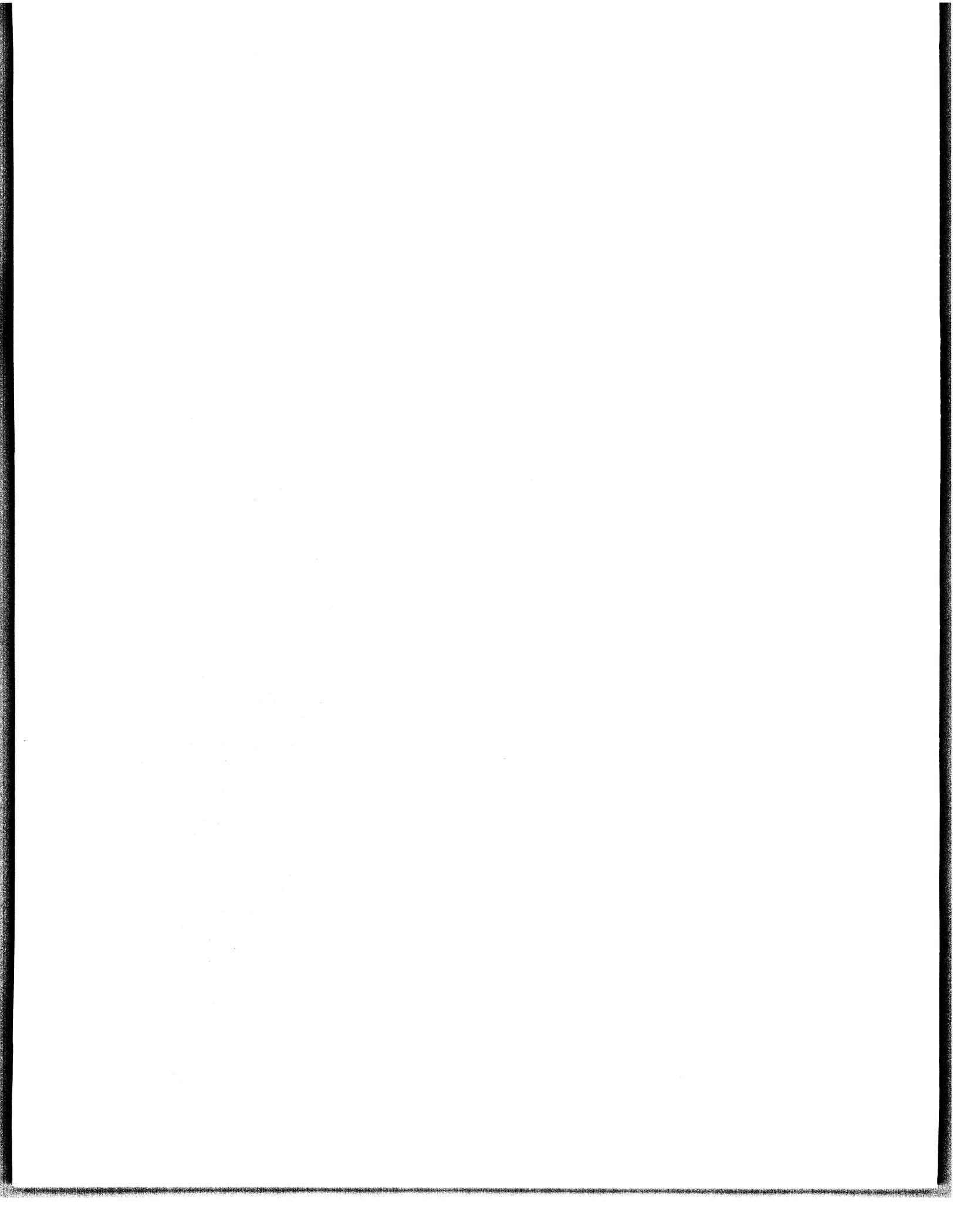
PAGE 5 OF 5

018

- Use MIM 192, Entry Point B to isolate the failure.

019

- Perform the referenced repair action.
- Verify the fix.



5253 DISPLAY STATION

MAP 2

PAGE 1 OF 8

ENTRY POINTS

FROM	ENTER THIS MAP		
MAP NUMBER	ENTRY POINT	PAGE NUMBER	STEP NUMBER
0100	A	1	001

001

(Entry Point A)

- Attempt to reset any error codes displayed before answering questions in this MAP.
- Check the proper positions of the jumpers on the planar (105).
- Reseat associated cables before doing a repair.

Does the Ready light remain on?

Y N

002

Does the Ready light remain off?

Y N

003

- Observe System Available for 15 seconds.

Does the indicator turn on and then off?

Y N

004

- Power off.
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

2
A B C

B C

005

This station may have the same address as another station on the line.

- Use MIM 175.

006

Is the screen blank?

Y N

007

Does the cursor remain in position A (210)?

Y N

008

Does the cursor remain in position B (210)?

Y N

009

Does the Line Check light flash off twice about each 4 seconds?

Y N

010

Is the Line Check light on?

Y N

2 2 2 2 2 2
D E F G H J

D E F G H J
1 1 1 1 1 1

MAP 2

PAGE 2 OF 8

011

- Power Off.
- Observe the LEDs.
- Power On.

Did all the LEDs come on during power on (about 1 second)?

Y N

012

- Use MIM 188.

013

- Use MIM 161.

014

- Use MIM 160.

015

- Use MIM 111 (Status switch).

016

- Use MIM 138 (Data strobe).

017

Is the Line Check light on?

Y N

018

- Use MIM 111 (Address switch).

019

- Use MIM 160.

020

Is the Storage Check light on?

Y N

021

Does the Line Check light flash on twice each second?

Y N

A K L M
1 1 1 1

022

Is the Line Check light on?

Y N

023

- Power Off.
- Observe the LEDs.
- Power On.

Did all the LEDs come on during power on (about 1 second)?

Y N

024

- Use MIM 188.

025

- Use MIM 163.

026

- Use MIM 162.

027

- Use MIM 161.

028

- Use MIM 163.

029

Inspect the screen for one of the following problems (158):

1. display not centered
2. tilted display
3. size incorrect
4. characters missing in corners

- OR -

- A. rolling vertically
- B. partial characters
- C. rolling horizontally
- D. multiple indicators (SA on, display not stable)

(Step 029 continues)

K L M

MAP 2

PAGE 3 OF 8

(Step 029 continued)

Did you find the problem in the list?

Y N

030

Is the System Available indicator on?

Y N

031

Is the cursor in position D (210)?

Y N

032

Is the Line Check light on?

Y N

033

Is the display CRT filament on (150)?

Y N

P Q R S T

034

- Check the AC voltage to the display assembly (150/184).

Is 120 Vac present?

Y N

035

- Replace power supply (181).

036

- Check fuse in display assembly. If OK, use MIM 157 and verify horizontal sync line.

037

- Use MIM 157.

038

- Use MIM 188.

039

- Power off.
- Switch to test.
- Power on.

Does the displayed address match the Address switches (210 & Cable Thru feature)? If not displayed, answer NO.

Y N

040

- Use MIM 111 (Address switches).

041

- Use MIM 175 (System cable/termination).

042

Cursor is not in position E (210) if any characters are preceding it.

Does the cursor remain in position E (210) or is a menu displayed?

Y N

8
N P Q R S T

4 4
U V

V
3

MAP 2

PAGE 4 OF 8

043

Is any character continually repeating on the screen without a key pressed? (A cursor is not a character).

Y N

044

- Turn the Brightness control clockwise.

Is a single cursor displayed? A repeating cursor, (one position at a time) is a single cursor.

Y N

045

Do you have a Keylock feature?

Y N

046

- Power off.
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

047

- Use MIM 114 (keylock).

048

Is the cursor in position D (210)?

Y N

049

The pad PC board or logic PC board is failing.

- Inspect and clean the pad PC board connector contacts on both top and bottom (130).
- Replace the logic PC board.

050

- Use MIM 214.

W

U W
3

051

- Clean or replace the failing key module or pad PC board (132, 133).

052

Note: If the cursor moves more than one position when a key is pressed, answer NO.

Exercise the keyboard data character keys in upper and lower shift.

Do ALL the keys pressed display the correct characters in both upper and lower shift?

Y N

053

Does only one key fail?

Y N

054

- Power off.
- Switch to test.
- Power on.

Is the displayed keyboard ID correct for this keyboard after a key is pressed (if no ID, answer NO) (142)?

Y N

055

Is the keyboard dead?

Y N

056

- Use MIM 136.

057

Is scan code 11111111 displayed (210)?

Y N

058

- Use MIM 138.

5 5 5 5
X Y Z A A

Z
4

A
4

MAP 2

PAGE 5 OF 8

059

- Use MIM 140 for cable check failure.

060

This checks for an open or grounded scan code line.

- Try several keys to be sure a failing key was not selected.
- Observe the displayed scan code as a key(s) is pressed (137/144).

Do all bits change at least once?

Y N

061

- Use MIM 137.

062

Did any key(s) fail to change the scan code?

Y N

063

- Press and hold all the top row data character keys.

Do all the keys fail to repeat (typamatic)?

Y N

064

- System problem.
- Use MIM 175.

065

- Inspect and clean pad PC Board connector contacts on both top and bottom (130).
- Replace the logic PC board.

066

- Inspect and clean pad PC Board connector contacts on both top and bottom (130).
- Replace the logic PC board.

X
4

Y
4

067

- Clean or replace the failing key module or pad PC board (132, 133).

068

- Power off.
 - Switch to test.
 - Power on.
 - Press and release ALL of the function keys .
- Do all the function keys cause the scan code bits to change (137/144)?

Y N

069

Were the three fields (scan code, keyboard ID, station address) displayed by any of the keys (210 & Cable Thru feature)? If these fields are displayed without pressing a key, answer NO.

Y N

070

Is the station address correct? Answer NO if not displayed.

Y N

071

- Use MIM 111 (switches).

072

- Power off.
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).
- Switch to normal.

6
A
B

6
A
C

A
B
5

A
C
5

MAP 2

PAGE 6 OF 8

073

- Switch to normal.
- While observing the screen, press and hold each data character key one key at a time. Look for the keyed character to repeat on the screen.

Do all the keys fail to repeat (typamatic)?

Y N

074

Does the cursor move key fail to move the cursor?

Y N

075

- Clean or replace the failing key module or the pad PC board (132, 133).

076

- Use MIM 137.

077

- Inspect and clean pad PC board connector contacts on both top and bottom (130).
- Replace the logic PC board.

078

- Allow the diagnostics to loop in test mode.

Do you hear the keyboard speaker?

Y N

079

- Use MIM 139.

7
A
D

MAP 2

080

- Power off.
- Switch to normal.
- Observe the LEDs.
- Power on.

Did all the LEDs come on during power on (about 1 second)?

Y N

081

- Use MIM 111.

082

- Use MIM 206 (check brightness, contrast, raster, attributes)

Were the tests OK?

Y N

083

- Perform corrective action for given test, see table below.

```

*****
| Brightness Problem | Use MIM 111 |
| Contrast Problem  | Use MIM 111 |
| Attribute Problem  | If top half of Display Field and Extended |
|                   | Attribute test only fails, do the following: |
|                   | - Replace the planar for a Field Attribute |
|                   | problem |
|                   | If entire display or bottom half of same |
|                   | test fails, do the following: |
|                   | - Use MIM 164 for a Character Attribute |
|                   | problem |
| Raster Problem    | Ensure raster check jumper is removed. |
|                   | Adjust brightness limiter (152). If |
|                   | adjustment cannot be made, replace the |
|                   | display (151). |
*****

```

N A
3 E
7

MAP 2

PAGE 8 OF 8

084

The machine is operating correctly.
If you suspect an intermittent problem, use
MAP 3.

085

For problems 1 through 4:
- Adjust display, if adjustment
cannot be made, replace
display assembly (151).
For problems A through D:
- Use MIM 157.

5253 DISPLAY STATION

MAP 3

PAGE 1 OF 15

ENTRY POINTS

FROM	ENTER THIS MAP		
MAP NUMBER	ENTRY POINT	PAGE NUMBER	STEP NUMBER
0200	A	1	001

001

(Entry Point A)

All problems must be started at Start of Call MAP.

If there is more than one repair action listed in the fix statement, perform one action per call and record the date.

If you get to a question you cannot answer, the repair actions on both the YES and the NO traces should be considered for this problem.

- If you get lost or do not find a repair action in the MAP, go to MAP 3 Entry Point B, on page 6, step 040.

Did the Ready light remain on?

Y N

002

Was the screen blank?

Y N

003

Did the cursor remain in position A (210)?

Y N

2 2 2
A B C D

D

004

Did the cursor remain in position B (210)?

Y N

005

Was the Line Check light on?

Y N

006

- Replace the LED for the failing light (111).

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

- Replace the power supply (181).

DATE / / .

- Repair or replace the control panel cable (106).

DATE / / .

007

- Replace the Extended Storage card.

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

008

- Inspect and clean the pad PC board connector contacts on both sides (130).

- Replace the keyboard logic PC board (131).

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

- Repair or replace the failing keyboard cable (106).

DATE / / .

B C
1 1

MAP 3

PAGE 2 OF 15

009

- Replace the Extended Storage card.
DATE / / .
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).
DATE / / .

010

Was the Storage Check light on?

Y N

011

Was the machine completely dead?

Y N

012

- Replace the Extended Storage Card.
DATE / / .
- Replace the power supply (181).
DATE / / .
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).
DATE / / .
- Replace the failing keyboard cable (106).
DATE / / .
- Replace the display signal/planar power cable (106).
DATE / / .

013

- Customer power may be failing.
- Switch to a different outlet.
DATE / / .
- Replace the AC power switch.
DATE / / .
- Replace the AC line filter (185).
DATE / / .
- Replace the power supply (181).
DATE / / .
- Replace the AC line cord (185).
DATE / / .

A E
1 1

014

- Replace the Extended Storage Card.
DATE / / .
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).
DATE / / .
- Replace the power supply (181).
DATE / / .

015

- A. rolling vertically
- B. partial characters
- C. rolling horizontally
- D. multiple indicators (SA on, display not stable)

Did one of the above problems occur (158)?

Y N

016

Was the System Available indicator on?

Y N

017

Was the cursor in position D (210)?

Y N

018

Was the Line Check light on?

Y N

E

1
F 3 3 3 3
G H J K

H 2
J 2
K 2

MAP 3

PAGE 3 OF 15

019

- Check the fuse in the display assembly (150).

DATE / / .

- Replace the display assembly (151).

DATE / / .

- Replace the power supply (181).

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

- Replace the display signal/planar power cable (106).

DATE / / .

- Replace the Brightness control or cable (106).

DATE / / .

020

- Replace the power supply (181).

DATE / / .

- Replace the display signal/planar power cable (106).

DATE / / .

021

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

- Replace the Address switch or cable (106).

DATE / / .

- Repair or replace the internal system cable (106).

DATE / / .

G 2

022

Cursor is not in position E (210) if any characters are preceding it.

Did the cursor remain in position E or was a menu displayed?

Y N

023

Was any character continually repeating on the screen without a key pressed? (A cursor is not a character).

Y N

024

- Inspect and clean the pad PC board connector contacts on both sides (130).

DATE / / .

- Replace the keyboard logic pc board (131).

DATE / / .

- Replace the Keylock switch or cable (106, 114).

DATE / / .

- Replace the planar, set jumpers correctly on new planar (103, 104, 105).

025

- Clean or replace the failing key module or pad PC board (132, 133).

026

NOTE: Pressing all the keys tests each key and the data path from the keyboard through the controller to the display.

Did all the keys pressed function correctly?

Y N

027

Did only one key fail?

Y N

4 4 4
L M N

L M N
3 3 3

MAP 3

PAGE 4 OF 15

028

- Inspect and clean the pad PC board connector contacts on both sides (130).
- Replace the keyboard logic PC board (131).

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

- Repair or replace the failing keyboard cable (106).

DATE / / .

- Replace the Extended Storage Card.

DATE / / .

029

- Clean or replace the failing key module or pad PC board (132, 133).

030

Did all the keys fail to repeat (typamatic)?

Y N

031

Did you hear the keyboard speaker when a key was pressed?

Y N

032

- Replace the speaker.
- DATE / / .
- Replace the keyboard logic PC board.
- DATE / / .
- Replace the planar; set jumpers correctly on new planar (103, 104, 105).
- DATE / / .

DATE / / .

- Repair or replace the keyboard cable(s) (106).

DATE / / .

1
4 P 5
Q

0
4

MAP 3

PAGE 5 OF 15

033

Did all the LEDs come on during power on (about 1 second)?

Y N

034

- Replace the LED for the failing light.

DATE / / .

- Repair or replace the control panel cable (106).

DATE / / .

- Replace the planar; set jumpers correctly on new planar (103, 104, 105).

DATE / / .

035

- Check cables, remove and reseat (106):

Connector B Keyboard cable

Connector D Display signal/planar power cable

Connector C Control Panel cable.

Were the cables OK?

Y N

036

The cables were loose.

037

- Check voltages at power supply test points (180).

+5.0 V +4.5 to 5.5

-5.0 V -4.5 to 5.5

+8.5 V +7.7 to 9.4

Are the voltages OK?

Y N

038

- Replace the power supply (181).

6
R

MAP 0300-5

MAP 3

039

- Get the error log (206).

Do you have a current error code(s)?

Y N

040

(Entry Point B)

TABLE A

The following chart lists the probable causes for common symptoms.

Major Symptom	Minor Symptom	Probable Cause	
***** * KEYING FUNCTION ******			
Characters repeat	Single key	Key module Pad PC board	
	More than one key	Logic PC board Pad PC board Logic PC board Voltages	
Binding key	Single key	Key module Dust shield	
	More than one key	Key modules Dust shield	
Spacebar		Key module Spacebar linkage Dust shield	
	***** * SYSTEM FUNCTION ******		
	Line check	Station only	Planar Power supply
Station and controller		Cable terminator Power supply Planar	

(Step 040 continues)

MAP 3

PAGE 7 OF 15

(Step 040 continued)

Internal check		External noise Line filter Planar Power supply Display assembly
Storage check		Cross-connectors External noise Extended storage card
Attributes	Loss of or incorrect	Extended storage card Planar
***** * DISPLAY FUNCTION * *****		
Jumping display	Single line More than one line	External magnetic noise Strong external magnetic field Planar Voltages Display assembly
Partial characters	Same character independent of display location	Planar Display assembly
No Brightness control	Out of focus	Brightness control (111) Control Panel Cable (111) Planar
Brightness changes	More than 5 minutes after power on	Display assembly Brightness control (111) Cable (111) Planar

(Step 040 continues)

MAP 3

PAGE 8 OF 15

(Step 040 continued)

No Contrast control		Contrast control (111) Control Panel Cable (111) Planar
Contrast changes (high intensity)		Contrast control (111) Cable interposer (111) Planar Display assembly
Random spots on the display		Display assembly External noise Planar
Loss of screen for a short period	Arcing noise from display area No noise in display	Display assembly Loose display cable Planar Display assembly
Horizontal lines		Extended storage card Brightness limiter Display assembly Planar
Image size changes		Display assembly
Vertical roll		Display cable Connector (157) Display assembly
Horizontal skew		Display cable Connector (157) Display assembly Planar

* OTHER SYMPTOMS *		

Circuit breaker trips		Power line disturbance, Reset circuit breaker

(Step 040 continues)

MAP 3

PAGE 9 OF 15

(Step 040 continued)

Power supply fuse blows		Power line disturbance, Replace fuse
Symptoms not described		Voltage/power supply Planar External noise

End of call.

041

- Compare the probable FRU's in Table A (Entry Point B) with Table B from error code listing (Entry Point C) and Table C (Entry Point D).

(Entry Point C)**TABLE B**

- Find the last error code from the error log in column 1 of the chart below.
- (The latest error code can be determined by noting the date in the error log.)
- Find the other error code if there is one in column 4.
- Column 5 lists the probable causes.
- If the last error code has the '3270 Feature Application Active' bit on (bit 1=1) in the Feature Mode Flag byte the Function Extension feature card is a probable cause in addition to those listed in column 5.

See MIM 208 Error History Table for sense information for the error codes.

(Step 041 continues)

MAP 3

PAGE 10 OF 15

(Step 041 continued)

1	2	3	4	5
Last Error Code	Name	Error Description	Other Error Code	Probable Cause
0100	No response	This error is reported when a display station is in use and no response to a poll occurs.		System cable Planar
0101	Transmit operation check	This error is reported by a controller during a poll or command being executed by the controller.		Controller
0103	Receive parity error	This error is reported by the controller when a frame is received and parity is bad in response to a poll command.	0104	Controller Planar System cable
0104	Line parity check	This error is sent in the poll response status from the display station. A line parity check must be reset with a poll command and the reset bit on.	0103	Planar Controller System cable
0106	Receive length check	The wrong number of bytes was received by the controller as a result of a poll or command.		Planar

(Step 041 continues)

MAP 3

PAGE 11 OF 15

(Step 041 continued)

0107	Wrong station responded	Incorrect station address returned in responses to a poll	0103 0104	Planar System cable System Cable
0108	Power on	The condition is determined in the exception status sent by the display station. It is reported as an error only if the station was in use.		Planar
0109	Activate command failure	Busy bit was not on after an activate command had been sent		System Cable
0111	Scan code not valid	The 7-bit code sent in the keyboard response frame does not translate to a character or function.	0103 0104	Keyboard System cable System cable
0120	Command not valid	This indicates that the poll command sent to the display is not a valid command or the device identification is wrong.	0103 0104	Planar System cable System cable
0121	Register value not valid	This indicates that the address counter value is not inside the user accessible limits.	0103 0104	Planar System cable System cable
0122	Storage or input queue overrun	This condition occurs when more than 16 commands and associated data frames have been sent, or when an attempt is made to store data beyond the limit of user accessible storage.		Planar Controller

(Step 041 continues)

MAP 3

PAGE 12 OF 15

(Step 041 continued)			
0123	Null or attribute	Null or attribute not found or address counter points to attribute.	System application program Planar
0124	Activate not valid	This condition indicates a wrong or not valid activate command was sent to the display station.	0103 Controller 0104 Planar System cable System cable
0125	Undefined exception status	Controller determined undefined status returned by station	Power Planar System Cable
0149	Command acceptance error	The display station has not accepted any commands	0103 Planar 0104 System cable System Cable
0170	Feature does not respond	The display station reports this error when the function extension feature fails to indicate that it received commands directed to it	Function Extension feature card Planar
0171	Feature parity error	The display station reports this error when a parity error is detected during an instruction fetch or a data read from the function extension feature.	Function Extension feature card Planar
0172	Feature diagnostic failure	The display station reports this error when a failure has been detected during execution of the function extension feature diagnostics.	Function Extension feature card Feature interface cable Planar

(Step 041 continues)

MAP 3

PAGE 13 OF 15

(Step 041 continued)

0173	Check-sum error on feature program load	The display station reports this error when the check-sum calculated by the display station is not the same as the check-sum sent with the feature program load from the controller.		Function Extension feature card Planar
0182	Device type Error	Unsupported device type responded to poll	0103	Planar System Cable
0183	Wrong size display	Image size ID incorrect		Jumpers on Planar
0184	Incorrect keyboard ID	Keyboard ID received incorrect		Keyboard ID controller
0189	Invalid outstanding status	The controller reports this error when an outstanding status is presented in the poll response and no outstanding status information is available		Planar
0190	Even/Odd change in status	Status sent to the controller has not changed in 200 milliseconds after the work station has received a poll command with a positive response and a not-busy response.		Planar
0191	Busy	The controller has found that the busy bit has been on for a time longer than 400 milliseconds.		Planar

(Step 041 continues)

MAP 0300-13

MAP 3

PAGE 14 OF 15

(Step 041 continued)

Do you have a common FRU?

Y N

042

- Use Error History Table (208) and tabulate errors. Enter in Table C.

(Entry Point D)

TABLE C

Error History Table Analysis
0100 System MSG--2 stations with same address if 0104 also occurs in logout.
No errors--system has varied station off.

043

- Use Table D to record date and FRU replaced.

TABLE D

RECORD REPLACEMENT FRU'S

DATE	SYMPTOM(S)	FRU REPLACED
-------------	-------------------	---------------------

044

- Inspect and clean pad PC board connector contacts on both top and bottom (130).
- Replace the logic PC board.

F
2

MAP 3

PAGE 15 OF 15

045

- Replace the display assembly (151).

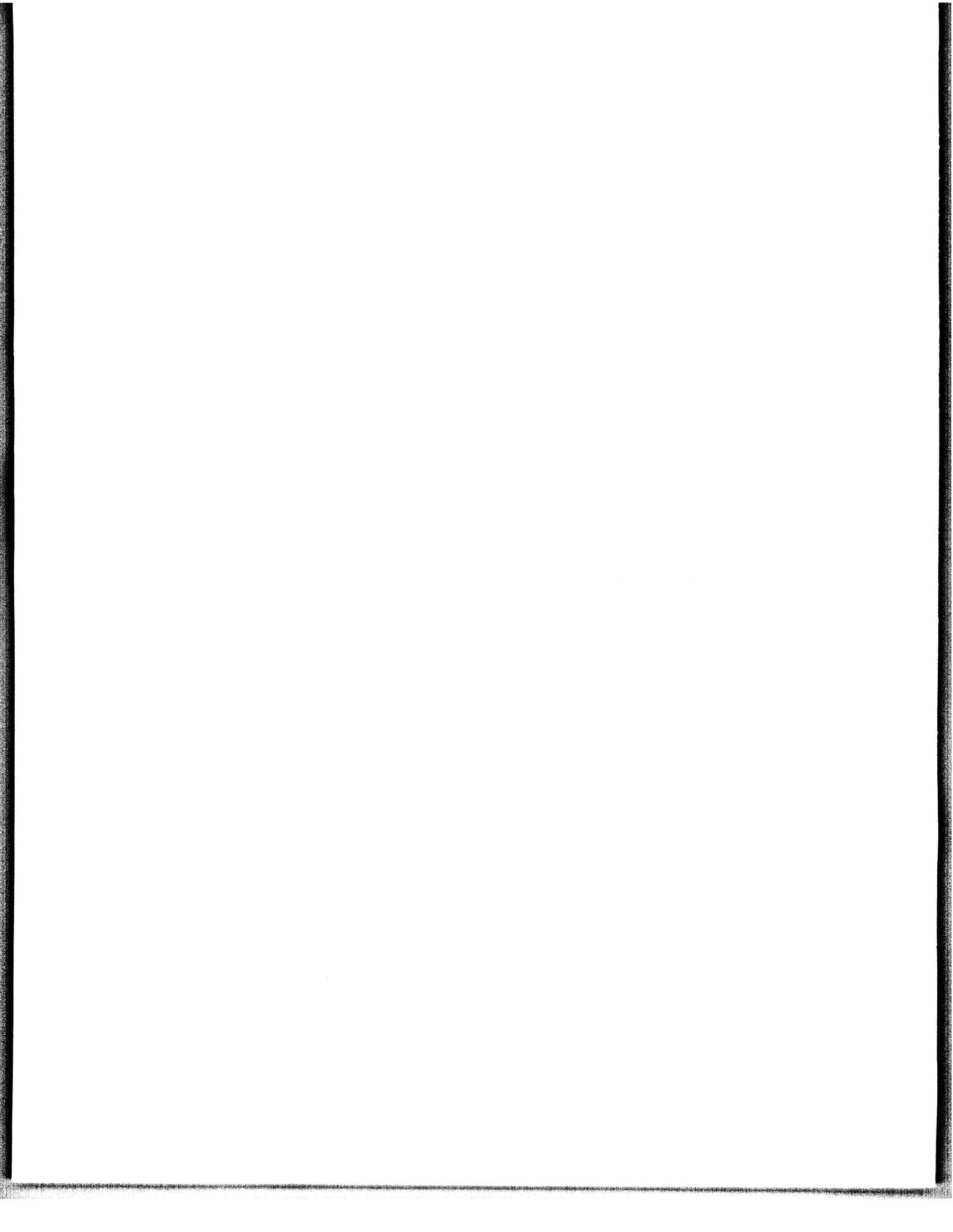
DATE / / .

- Repair or replace the display signal/planar
power cable (106).

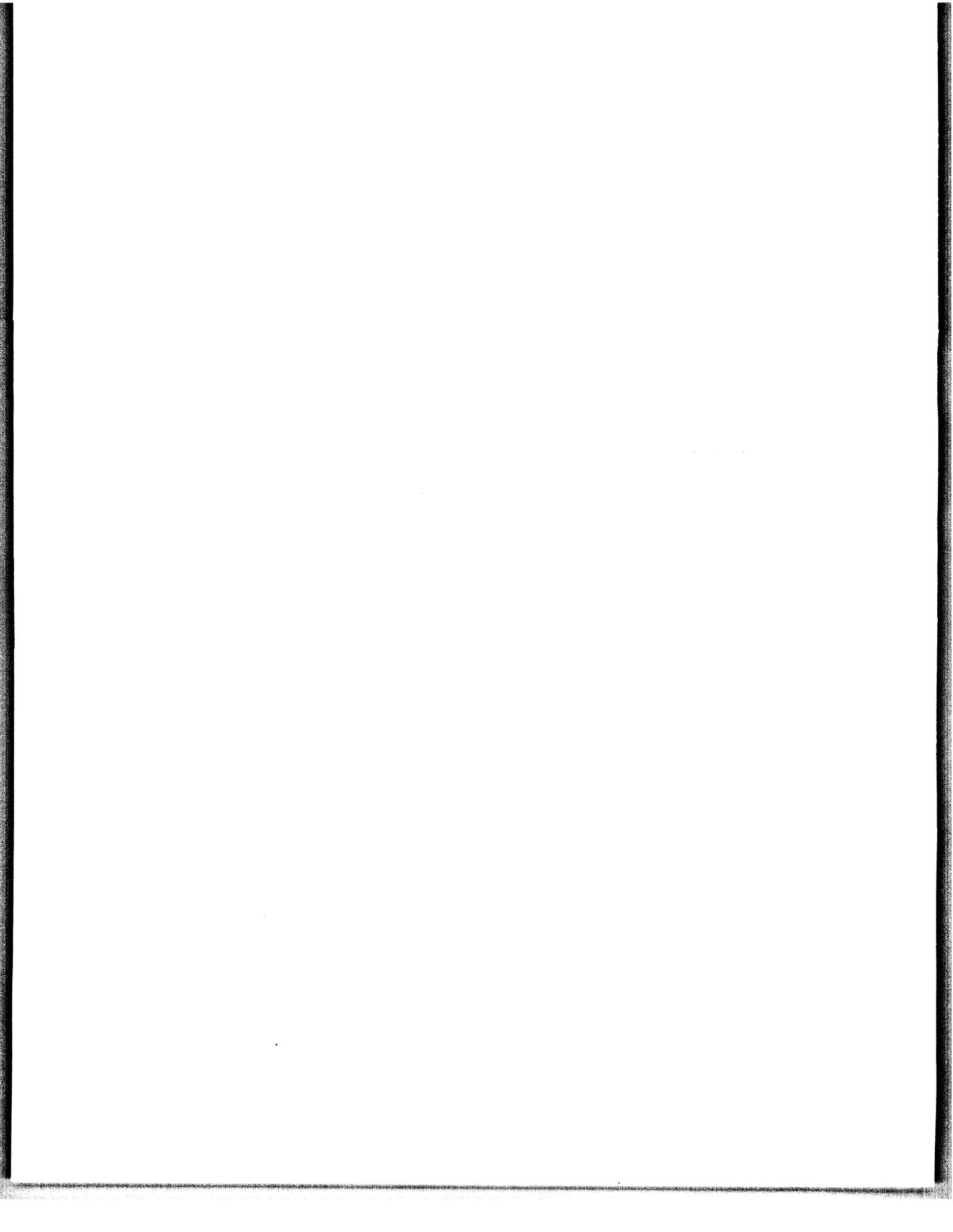
DATE / / .

- Replace the planar; set jumpers correctly on
new planar (103, 104, 105).

DATE / / .

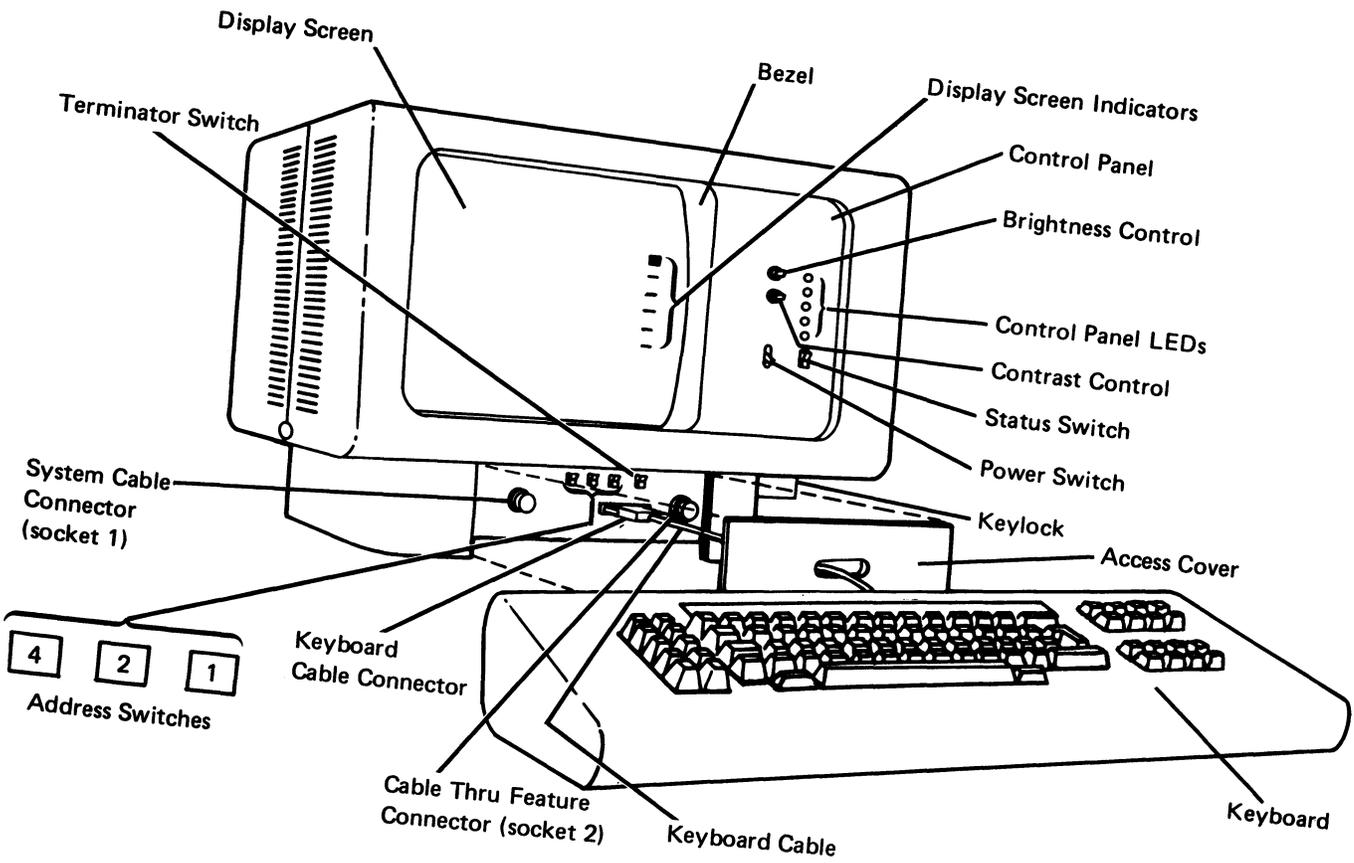


Part 2. Maintenance Information

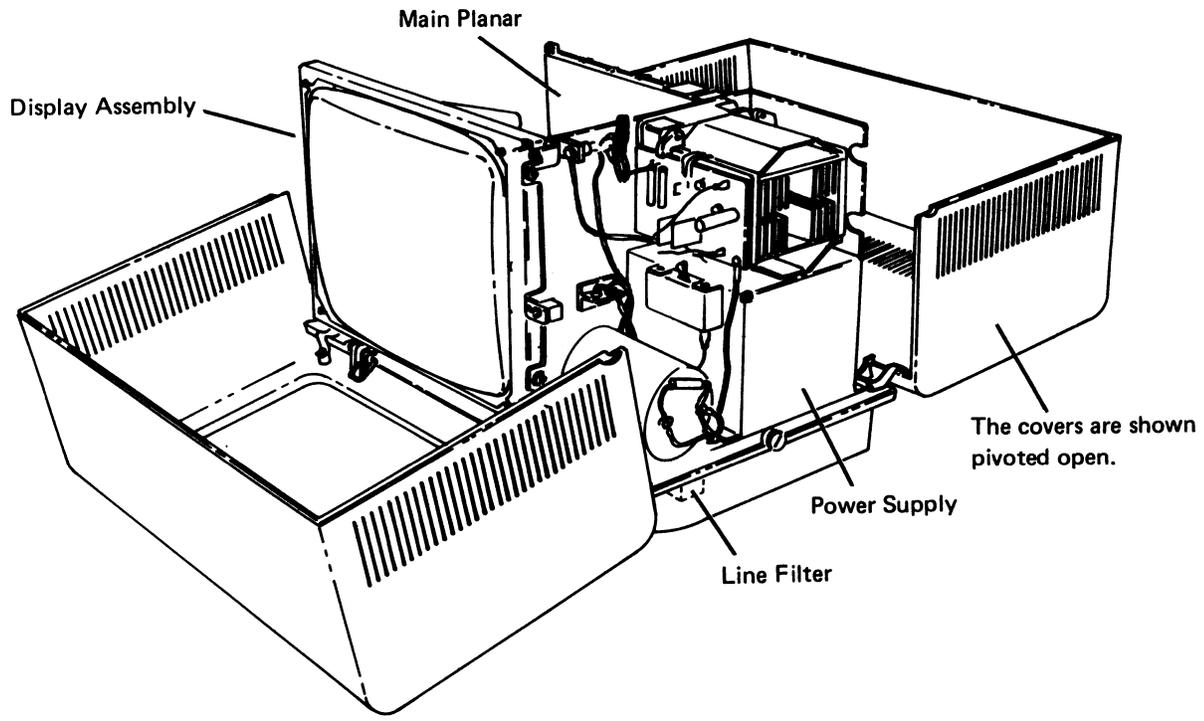


Locations

100 FRONT VIEW

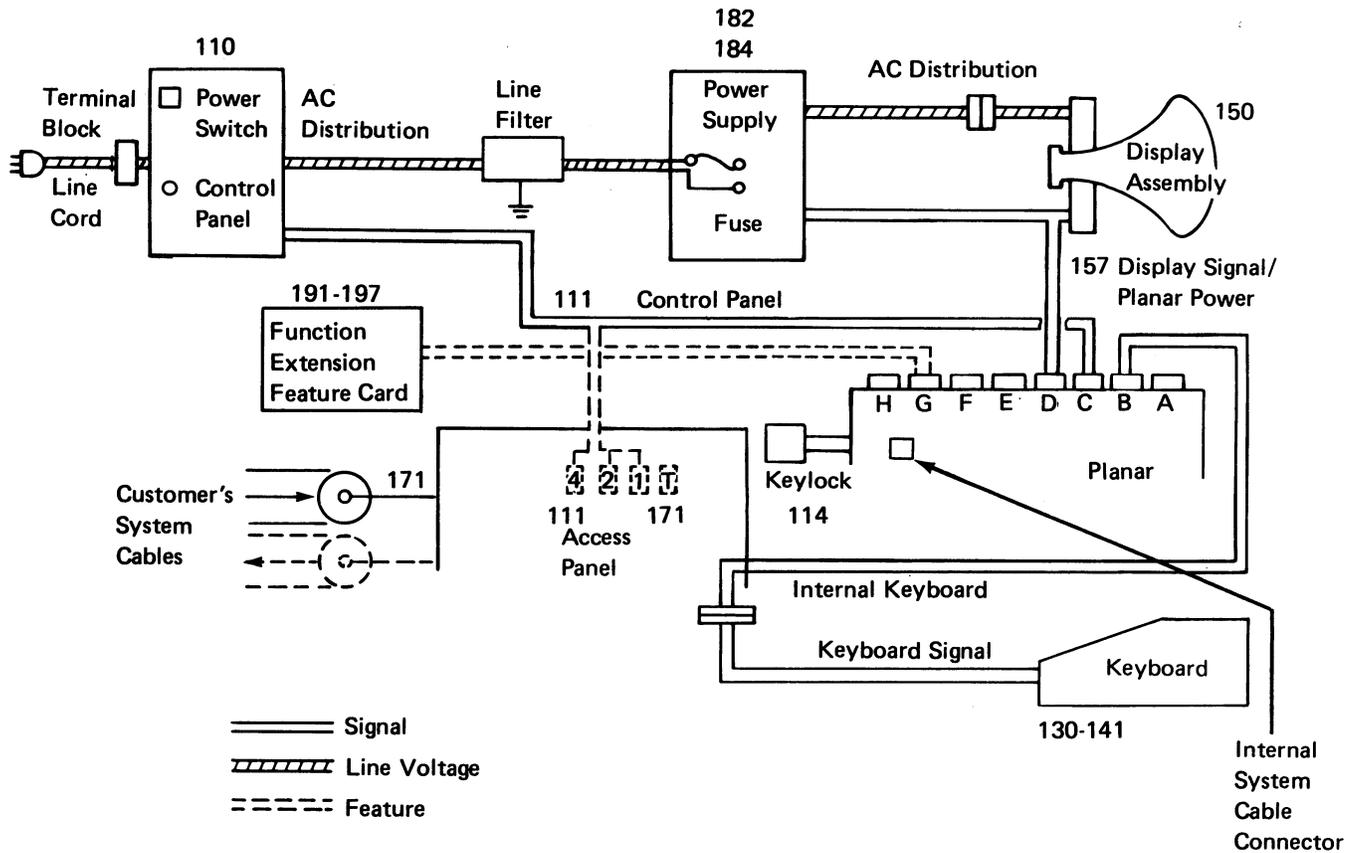


101 COVERS OPEN

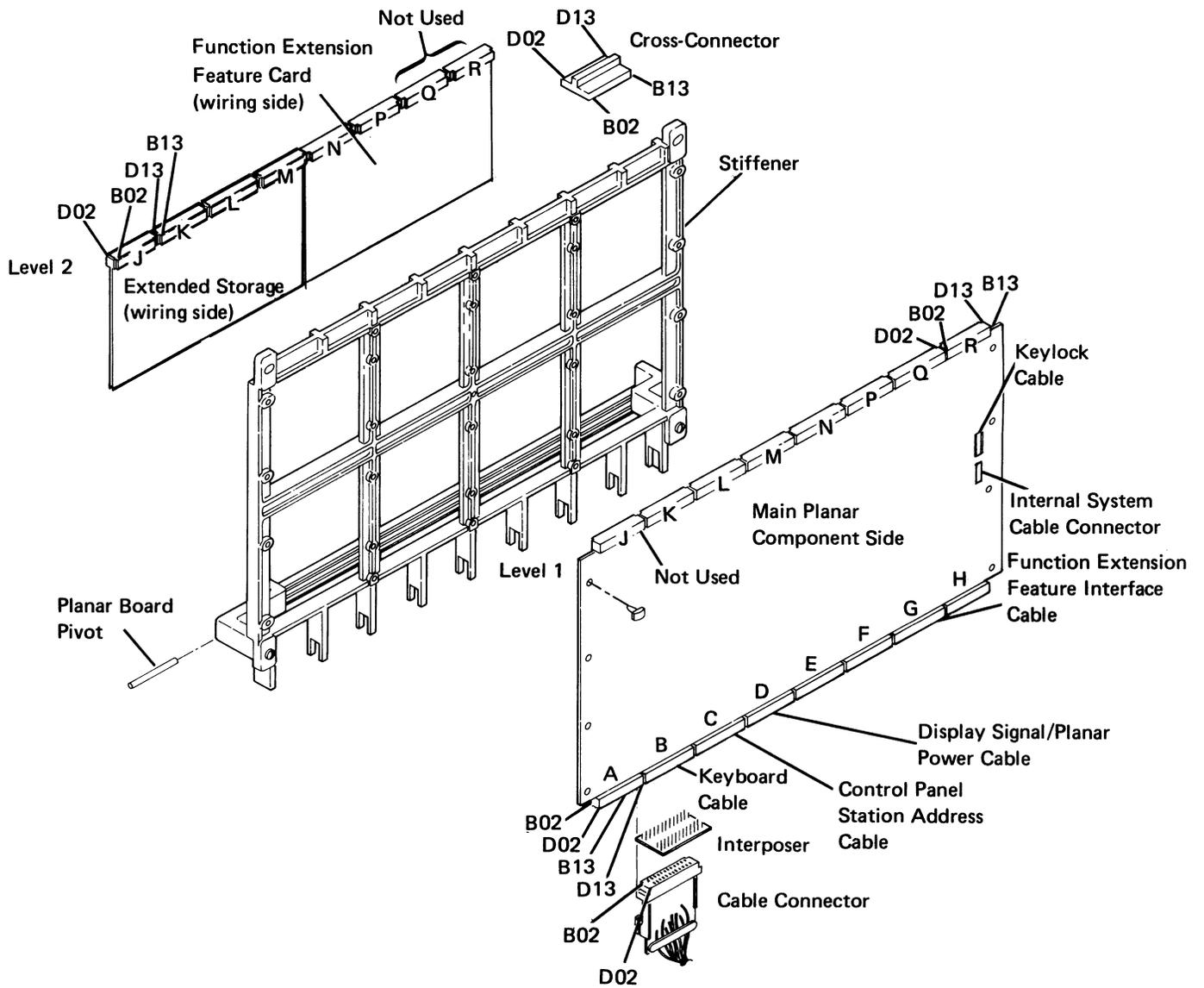


102 CABLE CHART

The numbers in the drawings indicate the section in this manual where you can find detailed information about the cabling for that part of the drawing.



103 MAIN PLANAR AND CARD LOCATIONS



104 MAIN PLANAR

103, 104

Removal

CAUTION

The logic used on planars can be damaged by electrostatic discharge. Avoid contact with any conductive parts. Handle the planar by the plastic frame only.

Ground yourself and the conductive plastic bag containing the new planar by holding the bag and momentarily touching the machine frame.

Ensure that the component side is face up when placing a planar on any surface.

1. Power off and disconnect the line cord from the wall outlet.
2. Unplug the internal system cable.
3. Unplug the keylock cable (if installed).
4. Remove the cross-connectors and the extended storage card.
5. Remove all feature cards (196).
6. Disconnect all cables at the bottom of the planar.
7. Remove the four screws that hold the planar in position.

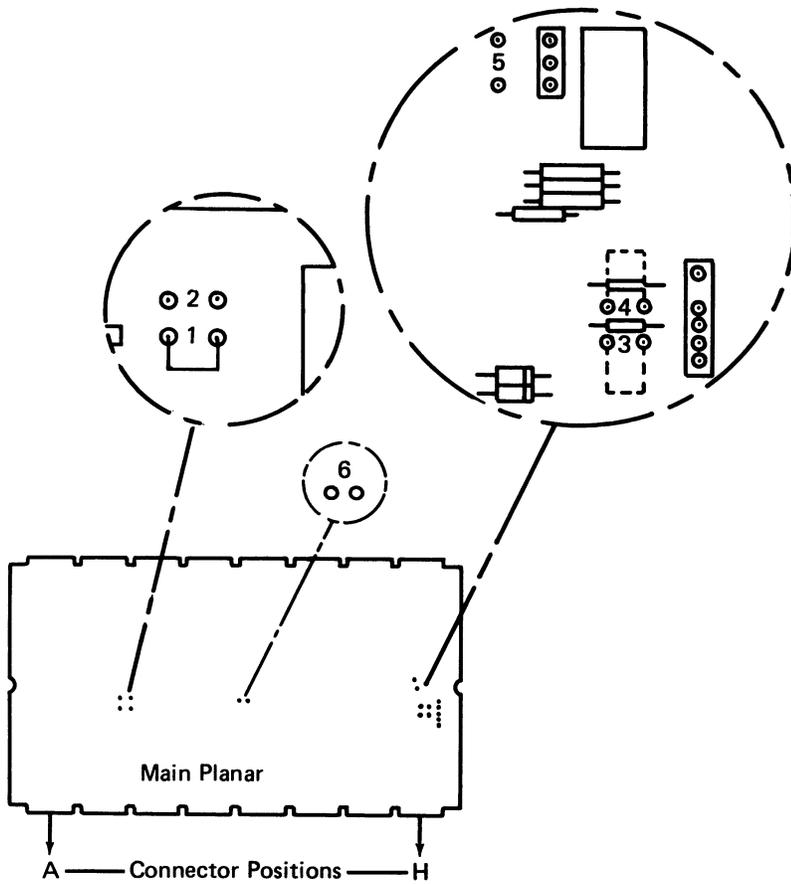
Replacement

Replace the planar by reversing the removal steps.

105 MAIN PLANAR JUMPERS

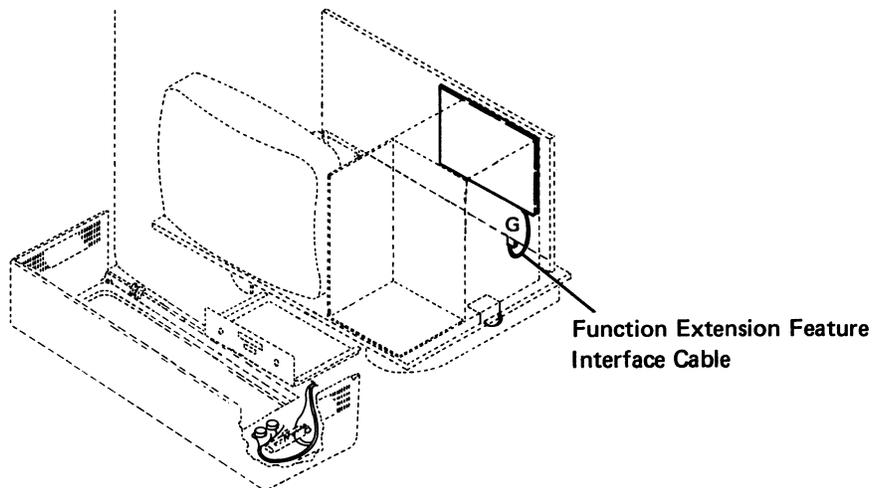
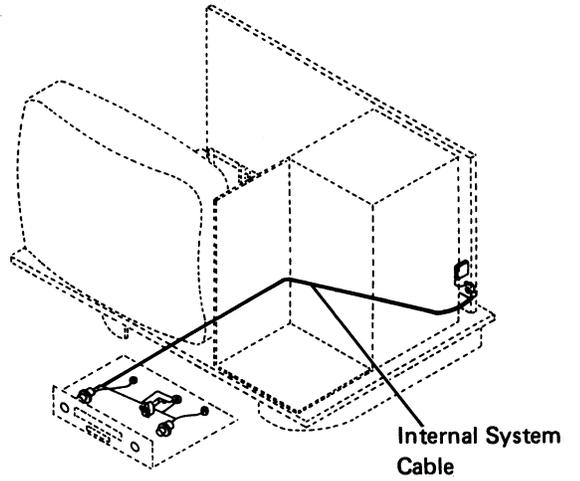
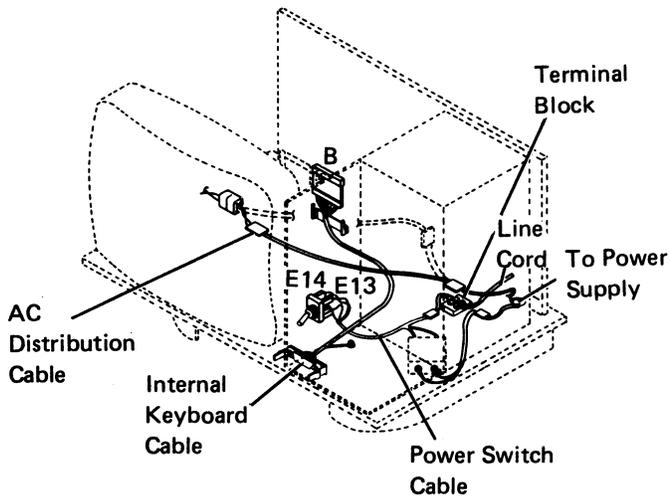
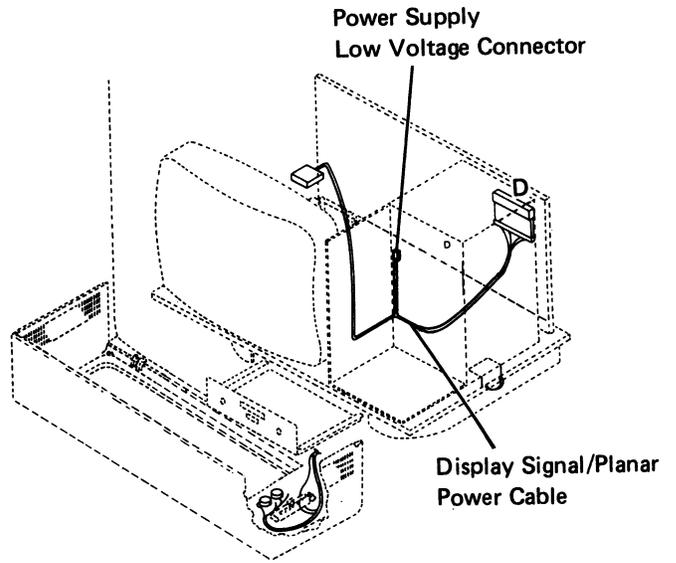
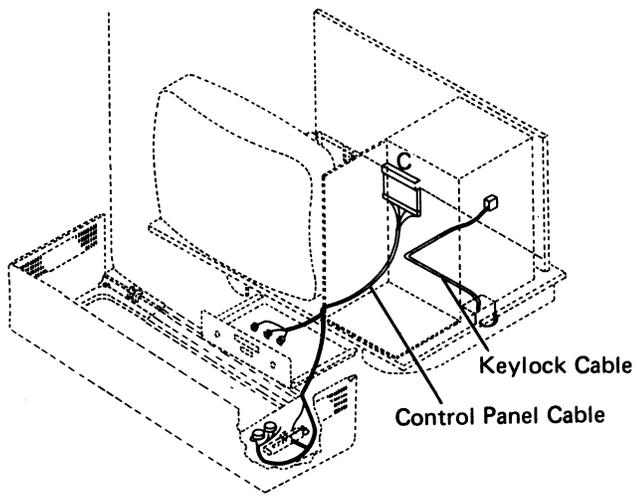
The jumper part number is 1794401.

Jumper Position	Description
1	Installed on the IBM 5253.
2	Installed when needed for raster check (156).
3, 4	Installed (both jumpers) when the Cable Thru feature is NOT installed.
5	Installed when the Keylock feature is NOT installed.
6	Reserved. Do not install a jumper.



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106 CABLE ROUTINGS, REMOVAL, AND REPLACEMENT AIDS



106 (continued)

Control Panel Cable Removal and Replacement Aids

Removal Aid

Remove the display assembly (151) before removing the control panel cable.

Replacement Aids

1. Connect the cable to the planar. Route the cable to the access panel, the address switch plate assembly, and the control panel face plate.
2. Connect the wires to the LEDs. The black wires (+5 V) go to the long lead and the yellow wires go to the short lead (110).
3. Connect the wires to the potentiometers.
 - a. The yellow wires (control wires for the potentiometers) go to the center terminals.
 - b. The +8.5 V black wires go to the top potentiometer tabs (110, 111).
4. Connect the wires to the address switches. The yellow wires go to the bottom tab and the black wires go to the center tab (110).
5. Connect the wires to the Status switch. The yellow wire goes to the bottom tab, and the black wire goes to the center tab (110).
6. Reinstall the display assembly.

Internal System Cable Removal and Replacement Aids

1. Remove the display assembly (151) to remove the cable.
2. Connect the wires correctly (171). The cable is phase-sensitive and the red or the white and red wire must go to the pin beside the black dot.

Keyboard Signal Cable Removal and Replacement Aids (100)

CAUTION

The screws that hold the clamps must be securely tightened. If the clamps can be moved, the screws are not tight enough and electrostatic discharge problems might occur.

Internal Keyboard Cable Removal and Replacement Aids

When replacing the cable, be sure the large guide pin is located on the right side and the long side of the connector goes at the top.

Keylock Cable Assembly Removal and Replacement Aids

Remove the keylock assembly (two screws) and pull the cable through the hole above the keylock.

Function Extension Feature Interface Cable Removal and Replacement Aids (197)

When replacing the cable, make sure that the cable connector is plugged completely into the socket on the function extension feature card.

Display Signal/Planar Power Cable (157, 182)

AC Distribution Cable (106)

Covers

108 DISPLAY STATION COVERS

CAUTION

Place the display station away from the edge of the table to prevent damage to the covers.

To open the covers:

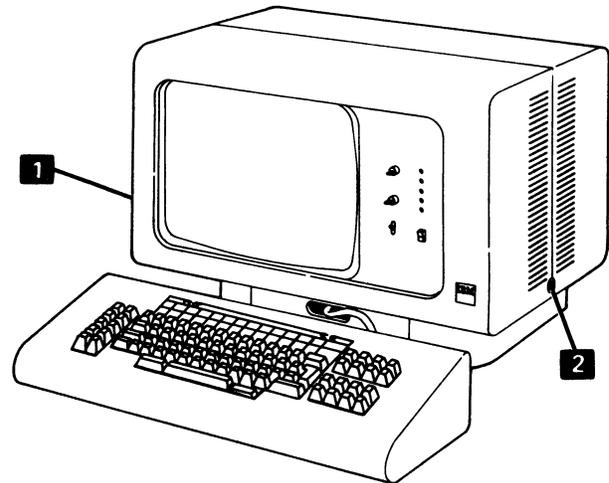
1. Loosen the cup screw **1** on the left side of the display station.
2. Loosen the cup screw **2** on the right side of the display station.
3. Hold the front half of the cover and pivot it toward the front of the display station.
4. Hold the back half of the cover and pivot it toward the rear of the display station.

CAUTION

When reinstalling the covers, ensure that the cup of the screw fits over the lip of the cover to prevent damage to the cover and to ensure that the cover is securely fastened down.

To close the covers:

1. Pivot the front half of the cover toward the rear of the display station.
2. Pivot the back half of the cover toward the front of the display station.
3. Tighten the cup screws **1** and **2**. Ensure that the cup fits over the lip on the cover.



109 KEYBOARD COVERS

Removal

1. Loosen the four screws on the bottom of the keyboard assembly.
2. Lift the cover away from the keyboard.

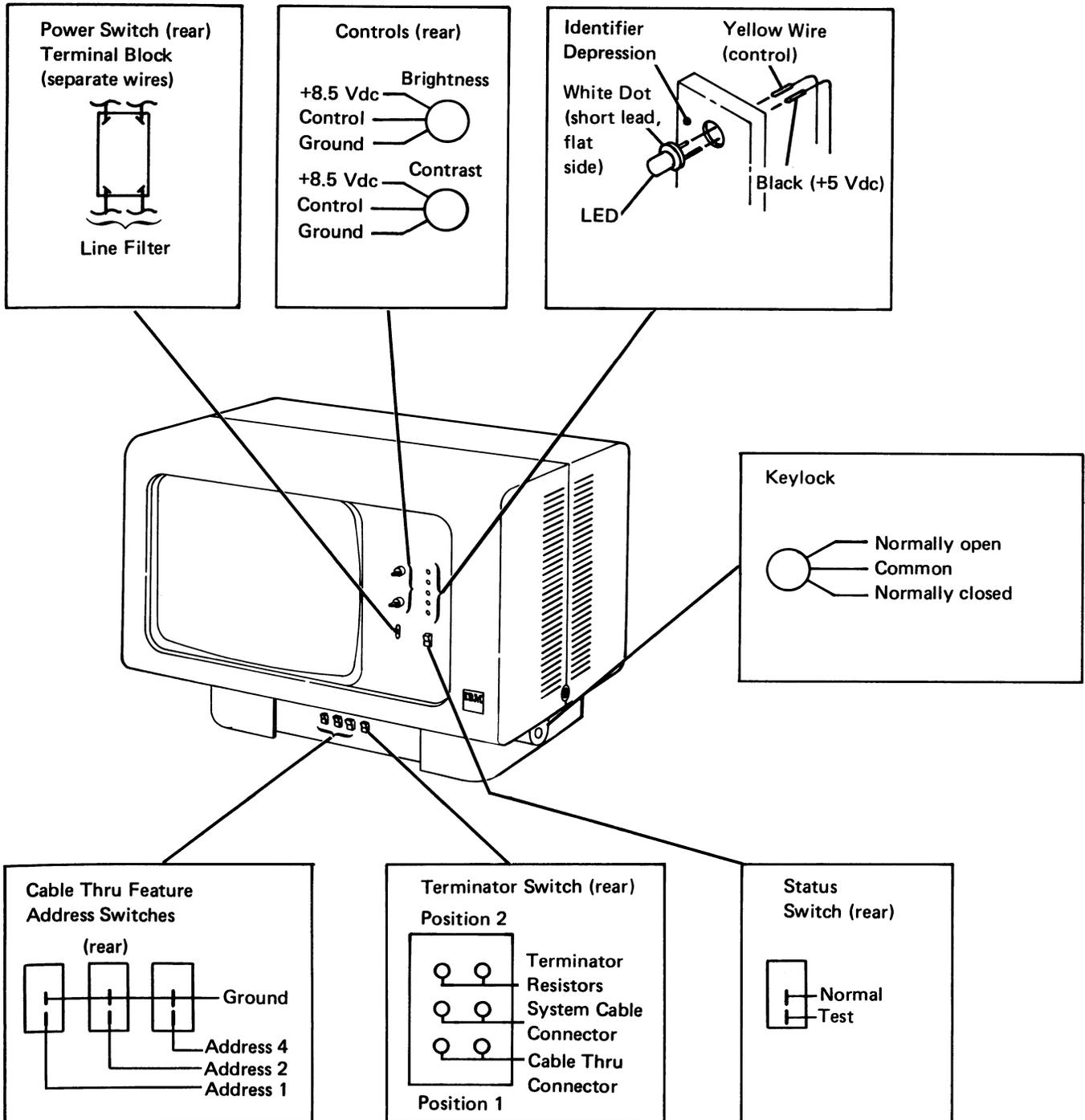
Replacement

1. Place the cover on the keyboard assembly.
2. Tighten the four screws on the bottom of the keyboard assembly.

Note: Ensure that the keys do not rub on the cover.

Control Panel and Keylock

110 CONTROL PANEL



LED and Status Switch Removal and Replacement

1. Power off and remove the line cord from the wall outlet.
2. Open the front and rear covers.
3. Remove the two screws and the clamp on the LED block.
4. Remove the plastic fasteners on the LED block.
5. Remove the LED/Status switch.
6. To reinstall the LED/Status switch, reverse this procedure. Ensure that the white dot or short lead on the LED is on the side toward the identifier depression in the block.

Brightness Control and Contrast Control Removal and Replacement

1. Power off and remove the line cord from the wall outlet.
2. Open the front and rear covers.
3. Remove the two screws and the clamp on the LED block.
4. Remove the control knobs and loosen or remove the lock nuts as needed.

CAUTION

If the wires are not installed correctly, machine damage can occur.

5. Remove the wires and be sure to place them in the same position on the new control.
6. Remove the control through the back of the panel.
7. Reinstall the control by reversing this procedure.

111 CONTROL PANEL CABLE MINI-MAP

110, 111

- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

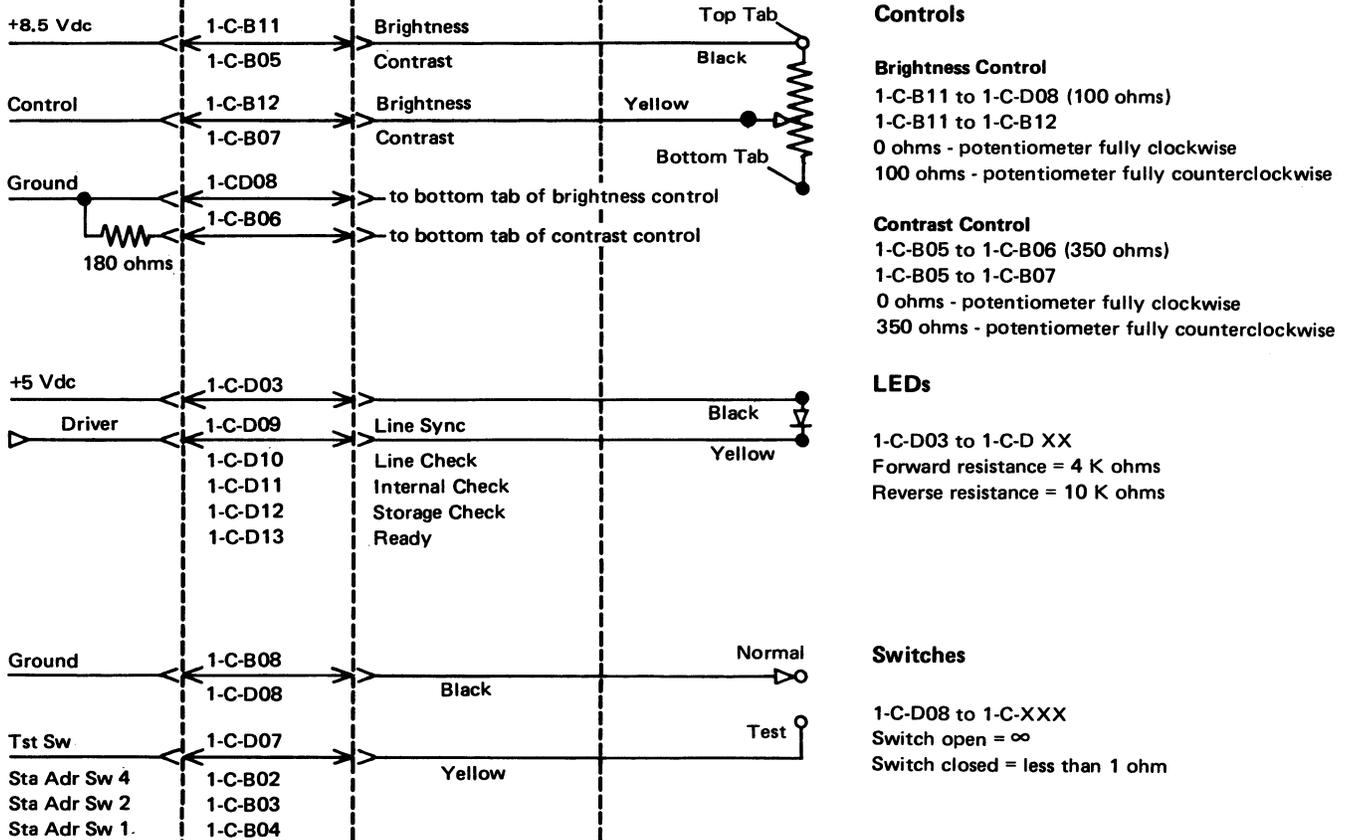
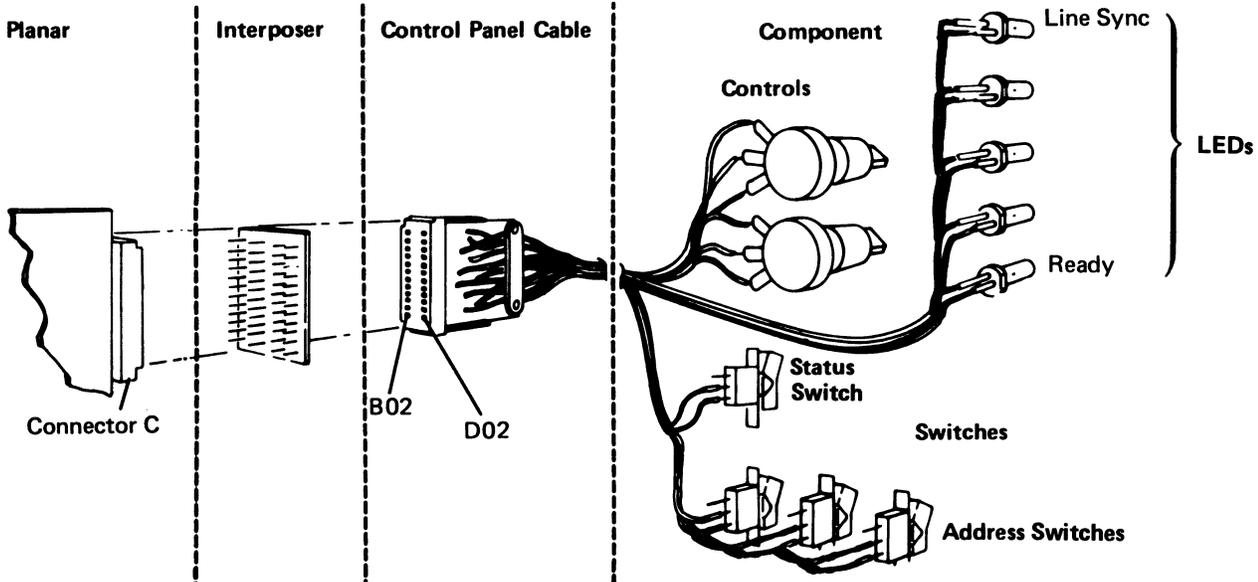
- All voltages are active.
- When a switch is closed the line is at a Down level and displayed as a 1 bit.

Tools

- CE meter

Service Aids

- Do not ground an LED line. Planar or LED damage will result.
- LEDs may be swapped to isolate the failure.
- When the Power switch is on, do not change the setting of the address switches.



111 (continued)

Check the voltages and grounds.

1-C-B05	(+8.5 V)
1-C-B11	(+8.5 V)
1-C-B08	(Gnd)
1-C-D08	(Gnd)
1-C-D03	(+5 V)

Are the conditions normal?

Y N

- Inspect the interposer.
- Replace the planar.
- Power off.
- Select the failing circuit (see facing page).
- Remove the cable at the planar.
- Using an ohmmeter, measure the resistance of the selected circuit at the cable.

Are the conditions normal?

Y N

- Trace the conditions to the component (see facing page).
- Repair or replace the cable or replace the component.
- Using an ohmmeter, measure the resistance between the selected circuit and frame ground. The meter should indicate an open circuit (∞).

Were there any grounds at the cable?

Y N

- Verify that the address switches are set correctly.
- Inspect the interposer.
- Check the jumper and replace the planar.
- Trace the ground on the component (see facing page).
- Repair or replace the cable.
- Replace the component.

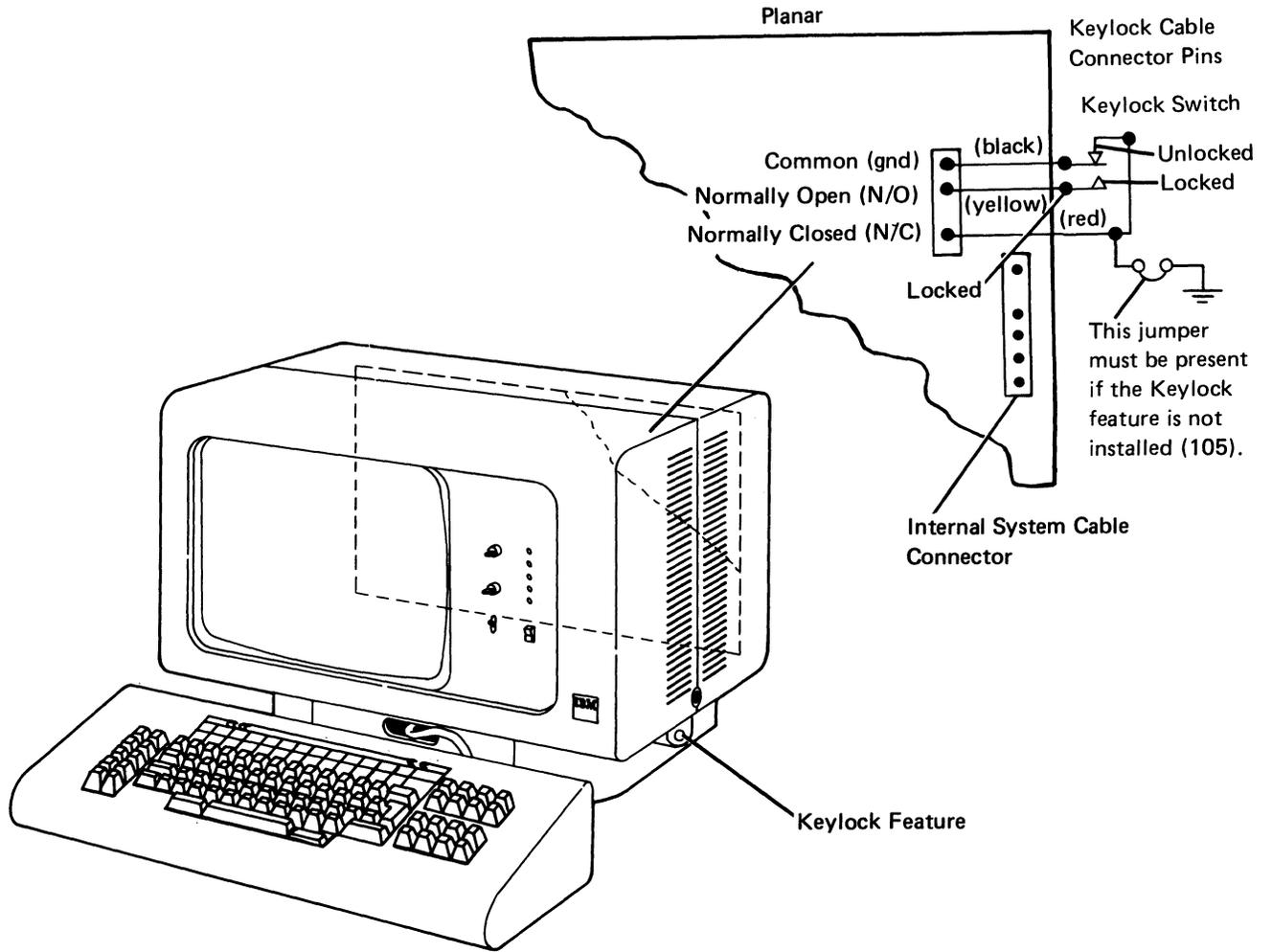
Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Replacement sequence:
 - Component.
 - Planar.
 - Control panel cable.

114 KEYLOCK MINI-MAP

Tools

- CE meter



114 (continued)

- Power off.
- Remove the connector from the planar.
- Use a CE meter.
- Check continuity at the planar end of the cable between the common and the normally open lines with the switch in the locked position.

Is there continuity?

Y N

- Repair or replace the keylock assembly.
- Check continuity at the planar end of the cable between the normally open and the normally closed lines with the switch in the locked position.

Does the CE meter indicate an open circuit?

Y N

- Repair or replace the keylock assembly.
- Check continuity at the planar end of the cable between the normally closed and the common lines with the switch in the unlocked position.

Is there continuity?

Y N

- Repair or replace the keylock assembly.
- Check continuity at the planar end of the cable between the normally open and common lines.

Is there continuity?

Y N

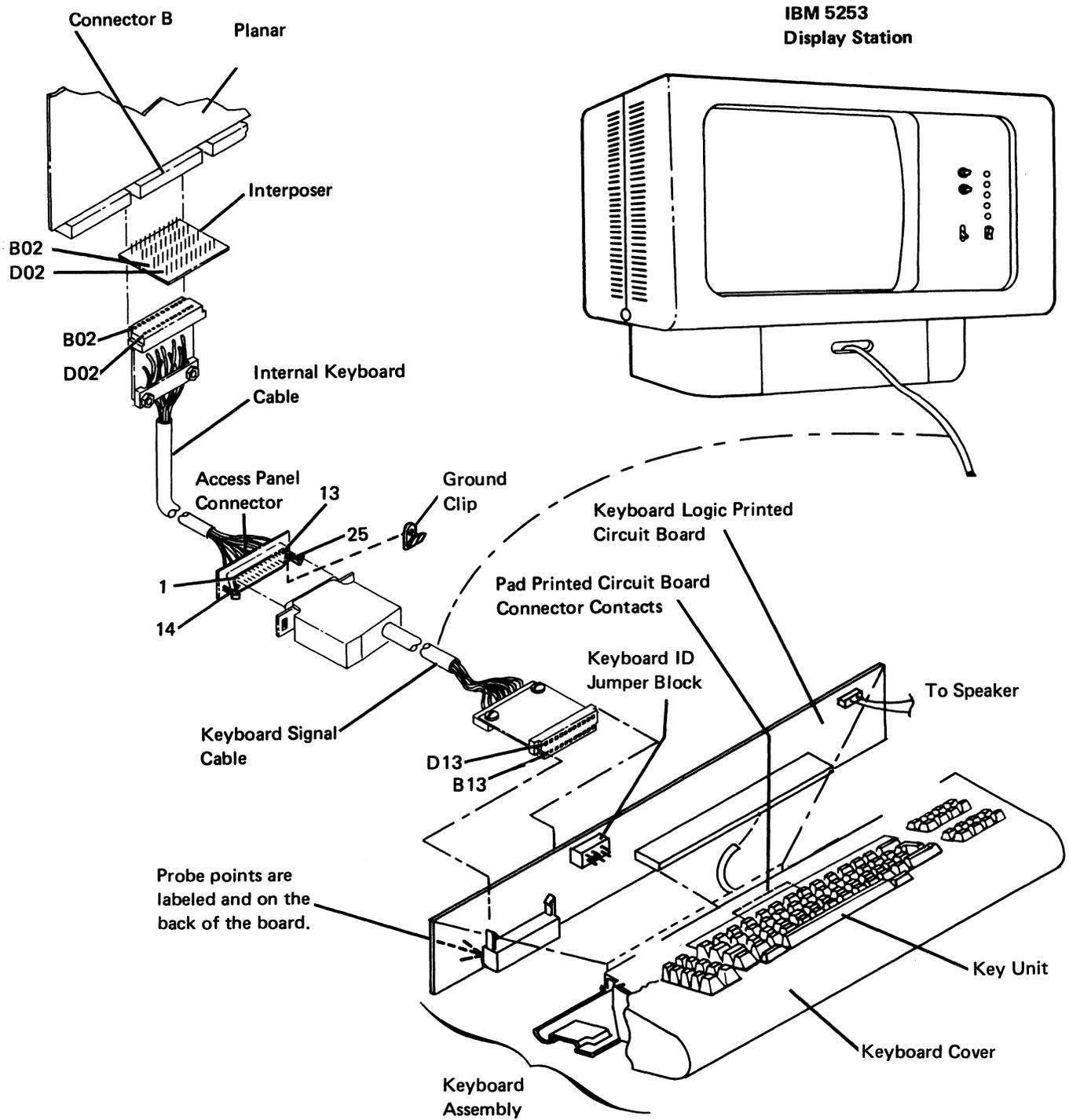
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Repair or replace the keylock assembly.

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Replacement sequence:
 - Keylock assembly.
 - Planar.

Keyboard

130 KEYBOARD LOCATIONS



131 KEYBOARD REMOVAL, DISASSEMBLY, AND ASSEMBLY

Removal

- 1. Power off.
- 2. Loosen the four screws on the bottom of the keyboard assembly (130).
- 3. Lift the keyboard cover away from the keyboard assembly.

Disassembly

- 1. Remove the two screws on each side of the keyboard.
- 2. Remove the keyboard logic printed circuit board (130) as follows:
 - a. Remove the two screws on the back of the printed circuit board.
 - b. Remove the keyboard signal cable connector.
 - c. Remove speaker wires.
 - d. Pull the logic printed circuit board off the pad printed circuit board.
- 3. If a key module is to be removed, locate the position of the key before the keyboard is inverted and pull off the keytop; use the keytop removal tool (part 9900373).
- 4. Lift the key unit out of the keyboard base.

CAUTION

The keyboard assembly must be kept free of dirt.

-
- 5. Invert the key unit and reinstall it on the original mounting block; use a screw on each side to hold the assembly in place.

CAUTION

Do not remove the pad printed circuit board while a key is pressed because the flyplate will jump out of the key module.

- 6. Ensure that there is no pressure on any keys.
- 7. Remove the two screws from one side; loosen the two screws on the other side of the pad printed circuit board.
- 8. Slowly lift the pad printed circuit board from the key assembly.

Assembly

To assemble, reverse the disassembly procedure steps.

132 KEYBOARD CLEANING

CAUTION

If you use excessive pressure when cleaning the flyplates, you could cause them to become disengaged from the spring.

- 1. Disassemble the keyboard (131).
- 2. Clean the pad printed circuit board with a lint free cloth that is moistened with isopropyl-alcohol solvent (part 2200200). Check the flyplates for dirt; clean only those flyplates that are dirty or are causing failures.
- 3. If cleaning does not eliminate the failures, it may be necessary to replace the keyboard (131).

133 KEY MODULE

Removal

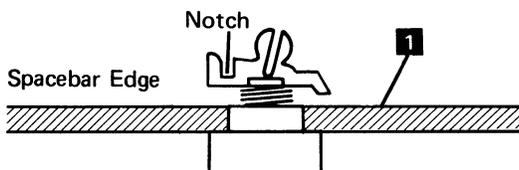
1. Use the keytop removal tool (part 9900373) to lift the keytops from the keys to be removed.

CAUTION

To prevent loosening a flyplate, ensure that no keys are pressed.

-
-
2. Disassemble the keyboard (131).
 3. Reach under the key unit and push up the failing key module until it is free.

Note: The module retaining ears must clear the frame **1** as shown.



Replacement

1. Insert the key module. Align the opening in the key module with the location lug in the mounting hole. The key stem must be positioned, so the notch is facing the Spacebar edge of the keyboard.
2. Reinstall the pad printed circuit board.
3. Turn the key unit over and, if necessary, place the dust shield in the correct position.
4. Put the keytop on the key unit.
5. Reinstall the logic printed circuit board and cover.
6. Reinstall the keyboard cover.

134 SPACEBAR

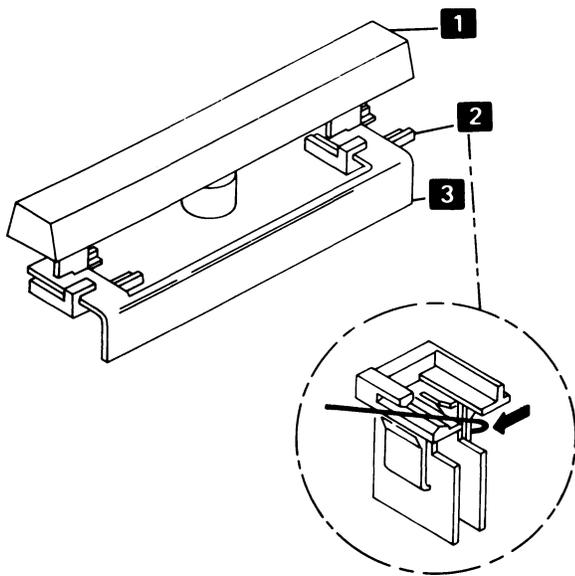
Removal

1. Disassemble the keyboard (131).
2. Lift the keytop from the Enter key (at the right of the Spacebar).
3. Pull upward while rocking the Spacebar **1** front-to-back (the Spacebar should slide off the key stem after about 3.2 mm [0.13 inches] of upward movement).
4. When the Spacebar is off the key stem, slide the Spacebar and counterweight **3** to the right to free the counterweight from the slots in the plastic blocks **2**.
5. If the plastic block needs to be replaced, proceed as follows:
 - a. With a springhook, reach through the hole at the right of the block **2** and hold the rear latch toward you.
 - b. Lift the rear of the plastic block.
 - c. With a springhook, reach through the hole at the right of the plastic block and hold the front latch away from you.
 - d. Lift the plastic block from the keyboard.
 - e. To install a plastic block, simply snap it into position.

134 (continued)

Replacement

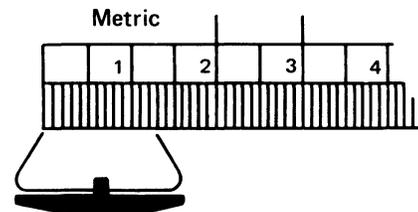
1. Insert the stems on the Spacebar **1** through the dust shield. The stems should be to the right of the slots in the plastic blocks.
2. Engage the counterweight slots in the Spacebar stem slots.
3. Slide the assembled Spacebar and counterweight into the slots on the plastic blocks **2**.
4. Press the Spacebar onto the key stem.
5. Press the Enter keytop onto its key stem.
6. Reassemble the keyboard (131).

**135 FLYPLATE REPLACEMENT**

Reinstalling a disconnected flyplate in a key module is not recommended.

If replacement is necessary because a new key module is not available, inspect the flyplate to ensure that the connection is not loose between the spring and the flyplate, or that the flyplate is not damaged.

1. Disassemble the keyboard (131).
2. Remove the key module (133).
3. Form the spring on the flyplate so that there is 12.7 mm (0.5 inch) between the ends of the spring.



135 (continued)

4. Tape the key stem down as shown.
5. Hold the key module and flyplate as shown. Line up the ends of the flyplate spring **1** with the tips of the flat spring **2** attached to the key stem.
6. Insert a small stylus or a straight paper clip through one of the access holes in the key module **3**.

11. Check the key stems for taper in the center opening and form them if necessary.

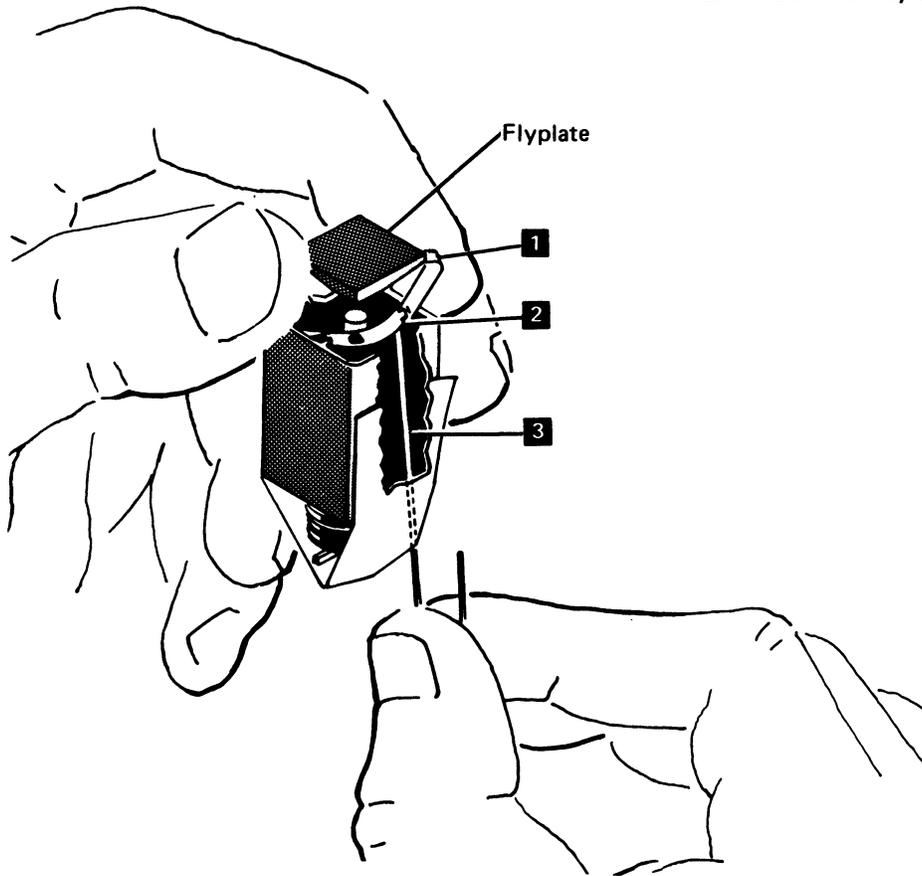
Correct



Wrong



12. Install the key module in the key assembly (133).



7. Push up on the tip of the flat spring on the inside of the flyplate spring.
8. Move the flat spring down until the tab drops into the opening of the flyplate spring.
9. Attach the other end of the spring in the same way.
10. Carefully remove the tape holding the key stem.

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136 KEYBOARD ID MINI-MAP

- Use this mini-MAP to locate an open or grounded ID line.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- ID lines *with* jumpers are at a Down level (displays a 1 in the ID field in Test mode when any data key is held down).
- ID lines *without* jumpers are at an Up level (displays a 0 in the ID field in Test mode when any data key is held down).

Service Aids

- Verify that the ID jumpers, shown on the Keyboard Identification chart (142) are correctly installed.
- The display station will *not* be damaged if powered-on after the keyboard cable is disconnected.

Tools

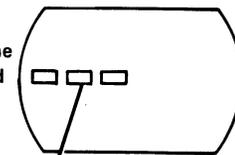
- CE meter
- CE probe (213)

Connect the CE probe as follows:

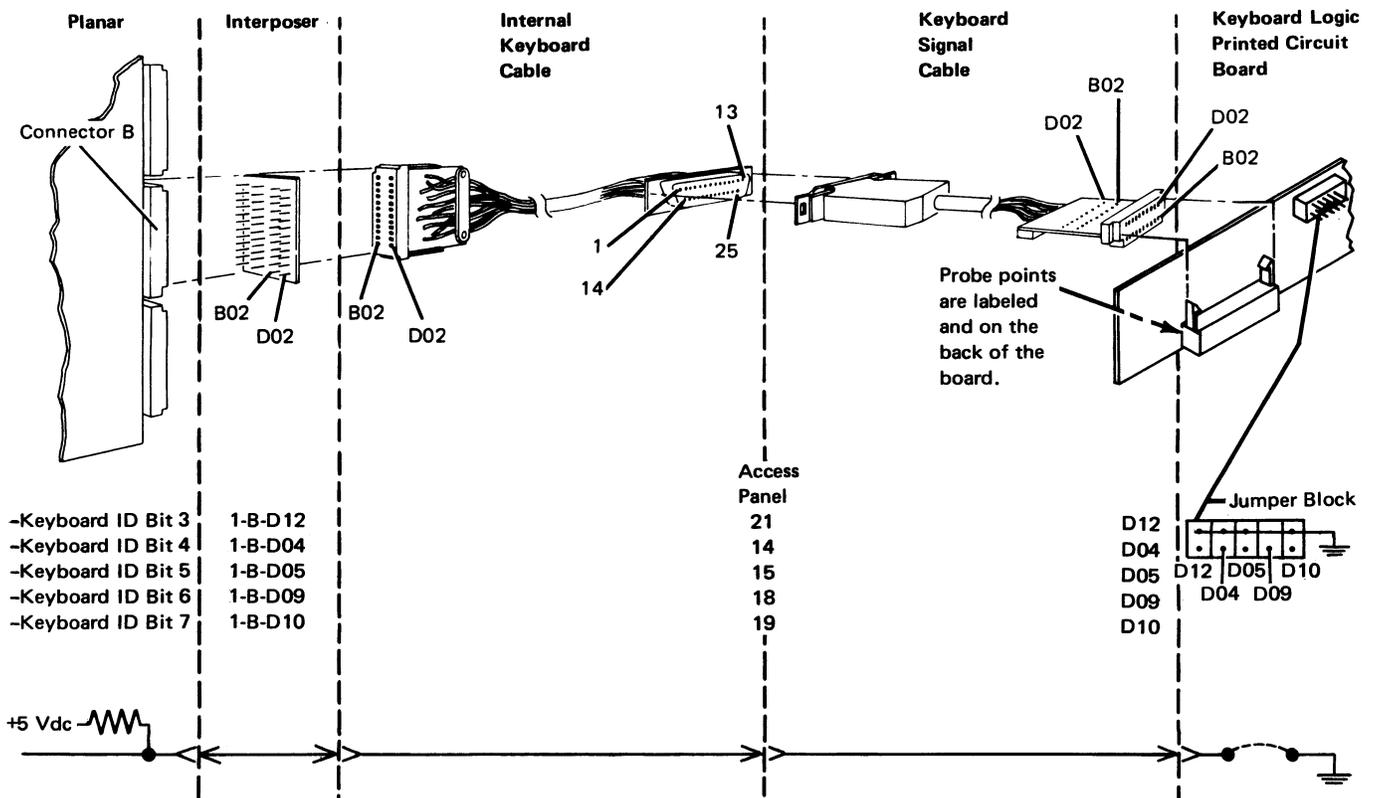
- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08

Display Screen

The Status switch is in the Test position; a keyboard key is pressed.



Keyboard ID
xxx34567



136 (continued)

Are the keyboard ID jumpers installed correctly (142) and is this kind of keyboard supported by the system?

Y N

- Set the ID jumpers correctly.
- A system problem exists.

- Check each ID bit line at the planar while the corresponding ID jumper is installed on the jumper block.
- Move the ID jumper as you check each line. The line should be at a Down level.

Is the line at a Down level?

Y N

- Check for an open line back through the keyboard logic PC board.

- Check each ID bit line at the planar while the ID jumper is removed.

The line should be at an Up level.

Is the line at an Up level?

Y N

- Leave the jumper off.
- Power off.
- Remove the cable at the planar.
- Check the line from the planar back to the jumper block on the logic PC board for a ground.

Is the line OK?

Y N

- Set the ID jumper correctly.
- Replace the cable or keyboard logic PC board.

- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the planar (103, 104, 105).
- Set the ID jumper correctly.
- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the planar (103, 104, 105).
- Set the ID jumper correctly.

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all of the connector contacts.
- Replacement sequence:
 - Planar.
 - Keyboard cables.
 - Keyboard logic PC board.

137 KEYBOARD SCAN CODE MINI-MAP

- Use this mini-MAP to locate an open or grounded scan code line.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The scan code lines are valid only after you press a key.

Service Aids

- All scan code lines change level when you press a keyboard key. A 1 is displayed in the scan code field on the display screen when a line is active.
- Use the Shift key to test the '-break code' line. The break code position in the displayed field is normally a 0. The position changes to a 1 only after the Shift key is pressed and released.

- The display station will *not* be damaged if it is powered-on after the keyboard cable is disconnected.
- Valid Keyboard scan codes are supplied in the scan code tables (144).

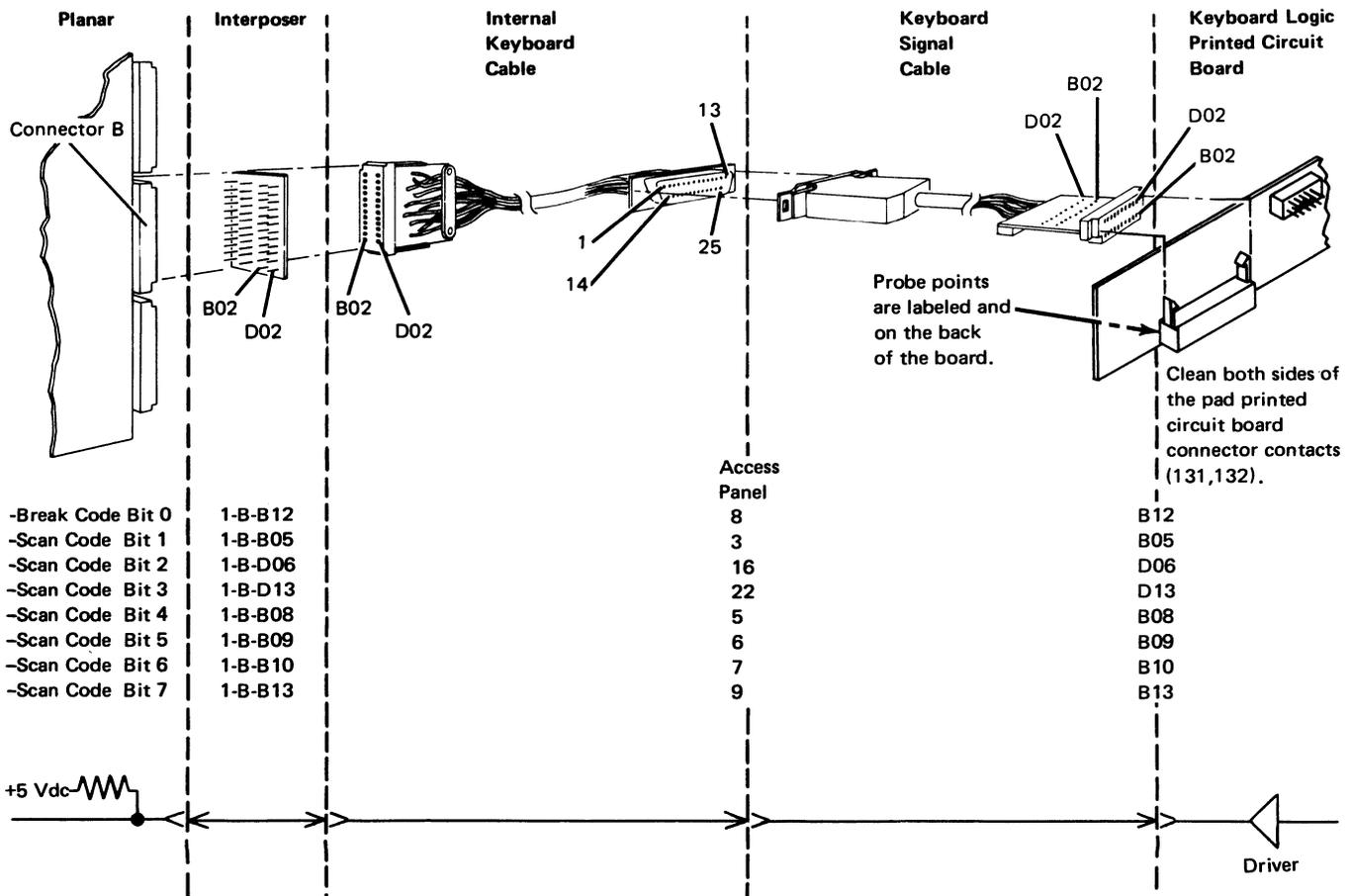
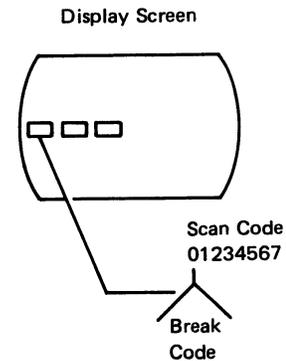
Tools

- CE meter
- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08

The Status switch is in the Test position; a keyboard key is pressed.



137 (continued)

- Check the failing scan code line at the planar (the bit line that did not change).
- Press and release a key that *should* activate the line and a key that *should not* activate the line (142, 143, 144).

Does the line change level for each key?

Y N

Is the line at a Down level?

Y N

- Power off.
- Check the failing scan code line in the cables for an open circuit.

Are the cables OK?

Y N

- Replace the failing cable.
- Replace the keyboard logic PC board; set the jumpers correctly on the new PC board (142).

- Power off.
- Disconnect the cable at the keyboard end.
- Power on.

Is the line still at a Down level?

Y N

- Replace the keyboard logic PC board; set the jumpers correctly on the new PC board (142).
- Power off.
- Disconnect the cable at socket B on the planar.
- Power on.

Is the line still at a Down level?

Y N

- Repair or replace the failing keyboard cable.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Clean the pad PC board contacts (132).
- Replacement sequence:
 - Keyboard logic PC board.
 - Planar.
 - Keyboard cables.

138 KEYBOARD VOLTAGE AND STROBE MINI-MAP

- Use this mini-MAP to correct a data strobe, power-on-reset, or strobe delay problem.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The voltage lines are active.
- The '-DATA strobe' line is positive (+) (the pulse will be negative when you press a key).
- The '-power-on reset' line is at an Up level.
- The '+DELAY strobe' line is negative (-) (the pulse will be positive when you press a key).

Service Aids

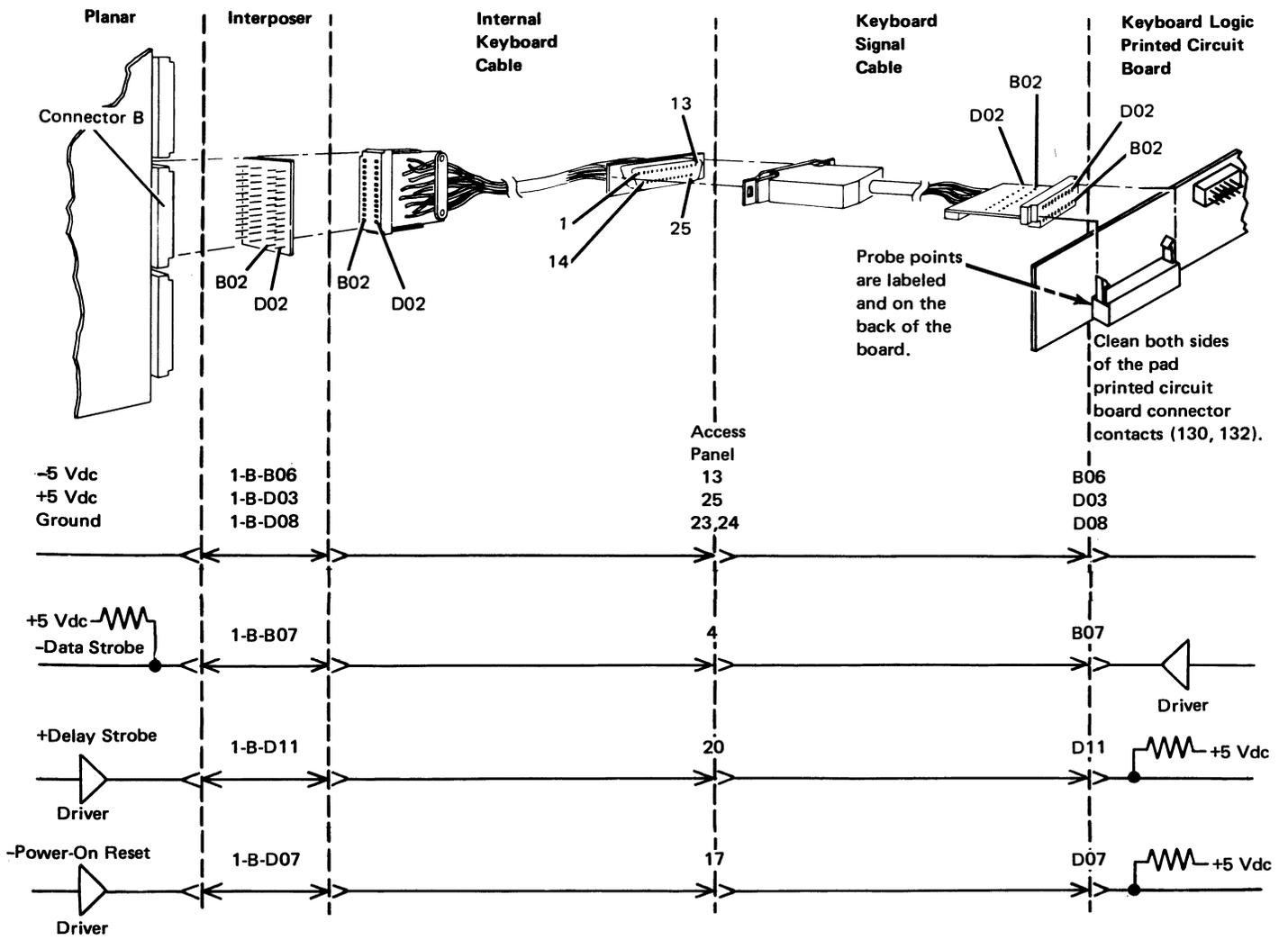
- The '-power-on-reset' line is at a Down level for about 0.5 seconds during power-on.
- When you press a key, the '-DATA strobe' line pulses at a Down level.
- When the planar receives the '-DATA strobe' line, it pulses the '+DELAY strobe' line at an Up level.
- A failure in the '-5 Vdc', '+5 Vdc', '-DATA strobe', or '+DELAY strobe' line causes both the '-DATA strobe' and '+DELAY strobe' lines to fail.
- The display station will *not* be damaged if it is powered-on after the keyboard cable is disconnected.

Tools

- CE meter
- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08



138 (continued)

- Ensure that all cables are plugged correctly on the planar.
- Check the 'power-on reset' line at the planar.

Is the line at an Up level?

Y N

- Use mini-MAP 141 to isolate the failure.
- Check the '+5 Vdc' and '-5 Vdc' lines at the planar.

Are the voltages correct?

Y N

- A ground in the cable or keyboard logic PC board could have damaged the planar.
- Check for a grounded voltage line and then replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Power off.
- Disconnect the keyboard signal cable at the keyboard end.
- Power on.
- Check the '+5 Vdc' and '-5 Vdc' lines at the keyboard end of the cable.

Are the voltages correct?

Y N

- Power off.
- Check for an open voltage line in the cables.
- Power off.
- Reconnect the keyboard signal cable.
- Power on.
- Check the 'DATA strobe' line at the planar.

Does the line pulse when a key is held down?

Y N

Is the 'DATA strobe' line at an Up level?

Y N

- Power off.
- Disconnect the keyboard signal cable at the keyboard end.
- Power on.

A B C

A
A

B
B

C
C

Is the line at a Down level?

Y N

- Replace the keyboard logic PC board.
- Check the 'DATA strobe' line for a ground.

Is the 'DELAY strobe' line at a Down level at the planar?

Y N

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Check the 'DATA strobe' line at the keyboard signal cable connector. These points are labeled and available on the back wiring side of the logic PC board.

Does the line pulse when a key is held down?

Y N

- Power off.
- Check the 'DELAY strobe' line for an open circuit.
- Inspect the -5, +5, and B07 ('DATA strobe' line) contacts on the keyboard end of the signal cable.

Are the cables OK?

Y N

- Repair or replace the failing cable.
- Replace the keyboard logic PC board; set the jumpers correctly on the new PC board (142).
- Check the 'DATA strobe' line in the cables for an open circuit.

Are the cables OK?

Y N

- Repair or replace the failing cable.
- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

138 (continued)

A

- Power off.
- Disconnect the keyboard signal cable at the keyboard end.
- Check the 'DELAY strobe' line for a ground.

Is the line grounded?

Y N

- Check the 'DELAY strobe' line for a ground at the cable connector on the keyboard logic PC board.

Is the line grounded?

Y N

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Replace the keyboard logic PC board; set the jumpers correctly on the new PC board (142).

- Disconnect the internal keyboard cable at the planar.
- Check the 'DELAY strobe' line for a ground at the planar.

Is the line grounded?

Y N

- Repair or replace the cable.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Clean the pad PC board contacts (132).
- Replacement sequence:
 - Logic PC board.
 - Planar.
 - Keyboard cables.

139 KEYBOARD SPEAKER MINI-MAP

- Use this mini-MAP to locate a keyboard speaker problem.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The '+8.5 V' line is active.
- The '-speaker activate' line is at an Up level.

Service Aids

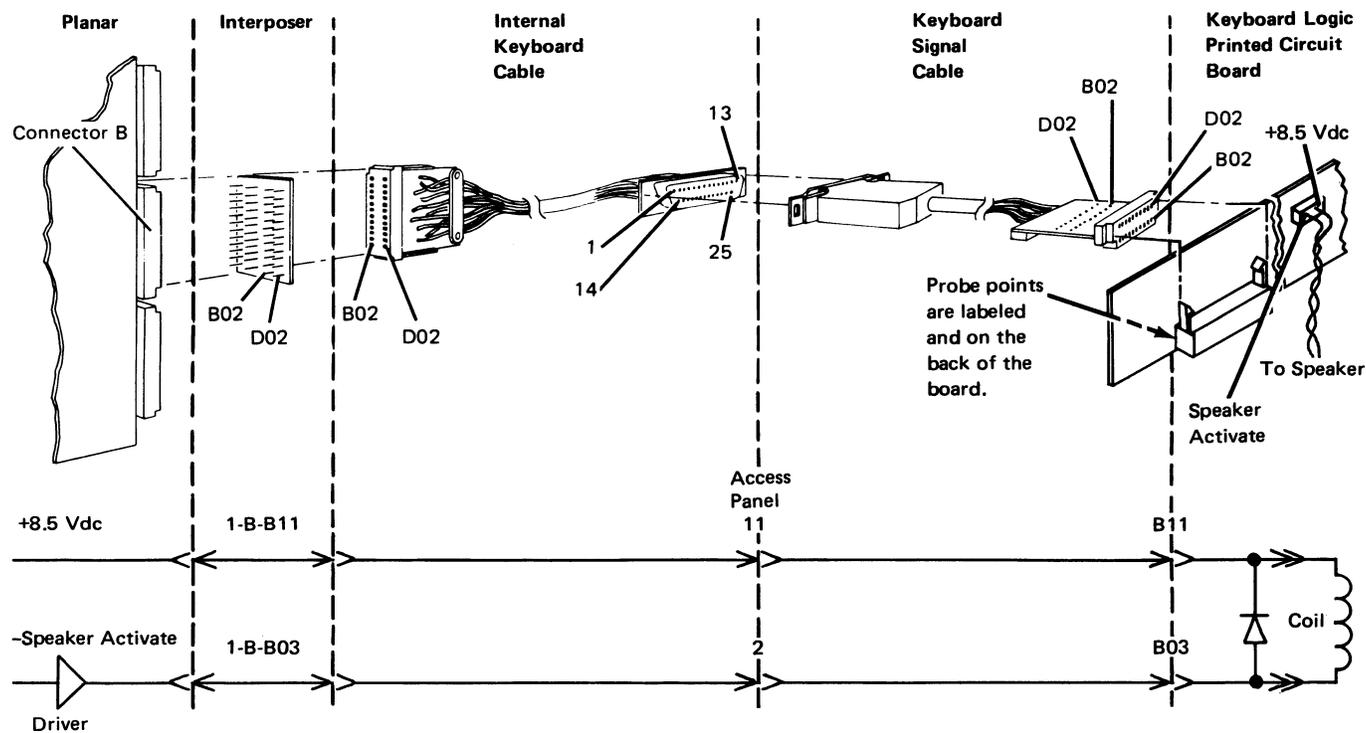
- The '-speaker activate' line pulses at a Down level when you press a key that causes the speaker to sound. This line also pulses each time the program loops in Test mode.
- The display station will *not* be damaged if it is powered-on after the keyboard cable is disconnected.

Tools

- CE probe (213)
- CE meter

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08
- Ground on the ID block



139 (continued)

Check the speaker coil and the '+8.5 Vdc' line as follows.

- Probe the 'speaker activate' signal line at the left speaker connector pin. Do not unplug the connector.

Is any probe light on?

Y N

- Check for +8.5 Vdc at the right speaker connector pin.

Is the voltage correct?

Y N

- Power off.
- Check for an open '+8.5 Vdc' line back to the planar.
- Replace the speaker.

- Check the 'speaker activate' line (B03) at the signal cable connector. These points are labeled and available on the back of the logic PC board.

Does the line pulse each time a key is pressed?

Y N

Is the line at a Down level?

Y N

- Probe the line (1-B-B03) at the planar.

Is the line at an Up level?

Y N

- Power off.
- Check the cable for an open.
- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Power off.
- Check the 'speaker activate' line for a ground.

- Check the keyboard end of the signal cable.
- Replace the logic PC board.

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Replacement sequence:
 - Speaker.
 - Keyboard logic PC board.
 - Planar.
 - Keyboard cables.

140 KEYBOARD CABLE CHECK MINI-MAP

- Use this mini-MAP to locate an open circuit in the cable check lines.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The '-cable check' line is at a Down level.

Service Aids

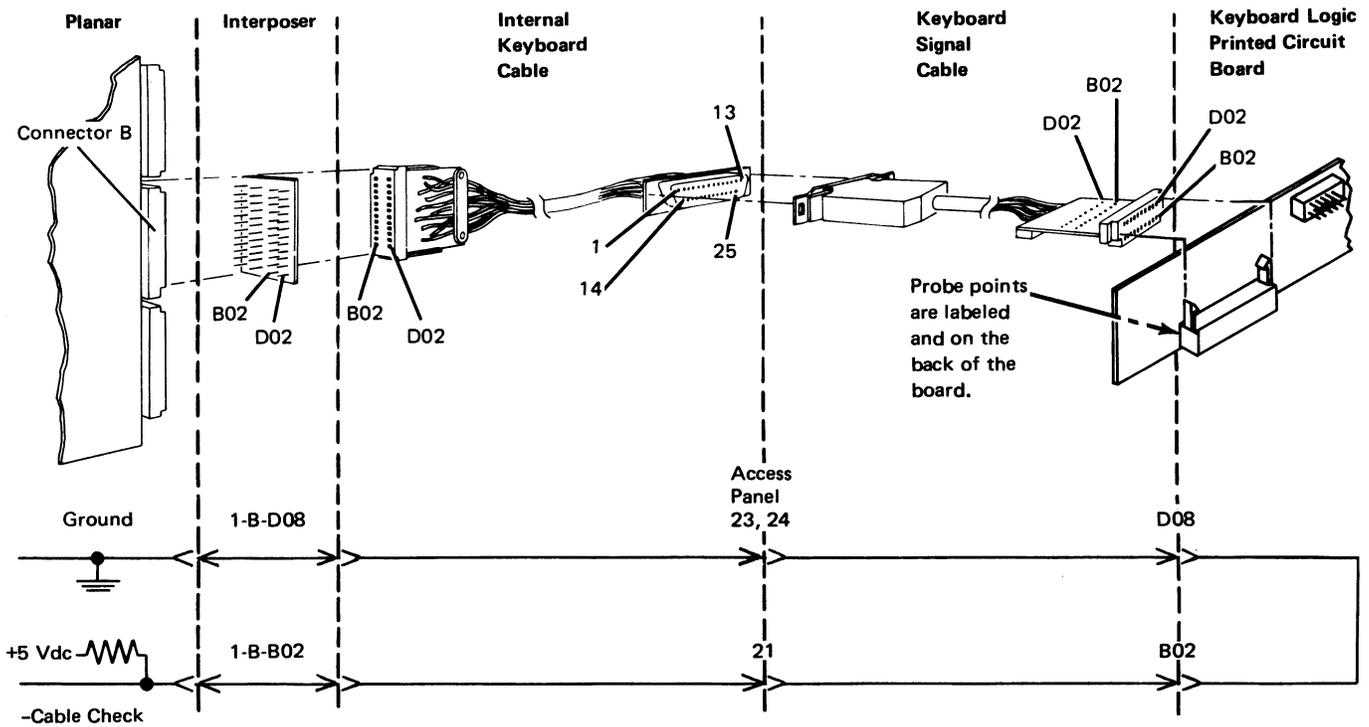
- The display station will *not* be damaged if it is powered-on after the keyboard cable is disconnected.

Tools

- CE probe (213)
- CE meter

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08



140 (continued)

- Probe '-cable check' line (B-B02) at the planar.

Is the line at a Down level?

Y N

- Power off.
 - Check for an open circuit through the cable and keyboard logic PC board back to ground on the planar.
- Probe 'scan code bit 7' line (1-B-B13).
- Press two keys that are next to each other.

Does the 'scan code' line change?

Y N

- Go to mini-MAP 138.
- Inspect the interposer.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Jumper 1-B-D08 to 1-B-B02.
- If the problem still occurs, replace the planar. If not, the cable or keyboard logic PC board could be open.

141 KEYBOARD POR MINI-MAP

- Use this mini-MAP to locate an open or grounded power-on reset (POR) line.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The '-power-on reset' line is at an Up level.

Service Aids

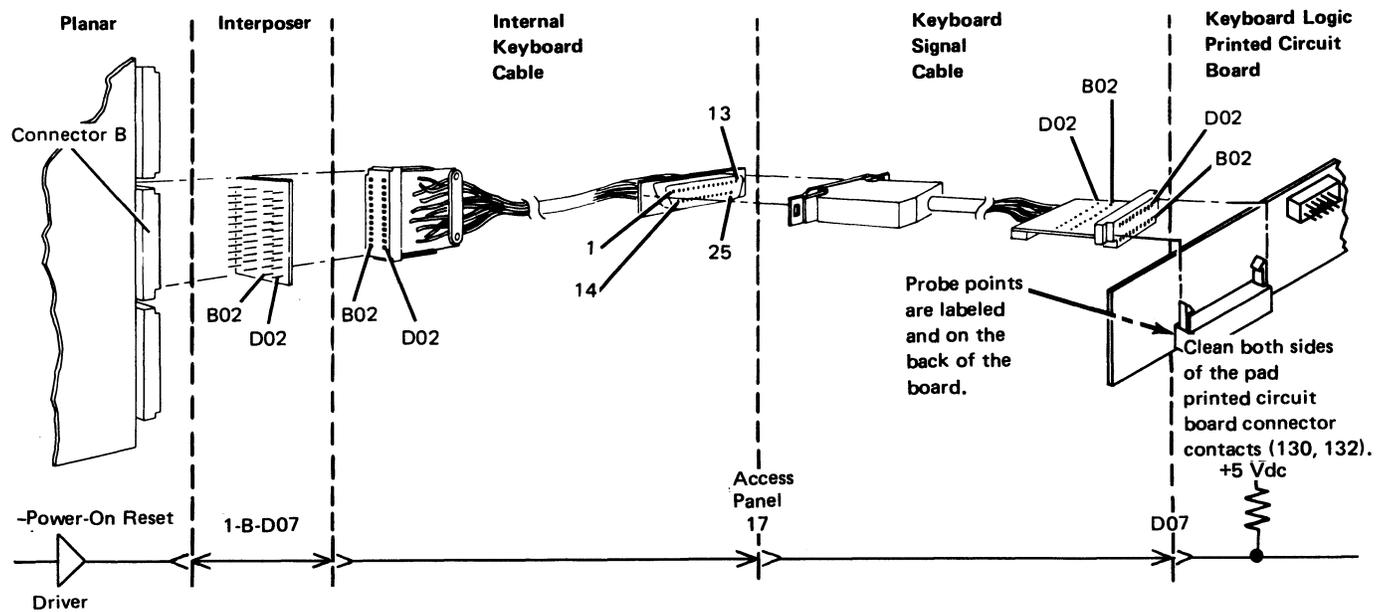
- The '-power-on reset' line is at a Down level for about 0.5 seconds during power-on.
- The display station will *not* be damaged if it is powered-on after the keyboard cable is disconnected.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08



141 (continued)

- Check the 'power-on reset' line at the planar.

Is the line at a Down level?

Y N

Does the line pulse Down for about 1 second during power-on?

Y N

- Inspect the interposer
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Go to mini-MAP 188.

- Power off.
- Remove the cable at connector B.
- Power on.

Is the line at a Down level at the planar?

Y N

- Power off.
- Check for a ground in the cable or keyboard logic PC board.

- Power off.
- Reinstall the cable at connector B.
- Remove the connector K interposer (103).
- Power on.

Is the line at a Down level at the planar?

Y N

- Inspect the interposer.
- Replace the extended storage card.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Clean the pad PC board contacts (132).
- Replacement sequence:
 - Logic PC board.
 - Planar.
 - Keyboard cables.

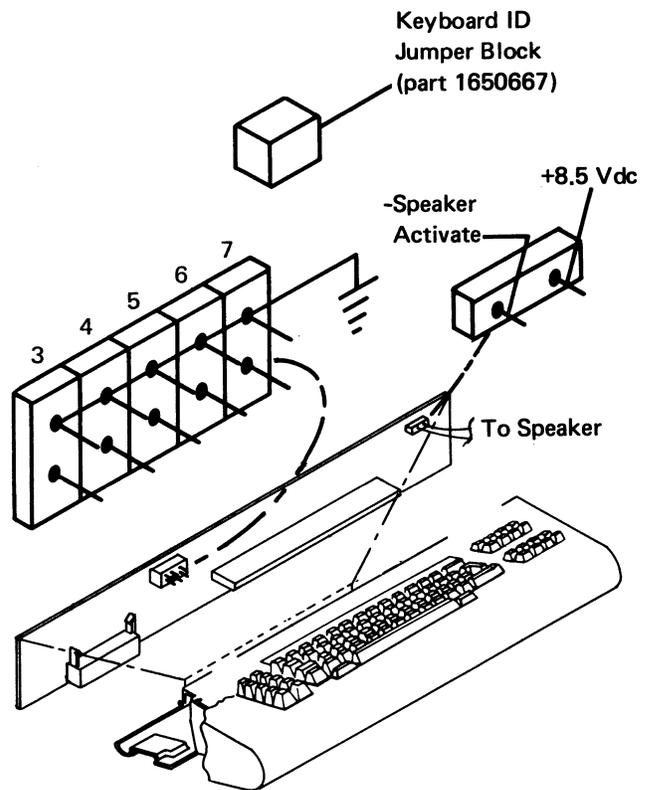
142 KEYBOARD IDENTIFICATION

The following figure shows the jumpers that are needed for keyboard identification.

Country	Language	Bit Assignment				
		3	4	5	6	7
United States (92 char.)	English	0	0	0	0	1
United States (96 char.)	English	0	0	1	1	0
Canada (bilingual)	English	1	0	0	1	0
Canada	French	1	0	0	1	0
Denmark	Danish	1	0	1	0	0
France/Belgium (AZERTY)	Dutch	0	1	1	1	1
France/Belgium (AZERTY)	French	0	1	1	1	1
Germany/Austria	German	0	1	1	1	0
Italy	Italian	1	1	0	0	1
Netherlands	Dutch	1	1	0	1	0
Norway	Norwegian	1	0	0	1	1
Sweden	Swedish	1	1	1	1	0
Switzerland	French	1	1	1	0	0
Switzerland	German	1	1	1	0	1
United Kingdom	English	1	0	1	0	1

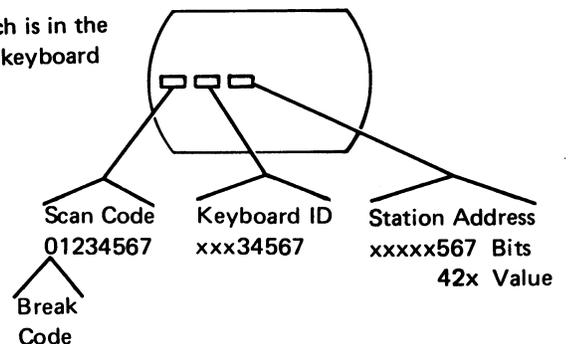
Notes:

1. A bit assignment of 0 0 0 0 0 indicates that no keyboard is attached.
2. 1 = jumpered; 0 = not jumpered.



Power-On Diagnostic Display

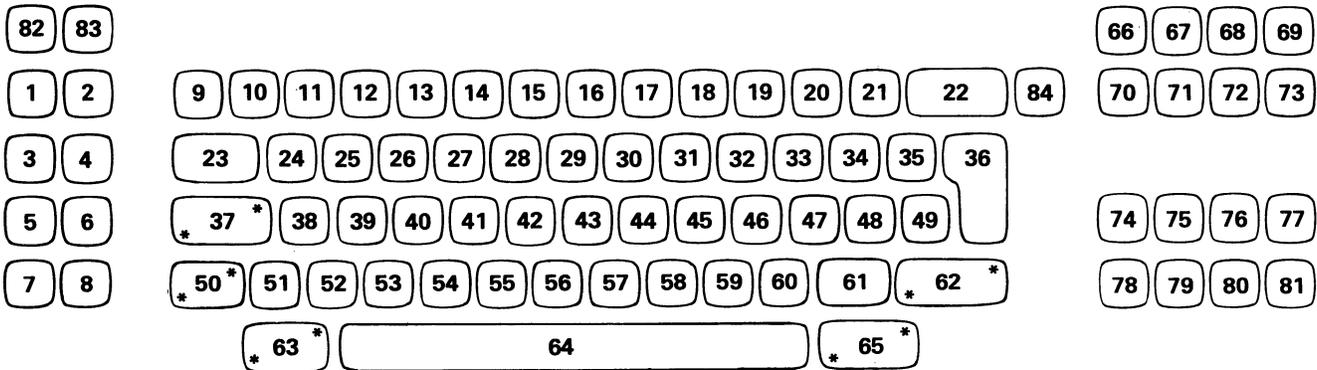
The Status switch is in the Test position; a keyboard key is pressed.



143 KEYBOARD ARRANGEMENT FOR 96-CHARACTER KEYBOARDS

The keyboard arrangement shown is for a 96-character keyboard. The 92-character keyboard is the same except that keys 49 and 51 are not present. The numbers inside the key outlines compare with the key positions in the scan code tables (144).

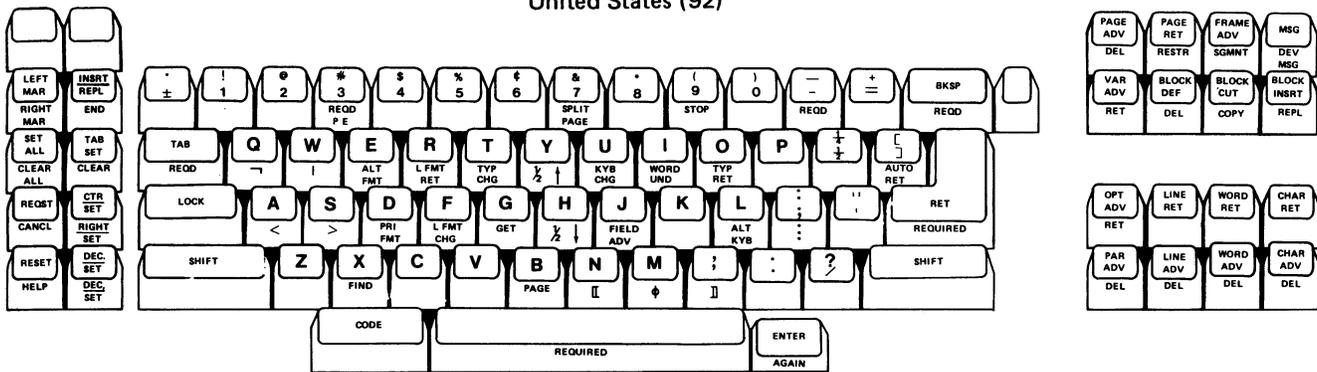
Scan-Coded Keyboard (96)



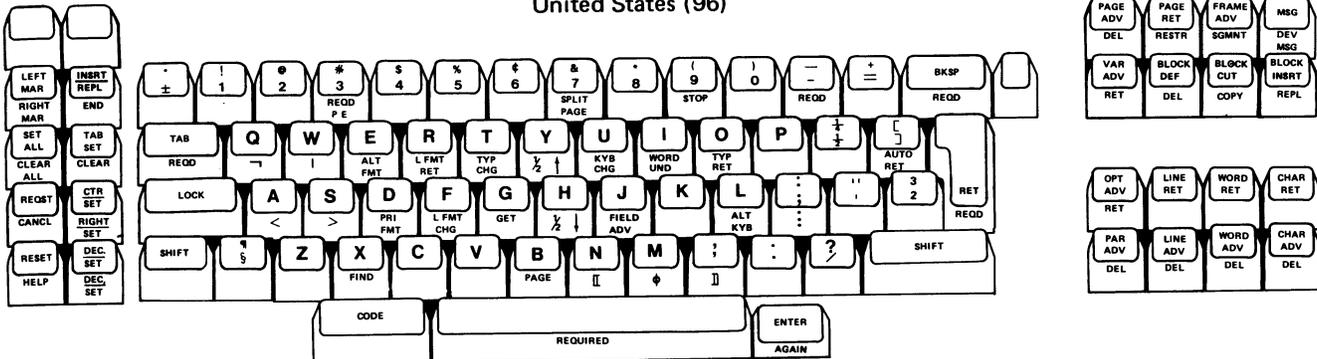
* A nontypamatic key. * A make/break key.

Standard Keyboard Layouts

United States (92)



United States (96)



144 SCAN CODE TABLES

Scan codes are a function of the physical position of the keyboard keys. The following table shows the scan code (made up of the break code and a 7-bit interface data code), the hexadecimal code, and the key position for the keyboards.

Key Position	Scan Code		Key Position	Scan Code		Key Position	Scan Code	
	Hex	Binary 01234567		Hex	Binary 01234567		Hex	Binary 01234567
1	7C	01111100	29	26	00100110	57	06	00000110
2	6F	01101111	30	27	00100111	58	07	00000111
3	6C	01101100	31	28	00101000	59	08	00001000
4	6D	01101101	32	29	00101001	60	09	00001001
5	6E	01101110	33	2A	00101010	61	0A	00001010
6	7D	01111101	34	2B	00101011	62*	0B	**0001011
7	71	01110001	35	2C	00101100	63*	0C	**0001100
8	70	01110000	36	2D	00101101	64	0F	00001111
9	3E	00111110	37*	2E	**0101110	65*	68	**1101000
10	31	00110001	38	11	00010001	66	73	01110011
11	32	00110010	39	12	00010010	67	72	01110010
12	33	00110011	40	13	00010011	68	61	01100001
13	34	00110100	41	14	00010100	69	7E	01111110
14	35	00110101	42	15	00010101	70	62	01100010
15	36	00110110	43	16	00010110	71	63	01100011
16	37	00110111	44	17	00010111	72	64	01100100
17	38	00111000	45	18	00011000	73	65	01100101
18	39	00111001	46	19	0011001	74	56	01010110
19	3A	00111010	47	1A	00011001	75	4D	01001100
20	3B	00111011	48	1B	00011011	76	47	01000111
21	3C	00111100	49	1C	00011100	77	48	01001000
22	3D	00111101	50*	1D	**0001101	78	49	01001001
23	20	00100000	51	0E	00001110	79	4E	01001110
24	21	00100001	52	01	00000001	80	54	01010100
25	22	00100010	53	02	00000010	81	57	01010111
26	23	00100011	54	03	00000011	82	66	01100110
27	24	00100100	55	04	00000100	83	67	01100111
28	25	00100101	56	05	00000101	84	10	00010000

*All keys except these are typamatic; bit 0 switches from a 0 to a 1 when a typamatic key is held down for more than 600 milliseconds.

**A make/break key. Bit 0 is 0 when the key is pressed and 1 when the key is released.

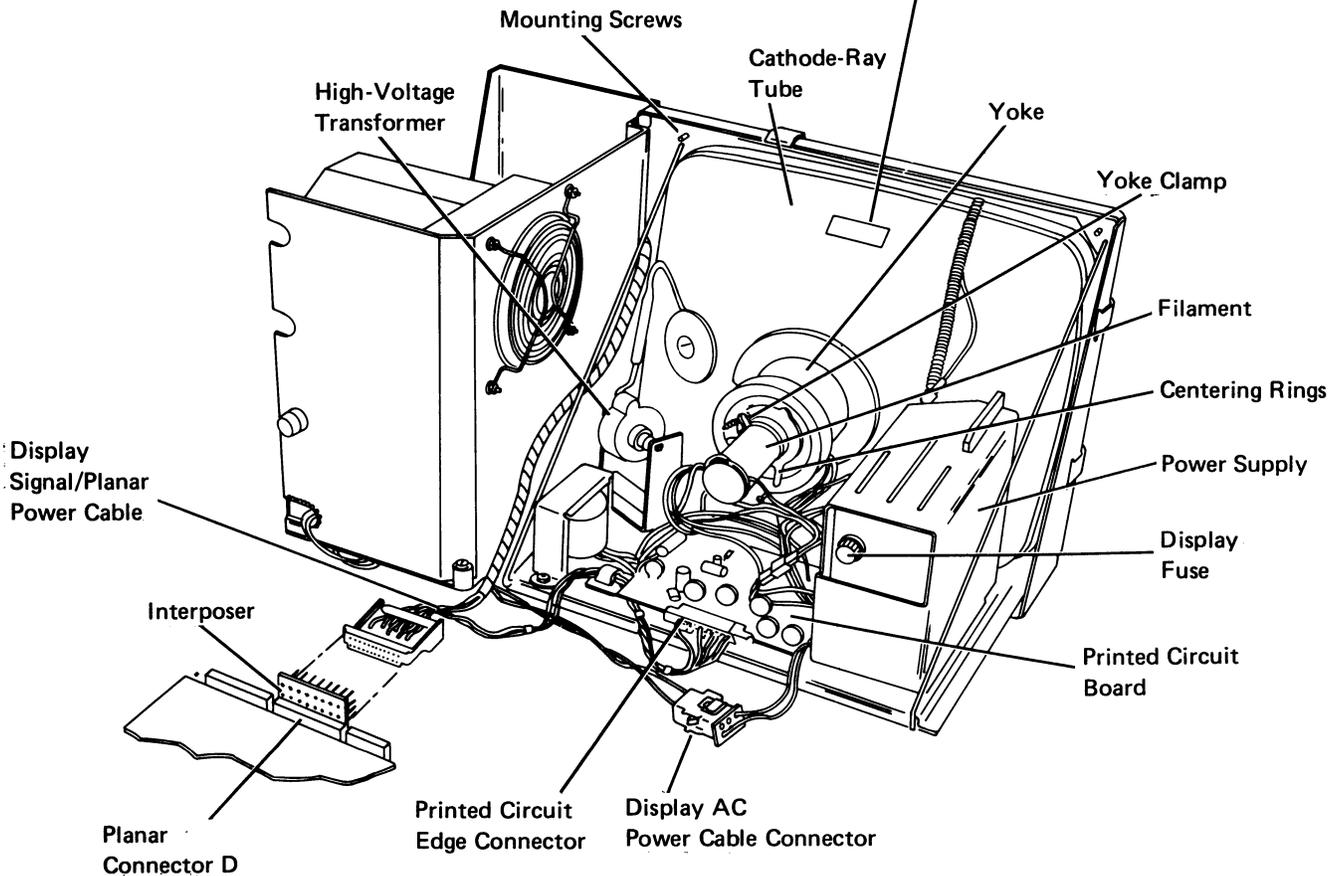
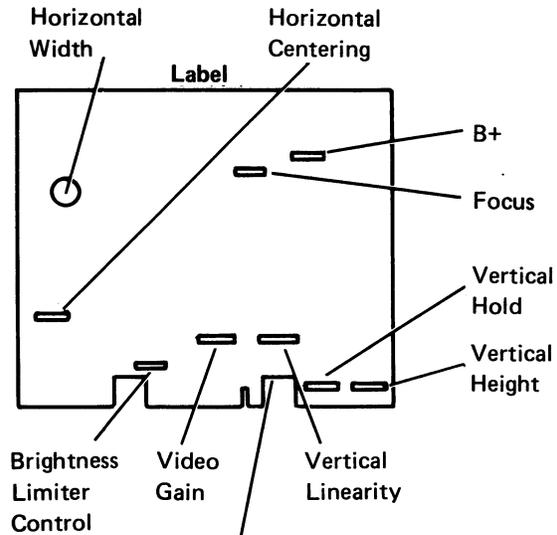
Display

150 DISPLAY ASSEMBLY LOCATIONS

The display assembly installed on your machine might not look the same as the one shown here because several manufacturers supply the display assemblies. Although the display assemblies might look different, they are similar and generate the same signals and displays.

Always refer to the label on the CRT to locate the adjustments on the printed circuit board. If the adjustment does not appear on the label, the adjustment is not required on your machine.

Note: Use the fiber screwdriver (part 460811) for display assembly adjustments.



151 DISPLAY ASSEMBLY REMOVAL AND REPLACEMENT

DANGER

The display assembly contains high voltages, and the green wire in the display assembly may not be at ground voltage.

Removal

1. Power off and remove the line cord from the wall outlet.
2. Open the front and rear covers (108).
3. Disconnect the display AC power cable connector.
4. Disconnect the printed circuit edge connector.
5. Remove the two base mounting screws and the four front mounting screws or screws and nuts.

DANGER

The cathode-ray tube can implode when it is hit or if it falls. For personal safety, wear safety glasses.

6. Lift the display assembly from the display station housing.
7. Place the used display assembly in the shipping container so it can be returned to the branch office.

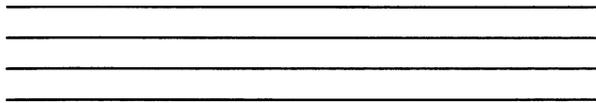
Replacement

1. Move the rubber shock mounts to the location needed for the type of display you are installing.
2. Set the new display assembly in the display station.
3. Fasten the display assembly with six mounting screws or screws and nuts.
4. Connect the printed circuit edge connector. Align the pointer on the connector with the notch in the printed circuit board (157).
5. Connect the display AC power cable (150).
6. If necessary, make the display adjustments (152 through 155).
7. Align the display assembly to allow the front cover to close properly.
8. Close the front and rear covers (108).
9. Check the gap between the bezel and the display assembly to ensure that the gap is not too much (100).
10. If the gap is too much, return to Step 7.

152 VIDEO ADJUSTMENTS

DANGER

The display assembly contains high voltages. The green wire in the display assembly may not be at ground voltage. Use the fiber screwdriver when making internal adjustments.



The following are the three adjustments common to all display assemblies:

- The Brightness control on the control panel.
- The Contrast control on the control panel.
- The brightness limiter potentiometer on the display assembly (150). Some displays also have a video gain/video drive adjustment.

Brightness Limiter Adjustment

1. Turn the Brightness control on the control panel fully clockwise.
2. Turn the brightness limiter potentiometer on the display assembly until the retrace lines just disappear. See the raster figure (156).

Note: Too much brightness can cause poor focus.

Contrast and Brightness Adjustments

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. The H characters on the display screen are of both normal and high intensity. Adjust the Contrast control and the Brightness control for the best display screen image.

Video Gain/Video Drive Adjustment

On some display assemblies, the video drive potentiometer is used to limit the brightness of the characters. Normally, use the Brightness control on the control panel for getting the best display screen image.

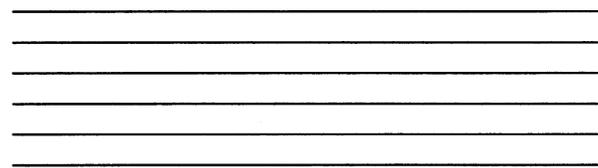
The video gain can also correct differences between the intensity of the horizontal and vertical lines of a character.

153 VERTICAL AND HORIZONTAL ADJUSTMENTS

DANGER

The display assembly contains high voltages, and the green wire in the display assembly may not be at ground voltage. Use the fiber screwdriver when making internal adjustments.

Always wear safety glasses when adjusting the yoke or the centering rings.



Use vertical adjustments to correct the following problems:

- If the characters have rapid vertical movement, perform the vertical hold adjustment.
- If the display image rolls vertically, perform the vertical hold adjustment.
- If the display image is too short, perform the vertical height adjustment.
- If the character height is not correct, perform the vertical linearity adjustment or the linearity phase adjustment.

Use horizontal adjustments to correct the following problems:

- If the display screen is too narrow, perform the horizontal width adjustment.
- If the right or left margin is not correct, perform the horizontal centering adjustment, horizontal set adjustment, or horizontal oscillator adjustment.
- If the display screen shows horizontal motion, perform the horizontal centering adjustment, horizontal set adjustment, or horizontal oscillator adjustment.

If the problem is not corrected by performing the adjustment, replace the display assembly (151).

Vertical Adjustments

The vertical adjustments could interact. Anytime the screen image rolls, you should adjust the vertical hold before continuing with other vertical adjustments.

Vertical Hold Adjustment

Turn the vertical hold potentiometer to obtain a stable display (not rolling) without display distortion (flat top).

1. Set the Status switch in the Test position to display the scan code, address, and ID fields.
2. Observe the display screen while you turn the vertical hold potentiometer in each direction until the screen image rolls. Remember each position of the potentiometer when the image starts to roll.
3. Turn the vertical hold potentiometer to the center of its range. Do not let the picture roll. If a small adjustment causes the picture to roll up and then down, replace the display assembly (151).

Vertical Height Adjustment

The vertical height potentiometer controls the screen image height.

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. The height should be $190 \text{ mm} \pm 6 \text{ mm}$ (7.48 inch \pm 0.24 inch). This is measured from the top of the highest H in row 1 to the bottom of the lowest H in the bottom row.

Vertical Linearity Adjustment

The vertical linearity potentiometer controls the height of the characters.

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. The vertical height and vertical linearity adjustments affect each other. Adjust them until you get the desired result.

Linearity Phase Adjustment

The linearity phase potentiometer controls the height of the characters between the top of the screen and the bottom of the screen as well as vertical stability of the characters. (An entire line might sometimes be displayed in a higher than normal position.)

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. Adjust for the desired result.

Horizontal Adjustments

Horizontal Width

The horizontal width potentiometer is used to control the width of the display. A special tool is needed to adjust it. This potentiometer is adjusted at the factory to secure a width of $252 \text{ mm} \pm 6 \text{ mm}$ (9.93 inch \pm 0.24 inch). This is measured from the left of the leftmost character H to the right of the rightmost character H. If there is a horizontal position problem, correct the problem by adjusting the centering rings (155).

Horizontal Centering, Horizontal Set, Horizontal Oscillator Adjustment

Adjust this potentiometer to center the video within the raster:

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. Obtain a raster by turning the brightness limiter potentiometer.
3. Center the raster horizontally on the display screen by moving the rear centering ring.
4. Center the raster vertically by moving the front centering ring.
5. Center the data on the display screen within the raster by using the horizontal centering, the horizontal set, or the horizontal oscillator potentiometer.
6. Turn the brightness limiter potentiometer until the raster disappears.

154 YOKE ADJUSTMENT

DANGER

The display assembly contains high voltages, and the green wire in the display assembly may not be at ground voltage. Use the fiber screwdriver when making internal adjustments.

Always wear safety glasses when adjusting the yoke or the centering rings.

Adjust the yoke (150) until the display is the correct size and is aligned horizontally.

1. Select Display Attributes from the Exercise Display Station menu on the Online Tests (206).
2. Loosen the clamp screw on the yoke collar.
3. Position the yoke as far forward as possible against the bell part of the cathode-ray tube.
4. Turn the yoke to correct the tilted display.
5. Tighten the clamp screw on the yoke collar.

Note: If the adjustment cannot be made, replace the display assembly (151).

155 CENTERING ADJUSTMENT

DANGER

The display assembly contains high voltages, and the green wire in the display assembly may not be at ground voltage. Use the fiber screwdriver when making internal adjustments.

Always wear safety glasses when adjusting the yoke or the centering rings.

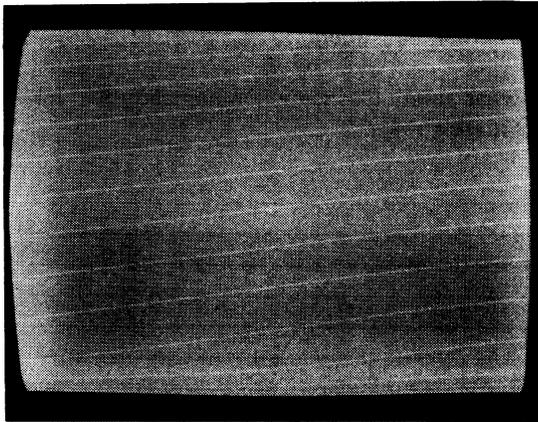
The centering rings (150) determine the horizontal and vertical positions of a display screen. (If the display screen is tilted, it is corrected by adjusting the yoke; do not try to correct tilt by adjusting the centering rings.) The following adjustments will affect each other. Adjust both rings to get the best results.

1. Select Display Attributes from the Exercise Display Station menu of the Online Tests (206).
2. Adjust the rear centering ring for horizontal centering. The spaces on the right and left margins of the display should be equal.
3. Adjust the front centering ring for vertical centering.

Note: If the adjustment cannot be made, replace the display assembly (151).

156 RASTER

Raster is a condition of the display screen; the display screen area is lighted but contains no data.



Note: A reverse image display could look like a raster display. However, when you use reverse image, the indicator area is not within the lighted area of the display screen. When a raster is displayed, the lighted area of the display screen includes the indicator area.

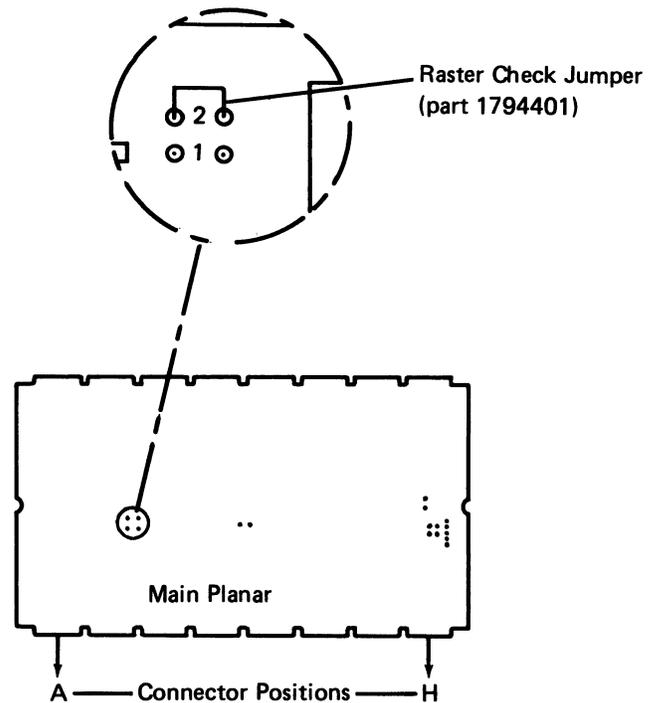
If there is a raster condition on the display screen, ensure that the raster check jumper (105) is removed, then perform *Video Adjustments* (152).

Raster Check

CAUTION

Power off when installing jumpers. This prevents damage to the planar.

To display a complete raster, install a jumper on jumper position 2 on the planar (105). This jumper places a continuous high-level voltage on the video signal line. The complete raster indicates that the display assembly and the display signal cable are OK.



156 (continued)

Factory Adjustments

CAUTION

The following factory adjustments should not be attempted. They are described for your information only.

- Focus Adjustment

The focus potentiometer is used to obtain a desired display focus. The factory adjusts the potentiometer to provide the best complete screen definition.

- B+ Adjustment

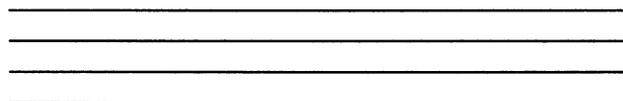
The B+ voltage is set at the factory with a precision meter. No attempt should be made to adjust this voltage. If the B+ voltage is out of adjustment, there is a loss of display image. Because many other parts in the display assembly can cause the same symptom, the display assembly should be replaced.

157 DISPLAY SIGNAL/PLANAR POWER CABLE MINI-MAP

- Use this mini-MAP to locate problems with the '+horizontal sync', '-vertical sync', and '+video' lines.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

CAUTION

Do not power on the display station while the display signal/planar power cable is disconnected unless the display AC power is also disconnected.



Conditions after Power-On

- Each line is pulsing.

Service Aids

- Open lines continue to pulse because of feedback from the display assembly. When probing for an open line, disconnect the display AC power connector (150).
- The power supply supplies power through the low-voltage connector on the power supply to connector D on the planar.
- The planar supplies signals to the display assembly. The display assembly has its own power supply.

Dark Screen

- The raster check jumper (156) can be installed to force a high-level video signal that lights the display screen.
- A video or horizontal sync failure causes a dark screen.

Vertical Rolling, Overlapped Lines of Data, or Unstable Display

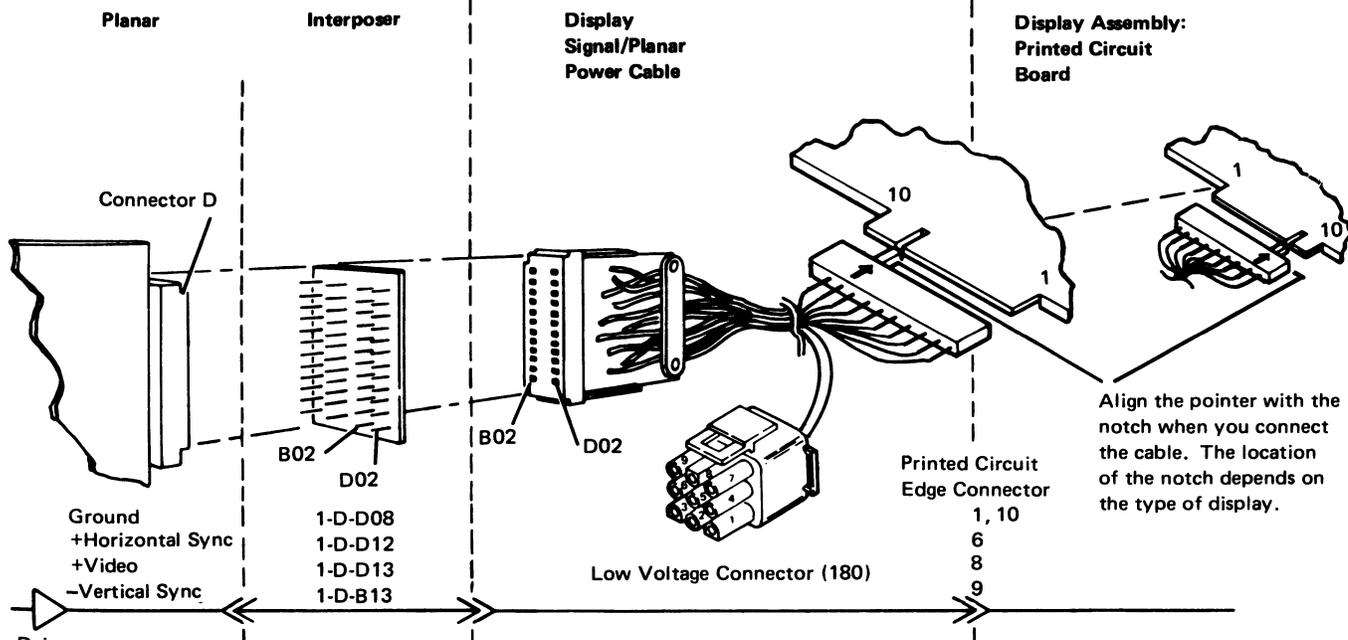
- Check the horizontal and vertical lines for open circuits.
- Check the adjustments (153).

Tools

- CE probe (213)
- CE meter

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 1-B-D08



All signals come from the planar; however, the display will cause an open line to continue to pulse at a high enough level to trigger the CE probe.

- Power off.
- Disconnect the display AC power connector (150).
- Power on.
- Check the signals at the planar.

Note: The Brightness control must be turned up (clockwise) all the way to make the video signal large enough to trigger the CE probe.

Is the line pulsing?

- Y N
- Power off.
 - Disconnect the display signal/planar power cable at the display.
 - Power on.

Does the line pulse now?

- Y N
- Check the cable for a grounded signal line.

Is the cable OK?

- Y N
- Repair or replace the cable.

A B C

- A B C
- Was the symptom a blank display?**
- Y N
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
 - Go to mini-MAP 111.
- Replace the display.

Is the line pulsing at the display?

- Y N
- Check the cable for an open.
 - Reseat, repair, or replace the cable.

Have the '+horizontal sync', '+video', and '-vertical sync' lines all been checked in this MIM?

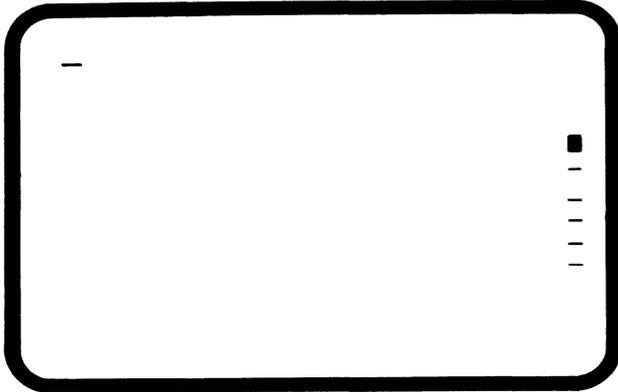
- Y N
- Repeat this procedure for the unchecked lines.
 - Reconnect the display AC power connector (150).
 - Make adjustments if applicable (153).
 - Replace the display assembly.

Suggested action for an intermittent problem:

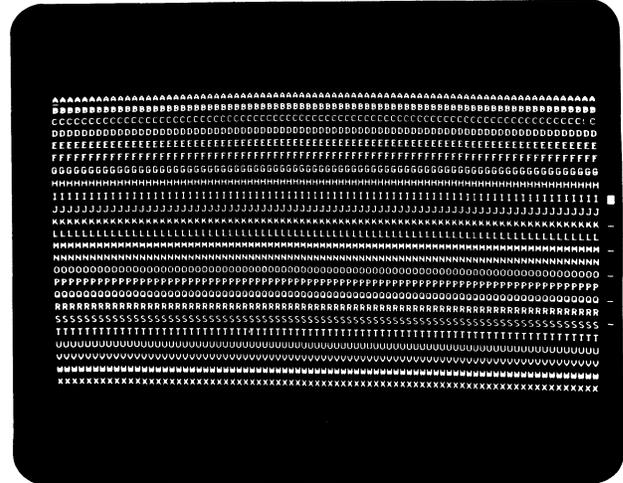
- Analyze the suspected line; inspect all the connector contacts.
- Replacement sequence:
 - Display assembly.
 - Planar.
 - Display signal/planar power cable.

158 DISPLAY SCREEN EXAMPLES

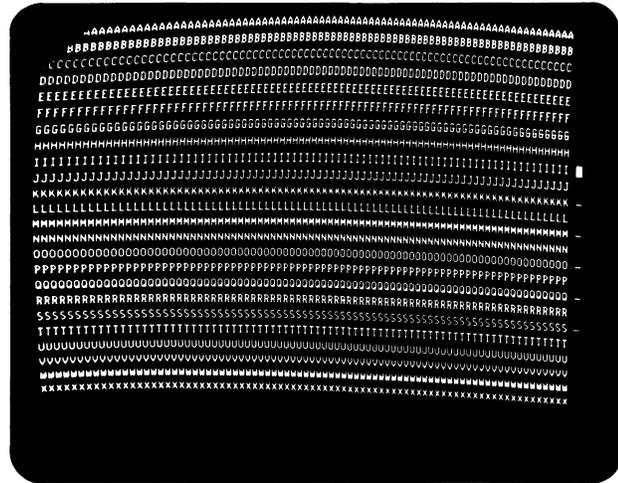
Normal screen (free key mode):



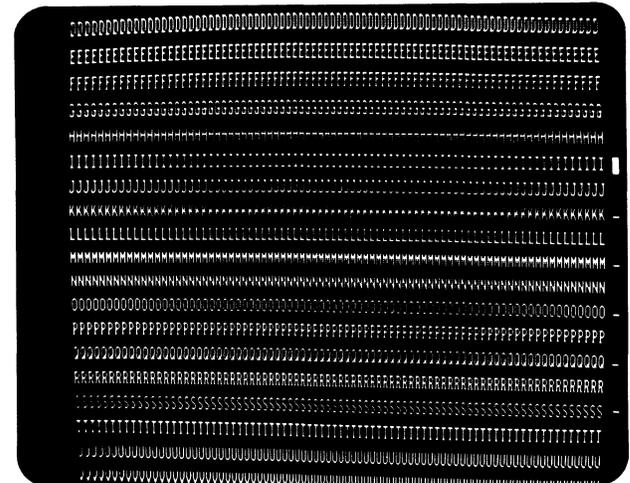
Display size not correct (too small) (see 154)



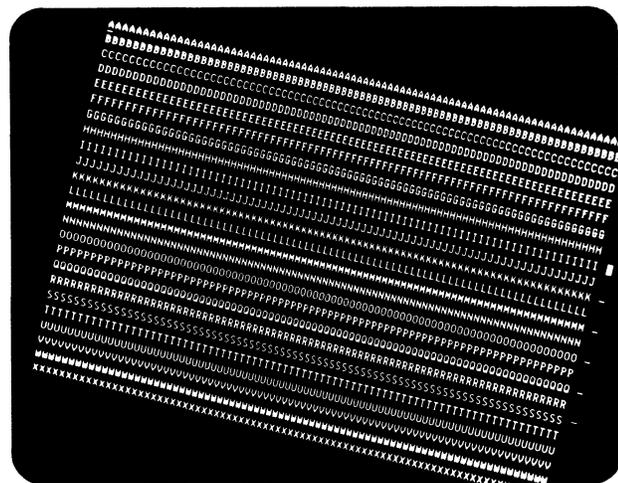
Display not centered (see 155)



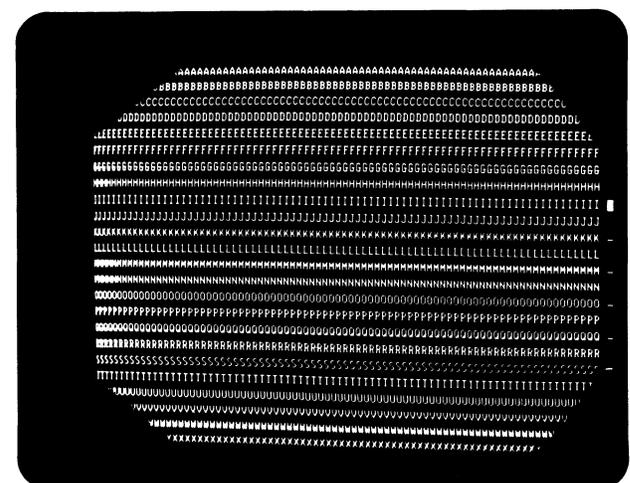
Display size not correct (expanded vertically) (see 154)



Tilted display (see 154)



Characters missing only in the corners (see 154 and 155)



Extended Storage

160 EXTENDED STORAGE MINI-MAP A

- Use this mini-MAP to correct extended storage card and planar problems.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

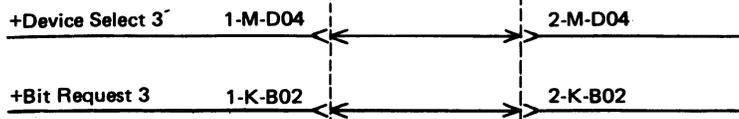
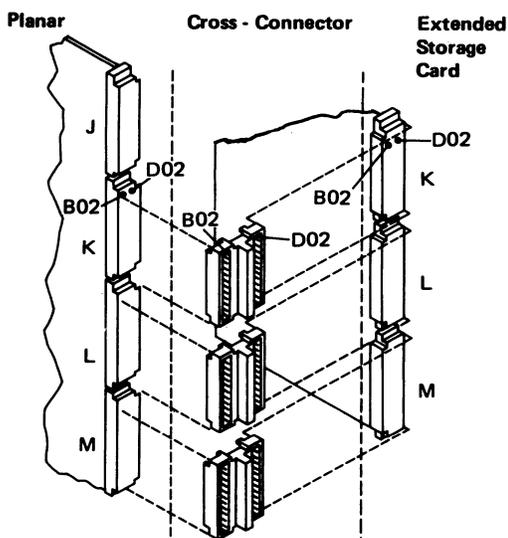
- All of the signal lines are pulsing.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 2-K/L/M-D08



- Power off.
- Switch to Normal mode.
- Power on.
- Probe the failing line at the cross-connector.

Is the line at a Down level?

Y N

Is the line pulsing?

Y N

- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Replace the extended storage card.
- Power off.
- Remove the cross-connector for the Down level line.
- Power on.
- Probe the Down level line at the extended storage card connector.

Is the line at a Down level?

Y N

- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Replace the extended storage card.

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all connector contacts.
- Replacement sequence:
 - Extended storage card.
 - Planar.

161 EXTENDED STORAGE MINI-MAP B

- Use this mini-MAP to correct extended storage card and planar problems.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

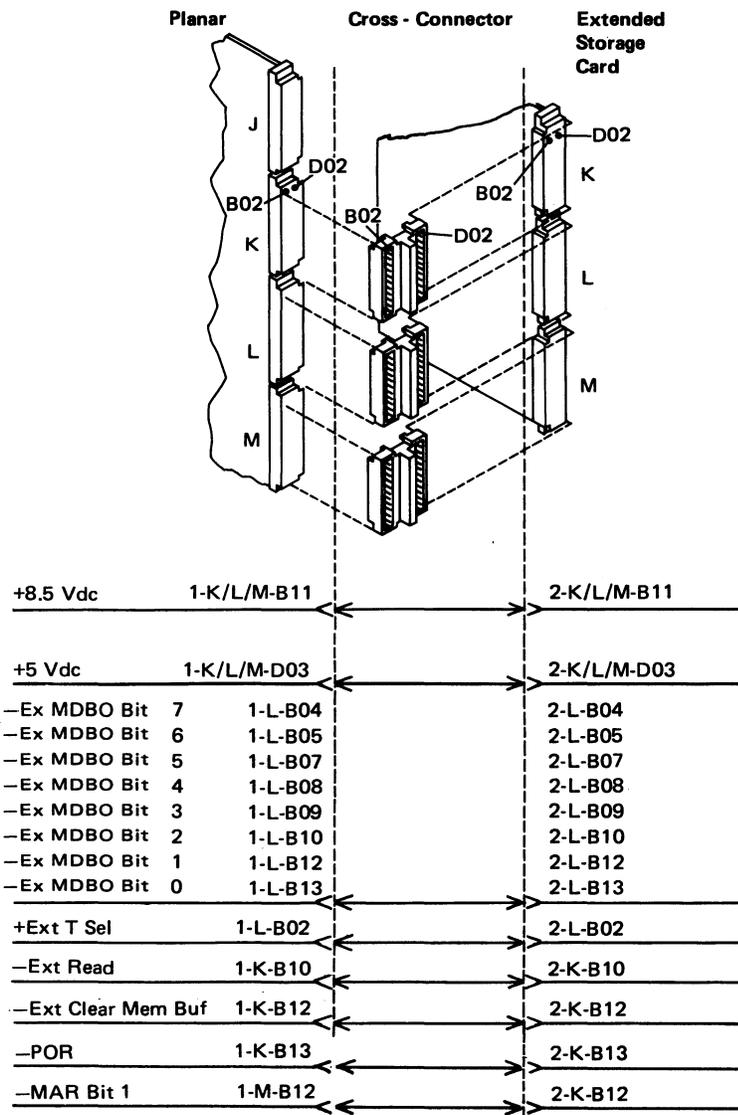
- The voltage lines are active.
- All of the signal lines are Up or pulsing.

Tools

- CE meter
- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 2-K/L/M-D08



- Check the +5 Vdc at the cross-connector on the extended storage card.

Is the voltage correct?

Y N

- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Check the +8.5 Vdc at the cross-connector.

Is the voltage correct?

Y N

- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Power off.
- Remove the K cross-connector.
- Power on.
- Probe 2-K-B11.

Is the line always at an Up level?

Y N

- Replace the extended storage card.

- Power off.
- Replace the K cross-connector.
- Remove the M cross-connector.
- Power on.
- Probe 2-M-B11.

Is the line always at an Up level?

Y N

- Replace the extended storage card.

- Power off.
- Replace the M cross-connector.
- Power on.
- Probe 1-K-B10, 1-K-B12, 1-K-B13, 1-M-B12 and 1-L-B02 on the cross-connector.

A

A

Are both probe lights off for any line?

Y N

Is the Up light off and the Down light on (not pulsing) for any line?

Note: It can take up to 5 seconds for pulsing to start.

Y N

- Probe the MDBO lines on the cross-connector, and write the results on paper.

Is the Up light off and the Down light on or pulsing for any line?

Y N

- Inspect the cross-connector.
- Replace the extended storage card.

- Power off.
- Remove the L cross-connector.
- Power on.
- Probe the line at the planar.

Is the Down light on?

Y N

Is the Up light on?

Y N

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

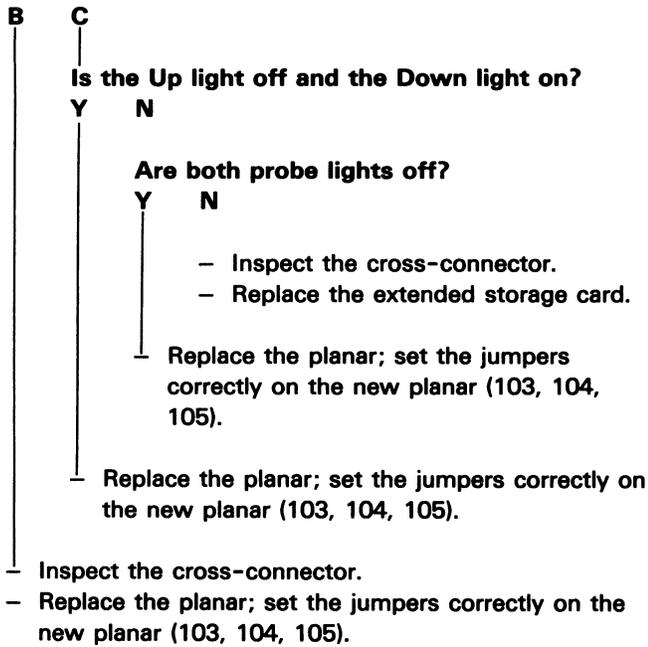
- Inspect the cross-connector.
- Replace the extended storage card.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Power off.
- Remove the cross-connector for that line.
- Power on.
- Probe the line at the planar.

B

C



Suggested action for an intermittent problem:

- Analyze the suspected lines; inspect all connector contacts.
- Replacement sequence:
 - Extended storage card.
 - Planar.

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162 EXTENDED STORAGE MINI-MAP C

- Use this mini-MAP to correct extended storage card and planar problems.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

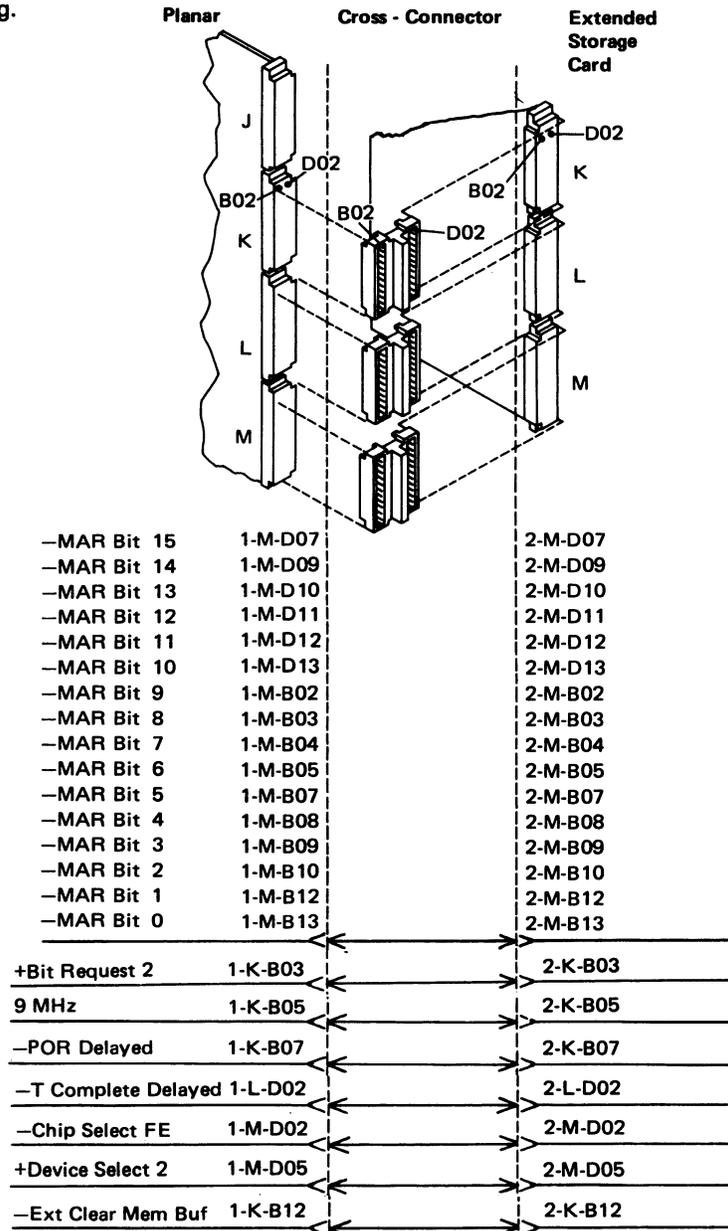
- The '-chip select FE' line is Up.
- The '-POR delayed' line is Up.
- All other lines are pulsing.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 2-K/L/M-D08



162 (continued)

- Power off.
- Switch to Test mode.
- Power on.
- Probe 1-K-B05 and 2-L-D02 on the cross-connector.

Is either line at a Down level?

Y N

- Probe 1-K-B12.

Are both probe lights off?

Y N

- Probe 2-M-D02 on the cross-connector.

Are both probe lights off?

Y N

Is the line at Down level?

Y N

- Probe all of the '-MAR Bit' lines on the cross-connector and write the results on paper.

Is any line at a Down level?

Y N

Are both probe lights off for any line?

Y N

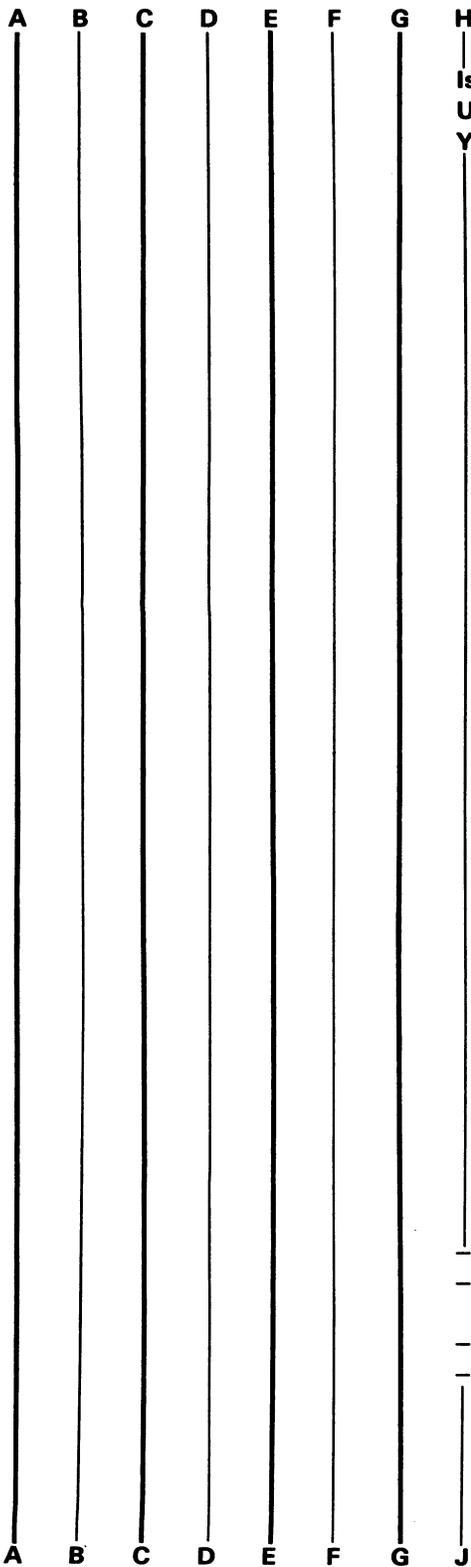
- Probe the '+device select 2' line (2-M-D05) on the cross-connector.

Are both probe lights off?

Y N

- Probe the '+Bit Req 2' line on the cross-connector (1-K-B03).

A B C D E F G H



Is the line at an
Up level?

Y N

- Power off.
- Remove the K cross-connector.
- Power on.
- Probe 2-K-B03 and 2-K-B07 at the extended storage card.

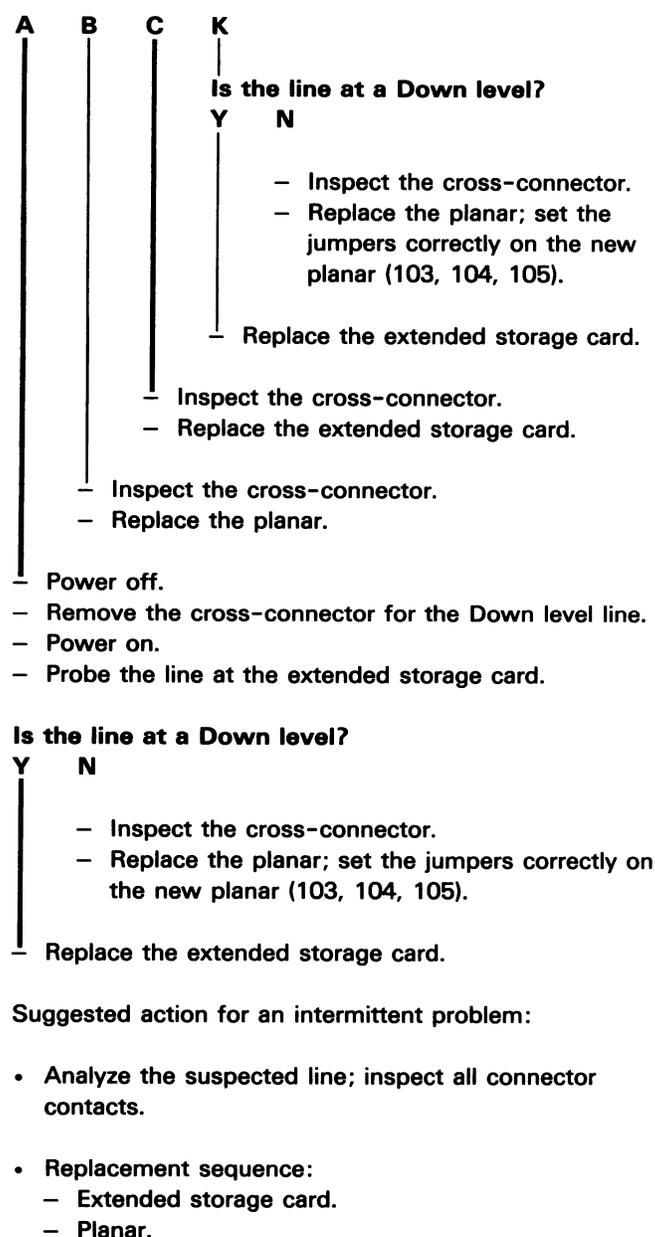
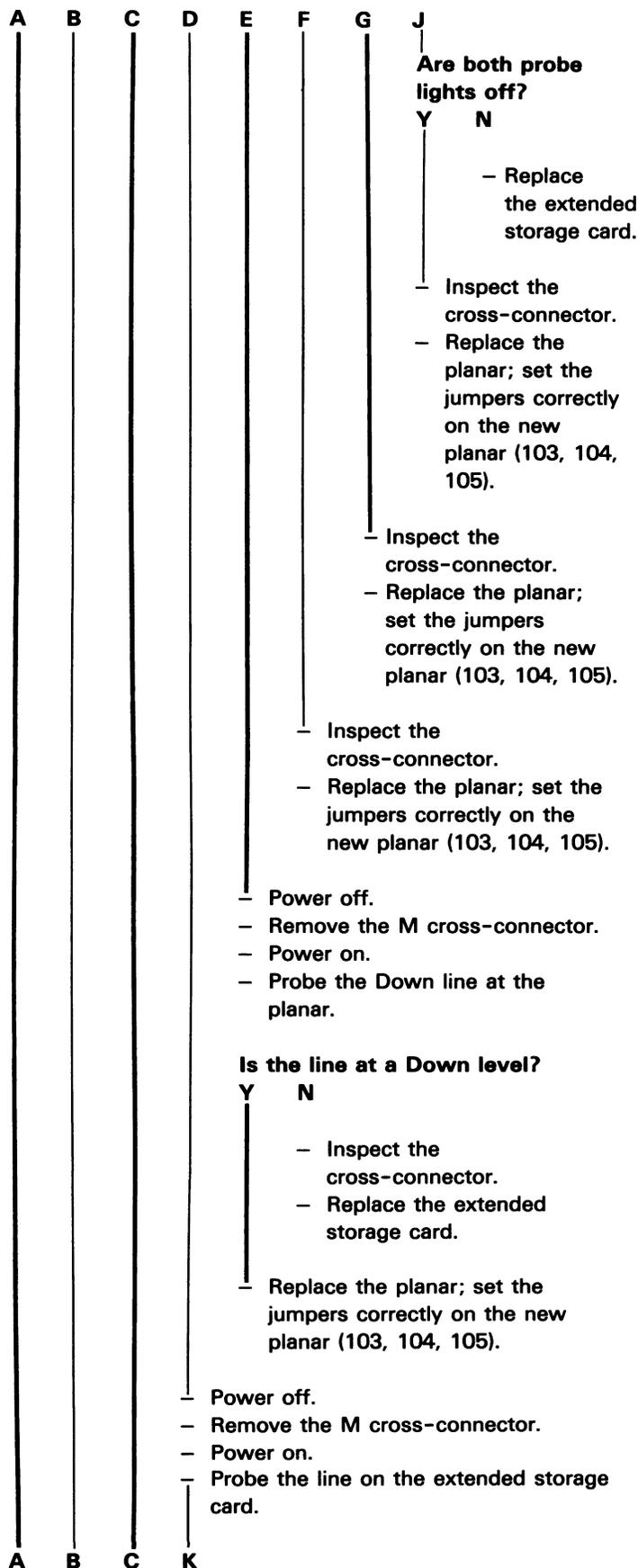
Is either line
at a Down
level?

Y N

- Replace the extended storage card.
- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Replace the extended storage card.

- Power off.
- Remove the M cross-connector.
- Power on.
- Probe the '+device select 2' line (2-M-D05) at the extended storage card.



163 EXTENDED STORAGE MINI-MAP D

- Use this mini-MAP to correct extended storage card and planar problems.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The voltage lines are active.
- The '-external parity error' line is at an Up level.
- The '-POR' line is at an Up level.
- All other lines are pulsing.

Service Aids

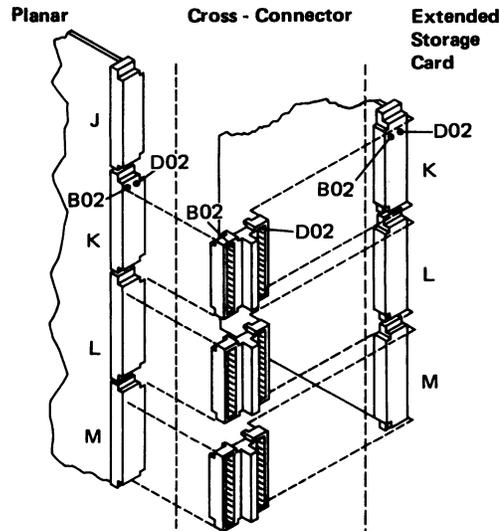
- All lines are signal lines except voltage and ground lines.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 2-K/L/M-D08



-MDBI Parity In Bit	1-L-D04	2-L-D04
-MDBI Bit 7	1-L-D05	2-L-D05
-MDBI Bit 6	1-L-D06	2-L-D06
-MDBI Bit 5	1-L-D07	2-L-D07
-MDBI Bit 4	1-L-D09	2-L-D09
-MDBI Bit 3	1-L-D10	2-L-D10
-MDBI Bit 2	1-L-D11	2-L-D11
-MDBI Bit 1	1-L-D12	2-L-D12
-MDBI Bit 0	1-L-D13	2-L-D13
+Bit Req 1	1-K-B04	2-K-B04
-Ext Parity Error	1-K-B09	2-K-B09
-Ext Read	1-K-B10	2-K-B10
-POR	1-K-B13	2-K-B13
-Memory Req Buf	1-K-D02	2-K-D02
+Dev Sel 1	1-M-D06	2-M-D06
-POR Delayed	1-K-B07	2-K-B07
9 MHz	1-K-B05	2-K-B05
-T Complete Delayed	1-L-D02	2-L-D02

- Probe the signal lines (1-K-B13, 1-K-B07, and 1-K-B05) on the cross-connector.

Are both probe lights off for any line?

Y N

- Power off.
- Switch to Test mode.
- Power on.
- Probe all of the circuit signal lines at each cross-connector and write the results on paper.

Is any line always at a Down level?

Y N

Are both probe lights off for any line?

Y N

- Power off.
- Remove the K cross-connector.
- Power on.
- Probe the MDBI lines.

Is any MDBI line always at an Up level?

Y N

- Power off.
- Replace the K cross-connector.
- Power on.

Note: Check closely; flashing might be dim.

Is the Line Check light on or flashing?

Y N

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Inspect the L cross-connector.
- Replace the extended storage card.

- Inspect the L cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Inspect the cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

A B

A B

Is 2-L-D04, 1-K-B09, or 1-K-B10 always at a Down level?

Y N

- Power off.
- Remove the L cross-connector.
- Power on.
- Probe the line that is always at a Down level at the planar connector.

Is the line always at a Down level?

Y N

- Inspect the cross-connector.
- Replace the extended storage card.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Power off.
- Remove the K cross-connector.
- Power on.
- Probe 1-K-B09, 1-K-B04, 1-K-B05, and 1-K-D02 at the planar connector.

Is any line always at a Down level?

Y N

- Probe 2-L-D02 and 2-L-D04 at the cross-connector.

Is either line always at a Down level?

Y N

- Probe 1-K-B10 at the planar connector.

Is the line always at a Down level?

Y N

Is the Line Check light flashing?

Y N

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Inspect the cross-connector.
- Replace the extended storage card.

A C D E

- A
 - C
 - D
 - E
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
 - Power off.
 - Replace the K cross-connector.
 - Remove the L cross-connector.
 - Power on.
 - Probe 1-L-D02 and 1-L-D04 at the planar.
- Is either line always at a Down level?**
- Y
 - N
- Inspect the cross-connector.
 - Replace the extended storage card.
- Power off.
 - Remove the M cross-connector.
 - Power on.
 - Probe 1-L-D02 and 1-L-D04 at the planar.
- Is either line always at a Down level?**
- Y
 - N
- Inspect the cross-connector.
 - Replace the extended storage card.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).
- Inspect the cross-connector.
 - Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all connector contacts.
- Replacement sequence:
 - Extended storage card.
 - Planar.

164 EXTENDED STORAGE MINI-MAP E

- Use this mini-MAP to correct extended storage and planar problems.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

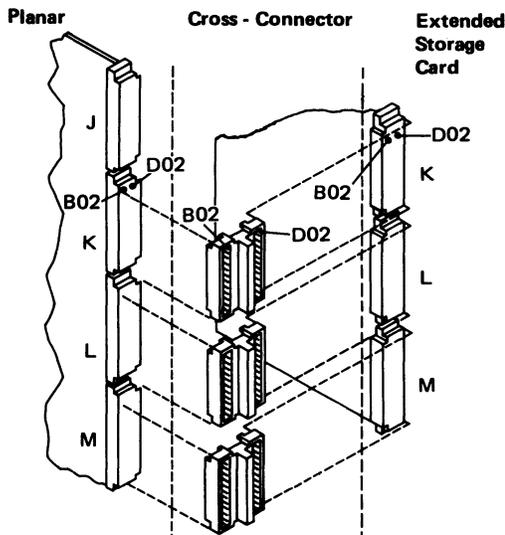
- The '-EOL mode' line is at a Down level.
- The '-EAB MDBO' lines are at an Up level.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +lead-1-D-D03
- -lead-1-D-D08
- Ground 2-K/L/M-D08



-EAB MDBO Bit 7	1-K-D05	2-K-D05
-EAB MDBO Bit 6	1-K-D06	2-K-D06
-EAB MDBO Bit 5	1-K-D07	2-K-D07
-EAB MDBO Bit 4	1-K-D09	2-K-D09
-EAB MDBO Bit 3	1-K-D10	2-K-D10
-EAB MDBO Bit 2	1-K-D11	2-K-D11
-EAB MDBO Bit 1	1-K-D12	2-K-D12
-EAB MDBO Bit 0	1-K-D13	2-K-D13
+EOL Mode	1-K-B08	2-K-B08

- Probe all of the 'EAB MDBO' lines on the cross-connector and write the results on paper.

Is any line at a Down level?

Y N

Are both probe lights off for any line?

Y N

- Probe the 'EOL mode' line (1-K-B08) on the cross-connector.

Are both probe lights off?

Y N

- Inspect the cross-connector.
- Replace the extended storage card.

Inspect the cross-connector.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Inspect the cross-connector.

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Power off.
- Remove the K cross-connector.
- Power on.
- Probe the Down line at the planar.

Is the line at a Down level?

Y N

Are both probe lights off?

Y N

- Inspect the cross-connector.
- Replace the extended storage card.

Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all connector contacts.
- Replacement sequence:
 - Extended storage card.
 - Planar.

Customer System Cable

170 SYSTEM CABLE SIGNAL QUALITY CHECK

The system cable signal quality check is a controller diagnostic procedure. See the controller documents. All display stations will be taken offline. An oscilloscope is needed for the signal quality check. If you are not trained on the controller, call for a system trained service representative.

171 INTERNAL SYSTEM CABLE AND TERMINATOR SWITCH

The internal system cable connects the twinaxial connector at the access panel to the planar board. If the Cable Thru feature is installed, the cable is also connected to the Terminator switch and the Cable Thru connector. If the Cable Thru feature is *not* installed, two planar jumpers are needed (105).

The jumpers on jumper positions 3 and 4 of the main planar board must be *removed* if the Cable Thru feature is installed on the display station.

The Terminator switch (Cable Thru feature) on the access panel has a position 1 and position 2. *Position 1* stops the communications signal and completes the circuit. Position 1 is the required position when the display station is the last display station on the line. All other stations in the series must have the Terminator switch in position 2.

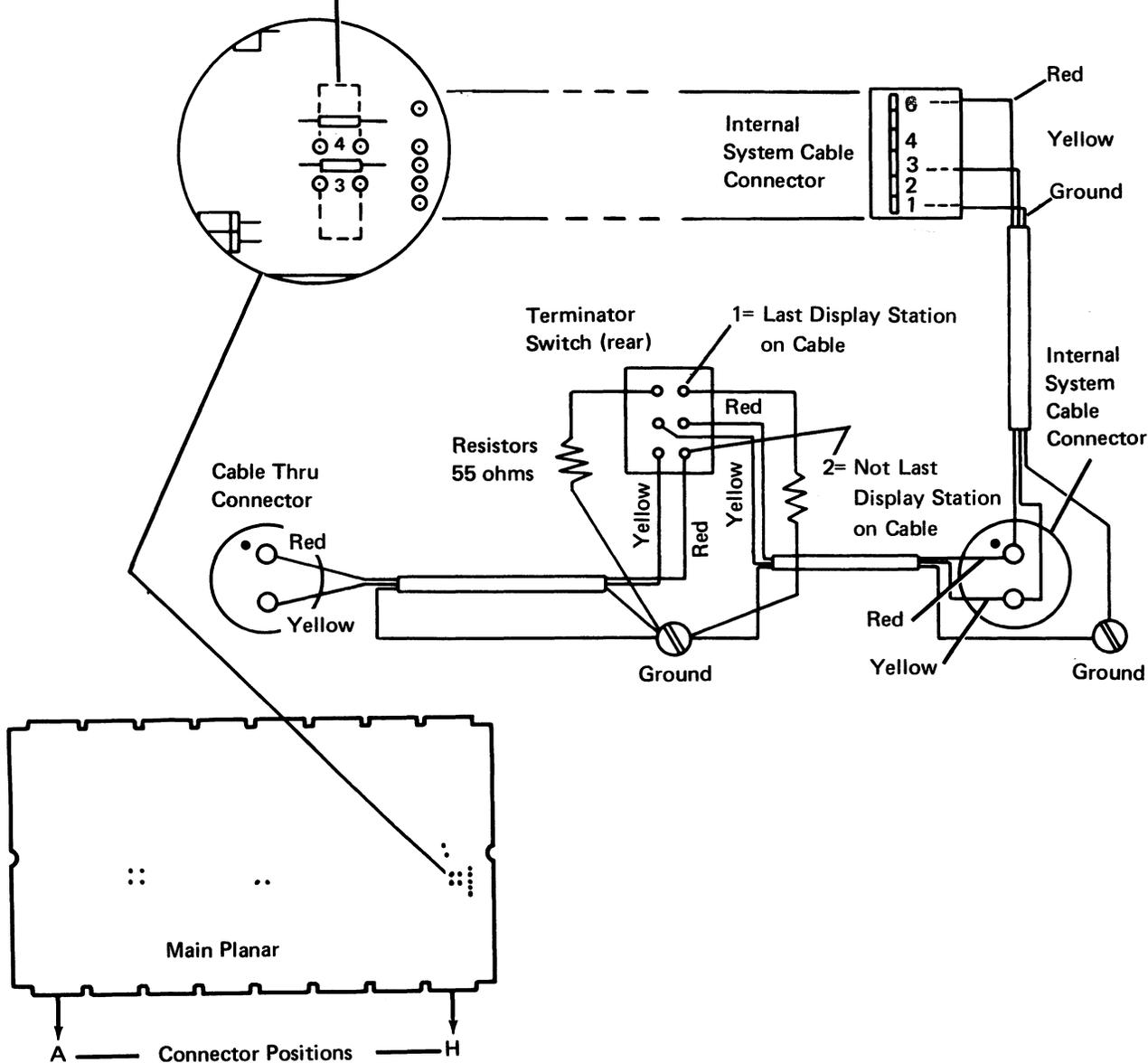
Position 2 allows the communications signal to flow through the display station to the next display station.

Note: Do not leave the system cable disconnected when servicing the display station that has the Cable Thru feature. Other devices are taken offline when this cable is disconnected. The display assembly must be removed (151) to service the Terminator switch.

Internal System Cable and Terminator Switch

Jumpers (part 1794401)

Installed (both jumpers) when the Cable Thru feature is NOT installed



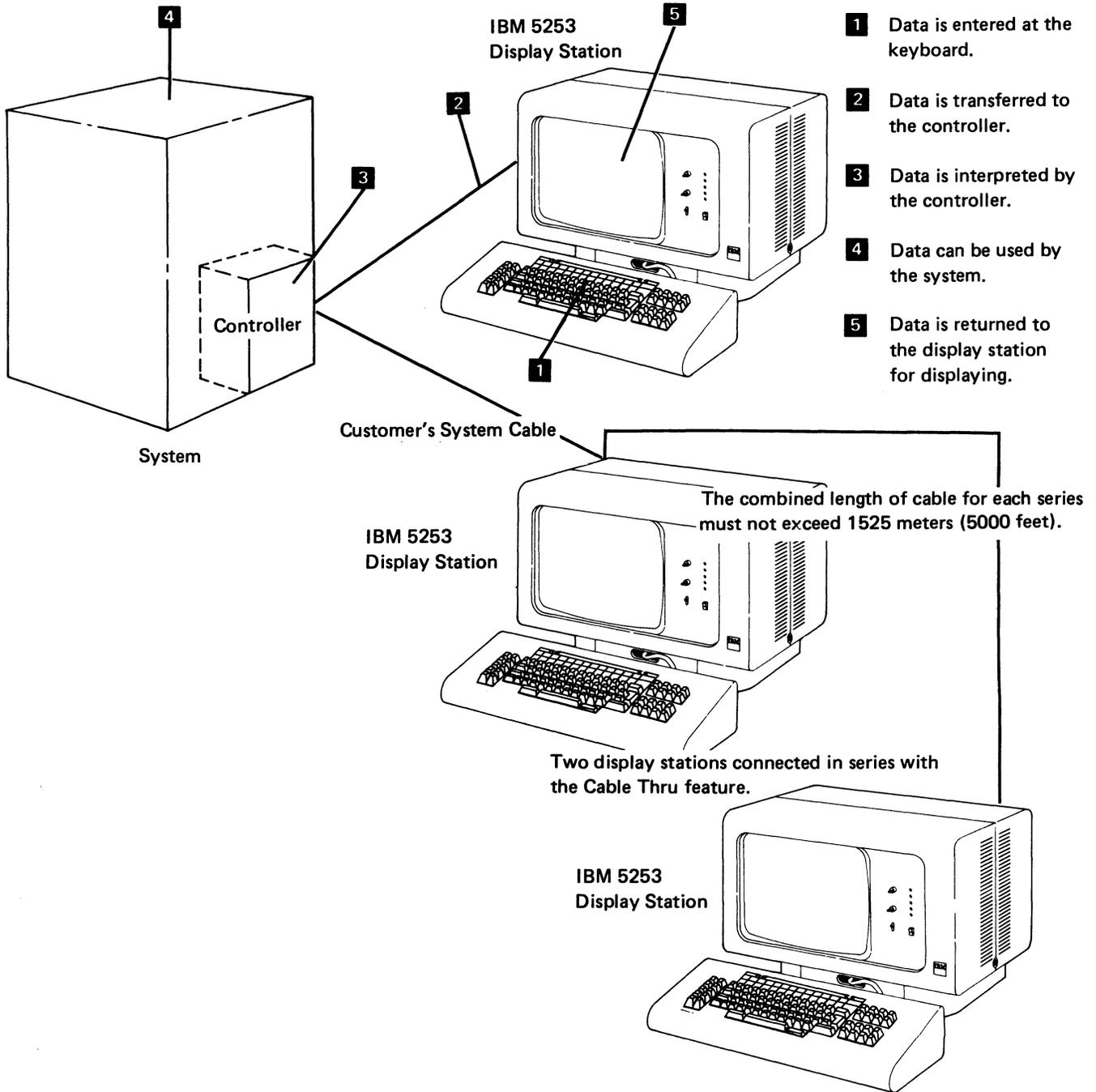
Note: In some cables, the red wire is replaced with a white and red wire and the yellow wire is replaced with a white and black wire.

172 TYPICAL DISPLAY STATION CONFIGURATION

The following figure shows 5253 Display Stations attached to a controller at a system location. Display stations can be attached in a point-to-point configuration, or they can be attached in a series configuration by means of a Cable Thru feature on each display station in the configuration except the last display station.

Data Flow

- 1** Data is entered at the keyboard.
- 2** Data is transferred to the controller.
- 3** Data is interpreted by the controller.
- 4** Data can be used by the system.
- 5** Data is returned to the display station for displaying.



173 STATION PROTECTOR

See the *IBM 5520 Administrative System Installation Manual—Physical Planning, GA23-1002* for detailed information.

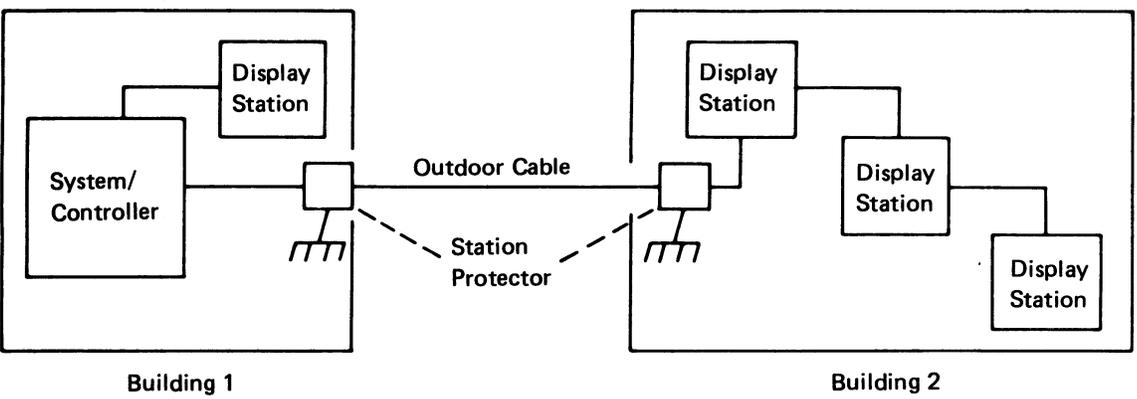
The station protector is owned and maintained by the customer. No more than two station protectors should be connected to one port.

DANGER
Never handle cables or connectors during an electrical storm.

Service Hint

If you have difficulty when isolating the failure to the station protector, you can temporarily bypass the station protector by using adapter part 7362230 or equivalent. Disconnecting the cables from the station protector will disconnect the display stations from the system.

Typical Installation



174 CABLE ASSEMBLY PROCEDURES

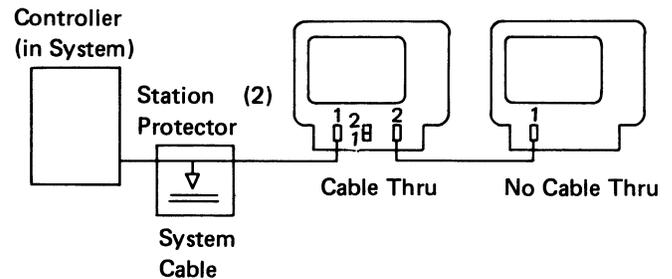
Assembling and maintaining the customer system cable should be done by the customer. However, if aid is requested, use the procedures in the *IBM 5250 Information Display System Planning and Site Preparation Guide*, GA21-9337 to assemble the cables.

175 SYSTEM NETWORK MINI-MAP

- Use this mini-MAP to isolate system cable problems with the system.

Service Aids

- The system might not be configured for this station.
- The system cable might be grounded, open, or the connector not installed correctly.
- The Terminator switch might be set to 1 on a work station between this station and the controller.
- Remember that a station protector, if installed, might be failing. Station protectors are a customer responsibility (173).



175 (continued)

- Power off.
- Switch to the Normal mode.
- Power on; wait 15 seconds.

Does the address configured for this station agree with the actual switch setting?

Y N

- Verify the correct address.
- Set the address switches.

Is the system cable connected?

Y N

- Connect the system cable.

Is the internal system cable connected?

Y N

- Connect the internal system cable.

- Disconnect the internal system cable.
- Check the internal system cable for grounds, opens, and shorts.

Is the internal system cable OK?

Y N

- Repair or replace the internal system cable.

- Connect the internal system cable.
- Check that the system or controller is powered on and polling this station. (No messages pending for this station on the console.)

Is the controller polling?

Y N

- This display station is operating correctly for the symptoms described.

- Check that the Terminator switch is set correctly. (See third item of the *Service Aids*.) If no station is between this work station and the controller or if the Terminator switch is set correctly, check the system cable by one of the following methods:
 - Optional resistance check.
 - Customer system cable signal quality check (170).

Is the network OK?

Y N

- Tell the customer of the system cable problem.

- Replace the planar (105).

Optional Resistance Check

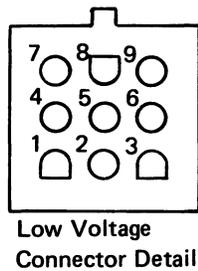
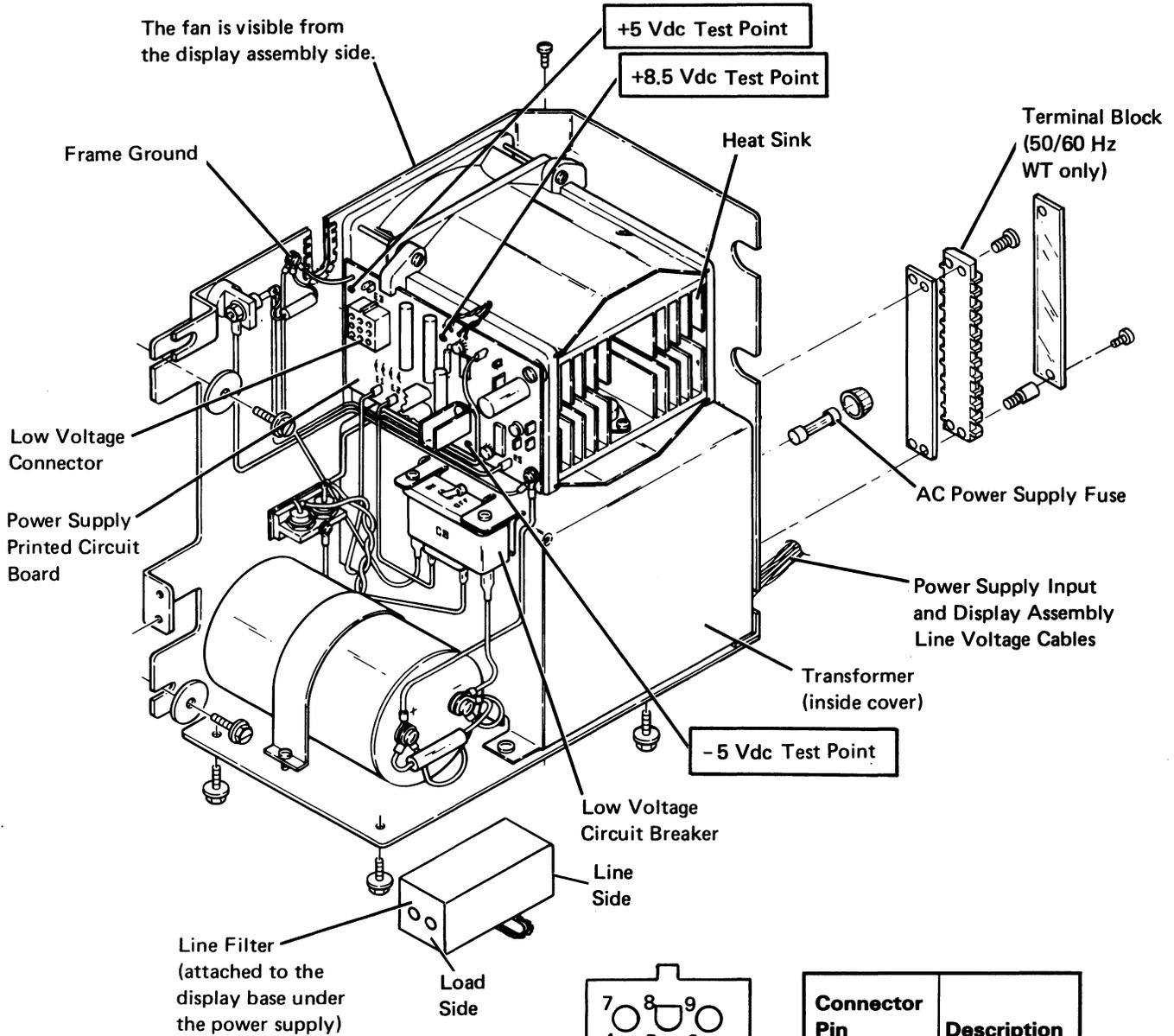
- Ensure that the power is off at the controller.
- Ensure that all stations on this system cable between this station and the controller have their Terminator switches set to 2.
- Disconnect the system cable at the display station.
- Temporarily bypass the station protector (see *Service Hint* in 173).
- Measure the resistance at the end of the cable.

The resistance from a signal wire to the shield should be about 55 to 130 ohms (55 + 5 ohms per 100 meters of cable or 55 + 15 ohms per 1000 feet of cable).

The resistance between signal wires should be about 110 to 210 ohms (110 + 7 ohms per 100 meters of cable or 110 + 20 ohms per 1000 feet of cable).

Power Supply

180 POWER SUPPLY LOCATIONS



Connector Pin	Description
2	-5 Vdc
3,5,6	+5 Vdc
1,4,7,8	Ground
9	+8.5 Vdc

181 POWER SUPPLY REMOVAL AND REPLACEMENT

Removal

1. Power off.
2. Disconnect the line cord from the wall outlet.
3. Open the front and rear covers.
4. Disconnect the low voltage connector from the power supply PC board (180), and remove the cable from the clamp.
5. Disconnect the display AC power cable (150).
6. Remove the ground wire from the rear of the power supply to the base.
7. Remove the power switch bracket (two screws) and the rear cover strain relief cable from the power supply.

CAUTION

Place the display station away from the edge of the table to prevent it from falling, and do not tip the machine on its back or side when removing the power supply.

8. Remove the three power supply mounting screws from the bottom.
9. Loosen the two side mounting screws and remove the rear mounting screw from the base.
10. Slide the power supply to the rear. Lift the power supply from the base and lay it flat on its side.
11. Remove the line filter cover and the two wires connected to the load side of the line filter. Place the used power supply in the shipping container.

Replacement

1. Install the new power supply by connecting the two wires with lugs to the load side of the line filter. Lift the power supply onto the base and slide it forward to engage the two side mounting screws.
2. Fasten the power supply with the mounting screws.
3. Reconnect the power switch bracket.
4. Reconnect the cables.
5. Install the ground wire from the base to the rear of the power supply.
6. Align the Power switch with the hole in the front bezel.

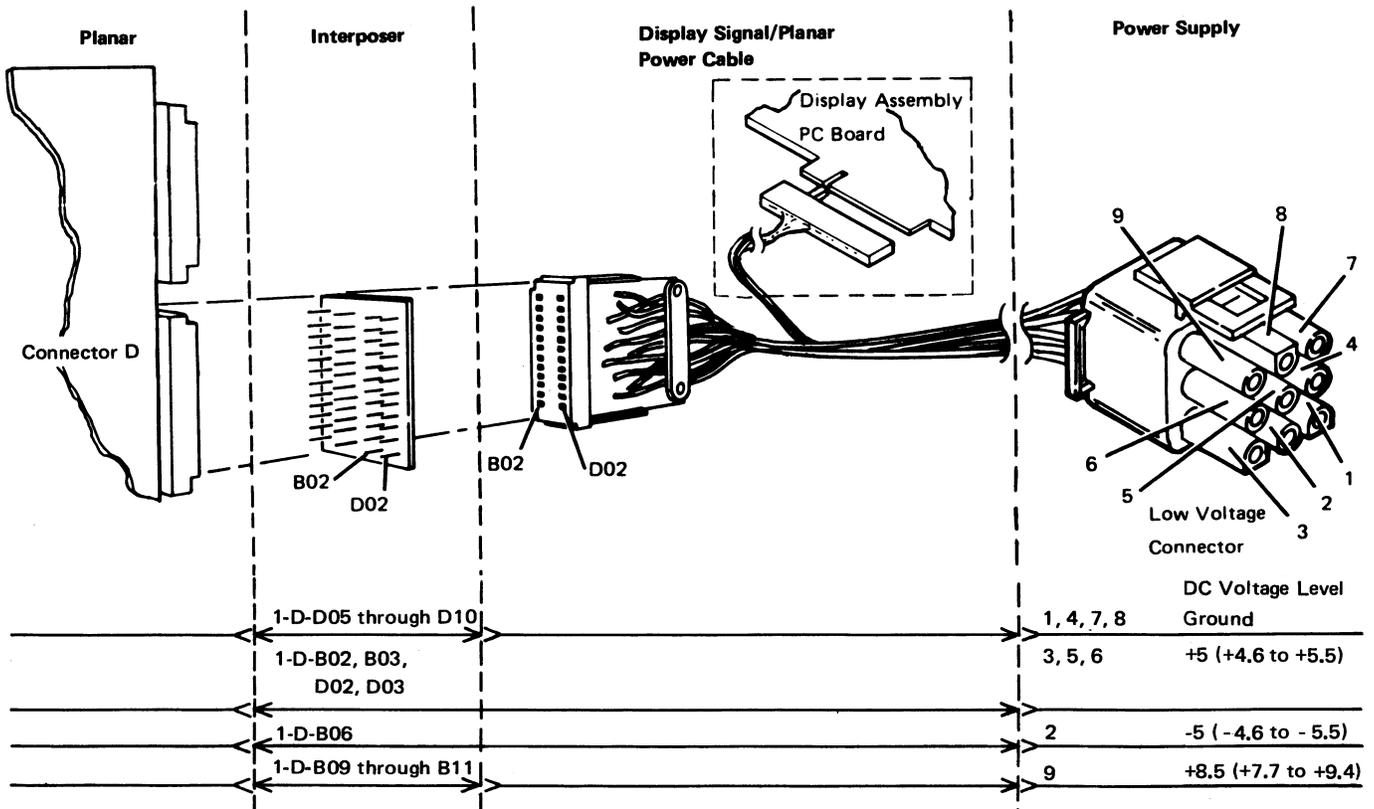
182 VOLTAGE LEVEL CHECKS

DANGER

Line voltage is present at the power supply.

Voltage levels can be checked as follows on the power cable to the main planar or at the power supply.

- The power supply provides power to the planar through the low voltage connector and connector D on the planar.
- The planar provides signals to the display assembly. (The display assembly has its own power supply.)



183 POWER SUPPLY RIPPLE LEVEL CHECK

The peak-to-peak output ripple level should be less than 4% of the respective DC voltages when measured with an oscilloscope.

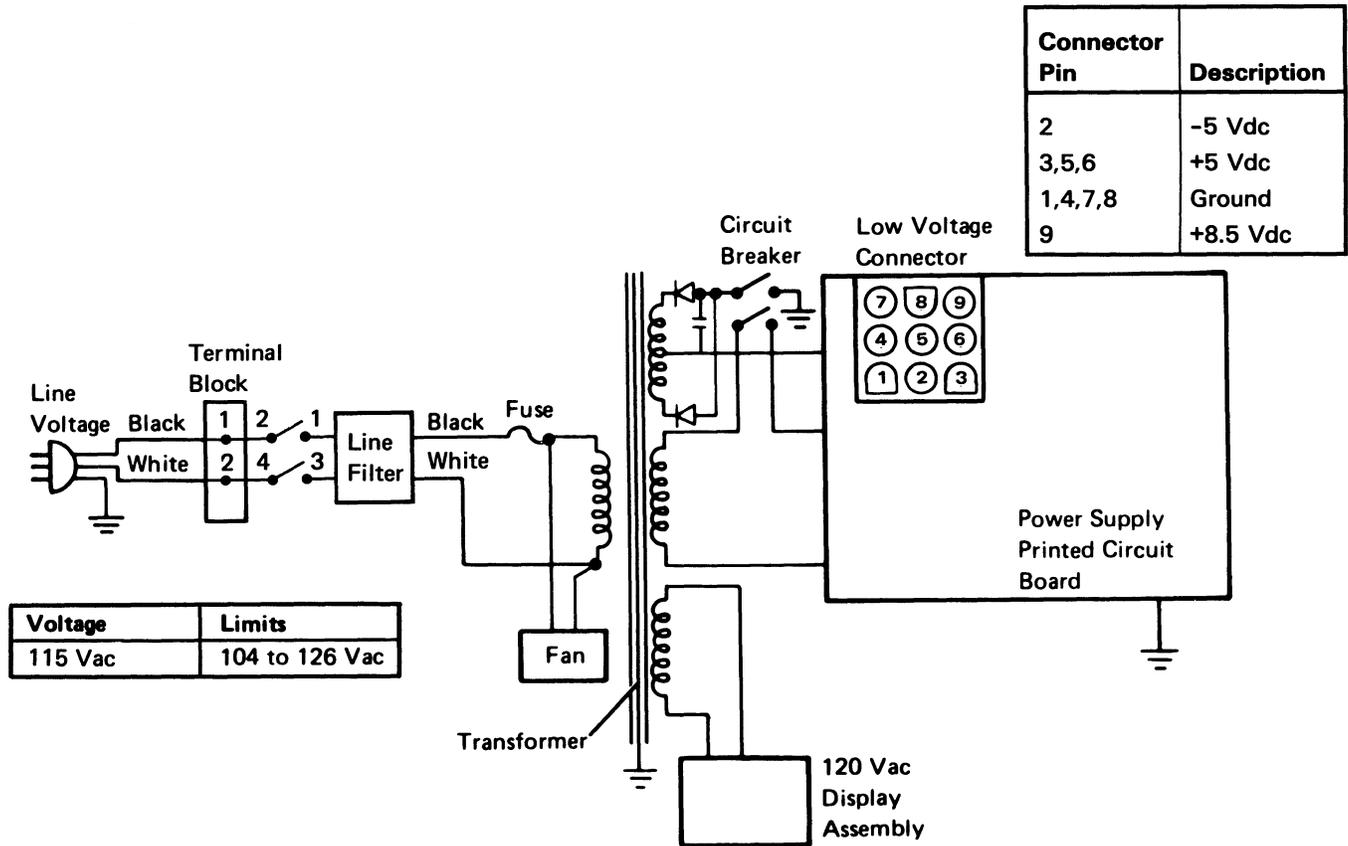
When an oscilloscope is not available, ripple voltage can be observed by using the multimeter with the dB adapter as follows:

1. Set the dB adapter to Bridge mode.
2. Set the Range switch to 0 dB.
3. Connect one of the dB adapter leads to frame ground and the other lead to the DC voltage in question.
4. Change the setting on the Range switch until the meter needle is as close as possible to the medium range.
5. Use the following table to determine if you have an acceptable ripple level:

Power Supply Voltage	Acceptable Ripple Level
± 5 Vdc	-21 dB to -60 dB
+8.5 Vdc	-17 dB to -60 dB

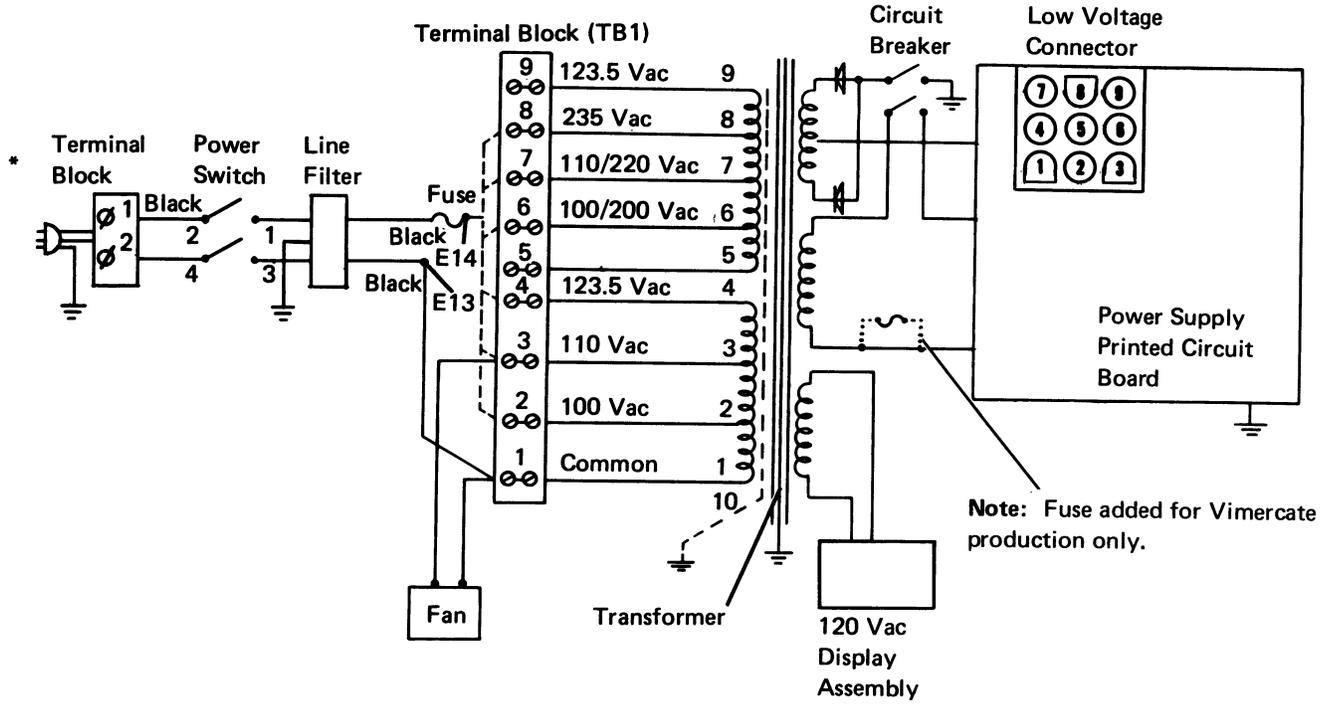
184 POWER SUPPLY CHARTS

115 Volt Power Supply (US)



Power Supplies (World Trade 50/60 Hz)

Connector Pin	Description
2	-5 Vdc
3,5,6	+5 Vdc
1,4,7,8	Ground
9	+8.5 Vdc



World Trade Transformer Primary Connections for Terminal Block

Line Voltage	Voltage Limits	E13 to	E14 to	Transformer Connections to TB
100 Vac	90 to 110 Vac	TB1-1	TB1-2	1 and 5 to TB1-1 2 and 6 to TB1-2
110 Vac	99 to 121 Vac	TB1-1	TB1-3	1 and 5 to TB1-1 3 and 7 to TB1-3
123.5 Vac	112 to 135 Vac	TB1-1	TB1-4	1 and 5 to TB1-1 4 and 9 to TB1-4
200 Vac	180 to 220 Vac	TB1-1	TB1-6	2 and 5 to TB1-2
220 Vac	198 to 242 Vac	TB1-1	TB1-7	3 and 5 to TB1-3
235 Vac	212 to 258 Vac	TB1-1	TB1-8	4 and 5 to TB1-4

185 LINE CORD/LINE FILTER REMOVAL AND REPLACEMENT

Line Cord Removal and Replacement

1. Power off.
2. Disconnect the line cord from the wall outlet.
3. Disconnect the line cord from the terminal block under the planar and disconnect the clamp from the base.
4. To replace the line cord, reverse this procedure.

Line Filter Removal and Replacement

1. Power off and disconnect the line cord from the wall outlet.
2. Remove the power supply (181).
3. Replace the line filter as shown (180).
4. Replace the power supply.

187 POWER SUPPLY FAN REMOVAL AND REPLACEMENT

Removal

1. Power off and disconnect the line cord from the wall outlet.
2. Open the front and rear covers.
3. Remove the fan assembly from the power supply.
4. Remove the two wires that connect the fan to the power supply.
5. Lift the heat sink assembly and the fan assembly from the power supply.
6. Remove the fan assembly from the heat sink assembly.

Replacement

DANGER

A safety hazard exists if the fan housing and the power supply are not at the same potential. If the fan assembly is not installed by self-tapping screws and the fan housing is metal that has been painted, then a star washer must be installed between the fan housing and the power supply.

To replace the fan assembly, reverse this procedure.

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188 POWER ISOLATION MINI-MAP

- Use this mini-MAP to isolate power and planar problems in the display station.

Service Aids

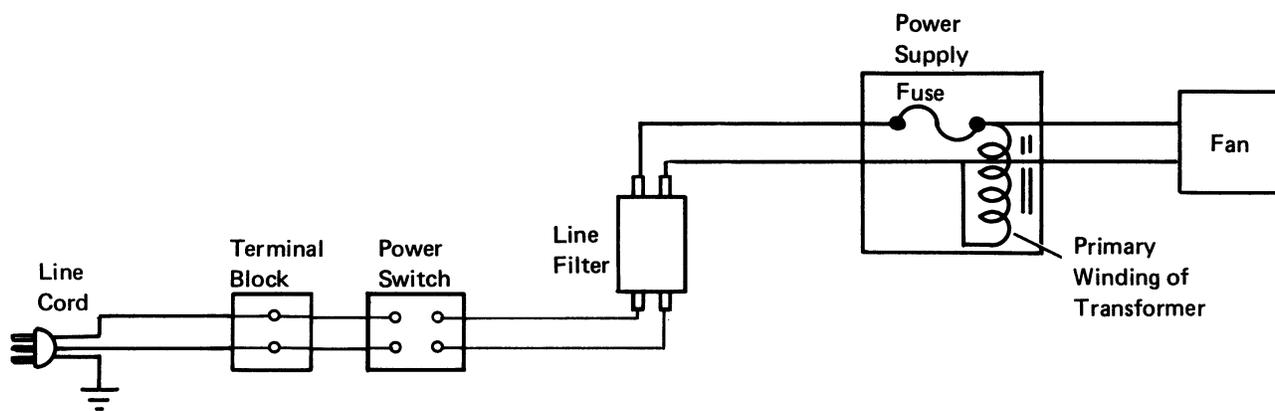
- Power off when disconnecting cables or checking fuses.

DANGER

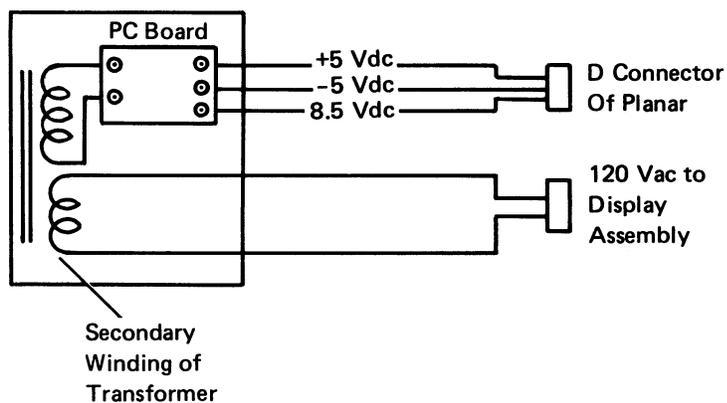
Line voltage is present at the power supply and AC cables.



AC Distribution



AC/DC Distribution



}	1-D	D03	+5 Vdc
		D02	
		B03	
		B02	
}	1-D	B06	-5 Vdc
	1-D	B09	+8.5 Vdc
		B10	

AC DISTRIBUTION CHECK FOLLOWS

Is the fan running?

Y N

Is the line cord plugged in?

Y N

- Plug in the line cord.

- Power off.

- Check the AC power supply fuse.

Is the AC power supply fuse OK?

Y N

- Replace the fuse with one of the proper size and rating.
- If the fuse opens again, replace the power supply.

- Power on.

- Measure the AC voltage at the line filter side (bottom terminals) of the Power switch.

Is the voltage inside the limits (184)?

Y N

- Measure the AC voltage at the terminal block.

Is the voltage inside the limits (184)?

Y N

- Ensure that the voltage at the wall outlet is OK.

Is the voltage OK (184)?

Y N

- Tell the customer of the wall outlet problem.

- Repair or replace the line cord (185).

- Disconnect the line cord from the wall outlet.

- Replace the Power switch.

- Check the line filter.

- Replace the power supply or fan (181, 187).

A

A

DC DISTRIBUTION CHECK FOLLOWS

Is the low voltage circuit breaker on?

Y N

- Ensure that the mounting screws on the PC card are tight.
- Set the low voltage circuit breaker.
- If the circuit breaker trips, disconnect:
 1. The AC power connector to the display.
 2. The low voltage cable at the power supply.
- Set the circuit breaker.

Does the circuit breaker trip?

Y N

- Power off.
- Disconnect all cables at the planar.
- Connect the low voltage cable at the power supply.
- Connect one cable at a time until the circuit breaker trips.

- Power off and disconnect the line cord from the wall outlet.

- Replace the power supply (181).

- Check the DC voltages at the power supply test points (180) and at connector D of the planar (182).

Voltage	Range	Location
+5.0 Vdc	4.6 to 5.5	1-D-B02, B03, D02, D03
-5.0 Vdc	-4.6 to -5.5	1-D-B06
+8.5 Vdc	7.8 to 9.3	1-D-B09, B10, B11

Are the voltages inside the limits?

Y N

- Repair or replace the power cable.
- Replace the power supply (181).

Are all the LEDs on?

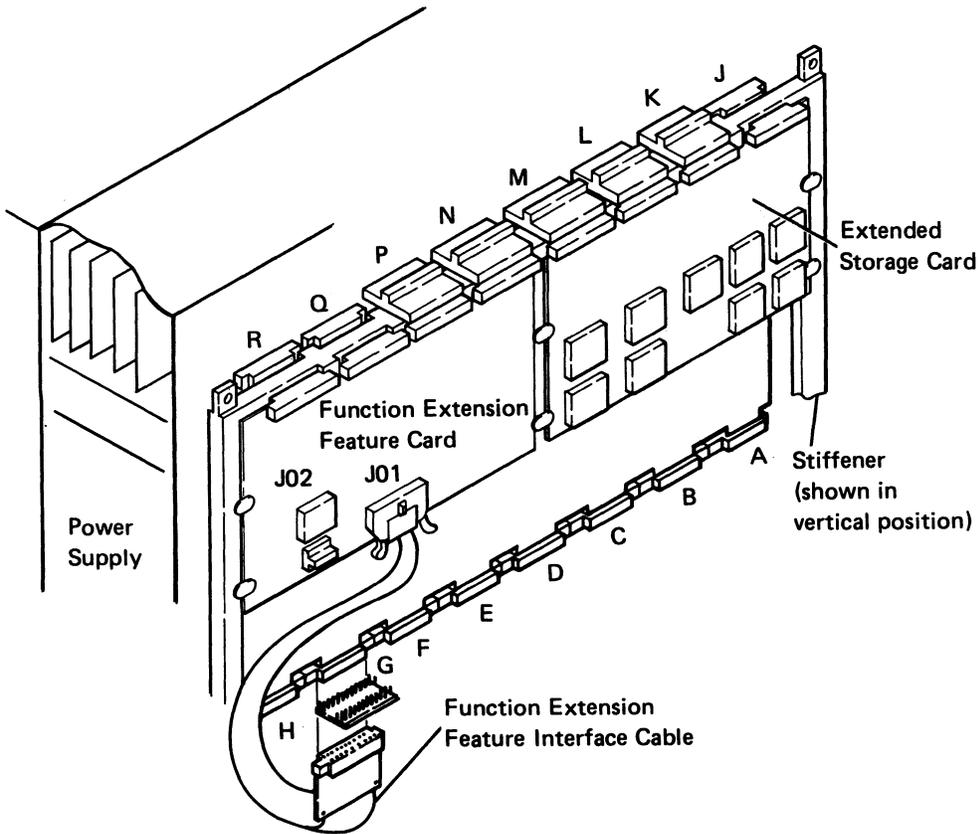
Y N

- Replace the power supply (181).

- Use mini-MAP 111, and the Ready light to locate the problems.

Function Extension Feature

191 FUNCTION EXTENSION FEATURE CARD LOCATION



192 FUNCTION EXTENSION FEATURE MINI-MAP A

Use this mini-MAP to correct function extension feature card problems.

- For a mini-MAP example, see *Troubleshooting Aids* (212).
- The failure that sent you to this mini-MAP could be caused by an incorrect or missing voltage. To check the voltage, use MIM 195.
- For intermittent problems, see the suggested action at the end of the MAP.

Conditions after Power-On

The following lines are pulsing:

- +Set Buf
- -IAR Bit 7

The following lines are at a Down level:

- -Reg 13 Bit 0
- -Reg 13 Bit 3
- -Reg 13 Bit 7
- -Reg 5 Bit 5
- -Reg 5 Bit 6

The following lines are at an Up level:

- -Reg 13 Bit 1
- -Reg 13 Bit 2
- -Reg 13 Bit 4
- -Reg 13 Bit 5
- -Reg 13 Bit 6
- -Reg 5 Bit 0
- -Reg 5 Bit 1
- -Reg 5 Bit 2

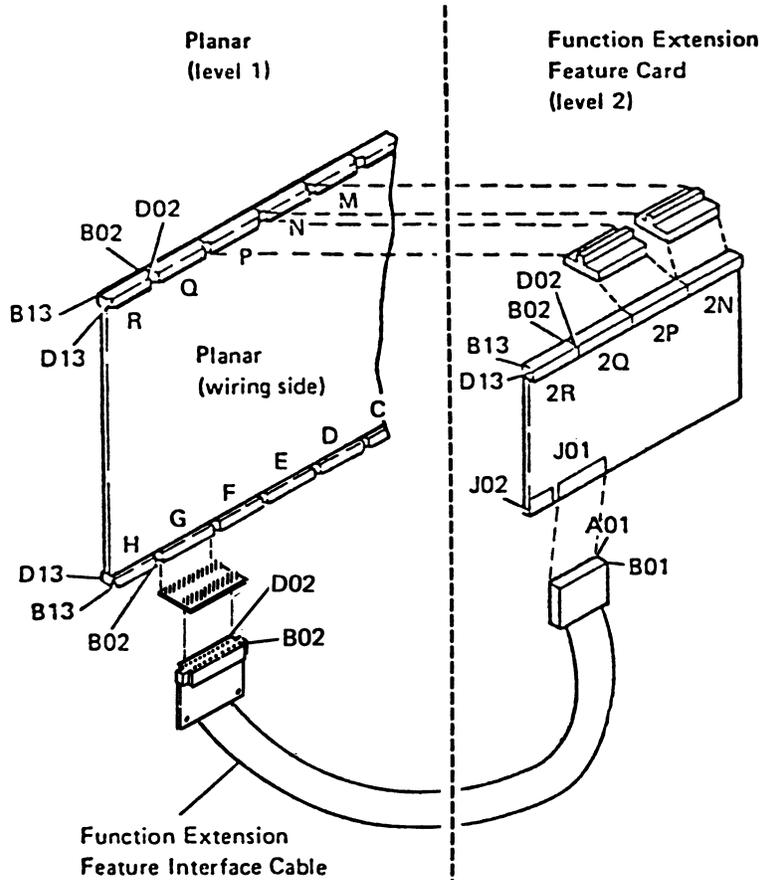
- -Reg 5 Bit 3
- -Reg 5 Bit 4
- -Reg 5 Bit 7

Tools

- CE probe (213)

Connect the CE probe as follows:

- +1-D-D03
- -1-D-D08
- Ground 2-N/P-D08



+Set Buf----->	1-P-D11 >-----	----->	2-P-D11 >----
-Reg 13 Bit 0--->	1-G-D04 >-----	----->	J01-A03 >----
-Reg 13 Bit 1--->	1-G-D05 >-----	----->	J01-A04 >----
-Reg 13 Bit 2--->	1-G-D07 >-----	----->	J01-A06 >----
-Reg 13 Bit 4--->	1-G-D09 >-----	----->	J01-A08 >----
-Reg 13 Bit 5--->	1-G-D10 >-----	----->	J01-A09 >----
-Reg 13 Bit 3--->	1-G-D11 >-----	----->	J01-A10 >----
-Reg 13 Bit 6--->	1-G-D12 >-----	----->	J01-A11 >----
-Reg 13 Bit 7--->	1-G-D13 >-----	----->	J01-A12 >----
-Reg 5 Bit 1---->	1-G-B03 >-----	----->	J01-B02 >----
-Reg 5 Bit 0---->	1-G-B05 >-----	----->	J01-B04 >----
-Reg 5 Bit 2---->	1-G-B07 >-----	----->	J01-B06 >----
-Reg 5 Bit 5---->	1-G-B08 >-----	----->	J01-B07 >----
-Reg 5 Bit 3---->	1-G-B09 >-----	----->	J01-B08 >----
-Reg 5 Bit 4---->	1-G-B10 >-----	----->	J01-B09 >----
-Reg 5 Bit 6---->	1-G-B12 >-----	----->	J01-B11 >----
-Reg 5 Bit 7---->	1-G-B13 >-----	----->	J01-B12 >----
-IAR Bit 7----->	1-P-D05 >-----	----->	2-P-D05 >----

192 (continued)

(Entry Point A)

- Power off.
- Reconnect the N and P cross-connectors.
- Reconnect the feature interface cable at planar socket location G and at J01 on the feature card.
- Power on.
- Probe the '+Set Buf' line (1-P-D11) at the cross-connector.

Are both probe lights off?

Y N

002

- Power off.
- Remove the N and P cross-connectors.
- Disconnect the feature interface cable at J01 on the feature card (191).
- Power on.

Does the basic machine operate correctly?

Y N

003

- Replace the feature interface cable (197).

004

- Inspect the N and P cross-connectors.
- Replace the feature card (196).

005

- Inspect the P cross-connector.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

The following are the correct operations of a basic machine: the Line Sync and Ready LEDs are on, System Available is on, cursor in position E (210) or menu is displayed and keyboard characters are displayed correctly as G, O, L, and M keys are pressed.

192 (continued)

(Entry Point B)

- Power off.
- Ensure that the N and P cross-connectors are seated properly.
- Ensure that the feature interface cable is seated properly at planar socket location G and at JO1 on the feature card.
- Power on.
- Probe all of the '-Reg 13 Bit' and all of the '-Reg 5 Bit' lines on the interposer at planar location G.

Are both probe lights off for any line?

Y N

- Probe the '-IAR Bit 7' line (1-P-D05) at the cross-connector.

Are both probe lights off?

Y N

- Inspect the P cross-connector.
 - Replace the feature card (196).
 - Replace the feature interface cable (197).
-
- Inspect the P cross-connector.
 - Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Inspect all connector contacts.
- Replacement sequence:
 - Feature card (196).
 - Planar (103, 104, 105).
 - Feature interface cable (197).

193 FUNCTION EXTENSION FEATURE MINI-MAP B

Use this mini-MAP to correct function extension feature card problems.

- For a mini-MAP example, see *Troubleshooting Aids* (212).
- If you suspect missing or incorrect voltage levels, use MIM 195.
- For intermittent problems, see the suggested action at the end of the MAP.

Conditions after Power-On

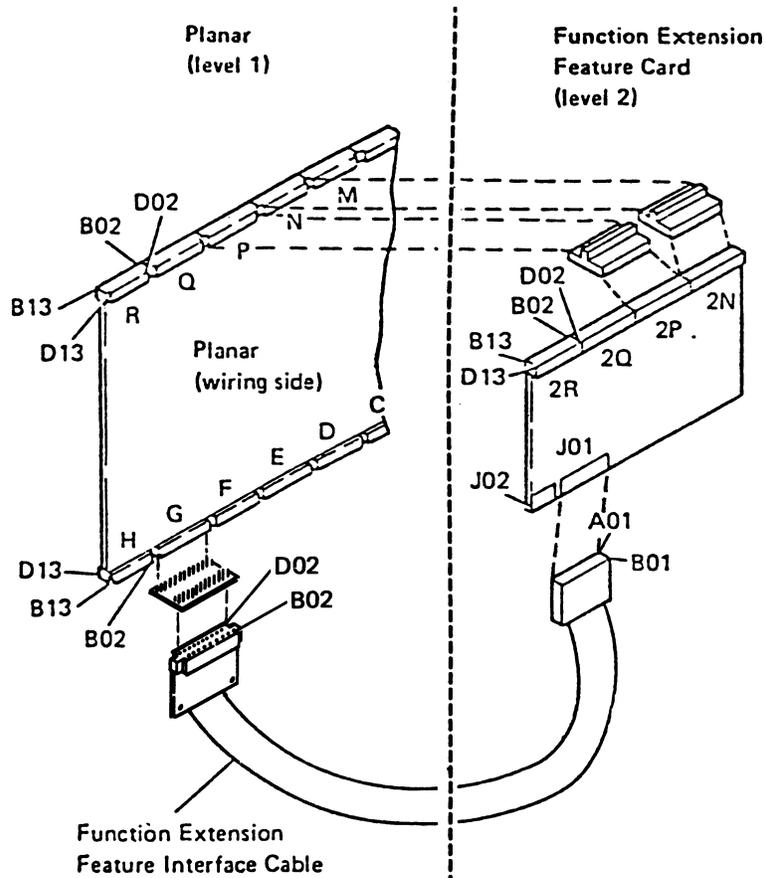
- The '-IAR Bit 2' line is at an Up level.
- All other signal lines are pulsing.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +1-D-D03
- -1-D-D08
- Ground 2-N/P-D08



-ROS Bit 10	----->	1-N-B03	>-----	----->	2-N-B03	>-----
-ROS Bit 7	----->	1-N-B04	>-----	----->	2-N-B04	>-----
-ROS Bit 4	----->	1-N-B05	>-----	----->	2-N-B05	>-----
-ROS Bit 2	----->	1-N-B08	>-----	----->	2-N-B08	>-----
-ROS Bit 0	----->	1-N-B09	>-----	----->	2-N-B09	>-----
-IAR Bit 12	----->	1-N-B13	>-----	----->	2-N-B13	>-----
-ROS Bit 12	----->	1-N-D02	>-----	----->	2-N-D02	>-----
-ROS Bit 8	----->	1-N-D04	>-----	----->	2-N-D04	>-----
-ROS Bit 5	----->	1-N-D09	>-----	----->	2-N-D09	>-----
-ROS Bit 3	----->	1-N-D10	>-----	----->	2-N-D10	>-----
-ROS Bit 11	----->	1-N-D13	>-----	----->	2-N-D13	>-----
-IAR Bit 2	----->	1-P-B07	>-----	----->	2-P-B07	>-----
-IAR Bit 14	----->	1-P-B08	>-----	----->	2-P-B08	>-----
-ROS Bit 13	----->	1-P-B13	>-----	----->	2-P-B13	>-----
-IAR Bit 13	----->	1-P-D10	>-----	----->	2-P-D10	>-----
2.25 MHz (VMP)	----->	1-P-D12	>-----	----->	2-P-D12	>-----

193 (continued)

- Power off.
- Ensure that the N and P cross-connectors are seated properly.
- Ensure that the feature interface cable is seated properly at planar socket location G and at J01 on the feature card.
- Power on.
- Probe all of the signal lines on the cross-connectors at planar locations N and P.

Are both probe lights off for any line?

Y N

- Inspect the N and P cross-connectors.
 - Replace the feature card (196).
-
- Inspect the N and P cross-connectors.
 - Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

Suggested action for an intermittent problem:

- Inspect all connector contacts.
- Replacement sequence:
 - Feature card (196).
 - Planar (103, 104, 105).
 - Feature interface cable (197).

194 FUNCTION EXTENSION FEATURE MINI-MAP C

Use this mini-MAP to correct function extension feature card problems.

- For a mini-MAP example, see *Troubleshooting Aids* (212).
- The failure that sent you to this mini-MAP could be caused by an incorrect or missing voltage. To check the voltages, use MIM 195.
- For intermittent problems, see the suggested action at the end of the MAP.

Conditions after Power-On

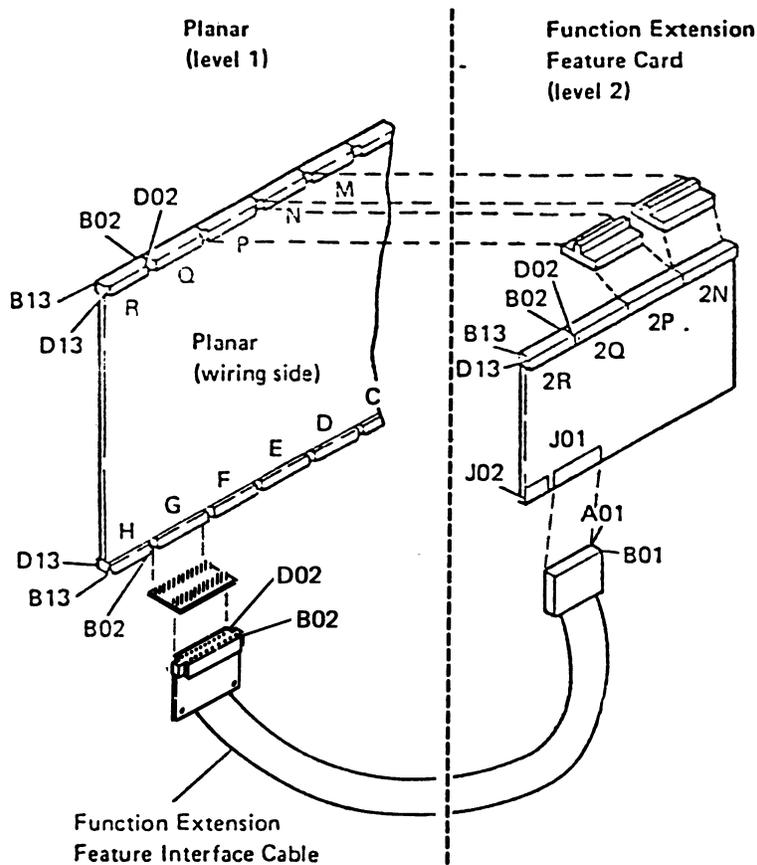
- The '-IAR Bit 0' line is at an Up level.
- All other signal lines are pulsing.

Tools

- CE probe (213)

Connect the CE probe as follows:

- +1-D-D03
- -1-D-D08
- Ground 2-N/P-D08



-IAR Bit 9----->	1-N-B12 >	----->	2-N-B12 >----
-ROS Bit 9----->	1-N-D05 >	----->	2-N-D05 >----
-ROS Bit 6----->	1-N-D06 >	----->	2-N-D06 >----
-IAR Bit 10----->	1-N-D07 >	----->	2-N-D07 >----
-ROS Bit 1----->	1-N-D11 >	----->	2-N-D11 >----
-IAR Bit 8----->	1-P-B03 >	----->	2-P-B03 >----
-IAR Bit 15----->	1-P-B09 >	----->	2-P-B09 >----
-ROS Bit 14----->	1-P-B12 >	----->	2-P-B12 >----
-IAR Bit 11----->	1-P-D02 >	----->	2-P-D02 >----
-IAR Bit 6----->	1-P-D06 >	----->	2-P-D06 >----
-IAR Bit 0----->	1-P-D09 >	----->	2-P-D09 >----
-ROS Bit 15----->	1-P-D13 >	----->	2-P-D13 >----

194 (continued)

- Power off.
- Ensure that the N and P cross-connectors are seated properly.
- Ensure that the feature interface cable is seated properly at planar socket location G and at J01 on the feature card.
- Power on.
- Probe the '-ROS Bit' and '-IAR Bit' lines on the cross-connectors at planar locations N and P.

Are both probe lights off for any line?

Y N

|

- Inspect the N and P cross-connectors.
- Replace the feature card (196).

- Inspect the N and P cross-connectors.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105)

Suggested action for an intermittent problem:

- Inspect all connector contacts.
- Replacement sequence:
 - Feature card (196).
 - Planar (103, 104, 105).
 - Feature interface cable (197).

**195 FUNCTION EXTENSION FEATURE
MINI-MAP D**

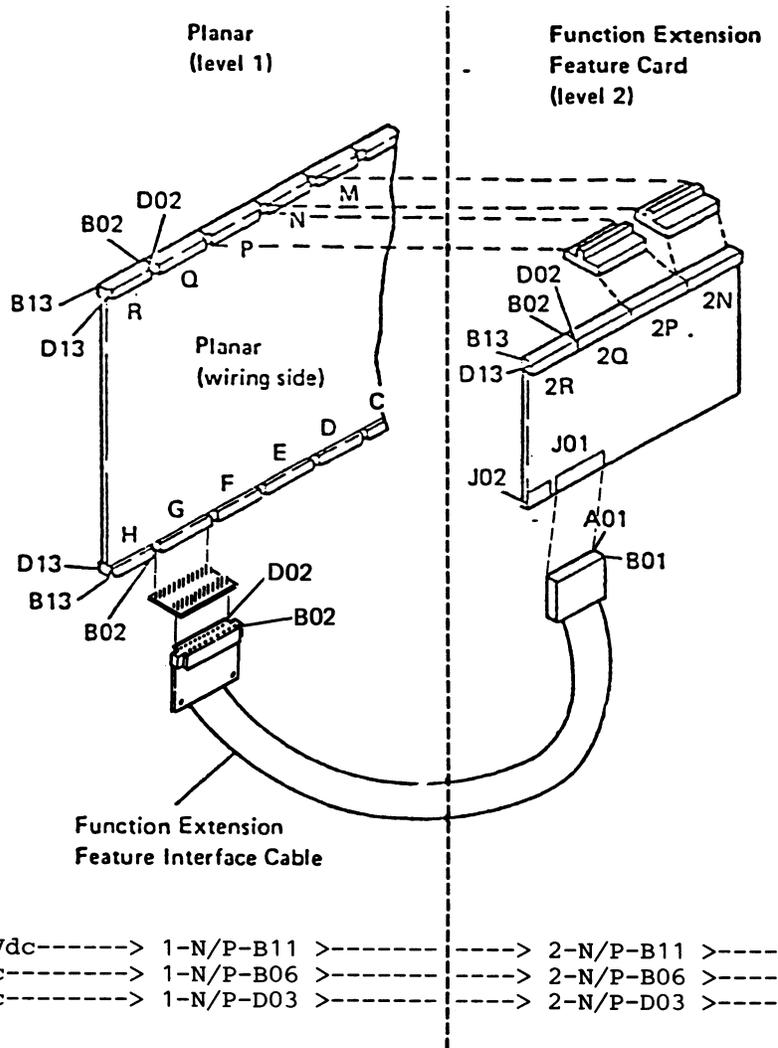
- Use this mini-MAP to correct missing or incorrect voltage levels at the function extension feature card.
- For a mini-MAP example, see *Troubleshooting Aids* (212).

Conditions after Power-On

- The voltage lines are active.

Tools

- CE meter



195 (continued)

- Check the +5 Vdc at the N and P cross-connectors.

Is the voltage correct?

Y N

- Inspect the N and P cross-connectors.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Check the -5 Vdc at the N and P cross-connectors.

Is the voltage correct?

Y N

- Inspect the N and P cross-connectors.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Check the +8.5 Vdc at the N and P cross-connectors.

Is the voltage correct?

Y N

- Inspect the N and P cross-connectors.
- Replace the planar; set the jumpers correctly on the new planar (103, 104, 105).

- Inspect the N and P cross-connectors.
- Replace the feature card (196).

196 FUNCTION EXTENSION FEATURE CARD REMOVAL AND REPLACEMENT

1. Power off the display station and disconnect the line cord from the wall outlet.
2. Open the display station rear cover (108).
3. Remove the two (2) upper stiffener mounting screws and position the stiffener in its vertical position.
4. Remove the cross-connectors at locations N and P.
5. Disconnect the function extension feature interface cable from the feature card J01.
6. Remove the feature card from the stiffener.

Replace the feature card in the reverse order of removal.

197 FUNCTION EXTENSION FEATURE INTERFACE CABLE REMOVAL AND REPLACEMENT

1. Power off the display station and disconnect the line cord from the wall outlet.
2. Open the display station rear cover (108).
3. Remove the two (2) upper stiffener mounting screws and position the stiffener in its vertical position.
4. Disconnect the feature interface cable from the function extension feature card J01.
5. Disconnect the feature interface cable from the main planar at location G.

Replace the feature cable in the reverse order of removal.

Diagnostic Aids

200 CONTROL PANEL LEDs

Five lights (LEDs) are located on the control panel of the display station, and are used by the operator and the customer engineer to determine the status of operation. All five LEDs are energized momentarily during power-on to test them. After power-on, the following descriptions apply:

Line Sync: When on, this light indicates that the display station has recognized a poll or data that the controller sent over the system cable. The poll or data can be for any display station on the cable (Cable Thru feature). The light goes off if more than 160 ms elapse between recognizable characters.

Line Check: When on, this light indicates that the display station has detected a parity error in the poll or data the controller sent. When the Cable Thru feature is installed, each display station turns on this light even if the poll or data is not addressed to that station. The addressed station returns an error response to the controller. The controller resends the information that causes the error until the information is received at the display station error free, at which time the light will be turned off.

Internal Check: When on, this light indicates that a parity error has been found in the data bus while data is moving from read/write storage. The Internal Check light is reset (off) when you set the Status switch to the Test position. A power-on reset occurs when this light is being reset by the Status switch.

Storage Check: When on, this light indicates that a parity error has been found in the data bus while data is moving from read/write storage on the extended storage card. The Storage Check light is reset (off) when you set the Status switch to the Test position. A power-on reset occurs when this light is being reset by the Status switch.

Ready: When on, this light indicates that the power-on diagnostic has completed correctly¹. The Ready light is off if the Status switch is in the Test position; if either or both the Storage Check and Internal Check lights are on; or if the microprocessor is in a diagnostic sequence. The MPU controls this light.

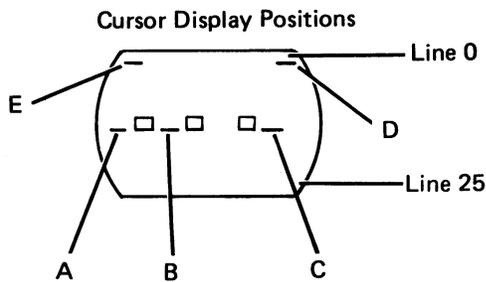
¹The function extension feature diagnostics are not run automatically at display station power-on (215).

201 STATUS SWITCH

The Status switch on the control panel is a diagnostic aid for the customer engineer. It also functions as a reset switch and a problem determination aid.

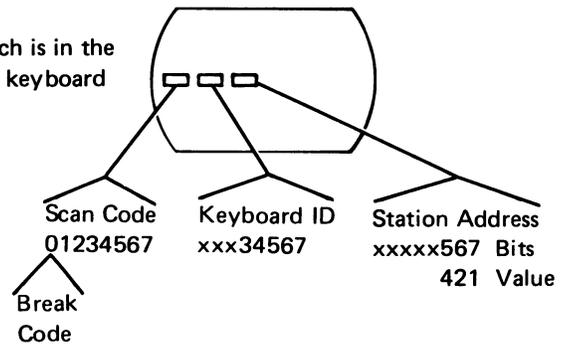
1. If the switch is in the Test position when the display station is powered-on, the power-on diagnostic displays the scan code, keyboard ID, and the station address when a key is pressed. The power-on diagnostic continues to loop with the cursor in position B until the switch is set to the Normal position.
2. The settings of the address switches (Cable Thru feature) should not be changed while the power-on diagnostic is looping, unless a keyboard data key is pressed and held down. Release the key to allow the power-on diagnostic to loop after the desired settings of the address switches are changed, so that the changes can be seen in the address field of the display screen.
3. If the cursor is in position D and the Status switch is in the Normal position, the speaker sounds only for the first four keys pressed. Additional keys can be pressed, but the speaker will not sound. If the Status switch is set to the Test position, lines 0 and 25 are displayed for approximately 5 seconds. During this 5 seconds, the hexadecimal code of the last key pressed will be displayed in position 76 of line 25.

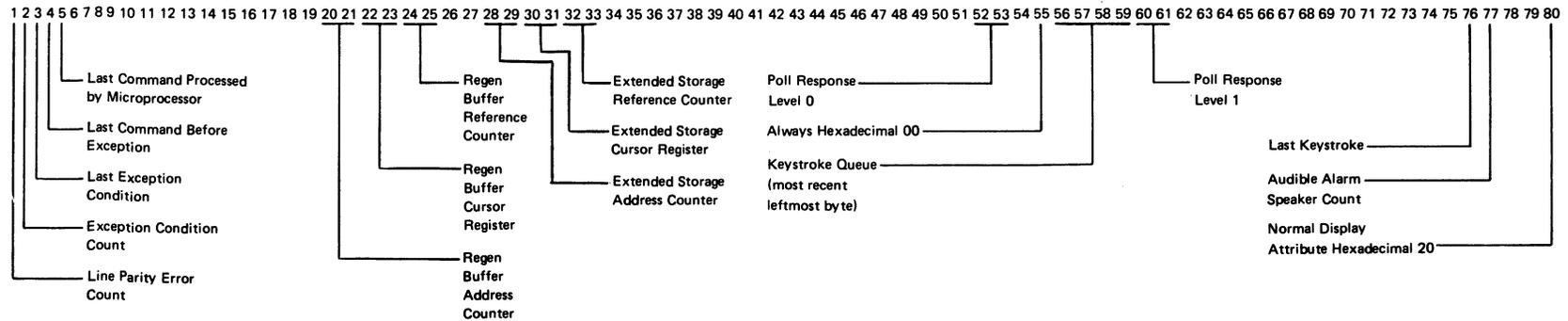
4. Lines 0 and 25 are displayed when the Status switch is set to the Test position during a customer job. When the cursor is in position E the display station operation is not recommended. Lines 0 and 25 are removed when the Status switch is set to the Normal position.
5. You can reset the Storage Check light and Internal Check light by setting the Status switch to the Test position. The operator must sign on and restart the customer job after the Status switch is set to the Normal position.
6. The attributes will be displayed when the Status switch is in the Test position.



Power-On Diagnostic Display

The Status switch is in the Test position; a keyboard key is pressed.





Line Position

1	Line parity error count
2	Exception condition count
3	Last exception condition
4	Last command before exception
5	Last command processed by microprocessor
6-11	(not used)
12	Time slice return address high
13	Time slice return address low
14-19	Time slice register save area
20	Regen buffer address counter high
21	Regen buffer address counter low
22	Regen buffer cursor register high
23	Regen buffer cursor register low
24	Regen buffer reference counter high
25	Regen buffer reference counter low
26-27	(not used)
28	Extended storage address counter high
29	Extended storage address counter low
30	Extended storage cursor register high
31	Extended storage cursor register low
32	Extended storage reference counter high
33	Extended storage reference counter low
34-35	(not used)
36-51	Cable adapter command queue
52-53	Poll response level 0

Line Position

54	Poll response delimiter
55	Always hexadecimal 00
56-59	Keyboard keystroke queue
60-61	Poll response level 1
62	Poll response delimiter
63-67	(not used)
68	Cable adapter control register high
69	Cable adapter control register low
70	Cable adapter address register high
71	Cable adapter address register low
72	Cable adapter length register high
73	Cable adapter length register low
74	Cable adapter sense register
75	Last cable adapter sense register value (stored by microcode)
76	Keycode of last key that was pressed
77	Audible alarm speaker count
78-79	User accessible address limit
80	Normal display attribute hexadecimal 20

Alternative Display

Line Position

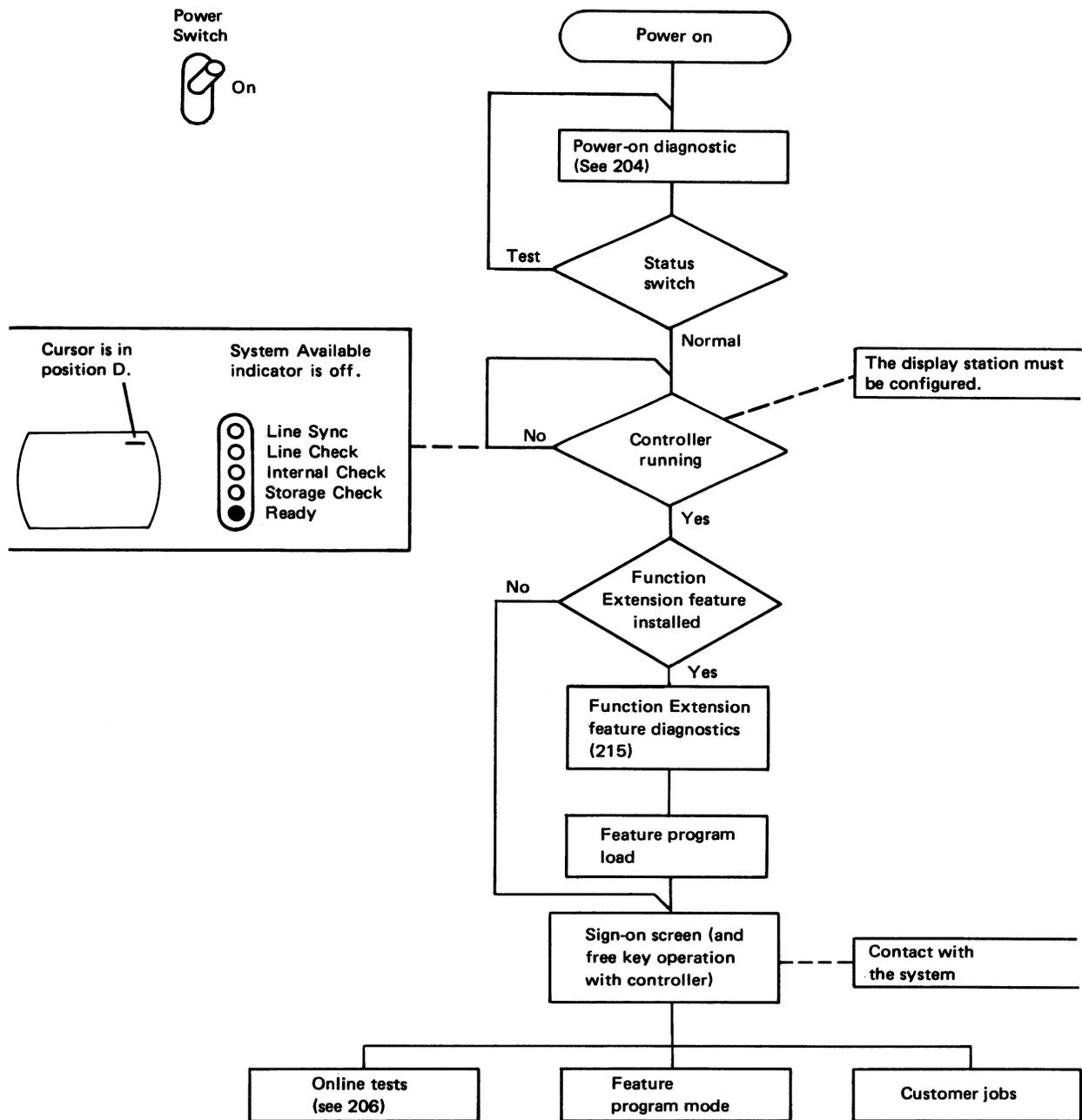
1-16	(not used)
17-32	I/O device data storage area
33	Keylock feature status hexadecimal 00 if off or not installed
34-39	(not used)
40-43	Subroutine save area
44-45	Save area
46	Same as position 1 of main display

Line 25 Information

The illustration shows the most commonly used information. The table indicates all the information displayed on line 25 when the Status switch is set to the Test position. An alternative display of line 25 occurs whenever contents of the last key log (position 76) contains the break bit. This is a result of pressing and releasing any shift key before or during the time the Status switch is set to the Test position.

203 DISPLAY STATION OPERATION OVERVIEW

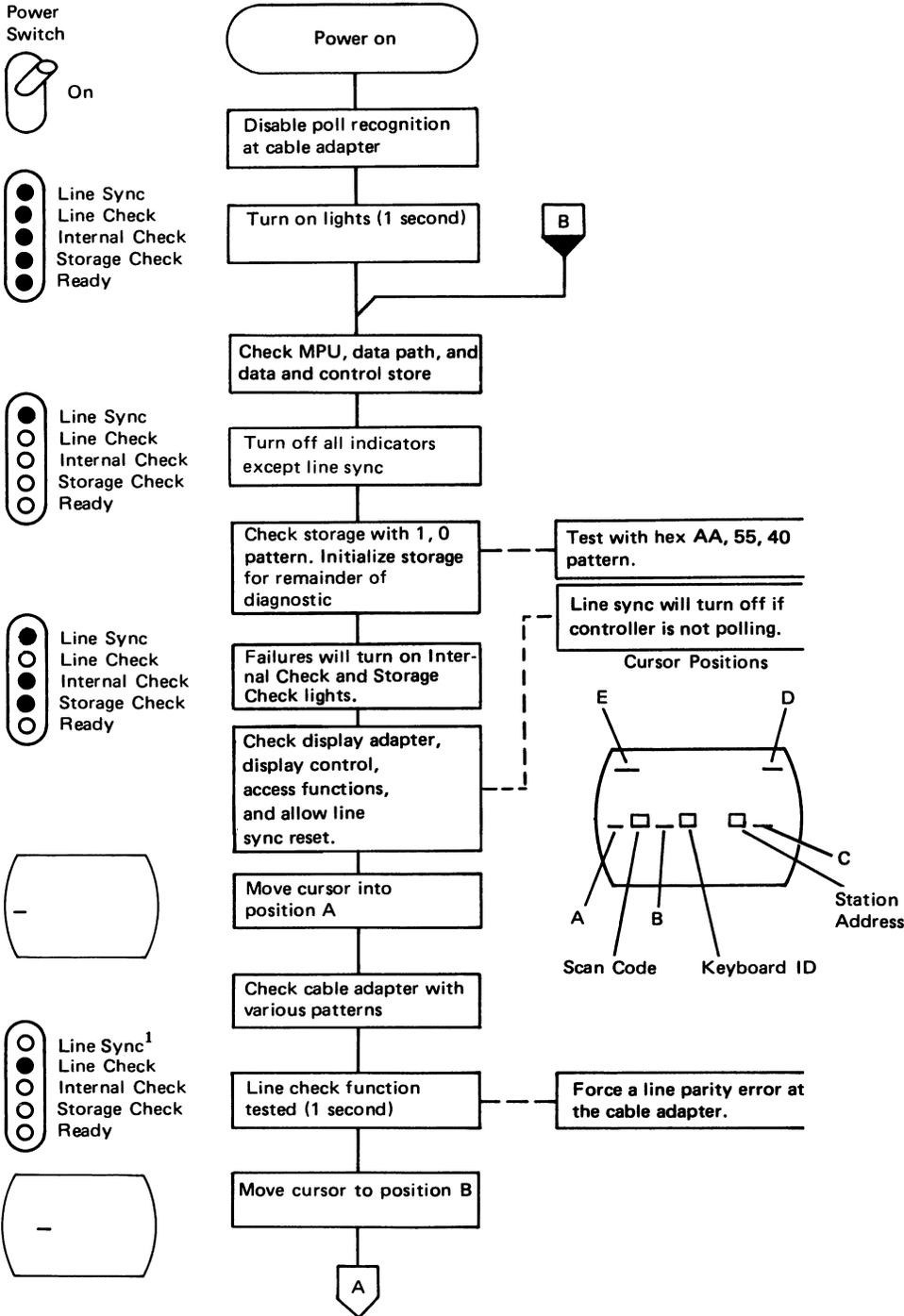
The following flowchart shows the sequence of operations from power-on to either customer sign-on, verification test, or feature program mode.



204 POWER-ON DIAGNOSTIC

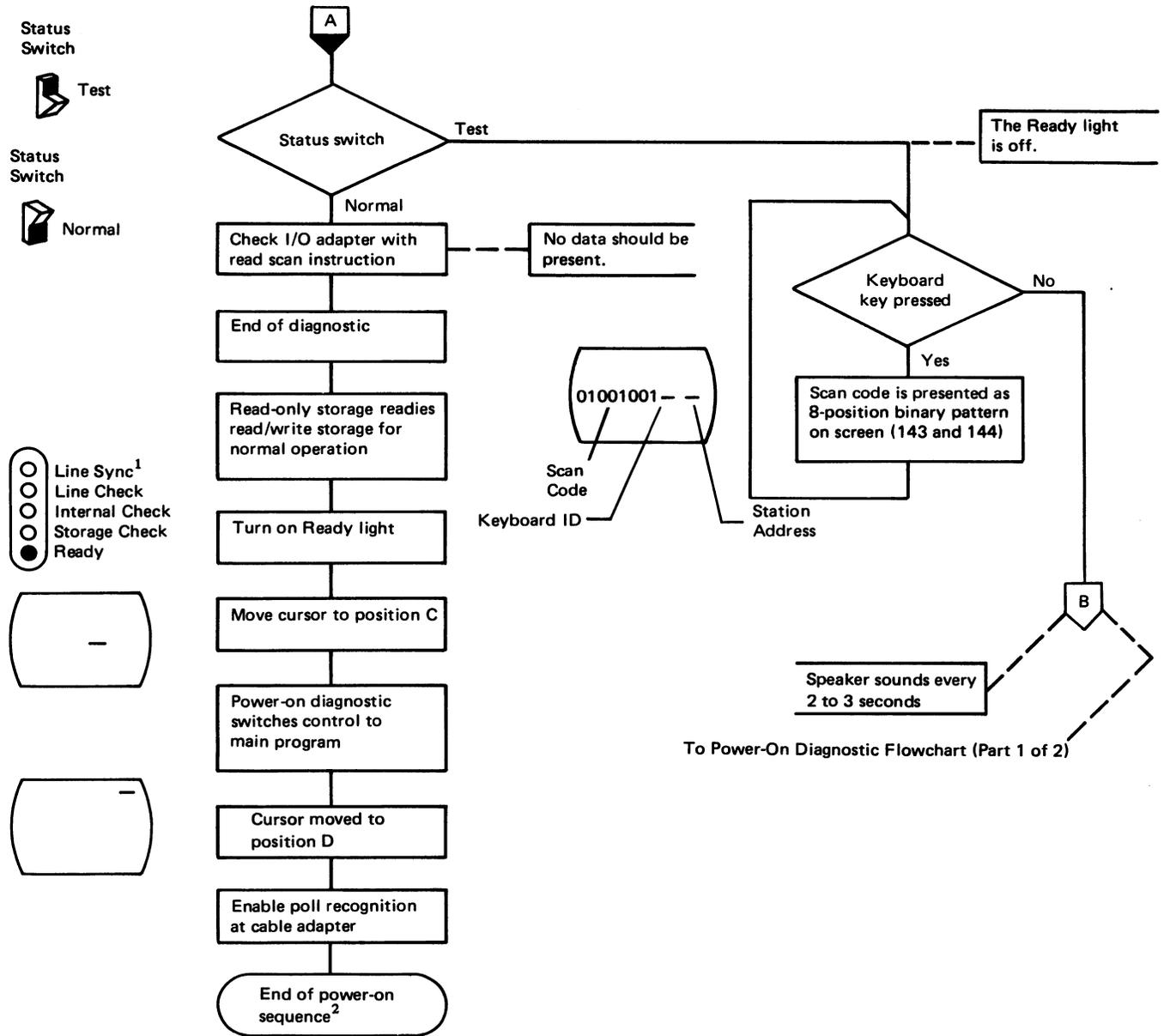
The following flowchart shows the steps of the internal diagnostics performed when the display station is powered-on.

Power-On Diagnostic Flowchart (Part 1 of 2)



¹The Line Sync light is on while the controller is polling.

Power-On Diagnostic Flowchart (Part 2 of 2)

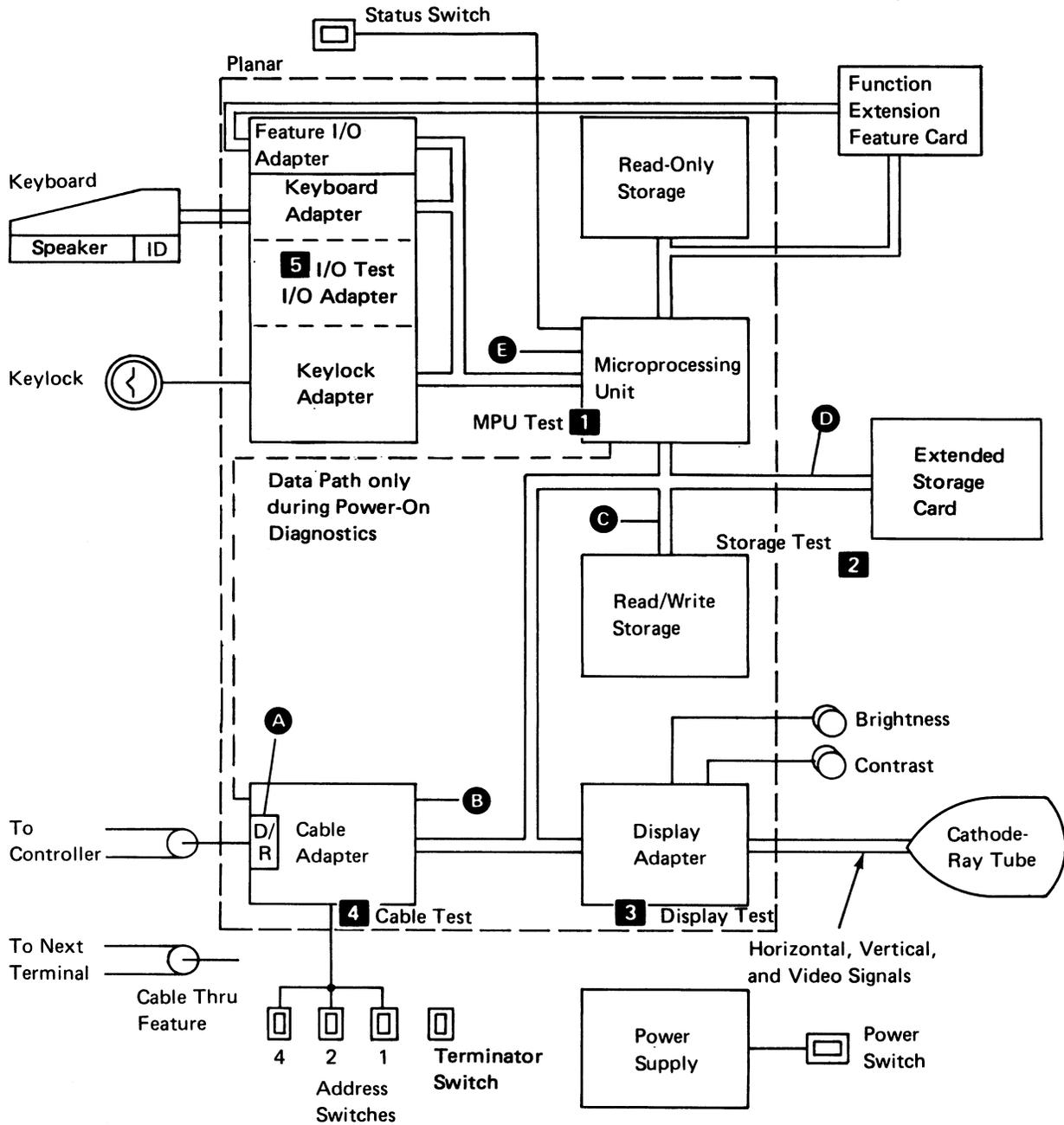


To Power-On Diagnostic Flowchart (Part 1 of 2)

¹The Line Sync light is on while the controller is polling.
²The function extension feature diagnostics are not run automatically at display station power-on (215).

Power-On Diagnostic Overview

The numbers indicate the sequence in which the power-on diagnostic checks the major areas of the adapters. The white-on-black letters indicate the areas that are associated with the various lights.

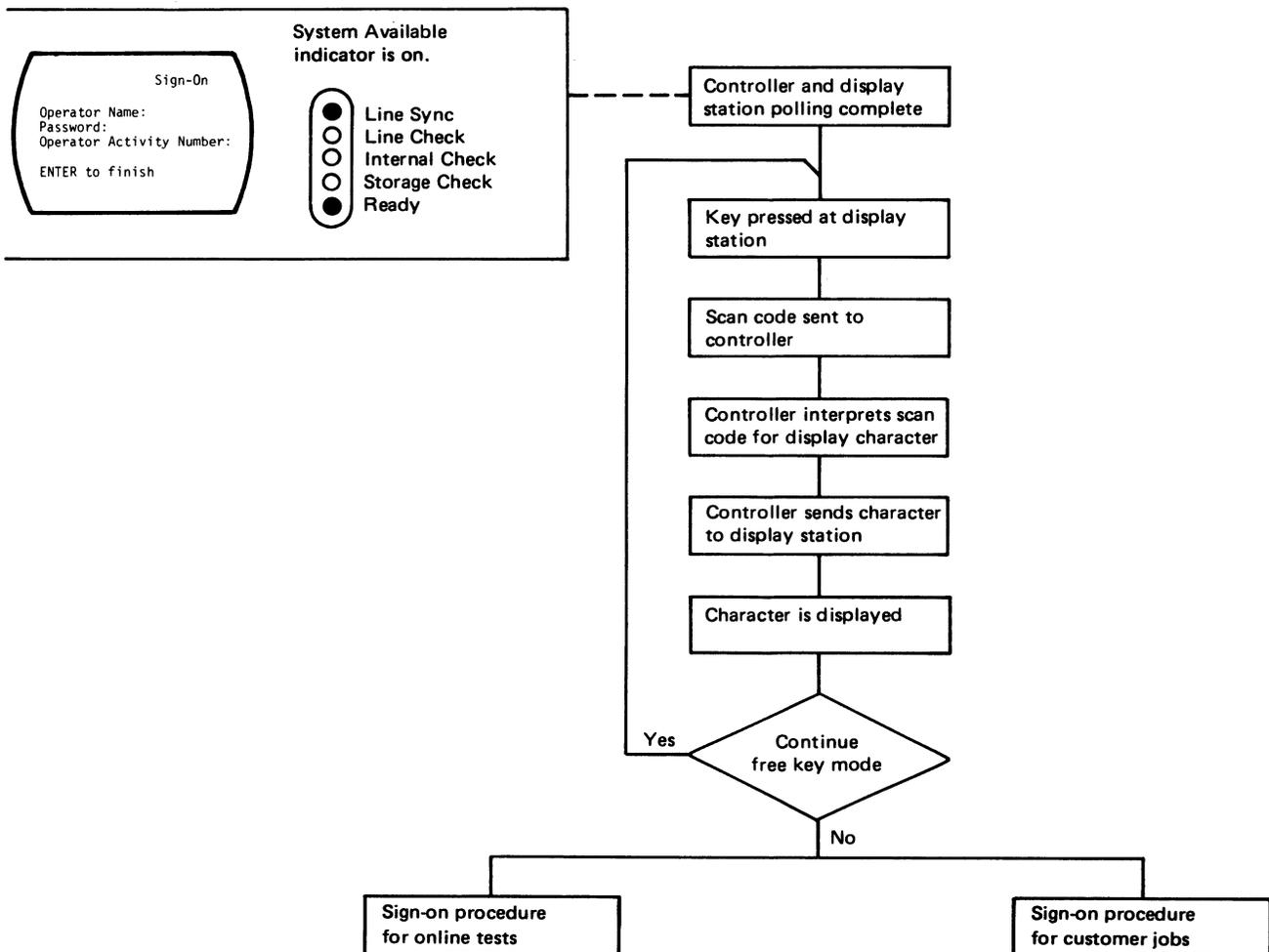


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205 FREE KEY OPERATION

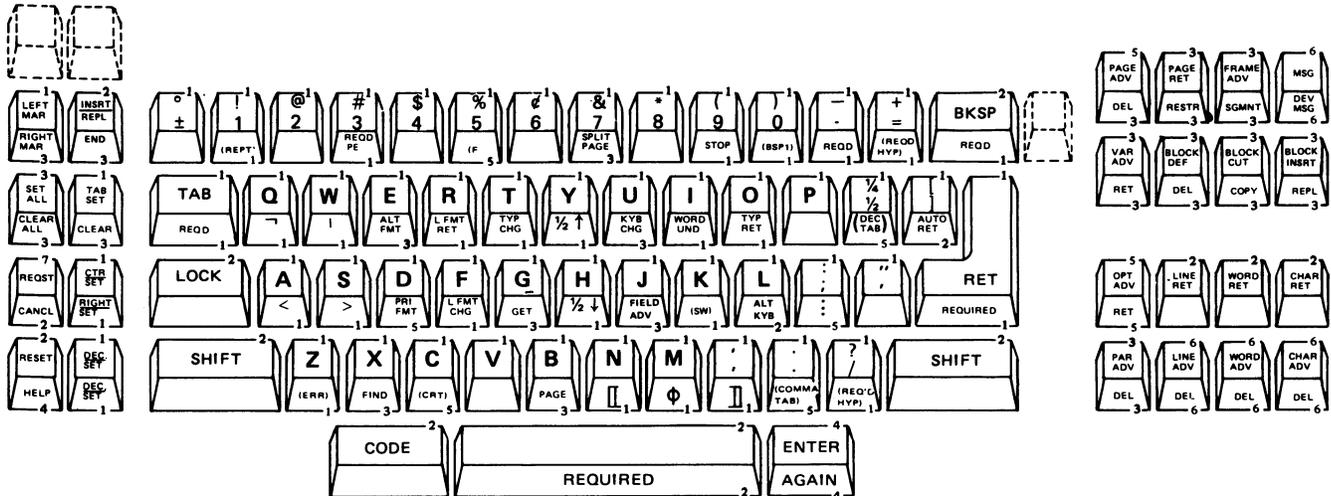
A free key operation is available after power-on as part of the set time/data menu on the master display station (or alternate display station) and as part of the sign-on menu on all display stations. Press the Reset key and then the Reqst key to make the 80-character request line available for free keying. If you are unable to get to the request line, go to the Start of Call MAP. Free keying can also be done as part of the Scroll Test during the Online Tests (206).

Free Key Overview



While in the free key mode, the display station communicates with the controller and permits keyed characters to be displayed; because keyed characters are displayed, you can check the alphanumeric keys. When free keying on the sign-on menu request line, the keys will cause the response shown in the figure below.

Free Key Feedback



Note: Key names in () are not engraved on the key.

System Feedback

- 1 Character displayed.
- 2 Function performed.
- 3 Invalid key message displayed (press reset key to continue).
- 4 Task not valid message displayed.
- 5 Key ignored.
- 6 Function is performed under normal conditions but the function will be ignored when some special conditions occur such as CHAR ADV key pressed when the character is already advanced to the edge of the screen.
- 7 Function is performed if the cursor is not on the request line. Key is ignored if the cursor is on the request line.

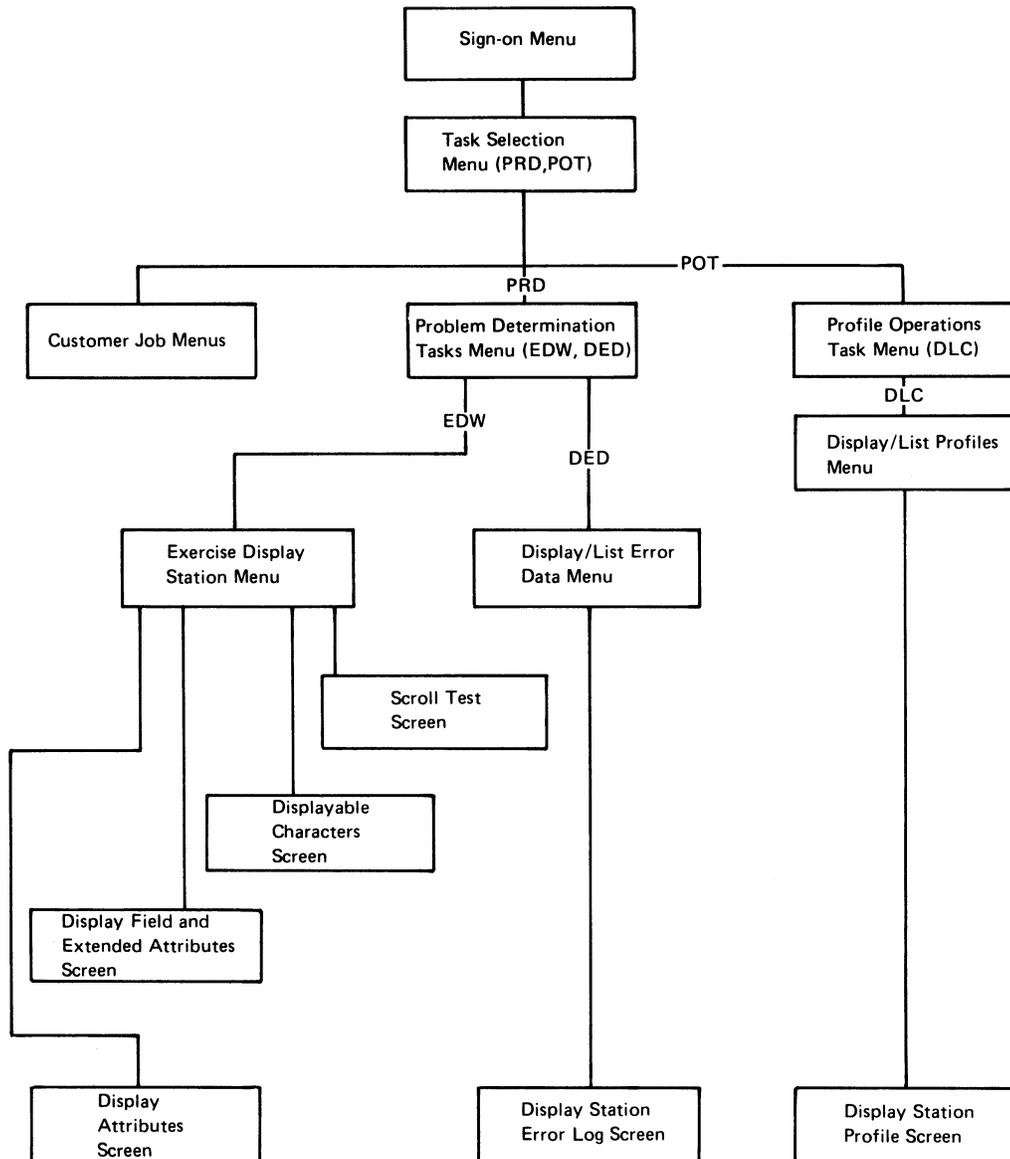
206 ONLINE TESTS

The online tests are in the IBM 5520 Administrative Processing Program.

Overview

The online tests include display station exerciser routines, error data, and profiles that are in the system. The tests can be run on the display station while other jobs are running on the system.

Throughout the tests you will make selections from options displayed on the screen. If you make an error and cannot recover by pressing the Reset key, press and hold the Code key down and press the CancI key. This will return you to the previous menu for task selection. Detailed operating procedures are in the pages following the flowchart below.



Exerciser Routines

These tests allow you to check out the operation of the display station.

The exerciser routines check the display station performance and, once successfully completed, indicate that the display station is operating properly. If the tests do not operate as described, go to the Start of Call MAP to start your trouble analysis.

The exerciser routines include the following screens: display attributes, displayable characters, display field and extended attributes, and the scroll test.

The display attributes screen demonstrates some of the attributes, shows alphameric symbols and special characters, and has a border of Hs. Use this screen when adjusting the display assembly or setting the contrast.

The displayable characters screen shows all displayable characters and the associated hexadecimal codes.

The display field and extended attributes screen demonstrates all available character attributes, field attributes, and several combinations of attributes.

The scroll test screens allow you to exercise the scrolling operation. Also, free keying is allowed anywhere on the scrolling screens.

Error Data

The display/list error data screens allow you to display or list (print) the error data recorded in the system.

Profiles

The display/list profile screens allow you to display or list (print) the profiles for devices attached to the same controller (system unit).

Procedures

The following procedures describe paths to any of the online tests. If you cannot reach the online tests¹ with the procedure given (or if you desire a more direct path to the tests), you can do the following when the task selection menu is displayed:

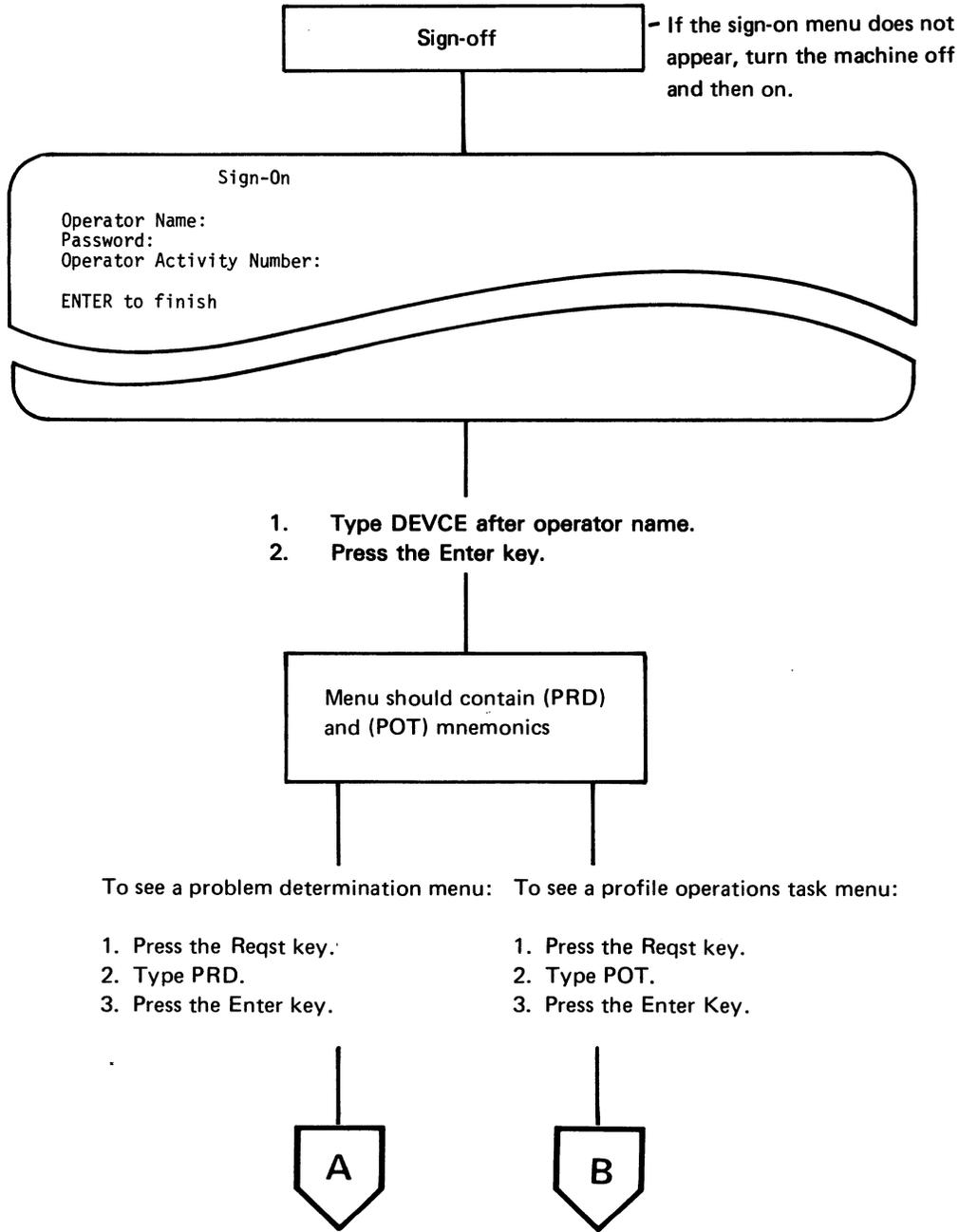
1. Press the Reqst key.
2. Type the appropriate mnemonic (EDW for exercise display station, DED for display/list error data, or DLC for display/list profiles).
3. Press the Enter key.

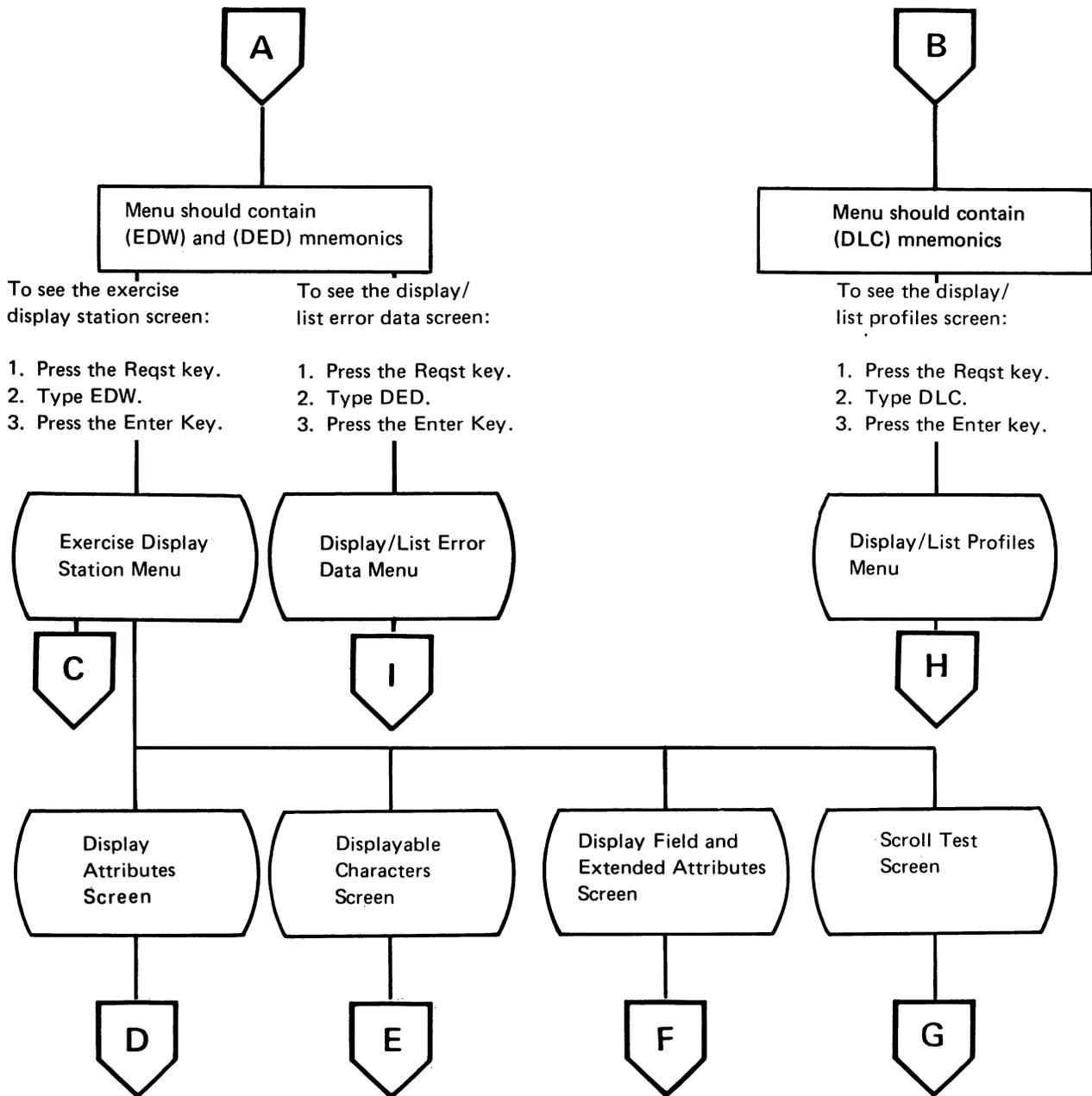
If a job that can be interrupted is running on the display station that you wish to test, sign off as follows:

1. Press and hold down the Code key and press the CancI key.
2. Press the Reqst key.
3. Type SOF.
4. Press the Enter key.

¹Some reasons you might not be able to sign on or reach the online tests are:

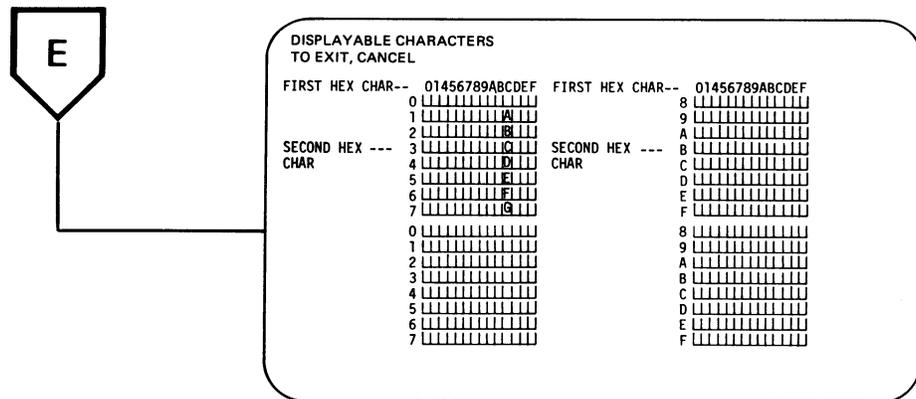
- The system is not powered on.
- The system load was not completed successfully.
- This station is not configured in the system.
- A typing or procedural error occurred.
- A system hardware or programming problem exists.
- A message is waiting at the master display station.





206 (continued)

To return to the problem determination or task selection menu, hold the Code key down and press the Cancel key.



To select the displayable characters test pattern:

1. Press the Reqst key, type EDW, and press the Enter key.
2. Press the Opt Adv key until Displayable Characters appears in the underlined space.
3. Press the Enter key.

The preceding illustration shows the layout of the display screen for a 5253 Display Station supported by Licensed Program 5611-SS2, Release 2 or later. If the displayable extended character set (ECS) is installed, then the upper half of the display screen contains the base displayable character set and the lower half contains the displayable extended character set. If the ECS function is not installed, then both the upper and lower half of the display screen contain the same information. Both character sets are shown in the tables on the following page.

To determine if the ECS function is installed, compare the characters displayed on the upper half of the display screen at locations hex 10, 11, 12, and 14 to those shown at the corresponding hex location in the upper half of the table. If the four characters on the display screen compare with those in the table, then the ECS function is installed.

The display screen is the same in both Normal and Test modes with the following exception: the character in locations hex E1 and 00 in the base displayable character set is not displayed in Normal mode.

If the 5253 Display Station is not supported by Licensed Program 5611-SS2 or later, then only the top half of the display screen is displayed. The second line of the display screen will read, PRESS CANCEL TO RETURN TO MENU:. This occurs with or without the ECS function installed on the display station.

If any characters are not correctly displayed for any of the above cases, then the main planar assembly is defective. The main planar is also defective for a display station supported by both Licensed Program 5611-SS2, Release 2, and ECS if either of the following occurs:

- The information displayed on the upper half of the display screen is the same as the information displayed on the lower half of the display screen.
- All characters display correctly while using the displayable characters option of the EDW function, but the correct characters are not displayed when using the alternative keyboard (keyboard 202 or 204).

In all of the above cases, the main planar assembly must be replaced (103, 104, and 105).

206 (continued)

Second Hex Character	0	1	4	5	6	7	8	9	A	B	C	D	E	F	
First Hex Character	0	·	̄	̄	&	z	ø	ø	°	μ	†	{	}	\	0
1	·	*	˘	é	/	É	a	j	˘	£	A	J	É	1	
2	-	:	â	ê	Â	Ê	b	k	s	¥	B	K	S	2	
3	H	:	ä	ë	Ä	Ë	c	l	t	℞	C	L	T	3	
4	,	+	à	è	À	È	d	m	u	f	D	M	U	4	
5	+	+	á	í	Á	Í	e	n	v	§	E	N	V	5	
6	+	+	ã	ï	Ã	Ï	f	o	w	¶	F	O	W	6	
7	+	+	ä	ï	Ä	Ï	g	p	x	¼	G	P	X	7	

Second Hex Character	0	1	4	5	6	7	8	9	A	B	C	D	E	F	
First Hex Character	8	↓	∏	∑	∫	∫	∫	h	q	y	½	H	Q	Y	8
9	†	x	ñ	β	Ñ	`	i	r	z	¼	I	R	Z	9	
A	†	†	[]	!	:	«	»	»	»	»	»	»	»	»
B	†	†	.	\$,	#	»	»	»	»	»	»	»	»	»
C	†	†	<	*	%	@	»	»	»	»	»	»	»	»	»
D	†	†	()	-	'	ý	»	»	»	»	»	»	»	»
E	†	†	+	;	>	=	»	»	»	»	»	»	»	»	»
F	†	†	!	^	?	"	±	»	»	»	»	»	»	»	»

Second Hex Character	0	1	4	5	6	7	8	9	A	B	C	D	E	F	
First Hex Character	0	·	·	//	≅	ij	∩	=	%	≅	0	Φ	o	L	0
1	·	·	∠	-	≅	U	α	∂	∇	∇	∇	∇	∇	∇	1
2	·	·	=	<	∇	C	∇	K	σ	2	∞	∇	∇	∇	2
3	·	·	-	>	∇	∇	ψ	ω	τ	3	ψ	Ω	→	∇	3
4	·	·	+	∇	∇	∇	∇	∇	∇	4	∇	∇	∇	∇	4
5	·	·	∞	∇	∇	∇	∇	∇	∇	5	∇	∇	∇	∇	5
6	·	·	π	∇	∇	∇	∇	∇	∇	6	∇	∇	∇	∇	6
7	·	·	Δ	∇	∇	∇	∇	∇	∇	7	∇	∇	∇	∇	7

Second Hex Character	0	1	4	5	6	7	8	9	A	B	C	D	E	F	
First Hex Character	8	·	·	→	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	8
9	·	·	/	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	9
A	·	·	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
B	·	·	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
C	·	·	<	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
D	·	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
E	·	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇
F	·	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇	∇

To return to the problem determination or task selection menu, hold the Code key down and press the Cancel key.



DISPLAY FIELD AND EXTENDED ATTRIBUTES
PRESS CANCEL TO RETURN TO MENU:

NORMAL..... X'20'... ABCDE	COMBINATIONS:
REVERSE IMAGE..... X'21'... ABCDE	*****
HIGH INTENSITY..... X'22'... ABCDE	* X'31'.. REVERSE AND COL SEP *
UNDERSCORE..... X'24'... ABCDE	* X'33'.. HI INT,REV,COL SEP *
NONDISPLAY..... X'27'... ABCDE	* X'35'.. UNDRSC,REV,COL SEP *
BLINK..... X'28'... ABCDE	*****
COLUMN SEPARATOR..... X'30'... ABCDE	
END OF LINE..... X'2F'... ABCDE	

DOUBLE UNDERSCORE.... X'40'... ABCDE	COMBINATIONS:
SLASH..... X'60'... ABCDE	*****
DASH..... X'80'... ABCDE	* X'49'...BLINK,REV,DBL UNSC *
NULL..... X'E0'... ABCDE	* X'86'...DASH,HI INT,UNDRSC *
REVERSE IMAGE..... X'01'... ABCDE	* X'E1'... *****
HIGH INTENSITY..... X'02'... ABCDE	
UNDERSCORE..... X'04'... ABCDE	
BLINK..... X'08'... ABCDE	

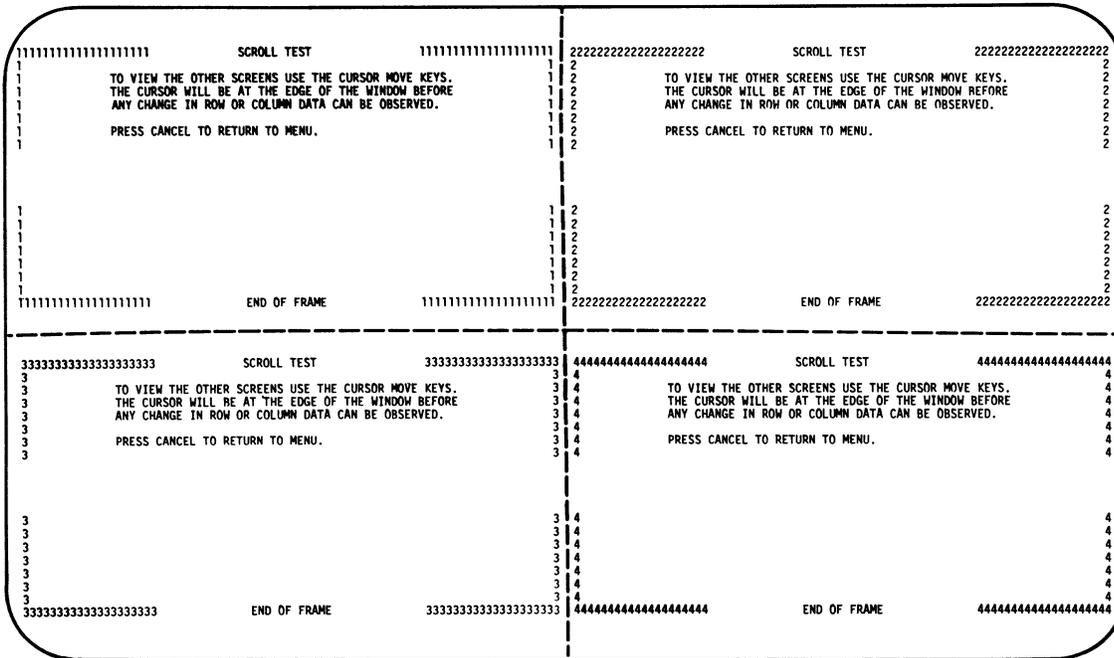
To select the display field and extended attributes test pattern:

1. Press the Reqst key, type EDW, and press the Enter key.
2. Press the Opt Adv key until Display Field and Extended Attributes appears in the underlined space.

3. Press the Enter key.

This test pattern provides a test of the character and field attributes. It verifies the function of the extended storage and decode in the display station. The test pattern also shows combinations of the attributes.

The following display is in storage in the display station, but only part of it can be viewed at one time.

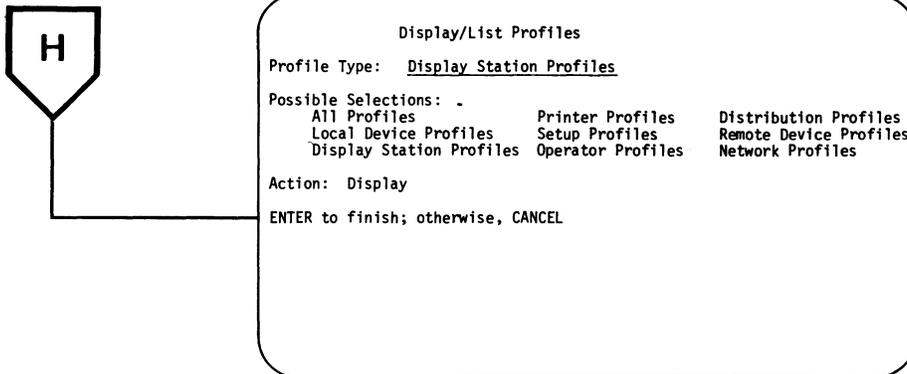


Note: A message line will appear on the top of this quadrant.

Use the Line Adv key to move information from bottom to top on the display screen. Use the Line Ret key to move information from top to bottom on the display screen.

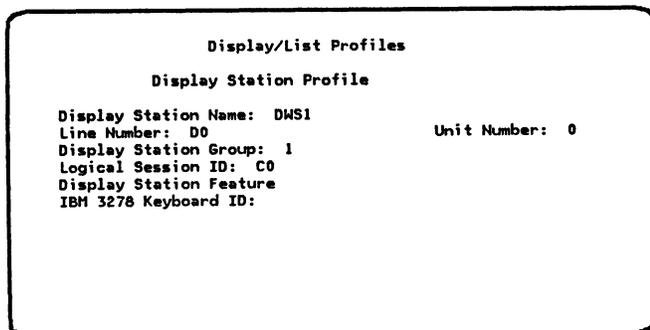
Use the Char Adv key to move information from right to left on the display screen. When the cursor reaches the right edge of the display, the information will move left 50 characters. Use the Char Ret key to move information from left to right on the display screen. When the cursor reaches the left edge of the display, the information will move to the right 50 characters. As you move the information around, you will see parts of the other three quadrants (which are bordered by 2s, 3s, and 4s).

To return to the problem determination or task selection menu, hold the Code key down and press the CancI key.



To find the profile name and/or ID (line and unit numbers) for this display station:

1. Press the Opt Adv key until Display Station Profiles appears in the underlined space.
2. Press the Enter key.
3. Press the Page Adv key.



1. Write the profile (device) name on paper for reference later in this procedure.
2. Press the Reqst key.
3. Type DLS.
4. Press the Enter key.

```

                Display System Status

Type the Name of One of the Following for Status Information:
  Device      Session
  Line       Background Job

For Background Jobs, type one of the following profile names:
  SYSPAGIN   (Pagination)
  SYSGREPL   (Global Replace)
  SYSMFT     (Merge File/Text)
  SYSFILE    (File Tasks)

ENTER to finish; otherwise, CANCEL
    
```

1. Type the profile name that you obtained from the display station profile screen.
2. Press the Enter key.

```

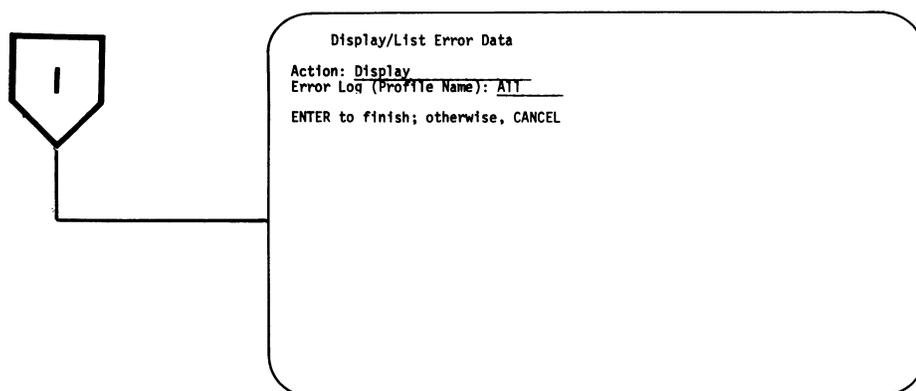
                Device Status (Display Station)

Display Station Name: DWS1
Line Number: D0      Unit Number: 1
State: Started      Signed-On Operator: DEVCE

CANCEL to exit
    
```

1. If the name after Signed-on Operator is DEVCE, the profile name is for this station. The ID for this station appears after Line Number. The line number represents the port this line is attached to. Unit Number is the address assigned to this station (and set in the address switches) if the Cable Thru feature is present.
2. If the name after Signed-on Operator is not DEVCE, the profile name was not for this display station. Find the next profile name as follows:
 - a. Hold the Code key down and press the CancI key. This returns you to the display station profile screen.
 - b. Press the Page Adv key to get the next profile name.
 - c. Return to the **1** under the display station profile screen and repeat the procedure.
3. To return to the Problem Determination or Task Selection menu, press and hold the Code key and press the CancI key.

206 (continued)



Display/List Error Data

Action: Display

Error Log (Profile Name): ATT

ENTER to finish; otherwise, CANCEL

Note: To either see or list (print) the error data for any display station, you need the profile (device) name. Refer to Display/List Profiles at  for details.

If you want to see the error data:

1. Press the Var Adv key.
2. If you want to see all error data, do this step; otherwise go to Step 3:
 - a. Press the Enter key.
 - b. Press the Page Adv key to see the next error data. When all error data has been shown, pressing the Page Adv key will cause a screen with the message End of Error Status Report to appear.

3. If you want to see the error data for this display station:
 - a. Press the Opt Adv key until appears in the underlined space.
 - b. Type the profile (device) name.
 - c. Press the Enter key.

ERROR STATUS										01/15/81	11:16						
NAME=DWS1										DATE LAST RESET 09/05/79							
<u>ERROR HISTORY TABLE FOR DISPLAY STATION</u>																	
ERR CODE	CABLE CNTLR	STATUS DEVICE	STATUS		FEAT		L/S ADDR	ACTIVE DISPLAYS/LINES							DATE	TIME	
			0	1	ST	MD		0	1	2	3	4	5	6	7	YYMMDD	HHMMSS
0190	01	40	00	00	00	00	01	60	40	00	00	00	00	00	00	810115	010305
0190	03	80	FF	00	00	00	01	60	40	00	00	00	00	00	00	810115	010305
0108	02	CE	FF	FF	00	00	01	60	40	00	00	00	00	00	00	810115	010305
0125	01	06	00	00	00	00	01	60	40	00	00	00	00	00	00	810115	010305

- d. Press the Page Adv key.

ERROR STATUS										01/15/81	11:16
NAME=DWS1										DATE LAST RESET 09/05/79	
<u>ERROR COUNTER TABLE FOR DISPLAY STATION</u>											
RECEIVE PARITY CHECKS.....											4
RECEIVE LENGTH CHECKS.....											7
TIMEOUT CHECKS.....											8
LINE PARITY CHECKS.....											9
FUNCTION EXTENSION FEATURE PARITY ERRORS.....											0
FUNCTION EXTENSION FEATURE DIAG. FAILURES.....											0
FUNCTION EXTENSION FEATURE LOAD FAILURES.....											0

Note: For an explanation of the error history table, see 208.

If you want to list (print) the error data, use the following procedures:

- Sign on as SYSCE.
- Create the document.
- Print the document.
- Delete the document.

You must sign on as a system CE to secure more complete access to the programs in the system. (When you signed on as DEVCE, only the asterisked items were accessible to you.) If a password is needed for signing on as SYSCE, get the password from the CE responsible for the system.

Creating the document consists of assigning a name and retention period. When you press Enter, the system stores the document for you.

Printing the document requires specifying the document name and the printer to be used.

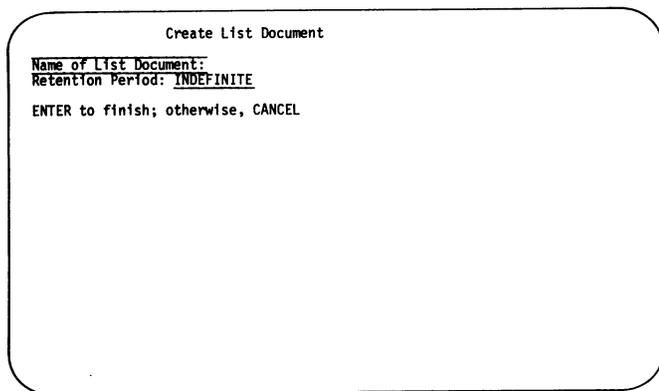
When the printout is finished, it is important to delete the error data document from the system. Failure to delete this document prevents the customer from having access to all of the system storage.

To sign on as SYSCE:

1. Return to the task selection menu by holding the Code key down and pressing the CancI key.
2. Sign off by pressing the Reqst key, typing SOF, and pressing the Enter key. The sign-on menu should appear.
3. Type SYSCE.
4. If a password is used, press the Var Adv key and type the password; otherwise go to the next step.
5. Press the Enter key. The task selection menu should appear.

To create the error data document:

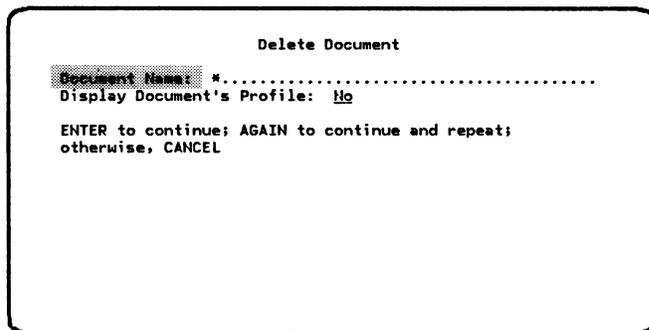
1. Press the Reqst key, type DED, and press the Enter key.
2. Press the Opt Adv key until List appears in the underlined space.
3. Press the Var Adv key and the Opt Adv key until □ appears after Error Log (profile name). Type the profile (device) name, and press the Enter key. To get the profile name go to .



4. Type ERAPDWS (the document name) and press the Enter key. (If Document Name Already Exists appears on the message line, delete the old document.) The system will store the new error data under the document name ERAPDWS. The task selection menu appears.

To delete the document:

1. Hold the Code key down and press the CancI key. The task selection menu appears.
2. Press the Reqst key, type DDC, and press the Enter key.



3. Type ERAPDWS and press the Enter key. The ERAPDWS document is deleted from the system.

206 (continued)

To print the document:

1. Press the Reqst key, type PRT, and press the Enter key.

Print Document

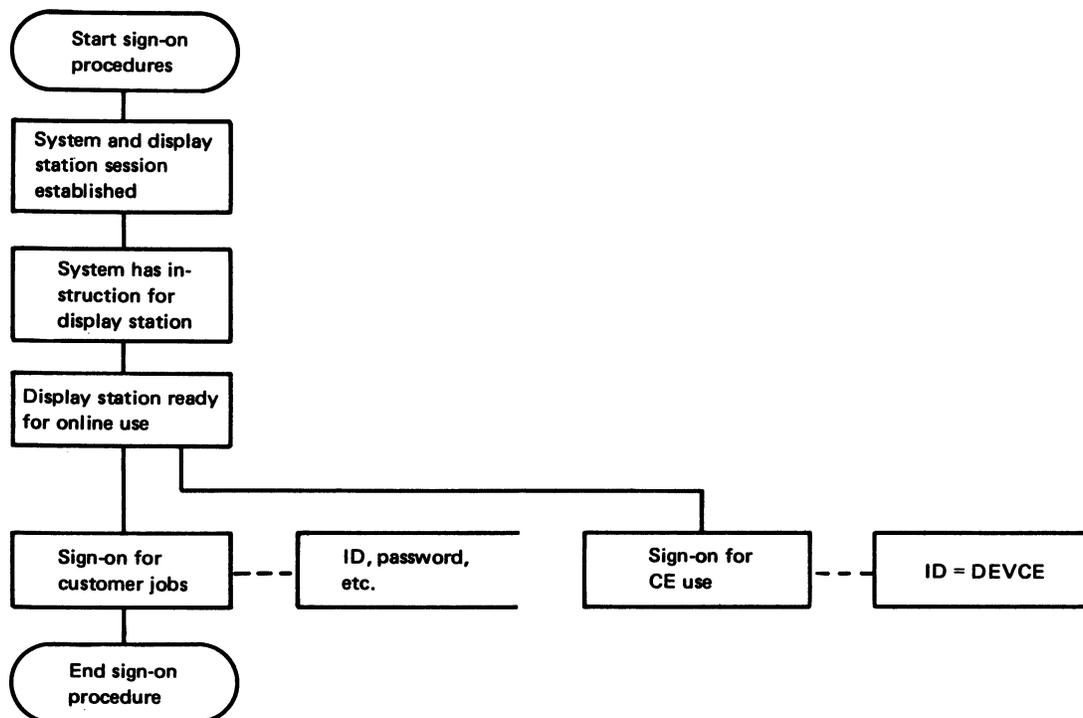
Document Name: _____	To Page: _____
From Page: _____	Date: _____
Print Quantity: _____	List Print Errors: _____
Stop After First Error: _____	
Start Page Number: _____	
Start Line Number: _____	
Printer Name: _____	
Printer Setup Name: _____	

ENTER to finish; AGAIN to finish and repeat; otherwise, CANCEL

2. Type ERAPDWS.
3. Write on paper the printer name that is on the display screen. This name will be used later in this procedure.
4. Press the Enter key. The Task Selection Menu should appear with OK on the message line. The error data will be printed. The Operator Message light turns on when printing is complete.
5. Press the Msg key and ERAPDWS Completed Printing appears.
6. Ask the operator for the location of the printer whose ID you wrote on paper.
7. Delete the ERAPDWS document from the customer files.

207 SIGN-ON PROCEDURE

This is the procedure that the customer and customer engineer use to sign on to use the display station. It is also a diagnostic, in that for the sign-on to be completed, all parts of the display station, system cable, controller, and system must be operating correctly (with the exception of the Function Extension feature)¹. The initial program load (IPL) sign-on procedure must be completed before this procedure can be used.



¹The function extension feature diagnostics are not run automatically at display station power on (215).

208 ERROR HISTORY TABLE

To print or display the error history table, see *Online Tests (206)*. The error history table represents errors in hexadecimal numbers (enclosed in dark border). The hexadecimal numbers have to be converted to binary to determine the meaning of the table.

Error code descriptions are in 209.

Error History Table Sample and Meanings

NAME=DWS1 ERROR STATUS

ERROR HISTORY TABLE FOR DISPLAY STATION

ERR CODE	CABLE-STATUS		STATUS	
	CNTRL	DEVICE	0	1
0190	01	40	00	00
0190	03	80	FF	00
0108	02	CE	FF	FF
0125	01	06	00	00

0123 0123 4567 0123 4567 0-7 0123 4567

Conversion Chart

Hex	Binary	Hex	Binary
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

- 0104
 - 0120
 - 0000
 - 0000
 - 0000
 - 0100
 - 0001
 - 00
 - 0000
 - 0000
- Error Code
 (0109) Activate Command Failure
 (0149) Acceptance Error
 (0101) Transmit Activity Check
 (0107) Wrong Station Responded
 (0103) Receive Parity Error
 (0106) Receive Length Check
 (0191) Busy
 (0190) Even/Odd Change In Status
 Busy
 (0104) Line Parity Check Acknowledge
 (0189) Invalid Outstanding Status

- Reserved
- Defines Status Byte 0
- 0001 Exception Status Error
 - 0010 Keyboard Scan Code Error (0111)
 - 0011 Device Type Error (0192)
 - 0100 Device Model Error (0183)
 - 0101 Keyboard ID Error (0184)

- 456
- 000 No Exception Status
 - 001 Null or Attribute Exception (0123)
 - 010 Activate Not Valid (0124)
 - 011 Undefined Exception Status (0125)
 - 100 Command Not Valid (0120)
 - 101 Storage or Input Queue Overrun (0122)
 - 110 Register Value Not Valid (0121)
 - 111 Power-On Transition (0108)

Level

Scan Code, Command, Device Type, Device Model, or Keyboard ID

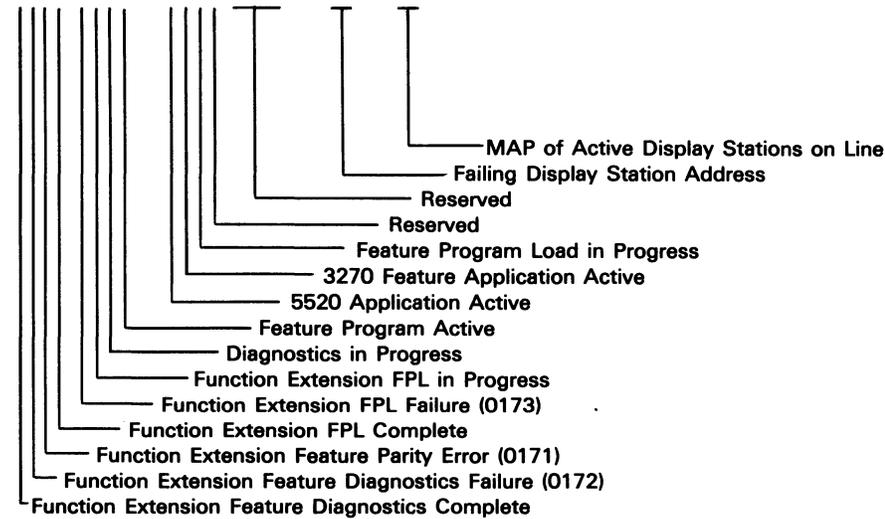
ERROR STATUS 01/15/81 11:16

DATE LAST RESET 09/05/79

FEAT	L/S	ACTIVE DISPLAYS/LINES	DATE	TIME
ST MD	ADDR	0 1 2 3 4 5 6 7	YYMMDD	HHMMSS
00 00	01	60 40 00 00 00 00 00 00	810115	010305
00 00	01	60 40 00 00 00 00 00 00	810115	010305
00 00	01	60 40 00 00 00 00 00 00	810115	010305
00 00	01	60 40 00 00 00 00 00 00	810115	010305

01234567 01234567 0-7 0-7

0000 0000 0000 0000 01 00
 0000 0000 0000 0000 01 00



209 DISPLAY STATION ERROR CODES

Errors that are relative to hardware failures or the servicing of a display station are listed. These errors are sensed by the controller from the status sent from the display station or as a result of either no response or a wrong response.

Errors are stored in the order they are received and are listed here in groups. Error code 01xx identifies a display station error.

Line/Interface Errors

0100 No Response

This error is reported when a display station is in use and no response to a poll occurs.

0101 Transmit Activity Check

This error is found at a controller while a poll or other command is being executed by the controller.

0103 Receive Parity Error

The controller reports this error when parity is wrong in a frame received in response to a poll or other command.

0104 Line Parity Check

The display station reports this error when parity is wrong in a poll or other command frame received from a controller.

0106 Receive Length Check

The controller reports this error when it receives the wrong number of bytes as a result of a poll or other command.

0107 Wrong Station Responded

The controller reports this error when an incorrect station address is returned to a poll or read command from the controller.

0108 Power-On Transition

The power-on transition status bits are set when the display station is powered-on. This error is reported only when these bits are set while the display station is in session with the controller.

0109 Activate Command Failure

This error is reported when the controller checks the device status and finds that the busy bit is not on after an activate command.

Keyboard Errors

0111 Scan Code not Valid

The controller reports this error when the 7-bit code (144) in the keyboard response frame does not translate to an assigned character or function that the controller specifies.

Command or Function Errors

0120 Command not Valid

This error is reported when either a poll or other command that is sent to the display station is not valid or the device ID is not correct. For valid commands, see *Commands* in the *Theory* section.

0121 Register Value not Valid

The controller reports this error when the address counter value indicates an area in storage that is not accessible to the user.

0122 Storage or Input Queue Overrun

The controller reports this error when more than 16 commands and associated data frames are sent, or when an attempt is made to store data in storage that is not accessible to the user.

0123 Null or Attribute Exception

This error is reported when either no attribute was found, or the address counter indicates an attribute.

209 (continued)

0124 Activate not Valid

This error is reported when an activate command sent to the display station is not valid.

0125 Undefined Exception Status

The controller reports this error when an undefined exception status is returned by the display station in response to a poll command.

0149 Acceptance Error

The controller reports this error when the display station fails to indicate that it received commands directed to it.

0182 Device Type Error

The controller reports this error when an unsupported device responds to a read device ID command. For valid device types, see *Read Device ID Responses* in the *Theory* section.

0183 Device Model Error

The controller reports this error when an unsupported model responds to the read device ID command. For valid device models, see *Read Device ID Responses* in the *Theory* section.

0184 Incorrect Keyboard ID

The controller reports this error when the keyboard ID received by the controller is not valid. For valid keyboard ID, see *Read Device ID Responses* in the *Theory* section.

0189 Invalid Outstanding Status

The controller reports this error when an outstanding status is presented in the poll response and no outstanding status information is available.

Time-Out Errors

0190 Even/Odd Change in Status

The controller reports this error when the status sent to the controller from the display station did not change within 225 ms after the controller sent a positive acknowledgment and received a not-busy response.

0191 Busy

The controller reports this error if the busy bit is on for more than 400 ms.

Function Extension Feature Errors

0170 Function Extension Feature Does not Respond

The display station reports this error when the Function Extension feature fails to indicate that it received commands directed to it.

0171 Function Extension Feature Parity Error

The display station reports this error when a parity error is detected during an instruction fetch or a data read from the Function Extension feature.

0172 Function Extension Feature Diagnostic Failure

The display station reports this error when a failure has been detected during execution of the function extension feature diagnostics.

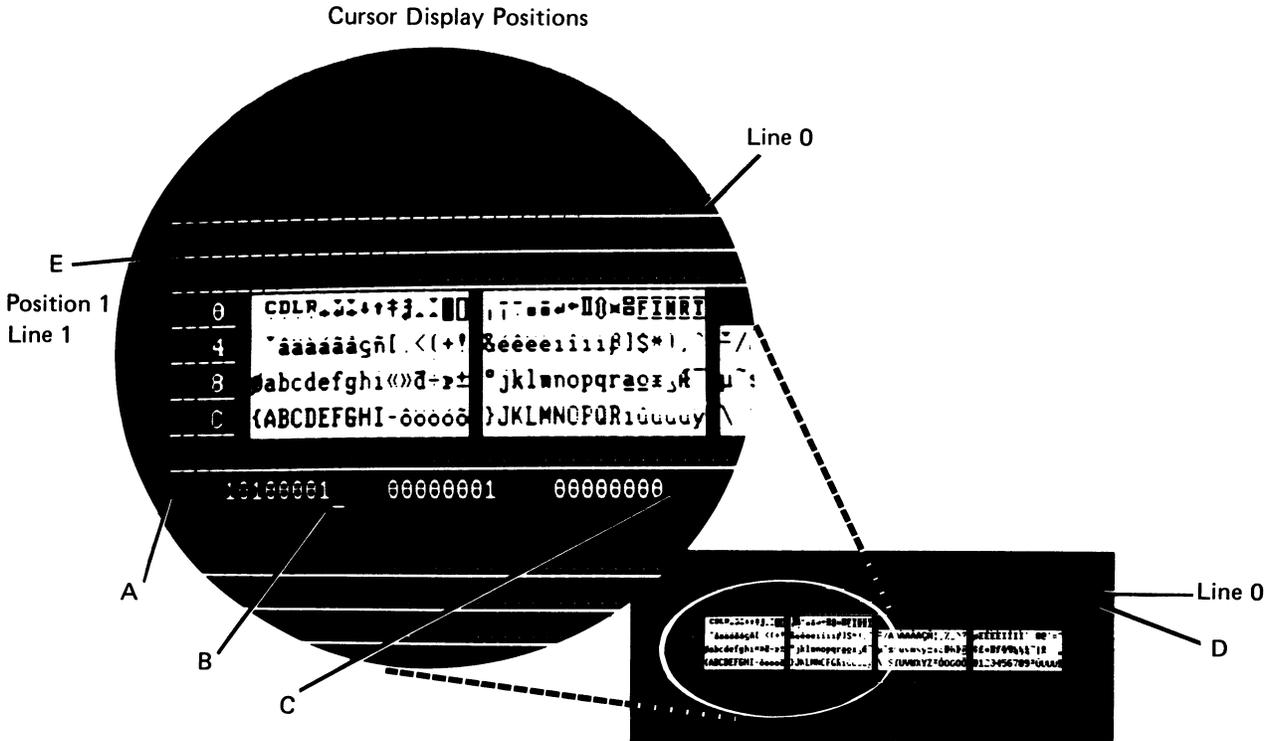
0173 Checksum Error On Feature Program Load

The display station reports this error when the checksum calculated by the display station is not the same as the checksum sent with the feature program load from the controller.

This page is intentionally left blank.

210 DIAGNOSTIC DISPLAY LOCATIONS

This figure shows the possible positions (A, B, C, D, and E) of the cursor.



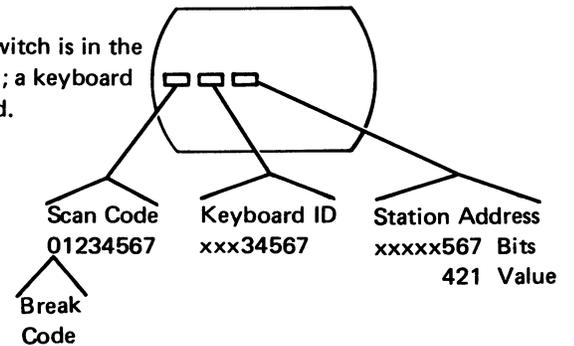
To see this test display:

- Power off.
- Switch to the Test mode.
- Power on.
- Press and hold down any key.

Note: See *Cable Thru Feature* in the *Features* section of this manual for address switch settings.

Power-On Diagnostic Display

The Status switch is in the Test position; a keyboard key is pressed.



212 TROUBLESHOOTING AIDS—MINI-MAP EXAMPLE

Mini-MAPs provide you with the following three levels of information:

1. A description of the circuit and how it can be tested.
2. A figure showing the circuit line names and pin numbers.
3. A detailed guide that uses a yes and no path of questions that you can follow to isolate the failures.

This procedure is used to give you as much information as possible about the failing circuit.

It is possible the symptoms could change or disappear during probing on an intermittent problem.

All the diagrams use the same format.

Conditions after Power-On

- Describes the normal condition of the circuit after power-on.

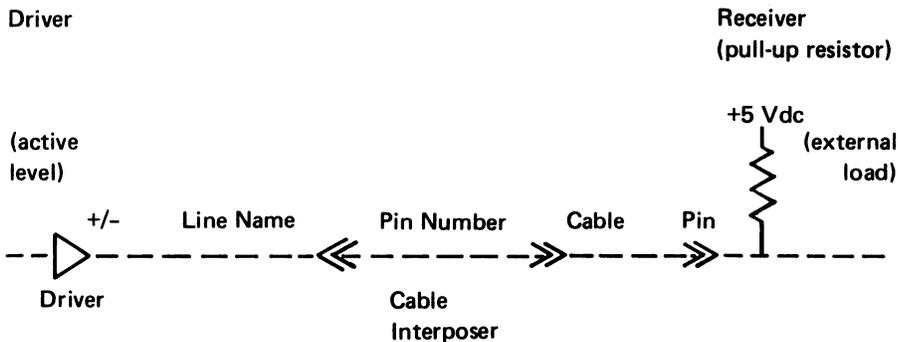
Service Aids

- Lists suggestions as to how the circuit can be tested, and gives additional information about the circuit.

Tools

- Suggests which tool to use.

Sample Circuit



212 (continued)

Is the signal present at the driver?

Y N

Is the line at a Down level?

Y N

- Replace the driver.

The line could be either grounded or logically driven to the Down level by the driver.

- Check for a ground.

Is the line grounded?

Y N

- Replace the driver.

- Replace the FRU that caused the ground.

Note: A pull-up resistor at the receiver will cause an Up level at the receiver if the cable is open.

Is the signal present at the receiver?

Y N

- Repair or replace the interposer or cable.

Is this the last signal line to be checked?

Y N

- Go through the same procedure for any other lines called out by the MAP.

- Replace the receiver.

Suggested action for an intermittent problem:

- Analyze the suspected line; inspect all the connector contacts.
- Replace sequence:
 - FRU A.
 - FRU B.

Note: The FRUs are listed in the order in which they should be replaced (considering repair time, failure rate, and parts cost).

213 PROBE AND PROBING INFORMATION

The general logic probe provides a visual indication of a line level. (Refer to the handbook that comes with the probe.)

Probe Setup and Accessories

Set up the probe as follows:

1. Set the Technology switch to the Multi position.
2. Set the Latch switch to the None position.
3. Set the Gate Ref switch to the Gnd position.

Use the following tips and cable as required:

- GLP extender cable (part 453605)
- SLT type probe tip (part 453826)
- SLT ground tip (use part 453826)
- 6/32 pin tip
- Alligator tip

Probe Power

Connect the probe power leads to the planar (103) as follows:

Black (-) to 1-D-D08
Red (+) to 1-D-D03

Probe Ground

Unless the mini-MAP specifies otherwise, ground your probe at 1-B-D08.

Probe Light Conditions

Two lights are used to indicate status. The two lights indicate four conditions:

Condition	Lights	
	UP	DOWN
Proper logical Up level (+)	On	Off
Proper logical Down level (-)	Off	On
Pulsing ¹ between valid levels	On ²	On ²
Invalid signal level	Off	Off

¹Pulse = Up to Down to Up or Down to Up to Down.
²Both lights are on, one light is on continuously while the other light turns on and off, or both lights turn on and off.

213 (continued)

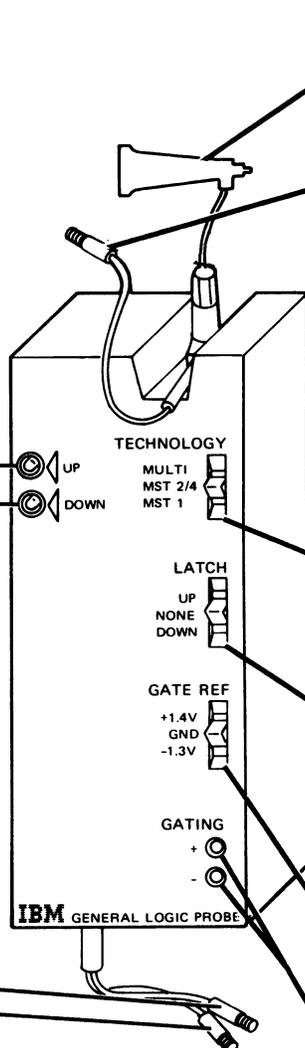
Probe

Indicator Lights

Power Leads

+Red
-Black

A voltage difference ranging from 4 V to 12 V is needed to power the probe. The black lead is always the most negative.



Test Terminal

Connect the line being probed to this terminal.

Ground Lead

CAUTION

Do not connect this lead to frame ground. Wrong results will occur if this lead is connected to frame ground.

Connect this lead to any *signal* ground near the probe point.

Logic Selector (TECHNOLOGY)

This switch sets the probe to the voltage levels used in the circuit to be tested.

Latch Switch

The Up position allows latching the Up light on a positive pulse. The Down position allows latching the Down light on a negative pulse. The None position resets the lights and prevents any latching action.

Gate Ref Volts Switch

Set the Gate Ref switch to ground (GND).

Gating Terminals

You do not need to use these terminals to probe within the display station.

214 DIAGNOSTIC TEST ROUTINE

- Power off.
- Switch to the Test mode.
- Power on.

Do the diagnostics loop?

Y N

- Use mini-MAP 188.
- Press the G key on the keyboard.

Are the scan code, keyboard ID, and station address fields displayed (to the address switches) correctly (210)?

Y N

- Replace the planar (105).
- Check that this station is configured in the system.
- If OK, use error logout.

215 FUNCTION EXTENSION FEATURE DIAGNOSTICS

The function extension feature diagnostics are run the first time the feature program code is loaded from the controller to the function extension feature card in the display station. These diagnostics are not run automatically at display station power-on.

The diagnostics verify operational data paths, control paths, and storage on the function extension feature card. During execution of the diagnostics, storage is initialized to zero, therefore any feature program load prior to this command is lost.

The feature status response *Diagnostics Failed* bit is set to a 1 if a failure has been detected during execution of the diagnostics. (See *Response Frames, Read Feature Status.*)

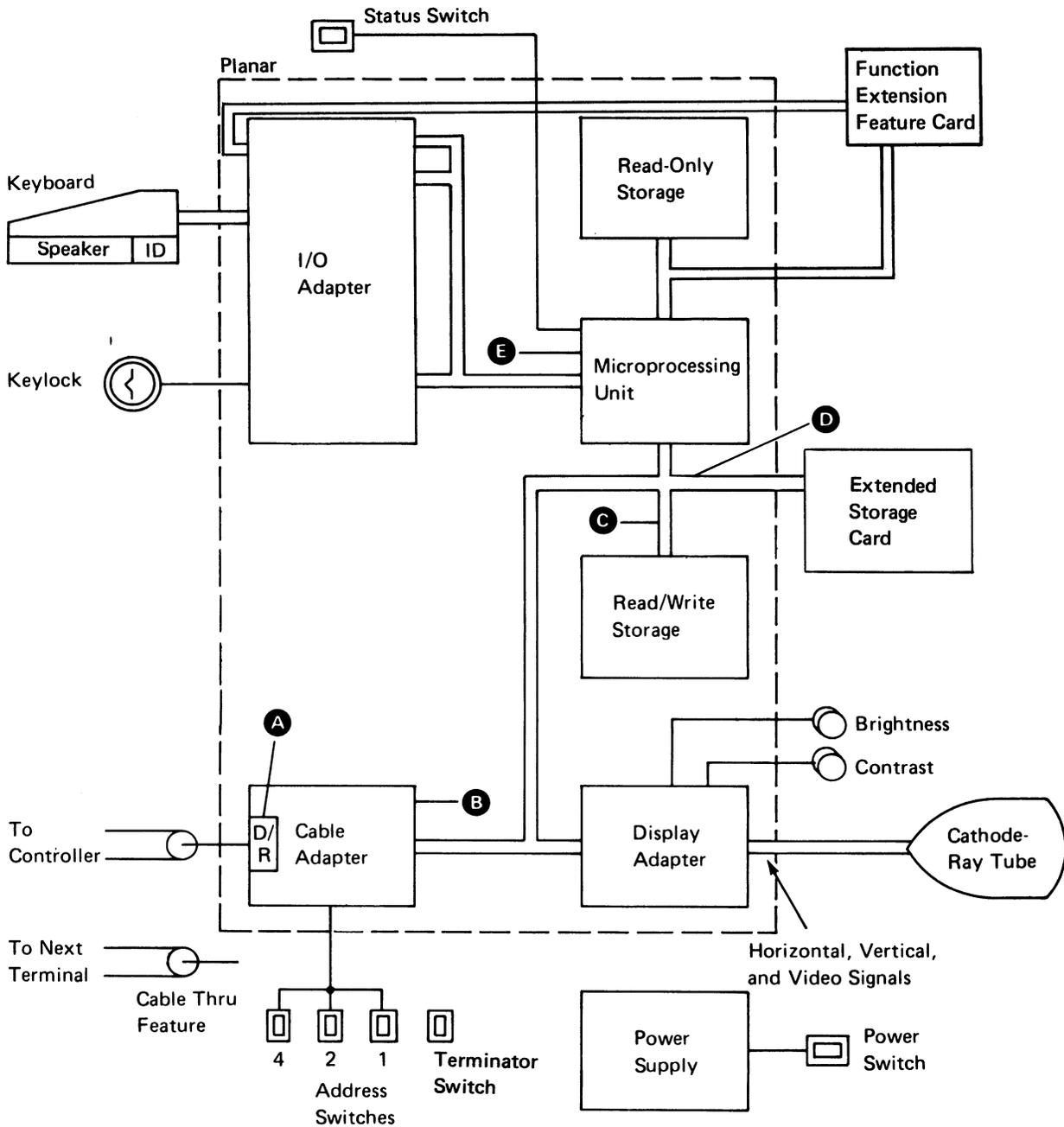
Introduction

The IBM 5253 Display Station is a tabletop, online work station for entering, editing, and displaying word processing information. The display station contains a display screen for displaying data, a movable keyboard for entering and moving information on the display screen, a control unit that contains storage, and a cable adapter for communication with a controller.

DATA FLOW

The next figure shows the data flow of the display station. The following pages of this section describe functions in each of the major sections of the display station.

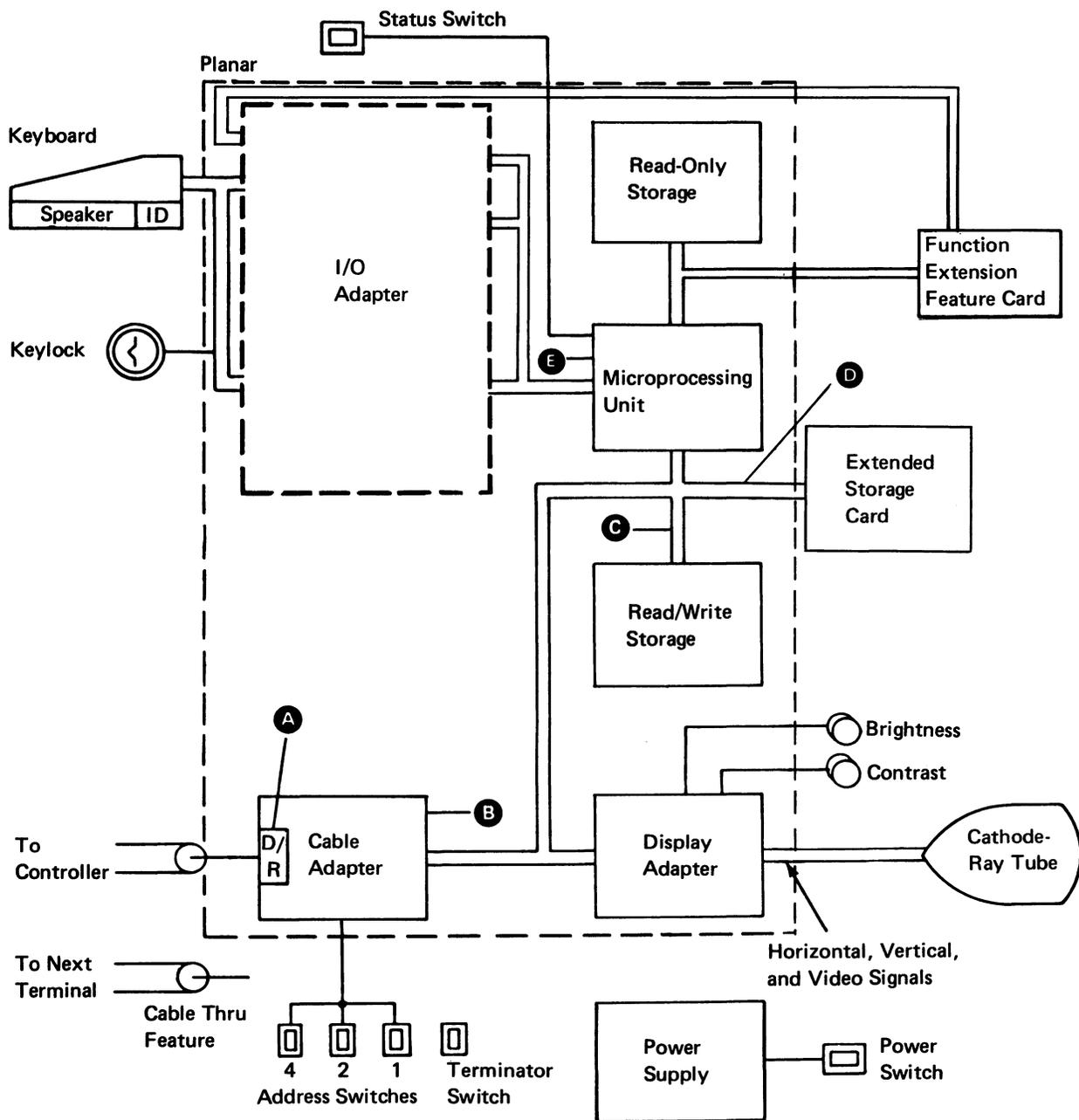
All the electronic logic of this display station, except for extended storage and the Function Extension feature, is on the main planar. The extended storage is on the extended storage card, and the Function Extension feature is on the function extension feature card.



Functional Units

I/O ADAPTER (KEYBOARD, KEYSWITCH, AND FUNCTION EXTENSION FEATURE) CONTROL

The I/O adapter control is a group of registers that control the interface and address functions of the I/O devices. These registers are controlled by the MPU (microprocessing unit) and are loaded with data from the I/O devices. The data is then moved to the read/write storage by the MPU.



KEYBOARD

The keyboard has three major parts: key modules, a pad printed circuit board, and a logic printed circuit board. Key modules, including the keytops, are the switches the operator presses. A pad printed circuit board below the key modules senses, by capacitive coupling, that a key has been pressed. The logic printed circuit board, which is attached to the pad printed circuit board, contains a scan counter that converts the signal that a key was pressed to a scan code.

The scan code is loaded into an eight-position buffer on the logic printed circuit board, while the keyboard signals the keyboard adapter control that a keystroke is ready to be sent. A strobe pulse moves the keystroke scan code to the keyboard adapter. The scan code moves through the display station to the controller. The controller interprets and converts the scan code to the character indicated by the keyboard. The keyboard identification specifies how the scan code is interpreted.

Depending on the operating mode, all keys can generate a break bit. The break bit is the most significant bit of the eight bits of data transferred from the keyboard to the controller. The break bit is active when a key is held down, or for Shift, Lock, Enter, or Code keys, when the key is let up.

When a typamatic key is held down, the break code shifts to an active (1) level after 600 milliseconds. The 1 level is a flag to the controller that the key is in typamatic mode. The controller determines if typamatic mode is allowed for this key. If typamatic mode is allowed, the controller determines what the rate should be. The controller then allows reloading the character buffer with the scan code. For maximum typamatic rate, the buffer is reloaded 15 times per second (once for each scan code cycle). The controller selects different rates depending on whether the buffer is loaded on every scan code cycle (for example, loading the buffer on every third scan code cycle would produce a rate of five repeated operations per second).

When a Shift, Lock, Enter, or Code key is released, the break code shifts to an active (1) level. This indicates a change in status to the controller.

Speaker

A speaker attached to the keyboard has three functions:

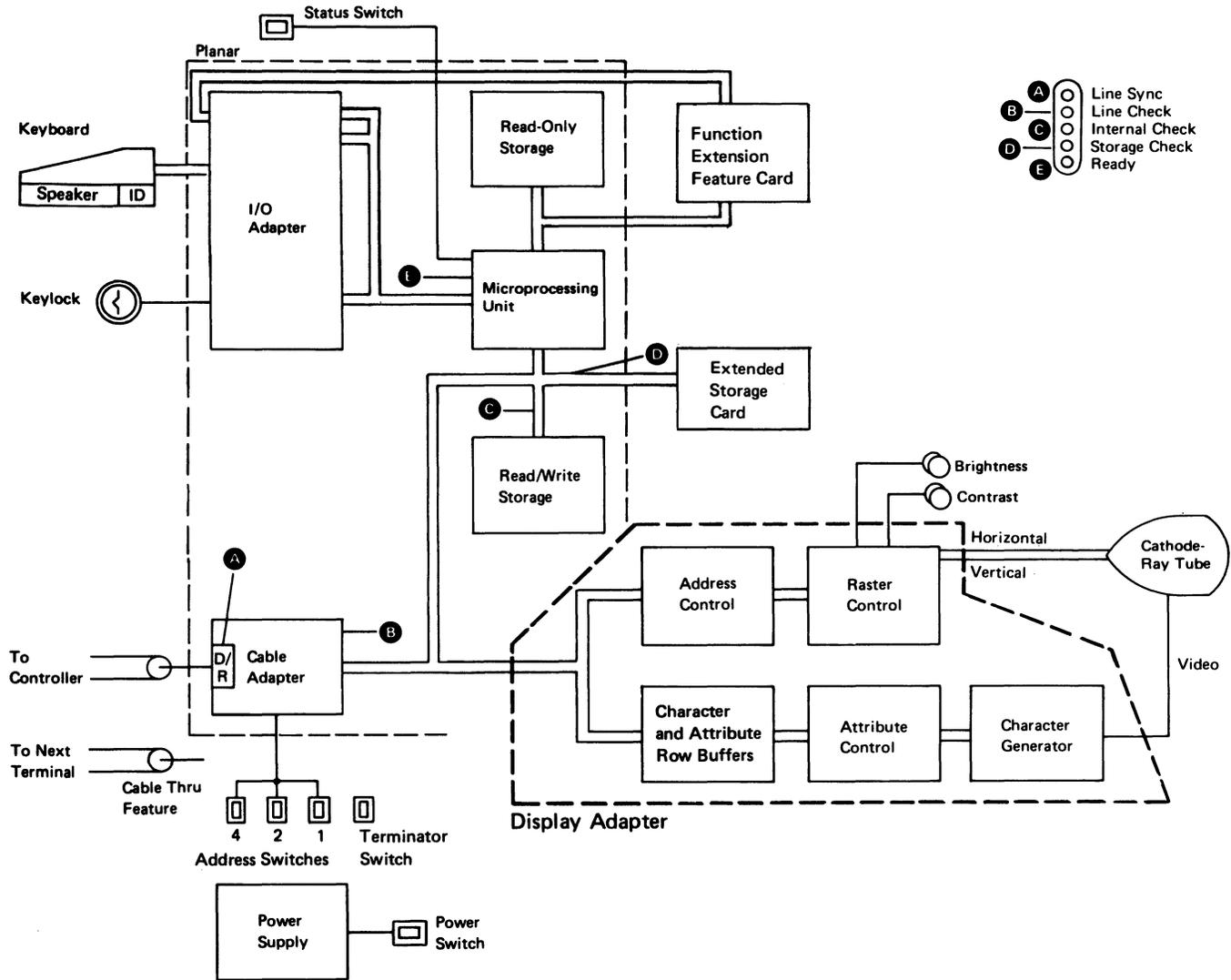
- It clicks once with each keystroke.
- It can generate an alarm to the operator.
- It can serve as a margin alert when the keying reaches the right margin area of a line.

Keyboard Identification

When requested, a 5-bit ID code is sent to the controller. The ID code lets the controller know which keyboard is being used. The ID code is set up when pins are jumpered on a plug board. The plug board is on the keyboard logic printed circuit board.

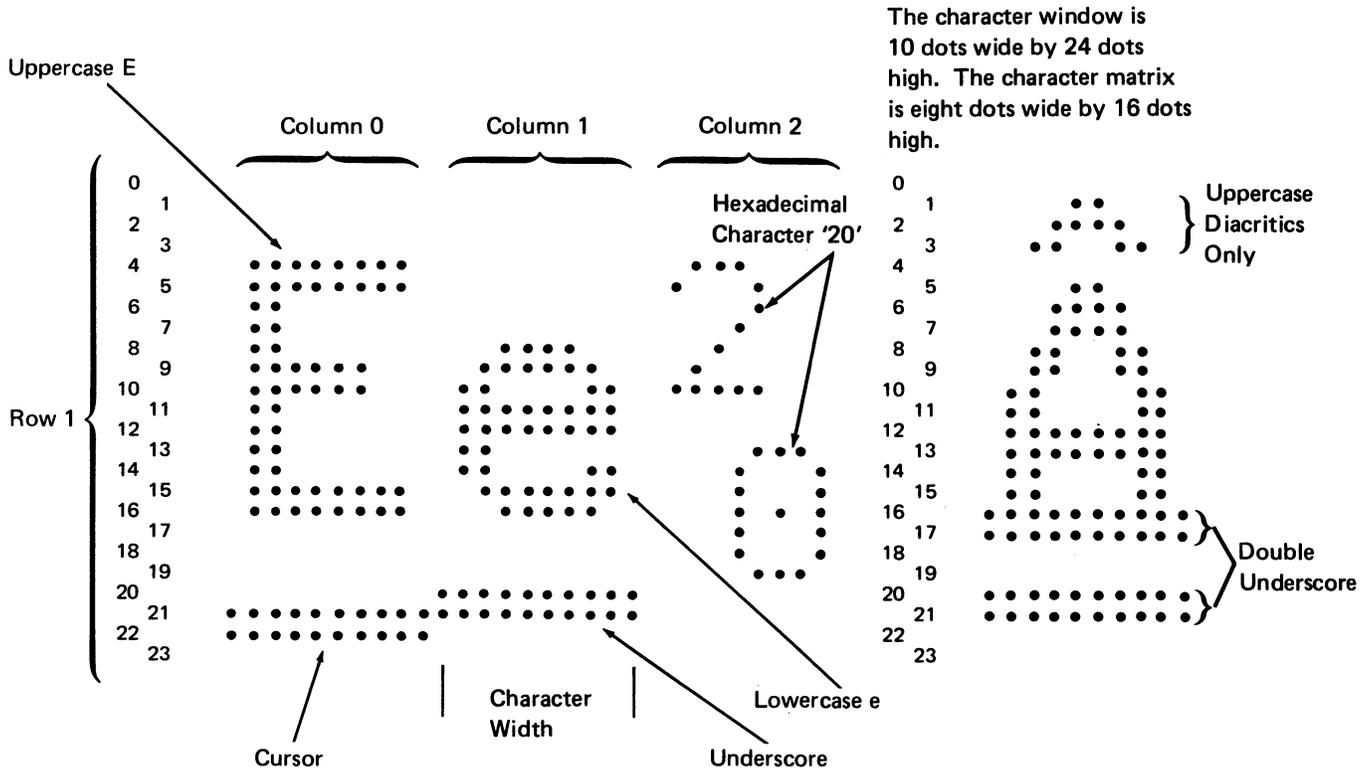
DISPLAY ADAPTER

The display adapter contains the circuits that control the video, horizontal, and vertical drive signals for the display assembly.



Buffering and Displaying

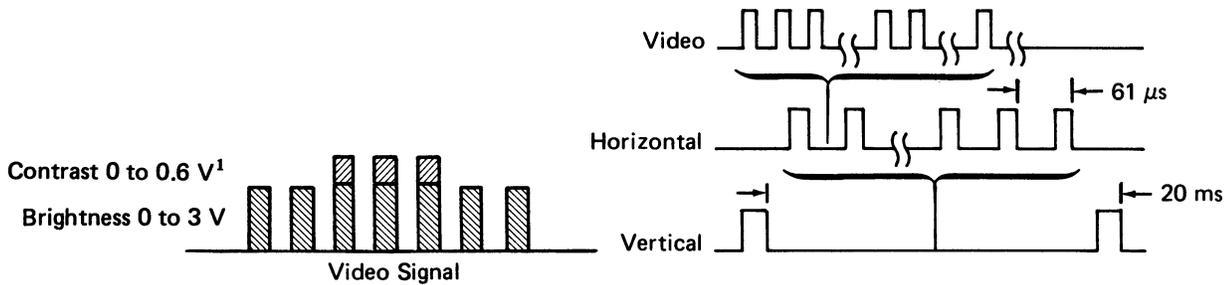
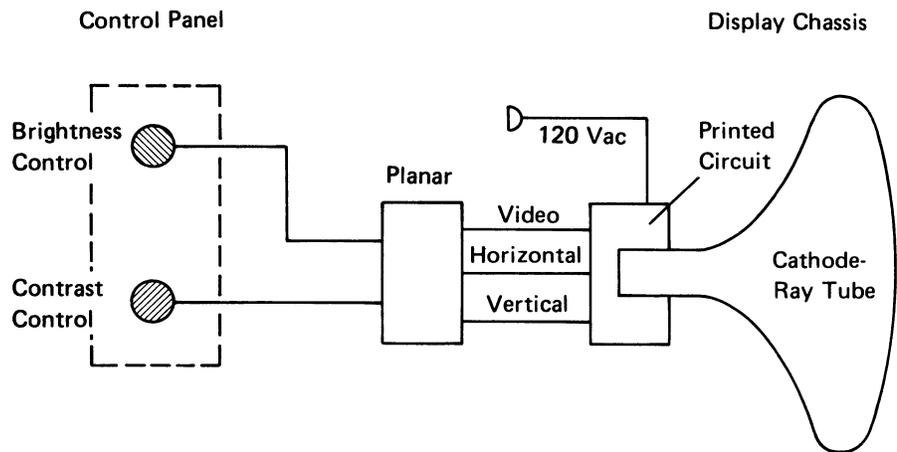
Data that is to be displayed is in read/write storage. The display adapter addresses the read/write storage area for this data, moves the data to one of the two-row buffers in the display adapter, converts the data into a dot pattern by using a character generator, and shifts the pattern onto the '-video' line that carries it to the cathode-ray tube. At the same time, the display adapter determines the display position, and converts the position into the vertical and horizontal drive signals for the cathode-ray tube. This routine is constantly repeated to refresh the display. The generated character matrix is a pattern of eight dots wide by 16 dots (scans) high.



CONTROL PANEL

The control panel has two display controls. The Brightness control determines the light difference between the displayed data and the remainder of the display screen. The Contrast control determines the brightness of the characters that are specified by the high intensity character attribute.

Both controls determine the voltage level of the video signal at the main planar.



¹ 0 to 0.6 V is added to the Brightness level voltage.

Display Screen

Character Attributes

Character attributes control how associated individual characters are displayed on the screen. Character attributes control display blinking, intensity, underscoring, and reverse image. Character attributes also allow a slash, dash, double underscore, or null to be placed on an associated character from the regen buffer. Character attributes are stored in a separate attribute buffer and do not take any space on the display screen. The application program controls character attributes. After power-on, character attributes default to normal intensity, no blinking, no underscoring, no slash, no dash, no double underscore, no null, and no reverse image when the screen is refreshed. Character attributes are active in default value with power-on.

Field Attributes

Field attributes control how fields of characters will be displayed on the screen. Field attributes control column separators, underscore, reverse image, and high intensity. The attribute controls all following characters until another attribute is located. The attribute is placed in the regen buffer and appears as a null character in Normal mode. With the Status switch in the Test mode, the hex code of the attribute is displayed.

Display Screen Indicators

These indicators appear on the display screen. A bright square indicates the *on* condition and a dash indicates the *off* condition. The controller controls all of the indicators except the System Available indicator. Power-on resets all the indicators.

When the display screen indicators are on, they indicate the following:

- **System Available:** indicates that the display station has received a poll or command. This indicator turns off if the display station receives no poll or other command within 200 milliseconds.
- **Input Inhibited:** indicates that the system cannot process any keyboard scan codes.
- **Auto Return:** indicates that this display station will automatically return to start the next line when the line being entered is full.
- **Reset Help:** indicates that the operator must enter either Reset or Help to continue. The indicator turns on when the system detects an operator error. The keyboard is disabled. Pressing the Reset key clears the error indication. Pressing the Help key causes the system to display an explanation of the error and how to recover from it.
- **Device Message:** indicates that operator service is needed at one or more of the devices controlled from this display station.
- **Operator Message:** indicates that a message is waiting for the operator.

A cursor, that is controlled by the MPU or controller, indicates where the next character will be shown on the display screen.

CABLE ADAPTER

The cable adapter consists of the hardware (drivers, receivers, and logic) on the planar; this hardware handles the incoming and outgoing communications between the controller and the display station.

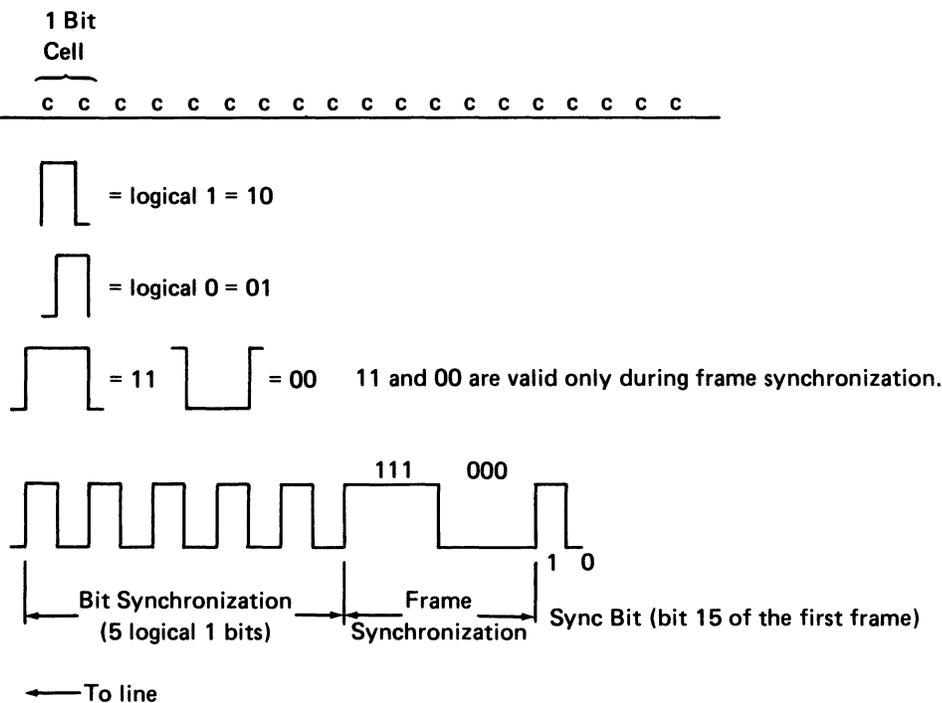
Note: A system cable connects the display station to the controller. See the *System Cable* section in the *Maintenance Procedures* section of this manual and the *Cable Thru Feature* section in the *Features* section.

The 16-Bit Frame

Communications between the controller and the cable adapter at the display station are carried by 16-bit frames that are sent to and from the controller as needed. The system cable carries no signal between frames.

To understand what is to follow, it is necessary to describe the phase encoding used for sending data on the system cable. The data is phase encoded so that a transition occurs during each bit time (a 0 to 1 transition is used for a 0 and a 1 to 0 transition is used for a 1). Because the transition divides the bit into two parts, the term *half bit* will be used in the description that follows. (The data is sent through the system cable in the form of a four-level signal. Refer to the system documents for more information on the phase encoding process.)

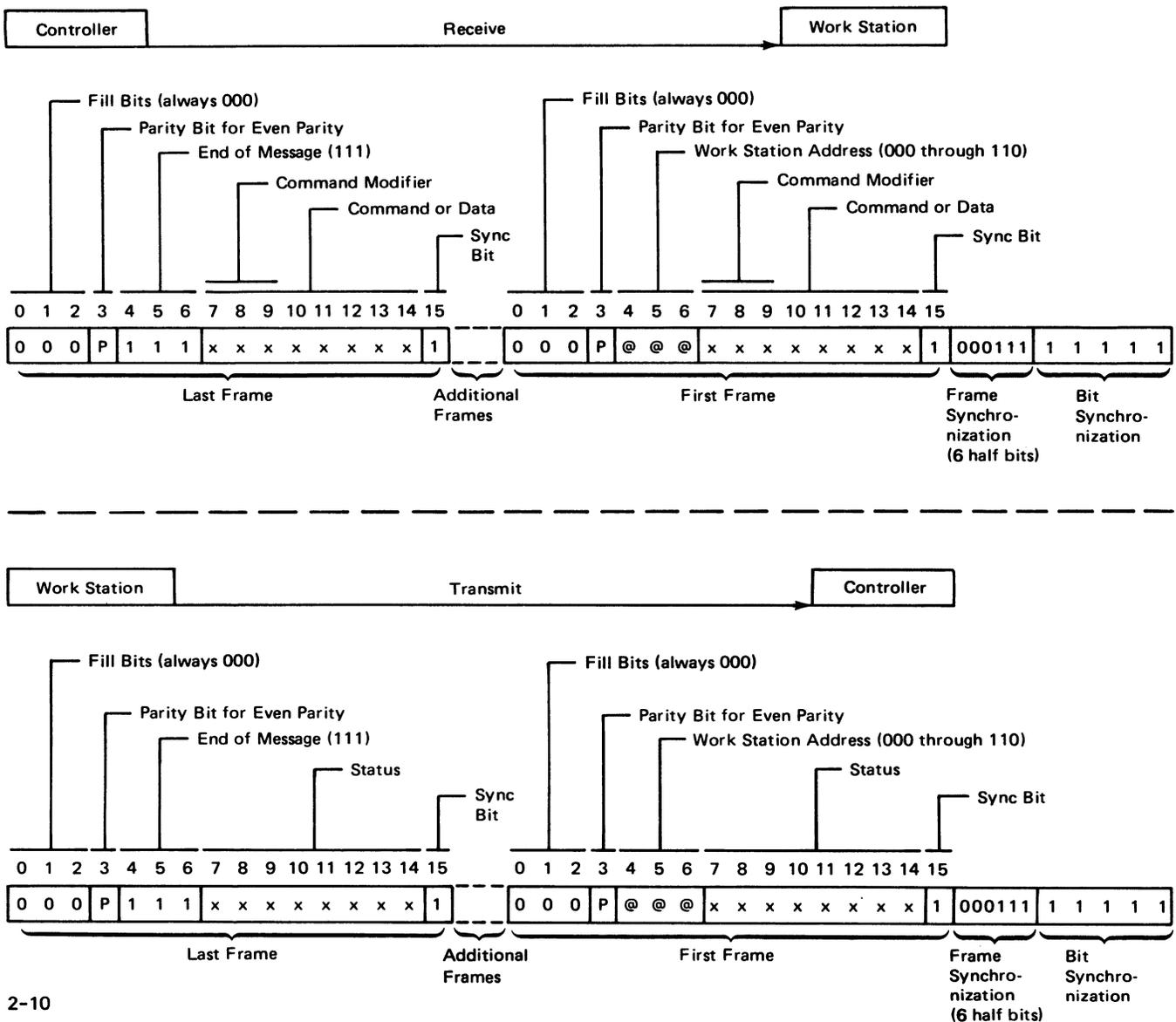
When information is to be sent on the cable, a group of five 1 bits (10101010 half bits) is sent to establish bit synchronization. Immediately after the 1 bits have been sent, a group of three half bit 1's and three half bit 0's is sent to establish frame synchronization. After the frame synchronization half bits have been sent, the frame is sent; the sync bit is sent first.



The maximum transmission rate is 1.0 MHz (16 microseconds per frame). The meaning of each bit of the frame during transmit and receive is shown in the following figure:

The 16-bit frame carries 13 bits of information in each direction. The fill bits, which are always 000, serve as a timing delay. The parity bit makes the active bits in the frame even. The display station decodes the address bits and responds to a specific address. The display station sends a response frame that contains the display station address. A display station address of 111 indicates an end of message and causes a line turnaround. At the work station, line turnaround extends from the time the last bit of a frame (bit 0) has been received until the time the same work station starts sending bit and frame synchronization patterns. Bits 7 through 14 contain the data or commands used by the display station and storage. Bit 15, which is always on, is the synchronization bit for both the controller and the display station.

Transmission Sequences



Commands (Basic)

Note: The binary number in parentheses next to the command is bits 10 through 14 of the command frame.

Clear (10010): Clears the addressed feature or display station from the present value of the address counter to the present value of the reference counter, inclusive.

EOQ (00010): Designates the end of the command queue. Bits 8 and 9 of the command frame must be on (1). Only poll commands will be accepted until a not busy status is returned to the controller in response to a poll command.

Insert Character (00011): Is followed by one data frame containing a character to be inserted at the address counter location.

Load Address Counter (10101): Is followed by two data words. When the regen buffer is addressed, bits 7 through 14 of the data words are written in the address counters for both the regen and attribute buffers. If the attribute buffer is addressed, the data words are written only in the address counter for the attribute buffer.

Load Cursor Register (10111): Is followed by two data words and loads the cursor register similar to the way the load address counter command loads the address counter.

Load Reference Counter (00111): Is followed by two data words and loads the reference counter similar to the way the load address counter command loads the address counter.

Move Data (00110): Moves data between limits set by the value of the address counter and the value of the cursor register. The data will be moved to the address value of the reference counter, byte by byte. Each byte moved will cause the address counter and the reference counter values to be updated.

Poll (10000): Is sent from the controller to the display station and starts the transmission of one or two status words per poll command. The poll command acknowledges and resets a line parity error from the display station. It also acknowledges receiving the last status transmission from the display station.

Read Activate (00000): This command is sent after the setup specified by a read command is completed and starts the transmission of the requested data.

Read Base ID¹ (01100): Requests the retransmission of one ID word. This command can be used to determine the characteristics of attached work stations.

Read Between Limits¹ (11010): Causes data to be returned from an area in read/write storage that is within the limits set by the address counter register and the reference counter register.

Read Data (01000): Starts the transmission of one byte of data from the display station to the controller. The byte location is determined by the value in the address counter.

Read Keyboard ID¹ (01100): Determines the type of keyboard.

Read Registers¹ (11100): Starts the transmission of six data words containing the contents of the address counter, the cursor register and the reference counter, in that order.

¹A command that must be followed by either a read activate or a write activate command.

Reset (00010): Can be done by addressing the base (regen buffer) or keyboard. Addressing the regen buffer initializes the machine to the same state as power on. Addressing the keyboard operates the speaker for each character that has been accepted from a programmed typamatic key. Addressing the extended attribute buffer is the same as the EOQ command.

Scroll (01001): Controls scrolling of the operating unit in the display window. Scrolling also allows out-of-sequence lines to appear in the window. Scrolling can be controlled vertically on a line basis. Horizontal scrolling can be in groups of 50 characters.

Search for Argument (01011): Is followed by one data frame that contains the byte (argument) to be searched for. The station searches the appropriate buffer starting at the address counter value and continuing either forward or backward until the argument is found or the reference counter value is reached and examined. The argument location is in the reference counter after the search.

Search Next Attribute (00100): Causes the display station to search the read/write storage for the next field attribute in either the regen or extended attribute buffer. Search starts at the address counter value and continues until an attribute is found or the end of the buffer is reached. The first-found attribute location, minus 1, is in the reference counter after search. Search is only in the forward direction.

Search Next Null (10100): Causes the display station to search read/write storage for the next null in either the regen or extended attribute buffer. Search starts at the address counter value and continues until a null is found or the reference counter value is reached and examined. The first-found null location, minus 1, is in the reference counter after search. Search is only in the forward direction.

Set Mode (10011): Causes the display station to receive one word that is specified as a mode control. This command must be sent before the display station can make any multiframe responses. The set mode command is also used to select whether the display, after power-on reset, will contain data from read/write storage (Normal mode), or be blank except for the indicators.

Write Activate (00001): Immediately precedes the data transmitted by the controller after the work station has been set up by a write command and causes the work station to start receiving the data from the controller.

Write Control Data (00101): Controls the display screen during error conditions, conditionally resets the exception status, controls the keyboard speaker during input inhibit, controls the audible alarm, and controls the speaker for right margin alert.

Write Data and Load Cursor (10001): Is followed by 1 to 14 data frames. The data is stored at the address value contained in the address counter, which is updated after each data frame stored. The cursor register is updated to each new value in the address counter only if the command is not addressed to the EAB.

Write Data and Load Cursor to the Indicators and Switches¹ (1010001): Is followed by 1 data byte, which contains the control information for the display screen indicators.

Write Immediate Data¹ (11101): Causes the display station to store all the data the controller sends. If the storage area is exceeded, a storage overrun error occurs with excess data not stored.

¹A command that must be followed by either a read activate or a write activate command.

Commands (Function Extension Feature)

Note: The binary number in parentheses next to the command is bits 11 through 14 of the command frame.

Read Status¹ (0100): Causes two bytes of data to be returned to the controller. The two bytes of data indicate the status of the Function Extension feature.

Run Diagnostics (0110): Causes execution of the function extension feature diagnostics. Feature program storage is initialized to zeros during the diagnostics.

FPL-Initial¹ (0011): Starts the feature program load sequence and is followed by two data words specifying the byte count to be transferred with the associated write activate command. It readies the display station for the transfer of the feature program from the controller to the function extension feature card.

FPL-Text¹ (0101): Is used to continue loading feature program code to the Function Extension feature in a manner similar to the FPL-Initial command. It is followed by two data words specifying the byte count to be transferred with the associated write activate command. The last two bytes transferred by the last FPL-text command contains the checksum calculated by the controller.

FPL-Final (0111): Signals completion of the feature program load sequence. It is followed by one data byte that is used to control checksum calculation and feature program execution.

FPL Abort (1011): Is used to stop the feature program load sequence between FPL-Initial and FPL-Final.

Execute Program (1001): Is used to transfer program control to the feature program loaded on the function extension feature card.

Get/Put¹ (1101): Is used to transfer data between the controller and the function extension feature card. The function of this command is to save data for the feature program when the feature program is not active.

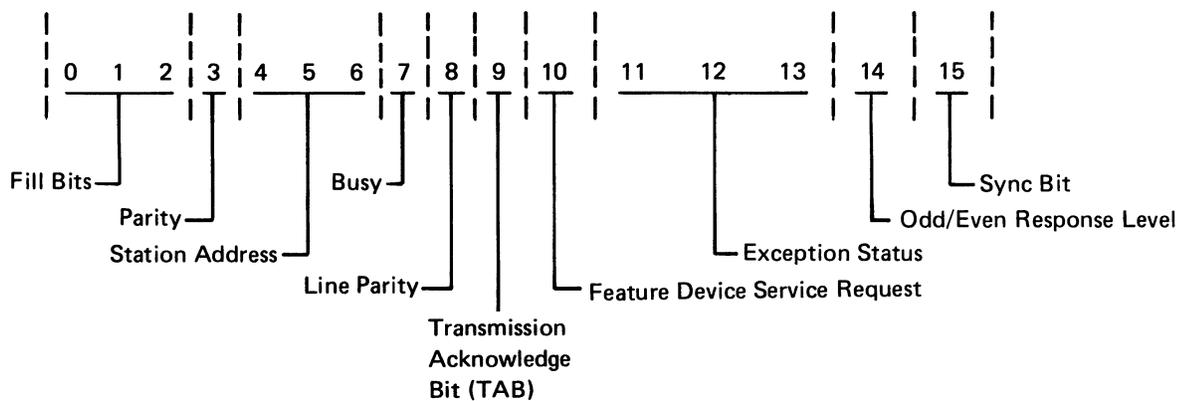
¹A command that must be followed by either a read activate or a write activate command.

Response Frames

Poll Response

A response frame is returned to the controller after the display station is polled following a power-on reset. The controller receives the first response frame and returns a set mode command.

A two-frame response is made to every poll command after the set mode command. The second frame contains a station address of all 1's (indicating the last message frame) and the scan code in bits 7 through 14. The first frame in the response contains the status information as follows:



Bit 7

- 0 = Display station not busy
- 1 = Display station busy

Bit 8

- 0 = No line parity error found
- 1 = Line parity error found

Bit 9

- Initialized to zero at power-on.
- Toggles when the first command in the queue is executed, and after each transmission.
- Status is valid only during not busy time.

Bit 10

- 0 = No feature device service request
- 1 = Feature device service request

Bits 11, 12, and 13

These three bits are encoded to indicate the exception status as follows:

11	12	13	Description
0	0	0	No exception status
0	0	1	Null or attribute error
0	1	0	Activate not valid
1	0	0	Command or device ID not valid
1	0	1	Input queue or storage overrun
1	1	0	Register value not valid
1	1	1	Power-on transition

Bit 14

By analyzing bit 14, the controller can determine if the information in the response frame received is the same as the previous response frame, or if the information has changed. Bit 14 is set to zero (0) after power-on. Any change in the response frame changes bit 14 from its previous condition.

Read Device ID Responses

The read device ID responses are returned when the read device ID command is issued to the base machine or to the keyboard. The response is logged into byte 0 of the device status word of the error log. For a read device ID command addressed to the base the following is logged:

- Device status byte 0 bits

Bits 1, 2

0 0 = 5254

0 1 = 5253

Bits 3, 4

0 0 = Display

Bits 5, 6, 7, 8

1 0 0 0 = 5253 or 5254 basic storage size

For a read device ID command addressed to the keyboard the following is logged:

- Device status byte 0 bits

Bits 4, 5, 6, 7, 8

0 0 0 0 0 = No keyboard attached

0 0 0 0 1 = US 92-character keyboard

0 0 1 1 0 = US 96-character keyboard

0 1 1 1 0 = Germany/Austria

0 1 1 1 1 = France/Belgium

1 0 0 1 0 = Canada

1 0 0 1 1 = Norway

1 0 1 0 0 = Denmark

1 0 1 0 1 = United Kingdom

1 1 0 0 1 = Italy

1 1 0 1 0 = Netherlands

1 1 1 0 0 = Switzerland (French)

1 1 1 0 1 = Switzerland (German)

1 1 1 1 0 = Sweden

Read Feature Status Response

The read feature status response is returned when the read status command is issued to the Function Extension feature. Two bytes of data are to be returned to the controller indicating the status of the function extension feature card. The first byte of the response is logged into the function extension feature device status byte of the error log.

- Function extension feature device status byte 0 bits

Bit 0 = Diagnostic complete

Bit 1 = Diagnostic failed

Bit 2 = Parity error detected

Bit 3 = FPL complete

Bit 4 = Checksum error

Bit 5 = FPL in progress

Bit 6 = Parity error during diagnostics

Bit 7 = Feature program active

The second status byte is used to indicate the failure mode when the diagnostic failed bit (Bit 1) is on in status byte 0.

- Function extension feature device status byte 1 bits

Bit 0 = Pattern test failure

Bit 1 = Address test failure

Bit 2 = Read parity checker failure

Bit 3 = I-Fetch test failure

Bit 4 = I-Fetch parity checker failure

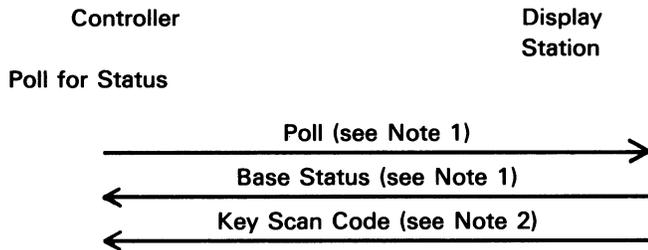
Bit 5 = Reserved

Bit 6 = Reserved

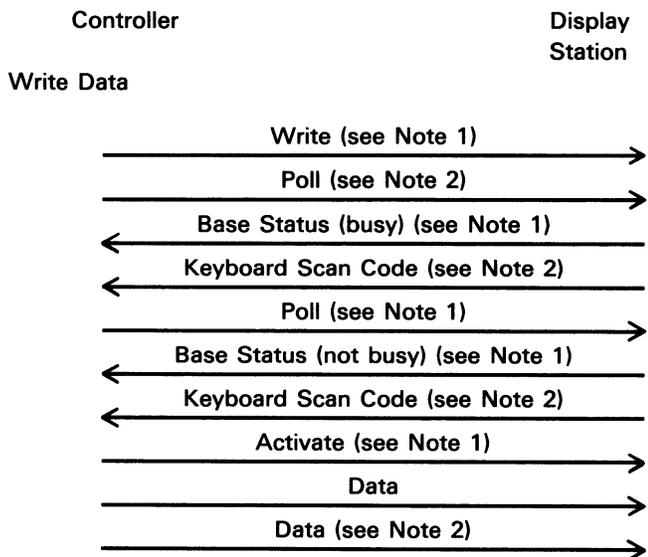
Bit 7 = Reserved

Interface

The following figure shows action and synchronization between a display station and a controller. All exchanges are started from the controller by a command. The flow is in two directions, one direction at a time. The arrow (→) indicates the exchange of one 16-bit frame in the indicated direction.



- The controller initiates a poll sequence.
- Base status of busy or not busy is returned to the controller.
- Base status is followed by a key scan code frame after a set mode command. When the display station has no scan code to move to the controller, zeros will be transferred.
- If a keyboard overrun occurs, a scan code of all 1's will be returned.
- The controller translates the scan code; a write data and load cursor command returns the scan code to the display station.

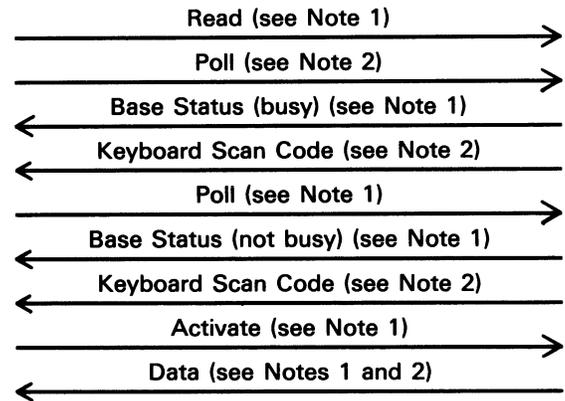


- A write operation is initiated and handled the same as a read operation, the difference being that the transferred data is from the controller to the display station.

Controller

Display Station

Read Data



- The controller initiates a read operation.
- The display station receives a poll frame, and responds with a busy base status and the automatic keyboard status frame. The display station, at this time, is moving data queues in preparation for the next operation.
- The controller continues to poll the display station until it responds with a base status of not busy.
- The controller issues an activate command, to start the read operation.
- The display station shifts the requested data onto the twinaxial line to the controller.

Notes:

1. The frame contains synchronization and instructions to switch the display station or controller to receive mode.
2. The frame contains an end-of-message delimiter: station ID of all ones (111).

Data Transfer

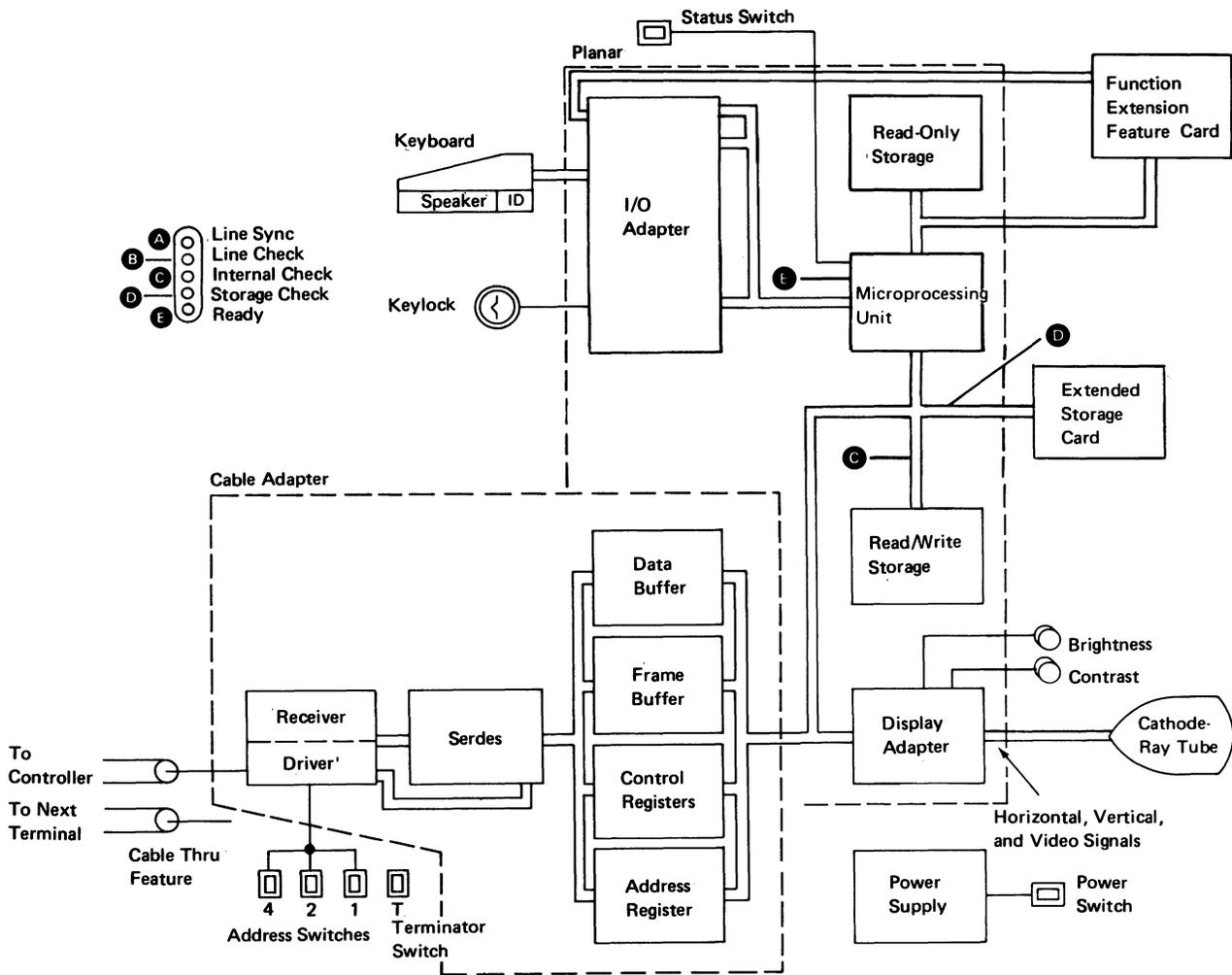
During data transfer, the cable adapter has three major functions:

- To respond to polling
- To shift data to the customer system cable for transmission to the controller
- To receive data from the cable and decode the data for either or both of the following:
 - Commands
 - Transferring data to read/write storage

The cable adapter finds the display station address on the first frame of a message transmitted. The address for a single online display station is 000. When this address is received and recognized, and a response is returned, the polling is complete.

Data to be transmitted to the controller is moved from read/write storage, through a serializer/deserializer (serdes) register, and to the customer system cable under control of the cable adapter.

Received data is moved into the serdes until the sync bit is in the high-order position. The serdes is stopped, permitting time for the data to be moved to read/write storage.



Microprocessing Unit (MPU)

The MPU (microprocessing unit) is the control center of the display station. The MPU receives data from the keyboard and from input/output controls. The MPU controls the displaying of data, and the flow of information to and from the controller. It is a processing unit controlled by a microprogram, and performs internal machine operations such as testing and comparing data, checking for machine errors, operating the I/O devices, and storing data in and getting data from the read/write storage.

The major parts of the MPU are read/write and read-only storage, storage registers, work registers, and an arithmetic and logic unit (ALU).

Read/Write Storage

Read/write storage is divided into three major parts: a display regeneration area, an I/O device control area, and an attribute buffer. The I/O device control area is also divided into three parts: a display control area, a cable adapter control area, and a microprocessing unit work space. The attribute buffer is on the extended storage card.

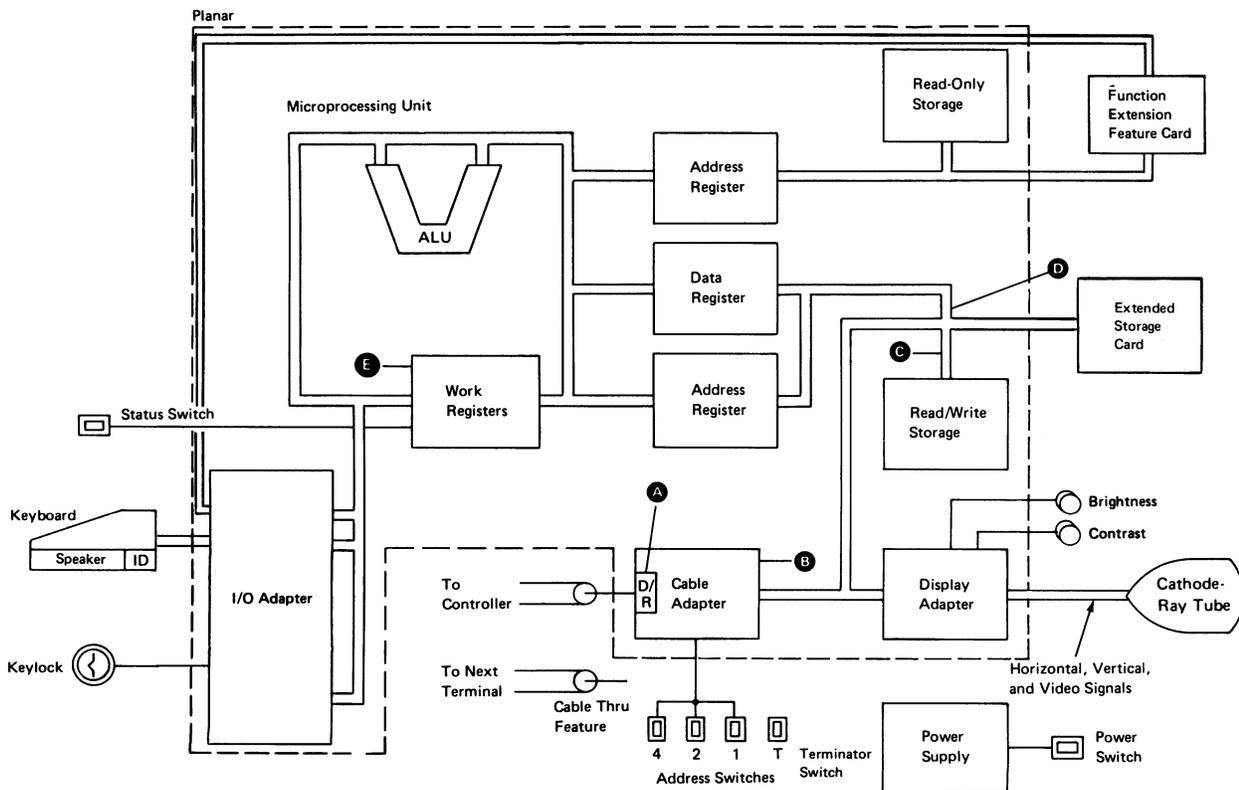
Internal Processing Queue

Each display station keeps a work area large enough to hold up to 16 frames of commands or associated data. Commands and associated data are executed from this work area in a first-in, first-out method.

Control Registers

Each display station contains six registers (two sets of three) that the controller can access. Each register is an address pointer. The registers are named the cursor, address counter, and the reference counter. One set of three accesses the regen buffer and another set of three accesses the extended attribute buffer (extended storage).

The cursor register controls the location of the cursor on the display screen. The address counter register is used while reading and writing data. The reference counter register is used when moving data from one display area to another.



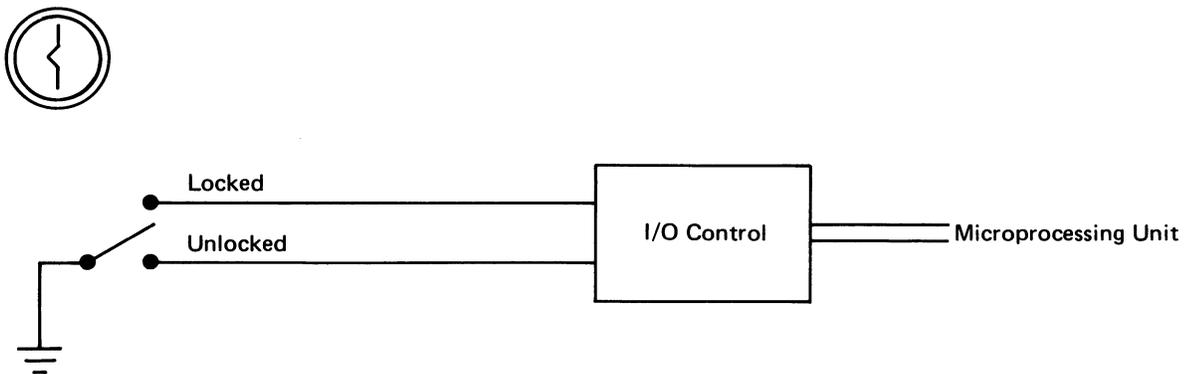
KEYLOCK FEATURE

The Keylock feature allows the display station to be locked for security.

When the display station is locked and the Status switch is at the Normal position, the display screen is blank except for the system indicators on the right side of the screen. Data displayed when the display station is locked is controlled by the application program. Keyboard data entered while the display station is locked will not be displayed by the display station.

The power-on diagnostic occurs whether the display station is locked or unlocked.

Keylock



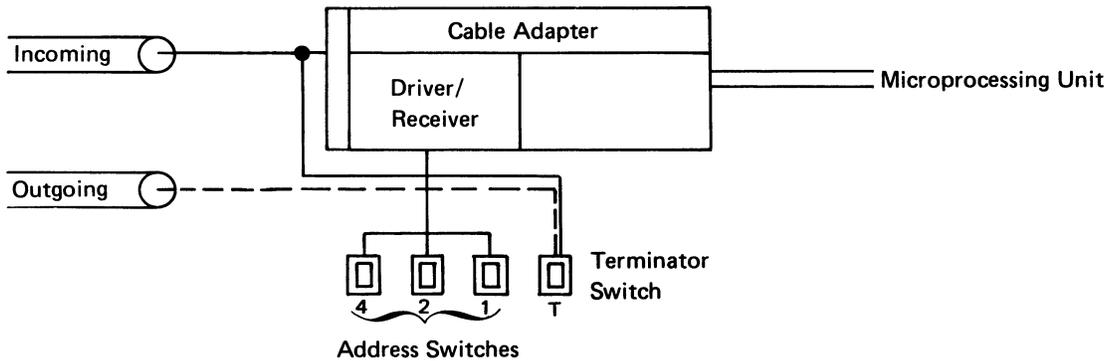
CABLE THRU FEATURE

If more than one display station is connected in series on the customer system cable, the Cable Thru feature must be installed on each of those display stations to supply connectors for the customer system cable to the next display station in the series. The last display station in a series does not require the Cable Thru feature. A maximum of seven display stations (six on the Model 20) can be connected in this series. An IBM 5253 Display Station without the Cable Thru feature is terminated internally and must have a station address of 000.

This feature has four switches. The first three switches permit a unique address for the display station (addresses range from 000 to 110). The fourth switch permits termination for the last display station in the series.

See the *Internal System Cable and Terminator Switch* (171) for additional information on the terminator switch.

Note: Do not leave the twinaxial cable disconnected when servicing the display station with the Cable Thru feature. When this cable is disconnected, other devices are taken offline. An adapter (IBM part 7362230 or equivalent) can be used to connect the twinaxial incoming and outgoing cables; in this way the display station is bypassed.



Address	Address Switches		
	4	2	1
0	off	off	off
1	off	off	on
2	off	on	off
3	off	on	on
4	on	off	off
5	on	off	on
6	on	on	off
7	Invalid		

FUNCTION EXTENSION FEATURE

The Function Extension feature provides additional read and write storage and controls for loading a feature program (like 3270 emulation) from the controller and for execution of that program in the display station. It also provides the hardware for 3270 emulation.

This feature is attached to the display station as a feature input/output (I/O) device that also has access to the microprocessing unit (MPU) program address and data bus.

The Function Extension feature consists of a feature card, a cable, and two cross-connectors.

The major parts of the Function Extension feature are read/write (R/W) storage, a read-only storage (ROS), an extended storage address register (ESAR), an instruction fetch (I-Fetch) register, and a read buffer.

The Function Extension feature and display processor interface consist of the instruction address/data bus and the I/O address/data bus.

The MPU instruction address and data bus is used to address feature storage and transfer the instructions that are fetched to the MPU. The MPU instruction address register (IAR) contains the feature storage address to fetch the next instruction. The instruction read from feature storage is latched in the I-Fetch register and then transferred to the MPU.

The MPU I/O address and data bus is used to read and write data to and from the Function Extension feature. Two MPU I/O registers are used for data and device addresses. The ESAR on the feature card is used to address feature R/W storage for a read or write command and ROS if a parity check is detected. Data read from feature R/W storage is latched in the read buffer on the feature card until it is transferred to the MPU I/O data register.

R/W storage on the feature card provides storage for feature program code loaded from the controller. ROS on the feature card contains the program necessary to support feature diagnostics, feature program load, program transition control, and error reporting and recovery.

Commands addressed to the function extension feature card, with a feature device address of X'B', will give program control to the feature ROS program.

Load Feature Program

The FPL-INITIAL command initiates the loading of the feature program into R/W storage. The function extension feature diagnostics are run if they have not been run prior to this command. If no failures are detected, the display station is made ready for the transfer of feature program code. Program code is loaded from the controller and temporarily stored in the extended attribute buffer (EAB). The code is then moved from the EAB to R/W storage addressed by the ESAR. FPL-TEXT commands continue to load feature program code to R/W storage. An FPL-FINAL command signals the completion of the load sequence. The checksum sent by the controller is verified and the EAB is set to null.

Execute Feature Program

The execute feature program command is used to transfer program control to the feature program loaded in R/W storage. The MPU IAR contains the address for addressing R/W storage or ROS. Instructions are read from storage, latched in the I-Fetch register and then executed by the MPU. A parity error will force a ROS address in the ESAR for the error logging and recovery program.

The following commands are supported by the feature ROS program:

- Read Status
- Run Diagnostics
- FPL-Initial
- FPL-Text
- FPL-Final
- Execute Program
- FPL-Abort
- Get/Put

Note: See the *Commands* section (2-13) for a description of these feature commands.

Feature troubleshooting and maintenance are provided in the *Maintenance Procedures* section of this manual.

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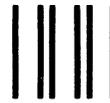
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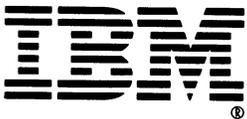
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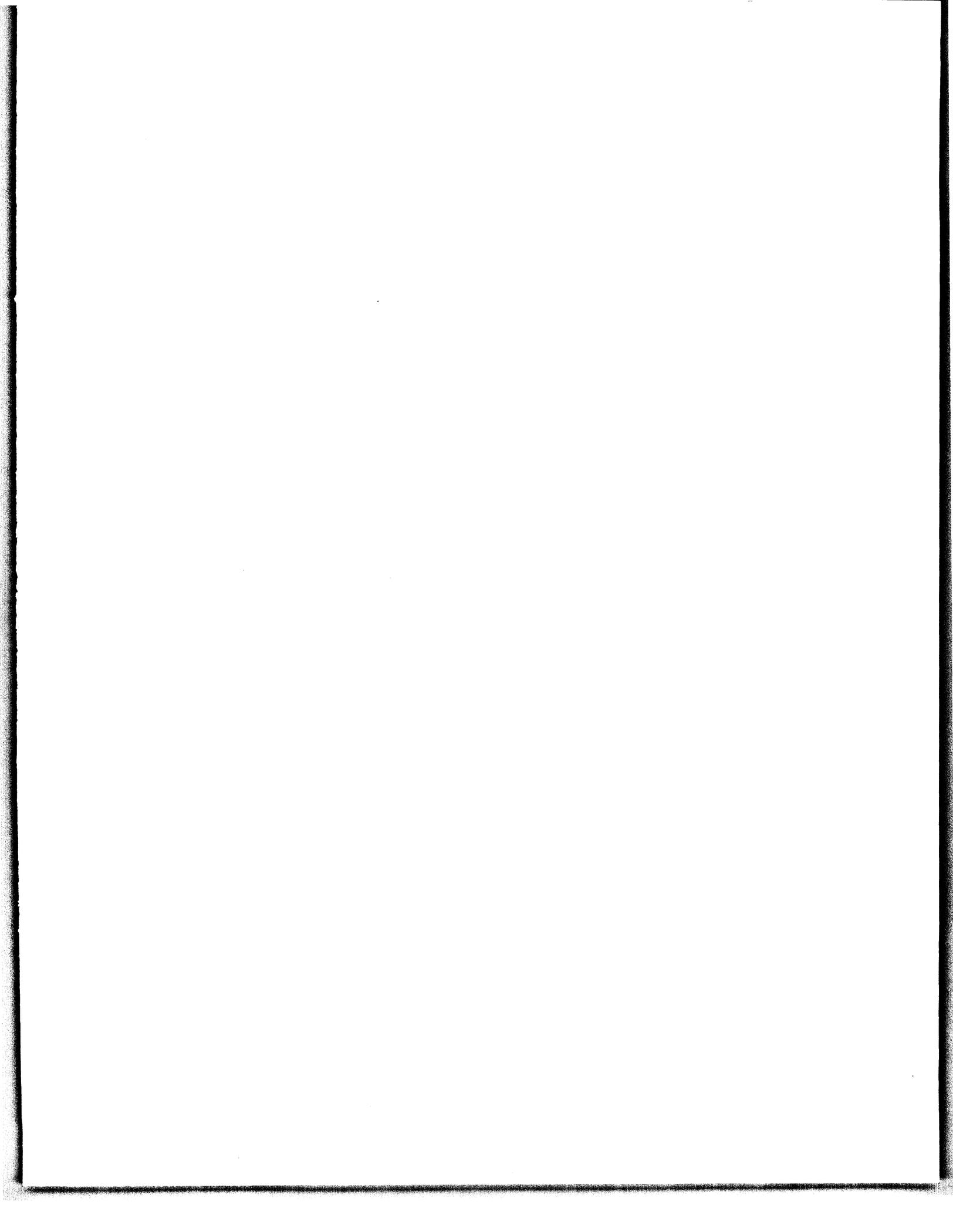


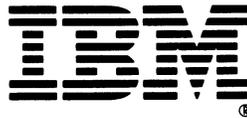
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MAP**

MAP 2

MAP 3

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