

**Maintenance Library**

**3742 Dual Data Station  
Theory-Maintenance**

**SY31-0502-0**

## PREFACE

This is the only manual you need to maintain the IBM 3742 Dual Data Station. The manual contains theory, operation procedures, MAPs, and remove-replace-and-adjust procedures. It also contains part numbers for the field replaceable units (FRUs). All the information is in an easy-to-use graphic format.

The starting point for each call is on page 1-1. Page 1-1 directs you to the *Symptom Index*. The *Symptom Index* in turn, based on the symptom, directs you to a MAP section. If the MAP does not lead you to the cause of the trouble, go back to the *Symptom Index* to look for another MAP. If symptom changes during machine warmup, use the last symptom to start the call. If there are no specific symptoms to guide you, use the *Machine Checkout* procedure.

Each MAP section contains step-by-step procedures to locate the failing part, and the remove-replace-and-adjust procedures to correct machine malfunction.

Look through the manual to see how it is organized and the information it contains.

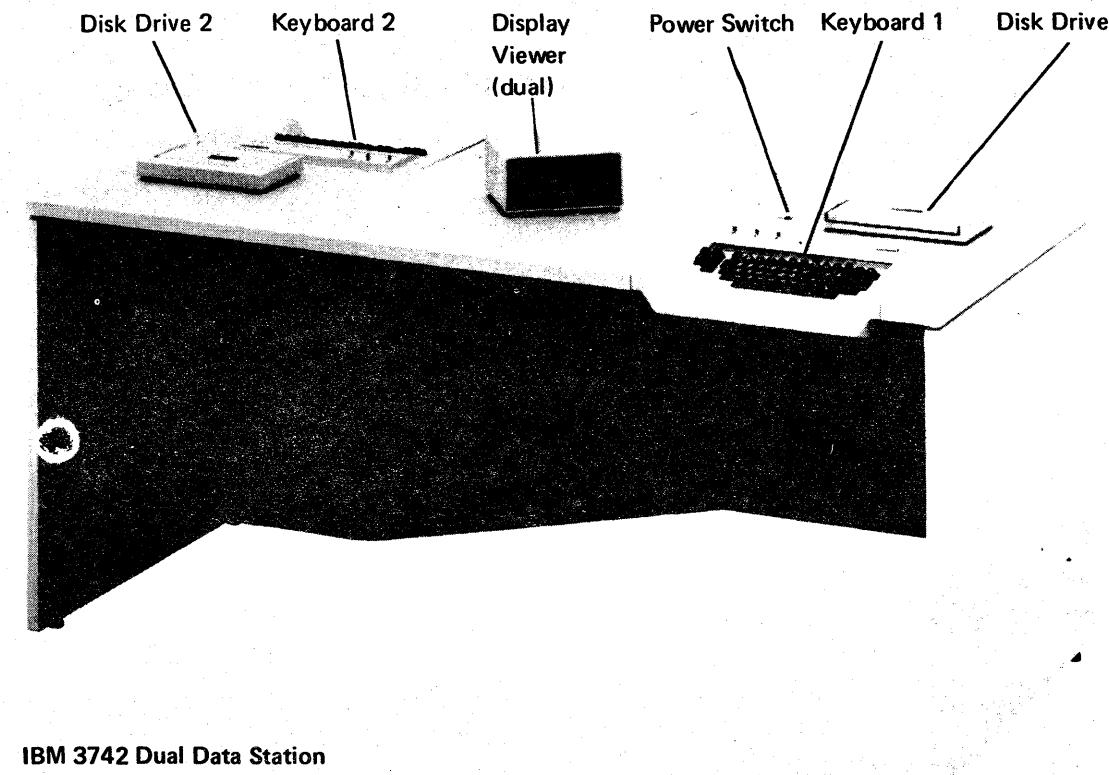
## First Edition (May 1977)

This publication replaces and obsoletes the part-numbered manual previously used with the 3742. A checkout procedure of the phototransistor in the diskette drive has been added to MAP 2-8. Changes concerning the file control card and several minor changes were also made throughout the manual.

Changes are periodically made to the information herein; any such change will be reported in subsequent revisions or technical newsletters.

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**IBM 3742 Dual Data Station**

## MAP Rules Summary

- Start of Call (page 1-1) insures that the highest priority symptom index group is used.
  - Use the most consistent symptom after power on. Use the last error code to be displayed.
  - MAPs are designed to locate an FRU that has a single mechanical or electrical failure. If the symptom changes after an adjustment or FRU replacement, use Start of Call with the new symptom.
  - If you cannot decide which MAP to use, see *Machine Checkout* (page 7-1.1) to guide you to the right MAP.
  - When asked to probe or measure multiple points in a table, probe or measure only until a failure is indicated.
  - The probe UP and DOWN lights will momentarily flash on during power on if the probe is connected to its machine power source please ignore.
  - Definitions:
    1. Load a diskette—Close the disk drive cover (with a diskette in the drive). Usually at the faulty station.
    2. Measure—Use IBM CE multimeter, P/N 452796.
3. Original keyboard or disk drive—The keyboard or disk drive located at the station with reported fault.
4. Other keyboard or disk drive—Opposite of the original keyboard or disk drive.
5. Power down—Turn power switch OFF.
6. Power up—Turn power switch ON. Always wait at least 5 seconds after a power down before powering up to allow for proper power on reset (POR).
7. Probe—Use IBM Universal Logic Probe, P/N 453212.
8. Remove a diskette—Take the diskette out of the disk drive.
9. Unload a diskette—Open the disk drive cover (does not mean remove).
10. Disconnect—Physically/electrically take apart.
11. Reconnect—Physically/electrically put back together.
12. Reinstall—Put the original part back in place of the new part.
13. Replace—Put the new part back in place of the original part.

See *How to Use This Manual* (page 10-5) for other information.

## Safety

To ensure personal safety and the safety of co-workers, each CE should make it a practice to observe safety precautions at all times. The *CE Safety Practice* card is reproduced below for your reference.

### 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 area of power supplies, performing mechanical inspection of power supplies and installing changes in machine circuitry.
3. Wall box power switch when turned off should be locked or tagged in off position. "Do not Operate" tags, form 229-1266, affixed when applicable. 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, the following precautions must be followed:
  - a. Another person familiar with power off controls must be in immediate vicinity.
  - b. Rings, wrist watches, chains, bracelets, metal cuff links, shall not be worn.
  - c. Only insulated pliers and screwdrivers shall be used.
  - d. Keep one hand in pocket.
  - e. When using test instruments be certain controls are set correctly and proper capacity, insulated probes are used.
  - f. Avoid contacting ground potential (metal floor strips, machine frames, etc.) — use suitable rubber mats purchased locally if necessary).
5. Safety Glasses must be worn when:
  - a. Using hammer to drive pins, riveting, staking, etc.
  - b. Power hand drilling, reaming, grinding, etc.
  - c. Using spring hooks, attaching springs.
  - d. Soldering, wire cutting, removing steel bands.
  - e. Parts cleaning, using solvents, sprays, cleaners, chemicals, etc.
  - f. All other conditions that may be hazardous to your eyes. **REMEMBER, THEY ARE YOUR EYES.**

6. Special safety instructions such as handling Cathode Ray Tubes and extreme high voltages, must be followed as outlined in CEM's and Safety Section 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. The maximum load to be lifted is that which in the opinion of you and management does not jeopardize your own health or well-being or that of other employees.
11. All safety devices such as guards, shields, signs, ground wires, etc. shall be restored after maintenance.

**KNOWING SAFETY RULES IS NOT ENOUGH  
AN UNSAFE ACT WILL INEVITABLY LEAD TO AN ACCIDENT  
USE GOOD JUDGMENT — ELIMINATE UNSAFE ACTS**

11/71 S229-1264-2

### CRT SAFETY

You must be especially aware of the dangerous voltage present in a 3742 and the potential hazard presented by an unprotected cathode ray tube (CRT). Thus, the following DANGER notice appears here.

#### DANGER

Voltages of 12,000, 400, +12 and -12 in the 3742. Be careful when working in the area of the high voltage power supply and CRTs. Do not remove the high voltage lead from the CRT following power off until the high voltage lead and anode have been grounded.

All CEs should become familiar with the general safety practices and procedures for performing artificial respiration that are outlined in CE Safety Practices (form 229-1264). In addition, each CE should review general safety CEM #45 on CRT safety.

### Cathode Ray Tubes — Safe Handling

Cathode ray tubes contain a high vacuum and are subject to implosion. Such an implosion can propel flying glass, thus presenting a source of personal injury. Therefore, when handling CRTs, be careful.

### Transportation Handling

1. Cathode ray tubes must be enclosed when received, transported, or otherwise moved from area to area. If they are shipped in a carton, they must be in the original carton or one of equivalent strength and securely sealed to prevent accidental opening. Also, original or equivalent packing materials and/or forms must be placed inside the carton to properly support and protect the tube. If tubes are transported in a unit or piece of equipment, the equipment must be able to contain the glass fragments if an implosion occurs.

2. Each CRT carton must be identified with a **DANGER Cathode Ray Tube Implosion HAZARD** label.
3. All persons handling tubes or in the vicinity of exposed CRTs under vacuum must wear safety glasses.

### Storage

1. Tubes must be kept in the carton or unit except when exposure is required for inspection or test.
2. Adequate storage area must be provided for all CRTs. Tubes should be stacked in such a manner that they cannot easily be tipped over and will not be a problem to handle when removed from the stack. It is recommended that the storage area be away from the normal flow of internal trucking and pedestrian traffic.

### Testing

Personnel who test CRTs must be instructed in the dangers and precautions to be observed.

### Protective Equipment

Persons handling or working with or near unprotected CRTs must wear safety glasses.

### Defective CRT Disposition

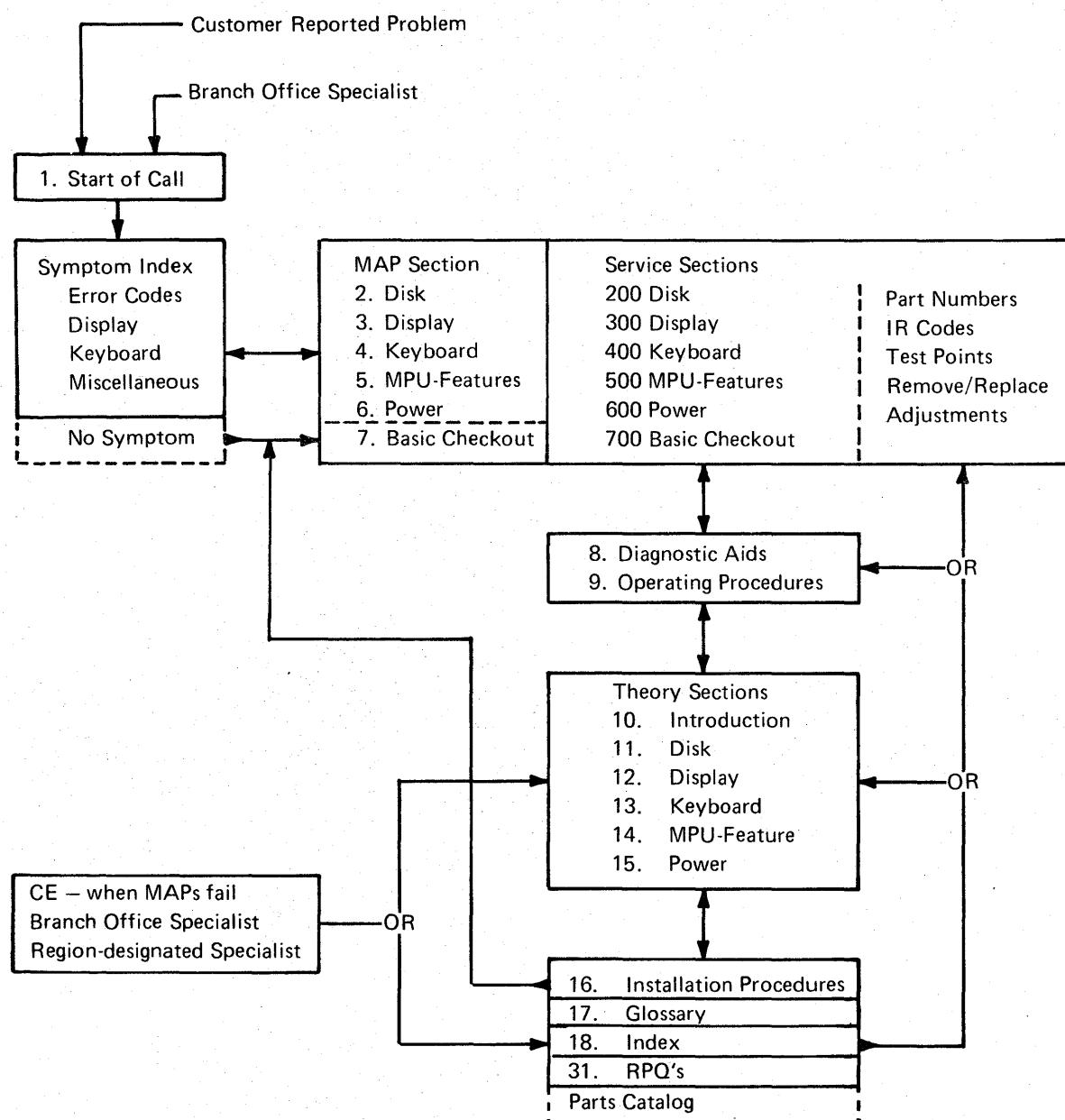
No attempt should be made to repair defective CRTs in the field. A defective CRT should be properly packed and disposed of in accordance with CRT disposition procedures.

Artificial Respiration	
<b>GENERAL CONSIDERATIONS</b>	
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 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.
<b>Rescue Breathing for Adults</b>	
Victim on His Back Immediately	
1. Clear throat of water, food, or foreign matter.	1. Lift head back to open air passage.
2. Blow until you see chest rise.	2. Pinch nostrils to prevent air leak, age when you blow.
3. Lift jaw up to keep tongue out of air passage.	3. Remove your lips and allow lungs to empty.
4. Pinch nostrils to prevent air leak, age when you blow.	4. Listen for snoring and gurglings, signs of throat obstruction.
5. Blow until you see chest rise.	5. Repeat mouth to mouth breathings 10-20 times a minute.
6. Remove your lips and allow lungs to empty.	6. Continue rescue breathing until he breathes for himself.
7. Listen for snoring and gurglings, signs of throat obstruction.	
8. Repeat mouth to mouth breathings 10-20 times a minute.	



Reprint Courtesy Mine Safety Appliances

### NORMAL SERVICE FLOW IN USE OF THE MLM



## START OF CALL

Is there an RPQ Special Feature installed? — — — — — A check mark in the Y or N box indicates the MAP path to follow. If neither box is check marked, determine if an RPQ is installed by looking at the machine history card and for an RPQ Section 31 in this ML.

Is there an error code displayed or reported?

- Power down.
- Remove all diskettes.
- Power up and wait for the machine to warm up. (See Note 1.)

Can you see the failure on the display before a diskette is loaded or a key is pressed? **A**

- Load a diskette at the failing station.

Can you see the failure on the display of the failing station before pressing a key? **B**

Is the reported failure a result of a keying operation?

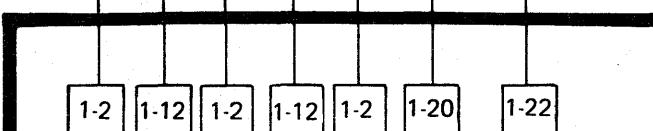
Error Code?  
(use last one)

Error Code?  
(use last one)

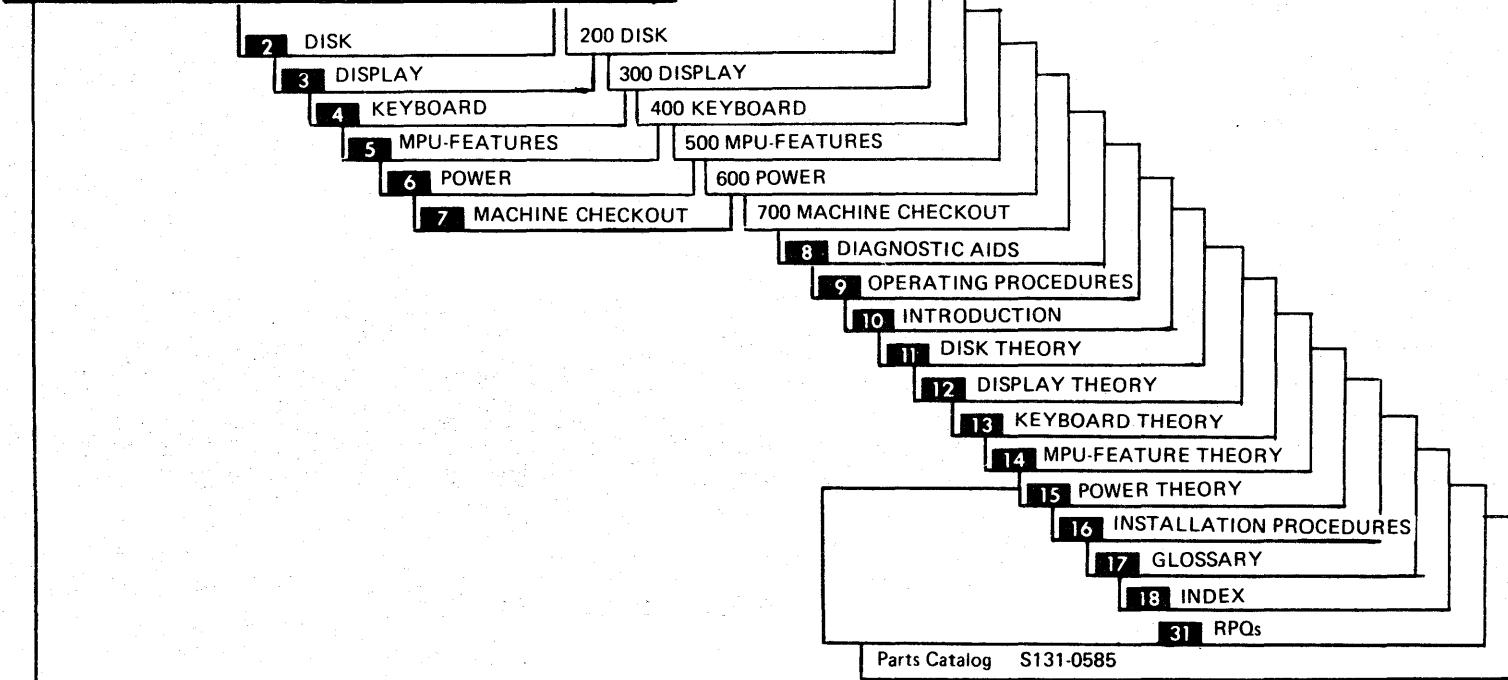
Do you have any other symptom?

— Use Machine Checkout MAP 7-1.

31-1



1



1 2 3 4 5 6 7

**Note 1:** — 128 Featured Machine Only

Ignore displayed information until 30 seconds after power up. (The internal diagnostics take longer than warmup of the CRT.)

**A** After Power Up  
No Diskette Loaded

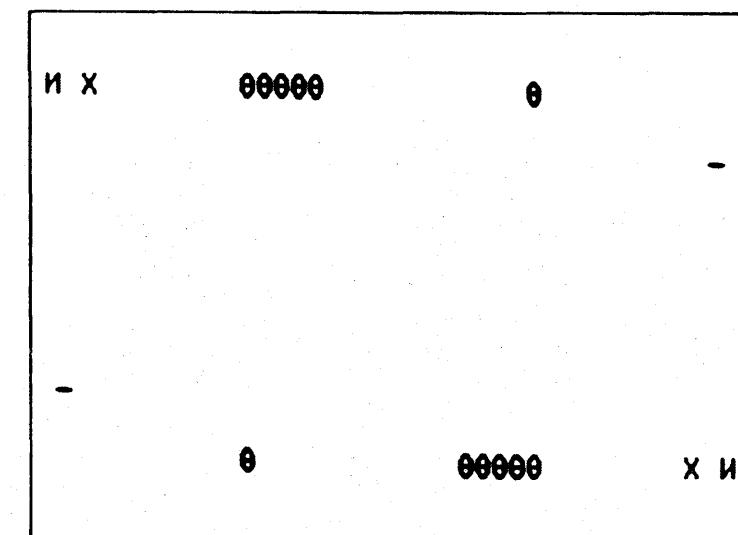
Display: Normal

Viewer: Removed

Brightness Control: Normal

For 128 Feature:

Either cursor may be in a different position than shown or may be missing from the display.

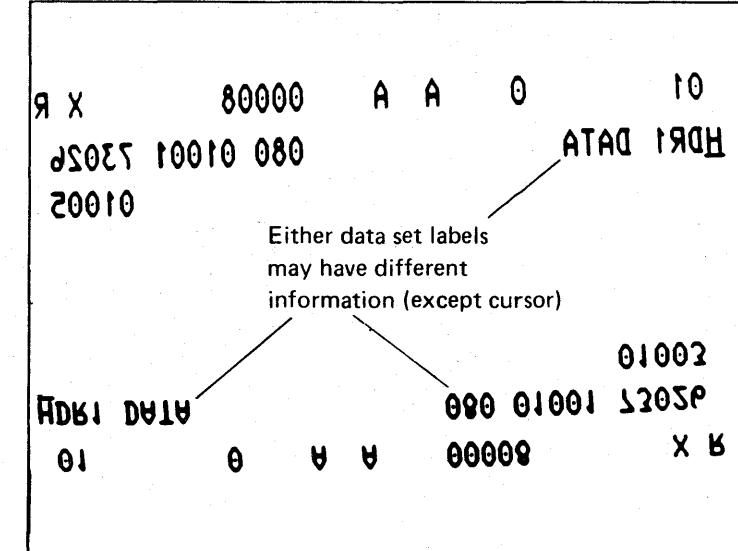


**B** Two Diskettes Loaded

Display: Normal

Viewer: Removed

Brightness Control: Normal



## **SYMPTOM INDEX**

## **ERROR CODE DESCRIPTION**

Code	Display Position	Diagnostic MAP	Description	Cause	Operating Procedure
7	8	9	10		
A			2-1 Data set non-accessible	<ul style="list-style-type: none"> <li>– The data set accessibility code field in the data set label or in the volume label has a non-blank character.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the disk.</li> </ul>
B			2-1 Bad data set label	<ul style="list-style-type: none"> <li>– One of the following conditions existed when you tried to select a mode from track 00:           <ol style="list-style-type: none"> <li>1. The last record read and currently displayed is from track 00, records 01 through 07.</li> <li>2. Position 4 of the header field in the data set label doesn't contain a 1.</li> <li>3. The data set label is flagged with a control address mark (such as is required for a deleted record).</li> </ol> </li> <li>– BOE is less than track 01, record 01.</li> <li>– EOE is greater than track 74, record 26.</li> <li>– EOE is less than BOE. EOE and/or BOE are incorrect.</li> <li>– BOE, EOE, or EOD is zero.</li> <li>– EOD is less than BOE. EOD and/or BOE are incorrect.</li> <li>– BOE, EOE, or EOD record is greater than 26.</li> <li>– EOD is greater than EOE + 1.</li> <li>– EOD is greater than track 75, record 01.</li> <li>– Record length (positions 23 through 27) is not 80 for basic machine: or, record length is 00 or greater than 128 for 128 record length featured machine.</li> <li>– Non-numeric characters are in positions where numeric characters are required in the data set.</li> <li>– Head specification is not zero.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET and REC ADV.</li> <li>– Press RESET and enter a 1 in position 04, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Enter H in position 1, press FUNCT SEL, M, and REC ADV.</li> <li>– Press RESET and enter the correct BOE, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct EOE, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct entry(s), press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct entry(s), press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct entry(s), press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct entry(s), press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct EOD, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct EOD, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter the correct EOD, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and enter 00 080 in positions 23 through 27, (or 00 001 thru 00 128 for 128 record length featured machine) press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and rekey, press FUNCT SEL lower, M, and REC ADV.</li> <li>– Press RESET and rekey head 0, press FUNCT SEL lower, M, and REC ADV.</li> </ul>
C			4-2 Self-check	<ul style="list-style-type: none"> <li>– The self-check digit doesn't compare properly.</li> <li>– The self-check field is blank in verify (V) mode.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET, field backspace, and rekey the field.</li> <li>– Press RESET and insert the self-check digit.</li> </ul>
D			2-6 Disk 2 not ready	<ul style="list-style-type: none"> <li>– A disk 2 record advance was attempted with one of the following conditions existing:           <ul style="list-style-type: none"> <li>– Copy feature is not installed.</li> <li>– Disk 2 is not ready.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Wait until disk 2 is ready, then continue processing. If the copy feature is not installed, use a machine which has disk copy feature.</li> </ul>

D	0			2-6	Disk removed	<ul style="list-style-type: none"> <li>– Disk was removed when waiting for a disk error to be cleared on record insertion mode. The EOD in the data set label is not updated. Duplicate records may exist in the data set. The hold buffer is not blanked. On the 3742 with the 128 feature and using station lockout, program levels 7, 8, 9, 10 are filled with N's.</li> <li>– Load a diskette. Hold down NUM SHIFT and press RESET.</li> </ul>	
D	5			2-4	Write error	<ul style="list-style-type: none"> <li>– The record at the currently displayed disk address was written in error. The record was one of the deleted records being inserted.</li> <li>– Press RESET.</li> </ul>	
E				2-2	End of extent	<ul style="list-style-type: none"> <li>– Attempting to read from disk 2 beyond the last record in the data set when using the copy feature.</li> <li>– Attempting to write to disk 1 beyond end of extent (EOE).</li> <li>– The last non-deleted record is verified. (This is not an error.)</li> <li>– Press RESET and continue the job on another data set or disk.</li> <li>– Press RESET and change EOE in the disk 1 data set label.</li> <li>– Press RESET and continue.</li> </ul>	
F				4-2	Function not available	<ul style="list-style-type: none"> <li>– The key pressed after FUNCT SEL is not valid.</li> <li>– The selected function is not installed.</li> <li>– Press RESET and press the valid key.</li> <li>– Move the job to another machine where the function is installed.</li> <li>– The key pressed following FUNCT SEL lower and M key is not REC ADV or DELETE.</li> <li>– Press RESET and REC ADV to write the label on the disk or press DELETE to delete the label.</li> <li>– Selected CE mode with a disk in other station.</li> <li>– Press RESET. Remove disk from other station.</li> </ul>	
G				4-2	Write protect	<ul style="list-style-type: none"> <li>– Enter (E) or verify (V) mode is selected and the data set is protected.</li> <li>– Attempted to write to the disk with the data set protected.</li> <li>– At EOD-1 of a data set in update (U) mode, and using REC ADV when the data set is protected.</li> <li>– Press RESET and select update mode.</li> <li>– Press RESET and either change the label or press REC ADV to advance to a proper label.</li> <li>– Press RESET and either change the data set label or use a different data set.</li> </ul>	
H				4-2	Copy setup	<ul style="list-style-type: none"> <li>– After pressing COPY:</li> <li>– The disk 2 address is less than track 00, record 08.</li> <li>– When disk 2 is inserted, you must press DISK 2 REC ADV to display the first data set label (00008). This error occurs then if you do not press DISK 2 REC ADV to display a data set label prior to copy setup.</li> <li>– COPY was not pressed in conjunction with any shift key.</li> <li>– Disk 1 is on track 00 but disk 2 isn't on track 00.</li> <li>– SEARCH SEQ CONTENT was pressed in copy setup.</li> <li>– Press RESET and advance to the proper disk 2 address.</li> <li>– Press RESET and press DISK 2 REC ADV.</li> <li>– Press RESET and ALPHA SHIFT or NUM SHIFT in conjunction with COPY.</li> <li>– Press RESET and press DISK 2 RET TO INDEX.</li> <li>– Press RESET and press the correct key.</li> </ul>	
I				4-2	Search address	<ul style="list-style-type: none"> <li>– The search address contains a non-decimal character.</li> <li>– The search address is not valid.</li> <li>– The search address is not within the extents of the data set.</li> <li>– Press RESET. Use a valid search address.</li> </ul>	

## ERROR CODE DESCRIPTION

Code Display Position 7 8 9 10	Diagnostic MAP	Description	Cause	Operating Procedure	
I		4-2 # of records	<ul style="list-style-type: none"> <li>– Number of records specified not 01-99 (00 or 1 digit gives I error or above 99 reads first two columns only).</li> <li>– Insufficient room in data set to insert the number of records specified. Number of records to be inserted must be equal to or less than (EOE minus EOD) plus 1.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET then press NUM SHIFT and key in number of records to be inserted. FUNCT lower and RIGHT ADJUST.</li> <li>– Press RESET. Check data set.</li> </ul>	
K		4-2 Keying	<ul style="list-style-type: none"> <li>– Upper shift A or Z key was pressed.</li> <li>– The program numeric shift switch is set to the numbers only position and the character keyed is not 0 through 9, -, space, +, or any alpha shift characters, while in a program numeric field.</li> <li>– The data key pressed following HEX is not a valid hex digit.</li> <li>– An invalid key code (a world trade key code was detected in a domestic machine).</li> <li>– The KANA SYMB key and a non-Katakana key were pressed together on a Katakana machine.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Press only valid keys.</li> </ul>	
L		4-2 Invalid function key	<ul style="list-style-type: none"> <li>– CHAR ADV was pressed in verify mode.</li> <li>– DISPLAY PROD STAT was pressed when not in read index or enter mode.</li> <li>– FIELD ADV was pressed in verify mode.</li> <li>– SCRL FWD was pressed in verify mode.</li> <li>– REC BKSP was pressed in field correct mode.</li> <li>– REC ADV was pressed in field correct mode.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Press only valid keys.</li> </ul>	
M		4-2 Incorrect mode selection	<ul style="list-style-type: none"> <li>– Selected copy mode from update (U), verify (V) or field correct (C) mode.</li> <li>– Selected enter (E) mode from other than index (X) mode.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Perform proper mode selection.</li> </ul>	

M (continued)	4-2	Incorrect mode selection	<ul style="list-style-type: none"> <li>– Selected field correct (C) mode while in an auto field with the AUTO DUP/SKIP switch on or currently at the end of the record.</li> <li>– Attempted the modify index function (FUNCT SEL, M) while not on track 00.</li> <li>– Selected search (S) mode from verify (V) or field correct (C) mode.</li> <li>– Selected SEARCH CONTENT or SEARCH SEQ CONTENT from verify (V) or field correct (C), or selected search content from enter (E) mode.</li> <li>– Selected update (U) mode from enter (E) mode or from search (S) mode when search was selected from enter (E) mode.</li> <li>– Selected verify (V) mode from enter (E) or search (S) mode.</li> <li>– Selected offline field totals from verify (V) mode or field correct (C) mode.</li> <li>– Selected PROG LOAD in verify (V) or field correct (C) mode.</li> <li>– FIELD COR pressed when not in verify mode.</li> <li>– Disk initialization selected and the secondary station has a disk loaded, or the primary station is not in index (X) mode.</li> <li>– Pressed DISPLAY PROG in conjunction with either shift key while in verify or field correct mode.</li> <li>– Pressed SEL PROG while in field correct mode.</li> </ul>
N	4-2	Keyboard overrun	<ul style="list-style-type: none"> <li>– Keying rate exceeded machine capacity.</li> </ul>
N	?	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>
O	4-2	Operation	<ul style="list-style-type: none"> <li>– Pressed DISPLAY FIELD TOTALS when not at the first position of a field.</li> <li>– While in a right-adjust field, pressed DUP when not at the first position of the field.</li> <li>– Pressed SEL PROG when the current program wasn't on a field boundary.</li> <li>– While in enter (E) mode, right-adjust field, pressed REC ADV when not at the first position of the field.</li> <li>– Pressed REC ADV after pressing any search key with numeric shift.</li> <li>– Pressed RIGHT ADJ when not in a right-adjust field except when at end of the record.</li> <li>– Pressed REC ADV or SKIP in right-adjust field and not at the first position of the right-adjust field.</li> <li>– Pressed DISPLAY PROD STAT in enter mode: <ul style="list-style-type: none"> <li>1. While not in program level 0.</li> <li>2. With the cursor not in position 1.</li> </ul> </li> <li>– Pressed SKIP, DUP, or REC ADV in a self-check field and not at start of the self-check field.</li> <li>– Pressed SCRL FWD or SCRL BKWD in a self-check field and not at start of the self-check field.</li> <li>– Pressed SCRL FWD or SCRL BKWD in a right-adjust field and not at the first position of that field.</li> </ul>

P		4-2	Program	<ul style="list-style-type: none"> <li>– The key pressed following SEL PROG or PROG LOAD is not a valid program number.</li> <li>– Selected a new program while not at a field boundary.</li> <li>– Invalid begin field character.</li> <li>– The first position of a program buffer is a continue field character.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET and enter a valid program number.</li> <li>– Press RESET and move the cursor to a field boundary.</li> <li>– Press RESET and enter a valid begin field character in the program.</li> <li>– Press RESET and enter a begin field character in the first position.</li> </ul>
Q		4-2	Field totals	<ul style="list-style-type: none"> <li>– No . (period) or digit following the format character.</li> <li>– The position number is greater than 080. (or 128 for the 128 record length feature).</li> <li>– No N or W follows the position number.</li> <li>– An invalid character following the mask.</li> <li>– Format 1 to 6 (or 1 through 9 and A for the 128 record length feature) not specified in the mask statement.</li> <li>– No &lt; sign found at beginning of the format statement.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Rewrite the control statement.</li> </ul>
R		4-2	Right adjust	<ul style="list-style-type: none"> <li>– Entered a data key after the right-adjust field was full except in verify mode.</li> <li>– Entered a data key after all non-fill characters have been verified.</li> <li>– A mismatch occurred on a fill character for a right-adjust field.</li> <li>– Pressed – (dash) or RIGHT ADJUST at the start of a field that isn't all fill characters. The error occurs when the first non-fill character is encountered.</li> <li>– Pressed other than RIGHT ADJUST to exit the field.</li> <li>– Press RIGHT ADJUST or NUM SHIFT and – (dash) when not at the start of an all fill character field or not at the end of the right-adjust field.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET and RIGHT ADJUST.</li> <li>– Press RESET and RIGHT ADJUST.</li> <li>– Press RESET and correct the fill character.</li> <li>– Press RESET and if the dash and right-adjust are correct, press FIELD COR.</li> <li>– Press RESET and RIGHT ADJUST.</li> <li>– Press RESET and key correctly.</li> </ul>
R	0	2-6	Disk removed	<ul style="list-style-type: none"> <li>– Disk was removed when waiting for a disk error to be cleared on record insertion mode. The EOD in the data set label is not updated. Duplicate records may exist in the data set. The hold buffer is not blanked. With the 128 feature and station lockout selected program levels 7, 8, 9 and 10 are not filled with N's.</li> </ul>	<ul style="list-style-type: none"> <li>– Load a diskette, NUM SHIFT press RESET.</li> </ul>

## ERROR CODE DESCRIPTION

Code Display Position				Diagnostic MAP	Description	Cause	Operating Procedure
7	8	9	10				
R	I			2-2	Length error	<ul style="list-style-type: none"> <li>— Length error in record read. The record will be written with record length corresponding to the record length in the data set label, the disk address of the record written is determined as described in R2 error.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET.</li> </ul>
R	2			2-2	No record found	<ul style="list-style-type: none"> <li>— The record at the displayed disk address could not be found. A blank record will be written to disk at an address determined by the displayed address plus the number of records to be inserted.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET.</li> </ul>
R	4			2-2	Read error	<ul style="list-style-type: none"> <li>— The record read is in error. The record will be written to disk at an address determined by the displayed address plus the number of records to be inserted.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET.</li> </ul>
S				4-2	Search	<ul style="list-style-type: none"> <li>— The search mask did not match any record.</li> <li>— A disk error occurred that failed the disk ERP. The disk error is displayed in position 8 on the status line.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET. If there is not a numeric error displayed, try a different search mask. If a numeric error is displayed, use that verification procedure.</li> </ul>
T				4-2	Operational error (truncation)	<ul style="list-style-type: none"> <li>— Attempting to enter data beyond the logical record length.</li> <li>— Pressed SCRL FWD when column indicator displayed 000.</li> <li>— Pressed DISPLAY PROD STAT in enter (E) mode and the record length is less than 21.</li> <li>— Pressed RIGHT ADJUST key at the end of the record.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET. Usually caused when AUTO REC ADV is off. Press REC ADV.</li> <li>— Press RESET. Press REC ADV.</li> <li>— Press RESET. Change record length to 21.</li> <li>— Press RESET. Press REC ADV.</li> </ul>
V				4-2	Verify mismatch	<ul style="list-style-type: none"> <li>— A mismatch occurs between the current data keystroke and the data character in the record.</li> <li>— A character in an auto skip field is not blank.</li> <li>— A mismatch occurs between the characters of an auto dup field in the record and corresponding characters of a previous record.</li> </ul>	<ul style="list-style-type: none"> <li>— Press RESET. Key in the correct character.</li> </ul>

W	0			2-6	Disk removed	<ul style="list-style-type: none"> <li>- Disk was removed when waiting for a disk error to be cleared on record insertion mode. The EOD in the data set label is not updated. Duplicate records may exist in the data set. The hold buffer is not blanked. With the 128 feature and station lockout selected program levels 7, 8, 9 and 10 are not filled with N's.</li> <li>- Load diskette. NUM SHIFT, press RESET.</li> </ul>
W	5			2-4	Write error	<ul style="list-style-type: none"> <li>- The record at the currently displayed disk address was written in error. Either the sector at the currently displayed disk address could not be found or the record was written in error.</li> <li>- Press RESET.</li> </ul>
W	6			2-4	Write error	<ul style="list-style-type: none"> <li>- The record at the currently displayed disk address was written with a special address mark and was not read with a special address mark.</li> <li>- Press RESET.</li> </ul>
X				4-2	Right-adjust sign	<ul style="list-style-type: none"> <li>- A sign mismatch occurred at the end of a right-adjust field in verify mode.</li> <li>- Press RESET. Use correct sign in right-adjust field.</li> </ul>

## ERROR CODE DESCRIPTION

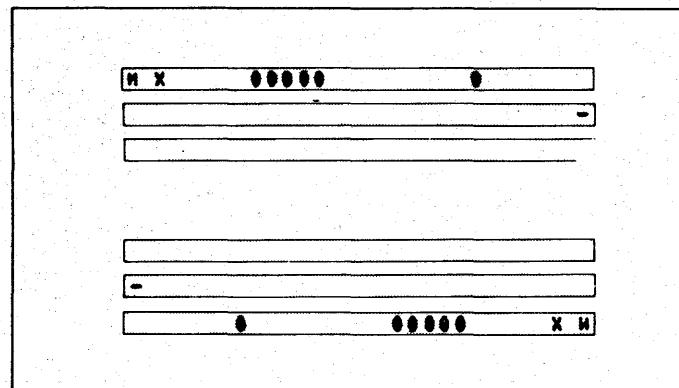
Code Display Position	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
Y					2-1	Empty data set	<ul style="list-style-type: none"> <li>– Attempted verify mode selection and data set was empty.</li> <li>– Attempted update mode selection and data set was empty.</li> <li>– Attempted search mode selection and data set was empty.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET. Enter data into the data set or choose a different data set.</li> </ul>
Z					2-4	Last record write error	<ul style="list-style-type: none"> <li>– In enter or update mode, write error occurred at EOE.</li> <li>– In verify mode, write error occurred on last non-deleted record.</li> </ul>	<ul style="list-style-type: none"> <li>– Press RESET.</li> </ul>
Z	2				2-2	Last record write error	<ul style="list-style-type: none"> <li>– In enter or update mode, write error occurred at EOE.</li> <li>– In verify mode, write error occurred on the last deleted record.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUMERIC SHIFT and press RESET.</li> </ul>
Z	3				2-9			
Z	4				2-2			
Z	5				2-4			
Z	6				2-2			
0					2-6	Early disk removal	<ul style="list-style-type: none"> <li>– Removed disk while disk operations were in process.</li> <li>– Removed disk while not on the index cylinder.</li> </ul>	<ul style="list-style-type: none"> <li>– Load a diskette. Hold NUM SHIFT and press RESET.</li> </ul>
1					2-2	Length	<ul style="list-style-type: none"> <li>– Record length was incorrect for this disk operation.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET. Use the correct record length.</li> </ul>
2					2-2	No record found	<ul style="list-style-type: none"> <li>– The disk read ERP failed because ID field could not be found.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET.</li> </ul>
2	?	?			2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>
3					2-9	Seek	<ul style="list-style-type: none"> <li>– Seek ERP failed because a track match did not occur.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET.</li> </ul>
3					2-9	Seek error	<ul style="list-style-type: none"> <li>– Seek error. An auto return to the index track is performed with the EOD being updated. Duplicate records may exist in the data set. The hold buffer is not blanked. With the 128 feature and station lockout selected program levels 7, 8, 9 and 10 are not filled with N's.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET.</li> </ul>
D	3							

	3	?	?	2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>
	4			2-2	Read	<ul style="list-style-type: none"> <li>– Disk ERP failed with a read error. The first record written on the disk after the read error may be wrong.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET.</li> </ul>
B	4	?	?	2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>
	5			2-4	Write	<ul style="list-style-type: none"> <li>– Disk write and write check ERP failed.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET.</li> </ul>
	5	?	?	2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>
	6			2-2	Deleted record	<ul style="list-style-type: none"> <li>– Last record read has a control address mark (such as is required for a deleted record).</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET. Press REC ADV. If the error occurred on the index track, change position one to an H, press FUNCT SEL, M, REC ADV.</li> </ul>
	6	?	?	2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>
	7			2-2	Address	<ul style="list-style-type: none"> <li>– A newly developed disk address is out of the current extent for a data set or is off the disk.</li> </ul>	<ul style="list-style-type: none"> <li>– Hold NUM SHIFT and press RESET. Use a correct address.</li> </ul>
				2-2	Invalid input specifications	<ul style="list-style-type: none"> <li>– Character not valid or odd number of characters specified.</li> <li>– Track zero is in bad track list.</li> <li>– Tracks 78 through 99 are specified as bad.</li> <li>– Sequence value is greater than 13.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the diskette. Press RESET. Insert a different diskette.</li> </ul>
=				2-1	Non-ascending bad track specification	<ul style="list-style-type: none"> <li>– Bad tracks are not specified in ascending sequence.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the diskette. Press RESET. Insert a different diskette.</li> </ul>
*				2-2	Bad track specification exceeded	<ul style="list-style-type: none"> <li>– More than two bad tracks specified on the disk.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the diskette. Press RESET. Insert a different diskette.</li> </ul>
(				2-4	Write check error	<ul style="list-style-type: none"> <li>– Error occurred while the disk was being initialized or disk check.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the diskette. Press RESET. Insert a different diskette.</li> </ul>
&				2-2	Delete record error	<ul style="list-style-type: none"> <li>– Error encountered while trying to delete records 9 through 26 on tracks zero.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove the diskette. Press RESET. Insert a different diskette.</li> </ul>
	?	?		2-4	Write test	<ul style="list-style-type: none"> <li>– Write gate error.</li> </ul>	<ul style="list-style-type: none"> <li>– Remove and reinsert the disk.</li> </ul>

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## DISPLAY UNIT SYMPTOMS

- If you are aware of the display unit symptom terms and the directions on this page, continue with the next command. Otherwise, review the information contained in the adjacent columns and then continue here.
- The diskettes can be either unloaded or loaded. (Loaded is preferred.)
- Remove the viewer.
- Turn up the brightness control (observe the caution in the next column).
- Look for a correct raster as shown. For this decision, disregard any characters that might also be evident within the raster.



Is the raster (relative size, position, and number of lines) as shown; and does the brightness remain stable?

Y N

- Review the symptoms, starting with 1 on the next page, until the most similar symptom is found. Use the MAP indicated.
- Return the brightness control to normal.
- Data may be entered, but is not required.

Are characters displayed and are they free of distortion?

Y N

- Review the symptoms, starting with 15, until the most similar symptom is found. Use the MAP indicated.
- Review the symptoms, starting with 24, until the most similar symptom is found. Use the MAP indicated.

## HOW TO USE THE DISPLAY UNIT SYMPTOMS

The following 7 pages contain descriptions and pictures of symptoms to direct you to the correct MAP to use for diagnosis.

The symptoms are numbered to indicate the priority sequence and to allow referencing.

Read the symptom description with each picture to understand the illustration and any variations that could be applicable.

For some symptoms, it could be necessary to turn the brightness control up to observe the symptoms.

**CAUTION:** Never make CRT tube face glow or bloom. Return brightness control to normal before proceeding into the MAPs.

Symptoms of display trouble are not readily illustrated exactly; each display symptom is an individual. Therefore, when using the following index, attempt to locate a picture or descriptive symptom that is similar to (not necessarily the same as) what you saw displayed.

If any of more than 1 picture might be the right one, see if they all use the same MAP. If so, no need to choose; just go to that MAP.

The correct MAP or procedure to use follows each picture.

Regardless of the starting point, it is necessary to compare all succeeding display symptoms up to the one that is similar to one you have. If no similar display can be found, use the *Display General MAP* following the last picture.

All display symptoms are shown with the viewer removed, and viewed from the key station 1 operator position.

Most of the symptoms are shown with the diskettes loaded. However, the symptom may be used as you first found it (unloaded, loaded, or with data), while being aware of the difference this makes on the display.

## DISPLAY UNIT GLOSSARY

**CRT:** Cathode ray tube (display).

**Blank CRT:** The display looks like power is off.

**Blooms:** The entire display appears to glow or the raster is excessively bright.

**Brightness:** The amount of light emitted from the raster.

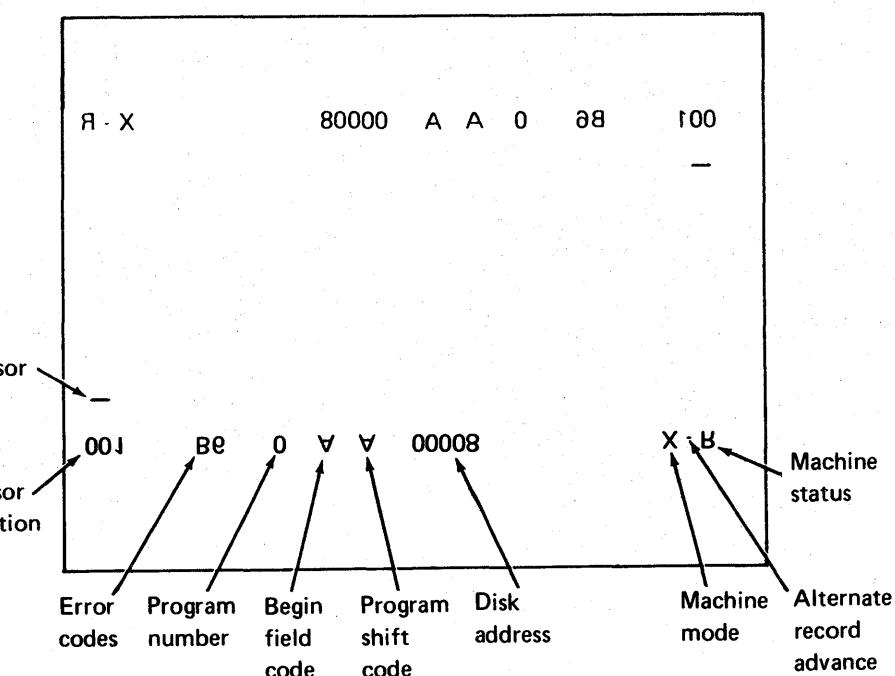
**Character:** All letters, numbers, special symbols, and the cursor, formed by a series of small dots.

**Deflection:** The vertical, horizontal, and wiggle sweeps needed to form the 6 lines, the line lengths and the line height.

**Raster:** The bright area of 6 lines, each about 0.2 inch (5.1 mm) high by from 3.5 to 5.5 inches (88.9 to 139.7 mm) long, caused by the deflection circuits. (On some CRTs, a raster might not be displayed except with the CE pins jumpered. This is due to gain variations between CRTs.)

**Retrace:** The return trace for the deflection sweeps.

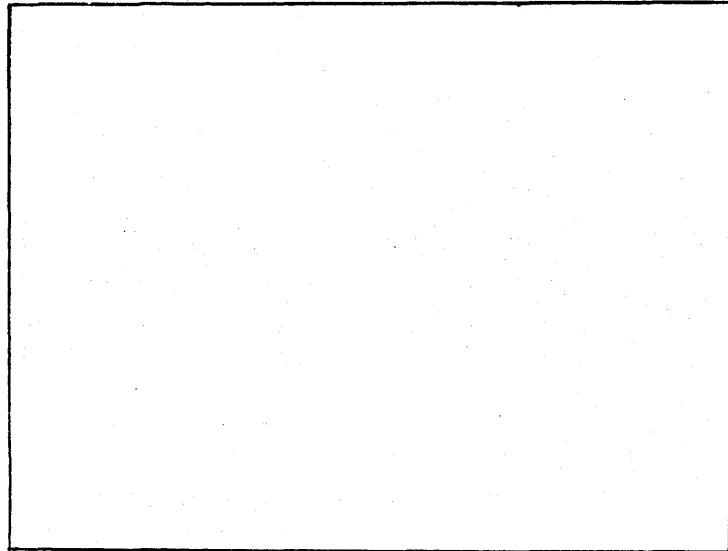
**Video:** Pulses, which are intensified dots, that result in characters.



## DISPLAY AND DISPLAY UNIT SYMPTOMS

- 1** Symptom: Blank CRT or brightness fades to blank.

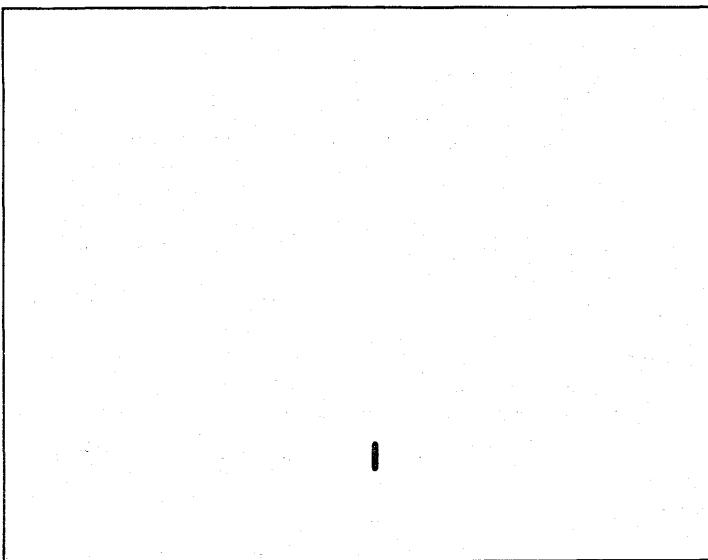
Brightness control: Turned up (caution)



MAP: 3-2

- 3** Symptom: Vertical bar—may be anywhere on the display.

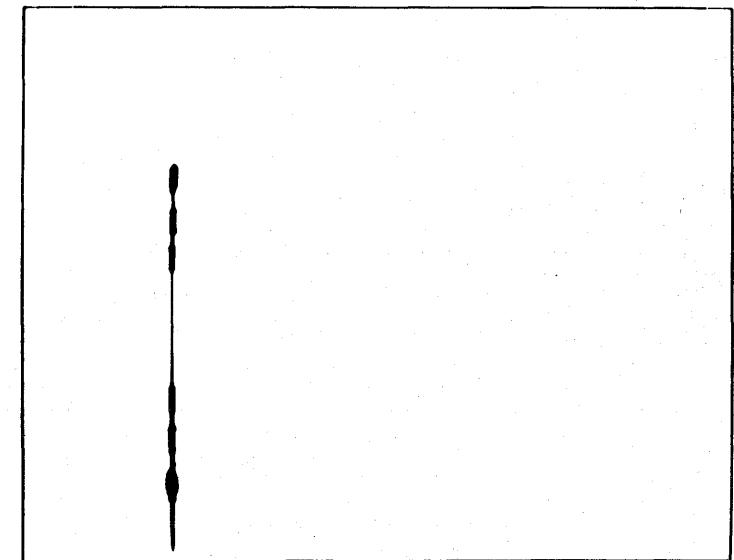
Brightness control: Turned up (caution)



MAP: 3-5

- 5** Symptom: Multiple vertical bars.

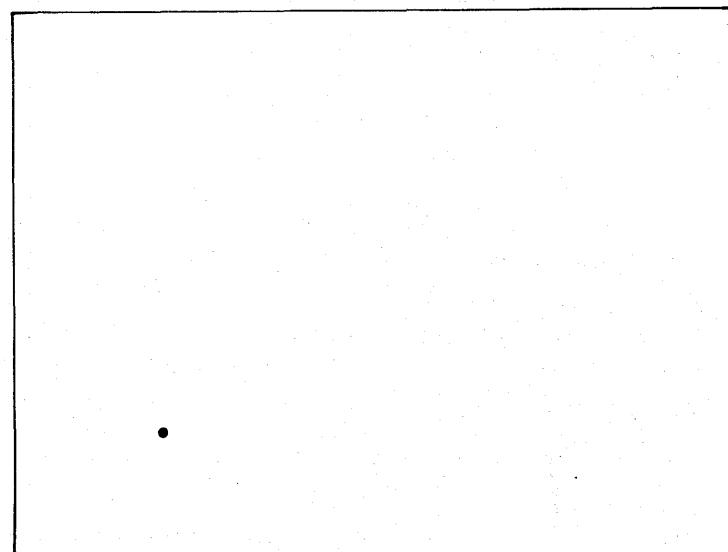
Brightness control: Turned up (caution)



MAP: 3-5

- 2** Symptom: Spot—may be anywhere on the display.

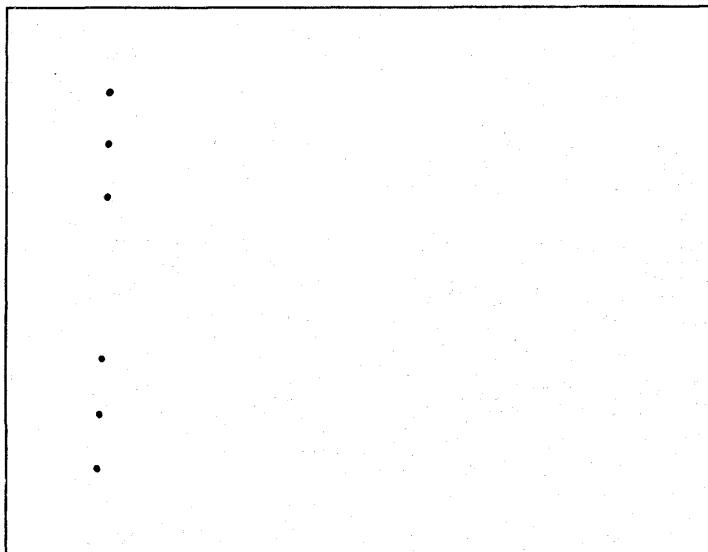
Brightness control: Turned up (caution)



MAP: 3-5

- 4** Symptom: Multiple vertical spots.

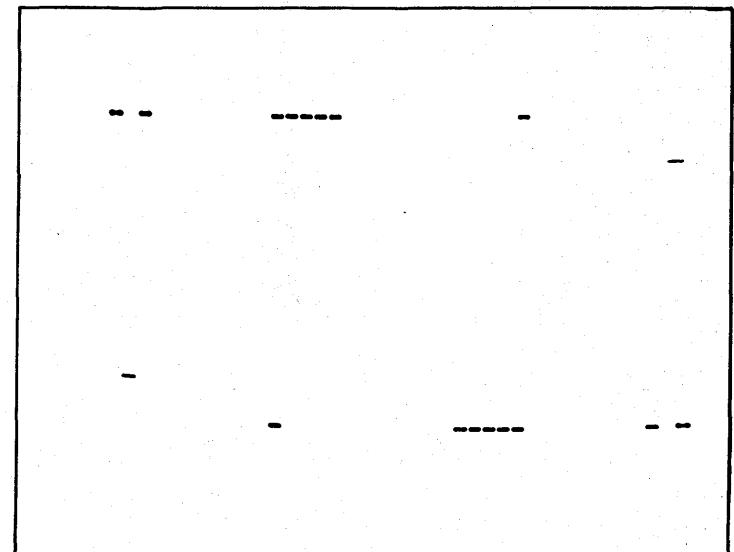
Brightness control: Turned up (caution)



MAP: 3-5

- 6** Symptom: All characters resemble cursors.

Brightness control: Normal

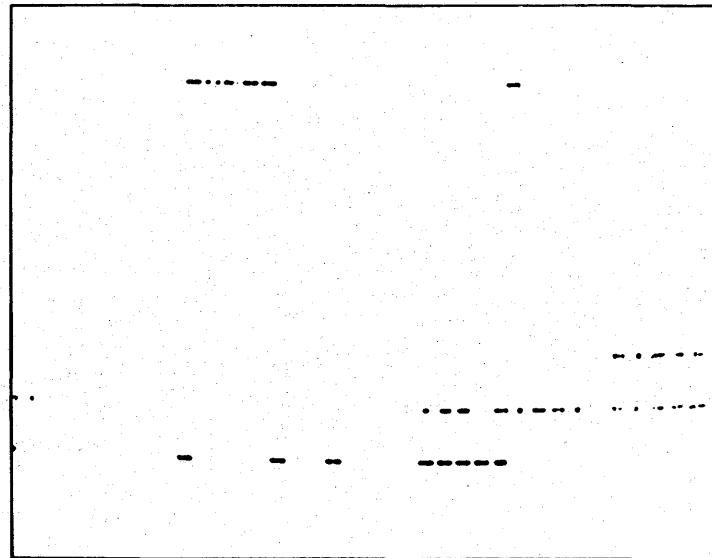


MAP: 3-5

## DISPLAY AND DISPLAY UNIT SYMPTOMS

7 Symptom: All characters resemble cursors.

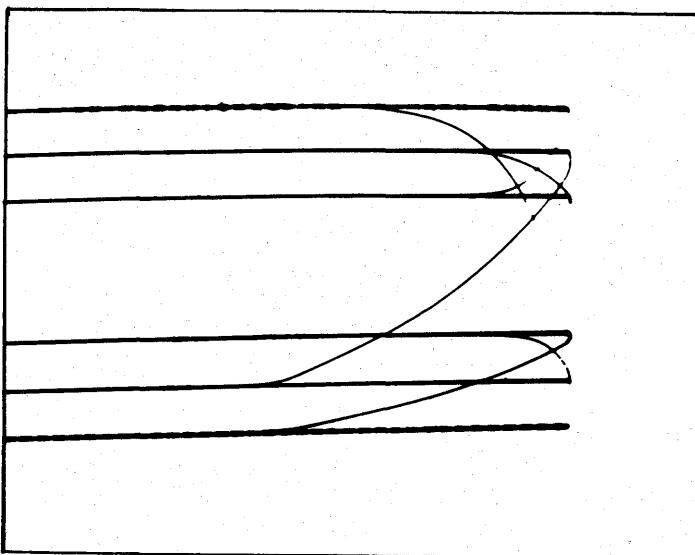
Brightness control: Normal



MAP: 3-5

8 Symptom: All characters resemble cursors.

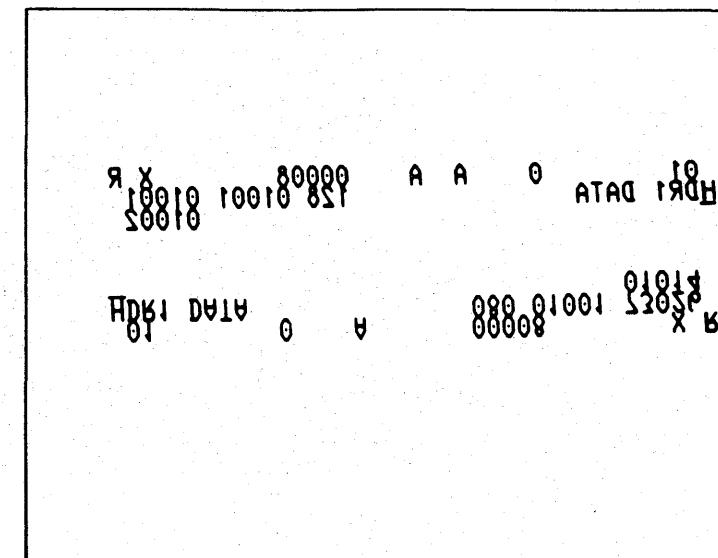
Brightness control: Turned up (caution)



MAP: 3-5

9 Symptom: Lines too close together.

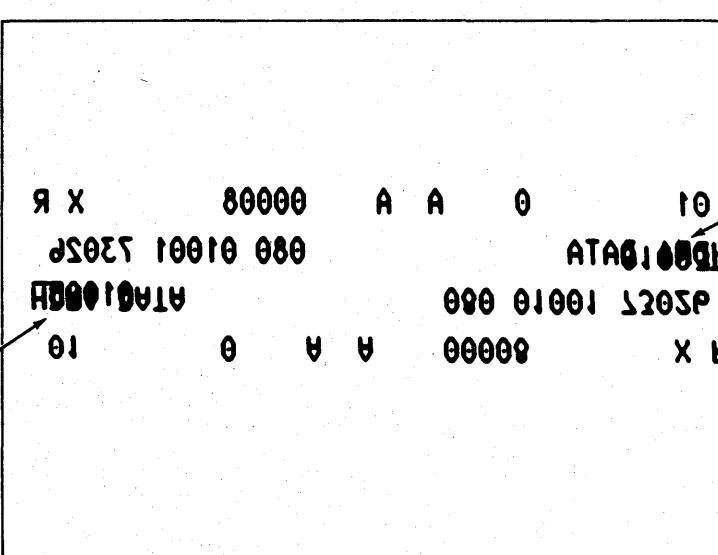
Brightness control: Normal



MAP: 3-5

10 Symptom: Lines on top of each other (Incorrect line location).

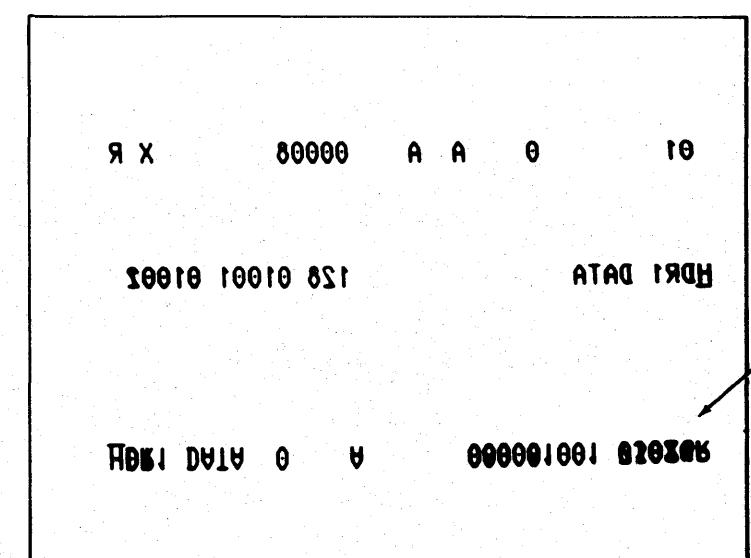
Brightness control: Normal



MAP: 3-5

11 Symptom: Lines on top of each other (Some raster lines missing).

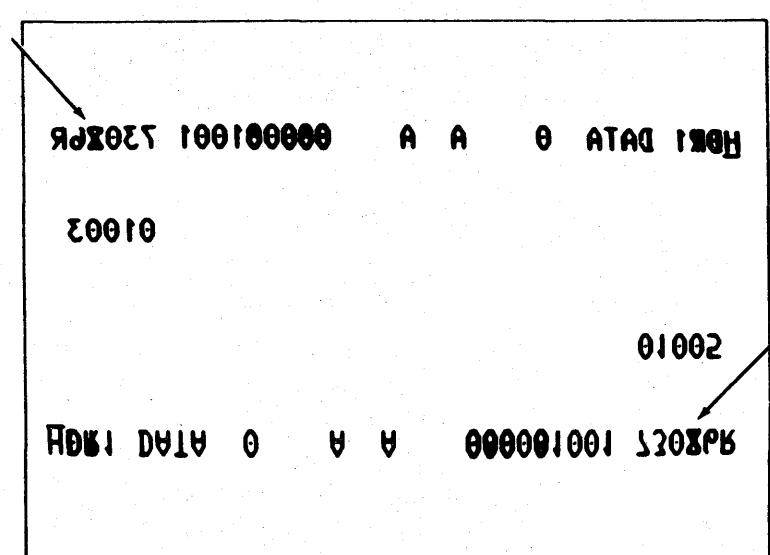
Brightness control: Normal



MAP: 3-5

12 Symptom: Lines on top of each other (Some raster lines missing).

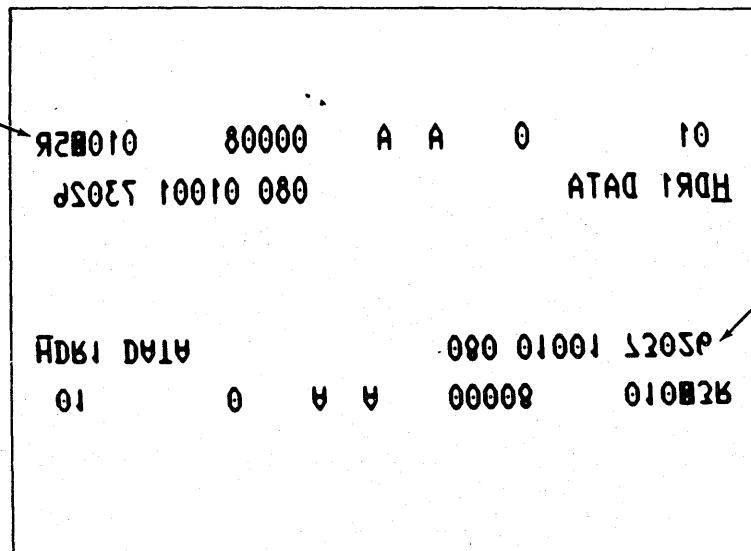
Brightness control: Normal



MAP: 3-5

13 Symptom: Lines on top of each other  
(Some raster lines missing).

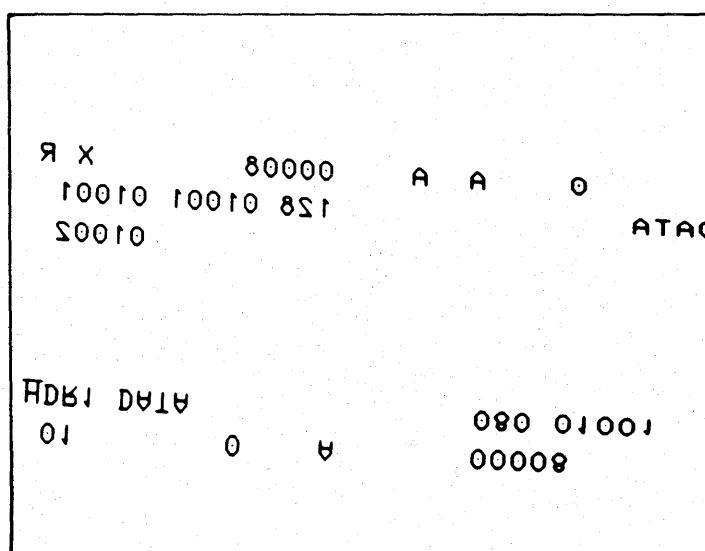
Brightness control: Normal



MAP: 3-5

14 Symptom: Excessive line length.

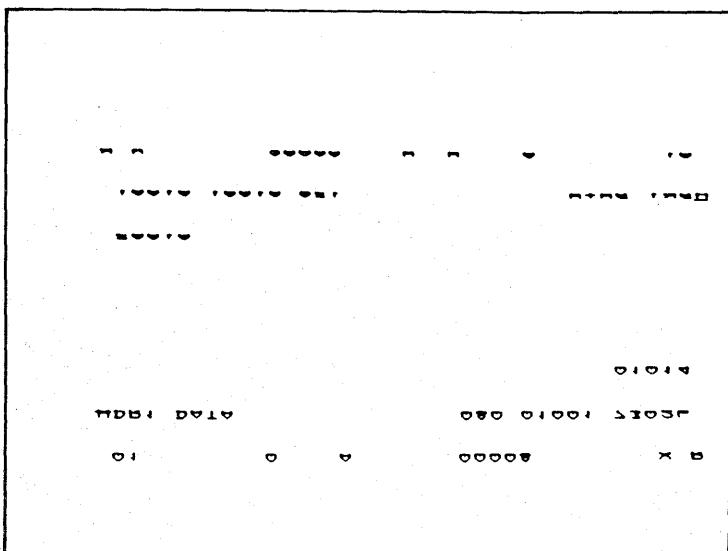
Brightness control: Normal



MAP: 3-5

15 Symptom: Character height compressed.

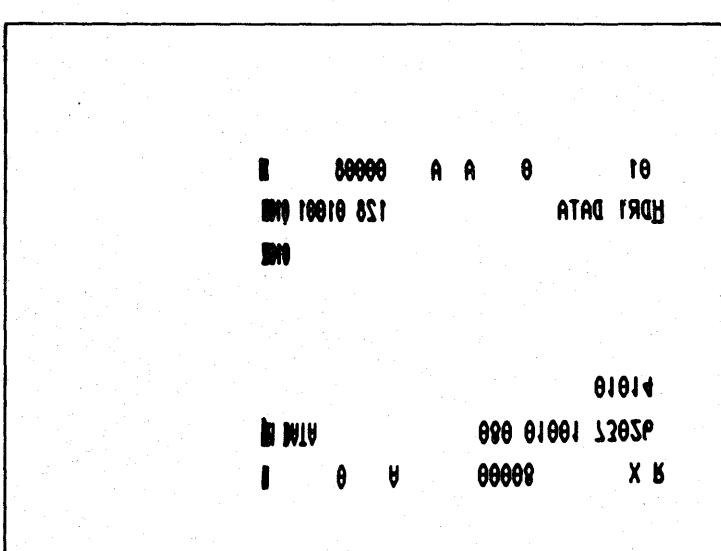
Brightness control: Normal



MAP: 3-5

16 Symptom: Lines compressed to the right.

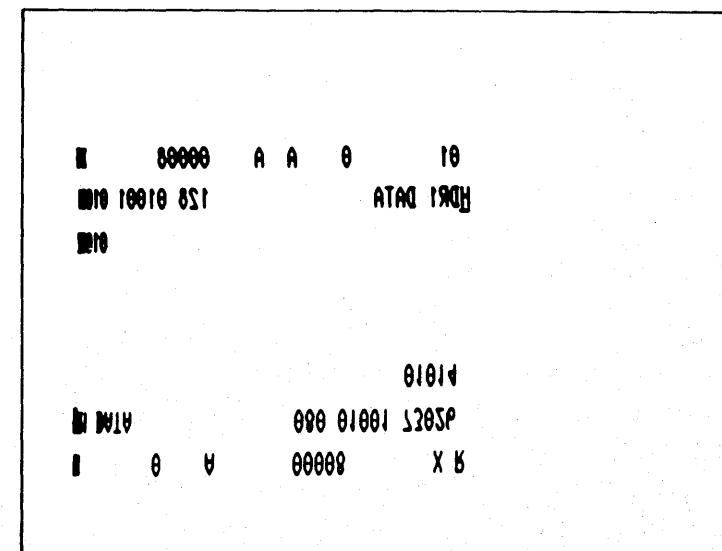
Brightness control: Normal



MAP: 3-5

17 Symptom: Lines compressed to the left.

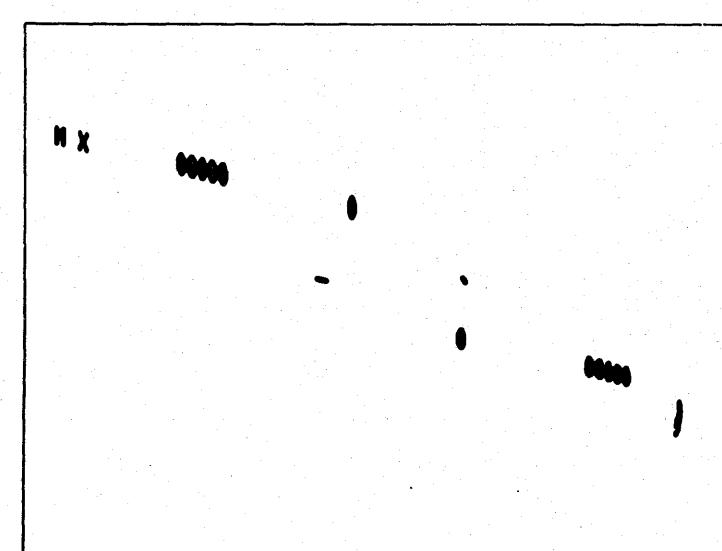
Brightness control: Normal



MAP: 3-5

18 Symptom: Skewed.

Brightness control: Normal



MAP: 3-5

## DISPLAY AND DISPLAY UNIT SYMPTOMS

**19 Symptom:** Distorted

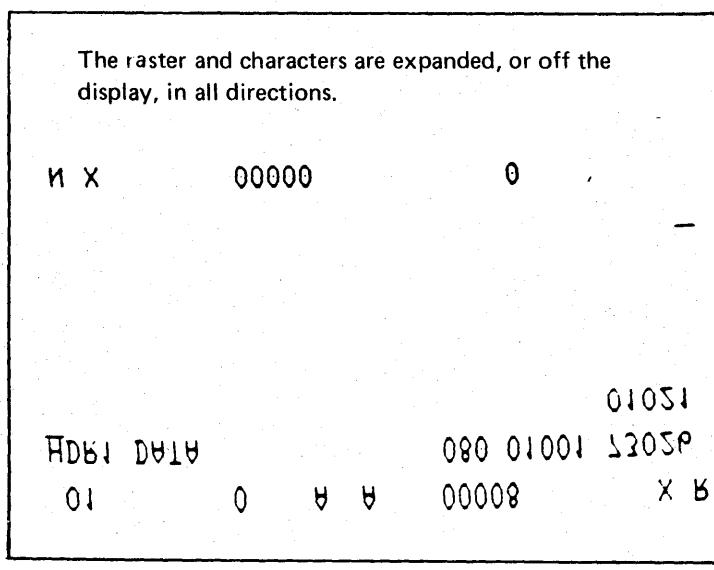
Brightness control: Normal



MAP: 3-5

**20 Symptom:** Overall enlarged display.

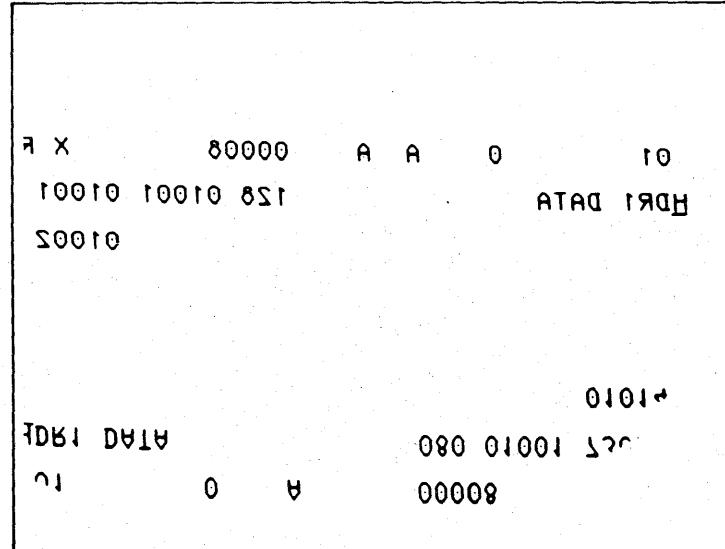
Brightness control: Normal



MAP: 3-7

**21 Symptom:** Lower corner(s) cut off.

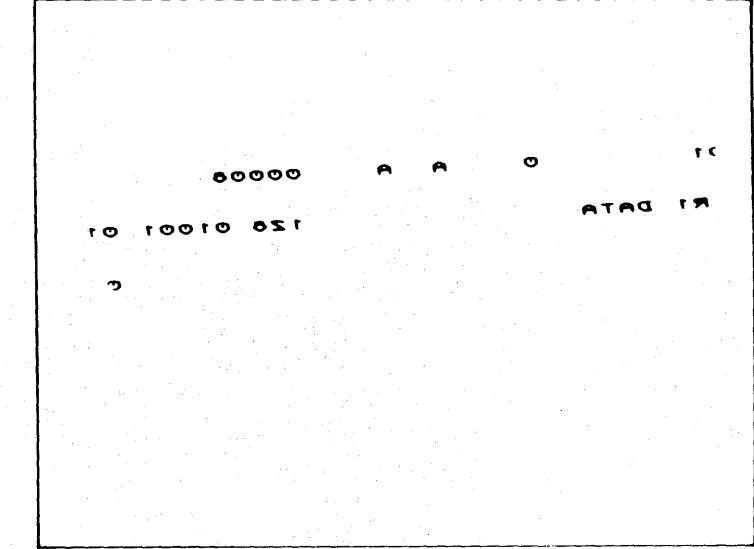
Brightness control: Normal



Adjustment procedure 305

**23 Symptom:** Display rotated and incomplete; characters small.

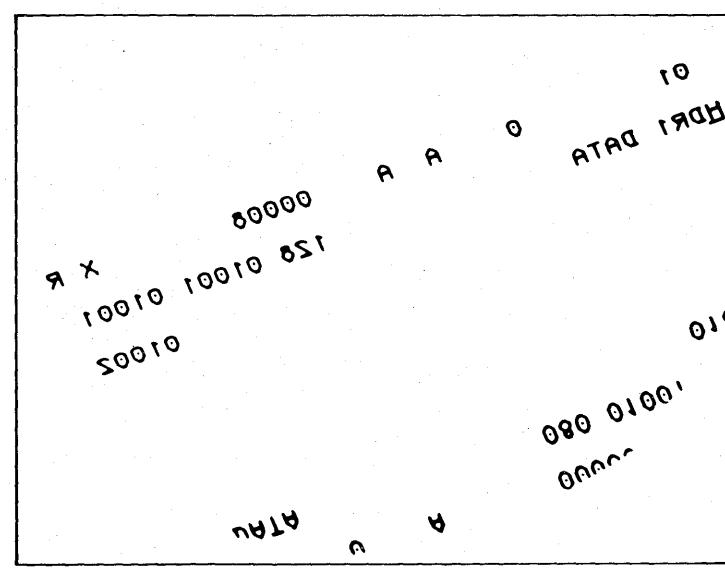
Brightness control: Normal



Adjustment procedure 305

**22 Symptom:** Display rotated and incomplete.

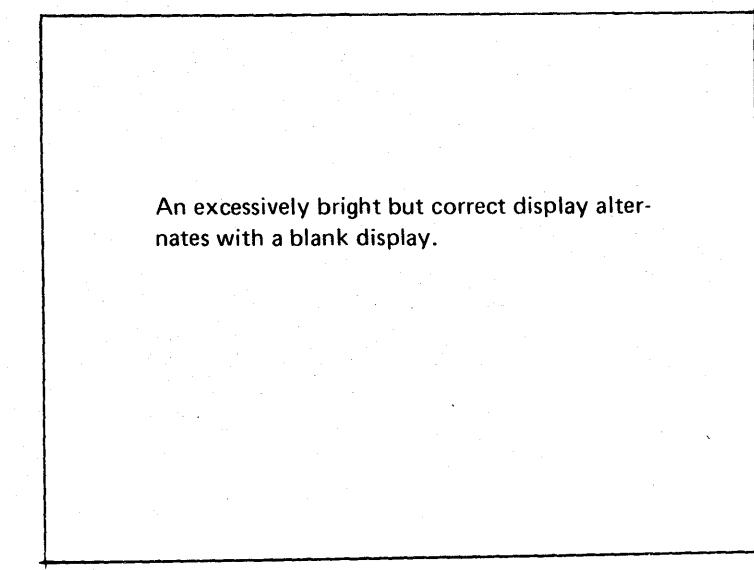
Brightness control: Normal



Adjustment procedure 305

**24 Symptom:** CRT blooms bright (on-off-on-off).

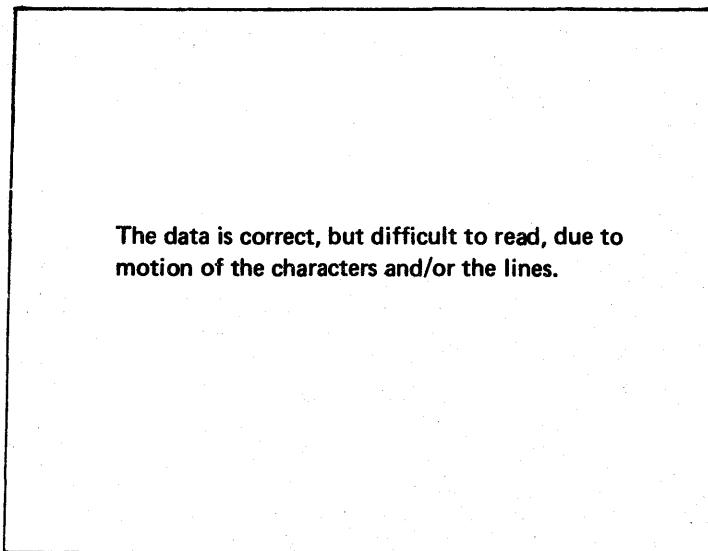
Brightness control: Normal



MAP: 3-6

## **25 Symptom: Jittery or jumping display.**

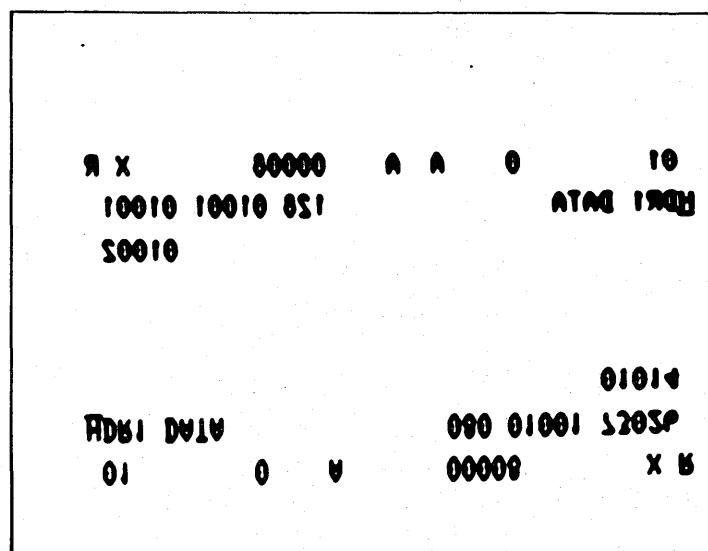
**Brightness control: Normal**



MAP: 3-4

**26 Symptom:** Fuzzy characters. (Raster size and brightness normal.)

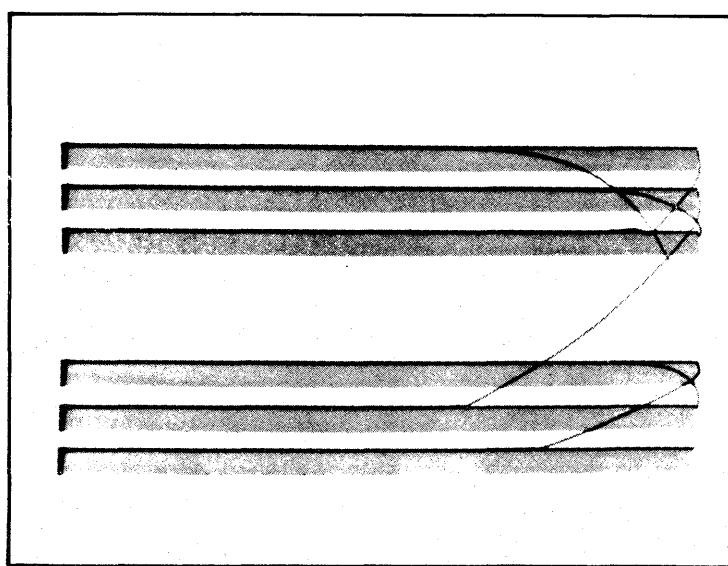
**Brightness control: Normal**



**MAP: 3-3**

**27** Symptom: No video (raster only).

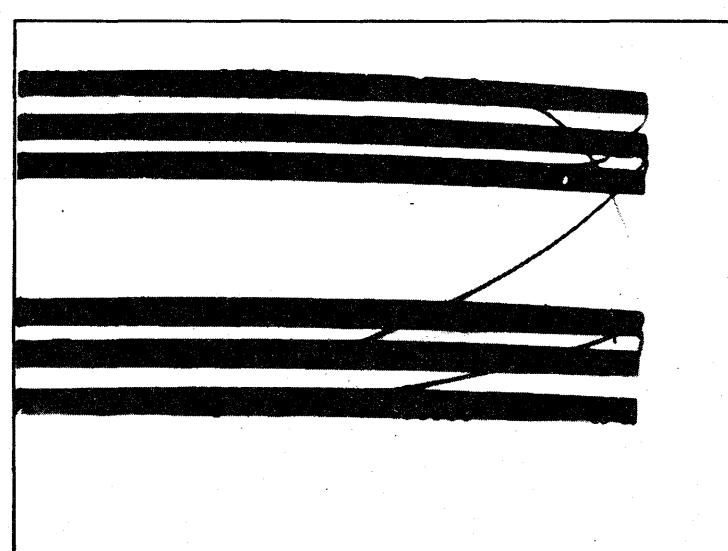
**Brightness control: Turned up (caution)**



MAP: 3-3

**28 Symptom:** Brightness increases slowly, or  
is unadjustable, or is intermittent.

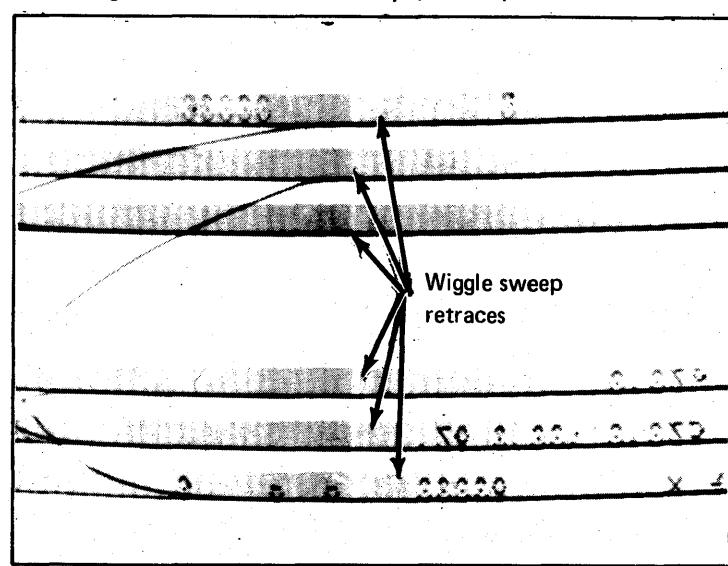
**Brightness control:** Normal



MAP- 3.1

**29 Symptom:** Failure to blank on wiggle sweep.

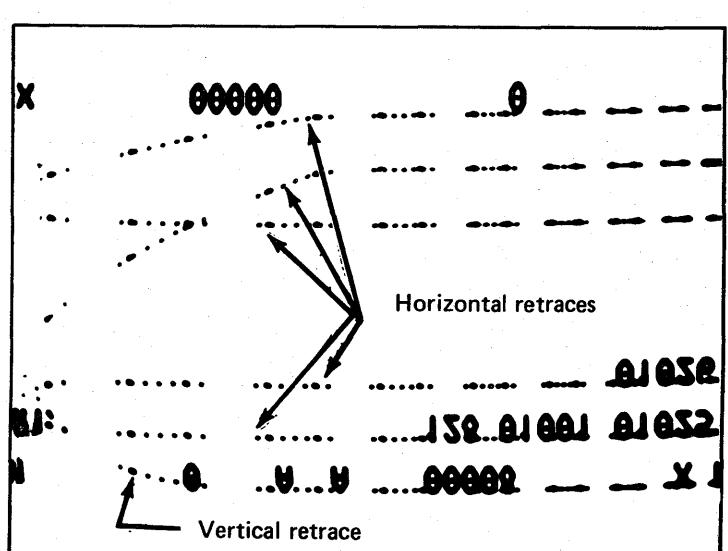
**Brightness control: Turned up (caution)**



### **MAP: 3-1**

**30 Symptom:** Failure to blank horizontal retrace.

#### **Brightness control: Turned up (caution)**

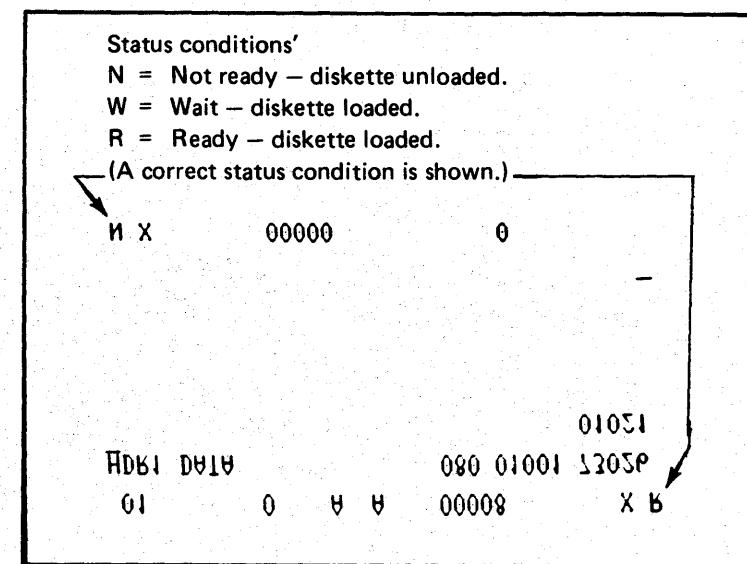


MAP: 31

## **DISPLAY AND DISPLAY UNIT SYMPTOMS**

### **31 Symptom: Machine status missing or wrong.**

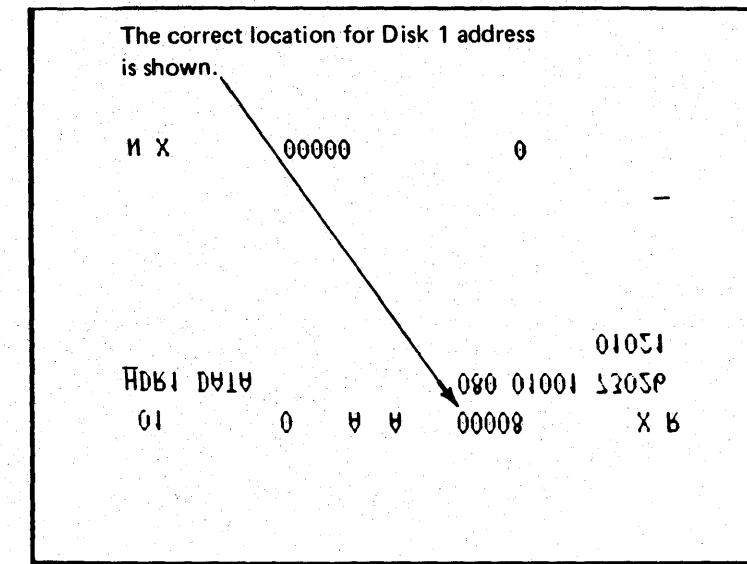
**Brightness control:** Normal



MAP: 2-6

### **32 Symptom: Disk address missing.**

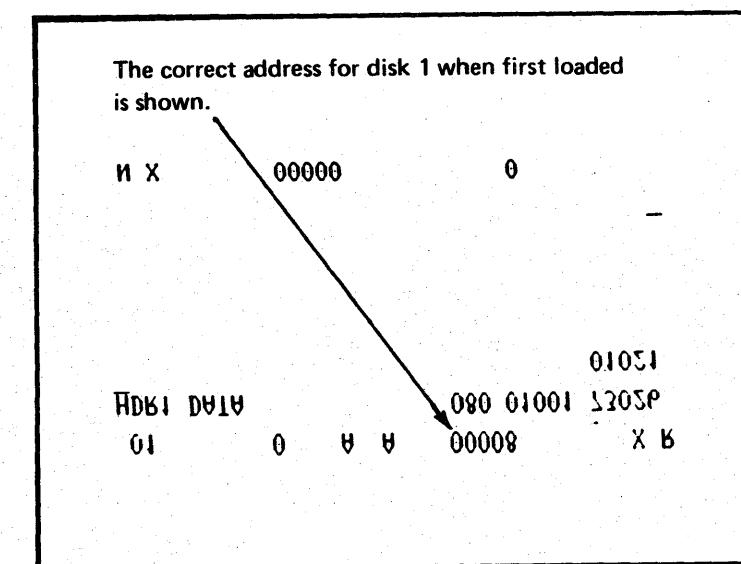
**Brightness control:** Normal



MAP: 2-6

### **33 Symptom: Disk address wrong**

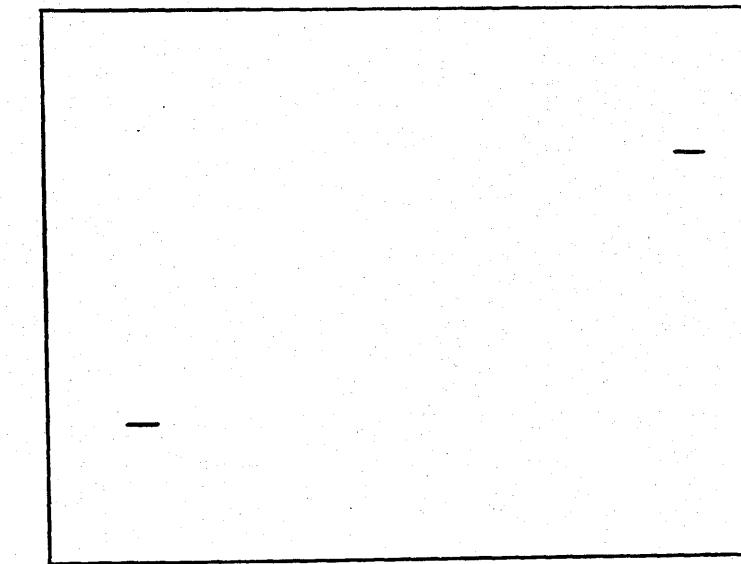
#### **Brightness control: Normal**



MAP: 2-2

### **34 Symptom: No characters; just cursors**

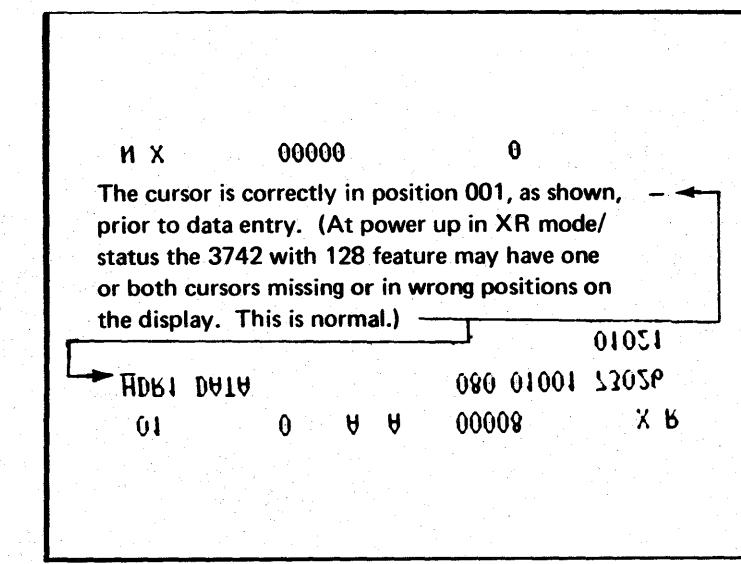
#### **Brightness control: Normal**



**MAP: 5-1**

**35 Symptom:** Cursors missing, or in wrong positions.

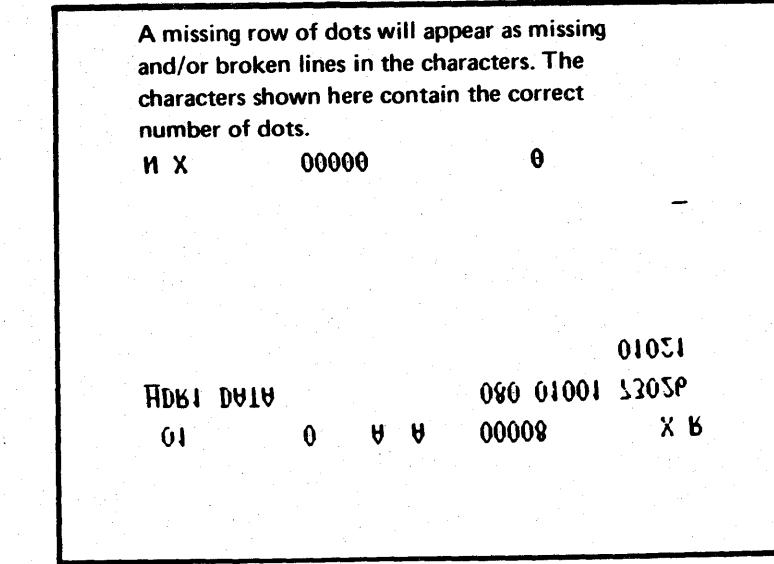
**Brightness control:** Normal



MAP: 5-1

### **36 Symptom: Dots missing from characters.**

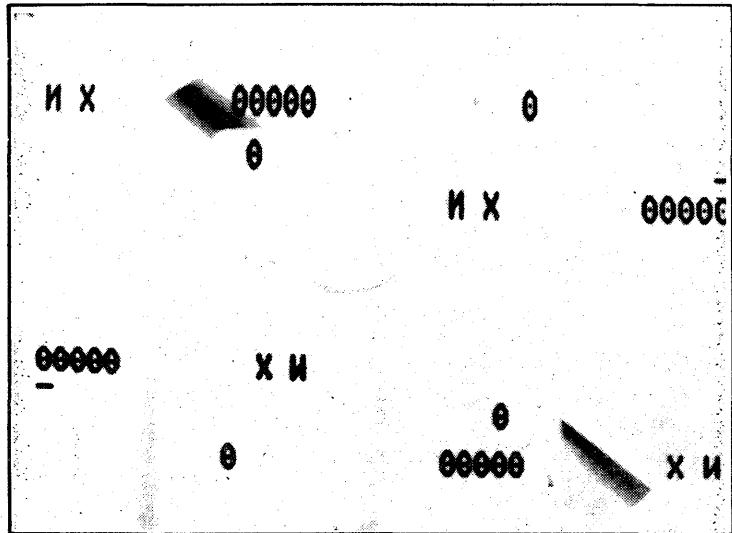
**Brightness control: Normal**



**MAP: 5-**

**37** Symptom: Added, missing, or wrong characters.

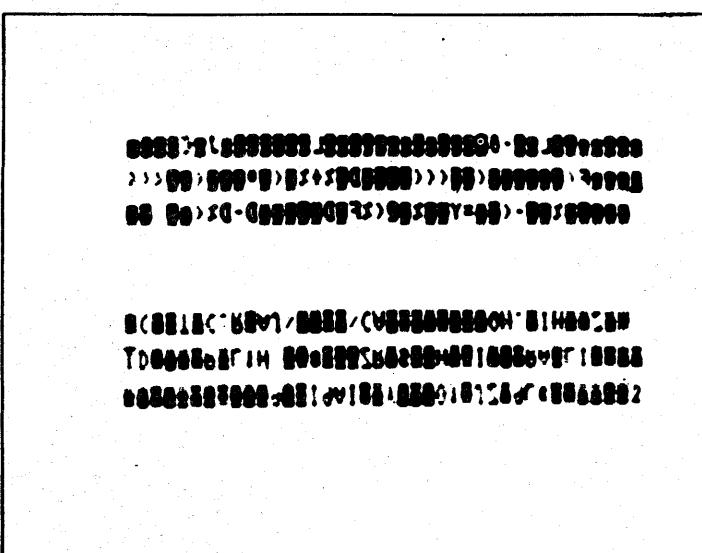
Brightness control: Normal



MAP: 5-1

**38** Symptom: Hex characters.

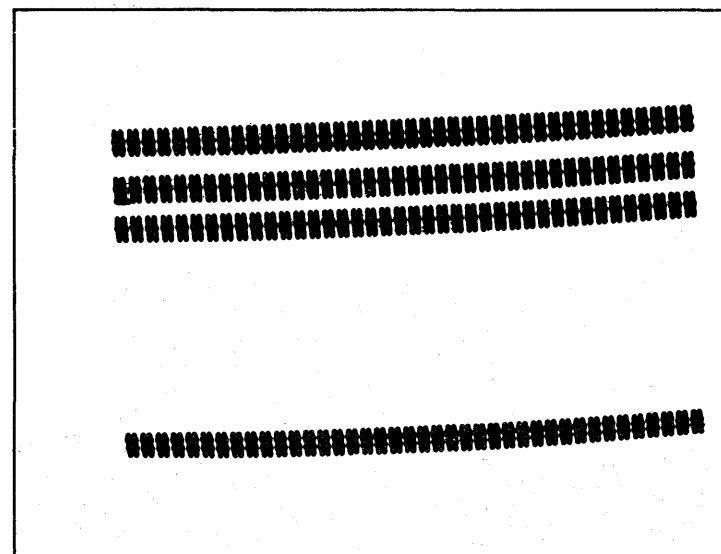
Brightness control: Normal



MAP: 5-1

**39** Symptom: Hex characters.

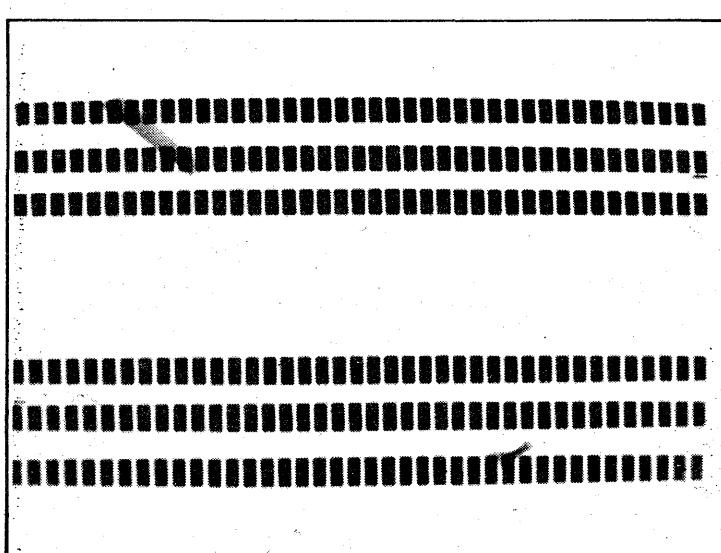
Brightness control: Normal



MAP: 5-1

**40** Symptom: Hex characters

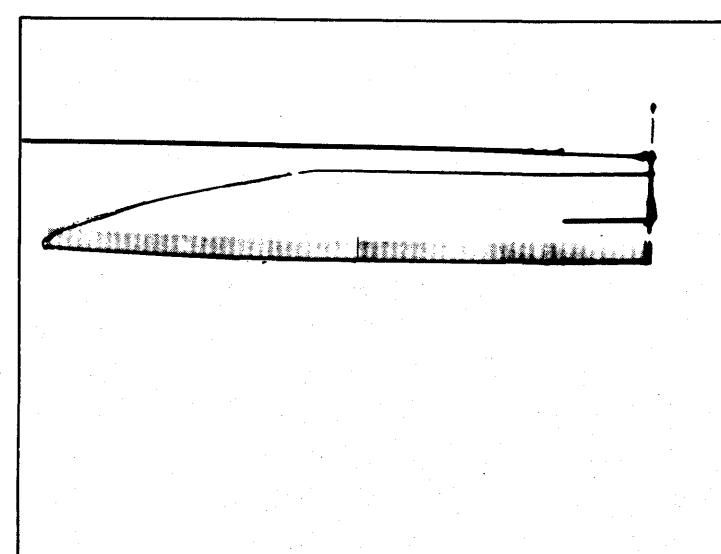
Brightness control: Normal



MAP: 5-1

**41** Symptom: Lines and hex characters.

Brightness control: Turned up (caution)



MAP: 6-1

#### DISPLAY-GENERAL

If none of the previous symptoms are *similar* to what you see on the display:

- Power down.
- Disconnect the keyboard signal cables at planar P and R.
- Power up (wait at least 30 seconds).

Does the machine still fail?

Y N

- Power down.
- Reconnect the keyboard cables at planar P and R.
- Use keyboard MAP 4-4.
- Power down.
- Reconnect the keyboard cables at planar P and R.
- Use MPU MAP 5-1.

**KEYBOARD AND OPERATIONAL SYMPTOMS****Alphabetic Shift**

- 4-2** Fails to override program control  
**4-2** Program fails  
**4-2** Will not alpha shift from keyboard

**Audio Feedback Device**

- 4-6** Always a tone  
**4-6** No tone at end of function  
**4-6** Tone or click at wrong time  
**4-6** No audio feedback from any key

**Auto Record Advance**

- 4-3** Always auto record advancing  
**4-2** Continual record advance  
**4-3** Fails to auto record advance  
**4-3** Fails to manual record advance

**Auto Dup/Skip**

- 4-3** Always auto dup/skip  
**4-3** Dups wrong data  
**4-3** Fails to auto dup/skip  
**4-3** Dups/skips a shift failure  
**4-3** Dups/skips too far  
**4-3** Dups/skips wrong fields

**Character Advance**

- 4-5** Continual character advance  
**4-2** Fails to character advance  
**4-5** Multiple character advance

**Character Backspace**

- 4-4** Character backspace beyond column 1  
**4-5** Continual character backspace  
**4-2** Fails to character backspace  
**4-5** Multiple character backspace

**Compute Field Totals**

- 4-5** Computes field totals wrong  
**4-2** Fails to compute field totals

**Copy**

- 4-5** Continual copy  
**4-4** Copies wrong data  
**4-2** Fails to copy  
**4-8C** Missing/extraneous records

**Dash (-)**

- 4-2** Fails to display  
**4-2** Fails to enter hex D

**Data**

- 4-2** No data entered and no click from one or more keys  
**4-4** No data entered with or without an audio response  
**4-6** Dead keyboard  
**4-8E** Altered/missing data

**Delete Index**

- 4-5** Deletes too many/wrong indexes  
**4-2** Fails to delete indexes

**Delete Record**

- 4-5** Deletes too many/wrong records  
**4-2** Fails to delete record

**Display Data**

- 4-4** Displays wrong data  
**4-2** Fails to display data

**Display Field Name**

- 4-4** Displays wrong field name  
**4-2** Fails to display field name

**Display Field Totals**

- 4-2** Always displays field totals  
**4-2** Fails to display field totals  
**4-4** Displays wrong field totals

**Display Program**

- 4-2** Always displays program  
**4-4** Displays wrong program  
**4-2** Fails to display program

**Display Field Program**

- 4-4** Displays wrong program  
**4-2** Fails to display program

**Display Production Statistics**

- 4-2** Displays production statistics always  
**4-4** Displays wrong production statistics  
**4-2** Fails to display production statistics

**Duplicate**

- 4-4** Dups too slow/fast  
**4-4** Dups wrong data  
**4-3** Fails to auto dup  
**4-2** Fails to manual dup

**Enter**

- 4-2** Always in enter mode  
**4-2** Fails to go into enter mode  
**2-4** Fails to write on disk

**Error**

- 4-6** Flashing display and no error code  
**4-6** Keyboard dead and no error code

**Field Advance**

- 4-5** Continual field advance  
**4-2** Fails to field advance  
**4-4** Field advances too far

**Field Backspace**

- 4-5** Continual field backspace  
**4-2** Fails to field backspace  
**4-4** Field backspaces too far

**Field Correct**

- 4-2** Fails to field correct

Field Totals		Production Statistics	Repeat	Search Sequential Content
4-2	Always displays field totals	4-2 Always displays production statistics	4-5 Continual repeat	4-4 Cannot enter content
4-2	Fails to display field totals	4-2 Fails to display production statistics	4-2 Fails to repeat	4-2 Fails to locate record
4-7	Wrong field totals	4-4 Wrong production statistics		4-2 Fails to search sequentially
4-8B	Field totals fails to function	4-8D Record count wrong	Reset	4-2 Fails to start search
				4-8F S errors
Function Select Upper or Lower		Program	4-5 Continual reset	Select Program
4-5	Always function select	4-2 Fails to program chain	4-2 Fails to reset	4-2 Fails to select program
4-2	Fails to function select	4-2 Fails to shift		4-4 Selects wrong program
4-4	Selects wrong function	4-4 Wrong program		
		4-4 Wrong program number		
Hex		Program Load	4-2 Always writes EOD	Self Check
4-5	Always enters hex	4-5 Always/extra program loads	4-2 Fails to write EOD	4-4 False errors
4-2	Fails to enter hex	4-2 Fails to program load		4-2 Wrong modulus
		4-2 Loaded wrong/no program		4-8A No self check error (modulus 10)
Initialize		Program Numeric Shift	Right Adjust	Skip
2-1	Fails to initialize when in initialize mode	4-5 Always in numeric shift	4-5 Continual right-adjust	4-2 Fails to alpha/num skip
4-2	Will not enter initialize mode	4-3 Fails to numeric shift	4-2 Fails to right-adjust	4-3 Fails to auto skip
			4-4 Incorrect right-adjust	4-2 Fails to program skip
Katakana Shift		Proof Keyboard Feature	Scroll Forward	4-2 Fails to skip
4-3	Always enters Katakana characters	7-6 Numeric keys enter incorrect data.	4-5 Always scrolls forward	4-4 Skips short/too far
4-3	Katakana shift switch fails to cause a Katakana shift			
4-5	Kana shift key fails to cause a Katakana shift			
5-1	Programmed Katakana shift fails			
Katakana Symbol Shift		Read Index	Scroll Backward	Space Bar
4-5	Always enters Katakana symbols	4-4 Displays wrong data	4-5 Always scrolls backward	4-2 Fails to space
4-5	Fails to Katakana symbol shift	2-2 Fails to read the index track	4-2 Fails to scroll backward	4-2 Cursor remains stationary
4-5	Fails to enter Katakana symbols			4-5 Spaces too far
Modify Index		Record Advance 1 or 2	Search Address	Update
4-4	Partial index modified	4-5 Continual record advances	4-4 Cannot enter search address	4-5 Always updates
4-2	Will not modify index	4-2 Fails to record advance	4-2 Fails to search	4-2 Fails to update
		4-5 Multiple record advances	4-4 Goes to wrong/no address	2-4 Fails to write on disk
Numeric Shift		Record Backspace 1 or 2	Search Content	Verify
4-2	Always numeric shift	4-5 Continual record backspaces	4-4 Cannot enter search content	4-2 Fails to verify
4-2	Fails to numeric shift	4-2 Fails to record backspace	4-2 Fails to locate record	4-4 False errors
		4-5 Multiple record backspaces	4-2 Fails to search	4-2 Verified wrong record
Record Insert		Record Insert	Search EOD	
4-2	Always numeric shift	4-2 Fails to record insert	4-2 Fails to locate EOD	
4-2	Fails to numeric shift		4-2 Fails to search	
			4-4 Locates wrong record	
			4-4 Stops on no EOD	

## MISCELLANEOUS SYMPTOMS

### CRT

**5-1** Hex characters during power up

### Disk Unit Symptoms

**2-1** Diskette problems  
**2-6** Not ready  
**2-2** Read check  
**2-9** Seek errors (no data errors)  
**2-4** Write check  
**2-11** Diskette not interchangeable with other disk units  
**2-6** Machine status or disk address missing  
**2-6** Machine status wrong  
**2-2** Disk address 1 or 2 wrong  
**2-12** Machine slow

### Features

**7-3** Feature A checkout procedure  
**7-4** 128 Record length feature checkout procedure  
**7-5** Record Insertion checkout procedure  
**7-6** Proof keyboard checkout procedure

### Keyboard

**4-8E** Altered/missing data  
**4-2** Binding key  
**4-6** Buzzing  
**4-6** Click only from reset  
**4-6** Dead keyboard  
**4-1** Error code but audio feedback device works  
**4-4** Incorrect data entered with or without audio response  
**4-4** Incorrect function performed with or without an audio response  
**4-6** Keyboard locked up  
**2-12** Machine slow  
**4-5** Multiple characters entered for one keystroke  
**4-6** No click from any key  
**4-2** No data entered and no click from one or more keys  
**4-4** No data entered with or without an audio response  
**4-2** No function performed and no click from one or more keys  
**4-4** No function performed with or without an audio response  
**4-6** No tone at end of function  
**4-2** Sticking key  
**4-3** Will not perform function selected by toggle switches

### Power Supply

**6-2** Burnt smell  
**6-1** Incorrect voltage at I/O unit  
**6-1** Intermittent operation  
**6-1** Machine inoperative  
**6-3** Service circuit breaker tripped  
**6-2** Smoke

# DISK MAPS

## MAP 2-1 —

- Remove the diskette.
- Power down.
- Wait 5 seconds.
- Power up.
- Load the diskette which is causing the errors.

— This MAP will help find diskette problems.

Is there an error?

Y N

Is the address of the fault known? —

Y N

- Perform failing operation, if known.

— Try to identify the record which had the error to isolate the problem to the diskette or to the disk drive unit.

Is there a numeric error code? —

Y N

— Use disk MAP 2-2.

— Search for the defective record; if none is evident, the disk drive unit that prepared the diskette is probably at fault.

— Remove the diskette.

— Load a different diskette. —

— Hold NUM SHIFT, and press RESET.

— Perform the failing operation.

— Try to isolate the problem to the diskette or to the disk unit that prepared the diskette.

Is there a numeric error code?

Y N

— The first diskette was defective; have it reinitialized. —

— CAUTION: The customer may wish to recover data from the diskette before it is reinitialized.

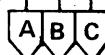
— Use disk MAP 2-2.

Is the defective record in track 00? •

Y N

- Press FUNCT SEL lower.
- Press SEARCH ADDRESS. —
- Key in the address of the suspected record.
- Press REC ADV.

— Try to locate the defective record.



A    B    C

Is there a numeric error code?

Y    N

— Use disk MAP 2-2.

— Remove the diskette.

— Load a different diskette. —

— Perform the failing operation.

— Try to isolate the problem.

Is there an error code?

Y    N

— The first diskette is defective; have it reinitialized. —

— Use disk MAP 2-2.

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

— Press REC ADV and advance to the faulty record.

Is there an error?

Y    N

— Use disk MAP 2-2.

— Hold NUM SHIFT and press RESET.

— Check the data set label (239).

Is the data set label OK?

Y    N

— Have the data set label corrected.

Does the machine still fail?

Y    N

— This disk is defective; have it reinitialized. —

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

Are there any numeric error codes?

Y    N

Are there any error codes?

Y    N

Is the machine still failing?

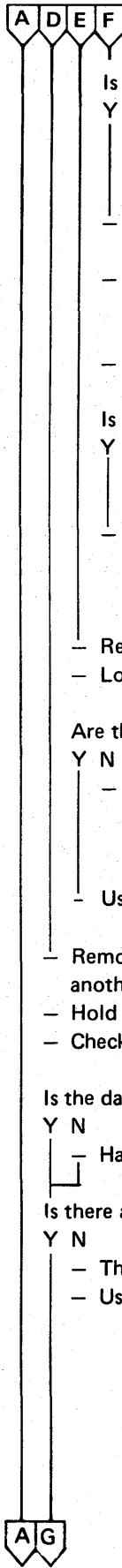
Y    N

— This diskette is defective; have it reinitialized. —

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

— Perform the failing operation.

A    D    E    F



Is there a numeric error code?

Y N

- Remove the diskette.
- Use disk MAP 2-2.
- Hold NUM SHIFT and press RESET.
- Remove the diskette and insert it into another disk drive unit. —
- Perform the failing operation.

— Try to isolate the problem to the diskette or to the disk drive which prepared that diskette.

Is there an error code?

Y N

- Use disk MAP 2-2.
- This diskette is defective; have it reinitialized. —
- Remove the diskette.
- Load a different diskette.

— **CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

Are there any error codes?

Y N

- The first diskette is defective; have it reinitialized. —
- Use MPU MAP 5-1.

— **CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

— Remove the diskette and insert it into another disk drive.

- Hold NUM SHIFT and press RESET.
- Check the data set label (239).

Is the data set label OK?

Y N

- Have the data set label corrected.

Is there a numeric error code?

Y N

- The first disk drive unit is defective.
- Use disk MAP 2-2. —
- The disk drive used prior to this one is defective. Use MAPs on defective disk drive.



Are there ?? in the error code?

Y N

- Hold NUM SHIFT and press RESET.
- Check the data set label (239).

Is data set label OK?

Y N

- Have the data set label corrected.

Does the machine still fail?

Y N

- The diskette is defective; have it reinitialized. —

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

Are there any numeric error codes?

Y N

Are there any error codes?

Y N

Is the machine still failing?

Y N

- The diskette is defective; have it reinitialized. —
- Perform the failing operation.

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

Is there a numeric error code?

Y N

- Remove the diskette.
- Use disk MAP 2-2.

— Hold NUM SHIFT and press RESET.

- Remove the diskette and insert it into another disk drive unit. —
- Perform the failing function.

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

Is there an error code?

Y N

- Use disk MAP 2-2.

— This diskette is defective; have it reinitialized. —

— Remove the diskette.

— Load a different diskette.

— Try to isolate the problem to the diskette or to the disk drive which prepared that diskette.

**— CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.





Are there any error codes?

Y N

— The first diskette is defective; have it reinitialized. —

— Use disk MAP 2-2.

— **CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

— Remove the diskette and insert it into another disk drive.

— Hold NUM SHIFT and press RESET.

— Check the data set label (239).

Is the data set label OK?

Y N

— Have the data set label corrected.

Is there a numeric error code?

Y N

— The first disk drive unit is defective.

— Use disk MAP 2-2. —

— The disk drive used prior to this one is defective.  
Use MAPs on defective disk drive.

— The diskette is defective; have it reinitialized. —

— **CAUTION:** The customer may wish to recover data from the diskette before it is reinitialized.

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## MAP 2-2 —

- This MAP will help find read check problems or disk-address-wrong problems.

The purpose of this section of the MAP is to help you determine which machine, disk drive, or diskette is the cause of the failure when it appears many machines or diskettes are involved.

Several conditions can exist:

1. Diskettes written on a failing drive can cause other machines to fail while the failing machine appears OK to the operator.
2. A drive with bad write current will cause failures on other machines and may or may not fail itself.
3. A poor quality diskette that causes failures on some or all machines.

In condition 1, a drive with a head partially out of adjustment will normally read a diskette that it has written since head alignment is not critical as long as diskettes are written and read on the same machine.

Has the failing disk drive been determined?

Y N

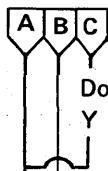
- To isolate the failing drive, use the CE diskette on machines that you know appear error free (error code 2 or 4).
- Load CE diskette in disk drive to be checked.
- Press REC ADV.
- Press FUNCT SEL lower.
- Press UPDATE.
- Use of the test diskette is to locate head alignment problems.
- If disk drive 2 is being checked, swap disk signal cables in positions J and K at MPU. Cables must be restored to original position upon completion of this test (212A).
- See MAP 2-11 for additional explanations. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09?

Y N

- Power down.
- Adjust the head (208).
- Verify the adjustment with CE diskette.

A B C



Does the machine still fail?

Y N

- The head was out of adjustment.

Is this the first drive you are isolating?

Y N

- Read the data written on the prior disk drive unit. —
- Use update mode.

— Locates defective writing by writing a record on one drive and reading that record on another drive.

Does the data read error free?

Y N

- The drive that wrote the data is failing when writing. Return to that drive and use disk MAP 2-4.
- Use a known good diskette.
- Enter at least one record taking care not to destroy customer data. Remember the location of this record; you need to read it on another drive.

Have all drives been tested?

Y N

- Return to the start of this MAP and test another suspect drive.

Check for a possible defective diskette in use.  
Use MAP 2-1.

Check to see if you can find any one of the following defects in the problem/suspect disk drive unit:

1. Belt-off or damaged (216K).
2. Pulley (2)—loose (216D and G).
3. Idler assembly—defective mechanical operation (216E).
4. Drive motor—binding or sticking (216N).
5. Cover or cover pivot (2)—loose or broken (224E).

Is the disk drive in the failing station free of all the listed defects?

Y N

- Repair or replace the faulty part.
- Verify the fix.



D E

Does the machine still fail?

Y N

Select the proper IR code and cause code for the faulty part from the charts.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps one on each call, until the problem is solved.
- Record the date of each action.
- Vibrate the machine to try to cause the failure.
- Check the room temperature and humidity and compare them to *Installation Procedures*, page 16-1.
- Check the dc voltages at the disk FC card (204A) with respect to frame ground.

**Note:** There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different.

VDC	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	TP17	TPA3	0

- Load the CE alignment diskette in the disk drive unit to be checked.
- Press REC ADV.
- Press FUNCT SEL lower.
- Press UPDATE.

- If disk drive 2 is being checked, swap disk signal cables in positions J and K at MPU. Cables must be restored to original position upon completion of this test.

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09? —

Y N

- Power down.
- Adjust the head (208).
- Verify the adjustment with the CE diskette.

DATE:

- See MAP 2-11 for additional explanation. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

F G



- Power down.
- Reseat both ends of disk signal cable (212A, 204B).
- Reseat the disk file cable at the disk FC card (204C).
- Verify the fix.

DATE:

- Power down.
- Swap the disk units.
- Verify the fix.

DATE:

Does the same station fail?

Y N

- Perform the following steps on the failing drive:
- Power down.
- Replace the VFO card (212B).

— Verify the fix.

DATE:

— Power down.

— Replace the disk signal cable (212A, 204B).

— Verify the fix.

DATE:

— Replace the ac line filter.

— Verify the fix.

DATE:

— Use MPU MAP 5-1.

- Power down.
- Clean the head **and** pressure pad (209).

— Verify the fix.

DATE:

— Power down.

— Replace the head and carriage assembly (225).

— Verify the fix.

DATE:

— Power down.

— Replace the disk FC card (204A).

— Verify the fix.

DATE:

— Power down.

— Reseat both ends of disk signal cable (204B, 212A). —

— Reseat the disk FC card (204A).

— Reseat the disk file cable at the disk FC card (204C).

— Reseat the planar cross connectors A and B (212B).

— Verify the fix.

— At disk unit and MPU planar, position J for disk 1 and K for disk 2.



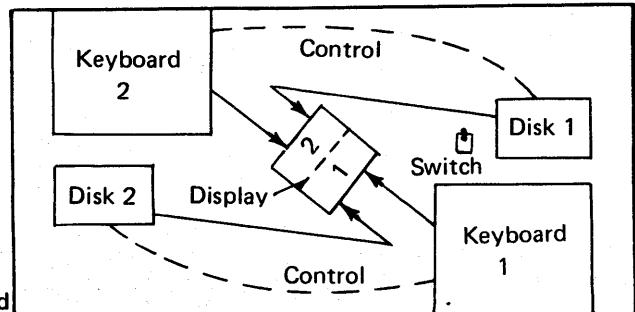
H

Does the machine still fail?

Y N

The cables or the disk FC card or cross connectors were loose.

- Remove the diskette.
- Power down.
- Swap the disk signal cables at planar sockets J and K. Disk drive 1 will now be connected to station 2 and disk drive 2 will be connected to station 1 (212A).
- Power up.
- Load a different diskette in the other disk drive.



— Control and display interactions with disk drive signal cables swapped at planar sockets J and K.

— A disk with no history of numeric errors.

Does the display status line of the original failing station show XR mode (mode-status) without an error?

Y N

- Power down.
- Reconnect the disk signal cables to their original connectors at planar sockets J and K.
- Replace the VFO card (212B).
- Verify the fix.

Does the machine still fail?

Y N

The VFO card was defective.

- Power down.
- Reinstall the original VFO card.
- Use MPU MAP 5-1.
- Power down.
- Reconnect the disk signal cables at planar sockets J and K to their original connectors.
- Power up.
- Remove the diskette from the other station and load it in the failing station.
- Wait for warm-up. (30 seconds)

Are the error code positions blank?

Y N

- Hold NUM SHIFT and press RESET.
- Press FUNCT SEL lower.
- Hold NUM SHIFT and press the C key.
- Press the J key.
- The machine is in CER (mode-status).

— The machine is in CEW (mode-status) displaying disk IDs.

Is the machine in CEW (mode-status)? —

Y N

- Use disk MAP 2-3.

J

J

Are 26 record IDs displayed?

Y N

- Load the CE diskette in the disk drive to be checked.
  - Press REC ADV.
  - Press FUNCT SEL lower.
  - Press UPDATE.

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09? —

Y N

- Power down.
  - Adjust the head (208).
  - Verify the adjustment with the CE diskette.

**Does the machine still fail?**

Y N

**The head was out of adjustment.**

- Use disk MAP 2-3.

— Use disk MAP 2-3.

There are 4 characters displayed per record ID.

- If disk drive 1 is being checked, swap disk signal cables in positions J and K at MPU. Cables must be restored to original position upon completion of this test.

- See MAP 2-11 for additional explanation. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

If you had changing error codes when you started this call, was the numeric part of the first error code 1, 2, 3, 4, 6, or 7 during the failing operation? (If you do not have changing error codes, continue in Y leg of this MAP.)

Y N

- If it was 0, use disk MAP 2-6.
- If it was 5, use disk MAP 2-4.

— Power up.

— Measure dc voltages at the disk FC card (204A) with respect to frame ground. —

**Note:** There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

Vdc	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TBA12	4.6 to 5.4
Ground	TP17	TPA3	0

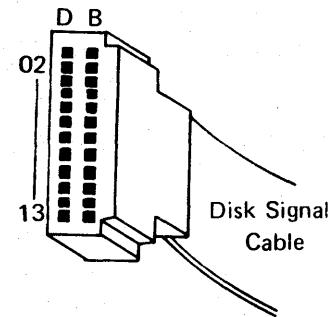
Are all dc voltages within limits?

Y N

- Make a note of the failing voltage measurement for future reference.
- Power down.
- Disconnect the disk signal cable (204B) at the disk FC card.
- Power up.
- Measure the failing voltage at the disk FC card end of the disk signal cable with respect to frame ground. —

Vdc	Test Points	Limits
+24	B10	22.0 to 26.5
+5	B03	4.7 to 5.5
-5	B11	4.6 to 5.4
Ground	B08	0

A B



A      B

Is the failing dc voltage within limits?

Y      N

- Power down.
- Reconnect disk signal cable.
- Use power supply MAP 6-1.

- Power down.
- Reconnect disk signal cable.
- Replace the disk FC card (204A).
- Verify the fix.
- Try loading the diskette at least twice. — —

— — A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error for the first time the diskette is loaded.

Does the machine still fail?

Y      N

- The disk FC card was defective.

- Power down.
- Reinstall the original FC card.
- Use MAP 6-7.

— Power down.

— Place the disk drive unit in the service position (206).

— Load the diskette.

— Close the cover.

— Jumper the disk FC card (204A): —

- For disk FC card X, from TP17 to TP22.
- For the disk FC card Y, from TPA3 to TPB4.

— Power up.

— Observe the head load actuator.

— To energize the head load actuator.

Is the head load actuator energized (207)?

Y      N

- Power down.
- Check the head load actuator cable for shorts and opens.

Is the head load actuator cable OK?

Y      N

- Replace the head load actuator wires in disk file cable (204C).
- Verify the fix.

The disk file cable was defective.

- Check head load actuator for proper mechanical operation (207).

C      D

C D

Is the head load actuator mechanically OK?

Y N

- Replace the head load actuator.
- Verify the fix.

The head load actuator was defective.

- Check the head load actuator for opens and shorts.

Is the head load actuator electrically OK?

Y N

- Replace the head load actuator.
- Verify the fix.

The head load actuator was defective.

- Replace the disk FC card (204A).

- Verify the fix.

The disk FC card was defective.

- Power down.

- Check the head load actuator for proper mechanical operation (207).

Is the head load actuator mechanically OK?

Y N

- Replace the head load actuator.
- Verify the fix.

The head load actuator was defective.

- Power up.

- Check/adjust the head load actuator (207).

Is the adjustment OK?

Y N

- Adjust the head load actuator (207).
- Verify the fix.

The head load actuator was out of adjustment.

- Observe the pressure pad (207).

Is the pressure pad pressing the disk against the head?

Y N

- Remove the jumper at the disk FC card (204A).
  - For disk FC card X, from TP17 to TP22.
  - For disk FC card Y, from TPA3 to TPB4.
- Power down.
- Replace the head and carriage assembly.
- Verify the fix.

The head and carriage assembly was defective.

- Use the *Leadscrew and Head Carriage Assembly Removal and Replacement procedure* (225). Then return to this point in this MAP.

E

— Open the disk cover.

- Remove the jumper from disk TP17 and TP22 (204).
- Observe the head load actuator as you close the disk cover.
- The MPU should attempt to read track 0. The head load actuator should be energized, until this action is completed, then be deenergized.

Does the head load actuator function?

Y N

- Set the CE meter to the 50 Vdc scale to test for a pulse on the disk FC card (204A).
  - For disk FC card X, from TP22 (+) to TP17 (-),
  - For disk FC card Y, from TPB4 (+) to TPA3 (-).
- Observe the meter as you open the disk cover and close it again.
- Checks the signal to the head load actuator coil.
- A pulse should deflect the meter needle momentarily.

Is there a pulse?

Y N

- Test the probe at planar P-B10 (signal ground P-D08). Both lights should be on.
- Probe the disk FC card (204A).
  - For the disk FC card X, from TP10 (+) to TP17 (-).
  - For disk FC card Y, from TPB13 (+) to TPA3 (-).
- Open the disk cover and close it again.



- Connect probe power leads to planar M-D13 (-) black, M-B05 (+).
- Checks the signal to the head load actuator coil.

Are both lights on?

Y N

- Probe planar socket J or K-D10.
- Open the disk cover and close it again.

- Try to isolate the trouble in the cable, or in the MPU. Signal ground at J or K-B08.

Are both lights on?

Y N

- Power down.
- Swap the disk FC cards (204A).
- Power up.

Does the machine still fail when using the same disk unit?

Y N

- Power down.
- Replace the disk FC card in other disk drive (204A).
- Verify the fix.

The disk FC card was defective.

F	G	H	J	K
---	---	---	---	---

F G H J K

- Power down.
- Check the disk signal cable for shorts or opens (204B).

Is the disk signal cable OK?

Y N

- Replace the disk signal cable.

- Verify the fix.

The disk signal cable was defective.

- Power down.

- Replace the VFO card (212B).

- Verify the fix.

Does the machine still fail?

Y N

The VFO card was defective.

- Power down.

- Reinstall the original VFO card.

- Use MPU MAP 5-1.

- Power down.

- Swap the disk FC cards (204A).

- Power up.

Does the machine still fail when using the same disk unit?

Y N

- Power down.

- Replace the disk FC card in other drive (204A).

- Verify the fix.

The disk FC card was defective.

- Power down.

- Check/Replace the disk signal cable(204B).

- Verify the fix.

The disk signal cable was defective.

- Power down.

- Swap the disk FC cards (204A).

- Power up.

Does the machine still fail when using the same disk unit?

Y N

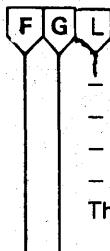
- Power down

- Replace the disk FC card in the other disk drive (204A).

- Verify the fix.

The disk FC card was defective.

F G L



- Power down.
- Remove the diskette.
- Replace the head load actuator (207).
- Verify the fix.

The head load actuator was defective.

- Power down.
- Replace the head load actuator (207).
- Verify the fix.

Does the machine still fail?

Y N

The head load actuator was defective.

- Power down.
- Reinstall the the original head load actuator.
- Check or replace the head load actuator wires in the disk file cable (204C).
- Verify the fix.

Does the machine still fail?

Y N

The disk file cable was defective.

- Load the CE diskette in the disk drive to be checked. —
- Press REC ADV.
- Press FUNCT SEL lower.
- Press UPDATE.

- If disk drive 2 is being checked, swap disk signal cables in position J and K at MPU. Cables must be restored to original position upon completion of this test (212A).

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09? —

Y N

- Power down.
- Adjust the head (208).
- Verify the adjustment with the CE diskette.

- See MAP 2-11 for additional explanation. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

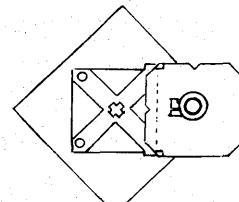
Does the machine still fail?

Y N

The head was out of adjustment.

- Power down.
- Move the head and carriage assembly up by turning stepper motor shaft two revolutions.
- Power up. —

- Ten seconds after power up, the MPU will cause a series of seek-to-track commands. Then the leadscrew wheel will stop in phase 0 position:



M

Did the head and carriage assembly move down to track 0?

Y N

- Use disk MAP 2-9.
- Load a different diskette.
- Perform the failing operation.

Does the machine still fail?

Y N

- The problem is the diskette.
- Use disk MAP 2-1 with the failing diskette.

- Power down.
- Swap disk FC cards (204A).
- Power up.
- Verify the fix.

If an error code occurs on the first attempt, reload — the diskette one or more times to see if no error occurs for those times.

- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

Does the machine still fail when using the same disk unit?

Y N

- Power down.
- Replace the disk FC card, in the other disk drive (204A).
- Verify the fix.

The disk FC card was defective.

- Power down.

— Reinstall the original FC card.

- Check the disk signal cable (204B) for opens and/or short circuits, including short circuits to the frame.

Is the cable OK?

Y N

- Replace the disk signal cable (204B).
- Verify the fix.

The disk signal cable was defective.

- Power down.

— Replace the VFO card (212B).

- Verify the fix.

N



Does the machine still fail?

Y N

The VFO card was defective.

— Power down.

— Reinstall the original VFO card.

— Replace the head and carriage assembly. —

— Verify the fix.

— Use the *Leadscrew and Head Carriage Assembly Removal and Replacement* procedure (225).

Then return to this point in this MAP.

Does the machine still fail?

Y N

The head and carriage assembly was defective.

— Reinstall the head and carriage assembly.

— Use MPU MAP 5-1.

## MAP 2-4 -

— This MAP will help find write check problems.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
- Record the date of each action.
- Vibrate the machine to try to cause the failure.
- Check the room temperature and the humidity and compare it to *Installation Procedure* page 16-1.
- Check the dc voltages at the disk FC card (204A) with respect to frame ground.

*Note:* There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

Vdc	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	TP17	TPA3	0

- Power down.
- Reseat both ends of the disk signal cable (204 B, 212A).
- Reseat the disk FC card.
- Reseat the disk file cable at the disk FC card (204C).
- Verify the fix.

DATE:

- Power down.
- Swap the disk units.
- Verify the fix. —

DATE:

- Power down.
- Clean the head and pressure pad (209).
- Verify the fix.

DATE:

- Power down.
- Replace the disk FC card (204A).
- Verify the fix. —

DATE:

- Power down.
- Replace the VFO card (212B).
- Verify the fix.

DATE:

- Power down.
- Replace the head and carriage assembly (225).
- Verify the fix.

DATE:

— If the failure does *not* follow the disk drive unit, skip to VFO card replacement further on in this procedure.

— Try loading the diskette at least twice. A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.





- Power down.
- Replace the disk signal cable (204B).
- Verify the fix.  
DATE: 

--	--	--
- Replace the ac line filter.
- Verify the fix.  
DATE: 

--	--	--
- Use MPU MAP 5-1.
  
- Power down.
- Reseat both ends of the disk signal cable (204B, 212A). —
- Reseat the disk FC card (204A).
- Reseat the disk file cable at the disk FC card (204C).
- Reseat planar cross connectors A and B (212B).
- Verify the fix.

Does the machine fail now?

Y N

- The disk signal cable or the disk FC card or the cross connectors were loose.
  
- Remove the diskette.
- Power down.
- Swap the disk signal cables at planar sockets J and K. Disk drive 1 will now be connected to station 2 and disk drive 2 will be connected to station 1. —
- Load a different diskette in the other disk drive.
- Do the failing operation.

Is there an error code in the display status line of the original failing station?

Y N

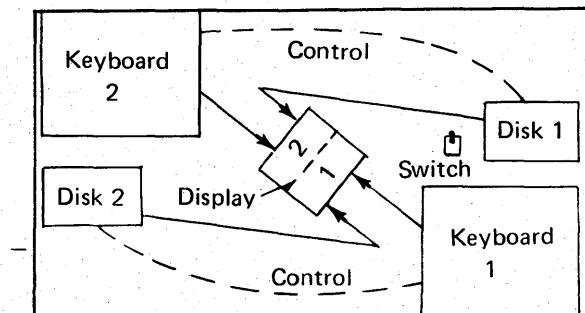
- Power down.
- Reconnect the disk signal cables at planar sockets J and K to their original connectors.
- Use disk MAP 2-5.
  
- Power down.
- Reconnect the disk signal cables at planar sockets J and K to their original connectors.
- Replace the VFO card (212B).
- Verify the fix.

Does the machine still fail?

Y N

- The VFO card was defective.
  
- Power down.
- Reinstall the original VFO card.
- Use MPU MAP 5-1.

- At disk unit and MPU planar, position J for disk 1 and K for disk 2.



Control and display interactions with disk drive signal cables swapped at planar sockets J and K (212A).

## MAP 2-5 —

- Power down.
- Wait 5 seconds. —
- Power up.
- Test the probe at planar P-B10. (Signal ground P-D08.) Both lights should be on. —
- Observe the probe for the disk FC card of the failing disk (204A).

**Note:** There are two types of disk FC cards: type X and type Y (204). Test points (TP) for the two cards are different:

- For disk FC card X, from TP9 (+) to TP17 (-).
- For disk FC card Y, from TPA6 (+) to TPA3 (-).

Whichever light is on before loading the diskette, the opposite light must turn on (momentarily or permanently) when the diskette is loaded. It does not matter whether the first light turns off or remains on. —

- For disk FC card X, from TP12 (+) to TP17 (-).
- For disk FC card Y, from TPA8 (+) to TPA3 (-).

The UP light should turn on momentarily when the diskette is loaded. —

Are both the probe results as stated?

Y N

- Observe the probe for each of the following test points as you load a known good diskette: —
  - Planar J-B02 (if second disk, K-B02): — Whichever light is on prior to loading the diskette, the opposite light must turn on (momentarily or permanently) when the diskette is loaded. It does not matter whether the first light turns off or remains on. —
  - Planar J-B05 (if second disk, K-B05): The UP light should turn on momentarily when the diskette is loaded. —

- This MAP is a continuation of MAP 2-4.
- Time required for power on reset to discharge a capacitor.
- Connect probe power leads to planar M-D13 (-) black, M-B05 (+).
- Tests the 'write data' line.

- Tests the 'write gate' line.
- A diskette with no history of numeric errors.
- Signal ground at J or K-B08.
- The signal you observe (write data) is very short. Watch closely.
- The signal you observe (write gate) is very short. Watch closely.

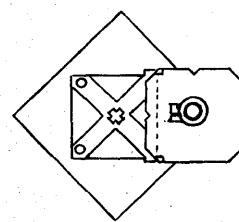


A      B

Are the probe results as stated?

Y    N

- Power down.
- Turn the stepper motor drive wheel several revolutions with your fingers. —
- Power up.
- Observe the head and carriage assembly. —
- Moves the head and carriage assembly away from track 0.
- At power up, the MPU should cause a series of seek-to-track 0 commands. Then the leadscrew wheel will stop in phase 0 position:



Did the head and carriage assembly move to track 0?

Y    N

- Use disk MAP 2-9.
- Power down.
- Place the disk drive unit in the service position (206).
- Load a diskette.
- Close the cover.
- Jumper the disk FC card (204A):
  - For disk FC card X, from TP17 to TP22.
  - For disk FC card Y, from TPA3 to TPB4.
- Power up.
- Observe the head load actuator.

Is the head load actuator energized?

Y    N

- Power down.
- Check the head load actuator cable for shorts and opens. —
- Part of the disk file cable (204C).

Is the head load actuator cable OK?

Y    N

- Replace the head load actuator wires in the disk file cable (204C).
- Verify the fix.

Does the machine still fail?

Y    N

The disk file cable was defective.

- Power down.
- Replace the head load actuator (207).
- Verify the fix.

Does the machine still fail?

Y    N

The head load actuator was defective.

- Power down.
- Reinstall the original head load actuator.
- Replace the disk FC card (204).
- Verify the fix.

The disk FC card was defective.

A      C      D



- Power down.
- Check the head load actuator for proper mechanical operation (207).

Is the head load actuator mechanically OK?

Y N

- Replace the head load actuator (207).
  - Verify the fix.
- The head load actuator was defective.
- Power up.
  - Check the head load actuator (207).

Is the adjustment OK?

Y N

- Adjust the head load actuator (207).
- Verify the fix.

The head load actuator is out of adjustment.

- Power down.
- Remove the jumper at the disk FC card (204A):
  - For disk FC card X, from TP17 to TP22.
  - For disk FC card Y, from TPA3 to TPB4.
- Swap the disk FC cards (204A).
- Power up.

If an error code occurs on the first attempt, reload the diskette one or more times to see if no error occurs for those times.

A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

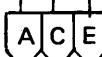
Does the machine still fail when using the same disk unit?

Y N

- Power down.
- Replace the disk FC card in the other unit (204A).
- Verify the fix.

The disk FC card was defective.

- Power down.
- Reinstall the original disk FC card.
- Check the disk signal cable for opens and shorts (204B).



A C E

**Is the cable OK?**

**Y N**

- Replace the disk signal cable (204B).
- Verify the fix.

The disk signal cable was defective.

- Replace the VFO card (212B).
- Verify the fix.

**Does the machine still fail?**

**Y N**

The VFO card was defective.

- Power down.
- Reinstall the original VFO card.
- Replace the head and carriage assembly (225).
- Verify the fix.

**Does the machine still fail?**

**Y N**

The head and carriage assembly was defective.

- Power down.
- Reinstall the original head and carriage assembly.
- Use MPU MAP 5-1.
- Power down.
- Replace the disk signal cable (204B, 202A).
- Verify the fix.

The disk signal cable was defective.

— Power down.

- Turn the stepper motor drive wheel several revolutions with your fingers.
- Power up.
- Observe the head and carriage assembly.

**Did the head and carriage assembly move to track 0?**

**Y N**

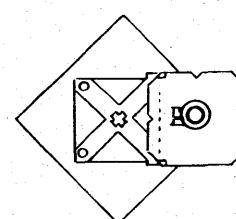
- Use disk MAP 2-9.

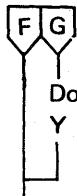
**Does the leadscrew wheel stop in phase 0 position?**

**Y N**

- Power down.
- Adjust the head (208).
- Verify the adjustment with the CE diskette (MAP 2-11).

- Moves the head and carriage assembly away from track 0.
- At power up, the MPU should cause a series of seek-to-track 0 commands. Then the leadscrew wheel will stop in phase 0 position:





Does the machine still fail?

Y N

The head was out of adjustment.

Load a known good diskette. —

— A diskette with no history of numeric errors.

— Perform the failing operation.

Does the machine still fail?

Y N

— The problem is the other diskette.  
— Use disk MAP 2-1 with the failing diskette.

— Power down.

— Swap the disk FC cards (204A).

— Power up.

— Try loading the diskette at least twice.

Does the machine still fail when using the same disk unit?

Y N

— Power down.  
— Replace the disk FC card in the other disk unit.  
— Verify the fix.

The disk FC card was defective.

— Power down.

— Reinstall the original disk FC card if replaced.

— Check the disk signal cable for opens, shorts, and grounds (204B).

Is the cable OK?

Y N

— Replace the disk signal cable (204B).  
— Verify the fix.

The disk signal cable was defective.

— Replace the VFO card (212B).

— Verify the fix.

Does the machine still fail?

Y N

The VFO card was defective.

— Power down.

— Reinstall the original VFO card.

— Replace the head and carriage assembly (225).

— Verify the fix.

The head and carriage assembly was defective.

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## MAP 2-6 -

— This MAP will help find not ready, missing disk address, and missing or wrong machine status problems.

- Check to see if you can find any one of the following defects in the problem/suspect disk drive unit:

1. Belt — off or damaged (216K).
2. Pulley (2) — loose (216D, 216G).
3. Idler assembly — defective mechanical operation (216E).
4. Drive motor — binding or sticking (216N).
5. Cover or cover pivot (2) — loose or broken (224E).

Is the disk drive in the failing station free of all the listed defects?

Y N

- Repair or replace the faulty part.
- verify the fix.

Does the machine still fail?

Y N

- Select the proper IR code and cause code for the faulty part from the charts.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
- Record the date of each action.
- Vibrate the machine to try to cause the failure.
- Check the room temperature and the humidity and compare it to the installation procedure, page 16-1.
- Check the dc voltages at the disk FC card (204A) with respect to fram ground.

*Note:* There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

Vdc	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	TP17	TPA3	0



- Power down.
- Reseat both ends of the disk signal cable (204B, 212A). —
- Reseat the disk file cable at the disk FC card (204C).

— Verify the fix.

DATE: 

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— Power down.

— Swap the disk units.

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Replace the LED assembly (223).

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Replace the phototransistor assembly (243).

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Replace the disk FC card (204A).

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Replace the disk file cable (204C).

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Replace the disk signal cable (204B).

— Verify the fix.

DATE: 

--	--	--

— Replace the ac line filter.

— Verify the fix.

DATE: 

--	--	--

— Power down.

— Reseat both ends of the disk signal cable (204B, 212A). —

— Reseat the disk FC card (204A).

— Reseat the disk file cable (204C).

— Verify the fix.

- At the disk unit and MPU planar, position J for disk 1 and K for disk 2.

C

C

Does the machine still fail?

Y N

The cables or the disk FC card was loose.

- Remove the diskette.
- Power down.
- Turn the stepper motor wheel several revolutions.
- Power up.
- Observe the head and carriage assembly (208G).
- The power-up routine should cause the stepper motor to seek track 0 several times. When the read/write head reaches track 0, the stepping action is audible.

Did the stepper motor cause the disk unit to seek

Track 00?

Y N

- Use disk MAP 2-9.
- Place the disk drive unit in the service position (206).
- Close the disk cover.
- The disk cover may be causing the failure.

Is the disk drive hub turning (216A)?

Y N

Is the disk drive motor running (216N)?

Y N

- Disconnect the ac cable at the disk drive motor (216F).
- Check the machine ac voltage tag for limits.
- Use the CE meter to measure the voltage at the cable connector.
- The ac voltage and limits are:
  - The two outside pins are the ac voltage pins.

Voltage	Limits	Voltage	Limits
100 Vac	90 to 110	204 Vac	179 to 229
110 Vac	99 to 121	208 Vac	187 to 229
115 Vac	103 to 127	220 Vac	198 to 242
123 Vac	111 to 136	230 Vac	207 to 253
200 Vac	180 to 220	235 Vac	211 to 259

Is the voltage within limits?

Y N

- Measure the voltage at the power supply transformer TB1, terminals 7 and 9 (244B).

D E F G

D E F G

Is the voltage within limits?

Y N

- Use power supply MAP 6-6.
- Power down.
- Replace the power supply ac cable (244A).
- Verify the fix.

The power supply ac cable was defective.

- Power down.
- Place the disk drive unit in the service position (206).
- Replace the disk drive motor (216N).
- Verify the fix.

The disk drive motor was defective.

- Power down.
- Place the disk drive unit in the service position (206).
- Remove the disk drive belt (216K).
- Spin the disk drive shaft with your fingers.

Is the disk drive shaft free of binds?

Y N

- Open the disk cover.
- Spin the disk drive shaft with your fingers.

Does the disk drive shaft bind now?

Y N

- Reinstall the disk drive belt (216K).
- Check the disk top cover for proper alignment (237).
- Verify the fix.
- Check the collet for spring deflection with the cover closed.

Does the spring deflect correctly?

Y N

- Replace the collet assembly (222).
- Verify the fix.

Does the machine still fail?

Y N

- The disk top cover needed adjustment.
- Power down.
- Replace the disk collet assembly (222).
- Verify the fix.

D H I J

D H I J

Does the machine still fail?

Y N

The disk collet assembly was defective.

- Power down.
- Reinstall the original disk collet assembly (222).
- Replace the disk drive cover (221).
- Verify the fix.

The disk drive cover was defective.

- Replace the disk drive shaft bearings and/or replace the disk drive hub and shaft assembly (217).

- Be sure the new shaft runs free.
- Verify the fix.

The disk drive hub and the shaft assembly and/or bearings were defective.

— Spin the disk drive motor with your fingers.

Does the disk drive motor bind?

Y N

- Check the disk idler assembly for proper mechanical operation and belt tracking (216E).

Is the disk idler OK?

Y N

- Adjust the disk idler assembly for proper belt tracking.
- Verify the fix.

Does the machine still fail?

Y N

The disk idler assembly was out of adjustment.

- Replace the disk idler assembly.
- Verify the fix.

The disk idler assembly was defective.

- Check/replace the disk drive belt (216K).

- Verify the fix.

D K L

D K L

Does the machine still fail?

Y N

The belt was worn or defective.

- Reinstall the original belt, if replaced.
- Replace the disk drive pulley (216G).
- Verify the fix.

The disk drive pulley was defective.

- Replace the disk drive motor (216N).
- Verify the fix.

The disk drive motor was defective.

- Load a diskette.

Are the error code positions blank?

Y N

- Hold NUM SHIFT and press RESET
- Remove any diskette in the other station.
- Press FUNCT SEL lower
- Hold NUM SHIFT and press the C key.
- Press the O key.

Did the machine *fail* to change to CEW mode?

Y N

The position of the cursor identifies the disk speed. Position 1 is 150 ms and each additional position is 1 ms. —

001	0	A	A	00008	CEW
01234567890123456_					

Is the disk speed between 163 and 171 ms?

Y N

- Power down.
- Place the disk drive in the service position (206).
- Replace disk collet assembly (222).
- Verify the fix.

Does the machine still fail?

Y N

The disk collet assembly was defective.

- Reinstall the original collet assembly.
- Replace the disk drive cover (221).
- Verify the fix.

The disk drive cover was defective.

- Use MAP 2-7.

M

M

Is the disk turning (observe the disk collet assembly) (224)?

Y N

Is the disk drive shaft turning?

Y N

- Power down.
- Tighten the disk drive pulley screw.
- Verify the fix.

Does the machine fail now?

Y N

The pulley was loose on the shaft.

- Power down.
- Replace the disk drive pulley (216G).
- Verify the fix.

The disk drive pulley was defective.

- Power down.
- Place the disk drive unit in the service position (206).
- Replace the disk collet assembly (222).
- Verify the fix.

Does the machine still fail?

Y N

The disk collet assembly was defective.

- Reinstall the original disk collet assembly.
- Replace the disk drive cover (221).
- Verify the fix.

The disk drive cover was defective.

— Use MAP 2-7.

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## MAP 2-7—

- Remove the diskette.
- Power down.
- Swap the disk cables at planar sockets J and K.  
Disk drive 1 will now be connected to station 2 and disk drive 2 will be connected to station 1.
- Power up.
- Load a different diskette in the other disk drive (a disk with no history of errors).

Does the machine still fail exactly as before?

Y N

- Power down.
  - Reconnect the disk signal cables at planar sockets J and K to their original connectors.
  - Power up.
  - Use disk MAP 2-8.
- 
- Power down.
  - Reconnect the planar cable connectors J and K to their original positions.
  - Reseat planar cross connectors A and B (212B).
  - Verify the fix.

Does the machine still fail?

Y N

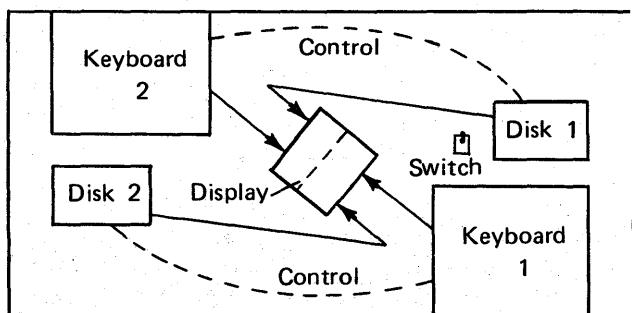
- A cross connector was loose.
- 
- Power down.
  - Replace the VFO card (212B).
  - Verify the fix.

Does the machine still fail?

Y N

- The VFO card was defective.
- 
- Power down.
  - Reinstall the original VFO card.
  - Use MPU MAP 5-1.

— This MAP is a continuation of MAP 2-6.



Control and display interactions with disk drive signal cables swapped at planar sockets J and K (212B).

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## MAP 2-8 —

— This MAP is a continuation of MAP 2-7.

- Power up.
- Set the CE meter to the 5 Vdc scale to measure the voltage on the disk FC card (204A). —

— Check the LED for input voltage.

**Note:** There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

- For disk FC card X, from TP16 (+) to TP17 (-).
- For disk FC card Y, from TPA2 (+) to TPA3 (-).

Is the voltage 1.0 to 1.6 Vdc?

Y N

- Set the CE meter to the 15 Vdc scale to measure the voltage on the disk FC card (204A): —
  - For disk FC card X, from TP23 (+) to TP17 (-).
  - For disk FC card Y, from TPB7 (+) to TPA3 (-).

— Check the FC card for a power supply voltage.

Is the voltage 4.7 to 5.5 Vdc?

Y N

- Make a note of the voltage measurement for future reference.
- Power down.
- Disconnect the disk signal cable from the disk FC card (204B).
- Power up.
- Measure the voltage at the disk FC card end of the disk signal cable with respect to frame ground. —

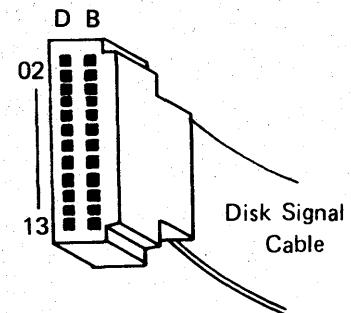
**Vdc      Test Point      Range**

+5      B03      4.7 to 5.5

Is the dc voltage within limits?

Y N

- Power down.
- Reconnect disk signal cable.
- Use power supply MAP 6-1.



A B C



- Power down.
- Reconnect the disk signal cable (204B).
- Replace the disk FC card (204A).
- Verify the fix.
- Attempt loading a diskette at least twice. —

Does the machine still fail?

Y N

- The disk FC card was defective.
- Power down.
- Reinstall the original disk FC card.
- Use MAP 6-7.

- Power down.
- Place the disk drive unit in the service position (206).
- Replace the LED assembly (223).
- Verify the fix.

Does the machine still fail?

Y N

- The LED assembly was defective.

- Power down.
- Reinstall the original LED.
- Replace the LED cable wires in the disk file cable (204C).
- Verify the fix.

Does the machine still fail?

Y N

- The disk file cable was defective.

- Power down.
- Replace the disk FC card (204).
- Verify the fix.

The disk FC card was defective.

- Power down.
- Check/adjust the disk top cover for binds (237).
- Verify the fix.



- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

D

Does the machine still fail?

Y N

- The disk drive top cover needed adjustment. —
- Power down.
- Place the disk drive unit in the service position (206).
- Remove the disk drive belt (216K).
- Check the disk idler assembly for proper mechanical operation (216E).

Is the disk idler OK?

Y N

- Repair or replace the disk idler assembly (216E).
  - Verify the fix.
- The disk idler assembly was defective.

- Reinstall the disk drive belt.
- Power up.
- Load a diskette.
- Test the probe at planar P-B10 (signal ground P-D08). Both lights should be on. — — — — —
- Probe the disk FC card (204A): — — — — —
  - For disk FC card X, from TP2 (+) to TP17 (-).
  - For disk FC card Y, from TPB14 (+) to TPA3 (-).
- Connect probe power leads to planar M-D13 (— black, M-B05 (+)).
- Output from the phototransistor amplifier.

Are both probe lights on?

Y N

- Check the interlock switch for loose wires (204).

Are the wires OK (not loose)?

Y N

- Connect the loose wires. —
  - Verify the fix.
- A wire was loose.
- Check the interlock switch for proper adjustment (220).

- If the switch terminals are pointing downward, carefully form them upward to a horizontal position or slightly above. This will prevent the wires from slipping off.

Is the adjustment OK?

Y N

- Adjust the interlock switch (220).
- Verify the fix.

The switch was out of adjustment.

E F

E F

- Power down.
- Disconnect the cable from the interlock switch.
- Set the CE meter to the Rx1 scale, and check the switch and the interlock cable (204). —

Is the switch OK?

Y N

- Replace the interlock switch (220).
  - Reconnect the cable at the interlock switch.
  - Verify the fix.
- The interlock switch was defective.
- Check the cable between the interlock switch and the disk FC card for an open circuit (204).

- The normally closed points should open when the disk top cover is closed.

Are the wires OK?

Y N

- Replace or repair the cable.
  - Reconnect the cable at the interlock switch.
  - Verify the fix.
- The cable was defective.
- Power down.
  - Reconnect the cable at the interlock switch.
  - Disconnect the ac power plug from the disk drive motor.
  - Remove the diskette from the drive and close the disk top cover. —
  - Set the CE meter to the 15 Vdc scale to measure the voltage on the disk FC card (204A):
    - For disk FC card X, from TP23 (+) to TP8 (-).
    - For disk FC card Y, from TPA3 (+) to TPB5 (-).
  - Power up.

— Preparing to check the phototransistor.

E G

E G

Is the voltage:

- +3.5 Vdc or more on disk FC card X? —
- -1 Vdc to -5.6 Vdc on disk FC card Y? —

Y N

- Adjust the phototransistor assembly (243).
- Measure the voltage:
  - For disk FC card X, from TP23 (+) to TP8 (-).
  - For disk FC card Y, from TPA3 (+) to TPB5 (-).

- The voltage should be +3.5 Vdc or more.
- The voltage should be -1 Vdc to -5.6 Vdc.

Is the voltage:

- +3.5 Vdc or more on disk FC card X?
- -1 Vdc to -5.6 Vdc on disk FC card Y?

Y N

- Replace the phototransistor assembly (243).
- Reconnect the ac power plug to disk drive motor.
- Verify the fix.

Does the machine still fail?

Y N

- The phototransistor was defective.
  - Replace the disk FC card (204A).
  - Reinstall the original phototransistor assembly (243).
  - Verify the fix.

The disk FC card was defective.

- Power down.
- Reconnect the ac power plug to the disk drive motor.
- Verify the fix.

The phototransistor assembly needed adjustment.

- Insert a diskette in the drive backwards so that the diskette jacket blocks light to the phototransistor.
- Close the disk top cover.
- Set the CE meter to the 5 Vdc scale to measure the voltage on the disk FC card (204A):
  - For disk FC card X, for TP23 (+) to TP8 (-).
  - For disk FC card Y, from TPB5 (+) to TPA3 (-).

E H



Is the voltage:

- +0.5 Vdc or less on disk FC card X? —
- +1 Vdc or more on disk FC card Y?

Y N

- Power down.
- Replace the phototransistor assembly (243).
- Reconnect the ac power plug to the disk drive motor.
- Verify the fix.

Does the machine still fail?

Y N

The phototransistor was defective.

- Power down.
- Replace the disk FC card (204A).
- Attempt loading the diskette at least twice. —
- Reinstall the original phototransistor assembly (243).
- Verify the fix.

The disk FC card was defective.

- Reconnect the ac power plug to the disk drive motor.
- Check the diskette for proper hole alignment. —

Is the disk hole alignment OK?

Y N

- Load a different diskette.
- Verify the fix.

- Power down.
- Swap the disk FC cards.
- Power up.
- Attempt loading the diskette at least twice. —

Does the machine still fail when using the same disk drive unit?

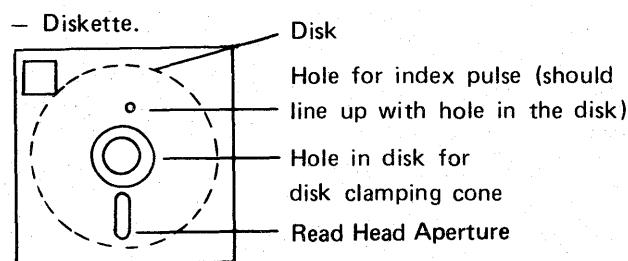
Y N

- Power down.
- Replace the disk FC card in the other disk drive unit (204A).
- Verify the fix.

The disk FC card was defective.

- The voltage should be +0.5 Vdc or less.
- The voltage should be +1 Vdc or more.

- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.



- A faulty disk FC card may cause a bad data set label 03 Write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.





- Power down.
- Reinstall the original disk FC card.
- Check the disk signal cable for opens, shorts, and grounds (204B).

Is the disk signal cable OK?

Y N

- Replace the disk signal cable (204B).
  - Verify the fix.
- The disk signal cable was defective.

Does the disk drive become ready (XR mode)

for each diskette used? —

— One index pulse per revolution.

Y N

Is the disk FC card type X (204A)?

Y N

- Adjust the index amplifier (205) on disk FC card Y.

Does the disk drive fail to become ready (XR mode) for each diskette used?

Y N

The index amplifier was affected by light from the LED passing through the diskette. The adjustment successfully desensitized disk FC card Y.

- Use MPU MAP 5-1.

— Use MPU MAP 5-1.

— Probe planar J-D13 (or K-D13).

— Attempt to isolate the trouble in either the disk signal cable or the MPU. Signal ground at J or K-B08.

Are both probe lights on?

Y N

- Power down.
- Replace the disk signal cable (204B).
- Verify the fix.

The disk signal cable was defective.

— Jumper the disk FC card (204A).

- For disk FC card X, from TP17 to TP22.
- For disk FC card Y, from TPA3 to TPB4.

Check the pressure pad. —

— Move the pressure pad away from the head and observe its return.



Is the pressure pad (221A) pressing the disk against the head?

Y N

- Remove the jumper from the disk FC card (204A).
  - For disk FC card X, from TP17 to TP22.
  - For disk FC card Y, from TPA3 to TPB4.
- Power down.
- Replace the head carriage assembly. —
- Verify the fix.

The head carriage assembly was defective.

- Use the *Leadscrew and Head Carriage Assembly Removal and Replacement* procedure (225); then return here.

— Power down.

- Remove the jumper from the disk FC card (204A).
  - For disk FC card X, from TP17 to TP22.
  - For disk FC card Y, from TPA3 to TPB4.
- Reseat planar cross connectors A and B (212B).
- Verify the fix.

Does the machine still fail?

Y N

A cross connector was loose.

- Power down.
- Replace the VFO card (212B).
- Verify the fix.

Does the machine still fail?

Y N

The VFO card was defective.

- Power down.
- Reinstall the original VFO card.
- Check the disk signal cable for an open, shorts, or grounds (204B).

Is the cable OK?

Y N

- Replace the disk signal cable.
- Verify the fix.

Does the machine still fail?

Y N

The disk signal cable was defective.

— Use MPU MAP 5-1.

— Use MPU MAP 5-1.

## MAP 2-9 -

- This MAP will help find seek errors (without data errors).

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
  - Record the date of each action.
  - Vibrate the machine to attempt to cause the failure.
  - Check the room temperature and humidity and compare them to *Installation Procedure*, page 16-1.
  - Check the dc voltages at the disk FC card (204A) with respect to frame ground.

**Note:** There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

Vdc	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	PT17	TPA3	0

- Remove any diskette in the other station.
- Load a diskette.
- Press FUNC SEL lower
- Hold NUM SHIFT and press the C key.
- Press the J key.
- Hold down the REP key and the space bar (SP on the proof keyboard) while observing the head assembly.

Does the head assembly advance without missing a step?

Y N

- Power down.
- Replace the stepper motor (229).
- Verify the fix.
- DATE:
- Power down.
- Replace the disk FC card (204A).
- Verify the fix.
- DATE:
- Replace the disk signal cable (204B).
- Verify the fix.
- DATE:

A B



- Power down.
- Reseat the disk signal cable (204B, 212A).
- Reseat the disk file cable (204C).
- Reseat the disk FC card (204A).

DATE: 

--	--	--

- Power down.
- Swap the disk units.
- Verify the fix.

DATE: 

--	--	--

- Replace the ac line filter.
- Verify the fix.

DATE: 

--	--	--

Does the other disk drive unit operate correctly?

Y N

- Use MAP 5-1.
- Power down.
- Place the failing disk drive unit in the service position (206).
- Check the leadscrew for binds (242). —

Is the leadscrew free of binds? —

Y N

- Loosen the stepper motor mounting and move it away from the leadscrew (242Z).
- Check the stepper motor for binds. —

- Turn the stepper motor drive wheel with your fingers.
- Try to identify where the problem is before replacing any parts.

- Turn the stepper motor drive wheel with your fingers.

Is the stepper motor assembly free of binds?

Y N

- Replace the stepper motor assembly (229). —
- Verify the fix.
- The stepper motor was out of adjustment.
- Check the leadscrew for binds (242).

- Remove the stepper motor and bracket assembly by removing two screws holding the stepper motor bracket to the baseplate.

Are there any binds?

Y N

- Reinstall and adjust the stepper motor (230). —
- Verify the fix.
- The stepper motor was out of adjustment.
- Replace the upper and lower leadscrew bearings and/or replace the head and carriage assembly and bearings as required (includes leadscrew). —
- Verify the fix.

- Use the *Stepper Motor Adjustment* procedure. Then return to this point in this MAP.

The head and carriage assembly and/or the leadscrew bearings were defective.

- Use the *Leadscrew and Head Carriage Assembly Removal and Replacement* procedure (225). Then return to this point in this MAP.

C

C

- Turn the stepper motor drive wheel several revolutions with your fingers (208M). —
- Power up.
- Observe the head and carriage assembly. —

Does the head carriage assembly move to track 00?

Y N

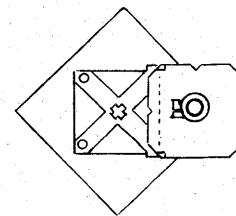
- Power down.
- Set the CE meter to the 50 Vdc scale.
- Measure the voltage for each listed pair of test points at the disk FC card (204A) as you turn the power on for each pair. During power up, the meter first reads 24 Vdc. After 5 or 10 seconds, the meter must pulse down to 20 or 15 Vdc.

**Note:** There are two types of disk FC cards: type X and type Y (204). Test points (TP) for the two cards are different:

- For disk FC card X:
  - TP17 (-) to TP18 (+) (stepper motor phase 0)
  - TP17 (-) to TP19 (+) (stepper motor phase 3)
  - TP17 (-) to TP20 (+) (stepper motor phase 2)
  - TP17 (-) to TP21 (+) (stepper motor phase 1)
- For disk FC card Y:
  - TPA3 (-) to TPB2 (+) (stepper motor phase 0)
  - TPA3 (-) to TPB1 (+) (stepper motor phase 3)
  - TPA3 (-) to TPB3 (+) (stepper motor phase 2)
  - TPA3 (-) to TPA1 (+) (stepper motor phase 1)

D E

- Moves the head and carriage assembly away from track 0.
- At power up, the MPU should cause a series of seek-to-track 0 commands. Then the lead-screw wheel will stop in phase 0 position:





Does the voltage pulse down to 20 or 15 Vdc for each pair of test points as stated before?

Y N

- Test the probe at planar P-B10 (signal ground P-D08). Both probe lights should be on. —
- Power down.
- Probe each test point in the line to the stepper motor amplifier at the disk FC card (204A) as you turn power on. Both lights should be on and pulsing during power up. —
- Power up for each test point.
  - For disk FC card X:
 

TP4 (+ access 2)	}	Signal ground TP17
TP6 (+ access 3)		
TP7 (+ access 1)		
  - For disk FC card Y:
 

TPB10 (+ access 2)	}	Signal ground
TPB11 (+ access 3)		
TPB9 (+ access 1)		
  - TPB8 (+ access 0)
- Connect probe power leads to planar M-D13 (-) black, M-B05 (+).
- Five or 10 seconds after power up, the MPU should cause a series of seek-to-track 0 commands.

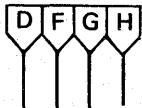
Are both probe lights on and pulsing for each test point during the disk seek operation?

Y N

- Power down.
- Disconnect the disk signal cable planar socket J (or planar socket K).
- Probe the pin in the line to the failing stepper motor amplifier at planar J (or planar K). Both lights should be on during power up.
- Power up for each test point. (Always wait 5 seconds after each power down.)
- After 5 or 10 seconds, the UP light should be on and pulsing. (Ignore the DOWN light.)

D03 (+ access 1)	}	Signal ground at
D02 (+ access 0)		
D04 (+ access 2)		
D05 (+ access 3)		





Is the UP light on and pulsing during the disk seek operation for each test point?

Y N

- Power down.
- Reconnect the disk signal cable connector at planar socket J (or planar socket K).
- Power up.
- Measure all voltages at the disk FC card (204A) with reference to frame ground. —

Vdc      Card X    Card Y    Limits

+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	TP17	TPA3	0

Are all voltages within limits?

Y N

- Make a note of the failing voltage measurement for future reference.
- Power down.
- Disconnect the disk signal cable at the disk FC card (204B).
- Power up.
- Measure the failing voltage at the disk end of the disk signal cable with respect to frame ground. —

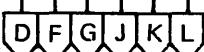
Test  
Vdc      Point    Range

+24	B10	22.0 to 26.5
+5	B03	4.7 to 5.5
-5	B11	4.6 to 5.4
Ground	B08	0

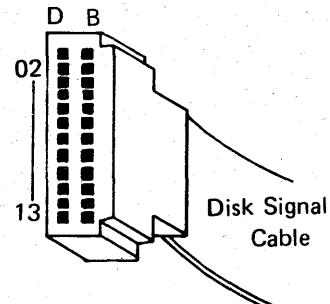
Is the failing voltage within limits?

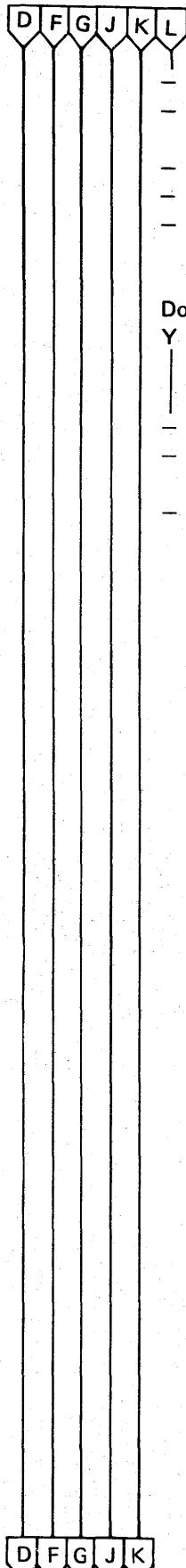
Y N

- Power down.
- Reconnect the disk signal cable.
- Use power supply MAP 6-1.



- The problem may be due to ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.





- Power down.
  - Reconnect the disk signal cable (204B).
  - Replace the disk FC card (204A).
  - Verify the fix.
  - Attempt loading a diskette at least twice. —

## Does the machine still fail?

Y. N

The disk FC card was defective.

- Power down.
  - Reinstall the original disk FC card.
  - Use MAP 6-7.

- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

D F G J K

- Power down.
- Swap the disk FC cards.
- Power up.

Does the machine still fail when using  
the same disk unit?

Y N

- Power down.
  - Replace the disk FC card in the other disk unit (204A).
  - Verify the fix.
- The disk FC card was defective.
- 
- Power down.
  - Reinstall the original disk FC card.
  - Check the disk signal cable for opens and shorts (204B).

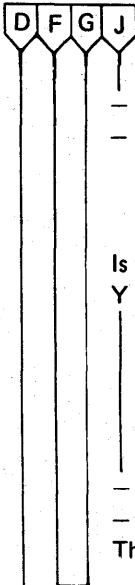
Is the disk signal cable OK?

Y N

- Replace the disk signal cable (204B).
  - Verify the fix.
- The disk signal cable was defective.
- 
- Use MPU MAP 5-1. —

- The failure may be caused by ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.

D F G J



- Power down.
- Check the disk signal cable for open and/or short circuits including short circuits to the frame (204B).

Is the cable OK?

Y N

- Replace the disk signal cable (204B).
- Verify the fix.

The disk signal cable was defective.

- Replace the disk FC card (204A).
- Verify the fix.

The disk FC card was defective.

- Use MAP 2-10.

- Load the CE diskette in the disk drive to be checked. —
- Press REC ADV
- Press FUNCT SEL lower
- Press UPDATE

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09? —

Y N

- Power down.
- Adjust the head (208).
- Verify the adjustment with the CE diskette.

Does the machine still fail?

Y N

The head was out of adjustment.

- Use MAP 2-10.

- If disk drive 2 is being checked, swap disk signal cables in positions J and K at MPU. Cables must be restored to original position upon completion of this test.
- See MAP 2-11 for additional explanation. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

## MAP 2-10 —

- Measure the dc voltages at the disk FC card (204A) with respect to frame ground. —

**Note:** There are two types of disk FC cards: type X and type Y (204A). Test points (TP) for the two cards are different:

Vdc	Card X	Card Y	Limits
+24	TP1	TPA11	22.0 to 26.5
+5	TP23	TPB7	4.7 to 5.5
-5	TP5	TPA12	4.6 to 5.4
Ground	TP17	TPA3	0

Are all voltages within limits?

Y N

- Make a note of the failing voltage measurement for future reference.
- Power down.
- Disconnect the disk signal cable (204B) at the FC card.
- Power up.
- Measure the failing voltage at the FC card end of the disk signal cable with reference to frame ground. —

Vdc	Test Point	Range
+24	B10	22.5 to 26.5
+5	B03	4.7 to 5.5
-5	B11	4.6 to 5.4
Ground	B08	0

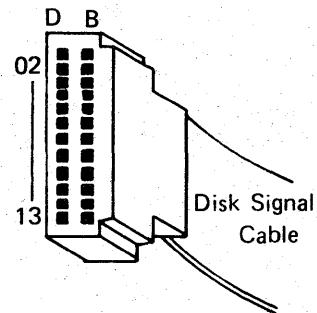
Is the failing voltage within limits?

Y N

- Power down.
- Reconnect the disk signal cable.
- Use power supply MAP 6-1.
- Power down.
- Reconnect the disk signal cable (204B).
- Replace the disk FC card (204A).
- Verify the fix.
- Attempt loading the diskette at least twice. —

- This MAP is a continuation of MAP 2-9.

- The problem may be caused by ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.



- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.





Does the machine still fail?

Y N

The disk FC card was defective.

- Power down.
- Reinstall the original disk FC card.
- Use MAP 6-7.
  
- Power down.
- Swap the disk FC cards (204).
- Power up.
- Attempt loading the diskette at least twice.

Does the machine still fail when using the same disk unit?

Y N

- Power down.
- Replace the disk FC card in the other disk drive.
- Verify the fix.

The disk FC card was defective.

- Power down.
- Reinstall the original disk FC card.
- Replace the stepper motor assembly (229). —
- Verify the fix.

— Remove the stepper motor and bracket assembly by removing the two screws holding the stepper motor bracket to the baseplate.

Does the machine still fail?

Y N

The stepper motor assembly was defective.

- Power down.
- Reinstall the original stepper motor assembly.
- Check the disk signal cable for shorts and opens (204B).

Is the cable OK?

Y N

- Replace the disk signal cable (204B).
- Verify the fix.

The disk signal cable was defective.

- Use MPU MAP 5-1.

## MAP 2-11 —

- Remove diskette(s) from both station disk units.
- Load CE diskette (P/N 2455026) in the disk unit to be tested. —

*Note:* The machine must be able to read and display track 00, and also to seek to and read other tracks on a disk. Use the *Symptom Index* (page 1-2) to trouble shoot machine malfunctions.

- Power up and wait for 30 seconds.

Are the error code positions blank?

Y N

- Hold numeric shift and press RESET
- Press REC ADV to advance to data set label 00009.
- Press FUNC SEL lower
- Press UPDATE ——————

Are the error code positions blank?

Y N

- Hold numeric shift and press RESET.
- Press REC ADV —

- The objective of the alignment check is to find a pair of matching record messages in each alignment check track. The tracks are 06, 07, 08, and 09. REC ADV to tracks 07, 08 and 09. —

Can a pair of matching record messages be read correctly from each of the four tracks?

Y N

- Check the head adjustment (208).
- Verify the fix.
- The head was out of adjustment.

- Press FUNCT SEL lower
- Press RETURN TO INDEX
- Remove the diskette.

The head alignment is correct.

- This MAP helps you check for bad head alignment.

- See *Display Data Head Alignment Service Check* (page 8-16) and *CE Alignment Check Diskette* (page 8-15).

— Dependent upon head alignment, the disk drive may or may not be able to read and match up the first ID of track 06 with the first record of track 06. If successful, the display will look like this:

001            0     A A    06001    U R  
TRACK 6, RECORD 1 CK STATUS LINE 06001  
HEAD ALIGNMT OK IF RECORD 2 CAN BE READ

— A correctly read and displayed record message is one that:

1. Is displayed immediately after REC ADV or REC BKSP with no error code.
2. Has correct data content.
3. Has track and record numbers in the record that agree with the record counter in the status line.

— Matching record messages refer to each other in pairs, like record 1 refers to record 2, and record 2 refers to record 1. Record 3 refers to record 4, record 4 to record 3, and so on. Failure to pass this test does not necessarily conclude that the head is out of adjustment since other faults which cause marginal reading may affect the results. (A single of matching records per track is sufficient. Increment to the next track when one good pair is found.)

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## MAP 2-12

The following MAPs are designed to assist in locating speed or throughput problems. These kinds of problems are normally caused by poor diskettes, malfunctioning disk drive, sticking/binding keys, clicker operation or head load actuator. —

- Power up.
- Load a diskette in disk drive 1.
- CHAR ADV to position 29. —
- Hold NUM SHIFT and enter 01001
- CHAR ADV to position 35.
- Hold NUM SHIFT and enter 73026
- Press FUNCT SEL lower.
- Press M
  - REC ADV
- Turn *OFF* the AUTO REC ADV and AUTO DUP/SKIP switches.
- Press FUNCT SEL lower
- DELETE REC
- Enter D----E
- Press FUNCT SEL lower
  - /
  - 1
- Press FUNCT SEL lower
  - ENTER
  - SEL PROG
  - 1
- Enter 123456
- Perform a 5-minute speed test.
- Set Auto DUP/SKIP and AUTO REC ADV to ON.
- Wait 5 minutes.
- Set AUTO REC ADV to OFF.
- Observe the disk 1 address in status line positions.
- See 245 for approximate timing information on search, copy, and initialization operations.
- The next steps will modify the data set label as follows: BOE=01001, EOE=73026.
- Blanks data to prepare for entering a program, D----E in program level 1.
- Numeric shift not necessary as D----E program is in numeric shift.

Is the disk address at least 28023?

Y N

- Press FUNCT SEL lower
- Press and hold NUM SHIFT and press C
- Press O (letter O).
- The position of the cursor identifies the disk speed. Position 1 is 150 ms and each additional position is 1 ms. —

— Check speed of disk drive.

001	0	A	A	00008	CEW
01234567890123456_					





**Is the disk speed between 163 and 171 ms?**

**Y N**

- Use **MAP 2-6**.
- Load **CE diskette (P/N 2455026)**.
- Press **REC ADV**

**FUNCT SEL lower  
UPDATE**

**Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09?** —

**Y N**

- Use **Disk MAP 2-2**.

- Use **Disk MAP 2-1**.

— See **MAP 2-11** for additional information. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

- Power down.
- Swap cables at MPU planar sockets J and K. —
- Power up.
- Load a diskette in disk drive 2.
- CHAR ADV to position 29. —
- Hold NUM SHIFT and enter 01001
- CHAR ADV to position 35.
- Hold NUM SHIFT and enter 73026
- Press **FUNCT SEL lower**
- Press **M**

**REC ADV**

- Turn off the AUTO REC ADV and AUTO DUP/SKIP switches

- Press **FUNCT SEL lower**
- **DELETE REC**

- Press **D----E**

- Press **FUNCT SEL lower**

/

1

- Press **FUNCT SEL lower**

**ENTER**

- Press **SEL PROG**

1

- Enter **123456**

- This step is to perform a 5-minute speed test. Turn on AUTO DUP/SKIP and AUTO REC ADV switches. At the end of 5 minutes turn OFF AUTO REC ADV.

- Test throughput speed of drive 2.

- The next steps modify the data set label as follows: BOE=01001, EOE=73026

- Blanks data to prepare for entering a program, D----E in program level 1.



C

- Observe the disk 1 address in status line positions.

Is the disk address at least 28023?

Y N

- Press FUNCT SEL lower.
- Press and hold NUM SHIFT and press C.
- Press the O (letter O) key.
- The position of the cursor identifies the disk speed. Position 1 is 150 ms and each additional position is 1 ms. — — — —

-- Check speed of disk drive.

001	0	A	A	00008	CEW
01234567890123456_					

Is the disk speed between 163 and 171 ms?

Y N

- Use MAP 2-6.
- Load CE diskette (P/N 2455026).
- Press REC ADV  
    FUNCT SEL lower  
    UPDATE

Can a pair of matching record messages be read correctly from tracks 06, 07, 08 and 09? —

Y N

- Power down.
- Reconnect the disk signal cables at planar sockets J and K to their original connectors.
- Use Disk MAP 2-2.
- Power down.
- Reconnect the disk signal cables at planar sockets J and K to their original connectors.
- Use Disk MAP 2-1.

- See MAP 2-11 for additional information. (A single pair of matching records per track is sufficient. Increment to the next track when one good pair is found.)

— Reswap the disk unit cables to their original locations in planar connectors J and K.

D

**D**

The following service aids for

1. STICKING/BINDING KEYS
2. CLICKER OPERATION

are to inform you of problems and corrections not necessarily in the MAPs. Use these service aids as required for failing keyboard(s).

### 1. STICKING/BINDING KEYS

Sticking/binding keys can occur due to a design problem. This problem is more acute when striking the keys at an angle (normal key operation). Due to the plane of the keyboard, the top row of keys are affected the most. The right adjust key and space bar are very sensitive because both keys use two modules.

The best fix is to replace the module.

An alternate fix is to rotate the module 180 degrees.

To test the machine's ability to accept input at high speed (such as when rolling keys), hold down four data keys and the repeat key simultaneously. Two or three keys (depending on the keys pressed) should alternately enter, repetitively to the end of the record, without an error. If an error results, or if the machine fails to function as stated, replace the keyboard PC board.

**E**

E

## 2. CLICKER OPERATION

The operation of the clicker can also affect the throughput. It usually results in complaints that the keys are hard to press. The purpose of the clicker is to indicate to the operator that the MPU accepted the character keyed. It also indicates to the operator when data is being transferred from current buffer to previous buffer. Any attempt to remove the clicker can result in more serious problems.

serious problems.

Is mechanical operation correct?

Y N

— Replace clicker (410).

— The clicking noise from the disk drive head load actuator has also caused the operator to reduce speed. This is especially true when keying short records. The operator mistakenly feels they have to wait for the disk drive to complete the write operation.

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# DISPLAY MAPS

## MAP 3-1 —

Can you make the machine fail?

Y N

- For the intermittent problem, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- Unadjustable brightness and failure to blank the CRT display can be intermittent because of a failing CRT. Vibration or powering up and down can remove the symptoms temporarily. Under this condition:
  - Power down.
  - Ground the CRT high voltage anode (304A).
  - Replace the chassis and CRT assembly (304E).
  - Adjust the yoke (304F, 311).
  - Verify the fix.
- DATE:
- Vibrate the machine to cause the failure.
- Check the room temperature and the humidity and compare them to *Installation Procedure*, page 16-1.
- Measure the voltages at 2-N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

- Reseat both ends of the display signal cable (304B) and the power supply dc cable (308C).
- Verify the fix.
- DATE:
- Replace the display PC board (304C).
- Verify the fix.
- DATE:
- Power down.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

A B

- This MAP helps you locate problems with uncontrollable brightness with video (characters) present. Brightness on the CRT is controlled from the 400 Vdc output of the converter. The brightness control forms part of a voltage divider from the 400 Vdc supply to ground. Turning the brightness control changes the voltage applied to the video amplifier. This changes the bias on the CRT, which regulates the electron flow to the face of the CRT and changes the brightness.

**A**

- Power down.
- Replace the brightness control potentiometer (304J).
- Verify the fix.

DATE:   

- If the CRT has no brightness (blank CRT) or fades out, use MAP 3-2.
- Otherwise, power down.
- Reseat both ends of the display signal cable (304B).
- Verify the fix.

**Does the machine still fail?****Y N****The display signal cable was loose.****C**

C

- Using the 500 Vdc scale, connect the CE meter from terminal 10 (+) to terminal 15 (-) on the display PC board (304C).
- Observe the caution.
- Power up.
- Wait 25 seconds.
- Vary the brightness control to its limits (304J).

Does the voltage vary smoothly from 0 to a minimum of 100 Vdc?

Y N

- Power down.
- Disconnect the wire from terminal 9 of the display PC board.

#### DANGER

400 Vdc is present.

- Using the 500 Vdc scale, connect the CE meter from terminal 7 (+) to terminal 6 (-) on the display PC board (304C).
- Power up.

Wait 25 seconds.

#### CAUTION

- Never make the tube face glow or bloom. The limit of brightness control is either:
  - a. that degree of brightness past which the tube face glows or blooms, or
  - b. the mechanical limits of the control knob.

- Checks the range of voltage available from the brightness control.

- A failure can cause 400 Vdc to appear.

D E

**D**  
**E**

Is the voltage between 300 and 410 Vdc?

**Y** **N**

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

— Power down.

- Disconnect the meter lead from terminal 7 (+) and connect it to terminal 9.
- Power up. Wait 25 seconds.

Is the voltage between 300 and 410 Vdc?

**Y** **N**

- Power down.
- Replace the PC board.
- Verify the fix.

The PC board was defective.

— Power down.

- Test the CE meter. —
- Set the CE meter to the Rx1K scale and zero the CE meter.
- Remove wire 10 from the display PC board (304C).
- While turning the brightness control to its limit, measure the resistance from wire 10 to wire 9.
- Disconnect the wire from terminal 11 of the display PC board.
- Perform the same check from wire 10 to wire 11. —

— CE meter test:

- Power down.
- Disconnect the disk signal cable (307).
- Set the meter to the Rx1 scale.
- Zero the meter.
- Measure the resistance between test points 16 and 23 on the disk FC card (307). The CE meter should read between 86 and 96 ohms.
- Reconnect the disk signal cable.
- Checks the resistance of the brightness control potentiometer.

**D**  
**F**

D F

Does the resistance on both checks vary from 0 to at least 800K ohms?

Y N

- Replace the brightness control potentiometer (304J).
- Verify the fix.

The brightness control potentiometer was defective.

- Reconnect the wires to terminals 9, 10, and 11.

— Power down.

- Disconnect the wire from terminal 17 of the display PC board.
- Set the CE meter to the Rx1 scale and zero the CE meter.
- Check wire 17 for ground.

Is wire 17 grounded?

Y N

- Using the 500 Vdc scale, connect the CE meter from terminal 17 (+) to terminal 16 (-) on the display PC board (wire 17 is still disconnected).
- Power up.
- Wait 25 seconds.
- Vary the brightness control to its limits.

Is the maximum voltage at least 100 volts?

Y N

- Power down.
- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

— Power down.

- Reconnect the wire to terminal 17.
- Disconnect the CRT socket from the CRT (304H).
- Check for bent pins on the CRT.
- Set the CE meter to the Rx1 scale and zero the CE meter.
- Check for continuity from:

- The display screen is on, but the brightness control does not have any control over the brightness.

- Loss of electrical contact due to bent pins can cause loss of brightness control.

#### CRT Socket — to — Display PC Board

Pin 2	Terminal 14
Pin 3	Terminal 8
Pin 4	Terminal 15
Pin 7	Terminal 17

G H

G H

**Is the CRT socket assembly OK?**

**Y N**

- Replace the CRT socket assembly (304H).
- Verify the fix.

The CRT socket assembly was defective.

- Ground the CRT high voltage anode (304A).

- Replace the chassis-and-CRT assembly (304E).

- Adjust the yoke assembly (304F, 311).

- Verify the fix.

The chassis-and-CRT assembly was defective.

- Replace the chassis and CRT assembly (304E).

- Adjust the yoke (304F, 311).

- Verify the fix.

The chassis and CRT assembly was defective.

## MAP 3-2 -

Can you make the machine fail?

Y N

- For intermittent problems, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- Vibrate the machine to cause the failure.
- Check the room temperature and the humidity and compare them to *Installation Procedure*, page 16-1.
- Measure voltage at MPU planar socket N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

- Reseat both ends of the display signal cable (304B), the power supply dc cable (309T) and the CRT socket assembly (304H).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the display PC board (304C).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Ground the CRT high voltage anode (304A).
- Replace the chassis and CRT assembly (304E).
- Adjust the yoke (304F, 305).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the power supply PC board (309P, 419).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the display signal cable (304B).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the power supply DC cable (309T).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Reseat both ends of the display signal cable.
- Verify the fix.

- This MAP helps you locate a problem of a blank CRT. A blank CRT indicates that the electron beam is not reaching the face of the CRT. The electron beam is generated when the filament heats the cathode of the tube. This electron beam is then controlled by the grids as it is attracted to the face of the CRT by the high voltage applied to the anode of the CRT.

A

**A**

**Does the machine still fail?**

**Y N**

— The display signal cables were loose.

— Power down.

— Check CB1 (604U), if installed.

**Is CB1 on?**

**Y N**

— Use MAP 6-5.

— Jumper the CE pins (304C).

— Power up.

— Wait 25 seconds.

— Observe the caution.

— Turn the brightness control (304J) clockwise until either the display intensity is maximum, or the control knob stops. —

**— CAUTION**

Never make the tube face glow or bloom. The limit of brightness control is either:

- that degree of brightness past which the tube face glows or blooms, or
- the mechanical limit of the control knob.

- Checks the CRT's ability to maintain maximum brightness.

**Is the display brightness failing and/or blank?**

**Y N**

— Power down.  
— Remove the jumper from the CE pins (304C).  
— Return the brightness control to normal.  
— Use MAP 3-3.

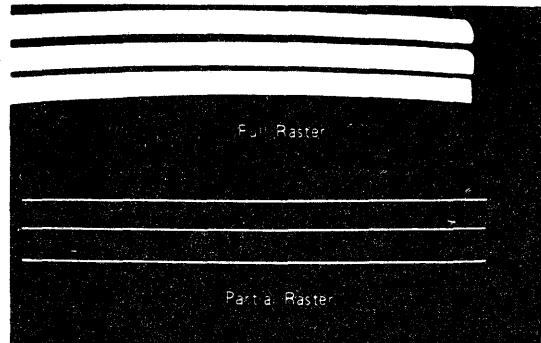
— Observe the display for a full or partial raster. —

**Is the raster always missing or fades to blank?**

**Y N**

— Power down.  
— Remove the jumper from the CE pins (304C).  
— Return the brightness control to normal.  
— Use MAP 3-3.

— Power down.  
— Remove the jumper from the CE pins (304C).  
— Return the brightness control to normal.  
— Power up.  
— Check if the disk drive unit motors are running.



(without viewer)

Low power supply voltage being applied to the display PC board can cause the bad display.

**Are the disk drive unit motors running?**

**Y N**

— Use MAP 6-6. —

— A blank CRT and the stopping of disk drive unit motors indicate an ac voltage service problem.

**B**

**B**

- Power down.
- Install the cable extender (307) in the display PC board (304C).
- Reconnect the display signal cable.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the voltages at the cable extender with reference to the frame ground:

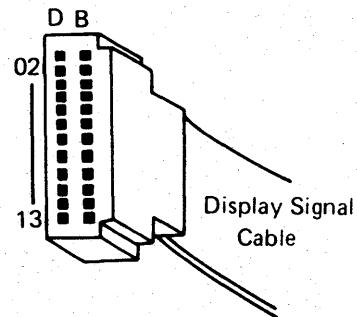
Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

Are all voltages within limits?

Y N

- Write down the failing voltage measurement for possible use in MAP 6-7.
- Power down.
- Remove the cable extender.
- Leave the signal cable disconnected from the display PC board.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the failing voltage from the frame ground to each of these cable pins at the display end:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0



Are all voltages within limits?

Y N

- Power down.
- Reconnect the display signal cable.
- Use MAP 6-1.
  
- Power down.
- Reconnect the display signal cable.
- Use MAP 6-7.

**C**

C

- Measure between display signal cable pin B12 (+) and frame ground (-). —

Is the voltage between 5.7 and 6.9 Vdc?

Y N

Is the voltage above 6.9 Vdc?

Y N

- Use MAP 6-1.
- Power down.
- Test the CE meter.
- Set the meter to the Rx1 scale and zero the meter.
- Disconnect the CRT socket (304H) from the CRT.
- Check for bent pins on the CRT. —
- Disconnect the display signal cable (304B).
- Measure the continuity from display PC board terminal 18 to B12 and from terminal 16 to D12 (304C).

Is each continuity measurement OK?

Y N

- Reconnect the CRT socket (304H).
- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Measure the continuity from terminal 18 to CRT socket pins 1 and 8 (continuity should be found to one of the pins). —
- Measure the continuity from terminal 16 to socket pins 1 and 8 (continuity should be to the pin opposite that found from terminal 18).

Is each continuity measurement OK?

Y N

- Remove the cable extender.
- Reconnect the display signal cable.
- Replace the CRT socket assembly (304H).
- Verify the fix.

The CRT socket assembly was defective.

- Checks for filament voltage.

CE meter test:

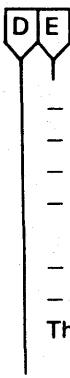
- Power down.
- Disconnect the disk signal cable (608).
- Set the meter to the Rx1 scale.
- Measure the resistance between the test points 16 and 23 on the disk FC card (608).

The CE meter should read between 86 and 96 ohms.

- Reconnect the disk signal cable.

- Loss of electrical contact due to bent pins can cause a blank CRT.

D E



- Remove the cable extender.
- Reconnect the display signal cable (304B).
- Ground the CRT high voltage anode (304A).
- Replace the chassis-and-CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).
- Verify the fix.

The chassis-and-CRT assembly was defective.

- Power down.
- Remove the cable extender.
- Reconnect the display signal cable to the display PC board.
- Set the CE meter to the 500 Vdc scale.
- Disconnect the wire from terminal 17 on the display PC board (304C).
- Connect the CE meter to display PC board terminals 15 (-) and 17 (+).
- Power up.
- Wait 25 seconds.
- Turn the brightness control (304J) both clockwise and counterclockwise to its limits.
- Checks the range of voltage available from the brightness control.
- A failure can cause 400 Vdc to appear.

Is the voltage at the low limit from 0 to 50 Vdc, and is the voltage at the upper limit beyond 90 Vdc? —

Y N

- Power down.
- Disconnect the CE meter.
- Set the CE meter to the 50 Vac scale.
- Connect the CE meter between display PC board terminals 1 and 3 (304C). —
- Power up.
- Wait 25 seconds.

— Checks the input to the converter.

Is the ac voltage steady between 12 and 30 Vac?

Y N

- Power down.
- Replace the display PC board (304C). —
- Verify the fix.

— The procedure to isolate voltage problems between the display PC board and converter requires replacement of one FRU at a time. We recommend obtaining both FRUs and replacing them in the sequence shown.

Does the machine still fail?

Y N

The display PC board was defective.



F G H

- Power down.
- Ground the CRT high voltage anode (304A).
- Reinstall the original display PC board.
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Power down.
- Reconnect the wire to terminal 17.
- Disconnect wire 9 of the display PC board.
- Set the CE meter to the 500 Vdc scale.
- Power up.
- Measure the voltage between display PC board terminals 6 (-) and 7 (+) (304C). — — — — — Checks the output of the converter.

Is the voltage between 300 and 410 Vdc?

Y N

- Power down.
- Reconnect the wire to terminal 9.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Power down.
- Test the CE meter. —
- Set the CE meter to the Rx1K scale and zero the CE meter.
- Remove wire 10 from the display PC board (304C).
- While turning the brightness control to its limits, measure the resistance from wire 10 to wire 9. — — — — —
- Remove the wire from terminal 11 of the display PC board.
- Perform the same check from wire 10 to wire 11.

— CE meter test:

- Power down.
- Disconnect the disk signal cable (608).
- Set the meter to the Rx1 scale.
- Measure the resistance between test points 16 and 23 on the disk FC card (608).
- The CE meter should read between 86 and 96 ohms.
- Reconnect the disk signal cable.

— Checks the resistance of the brightness control.

Does the resistance on both checks vary from 0 to at least 800K ohms?

Y N

- Replace the brightness control potentiometer (304J).
- Verify the fix.

The brightness control potentiometer was defective.

F J



- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Power down.
- Reconnect the wire to terminal 17.
- Set the CE meter to the Rx1 scale.
- Measure the continuity from display PC board terminal 7 to terminal 8.

Is continuity measured?

Y N

- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Disconnect the CRT socket from the CRT (304H).

- Check for bent pins on the CRT.
- Check for continuity from:

- Loss of electrical contact due to bent pins can cause loss of brightness control.

#### CRT Socket — to — Display PC Board

Pin 2	Terminal 14
Pin 3	Terminal 8
Pin 4	Terminal 15
Pin 7	Terminal 17

Is each continuity measurement OK?

Y N

- Replace the CRT socket assembly (304H).
- Verify the fix.

The CRT socket assembly was defective.

Did the display degrade in brightness slowly (during several days or weeks)?

Y N

- Reconnect the CRT socket.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Ground the CRT high voltage anode (304A).
- Replace the chassis-and-CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).
- Verify the fix.

The chassis-and-CRT assembly was defective.

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### MAP 3-3 —

Can you make the machine fail?

Y N

- For intermittent problems, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- Vibrate the machine to cause the failure.
- Check the room temperature and the humidity and compare them to *Installation Procedure*, page 16-1.
- Measure the voltage at MPU planar socket N with respect to frame ground:

Vdc	Pin	Limits
-----	-----	--------

+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
+6.3	B12	5.7 to 6.9

- Reseat both ends of the display signal cable (304B) and the CRT socket (304H).
  - Verify the fix.  
DATE: 

--	--	--
  - Power down.
  - Replace the display PC board (304C).
  - Verify the fix.  
DATE: 

--	--	--
  - Power down.
  - Replace the display signal cable (304B).
  - Verify the fix.  
DATE: 

--	--	--
  - Power down.
  - Ground the CRT high voltage anode (304A).
  - Replace the chassis-and-CRT assembly (304E).
  - Adjust the yoke (304F, 305).
  - Verify the fix.  
DATE: 

--	--	--
  - Power down.
  - Ground the CRT high voltage anode (304A).
  - Replace the converter (304G).
  - Verify the fix.  
DATE: 

--	--	--
  - Use MAP 5-1.
- Power down.
- Reseat both ends of the display signal cable (304B) and the CRT socket (304H).
- Verify the fix.

— This MAP helps you locate problems with the video circuits for missing or fuzzy characters.

*Note:* The cursor is considered a character.

A



**Does the machine still fail?**

**Y N**

The display signal cable was loose.

- Power down.
- Install the cable extender (307) on the display PC board (304C).
- Reconnect the display signal cable.
- Power up.
- Test the probe at MPU planar P-B10 (signal ground MPU planar P-D08). Both lights should be on.
- Probe extender pin B07 for pulses (signal ground pin D08) (307).

- Connect the probe power leads to MPU planar M-D13 (-) black MPU planar M-B05 (+).

**Are both lights on?**

**Y N**

- Probe 2-N-B07 for pulses (signal ground N-D08).

**Are both lights on?**

**Y N**

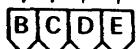
- Power down.
- Disconnect the display signal cable from MPU planar N (308).
- Power up.
- Probe MPU planar for pulses (signal ground MPU planar N-D08).

**Are both lights on?**

**Y N**

- Set the CE meter to the 15 Vdc scale.
- Measure the voltage at 2-M with reference to frame ground:

Vdc	Pin	Limits
+5.0	B06	4.7 to 5.5



B C D E

Is the voltage within limits?

Y N

- Power down.
- Remove the cable extender.
- Reconnect the display signal cable at both ends.
- Use MAP 6-1.

- Power down.
- Remove the cable extender.
- Reconnect the display signal cable to the PC board.
- Replace the MPU planar (504, 505).
- Verify the fix.

The MPU planar was defective.

- Power down.
- Disconnect the display signal cable from the cable extender.
- Reconnect the display signal cable at 2-N.
- Power up.
- Probe 2-N-B07 for pulses (signal ground N-D08).

Are both lights on?

Y N

- Power down.
- Replace the display signal cable (304B).
- Verify the fix.

The display signal cable was defective.

- Power down.
- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Power down.
- Replace the display signal cable (304B).
- Verify the fix.

The display signal cable was defective.

B

B

- Set the CE meter to the 15 Vdc scale.
- Measure the voltage from the frame ground to each of these extender pins: —

Vdc	Pin	Limits
-----	-----	--------

+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
+6.3	B12	5.7 to 6.9
Ground	D06, D07	0
Ground	D08	0

- Checks the voltages to the display PC board for distribution to deflection coils in the yoke and to the CRT filament. Does not check for loose connectors (304D or 304H).

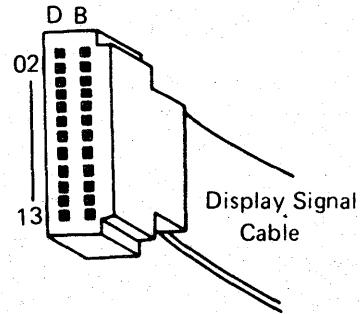
Is the voltage within limits?

Y N

- Write down the failing voltage measurement for possible use in MAP 6-7.
- Power down.
- Remove the cable extender.
- Leave the signal cable disconnected from the display PC board.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the failing voltage from the frame ground to each of these cable pins at the display end: —

Vdc	Pin	Limits
-----	-----	--------

+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
+8.5	B12	8.0 to 9.4
Ground	D06, D07	0
Ground	D08	0



- When the cable is disconnected, the 6.3V goes to 8.5V level.

Is the voltage within limits?

Y N

- Power down.
- Reconnect the display signal cable.
- Use MAP 6-1.
  
- Power down.
- Reconnect the display signal cable.
- Use MAP 6-7.

F

F

- Power down.
- Disconnect the wire from terminal 9 of the display PC board.

#### DANGER

400 Vdc is present.

- Using the 500 Vdc scale, connect the CE meter from terminal 7 (+) to terminal 6 (-) on the display PC board (304C). — Checks the 400 Vdc output of the converter.
- Power up.
- Wait 25 seconds.

Is the voltage between 300 and 410 Vdc?

Y N

- Power down.
- Remove the cable extender from the display PC board.
- Reconnect the display signal cable (304B).
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Disconnect the display signal cable from the display PC board (304C).
- Test the CE meter. —
- Set the CE meter to the Rx1 scale.
- Measure the continuity in the display PC board circuits (304C).

Terminal 7 to terminal 8

Terminal 14 to terminal 15

Terminal 14 to cable connector pin D13

- CE meter test:

- Power down.
- Disconnect the disk signal cable (608).
- Set the meter to the Rx1 scale.
- Measure the resistance between test points 16 and 23 on the disk FC card (608).
- The CE meter should read between 86 and 96 ohms.
- Reconnect the disk signal cable.

Is each continuity measurement OK?

Y N

- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

G

G

- Remove the cable extender from the display PC board.
- Reconnect the display signal cable (304B).
- Disconnect the CRT socket from the CRT (304H).
- Check for bent pins on the CRT. —
- Set the CE meter to the Rx1 scale.
- Check for continuity from:

— Loss of electrical contact due to bent pins can cause loss of brightness control or loss of video.

#### CRT Socket – to – Display PC Board

Pin 2	Terminal 14
Pin 3	Terminal 8
Pin 4	Terminal 15
Pin 7	Terminal 17

Is the CRT socket assembly OK?

Y N

- Replace the CRT socket assembly (304H).
- Verify the fix.

The CRT socket assembly was defective.

Are characters fuzzy (rather than missing)?

Y N

- Reconnect the CRT socket to the CRT.
- Disconnect the wire from terminal 17 on the display PC board (304C).
- Power up.
- Wait for 25 seconds.
- Touch the wire removed from terminal 17 to the frame ground. —

— Grounds the CRT control grid, which increases the brightness of the CRT. The display could then go blank for a few seconds before resuming its former condition.

Does the display flash when the pin is grounded?

Y N

- Power down.
- Reconnect the wire to terminal 17.
- Ground the CRT high voltage anode (304A).
- Replace the chassis-and-CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).
- Verify the fix.

The chassis-and-CRT assembly was defective.

H J

H J

- Power down.
- Reconnect the wire to terminal 1.
- Disconnect the display signal cable from the PC board.
- Use a CE meter set to the Rx10 scale.
- Check for shorts (resistance must exceed 1K ohm) between the signal cable pins at the display end:
  - B07 to B05
  - B07 to B10

Are all resistance checks OK?

Y N

- Remove the cable at MPU planar N (308).
- Check the failing cable wires for shorts.

Is the display signal cable OK?

Y N

- Replace the display signal cable (304B).
- Verify the fix.

The display signal cable was defective.

- Reconnect the display signal cable to the display PC board.
- Replace the MPU planar (504, 505).

The MPU planar was defective.

- Replace the display PC board (304C).
- Verify the fix.

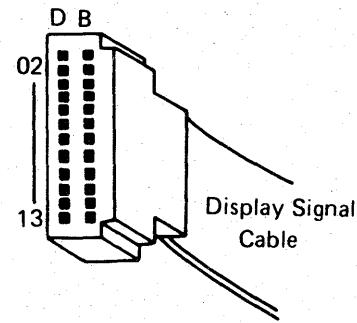
The display PC board was defective.

- Ground the CRT high voltage anode (304A).
- Replace the chassis-and-CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).

- Verify the fix. —

The chassis-and-CRT assembly was defective.

- Checks for shorts of the MPU planar modules and the cable. For display theory, see page 12-1.



- If characters are fuzzy on a new CRT assembly, the only correction is to try another CRT assembly.

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## MAP 3-4 —

Can you make the machine fail?

Y N

- For the intermittent problem, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- Vibrate the machine to cause the failure.
- Check the room temperature and the humidity and compare them to the *Installation Procedure*, page 16-1.
- Measure the dc voltages at MPU planar N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

- Reseat both ends of the display signal cable (304B) and the power supply dc cable (309T).
  - Verify the fix.  
DATE:
  - Replace the display PC board (304C).
  - Verify the fix.  
DATE:
  - Ground the CRT high voltage anode (304A).
  - Replace the converter (304G).
  - Verify the fix.  
DATE:
  - Replace the power supply PC board (309P).
  - Verify the fix.  
DATE:
  - Replace the display signal cable (304B).
  - Verify the fix.  
DATE:
  - Replace the power supply dc cable (309T).
  - Verify the fix.  
DATE:
  - Replace the ac line filter (309Q).
  - Verify the fix.  
DATE:
- Power down.
  - Reseat both ends of the display signal cable (304B).
  - Verify the fix.

— This MAP helps you locate a jittery display problem. A jittery (moving, unstable) display can be caused by ripple in the +12 Vdc power supply; or a magnetic field caused by a motor, transformer, or a machine operating nearby. If you suspect ripple, use *Power Theory* in Section 15.

A

**A**

Does the machine still fail?

Y N

The display signal cable was loose.

- Power down.
- Install the cable extender (307) in the display PC board (304C).
- Reconnect the display signal cable.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the voltage from the frame ground to each of these extender pins:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0

- Checks the voltages to the display PC board for distribution to the deflection coils in the yoke assembly. Does not check for loose connectors (304D or 304H).

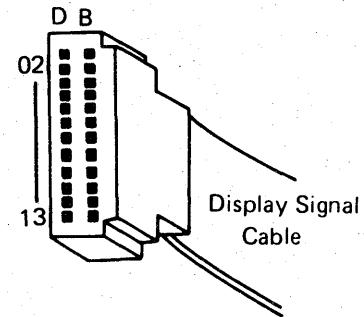
A ripple in the +12 Vdc power supply can cause a jittery display. If you suspect ripple, use *Power Theory* in Section 15.

Are all voltages within limits?

Y N

- Write down the failing voltage measurement for possible use in MAP 6-7.
- Power down.
- Remove the cable extender.
- Leave the signal cable disconnected from the display PC board.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the failing voltage from the frame ground to each of these cable pins at the display end:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0



Are all voltages within limits?

Y N

- Power down.
- Reconnect the display signal cable.
- Use MAP 6-1.
  
- Power down.
- Reconnect the display signal cable.
- Use MAP 6-7.

**B**

B

- Power down.
- Remove the cable extender.
- Reconnect the display signal cable.
- Visually check for items that could cause a magnetic field near the machine.—

Is there a magnetic field?

Y N

- Power down.
- Replace the display PC board (304C). —
- Verify the fix.

Does the machine still fail?

Y N

The display PC board was defective.

- Power down.
- Reinstall the original display PC board.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- A motor, transformer, or a machine operating nearby can cause a magnetic field.

- Eliminate the cause of the magnetic field.

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## MAP 3-5 —

Can you make the machine fail?

Y N

- For the intermittent problem, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- A symptom of a spot, or a vertical line on one side of the display, which returns to correct operation following a power on reset, is an indication of an arcing CRT. A CRT assembly causing this problem more than once a week should be replaced:
  - Ground the CRT high voltage anode (304A).
  - Replace the chassis-and-CRT assembly (304E).
  - Adjust the yoke assembly (304F, 305).
  - Verify the fix.
- DATE:
- Vibrate the machine to cause the failure.
- Check the room temperature and the humidity and compare them to *Installation Procedure*, page 16-1.
- Measure the dc voltages at MPU planar N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

- Reseat both ends of the display signal cable (304B), and the yoke connector (304D).
- Verify the fix.
- DATE:
- Replace the display PC board (304C).
- Verify the fix.
- DATE:
- Replace the yoke assembly (304F).
- Adjust the yoke assembly (305).
- Verify the fix.
- DATE:
- Replace the display signal cable (304B).
- Verify the fix.
- DATE:
- Use MAP 5-1.
- Power down.
- Reseat both ends of the display signal cable (304B).
- Verify the fix.

Does the machine still fail?

Y N

The display signal cable was loose.

- This MAP helps you locate CRT yoke coils and the deflection circuits problems.

The wiggle sweep circuit moves the electron beam up and down to give the characters height. Control pulses are generated by the MPU, sent to the display PC board, amplified, and used to drive current through the character yoke. This current generates the magnetic field to move the electron beam.

The vertical sweep circuit positions the electron beam vertically on the face of the CRT. This positioning provides the six lines on the display. Vertical inputs are generated by the MPU, sent to the display PC board, amplified, and used to drive current through the vertical yoke. This current generates the magnetic field to move the electron beam.

The horizontal sweep circuit moves the electron beam in a horizontal line across the face of the CRT. The MPU generates horizontal input pulses. These pulses trigger amplifiers on the display PC board. These amplifiers drive current through the two horizontal yoke windings. This current generates the magnetic field to move the electron beam. The magnetic field from each winding moves the beam halfway.

No horizontal or vertical deflection causes a spot on the screen.

A failure of the horizontal sweep circuit causes characters to be distorted at the edge of the display. The failure causes the sweep to be non-linear at the ends. A bad yoke assembly or incorrect drive current through the yoke assembly can cause the problem.

A

**A**

- Power down.
- Install the cable extender (307) in the display PC board (304C).
- Reconnect the display signal cable.
- Power up.
- Test the probe at MPU planar P-B10 (signal ground MPU planar P-D08). Both lights should be on.
- Probe these extender pins for pulses (307).

B02  
 B03 } Signal ground  
 B04 } pin D08  
 B05  
 B10 }

- Connect probe power leads to MPU planar M-D13 (-) black, MPU planar M-B05 (+).

**Are both lights on for each pin?**

**Y N**

- Probe these 2-N pins for pulses:

B02  
 B03 } Signal ground  
 B04 } N-D08  
 B05  
 B10 }

**Are both lights on for each pin?**

**Y N**

- Power down.
- Disconnect the display signal cable from MPU planar (308).
- Power up.
- Probe these MPU planar N pins for pulses.

B02  
 B03  
 B04 } Signal ground  
 B05 } MPU planar N-D08  
 B10 }

**Are both lights on for each pin?**

**Y N**

**B C D E**

B C D E

- Set the CE meter to the 15 Vdc scale.
- Power down.
- Wait 5 seconds.
- Measure POR with reference to frame ground at 2-M-B08 at power up. POR should be a +5 volt pulse during power up.
- Power up.
- Measure the voltage at MPU planar M with reference to frame ground:

Vdc	Pin	Limits
+5.0	B06	4.7 to 5.5

Are the voltage and POR within limits?

Y N

- Power down.
- Remove the cable extender.
- Reconnect the display signal cable at both ends.
- Use MAP 6-1.
  
- Power down.
- Remove the cable extender.
- Reconnect the display signal cable to the display PC board.
- Replace the MPU planar (504).

The MPU planar was defective.

- Power down.
- Disconnect the display signal cable from the cable extender.
- Reconnect the display signal cable at 2-N.
- Power up.
- Probe these MPU planar pins for pulses:

B02  
B03  
B04 } Signal ground  
B05 } MPU planar N-D08  
B10

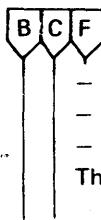
Are both lights on for each pin?

Y N

- Power down.
- Replace the display signal cable (304B).
- Verify the fix.

The display signal cable was defective.

B C F



- Power down.
- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Power down.
- Replace the display signal cable (304B).
- Verify the fix.

The display signal cable was defective.

- Set the CE meter to the 15 Vdc scale.
- Measure the voltage from the frame ground to each of these extender pins: —

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0

Are all the voltages within limits?

Y N

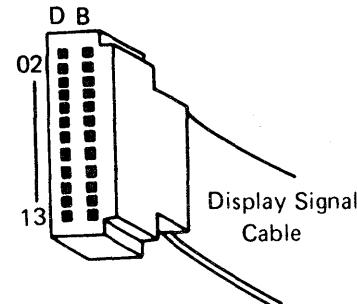
- Write down the failing voltage measurement for possible use in MAP 6-7.
- Power down.
- Remove the cable extender.
- Leave the signal cable disconnected from the PC board.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the failing voltage from the frame ground to each of these cable pins at the display end: —

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0

Are all the voltages within limits?

Y N

- Power down.
- Reconnect the display signal cable.
- Use MAP 6-1.
  
- Power down.
- Reconnect the display signal cable.
- Use MAP 6-7.



G

G

- Power down.
- Test the CE meter. —
- Remove the yoke connector (304D) from the display PC board (304C) and check for faulty contacts.
- Set the CE meter to the Rx1 scale.
- Lines or dots on the display are an indication of a gross failure, which could occur from an open coil. Be more critical of the coil resistance measurement if the display or characters show distortion, which could occur from an out-of-specification coil.
- Exact resistance specifications are given for the yoke coils. The CE meter might not measure with the accuracy stated. If all readings are high, or all are low, suspect an inaccurate meter. If only one reading is high or low (more than 10% error), suspect a bad coil.
- Perform the yoke coil resistance checks at the yoke connector (304D and 304C):

**Measure Yoke Coil      Resistance**

Wire B to wire D	11.0 to 12.5 ohms
Wire C to wire E	10.5 to 12.0 ohms
Wire A to wire F	9.5 to 11.0 ohms

— CE meter test:

- Power down.
- Disconnect the disk signal cable (608).
- Set the meter to the Rx1 scale.
- Measure the resistance between test points 16 and 23 on the disk FC card (608).
- The CE meter should read between 86 and 96 ohms.
- Reconnect the disk signal cable.

- Disconnect the wire from terminal 12 on the display PC board (304C):

**Measure Yoke Coil      Resistance**

PC board terminal 13 to wire from terminal 12	0.7 to 1.0 ohms
--	-----------------

- Check the yoke connector for shorts from wire A to wire B, from wire A to wire C, and from wire B to wire C.

— Wire B to wire D and wire C to wire E checks the two horizontal deflection windings in the CRT yoke. A horizontal yoke with some of the windings shorted can cause horizontal sweep problems.

— The vertical yoke is connected between terminals A and F of the display PC board. A vertical yoke with some of the windings shorted can cause vertical sweep problems.

— The character yoke is connected between terminals 12 and 13 of the display PC board. Removing the wire from terminal 12 isolates the yoke from the circuit. An open character yoke causes the characters to appear as cursors.

Are the yoke coils and the connector OK?

Y N

- Remove the cable extender.
- Reconnect the cable to the display PC board.
- Replace the yoke assembly (304F).
- Adjust the yoke assembly (305).
- Verify the fix.

The yoke assembly was defective.

H

**H**

- Remove the cable extender.
- Leave the signal cable disconnected from the display PC board.
- Use a CE meter set to the Rx10 scale.
- Check for shorts (resistance must exceed 1K ohm) between the signal cable pins at the display end:

B02 to B03	B03 to B04	B04 to B07
B02 to B04	B03 to B05	B04 to B10
B02 to B05	B03 to B07	B05 to B07
B02 to B07	B03 to B10	B05 to B10
B02 to B10	B04 to B05	B07 to B10

Are all resistance checks OK?

**Y N**

- Reconnect the yoke connector and the wire on terminal 12.
- Disconnect the display signal cable at 2-N.
- Check the failing cable wires for shorts.

Is the display signal cable OK?

**Y N**

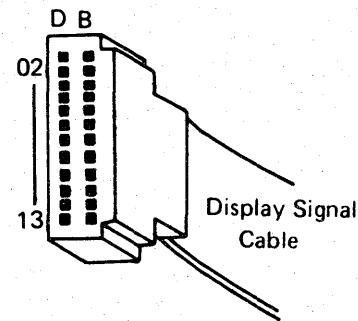
- Replace the display signal cable (304B).
  - Verify the fix.
- The display signal cable was defective.
- Reconnect the display signal cable to the display PC board.
  - Replace the MPU planar (504).

The MPU planar was defective.

- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Checks for shorts of the MPU planar modules and the display signal cable. For display theory, see page 12-1.



## MAP 3-6 -

Can you make the machine fail?

Y N

- This symptom is a normal condition if it occurs no more than once a week. More frequent occurrence is cause to perform the following steps, one on each call, until the problem is corrected.
- Record the date for each step.
- Vibrate the machine to cause the failure.
- Check the room temperature and humidity and compare them to *Installation Procedure*, page 16-1.
- Measure the voltages at MPU planar N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

- Ground the CRT high voltage anode (304A).
- Replace the chassis and CRT assembly (304E).
- Adjust the yoke assembly (305, 304F).
- Verify the fix.

DATE:

- Replace the display PC board (304C).

- Verify the fix.

DATE:

- Ground the CRT high voltage anode (304A).

- Replace the converter (304G).

- Verify the fix

DATE:

- Replace the ac line filter (309Q).

- Verify the fix.

DATE:

- This MAP helps you locate an overload condition on the high voltage power supply. The display flashes because the high voltage is being cut off. When the high voltage supply is overloaded, it turns off. After 10 seconds, the high voltage supply turns on again. If an overload condition still exists, the display flashes on for 1 second and then off for 10 seconds. Changes in the 400 Vdc used for brightness control can cause flashing or changes in the brightness.

**A**

- Power down.
- Ground the CRT high voltage anode (304A).
- Disconnect the anode wire from the CRT.
- Disconnect wire 9 from the display PC board.
- Set the CE meter to the 500 Vdc scale.
- Measure the voltage between terminals 6 (-) and 7 (+) on the display PC board (304C).
- Power up.
- Wait 25 seconds.

**Is the voltage steady and between 300 and 410 Vdc?**

Y N

- Power down.
- Ground the CRT high voltage anode wire (304A).
- Reconnect the CRT anode wire to the anode.
- Replace the display PC board (304C).
- Verify the fix.

**Does the machine still fail?**

Y N

- The display PC board was defective.
- Power down.
- Ground the CRT high voltage anode (304A).
- Reinstall the original display PC board.
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Power down.
- Reconnect terminal 9 (304C).
- Disconnect terminal 17.
- Set the CE meter to the 500 Vdc scale.
- Measure terminal 17 (+) to frame ground (-).
- Power up.
- Wait 25 seconds.
- Vary the brightness control.

**Does the voltage vary at least 60 volts?**

Y N

- Power down.
- Ground the CRT high voltage anode wire (304A).
- Reconnect the CRT anode wire to the anode.
- Replace the display PC board (304C).
- Verify the fix.

The display PC board was defective.

- Place the end of the anode wire at least 1/2 inch (12.7 mm) from a conducting surface, otherwise arcing can occur with power on.
- The 400 Vdc brightness control voltage should not vary.

**B**

B

- Power down.
- Reconnect the wire to terminal 17.
- Disconnect the CRT socket from the CRT (304H).
- Test the CE meter.
- Use the CE meter set to the Rx1 scale.
- Check for continuity from:

#### CRT Socket — to — Display PC Board

Pin 2	Terminal 14
Pin 3	Terminal 8
Pin 4	Terminal 15
Pin 7	Terminal 17

- CE meter test:
  - Power down.
  - Disconnect the disk signal cable (608).
  - Set the meter to the Rx1 scale.
  - Measure the resistance between test points 16 and 23 on the disk FC card (608).
  - The CE meter should read between 86 and 96 ohms.
  - Reconnect the disk signal cable.

#### Is the CRT socket assembly OK?

Y N

- Ground the CRT high voltage anode wire (304A).
- Reconnect the CRT anode wire to the anode.
- Replace the CRT socket assembly (304H).
- Verify the fix.

The CRT socket assembly was defective.

- Ground the CRT high voltage anode wire (304A).
- Replace the chassis-and-CRT assembly.
- Adjust the yoke assembly (305).
- Verify the fix.

The chassis-and-CRT assembly was defective.

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## MAP 3-7 —

Can you make the machine fail?

Y N

- For the intermittent problem, perform the following steps, one on each call, until the problem is corrected.
- Record the date of each step.
- Vibrate the machine to cause the failure.
- Check the room temperature and humidity and compare them to *Installation Procedure*, page 16-1.
- Measure the voltages at 2-N with respect to frame ground:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2

— This MAP helps you locate a problem of low voltage output of the high voltage power supply. A very large display is caused when the high voltage applied to the CRT anode is low. When this voltage is low, the electron beam moves slower toward the face of the CRT. This permits the magnetic field developed by the yoke to deflect the beam a greater distance. The high voltage oscillator on the display PC board provides the drive pulses to the converter. The converter changes these pulses to 400 Vdc for brightness control and the high voltage for the anode lead.

- Reseat both ends of the display signal cable (304B) and the power supply dc cable (309T).
- Verify the fix.  
DATE:
- Replace the display PC board (304C).
- Verify the fix.  
DATE:
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.  
DATE:
- Replace the display signal cable (304B).
- Verify the fix.  
DATE:
- Replace the power supply dc cable (309T).
- Verify the fix.  
DATE:
- Replace the power supply PC board (309P).
- Verify the fix.  
DATE:
- Replace the ac line filter (309Q).
- Verify the fix.  
DATE:

A

**A**

- If the raster and characters are off the display screen or expanded in only one direction, use MAP 3-5.
- If the total display is enlarged such that all the characters are enlarged including the width and height of each line and the total height of all the lines of the raster, continue in this MAP.
- Power down.
- Reseat both ends of the display signal cable (304B).
- Verify the fix.

**Is the display unit still failing?**

**Y N**

The display signal cable was loose.

- Power down.
- Install the cable extender (307) on the display PC board (304C).
- Reconnect the display signal cable.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the voltage from the frame ground to each of these extender pins.

- Checks the voltages to the display PC board for distribution to deflection coils in the yoke. Does not check for loose connectors (304H or 304D).

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0

**B**

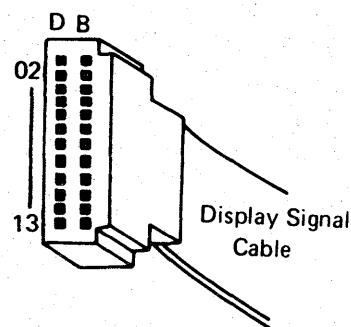
**B**

**Are all the voltages within limits?**

Y N

- Write down the failing voltage measurement for possible use in MAP 6-7.
- Power down.
- Remove the cable extender.
- Leave the signal cable disconnected from the display PC board.
- Power up.
- Set the CE meter to the 15 Vdc scale.
- Measure the failing voltage from the frame ground to each of these cable pins at the display end:

Vdc	Pin	Limits
+12.0	B08, B09	11.0 to 13.2
+12.0	D09, D10	11.0 to 13.2
-12.0	D02	11.0 to 13.2
Ground	D06, D07	0
Ground	D08	0



**Are all the voltages within limits?**

Y N

- Power down.
- Reconnect the display signal cable.
- Use MAP 6-1.
  
- Power down.
- Reconnect the display signal cable.
- Use MAP 6-7.
  
- Power down.
- Remove the cable extender from the display PC board.
- Reconnect the signal cable.
- Set the CE meter to the 500 Vdc scale.
- Measure the voltage between display PC board terminals 6 (-) and 7 (+) (304C).
- Power up.
- Wait 25 seconds.

**Is the voltage between 300 and 410 Vdc?**

Y N

- Power down.
- Ground the CRT high voltage anode (304A).
- Disconnect the anode wire from the CRT.
- Test the meter.
- Set the CE meter to the Rx1 scale.
- Test for a short circuit; CRT anode wire to frame ground. —

- CE meter test:
  - Power down.
  - Disconnect the disk signal cable (608).
  - Set the meter to the Rx1 scale.
  - Measure the resistance between test points 16 and 23 on the disk FC card (608).
  - The CE meter should read between 86 and 96 ohms.
  - Reconnect the disk signal cable.
  
- It is possible that the high voltage wire or converter is shorted, thus putting a heavier than normal load on the converter.

**C D**



Is there a short circuit?

Y N

- Reconnect the anode wire to the CRT (304A).
- Replace the display PC board (304C). —
- Verify the fix.

Does the machine still fail?

Y N

The display PC board was defective.

- Power down.
- Ground the CRT high voltage anode (304A).
- Reinstall the original display PC board.
- Replace the converter (304G).
- Verify the fix.

The converter was defective.

- Power down.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).

The converter was defective.

— The procedure to isolate voltage problems between the display PC board and converter requires replacement of one FRU at a time. We recommend obtaining both FRUs and replacing them in the sequence shown.

# KEYBOARD MAPS

## MAP 4-1

Can you make the machine fail? —

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
- Record the date of each action.
- Vibrate the machine to cause the failure.
- Check the room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltage at the keyboard with respect to frame ground (407L). —

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
ground	D08	0
-5.0	D06	4.6 to 5.4

- This MAP will find failures in the keyboard PC board.

- For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.

- Power down.
- Reseat both ends of keyboard signal cable (407H).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace keyboard PC board (407G).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace MPU (504).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the failing key modules as they are identified (408, 409).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Clean flyplates (407D) and pad area (407K) of the keyboard PC board with a lint-free cloth (P/N 2108931) —
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace the ac line filter (418A).
- Verify the fix.  
DATE: 

--	--	--

- Dampen the cloth with water or alcohol (P/N 2200200).



A      B

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y    N

- Power down.
  - Replace the ROS feature card at sockets C and D (505B).
  - Verify the fix.
- DATE:
- Power down.
  - Replace cross connectors C and D (505B).
  - Verify the fix.
- DATE:

- If the T error code occurs with the AUTO REC ADV switch on, use keyboard MAP 4-5. Otherwise, continue with this MAP.
- Power down.
- Reseat both ends of the keyboard signal cable (407H).
- Verify the fix.

Does the machine still fail?

Y    N

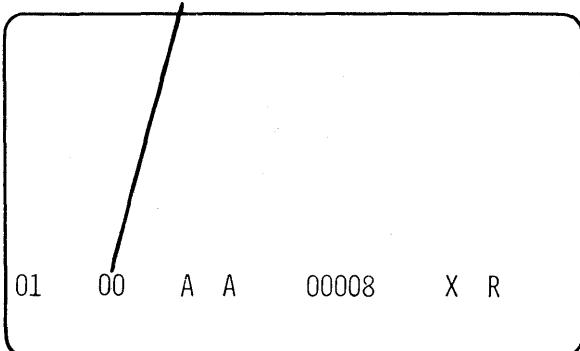
A cable was loose.

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y    N

- Power down.
- Disconnect cross connectors C and D (505B).
- Power up.
- The ROS feature card is now disconnected.
- Perform the failing operation. —

#### Error Code Positions 7 and 8



Does the machine still fail?

Y    N

- Power down.
- Reconnect cross connectors C and D (505B).
- Use MAP 5-1.
  
- Power down.

Reconnect cross connectors C and D.

- Power down and wait 5 seconds.
- Power up.
- Load a diskette.
- Perform the failing operation.

- The keyboard function with the ROS feature card removed is the same as that of a standard data entry keyboard. For example, pressing NUM SHIFT and M enters a 7 rather than a 1.

C

C

Are the status line error code positions blank?

Y N

- Power down.
- Disconnect the keyboard signal cable from MPU planar sockets P and R.
- Power up.
- Load a diskette.

Is an error code displayed now?

Y N

- Power down.
- Reinstall the keyboard signal cable in MPU planar sockets P and R.
- Replace the keyboard PC board (407G).
- Verify the fix.

Does the machine still fail?

Y N

The keyboard PC board was defective.

— Power down.

- Reinstall the original keyboard PC board.
- Check the keyboard signal cable for opens/shorts/ground (407H).

Is the cable OK?

Y N

- Replace the keyboard signal cable.
- Verify the fix.

The keyboard signal cable was defective.

— Reconnect the cable.

- Use MPU MAP 5-1.

— Power down.

- Reconnect the keyboard signal cables at planar sockets P and R.

- Use MPU MAP 5-1.

— Insert a diskette in the other station.

- Test the keyboard at the other station by pressing all of the data keys. The correct data should be displayed as each key is pressed.

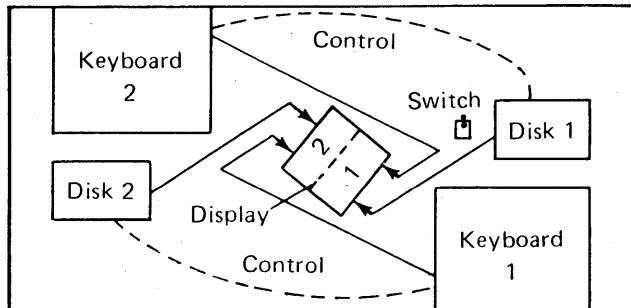
D

D

Does the machine still fail?

Y N

- Use MPU MAP 5-1.
- Power down.
- Swap the keyboard signal cables at MPU planar sockets P and R.
- Remove the viewer.
- Power up.
- Ensure that a diskette is in each drive.
- Swapping keyboard cables causes one keyboard to control the other station. Therefore, data keyed at one station will be displayed on the other station's area of the display.
- Press all of the data keys. The correct data should be displayed as each key is pressed.
- Perform this operation at the station which originally reported the trouble.



Control and display interactions with keyboard signal cables swapped at planar sockets P and R.

Does the machine still fail?

Y N

- Power down.
- Reconnect the cables to their original locations.
- Use MPU MAP 5-1.
- Power down.
- Reconnect the keyboard cables to their original connectors at MPU planar sockets P and R.
- Check the failing keys for binds.
- Remove key top buttons from failing keys (407B).
- Remove the all keys unit (407A).
- Turn the all keys unit over carefully and check the flyplates of the failing keys (407D).

E

E

Are all keys free of binds and are flyplates attached to the modules?

Y N

- Repair or replace the key modules (407C, 408, 409).
  - Verify the fix.
- Certain key modules were defective.
- Clean the key module flyplate (407D) and pad area (407K) of the keyboard PC board with a lint-free cloth (P/N 2108930) dampened with water or alcohol (P/N 2200200).
  - Reinstall the all keys unit after all flyplates and the pad area are dry.
  - Power up.
  - Load a diskette.
  - Press the failing key and check for binds and correct data entry.

Does the machine still fail?

Y N

The keyboard PC board was dirty.

— Power down.

- Replace the keyboard PC board (407G).
- Verify the fix.

Does the machine still fail?

Y N

The keyboard PC board was defective.

— Power down.

- Reinstall the original keyboard PC board.
- Replace the keyboard signal cable (407H).
- Verify the fix.

The signal cable was defective.

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## MAP 4-2 -

- This MAP will find problems in data and function keys.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
- Record the date of each action.

When operating the 3742, does the display suddenly go blank but come on again in about 10 seconds and the keyboard locks up? — — — — —

Y N

- Vibrate the machine to cause the failure. Check room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltages at keyboard with respect to frame ground (407L). — — —

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
ground	D08	0
-5.0	D06	4.6 to 5.4

- Power down.
- Reseat both ends of keyboard signal cable (407H).
- Verify the fix.

DATE:

- Power down.
- Replace the keyboard PC board (407G).
- Verify the fix.

DATE:

- Power down.
- Replace MPU (505N, 504).

- Verify the fix.

DATE:

- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.

DATE:

- Power down.
- Clean flyplates (407D) and pad area (407K) of keyboard with a lint-free cloth. (P/N 2108930) —

- Verify the fix.

DATE:

- Replace audio feedback device (407J, 410).

- Verify the fix.

DATE:

- Power down.

- Replace the ac line filter (418A).

- Verify the fix.

DATE:

- Highly intermittent keyboard lockups with/without flashing screen and with/without error codes may occur due to arcing in the CRT. These lockups cannot be reset with the RESET key. On machines with keyboard PC board at EC level 310084 and 309728, these lockups can be reset with the REPEAT key. On machines with keyboard PC board at EC 309786 (latest), it requires power OFF/ON to reset the lockup. A CRT high voltage converter with excessive high voltage output or a defective CRT can cause CRT arcing.

A CRT causing these intermittent problems more than once a week should be replaced. On initial installation, a CRT may arc once or twice. This is not unusual after shipping and handling.

- For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.

- Dampen cloth with water or alcohol (P/N 2200200).

A B C

DATE:



If the machine is equipped with a proof keyboard, perform the following steps:

- Power down.
- Replace the ROS feature card at C and D (505B).
- Verify the fix.  
DATE:
- Power down.
- Replace cross connectors C and D (505B).
- Verify the fix.  
DATE:

- Power down.
- Disconnect the wire from terminal 9 of the display PC board (304C).
- Using the 500 Vdc scale, connect the CE meter from terminal 7 (+) to terminal 6 (-) on the display PC board.
- Power up and wait 25 seconds.

Is the voltage between 300 and 410 Vdc?

Y N

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.  
DATE:

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage (304A).
- Replace the chassis and CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).
- Verify the fix.  
DATE:



A

The following service aids for

1. STICKING/BINDING KEYS
2. EXTRA CHARACTERS

are to inform you of problems and corrections  
not necessarily in the MAPs. Use these service  
aids as required.

### 1. STICKING/BINDING KEYS

Sticking/binding keys can occur due to a design problem. This problem is more acute when striking the keys at an angle (normal key operation). Due to the plane of the keyboard, the top row of keys are affected the most. The right adjust key and space bar are very sensitive because both keys use two modules.

The best fix is to replace the module.

### Key Module Differences

#### Nonbinding Key Module

New modules are white and have a different part number. P/N 1643192 is used in all positions *except* the right adjust key. For positions that do not require a flyplate, use the same P/N 1643192 and remove the flyplate.

#### Right Adjust Key Position

There are two styles of right adjust keys. One (old style) uses two modules, and the new style uses one module. The new style uses module 1643192 (same as all other positions). The old style uses module 5183447. The only difference between the two parts is the key stem spring. P/N 5183447 uses a lighter spring to compensate for using two modules for one key. For the position not requiring a flyplate on the old style, use P/N 5183447 and remove the flyplate.

#### Field Update of Keyboards

A field B/M will be provided to update keyboards with PC board at EC 310084. This field B/M (EC 823177) will provide a complete keyboard assembly.

A field B/M will be provided to update keyboards with PC boards at EC 309728 and 309786. This B/M (EC 825709) will provide all contamination shields and 10 new modules for critical positions.

D

**D**

An alternate fix is to rotate the modules 180 degrees.

An ECA will be released to provide a new keyboard assembly. This keyboard assembly will include the latest level PC board, dust seals and improved key modules.

To test the machine's ability to accept input at high speed (such as when rolling keys), hold down four data keys and the Repeat key simultaneously. Two or three keys (depending on the keys pressed) should alternately enter, repetitively to the end of the record, without an error. If an error results, or if the machine fails to function as stated, replace the keyboard PC board.

## 2. EXTRA CHARACTERS

A quick check to determine a failing data key is to hold down the repeat key with a diskette loaded and observe the display.

The PC board must be cleaned with a lint-free cloth and alcohol or tape cleaner. Any contamination over 0.001 inch (0.02 mm) thick will cause failures on PC boards at EC level 310084.

New level PC boards (EC 309728 and 309786B) have been desensitized and will allow contamination of .005 to .007 inch before failing. An ECA will be released to provide a new keyboard assembly. This keyboard assembly will include the latest level PC board, dust seals and improved key modules.

EC and part number are either in the upper left hand corner of the PC board or on the signal cable connector.

- Load a diskette.
  - Press several data keys.
  - Observe the display. —
- Any data keyed should appear on the display.

**E**

E

Does the data display correctly?

Y N

- Use keyboard MAP 4-6.

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y N

- Power down.
- Disconnect cross connectors (505B).
- Power up.
- Perform the failing operation.

Does the machine still fail?

Y N

- Reconnect cross connectors C and D.
- Use MAP 5-1.

— The ROS feature card is now disconnected (505E).

— The keyboard function with the ROS feature card removed is the same as that of a standard data entry keyboard. (For example, pressing NUM SHIFT and M enters a 7 rather than a 1.)

- Power down.

- Reconnect cross connectors C and D.

- Power up.

— Insert a diskette in each station.

— Perform the same function and/or key data on the other keyboard.

Does this keyboard work correctly?

Y N

- Test the probe at planar P-B12 (signal ground P-D08). Both probe lights should be on.
- Probe keyboard B10, signal ground D08 (407L).

- Connect probe power leads to planar M-D13 (- black, M-B05 +).

Are both lights on?

Y N

- Power down.
- Disconnect keyboard signal cable at original keyboard.
- Power up.
- Probe keyboard B10 at the other keyboard.

Are both lights on?

Y N

- Power down.
- Disconnect keyboard signal cable from other keyboard.
- Reconnect keyboard signal cable to original keyboard.
- Power up.
- Probe original keyboard B10.

F G

H

F G H

Are both lights on?

Y N

- Power down.
- Disconnect keyboard signal cable at MPU planar sockets P and R.
- Power up.
- Probe planar sockets P and R, B10.

Are both lights on?

Y N

- Power down.
- Reconnect the cables to their original locations.
- Use MPU MAP 5-1.

- Power down.
- Check both cables.
- Replace defective keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Power down.
- Replace the keyboard PC board for both keyboards (407G).
- Verify the fix.

The keyboard PC boards were defective.

Power down.

- Replace keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

Power down.

- Swap the keyboard signal cables at MPU planar sockets P and R.

— Remove the viewer.

— Power up.

— Ensure that a diskette is in each drive.

— Reversing the keyboard cables causes one keyboard to control the other station.

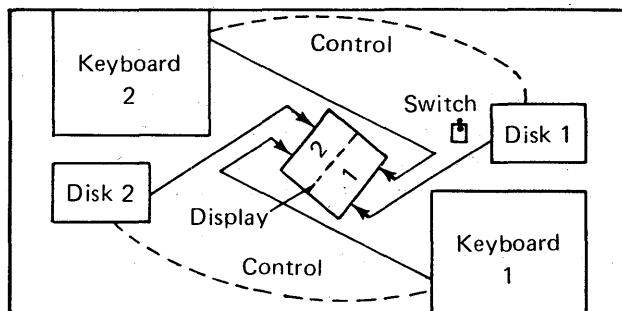
Therefore, data keyed at one station will be displayed on the other station's area of the display.

— Perform the failing operation at the station which originally reported the trouble.

Does the machine still fail?

Y N

- Power down.
- Reconnect the cables to their original locations.
- Use MPU MAP 5-1.



Control and display interactions with keyboard signal cables swapped at planar sockets P and R.

J

J

- Power down.
- Reconnect the keyboard signal cables to their original connectors at MPU planar sockets P and R.
- Check the failing keys for binds.
- Remove the all keys unit on the failing keyboard (407A).
- Turn the all keys unit over carefully and check the flyplates (407D).

Are all keys free of binds and are all flyplates attached to the module?

Y N

- Repair or replace the defective key modules (407C, 408, 409).
- Verify the fix.  
Certain key modules were defective.
- Clean the key module flyplates and pad area of the keyboard PC board with lint-free cloth (P/N 2108930) dampened with water or alcohol. (P/N 2200200).
- Reinstall the all keys unit after all flyplates and pad areas are dry.
- Verify the fix.

Does the machine still fail?

Y N

- The keyboard PC board was dirty.
- Power down.
- Replace the keyboard PC board (407G).
- Verify the fix.

Does the machine still fail?

Y N

- The keyboard PC board was defective.
- Power down.
- Reinstall the original PC board.
- Check the keyboard signal cable for opens/shorts/ground. If station 1, check the cable at power supply test point 4 (419B).

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
- Verify the fix.

Does the machine still fail?

Y N

- The keyboard signal cable was defective.
- Use MPU MAP 5-1.

**This page is intentionally left blank.**

## MAP 4-3 -

— This MAP will find problems in the switches.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.
- Record the date of each action.
- Vibrate the machine to cause the failure. Check room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltages at keyboard with respect to frame ground (407L). —

Voltage	Pin	Limits
---------	-----	--------

+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4

- For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.

- Power down.
- Reseat both ends of the keyboard signal cable (407H).
- Verify the fix.

DATE: 

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- Power down.
- Replace the toggle switch associated with failing machine operation (407E).
- Verify the fix.

DATE: 

--	--	--

- Power down.
- Replace the MPU (505N, 504).
- Verify the fix.

DATE: 

--	--	--

- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.

DATE: 

--	--	--

- Replace keyboard PC board (407G).
- Verify the fix.

DATE: 

--	--	--

- Power down.
- Replace the ac line filter (418A).
- Verify the fix.

DATE: 

--	--	--

A

**A**

- Power down.
- Reseat both ends of the keyboard signal (407H) and toggle switch (407F) cables.
- Verify the fix.

Does the machine fail now?

Y N

- A cable was loose.

Is an error code displayed?

Y N

- Load a diskette.
- Press CHAR ADV 16 times. —
- Set all toggle switches down.
- Remove disk from other station. —
- Press FUNCT SEL lower
- Hold NUM SHIFT and press C
- Release NUM SHIFT and then press U
- Observe the toggle switch test code on the display and do not operate the toggle switches. —

- This locates the test code position.
- An F error will occur if CE mode is attempted while a disk is in the other station.
- The machine is now in CER mode.
- The machine is now in CEW mode.

#### — Toggle Switch Test Code Location

08	50	00	00	00	01	01	00	00	00
66	00	00	00	00	07	00	00	00	00
00	00	04	02	00	00	00	00	02	00

Katakana shift switch test code location.

Any switch circuit failing?

Y N

- Operate the toggle switches in the (407E) sequence shown in the following chart:

Correct Code	Open Switch Circuit Code
1. AUTO DUP/SKIP up.	8
2. AUTO REC ADV up.	A
3. PROG NUM SHIFT up.	E
4. KATAKANA SHIFT up <sup>1</sup> .	2

Any switch circuit failing?

Y N

- Use MPU MAP 5-1.

<sup>1</sup> Test applies on Katakana machines only.  
Press a data key several times to test while observing the Katakana shift switch test location.

**B**

B

- Power down.
- Disconnect the toggle switch cable wire from the failing switch (411).
- Use the CE meter set to the Rx1 scale and check the switch (407E, 411).

Does the switch function correctly?

Y N

- Replace the defective toggle switch.
- Reconnect the cable wire to the switch.
- Verify the fix.

The toggle switch was defective.

Is this machine other than a Katakana machine?

Y N

Is the failure in the ARA, ADS, or PNS switch circuit?

Y N

- Check the KATAKANA SHIFT switch cable wire for opens, shorts, grounds (411).

Is the cable OK?

Y N

- Replace the toggle switch cable.
- Verify the fix.

The toggle switch cable was defective.

- Check the KANA SHIFT key for binds.
- Remove the KANA SHIFT key top.
- Remove the all keys unit (407A).
- Turn the all keys unit over carefully and check the flyplate on the KANA SHIFT key (407D).

Is the key free of binds and is the flyplate attached to the module?

Y N

- Repair or replace the key module (407C). (See *Flyplate Replacement* on page 414.)
- Reinstall the all keys unit.
- Verify the fix.

The key module was defective.

- Replace the keyboard PC board (407G).
- Verify the fix.

C

- Disconnect the keyboard signal cable from MPU planar socket P or R (505).
- Check the switch circuit from the switch cable wire to the signal cable for opens/shorts/grounds (411).

**Are there any opens/shorts/grounds?**

**Y N**

- Power down.
- Reconnect all cables.
- Use MPU MAP 5-1.
  
- Disconnect the keyboard signal cable from the keyboard PC board connector (407H).
- Check the switch circuits of the signal cable for opens/shorts/grounds (407H).

**Are there any opens/shorts/grounds?**

**Y N**

- Check the toggle switch cable for opens/shorts/ground (407F, 411).

**Is the cable OK?**

**Y N**

- Replace the toggle switch cable.
  - Verify the fix.
- The toggle switch cable was defective.

- Power down.
- Reinstall original toggle switch cable.
- Replace the keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

- Replace the keyboard signal cable (407H).

- Verify the fix.

The keyboard signal cable was defective.

## MAP 4-4 —

— This MAP will find problems in the keyboard data gate line.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the trouble is fixed.
- Record the date of each action.
- Vibrate the machine to cause the failure. Check room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltages at keyboard with respect to frame ground (407L). —

Voltage	Pin	Limits
---------	-----	--------

+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4

- For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.

- Power down.
- Reseat both ends of the keyboard signal cable (407H).

— Verify the fix.

DATE: 

--	--	--

- Power down.
- Replace the keyboard PC board (407G).

— Verify the fix.

DATE: 

--	--	--

- Power down.

— Replace the MPU (505N, 504).

— Verify the fix.

DATE: 

--	--	--

- Power down.

— Replace the keyboard signal cable (407H).

— Verify the fix.

DATE: 

--	--	--

- Power down.

— Replace the ac line filter (418A).

— Verify the fix.

DATE: 

--	--	--

A

**A**

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

**Y N**

- Power down.
- Replace the ROS feature card at sockets C and D (505B).
- Verify the fix.  
DATE: 

--	--	--
- Power down.
- Replace cross connectors C and D (505B).
- Verify the fix.  
DATE: 

--	--	--

— Power down.

- Reseat both ends of the keyboard signal cable (407H).
- Verify the fix.

Does the machine still fail?

**Y N**

- The cables were loose.

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

**Y N**

- Power down.
- Disconnect cross connectors C and D (505B). — — The ROS feature card is now disconnected (505B)
- Power up.
- Perform the failing operation. — — The keyboard function with the ROS feature card removed is identical to that of a standard data entry keyboard. For example, pressing the NUM SHIFT and M enters a 7 rather than a 1.

Does the machine still fail?

**Y N**

- Reconnect cross connectors C and D.
- Use MAP 5-1.
  
- Power down.
- Reconnect cross connectors C and D.
- Power up.

**B**



- Load a diskette.
- Press several data keys.

Is the audio feedback device making a clicking noise (407J, 410)?

Y N

- Use keyboard MAP 4-6.

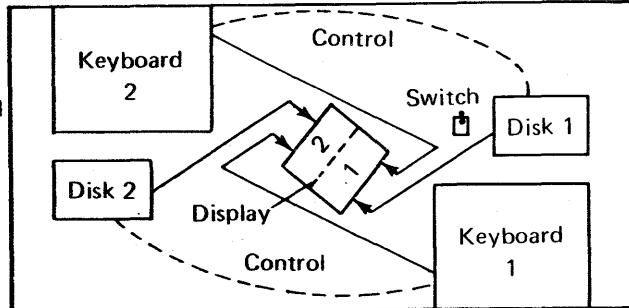
Does the other keyboard work correctly?

Y N

- Use MPU MAP 5-1.

— Power down.

- Swap the keyboard signal cables at MPU planar sockets P and R.
- Remove the viewer.
- Power up.
- Ensure that a diskette is in each drive.
- Swapping the keyboard cables causes one keyboard to control the other station. Therefore, data keyed at one station will be displayed on the other station's area of the display.
- Press the failing key on the failing keyboard.
- Perform this operation at the station which originally reported the trouble.



Does the machine still fail?

Y N

- Power down.
  - Reconnect the keyboard signal cables to their original position.
  - Use MPU MAP 5-1.
- 
- Power down.
  - Reconnect the keyboard cables to their original connectors.
  - Check the keyboard signal cable (407H) for opens/shorts/ground. If at station 1, check cable at power supply TP4 (419B).

Control and display interactions with keyboard signal cables swapped at planar sockets P and R.

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
  - Verify the fix.
- The keyboard signal cable was defective.
- 
- Replace the keyboard PC board (407G).
  - Verify the fix.
- The keyboard PC board was defective.

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## MAP 4-5 —

- This MAP will find problems in the REP key.

Can you make the machine fail?

Y N

- When the failure is intermittent, perform the following steps, one on each call, until the trouble is fixed.
- Vibrate the machine to cause the failure. Check room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltages at keyboard with respect to frame ground (407L). —

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4

- For easier probing with the CE probe remove the ground lead of the switch cable (407F) and use that ground pin.

- Power down.
- Replace the REP key module (407C).

- Verify the fix.

DATE:

- Power down.

- Replace the failing key module (407C, 408, 409).

- Verify the fix.

DATE:

- Power down.

- Replace the keyboard PC board (407G).

- Verify the fix.

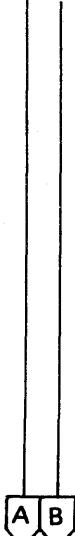
DATE:

- Power down.

- Replace the ac line filter (418A).

- Verify the fix.

DATE:



A | B

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y N

- Power down.
  - Replace the ROS feature card at C and D (505B).
  - Verify the fix.
- DATE:
- Power down.
  - Replace cross connectors C and D (505B).
  - Verify the fix.
- DATE:

— Power down.

- Reseat both ends of the keyboard signal cable (407H).
- Verify the fix.

Does the machine still fail?

Y N

The cable was loose.

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y N

- Power down.
- Remove cross connectors C and D (505B). — — — — —
- Power up.
- Perform the failing operation. — — — — —

|  
— The keyboard function with the ROS feature card removed is identical to that of a standard data entry keyboard. For example, pressing NUM SHIFT and M enters a 7 rather than a 1.

Does the machine still fail?

Y N

- Power down.
- Reinstall cross connectors C and D (505B).
- Use MAP 5-1.
  
- Power down.
- Reconnect cross connectors C and D.
- Power up.

— Remove the diskette from the other station.

— Load a diskette:

— Press and hold CHAR ADV. —

— This checks the REPEAT function.

Did the cursor move more than one position?

Y N

- Press and hold CHAR ADV.
- Advance the cursor to position 13 by pressing the REPEAT key. —

— This checks the REPEAT key.

C | D

C D

Did the cursor fail to move to position 13. —

Y N

- Press FUNCT SEL lower.
- Hold NUM SHIFT and press C.

Did the machine fail to change to CER (mode-status)?

Y N

- Release NUM SHIFT and press U

For Katakana: Is register group 24 different from this?

For standard keyboard: Is register group 4 different from this?

Y N

- Press every key except RESET and REP several times. Check ALPHA SHIFT and NUM SHIFT keys by pressing L with each; ALPHA SHIFT should give A6, NUM SHIFT should give 66 (415).
- Look at group 4 of the data display.

For Katakana: Pressing the L key with KANA SYMB should give E6 in group 24. If E6 is displayed by pressing the KANA SYMB key alone, the key is defective.

To check the Kana shift key, press KANA SHIFT then L several times. Register 24 should display 20 (416).

- Look at group 24 of the data display.

Are there any failing keys (415)?

Y N

- Press RESET several times.

Did the machine fail to change to XR (mode-status)?

Y N

- Use MPU MAP 5-1.

- Power down.
- Check the failing key for binds.
- Remove the all keys unit (407A).
- Turn the all keys unit over carefully, and check the flyplate on the failing key (407D).

— Position 13 locates the keyboard test code when the machine is in CE mode.

•08 50 00 00 00 01 01 00 00 00  
66 00 00 00 00 07 00 00 00 00  
00 00 04 02 00 00 00 00 02 00

— A key may have to be pressed more than once because the keyboard data register is periodically reset by the diagnostic program and may not accept the first key depression.

08 50 00 00 00 01 01 00 00 00  
66 00 00 00 00 07 00 00 00 00  
00 00 04 02 00 00 00 00 02 00

E

Is the key free of binds and is the flyplate attached to the module?

Y N

- Repair or replace defective key modules (407C).
- Reinstall the all keys unit.
- Verify the fix.

The key module was defective.

Clean the key module flyplates (407D) and pad area (407K) of the keyboard PC board with a lint-free cloth (P/N 2108930) dampened with water or alcohol (P/N 2200200).

- Reinstall the all keys unit after all flyplates and the pad area are dry.
- Verify the fix.

Does the machine still fail?

Y N

The keyboard PC board was dirty.

- Power down.
- Replace the keyboard PC board (407G).
- Verify the fix.

Does the machine still fail?

Y N

The keyboard PC board was defective.

- Power down.
- Reinstall the original PC board.
- Check the keyboard signal cable (407H) for opens/shorts/grounds. If at station 1, check cable at power supply TP4 (419B).

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Use MPU MAP 5-1.

## MAP 4-6 -

- This MAP will find problems in the audio feedback device.

Can you make the machine fail?

Y N

- Where the trouble is intermittent, perform the following steps, one on each call, until the problem is fixed.
- Record the date of each step.

When operating the 3742, does the display suddenly go blank but come on again in about 10 seconds and the keyboard locks up? —

Y N

- Vibrate the machine to cause the failure. Check room temperature and humidity and compare to *Installation Procedure*, page 16-1. Check dc voltages at keyboard with respect to frame ground. — — — —

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4

- Power down.
- Clean the key module flyplates and pad area of the keyboard PC board with a lint-free (P/N 2108930) cloth damped with water or alcohol (P/N 2200200).
- Reinstall the all keys unit (407A) after all flyplates are dry.
- Verify the fix.  
DATE:
- Power down.
- Reseat both ends of the keyboard signal cable (407H).
- Verify the fix.  
DATE:
- Power down.
- Replace the audio feedback device (407J, 410).
- Verify the fix.  
DATE:
- Power down.
- Replace the keyboard PC board (407G).
- Verify the fix.  
DATE:
- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.  
DATE:

A B C

- Highly intermittent keyboard lockups with/without flashing screen and with/without error codes may occur due to arcing in the CRT. These lockups cannot be reset with the RESET key. On machines with keyboard PC boards at EC level 310084 and 309728, these lockups can be reset with the REPEAT key. On machines with keyboard PC board at EC 309786 (latest), it will require power OFF/ON to reset the lockup. A CRT high voltage converter with excessive high voltage output or a defective CRT can cause CRT arcing.

A CRT causing these intermittent problems more than once a week should be replaced. On initial installation, a CRT may arc once or twice. This is not unusual after shipping and handling.

- For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.

**A** **B** **C**

- Power down.
- Replace the ac line filter (418A).
- Verify the fix.

DATE:

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

**Y** **N**

- Power down.
  - Replace the ROS feature card at C and D (505B).
  - Verify the fix.
- DATE:
- Power down.
  - Replace cross connectors C and D (505B).
  - Verify the fix.
- DATE:
- Use MAP 5-1.
  - Use MAP 5-1.
  - Power down.
  - Disconnect the wire from terminal 9 of the display PC board (304C).
  - Using the 500 Vdc scale, connect the CE meter from terminal 7 (+) to terminal 6 (-) on the display PC board.
  - Power up and wait 25 seconds.

Is the voltage between 300 and 410 Vdc?

**Y** **N**

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage anode (304A).
- Replace the converter (304G).
- Verify the fix.

DATE:

- Power down.
- Reconnect the wire to terminal 9 of the display PC board.
- Ground the CRT high voltage (304A).
- Replace the chassis and CRT assembly (304E).
- Adjust the yoke assembly (304F, 305).
- Verify the fix.

DATE:

- Power down.
- Reseat both ends of the keyboard signal cable (407H, 505).
- Verify the fix.

**D**

D

Does the machine still fail?

Y N

The cable was loose.

Is the machine equipped with a data entry keyboard rather than a proof keyboard?

Y N

- Power down.
- Remove cross connectors C and D (505B).
- Power up.
- Perform the failing operation.

— The ROS feature card is now disconnected (505B).

— The keyboard function with the ROS feature card removed is the same as that of a standard data entry keyboard. For example, pressing NUM SHIFT and M enters a 7 rather than a 1.

Does the machine still fail?

Y N

- Power down.
- Reinstall cross connectors C and D.
- Use MAP 5-1.
  
- Power down.
- Reconnect cross connectors C and D.
- Power up.

Error Code Positions 7 and 8

Are the error code positions blank? —

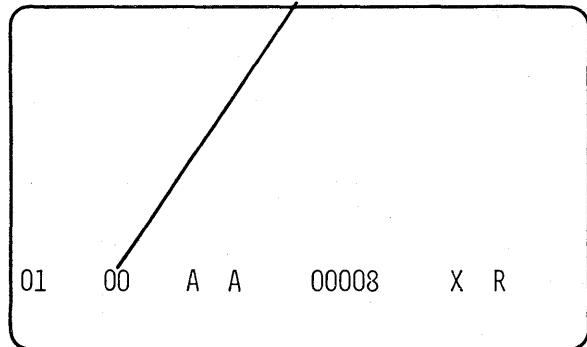
Y N

- Power down.
- Disconnect the keyboard signal cables from MPU planar sockets P and R.
- Power up.
- Load a diskette.

Is an error code displayed now?

Y N

- Power down.
- Reconnect the keyboard signal cables to MPU planar sockets P and R.
- Replace the keyboard PC board (407G).
- Verify the fix.



Does the machine still fail?

Y N

The keyboard PC board was defective.

- Power down.
- Reinstall the original keyboard PC board.
- Check/replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Power down.
- Reconnect the keyboard signal cables.
- Use MPU MAP 5-1.

E

**E**

Is the display flashing?

Y N

- Load a diskette in the other station.
- At the other station, perform failing operation.

Does this keyboard work correctly?

Y N

- Power down.
- Disconnect the other signal cable at either MPU planar sockets P or R and at power supply TP4 (419B) if the other keyboard is at station 1.
- Check the following dc voltages at the failing keyboard PC board with reference to frame ground (407L). —
- Power up.

- The problem may be due to ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.

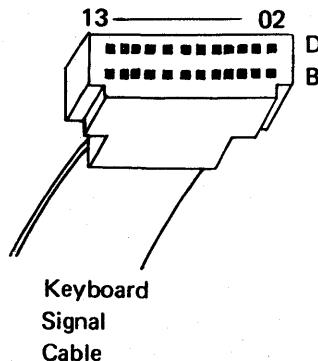
Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4

Are all voltages within limits?

Y N

- Make a note of the failing voltage measurement for future reference.
- Power down.
- Disconnect signal cable (407H) at keyboard PC board.
- Check the following dc voltages at the keyboard end of the signal cable with reference to the frame ground. —
- Power up.

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4



Are all voltages within limits?

Y N

- Power down.
- Reconnect the cable.
- Use power MAP 6-1.

**F G H J**

F G H J

- Power down.
- Reconnect the keyboard signal cable.
- Replace the keyboard PC board (407G).
- Verify the fix.
- Attempt loading a diskette at least twice. —

Does the machine still fail?

Y N

The keyboard PC board was defective.

- Power down.
- Reinstall the original keyboard PC board.
- Use MAP 6-7.
- Test the probe at planar P-B12 (signal ground P-D08). Both probe lights should be on. —
- Probe keyboard B10 (signal ground D08) (407L). —

- A faulty disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

Are both lights on?

Y N

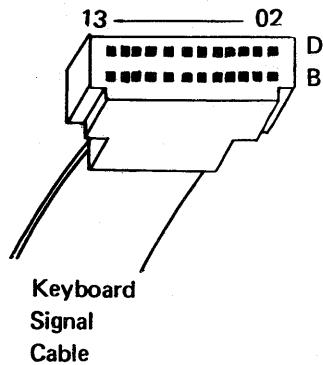
- Power down.
- Disconnect signal cable (407H) from keyboard.
- Power up.
- Probe cable B10 at keyboard end (signal ground pin D08). —

Are both lights on?

Y N

- Power down.
- Disconnect the keyboard cable from MPU connector P or R.
- Power up.
- Probe planar P-B10 (R-B10). — Signal ground P-D08 (R-D08).

- Connect probe power leads to planar M-D13 (-) black, M-B05 (+).
- Checks for oscillator pulses.



- Checks for oscillator pulses.

F G K L M



Are both lights on?

Y N

- Power down.
- Reconnect the keyboard signal cable.
- Use MPU MAP 5-1.
  
- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Power down.
- Replace keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

- Probe keyboard B11 (407L).
- Power down and wait 5 seconds.
- As you watch the probe for the DOWN light, turn the power on. —

Did the DOWN light come on?

Y N

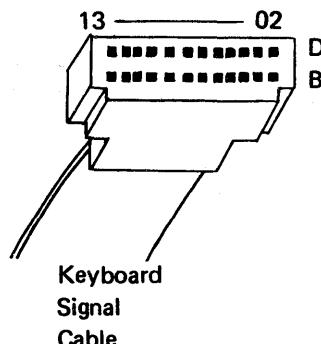
- Power down.
- Disconnect signal cable (407H) from keyboard.
- Probe cable B11 at keyboard end (signal ground pin D08). —
- Observe the DOWN light as you turn power on.

Did the DOWN light come on?

Y N

- Power down.
- Disconnect the keyboard signal cable from MPU connector P (or R).
- Probe planar P-B11 (R-B11). Signal ground P-D08 (R-D08).
- As you watch the probe for the DOWN light, turn the power on. —

- Checks for power-on reset pulse. If functioning properly, the POR pulse occurs and the DOWN light comes on for a short time after the POWER switch is turned on.



- Checks for power-on reset pulse. If functioning properly, the POR pulse occurs and the DOWN light comes on for a short time after the POWER switch is turned on.



F G N P

Did the DOWN light come on?

Y N

- Power down.
  - Reconnect the cable.
  - USE MPU MAP 5-1.
- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.
- The keyboard signal cable was defective.
- Power down.
  - Replace the keyboard PC board (407G).
  - Verify the fix.

Does the machine still fail?

Y N

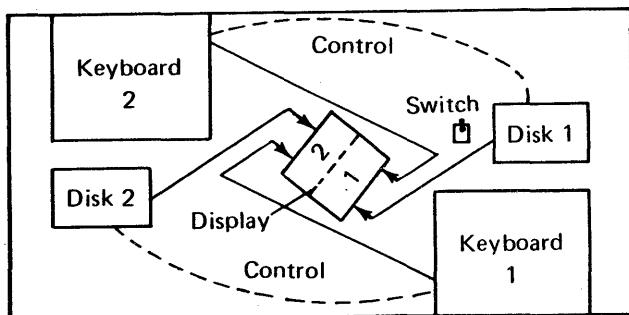
- The keyboard PC board was defective.
- Power down.
  - Reinstall the original keyboard PC board.
  - Check the keyboard signal cable (407H) for opens/shorts/ground. If at station 1, check cable at power supply TP4 (419B).

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
  - Verify the fix.
- The keyboard signal cable was defective.
- Use MPU MAP 5-1.

- Power down.
- Swap the keyboard signal cables at MPU planar sockets P and R.
  - Remove the viewer.
  - Power up.
  - Ensure that a diskette is in each drive.
  - Swapping the keyboard cables causes one keyboard to control the other station.
- Therefore, data keyed at one station will be displayed on the other station's area of the display. —
- At the failing keyboard, perform the failing operation.



- Control and display interactions with keyboard signal cables swapped at planar sockets P and R.

F Q



Does the machine still fail?

Y N

- Power down.
- Reconnect the cables to their original location.
- Use MPU MAP 5-1.
  
- Power down.
- Reconnect the keyboard cables to their original connectors.
- Reinstall the viewer.
- Check the audio feedback device for correct mechanical operation (410).

Does the audio feedback device operate OK mechanically?

Y N

- Repair or replace the audio feedback device (407J, 410).
- Verify the fix.

The audio feedback device was defective.

— Power down.

- Test the CE meter. —
- On the failing keyboard, disconnect one wire from the audio feedback device (407J).
- Measure the resistance of the audio feedback device.

Is the resistance 55 to 60 ohms (new style) or 90 to 110 ohms (old style) (410)?

Y N

- Replace the audio feedback device (407J).
- Verify the fix.

The audio feedback device was defective.

— Reconnect the wire to the audio feedback device.

— Power up.

— Check the following dc voltages at the keyboard PC board with reference to the frame ground (407L). —

— Power up.

— CE meter test:

- Power down.
- Disconnect the disk signal cable (204B).
- Set the meter to the Rx1 scale.
- Measure the resistance between test points 16 and 23 on the disk FC card (204A).
- The CE meter should read between 86 and 96 ohms.
- Reconnect the disk signal cable.

— The problem may be due to ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
5.0	D06	4.6 to 5.4



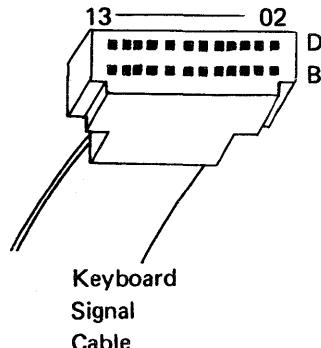
F R

Are all voltages within limits?

Y N

- Make a note of the failing voltage measurement for future reference.
- Power down.
- Disconnect the signal cable at keyboard PC board.
- Power up.
- Check the following dc voltage at the keyboard end of the signal cable with reference to frame ground (407H).

Voltage	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	4.6 to 5.4



Are all voltages within limits?

Y N

- Power down.
- Reconnect the keyboard signal cable (407H).
- Use MAP 6-1.
- Power down.
- Reconnect the keyboard signal cable.
- Replace keyboard PC board (407G).
- Verify the fix.
- Attempt loading a diskette at least twice.

Does the machine still fail?

Y N

- The keyboard PC board was defective.
- Power down.
  - Reinstall the original keyboard PC board.
  - Use MAP 6-7.

- A fault disk FC card may cause a bad data set label 03 (write gate check) to be written on the disk. A good disk FC card will correct the write test label but will indicate an error the first time the diskette is loaded.

F S

F S

- Load a diskette.
- Test the probe at planar P-B12 (signal ground P-D08). Both probe lights should be on. —
- Probe keyboard D10, signal ground D08 (407L). —
- Observe the probe as you load a diskette.

Does the UP light turn on?

Y N

- Unload the diskette.
- Power down.
- Disconnect signal cable (407H) from keyboard.
- Power up.
- Probe cable D10 at keyboard end. — Signal ground pin D08.
- Observe the probe as you insert a diskette.

Does the UP light turn on?

Y N

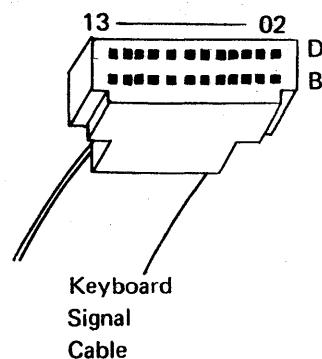
- Power down.
- Replace keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

Probe keyboard B10 (407L).

Signal ground pin D08. —

- Connect probe power leads to planar M-D13 (—) black, M-B05 (+).
- Checks for busy pulse. The DOWN lights should be on if no keys were pressed. For easier probing with the CE probe, remove the ground lead of the switch cable (407F) and use that ground pin.



Are both lights on?

Y N

- Power down.
- Disconnect signal cable (407H) from the keyboard.
- Power up.
- Probe cable B10 at keyboard end. — Signal ground pin D08.

Are both lights on?

Y N

- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Power down.
- Replace keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

- Checks for oscillator pulses.

F T

F T

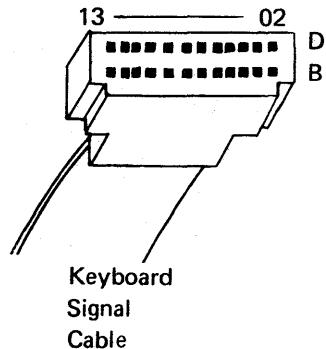
- Probe keyboard B11 (407L).  
Signal ground pin D08.
- Power down and wait 5 seconds.
- As you watch the probe for the DOWN light, turn the power on. —

Did the DOWN light come on?

Y N

- Power down.
- Disconnect the signal cable from the keyboard (407H).
- Probe cable B11 at keyboard end. —  
Signal ground pin D08.
- Observe the DOWN light as you power up.

- Checks for power-on reset pulse. If functioning properly, the POR pulse occurs and the DOWN light comes on for a short time after the POWER switch is turned on.



Did the DOWN light come on?

Y N

- Power down.
- Replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Power down.

- Replace keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

Power down.

- Replace the keyboard PC board (407G).
- Verify the fix.

Does the machine still fail?

Y N

The keyboard PC board was defective.

— Power down.

- Reinstall the original keyboard PC board.
- Check the keyboard signal cable for opens/shorts/ground. If at station 1, check the cable at power supply TP4 (419B).

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
- Verify the fix.

The keyboard signal cable was defective.

- Use MPU MAP 5-1.

U

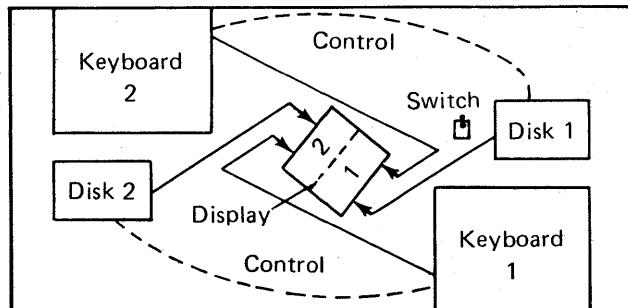
**U**

- Load a diskette in the other station.
- At the other station, perform the failing operation.

Did all keys work correctly?

Y N

- Use MPU MAP 5-1.
- Power down.
- Swap the keyboard signal cables at MPU planar sockets P and R.
- Remove the viewer.
- Power up.
- Ensure that a diskette is in each drive.
- Swapping the keyboard cables causes one keyboard to control the other station. Therefore, data keyed at one station will be displayed on the other station's area of the display. — —
- At the failing keyboard, perform the failing operation (at the station which originally reported the trouble).



Does the machine still fail?

Y N

- Power down.
- Reconnect the cables to their original locations.
- Use MPU MAP 5-1.
- Power down.
- Reconnect the keyboard cables to their original connectors at MPU planar sockets P and R.
- Reinstall the viewer.
- Check the keyboard signal cable for opens/shorts/ground. If at station 1, check the cable at power supply TP4 (419B).

Is the cable OK?

Y N

- Replace the keyboard signal cable (407H).
- Verify the fix.
- The keyboard signal cable was defective.
- Replace the keyboard PC board (407G).
- Verify the fix.

The keyboard PC board was defective.

## MAP 4-7

### INCORRECT ONLINE FIELD TOTALS

Online field totals errors can result from *seemingly* correct operator procedures. There are restrictions relative to record backspace, record advance, and program selection. The restrictions are shown below and should be used to ensure the failure is not caused by violations. —

Additional information about online field totals can be found on page 9-22.

If the problem cannot be isolated using this information, use MAP 4-4.

#### Restrictions

To ensure the accuracy of the field total in the accumulator, remember the following restrictions.

- When using more than one program to process a record, all programs used must have identical field total fields.
- When deleting a record or backspacing to a previous record from a partially entered, updated, or verified record, select the same program for deleting and backspacing over the record that was used to create that record.
- A field programmed to have the contents of an accumulator read into it must be preceded by at least one programmed manual field and must not be followed within the same record by a field totals field relating to that accumulator.
- Backspacing over a previous record with a field programmed to have an accumulator read into it is not allowed.

#### — Example of Violation

The following steps detail a seemingly correct operator procedure which is one example of causing a field totals error.

1. The operator *fails* to select a program at the beginning of a job. (The machine is now in program level 0.)
2. The operator enters some data before remembering to select a program. Assume a 123 is keyed. This will display as UIO since the program is in alpha shift.
3. The operator backspaces to the beginning of the record and selects the correct program.
4. If the selected program has a 4 position field total program in program position 1, the machine will subtract what was keyed in step 2 (the numeric portion of UIO which is 496).
5. The operator now keys in the correct data, 123, etc. The value in the accumulator is now the difference between the two keying operations (373, etc).

The correct operation to prevent this error is to press FUNCT SEL and DELETE REC prior to selecting the correct program in step 3.





- After updating a record, deleting a record, or correcting a record in the verify mode, all succeeding fields programmed to accept an accumulator total that were affected by the operation must be executed. To execute this field total operation, record advance to the record that the accumulator is to be read into, select the correct program level, and field advance over the field that is to contain the total.
- In update mode, a field that is to have a total read into it is not executed if REC ADV is pressed before the cursor enters that field.
- Selection of second disk functions, communications functions, and print functions other than print record should be avoided to maintain online field total integrity.
- Program load functions should be done under program level 0 to maintain online field totals integrity.

## **MAPS 4-8 A THROUGH F**

### **MAP 4-8A NO SELF-CHECK ERROR (MODULUS 10)**

#### *No Self Check Error (Modulus 10)*

It is possible to fail to indicate a C self-check error using modulus 10. This situation occurs when all the following conditions are met.

1. Program numeric switch set to numbers only.
2. The self check digit is zero.
3. The operator fails to key enough numerical data to fill the self-check field, and then enters an alpha character in the last position.

### **MAP 4-8B OFFLINE FIELD TOTALS FAILS TO FUNCTION**

#### *Field Totals Fails to Function*

Offline field totals cannot be selected after a disk copy if during disk copy a deleted record was encountered. To correct, press rest then select offline field totals.

If the problem cannot be isolated using this information, use MAP 4-2.

### **MAP 4-8C DISK COPY MISSING/EXTRA RECORDS**

#### *Disk Copy -- Missing/Extra Records*

- Missing or extra record may occur during disk copy using diskettes initialized with alternate record sequence. Records are located on the diskette in the following sequence:  
1,3,5,... 25,2,4,6,... 24.

This will be corrected on an EC.

If the problem cannot be isolated using this information, use MAP 4-2.

**MAP 4-8D RECORD COUNT WRONG*****Record Count Wrong***

Record counts can be different when entering or verifying the same job. Some examples are as follows:

If the operator enters a record on the disk (record count adds 1) and then decides to change the record, the act of changing and recording it on the disk causes another record count. In effect, for one record on the disk the record count is two. When this record is verified, it counts as one record.

The same is true during verification; if a record is verified and then the operator decides to change the data, the machine counts this as two records processed.

The record counter counts the number of records processed in enter, update and verify modes. The maximum count is 65,535, the counter then resets to zero. In enter mode every REC ADV is counted. In update mode every REC ADV is counted *if* any data is keyed or auto duplicated. In verify mode a REC ADV is counted *if* any data has been verified or auto verified.

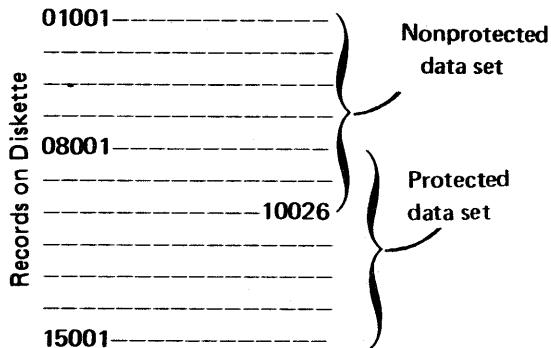
If the above information does not solve the problem, use MAP 4-4.

## **MAP 4-8E ALTERED OR MISSING DATA**

### **ALTERED or MISSING DATA**

- Caution must be used when using diskettes having file protected data sets. The machine can write over protected data if the extents for the nonprotected data set overlaps with a protected data set. For example:

	BOE	EOE
(nonprotected data set)	01001	10026
(protected data set)	08001	15026



Data can be written into records 08001 to 10026 in the above example despite being within the protected data set extents. The machine works with one data set at a time and in the case of the example, the machine is unaware it may be writing in a protected area.

**MAP 4-8F S ERRORS, SEARCH SEQUENTIAL  
CONTENT DISK 2**

Search sequential content works on disk 1, with the complete 64-character set (421). This is not true, however, for disk 2 on some machines.

The character set is divided into two groups; 27 characters (blank through "'), and 43 characters (: through 9). Data, to be successfully searched on disk 2, must contain characters from one group; either one but not both.

If the data meets requirements, and the machine still fails, use MAP 4-2.

If you have one of these machines, and it is a problem to the customer, refer to ECA 6 for a method of correcting it.

# MPU MAPS

## MAP 5-1 —

- This MAP is the primary entry point for MPU problems.

Can you make the machine fail?

Y N

- When the problem is intermittent, perform the following actions, one on each call, until the problem is corrected.
- Record the date of each action.
- Vibrate the machine to try to cause the failure.
- Check room temperature and humidity and compare to *Installation Procedure*, page 16-1.
- Check dc voltages at planar M with reference to frame ground:

Vdc	Pin	Limits
+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

- Replace the ROS feature card (505B) in sockets C and D.  
DATE:
- Verify the fix.
- Replace the ROS feature card (505D) in sockets E and F.  
DATE:
- Verify the fix.
- Replace all memory cards (505C). —  
DATE:
- Verify the fix.
- If the machine has 128 record length feature, replace the memory socket card assembly (505C). —  
DATE:
- Verify the fix.
- Replace the MPU planar assembly (504, 505N).  
DATE:
- Verify the fix.
- Replace the MPU cross connectors (505P).  
DATE:
- Verify the fix.
- Power down.  
DATE:
- Replace the ac line filter (418A).  
DATE:
- Verify the fix.

- Two interchangeable memory cards are connected in parallel for the 128 record length feature.
- On some WTC machines with the 128 record length feature, one 4K memory card is used in place of two 2K cards. With the 4K card, the memory socket-card-assembly is not present.

A

**A**

- Power down.
- Reseat the display cable at planar N.
- Reseat the keyboard cable at planars P and R.
- Reseat the power supply cable at planar M.
- Reseat all MPU cross connectors (505P).
- Reseat the disk cable at planars J and K.
- Verify the fix.

Does the machine still fail?

Y N

The connectors were loose.

- If the symptom is a hex character appearing immediately after power up, see note. —

Is the symptom other than extra characters appearing when the disk is loaded?

Y N

- Power down.
- Disconnect the keyboard signal cable at the keyboard PC board (407H).
- Power up.

Do extra characters still appear when the disk is loaded?

Y N

- Power down.
- Reconnect the keyboard signal cable.
- Use MAP 4-2.
  
- Power down.
- Reconnect the keyboard signal cable.
  
- Power down for at least 5 seconds.
- Measure POR, with reference to frame ground, at planar M-B08 at power up. POR should be a +5 volt pulse during power up. —
- Power up.
- Check dc voltages at planar M with reference to frame ground. —

Vdc	Pin	Limits
+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

Are all dc voltages and POR within limits?

Y N

**B** — Use MAP 6-1.

- **Note:** The high voltage delay circuit forces the display to remain blank for at least 15 seconds after each power up. If the display brightness comes on with hex characters before 15 seconds, the display PC board is failing. Hex characters may appear briefly after the 15 seconds due to machine self-check procedures still in progress. Replace a failing display PC board if this symptom is a customer complaint. Machine functions are not affected by this problem.

- POR means power on reset.

- The problem may be due to ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.

**B**

Does the machine have a ROS feature card in sockets E and F (505D). —

Y N

Does the machine have ROS feature card in sockets C and D (505B)? —

Y N

- Use MPU MAP 5-2.
- Power down.
- Disconnect ROS feature card in sockets C and D (505B).
- Power up.
- Perform the failing operation that caused the original failure symptom.

Does the machine fail to indicate an F error?

Y N

- Power down.
  - Replace the ROS feature card in sockets C and D and connect it (505B).
  - Verify the fix.
- If a proof keyboard feature is installed on the machine (505B), keyboard function with the ROS feature card removed is that of a standard data entry keyboard. (For example, pressing the NUM SHIFT and M enters a 7 rather than a 1.)
- If ROS feature 128 card is not installed, remove MPU cross connectors C and D (504); otherwise, disconnect ROS feature card from ROS feature 128 card.

Does the machine still fail?

Y N

The ROS feature card in sockets C and D was defective.

- Power down.
- Reinstall the original ROS feature card in sockets C and D (505B).
- Replace MPU planar assembly (504, 505N).
- Verify the fix.

Does the machine still fail?

Y N

The planar assembly was defective.

- Power down.
- Reinstall the original MPU planar assembly.
- Replace MPU cross connectors C and D (504, 505P).
- Verify the fix.

The cross connectors were defective.

Does the machine still fail?

Y N

- Power down.
- Replace the ROS feature card in sockets C and D and connect it (505B).
- Verify the fix.

Does the machine still fail?

Y N

The ROS feature card in sockets C and D was defective (505B).

C D E

- The ROS feature card in sockets E and F has only record insert.

- The ROS feature card can include one of the following feature combinations.

- Proof keyboard.
- 128 feature and proof keyboard.
- 128 feature, proof keyboard, and feature group A.
- Proof keyboard and feature group A.
- Feature group A.
- Feature group A and 128 feature.

- If a proof keyboard feature is installed on the machine (505B), keyboard function with the ROS feature card removed is that of a standard data entry keyboard. (For example, pressing the NUM SHIFT and M enters a 7 rather than a 1.)

- If ROS feature 128 card is not installed, remove MPU cross connectors C and D (504); otherwise, disconnect ROS feature card from ROS feature 128 card.



- Power down.
- Reinstall the original ROS feature card in sockets C and D (505B).
- Replace MPU planar assembly (504, 505N).
- Verify the fix.

Does the machine still fail?

Y N

The planar assembly was defective.

- Power down.
- Reinstall the original MPU planar assembly.
- Replace MPU cross connectors C and D (504, 505P).
- Verify the fix.

The cross connectors were defective.

- Power down.
- Reconnect the ROS feature card in sockets C and D (505B).
- Use MPU MAP 5-2.

Power down.

- Disconnect the ROS feature card in sockets E and F (505D). —

Power up.

- Perform the failing operation that caused the original failure symptom.

— ROS feature card in sockets E and F controls record insert function.

Does the machine fail to indicate an F error?

Y N

- Power down.
- Replace the ROS feature card in sockets E and F (505D).
- Verify the fix.

Does the machine still fail?

Y N

The ROS feature card in sockets E and F was defective (505D).

- Power down.
- Reinstall the original ROS feature card in sockets E and F (505D).
- Replace MPU cross connectors E and F (505D).
- Verify the fix.

Does the machine still fail the same?

Y N

The cross connectors in E and F were defective.





## Does the machine still fail?

Y N

- Power down.
  - Replace the ROS feature card in sockets E and F and connect it (505D).
  - Verify the fix.

**Does the machine still fail?**

Y N

The ROS feature card in sockets E and F was defective (505D).

- Power down.
  - Reconnect the ROS feature card in sockets E and F (505D).

Does the machine have a ROS feature card in sockets C and D (505B)?

Y N

- Use MPU MAP 5-2.

- Disconnect ROS feature card in sockets C and D (505B). -----
  - Power up.
  - Perform the failing operation that caused the original failure symptom.

- If ROS feature 128 card is not installed, remove MPU cross connectors C and D, (504); otherwise disconnect ROS feature card from ROS feature 128 card.

**Does the machine fail to indicate an F error?**

Y N

- Power down.
  - Replace the ROS feature card in sockets C and D and connect it (505B).
  - Verify the fix.

If a proof keyboard feature is installed on the machine (505B), keyboard function with the ROS feature card removed is that of a standard data entry keyboard. For example, pressing NUM SHIFT and M enters a 7 rather than a 1.

Does the machine still fail?

Y N

The ROS feature card in sockets C and D was defective (505B).

- Power down.
  - Reinstall the original ROS feature card in sockets C and D (505B).
  - Replace MPU planar assembly (504).
  - Verify the fix.





**Does the machine still fail?**

**Y N**

**The planar assembly was defective.**

— Power down.

— Reinstall the original MPU planar assembly.  
— Replace MPU cross connectors C and D (504, 505).

— Verify the fix.

**The cross connectors were defective.**

**Does the machine still fail?**

**Y N**

— Power down.

— Replace the ROS feature card in sockets C and D and connect it (505B).

— Verify the fix.

**Does the machine still fail?**

**Y N**

**The ROS feature card in sockets C and D was defective (505B).**

— Power down.

— Reinstall the original ROS feature card in sockets C and D (505B).  
— Replace MPU planar assembly (504, 505N).

— Verify the fix.

**Does the machine still fail?**

**Y N**

**The planar assembly was defective.**

— Power down.

— Reinstall the original MPU planar assembly.  
— Replace MPU cross connectors C and D (504, 505P).  
— Verify the fix.

**The cross connectors were defective.**

— Power down.

— Reconnect the ROS feature card in sockets C and D (505B).  
— Use MPU MAP 5-2.

## MAP 5-2 —

— This MAP is a continuation of MAP 5-1.

- If the machine completes its power on diagnostics OK, (both stations show XN status/mode correctly on power up), apply this test to the disk unit of the faulty station, otherwise test disk unit 1 (510).
- Power down.
- Turn stepper motor wheel several revolutions on the disk unit selected for test.
- Observe disk unit carriage while you power up.

Does the disk unit carriage seek track 00?

Y N

- Test the probe at planar P-B 10 (signal ground P-D08). Both lights should be on. —
- Power down.
- On planar J or K, depending on which disk unit is being tested, probe the following pins:
  - Turn power on for each pin probed. — (Always wait at least 5 seconds after power down before power up.) Observe the probe for both lights on/pulsing a few seconds after power on for drive 1, a longer delay for drive 2.

D02 }  
D03      Signal ground  
D04 }  
D05      J/K-B08

Are both probe lights on and pulsing during the disk seek operation for each test point?

Y N

- Power down.
- Disconnect the signal cable of the disk unit being tested from planar J or K.
- On the vacated planar connector (J or K) probe the following pins:
  - Turn power on for each pin probed. (Always wait at least 5 seconds after power down before power up.) Observe the probe lights during disk seek time. The up light should turn on and pulse a few seconds after power up for drive 1, a longer delay for drive 2. Ignore the DOWN light.

D02 }  
D03      Signal ground  
D04 }  
D05      J/K-B08



- Connect probe power leads to planar M-D13 (-) black, M-B05 (+).
- The stepping motor control (MC) lines should pulse during power up (after a delay, possibly as much as a few seconds). If the lines pulse, and if there is power to the motor, the disk unit carriage should seek a lower position.

A B C

Is the UP light on and pulsing during the disk seek operation for each test point? —

Y N

Did you have to disconnect and reconnect MPU cross connectors C and D to disconnect/reconnect ROS feature card?

Y N

Are MPU cross connectors C and D *not* used in this machine (505P)?

Y N

- Power down.
- Check MPU cross connectors C and D for opens and shorts.

Are the MPU cross connectors OK?

Y N

- Replace the defective cross connector(s).
- Verify the fix.

Does the machine still fail?

Y N

The cross connector(s) was defective.

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

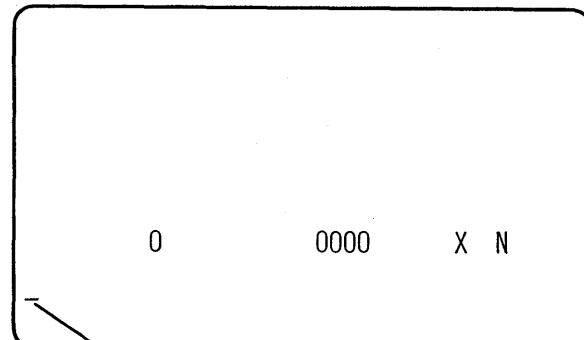
- Power down.
- Reconnect the signal cable at planar socket J.
- Use disk MAP 2-9.

- Power down.
- Replace the planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

— The problem may be due to ripple on the power supply. If ripple is suspected, use *Power Theory* in Section 15.

D



D

Is the display status line as shown?

Y N

- Test the probe at planar P-B10 (signal ground P-D08). —  
Both lights shoud be on.
- Probe planar N-B05, B07, B10 (signal ground N-D08) for pulses. —
- Connect probe power leads to planar M-D13  
(-) black, M-B05 (+).
- Test points in the horizontal return, CRT dot, and wriggle return respectively.

Are both probe lights on for each test point?

Y N

- Power down.
- Disconnect the display signal cable from planar socket N.
- Power up.
- Probe planar N-B05, B07, B10 (signal ground N-D08) for pulses.

Are both probe lights on for each test point?

Y N

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

- Power down.
- Reconnect the signal cable at planar N.
- If B05 failed, use display MAP 3-5.
- If B07 failed, use display MAP 3-3.
- If B10 failed, use display MAP 3-5.

— Observe the display.

Is the display filled with characters and are they all the same character?

Y N

- Power down.
- Remove planar cross connectors G and H (505P). —
- Power up.
- Probe planar H-D02.  
Signal ground H-B08.
- This will change the display.

E F G

**E F G**

Is the UP light on?

**Y N**

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

- Probe planar H-B04.

Is only the down light on?

**Y N**

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

- Probe planar G-D08. Signal ground G-B08.

Are both probe lights on?

**Y N**

- Probe planar G-D02. Signal ground G-B08.

Are both probe lights on?

**Y N**

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

- Probe planar H-D08. Signal ground H-B08.

Are both probe lights on?

**Y N**

- Probe planar H-B07. Signal ground H-B08.

Are both probe lights on?

**Y N**

- Power down.
- Replace the MPU planar assembly.
- Verify the fix.

The planar assembly was defective.

- Power down.

- Reinstall MPU cross connectors G and H. — This reconnects the memory.

**E H**

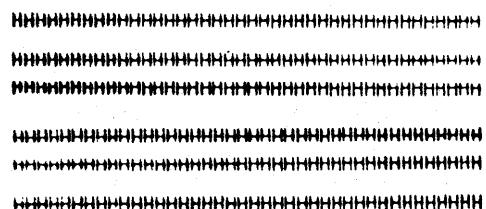
**E** **H**

- Power down.
- Jumper planar H-D02 to planar H-B08 (and jumper planar H-B09 to planar G-B08 if there are two memory cards installed) (505C).
- Power up. Wait 30 seconds.
- Observe the display.

Is the display as shown? —

**Y** **N**

- Power down.
- Remove the jumper from planar H-D02 to planar H-B08 (and planar H-B09 to planar G-B08).
- Remove MPU cross connectors G and H (505P).
- Power up. Wait 30 seconds.
- Observe the display.



The display may be flashing; disregard the cursor.

Is the display as shown?

**Y** **N**

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

Power down.

- Replace all memory cards and connect them (505C).
- Verify the fix.

Does the machine still fail?

**Y** **N**

The memory cards were defective.

Power down.

- Reinstall the original memory cards.

- Two interchangeable memory cards are connected in parallel for the 128 record length feature.

On some WTC machines with the 128 record length feature, one 4K memory card is used in place of two 2K cards. With the 4K card, the memory socket-card-assembly is not present.

Is this an 80 record length machine (128 record length feature not installed)?

**Y** **N**

- Replace the memory socket card assembly (505C).
- Verify the fix.

Does the machine still fail?

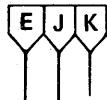
**Y** **N**

The socket card assembly was defective.

Power down.

- Reinstall the original memory socket card assembly.

**E** **J** **K**



- Check MPU cross connectors G and H for shorts and opens (505P).

Are the cross connectors OK?

Y N

- Replace defective cross connectors.
  - Verify the fix.

The cross connectors were defective.

- Power down.
  - Replace the MPU planar assembly (504, 505N).
  - Verify the fix.

The planar assembly was defective.

- Power down.
  - Remove the jumper from planar H-D02 to planar H-B08 (and planar H-B09 to planar G-B08).
  - Remove MPU cross connectors G and H (505P).
  - Remove MPU cross connectors A and B, (505P) and reinstall in MPU sockets G and H as shown (509).
  - Power up.
  - Connect one end of a jumper wire to planar G-B12.
  - Observe how the displays change as you connect the other end of the jumper wire to each of the test points listed (508).

Does data line 1 of the display change according to test patterns (508) when jumper is installed on test points shown? —

Y N

- Power down.
  - Replace MPU planar assembly (504, 505N).
  - Verify the fix.

The planar assembly was defective.

- Power down.
  - Reinstall the original MPU cross connectors A and B.
  - Replace all memory cards and connect them (505C). –
  - Verify the fix.



The image shows a decorative border made of a repeating pattern of small, stylized, symmetrical shapes. These shapes resemble stylized 'H' or 'M' characters and are arranged in a grid pattern. The border is composed of two rows of these characters, creating a dense and intricate pattern.

Display may be flashing, disregard cursor.

Data line 1 with viewer removed and viewed from station 1 side. \_\_\_\_\_

In some cases, data line 1 may start with blank character(s) rather than with the H character(s).

- Two interchangeable memory cards are connected in parallel for the 128 record length feature.

E L

Does the machine still fail?

Y N

The memory cards were defective.

- Power down.
- Reinstall the original memory cards.

Is this an 80 record length machine (128 record length feature not installed)?

Y N

- Replace the memory socket card assembly (505C).
- Verify the fix.

Does the machine still fail?

Y N

The socket card assembly was defective.

- Power down.
- Reinstall the original memory socket card assembly.
- Replace MPU cross connectors G and H.
- Verify the fix.

Does the machine still fail?

Y N

The cross connectors were defective.

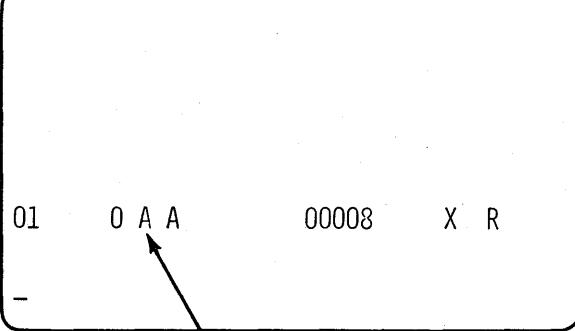
- Reinstall original MPU cross connectors G and H.
  - Replace MPU planar assembly.
  - Verify the fix.
- 
- Load a diskette.
  - Observe the display. —

Is the display correct?

Y N

- Test the probe at planar P-B10, (signal ground P-D08). —  
Both lights should be on.
- Probe planar J-D13 (signal ground J-B08).

M N



The data set label will be shown with the status line.

- Connect probe power leads to planar M-D13  
(-) black, M-B05 (+).



Are both lights on?

Y N

- Power down.
- Replace the VFO card (505A).
- Verify the fix.

Does the machine still fail?

Y N

- The VFO card was defective.
- Power down.
- Reinstall the original VFO card.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

Does the machine still fail?

Y N

- The planar assembly was defective.
- Power down.
- Reinstall the original planar.
- Replace MPU cross connectors A and B (505P).

The cross connectors were defective.

Is the keyboard dead?

Y N

- Power down.
- Replace the MPU planar assembly (504, 505N).
- Verify the fix.

The planar assembly was defective.

Does the machine still fail?

Y N

- The planar assembly was defective.
- Power down.
- Reinstall the original planar assembly.
- Replace all memory card(s).
- Reinstall cross connectors G and H.
- Verify the fix.

Does the machine still fail?

Y N

- The memory cards were defective.
- Power down.
- Reinstall the original memory cards.
- Replace the memory socket card assembly.
- Replace MPU cross connectors G and H.
- Verify the fix.

The memory socket card and the cross connectors were defective.

**P**

- Probe 2-P-D02 (diskette loaded), signal ground 2-P-D08, for keyboard 1. —
- Probe 2-R-D02 (diskette loaded), signal ground 2-R-D08, for keyboard 2.

- Connect the probe power leads to 2-M-D13 (-) black, 2-M-B05 (+).

Is the UP light on?

Y N

- Power down.
- Replace the MPU planar (504, 505N).
- Ground the CRT high voltage anode (304A). —
- Replace the CRT and chassis assembly (304E).
- Adjust the yoke (304F, 305).
- Verify the fix.

- An arcing CRT caused the MPU to be defective both must be replaced.

The MPU planar and CRT and chassis assembly were defective.

- Power down.
- Replace the MPU planar (504, 505N).
- Verify the fix.

The MPU planar was defective.

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### MAP 5-3 —

Is an ROS feature card directly connected to the planar by MPU cross connectors C and D (505B)? —

Y N

- Power down.
- Reseat the ROS feature card in sockets on the ROS feature 128 card (505B).
- Verify the fix.

— This MAP checks for failure in the ROS feature card.

— Answer will be yes for all machines except those with field installed 128 record length feature or an ROS EC.

Does the machine still fail?

Y N

The ROS feature card was loose.

- Power down.
- Replace the ROS feature card (505B).
- Verify the fix.

Does the machine still fail?

Y N

The ROS feature card was defective.

- Power down.
  - Reinstall the original ROS feature card.
  - Use MPU MAP 5-1.
- 
- Power down.
  - Reseat MPU cross connectors C and D (505P).
  - Verify the fix.

Does the machine still fail?

Y N

The cross connector(s) was loose.

- Power down.
- Replace the ROS feature card in sockets C and D (505B).
- Verify the fix.

Does the machine still fail?

Y N

The ROS feature card in sockets C and D was defective (505B).

- Power down.
- Reinstall the original ROS feature card in sockets C and D.
- Replace MPU cross connectors C and D (505P).
- Verify the fix.

Does the machine still fail?

Y N

The cross connector(s) was defective.

- Use MPU MAP 5-1.

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# POWER MAPS

## MAP 6-1 —

— Incorrect voltage at I/O unit. Intermittent machine operation. Machine inoperative.

- Power down.
- Reseat the power supply dc cable (604F).
- Verify the fix.

Does the machine still fail?

Y N

- The power supply dc cable was loose.
- Power down
- Check CB1 (604U), if installed.

Is CB1 on?

Y N

- Use MAP 6-5.

- Test the CE meter.
- Check/replace the primary (604D) and secondary fuses (604E).

- Adjust the meter to 0 ohms with the meter leads shorted and using the Rx1 scale.
- Remove each fuse and measure its resistance with the ohmmeter.

*Note:* There may be multiple blown fuses.

Is the 8.5V fuse (fuse 3) OK?

Y N

An arcing CRT can cause the 8.5V fuse to blow. If the fuse blows intermittently during normal operation, suspect a failing CRT. Replace it as shown on the first N below. If the fuse blows very often, proceed as follows:

- Power down.
- Replace the 8.5V fuse.
- Ground the CRT high voltage anode (304A).
- Disconnect the lead from the CRT high voltage anode.
- Power up.

Does the 8.5V fuse blow again?

Y N

- Power down.
- Ground the CRT high voltage anode (304A) and lead.
- Replace the chassis and CRT assembly (304E).
- Adjust the yoke (304F, 305).
- Verify the fix.

The chassis and CRT assembly was defective.

- Power down.
- Ground the CRT high voltage anode (304A) and lead.
- Reconnect the lead to the anode.

— Verify the fix.

A

**A**

Does the machine still fail?

**Y N**

— The fuse was open.

— Power down.

— Recheck the primary (604D) and secondary fuses (604E). —

Are any fuses blown now?

**Y N**

— Power up.

— Test your voltmeter on the pins shown.

— Measure the following dc voltages at the power supply PC board with reference to frame ground (604H).

Vdc	Test Point	Limits
-12	Fuse F2	11.0 to 13.2
+5	DC TP 4	4.7 to 5.5
+8.5	Fuse F3	8.0 to 9.4
+12	Fuse F1	11.0 to 13.2
+24	Fuse F4	22.0 to 26.5

Are all dc voltages within limits?

**Y N**

Are any dc voltages within limits?

**Y N**

— Use power MAP 6-6.

— Power down.

— Disconnect the power supply (604F), disk (604Q), and keyboard (604R) dc cables from the power supply PC board. —

— Measure POR at the power supply (604F), pin B08, as you turn power on. POR should be a +5 volt pulse during power up. —

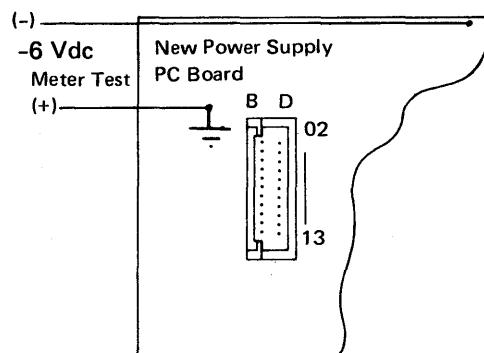
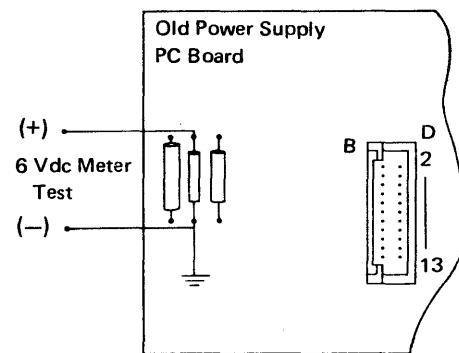
— Power up.

— Check the following dc voltages at the power supply with reference to frame ground (604F).

Vdc	Pin	Limits
+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

**B C D**

— Remove each fuse and measure its resistance with the ohmmeter.



— Try to isolate the problem.

— POR means power on reset.

B C D

Are all dc voltages and POR within limits?

Y N

- Power down.
- Reconnect all dc cables.
- Power up.
- Check the following ac secondary voltages to the power supply at the power supply ac test points (604H).

Vac	Between TP	Limits
5	K and L	4.75 to 6.5
8.5	C and D	8.0 to 10.5
12	A and D	11.4 to 14.0
12	B and D	11.4 to 14.0
24	F and G	22.5 to 26.5

Are the ac input voltages within limits?

Y N

- Use power MAP 6-6.
- Power down.
- Check/replace the power supply PC board (604H). —
- Verify the fix.
- The power supply PC board was defective.
- Use power MAP 6-4.

— Check for loose parts. Repair as required.

Measure the following dc voltages at the power supply PC board with reference to frame ground (604H).

Vdc	Test Point	Limits
-5	12	4.6 to 5.4
+6.3	13	5.7 to 9.4
Ground	3	0

B E

Are all dc voltages within limits?

Y N

- Power down.
- Disconnect the power supply (604F), disk (604Q), and keyboard (604R) dc cables from the power supply PC board.
- Measure POR, at the power supply (604F), pin B08, as you turn power on. POR should be a +5 volt pulse during power up. — — POR means power on reset.
- Power up.
- Check the following dc voltages at the power supply with reference to frame ground.

Vdc	Pin	Limits
+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

Are all dc voltages and POR within limits? —

Y N

- Power down.
- Reconnect all dc cables.
- Power up.
- Check the following ac secondary voltages to the power supply at the power supply ac test points (604H).

— The problem may be due to ripple. If ripple is suspected, use *Power Theory* in Section 15.

Vac	Between TP	Limits
5	K and L	4.75 to 6.5
8.5	C and D	8.0 to 10.5
12	A and D	11.4 to 14.0
12	B and D	11.4 to 14.0
24	F and G	22.5 to 26.5

Are the ac input voltages within limits?

Y N

- Use power MAP 6-6.

— Power down.

— Check/replace the power supply PC board (604H). —

— Verify the fix.

The power supply PC board was defective.

— Check for loose parts. Repair as required.

— Use power MAP 6-4.



- Power down.
- Disconnect the power supply (604F) dc cables from the power supply PC board.
- Measure POR at the power supply (604F), pin B08, as you turn power on. POR should be a +5 volt pulse during power up. —
- POR means power on reset.
- Power up.
- Check the following dc voltages at the power supply with reference to frame ground (604F).

**Vdc      Pin      Limits**

+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

Are all dc voltages and POR within limits? —

Y N

- Power down.
- Reconnect all dc cables.
- Power up.
- Check the following ac secondary voltages to the power supply at the power supply ac test points (604H).

- The problem may be due to ripple in the power supply. If ripple is suspected, use *Power Theory* in Section 15.

**Vac      Between TP      Limits**

5	K and L	4.75 to 6.5
8.5	C and D	8.0 to 10.5
12	A and D	11.4 to 14.0
12	B and D	11.4 to 14.0
24	F and G	22.5 to 26.5

Are the ac input voltages within limits?

Y N

- Use power MAP 6-6.
- Power down.
- Check/replace the power supply PC board (604H). —
- Verify the fix.

- Check for loose parts. Repair as required.

The power supply PC board was defective.

- Power down.
- Reconnect the power supply dc cable.
- Use power MAP 6-7.

B

B

Is the blown fuse a secondary fuse?

Y N

- Replace the primary fuse (604D).
- Disconnect the ac input cable at the power supply PC board (transformer secondary wires A through L to PC board).
- Power up.
- Power down.
- Recheck the primary fuse (604D). —
- Remove the fuse and measure its resistance.

Did the primary fuse blow again?

Y N

- Check/replace the power supply PC board (604H). —
- Verify the fix.
- The power supply PC board was defective.
- Replace the primary fuse (604D).
- Replace the ac capacitor (604J).
- Verify the fix.
- Check for loose parts. Repair as required.

Does the machine still fail?

Y N

- The ac capacitor was defective.
- Power down.
- Reinstall the previously removed ac capacitor in the machine.
- Replace the transformer (604K).
- Verify the fix.

The transformer was defective.

- Replace the secondary fuse (604E).
- Disconnect the power supply, disk, and keyboard dc cables from the power supply PC board (604F, Q, and R).
- Power up.
- Power down.
- Recheck the secondary fuse (604E).

Did a fuse blow again?

Y N

- Use power MAP 6-5.
- Check/replace the power supply PC board (604H).
- Verify the fix.

The power supply PC board was defective.

## MAP 6-2 —

- Disconnect the machine line cord.
- Check the machine for burned smell or burned parts. —
- This MAP will help find overheating problems.
- Look for parts that appear overheated.

Does the power supply appear to be OK?

Y N

- Look for burned parts on the power supply PC board (604H).

Is the power supply PC board burned?

Y N

- Test the CE meter. —
- Test the transformer primary and secondary windings for open circuits (604K).

- Adjust the meter to 0 ohms with the meter leads shorted and using the Rx1 scale.

Do the transformer windings all have continuity?

Y N

- Replace the transformer.
- Replace the ac capacitor (604J).
- Verify the fix.

Does the machine work OK now?

Y N

- Use power MAP 6-3.

The power supply transformer and the ac capacitor were defective.

- Test the CE meter. —

- Adjust the meter to 0 ohms with the meter leads shorted and using the Rx1 scale.

- Test the transformer primary and secondary windings for shorts between windings (604K).

Are there any shorts?

Y N

- Replace the power supply PC board (604H).
- Verify the fix.

The power supply PC board was defective.

- Replace the power supply PC board (604H).
- Replace the transformer (604K).
- Replace the ac capacitor (604J).
- Verify the fix.

The power supply PC board, the transformer, and the ac capacitor were defective.

A

A

- Check the display unit for burned smell or burned parts. —

- Look for parts that appear overheated.

Does the display unit appear OK?

Y N

- Replace the burned FRU in the display unit.
- Verify the fix.

The display unit was defective.

- Check the MPU for burned smell or burned parts. —

- Look for parts that appear overheated.

Does the MPU appear OK?

Y N

- Replace the burned FRU in the MPU.
- Verify the fix.

The MPU was defective.

- Check both keyboards for burned smell or burned parts. —

- Look for parts that appear overheated.

Do the keyboards appear OK?

Y N

- Replace the burned FRU in the keyboard.
- Verify the fix.

The keyboard was defective.

- Check both disk units for burned smell or burned parts. —

- Look for parts that appear overheated.

- Replace the burned FRU in the disk unit.

- Verify the fix.

The disk unit was defective.

### MAP 6-3 -

— This MAP will help find why the service breaker tripped.

- Power down.
- Remove the attachment cord from the customer's ac outlet.
- Test the CE meter. —
- Check the attachment cord for shorts (604P). —

- Adjust the meter to 0 ohms with the meter leads shorted and using the Rx1 scale.
- Measure between the prongs on the attachment cord.

Are there any shorts?

Y N

- Turn the mainline switch on.
  - Check the attachment cord for shorts (604P). —
  - Measure between the prongs on the attachment cord.
- Are there any shorts?
- Y N
- Inform the customer that no trouble was found. —
  - Disconnect both disk unit ac cables (604B and M).
  - Check attachment cord for shorts (604P).

- The problem is probably in the customer's service.

Are there any shorts?

Y N

- Reconnect the disk unit 1 ac cable (604M).
- Check attachment cord for shorts.

Are there any shorts?

Y N

- Check/replace the disk unit 2 drive motor (604A).
- Verify the fix.  
The disk drive motor was defective.
- Check/replace the disk unit 1 drive motor (604N).
- Reconnect the disk unit 2 ac cable (604B).
- Verify the fix.  
The disk drive motor was defective.
- Check/replace the POWER switch (604C).
- Verify the fix.

Does the machine still fail?

Y N

- The POWER switch was defective.

A B



- Power down.
- Remove the attachment cord from the customer's ac outlet.
- Check/replace the primary fuse holder (604D).
- Verify the fix.

Does the machine still fail?

Y N

The mainline fuse holder was defective.

- Power down.
- Remove the attachment cord from the customer's ac outlet.
- Check/replace the power supply ac cable (604L).
- Verify the fix.

Does the machine still fail?

Y N

The power supply ac cable was defective.

- Power down.
- Remove the attachment cord from the customer's ac outlet.
- Check/replace the transformer (604K).
- Verify the fix.

The transformer was defective.

- Check/replace the ac line filter (604G).
- Verify the fix.

Does the machine still fail?

Y N

The ac line filter was defective.

- Power down.
- Remove the attachment cord from the ac outlet.
- Reinstall the ac line filter.
- Check/replace the POWER switch (604C).
- Verify the fix.

Does the machine still fail?

Y N

The POWER switch was defective.

- Power down.
- Remove the attachment cord from the customer's ac outlet.
- Check/replace the attachment cord (604P).
- Verify the fix.

The attachment cord was defective.

## MAP 6-4 -

— This MAP will help find the cause of a missing or incorrect dc voltage.

- Power down.
- Disconnect all signal cables from the MPU.
- Disconnect the keyboard and disk dc cables at the power supply TP3 and TP4 (604Q and R).
- Reconnect the power supply dc cable at both the power supply PC board and at MPU-M (604F, 610).
- Measure POR at planar M-B08 as you turn power on. POR should be a +5V pulse during power up.
- Power up.
- Check the following dc voltages at planar M with reference to frame ground (610).

Vdc	Pin	Limits
+8.5	B05	8.0 to 9.4
+5.0	B06	4.7 to 5.5
+6.3	B09	5.7 to 9.4
+12.0	B12	11.0 to 13.2
+24.0	D05	22.0 to 26.5
Ground	D13	0
-5.0	B10	4.6 to 5.4
-12.0	B11	11.0 to 13.2

Are all dc voltages and POR within limits?

Y N

- Power down.
- Reconnect all signal cables and dc cables.
- Check/replace the power supply dc cable (604F). —
- Verify the fix.
- Check for open wires, shorts to adjacent wires, and shorts to the frame.

Does the machine still fail?

Y N

The power supply dc cable was defective.

- Power down.
- Reinstall the previously removed power supply dc cable.
- Replace the MPU planar (504, 505N).
- Verify the fix.

The MPU planar was defective.

A

**A**

- Check the following dc voltages at planar N with reference to frame ground (610).

Vdc	Pin	Limits
-12.0	D02	-11.0 to -13.2
+6.3	B12	5.7 to 9.4
+12.0	D09	11.0 to 13.2
Ground	D08	0

Are all dc voltages within limits?

Y N

- Power down.
- Replace the MPU planar (504, 505N).
- Reconnect all signal cables and dc cables.
- Verify the fix.

The MPU planar was defective.

- Power down.
- Reconnect the display signal cable at MPU-N.
- Install a cable extender (607C) at the display PC board (607A). —
- Power up.
- Check the following dc voltages at the cable extender (607C) with reference to frame ground.

- Do not twist the cable when attaching it to the cable extender.

Vdc Pin Limits

+6.3	B12	5.7 to 9.4
+12.0	D09	11.0 to 13.2
Ground	D08	0
-12.0	D02	-11.0 to -13.2

Are all dc voltages within limits?

Y N

- Power down.
- Reconnect all signal cables and dc cables.
- Remove the cable extender.
- Check/replace the display signal cable (607B). —
- Verify the fix.

- Check for open wires, shorts to adjacent wires, and shorts to the frame.

Does the machine still fail?

Y N

The display signal cable was defective.

- Power down.
- Reinstall the previously removed display signal cable in the machine.

**B C**



— Replace the display PC board (607A).

— Verify the fix.

The display PC board was defective.

— Power down.

— Remove the cable extender (607C) and reconnect the display signal cable (607B).

— Power up.

— Check the following dc voltages at planar R with reference to frame ground (610).

Vdc	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	-4.6 to -5.4

Are all dc voltages within limits?

Y N

— Power down.

— Replace the MPU planar (504, 505N).

— Reconnect all signal cables and dc cables.

— Verify the fix.

The MPU planar was defective.

— Power down.

— Reconnect the keyboard 2 signal cable at MPU-R.

— Power up.

— Check the following dc voltages at the station 2 keyboard, K2, with reference to the frame ground (609A).

Vdc	Pin	Limits
+5.0	B09	4.7 to 5.5
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	-4.6 to -5.4

Are all dc voltages within limits?

Y N

— Power down.

— Reconnect all signal cables and dc cables.

— Check/replace the keyboard 2 signal cable. —

— Verify the fix.

— Check for open wires, shorts to adjacent wires, and shorts to the frame.





Does the machine still fail?

Y N

The keyboard 2 signal cable was defective.

- Power down.
- Reinstall the previously removed keyboard 2 signal cable in the machine.
- Replace the keyboard 2 PC board (609A).
- Verify the fix.

The keyboard PC board was defective.

- Check the following dc voltages at planar K with reference to frame ground (610).

Vdc	Pin	Limits
+5.0	B03	4.7 to 5.5
Ground	B08	0
+24.0	B10	22.0 to 26.5
-5.0	B11	-4.6 to -5.4

Are all dc voltages within limits?

- Power down.
- Replace the MPU planar (504, 505N).
- Reconnect all signal cables and dc cables.
- Verify the fix.

The MPU planar was defective.

- Power down.
- Reconnect the disk 2 signal cable at MPU-K.
- Power up.
- Check the following dc voltages at the FC card of the disk, D2, with reference to frame ground (608B).

Vdc	TP	Limits
+24.0	1	22.0 to 26.5
Ground	17	0
+5.0	23	4.7 to 5.5
-5.0	5	-4.6 to -5.4



F

Are all dc voltages within limits?

Y N

- Power down.
- Reconnect all signal cables and dc cables.
- Check/replace the disk 2 signal cable. —
- Verify the fix.
- Check for open wires, shorts to adjacent wires, and shorts to the frame.

Does the machine still fail?

Y N

The disk signal cable was defective.

- Power down.
- Reinstall the previously removed disk signal cable in the machine.
- Replace the disk 2 FC card (608B).
- Verify the fix.

The disk FC card was defective.

- Check for the following voltages at planar J with reference to frame ground (610).

Vdc	Pin	Limits
+24.0	B10	22.0 to 26.5
-5.0	B11	-4.6 to -5.4

Are all dc voltages within limits?

Y N

- Power down.
- Replace the MPU planar (504, 505N).
- Reconnect all signal cables and dc cables.
- Verify the fix.

The MPU planar was defective.

G



- Power down.
- Reconnect the disk 1 signal cable (604Q) at MPU-J and the D1 dc cables at TP3 and TP4 of the power supply (604H).
- Power up.
- Check the following dc voltages at the FC card (608B) of station 1 disk, D1, with reference to frame ground.

Vdc	TP	Limits
+24.0	1	22.0 to 26.5
Ground	17	0
+5.0	23	4.7 to 5.5
-5.0	5	-4.6 to -5.4

Are all dc voltages within limits?

Y N

- Power down.
- Reconnect all signal cables and dc cable.
- Check/replace the disk 1 signal cable (604Q). —
- Verify the fix.
- Check for open wires, shorts to adjacent wires, and shorts to the frame.

Does the machine still fail?

Y N

The disk signal cable was defective.

- Power down.
- Reinstall the previously removed disk 1 signal cable in the machine.
- Replace the disk 1 FC card (608B).
- Verify the fix.

The disk FC card was defective.

- Check the following dc voltages at planar P with reference to frame ground (610).

Vdc	Pin	Limits
+8.5	D03	8.0 to 9.4
Ground	D08	0
-5.0	D06	-4.6 to -5.4



H

Are all dc voltages within limits?

Y N

- Power down.
- Replace the MPU planar (504, 505N).
- Reconnect all signal cables and dc cable.
- Verify the fix.

The MPU planar was defective.

- Power down.
- Reconnect the keyboard 1 signal cable at MPU-P and the K1 dc cable at TP4 of power supply.
- Power up.
- Check the following voltages at the station 1 keyboard, K1, with reference to frame ground (609A).

Vdc	Pin	Limits
-5	D06	-4.6 to -5.4
+5	B09	4.7 to 5.5
+8.5	D03	9.0 to 9.4
Ground	D08	0

**This page intentionally left blank.**

## MAP 6-5 —

- Power down.
- Disconnect *all* signal cables from the MPU.
- Disconnect the keyboard and disk dc cables at the power supply (TP3 and TP4).
- Reconnect the power supply dc cable at both the power supply PC board and at MPU-M (604F, 610).
- Power up.
- Power down.
- Recheck the secondary fuse (604E) and CB1 (604U). —

Are the fuse and CB1 OK?

Y N

- Reconnect all signal cables and dc cables.
- Replace the secondary fuse (604E) or turn on CB1 (604U).
- Check/replace the power supply dc cable (604F). —
- Verify the fix.

Does the machine still fail?

Y N

The power supply dc cable was defective.

- Power down.
- Reinstall the previously removed power supply dc cable in the machine.
- Disconnect all cross connectors (A, B, C, D, E, F, G, and H) from the MPU planar (505P). —
- Replace the secondary fuse or turn on CB1 (604U).
- Power up.

- This MAP will help find the cause of a blown secondary fuse or a tripped circuit breaker (CB1), if installed.

- Remove the fuse and measure its resistance.

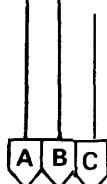
- Check for shorts to adjacent wires and to the frame.

Did the fuse blow or CB1 trip?

Y N

- Power down.
- Install cross connectors one-at-a-time, powering up after each cross connector is installed. If the fuse blows, there is a short circuit either in the cross connector that was just removed or in the card that was connected by the cross connector.
- Power down.
- Replace the cross connector that was just installed.
- Replace the secondary fuse or turn on CB1.
- Power up.

- Some connectors may not be installed.



A    B    C

**Are the fuse and CB1 OK?**

Y    N

- Replace the card that was connected by the cross connector just installed.
- Replace the secondary fuse or turn on CB1 (604U).
- Reinstall all remaining cross connectors.
- Verify the fix.

The circuit card (VFO, memory, or ROS) was defective.

- Power down.

- Reinstall the remaining cross connectors.
- Verify the fix.

The cross connector was defective.

- Replace the MPU planars (504, 505N).
- Replace the secondary fuse or turn on CB1 (604U).
- Verify the fix.

The MPU planar was defective.

- Reconnect the display signal cable at MPU-N.
- Power up.
- Power down.
- Recheck the secondary fuse (604E). —

- Remove the fuse and measure its resistance.

**Is the fuse OK?**

Y    N

- Reconnect all signal and dc cables.
- Replace the secondary fuse (604E).
- Check/replace the display signal cable (607B). —
- Verify the fix.

- Check for shorts to adjacent wires and to the frame.

**Does the machine still fail?**

Y    N

The display signal cable was defective.

- Power down.
- Reinstall the previously removed display signal cable in the machine.
- Replace the display PC board (607A).
- Verify the fix.

The display PC board was defective.

- Reconnect the station 1 keyboard signal cable, K1 at MPU-P and at the power supply, dc test point 4 (604R).
- Power up.
- Power down.
- Recheck the secondary fuse (604E) and CB1 (604U). —

- Remove the fuse and measure its resistance.

D

D

**Are the fuse and CB1 OK?**

**Y N**

- Reconnect all signal cables and dc cables.
- Replace the secondary fuse (604E) or turn on CB1 (604U).
- Check/replace the station 1 keyboard signal cable (604R). —
- Verify the fix.
- Check for shorts to adjacent wires and for shorts to the frame.

**Does the machine still fail?**

**Y N**

- The keyboard signal cable was defective.
- Power down.
- Reinstall the previously removed keyboard signal cable in the machine.
- Replace the station 1 keyboard PC board (609A).
- Verify the fix.

The keyboard PC board was defective.

- Reconnect the station 1 disk signal cable at MPU-J and at power supply, dc test points 3 and 4 (604Q).
- Power up.
- Power down.
- Recheck the secondary fuse (604E) and CB1 (604U). —

- Remove the fuse and measure its resistance.

**Are the fuse and CB1 OK?**

**Y N**

- Reconnect all signal cables.
- Replace the secondary fuse (604E) or turn on CB1 (604U).
- Check/replace the station 1 disk signal cable (604Q). —
- Verify the fix.

- Check for shorts to adjacent wires and to the frame.

**Does the machine still fail?**

**Y N**

- The disk signal cable was defective.
- Power down.
- Reinstall the previously removed disk signal cable in the machine.
- Replace the station 1 disk FC card (608B).
- Verify the fix.

The disk FC card was defective.

- Reconnect the station 2 disk signal cable at MPU-K.
- Power up.
- Power down.
- Recheck the secondary fuse (604E) and CB1 (604U). —

- Remove the fuse and measure its resistance.

E

**E****Are the fuse and CB1 OK?****Y N**

- Replace the secondary fuse (604E) or turn on CB1 (604U).
- Check/replace the station 2 disk signal cable.
- Verify the fix.
- Check for shorts to adjacent wires and to the frame.

**Does the machine still fail?****Y N****The station 2 disk signal cable was defective.**

- Power down.
- Reinstall the previously removed station 2 disk signal cable in the machine.
- Replace the station 2 disk FC card (608B).
- Verify the fix.

**The disk FC card was defective.**

- Reconnect all signal cables.

- Check/replace the station 2 keyboard signal cable.
- Verify the fix.

- Check for shorts to adjacent wires and to the frame.

**Does the machine still fail?****Y N****The station 2 keyboard signal cable was defective.**

- Power down.
- Reinstall the previously removed station 2 keyboard signal cable in the machine.
- Replace the station 2 keyboard PC board (609A).
- Verify the fix.

**The keyboard PC board was defective.**

## MAP 6-6 —

— This MAP will help find problems in the ac voltages.

- Check the machine tag for line voltage limits.
- Check for line voltage between terminals TB1-1 and TB1-2 (or TB1-3, 4, 5, 6, 13, or 14) on the transformer (604K).

Is the line voltage within limits? —

Y N

- Power down.
  - Check for line voltage between the top terminals of the ac line filters (604G).
- Is the line voltage within limits?
- Y N
- Power down.
  - Remove the attachment cord from the customer's ac outlet.
  - Look at the attachment cord plug (604P). The key prong should be wired to the machine frame. Each of the other two prongs should be wired individually to one of the ac line filters.
  - Measure for continuity between each of the other two prongs and the top of the ac line filters. —

Are there any improper open circuits?

Y N

- The problem is the customer's responsibility.
- Check/replace the ac line filters (604G).
  - Verify the fix.

Does the machine still fail?

Y N

- The ac line filter was defective.
- Power down.
  - Remove the attachment cord from the ac outlet.
  - Reinstall the ac line filters.
  - Check/replace the attachment cord (604P).
  - Verify the fix.



— Ac line voltage limits:

AC Voltage	Limits
100	90 to 110
110	99 to 121
115	103 to 127
123.5	111 to 136
200	180 to 220
204	179 to 229
208	187 to 229
220	198 to 242
230	207 to 253
235	211 to 259

- Adjust the meter to 0 ohms with the meter leads shorted and using the Rx1 scale.



**Does the machine still fail?**

**Y N**

The attachment cord was defective.

- Check/replace the power supply ac cable (604L).
- Verify the fix.

The power supply ac cable was defective.

- Remove the primary fuse (604D).

- Power up.

- Check for line voltage between terminals TB1-8 and TP1-10 at the transformer (604K).

**Is the line voltage within limits?**

**Y N**

- Power down.
- Disconnect both disk ac cables (604B and M).
- Power up.
- Check for line voltage between terminals TB1-8 and TB1-10 at the transformer (604K).

**Is the line voltage within limits?**

**Y N**

- Power down.
- Check/replace the power on switch (604C).
- Verify the fix.

**Does the machine still fail?**

**Y N**

The POWER switch was defective.

- Power down.

- Check/replace the primary fuse holder (604D).

- Verify the fix.

**Does the machine still fail?**

**Y N**

The primary fuse holder was defective.

- Power down.

- Check/replace the ac power supply cable (604L).

- Verify the fix.

The power supply ac cable was defective.



A D E

- Power down.
- Reconnect the disk ac cable for the station 2 disk, D2 (604B).
- Power up.
- Check for line voltage between terminals TB1-8 and TB1-10 at the transformer (604K).

Is the line voltage within limits?

Y N

- Power down.
- Replace station 2 disk drive motor (608A).
- Verify the fix.

The disk drive motor was defective.

- Power down.
- Reconnect the disk ac cable for the station 1 disk, D1 (604M).
- Power up.
- Check for line voltage between terminals TB1-8 and TB1-10 at the transformer (604K).

Is the line voltage within limits?

Y N

- Power down.
- Replace station 1 disk drive motor (604N).
- Verify the fix.

The disk drive motor was defective.

— Ac line voltage limits:

	AC Voltage	Limits
— The problem is corrected.	100	90 to 110
— The problem is corrected.	110	99 to 121
— The problem is corrected.	115	103 to 127
— The problem is corrected.	123.5	111 to 136
— The problem is corrected.	200	180 to 220
— The problem is corrected.	204	179 to 229
— Power down.	208	187 to 229
— Check/replace the primary fuse holder (604D).	220	198 to 242
— Verify the fix.	230	207 to 253
— Verify the fix.	235	211 to 259

Does the machine still fail?

Y N

The primary fuse holder was defective.

- Power down.
- Check/replace the POWER switch (604C).
- Verify the fix.

Does machine still fail?

Y N

The POWER switch was defective.

A F



- Power down.
- Reinstall the previously removed power on switch in the machine (604C).
- Check/replace the transformer (604K).
- Verify the fix.

Does the machine still fail?

Y N

The transformer was defective.

- Power down.
- Reinstall the previously removed transformer in the machine (604K).
- Check/replace the power supply ac cable (604L).
- Verify the fix.

The power supply ac cable was defective.

- Power down.
- Check/replace the ac capacitor (604J).
- Verify the fix.

Does the machine still fail?

Y N

The ac capacitor was defective.

- Power down.
- Reinstall the previously removed ac capacitor.
- Replace power supply PC board (604H).
- Verify the fix.

Does the machine still fail?

Y N

The power supply PC board was defective.

- Power down.
- Reinstall the previously removed power supply PC board in the machine.
- Replace the transformer (604K).
- Verify the fix.

The transformer was defective.

## MAP 6-7 —

### General Power Distribution Information

- Use this MAP for *free-lance* fault-finding instead of the normal directed procedure. If you have any problem using this MAP, use MAP 6-4.
- Read through this MAP. Then use 610, which is an easy to understand layout of the power distribution. Make point-to-point measurements to locate an open or overloaded circuit.
- Power distribution to the units can be either through the MPU planar lands or directly from the power supply PC board.
- Some voltages are on multiple wires in the cables.
- Some voltages are used only on a specific unit.
- Cables to the units contain both voltages and signals.
- Probing cross connectors could require using an exposed pin, rather than the actual circuit pin shown.
- Power down to disconnect or reconnect any of the cables.
- Be sure you reconnect all the cables when you are done.

- This MAP helps you locate dc voltage distribution problems.

- Unit locations are:
  - Disk FC card (204)
  - CRT (304)
  - Keyboard (407)
  - MPU and features (504)
  - Power supply (604)

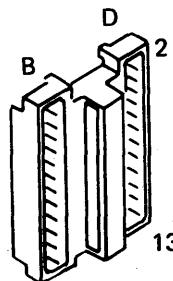
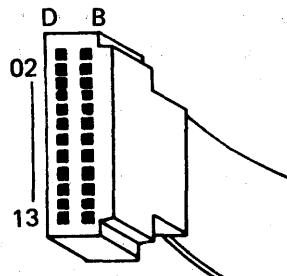
### General References Information

- The correct voltage limits measured to frame ground at any unit are:

Vdc	Test Point	Limits
-5.0		4.6 to 5.4
-12.0		11.0 to 13.2
+5.0	All test points	4.7 to 5.9
+6.3	are shown on	5.7 to 6.9 <sup>1</sup>
+8.5	610.	8.0 to 9.8
+12.0		11.0 to 13.2
+24.0		22.0 to 26.5
Ground		0

- Unit locations are:
  - Disk FC card (204)
  - CRT (304)
  - Keyboard (407)
  - MPU and features (504)
  - Power supply (604)

<sup>1</sup> If the load is open, the upper limit of the +6.3 Vdc can be 9.8 Vdc.

**A****Cross Connector Pin Identification****Cable Connector Pin Identification****To Locate an Open Circuit (Missing Voltage)**

- While using MAP 6-1, the power supply dc cable output voltages could have been OK. But, one or more of these voltages could have been missing at a specific unit while using the MAP for that unit.
- Use either continuity or voltage checks to locate the open circuit per 610.
- Repair or replace the failing FRU.

- Unit locations are:
  - Disk FC card (204)
  - CRT (304)
  - Keyboard (407)
  - MPU and features (504)
  - Power supply (604)

**To Locate an Overloaded Circuit**

This is when the voltage is OK unloaded but is low when loaded.

- Use a voltage check to determine any difference between the failing voltage when measured at the power supply fuse or the test point as shown in 610 and the measurement at the unit with all the cables connected.
- If the voltage is normal at the power supply but low at the load, a resistance within the circuit is dropping the voltage. Use the CE meter to locate the FRU causing the failure, by progressing along the circuit with voltage checks at each test point.
- If the voltage is low at the power supply but no appreciable voltage difference exists from the power supply to the load, replace the load (the disk FC card, display PC board, keyboard PC board, or a planar).

- Unit locations are:
  - Disk FC card (204)
  - CRT (304)
  - Keyboard (407)
  - MPU and features (504)
  - Power supply (604)

# MACHINE CHECKOUT

## 7-1 BASIC MACHINE HARDWARE CHECKOUT PROCEDURE (EITHER STATION)

- Remove all diskettes.
- Power down and wait 5 seconds.
- Set all keyboard switches down.
- Power up and wait for machine warm-up, (for 128 feature, wait 30 seconds).

Is the display like this? —

Y N

The cursor is not always in this position.

0	00000	X	N
—			

This checks the display.

Is the display like this? —

Y N

Is the mode correct?

Y N

Is the mode-status XW?

Y N

- Use disk MAP 2-2.
- Use disk MAP 2-6.

0	1	0	A	A	00008	X	R
—							

This checks the disk drive.

Disk data set label will be shown with the status line. Cursor position shows 001 if 128 feature is installed.

A B

A | B

Are the error code positions blank?

Y N

- If your error code is one of these, use the indicated MAP.

Error Code	MAP	Page
?	Disk	2-4
2	Disk	2-2
3	Disk	2-9
4	Disk	2-2
N	Keyboard	4-2
A	Disk	2-1
B	Disk	2-1
5	Disk	2-4

- If your error code is not shown in the above list, use *Starting of call*, page 1-1.
- Use the MPU MAP 5-1.

— Listen and press RESET.

Did you hear the audio feedback device click?

Y N

- Use the keyboard MAP 4-6.

Is the display like this? —

Y N

- Use keyboard MAP 4-1.

— Press CHAR ADV 12 times.

Is cursor in position 13? —

Y N

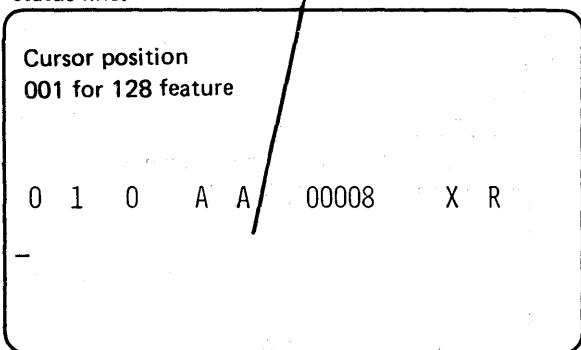
- Use keyboard MAP 4-2.

— Unload the other disk drive.

— Press FUNCT SEL lower.

— Hold down NUM SHIFT and press C.

The disk data set label will be shown with the status line.



This checks RESET and NUM SHIFT.

- This checks CHAR ADV.

C

C

Did machine change to CER (mode-status)? —

Y N

- Use keyboard MAP 4-6.
- Release NUM SHIFT and press U.

— This checks FUNCT SEL lower.

Is the left half of register group 4 as shown?

Y N

- Use keyboard MAP 4-6.

— Listen for the audio-feedback device and observe register group 4 as you press every key, — except RESET and REP, several times. Register group 4 should change to the code shown for each key (705A).

- Press L along with ALPHA SHIFT; the code displayed is A6.
- Press L along with NUM SHIFT; the code is 66.
- On Katakana machines, press L along with KANA SHIFT; the code is E6.

Did you hear the audio feedback device click every time a key was pressed?

Y N

- Use keyboard MAP 4-6.

Did the correct code for each key appear in group 4 (checks the key encoder) (705A)?

Y N

- Use keyboard MAP 4-2.

— Look at the left half of group 5 of the data display as you set the keyboard switches to the UP position in the following sequence:

All switches down	= 0
AUTO DUP/SKIP up	= 8
AUTO REC ADV up	= A
PROG NUM SHIFT up	= E

Did the correct code for each switch appear in group 5?

Y N

- Use keyboard MAP 4-3.

— Puts machine in CEW mode-status to display keyboard data.

08 50 00 00 00 01 01 00 00 00  
66 00 00 00 00 07 00 00 00 00  
00 00 04 02 00 00 00 00 02 00

- A key may have to be pressed more than once because the keyboard data register is periodically reset by the diagnostic program and may not accept the first key depression.
- Checks the audio feedback device and the key encoder.

#### Register Group 24 (Katakana only)

08 50 00 00 00 01 01 00 00 00  
66 00 00 00 00 07 00 00 00 00  
00 00 04 03 00 00 00 00 02 00

D

**D**

Is this machine other than a Katakana machine?

Y N

- Look at group 24 of the data display as you set the KATAKANA SHIFT switch up and press a data key several times.

Did the code change from 00 to 20 in group 24?

Y N

- Use keyboard MAP 4-3.
- Set all switches down.
- Press RESET several times.
- Press FUNCT SEL lower
- Hold NUM SHIFT and press C
- Release NUM SHIFT and press U
- Look at group 24 of the data display as you hold KATA SHIFT key and press a data key several times.

Did the code change from 00 to 20 in group 24?

Y N

- Use keyboard MAP 4-5.
- Press RESET enough times to return to CER mode.
- Press O

**E**

E

Is there a cursor?

Y N

- Use keyboard MAP 4-2.
  - Position 1 is 150 ms and each additional position is 1 ms. The position of the cursor identifies the disk speed.

Is the disk speed between 163 and 171 ms?

Y N

- Use disk MAP 2-6.
  - Press RESET. -
  - Press J. -
  - Look at the display a  
four times slowly. -

Do the track ID characters change correctly and remain stable after each time the space bar is pressed?

Y N

- Use disk MAP 2-2.

CEW

- RESET puts machine in CER mode.
  - The J key puts the machine in CEW mode to display the disk IDs.
  - The disk read/write head should advance one track each time the space bar is pressed. The track ID characters should change with each track advance. The first character of each line should change from

100

to  0  
1 to  0  
2 to  0  
3 to  0  
4

CEW

A defective record is identified by missing or unstable hex characters.

- Press RESET two times. —
  - Set all keyboard switches down.

- Puts machine in XR mode.

Is the display like this? —

Y N

- Use disk MAP 2-9.

— Hold REP and press A. — — — —

F

01 0 A A 00003 X R

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-

3742 ML 7-1.5



Does character A repeat?

Y N

- Use keyboard MAP 4-2.
- Press REC BKSP.
- The hardware checkout for one station is complete.
- Repeat MAP 7-1 for the other station, unless already done (needed only for installation or to find a symptom on other station).
- If you wish to check the functions in the basic machine, use MAP 7-2.

## 7-2 BASIC MACHINE FUNCTIONAL CHECKOUT

This procedure is based on the assumption that MAP 7-1 has been successfully completed.

- Unload diskettes.
- Power down.
- Set all keyboard switches down.
- Power up.
- Wait for warm-up delay (30 seconds for 128 feature).
- Load a diskette (a diskette with no known history of errors).
- Press N

E  
FUNCT SEL lower  
PROG LOAD  
4  
SEL PROG  
4

- Look at the display and listen for the audio feedback device.
- Press S ——————

Is a K error displayed? —

Y N

- Use MPU MAP 5-1.

Was the audio feedback device quiet? —

Y N

- Use keyboard MAP 4-6.

— Press RESET.

— Press REC BKSP.

— Set PROG NUM SHIFT to ALL CHAR.

— Press SEL PROG

4

5

Did you hear the audio feedback device click?

Y N

- Use keyboard MAP 4-6.

Enters a program.

N is program numeric shift.

E is end of program.

— Checks program load.

— Loads program in storage area 4.

— Checks program select.

— Selects the program from storage area 4.

— Checks the program numeric shift switch function. The disk data set label will be shown with the status line. (Cursor position 001 for 128 feature.)

01 K 4 N N 00008 X R

— The error circuits prevent the audio feedback device from clicking.

— Checks the record backspace function.

— Program chaining may force a different program.

A



Is the record address 00007? —

Y N

— Use MPU MAP 5-1.

— Set AUTO REC ADV up. —

Is the record address 00008?

Y N

— Use MPU MAP 5-1.

— Set AUTO REC ADV down.

Is the error code position blank? —

Y N

— Use *Error Code Description* under *Symptom Index*, page 1-2.

— Hold NUM SHIFT and press DUP. —

Is there an N in position 001? —

Y N

— Use MPU MAP 5-1.

— Unload the diskette.

— Power down.

— Wait 5 seconds.

— Power up.

— Wait 30 seconds. —

— Set all switches down.

— Set PROG NUM SHIFT to ALL CHAR.

— Load a diskette (a diskette with no known history of errors).

— Press U N Y — N D E

    FUNCT SEL lower

    PROG LOAD

    1

    SEL PROG

    1

— Set the AUTO DUP/SKIP up.

Does 02 appear in the column indicator? —

Y N

— Use MPU MAP 5-1.

— Press HEX

    A

    B



— The record address will advance if the auto record advance function is failing.

— Checks the auto record advance function.

— Depending on the information in the index track, an error may be caused by a normal operating procedure.

— Checks the auxiliary duplicate function.

— Look at the first character of the data line. The cursor counter will show 000 (between records) because of the short program.

— Resets all buffers.

— This is a program.

    U is AUTO DUP ALPHA SHIFT.

    N is program NUM SHIFT.

    Y is verify, bypass, numeric shift, right-adjust, blank fill.

    D is continuous field numeric shift.

    E is AUTO DUP NUM SHIFT.

    E is End-of-Program.

— Checks the auto duplicate/skip function.

— Checks the hex function. The HEX key requires that two key depressions follow it.

**B**

Does a hex character ~~H~~ appear on the display? —

Y N

— Use MPU MAP 5-1.

— Press 2.

— Press RIGHT ADJ.

— The hex character appears as several lines within the dot matrix of one character (page 8-4).

— Checks the right adjust function.

Did the 2 move to position 004?

Y N

— See MPU MAP 5-1.

— Set AUTO DUP/SKIP down.

— Press FIELD BKSP.

— Cursor is in position 005.

— Checks the field backspace function.

Did the cursor move to position 003?

Y N

— Use MPU MAP 5-1.

— Press FIELD ADV.

— Checks the field advance function.

Did the cursor move to position 005?

Y N

— Use MPU MAP 5-1.

— Press CHAR BKSP.

— Checks the character backspace function.

Did the cursor move to position 004?

Y N

— Use MPU MAP 5-1.

— Press REC BKSP.

— Press DUP.

— Checks the duplicate function.

Does the cursor move to position 002?

Y N

— Use MPU MAP 5-1.

— Hold ALPHA SHIFT and press A.

— Checks the alpha shift function.

Is this other than a Katakana machine?

Y N

Is the error code position blank?

Y N

— Use MPU MAP 5-1.

— Press CHAR BKSP

— Hold KANA SHIFT key and press Z

— Checks the Katakana shift function.

**C D**

**C D**

Is the error code position blank?

Y N

— Use MPU MAP 5-1.

— Press CHAR BKSP

— Hold KANA SYMB key and press Z

— Checks the Katakana symbol function.

Is the error code position blank?

Y N

— Use MPU MAP 5-1.

— Press SKIP.

— Checks the skip function.

Did the cursor move to position 005?

Y N

— Use MPU MAP 5-1.

— Unload the diskette.

— Power down.

— Wait 5 seconds.

— Power up. Wait 30 seconds. —

— Set all keyboard switches down.

— Set PROG NUM SHIFT to ALL CHAR.

— Load the diskette.

— Be sure to use a data set with a record length 006 or greater (positions 25-27) and extent of at least four records (BOE, positions 29-33 to EOE, positions 35-39 in the data set label).

— Press FUNCT SEL lower  
DELETE REC

— Resets all buffers.

Did the display data lines go blank?

Y N

— Use MPU MAP 5-1.

— Press U N Y – N D E

FUNCT SEL lower

PROG LOAD

1

SEL PROG

1

FUNCT SEL lower

ENTER

— Checks the enter function.

Is the error code position blank?

Y N

— Use *Error Code Description* under *Symptom Index*, page 1-2.

— Enter U23

— Press RIGHT ADJ

— Enter 45

— Checks the right adjust function.

**E**

E

Is position 003 blank? —

Y N

— Use MPU MAP 5-1.

— Press REC ADV.

— Position counter shows 000 indicating between records.

Are the error code positions blank?

Y N

— Use *Error Code Description* under *Symptom Index*, page 1-2.

— Set the AUTO DUP/SKIP up.

— Enter 23

— Press RIGHT ADJ

REC ADV

REC BKSP

— Checks that the alternative method of record advance does not function.

Does the display look like this? —

Y N

— Use MPU MAP 5-1.

— Press REC ADV

FUNCT SEL lower

R

Could be any disk address.

02 1 N N XXXXX U R  
U2 3 5

— This changes record advance to the alternative method.

Does a dash (—) appear in position 039 of the status line?

Y N

— Use MPU MAP 5-1.

— Enter 23

— Press RIGHT ADJ

REC ADV

REC BKSP

— Checks the alternative method of record advance.

Does the display look like this? —

Y N

— Use MPU MAP 5-1.

— Press FUNCT SEL lower

K

— Set AUTO DUP/SKIP down.

cursor position 002

for 128 feature

Could be any disk address.

02 1 N N XXXXX U-R  
U2 3

Is position 039 of the status line blank?

Y N

— Use MPU MAP 5-1.

— Changes the machine back to regular method of record advance.

F

F

- Press FUNCT SEL lower  
RETURN TO INDEX

Are the error code positions blank? —

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

- Press FUNCT SEL lower  
UPDATE

- The function select lower—return to index sequence is always required to complete the job.
- A normal job error could be caused by exceeding the end of extent.

- Checks the update function.

Are the error code positions blank?

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

— Does the display look like this? —

Y N

- Use disk MAP 2-4.

- Press FUNCT SEL lower  
RETURN TO INDEX
- FUNCT SEL lower  
SEARCH EOD

Does the display look like this? —

Y N

- Use MPU MAP 5-1.

- Press SEL PROG  
1
- FUNCT SEL lower  
DISPLAY PROG

Cursor position

001 for 128 Could be any disk address.  
feature.

01	0	A	A	XXXXX	U	R
U2 345						

This checks the disk drive.

- This function select lower-return to index sequence is always required to complete the job.

Checks the search EOD function.

Cursor position

001 for 128 Could be any disk address.  
feature.

01	0	A	A	XXXXX	U	R
U2 3						

— Checks the program display function.

Is the program UNY – NDE displayed?

Y N

- Use MPU MAP 5-1.

G

G

- Press FUNCT SEL lower  
DISPLAY DATA

— Checks the data display function.

Does the display look like this? —

Y N

- Use MPU MAP 5-1.
- Press FUNCT SEL lower.
- Hold NUM SHIFT and press DISPLAY PROG
- Press 1  
REC ADV  
FUNCT SEL lower  
RETURN TO INDEX
- Observe EOD address in positions 075-079.
- Press FUNCT SEL lower  
SEARCH ADDRESS  
Keys for address of EOD minus 1  
REC ADV

Do positions 001 and 002 contain UN?

Y N

- Use MPU MAP 5-1.
- Press FUNCT SEL lower  
DELETE REC  
REC ADV  
REC BKSP

Cursor position

001 for 128 Could be any disk address.  
feature.

01 1 U A XXXXX U R  
U2 3

— Checks writing a program on the disk from a program buffer.

— EOD minus 1 is 1 record less than the end of data address. It isn't necessary to use the NUM SHIFT key.

Is there a 6 error?

Y N

- Use MPU MAP 5-1.
- Hold NUM SHIFT and press RESET
- Press 1  
REC ADV
- Remove the diskette. —

— Checks the delete record function.

Cursor position

001 for 128 Could be any disk address.  
feature.

01 6 0 A A XXXXX U R  
D2 345

— Change D to 1 to correct the deleted record.  
— Checks the error function.

H



Does the audio feedback device buzz?

Y N

- Use MPU MAP 5-1.
- Load the diskette.
- Hold NUM SHIFT and press RESET
- Unload the diskette.
- Power down.
- Wait 5 seconds.
- Power up (wait 30 seconds). —
- Set all keyboard switches down.
- Set PROG NUM SHIFT to ALL CHAR.
- Load the diskette (a diskette with no known history of errors).
- Press CHAR ADV five times.
- Resets all buffers.

Did the cursor move to position 006?

Y N

- Use MPU MAP 5-1.
- Enter TEST from keyboard.
- Press FUNCT SEL lower
  - M
  - REC ADV
  - REC BKSP
  - REC ADV
  - Checks the modify index function.

Does TEST appear in positions 006-009?

Y N

- Use MPU MAP 5-1.
- Press FUNCT SEL lower
  - ENTER
  - Enters a record on the disk to be verified.
- Enter ABCD
- Press REC ADV
  - FUNCT SEL lower
  - RETURN TO INDEX
  - FUNCT SEL lower
  - VERIFY

Are the error code positions blank? —

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

- An error may indicate the wrong key pressed or the feature not installed.



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## DIAGNOSTIC AIDS

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## CE Display Mode

### INTRODUCTION

The diagnostic programs for CE display mode reside in a special section of ROS that can be used independently of the machine functional ROS. These diagnostic programs can be used separately to cause the display of:

- Disk speed
- Disk track IDs
- Display registers contents

Selecting the CE display mode cancels the previous operator mode and all data in memory, such as stored programs, production statistics, field totals, and duplication data. CE display mode can be selected from the following machine modes:

- Read index
- Update
- Enter
- Search
- Verify and field correct

A diskette must be installed only in the disk drive to be selected for CE display mode.

### Selecting CE Display Mode

To select CE display mode, use the following keying sequence:

- FUNCT SEL lower.
- NUM SHIFT (or ALPHA SHIFT) and the C key.

The characters CER, indicating CE display mode ready will appear at the right end of the status line. (The status line is the first line of the display.) The remainder of the display will not change.

The diagnostic program desired can now be selected.

### Terminating CE Display Mode

Pressing RESET terminates CE display mode. The machine automatically causes a seek to the index track (track 00) of the disk; and mode/status will go to X R, or X N if the diskette has been removed.

### Selecting a Diagnostic Program

Select CE display mode (CER is displayed on the status line) then press one of the keys shown in the table below to select the desired diagnostic program. CER mode and status changes to CEW, and the results of the diagnostic are displayed.

**Note:** When selecting a diagnostic program for disk 2, the NUM SHIFT must be pressed with the proper program select key.

Diagnostic Program	Program Select Key
Display disk speed	O
Display disk track IDs	J
Display registers	U

### Terminating a Diagnostic Program

To terminate a diagnostic program, press RESET:

**Note:** RESET may have to be pressed more than once to terminate the display registers diagnostic, because the reset key code can be accepted in the KBDATA register only at times other than when that register is being periodically set to zero.

Termination of a diagnostic program is indicated by a mode/status change from CEW to CER. Now another diagnostic can be selected or CE display mode can be terminated.

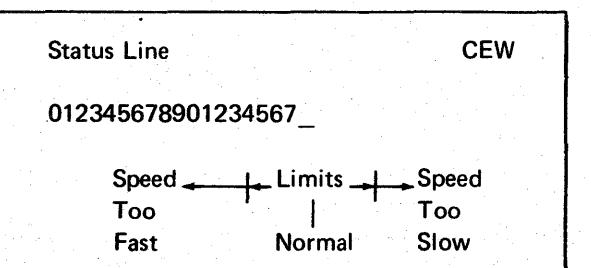
## DIAGNOSTIC PROGRAMS

### Display Disk Speed

This diagnostic causes a line of digits to be displayed which can be used to calculate disk speed in terms of milliseconds per revolution. The diagnostic can be selected while at any track on the disk as long as the first record of that track is good (it can be a deleted record).

The display-to-cursor operation of the display attachment is used, which means that no digits are displayed at or beyond the cursor position. The cursor moves as the disk speed varies. It is normal that other data may appear lightly, at short intervals, on the display.

To use the display disk speed diagnostic, select CE display mode, and press the O key. The display will look similar to this:



The first digit (0) displayed on the data line represents 150 milliseconds. Each digit in order to the right represents an increase of one millisecond.

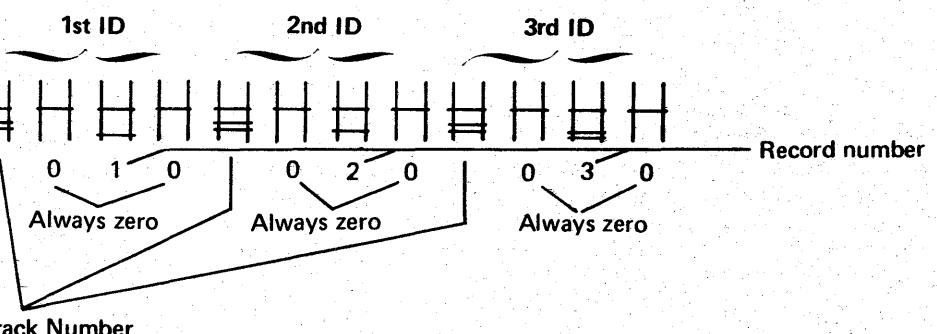
To calculate disk rotational speed, count the digits to the right of the first 0, up to the cursor, and add 150. The example display shows 17 digits to the right of the first 0 (1 through 0 = 10, 1 through 7 = 7).  $150 + 17 = 167$  milliseconds. This represents normal disk speed, which should be  $167 \pm 4$  milliseconds.

To terminate the display disk speed diagnostic, press RESET once to return to CER mode. Another diagnostic can now be selected, or an exit from CE display mode can be made by pressing RESET a second time.

**Note:** This diagnostic depends on the disk drive being able to read the first record of any track on a disk. A write check to record one command is issued repeatedly. Write check causes the record to be read each revolution. Rotational disk speed computation is based on the frequency at which record one is read.

If, after selection of this mode, disk speed is not displayed, or disk speed displayed is unstable, try the following:

- Press RESET to terminate disk speed diagnostic.
- Press J key to select display disk track IDs diagnostic.
- Look at the first three sets of four double binary characters to determine if record one ID (identifier) is present and stable. (The first set of four double binary characters should be the record one ID. Its characters may have to be compared to the next two IDs in order to identify it as record one.) The first three IDs should look like this:



The track number is the first double binary character of each group of four. There should be 26 alike for each track. (See the description of *Display Disk Track IDs* for explanation of how to decode the double binary characters.)

A missing or unstable record one ID results in a blank or unstable disk speed display. In this case, press the space bar (or any key except RESET, SHIFT, or REPEAT) to advance to the next track up on the disk and observe the IDs. If record one ID looks OK, use this track to display disk speed by pressing RESET to get to CER mode, then press the O key. If record one does not look good on this track, either try a different diskette or, if there is a problem with all diskettes, go to disk diagnostic MAPs.

### Service Applications

The display disk speed diagnostic can be used to:

- Locate a failing machine.
- Determine causes of changing or out of tolerance disk speed.
- Verify display-to-cursor operation.
- Adjust actuator bail.
- Cause a repetitious read.

#### Locate Failing Machine

This could be a machine which has a disk drive running at a disk speed either higher or lower than the normal limits. Disks written on or initialized by the out-of-spec machine will work well in that machine, and may work OK in some machines of the group. But, the out-of-spec disk may not work well in other machines of the group that are running in-spec at a speed (high or low) opposite the out-of-spec machine.

#### Disk Speed

##### Too high

- ac power out of specification.
- Wrong drive motor pulley.

##### Too Low

- ac power out of specification.
- Wrong drive motor pulley.
- Drive motor bearings binding.
- Disk drive hub shaft bearings binding.
- Disk drive belt slipping.
- Disk drive belt idler pulley binding or sticking.
- Collet not clamping disk to drive hub tightly enough.
- Pad on the bail of the head load actuator assembly puts too much pressure on the diskette.
- Pressure pad arm loads disk to head too tightly.
- Disk sticks in diskette.

#### Display to Cursor Operation

Digits should be displayed only up to the cursor position. A fault in the display-to-cursor operation would allow all 40 digits to appear on the first data line with the cursor under one of the digits.

#### Adjust Actuator Bail

Use the display disk speed diagnostic to keep the disk drive head load actuator magnet energized while adjusting the actuator bail.

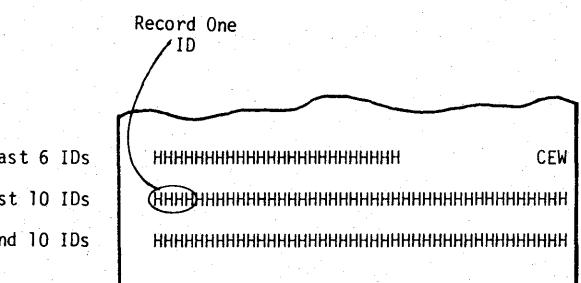
#### Repetitious Read

Repeated reading record one of a particular track allows the CE to look at the read amplifier or the file data line with an oscilloscope.

#### Display Disk Track IDs

This diagnostic causes the track and record IDs (identifiers) to be displayed for the track in use at the time the diagnostic is selected. The diagnostic can be selected while at any track on the disk and does not depend on any of the IDs either being present or good. This diagnostic can also be used to cause the disk drive to seek up or down one track at a time to cause display of the IDs of any track on the disk.

To use the display track IDs diagnostic, install an initialized diskette, select CE display mode, and press the J key. The display will look similar to this:



The cursor will show on the display in position three. Its position is determined by the contents of the sense register.

Each record ID displayed contains four double binary characters. Each track has 26 record locations, thus 104 (26 X 4) of the double binary characters should be displayed. If an ID is missing in a track, or cannot be read, the next ID read will be displayed in its place, followed by the rest of the IDs read. The result will be a shortened total display length. For example, if six IDs are missing in a track, only two lines of double binary characters are displayed. To determine the order in which the IDs were placed on the track during disk initialization one can decode the individual record IDs. Since all tracks on a particular disk will have their

IDs in the same order, it is possible to compare a good track (one that displays all 26 IDs) to the faulty track as a means of determining which IDs are missing on the faulty track.

The total display length increases if more IDs are read during a disk revolution than were read on any previous revolution, but the length does not decrease due to a lesser number of IDs read on a subsequent revolution. Individual double binary characters will look unstable if all track IDs do not read correctly for each revolution of the disk due to an ID shift to the left to replace missing IDs. The total display will not shorten.

The head load magnet stays energized for continuous read mode while the display IDs diagnostic is operating.

The display can be blanked and refreshed by pressing the RESET key followed by the J key.

A new display length will be shown for the disk revolution following the J key.

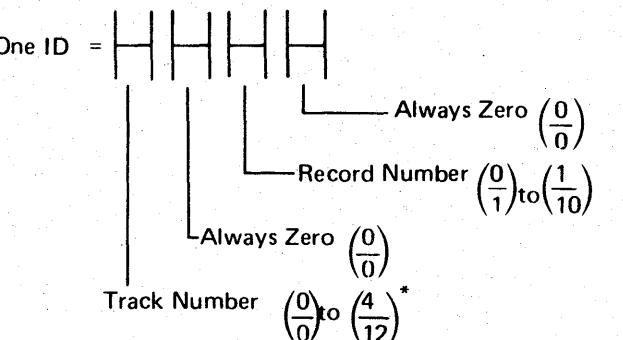
Pressing the reset key retracks the read head and the ID display goes blank. Pressing the J key causes the read head to rescan the same track, and the display to show the IDs as they are read on the first full read revolution.

On some machines, CE mode causes the display to change as the number of IDs read changes. If less than 26 are read on some revolutions, the display seems to flash. If 26 IDs are read every-time, the display is stable. This dynamic mode of operation allows observation of the number of IDs read each disk revolution.

Disk IDs may be displayed track by track while this CE diagnostic mode is in control. To advance up, away from the index track, press the space bar (or any other key except RESET, SHIFT, or REPEAT). To step down one track, press ALPHA SHIFT and the space bar (or any other key except RESET or REPEAT). The display goes blank, and new IDs are displayed for each new track selected.

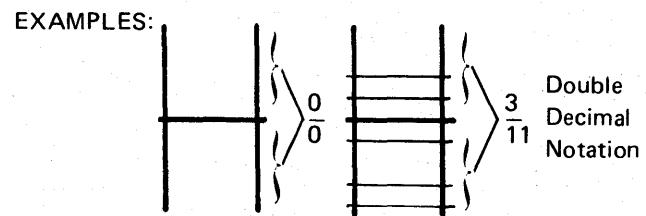
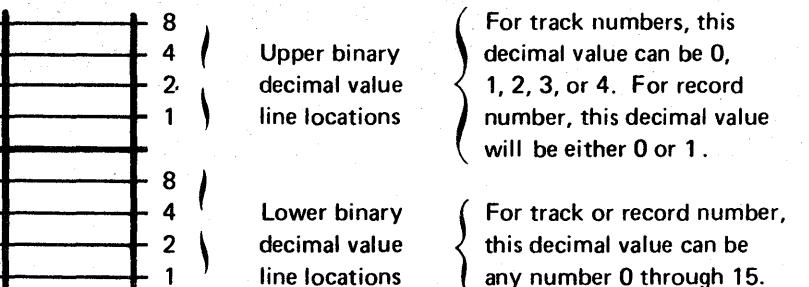
**Note:** When using disk drive 2, NUM SHIFT must be used with the keys specified above to step up or down.

One ID is represented by four double binary characters in a row. The basic frame of each double binary character looks something like an extended football goal post. It alone represents a double binary character of zero over zero.  $\frac{0}{0}$



\* $(\frac{4}{12})$  is displayed as  $(<)$ .

Each goal post has a binary decimal value above the cross bar and a binary decimal value below the cross bar, therefore, the name double binary character. Each binary decimal value can be determined by observing the location of lines parallel to the cross bar as shown here:



The 0 character should occupy one half of the character positions (all even numbered positions) in the ID display. Its presence in the display lines help to locate the cross bar for decoding multiple line characters like the 3 example above.

Table 1 shows the double decimal notation for all

77 track numbers that will appear in IDs. Note that the double decimal ID notation goes from 0 for track 00 through 4 for track 73, also note 9

that the ID for track 64 is a blank, 74 is a \$, 75 is a . (period), 76 is a <.

The top line of Table 2 shows the double decimal ID notation for the 26 records in a track, arranged serially 1 through 26. The notation goes from 0 for record 01 through 1 for record 26.

10

The rest of Table 2 shows the other record sequences that can occur in a track depending on the digits written in positions 77 and 78 of record 07 of track 00 during initialization of a disk. All tracks on any particular disk will have the same record sequence.

To terminate the display disk track IDs, press RESET once to return to CER mode. Another diagnostic can now be selected, or an exit from CE display mode can be made by pressing RESET a second time.

**Note:** Terminating CE display mode will cause the machine to seek to track 00 of disk 1. If disk 2 has been selected and it is desired to return to track 00 of disk 2, first terminate CE display mode by pressing RESET, then press FUNCT SEL upper and disk 2 RET TO INDEX.

## Service Applications

The display disk track IDs diagnostic can be used to:

- Determine disk track record order.
- Verify head location.
- Determine missing IDs.
- Determine or verify faulty tracks.
- Adjust actuator bail.
- Cause a continuous read.
- Verify operation of sense register.
- Discover intermittent problems in the disk drive attachment.
- Locate disk problems.
- Check track accessing.
- Check head track alignment.

## Disk Track Record Order

All tracks on any one disk, including the index track (track 00), should have their records arranged in the same order. The order is determined at the time of disk initialization by control digits that are keyed by the operator in positions 7 and 8 of track 00. If positions 7 and 8 of the record are left blank, or if 01 is entered in those positions, all records in each track on that disk are arranged in sequence 1, 2, 3, 4, through 26, as shown by line 1 of Table 2. If 02 is entered in positions 7 and 8, then all records in each track on that disk are arranged, at time of initialization, in the sequence shown by line two of Table 2. 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26.

Note that:

- All record sequences start with record 01.
- There are 13 different sequences possible.
- When the next number in a sequence will exceed 26 if the sequence is allowed to continue naturally, the machine will choose the next unused number after 1 for that record number and then continue the sequence naturally. Example, line 07 of Table 2.

1, 8, 15, 22, 2, 9, 16, 23, 3, 10, etc.

During disk initialization, the machine writes the sequence digits in positions 77 and 78 of sector 07, track 00. Display of sector 07, track 00, will show the sequence digits in 77 and 78.

Record order on the disk will be transparent to the operator of the machine. One of the 13 record order sequences other than 1, 2, 3, 4, 5, etc., may provide best disk access times for a certain job.

## Head Location

This diagnostic verifies actual head location by reading the track number found in the IDs displayed after a track selection has been made from the index track, or a search has been keyed. Table 1 shows track numbers. All track numbers in a particular track must be identical.

## Missing IDs

If the display of IDs shows a lesser number than 26 (as shown to the right), the missing IDs can be due to:

- Accidental erasure.
- Faulty track on the disk.
- Uninitialized disk.
- Weak read amplifier (faulty FC card).
- Faulty VFO card.

Accidental erase and faulty tracks can be resolved by reinitialization of the disk. If at the end of initialization, the number of bad tracks identified exceeds two, the disk should be discarded, otherwise, it can be used only if a special operator procedure is used. An uninitialized disk would display no IDs. Initialize that disk for use in the machine.

## Faulty Tracks

IDs that are present in the display of a faulty track (fault has developed since last disk initialization), or IDs of an adjacent good track, can be decoded for their track number double decimal value. The double decimal value can then

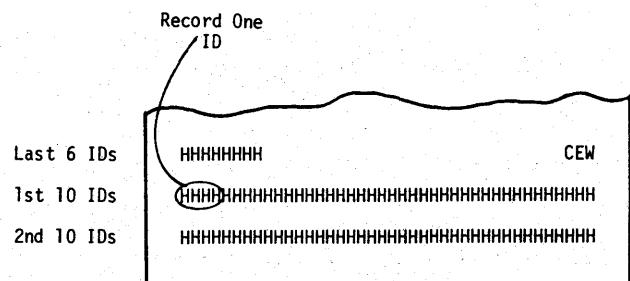
be found in Table 1 with its corresponding track number. If the machine finds a faulty track during disk initialization, it will identify that track by writing 'bad-track' IDs 15 in all ID positions 15 that will accept the writing.

## Actuator Bail Adjustment

This diagnostic will keep the disk drive head load actuator magnet energized while making an adjustment of the actuator bail. (Display disk speed CE mode can also be used for the same purpose.)

## Continuous Read

A continuous read of a particular track on a disk allows the CE to look at the read amplifier on the 'file data' line with an oscilloscope.



### Sense Register Operation

The operation of the sense register is verified by noting the position of the cursor in the ID display. During the display IDs diagnostic, the binary value of sense information stored in the sense register each disk revolution controls the position of the cursor in the display. For example, if the track is good\* and all IDs present are proper length and have correct CRC (cycle redundancy check) bytes, the cursor will display steadily under the third double binary character from the left. This is the normal cursor position for the display ID diagnostic. If the track being read has no IDs, the cursor will display under the first double binary character position; or if a wrong CRC byte is present in the track for any ID, the cursor will display under the seventh double binary character.

\*A good track is one that has no 15 double decimal  ID characters written on it.

An intermittent condition of reading no IDs or a wrong CRC would cause the cursor to shift from the third position in the display to the first or seventh position intermittently.

The position of the cursor is determined by the sum of the binary values of the sense bits set in the sense register each disk revolution, according to this table:

Sense Bit	Binary Value
ID matched	2
CRC error	4
Length error	8
Special address mark	16
Bad track	32
Index	64

### Sense Bit Definitions

- An 'ID matched sense bit' (binary value 2) is set each disk revolution that one or more double binary ID characters are read from a track. The ID character may be any double decimal value notation from 0 through 15.

0            15

- A 'CRC error sense bit' (binary value 4) is set if the CRC read in an ID field does not match the CRC computed for that ID field.

- A 'length error sense bit' (binary value 8) is set if the number of double binary characters in an ID exceeds 4.

- A 'special address mark sense bit' (binary value 16) is set if such mark is read. The special address mark is used to indicate a deleted record.

- A 'bad track sense bit' (binary value 32) is set if one or more ID double binary characters are read which have a double decimal ID notation of 15. During disk initialization,

15

- if the machine finds a track that produces unacceptable output of read back (write check or read check error) it tries to write all 26 IDs with the bad track double binary character.

A CRC error can not normally occur without also having ID matched, see missing cursor, positions (binary sum 4, 12, 20, etc. below).

The possible cursor positions are displayed as follows:

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	etc.	97
	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	
Binary Value	0	2				6	8	10				14	16	18									96
Sum Location																							

The illustration shows the normal cursor position for 'ID matched sense bit' and no errors; binary value 2, display position 3. It is normal for the cursor to flash faintly once each disk revolution in the binary value sum location 66.

- An 'index sense bit' (binary value 64) is set if the index pulse does not follow before the first ID is read on any revolution.

### Disk Drive Attachment Troubleshooting Intermittent Problems

The disk drive attachment control electronics are exercised continuously during display disk track IDs diagnostic mode. A read ID command has to be issued every 6.41 milliseconds to read each of the 26 IDs on the track every revolution of the disk. Intermittently missing read ID commands would cause some of the displayed double binary characters to look unstable in the same manner as described for missing IDs, page 8-4.

If IDs are still read intermittently after performing the following measurements, adjustments, and replacements, then the attachment circuitry on the MPU planar board is at fault and the MPU planar board must be replaced.

- Try more than one diskette in this machine; diskettes that read IDs OK in another machine.
- Reinitialize one of the disks in another machine and try it again in this machine.
- Check voltages at the MPU and at the disk drive FC card.
- Make sure the disk drive signal cable is well seated in its socket at both ends.
- Try a different FC card.
- Try a different VFO card.
- Check read/write head adjustment.
- Replace head and carriage assembly.

### Locate Disk Problems

The display disk track IDs diagnostic can show the frequency of failure of the IDs in each track of disk, and thus provide a relative guide to the number of soft error machine retries to expect for any given track. Reinitialize a suspect disk and then display track IDs again. Don't forget to try other diskettes in the same disk drive as a comparison. Try the suspect disk in another machine if available. The object here is to establish whether the machine or the disk is the marginal or faulty one.

#### Check Track Accessing

See page 8-2 for how to move the head up or down. Access to the upper or lower stop can be caused by this method.

- While accessing, mechanical action of the stepper motor and the stepper motor and leadscrew wheels can be observed.
- Test points on the FC card can be probed during accessing.
- Track IDs can be observed to determine if the head is being accessed the proper amount each time.
- On the last seek up or the last seek down, when the head carriage is stopped by the upper or lower stop, some IDs from track 76 or track 00 should still be displayed. If no IDs are displayed, the appropriate limit stop is out of adjustment. This is true only if the head carriage is properly adjusted for track 00.

**Note:** During accessing, the display is blanked. Therefore, a new display is provided for each track and also for the above and below limit stop positions. This allows a new length to be displayed shorter than the previous if not all IDs are read for the new location. See length explanation under *Display Track IDs*, page 8-3.

TABLE 1

Track Number	ID	*ID								
00	0 0	16	1 0	32	2 0	48	3 0	64	(Blank)	(Blank)
01	0 1	17	1 1	33	2 1	49	3 1	65	4 1	•
02	0 2	18	1 2	34	2 2	50	3 2	66	4 2	Γ
03	0 3	19	1 3	35	2 3	51	3 3	67	4 3	Ј
04	0 4	20	1 4	36	2 4	52	3 4	68	4 4	₩
05	0 5	21	1 5	37	2 5	53	3 5	69	4 5	•
06	0 6	22	1 6	38	2 6	54	3 6	70	4 6	⌚
07	0 7	23	1 7	39	2 7	55	3 7	71	4 7	ᴾ
08	0 8	24	1 8	40	2 8	56	3 8	72	4 8	Ί
09	0 9	25	1 9	41	2 9	57	3 9	73	4 9	₪
10	0 10	26	1 10	42	2 10	58	3 10	74	₪	₪
11	0 11	27	1 11	43	2 11	59	3 11	75	₪	₪
12	0 12	28	1 12	44	2 12	60	3 12	76	<	<
13	0 13	29	1 13	45	2 13	61	3 13			
14	0 14	30	1 14	46	2 14	62	3 14			
15	0 15	31	1 15	47	2 15	63	3 15			

\*Katakana machines only.

TABLE 2

Selected Sequence *Displayed in Pos. 77 and 78, Record 07, Track 00.	PHYSICAL SEQUENCE OF RECORDS IN A TRACK																									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Blank or 01	$\frac{0}{1}$	$\frac{0}{2}$	$\frac{0}{3}$	$\frac{0}{4}$	$\frac{0}{5}$	$\frac{0}{6}$	$\frac{0}{7}$	$\frac{0}{8}$	$\frac{0}{9}$	$\frac{0}{10}$	$\frac{0}{11}$	$\frac{0}{12}$	$\frac{0}{13}$	$\frac{0}{14}$	$\frac{0}{15}$	$\frac{1}{0}$	$\frac{1}{1}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$
RECORD NUMBERS – DOUBLE DECIMAL ID NOTATION																										
02	$\frac{0}{1}$	$\frac{0}{3}$	$\frac{0}{5}$	$\frac{0}{7}$	$\frac{0}{9}$	$\frac{0}{11}$	$\frac{0}{13}$	$\frac{0}{15}$	$\frac{1}{1}$	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{7}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{4}$	$\frac{0}{6}$	$\frac{0}{8}$	$\frac{0}{10}$	$\frac{0}{12}$	$\frac{0}{14}$	$\frac{1}{0}$	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{10}$
03	$\frac{0}{1}$	$\frac{0}{4}$	$\frac{0}{7}$	$\frac{0}{10}$	$\frac{0}{13}$	$\frac{1}{0}$	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{5}$	$\frac{0}{8}$	$\frac{0}{11}$	$\frac{0}{14}$	$\frac{1}{1}$	$\frac{1}{4}$	$\frac{1}{7}$	$\frac{1}{10}$	$\frac{0}{3}$	$\frac{0}{6}$	$\frac{0}{9}$	$\frac{0}{12}$	$\frac{1}{5}$	$\frac{1}{2}$	$\frac{1}{8}$	
04	$\frac{0}{1}$	$\frac{0}{5}$	$\frac{0}{9}$	$\frac{0}{13}$	$\frac{1}{1}$	$\frac{1}{5}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{6}$	$\frac{0}{10}$	$\frac{0}{14}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{10}$	$\frac{0}{3}$	$\frac{0}{7}$	$\frac{0}{11}$	$\frac{0}{15}$	$\frac{1}{3}$	$\frac{1}{7}$	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{12}$	$\frac{0}{4}$	$\frac{0}{8}$	
05	$\frac{0}{1}$	$\frac{0}{6}$	$\frac{0}{11}$	$\frac{1}{0}$	$\frac{1}{5}$	$\frac{1}{10}$	$\frac{0}{2}$	$\frac{0}{7}$	$\frac{1}{12}$	$\frac{1}{1}$	$\frac{1}{6}$	$\frac{0}{3}$	$\frac{0}{8}$	$\frac{0}{13}$	$\frac{1}{2}$	$\frac{1}{7}$	$\frac{0}{4}$	$\frac{0}{9}$	$\frac{0}{14}$	$\frac{1}{3}$	$\frac{1}{8}$	$\frac{0}{5}$	$\frac{0}{10}$	$\frac{1}{4}$	$\frac{1}{9}$	
06	$\frac{0}{1}$	$\frac{0}{7}$	$\frac{0}{13}$	$\frac{1}{3}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{8}$	$\frac{0}{14}$	$\frac{1}{4}$	$\frac{1}{10}$	$\frac{0}{3}$	$\frac{0}{9}$	$\frac{0}{15}$	$\frac{1}{5}$	$\frac{0}{4}$	$\frac{0}{10}$	$\frac{1}{0}$	$\frac{1}{6}$	$\frac{0}{5}$	$\frac{0}{11}$	$\frac{1}{1}$	$\frac{1}{7}$	$\frac{0}{6}$	$\frac{0}{12}$	$\frac{1}{2}$	$\frac{1}{8}$
07	$\frac{0}{1}$	$\frac{0}{8}$	$\frac{0}{15}$	$\frac{1}{6}$	$\frac{0}{2}$	$\frac{0}{9}$	$\frac{1}{0}$	$\frac{1}{7}$	$\frac{0}{3}$	$\frac{0}{10}$	$\frac{1}{1}$	$\frac{1}{8}$	$\frac{0}{4}$	$\frac{0}{11}$	$\frac{1}{2}$	$\frac{1}{9}$	$\frac{0}{5}$	$\frac{0}{12}$	$\frac{1}{3}$	$\frac{1}{10}$	$\frac{0}{6}$	$\frac{0}{13}$	$\frac{1}{4}$	$\frac{0}{7}$	$\frac{1}{14}$	$\frac{1}{5}$
08	$\frac{0}{1}$	$\frac{0}{9}$	$\frac{1}{1}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{10}$	$\frac{1}{2}$	$\frac{1}{10}$	$\frac{0}{3}$	$\frac{0}{11}$	$\frac{1}{3}$	$\frac{0}{4}$	$\frac{0}{12}$	$\frac{1}{4}$	$\frac{0}{5}$	$\frac{0}{13}$	$\frac{1}{5}$	$\frac{0}{6}$	$\frac{0}{14}$	$\frac{1}{6}$	$\frac{0}{7}$	$\frac{0}{15}$	$\frac{1}{7}$	$\frac{0}{8}$	$\frac{1}{0}$	$\frac{1}{8}$
09	$\frac{0}{1}$	$\frac{0}{10}$	$\frac{1}{3}$	$\frac{0}{2}$	$\frac{0}{11}$	$\frac{1}{4}$	$\frac{0}{3}$	$\frac{0}{12}$	$\frac{1}{5}$	$\frac{0}{4}$	$\frac{0}{13}$	$\frac{1}{6}$	$\frac{0}{5}$	$\frac{0}{14}$	$\frac{1}{7}$	$\frac{0}{6}$	$\frac{0}{15}$	$\frac{1}{8}$	$\frac{0}{7}$	$\frac{1}{0}$	$\frac{1}{9}$	$\frac{0}{8}$	$\frac{1}{1}$	$\frac{1}{10}$	$\frac{0}{9}$	$\frac{1}{2}$
10	$\frac{0}{1}$	$\frac{0}{11}$	$\frac{1}{5}$	$\frac{0}{2}$	$\frac{0}{12}$	$\frac{1}{6}$	$\frac{0}{3}$	$\frac{0}{13}$	$\frac{1}{7}$	$\frac{0}{4}$	$\frac{0}{14}$	$\frac{1}{8}$	$\frac{0}{5}$	$\frac{0}{15}$	$\frac{1}{9}$	$\frac{0}{6}$	$\frac{0}{10}$	$\frac{1}{7}$	$\frac{1}{1}$	$\frac{0}{8}$	$\frac{1}{2}$	$\frac{0}{9}$	$\frac{1}{3}$	$\frac{0}{19}$	$\frac{1}{4}$	
11	$\frac{0}{1}$	$\frac{0}{12}$	$\frac{1}{7}$	$\frac{0}{2}$	$\frac{0}{13}$	$\frac{1}{8}$	$\frac{0}{3}$	$\frac{0}{14}$	$\frac{1}{9}$	$\frac{0}{4}$	$\frac{0}{15}$	$\frac{1}{10}$	$\frac{0}{5}$	$\frac{0}{1}$	$\frac{0}{6}$	$\frac{1}{1}$	$\frac{0}{7}$	$\frac{1}{2}$	$\frac{0}{8}$	$\frac{1}{3}$	$\frac{0}{9}$	$\frac{1}{4}$	$\frac{0}{10}$	$\frac{1}{5}$	$\frac{0}{11}$	$\frac{1}{6}$
12	$\frac{0}{1}$	$\frac{0}{13}$	$\frac{1}{9}$	$\frac{0}{2}$	$\frac{0}{14}$	$\frac{1}{10}$	$\frac{0}{3}$	$\frac{0}{15}$	$\frac{0}{4}$	$\frac{1}{0}$	$\frac{0}{5}$	$\frac{1}{1}$	$\frac{0}{6}$	$\frac{1}{2}$	$\frac{0}{7}$	$\frac{1}{3}$	$\frac{0}{8}$	$\frac{1}{4}$	$\frac{0}{9}$	$\frac{1}{5}$	$\frac{0}{10}$	$\frac{1}{6}$	$\frac{0}{11}$	$\frac{1}{7}$	$\frac{0}{12}$	$\frac{1}{8}$
13	$\frac{0}{1}$	$\frac{0}{14}$	$\frac{0}{2}$	$\frac{0}{15}$	$\frac{0}{3}$	$\frac{1}{0}$	$\frac{0}{4}$	$\frac{1}{1}$	$\frac{0}{5}$	$\frac{1}{2}$	$\frac{0}{6}$	$\frac{1}{3}$	$\frac{0}{7}$	$\frac{1}{4}$	$\frac{0}{8}$	$\frac{1}{5}$	$\frac{0}{9}$	$\frac{1}{6}$	$\frac{0}{10}$	$\frac{1}{7}$	$\frac{0}{11}$	$\frac{1}{8}$	$\frac{0}{12}$	$\frac{1}{9}$	$\frac{0}{13}$	$\frac{1}{10}$

\* The sequence numbers that are entered by the operator in positions 7 and 8 of record 07, track 00, prior to disk initialization, are machine written in positions 77 and 78 of that record during initialization.

### Display Registers

The diagnostic causes the contents of thirty of the 8-bit registers to be displayed. Each register will be represented by two alphabetic characters out of the group: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. If all keyboard toggle switches are in a down (off) position and the machine is in the XR mode (initialized diskette installed) when the CE mode is selected, then when the display register diagnostic is selected, the display should look similar to Figure 1.

(The six highlighted registers should always be 00 for a properly operating machine. The other registers will show their contents when the 1/U key is pressed and may be different than shown in Figure 1.)

Key Group											
66	00	00	00	00	07	00	00	00	00	00	00
1-10											
00	00	04	02	00	00	00	00	02	00	00	00
11-20											
08	50	00	00	00	01	01	00	00	00	00	00
21-30											

FIGURE 1

The cursor will be displayed in the same position that it was in when the CE display mode was selected—CER mode.

The six highlighted registers in Figure 1 will always be 00 at first selection of the diagnostic if the machine is operating properly.

The display registers diagnostic can be used to:

- Test keyboard switches.
- Test keyboard keys.
- Test shift keys.
- Test repeat keys.
- Test system error indicator.

### Keyboard Fourth Switch Test — Katakana Machines

The KATAKANA SHIFT switch can be tested by following the procedure outlined for Keyboard Switch Test, with these differences:

- The indication characters will be displayed in register group 24 (fourth group from the left in the top line for the 3742).
- The switch off characters should be 00.
- The switch on characters should be 20.
- A data key must be pressed several times to test the switch function.

— Observe the character displayed directly above the cursor. It should be a 0. If it is not a 0, then a reason could be, (see below):

- Not all of the switches were turned 'off' before the CE Display Mode was selected.
- Press the RESET key two or more times until XR mode is displayed again and start the test over.
- One or more switches are stuck "ON" electrically or are wired backwards.
- Switch wiring is shorted or PC board land pattern lines are shorted.
- The register has one or more 'stuck' bits.

2	indicates AUTO REC ADV (ARA) is on
4	indicates PROG NUM SHIFT (PNS) is on
8	indicates AUTO DUP/SKIP (AD/S) is on
6	indicates ARA and PNS are on
A	indicates AD/S and ARA are on
C	indicates AD/S and PNS are on
E	indicates that all three switches are on

TABLE 3

- If the character in position 17 above the cursor is a 0, proceed with the switch test. Each switch has a value of 2, 4, or 8 as shown in Table 3. As the switches are turned on in sequence, their values will be additive in the register and the display character will change accordingly (for each good switch).

Note that the character: A is the numeric equivalent of 10. C is the numeric equivalent of 12. E is the numeric equivalent of 14.

The switches may be turned on in any sequence. Turning a switch off while in the CEW or CER modes should have no effect on the display once the register has been set.

- An easy sequence to follow is to turn the switches on (flip up) one at a time from left to right. The character above the cursor in position 17 should change from 0 to 8 to A to E as each good switch is turned on. For a sequence from right to left, the character above the cursor in position 17 should change from 0 to 4 to 6 to E.
- Any one switch can be tested repeatedly by terminating the CE display mode and then starting the test over again. (Use Table 3 as a reference.) The cursor doesn't have to be moved to position 17 each time, but it does help to spot the active register position. RESET may have to be pressed more than once to change from CEW to CER mode because the keyboard data register is periodically reset by the diagnostic program and may not accept the first RESET input.

*Note:* If the keyboard switch test indicates a bad switch position the problem could be:

- Switch fails to make or break. Check with the CE ohmmeter.
- Open or shorted wiring connections to the keyboard PC board.
- Broken, shorted, or open pin or land pattern on the keyboard PC board.

#### Keyboard Key Test

- Insert an initialized diskette in the disk drive and close the drive cover. The machine should go from XN to XR mode and display record 08 of track 00.
- Use CHAR ADV to move the cursor out to position 14 as shown by the position indicator. Both register positions 13 and 14 (register group four) will be used in this test.
- Press FUNCT SEL lower (the right hand function select key).
- Hold down NUM SHIFT and press the C key. The machine mode and status should change to CER.
- Press the U key. The machine mode and status should change to CEW and the display appear similar to the one below. (The six highlighted registers should always be 00 for a properly operating machine. The other registers will show their contents when the U key is pressed and may be different than shown below.)

										Reg Group
66	00	00	00	00	07	00	00	00	00	1-10
00	00	04	02	00	00	00	00	02	00	11-20
08	50	00	00	00	01	01	00	00	00	21-30

- Observe the two characters displayed above and to the left of the cursor. They should be zero, (00). If they are not both 0, then the reason could be:

- A stuck key (flyplate, dirt on PC board, etc.).
- A faulty PC board.
- The register has one or more stuck bits.
- Test any key on the keyboard by pressing it alone. Do not press RESET.

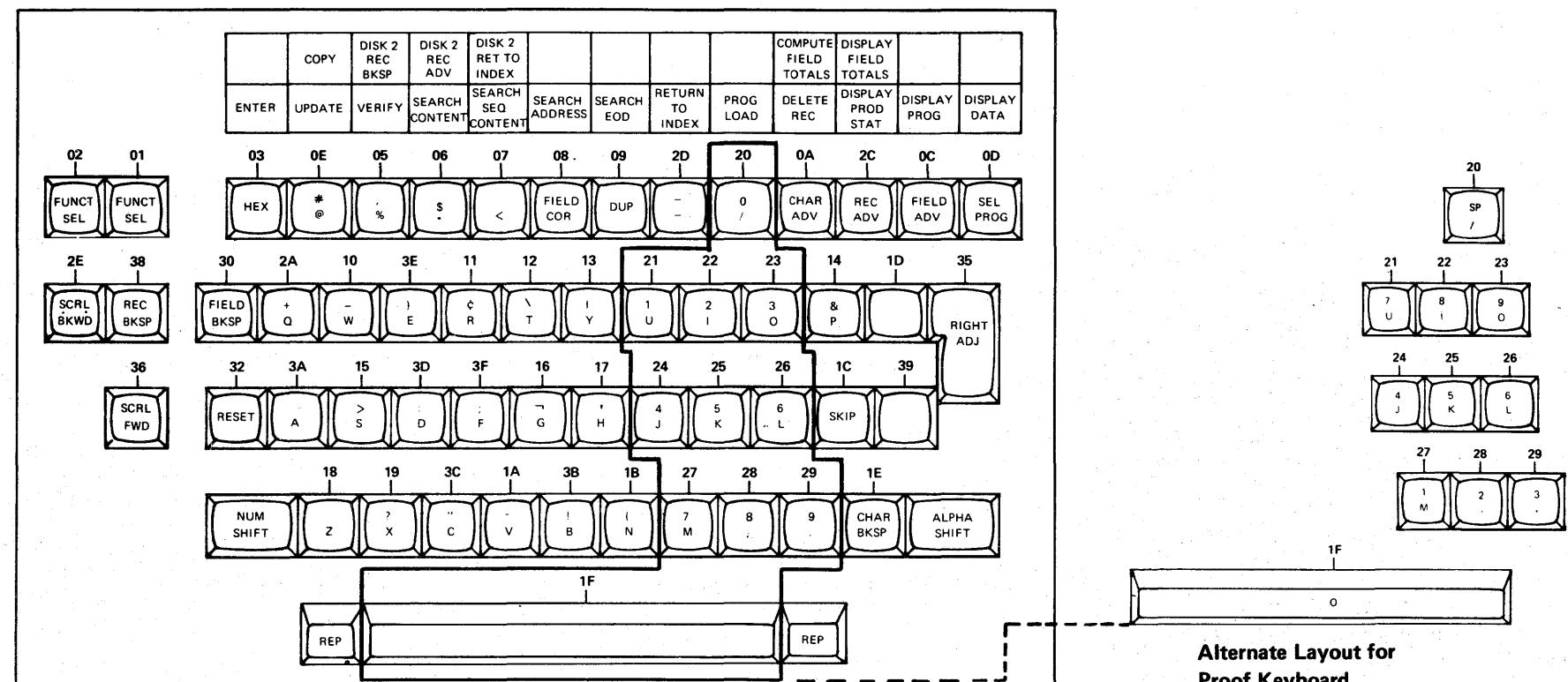
The shift keys and the repeat keys cannot be tested alone.

A key may have to be pressed more than once because the keyboard data register is periodically reset by the diagnostic program and may not accept the first key depression.

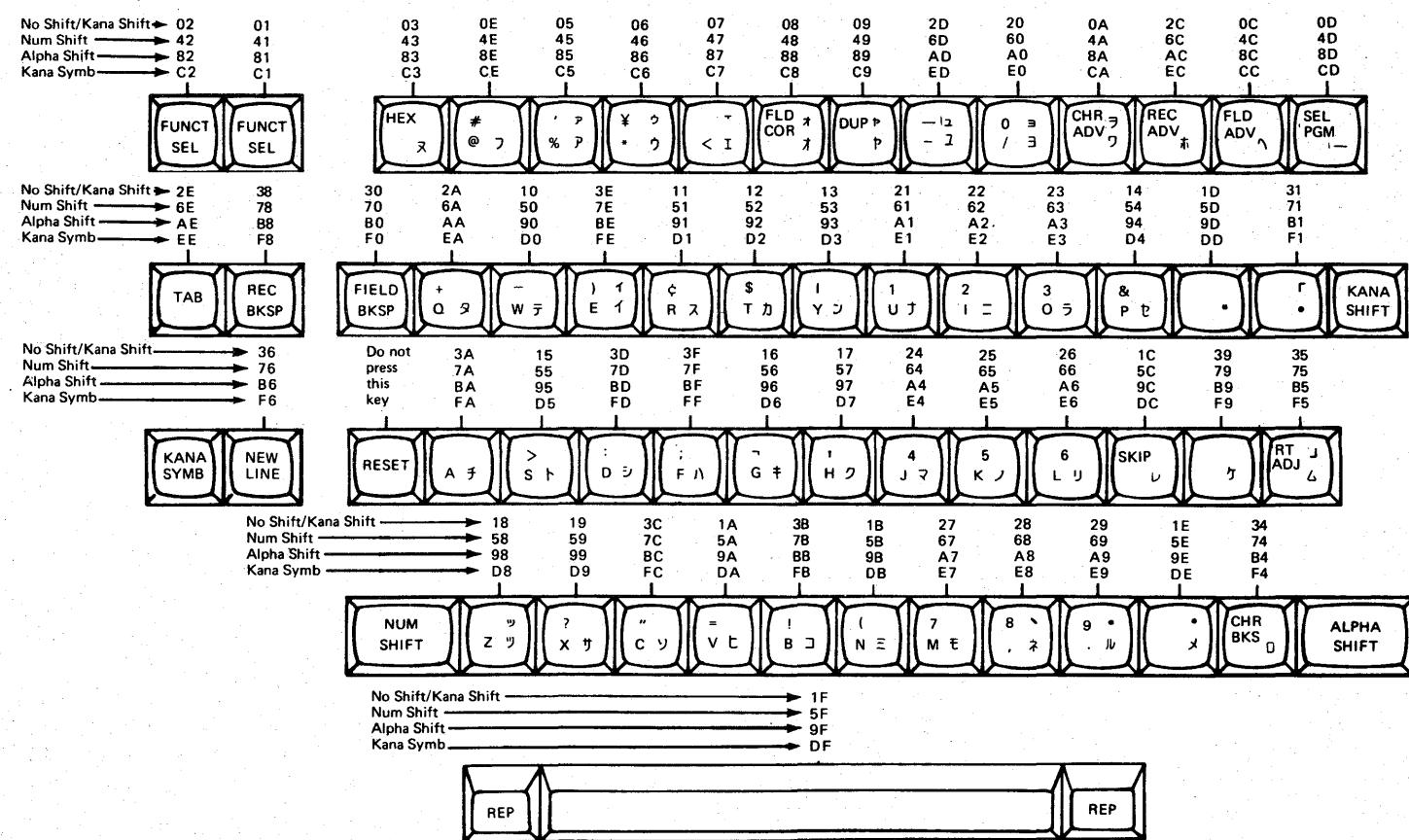
- Observe the two characters that are displayed for a particular key depression. They should agree with the codes shown for that key in the *Key Codes Chart*. If not, some possible problems are:

- Faulty key module.
- Faulty keyboard PC board.
- Faulty keyboard register.

### KEY CODES CHART



**Alternate Layout for Proof Keyboard**



**Alternate Layout For Katakana Keyboard**

**Repeat Key Test**

The repeat (REP) key by itself will cause no change in the display of registers and will not produce a keyboard click. REP, held down with another key, should cause the other key to be repetitively sampled to the register. The register will accept the input at a time when it is not being reset as previously explained. The display will change once when the register accepts the input. The keyboard should click repetitively while the two keys are held down.

**System Error Indication Test**

The object of this test is to try to set the error bit in the proper register and see if the bit sets and also if the error alarm conditions are implemented by the machine.

- Start in XR mode.
- Use CHAR ADV to move the cursor out to position 18.
- Select CER mode as described for the previous test.
- Press the U key to select display registers program.
- Observe the character above the cursor in position 18; it should be a zero (0).
- Use the heel of your hand and press down several keys on the keyboard to cause an overrun error.
- The display should start flashing.
- The keyboard should go dead — no more clicks.
- There should a one (1) displayed above the cursor in position 18.

**Shift Key Test**

The left hand character of the two characters displayed for key codes (position 13 in the display) should always be a 0, 1, 2, or 3 as shown in the *Key Codes Chart*.

- Press a key and check that the characters displayed agree with the key code shown in the *Key Codes Chart* for that key.
- Hold NUM SHIFT down and press the same key as in the previous steps. The left hand character should increase by 4. See Table 4.
- Hold ALPHA SHIFT down and press the same keys as in the two previous steps. The left hand character should again increase by 4. In effect, ALPHA SHIFT causes an increase of 8. See Table 4.
- Hold KANA SYMB down and press the same key as in the previous steps. The left hand character should increase by 12 over the no shift character. See Table 4.
- Hold KANA SHIFT down and press the same key as in the previous steps. The indication characters will be displayed in register group 24 (fourth group from the left in the top line). The no Kana shift condition is 00. The Kana shift is 20.

**FIRST (LEFT HAND) DIGIT  
(POSITION 13)**

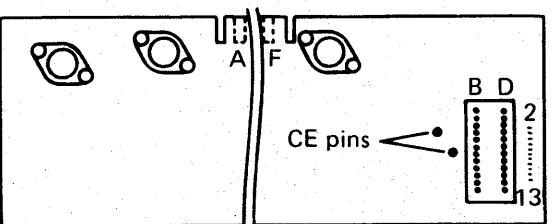
First (left hand) digit of key code				
No shift	0	1	2	3
NUM SHIFT	4	5	6	7
ALPHA SHIFT	8	9	A	B
KANA SYMB	C	D	E	F

**TABLE 4**

## CE Pins for Raster Display

The CE pins for raster display are located adjacent to the left side of the signal cable connector on the display PC board. One of the CE pins is connected to the PC board ground. The other CE pin is connected to the 'video signal' line.

When the CE pins are connected together with a jumper wire, the 'video signal' line is grounded, thus preventing the display of characters on the CRT.



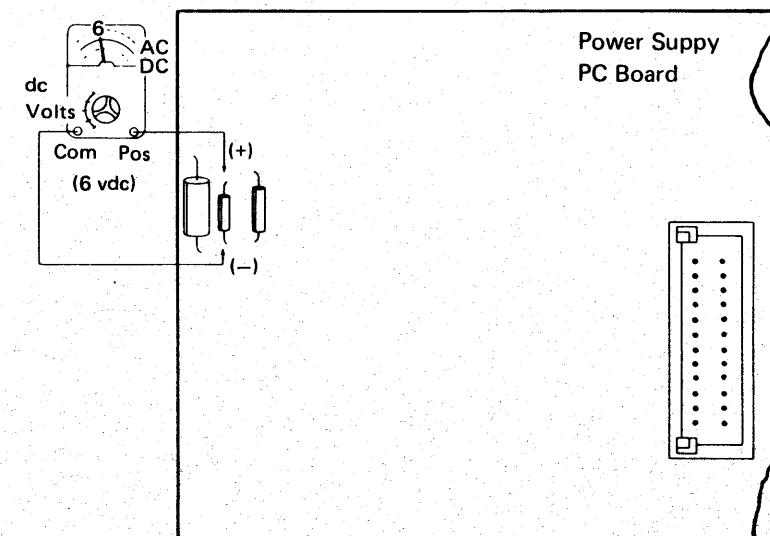
Display PC Board

It may be difficult to see the raster retrace pattern on some display units when the brightness control is turned all the way clockwise and characters are being displayed. For these cases, the characters can be removed from the display by connecting the CE pins together with a jumper wire. The absence of the brilliant characters will allow the raster retrace lines to be more visible.

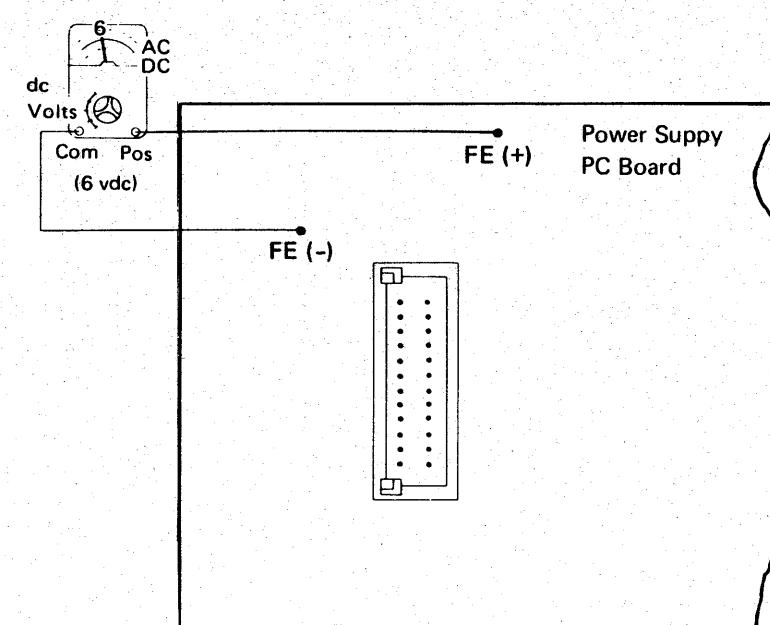
## CE Voltmeter P/N 452796 Accuracy Check (15 Vdc Range)

To check the accuracy of the 15 volt dc range of your voltmeter, measure the voltage drop across the zener diode on the power supply PC board. The zener diode has a closely controlled voltage drop of 6 volts dc with power on.

Set the meter selector switch to the 15 volt range and connect as shown in the diagram. The meter should indicate 6 volts dc.



Original Power Supply  
(with diode board)



Revised Power Supply  
(no diode board)

## The CE General Logic Probe P/N 453212

The universal logic probe provides a visual indication of a line level. The probe can also be used to detect pulses and as a babysitter. (Refer to handbook that comes with probe.)

Ignore the flashing UP and DOWN lights during POWER ON while the probe is connected to its machine power source.

### Indicator Lights

UP indicates an up level (+).  
DOWN indicates a down level (-).

A pulsing line is indicated by both lights being on.

Both lights are off if the line level is from +1.0 to +2.0 Vdc for MULTI logic setting.

### Safe Operating Ranges:

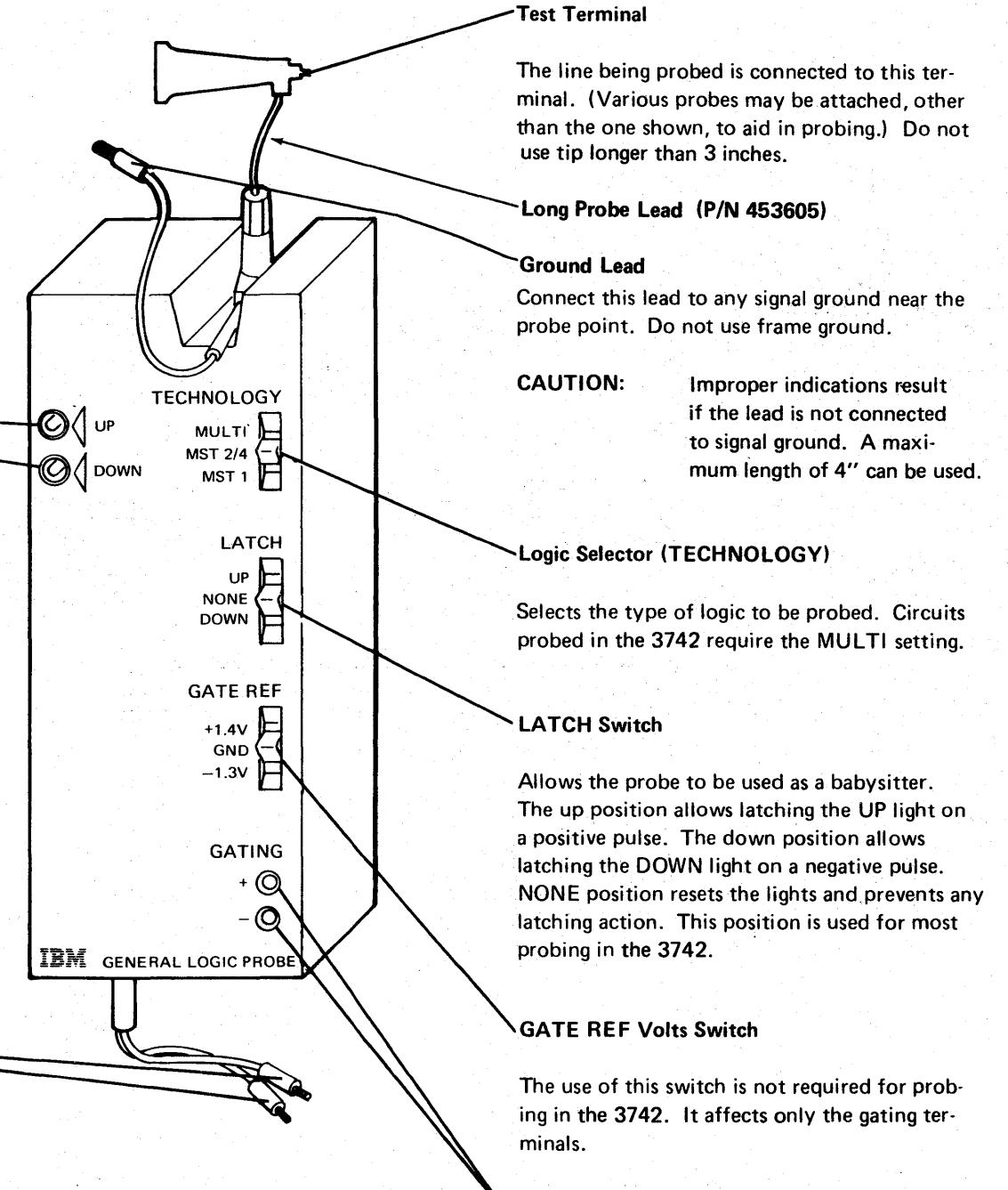
Logic selector	MULTI	+60.0V
	MST 2/4	+14.0V
	MST 1	+14.0V

Voltages greater than the above ranges will damage the probe.

### Power Leads

Connect the black (-) lead to planar M, D13 (gnd). Connect the other (+) lead to planar M, B05 (+8.5V). A voltage difference of 4 to 12 volts is needed to power the probe, with the black lead always the most negative. Do Not power the probe with the -5 Vdc supply it can not furnish the power required.

**CAUTION:** Improper connection of power lead may cause the probe to malfunction.



### Test Terminal

The line being probed is connected to this terminal. (Various probes may be attached, other than the one shown, to aid in probing.) Do not use tip longer than 3 inches.

### Long Probe Lead (P/N 453605)

Connect this lead to any signal ground near the probe point. Do not use frame ground.

**CAUTION:** Improper indications result if the lead is not connected to signal ground. A maximum length of 4" can be used.

### Logic Selector (TECHNOLOGY)

Selects the type of logic to be probed. Circuits probed in the 3742 require the MULTI setting.

### LATCH Switch

Allows the probe to be used as a babysitter. The up position allows latching the UP light on a positive pulse. The down position allows latching the DOWN light on a negative pulse. NONE position resets the lights and prevents any latching action. This position is used for most probing in the 3742.

### GATE REF Volts Switch

The use of this switch is not required for probing in the 3742. It affects only the gating terminals.

### GATING

The use of these terminals is not required for probing in the 3742.

Do not probe FET signals with gate inputs.  
Gate input limits are  $\pm 14$  volts.

## CE Alignment Check Diskette P/N 2455026

### HEAD ALIGNMENT SERVICE CHECK TRACKS

The CE diskette has special tracks written on its disk that can be used by the CE for a fast service check of a disk drive unit to determine if the unit has acceptable R/W head-to-track alignment. This service check can be used to quickly determine which disk drive unit out of several needs R/W head adjustment to make it compatible with the rest of the units.

An identifier field, called a disk track ID, is written at the beginning of each record location in every track when a disk is initialized. There are 26 ID fields per track. Each ID field has a track number ID and one of the 26 record number ID's for that track.

The special tracks on the CE diskette disk are precision written in a manner that alternately offsets the ID fields of each track a certain distance from the track centerline. Special messages to the CE are written in the 26 record areas of each track (see *Display Data Head Alignment Service Check*). Each record is off-set on the opposite side of a track from its offset ID.

Since the disk drive stepper motor/leadscrew wheels have four discrete stop positions each revolution, a set of four special tracks is provided so that all wheel stop positions can be checked. These tracks are located in track positions 06, 07, 08, and 09. A second set of four special tracks is also provided. The IDs and records are written more off-set than they are for the first set. Track positions are 12, 13, 14, and 15.

Note that the phase zero position of the stepper motor/leadscrew wheels corresponds to tracks 00, 04, 08, 12, etc.

Track 00 through 04 and all tracks beyond track 16 are written with all 26 IDs on the centerline of each track.

Data set label 00019 defines tracks 05 through 16 as HD ALIGN TRACKS. Actually, tracks 05, 10, 11, and 16 are head alignment guard band tracks.

Data set label 00009 defines tracks 06 through 09 as HD ALIGN

Also, data set label 00018 defines tracks 12 through 15 as HD ALIGN.

Records and IDs are written off-track center-line on all twelve tracks, either OUT away from the disk center hole, or IN toward the disk center hole. Tracks 11 through 16 are written farther off-track than are tracks 05 through 10.

#### A. Tracks 06 through 09 (also tracks 12 through 15):

1. Odd numbered record IDs are written OUT.  
Even numbered record IDs are written IN.
2. Odd numbered records are written IN.  
Even numbered records are written OUT.

Figure 1 shows the sequential order of the IDs and records on the disk for any one of the above 8 tracks.

#### B. Tracks 05 and 11 (Guard Bands):

1. Even numbered IDs are written IN (toward track 06 or 12).  
Odd numbered records are written IN (toward track 06 or 12).
2. No odd numbered IDs are written.  
No even numbered records are written.

#### C. Tracks 10 and 16 (Guard Bands):

1. Odd numbered IDs are written OUT (toward track 09 or 15).  
Even numbered records are written OUT (toward track 09 or 15).
2. No even numbered IDs are written.  
No odd numbered records are written.

Any two record messages of a matching pair (with their corresponding IDs) are written on the disk 180° from each other. (See Figure 1.)

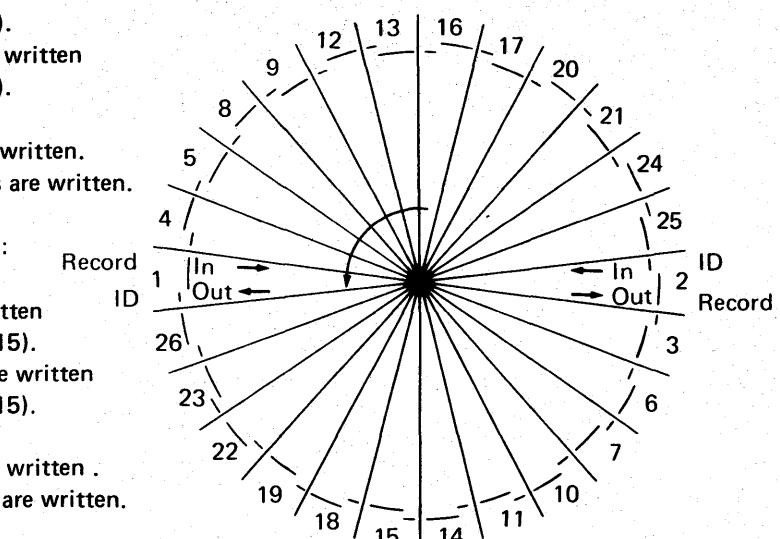
The guard ban tracks (05, 10, 11, and 16) have only 13 ID's each. No record messages are displayable from the guard band tracks. ID's have no corresponding records. (See B and C above.)

#### Typical Example for Successful Display of a Pair of Matching Record Messages:

As explained above, each odd ID is written OUT and its corresponding odd record is written IN. Each even ID is written IN and its corresponding even record is written OUT. Therefore, the correct display of a pair of matching record messages results when the Read/Write head can read correctly an OUT ID and its IN record, and then 180° away on the track can also read an IN ID and its OUT record. (See figure 1)

The total number of pairs of matching record messages that can be read for any one of the four tracks gives an indication of two mechanical condititons:

1. Head location in reference to the track centerline.
2. How well the disk is centered while it is clamped to the disk drive hub.



Matching record messages refer to each other in pairs, like record 1 refers to record 2, and record 2 refers to record 1. Record 3 refers to record 4; record 4 refers to record 3, and so on.

FIGURE 1

## DISPLAY DATA HEAD ALIGNMENT SERVICE CHECK

**Note:** The machine must be operative enough to be able to read and display track 00, and also to seek and to read other tracks on a disk. (This disk does not detect a maladjusted lower-limit stop.) Use the ML to troubleshoot machine malfunctions.

- Remove the disk from the other disk unit.
- Insert CE diskette in a disk drive and close the drive cover.
- Press REC ADV to get to data set label 00009, HDR1 HD ALIGN
- Press FUNC SEL lower
- Press UPDATE

Dependent upon head alignment, the disk drive may or may not be able to read and match up the first ID of track 06 with the first record of track 06. If successful, the display will look like this (cursor in position 001 for 128 feature machines):

01            0     A A    06001            U R

TRACK 6, RECORD 1 CK STATUS LINE 06001

### HEAD ALIGNMT OK IF RECORD 2 CAN BE READ

If not successful, there will be a pause while the machine is retrying, then an error will be displayed for no record found (2) or read (4). RESET the error and press REC ADV.

The objective of the alignment check is to find a pair of "matching" record messages in each alignment check track that read and display correctly. The tracks are 06, 07, 08, and 09.

Matching record messages refer to each other in pairs, like record 1 refers to record 2, and record 2 refers to record 1. Record 3 refers to record 4; record 4 to record 3, and so on. (See example above.)

A correctly read and displayed record message is one that:

1. Is displayed immediately after REC ADV or REC BKSP with no retries.
2. Has correct data contents.
3. Has track and record numbers in the record that agree with the record counter in the status line.

- Can a pair of matching record messages be read correctly from each of the four tracks?

Y N

- Adjust the head (231).
- Verify the adjustment with the test diskette.

Head alignment is OK.

\*To terminate the service check, press FUNC SEL lower followed by RETURN TO INDEX key. The CE diskette may be removed from the disk drive as soon as the data set label in track 00 is displayed.

## DISPLAY DISK TRACK IDs HEAD ALIGNMENT SERVICE CHECK

If the disk drive does not pass the read/write head alignment service check using the matching record messages on the CE diskette, you may do the following as a further check on head alignment:

1. With the CE diskette installed, put the machine into CE mode display disk track IDs, and move the R/W head to track 12, 13, 14, or 15 by successively pressing the space bar. (See CE Mode, page 8-1, for details of CE mode operation and how to interpret disk track IDs.)
2. Remove or move the display mirror assembly so that you can watch the display from the rear of the machine.
3. Now manually turn the disk drive stepper motor wheel a small amount in one direction to see if more IDs can be made to display for that track. Be sure the track IDs, the first character of each group of four, do not change to indicate an adjacent track.

4. If the first direction is not successful, re-select (using the space bar) the same track selected in step 1, and then manually turn the disk drive stepper motor wheel a small amount in a direction opposite to the first direction to see if more ID's can be made to display. You may have to try the above steps more than once in order to find the right setting of the stepper motor wheel. Another way to refresh the display is to press RESET once, then press the 4/J key. The head carriage will not move in this case.

**Note:** Some machines will have CE Mode ROS that will cause the display to refresh each disk revolution that 26 ID's are *not* read. The display will seem to be flashing. This is a dynamic mode of operation that allows observation of the changing number of ID's read as the head carriage is moved manually. If all 26 ID's can be read correctly, the display will stop flashing.

If either step 3 or 4 is successful in displaying more ID's correctly, (or all 26), the read/write head is out of alignment. Do the read/write head adjustment outlined in service aid 231 of the ML after terminating this service check. (\*)

If neither step 3 or 4 is successful in displaying more ID's correctly, the trouble is other than read/write head alignment. Terminate this service check (\*) and return to a MAP in the ML based on the error code displayed or other symptom. Remember that you have checked read/write head alignment only. That shouldn't be necessary again until you are ready to verify a fix.

#### Service Notes

The special tracks on a CE diskette can be verified for adequate signal amplitude and presence of ID's and records if the read/write alignment service check can be performed successfully in another disk drive unit.

During the display disk track ID's head alignment service check, if the read/write head is moved so that no ID's are displayed, it will be necessary to manually move the stepper motor wheel to a point where at least one ID is displayed in order to be able to step track by track with the space bar. It may become necessary to remove the diskette and press the RESET key so that the disk drive accessing mechanism gets recalibrated with the access control counter. If after re-installing the diskette record 08 of track 00 is not displayed, power down and wait five seconds, then power up to cause the recalibration procedure to be executed.

#### Diskette Special Handling

All diskettes undergo small reversible dimension changes with changes in ambient temperature and humidity. Allow the CE Diskette to stabilize to a new environment before use. This takes a few minutes up to a few hours depending on the magnitude of change.

Storage in sunlight, or temperatures exceeding 110°F, are apt to cause irreversible dimension changes which degrade precision of the diskettes alignment tracks. The CE diskette is a service aid only, consistent conflict between it and the mechanical alignment tool is cause to replace the CE diskette.

### Offline Field Totals

#### Test Procedure

- Set AUTO REC ADV switch up.
- Load the CE Diskette, PN 2455026.
- REC ADV to data set label 00011. —  
(The cursor is in position 001 in  
128 feature machines.)

01 0 A A 00011 X R  
HDR1 OFF-LINE TOT PROG 080 39001 39026  
 P 39006

- Press FUNC SEL lower  
UPDATE
- Execute, with the following procedure,  
the displayed instruction to load four  
programs.

01 0 A A 39001 U R  
OFF-LINE TOT TEST LOAD THE FOLLOWING  
4 PROGRAMS IN PROGRAM STORAGE 1 THRU 4

Press REC ADV  
FUNC SEL lower  
PROG LOAD  
1

01 0 A A 39002 X R  
N12-----E  
 (12 dashes)

REC ADV  
FUNC SEL lower  
PROG LOAD  
2

01 0 A A 39003 X R  
N23-----E  
 (12 dashes)

REC ADV  
FUNC SEL lower  
PROG LOAD  
3

01 0 A A 39004 X R  
N23-----E  
 (11 dashes)

REC ADV  
FUNC SEL lower  
PROG LOAD  
4

01 0 A A 39005 X R  
L1001WS;2001NS,X;3001WX&002NA,B.

REC ADV—

The READ/WRITE head  
returns to the index track  
(label 00011) and the  
display shows a 'G' error.

- Press RESET
- REC ADV to data set label 00012. —

01 0 A A 00012 X R  
HDR1 OFF-LINE TOT DATA 080 40001 40026  
 P 40023

— Press FUNCT SEL upper  
COMPUTE FIELD TOTALS

— Starts an automatic  
computing routine. The  
display shows, in rapid  
succession, the following  
22 records containing  
test data:

01 0 A A 40001 F R  
SA11111111111A

40002 VB22222222222B  
40003 SC33333333333C  
40004 VD44444444444D  
40005 SE55555555555E  
40006 VF66666666666F  
40007 SG77777777777G  
40008 VH88888888888H  
40009 SI99999999999I  
40010 VA11111111111J  
40011 SB22222222222K  
40012 VC33333333333L  
40013 SD44444444444M  
40014 VE55555555555N  
40015 SF66666666666O  
40016 VG77777777777P  
40017 SH88888888888Q  
40018 VI99999999999R  
40019 XA111111111111  
40020 XB222222222222  
40021 X11111111111111

— Wait for the computation to  
be finished. —

— Press FUNCT SEL upper  
DISPLAY FIELD TOTALS

— Examine the display to confirm  
correct field totals. —  
— Press RESET.

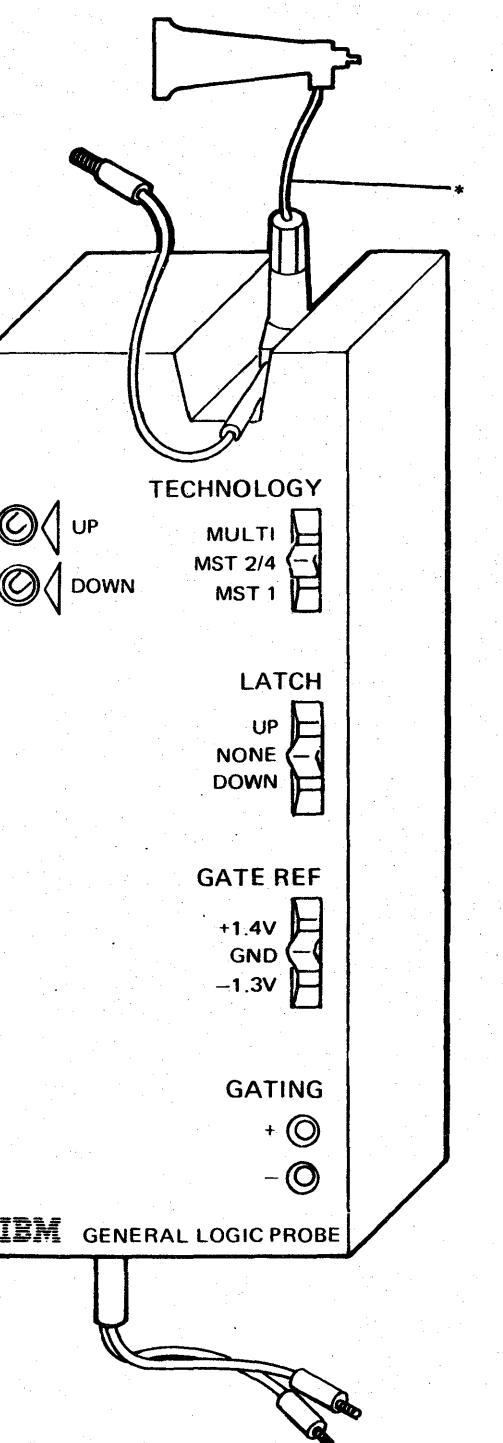
The field totals test is complete;  
the diskette can be removed.

01 0 A A 40022 F R  
X333333333333

01 0 A A 00012 X R  
HDR1 OFF-LINE TOT DATA 080 40001 40026  
P 40023

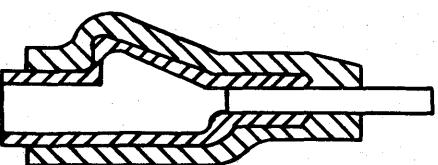
01 0 A A 00012 X R  
9999999999999+ 4444444444444+  
1111111111111- -

## CE TOOLS

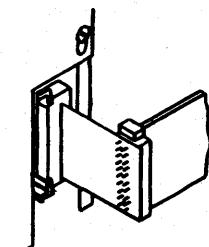


**CE General Logic Probe  
PN 453212**

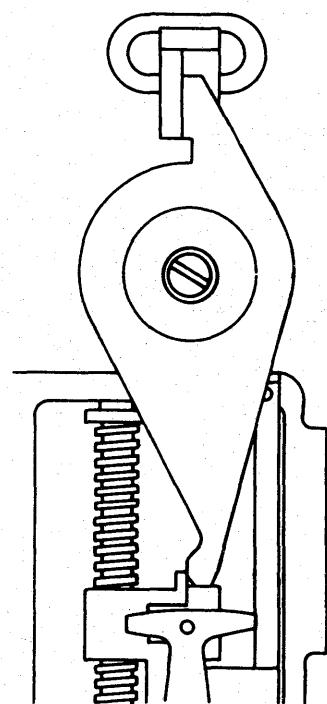
\*(long probe lead)  
**PN 453605**



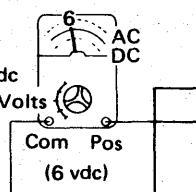
**Terminal Assembly Probe  
PN 2594238**



**Cable Extender  
PN 5998763**



**CE Head Adjusting Tool  
PN 2200698**



**CE Voltmeter  
(15 Vdc range) (PN 452796)**

Voltmeter leads with  
SMS connectors  
**PN 2124599**

**CE Diagnostic Diskette, PN 2455026**  
Function Control Feature  
Diagnostic Diskette  
Without Proof Keyboard, PN2446088  
With Proof Keyboard, PN2446089

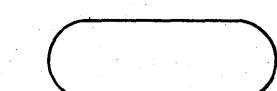
# OPERATING PROCEDURES

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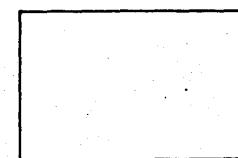
Page	Procedure
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9-5	Delete Dataset Label
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9-34	Initialize, Disk
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9-8	Update
9-10	Verify (With Field Correct)

## FLOWCHARTING CONVENTIONS

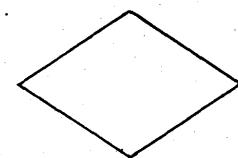
The flowcharting symbols used in the operating procedures flowcharts are:



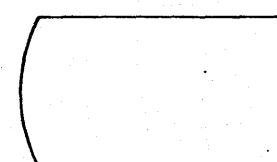
Entry/Exit



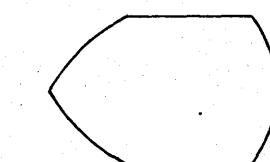
Processing



Decision



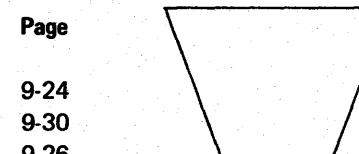
Keying



Display



Document



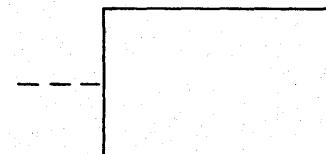
Manual Operation

3

On-Page



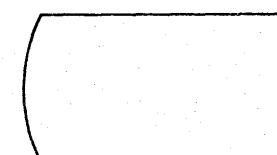
Off-Page



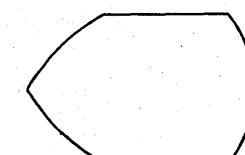
Comment

### Connectors

Most of the symbols are self-explanatory, but the following symbols deserve comment:



Identifies specific keys to press on the keyboard, or refers to keyed data.



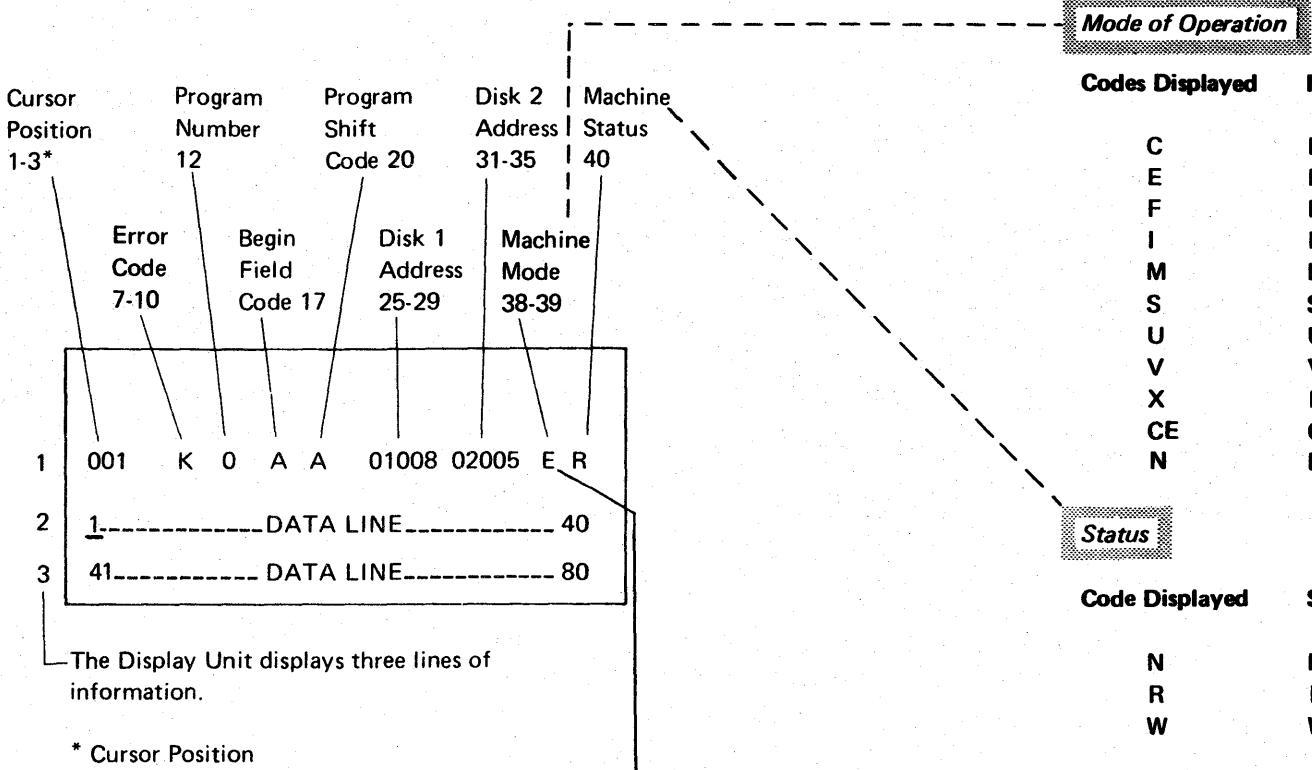
Identifies information displayed.



Refers to a specific MAP.

## 3742 DATA STATION

### Operator Display



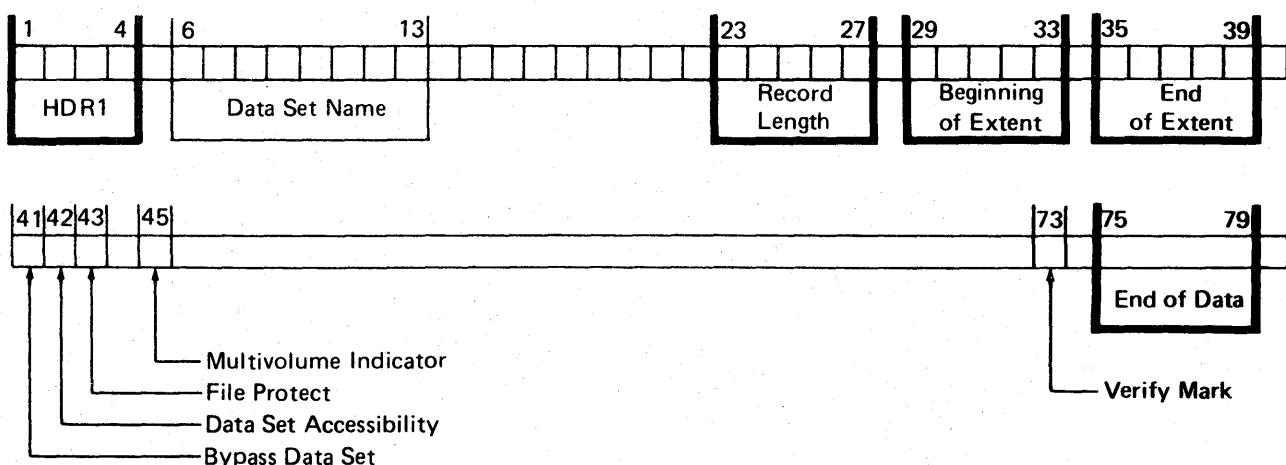
\* Cursor Position

Positions 2 and 3 only on 80-record-length machines.

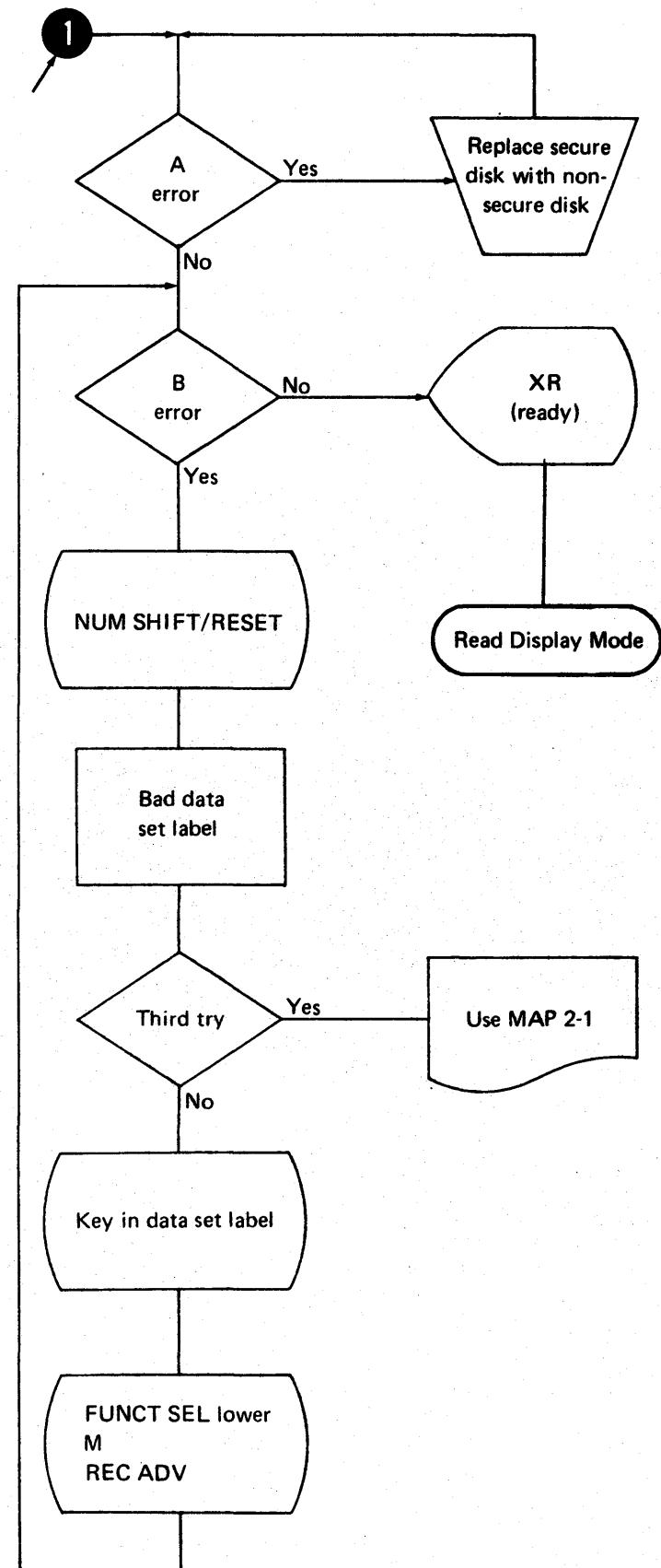
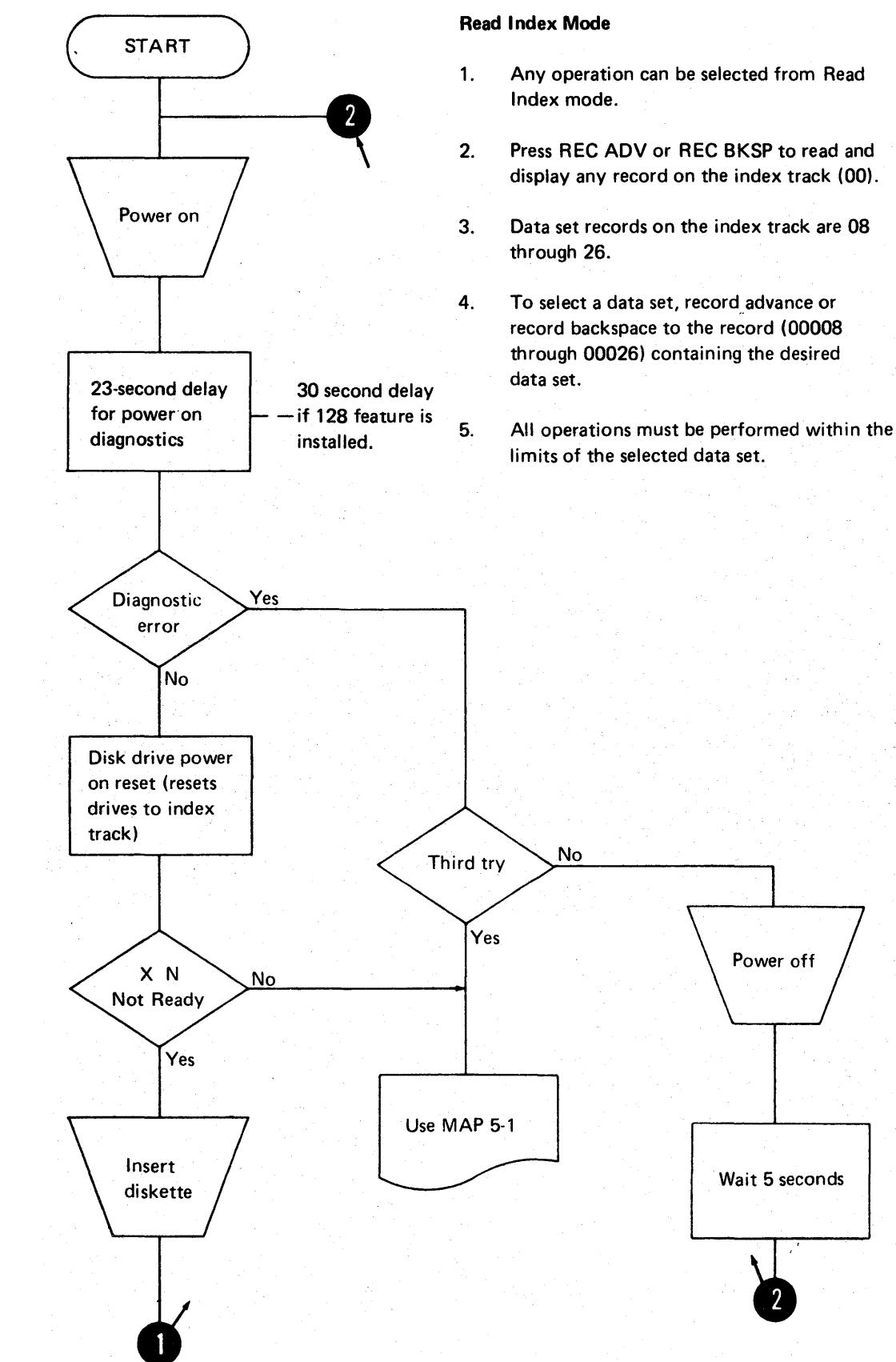
A dash (-), between mode and status, indicates the alternative method of record advance was selected.

### Data Set Label

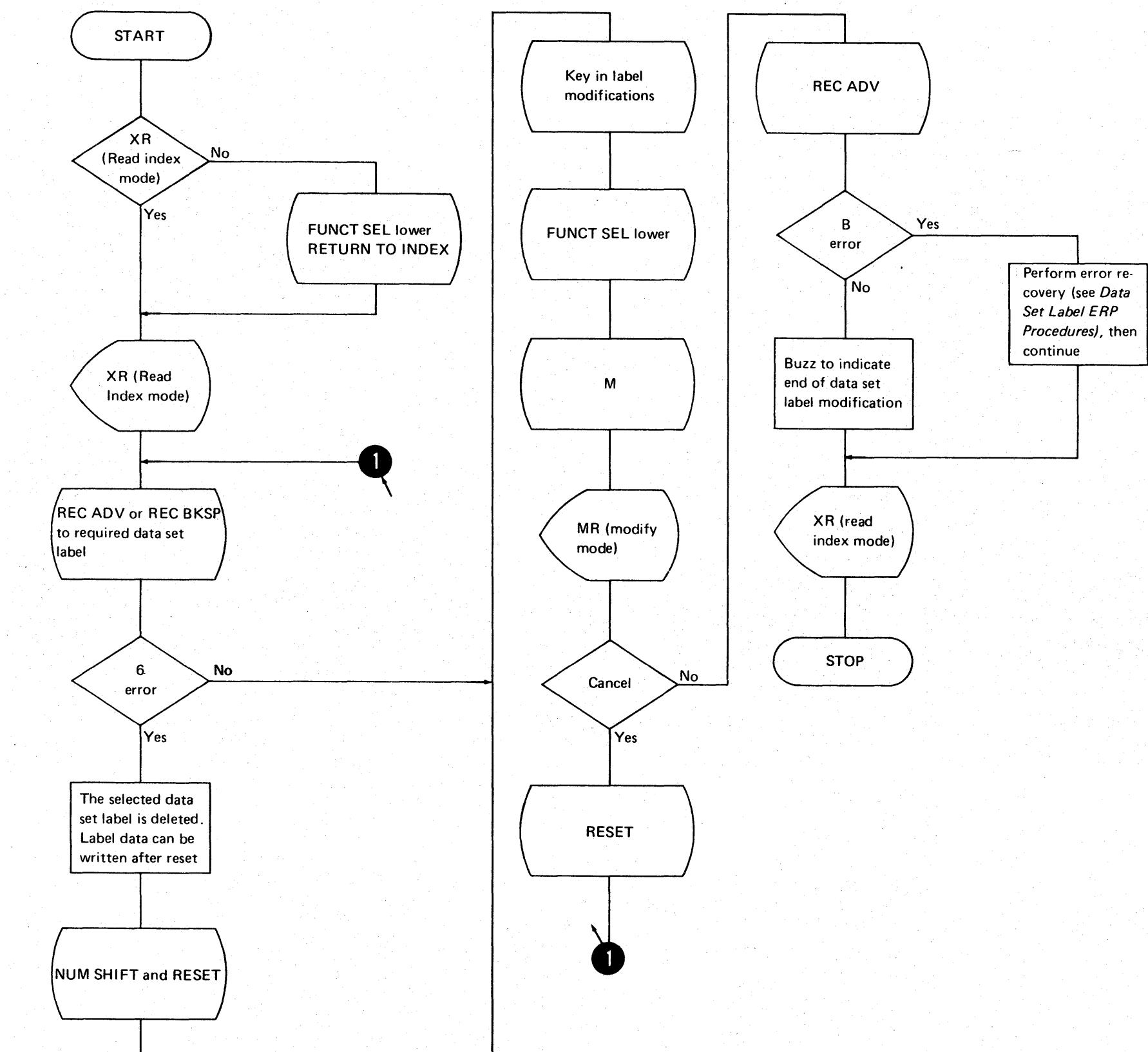
Fields in heavy lines are required by the 3740 data entry system.



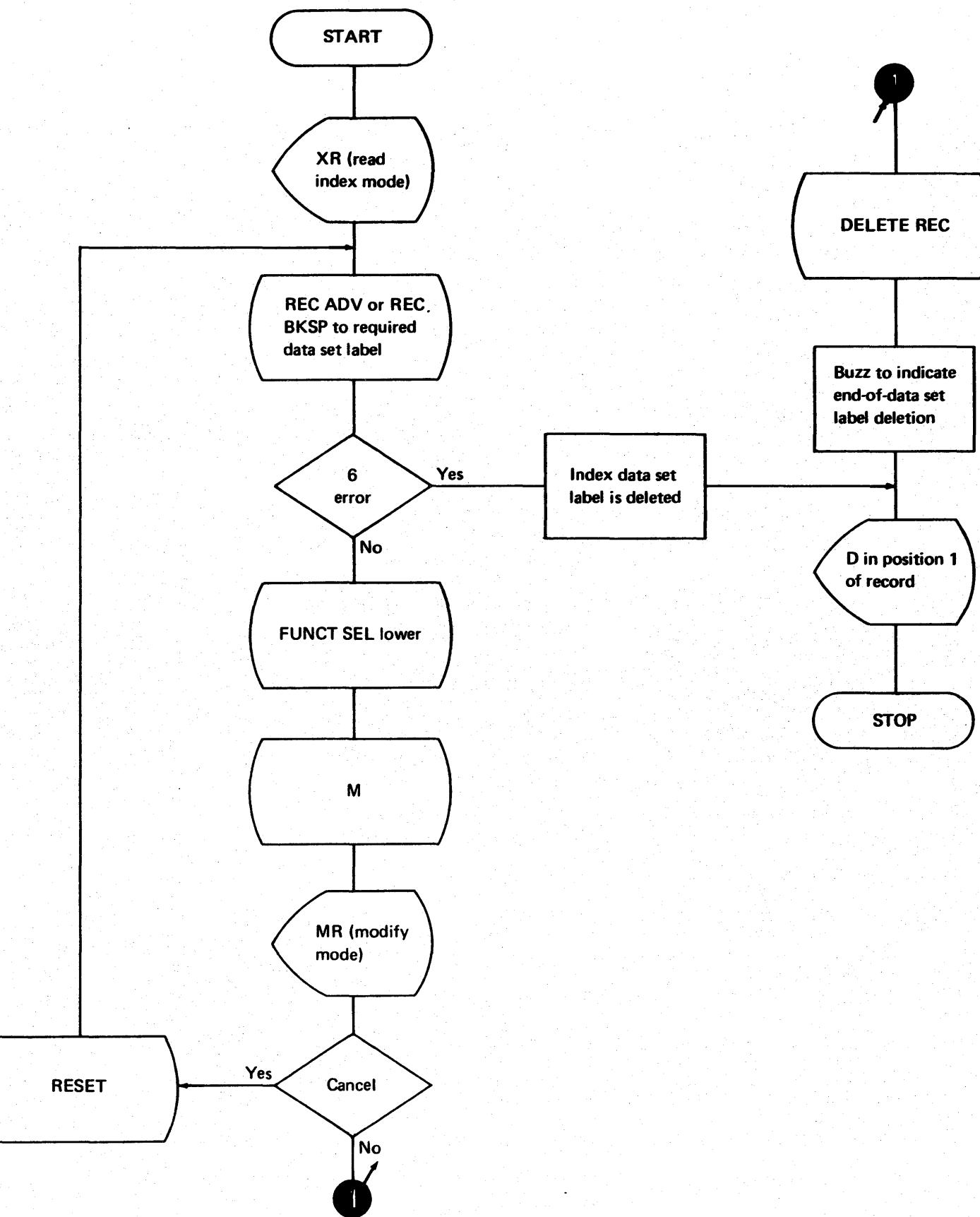
## **Power On and Read Index**



### Modify Index



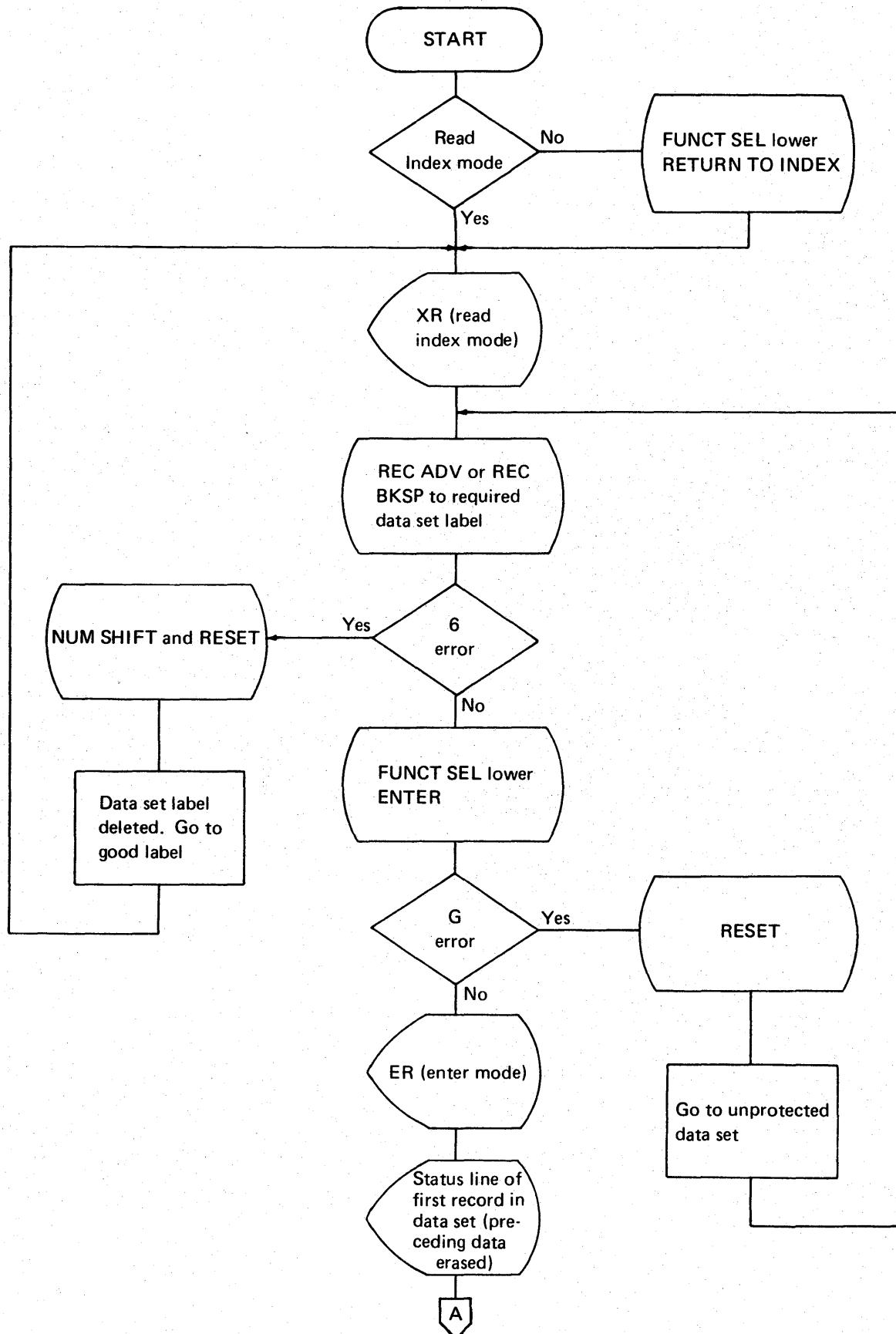
### Delete Data Set Label

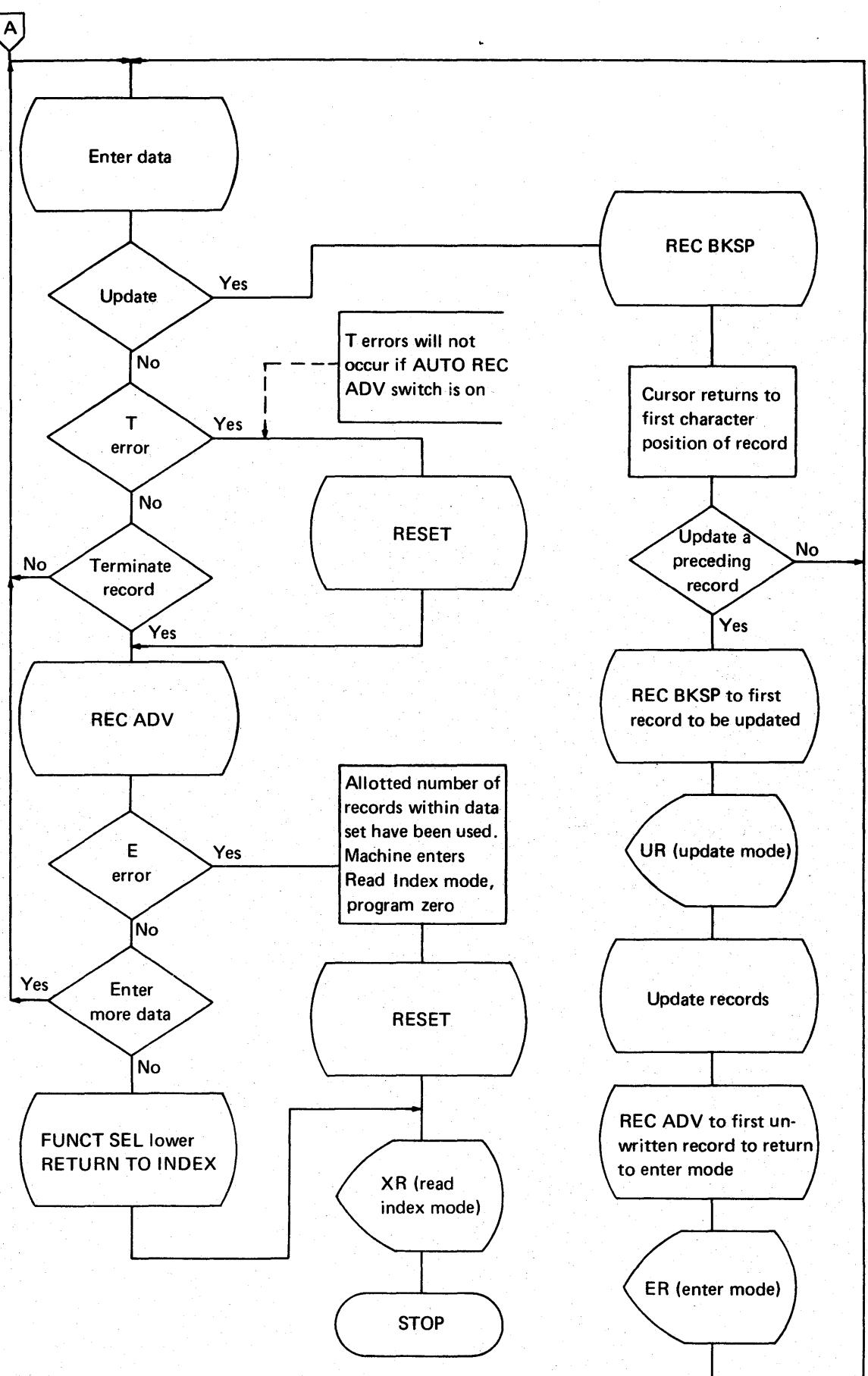


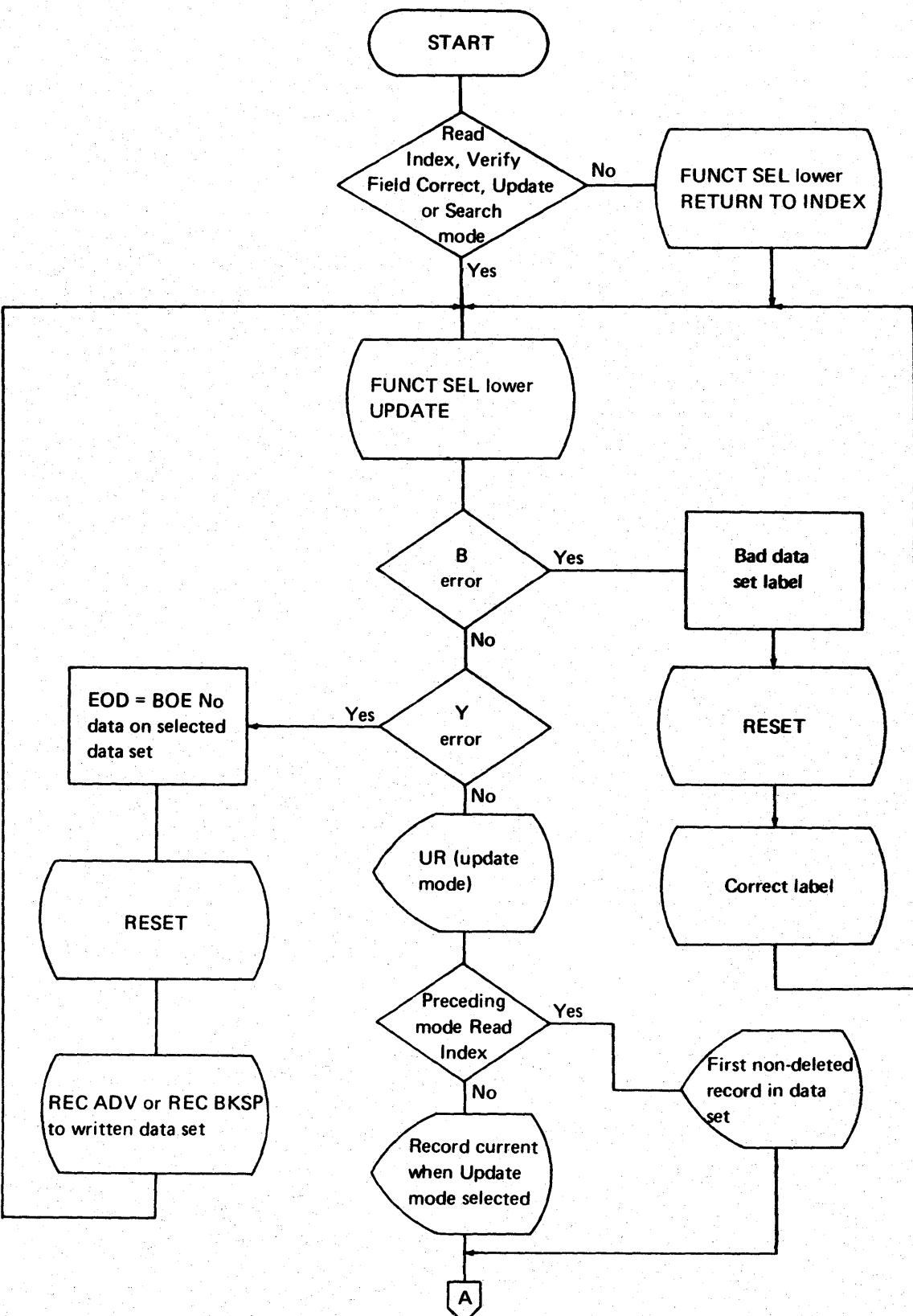
**Enter**

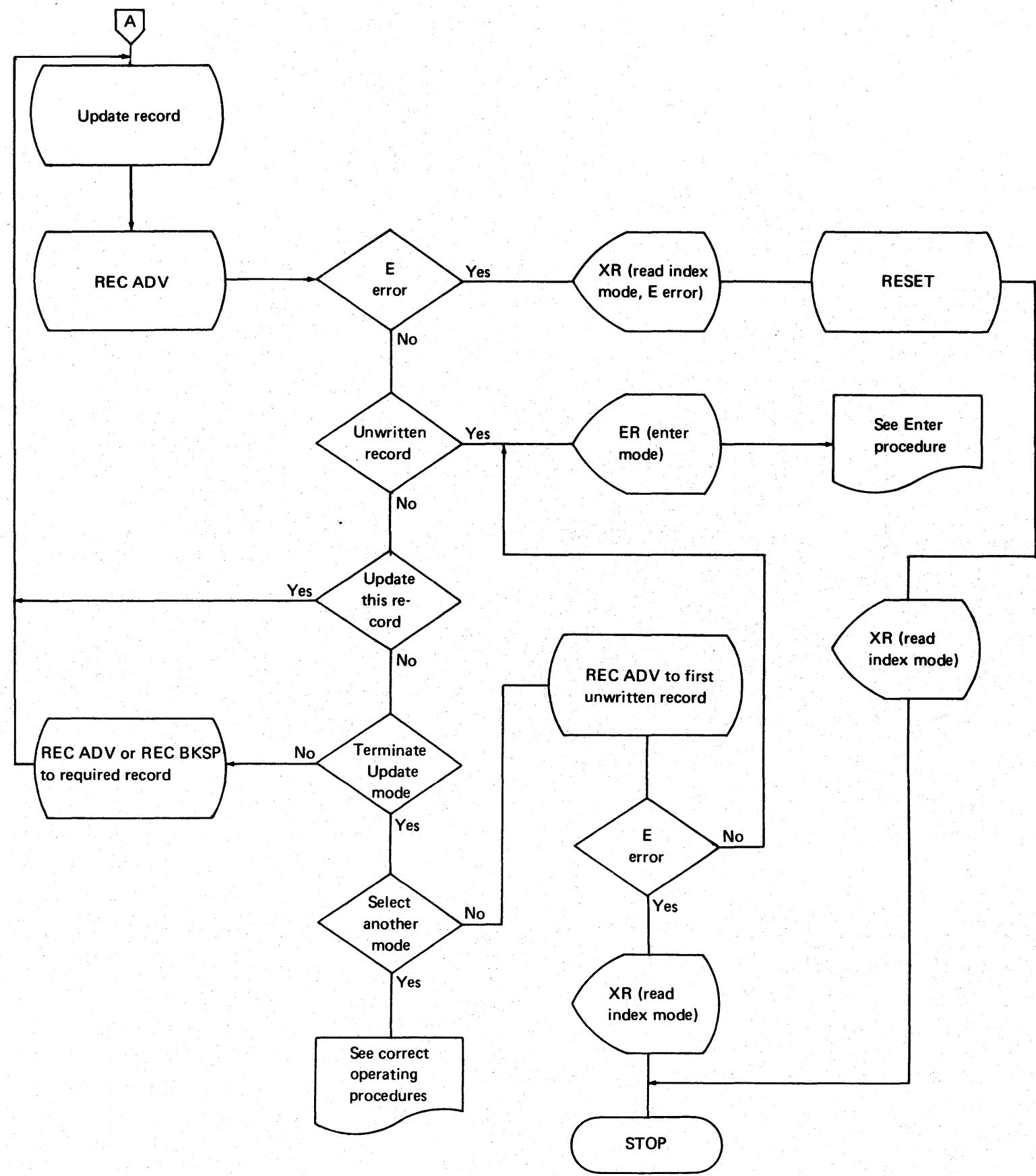
When enter mode is selected, both the current record buffer and the preceding record buffer are filled with blanks. Keyed characters are then accumulated in the current record buffer until an entire record is entered. The record can be changed or corrected if record advancing hasn't occurred.

At the time record advancing occurs, the current record is moved to the preceding record buffer, and written to disk. The image of the last record entered remains in the preceding record buffer until record advancing occurs again.

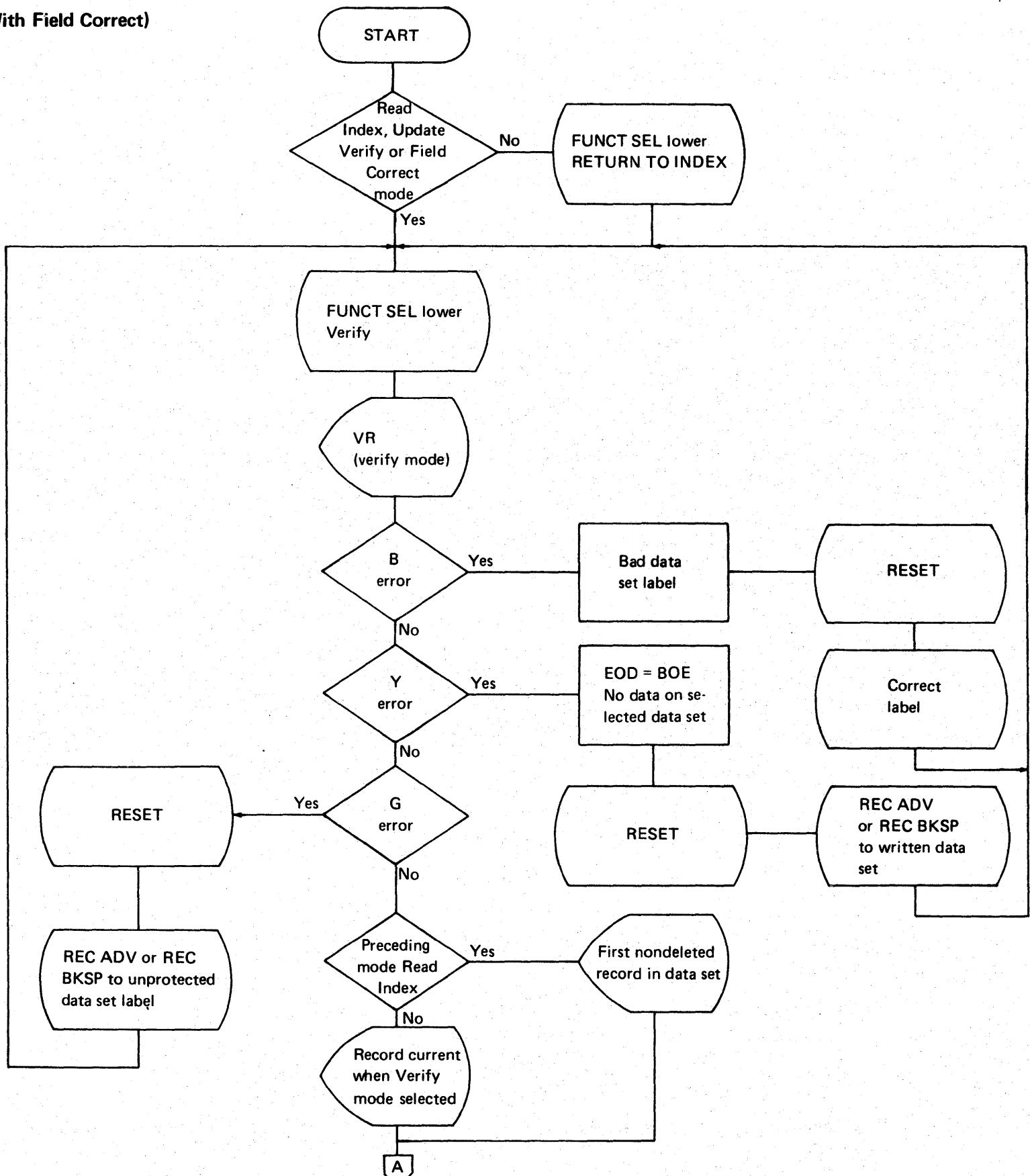


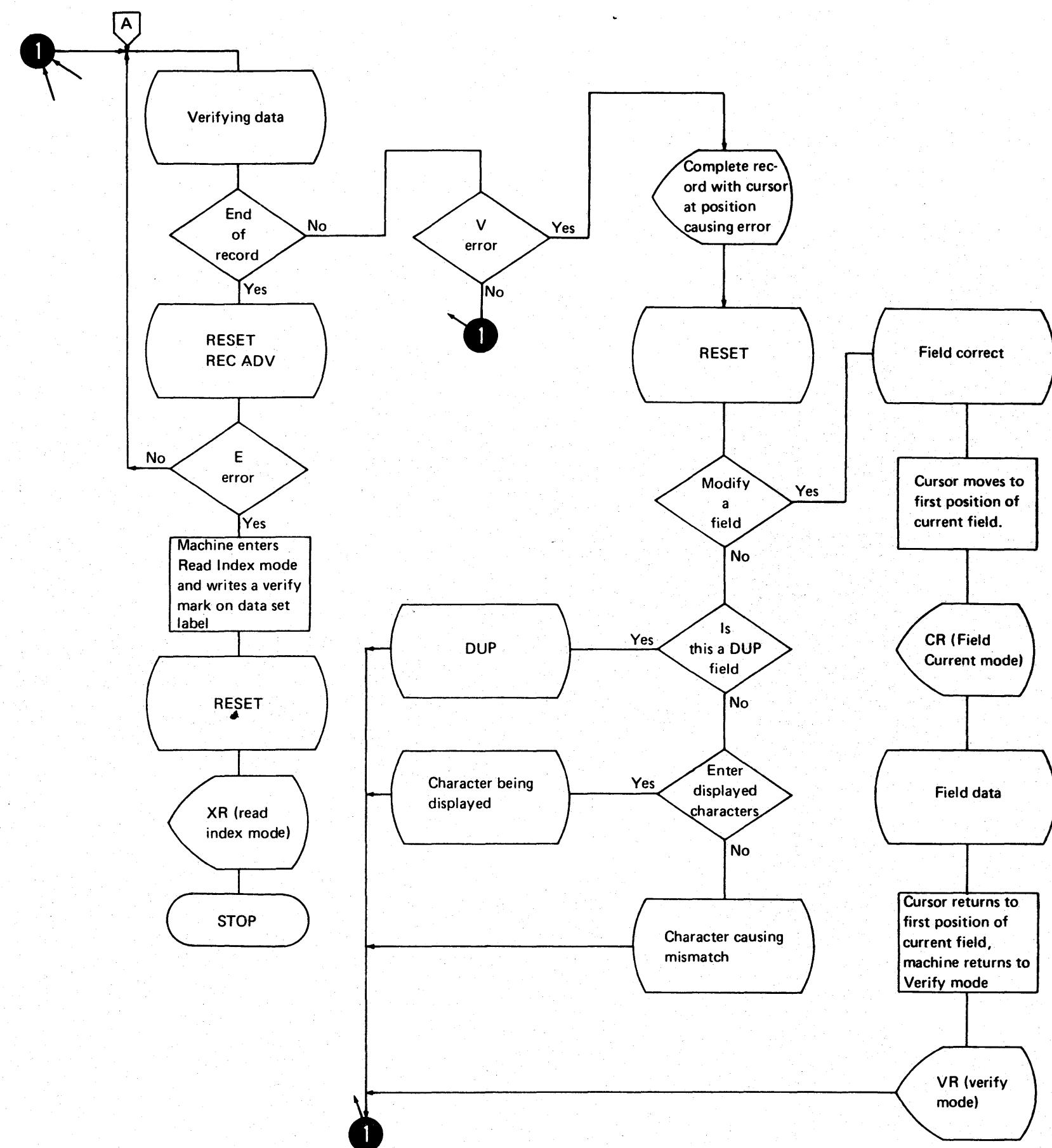


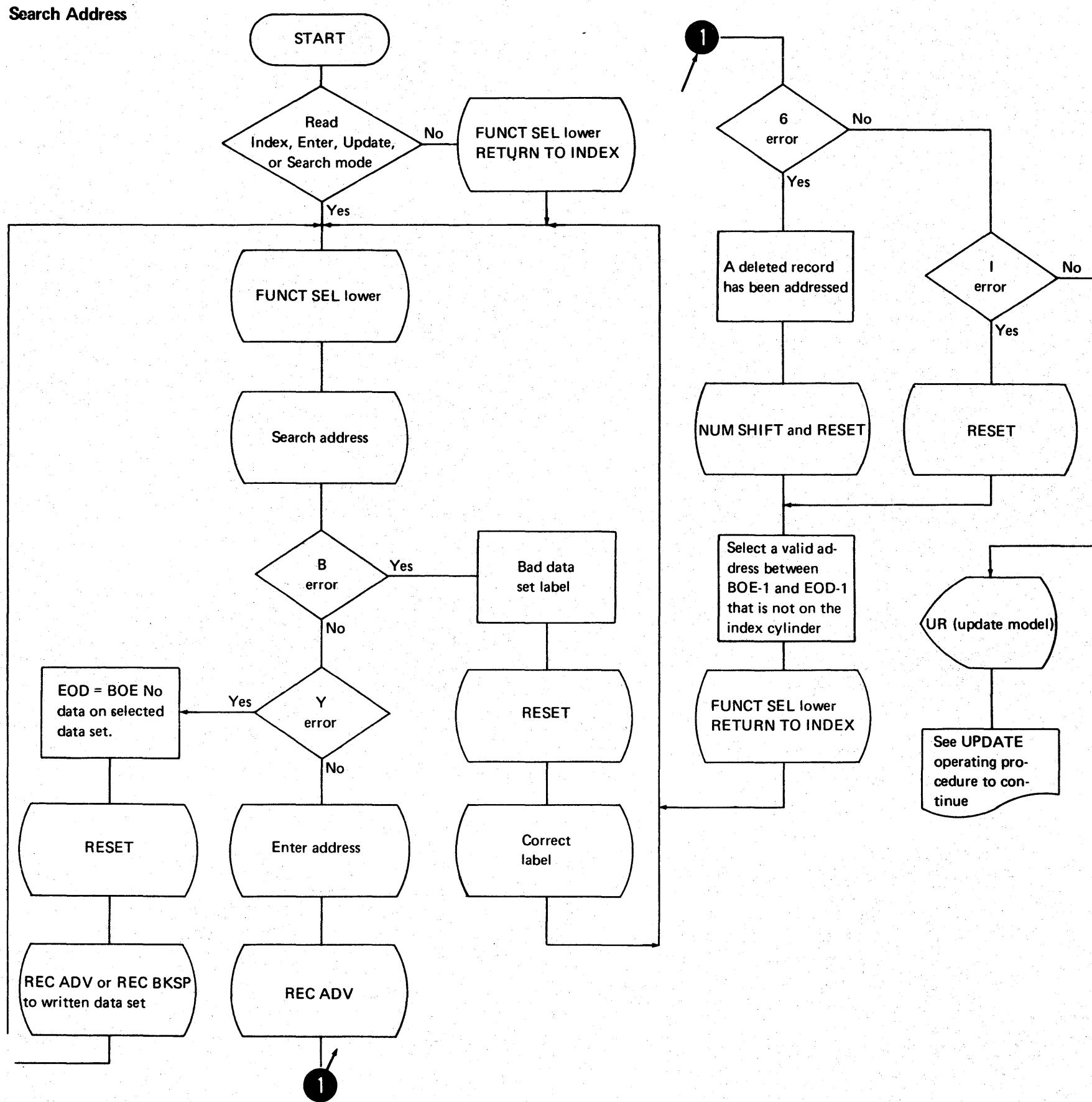
**Update**



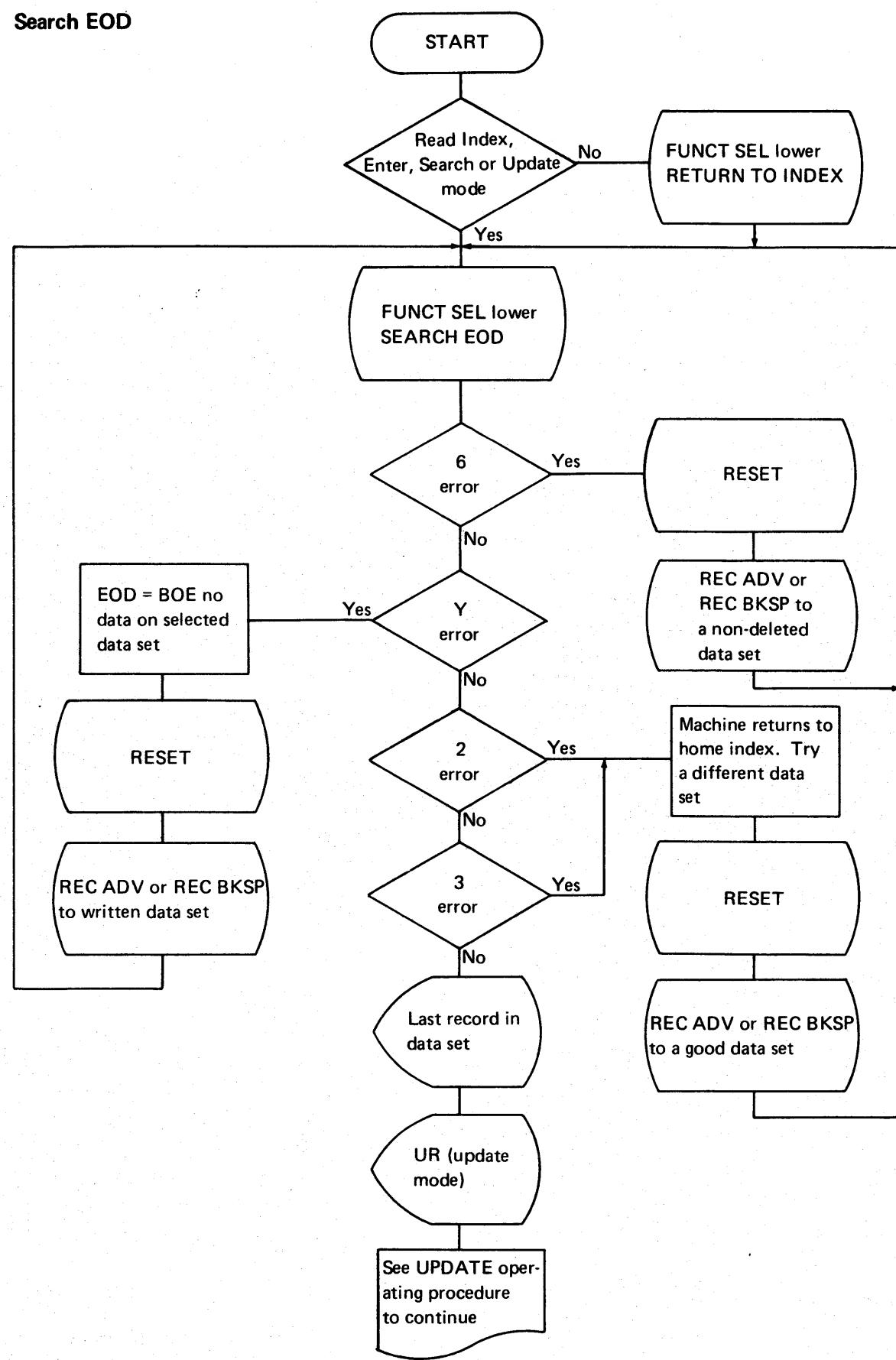
### Verify (With Field Correct)





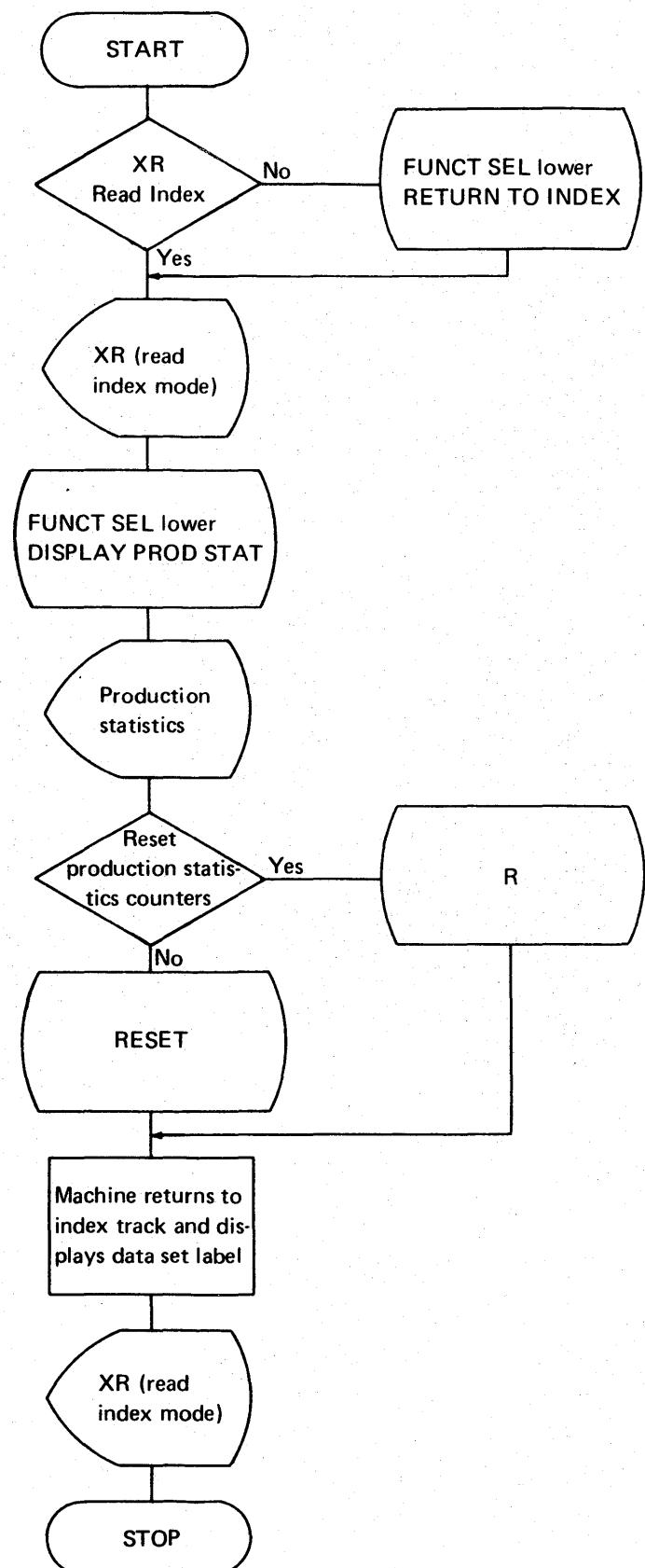


### Search EOD



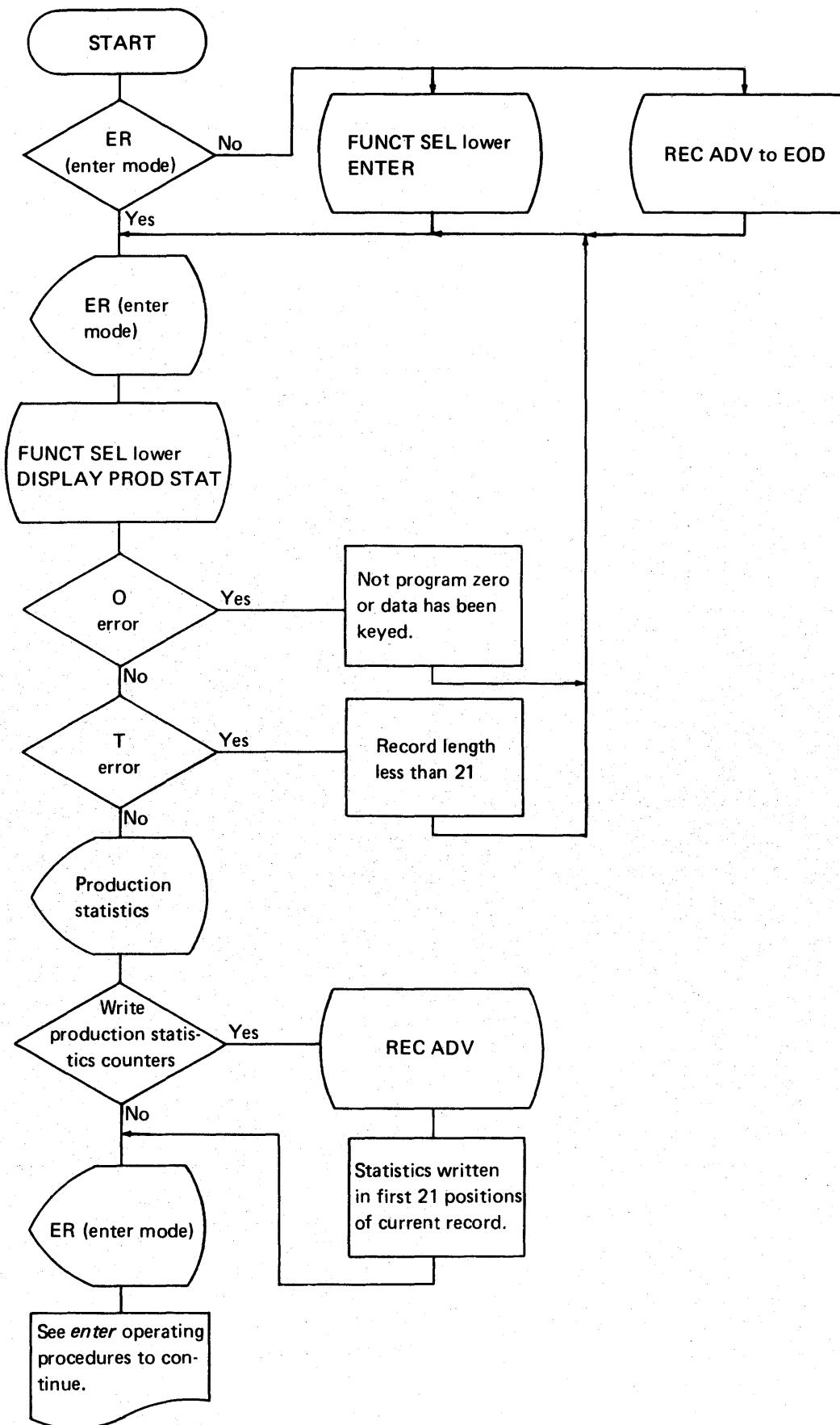
### Production Statistics

#### Read Index Mode



## Production Statistics

### Enter Mode



## Search Content and Search Sequential Content

### Search Masks

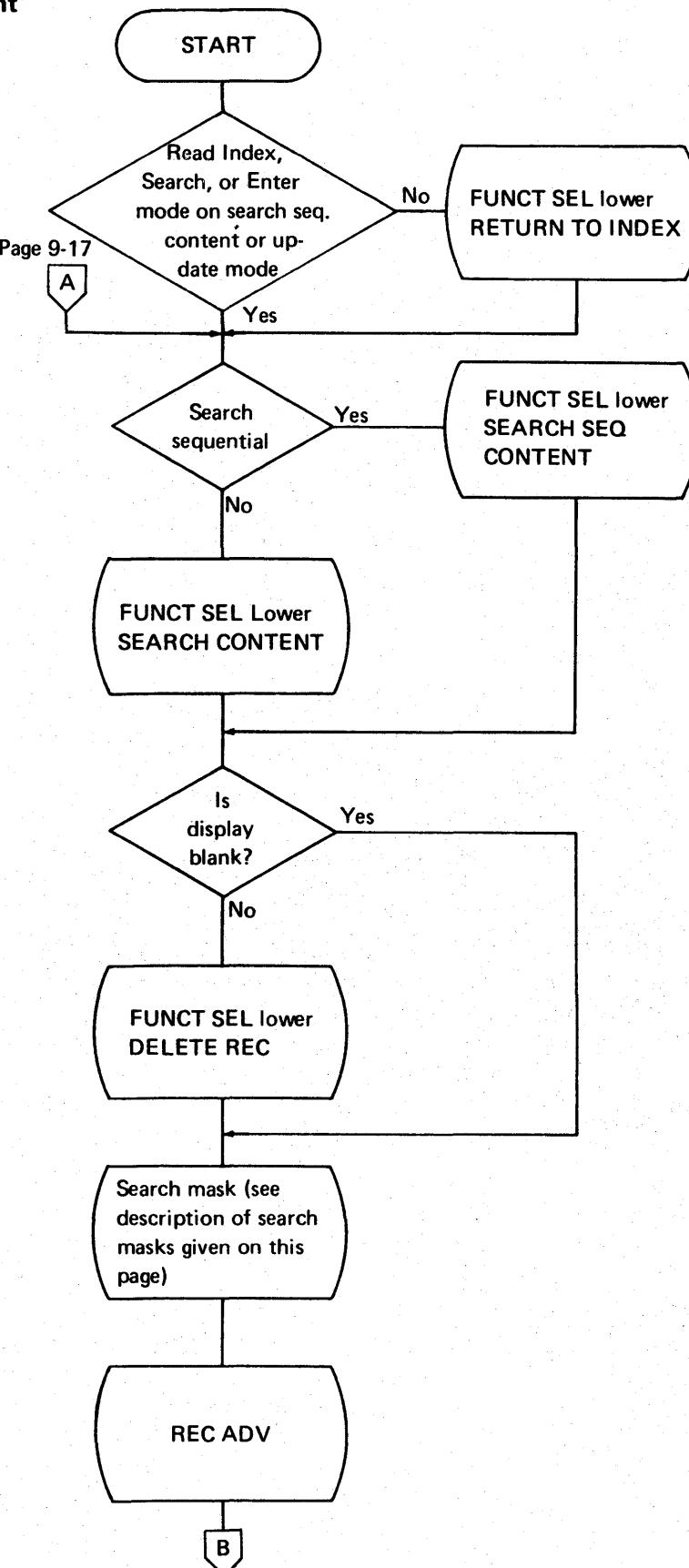
Search Content and Search Sequential Content both require a search mask.

### Search Content Mask

A Search Content mask contains part or all of the data contained in the record being located. Data selected for a search mask must appear in identical positions in the mask and the corresponding record.

### Search Sequential Content Mask

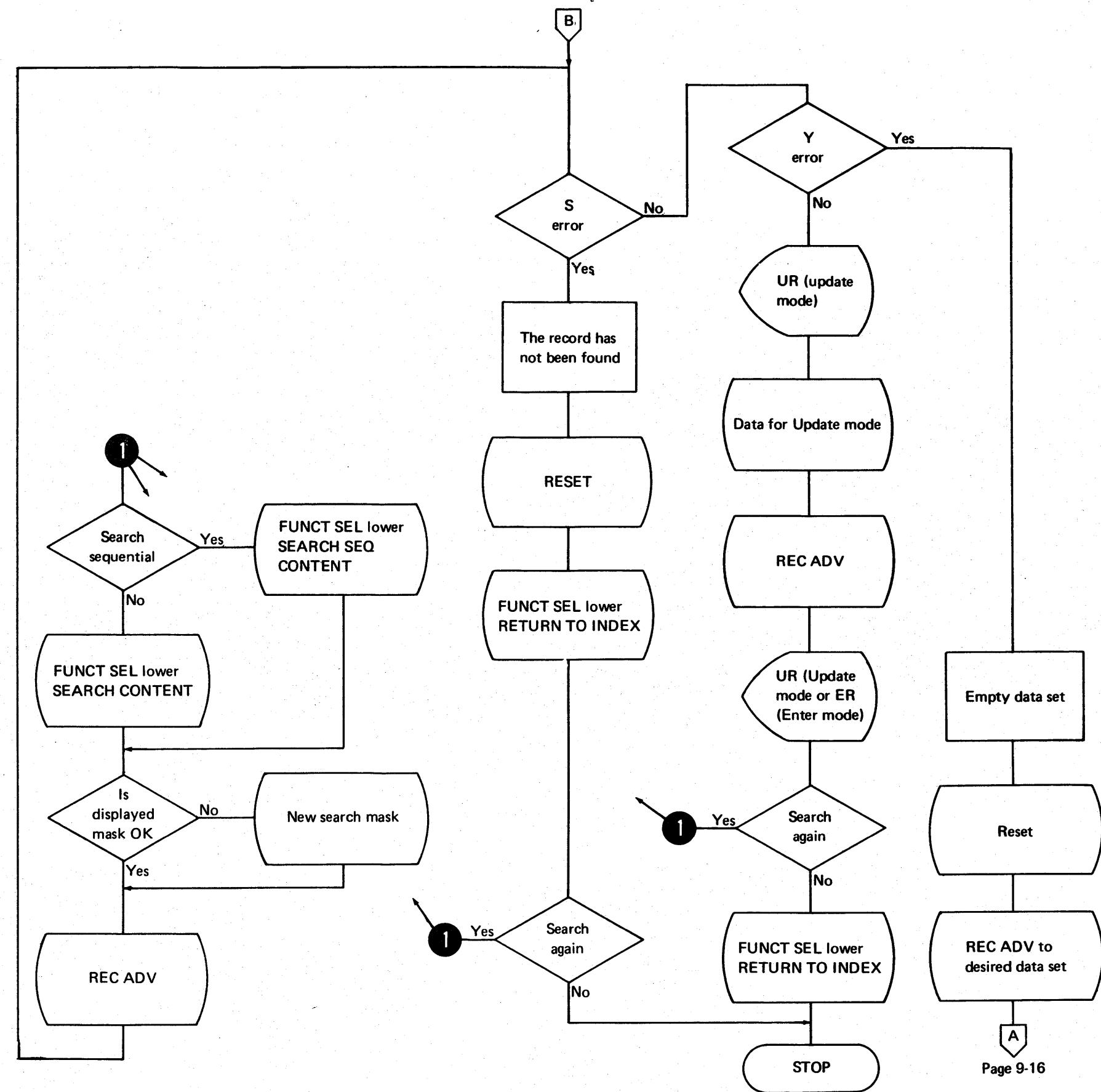
A Search Sequential Content mask is the same as a Search Content mask, but the records being searched must be in ascending alpha numeric order by search field. That is, the search field of each succeeding record must have a higher value than the search field of the preceding record.



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A

B



### Offline Field Totals

The offline field totals feature is used to obtain totals from records that have already been entered, updated, or verified. The offline field totals feature uses the three 19-digit accumulators to add, under program control, data in specific fields into the assigned accumulator. A field total may include any number 0-9 and any of the 256 EBDCIC codes. All codes with low order 4 bits equaling 0-9 are added with a value 0-9. All other codes have the value of zero. All fields in which the units position codes have the high order bits equal to A, B, or D, are negative fields.

The offline field totals feature allows the user to read field totals from an accumulator into a record with or without resetting the accumulator.

#### Selecting Offline Field Totals

Offline field totals feature can be selected from the read index or update mode. When this feature is selected, the mode changes to field totals and an F is displayed on the status line. To perform offline field totals:

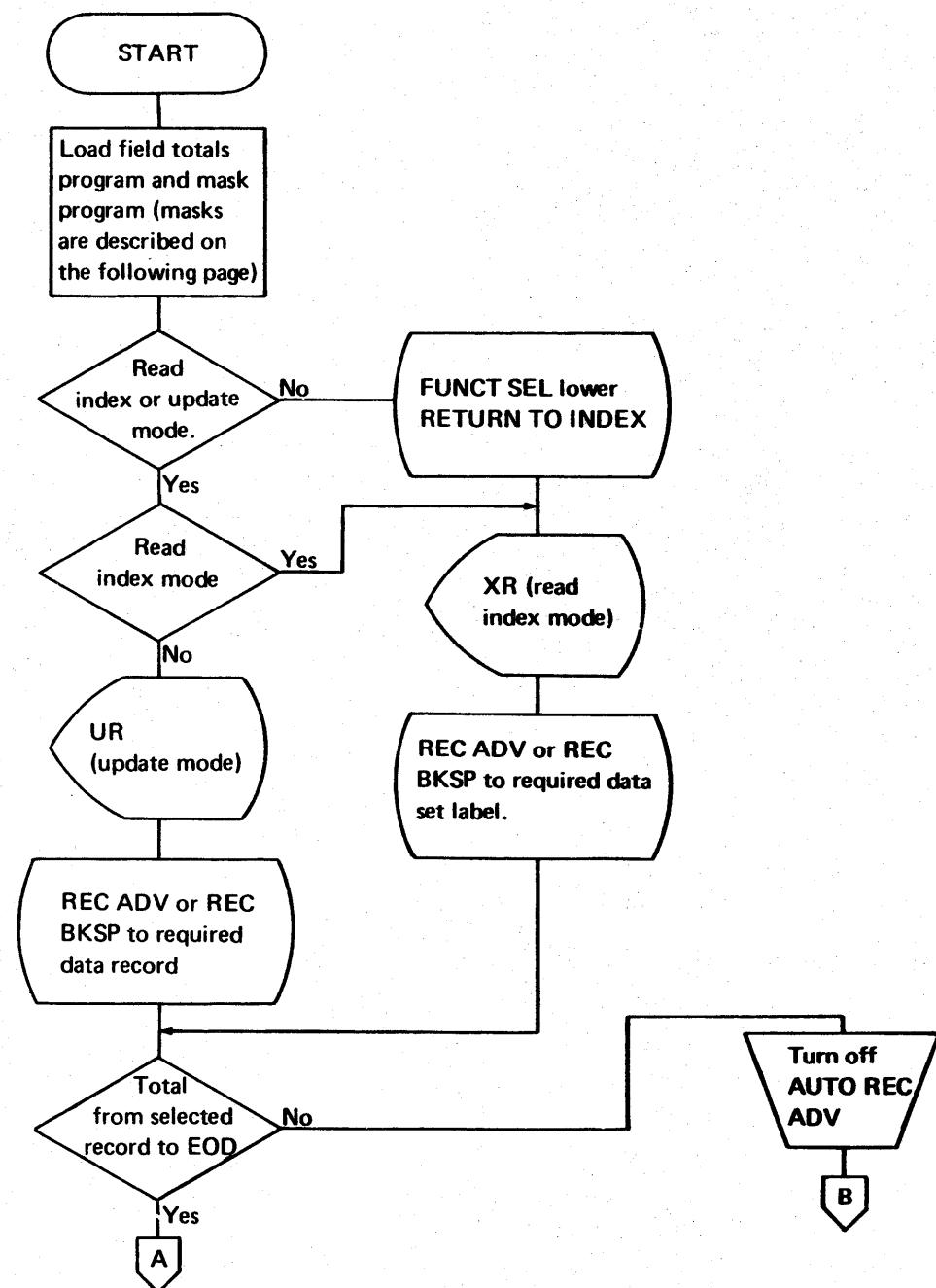
1. Insert diskette and close cover.
2. Load the program and mask statements needed to obtain the field totals.
3. If in the update mode, position the disk to the first record to be used in the field totals operation.
4. Turn AUTO REC ADV switch on for automatic record advancing.
5. Press FUNCT SEL upper and COMPUTE FIELD TOTALS.

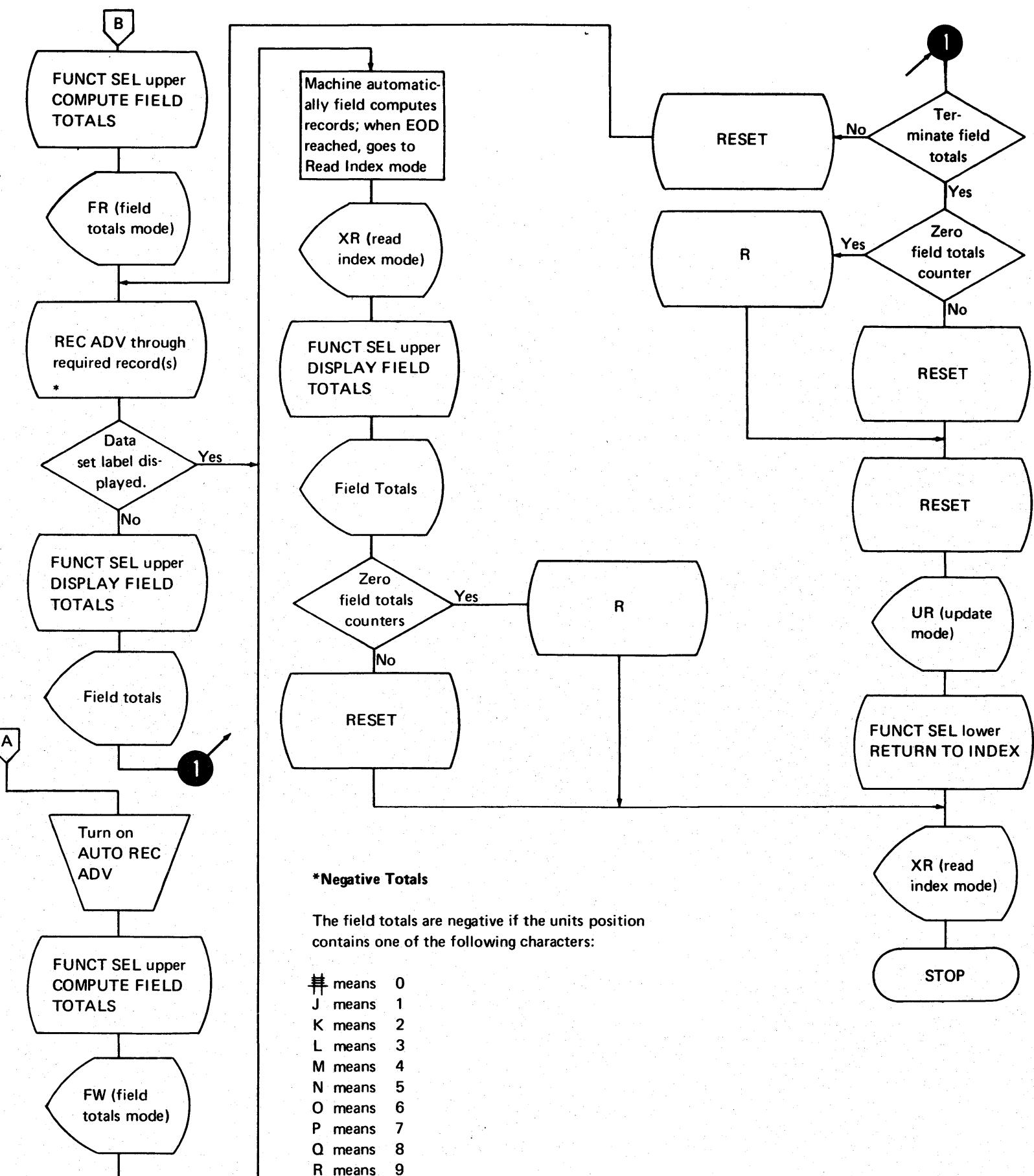
The accumulators are reset to zero, and the field totals operation begins. Records are processed under control of the program specified in the mask statements. Field definition characters are ignored, except those followed by a number. Field totals fields are identified by following a field definition character with a 1, 2, or 3 which specifies which of the three accumulators is to be used. The second and third positions after the field definition character can be used to cause the field to be accumulated into two or three accumulators.

The low order 14 digits of a field totals field are added into the specified accumulators. Overflow beyond 19 digits in an accumulator is not indicated. Deleted records are bypassed. Disk errors and invalid mask statement errors stop the field totals operations.

If AUTO REC ADV is turned off, the field totals operation stops and the record following the last record processed is displayed. Press REC ADV to process the record displayed and advance to the next record. Pressing RESET during a field totals operation changes the mode to update mode.

At the end of a field total operation, the accumulators retain the field totals. If the end-of-data address is reached, the data set label is displayed and the mode changed to read index mode.





### Writing Field Totals Into Records on Disks

After field totals are accumulated in the accumulators, the contents of the accumulators can be written into a field in the record on disk. This is done by programming the field in the record into which the total is to be read with the field definition character B followed by 4, 5, 6, 7, 8, or 9. If 4, 5, or 6 is specified, the contents of the accumulator does not change. If 7, 8, or 9 is specified, the accumulator is reset to zero. (4 and 7 specify accumulator 1, 5 and 8 specify accumulator 2, and 6 and 9 specify accumulator 3.)

If the field in the record that the accumulated total is to be read into is shorter than the accumulated total, only the low order digits of the accumulator are read into the field in the current record buffer. If the field in the record is larger than the accumulated total (19 digits), the total is right-adjusted in the field and the remainder of the field is filled with zeroes.

### Sample Field Totals Procedure

- Press FUNCT SEL lower
- Press RETURN TO INDEX
- Press FUNCT SEL lower
- Press DISPLAY FIELD TOTALS
- Press R
- Set AUTO REC ADV switch on.
- Enter the following N
- Press NUM SHIFT and U
- Press E
- Press FUNCT SEL lower
- Press PROG LOAD
- Press U
- Enter the following < 1. (include period).
- Press FUNCT SEL lower
- Press PROG LOAD
- Press I
- Press SEL PROG
- Press U
- Press FUNCT SEL lower
- Press ENTER
- Hold REP and press U key to enter 32 records. (32 records in this example)
- Press FUNCT SEL lower
- Press RETURN TO INDEX
- Press FUNCT SEL upper
- Press COMPUTE FIELD TOTALS
- Press FUNCT SEL upper
- Press DISPLAY FIELD TOTALS (if 32 records were accumulated, display should be +352)
- Press R

### Mask Statements

A mask statement can be used to cause a particular program to be selected to process a particular type of record. The mask statement has the following formats:

<FCCCWM,M,M.  
or  
<FCCCNM,M,M.

The characters in the mask statement format have the following meanings:

Characters	Meaning
<	This character identifies the program as a field totals mask format and must be in the first position of every program buffer used for mask statements.
F	The F stands for any character 1-9 or A indicating which field totals program is to be selected if this mask statement is satisfied.
CCC	CCC stands for a 3-digit position number indicating the position of the data record that is to be compared with the mask: 001-080 (001-128 if the 128-record-length feature is installed.)
W or N	W indicates the position in the record must contain the character used as a mask for the search to be satisfied. N indicates that the record position must not have the mask character.
M	M stands for the character with which the record position is to be compared. This is called the mask.

A comma (,) must separate mask characters.

The mask statement <1010WA, B, C. means that the data record is processed by the off-line field totals program in program buffer 1 if position 10 of the data record contains at least one of the characters A, B, or C. The mask statement <1010NA, B, C. means that the data record is processed by the off-line field totals program in program buffer 1 if position 010 of the data record does not contain any of the characters A, B, or C.

The & character can also be used in a mask statement to perform a logical 'and' function. For example, the mask statement <1001WA,B&010WZ. means that the data record is processed by the field totals program in program buffer 1 if position 001 of the data record contains one of the characters A or B and position 010 of the record contains the character Z.

If more than one mask statement is specified in a program buffer, each mask statement must be separated by a semicolon (;). The last character in a program buffer must be either a colon (:) or a period (.). The colon indicates that the mask statements are continued in a higher numbered program buffer. (If a colon is specified after a W, N, or comma, the colon is treated as a mask character.) The period indicates the end of the last mask statement. A program number followed by a period (1.) indicates an unconditional program selection.

If none of the mask statements are satisfied by the data record, the data record is not processed by the field totals program.

### Example

An offline field totals operation is to be performed on a data set that contains several different kinds of records. The field totals operation to be performed depends upon the content of the records.

The following table shows the field totals operation to be performed for each record type. If the record type indicated by the first column in the figure contains the data indicated by the second column, the operation in the third column needs to be performed.

Depending upon the type of record, one of four different types of field total operations are performed: (1) add a field to both accumulators 1 and 2, (2) add the field to accumulator 2 only,

Record Type	Contents	Desired Operation
1	A in position 10 and a B in position 25 or A in position 10 and a C in position 25	Add the field in positions 30-35 of the record to accumulators 1 and 2
2	Numbers in position 50	Add the field in positions 30-35 of the record to accumulator 2
3	Positions 50 through 55 are blank	Read the contents of accumulator 1 into the record in positions 1-10 and reset accumulator 1
4	All records that do not satisfy the conditions of the other 3 types of records	Add the field in positions 30-35 of the record to accumulator 3

(3) read the contents of accumulator 1 into the current record buffer and reset the accumulator, or (4) add the field to accumulator 3. Four different programs are required to do these operations.

This example used program buffers 1-4 for these programs. Program buffer 1 contains the program to add the field in positions 30-35 of the data record into accumulators 1 and 2. To program a field as a field totals field, use any field definition followed by 1, 2, or 3 to indicate the accumulator. All field definition characters in the program except those used by field totals are ignored.

In this example, all fields except the field totals field are programmed as bypass fields. The program in program buffer 1 is:

B-----N12---E  
Field totals  
field positions 30-35

Program buffer 2 contains the program to add the field in positions 30-35 of the data record into accumulator 2. The program in program buffer 2 is:

B-----N2---E  
Field totals  
field in positions 30-35

Program buffer 3 contains the program for the record that accumulator 1 is to be read into. The accumulator is read into positions 1 through 10 of the record. The program also causes accumulator 1 to be reset to zero. The program in program buffer 3 is:  
B7-----E

Program buffer 4 contains the program to add the field in position 30-35 of the record into accumulator 3 if the conditions to use the program in program buffers 1-3 are not satisfied. The program in program buffer 4 is:  
B-----N3---E

To cause the program that is to process each record type to be selected automatically, you write mask statements. Each mask statement indicates the condition that must be satisfied before a program is selected. The mask statements for this example begin in program buffer 5. Each mask statement is separated by a semicolon. The colon is used at the end of program buffers 5 and 6 to indicate the mask statements are continued in the next program buffer. The mask statements follow:

**Program Buffer 5**  
<1010WA&025WB,C ;2050W0,1,2,3:

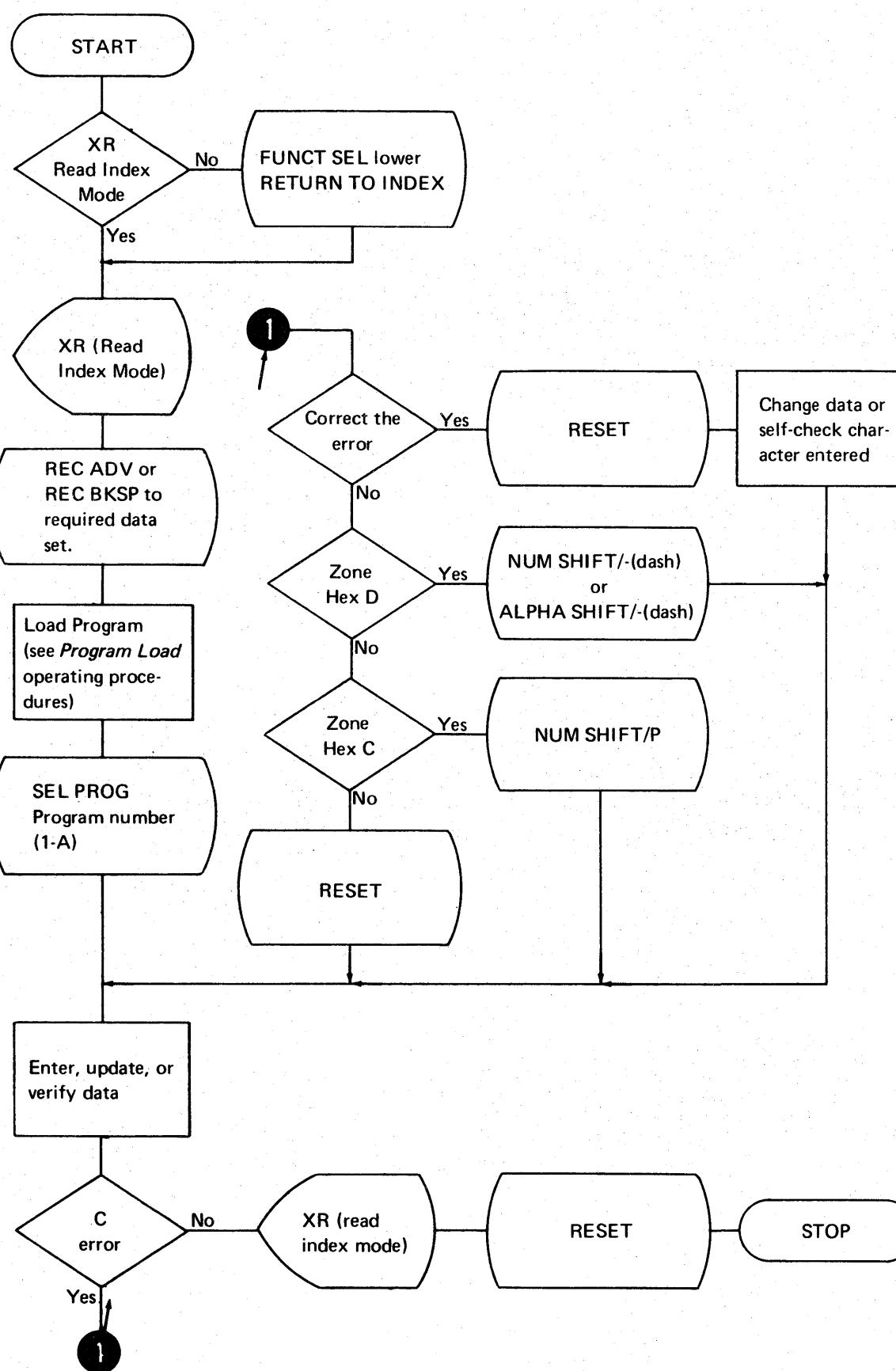
Selects program level 1 if position ten contains an A and position 25 contains a B or C. Selects program level 2 if position 50 is numeric. This mask statement is continued in program buffer 6.

**Program Buffer 6**  
<4,5,6,7,8,9;3050Wb&051Wb&052Wb&053Wb&;

Continued from program buffer 5 Selects program level 3 if positions 50-55 are blank. (The b in the example represents a blank space.) This mask statement is continued in program buffer 7.

**Program Buffer 7**  
<054Wb&055Wb;

Continued from program buffer 6 Selects program level 4 if another program level has not been selected.

**Self-Check****Self Check****Modulus 10**

Modulus 10 is designed to detect either incorrect keying of a single digit or a single transposition. The following arithmetic process is used to generate the check digit, regardless of the method of generation employed (generator, computer, or manual):

1. The units position and every alternate position of the basic code number is multiplied by 2.
2. The digits in the product and the digits in the basic code number that are not multiplied by 2 are crossfooted.
3. The crossfooted total is subtracted from the next higher number ending in zero.
4. The difference is the check digit.

**Example:**

Basic code number	6 1 2 4 8
Units and every alternate position of basic code number	6 2 8
Multiply by 2	X2
Product	1 2 5 6
Digits not multiplied by 2	1 4
Cross add	1+2+1+5+4+6 =19
Next higher number ending in zero	20
Subtract crossfooted total	-19
Check digit	1
Self-checking number	6 1 2 4 8 1

**Other Examples:**

Self-Checking Number		
Basic Code Number	Basic Code	Check Digit
45626	45626	9
30759	30759	5
73074	73074	7

In Modulus 10 self-checking, the space and zero have the same numeric value; therefore, spaces can be substituted for nonsignificant leading zeros. The use of spaces is valid only when they are keyed.

### **Modulus 11**

Modulus 11 is designed to detect single digit mispunches, single transpositions, and double transpositions. The main feature of this system, distinguishing it from other self-checking number systems, is that it is based on a weighted checking factor for each digit in the basic number being tested. Regardless of how the self-check digit is generated, the following arithmetic process is used:

1. Each digit position of any basic number is assigned a weight (checking factor). These factors are: 2, 3, 4, 5, 6, 7, 2, 3, 4, 5 . . . starting with the units position of the number and progressing toward the high-order digit.
2. In the following example, write the number as illustrated, leaving space between the digits.
3. Below each digit, starting at the right and working left, place the corresponding checking (weighting) factor.
4. Multiply each digit by its checking factor and add the products.
5. Because this is a Modulus 11 operation, divide the sum of the products by 11, and subtract the remainder from 11. The result is the check digit.

#### **Example**

Basic number: 943457842									
Write digits of basic number: 9    4    3    4    5    7    8    4    2									
From right to left, write checking factors:        4    3    2    7    6    5    4    3    2									
Add the products:                          36 + 12 + 6 + 28 + 30 + 35 + 32 + 12 + 4 = Total 195									
Divide: 195 divided by 11 = 17 plus a remainder of 8									
Subtract: 8 subtracted from 11 = 3 (the check digit)									
The new self-checking number is: 9434578423									

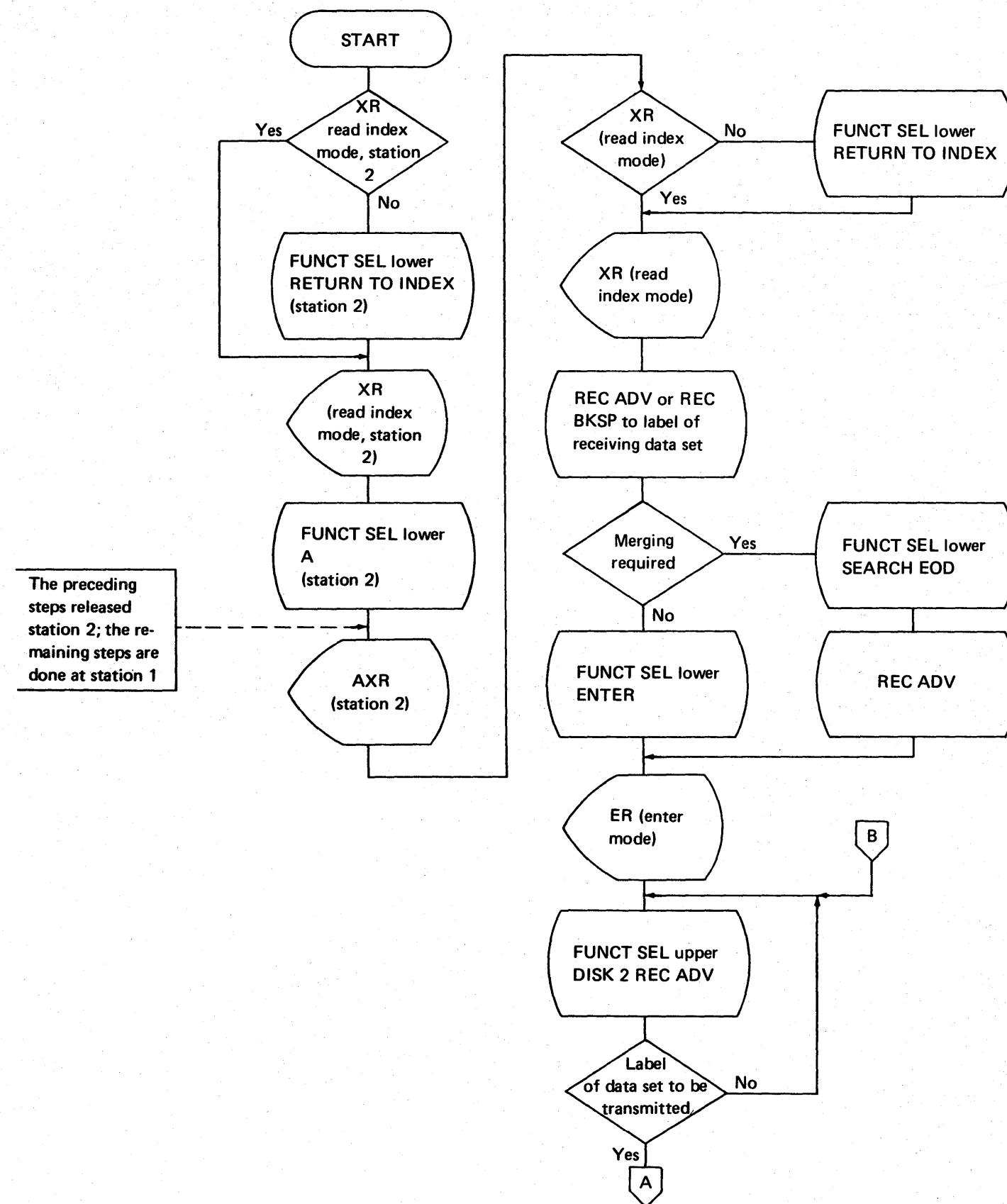
In Modulus 11 operation, basic numbers that require a check digit of 10 cannot be used as self-checking numbers. The accounting system must be adjusted to eliminate such numbers from codes that are to be self-checked. If an operator is generating check digits and punches a basic number requiring a check digit of 10, the machine indicates an error condition.

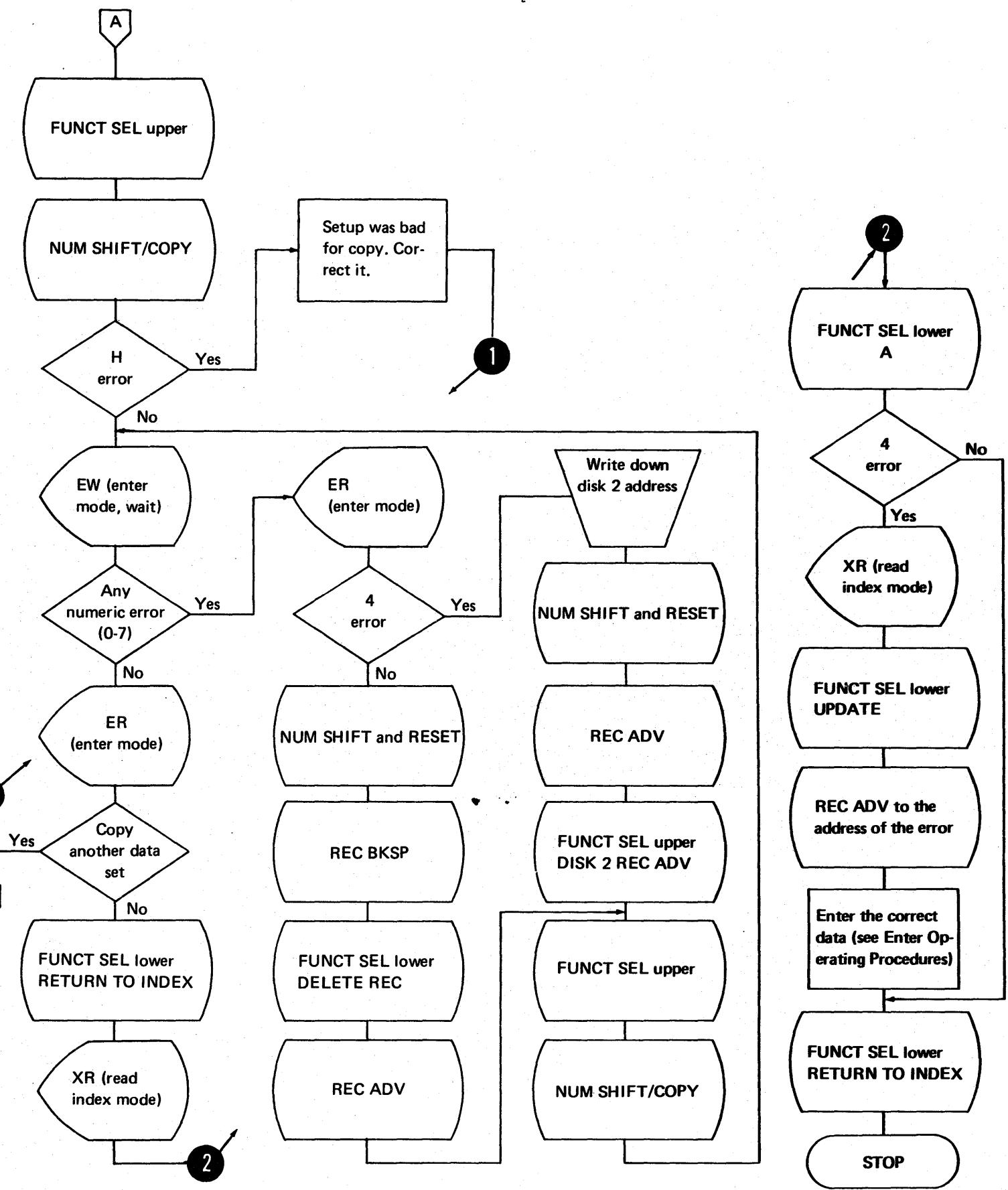
Self-check fields are specified in the program by the use of one of the characters C, G, M or H, F, L as the field identification character. The field definition characters have the following meanings:

C or H — modulus 11 or 10 — Normal  
G or F — modulus 11 or 10 — Skip  
M or L — modulus 11 or 10 — Dup

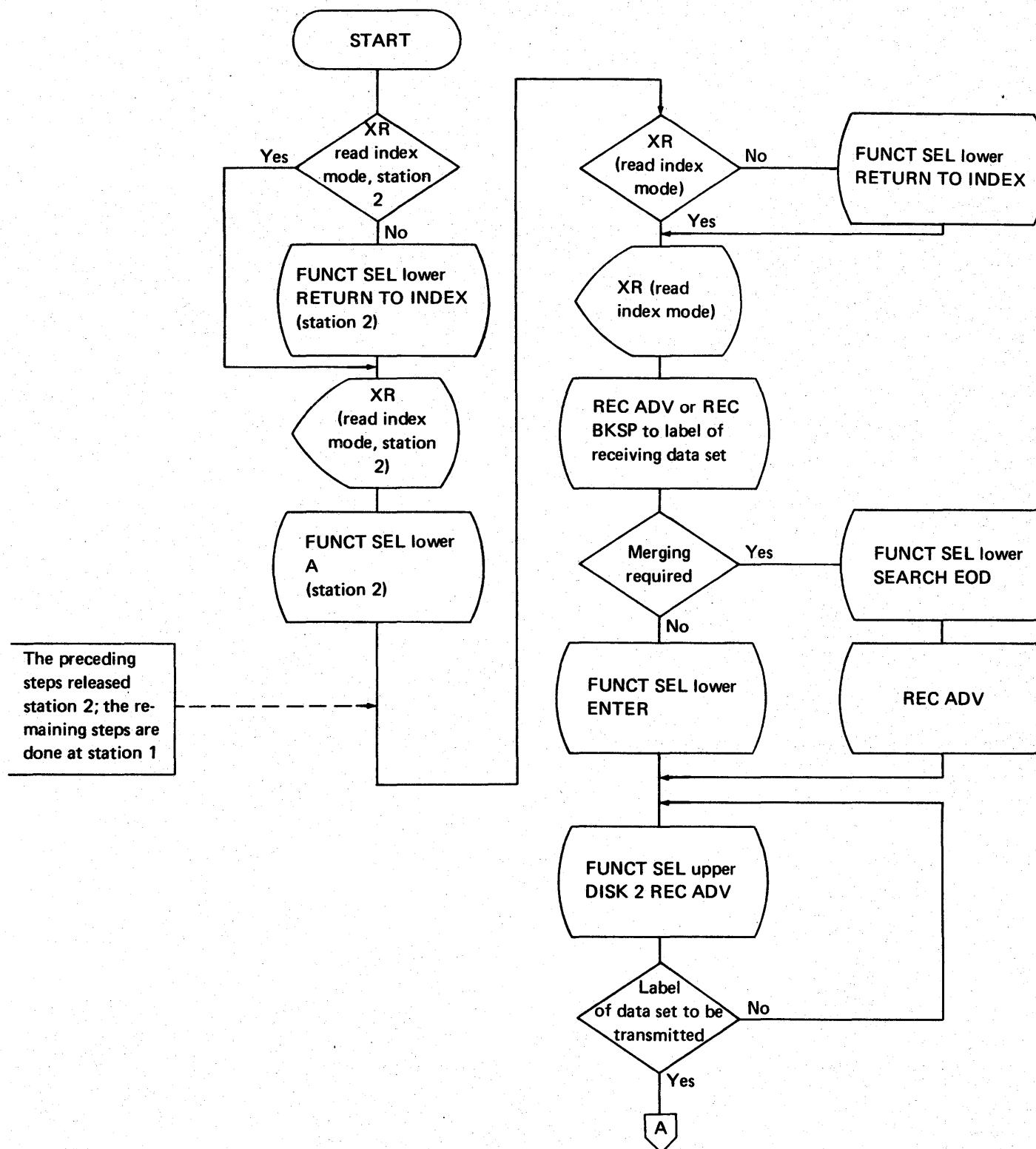
Blank fields (fields totally filled with the blank character) will check correctly in the Enter mode, but will cause an error in the Verify mode.

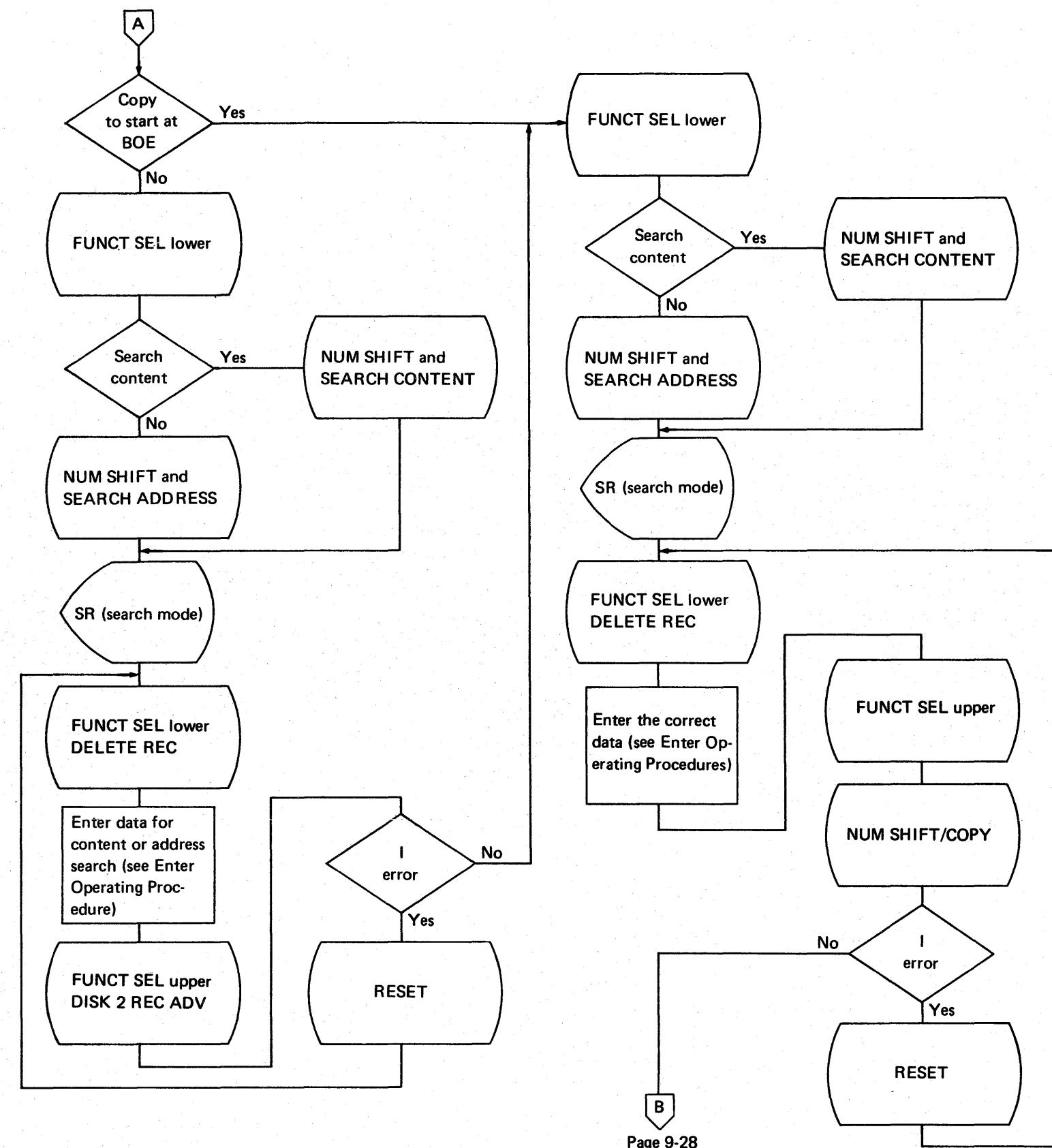
### Copy Data Set (to EOD)



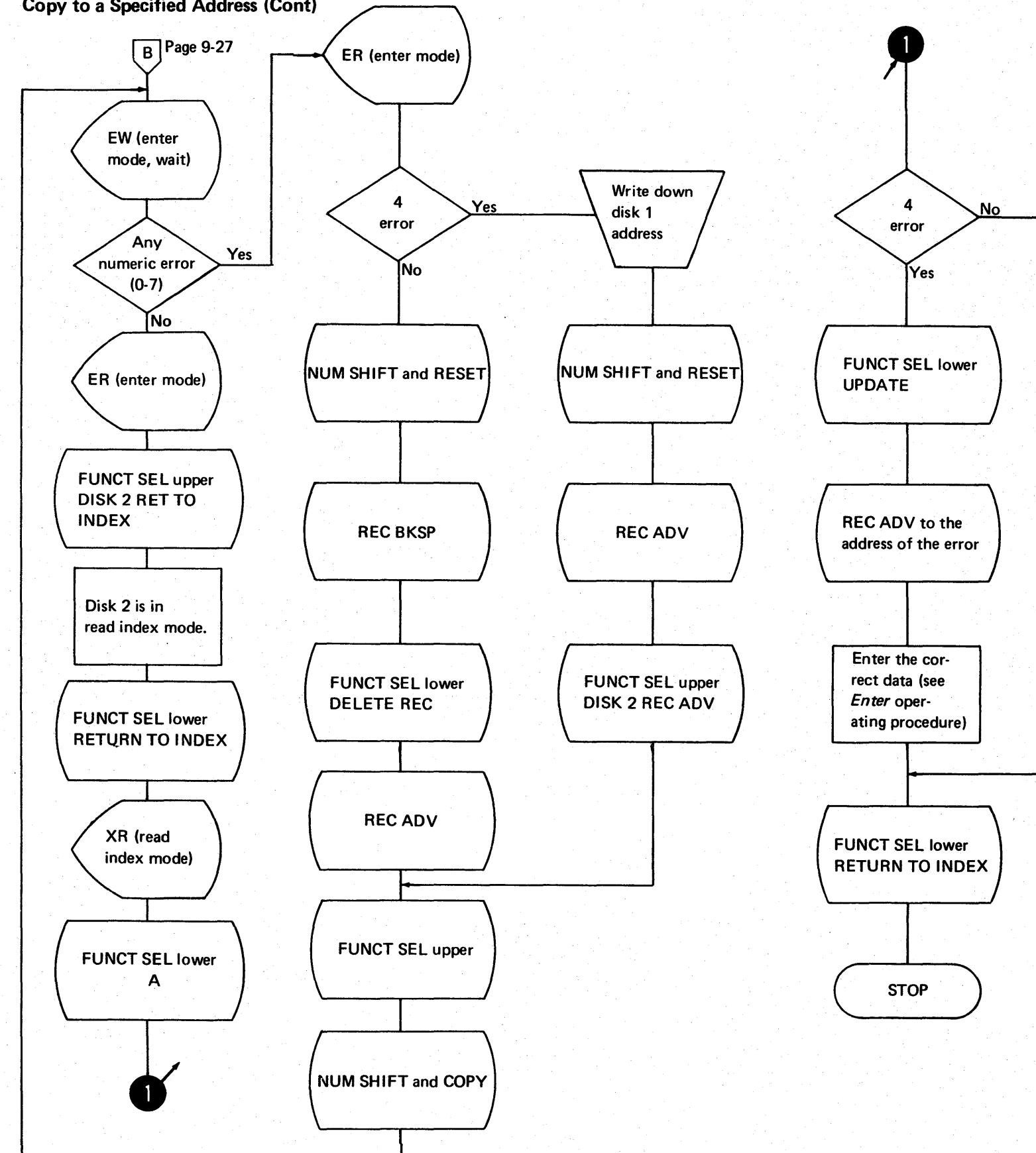


## **Copy to a Specified Address**



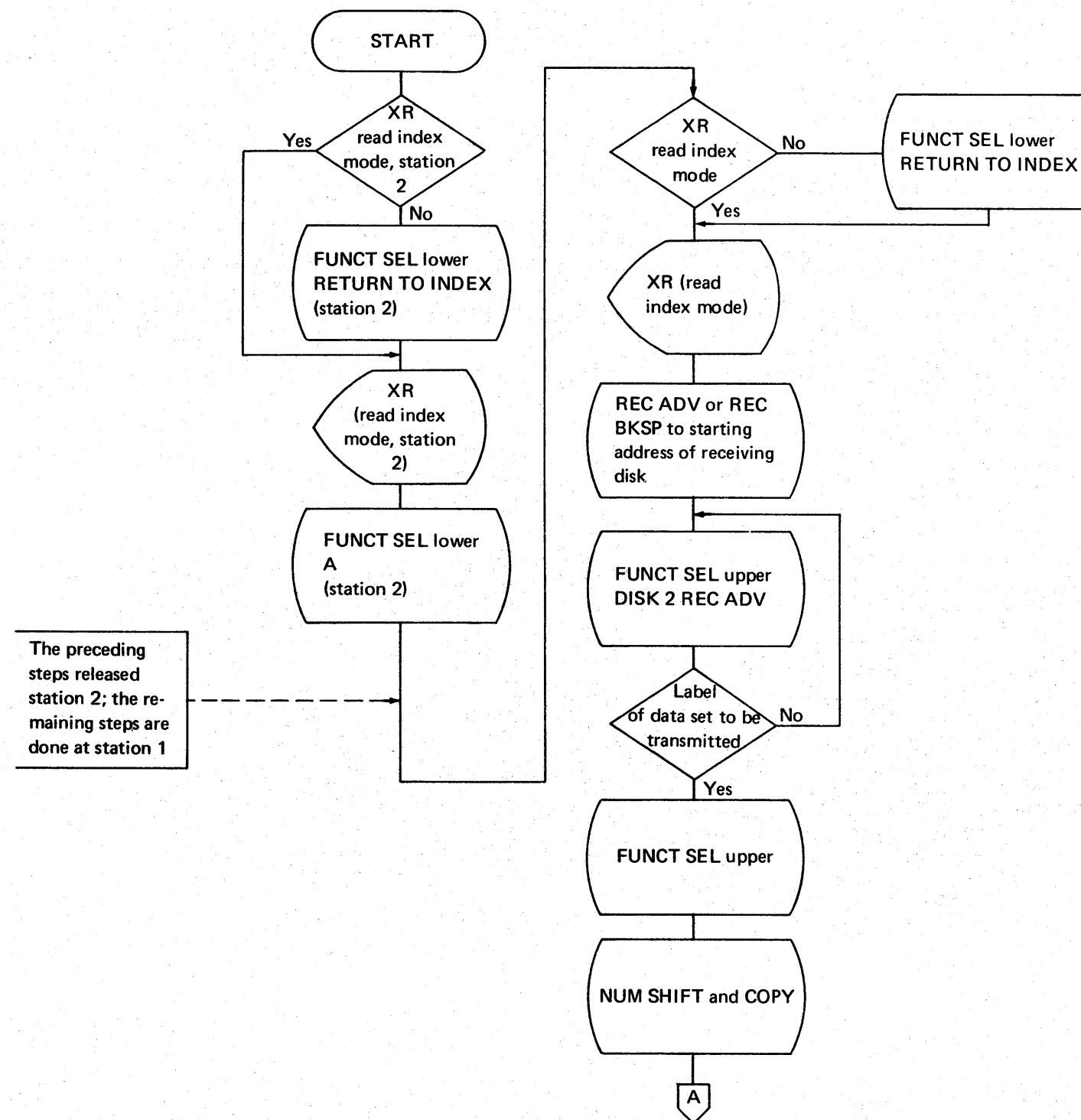


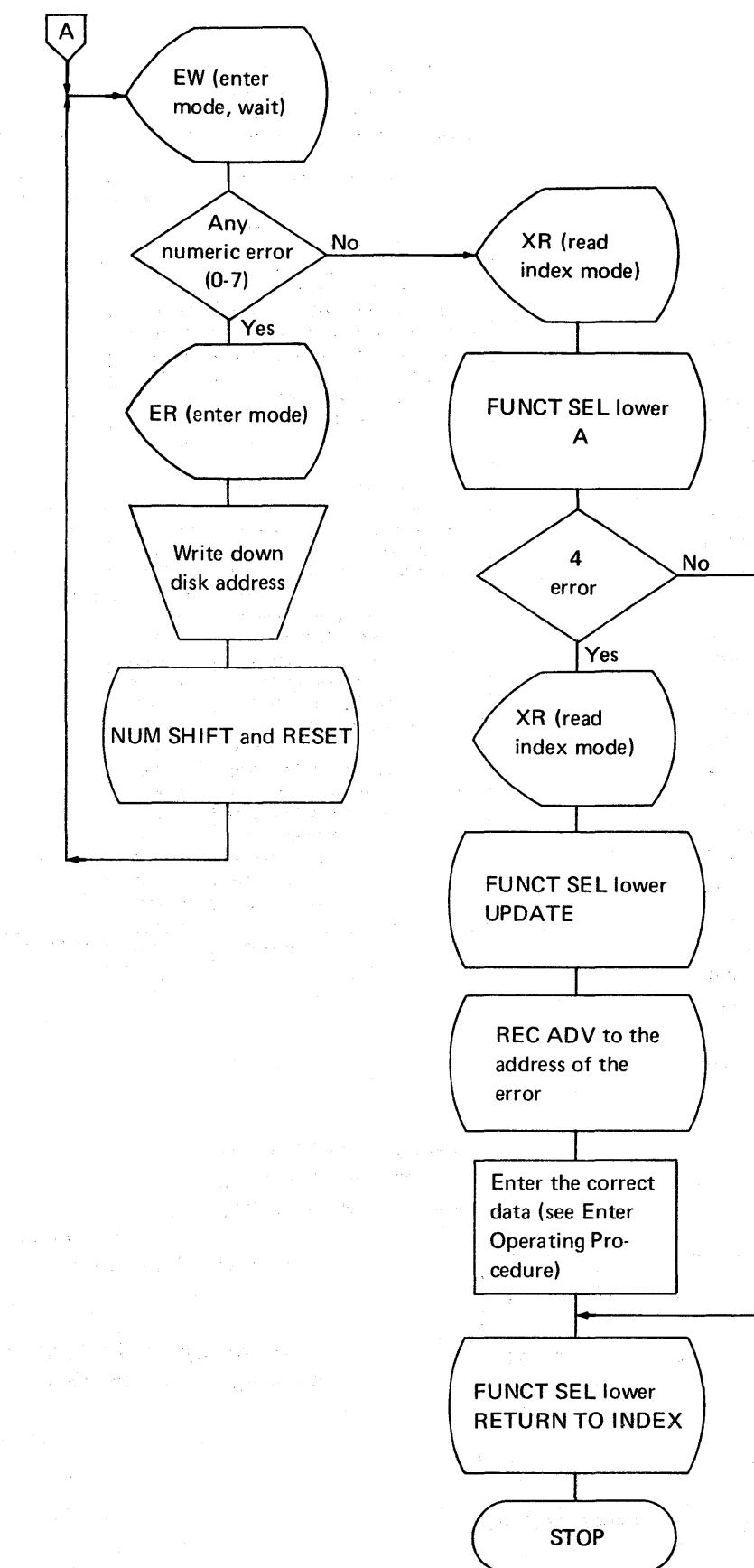
### Copy to a Specified Address (Cont)



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### Copy Image (to EOE)





### How to Make a Program

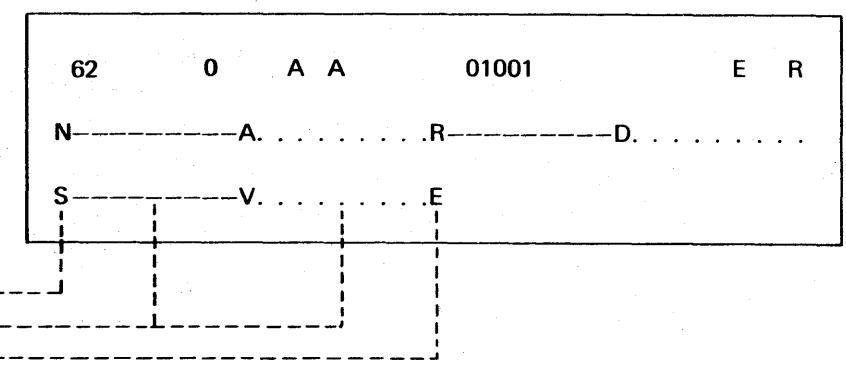
1. Start each field with a Begin Field code.
2. After the Begin Field code, put the number of Continue Field codes, — (dash) for numeric shifts and . (period) for alpha shifts, you need to complete the length of the field.
3. Put an E at the end of your program unless the program uses all the record positions specified in the record length.

Program Code Chart

	Code	Verify Bypass	Shift	Function
Begin Field Codes	N A ↗ J R ↗ I B D U ↗ S K ↗	V W ↗ Y X ↗ Z	Numeric Alpha "Katakana Numeric Numeric "Katakana Alpha Numeric Alpha "Katakana Numeric Alpha "Katakana	Manual Fields Manual Fields Manual Fields Right-Adjust, blank fill Right-Adjust, zero fill Right-Adjust, blank fill Right-Adjust, blank fill Bypass Automatically Duplicates Automatically Duplicates Automatically Duplicates Automatically Skips Automatically Skips Automatically Skips
Continue Field Codes	— • □		Numeric Alpha "Katakana	Continues Field in Numeric Shift Continues Field in Alpha Shift Continues Field in Katakana Shift
End Program Code	E			Marks End of Program
Feature Begin Field Codes	H C F G L M		Numeric Numeric Numeric Numeric Numeric Numeric	Self-Check, Modulus 10 Self-Check, Modulus 11 Auto Skip Self-Check, Modulus 10 Auto Skip Self-Check, Modulus 11 Auto Dup Self-Check, Modulus 10 Auto Dup Self-Check, Modulus 11 (See "Self-Check", page 9-15.) Field Totals Entry (See "Field Totals", page 9-12 and 9-14.)
Any Begin Field character followed by 1, 2, or 3.				
B Bypass Begin Field character followed by 4, 5, or 6;				
B followed by 7, 8, or 9.				
Field Totals Read Out – Offline				
Field Totals Read Out and Reset – Online or Offline (See "Writing Field Totals into Records or Disks", page 9-13.)				

\*Katakana machines only.

### Sample Program



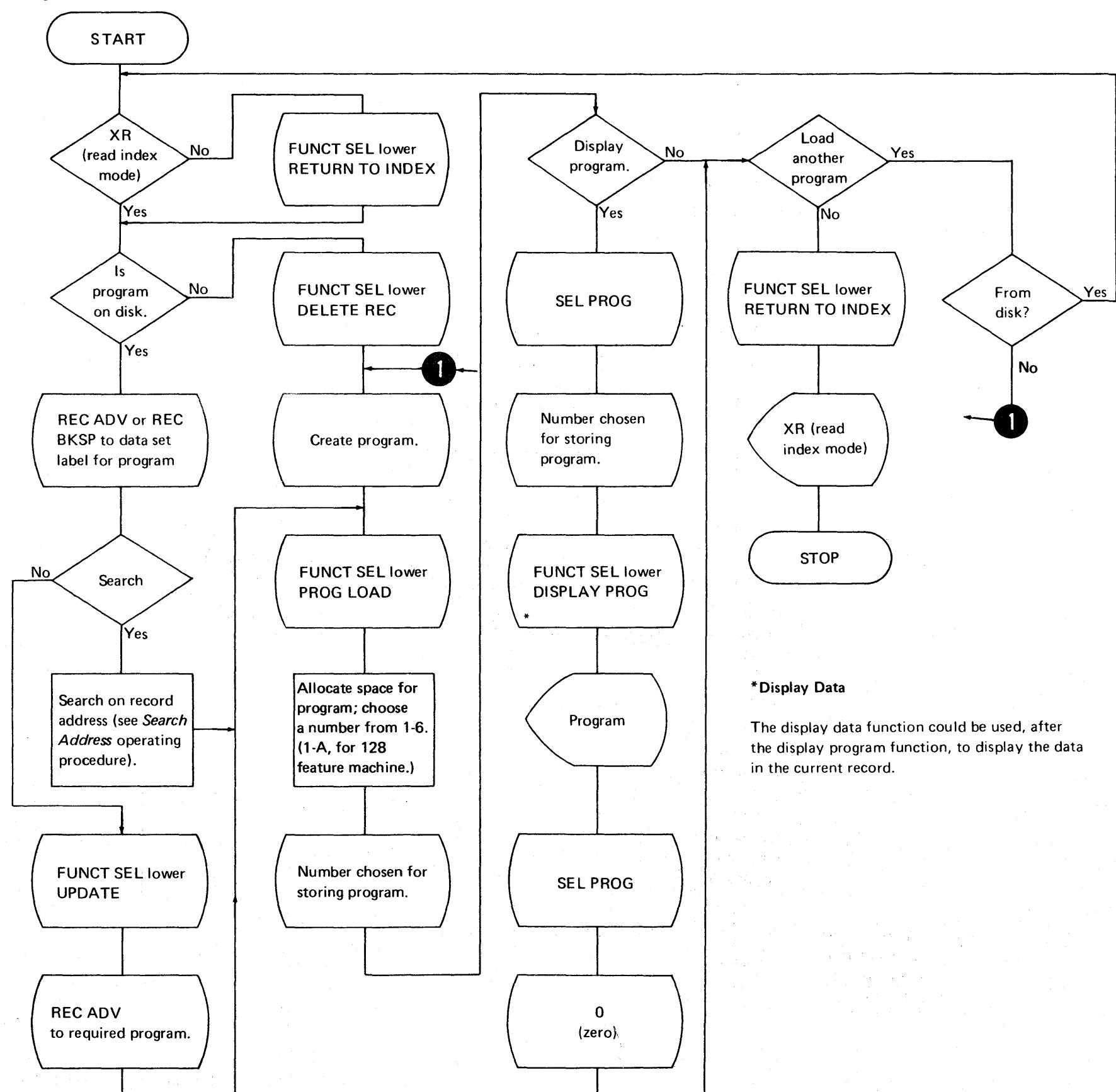
### Program Record Length

Program records can be any length up to the maximum of 80 characters (128 characters if the 128-record-length feature is installed), but all program records on a data set must have the same logical record length. Users can choose to make all program records 80 (or 128) characters long regardless of program length and terminate programs with E. Programs generated on the keyboard after the logical record length has been established (a record has been read in Update or Verify mode or written in Enter mode) do not require the E.

### Program Chaining

Program chaining provides automatic selection of the program to be used with the next record. The program to be selected, when record advancing, is designated by the appropriate program number in position 80 (position 128 if the 128-record-length feature is installed) of the current program. The program to be selected, when record backspacing, is designated by the appropriate program number in position 79 (position 127 if the 128-record-length feature is installed) of the current program.

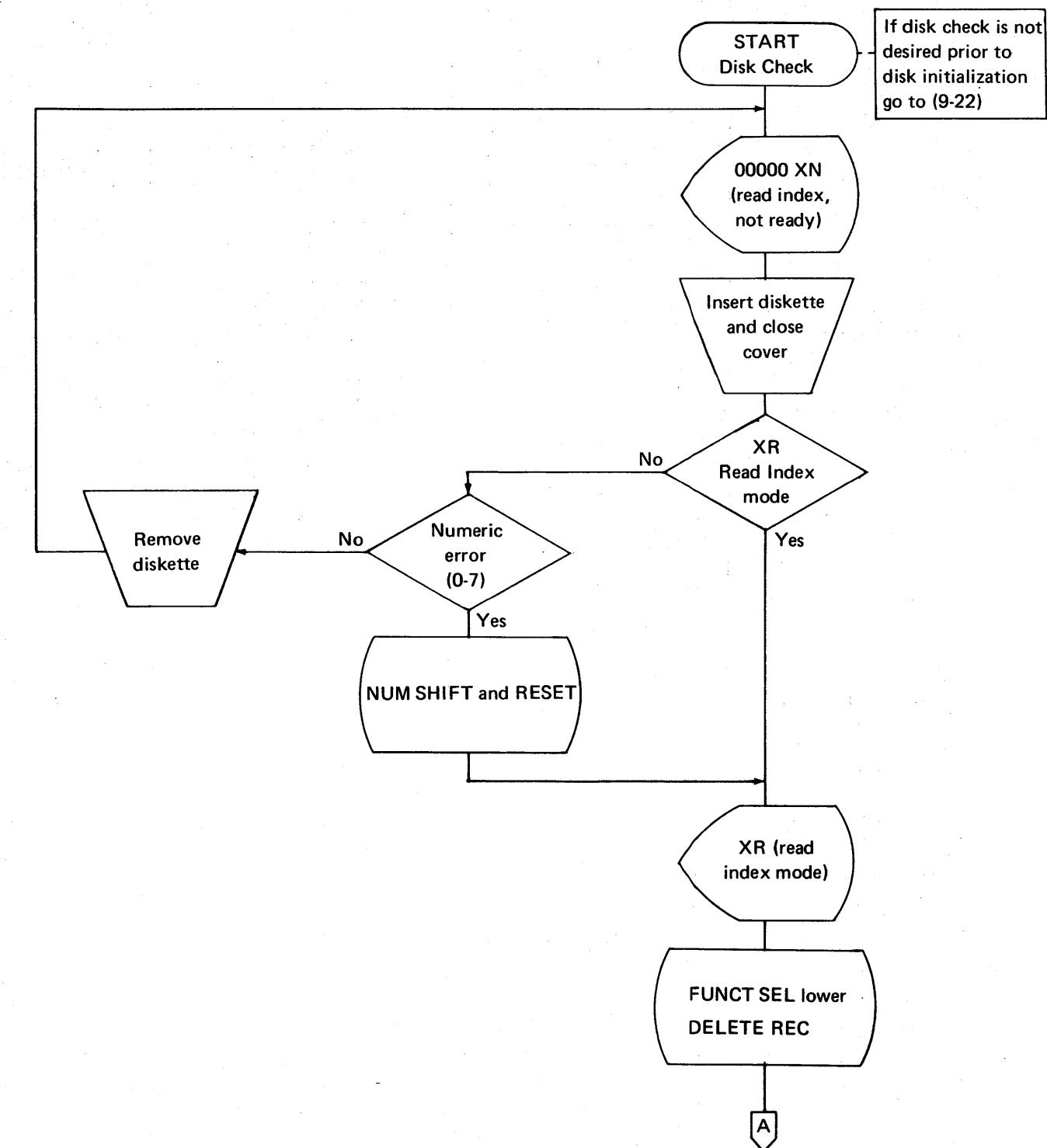
### Program Load



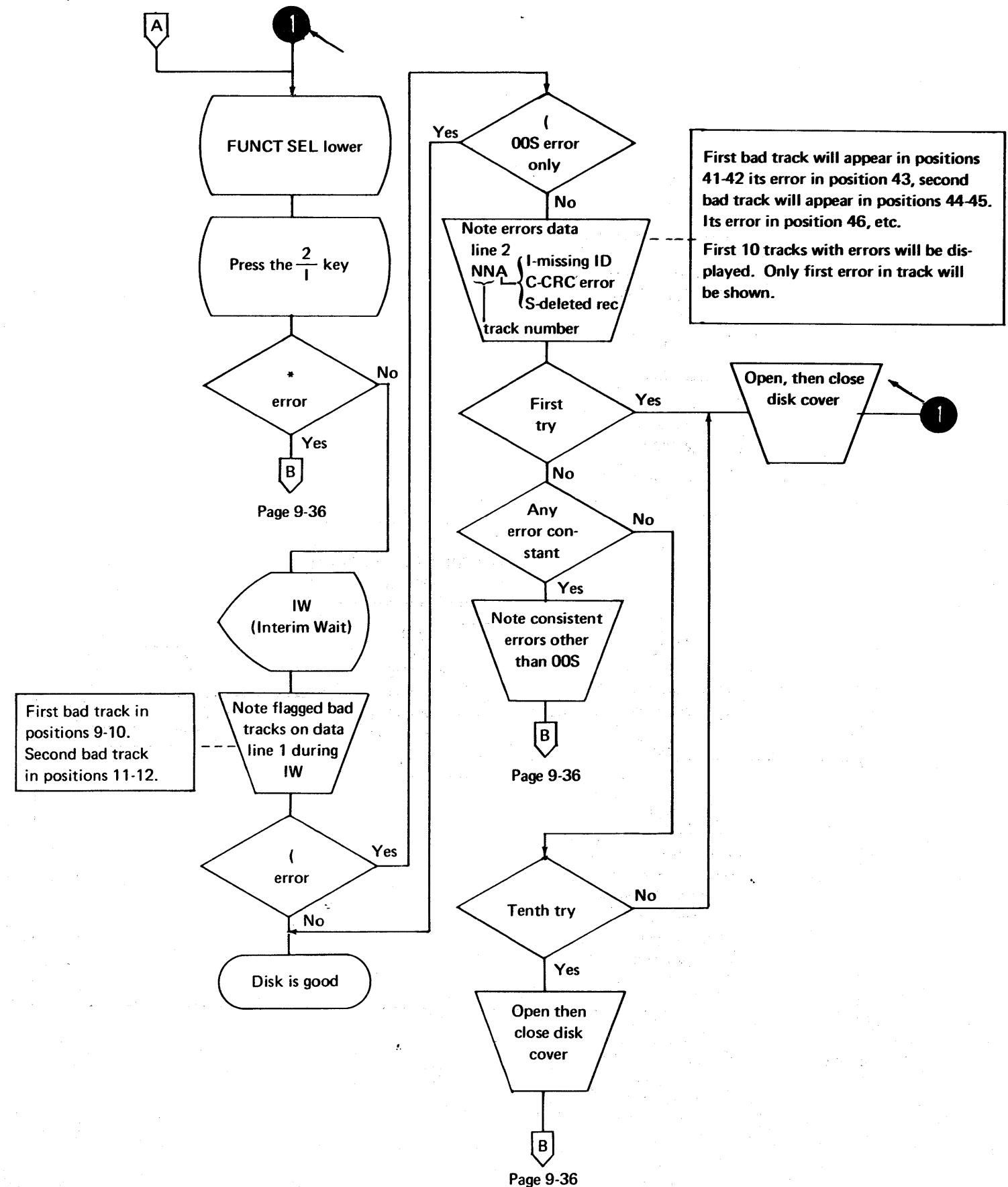
#### \*Display Data

The display data function could be used, after the display program function, to display the data in the current record.

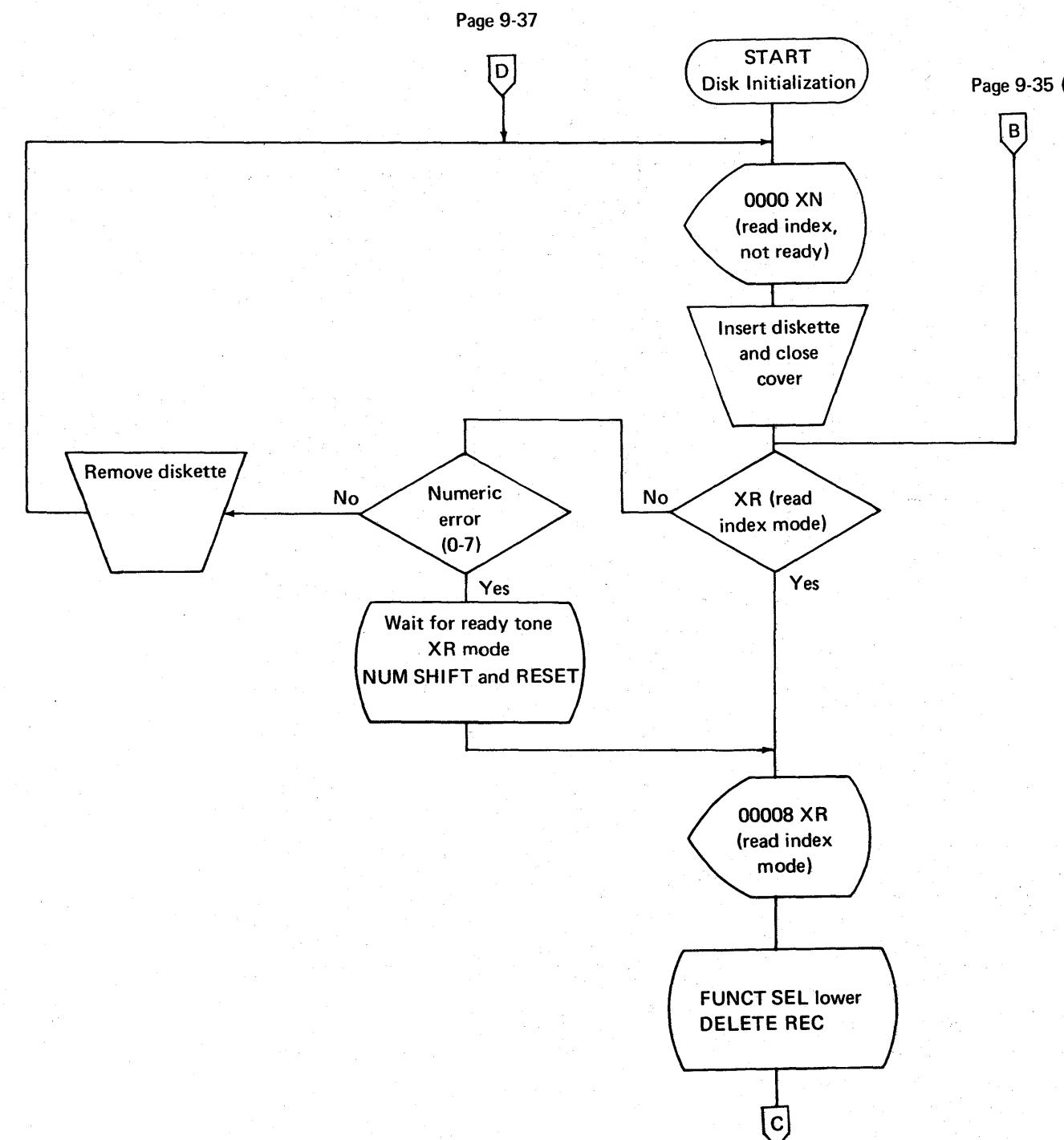
## Disk Initialization (Disk Check Portion)

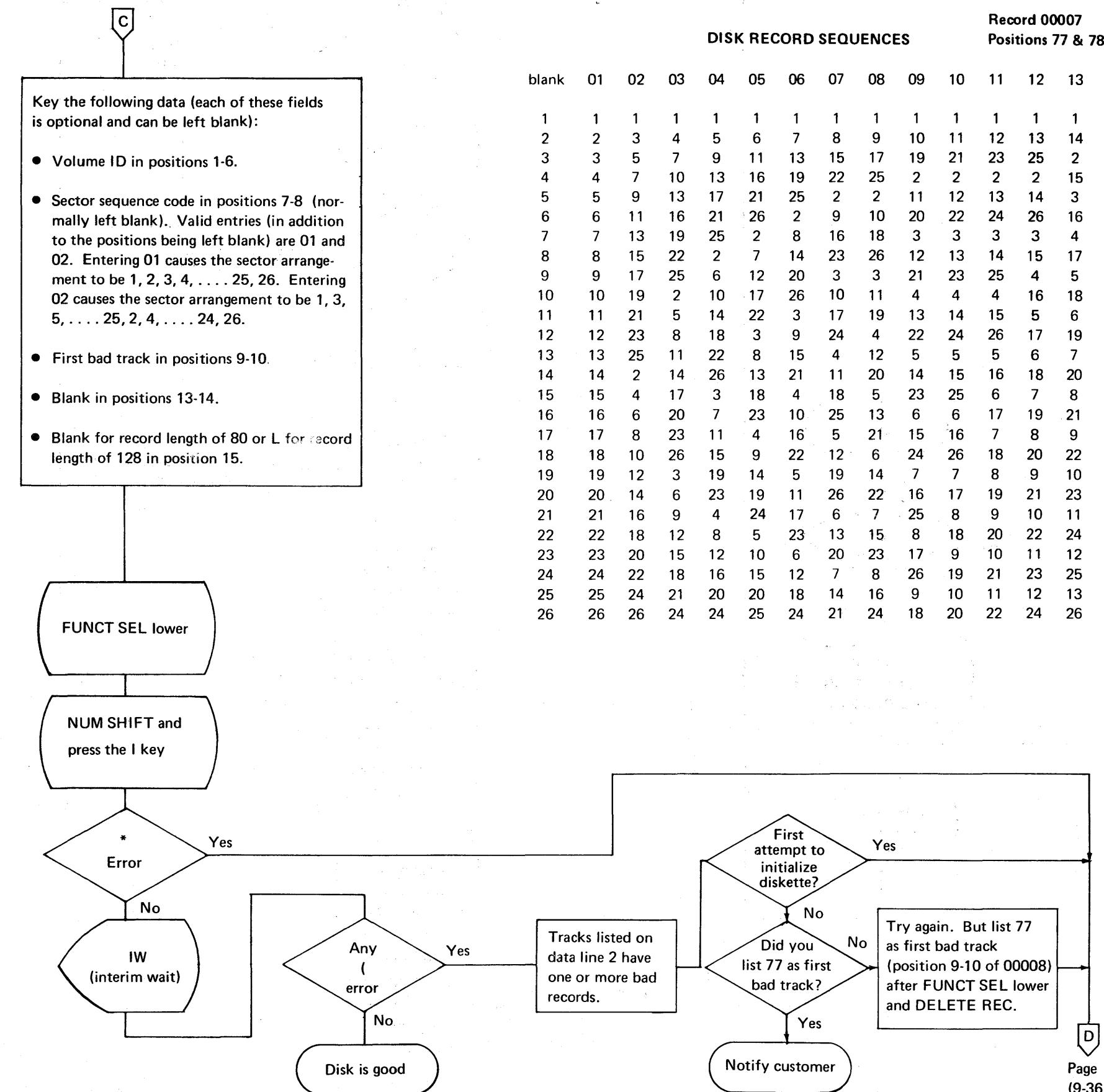


Disk Initialization (Disk Check portion) — Continued

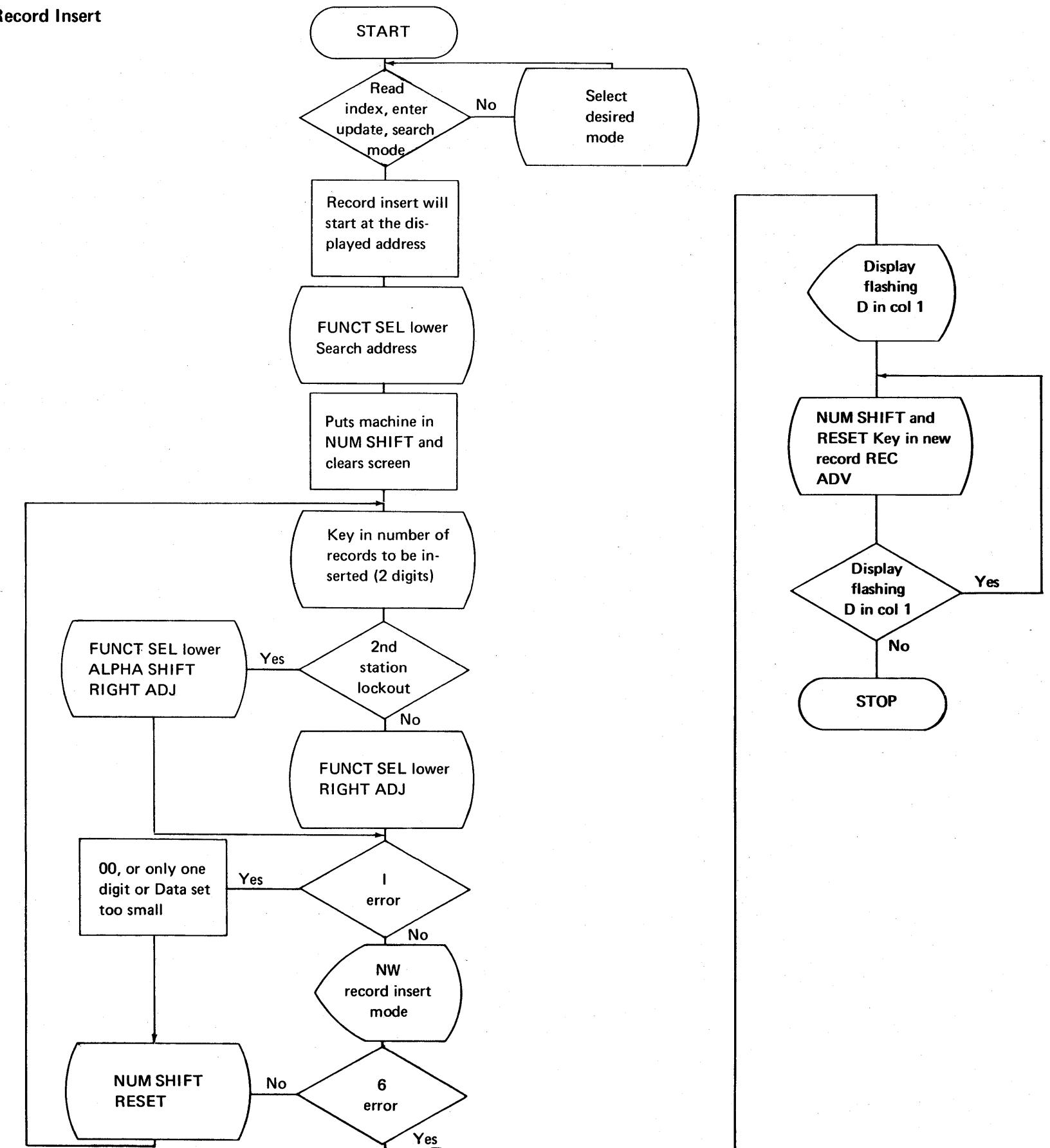


## Disk Initialization (Disk Check Portion) – Continued





## Record Insert



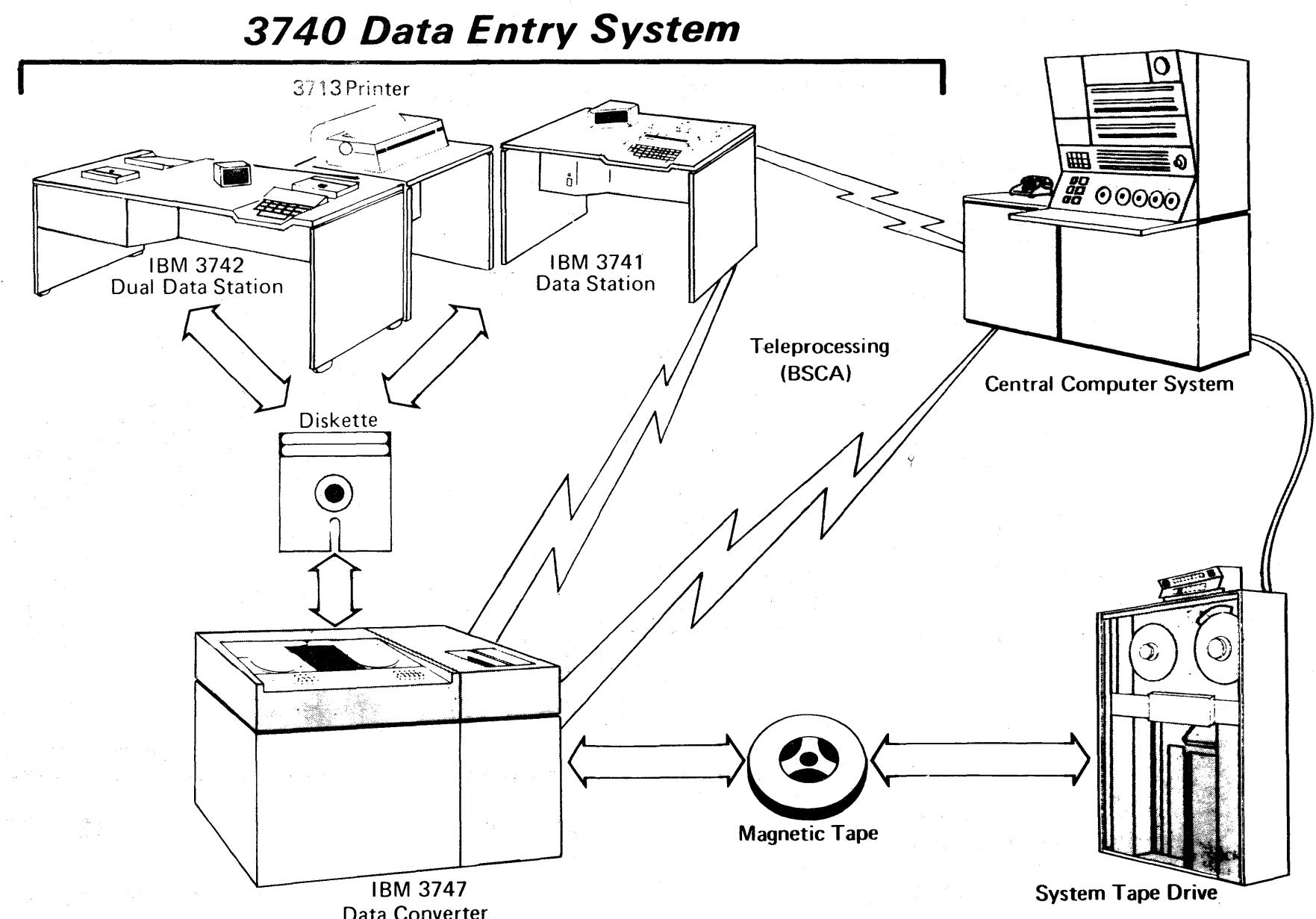
## INTRODUCTION – How to use

The IBM 3740 Data Entry System is a family of devices that provides a key-to-disk-to-tape data handling capability. This is performed in two stages. During the first stage, the data is keyed onto a small flexible magnetic disk via one of the data stations. During the second stage, the data on the disk is transferred to 1/2-inch computer tape by the data converter.

The two data entry stations are the IBM 3741 and the IBM 3742. The IBM 3742 Dual Data Station has two keying stations in 1 machine frame. The IBM 3741 Data Station has one keying station. The 3742 provides basic functions similar to the IBM 029, 059, and 129. The 3741 provides these basic functions along with additional features such as a printer and a BSCA (Binary Synchronous Communications Adapter) unit.

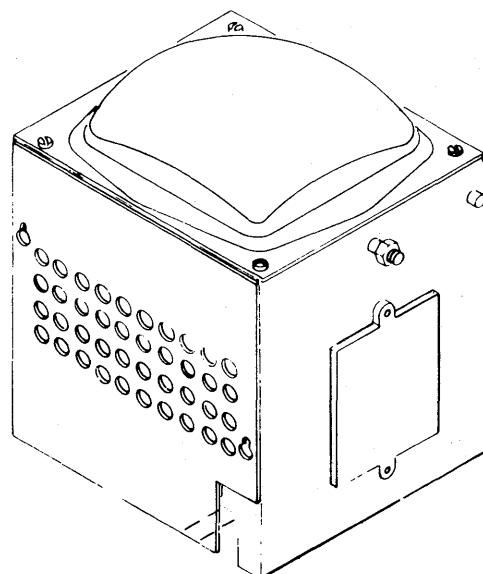
The IBM 3747 Data Converter feeds, reads and stacks the diskettes. The data it reads is transferred to 9-track computer compatible magnetic tape. The 3747 can also be equipped with a BSCA unit.

The BSCA unit installed on a 3741 or 3747 allows data transfer between these units or between these units and a CPU equipped with BSCA. A BSCA equipped 3741 or 3747 can communicate with another BSCA equipped 3741 or 3747.

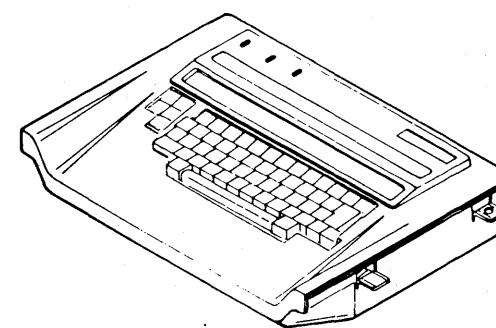


**IBM 3742 Functional Units****Display A**

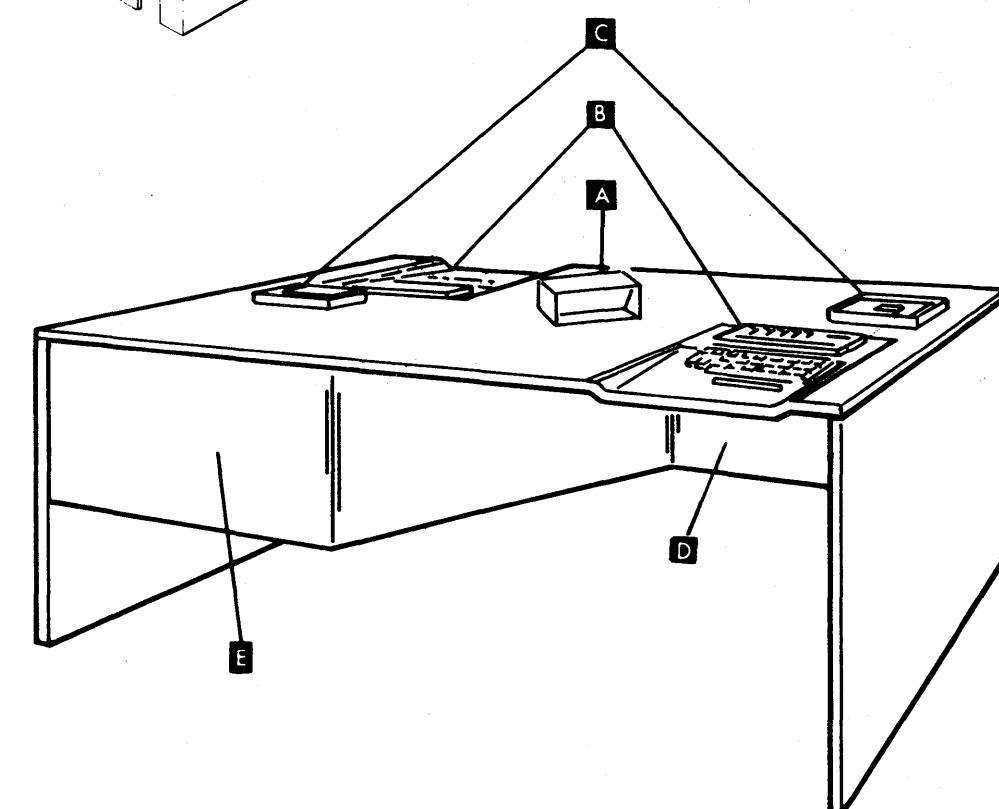
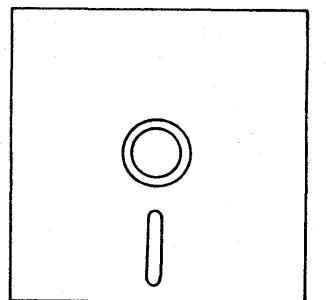
Provides visual display of machine status and data to both operators.

**Keyboard B**

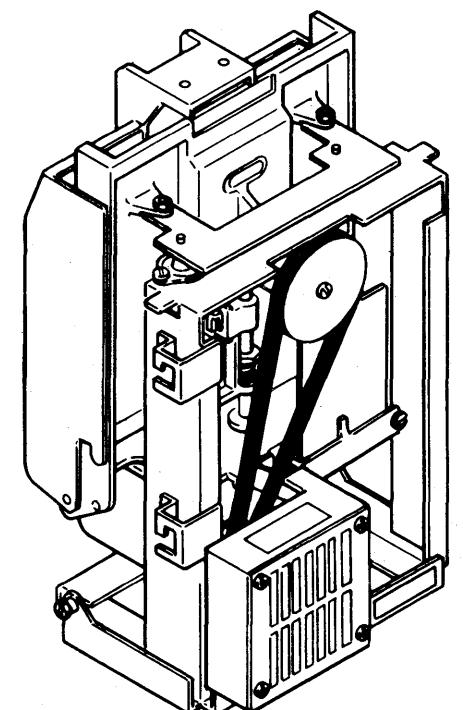
Provides the operator an interface to the machine.

**Diskette**

Recording medium for the disk drive (customer purchased).

**Disk Drive C**

Reads and writes data and control information in the diskettes.



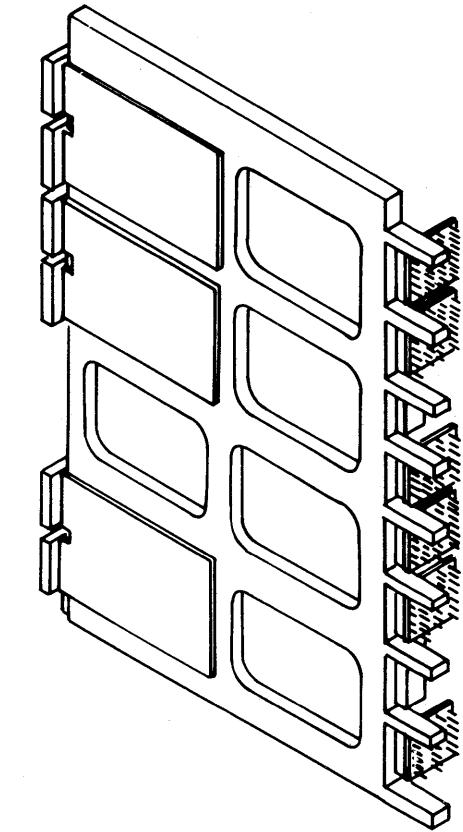
**IBM 3742 Functional Characteristics  
and Features**

**Functional Characteristics**

Six program storage areas	Standard
Enter	Standard
Program chaining	Standard
Update	Standard
80 character record length	Standard
Search EOD	Standard
Search data address	Standard
Verify	Standard
Production statistics	Standard
Katakana	Optional
Feature group A	Optional
Search content	
Search sequential content	
Self-check (modulus 10 and modulus 11)	
Field totals (offline)	
Disk initialization	
Disk copy	
Record Insert	Optional
Proof Keyboard	Optional
128-character-record length	Optional
Ten program-storage areas.	
1 to 128 character record length.	
RPOs with or without other features	Optional

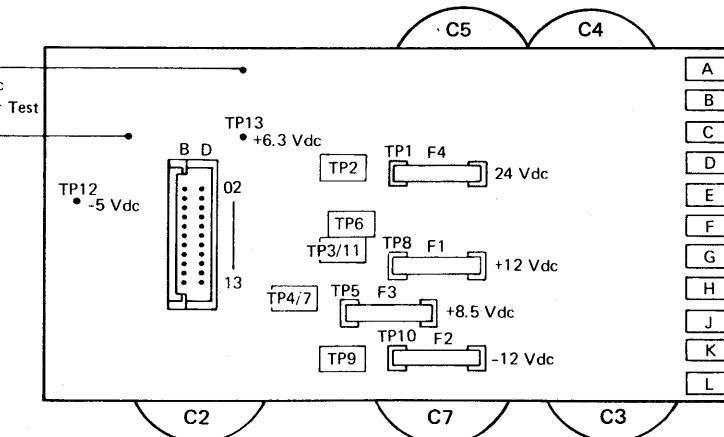
**MPU D**

Provides control and monitoring circuitry for  
the keyboards, disk drives, and the display.



**Power Supply E**

Provides the required voltages for the 3742.



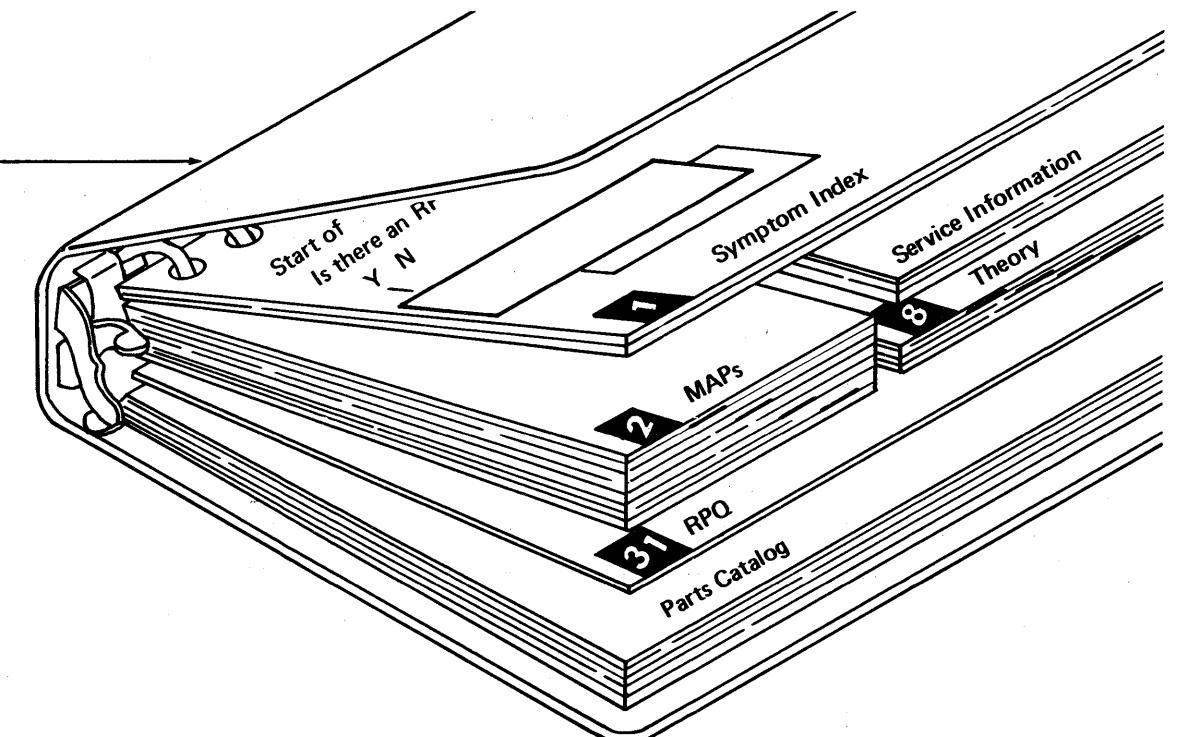
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## How to Use This Manual

The Manual contains all documents necessary to maintain the 3742 Data Station. The material is arranged as shown.

Page 1-1, *Start of Call*, leads you into a failure-analysis procedure based on the guideline: Start with the highest order symptom that appears after power on. Begin every repair action at *Start of Call*. Answering the questions asked, following the paths indicated by Yes and No answers, and performing the actions required, leads you, in most cases, to the cause of machine failure.

*Start of Call* guides you either to the correct MAP (maintenance analysis procedure) via the *Symptom Index*, or to the *Machine Checkout Procedure*.

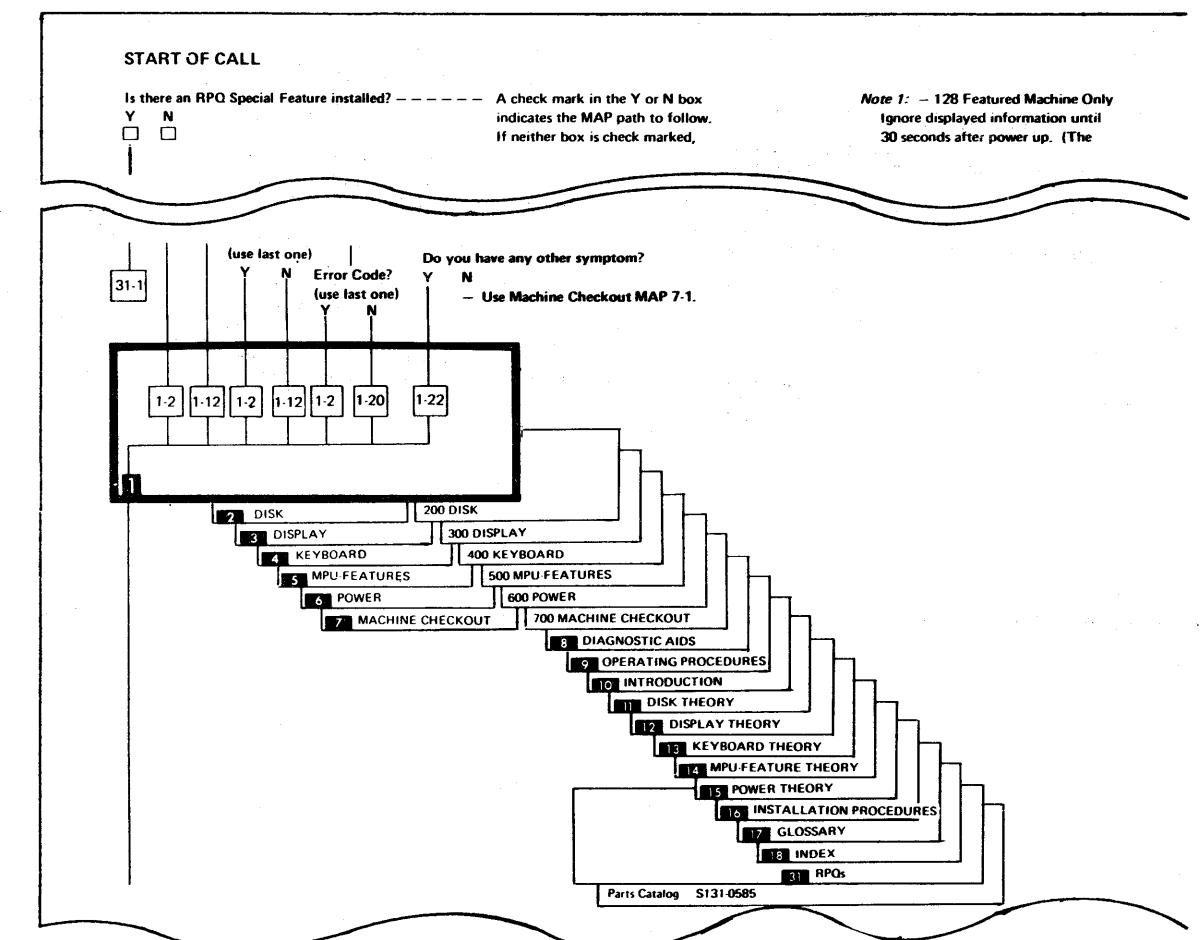


### 1

A list of machine failure symptoms is divided into four categories:

1. Error codes
2. Symptoms observed on the display
3. Failure of keyboard-initiated operations
4. Others

The order of listing the categories indicates the importance level of symptoms. The index, indeed the whole maintenance philosophy, is based on this arrangement of symptoms.



## Error Codes

Error codes are in alphabetical, numeric, and special-character order along the left edge of the Index pages. In the space to the right of each code are the MAP-page reference, failure description, probable cause, and how-to-fix information. If multiple codes are displayed, use the most consistent and stable one, or the last one displayed. Some disk-drive failures are chargeable and slow to stabilize due to automatic retry procedures.

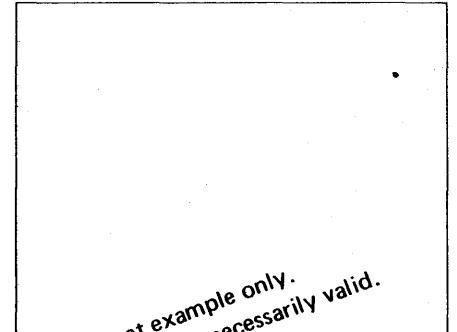
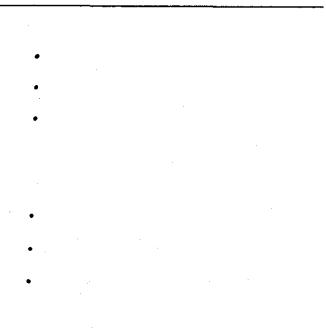
### SYMPTOM INDEX

#### ERROR CODE DESCRIPTION

	Code	Display Position	Diagnostic	Description	Cause	Operating Procedure
7	8	9	10	MAP		
A				21	Data set non-accessible	- The data set accessibility code field in the data set label or in the volume label has a non blank character. - Remove the disk.
B				21	Bad data set label	<ul style="list-style-type: none"> <li>- One of the following conditions existed when you tried to select a mode from track 00:</li> <li>1. The last record read and currently displayed is from track 00, records 01 through 07.</li> <li>2. Position 4 of the header field in the data set label doesn't contain a 1.</li> <li>3. The data set label is flagged with a control address mark (such as is required for a deleted record).</li> <li>- BOE is less than track 01, record 01.</li> <li>- EOE is greater than track 74, record 26.</li> <li>- BOE is less than EOE. EOE and/or BOE are incorrect.</li> </ul> <ul style="list-style-type: none"> <li>- Press RESET and REC ADV.</li> <li>- Press RESET and enter a 1 in position 04, press FUNCT SEL lower, M, and REC ADV.</li> <li>- Enter H in position 1, press FUNCT SEL, M, and REC ADV.</li> <li>- Press RESET and enter the correct BOE, press FUNCT SEL lower, M, and REC ADV.</li> <li>- Press RESET and enter the correct EOE, press FUNCT SEL lower, M,</li> </ul>

### Symptoms Observed on the Display

Symptoms observed on the display are shown either as pictures of the display, or described and listed alphabetically. Each Symptom has associated MAP-reference and descriptive information.

<b>DISPLAY AND DISPLAY UNIT SYMPTOMS</b>	Display: Spot Viewer: Removed Brightness Control: Turned up (caution) MAP: 6-1	Display: No characters Viewer: Removed Brightness Control: Turned up MAP: 3-2
<p>Look for a picture or descriptive symptom similar to what you see on the display</p> <p>Note: Some of the pictured symptoms are with a diskette installed. A less number of characters may be displayed when a diskette is <i>not</i> installed, but the symptom will be the same. Examples:          Lines on top of each other.          Missing characters.          All characters resemble cursors/dashes.          Skewed-yoke adjustment.</p> <p>For some symptoms, it may be necessary to turn the brightness control up to observe the display symptoms.</p> <p><b>CAUTION:</b> Never make CRT, Tube face glow or bloom. Return brightness normal before</p>	 <p>Format example only. Content not necessarily valid.</p>	 <p>Format example only. Content not necessarily valid.</p>

DISPLAY AND DISPLAY UNIT SYMPTOMS		Brightness	DISPLAY-GENERAL
Display:	Failure to blank on wiggle sweep	3.2 Blank display	If none of the above symptoms are <i>similar</i> to what you see on the display:
Viewer:	Removed	3.2 Brightness fades out slowly	- Power down.
Brightness Control:	Turned up	3.1 Brightness failure	- Disconnect the keyboard signal cables (407H) at planar P and R. (505)
MAP:	3.1	3.1 Intermittent/unadjustable	- Power up. (Wait at least 30 seconds.)
Display:	Failure to blank	3.1 Brightness increases slowly	
		Characters	Does the machine still fail?
		3.11 Distorted	Y N
		5.1 Dot missing	- Power down.
			- Reconnect the keyboard cables (407H) at planar P and R (505).
			- Use keyboard MAP 4-4.
		Cursor (Position Indicator)	
		5.1 Missing	- Power down.
		5.1 Wrong position	(At Power Up in XN mode/status the 3742 with 128)

## Failure of Keyboard-Initiated Operations

Symptoms of keyboard-initiated operational failures are listed alphabetically by the names of all the keys and switches. Each index entry has failure descriptive matter and associated MAP-page reference.

KEYBOARD AND OPERATIONAL SYMPTOMS		Copy	Display Field Program
Alphabetic Shift		4.5 Continual copy	4.4 Displays wrong program
4.2 Fails to override program control		4.4 Copies wrong data	4.2 Fails to display program
4.2 Program fails		4.2 Fails to copy	
4.2 Will not alpha shift from keyboard			
Audio Feedback Device		Dash (-)	Display Production Statistics
4.6 Always a tone		4.2 Fails to display	4.2 Displays production statistics always
4.6 No tone at end of function		4.2 Fails to enter hex D	4.4 Displays wrong production statistics
4.6 Tone or click at wrong time			

## Others

Other (miscellaneous) symptoms include any that do not conform to categories 1, 2, and 3.

Notice how *Start of Call* (Page 1-1) guides you to the correct symptom category, and the Symptom Index directs you to a MAP.

MISCELLANEOUS SYMPTOMS	
Disk Unit Symptoms	
2.1 Diskette problems	
2.6 Not ready	
2.2 Read check	
2.9 Seek errors (no data errors)	
2.4 Write check	
2.10 Diskette not interchangeable with other disk units	
2.6 Machine status or disk address missing	
2.6 Machine status wrong	
2.2 Disk address 1 or 2 wrong	
Features	
7.3 Feature A checkout procedure	
7.4 128 Record length feature checkout procedure	
Keyboard	
4.1 Audio feedback device works with an error	
4.2 Binding key	

**2****MAPs (Maintenance Analysis Procedures)**

through

**6**

This is the step-by-step MAP that guides you to the cause of failure.

**Prompting Message** — This column contains bits of helpful information, hints, cautions, etc.

MAP Number

2 = Disk MAP

6 = The sixth in a series of eleven disk MAPs

**MAP 2-6**

— Check to see if you can find any one of the following defects in the problem/suspect disk drive unit:

1. Belt – off or damaged. (223K)
2. Pulley (2) – loose. (223D and 223G)
3. Idler assembly – defective mechanical operation. (223E)
4. Drive motor – binding or sticking. (214)
5. Cover or cover pivot (2) – loose or broken. (221E)

— This MAP will help find not ready problems; also disk address missing, or machine status missing or wrong.

This number refers to the Drive Motor Removal/ Replacement Procedure. See section 2 in service information.

This number refers to the pivot screw labeled **E** on the Disk-Cover-locations graphic number 221. See section 2 in service information.

Is the disk drive in the failing station free of all the listed defects?

Y N  
— Replace or repair the faulty part.  
— Verify the fix.

Does the machine still fail?

Y N  
— Select the proper IR code and cause code for the faulty part from the charts.

Can you make the machine fail?

Y N  
— When the failure is intermittent, perform the following steps, one on each call, until the problem is solved.  
— Record the date of each action.  
— Vibrate the machine to try to cause the failure. Check room temperature and humidity and compare it to the installation procedure, page 16-1. Check dc voltages at disk FC card (204A) with respect to frame ground.

Vdc	Test Point	Limits
+24	1	22.0 to 26.5
+5	23	4.7 to 5.5
-5	5	4.6 to 5.4
ground	17	0

Follow this line after a Yes answer.

The next action is indicated with a dash.

Off-page connector refers you to the same indicator on the next page.

The disk MAPs have a 2 tab. This is also indicated on page 1-1; both in the diagram and at the bottom edge of the page.

*Format example only.  
Content not necessarily valid.*

2-6.2

The on-page connectors indicate you get here from the A and B connectors on the previous page.

Notice the A connector at both the top and bottom of this page. The line continues over as many pages as have no action in that path. An action changes the next off-page connector in that path to another character.

These blocks are for recording the date the preceding action was performed.

Format example only.  
Content not necessarily valid.

- Power down.
- Reseat both ends of the disk signal cable. (204B)
- Reseat the disk file cable at the FC card. (204C)
- Verify the fix.  
DATE:
- Power down.
- Swap the disk units.
- Verify the fix.  
DATE:
- Power down.
- Replace the LED assembly. (218)
- Verify the fix.  
DATE:
- Power Down.
- Replace the phototransistor assembly. (243)  
Verify the fix.  
DATE:
- Power down.
- Replace the disk FC card. (204A)  
Verify the fix.  
DATE:
- Power down.
- Replace the disk file cable. (204C)  
Verify the fix.  
DATE:
- Power down.
- Replace the disk signal cable. (204B)  
Verify the fix.  
DATE:
- Replace the ac line filter.
- Verify the fix.  
DATE:

A dash after an action statement indicates there is a prompting message in the column to the right.

If the original symptom still exists when this question is asked, then the machine is still failing.

This word assists you in determining the correct cause code. In this case, use code 01. Refer to the listing on the first page of each section of service information.

- See (237). A malfunction can be caused by a broken pivot. Check the collet for spring deflection with jaws closed.

Does the disk drive shaft bind now?

Y N

- I - Re-install the disk drive belt. (223K)
- Check the disk top cover for proper alignment. -
- Verify the fix.

Does the machine still fail?

Y N

The disk top cover needed adjustment.

Power down.  
Replace the disk collet assembly.  
(217)  
Verify the fix.

## Service Information

Service aids, graphics, procedures, adjustments, etc., on these pages are presented in six groups, each associated with a set of MAPs. For example, the group from which these illustration pages were chosen bears numbers between 201 and 299. It supplements disk MAPs, section 2. The service and group numbered between 301 and 399 is for use with Display MAPs, section 3, and so on through the group numbered between 701 and 799.

214 Graphic Identification Number

This is the procedure 214 referred to in the explanation of MAPs on page 10-8.

**213 Disk Drive Pulley and Belt**

**Removal**

- Power down.
- Unplug motor cable. (222F)
- Remove fan guard assembly (222M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (222L) (note blade curvature).
- Remove drive belt. (222K)
- Loosen setscrew and remove pulley. (222G)

**Replacement**

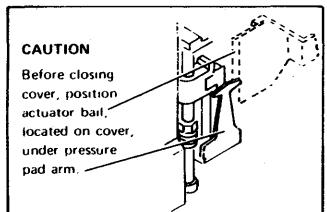
- Position pulley on shaft so outer edge of pulley is flush with end of shaft.
- Align setscrew with flat surface of shaft and tighten.
- Replace belt.
- Check belt tracking.
- Replace fan belt and guard (note blade curvature).

**216 Disk Drive Cover**

**Removal and Replacement**

**CAUTION:** Avoid damage to head load actuator (221D) and cable clamp holding wires to cover. To replace, reverse procedure.

**Format example only.  
Content not necessarily valid.**



**219 Hub and Shaft Assembly**

**Removal and Replacement**

- Remove cover.
- Remove drive belt. (222K)
- Remove screw and pulley. (222D)
- Remove shaft assembly. (222A)
- Remove bearing retaining screws and bearing. (222B)
- Remove bearing and spacer. (222C)

**CAUTION:** The front bearing must be flush with front surface of baseplate. To do this, tighten front bearing retaining screws first. Seal on bearing should face outside.

– To replace, reverse procedure and check belt tracking.

**214 Drive Motor**

**Removal and Replacement**

- Power down.
- Unplug motor cable. (222F)
- Remove fan guard assembly (222M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (222L) (note blade curvature).
- Remove drive belt. (222K)
- Loosen screws and remove guard plate. (222J)
- Remove motor clips by loosening screws. (222H)
- Remove motor through bottom of frame.
- Loosen setscrew and remove drive pulley. (222G)
- To replace, reverse procedure and check for belt tracking.

**217 Collet Assembly**

**Removal and Replacement**

- Close the disk cover until it latches.
- Loosen spring mounting screws.
- Adjust the spring (upward) to activate the switch. The switch may be overadjusted up to .050".
- Tighten spring mounting screws.

**220 Disk Cover Interlock (223N)**

**Adjustment**

- Close the disk cover until it latches.
- Loosen spring mounting screws.
- Adjust the spring (upward) to activate the switch. The switch may be overadjusted up to .050".
- Tighten spring mounting screws.

**215 Idler Assembly**

**Removal**

- Remove belt. (222K)
- Remove idler assembly. (222E)
- To replace, reverse procedure and check belt tracking.

**Belt Tracking**

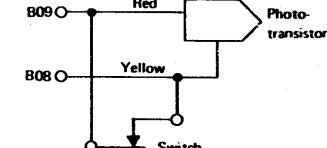
Belt must be riding in center of drive pulley and hub pulley.

**218 LED Assembly**

**Removal and Replacement**

- Power down.
- Remove disk drive cover.
- Remove collet assembly mounting screw. (221B)
- To replace, reverse procedure.

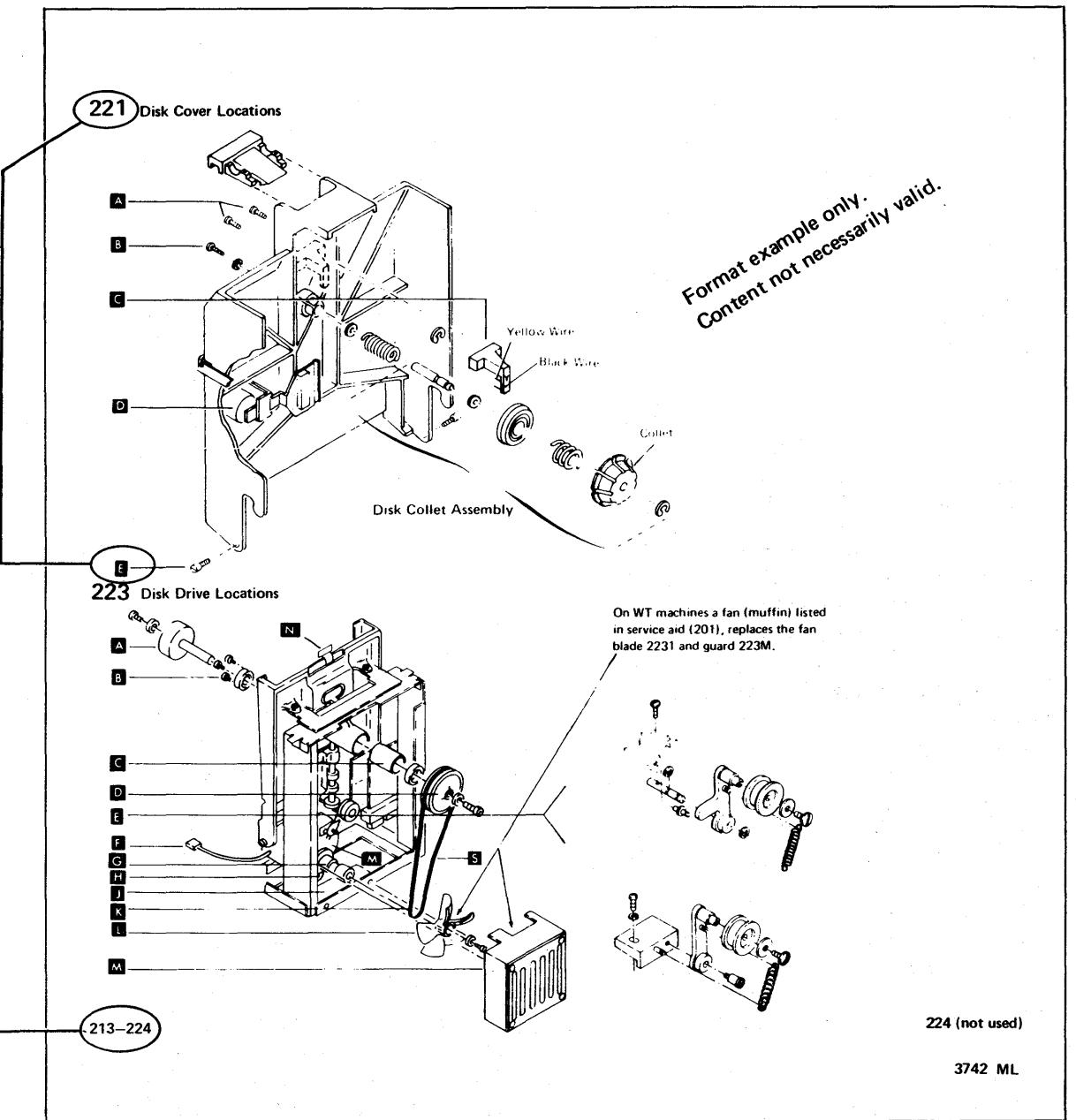
**221 Interlock Switch Circuit**



```

    graph TD
      Red((Red)) --> Inv[Inverter]
      Yellow((Yellow)) --> Inv
      Inv --> Photo[Photo-transistor]
      Photo --> Switch[Switch]
      Switch --> Ground(( ))
  
```

*Format example only.  
Content not necessarily valid.*



## 7 Machine Checkout

The basic checkout procedure is used when:

- No symptom is obvious.
- During installation.
- MAPs fail.

## MAP Rules Summary

(See *How to Use this Manual*, page 10-5, for other information)

- A. *Start Of Call*, page 1-1, insures that the highest priority symptom index group is used.
- B. Use the most consistent symptom after power on. Use the last error code to be displayed.
- C. MAPs are designed to locate a FRU that has a single mechanical or electrical failure. If the symptom changes after an adjustment or FRU replacement, use *Start Of Call* with the new symptom.
- D. If you cannot decide which MAP to use, the *Machine Checkout Procedure* (page 7-1) will guide you to the right MAP.
- E. When asked to probe or measure multiple points in a table — probe or measure only until a failure is indicated.
- F. The probe UP and DOWN lights will momentarily flash on during power on if the probe is connected to its machine power source. Please ignore.

## 8 Diagnostic Aids

- CE display mode  
 — Display disk speed  
 — Display track IDs  
 — Display registers  
 CE universal logic probe  
 CRT jumper for raster display  
 Track alignment test deck  
 CE meter test

## 9 Operating Procedures

Complete instructions on machine operating procedures.

## 10 Introduction

The introduction tells you about the 3740 system configuration, and how to use this manual.

## 17 Glossary

The glossary gives definitions of terms used in this manual.

## 18 Index

Alphabetical list of items contained in this manual.

## Parts Catalog

The parts catalog is a separate manual from this one, but should be stored with this manual.

## G. Definitions:

1. LOAD a diskette — Close the disk drive cover (with a diskette in the drive). Usually at the faulty station.
2. MEASURE — Use IBM CE multimeter, PN 452796.
3. ORIGINAL keyboard or disk drive — the keyboard or disk drive located at station with reported fault.
4. OTHER keyboard or disk drive — opposite of original keyboard or disk drive.
5. POWER DOWN — turn power switch OFF.
6. POWER UP — turn power switch ON. Always wait at least 5 seconds after a power down before powering up to allow for proper power on reset (POR).
7. PROBE — use IBM Universal Logic Probe, PN 453212.
8. REMOVE a diskette — take the diskette out of the disk drive.
9. UNLOAD a diskette — open the disk drive cover. (Does not mean remove.)
10. DISCONNECT — Physically/electrically take apart.
11. RECONNECT — Physically/electrically put back together.
12. REINSTALL — Put original part back in place of new part.
13. REPLACE — Put new part in place of original part.

## DISK THEORY

Disk format description	11-2
Data set label	11-4
Disk unit field replaceable units	11-6
Operating sequence	11-11
Scope pictures	11-14
Disk characteristics	11-20
Operational flowcharts	11-21

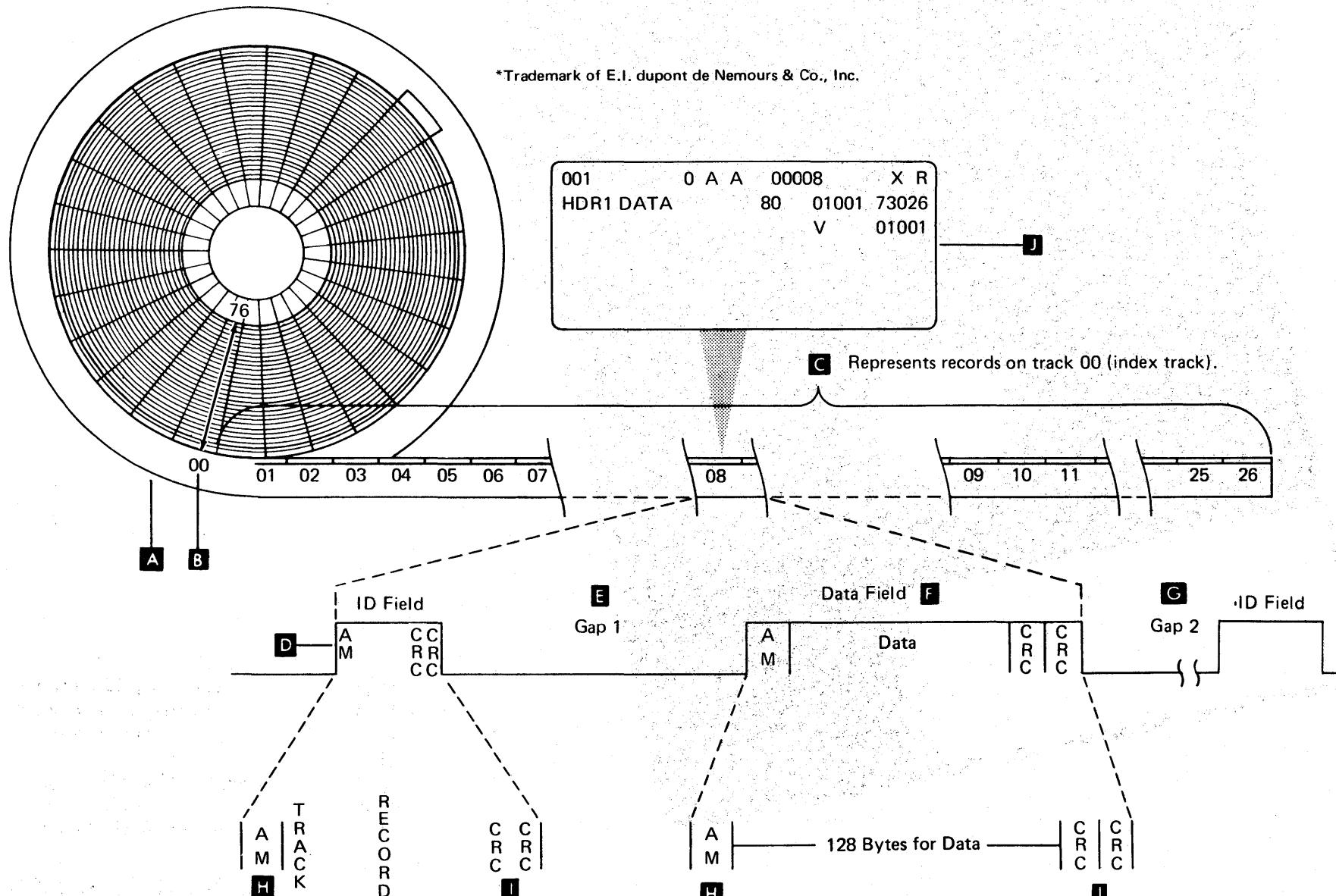


## Diskette

### Disk Format Description

The IBM diskette is a packaged Mylar\* disk. **A** Information is stored magnetically on the disk surface which is coated with magnetic oxide. The disk is free to rotate inside the package. The package has access holes for rotating the disk, for read/write head contact, and for index hole sensing.

Information is arranged on the disk in tracks. A track is a circular path on the disk surface. Information is magnetically written or read on a track by a read/write head as the disk rotates. Each disk has 77 tracks (tracks 00 through 76). **B**



Track 00 (the index track) is always physically the outermost track from the center of the disk. A maximum of two tracks may be identified as unusable (bad) tracks. Usable tracks are numbered 00 through 73 in sequence, skipping over any bad tracks. Tracks 01 through 73 are used for data entry.

There are 26 records, numbered 01 through 26, on each track **C**. Therefore, each record on the disk has a definite address consisting of a track and record number. This address is recorded at the record's physical location on the disk.

Displayed record address 00008  
Track number 08  
Record number 01

Diskettes that contain prerecorded record addresses are known as initialized disks. Initialized disks actually contain the following information at each record location:

- ID field — contains track and record number and record length of the following data field. **D**
- Gap 1 — Gap between ID field and data field. **E**
- Data field — contains data record specified by preceding ID field. **F**
- Gap 2 — Gap between data field and ID field of the next record. **G**

\*Trademark of E.I. duPont de Nemours & Co., Inc.

The first byte of all ID and data fields is a special 8 bit code referred to as an address mark (AM). **H**

The last two bytes of all ID and data fields are Cyclic Redundancy Check (CRC) bytes used to verify read operations. **I**

The 3742 requires an initialized disk for all operations except the initialize (optional feature) operation. This feature allows the operator to prepare an initialized disk on the 3742. All disks are initialized prior to shipping to customers.

Track 00 is the index track and is reserved for descriptive information about the data on the disk. The assignment of the records on the index track is:

Record 1-2	Not used on 3742
Record 3	Reserved for write gate check
Records 4-6	Not used on 3742
Record 7	Check for accessibility
Records 8-26	Data set labels

Each data set label is used to reserve a block of records for a particular use. They also contain controls and status information about that block of records.

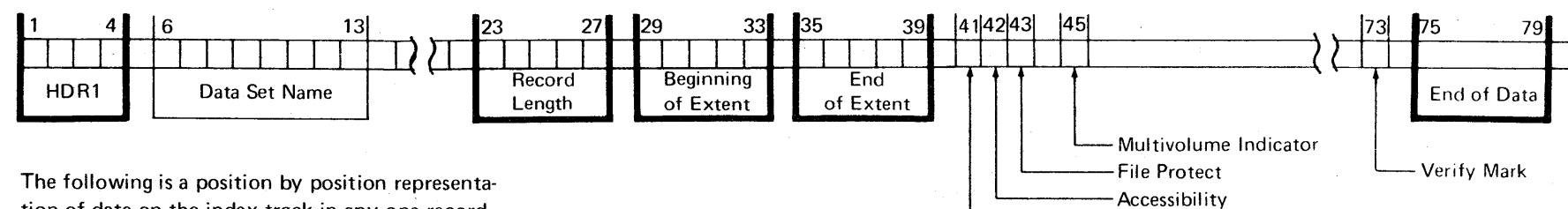
On the 3742 after power up and inserting a disk, record 00008, the first data set label, is automatically read and displayed. **J** The operator then can select the data set label to be used by pressing REC ADV to the location of that data set label (00008 to 00026). Any machine operation performed must occur within the boundaries of the selected data set.

#### **Handling**

Damaged diskettes should not be inserted into the disk drive. Diskettes which are physically damaged (torn, creased, warped) or contaminated with foreign materials (eraser dust, fingerprints, cleaning fluid, etc.) may cause the disk to fail to contact the read/write head resulting in read/write errors.

**Data Set Label**

Fields in heavy lines are required by the 3740  
data entry system:



The following is a position by position representation of data on the index track in any one record of records 8-26:

Field Name	Position	Purpose
Header 1	1-4	Label identifier, must be HDR1.
	5	Reserved.
Data set name	6-13	User optional field.
	14-22	Reserved.
Record length	23-27	Logical record length.
	28	Reserved.
Beginning of extent (BOE)	29-33	Identifies the address of the first record of a data set.
	34	Reserved.
End of extent (EOE)	35-39	Identifies the address of the last record space reserved for this data set.
	40	Reserved.
Bypass data set	41	The IBM 3747 Data Converter requires that this field contain a B or a blank. If a B is present, the data set is ignored. If a blank is present, a data set is processed. The 3747 will not transmit a data set if this field contains a B.
Accessibility	42	This field must contain a blank for processing to take place.
File protect	43	If this field contains a P, the disk is read only. It must be blank to allow reading and writing.
	44	Reserved.
Multivolume indicator	45	A blank in this field indicates the data set is not continued from or on another disk. C means the data set is continued on another disk. L indicates this is the last disk on which a continued data set is located.
	46-72	Reserved.
Verify mark	73	This field must contain a V or a blank.
	74	Reserved.
End of data (EOD)	75-79	Identifies the address of the next unused record space on the disk.
	80	Reserved.

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**Disk Unit Field Replaceable Units (FRUs)****Disk Drive**

The disk drive provides the 3742 with the ability to read and write on the disk.

To accomplish this, the disk drive has the following major components:

**Disk Drive Cover **A****

The disk drive cover permits insertion and removal of the disk and clamps the disk to the disk drive.

**Light Emitting Diode (LED) Assembly **B** and Phototransistor **E****

When the disk cover is closed, the continuous infra-red light emitted from the LED is directed towards the phototransistor assembly. Once every revolution, the index hole in the disk allows light from the LED to reach the phototransistor. The phototransistor sends index pulses to the MPU. The index pulses signal the MPU that the disk is rotating.

**Disk Collet Assembly **D****

When the disk cover is closed, the spring loaded collet centers and clamps the disk to the disk drive hub.

**File Control (FC) Card Assembly **F****

The FC card provides the electronics for controlling the stepper motor and the head load actuator, detecting the index hole (of the disk), and reading/writing of data.

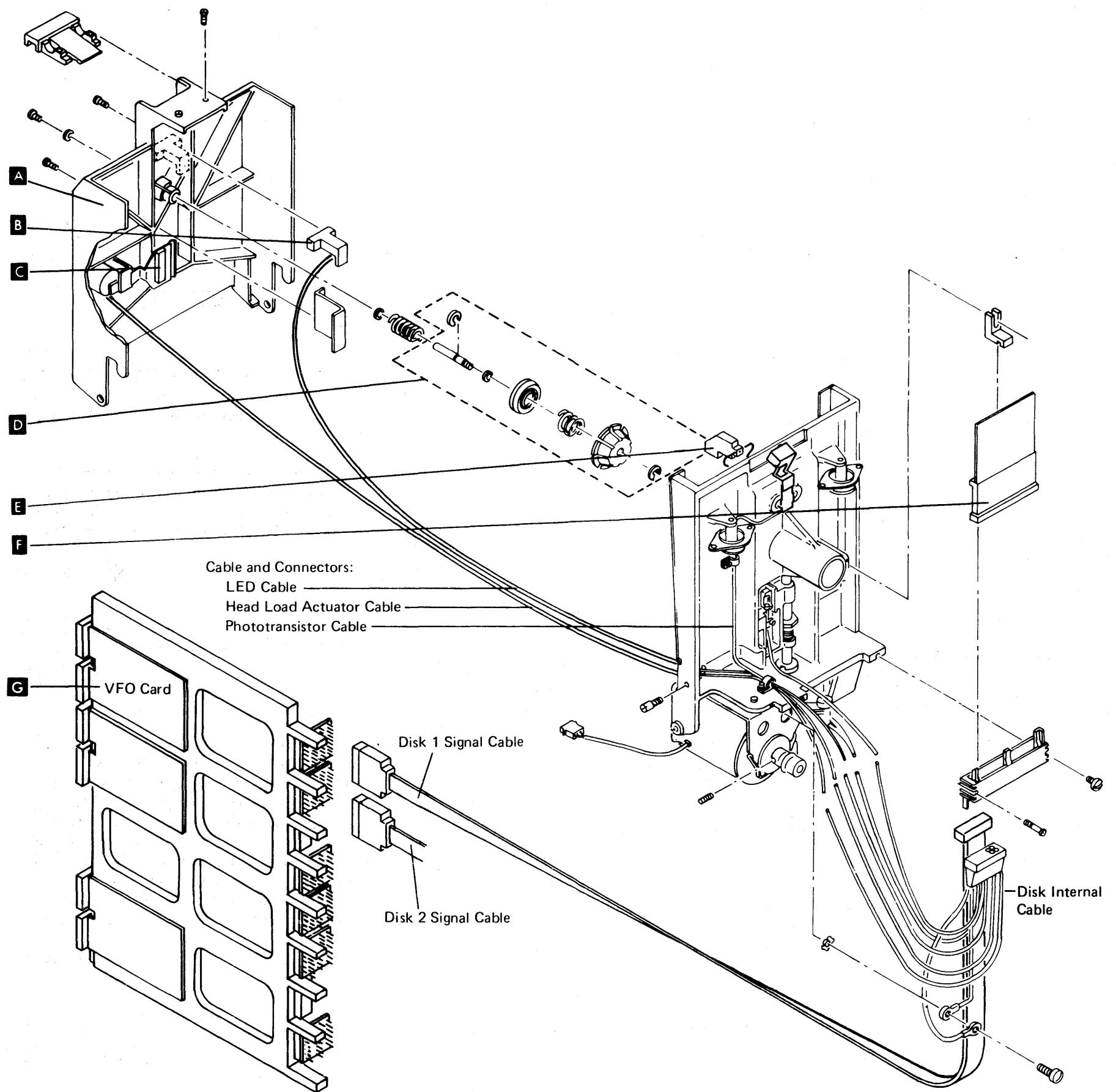
**Head Load Actuator Assembly **C****

The head load actuator presses the disk against the read/write head.

The head load actuator assembly consists of a magnet and armature. During a read or write operation, the head load actuator is energized and allows the pressure pad arm to push the disk against the read/write head. At the same time, the head load actuator armature forces the disk package against the disk to clean the disk. While not reading or writing, the head load actuator is de-energized and holds the pressure pad assembly away from the disk to reduce wear to the disk surface or the read/write head.

**Variable Frequency Oscillator (VFO) Card **G****

The VFO is used at all times while reading. The VFO is used while reading the ID field during the write operation. The VFO card separates data signals from the clock signals received from the FC card. The data signals from the VFO card are sent to the disk controller and transferred to the data buffer. Both drives use the same VFO card.



**Motor and Drive H**

The motor and drive rotate the disk.

**Stepper Motor Assembly J**

The Stepper Motor moves the read/write head from track to track. The stepper motor wheel is permanently mounted on the end of the stepper motor shaft. The stepper motor shaft turns in increments of 90° in either direction under the control of access pulses. The stepper motor wheel engages the leadscrew wheel. When the stepper motor rotates 90°, it causes the leadscrew to rotate 90°. The head carriage assembly then moves up or down one track on the disk.

**Preload Spring K**

The preload spring loads the leadscrew to ensure head alignment with the disk.

**Limit Stops L**

The upper limit stop prevents the head from being driven more than 1/2 track beyond track 76. The lower limit stop prevents the head from being driven more than one track lower than track 00.

**Head and Carriage Assembly M**

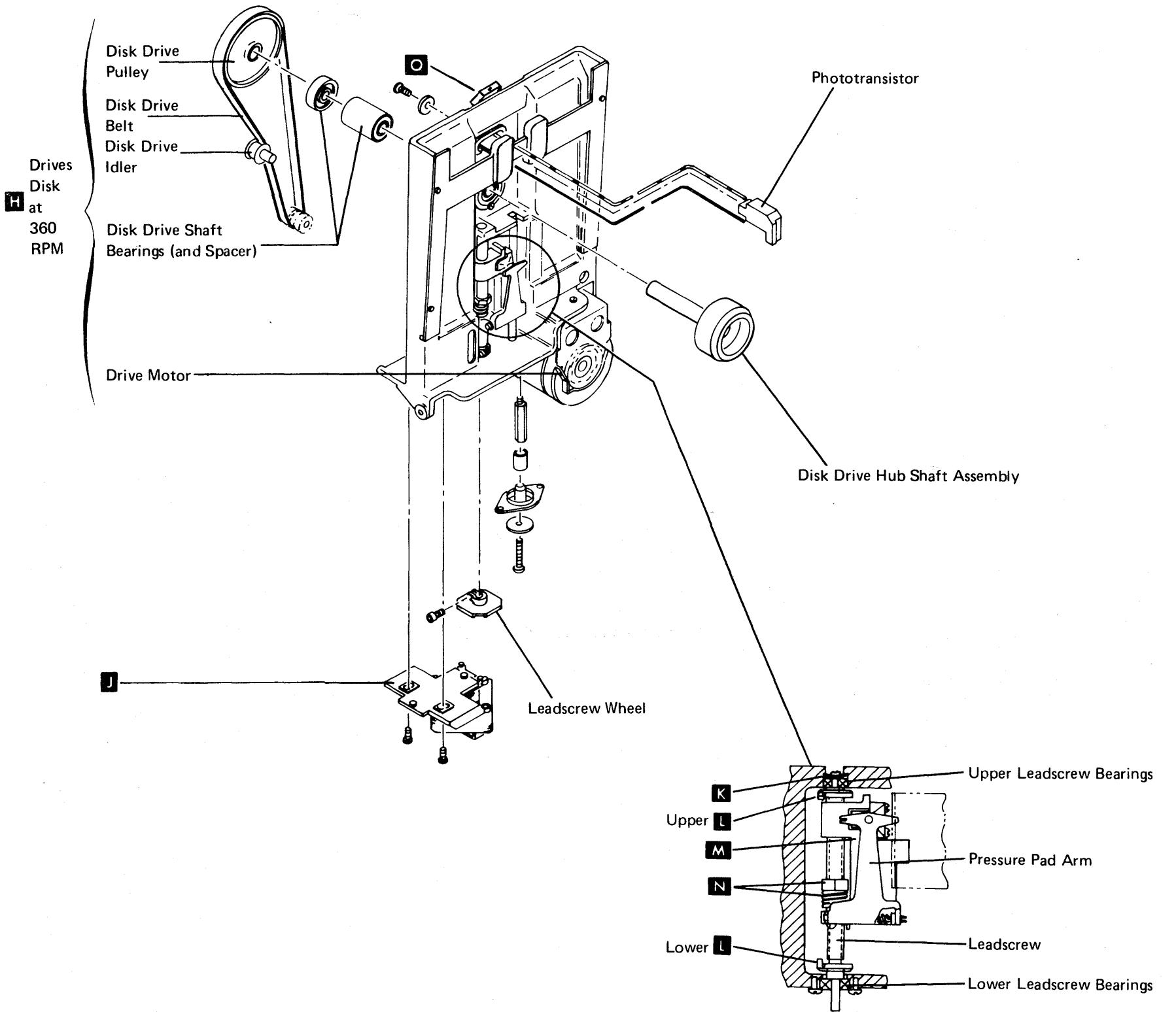
The head and carriage assembly provides read, write, and erase functions.

**Leadscrew Nut and Spring N**

The leadscrew nut and spring loads the head and carriage assembly to ensure head alignment with the disk.

**Cover Interlock Switch O**

The normally closed points of the cover interlock switch are in parallel with the phototransistor (see schematic on next page). This switch prevents index pulses until a diskette is fully loaded in the disk drive. (Diskette installed and the cover latched closed.)

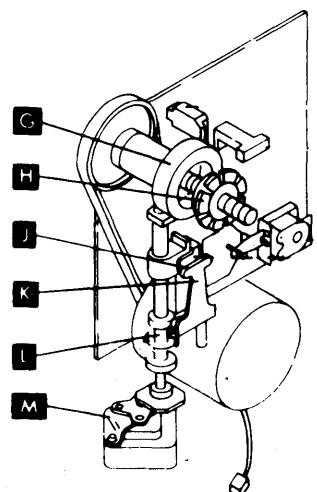
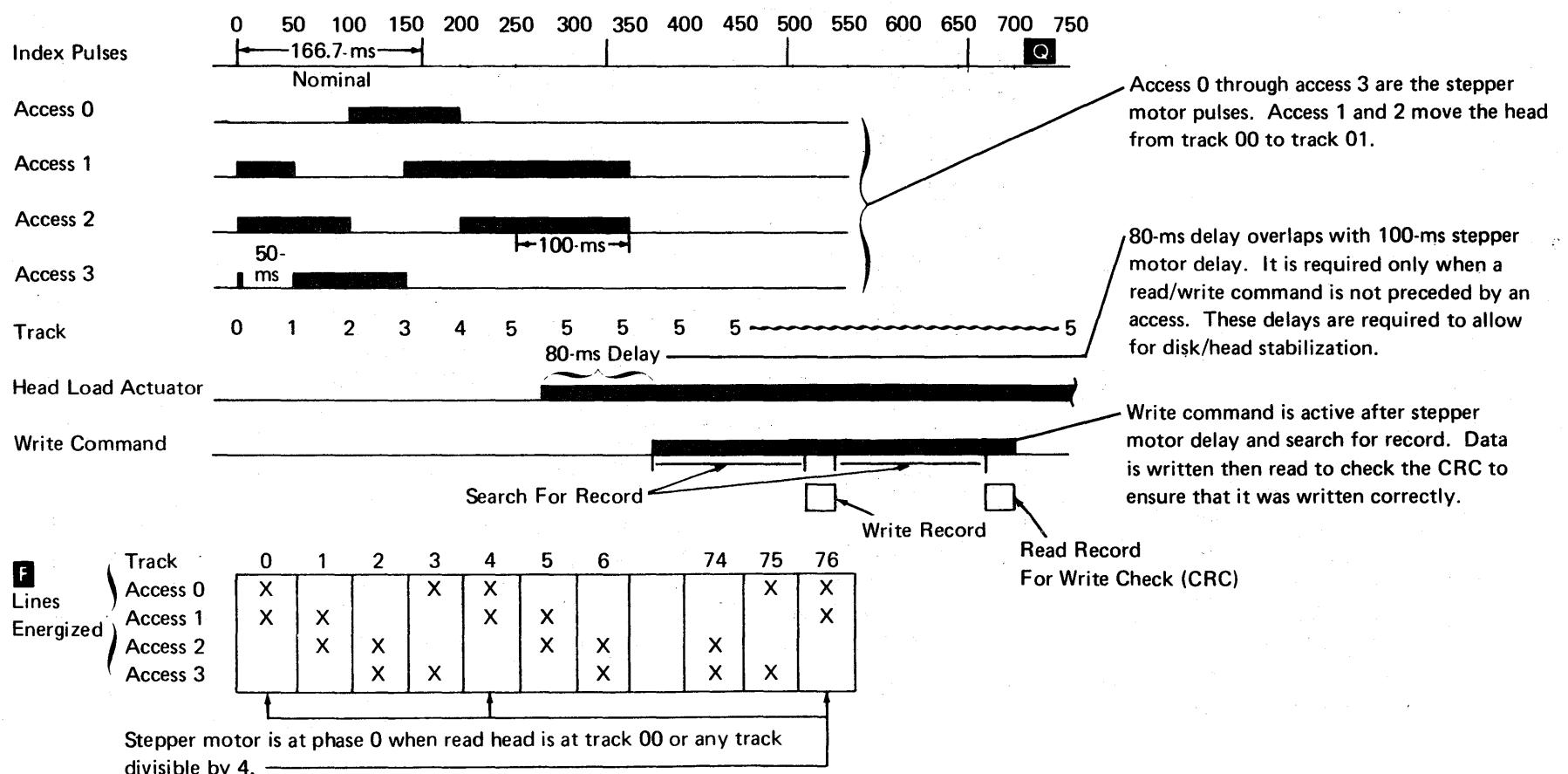


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### Operating Sequence

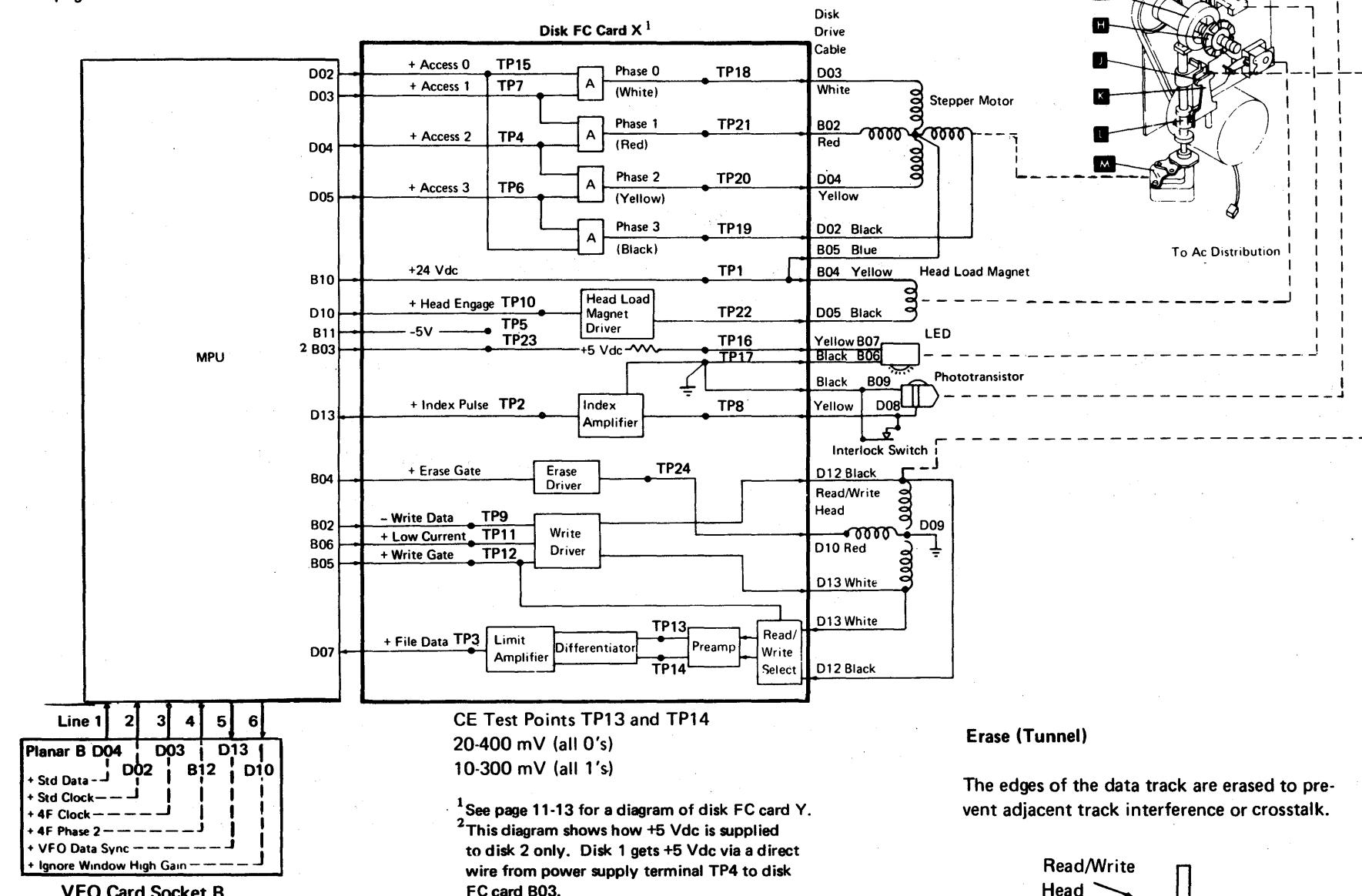
1. Ac and dc power comes on under control of the 3742 power on/off switch. A diskette can be inserted or removed with power up or down.
2. Load a diskette and close the cover. Closing of the cover presses the collet **H** into the drive hub **G** thus clamping the disk in place. With power up, the disk turns counterclockwise as viewed at the head side (back) of the disk drive.
3. After a 10-second delay from power on, index pulses **Q** are read once every disk revolution (nominally, every 166.7 ms).
4. To initiate a read or write operation, the '+ head engage' line **P** is activated. This allows the pressure pad assembly **K** to push the disk against the head **J**. After 80-ms delay, data can be gated into the system.
5. For each access command, the stepper motor **M** rotates the leadscrew **L** 90°. This moves the read head one track position. Clockwise rotation (looking down on the disk drive unit) moves the head up; counterclockwise rotation moves it down. Two adjacent access lines must be energized for an overlapping period of 50 ms to rotate the motor 90°. After accessing to a track and prior to a read or write operation, the two lines must be energized for an additional 100 ms. Access codes to cause rotation to a given track are shown at the right **F**.
6. If any read or write command does not execute within two index pulses after it is issued, the command is automatically reset.
7. The pressure pad is lifted three index pulses after completion of the last read, write or access operation to reduce disk wear unless another read or write command is issued.

### Typical Timing Sequence



To Ac Distribution

Two types of disk FC cards are used.  
See page 204-1 for details.

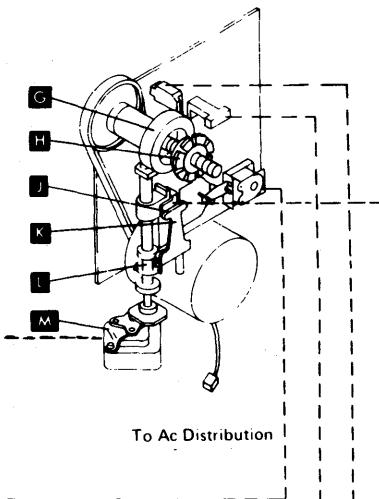


#### Write Data

For each transition in the 'write data' line, current is switched in the read/write head, causing a flux change on the disk.

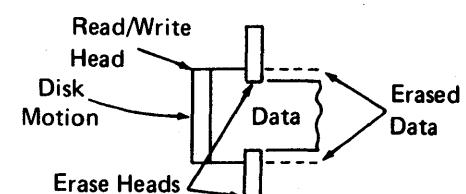
#### Low Current

The '+low current' line is active when data is being written on tracks 42 through 76. The line is inactive when data is being written on tracks 0 through 41. Lower current is needed for writing at greater density on the higher numbered tracks.



#### Erase (Tunnel)

The edges of the data track are erased to prevent adjacent track interference or crosstalk.



#### Read Amplifier

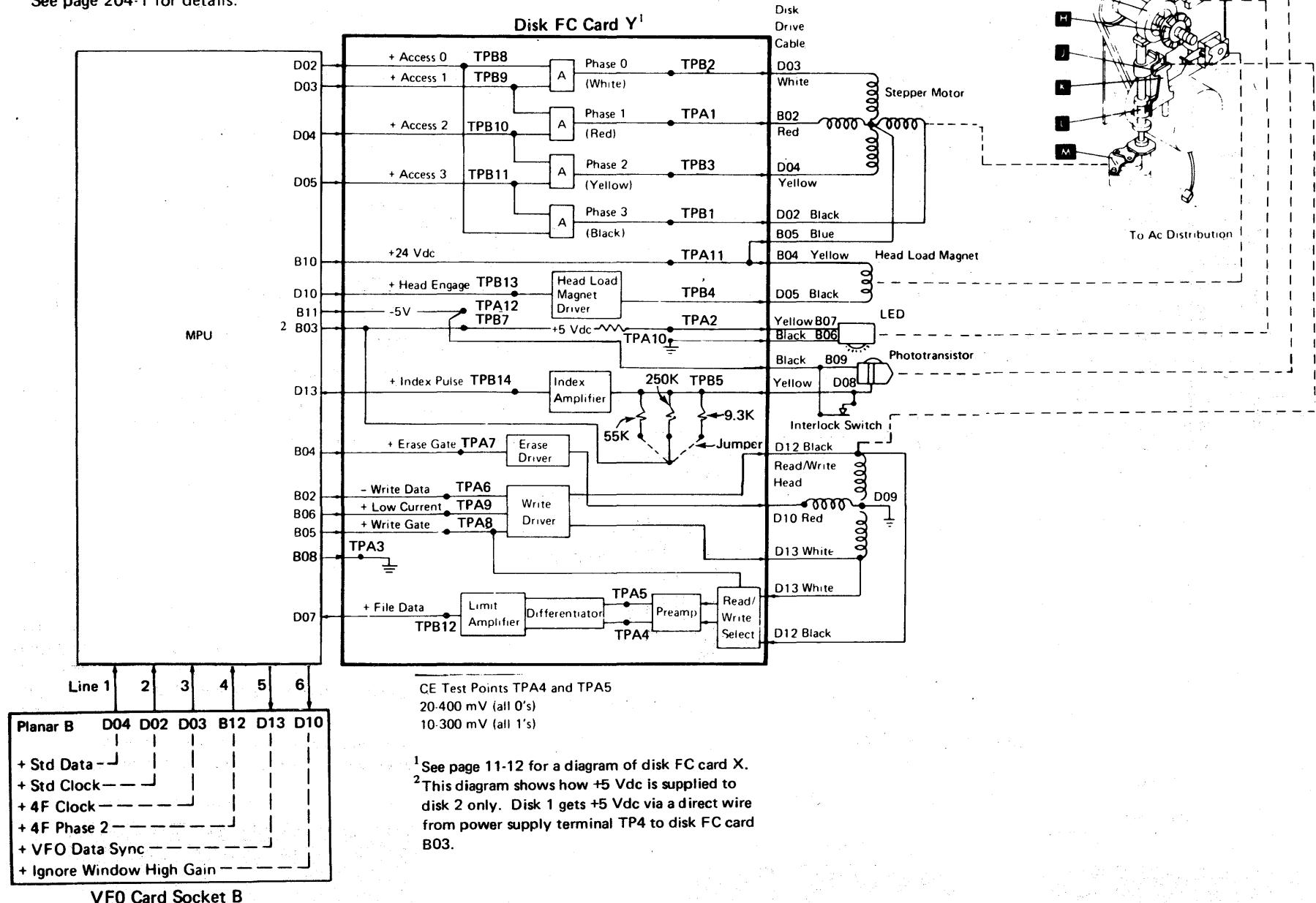
Higher voltage is present at the outer track because of higher disk speed and lower bit density.

All 0's pattern gives a higher voltage amplitude than all 1's pattern.

#### Limit Amplifier and VFO Card

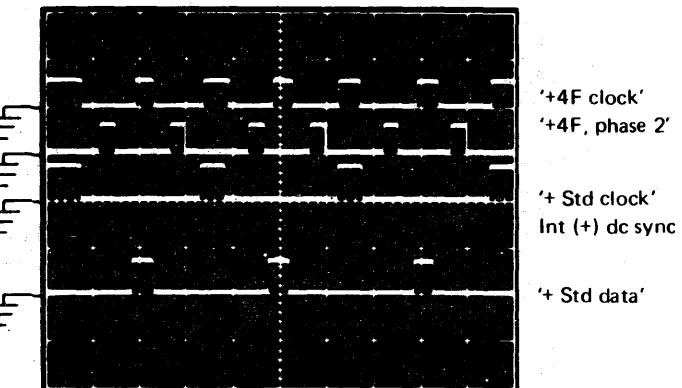
Detects magnetic flux changes from the read/write head and generates file data line. File data is the FM (frequency modulated) encoded data which is sent to the VFO card to be separated into data and clock signals.

Two types of disk FC cards are used.  
See page 204-1 for details.



## Disk Test Points

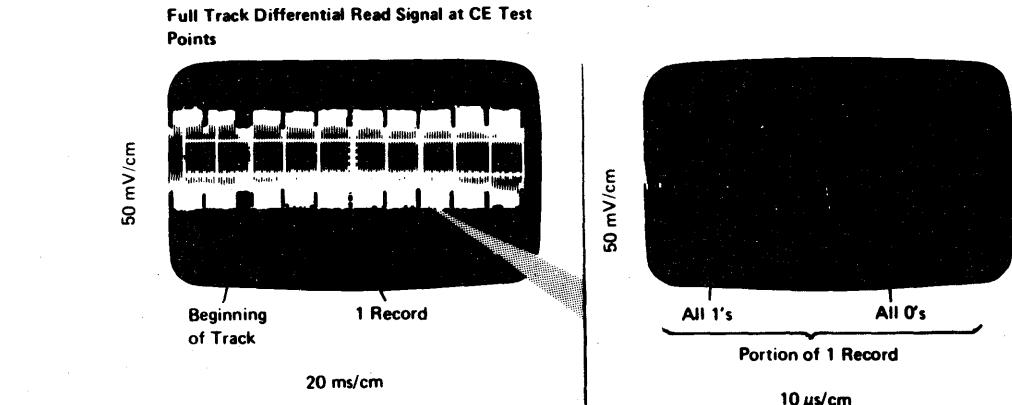
**Output of separated data and clock signals from the VFO card.**



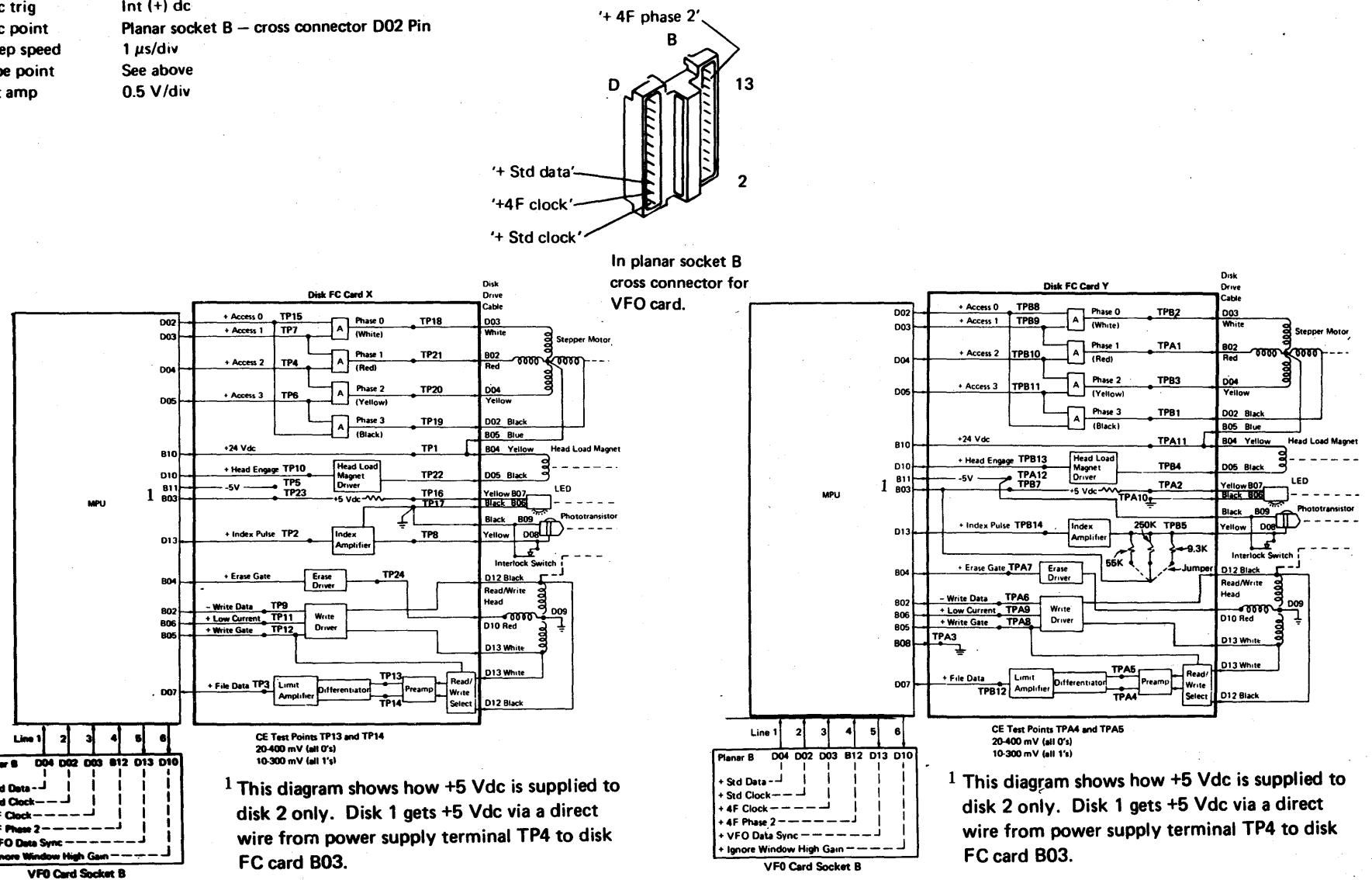
### **Continuous – free running**

'+ Std clock' and '+ std data' signals are not always present at all locations shown due to the scope sync.

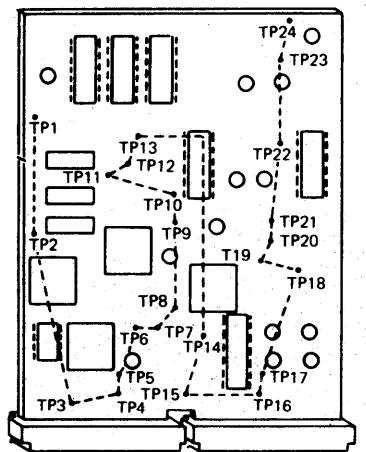
Sync trig	Int (+) dc
Sync point	Planar socket B – cross connector D02 Pin
Sweep speed	1 $\mu$ s/div
Probe point	See above
Vert amp	0.5 V/div



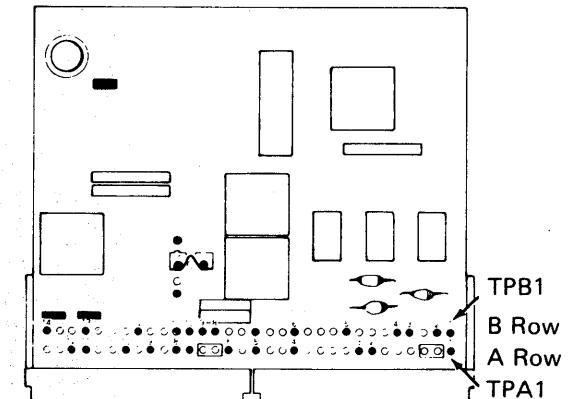
**Note:** Use X10 probe for all displays.



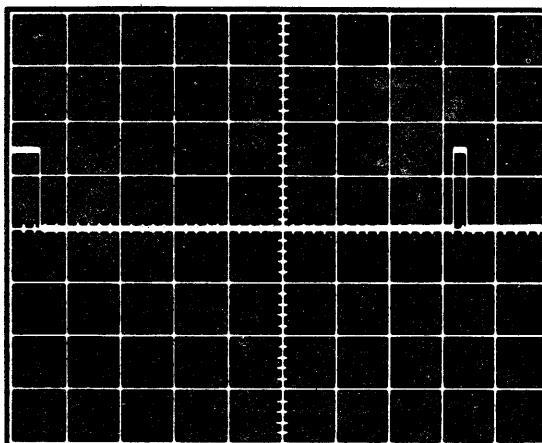
Disk FC Card X



Disk FC card Y



'+ Index'



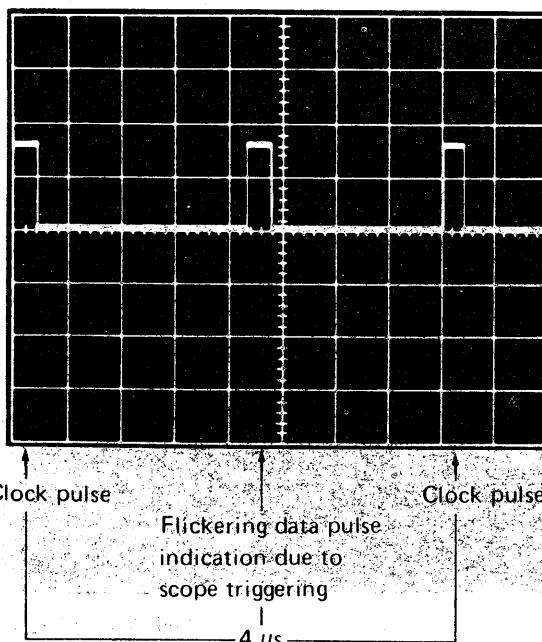
The two pulses show the disk speed time period; should be approximately 167 ms.

Sync trig Int (+) dc  
Sweep speed 20 ms/div  
Vert amp 0.2 V/div  
Probe point { Card X, TP2  
Card Y, TPB14

The signal is always present with the diskette in the drive, the cover closed, and the power on.

The index pulse duration is approximately 5 ms.

'+ File data'



Clock pulses are always present when the machine has power on.

Sync trig Int (+) dc  
Sweep speed 0.5 μs/div  
Vert amp 0.2 V/div  
Probe point { Card X, TP3  
Card Y, TPB12

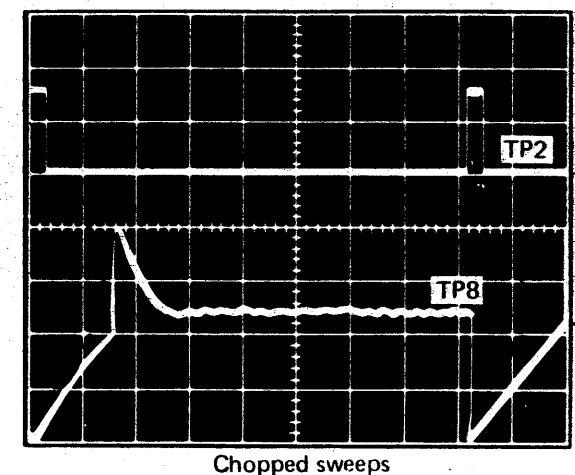
Data pulses are present when the disk drive is reading a track on the disk.

CE mode and display IDs were used for this picture (see Chapter 8).

A longer time base will show a '+ file data' envelope but no individual clock or data pulses.

Note: Use X10 probe for all displays.

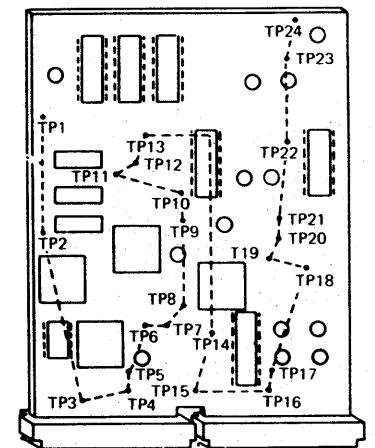
Disk FC card X  
TP8 – Phototransistor  
TP2 – '+ Index'



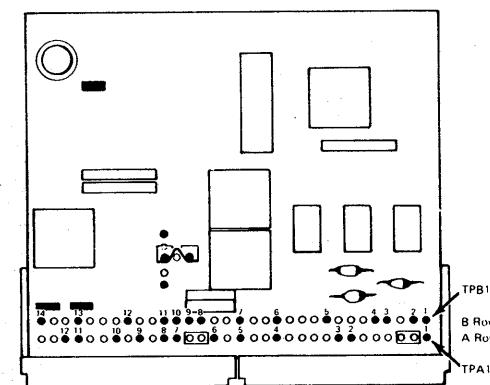
Sync trig  
Sync point  
Sweep speed  
Probe point  
Vert amp

Int (+) dc  
TP2  
20 ms/div  
See trace drawing  
0.2 V/div

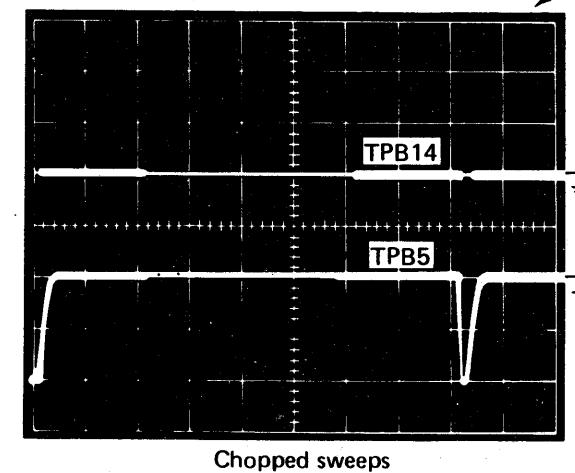
Disk FC Card X



Disk FC Card Y

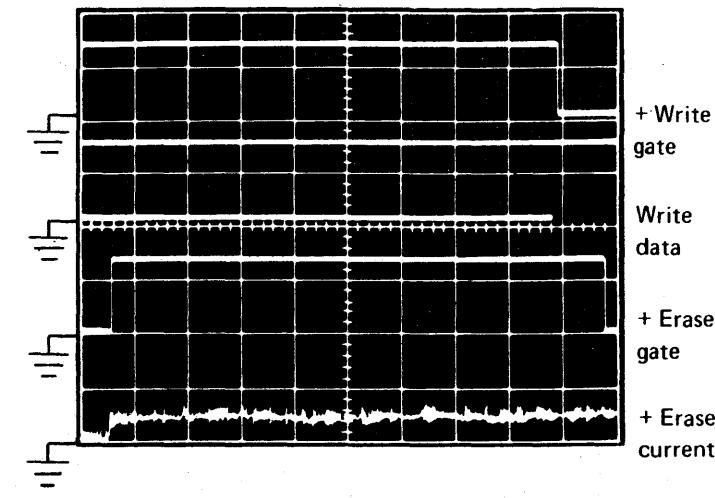


Disk FC card Y  
TPB14 – '+ Index'  
TPB5 – Phototransistor



Sync trig  
Sync point  
Sweep speed  
Probe point  
Vert amp

Int (+) dc  
TPB14  
20 ms/div  
See trace drawing  
0.2 V/div for TPB14  
0.5 V/div for TPB5



+ Write gate  
Sync for these pictures in Int (+) with rise of '+ write gate'.  
Pictures taken in enter mode (diskette in the machine) while holding down REP with REC ADV.

Probe point Write data  
+Erase gate

Particularly note that the 'write data' signal can end either plus or ground, depending on the transition in progress at the end of 'write gate'.

This picture is a different time scale to show more clearly the turn-on and turn-off lag of '+ erase gate' and 'erase current' with respect to '+ write gate' and 'write data.'

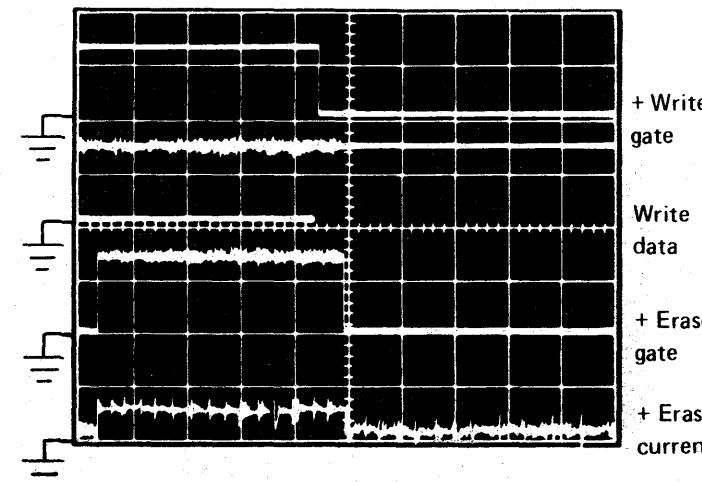
Sync trig Int (+) dc  
Sweep speed .5 ms/div  
Vert amp 0.2 V/div  
Sync point +Write gate  
{ Card X, TP12  
Card Y, TPA8

{ Card X, TP9  
Card Y, TPA6

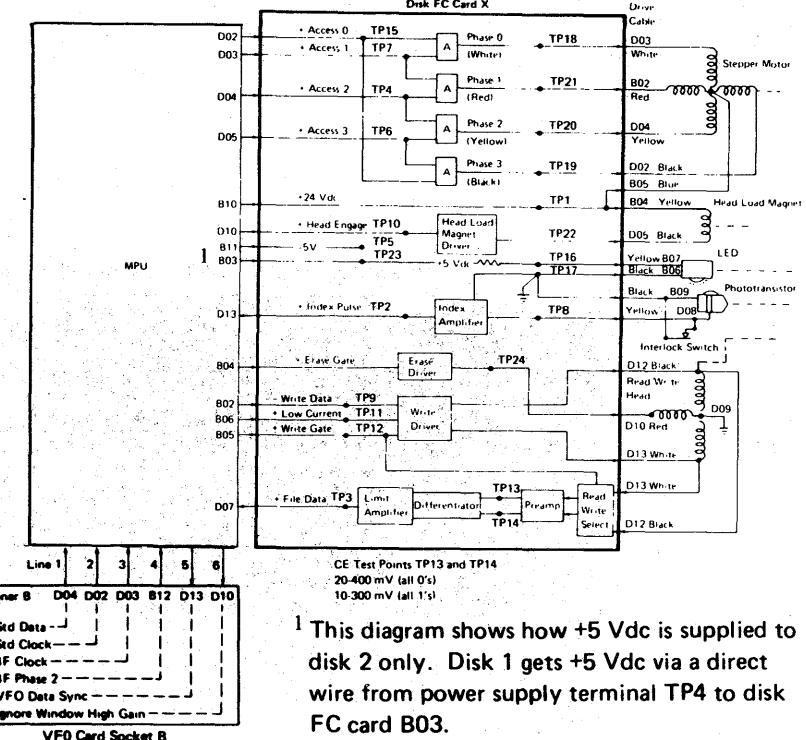
{ Card X, B04  
Card Y, TPA7

{ Card X, TP24  
Card Y, None

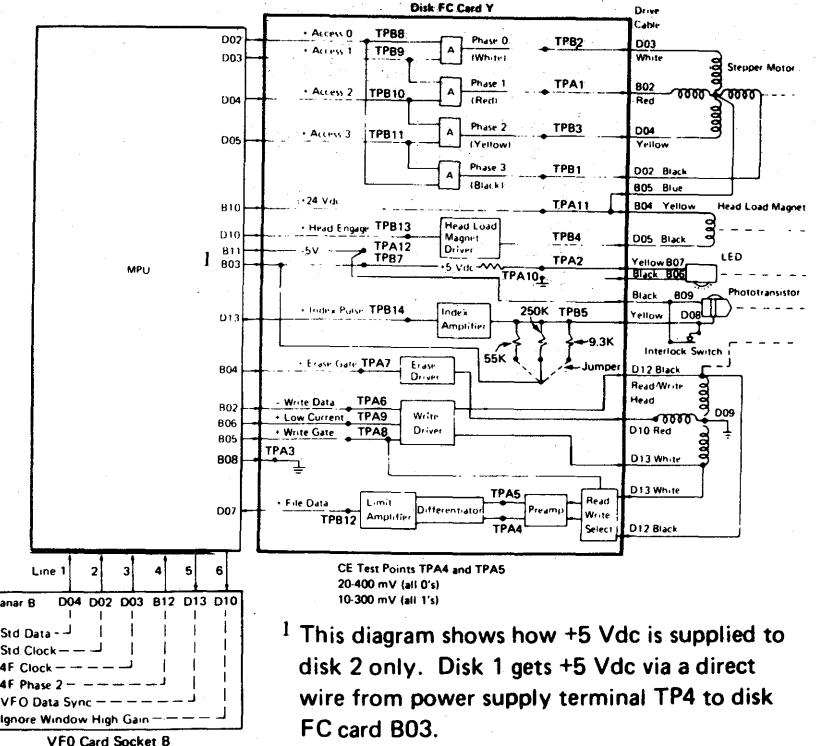
Set up as above except:  
Sweep speed 1 ms/div



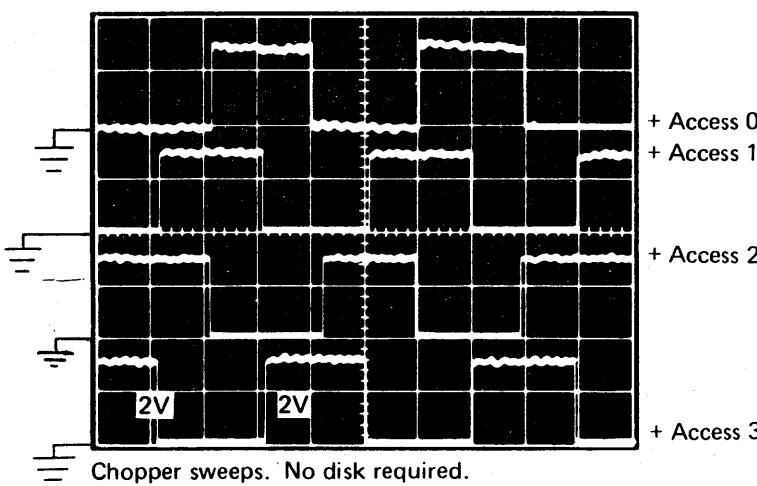
Particularly note that the 'write data' signal can end either plus or ground, depending on the transition in progress at the end of 'write gate'.



<sup>1</sup> This diagram shows how +5 Vdc is supplied to disk 2 only. Disk 1 gets +5 Vdc via a direct wire from power supply terminal TP4 to disk FC card B03.



Note: Use X10 probe for all displays.

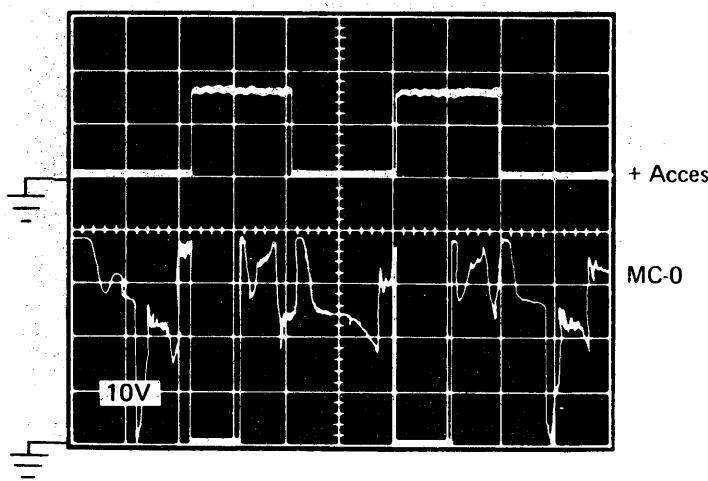


Pictures taken after power on while disk drive seeking 78 low (or seeking low to/at track 0). Timing sequence *down* as related to head location.

Sync trig Int (-) dc  
Sweep speed 50 ms/div  
Vert amp 0.2 V/div  
Sync point + Access 0  
Card X, TP15  
Card Y, TPB8

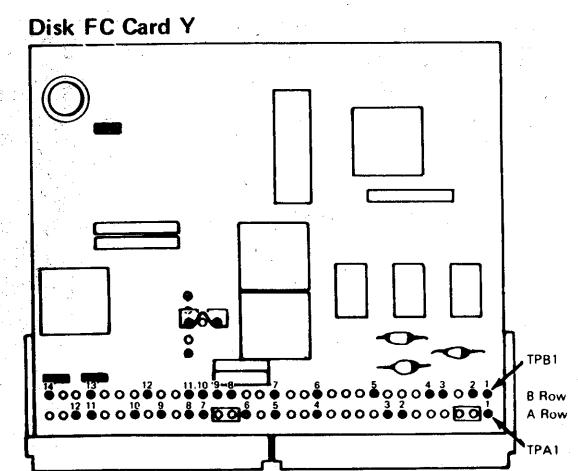
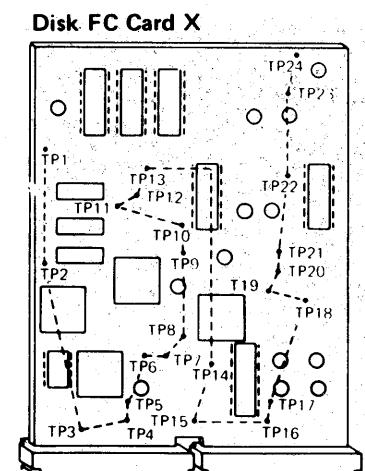
Probe point  
+ Access 1 Card X, TP7  
Card Y, TPB9  
+ Access 2 Card X, TP4  
Card Y, TPB10  
+ Access 3 Card X, TP6  
Card Y, TPB11  
MC-0<sup>1</sup> Card X, TP18  
Card Y, TPB2  
MC-1<sup>1</sup> Card X, TP21  
Card Y, TPA1  
MC-2<sup>1</sup> Card X, TP20  
Card Y, TPB3  
MC-3<sup>1</sup> Card X, TP19  
Card Y, TPB1

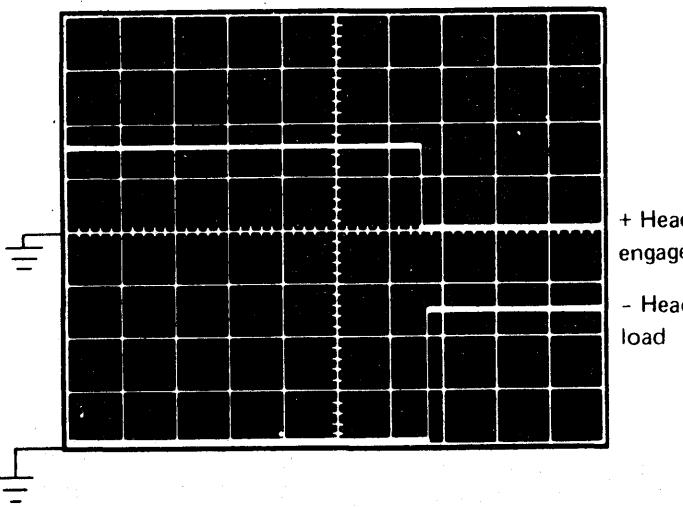
<sup>1</sup> When probing the MC points, use an X10 probe and set the vert amp to 1 V/div.



Similar scope traces should be seen between:  
+ Access 1 and MC-1  
+ Access 2 and MC-2  
+ Access 3 and MC-3

Set up same as above.





Sync the scope Int (+) on '+ head engage'.

A disk must be in the drive.

Picture taken at power on when head load magnet is picked and dropped (3742).

The approximate time energized is 1.35 seconds (1350 ms).

Sync trig Int (+) dc  
Sweep speed 200 ms/div  
Vert amp 0.2 V/div for  
'+ head engage'  
1 V/div for  
'- head load'

Sync point + Head engage  
Probe point - Head load

Card X, TP10  
Card Y, TPB13  
Card X, TP22  
Card Y, TPB4

**Note:** Use X10 probe for all displays.

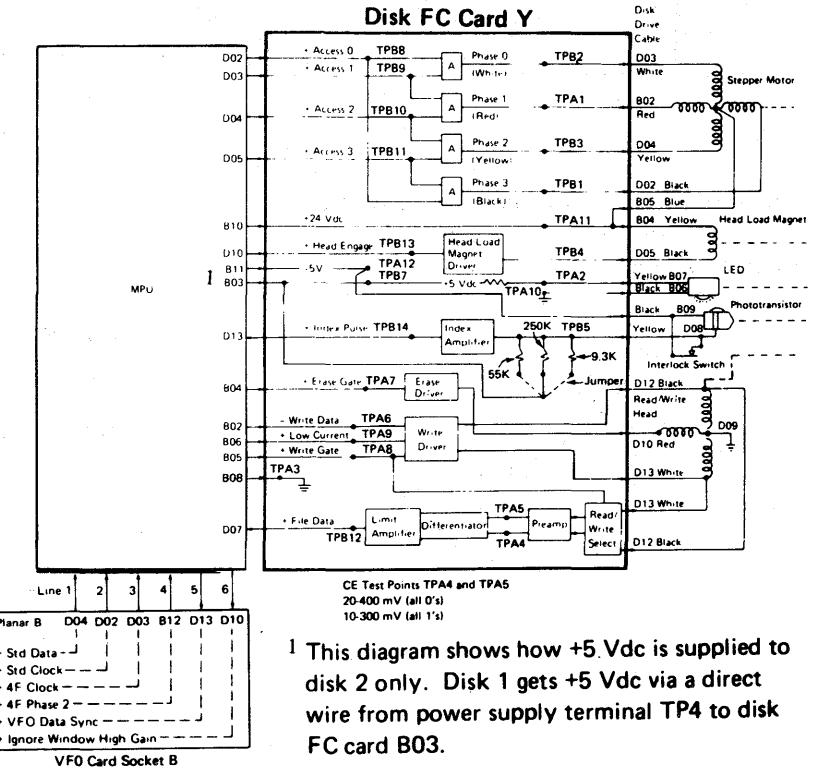
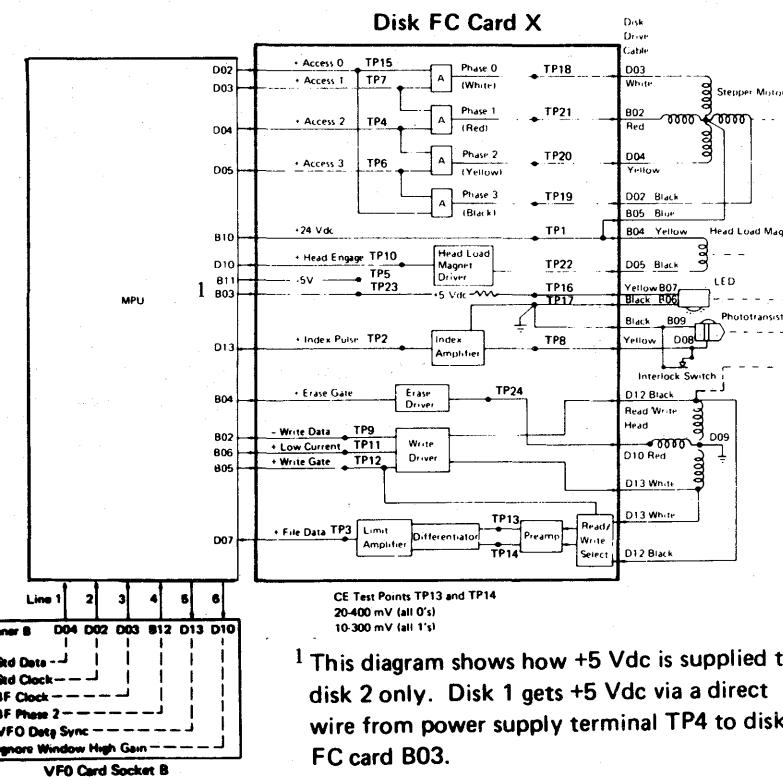
'LED current' – no pictures

This point is called out in the MAPs section of the manual to be measured as a voltage with reference to ground using the CE meter. The measurement for 'LED current' on the disk FC card is: card X, TP16; card Y, TPA2.

When using the oscilloscope, set at 500 mV/div (0.5 V/div), the voltage level was observed to be about +1.2V above ground.

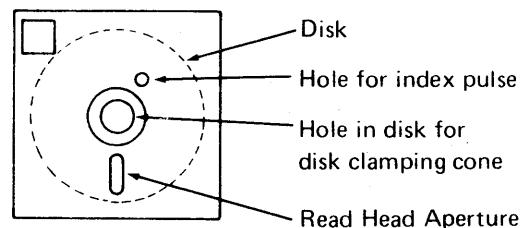
'+ Low current' – no pictures

'+ Low current' is at 0 volts during writing of tracks 00 through 43, at which time it switches to a +3V level for each '+ write gate' time while writing on tracks 44 through 76. The measurement for '+ Low current' on the disk FC card is: card X, TP11; card Y, TPA9.

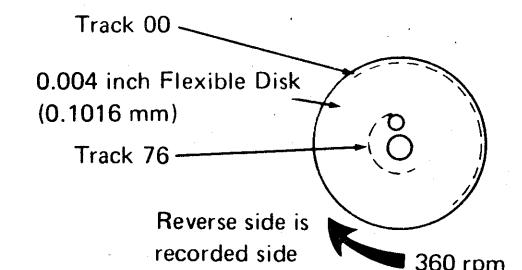


## DISKETTE CHARACTERISTICS

### Diskette



### Disk



### Long Term Storage

Place diskettes in their envelopes and store in the following environment:

- Temperature: 50° to 125°F (10.0° to 51.5°C)
- Relative humidity: 8% to 80%
- Maximum wet bulb: 85°F (29.4°C)

If a diskette has been exposed to temperatures outside the range, allow five minutes acclimation time before use. The diskette should be removed from its plastic shipping container during this time.

### Shipping and Receiving

Use shipping cartons only for shipping disks. Additional shipping cartons are available at IBM branch offices. With the diskette in place, the package weighs 10 ounces (280 g). Be sure to label the package: DO NOT EXPOSE TO HEAT OR SUNLIGHT.

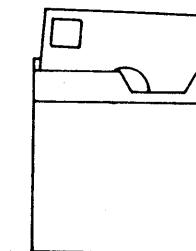
Save the carton for diskette storage and/or later shipment.

### Handling

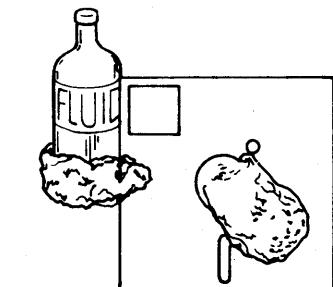
Damaged diskettes should not be inserted into the disk drive. Diskettes which are physically damaged (torn, creased, warped) or contaminated with foreign materials (eraser dust, fingerprints, cleaning fluid, etc.) may cause the disk to fail to contact the read/write head resulting in read/write errors.

Placing heavy objects on the diskettes may damage the disk.

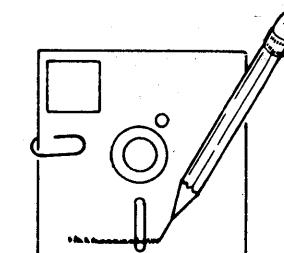
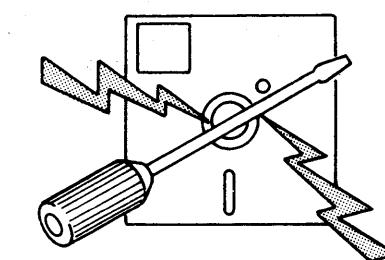
- Return diskette to envelope whenever it is removed from the disk unit.



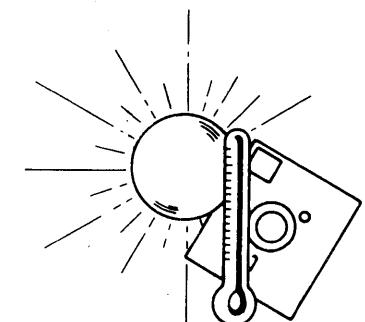
- Do not touch or attempt to clean the disk surface.



- Keep diskette away from magnetic fields and from ferromagnetic materials which might be magnetized. Any diskette exposed to a magnetic field may lose information.



- Do not use clips. Never write on a diskette with an erasable pencil. (Erasures may cause disk failures.)



- Do not expose diskette to heat or sunlight.

Chart 1  
Power on reset for disk drive.

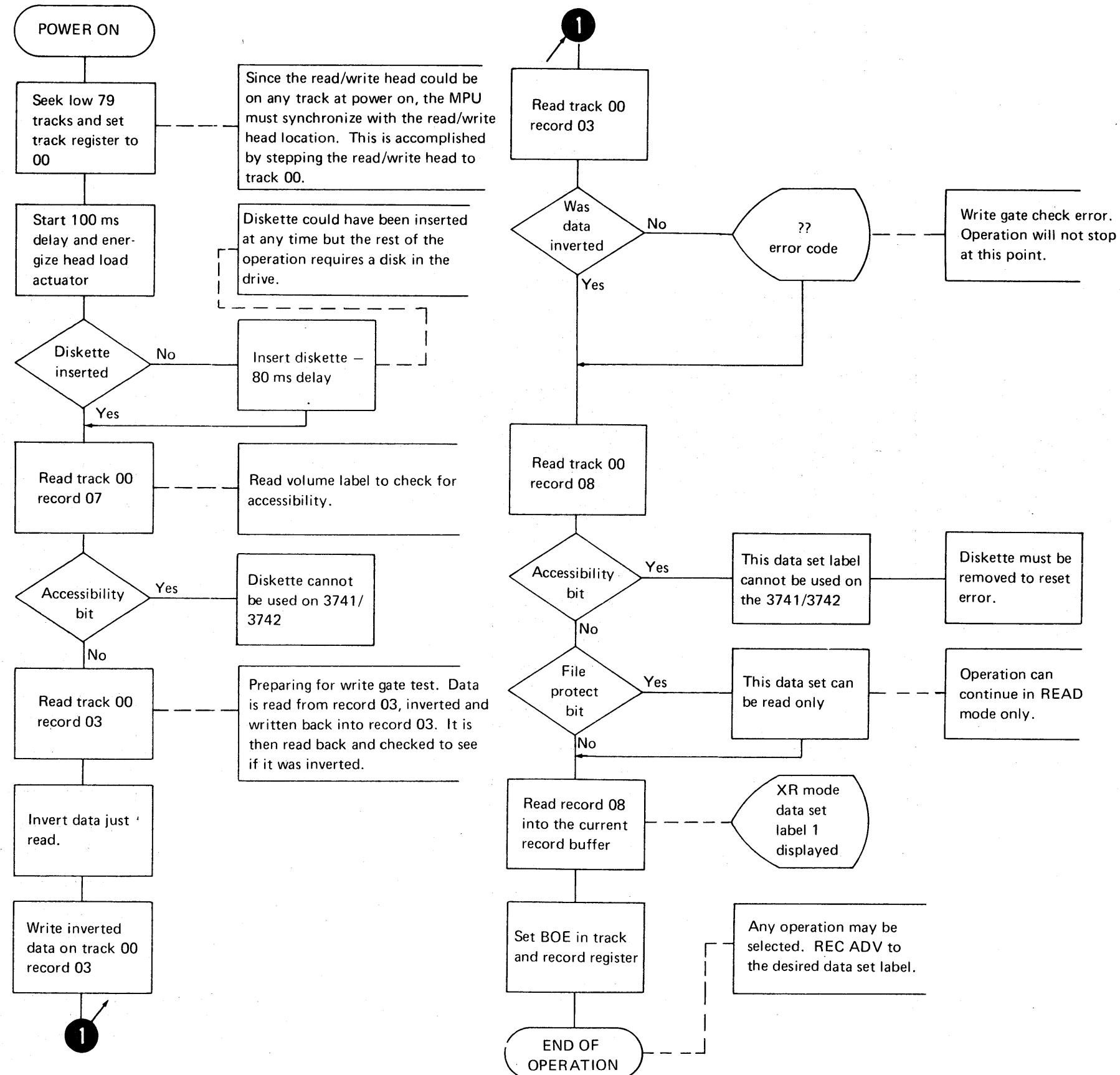


Chart 2  
The following flowchart continues from Chart 1  
and shows a *write operation using enter mode*.  
Assumes data set label 1 has a BOE of 05004.

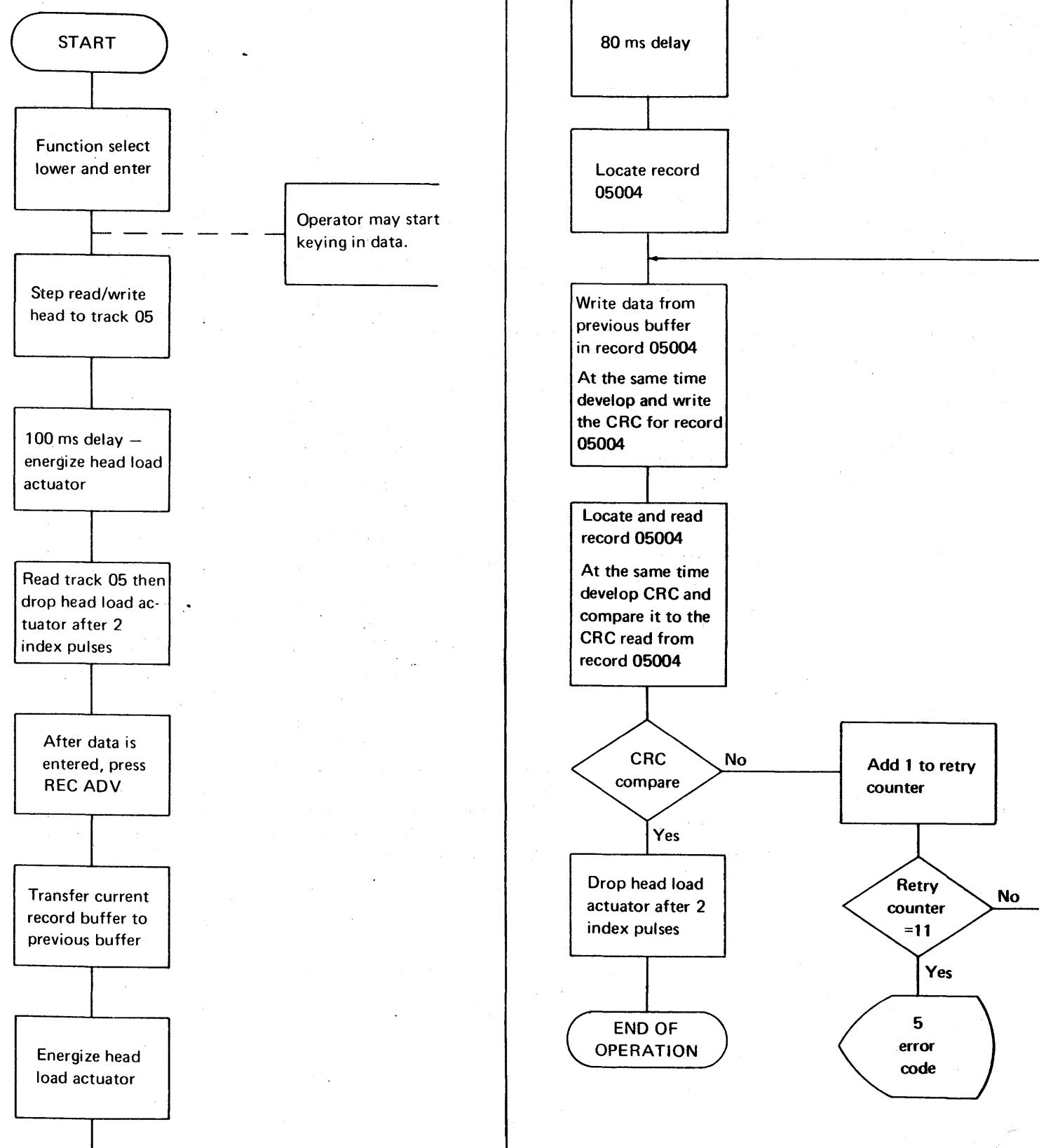
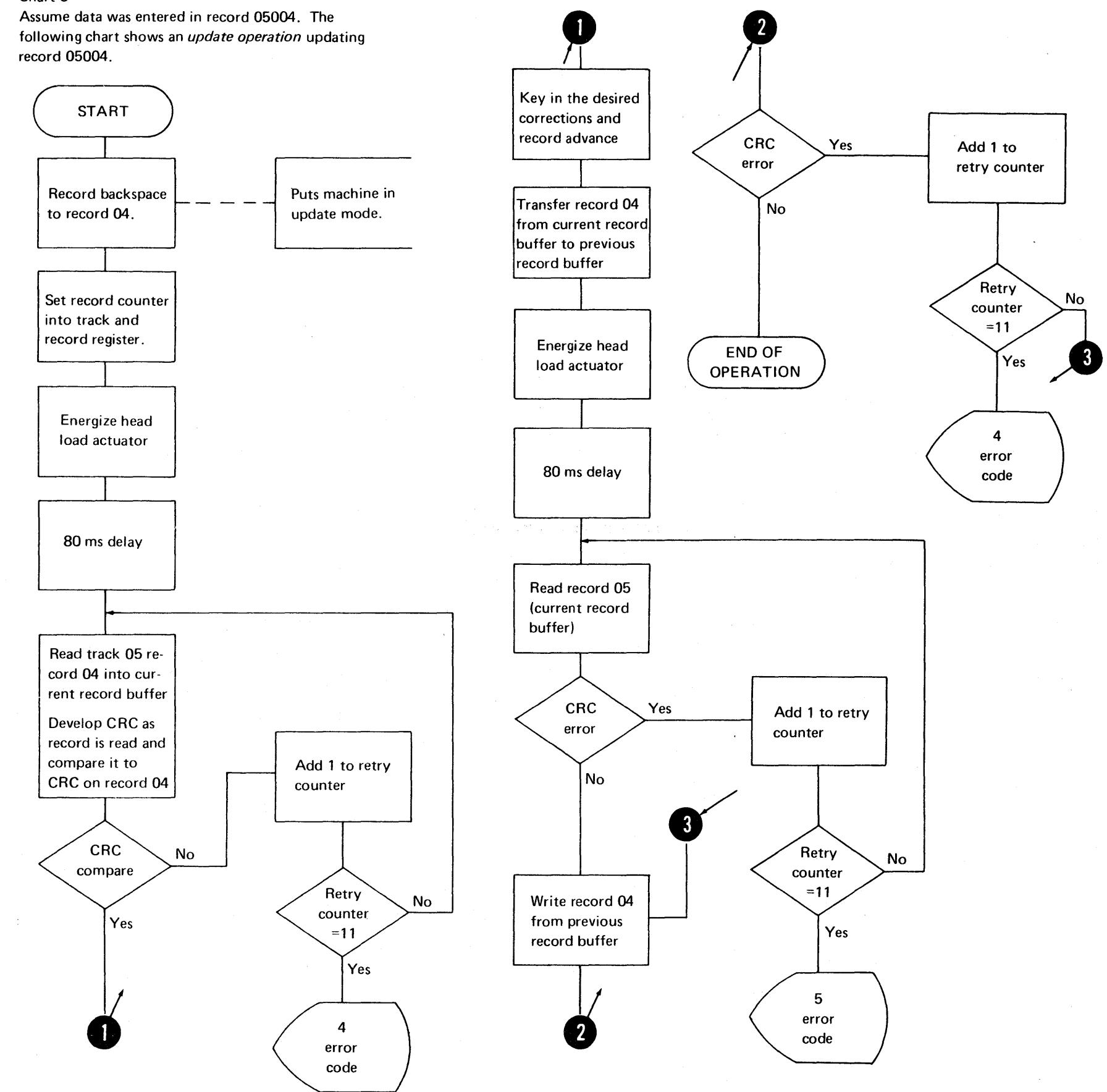


Chart 3

Assume data was entered in record 05004. The following chart shows an *update operation* updating record 05004.



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## DISPLAY THEORY

The display unit **A** gives the operator visual communications with the 3742 Dual Data Station. The display is mounted vertically in the machine and can display six lines of data, three for each station. **C** **D**

When the viewer assembly is installed, the information is displayed to the operator via a polished mirror. **B**

Details of information displayed are shown in the Operating Procedures section of this manual.

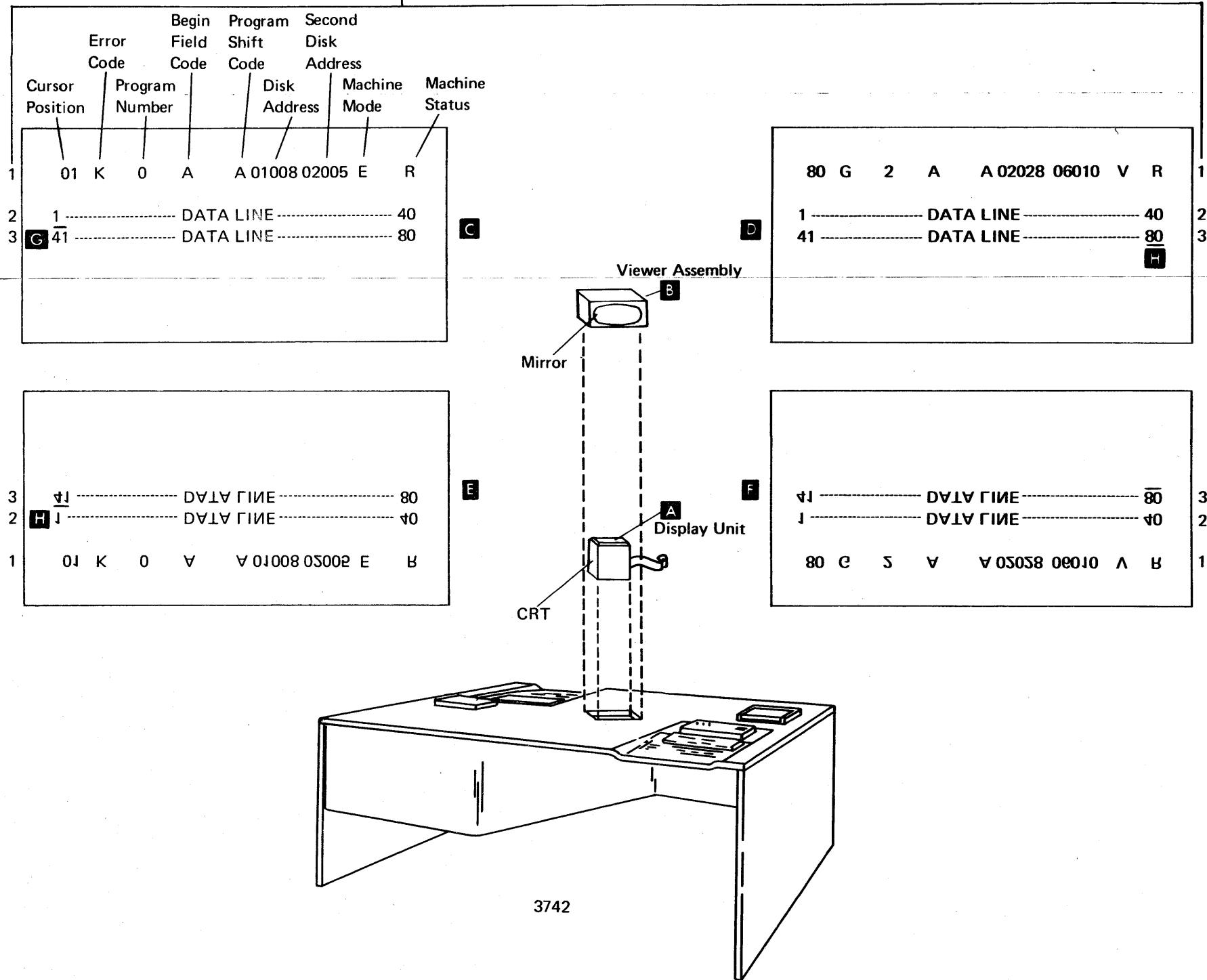
When the mirror assembly is removed, the information on the CRT looks like this. **E** **F**

The cursor is a line under the display positions being operated upon. **G** **H**

The display unit displays six lines of information, three lines to each station.

	Error Code	Begin Field Code	Program Shift Code	Second Disk Address	Machine Mode	Machine Status
	Cursor Position	Program Number		Disk Address		
1	01 K	0 A		A 01008	02005 E	R
2	1 -----	----- DATA LINE -----	40			
3	G 41 -----	----- DATA LINE -----	80			

3	J 4 -----	----- ENI ATA -----	80
2	H -----	----- ENI ATA -----	40
1	J 0 -----	----- ENI ATA -----	80



3742

### Formation of Characters

The CRT printed circuit board **A** contains the amplifiers and drivers required to generate, accelerate, deflect, and intensify the beam in the CRT **B**.

The MPU synchronizes the amplifiers and drivers so that intelligent data is displayed on the CRT screen.

The electron beam, created by the cathode and high voltage converter **C**, is deflected by a yoke **D**. The yoke contains four separate coils. The function of each coil is:

1. The vertical coil positions the beam to the line to be displayed (one of six lines).
2. The horizontal coils (master and slave) deflect the beam across the CRT screen on the line selected by the vertical yoke.
3. The character coil deflects the beam up and down over the height of the character as the beam moves across the screen.

Characters appear on the CRT screen as a result of the MPU sending the display unit Video dot pulses synchronized with the movement of the electron beam. These pulses are applied to the cathode and result in intensification of spots or dots on the screen to form characters.

### Functional Sequence

All functions except the high voltage oscillator and brightness control are directly synchronized by the MPU.

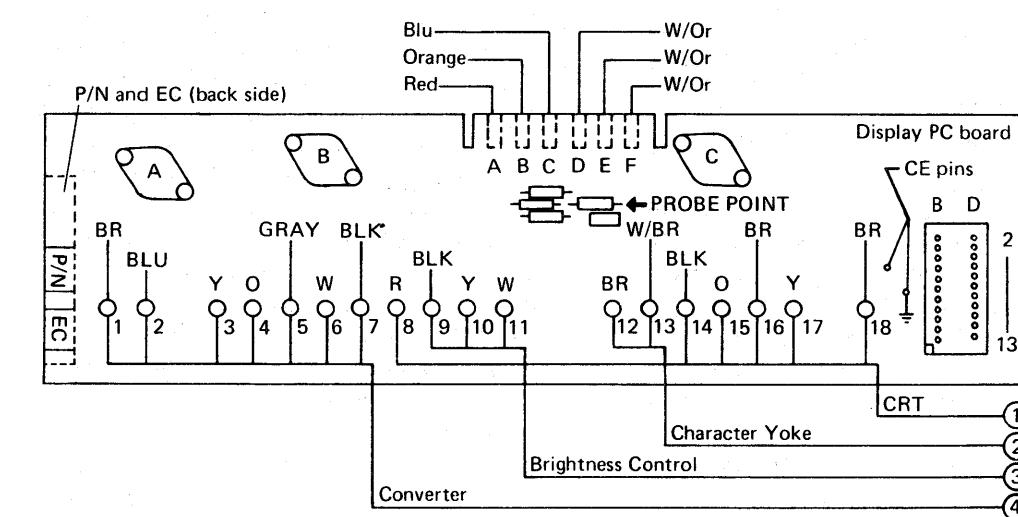
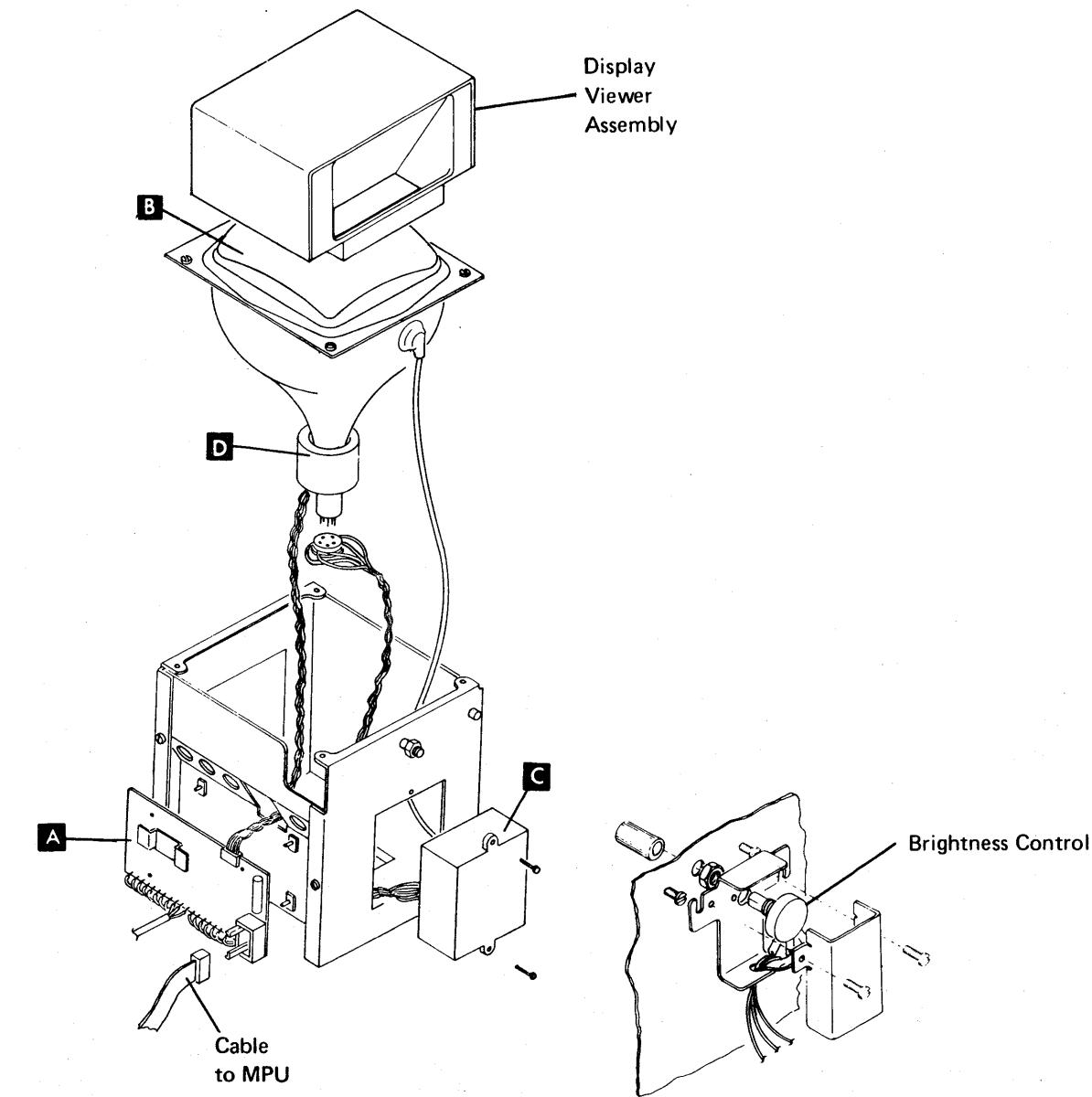
MPU signals to the CRT circuit board occur in the following sequence for each of the six displayable lines.

1. MPU activates one or more of the input lines to the vertical line control function. The electron beam is deflected vertically to the selected line location on the CRT screen.
2. MPU then activates the horizontal deflection amplifier. This starts the beam moving across the CRT screen (left to right).
3. MPU issued repetitive pulses to the character (wiggle sweep) control. This function causes the electron beam to be rapidly deflected up and down as it is moved across the CRT screen. The distance of deflection is equal to the height of a character.
4. The MPU issues dot pulses to the video dot amplifier. The pulses combined with the motion of the electron beam "wiggling" across the CRT screen form characters on the CRT screen.

### Display Unit Functional Circuits

Circuits packaged on the display unit printed circuit board accelerate, deflect, and intensify the electron beam. These circuits are:

1. High voltage supply (oscillator). **E**
2. Character wiggle sweep circuit. **F**
3. Horizontal deflection circuit. **G**
4. Vertical deflection (line control) circuit. **H**
5. Brightness control circuit. **I**
6. Video dot amplifier. **J**



### Circuit Description

The high voltage oscillator **E** is free running. The purpose of the oscillator and the high voltage converter **K** is to generate the 400 and 12,000-volt levels from the 12-volt supply. A time delay circuit on the CRT circuit card prevents the high voltage oscillator from starting for approximately 15 seconds after machine is turned on, to prevent damage to the CRT during filament warm-up. A current detecting circuit on the CRT circuit board monitors the high voltage oscillator current at all times. If the oscillator current exceeds the maximum limits, the oscillator is turned off for approximately 15 seconds. The high voltage converter has two outputs. One output is labeled 12,000 volts, the other is labeled 400 volts dc. The 12,000 volts is used to accelerate the electron beam. The 400 volts is used for brightness control. **J**

The brightness control is part of a voltage divider for the 400 volts dc from the converter. The center tap voltage of brightness control pin 10 is fed to the video dot amplifier. **J** It controls the bias voltage on the cathode of the CRT on pin 17. The bias voltage can be varied from approximately +30 volts to approximately +120 volts by turning the brightness control *potentiometer*. **L** The lower the voltage is on pin 17, the greater the light intensity will be on the face of the CRT.

The video dot amplifier **J** is used to amplify the video pulses sent by the MPU. When a dot is to be indicated on a face of the CRT, the MPU issues a negative going signal for 444 nanoseconds to the video dot amplifier. The negative pulse is amplified and sent to the cathode of the CRT. The negative pulse forces the positive bias on the cathode down to a negative level, allowing the electron beam to be sent to the face of the CRT. The MPU holds the video line at a (+) level during horizontal retrace to block out video during retracing.

A wiggle sweep circuit **F** is used to control the height of the characters displayed on the CRT. The MPU controls the duration of each wiggle sweep cycle. The electron beam is deflected (by the character yoke) upward and downward 10 times for each character displayed on the CRT. Wiggle sweep pulses and video dot pulses are synchronized by the control unit to form characters on the face of the CRT. The dot pattern

for an H is shown in the diagram. **M** Also, shown in the diagram is the dot pattern for a *cursor* in the position immediately following the H character. There are 64 characters which can be displayed on the CRT. Katakana machines can display an additional 64 characters. Additional characters are used within the machine, such as characters that are entered from the keyboard in hexadecimal code. These characters are displayed as a cross hatch pattern.

Horizontal deflection **G** of the electron beam is accomplished with two horizontal coils (master **N** and slave **P** coil). These deflection coils work together in a push/pull fashion as follows:

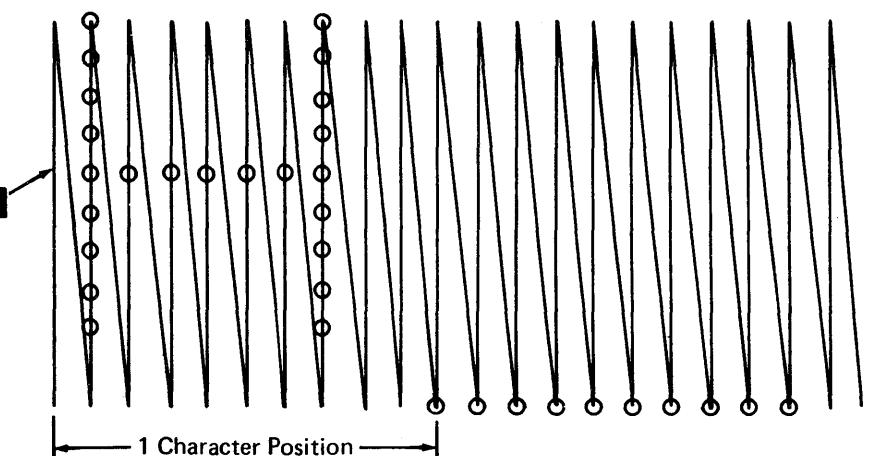
Assume the initial location of the electron beam is at the extreme left side of the CRT screen.

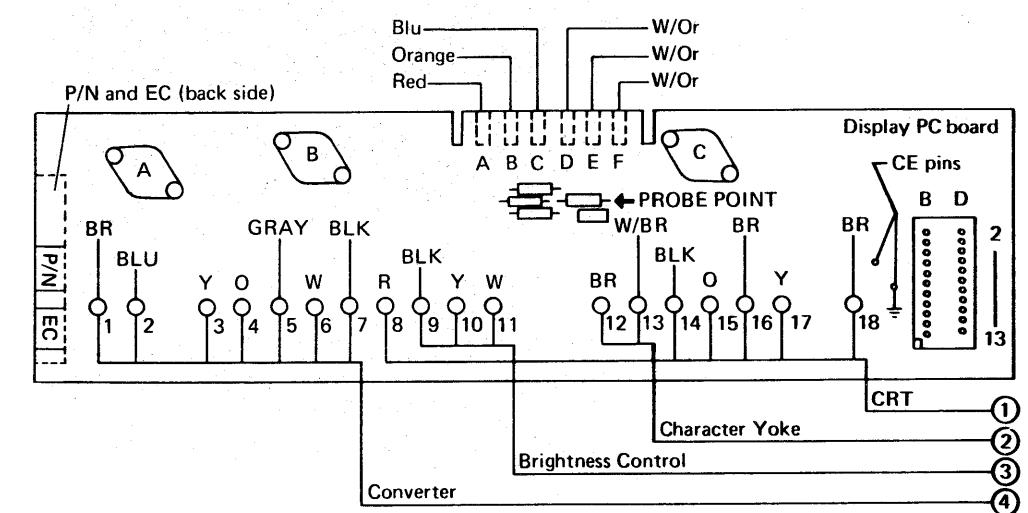
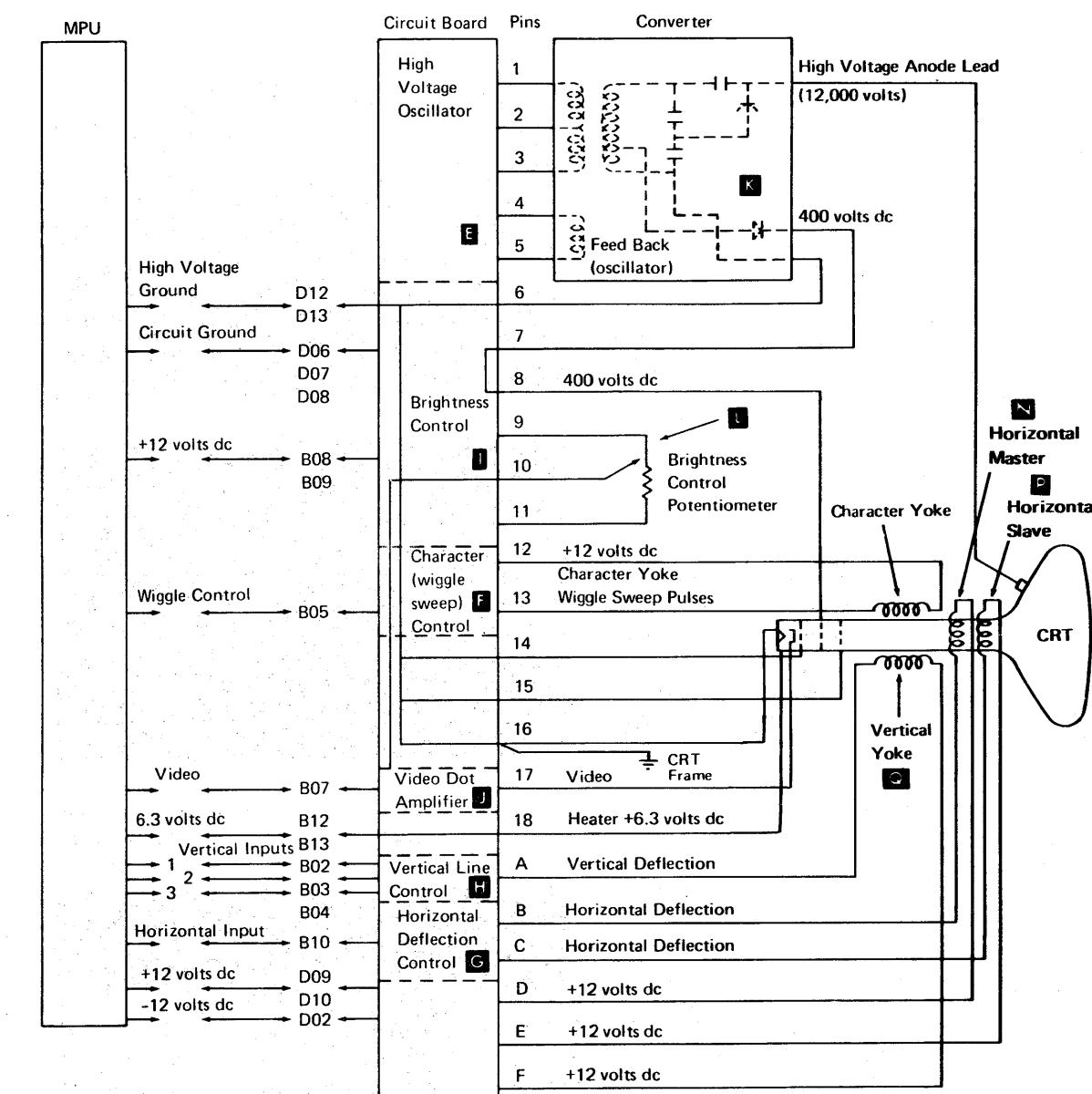
1. The MPU sends a (-) horizontal sweep pulse to the CRT circuit board on pin B10.
2. The horizontal deflection amplifier applies an increasing current to the master coil and a decreasing current to the slave coil. When the current in the two coils are approximately equal, the electron beam will be in the center of the CRT screen. When the master coil is maximum, the slave coil current will be minimum and the electron beam will be on the extreme right side of the CRT screen.
3. The MPU now sends a (+) horizontal sweep pulse to the CRT circuit board on pin B10 (retrace command).

4. The horizontal deflection amplifier changes the current through the coils as follows: The master coil current decreases and the slave coil current increases. The electron beam will be at the extreme left side of the CRT screen when the slave coil current is maximum and the master coil current is minimum.

The total time to trace one horizontal line and return the electron beam to the left is 4 milliseconds. Therefore, the time required to trace or display six lines is 24 milliseconds and each line is retraced or refreshed every 24 milliseconds. The line refresh rate divided into 1 second gives a frame (picture) refreshment rate of approximately 42 times per second.

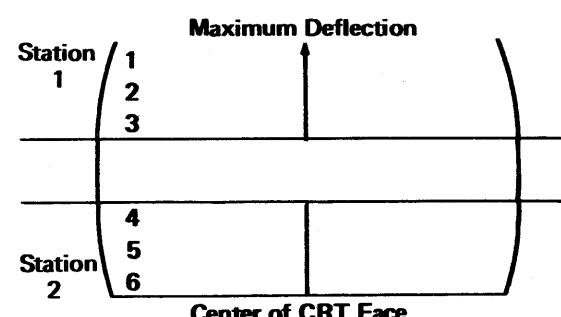
The vertical step circuit **H** controls the vertical location of the data line on the CRT. Three vertical inputs control the location of this line. The vertical inputs from the MPU are added by the vertical control circuitry on the CRT printed circuit board. The resulting output current is sent to the vertical coil **Q** which moves the electron beam to the appropriate location on the face of the CRT. Below is a chart which identifies the status of the three signal lines from the MPU to the CRT circuit board for each of the six video lines displayed on the face of the CRT. The chart also shows the sequence in which the lines are traced. A negative input causes current to increase through the vertical yoke.

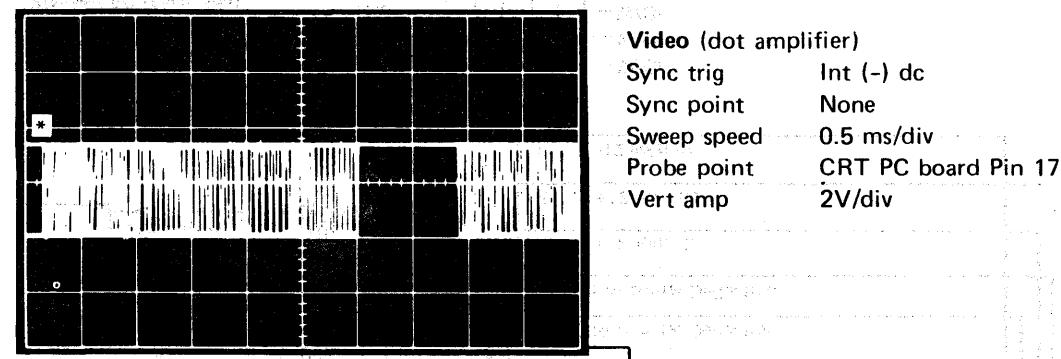
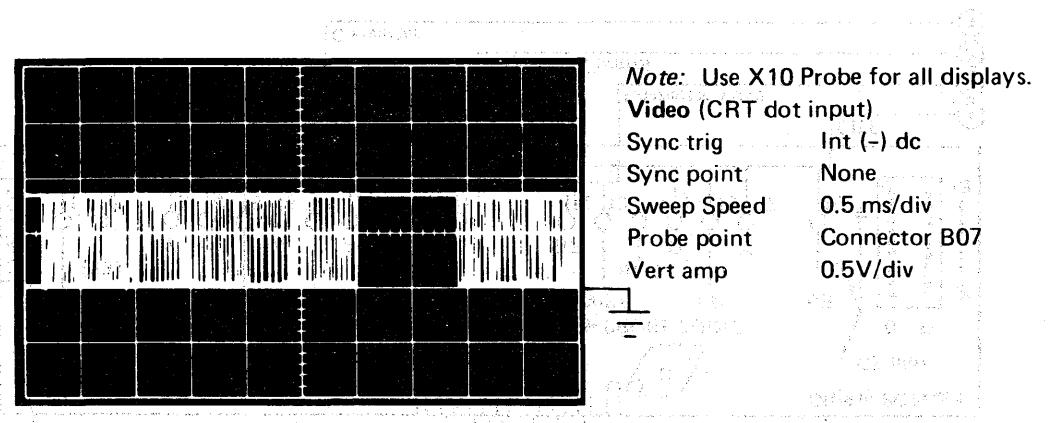




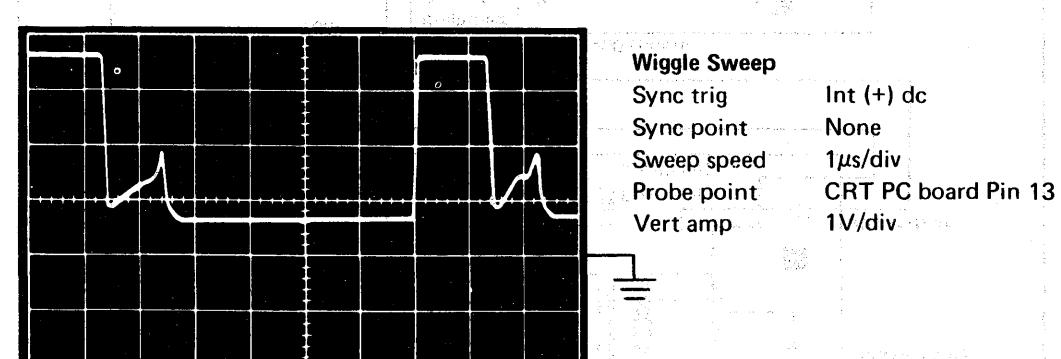
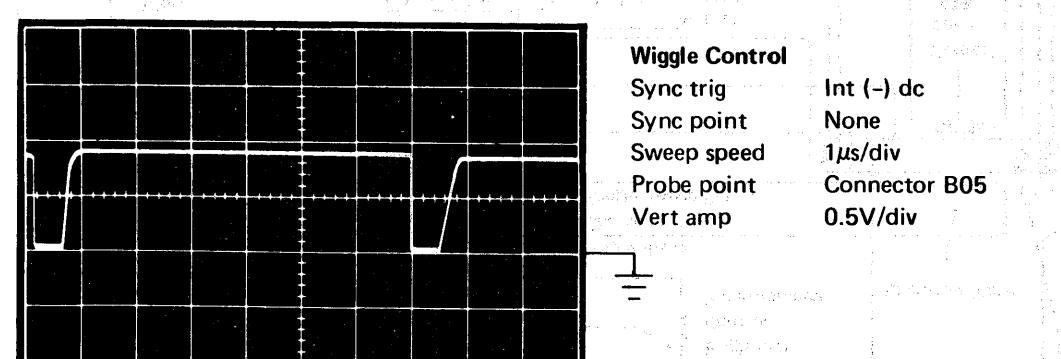
CRT Line Number and Sequence	Vertical Input Lines (Signal Polarity)		
	Pin B02	Pin B03	Pin B04
2	+	-	-
3	-	+	-
1	-	-	-
6	+	+	+
4	+	-	+
5	-	+	+

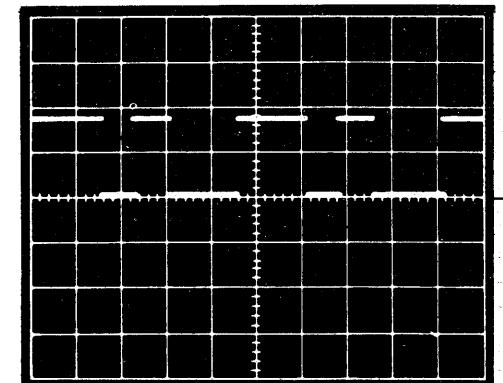
**Note:** Polarity is (-) for an active signal.





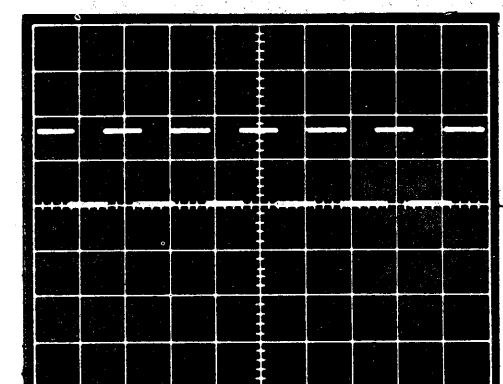
\*Note: Position above ground varies with intensity control. Lowest position with maximum intensity.





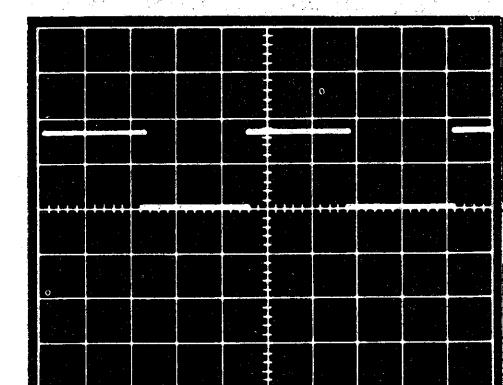
#### Vertical Input 1

Sync trig Ext (+) dc  
Sync point Connector B04  
Sweep speed 5 ms/div  
Probe point Connector B02  
Vert amp 0.5V/div



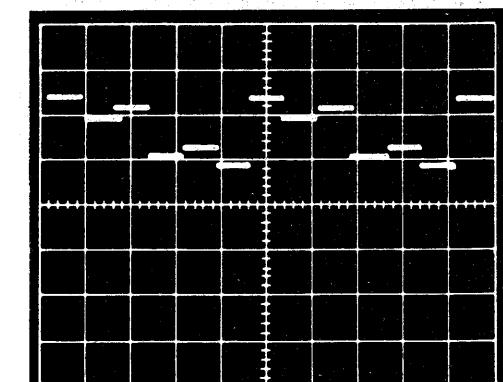
#### Vertical Input 2

Sync trig Ext (+) dc  
Sync point Connector B04  
Sweep speed 5 ms/div  
Probe point Connector B03  
Vert amp 0.5V/div



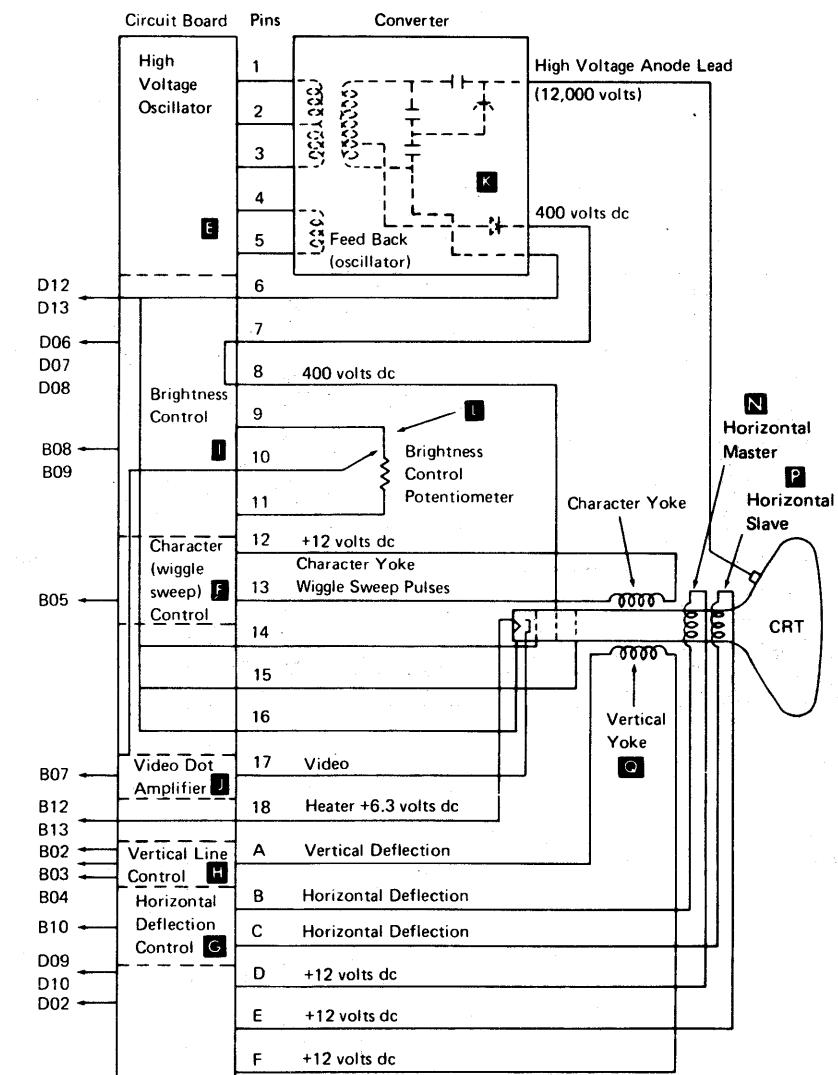
#### Vertical Input 3

Sync trig Ext (+) dc  
Sync point Connector B04  
Sweep speed 5 ms/div  
Probe point Connector B04  
Vert amp 0.5V/div



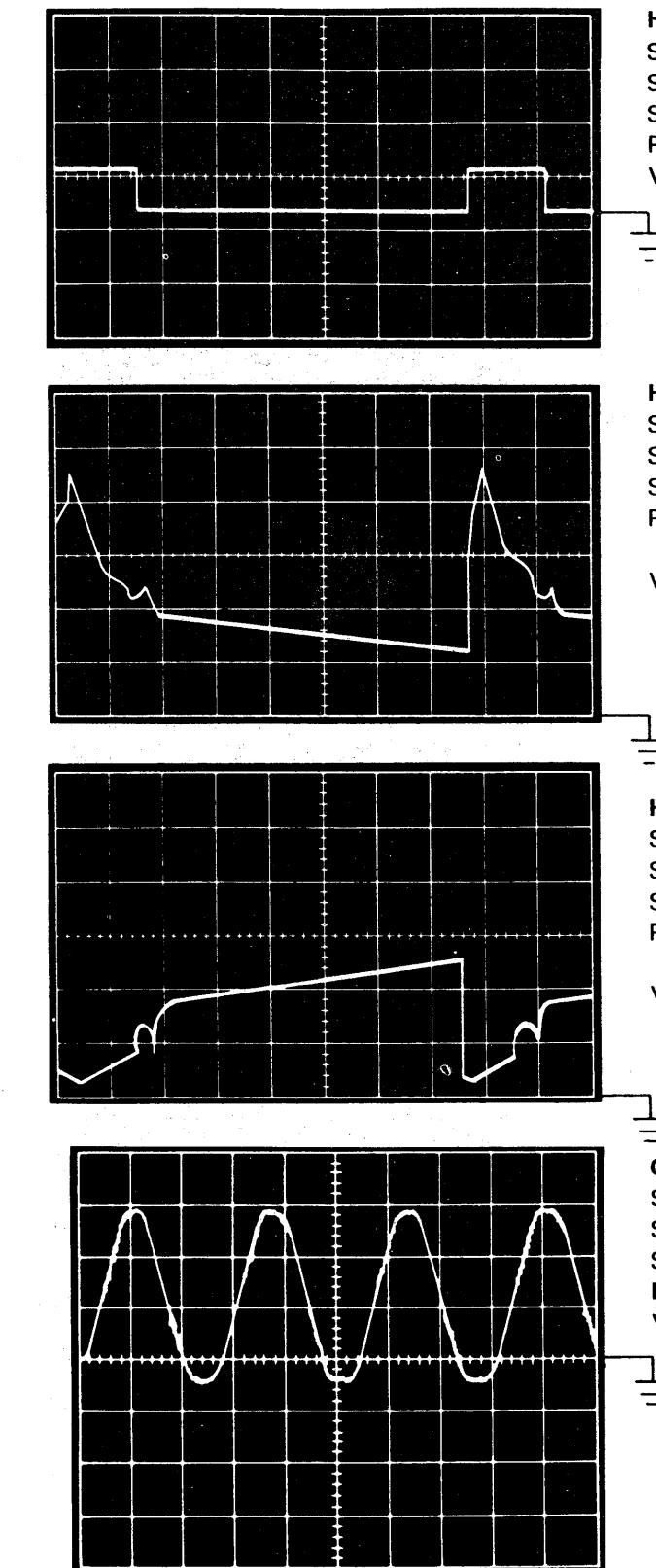
#### Vertical Deflection

Sync trig (Ext (+) dc  
Sync point Connector B04  
Sweep speed 5 ms/div  
Probe point CRT PC board  
Pin A  
Vert amp 0.5V/div



\*\* Line 6 is top line of this pattern.  
Line 1 is bottom.

**Note:** Large voltage spikes may appear at start of each step.

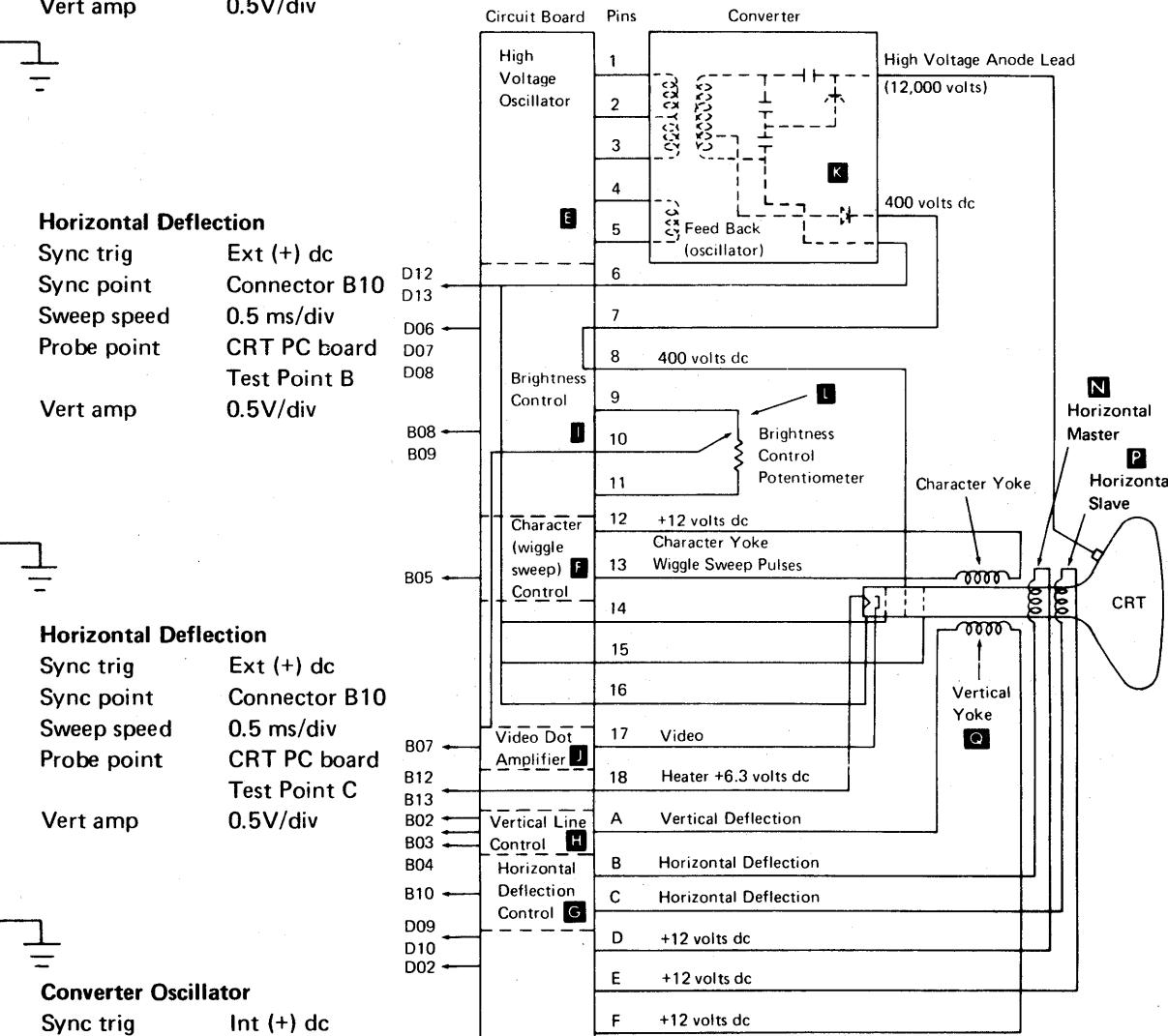


**Horizontal Input (Return)**  
Sync trig Int (+) dc  
Sync point None  
Sweep speed 0.5 ms/div  
Probe point Connector B10  
Vert amp 0.5V/div

**Horizontal Deflection**  
Sync trig Ext (+) dc  
Sync point Connector B10  
Sweep speed 0.5 ms/div  
Probe point CRT PC board  
Test Point B  
Vert amp 0.5V/div

**Horizontal Deflection**  
Sync trig Ext (+) dc  
Sync point Connector B10  
Sweep speed 0.5 ms/div  
Probe point CRT PC board  
Test Point C  
Vert amp 0.5V/div

**Converter Oscillator**  
Sync trig Int (+) dc  
Sync point None  
Sweep speed 20 $\mu$ s/div  
Probe point CRT PC board Pin 1  
Vert amp 1V/div



## KEYBOARD THEORY

The keyboard provides operator interface to the MPU. Keyboard interface is provided by way of toggle switches and key modules. Toggle switches control Auto Dup/Skip, Auto Record Advance, Program Numeric Shift, and either Katakana shift or speed select.

### Toggle Switches

The toggle switches are mounted on a bracket which is attached to the bottom of the keyboard. The switches indicate the following.

#### AUTO DUP/SKIP (ADS)

When the switch is on and the field is a programmed duplicate field, the MPU automatically duplicates (enters) data from the corresponding field of the previous record into the current record. When the switch is off, it signals the MPU that all fields are manual fields.

#### AUTO REC ADV (ARA)

This signals the MPU that, when a complete record is entered, the MPU can automatically store the record on disk, and prepare for the next record entry.

#### PROG NUM SHIFT (PNS)

In the ALL CHAR position, under program control, the switch indicates to the MPU that all the character keys are active. In the NUMBERS ONLY position, the switch indicates to the MPU that only the characters 0-9, dash, space and plus are valid. When the machine is in alpha shift, all characters are active regardless of the position of the switch.

#### KATAKANA SHIFT (KSW)

When this switch is ON, the station is placed in the KATAKANA SHIFT state for all keying. If the station is under program control, this switch will override other programmed shifts. ALPHA SHIFT, NUM SHIFT, and KANA SYMB will each override the KATAKANA SHIFT switch.

### Key Modules

Each keyboard contains up to 64 key modules (buttons) mounted into an all keys assembly. Each key module contains a flyplate that normally rests on two etched pads on the keyboard circuit board. When the key is pressed, the flyplate moves away from the circuit board. Releasing the key returns the flyplate to its normal position. The keyboard circuit board contains logic to perform the following functions.

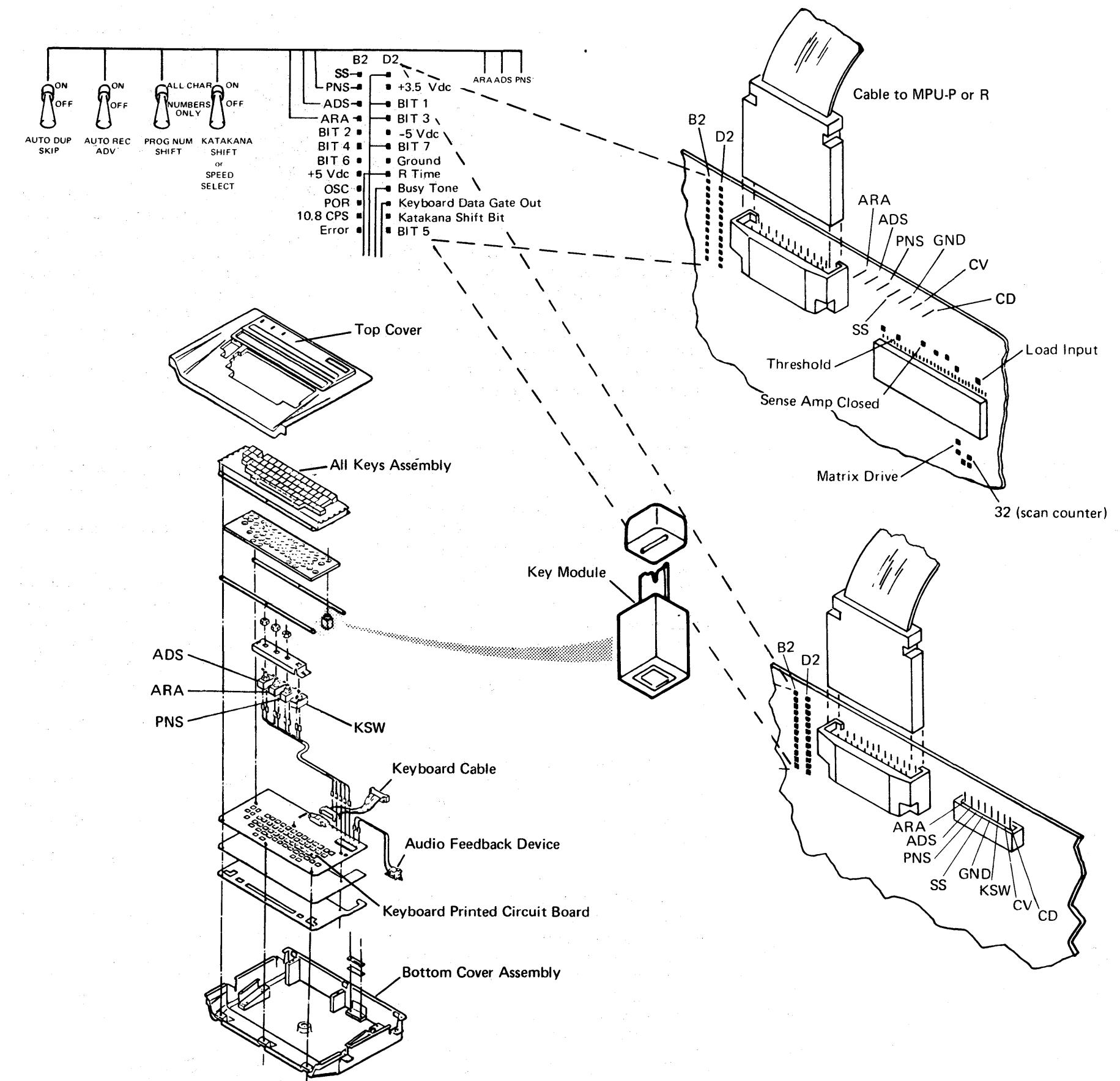
1. Audio feedback control.
2. Key detection and decode control.
3. Character storage control.
4. Keyboard character transfer control.
5. Alpha and numeric shift functions.
6. Character repeat function.

### Audio Feedback Control (Clicker)

This device is an electromechanical device which causes a click to be emitted each time a key code enters the character buffer.

An MPU detected error, such as an operator error or a keyboard overrun error activates the error line between the keyboard and the MPU. This error line prevents the clicker operation. The RESET key is used to reset the error. The RESET key is the only key that will give a click every time it is pressed, even though there is an error.

A busy tone, or buzz, signifies that the MPU is busy and cannot accept characters from the keyboard. The MPU becomes momentarily busy each time a record is written on disk. A busy signal (50-Hz square wave) is placed on the interface line from the MPU to the keyboard each time the MPU wishes to signal the operator that it is busy. When the busy tone stops, the MPU is no longer busy.



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### Key Detection and Decode Control

The unique design of the keyboard is based upon key detection through capacitive coupling. The detection of a pressed key (flyplate up) is the same for all keys on the keyboard. An address is developed by a scan counter and is used to sample each key position one at a time until all 64 positions have been sampled. This sampling process takes place continuously as long as power is on. The sampling of the 64 key positions takes 16 ms. The keyboard circuitry, therefore, takes 250  $\mu$ s to process each key position.

The above addressing and sampling schemes are accomplished in the following manner. The display sends oscillator pulses via the MPU at the rate of 140.6 kHz/s, to the keyboard. This signal is fed to a key cycle control circuit. The key cycle control circuit generates a load input pulse every 250  $\mu$ sec which is used to develop matrix drive pulses and to advance a scan counter.

The 6-bit position binary scan counter counts from 00 to 63 continuously. At any given point in time, the contents of this counter is the address of the key pad that the keyboard circuitry is probing. If the flyplate is in the up position, the contents of the scan counter is encoded to be sent to the MPU.

The first four bit positions of the scan counter, positions 1, 2, 4, and 8, are sent to a 4 to 16-bit encode driver. Only one of the 16 output lines of the encode driver will be active at a time. Each of the 16 output lines is ANDed with matrix drive pulses and then sent to four etched key pads.

Matrix drive pulses are capacitively coupled through each key pad to AND gates of the appropriate sense amplifiers as long as the key module flyplate is in the down position.

The scan counter positions 16 and 32 are sent to a circuit which encodes the two bit lines into four select lines. The select lines are ANDed with the capacitively coupled matrix drive lines from the key pads.

Sense amplifiers produce a sense amplifier closed pulse when the following conditions are satisfied:

1. A sense amplifier is selected by active select line.
2. A matrix drive pulse is not present. This means the associated flyplate is more than 0.006" above its etched pad.

This combination of matrix drive pulses and select line pulses, allows the keyboard circuitry to sample each of the 64 key positions one at a time.

### Shift Key Functions

The shift keys are processed somewhat differently than the rest of the keys on the keyboard. However, detection of these keys being pressed is exactly the same as all other keys. The shift keys are used only to modify the character code that is sent to the MPU. Each time a shift key is pressed, the appropriate shift bit latch is set on. It will remain on for 16 ms (one keyboard cycle). At the end of this cycle, the shift latches are reset. If the key is still pressed at the start of the next cycle, the shift latch is again turned on. If a character key is pressed while the shift latch is on, the shift bit and the appropriate character codes are transferred to the keyboard character buffer. Any shift key can override a programmed shift function in the MPU.

Anytime the station is in Katakana shift (programmed for Katakana shift, the KATAKANA SHIFT switch ON, or the KANA SHIFT key pressed), the Katakana shift can be overridden with ALPHA SHIFT, NUM SHIFT, or KANA SYMB. The overriding shift key will define the character or function that will be entered into the station when a character key or function key is pressed.

When the station is in Katakana shift, the following function keys require that ALPHA SHIFT or NUM SHIFT be used with that key to activate the function, otherwise the corresponding Katakana character will be entered into the station:

HEX, FLD COR, DUP, CHAR ADV, REC ADV, FLD ADV, SEL PRG, SKIP, RT ADJ, and CHR BKS.

### Character Repeat Function

This function provides the operator with a quick method of repetitively entering the same character. Pressing REP is sensed the same as all other keys. However, the bit code for REP is never sent to the MPU.

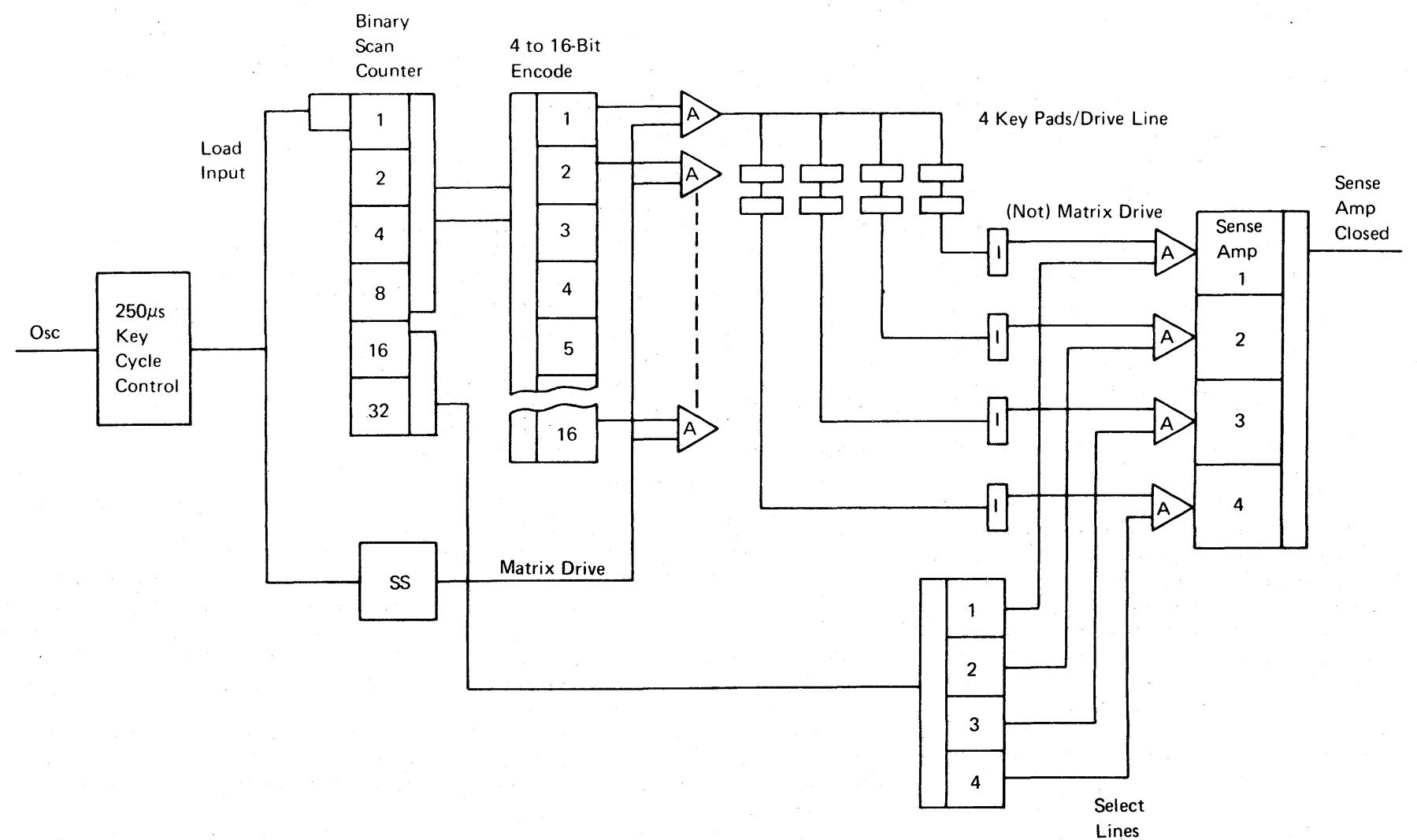
Using this function, key codes can be sent to the keyboard character buffer at a 10.8 character per second rate.

Normally, the three character compare register would inhibit a character from being transferred to the keyboard character buffer more than once unless the key is released and pressed again. With the repeat function, the compare register is reset at the 10.8-Hz rate allowing the key code to be accepted the next time it is scanned.

The MPU provides the 10.8-Hz square wave signal to the keyboard where it is used only with the repeat function. The repeat key latch is set on when the keyboard circuitry detects that REP is pressed and when the 10.8-Hz square wave is at its most positive level. This latch resets the scan counter and holds the scan counter at 0 with a load input pulse. The keyboard is, therefore, inactive while this latch is on. When the 10.8-Hz signal changes to its negative level, the repeat key latch is reset and the three character compare register is reset. The scan counter resumes normal operation at the occurrence of the next load input pulse.

During the negative level of the 10.8-Hz signal, the repeat key latch cannot be set on, and the scan counter can complete approximately three complete keyboard scan cycles. Therefore, during this time, codes for pressed keys can be sent to the keyboard character register buffer one at a time under normal control of the three character compare register.

When the 10.8-Hz signal returns to its most positive level, the repeat key latch is set on and the function repeats. The code for any key, held down in conjunction with REP, will therefore be sent to the MPU at a 10.8 character per second rate.



### Character Storage Control

A three-character compare register is used to prevent multiple entries by a single key being pressed. If a key is pressed and held, this compare register blocks the same key code from being sent to the character buffer more than one time. Blocking continues until the character is erased from the compare register. Erasing is accomplished by releasing the keyboard key.

As the name implies, the three-character compare register can store up to three characters. Therefore, three keys could be pressed and held. The first complete keyboard scan made on these keys would result in sending each of the characters to the character buffer one at a time. A fourth character cannot be sent to the character buffer until at least one of the three previously pressed keys has been released.

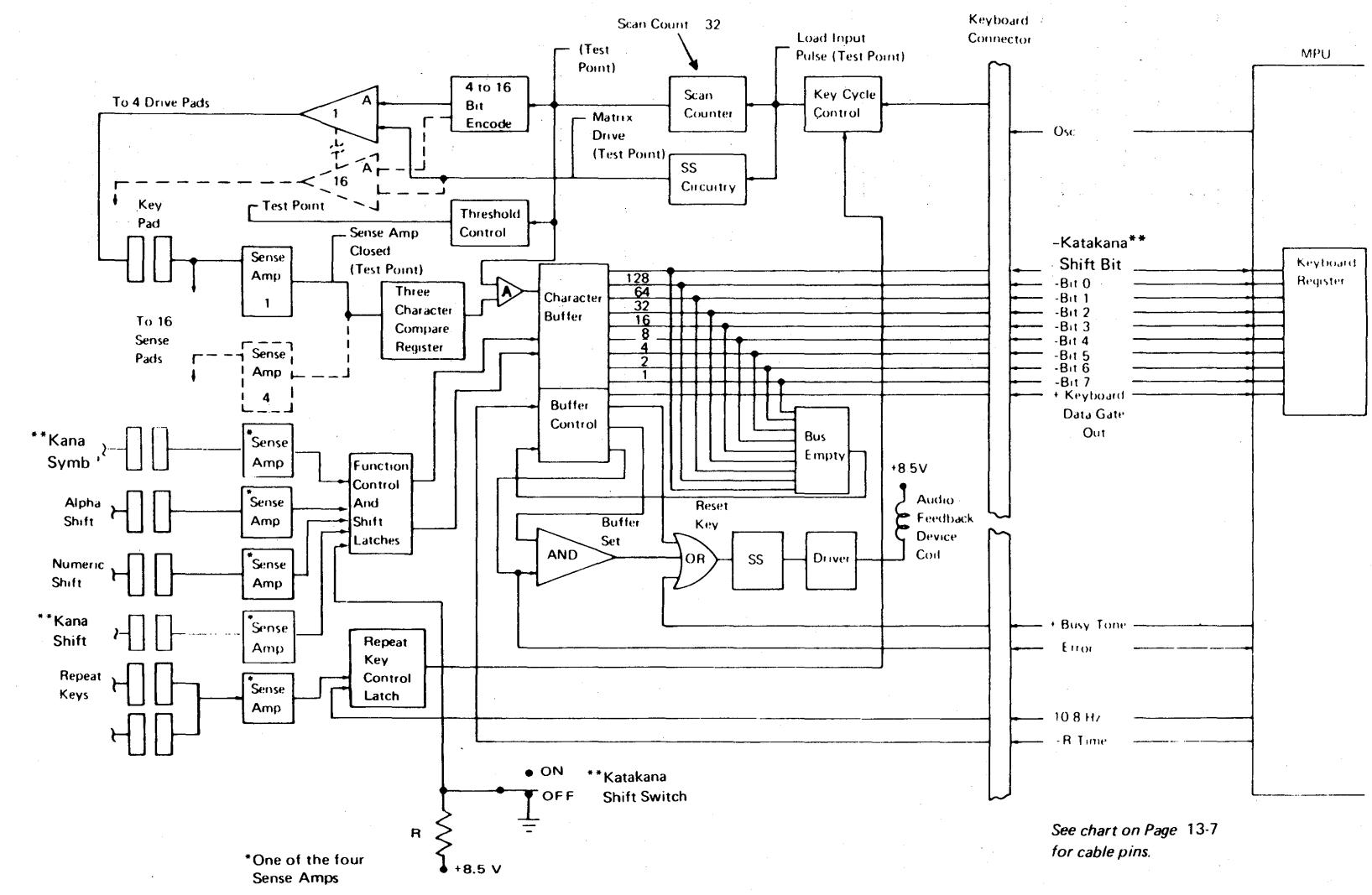
### Keyboard Character Transfer Control

The keyboard character buffer is a temporary storage device. It contains eight bit positions of storage. Bit positions 128 and 64 are alpha and numeric shift bits respectively and bit positions 1, 2, 4, 8, 16, and 32 are the codes associated with all other keys.

The keyboard circuitry stores a character in its character buffer. It then turns on the buffer control latch and looks at all bit lines to the MPU to see if the MPU keyboard register is empty. If any one of these bit lines is at a negative level (active bit) the character stored in the character buffer does not get transferred to the MPU. The bit lines can be controlled by either the MPU or the keyboard.

When the MPU processes the previous character, the bit lines to the keyboard will go to a positive state. Now the keyboard activates an interface line to the MPU called data gate out and gates the contents in the keyboard character buffer to the MPU keyboard register by changing one or more bit lines to a negative level. The MPU then processes this character and clears the content of the MPU keyboard register. All bit lines will then be at a positive level and the next character transfer can take place.

Anytime the MPU keyboard register is reset to zero (during -R time) the Bus Empty gate allows the buffer control to issue a keyboard data gate out signal, which in turn allows data in the character buffer to be transferred to the MPU keyboard register. (Data transfer is inhibited during -R time.) If a new data key is sensed (one that is not stored in the three character compare register) before the character buffer contents has been transferred, a keyboard overrun error occurs.

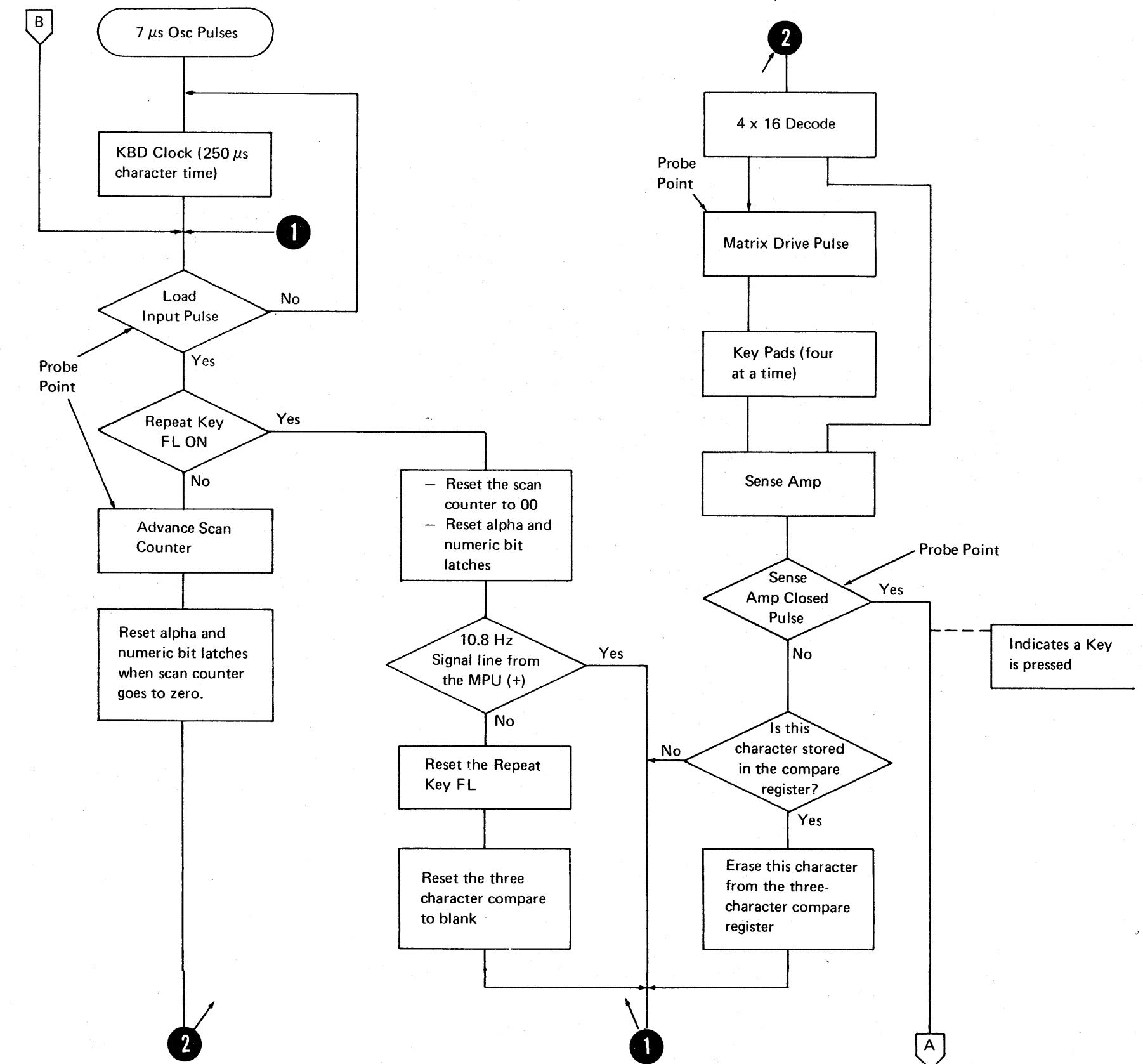


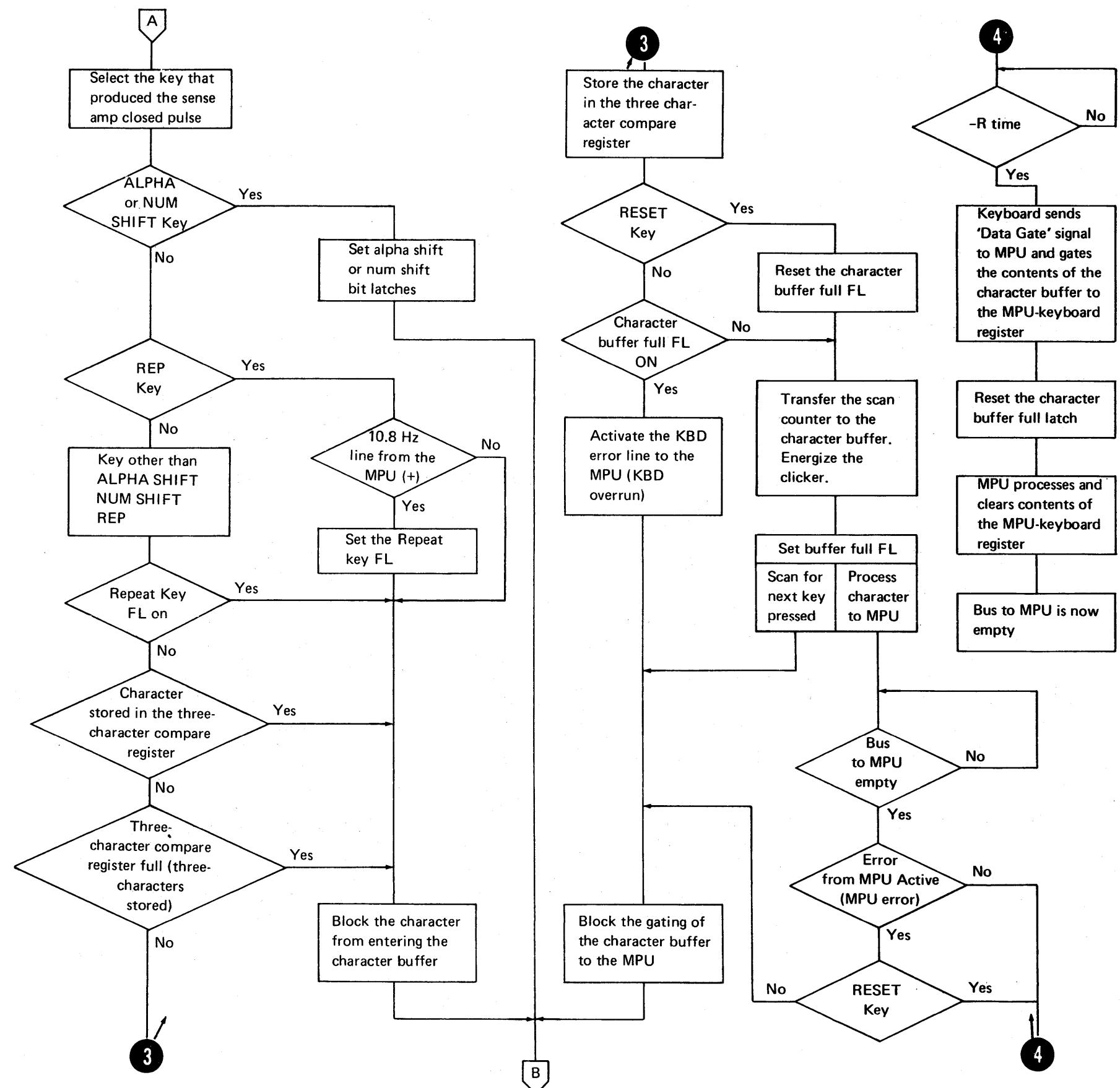
See chart on Page 13-7  
for cable pins.

**KEYBOARD CABLE PIN DEFINITIONS**

B02	SPEED SELECT	Speed Select installed on 3741 Model 2, World Trade only. This line signals the MPU that the attached Binary Synchronous Channel Adapter (BSCA) is running at 1200 bits per second (switch on) or 600 bits per second (switch off).
B03	PROG NUM SHIFT Switch	In the ALL CHAR position, the switch, under program control, indicates to the MPU that all the character keys are active. In the NUMBERS ONLY position the switch indicates to the MPU that only the characters 0 through 9, dash, space, and plus are valid. But when the machine is in alpha shift, all characters are active regardless of the position of the switch.
B04	AUTO/DUP/SKIP Switch	When on for duplicate fields, this switch, under program control, signals the MPU to automatically duplicate (enter) data from the corresponding field or positions of the previous record into the current record. When the switch is off, it signals the MPU all fields are manual fields.
B05	AUTO REC ADV Switch	Signals the MPU that, when a complete record is entered, the MPU can automatically store the record on the disk, and prepare for the next record entry.
B06	-Bit 2	Data line to MPU.
B07	-Bit 4	Data line to MPU.
B08	-Bit 6	Data line to MPU.
B09	+5 Vdc	Power from MPU to keyboard 2; from power supply TP4 for keyboard 1.
B10	+5V 7µs oscillator	Develops keyboard scan pulses and keyboard timing pulses.
B11	-Power on reset (POR)	Down level for 550ms. Wait 5 seconds between power down and power up. This 5 seconds allows the capacitor in the power on circuit to discharge.
B12	10.8 Hz	Used with REP key.
B13	-Error	Inhibits audio feedback device (clicker).
D02	-Bit 0 (Alpha Shift)	Data line to MPU.
D03	+8.5 Vdc	Power from MPU.
D04	-Bit 1 (Num Shift)	Data line to MPU.
D05	-Bit 3	Data line to MPU.
D06	-5 Vdc	Power from MPU.
D07	-Bit 7	Data line to MPU.
D08	Ground	
D09	-R time	MPU is busy, therefore, cannot accept a character from the keyboard.
D10	+Busy tone	Indicates to operator the MPU is busy.
D11	+Kbd data gate out	Gates data which is on the data lines to the MPU.
D12	-Katakana shift bit	Data line to MPU.
D13	-Bit 5	Data line to MPU.

## Keyboard Operation

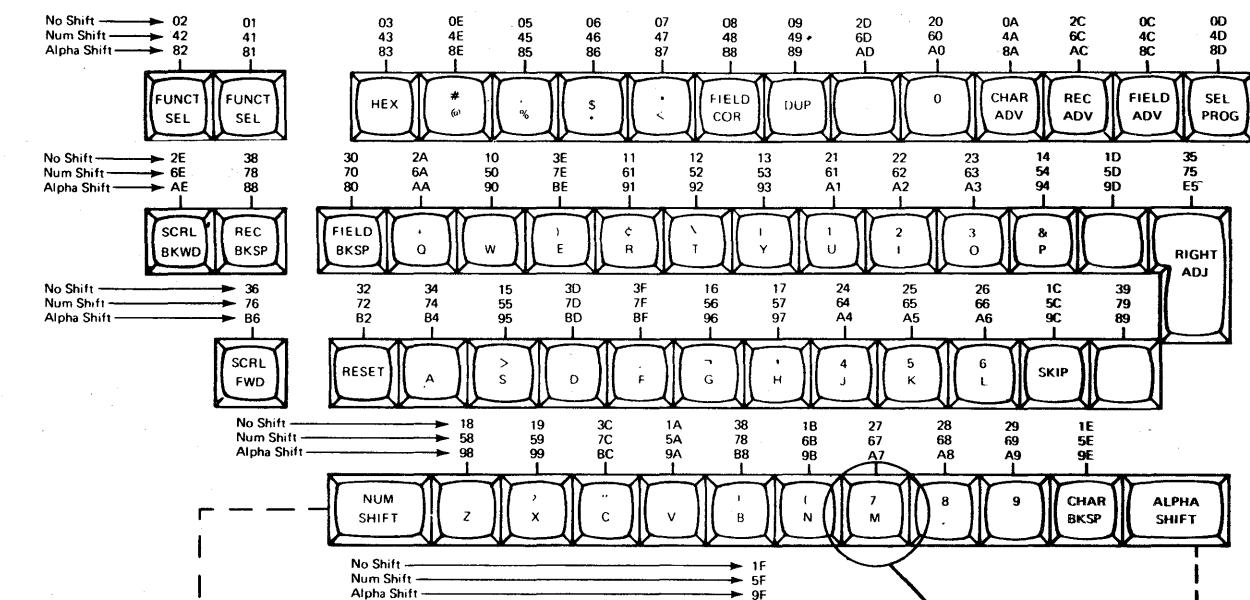


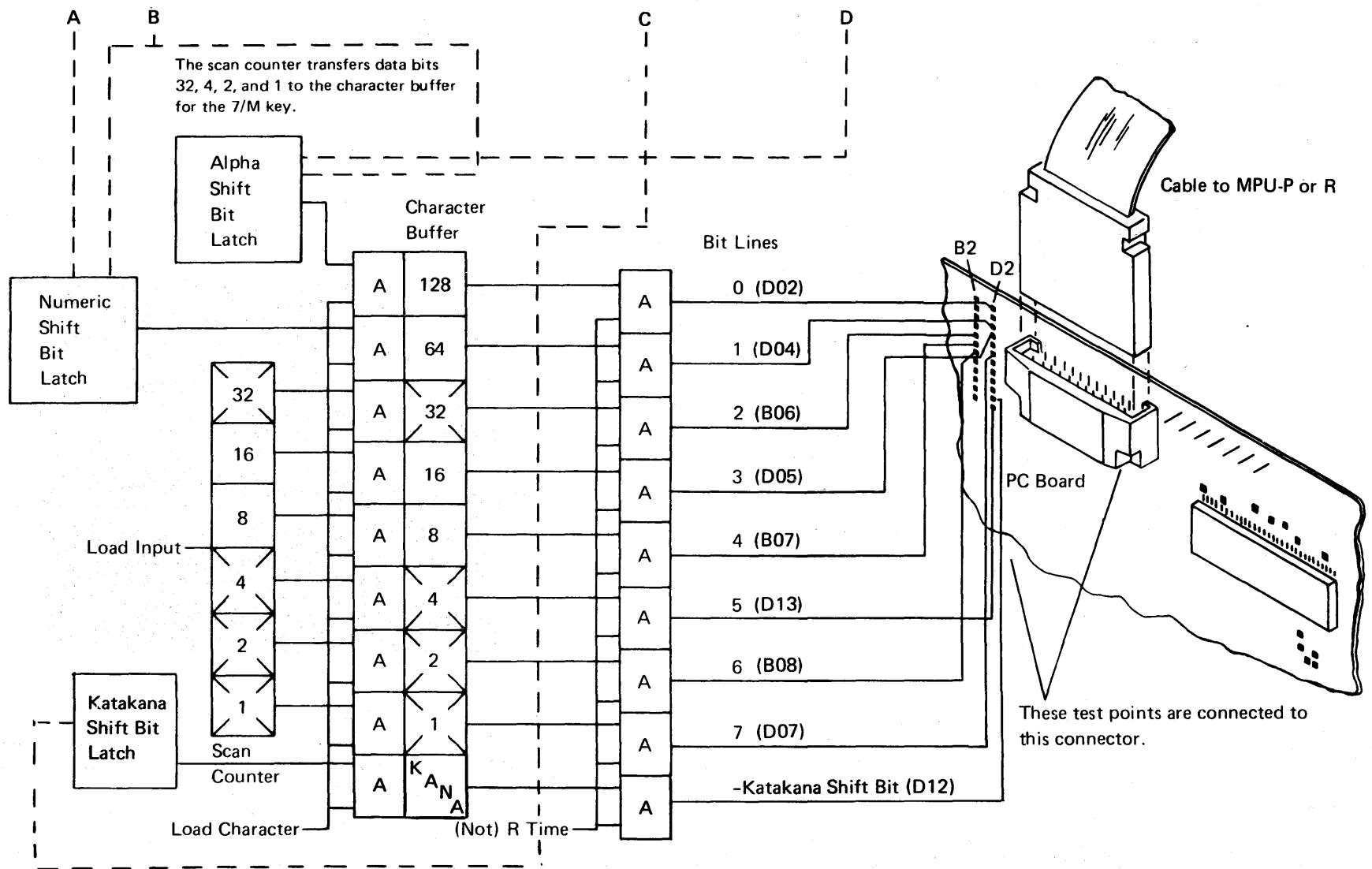


### Keyboard Interface Decode

Objective: Decode the character 7/M and transfer it across the data lines to the MPU.

Key Codes



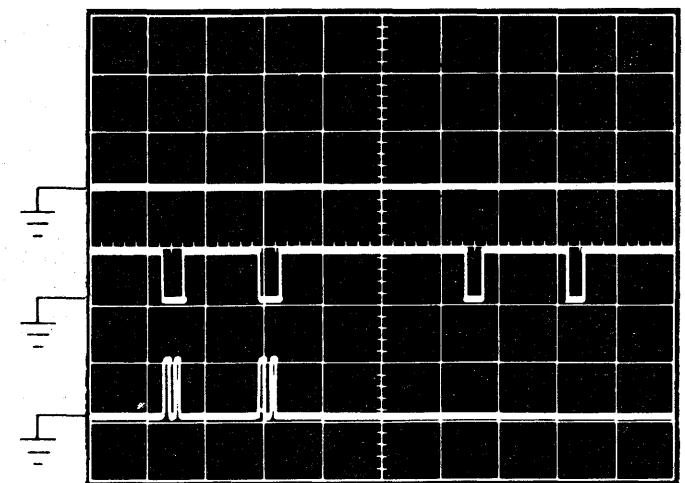


#### Special Keys

Key	Scan Number	Hex Value
ALPHA SHIFT	0	00
NUM SHIFT	4	04
RESET	50	32
REP (left)	11	0B
REP (right)	15	0F
KANA SHIFT	51	33
KANA SYMB	43	28

For the 7/M key, bit lines 2, 5, 6, and 7 (pins B06, D13, B08, and D07 respectively) should be down (-). Bit lines 0, 1, 3, and 4 (pins D02, D04, D05, and B07 respectively) should be up (+).

## Keyboard Test Points



32 ('Scan counter')

'Matrix drive'

'SA closed'

NOTE: Use X10 Probe for all displays.

ALPHA SHIFT  
key held down.

Scan Counter	Sync trig
Time	Int (-) dc
0	Sync point

32 (Scan counter)  
50 $\mu$ s/div  
Probe point  
Vertical amp

FUNCT SEL  
lower key held  
down

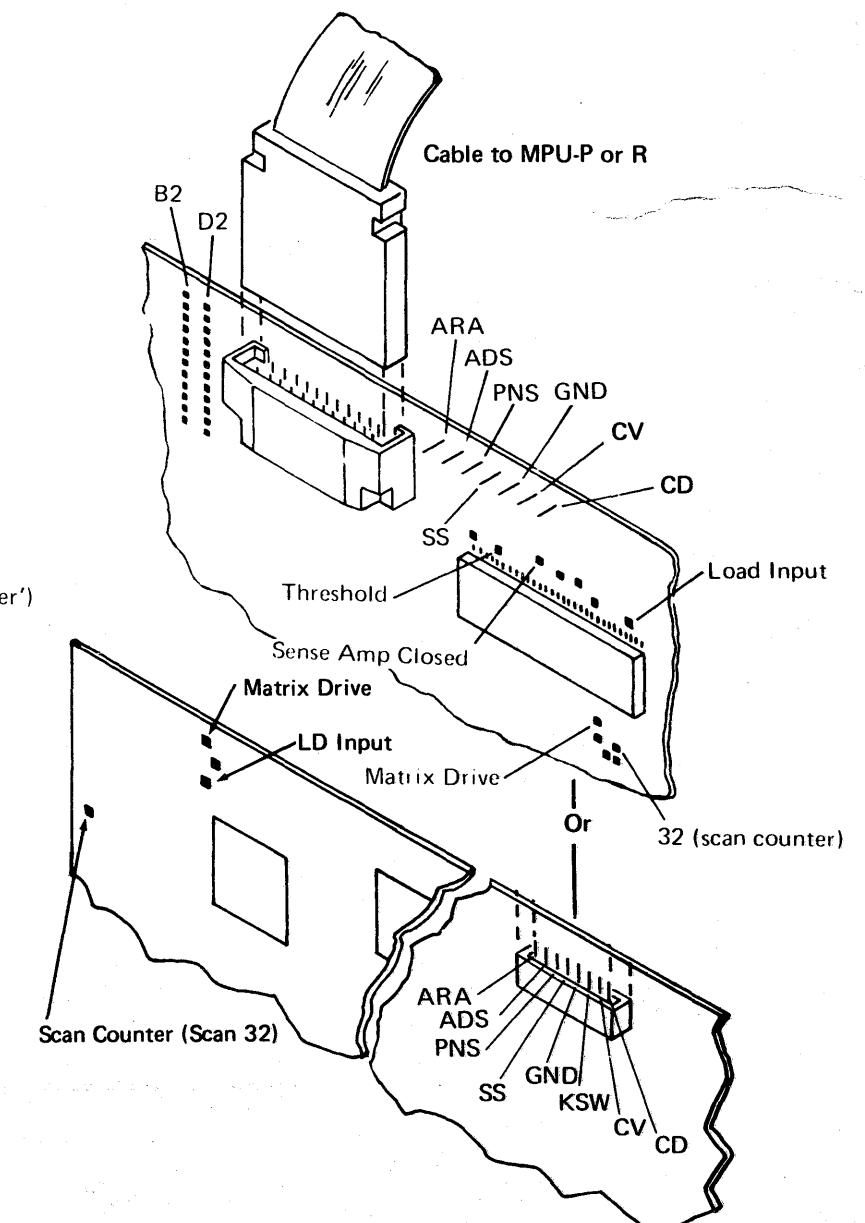
Scan Counter	Sync trig
Time	Int (-) dc
1	Sync point

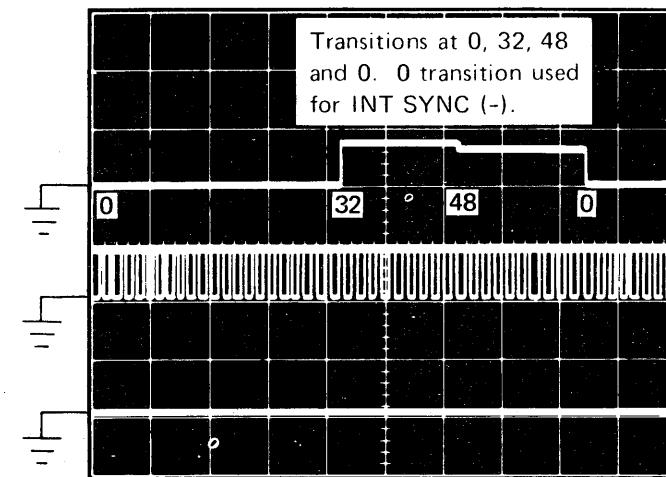
32 (Scan counter)  
50 $\mu$ s/div  
Probe point  
Vertical amp

Scan Counter  
Time  
1

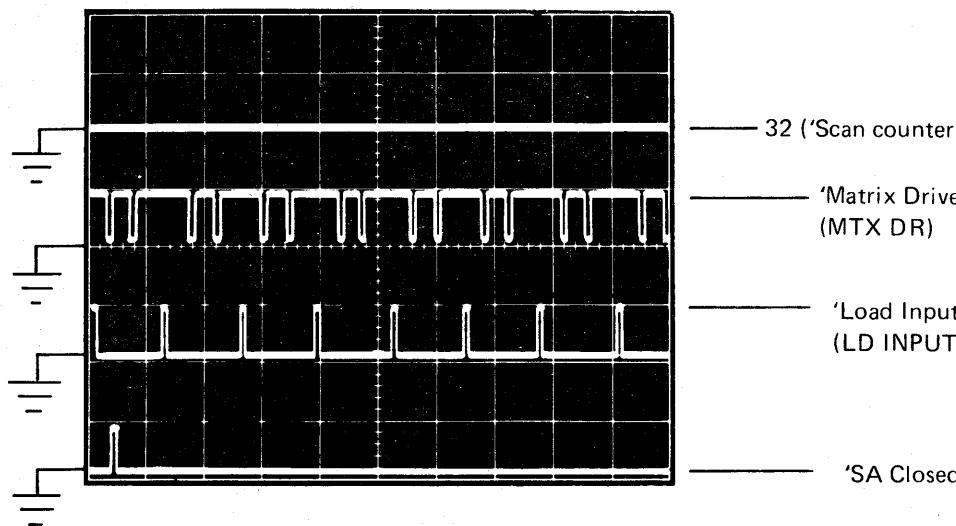
Sync trig  
Sync point  
Sweep speed  
Probe point  
Vertical amp

Int (-) dc  
32 (Scan counter)  
50 $\mu$ s/div  
See above  
0.5V/div

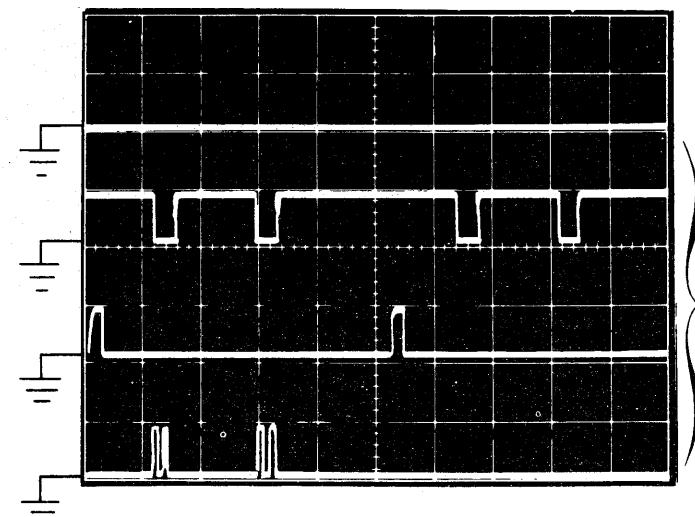




Scan Counter Time	63	Sync trig	Int (-) dc
	0	Sync point	32 (Scan counter)
		Sweep speed	2 ms/div
		Probe point	See above
		Vertical amp	0.5V/div

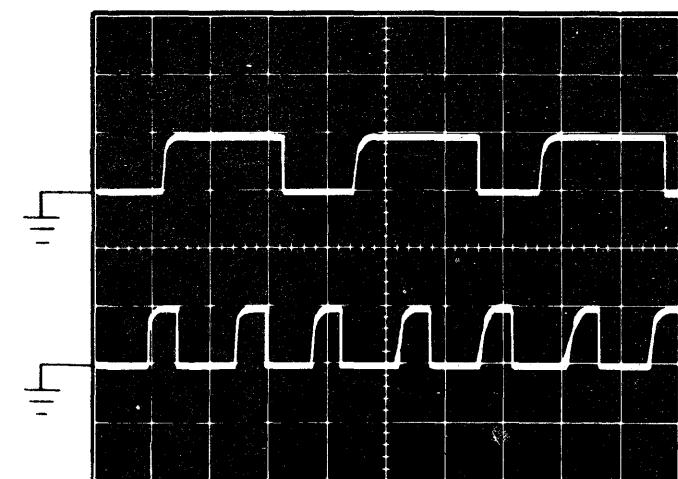


Scan Ctr Time	0	Sync trig	Int (-) dc
		Sync point	32 (Scan counter)
		Sweep speed	200μs/div
		Probe point	See above
		Vertical amp	0.5V/div



Same as 4 above  
except that sweep  
speed = 50 μs.

## Keyboard Test Points



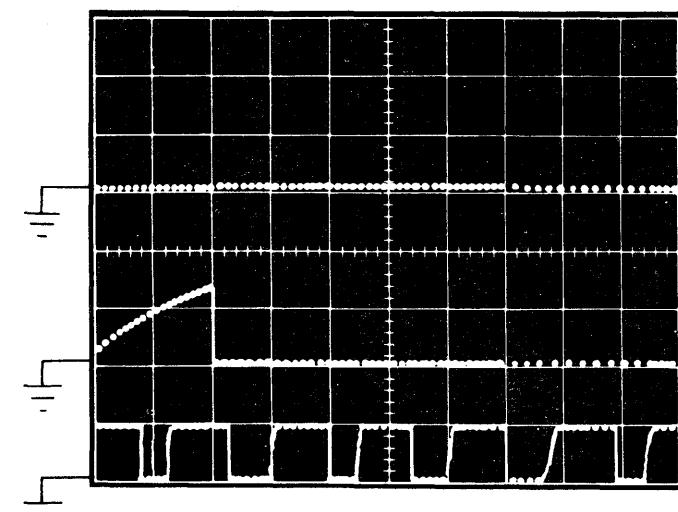
Free running signals  
(-) sync on either one  
(not synchronized)

D09, '-R Time' from MPU

B10, 'Data Key Drive'  
7.5  $\mu$ s osc from display

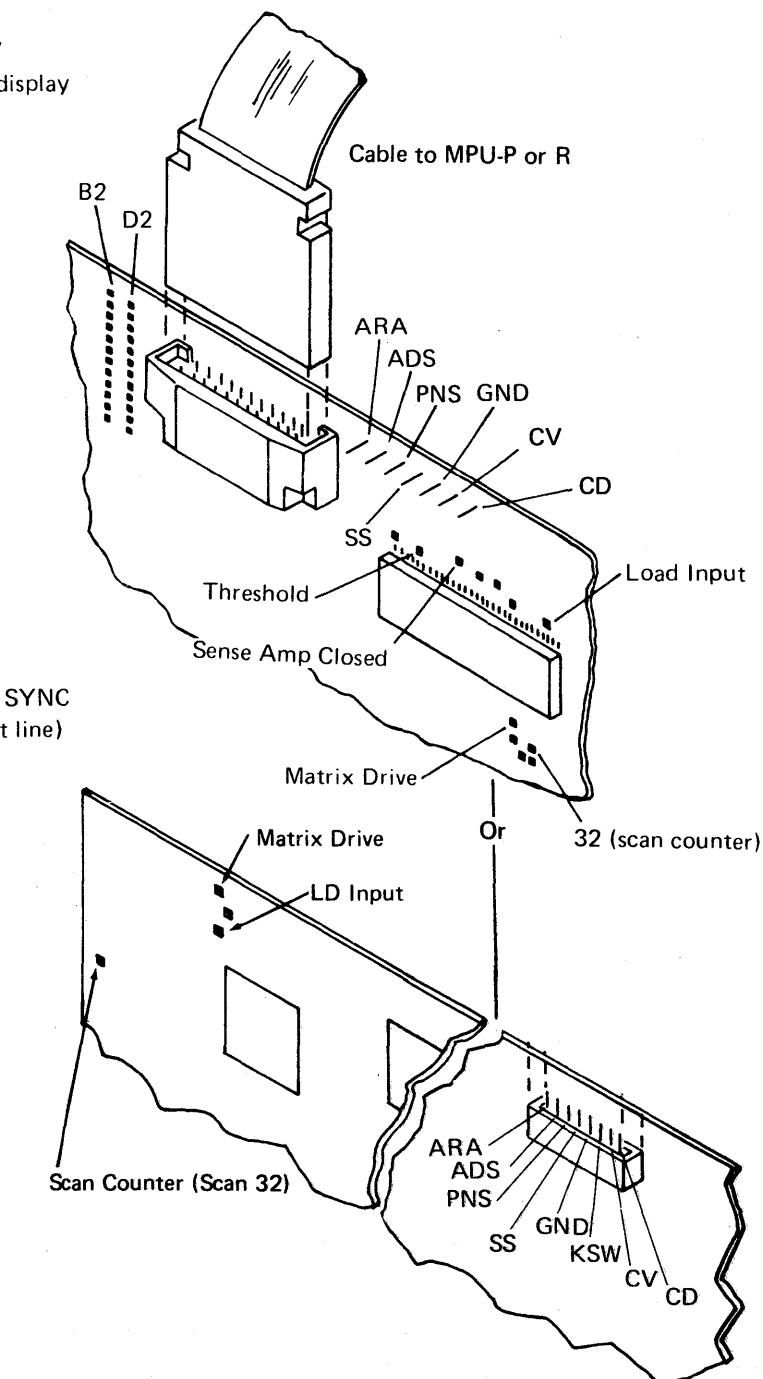
**NOTE: Use X10 Probe for all displays**

Sync trig Int (-) dc  
Sync point None  
Sweep speed 5 $\mu$ s/div  
Probe point See above  
Vert amp 0.5V/div

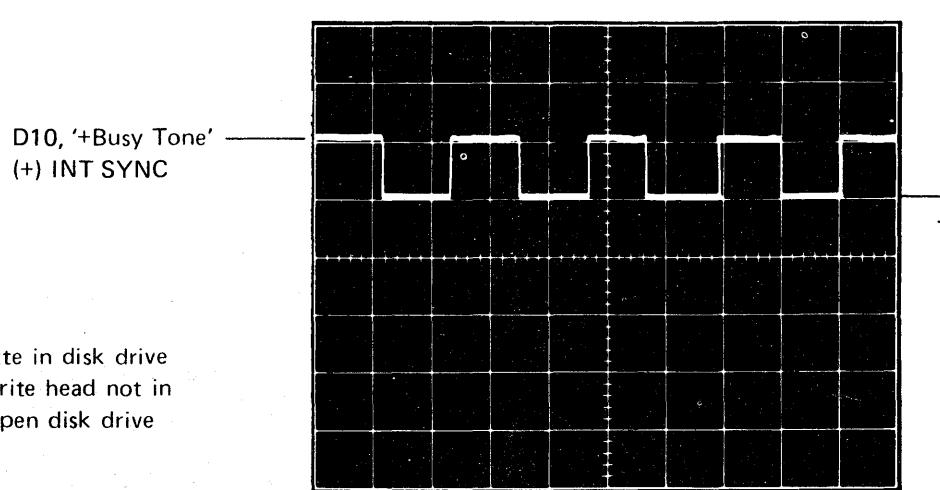


Hold down 'F' key and  
'REP' key

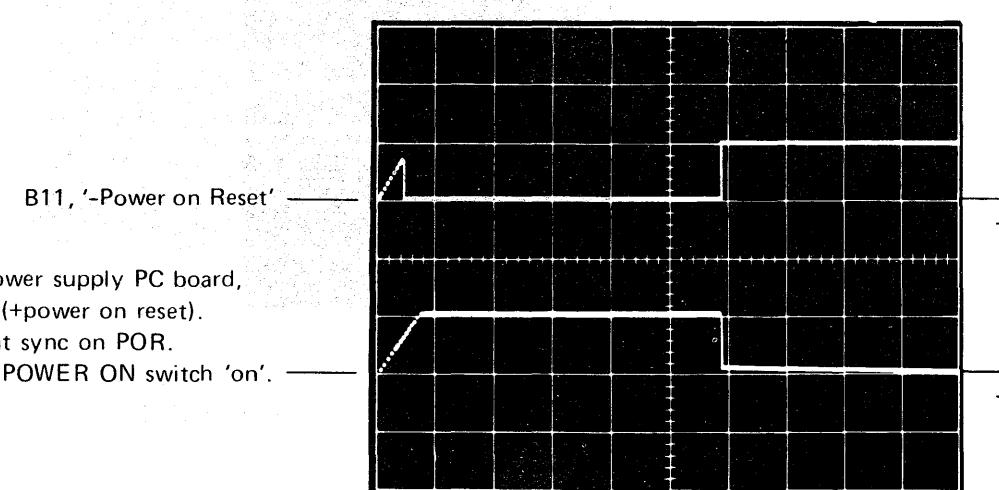
Sync trig Int (-) dc  
Sync point D07 (-bit 7)  
Sweep speed 10 $\mu$ s/div  
Probe point See above  
Vert amp 0.5V/div



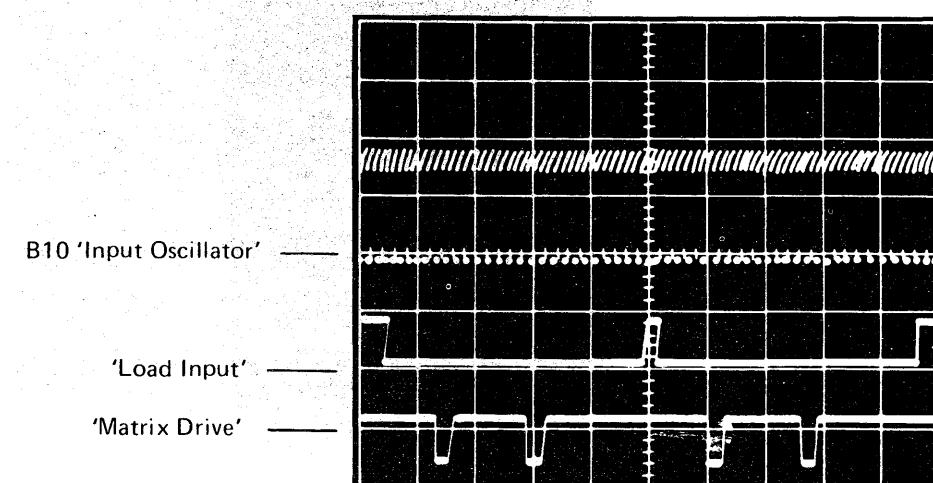
### Keyboard Test Points



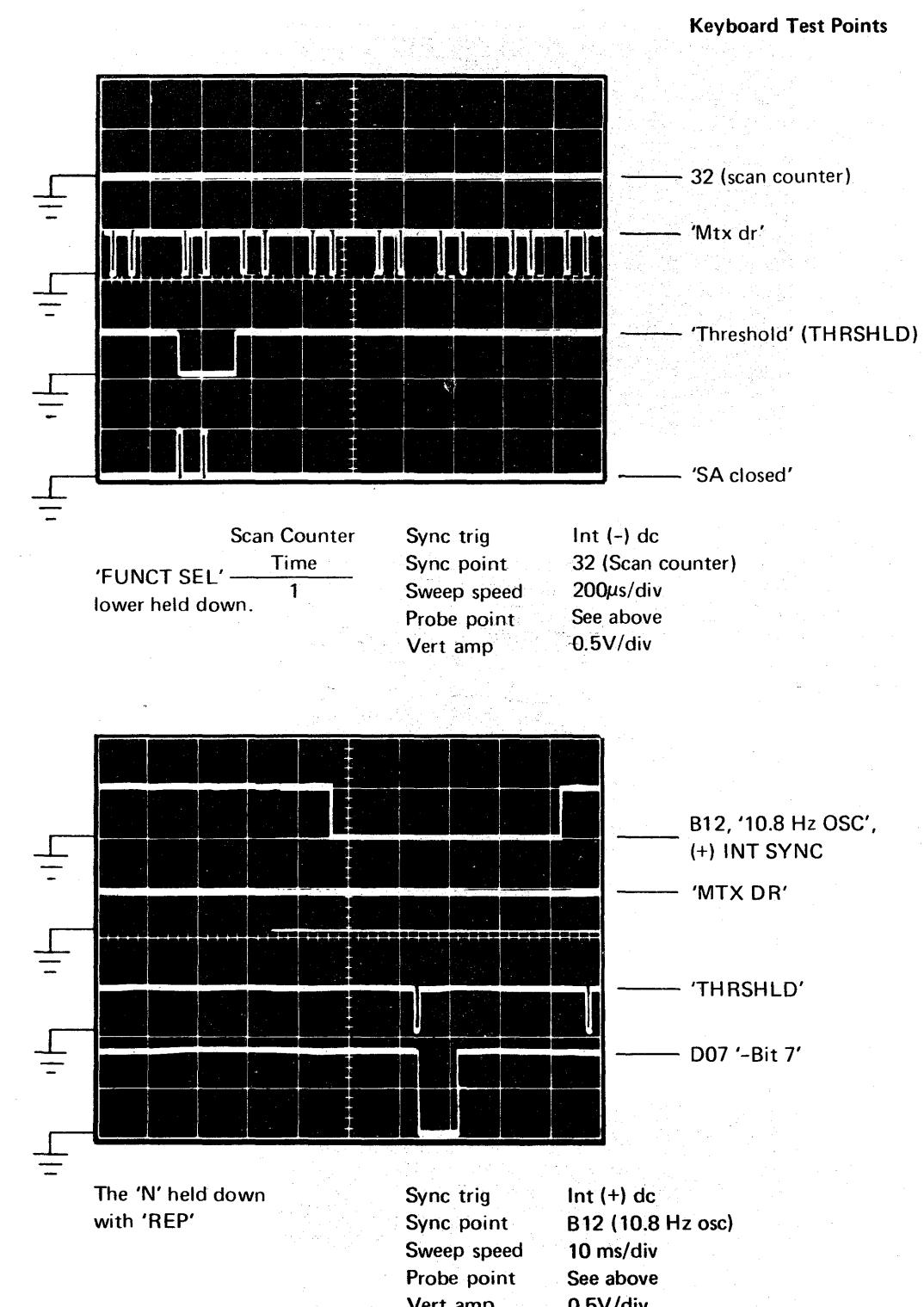
Sync trig Int (+) dc  
Sync point D10 '+busy tone'  
Sweep speed 10 ms/div  
Probe point D10 '+busy tone'  
Vert amp 0.5V/div



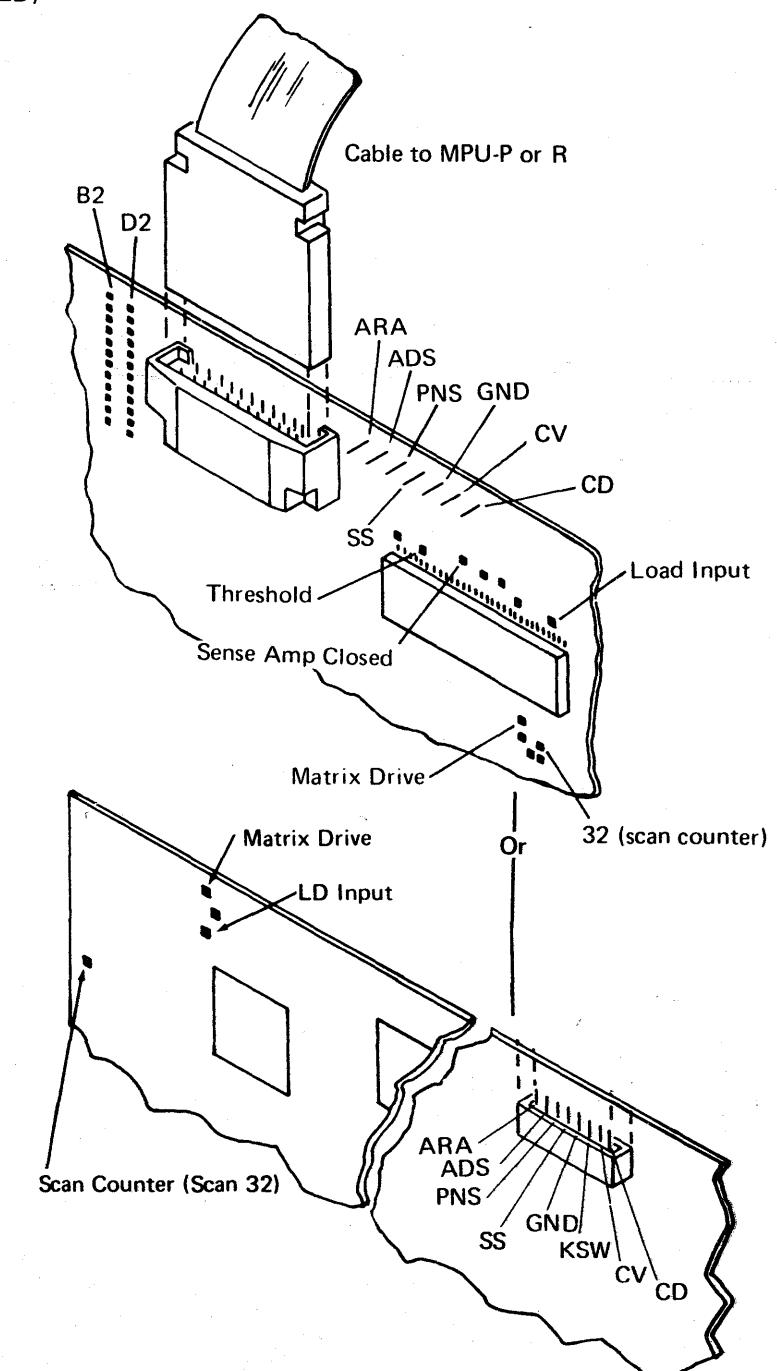
Sync trig Int (+) dc  
Sync point POR power supply PC board  
Sweep speed 200 ms/div  
Probe point See above  
Vert amp 0.5V/div



Sync trig Ext (+) dc  
Sync point Load input  
Sweep speed 50µs/div  
Probe point See above  
Vert amp 0.5V/div — 'Load input'  
— 'Matrix drive'  
0.2V/div — 'Input oscillator'



NOTE: Use X10 Probe for all displays.



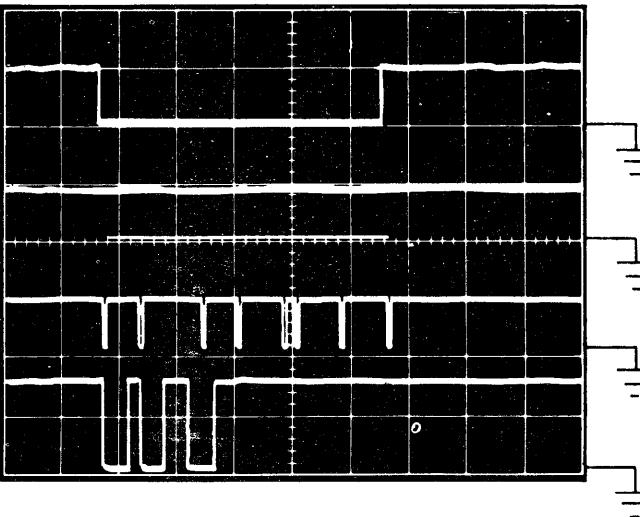
### Keyboard Test Points

(+) INT SYNC on B12 Test Point  
"10.8 Hz OSC" (repeat key gate)

'Mtx dr' Shown being started  
and stopped by repeat key gate.

'Threshold'

D07, 'Bit 7'  
The 'U', 'B', 'N',  
and 'REP' keys held  
down simultaneously.



Sync trig ,  
Sync point  
Sweep speed  
Probe point  
Vert amp

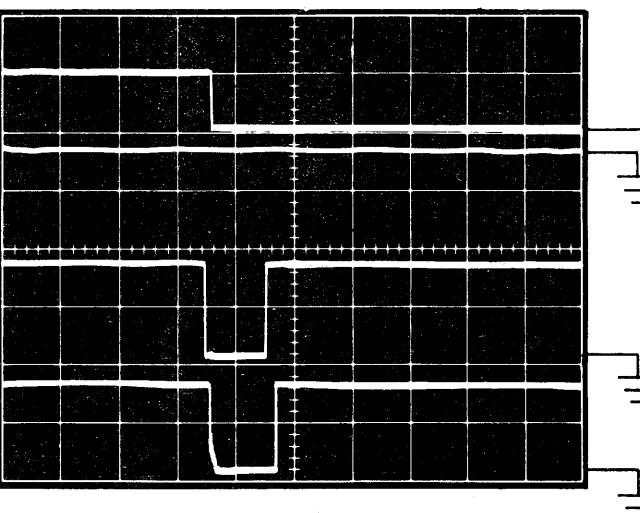
Int (+) dc  
B12 test point  
10 ms/div  
See above  
0.5V/div

'10.8 Hz OSC', B12  
(+) int sync  
D02 '-Bit 0' (not present)

B06 '-Bit 2'

D07 '-Bit 7'

The 'U' held down  
with 'REP'



Sync trig  
Sync point  
Sweep speed  
Probe point  
Vert amp

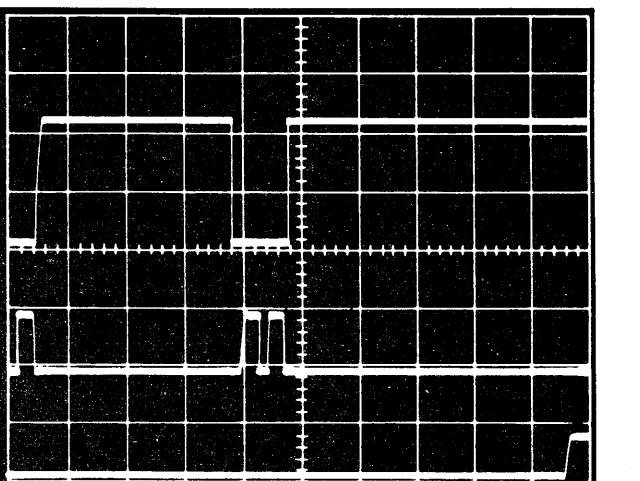
Int (+) dc  
B12 test point  
5 ms/div  
See above  
0.5V/div

Matrix Drive

Sense Amp Closed

Threshold Control

L held down.



Sync trig  
Sync point  
Sweep speed  
Probe point  
Vert amp

Int (-) dc  
Threshold control  
20µs/div  
See above  
0.5V/div - 'Threshold control'  
0.2V/div - 'Matrix drive'

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## MPU THEORY

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Microcontroller	14-2
Microcontroller/buffer interface	14-2
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Disk unit controller	14-2
Display unit controller	14-2
Data flow	14-3
3742 functional characteristics	14-5
3742 features	
128 record length feature	14-7

### Introduction

The MPU (Microprocessing Unit) is the control center of the 3742. The MPU receives data from the keyboard, controls the displaying of the data on the display unit, and manages the flow of information to and from the disk units.

The keyboard, display unit, disk unit, and power supply are external to the MPU. The MPU consists of five functional units in its largest configuration:

1. Microcontroller
2. Microcontroller/buffer interface
3. Keyboard attachment
4. Disk unit controller
5. Display unit controller

### Microcontroller A

The microcontroller is a small ROS controlled processor. The microcontroller supervises the entire 3742 system and manages the data into and out of the MPU. The microcontroller contains the system clock which is the master timing unit of the MPU. The clock insures correct synchronization of data flow within the MPU.

### Microcontroller/Buffer Interface B

The microcontroller/buffer interface controls the transfer of data between the buffer (a random access memory) and the microcontroller, the disk unit, or the display unit. The transfer of data is performed upon request of any of these devices.

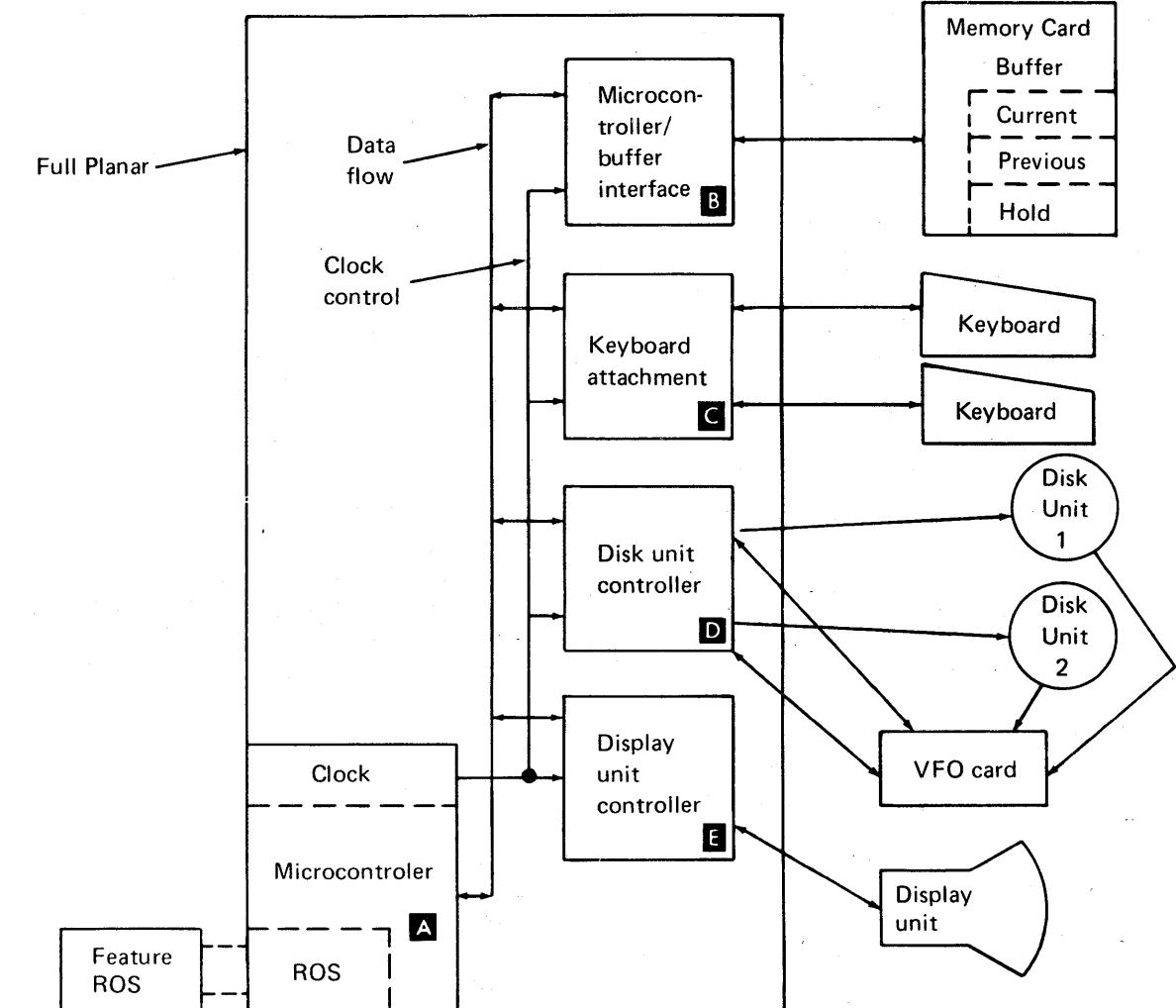
### Keyboard Attachment C

The keyboard attachment interfaces the keyboard to the microcontroller. It stores decoded key stroke information for use by the microcontroller.

### Disk Unit Controller D

The disk unit controller controls all disk unit operations. It interacts with the microcontroller/buffer interface to manage data transfers between the disk unit and the buffer. It maintains status information which can be sampled by the microcontroller. Disk unit operations are initiated by the microcontroller issuing the disk unit controller a command (such as read, write, seek high, seek low). The disk unit controller then goes into a busy state and controls the sequence of operations necessary to execute the command. Upon completion of the command, the disk unit controller drops the busy status condition. This condition, along with other appropriate status conditions, can be sampled by the microcontroller.

During seek operations, the disk unit controller sends "seeks" for the number of tracks the microcontroller specifies and automatically verifies that the proper track is arrived at. If an error occurs, the microcontroller takes appropriate steps to get the track desired.



During read and write operations all resynchronization is controlled automatically by the disk unit controller. On the 3742 the disk unit controller manages both disk drives for standard two-station operation, and when the disk copy feature is used.

Only one disk unit is activated at any one time.

### Display Unit Controller E

The display unit controller accesses the buffer, under the control of the microcontroller/buffer interface. An ROS character generator converts the character code into the correct bit pattern to generate video signals which control blanking of the electron beam. The blanking and unblanking of the electron beam forms the 7 x 9 character matrix on the face of the display unit as the beam is swept across the CRT. The microcontroller supplies control signals to the display unit, which are used by that unit to position the data on the CRT.

## DATA FLOW

### Keyboard to Buffer

Keyboard to keyboard attachment

- Keyboard attachment to microcontroller
- Microcontroller to buffer (under control of the microcontroller/buffer interface)

### Write From Buffer to Disk\*

- Buffer to disk unit controller under control of microcontroller/buffer interface
- Disk unit controller to disk unit. All records written on the disk are write checked under control of the microcontroller. The check consists of reading the record and checking the CRC that was written by the disk unit with the CRC calculated by the microcontroller as the record was read. The buffer is not involved in the check.
- For check operation data flow is disk unit to disk unit controller where the CRC is verified. This takes place one revolution following the write operation.

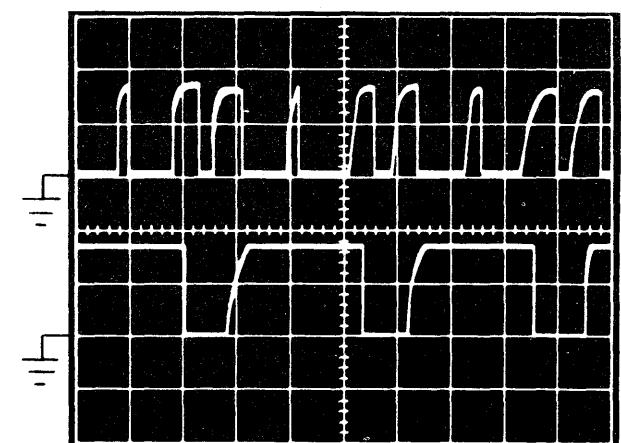
### Read From Disk Unit to Buffer\*

- Disk unit to disk unit controller
- Disk unit controller to buffer under control of the microcontroller/buffer interface

### Buffer to Display Unit

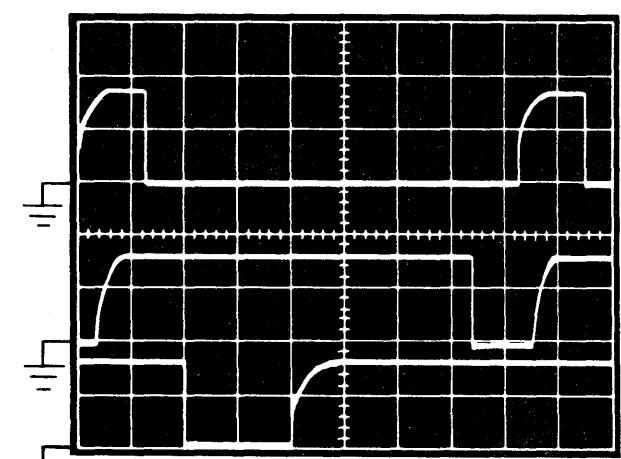
- Buffer to display unit controller
- Display unit controller to character generator
- Character generator to display unit controller
- Display unit controller to display unit

\*All data flow between the disk unit and buffer occurs in blocks of 1 record at a time. The actual transfer is accomplished 1 byte at a time.



**Clock pulses**  
continuous while power is on.

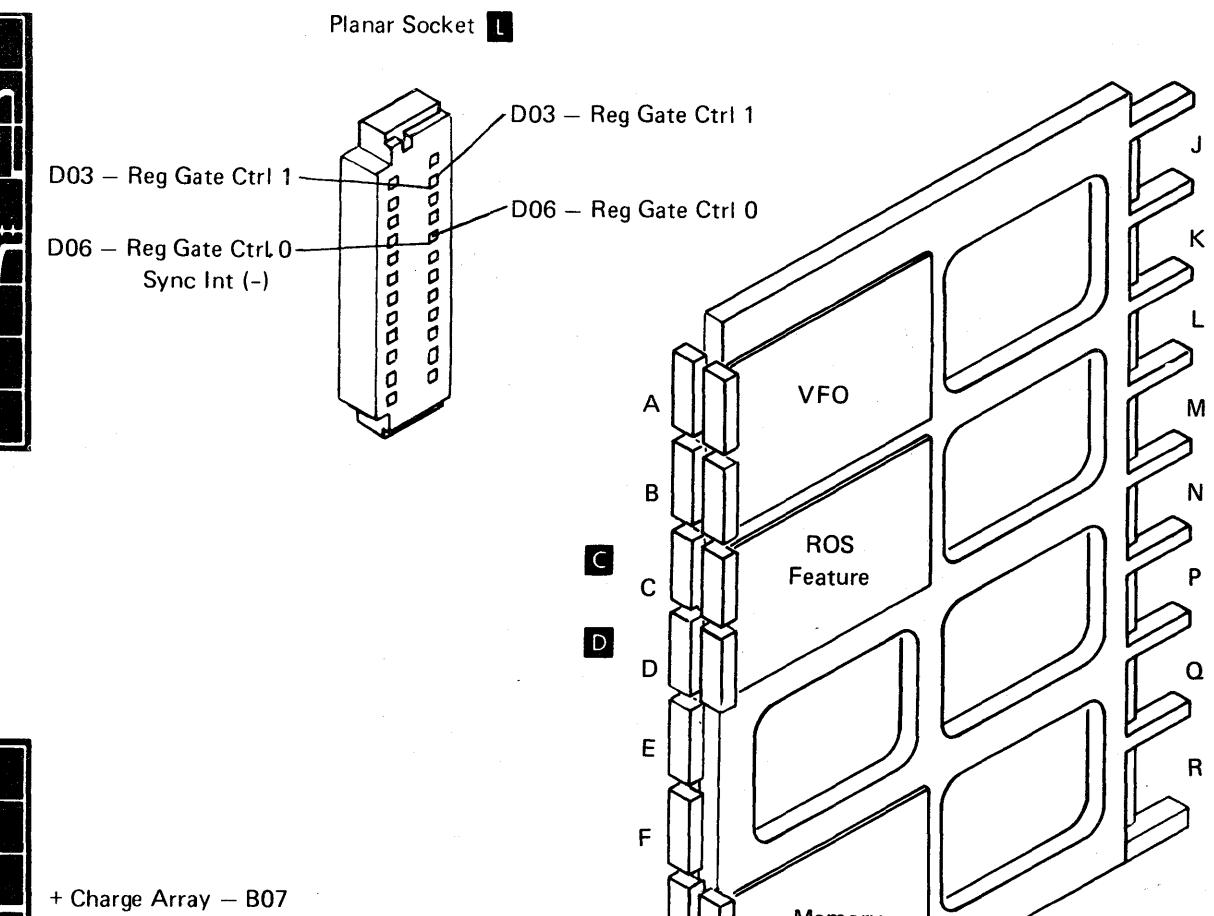
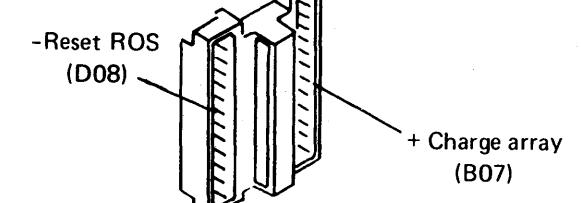
Sync Trig Int (-) dc  
Sync Point D06 ('-Reg gate ctrl 0')  
Sweep Speed 5  $\mu$ s/div  
Probe Point See above  
Vert Amp 0.5V/div



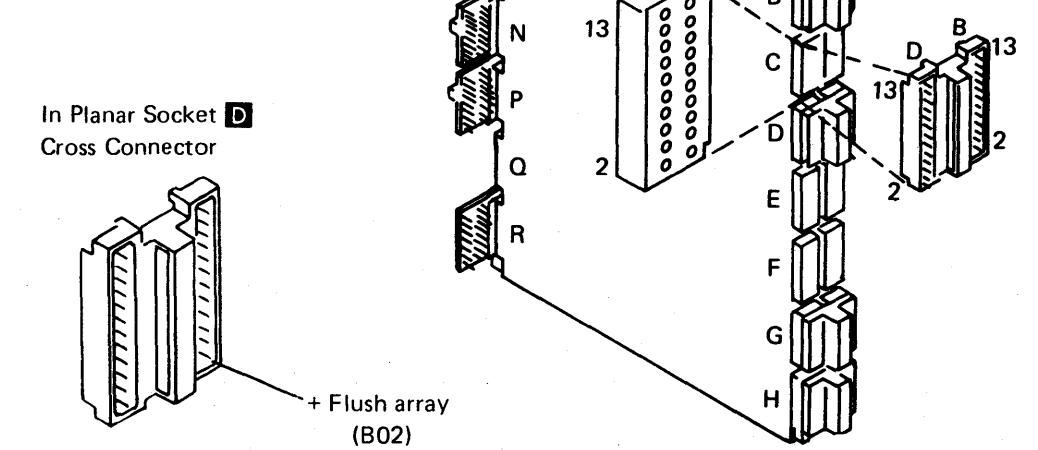
- Free running while power is on.

Sync Trig Int (-) dc  
Sync Point '+ charge array'  
Sweep Speed 2  $\mu$ s/div  
Probe Point See above  
Vert Amp 0.5 V/div

In Planar Socket C  
Cross Connector



+ Charge Array - B07  
(+ Int Sync  
-Reset ROS - D08  
+ Flush Array - B02



## 3742 FUNCTIONAL CHARACTERISTICS

### Program Storage Area

The 3742 contains six program buffers (ten program buffers if the 128-record-length feature is installed). Programs to control record format, similar to those used in the IBM 029 Card Punch, can be written and loaded into those buffers from the current record buffer. These programs can be entered from the keyboard or from a disk. An additional program (program level 0) is provided which has a fixed program of 80 (128 if the 128-record-length feature is installed), single character alpha fields. When operating under manual control, this program is selected. Any program can be selected from the keyboard by way of the program select routine and the program level number will be displayed on the status line.

### Enter

Enter mode is used for writing records on a disk. As an operator keys a record, the data is stored in the current record buffer. In this mode, this buffer is displayed. When a record advance occurs, the MPU transfers the data from the current record buffer to the previous record buffer. The record in the previous record buffer is then written on the disk.

### Program Chaining

Program chaining provides automatic selection of the program to be used with the next record. The program to be selected when record advancing is designated by the appropriate program number in position 80 (position 128 if the 128-record-length feature is installed), of the current program. The program to be selected when record backspacing is designated by the appropriate program number in position 79 (position 127 if the 128-record-length feature is installed), of the current program.

### Verify

Verify mode is used to check the accuracy of records already on disk and to make corrections to records when errors are found. As data for a record is rekeyed from the source document, each character is compared with the corresponding

character in the record in the current record buffer. If characters do not compare, a V error occurs. After the error is reset, the first character keyed is accepted if it agrees with either the character in the current record buffer or the character which caused the error. The next record to be verified is stored in the hold buffer. When record advancing occurs in verify mode, the MPU moves the contents of the current record buffer to the previous record buffer and the contents of the hold buffer to the current record buffer. The contents of the previous record buffer will then be written on disk only if a change had been made to the record. After the last record of the data set has been verified, a verify mark (V) will be automatically inserted in the data set label.

### Update

The update mode is used to read records from the disk for review, modification or use as program records. In this mode, the record located at the current disk address is displayed from the current record buffer. Any changes will be keyed into this buffer. When a record advance is performed, the MPU moves the contents of the current record buffer to the previous record buffer and reads the next record from the disk into the current record buffer. Then only if a change has been made to the record now in the previous record buffer, the contents of the previous record buffer will be written onto disk. When a record is written in update mode, it is always written at the disk address at which the record was located before it was changed.

### Record Length

The capacity of the space on a disk, allotted to a record, is 80 (128 if the 128-record-length feature is installed) characters. When writing a record of less than 80 characters, the 80-record-length 3742 writes blank characters from the end-of-record through position 80. With the 128-record-length feature installed, the record length for any one data set can be any value from 1 to 128 characters.

### Production Statistics

The production statistics feature provides statistics on data production for use in measurement of work load, analysis of error, and job accounting.

Three counters are used to count:

1. Number of key strokes.
2. Number of records processed.
3. Number of characters corrected during verify mode, including all characters keyed in field correct mode.

These counters are reset when power is turned on or when the R key is pressed while production statistics are being displayed.

### Search EOD

The search EOD (end of data) function causes the machine to search the disk for the last record of a data set. When this function is completed, the last record of the data set will be displayed, and stored in both the current record and previous record buffers.

### Search Data Address

The search data address function allows searching for a record in a data set by specifying its disk address. When this function is completed, the record at the specified address will be displayed, and stored in both the current and previous record buffers.

### Search Content

The search content function provides a search for the record in a data set which contains specific data. The data being searched for is called a mask. The mask can be part or all of the record. A blank in any position means that position will not be compared during a search operation. When the search content function is selected, the MPU moves the contents of the hold buffer into the current record buffer. Here it can be reviewed and if necessary, modified before use as a mask. When the search operation is completed, the mask will be stored in the hold buffer; and the record found will be in both the current record buffer and the previous record buffer. The current record buffer is displayed. The search can be continued with the same mask since the mask will be recalled from the hold buffer when the search content function is again selected.

## FUNCTIONAL CHARACTERISTICS (cont'd)

### Search Sequential Content

Search sequential content is a faster form of search content. To find the record with the selected mask, the records in the data set must be arranged so that the search fields of each succeeding record have a higher value than in the preceding record. If one or more records do not meet this requirement, the search may fail.

### Disk Initialization

The purpose of the disk initialization feature is:

1. To write identification fields in each sector of all active tracks on the disk.
2. To write the bad track code in all defective tracks.
3. To write a record in each sector of each active track (blank characters are written in all tracks except track 00).
4. To write 80-character records in track 00 as described in the *Disk Theory* section of this manual.
5. To check a disk for tracks marked with the bad track code and for tracks exhibiting errors.

All disks are initialized before they are shipped to a customer. They should be reinitialized only if:

1. The disk was exposed to a strong magnetic field.
2. A defect occurred in one or more tracks.
3. A sector sequence other than the existing sequence is needed.

### Disk Copy

The disk copy feature is provided by the 3742 to permit:

1. Duplication of a disk to have more than one copy or salvage data from a disk that has developed a defect.
2. Merging of records from a disk with records from the keyboard.
3. Pooling data from several disks onto one disk.
4. Extended storage for programs since programs can be loaded into the program buffers from the second disk without removing the primary disk.

On the 3742, dual disk operation is obtained by disabling the secondary station and controlling its disk from the primary station. During dual disk operation, write functions cannot be performed on the secondary disk.

A 5-digit secondary disk address is displayed on the display status line after completing any second disk operation, indicating the address of the last record read from the secondary disk.

When duplicating a disk, seven records are read from disk 2 in one revolution. These records are temporarily stored in the buffer, from where they are written on disk 1. All seven records are written on one disk revolution. Program buffers are used for this operation.

### Field Totals (Offline)

The offline field totals feature provides the ability to add fields within a record or within several records and to enter that total into the same or the following records. All addition and enter operations are under program control. The feature is used to obtain totals from records already written on the disk.

Three 19-digit accumulators are provided with this feature. Data can be algebraically added into one or more of these accumulators from a specified field or fields in any or all records of a data set. Data in these accumulators can be entered into a field of a record with or without resetting the accumulator, depending on the control program. All accumulators are reset when power is turned on, when offline field totals is initiated or when field totals are displayed and the R key is pressed.

Detailed programming information is contained in section 9 of this manual.

### Self-Check (Modulus 10 and Modulus 11)

The self-check feature provides a method for checking the entry of the numeric fields that contain a precomputed self-check digit. The self-check digit is the last digit in the field and is precomputed using a modulus 10 or 11 algorithm. The 3742 recomputes the self-check digit according to the algorithm, and when the last digit is entered or verified, it is compared for identity with the computer value.

### Record Insert

The record insert feature provides the ability to open a space within an existing data set into which records can be added. This is achieved by moving all records starting with the record at the currently displayed disk address through the EOD, minus 1, record. The new disk address for the records is determined by the previous disk address of the record plus the number of records to be inserted. The space that is opened, from 01 to 99 sectors, is filled with deleted records that then can be modified. Two methods of record insertion are available: continuous service on the other station during the record insert function or lockout of the other station during the record insert function. After completion of record insert, the second station automatically gets control back.

## 128 Record Length Feature Display Modes

The capacity of the three-line display is inadequate for showing a 128 character record (plus status line) when the 128 record length feature is installed. Part of the feature is a method, called scrolling; displaying the long record. It performs the function in three steps;

### Step 1

1	-----	40
41	-----	80

### Step 2

41	-----	80
81	-----	120

### Step 3

81	-----	120
121	-----	128

The display scrolls forward automatically when cursor control advances beyond the limits of steps 1 or 2. If the AUTO REC ADV switch is OFF, and the cursor control advances past 128 to 000 (control is between records), any key depression which causes the cursor to advance, results in the T operational error. Resetting the error and advancing to a new record sets the display at step 1 for the new record. The display also scrolls backward automatically when cursor control passes from position 121 to 120, or from 81 to 80.

**Note:** When in ENTER mode with the AUTO DUP/SKIP and AUTO REC ADV switches ON, the display remains blank if a record consists entirely of auto fields. Also if the last field of a record is an auto field, that portion of the record display remains blank.

Two data-station keyboard keys; SCRL FWD and SCRL BKWD, provide manual control of scrolling forward and scrolling backward.

### Scroll Forward (SCRL FWD) Key

This key, when depressed, causes the display to scroll forward, step 1 to step 2, step 2 to step 3, and if the AUTO REC ADV switch is ON, step 3

to step 1 of the next record. If the AUTO REC ADV switch is OFF, the display cannot scroll past Step 3. Instead, the cursor advances beyond position 128 to 000. The scroll forward key, if pressed while the cursor is at 000, causes the T operational error.

All auto fields are executed as auto by-pass fields while the Auto DUP/SKIP switch is ON. It is thus possible, with one depression of the SCRL FWD key, to advance from step 1 directly to step 3 if positions 81 through 120 are in DUP or SKIP fields.

In verify mode, depressing the SCRL FWD key results in the L incorrect function error.

### Scroll Backward (SCRL BKWD) Key

This key, when depressed, causes the display to scroll backward, step 3 to step 2, or step 2 to step 1. If the AUTO DUP/SKIP switch is OFF during display step 1, pressing the SCRL BKWD key causes the cursor to move to position 001.

With the AUTO DUP/SKIP switch ON, the cursor moves backward, from its position at key depression time, to:

1. The first manual position of step 1, if back scrolling from step 1 or step 2, or if back scrolling from step 3 and positions 81 through 120 contain no first position of a manual field.
2. The first manual position of the first manual field of step 2, if back scrolling from step 3, or if back scrolling from step 2 and positions 1 through 80 contain no first position of a manual field.

Scroll backward, while in verify mode, is a valid function. However, the fields backed over must be reverified.

To press either manual scroll key, while the cursor is in a self-check or right-adjust field (except in the first column of each field), causes an error condition.

## Katakana

The Katakana feature provides the ability of entering the Katakana EBCDIC code onto the disk. It has a keyboard containing 64 Katakana characters plus 63 domestic characters. The Katakana characters are generated by the Katakana shift and the Kana symbol functions.

Anytime the station is in Katakana shift (programmed for Katakana shift, the KATAKANA SHIFT switch ON, or the KANA SHIFT key pressed) the Katakana shift can be overridden with ALPHA SHIFT, NUM SHIFT, or KANA SYMB. The overriding shift key will define the character or function that will be entered into the station when a character key or function key is pressed.

When the station is in Katakana shift, the following function keys require that ALPHA SHIFT or NUM SHIFT be used with that key to activate the function, otherwise the corresponding Katakana character will be entered into the station:

HEX, FLD COR, DUP, CHAR ADV, REC ADV, FLD ADV, SEL PRG, SKIP, RT ADJ, and CHR BKS.

Pressing KANA SYMB activates both the alpha shift bit line (-bit 0) and the numeric shift bit line (-bit 1) of the keyboard character buffer.

Any machine function, other than data entry, that requires ALPHA SHIFT or NUM SHIFT to be used in selection of that function can also be selected by using KANA SYMB in place of the prescribed shift key. Likewise, any reset operation that requires the use of ALPHA SHIFT and/or NUM SHIFT with RESET can be performed by using KANA SYMB with RESET.

### Proof Keyboard Feature

The proof keyboard feature which can be installed on a 3742 differs from a standard data entry keyboard by a rearrangement of the numeric keys. Under alpha shift, there is no change in keyboard function. Under numeric shift, the slash key functions as the space bar, and the space bar functions as the 0 (zero) key. Also, the 1, 2, and 3 keys on the data entry keyboard are interchanged with the 7, 8, and 9 keys on the proof keyboard, respectively. The 4, 5, and 6 keys remain unchanged.

The outputs of these keys in numeric shift mode are translated by the MPU under ROS feature control. If a machine with this feature is operated with the ROS Feature card removed from sockets, the keyboard function will revert to that of the standard data entry configuration.

## POWER THEORY

**Power Supply Field Replaceable Units (FRUs)**

**Disk Drive Motor A L**

Turn the disks within the disk drive units. The disks turn in order to read or write on the disks.

**Power Supply (ac) Cable B**

Distributes input ac voltage from POWER ON switch through the primary fuse, to TB-1, to disks 1 and 2. Also connects frame ground to POWER ON.

**Power On Switch C**

Switches ac input from the attachment cord to the primary of the transformer.

**Primary Fuse (ac) Holder D**

Holds fuse for the ac input.

**Fuses (dc) E**

Protects +24 Vdc, +8.5 Vdc, +12 Vdc, and -12 Vdc output from the overload.

**Power Supply (dc) Cable F**

Connects the power supply PC board dc voltages to the MPU.

**Power Supply PC Board G**

Develops and distributes dc voltage to the machine.

**Line Filter (ac) H**

Feed-through capacitor filters line noise to frame ground.

**Capacitor (ac) (C-1) J**

Keeps ac output from the transformer at a constant level.

**Circuit Breaker (CB1) U\***

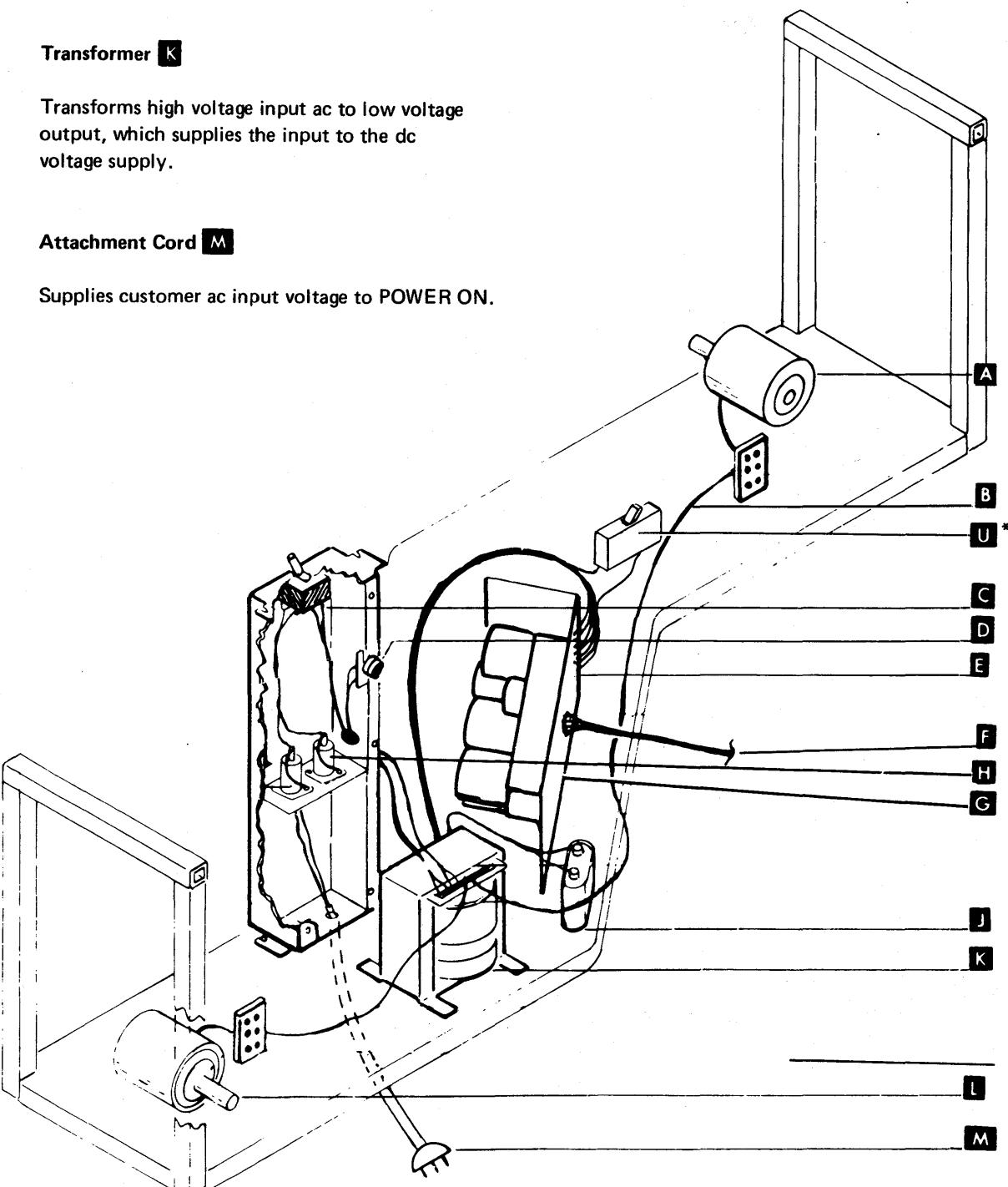
If installed, protects the +5 Vdc output from overloads.

**Transformer K**

Transforms high voltage input ac to low voltage output, which supplies the input to the dc voltage supply.

**Attachment Cord M**

Supplies customer ac input voltage to POWER ON.



\*Not installed on all machines

### AC Voltage Distribution (with diode board)

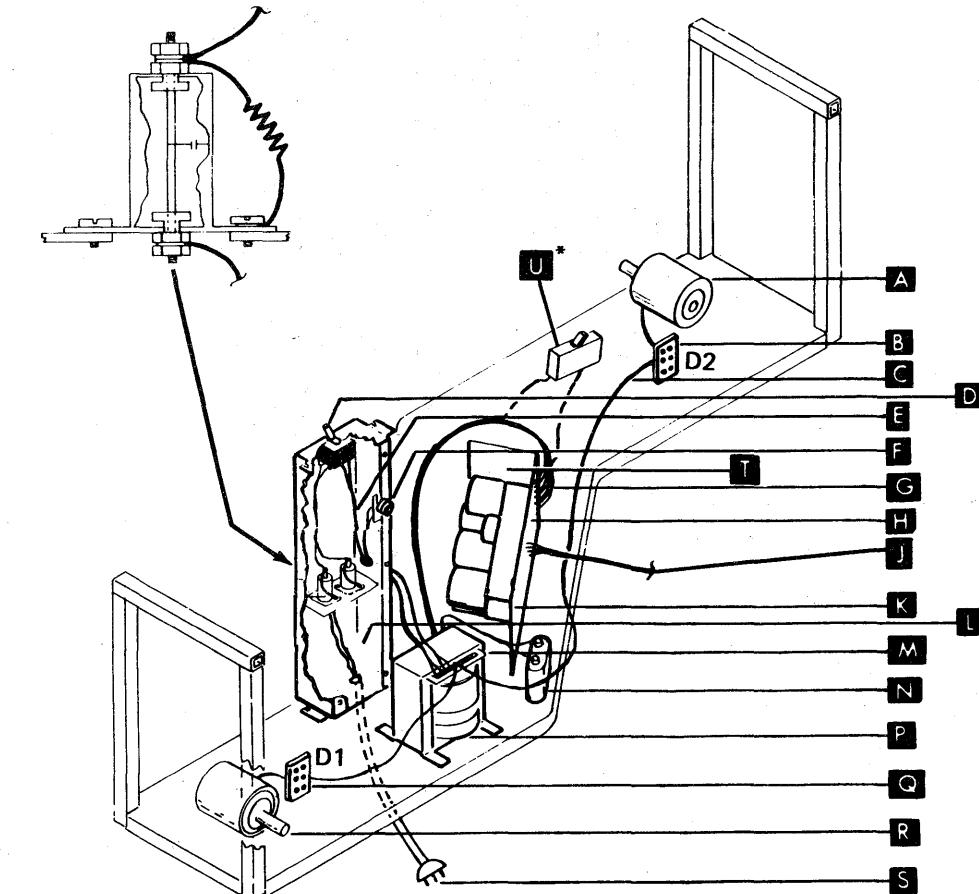
This distribution is for the original power supply with a diode board **T**. See pages 15-4 and 15-5 for the revised power supply.

#### POWER ON

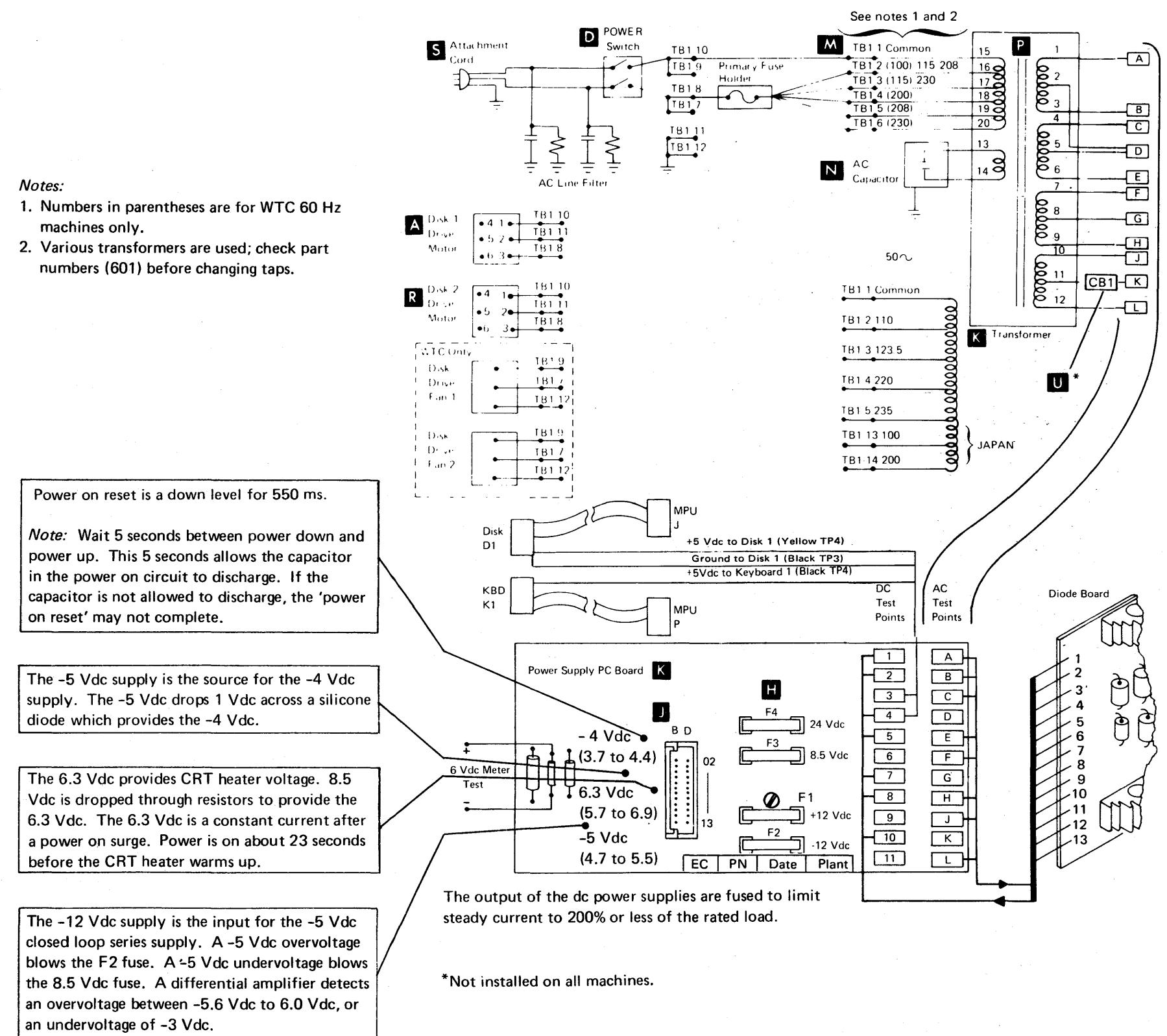
- Plug the attachment cord into the properly rated ac outlet. **S**

AC Voltage	Range	Frequency
115	10%	60 Hz
204	12%	60 Hz
200/220/235 100/110/123.5	10%	50 Hz
100/110/123.5 200/220/235	10%	60 Hz

- Close the power on switch. **D**
- Alternating current is sent through the primary fuse to the transformer. **P**
- TB distributes ac through cables to disk 1 and 2. **B** **Q**
- The capacitor C1 **N** makes the transformer provide regulated ac input voltage to the dc supplies.
- The power supply PC board **K** along with capacitors 2-7 and the rectifier board, develops all dc voltages.



\*Not installed on all machines.



### AC Voltage Distribution (without diode board)

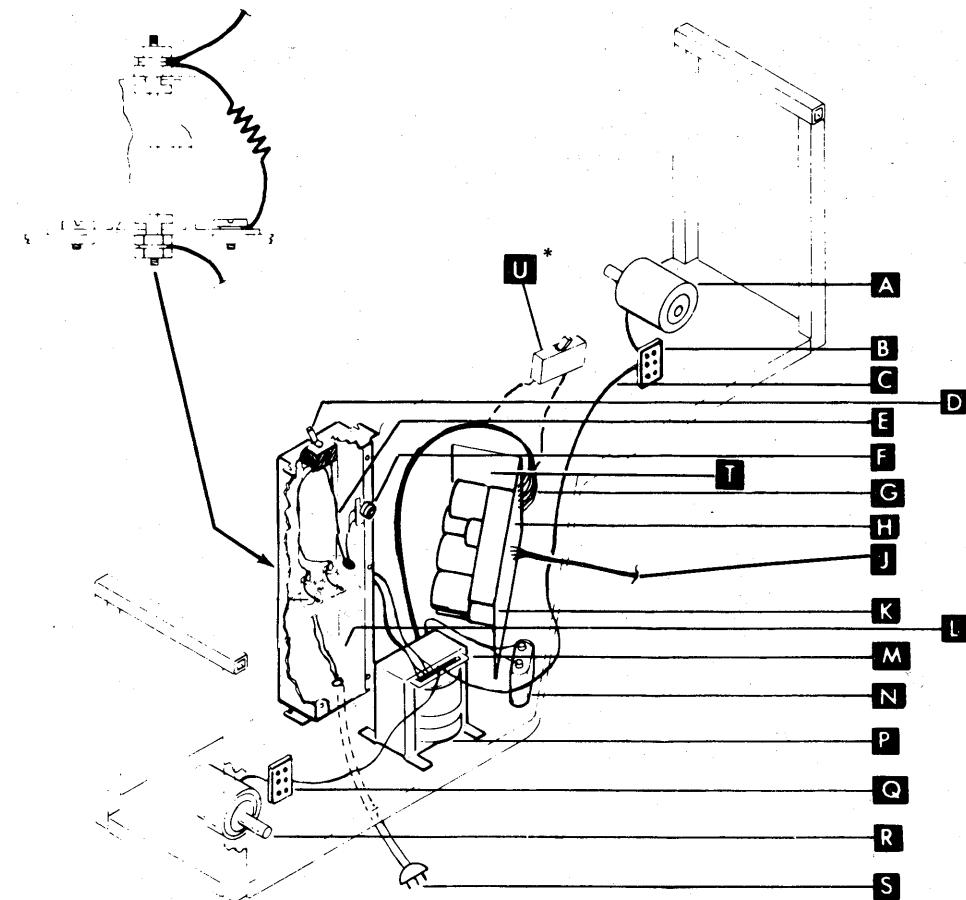
This distribution is for the revised power supply with no diode board. See pages 15-2 and 15-3 for the original power supply.

#### POWER ON

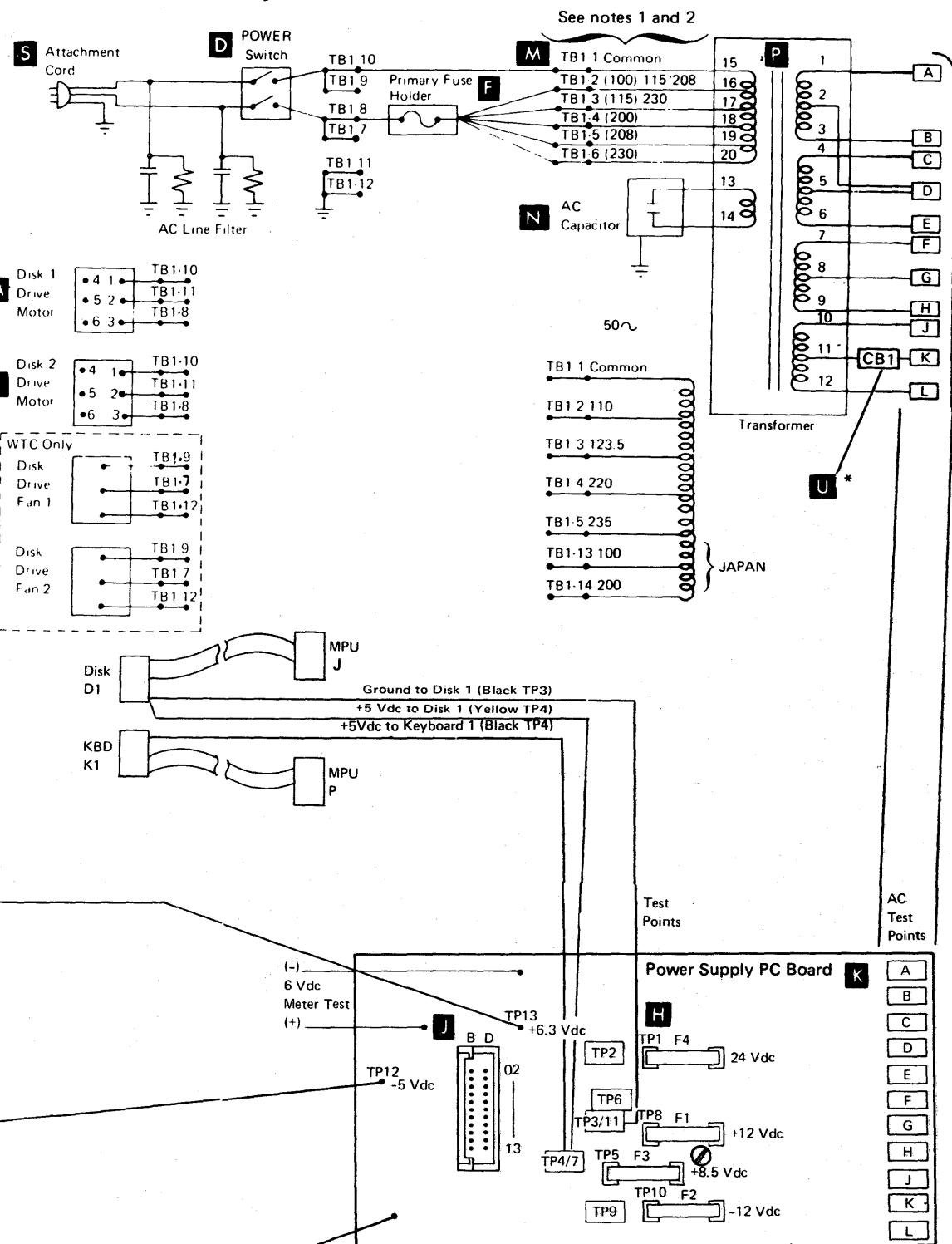
- Plug the attachment cord into the properly rated ac outlet. **S**

AC Voltage	Range	Frequency
115	10%	60 Hz
204	12%	60 Hz
200/220/235 100/110/123.5	10%	50 Hz
100/110/123.5 200/220/235	10%	60 Hz

- Close the power on switch. **D**
- Alternating current is sent through the primary fuse to the transformer. **P**
- TB distributes ac through cables to disk 1 and 2. **B** **Q**
- The capacitor C1 **N** makes the transformer provide regulated ac input voltage to the dc supplies.
- The power supply PC board **K** along with capacitors 2-7 and the rectifier board, develops all dc voltages.



\*Not installed on all machines.



**Notes:**

1. Numbers in parentheses are for WTC 60 Hz machines only.
2. Various transformers are used; check part numbers (601) before changing taps.

The 6.3 Vdc provides CRT heater voltage. 8.5 Vdc is dropped through resistors to provide the 6.3 Vdc. The 6.3 Vdc is a constant current after a power on surge. Power is on about 23 seconds before the CRT heater warms up.

The -12 Vdc supply is the input for the -5 Vdc closed loop series supply. A -5 Vdc undervoltage blows the 8.5 Vdc fuse. A differential amplifier detects an undervoltage of -3 Vdc. Overvoltage protection is provided by a clamp which limits overvoltage to 6.5 Vdc.

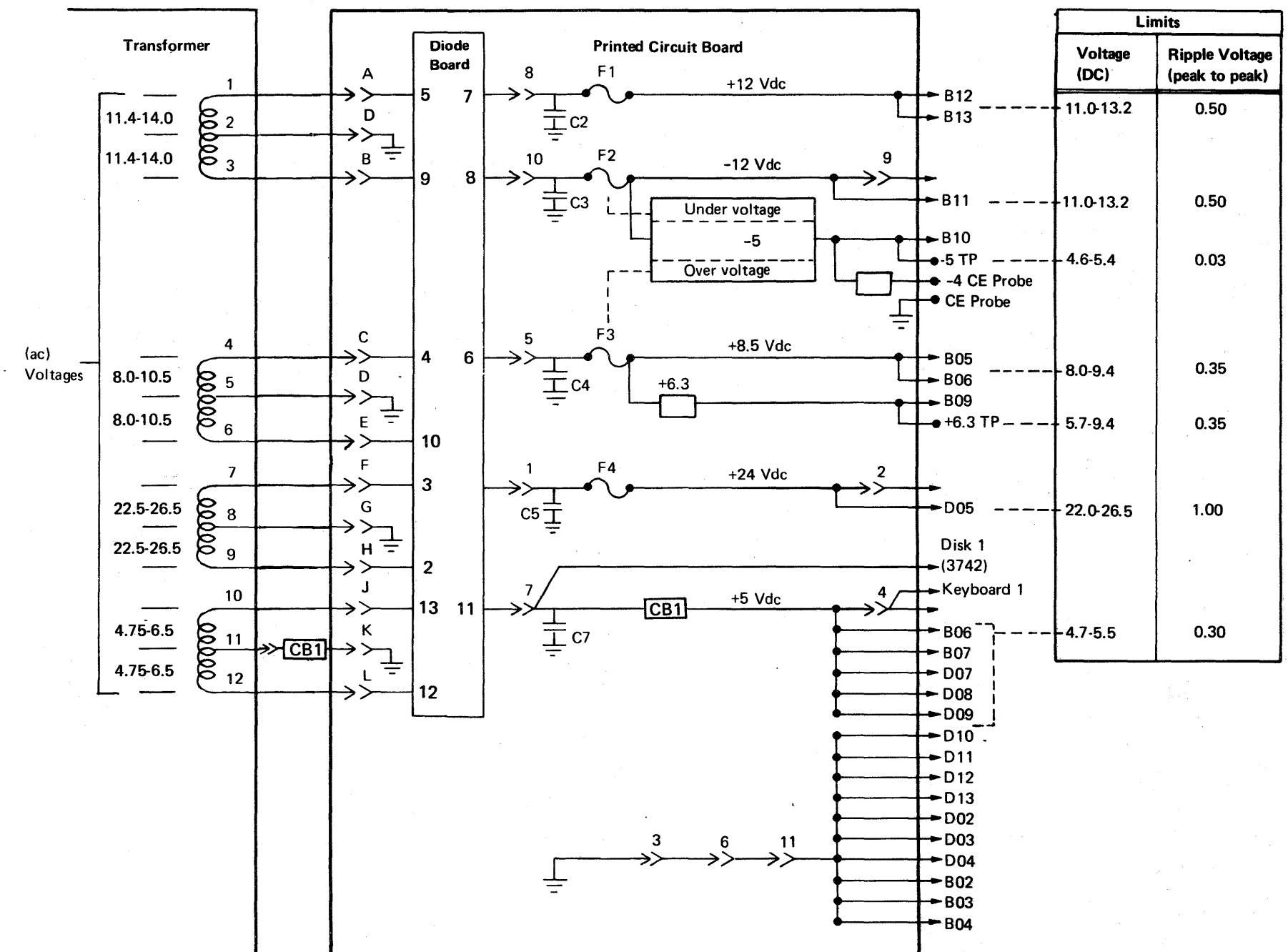
'Power on reset' is at down level for 550 ms.

**Note:** Wait 5 seconds between power down and power up. This 5 seconds allows the capacitor in the power on circuit to discharge. If the capacitor is not allowed to discharge, the 'power on reset' may not complete.

\*Not installed on all machines.

### Printed Circuit Board Diagram

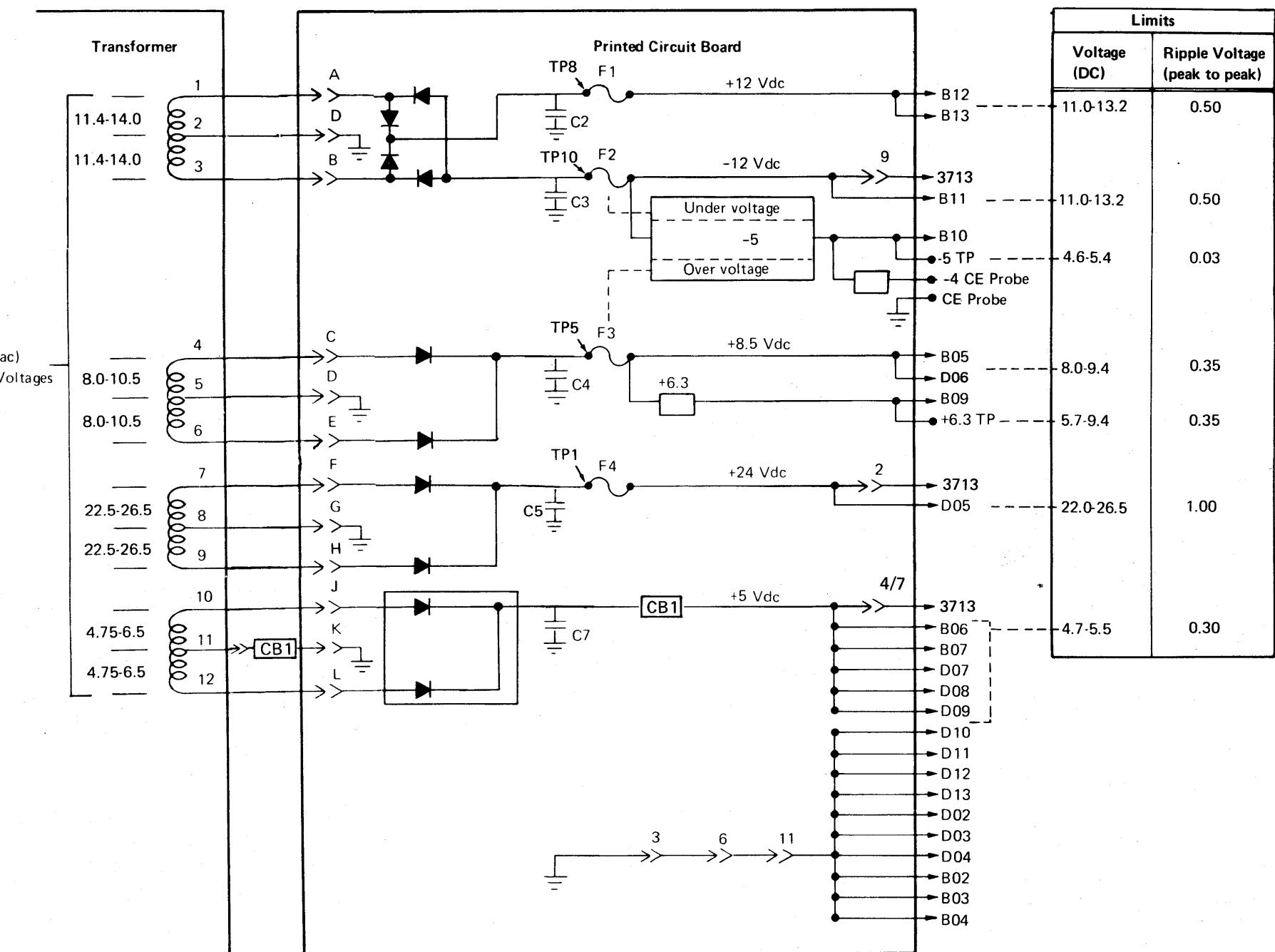
This diagram is for the original power supply with diode board.



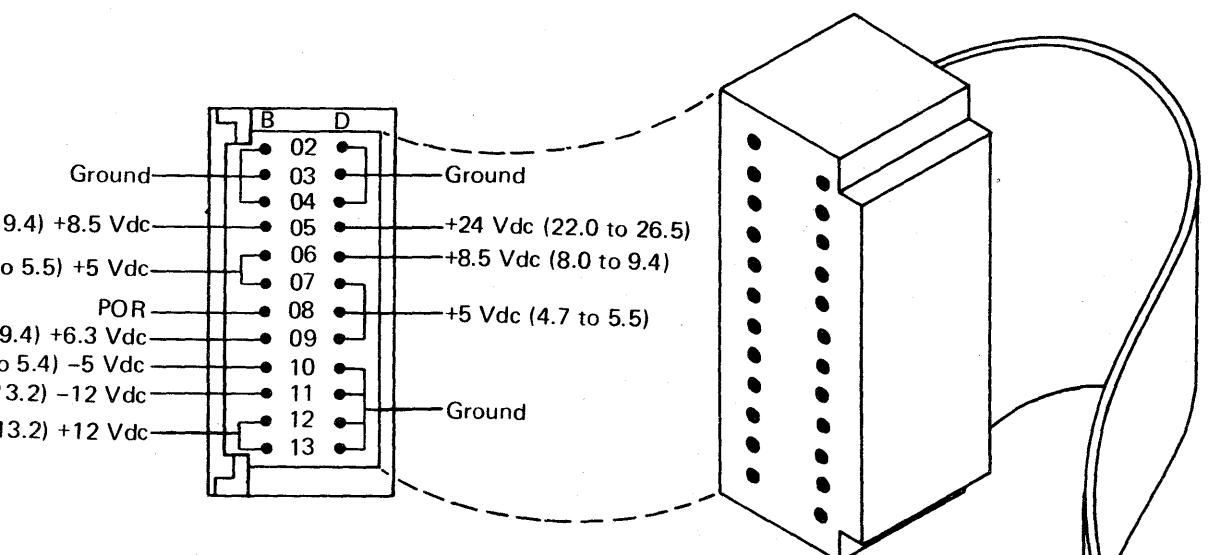
Note: See Ripple Measurement later this section.

### Printed Circuit Board Diagram

This diagram is for the revised power supply with no diode board.



Note: See Ripple Measurement later this section.



### Dc Voltage Distribution

#### Power Supply dc Cable

The power supply dc cable **L** carries dc voltages to the connector **M** on the MPU.

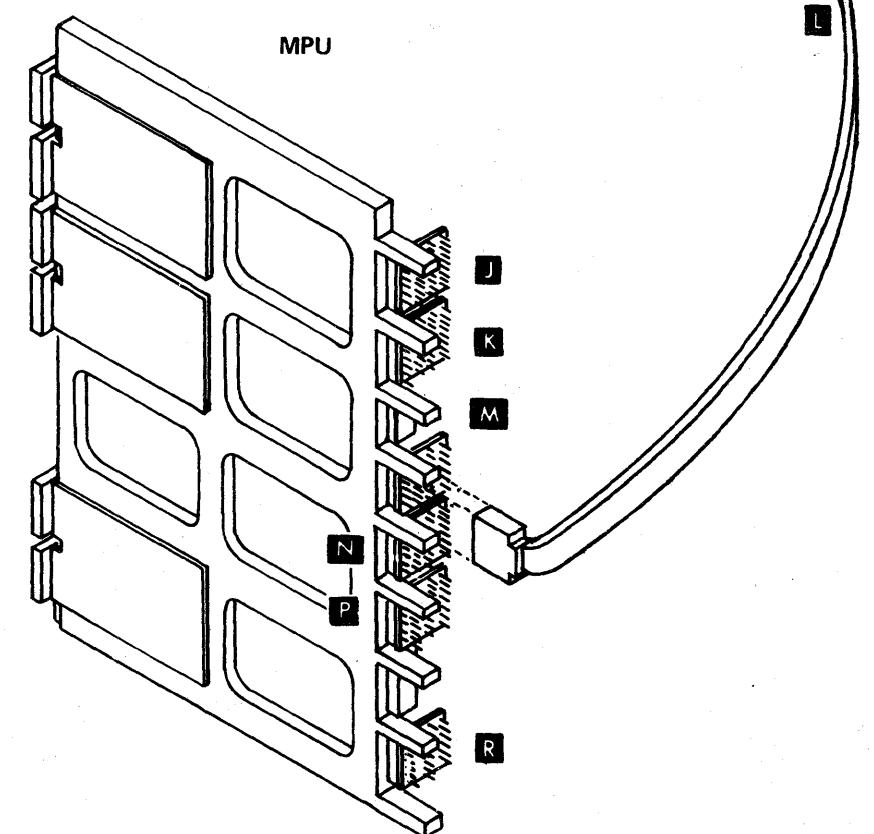
The MPU sends signals and dc voltages from:

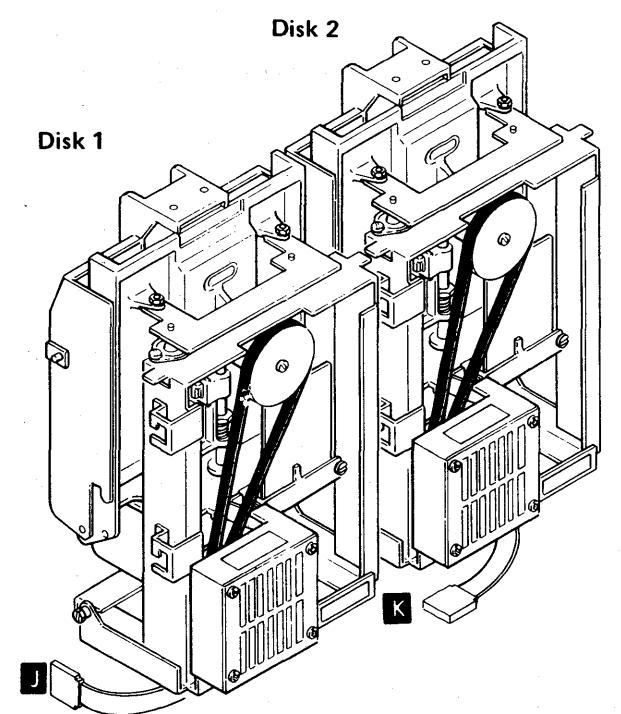
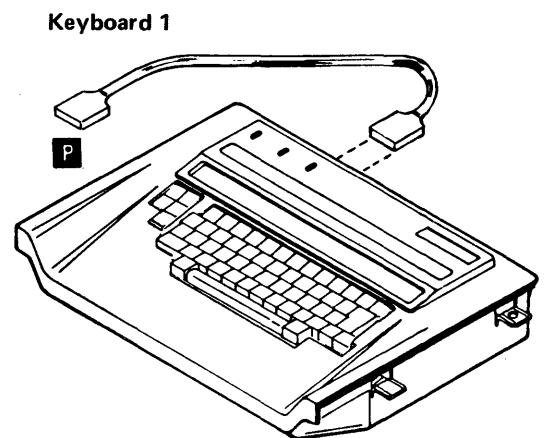
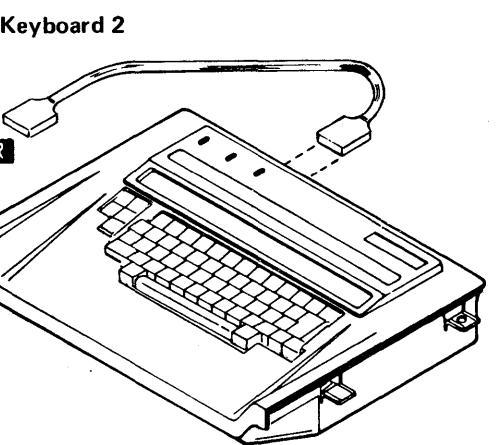
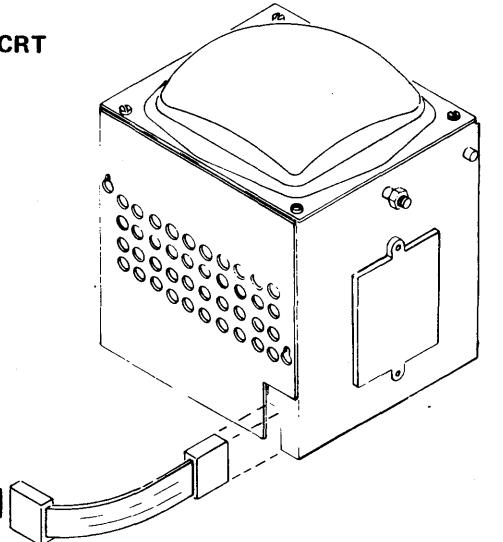
- Connector **J** to disk 1.
- Connector **K** to disk 2.
- Connector **N** to the display unit.
- Connector **P** to Keyboard 1.
- Connector **R** to Keyboard 2.

#### Voltages and Pin Numbers To and From MPU

Voltages	Disk 1 & 2	CRT	Keyboard
-5	B11		D06
+5	*B03		*B09
+6.3		B12 B13	
+6.8			
-7.5			
+8.5			D03
-12		D02	
+12		D09 D10 B08 B09	
+24	B10		

\* +5 for disk 1 and keyboard 1 goes directly to power PC board TP4 rather than to the MPU.





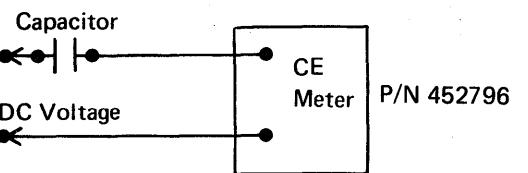
The disk drive units are not  
side by side in the 3742 as  
shown here.

## Ripple Measurement

Use an oscilloscope, if available, to measure ripple voltage.

The CE meter, used as described below, affords an alternate way to get an *indication* of ripple voltage:

1. Connect a capacitor (0.22 mfd or larger, 50 Vdc or higher) in series with one meter lead. The capacitor is not furnished.
2. Set the meter range to 15 Vac.
3. Connect one meter lead to the dc voltage in question; the other lead to frame ground. (Remember the capacitor in series with one lead.)



4. The meter needle should not leave zero on the scale if ripple voltage is within limits.

*Note:* A loose power supply capacitor terminal screw can cause ripple.

## INSTALLATION PROCEDURE

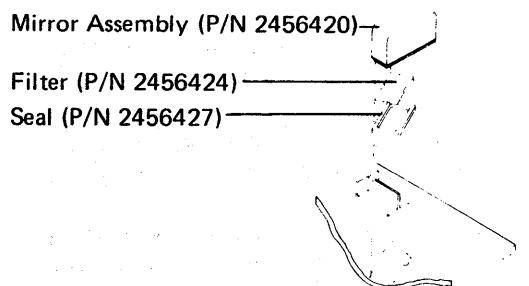
### CRT Safety

See the CRT safety notice on the inside of the front cover of the maintenance library (page 0-2).

### Mirror Installation

Unpack the mirror assembly (P/N 2456420) from its container and install as follows:

- Install the seal (P/N 2456427) making sure that the seal does not obstruct the area being displayed on the CRT face.
- Install the filter (P/N 2456424) on top of the seal.
- Align the mirror assembly (P/N 2456420) with the holes in the tabletop and push down until the assembly is latched.



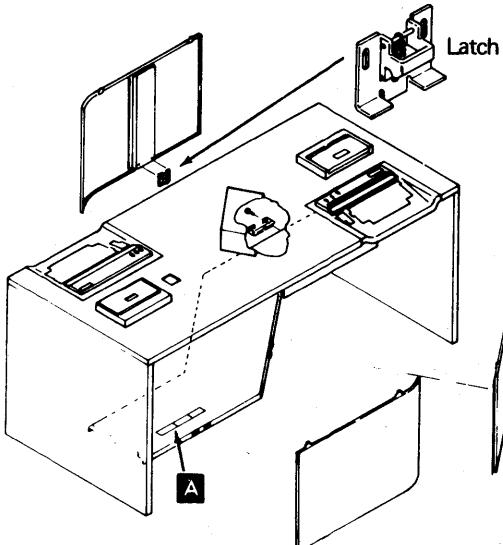
### Pre-Power Check

- Check that all cable connectors and cross connectors are plugged and seated properly.
- Check the customer's power system for proper grounding.
- Make sure the customer's voltage matches the voltage specified on the machine voltage tag. This tag is inside the cover, on the frame, below the disk unit, of the primary station **A**.

**Note:** If changes are made, DP Orders and Movements must submit a Records Purpose Only MES for the machine to update MLC records. It is essential that you inform DP Orders and Movements of this change. Excessive installation time can occur on sales features and engineering changes if MLC records are incorrect.

### Cover Removal

If the cover will not come off by lifting it upward at the lower corners, remove the cover by lifting the latch upward with a small screwdriver and swinging the bottom of the cover out.



### Power On Check

- Make sure the MAINLINE switch is off.
- Be sure the mainline cord is not under the machine legs.
- Check RPQ Section 31 for any procedure required before turning power on. Refer to the machine history card to find out if any RPQ features are installed.
- Connect the mainline cord to the customer's outlet.
- Turn on the MAINLINE switch.
- Observe the machine for signs of overheating or smoke. Turn off the MAINLINE switch immediately, if any abnormal conditions are noted.
- Check that the disk drive hub and drive belt are turning.
- Use the *Machine Checkout* Procedure to check the machine operation and performance:  
Base machine — MAPs 7-1 and 7-2.  
Feature group A — MAP 7-3.  
128 record length feature — MAP 7-4.  
RPQ — Section 31. (Refer to the machine history card to determine if an RPQ is installed.)

### Completion of Installation

The machine serial number is inside the cover, on the frame, below the disk unit, of the primary station **A**.

- Be sure that all safety shields are installed that were removed during this installation.
- Place the MLM in the folder and then put the label on the folder. Put the parts catalog in the same folder. Then put the folder in the storage area of the machine.
- Fill out the IR and report the installation according to local procedures.
- The disk and operations manuals belong to the customer.

### Specifications

#### Dimensions:

	F	S	H
Inches	65	29-1/2	33
Centimeters	165	75	84

**Weight:** 300 lb (136 kg)

**Heat Output:** 850 Btu/hr (215 kcal/hr)

#### Power Requirements:

kVA	0.4
Phases	1
Voltage	115, 208, or 230 ( $\pm 10\%$ )

#### Environment Operating:

Temperature	60° to 90°F (16° to 32°C)
Relative humidity	8 to 80%
Maximum wet bulb	73°F (23°C)

### Cleaning

#### CAUTION

Do *not* use sprays on the keys or near the keyboard. Do *not* use IBM cleaning fluid (methyl chloroform) or isopropyl alcohol for cleaning.

Use a cloth dampened with mild soap and water on covers, CRT face, CRT filter, CRT mirror, and keyboard.

### Packing Instructions

**CAUTION:** The 3742 weighs 300 pounds.

- Tape the following with nylon filament tape:
  - Disk file covers in closed position.
  - Display unit mirror to the table top.
  - Keyboard covers in closed position.
  - Base covers to base and legs.
  - Power cord to table tops.
- Place the 3742 on the shipping pallet and locate the 3742 glides in the shipping pallet recesses.
- Using the corner protectors, tape the 3742 to the shipping pallet with three wraps of nylon filament tape.
- Cover the 3742 with the polyethylene bag and apply the labels.

### Extended Reading Board Installation

- Remove all electrical power from the machine by unplugging the mainline cord.

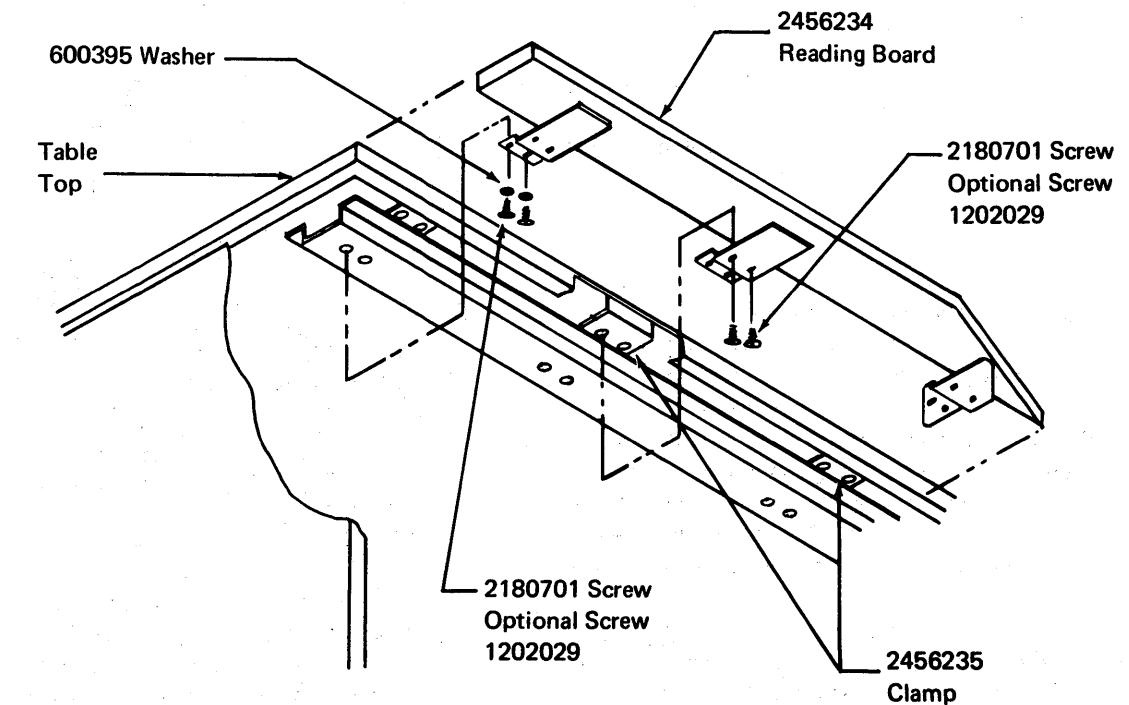
These instructions apply to installing an extended reading board on either side of the machine.

- Remove the curved access cover.

#### Access Cover Adjustment:

1. Lower the two cover hanger brackets (loosen two screws) to the maximum of the slots (tighten the two screws).
2. On the logic gate side, ensure that the cover hanger bracket does not interfere with opening the logic gate; adjust the brackets as low as possible accordingly.
3. Adjust the cover latch assembly (on the access cover) to match the adjustment made to the cover hanger brackets.
4. Reinstall the access cover and check the cover fit and position; readjust the hanger brackets and/or latch if necessary.

5. Remove the access cover. Slide the three mounting clamps (2456235) in the table top lip with the bend in the clamps toward the front (toward you).
  - Slide the reading board (PN 2456234) into position and fasten two screws (PN 1202029) and two washers (PN 600395) through the back holes (furthest away) in the middle mounting brace.
  - Use an 1/8 inch allen wrench for the screws, but do not tighten them completely.
  - Fasten two screws and two washers in the back holes of the right hand (keyboard end) mounting brace of the board. Do not tighten them completely.
  - Fasten two screws and two washer in the back holes of the left hand mounting brace of the board. Do not tighten them completely.
- Fasten two screws to each mounting clamp through the front holes in the board mounting brace. Ensure that the clamp is positioned on the table top lip.
- Align the reading board with the end of the table top and tighten all the screws.
- Do the other side by repeating this procedure.
- Reinstall the access cover.
- Plug in the mainline cord and power up the machine.



## GLOSSARY

**All Keys Mechanical Assembly**—A keyboard frame, which includes all the data and function key modules, and fastens to the keyboard printed circuit board.

**AM**—Address Mark: A byte of data on the disk, used to identify the ID field and data field in the record on the disk.

**Audio Response**—The sound produced by the clicker.

**Audio Feedback Device**—A mechanical and electrical device producing an audible signal to the operator that a key entry was accepted by the machine.

**BOE**—Beginning of Extent: A 5-character field (positions 29 through 33) which identifies the position of the first record of the data set.

**BPS**—Baud Per Second: Communication line Transmission rate.

**BSCA**—Binary Synchronous Communications Adapter: A feature that allows the 3741 to communicate with other machines via telephone equipment.

**Byte**—A byte is composed of 8 binary bits that define a character.

**Clicker**—A mechanical and electrical device producing an audible signal to the operator that a key entry was accepted by the machine.

**Collet**—A device which centers and clamps the disk to the disk drive hub when the disk drive cover is closed.

**Control Address Mark**—A character, D, in the first byte of the data field of a record, denoting a deleted record.

**Converter**—Converts 12 Vdc to 12,000 Vdc to accelerate the electron beam to the face of the CRT. It also provides the 400 Vdc for the brightness control.

**CRC**—Cyclic Redundancy Check: An error check, counting of the bits on a record.

**Crossfoot Total**—Add a group of numbers in several different orders to make sure the total is correct.

**CRT**—Cathode Ray Tube.

**Data**—Information; Records.

**Data Link Control Characters**—A transmission control character used by the BSCA feature. This character is for control only, not to be transmitted.

**Data Set**—A block or group of records assigned for a particular use.

**Data Set Label**—Any record (disk address 00008 through 00026) which contains stored information defining a data set.

**Deserialized**—Signals received one after another are made into characters.

**Display Viewer**—The display viewer reflects the display unit information to the operator.

**EOD**—End of Data: A 5-character field (positions 75 through 79) which is the address of the last record of the data set plus 1, or next available record on the disk. If a data set is defined by BOE and EOE but no data is entered, then EOD equals BOE.

**EOE**—End of Extent: A 5-character field (positions 35 through 39) for the address of the last record of a data set.

**EOF**—End of File: A code which signals that the last record of a file has been read.

**Extent**—The limit, one end or the other of a data set.

**FET**—Field Effect Transistor logic.

**Flyplate**—The pad on the bottom of a keyboard key module. When a key is pressed, the flyplate raises and the capacitive change indicates to the keyboard printed circuit that the key is pressed.

**FRU**—Field Replaceable Unit.

**Hash Total**—A sum of fields used only for checking of one or more other fields. The 3742 field totals feature provides the ability to create a hash total for a group of records.

**Hex**—Hexidecimal Code.

**ID**—Identification.

**IDR**—Identification Reader.

**Jittery**—The display unit information is hard to read because it moves up and down and side to side.

**LED**—Light Emitting Diode: Activates the phototransistor which detects index pulses on the disk unit.

**MAP**—Maintenance Analysis Procedure: Provides the step by step procedure which locates a failing part.

**Master Coil**—A horizontal deflection coil in the display unit.

**Medium**—The disk.

**Memory**—A high density field effect transistor (FET) memory, used by the microprocessor unit (MPU).

**MPU**—A Microprocessing Unit which receives, controls, and manages the flow of information for the machine.

**PC Board**—A printed circuit board is an electrical circuit mounted on a board to distribute signals and voltages.

**Planar Board**—The microprocessing unit electronic board.

**POR**—Power On Reset: A signal occurring during power on, used to reset all circuits to an operational starting point.

**Protected Data Set**—A protected data set cannot be written to, and an attempt to go into enter or verify mode will result in a file protect error. If you are in update mode and attempt to modify a record, you will also get the file protect error.

**Raster**—The path of the electron beam which produces the image on the display unit.

**Record**—A consecutive string of 80 (128 with 128-record-length feature installed) or less bytes (characters) on the disk. Some or all of the characters may be blank.

**Reseat**—To remove, unplug, unfasten, or detach an object from its position or mounting and put the same object back in place again. Example: to remove a cable from its connector, and put it back again.

**RI**—Record Insert.

**ROS**—Read-Only Storage: A storage whose contents are not changed by computer instructions.

**RPQ**—Request for Price Quotation: Used by IBM to answer specific needs of customers for equipment and special features not available in the sales manual.

**Scrolling**—The action of the two line 80-character display as it progresses or regresses through the three steps of displaying a 128 character record.

**Search**—The act of locating a desired record on the disk. Search functions can be performed by:

- Search EOD
- Search data address
- Search content
- Search sequential content

**Seek**—The movement of the read/write head from one track to another one on the disk.

**Self-Check**—A method for checking the entry of numeric fields that contain a precomputed self-check digit, which is the last digit in the field.

**Slave Coil**—A horizontal deflection coil in the display unit.

**Swap**—To exchange one for another.

**Sweep**—To deflect, or produce vertical, horizontal, and oscillating motion to the CRT electron beam, in order to exhibit a constant image.

**TTL**—Transistor-Transistor Logic.

**Unprotected Data Sets**—An unprotected data set can be written to or read from. The data set label for an unprotected data set contains a blank in position 43.

**Video**—Information relating to or used in receiving the image on the face of the display unit.

**Wiggle Sweep**—Deflects the electron beam in the display unit, in an oscillating motion, to produce character height.

**Write Protected Data Set**—A write protected data set cannot be written to, and an attempt to go into enter or verify mode will result in a write protect error. If you are in update mode and attempt to modify a record, you will also get the write protect error.

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## **RPQ (SPECIAL FEATURE)**

There are no RPQs installed on this machine. Return to page 1-1 and check the N box.



# Technical Newsletter

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## IBM 3742 Dual Display Station Theory-Maintenance

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This technical newsletter provides replacement pages for the subject publication. Pages to be inserted and/or removed are:

2-2.3, 2-2.4  
2-3.1, 2-3.2  
2-4.1, 2-4.2  
2-6.1, 2-6.2  
2-8.1, 2-8.2  
2-9.1, 2-9.2  
2-9.5, 2-9.6  
2-10.1, 2-10.2  
201, 204-1

Changes to text and illustrations are indicated by a vertical line at the left of the change.

### Summary of Amendments

Probing point TPB14 is changed to TPB7.

**Note:** Please file this cover letter at the back of the manual to provide a record of changes.

IBM Corporation, Publications, Department 245, Rochester, Minnesota 55901

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## 201 Part Numbers and Cause Codes

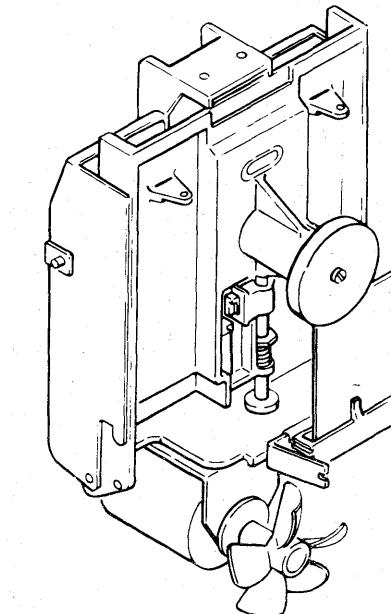
Part Name	Number	IR Code	Part Name	Number	IR Code
AC Distribution Cables:			Leadscrew Wheel	2305544	820-12
100-115 Vac D1	2456362	100-01	LED Assembly	2305656	820-10
200-235 Vac D1	2456387	100-01	Limit Stop		
100-123.5 Vac D2	2456480	100-01	Upper	2305618	820-09
200-235 Vac D2	2456386	100-01	Lower	2305528	820-09
AC Line Filter	2192519	600-07	Phototransistor Assembly	2305604	820-10
Blade, Fan	2455814	820-25	Signal Cables		
CE Test Disk	2455026		Disk 1	2456370	100-04
Collet-Disk Clamp	<i>See Parts Catalog</i>	820-05	Disk 2	2456371	100-04
Assembly			Display	2456372	100-04
Disk Cover Latch	2305650	820-06	Spring Washer	2305663	820-09
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Disk Drive Shaft Bearing	5344991	820-13			
Disk File Cable and					
Connectors	2305599	820-03			
Disk Idler Assembly	<i>See Parts Catalog</i>	820-15			
Drive Belt	2305616	820-02			
Drive Motor					
(50 Hz 115 Vac)	2305706	820-11			
Drive Motor					
(50 Hz 200/235 Vac)	2305707	820-11			
Drive Motor					
(60 Hz 115 Vac)	2305672	820-11			
Drive Motor					
(60 Hz 208/230 Vac)	2305633	820-11			
Drive Motor Pulley					
(50 Hz)	2305451	820-11			
Drive Motor Pulley					
(60 Hz)	2305597	820-11			
Fan 50 Hz					
(100-115)	2455819	820-25			
(200-235)	2455820	820-25			
File Control Card (FC)	<i>See Parts Catalog</i>	820-04			
Head and Carriage					
Assembly (with pressure					
pad arm and lead screw)	2305670	820-07			
Head Load Actuator					
Assembly	2305609	820-08			
Interlock Assembly					
Spring	2305532	820-24	Cause Codes		
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Damaged	20	Loose	34		
Defective	21	Open	42		

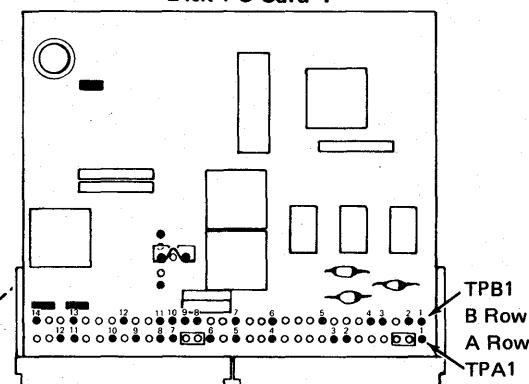
202 (not used)  
203 (not used)

204 File Control Card

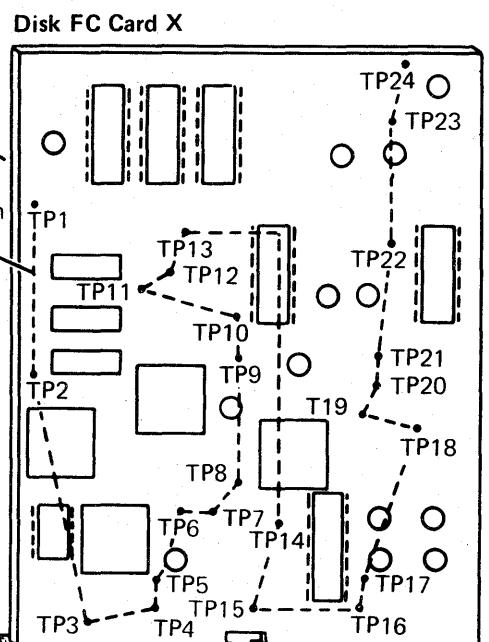


A

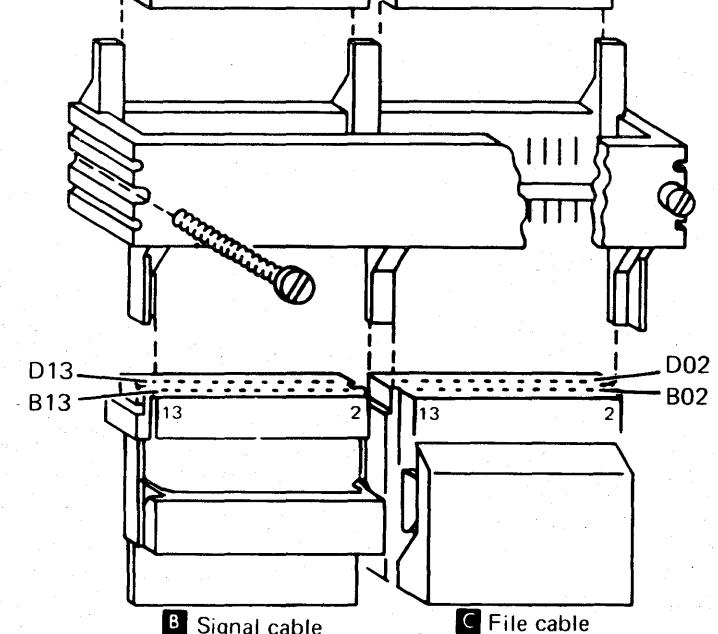
Disk FC Card Y



Or



Or

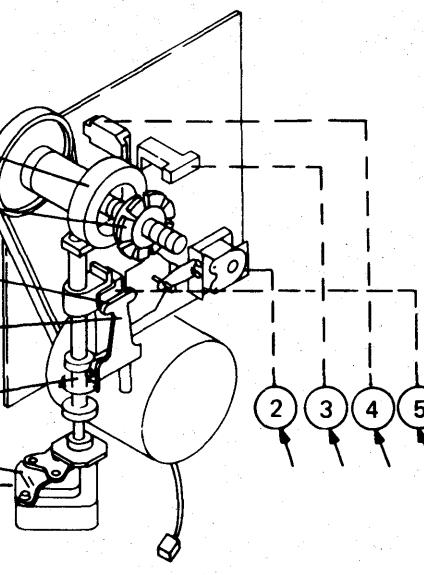


B Signal cable

C File cable

Function	Test Pin Name	Card Test Points		Signal Cable to MPU	File Cable
		Type X	Type Y		
Power/Voltage	+24 volts +5 volts -5 volts Ground	TP1 TP23 TP5 TP17	TPA11 TPB7 TPA12 TPA3 TPA10	B10 B03 B11 B08 B06, B08 B09, D09	B04, B05
Stepper Motor	+Access 0 +Access 1 +Access 2 +Access 3 -MC phase 0 -MC phase 1 -MC phase 2 -MC phase 3	TP15 TP7 TP4 TP6 TP18 TP21 TP20 TP19	TPB8 TPB9 TPB10 TPB11 TPB2 TPA1 TPB3 TPB1	D02 D03 D04 D05 D03 B02 D04 D02	
Head Load Magnet	-Head load +Head engage	TP22 TP10	TPB4 TPB13	D10	D05
LED	+LED voltage	TP16	TPA2		B07
PTX <sup>1</sup>	PTX (output) +Index	TP8 TP2	TPB5 TPB14	D13	D08
Read/Write	Head A Head B Preamp Preamp +File data -Write data +Write gate +Low current	TP13 TP14 TP3 TP9 TP8 TP6 TP5 TP4 TP15 TP10 TP11 TP12 TP13 TP19 TP18 TP17 TP16	TPA5 TPA4 TPB12 TPA6 TPA8 TPA9	D07 B02 B05 B06	D12 Black D13 White
Erase	+Erase gate Erase current	TPA7 TP24	B04	D10	

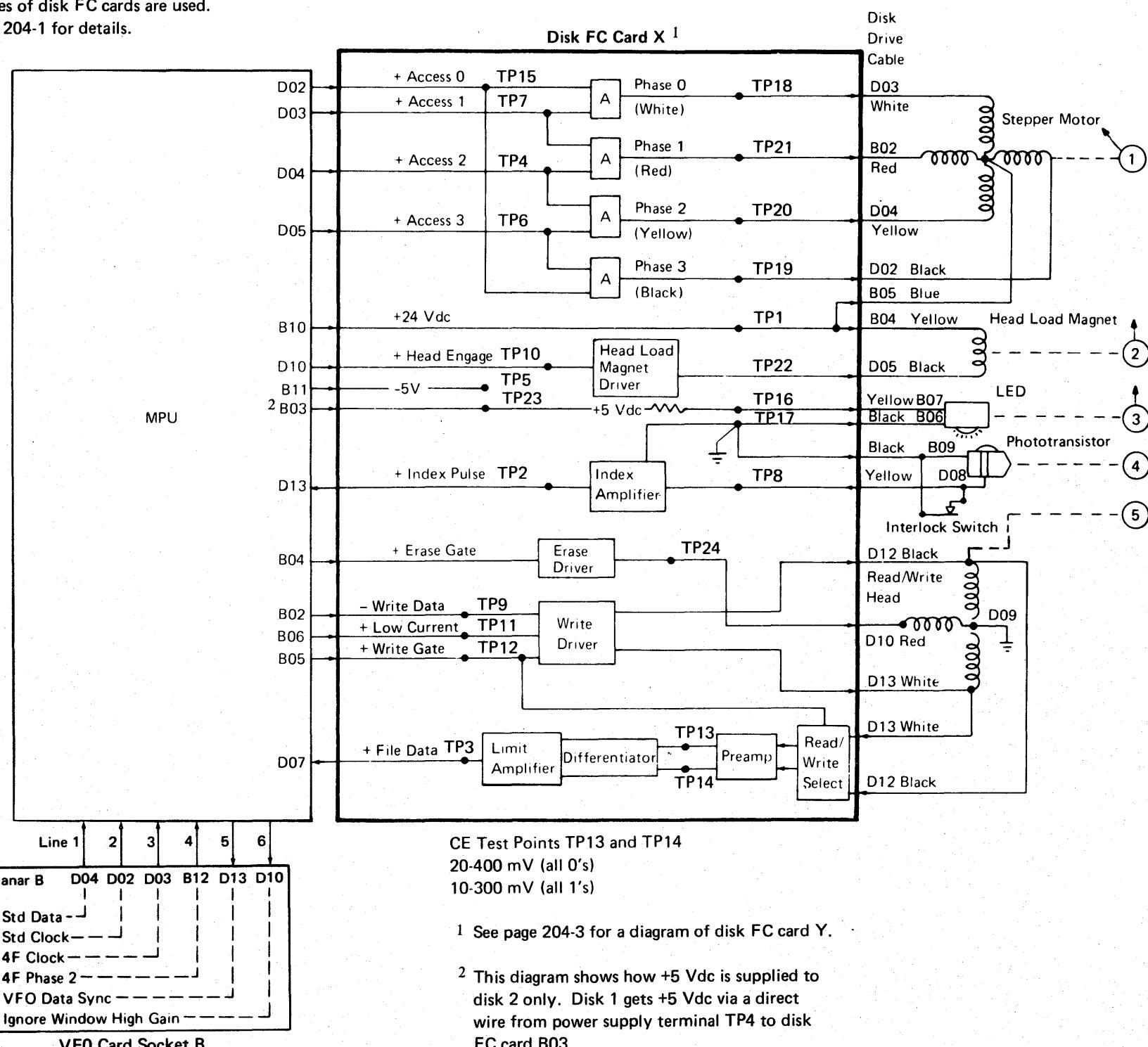
<sup>1</sup> Phototransistor



To ac Distribution

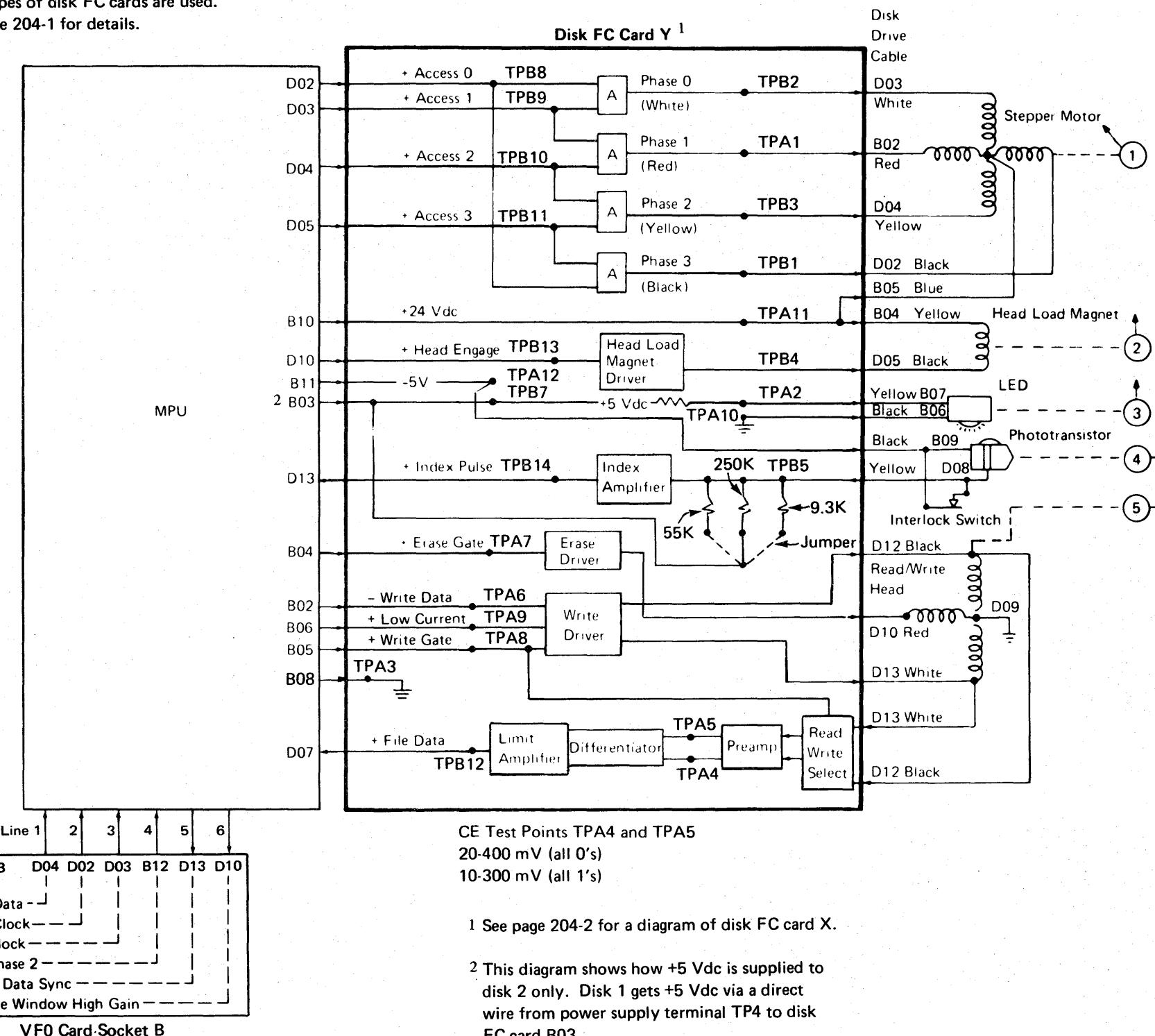
**ZU4 File Control Card (Continued)**

Two types of disk FC cards are used.  
See page 204-1 for details.



## 204 File Control Card (Continued)

Two types of disk FC cards are used.  
See page 204-1 for details.

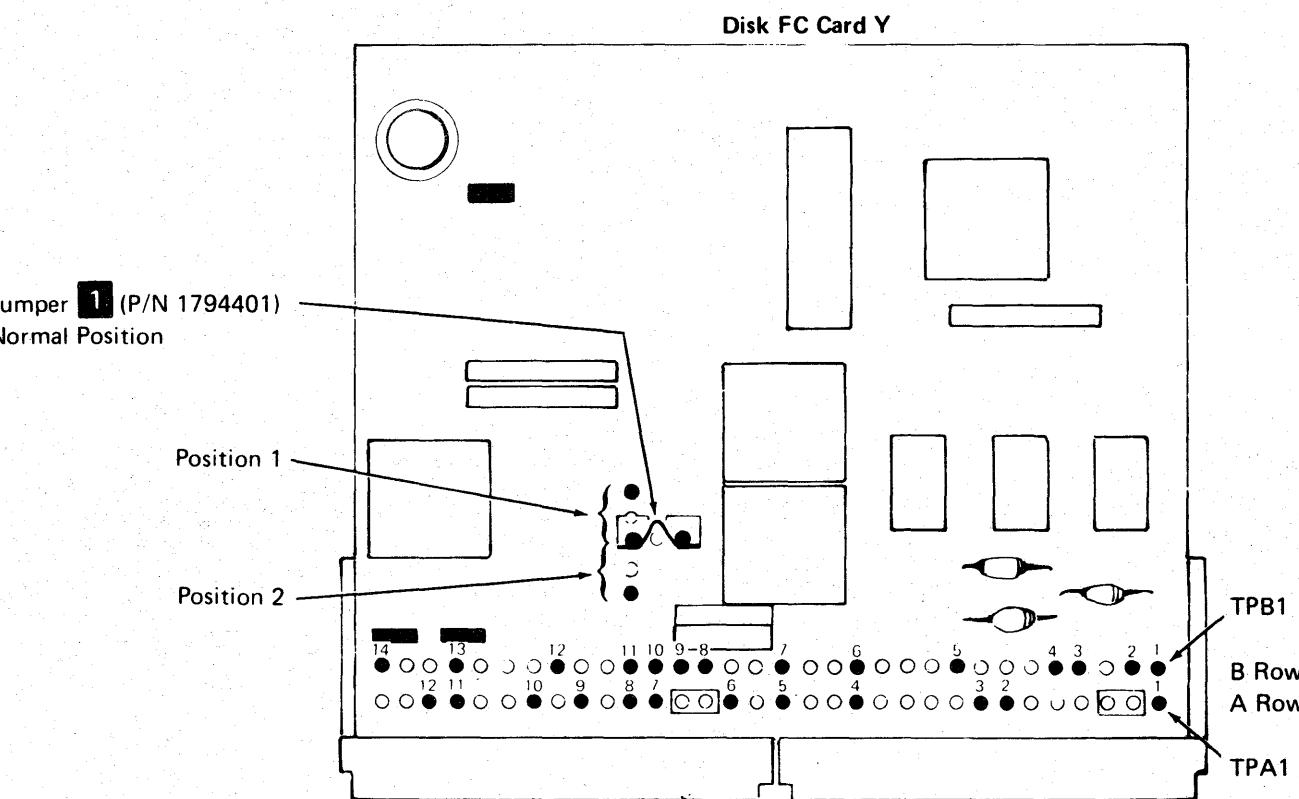


## 205 Index Amplifier Adjustment

This adjustment decreases the sensitivity of the index amplifier to the LED light passing through the diskette. The LED light passing through a diskette can cause multiple index pulses or no index pulse per revolution.

### Adjustment

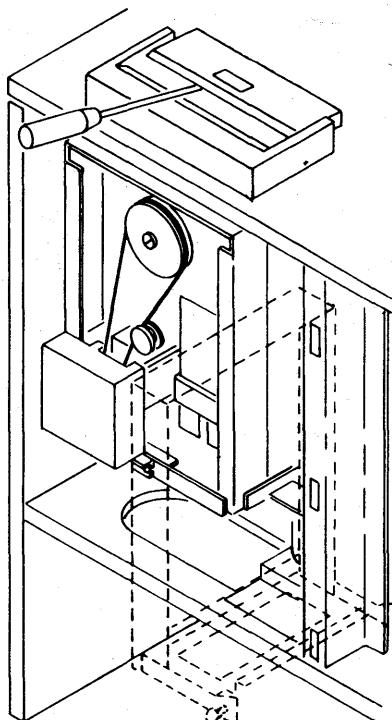
The index amplifier input level can be changed by moving jumper **1** on disk FC card Y only. The sensitivity level (jumper position) should not be decreased more than necessary to ensure correct operation.



Disconnect the jumper from the normal position and connect it to position 1 or 2. Position 1 decreases the sensitivity of the index amplifier to 1/5 of the original amount. Position 2 decreases the sensitivity of the index amplifier to 1/25 of the original amount.

## 206 Disk Drive Service Position

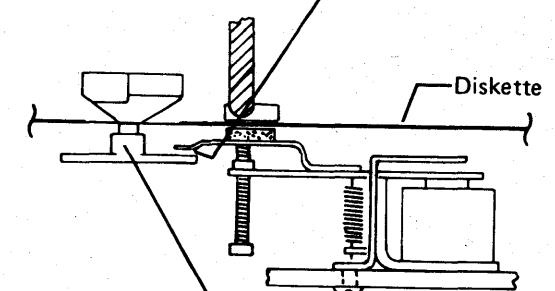
- Turn power off.
- Open door.
- Loosen (turn one revolution) two screws holding door to disk drive cover.
- Remove screw holding disk drive frame to machine base.
- Tip disk unit (bottom first) out of base and hang on brackets.



## 207 Head Load Actuator (224D)

### Service Check

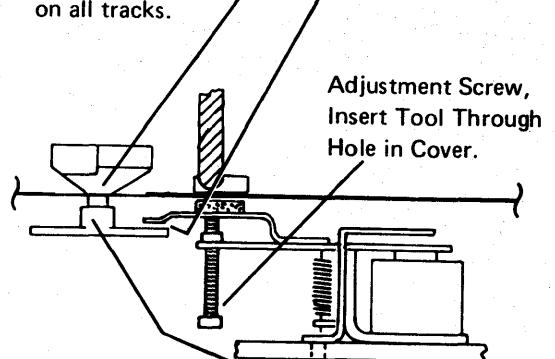
Check for a visual clearance here at all track positions.



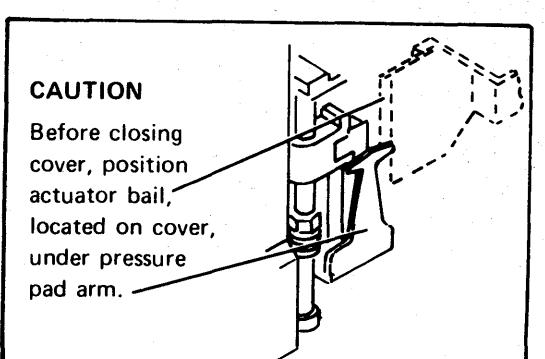
Make sure diskette clears pressure pad when coil is not energized. (Power down.)

### Adjustment

- Energize by jumpering TP22 to TP17 on the FC card with a disk in the unit.
- Adjust for visual clearance here for tracks 0 through 77 and contact here on all tracks.

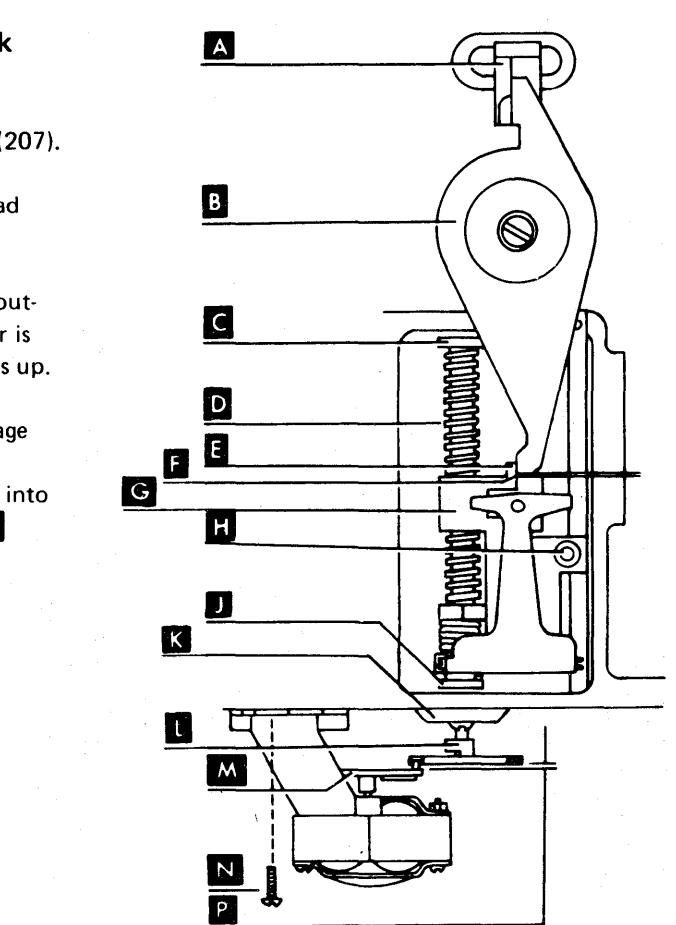
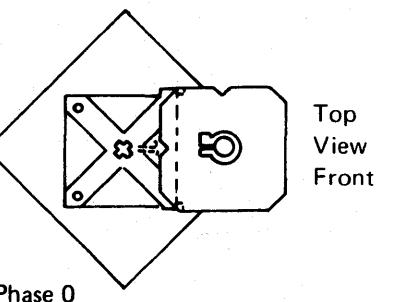


- When coil is not energized, the pressure pad should be completely away from the disk.



## 208 Head Adjustment Service Check

- Place disk drive in service position (206).
- Perform head load actuator service check (207).
- Remove disk drive cover (221).
- Use stepper motor wheel **M** to access head carriage **G** down until stopped by lower limit stop **J**.
- Rotate disk drive hub so white sticker on outside diameter of hub is up. If white sticker is not present, rotate hub so indented mark is up.
- Loosen the phototransistor assembly **A**.
- Install CE tool **B**; it should contact carriage surface **E**. Do not force.
- Rotate stepper motor wheel **M** about 90° into phase 0 alignment with leadscrew wheel **L** as shown:



- Check clearance **F**, for GO with feeler gage of thickness in thousandths shown on carriage **H**. Check NO GO for number shown at **H**, +0.001" (0.0254 mm).
- Do *Head Adjustment* (231) if any one of the above steps gives trouble.
- If head adjustment was OK, position and fasten phototransistor holder with mounting screw so the raised edge is contacting but not pressing against the CE tool.
- Remove the CE tool.
- Reinstall the disk drive cover (221) and test the disk drive by using the disk alignment tracks on the CE test diskette (P/N 2455026). Use MAP 2-11.

### Legend

<b>A</b>	Phototransistor	<b>H</b>	Clearance number
<b>B</b>	CE tool	<b>J</b>	Lower limit stop
<b>C</b>	Upper limit stop	<b>K</b>	Bearing holding screws
<b>D</b>	Leadscrew	<b>L</b>	Leadscrew wheel
<b>E</b>	Carriage Surface	<b>M</b>	Stepper motor wheel
<b>F</b>	Clearance (head-to-CE tool)	<b>N</b>	Stepper motor bracket screws
<b>G</b>	Head carriage assembly	<b>P</b>	Clearance (stepper-to-leadscrew wheels)

## 209 Head and Pressure Pad Cleaning Procedure

### CAUTION

Use only the materials listed below to clean head and pressure pad.

- With cover open, manually rotate stepper motor wheel until carriage assembly is at the upper limit stop.

### CAUTION

Do not allow pressure pad arm to snap against head.

- Pivot pressure pad arm away from head and check pad for contamination. If contaminated, use dry brush (P/N 2200106) to remove caked deposits and to fluff pad.

### CAUTION

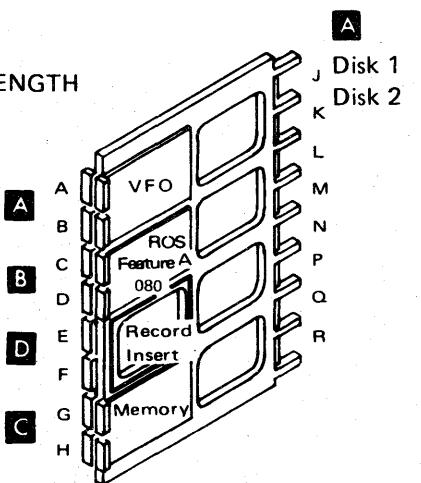
Fluid treated cloth should not contact pressure pad.

- While holding pressure pad arm out, clean polished head surface with isopropyl alcohol (P/N 2200200) applied to a clean cloth (P/N 2108930).
- Perform head load actuator service check (207).

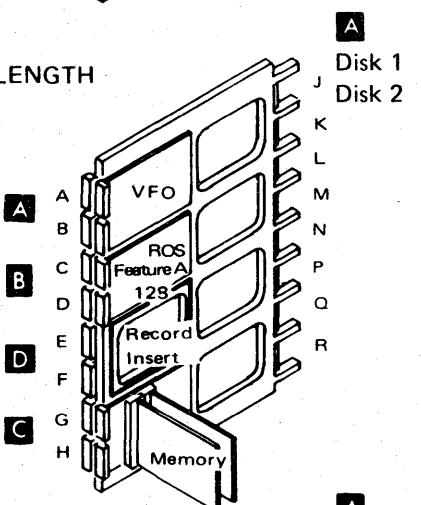
210 (not used)  
211 (not used)

## 212 VFO Card Location

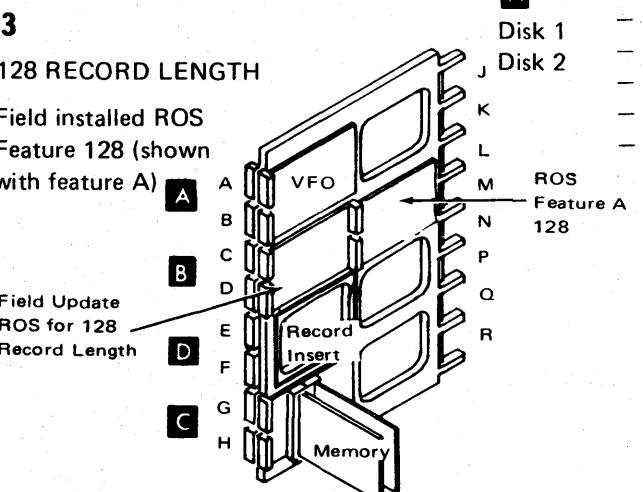
**1**  
80 RECORD LENGTH  
(shown with feature A)



**2**  
128 RECORD LENGTH  
ROS feature  
128 on planar  
(shown with feature A)



**3**  
128 RECORD LENGTH  
Field installed ROS  
Feature 128 (shown with feature A)



**Note:**  
This configuration will change to look like configuration **2** if the MPU planar assembly is changed as a FRU.

## 213 Disk Drive Pulley and Belt

### Removal

- Power down.
- Unplug motor cable. (216F)
- Remove fan guard assembly (216M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (216L) (note blade curvature).
- Remove drive belt. (216K)
- Loosen setscrew and remove pulley. (216G)

### Replacement

- Align setscrew with flat surface of shaft and tighten.
- Replace belt.
- Check belt tracking (215).
- Replace fan belt and guard (note blade curvature).

## 214 Drive Motor

### Removal and Replacement

- Power down.
- Unplug motor cable. (216F)
- Remove fan guard assembly (216M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (216L) (note blade curvature).
- Remove drive belt. (216K)
- Loosen screws and remove guard plate. (216J)
- Remove motor clips by loosening screws. (216H)
- Remove motor through bottom of frame.
- Loosen setscrew and remove drive pulley. (216G)
- To replace, reverse procedure and check for belt tracking.

## 215 Idler Assembly

### Removal

- Remove belt. (216K)
- Remove idler assembly. (216E)
- To replace, reverse procedure and check belt tracking.

### Belt Tracking

Belt must ride in the center of the drive and hub pulleys when the drive pulley is rotated counter-clockwise (as viewed from the pulley side).

### Adjustment

**CAUTION:** Make sure the drive pulley setscrew is on the flat surface of the motor shaft.

Adjust the drive pulley and idler positions so that the belt is centered on the drive and hub pulleys. You may have to form the idler pulley arm.

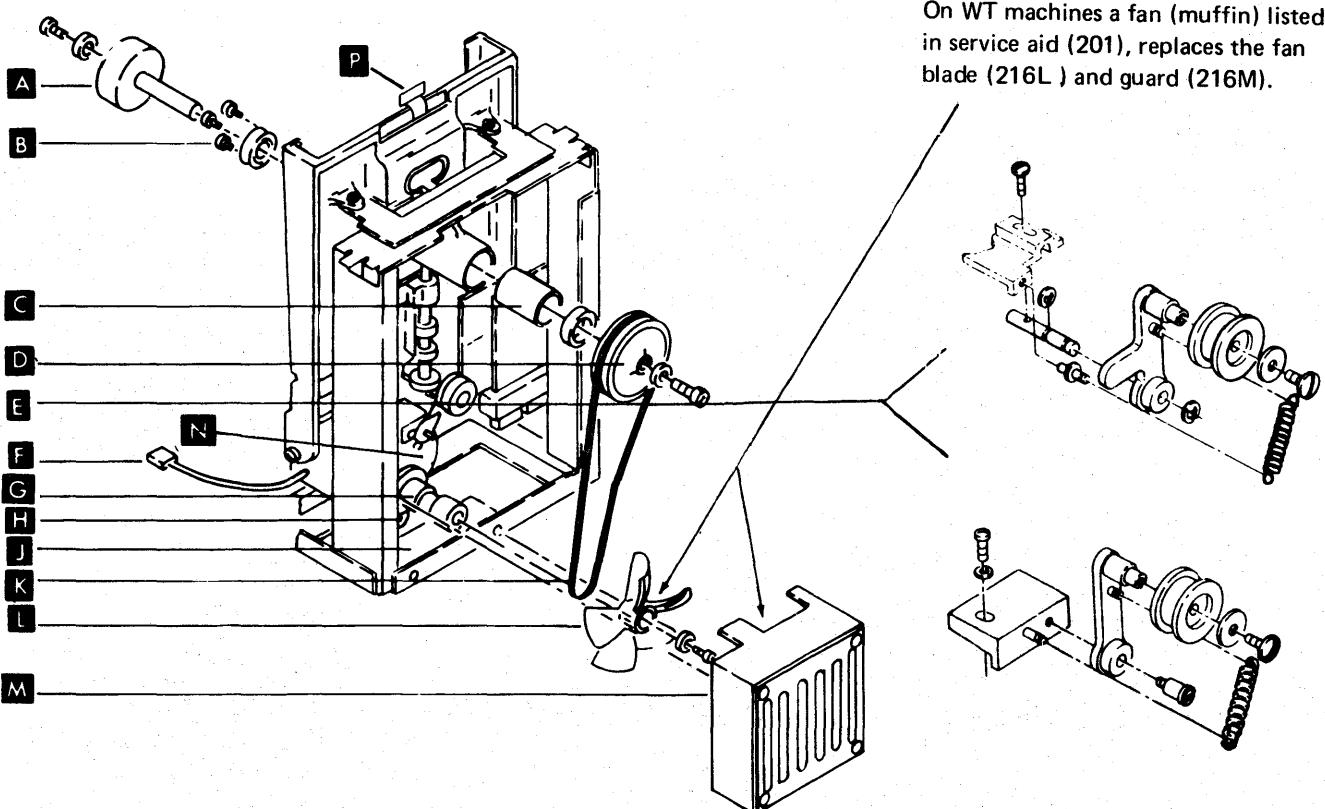
**Note:** Some disk drives have an idler pulley with a narrower groove. To adjust belt tracking on this type, loosen the screw and slide the idler so the belt is centered on the drive and hub pulleys.

- Removal and Replacement**
- Remove cover.
  - Remove drive belt. (216K)
  - Remove screw and pulley. (216D)
  - Remove shaft assembly. (216A)
  - Remove bearing retaining screws and bearing. (216B)
  - Remove bearing and spacer. (216C)

**CAUTION:** The front bearing must be flush with front surface of baseplate. To do this, tighten front bearing retaining screws first. Seal on bearing should face outside.

- To replace, reverse procedure and check belt tracking.

## 216 Disk Drive Locations



212-219

218 (not used)  
219 (not used)

3742 ML

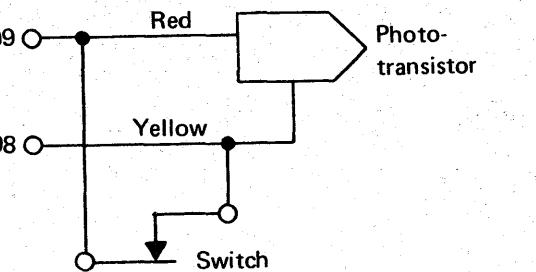
### Legend

A	Shaft assembly
B	Bearing retaining screw
C	Spacer
D	Pulley
E	Idler assembly
F	Motor cable
G	Drive pulley
H	Motor clip
I	Guard plate
J	Drive belt
K	Fan blade
L	Fan guard
M	Drive motor
P	Interlock

## 220 Disk Cover Interlock (216P)

### Adjustment

- Close the disk cover until it latches.
- Loosen spring mounting screws.
- Adjust the spring (upward) to activate the switch. The switch may be overadjusted up to .050".
- Tighten spring mounting screws.

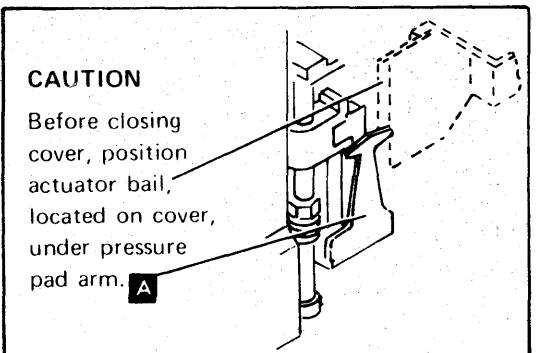


## 221 Disk Drive Cover

### Removal and Replacement

**CAUTION:** Avoid damage to the two twisted pairs of wires.

- Remove the two pivot pins. (224E)
- Remove cover carefully.
- Remove wires from head load actuator and LED assembly. (224D)
- Release cable clamp holding wires to cover.
- To replace, reverse procedure.
- The yellow wire goes to LED terminal marked Y.



**CAUTION:** Make sure that correct wires are connected to the LED.

## 222 Collet Assembly

### Removal and Replacement

- Power down.
- Remove disk drive cover.
- Remove collet assembly mounting screw. (224B)
- To replace, reverse procedure.

## 223 LED Assembly

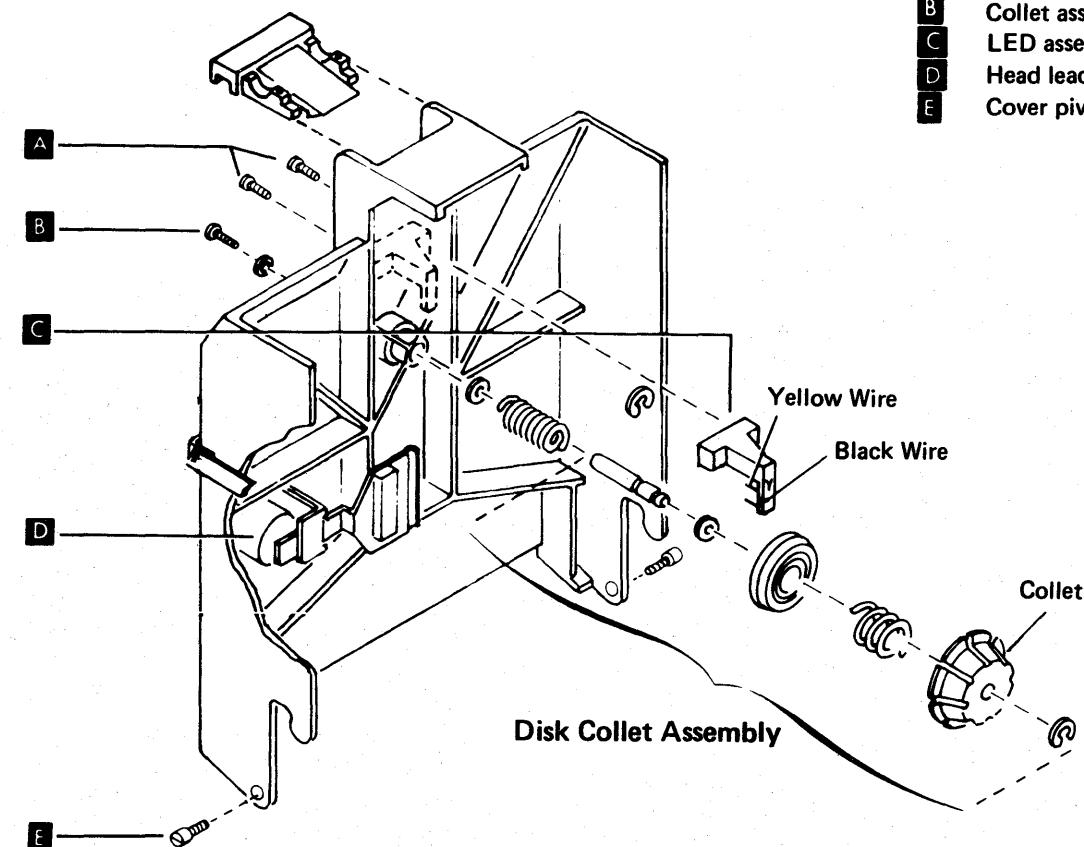
### Removal and Replacement

- Power down.
- Remove disk drive cover.
- Remove LED assembly mounting screws. (224A)
- To replace, reverse procedure.

## 224 Disk Cover Locations

### Legend

- A LED assembly mounting screws
- B Collet assembly mounting screws
- C LED assembly
- D Head lead actuator
- E Cover pivot



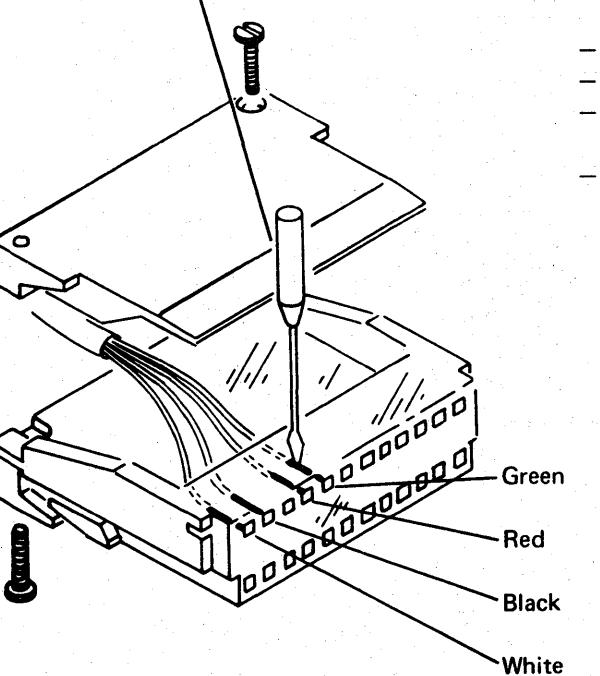
220-224

3742 ML

## 225 Leadscrew and Head Carriage Assembly Removal and Replacement

### Removal

- Center head carriage assembly (226G) on lead-screw by moving stepper motor wheel (226M).
- Loosen limit stop clamping screws (226C and J).
- Remove stepper motor and bracket assembly by removing screws (226N) holding stepper motor bracket to baseplate.
- Loosen clamping screw in leadscrew wheel (226L) and remove wheel.
- Remove bearing holding screws (226K).
- Note location of wires to head before removing cable. Press down with small screwdriver to release terminals.

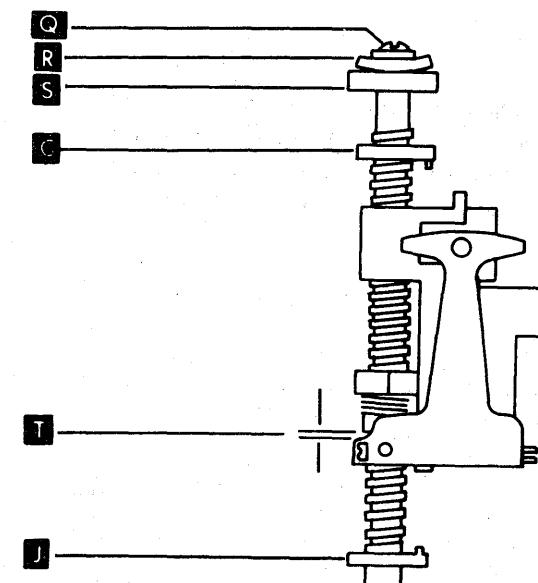
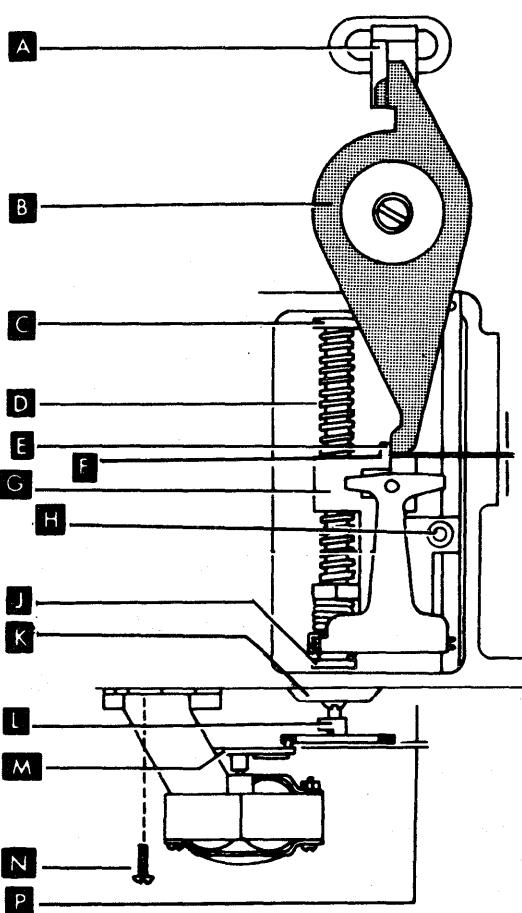


- Slide leadscrew down until top is free; tip and remove upward.
  - Remove the following from the leadscrew.
- |                        |        |
|------------------------|--------|
| SPRING WASHER RETAINER | (226Q) |
| SPRING WASHER          | (226R) |
| UPPER BEARING          | (226S) |
| UPPER STOP             | (226C) |
| LOWER STOP             | (226J) |

### Replacement

- Check for  $0.020 \pm 0.015"$  clearance at (226T). Rethread if necessary.
- Center head carriage assembly (226G) on lead-screw.
- Install limit stops (226C and J) on each end of leadscrew with limit stop projections pointing toward head assembly as shown in (226).
- Install top bearing on leadscrew (226S).
- Install spring washer, concave side up (226R).
- Install retainer (226Q).
- Install total assembly. Put bottom of leadscrew in place first.
- Install lower bearing (226J) with holding screws. (226K) Check for about 0.030" up and down movement of leadscrew against spring washer force.
- Slip leadscrew wheel (226L) on leadscrew.
- Install head wires into connector.
- Install stepper motor and bracket with screws (226N).
- Do the stepper motor adjustment (230).

**220 Head Locations**



A	Phototransistor
B	CE tool
C	Upper limit stop
D	Leadscrew
E	Carriage surface
F	Clearance (head-to-CE tool)
G	Head carriage assembly
H	Clearance number
J	Lower limit stop
K	Bearing holding screws
L	Leadscrew wheel
M	Stepper motor wheel
N	Stepper motor bracket screws
P	Clearance (stepper-to-leadscrew wheels)
Q	Spring washer retainer
R	Spring washer
S	Upper bearing
T	Clearance

225-228

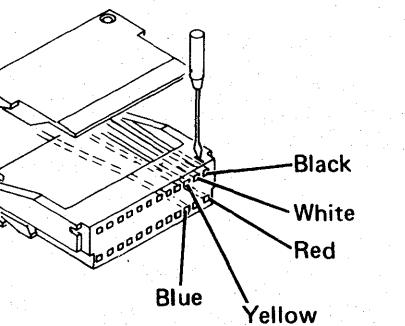
227 (not used)  
228 (not used)

3742 ML

## 229 Stepper Motor

### Removal and Replacement

- Power down.
- Remove wires by pressing down with small screwdriver to release terminals.

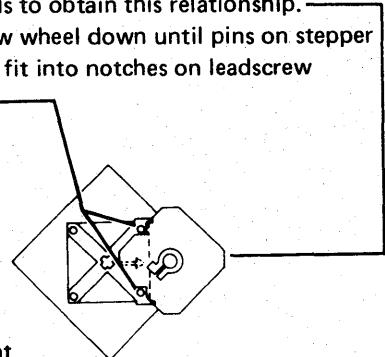


- Remove stepper motor and bracket assembly by removing screws (230N) holding stepper motor bracket to baseplate.
- To replace, reverse procedure and do stepper motor adjustment. Use the 'Stepper Motor Adjustment' procedure (230).

## 230 Stepper Motor Adjustment

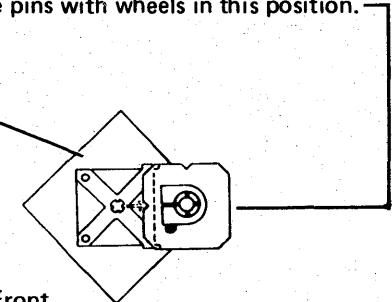
### (Perform with disk drive unit in upright position)

- Loosen the two screws **N** holding stepper motor bracket to baseplate.
- Move stepper motor away from the leadscrew **D**.
- Loosen screw in leadscrew wheel **L** and slide wheel up on leadscrew so wheels can rotate without touching.
- Rotate wheels to obtain this relationship.
- Pull leadscrew wheel down until pins on stepper motor wheel fit into notches on leadscrew wheel.



Top View, Front

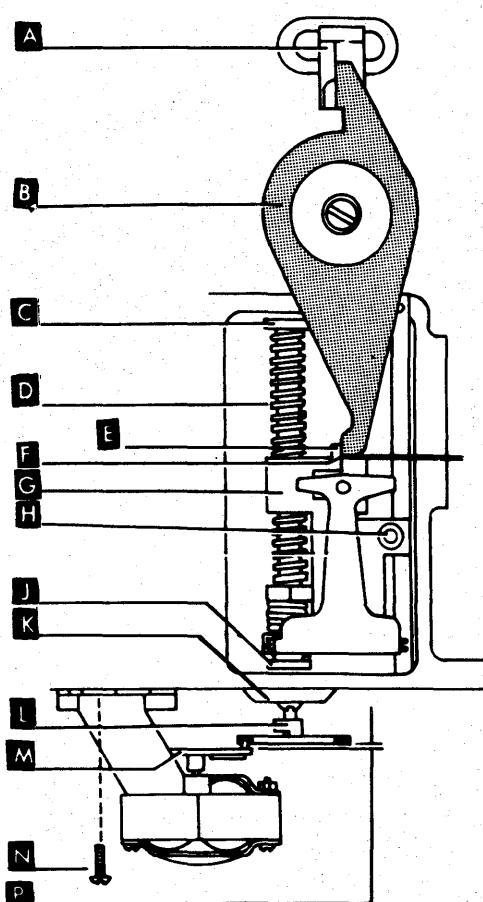
- Slide stepper motor bracket toward leadscrew until pins contact notches.
- Tighten two screws that mount stepper motor bracket to baseplate.
- Push leadscrew wheel up until wheels rotate without touching.
- Engage drive pins with wheels in this position.



Top View, Front

- Rotate stepper motor wheel by hand four revolutions. If any binding of the wheels is felt, reinstall the CE tool **B**, repeat the stepper motor adjustment while maintaining correct clearance **F**.
- Do the head adjustment (231).

### Head Locations



## 231 Head Adjustment (for track 00)

### CAUTION

Test diskette before adjusting.

- Place disk drive in service position (206).
- Remove disk drive cover (221).
- Loosen clamping screw in lower limit stop (230J).
- Using stepper motor wheel (230M), access head carriage assembly (230G) down by hand until the lower limit stop (230J) is pressed against the frame and the head carriage is against the lower limit stop.
- Loosen mounting screw and move phototransistor holder (230A) to the left so it will not interfere with CE tool.
- Loosen clamp on leadscrew wheel (230L).

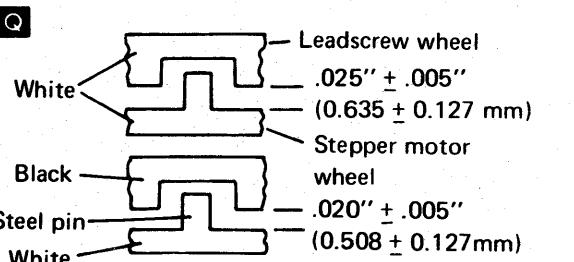
### CAUTION

Avoid any contact of CE tool with face (highly polished front surface) of head.

- Install CE tool (230B).
- Rotate tool until it contacts surface (230E).
- Rotate disk drive hub so white sticker on outside diameter of hub is up. If white sticker is not present, rotate hub so indented mark is up.

To properly make the head adjustment, you must obtain three simultaneous conditions:

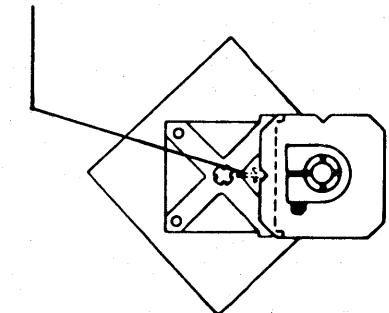
1. Correct head-to-CE tool clearance.
  2. Correct relationship between the stepper motor and leadscrew wheels.
  3. Correct clearance between the stepper motor and leadscrew wheels.
- Determine type of stepper assembly (below) and check/adjust for the specified clearance (230P) between the stepper motor and leadscrew wheels for the type used.



**Note:** If leadscrew wheel has been replaced, the slot should be 25-40% full with IBM #23 grease.

- Position the stepper motor and leadscrew wheels to Phase 0 relationship by rotating the stepper motor wheel.

**Note:** Arrow molded into bottom of the stepper wheel.



Phase 0  
Top View, Front

- Using upper limit stop (230C), rotate leadscrew (230D) to obtain correct clearance (230F), between head and CE tool.

**Note:** This clearance is marked on the front of the head assembly (230H). The number represents the clearance in thousandths of an inch. On late level heads, this number is molded into the plastic carriage and is always 3. Make adjustment for a slight drag using a clean, undamaged feeler gauge.

- Make sure CE tool is touching surface (230E) of head carriage (230G) while obtaining clearance (230F).

You should now have the following simultaneous conditions:

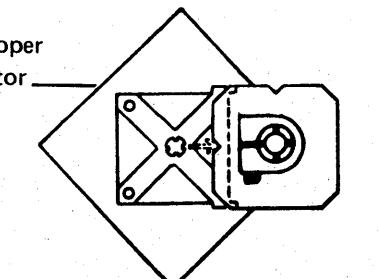
1. Correct head-to-CE tool clearance.
2. Phase 0 relationship between the stepper motor and leadscrew wheels.
3. Specified clearance between stepper motor and leadscrew wheels.

If all three conditions are correct, securely tighten the leadscrew clamping wheel. (Use the short end of an allen wrench in the screw). If all three conditions are not correct, repeat this procedure (231) starting after 'Install CE tool'.

- Position and fasten phototransistor holder with mounting screw so raised edge is contacting but not pressing against CE tool.
- Remove CE tool.
- Rotate stepper wheel four revolutions and check for binding. If binding occurs and clearance (230P) is correct, replace leadscrew wheel and stepper motor assembly.
- Do the lower limit stop and upper limit stop adjustments, (232 and 234).
- Reinstall disk drive cover (221) and test disk drive by using the disk alignment tracks on the CE test diskette PN 2455026. See *Display Data Head Alignment Service Check* (page 8-1).

## 232 Lower Limit Stop Adjustment

- Be sure that head is adjusted for track 00 and that leadscrew and stepper motor wheels **L** and **M** are in this position for track 00.



Top View, Front

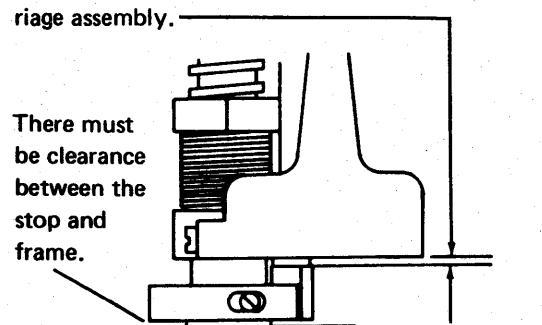
- Make sure lower limit stop clamping screw is loose.
- Move the head carriage assembly down by rotating stepper motor wheel about  $90^{\circ}$  until the wheels are in this position.



Top View, Front

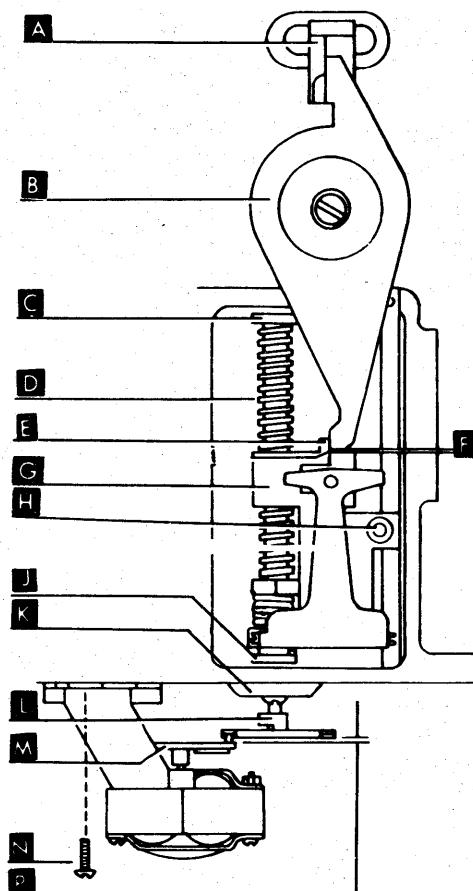
(Two corner projections and the arrow on the stepper motor wheel **M** should point toward the front of the disk drive.)

- Position lower limit stop so that its projection is in front of and contacts the head carriage assembly stop projection as shown below.
- Tighten lower limit stop clamping screw while maintaining  $0.012'' \pm 0.003''$  between lower limit stop projection and bottom of head carriage assembly.



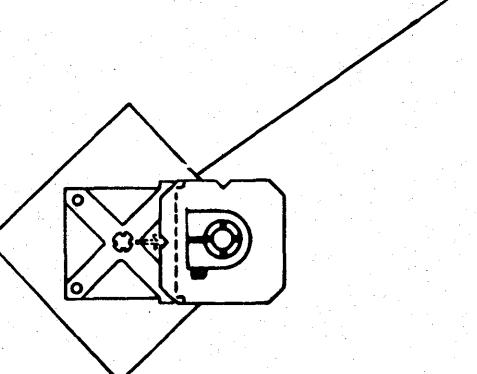
- There must be clearance between the stop and frame.

Remove CE tool. Front View



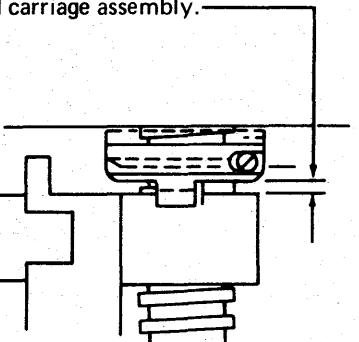
## 234 Upper Limit Stop Adjustment

- Start this procedure from rear of disk drive.
- Loosen clamping screw in upper limit stop (232C).
- Move head carriage assembly (232G) up by turning stepper motor wheel (232M); continue until upper limit stop body is pressed against disk drive frame by head carriage assembly. (Make sure limit stop projection is clear of top surface of head carriage assembly.)
- Move head carriage assembly down by turning stepper motor wheel to first phase 0.



Top View, Front

- Position upper limit stop so its projection is behind the head carriage assembly, and clamping screw faces directly back as shown below.
- Tighten clamping screw while maintaining  $0.030'' \pm 0.005''$  between stop body and top of head carriage assembly.



Rear View

- Install cover.
- Install disk drive.

232-236

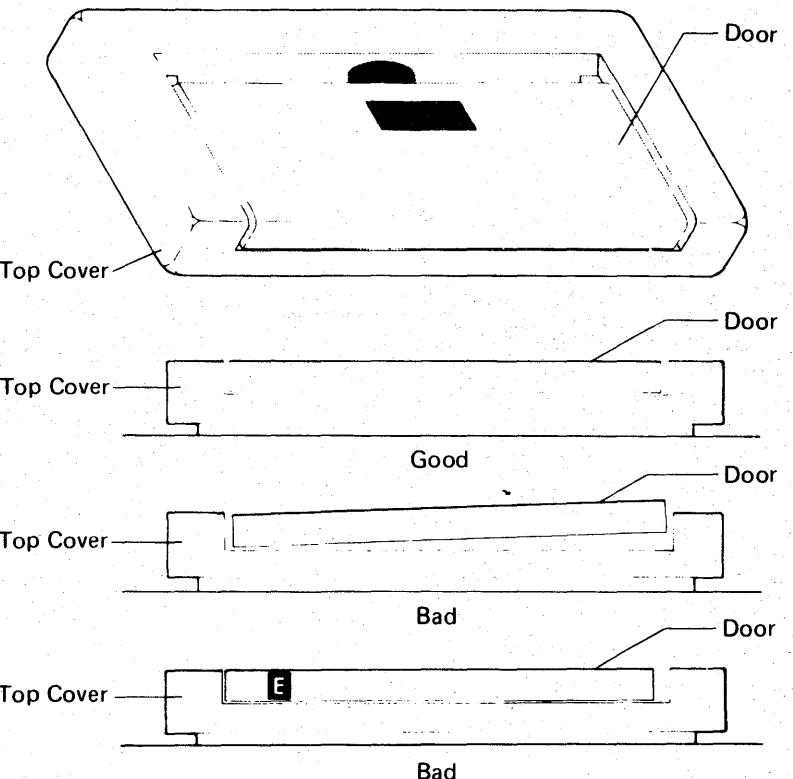
233 (not used)  
235 (not used)  
236 (not used)

3742 ML

## 237 Disk Top Cover Vertical Alignment Checks

If the machine has eccentric bolts **B** :

- Loosen the eccentric-bolt locking nuts.
- Loosen the clamping screw **A**.
- Make required adjustment by turning the eccentric bolts.
- Tighten the clamping screw **A**.
- Tighten the eccentric-bolt locking nuts.
- Perform 238 if necessary.

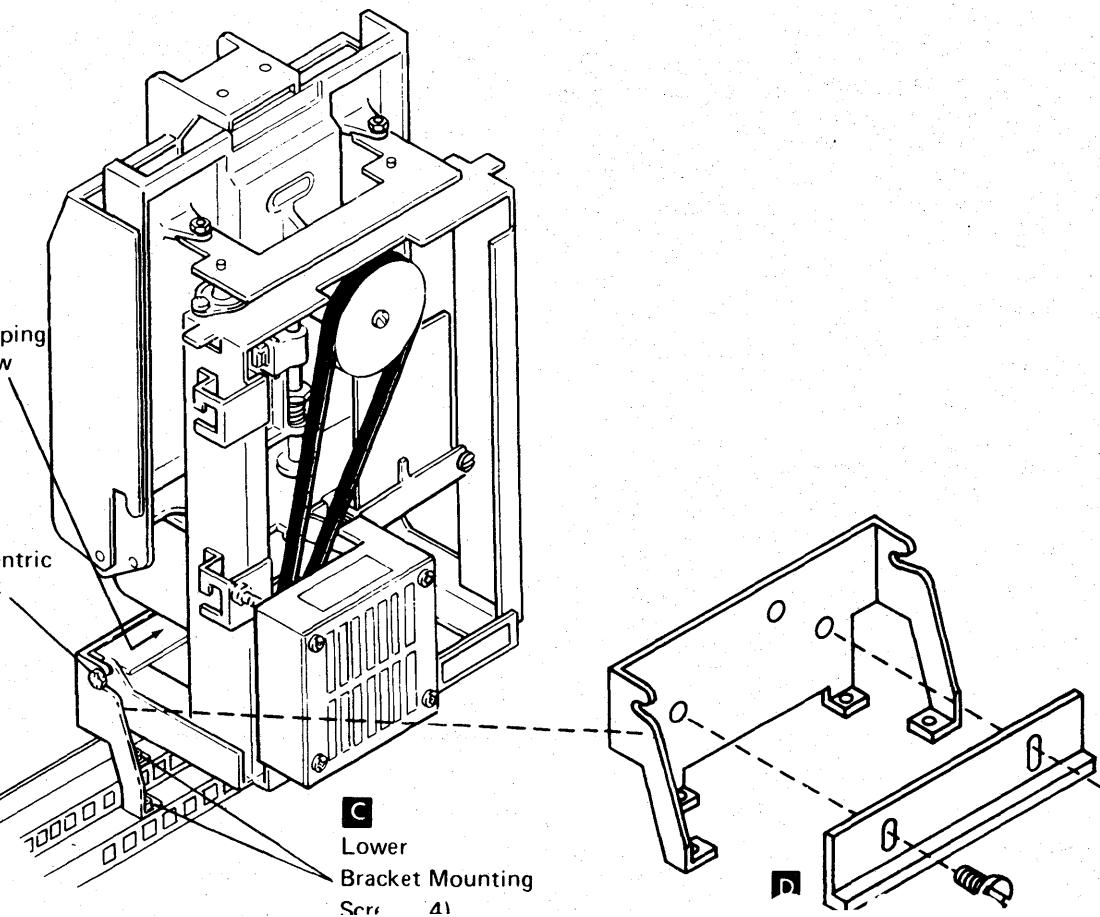


If the machine has a bar-type bracket **D** instead of the eccentric bolts **B** :

- Loosen two screws in the bar **D**.
- Loosen the clamping screw **A**.
- Make the required adjustment by moving the drive unit about. When it is in position, tighten the clamping screw.
- Raise the bar to seat against the base of the drive unit and tighten the two screws in the bar.
- Perform 238 if necessary.

## 238 Disk Door Lateral Adjustment

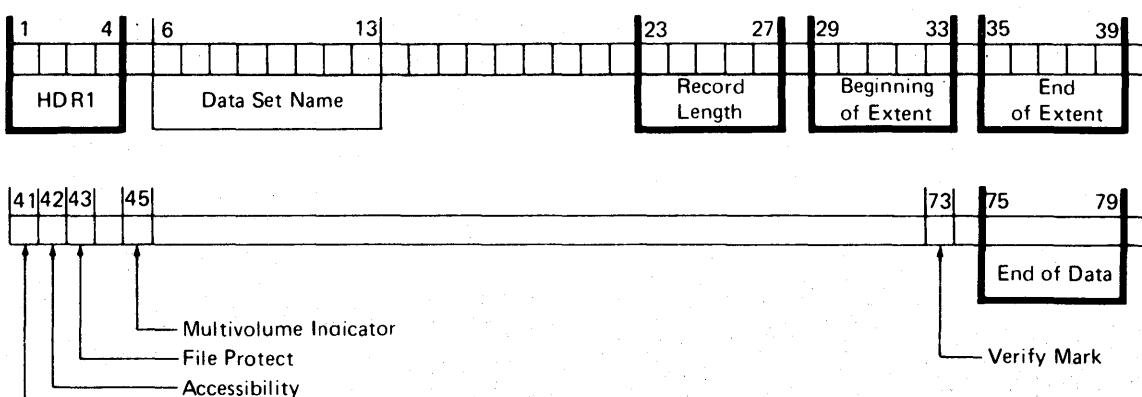
- Loosen the four bracket mounting screws **C**.
- Move the lower bracket right or left to center the door **E**.
- Tighten the four bracket mounting screws.
- Perform 237 if necessary.



## 239 Data Set Label Format

(Fields in heavy lines are required by the 3740 system.)

- Any operation may be selected from read index mode.
- Record advance or record backspace to read and display any label on the index track (00).
- Data set labels are 08 through 26 on the index track.
- To select a data set, record advance, or record backspace to the label (00 08 through 00 26) containing the desired data set, then select a machine mode.
- All operations must be performed within the boundaries of the selected data set.



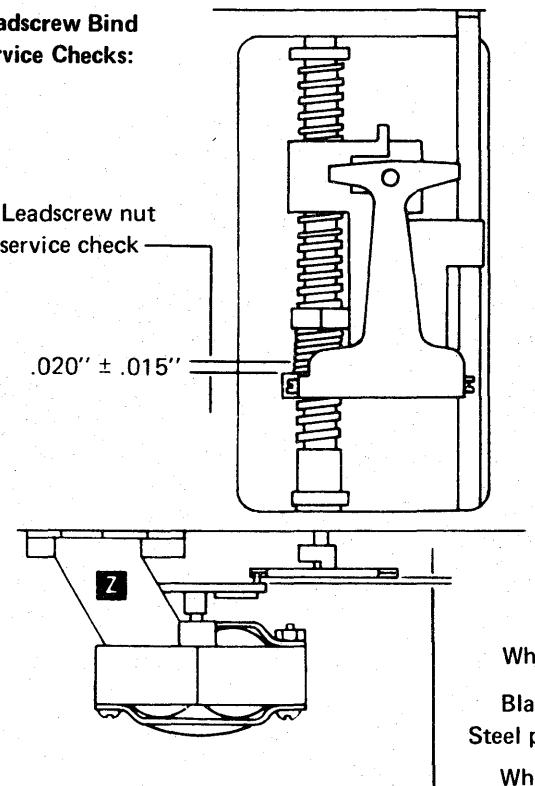
Error Code	Type	Mode	Causes
B	Incorrect Data Set Label		

X	BOE is greater than EOE or EOD.	What You Do
X	BOE is less than track 01, sector 01.	Note: You must press FUNCT SEL lower, M and REC ADV after making correction to the label.
X	EOE is greater than track 74, sector 26.	Reset and correct the BOE, EOE, and/or EOD.
X	EOD is greater than EOE + 1.	Reset and correct the BOE.
X	EOD is greater than track 75, sector 01.	Reset and correct the EOE.
X	Record length is 00 or greater than 128.	Reset and correct the EOD and/or the EOE.
X	BOE, EOE, or EOD sector number is 00 or is greater than 26.	Reset and correct the EOD.
X	The third position in the BOE, EOE, or EOD is not a zero.	Reset and enter the correct record length.
X	Data is entered in positions 23 and/or 24.	Reset and enter the correct sector number.
X	One of the following conditions existed when you tried to select a mode from the Index track:	Reset and insert a zero in the third position.
	— The current sector address displayed in the status line is either: 01, 02, 03, 04, 05, 06, or 07.	Delete data entered in these positions.
	— Position 4 in the label doesn't contain a 1.	
	— The data set label has been deleted.	
R	A card read function was selected in a data set that had a label containing a B in position 41 (bypass indicator).	Reset and press REC ADV to locate the desired label.
		Reset, enter a 1 in position 4 of the label.
		Change to another label or enter an undeleted label.
		Advance to a data set with a valid label and reinitiate the card read function.

240 not used  
241 not used

## 242 Leadscrew Service Check

### Leadscrew Bind Service Checks:



- Spring washer service check. Check for about .030" up and down movement of leadscrew against spring washer.

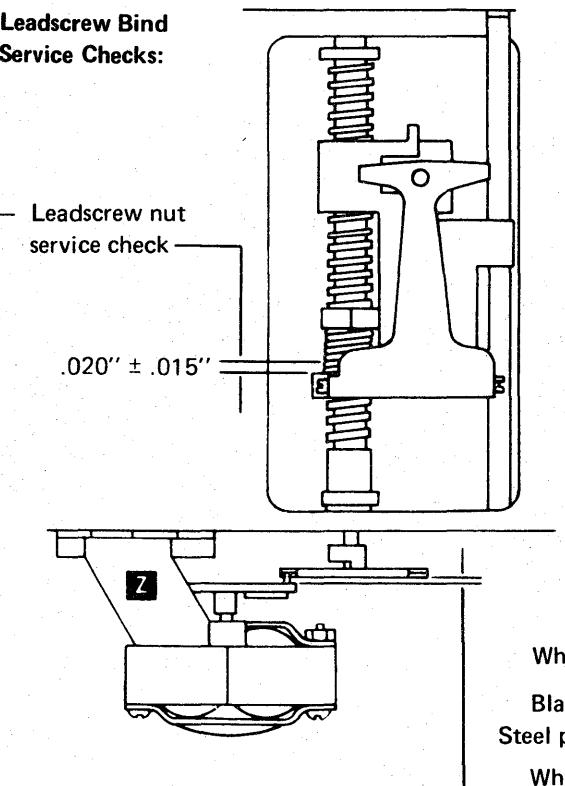
## 243 Phototransistor Assembly

### Adjustment

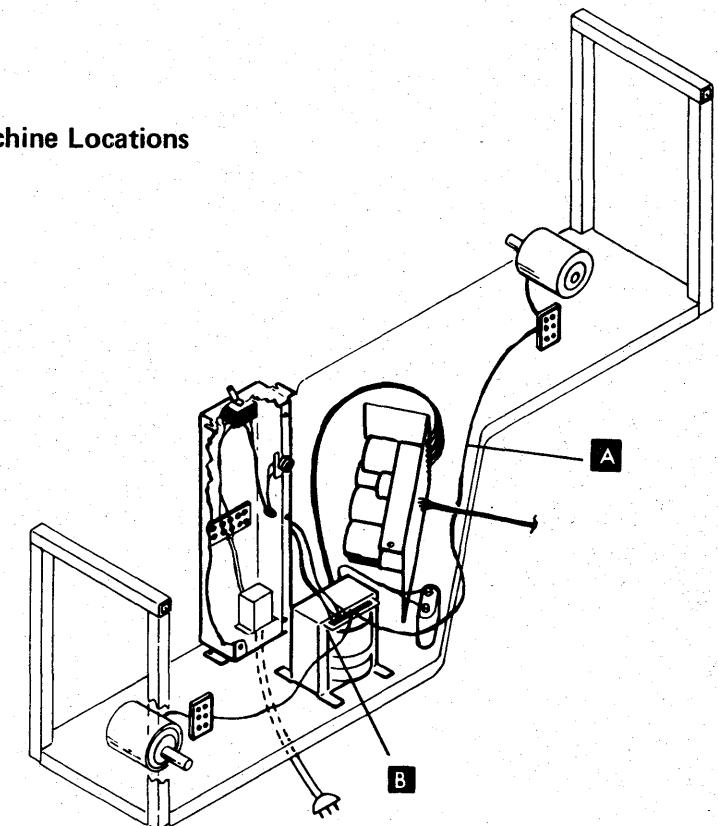
- Access to track 0.
- Remove cover, if necessary.
- Loosen mounting screw, and move phototransistor assembly to left.
- Install CE tool as shown at right.
- Adjust phototransistor assembly so that raised edge is in contact with, not pressing against, tool.
- Tighten mounting screw.
- Remove CE tool.
- Replace cover.

### Removal and Replacement

- Remove cover, if necessary.
- Remove two mounting screws (234A).
- Remove leads. (Yellow wire goes to terminal marked Y.)
- To replace, reverse procedure.

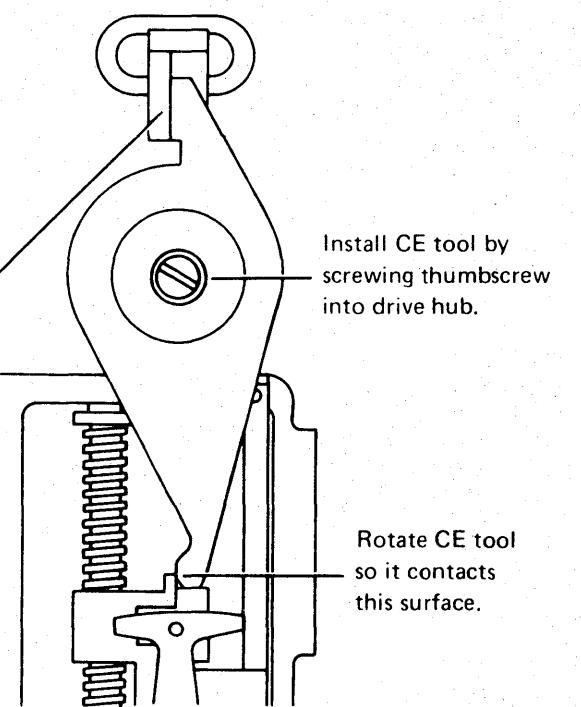


## 244 Machine Locations



### Legend

- A** Power supply ac cables  
**B** Terminal board (TB1)



## 245 Timings

The following chart provides approximate timing information for search, copy, and initialization operations on the 3742. Timings are shown for the normal sector sequence (1, 2, 3, . . . , 25, 26) and for the alternate sector sequence (1, 3, 5, . . . , 25, 2, 4, . . . , 24, 26). The timings provided in the chart should serve as a useful guide when relative job timing must be considered.

The timings are based on 80 character records. Timing can be affected by such things as disk speed, length and location of search masks, and the location of data sets on the disk.

TIMING CHART

Operation	Number of Records	Normal Sector Sequence (01)		Alternate Sector Sequence (02)	
		Disk 1	Disk 2	Disk 1	Disk 2
Search end of data	1898 (Assume EOD is 74001)	7 sec	7 sec	7 sec	7 sec
	949 (assume EOD is 37014)	4 sec	4 sec	4 sec	4 sec
	400 (assume EOD is 16001)	2 sec	2 sec	2 sec	2 sec
Search on sequential content	1898	9 sec	9 sec	9 sec	9 sec
	949	7 sec	7 sec	7 sec	7 sec
	400	4 sec	4 sec	4 sec	4 sec
Search on content	1898	4 min	6 min	5 min	6 min
	949	2 min	3 min	3 min	3 min
	400	1 min	1 min 30 sec	1 min	1 min 30 sec
Disk Initialization	-----	2 min	-----	2 min	-----
Image copy	1898 plus index track	4 min	-----	10 min	-----
Data set copy	949	11 min	-----	9 min	-----
Data set copy	400	4 min	-----	4 min	-----

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**301 Part Numbers and Cause Codes**

Part Name	Number	IR Code
Ac Line Filter	2192519	600-07
Brightness control	2455605	200-04
<b>Chassis and CRT</b>		
assembly	2455625	200-02
Converter	2455603	200-03
<b>CRT socket</b>		
assembly	2455699	200-06
Display PC board	<i>See Parts Catalog</i>	200-05
Display signal cable	2456372	100-05
Power Supply dc cable	2456361	100-08
<b>Power Supply</b>		
PC board	<i>See Parts Catalog</i>	600-04
Yoke assembly	2455601	200-07

**Cause Codes**

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34		
Defective	21	Open	42		

301-303

302 (not used)  
303 (not used)

3742 ML

## 304 CRT Locations

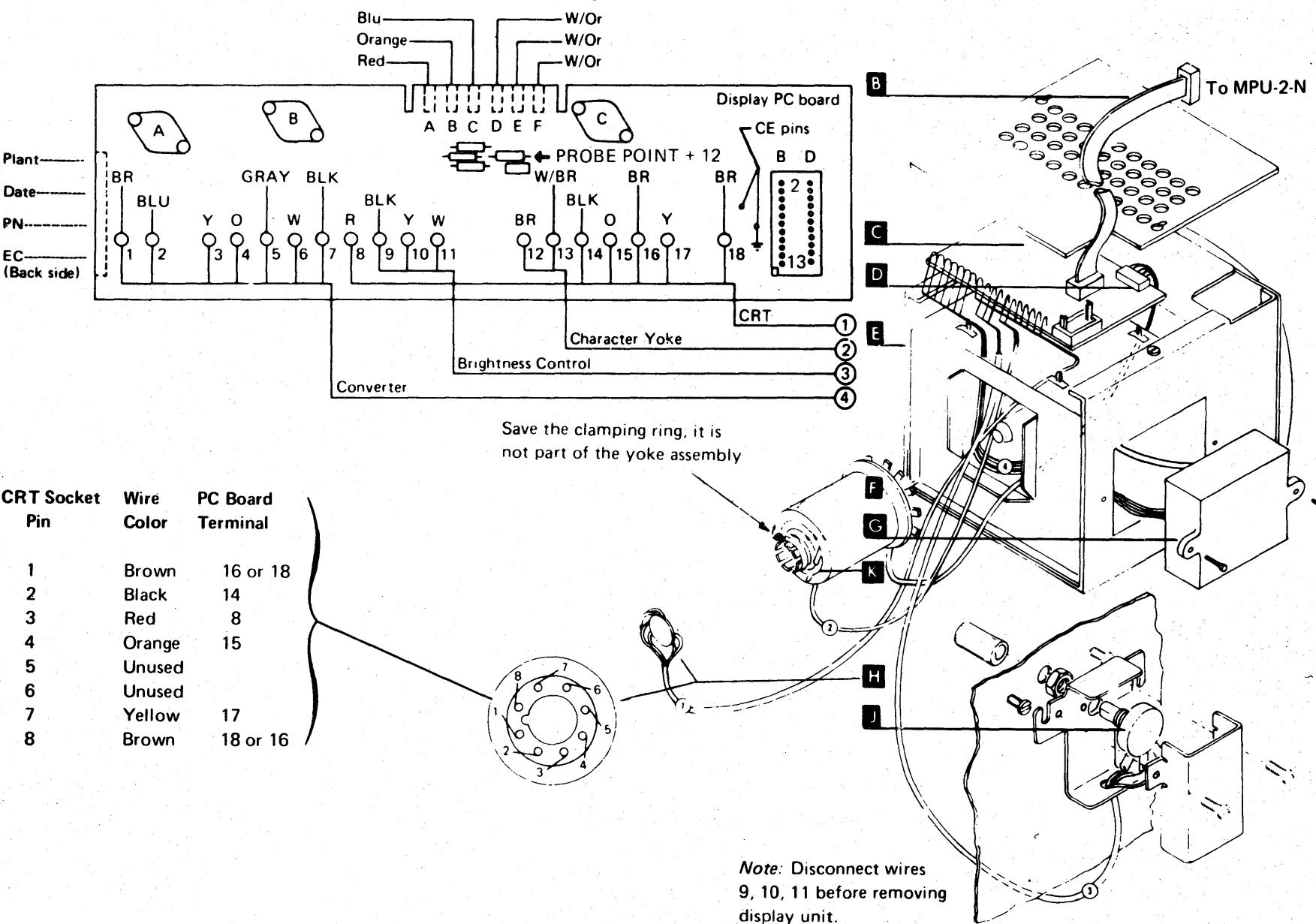
### Legend

- A CRT high voltage anode
- B Display signal cable
- C Display PC board
- D Yoke cable connector
- E Chassis and CRT assembly
- F Yoke assembly
- G Converter
- H CRT socket assembly
- J Brightness control
- K Centering rings

### DANGER:

12,000 Vdc

- Power down.
- Ground both the CRT high voltage anode and the anode wire to the frame A
- Display unit is safely grounded only if the mounting screws are tight.
- If the anode wire is disconnected from the CRT, touch the shorting tool against the anode wire connector to ground it again.
- Do not apply power to the display unit while it is out of its mounting brackets.

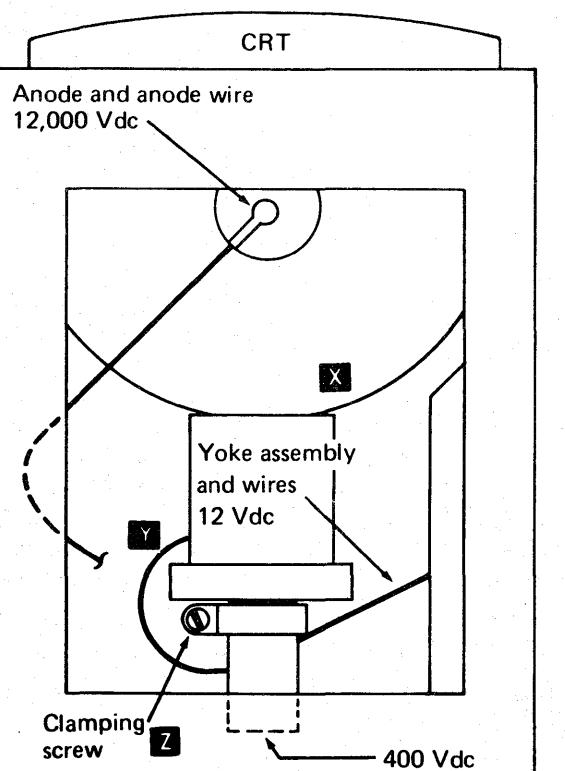


## SUG Yoke Adjustment

The objective is to align and center the display in the viewing mirror.

**DANGER:** Due to high voltage (12,000 Vdc and 400 Vdc) in the display unit, use caution.

Alternate adjustment methods (power on and power off) are described below. (The power on method is recommended.):



### Power On Method

1. Power down.
2. Ground CRT anode. **A**
3. Loosen the clamping screw **Z** and slide the yoke into contact with the fat part of the CRT. **X**
4. Orient the yoke with the wires away from the PC board. **Y**
5. Using just your fingertips on the screwdriver handle, tighten the clamping screw. Then tighten the screw 1/8 of a turn more. The yoke **F** can now be rotated about the CRT neck, but stays in any desired position.
6. Power up. After warming up, the display status line should show XN.
7. Adjust the brightness control **J** to get a raster which is clearly visible but is not too bright and is not enlarged.
8. Rotate the yoke to make the display straight on the viewing mirror.

*Note:* The voltage on the yoke is 12 Vdc.

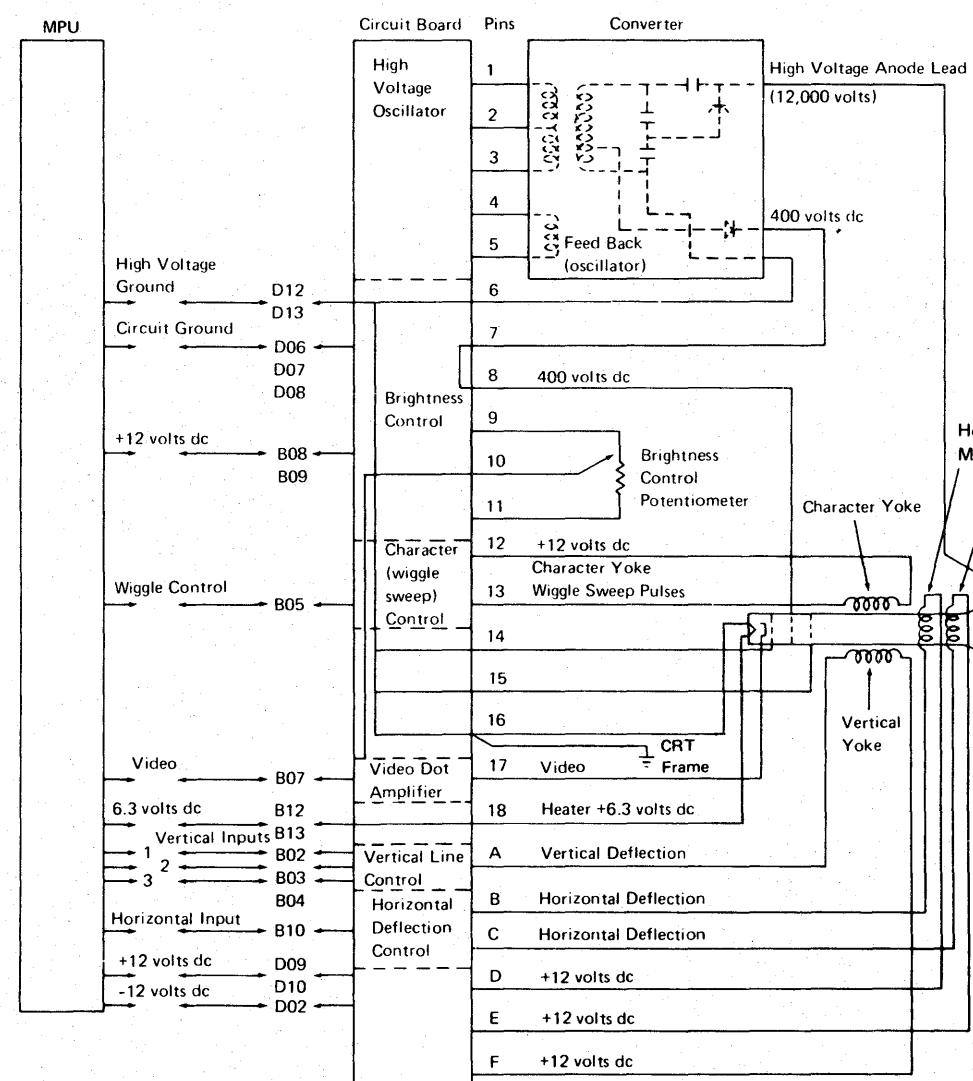
9. Rotate the centering rings **K** on the end of the yoke to center the display on the viewing mirror.

### Power Off Method

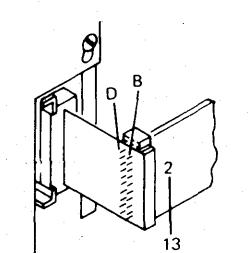
1. Power down.
2. Ground CRT anode. **A**
3. Loosen the clamping screw **Z** and slide the yoke into contact with the fat part of the CRT. **X**
4. Orient the yoke with the wires away from the PC board. **Y**
5. Using just your fingertips on the screwdriver handle, tighten the clamping screw. Then tighten the screw 1/8 of a turn more. The yoke **F** can now be rotated about the CRT neck, but stays in any desired position.
6. Power up. After warming up, the display status line should show XN.
7. Adjust the brightness control **J** to get a raster which is clearly visible but is not too bright and is not enlarged.
8. If adjustment is needed, power down and ground the CRT high voltage anode to discharge the high voltage power supply. **A**
9. Rotate the yoke and/or the centering rings **K** (on the end of the yoke) to correct the position of the raster on the viewing mirror.
10. Power up. After warming up, the display line status should show XN. .
11. Repeat steps 7 through 9 until the adjustment is satisfactory.

*Note:* Sit in the operator's chair to observe the display. The center of the viewing mirror can be judged only when viewed from the operator's viewpoint.

306 Circuit Diagram

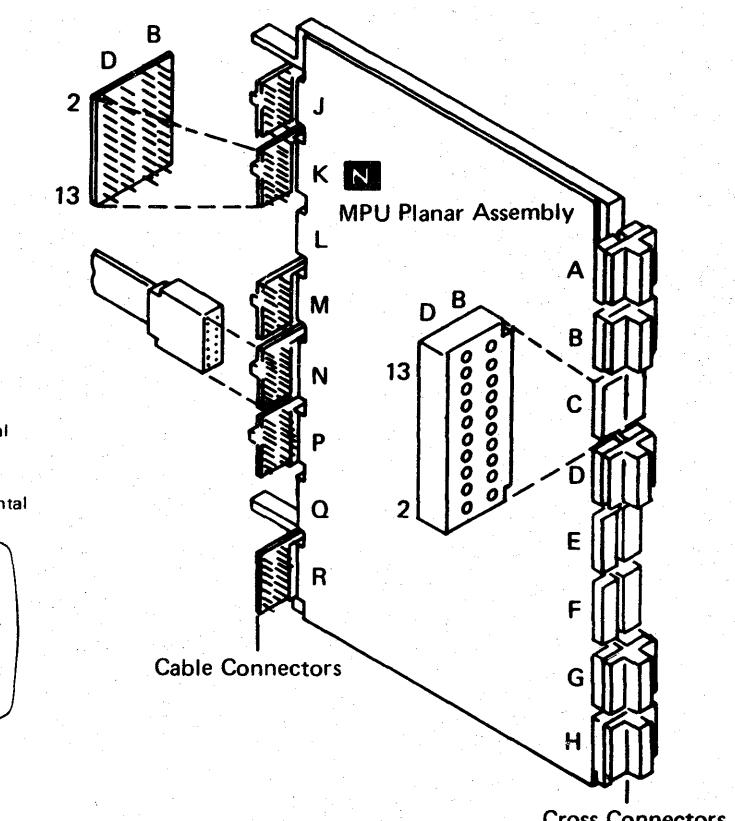


307 Cable Extender

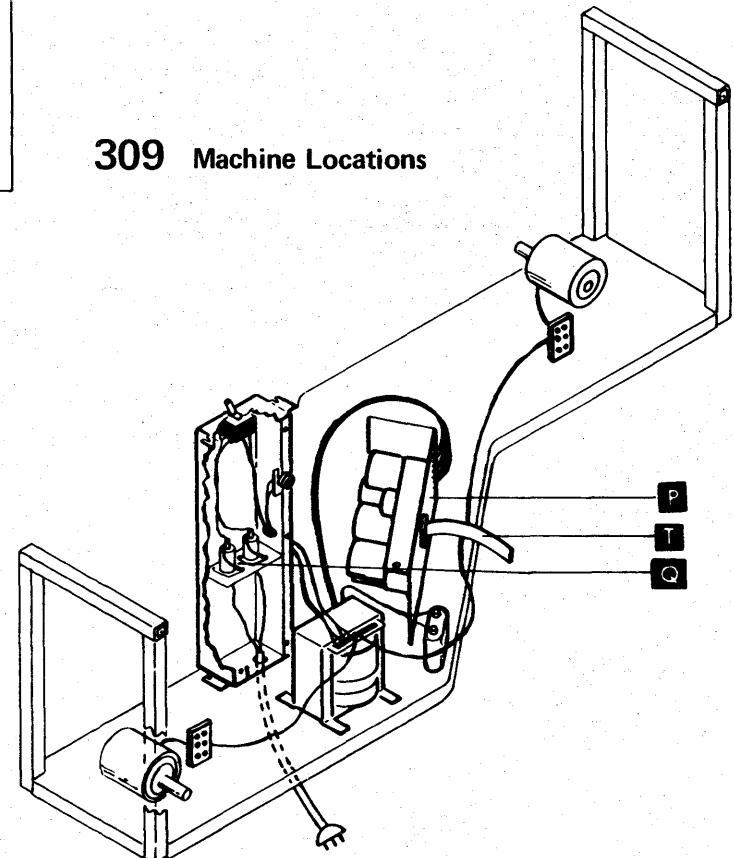
**Legend**

- |          |                       |
|----------|-----------------------|
| <b>P</b> | Power supply PC board |
| <b>Q</b> | AC line filter        |
| <b>T</b> | Power supply dc cable |

308 MPU Locations



309 Machine Locations



## 401 Part Numbers and Cause Codes

Part Name	Number	IR Code
ac line filter	219519	600-07
Audio feedback device	1611403	040-02
Cover, bottom	2455127	040-00
Cover, top	See Parts Catalog	040-04
Key module	See Parts Catalog	040-08
KBD PC board	See Parts Catalog	040-07
KBD signal cable		
No. 1	2455729	100-01
No. 2	2456360	100-01
Space Bar module	See Parts Catalog	040-09
Toggle switch	1620065	040-03
Toggle switch cable		
3 sw	2455148	040-01
4 sw	2456292	040-01

### Cause Codes

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34		
Defective	21	Open	42		

306-309

401-403

402 (not used)  
403 (not used)

3742 ML

## 407 Keyboard Disassembly/Assembly and Locations

**Important!** Work cleanly. The keyboard assembly MUST be kept free of dirt.

- Lay the keyboard down on its key tops and remove 6 screws from the bottom.

### CAUTION

Do not disassemble the unit yet. If a key happens to be pressed, the flyplate will jump out of the key module.

- Hold the keyboard in a way to keep all components in place, and turn it over so that the key tops are up.

### CAUTION

Be sure no keys are pressed. Lift the all keys unit and lay it on a smooth, clean surface. If the all keys unit is lifted and a key has been pressed, the flyplate of the pressed key will jump out of its module.

- To reassemble the keyboard, follow the above instructions in reverse order.

### CAUTION

The keyboard baseplate (407N) has a projection that should fit through holes in insulation (407M) and contact the PC board (407G). Be sure the base plate is assembled correct side up. Incorrect assembly might result in a ground circuit failure that intermittently causes extra characters.

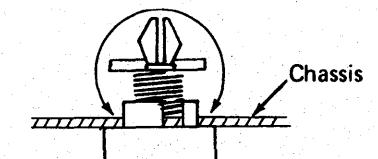
### Space Bar Removal

- Hold the ends of the space bar and pull up to slide the bar off the key stems.
- If pivots need to be removed, insert a screwdriver tip in the slot in the side of the frame and twist the screwdriver slightly until the pivot is removed.

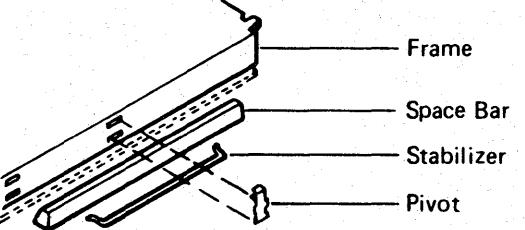
### Space Bar Installation

- Press the pivots into place in the frame.
- Place the space bar in position over its key modules.
- Guide the stabilizer into the slots in the pivots.
- Press the space bar down onto the key stems.

- Lift one edge of the all keys unit about 0.5 in (12.7 mm) and push and wiggle the failing key modules down until they snap free. If the keyboard has a contamination shield, note that the module retaining ears must clear the chassis as shown, but they are not visible.



- Lift the all keys unit, leaving the loosened modules.



### Key Module Installation

- Set the key module upright and place the all keys unit in position over it. Align the slot in the module with the orientation lug in the mounting hole.
- Press down on the ends of the all keys unit to snap the module into place.
- Position the contamination shield if required.
- Reassemble the keyboard.

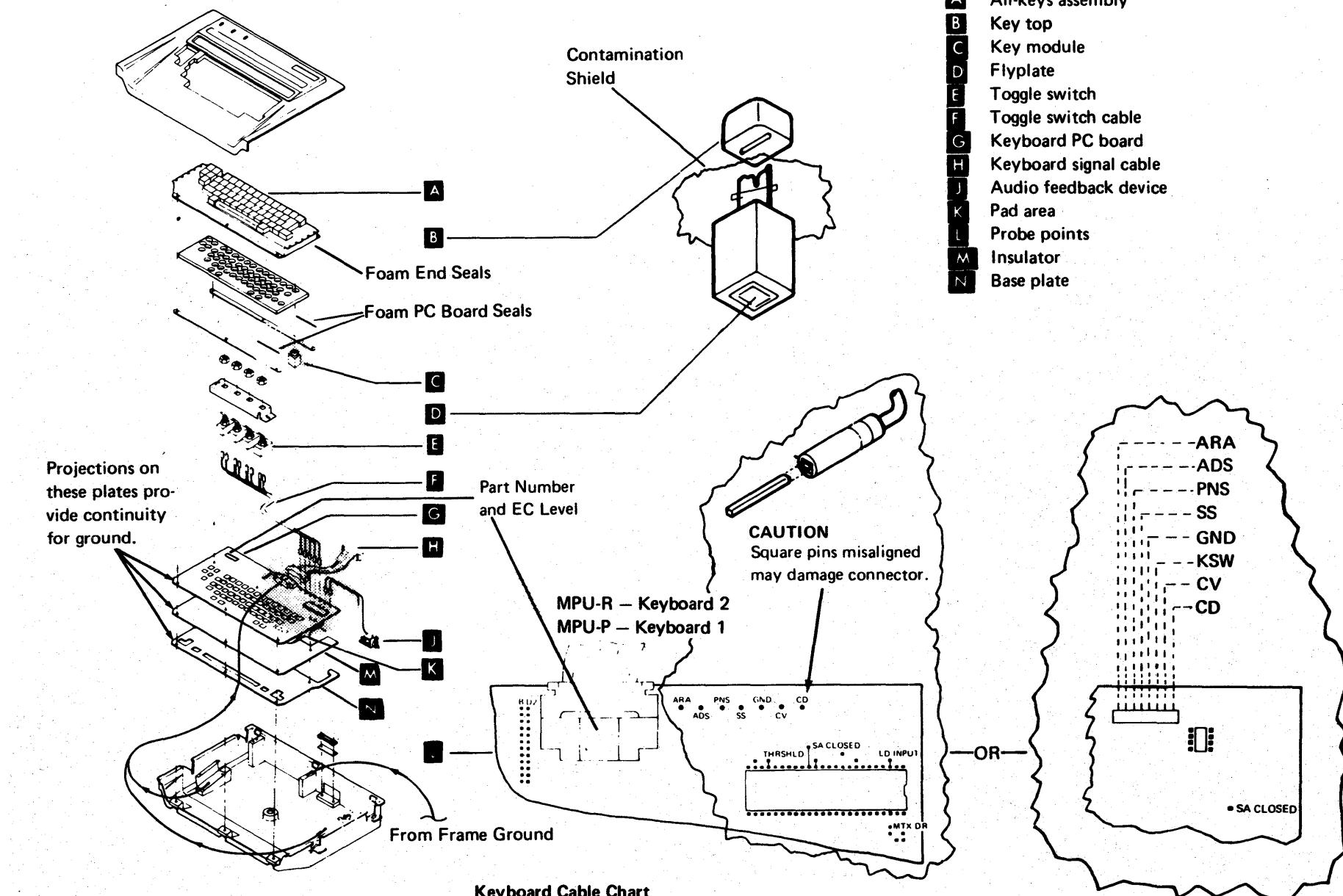
### Key Module Removal

- Disassemble the keyboard.
- Use the key top pulling tool to lift the key top buttons from the key positions to be removed.

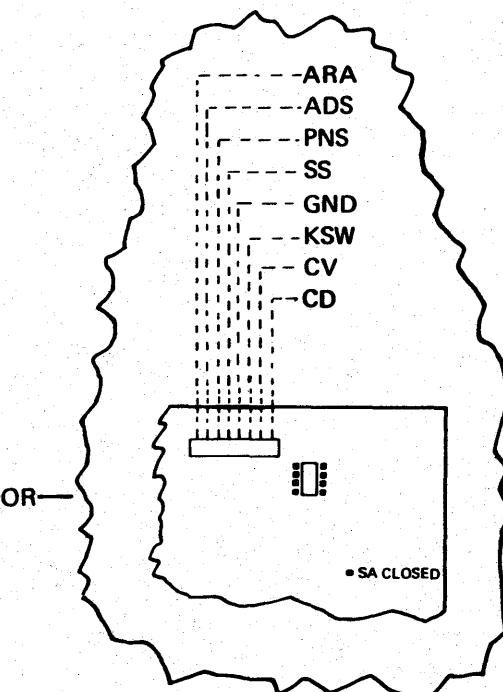
### CAUTION

Be sure that no keys are pressed.

## 407 Keyboard Disassembly/Assembly and Locations (Continued)



Legend	
A	All-keys assembly
B	Key top
C	Key module
D	Flyplate
E	Toggle switch
F	Toggle switch cable
G	Keyboard PC board
H	Keyboard signal cable
J	Audio feedback device
K	Pad area
L	Probe points
M	Insulator
N	Base plate

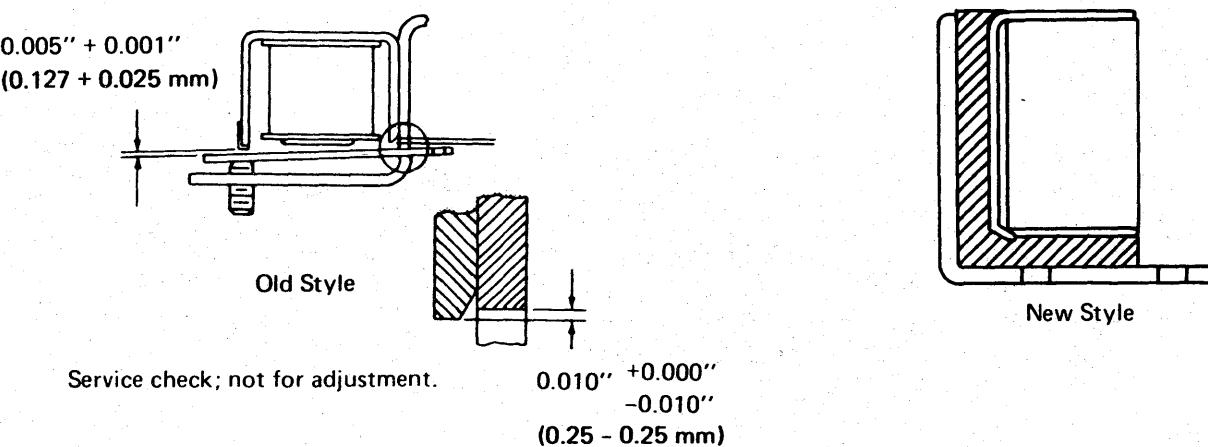


B02 SPEED SELECT Switch	D02 – Bit 0
B03 PROG NUM SHIFT switch	D03 + 8.5V Power
B04 AUTO DUP/SKIP switch	D04 – Bit 1
B05 AUTO REC ADV switch	D05 – Bit 3
B06 – Bit 2	D06 – 5V Power
B07 – Bit 4	D07 – Bit 7
B08 – Bit 6	D08 Ground
B09 + 5V Power	D09 – R Time
B10 + 5V 7 – $\mu$ s Osc	D10 + Busy Tone
B11 – Power on Reset	D11 + Keyboard Data
B12 + 10.8 Hz 5V Osc	Gate Out
B13 – Error	D12 Katakana Shift Bit <sup>1</sup>
	D13 – Bit 5

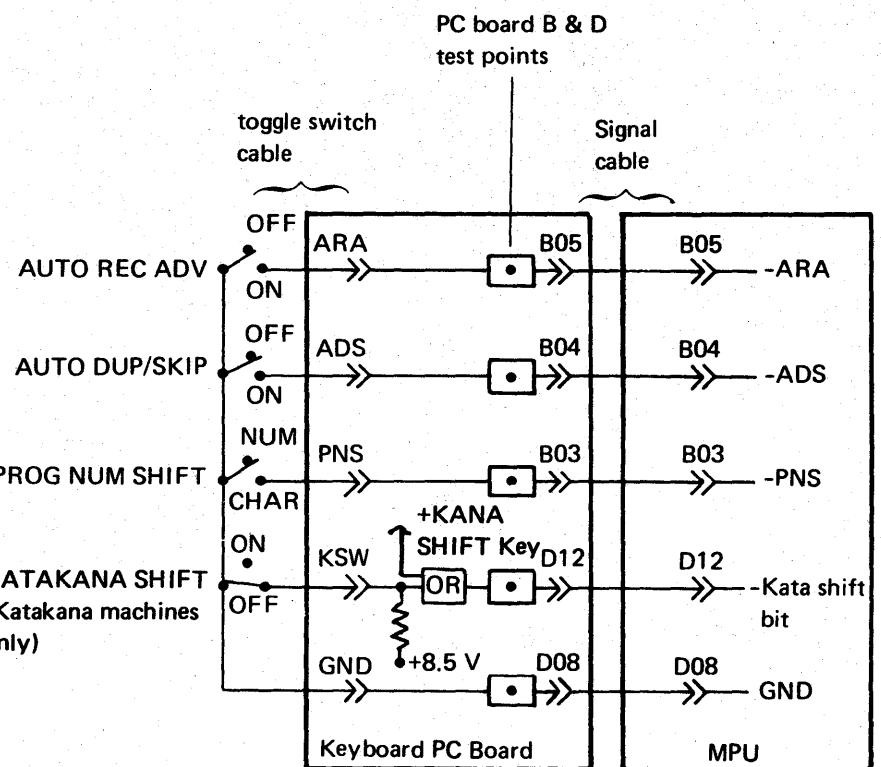
<sup>1</sup> Present only on Katakana machines.

## 410 Clicker Service Check

See 407J for location.



## 411 Keyboard Switch Circuits

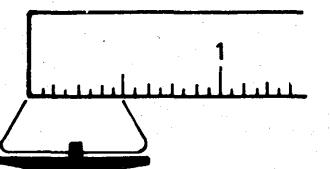


**Note:** The up position is open circuit on the KATAKANA SHIFT switch only, all others are shown in the down position.

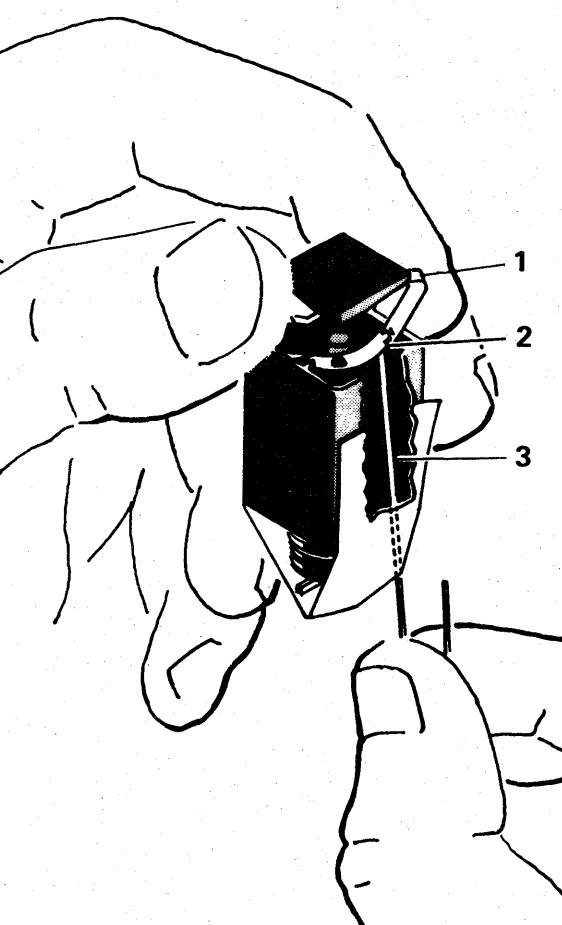
## 414 Flyplate Replacement

Replacing a dislodged flyplate in a key module is not recommended. However, if replacement is necessary because a new key module is not available, inspect the flyplate to make sure the joint between the spring and flyplate is not loose or the flyplate is not cracked or damaged.

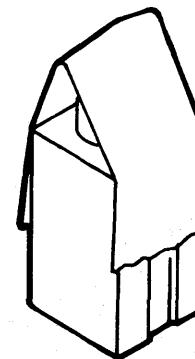
- Form the spring on the flyplate so that there is 0.5 inch between the ends of the spring.



- Remove the keybutton from the key module and remove the module from the keyboard.



- Tape the keystem in the down position.



- Holding 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 keystem.

- Insert a small stylus or straightened paper clip through one of the access holes in the key module 3.

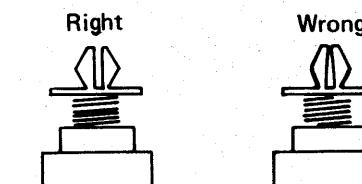
- Push the tip of the flat spring up on the inside of the flyplate spring.

- Ease the flat spring down until the tab drops into the slot of the flyplate spring.

- Attach the other end of the spring in the same way.

- Carefully remove the tape holding the keystem.

- Check the keystem ears for taper in the center slot and form the ears if necessary.



- Install the key module in the keyboard.

408 (not used)  
409 (not used)  
412 (not used)  
413 (not used)

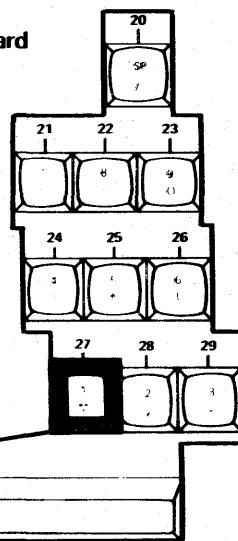
3742 ML

## 415 CE Mode

### Key Codes

	COPY	DISK 2 REC BKSP	DISK 2 REC ADV	DISK 2 RET TO INDEX					COMPUTE FIELD TOTALS	DISPLAY FIELD TOTALS	
ENTER	UPDATE	VERIFY	SEARCH CONTENT	SEARCH SEQ CONTENT	SEARCH ADDRESS	SEARCH EOD	RETURN TO INDEX	PROG LOAD	DELETE REC	DISPLAY PROG STAT	DISPLAY PROG
02	01	03	0E	05	06	07	08	09	2D	20	0A
FUNCT SEL	FUNCT SEL	HEX	*	^	S	<	FIELD COR	DUP	0	CHAR ADV	REC ADV
2E	38	30	2A	10	3E	11	12	13	21	22	23
SCRL BKWD	REC BKSP	FIELD BKSP	O	W	E	C	R	T	U	I	3
36	SCRL FWD	3A	15	3D	3F	16	17	24	25	26	1C
RESET	A	>	S	D	F	G	H	4	5	6	SKIP
18	19	3C	1A	3B	1B	27	28	29	1E		
NUM SHIFT	Z	X	C	V	B	N	M	7	8	9	CHAR BKSP
											ALPHA SHIFT
									1F		
										REP	REP

### Layout for Proof Keyboard



Example: For the 7/M key, 27 is the character code for no shift key pressed. The first character of the CE mode code is a 2. The second character is a 7. Bit lines B07, D02, D04, and D05 should be up (+), and bit lines B06, B08, D07, and D13 should be down (-).

### Key Test Code Location

```
08 50 00 00 00 01 01 00 00 00  
66 00 00 27 00 07 00 00 00 00  
00 00 04 02 00 00 00 00 02 00
```

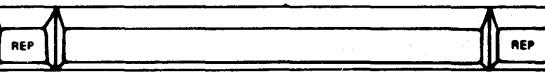
### Bit Line Levels

First Character of CE Mode Code	Up (+) and Down (-) Bit Lines				Second Character of CE Mode Code	Up (+) and Down (-) Bit Lines			
	B06	D02	D04	D05		B07	B08	D07	D13
0	+	+	+	+	0			+	+
1	+	+	+	-	1			+	-
2	-	+	+	+	2			-	+
3	-	+	+	-	3			-	+
4	+	+	-	+	4			+	+
5	+	+	-	-	5			+	-
6	-	+	-	+	6			+	-
7	-	+	-	-	7			-	-
8	+	-	+	+	8			-	+
9	+	-	+	-	9			-	+
A	-	-	+	+	A			-	+
B	-	-	+	-	B			-	+
C	+	-	-	+	C			+	-
D	+	-	-	-	D			-	-
E	-	-	+	-	E			-	+
F	-	-	-	-	F			-	-
Reset Key	-	+	+	-				+	+

Note: A bit line off is up (+). A bit line on is down (-).

#### 416Katakana CE Mode

**Example:** For a failing M key, 27 is the character code for no shift key pressed. The first character of the CE mode code is a 2. The second character is a 7. Bit lines B07, D02, D04, and D05 should be up (+), and bit lines B06, B08, D07, and D13 should be down (-).



## **Key Test Code Location –**

08 50 00 00 / 00 01 01 00 00 00  
66 00 00 27 00 07 00 00 00 00  
00 00 04 02 00 00 00 00 02 00

## Bit Line Levels

First Character of CE Mode Code	Up (+) and Down (-) Bit Lines				Second Character of CE Mode Code	Up (+) and Down (-) Bit Lines			
	B06	D02	D04	D05		B07	B08	D07	D13
	2	0	1	3		4	6	7	5
0	+	+	+	+	0	+	+	+	+
1	+	+	+	-	1	+	+	-	+
2	-	+	+	+	2	+	-	+	+
3	-	+	+	-	3	+	-	-	+
*	+	+	-	+	4	+	+	+	-
4	+	+	-	+	5	+	+	-	-
5	+	+	-	-	6	+	-	+	-
6	-	+	-	+	7	+	-	-	-
7	-	+	-	-	8	-	+	+	+
8	+	-	+	+	9	-	+	-	+
9	+	-	+	-	A	-	-	+	+
A	-	-	+	+	B	-	-	-	+
B	-	-	+	-	C	-	+	+	-
C	+	-	-	+	D	-	+	-	-
D	+	-	-	-	E	-	-	+	-
E	-	-	-	+	F	-	-	-	-
F	-	-	-	-	Reset Key	-	+	-	+

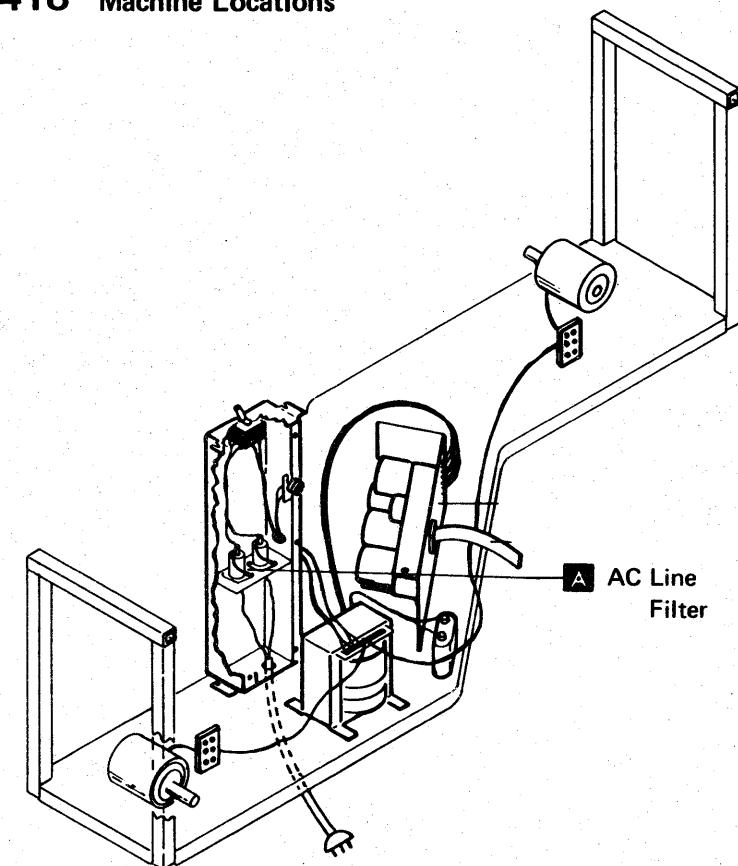
**Note:** A bit line off is up (+).

A bit line on is down (-).

115-417

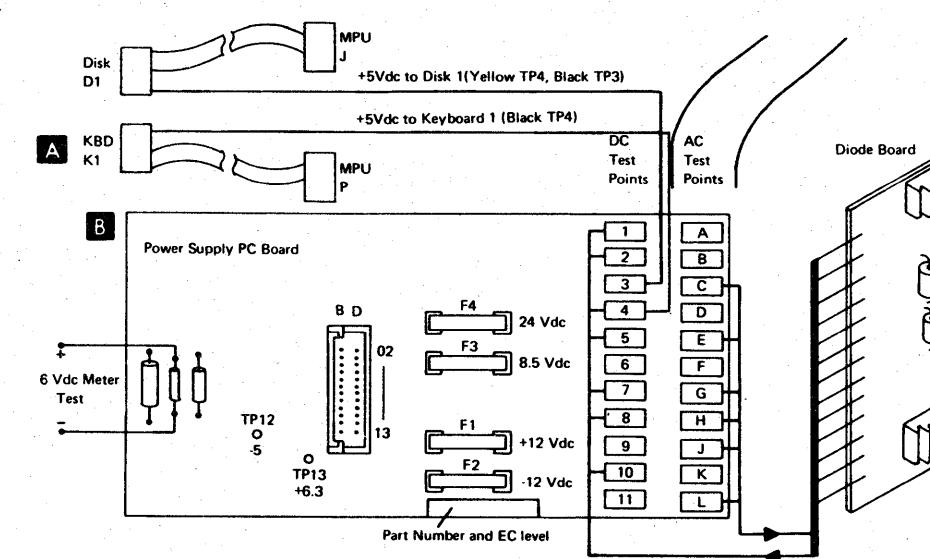
417 (not used)

**418 Machine Locations**

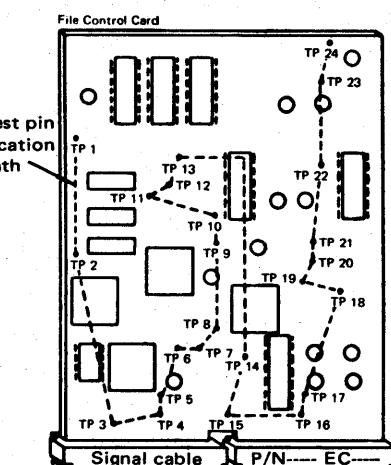


The diagram illustrates the front panel of the IBM 3742 Dual Data Station. It features two rectangular disk drives, one labeled "Disk 1" and the other "Disk 2". Above each disk is a small rectangular component labeled "Keyboard 2" and "Keyboard 1" respectively. To the right of the disks is a vertical rectangular component labeled "Viewer". A central vertical rectangular component is labeled "POWER Switch". The entire assembly is contained within a rectangular housing.

## **419 Power Supply Locations**



## **420 Disk FC Card**



## 421 EBCDIC Collating Sequence

Order in the Sequence	Character	Corresponding Hexadecimal Number
1 (lowest)	Blank	40
2	Ø	4A
3	,	4B
4	<	4C
5	(	4D
6	+	4E
7	-	4F
8	€	50
9	!	5A
10	\$	5B
11	•	5C
12	)	5D
13	:	5E
14	▀	5F
15	- (minus)	60
16	/	61
17	,	6B
18	%	6C
19	— (Underscore)	6D
20	>	6E
21	?	6F
22	:	7A
23	#	7B
24	@	7C
25	'	7D
26	=	7E
27	"	7F
28	A	C1
29	B	C2
30	C	C3
31	D	C4
32	E	C5
33	F	C6
34	G	C7
35	H	C8
36	I	C9
37	J	D1
38	K	D2
39	L	D3
40	M	D4
41	N	D5
42	O	D6
43	P	D7
44	Q	D8
45	R	D9
46	＼	E0
47	S	E2
48	T	E3
49	U	E4
50	V	E5
51	W	E6
52	X	E7
53	Y	E8
54	Z	E9
55	0	F0
56	1	F1
57	2	F2
58	3	F3
59	4	F4
60	5	F5
61	6	F6
62	7	F7
63	8	F8
64 (highest)	9	F9

Group A →

Disk 2 search sequential content will work with either Group A or Group B but not both groups before ECA022. After ECA 022, disk 2 search is like disk 1.

Group B →

Disk 1 search sequential content will work with this group of characters.

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## 501 Part Numbers and Cause Codes

Part Name	Number	IR Code
AC Line Filter	2192519	600-07
Cross Connector	2731026	300-02
Memory Socket Card	2455860	300-09

For card and planar part numbers, refer to the following pair of facing pages (501 continued).

### Cause Codes

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34		
Defective	21	Open	42		

**501 (Continued)**

Cards	IR Code	PN	PN	PN	PN	PN	PN
VFO	300-07	8523120	8524222	8527646			
Basic Memory	300-05	8230516	8238725				
ROS Feature A (80 character)	300-06	2455108	2456039	2456218			
ROS Feature A (128 character)	300-06	2455545		2456219			
Proof Keyboard	300-06	1620159					
Proof Keyboard and Feature							
Group A (80 character)	300-06	1620161					
Proof Keyboard and Feature							
Group A (128 character)	300-06	1620162					
Record Insert (80 character)	300-06	2455492					
Record Insert (128 character)	300-06	2455493					

**Full Planar Assemblies (80 character)      IR Code 300-03**

Country	PN	PN	PN	PN	PN	PN
US, Canada, Italy, France (QWERTY) and Germany (QWERTY)	2455313	2456209	1610601	2469523		
Denmark	2455320	2455639	5565798	2469532		
Finland/Sweden	2455319	2455640	5565799	2469533		
Germany (QWERTZ)	2455321	2455677	1610635	2469524		
Norway	2455317	2455831	1610636	2469525		
United Kingdom	2455315	2455832	1610637	2469526		
Spain	2455326	2455833	1610638	2469527		
Japan	2455322	2455834	1610639	2469528		
Portugal	2455323	2455835	1610640	2469529		
Belgium/France (AZERTY)	2455324	2456211	1610641	2469530		
Latin America	2455325	2456214	1610642	2469531		
Katakana	1610669	2455670				
ASCII		1611358				
Brazil			2469307	2469534		

**Full Planar Assemblies**

**Full Planar Assemblies (128 character)      IR Code      300-03**

Country	PN	PN	PN	PN	PN	PN	PN
US	2455807	2456125	1610650	2469535	2469862		
Canada; Italy, France (QWERTY), and Germany (QWERTY)	2455807	2456125	1610650	2469535	2469862		
Denmark	2455395	2456042	1610646	2469544	2469871		
Finland/Sweden	2455396	2456063	1610647	2469545	2469872		
Germany (QWERTZ)	2455393	2456009	1610644	2469536	2469863		
Norway	2455394	2456038	1610645	2469537	2469864		
United Kingdom	2456019	2456149	1610651	2469538	2469865		
Spain	2455397	2456064	1610648	2469539	2469866		
Japan	2456020	2456185	1610652	2469540	2469867		
Portugal	2455541	2456122	1610649	2469541	2469868		
Belgium/France(AZERTY)	2455392	2455957	1610643	2469542	2469869		
Latin America	2456021	2456187	1610653	2469543	2469870		
Katakana	1610667	2455669					
ASCII	1611363						
Brazil				2469546	2469873		

**Note:** Part numbers are in ascending order, the latest level is shown on the right. When replacing a planar, check the part number of the removed planar. Use that part number or a later level one. The part number is on the connector shroud of the B, D, F, or H connector on the module side of the planar (504). The part number and EC number may have been scratched out at one location and an update part number and EC number etched on the next location.

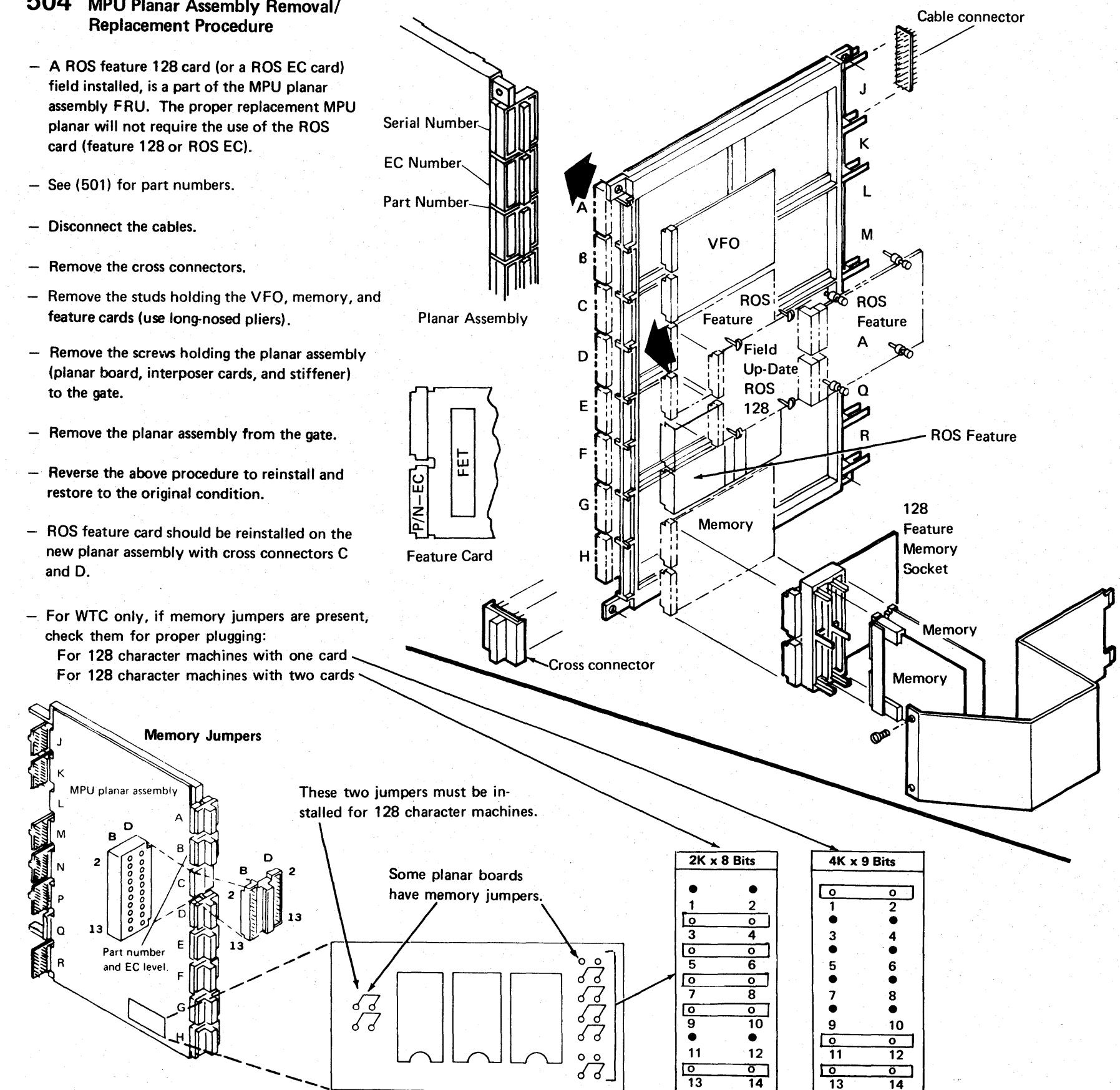
**501-503**

**502 (not used)  
503 (not used)**

**3742 ML**

## 504 MPU Planar Assembly Removal/ Replacement Procedure

- A ROS feature 128 card (or a ROS EC card) field installed, is a part of the MPU planar assembly FRU. The proper replacement MPU planar will not require the use of the ROS card (feature 128 or ROS EC).
- See (501) for part numbers.
- Disconnect the cables.
- Remove the cross connectors.
- Remove the studs holding the VFO, memory, and feature cards (use long-nosed pliers).
- Remove the screws holding the planar assembly (planar board, interposer cards, and stiffener) to the gate.
- Remove the planar assembly from the gate.
- Reverse the above procedure to reinstall and restore to the original condition.
- ROS feature card should be reinstalled on the new planar assembly with cross connectors C and D.
- For WTC only, if memory jumpers are present, check them for proper plugging:  
 For 128 character machines with one card  
 For 128 character machines with two cards

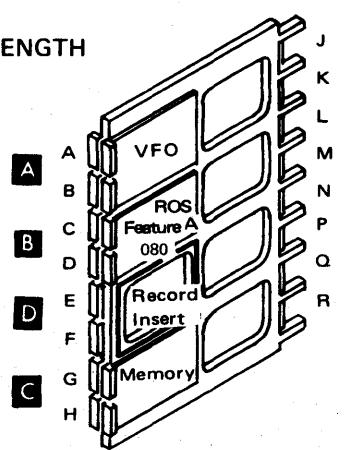


## 505 MPU Locations

1

80 RECORD LENGTH

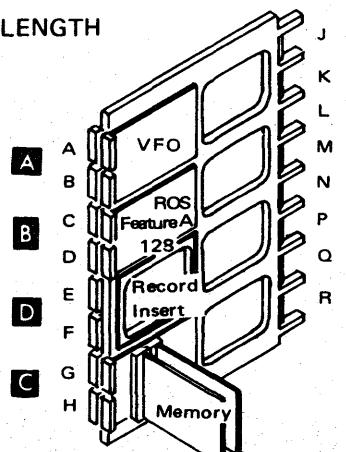
(shown with  
feature A)



2

128 RECORD LENGTH

ROS feature  
128 on planar  
(shown with  
feature A)

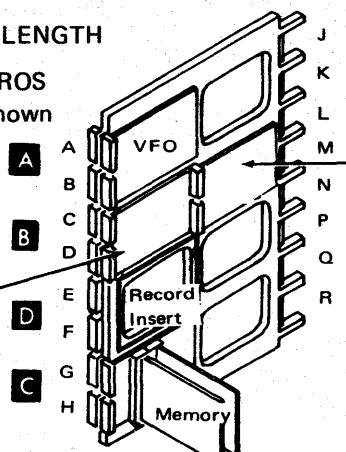


3

128 RECORD LENGTH

Field installed ROS  
Feature 128 (shown  
with feature A)

Field Update  
ROS for 128  
Record Length



Note:  
This configuration will change  
to look like configuration 2  
if the MPU planar assembly  
is changed as a FRU.

504-507

## MPU Cables

J Disk 1  
grnd B08

K Disk 2  
grnd B08

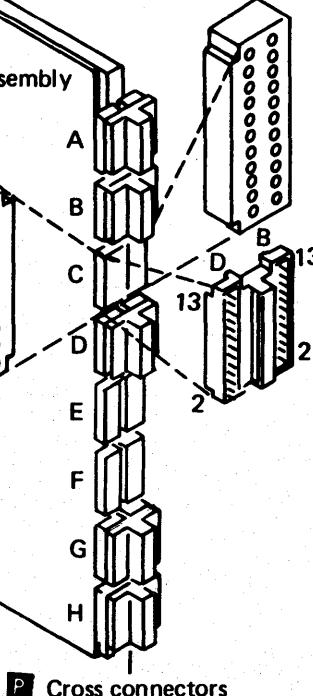
M Power Supply  
grnd D13

N Display  
grnd D08

P Keyboard 1  
grnd D08

R Keyboard 2  
grnd D08

Cable connectors



506 (not used)

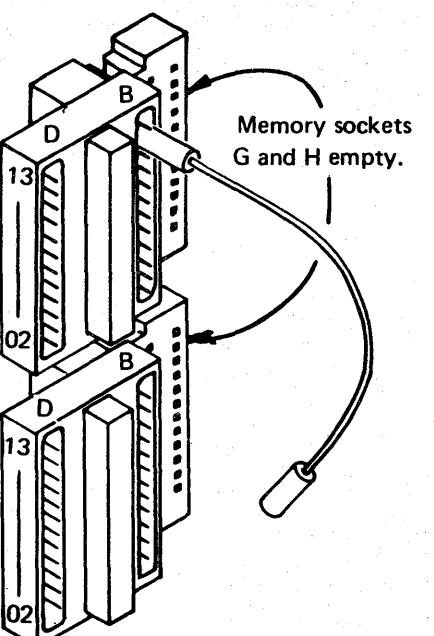
507 (not used)

3742 ML

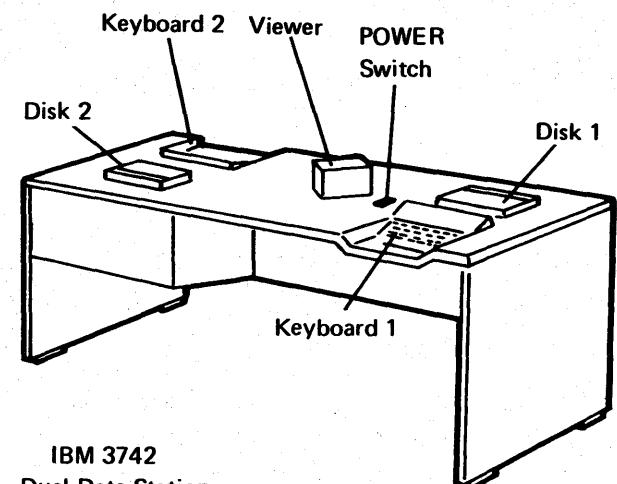
508 Test Patterns

\* In some cases the data line may start with blank character(s) rather than with H character(s).

## **509** Socket Locations



## **510 Machine Locations**



## **601 Part Numbers and Cause Codes**

602 (not used)  
603 (not used)

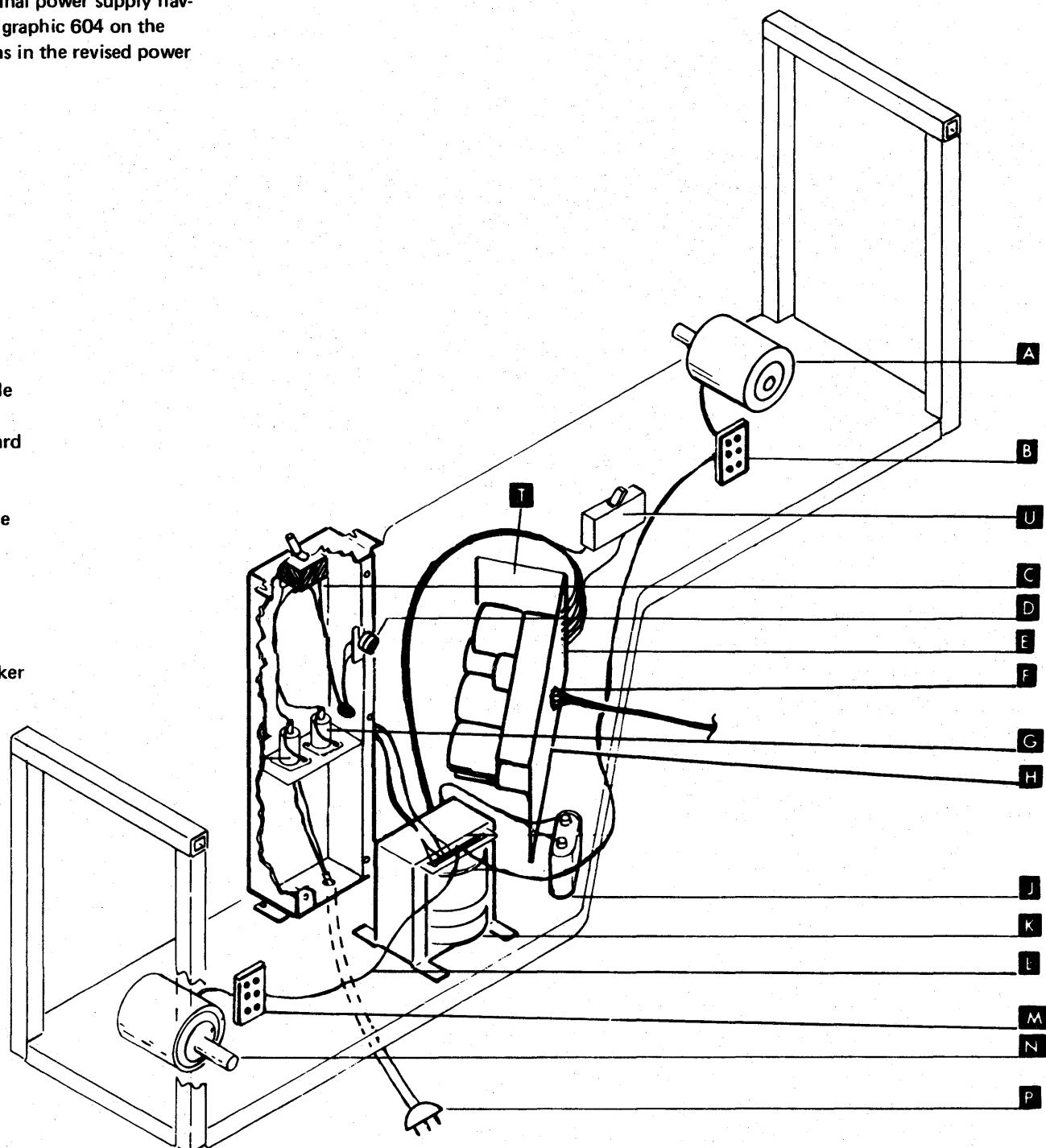
**3742 ML**

## 604 Power Supply Locations (with diode board)

These locations are for original power supply having a diode board **T**. See graphic 604 on the following pages for locations in the revised power supply.

### Legend

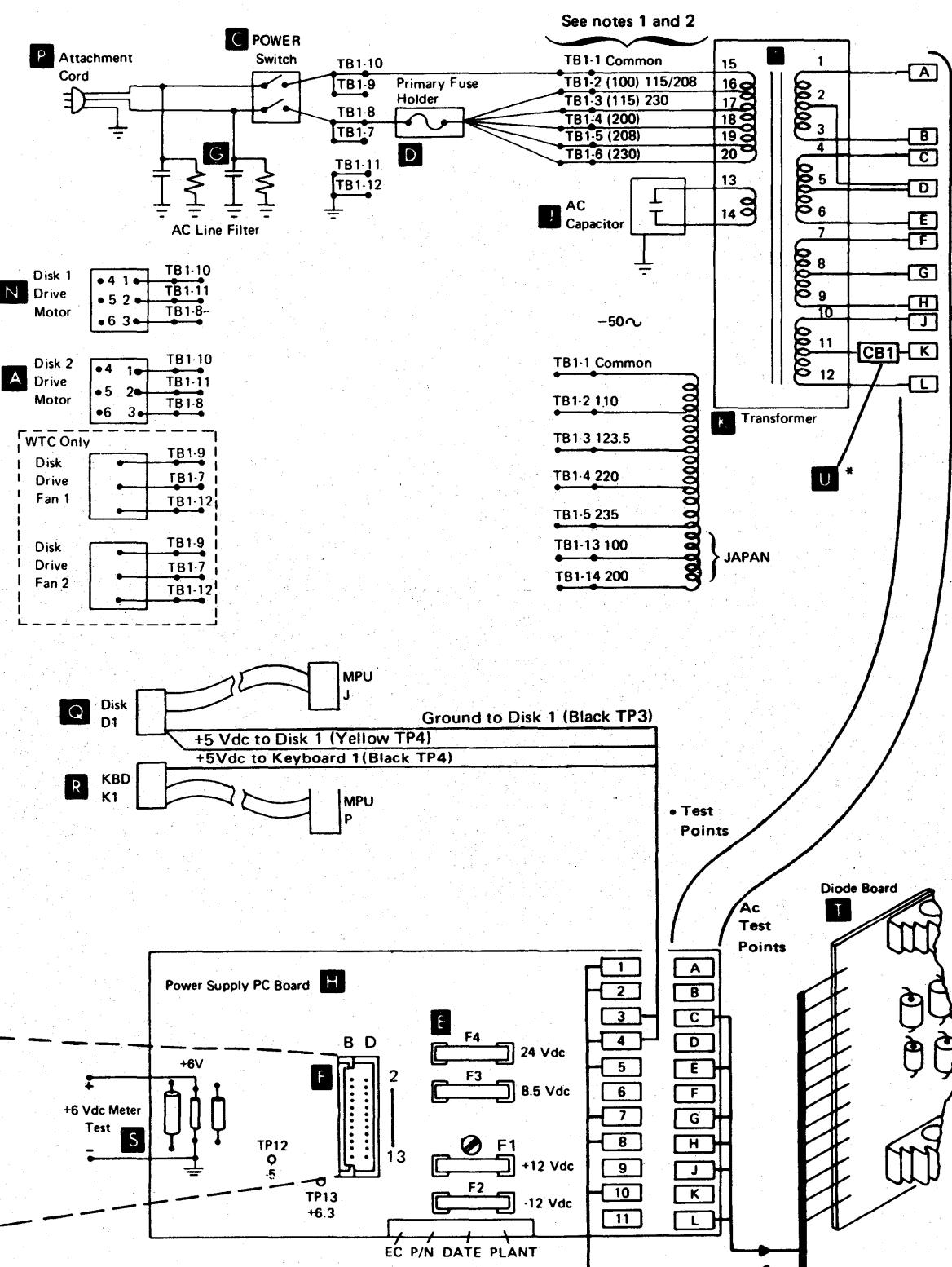
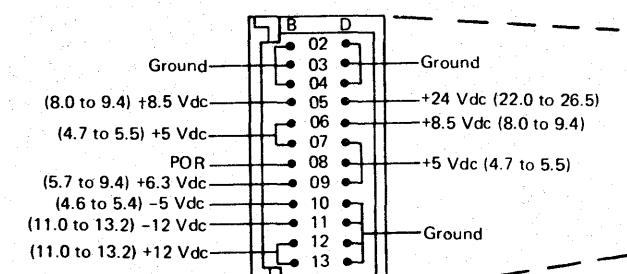
- A** Disk drive motor 2
- B** Disk unit 2 ac cable
- C** Power switch
- D** Primary fuses
- E** Secondary fuses
- F** Power supply dc cable
- G** AC line filter
- H** Power supply PC board
- J** AC capacitor
- K** Transformer
- L** Power supply ac cable
- M** Disk unit 1 ac cable
- N** Disk drive motor 1
- P** Power cord
- Q** Disk dc cable
- R** Keyboard dc cable
- U** \* CB1, 5V circuit breaker



\*Not installed on all machines

**Notes:**

1. Numbers in parentheses apply to WTC 60 Hz machines only.
2. Various transformers are used; check part numbers (601) before changing taps.



\*Not installed on all machines

**604-606**

**3742 ML**

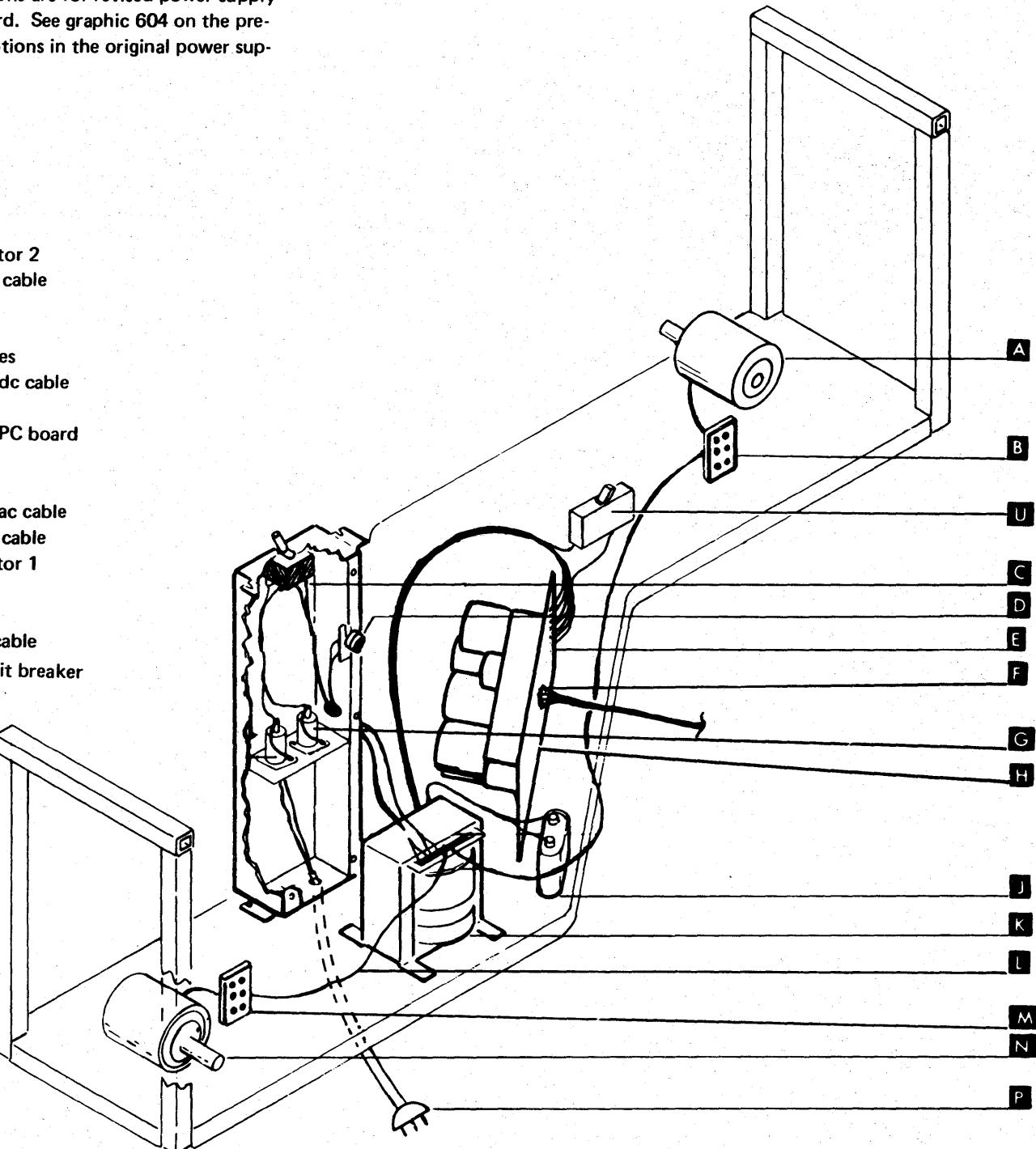
**604-2**

## 604 Power Supply Locations (without diode board)

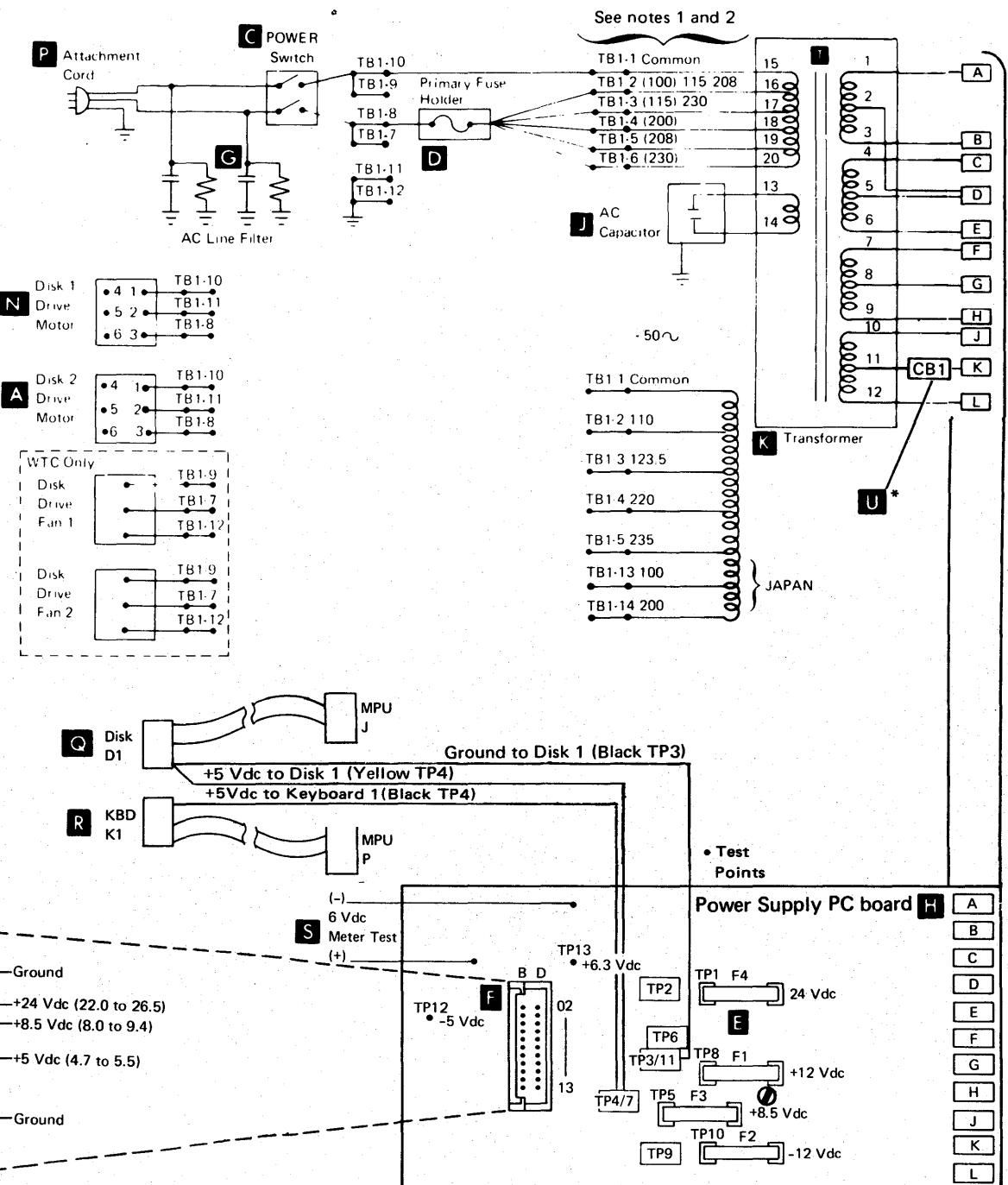
The following locations are for revised power supply having no diode board. See graphic 604 on the preceding pages for locations in the original power supply.

### Legend

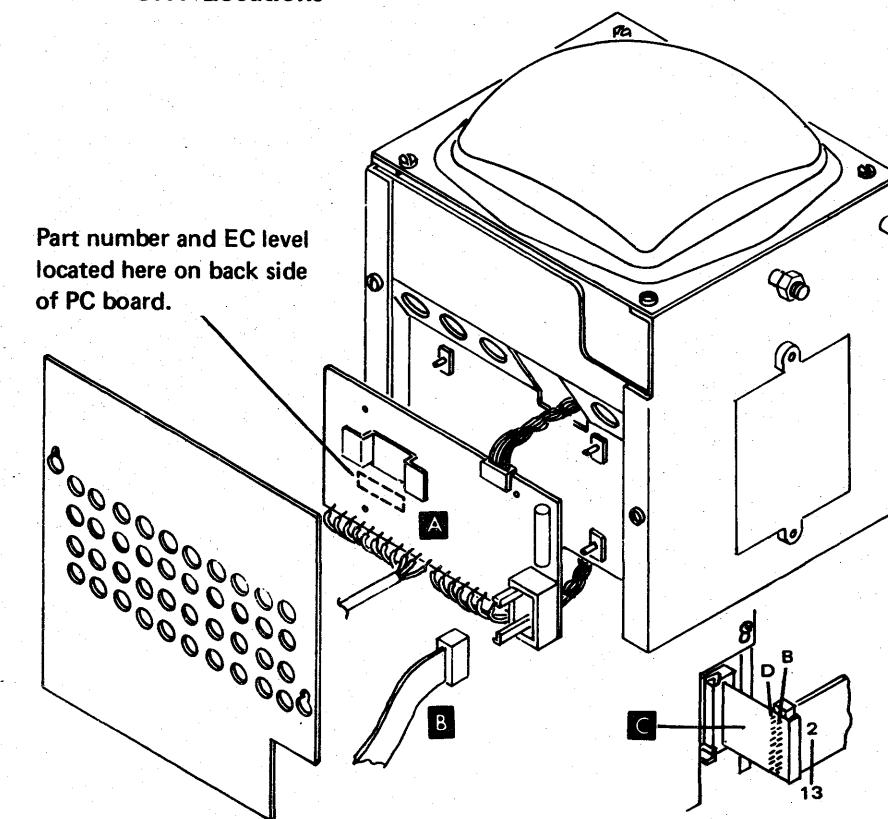
- A Disk drive motor 2
- B Disk unit 2 ac cable
- C Power switch
- D Primary fuses
- E Secondary fuses
- F Power supply dc cable
- G AC line filter
- H Power supply PC board
- J AC capacitor
- K Transformer
- L Power supply ac cable
- M Disk unit 1 ac cable
- N Disk drive motor 1
- P Power cord
- Q Disk dc cable
- R Keyboard dc cable
- U CB1, 5V circuit breaker
- U\* CB1, 5V circuit breaker



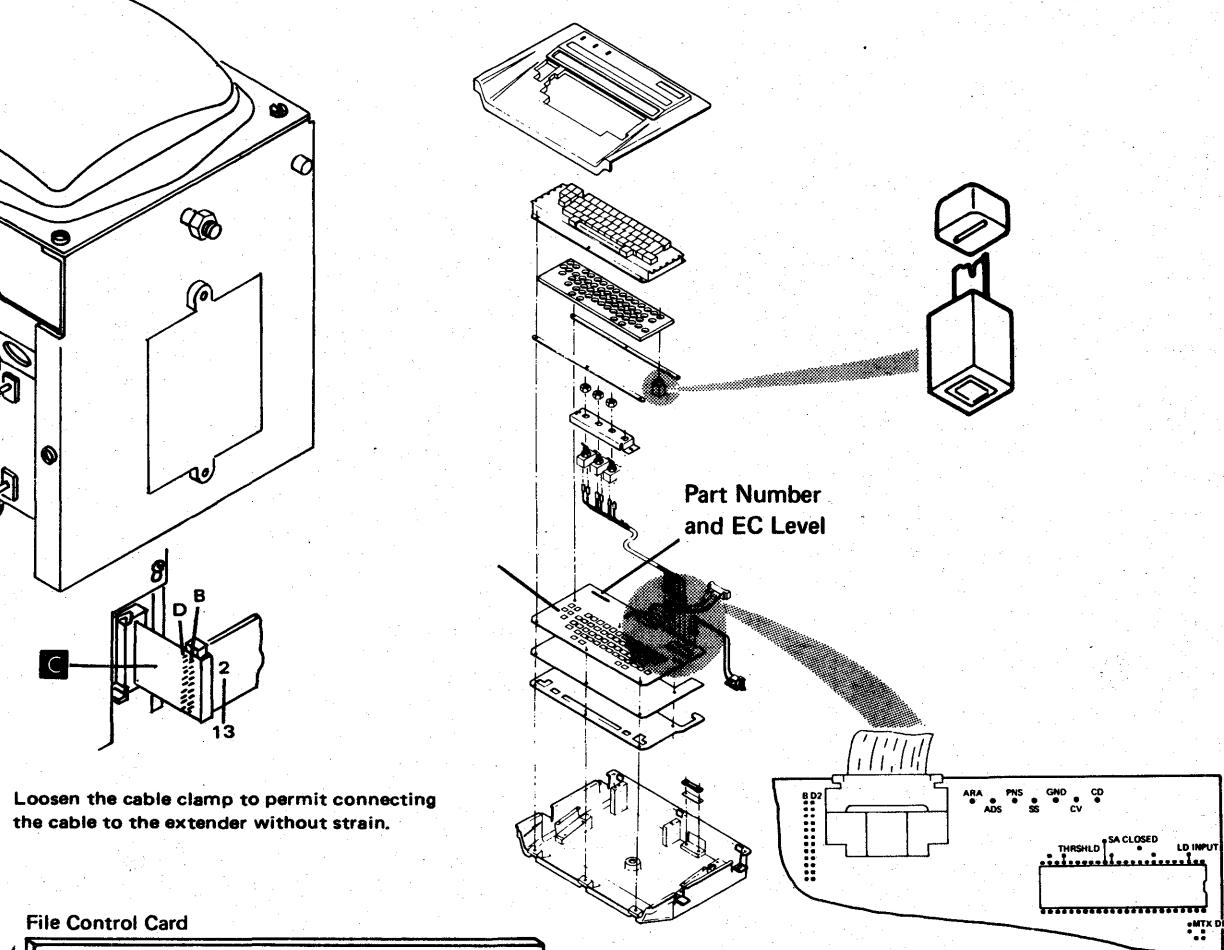
\*Not installed on all machines



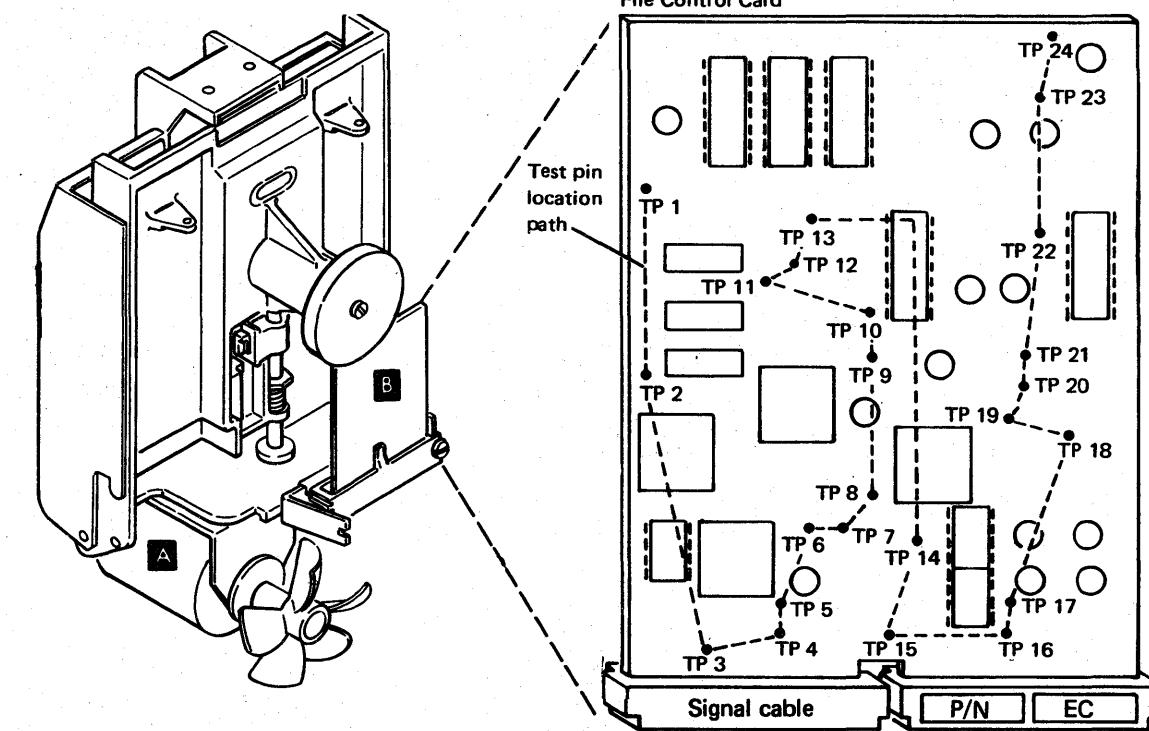
607 CRT Locations



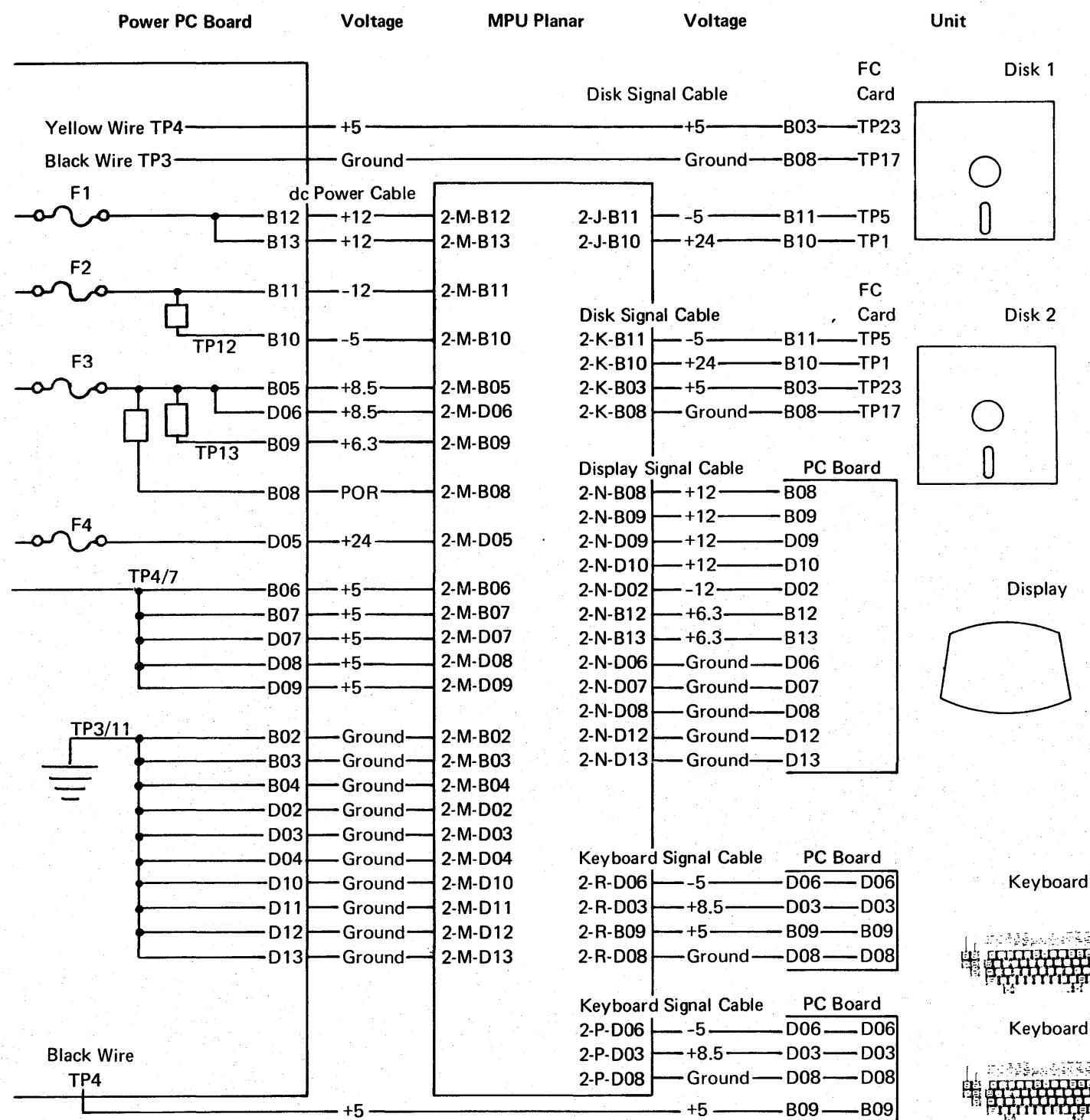
609 Keyboard Locations



608 Disk Drive Locations



## 610 DC Voltage Distribution



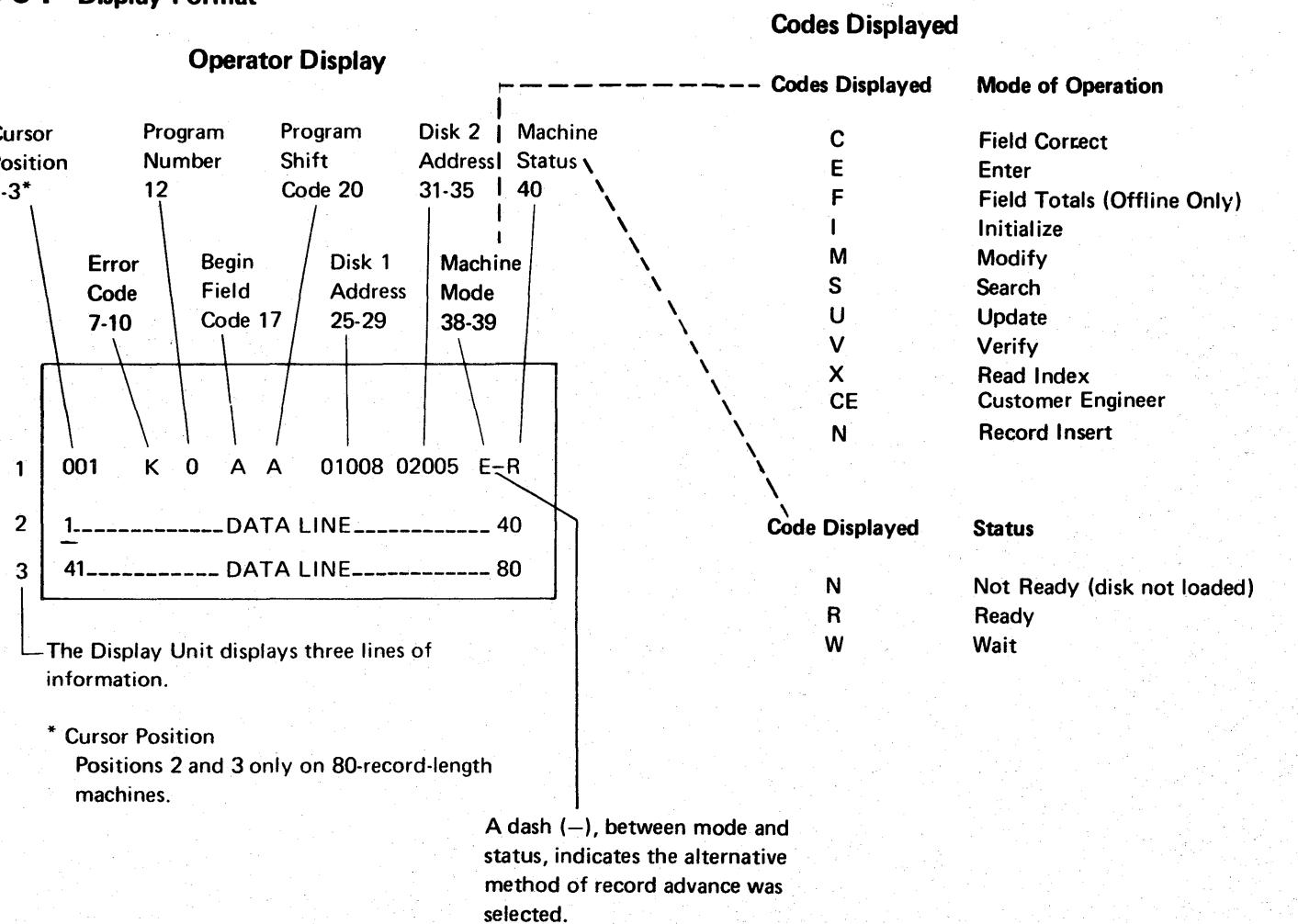
607-610

3742 ML

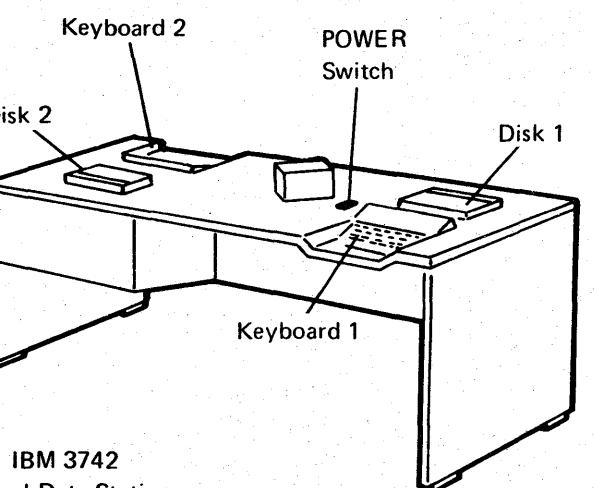
610-1

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## 701 Display Format



## 702 Machine Locations



701-703

703 (not used)

3742 ML

J

Is the machine in VR mode-status? —

Y N

— Use MPU MAP 5-1.

— VR mode-status should be displayed.

— Press FIELD COR

Is the machine in CR mode-status? —

Y N

— Use MPU MAP 5-1.

— Field correction mode.

— Enter RRBCD

— Press REC ADV

RESET

FUNCT SEL lower

DISPLAY PROD STAT

— Completes the verify procedure.

— Display information RBCD, the first R keyed set up status.

— An E error is displayed.

Are the error code positions blank? —

Y N

— Use *Error Code Description* under *Symptom Index*, page 1-2.

— An error may indicate the wrong key pressed or the feature not installed.

Does the display show the production statistics? —

Y N

— Use MPU MAP 5-1.

— Production statistics appear on the display as the output of three accumulators.

— Press RESET

Cursor position

001 for 128

feature.

01            0        A    A 00008    X    R

  000002    000023    000001

— Could be any value.

BASIC CHECKOUT COMPLETE.

**This page intentionally left blank.**

### 7-3 FEATURE GROUP A CHECKOUT

#### PROCEDURE —

Do not attempt this procedure until you have successfully completed MAPs 7-1 and 7-2.

- Power down.
- Wait 5 seconds.
- Power up, wait 30 seconds.
- Set all keyboard switches down.
- Set PROG NUM SHIFT to ALL CHAR.
- Load a diskette (a diskette with no known history of errors).
- Be sure to use a data set with a record length 005 or greater (positions 025-027) and extent of at least 33 records (BOE, positions 029-033 to EOE, positions 035-039) in the data set label.

— Press H---E  
FUNCT SEL lower  
PROG LOAD  
1  
SEL PROG  
1  
FUNCT SEL lower  
ENTER  
2 key four times

- Feature group A contains production statistics, verify, self check, field totals, and disk initialization.

- A program to check the self-check feature.

- Load the program in program area 1.

- Select program 1.

Is a C error code displayed? —

- Y N
- Use MPU MAP 5-3.
  - Press RESET
  - Hold NUM SHIFT and enter 0
  - Press REC ADV  
FUNCT SEL lower  
RETURN TO INDEX
  - Set the AUTO REC ADV up.
  - The wrong self-check digit was entered. If an error does not occur, the feature is failing.
  - The correct self-check digit is 0.

A

A

— Press FUNCT SEL lower

DELETE REC

N

NUM SHIFT and 1

E

FUNCT SEL lower

PROG LOAD

1

<

NUM SHIFT and 1

. (period-bottom row)

FUNCT SEL lower

PROG LOAD

2

SEL PROG

1

FUNCT SEL lower

ENTER

— Program (N1E) for field total data.

— Load the program in program area 1.

— A program for accumulating field totals (<1.).

— Load the program in program area 2.

— Select program 1.

— Hold REP and press 1 to enter 32 records. —

— Press FUNCT SEL lower

RETURN TO INDEX

FUNCT SEL upper

COMPUTE FIELD TOTALS

— This, under program 1 control, enters the amount 11 in each record. Create *exactly* 32 records.

— Checks offline field totals.

Are the error code positions blank?

Y N

— Use *Error Code Description* under *Symptom Index*, page 1-2.

Does the display show the record advancing?

Y N

— Use MPU MAP 5-3.

— Press FUNCT SEL upper

— Press DISPLAY FIELD TOTALS

Cursor position

001 for 128

feature.

01	0	A	A	00008	X	R
				352+	+	
-						

— Resets all accumulators.

Does 352 appear on the display? —

Y N

— Use MPU MAP 5-3.

— Press R

FUNCT SEL upper

DISPLAY FIELD TOTALS

B



Are the accumulators blank?

Y N

- Use MPU MAP 5-3.

— Press RESET

FUNCT SEL lower

SEARCH SEQ CONTENT

Hold NUM SHIFT and press 1

REC ADV

- This is the argument for the search function.

Are the error code positions blank? —

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

Does 11 appear in positions 001 and 002? —

Y N

- Use MPU MAP 5-3.

— Press FUNCT SEL lower

RETURN TO INDEX

FUNCT SEL lower

SEARCH CONTENT

Hold NUM SHIFT and press 1 key two

times —

REC ADV

- An error may indicate the wrong key pressed or the feature may not be installed.

- The record address should be the same as the first record in the data set.

Are the error code positions blank? —

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

Does 11 appear in positions 001 and 002? —

Y N

- Use MPU MAP 5-3.

— Press FUNCT SEL lower

RETURN TO INDEX

— Load a diskette in station 1. —

— Press FUNCT SEL lower

DELETE REC

FUNCT SEL lower

I (letter)

- An error may indicate the wrong key pressed or the feature not installed.

- The record address should be the same as the first record in the data set.

- The purpose of this checkout is to find if the diskette check circuits on feature A card work correctly. Use a known good diskette so that any problems are caused by the circuits and not the diskette. If you have diskette problems, see MAP 2-1.





Are the error code positions blank except for disk check error codes? —

Y N

- Use *Symptom Index*, page 1-2.

Does the machine complete disk check successfully (9-34)? —

Y N

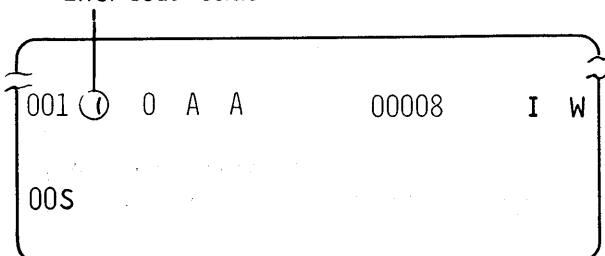
- Use MAP 5-3.

- Remove the diskette.

- An error can indicate the incorrect key pressed or the feature is not installed.

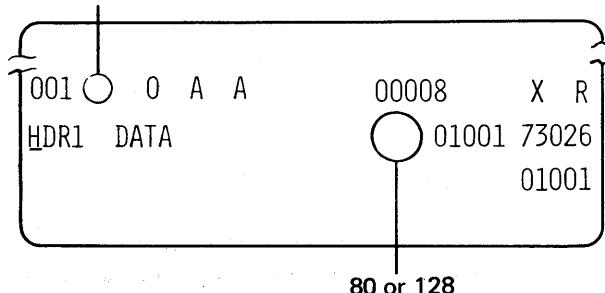
- The display below shows a successful disk check and no bad tracks on a disk that had at least one deleted header:

Error Code Position



The display below shows a successful disk check on a disk that had no deleted headers and no defective tracks:

Error Code Position



- Prepares the machine for checking the disk copy function.

- An error may indicate the wrong key pressed or the feature may not be installed.

Are the station 1 error code positions blank? —

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.

Is the disk 2 record displayed at station 1? —

Y N

- Use MPU MAP 5-3.

- Press Station 1 FUNCT SEL lower

A

- Remove the diskettes.

- The data set label on disk 2 should be displayed. The record address should be displayed on the status line.

- Removes the disk 2 address from the display and releases station 2 for normal use.

**FEATURE GROUP A CHECKOUT PROCEDURE IS COMPLETE**

## 7-4 128 RECORD LENGTH FEATURE CHECKOUT PROCEDURE

This procedure is based on the assumption the basic checkout procedure has been successfully completed (MAPs 7-1, 7-2, and if the machine has feature group A, 7-3).

- Set all keyboard switches down.
- Set PROG NUM SHIFT switch up.
- Load a diskette (a diskette with no known history of errors).

Are the error code positions blank?

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.
- Look at record length in the index track data set label 08. —
  - Positions 025, 026 and 027 in the status line.

Is the record length 128?

Y N

- If this is a customer diskette, write down the record length. —
- Use CHAR ADV to move the cursor to position 025.
- Press NUM SHIFT 128 FUNCT SEL lower M REC ADV
- This is only necessary if the original data set label must be preserved.
- To modify the data set label to 128-record-length.

Are the error code positions blank?

Y N

- Use *Error Code Description* under *Symptom Index*, page 1-2.
- If this is a customer diskette, restore the record length to what you previously wrote down. —
  - This is only necessary if the original must be preserved.

A

A

- Press REC BKSP
- FUNCT SEL lower
- DELETE REC
- Enter DUSK
- Hold the REP key and the period key to enter periods through position 036.
- Starting in position 037, enter SUNSSUNS
- Hold the REP key and the dash key to enter dashes through position 076.
- Starting in position 077, enter DUS
- Watch the display and enter K

Did the display scroll and does it now appear as shown? —

- Y N
- Use MPU MAP 5-1.

- Hold the REP key and the period key to enter periods through position 117.
- Starting in position 118, press the period key three more times.

Did the display scroll and does it now appear as shown? —

- Y N
- Use MPU MAP 5-1.
- Starting in position 121, enter SUNDUSK
  - Watch the display and enter Y

Does the display appear as shown? —

- Y N
- Use MPU MAP 5-1.
- Press any data key.

— Index track record 07 will be used.

— To clear data portion of the display.

081     0    A    A    00007    X   R

SUNS-----DUSK

121     0    A    A    00007    X   R

-----

000     0    E    00007    X   R

SUNDUSKY\_

B

B

Does a T error show on a flashing display?

Y N

- Use MPU MAP 5-1.
- Press RESET.
- Press CHAR BKSP eight times to make the cursor location counter show 121.
- Watch the display and press CHAR BKSP.

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.
- Hold the REP key and CHAR BKSP to move the cursor to position 081.
- Watch the display and press CHAR BKSP.

120 0 A A 00007 X R  
SUNS-----DUSK  
.....

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.
- Press REC BKSP to move the cursor to position 001.
- Watch the display and press SCRL FWD.

080 0 A A 00007 X R  
DUSK.....SUNS  
SUNS-----DUSK

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.
- Watch the display and press SCRL FWD.

081 0 A A 00007 X R  
SUNS-----DUSK  
.....

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.
- Watch the display and press SCRL FWD.

121 0 A A 00007 X R  
.....  
SUNDUSKY

C

**C**

Did the display change and does it now appear as shown? —

**Y N**

— Use MPU MAP 5-1.

— Press SCRL FWD.

Does a T error show on a flashing display? —

**Y N**

— Use MPU MAP 5-1.

— Press RESET.

— Watch the display and press SCRL BKWD.

Did the display scroll and does it now appear as shown? —

**Y N**

— Use MPU MAP 5-1.

— Watch the display and press SCRL BKWD.

Did the display scroll and does it now appear as shown? —

**Y N**

— Use MPU MAP 5-1.

— Watch the display record number and press SCRL BKWD.

Did the record number stay the same? —

**Y N**

— Use MPU MAP 5-1.

— Press FUNCT SEL lower

PROG LOAD

A

SEL PROG

A

000 0 E 00007 X R

SUNDUSKY\_

— SCRL FWD should not cause a record advance while the AUTO REC ADV switch is off.

081 0 A A 00007 X R

SUNS-----DUSK

-----

001 0 A A 00007 X R

DUSK.....SUNS

SUNS-----DUSK

— SCRL BKWD should never cause a record backspace.

— Check that feature program area 10 is usable.

**D**

D

Does the display status line appear as shown? —

Y N

- Use MPU MAP 5-1.

— Press FUNCT SEL lower  
DISPLAY PROG

Does the display now appear as shown? —

Y N

- Use MPU MAP 5-1.

— Set the AUTO DUP/SKIP switch up. —  
— Press U.  
— Watch the display and press U.

Did the display scroll and does it appear as shown? —

Y N

- Use MPU MAP 5-1.

— Watch the display and press CHAR BKSP twice.

Did the display scroll and does it appear as shown? —

Y N

- Use MPU MAP 5-1.

— Watch the display and press CHAR BKSP.

Did the display stay the same?

Y N

- Use MPU MAP 5-1.

— Watch the display and press SCRL FWD.

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.

— Watch the display and press SCRL BKWD.

001	A	D	N	00007	X R
—					
—					

001	A	D	N	00007	X R
DUSK,.....SUNS					
SUNS-----DUSK					

123	A	N	N	00007	X R
.....					
SUNDUSKY					

039	A	N	N	00007	X R
DUSK,.....SUNS					
SUNS-----DUSK					

123	A	N	N	00007	X R
.....					
SUNDUSKY					

E

**E**

Did the display scroll and does it now appear as shown? —

Y N

- Use MPU MAP 5-1.

- Watch the display record number and press SCRL BKWD.

Did the record number stay the same?

Y N

- Use MPU MAP 5-1.

- Set the AUTO REC ADV switch up.

- Press SCRL FWD.

- Watch the display record number and press SCRL FWD.

Did the record number change to 00008 with the cursor in position 039?

Y N

- Use MPU MAP 5-1.

- Set the AUTO DUP/SKIP switch down.

- Press SEL PROG

0 (number)

- Use REC ADV or REC BKSP to find an unprotected index label that is OK to modify; and also OK to write in its related data set.

- Be sure the data set has an extent of at least two records (BOE, positions 29-33 to BOE, positions 35-39 in the data set label).

- Use CHAR ADV to move the cursor to position 025.

- Hold NUM SHIFT and enter 003

- Press FUNCT SEL lower

M

REC ADV

039	A	N	N	00007	X	R
DUSK.....				SUNS		
SUNS-----				DUSK		

- The DUP and SKIP fields should make the cursor appear to remain in position 039.

- The cursor should jump to position 123.

**F**

F

Are the error code positions blank?

Y N

- Use *Error Code Description under Symptom Index*, page 1-2.
- Press FUNCT SEL lower  
ENTER
- Watch the display record counter and enter  
ASD
- Ready to write records for verification.
- Check for enter control of short records.

Did an automatic record advance occur as the D key was pressed?

Y N

- Use Disk MAP 2-4.
- Enter FGH
- Press REC BKSP twice  
FUNCT SEL lower  
VERIFY
- Enter AS
- To verify the first two characters of record 01.

Are the error code positions blank?

Y N

- Use *Error Code Description under Symptom Index*, page 1-2.
- Press SCRL FWD
- Does an L error show on a flashing display?  
Y N
- SCRL FWD should not be functional while in a verify field.
- Use MPU MAP 5-1.
- Press RESET  
SCRL BKWD

Are the display data lines blank except for the cursor in position 001?

Y N

- Use MPU MAP 5-1.
- SCRL BKWD should function while in a verify field. The field must be reverified.

G

- Enter ASD
- Press FUNCT SEL lower  
RETURN TO INDEX
- REC BKSP to index label 00007.
- Set the AUTO REC ADV switch down.
- Press FUNCT SEL lower  
DELETE REC

- Enter R---NC---E
- Press FUNCT SEL lower  
PROG LOAD
- 7
- SEL PROG
- 7

Does the display appear as shown? —

Y N

- Use MPU MAP 5-1.

- Enter OL
- Press SCRL FWD

Does a 0 error show on a flashing display? —

Y N

- Use MPU MAP 5-1.

- Press RESET
- SCRL BKWD

Does a 0 error show on a flashing display? —

Y N

- Use MPU MAP 5-1.

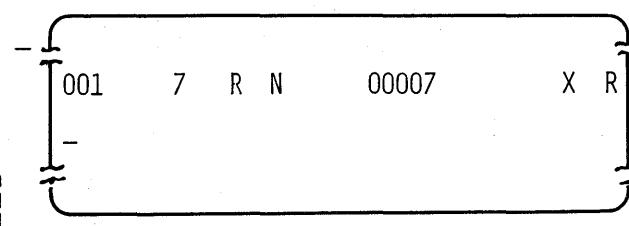
- Press RESET
- RIGHT ADJ

Is the cursor now in position 005?

Y N

- Use MPU MAP 5-1.

- A program for right-adjust and self-check fields (self check programmed modulus 11).
- Check that feature program area 7 is usable.
- Select program area 7.



- Enter 2 digits in a right-adjust field (3, 6).

- SCRL FWD should not be functional while in a right-adjust field.

- SCRL BKWD should not be functional while in a right-adjust field.



**Does this 3742 have feature group A installed? —**

**Y N**

- Press FUNCT SEL lower  
RETURN TO INDEX

**End of checkout; the diskette can be removed.**

- Feature group A includes self check, offline field totals, disk copy, disk initialization, and search content plus search sequential content.

**Press 222**

**SCRL FWD**

**Does a 0 error show on a flashing display? —**

**Y N**

- Use MPU MAP 5-1.

- Enter two digits (the last two 25) in a self-check field.

- SCRL FWD should not be functional while in a self-check field.

**Press RESET**

**SCRL BKWD**

**Does a 0 error show on a flashing display? —**

**Y N**

- Use MPU MAP 5-1.

- SCRL BKWD should not be functional while in a self-check field.

**Press RESET**

**Enter 24**

- Enter the last two self-check field digits (2, 4).

**Are the error code positions blank?**

**Y N**

- Use MPU MAP 5-3.

- The error code positions should be blank.

**Press FUNCT SEL lower**

**RETURN TO INDEX**

**End of checkout; the diskette can be removed.**

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## 704 Katakana Keyboard Codes

## 7-5 RECORD INSERT FEATURE (3742)

**CHECKOUT PROCEDURE (EITHER STATION)** — Record insert function is on feature ROS card in positions E and F (505D).

This checkout procedure is based on the assumption that MAPs 7-1 and 7-2 have been successfully completed for both stations.

- Set all keyboard switches down.
- Load a diskette that has a usable data set of at least 25 records. (EOE is greater than BOE by at least 24 records.) —
- REC ADV or REC BKSP to the data set label for the usable data set.
- Press FUNCT SEL lower  
ENTER
- Create 10 records in the following manner:
  - Use REPEAT key with the A key to put several A's in the first record (record 01).
  - REC ADV
  - Use REPEAT key with the B key to put several B's in the second record (record 02).
  - REC ADV
  - Continue the above procedure for 8 more records using the C, D, E, F, G, H, I and J keys in turn. —
- REC BKSP to display the third record (03, the C's record).
- Hold NUM SHIFT and press digit key 0 then 5. — — — — —
- Press FUNCT SEL lower  
RIGHT ADJ
- For ease of operation, the record number part of the BOE should equal 01.
- Record advance after each record is written. Ten records total, each record containing only one letter of the alphabet repeated.
- Set up for record insertion of 5 records in update mode, starting at a selected record address.
- The machine mode and status should be N W while record insertion is taking place.

Does the display flash with a 6 error code and show the third record (03) with a D in column

- 1? —
- Y N
- Use MPU MAP 5-1.
  - Hold NUM SHIFT and press RESET
  - Press REC BKSP
  - The D in column 1 indicates a deleted record. The third record (03) is no longer the C's record. It should have been moved to record position eight (08).

A

A

Does the second record (02) have the several B's? —

Y N

- Use MPU MAP 5-1.

Press FUNCT SEL lower  
RETURN TO INDEX  
FUNCT SEL lower  
SEARCH EOD

Is the record of several J's displayed and is it the fifteenth record (record 15)? —

Y N

- Use MPU MAP 5-1.

Press FUNCT SEL lower  
RETURN TO INDEX

- Hold NUM SHIFT and PRESS digit key 0, then 5. —
- Press FUNCT SEL lower  
RIGHT ADJ

Does the display flash with a 6 error code and show the first record (01) with a D in column 1? — T

Y N

- Use MPU MAP 5-1.

Hold NUM SHIFT and PRESS RESET

- Press FUNCT SEL lower  
RETURN TO INDEX  
FUNCT SEL lower  
VERIFY

Is the record of several A's the sixth record (record 06)?

Y N

- Use MPU MAP 5-1.

Press FUNCT SEL lower  
RETURN TO INDEX  
FUNCT SEL lower  
SEARCH EOD

- The B's record should not have been moved.

- Starting with the C's record, all records to EOD should have been moved 5 record positions. Five deleted (blank) records should have been inserted between the B's record and the C's record. The J's record should have moved from position 10 to position 15.
- Set up for record insertion of 5 records in read index mode. The insertion will start at the first record address of the data set.
- The machine mode and status should be N W while record insertion is taking place.

- The D in column 1 indicates a deleted record. The first record (01) is no longer the A's record. It should have been moved to record position six (06).

B

B

Is the record of several J's displayed and is it the twentieth record (record 20)? —

Y N

- Use MPU MAP 5-1.
- Press FUNCT SEL lower  
RETURN TO INDEX
- Hold NUM SHIFT and PRESS DIGIT KEY 0 two times.
- Press FUNCT SEL lower  
RIGHT ADJ

Does the display flash with an I error code?

Y N

- Use MPU MAP 5-1.
- Press RESET
- Press FUNCT SEL lower  
ENTER  
REC ADV  
FUNCT SEL lower  
RET TO INDEX
- Unload diskette.

This completes the record insertion checkout for either station.

Second station lock out procedure.

- Load a diskette that has a usable data set of at least 21 tracks (EOE is greater than BOE by at least 20 tracks).
- Make the EOD 20 *tracks* greater than the BOE.
- Make the EOE 5 *records* greater than the EOD.
- Press FUNCT SEL lower  
RETURN TO INDEX

Is EOD 20 *tracks* greater than BOE and the BOE 5 *records* greater than the EOD?

Y N

- Correct data set label.
- Press NUM SHIFT  
Keys 0, 5  
FUNCT SEL lower
- Hold ALPHA SHIFT
- Press RIGHT ADJ

— Starting with the first record of the data set (the A's record in this case), all records to EOD, including the 5 deleted records between the B's and C's records, should have been moved 5 positions. Five deleted (blank) records should have been inserted at the beginning of the data set. The J's record should have moved from position 15 to position 20.

— The number of records specified to be moved is 00. Digits 01 thru 99 are the only valid characters that can be specified. Note that only the first two character positions of the displayed record will be scanned for the move specification. EXAMPLE: The first five character positions of the displayed record are 12345; the move specification will be 12 positions. EXAMPLE: the first four character positions of the displayed record are 0015; the move specification will be read as an invalid 00 positions and an I error will be posted.

— Changes data set label so the disk can be used again.

- EXAMPLE: (BOE 04001) (EOE 24006)  
(EOD 24001)
- Refer to 239 for data set format and 9-4 to modify data set label.

C

Is N W posted?

Y N

— Use MPU MAP 5-1.

— Load a diskette in the other station and try to enter data.

Is that keyboard locked out?

Y N

— Use MPU MAP 5-1.

When operation is complete on first station is the display flashing with a 6 error and a D in column 1?

Y N

— Use MPU MAP 5-1.

— Press NUM SHIFT

RESET

FUNCT SEL lower

RETURN TO INDEX

— Press FUNCT SEL lower

ENTER

REC ADV

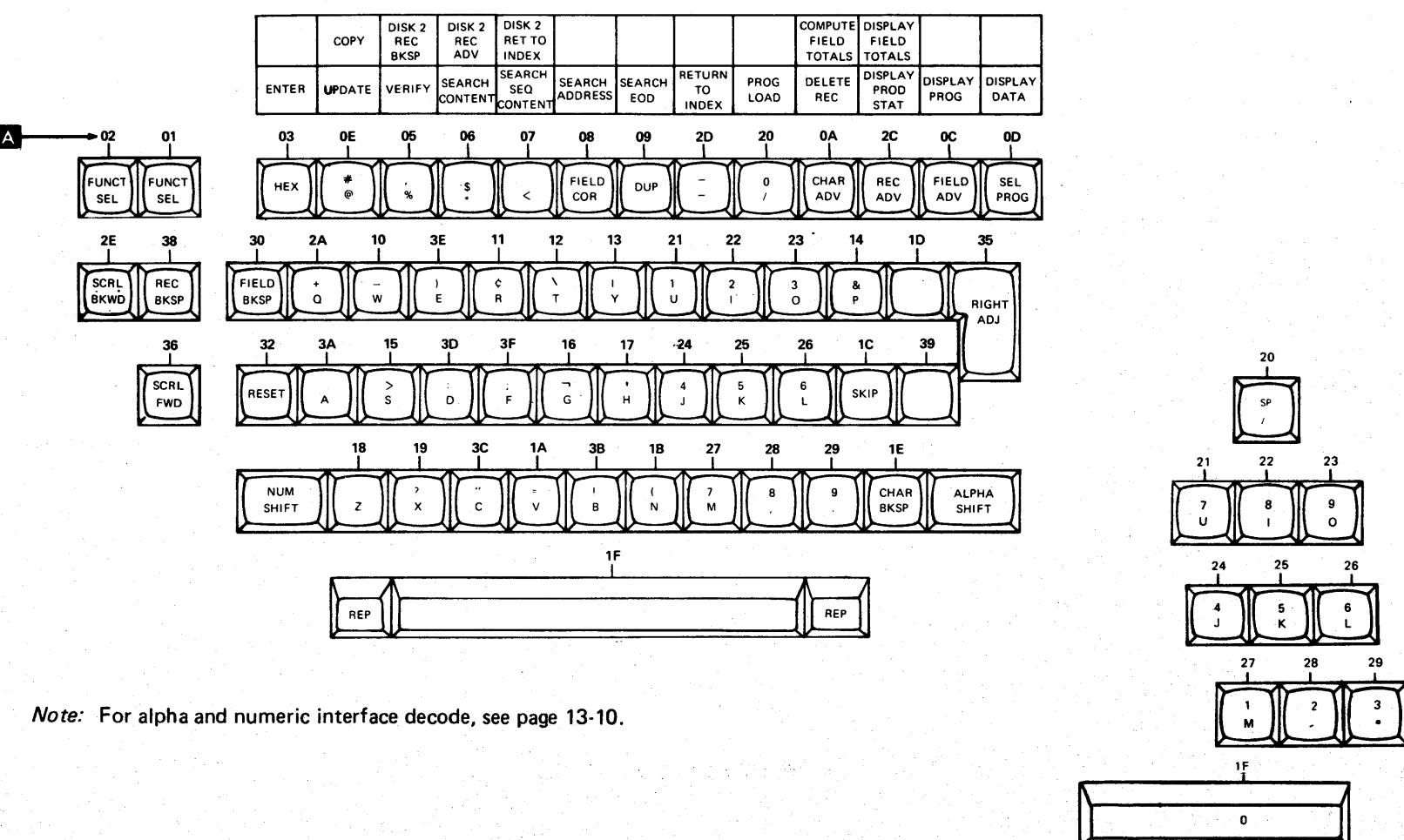
FUNCT SEL lower

RETURN TO INDEX

— Unload diskette.

THIS COMPLETES THE RECORD INSERT  
CHECKOUT PROCEDURE.

## 705 Keyboard Codes



Note: For alpha and numeric interface decode, see page 13-10.

## 706 Track Addresses

	Example 1	Example 2	Example 3
Starting record address —	XX001	XX014	XX020
	+32	+32	+32
	33	46	52
	-26	-26	-26

Next track—ending record address—XX007  
 (Do not enter a record at this address)

Aid: If you stop short of the next track ending address when using the repeat key, additional records may be entered by pressing the U key twice for each record.

704-706

Layout for Proof Keyboard

## MAP 7-6 PROOF KEYBOARD CHECKOUT PROCEDURE

This procedure is based on the assumption that MAPs 7-1 and 7-2 were successfully completed.

- Power down.
- Wait 5 seconds.
- Power up.
- Set all keyboard switches down.
- Load a diskette.
- Press FUNCT SEL lower  
ENTER
- Press numeric keys 1 through 9 and SP several times.

Do the correct ALPHA SHIFT characters appear on the display?

Y N

- Use MAP 4-2.
- Press REC BKSP
  - space bar (not SP) 5 times
  - REC ADV
  - REC BKSP

Are the first 5 character positions of the previously entered record blanked?

Y N

- Use MAP 4-2.
- Press NUM SHIFT and each numeric key (0 through 9) several times.

Do the correct NUM SHIFT characters appear on the display?

Y N

- Use MAP 4-2.
- Press REC BKSP
- Hold down NUM SHIFT and press SP 5 times.
- Press REC ADV
  - REC BKSP

Are the first 5 character positions of the previously entered record blanked?

Y N

- Use MAP 4-2.

PROOF KEYBOARD FEATURE CHECKOUT  
PROCEDURE IS COMPLETE FOR ONE  
STATION. —

- For second station, repeat proof keyboard checkout procedure.

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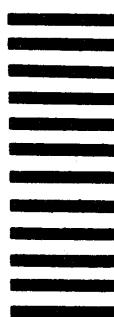
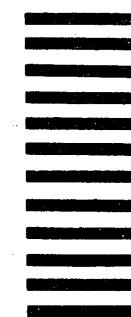
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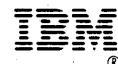
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