IBM Maintenance Library

3741 Data Station
Theory-Maintenance

EC 823146	825853	825979	825958	826065	PN 1607500
10/30/74	11/15/74	12/20/74	3/21/75	5/16/75	

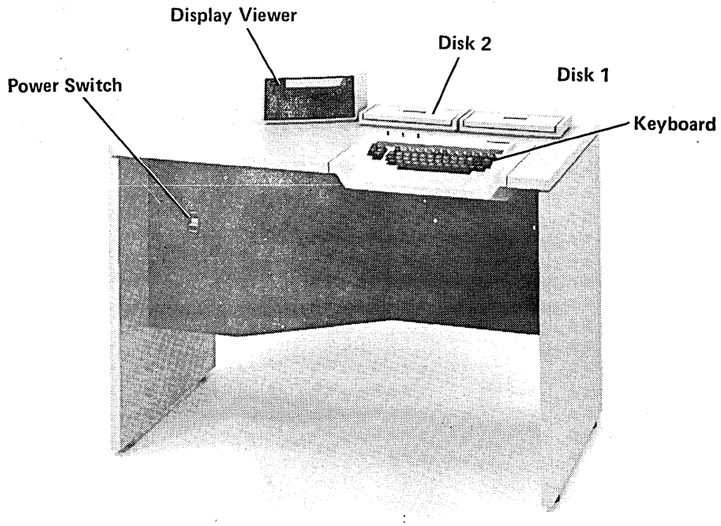
PREFACE

This is the only manual you need to maintain the IBM 3741 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, or use the *Basic Machine Checkout Procedure,* MAP 7-1. If the symptom changes during machine warm-up, use the last symptom to start the call. If there are no specific symptoms to guide you, use MAP 7-1.

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

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



IBM 3741 Data Station

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 water on covers, CRT face, CRT filter, CRT mirror, and keyboard.

Sixth Edition (August 1975)

Changes are continually made to the specifications herein. This manual is under EC control and will be updated with each Engineering Change applied to the machine this manual accompanies.

Do not use this manual to service other machines as they can have features not included in this manual, or they can be at a different EC level.

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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 Practices 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 a 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. Lift by standing or pushing up with stronger leg muscles — this takes strain off back muscles. Do not lift any equipment or parts weighing over 60 pounds.
11. All safety devices such as guards, shields, signs, ground wires, etc. shall be restored after maintenance.
12. Each Customer Engineer is responsible to be certain that no action on his part renders product unsafe or exposes hazards to customer personnel.
13. Place removed machine covers in a safe out-of-the-way place where no one can trip over them.
14. All machine covers must be in place before machine is returned to customer.
15. Always place CE tool kit away from walk areas where no one can trip over it (i.e., under desk or table).
16. Avoid touching mechanical moving parts (i.e., when lubricating, checking for play, etc.).
17. When using stroboscope — do not touch ANYTHING — it may be moving.
18. Avoid wearing loose clothing that may be caught in machinery. Shirt sleeves must be left buttoned or rolled above the elbow.
19. Ties must be tucked in shirt or have a tie clasp (preferably nonconductive) approximately 3 inches from end. Tie chains are not recommended.
20. Before starting equipment, make certain fellow CE's and customer personnel are not in a hazardous position.
21. Maintain good housekeeping in area of machines while performing and after completing maintenance.

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

Rescue Breathing for Adults
Victim on His Back Immediately

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

Continue rescue breathing until he breathes for himself.

Artificial Respiration
GENERAL CONSIDERATIONS

1. **Start Immediately, Seconds Count**
   Do not move victim unless absolutely necessary to remove from danger. Do not wait or look for help or stop to loosen clothing, warm the victim or apply stimulants.
2. **Check Mouth for Obstructions**
   Remove foreign objects — Pull tongue forward.
3. **Loosen Clothing — Keep 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.

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CRT SAFETY

You must be especially aware of the dangerous voltages present in a 3741 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 3741. 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.

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Date 11/15/74	3/21/75	8/1/75	

CE'S QUICK REFERENCE TO FEATURE INFORMATION

At machine installation time, indicate the presence of factory installed features by filling in *Install Date* Fill in others when you install the field bills.

Install Date	Feature	Model 1	Model 2
_____	BSCA	Not available	Standard
_____	Feature group A Production statistics Verify Self-check (modulus 10 and modulus 11) Field totals (online) Field totals (offline) Disk initialization	Optional	Optional
_____	Expansion feature (feature E) Printer adapter (3713, 3715, 3717) Second disk adapter	Optional	Optional
_____	Second disk	Optional	Optional
_____	Printer (3713, 3715, 3717)	Optional	Optional
_____	Synchronous clock	Not available	Optional
_____	Terminal identification	Not available	Optional
_____	Keylock	Not available	Optional
_____	Operator ID card reader	Not available	Optional
_____	1200 bps line adapter (non-switched, switched)	Not available	Optional
_____	Expanded BSCA	Not available	Optional
_____	Multipoint data-link control	Not available	Optional
_____	Record insert	Optional	Optional
_____	Proof keyboard	Optional	Optional
_____	Katakana (five added program storage areas)	Optional	Optional
_____	Data recorder attachment	Optional	Optional
_____	I/O adapter	Optional	Optional

RPQs _____

Note: Refer to Chapter 16 for information about printer and communications jumpering.

Information to complete the following is available from customer engineering field management or the account salesman.

Machine type _____ Model _____ Serial number _____

CPU identification of line, or multipoint polling address _____

Type of service (switched, non-switched, 2w/4w, private) _____

Modem type _____ Line speed _____ BPS

Common carrier line identification _____

Remote machine type _____

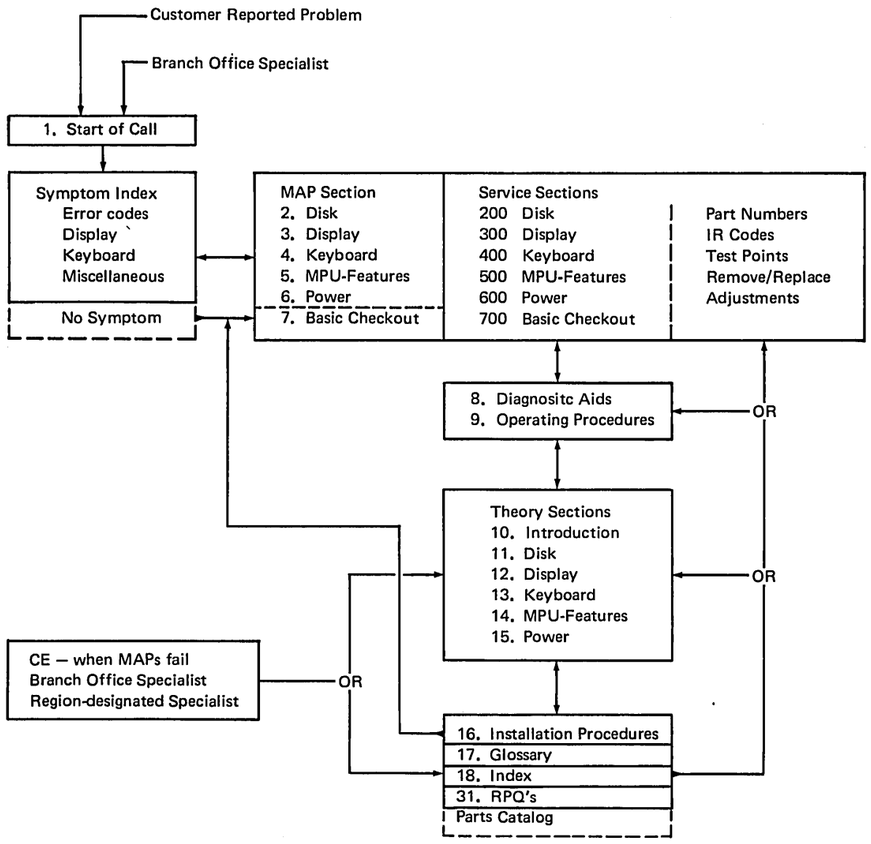
Location _____ Telephone number _____

Customer contact at remote location _____

Communications facility contacts responsible for this system:

	Name	Telephone
Modem	_____	_____
line	_____	_____
	_____	_____
	_____	_____

NORMAL SERVICE FLOW IN USE OF THE MLM



MAP RULES SUMMARY

For other information, see *How to Use This Manual,* page 10-5.

- *Start of Call,* page 1-1, ensures that the highest priority symptom index group is used.
- Use the most consistent symptom after power up. Use the last error code to be displayed.
- The 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,* page 1-1, with the new symptom.
- If you cannot decide which MAP to use, use MAP 7-1, the *Basic Machine Checkout Procedure.* MAP 7-1 guides you to the correct MAP.
- When asked to probe or measure multiple points in a table, probe or measure only until a failure is indicated.
- If a probe is connected to its machine power source, the UP and DOWN lights momentarily flash on during power up. Please ignore this situation.

Definitions

- DISCONNECT – physically/electrically take apart.
- LOAD a diskette – close the disk drive cover (with a diskette in the drive). Usually at the faulty station.
- MEASURE – use IBM CE multimeter, PN 452796.
- ORIGINAL keyboard or disk drive – the keyboard or disk drive located at the station with reported fault.
- OTHER keyboard or disk drive – the opposite of original keyboard or disk drive.
- POWER DOWN – turn power switch OFF.
- POWER UP – turn power switch ON. Always wait at least five seconds after a power down before powering up to allow for proper power-on reset (POR).
- PROBE – use IBM universal logic probe, PN 453212.
- RECONNECT – physically/electrically put back together.
- REMOVE a diskette – take the diskette out of the disk drive.
- REPLACE – put new part in place of original part.
- REINSTALL – put original part back in place of new part.
- RESEAT – remove, unplug, unfasten, or detach an object from its position or mounting and put the same object back in its place again.
- UNLOAD a diskette – open the disk drive cover (does not mean remove).

START OF CALL

Is there an RPQ installed? — — — — — — — — — — — — — — — A checkmark in the Y or N box indicates the MAP path to follow. If neither box is checkmarked, determine if an RPQ is installed by looking at the machine history card and for an RPQ Section 31 in this ML. Checkmark the appropriate Y, N box and continue down that MAP path.

Y ☐ N ☐

Is there a valid error code displayed or reported? — — — — — — — — — — — — — — —

SYMPTOM INDEX

INDEX OF VALID ERROR CODES

See page 9-2 for error code locations on the display.

All Models

Code Display Position 4 5 6 7 8 9 10	Page
0 ? ?	1-2
1	
2	
2 ? ?	
3	
3 ? ?	
4	
4 ? ?	
5	
5 ? ?	
6	
6 ? ?	
7	
7 ? ?	
A	
A 4	
B	1-3

Code Display Position 4 5 6 7 8 9 10	Page
B 4	
C	
D	1-4
D 0	
D 3	
D 5	
E	
F	
G	1-5
H	
I	1-6
J	
K	
L	
M	1-7
N	
N ? ?	
O	

Code Display Position 4 5 6 7 8 9 10	Page
P	
Q	1-8
R	
R 0	
R 1	
R 2	
R 4	
S	
T	1-9
U	
U 0	
U 1	
U 2	
U 3	
U 4	
V	
W	

Code Display Position 4 5 6 7 8 9 10	Page
W 0	1-10
W 5	
W 6	
X	
Y	
Z 5	
Z 6	
'	
+	
=	
★	
>	
(	
&	
A 1	1-11
A 2	
A 3	

Code Display Position 4 5 6 7 8 9 10	Page
A 4	
A 5	
A 6	
A 8	
A 9	
y z 0 x	1-12.1
y z 0 2	
y z 1 x	
y z 2 x	
y z 3 x	
y z 4 x	
y z 5 x	
y z x ? ?	1-12.2
y z 9 1	
y z 9 2	
y z 9 5	
y z 9 6	

Code Display Position 4 5 6 7 8 9 10	Page
y z 9 7	
y z 9 8	
y z 9 9	
y z A x	
y z B x	
y z C 1	1-12.3
y z C E x	
y z V x	
y z W x	
y z X x	
y z Z	
y z 8 1	
y z 8 2	
y z 8 4	
y z 8 6	
y z 8 7	
y z 8 8	

Models 3 and 4 Mode

Code Display Position 4 5 6 7 8 9 10	Page
P 1	1-1.7
P 2	
P 3	
P 4	
2 P y	
4 P y	
5 P y	1-1.8
6 P y	
7 P y	
8 P y	
9 P y	
1 0 P y	
1 1 P y	
1 2 P y	
1 3 P y	
1 4 P y	
1 5 P y	
1 6 P y	
x 0	1-1.9
x 2	
x 3	

Code Display Position 4 5 6 7 8 9 10	Page
x 4	
x 5	
x 7	1-1.10
x 8	
x 9	
x B	
x C	1-1.11
x D	
9 0	
9 1	
9 2	
1 0 0	
1 5 0	
1 5 1	
1 5 2	
1 5 3	1-1.12
1 5 4	
1 5 5	
2 0 0	
2 0 1	
2 0 2	

Code Display Position 4 5 6 7 8 9 10	Page
2 0 3	
2 0 4	1-1.13
2 0 5	
2 0 6	
2 0 7	
2 5 3	
2 5 5	
5 x 0	
5 x 1	1-1.14
5 x 2	
5 x 3	
5 x 4	
5 x 5	
5 x 6	
5 x 7	
5 x 8	
5 x 9	1-1.15
5 x ?	
5 x A	
6 x 0	
6 x 3	1-1.16

Code Display Position 4 5 6 7 8 9 10 34 35	Page
6 x 4	
6 x 5	
6 x 8	
6 x 9	1-1.17
7 x 0	
7 x 2	
7 x 3	1-1.18
7 x 4	
7 x 5	
7 x 7	
7 x 8	
7 x 9	1-1.19
7 x B	
7 x C	
7 x D	
7 x E	
8 8 1 y z	1-12.5
8 8 2 y z	
8 8 4 y z	
8 8 6 y z	
8 8 7 y z	

Code Display Position 4 5 6 7 8 9 10 34 35	Page
8 8 8 y z	
8 8 9 y z	
8 x 0 y z	
8 x 2 y z	
8 x 3 y z	1-12.6
8 x B y z	
8 x C y z	
8 x E y z	
8 x F y z	
8 x G y z	
8 x W y z	
9 x 0	
9 x 1	1-1.20
9 x 2	
9 x 3	
9 x 4	
9 x 5	
9 x 6	
1 y y y	
S 0	1-1.21
O 0	

Code Display Position 4 5 6 7 8 9 10	Page
S 3	
O 3	
S 4	
O 4	
S 5	
O 5	
S 8	1-1.22
O 8	
S 9	
O 9	
S 1 0	
O 1 0	
S 1 1	
S 1 2	
O 1 4	
O 1 5	1-1.23
O 1 6	
O 1 7	
O 1 9	
H in column 1	1-5

ERROR CODE DESCRIPTION

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
					?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				0			2-6	Early diskette removal	– Removed the diskette while disk operations were in process. – Removed the diskette while not on the index track.	– Load a diskette. Press RESET.
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted to print.	
				1			2-2	Length	– Record length was incorrect for this disk operation.	– Hold down NUM SHIFT and press RESET. Use the correct record length.
				2			2-2	No record found	– The disk read ERP failed because the ID field was not found.	– Hold down NUM SHIFT and press RESET.
				2	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				3			2-9	Seek (record insert)	– Seek error. An auto return to the index track is performed with the EOD being updated. Duplicate records can exist in the data set. The hold buffer is not blanked.	– Hold down NUM SHIFT and press RESET.
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted to print.	
							2-9	Seek	– Seek ERP failed because a track match did not occur.	– Hold down NUM SHIFT and press RESET.
				3	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				4			2-2	Read	– Disk ERP failed with a read error. The first record written on the disk after the read error can be incorrect.	– Hold down NUM SHIFT and press RESET.
				4	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				5			2-4	Write	– Disk write and write check ERP failed.	– Hold down NUM SHIFT and press RESET.
				5	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				6			2-2	Deleted record (D in position 001)	– Last record read has a control address mark (such as is required for a deleted record).	– Hold down NUM SHIFT and press RESET. Press REC ADV. If the error occurred on the index track, change position 1 to an H, press FUNCT SEL lower, M, and REC ADV.
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted to print.	
				6	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
				7			2-2	Address	– A newly developed disk address is out of the current extent for a data set or is off the disk.	– Hold down NUM SHIFT and press RESET. Use a correct address.
				7	?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
			A				2-1	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 diskette.
			A	4			No MAP	Read error ID	– Read error on the index track followed by the detection of a source data set label.	– Remove the diskette.

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ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			B				2-1	Bad data set label	– One of the following conditions existed when you attempted to select a mode from track 00: 1. The last record read and currently displayed is from track 00, records 01 through 07. 2. Position 4 of the header field in the data set label does not contain a 1. 3. The data set label is flagged with a control address mark (such as is required for a deleted record).	 – Press RESET and REC ADV. – Press RESET and enter a 1 in position 4, press FUNCT SEL lower, M, and REC ADV. – Enter H in position 1, press FUNCT SEL lower, M, and REC ADV.
									– BOE is less than track 01, record 01.	– Press RESET and enter the correct BOE. Then press FUNCT SEL lower, M, and REC ADV.
									– EOE is greater than track 74, record 26.	– Press RESET and enter the correct EOE. Then press FUNCT SEL lower, M, and REC ADV.
									– EOE is less than BOE. EOE and/or BOE are incorrect.	– Press RESET and enter the correct entries. Then press FUNCT SEL lower, M, and REC ADV.
									– BOE, EOE, or EOD is zero.	– Press RESET and enter the correct entries. Then press FUNCT SEL lower, M, and REC ADV.
									– EOD is less than BOE. EOD and/or BOE are incorrect.	– Press RESET and enter the correct entries. Then press FUNCT SEL lower, M, and REC ADV.
									– BOE, EOE, or EOD record is greater than 26.	– Press RESET and enter the correct entries. Then press FUNCT SEL lower, M, and REC ADV.
									– EOD is greater than EOE plus 1.	– Press RESET and enter the correct EOD. Then press FUNCT SEL lower, M, and REC ADV.
									– EOD is greater than track 75, record 01.	– Press RESET and enter the correct EOD. Then press FUNCT SEL lower, M, and REC ADV.
									– Record length (positions 23 through 27) is greater than 128 or equal to zero. – Non-numeric characters are in positions where numeric characters are required in the data set. – Head specification is not zero.	– Press RESET and enter ⌀⌀128 in positions 23 through 27. Then press FUNCT SEL lower, M, and REC ADV. – Press RESET and re-enter, press FUNCT SEL lower, M, and REC ADV. – Press RESET and re-enter head 0, press FUNCT SEL lower, M, and REC ADV.
			B	4			2-4	Write test	– Write gate error.	– Unload and load the diskette.
			C				4-2	Self-check	– The self-check digit does not compare properly. – The self-check field is blank in verify (V) mode.	– Press RESET, FIELD BKSP, and re-enter the field. – Press RESET and enter the self-check digit.
							7-7	Communications line check	– There is no activity on the communications line for 20 seconds or no initial linkup can be established with the remote end.	– Note the displayed address. Call the remote end to re-establish linkup. Establish start point on the disk. Enter communications (C) mode.
			D				7-7	Communications disk full	– Disk overflows in receive mode. – Disk index track overflows. – No valid index. – No disk 2.	– Press RESET. Load a new diskette. Enter communications (C) mode. Call the remote end to re-establish linkup.
							2-6	Disk 2 not ready	– A disk 2 record advance was attempted with one of the following conditions existing: 1. Disk 2 unit is not installed. 2. Disk 2 is not ready.	– Press RESET. Wait until disk 2 is ready, then continue processing. If the disk 2 feature is not installed, use a machine that has disk 2.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			D	0			2-6	Diskette removed	– Removed the diskette while waiting for a disk error to be cleared on record insert mode. The EOD in the data set label is not updated. Duplicate records can exist in the data set. The hold buffer is not blanked.	– Load a diskette. Hold down NUM SHIFT and press RESET.
			D	3			2-9	Seek	– Seek ERP failed because a track match did not occur.	– Hold down NUM SHIFT and press RESET.
			D	5			2-4	Write error	– The record at the currently displayed disk address was written in error. The record was one of the deleted records being inserted.	– Press RESET.
			E				2-2	End of extent	– Attempted to read from disk 2 beyond the last record in the data set. – Attempted to write to disk 1 beyond EOE. – The last non-deleted record is verified. (This is not an error.)	– Press RESET and continue the job on another data set or diskette. – Press RESET and change EOE in the disk 1 data set label. – Press RESET and continue.
			F				4-2	Function not available	– The key pressed after FUNCT SEL is not valid. – The selected function is not installed	– Press RESET and the valid key. – Move the job to another machine where the function is installed.
							No MAP	Invalid condition	– The key pressed following FUNCT SEL lower and M is not REC ADV or DELETE REC.	– Press RESET and REC ADV to write the label on the disk or press DELETE REC to delete the label.
							7-5	Printer function not available 3713	– The selected function is not installed.	– Move the job to another machine where the function is installed.
							7-19	3715	– The selected function is not installed or the machine failed.	– Move the job to another machine where the feature is installed.
							Use *3717 MLM*	3717	– The printer jumpers are incorrectly installed.	– Install the jumpers correctly.
							5-40	Data recorder function not available	– The selected function is not installed or the machine failed.	– Move the job to another machine where the function is installed.
							7-7	Communications function not available	– BSCA or EBSCA function not installed. – Keying error. – Machine failure.	– Press RESET, FUNCT SEL upper, and COMM.
							7-21	I/O adapter function not available	– The selected function is not installed. – Keying error.	– Press RESET and rekey.
			G				4-2	Write protect	– Enter (E) or verify(V) mode is selected and the data set is protected. – Attempted to write to the disk with the data set protected. – At EOD minus 1 of a data set in update (U) mode, and using REC ADV when the data set is protected.	– Press RESET and select update (U) mode. – Press RESET and either change the label or press REC ADV to a proper label. – Press RESET and either change the data set label or use a different data set.
							7-7	Communications write protect	– The first data set label available for receive is write-protected.	– Press RESET, and change the data set label or use a different diskette for receive.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			H				4-2	Copy Setup	– After pressing COPY: 1. The disk 2 address is less than track 00, sector 08. 2. After loading a diskette in disk 2, you must press DISK 2 REC ADV to display the first data set label (00008). This error occurs if you do not press DISK 2 REC ADV to display a data set label prior to copy setup. 3. COPY was not pressed with any shift key. – Disk 1 is on track 00 but disk 2 is not on track 00. – SEARCH SEQ CONTENT was pressed in copy setup.	– Press RESET and advance to the proper disk 2 address. – Press RESET, FUNCT SEL upper, and DISK 2 REC ADV. – Press RESET and ALPHA SHIFT or NUM SHIFT with COPY. – Press RESET, FUNCT SEL upper, and DISK 2 RET TO INDEX. – Press RESET and the correct key.
							7-7	Communications setup error	– Machine is not in X or U mode before C mode. – Cursor is past position 16 when entering C mode. – Machine is at bad index when entering C mode. – Keylock is not turned on. – A transmit mode (T, P, or J) was selected after print unattended. – Inquiry mode was selected and the record length of the data set was not 128. – Receive mode or inquiry mode was selected and the first data set EOE was greater than 73026. – Communications was entered from update (U) mode and current disk address is greater than 73026. – Inquiry mode was selected from update (U) mode and EOD is greater than 73026. – An invalid CE test mode was selected. – Print unattended function is selected and AUTO REC ADV is OFF. – Receive data and insert constants program is not the same length as the record length on the data set selected from update (U) mode.	– Press RESET. Use the correct setup procedure.
							7-21	I/O adapter setup error	– Invalid mode selected.	– Press RESET. Use the correct setup procedure.
			I				4-2	Search address	– Search address contains a non-decimal character. – Search address is not valid. – Search address is not within the extents of the data set.	– Press RESET. Use a valid search address.
							7-7	Communications data set not ready	– Modem 'data set ready' line has gone off prematurely.	– Note the displayed address. Call remote end to set-up the line connection again. Determine the start point on disk. Enter communications (C) mode.
							4-2	Number of records	– Number of records specified is not 01 through 99 (00 gives an I error or above, 99 reads the first 2 columns only). – Insufficient room is in the data set to insert the number of records specified. The number of records to be inserted must be equal to or less than EOE minus EOD plus 1.	– Press RESET, then press NUM SHIFT and enter the number of records to be inserted. Press FUNCT SEL lower and RIGHT ADJ. – Press RESET. Check data set.
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted a print operation.	

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			J				7-5	Print to EOD	– This error occurs when the printer has printed the last record of the current disk of a continued data set.	– Press RESET. Remove the diskette. Load the next diskette. Press FUNCT SEL upper. Hold down NUM SHIFT and press PRINT TO EOD.
			K				4-2	Keying	– Numeric shift A or Z key was pressed. – PROG NUM SHIFT switch is set to the NUMBERS ONLY position and the character keyed is not 0 through 9, –, space, +, any alpha shifted characters, or while in a program numeric field. – The data key pressed following the HEX key is not a valid hex digit. – An invalid key code (a World Trade key code was detected in a United States machine). – KANA SYMB and a non-Katakana key were pressed together on a Katakana machine.	– Press RESET. Press only valid keys.
			L				4-2	Incorrect function	– CHAR ADV was pressed in verify (V) mode. – DISPLAY PROD STAT was pressed when not in read index (X) or enter (E) mode. – FIELD ADV was pressed in verify (V) mode. – REC BKSP was pressed in field correct (C) mode. – REC ADV is not valid in field correct (C) mode.	– Press RESET. Press only valid keys.
			M				4-2	Mode selection	– Selected COPY mode from update (U), verify (V), or field correct (C) mode. – Selected enter (E) mode from other than index (X) mode. – 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. – Attempted the modify index function (FUNCT SEL lower, M) while not on track 00. – Selected search (S) mode from verify (V) or field correct (C) mode. – Selected SEARCH CONTENT or SEARCH SEQ CONTENT from verify (V) or field correct (C), or selected SEARCH CONTENT from enter (E) mode. – Selected update (U) mode from enter (E) mode or from search (S) mode when search was selected from enter (E) mode. – Selected verify (V) mode from enter (E) or search (S) mode. – Selected offline field totals from verify (V) mode or field correct (C) mode. – Selected communications mode from verify (V), enter (E), or search (S) mode. – Selected PROG LOAD in verify (V) or field correct (C) mode. – Selected PRINT TO EOD in verify (V) or field correct (C) mode. – FIELD COR pressed when not in verify (V) mode. – Disk initialization selected when 3741 was not in index (X) mode. – Pressed DISPLAY PROG with either shift key while in verify (V) or field correct (C) mode. – Pressed SEL PROG while in field correct (C) mode. – Selected SEARCH CONTENT when on the last record in the data set.	– Press RESET. Perform proper mode selection.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			N				4-2	Keyboard overrun	– Keying rate exceeded machine capacity.	– Press RESET and continue.
			N		?	?	2-4	Write test	– Write gate error.	– Unload and load the diskette.
			O				4-2	Operation	– Pressed DISPLAY FIELD TOTALS when not at the first position of a field.	– Press RESET and move the cursor to the first position of the field.
									– While in a right-adjust field, pressed DUP when not at the first position of the field.	– Press RESET and move the cursor to the first position of the field.
									– Pressed SEL PROG when the current program is not on a field boundary.	– Press RESET and move the cursor to the first position on the field.
									– While in enter (E) mode, right-adjust field, pressed REC ADV while not at the first position of the field.	– Press RESET and move the cursor to the first position of the field.
									– Pressed REC ADV after pressing any search key with NUM SHIFT.	– Press RESET, FUNCT SEL upper, and DISK 2 REC ADV.
									– Pressed RIGHT ADJ while not in a right-adjust field except when at end of the record.	– Press RESET and move the cursor to right-adjust field.
									– Pressed SKIP DUP, REC ADV, or in a right-adjust field and not at the first position of the right-adjust field.	– Press RESET and move the cursor to the first position of the right-adjust field.
									– Pressed DISPLAY PROD STAT in enter (E) mode:	
									1. While not in program level 0.	– Press RESET and select program level 0.
									2. With the cursor not in position 1.	– Press RESET and move the cursor to position 1.
									– SKIP, DUP, or REC ADV pressed in a self-check field and not at start of the self-check field.	– Press RESET and move the cursor to the start of self-check field.
			P				4-2	Program	– The key pressed following SEL PROG or PROG LOAD is not a valid program number.	– Press RESET and enter a valid program number.
									– Selected a new program while not at a field boundary.	– Press RESET and move the cursor to a field boundary.
									– Invalid begin field character.	– Press RESET and enter a valid begin field character in the program.
									– The first position of a program buffer is a continue field character.	– Press RESET and enter a begin field character in the first position.
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted a print operation.	
			Q				4-2	Field totals	– No . (period) or digit follows the format character. – The position number is greater than 128. – No N or W follows the position number. – An invalid character follows the mask. – Format 1 to 9 or A not specified in the mask statement. – No < sign found at the beginning of the format statement.	– Press RESET. Rewrite the control statement.
							7-7	Communications message aborted	– Received 4 consecutive negative responses to the same data record.	– Note the displayed address. Call the remote end to re-establish linkup. Establish the start point on the disk. Enter communications (C) mode.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			R				7-7	Communications remote end abort	– Remote end terminates communications prematurely by sending EOT or disconnect (DLE EOT).	– Note the displayed address. Call the remote end to set up the line connection again. Determine the start point on the disk. Enter communications (C) mode.
							4-2	Right-adjust	– Entered a data key after the right-adjust field was full, except in verify (V) mode. – Entered a data key after all non-fill characters were verified. – A mismatch occurred on a fill character for a right-adjust field. – Pressed – (dash) or RIGHT ADJ at the start of a field that is not all fill characters. The error occurs when the first non-fill character is encountered. – Pressed key other than RIGHT ADJ to exit the field. – Pressed RIGHT ADJ, 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.	– Press RESET and RIGHT ADJ. – Press RESET and RIGHT ADJ. – Press RESET and correct the fill character. – Press RESET and if the dash and right-adjust are correct, press FIELD COR. – Press RESET and RIGHT ADJ. – Press RESET and key correctly.
			R	0			2-6	Diskette removed	– Removed the diskette while waiting for a disk error to be cleared on record insert mode. The EOD in the data set label is not updated. Duplicate records can exist in the data set. The hold buffer is not blanked.	– Load a diskette. Hold down NUM SHIFT and press RESET.
			R	1			2-2	Length error	– Length error in record read. The record is written with a record length corresponding to the record length in the data set label. The disk address of the record written is determined as described in the R2 error.	– Press RESET.
			R	2			2-2	No record found	– The record at the displayed disk address could not be found. A blank record is written to disk at an address determined by the displayed address plus the number of records to be inserted.	– Press RESET.
			R	4			2-2	Read error	– The record read is in error. The record is written to disk at an address determined by the displayed address plus the number of records to be inserted.	– Press RESET.
			S				7-7	Operator initiated termination during communications operation	– Pressed RESET while the machine was transmitting a status message.	– Press RESET and continue.
							4-8F	Search	– The search mask did not match any record. – A disk error occurred that failed the disk ERP. The disk error is displayed in position 8 on the status line.	– Press RESET. If there is not a numeric error displayed, attempt a different search mask. If a numeric error is displayed, use that verification procedure.
			T				4-2	Operational error	– Attempted to enter data beyond the logical record length. – Pressed DISPLAY PROD STAT in enter (E) mode and the record length is less than 21. – Pressed RIGHT ADJ at the end of the record.	– Press RESET. Usually caused when AUTO REC ADV is OFF. Press REC ADV. – Press RESET. Change the record length to 21. – Press RESET. Press REC ADV.

(continued)

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			T (continued)				7-7	Communications transparency error	– Detected a data link control character in the data to transmit. – SYN, EOT, DLE, NAK, ENQ, ETB, ETX, ITB, STX, or SOH in T, B, J, or K mode. – IRS, or IFS in J or K mode.	– Note the displayed address. Press RESET. Correct the data on the diskette. Establish the start point on the disk. Enter communications (C) mode. Call the remote end to set up the line connection again. – Or use transparent mode of transmission (P or D mode).
							7-19	Printer attachment error	– Feature half planar ROS failed when you attempted a print operation.	
			U				7-7	Communications received data block	– Received a data block when in transmit mode.	– Press RESET. Place the machine in receive mode if the remote end intends to transmit data.
							7-5	Printer 3713	– The printer has run out of forms. – The printer has failed. – The printer left margin was changed.	– Press RESET. Check/load forms. – Power down. Wait 5 seconds. Power up.
							5-19	3715 status = 15 (line 6 position 1)	– The printer is out of forms. – The printer power switch is off. – Printer has failed.	– Press RESET. Check/load forms. – Press RESET. Turn printer power switch on.
							7-19	3715 status = ⌀3 (line 6 position 1)	– Illegal character in data.	– Press RESET. Correct illegal character or move the PROG NUM SHIFT switch to the ALL CHAR position to print blanks for illegal characters.
							Use *3717 MLM*	3717		
			U	0			2-6	Diskette removed	– Removed a diskette while waiting for a printer error to be cleared.	– Load a diskette. Hold down NUM SHIFT and press RESET.
			U	1			2-2	Length error	– Disk length error and printer error occurred during a print operation.	– Press RESET twice.
			U	2			2-2	No record found	– A no-record-found error and a printer error occurred during a print operation.	– Press RESET twice.
			U	3			2-9	Seek	– A diskette seek error and a printer error occurred during a print operation.	– Press RESET twice.
			U	4			2-2	Read error	– A diskette read error and a printer error occurred during a print operation.	– Press RESET twice.
			V				4-2	Verify mismatch	– A mismatch occurs between the current data keystroke and the data character in the record. – A character in an auto skip field is not blank. – A mismatch occurs between the characters of an auto dup field in the record and corresponding characters of the previous record.	– Press RESET. Enter in the correct character.
							7-7	Communications received line bid	– Remote end re-established communications (sent ENQ) when local end posts complete or incomplete status.	– Note the displayed address. Call the remote end to set up the line connection again. Establish the start point on the disk. Enter communications (C) mode.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			W				7-7	Communications length error	– Remote end sends record length with zero characters or greater than 128 charactres or a length different from the previous record sent. – The length of the first received record is not equal to the number of greater-than symbols (>) in the receive-data and insert-constants program. – Continuation of the data set on the second disk does not have the same record length as the initial portion of the data set on disk 1 (transmit).	– Note the displayed address. Call the remote end to set up the line connection again. Establish the start point on the disk. Enter communications (C) mode.
							7-5	Printer format	– An invalid printer format was used. – An invalid data stream control character was used.	– Press RESET. Use the correct printer format. – Press RESET. Use the correct data stream control character.
			W	0			2-6	Diskette removed	– Removed the diskette while waiting for a disk error to be cleared on record insert mode. The EOD in the data set label is not updated. Duplicate records can exist in the data set. The hold buffer is not blanked. – Removed the diskette while waiting for a printer format error to be cleared.	– Load a diskette. Hold down NUM SHIFT and press RESET.
			W	5			2-4	Write error	– 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.	– Press RESET.
			W	6			2-4	Write error	– The record at the currently displayed disk address was written with a special address mark and was not read with a special address mark.	– Press RESET.
			X				4-2	Right-adjust sign	– A sign mismatch occurred at the end of a right-adjust field in verify (V) mode.	– Press RESET. Use the correct sign in the right-adjust field.
							7-7	Communications negative line bid response	– Remote end responds with NAK or DISC (DLE EOT) to line bid.	– Note the displayed address. Call the remote end to set up the line connection again. Determine the start point on the disk. Enter communications (C) mode.
			Y				2-1	Empty data set	– Attempted verify (V) mode selection and the data set was empty. – Attempted update (U) mode selection and the data set was empty. – Attempted search (S) mode selection and the data set was empty.	– Press RESET. Enter data into the data set or choose a different data set.
			Z	5 6			2-4	Last record write error	– In enter (E) or update (U) mode, the write error occurred at EOE. – In verify (V) mode, the write error occurred on the last non-deleted record.	– Press RESET.
			(				2-4	Write check error	– Error occurred while the disk was being initialized or disk checked.	– Remove the diskette; press RESET. Load a different diskette.
			+				7-7	Communications FE test badge	– The FE test badge read correctly.	– Remove the FE test badge. Press REC ADV or insert the customer's badge.
			&				2-2	Delete record error	– Error encountered while attempting to delete records 9 through 26 on track 00.	– Remove the diskette; press RESET. Load a different diskette.

ERROR CODE DESCRIPTION (Continued)

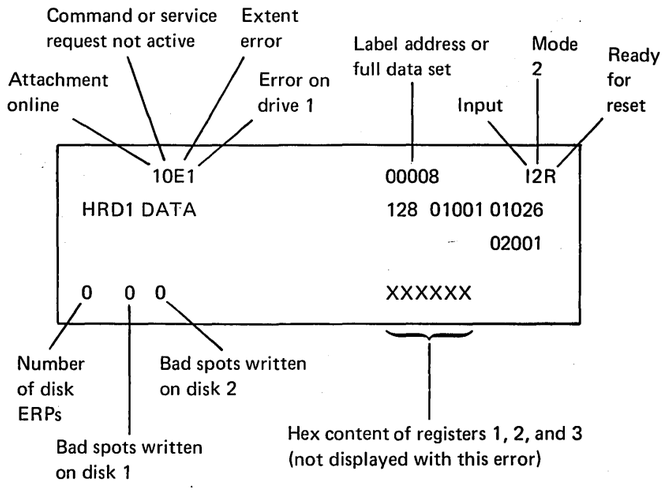
Code Display Position 4	5	6	7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
			*				2-2	Bad track specification exceeded	– More than 2 bad tracks specified on the diskette.	– Remove the diskette; press RESET. Load a different diskette.
							7-7	Communications ID reader	– The ID reader data is all 1 bits in TB mode.	– The ID reader attachment is functioning properly.
								Uninitialized diskette	– New diskette not initialized.	– See page 9-52 for procedure.
			'				2-2	Invalid input specifications	– Characters not valid or an odd number of characters specified. – Track 00 is in a bad track list. – Sequence value is greater than 13. – Tracks 78 through 99 are specified as bad.	– Remove the diskette; press RESET. Load a different diskette.
			>				7-7	Communications ID reader	– The ID reader data is all 0 bits in TB mode.	– The ID reader attachment is functioning properly.
			=				2-1	Non-ascending bad track specification	– Bad tracks are not specified in ascending sequence.	– Remove the diskette; press RESET. Load a different diskette.
		A	1				5-32	Data recorder unit error	– Data recorder attachment cable not installed. – Data recorder is not ready. – Data recorder switches not set to correct positions.	– Check the switches on the data recorder for correct position; press RESET.
		A	2				5-33	Data recorder unit jam	– Hopper empty. – Stacker full. – Transport jam. – Hopper jam (feed jam). – 129 data recorder powered up in online mode. – 129 data recorder powered up with cards in the read station.	– Place cards in the hopper; press RESET (129 needs two cards fed; press FEED). – Remove cards from the stacker; press RESET. – Clear jammed card; IBM 129—feed two cards and press VER REC; 5496—set TERMINAL switch to MANUAL, press REL, set the TERMINAL switch to TERMINAL, press 3741 RESET. – Feed two cards, press VER RES; press 3741 RESET. – Clear transport, feed two cards, and press VER RES; press 3741 RESET.
		A	3				5-35	Data recorder data error	– Read/punch data miscompare. – Character outside 256 EBCDIC characters was read.	– Read operation – place last card read in the hopper, press 3741 RESET. – Punch operation – press 3741 RESET.
		A	4				5-40	Data recorder ACL programming sequence error	– Program error.	– Press NUM SHIFT with RESET to skip the Data Recorder operation. – Press ALPHA SHIFT or NUM SHIFT with RESET to cancel entire operation.
		A	5				7-20	Data recorder format error	– Format syntax error. – Format length exceeded (128 characters).	– Press RESET; correct the format program.
		A	6				7-20	Data recorder EOE error	– Reached EOE without an end of file card read.	– Press RESET; correct deck or disk.
		A	8				7-20	Data recorder abnormal termination	– Ended operation other than reset or normal job termination.	– Press RESET.
		A	9				2-1	Data recorder no valid label on disk	– Disk is out of space during a read to EOF. – All labels are deleted.	– Press RESET; load a new disk. – Press RESET; correct deleted label.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4 5 6 7 8 9 10	Diagnostic MAP	Description	Cause	Operating Procedure

Introduction to 3741 Models 1 and 2 I/O Adapter Errors

The following display is typical of an I/O adapter error. Note that the error code is not 10E1 but is an E error on drive 1 with the attachment online and command or service request not active.



Display positions 5 and 6 are used to monitor the 3741 I/O adapter-attachment status. Although characters in these positions are not error codes, they can aid in diagnosing problems.

The x in position 8 shows the disk drive involved in the error (1 = drive 1, 2 = drive 2).

The y in position 5 shows the condition of the attachment.

- y = 0 Attachment is offline
- y = 1 Attachment is online
- y = 2 Attachment is online and busy

The z in position 6 shows the condition of the I/O adapter-attachment interface lines.

- z = 0 Command or 'service request' not active
- z = 1 Command is active
- z = 2 'Service request' line is active
- z = 3 'End of record' is active
- z = 4 'End of data set out' is active
- z = 5 'End of job out' is active
- z = 6 '3741 attention required' is active
- z = 7 'Bus in parity error' is active
- z = 8 'Attachment reset' has been issued and the 3741 is waiting for the attachment to go online
- z = A 'Sense response' received after a read or write command was issued
- z = B 'Sense response' received after 'service request' was issued
- z = C 'Sense response' received after an 'end of record' was issued
- z = D 'Sense response' received after an 'end of data set out' was issued
- z = E 'Sense response' received after an 'end of job out' was issued
- z = F 'Sense response' received after a '3741 attention required' was issued
- z = G 'Sense response' received after a 'bus in parity error' was issued
- z = H 'Response' was on before a read or write command was issued

ERROR CODE DESCRIPTION (Continued)

Code Display Position							Diagnostic			
4	5*	6*	7	8*	9	10	MAP	Description	Cause	Operating Procedure
	y	z	0	x			2-6	Early diskette removal (also see next error if x = 2) (I/O adapter)	– Diskette removed during file processing, overlapped extent scan, or update of data set labels.	– Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	0	2			2-6	Early diskette removal from drive 2 (recal) (I/O adapter)	– Diskette removed during drive 2 recalibration.	– Press RESET to continue on drive 1.
	y	z	1	x			2-2	Length error (I/O adapter)	– The record length read from the disk didn't match the record length in the data set label.	– Press NUM SHIFT with RESET to try the next record. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	2	x			2-2	No record found (I/O adapter)	– No record corresponding to the current disk address could be found.	– Press NUM SHIFT with RESET to continue operation – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	3	x			2-9	Seek error (also see next error if x = 2) (I/O adapter)	– No track with the current disk address could be found.	– Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	3	2			2-9	Seek error during drive 2 recalibration (I/O adapter)	– Track zero could not be found on drive 2.	– Press NUM SHIFT with RESET to continue on drive 1 – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	4	x			2-2	Read error (I/O adapter)	– The record at the current disk address could not be read.	– To bypass the record, hold down NUM SHIFT and press RESET. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	5	x			2-4	Write error (I/O adapter)	– The record could not be written at the current disk address.	– To bypass the record, hold down NUM SHIFT and press RESET. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.

* See page 1-12 for explanation of x, y, and z.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5*	6*	7	8*	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
	y	z		x	?	?	2-4	Write gate test (I/O adapter)	– Write gate failed.	– To continue (data will not be written and no error is posted), press RESET. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	9	1			7-21	EOJ terminate (I/O adapter)	– 3741 requested a record but received 'end of job in' in single read mode.	– Press RESET to return to XR mode and take the I/O adapter offline.
	y	z	9	2			7-21	EOD terminate (I/O adapter)	– 3741 requested a record but received 'end of data set in' in single read mode.	– Press RESET to return to 3741 mode that was active when the channel operation was requested.
	y	z	9	5			7-21	Format (I/O adapter)	– Error detected while processing a format.	– Press RESET to return to XR mode. – Correct the format program.
	y	z	9	6			7-21	End of extent (I/O adapter)	– End of extent reached prior to receiving 'EOD in' or 'EOJ in'.	– To continue, press RESET. The label will be updated and marked continued. Processing will continue with the next valid label. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to update the label, return to XR mode, and take the I/O adapter offline.
	y	z	9	7			7-21	Invalid mode for P or Q format (I/O adapter)	– A P or Q instruction was issued while on the index track or in enter mode.	– Press RESET to return to XR mode.
	y	z	9	8			7-21	Abnormal termination (I/O adapter)	– 3741 search routine terminated abnormally.	– Press RESET to return to XR mode with the I/O adapter online, or – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	9	9			7-21	No label (I/O adapter)	– No valid label after the data set for the initial label.	– Press RESET to return to XR mode with the I/O adapter online, or – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline. – Correct the diskette labels.
	y	z	A	x			2-1	Secure label (I/O adapter)	– The volume label or any data set label is marked secure.	– Replace the secure diskette. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to terminate.
	y	z	B	x			2-1	Label error (I/O adapter)	– No HDR1 label. – Bypass data set label. – Improper extents.	– Mode 1 or 2, press RESET to return to the HDR label in 3741, mode with the I/O adapter online. – If not mode 1 or 2, hold down NUM SHIFT and press RESET to continue with the next valid label. – Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.

* See page 1-12 for explanations of x, y, and z.

ERROR CODE DESCRIPTION (Continued)

Code Display Position 4	5*	6*	7	8*	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
	y	z	C	1			2-6	Drive not ready	— Operator failed to load new diskette when required.	— Replace the diskette and press RESET, or — Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	E	x			2-2	End of extent	— Data set extent has overflowed.	— Press RESET to return to XR mode with the I/O adapter online, or — Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	V	x			2-1	Volume label	— Positions 1-4 of the volume label do not contain 'vol 1'.	— Mode 1 or 2, press RESET to return to the volume label in 3741 mode with the I/O adapter online. — To bypass the volume label check, hold down ALPHA SHIFT and press RESET. — Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O offline.
	y	z	W	x			2-2	End of extent (all data received)	— There are records in the buffer that cannot be written because EOE was reached.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	X	x			2-2	Overlapped extent	— Data sets overlap; label incorrect.	— Mode 1 or 2, press RESET to return to the volume label in 3741 mode with the I/O adapter online. — If not mode 1 or 2, hold down NUM SHIFT and press RESET to continue with the first valid label. — To ignore this error, hold down ALPHA SHIFT and press RESET. — Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z	Z				2-2	Bad spots	— Special address marks were written on the disk.	— Press RESET to return to XR mode with the I/O adapter offline.
	y	z			8	1	7-21	Parity check, write to attachment	— Attachment received invalid data.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z			8	2	7-21	Parity check, read from attachment	— 3741 received invalid data.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z			8	4	7-21	Record length	— Attachment record length does not equal 3741 record length.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z			8	6	7-21	Attachment	— Attachment is unable to send data.	— Hold down NUM SHIFT and press RESET to retry operation. — Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z			8	7	7-21	Attachment issued 'EOD in' during mode 4 read from attachment.	— 'EOD in' is not a valid means of terminating mode 4.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.
	y	z			8	8	7-21	Attachment issued 'EOJ in' during mode 4 read from attachment.	— 'EOJ in' is not a valid means of terminating mode 4.	— Hold down NUM SHIFT and ALPHA SHIFT, and press RESET to return to XR mode and take the I/O adapter offline.

* See page 1-12 for explanations of x, y, and z.

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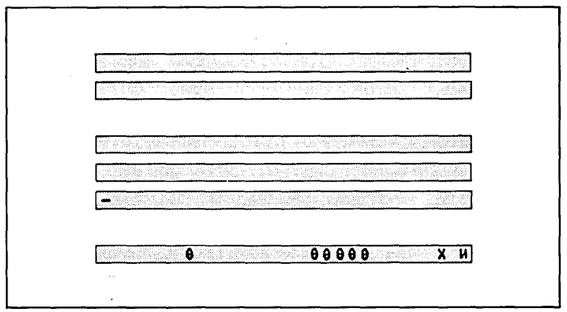
DISPLAY UNIT SYMPTOMS

- 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 diskette can be either unloaded or loaded. (Loaded is preferred.)
- Remove the viewer.
- Turn up the brightness control (observe the caution).
- 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 14, until the most similar symptom is found. Use the MAP indicated.

- Review the symptoms, starting with 23, 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.

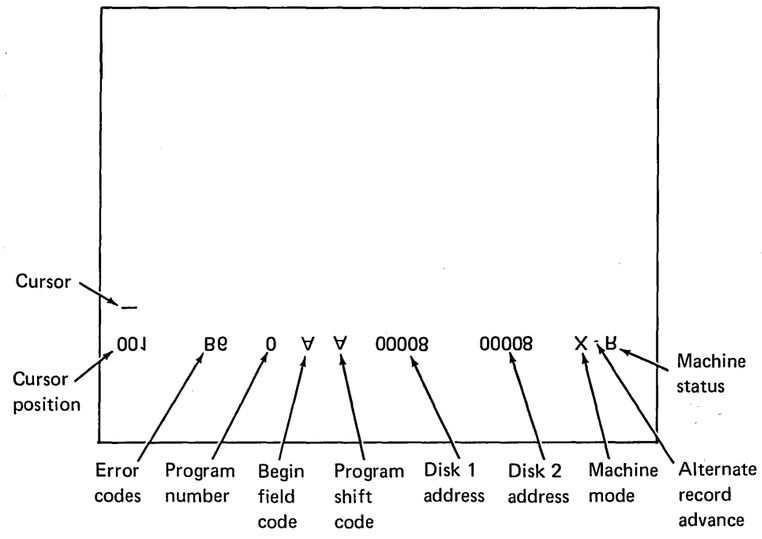
Regardless of the starting point, it is necessary to compare all succeeding display symtoms up to the one that is similar to one you have. If no similar display can be found, use the *Display General MAP* following the last picture.

All display symptoms are shown with the viewer removed, and viewed from the operator side of the machine.

Most of the symptoms are shown with a diskette 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.

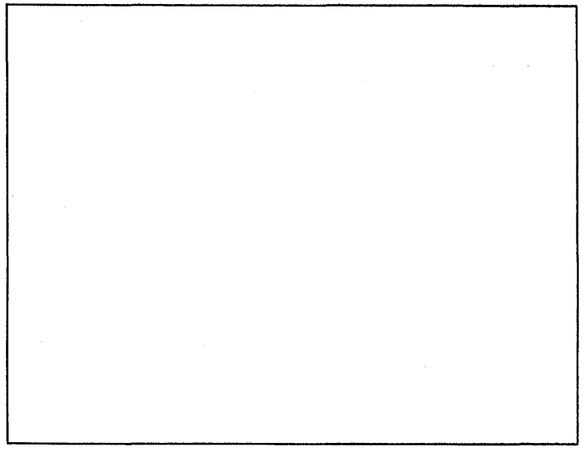
DISPLAY UNIT GLOSSARY

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 six 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. (A raster might not be displayed, except with the CE pins jumpered, on some CRTs because of normal gain variation between CRTs.)
Retrace:	The return trace for the deflection sweeps.
Video:	Pulses, which are intensified dots, that result in characters.



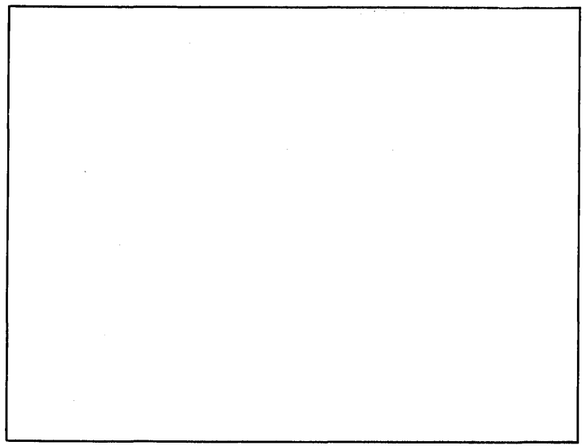
DISPLAY AND DISPLAY UNIT SYMPTOMS

1 Symptom: Blank CRT or brightness fades to blank.
Brightness control: Turned up (caution)



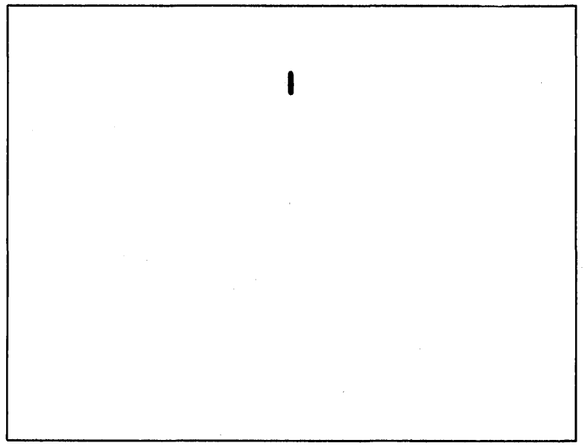
MAP 3-2

2 Symptom: Spot – can be in any location on display.
Brightness control: Turned up (caution)



MAP 3-5

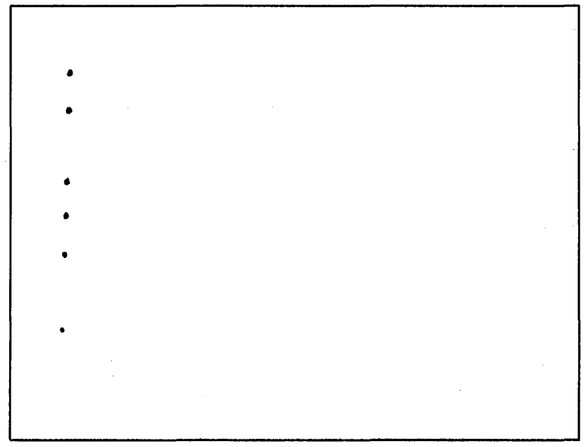
3 Symptom: Vertical bar – can be in any location on display.
Brightness control: Turned up (caution)



MAP 3-5

4 Symptom: Multiple vertical spots.

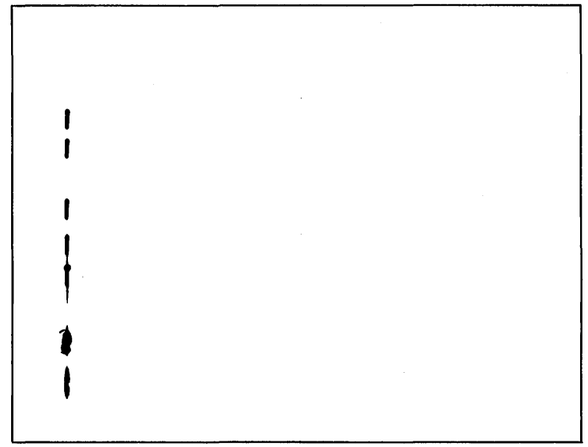
Brightness control: Turned up (caution)



MAP 3-5

5 Symptom: Multiple vertical bars.

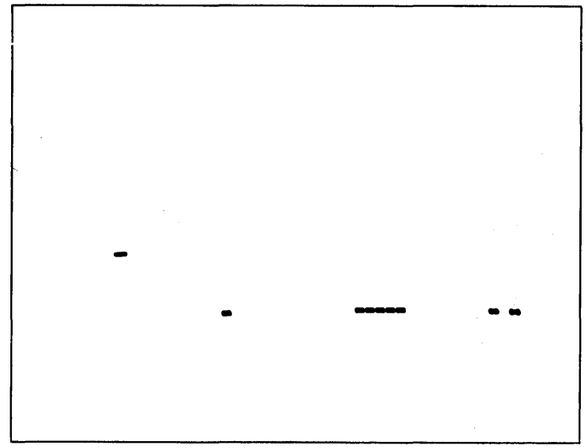
Brightness control: Turned up (caution)



MAP 3-5

6 Symptom: All characters resemble cursors.

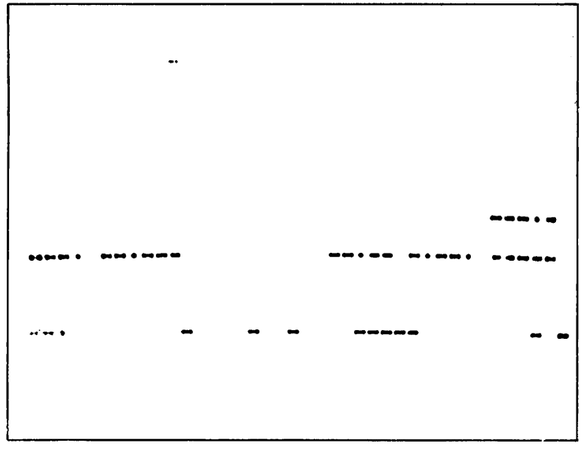
Brightness control: Normal



MAP 3-5

7 Symptom: All characters resemble cursors.

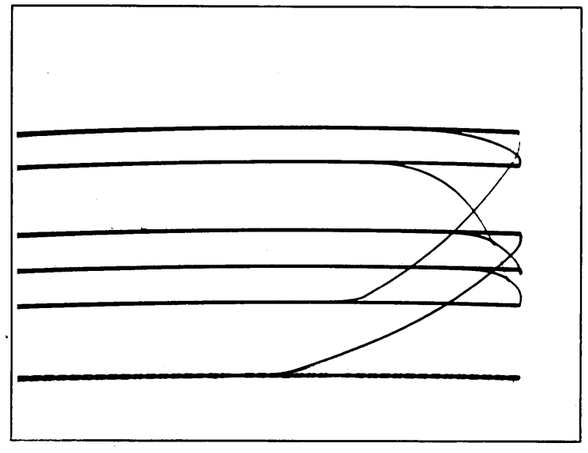
Brightness control: Normal



MAP 3-5

8 Symptom: All characters resemble cursors.

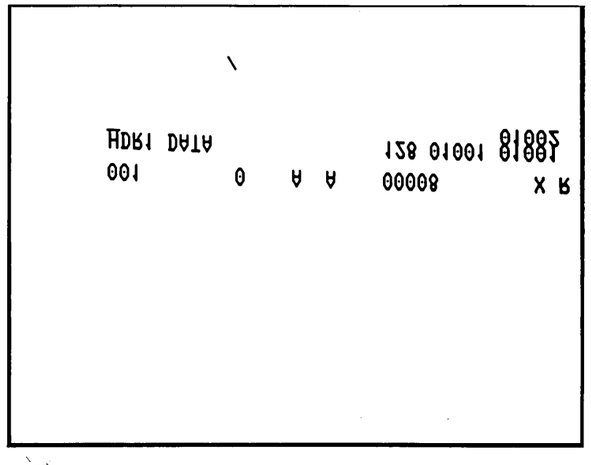
Brightness control: Turned up (caution)



MAP 3-5

9 Symptom: Lines too close together.

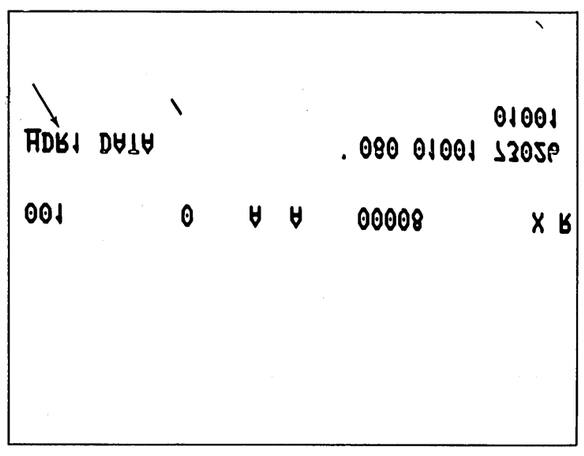
Brightness control: Normal



Map 3-5

10 Symptom: Incorrect line location.

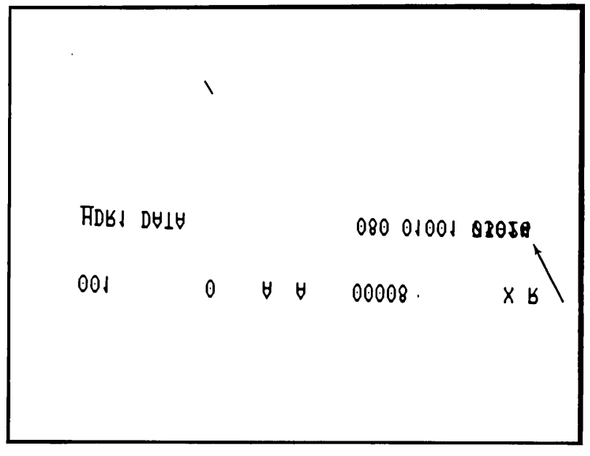
Brightness control: Normal



MAP 3-5

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

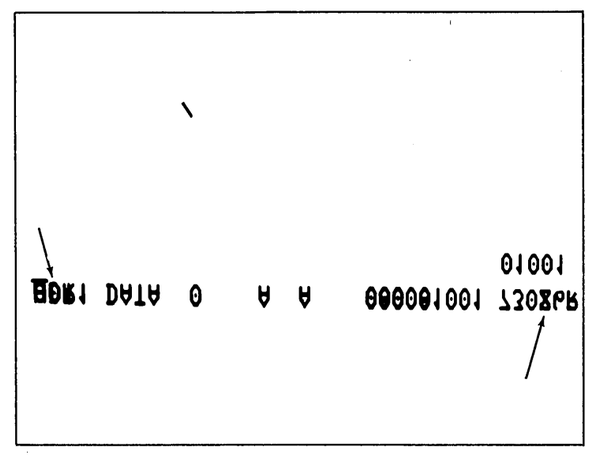
Brightness control: Normal



MAP 3-5

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

Brightness control: Normal

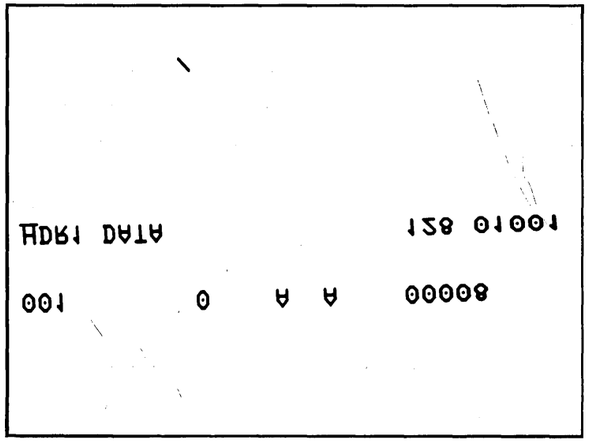


MAP 3-5

DISPLAY AND DISPLAY UNIT SYMPTOMS

13 Symptom: Excessive line length.

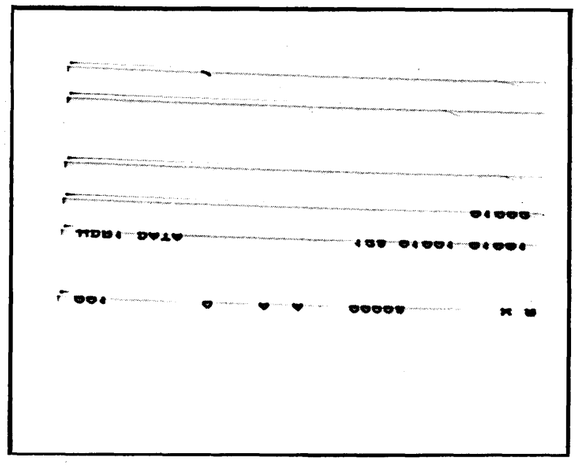
Brightness control: Normal



MAP 3-5

14 Symptom: Character height compressed.

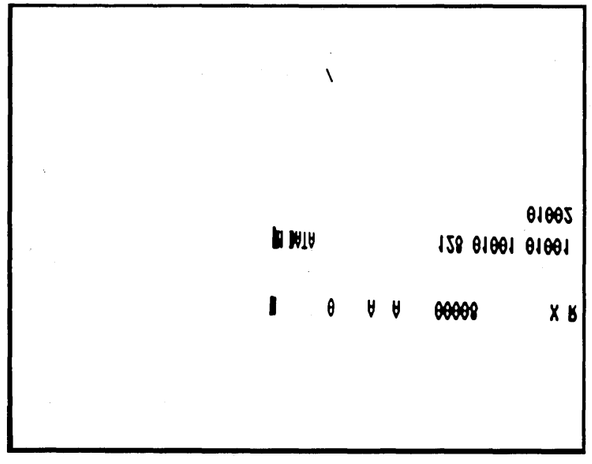
Brightness control: Turned up (caution)



MAP 3-5

15 Symptom: Lines compressed to right.

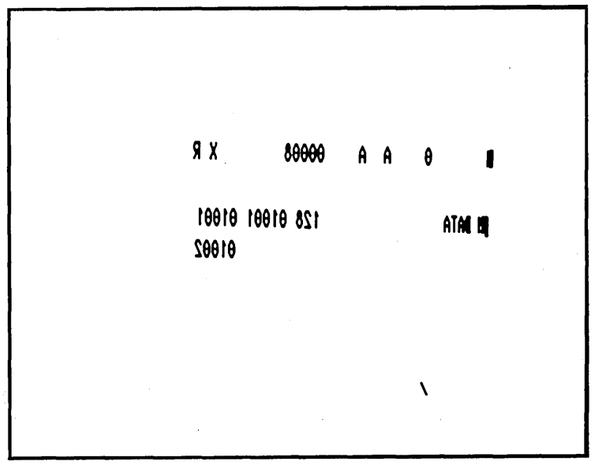
Brightness control: Normal



MAP 3-5

16 Symptom: Lines compressed to left.

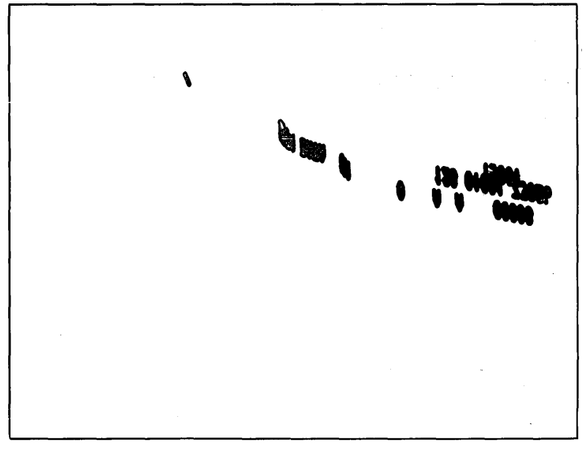
Brightness control: Normal



MAP 3-5

17 Symptom: Skewed.

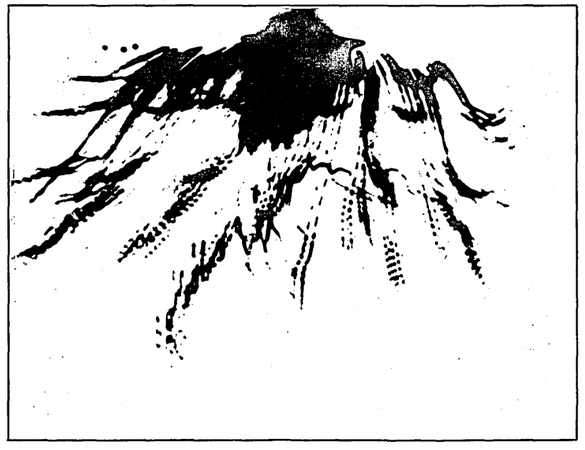
Brightness control: Normal



MAP 3-5

18 Symptom: Distorted.

Brightness control: Normal



MAP 3-5

19 Symptom: Overall enlarged display.

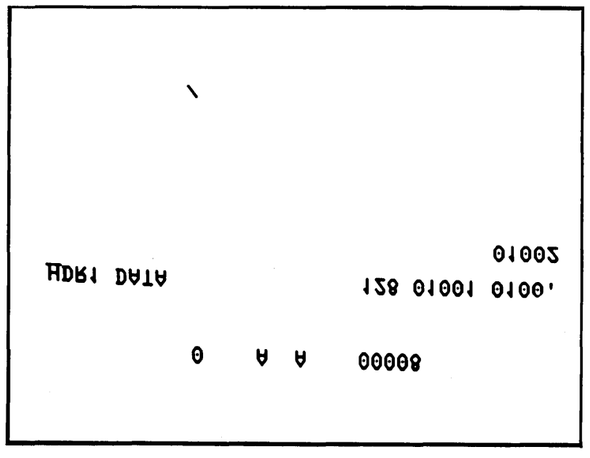
Brightness control: Normal

The raster and characters are expanded or off the display in all directions.

Adjustment procedure 311

20 Symptom: Lower right corner missing.

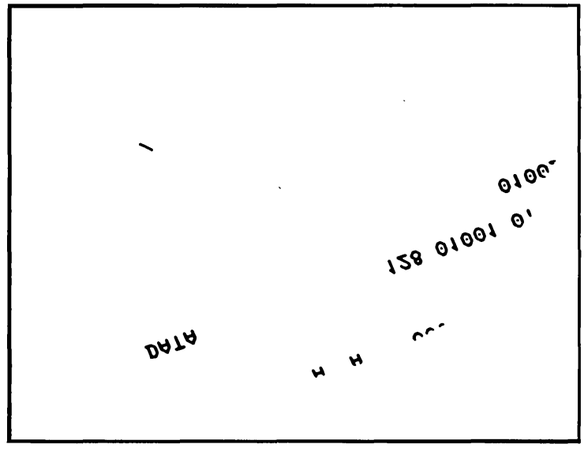
Brightness control: Normal



Adjustment procedure 311

21 Symptom: Display rotated and incomplete.

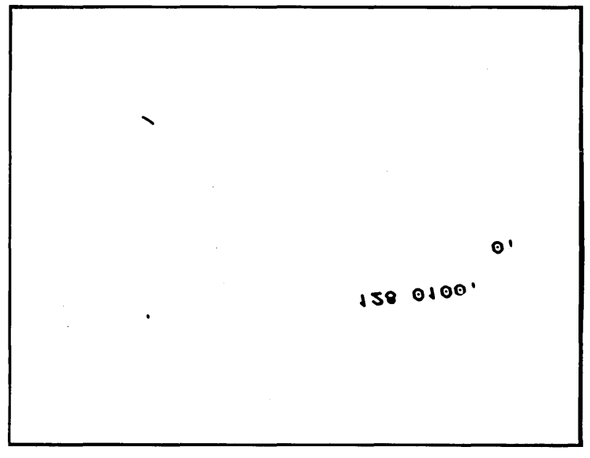
Brightness control: Normal



Adjustment procedure 311

22 Symptom: Display rotated and incomplete; characters small.

Brightness control: Normal



Adjustment procedure 311

23 Symptom: Display not centered for the operator.

Brightness control: Normal

Display not centered on mirror or operator fails to see upper or lower lines while seated in a normal position (for full display; no lines on top of each other).

Adjustment procedure 311

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

Brightness control: Normal

An excessively bright, but correct display, alternates with a blank display.

MAP 3-6

EC 823146	826065		PN 1607520
Date 9/15/74	8/1/75		

1

DISPLAY AND DISPLAY UNIT SYMPTOMS

25 Symptom: Unsteady display.

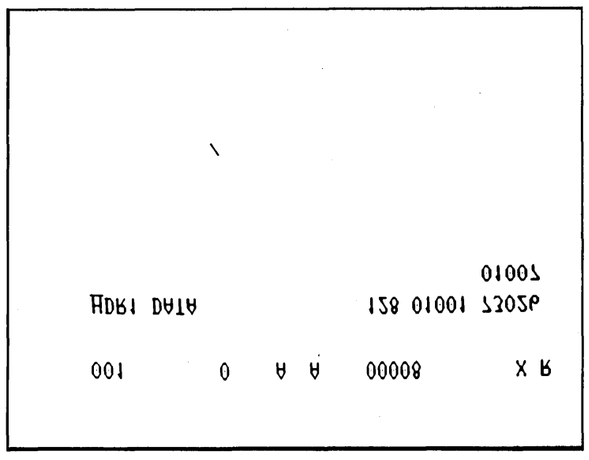
Brightness control: Normal

The data is correct but a problem to read because of the motion of the characters and/or the lines.

MAP 3-4

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

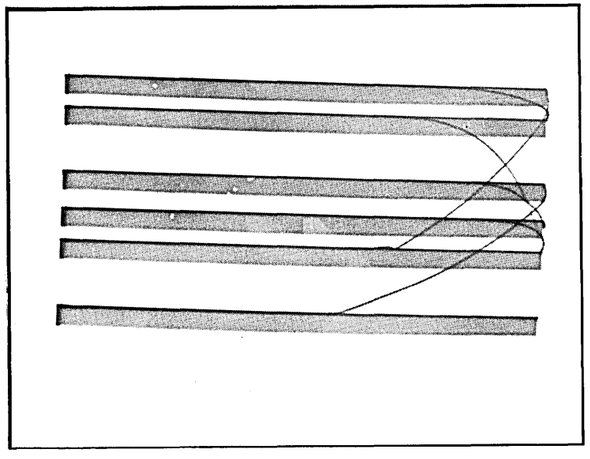
Brightness control: Normal



MAP 3-3

27 Symptom: No video (raster only).

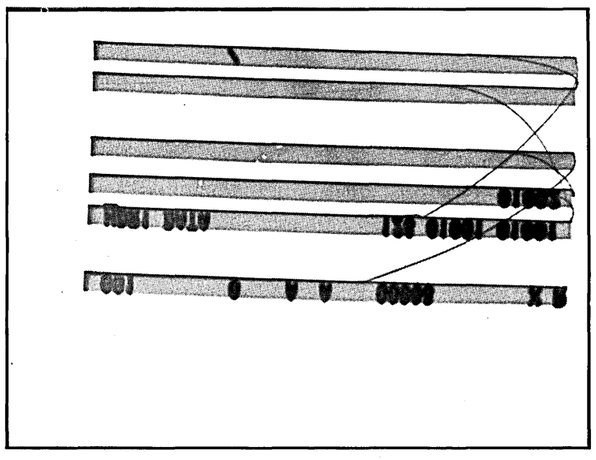
Brightness control: Turned up (caution)



MAP 3-3

28 Symptom: Brightness increases slowly or unadjustable or intermittent.

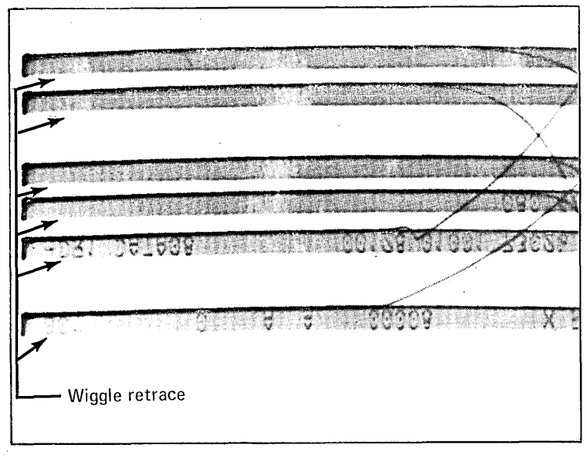
Brightness control: Normal



MAP 3-1

29 Symptom: Failure to blank on wiggle sweep.

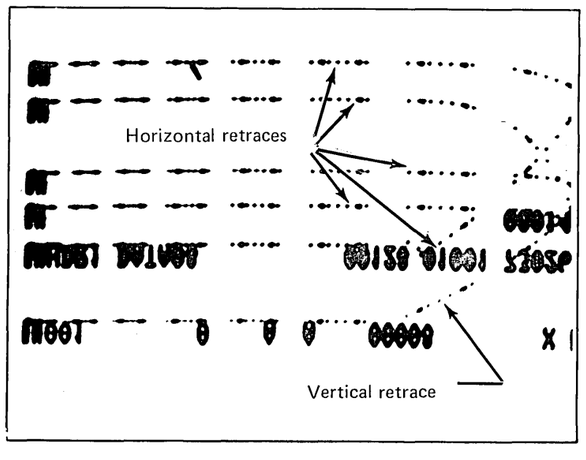
Brightness control: Turned up (caution)



MAP 3-1

30 Symptom: Failure to blank horizontal retrace.

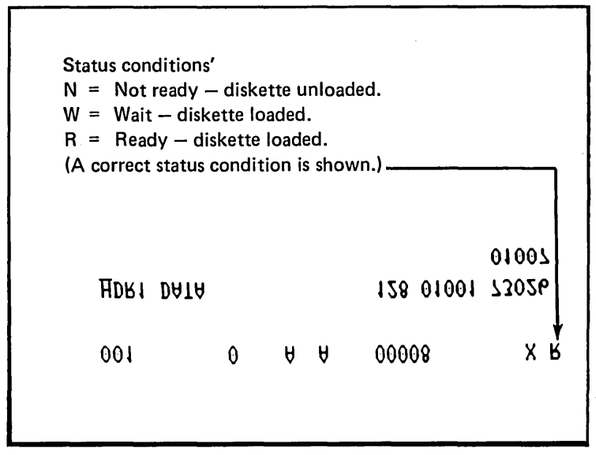
Brightness control: Turned up (caution)



MAP 3-1

31 Symptom: Machine status missing or incorrect.

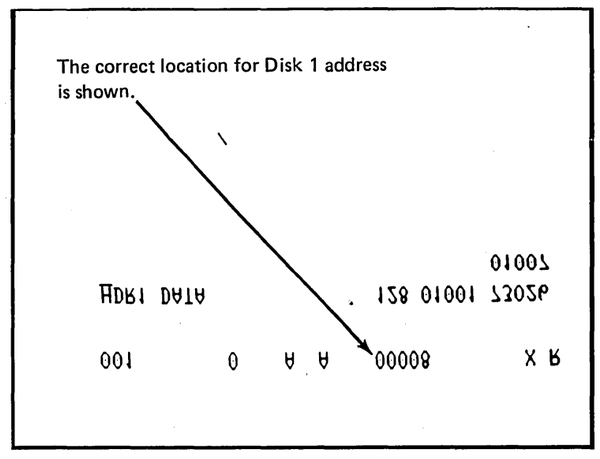
Brightness control: Normal



MAP 2-6

32 Symptom: Disk address missing.

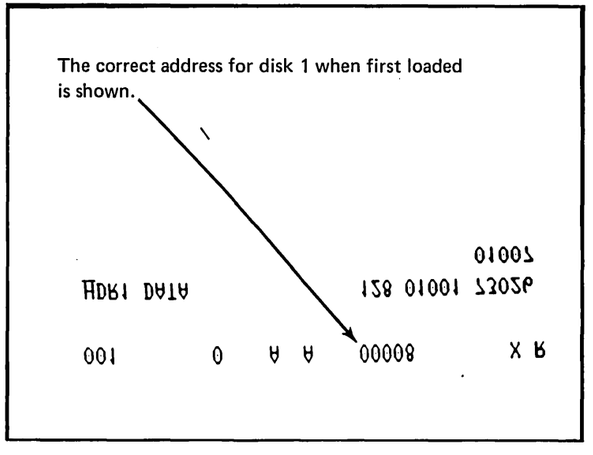
Brightness control: Normal



MAP 2-6

33 Symptom: Disk address incorrect.

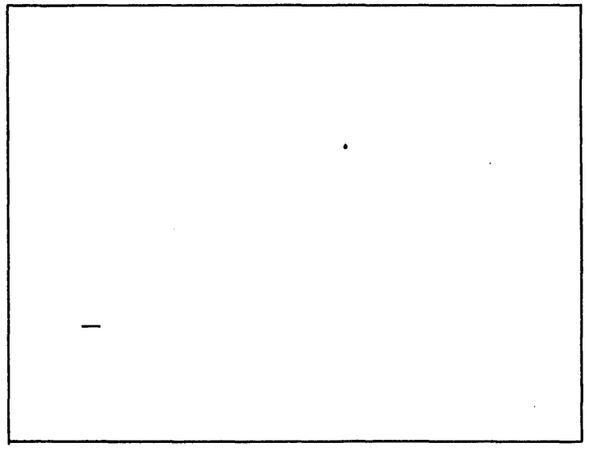
Brightness control: Normal



MAP 2-2

34 Symptom: No characters except cursor.

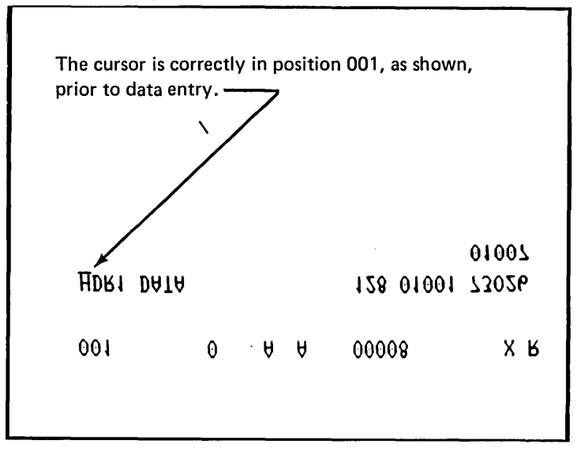
Brightness control: Normal



MAP 5-1

35 Symptom: Cursor missing or incorrect position.

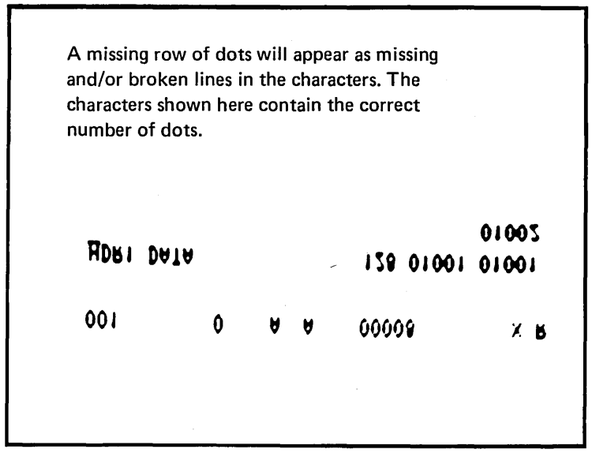
Brightness control: Normal



MAP 5-1

36 Symptom: Dots missing from characters.

Brightness control: Normal

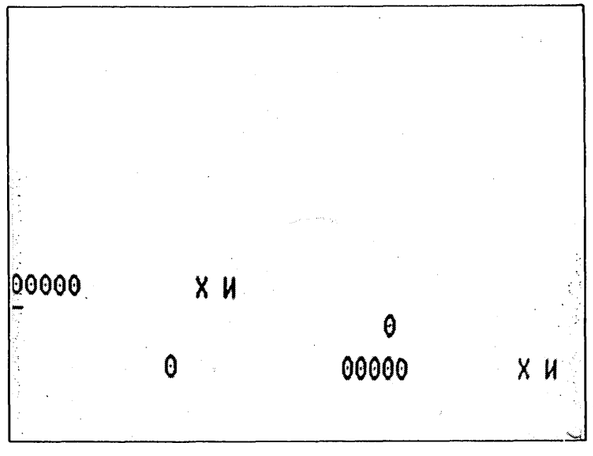


MAP 5-1

DISPLAY AND DISPLAY UNIT SYMPTOMS

37 Symptom: Added, missing, or incorrect characters.

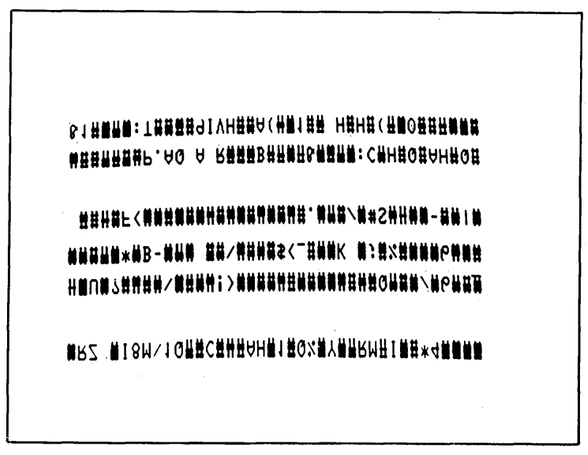
Brightness control: Normal



MAP 5-1

38 Symptom: Hex characters (only the status line may be displayed).

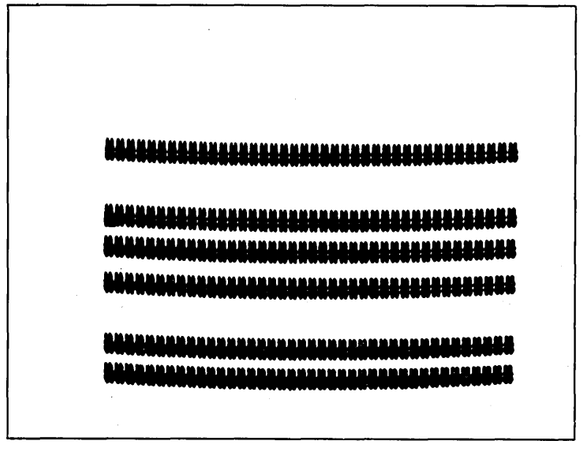
Brightness control: Normal



MAP 5-1

39 Symptom: Hex characters.

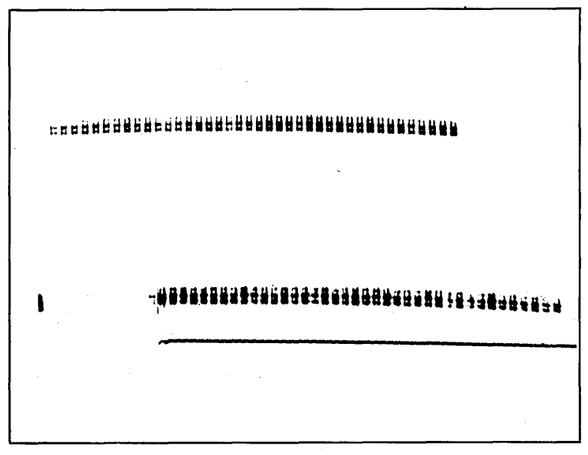
Brightness control: Normal



MAP 5-1

40 Symptom: Lines and hex characters.

Brightness control: Turned up (caution)



MAP 6-1

DISPLAY GENERAL MAP

If none of the previous symptoms are *similar* to what you see on the display:
- Power down.
- Disconnect the keyboard signal cable at 2-P.
- Power up..
- Wait 25 seconds.

Does the machine still fail?

Y
- Power down.
- Reconnect the keyboard cable at 2-P.
- Use MAP 4-4.

N
- Power down.
- Reconnect the keyboard cable at 2-P.
- Use MAP 5-1.

KEYBOARD AND OPERATIONAL SYMPTOMS

Alphabetic Shift

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

Audio Feedback Device

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

Auto Rec Adv

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

Auto Dup/Skip

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

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

Communications

7-7	Fails communication mode
7-7	Fails to receive
7-7	Fails to transmit
7-7	Communication terminates prematurely
7-7	Communications set-up problems
7-7	Fails to establish communications with remote end.

Compute Field Totals

4-5	Computes field totals incorrect
4-2	Fails to compute field totals

Copy

4-5	Continual copy
4-4	Copies incorrect data
4-2	Fails to copy
4-8C	Missing/extra records

Dash (–)

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

Data

4-8E	Altered/missing data
4-6	Dead keyboard
4-2	No data entered and no click from 1 or more keys
4-4	No data entered with or without an audio response
2-12	Slow machine

Delete Index

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

Delete Record

4-5	Deletes too many records or the wrong records
4-2	Fails to display data

Display Data

4-4	Displays incorrect data
4-2	Fails to display data

Display Field Name

4-4	Displays incorrect field name
4-2	Fails to display field name

Display Field Program

4-4	Displays incorrect field program
4-2	Fails to display field program

Display Field Totals

4-2	Always displays field totals
4-4	Displays incorrect field totals
4-2	Fails to display field totals

Display Production Statistics

4-4	Displays incorrect production statistics
4-2	Displays production statistics always
4-2	Fails to display production statistics

Display Program

4-2	Always displays program
4-4	Displays incorrect program
4-2	Fails to display program

Duplicate

4-4	Dups incorrect data
4-4	Dups too slow/fast
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

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KEYBOARD AND OPERATIONAL SYMPTOMS

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

4-2	Always displays field totals
4-2	Fails to display field totals
4-7	Incorrect field totals
4-8B	Field totals function fails

Function Select Upper or Lower

4-5	Always function select
4-2	Fails to function select
4-4	Selects incorrect function

Hex

4-5	Always enters hex
4-2	Fails to enter hex

I/O Adapter

7-21	Fails to transfer data
7-21	Parity error
7-21	Fails to enter adapter mode
7-21	Display positions 5 and 6 show I/O adapter problem

Initialize

2-1	Fails to initialize when in initialize mode
4-2	Does not enter initialize mode

Katakana Shift

4-3	Always enters Katakana characters
4-5	KANA SHIFT key fails
4-3	KATAKANA SHIFT switch fails
5-1	Programmed KATAKANA SHIFT fails

Katakana Symbol Shift

4-5	Always enters Katakana symbols
4-5	Fails to enter Katakana symbols
4-5	KANA SYMB fails

Modify Index

4-2	Does not modify index
4-4	Partial index modified

New Line Function

7-5	Fails to advance to new line

New Line Key

4-5	Extra advances to new lines
4-2	Fails to advance to new line

Numeric Shift

4-2	Always numeric shift
4-2	Fails to numeric shift

Operator Guidance

4-2	/ (slash) does not replace data (backspace)
4-2	Data does not replace / (slash)
4-2	Fails to display operator guidance

Print Characters

7-5	Incorrect characters

Print EOD

7-5	Fails to print to EOD
7-5	Prints past EOD

Print Record

7-5	Extra records printed
7-5	Fails to print record
7-5	Incorrect records printed

Production Statistics

4-2	Always displays production statistics
4-2	Fails to display production statistics
4-8D	Incorrect record count

Program

4-2	Fails to program chain
4-2	Fails to shift
4-4	Incorrect program
4-4	Incorrect program number

Program Load

4-5	Always/extra program loads
4-2	Fails to program load
4-2	Loaded incorrect program

Program Numeric Shift

4-5	Always in numeric shift
4-3	Fails to numeric shift

Proof Keyboard Feature

4-2	Numeric keys enter incorrect data

Punch to EOD

7-20	Fails to punch to EOD
7-20	Fails to punch correctly

Read Index

4-4	Displays incorrect data
2-2	Fails to read the index track

Read to EOF

7-20	Fails to read to EOF
7-20	Fails to read correctly

Record Advance 1 or 2

4-5	Continual record advances
4-2	Fails to record advance
4-5	Multiple record advances

Record Backspace 1 or 2

4-5	Continual record backspaces
4-2	Fails to record backspace
4-5	Multiple record backspaces

Record Insert

4-2	Fails to record insert

Repeat

4-5	Continual repeat
4-5	Fails to repeat

Reset

4-5	Continual reset
4-2	Fails to reset

Return to Index 1 or 2

4-5	Always returns to index track
4-2	Fails to return to index track

Right-Adjust

4-5	Continual right-adjust
4-2	Fails to right-adjust
4-4	Incorrect right-adjust

Search Address

4-4	Cannot enter search address
4-2	Fails to search
4-4	Goes to incorrect/no address

Search Content

4-4	Cannot enter search content
4-2	Fails to locate record
4-2	Fails to search
4-4	Stops on incorrect record

Search EOD

4-2	Fails to locate EOD
4-2	Fails to search
4-4	Locates incorrect record
4-4	Stops on no EOD

Search Sequential Content

4-4	Cannot enter content
4-2	Fails to locate record
4-2	Fails to search sequentially
4-2	Fails to start search
4-8F	S errors

Select Program

4-2	Fails to select program
4-4	Selects incorrect program

Self-Check

4-4	False errors
4-2	Incorrect modulus
4-8A	No self-check error (modulus 10)

Skip

4-2	Fails to alpha/num skip
4-3	Fails to auto skip
4-2	Fails to program skip
4-2	Fails to skip
4-4	Skips short/too far

Spacebar or SP Key

4-2	Fails to space
4-2	Cursor remains stationary
4-5	Spaces too far

Tab Function

5-5	Fails to tab

Tab Key

4-5	Extra tabs
4-2	Fails to tab

Update

4-5	Always updates
4-2	Fails to update
2-4	Fails to write on disk

Verify

4-2	Fails to verify
4-4	False errors
4-2	Verified incorrect record

MISCELLANEOUS SYMPTOMS

Communications

	Communication terminates prematurely
7-7	BSCA
7-7	EBSCA
	Fails in print-unattended mode
7-5	EBSCA only
	Fails to go into communications mode
7-7	BSCA
7-7	EBSCA
	Multipoint alarm fails to sound
7-7	EBSCA
	Set-up problems
7-7	BSCA
7-7	EBSCA

CRT

4-6	Flashing screen with no error code
5-1	Hex characters during power up

Data Recorder Attachment

5-38	Card jam or misfeed but no A-2 error
5-39	Card feed problem on power up
7-20	Card jam
7-20	Flashing screen with no error code
7-20	No response from data recorder
7-20	No response from data recorder and no error code displayed.
7-20	Setup problems

Disk Drive Unit

4-8E	Altered/missing data
2-6	Disk address 1 or 2 incorrect
2-1	Diskette problems
2-6	Diskette written in 1 disk drive unit gives trouble in other disk drive units
2-6	Machine status incorrect
2-6	Machine status or disk address missing
2-6	Not ready
2-2	Read check
2-9	Seek errors (no data errors)
2-12	Slow machine operation
2-4	Write check

Feature Checkout Procedures

7-6	BSCA
	BSCA subfeatures
7-6	ID reader
7-6	Keylock
7-6	Synchronous clock
7-6	Terminal ID
7-6	1200 bps (line adapter) (line adapter)
7-20	Data recorder attachment (129/5496)
7-9	EBSCA (expanded communications)
	EBSCA subfeatures
7-9	ID reader
7-9	Keylock
7-9	Multipoint
7-9	Synchronous clock
7-9	Terminal ID
7-9	1200 bps (line adapter)
7-3	Feature A
7-4	Feature E (expanded)
7-21	I/O adapter
14-31	Inquiry mode operation (theory)
	Printer
7-5	3713
7-5	3717 (also use MAP 5 in the *3717 MLM)*
7-19	3715
7-17	Proof keyboard
7-8	Record insert

Keyboard

4-2	Binding key
4-6	Buzzing
4-6	Click only from reset
4-6	Dead keyboard
4-3	Does not perform function selected by toggle switches
4-1	Error code – audio feedback device works also
4-4	Incorrect data entered with or without audio response
4-4	Incorrect functions performed with or without audio response
4-6	Keyboard locked up
4-5	Multiple characters entered for 1 keystroke
4-6	No click from any key
4-2	No data entered and no click from 1 or more keys
4-4	No data entered with or without an audio response
4-2	No function performed and no click from 1 or more keys
4-4	No function performed with or without an audio response
4-6	No tone at end of function
2-12	Slow machine operation
4-2	Sticking key

Power Supply

6-2	Burned smell
6-1	Incorrect voltage at I/O unit
6-1	Intermittent operation
6-1	Machine inoperative
6-9	Service circuit breaker tripped
6-2	Smoke

3713 Printer (Head Motion)

7-5	Head crash stops at left margin
7-5	Head crash stops at right margin
7-5	Head does not move
7-5	Incorrect head speed
4-8G	Double spacing

3715 Printer

5-19	Head crash stops at left or right margin
5-19	Head does not move
5-19	Printed characters misaligned
5-19	Forms do not move
5-19	Forms space too far
5-19	Printer does not print
5-19	Dots missing from characters
5-19	Extra dots in characters
5-19	Head motion noisy
5-19	Characters missing
5-19	Paper tears
5-19	Ribbon will not feed
4-8G	Double spacing

3717 Printer

Use the *Symptom Index* in the *3717 MLM.*

201 Part Numbers and Cause Codes

Part Name	Number	IR Code
Ac line filter	2192519	600-07
Blade, fan	2455814	820-25
CE test disk	2455026	
Collet-disk clamp assembly	See *Parts Catalog*	820-05
Cross connector	2731026	300-02
Disk ac cable disk 2 (115V)	2456480	100-01
Disk ac cable disk 2 (208/230V)	2456386	100-01
Disk cover latch	2305650	820-06
Disk drive cover	2305648	820-06
Disk drive hub and shaft	2305619	820-13
Disk drive pulley	2305621	820-13
Disk drive shaft bearing	5344991	820-09
Disk file cable and connectors	2305599	820-03
Disk idler assembly	See *Parts Catalog*	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

Part Name	Number	IR Code
Fan 50 Hz (100-115V)	2455819	820-25
Fan 50 Hz (200-235V)	2455820	820-25
File control card (FC)	See *Parts Catalog*	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
Switch	2305534	820-24
Wire jumper	2305533	820-24
Leadscrew wheel	2305544	820-12
Leadscrew bearing		
Upper	233355	820-09
Lower	155749	820-09
Limit stop		
Upper	2305618	820-09
Lower	2305528	820-09
LED assembly	2305656	820-10
Phototransistor assembly	2305604	820-10
Power supply ac cable (115V)	2456462	100-01
Power supply ac cable (208/230V)	2456385	100-01
Signal cables		
D1	2456402	100-04
D2	2456403	100-04
Spring washer	2305663	820-07
Stepper motor with stand and wheel	2305545	820-12
VFO card	Page 502	300-07

Cause Codes

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34	Other	00
Defective	21	Open	42		

202 not used
203 not used

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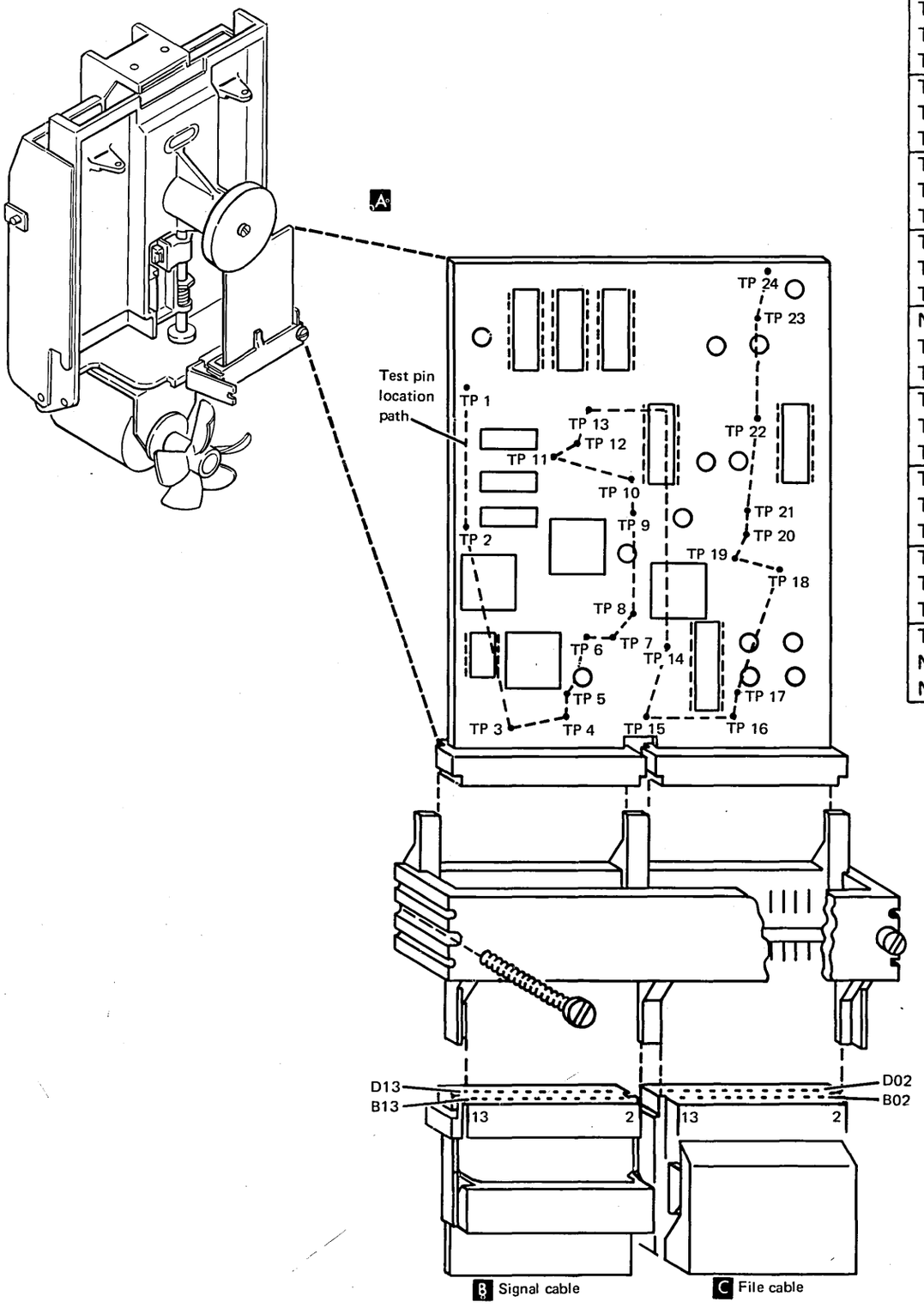
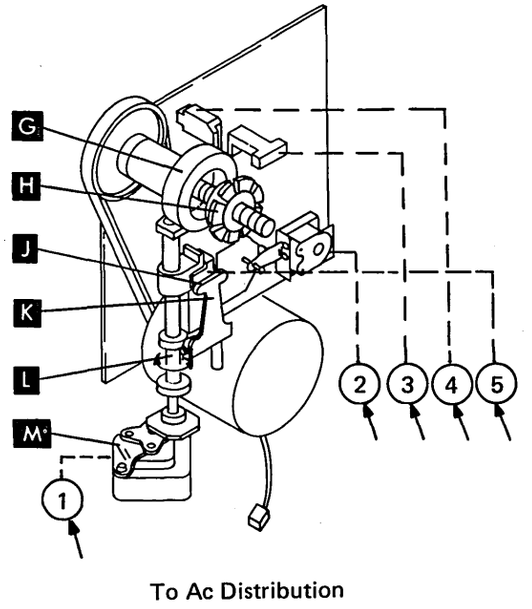
Date 9/15/74	8/1/75		

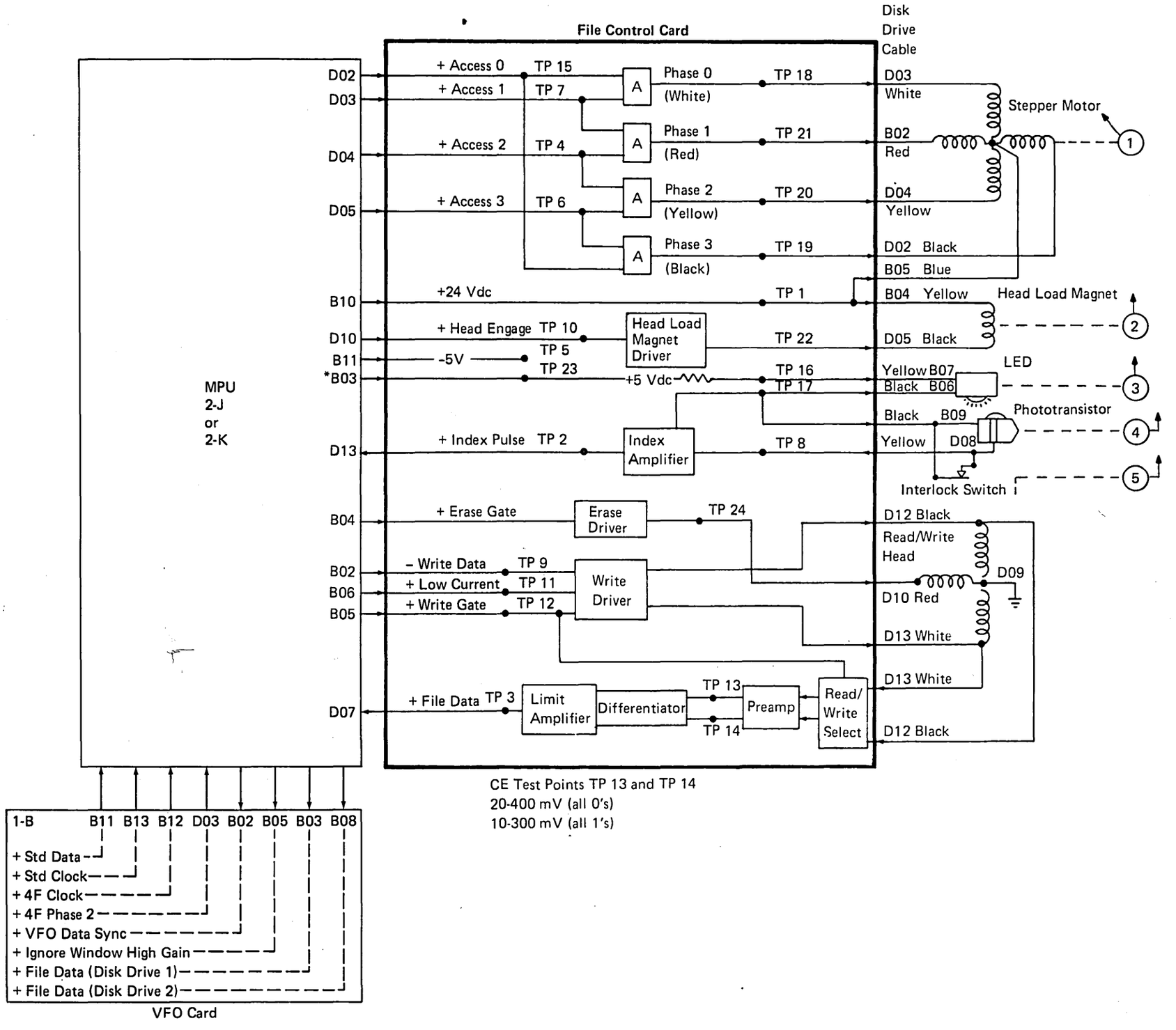
EC 823146	825853	826065	PN 1618882
Date 9/15/74	11/15/74	8/1/75	

204 File Control Card

FC Card Test Point	Test Pin Name	Signal Cable	File Cable
TP -1	+24 volts	B10	B04, B05
TP 2	+ Index	D13	
TP 3	+ File data	D07	
TP 4	+ Access 2	D04	
TP 5	–5 volts	B11	
TP 6	+ Access 3	D05	
TP 7	+ Access 1	D03	
TP 8	Phototransistor		D08
TP 9	+ Write data	B02	
TP 10	+ Head engage	D10	
TP 11	+ Low current	B06	
TP 12	+ Write gate	B05	
None	+ Erase gate	B04	
TP 13	Preamp TP 2		
TP 14	Preamp TP 1		
TP 15	+ Access 0	D02	
TP 16	LED current		B07
TP 17	Ground	B08	B06, B08, B09, D09
TP 18	–MC-0		D03
TP 19	–MC-3		D02
TP 20	–MC-2		D04
TP 21	–MC-1		B02
TP 22	– Head load		D05
TP 23	+5 volts	B03	
TP 24	Erase current		D10
None	Head A		D12 Black
None	Head B		D13 White







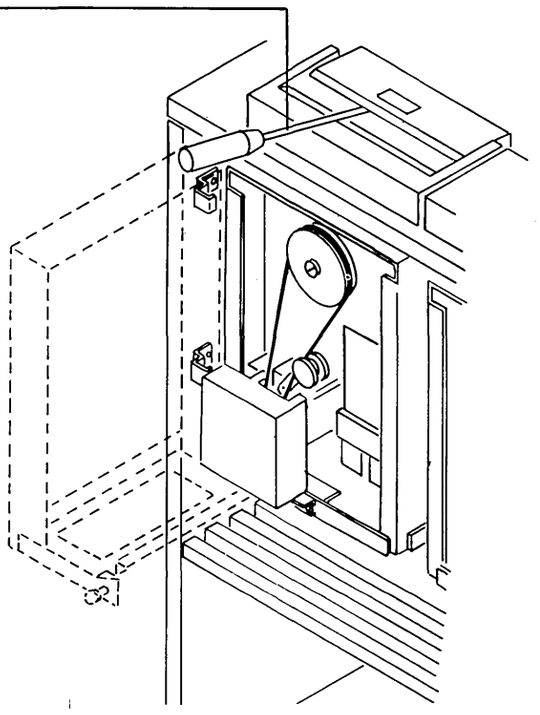
205 not used

EC 823146	826065		PN 1618883
Date 9/15/74	8/1/75		

EC 823146			PN 1618884
Date 9/15/74			

206 Disk Drive Service Position

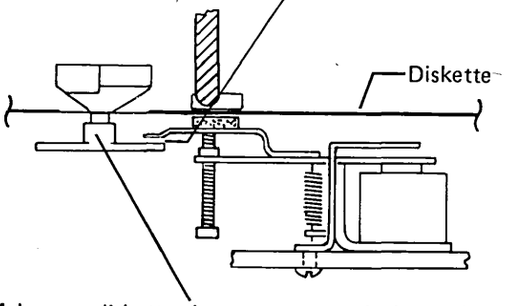
- Turn power off.
- Open door.
- Loosen (turn one revolution) two screws holding door to disk drive cover.
- Remove screw holding disk drive frame to machine base.
- Tip disk unit (bottom first) out of base and hang on brackets.



207 Head Load Actuator

Service Check

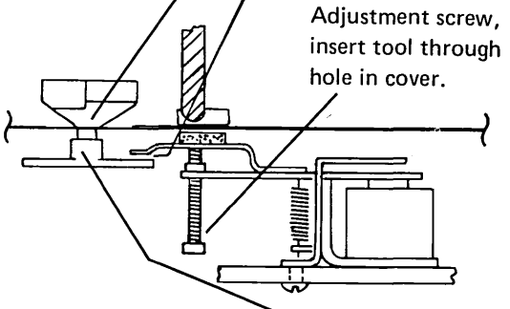
Check for a visual clearance here at all track positions.



Make sure diskette clears pressure pad when coil is not energized. (Power down.)

Adjustment

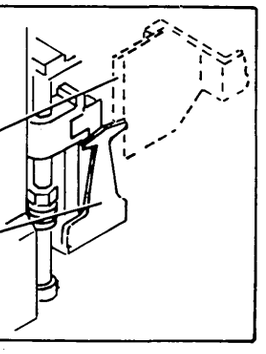
- Energize by jumpering TP22 to TP17 on the FC card with a disk in the unit.
- Adjust for visual clearance here for tracks 0 through 77 and contact here on all tracks.



- When coil is not energized, the pressure pad should be completely away from the disk.

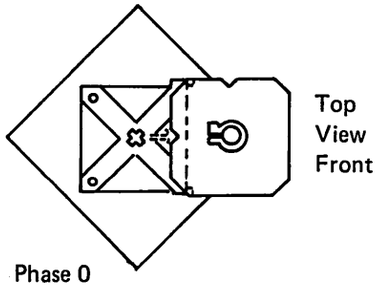
CAUTION

Before closing cover, position actuator bail, located on cover, under pressure pad arm.

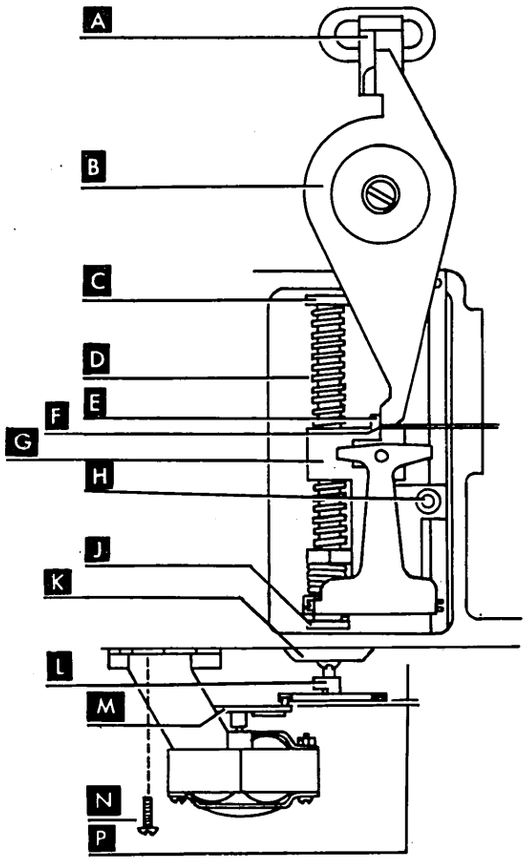


208 Head Adjustment Service Check

- 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.



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).

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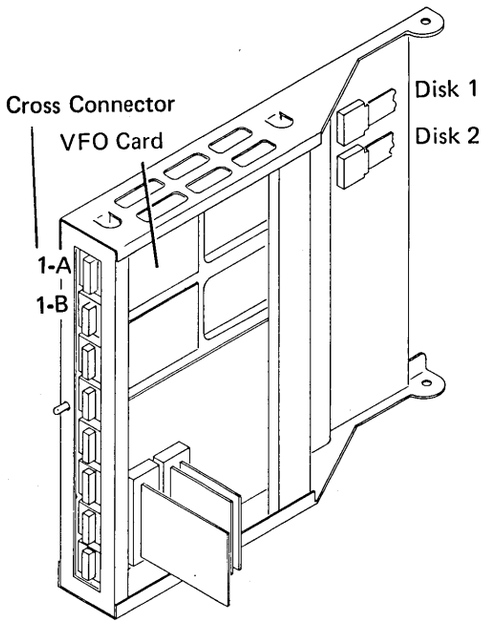
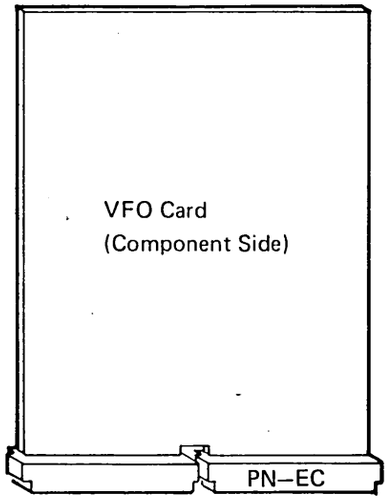
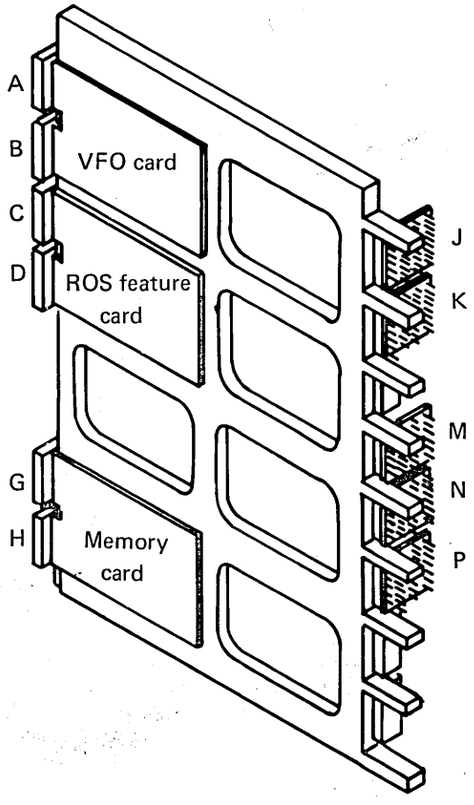
Date 9/15/74	8/1/75		

211 VFO Card Location





212 MPU



213 Disk Drive Pulley and Belt

Removal
- Power down.
- Unplug motor cable (217F).
- Remove fan guard assembly (217M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly.
- Loosen screw, mark, and remove fan blade (217L) (note blade curvature).
- Remove drive belt (217K).
- Loosen setscrew (217G) and remove pulley.

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 (217F).
- Remove fan guard assembly (217M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (217L) (note blade curvature).
- Remove drive belt (217K).
- Loosen screws and remove guard plate (217J).
- Remove motor clips by loosening screws (217H).
- Remove motor through bottom of frame.
- Loosen setscrew and remove drive pulley (217G).
- To replace, reverse procedure and check for belt tracking (215).

215 Idler Assembly

Removal
- Remove belt (217K).
- Remove idler assembly (217E).
- To replace, reverse procedure and check belt tracking.

Belt Tracking

Belt must run in center of drive pulley and hub pulley when drive pulley is rotated counterclockwise and viewed from pulley side.

Adjustment

CAUTION
Drive pulley set screw must be aligned with flat on motor shaft.

- Adjust drive pulley and idler position so belt runs in center of drive pulley and hub pulley. Forming of the idler pulley arm may be required.

Note: Late level disk drives have an idler pulley with a narrow groove. To adjust belt tracking, loosen screw and slide idler until belt runs in center of drive pulley and hub pulley.

216 Hub and Shaft Assembly

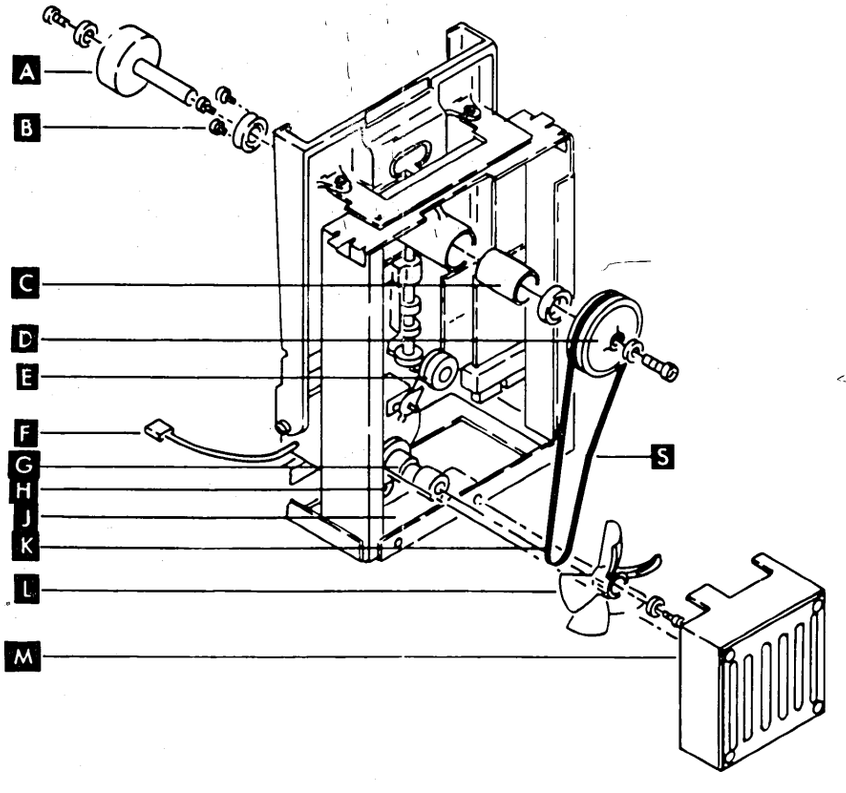
Removal and Replacement
- Remove cover.
- Remove drive belt (217K).
- Remove screw (217D) and pulley .
- Remove shaft assembly (217A).
- Remove bearing retaining screws and bearing (217B).
- Remove bearing and spacer (217C).

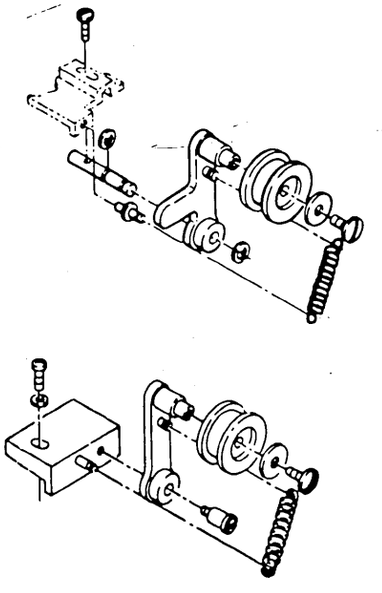
CAUTION
The front bearing must be flush with front surface of baseplate. To do this, tighten front bearing retaining screws first. Seal on bearing should face outside.

- To replace, reverse procedure and check belt tracking (215).

217 Disk Drive Locations

Legend
- A Shaft assembly
- B Bearing retaining screw
- C Spacer
- D Pulley
- E Idler assembly
- F Motor cable
- G Drive pulley
- H Motor clip
- J Guard plate
- K Drive belt
- L Fan blade
- M Fan guard





218 not used
219 not used

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Date 9/15/74			

220 Disk Cover Interlock

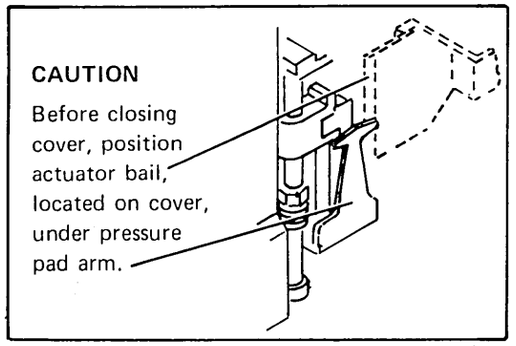
Adjustment
- Close the disk cover until it latches.
- Loosen spring mounting screws.
- Adjust the spring (upward) to activate the switch. The switch may be overadjusted up to 0.050" (1.27 mm).
- Tighten spring mounting screws.

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 (224D) and LED assembly (224C).
- Release cable clamp holding wires to cover.
- To replace, reverse procedure.
- Yellow wire goes to LED terminal marked Y.



CAUTION
Make sure that correct wires are connected to the LED.

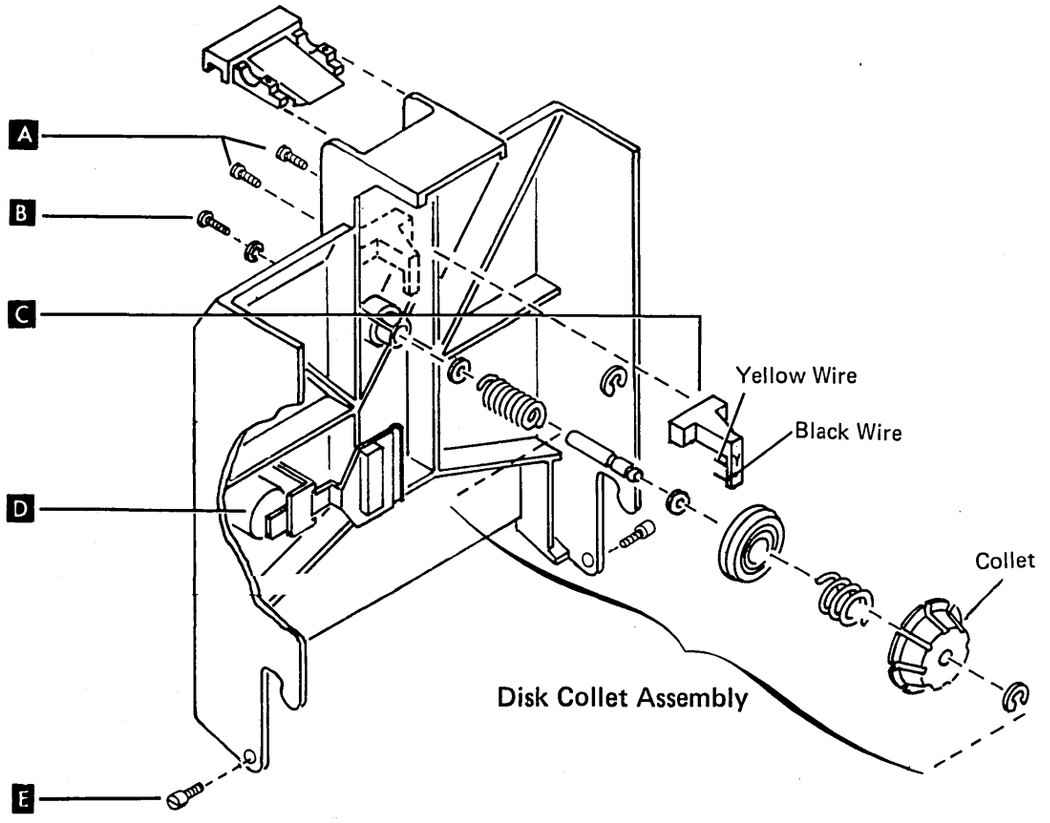
222 Collet Assembly

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 screw
- C LED assembly
- D Head load actuator
- E Cover pivot

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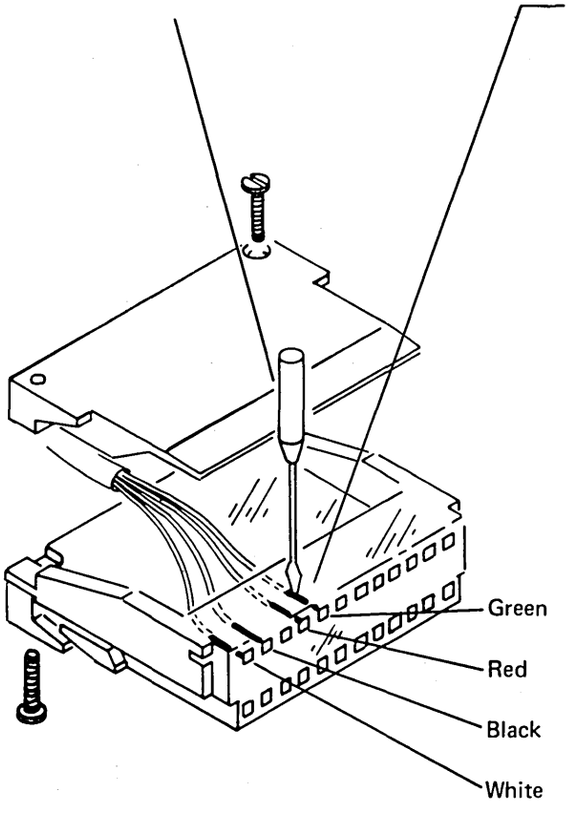
225 Leadscrew and Head Carriage Assembly Removal and Replacement

Removal

- Center head carriage assembly (226G) on leadscrew by moving stepper motor wheel (226M).
- Loosen limit stop clamping screws (226C and 226J).
- 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.



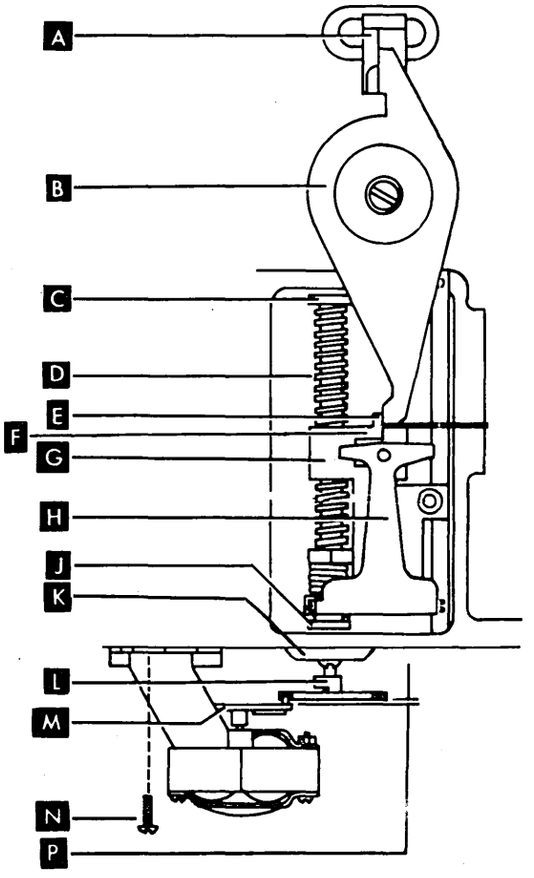
- Slide leadscrew down until top is free; tip and remove upward.
- Remove the following from the leadscrew.

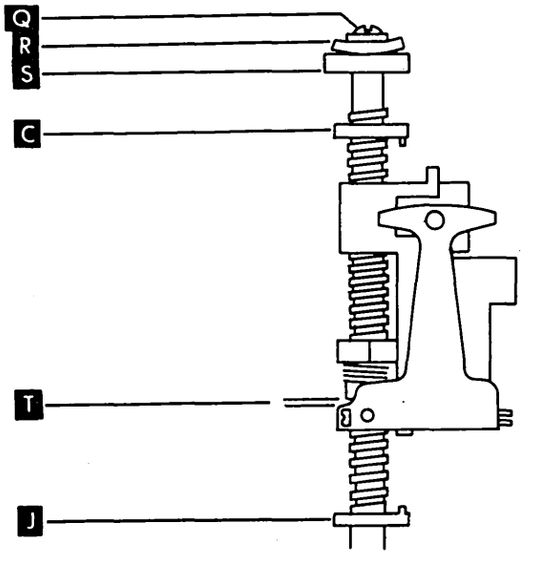
Spring washer retainer	(226Q)
Spring washer	(226R)
Upper bearing	(226S)
Upper stop	(226C)
Lower stop	(226J)

Replacement

- Check for 0.020" ± 0.015" (0.508 mm ± 0.381 mm). Adjust by rethreading if necessary (226T).
- Center head carriage assembly (226G) on leadscrew.
- Install limit stops (226C and J) on each end of leadscrew with limit stop projections pointing toward head assembly as shown above.
- 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 with holding screws (226K). Check for about 0.030" (0.762 mm) 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).

226 Head Locations





Legend

- 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

227 not used
228 not used

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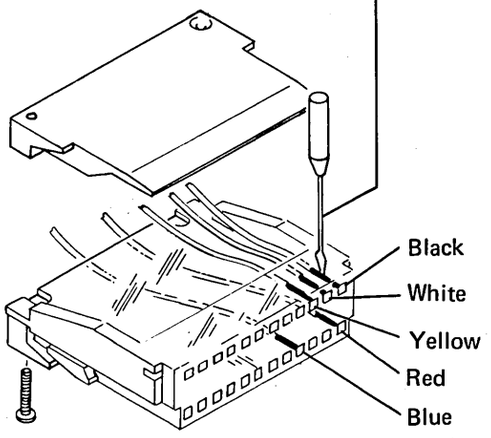
229 Stepper Motor

Removal and Replacement

- Power down.
- Remove wires by pressing down with small screwdriver to release terminals.

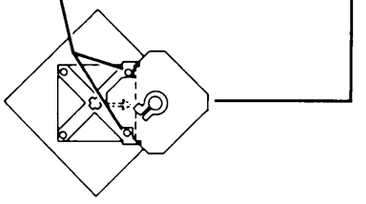


- Remove stepper motor and bracket assembly by removing screws (230N) holding stepper motor bracket to baseplate.
- To replace, reverse procedure and do stepper motor adjustment. Use the *Stepper Motor Adjustment* procedure (230).

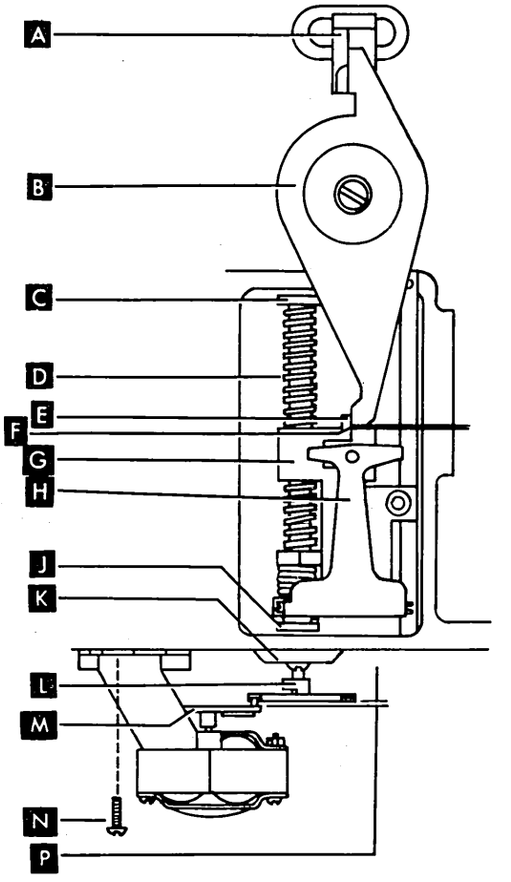
230 Stepper Motor Adjustment

(Perform with disk drive unit in upright position)

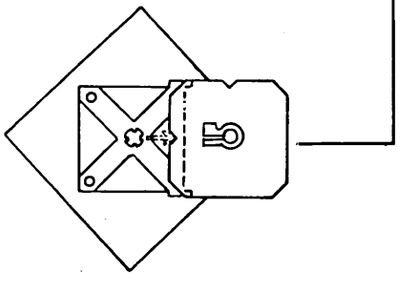
- Loosen the two screws N holding stepper motor bracket to baseplate.
- Move stepper motor away from the leadscrew D .
- Loosen screw in leadscrew wheel L and slide wheel up on leadscrew so wheels can rotate without touching.
- Rotate wheels to obtain this relationship.
- Pull leadscrew wheel down until 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.



Phase 0
Top View, Front

- Rotate the stepper motor wheel by hand four revolutions. If any binding of the wheel is felt, repeat the stepper motor adjustment.
- Do the *Head Adjustment* (231).

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.

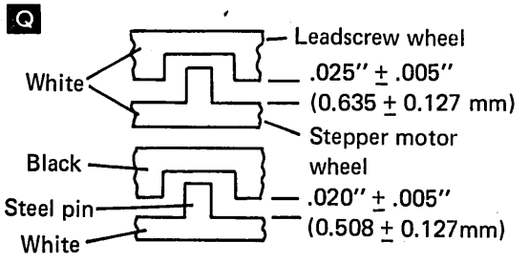
- Install CE tool (230B).
- Rotate tool until it contacts surface (230E).
- Rotate disk drive hub so white sticker on outside diameter of hub is up. If white sticker is not present, rotate hub so indented mark is up.

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.

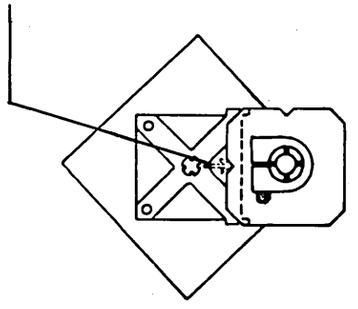
Q



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 Q (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).

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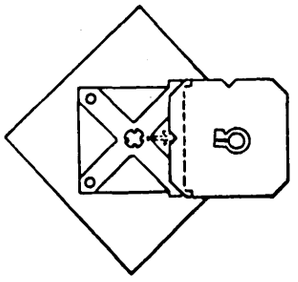
232 Lower Limit Stop Adjustment

– Be sure that head is adjusted for track 00 and that leadscrew and stepper motor wheels (234L) and (234M), are in this position for track 00.



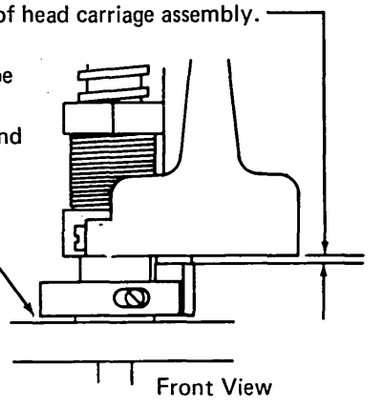
Top View, Front

– Make sure lower limit stop clamping screw is loose.
– Move the head carriage assembly down by rotating stepper motor wheel about 90^{0} until the wheels are in this position.

Top View, Front

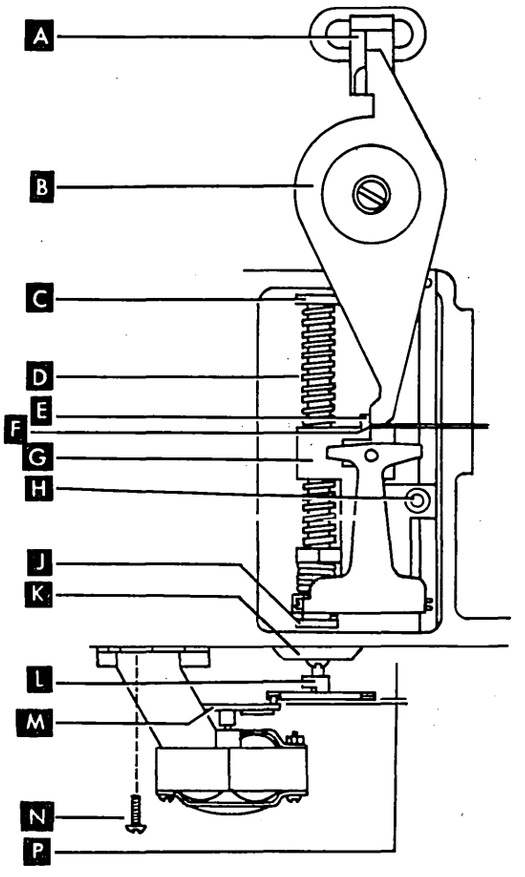
(Two corner projections and the arrow on the stepper motor wheel (234M), should point toward the front of the disk drive.)

– 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" ± 0.001" (0.305 mm ± 0.025 mm) between lower limit stop projection and bottom of head carriage assembly.
– There must be clearance between stop and frame.

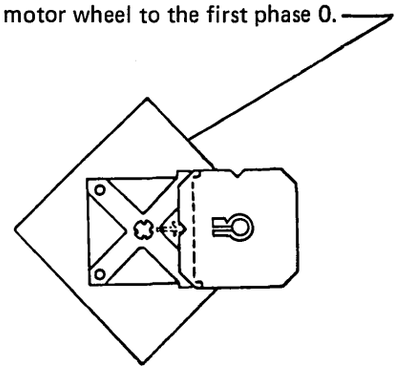


Front View

234 Upper Limit Stop Adjustment

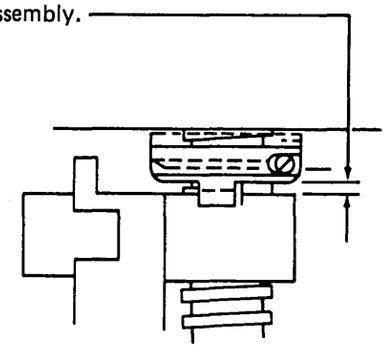


- Start this procedure from rear of disk drive.
- Loosen clamping screw in upper limit stop C.
- Move head carriage assembly G up by turning stepper motor wheel; M continue until upper limit stop body is pressed against disk drive frame by head carriage assembly. (Make sure limit stop projection is clear of top surface of head carriage assembly.)
- Move head carriage assembly down by turning stepper motor wheel to the 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" ± 0.005" (0.762 mm ± 0.127 mm) between stop body and top of head carriage assembly.



Rear View

- Install cover.
- Install disk drive.

233 not used
235 not used
236 not used

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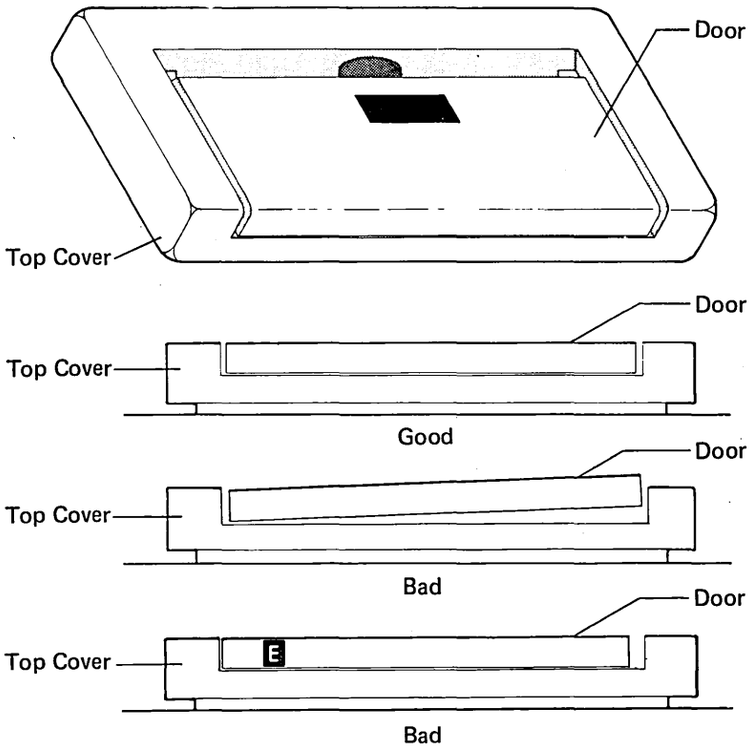
237 Disk Top Cover Vertical Alignment Checks

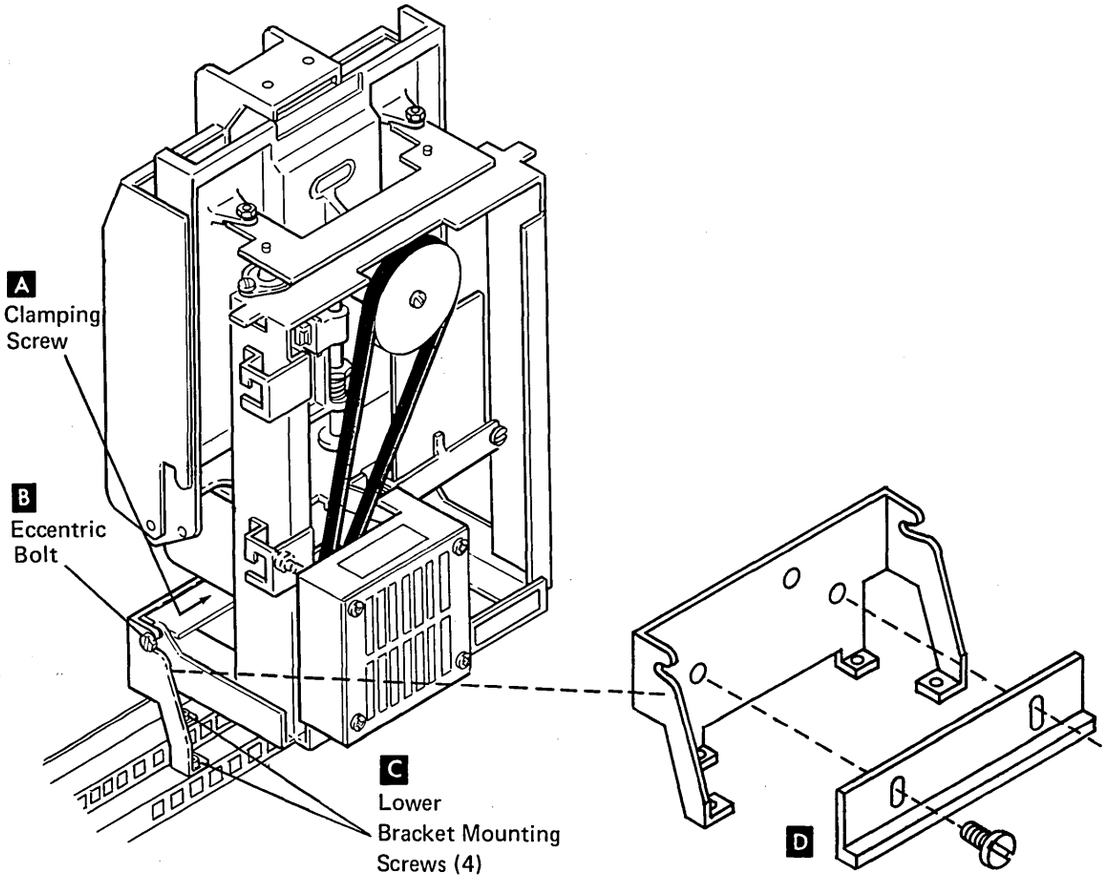
If the machine has eccentric bolts **B** :
- Loosen the eccentric-bolt locking nuts.
- Loosen the clamping screw **A** .
- Make required adjustment by turning the eccentric bolts.
- Tighten the clamping screw **A** .
- Tighten the eccentric-bolt locking nuts.
- Perform 238 if necessary.

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

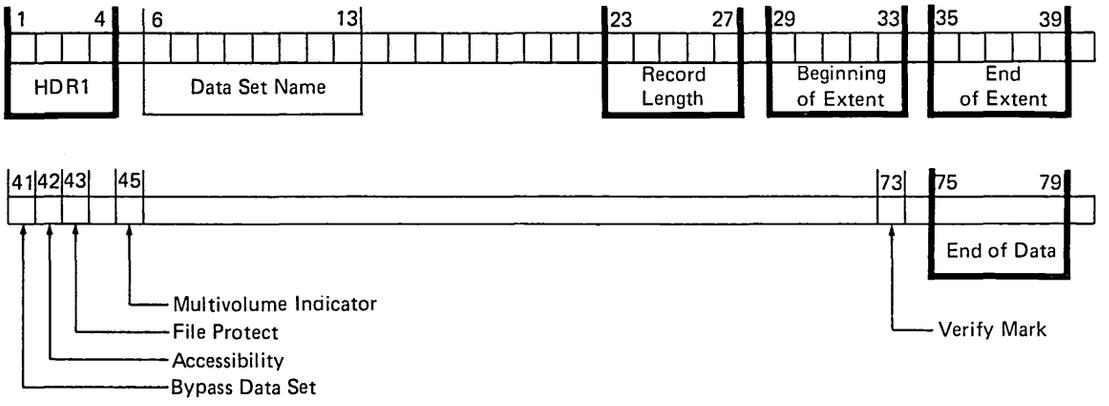
- Loosen the four bracket mounting screws **C**
- Move the lower bracket right or left to center the door **E** .
- Tighten the four bracket mounting screws.
- Perform 237 if necessary.



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	What You Do
B	Incorrect Data Set Label			*Note:* You must press FUNCT SEL lower, M and REC ADV after making correction to the label.
		X	BOE is greater than EOE or EOD.	Reset and correct the BOE, EOE, and/or EOD.
		X	BOE is less than track 01, sector 01.	Reset and correct the BOE.
		X	EOE is greater than track 74, sector 26.	Reset and correct the EOE.
		X	EOD is greater than EOE + 1.	Reset and correct the EOD and/or the EOE.
		X	EOD is greater than track 75, sector 01.	Reset and correct the EOD.
		X	Record length is 00 or greater than 128.	Reset and enter the correct record length.
		X	BOE, EOE, or EOD sector number is 00 or is greater than 26.	Reset and enter the correct sector number.
		X	The third position in the BOE, EOE, or EOD is not a zero.	Reset and insert a zero in the third position.
		X	Data is entered in positions 23 and/or 24.	Delete data entered in these positions.
		X	One of the following conditions existed when you tried to select a mode from the Index track: – The current sector address displayed in the status line is either: 01, 02, 03, 04, 05, 06, or 07. – Position 4 in the label doesn't contain a 1. – The data set label has been deleted.	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.
		R	A card read function was selected in a data set that had a label containing a B in position 41 (bypass indicator).	Advance to a data set with a valid label and reinitiate the card read function. Remove the bypass indicator. If a card read was initiated while in the enter or update modes, the EOD was not updated to reflect the new records. To recover the data, change the EOD to equal the EOE. Search the data set for the last record written, press REC ADV, note the current disk address from the status line, return to the index track, and change the EOD to the correct address.

240 not used
241 not used

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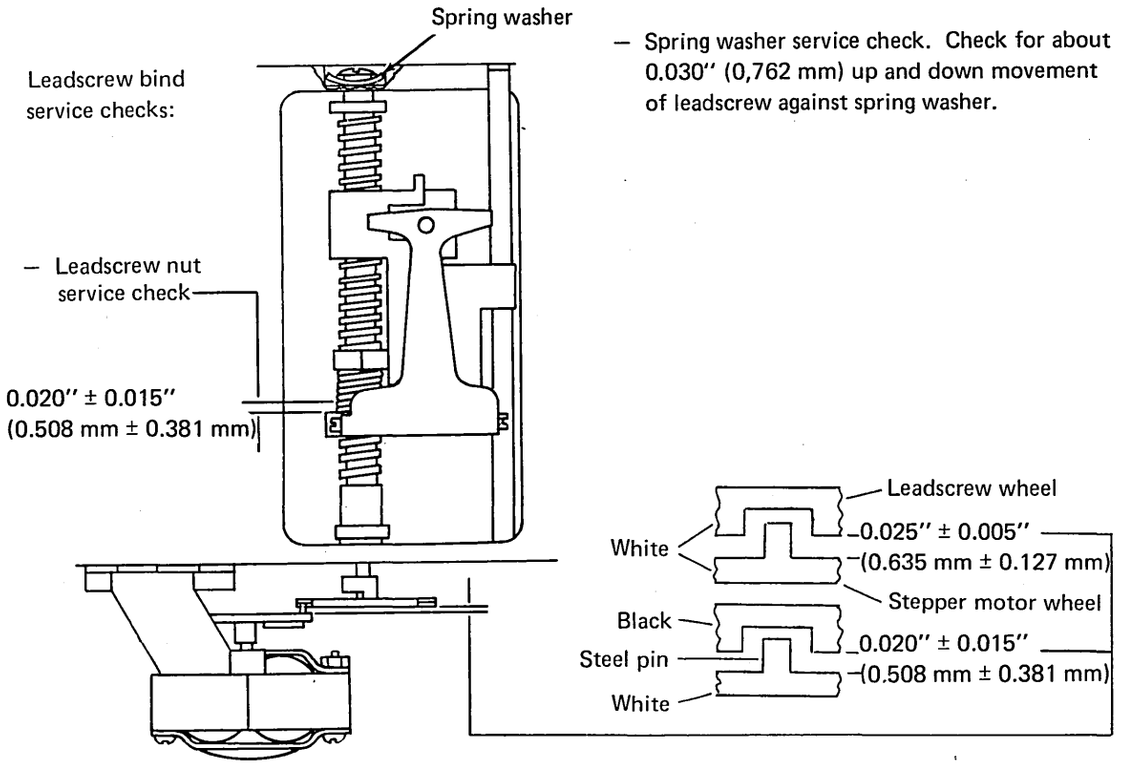
242 Leadscrew Service Check



– Spring washer service check. Check for about 0.030" (0,762 mm) up and down movement of leadscrew against spring washer.

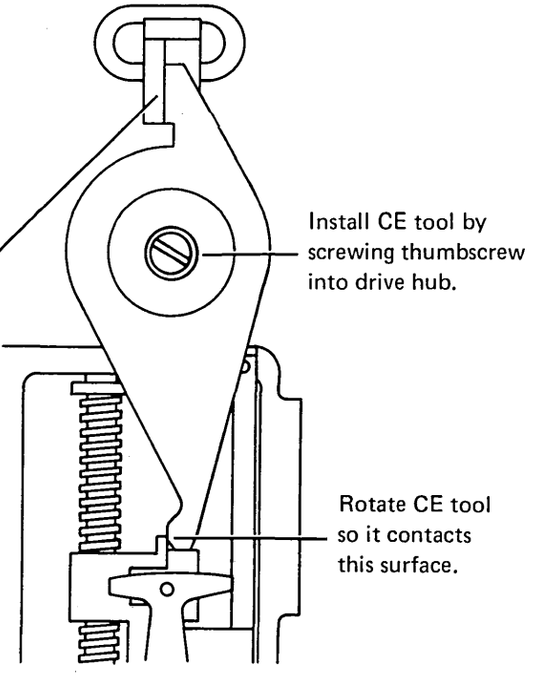
– Leadscrew wheel and stepper motor service check.

Determine type of stepper assembly (below) and check for the specified clearance for type used.

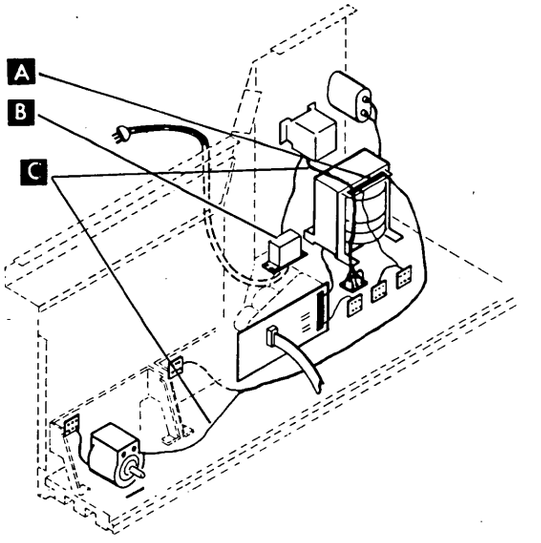
243 Phototransistor Assembly

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.
- Remove leads. (Yellow wire goes to terminal marked Y.)
- To replace, reverse procedure.



244 Machine Locations



Legend
- A Terminal board (TB1)
- B Ac line filter
- C Power supply ac cable

245 Disk Operations Timings

The following chart provides approximate timing information for search, copy, and initialization operations on the 3741. 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.

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)	5 sec	5 sec	5 sec	5 sec
	949 (assume EOD is 37014)	3 sec	3 sec	3 sec	3 sec
	400 (assume EOD is 16001)	2 sec	2 sec	2 sec	2 sec
Search on sequential content	1898	30 sec	8 sec	30 sec	8 sec
	949	15 sec	8 sec	15 sec	8 sec
	400	8 sec	8 sec	7 sec	7 sec
Search on content	1898	5 min 30 sec	5 min 30 sec	2 min 50 sec	2 min 50 sec
	949	2 min 45 sec	2 min 45 sec	1 min 30 sec	1 min 30 sec
	400	1 min 10 sec	1 min 10 sec	40 sec	40 sec
Disk initialization	------	1 min 50 sec	------	1 min 50 sec	------
Image copy	1898 plus index track	3 min 30 sec	------	10 min	------
Data set copy	949	10 min	------	9 min	------
Data set copy	400	4 min 30 sec	------	3 min 50 sec	------

EC 823146			PN 1618900
Date 9/15/74			

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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
Chassis and CRT assembly	2455625	200-02
Converter	2455603	200-03
CRT socket assembly	2455699	200-06
Display PC board	See *Parts Catalog*	200-05
Display signal cable	2456372	100-05
Power supply cable	2456361	100-08
Power supply PC board	See *Parts Catalog*	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	Other	00
Defective	21	Open	42		

302 not used
303 not used

EC 823146			PN 1618902
Date 9/15/74			

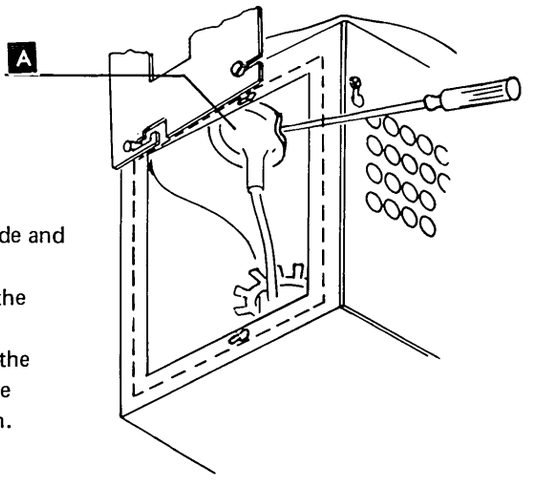
304 CRT Locations

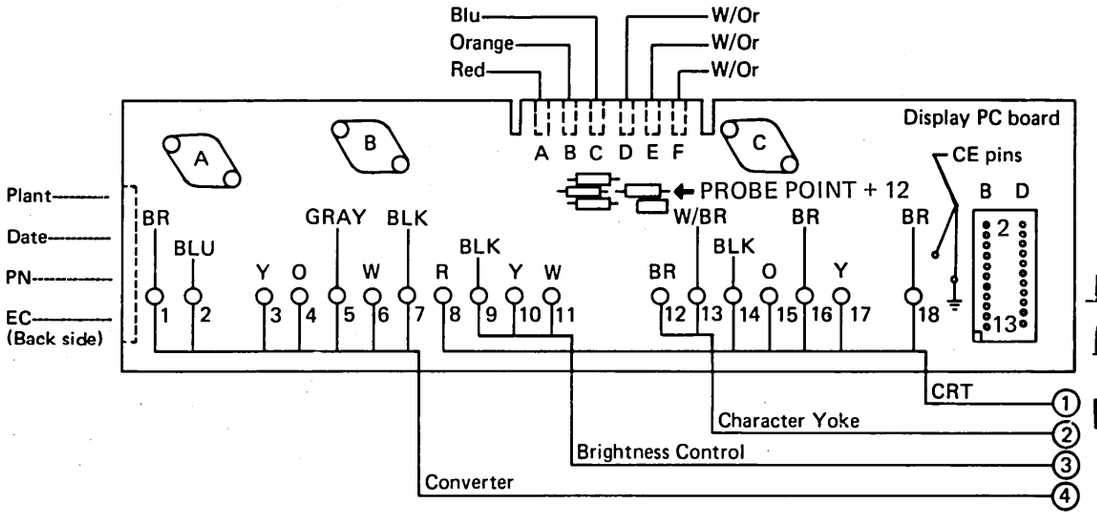
Legend

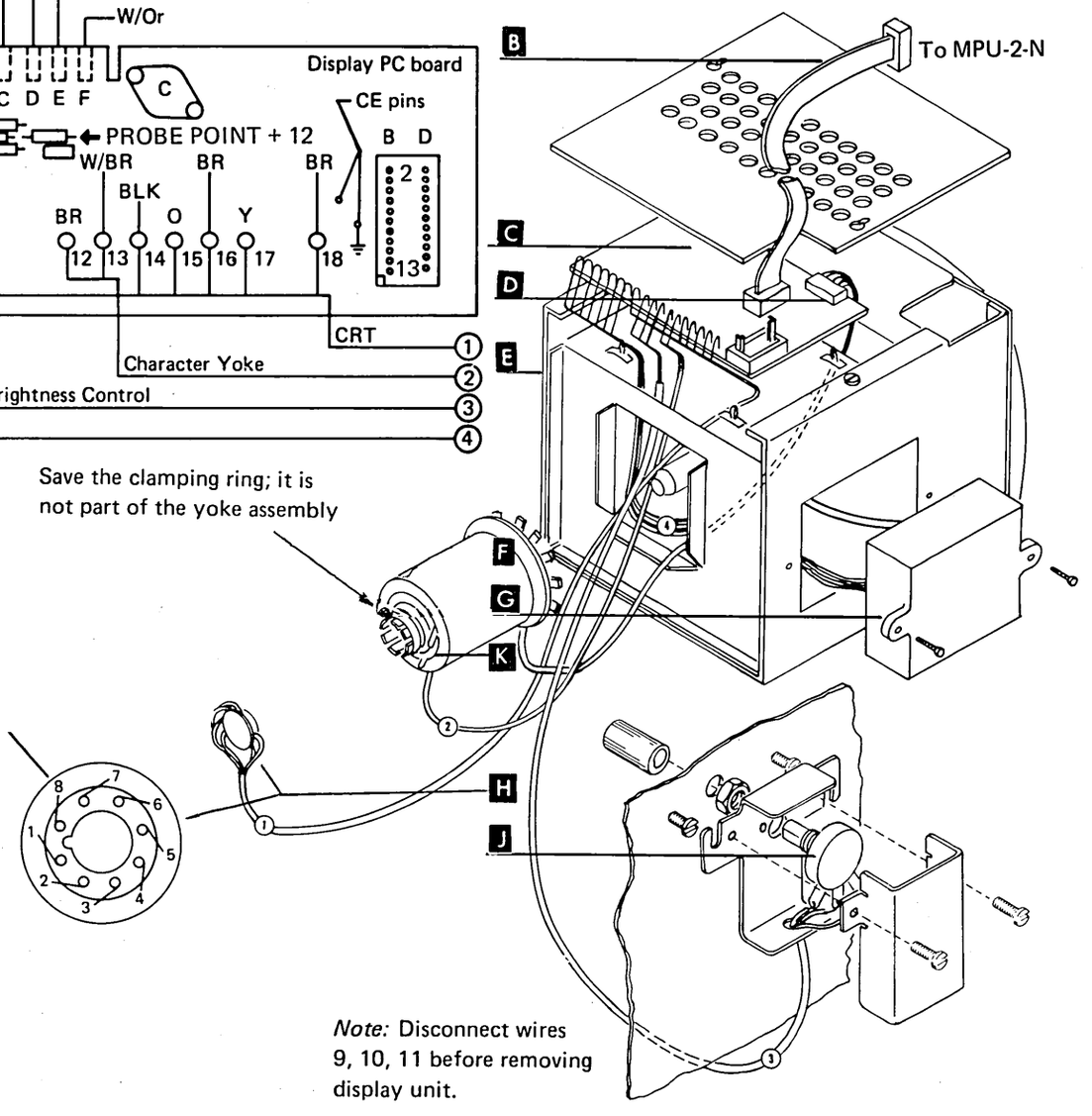
- A CRT high voltage anode
- B Display signal cable
- C Display PC board
- D Yoke cable connector
- E Chassis and CRT assembly
- F Yoke assembly
- G Converter
- H CRT socket assembly
- J Brightness control
- K Centering rings

DANGER:
12,000 Vdc

- Power down.
- Ground both the CRT high voltage anode and the anode wire to the frame.
- 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.

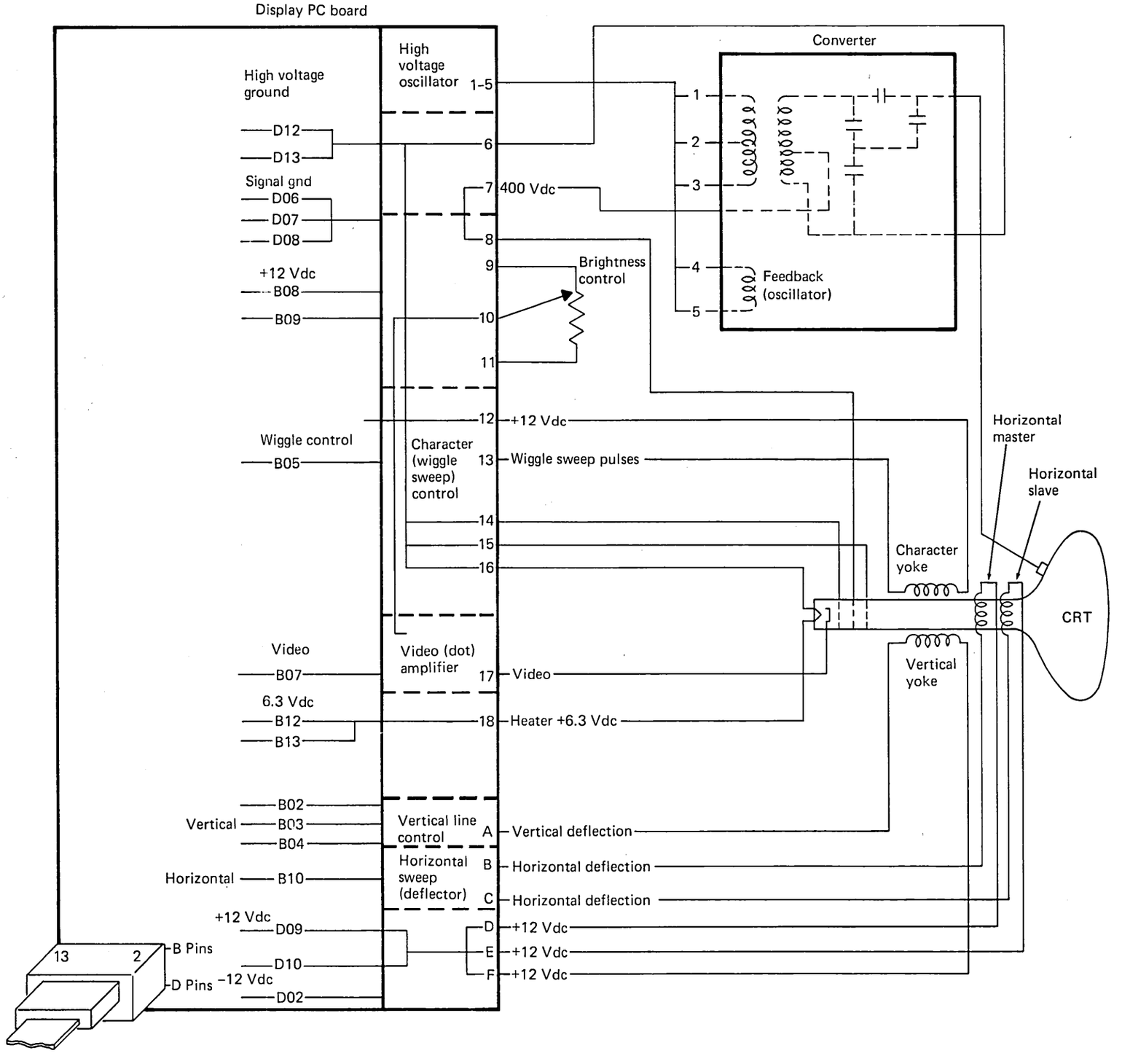






CRT Socket Pin	Wire Color	PC Board Terminal
1	Brown	16 or 18
2	Black	14
3	Red	8
4	Orange	15
5	Unused	
6	Unused	
7	Yellow	17
8	Brown	18 or 16

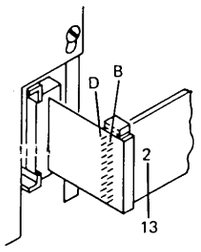
305 Circuit Diagram



EC 823146			PN 1618903
Date 9/15/74			

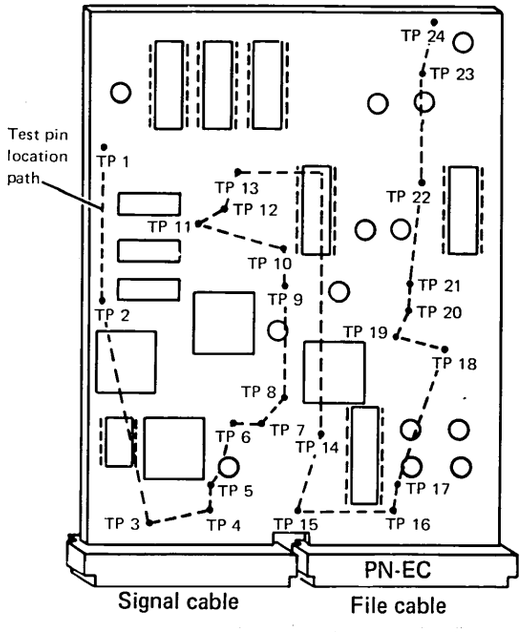
EC 823146	826065		PN 1618904
Date 9/15/74	8/1/75		

306 Cable Extender (PN 5998763)

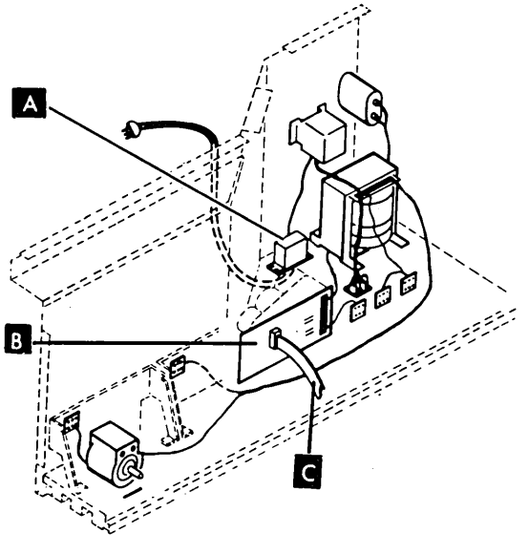


Loosen the cable clamp to permit connecting the cable to the extender without strain.

307 FC Card



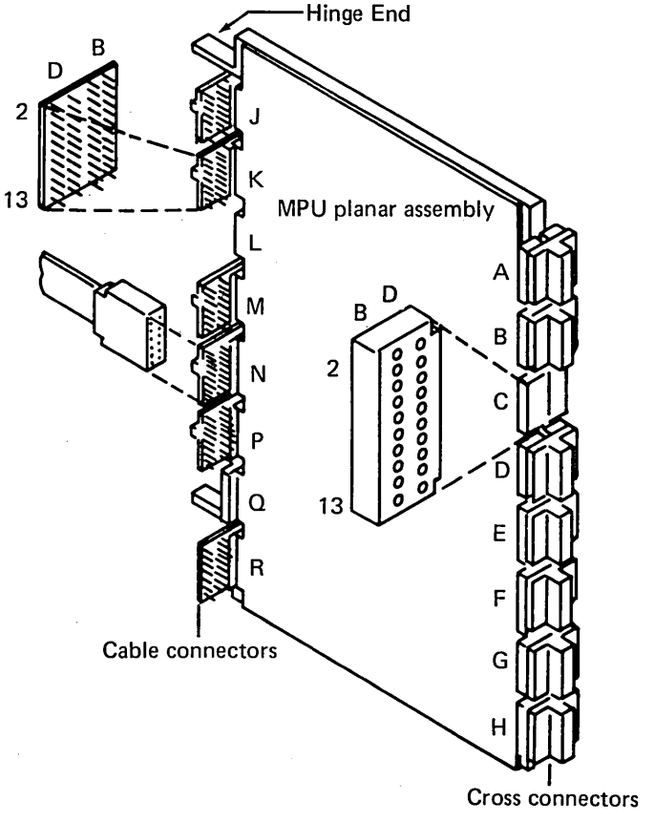
308 Machine Locations



Legend

- **A** AC line filter
- **B** Power supply PC board
- **C** Power supply dc cable

309 MPU Locations

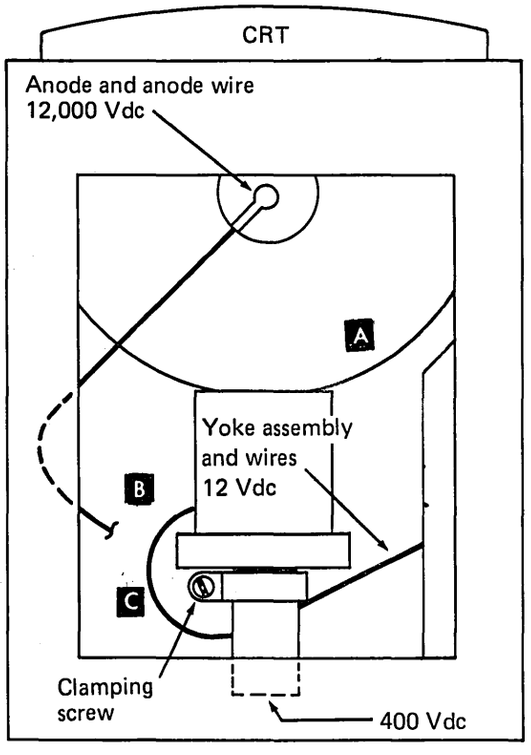


311 Yoke Adjustment

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.
3. Loosen the clamping screw C and slide the yoke into contact with the fat part of the CRT A.
4. Orient the yoke with the wires away from the PC board B.
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 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 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 (304K) on the end of the yoke to center the display on the viewing mirror such that the operator can view both the upper and lower lines in a normal seated position.

   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.

Power Off Method

1. Power down.
2. Ground CRT anode.
3. Loosen the clamping screw and slide the yoke into contact with the fat part of the CRT.
4. Orient the yoke with the wires away from the PC board.
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 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 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.
9. Rotate the yoke and/or centering rings (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.

310 not used

EC 823146			PN 1618906
Date 9/15/74			

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401 Part Numbers and Cause Codes

Part Name	Number	IR Code
Ac line filter	2192519	600-07
Audio feedback device	1611403	040-02
Cover, bottom	2455127	040-00
Cover, top	See *Parts Catalog*	040-04
KBD PC board	See *Parts Catalog*	040-07
KBD signal cable	2456460	100-06
Key module	See *Parts Catalog*	040-08
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		

402 not used
403 not used

EC 823146	826065		PN 1618909
9/15/74	8/1/75		

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.

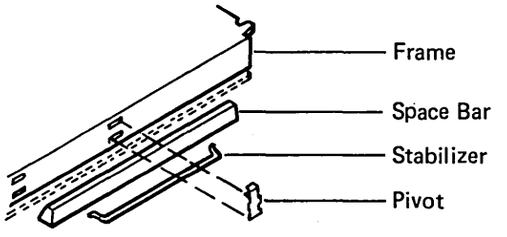
CAUTION
The keyboard baseplate (407N) has a projection that should fit through holes in insulation (407M) and contact the PC board (407G). Be sure the base plate is assembled correct side up. Incorrect assembly might result in a ground circuit failure that intermittently causes extra characters.

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.

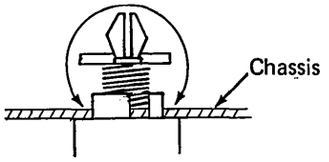


Key Module Removal

– 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.

– 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.

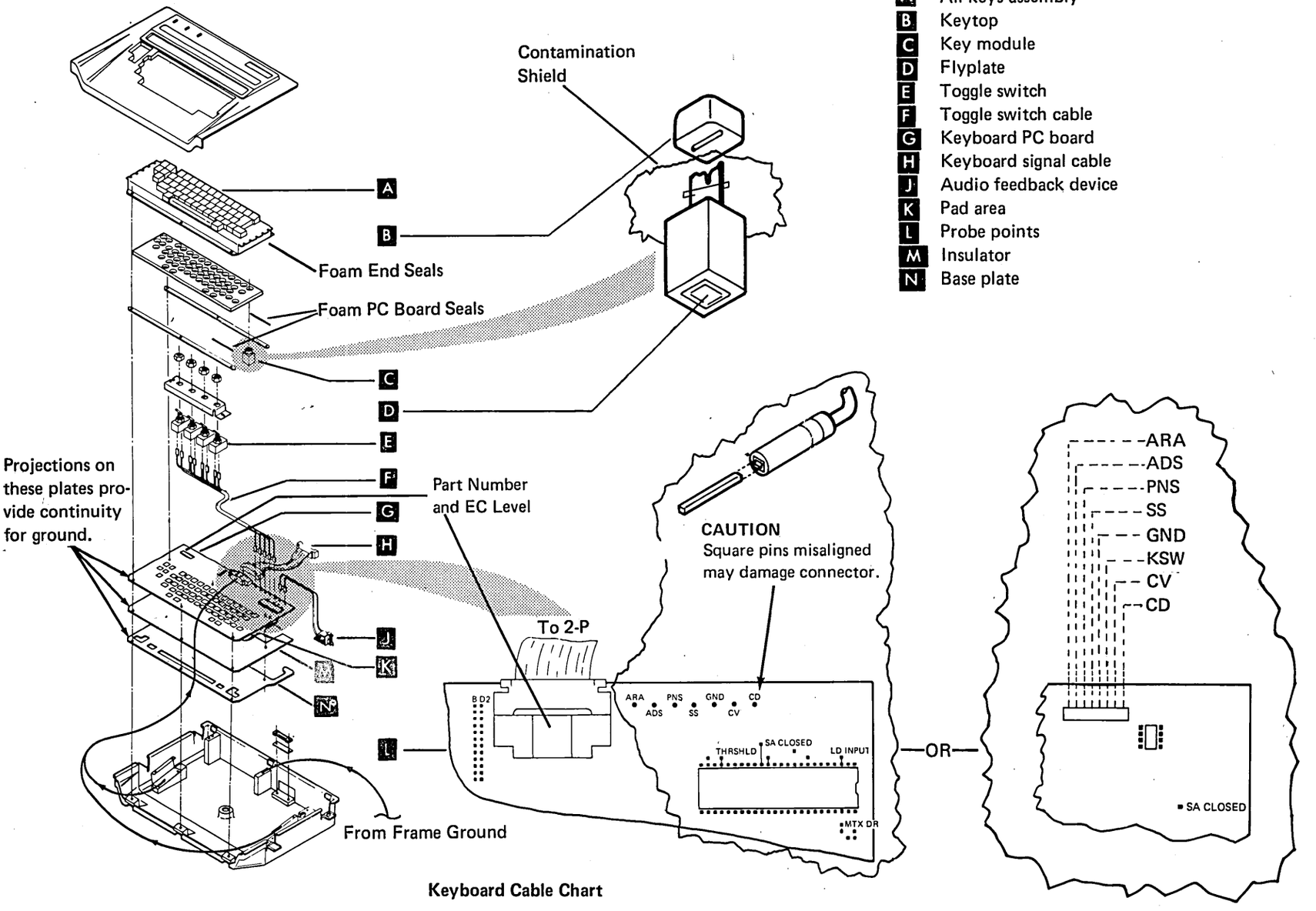
Key Module Installation

– 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.

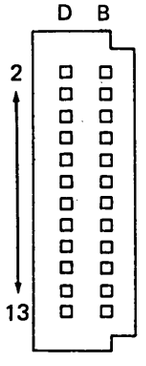
407 Keyboard Disassembly/Assembly and Locations (Continued)

Legend

- A All-keys assembly
- B Keytop
- 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



Keyboard Cable Chart



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 – μs Osc	D10	+ Busy Tone
B11	– Power on Reset	D11	+ Keyboard Data Gate Out
B12	+ 10.8 Hz 5V Osc	D12	Katakana Shift Bit*
B13	– Error	D13	– Bit 5

*Present only on Katakana machines.

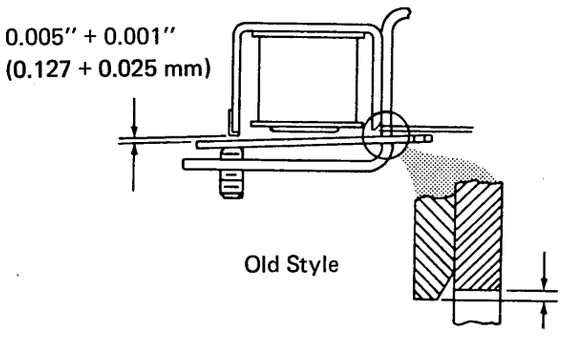
404 not used
405 not used
406 not used

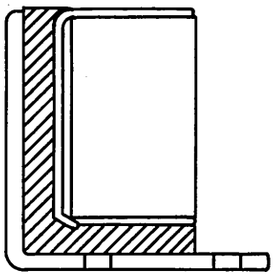
EC 826065			PN 1619560
8/1/75			

EC 826065			PN 1619561
8/1/75			

410 Clicker Service Check

See 407J for location.

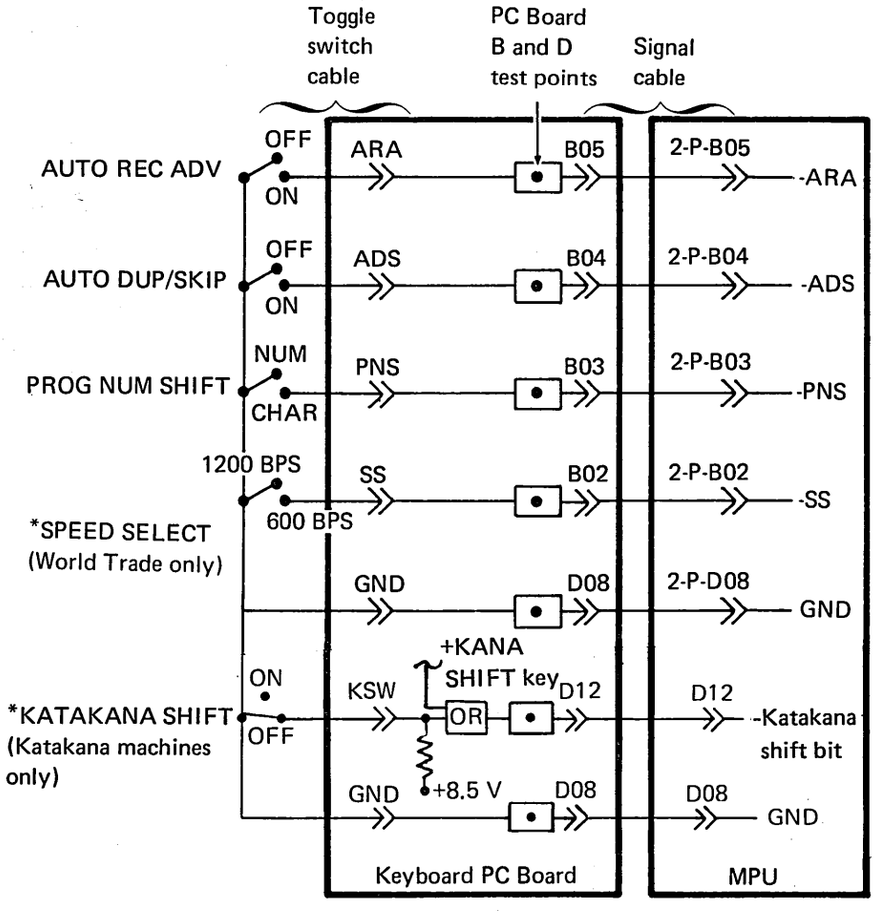




Service check; not for adjustment.

0.010" +0.000" −0.010"
(0.25 - 0.25 mm)

411 Keyboard Switch Circuits

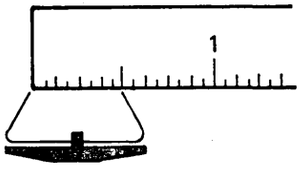


Note: The up position is open circuit on the SPEED SELECT and KATAKANA SHIFT switches only, all others are shown in the down position.

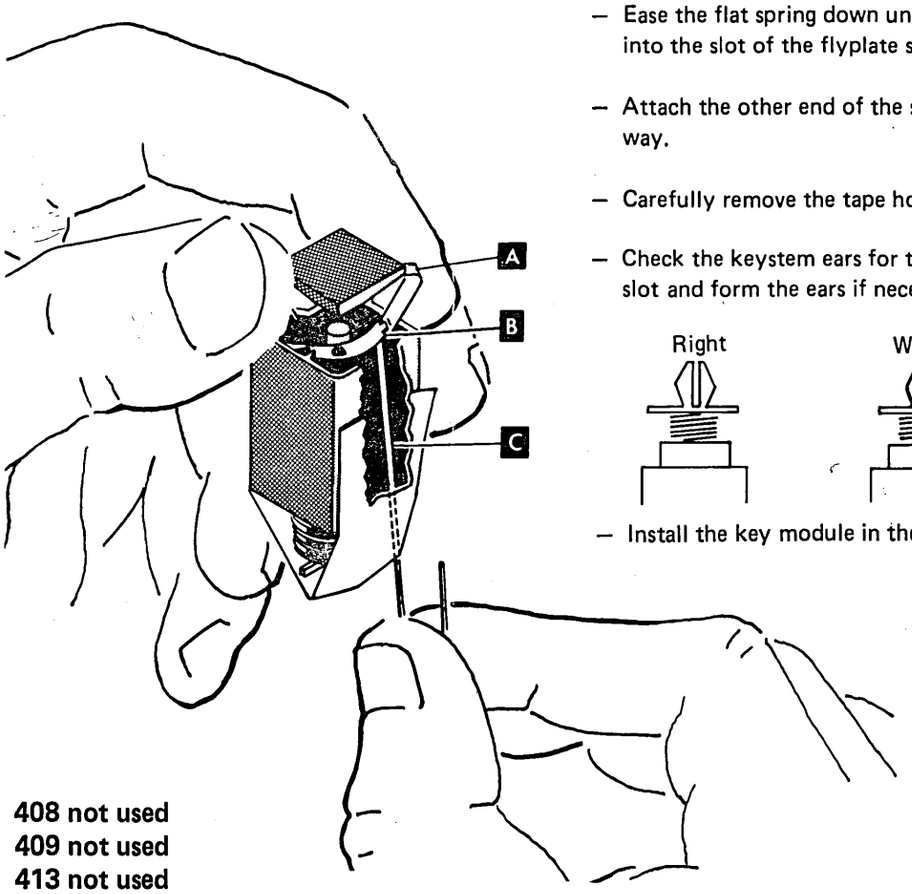
412 Flyplate Replacement

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.

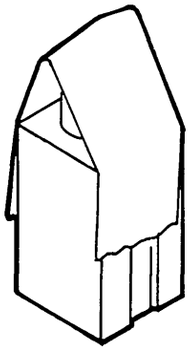
– Form the spring on the flyplate so that there is 0.5 inch (12.7 mm) between the ends of the spring.



– 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 **A** with the tips of the flat spring **B** attached to the keystem.

– Insert a small stylus or straightened paper clip through one of the access holes in the key module **C**

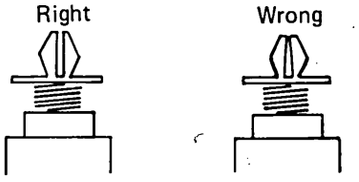
– Push the tip of the flat spring up on the inside of the flyplate spring.

– 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 (407).

408 not used
409 not used
413 not used
414 not used

EC 823146	826065		PN 1618911
Date 9/15/74	8/1/75		

EC 823146	825853		PN 1618912
Date 9/15/74	11/15/74		

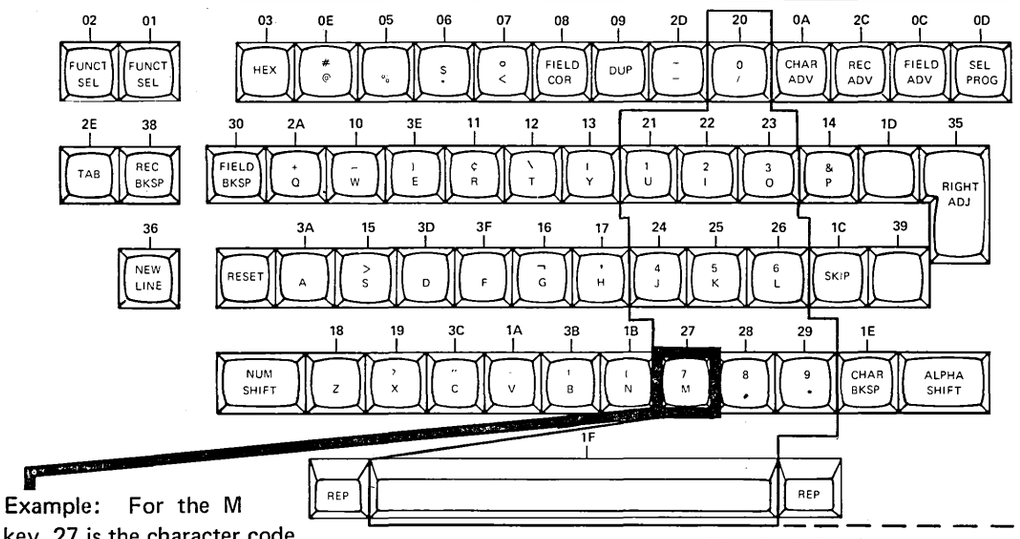
415 CE Mode

Key Codes
See note 3

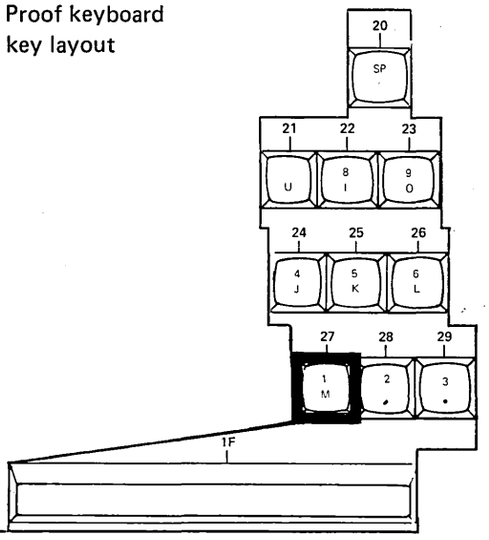
See note 1

See note 2

COMM	COPY	DISK 2 REC BKSP	DISK 2 REC ADV	DISK 2 RET TO INDEX	READ TO EOF	PUNCH TO EOD	PRINT REC	PRINT TO EOD	COMPUTE FIELD TOTALS	DISPLAY FIELD TOTALS	DISPLAY FIELD PROG	DISPLAY FIELD NAME
ENTER	UPDATE	VERIFY	SEARCH CONTENT	SEARCH SEQ CONTENT	SEARCH ADDRESS	SEARCH EOD	RETURN TO INDEX	PROG LOAD	DELETE REC	DISPLAY PROD STAT	DISPLAY PROG	DISPLAY DATA



Proof keyboard key layout



Example: For the 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 (-). See note 3

Key Code Display

001			0	/	A	A	00008			CEW
66	00	00	27		00	07	00	00	00	00
00	00	04	02		00	00	00	00	02	00
08	50	00	00		00	01	01	00	00	00

L

M

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 2	D02 0	D04 1	D05 3		B07 4	B08 6	D07 7	D13 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	–	+	+	–
					D	–	+	–	–
					E	–	–	+	–
					F	–	–	–	–
Reset Key	–	+	+	–		+	–	+	+

Note: A bit line off is up (+).
A bit line on is down (-).

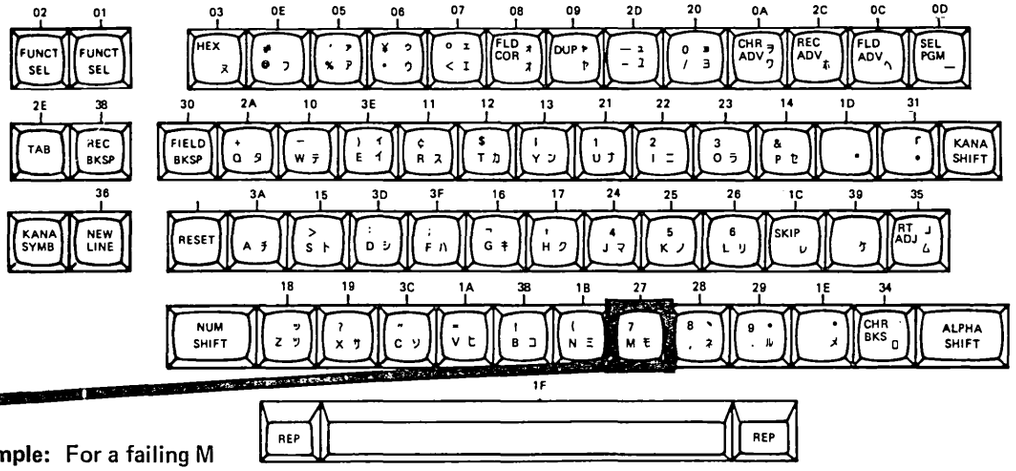
Notes:
1. For I/O Adapter, this label is INPUT TO 3741.
2. For I/O Adapter, this label is OUTPUT FROM 3741.
3. For alpha and numeric keyboard interface decode, see page 13-8.

Katakana CE Mode

Key Codes
See note 3

See note 1 — See note 2

COMM	COPY	DISK 2 REC BKSP	DISK 2 REC ADV	DISK 2 RET TO INDEX	READ TO EOF	PUNCH TO EOD	PRINT REC	PRINT TO EOD	COMPUTE FIELD TOTALS	DISPLAY FIELD TOTALS	DISPLAY FIELD PROG	DISPLAY FIELD NAME
ENTER	UPDATE	VERIFY	SEARCH CONTENT	SEARCH SEQ CONTENT	SEARCH ADDRESS	SEARCH EOD	RETURN TO INDEX	PROG LOAD	DELETE REC	DISPLAY PROD STAT	DISPLAY PROG	DISPLAY DATA



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 (-). See note 3

Key Code Display

66 00 00 27 00 07 00 00 00 00

08 50 00 00 00 01 01 00 00 00

00 00 04 02 00 00 00 00 02 00

Bit Line Levels

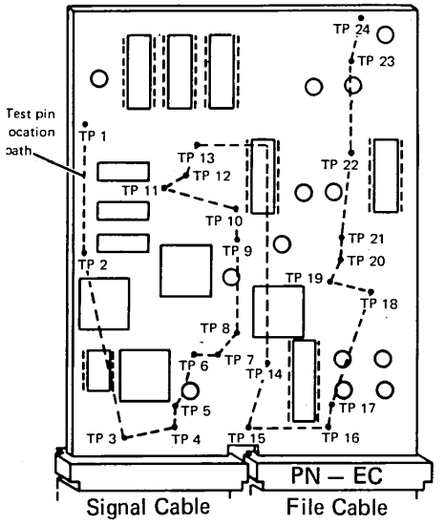
First Character of CE Mode Code	Up (+) and Down (-) Bit Lines				Second Character of CE Mode Code	Up (+) and Down (-) Bit Lines			
	B06 2	D02 0	D04 1	D05 3		B07 4	B08 6	D07 7	D13 5
0	+	+	+	+	0	+	+	+	+
1	+	+	+	–	1	+	+	–	+
2	–	+	+	+	2	+	–	+	+
3	–	+	+	–	3	+	–	–	+
4	+	+	–	+	4	+	+	+	–
5	+	+	–	–	5	+	+	–	–
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 (-).

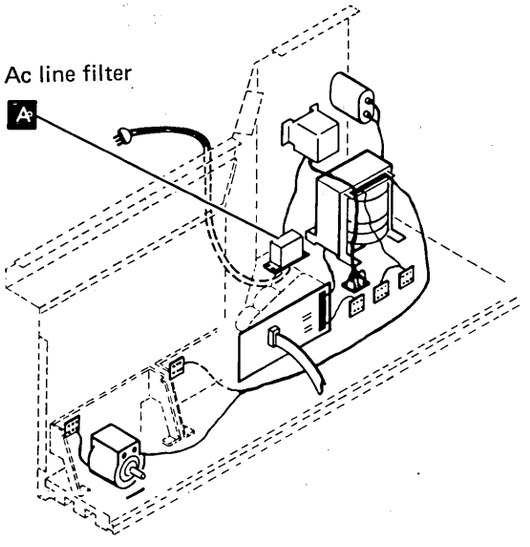
EC 823146	825853		PN 1618913
Date 9/15/74	11/15/74		

EC 823146	826065		PN 1618914
Date 9/15/74	8/1/75		

416 Disk FC Card



417 Machine Locations



418 EBCDIC Collating Sequence

Order in the Sequence	Character	Corresponding Hexadecimal Number
1 (lowest)	Blank	40
2	¢	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	' (apostrophe)	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

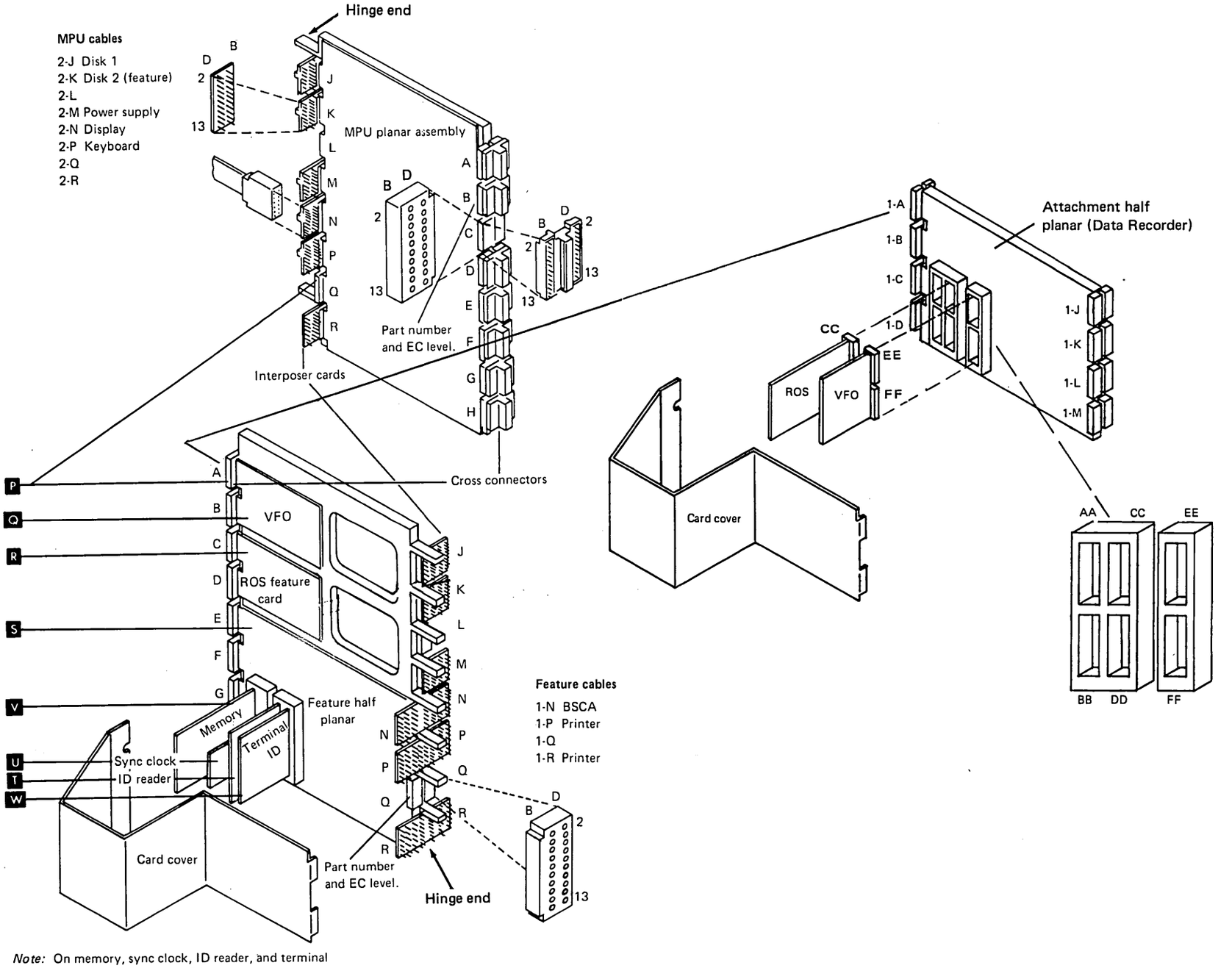
Group A →

Group B →

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.

Disk 1 search sequential content will work with this group of characters. →

419 MPU Locations



Note: On memory, sync clock, ID reader, and terminal ID cards, the part number and EC level are on the connector block.

EC	823146	825853	826065	PN 1618915
Date	9/15/74	11/15/74	8/1/75	

EC 823146			PN 1618916
Date 9/15/74			

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501 Part Numbers and Cause Codes

Part Name	Part Number	IR Code
AC line filter	2192519	600-07
BSCA cable	2455893	100-03
Communication line cable	2455119	100-03
ID reader motor		990-01
60 Hz 115V	2252233	
60 Hz 100V	2252234	
50 Hz 123.5V	2252235	
ID reader		990-01
60 Hz 115V	2144255	
60 Hz 100V	2144256	
50 Hz 123.5V	2144257	
Interposer card	2731011	300-08
Jumper (memory/feature)	1794401	
Keylock	2455097	990-02
Line coupler cable	2455894	100-03
Line plate cable	1611380	100-02
Telephone /PD cable	2469321	100-02
Modem cable	2455573	100-02
MPU cross connector	2731026	300-02
MPU cross connector (wide)	2732453	300-02
Multipoint audible alarm	2197244	990-02
Optional 40' modem cable	1611341	100-02
Data recorder cable	1610677	100-02
I/O adapter cable		
20'	1620318	100-02
40'	1620319	100-02

Cause Codes

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34	Other	00
Defective	21	Open	42		

502 Lists MPU Planar, Half Planars, Line Adapter, and Cards

EC 823146	825853	826065	PN 1618918
Date 9/15/74	11/15/74	8/1/75	

502 Cards, Planars, and Half Planars (Part 1 of 6)

Cards	IR Code	PN	PN	PN	PN	PN	PN
VFO	300-07	8523120	8527646				
Memory 2K	300-05	*8230516	8238725				
ROS Feature	300-06						
Feature group A		2455111	2456220				
Feature group A (Katakana)		2455544	2456221				
Feature group A and record insert		2455490	1620160				
Feature group A and record insert (Katakana)		2455491					
Record insert		2455494					
Proof keyboard		1610661	1620159				
Proof keyboard and record insert		1610662	1620160				
Proof keyboard, record insert and feature group A		1610663	1620163				
Proof keyboard, record insert and feature group A (Katakana)		1610666	1620166				
Proof keyboard and feature group A		1610664	1620164				
Proof keyboard and feature group A (Katakana)		1610665	1620165				
EBSCA ROS	300-06	1620270	2469421				
ASCII ROS	300-06	1611361					
Katakana ROS	300-06	2455544					
Sync clock	300-01	5863575					
Terminal ID	300-01	8521286					
ID reader	300-01	8521326					
Autoanswer basic	584-81	5861862					
Autoanswer interface	584-81	5862829					
Receive	584-87	5862859					
Transmit	584-89	5862858	5863763				
Multipoint feature		8523689					
WTC PSN	584-81	5863123	5864233				
WTC equalizer	584-81	5863944					
WTC cable card	584-81	5864174					

* Some memory cards may have a B/M number 8234646 above the card number 8230516 on the shroud. Disregard the B/M number 8234646 when ordering.

Note: Part numbers are in ascending sequence, the latest levels are shown on the right. When replacing a planar, check the P/N of the removed planar. Use this P/N or a later level P/N. The P/N is located on the connector shroud of the B, D, F or H connectors on the module side of the planar (504). The P/N and EC may be scratched out at one location and an update P/N and EC etched on the next location.

502 Cards, Planars, and Half Planars (Part 2 of 6)

MPU Planars — IR Code 300-03

Country	PN	PN	PN	PN	PN	PN
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	2456950	2455498	1610600	1620259	2469185	
Denmark	2456954	2456210	1610602	1620260	2469186	
Finland and Sweden	2455311	2455602	1610603	1620261	2469187	
Germany (QWERTZ)	2456955	2455607	1610604	1620262	2469188	
Norway	2455300	2455608	1610605	1620263	2469189	
United Kingdom	2456951	2455610	1610606	1620264	2469190	
Spain	2456950	2455615	1610607	1620265	2469191	
Japan	2456956	2455619	1610608	1620266	2469192	
Portugal	2456957	2455620	1610609	1620267	2469193	2469312
Belgium/France (AZERTY)	2456958	2455621	1610610	1620268	2469194	
Latin America	2456959	2455622	1610611	1620269	2469195	
Katakana	1610670	2455671	2469198			
ASCII	1611329					
Brazil	2469306					

Feature Half Planars — IR Code 300-04

Country	PN	PN	PN	PN	PN	PN	PN	PN
With BSCA only								
Same all countries	2455839	2455075	2455263	2456027	1610616	1611442	2468702	2468726
ASCII	1611327							
With 3713 Printer and second disk								
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	2455073	2456127	2455989	1611432	2469230			
Denmark/Norway	2455090	2456145	2455996	1611439	2469237			
Finland and Sweden	2455088	2456143	2455995	1611438	2469236			
Germany (QWERTZ)	2455092	2456146	2455997	1611440	2469238			
United Kingdom	2455086	2456142	2455994	1611437	2469235			
Spain	2455094	2456148	2455998	1611441	2469239			
Japan	2455081	2456129	2455991	1611434	2469232			
Portugal	2455082	2456139	2455992	1611435	2469233	2469315		
Belgium/France (AZERTY)	2455084	2456140	2455993	1611436	2469234			
Latin America	2455076	2456128	2455990	1611433	2469231			
Katakana	2455674	2469240						
ASCII	1611323							
Brazil	2469328							

EC	823146	825853	826065	PN 1618919
Date	9/15/74	11/15/74	8/1/75	

EC 823146	825853	826065	PN 1618920
Date 9/15/74	11/15/74	8/1/75	

502 Cards, Planars, and Half Planars (Part 3 of 6)

Country	PN	PN	PN	PN	PN	PN	PN	PN	PN
With BSCA, 3713 Printer and second disk									
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	2455074	2455262	2456026	2455964	1610615	1611421	1620016	2468703	2468727
Denmark/Norway	2455089	2455279	2456035	2455984	1610629	1611428	1620023	2468710	2468734
Finland and Sweden	2455087	2455278	2456034	2455983	1610627	1611427	1620022	2468709	2468733
Germany	2455091	2455280	2456036	2455985	1610631	1611429	1620024	2468711	2468735
United Kingdom	2455085	2455276	2456032	2455969	1610625	1611426	1620021	2468708	2468732
Spain	2455093	2455281	2456037	2455986	1610633	1611430	1620025	2468712	2468736
Japan	2455078	2455265	2456029	2455966	1610619	1611423	1620018	2468705	2468729
Portugal	2455079	2455274	2456030	2455967	1610620	1611424	1620019	2468706	2469320
Belgium	2455080	2455275	2456031	2455968	1610621	1611425	1620020	2468707	2468731
Latin America	2455077	2455264	2456028	2455965	1610618	1611422	1620017	2468704	2468728
Katakana	2455673	2468736							
ASCII	1611325								
Brazil	2469329								
With EBSCA only									
Same all countries	2456753	1620244	2469881						
With EBSCA, 3713 Printer, and second disk									
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	2456978	1620245	2469244		2469894				
Denmark/Norway	2456979	1609265	2469245		2469901				
Finland and Sweden	2456980	1609266	2469246		2469900				
Germany (QWERTZ)	2456981	1609267	2469247		2469902				
United Kingdom	2456982	1609268	2469248		2469899				
Spain	2456983	1609269	2469249		2469903				
Japan	2456984	1609270	2469250		2469896				
Portugal	2456985	1609271	2469251	2469319	2469897				
Belgium/France (AZERTY)	2456986	1609272	2469252		2469898				
Latin America	2456987	1609273	2469253		2469895				
Katakana	2456988	2469242	2469905						
Brazil	2469330	2469904							

502 Cards, Planars, and Half Planars (Part 4 of 6)

With 3715 Printer and second disk	PN	PN	PN	PN	PN	PN	PN	PN
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	1620305	2469218	2469492	2469260		2469693	2469733	2469778
Denmark/Norway	1620307	2469220	2469494	2469262		2469696	2469735	2469780
Finland and Sweden	1620308	2469221	2469495	2469263		2469697	2469736	2469781
Germany (QWERTZ)	1620309	2469222	2469496	2469264		2469698	2469737	2469782
United Kingdom	1620315	2469228	2469502	2469270		2469703	2469743	2469788
Spain	1620314	2469227	2469501	2469269		2469702	2469742	2469787
Japan	1620311	2469224	2469498	2469266		2469700	2469739	2469784
Portugal	1620313	2469226	2469500	2469268	2469318	2469704	2469744	2469786
Belgium/France (AZERTY)	1620306	2469219	2469493	2469261		2469695	2469734	2469779
Latin America	1620310	2469223	2469497	2469265		2469699	2469738	2469783
Katakana	1620312	2469728	2469740	2469785				
Brazil	2469322	2469701	2469741	2469789				

EC 825853	826065		PN 1619380
Date 11/15/74	8/1/75		

502 Cards, Planars, and Half Planars (Part 5 of 6)

Country	PN	PN	PN	PN	PN	PN	PN	PN	PN
With BSCA, 3715 Printer and second disk									
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	1620283	2468738	2469471	2469282		2469694	2469745	2469790	
Denmark/Norway	1620285	2468740	2469473	2469284		2469707	2469747	2469792	
Finland and Sweden	1620286	2468741	2469474	2469285		2469708	2469748	2469793	
Germany (QWERTZ)	1620287	2468742	2469475	2469286		2469709	2469749	2469794	
United Kingdom	1620293	2468747	2469480	2469292		2469714	2469755	2469800	
Spain	1620292	2468746	2469479	2469291		2469713	2469754	2469799	
Japan	1620289	2468744	2469477	2469288		2469711	2469751	2469796	
Portugal	1620291	2468745	2469478	2469290	2469316	2469715	2469756	2469798	
Belgium	1620283	2468739	2469472	2469283		2469706	2469746	2469791	
Latin America	1620288	2468743	2469476	2469287		2469710	2469750	2469795	
Katakana	1620290	2469729	2469752	2469797					
Brazil	2469323	2469712	2469753	2469801					
With EBSCA only									
Same all countries	2456753	1620244	2469881						
With EBSCA, 3715 Printer, and second disk									
US, Canada, Italy, France (QWERTY), and Germany (QWERTY)	1620294	2469207	2469481	2469271		2469716	2469757	2469802	2469882
Denmark/Norway	1620296	2469209	2469483	2469273		2469718	2469759	2469804	2469884
Finland and Sweden	1620297	2469210	2469484	2469274		2469719	2469760	2469805	2469885
Germany (QWERTZ)	1620298	2469211	2469485	2469275		2469720	2469761	2469806	2469886
United Kingdom	1620304	2469217	2469491	2469281		2469726	2469767	2469812	2469892
Spain	1620303	2469216	2469490	2469280		2469725	2469766	2469811	2469891
Japan	1620300	2469213	2469487	2469277		2469722	2469763	2469808	2469888
Portugal	1620302	2469215	2469489	2469279	2469317	2469724	2469765	2469813	2469890
Belgium/France (AZERTY)	1620295	2469208	2469482	2469272		2469717	2469758	2469803	2469883
Latin America	1620299	2469212	2469486	2469276		2469721	2469762	2469807	2469887
Katakana	1620301	2469723	2469764	2469809	2469889				
Brazil	2469324	2469727	2469768	2469810	2469893				

502 Cards, Planars, and Half Planars (Part 6 of 6)

With BSCA, 3717 Printer, and second disk

Same all countries	1607406	1607457	1607459

With 3717 Printer and second disk

Same all countries	1607404	1607456	1607460

With EBSCA, 3717 Printer, and second disk

Same all countries	1607407	1607458	1607461

Half Planar in 3717 Printer

Same all countries (except Katakana)	1607438
Katakana	1607439

Attachment Half Planars — IR Code 300-11

County	PN	PN
Data Recorder (129/5496)		
Same all countries	2468902	2469336
I/O Adapter on 3741 Models 1 and 2		
Same all countries	1620188	

Line Adapter Boards — IR Code 584-00

County	PN	PN
Same all countries		
Non-switched	2455072	2469520
Switched line	2455892	2469518
Public switched network, WTC	1611373	2469516
Line Plate		
Line plate assembly, WTC	1780955	

EC 826065			PN 1619562
8/1/75			

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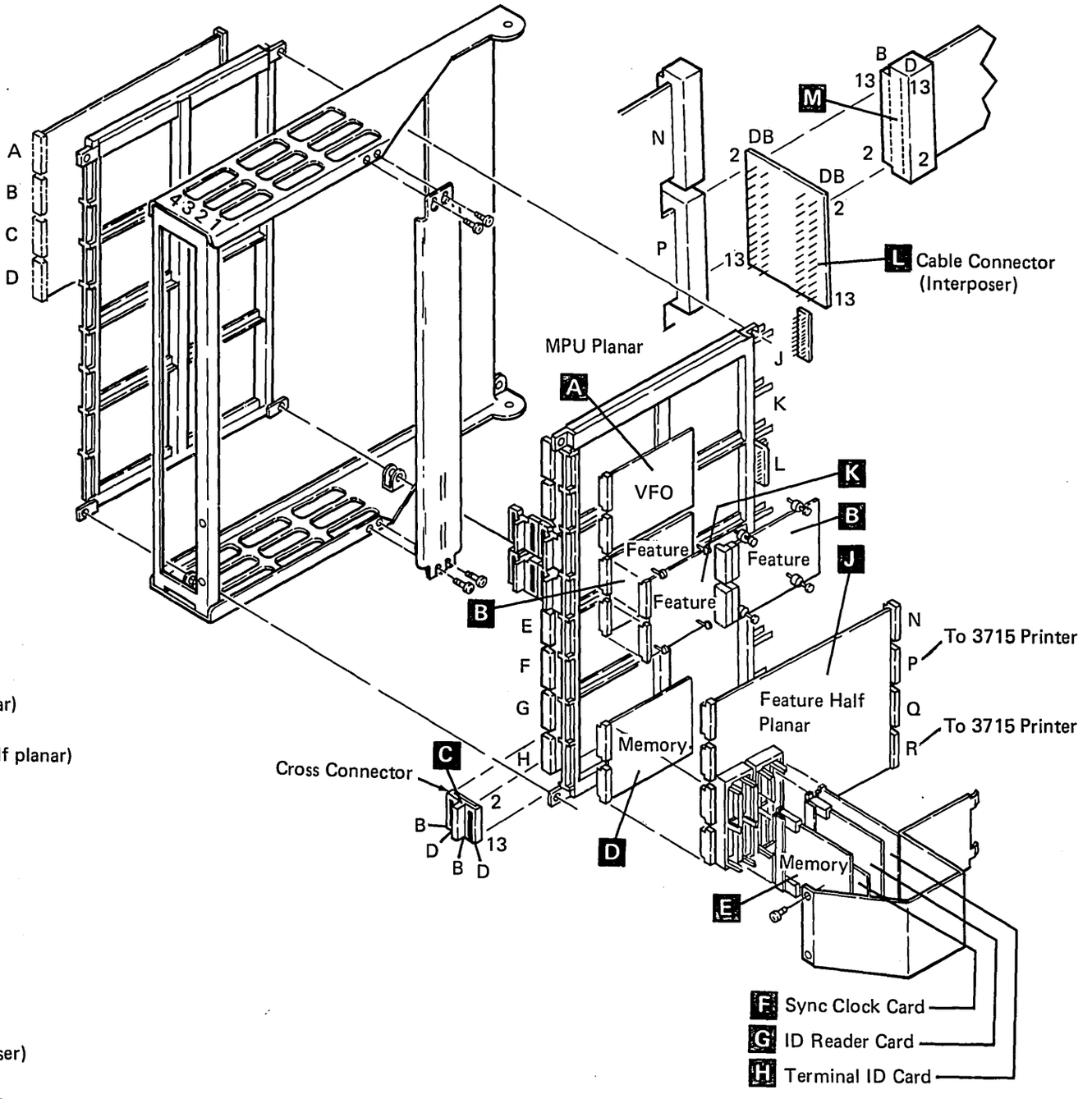
503 3715 Printer Cables and Jumpers — Feature Half Planar (Part 1 of 3)



Legend

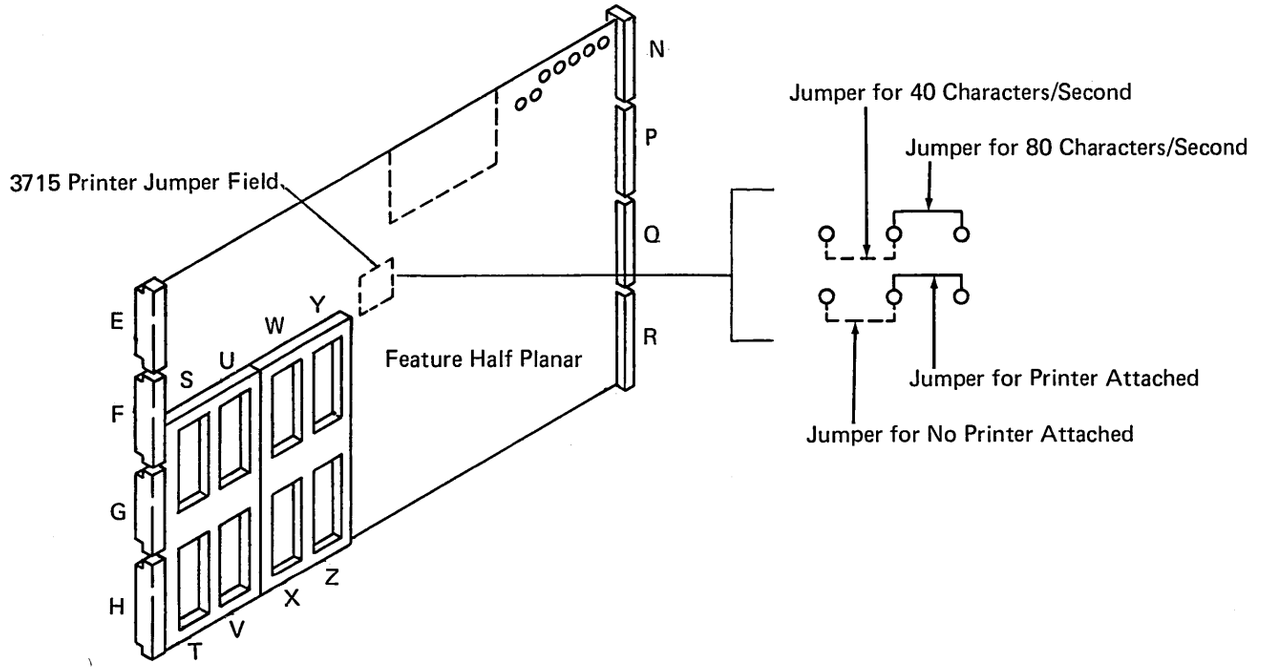
- A VFO card
- B ROS feature card
- C Cross connector
- D Memory card (MPU planar)
- E Memory card (feature half planar)
- F Sync clock card
- G ID reader card
- H Terminal ID card
- J Feature half planar
- K Field update ROS
- L Cable connector (Interposer)
- M 3715 cable pin numbering
- P 3715 printer jumpers (503-2)
- Q 3715 printer signal cable (503-4)
- R 3715 printer ac power cable (503-2)

EC 825853	826065		PN 1619382
Date 11/15/74	8/1/75		

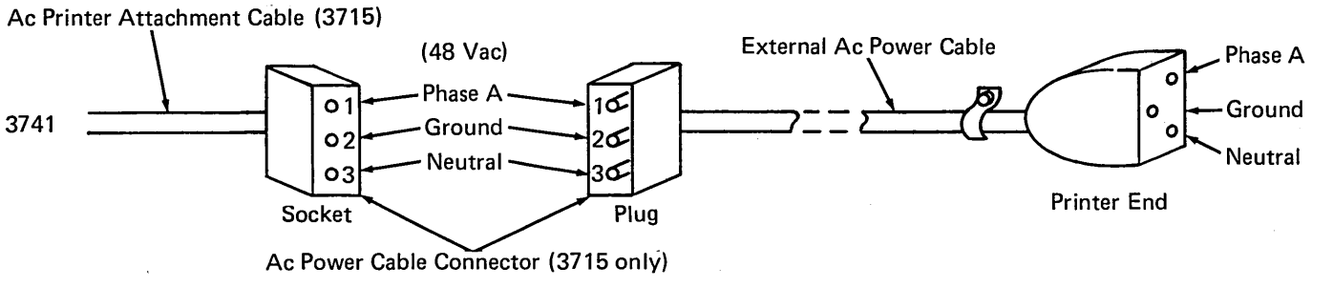
EC 825853	826065		PN 1619383
11/15/74	8/1/75		

503 3715 Printer Cables and Jumpers — Feature Half Planar (Part 2 of 3)

P



R

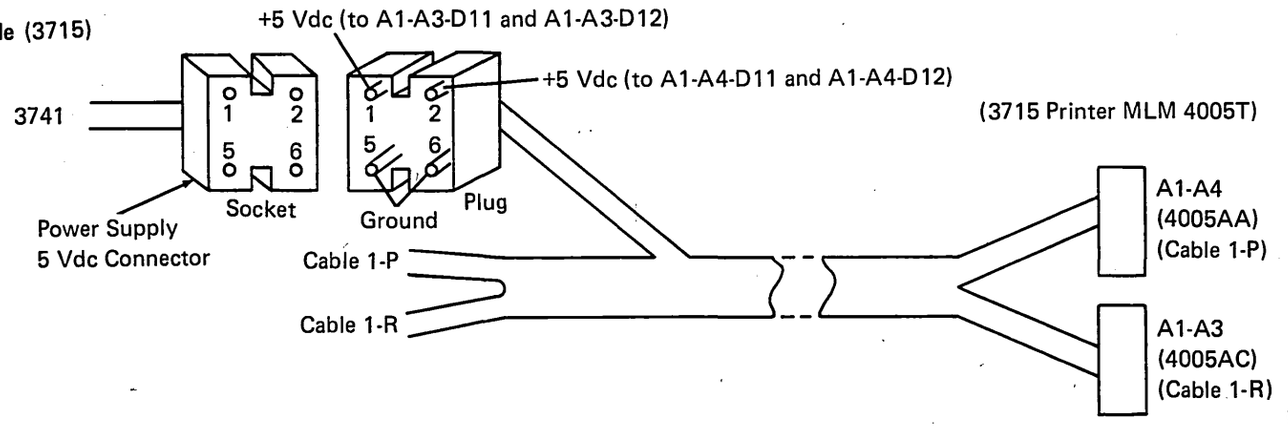


Note:

Phase A to Neutral = 48 Vac
Phase A to Ground = 24 Vac
Neutral to Ground = 24 Vac

503 3715 Printer Cables and Jumpers — Feature Half Planar (Part 3 of 3)

Q Printer Signal Cable (3715)



Half Planar Socket 1-R	Cable (Half Planar End)	Line Name	Cable (Printer End A1-A3)
B02	D13	+End of Forms	D13
*		+5 Vdc	D12
*		+5 Vdc	D11
*		Gnd	D09
*		Gnd	D08
B08	D07	-Print Wire Drive 8	D07
B09	D06	-Print Wire Drive 6	D06
B10	D05	-Print Wire Drive 4	D05
B11	D04	-Print Wire Drive 2	D04
B13	D02	+Ready	D02
D03	B12	-Printer Reset	B12
D05	B10	-Print Emitter 1	B10
D06	B09	-Print Emitter 2	B09
D07	B08	-Print Emitter 3	B08
D08	B07	-Print Wire Drive 7	B07
D10	B05	-Print Wire Drive 5	B05
D11	B04	-Print Wire Drive 3	B04
D12	B03	-Print Wire Drive 1	B03

*From the +5 Vdc connector.

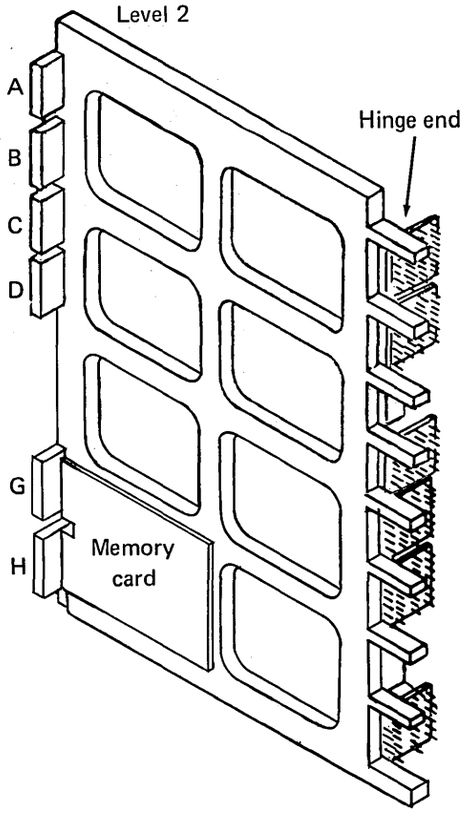
Half Planar Socket 1-P	Cable (Half Planar End)	Line Name	Cable (Printer End A1-A4)
*		+5 Vdc	D12
*		+5 Vdc	D11
*		Gnd	D09
*		Gnd	D08
B08	D07	-Forms Emitter A	D07
B09	D06	-Print Motor Drive B	D06
B10	D05	-Forms Drive A	D05
B11	D04	-Forms Drive B	D04
D03	B12	-Forms Emitter B	B12
D05	B10	-Left Margin	B10
D06	B09	-Wire Check	B09
D07	B08	-Print Motor Drive A	B08
D08	B07	-Print Motor Drive A	B07
D10	B05	-Print Motor Drive B	B05
D11	B04	-Forms Drive A	B04
D12	B03	-Forms Drive B	B03

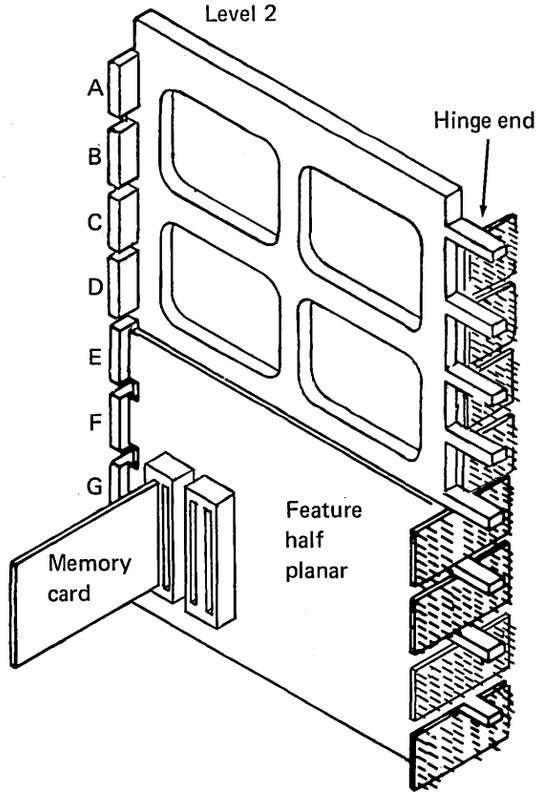
*From the +5 Vdc connector.

EC 825853	825958	826065	PN 1618922
11/15/74	3/21/75	8/1/75	

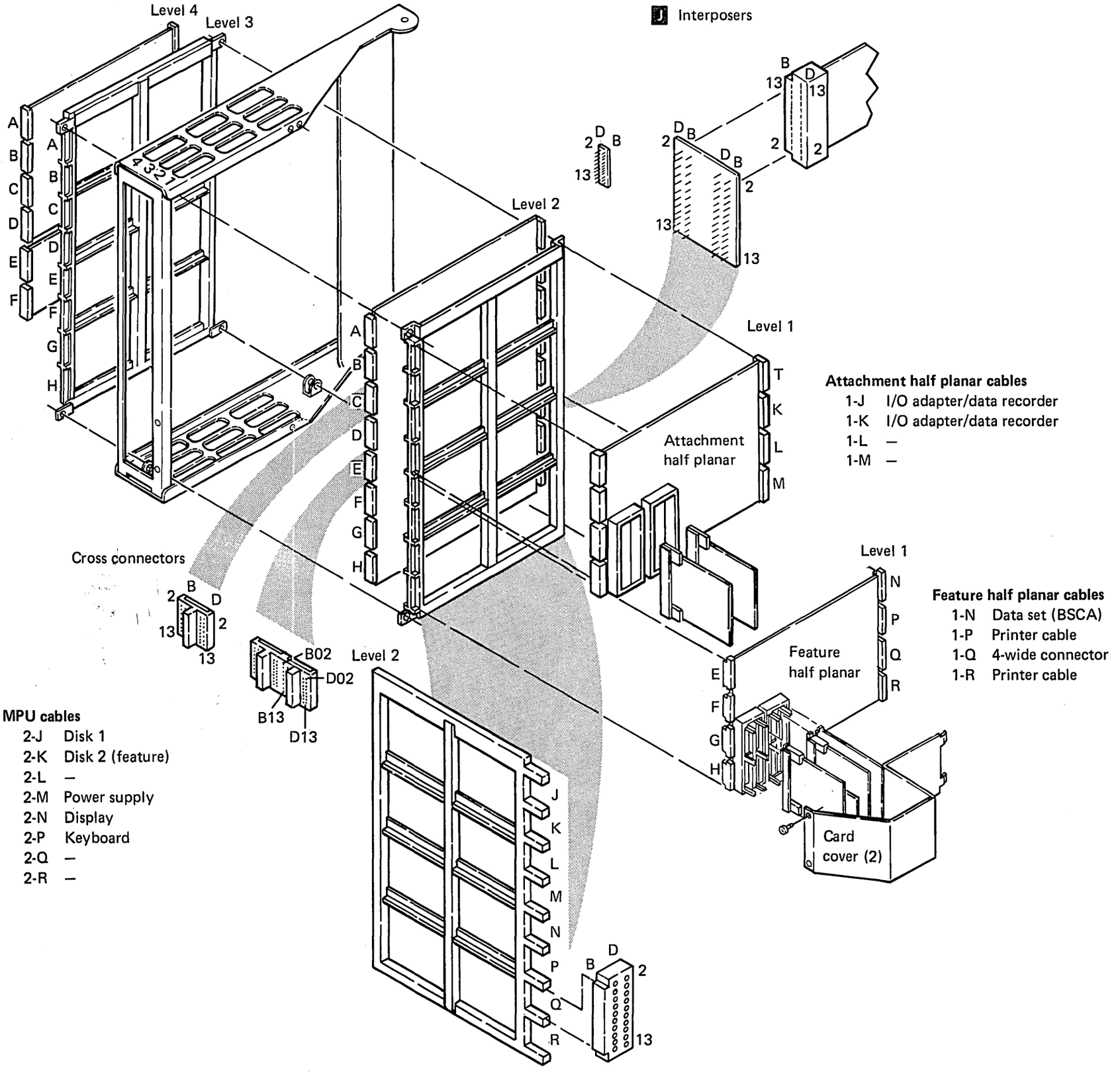
504 MPU Locations (Part 1 of 6)

- Most of the logic required for the machine is located on the gate.
- Card locations change when half planars are added for the various machine models and features. For example, the drawing on the left shows the location of a memory card on a 3741 Model 1 without features. The drawing on the right shows the location of a memory card on a 3741 Model 1 that has the feature half planar installed (printer and/or second disk).





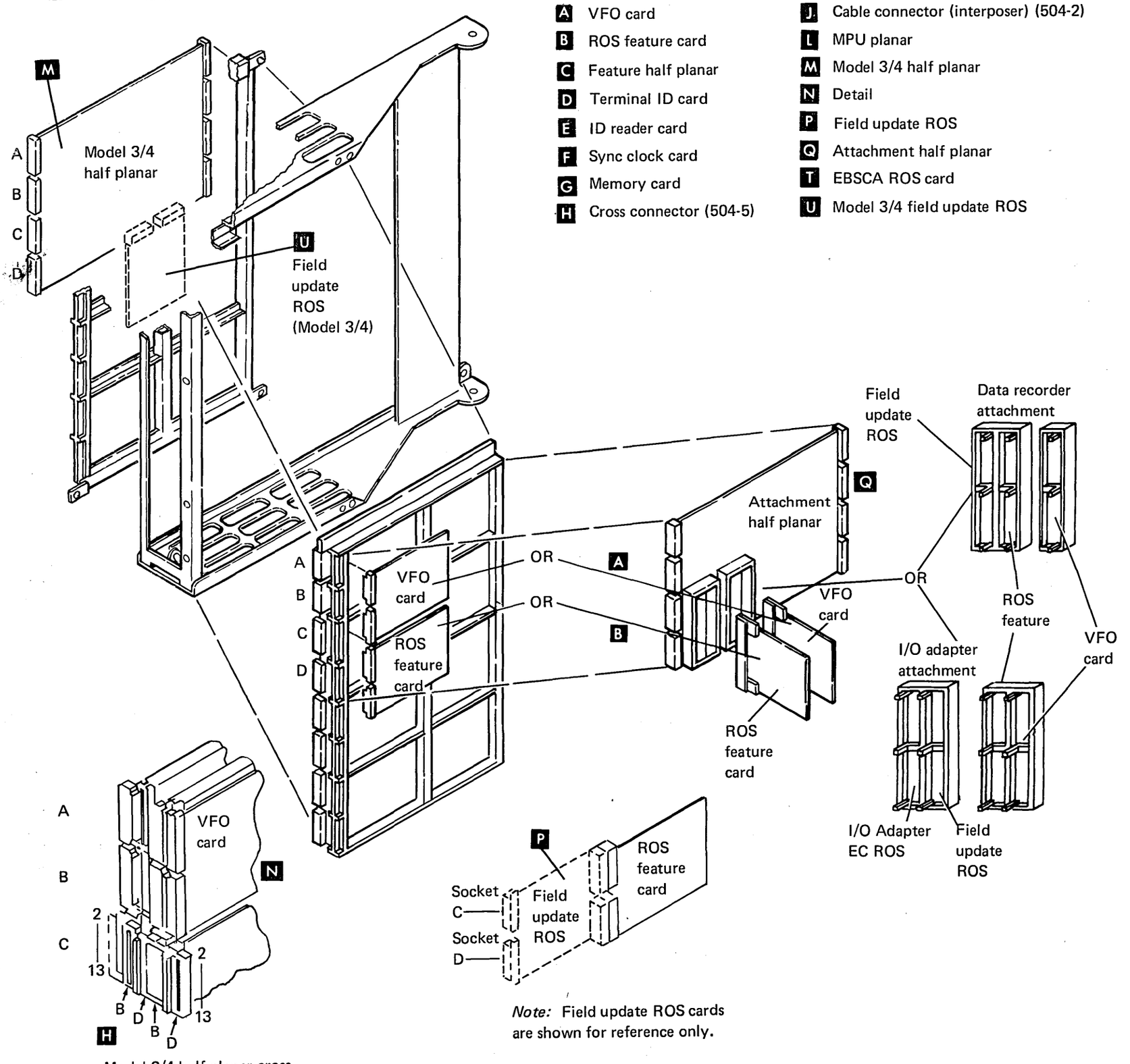
504 MPU Locations (Part 2 of 6)



EC 825853	825958	826065	PN 1618923
11/15/74	3/21/75	8/1/75	

504 MPU Locations (Part 3 of 6)

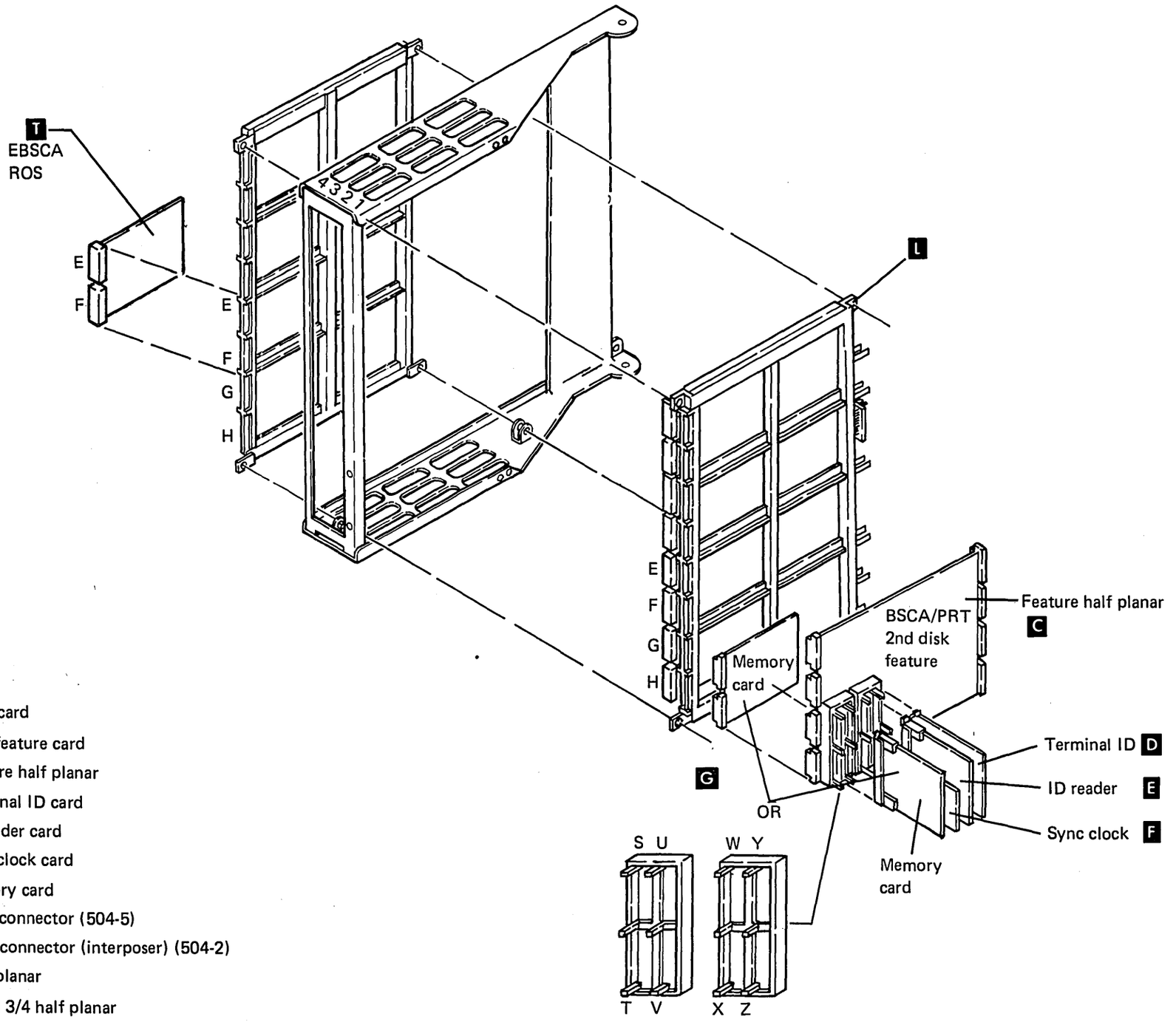
- A VFO card
- B ROS feature card
- C Feature half planar
- D Terminal ID card
- E ID reader card
- F Sync clock card
- G Memory card
- H Cross connector (504-5)
- J Cable connector (interposer) (504-2)
- L MPU planar
- M Model 3/4 half planar
- N Detail
- P Field update ROS
- Q Attachment half planar
- T EBSCA ROS card
- U Model 3/4 field update ROS



Model 3/4 half planar cross connectors C, D, and L are shown on 504-5.

Note: Field update ROS cards are shown for reference only.

504 MPU Locations (Part 4 of 6)



- A VFO card
- B ROS feature card
- C Feature half planar
- D Terminal ID card
- E ID reader card
- F Sync clock card
- G Memory card
- H Cross connector (504-5)
- J Cable connector (interposer) (504-2)
- L MPU planar
- M Model 3/4 half planar
- N Detail
- P Field update ROS
- Q Attachment half planar
- T EBSCA ROS card
- U Model 3/4 field update ROS

EC 825853	826065		PN 1619387
11/15/74	8/1/75		

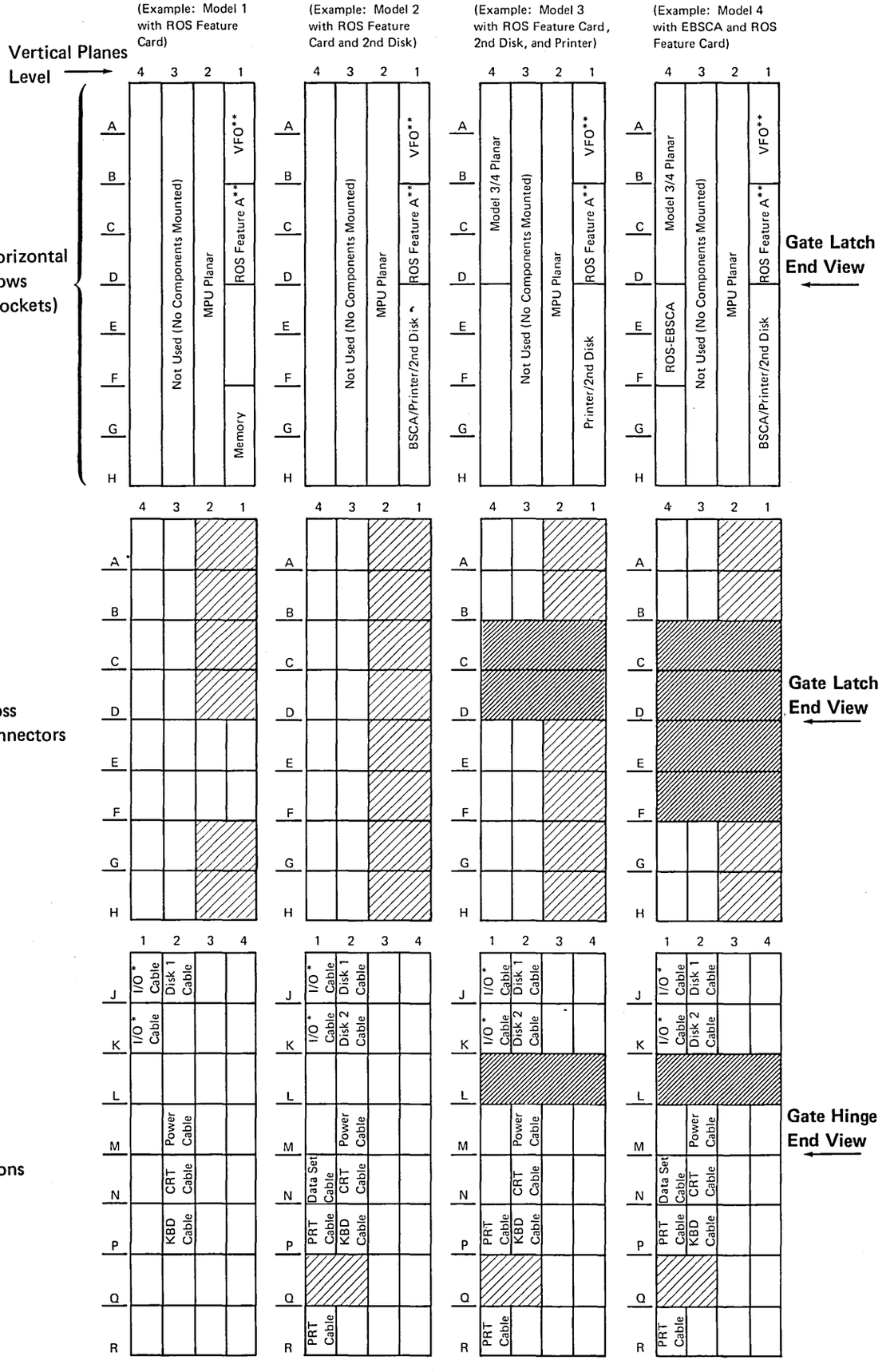
EC 826065			PN 1619563
Date 8/1/75			

504 MPU Locations (Part 5 of 6)

Note: Shaded blocks represent cross connectors.

Represents 2 wide connectors

Represents 4 wide connectors

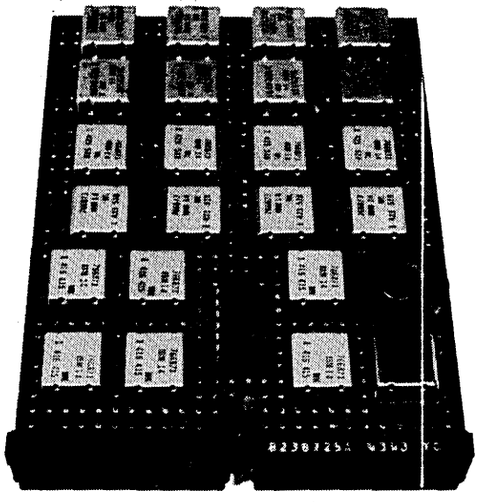


* Present only with attachment half planar.

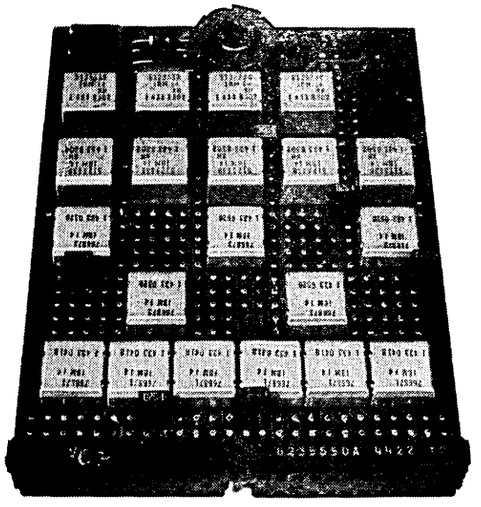
** Attachment half planar, when installed, is located here.

504 MPU Locations (Part 6 of 6)

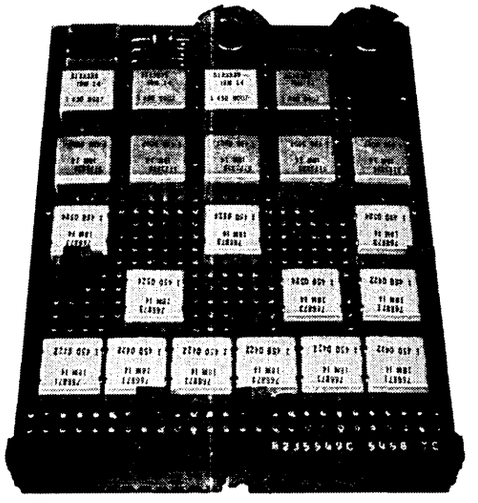
- The part numbers shown are for reference only. See 502 for card part numbers.
- Replace cards with one of the same or a later part number.
- Refer to service aid CEM for more information.



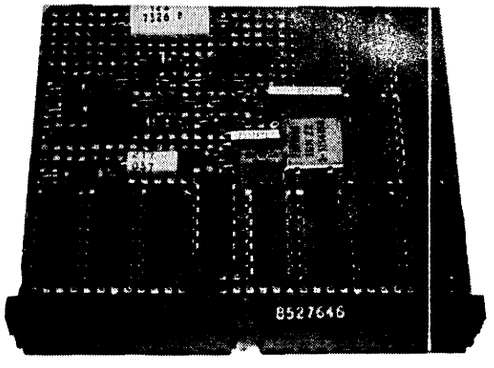
Memory (base 2K), 8238725



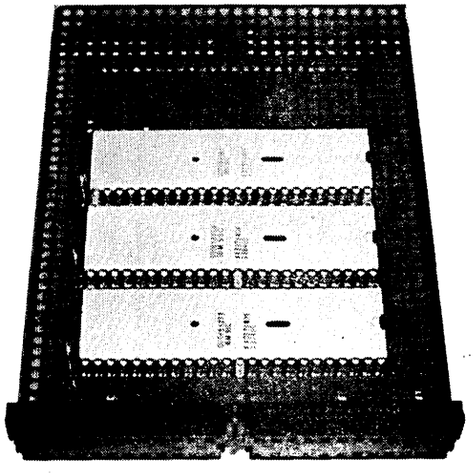
Memory, 4K, 8235550



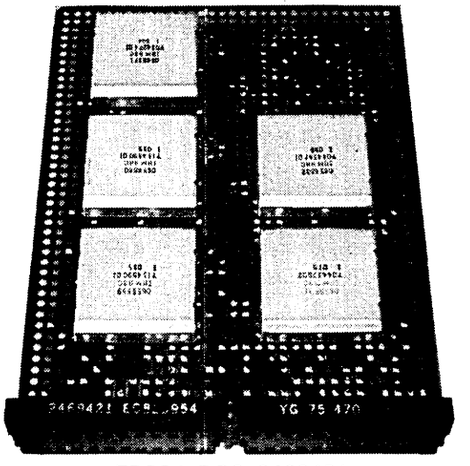
Memory, 8K, 8235549



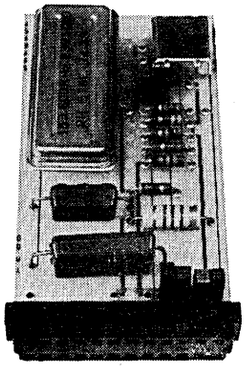
VFO, 8527646



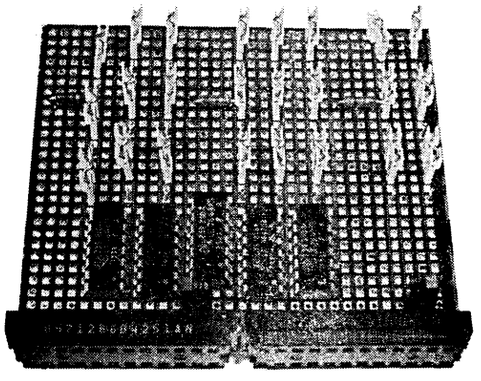
ROS Feature A, 2456220



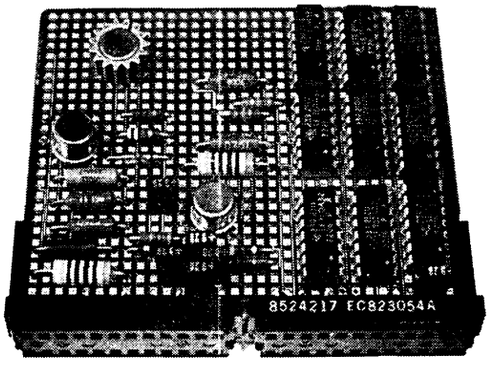
EBSCA ROS, 2469421



Sync Clock, 5863575



Terminal ID, 8521286



ID Reader, 8524217

EC 826065			PN 1619564
8/1/75			

3741 ML

EC 823146	825853	826065	PN 1618924
Date 9/15/74	11/15/74	8/1/75	

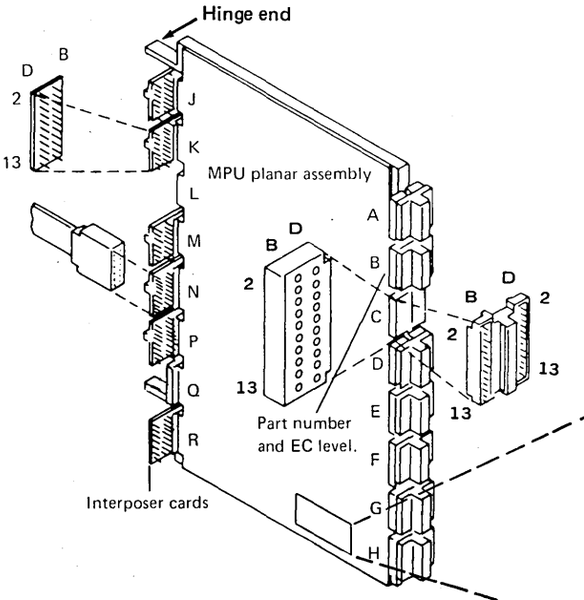
505 MPU Planar Removal/Replacement Procedure

- See 502 for planar part numbers and 504 for location.
- Disconnect the cables.
- Remove the cross connectors.
- Remove the studs holding the VFO and ROS feature cards, and feature half planar (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.
- Check memory jumpers on new planar board being installed for correct location (507).
- Reverse the above procedure to reinstall and restore to the original condition.

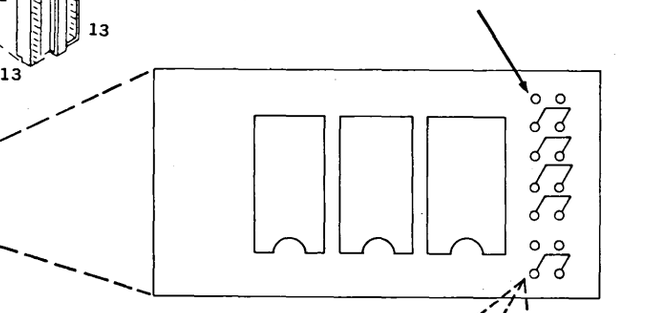
506 Feature Half Planar Board Reassembly Procedure

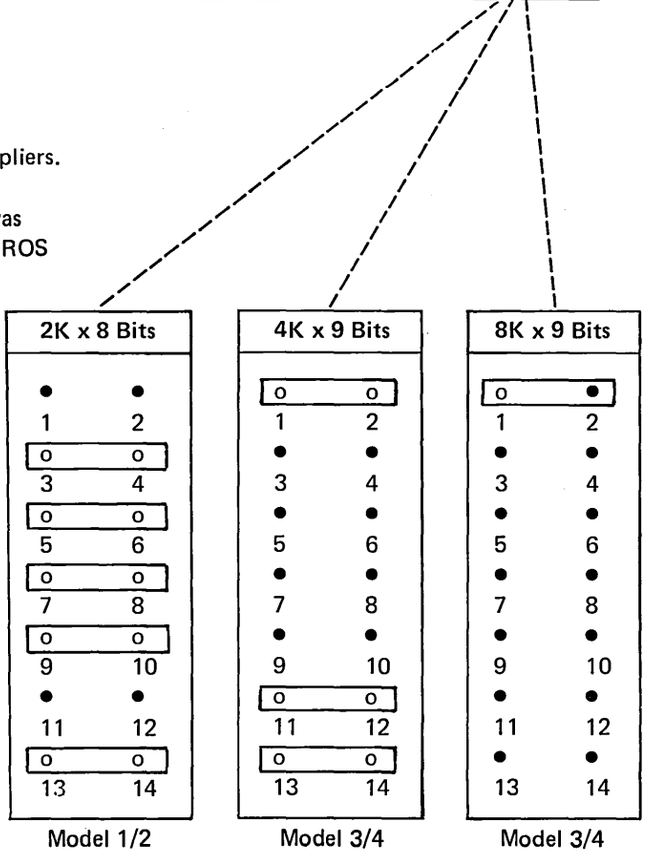
- See 502 for half planar part numbers and 504 for locations.
- Power down.
- Remove MPU cross connectors 1-G and 1-H (504H).
- Remove the memory card (504G). ---------- Remove mounting studs with long-nosed pliers.
- Reinstall the feature half planar which was removed (504C). ---------- Fasten with mounting studs. Also, if it was previously removed, reinstall the EBSCA ROS card (504T).
- Check feature half planar jumpers (16-4).
- Reinstall all MPU cross connectors.
- Reinstall the memory card on the feature half planar (504G).
- Return to the place in MAP where you left to come here (unless otherwise instructed).

507 Memory Jumpers



Some planar boards have memory jumpers (501 for part numbers).





Storage Configuration Plug Chart*

* To determine the storage capacity of a machine, get the part number of the memory card and look in the list on 502-1.

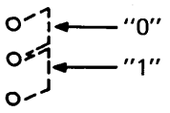
508 Attachment Half Planar Removal/ Replacement Procedure (504Q)

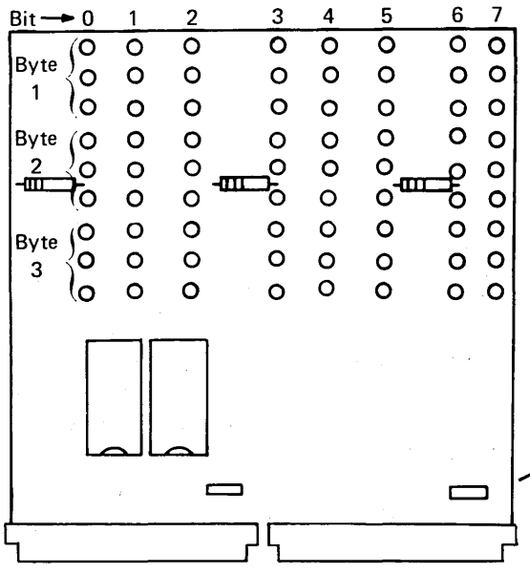
1. Power down.
2. Remove the card cover(s) and cover bar from the gate.
3. Remove the VFO and ROS feature cards from the half planar, if installed (504A and 504B).
4. Remove the cross connectors at planar sockets 1-A, 1-B, 1-C, and 1-D.
5. Unplug power cable from socket 2-M.
6. Remove the cross connectors at planar sockets 1-M and 1-L.
7. Remove the attachment cables from 1-J and 1-K.
8. Pull all the plastic board fasteners from the attachment half planar (carefully hold the planar and use duck-billed pliers). When fasteners are removed, the planar can be removed.
9. Carefully remove the half planar.
10. Remove the cable connectors (interposers) from 1-J and 1-K.
11. To install attachment half planar, reverse the above procedure.

509 not used

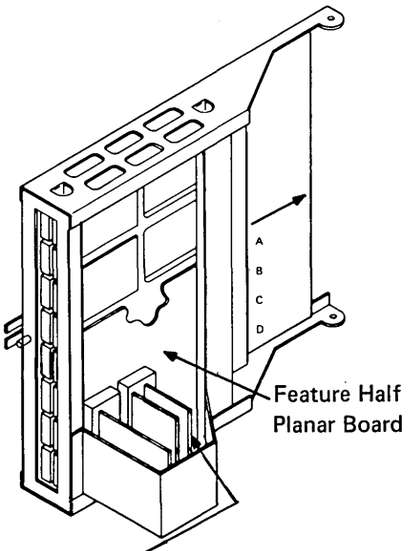
510 Terminal ID Jumpers

Each Bit Position





Terminal ID Card



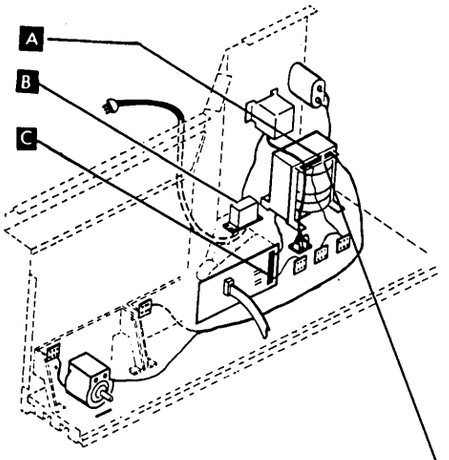
ID Character Jumper Placement

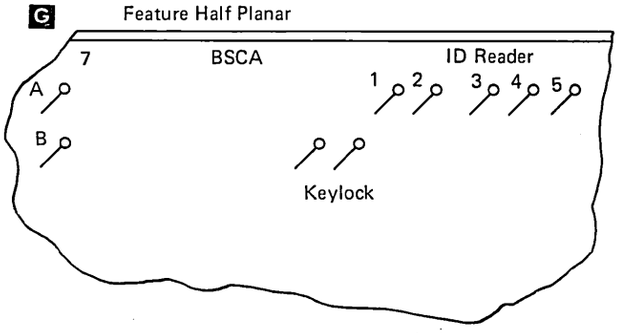
Row	Hex	0 1 2	3 4 5	6 7		Hex	0 1 2	3 4 5	6 7
a	81	● ○ ○	○ ○ ○	○ ○	n	95	○ ○ ○	● ○ ●	○ ○
b	82	● ○ ○	○ ○ ○	● ○	o	96	○ ○ ○	● ○ ●	● ○
c	83	● ○ ○	○ ○ ○	● ●	p	97	○ ○ ○	● ○ ●	● ●
d	84	● ○ ○	○ ○ ●	○ ○	q	98	○ ○ ○	● ● ○	○ ○
e	85	● ○ ○	○ ○ ●	○ ●	r	99	○ ○ ○	● ● ○	○ ●
f	86	● ○ ○	○ ○ ●	● ○	s	A2	○ ○ ●	○ ○ ○	○ ○
g	87	● ○ ○	○ ○ ●	● ●	t	A3	○ ○ ●	○ ○ ○	● ○
h	88	● ○ ○	○ ● ○	○ ○	u	A4	○ ○ ●	○ ○ ●	○ ○
i	89	● ○ ○	○ ● ○	○ ●	v	A5	○ ○ ●	○ ○ ●	○ ●
j	91	● ○ ○	○ ● ○	● ○	w	A6	○ ○ ●	○ ○ ●	● ○
k	92	● ○ ○	○ ● ○	● ●	x	A7	○ ○ ●	○ ○ ●	● ●
l	93	● ○ ○	○ ● ●	○ ○	y	A8	○ ○ ●	○ ● ○	○ ○
m	94	● ○ ○	○ ● ●	○ ●	z	A9	○ ○ ●	○ ● ○	○ ●

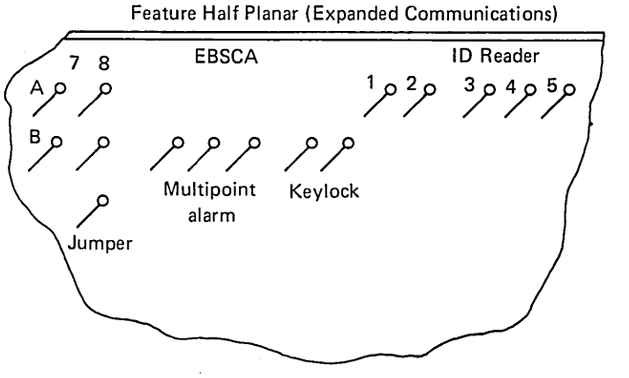
511 ID Reader Locations

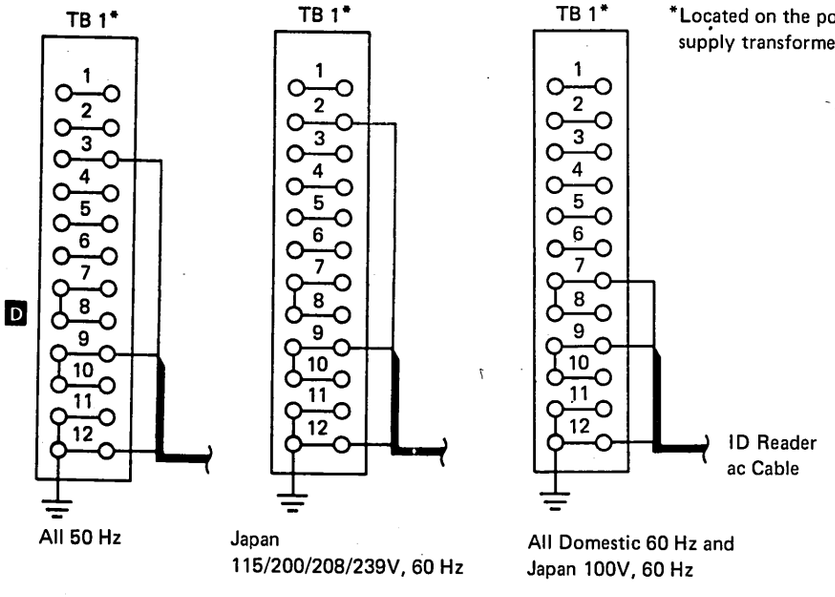
Legend

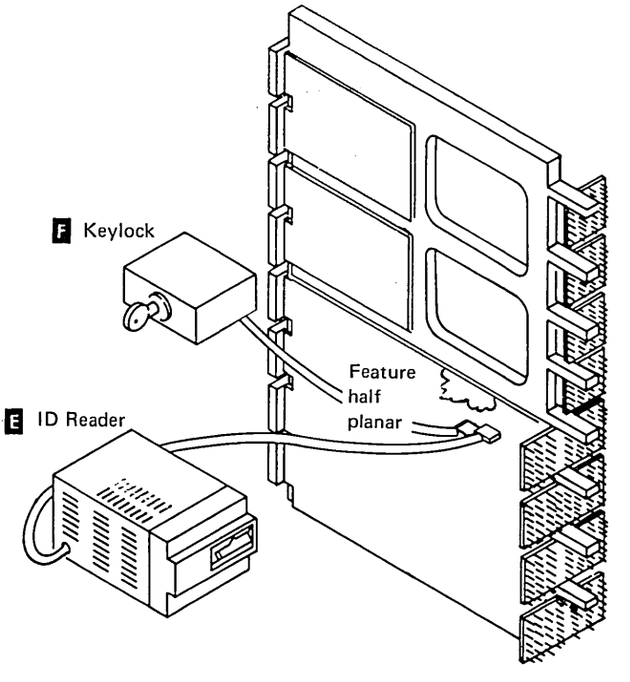
- A Transformer
- B Ac line filter
- C Test points
- D Terminal board
- E ID reader
- F Keylock
- G Feature half planar jumpers











EC 823146	825853		PN 1618927
Date 9/15/74	11/15/74		

EC 825853			PN 1619388
Date 11/15/74			

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512 Feature Half Planar Removal/ Replacement Procedure

- Power down.
- Remove the memory card (504G).
- Remove terminal ID (504D), ID reader (504E), and sync clock (504F) cards, if installed.
- Disconnect the cables 1-N, 1-P, and 1-R. Disconnect cross connectors 1-Q, 1-E, 1-F, 1-G, and 1-H. Remove the studs holding the feature half planar (use long-nosed pliers).
- Remove feature half planar (504C).
- Install the new feature half planar (504C).
- Reinstall the MPU cross connectors 1-Q, 1-E, 1-F, 1-G, and 1-H.
- Reinstall the memory card on the feature half planar (504G) and the terminal ID (504D), ID reader (504E), and sync clock (504F) cards, if removed.
- Return to the place in MAP where you left (unless otherwise instructed).

- Cross connectors 1-G and 1-H may have to be removed.

513 not used

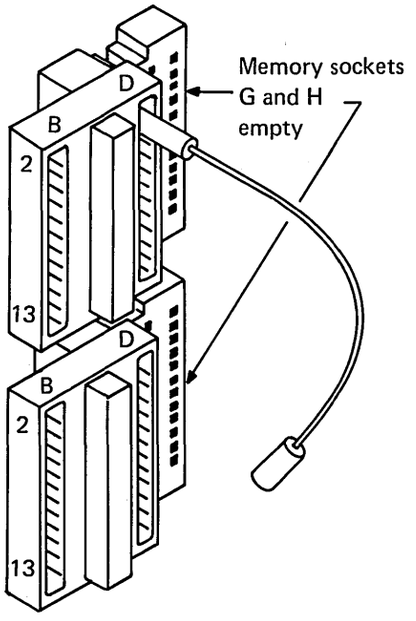
EC 825853	826065		PN 1619389
Date 11/15/74	8/1/75		

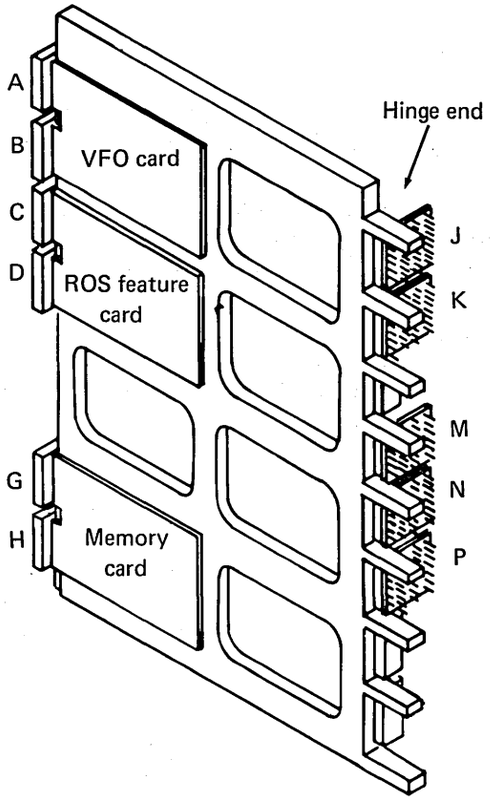
EC 823146	826065		PN 1618928
Date 9/15/74	8/1/75		

514 MPU Test Patterns

Test Point	The First Data Line *	Ratio H/Blank Characters
No jumper	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	No blanks
2-G-D02	H H H H H H H H H H H H H H H H H H H H	1/1
2-H-D04	HH HH HH HH HH HH HH HH HH HH	2/2
2-G-D13	HHHH HHHH HHHH HHHH HHHH	4/4
2-G-D05	HHHHHHHH HHHHHHHH HHHHHHHH	8/8
2-H-D09	HHHHHHHHHHHHHHHH HHHHHHHH	16/16
2-H-B02	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	32/32
2-G-B03	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	64/64
2-H-D10	HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH	120/120

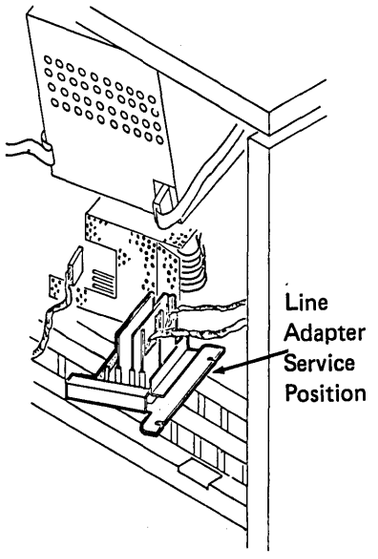
* In some cases the *data line* may start with blank character(s) rather than with H character(s). Test point 2-H-D10 may result in all blanks in such a case. Power down and try again.





Note: On memory, VFO, and ROS feature cards, the part number and EC level are on the connector block.

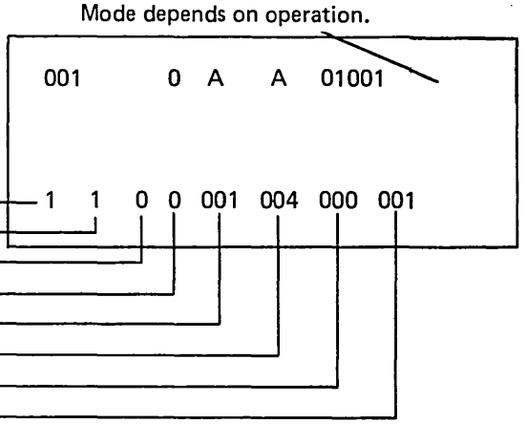
515 1200 bps Line Adapter Location



516 BSCA Error Logout

BSCA Error Logout

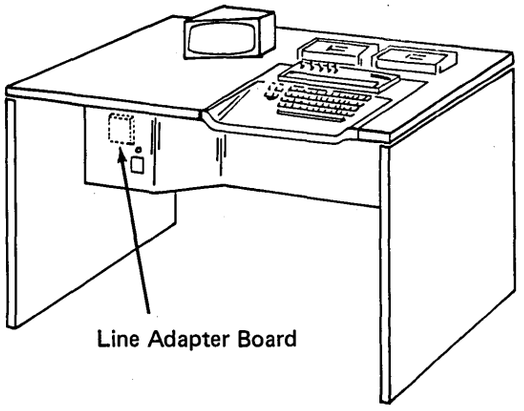
When in T, P, B, D, or R mode, the bottom line on the display shows the following:

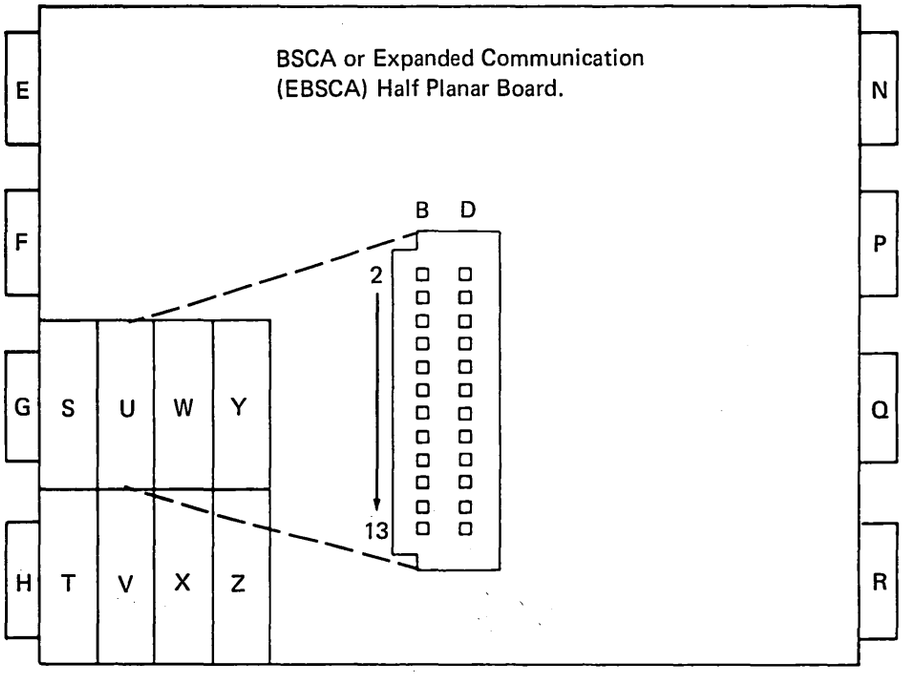


Position	Meaning
* 1	Data terminal ready.
* 4	Data set ready.
* 7	Request to send.
* 10	Clear to send.
**14 · 16	CRC checks in receive.
**19 · 21	NAKs received in transmit.
**24 · 26	Two-second time-outs.
**29 · 31	Three-second time-outs.

**Note:* 1 indicates on; 0 indicates off.
***Note:* three-position decimal counts.

517 Feature Half Planar Locations





518 not used
519 not used

EC 823146	825853	826065	PN 1618929
Date 9/15/74	11/15/74	8/1/75	

EC 823146	826065		PN 1618930
Date 9/15/74	8/1/75		

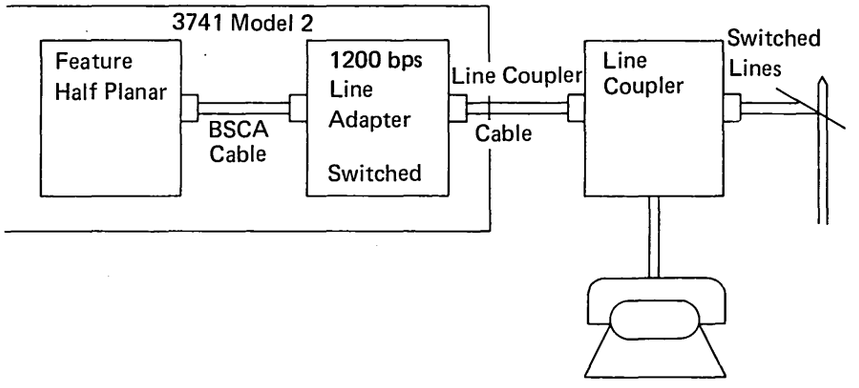
520 1200 bps Line Adapter Switched Line Transmit Level Adjustment

The transmit level must be adjusted, at the transmit card **B** to match the level specified for the data coupler. Also, the autoanswer basic card must be jumpered for that same transmit level (523).

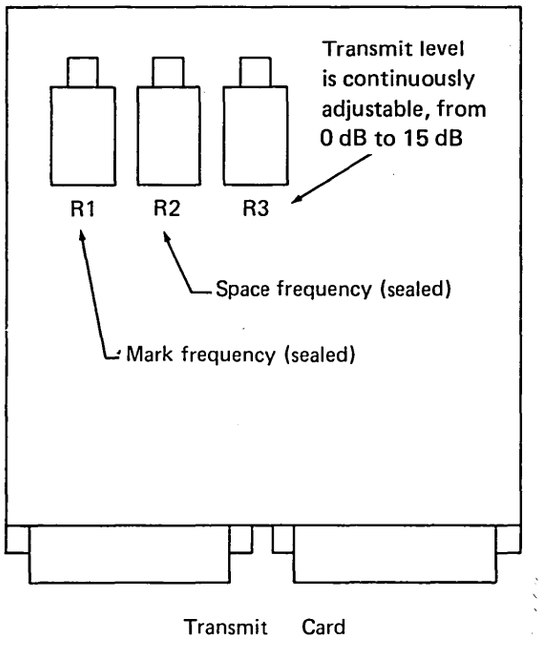
Adjust the transmit output:

1. Turn off the 3741 mainline power.
2. Disconnect the line coupler cable from line adapter board E2 **C**.
3. On the dB meter:
   a) Set the 2W-4W TRANS/REC switch to TRANS.
   b) Set the bridging 600, 324 switch to 600.
4. Remove the autoanswer interface card from line adapter board B2 **C**.
5. Jumper line-adapter-board pins 6, 7, 8, and 9 together to ground or, turn on 'request to send' and unclamp the transmitter **C**.
6. Jumper line-adapter-board pins 4 and 5 together to turn on 'data set ready' **C**.
7. Connect the dB meter's black line terminal to pin 10, and red line terminal to pin 11.
8. Turn power on the 3741 and the dB meter.
9. Adjust R3 on the transmit card to attain the correct transmit level reading on the dB meter scale **B**.
10. Power down.
11. Remove the jumpers from the line-adapter-board pins **C**.
12. Reinstall the autoanswer interface card in line adapter board B2 **C**.
13. Reconnect the line coupler cable to line adapter board E2 **C**.

A

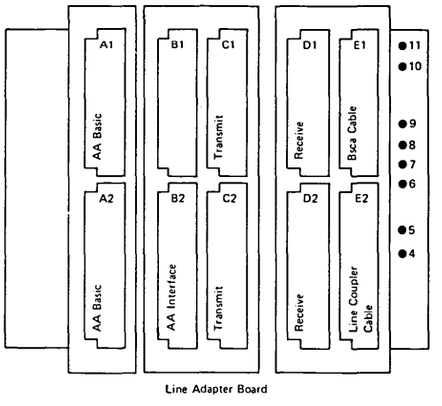


B



Transmit Card

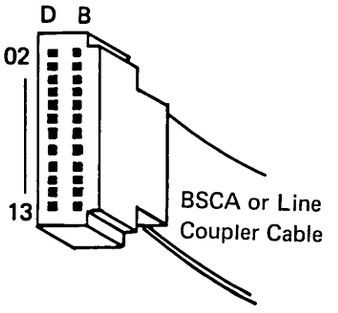
C



Line Adapter Board

521 BSCA—To—Line Adapter Cable

Socket 1-N	Line name	Half planar end	Line Adapter End
B13	+ Request to Send (RTS)	D02	D02
B12	- Transmit Data (TD)	D03	D03
B11	- Received Data (RD)	D04	D04
B10	+ Clear to Send (CTS)	D05	D05
B07	Ground	D08	D08
D12	+ Data Set Ready (DSR)	B03	B03
D11	+ Ring Indicator (RI)	B04	B04
D07	+ Data Terminal Ready (DTR)	B08	B08
D04	- 12 Volts	B11	B11
D02	+ 12 Volts	B13	B13

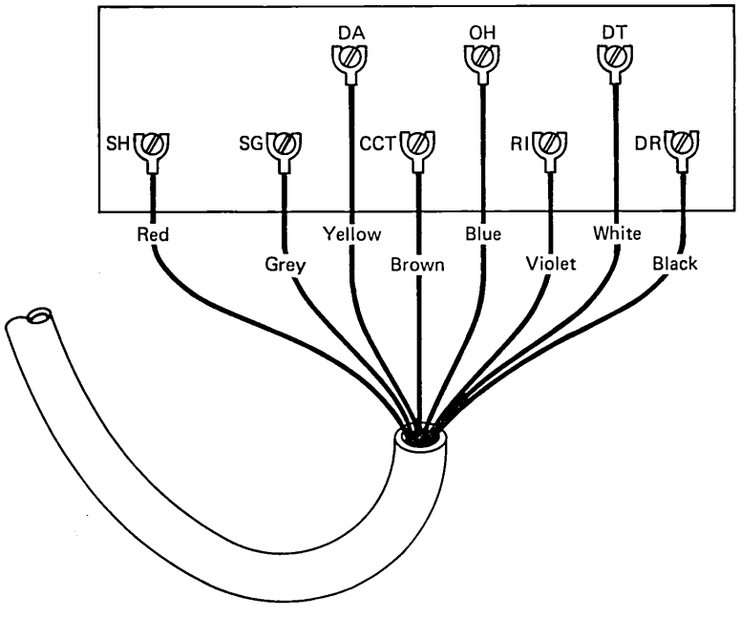


Line Adapter End

522 Line Coupler Cable

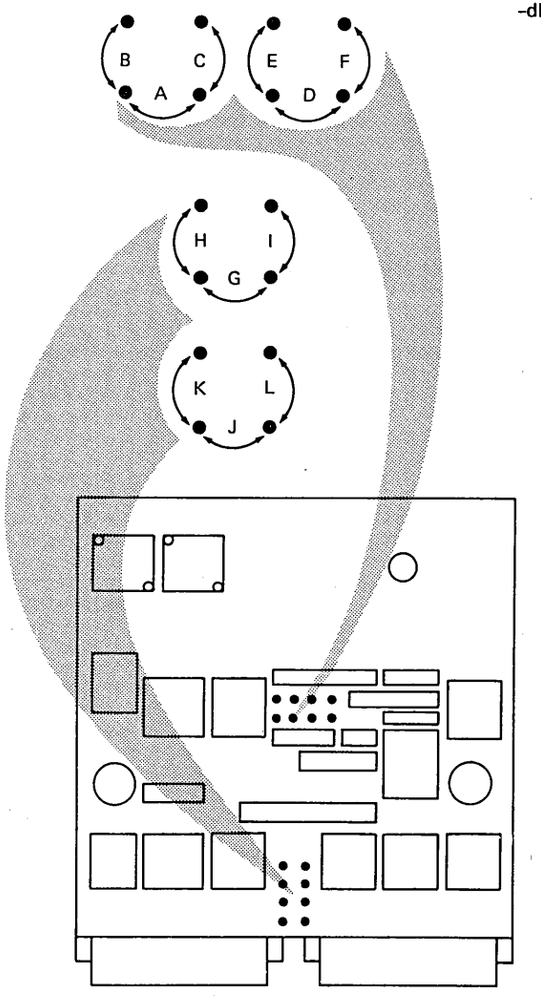
Line Adapter	Cable		Coupler
D05	Data Tip	(DT)	White
D07	Coupler Cut Through	(CCT)	Brown
D09	Signal Ground	(SG)	Gray
B05	Ring Indicate	(RI)	Violet
B07	Switch Hook	(SH)	Red
B08	Data Modem Ready	(DA)	Yellow
B12	Data Ring	(DR)	Black
B13	Off Hook	(OH)	Blue

Line Adapter Cable
(provided with IBM machine)



EC 823146			PN 1618932
Date 9/15/74			

523 Autoanswer Basic Card

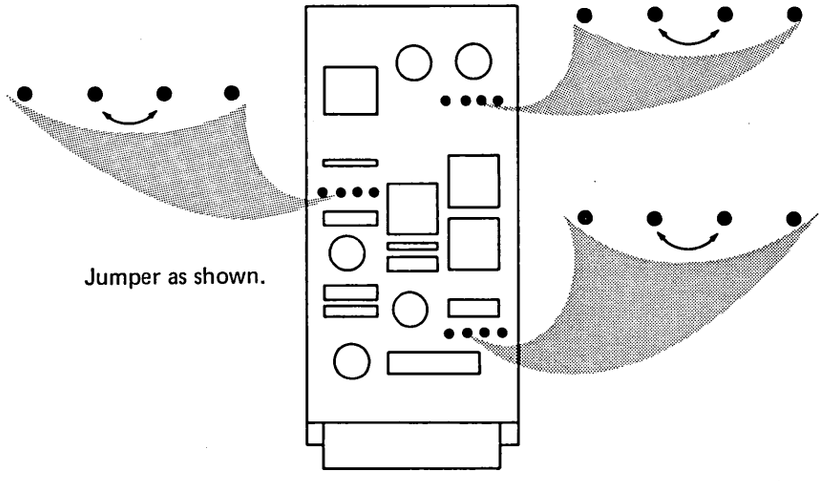


Autoanswer Basic Card

-dB level	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15
A	X		X		X		X		X		X		X		X	
B		X		X		X		X		X		X		X		X
C		X		X		X		X		X		X		X		X
D	X	X			X	X			X	X			X	X		
E			X	X			X	X			X	X			X	X
F			X	X			X	X			X	X			X	X
G	X	X	X	X					X	X	X	X				
H					X	X	X	X					X	X	X	X
I					X	X	X	X					X	X	X	X
J	X	X	X	X	X	X	X	X								
K									X	X	X	X	X	X	X	X
L									X	X	X	X	X	X	X	X

Jumper the attenuator pins in accord with this chart, to match level requirements of the line coupler.

524 Autoanswer Interface Card



Jumper as shown.

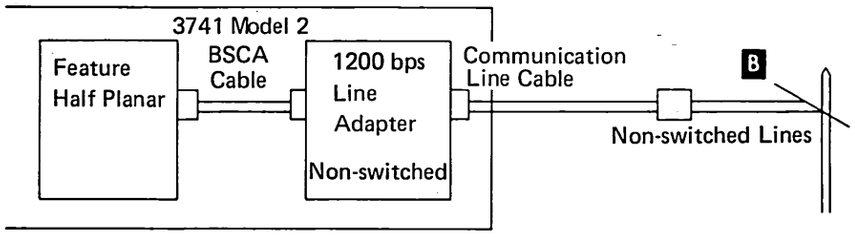
Austoanswer Interface Card

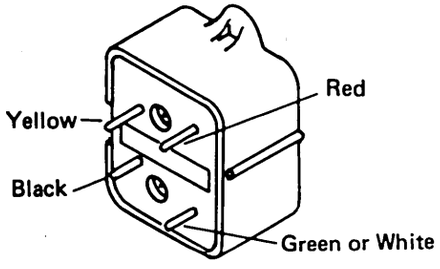
527 1200 bps Line Adapter Non-switched Line Transmit Level Adjustment Procedure

Direct attachment to a non-switched line usually requires a zero dB transmit level.

Adjust the transmit output:

1. Turn off the 3741 mainline power.
2. Disconnect the communication line plug and insert it into the TRANS/REC jack in the dB meter cover **B**.
3. On the dB meter:
   a) Set the 2W-4W TRANS/REC switch to TRANS.
   b) Set the bridging 600, 324 switch to 600.
   c) Jumper the line terminals on the cover to the line terminals on the meter.
4. Jumper line-adapter-board pins 4, 5, and 6 together to unclamp the transmitter and turn on 'request to send' (528A).
5. Turn power on the 3741 and the dB meter.
6. Adjust R3 on the transmit card to attain the zero dB output level on the meter scale **C**.
7. Power down.
8. Remove the jumpers from the line-adapter-board pins (528A).
9. Reconnect the communication line plug.

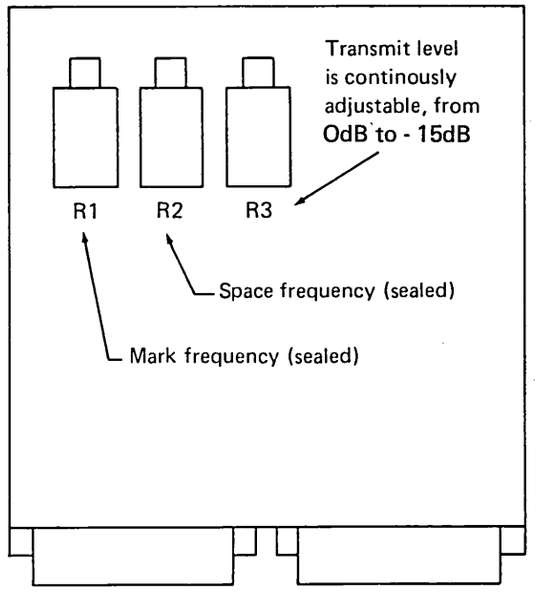




D Communication Line Cable

Line Adapter	Cable	Communication Line
D05	4 Wire Transmit/ 2 Wire	Red
B12	4 Wire Transmit/ 2 Wire	Green or White
B09	4 Wire Receive	Black
D13	4 Wire Receive	Yellow

C



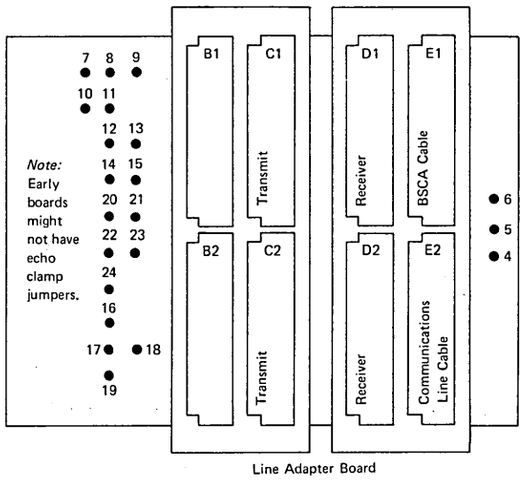
Transmit Card

525 not used
526 not used

EC 823146	826065		PN 1618934
Date 9/15/74	8/1/75		

528 Line Adapter Board

A



Line Adapter Board

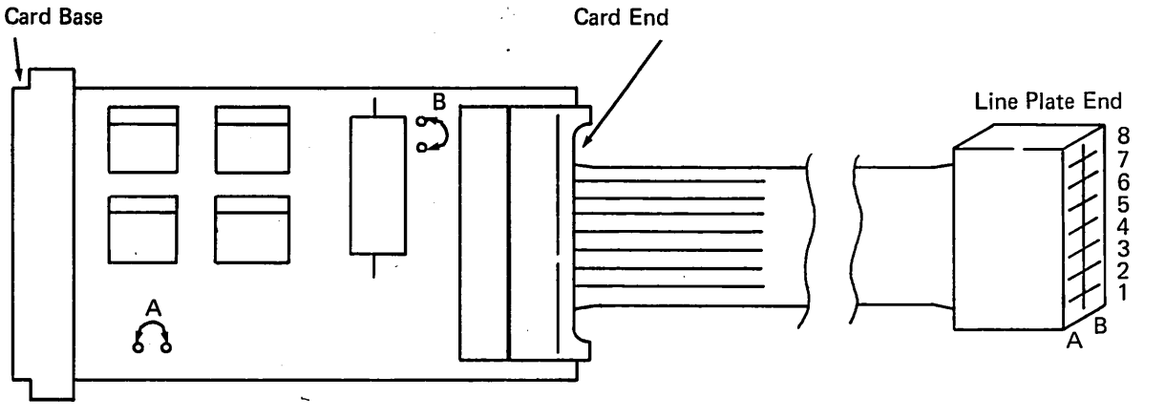
B **2 Wire — 4 Wire**

For 2 Wire	For 4 Wire
8 to 9	7 to 8
12 to 13	10 to 11
14 to 15	

Use		With	
Echo Clamp Delay	**Jumpered**	**Clear to Send (CTS) Delay**	**Jumpered**
130 ms	20 to 21 and 22 to 23	200 ms	17 to 19
50 ms	20 to 21 and 22 to 24	75 ms	17 to 18
0 ms	22 to 23	25 ms	17 to 16

CAUTION
The short delay combinations might cause intermittent echo problems.

530 Line Plate Cable and Jumpers



Ringing Jumpers

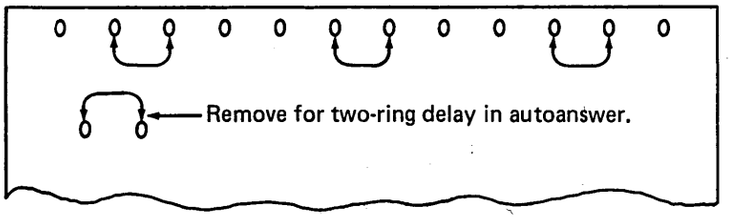
A – Mandatory.

B – Remove for two-ring delay in autoanswer.

Line Plate Cable

Card Base	Card End	Signal	Line Plate
D08	B06	Current Detect 2	A2
D13	B07	Data Indicator	A4
B12	B05	Data Ring	A6
D05	B10	Data Tip	A8
B13	B04	Current Detect 1	B1
B04	B11	+12 Vdc	B3
B05	B09	Transfer Relay	B5
D08	B08	Ground	B7

PSN Card Jumpers

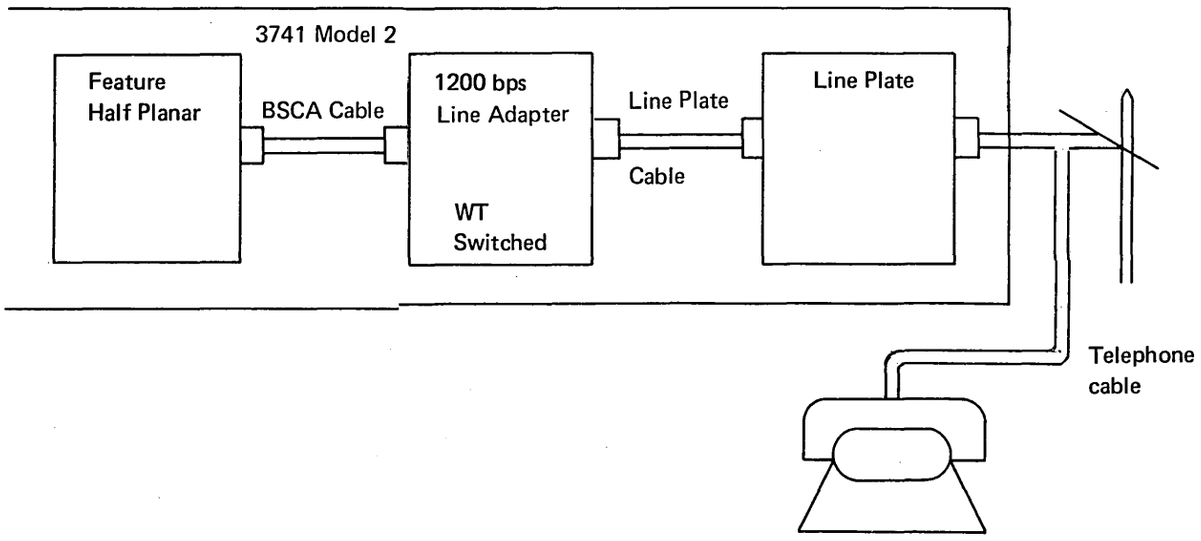


529 not used

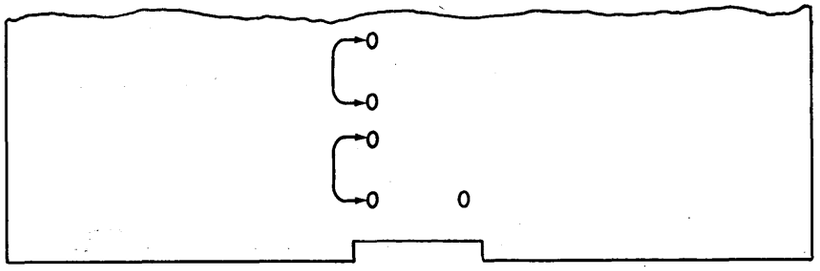
EC 825853	826065		PN 1619390
Date 11/15/74	8/1/75		

EC 823146	825853		PN 1618935
Date 9/15/74	11/15/74		

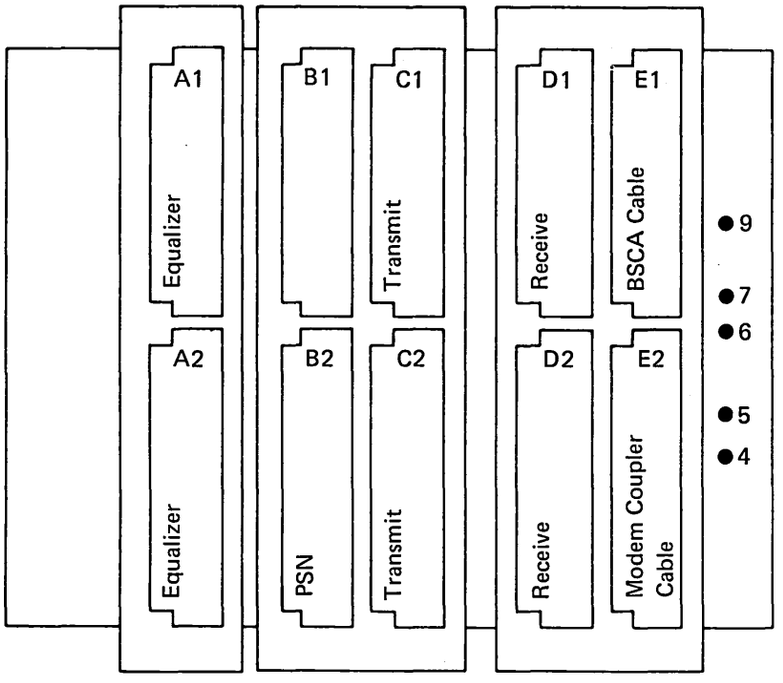
531 Feature Half Planar to Line Plate Cables



532 Line Adapter Board

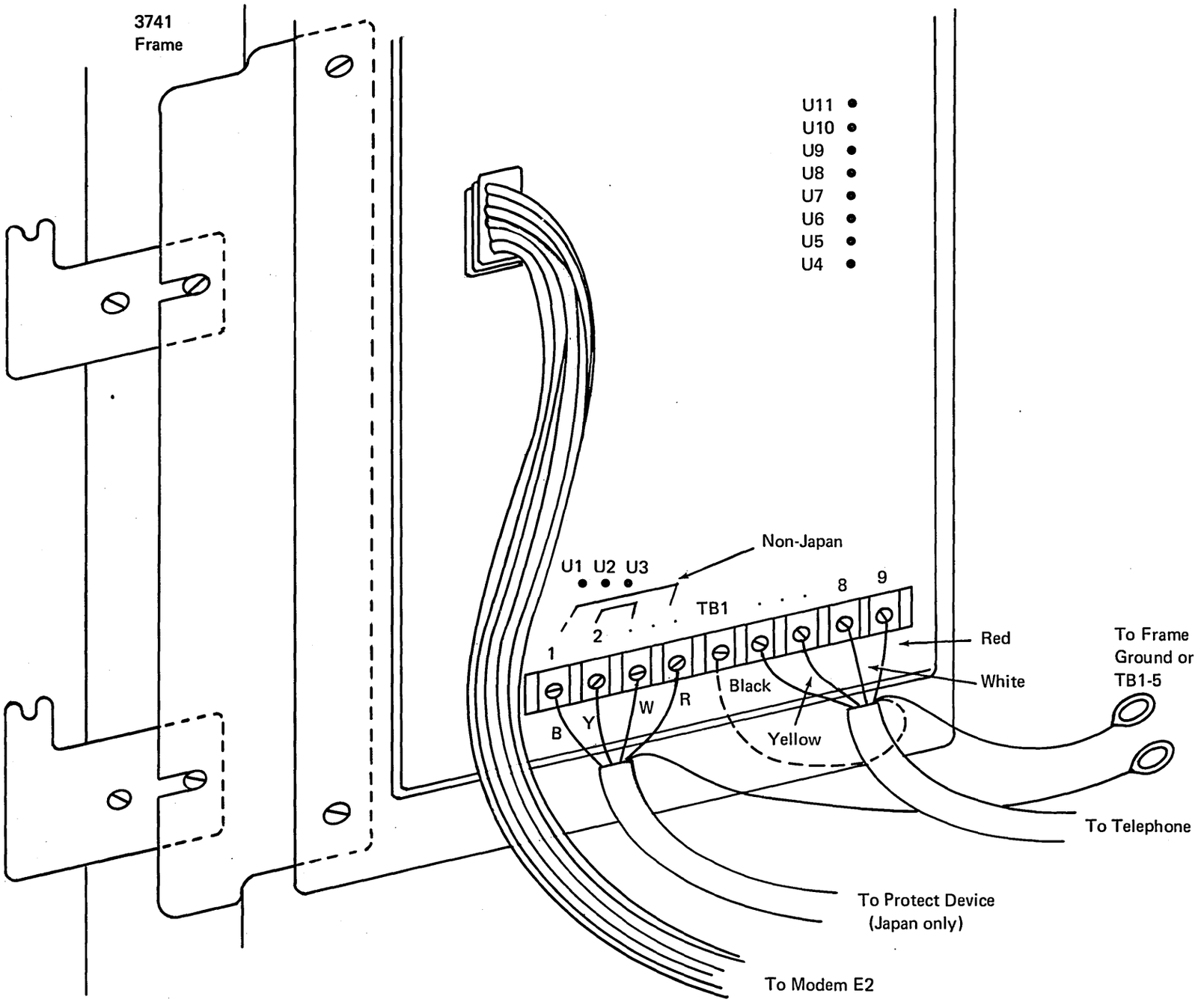


Equalizer Card Jumpers



Line Adapter Board

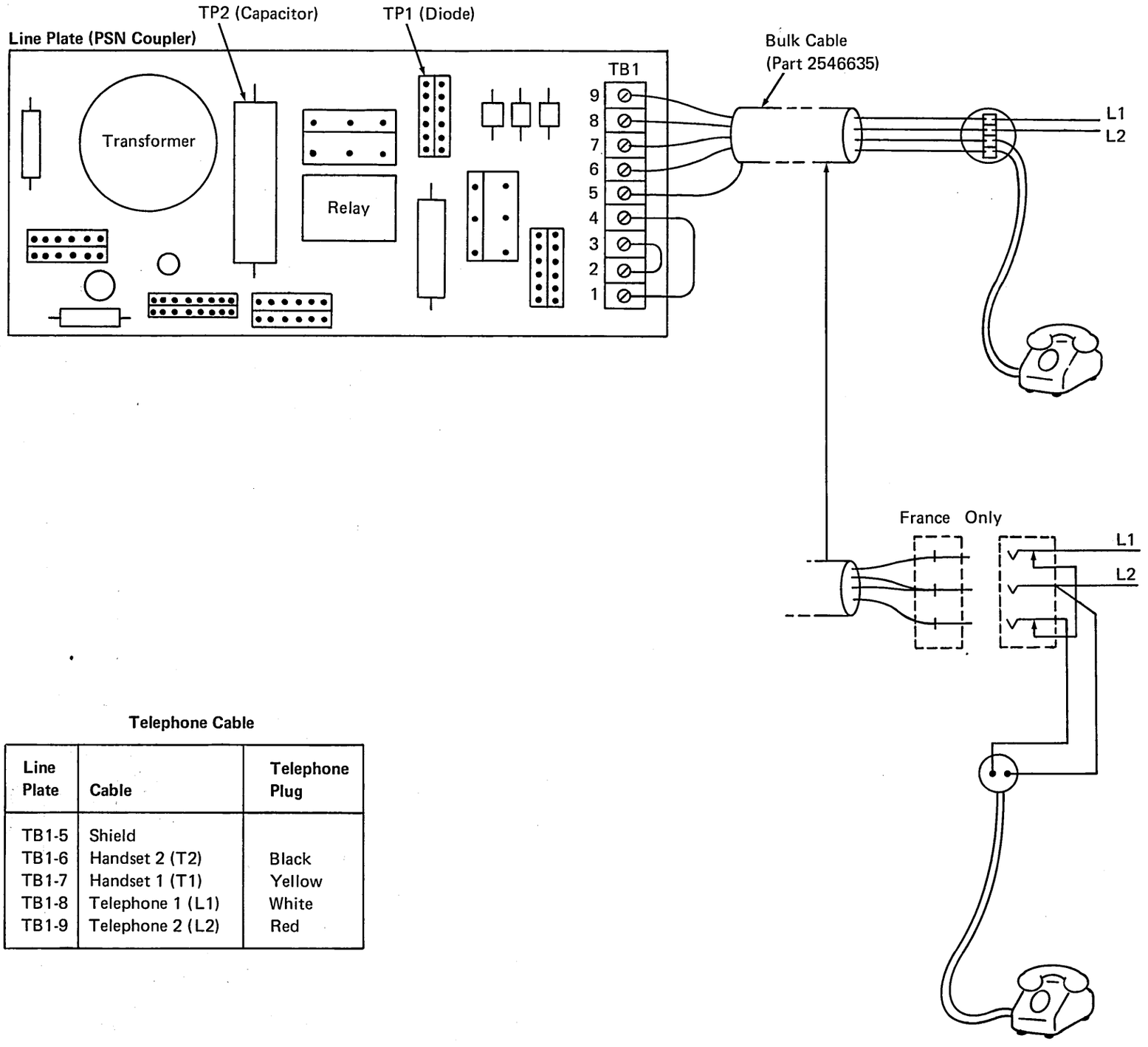
533 Line Plate Coupler



EC 823146	825853		PN 1618936
Date 9/15/74	11/15/74		

EC 825853	826185		PN 1619391
Date 11/15/74	5/23/75		

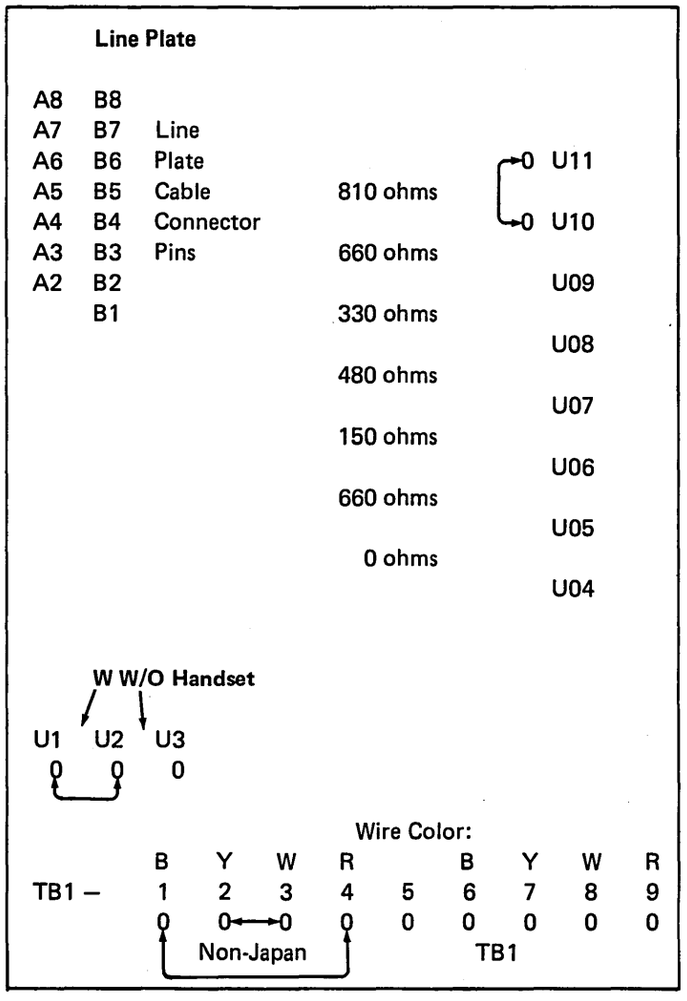
534 WT PSN Line Plate and Cable Connections



Telephone Cable

Line Plate	Cable	Telephone Plug
TB1-5	Shield	
TB1-6	Handset 2 (T2)	Black
TB1-7	Handset 1 (T1)	Yellow
TB1-8	Telephone 1 (L1)	White
TB1-9	Telephone 2 (L2)	Red

534 WT PSN Line Plate and Cable Connections (Continued)



EC 825853			PN 1619393
Date 11/15/74			

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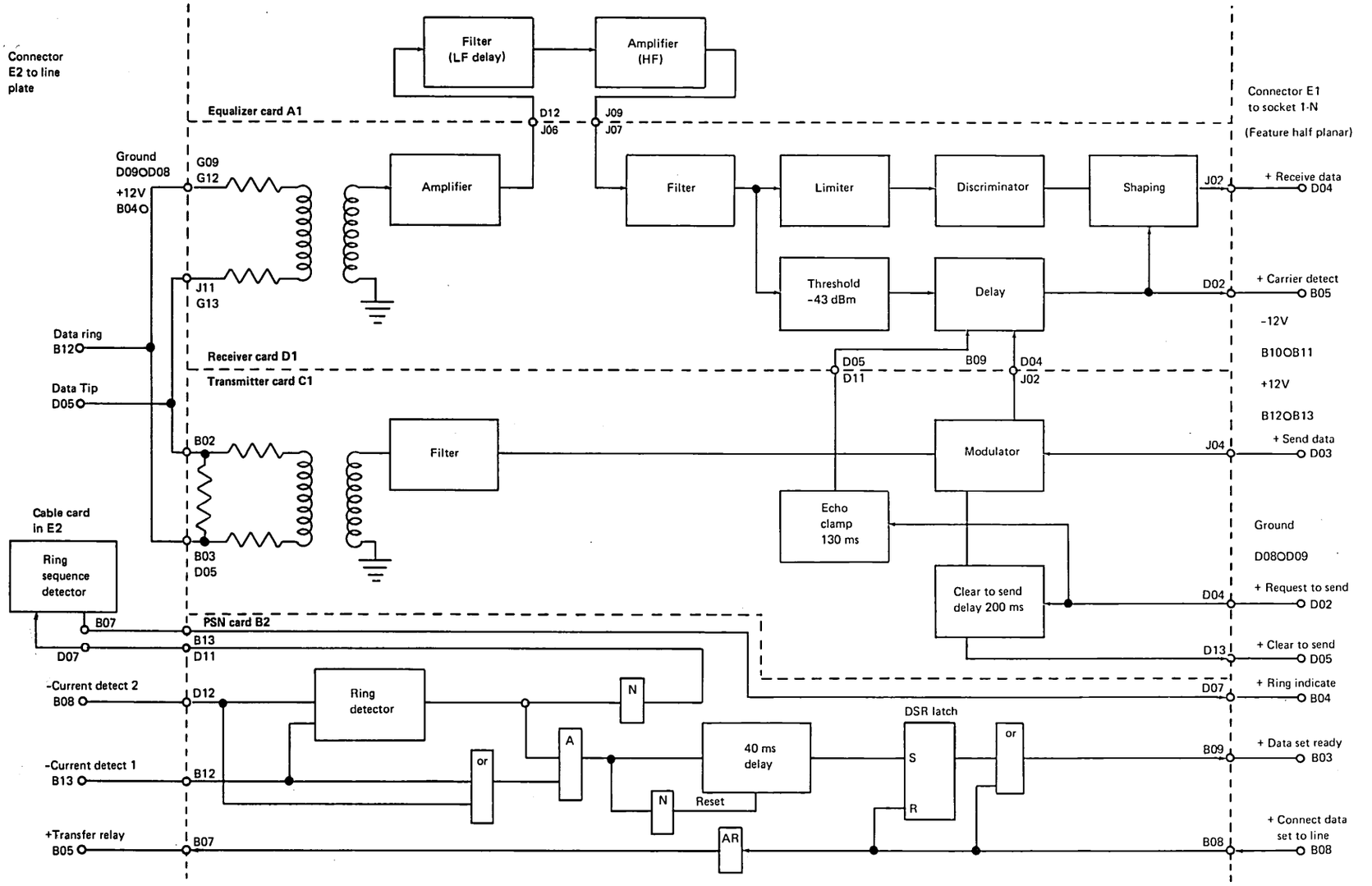
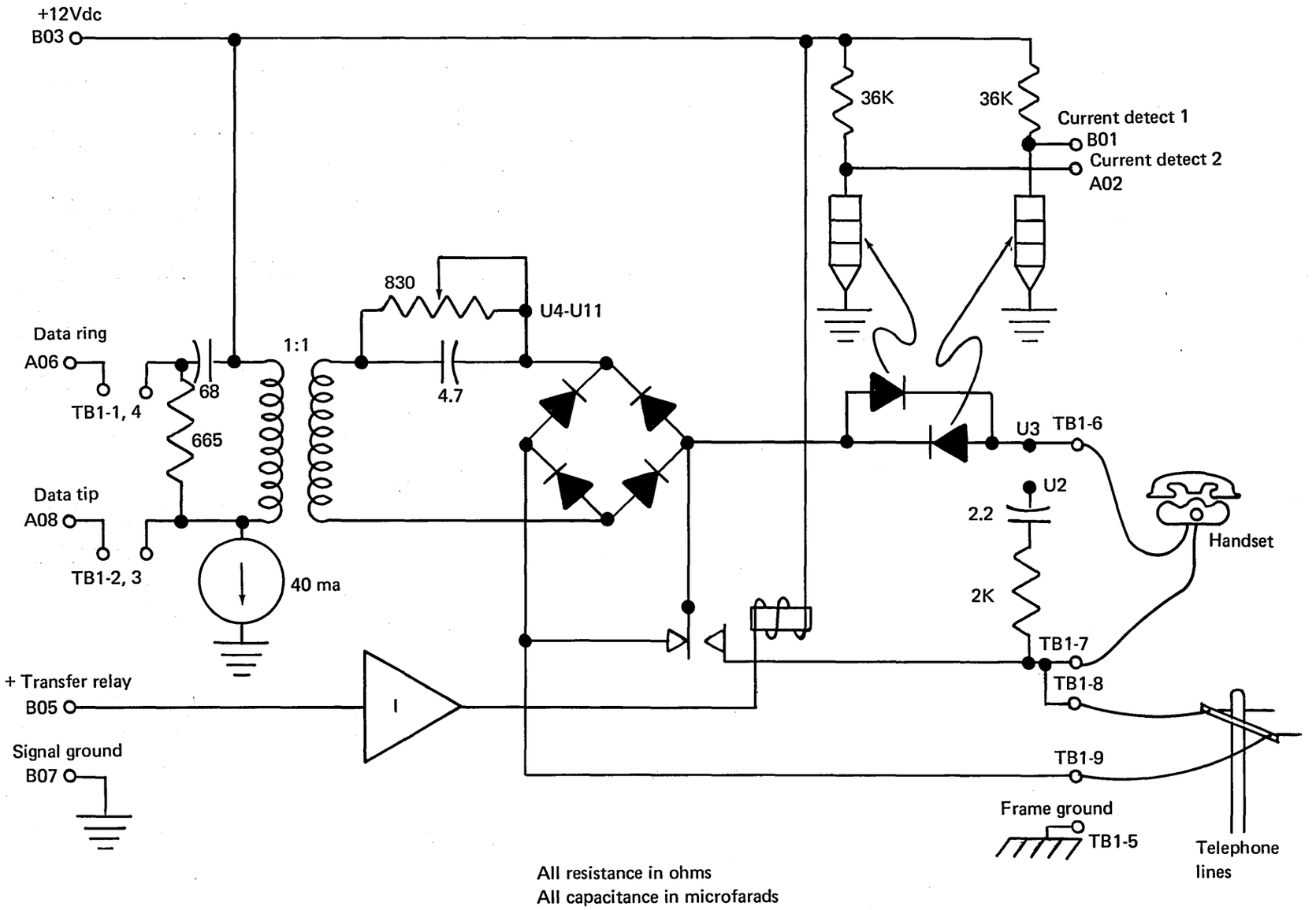
535 1200 bps Line Adapter for WT PSN
Feature



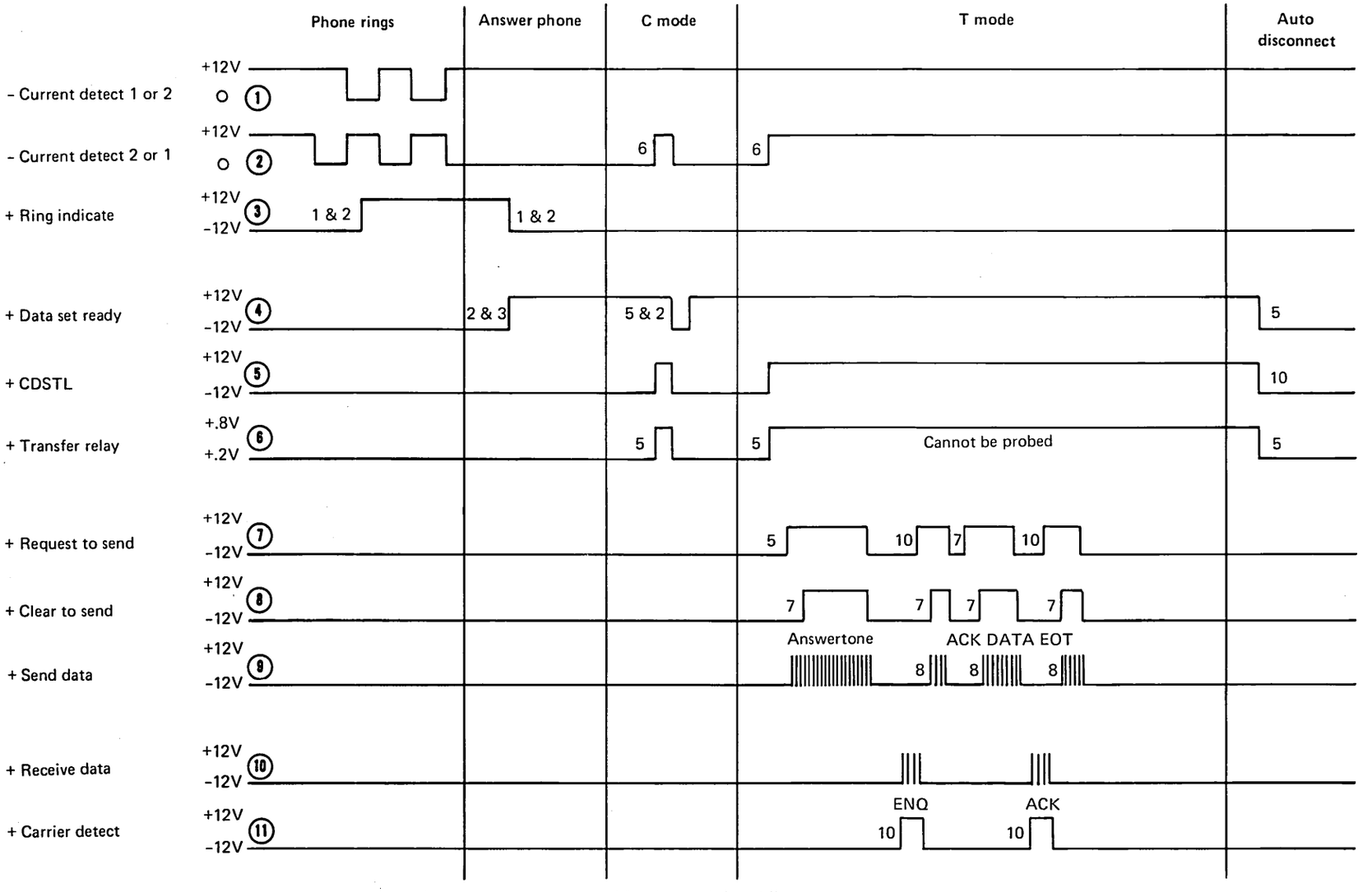
EC 825853	825958	826065	PN 1618937
Date 11/15/74	3/21/75	8/1/75	

EC 823146	825853	826065	PN 1618938
Date 9/15/74	11/15/74	8/1/75	

536 WT PSN Line Plate Functional Schematic



537 Manual Answer Sequence for WT PSN



The time scale is not linear.

Manual Answer Sequence

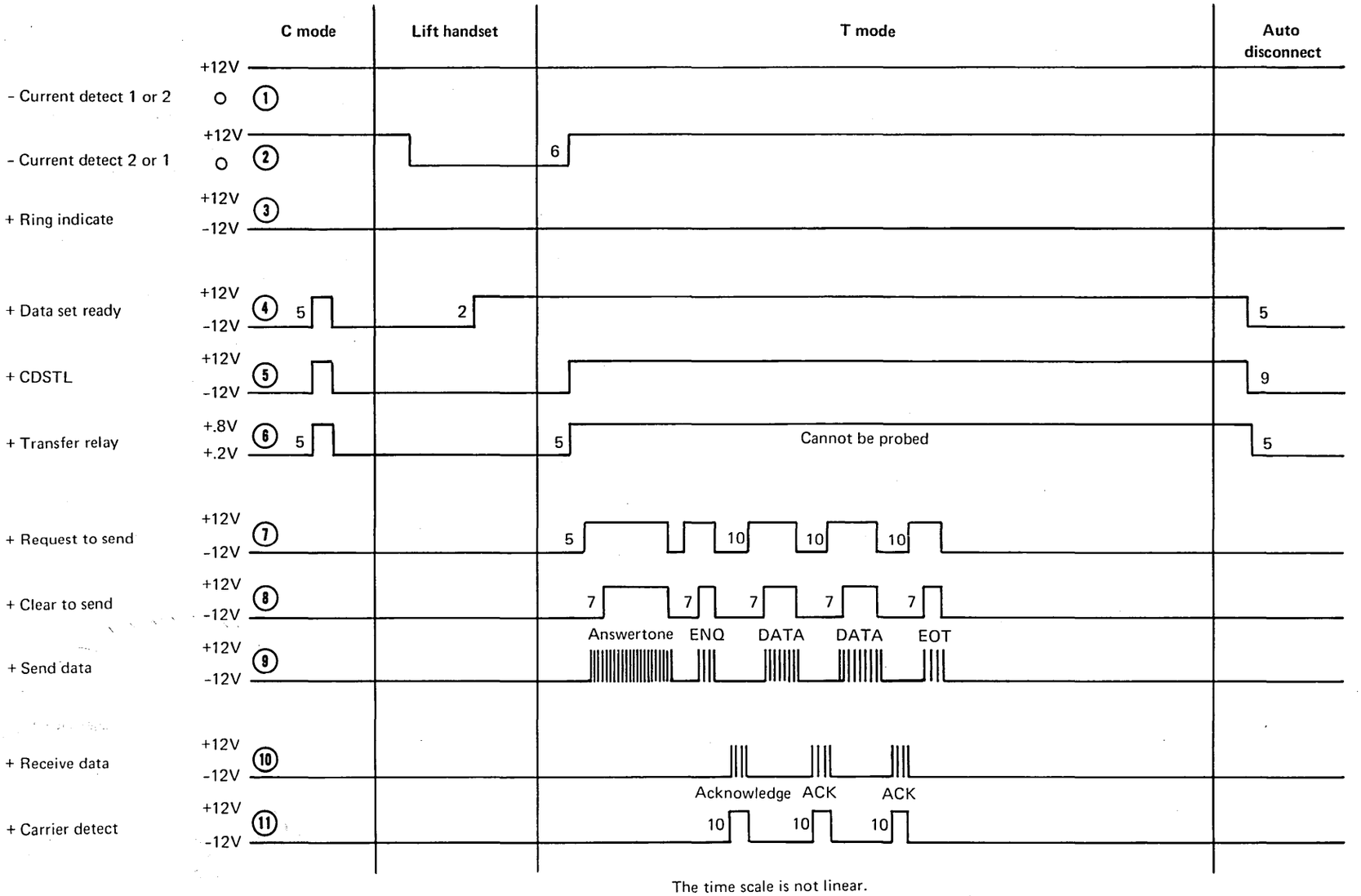
In order to perform a manual answer operation, the 3741 should not be in transmit or receive mode but may be in communications (C) mode. If the 3741 is set up for communications (T or R mode) before a call is received, autoanswer sequence will take place. If the 3741 is set up for communications (FSU, COMM) while the phone is ringing, the line will be disconnected due to the internal BSCA test which pulses 'connect data set to line' (CDSTL).

The ringing causes 'ring indicate' to come on; lifting the handset causes 'ring indicate' to go off and 'data set ready' to come on. After answering the phone, and when ready to transmit, the operator keys 'FSU', 'COMM', (if he or she has not already done so), and then selects the appropriate mode (T in the example). The remainder of the sequence is similar to manual call.

EC 823146	825853	826065	PN 1618939
Date 9/15/74	11/15/74	8/1/75	

EC 823146	825853	826065	PN 1618940
Date 9/15/74	11/15/74	8/1/75	

538 Manual Call Sequence for WT PSN



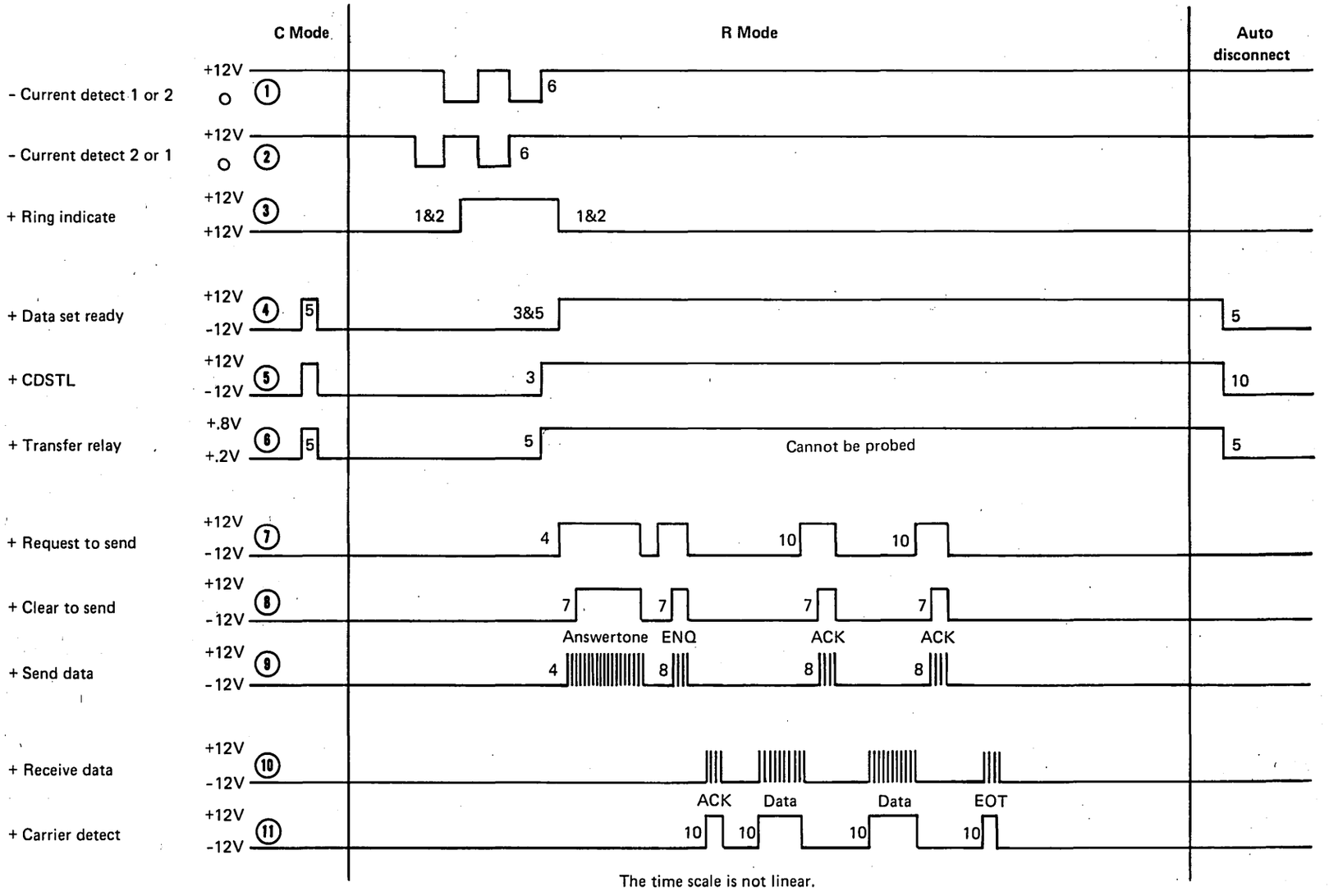
The time scale is not linear.

Manual Call Sequence

To make a manual call, the operator selects communications (C) mode (FSU, COMM, M key). This initiates an internal test of the feature half planar. The operator then lifts the handset and contacts the remote end. Depending on the polarity of the telephone DC voltage, either 'current detect 1' or 'current detect 2' will drop. This causes 'data set ready' (DSR) to come on.

When the operator is ready to transmit, he or she presses the T key (for this example). 'Connect data set to line' (CDSTL) will come on which causes 'transfer relay' (TR) to come on: The modem's 'data tip' and 'data ring' are now connected to the telephone lines and the handset is disconnected. 'Request to send' (RTS) is raised by the feature half planar and after 200 msec 'clear to send' (CTS) comes on. Communications follow until the 'end of transmission' (EOT) is sent. Twenty seconds later, CDSTL drops and the sequence is complete.

539 Autoanswer Sequence for WT PSN



The time scale is not linear.

Autoanswer Sequence (Receive)

To perform autoanswer, the 3741 is set to the appropriate mode (FSU, COMM, M, R in this example). When the phone rings, 'ring indicate' (RI) comes on. This causes the feature half planar to turn on 'connect data set to line' (CDSTL). CDSTL causes 'transfer relay' (TR) to switch the telephone lines from the handset to the modem's 'data tip' and 'data ring' signals. The feature half planar sends the answertone for 3.5 seconds and then sends inquire (ENQ) signals every second. After the remote end sends an acknowledge (ACK), communications will take place until the remote end sends an 'end of transmission' (EOT). If an error has been detected by this 3741, (for example, not enough room on the disk), an attempt to send status to the remote end will be made. After 20 seconds, CDSTL drops and the sequence is complete.

If an ACK is not received within 21 seconds after the answertone, the 3741 will send 15 ENQs 1 second apart attempting to send status. If no contact is made, CDSTL drops and 21 seconds later the 3741 will accept a call.

EC 823146	825853	826065	PN 1618941
Date 9/15/74	11/15/74	8/1/75	

540 WT Switched Lines Adjustment Procedure

The dc resistance of the line plate must be set to limit the current from the telephone lines (533).

A To adjust this resistance:

1. Turn off the 3741 main line power.

   DANGER
   Voltage is present on the line plate from the telephone lines.

2. Remove the PSN card from line adapter board socket B2 (532).

3. Remove disk drive 1 so that the line plate can be removed from its bracket.

4. Remove the line plate from its bracket and remove its protective cover (533).

5. Use the 3 Vdc scale of the CE meter.

6. Connect the CE meter between TP1 (+), diode lead, and TP2 (-), capacitor lead (534).

7. Turn on the 3741 main line power.

8. Find a jumper position of two adjacent pins U04 through U11 that indicates a voltage between 0.5 Vdc and 1.7 Vdc (534).

9. If the installation does not use a handset, jumper U2-U3; if it does use a handset, jumper U1-U2.

10. Remove the CE meter.

The transmit level must be adjusted at the transmit card to match the level specified by the telephone company (use dB meter, P/N 453545).

B To adjust the transmit output:

11. Turn off the 3741 main line power.

12. On the dB meter, set the BRIDGING, 600, 324, switch to BRIDGING.

13. Jumper line adapter board pins 6, 7, and 9 to turn on 'request to send' and to unclamp the transmitter (532).

14. Jumper line adapter board pins 4 and 5 to turn on 'data set ready'.

15. Connect the dB meter black line terminal to TB1-3 and the red line terminal to TB1-4 on the line plate.

16. Turn power UP the 3741 and dB meter.

17. Press: FUNCT SEL upper
    COMM
    K

18. Adjust R3 on the transmit card (line adapter socket C) for the correct transmit level reading on the dBm scale (520). Adjust for -9 dBm unless otherwise specified by the local telephone company. Add +1 dBm to the PTT value for loss in the line plate.

19. Power down the 3741 and dB meter.

20. Remove the jumpers from the line adapter board.

21. Plug the PSN card in line adapter board socket B2 (532).

22. Reinstall the line plate assembly and disk drive 1 (533).

dBm to Voltage Conversion Table

dBm (600 Ohms)	Voltage (RMS Volts)
+ 2	.975
0	.775
- 2	.615
- 4	.489
- 6	.388
- 8	.308
-10	.245
-12	.195
-14	.123

To find a voltage outside the range of this table, divide the voltage by 10 for every decrease of 20 dBm. For example, to find the voltage for -32 dBm, divide the voltage for -12 dBm (.195) by 10 (.0195).

550 Test Mode 2 Procedure

- Power down.
- Disconnect the modem cable or the BSCA cable from 1-N.
- Connect the wrap adapter to socket 1-N.
- Power up.
- Load a diskette.
- Turn on keylock, if feature is installed.
- Hold down NUM SHIFT.
- Press 2
- Release NUM SHIFT.
- Press FUNCT SEL upper
  COMM
  W
- Machine will execute wrap tests in about 2 seconds.

	Indicator	
	Point-to-Point Lines	**Multipoint Lines**
Test complete without failure	WC mode indicator	WC mode indicator and audible alarm sounded for approximately 5 seconds and then turned off.
Machine failure	W mode indicator remaining after 2 seconds — or — WI mode indicator	W mode indicator remaining after 2 seconds — or — WI mode indicator — or — WC mode indicator but alarm does not sound or does not turn off.

551 Wrap Adapter

Modem Cable Wrap Adapter (External Modem)

From	Pin	To	Pin
Transmit data	2	Received data	3
Request to send	4	Clear to send	5
Data terminal ready	20	Data set ready	6
Test clock	25	Serial clock transmit	15
Test clock	25	Serial clock receive	17

BSCA Cable Wrap Adapter (1200 bps Integrated Modem)

From	Pin	To	Pin
Transmit data	D03	Receive data	D04
Request to send	D02	Clear to send	D05
Data terminal ready	B08	Data set ready	B03

Feature Half Planar Wrap Adapter

From	Pin	To	Pin
Transmit data	D03	Receive data	D04
Request to send	D02	Clear to send	D05
Data terminal ready	B08	Data set ready	B03
Test clock	B06	Serial clock transmit	D06
Test clock	B06	Serial clock receive	D07

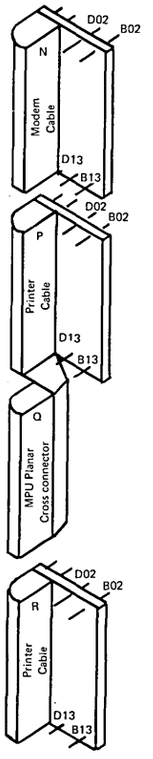
541-549 not used

EC 823146			PN 1618944
Date 9/15/74			

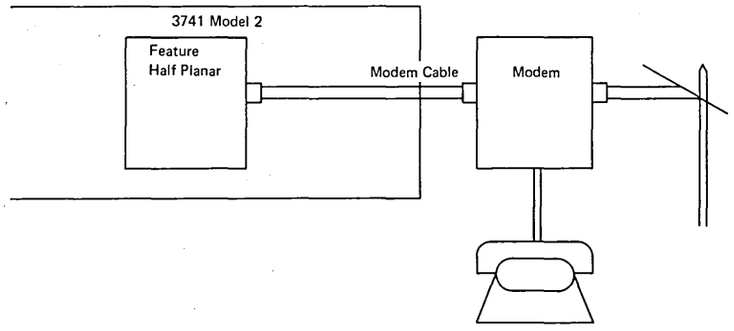
552 Modem Cable/BSCA Cable

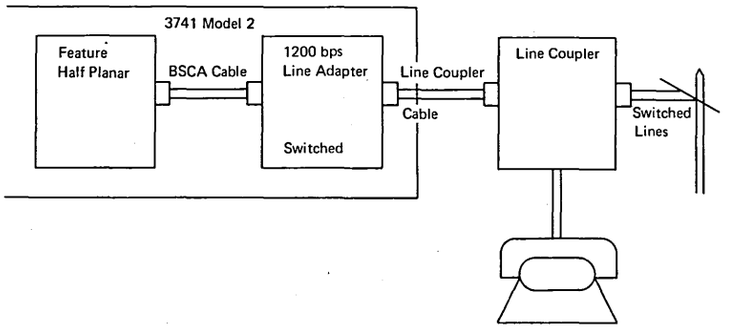
Socket 1-N	Line Name	Modem Cable		BSCA Cable	
		Half Planar End	Modem End	Half Planar End	1200 bps Line Adapter End
B13	Request to Send	D02	4	D02	D02
B12	Transmit Data	D03	2	D03	D03
B11	Receive Data	D04	3	D04	D04
B10	Clear to Send	D05	5	D05	D05
B09	Serial Clock Transmit	D06	15	–	–
B08	Serial Clock Receive	D07	17	–	–
B07	Signal Ground	D08	7	D08	D08
D12	Data Set Ready	B03	6	B03	B03
D11	Ring Indicator	B04	22	B04	B04
D10	Carrier Detect	B05	8	–	–
D08	Rate Selector	B07	23	–	–
D07	Data Terminal Ready	B08	20	B08	B08
D06	SCTE	B09	24	–	–
–	Frame Ground	Frame	1	–	–
D02	+12 Vdc	B13	–	B13	B13
D04	-12 Vdc	B11	–	B11	B11
D13	Test Mode	B02	18	–	–
D09	Test Clock	B06	25	–	–

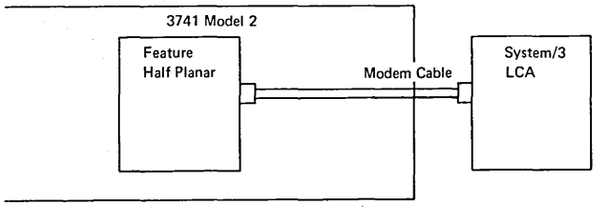
553 Cable Connectors

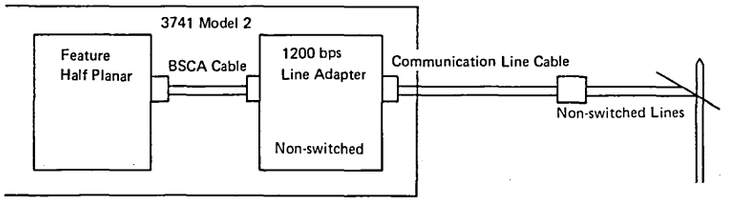


554 3741 Communications Attachment Configurations









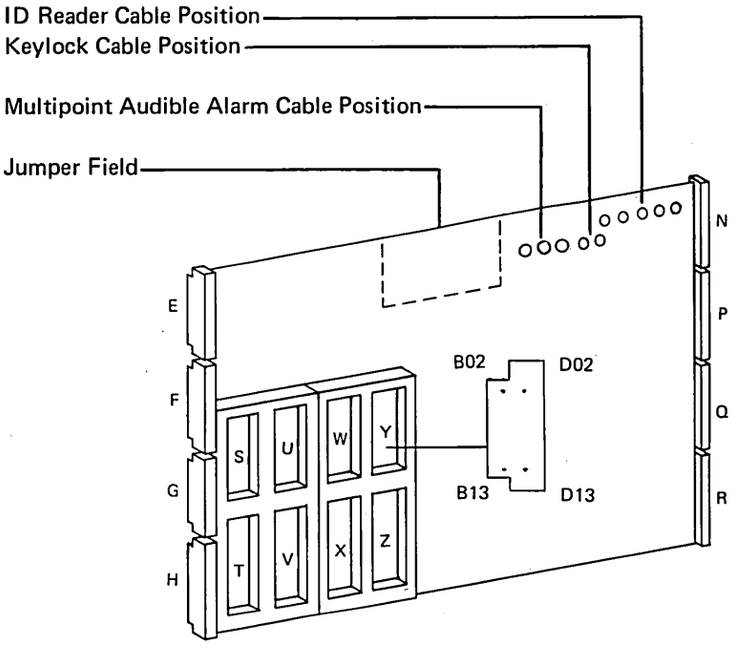
555 Feature Half Planar Sockets

1-N — Modem cable
1-P — Printer signal cable (from printer)
1-Q — Cross connector to MPU planar
1-R — Printer signal cable (to printer)
1-E — Cross connector to MPU planar and EBSCA ROS card
1-F — Cross connector to MPU planar and EBSCA ROS card
1-G — Cross connector to MPU planar (memory)
1-H — Cross connector to MPU planar (memory)
1-S — Card socket — memory
1-T — Card socket — memory
1-U — Test socket

EBSCA Feature Cards

1-V — Card socket — sync clock
1-W — Card socket — ID reader
1-X — Card socket — ID reader
1-Y — Card socket — terminal ID card or MP address
1-Z — Card socket — terminal ID or MP address

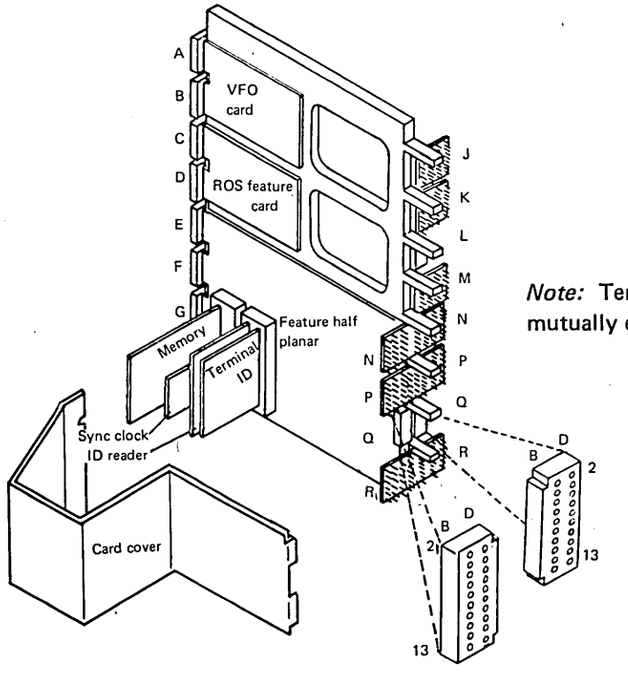
556 Feature Half Planar Socket Locations for ID Reader, Keylock, and Multipoint Audible Alarm



Feature Half Planar Socket Location

557 EBSCA Feature Card Locations

Sync clock
ID reader
Terminal ID or
Multipoint



Note: Terminal ID and multipoint are mutually exclusive features.

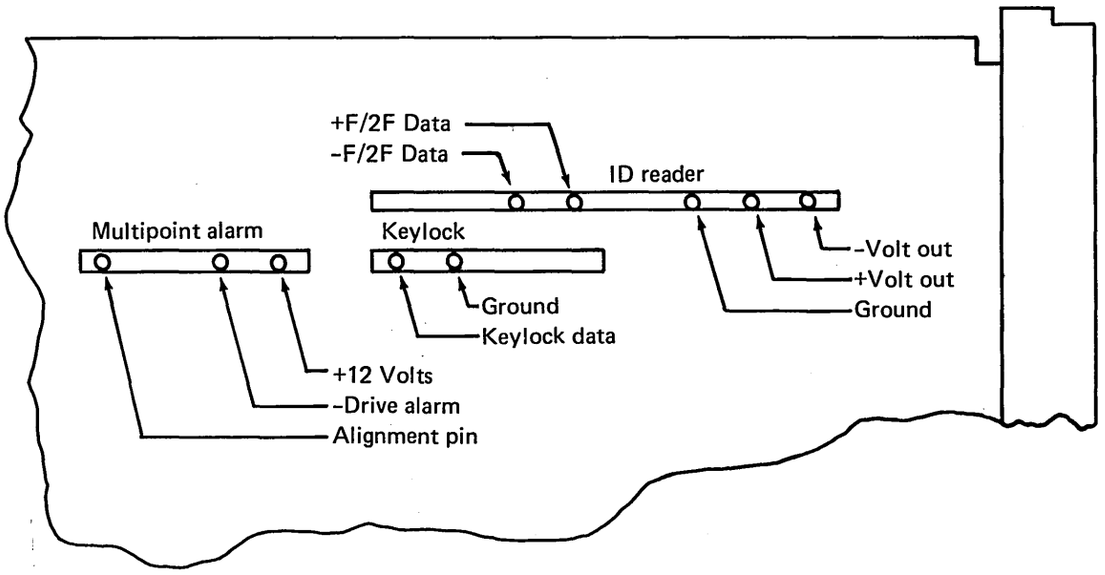
EC 823146	825853	826065	PN 1618945
Date 9/15/74	11/15/74	8/1/75	

EC 823146			PN 1618946
Date 9/15/74			

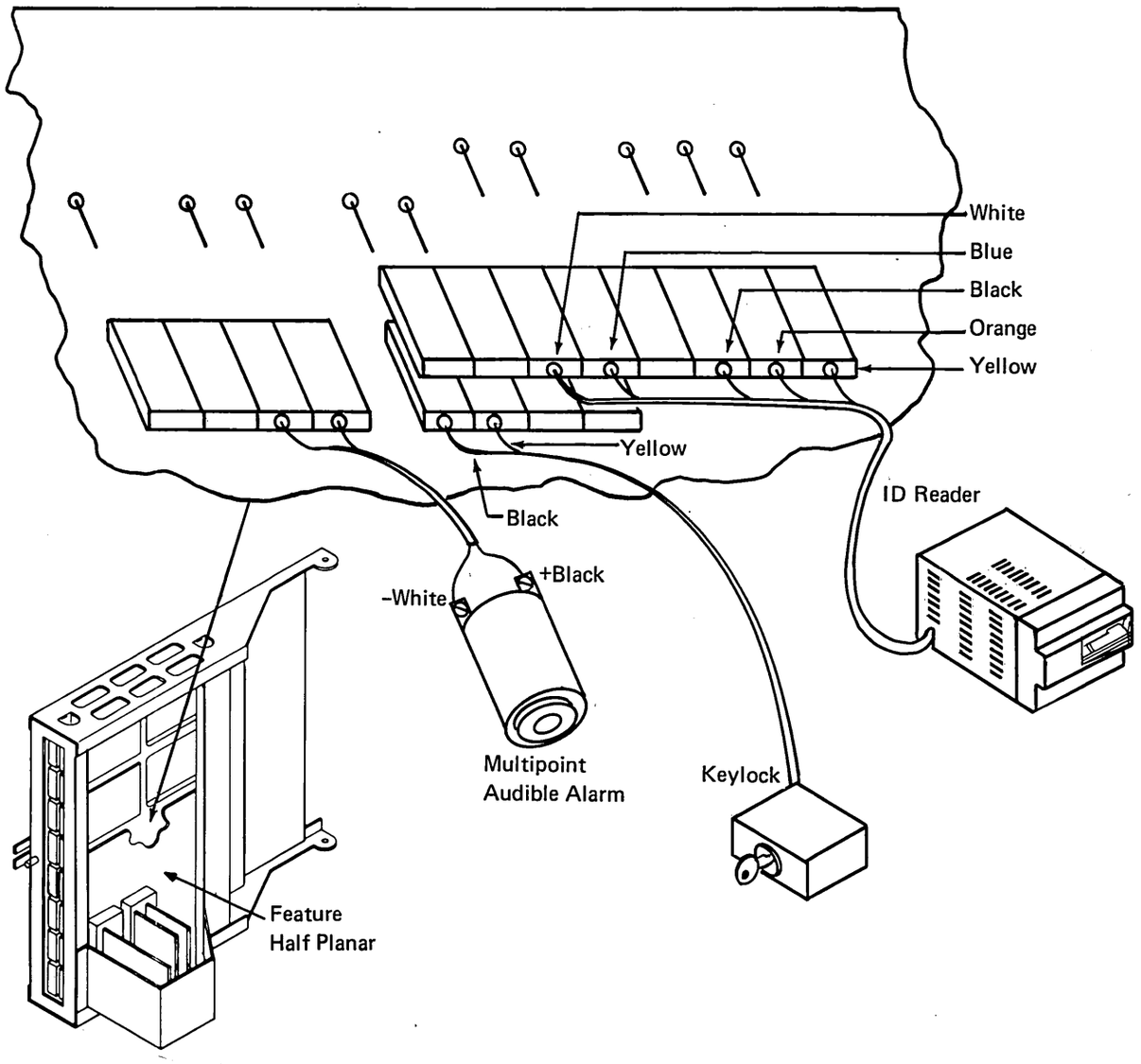
558

Feature Half Planar Cable Connectors for Expanded Communications

Keylock
ID Reader
Multipoint Audible Alarm



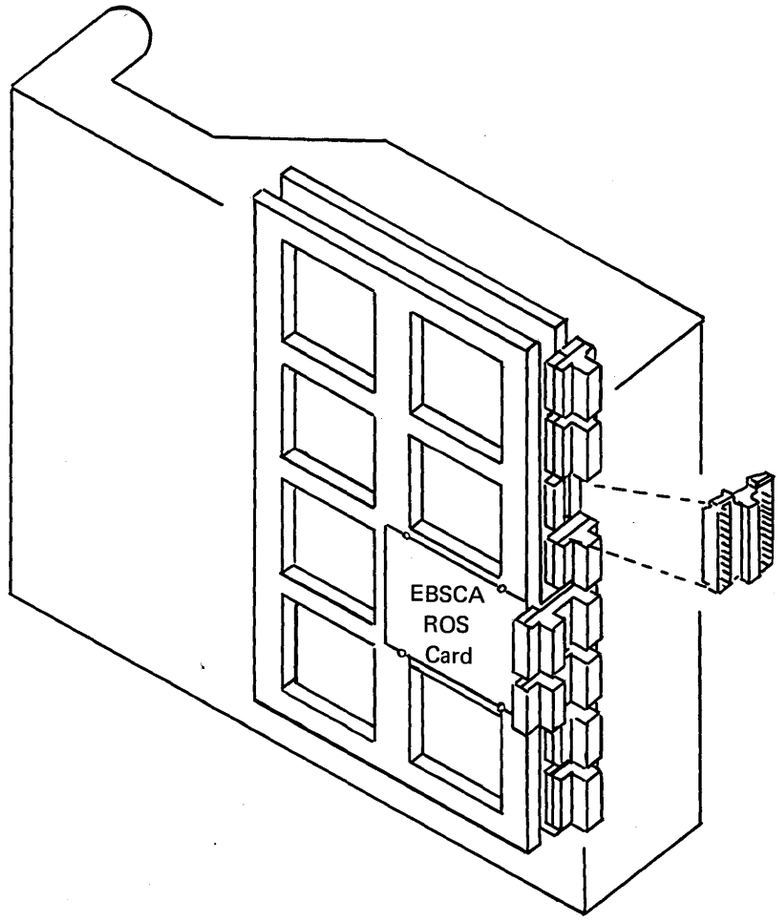
559 ID Reader, Keylock, and Multipoint Alarm Cable Connections to the Feature Half Planar



EC 823146	825853		PN 1618947
Date 9/15/74	11/15/74		

EC 823146			PN 1618948
Date 9/15/74			

560 EBSCA ROS Card



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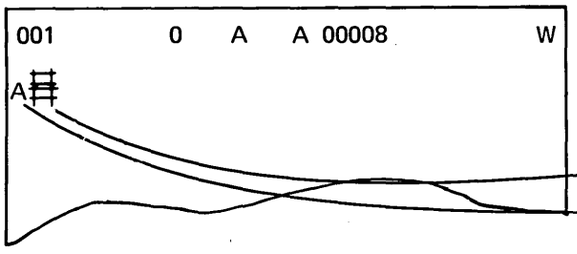
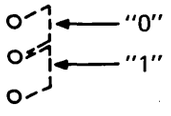
EC 823146	825853		PN 1618950
9/15/74	11/15/74		

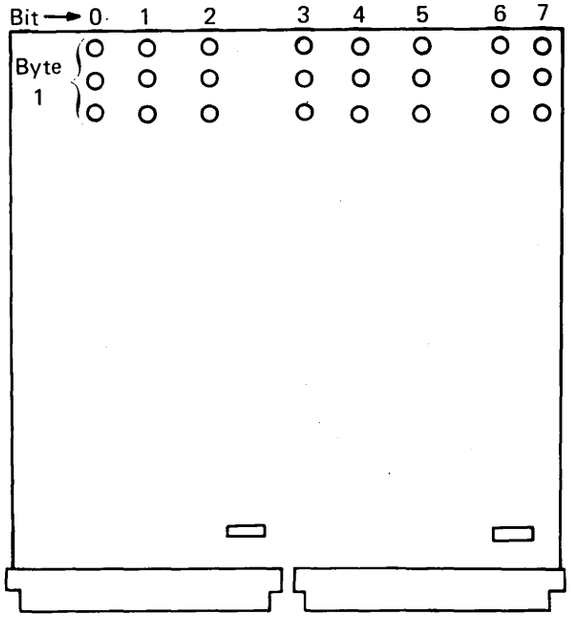
561 Multipoint Address in Feature Half Planar Sockets Y and Z

Display (Refer to **757** to decode the hex characters.)



Each Bit Position





Multipoint Addressing

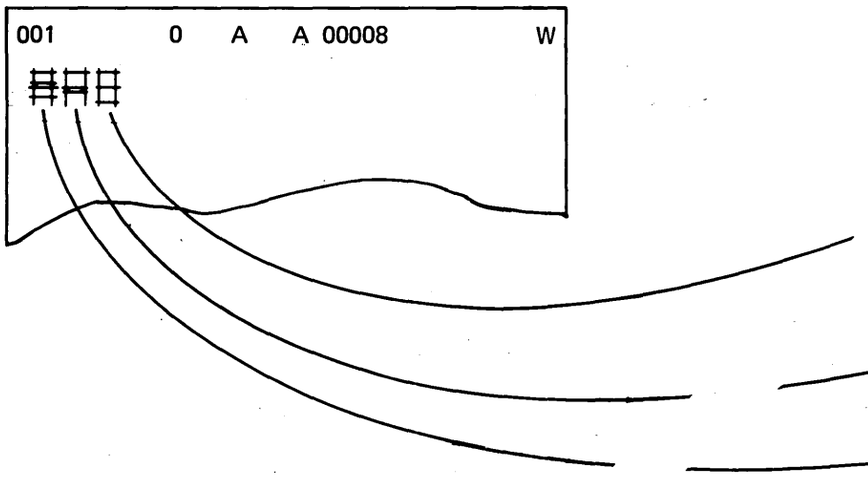
For a given polling character, the corresponding select character is defined.

Poll Char	Poll Hex	Sel Hex	Binary	Poll Char	Poll Hex	Sel Hex	Binary
	C0	80	1100 0000		E0	A0	1110 0000
A	C1	81	1100 0001		E1	A1	1110 0001
B	C2	82	1100 0010	S	E2	A2	1110 0010
C	C3	83	1100 0011	T	E3	A3	1110 0011
D	C4	84	1100 0100	U	E4	A4	1110 0100
E	C5	85	1100 0101	V	E5	A5	1110 0101
F	C6	86	1100 0110	W	E6	A6	1110 0110
G	C7	87	1100 0111	X	E7	A7	1110 0111
H	C8	88	1100 1000	Y	E8	A8	1110 1000
I	C9	89	1100 1001	Z	E9	A9	1110 1001
	CA	8A	1100 1010		EA	AA	1110 1010
	CB	8B	1100 1011		EB	AB	1110 1011
	CC	8C	1100 1100		EC	AC	1110 1100
	CD	8D	1100 1101		ED	AD	1110 1101
	CE	8E	1100 1110		EE	AE	1110 1110
	CF	8F	1100 1111		EF	AF	1110 1111
	D0	90	1101 0000	0	F0	B0	1111 0000
J	D1	91	1101 0001	1	F1	B1	1111 0001
K	D2	92	1101 0010	2	F2	B2	1111 0010
L	D3	93	1101 0011	3	F3	B3	1111 0011
M	D4	94	1101 0100	4	F4	B4	1111 0100
N	D5	95	1101 0101	5	F5	B5	1111 0101
O	D6	96	1101 0110	6	F6	B6	1111 0110
P	D7	97	1101 0111	7	F7	B7	1111 0111
Q	D8	98	1101 1000	8	F8	B8	1111 1000
R	D9	99	1101 1001	9	F9	B9	1111 1001
	DA	9A	1101 1010		FA	BA	1111 1010
	DB	9B	1101 1011		FB	BB	1111 1011
	DC	9C	1101 1100		FC	BC	1111 1100
	DD	9D	1101 1101		FD	BD	1111 1101
	DE	9E	1101 1110		FE	BE	1111 1110
	DF	9F	1101 1111		FF	BF	1111 1111

Binary value jumpered on card
Select character in HEX
Poll character in HEX
Poll character

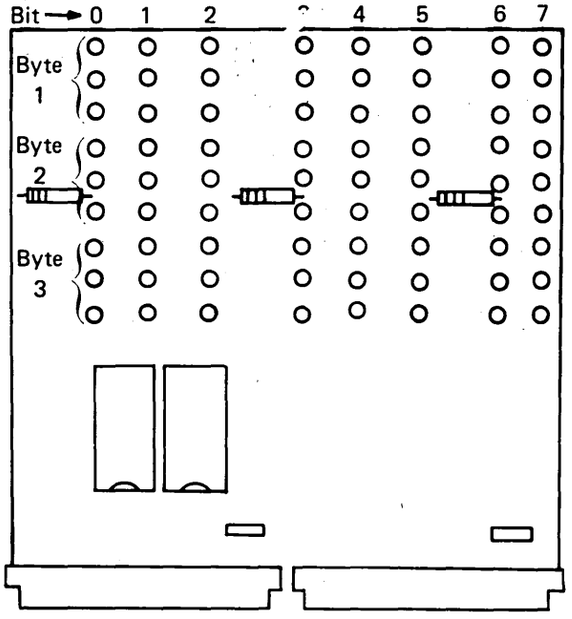
562 Terminal ID in Feature Half Planar Sockets Y and Z

Display (Refer to 757 to Decode the Hex Characters.)

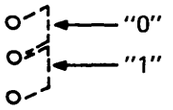


ID Character Jumper Placement

Hex	0	1	2	3	4	5	6	7
81								
82								
83								
84								
85								
86								
87								
88								
89								
91								
92								
93								
94								
95								
96								
97								
98								
99								
A2								
A3								
A4								
A5								
A6								
A7								
A8								
A9								



Each Bit Position



EC 826065			PN 1619566
8/1/75			

EC 826065			PN 1619567
8/1/75			

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601 Part Numbers and Cause Codes (Part 1 of 2)

Part Name	Number	IR Code
Ac capacitor (non PCB)		600-02
(with 3713)	5252841	
(without 3713)	5252840	
Ac capacitor (PCB)		600-02
(with 3713)	5252624*	
(without 3713)	5252695*	
Ac distribution cable		100-01
Disk 1 (115V)	2456462	
Disk 1 (208/230V)	2456385	
Disk 2 (115V)	2456480	
Disk 2 (208/230V)	2456386	
Ac line filter	2192519	600-07
Cross connector	2731026	300-02
Disk drive motor		820-11
50 Hz 115V	2305706	
50 Hz 200/235V	2305707	
60 Hz 115V	2305672	
60 Hz 200/235V	2305633	
Disk drive shaft bearing	5344991	820-09
Display signal cable	2456272	100-05
Display PC board		200-05
ID reader motor		990-01
50 Hz 123.5V	2252235	
60 Hz 100V	2252234	
60 Hz 115V	2252233	
ID reader		990-01
50 Hz 123.5V	2144257	
60 Hz 100V	2144256	
60 Hz 115V	2144255	

*Capacitors 5252695 and 5252624 are being replaced by 5252840 and 5252841 respectively. If replacing 5252695 with 5252840, order capacitor mounting clamp PN5404092 also.

Part Name	Number	IR Code
Keyboard signal cable	2456460	100-06
Keyboard PC board		040-07
Line cord		100-07
WT, no plug, 8 ft (2.44 m)		
50 Hz	2455034	
60 Hz	2455223	
115V		
6 ft (1.83 m)	2455033	
8 ft (2.44 m)	2455030	
115V, lock plug		
6 ft (1:83 m)	2455578	
8 ft (2.44 m)	2455579	
220V		
6 ft (1.83 m)	2455031	
8 ft (2.44 m)	2455035	
220V, lock plug		
6 ft (1.83 m)	2455580	
8 ft (2.44 m)	2455581	
Power supply dc cable	2456461	100-08
Power supply PC board		600-04
POWER switch	731506	600-05
Primary fuse (with print)		600-03
115V	512137	
208/230V	2456618	
Primary fuse (without print)		600-03
115V	338165	
208/230V	1176668	
Primary fuse holder	2456367	600-03
Printer ac cable		100-11
3713	2456479	
3715	1611368	
3717	2455200	
Printer dc cable		
3713	2456483	
3715	1611367	
3717	2455201	

Part Name	Number	IR Code
Transformer (U.S. and Canada)		600-06
115V	1620206	
208/230V	1620207	
Transformer (WT)		600-06
110, 123.5, 220, or 235V 50 Hz	4119447	
100, 115, 200, 208, or 230V 60 Hz	4110448	
100, 110, 123.5, 200, 220, or 235V 50 Hz	4119449	

EC	823146	825853	826065	PN 1618955
Date	9/15/74	11/15/74	8/1/75	

EC 823146	825853	826065	PN 1618956
Date 9/15/74	11/15/74	8/1/75	

601 Part Numbers and Cause Codes (Part 2 of 2)

Cause Codes

Adjustment	01	Dirty	22	Short	46
Bent	07	Grounded	28	Worn	70
Damaged	20	Loose	34	Other	00
Defective	21	Open	42		

Secondary Fuses IR Code 600-03

Fuse (with 3713)	Original Power Supply			Revised Power Supply		
	Current	Type	Part No.	Current	Type	Part No.
F1 (+12V)	3.0A	MDL	338165	3.0A	AGC	855252
F2 (-12V)	1.6A	MDL	78951	1.5A	AGC	111256
F3 (+8.5V)	4.0A	BA3	1143492	4.0A	BA3	1143492**
				(5.0A	MDX	512137*)
F4 (+24V) (without 3713)	8.0A	MDL	1146953	8.0A	AGC	433557
F1 (+12V)	2.5A	MDL	361755	3.0A	AGC	855252
F2 (-12V)	1.5A	MDL	505077	1.5A	AGC	111256
F3 (+8.5)	4.0A	BA3	1143492	4.0A	MTH	111257**
F4 (+24V)	2.5A	MDL	361755	3.0A	AGC	855252

*For power supplies at EC 825737 or later.
**For power supplies prior to EC 825737.

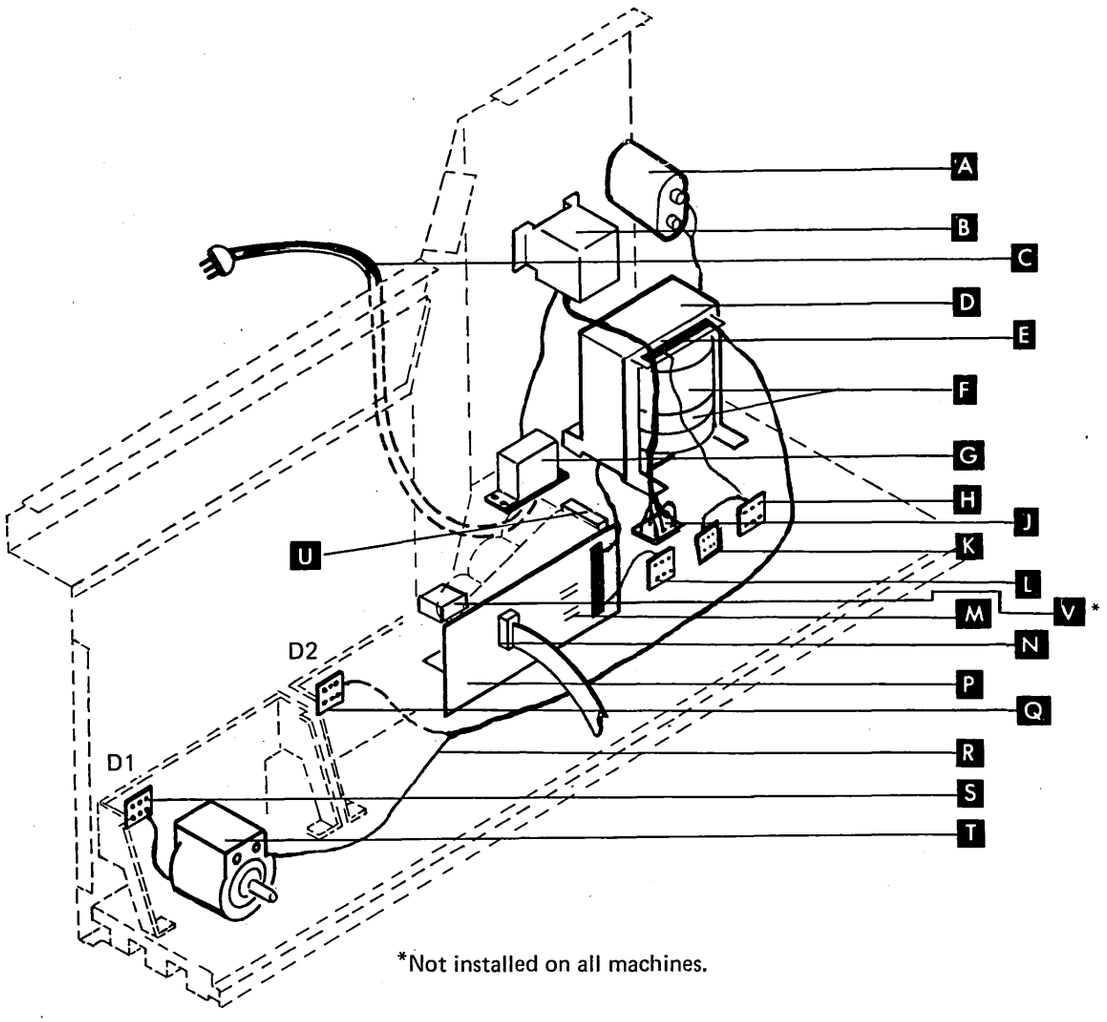
604 Power Supply Locations

Original Power Supply With Diode Board

These locations are for the original power supply having a diode board U. See graphic 604 on the following pages for locations in the revised power supply.

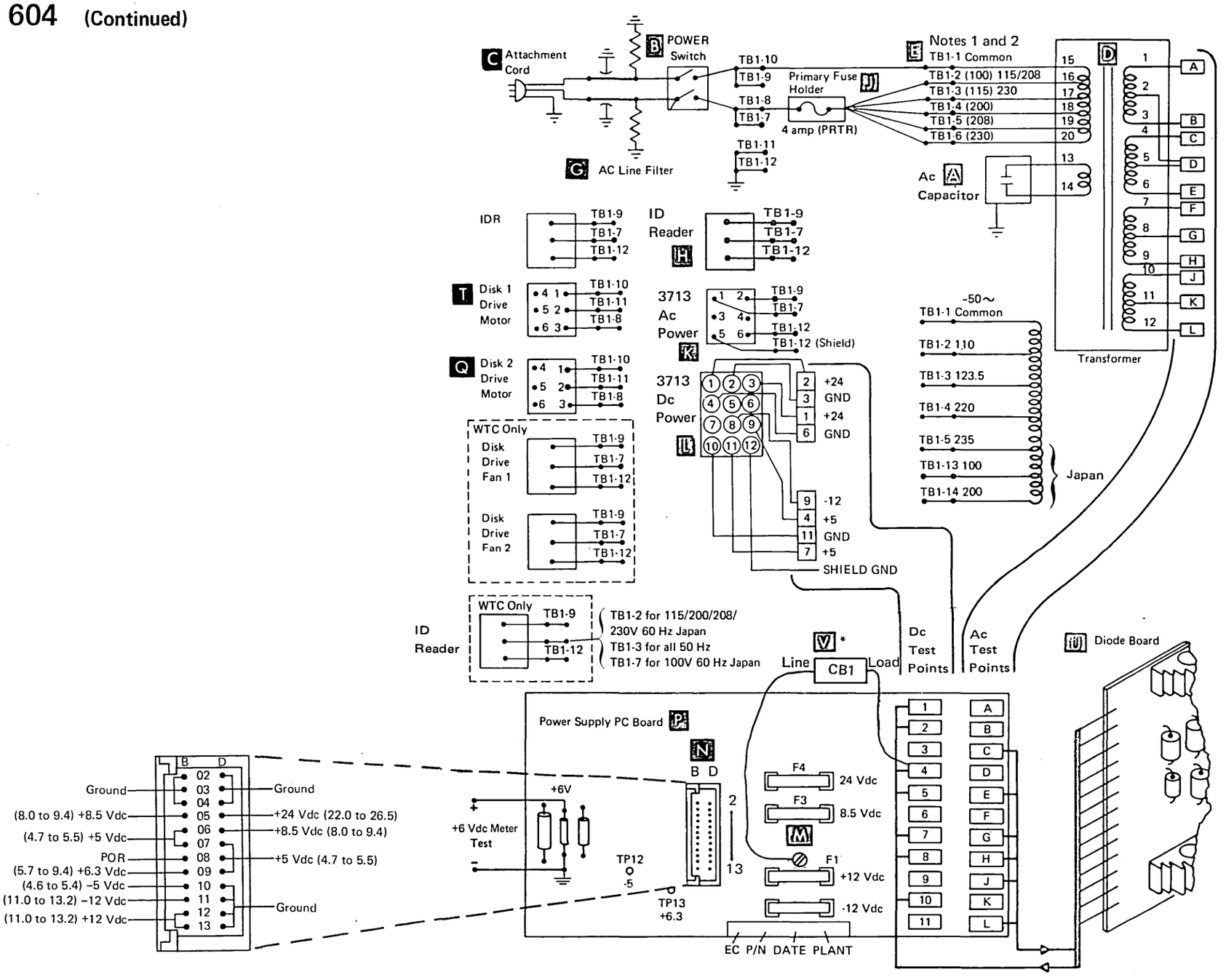
Legend

- A Capacitor
- B Power-on switch
- C Attachment cord
- D Transformer
- E Terminal board (TB1)
- F Power supply ac cable
- G Ac line filter
- H ID reader ac cable
- J Primary ac fuse holder
- K Printer ac cable
- L Printer dc cable
- M Dc fuses
- N Power supply dc cable
- P Power supply PC board
- Q Disk 2 ac cable
- R Disk ac cable
- S Disk 1 ac cable
- T Disk drive motor
- U Diode board
- V CB1, 5V circuit breaker



*Not installed on all machines.

604 (Continued)



Notes:

1. Numbers in parentheses apply to WTC 60 Hz only.
2. Various transformers are used; check part number (601) before changing taps.

*Not installed on all machines

602 not used
603 not used

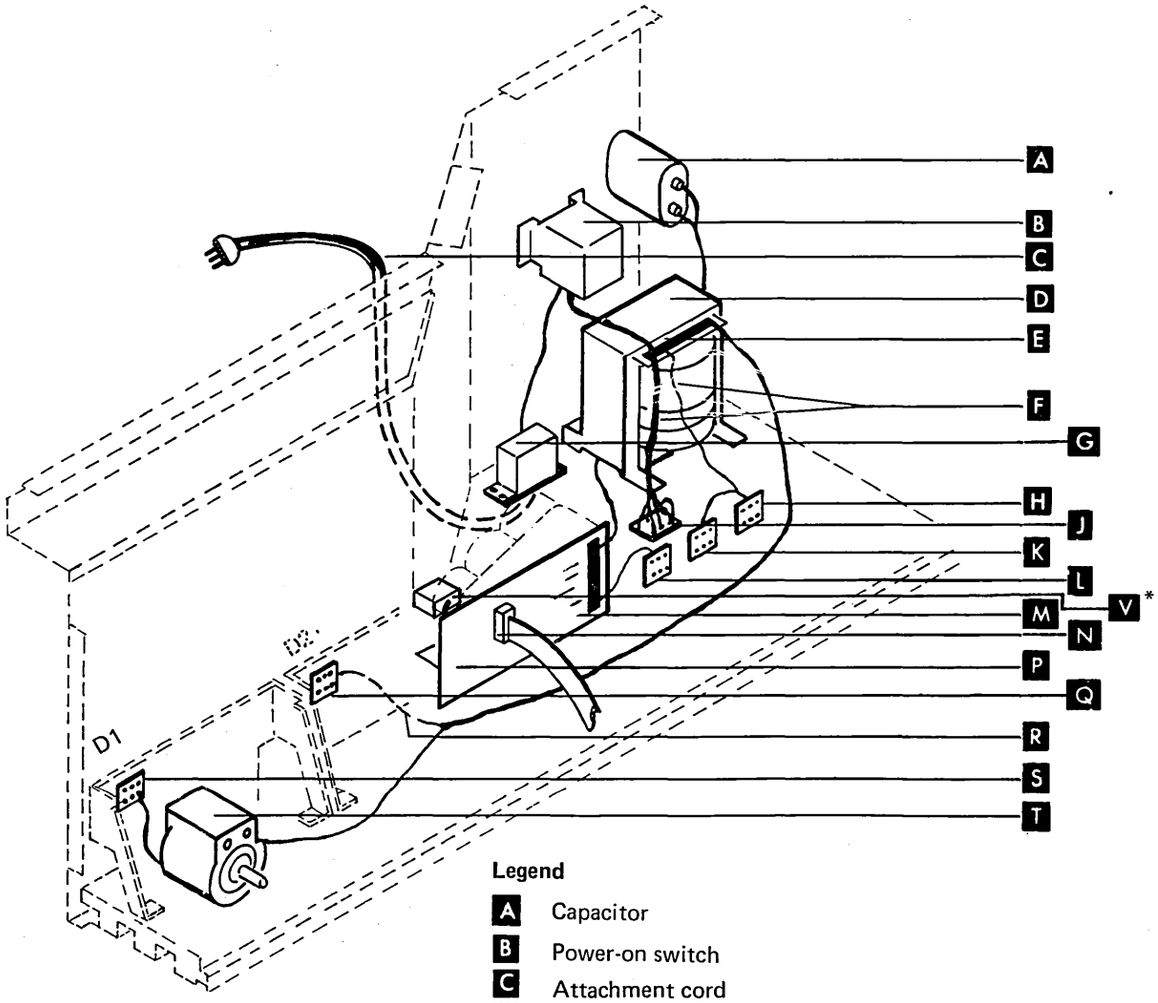
EC 823146	825853	826065	PN 1618957
Date 9/15/74	11/15/74	8/1/75	

EC 823146	825853	826065	PN 1618958
Date 9/15/74	11/15/74	8/1/75	

604 (Continued)

Revised Power Supply, No Diode Board

These locations are for the revised power supply having no diode board. See graphic 604 on the preceding pages for locations in the original power supply.

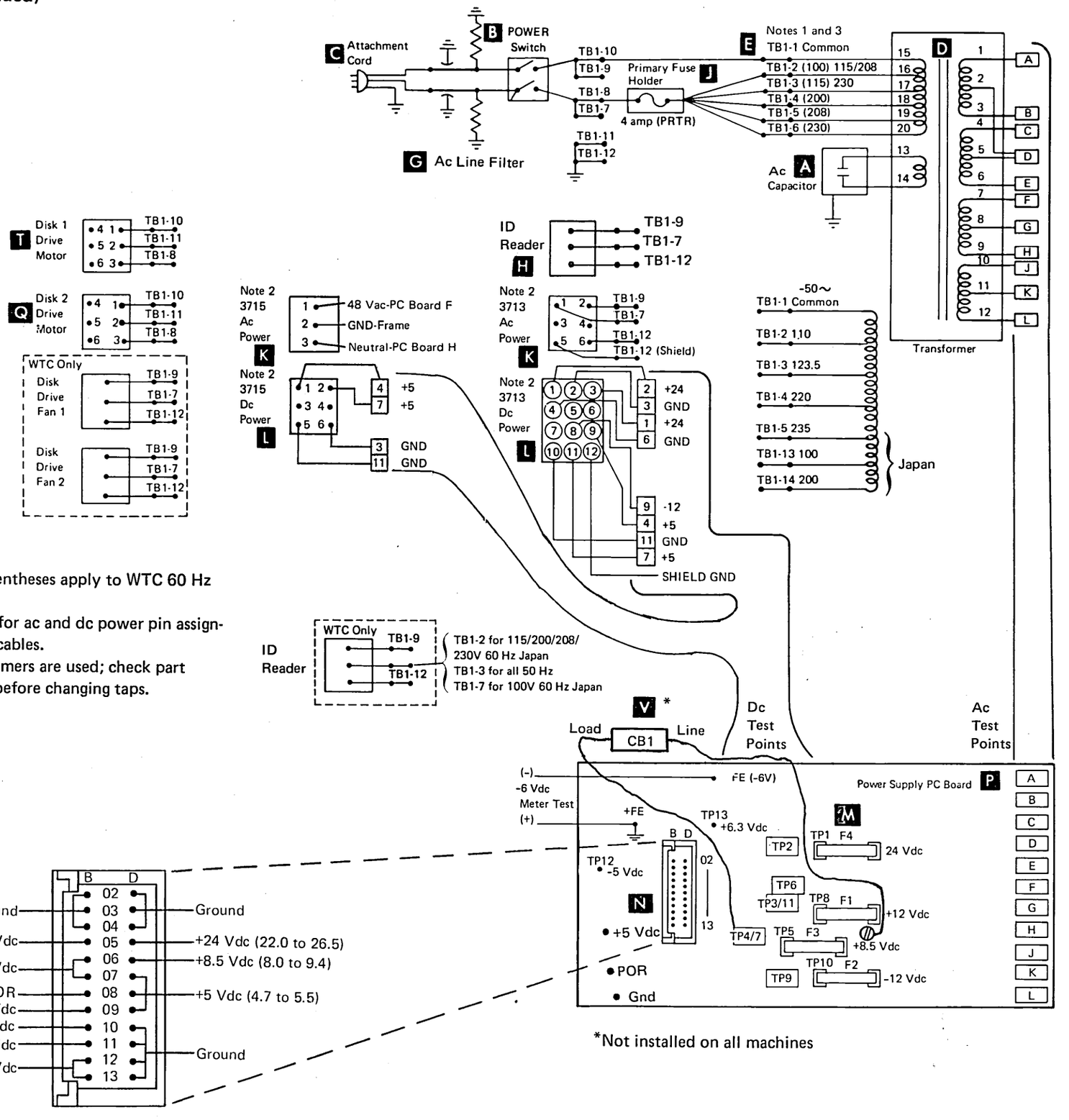


Legend

- A Capacitor
- B Power-on switch
- C Attachment cord
- D Transformer
- E Terminal Board (TB1)
- F Power supply ac cable
- G AC line filter
- H ID reader ac cable
- J Primary ac fuse holder
- K Printer ac cable
- L Printer dc cable
- M DC fuses
- N Power supply dc cable
- P Power supply pc board
- Q Disk 2 ac cable
- R Disk ac cable
- S Disk 1 ac cable
- T Disk drive motor
- V CB1, 5V circuit breaker

* Not installed on all machines

604 (Continued)



Notes:

1. Numbers in parentheses apply to WTC 60 Hz only.
2. See 3717 MLM for ac and dc power pin assignments on 3717 cables.
3. Various transformers are used; check part numbers (601) before changing taps.

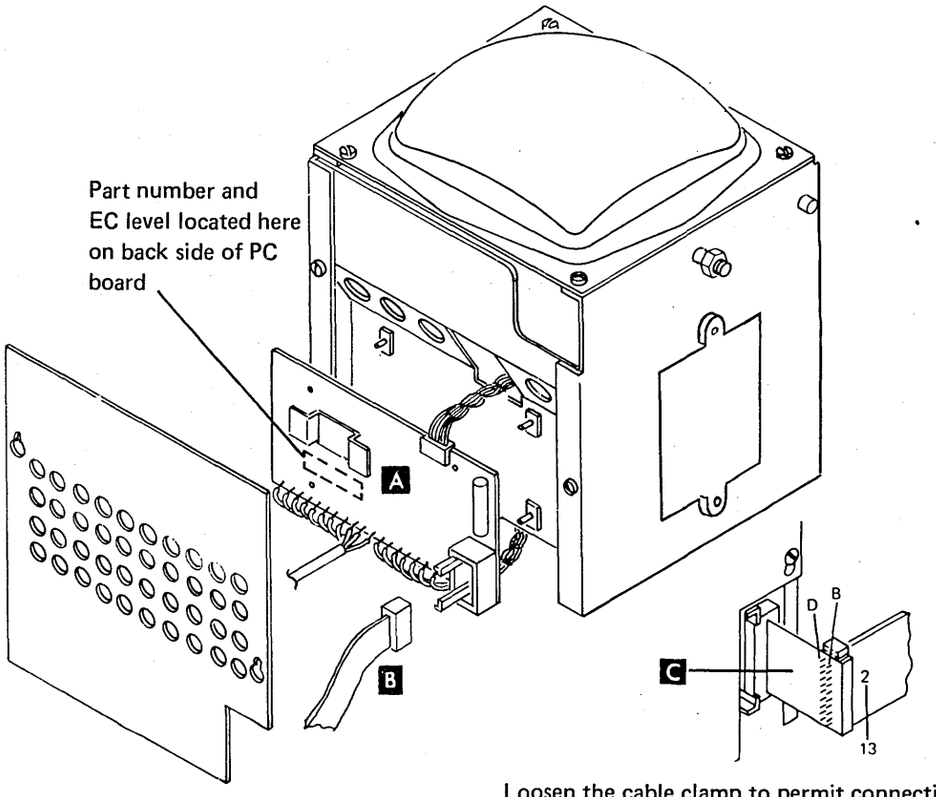
*Not installed on all machines

605 not used
606 not used

EC 823146	825853	826065	PN 1618959
Date 9/15/74	11/15/74	8/1/75	

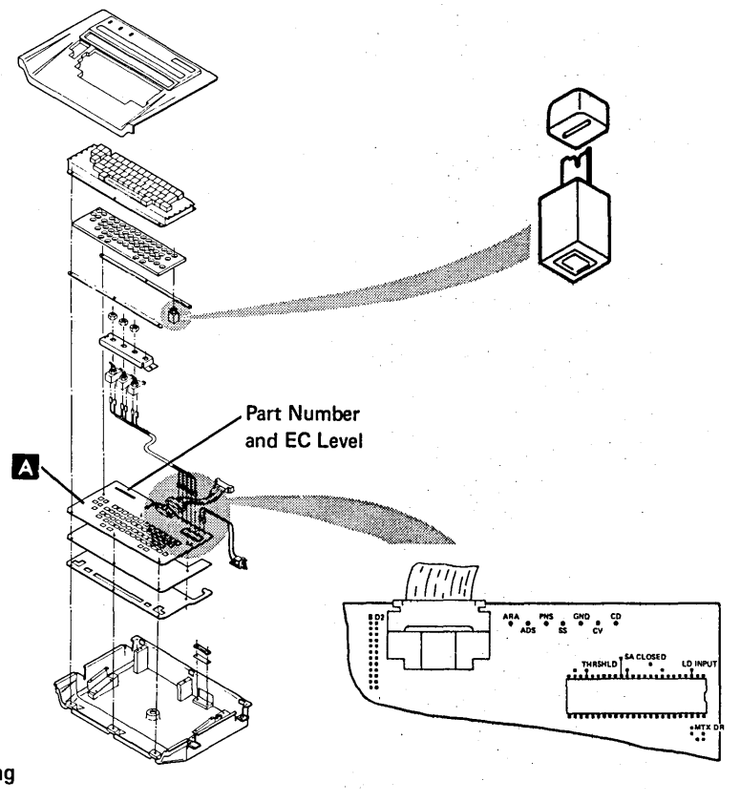
EC 823146	825853		PN 1618960
Date 9/15/74	11/15/74		

607 CRT Locations

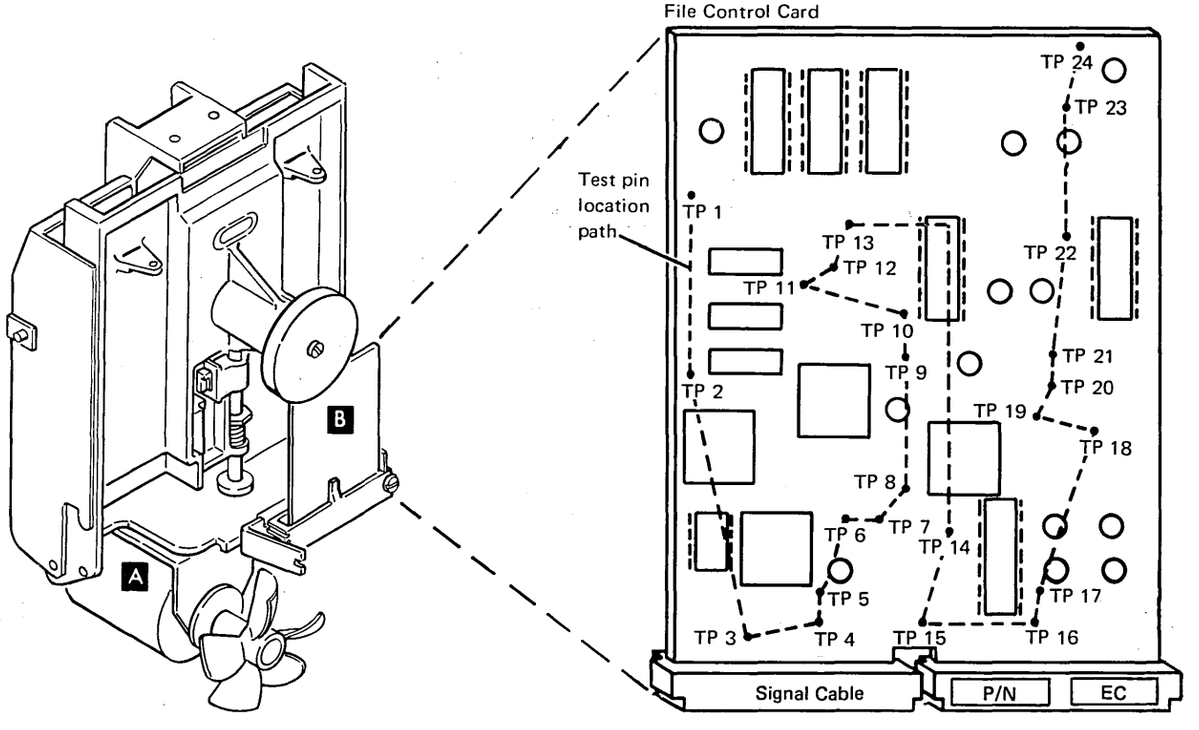


Loosen the cable clamp to permit connecting the cable to the extender without strain.

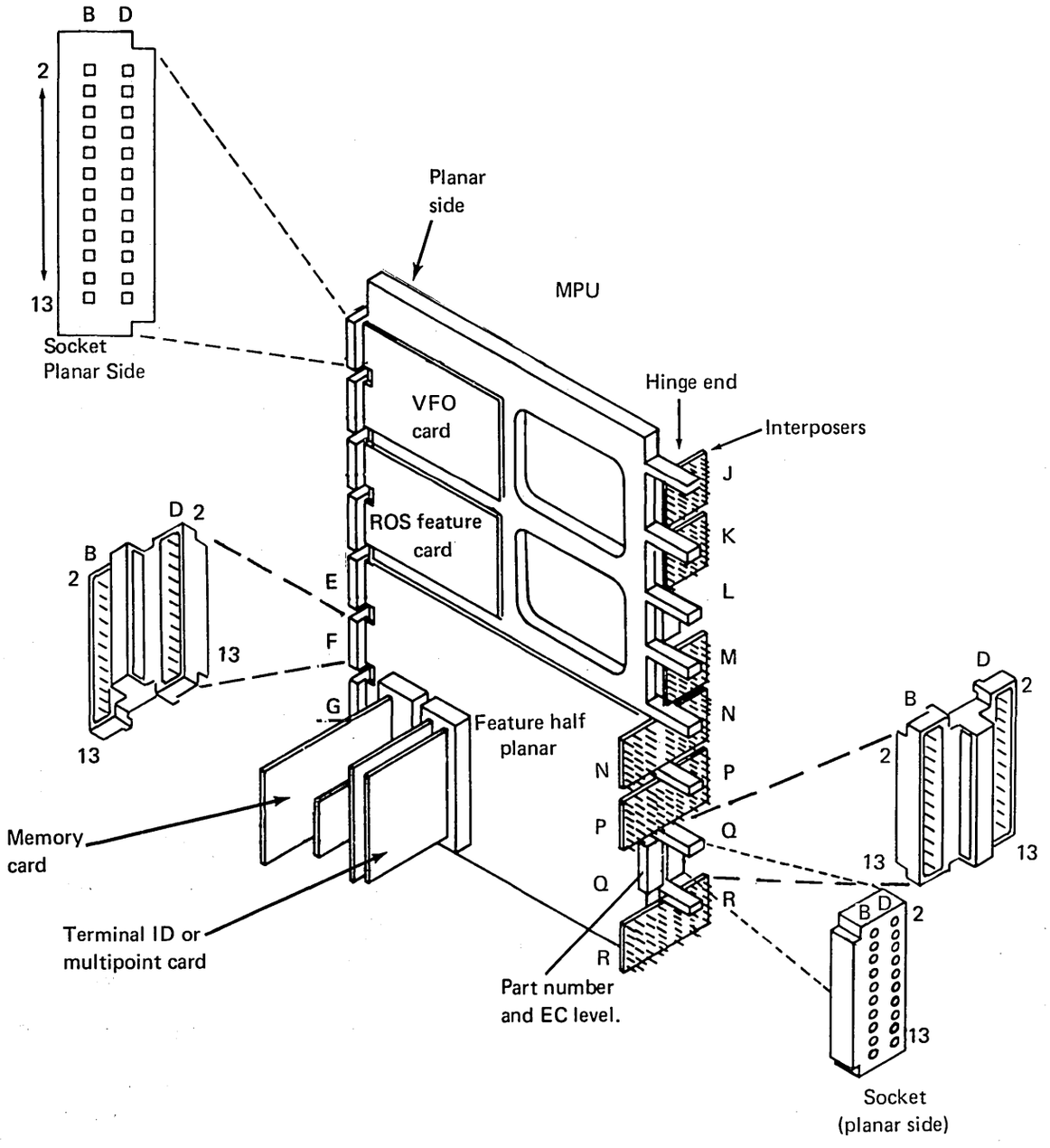
609 Keyboard Locations



608 Disk Drive Locations



610 MPU Locations

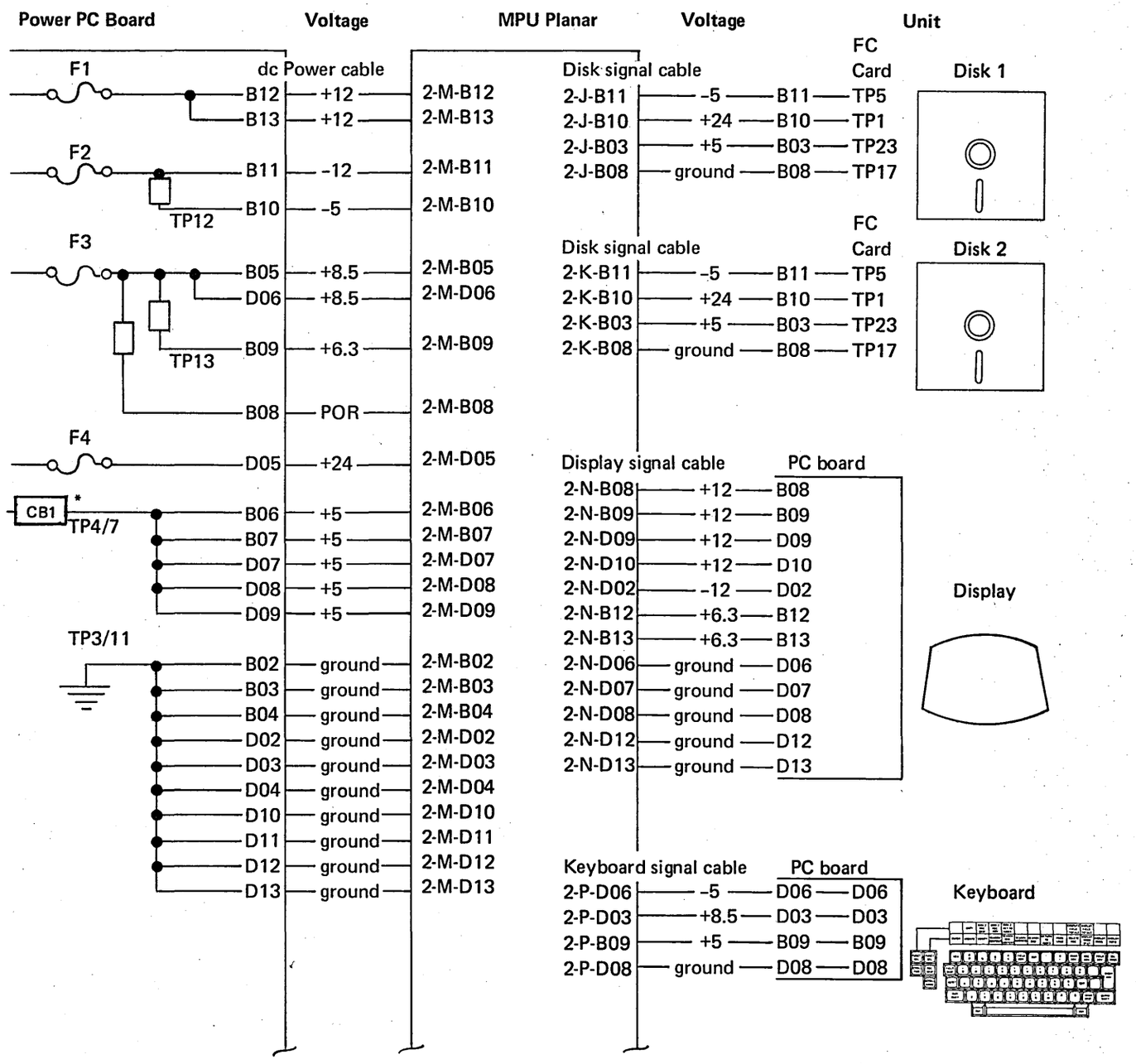


611 not used
612 not used

EC 823146	826065		PN 1618961
Date 9/15/74	8/1/75		

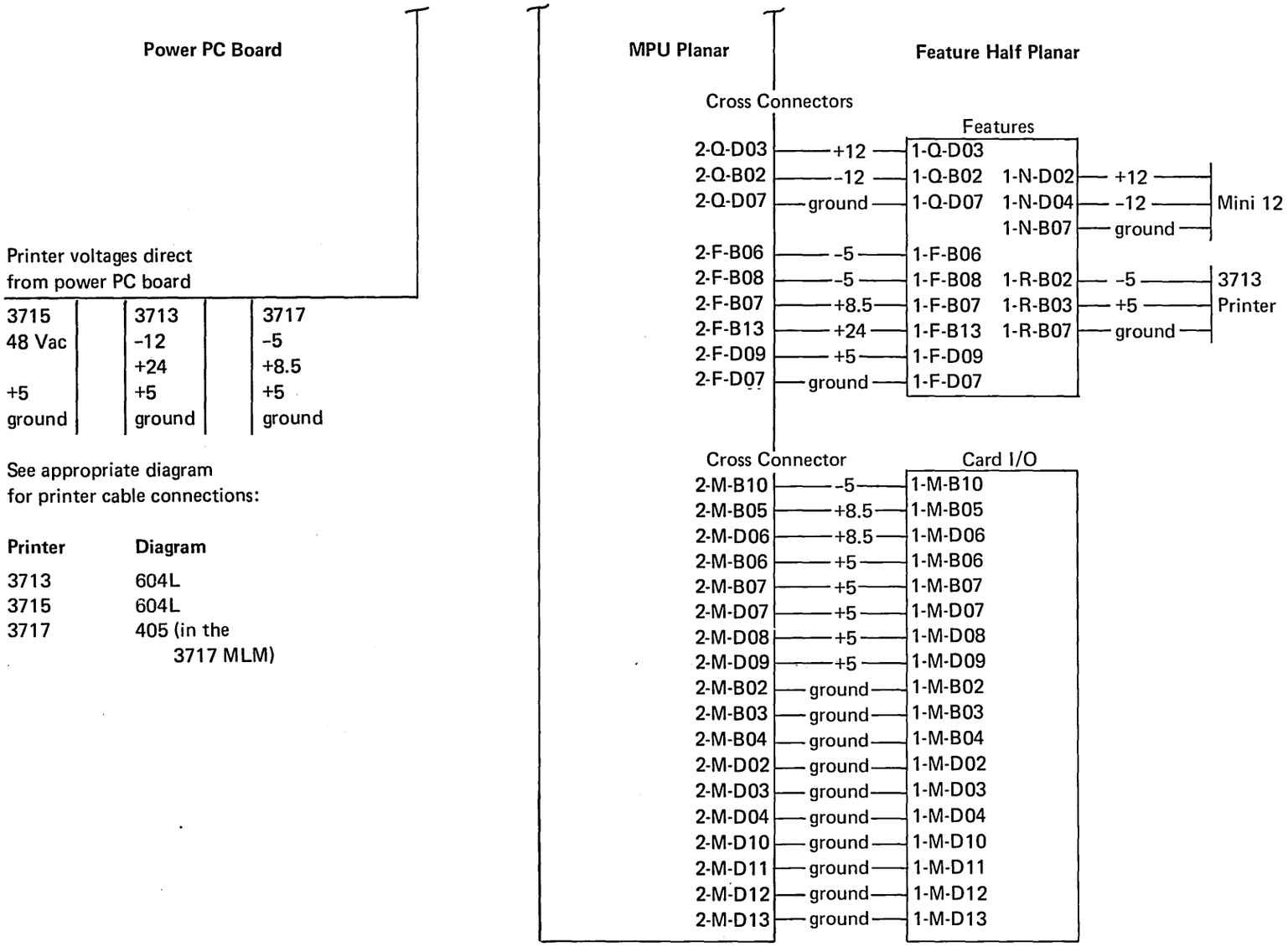
EC 823146	825853	826065	PN 1618962
Date 9/15/74	11/15/74	8/1/75	

613 DC Voltage Distribution



*Not installed on all machines

613 (Continued)



See appropriate diagram for printer cable connections:

Printer	Diagram
3713	604L
3715	604L
3717	405 (in the 3717 MLM)

EC 823146	825853		PN 1618963
Date 9/15/74	11/15/74		

3741 ML

613-2

EC 823146			PN 1618964
Date 9/15/74			

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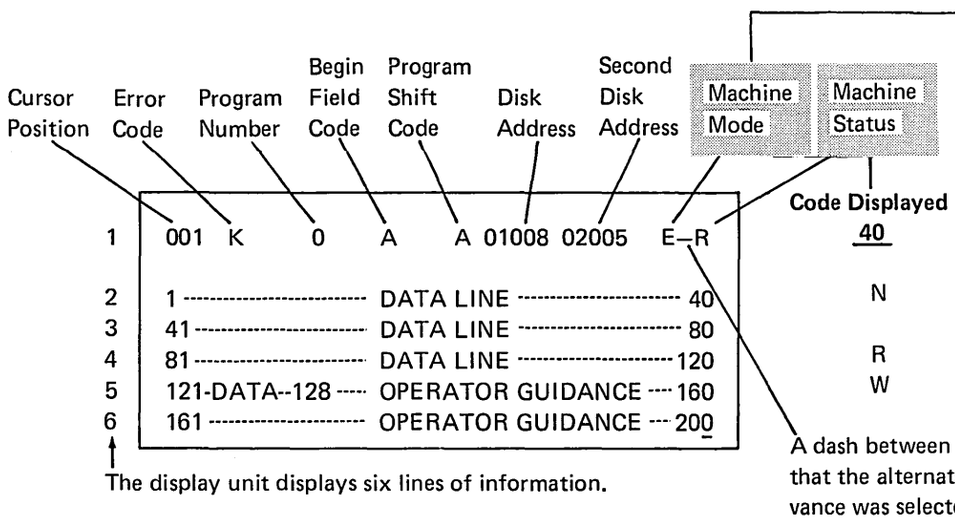
704 Display Format



The display unit displays six lines of information.

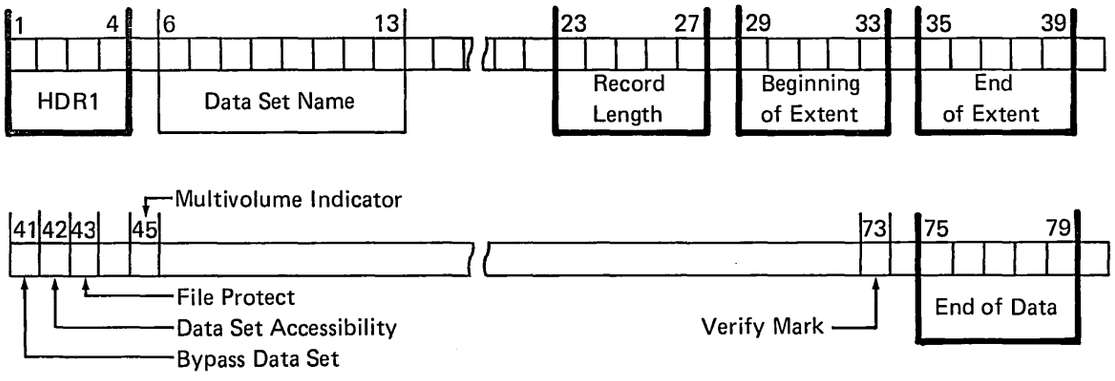
Code Displayed 40	Status
N	Not Ready (disk not loaded)
R	Ready
W	Wait

A dash between mode and status means that the alternate method of record advance was selected. (The 3741 bypasses all fields past the cursor when REC ADV is pressed in enter mode.)

Codes Displayed 37	38	Mode of Operation
I		Input to 3741
	Ø	Record Mode
	1 ↓ 5	File Modes
O		Output from 3741
	Ø	Record Mode
	1 ↓ 5	File Modes
H	U	Character Mode
R		Single Read
P		Single Punch
C		Field Correct
E		Enter
F		Field Totals
I		Initialize
M		Modify
N		Record Insert
P		Print
S		Search
U		Update
V		Verify
X		Read Index
C	E	Customer Engineer
	R	Read
	P	Punch

Data Set Label

Fields in heavy lines are required by the 3740 data entry system.



BSCA/EBSCA Mode	Col 37	Mode Col 38	Status Indicators Col 39				Col 39
Communications		C					
Transmit		T	T	I			B
Transmit-transparent		P	T	I			B
Receive	P	R			C	J	
Transmit-receive	P	B	T	I	C	J	B
Transmit-transparent/receive	P	D	T	I	C	J	B
Transmit buffered		J	T	I			B
Transmit buffered/receive	P	K	T	I	C	J	B
Inquiry		I	T	I	C	J	B
Request for test (RFT)	P	%	T	I	C	J	
E test mode		W		I	C		

Status Legend

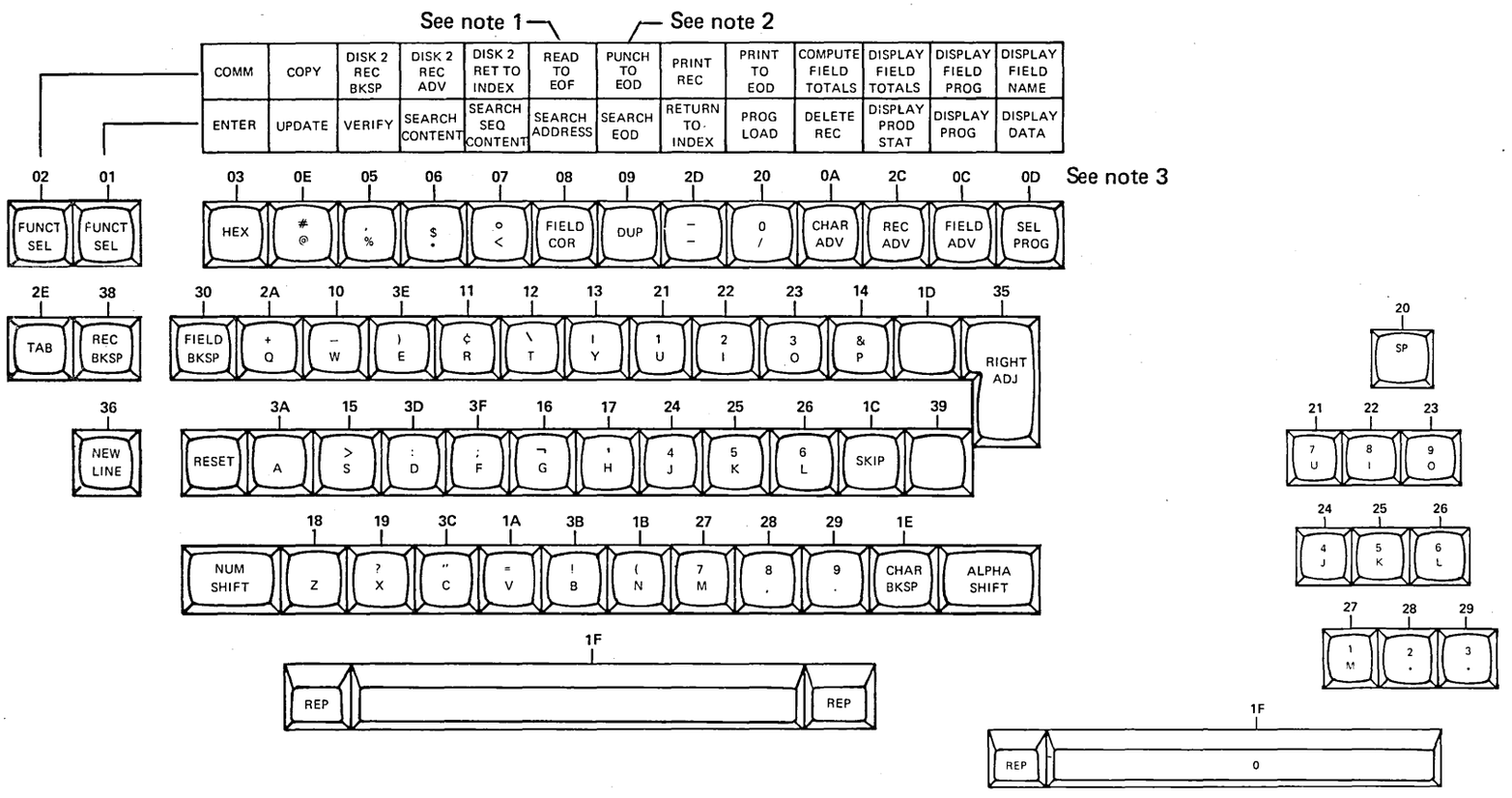
B = Read ID card
C = Reception complete
I = Transmission incomplete
J = Reception incomplete
P = Print unattended
T = Transmission complete

701-703 not used, 705-706 not used

EC 825853	825958	826065	PN 1618965
11/15/74	3/21/75	8/1/75	

EC 823146	825853		PN 1618966
Date 9/15/74	11/15/74		

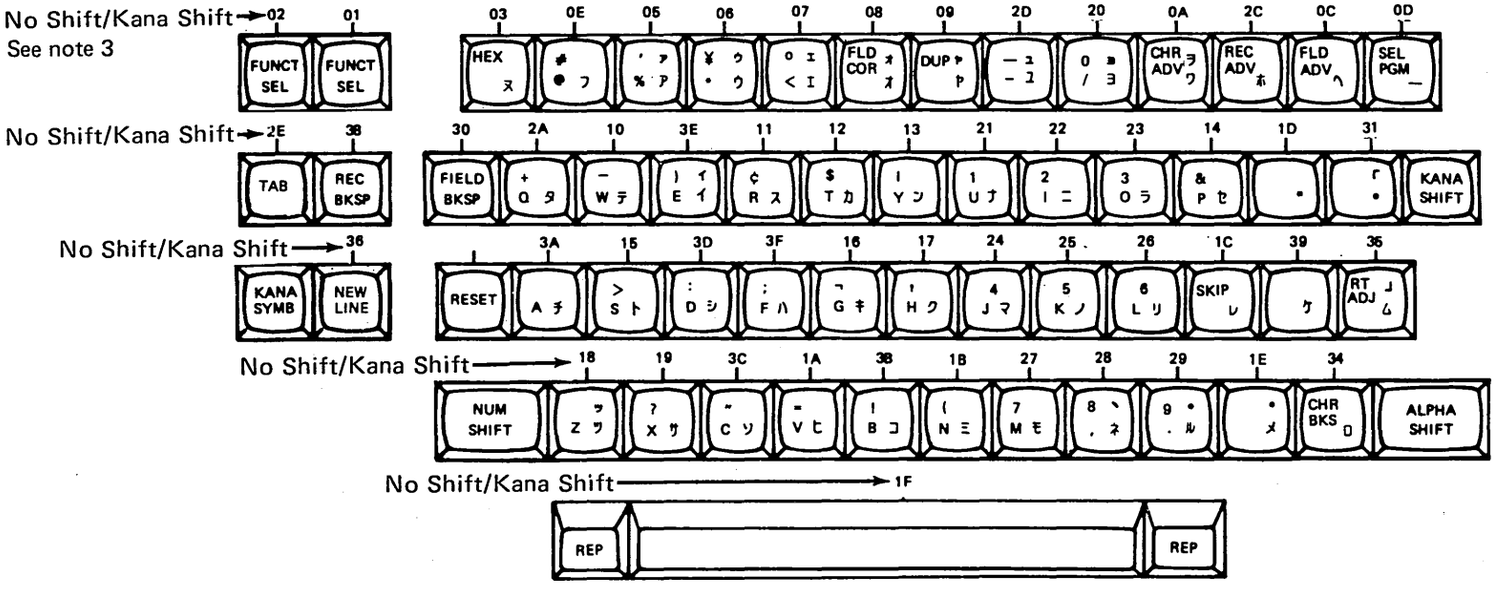
707 Keyboard



Alternate keyboard layout used with proof keyboard.

Notes:

1. For I/O Adapter, this label is INPUT TO 3741.
2. For I/O Adapter, this label is OUTPUT FROM 3741.
3. For alpha and numeric keyboard interface decode, see page 13-8.



Alternate Keyboard Layout Used with Katakana Machines

708 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	XX020	XX026

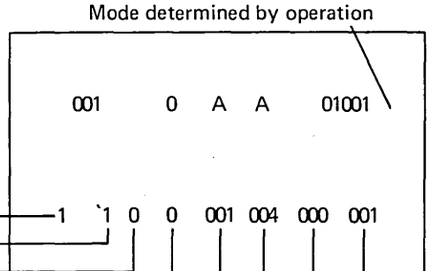
(Do not enter a record at this address)

Note: 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.

709 BSCA Error Logout

BSCA Error Logout

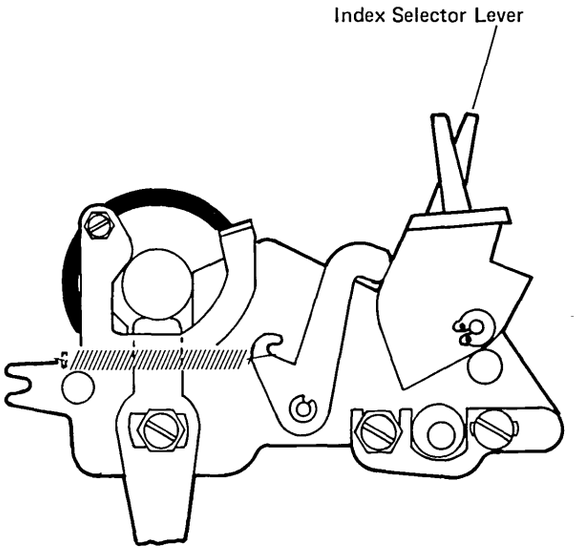
When in R, T, P, B, or D mode, the bottom line on the display shows the following:



Position	Meaning
* 1	Data terminal ready.
* 4	Data set ready.
* 7	Request to send.
* 10	Clear to send.
**14 - 16	CRC checks in receive.
**19 - 21	NAKs received in transmit.
**24 - 26	Two second time-outs.
**29 - 31	Three second time-outs.

**Note:* 1 indicates on; 0 indicates off.
***Note:* Three position decimal counter.

710 3713 Printer Index Selector Lever



Printer – Right End

EC 823146	825853	826065	PN 1618968
Date 9/15/74	11/15/74	8/1/75	

711 BSCA Display Mode Indicator

BSCA Display Mode Indicators

A mode indicator is displayed in positions 37 and 38 of the status line. The following shows the key required to select the mode, the mode displayed, and the meaning:

Key	Display	Meaning
C	C	Communication
T	T	Transmit
T	TI	Transmit incomplete
T	TT	Transmit complete
P	P	Transmit transparent text
P	PI	Transmit transparent incomplete
P	PT	Transmit transparent complete
R	R	Receive mode
R	RC	Receive complete
R	RJ	Receive incomplete
B	B	Transmit/receive (T/R)
B	BT	Transmit portion of T/R complete
B	BI	Transmit portion of T/R incomplete
B	BJ	Receive portion of T/R incomplete
B	BC	T/R complete
D	D	Transmit transparent/receive (TT/R)
D	DI	Transmit portion of TT/R incomplete
D	DT	Transmit portion of TT/R complete
D	DJ	Receive portion of TT/R incomplete
D	DC	TT/R complete
	%	Online test mode
	%C	Online test complete
	%T	Online test (transmit)
	W	Wrap test
	WI	Wrap test incomplete
	BB	Read operator ID (T/R)
	DB	Read operator ID (TT/R)
	PB	Read operator ID (transmit transparent)
	TB	Read operator ID (transmit)
	%J	Online test incomplete (receive portion)
	%I	Online test incomplete (transmit portion)

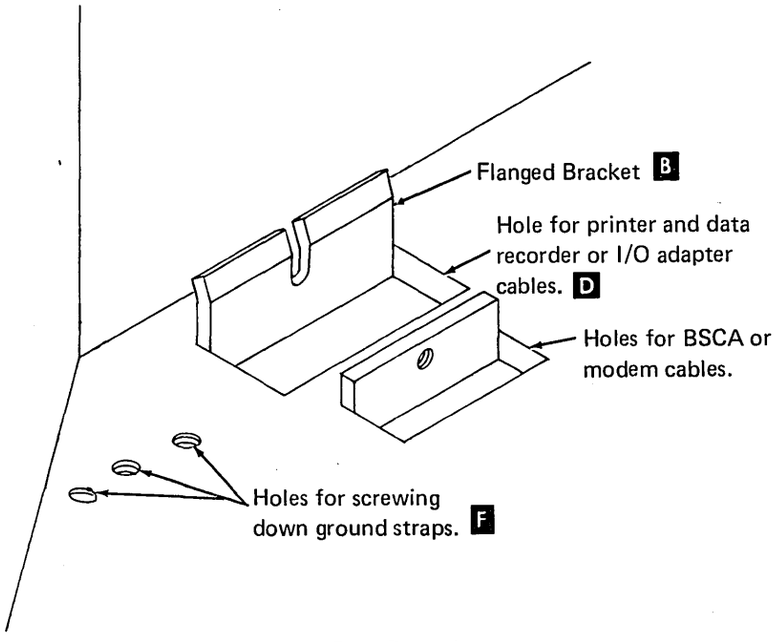
If the mode indicates an incomplete operation, check the error indicator in position 7. See *Symptom Index; Error Indicators,* 1-2.

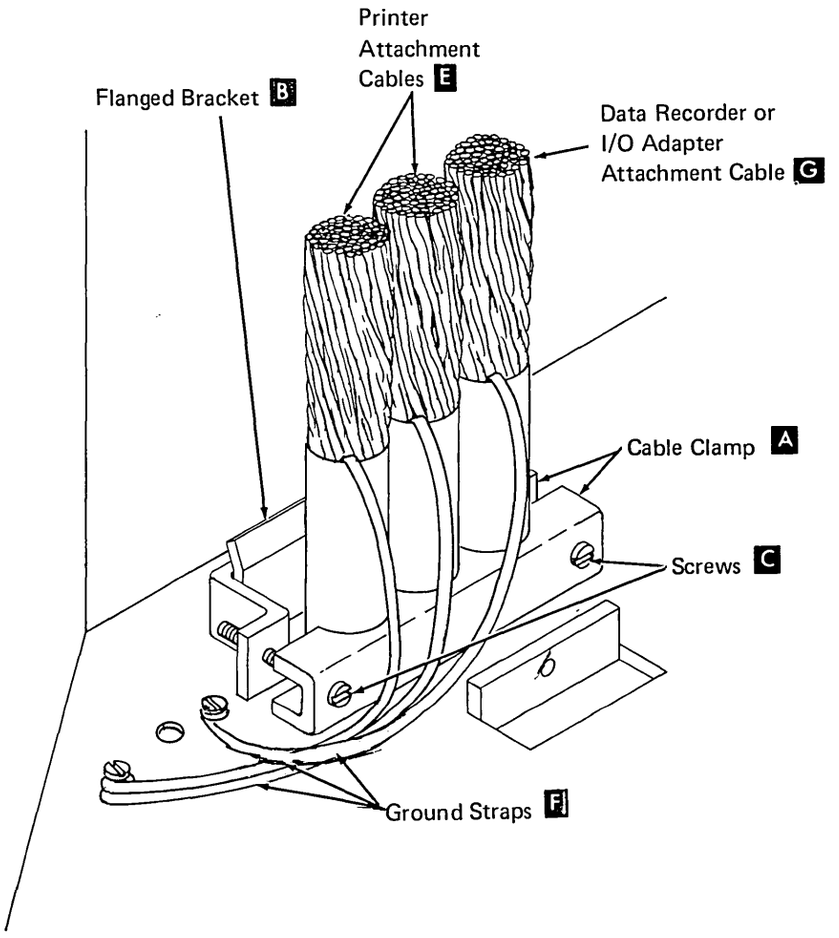
712 Data Recorder/I/O Adapter/Printer Cable Replace/Remove Procedure

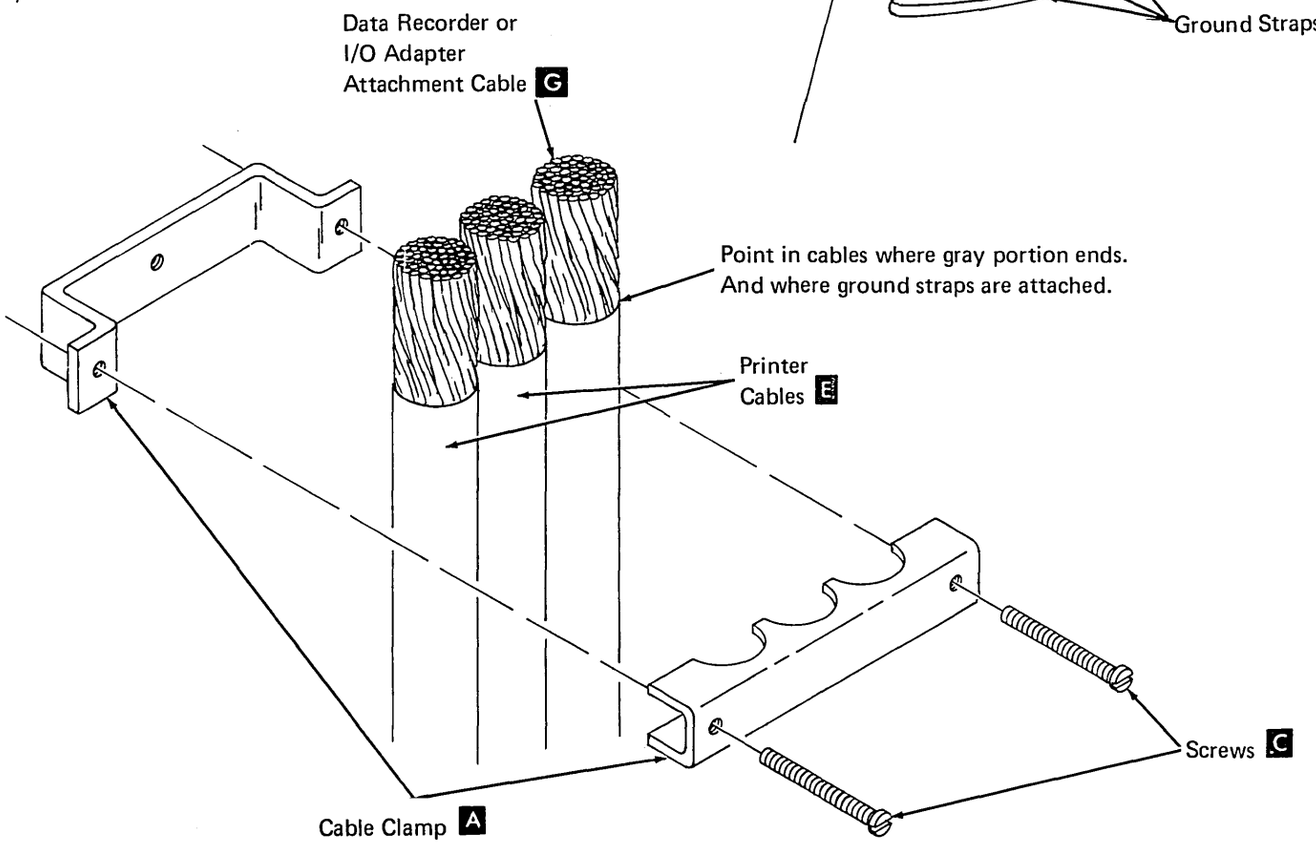
SAFETY:

Remove all electrical power from the machine by unplugging the mainline cord.

1. Remove the back cover of the 3741 and open the gate.
2. Remove the safety shield from the power supply and unplug cable connector from power supply.
3. Loosen the two screws holding the power supply and disconnect the power supply ground strap. Then move the power supply as far as the cables will allow.
4. If a printer has not been attached, skip to step 7.
5. Remove the screw (19944) and nut (257198) from the clamp(2456297) **A** and remove tha printer attachment cable ground straps **F** .
6. Pull all of the gray covered portion of the printer attachment cables out of the machine.
7. Route the data recorder/I/O adapter cable, one paddle at a time, through the hole **D** and to the right of the printer cables **E** if installed. This is a tight fit with the printer cables inserted.
8. Pull the data recorder/I/O adapter cable through the hole until the gray portion is about 12 inches (30cm) inside the machine.
9. If a printer has not been attached, skip to step 11.
10. If possible, pull the gray portion of the printer cables about 12 inches (30cm) inside the machine.
11. Loosely assemble the cable clamp **A** to the cable or cables; just get the two screws **C** started. The data recorder/I/O adapter cable **G** goes to the right of the printer cables.
12. Pull the cables back out of the machine until the cable clamp rests on the flanged bracket **B** .
13. Slide the cable clamp over the flanged bracket and secure it by tightening the two screws **C** .
14. Screw the ground straps to the machine base **F** .
15. Route the cable or cables behind the power supply (toward the machine front) and up to 1/2 planar sockets. Secure cable to gate with plastic straps in 2 places.
16. Refasten the power supply in its original position.
17. Screw the power supply ground strap on the base.
18. Mount the power supply safety shield and cable connector removed in step 2.
19. To remove the cable, reverse the above procedure.





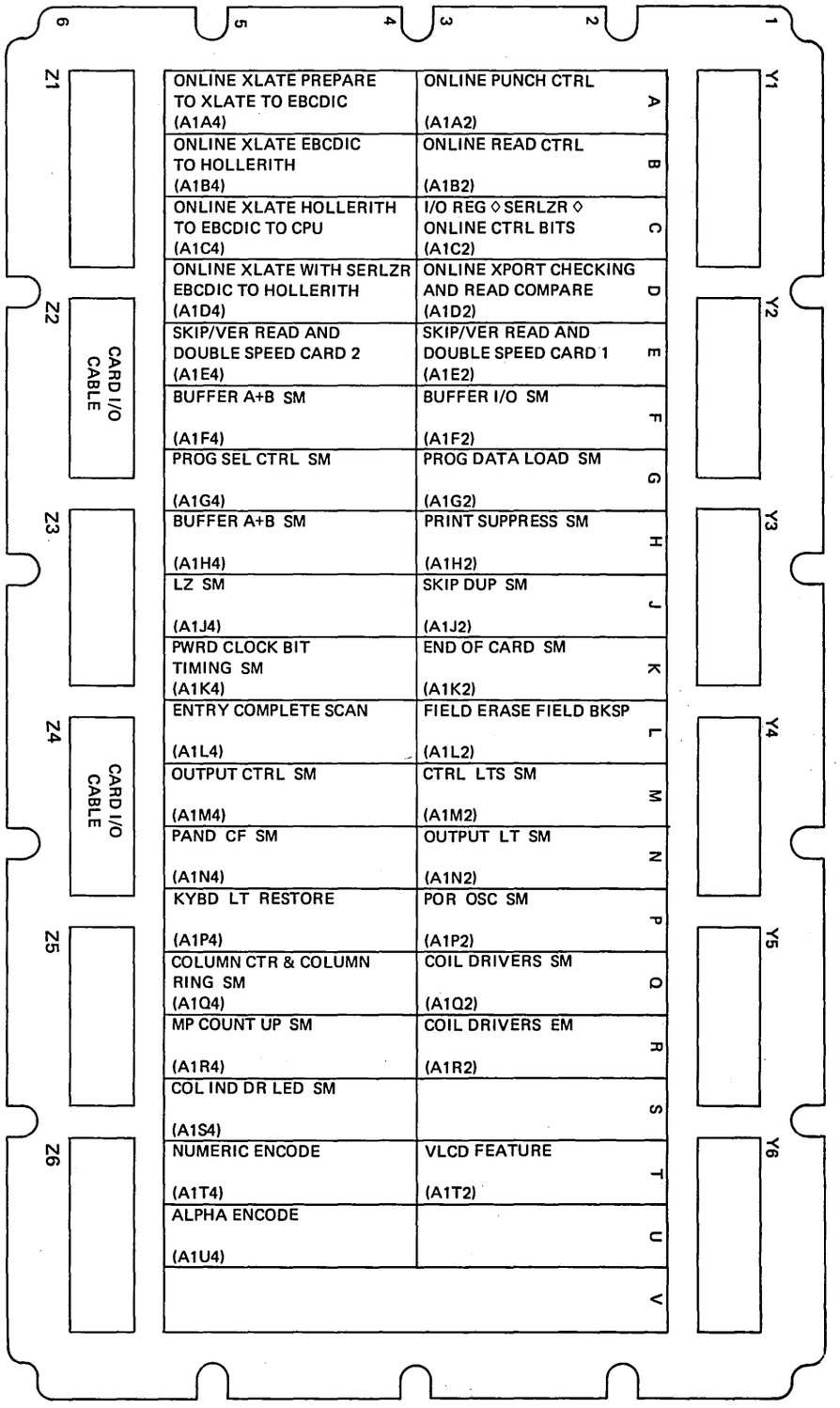


EC 825853	826065		PN 1619394
Date 11/15/74	8/1/75		

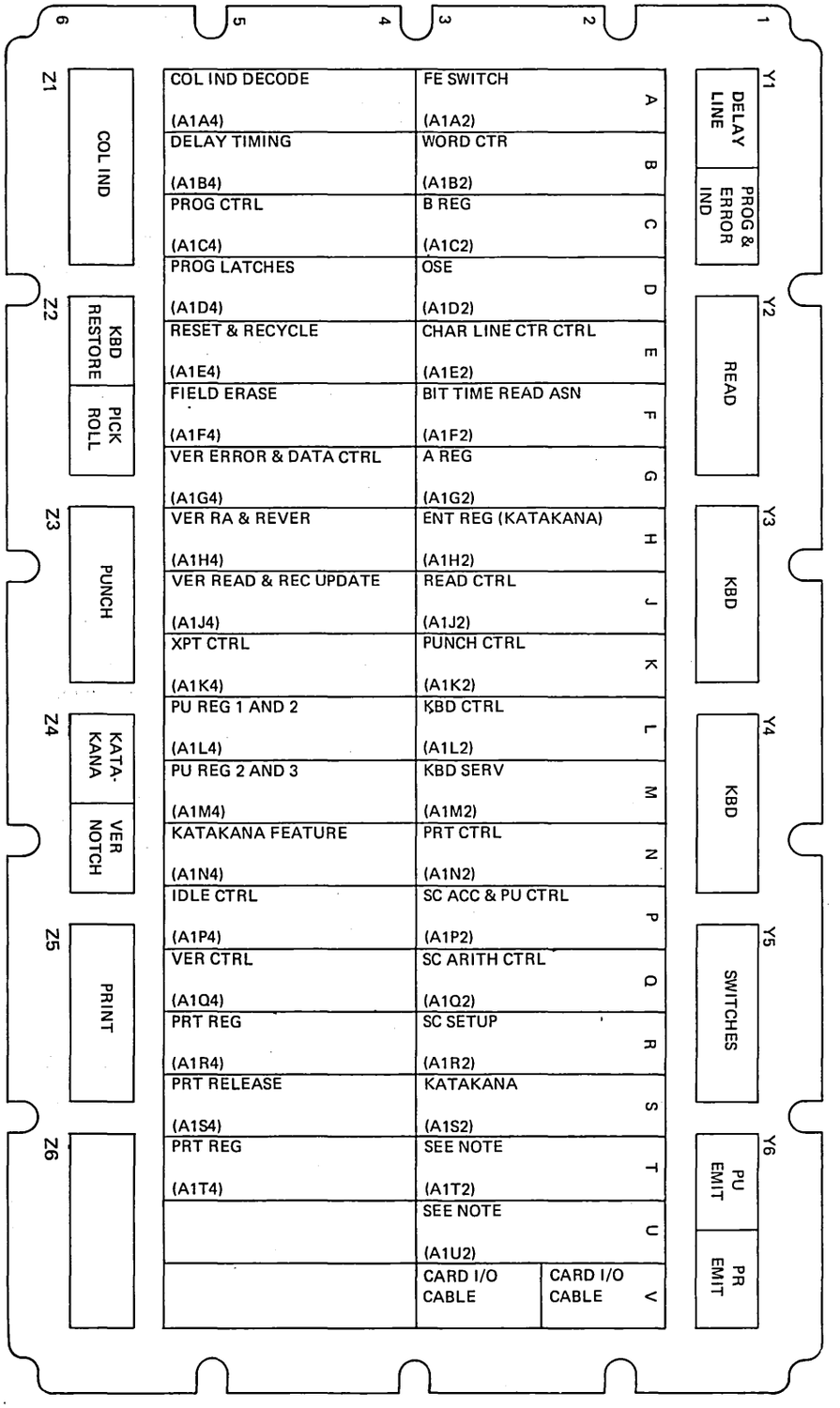
EC 825853	825979		PN 1619395
Date 11/15/74	12/20/74		

713 Data Recorder Attachment Cards

129 Data Recorder



5496 Data Recorder

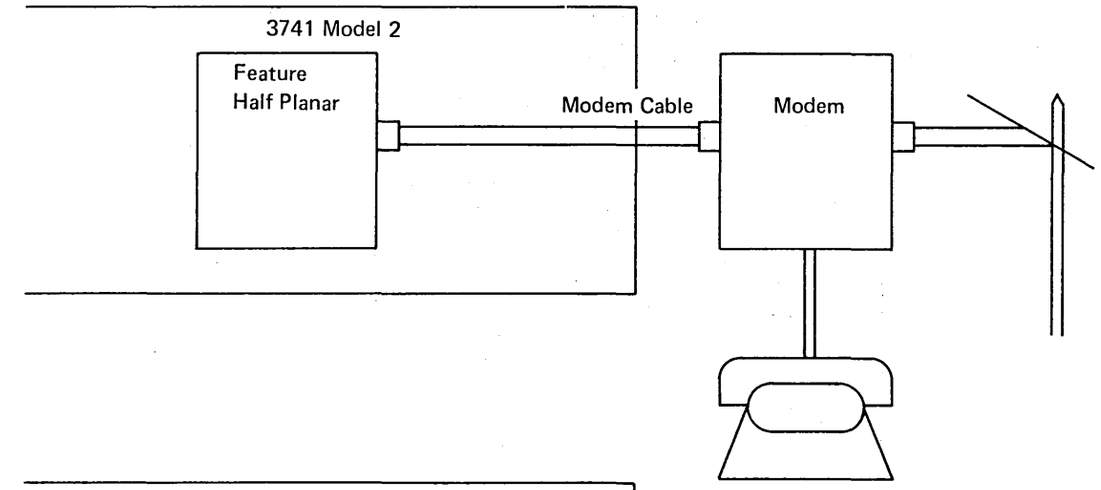


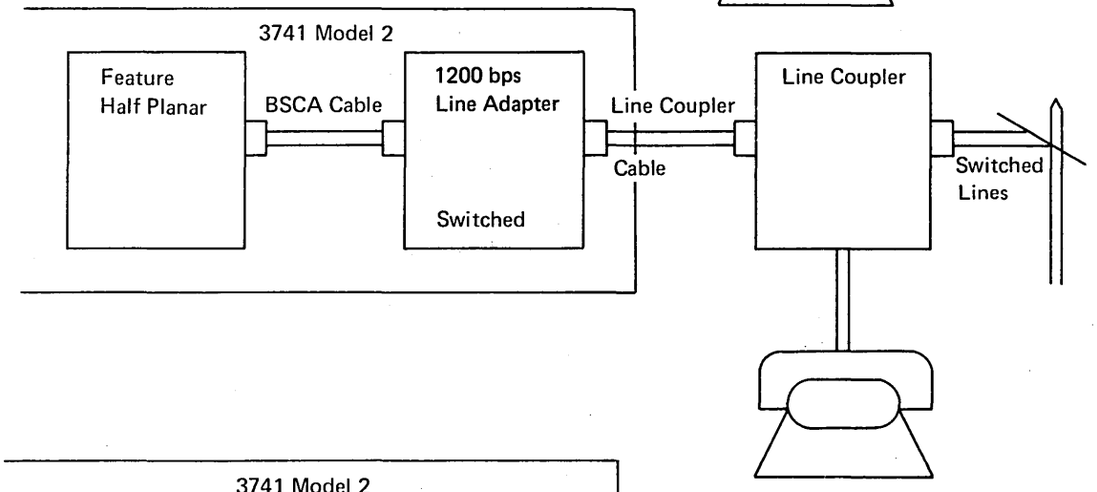
Note: This card on attachment feature only.

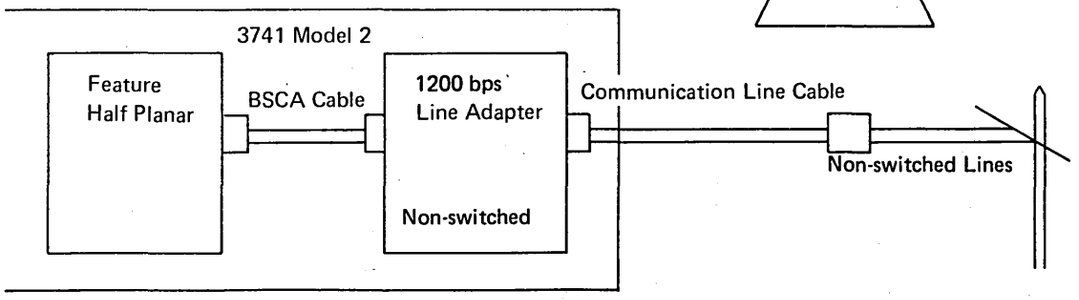
EC 825853	825979		PN 1619396
Date 11/15/74	12/20/74		

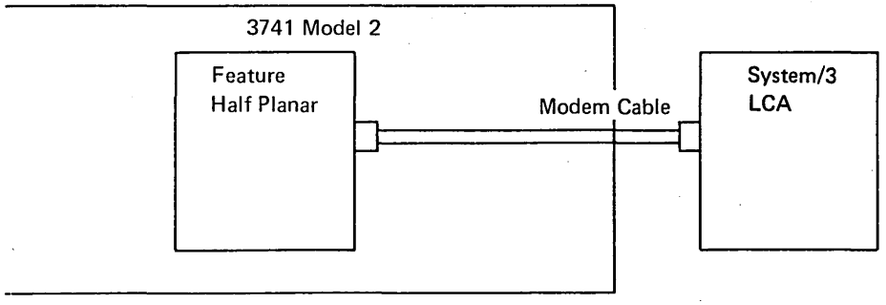
EC 825853			PN 1619397
Date 11/15/74			

714 Communications Configurations









715 Feature Board Jumpers

Feature Half Planar

3713 Printer/2nd Disk/BSCA

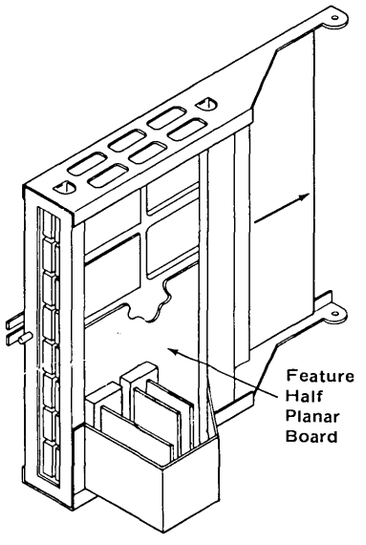
3713 Printer/2nd Disk

1	2	3	4	5	6	7
0	0	0	0	0	0	0
NO	A	YES	C	YES	E	
0	0	0	0	0	0	0
YES	B	NO	D	NO	F	
0	0	0	0	0	0	

BSCA or
3717 Printer/2nd Disk/BSCA or
3715 Printer/2nd Disk/BSCA

Note: Depending on features installed all jumper positions may not be present.

Note: Refer to 503P for description of 3715 printer jumper locations.



1. Printer (3713 only)
   No = Printer is not installed.
   Yes = Printer is installed.
   Note: Jumper position 1 is only on feature half planars made for the 3713 Printer. Jumper positions 2 through 6 are only on feature half planars made for BSCA.

2. BSCA speed select
   A = Low speed (600 bps).
   B = High speed (1200 bps) or baud select switch (WT) or modem clocking (1200, 2000, 2400 bps).

3. Keylock
   Yes = Keylock is installed.
   No = Keylock is not installed.

4. BSCA line control
   C = Connect data set to line (CDSTL). Plug for non-switched lines (except some WTC switch line modems). Plugging this position will hold the 'data terminal ready' (DTR) line off until 'data set ready' (DSR) or 'ring indicator' is on.
   D = Data terminal ready (DTR). Plug for switched lines (except some WTC modems). Plugging this position causes the 3741 to check DSR to see if it is off before it will turn DTR on.

5. Send answertone
   Yes = Data terminal must send answertone (WT only, where data terminal is required to send answertone).
   No = Data terminal does not send answertone, modem does.

6. BSCA line facility
   E = Switched lines. For time out and auto disconnect if no line bids are received and provides auto recovery from time outs in unattended operation (auto-answer).
   F = Non-switched line. Continuous line bids on transmit. Continuous wait for line bids in receive.

7. ID reader test pins.
   No jumper required.

716 IBM Modem Cross-Reference

Modem	Non-switched/ Switched	CDSTL/ DTR	Send Answer-tone	Speed Select	Sync Clock Required
Jumper	6	4	5	2	–
IBM 3976-III	Switched	DTR	No	High	Yes
IBM 3976-III	Non-switched	CDSTL	No	High	Yes
IBM 3872	Switched	DTR	No	High	No
IBM 3872	Non-switched	CDSTL	No	High	No
1200 bps line adapter	Non-switched	CDSTL	No	High	Yes
1200 bps line adapter	Switched	DTR	No	High	Yes
WTC PSN line adapter	Switched	CDSTL	Yes	High	Yes
System/3 LCA	Non-switched	CDSTL	No	High	No

Note: DTR – Data terminal ready
CDSTL – Connect data set to line

717 not used

EC 823146	826065		PN 1618970
Date 9/15/74	8/1/75		

718 Modem Cable/BSCA Cable

Socket 1-N	Line Name	Modem Cable		BSCA Cable	
		Feature Half Planar End	Modem End	Feature Half Planar End	1200 bps Line Adapter End
B13	Request to Send	D02	4	D02	D02
B12	Transmit Data	D03	2	D03	D03
B11	Receive Data	D04	3	D04	D04
B10	Clear to Send	D05	5	D05	D05
B09	Serial Clock Transmit	D06	15	–	–
B08	Serial Clock Receive	D07	17	–	–
B07	Signal Ground	D08	7	D08	D08
D12	Data Set Ready	B03	6	B03	B03
D11	Ring Indicator	B04	22	B04	B04
D10	Carrier Detect	B05	8	–	–
D08	Rate selector	B07	23	–	–
D07	Data Terminal Ready	B08	20	B08	B08
D06	SCTE	B09	24	–	–
–	Frame Ground	Frame	1	–	–
D02	+12 Vdc	B13	–	B13	B13
D04	-12 Vdc	B11	–	B11	B11
D13	Test Mode	B02	18	–	–
D09	Test Clock	B06	25	–	–

Characters Per Record	Records/Minute						
	2400 bps			2000 bps	1200 bps		
	Non-switched*		Switched**	Switched	Non-switched*		Switched**
	Transmit	Receive	Transmit or Receive	Transmit or Receive	Transmit	Receive	Transmit or Receive
20	345	175	110	105	180	170	85
40	260	175	100	90	130	115	70
60	200	175	90	80	100	85	60
80	160	115	80	70	80	75	55
100	135	115	75	65	65	65	45
120	115	115	70	60	55	55	40
128	110	100	65	55	55	55	40

* Full duplex facility or four wire switched network

** Two wire switched or non-switched half-duplex facility

Disk Data Set Label	Transmit Mode	Receive Mode	Transmit/Receive Mode			
			On Disk 1		On Disk 2	
			Transmitting	Receiving	Transmitting	Receiving
Normal Data Set Label: • Has HDR1 in positions 1 through 4 • Has valid extent and record length • Is accessible • Is not deleted • Is not a bypassed data set (B in position 41)	Data set will be transmitted.	Label will be used in receiving data	Data set will be transmitted	Not used because label identifies data set that was transmitted	Data set will be transmitted if: 1. it is the first data set (00008) 2. it is a continuation of the last data set transmitted on disk 1.	Label will be used in receiving data
Bypassed Data Set Label: • Has HDR1 in positions 1 through 4 • Is accessible • Has valid extents and record length • Is not deleted • Has a B (bypass) in position 41	Data set will not be transmitted	Label will be used in receiving data	Data set will not be transmitted	Labels beyond the last transmitted data set will be used in receiving data	Data set will not be transmitted	Label will be used in receiving data
Deleted Data Set Label or Invalid Data Set Label: • Does not have HDR1 in positions 1 through 4 • Has invalid extents or record length • Is not accessible • Is deleted	Data set will not be transmitted	Label will not be used in receiving data	Data set will not be transmitted	Label will not be used in receiving data	Data set will not be transmitted	Label will not be used in receiving data

Note: The write protect byte of a data set label is checked only for the first data set to be received on either disk. Subsequent data set labels are not checked. Therefore, caution should be used to ensure write protected data is not written over during receive operations. On early shipments of the 3741 with binary synchronous communciations, the write protect byte status of the first used label was not used. Your 3741 can be field upgraded so that the write protect byte can be used. Contact your IBM representative for more information.

719 not used
721 not used
722 not used

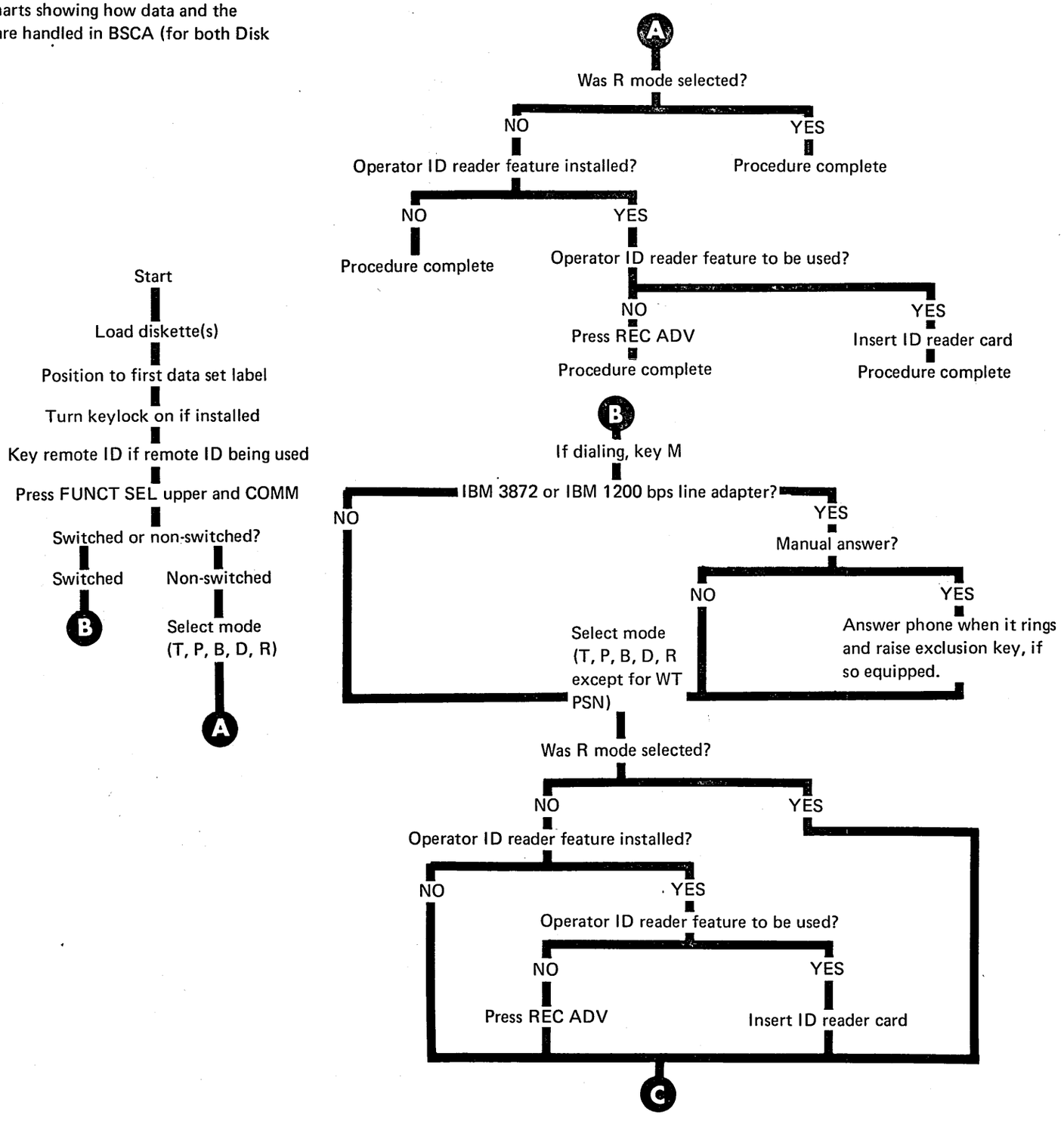
EC 823146	826065		PN 1618971
Date 9/15/74	8/1/75		

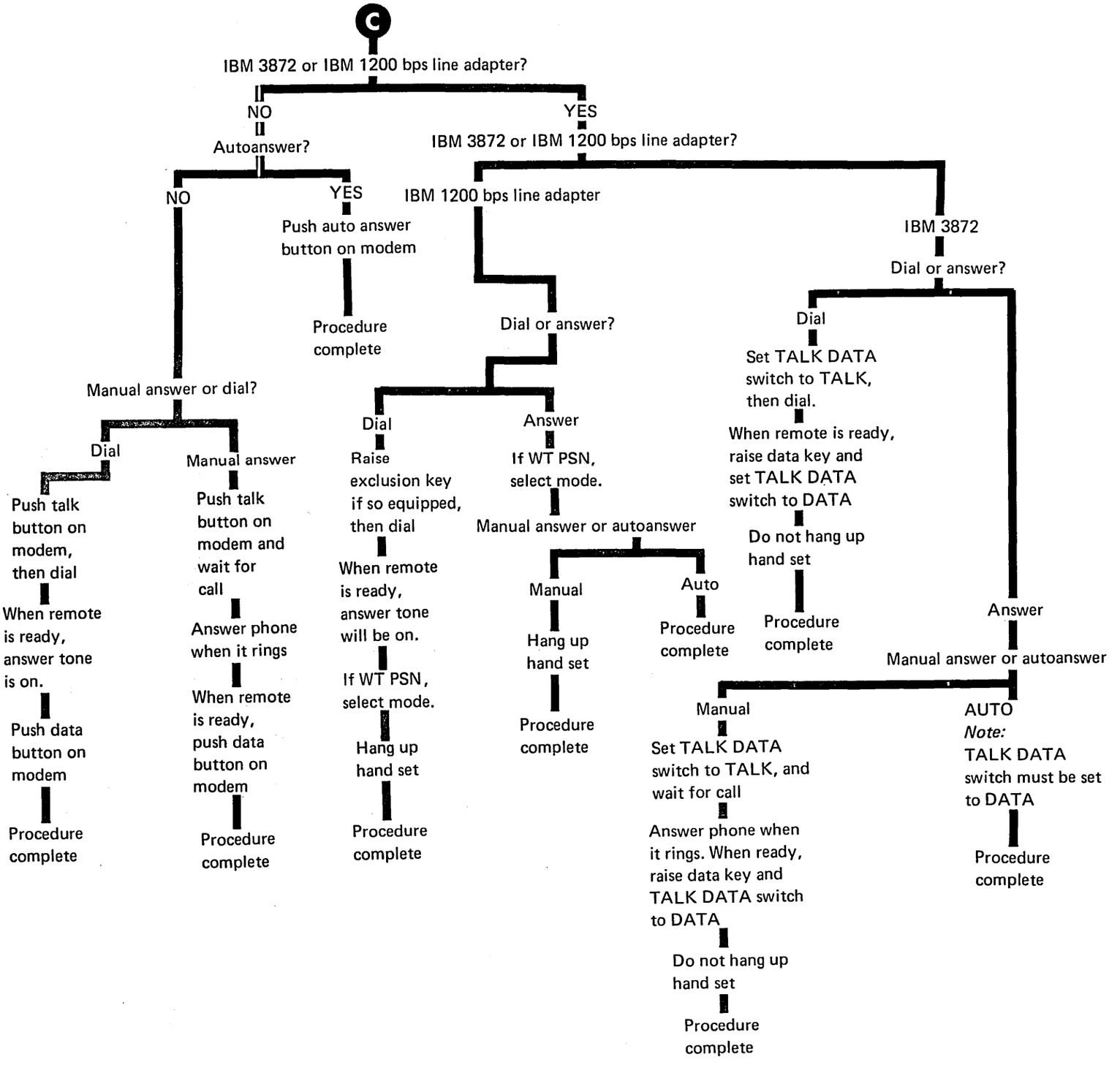
EC	823146	826065		PN 1618972
Date	9/15/74	8/1/75		

723 Operating Procedures

Operating Procedures

This section shows the actual operating procedures and also flowcharts showing how data and the data set labels are handled in BSCA (for both Disk 1 and Disk 2).

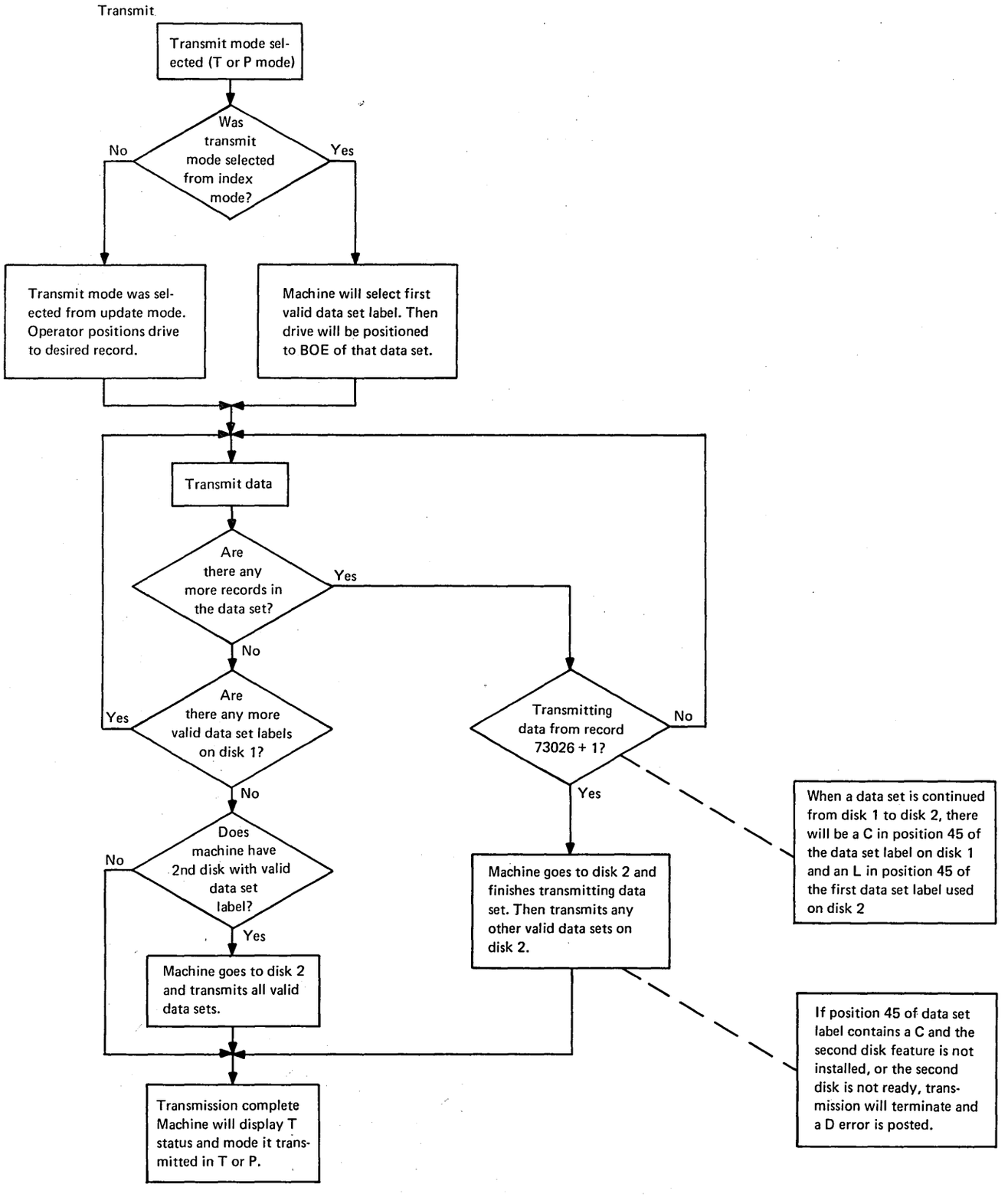


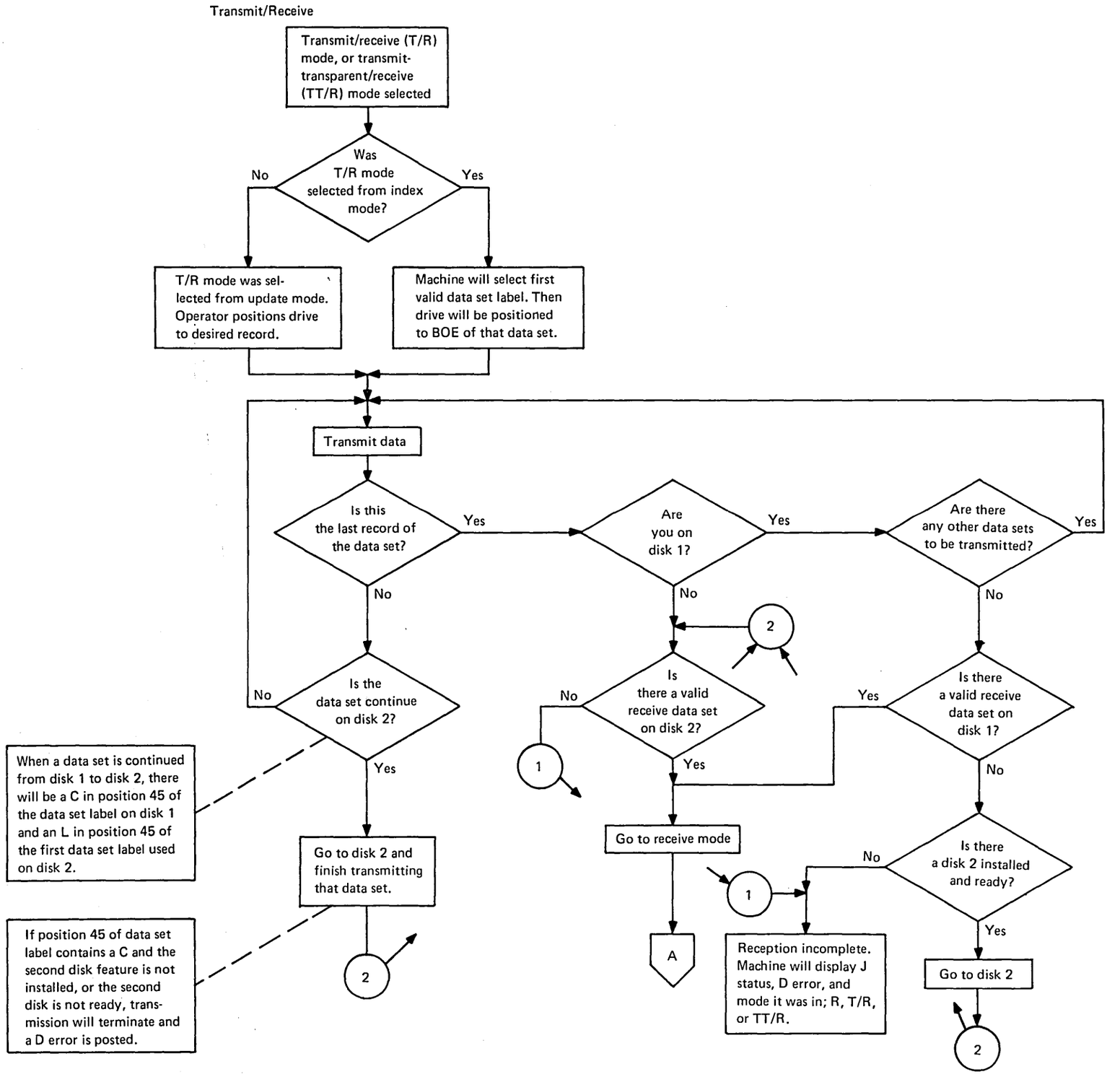


EC 823146	826065		PN 1618973
Date 9/15/74	8/1/75		

EC 823146			PN 1618974
Date 9/15/74			

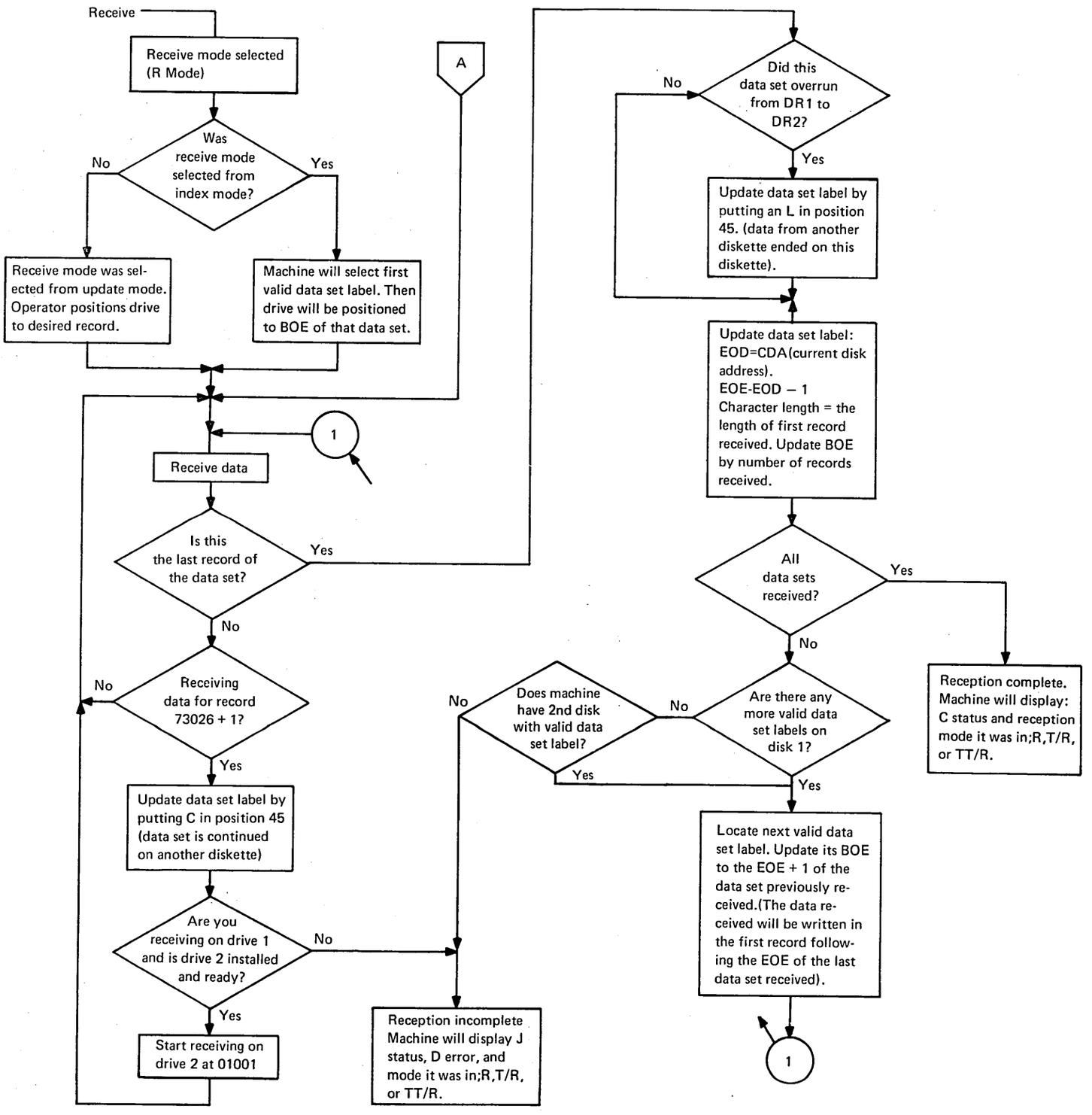
724 Communication (Functional Flowcharts)




Transmit/Receive
Transmit/receive (T/R) mode, or transmit-transparent/receive (TT/R) mode selected
Was T/R mode selected from index mode?
No
Yes
T/R mode was selected from update mode. Operator positions drive to desired record.
Machine will select first valid data set label. Then drive will be positioned to BOE of that data set.
Transmit data
Is this the last record of the data set?
Yes
No
Are you on disk 1?
Yes
No
Are there any other data sets to be transmitted?
Yes
No
2
Is the data set continue on disk 2?
No
Yes
Is there a valid receive data set on disk 2?
No
Yes
Is there a valid receive data set on disk 1?
Yes
No
1
When a data set is continued from disk 1 to disk 2, there will be a C in position 45 of the data set label on disk 1 and an L in position 45 of the first data set label used on disk 2.
Go to disk 2 and finish transmitting that data set.
Go to receive mode
Is there a disk 2 installed and ready?
No
Yes
If position 45 of data set label contains a C and the second disk feature is not installed, or the second disk is not ready, transmission will terminate and a D error is posted.
2
A
1
Reception incomplete. Machine will display J status, D error, and mode it was in; R, T/R, or TT/R.
Go to disk 2
2

EC 823146			PN 1618976
Date 9/15/74			

725 Communication (Functional Flowchart)



726 Machine Characteristics (Service Hints)

Be aware that the machine characteristics described below may cause problems. You can either circumvent them with changes in the customer's routine, or if that's not satisfactory, field bills of material are available to correct the conditions.

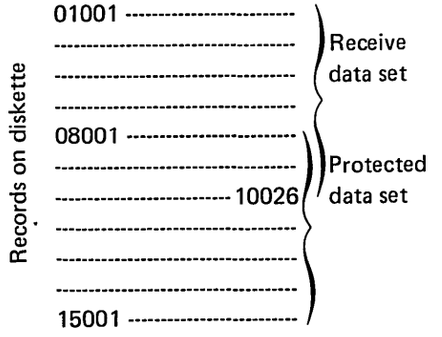
Machine characteristics:

- In receive mode, if a data set ends exactly at 73026 and a null record is received, a D error is displayed even though all data is received correctly.
- Invalid ACK, after a 3-second time-out, does not result in resending the previous record.
- If communications starts on a data set, a redial (after a remote abort) will proceed from one record beyond the original starting position. This is intermittent and one record may be lost.
- If receive mode detects a read index error, the error is displayed and an EOT is sent even though no more data is sent.
- T/R mode. If the last data set transmitted is file-protected, then all receive data is file-protected and will not be written on the diskette even though it appears to function normally.
- In transmit mode, if an A error or a read index error occurs, the null record to end the last data set is not transmitted, thus giving the remote end the impression that not all data was transmitted in the last data set.
- Due to file (write) protect, it is possible for the 3741 to give an indication that it has written data to disk when in fact nothing has changed.

  The following machine characteristics cause problems only in conjunction with improper operating procedures.

- If receive mode overflows Disk 2, no C will be put in position 45 (multivolume indicator) of the data set label.
- During any receive mode, the 3741 can write over protected data. This will occur if the extents for the receive data set overlaps a protected data set. For example:

	BOE	EOE
(Receive data set)	01001	10026
(Protected data set)	08001	15026



- Clear-to-send and echo-clamp delays of less than 200 ms and 130 ms, respectively, might cause echo problems.

EC 823146	826065		PN 1618978
Date 9/15/74	8/1/75		

727 Facilities

The 3741 is designed to operate satisfactorily at 600, 1200, 2000, or 2400 bps.

Modems being used must be end-to-end compatible, running at the same speed with the correct options. The modem options generally required are:

- EIA voltage interface.
- Half duplex.
- Carrier controlled by request to send.
- Without new sync.
- Internal clocking (on the modem) must be specified if sync clock is *not* used in the 3741.

The IBM 3872 and the IBM 1200 bps Line Adapter features are *not* end-to-end compatible.

When the CBS Data Access Arrangement (DAA) using the 1001A coupler or equivalent is used with the switched 1200 bps line adapter feature, it must be ordered:

- With series 5 or later connected to Type II local loop.
- With DAA controlling the line (you must raise the exclusion key to hear the dial tone).
- With ringer connected on the line side of the exclusion key.
- With DAA supplying its own power so that the hook switch transfers when receiver is lifted from, or set on, the cradle.
- With a handset type 502A, or equivalent.

For more information see *Service Aids—3741 with 1200 bps Line Adapter/CBS Coupler* (page 8-1).

728 Feature Mix

The synchronous clock must *not* be installed in the 3741 if attached to System/3 LCA.

The synchronous clock *must not* be installed when using 2000 or 2400 bps modems.

The synchronous clock *must* be installed if 1200 bps line adapter is installed.

729 System/3 LCA

Pin plugging on the System/3 LCA to the 3741 or 3747:

5410 gate B, card W5A4 jumpers:

New sync	B
Rate select	C
DTR	D
SCTE	B

The above data is from page HE660 in the System/3 MAPs.

Page A6009 lists 5410 BSCA tie-downs. 'Last board on channel' or 'not last board on channel' *must* be tied down. Other tie-downs listed *must not* be tied down for LCA.

The *3741 MLM* specifies a CPU with RFT capability. The System/3 with diagnostic 80A provides this capability.

The synchronous clock should not be installed in a 3741 to be used with System/3 LCA.

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EC 823146	826065		PN 1618980
Date 9/15/74	8/1/75		

730 Common Communications Error Codes and Causes

See *Symptom Index* for error codes not covered here.

Error Code	Description	Cause
C	Line Check	No activity on communication line (the 3741 has not decoded character sync) for 20 seconds. On initial linkup, it can occur: 1. If both ends are bidding (sending ENQ) or waiting for a line bid caused by improper use of the M key. (See 731). 2. If terminal ID and remote ID compare functions are being used and the IDs do not compare. 3. If there is a modem or communication line problem that prevents end-to-end communication. Line checks occurring during data transfer can be caused by: 1. Modem or communication line problems. 2. Remote end programming or malfunction that prevents a normal termination (EOT or Disconnect, DLE EOT). *Note:* Error recovery problems on early 3741 base BSCA machines caused an abnormal number of calls to end in a line check error. This problem was corrected with ECA 14 and/or ECA 22.
D	Disk Full	In receive mode: 1. Not enough physical space to write all records remote end is attempting to send. 2. There are not enough valid labels to receive all the data sets the remote end is attempting to send. In transmit or transmit/receive mode: 1. Continued data set was indicated on disk 1 but disk 2 was not available or there were no valid labels on disk 2. 2. Continued data set was indicated on disk 2.
I	Data Set Ready Has Dropped	The 'data set ready' interface line (from the modem) has dropped unexpectedly (while 'data terminal ready' was still on). This can be caused by: 1. The remote end dropping the connection on a switched line unexpectedly. 2. Modem powering off or malfunction.
Q	Message Aborted	The transmitting 3741 has received four consecutive negative acknowledgements (NAKs) to the same record. The receiving station has experienced CRC checks due to line or modem problems or receive malfunction in calculating CRCs.
R	Remote Abort	The remote device has terminated communications prematurely by sending an EOT or disconnect (DLE EOT) prior to sending ETX (end of text). Call remote end to determine what error caused it to terminate communications.
T	Transparency Error	Hex data was detected in the record to be transmitted in T, B, J, or K mode. The characters SOH ('01'), STX ('02'), NAK ('3D'), ETB ('26'), ETX ('03'), SYN ('32'), IUS ('1F'), DLE ('10'), ENQ ('2D'), IRS ('1E'), IFS ('1C'), or EOT ('37') cannot be sent in T, B, J, or K mode. They could be sent in P or D mode. Often a transparency check occurs when data set extents overlap or a data set is transmitted which is not intended to be transmitted.
U	Received Data Block	The 3741 received a data block starting with SOH or STX when in transmit mode. This error can occur if the receiving station has an error before transmission begins and attempts to send status to the transmitting station, or both stations are in transmit mode.

730 (Continued)

Error Code	Description	Cause
W	Wrong Length	In receive mode: 1. Two consecutive records of different length were received. 2. First record received was a different length than record length of data set (if receive began in update mode). In EBSCA: 1. Length of first received record is not equal to the number of greater than signs (>) in the receive data and insert constants program. 2. In transmit mode the continuation of a data set on disk 2 has a different record length than the data set on disk 1.
V	Received Line Bid	The remote end sent a line bid (ENQ) after the 3741 has posted complete or incomplete status.
X	Negative Bid Response	The remote end responded NAK or disconnect (DLE EOT) to a line bid. This can occur if the 3741 has a disk error, attempts to send a bid for status, and receives a NAK from the remote device. The disk error is the significant error in this case.

733-739 not used

731 3741 — Use of the M Key

When the 3741 is set up to operate on switched lines, the M key determines whether or not the 3741 will send the initial line bid (ENQ). The M key has no function on the non-switched line.

According to convention, the station placing the call (calling station) should bid the line (ENQ). If the 3741 is the station placing the call, the operator setup should be:

Press FUNC SEL upper
COMM
M
T, P, B, D or R

The M key tells the 3741 to bid the line (ENQ), independent of the mode selected or the following key strikes. If a CPU is the remote end receiving the call, it should be programmed to look for a line bid (receive ENQ).

Also, according to convention, the station receiving the call (called station) should wait for a line bid (receive ENQ). If the 3741 is the station receiving the call, the operator setup should be:

Press FUNC SEL upper
COMM
T, P, B, D or R

The absence of the M key indicates to the 3741 that it should wait for a line bid for 20 seconds. If the CPU is the remote station placing the call, it should be programmed to send the initial line bid (ENQ).

732 Service Aids for Modem and Line Problems

Line Bids (Sending and Receiving ENQs)

Proper use of the M key can be verified by:

1. Calling the bidding station from a convenient telephone. After the answertone, you should hear the line bids (on a one- or three-second interval).
2. Calling the station that is to receive the line bid. After the answertone, there should be a 20-second period of silence on the line. (After 20 seconds, the station may bid the line to send a status message.)
3. If the station that receives the line bid turns on request to send (within the 20 seconds), it indicates that it has received the line bid and has responded.

Use the following to diagnose modem and communication line problems:

1. CBS coupler service aids (page 8-38).
2. 1200 bps line adapter transmit level and receive level check (page 8-36.5).
3. TDAT is modem eliminator (TDAT test procedures 8-26.10).
4. Expanded communications feature diagnostic aids (8-33).
5. Probe transmit data and receive data interface lines to verify that data is being transmitted and received (764).
6. Attempt to communicate with another system with each device to prove the communication capability of each.
7. When attempting to diagnose linkup problems on switched lines, changing jumper 6 to non-switched will eliminate the 20-second time-out and disconnect (for diagnosis only). See page 16-4 for information on jumper 6.

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Date 9/15/74	8/1/75		

740 Communication Throughput Rates for the 3741 Model 2 with the Expanded Communications Features

Characters Per Record	Records Per Block	Records Per Minute									
		2400 bps				2000 bps		1200 bps			
		Non-switched*		Switched**		Switched		Non-switched*		Switched**	
		Transmit	Receive	Transmit	Receive	Transmit	Receive	Transmit	Receive	Transmit	Receive
20	24	310	160	299	151	321	157	321	163	321	157
40	12	310	160	310	154	287	166	200	166	182	166
60	8	264	163	224	163	192	163	134	134	122	122
80	6	199	160	169	160	145	145	101	101	92	92
100	5	160	160	137	137	117	117	81	81	74	74
120	4	133	133	113	113	97	97	67	67	61	61
128	3	123	123	100	100	87	87	62	62	56	56

* Full duplex facility or four-wire switched network

** Non-switched half-duplex facility or two-wire switched

741 Throughput Considerations

720 and **740** show typical throughput rates for the 3741 Model 2 with and without the expanded communications feature or with the expanded communications/multipoint feature, respectively. The figures show throughput rates in terms of the number of records per minute processed as a function of record size, line facility, and modem speed. The rates listed are for information only.

The assumptions made in determining the throughput rates are:

- Setup and line initialization sequences are not included in determining the throughput rates.
- Non-transparent data is transmitted or received.
- Disk sequence is 01.
- No deleted records or disk errors are encountered. (Excessive number of retries on disk operations, as indicated by a large number of two-second time-outs, can degrade throughput.)
- Propagation delay and CPU delay are negligible.
- Speed of remote device is equal to or faster than the 3741.
- For two-wire lines, the 1200, 2000 and 2400 bps modems have 200, 175, and 180 millisecond clear-to-send delays, respectively.
- For four-wire lines, the 1200 and 2400 bps modems have 25- and 85- millisecond clear-to-send delays, respectively.
- For **720** a transmit selected records program was not used.
- No retransmissions. (Modem and line problems can cause a large number of retransmissions as indicated by a large number of three-second time-outs.)

750 Voltage Checkout Procedures

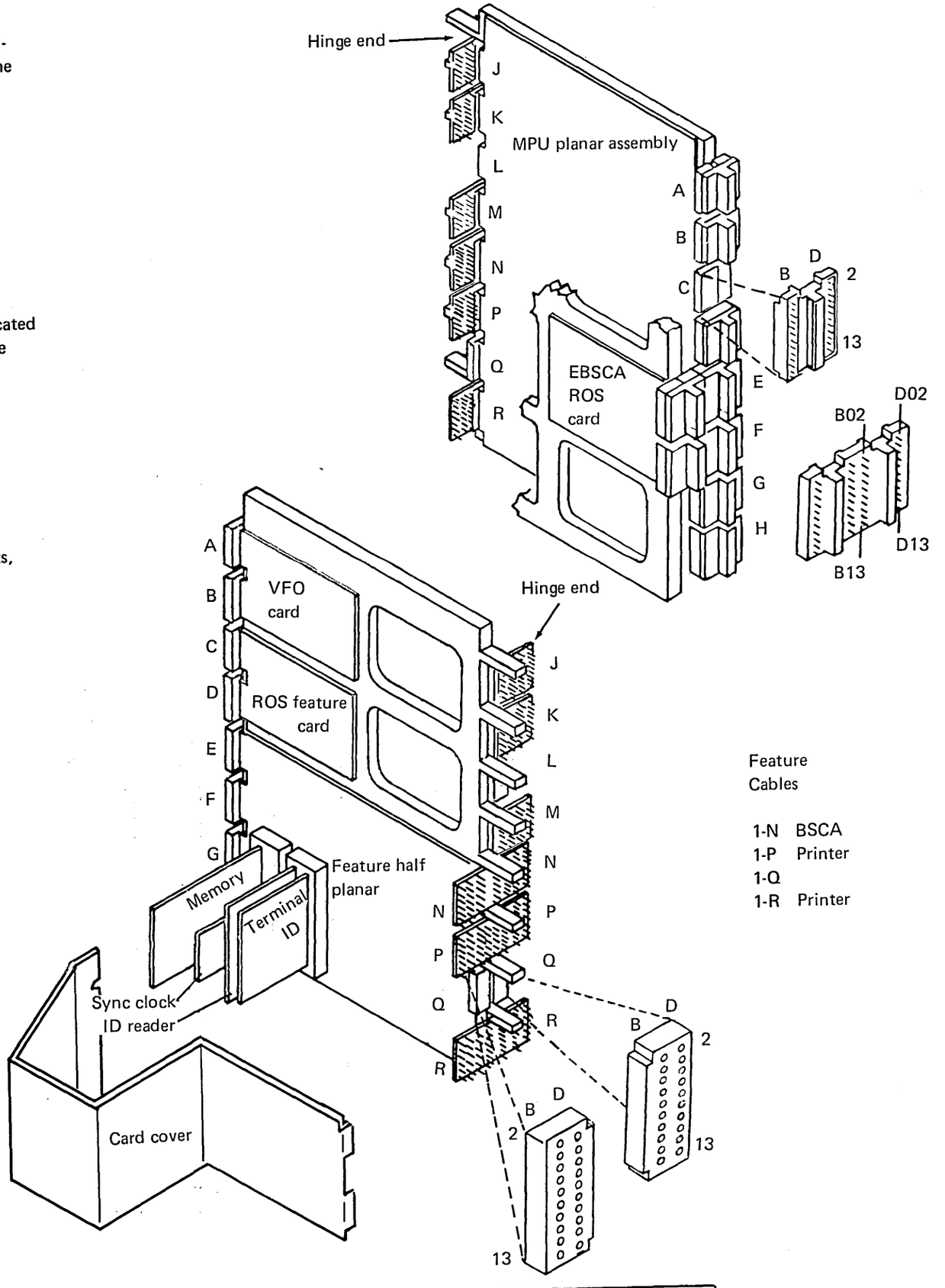
Measures the following dc voltages, at the indicated MPU planar pins, with reference to frame ground:

Vdc	Pin	Limits
+5.0	F-D09	4.7 to 5.5
+8.5	F-B07	8.0 to 9.4
Ground	B-B07	0
-5.0	F-B08	4.6 to 5.4
-5.0	F-B06	4.6 to 5.4

– Measure the following dc voltages, at indicated BSCA board pins, with references to frame ground:

Vdc	Pin	Limits
+12.0	1-N-D02	11.0 to 13.2
-12.0	1-N-D04	11.0 to 13.2
Ground	1-N-B07	0

– If all voltages are present and within limits, voltage check is OK.
– Return to MAP.



742-749 not used

EC 823146	826065		PN 1618983
9/15/74	8/1/75		

EC 823146			PN 1618992
Date 9/15/74			

755 Expanded Communications Modes

BSCA Mode	Col 37	Col 38	Status Indicators Col 39				Col 39*
Communications		C					
Transmit		T	T	I			B
Transmit-transparent		P	T	I			B
Receive	P	R			C	J	
Transmit-receive	P	B	T	I	C	J	B
Transmit-transparent/receive	P	D	T	I	C	J	B
Transmit buffered		J	T	I			B
Transmit buffered/receive	P	K	T	I	C	J	B
Inquiry		I	T	I	C	J	B
Request for test (RFT)	P	%	T	I	C	J	B
E test mode		W		I	C		

Print unattended Mode

Transmission complete

Transmission incomplete

Reception complete

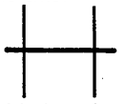
Reception incomplete

*Read ID

*Read ID card when column 39 contains B

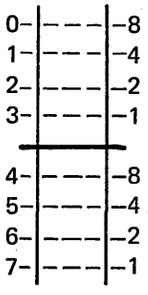
757 Expanded Communications Modes, Hexadecimal

When hex data is keyed or displayed, not all of the data represents display characters such as an A B C . . . or 0 1 2 3 . . . When the hex data keyed is not a displayable character, a hexadecimal display is provided that represents the 8-bit code for the data. The basic display (no bits on) looks like this:



Other lines are added to the display for each bit that is on in the EBCDIC code.

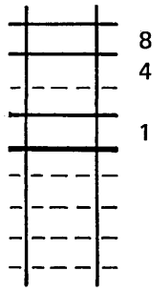
Bit Position — Hex Value of Bit Position



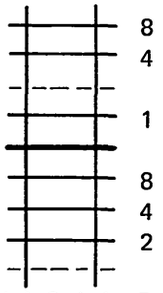
Add these values together to get the first hex digit. Only add those values together for the lines displayed.

Add these values together to get the second hex digit. Only add those values together for the lines displayed.

Example: Assume the display looks like this:

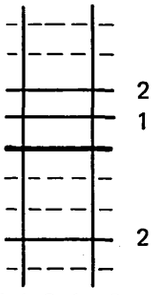


The first hex digit is 8+4+1 = D and the second hex digit is a 0. The hexadecimal value is hex D0. Assume another display looks like this:

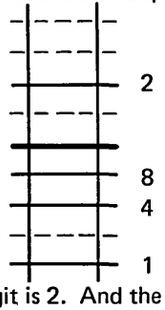


The first hex digit is 8+4+1 = D and the second hex digit is 8+4+2 = E. The hexadecimal value is hex DE.

Example: Assume the display looks like this:



The first hex digit is 2+1 = 3 and the second hex digit is a 2. The hexadecimal value is hex 32 (SYN). Assume another display looks like this:



The first hex digit is 2. And the second hex digit is 8+4+1 = D. The hexadecimal value is hex 2D (ENQ).

751 not used
752 not used
753 not used
754 not used
756 not used

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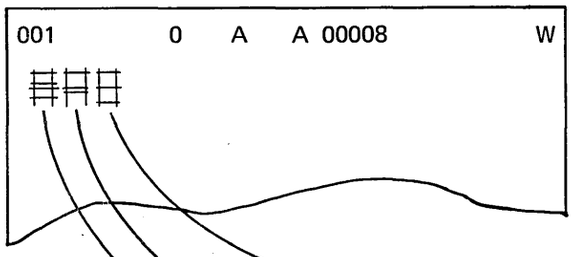
Date 9/15/74	8/1/75		

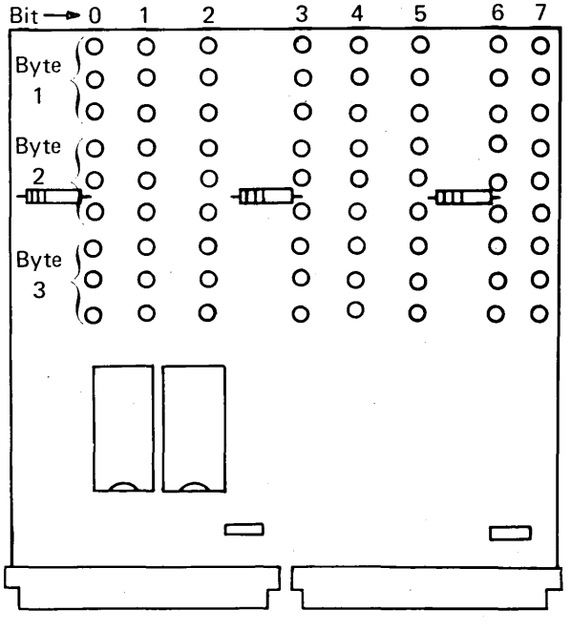
758 Terminal ID and Feature Half Planar Sockets Y and Z

Display (Refer to **757** to decode the hex characters.)

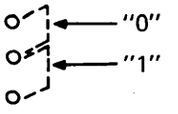


ID Character Jumper Placement

Row	Hex	0	1	2	3	4	5	6	7		Hex	0	1	2	3	4	5	6	7
a	81									n	95								
b	82									o	96								
c	83									p	97								
d	84									q	98								
e	85									r	99								
f	86									s	A2								
g	87									t	A3								
h	88									u	A4								
i	89									v	A5								
j	91									w	A6								
k	92									x	A7								
l	93									y	A8								
m	94									z	A9								

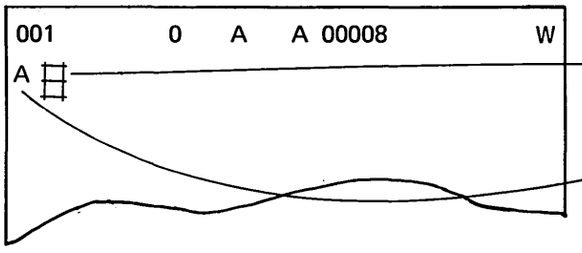


Each Bit Position

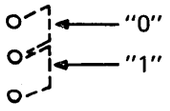


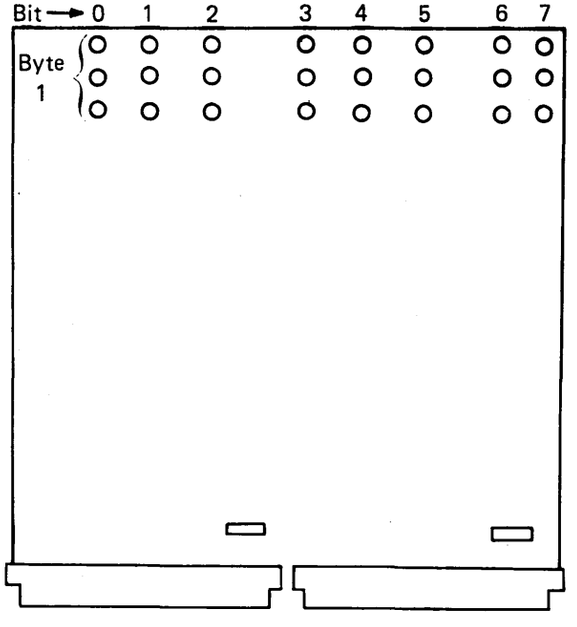
759 Multipoint Address and Feature Half Planar Sockets Y and Z

Display (Refer to **757** to decode the hex characters.)



Each Bit Position





Multipoint Addressing

For a given polling character, the corresponding select character is defined.

Poll Char	Poll Hex	Sel Hex	Binary	Poll Char	Poll Hex	Sel Hex	Binary
	C0	80	1100 0000		E0	A0	1110 0000
A	C1	81	1100 0001		E1	A1	1110 0001
B	C2	82	1100 0010	S	E2	A2	1110 0010
C	C3	83	1100 0011	T	E3	A3	1110 0011
D	C4	84	1100 0100	U	E4	A4	1110 0100
E	C5	85	1100 0101	V	E5	A5	1110 0101
F	C6	86	1100 0110	W	E6	A6	1110 0110
G	C7	87	1100 0111	X	E7	A7	1110 0111
H	C8	88	1100 1000	Y	E8	A8	1110 1000
I	C9	89	1100 1001	Z	E9	A9	1110 1001
	CA	8A	1100 1010		EA	AA	1110 1010
	CB	8B	1100 1011		EB	AB	1110 1011
	CC	8C	1100 1100		EC	AC	1110 1100
	CD	8D	1100 1101		ED	AD	1110 1101
	CE	8E	1100 1110		EE	AE	1110 1110
	CF	8F	1100 1111		EF	AF	1110 1111
	D0	90	1101 0000	0	F0	B0	1111 0000
J	D1	91	1101 0001	1	F1	B1	1111 0001
K	D2	92	1101 0010	2	F2	B2	1111 0010
L	D3	93	1101 0011	3	F3	B3	1111 0011
M	D4	94	1101 0100	4	F4	B4	1111 0100
N	D5	95	1101 0101	5	F5	B5	1111 0101
O	D6	96	1101 0110	6	F6	B6	1111 0110
P	D7	97	1101 0111	7	F7	B7	1111 0111
Q	D8	98	1101 1000	8	F8	B8	1111 1000
R	D9	99	1101 1001	9	F9	B9	1111 1001
	DA	9A	1101 1010		FA	BA	1111 1010
	DB	9B	1101 1011		FB	BB	1111 1011
	DC	9C	1101 1100		FC	BC	1111 1100
	DD	9D	1101 1101		FD	BD	1111 1101
	DE	9E	1101 1110		FE	BE	1111 1110
	DF	9F	1101 1111		FF	BF	1111 1111

Binary value jumpered on card
Select character in HEX
Poll character in HEX
Poll character

EC 823146			PN 1618995
Date 9/15/74			

EC 823146			PN 1618996
Date 9/15/74			

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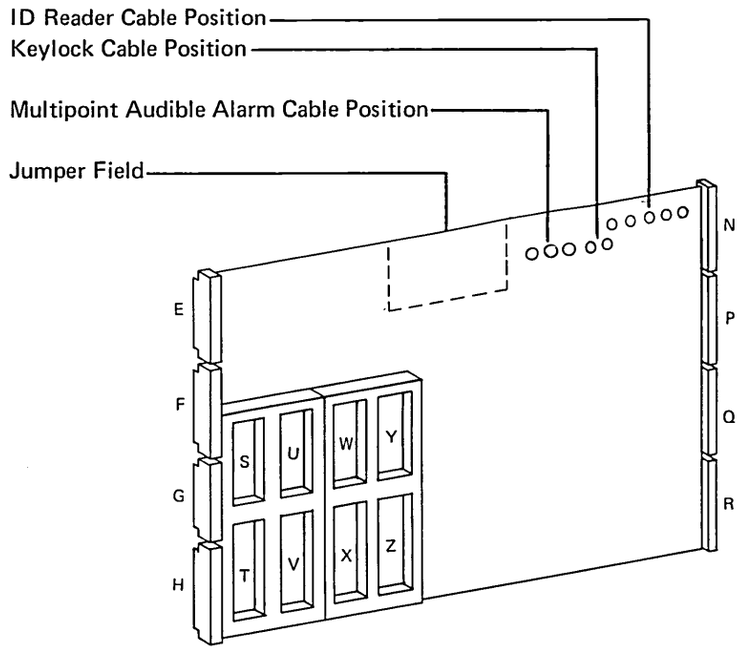
760 Feature Half Planar Socket and Card Locations

Socket

1-N — Modem cable
1-P — Printer signal cable (from printer)
1-Q — Cross connector to MPU planar
1-R — Printer signal cable (to printer)
1-E — Cross connector to MPU planar
1-F — Cross connector to MPU planar
1-G — Cross connector to MPU planar (memory)
1-H — Cross connector to MPU planar (memory)
1-S — Card socket — memory card
1-T — Card socket — memory card
1-U — Test socket

EBSCA Feature Cards

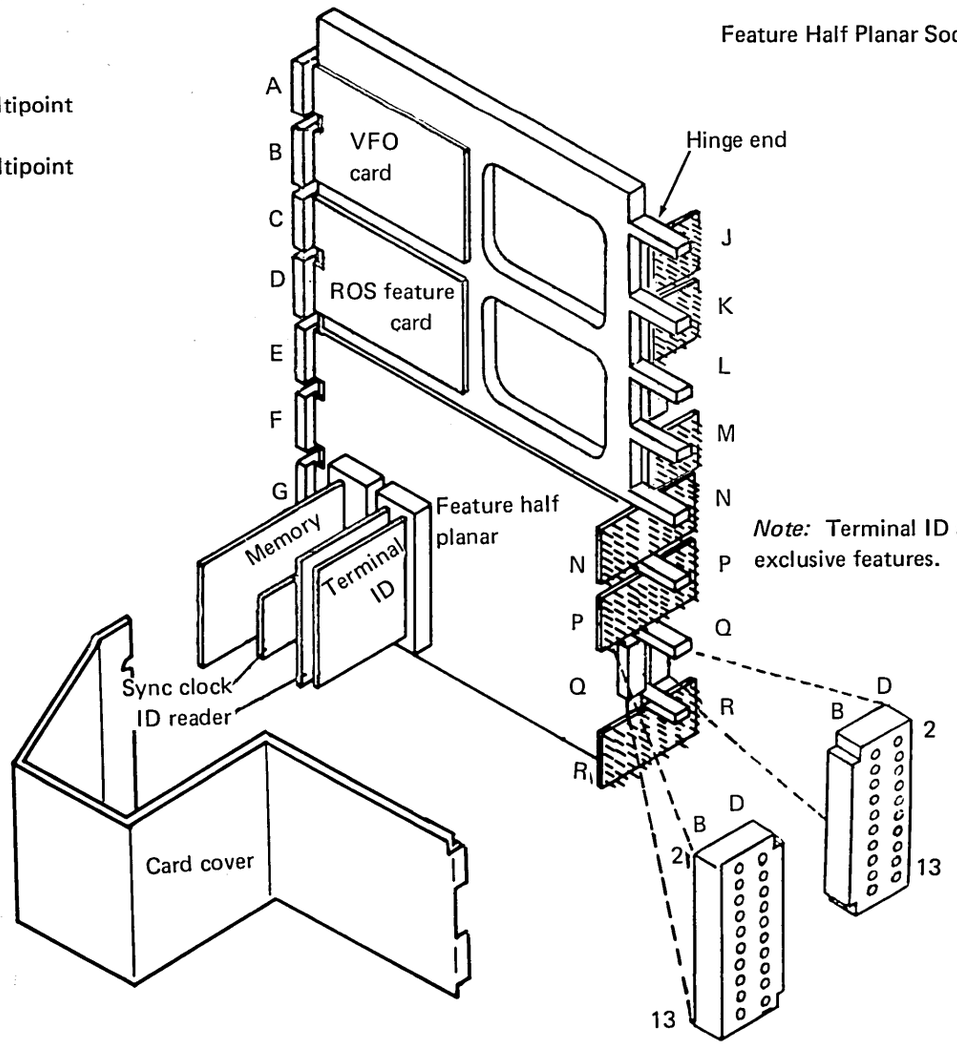
1-V — Card socket — sync clock card
1-W — Card socket — ID reader card
1-X — Card socket — ID reader card
1-Y — Card socket — terminal ID or multipoint card
1-Z — Card socket — terminal ID or multipoint card



Feature Half Planar Socket Location

EBSCA Feature Cards

Sync clock
ID reader
Terminal ID or
Multipoint



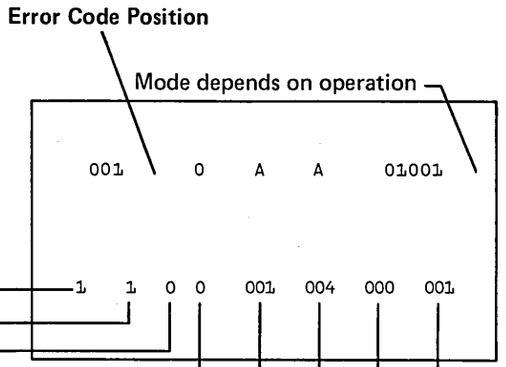
Note: Terminal ID and multipoint are mutually exclusive features.

EC 823146	826065		PN 1618997
Date 9/15/74	8/1/75		

EC 823146	826065		PN 1619001
9/15/74	8/1/75		

762 EBSCA Error Logout

When in R, T, P, B, D, J, K, %, or I mode after pressing FUNCT SEL upper and S or when in W mode in tests 1, 2, 3, or 4, the bottom line on the display shows the following:



Position		Meaning	
*	1	Data terminal ready.	1
*	4	Data set ready.	1
*	7	Request to send.	0
*	10	***Clear to send.	0
**14	- 16	CRC checks in receive.	001
**19	- 21	NAKs received in transmit.	004
**24	- 26	Two-second time-outs.	000
**29	- 31	Three-second time-outs.	001

**Note:* 1 indicates on; 0 indicates off.

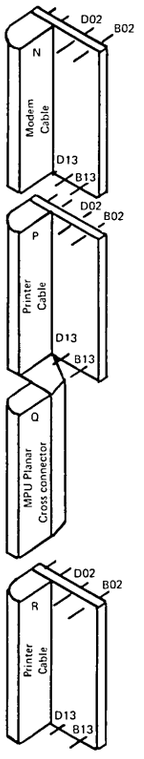
***Note:* Three position decimal counts.

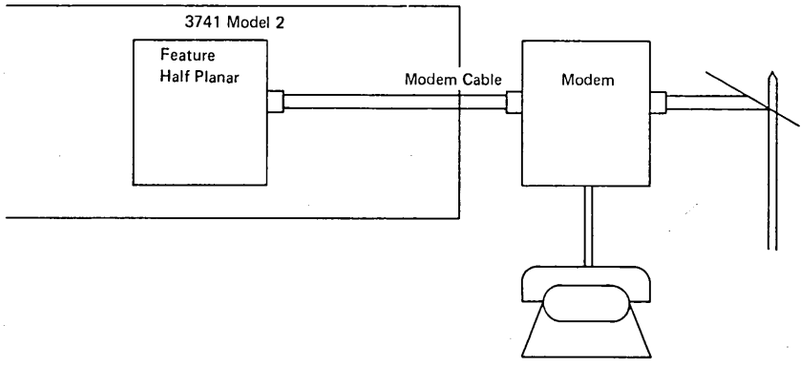
****Note:* When short records are transmitted in blocked (J or K) mode, 'clear to send' may not be logged on or may be on only a short time. This is because the controller is busy reading and buffering records. The actual operation of 'clear to send' can be checked at the modem cable interface (1-N-B10).

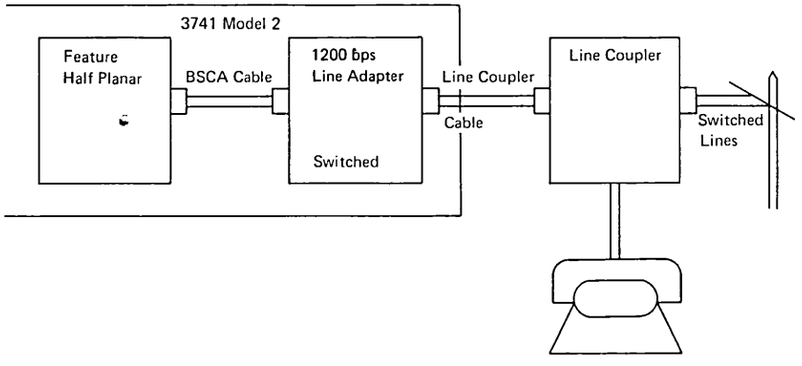
764 Modem Cable/BSCA Cable

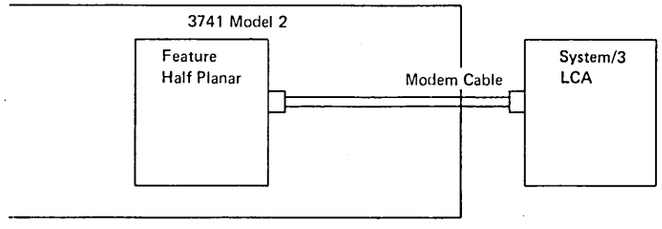
Socket 1-N	Line Name	Modem Cable		BSCA Cable	
		Half Planar End	Modem End	Half Planar End	1200 bps Line Adapter End
B13	Request to Send	D02	4	D02	D02
B12	Transmit Data	D03	2	D03	D03
B11	Receive Data	D04	3	D04	D04
B10	Clear to Send	D05	5	D05	D05
B09	Serial Clock Transmit	D06	15	–	–
B08	Serial Clock Receive	D07	17	–	–
B07	Signal Ground	D08	7	D08	D08
D12	Data Set Ready	B03	6	B03	B03
D11	Ring Indicator	B04	22	B04	B04
D10	Carrier Detect	B05	8	–	–
D08	Rate selector	B07	23	–	–
D07	Data Terminal Ready	B08	20	B08	B08
D06	SCTE	B09	24	–	–
–	Frame Ground	Frame	1	–	–
D02	+12 Vdc	B13	–	B13	B13
D04	-12 Vdc	B11	–	B11	B11
D13	Test Mode	B02	18	–	–
D09	Test Clock	B06	25	–	–

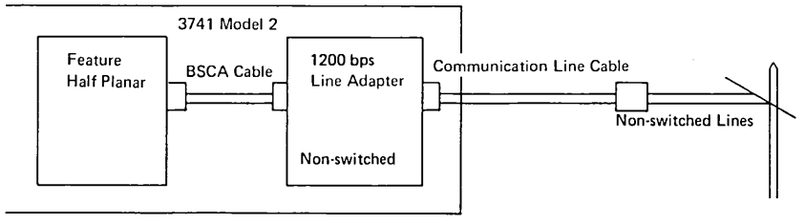
B Cable Connectors









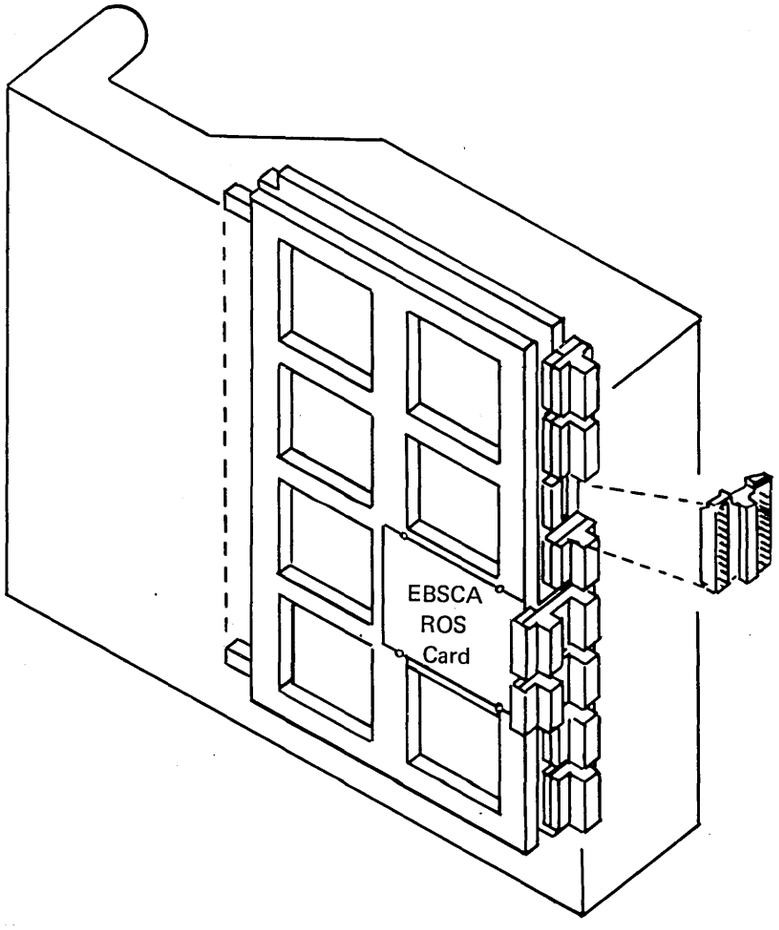


763 not used

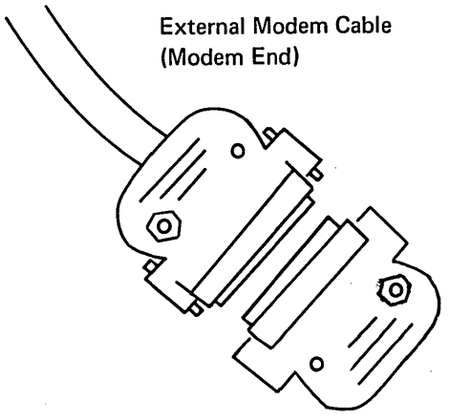
EC 823146	826065		PN 1619004
9/15/74	8/1/75		

EC 823146	826065		PN 1619005
9/15/74	8/1/75		

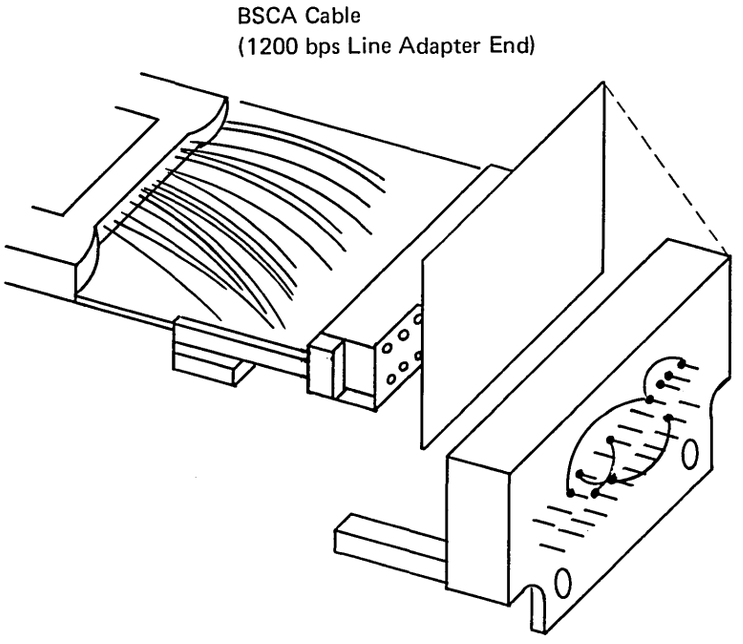
765 EBSCA ROS Card Location



766 Wrap Adapter



Modem Cable
Wrap Adapter (PN 2456702)



BSCA Cable
Wrap Adapter (PN 7365241)

Modem Cable Wrap Adapter (External Modem)

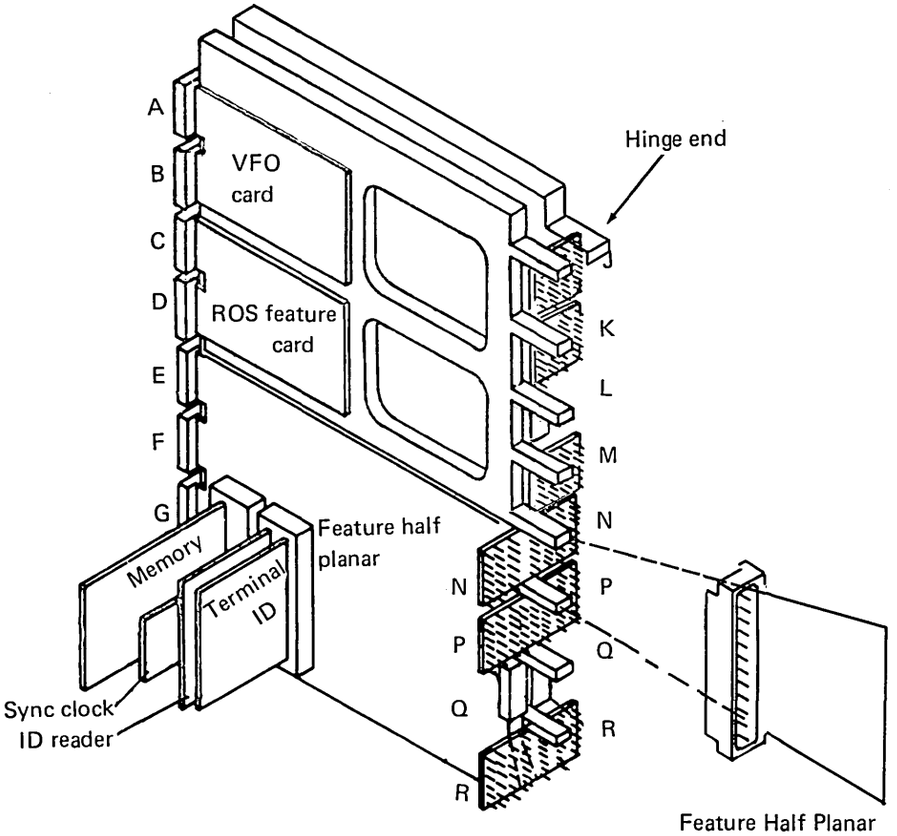
From	Pin	To	Pin
Transmit data	2	Received data	3
Request to send	4	Clear to send	5
Data terminal ready	20	Data set ready	6
Test clock	25	Serial clock transmit	15
Test clock	25	Serial clock receive	17

BSCA Cable Wrap Adapter (1200 bps Line Adapter)

From	Pin	To	Pin
Transmit data	D03	Receive data	D04
Request to send	D02	Clear to send	D05
Data terminal ready	B08	Data set ready	B03

Feature Half Planar Wrap Adapter

From	Pin	To	Pin
Transmit data	D03	Receive data	D04
Request to send	D02	Clear to send	D05
Data terminal ready	B08	Data set ready	B03
Test clock	B06	Serial clock transmit	D06
Test clock	B06	Serial clock receive	D07



Feature Half Planar
Wrap Adapter
(PN 1620152)

EC 823146	825958	826065	PN 1619007
Date 9/15/74	3/21/75	8/1/75	

EC 825853			PN 1619008
Date 11/15/74			

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DIAGNOSTIC AIDS

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* See *3717 MLM* for 3717 CE diagnostic and test programs.

CE DISPLAY MODE

The diagnostic programs for CE display mode use 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 in the disk drive to be selected for CE display mode. If disk drive 2 is the drive selected, then a diskette must also be installed in disk drive 1, but the opposite is not necessary.

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

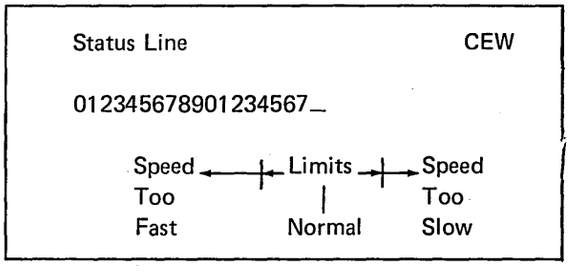
The display disk speed diagnostic can be used to:

- Locate a failing machine.
- Determine causes of changing or out-of-tolerance disk speed.
- Verify display-to-cursor operation.
- Adjust actuator bail.
- Cause a repeated read.

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 letter O key. (For disk drive 2, hold down NUM SHIFT and press the letter 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.

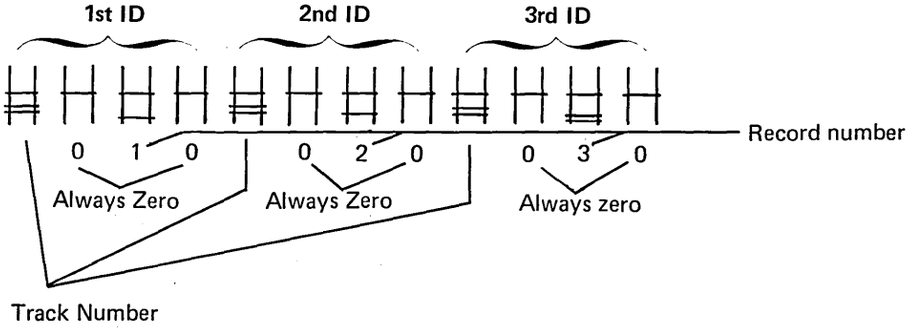
To calculate disk rotational speed, count the digits to the right of the first 0, up to the cursor, and add 150. The example display shows 17 digits to the right of the first 0 (1 through 0 = 10, 1 through 7 = 7). 150 + 17 = 167 milliseconds. This represents normal disk speed, which should be 167 ± 4 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 sent 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 REP) 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.

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.

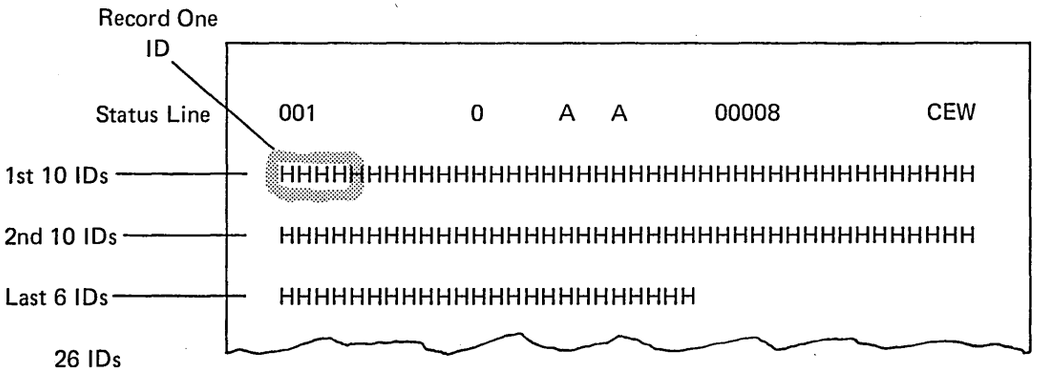
Repetitious Read

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. (See page 8-5, *Sense/Command Register Operation*.)

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.

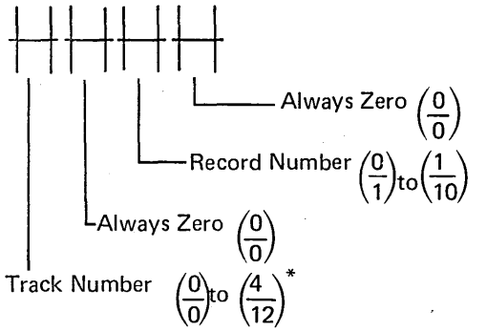
A new display length will be shown for the disk revolution following the J key.

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 REP). To step down one track, press ALPHA SHIFT and the space bar (or any other key except RESET or REP). The display is blanked and refreshed each time a new track is selected.

Note: When using disk drive 2, NUM SHIFT must be used with the keys specified above to step up or down.

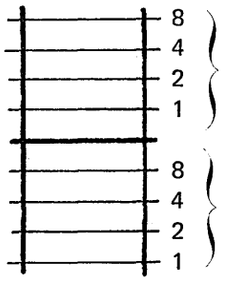
One ID is represented by four double binary characters in a row. The basic frame of each double binary character looks something like an H with the crossbar extended. It alone represents a double binary character of zero over zero. $\frac{0}{0}$.

One ID =



*$\left(\frac{4}{12}\right)$ is displayed as (<).

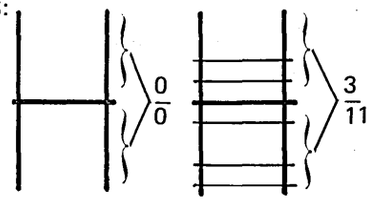
Each character has a binary decimal value above the cross bar and a binary decimal value below the cross bar, therefore, the name double binary character. Each binary decimal value can be determined by observing the location of lines parallel to the cross bar as shown here:



Upper binary decimal value line locations — For track numbers, this decimal value can be 0, 1, 2, 3, or 4. For record number, this decimal value will be either 0 or 1.

Lower binary decimal value line locations — For track or record number, this decimal value can be any number 0 through 15.

EXAMPLES:



Double Decimal Notation

The $\frac{0}{0}$ 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 $\frac{3}{11}$ example above.

Table 1 (page 8-7) 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 $\frac{4}{9}$ for track 73, also note 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 $\frac{0}{1}$ for record 01 through $\frac{1}{10}$ for record 26.

The rest of Table 2 (page 8-8) 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 (continued)

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.
- Check 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.

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 (page 8-8). 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 (page 8-8); 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 (page 8-8); 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 specific 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 (page 8-7) 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:

- Improper track 0 stop adjustment.
- Accidental erasure.
- Faulty track on the disk.
- Uninitialized disk.
- Weak read amplifier (faulty FC card).
- Faulty VFO card.
- Misadjusted actuator bail (207).

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. An uninitialized disk would display no IDs, or all tracks would contain 'FF' IDs. Initialize that disk for use in the machine.

Faulty Tracks

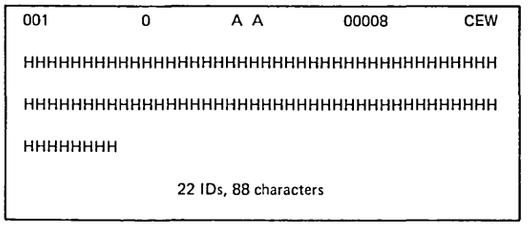
IDs that are present in the display of a faulty track (fault has developed since last disk initialization), or IDs of an adjacent good track, can be decoded for their track number double decimal value. The double decimal value can then be found in Table 1 (page 8-7) with its corresponding track number. If the machine finds a faulty track during disk initialization, it will identify that track by writing 'bad-track' IDs $\frac{15}{15}$ in all ID positions 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 or the 'file data' line with an oscilloscope.



Sense/Command Register Operation

The CE can verify the operation of the sense register part of the sense/command register 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 (no $\frac{15}{15}$ double decimal ▤ ID characters on it) and all IDs present are proper length and have correct CRC (cyclic redundancy check) bytes, the cursor will display steadily under the third character position. 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 position; or if a wrong CRC byte is present in the track for any ID, the cursor will display under the seventh position.

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 the table.

The possible cursor positions are 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. through	97
Binary Value Sum Location	0		2				6		8		10				14		16		18				96

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.

The sense bits on in relation to cursor position are shown in the following table:

Sense Bit Definitions

- An 'ID matched sense bit' (binary value 2) is set each disk revolution that one or more double binary ID characters is read from a track. The ID character may be any double decimal value notation from $\frac{0}{0}$ through $\frac{15}{15}$.
- 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 $\frac{15.}{15}$. During disk initialization, 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.
- 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 8-5.

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.

Cursor Position → (read down)	1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69	71	73	75	77	79	81	83	85	87	89	91	93	95	97	99	101	103	105	107	109	111	113	115	117	119	121	123	125	127
Binary Value → (read down)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126
Sense Bits On			

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. Do not 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 *Display Disk Track IDs* (page 8-3) 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 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.

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 Disk Track IDs,* page 8-3.

*One ID =

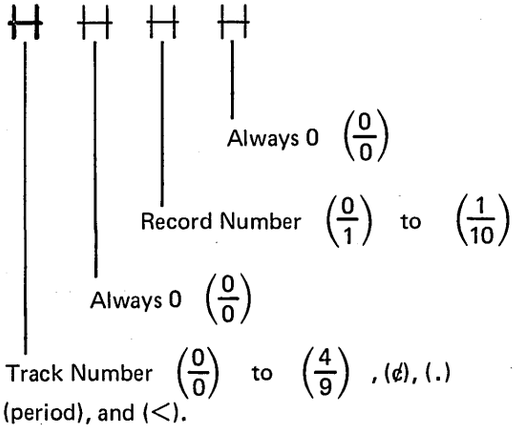


TABLE 1 DOUBLE DECIMAL NOTATION FOR TRACK NUMBERS IN IDs*

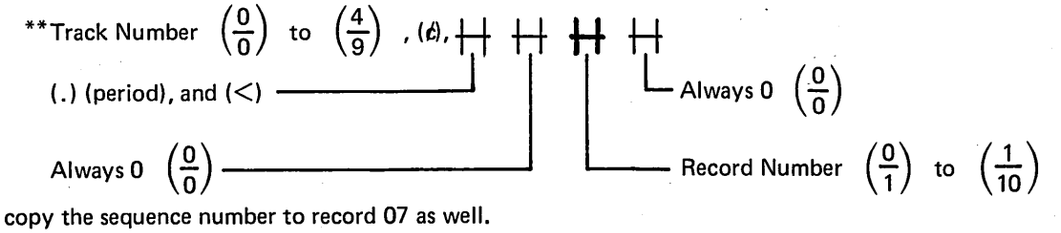
Track Number	ID	Track Number	ID	Track Number	ID	Track Number	ID	Track Number	ID**
00	0/0	16	1/0	32	2/0	48	3/0	64	(Blank)
01	0/1	17	1/1	33	2/1	49	3/1	65	4/1 ｡
02	0/2	18	1/2	34	2/2	50	3/2	66	4/2 ｢
03	0/3	19	1/3	35	2/3	51	3/3	67	4/3 ｣
04	0/4	20	1/4	36	2/4	52	3/4	68	4/4 ､
05	0/5	21	1/5	37	2/5	53	3/5	69	4/5 ･
06	0/6	22	1/6	38	2/6	54	3/6	70	4/6 ｦ
07	0/7	23	1/7	39	2/7	55	3/7	71	4/7 ｧ
08	0/8	24	1/8	40	2/8	56	3/8	72	4/8 ｨ
09	0/9	25	1/9	41	2/9	57	3/9	73	4/9 ｩ
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		

**Characters in right-hand column are for Katakana machines only.

TABLE 2

Selected Sequence *Displayed in Pos. 77 and 78, Record 07, Track 00.	RECORD NUMBERS** – 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	0/1	0/2	0/3	0/4	0/5	0/6	0/7	0/8	0/9	0/10	0/11	0/12	0/13	0/14	0/15	1/0	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
	RECORD NUMBERS** – SELECTED SEQUENCES FROM COLUMNS 77 AND 78																								
02	0/1	0/3	0/5	0/7	0/9	0/11	0/13	0/15	1/1	1/3	1/5	1/7	1/9	0/2	0/4	0/6	0/8	0/10	0/12	0/14	1/0	1/2	1/4	1/6	1/8	1/10
03	0/1	0/4	0/7	0/10	0/13	1/0	1/3	1/6	1/9	0/2	0/5	0/8	0/11	0/14	1/1	1/4	1/7	1/10	0/3	0/6	0/9	0/12	0/15	1/2	1/5	1/8
04	0/1	0/5	0/9	0/13	1/1	1/5	1/9	0/2	0/6	0/10	0/14	1/2	1/6	1/10	0/3	0/7	0/11	0/15	1/3	1/7	1/4	1/8	1/12	0/0	0/4	0/8
05	0/1	0/6	0/11	1/0	1/5	1/10	0/2	0/7	0/12	1/1	1/6	0/3	0/8	0/13	1/2	1/7	0/4	0/9	0/14	1/3	1/8	0/5	0/10	0/15	1/4	1/9
06	0/1	0/7	0/13	1/3	1/9	0/2	0/8	0/14	1/4	1/10	0/3	0/9	0/15	1/5	0/4	0/10	1/0	1/6	0/5	0/11	1/1	1/7	0/6	0/12	1/2	1/8
07	0/1	0/8	0/15	1/6	0/2	0/9	1/0	1/7	0/3	0/10	1/1	1/8	0/4	0/11	1/2	1/9	0/5	0/12	1/3	1/10	0/6	0/13	1/4	0/7	0/14	1/5
08	0/1	0/9	1/1	1/9	0/2	0/10	1/2	1/10	0/3	0/11	1/3	0/4	0/12	1/4	0/5	0/13	1/5	0/6	0/14	1/6	0/7	0/15	1/7	0/8	1/0	1/8
09	0/1	0/10	1/3	0/2	0/11	1/4	0/3	0/12	1/5	0/4	0/13	1/6	0/5	0/14	1/7	0/6	0/15	1/8	0/7	1/0	1/9	0/8	1/1	1/10	0/9	1/2
10	0/1	01/11	1/5	0/2	0/12	1/6	0/3	0/13	1/7	0/4	0/14	1/8	0/5	0/15	1/9	0/6	1/0	1/10	0/7	1/1	0/8	1/2	0/9	1/3	0/19	1/4
11	0/1	0/12	1/7	0/2	0/13	1/8	0/3	0/14	1/9	0/4	0/15	1/10	0/5	1/0	0/6	1/1	0/7	1/2	0/8	1/3	0/9	1/4	0/10	1/5	0/11	1/6
12	0/1	0/13	1/9	0/2	0/14	1/10	0/3	0/15	0/4	1/0	0/5	1/1	0/6	1/2	0/7	1/3	0/8	1/4	0/9	1/5	0/10	1/6	0/11	1/7	0/12	1/8
13	0/1	0/14	0/2	0/15	0/3	1/0	0/4	1/1	0/5	1/2	0/6	1/3	0/7	1/4	0/8	1/5	0/9	1/6	0/10	1/7	0/11	1/8	0/12	1/9	0/13	1/10

* The sequence numbers that are entered by the operator in positions 7 and 8 of the current buffer, prior to disk initialization, are machine written in positions 77 and 78 of record 7 track 00 during initialization.



Note: Full disk image copy from diskette 2 to diskette 1 may copy the sequence number to record 07 as well. This may cause positions 77 and 78 to indicate incorrect sequence number values.

Display Registers

The diagnostic causes the contents of 30 of the 8-bit registers to be displayed. Each register will be represented by two alphameric 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 initially 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 in Figure 1.)

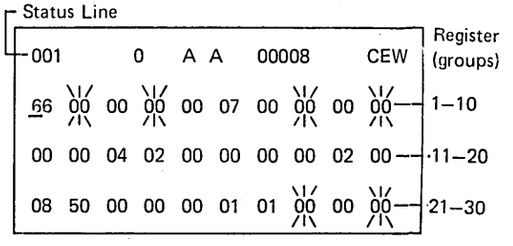


FIGURE 1

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 Switch Test

- Flip all keyboard toggle switches down (off).

- 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 17 as shown by the position indicator.

- Press FUNCT SEL lower (the right-most FUNCT SEL key).

- Hold down the NUM SHIFT key 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 should look similar to Figure 1 (except that the cursor is in position 017). (The six highlighted registers should initially 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 in Figure 1.)

- 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);

  - One or more keyboard toggle switches were on when 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 bits that cannot be reset.

TABLE 3

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

- 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: 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 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 bottom line for the 3741).

- The switch OFF characters should be 00.

- The switch ON characters should be 20.

- The data key must be pressed several times to test the switch shift function.

Keyboard Key Test

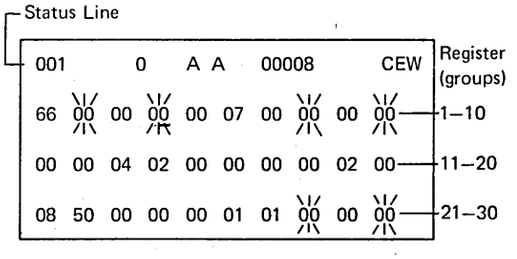
- Insert an initialized diskette in the disk drive and close the drive cover. The machine should go from XN to XR mode and display record 08 of track 00.

- Use CHAR ADV to move the cursor out to position 14 as shown by the position indicator. Both register positions 13 and 14 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 initially 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.)



- 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.

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 bottom line). The no Katakana shift condition is 00. The Katakana shift is 20.

TABLE 4

	First (left hand) digit of key code (position 13)			
No shift	0	1	2	3
NUM SHIFT	4	5	6	7
ALPHA SHIFT	8	9	A	B
KANA SYMB	C	D	E	F

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).

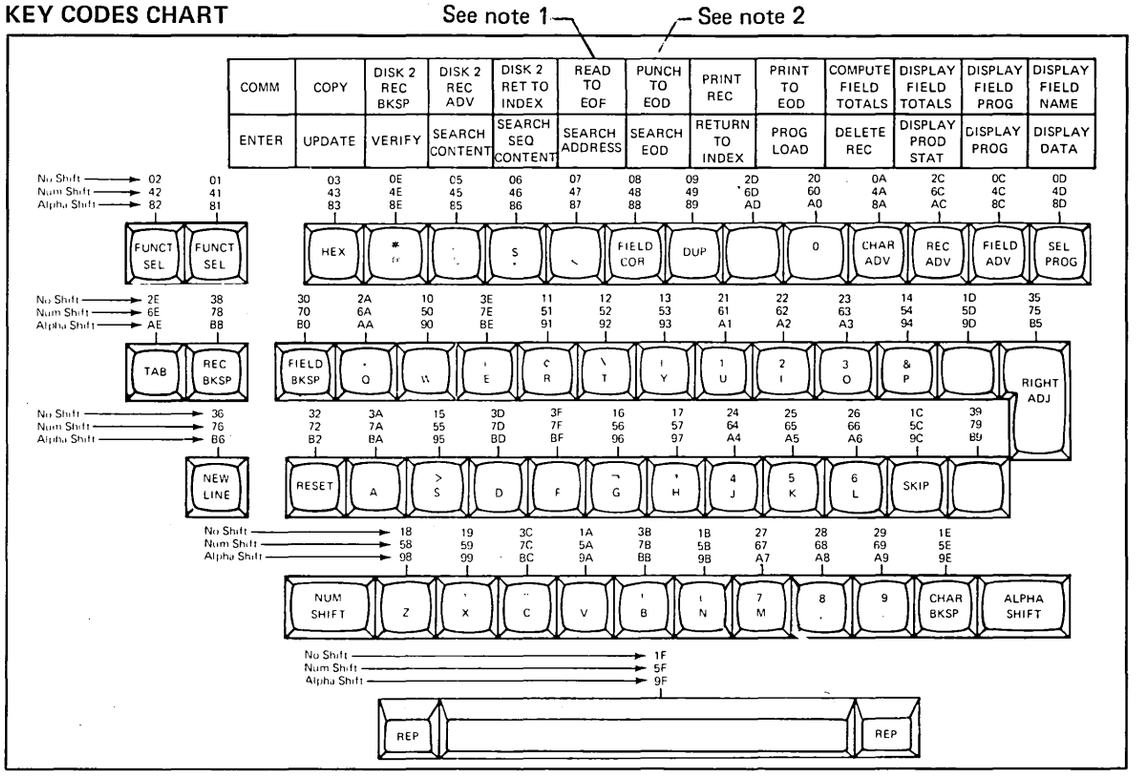
- Use the heel of your hand and press down several keys on the keyboard to cause an overrun error.

- The display should start flashing.

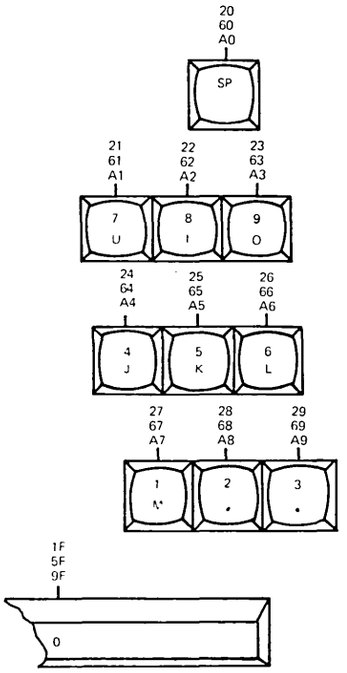
- The keyboard should go dead — no more clicks.

- There should a one (1) displayed above the cursor in position 18.

KEY CODES CHART



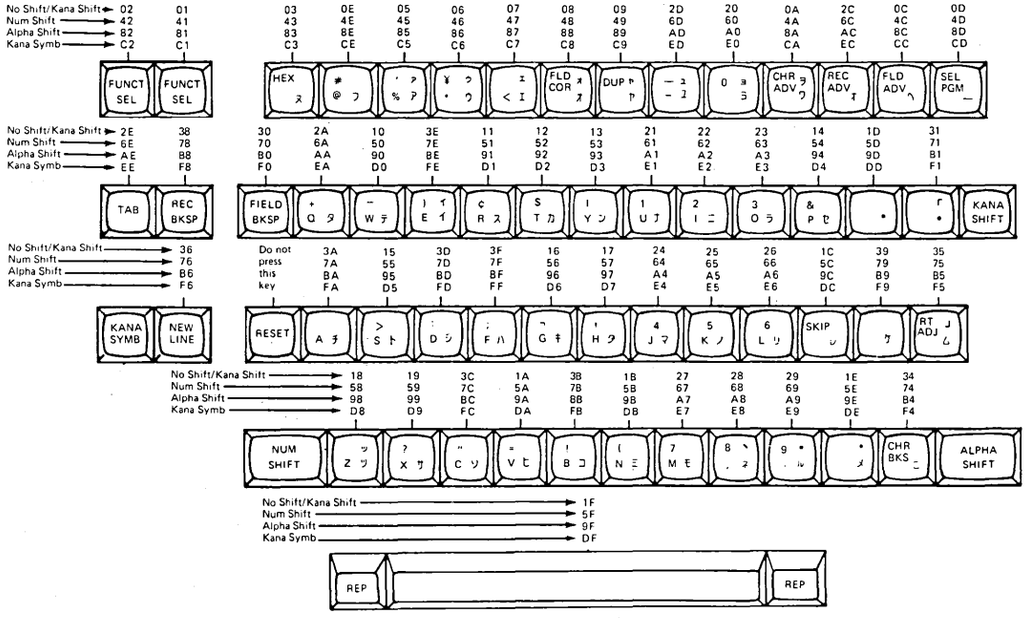
Alternate layout used with proof keyboard.



Notes:

1. For I/O Adapter, this label is INPUT TO 3741.
2. For I/O Adapter, this label is OUTPUT FROM 3741.

Alternate Keyboard Layout Used with Katakana Machines



EC 826065			PN 1619568
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Read/Write Storage Test for Models 1 and 2

For Models 3 and 4 see page 8-38.1.

CE mode 1 is used in this procedure to determine if R/W storage can be accessed by the MPU, disk, and display attachment.

The power on sequence chart, in Chapter 14, shows that the first 2K bytes of R/W storage are tested by MPU ROS routines. After a successful test, buffers 0 through 15 are initialized (loaded) with known data. If the power-up sequence is successfully completed, it can be assumed that:

- The '+read/-write' line, sent to the memory card from the MPU address register, worked correctly.
- The memory card can be accessed by the MPU.

1. Power-up (loads buffers 0 through 15 with known data).
2. Load a diskette to X R mode.
3. Select CE mode 1 as follows:
   Press FUNCT SEL lower
   Hold NUM SHIFT and press C
   Press letter I

   The machine now displays buffer 0 of R/W storage. Use the space key to display the contents of each buffer. Then compare the contents to the R/W Storage Diagram 1 for Models 1 and 2 (you must count keystrokes, after entering CE mode 1, to know the number of the buffer being displayed.)

   The buffer address wraps around to buffer 0 after 16 keystrokes.

   If the buffer contents are not as shown in Diagram 1, a planar, cross connector, or memory card might be defective.
4. Press RESET several times to return to X R mode.

R/W MEMORY CARD (INPUT, OUTPUT, ADDRESS CONTROL, AND VOLTAGE LINES)

Test Pin	Active Level (+ or -)	Line Name	Line Function
1-G-D02	-	SAR 1	These lines form a single byte address to select one byte within a 128-byte buffer.
1-H-D04	-	SAR 2	
1-G-D13	-	SAR 3	
1-G-D05	-	SAR 4	
1-H-D09	-	SAR 5	
2-H-B02	-	SAR 6	
2-G-B03	-	SAR 7	
1-H-D10	-	SAR 8	These lines select one buffer (128 bytes) within a 1K block of storage. (1K of storage contains 8 buffers.)
1-G-D09	-	SAR 9	
2-H-B06	-	SAR 10	
2-G-B07	+	CSY 1	Selects the first, third, fifth, seventh, and ninth 1K blocks of storage.
2-G-B13	+	CSY 2	Selects the second, fourth, sixth, and eighth 1K blocks of storage.
2-H-B07	+	CSX 1	Selects the first 2K byte block of storage (bytes 0000-2047).
1-H-B08	+	CSX 2	Selects the second 2K byte block of storage (bytes 2048-4095).
2-H-B10	+	CSX 3	Selects the third 2K byte block of storage (bytes 4096-6143).
1-H-D13	+	CSX 4	Selects the fourth 2K byte block of storage (bytes 6144-8191).
2-H-B11	+	Data strobe	A timing pulse from the MPU which allows reading or writing in storage.
1-H-D11		+Write/-read	A line from the MPU which selects either a read or write function in storage.
2-H-B13	+	Card select	A line from the MPU which activates the memory card.
2-G-B04	+	8.5 volts	Input voltages
2-G-B09	-	5 volts	
1-H-D12	+	5 volts	
2-H-B04	+	8.5 volts	
1-H-D07	-	Ground	
1-G-D07	-	Ground	
2-G-B06	-	Bit 1	Data bits to R/W storage. (Data bus in)
2-G-B05	-	Bit 2	
2-G-B10	-	Bit 3	
2-G-B08	-	Bit 4	
2-G-B12	-	Bit 5	
2-G-B11	-	Bit 6	
2-H-B05	-	Bit 7	
2-H-B03	-	Bit 8	
2-H-B08	-	Bit 9 (parity)	
1-G-D04	-	Bit 1	Data bits from R/W storage. (Data bus out)
1-G-D03	-	Bit 2	
1-G-D08	-	Bit 3	
1-G-D06	-	Bit 4	
1-G-D11	-	Bit 5	
1-G-D10	-	Bit 6	
1-H-D03	-	Bit 7	
1-H-D02	-	Bit 8	
1-H-D06	-	Bit 9 (parity)	

R/W Storage Diagram 1

Buffer Number	Buffer Name	Buffer Contents*
0	Present buffer	Data should be the data read from data set label 8 of diagnostic disk.
1	Search mask buffer	Blank.
2	Previous buffer	Data should be the data read from data set label 3 of diagnostic disk.
3	Status line	Same data as that being displayed on status line 1.
4	Program buffer	Hex characters.
5	Control totals	Hex characters.
6	Format buffer 2	NNN → N
7	1	NNN → N
8	4	
9	3	
10	6	
11	5	
12	8	
13	7	
14	A	
15	9	
16	C	
17	B	
18	E	
19	Format buffer D	
20		
21	Format buffer F	
22		
23		
24		* The 3741 Models 1 and 2 use only 2K of storage.
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		For 3741 Models 3 and 4 the Ns do not appear until ACLT 1 is loaded.
36		
37		
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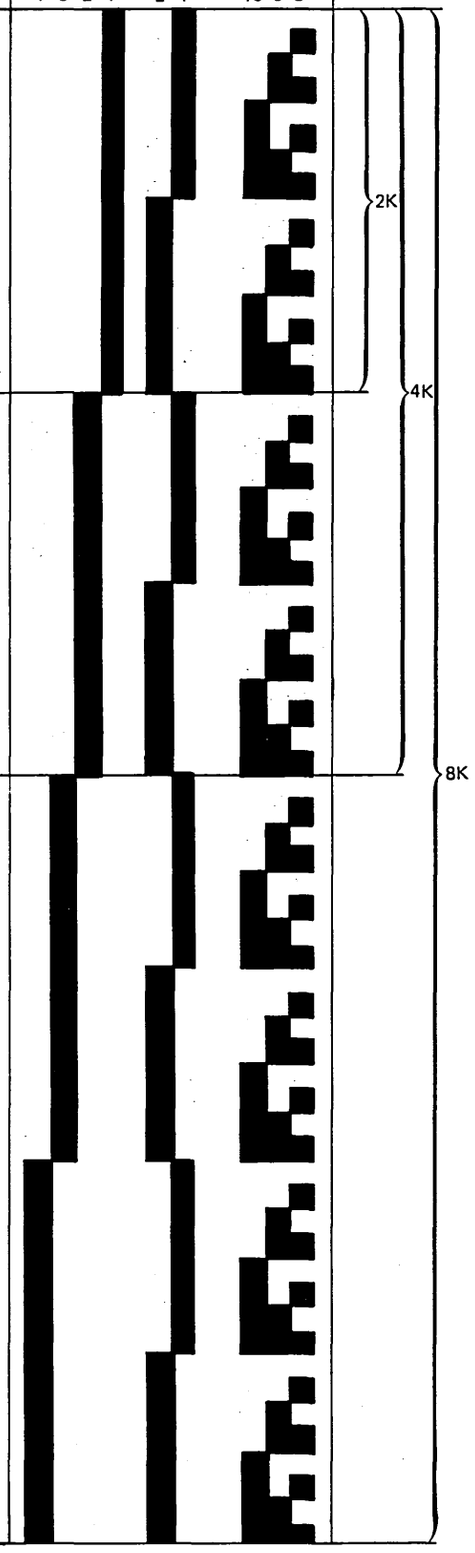
56		
57		
58		
59		
60		
61		
62		
63		NNN → N



EC 823146	825853	826065	PN 1619019
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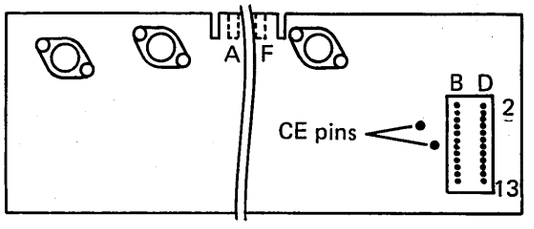
CE PINS FOR RASTER DISPLAY

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.

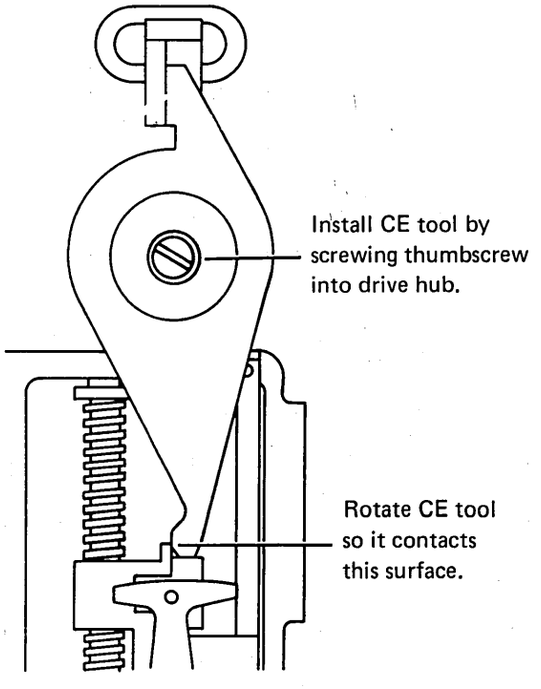
When the CE pins are connected together with a jumper wire, the 'video signal' line is grounded, thus preventing the display of characters on the CRT.



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.

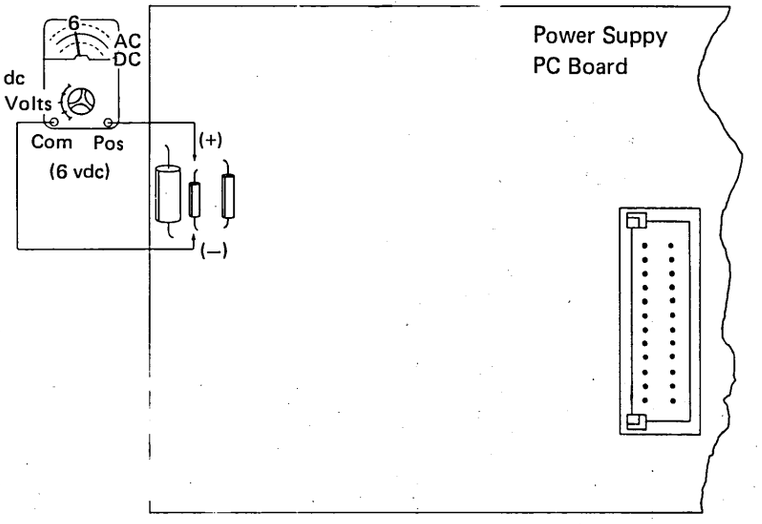
CE HEAD-ADJUSTING TOOL (PN 2200698)



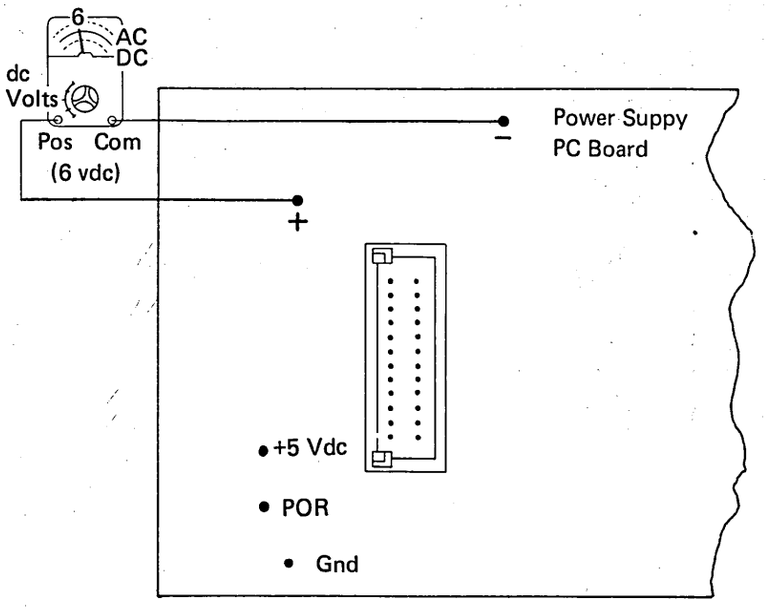
CE VOLTMETER ACCURACY CHECK (15 Vdc Range) (PN 452796)

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)

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.)

Probe UP and DOWN lights will momentarily flash on during power on if the probe is connected to its machine power source. Please ignore.

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:

	MULTI	+60.0V
Logic	MST 2/4	+14.0V
selector	MST 1	+14.0V

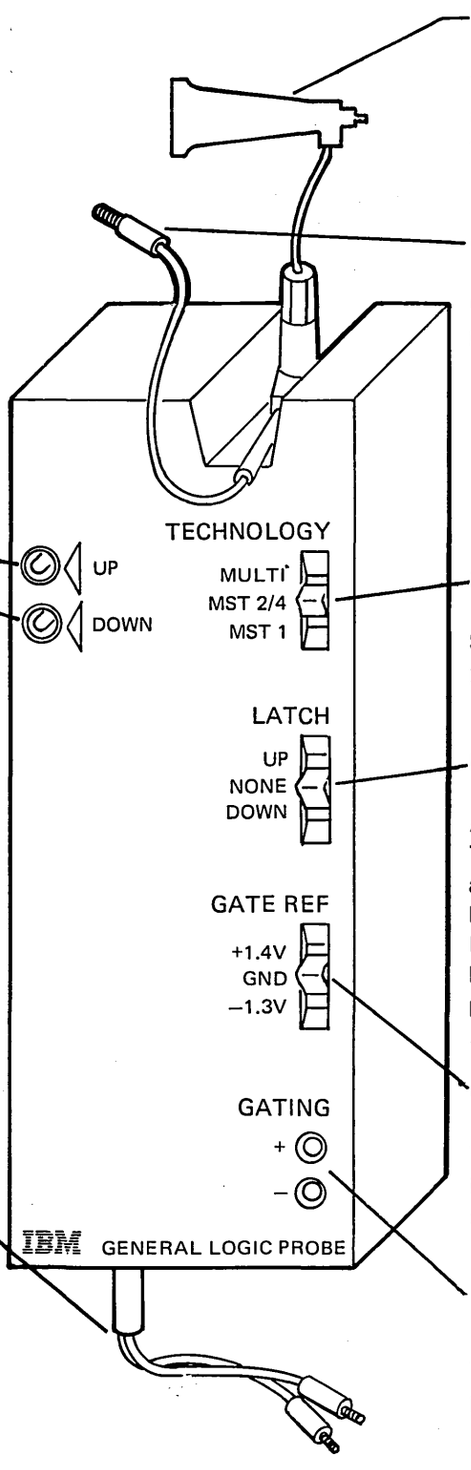
Voltages greater than the above ranges will damage the probe.

Power Leads

Connect the black (-) lead to 2-M-D13 (gnd). Connect the other (+) lead to 2-M-B05 (+8.5V) (or connect the black [-] lead to ground and the other lead to +5 Vdc on the power supply PC board, see page 8-12). A voltage difference of 4 to 12 volts is needed to power the probe, with the black lead always the most negative.

Note: Do not use the -5 Vdc supply to power the probe. The power required by the probe will overload the -5 Vdc supply.

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.)

Ground Lead

Connect this lead to any signal ground near the probe point. Do not use frame ground.

CAUTION
Improper indications result if this lead is not connected to signal ground. A maximum length of 4 inches (101.6 mm) can be used.

Logic Selector (TECHNOLOGY)

Selects the type of logic to be probed. Circuits probed in the 3741 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 3741.

GATE REF Volts Switch

The use of this switch is not required for probing in the 3741. It affects only the gating terminals.

GATING Terminals

The use of these terminals is not required for probing in the 3741.

Do not probe FET signals with gate inputs. Gate input limits are ±14 volts.

EC	823146	825853	826065	PN 1619021
Date	9/15/74	11/15/74	8/1/75	

CE DISKETTES

The following diskettes are available to aid in servicing the 3741:

- Alignment check (PN 2455026)
- CE diagnostics (PN 2469688)
- I/O adapter (PN 2469460)
- Two diskettes for Models 3 and 4

Handling Precautions

The CE should be aware that all diskettes undergo small reversible dimensional changes as temperature and humidity changes occur. The CE diskettes should be allowed to stabilize to the ambient environment before use. The stabilization period may vary from a few minutes to several hours depending on the magnitude of the change.

Storage in sunlight or temperatures exceeding 110° F is expressly prohibited. If subject to high temperatures for extended periods of time, small irreversible dimensional changes may occur which would degrade the precision of the alignment tracks.

The alignment check diskette is intended as a service aid only. If consistent conflicts between the mechanical alignment tool and the diskette occur, the diskette should be replaced.

Alignment Check Diskette

This is a specially treated diskette designed for checking head alignment.

Model 3/4 Diagnostics Diskettes

These two diskettes are described in the Model 3 and 4 part of this chapter.

I/O Adapter Diagnostic Diskette

Contained on this diskette are tests to aid in diagnosing troubles on the I/O adapter. See the I/O Adapter sections of this chapter.

CE Diagnostics Diskette

This diskette contains programs and data for most of the other base machine tests (such as printer and data recorder attachment tests).

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 IDs 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 offset 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 offset 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 09 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 10 defines tracks 12 through 15 as HD ALIGN.

Records and IDs are written off-track centerline on all 12 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.

Matching record messages refer to each other in pairs; that is, record 1 refers to record 2, and record 2 refers to record 1; record 3 refers to record 4, and record 4 refers to record 3; and so on.

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 band tracks (05, 10, 11, and 16) have only 13 IDs each. No record messages are displayable from the guard band tracks. IDs have no corresponding records. (See B and C.)

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 conditions:

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.

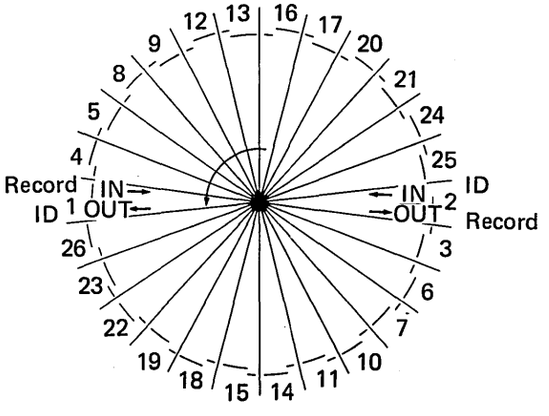


Figure 1

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 diskette. Use the ML to troubleshoot machine malfunctions.

- 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. (For second disk, press FUNCT SEL upper followed by disk 2 REC ADV.)
- Press FUNCT SEL lower.
- Press UPDATE. (For second disk, hold NUM SHIFT and press SEARCH ADDRESS, enter the address, press FUNCT SEL upper followed by disk 2 REC ADV.) 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
```

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. (For second disk, press FUNCT SEL upper followed by disk 2 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; that is, record 1 refers to record 2, and record 2 refers to record 1; record 3 refers to record 4, and record 4 refers 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 two 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.

3713 PRINTER TEST PROGRAMS

Refer to *3717 MLM* for 3717 test procedures.

The printer test programs are divided into eight sections:

Section 1 — Print a 132-character line.

The 3741 may have either 128- or 132-character position ROS for the printer. When the machine has 132 ROS, any characters that are printed that exceed the print line overprint the first positions of the line. For example, if 132 characters are printed on a 120-position printer, positions 121 through 132 overprint 1 through 12.

When the machine has 128 ROS, any characters that are printed up to 128 characters overprint the first positions of the line. For example, if 128 characters are printed on a 120-position printer, positions 121 through 128 overprint positions 1 through 8. When a 132-character line is printed using 128 ROS, the positions up to 128 overprint; positions 129 through 132 cause an extra line feed. For example, a 132-character line printed with 128 ROS on a 120-position printer, positions 121 through 128 overprint positions 1 through 8, and positions 129 through 132 cause an extra line feed (blank line).

Section 2 — Leading zeros suppression test.

Section 3 — Substitution of asterisks for leading zeros test.

Section 4 — Print signed data fields test.

Section 5 — Tab test.

Section 6 — Skip characters and reverse bypass test.

Section 7 — Read next record test.

Section 8 — Vertical skip test.

Each section begins with a description line which is formatted by program storage 1.

Program Level 1

N3CY127A3CQ

N = No op.

3C = 3 spaces.

Y = Skip first character.

127A = Load characters 2 through 128 into the the print buffer.

3C = Print, carriage return, and line feed three times.

Q = End of program.

To run the printer test:

— Load programs

1. Record advance or backspace to the PT PROG (printer test program) data set label. This label is at address 00015.
2. Select UPDATE.
3. Load the 10 programs into program levels 1 through A (the program at 34002 into program level 1, the program at 34003 into program level 2, etc.).
4. Select RETURN TO INDEX.

— Print

1. Record advance or backspace to the PT DATA (printer test data) data set label. This label is at address 00016.
2. Select PRINT TO EOD.

Note: The % in the first position of program level A indicates that the printer format program level is defined by the character in column 001 of the data record.

Section Descriptions

Each section will be described by showing:

1. The **Test Data** for the section.
2. The **Correct Printed Output** for the section.
3. A description of the **Program** for that section.

Section 1 — Print a 132 Character Line

Test Data

```
1SECTION 1--132 PRINT TEST. THE PROGRAM IS IN PROG. STORAGE 2.
2                                                
```

Section 2 — Leading Zeros Suppression Test

Test Data

```
1SECTION 2--LEADING ZEROS SUPPRESSION TEST. THE PROGRAM IS IN PROG. STORAGE 3.
3000000000112345678900000000011234567890
3000000001201234567890000000012012345678 9
3000000012300123456780000000123001234567 8
3000000123400012345670000001234000123456 7
3000001234500001234560000012345000012345 6
3000012345600000123450000123456000001234 5
3000123456700000012340001234567000000123 4
3001234567800000001230012345678000000012 3
3012345678900000000120123456789000000001 2
3123456789000000000011234567890000000000 1
```

Correct Printed Output

```
SECTION 2--LEADING ZEROS SUPPRESSION TEST.
           THE PROGRAM IS IN PROG. STORAGE 3.


         1     1234567890              1     1234567890
        12      123456789             12      123456789
       123       12345678            123       12345678
      1234        1234567           1234        1234567
     12345         123456          12345         123456
    123456          12345         123456          12345
   1234567           1234        1234567           1234
  12345678            123       12345678            123
 123456789             12      123456789             12
1234567890              1     1234567890              1
```

Program Level 3

NY10B5X10B5X10B5X10BCQ

N = No op.

Y = Skip first character.

10B = Load 10 characters into the print buffer and remove zeros to the left of the significant digit.

5X = Load 5 blanks to the print buffer.

C = Print, carrier return, and line feed.

Q = End of program.

Section 3 — Substitution of Asterisks For Leading Zeros Test

Test Data

```
1SECTION 3--SUBSTITUTION OF ASTERISKS FOR LEADING ZEROS TEST.
          THE PROGRAM IS IN PROG.STORAGE 4.

40000000001123456789000000000011234567890
40000000012012345678900000000120123456789
40000000123001234567800000001230012345678
40000001234000123456700000012340001234567
40000012345000012345600000123450000123456
40000123456000001234500001234560000012345
40001234567000000123400012345670000001234
40012345678000000012300123456780000000123
40123456789000000000120123456789000000012
41234567890000000000112345678900000000001
```

Correct Printed Output

```
SECTION 3--SUBSTITUTION OF ASTERISKS FOR LEADING ZEROS TEST.
          THE PROGRAM IS IN PROG.STORAGE 4.

**********1      1234567890      **********1      1234567890
*********12      *123456789      *********12      *123456789
********123      **12345678      ********123      **12345678
*******1234      ***1234567      *******1234      ***1234567
******12345      ****123456      ******12345      ****123456
*****123456      *****12345      *****123456      *****12345
****1234567      ******1234      ****1234567      ******1234
***12345678      *******123      ***12345678      *******123
**123456789      ********12      **123456789      ********12
*1234567890      *********1      *1234567890      *********1
```

Program Level 4

NY10Z5X10Z5X10Z5X10ZCQ

N = No op.

Y = Skip first character.

10Z = Load 10 characters into the print buffer and replace the zeros to the left of the significant digit with asterisks.

5X = Load 5 blanks to the print buffer.

C = Print, carrier return, and line feed.

Q = End of program.

Section 4 — Print Signed Data Fields Test

Test Data

```
1SECTION 4--PRINT SIGNED DATA FIELDS TEST.
           THE PROGRAM IS IN PROG STORAGE 5.

50000J    SHOULD BE MINUS  00001    SHOULD BE PLUS
50000K    SHOULD BE MINUS  00002    SHOULD BE PLUS
50000L    SHOULD BE MINUS  00003    SHOULD BE PLUS
50000M    SHOULD BE MINUS  00004    SHOULD BE PLUS
50000N    SHOULD BE MINUS  00005    SHOULD BE PLUS
50000O    SHOULD BE MINUS  00006    SHOULD BE PLUS
50000P    SHOULD BE MINUS  00007    SHOULD BE PLUS
50000Q    SHOULD BE MINUS  00008    SHOULD BE PLUS
50000R    SHOULD BE MINUS  00009    SHOULD BE PLUS
50001     SHOULD BE MINUS  00010    SHOULD BE PLUS
```

Note: The blank in the last record occurs because an unprintable character (hex D0) is in the record at that place.

Correct Printed Output

```
SECTION 4--PRINT SIGNED DATA FIELDS TEST.
           THE PROGRAM IS IN PROG STORAGE 5.

00001-    SHOULD BE MINUS  00001     SHOULD BE PLUS
00002-    SHOULD BE MINUS  00002     SHOULD BE PLUS
00003-    SHOULD BE MINUS  00003     SHOULD BE PLUS
00004-    SHOULD BE MINUS  00004     SHOULD BE PLUS
00005-    SHOULD BE MINUS  00005     SHOULD BE PLUS
00006-    SHOULD BE MINUS  00006     SHOULD BE PLUS
00007-    SHOULD BE MINUS  00007     SHOULD BE PLUS
00008-    SHOULD BE MINUS  00008     SHOULD BE PLUS
00009-    SHOULD BE MINUS  00009     SHOULD BE PLUS
00010-    SHOULD BE MINUS  00010     SHOULD BE PLUS
```

Program Level 5

NY5D20A5D20ACQ

N = No op.

Y = Skip first character.

5D = Load characters 2 through 6 into positions 1 through 5 of the print buffer. If the last character in the 5D field (test data column 6) has a D zone, load a — (dash) in position 6 of the print buffer (correct printed output column 6). If character 6 has an F zone, load a blank into position 6 of the print buffer.

20A = Load characters 7 through 26 into the print buffer.

5D = Load characters 27 through 31 into positions 27 through 31 of the print buffer. If character 31 has a D zone, load a — (dash) into position 32 of the print buffer. If the last data character in the 5D field (test data column 31) has an F zone, load a blank in position 32 (correct printed output column 32).

20A = Load characters 32 through 51 into the print buffer.

C = Print, carrier return, and line feed.

Q = End of record.

Section 5 — Tab Test

Test Data

```
Column 1     6          16                31                51                76                106
       1SECTION 5--TAB TEST. THE PROGRAM IS IN PROG. STORAGE 6. THE * SHOULD LINE UP WITH THE +.
       +     +          +                 +                 +                 +                 +
       6*********
       6*********
       6*********
       6*********
       6*********
```

Correct Printed Output

```
      SECTION 5--TAB TEST. THE PROGRAM IS IN PROG. STORAGE 6. THE * SHOULD LINE UP WITH THE +.

Column 1     6          16                31                51                76                106
       +     +          +                 +                 +                 +                 +
       *     *          *                 *                 *                 *                 *
       *     *          *                 *                 *                 *                 *
       *     *          *                 *                 *                 *                 *
       *     *          *                 *                 *                 *                 *
       *     *          *                 *                 *                 *                 *
```

Program Level 6

NYATA2TA3TA4TA5TA6TACQ

- **N** = No op.
- **Y** = Skip first character.
- **A** = Load 1 character into the print buffer.
- **T** = Load enough blanks into the print buffer to get to the indicated tab stop.
- **C** = Print, carrier return, and line feed.
- **Q** = End of program.

Tab Stops in Program Storage A

```
Column    1  6   11   16   21   26   31   36   41   46   51   56   61   66   71   76   81   86   91   96   101  106  111  116
          |  |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
          %2 T3  4T   5 0  7  T8   9T   F    T    T    T    T    T    T    T    T    T    T    T    T    T    T    T    T
             |        |                   |                   |                   |                   |
Tab Stops    1        3                   6                   10                  15                  21
```

EC 823146	826065		PN 1619029
Date 9/15/74	8/1/75		

Section 6 — Skip Characters and Reverse Bypass Test

Test Data

```
1SECTION 6--SKIP CHARACTERS & REVERSE BYPASS TEST. THE PROGRAM
IS IN PROG. STORAGE 7. THE NEXT 5 LINES SHOULD LOOK LIKE THIS.

Column 1    5     10    15    20    25    30    35    40    45
       1    1A    2B    3C    4D    5E    6F    7G    8H    9I
       7123456789ABCDEFGHI
       7123456789ABCDEFGHI
       7123456789ABCDEFGHI
       7123456789ABCDEFGHI
       7123456789ABCDEFGHI
```

Correct Printed Output

```
SECTION 6--SKIP CHARACTERS & REVERSE BYPASS TEST. THE PROGRAM
IS IN PROG. STORAGE 7. THE NEXT 5 LINES SHOULD LOOK LIKE THIS.


Column    4     9     14    19    24    29    34    39    44
          1A    2B    3C    4D    5E    6F    7G    8H    9I


          1A    2B    3C    4D    5E    6F    7G    8H    9I
          1A    2B    3C    4D    5E    6F    7G    8H    9I
          1A    2B    3C    4D    5E    6F    7G    8H    9I
          1A    2B    3C    4D    5E    6F    7G    8H    9I
          1A    2B    3C    4D    5E    6F    7G    8H    9I
```

Program Level 7

```
Column 1         10        20        30        40        50        60        70
       NY3XA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YACQ
```

N = No op.

Y = Skip first character.

3X = Load 3 blanks into the print buffer.

A = Load 1 character into the print buffer.

8Y = Skip 8 characters.

9F = Reverse bypass 9 positions.

C = Print, carrier return, and line feed.

Q = End of program.

Section 7 — Read Next Record Test

Test Data

```
1SECTION 7--READ NEXT RECORD TEST. THE PROGRAM IS IN PROG. STORAGE 8.
THE NEXT LINE SHOULD PRINT A THRU Z IN POSITIONS 1 THRU 26
 8A
 8B
 8C
 8D
 8E
 8F
 8G
 8H
 8I
 8J
 8K
 8L
 8M
 8N
 8O
 8P
 8Q
 8R
 8S
 8T
 8U
 8V
 8W
 8X
 8Y
 8Z
```

Correct Printed Output

```
SECTION 7--READ NEXT RECORD TEST. THE PROGRAM IS IN PROG. STORAGE 8.
 THE NEXT LINE SHOULD PRINT A THRU Z IN POSITIONS 1 THRU 26

ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

Program Level 8

```
Column      10        20        30        40        50        60        70        80
NYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYACQ
```

N	= No op.	**R**	= Read next record.
Y	= Skip first character.	**C**	= Print, carrier return, and line feed.
A	= Load 1 character into the print buffer.	**Q**	= End of program.

Section 8 — Vertical Skip Test

Test Data

```
1SECTION 8--VERTICAL SKIP TEST. THE PROGRAM IS IN PROG. STORAGE 9.
9*****
9====== SKIP TO 2. SHOULD BE 1/2 INCH FROM *****.
9====== SKIP TO 3. SHOULD BE 1 INCH FROM *****.
9====== SKIP TO 4. SHOULD BE 1 1/2 INCH FROM *****.
9====== SKIP TO 5. SHOULD BE 2 INCHES FROM *****.
9====== SKIP TO 6. SHOULD BE 2 1/2 INCHES FROM *****.
9====== SKIP TO 7. SHOULD BE 3 INCHES FROM *****.
9====== SKIP TO 8. SHOULD BE 3 1/2 INCHES FROM *****.
9====== SKIP TO 9. SHOULD BE 4 INCHES FROM *****.
9====== SKIP TO 1. SHOULD BE 5 INCHES FROM *****.
```

Correct Printed Output

```
SECTION 8--VERTICAL SKIP TEST. THE PROGRAM IS IN PROG. STORAGE 9.




*****

====== SKIP TO 2. SHOULD BE 1/2 INCH FROM *****.

====== SKIP TO 3. SHOULD BE 1 INCH FROM *****.

====== SKIP TO 4. SHOULD BE 1 1/2 INCH FROM *****.

====== SKIP TO 5. SHOULD BE 2 INCHES FROM *****.

====== SKIP TO 6. SHOULD BE 2 1/2 INCHES FROM *****.

====== SKIP TO 7. SHOULD BE 3 INCHES FROM *****.

====== SKIP TO 8. SHOULD BE 3 1/2 INCHES FROM *****.

====== SKIP TO 9. SHOULD BE 4 INCHES FROM *****.




====== SKIP TO 1. SHOULD BE 5 INCHES FROM *****.
```

Program Level 9

```
Column      10        20        30        40        50        60        70
            |         |         |         |         |         |         |
NY1S5ACRY2S60ACR3S60ACRY4S60ACRY5S60ACRY6S60ACRY7S60ACRY8S60ACRY9S60ACRY1S60ACQ
```

N = No op.

Y = Skip first character.

1S = Skip to number preceding S.

5A = Load 5 characters into the print buffer.

C = Print, carrier return, and line feed.

R = Read next record

Q = End of program.

Skip Stops in Program Storage A

```
Column      1   6   11  16  21  26  31  36  41  46  51  56  61  66  71  76  81  86  91  96  101 106 111 116
            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
            %   2T3 4T  5 0 7 T8  9T  F   T   T   T   T   T   T   T   T   T   T   T   T   T   T   T   T
            |   |       |                   |
Skip Stops  1   3       6                   End of Form
```

3715 PRINTER DIAGNOSTIC PROGRAMS

Introduction

Five diagnostic programs are available for CE use and are designated CE1 through CE5:

- CE1 – Normal Print Pattern
- CE2 – Ripple Print Pattern
- CE3 – Over-Print Pattern
- CE4 – Head Home Test
- CE5 – Line Feed Test

These diagnostic programs are in the printer ROS.

Entry Into the Diagnostic Programs

To execute the diagnostic programs, perform the following sequence on the 3741:

1. Load a diskette and press RESET.
2. Turn the AUTO DUP/SKIP switch OFF.
3. Turn the AUTO REC ADV switch OFF.
4. Place the PROG NUM SHIFT switch in the ALL CHAR position (used for CE3).
5. Press FUNCT SEL lower and DELETE REC.
6. Key in CE1 (if program 1 is desired; otherwise, the correct number of desired program).
7. Press FUNCT SEL lower and PROG LOAD.
8. Key in A.

CAUTION
In the next step, do not enter more characters than can be printed on the paper used.

9. Key in up to 128 characters desired into the current record (used only for CE1, CE2, and CE3).
10. Press FUNCT SEL upper.
11. Press PRINT REC.
12. The diagnostic will be executed.
13. Each depression of REC ADV causes one line to print or one line space. However, turning the AUTO REC ADV switch to ON allows continuous running of the diagnostic after REC ADV is pressed.

Note: Terminating any CE program initializes program level A to all N's (No-Ops).

Exit from the Diagnostic Programs

All the test programs, CE1 through CE5, will stop if an error occurs. Pressing RESET once and only once resets the error and pressing REC ADV continues the test.

To terminate a test that is running, turn off the REC ADV switch, wait for the printer to stop, and press RESET.

To terminate a test that is stopped with an error, press RESET to reset the error and then press RESET again to exit the test.

CAUTION
Whenever running any of the diagnostic test programs, all hardware checks are maintained. For example, CE1 can fail if the printer is out of paper and the paper release lever is in the forward position.

Printer Diagnostic Program CE1

CE1 allows a continuous printing with single line spacing by printing the contents of the current record. When used to print H's, this routine is an aid in detecting print quality problems as well as the ability to print.

Printer Diagnostic Program CE2

CE2 is the same as CE1 except that it prints the contents of the current record on line 1; on line 2 it prints the current record rotated one position to the right, etc. This routine is an aid in ensuring that all characters are printed in all print positions.

If the current buffer is not loaded when CE1 or CE2 is selected, a zero length record is printed. This gives the appearance of the printer sitting at left margin and doing single line spaces.

Printer Diagnostic Program CE3

CE3 allows the contents of the current record to be printed without line feeds. This routine is an aid in ensuring that there is proper vertical alignment of characters. This routine can also be used to determine proper print-head carrier motion without printing whenever there are no characters in the current record.

Unlike CE1 and CE2, this routine moves the head the width of the carrier whether or not the current buffer is loaded because the program inserts an unprintable character into print position 128. Therefore, when running CE3, the PROG NUM SHIFT switch must be in the ALL CHAR position or a U-3 error will be set. (U appears in the upper right and 3 appears as status in the lower left of the display.)

Printer Diagnostic Program CE4

CE4 is the head home test. The routine allows the carriage home command to be issued to the printer adapter. This routine is an aid in ensuring that the head is properly positioned on the ramp and retracted from the platen. This routine may also be useful in detecting intermittent left margin problems. (When CE4 is running correctly, the head will move two character positions to the right of the left margin, stop, then return to the home position with the head retracted from the paper.)

Printer Diagnostic Program CE5

CE5 allows single and multiple line spacing with no head motion. This routine is an aid in ensuring proper line spacing (indexing).

3715 PRINTER TEST PROGRAMS

The printer test programs are used, primarily, to verify that programming and program formatting operate correctly.

The printer test programs are divided into 7 sections:

- Section 1 = 132 print test
- Section 2 = Leading zero suppression test; substitution of asterisks for leading zeroes and print signed data fields test
- Section 3 = Tab test
- Section 4 = Skip characters and reverse bypass test
- Section 5 = Read next record and print disk address test
- Section 6 = Edit test
- Section 7 = Vertical skip test

Formatting

Each section begins with a description line which is formatted by program storage 1.

Note: A complete description of program characters is contained in Section 9 *Operating Procedures.*

Program Level 1

N1H3LY127ACRY127A3CQ

- N = No op
- 1H = Skip to number preceding H unless a page boundary is going to be crossed. Then do the 3L function.
- 3L = Link to program 3
- Y = Skip first character
- 127A = Load 127 characters (2 through 128) into the print buffer
- C = Print, carriage return, and line feed
- R = Read next record
- Q = End of program

Each page begins with a heading line which is formatted by program storage 3.

Program Level 3

N6C54X23I3717/3715 PRINTER TESTS47X4IPAGEXPCL

- N = No cp
- 6C = 6 line feeds
- 54X = Load 54 blanks into the print buffer
- 23I = Load next 23 characters (3717/3715 Printer Tests) from the print program into the print buffer
- 47X = Load 47 blanks into the print buffer
- 4I = Load next 4 characters (page) from the print program into the print buffer
- X = Load one blank into print buffer
- P = Load the page number into the print buffer
- C = Print, carriage return, and line feed
- L = Link to program 1

Note: Tests can be entered from the keyboard or from the CE test diskette.

Running the Printer Test

To run the printer test from the test diskette:

1. Load programs
   - Record advance or backspace to the 3717/15 test prog, (printer test program) data set label. This label is at address 00018.
   - Select update mode.
   - Load the ten programs into program storage 1 through A (the program at 44002 into program storage 1, the program at 44003 into program storage 2, etc.)
   - Select RETURN TO INDEX.
2. Print
   - Record advance or backspace to the 3717/15 test data (printer test data) data set label. This label is at address 00019.
   - Select PRINT TO EOD.

Section Description

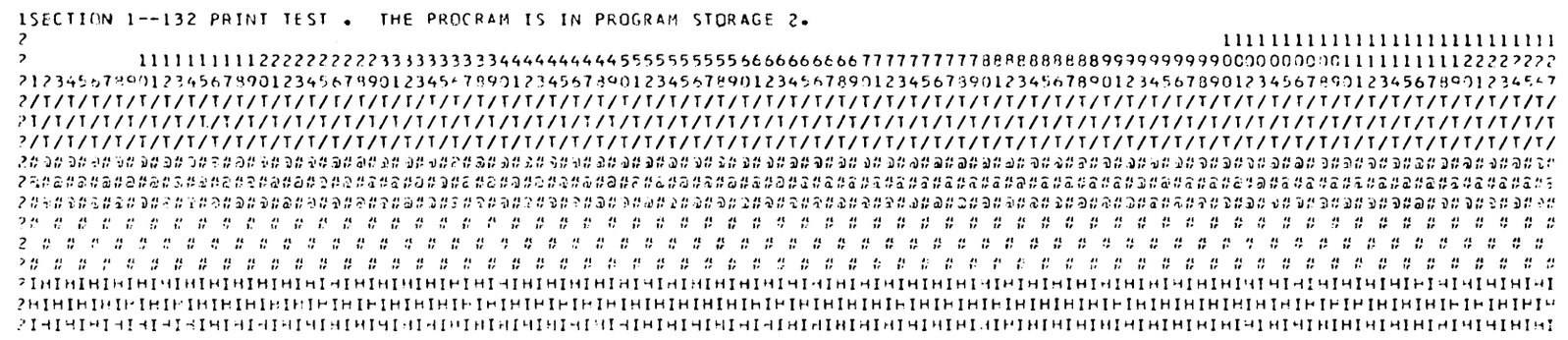
Each section is described by showing:

1. The test data for the section.
2. The correct printed output for the section.
3. A description of the program for that section.

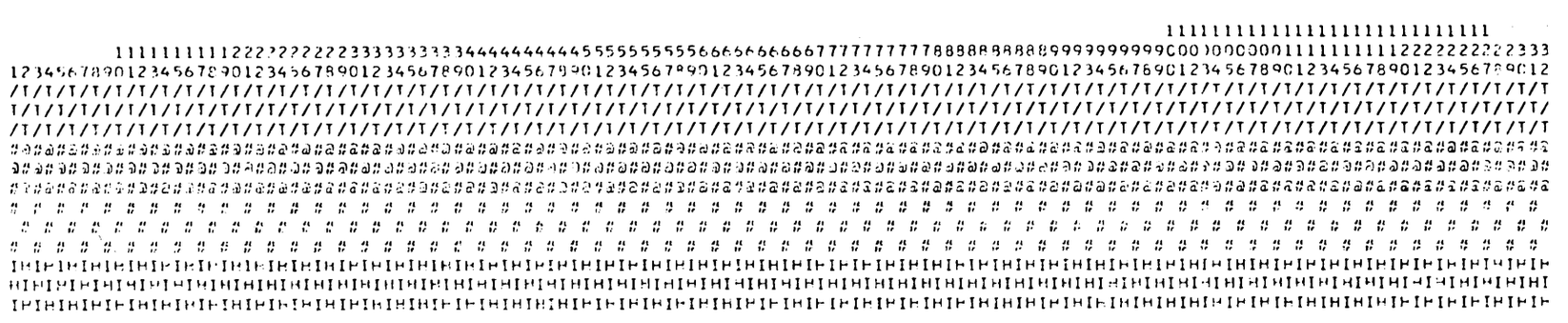
Section 1. 132 Print Test

The program is in Program Storage 2.

Test Data



Correct Printed Output



Program Level 2

NY127A100F5ACQ

- N = No op
- Y = Skip first character
- 127A = Load characters 2 through 128 into the print buffer
- 100F = Reverse bypass to character 29
- 5A = Load 5 characters (29 through 34) into the print buffer
- C = Print, carriage return, line feed
- Q = End of program

Section 2. Leading Zeros Suppression Test

Substitution of asterisks for leading zero and print signed data field test.

Test Data

```
1SECTION 2--LEADING ZERO SUPPRESSION, SUBSTITUTION OF ASTERISKS FOR LEADING ZERO, AND PRINT SIGNED DATA FIELDS TESTS.
1THE PROGRAM IS IN PROGRAM STORAGE 4
400000000011234567890000000000112345678900000000001123456789000000000011234567890000J MINUS AND PLUS 00001
400000000120123456789000000000120123456789000000000120123456789000K MINUS AND PLUS 00002
400000001230012345678000000012300123456780000000012300123456780000L MINUS AND PLUS 00003
400000012340001234567000000123400012345670000001234000123456700000M MINUS AND PLUS 00004
400000123450000123456000001234500001234560000012345000012345600000N MINUS AND PLUS 00005
400001234560000012345000012345600000123450000123456000001234500001234560000001234500000 MINUS AND PLUS 00006
400012345670000001234000123456700000012340001234567000000123400012345670000001234000P MINUS AND PLUS 00007
400123456780000000123001234567800000001230012345678000000012300123456780000000012300000Q MINUS AND PLUS 00008
401234567890000000012012345678900000000120123456789000000001201234567890000000012000OR MINUS AND PLUS 00009
412345678900000000001123456789000000000011234567890000000000112345678900000000000010001  MINUS AND PLUS 00010
```

Correct Printed Output

```
SECTION 2--LEADING ZERO SUPPRESSION, SUBSTITUTION OF ASTERISKS FOR LEADING ZERO, AND PRINT SIGNED DATA FIELDS TESTS.
THE PROGRAM IS IN PROGRAM STORAGE 4

         1  1234567890           1  1234567890  *********1  1234567890  *********1  1234567890  00001- MINUS AND PLUS 00001
        12   123456789          12   123456789  ********12  *123456789  ********12  *123456789  00002- MINUS AND PLUS 00002
       123    12345678         123    12345678  *******123  **12345678  *******123  **12345678  00003- MINUS AND PLUS 00003
      1234     1234567        1234     1234567  ******1234  ***1234567  ******1234  ***1234567  00004- MINUS AND PLUS 00004
     12345      123456       12345      123456  *****12345  ****123456  *****12345  ****123456  00005- MINUS AND PLUS 00005
    123456       12345      123456       12345  ****123456  *****12345  ****123456  *****12345  00006- MINUS AND PLUS 00006
   1234567        1234     1234567        1234  ***1234567  ******1234  ***1234567  ******1234  00007- MINUS AND PLUS 00007
  12345678         123    12345678         123  **12345678  *******123  **12345678  *******123  00008- MINUS AND PLUS 00008
 123456789          12   123456789          12  *123456789  ********12  *123456789  ********12  00009- MINUS AND PLUS 00009
1234567890           1  1234567890           1  1234567890  *********1  1234567890  *********1  00010- MINUS AND PLUS 00010
```

Program Level 4

```
Column     10        20        30        40        50
NY10B2X10B2X10B2X10B2X10Z2X10Z2X10Z2X10Z2X5D16A5DCQ
```

- N = No op.
- Y = Skip first character.
- 10B = Load 10 characters into the print buffer and remove zeros to the left of the significant digit.
- 2X = Load 2 blanks into the print buffer.
- 10Z = Load 10 characters into the print buffer and replace the zeros to the left of the most significant digit with asterisks.
- 5D = Load 5 characters into the print buffer and load a minus sign. If the last character has a D zone, load a blank.
- 16A = Load 16 characters into the print buffer.
- C = Print, carrier return, and line feed
- Q = End of program.

Section 3. Tab Test

Test Data

```
1SECTION 3--TAB TEST.  THE * SHOULD LINE UP WITH THE +.
1THE PROGRAM IS IN PROGRAM STORAGE 5
+     +          +                +                +                +                +
5*******
5*******
5*******
5*******
5*******
```

Correct Printed Output

```
SECTION 3--TAB TEST.  THE * SHOULD LINE UP WITH THE +.
THE PROGRAM IS IN PROGRAM STORAGE 5

+     +          +                +                +                +                +
*     *          *                *                *                *                *
*     *          *                *                *                *                *
*     *          *                *                *                *                *
*     *          *                *                *                *                *
*     *          *                *                *                *                *
```

Program Level 5

NYATA2TA3TA4TA5TA6TACQ

- N = No op
- Y = Skip first character
- A = Load one character into the print buffer
- T = Load enough blanks into the print buffer to get to the indicated tab stop
- C = Print, carriage return, line feed
- Q = End of program

Tab Stops in Program Storage A

End of Forms

Col.	1	6	11	16	19	21	26	31	36	41	46	51	56	61	66	71	76	81	86	91	96	101	106	111	116	121	126
	%	T	T1	J	2	T3	4T	5 O 7	J8.	9T	T	T	T	T	TE	T	T	T	T	T	T	T	T	T	T	T	T

Section 4. Skip Characters and Reverse Bypass Test

Test Data

```
1SECTION 4--SKIP CHARACTERS AND REVERSE BYPASS TEST.  THE NEXT FIVE LINES SHOULD LOOK LIKE THE FIRST LINE.
1THE PROGRAM IS IN PROGRAM STORAGE 6.

Col. 4      9     14    19    24    29    34    39    44
     |      |     |     |     |     |     |     |     |
     1A    2B    3C    4D    5E    6F    7G    8H    9I
6123456789ABCDEFGHI
6123456789ABCDEFGHI
6123456789ABCDEFGHI
6123456789ABCDEFGHI
6123456789ABCDEFGHI
```

Correct Printed Output

```
    SECTION 4--SKIP CHARACTERS AND REVERSE BYPASS TEST.  THE NEXT FIVE LINES SHOULD LOOK LIKE THE FIRST LINE.
    THE PROGRAM IS IN PROGRAM STORAGE 6.

Column 4      9     14    19    24    29    34    39    44
       |      |     |     |     |     |     |     |     |
       1A    2B    3C    4D    5E    6F    7G    8H    9I
       1A    2B    3C    4D    5E    6F    7G    8H    9I
       1A    2B    3C    4D    5E    6F    7G    8H    9I
       1A    2B    3C    4D    5E    6F    7G    8H    9I
       1A    2B    3C    4D    5E    6F    7G    8H    9I
       1A    2B    3C    4D    5E    6F    7G    8H    9I
```

Program Level 6

```
Column      10        20        30        40        50        60        70
            |         |         |         |         |         |         |
NY3XA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YA3X9FA8YACQ
```

- N = No op
- Y = Skip first character
- 3X = Load 3 blanks into the print buffer
- A = Load 1 character into the print buffer
- 8Y = Skip 8 characters
- 9F = Reverse bypass 9 positions
- C = Print, carrier return, line feed
- Q = End of program

Section 5. Read Next Record And Print Disk Address Test

Test Data

```
1SECTION 5--READ NEXT RECORD AND PRINT DISK ADDRESS TESTS.  THE NEXT LINE SHOULD BE 4622 FOLLOWED BY A THRU Z FOLLOWED BY 4721.
1THE PROGRAM IS IN PROGRAM STORAGE 7.
7A
7B
7C
7D
7E
7F
7G
7H
7I
7J
7K
7L
7M
7N
7O
7P
7Q
7R
7S
7T
7U
7V
7W
7X
7Y
7Z
```

Correct Printed Output

```
SECTION 5--READ NEXT RECORD AND PRINT DISK ADDRESS TESTS.  THE NEXT LINE SHOULD BE 4622 FOLLOWED BY A THRU Z FOLLOWED BY 4721.
THE PROGRAM IS IN PROGRAM STORAGE 7.


4622 ABCDEFGHIJKLMNOPQRSTUVWXYZ 4721
```

Program Level 7

```
Column      10        20        30        40        50        60        70        80
            |         |         |         |         |         |         |         |
NYWXARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYARYAXWCQ
```

- N = No op
- Y = Skip first character
- W = Load current disk address into print buffer
- X = Load 1 blank into the print buffer
- A = Load 1 character
- R = Read next record
- C = Print, carrier return, line feed
- Q = End of program

Section 6. Edit Test

Test Data

```
1SECTION 6--EDIT TEST.
1THE PROGRAM IS IN PROGRAM STORAGE 8.
801234567890J23456789012L45678901234N67890123456P890123
845678R01234567890J23456789012L45678901234N67890123456P
800012345678R01234567890J23456789012L45678901234N678901
823456P00012345678R01234567890J23456789012L45678901234N
867890123456P00012345678R01234567890J23456789012L456789
801234N67890123456P00012345678R01234567890J23456789012L
845678901234N67890123456P00012345678R01234567890J234567
889012L45678901234N67890123456P00012345678R01234567890J
823456789012L45678901234N67890123456P00012345678R012345
867890J23456789012L45678901234N67890123456P00012345678R
```

Correct Program Output

```
SECTION 6--EDIT TEST.
THE PROGRAM IS IN PROGRAM STORAGE 8.

  $123.45 $6,789.01 $2,345.67 89/ 1/23 +456,789  -12,345 6  78  9 01 CENTS+ 2,345.67CR 8,901.23
$4,567.89 $  123.45 $6,789.01 23/45/67  890,123  456,789 0  12  3 45 CENTS- 6,789.01   2,345.67DB
    $1.23 $4,567.89 $**123.45 67/89/ 1 +234,567 -890,123 4  56  7 89 CENTS+ 0,123.45CR 6,789.01
$2,345.67 $    1.23 $4,567.89  1/23/45  678,901  234,567 8  90  1 23 CENTS- 4,567.89   0,123.45DB
$6,789.01 $2,345.67 $****1.23 45/67/89  +12,345 -678,901 2  34  5 67 CENTS+ 8,901.23CR 4,567.89
  $123.45 $6,789.01 $2,345.67  0/ 1/23  456,789   12,345 6  78  9 01 CENTS- 2,345.67   8,901.23DB
$4,567.89 $  123.45 $6,789.01 23/45/67    +,123 -456,789 0  12  3 45 CENTS+ 6,789.01CR 2,345.67
$8,901.23 $4,567.89 $**123.45 67/89/ 1  234,567       123 4  56  7 89 CENTS- 0,123.45   6,789.01DB
$2,345.67 $8,901.23 $4,567.89  1/23/45 +678,901 -234,567 0  00  1 23 CENTS+ 4,567.89CR 0,123.45
$6,789.01 $2,345.67 $8,901.23 45/67/89  12,345  678,901 2  34  5 67 CENTS- 0,001.23   4,567.89DB
```

Program Level 8

```
     Y'$$,$$$.99'X'$Z,ZZZ.99'X'$*,***.99'X'Y9/Y9/Y9'X'++++V,999'X'----,999'X'9BB99BB9'X'99" CENTS"S'X'9,999.99CR'X'9,999.99DB'2CQ
col. 1        10        20        30        40        50        60        70        80        90        100       110       120
```

Y	=	Skip first character	'++++V,999'	=	Load 6-digit field with leading + sign into the print buffer (see note)	'9,999.99CR'	= Load 6-digit field with following CR if minus field into the print buffer (see note)
'$$,$$$.99'	=	Load 6-digit field with floating $ into the print buffer	'----,999'	=	Load 6-digit field with - sign into the print buffer (see note)	'9,999.99DB'	= Load 6-digit field with following DB if minus field into the print buffer (see note)
X	=	Load 1 blank into the print buffer	'9BB99BB9'	=	Load 4-digit field with fixed blanks into the print buffer	2C	= Print, carriage return, and two line feeds
'$Z,ZZZ.99'	=	Load 6-digit field with fixed $ and leading blanks into the print buffer	'99"cents"s'	=	Load 2-digit field with cents and a + or - sign into the print buffer (see note)	Q	= End of program
'$*,***.99'	=	Load 6-digit field with fixed $ and leading * into the print buffer					
'Y9/Y9/Y9'	=	Load 6-digit field with slashes and blanks into the print buffer					

Note: For further explanation of the editing capability refer to the *IBM 3741 Data Station Reference Manual*, GA21-9183-1, or *3715 Printer Programs* in Chapter 9 of this manual.

Section 7. Vertical Skip Test

Test Data

```
1SECTION 7--VERTICAL SKIP TEST.
1THE PROGRAM IS IN PROGRAM STORAGE 9.
9*****
9===== SKIP TO 2.  SHOULD BE 1/2 INCH FROM *****.
9===== SKIP TO 3.  SHOULD BE 1 INCH FROM *****.
9===== SKIP TO 4.  SHOULD BE 1 1/2 INCHES FROM *****.
9===== SKIP TO 5.  SHOULD BE 2 INCHES FROM *****.
9===== SKIP TO 6.  SHOULD BE 2 1/2 INCHES FROM *****.
9===== SKIP TO 7.  SHOULD BE 3 INCHES FROM *****.
9===== SKIP TO 8.  SHOULD BE 3 1/2 INCHES FROM *****.
9===== SKIP TO 9.  SHOULD BE 4 INCHES FROM *****.
```

Correct Printed Output

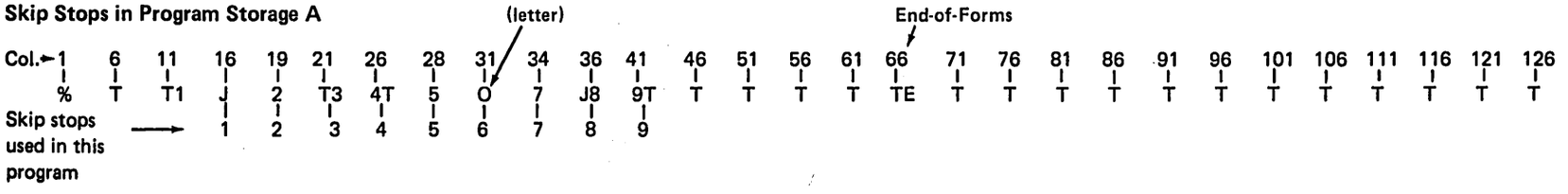
```
SECTION 7--VERTICAL SKIP TEST.
THE PROGRAM IS IN PROGRAM STORAGE 9.


*****


===== SKIP TO 2.  SHOULD BE 1/2 INCH FROM *****.


===== SKIP TO 3.  SHOULD BE 1 INCH FROM *****.


===== SKIP TO 4.  SHOULD BE 1 1/2 INCHES FROM *****.


===== SKIP TO 5.  SHOULD BE 2 INCHES FROM *****.


===== SKIP TO 6.  SHOULD BE 2 1/2 INCHES FROM *****.


===== SKIP TO 7.  SHOULD BE 3 INCHES FROM *****.


===== SKIP TO 8.  SHOULD BE 3 1/2 INCHES FROM *****.


===== SKIP TO 9.  SHOULD BE 4 INCHES FROM *****.
```

Program Level 9

```
Column      10        20        30        40
NY1S5ACRY2S60ACRY3S60ACRY4S60ACRY5S60ACRY6S
60ACRY7S60ACRY8S60ACRY9S60ACRY20C66X14ACSQ
        50        60        70        80
```

- N = No op.
- Y = Skip first character.
- 1S = Skip to number preceding S.
- 5A = Load 5 characters into the print buffer.
- C = Print, carriage return, line feed.
- R = Read next record.
- 20C = 20 line feeds.
- 66X = Load 66 blanks into the print buffer.
- 14A = Load 14 characters into the print buffer.
- Q = End of program.

Skip Stops in Program Storage A



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3715 PRINTER LINE CONTROL EXERCISER PROGRAM

The printer control program causes the print carriage assembly to duplicate movements and conditions equivalent to any customer application program, including Model 3 and 4 operations. It may be used in problem determination of carriage control vertical forms movement related symptoms.

– Turn AUTO REC ADV switch to OFF.
– Insert any valid diskette.
– Press: FUNCT SEL lower
DELETE REC (clears current buffer)
– Key in **N2S128A2L**

N = No op. This starts the printer control program.

2S = Skip to number preceding S (vertical skip control). A character 2 preceding the S means that the program will search out, in program level A, the line to print on. If a line is to be printed on line 1 (top of page), substitute a 1S for the 2S.

128A = Load 128 characters into the print buffer. This can be any number from 1 to 128.

2L = Link to program level 2.

– Press: FUNCT SEL lower
PROG LOAD
1
This loads the first section of the printer control program into program buffer 1 and clears the current buffer for further entries.
– Key in **N128F4A4FC1L**

N = No op. This starts this program.

128F = Reverse bypass to character 1. The number of characters to be reverse bypassed (1 - 128) must agree with the same number keyed in the previous program. Reverse bypass positions or repeats the same characters over and over by moving back an output pointer.

4A = Load 4 characters into the print buffer. (See explanation under 4F.)

4F = Reverse bypass to character 1. 4A4F tells the program to print 4 more characters for 132 print positions. If it were 3A3F, 131 characters would print; 2A2F, 130 characters; etc. Insert this field only if the number of characters to be printed is more than 128.

C = Print, carrier return, and line feed. This prints out the line of data.

1L = Link back to program level 1.

– Press: FUNCT SEL lower
PROG LOAD
2
This loads the second part of the printer control program to program buffer 2 and clears the current buffer for further entries.
– Key in the following:

Position	Data
1	:
5	2
14	2
29	2
30	2
31	2
50	2
67	E

: = Printer will use currently selected program.

2 = Vertical control stop. Each column in which the 2 is entered corresponds to a line on the printed form. If a line is to be printed on line 1 (top of page), substitute 1 for each 2 above.

E = End of vertical forms. This character is placed one position beyond the number of lines per page on each form.

– Press: FUNCT SEL lower
PROG LOAD
A
This loads the vertical forms control program into program buffer A and clears the current buffer for further entries.
– Key in any data to be printed.
– Press: REC BKSP
The number of characters should be equal to the print line length (in this case, 128 characters).
– Press: SEL PROG
1
This indicates which program level to start with when printing begins.
– Press: FUNCT SEL upper
PRINT REC
This starts printing. If more than one print line is desired, turn the AUTO REC ADV switch to ON and press REC ADV. If a pause is desired, turn the AUTO REC ADV switch to OFF.

RFT PROCEDURES AND TDAT (BSCA/EBSCA)

Please read these instructions carefully before proceeding with the RFTs.

If you are experiencing problems on your machine, it is very important to use the MAPs prior to running the RFTs. The MAPs will have you run the RFTs at the proper time. Use MAP 7-7 for both BSCA and EBSCA.

The procedures in this section allow you to do the following:
- Point-to-point checkout (BSCA/EBSCA)
- Multipoint checkout (EBSCA)

The above checkouts can be done with the following options:
- Using existing dial up or modem.
- Using 1200 TDAT to replace the line adapter or 3872.
- Using 1200 TDAT as an acoustic coupler to allow running with your line adapter (under cover modem) to eliminate the line coupler and local loop.
- Recording a test tape using 1200 TDAT.
- Checking offline using a prerecorded test tape and 1200 TDAT.
- Using System/3 LCA (1200 TDAT *cannot* be used).

The flowchart shows the organization of the RFT procedures and options available.

Start of RFT and TDAT Procedures

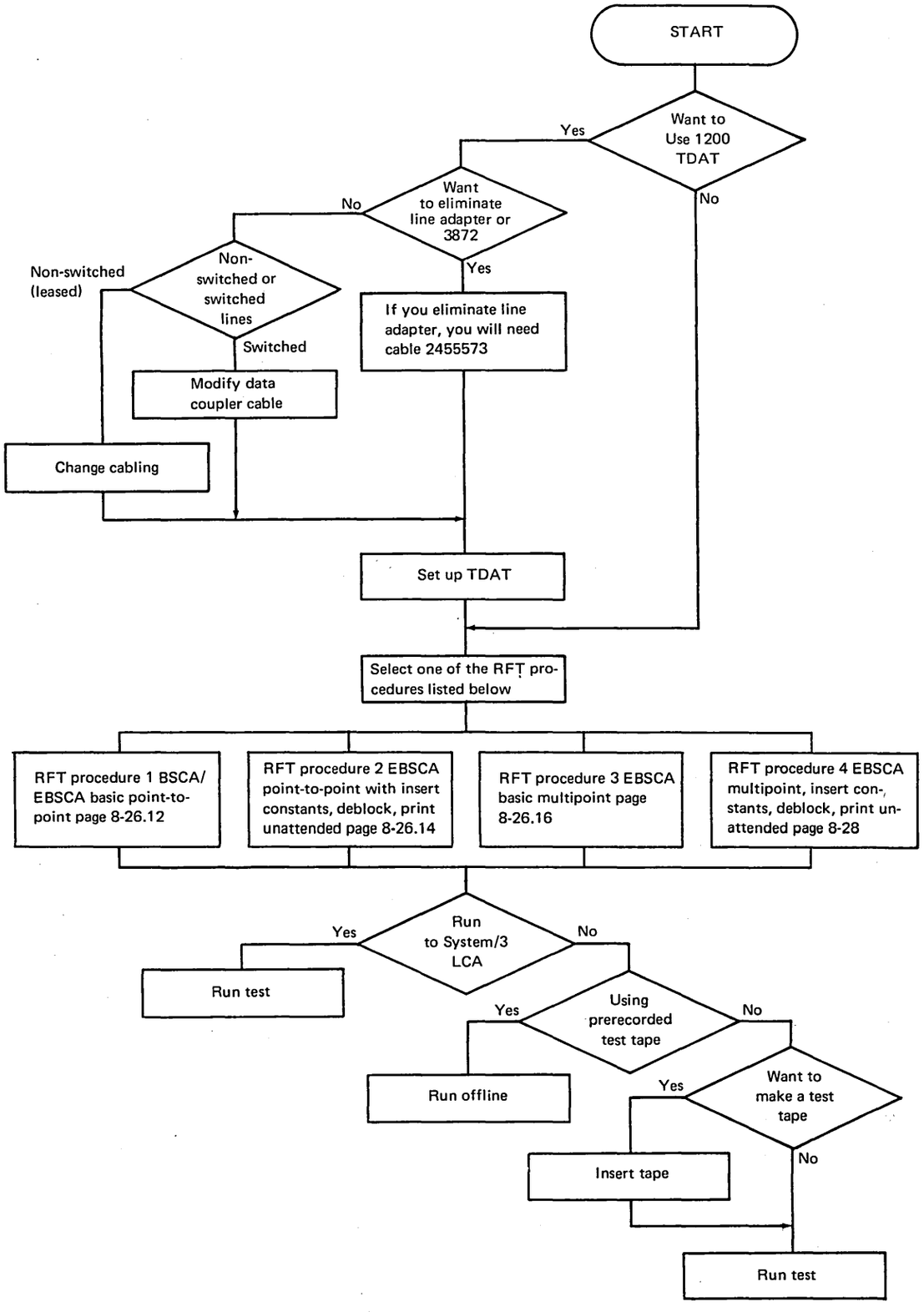
Locate a CPU with 'request for test' (RFT) responder capability.

Do you wish to use a 1200 TDAT?
Y N
| — Go to entry point A on next page.

Do you have a 1200 bps line adapter or a 3872?
Y N
| — Eliminate the external modem to use the 1200 TDAT.

A B

Organizational Flowchart



A B

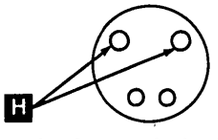
– Disconnect the 3741 modem cable from the modem and plug it into one of the three EIA connectors on the TDAT.
– Go to entry point B on this page.

Do you wish to eliminate the 1200 bps line adapter or the 3872?
Y N
– If using a 3872, it is best to set the mode switch to 1200 NON/SW.

Do you have non-switched (leased) line operation?
Y N
– Check with your local management to see if it is permissible to disconnect the eight wires of the modem cable going to the data coupler.

Is it permissible to disconnect the eight wires?
Y N
– Make up a modified cable using the procedure on page 8-36.2; then return here.
– Go to entry point B on this page.

– Disconnect the eight wires from the data coupler.
– Use a hemostat to attach the DA (yellow) cable lead to the CCT (brown) cable lead.
– Attach one CE meter lead to the DT (white) cable lead, and plug the other end of the lead into one of the holes on the wide side of the 4-prong jack-plug in the TDAT **H** .
– Attach another CE meter lead to the DR (black) cable lead and plug the other end of the lead into the other hole on the wide side of the 4-prong jack-plug in the TDAT **H** .
– Go to entry point B on this page.



– Disconnect the 4-prong jack-plug at the wall and plug it into the jack-plug on the TDAT.
– Plug CTS delay to maximum.
– Go to entry point B on this page.

1

1

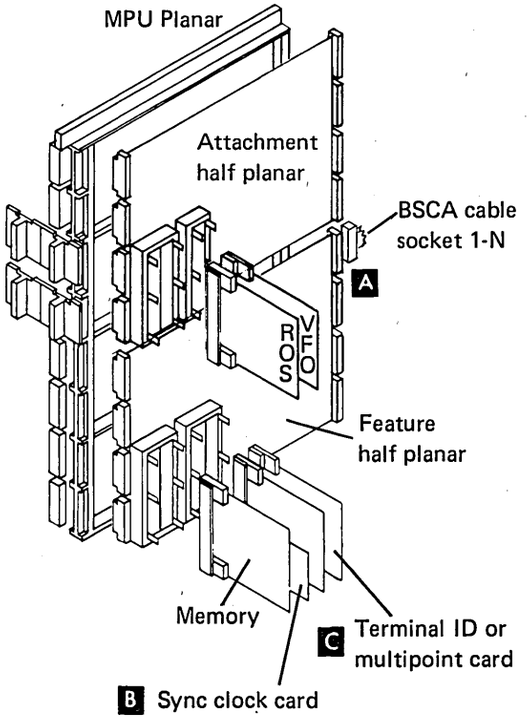
Do you have a line adapter (internal modem)?
Y N
You have a 3872.
– Disconnect the 3741 modem cable at the modem and plug it into one of the three EIA connectors on the TDAT.
– Go to entry point B.

– Disconnect the line adapter (internal modem) cable at socket 1-N on the feature half planar **A** .
– You will need cable 2455573 to complete this procedure. (It is available through the branch office.)
– Connect the SLT connector of cable 2455573 to socket 1-N of the feature half planar. Connect the other end of the cable into one of the three EIA connectors on the TDAT.

ENTRY POINT B

Are you communicating through a modem?
Y N
– Remove the sync clock card **B** .

2



2

– Make sure that the jumpers are plugged as follows (16-4):
4 (BSCA line control) jumper to C (upper) Plug jumper 4 to lower if using a switched 1200 bps line adapter or a switched 3872.
6 (BSCA facility) jumper to F (lower)
– If the 3741 has the multipoint feature and you wish to run RFT 1 or RFT 2, make the following changes:

– Remove the multipoint card.
– Change jumper 8 to NO (upper) on feature half planar.

– Set the TDAT switches as follows:

Switch	Setting
SD-RD	SD
Monitor	OFF
Simulate	DS
Speed	1200
Tape I/O	RCV
Clock	ONE
	Note: Set switch to OFF if communicating through your modem.
Modem	2W
Mode	0-1200
	Note: Set switch to MODEM if communicating through your modem.
Data	NRM
Coupler	OFF

– Connect the TDAT to the power source.
– Power up the TDAT.

ENTRY POINT A

– Now you must select the RFT to be run:

RFT 1, page 8-26.12 BSCA/EBSCA basic point-to-point checkout.

RFT 2, page 8-26.14 EBSCA basic point-to-point checkout. It also tests receive data, insert constants, deblocking, and unattended printing.

RFT 3, page 8-26.16 EBSCA basic multipoint checkout.

RFT 4, page 8-28 EBSCA multipoint checkout with receive data, insert constants, deblocking, and unattended printing.

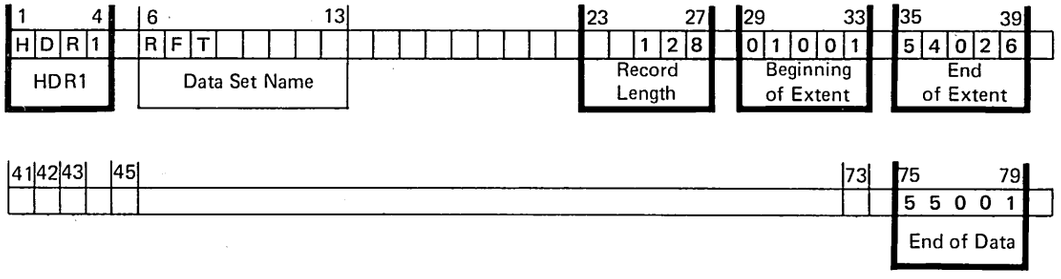
RFT (Request for Test) Procedure 1

This procedure is for BSCA/EBSCA basic point-to-point checkout.

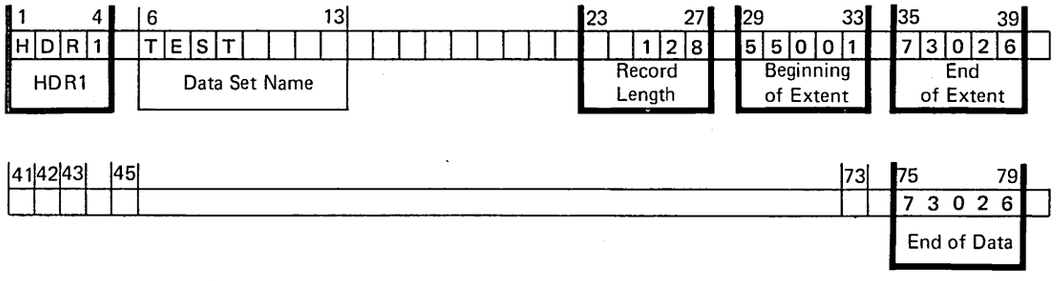
– Power up.
– Load a diskette.

CAUTION
This procedure may alter data on the diskette.

– Check that data set label *00008* is as follows:



– To modify data set label *00008:*
  – Key in the data as shown above.
  – Press: FUNCT SEL lower
    M
    REC ADV
  – Check that the data was correctly entered.
  – Press: REC ADV.
– Check that data set label *00009* is as follows:



– To modify data set label *00009:*
  – Key in the data as shown above.
  – Press: FUNCT SEL lower
    M
    REC ADV
  – Check that the data was correctly entered.
– REC BKSP to data set label *00008.*
– The following steps enter the RFT message.

(1)

(1)

– Press: FUNCT SEL lower
  ENTER
  %
  XX = Two numeric characters to define the test. TEST 14 is recommended.
    14 Receive text, EBCDIC
    01 Transmit/receive
    15 Receive all zeros, weak pattern
    16 Receive alternate zeros and ones
    20 Receive transparent text (80 bytes)
    21 Receive transparent text (120 bytes)
  YY = Two numeric characters to define the number of times the data is to be received. 50 is recommended.
– Hold down NUM SHIFT and press 0 (number).

Are you transmitting transparent data? (Transparent data allows transmission of all 256 characters.)
Y N
– Go to entry point D, on this page.

– Press: HEX
  1 (number)
  0 (number)

ENTRY POINT D

– Press: HEX
  0 (number)
  2
– Enter //NNN3741
  (NNN = Any identifying number expected by a supporting CPU.)
– If the test is 01, enter the alphabet. (Any data could be entered.)

(A)

(A)

- Observe the display; it should show one of the following RFT messages:
  %14500#//NNN3741
  (for recommended test format)
  %01150#//NNN3741ABC. . . etc
  (01 test, nontransparent)
  %01150 ## //NNN3741ABC. ## . . .etc
  (01 test, transparent — data stream may contain HEX characters)
- Press: REC ADV
  FUNCT SEL lower
  RETURN TO INDEX
- If you entered this procedure from a MAP, return to that MAP.
- If you started this procedure from page 8-26.10, continue this procedure.
- Are you communicating with a System/3 with LCA?
  Y N
  - Go to page 8-30.
  - Go to page 8-32.

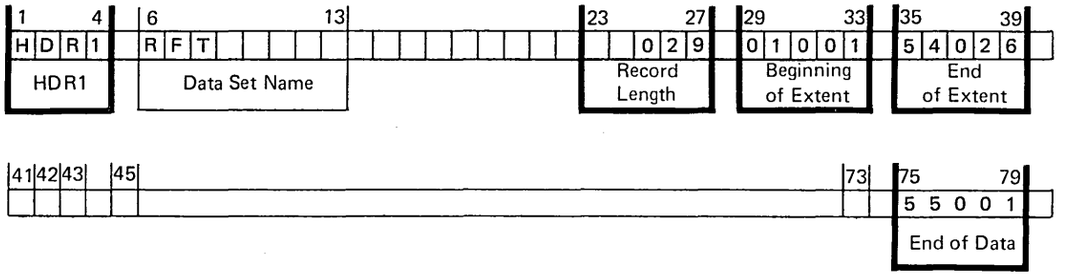
RFT (Request for Test) Procedure 2

This procedure is only for EBSCA basic point-to-point checkout. It also tests receive data, insert constants, deblocking, and print unattended.

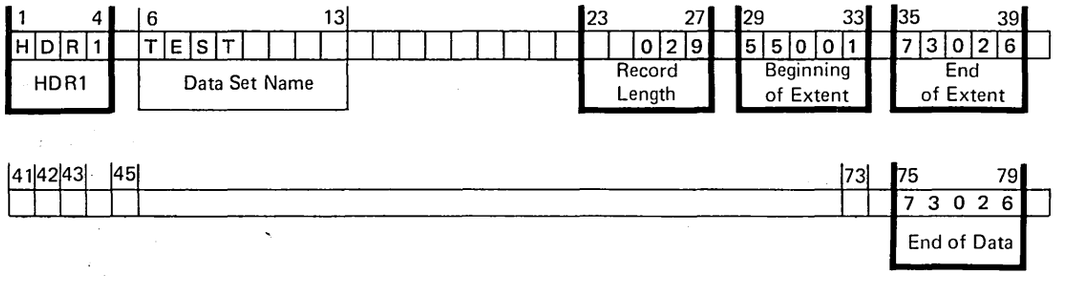
- Power up.
- Load a diskette.

CAUTION
This procedure may alter data on the diskette.

- Check that data set label *00008* is as follows:



- To modify data set label *00008:*
  - Key in data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that data was correctly entered.
  - Press: REC ADV.
- Check that data set label *00009* is as follows:



- To modify data set label *00009:*
  - Key in the data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that the data was correctly entered.

(1)

(1)

- REC BKSP to data set label *00008.*
- The following steps insert constants.
- Press: FUNCT SEL lower
  DELETE REC
- Enter
  >>>>>>>>>␣NUMBER␣>␣ON–LINE␣TEST␣
  9>'s, blank, Pad blanks to end of record
- Press: FUNCT SEL lower
  PROG LOAD
  8
  FUNCT SEL lower
  RETURN TO INDEX
- The following steps enter the RFT message.
- Press: FUNCT SEL lower
  ENTER
  %
- Press: 0 (number)
  1 (number)
  (01 = transmit/receive test)
- Press:
  YY = Two numeric characters to define the number of times the data is to be received. (50 is recommended.)
- Hold down NUM SHIFT and press 0 (number).
- Press: HEX
  0 (number)
  2
- Enter //NNN3741A
  (NNN = Any identifying number expected by a supporting CPU.)
- Press: HEX
  1 (number)
  E
- Enter
  TESTING␣␣B
- Press: HEX
  1 (number)
  E
- Observe the display; it should show the following RFT message:
  %01500 ╫ //NNN3741A ╫ TESTING␣␣B ╫
- Press: REC ADV
  FUNCT SEL lower
  RETURN TO INDEX

(A)

A

- If you entered this procedure from a MAP, return to that MAP.
- If you started this procedure from page 8-26.10, continue this procedure.
- Are you communicating with a System/3 with LCA?

  Y N

  Y — Go to page 8-30.

  N — Go to page 8-32.

RFT (Request for Test) Procedure 3

This procedure is for EBSCA basic multipoint checkout.

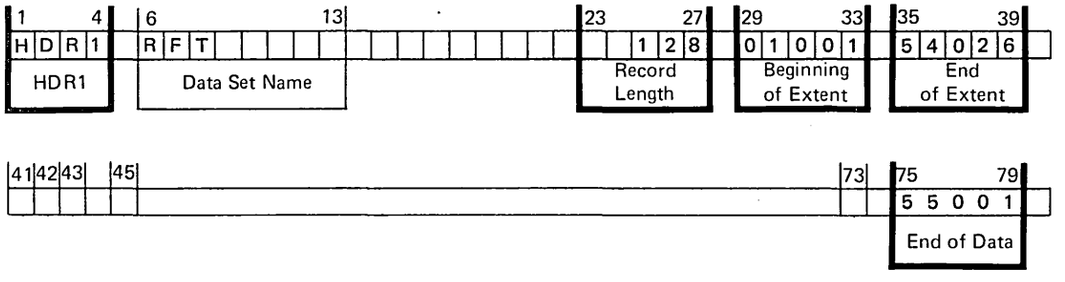
Note: If the 3741 has multipoint but you wish to run without it, remove the multipoint card from sockets 1-Y and 1-Z on the feature half planar (504) and move jumper 8 to the NO position (up) (16-4). Then use RFT 1 (8-26.12) or RFT 2 (8-26.14).

It may be necessary to change the polling address if the testing is with a different CPU. (For example, you may have to change your polling address character to EBCDIC upper case A (HEX C1) if the CPU only polls AA in RFT responder (or OLT) mode.) See 759.

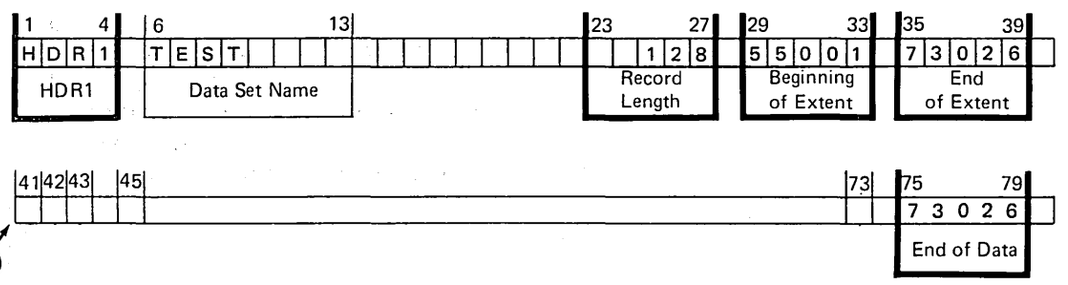
- Power up.
- Load a diskette.

CAUTION
This procedure may alter data on the diskette.

- Check that data set label *00008* is as follows:



- To modify data set label *00008:*
  - Key in the data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that the data was correctly entered.
- Press: REC ADV.
- Check that data set label *00009* is as follows:



(1)

(1)

- To modify data set label *00009:*
  - Key in the data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that the data was correctly entered.
- REC BKSP to data set label *00008.*
- The following enters the RFT message:
- Press: FUNCT SEL lower
  ENTER
  %
  XX = Two numeric characters to define the test. TEST 14 is recommended.
    - 14 Receive test, EBCDIC
    - 01 Transmit/receive
    - 15 Receive all zeros, weak pattern
    - 16 Receive alternate zeros and ones
    - 20 Receive transparent text (80 bytes)
    - 21 Receive transparent text (120 bytes)

  YY = Two numeric characters to define the number of times the data is to be received. 50 is recommended.
- Hold down NUM SHIFT and press 2.
- Enter the character selection address of the 3741. (HEX 81 is used here as an example.)
- Press: HEX
  8
  1 (number)
  HEX
  8
  1 (number)

(A)

A

Are you transmitting transparent data? (Transparent data allows transmission of all 256 characters.)

Y N

— Go to entry point E on this page.

— Press: HEX
1 (number)
0 (number)

ENTRY POINT E

— Press: HEX
0 (number)
2

— Enter the following data:
//NNN3741
(NNN = Any identifying number expected by a supporting CPU.)

— If you selected test 01, enter the alphabet. (Any data may be entered.)

— Observe the display, it should show one of the following RFT messages:
%14502### //NNN3741
(recommended test)
%01502### //NNN3741ABC . . . etc
(01 test, nontransparent)
%01502###### //NNN3741ABC## . . . etc
(01 test, transparent — HEX within the data stream)

— Press: REC ADV
FUNCT SEL lower
RETURN TO INDEX

— If you entered this procedure from a MAP, return to that MAP.

— If you started this procedure from page 8-26.10, continue this procedure.

Are you communicating with a System/3 LCA?

Y N

— Go to page 8-30.

— Go to page 8-32.

RFT (Request for Test) Procedure 4

This procedure is for EBSCA multipoint check-out with receive data, insert constants, de-blocking, and print unattended.

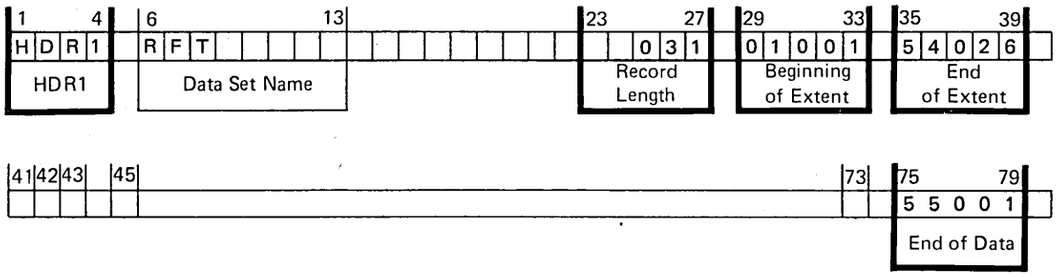
Note: If the 3741 has multipoint, but you wish to run without it, remove the multipoint card from socket 1-Y and 1-Z on the feature half planar (504) and move jumper 8 to the NO position (up) (16-4). Then use RFT 1 (8-26.12) or RFT 2 (8-26.14).

It may be necessary to change the machine polling address if you are testing with a different CPU. (For example, you may have to change the polling address to EBCDIC upper case A (HEX C1) if the CPU polls only AA in RFT responder (or OLT) mode.) See 759.

- Power up.
- Load a diskette.

CAUTION
This procedure may alter data on the diskette.

- Check that data set label *00008* is as follows:

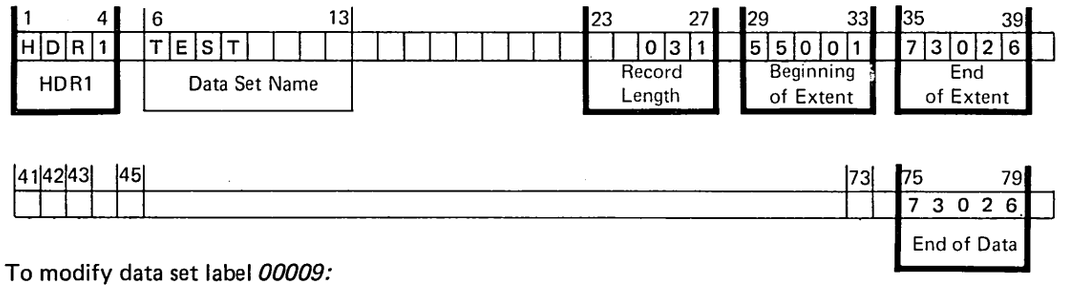


- To modify data set label *00008:*
  - Key in the data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that the data was correctly entered.
- Press REC ADV.

(1)

(1)

- Check that data set label *00009* is as follows:



- To modify data set label *00009:*
  - Key in the data as shown above.
  - Press: FUNCT SEL lower
    M
    REC ADV
  - Check that the data was correctly entered.
- REC BKSP to data set label *00008.*
- The following steps insert constants.
- Press: FUNCT SEL lower
  DELETE REC

(2)

(2)

- Enter:
  >>>>>>>>>>␣NUMBER␣>␣ON-LINE␣TEST␣.
  9>'s blank Pad blanks to end of record
- Press: FUNCT SEL lower
  PROG LOAD
  8
  FUNCT SEL lower
  RETURN TO INDEX
- The following steps enter the RFT message.
- Press: FUNCT SEL lower
  ENTER
  %
  0 (number)
  1 (number)
  (01 = Transmit/receive test)
- Press:
  YY = two numeric characters to define the number of times the data is to be received. 50 is recommended.
- Hold down NUM SHIFT and press 2.
- Enter the 2-character selection address of your 3741. (HEX 81 is used here as an example.)
- Press: HEX
  8
  1 (number)
  HEX
  8
  1 (number)
- Press: HEX
  0 (number)
  2

(A)

A

- Enter the following data:
  //NNN3741A
  (NNN = Any identifying number expected by a supporting CPU.)
- Press: HEX
  1 (number)
  E
- Enter the following data:
  TESTINGØØB
- Press: HEX
  1 (number)
  E
- Observe the display; it should show the following RFT message:
  %01502#### //NNN3741 ## TESTINGØØB ##
- Press: REC ADV
  FUNCT SEL lower
  RETURN TO INDEX
- If you entered this procedure from a MAP, return to that MAP.
- If you entered this procedure from page 8-26.10, continue with this procedure.

Are you communicating to a System/3 with LCA?

Y N

- Y: Go to page 8-30.
- N: Go to page 8-32.

Are you using a prerecorded test tape and TDAT? (offline mode)

Y N

- If you want to record a test tape, place the cassette in the recorder and rewind to the beginning of the tape.
- To place the 3741 in transmit mode:
  Press: FUNCT SEL lower
  COMM
- If you are running RFT *1 or 3:*
  Press: M (M bids for the line)
  T or P (P if transparent data is to be transmitted)
- If you are running RFT *2 or 4:*

With Unattended Printing	**Without Printing**
Set AUTO REC ADV SW	Press M
Press FUNCT SEL upper	B
PRINT TO EOD	
M	
B	

(M bids for the line)

- If the 3741 is in TB or PB mode, press REC ADV.

Is the 3741 in T, P, or B mode?

Y N

- Go to MAP 7-7.

Are you using a 1200 TDAT?

Y N

- Call remote end.
- Go to data after the steady tone (answer tone) by hanging up the handset **C** .
- Go to entry point C on this page.

- *Note:* Read through the next four steps to acquaint yourself with the procedure, you will have only 20 seconds to complete it.

- Call the remote end. After you get a steady tone, go to data by placing the handset securely on the acoustic coupler cups. Observe the cord-side orientation by the cups **C** .
- If you are recording a test tape, place the recorder in record mode by pressing and holding the red REC button while pushing the center switch forward.

(1)

(1)

- Set the TDAT coupler switch to ON.
- If you have a switched line and are running through your modem:

  - Momentarily touch the RI (violet) cable lead to DA (yellow)/CCT (brown) cable leads (these are shorted by the hemostats); or, if you have made up your own cable, momentarily press the microswitch button on the 4-prong jack-plug.

ENTRY POINT C

Did the job run to completion?
(% C displayed)

Y N

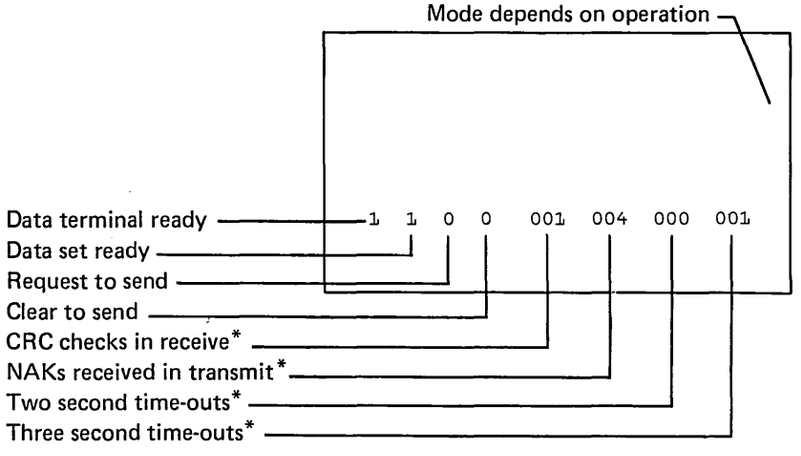
- Stop the recorder if making a test tape.
- Remove the handset and talk with someone at the remote end to define the problem.

Does the remote end have problems?

Y N

- Check your setup instructions. Retry the procedure. If the problems persists after two tries, use MAP 7-7.

C When you go to data, the error logout line at the bottom of the display will show:



Note: 1 indicates on; 0 indicates off.
* Three-position decimal counter.

The cursor moves from the bottom right corner, across the screen (one line at a time) to the upper left corner.

A B C

A B C

- Hang up and wait until the remote end is ready to communicate again; then retry the procedure.

- The test has run to completion indicating the 3741 is OK.
- Stop the recorder if making a test tape. You should now have a good test tape to use in a service situation.
- If you are using the TDAT:
  - Hang up the telephone handset.
  - Power down the 3741.
  - Reconnect the 3741 modem cable.

- Power down the 3741.
- Reinstall the multipoint card, if it was removed.
- Reinstall the sync clock card, if it was removed.
- Return the jumpers to their original positions on the feature half planar.
- The 3741 is OK. If the customer still has problems, it is probably due to:
  - Incorrect setup or procedures.
  - Incorrect remote end setup or programming.
  - Communications facilities, modems, or lines.

- Place a recorded test tape in the tape player.
- Rewind to start of tape.
- To place the 3741 in communications mode:

  - Press: FUNCT SEL upper
    COMM

- If you are using unattended printing:
  - Put AUTO REC ADV switch to ON
  - Press: FUNCT SEL lower
    PRINT TO EOD
- Press: R (receive mode)
- Start the tape player in playback mode.

③

③

Did the job run to completion?
(% C displayed)
Y N

- Check your setup instructions and retry the procedure. If it fails after 2 tries, make a new test tape and try this procedure again. If it still fails, go to MAP 7-7.

- The test has run to completion indicating the 3741 is OK.
- Stop the tape recorder.
- Hold down NUM SHIFT while pressing RESET.
- Power down the 3741.
- Reconnect the 3741 modem cable.
- Reinstall the sync clock card if it was removed.
- Return jumpers to original positions on the feature half planar.
- Reinstall the multipoint card if it was removed.
- The 3741 is OK. If the customer still has problems, it is probably due to:
  - Incorrect setup procedures.
  - Incorrect remote setup or programming.
  - Communications facilities, modems, or lines.

– To place the 3741 in transmit mode:
  Press: FUNCT SEL upper
  COMM
  M
  T or P (P if transparent data is to be transmitted)
– If the 3741 is in TB or PB mode:
  Press: REC ADV.

Is the 3741 in T or P mode?
Y N
– Go to MAP 7-7.

– The 3741 is now ready to communicate.
– Set up the System/3, refer to System/3 documentation for diagnostic 80A RFT procedure. Also refer to 729 in this manual.

Did the job run to completion?
(% C displayed)
Y N
– Check your setup instructions. Retry the procedure; if it still fails, use MAP 7-7.

– The test has run to completion indicating the 3741 is OK.

DIAGNOSTIC AIDS EXPANDED COMMUNICATIONS (EBSCA) TEST PROCEDURES

Test Procedures Number	Test
1	Transmit Continuous Character
2	Cable wrap
3	Modem wrap (IBM 3872 Modem)
4	Receive and Display Characters
5	Display Terminal ID or Multipoint Address
6	Display Transmit Buffers

Test 1 — Transmit Continuous Character

Test 1 is used to transmit a continuous character or sequence of characters.

To set up the test:

- Enter 1 followed by 1 to 14 data characters to be transmitted.
- Press FUNCT SEL upper
  COMM
  W

The machine monitors for 'data set ready'. When it detects 'data set ready' is on, it raises 'request-to-send' and waits for 'clear-to-send'. After 'clear-to-send' comes on, the adapter sends an initial

P P P S S
A A A Y Y
D D D N N

followed by the entered data characters. It repeats the characters without requiring any response, until the RESET key is pressed. When setting up the test, the cursor must be past column 2, or an H error will be posted.

Possible applications include:
- Sending Test Patterns
- Sending Test Sequences

Sending Test Patterns

Test patterns can be set up for probing the transmit data line or integrated modem transmit line frequencies.

To send an all zeros signal (space):
- Enter 1
- Press HEX
  0
  0
- Press FUNCT SEL upper
  COMM
  W

After the initial

P P P S S
A A A Y Y
D D D N N

the adapter sends continuous hex '00' characters. This is a solid logical 0 level (positive voltage) on transmit data pin 1-N-B12, and a 2100-Hz frequency on the integrated modem output.

To send an all ones signal (mark):
- Enter 1
- Press HEX
  F
  F
- Press FUNCT SEL upper
  COMM
  W

After sending initial PADs and SYNs, the adapter sends continuous hex 'FF' characters. This is a solid logical 1 level (negative voltage on transmit-data pin 1-N-B12, and a 1300-Hz frequency on the integrated modem output.

By entering hex 'AA' or '55' instead of '00' or 'FF', the adapter sends alternating ones-zeros down the line.

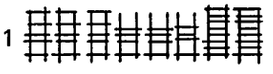
Sending Test Sequences

This test can be used to send a continuous line bid sequence,

P P P S S E P P
A A A Y Y N A A
D D D N N Q D D

- Enter 1
- Press the following three times:
  HEX
  A
  A
- Press the following two times:
  HEX
  3
  2
- Press HEX
  2
  D
- Press the following two times:
  HEX
  F
  F

The display should show:

1 

- Press FUNCT SEL upper
  COMM
  W

The adapter sends this sequence continuously. A remote device could be checked to see that it receives the sequence, establishes character phase, recognizes ENQ, and attempts to respond.

If the remote terminal requires terminal ID, that could be entered between the SYN and ENQ characters.

This test can be used in conjunction with test 4 to display received characters.

- Enter 1
- Press the following three times:
  HEX
  A
  A
- Press the following two times:
  HEX
  3
  2
- Press A
  B
  C
  D
  E
  F
- Press FUNCT SEL upper
  COMM
  W

If the remote end 3741 was set up in test 4, the receiving station should be displaying the A, B, C, D, E, F characters.

Test 2 – Cable Wrap

The cable wrap test requires that the modem or BSCA cable be removed from the modem and the appropriate wrap adapter be installed.

To initiate the test:
- Enter 2
- Press FUNCT SEL upper
  COMM
  W

The adapter generates three tests:

1. It generates a serial-by-bit test sequence on transmit data line which is wrapped back to receive data. This received data is shifted into the BSCA SERDES and establishes character sync, character buffering, and CRC generation on receive.

2. It then loads a sequence of bytes, as in transmit mode, and monitors the transmit data line to ensure that the correct serial bits are transmitted. This checks the character buffering, CRC generation, and SERDES in a transmit operation.

3. If the multipoint feature is installed, it generates a serial-by-bit selection sequence. When the machine adapter correctly decodes the selection, it causes the audible alarm to sound.

A successful test results in posting WC and (if multipoint is installed) sounding the audible alarm. The audible alarm automatically turns off after about five seconds.

If WI is posted, or W is still displayed after two seconds, or WC is posted but the alarm fails to sound or turn off (if multipoint is installed), a hardware failure is indicated.

Test 3 — Modem Wrap

This test causes a local wrap on an IBM 3872 modem.

To initiate the test:
- Enter 3
- Press FUNCT SEL upper
  COMM
  W

The adapter raises the '+test' line to the 3872 to make a local loop. The adapter then generates a logic 1 level for one minute and monitors the output (received data). It then generates a logic 0 level and monitors the output. If the machine posts a WI and returns to index (X R) mode in less than 1-1/2 minutes, or posts a W error that remains after 2-1/2 minutes, an error exists. If the test is completed without error, it automatically returns to read index (X R) mode in about 2 minutes. This test checks the transmit, scrambler, de-scrambler, and receives functions in the 3872. When the test is in progress, the OPERATE light comes on in the 3872.

Test 4 — Receive and Display Characters

This test provides the capability to display characters received at the communications adapter interface.

To initiate this test:
- Enter 4
- Press FUNCT SEL upper
  COMM
  W

After 'data set ready' comes on, the adapter waits for characters sync to be established.

(received
P P S S
A A Y Y
D D N N)

After character sync, all subsequent received characters are displayed. Pressing any key, except RESET, during the test causes the test to stop so that particular characters can be examined. Pressing that key again allows the test to continue. Pressing the RESET key causes the test to terminate.

This test can be used to receive and display data with test 1 being used on the remote end as described in Test 1.

It can also be used to check IDs or addresses sent from the remote end. If the remote end sends

P P S S E P
A A Y Y ABCD N A
D D N N Q D,

the test will display ABCD where ABCD is the address or ID.

In this way the ID or address can be checked.

Note: The test generates no responses to this line bid.

If character sync is first established, this test displays, with the following exceptions, all data on the line:

1. The initial
   P P S S
   A A Y Y
   D D N N
   required to establish character phase is not displayed.

2. Any characters after an ENQ (hex '2D') are not displayed. An ENQ causes the adapter to abort character sync so that another
   P P S S
   A A Y Y
   D D N N
   sequence is required before additional characters are displayed.

3. Characters after a CRC checking sequence are not displayed, character phase is aborted, and another
   P P S S
   A A Y Y
   D D N N
   sequence is required.

A CRC checking sequence is started by receiving a STX, SOH, or DLE-STX character and is ended by receiving ETB, ETX, DLE-ETB or DLE-ETX characters. The two bytes following the ending characters are assumed to be the block check characters (BCC). The adapter compares its computed BCC to the two bytes received. If they compare, it displays a single hex '00' byte in place of the BCCs. If they do not compare, the adapter displays a single, hex 'FF' character.

Note: The BCCs are never displayed and character phase is aborted after the BCCs.

4. Once character synchronization is established, all characters received in that transmission will be displayed correctly. If another transmission is received, it may not be displayed correctly because the test does not reset character synchronization between transmissions. For example, if a remote station sent an EOT sequence, stopped transmitting, and then sent a poll sequence, only the EOT sequence would be displayed correctly because the test did not reset character synchronization between transmissions. However, if the remote station sent the EOT and poll sequences as one transmission, it would all be displayed correctly. In test 4, a continuous sequence should be sent and received.

Pressing any key, except RESET, during the test causes the test to pause such that the particular characters being displayed can be examined. Pressing that key again causes the test to continue and subsequent received characters are displayed. Pressing the RESET key causes the test to terminate and return to read index mode.

Test 5 — Display Terminal ID or Multipoint Address Characters

This test allows the machine to display the terminal ID characters jumpered on the terminal ID feature card or the multipoint address card.

— To perform the test:
— Enter 5
— Press FUNCT SEL upper
COMM
W
The characters will be displayed.

If multipoint is installed (multipoint jumper on installed position and address card installed), the test displays the poll address character jumpered on the card, followed by the corresponding select character. Note that in normal multipoint addressing, the character (poll or select) must be sent twice.

If the terminal ID feature is installed, the test displays the three ID characters jumpered on the feature card. For example, if lower case abc were jumpered on the card, the hex character representation would be displayed. Also, the complete ID for the machine would be vabc. The lower case v denotes the terminal as a 3741 with the remaining three characters identifying the particular 3741.

If neither feature is installed, the test should display three hex '00' characters denoting no address characters for the machine.

Pressing the RESET key causes a return to read index mode.

Test 6 — Display Transmit Buffers

This test provides the capability to check the transmit selected records, transmit selected fields, and record blocking functions.

The basic operator procedures are:
— Set up a transmit selected records or transmit selected fields program in format buffer 8.
— Position the diskette at the desired data set either in read index or update mode.
— Enter 6 in column 1 of the current record buffer.
— Press FUNCT SEL upper
COMM
W

The machine reads until the first 512-byte buffer is filled or until all the records in the data set are read. The format buffers (2, 1, 4, 3) can then be displayed using CE mode (display buffers) or by using select program mode. Note that only the first 512-byte buffer is filled whereas two 512-byte buffers are used in communications. The following examples illustrate the detailed operation of the test.

Example 1

Using transmit selected records program and displaying using select program mode:
— Power off, wait 5 seconds, and power on (to clear buffers).
— Set up a test data set whose record length is 63 and enter the following 9 records using the enter function. Refer to page 9-4 to find how to create or modify data set labels.

Column

```
123456789 10                                  63
Record 1  AAAAA.....\AAAAAAAAAAA
Record 2  BBBBBB.....BBBBBBBBBBBB
Record 3  AAAAA.....AAAAAAAAAAA
Record 4  BBBBB'.....BBBBBBBBBBBB
Record 5  AAAA.....\AAAAAAAAAAA\
Record 6  BBBBL.....BBBBBBBBBBBB
Record 7  AAAA/.....\AAAAAAAAAAA
Record 8  BBBBBBl.....BBBBBBBBBBB
Record 9  AAAAA.....\AAAAAAAAAAA
```

(columns 10 through 63 are A's, B's etc.)

Press FUNCT SEL lower
RET TO INDEX

This data is used for both example 1 and 2.

— Perform the following sequence to enter the transmit selected records program:
— Press FUNCT SEL lower
DELETE RECORD
— Enter the following mask —

```
1        9 10 11                          63
========= A ============/ /=======
```

where columns 1 through 9 are =, column 10 is A, and columns 11 through 63 are =.

— Press FUNCT SEL lower
PROG LOAD
8
FUNCT SEL lower
RET TO INDEX
— Record backspace or advance to the test data set.
— Enter 6.
— Press FUNCT SEL upper
COMM
W

The machine reads the test records comparing each to the mask. Those that match are written to the 512-byte buffer.

After the test goes to completion (returns to read index mode), use the following sequence to display the data in select program mode.

– Press SEL PROG
  2
  FUNCT SEL lower
  DISPLAY PROG

This display shows record 1 followed by an IRS (hex '1E') character followed by record 3 and an IRS in format buffer 2.

Note: Record 2 was not read into buffer and would not be transmitted because it did not match the program in buffer 8.

– Press SEL PROG
  1

The display shows record 5 followed by an IRS, followed by record 7 and an IRS in format buffer 1.

– Press SEL PROG
  4

This causes the next 128-byte section of the buffer (format buffer 4) to be displayed containing record 9, the last record of the data set. The remainder is empty (contains N's).

– Press SEL PROG
  3

This causes the last 128-byte section (format buffer 3) to be displayed which is empty (N's).

Note: Because the buffers are being displayed as format buffers, certain data such as numerics cannot be the first character in the buffer. Attempting to display these will result in an error.

In this case the alternative method of displaying the buffers described in the next example should be used.

This test demonstrates that only those records that match the mask (contain an A in column 10) are buffered up to be transmitted.

Example 2

Using transmit selected fields program and displaying using CE mode (display buffers).

– Power off, wait 5 seconds, and power on (to clear buffers).
– Use data set and data previously entered in example 1.
– Perform the following sequence to enter the transmit selected fields program:
– Press FUNCT SEL lower
  DELETE REC
– Enter the following mask:

```
1      67                              63
''''''"""""""".....................
```

  where 1 through 6 are apostrophes and 7 through 63 are quotes.
– Press FUNCT SEL lower
  PROG LOAD
  8
– Press FUNCT SEL lower
  RET TO INDEX
– Record advance or record backspace to the test data set.
– Enter 6
– Press FUNCT SEL upper
  COMM
  W

The machine reads the test records checking each against the mask. The masked-off positions are written in the 512-byte buffer.

After the test goes to completion (returns to read index mode), use the following sequence to display the data using CE mode (display buffers).

– Press FUNCT SEL lower.
– Hold down NUM SHIFT and press C (should be in CER mode).
– Release NUM SHIFT.
– Hold down NUM SHIFT and press I (letter).
– Press the space bar six times.

The machine is now displaying buffer 2.

The display shows the 1 and A's from record 1 followed by an IRS (hex '1E'), followed by the 2 and B's from record 2 and an IRS, followed by the 3 from record 3.

Note: Using this mode only the first 120 of the 128 bytes of the buffer can be displayed.

– Press the space bar.

The machine is now displaying buffer 1.

The display shows the A's from record 3 followed by an IRS, followed by the 4 and B's from record 4 and an IRS, followed by the 5 and A's from record 5.

– Press the space bar.

The machine is now displaying buffer 4.

The display shows the remaining A's from record 5 followed by an IRS, the 6 and B's from record 6 followed by an IRS, and the 7 and a portion of the A's from record 7.

– Press the space bar.

The machine is now displaying buffer 3.

The display shows the remaining A's from record 7 followed by an IRS, and the 8 and B's from record 8 followed by an IRS and N's indicating no data. The remaining blank positions were not sufficient (48 positions) to hold the portion of record 9 and an IRS (57 characters).

This test demonstrates that only those portions of the records required by the mask are loaded to the buffer to be transmitted.

This test may be used on any data, using any valid transmit selected records or transmit selected fields program to verify the masking and buffering that is performed. Keep in mind, however, that not all data can be displayed using select program mode; and, if CE mode (display buffers) is used, only the first 120 bytes of each 128-byte buffer can be displayed.

ONLINE 1200 bps LINE ADAPTER CABLE TEST

The following is a procedure for modifying the 1200 bps line adapter cable to:

1. Adapt the cable to use the 1200 TDAT acoustic coupler section.
2. Run the 3741 Model 2 to a CPU with RFT capability.
3. Run the 1200 TDAT, using the modified cable, to check out the 1200 bps integrated modem.

– Order from local parts the required material to make up the test cable:

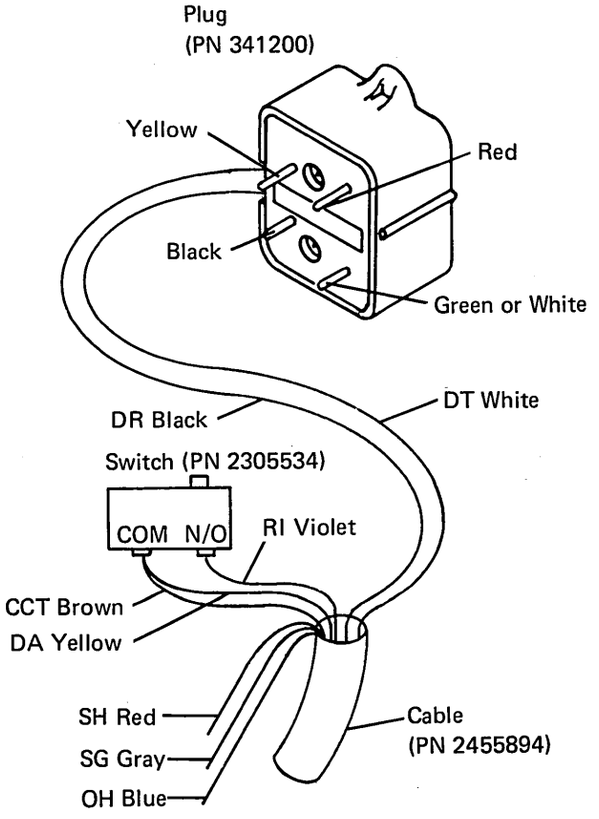
1. 1200 bps line adapter cable (PN 2455894)
2. Plug (PN 341200)
3. Switch (PN 2305534)

– Connect the cable to the plug and microswitch as follows:

1. Cut the spade clips from all eight cable wires.
2. Connect them as follows:
   a. Black and white to the red and green (wide-spaced pair of pins on the jack plug).
   b. Brown and yellow to the microswitch common.
   c. Violet to the microswitch N/O.
   d. Red, gray, and blue are spares. Tape them back along the cable body.

You now have a modified switched line adapter cable to use in running the 3741 on a switched line via the 1200 TDAT.

Cable Wires Used	Color
Data tip (DT)	White
Data ring (DR)	Black
Data modem ready (DA)	Yellow
Coupler cut through (CCT)	Brown
Ring indicator (RI)	Violet



1200 bps Line Adapter/TDAT Test Procedure

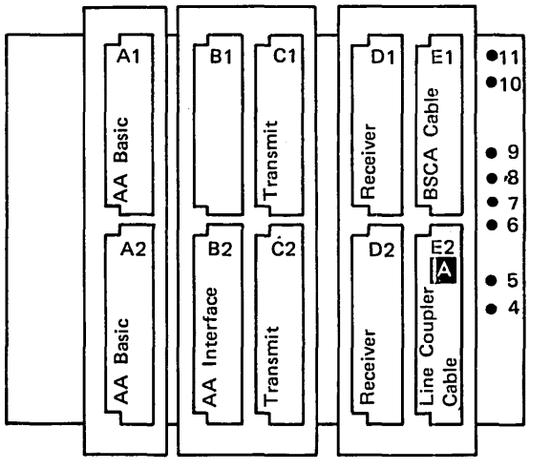
See page 8-26.10 for comprehensive test procedure.

1. On the feature half planar, change jumper 4 to up and all other BSCA jumpers to down **B** .

2. Remove the SLT connector from the E2 socket on the switched line adapter board **A** .

3. Plug the SLT connector on the modified 1200 bps (switched line) adapter cable into the E2 socket of the switched line adapter board **A** .

4. Plug the telephone jack plug on the modified adapter cable into the TDAT.



Line Adapter Board

5. Set the TDAT switches as follows:

   SD-RD to SD
   SIMULATE to DS
   TAPE I/O to RCV
   MODEM to 2W
   DATA to NRM
   MONITOR to OFF
   SPEED to 1200
   CLOCK to OFF
   MODE to MODEM
   COUPLER to OFF

   Then power on the TDAT.

6. Insert the modified diskette to head label 00008 (request for test). (Page 7-28 shows how to make up a request for test data set.)

7. Place the 3741 in transmit mode:

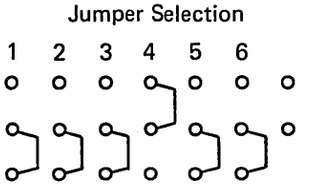
   Press: FUNCT SEL upper
   COMM
   M
   T

8. Call the remote end.

9. When the remote end goes to DATA:
   a. Place the handset in the acoustic-coupler.
   b. Turn the TDAT coupler switch to ON.
   c. Momentarily press the switch button on the switch.

10. The test should run to completion and display %C in the upper right corner of the screen.

B



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1200 bps Line Adapter Receive Level Check Procedures

Non-switched Line BSCA

To make this check CEs must be at the transmit station and at the receive station. They also must be in verbal contact with each other throughout the procedure. The transmit station is the station that will send the signal to be checked; the receive station is the station where the signal level is to be checked.

Before making this check, verify that the transmit signal level is correct at both the transmit station and at the receive station (see Non-switched Line Transmit Level Adjustment Procedure).

Tools Needed: dB meter, Part 453545
jumper, Part 5159491*

* shipped with machine

READ THIS ENTIRE PROCEDURE BEFORE PERFORMING CHECK

Procedure — Transmit Station

1. Turn machine power on.
2. Insert diskette and position disk to any valid data set label using REC ADV or REC BKSP.
3. Press FUNC SEL UPPER and COMM (C mode **A**).
4. Press R key (R mode, **B**); this is done intentionally so 3741 does not send inquiry.
5. Jumper pin 4 to 6 on line adapter board (request-to-send to ground, **C**) and wait until the CE at the receive station is finished checking receive level.

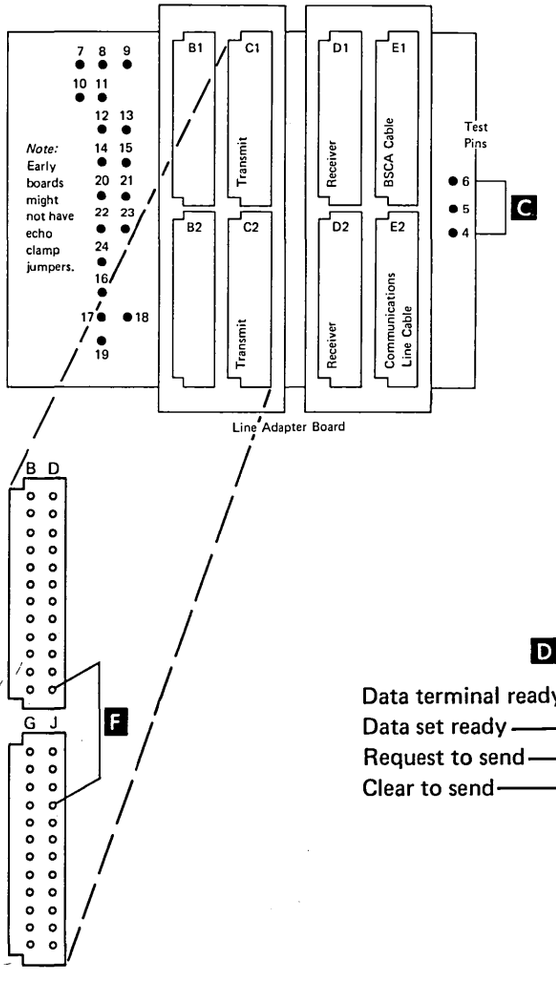
   Note: When the jumper between pin 4 and 6 is in place, request-to-send is 0 and clear-to-send is 1 on the status line (**D**).

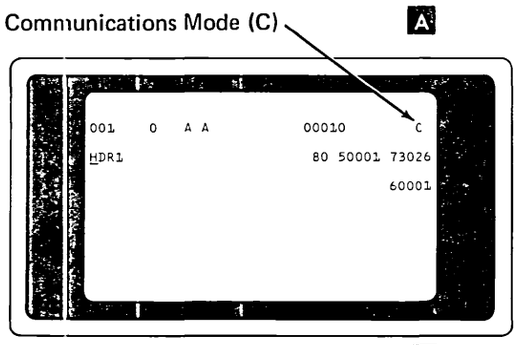
The above procedure checks line loss at 1300 Hz (mark = 1 = minus EIA level). The next step checks line loss at 2100 Hz (space = 0 = plus EIA level).

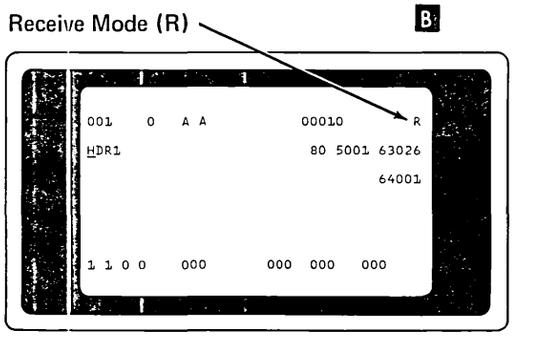
6. Jumper C1-J04 ('transmit data') to C1-D13 (CTS) on the pin side of the modem board **F** . Wait until the CE at the receive station is finished checking receive level.

   Note: These procedures allow checking for high and low frequency roll-off.

7. After check is complete, remove jumpers from pins 4 and 6 on the line adapter board, and from C1-D13 and C1-J04 on the modem board.
8. Press RESET to return machine to XR mode **E** .
9. Remove diskette.

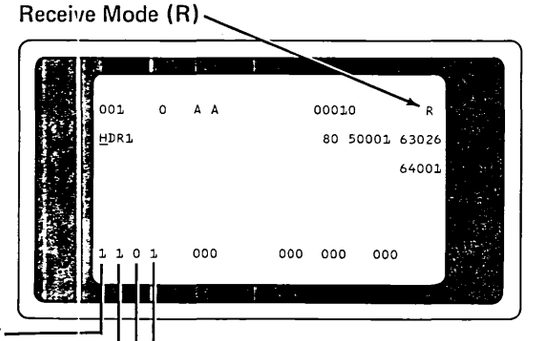


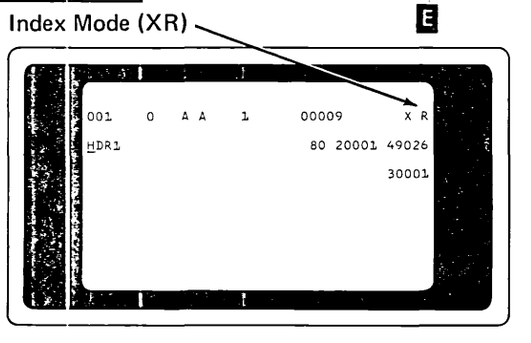




Test Pin Designation

Pin	Line Name
4	Ground
5	-Wrap unclamp
6	-Request-to-send





EC 826065			PN 1619580
Date 8/1/75			

Procedure — Receive Station

1. Turn machine power on.

2. Insert diskette and position disk to any valid data set label using REC ADV or REC BKSP.

3. Press FUNC SEL UPPER and COMM (C mode F).

4. Press R (R mode, G).

5. Remove the communication line plug (283B plug, H) from its outlet.

6. Remove cover from the communication line plug (283B, J).

7. Install communication line plug in its outlet.

8. Set the dB meter bridge, 600, 324 switch to the bridge position and turn dB meter power on (ref K).

9. Check 2W/4W jumpering on line adapter board (L).

   If jumpered 2W go to step 10.
   If jumpered 4W go to step 11.

10. Connect meter leads from the line terminals *on the dB meter* P to the red wire and the green or white wire on the communication line plug (terminals farthest apart M). Go to step 12.

11. Connect meter leads from the line terminals *on the dB meter* P to the black and yellow wires on the communication line plug (terminals closest together, N).

12. After the CE at the transmit station jumpers request-to-send on (causing carrier to be transmitted), receive level can be observed. At an agreed-upon time, the CE at the transmit station will send a space frequency (2100 Hz). To interpret the dB level, algebraically add the values of the dB meter needle indication to the numeric value indicated by the setting of the add dial:

   Example: -5 on dial
   -10 on meter
   -15 dBm

   A good operating level is between -10 dBm and -20 dBm.

   Note: The receive sensitivity of the mini-12 non-switched modem is -33 dBm. Receive sensitivity is defined as the lowest possible signal level received on a communication line before circuits in the modem reject it as noise. On the mini-12 non-switched modem, a receive signal below -33 dBm is considered unacceptable. Check both mark (1300 Hz) and space (2100 Hz) for receive level.

13. If the transmit level at the transmit level at the transmit station is correct, and the receive level at the receive station is *not* correct, the common carrier must be called to correct the problem.

14. After check is complete, press RESET to return machine to XR mode (ref R).

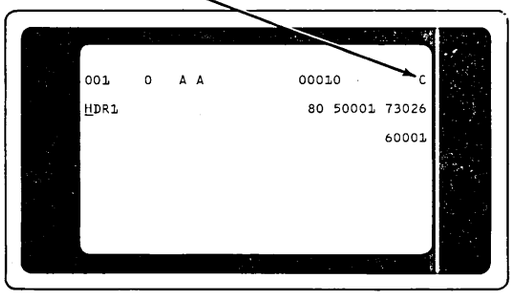
    Note: RESET key may have to be pressed several times.

15. Remove dB meter leads from the communication line plug.

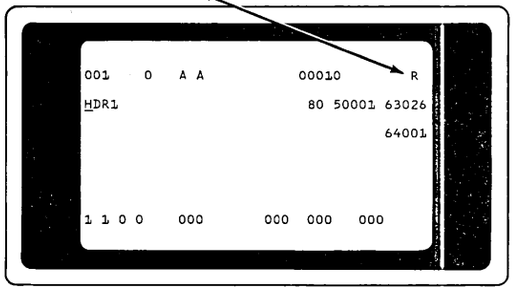
16. Replace cover on the communication line plug.

17. Remove diskette from machine.

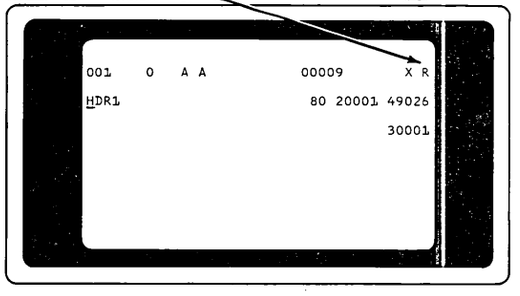
Comm Mode (C) **F**



Receive Mode (R) **G**

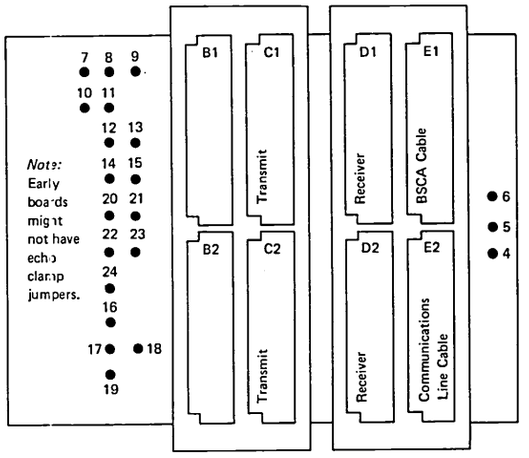


Index Mode (XR) **R**



2 Wire — 4 Wire

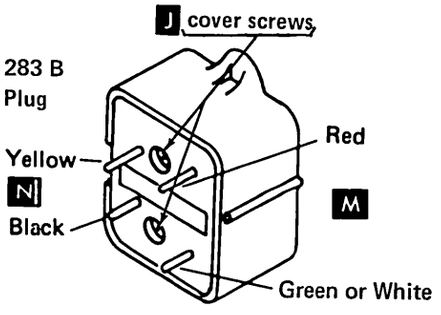
For 2 Wire	For 4 Wire
8 to 9	7 to 8
12 to 13	10 to 11
14 to 15	



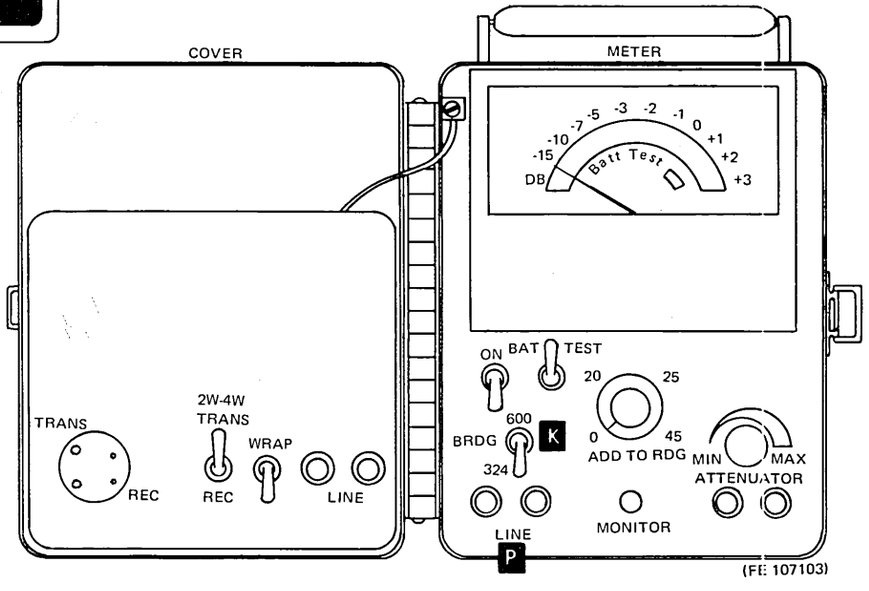
Line Adapter Board

Use		With	
Echo Clamp Delay	Jumpered	Clear to Send (CTS) Delay	Jumpered
130 ms	20 to 21 and 22 to 23	200 ms	17 to 19
50 ms	20 to 21 and 22 to 24	75 ms	17 to 18
0 ms	22 to 23	25 ms	17 to 16

CAUTION
The short delay combinations might cause intermittent echo problems.



H Communication Line Plug



dB Meter

EC 826065			PN 1619582
8/1/75			

Switched Line BSCA

To make this check, CEs must be at the transmit station and at the receive station. They also must be in verbal contact with each other throughout the procedure. The transmit station is the station that will send the signal to be checked; the receive station is the station where the signal level is to be checked.

Before making this check, verify that the transmit signal level is correct at both the transmit station and at the receive station (see Switched Line Transmit Level Adjustment Procedure).

Tools needed: dB meter, part 453545
jumper, part 5159491*

* Shipped with machine

READ THIS ENTIRE PROCEDURE BEFORE PERFORMING CHECK

Procedure: Transmit Station

1. Turn machine power on.
2. Insert diskette and position disk to any valid data set label using REC ADV or REC BKSP.
3. Press FUNC SEL UPPER and COMM (C mode **A**).
4. Press T key (T mode, **B**).
5. Wait for call from receive station.
6. After the connection has been made between the receive station and the transmit station (indication on 3741 screen's status line is DTR and DSR set to 1), jumper pin 6 to 7 (request-to-send to ground on the line adapter board **C** .

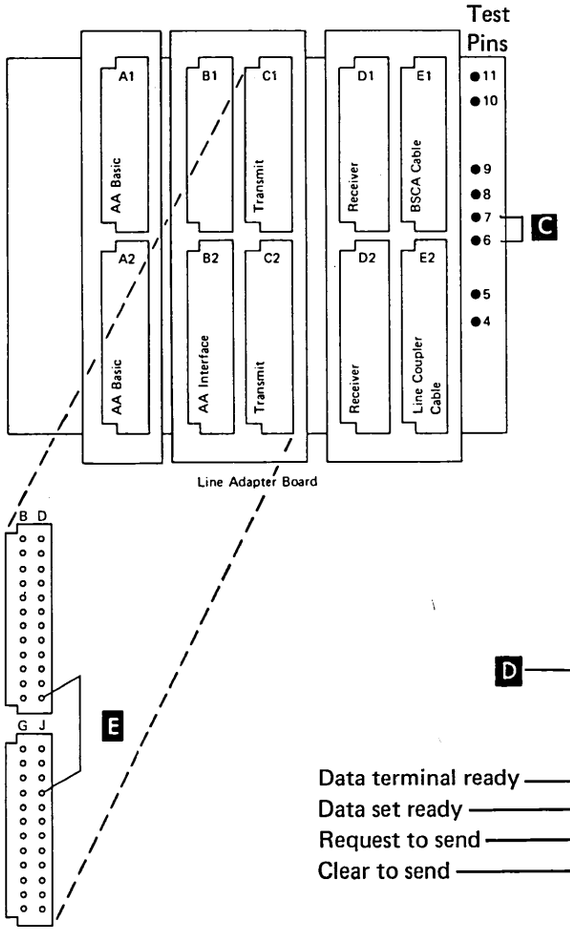
   Note: The entire status line does not display until data set ready becomes active.

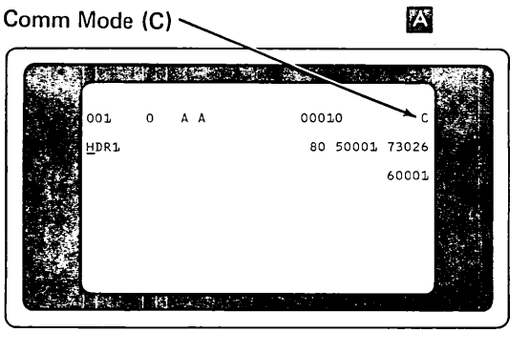
   When jumper between pin 6 and 7 is in place request-to-send is 0 and clear-to-send is 1 on the status line **D** .
7. Wait until CE at receive station is finished checking receive level.

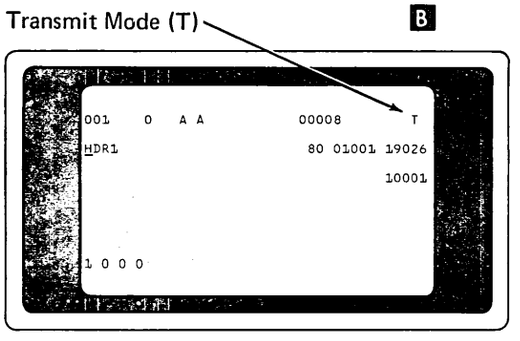
The above procedure checks line loss at 1300 Hz (mark = 1 = minus EIA level). The next step checks line loss at 2100 Hz (space = 0 = plus EIA level).

8. Jumper C1-J04 ('transmit data') to C1-D13 (CTS) on the pin side of the modem board **E** . Wait until CE at the receive station is finished checking receive level.

   Note: These procedures allow checking for high and low frequency roll-off.
9. After check is complete, remove jumpers from pins 4 and 6 on line adapter board, and from C1-D13 and C1-J04 on the modem board.
10. Reset machine (press RESET key).
11. Remove diskette.

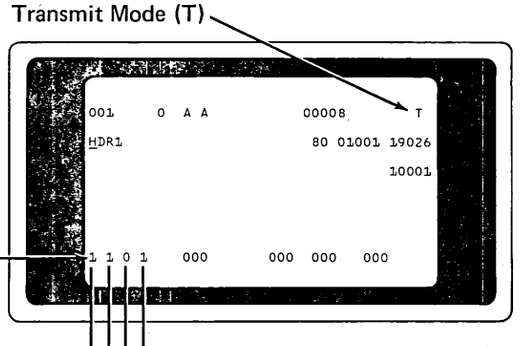






Test Pin Designation

Pin	Line Name
4	Data set ready
5	+ Data set ready to modem
6	Ground
7	- Request to send
8	Data tip
9	- Wrap unclamp
10	Ground
11	Data ring



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Procedure: Receive Station

READ THIS ENTIRE PROCEDURE BEFORE PERFORMING CHECK

1. Turn machine power off.
2. Remove jumper 6 on half planar board from position E and install jumper in the F position (ref **A**).
3. Set the dB meter bridge, 600, 324 switch to the bridge position and turn dB meter power on **B** .
4. Connect meter leads from the line terminals *on the dB meter* **C** to the DT and DR spade clips on the coupler (*do not* connect leads to the locking screws for the spade clips).
5. Turn machine power on.
6. Insert diskette and position disk to any valid data set label using REC ADV or REC BKSP.
7. Press FUNC SEL UPPER and COMM (C mode **D**).
8. Press R key **E** .
9. Raise exclusion key and dial transmit station.
10. After answertone has stopped, place handset in cradle. ('Data set ready' becomes active **G**).
11. Transmit station CE will jumper request-to-send on causing carrier to be transmitted to the receive station. At an agreed-upon time, the transmit station CE will transmit a space frequency (2100 Hz).
12. Signal level can now be observed on the dB meter. To interpret the dB level, algebraically add the value of the dB meter needle indication to the numeric value indicated by the setting of the add dial:

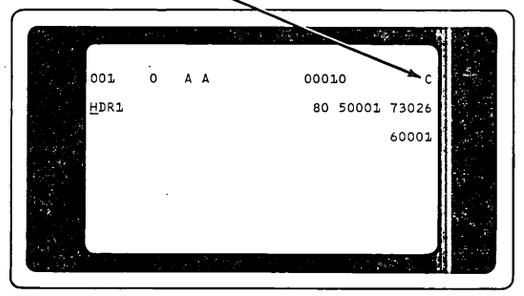
Example:	-5 on dial	-5
	-10 on meter	+2
	-15 dBm	-3 dBm

A good operating level is between -15 dBm and -27 dBm. Check both mark (1300 Hz) and space (2100 Hz) for receive level.

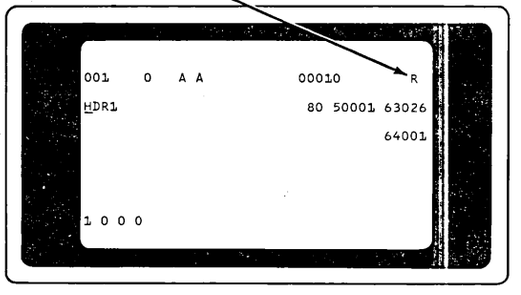
Note: The receive sensitivity of the 1200 bps switched modem is -43 dBm. Receive sensitivity is defined as the lowest possible signal level received on a communication line before circuits in the modem reject it as noise. On the 1200 bps switched modem, a receive signal level below -43 dBm is considered unacceptable.

13. If the transmit level at the transmit station is correct and the receive level at the receive station is *not* correct, the common carrier must be called to correct the problem.
14. After the check is complete, press RESET to return to XR mode **F** .
15. Remove diskette.
16. Turn machine power off.
17. Remove jumper 6 on the featue half planar from position F and install jumper in the E position **A** .
18. Remove dB meter leads from the DT and DR spade clips on the coupler.

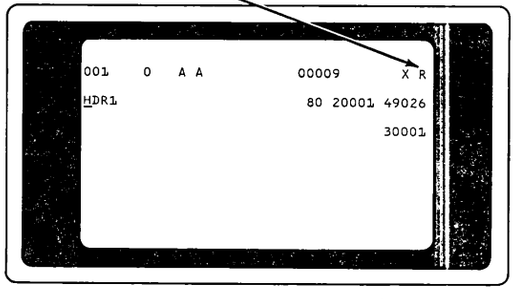
Comm Mode (C) D



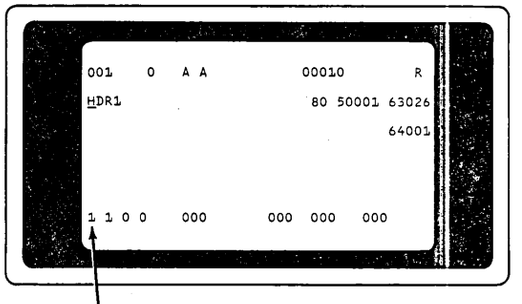
Receive Mode (R) E



Index Mode (XR) F

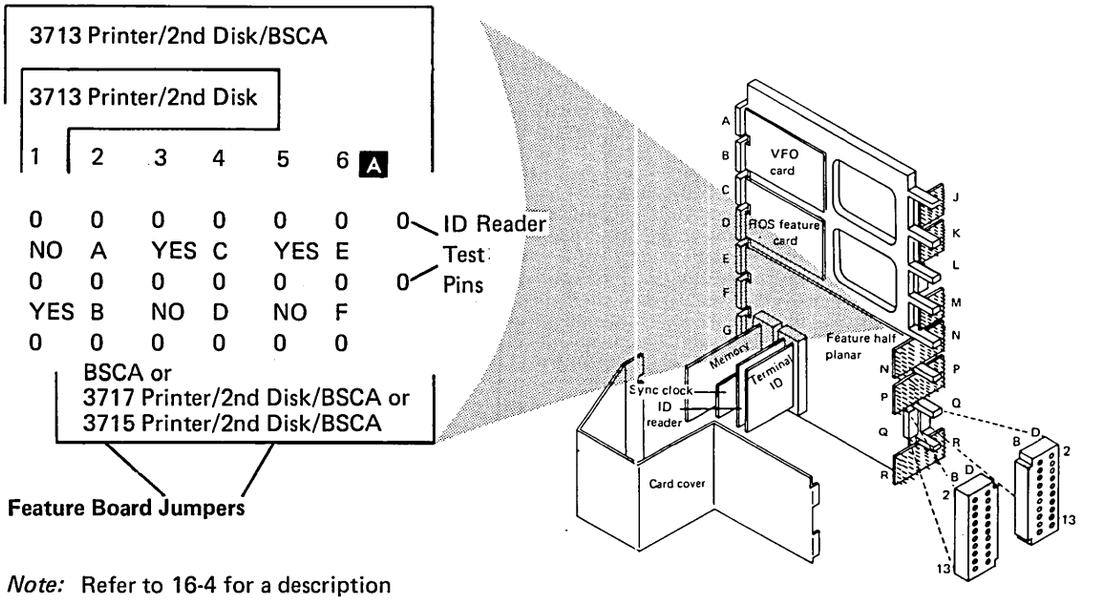


Receive Mode (R)

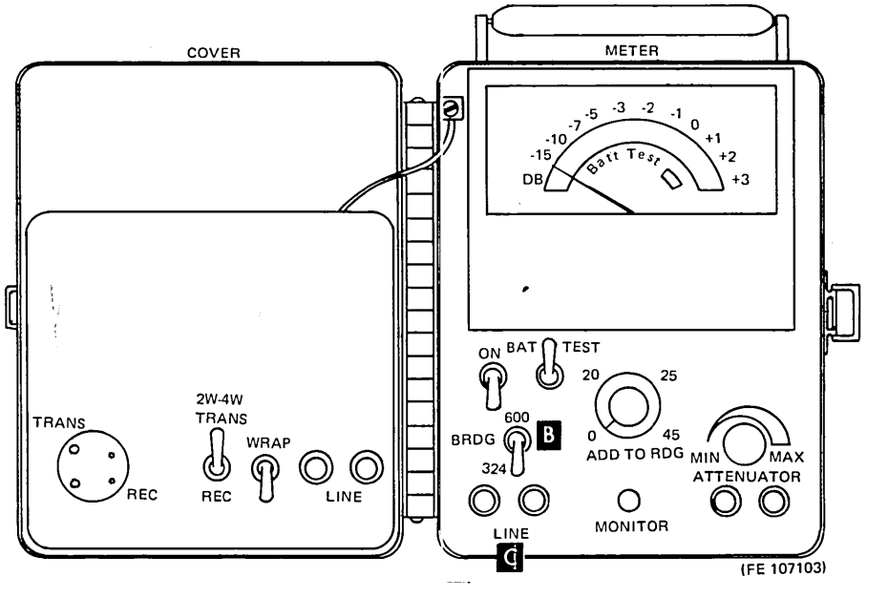


G

Note: Depending on features installed all jumper positions may not be present.



Note: Refer to 16-4 for a description of 3715 printer jumper locations.



EC 826065			PN 1619586
8/1/75			

Service Aids — 3741 With 1200 bps Line Adapter/CBS Coupler

Connection of the 3741 or 3747 with 1200 bps line adapter to the switched telephone network requires a data access arrangement (DAA) type CBS, usually referred to as a "coupler". The coupler is provided and installed by the telephone company. Most commonly used coupler types are the GDC 1001A, or Western Electric 1001A (series 5 or later, or equivalent).

Two options are available on the coupler. They must be specified by the customer when ordering and strapped by the telephone company when installing:

1. Line controlled by coupler. This allows the transfer of data when the handset of the attached telephone is cradled.

2. Ringer connected on the line side of the exclusion key. This causes the telephone to ring on an incoming call.

Special Considerations:

1. The couplers must be mounted vertically on a flat vertical surface because of mercury relays in the coupler. (This may change with newer models of couplers.)

2. The telephone company must strap the coupler for a predetermined transmit level for each installation and indicate this level on the cover of the coupler. The attaching 1200 bps line adapter must be adjusted to this indicated dB level (transmit card *and* autoanswer card). If the level is not indicated on the coupler's cover, advise the customer to contact the telephone company for this information.

3. CBS type couplers have their own power supply (standard). The customer provides a suitably located AC outlet.

4. Do not remove the coupler covers. The points of demarcation are the terminal lugs attached to the interface cable from the 1200 bps line adapter.

5. The cable from the 1200 bps line adapter to the coupler is supplied by IBM with the line adapter.

When defining CBS coupler interface problems, the points of demarcation are the terminal lugs attached to the cable end at the CBS coupler. Under no conditions should the coupler's cover be removed, or any attempt be made to meter or scope signals within the coupler.

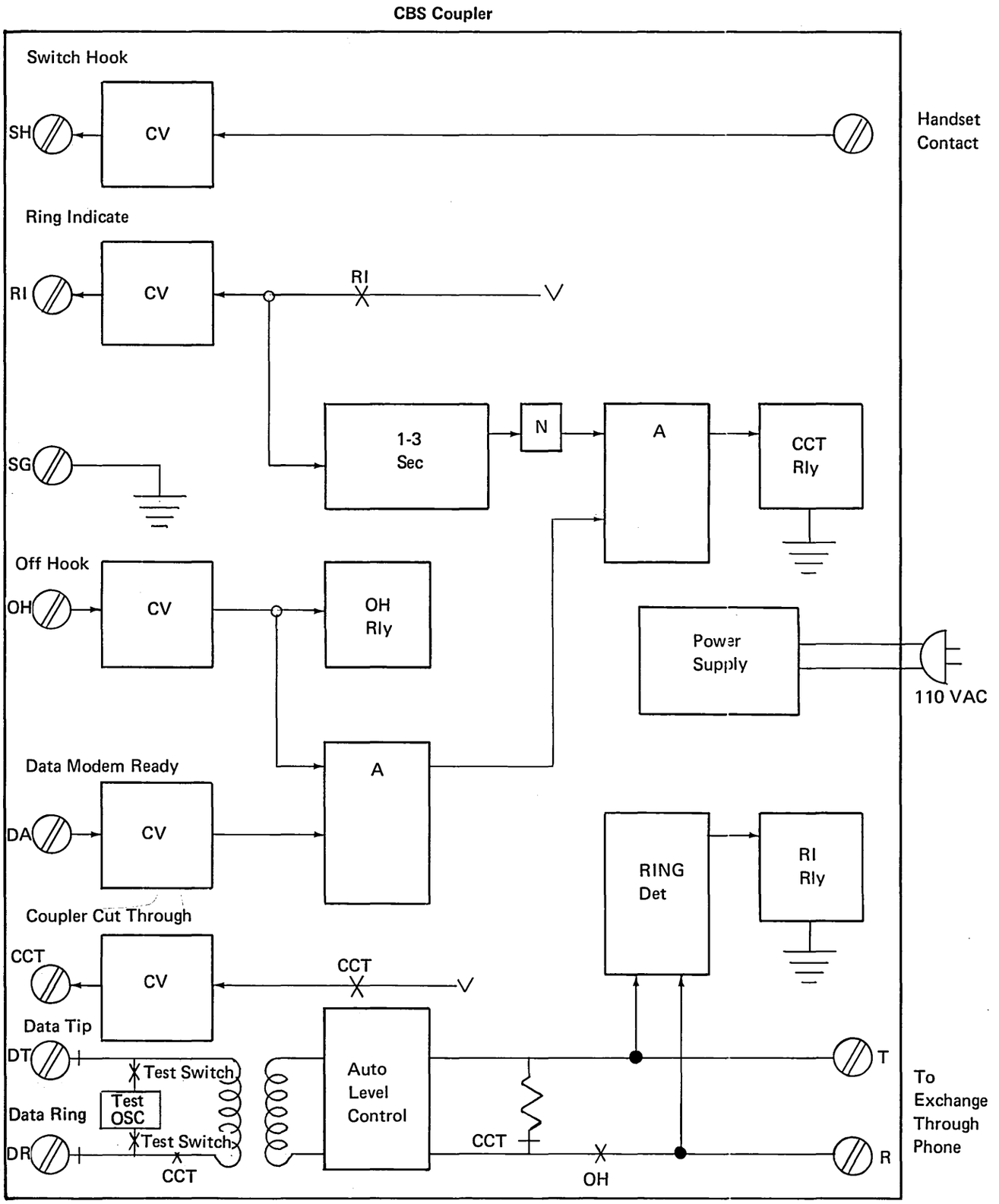
When a problem is defined to the coupler, it is the customer's responsibility to contact the telephone company for corrective action.

The following procedures will be helpful in defining a problem on the coupler interface.

Note: Valid voltages for an EIA interface are:

+3 to +25 volts range for *up* level
-3 to -25 volts range for *down* level

The voltage swing usually found on coupler interface leads is +8 volts up level to -8 volts down level with a small amount of AC ripple except on data tip and data ring.



EC 826065			PN 1619588
Date 8/1/75			

Operation Sequences

A. Manual Call Sequence

	Action	Interface Results
1.	3741: Place in communicate mode (transmit or receive) 3747: Ready with a control diskette to 0406 state	SH = down OH = down CCT = down DA = up (tied to +12 volts) RI = down
2.	Lift handset	SH = up OH = up CCT = up within 10 ms of OH going up (normal) but not more than 200 ms DA = up RI = down
3.	Raise exclusion key	No change from 2 above. Listen for dial tone.
4.	Replace handset	SH = down OH = down when 3741/3747 times out CCT = down after OH goes down DA = up RI = down

B. Manual Answer Sequence

	Action	Interface Results
1.	3741/3747 power on but *not* set up for communicate mode	SH = down OH = down CCT = down DA = up (tied to +12 volts) RI = down
2.	Call the coupler from the nearest phone	Phone rings SH = down OH = down CCT = down DA = up RI = up-level pulses
3.	Answer the coupler phone by lifting handset, raise exclusion key	SH = up OH = up CCT = up DA = up RI = down
4.	Set up 3741/3747 for communicate mode	No change from 3 above
5.	Replace handset on coupler phone	SH = down OH = down when 3741/3747 times out CCT = down after OH goes down DA = up RI = down

C. Autoanswer Sequence

	Action	Interface Results
1.	3741: Set up for communicate mode 3747: Set up for autoanswer (0407 state)	SH = down OH = down CCT = down DA = up (tied to +12 volts) RI = down
2.	Dial the coupler phone from a convenient local phone	SH = down OH = up when RI pulsed up CCT = up after OH goes up, delayed a *minimum* of 200 ms (2 seconds normal) DA = up RI = up level pulse(s), until OH goes up Listen for approximately 3 seconds of answertone (slightly rising in volume) at the calling phone.*
3.	Wait for 3741/3747 to time-out	SH = down OH = down after time-out (20 seconds) CCT = down following OH DA = up RI = down

* Also listen for short burst (DLE EOT) just prior to the 20-second time-out.

Problems With the Interface to Coupler

Coupler Cut Through

A. Symptom: 3741 or 3747 set up for autoanswer. Dial in, modem (line adapter) goes 'off hook', no answertone heard.

Check: CCT delay, should be approximately 2 seconds but not exceed 5 seconds.

How: Use a scope. Trigger scope on 'off hook' going plus, look at CCT going plus. Set scope for 1 sec/div.

B. Symptom: 3741 or 3747 set up for autoanswer. Dial in, get answertone back immediately.

Check: CCT delay. Probably has no delay at all.

How: Use a scope. Same as previous symptom.

C. Symptom: Dial in autoanswer. Autoanswer answers; nothing happens.

Check: Glitching of coupler cut through in transition region (-3 to +3 volts)

How: Use a scope. Set scope for 5v/div, .5 ms/div.
Channel 1 - CCT interface lead
Channel 2 - CCT output on autoanswer card
Scope CCT on AA card and look for double pulse.

D. Symptom: Dial in on autoanswer, go 'off hook', short answertone, a delay, then answertone.

Check: CCT in transition region, has very large glitch.

How: Same as for previous symptom. CCT output on the AA card should be only one pulse going from down to up level.

Switch Hook

A. Symptom: Dial in on autoanswer, phone is busy.

Check: Switch hook. The 1200 bps line adapter requires that 'switch hook' be off (down level) when phone is cradled, on (up level) when handset is lifted from cradle.

How: Scope or meter 'switch hook' lead, pick up handset. Lead should go from approximately -8 volts to +8 volts.

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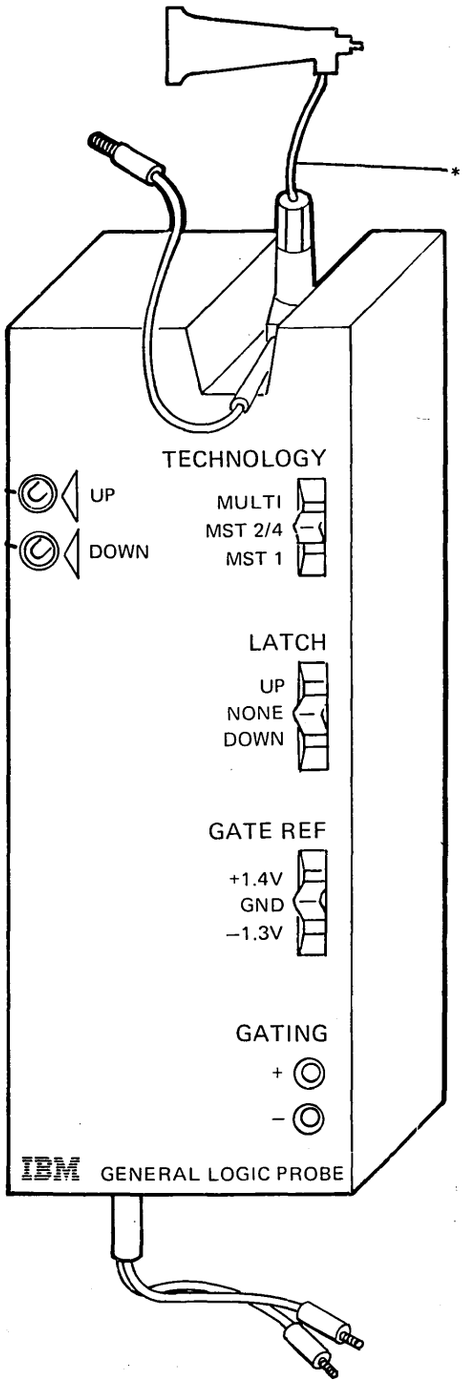
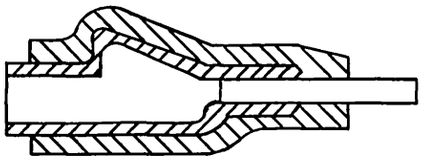
CE TOOLS

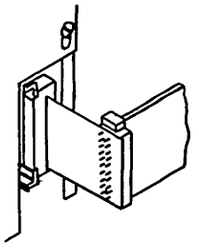


CE General Logic Probe
PN 453212

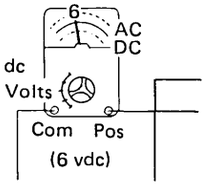
*(long probe lead)
PN 453605



Terminal Assembly Probe
PN 2594238

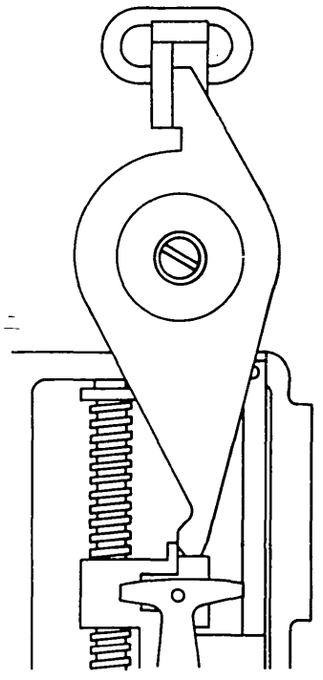


Cable Extender
PN 5998763



CE Voltmeter
(15 Vdc range) (PN 452796)

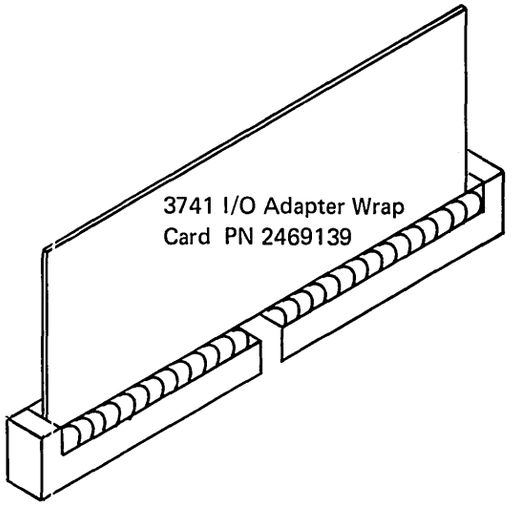
Voltmeter leads with
SMS connectors
PN 2124599



CE Head Adjusting Tool
PN 2200698

Diagnostic Diskettes:

Alignment Check	PN 2455026
I/O Adapter	PN 2469460
CE Diagnostic (Card I/O)	PN 2469688
Function Control RPQ	
With Proof Keyboard	PN 2446068
Without Proof Keyboard	PN 2446067
Model 3/4	
ACL Diagnostic 1	PN 2455484
ACL Diagnostic 2	PN 5566089



3741 I/O Adapter Wrap Card (PN 2469139)

EC 825853	825958	826065	PN 1619410
Date 11/15/74	3/21/75	8/1/75	

8

DATA RECORDER DIAGNOSTIC DISKETTE PROGRAMS

The data recorder part of the CE diagnostic diskette checks data transfer to and from the data recorder. Areas checked during data transfer are: attachment half planar ROS, interface and control lines on the attachment half planar, MPU interface lines, and storage. Also, the normal diskette read/write areas and CRT display areas are checked.

Data Recorder Attachment Diagnostic Procedure

Power down the 3741 and the data recorder.

Place a deck of at least 26 blank cards in the hopper.

Do you have a 129 or a 5496?

129

Set the SPL FEAT switch to OFF.

Power up the 3741 and the 129.

Operate the 129 CLEAR switch to clear the transport.

Set the 129 switches as follows:

SPL FEAT	ON
PROG MODE	DATA READ
REC ADV	AUTO
CHAR MODE	64
PRINT	ON or OFF

Press the FEED key twice to feed two cards.

Load the diagnostic diskette into drive 1.

Keep diskette at data set label 00008.

5496

Power up the 3741 and the 5496.

Set the 5496 switches as follows:

TERMINAL/MANUAL	TERMINAL
PUNCH VERIFY	PUNCH
REC ADV	AUTO
PROGRAM	OFF
PRINT	ON or OFF

Note: All other switch settings are optional; they have no function when the 5496 is online.

Load the diagnostic diskette in drive 1.

Record advance to data set label 00009.

Set the 3741 AUTO REC ADV switch to ON.

Press: FUNCT SEL lower
S
FUNCT SEL upper
PUNCH TO EOD (PR will be displayed)

Were exactly 26 cards punched?

No

Use MAP 5-32.

Yes

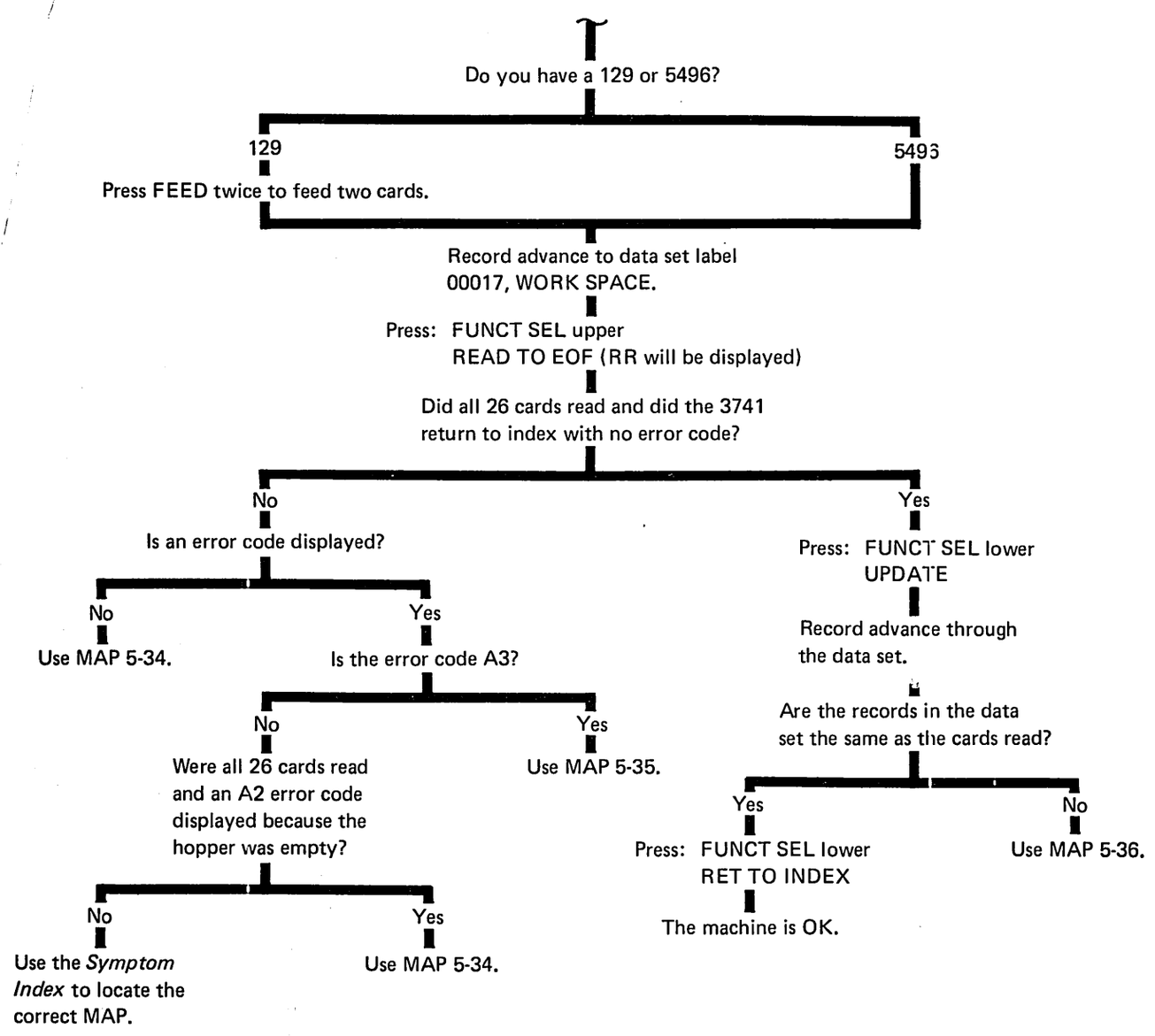
Are the cards punched as shown on page 8-41 (129) or 8-42 (5496)?

Yes

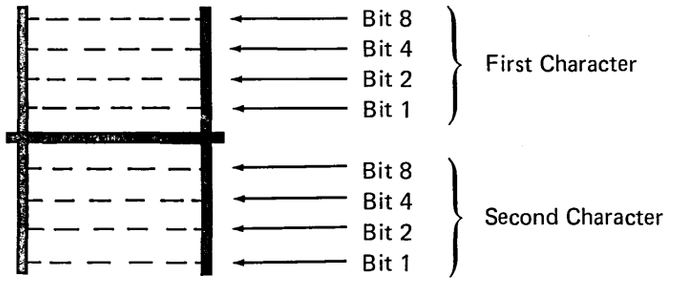
Place the 26 cards just punched in the hopper.

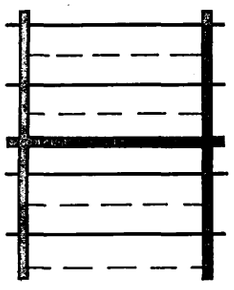
No

Use MAP 5-36.

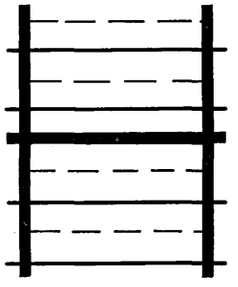

Do you have a 129 or 5496?
129
5496
Press FEED twice to feed two cards.
Record advance to data set label 00017, WORK SPACE.
Press: FUNCT SEL upper
READ TO EOF (RR will be displayed)
Did all 26 cards read and did the 3741 return to index with no error code?
No
Yes
Is an error code displayed?
Press: FUNCT SEL lower
UPDATE
No
Yes
Use MAP 5-34.
Is the error code A3?
Record advance through the data set.
No
Yes
Are the records in the data set the same as the cards read?
Were all 26 cards read and an A2 error code displayed because the hopper was empty?
Use MAP 5-35.
Yes
No
Press: FUNCT SEL lower
RET TO INDEX
Use MAP 5-36.
No
Yes
The machine is OK.
Use the *Symptom Index* to locate the correct MAP.
Use MAP 5-34.

Basic Hex Display





Hexadecimal Display of a Hex 'AA'

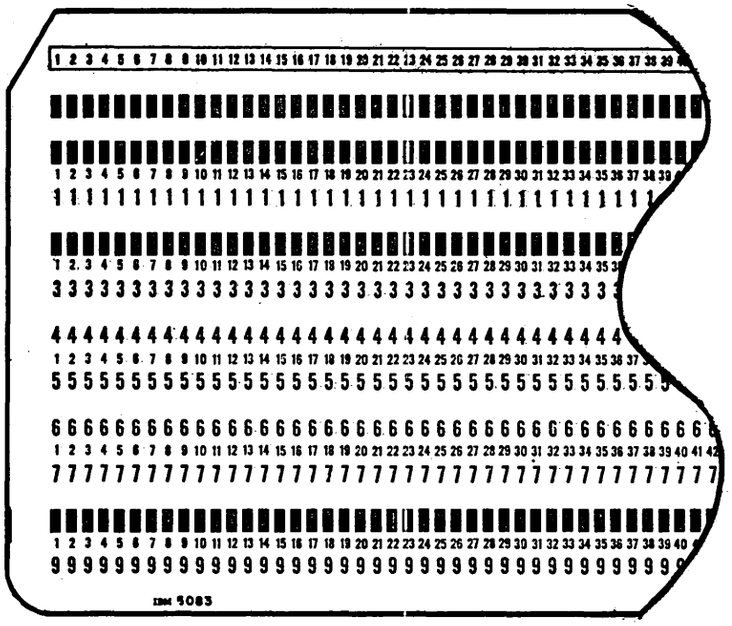


Hex '55'

Active Bits	Total Value of Bits — Hex Character Symbol
1 2 4 8	15 – F
2 4 8	14 – E
1 4 8	13 – D
4 8	12 – C
1 2 8	11 – B
2 8	10 – A
1 8	9 – 9
8	8 – 8
1 2 4	7 – 7
2 4	6 – 6
1 4	5 – 5
4	4 – 4
1 2	3 – 3
2	2 – 2
1	1 – 1
	0 – 0

Sample Printout

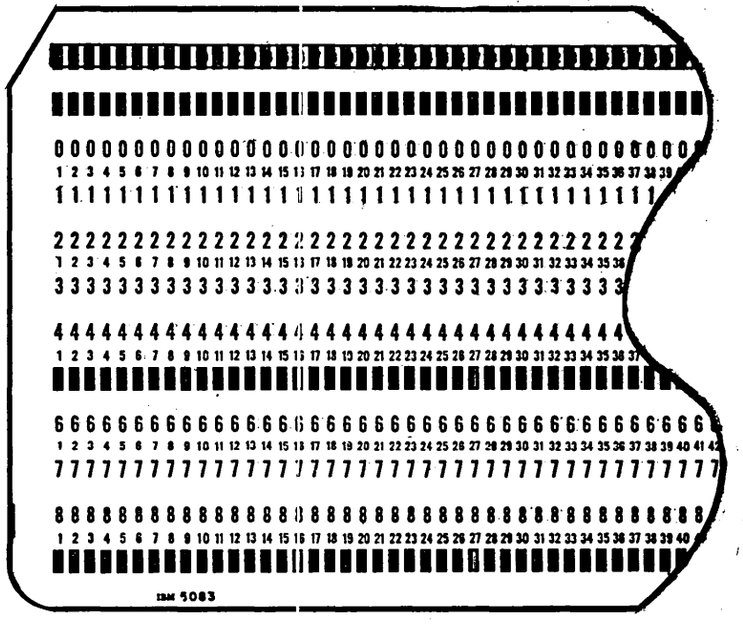
```
ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789?,/*                                                
```



IBM 129 Cards Punched from Data Set—129 Data

Cards 1-10 should have all eighty columns punched as shown on left.

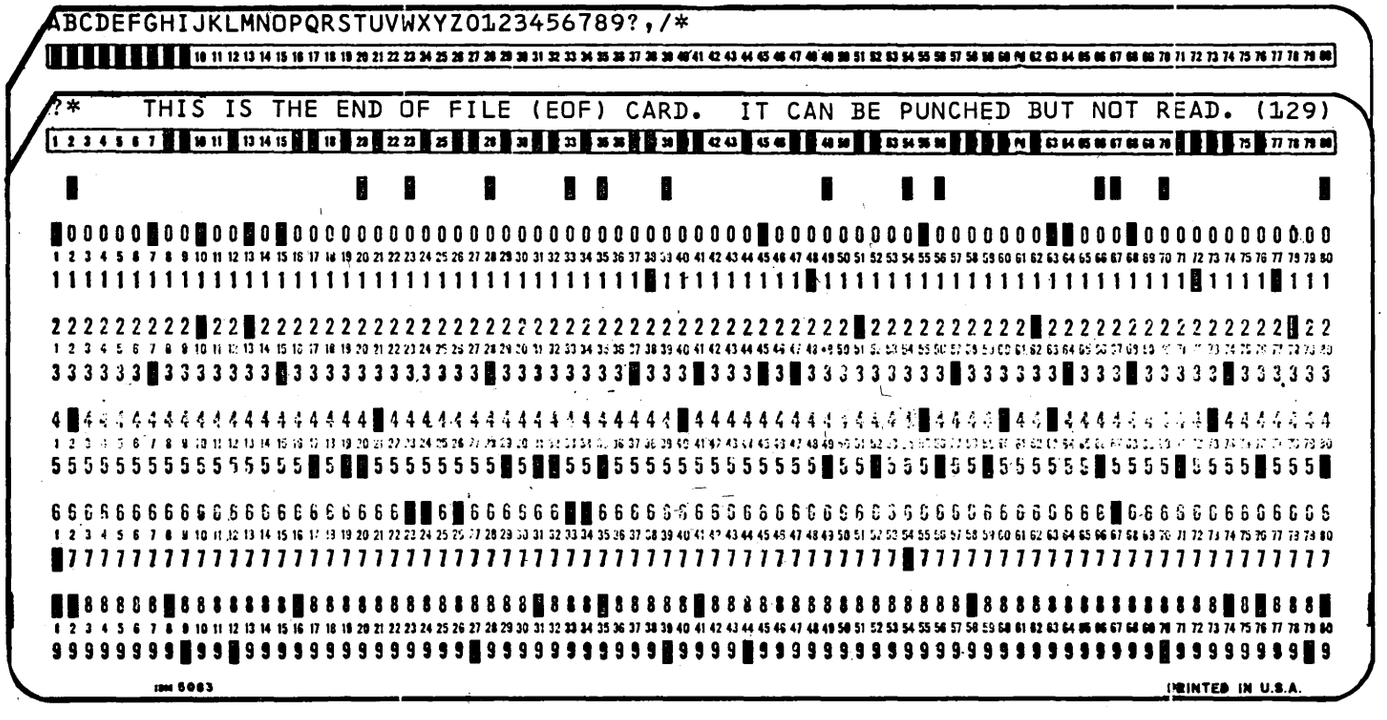
Hex 'AA'
(1010-1010)



Cards 11-20 should have all eighty columns punched as shown on right.

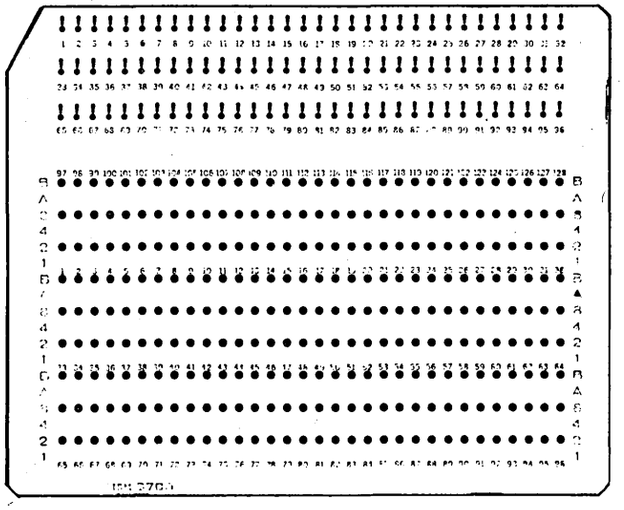
Hex '55'
(0101-0101)

Cards 21-25 should be as below.

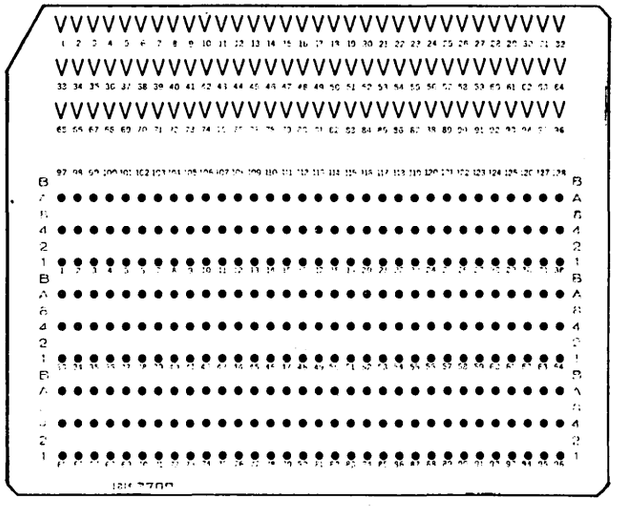


EC 825853	826065		PN 1619412
Date 11/15/74	8/1/75		

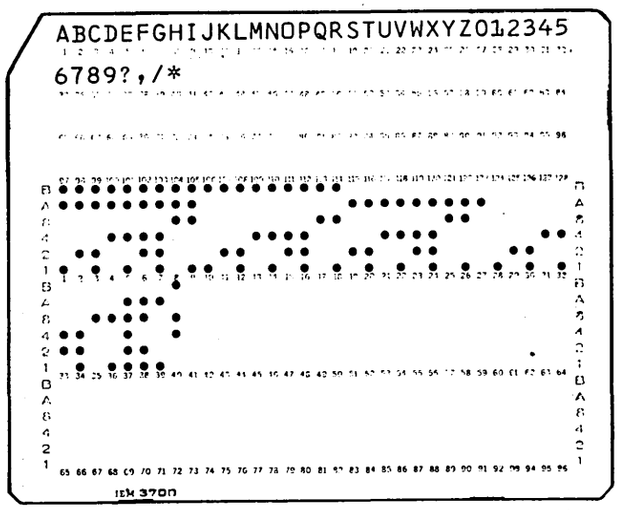
IBM 5496 Cards Punched from Data Set—5496 Data



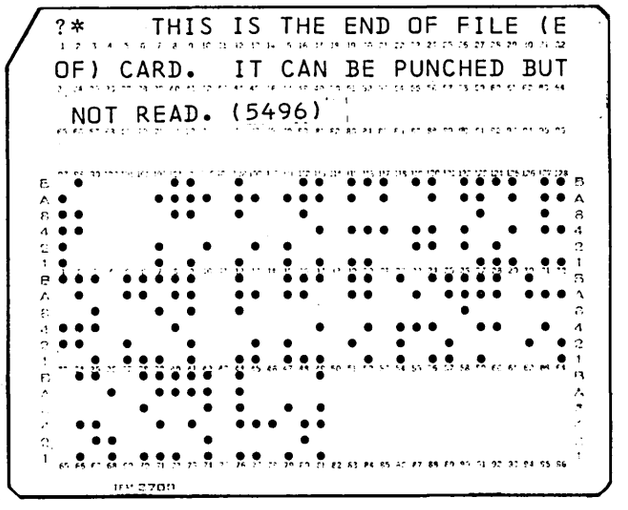
First 10 Cards
1 through 10
(XX10-1010)



Second 10 Cards
11 through 20
(XX01-0101)



Cards 21 through 25



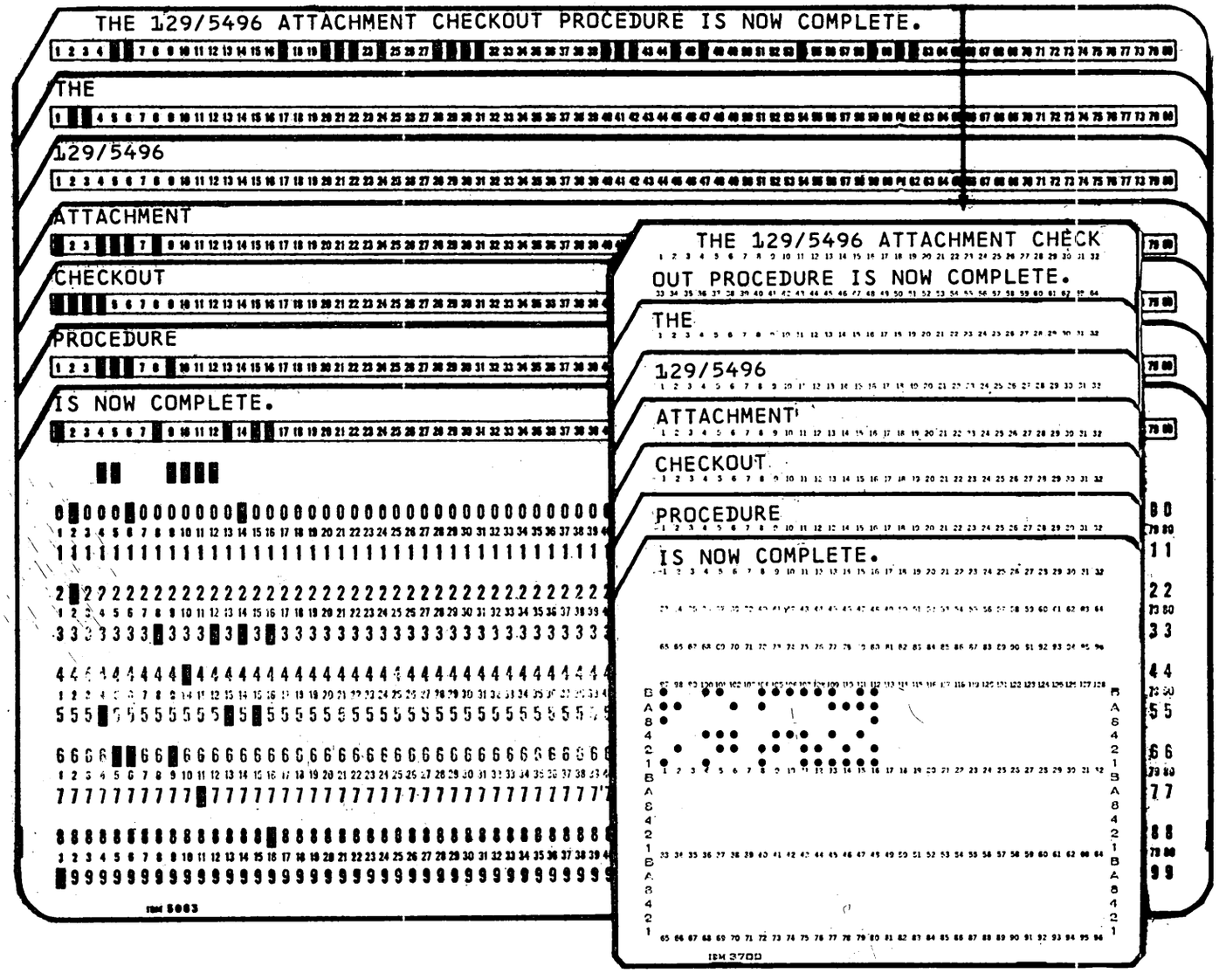
26 Card — Last Card

DATA RECORDER ATTACHMENT TEST PROGRAM

The 3741 takes one record and punches 7 cards from it. The numbers between the words are skipped or deleted testing all the program format functions. See *Data Recorder Programs* on page 9-1.

IBM 129 Cards

IBM 5496 Cards



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I/O ADAPTER DIAGNOSTIC DISKETTE (P/N 2469460)

This diskette aids the CE in diagnosing troubles in the I/O adapter. The diskette contains:

- Three programs to permit checkout of the I/O adapter circuits and cable by connecting the output lines to the input lines using a wrap connector. The programs are identical except for ending sequences.
- For the 3741 Mod 3/4, an ACL program (ACLT20) for loading the wrap test. (On Models 1 and 2, the test is loaded manually.)
- Scratch space for use by the System/3 diagnostics.
- ACL tests for Mod 3/4

I/O Adapter Wrap Test Load and Run Procedure for Model 1 and 2 Program

- Load the I/O adapter diagnostic diskette in drive 1.
- Record advance to sector 10.
- Press FUNCT SEL lower
  UPDATE
  FUNCT SEL lower
  PROG LOAD
  1 (number)
  REC ADV

  The first format buffer is now loaded. The instructions in buffer 1 will load the other format buffers from the diskette. To continue the loading sequence:
- Press SEL PROG (See note 1)
  1 (number)
  FUNCT SEL upper
  H
  RESET (See note 2)

  A G6 error code is displayed when the program loads properly. If anything else is displayed in the error code position (such as a 6 or nothing), reload the program to rule out possible errors in entry. Continue the test.
- Press RESET (See note 2)
  If the test runs without error, a G4 error code and 00 63 01 3A register contents are displayed on a flashing screen. Any other display (including a blank) is an error.
  (See notes 3 and 4)
- Return to the MAP that sent you here.
- If you did not enter this procedure from a MAP, end the test by pressing RESET.

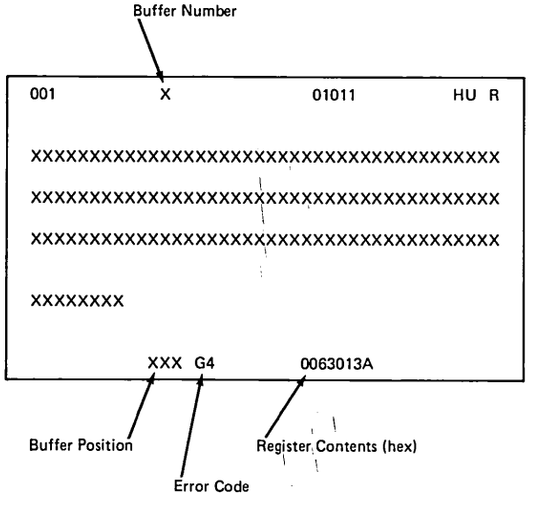
Options

In addition to the single-pass operation described previously, a stop-and-go operation or a loop operation can be selected by starting in sector 11 or sector 12, respectively. The three wrap tests on the diskette differ only in the ending sequence. (This provides a backup program if the program starting in sector 10 is damaged.)

- Single-pass operation (normal) is selected by starting in sector 10.
- Stop-and-go operation is selected by starting in sector 11. If the test runs without error, the program stops with a G4 displayed. Pressing RESET causes the program to make another pass. Holding ALPHA SHIFT and NUM SHIFT while pressing RESET, ends the test.
- Loop operation is selected by starting in sector 12. After loading, the test loops until stopped by an error or by holding ALPHA SHIFT and NUM SHIFT while pressing RESET.

Notes:

1. To re-execute the program, start at this point but select program A rather than program 1.
2. To enter trace mode, which allows you to single-step through the remaining program, hold ALPHA SHIFT and NUM SHIFT while pressing FUNCT SEL lower. This must be done before pressing RESET. Each time RESET is pressed, one instruction is executed.
3. A J5 code with XX 00 00 14 indicates that the wrap connector might not be installed.
4. A J5 code with XX 01 00 14 indicates that the cables are still connected to the attachment.



Wrap Test Program Instructions

The following character transfer instructions apply to the wrap test contained on the I/O adapter diagnostic diskette.

Legend:

n	=	register number
x	=	hex character with which register is loaded and tested (mask)
yy	=	buffer number
zzz	=	buffer position (1 through 128)

Instructions:

Anxyyzzz	Jump on unequal
Bnxyyzzz	Jump on equal
Hnxyyzzz	Jump if any mask bits are on
Qyy	Read record from diskette (in update mode), put it in the format buffer indicated, and advance to the next record
Unx	Load the hex character into the register specified
Wnyyzzz	Load the contents of the specified register into the specified buffer. (Used only in Mod 3/4 diagnostic program.)
Xnx	Add the specified hex character into the specified register.

Valid Error Codes for the Wrap Test

Invalid instructions are used for error codes (for example, a U5 is an invalid instruction because U should be followed only by 0, 1, 2, or 3). Whenever a test fails, the program jumps to an invalid instruction (error code). The invalid instructions cause the 3741 to stop with a flashing screen and display the instruction that caused the error along with the contents of registers 0 through 3. Valid error codes are:

6
C2 and C3
J4 through J9
K4 through K9
L4 through L9
M4 through M9
U4 through U9
G4 (program ran error free)
G6 (program loaded OK)
Z2 through Z9

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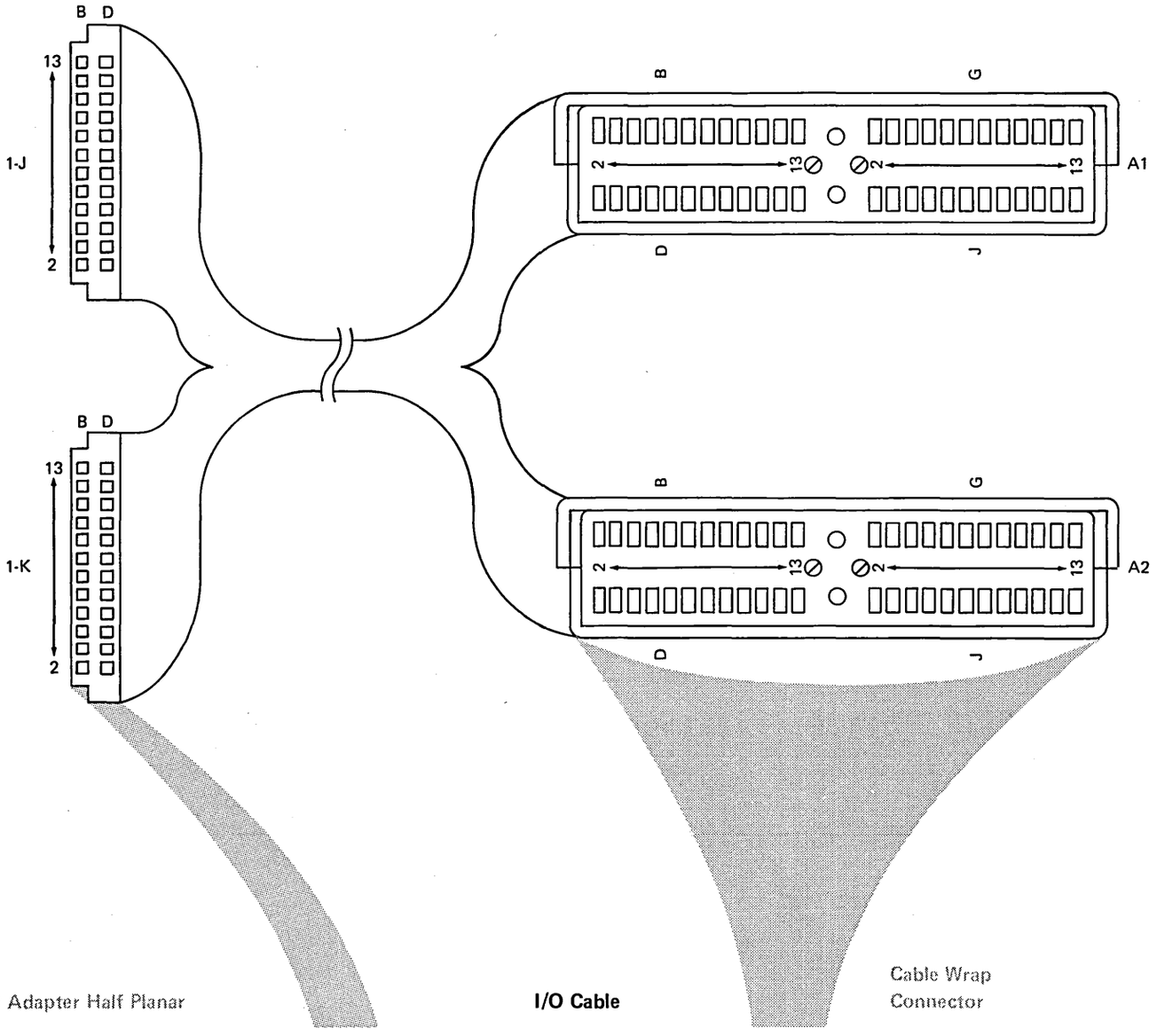
I/O Adapter Diagnostic Wrap Error Code Chart

These error codes and register contents indicate board or cable problems. No other codes can result from a solid open or ground in the cable.

- Use the error code and register contents to find the wire reference number.
- Use this reference number to locate the failing wire on the cable wrap diagram on the following pages.
- If the error code and register contents cannot be found in the chart, replace the cable (712).

Error Codes	Register Contents				Wire Reference Numbers	
	0	1	2	3	Open	Grounded
J5	XX	00	00	14	14 Wrap connector might not be installed.	14
	XX	00	00	54	17	17
	XX	01	00	14	Cables are still connected to the attached device.	
Z9	00	EF	FF	65	5	5
	00	F7	FF	65	6	6
	00	FB	FF	65	7	7
	00	FD	FF	65	8	8
	00	FE	FF	65	9	9
	00	FF	FF	65	1	1
	00	00	FF	65	16	16
	00	7F	FF	65	2A, 2C	2A-2C
	00	BF	FF	65	3	3
	00	DF	FF	65	4	4
J6	00	20	00	18	12	12
K4	00	BA	AA	A3	10E, 10H	10A-10H
K5	00	10	10	A9	10F	
K6	00	71	AA	A1	13	13
	00	33	AA	A1	15	15
L4	00	63	08	5E	11	11
	00	6A	08	5E	10D	
Z5	00	7A	10	B1	2B	
L9	00	B4	30	71	10C	
M9	00	7A	80	5E	10A	
U5	00	6A	40	5E	10B	
U8	00	6A	01	5E	10G	

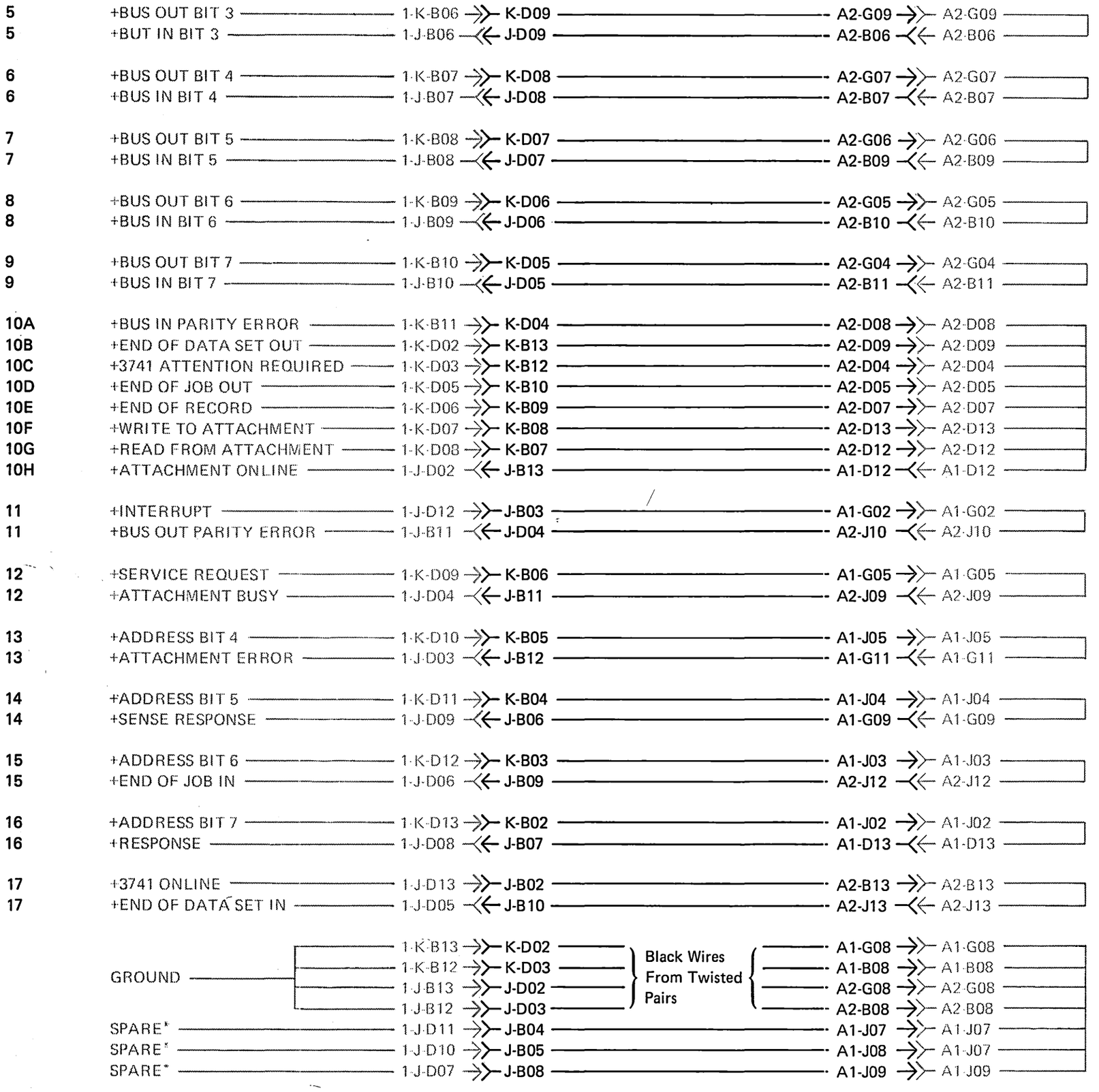
I/O Adapter Cable Wrap Diagram



Reference Number	3741 I/O Adapter Half Planar		I/O Cable		Cable Wrap Connector	
1	+BUS OUT BIT P	1-K-B02	K-D13	A2-G13	A2-G13	
1	+BUS IN BIT P	1-J-B02	J-D13	A2-B12	A2-B12	
2A	+BUS OUT BIT 0	1-K-B03	K-D12	A2-G12	A2-G12	
2B	+ATTACHMENT RESET	1-K-D04	K-B11	A2-D10	A2-D10	
2C	+BUS IN BIT 0	1-J-B03	J-D12	A2-B02	A2-B02	
3	+BUS OUT BIT 1	1-K-B04	K-D11	A2-G11	A2-G11	
3	+BUS IN BIT 1	1-J-B04	J-D11	A2-B04	A2-B04	
4	+BUS OUT BIT 2	1-K-B05	K-D10	A2-G10	A2-G10	
4	+BUS IN BIT 2	1-J-B05	J-D10	A2-B05	A2-B05	

(continued below)

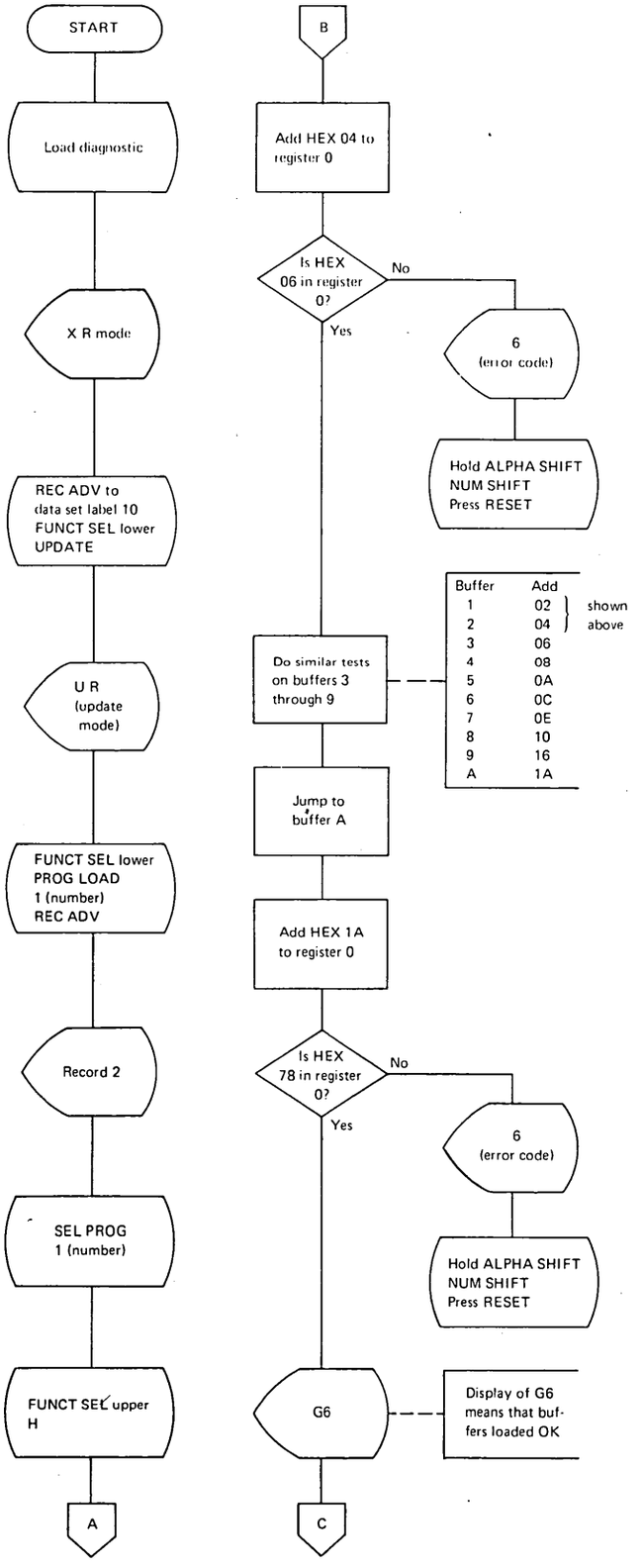
(continued below)

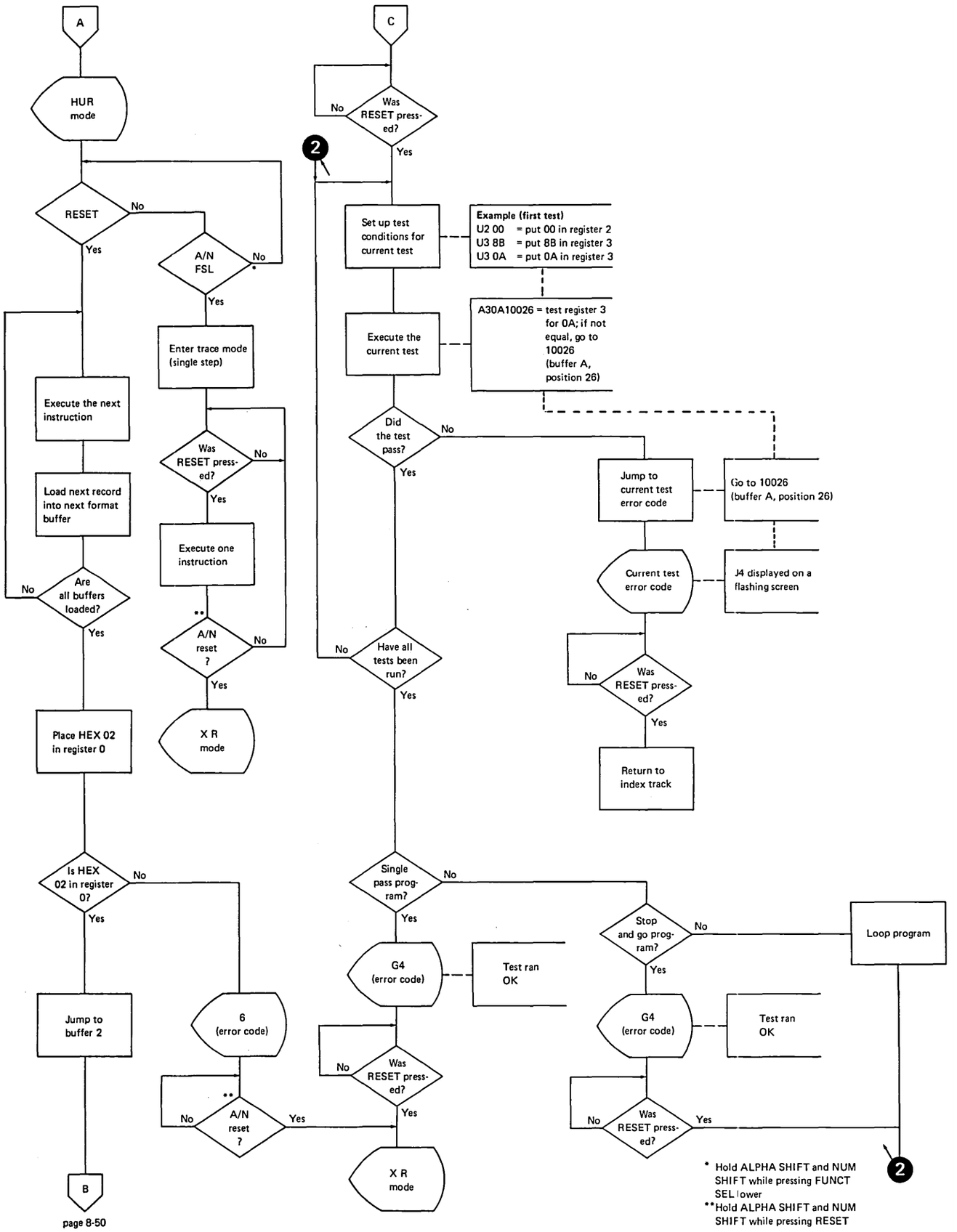


*Spare wires are shown because they are useful in cable repair.

EC 825958			PN 1607997
Date 3/21/75			

I/O Adapter Diagnostic Wrap Program Flowchart





EC 825958			PN 1607999
Date 3/21/75			

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OPERATING PROCEDURES

OPERATING PROCEDURES INDEX

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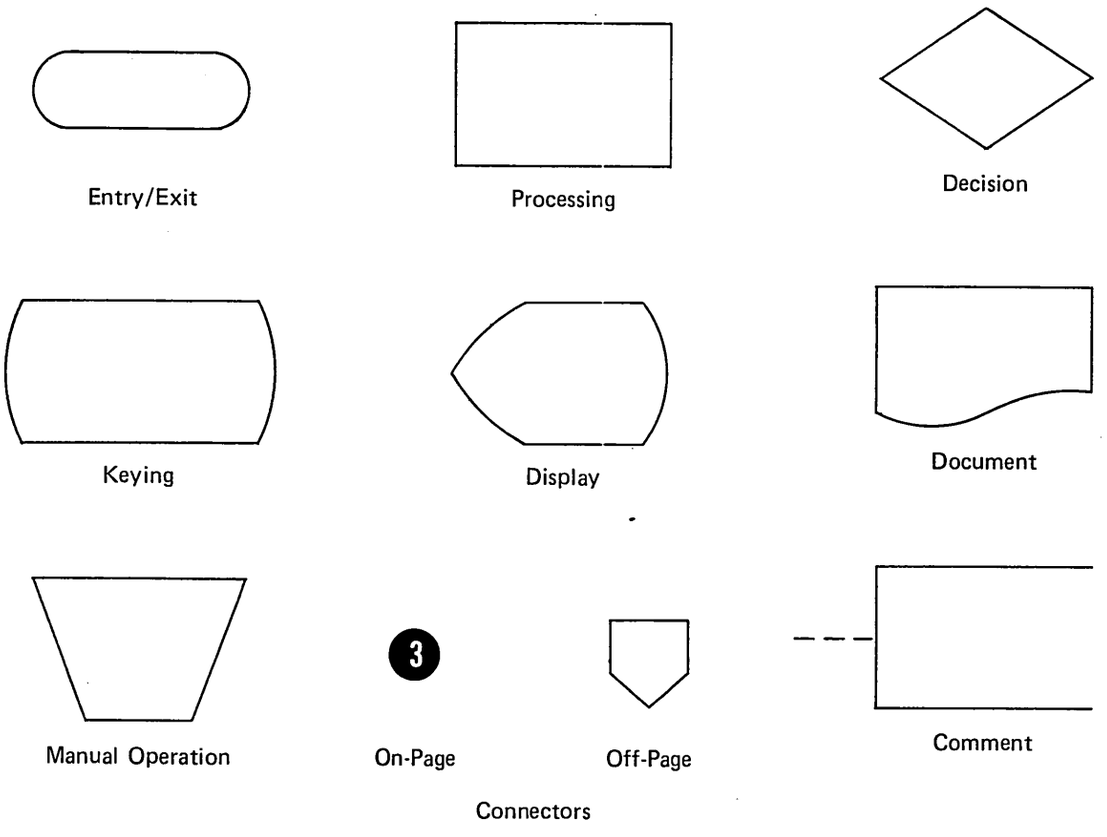
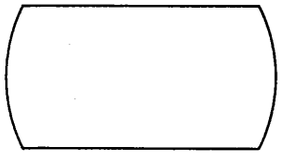
Note: See 3717 MLM for 3717 procedures.

FLOWCHARTING CONVENTIONS

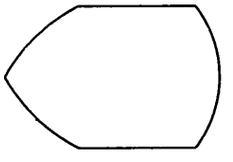
The flowcharting symbols used in the operating procedures flowcharts are:



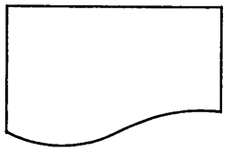
Most of the symbols are self-explanatory, but the following symbols deserve comment:



Identifies specific keys to press on the keyboard, or refers to keyed data.



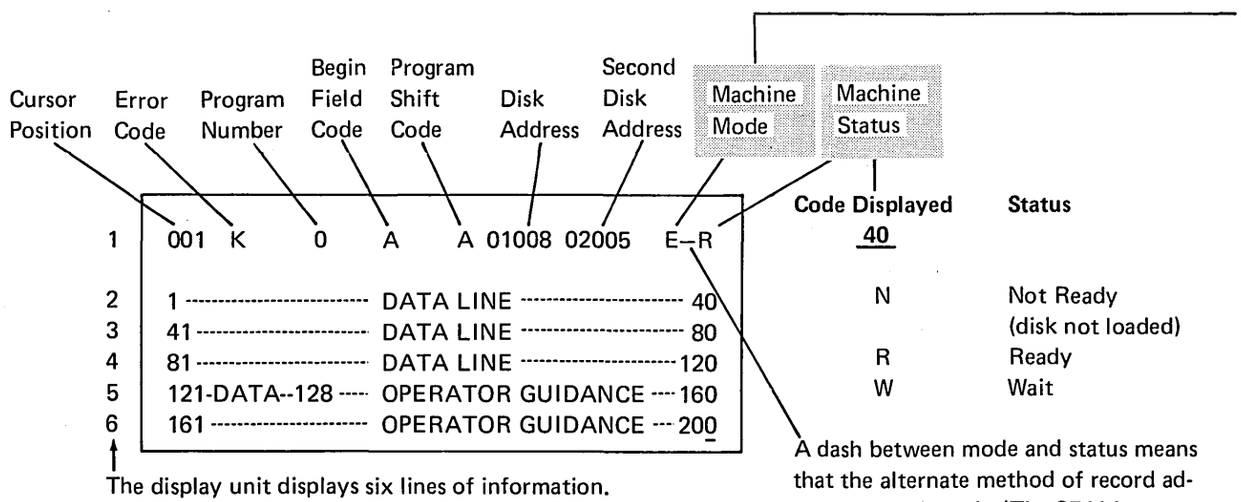
Identifies information displayed.



Refers to a specific MAP.

EC 825853	825958	826065	PN 1619047
11/15/74	3/21/75	8/1/75	

OPERATOR DISPLAY



The display unit displays six lines of information.

Code Displayed / **Status**

40

N	Not Ready (disk not loaded)
R	Ready
W	Wait

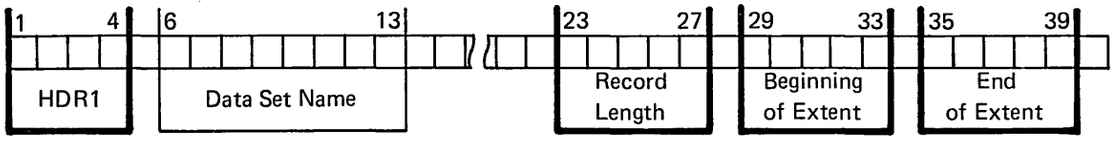
A dash between mode and status means that the alternate method of record advance was selected. (The 3741 bypasses all fields past the cursor when REC ADV is pressed in enter mode.)

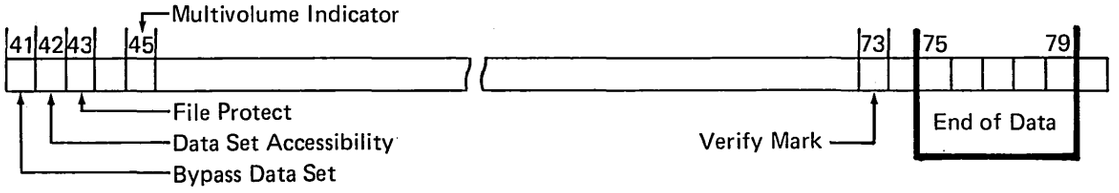
Codes Displayed (37 38) / **Mode of Operation**

37	38	Mode of Operation
I		Input to 3741
	∅	Record Mode
	1–5	File Modes
O		Output from 3741
	∅	Record Mode
	1–5	File Modes
H	U	Character Mode
R		Single Read
P		Single Punch
C		Field Correct
E		Enter
F		Field Totals
I		Initialize
M		Modify
N		Record Insert
P		Print
S		Search
U		Update
V		Verify
X		Read Index
C	E	Customer Engineer
	R	Read
	P	Punch

Data Set Label

Fields in heavy lines are required by the 3740 data entry system.



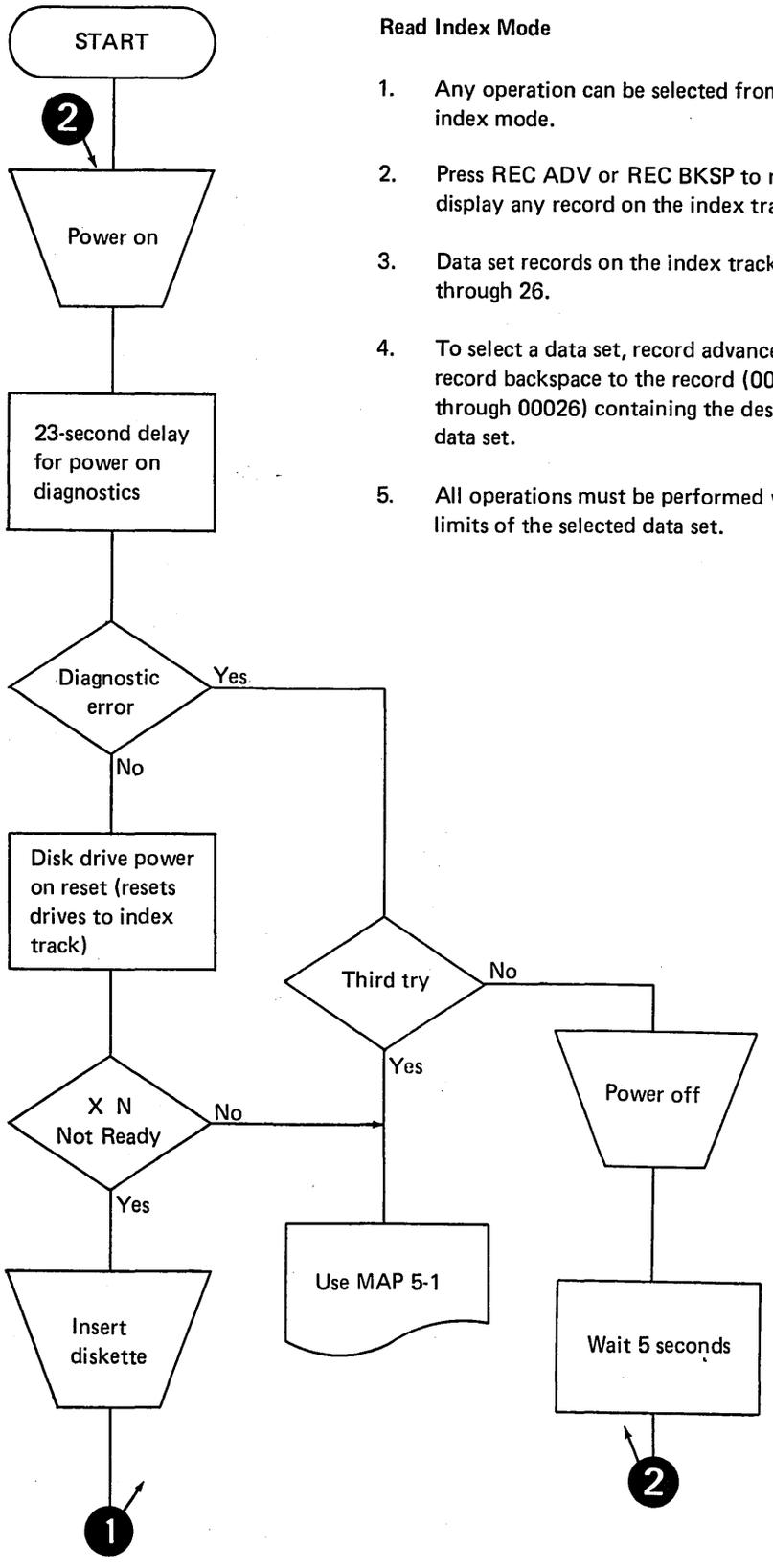


BSCA/EBSCA Mode	Col 37	Mode Col 38	Status Indicators Col 39				Col 39
Communications		C					
Transmit		T	T	I			B
Transmit-transparent		P	T	I			B
Receive	P	R			C	J	
Transmit-receive	P	B	T	I	C	J	B
Transmit-transparent/receive	P	D	T	I	C	J	B
Transmit buffered		J	T	I			B
Transmit buffered/receive	P	K	T	I	C	J	B
Inquiry		I	T	I	C	J	B
Request for test (RFT)	P	%	T	I	C	J	
E test mode		W		I	C		

Status Legend

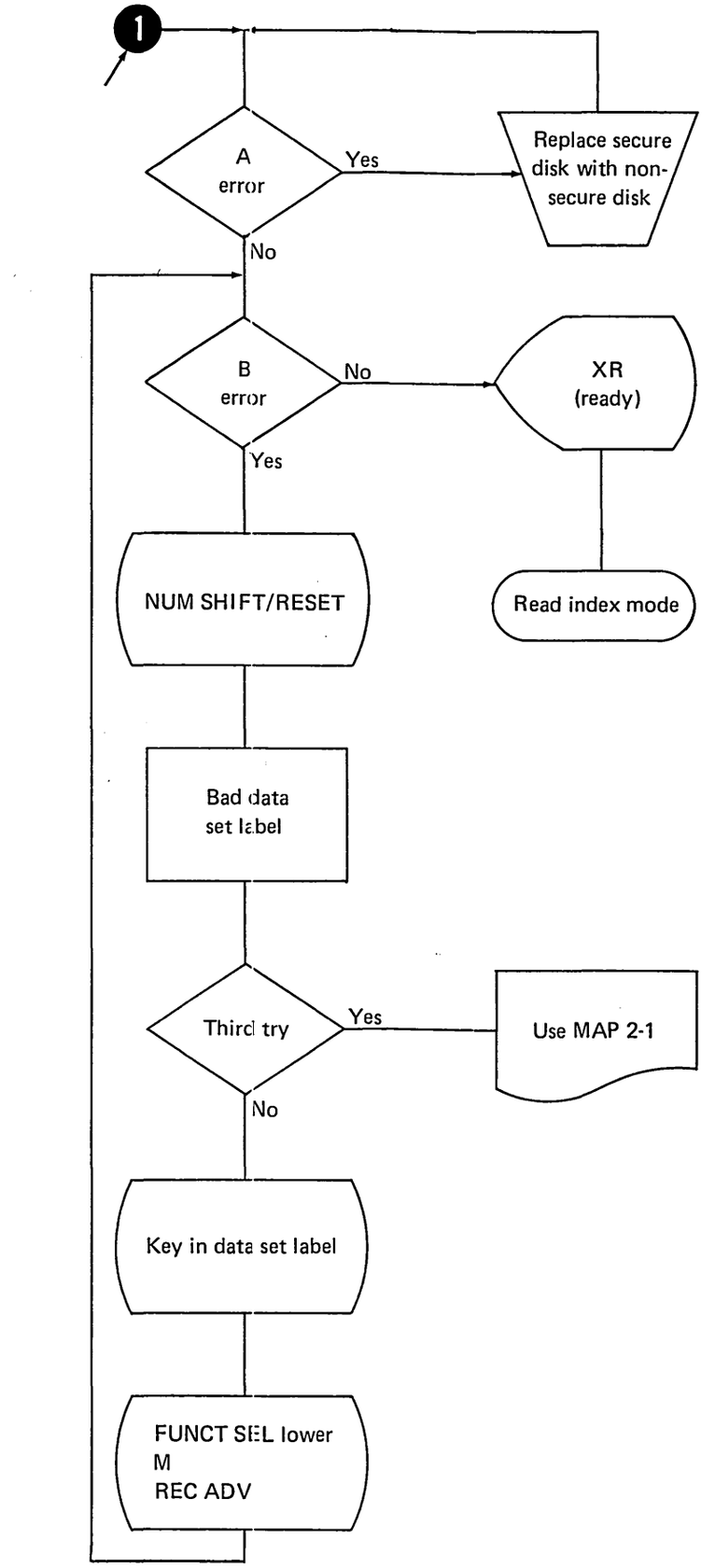
B = Read ID card
C = Reception complete
I = Transmission incomplete
J = Reception incomplete
P = Print unattended
T = Transmission complete

POWER ON AND READ INDEX



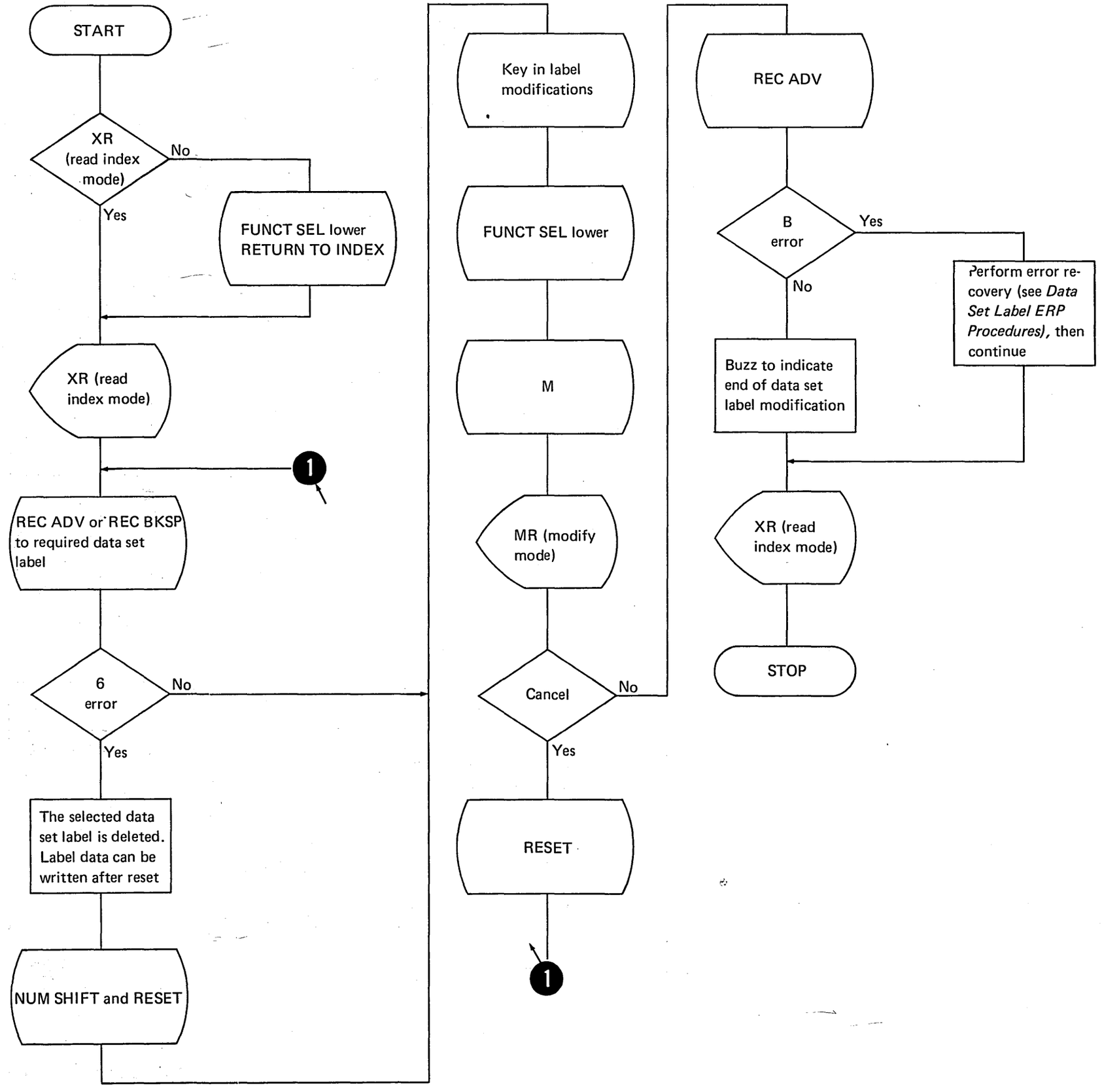
Read Index Mode

1. Any operation can be selected from read index mode.
2. Press REC ADV or REC BKSP to read and display any record on the index track (00).
3. Data set records on the index track are 08 through 26.
4. To select a data set, record advance or record backspace to the record (00008 through 00026) containing the desired data set.
5. All operations must be performed within the limits of the selected data set.

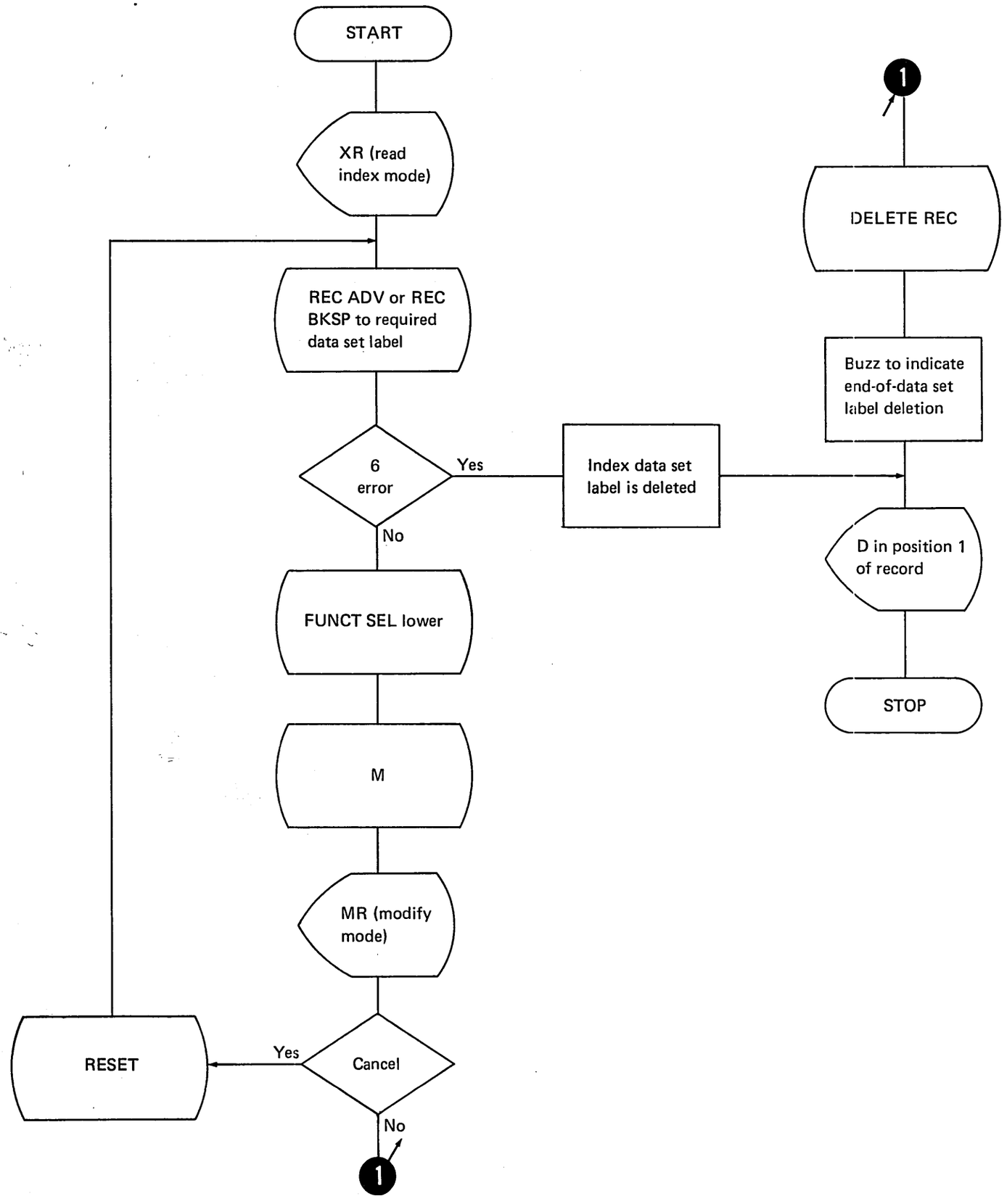


EC 823146			PN 1619049
Date 9/15/74			

MODIFY INDEX



DELETE DATA SET LABEL

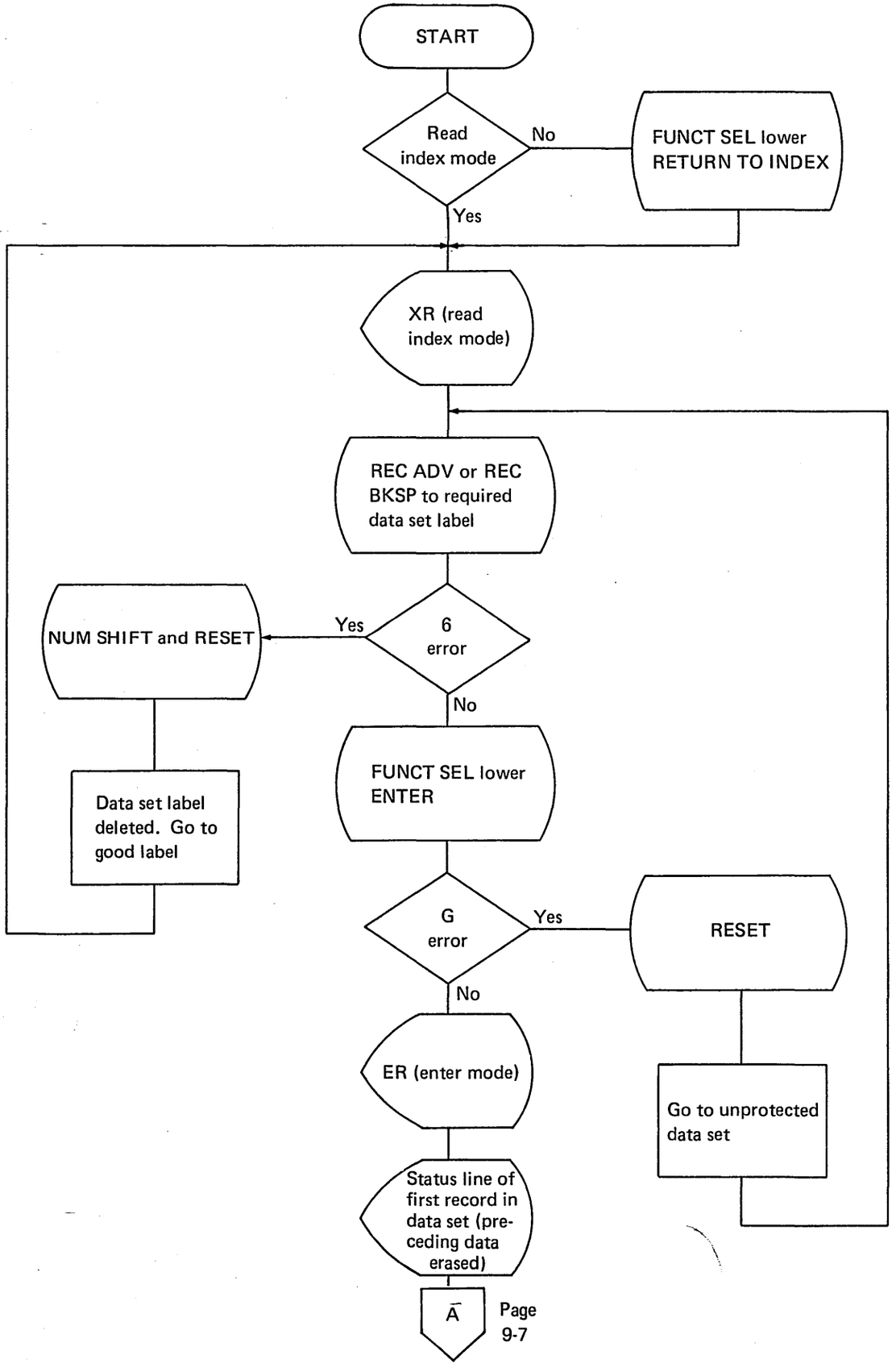


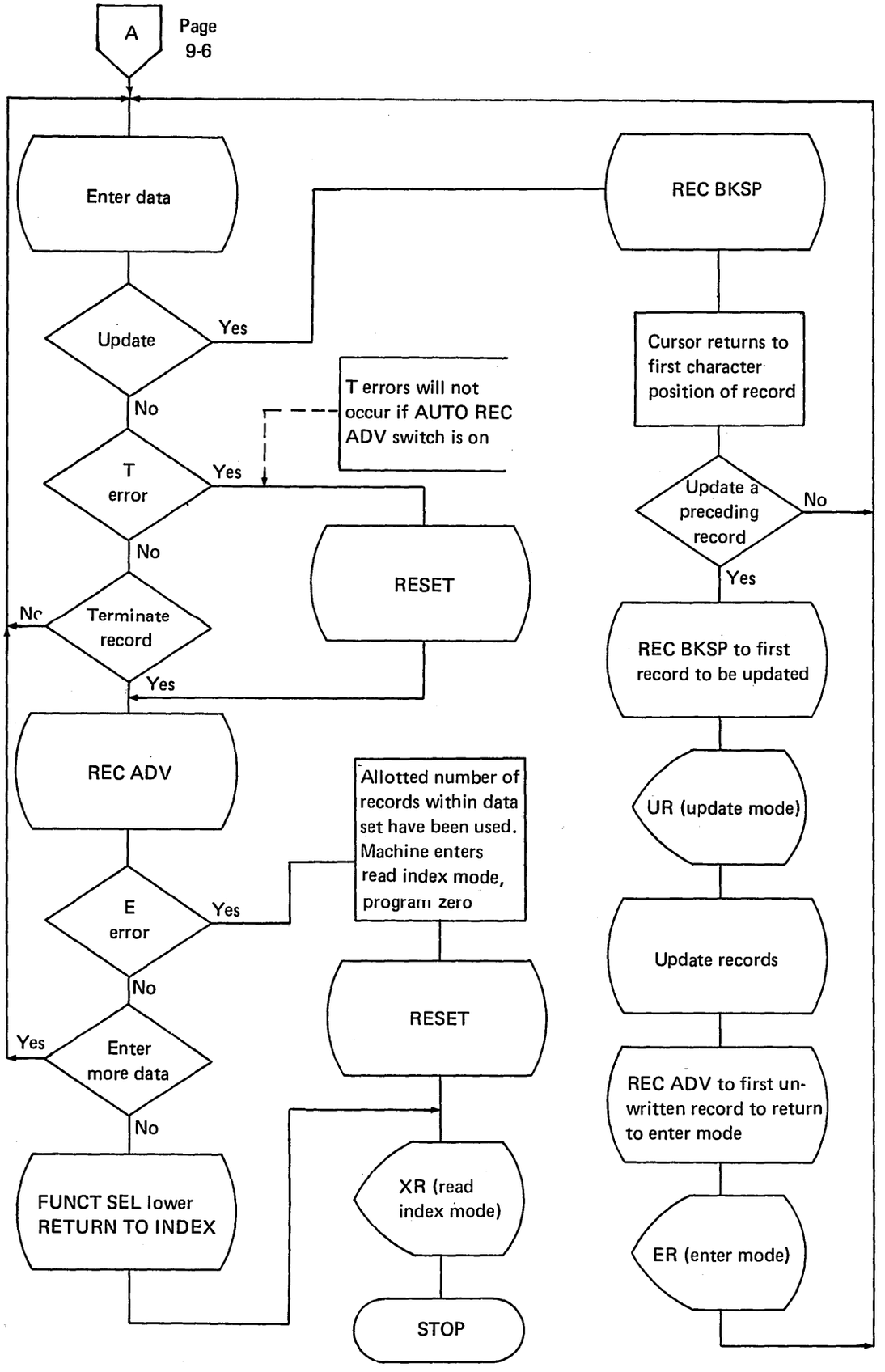
EC 823146			PN 1619051
Date 9/15/74			

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.

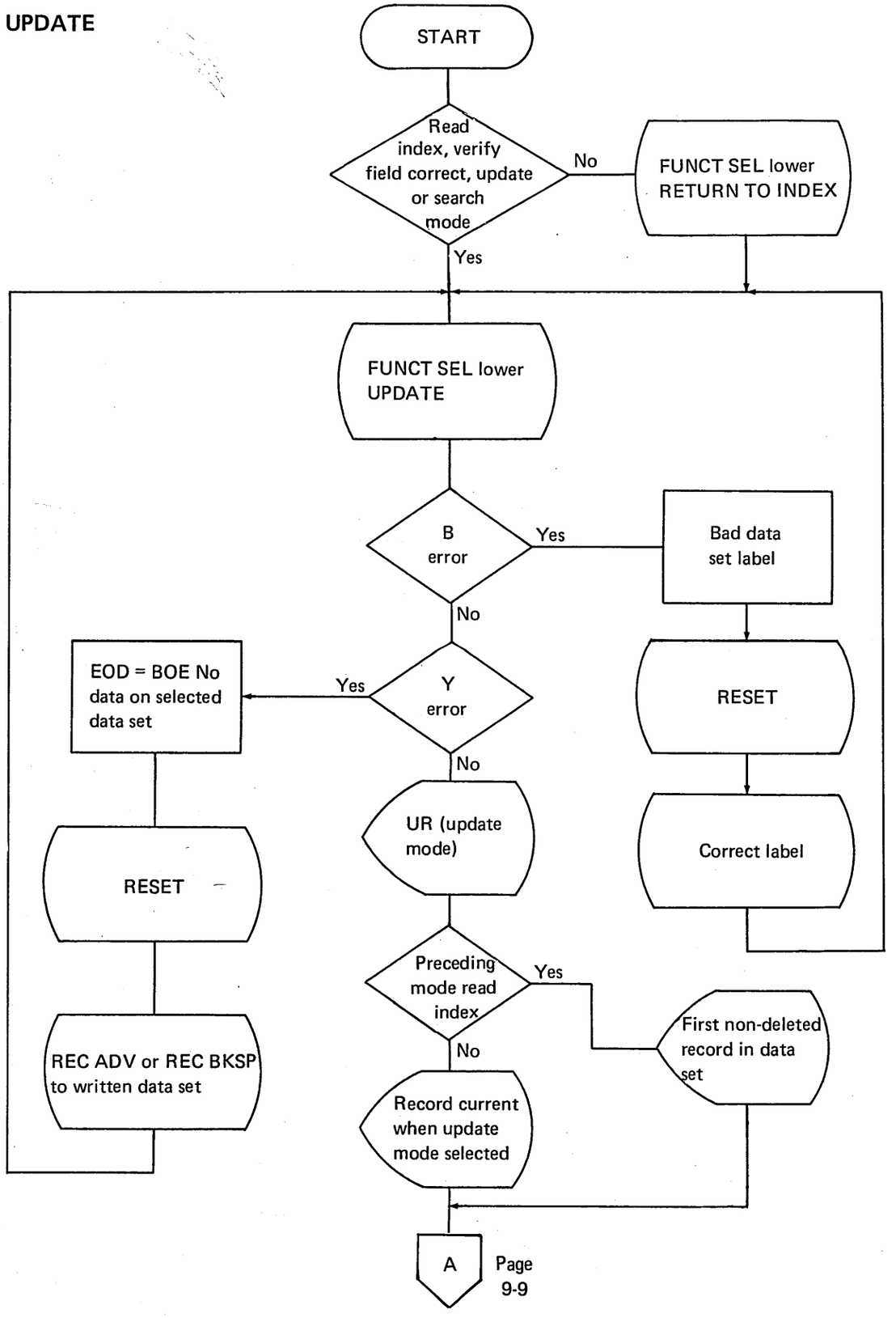
At the time record advancing occurs, the current record is moved to the preceding record buffer, and written to disk. The image of the last record entered remains in the preceding record buffer until record advancing occurs again.

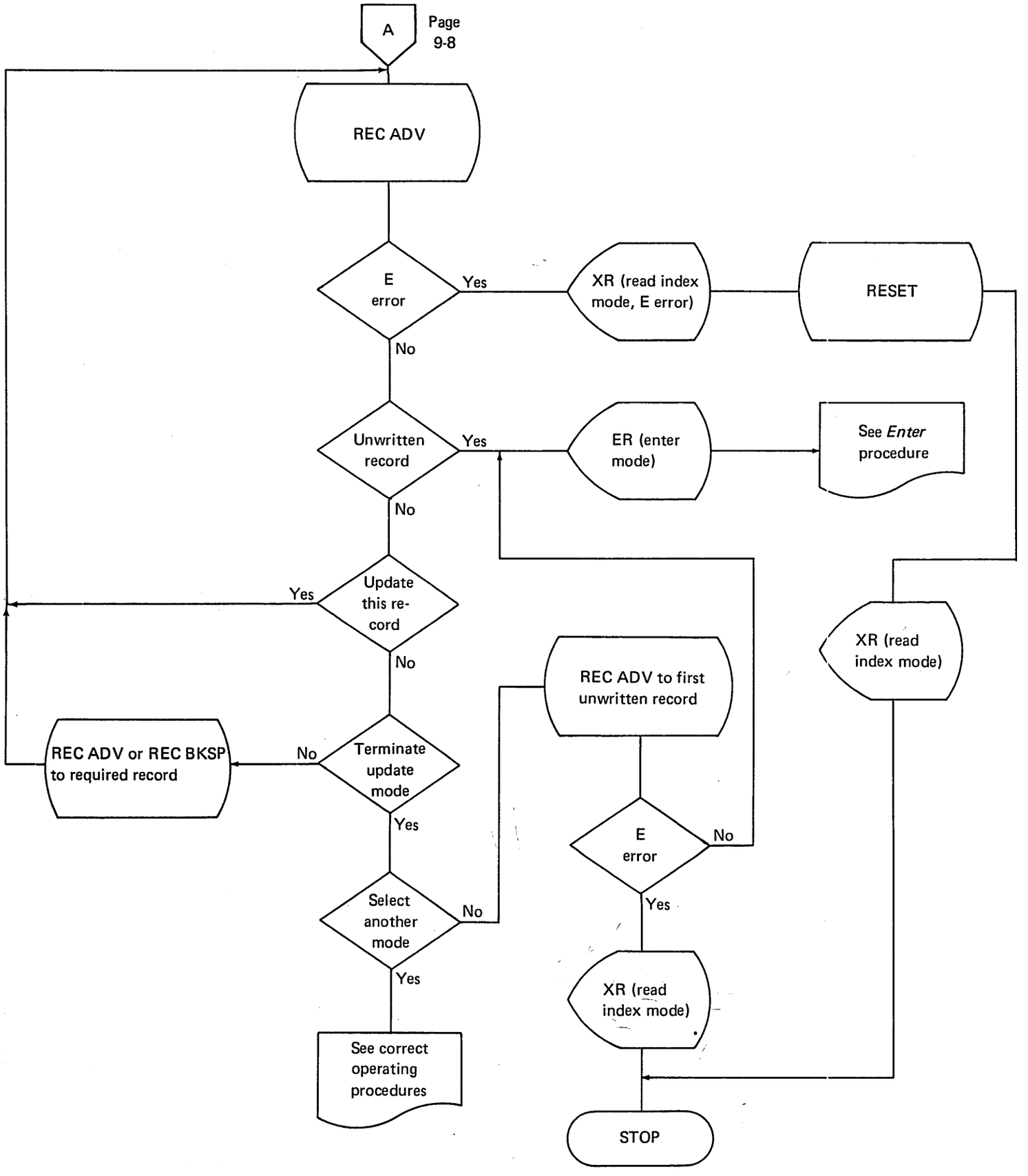




EC 823146			PN 1619053
Date 9/15/74			

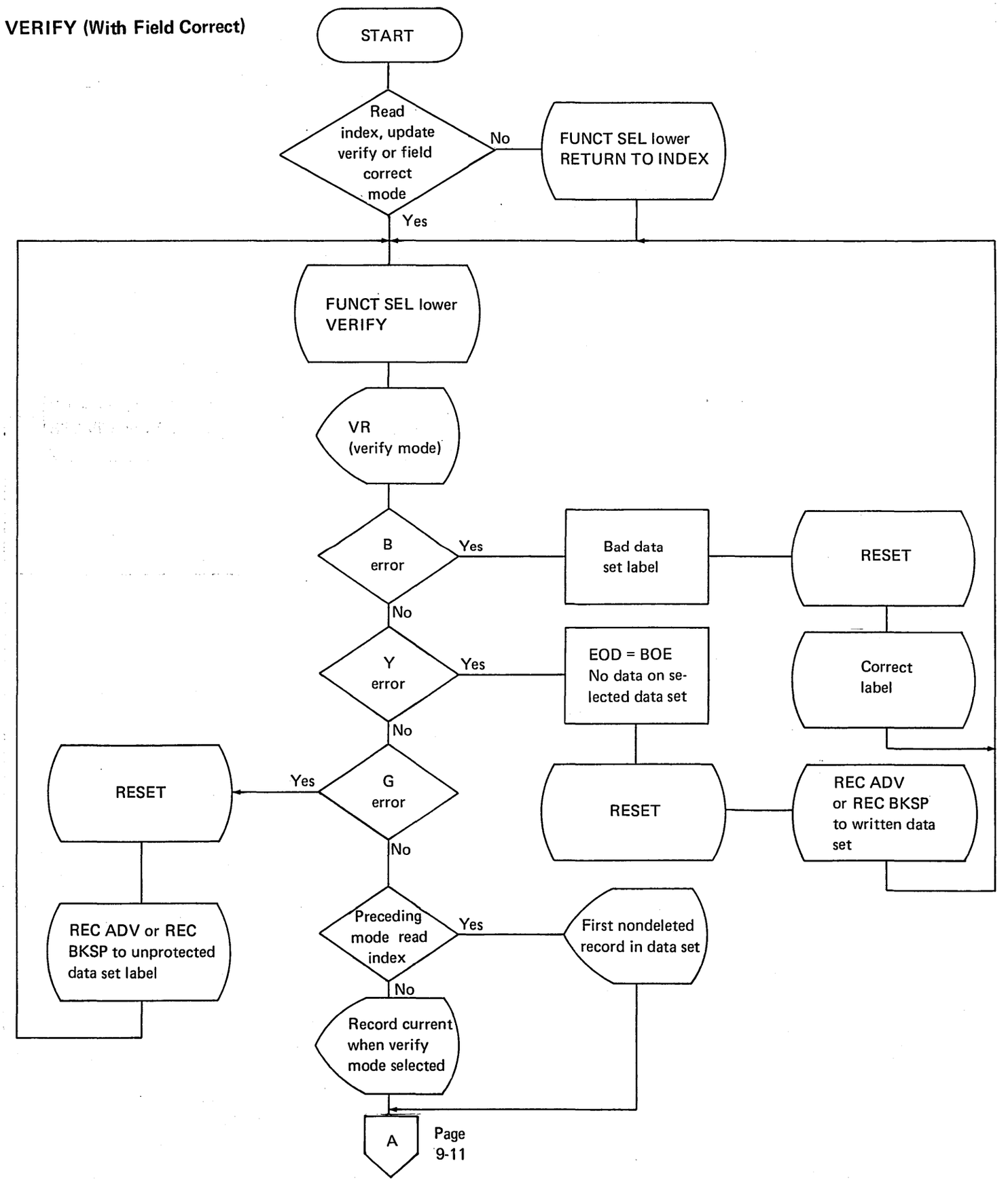
UPDATE

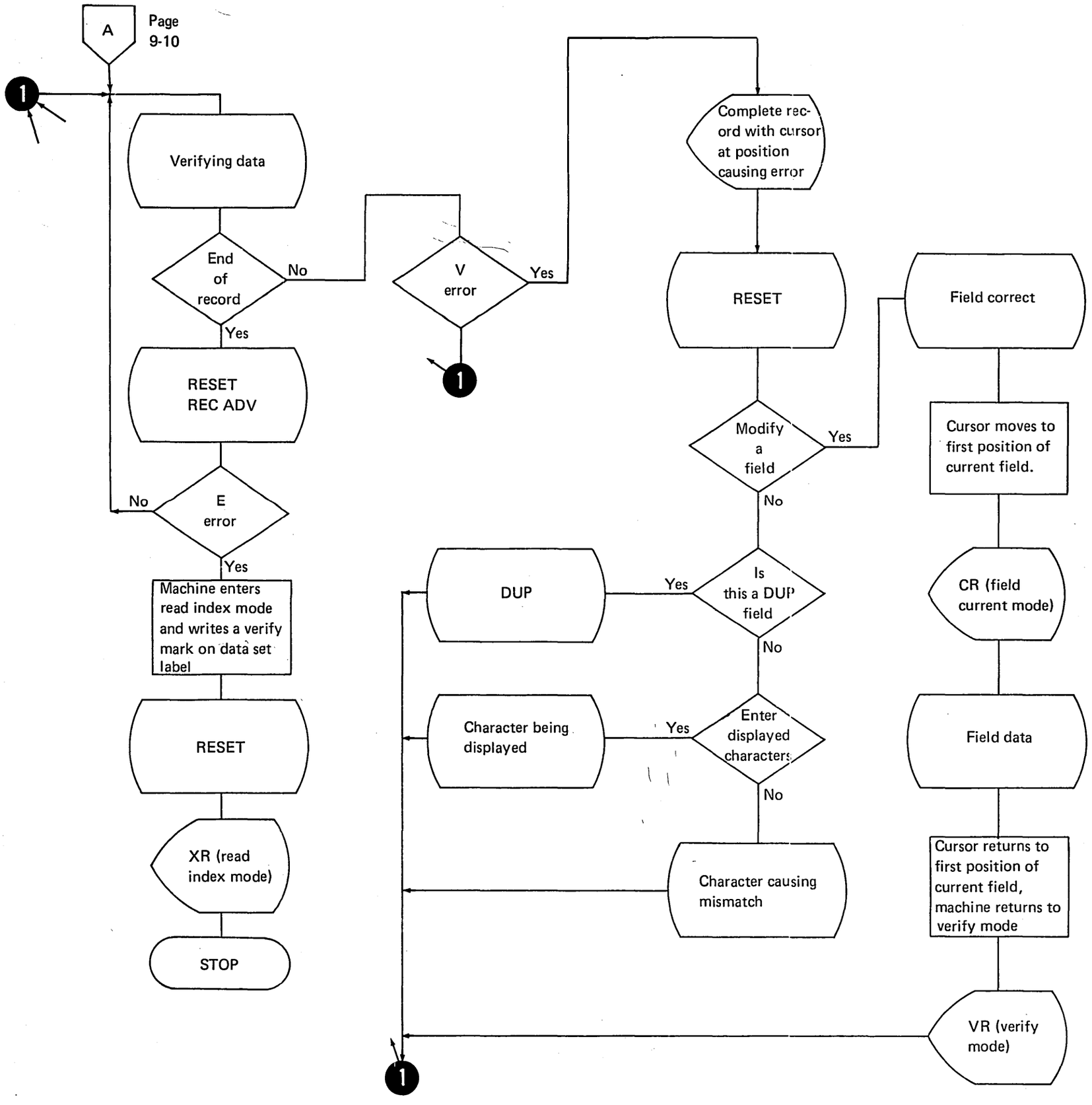

START
Read index, verify field correct, update or search mode
No
FUNCT SEL lower RETURN TO INDEX
Yes
FUNCT SEL lower UPDATE
B error
Yes
Bad data set label
No
EOD = BOE No data on selected data set
Yes
Y error
RESET
No
UR (update mode)
Correct label
RESET
Preceding mode read index
Yes
First non-deleted record in data set
REC ADV or REC BKSP to written data set
No
Record current when update mode selected
A
Page 9-9



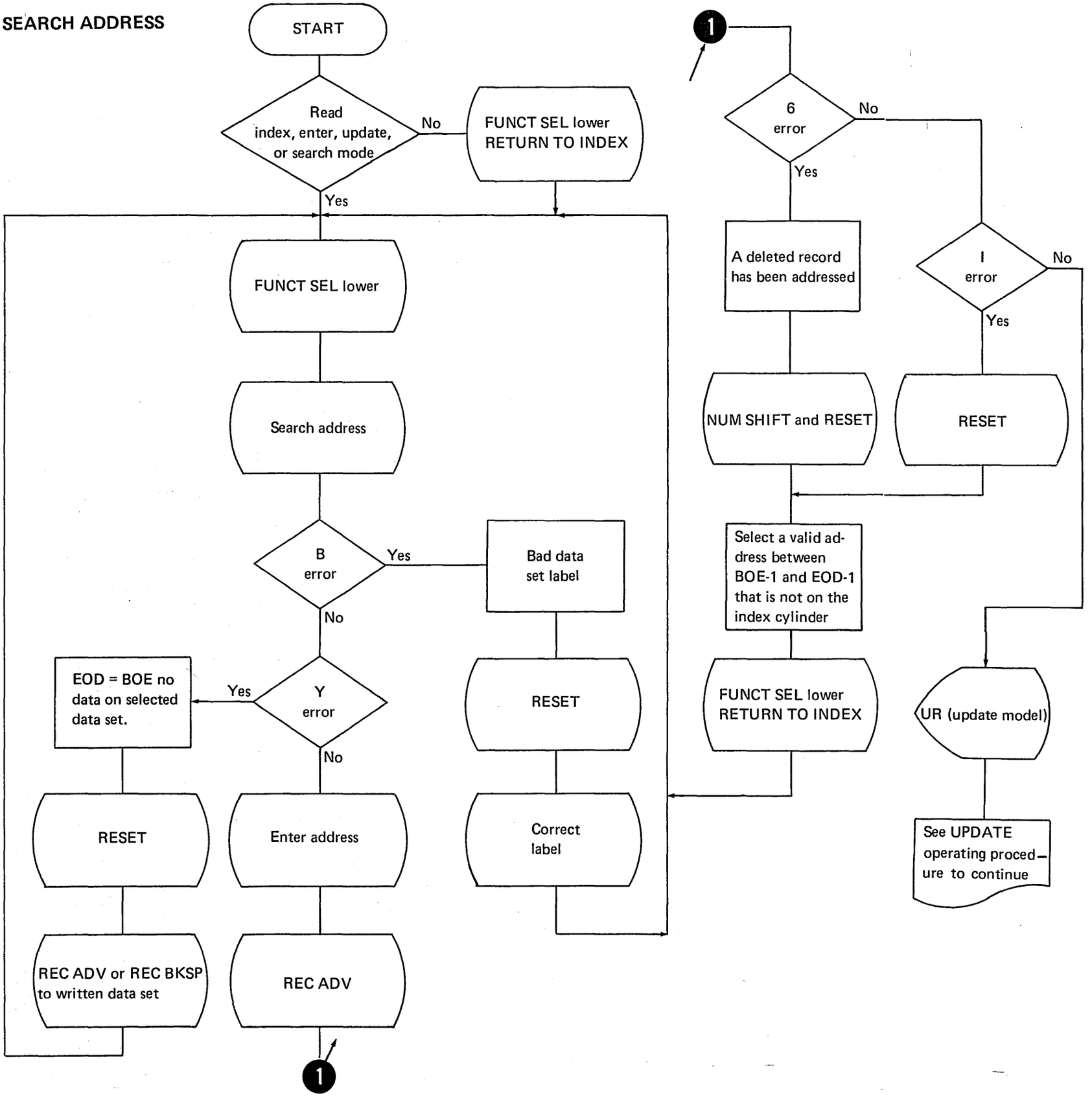
EC 823146			PN 1619055
Date 9/15/74			

VERIFY (With Field Correct)

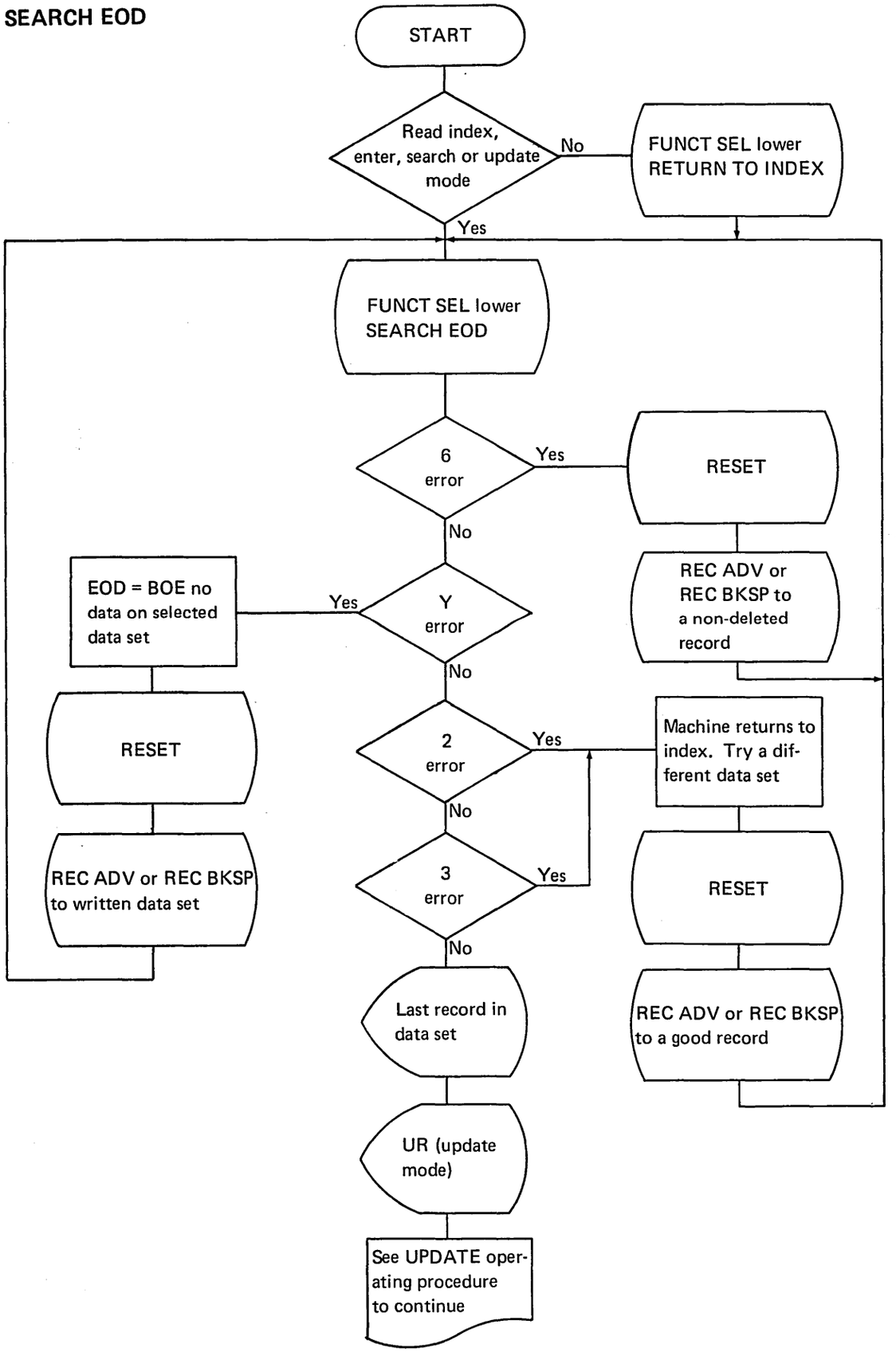



A
Page 9-10
1
Verifying data
End of record
No
Yes
V error
Yes
1
RESET REC ADV
No
E error
Yes
Machine enters read index mode and writes a verify mark on data set label
RESET
XR (read index mode)
STOP
Complete record with cursor at position causing error
RESET
Modify a field
Yes
No
Is this a DUP field
Yes
DUP
No
Enter displayed characters
Yes
Character being displayed
No
Character causing mismatch
Field correct
Cursor moves to first position of current field.
CR (field current mode)
Field data
Cursor returns to first position of current field, machine returns to verify mode
VR (verify mode)
1

SEARCH ADDRESS

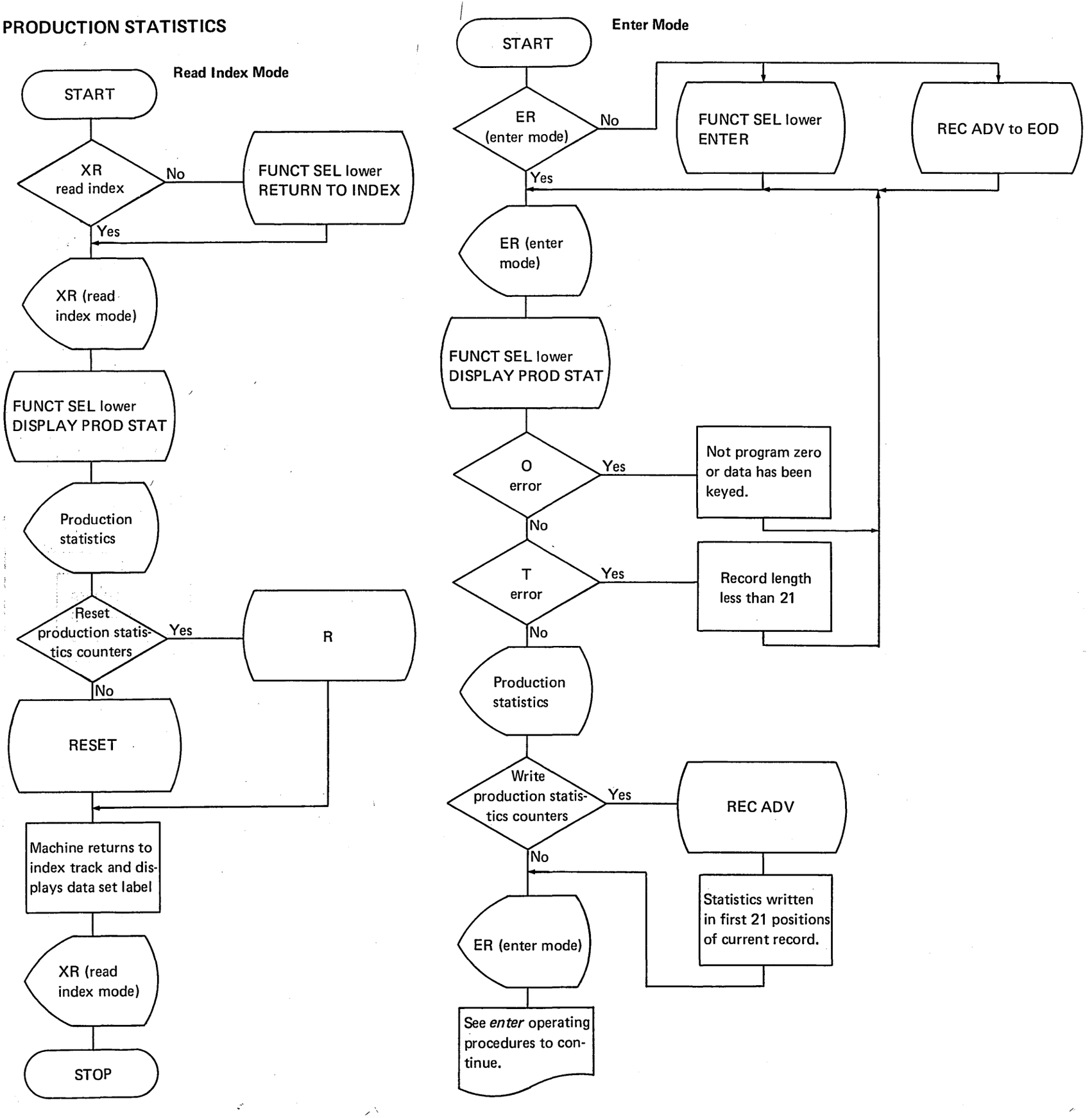


SEARCH EOD

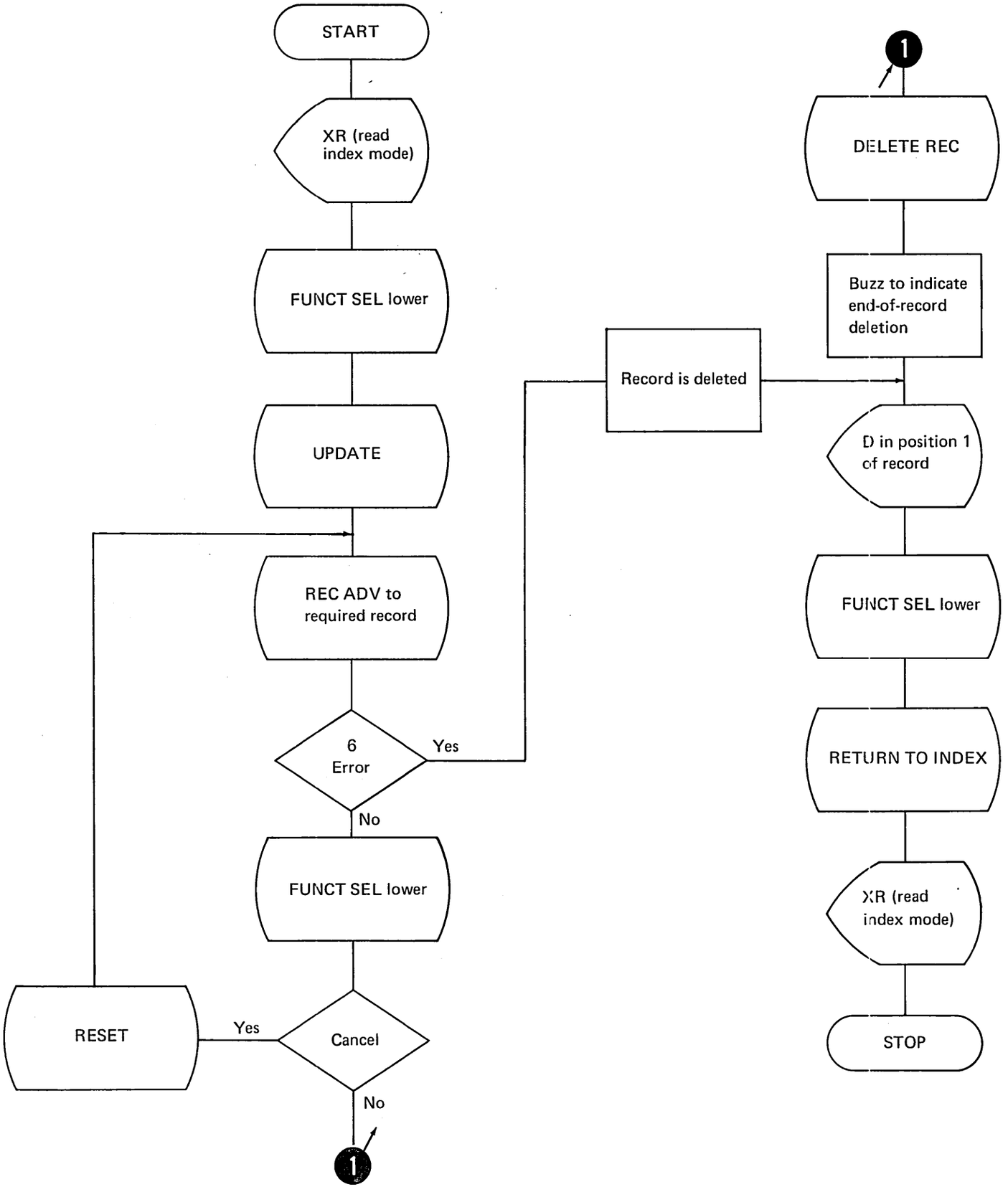


EC 823146	826065		PN 1619059
Date 9/15/74	8/1/75		

PRODUCTION STATISTICS



DELETE RECORD



EC 823146			PN 1619061
Date 9/15/74			

SEARCH CONTENT AND SEARCH SEQUENTIAL CONTENT

Search Masks

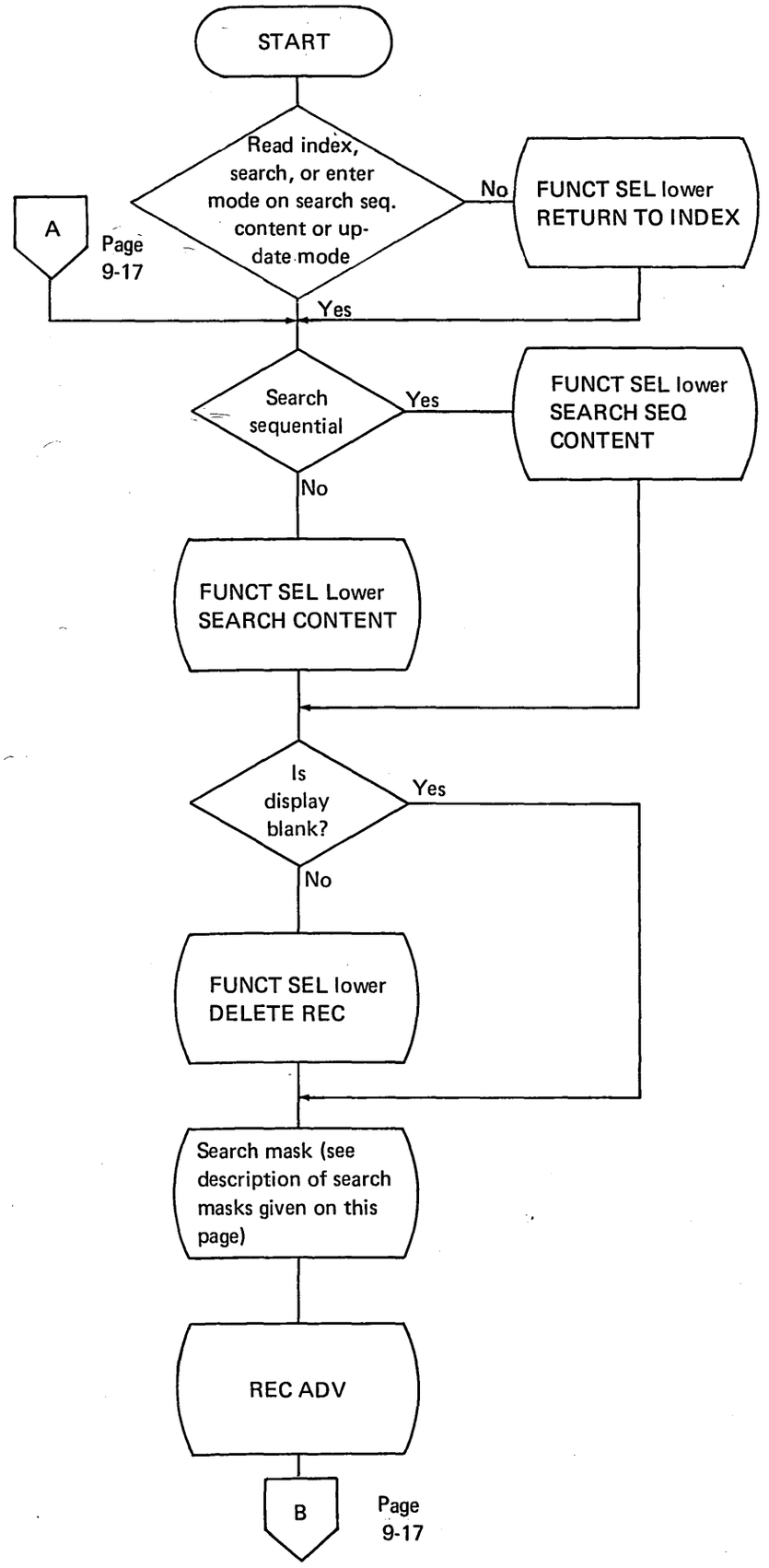
Search content and search sequential content both require a search mask.

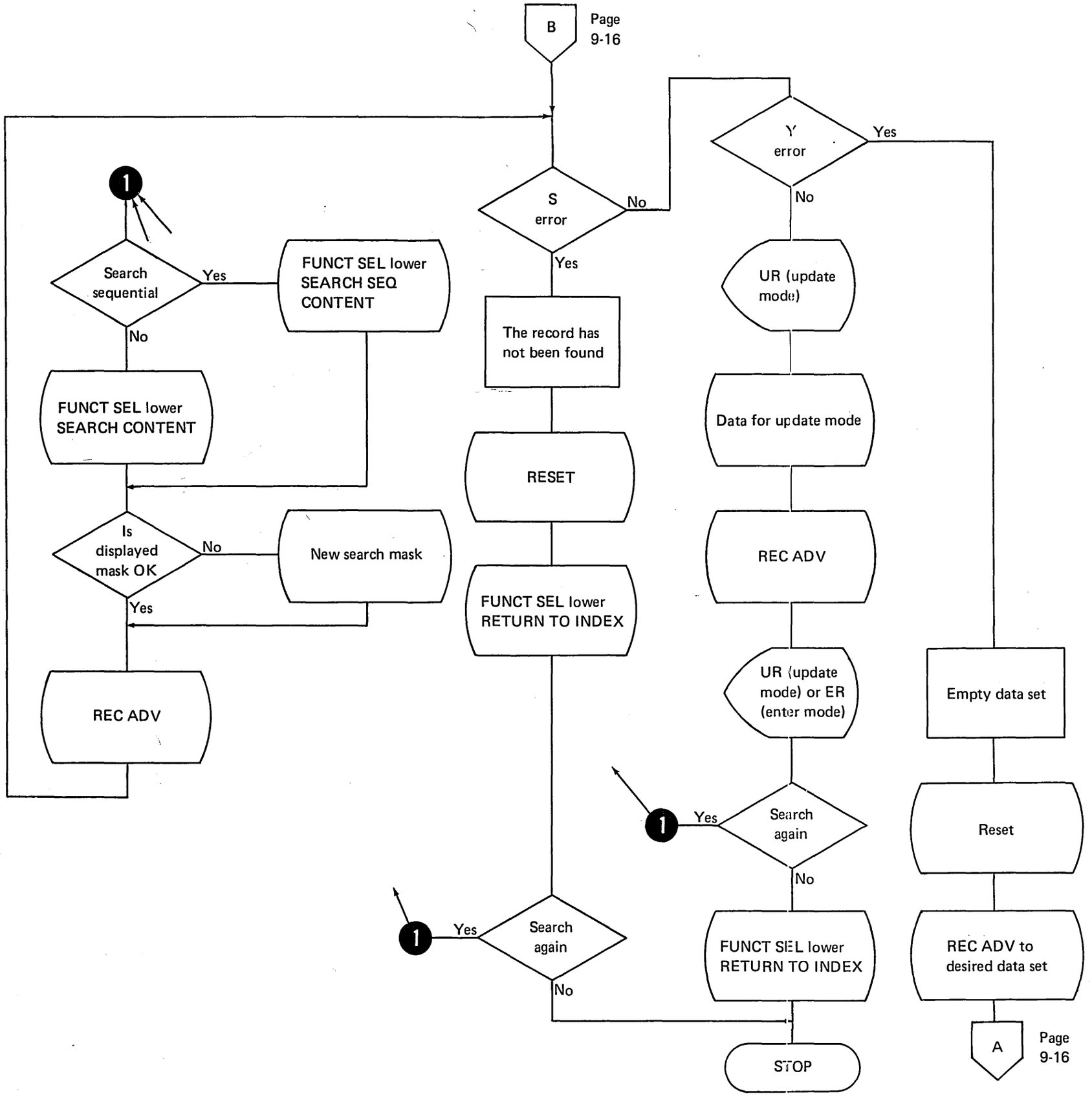
Search Content Mask

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.





EC 823146			PN 1619063
Date 9/15/74			

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 equalling 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:

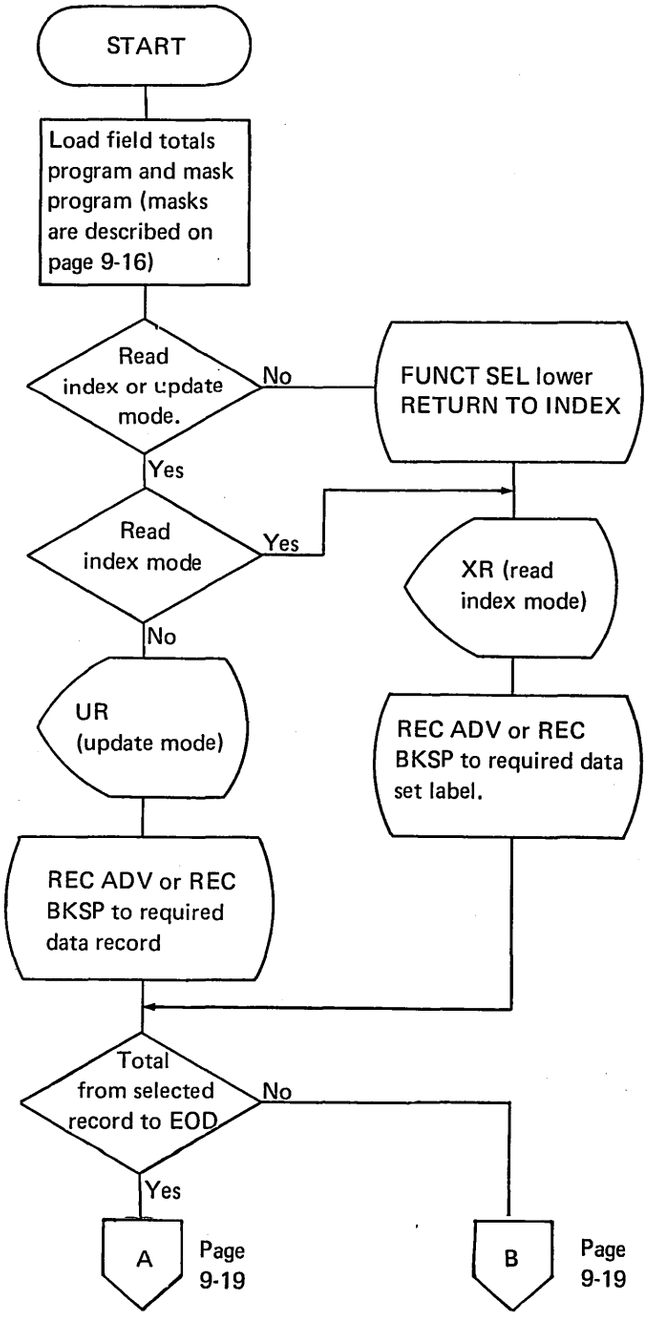
1. Insert diskette and close cover.
2. Load the program and mask statements needed to obtain the field totals.
3. If in the update mode, position the disk to the first record to be used in the field totals operation.
4. Turn AUTO REC ADV switch on for automatic record advancing.
5. Press FUNCT SEL upper and COMPUTE FIELD TOTALS.

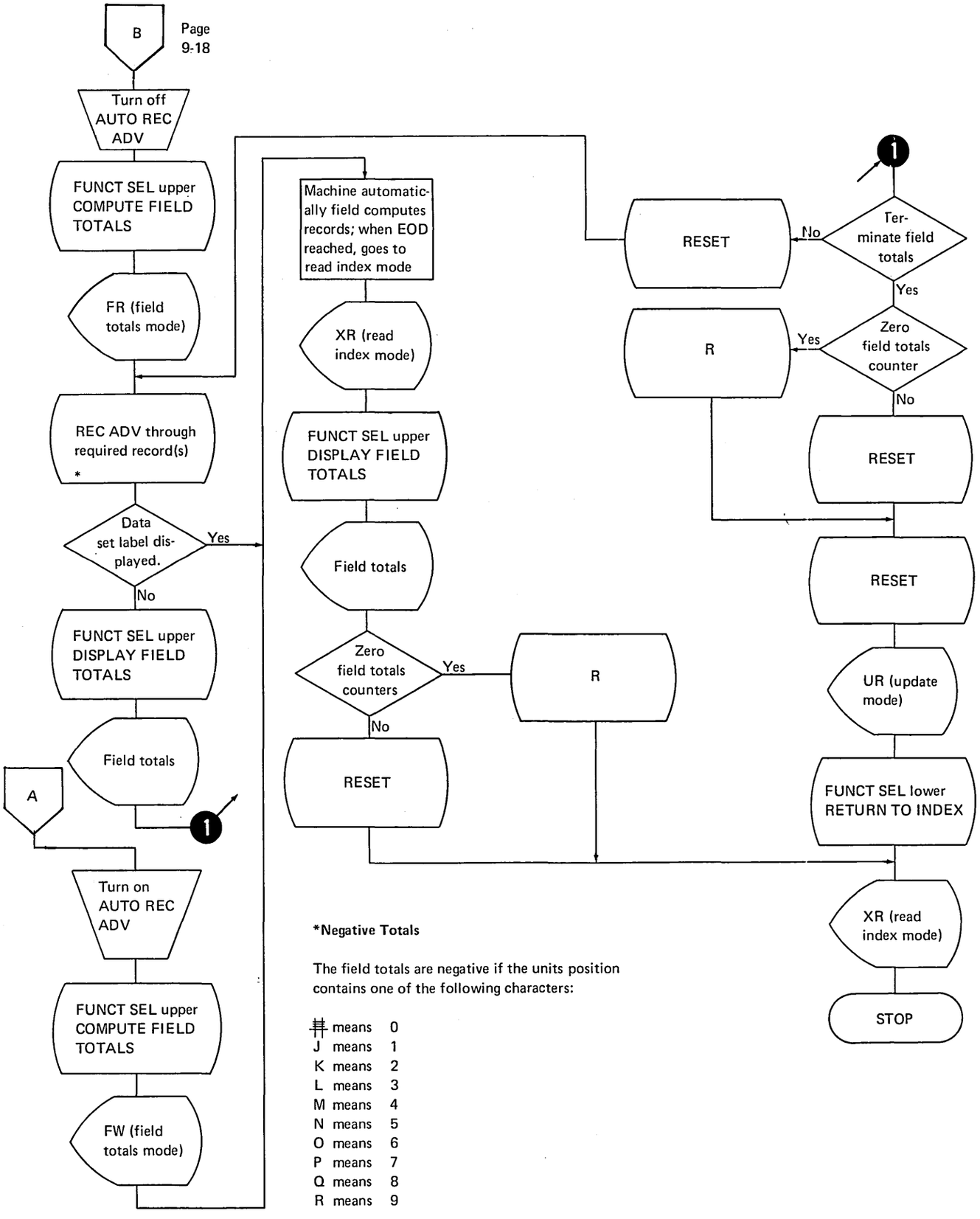
The accumulators are reset to zero, and the field totals operation begins. Records are processed under control of the program specified in the mask statements. Field definition characters are ignored, except those followed by a number. Field totals fields are identified by following a field definition 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.





***Negative Totals**

The field totals are negative if the units position contains one of the following characters:

⧺ means	0
J means	1
K means	2
L means	3
M means	4
N means	5
O means	6
P means	7
Q means	8
R means	9

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 (Online and Offline)

- 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 DISPLAY FIELD TOTALS (If 32 records were entered and accumulated online, display should be 352)
- Press R
- Press FUNCT SEL upper
- Press COMPUTE FIELD TOTALS
- Press FUNCT SEL upper
- Press DISPLAY FIELD TOTALS (If 32 records were accumulated offline, display should be 352)
- Press R

Mask Statements

A mask statement can be used to cause a specific program to be selected to process a specific 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: (001-128).
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 offline 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 offline 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 (page 9-21) 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; 4.

Continued from program buffer 6

Selects program level 4 if another program level has not been selected.

ONLINE FIELD TOTALS

Three 19-digit accumulators are provided with this feature. Data can be algebraically summed in these accumulators from a specified field or fields in any or all records in a batch. The summation is under control of the program. The program specifies that a field is to be summed and into which of the three accumulators the sum will be placed. 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 may be used to cause the field to be accumulated in two or three accumulators. The low order 14 digits of a field total field are added into a specified accumulator. If overflow beyond 19 digits occurs in an accumulator it will not be indicated.

In addition to the numbers 0 through 9, a field total field may include any of the 256 EBCDIC codes. All codes with the low order four bits of the codes equal to 0 through 9 are added with a value 0-9. All other codes are added with a numeric value of zero. All fields in which the units position codes have the high order 4 bits equal to B or D are considered negative. All other fields are considered positive.

In online field totals, the accumulators are reset to zero when power is turned on, when a reset is accomplished by pressing the R key with field totals displayed, or when entering a field in a record that is programmed as a read out and reset field.

During online field totals operation, the amount that is added to an accumulator in a given field is equal to the change that occurs in the field from the time the cursor comes into the field until the cursor leaves the field. In enter mode the field is always blank and its numeric value is zero; therefore, the amount added to the accumulator is equal to the amount entered. In update or verify, the amount added is zero unless the field is modified, and if so the amount added is the algebraic difference obtained by subtracting the initial amount of the field from the final amount of the field.

The accumulators represent the field totals operations to the most advanced record written on disk and any operations on the current record being processed. Deleting a record or backspacing to a previous record from a partially entered, updated, or verify corrected record, algebraically subtracts all accumulate fields from the specified accumulators.

Displaying Field Totals

Field totals accumulators can be displayed when the cursor is at the beginning of a field by pressing DISPLAY FIELD TOTALS. Any data currently being displayed is removed from the screen and the amounts currently residing in the accumulators are displayed. At this point the system accepts only two keys, RESET and R. Pressing R removes the field totals display, displays the record, and resets all accumulators to zero. Pressing RESET removes the field totals display and displays the record; but does not reset the accumulators.

In enter mode the numbers 7, 8, and 9 following a bypass field definition code, B, cause the specified accumulator or accumulators to be read out into the field and reset. Accumulator 1 is specified by 7, accumulator 2 by 8, and accumulator 3 by 9. In update and verify modes, the amount in the accumulators is added to the amounts that already exist in the field.

Online Field Totals Restrictions

To insure 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.
- After updating a record, deleting a record, or correcting a record in the verify mode, all succeeding fields programmed to accept in 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 zero to maintain online field totals integrity.

Example:

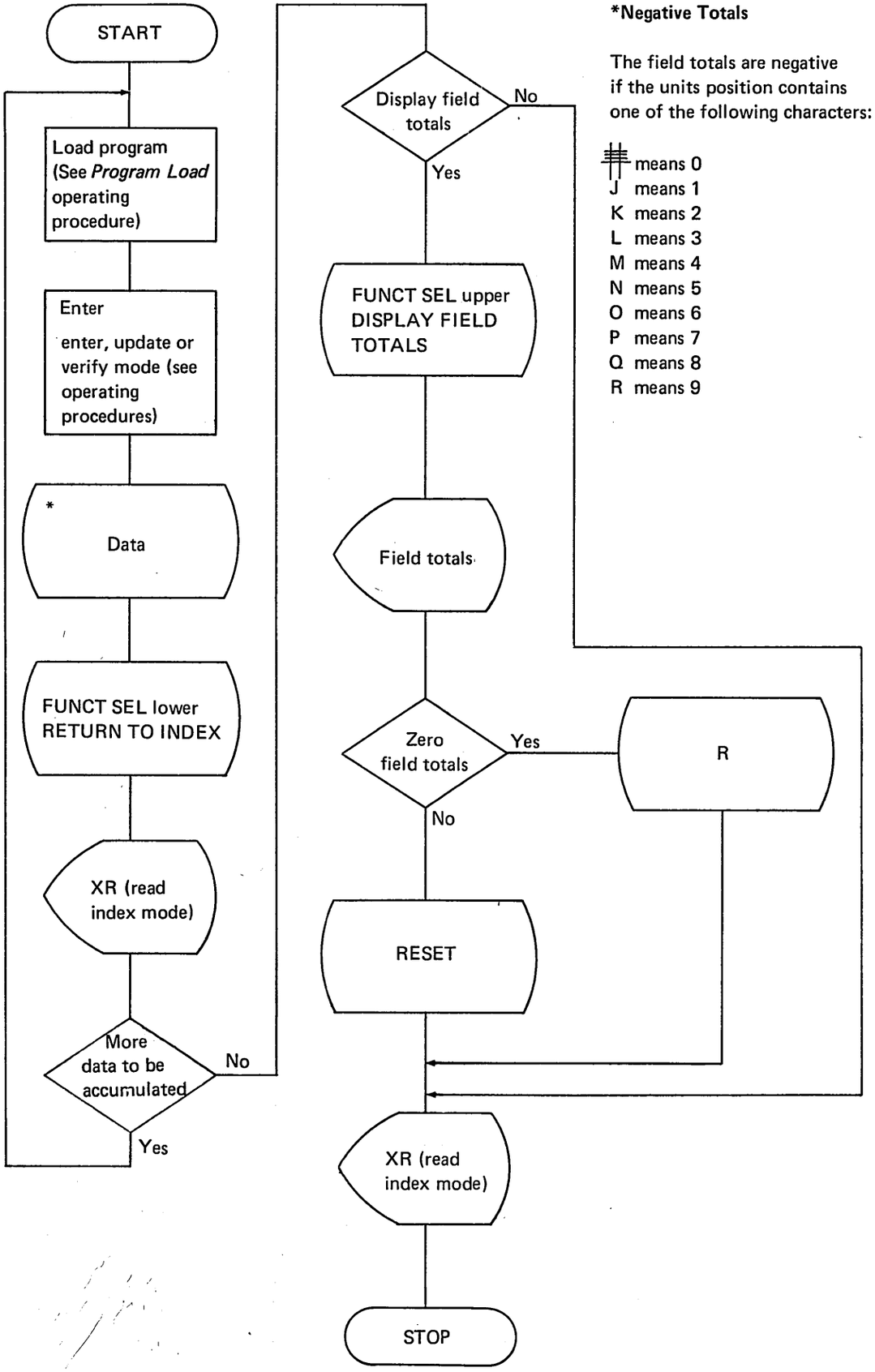
To accumulate totals across several records, the following program could be used:

N1---R2-----E

The first field is a 5-position numeric field which will be totaled in accumulator one.

The second field is a 7-position numeric right-adjust field which will be totaled in accumulator two. To read accumulator 2 into a summary record and reset the accumulator to zero, the following program could be used for the summary record.

N----B8-----E.



***Negative Totals**

The field totals are negative if the units position contains one of the following characters:

╫	means 0
J	means 1
K	means 2
L	means 3
M	means 4
N	means 5
O	means 6
P	means 7
Q	means 8
R	means 9

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, no matter which method of generation is 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, that makes it different 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. It does not matter 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)

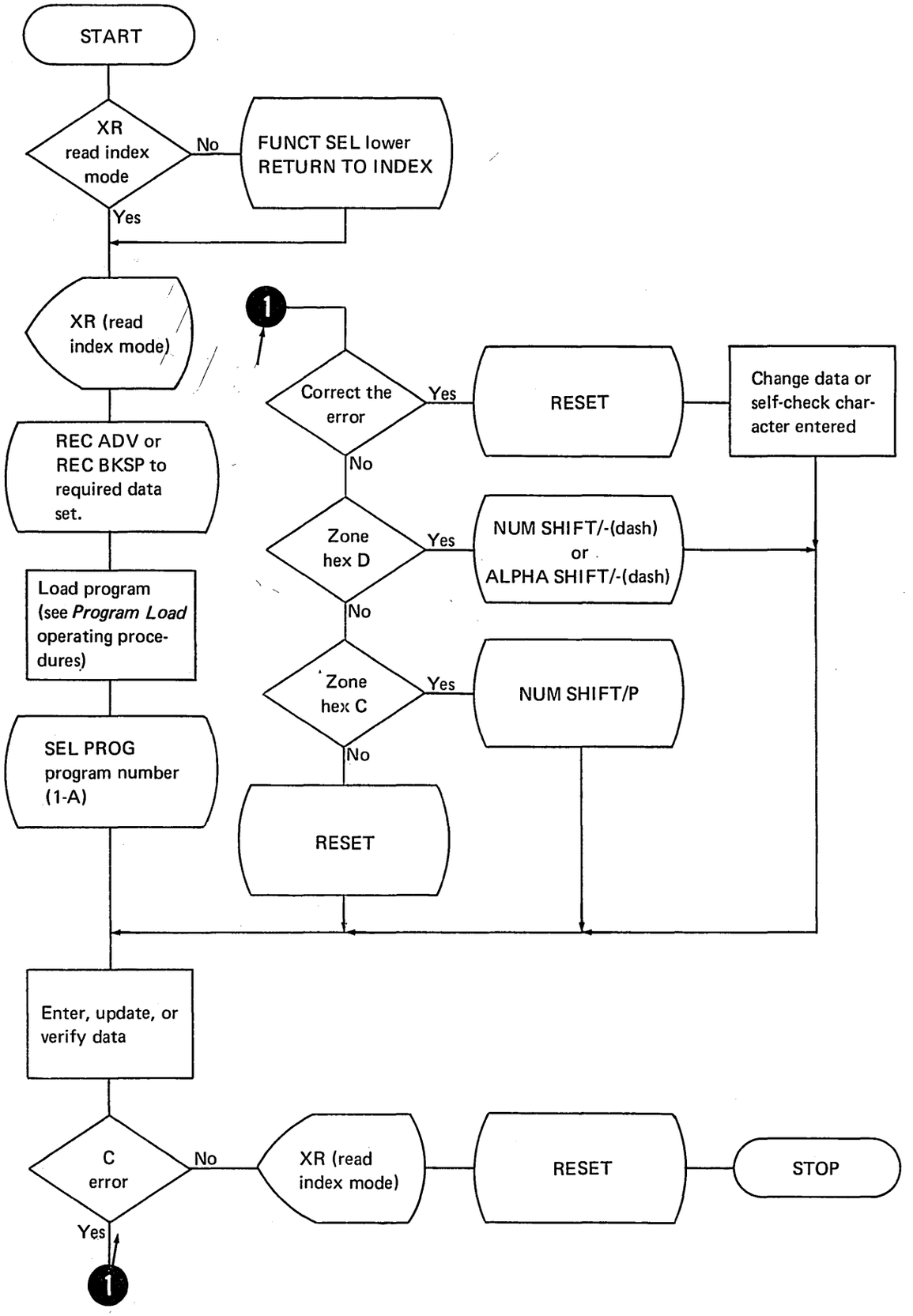
The new self-checking number is: 9434578423

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. In addition, only one position is reserved for the check digit. A check digit of 11 is entered as zero.

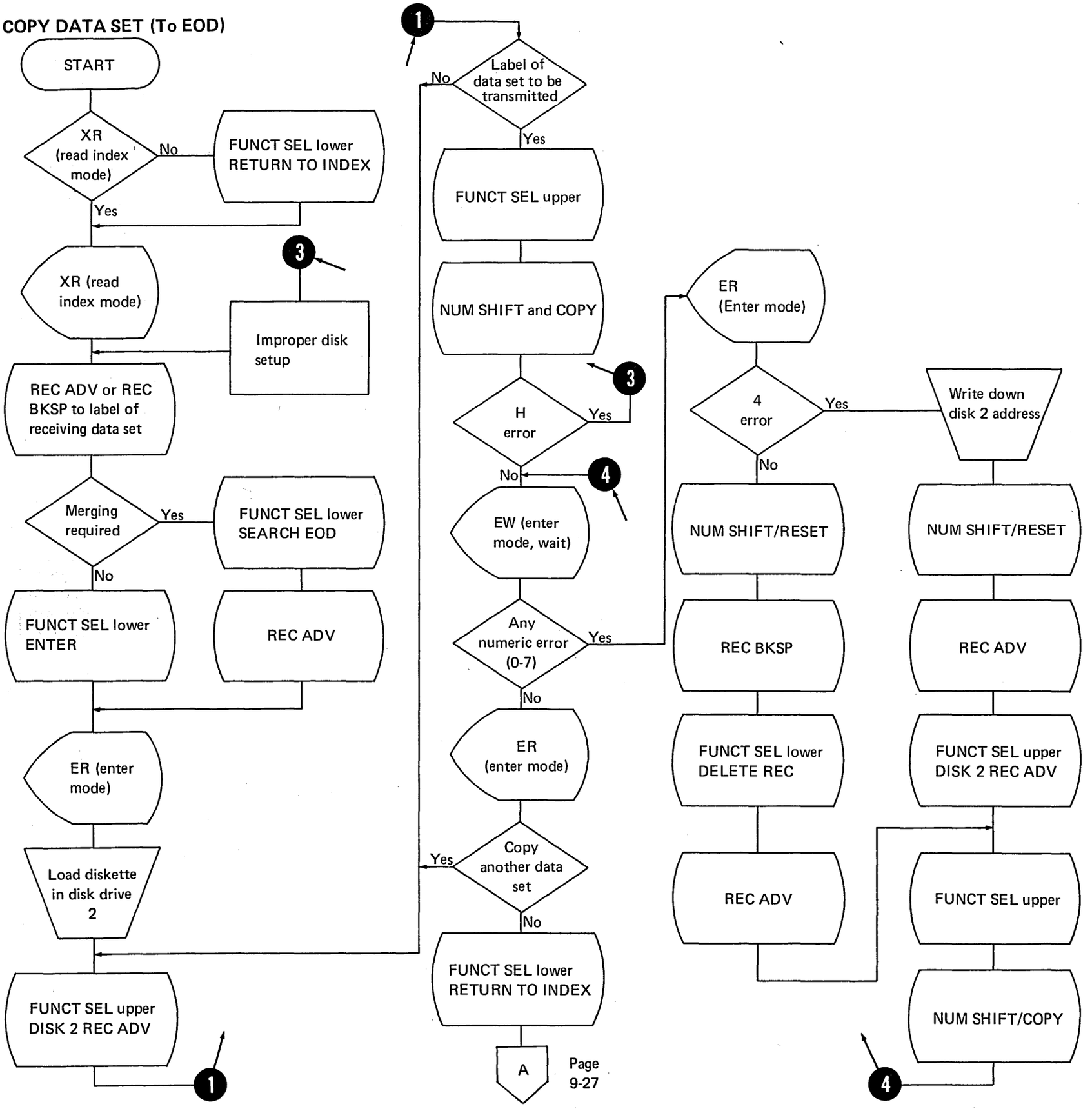
Self-check fields are specified in the program by the use of one of the characters C, G, M or H, F, L as the field identification character. The field definition characters have the following meanings:

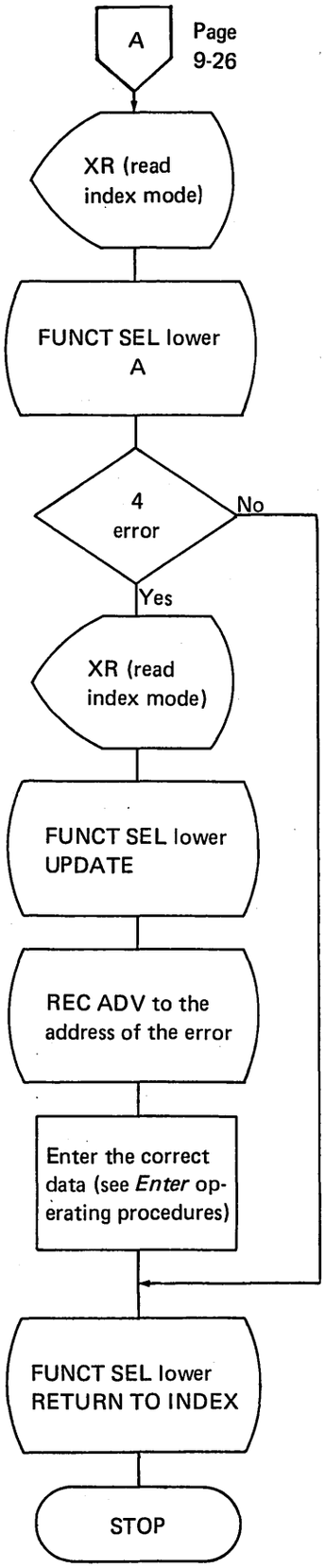
C or H – modulus 11 or 10 – Normal
G or F – modulus 11 or 10 – Skip
M or L – modulus 11 or 10 – Dup

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.

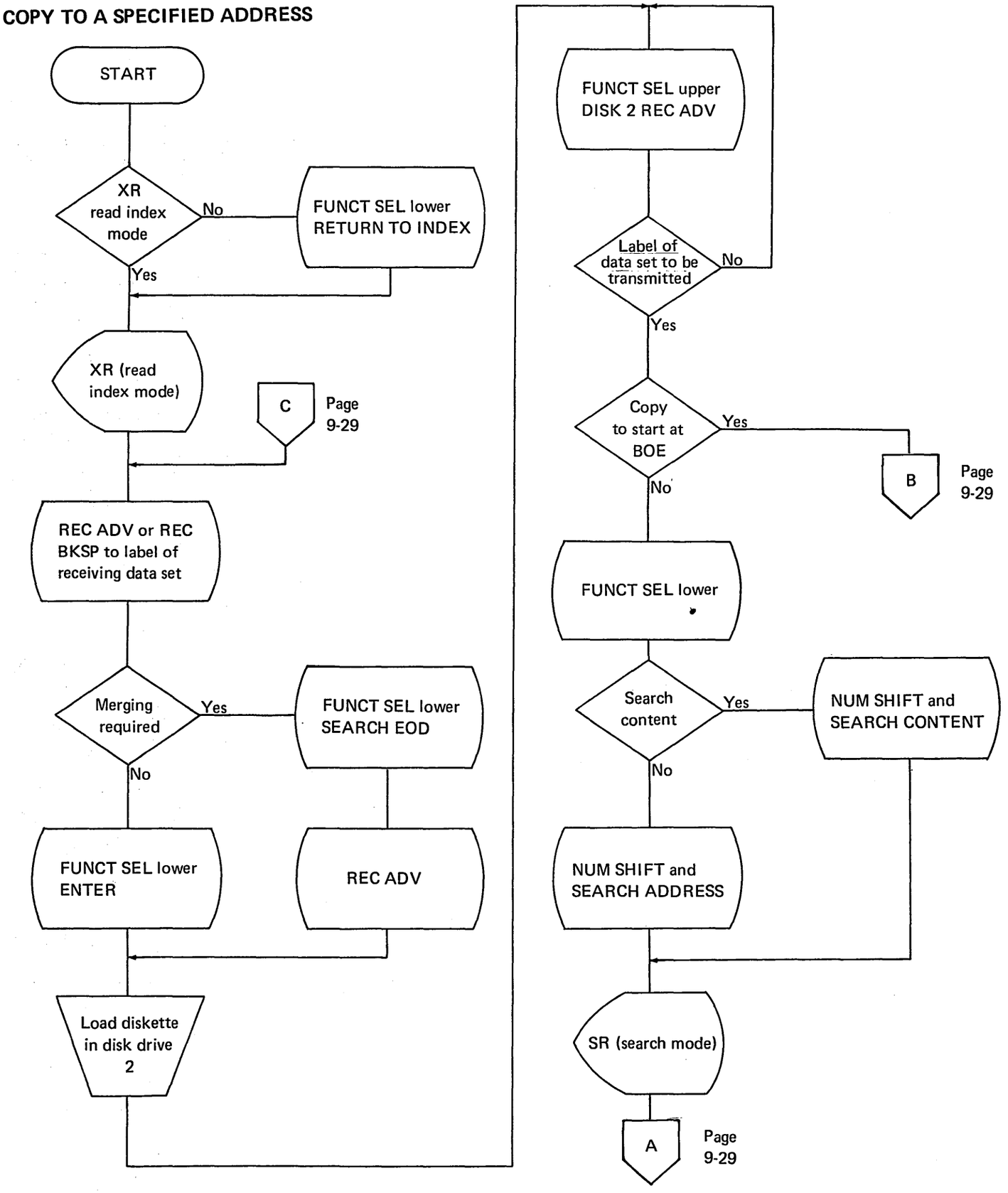

START
XR read index mode
No
FUNCT SEL lower RETURN TO INDEX
Yes
XR (read index mode)
REC ADV or REC BKSP to required data set.
Load program (see *Program Load* operating procedures)
SEL PROG program number (1-A)
Enter, update, or verify data
C error
No
XR (read index mode)
RESET
STOP
Yes
1
1
Correct the error
Yes
RESET
Change data or self-check character entered
No
Zone hex D
Yes
NUM SHIFT/-(dash) or ALPHA SHIFT/-(dash)
No
Zone hex C
Yes
NUM SHIFT/P
No
RESET

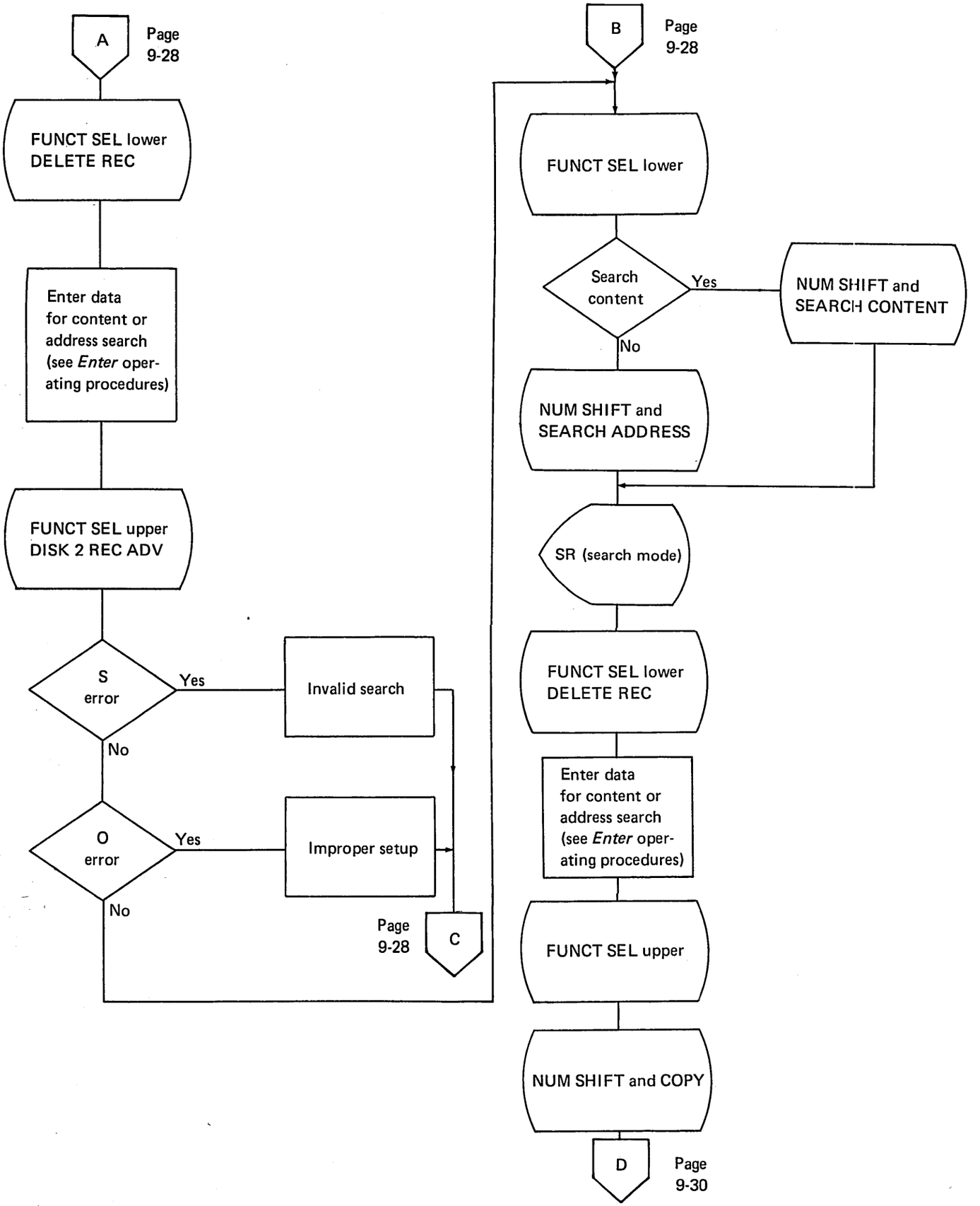
COPY DATA SET (To EOD)




A
Page 9-26
XR (read index mode)
FUNCT SEL lower A
4 error
No
Yes
XR (read index mode)
FUNCT SEL lower UPDATE
REC ADV to the address of the error
Enter the correct data (see *Enter* operating procedures)
FUNCT SEL lower RETURN TO INDEX
STOP

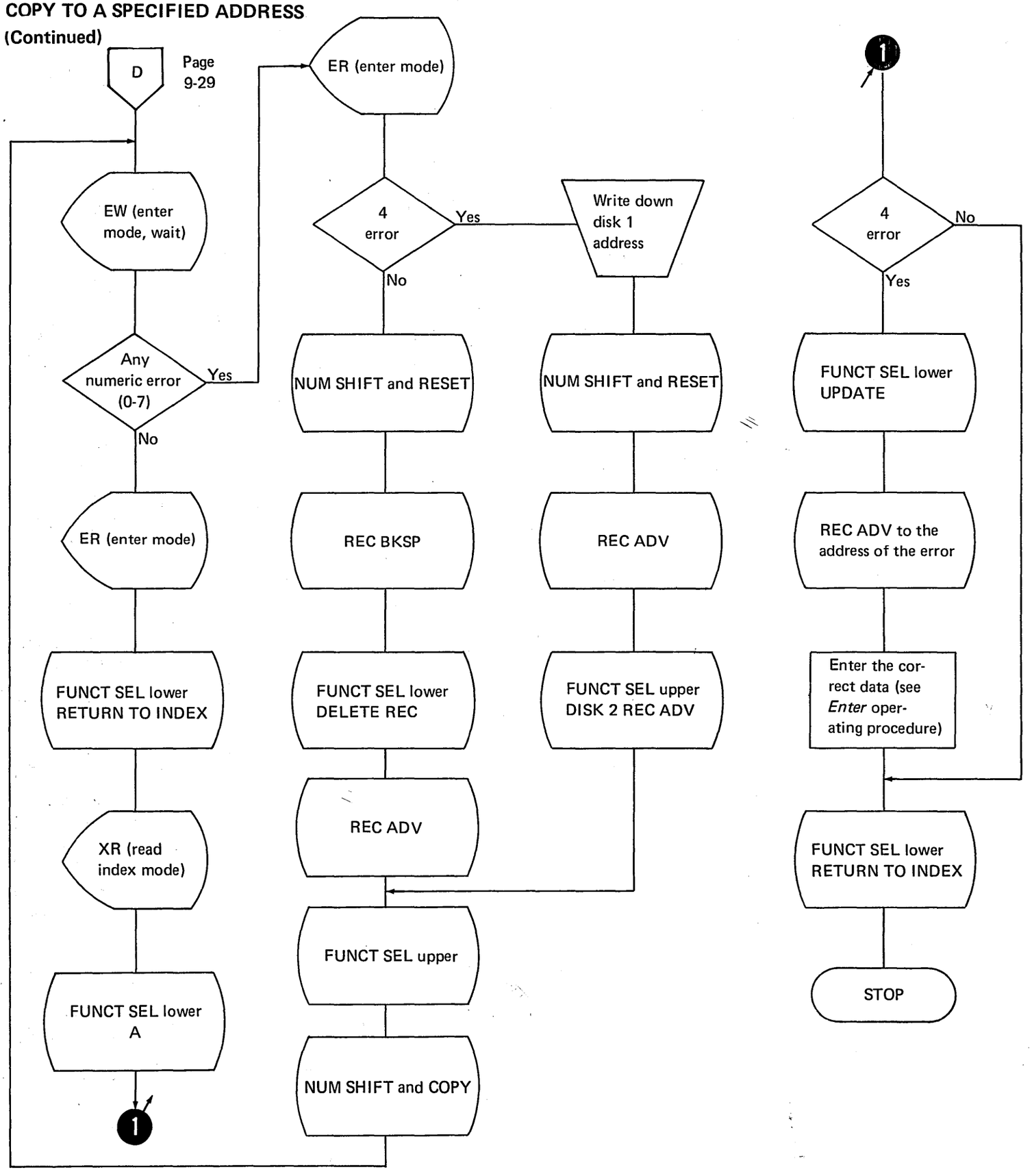
COPY TO A SPECIFIED ADDRESS



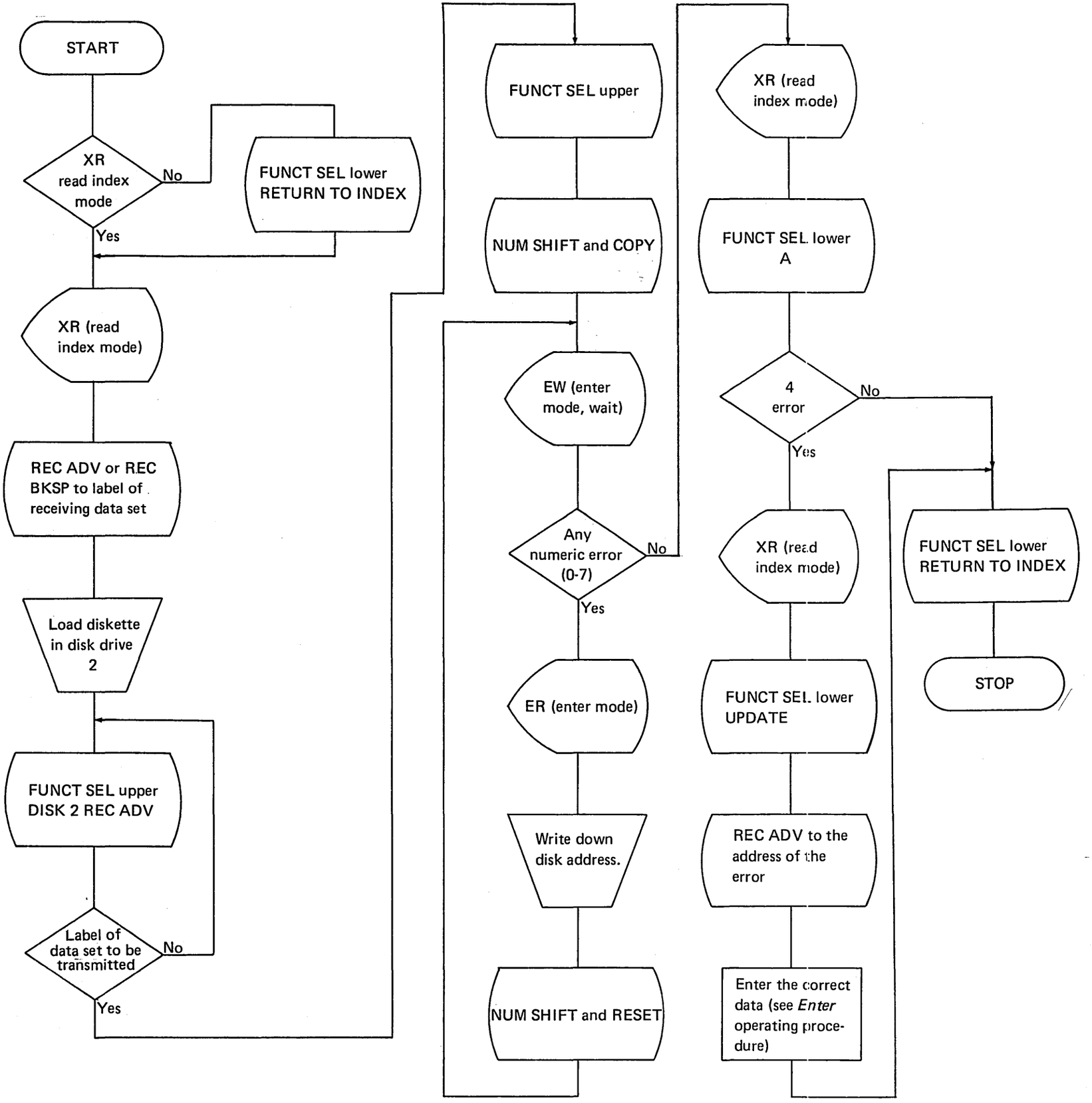


EC 823146			PN 1619075
Date 9/15/74			

COPY TO A SPECIFIED ADDRESS (Continued)



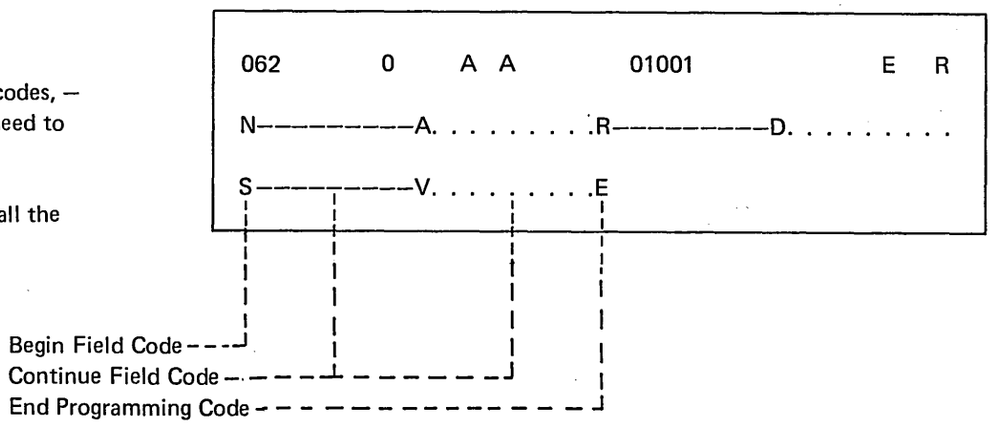
COPY IMAGE (To EOE)



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.

Sample Program



Program Code Chart

	Code	Verify Bypass	Shift	Function
Begin Field Codes	N	V	Numeric	Manual fields
	A	W	Alpha	Manual fields
	ｱ	ﾊ	Katakana	Manual fields
	J	Y	Numeric	Right-adjust, blank fill
	R	X	Numeric	Right-adjust, zero fill
	ﾌ	ﾍ	Katakana	Right-adjust, blank fill
	I	Z	Alpha	Right-adjust, blank fill
	B		————	Bypass
	D		Numeric	Automatically duplicates
	U		Alpha	Automatically duplicates
	ﾃ		Katakana	Automatically duplicates
	S		Numeric	Automatically skips
	K		Alpha	Automatically skips
	ｽ		Katakana	Automatically skips
Continue Field Codes	–		Numeric	Continues field in numeric shift
	.		Alpha	Continues field in alpha shift
	ｺ		Katakana	Continues field in Katakana shift
End Program Code	E			Marks end of program
Feature Begin Field Codes	H		Numeric	Self-check, modulus 10
	C		Numeric	Self-check, modulus 11
	F		Numeric	Auto skip self-check, modulus 10
	G		Numeric	Auto skip self-check, modulus 11
	L		Numeric	Auto dup self-check, modulus 10
	M		Numeric	Auto dup self-check, modulus 11 (See *Self-Check,* page (9-24).
	Any begin-field character followed by 1, 2, or 3.			field totals entry (See *Field Totals,* page (9-18) and (9-22)
	B	Bypass begin-field character followed by 4, 5, or 6;		Field totals read out – offline
	B	followed by 8, 8, or 9.		Field totals read out and reset – online or offline
				(See *Writing Field Totals into Records or Disks,* page (9-20).

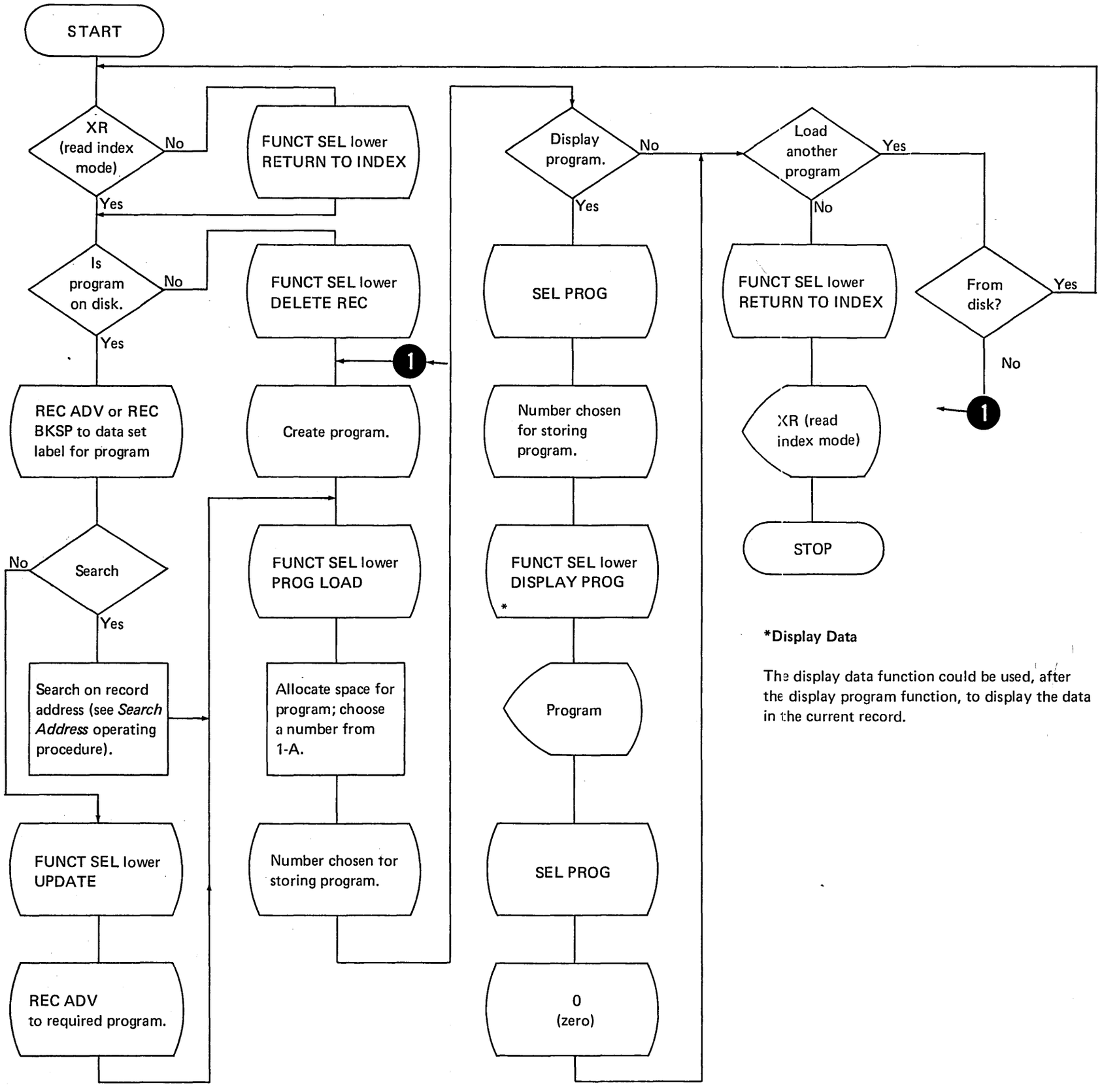
Program Record Length

Program records can be any length up to the maximum of 128 characters, but all program records on a data set must have the same logical record length. Users can choose to make all program records 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 128 of the current program. The program to be selected, when record backspacing, is designated by the appropriate program number in position 127 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.

3713 PRINTER PROGRAMS

Loading Printer Programs

Printer programs are loaded the same way as key entry programs:

- Press FUNCT SEL lower.
- Press PROG LOAD.
- Key in program number.

Program storage area A is reserved for vertical forms control, horizontal tab stops, and printer program source control. Program storage areas 1 through 9 can be used for printer formatting programs.

Printer Program Control Characters

Program A

Column 1 of program storage area A is used to control printer program selection:

- A colon (:) in column 1 means that the printer will use the currently selected program.
- A percent (%) in column 1 means that the first character of each record will select the printer program for printing that record.
- A plus (+) in column 1 means data stream control characters will be used to control printer formatting.
- Any other character in column 1 means that no program control will be used (data will be printed on a one record per line basis).

Other columns in program storage area A can contain the following characters.

Control Character	Function
1-9	Vertical control stop.
E	End of vertical forms (placed in the column that is numbered one greater than the number of lines on the printed page).
F	Combination horizontal stop and end of vertical forms.
J-R	Combination horizontal and vertical stop.
T	Horizontal tab stop.

Programs 1-9

Operational Commands: Data is transferred from current buffer to print buffer.

Control Characters	Function
A	Identifies field
B	Blank leading zeros
D	Signed data field
Z	Security asterisks for zeros.

Forms Control Commands: Data may be transferred into print buffer (blanks only).

Control Characters	Function
C	Carriage return and start print
S	Vertical skip
T	Horizontal tab
X	Insert space

Processor Commands: No data is put into print buffer. Used for selecting information in current buffer.

Control Characters	Function
F	Reverse by pass
N	No-op (start PRO)
Q	End program
R	Skip to next record
Y	Forward by pass

Numbers preceding A, B, D, F, X, Y, and Z indicate field length (no number means 1).

Numbers preceding T and C indicate the number of times to perform the function (no number means 1).

A number preceding S is compared to the characters in program A to determine the line to skip to (no number means a 1).

Numbers preceding N, Q, and R are ignored.

A,B,D,F,T,X,Y, and Z format data. Printing is initiated by a carriage return (C).

If Q is preceded by any character other than A,B, C,D,F,N,R,S,T,X,Y,Z,1,2,3,4,5,6,7,8, or 9, a W error results.

Printer Program Considerations

- If no printer programs are used for printing, all data is printed one record per line.
- The printer begins a printer program as if the paper were positioned at line 1 of a page.
- All print to EOD functions must begin in read index or update mode.
- The AUTO REC ADV switch must be on for continuous printing. If it is off, printing stops at the end of each print line, and REC ADV must be pressed to continue printing.
- RESET can be pressed to exit from print mode. If RESET is pressed in a print record function, the machine returns to the mode it was in before printing the record. If RESET is pressed in a print to EOD function, the machine goes to update mode.

Data Stream Formatting

When the first character in program A is a plus (+) character, the following printer control characters are recognized from the data stream:

Characters		Meaning
HT (TAB)		Tab to the next tab stop in program A
NL (Newline) or LF (Line Feed)		Execute a carriage return/ line feed function
ESC A		Skip to code 1 in program A
ESC B		Skip to code 2 in program A
ESC C		Skip to code 3 in program A
ESC D		Skip to code 4 in program A
ESC E		Skip to code 5 in program A
ESC F		Skip to code 6 in program A
ESC G		Skip to code 7 in program A
ESC H		Skip to code 8 in program A
ESC I		Skip to code 9 in program A
ESC /	See Note	Skip one line
ESC S		Skip two lines
ESC T		Skip three lines
ESC U		Skip four lines
ESC V		Skip five lines
ESC W		Skip six lines
ESC X		Skip seven lines
ESC Y		Skip eight lines
ESC Z		Skip nine lines

Note: Early shipments of the IBM 3713 Printer cannot use ESC /, S, T, U, V, W, X, Y, or Z. These early machines can be field upgraded.

The last ESC function is executed by the next new line (NL) or line feed (LF) control character.

If the print buffer is filled with 128 characters and the next character is not a NL/LF, or ESC sequence, a carriage return/line feed function and a pending escape function is performed.

3715 Printer Programs

Loading Printer Programs

Printer programs are loaded the same way as key entry programs:

- Press FUNCT SEL lower.
- Press PROG LOAD.
- Key in program number.

Program storage area A is reserved for vertical forms control, horizontal tab stops, and printer program source control. Program storage areas 1 through 9 can be used for printer formatting programs.

Printer Program Control Characters

Program A

Column 1 of program storage area A is used to control printer program selection:

- A colon (:) in column 1 means that the printer will use the currently selected program.
- A percent (%) in column 1 means that the first character of each record will select the printer program for printing that record.
- A plus (+) in column 1 means data stream control characters will be used to control printer formatting.
- Any other character in column 1 means that no program control will be used (data will be printed on a one record per line basis).

Other columns in program storage A can contain the following characters.

Control Character	Function
1-9	Vertical control stop.
E	End of vertical forms (placed in the column that is numbered one greater than the number of lines on the printed page).
F	Combination horizontal stop and end of vertical forms.
J-R	Combination horizontal and vertical stop.
T	Horizontal tab stop.

Programs 1-9

Operational Commands: Data is transferred to the print buffer.

Control Characters	Function
A	Indicates field.
B	Blank leading zeros.
D	Signed data field.
I	Transfers data from the program buffer to the print buffer.
P	Loads three digit page number into the print buffer.
W	Loads four-digit disk address into the print buffer.
Z	Security asterisks for zeros.

Forms Control Commands: Data may be transferred into print buffer (blanks only).

Control Characters	Function
C	Carriage return and start print.
H	Vertical skip control
L	Program link.
S	Vertical skip.
T	Horizontal tab.
X	Insert space.

Processor Commands: No data is put into print buffer. Used for selecting information in current buffer.

Control Characters	Function
F	Reverse bypass.
N	No-op (start PRO).
Q	End program.
R	Skip to next record.
Y	Forward bypass.

Edit Commands: An edit word consists of edit characters that indicate the editing function to be performed. Edit words are placed in the printer format program along with the printer format control characters and must be enclosed by apostrophes (').

Control Characters	Function
9	Decimal digit. A decimal digit is accepted for output in the corresponding position of the print buffer.
Z	Suppress leading zeros. The corresponding position in the print buffer is blanked if the character is a leading zero **A** .
B	Insert blank character. A blank is inserted into the corresponding position in the print buffer **C** .
Y	Insert blank character if zero. A blank is inserted into the corresponding position in the print buffer if the position contains a zero **C** .
*	Insert asterisk. An asterisk is inserted into the corresponding position in the print buffer if the position contains a leading zero **C** .
,	Insert comma. A comma is inserted into the corresponding position in the print buffer. A comma is not inserted into the indicated position if zero suppression has occurred **C** .
/	Insert slash. A slash is inserted into the corresponding position in the print buffer. A slash is not inserted into the indicated position if zero suppression has occurred **C** .

Control Characters	Function
	Insert period. A period is inserted into the corresponding position in the print buffer. A period is not inserted into the indicated position if zero suppression has occurred C .
V	Stop zero suppression. The V stops zero suppression at the corresponding position in the print buffer. The V must be followed by a comma, slash, or period C .
$	Insert dollar sign. The dollar sign can be at a fixed position or floating (placed to the left of the most significant digit). To insert the dollar sign at a fixed position, place only one dollar sign character at the desired position. To insert a dollar sign to the left of the most significant digit, place a dollar sign character in all leading digit positions of the associated field C .
-	Insert minus sign. A minus sign can be placed at a fixed position or floating (placed to the left of the most significant digit) if the field is negative. To insert the minus sign at a fixed position, place one minus sign at the desired position. To insert a minus sign to the left of the most significant digit, place a minus sign character in all leading digit positions of the associated field C .
+	Insert plus sign. A plus sign can be placed at a fixed position or floating (placed to the left of the most significant digit) if the field is positive. To insert the plus sign at a fixed position, place one plus sign at the desired position. To insert a plus sign to the left of the most significant digit, place a plus sign character in all leading digit positions of the associated field C .
S	Insert sign. This edit character is used to insert the sign (+ or -) of a field. The sign can be placed at a fixed position or floating (placed to the left of the most significant digit). To insert the sign of the field at a fixed position, place one S at the desired position. To insert the sign to the left of the most significant digit, place an S in all leading digit positions of the associated field C .
CR	Insert CR. CR is inserted in the associated positions in the print buffer if the field is negative; otherwise, the associated positions are blank C .
DB	Insert DB. DB is inserted in the associated positions in the print buffer if the field is negative; otherwise, the associated positions are blank.
"	Insert edit word constant. The characters enclosed by quotes (") are inserted in the associated positions in the print buffer. The quotes are not printed C .

General Rules

- Numbers preceding A, B, D, F, I, X, Y, and Z indicate field length (no number means 1).
- A number preceding L is the program number to be linked to.
- Numbers preceding T and C indicate the number of times to perform the function (no number means 1).
- A number preceding S or H is compared to the characters in program A to determine the line to skip to (no number means 1).
- Numbers preceding I, N, P, Q, R, and W are ignored.
- A, B, D, F, T, X, Y, and Z format data. Printing is initiated by a carriage return (C).
- If Q is preceded by any character other than A, B, C, D, F, H, I, L, N, P, R, S, T, W, X, Y, Z, 1, 2, 3, 4, 5, 6, 7, 8, 9, blank, or edit word, a "W" error results.

A Examples of Zero Suppression

Input Field	Edit Word	Output Field
12345	ZZZ99	12345
00100	ZZZ99	ⱡⱡ100
00000	ZZZ99	ⱡⱡⱡ00
00100	ZZZZZ	ⱡⱡⱡ100
00000	ZZZZZ	ⱡⱡⱡⱡⱡ
00100	*****	**100
00000	*****	*****
00100	YYYYY	ⱡⱡ1ⱡⱡ
10203	9Y9Y9	1ⱡ2ⱡ3

B Examples of Floating Characters

Input Field	Edit Word	Output Field
12345	$999.99	$123.45
00123	$ZZZ.99	$ⱡⱡ1.23
00000	$ZZZ.ZZ	$ⱡⱡⱡⱡⱡⱡ
12345	$$$9.99	$123.45
00123	$$$9.99	ⱡⱡ$1.23
12	99$	12$
00012	$$$.999	ⱡⱡⱡ$012
01234	$$$.999	ⱡ$1,234
12345	S999.99	+123.45
1234N	S999.99	-123.45
1234N	+999.99	ⱡ123.45
12345	-999.99	ⱡ123.45
12345	999.00S	123.45+
00123	++B+9.99	ⱡⱡⱡ+1.23
00123	---9.99	ⱡⱡⱡ1.23
0012L	SSS9.99	ⱡⱡ-1.23

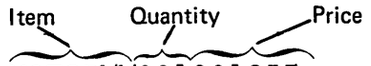
C Examples of Character Insertion

Input Field	Edit Word	Output Field
1234	9,999	1,234
123456	9,999.99	1,234.56
1234	ZZ.ZZ	12.34
1234	ZZV.99	12.34
0003	ZZ.ZZ	ⱡⱡⱡⱡ3
0003	ZZV.99	ⱡⱡ.03
0000	ZZ.ZZ	ⱡⱡⱡⱡⱡ
0000	ZZV.99	ⱡⱡ.00
123456789	9,999,999.99	1,234,567.89
1234567	**,999.99	12,345.67
0012345	**,999.99	***123.45
123456789	9.999.999,99	1,234.567,89
123456	99/99/99	12/34/56
123456	99.9/99.9	12.3/45.6
001234	ZZ/ZZ/ZZ	ⱡⱡⱡ12/34
000012	ZZ/ZZ/ZZ	ⱡⱡⱡⱡⱡⱡ12
000000	ZZ/ZZ/ZZ	ⱡⱡⱡⱡⱡⱡⱡⱡ
000000	**/**/**	********
123456	99B99B99	12ⱡ34ⱡ56
123	9BB9BB9	1ⱡⱡ2ⱡⱡ3
12	9BB/9BB	1ⱡⱡ/2ⱡⱡ

Editing Examples

The following examples show two possible ways of editing an input record.

Example 1



Data Record MOTOR¢¢001001257

Printer Format Program 7A4X3B6X'$$,$$$.99'2X3INET2CQ

❶ 7A – means load the print buffer with seven characters from the record (MOTOR¢¢).

❷ 4X – means load print buffer with four blanks.

❸ 3B – means load print buffer with three characters from the record and suppress leading zeros (001).

❹ 6X – means load print buffer with six blanks.

❺ '$$,$$$.99' – edit word to punctuate price field when loaded to print buffer.

❻ 2X – means load print buffer with two blanks.

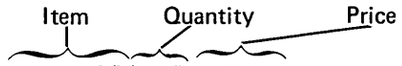
❼ 3INET – the 3I means load the print buffer with three constant characters NET.

❽ 2C – means perform carriage return and two line feeds.

❾ Q – end of printer format program.

Print Line MOTOR¢¢¢¢¢¢¢¢¢1¢¢¢¢¢¢¢¢¢¢$12.57¢¢NET

Example 2



Data Record MOTOR␣␣001001257

Printer Format Program 7A4X3B6X'Z,ZZZ"DOLLARS␣AND␣"99"␣CENTS"'2X3INET2CQ

❶ 7A – means load the print buffer with seven characters from the record.

❷ 4X – means load print buffer with four blanks.

❸ 3B – means load print buffer with three characters from the record and suppress leading zeros (001).

❹ 6X – means load print buffer with six blanks.

❺ 'Z,ZZZ"DOLLARS␣AND␣"99"␣CENTS"'
– Edit word to punctuate price field and insert constants.

❻ 2X – means load print buffer with two blanks.

❼ 3INET – The 3I means load the print buffer with three constant characters NET.

❽ 2C – means perform carriage return and two line feeds.

❾ Q – means end of printer program.

Print Line MOTOR␣␣␣␣␣␣␣1␣␣␣␣␣␣␣␣12␣DOLLARS␣AND␣57␣CENTS␣␣NET

Printer Program Considerations

- If no printer programs are used for printing, all data is printed one record per line.
- The printer begins a printer program as if the paper were positioned at line 1 of a page.
- All print to EOD functions must begin in read index or update mode.
- The AUTO REC ADV switch must be on for continuous printing. If it is off, printing stops at the end of each print line, and REC ADV must be pressed to continue printing.
- RESET can be pressed to exit from print mode. If RESET is pressed in a print record function, the machine returns to the mode it was in before printing the record. If RESET is pressed in a print to EOD function, the machine goes to update mode.

Data Stream Formatting

When the first character in program A is a plus (+) character, the following printer control characters are recognized from the data stream:

Characters	Meaning
HT (TAB)	Tab to the next tab stop in program A
NL (Newline) or LF (Line Feed)	Execute a carriage return/ line feed function
ESC A	Skip to code 1 in program A
ESC B	Skip to code 2 in program A
ESC C	Skip to code 3 in program A
ESC D	Skip to code 4 in program A
ESC E	Skip to code 5 in program A
ESC F	Skip to code 6 in program A
ESC G	Skip to code 7 in program A
ESC H	Skip to code 8 in program A
ESC I	Skip to code 9 in program A
ESC /	Skip to line 1
ESC S	Skip to line 2
ESC T	Skip to line 3
ESC U	Skip to line 4
ESC V	Skip to line 5
ESC W	Skip to line 6
ESC X	Skip to line 7
ESC Y	Skip to line 8
ESC Z	Skip to line 9
(IGS) h	Insert "h" blanks in a print line. "h" can be from 2 to 63 spaces. If more spaces are needed, two compression sequences can be strung together.

The last ESC function is executed by the next new line or line feed control character.

If the print buffer is filled with 128 characters and the next character is not a new line/line feed, or ESC sequence, a carriage return/line feed function and a pending escape function is performed.

A null character is a hex 00. A blank character is a hex 40.

Printer Operations With 3741 Features

Disk 1 Only

The 3715 can print to EOD from disk 1 if the entire data set is contained as one diskette. If the data set is contained as multiple diskettes and continuous printing is desired, then there must be a C in position 45 of the data set label. In this case when the end of the disk is reached, the printer will stop, and the 3741 will post a J error and a status of PI. The operator then keys RESET which causes the error to be reset and cause a return to index. Next, the disk is removed and the next disk inserted, then key:

FUNCT SEL upper
NUM SHIFT (hold down when keying next key)
PRINT TO EOD

This will cause the printer to continue (AUTO REC ADV switch must be on). This procedure can be repeated regardless of how many disks the data set occupies.

Disk 1 and Disk 2

Continuous printing can be done as mentioned in the last section *Disk 1 Only*, but in this case a disk must not be present in drive 2. If a disk is present in drive 2, the control automatically passes to drive 2, reads the first valid header label of the index track, and prints the data set indicated by that label. Further continuation is then via drive 1 or drive 2 at the operator option.

All print operations must start on drive 1 and can be continued on drive 2. No operator print function can begin on drive 2. If both drives have a disk present and an operation is started, the two disks are treated as one disk of double size. All operations will continue to the second disk and terminate the same as a system with only 1 drive.

Expanded Communications Feature

The system can be set up to print unattended with this feature. After communication is complete, the feature sets up buffers the same as in index mode and control passes to the 3741 mainline program to a printer, after the keying sequence FUNCT SEL and PRINT TO EOD routines. If the first received data set is on disk 2, EBSCA will set disk 1 on the index track record 7 volume label, then control will branch to the print routine and print the data set from disk 2. If the first data set is received on disk 1, operation is the same as in the previous sections *Disk 1 Only* and *Disk 1 and Disk 2.*

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Date 11/15/74			

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Sample Printer Program

Do steps 1-3.

1. Enter on disk the following data records:

Record 1:
```
5**************************************
*
```

Record 2:
```
6*****        PRINTER FORMATING EXAMPLE
     *****
```

Record 3:
```
5**************************************
*
```

Record 4:
```
7THE TYPE OF FORMAT CONTROL IS DETERMINE
D BY THE FIRST CHARACTER IN PROGRAM
```

Record 5:
```
8LEVEL A. IF THE CHARACTER IS A COLON, P
RINTING WILL BE CONTROLLED BY
```

Record 6:
```
8THE CURRENTLY SELECTED PROGRAM. IF THE
CHARACTER IS A PERCENT SIGN,
```

Record 7:
```
8THE FIRST CHARACTER OF EACH INDIVIDUAL
RECORD WILL SELECT THE PRINTER
```

Record 8:
```
8PROGRAM FOR THAT RECORD. IF THE CHARACT
ER IS A PLUS SIGN, DATA STREAM
```

Record 9:
```
8CONTROL CHARACTERS WILL BE USED TO CONT
ROL PRINTER FORMATING.  IF THE
```

Record 10:
```
8CHARACTER IS ANYTHING ELSE, DATA WILL B
E PRINTED WITH ONE RELOAD PER
```

Record 11:
```
8LINE AND NO FORMATING.
```

Record 12:
```
7PRINTER CONTROL PROGRAMS ARE MADE IN TH
E FORM NUMBER FORMAT CODE, NUMBER
```

Record 13:
```
8FORMAT CODE, ...Q. THE FORMAT CODE DETE
RMINES THE FIELD TYPE OR
```

Record 14:
```
8FUNCTION AND THE NUMBER DETERMINES FIEL
D LENGTH OR NUMBER OF TIMES THE
```

Record 15:
```
8FUNCTION IS TO BE EXECUTED. ALL PRINTER
 CONTROL PROGRAMS MUST END WITH
```

Record 16:
```
8Q CODE.
```

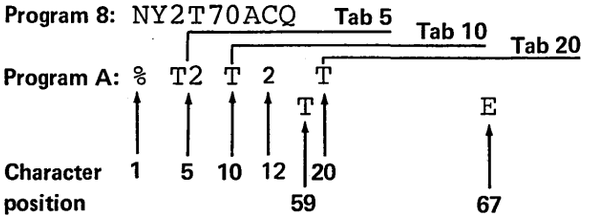
2. Enter into the program buffers the following programs:

Program 5: NY2S3T40ACQ

Program 6: NY3TATAC3TATAC3T40AC3TATAC3TATACQ

Program 7: NY3CT75ACQ

Program 8: NY2T70ACQ



3. Press FUNCT SEL upper and press PRINT TO EOD to print the following page:

skip to line 6 →
```
**********************************************
*                                            *
*                                            *
*        PRINTER FORMATING EXAMPLE           *
*                                            *
*                                            *
**********************************************
```
← skip to line 12

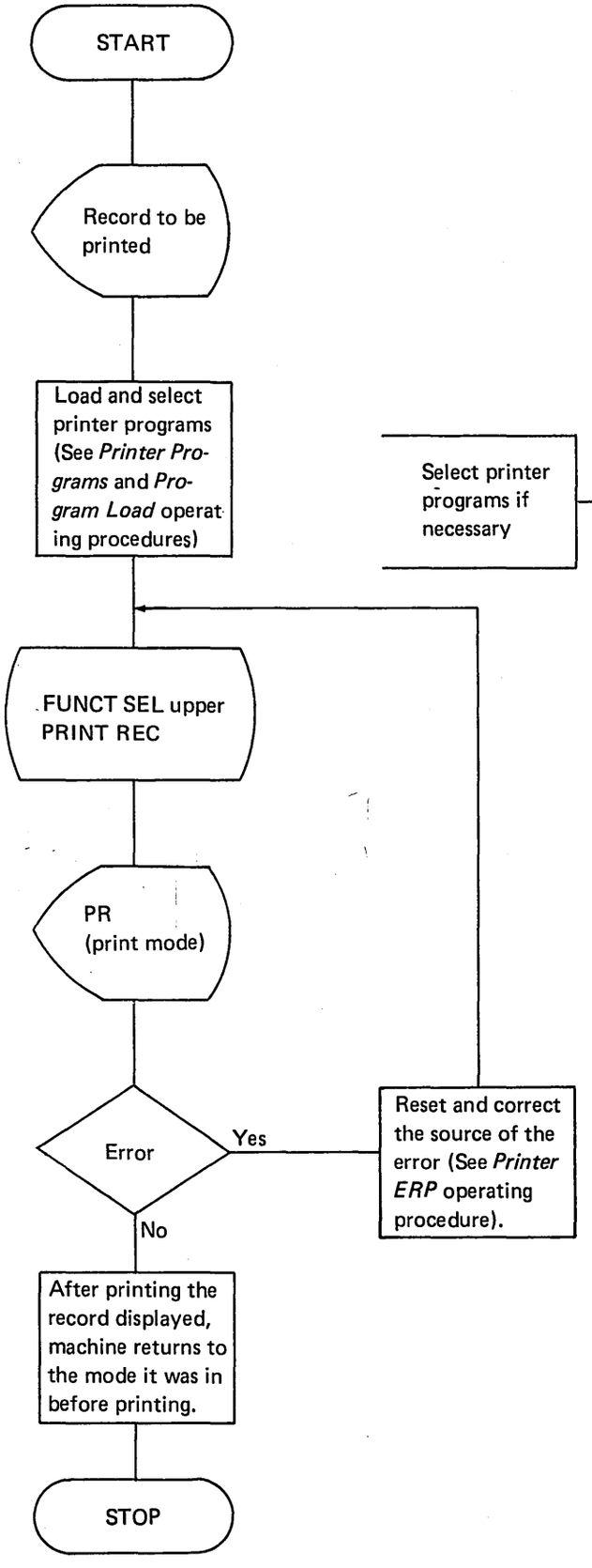
THE TYPE OF FORMAT CONTROL IS DETERMINED BY THE FIRST CHARACTER IN PROGRAM LEVEL A. IF THE CHARACTER IS A COLON, PRINTING WILL BE CONTROLLED BY THE CURRENTLY SELECTED PROGRAM. IF THE CHARACTER IS A PERCENT SIGN, THE FIRST CHARACTER OF EACH INDIVIDUAL RECORD WILL SELECT THE PRINTER PROGRAM FOR THAT RECORD. IF THE CHARACTER IS A PLUS SIGN, DATA STREAM CONTROL CHARACTERS WILL BE USED TO CONTROL PRINTER FORMATING. IF THE CHARACTER IS ANYTHING ELSE, DATA WILL BE PRINTED WITH ONE RELOAD PER LINE AND NO FORMATING.

PRINTER CONTROL PROGRAMS ARE MADE IN THE FORM NUMBER FORMAT CODE, NUMBER FORMAT CODE, ...Q. THE FORMAT CODE DETERMINES THE FIELD TYPE OR FUNCTION AND THE NUMBER DETERMINES FIELD LENGTH OR NUMBER OF TIMES THE FUNCTION IS TO BE EXECUTED. ALL PRINTER CONTROL PROGRAMS MUST END WITH Q CODE.

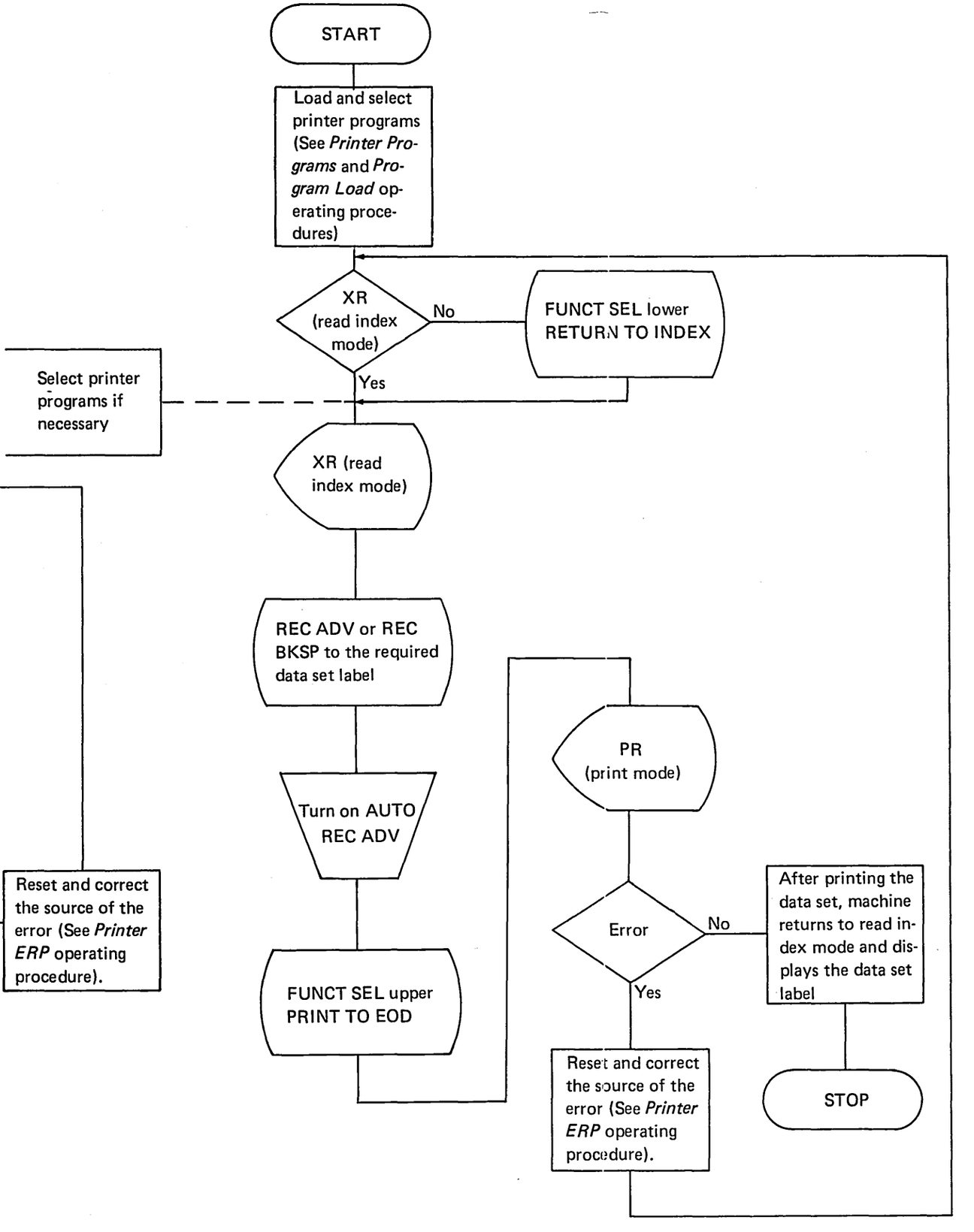
Tab 5 Tab 10 Tab 20

Edge of form

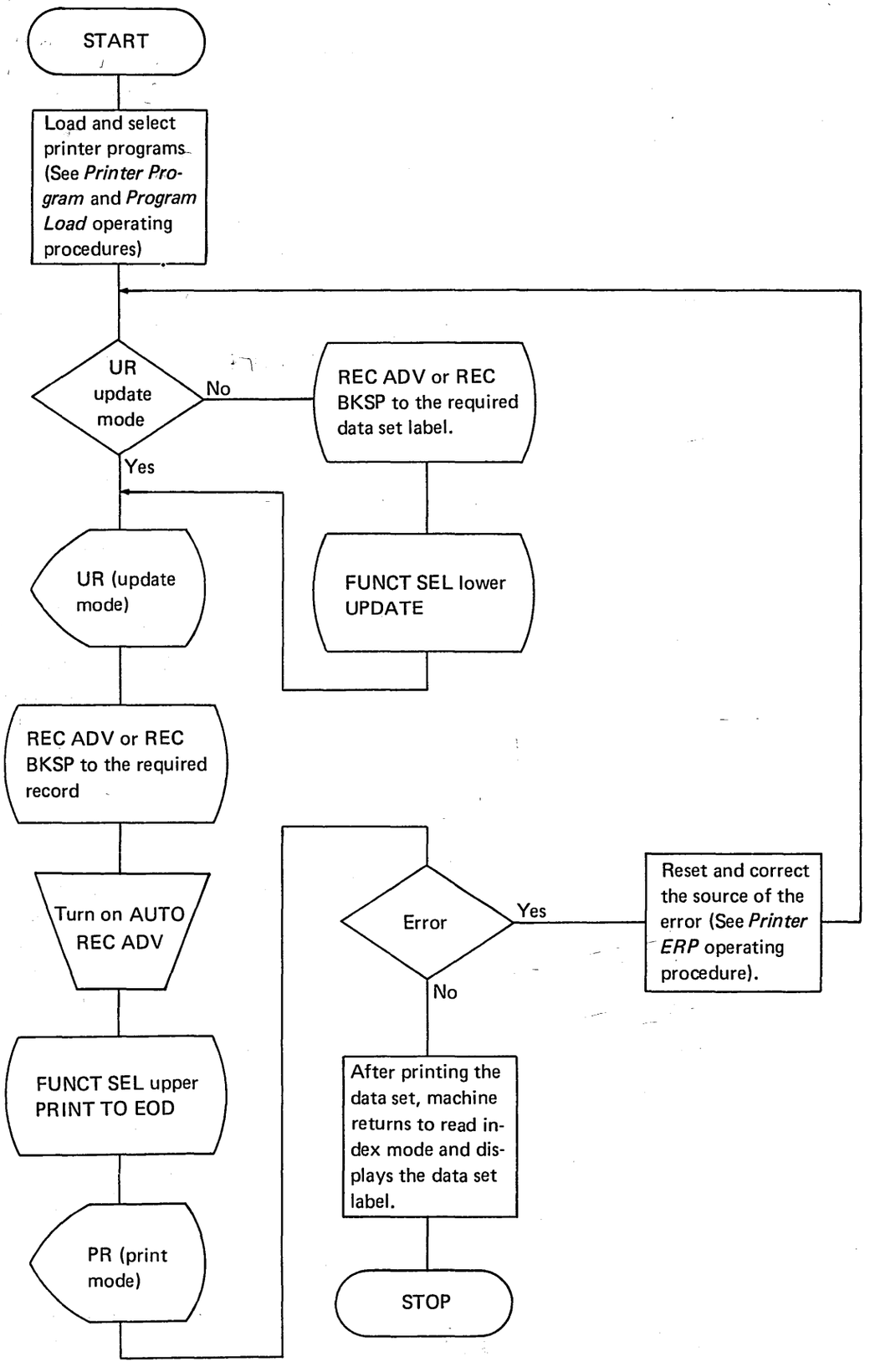
PRINT A DISPLAYED RECORD



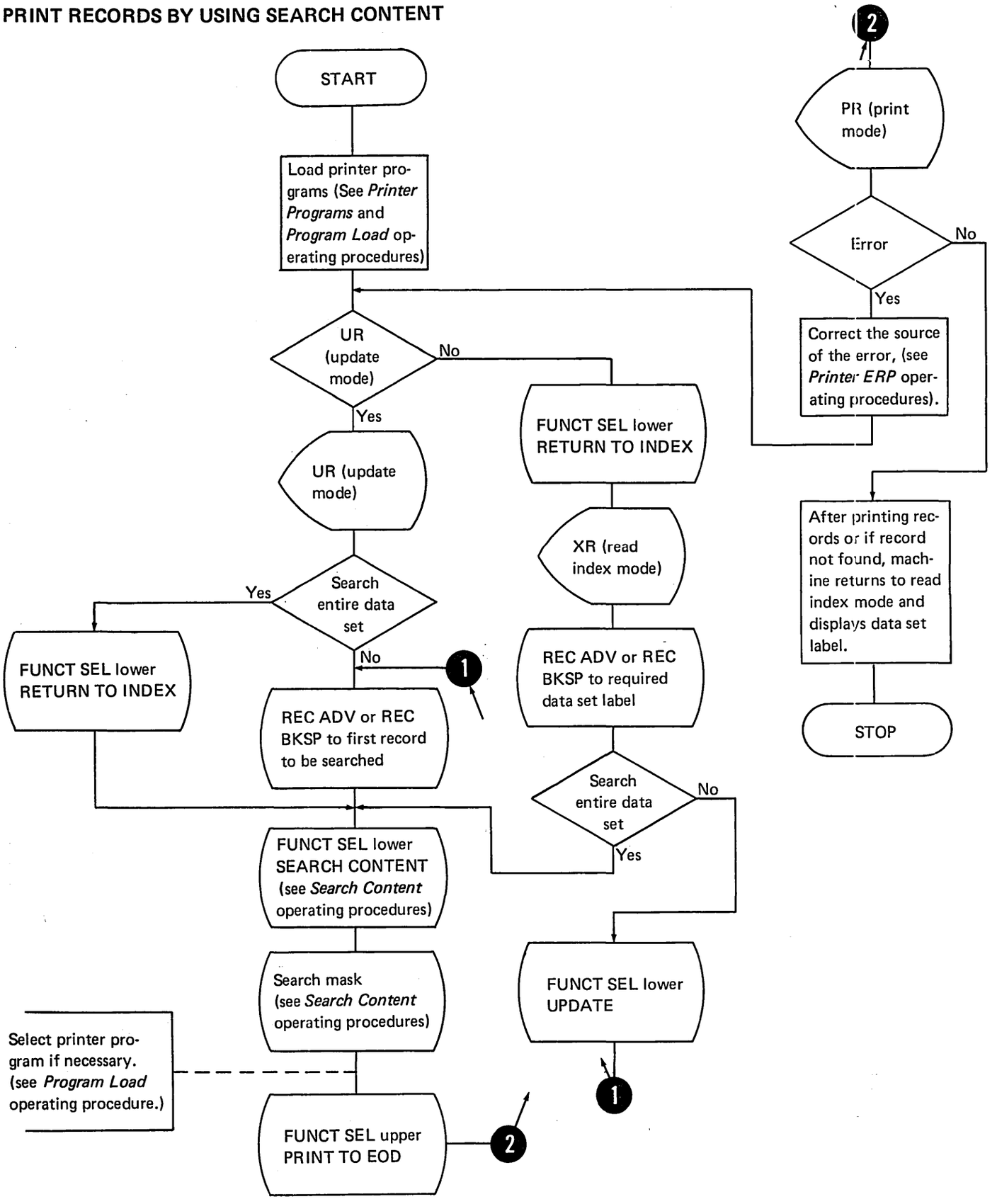
PRINT A DATA SET (To EOD)



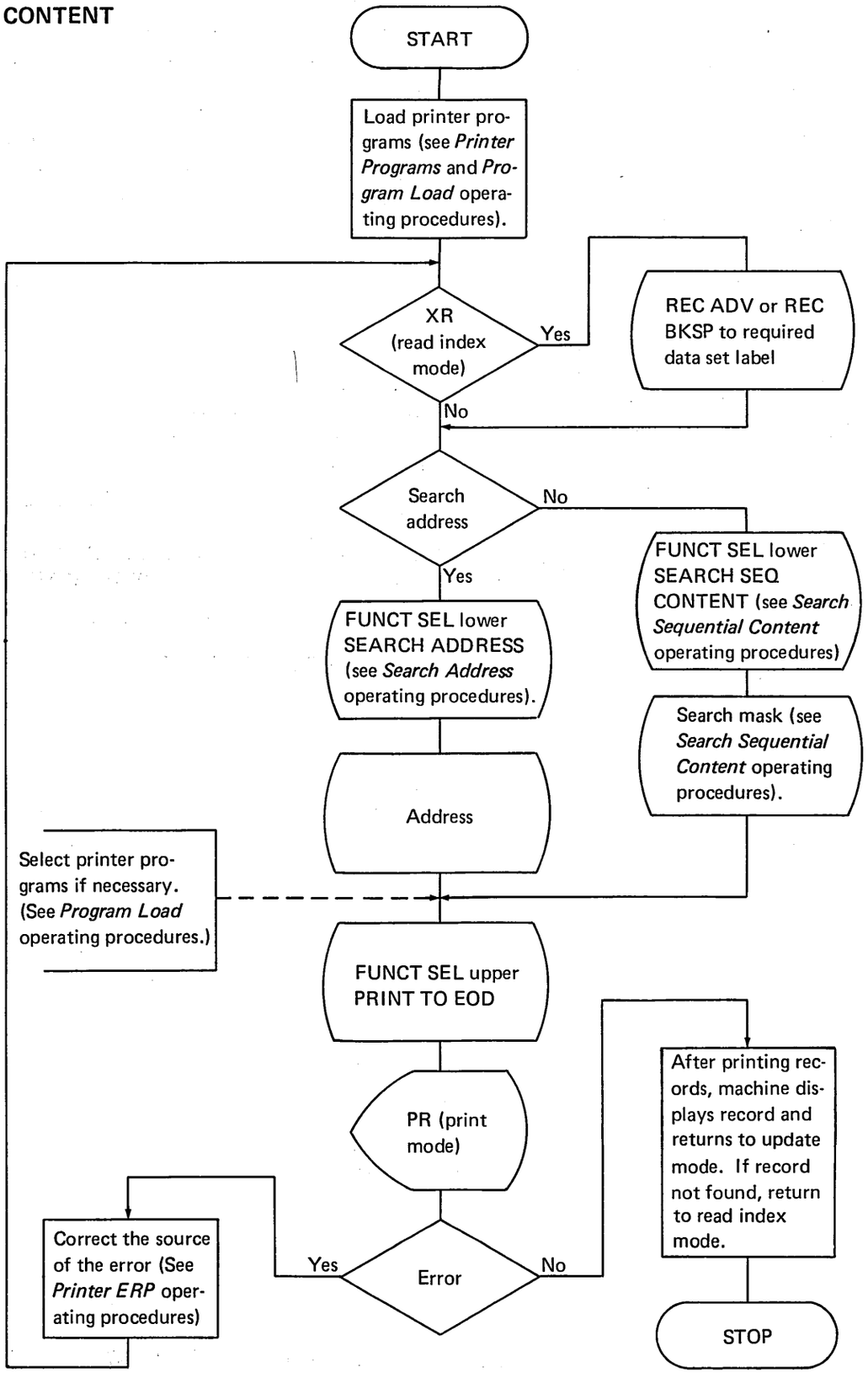
PRINT PART OF A DATA SET (To EOD)



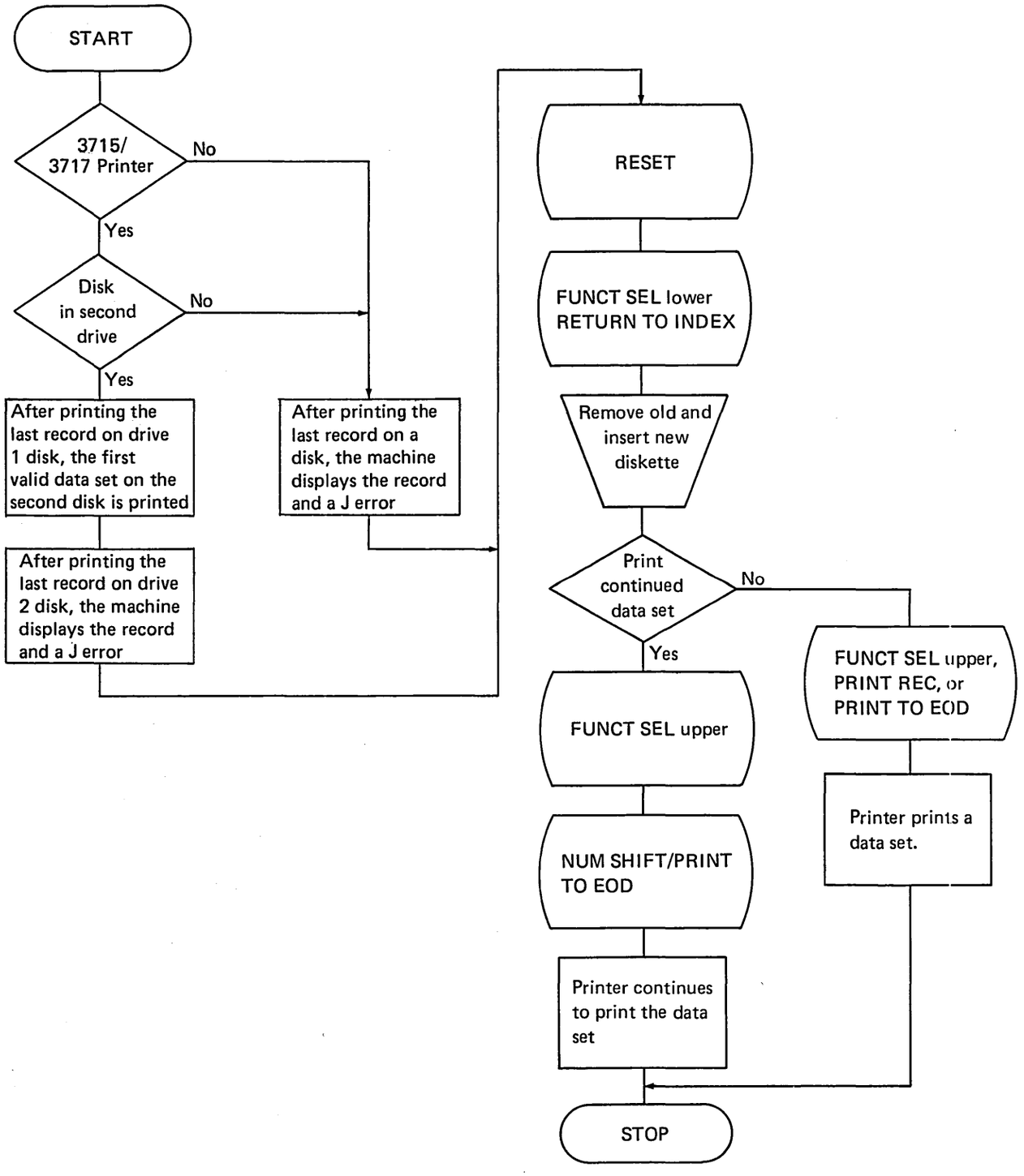
PRINT RECORDS BY USING SEARCH CONTENT



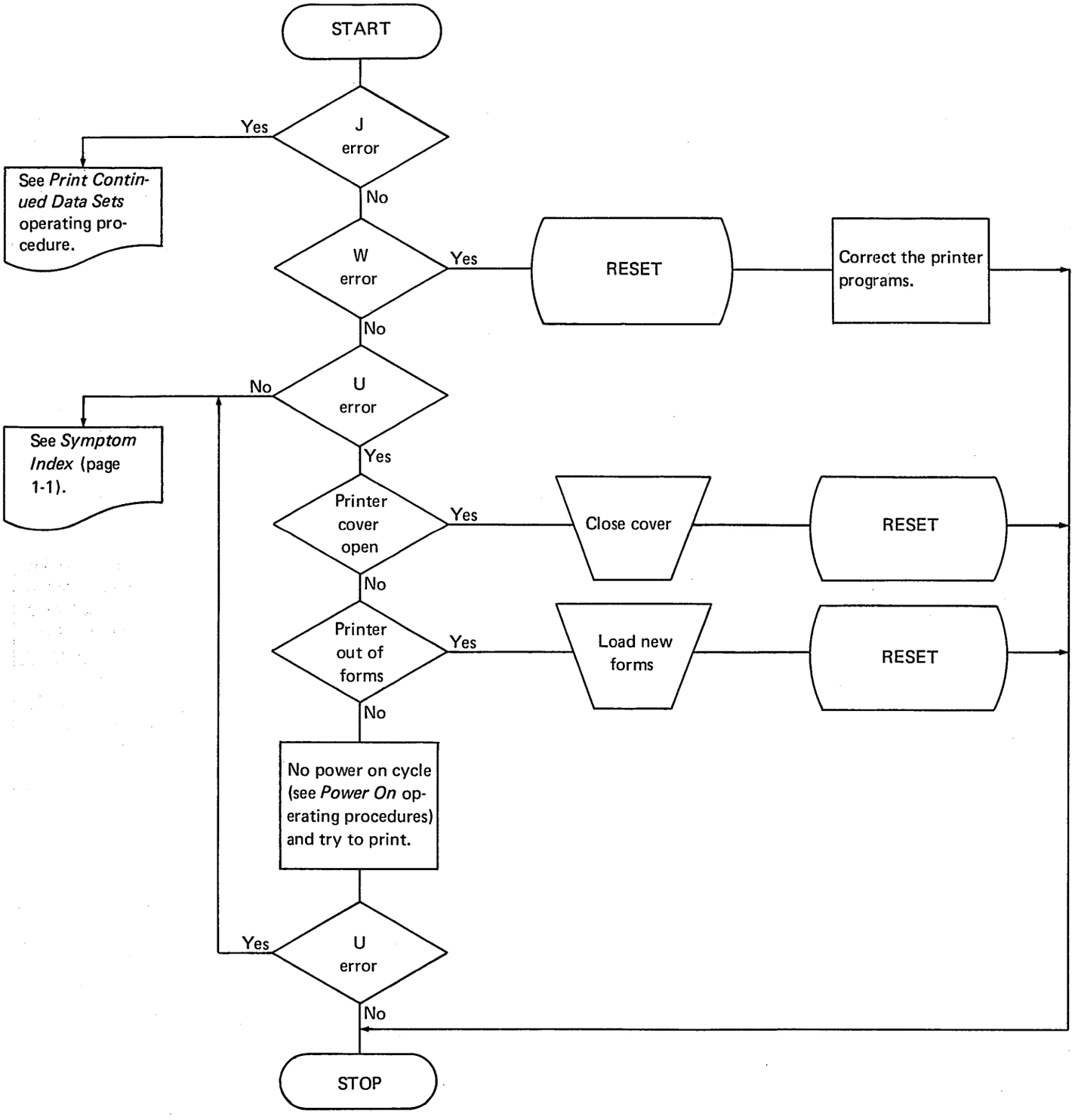
PRINT A RECORD BY USING SEARCH ADDRESS OR SEARCH SEQUENTIAL CONTENT



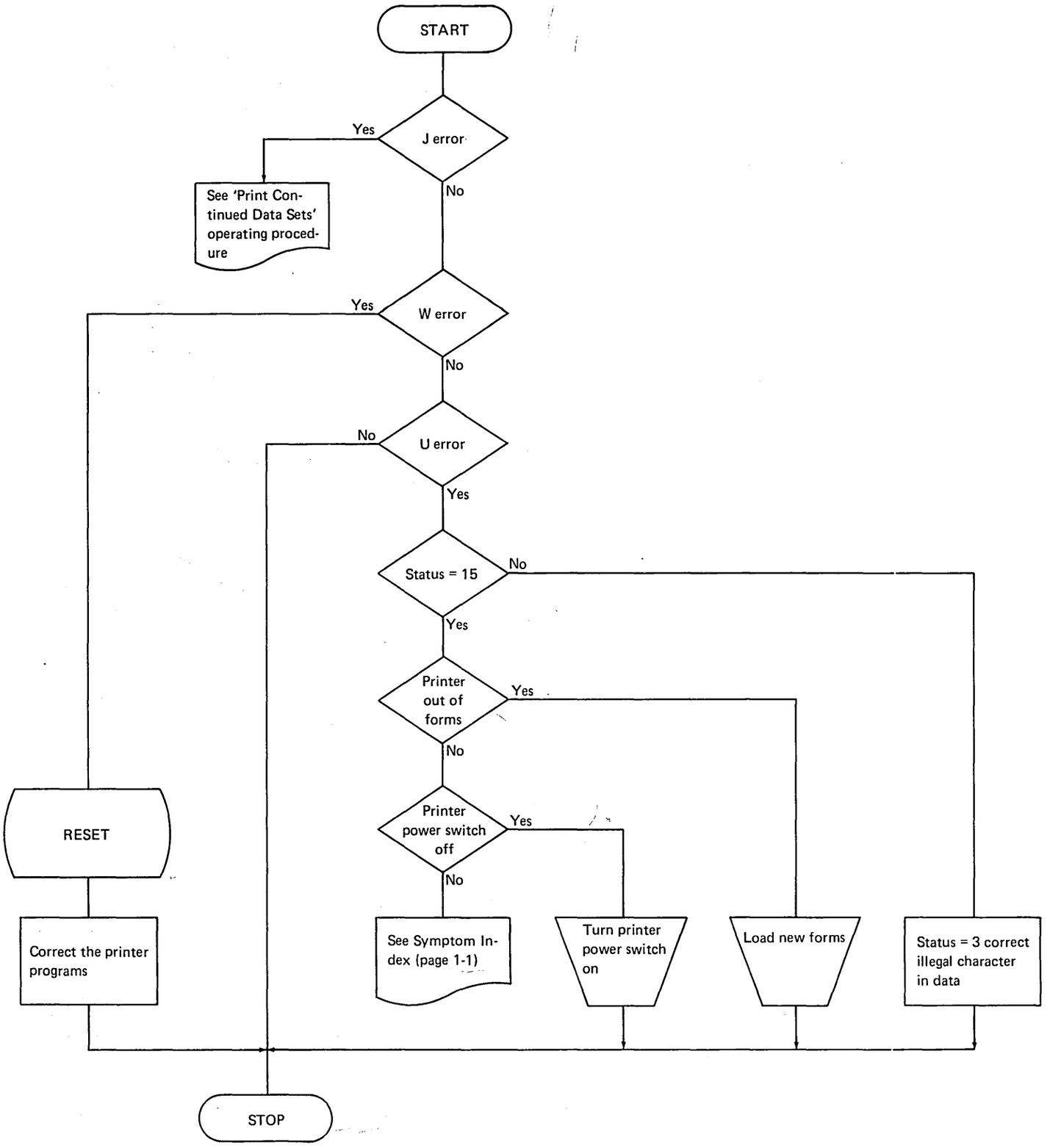
PRINT CONTINUED DATA SETS



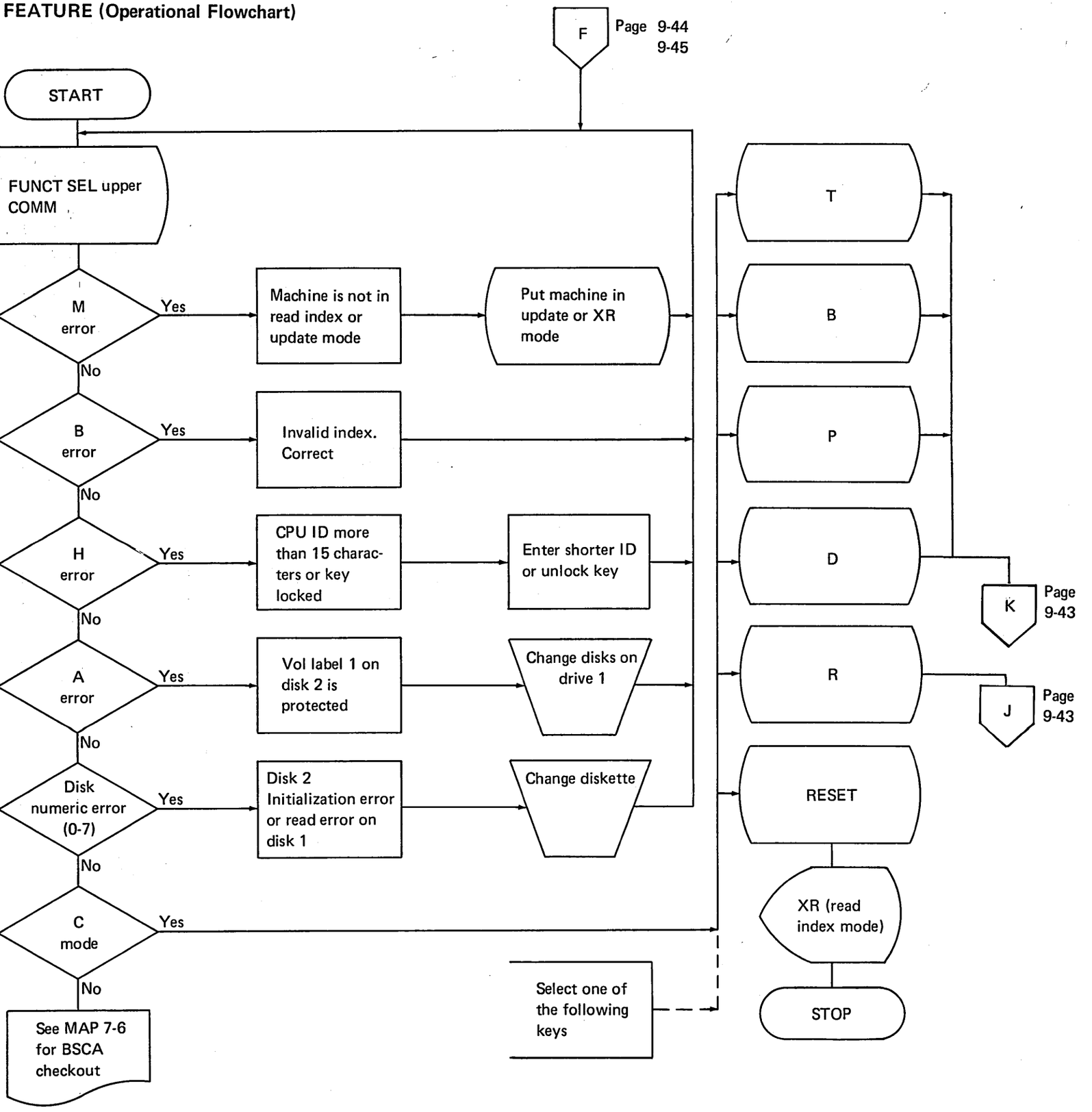
3713 PRINTER ERROR RECOVERY PROCEDURES (ERP)

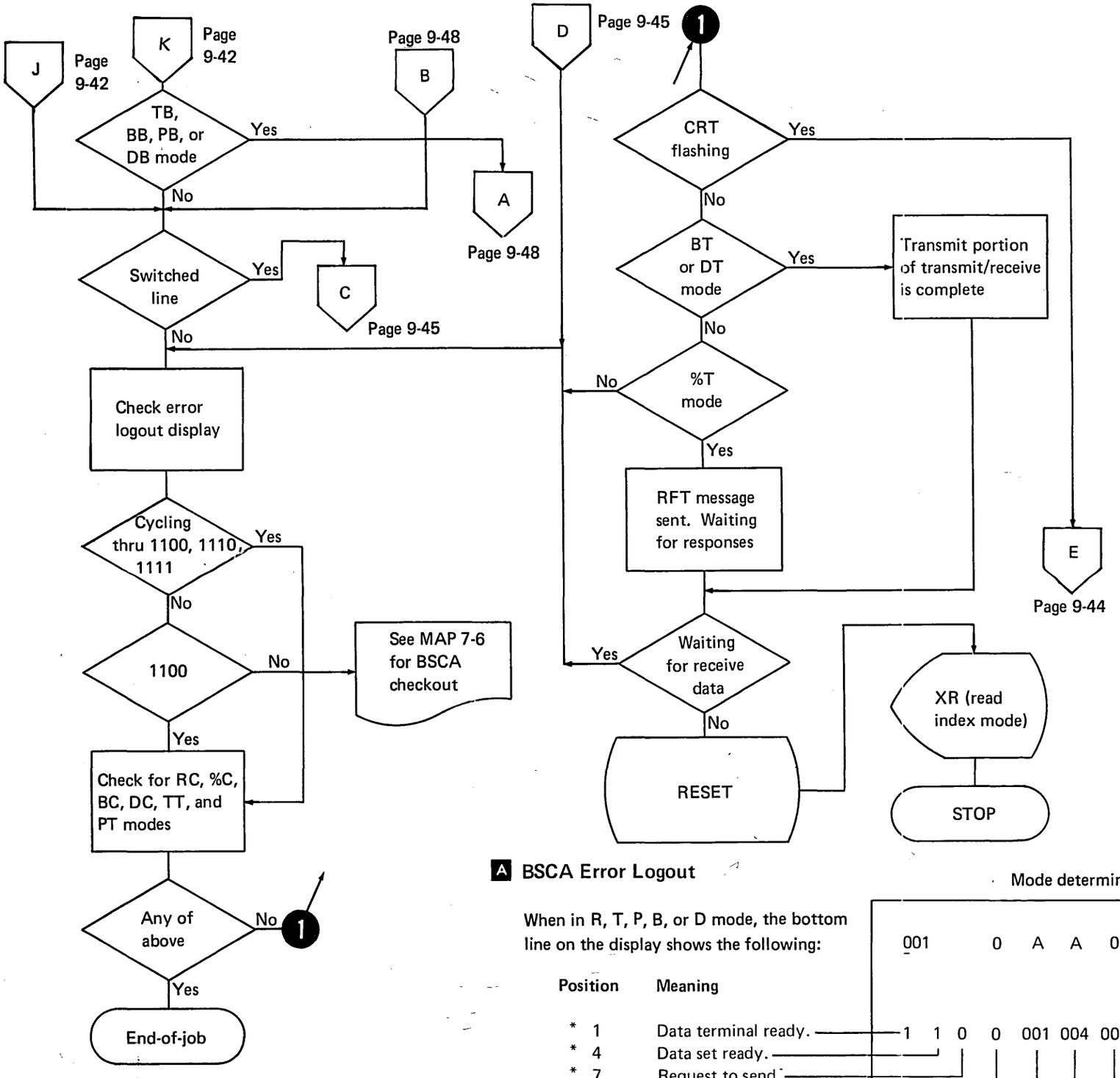


3715 PRINTER ERROR RECOVERY PROCEDURES (ERP)



BSCA FEATURE (Operational Flowchart)





A BSCA Error Logout

When in R, T, P, B, or D mode, the bottom line on the display shows the following:

Mode determined by operation.

001 0 A A 01001

Position	Meaning
* 1	Data terminal ready.
* 4	Data set ready.
* 7	Request to send.
* 10	Clear to send.
** 14 - 16	CRC checks in receive.
** 19 - 21	NAKs received in transmit.
** 24 - 26	Two second time-outs.
** 29 - 31	Three second time-outs.

1 1 0 0 001 004 000 001

* *Note:* 1 indicates on; 0 indicates off.

** *Note:* Three position decimal counter.

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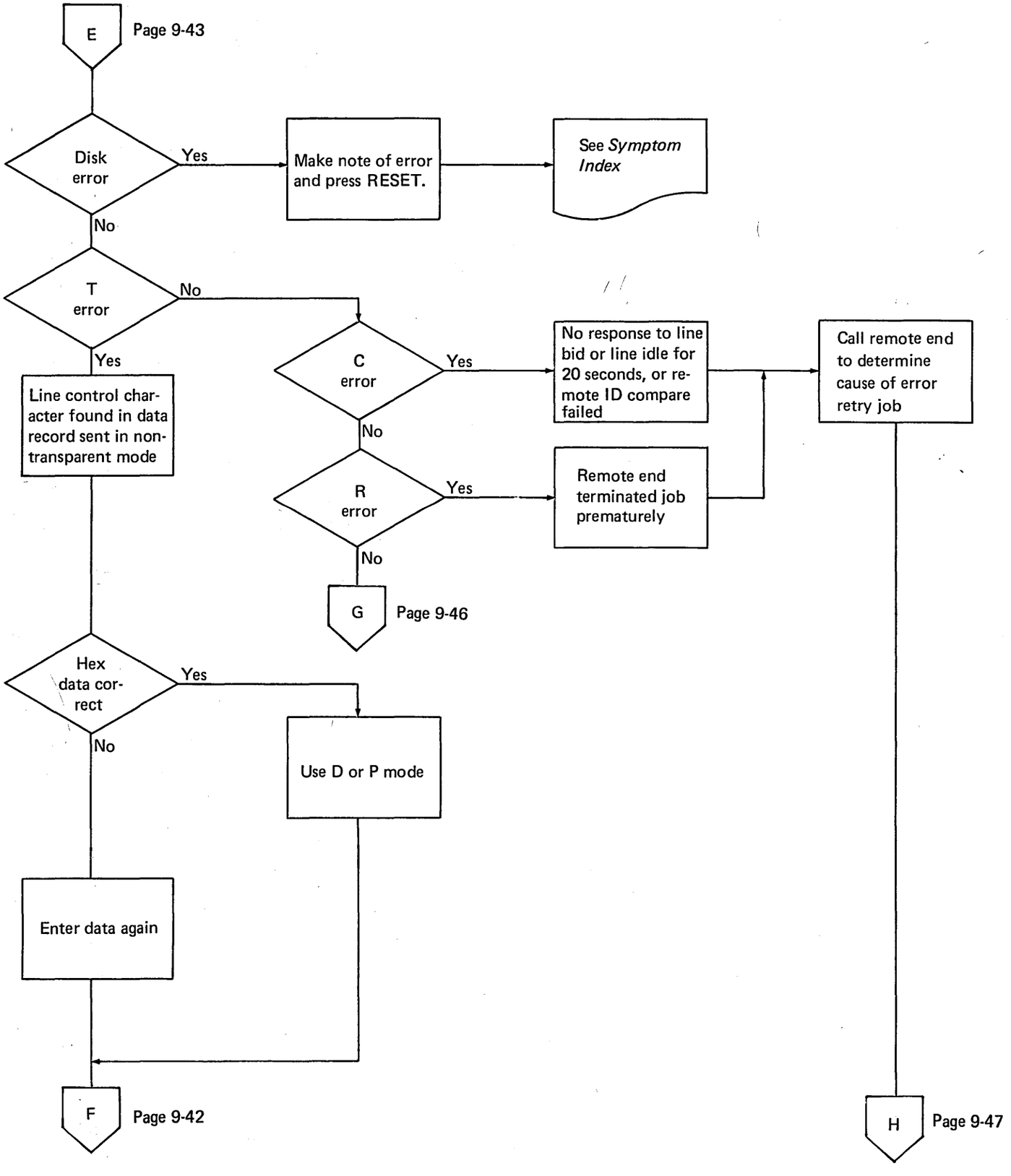
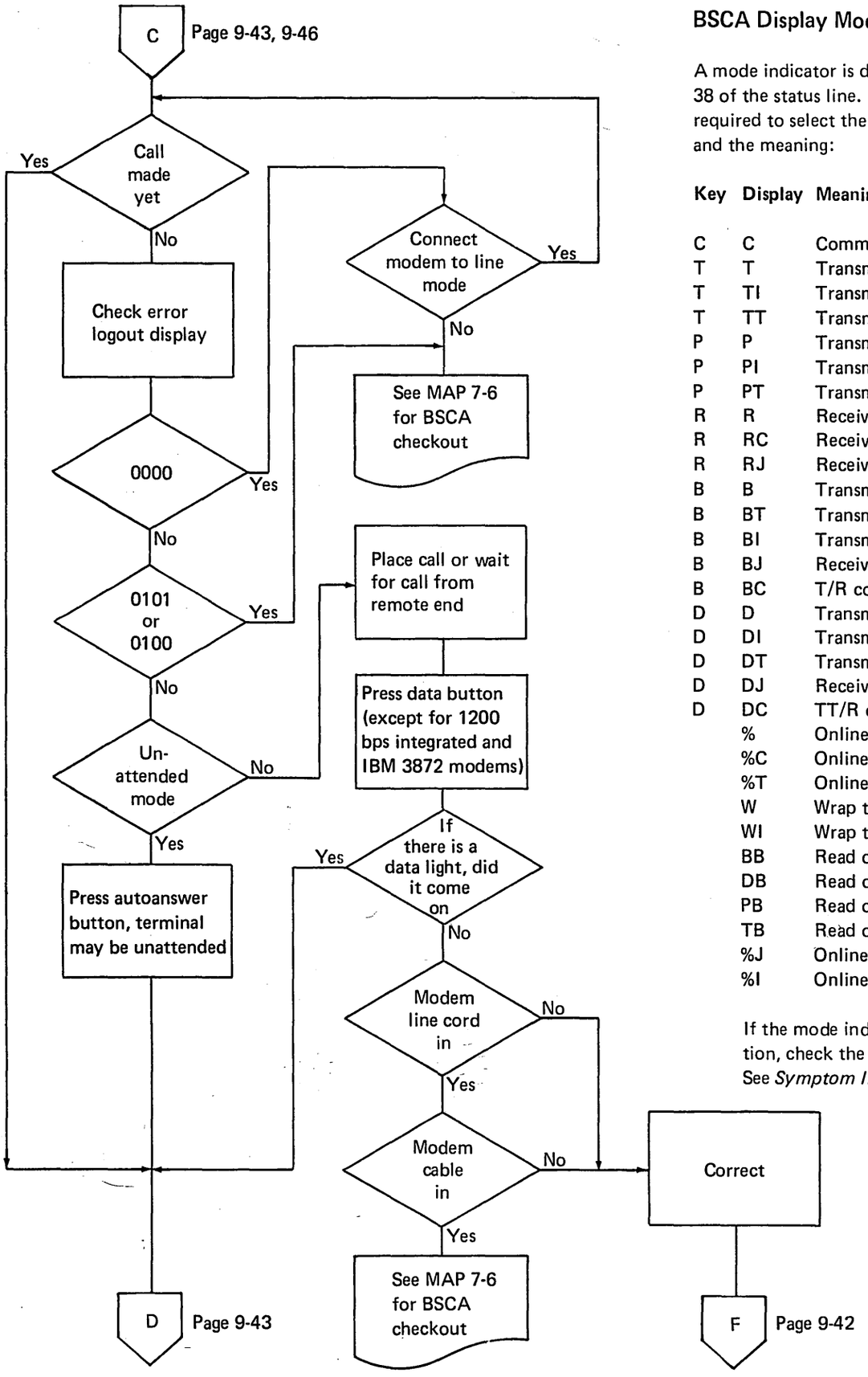
Date 9/15/74	8/1/75		

BSCA FEATURE (Continued)





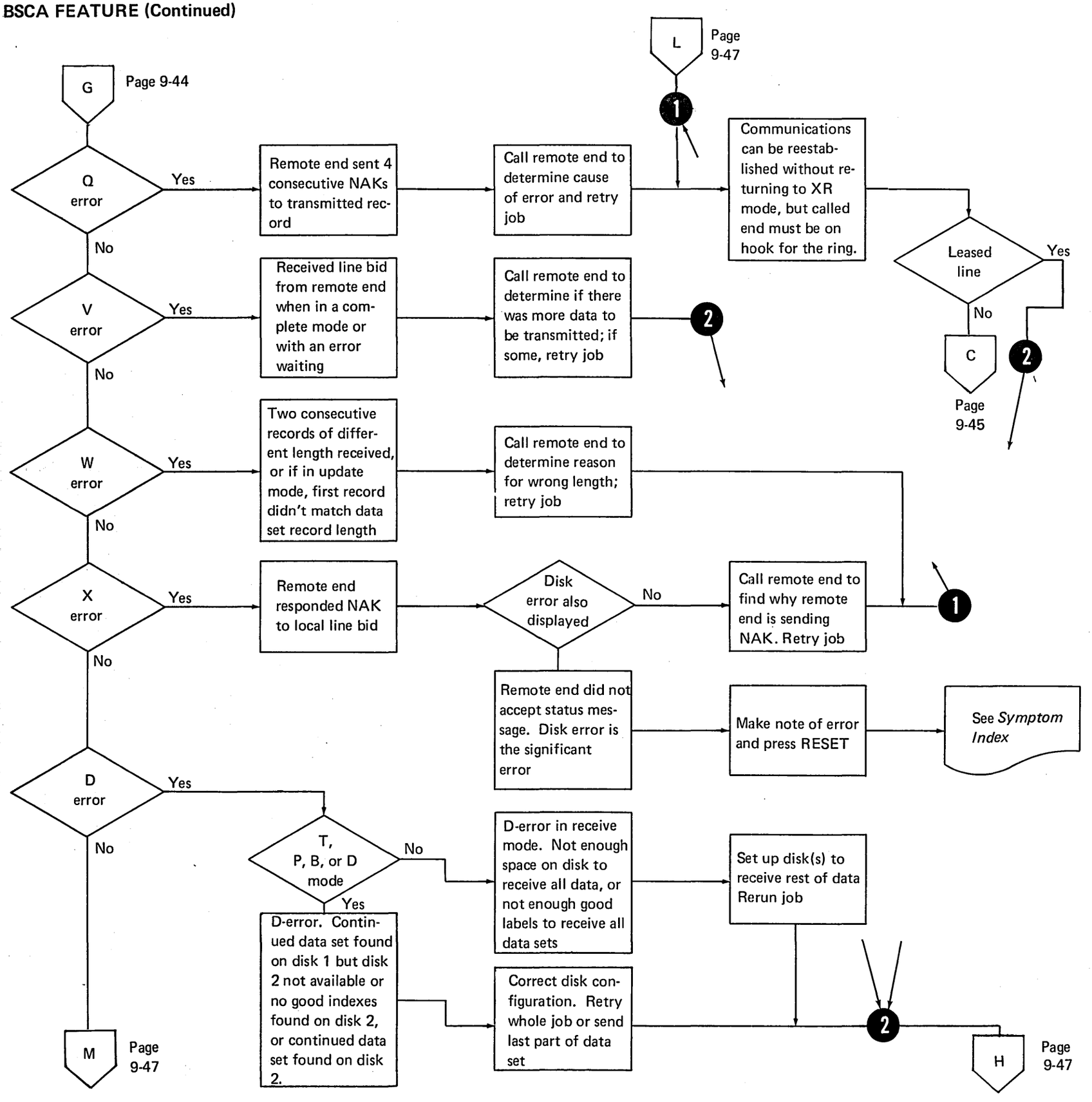
BSCA Display Mode Indicators

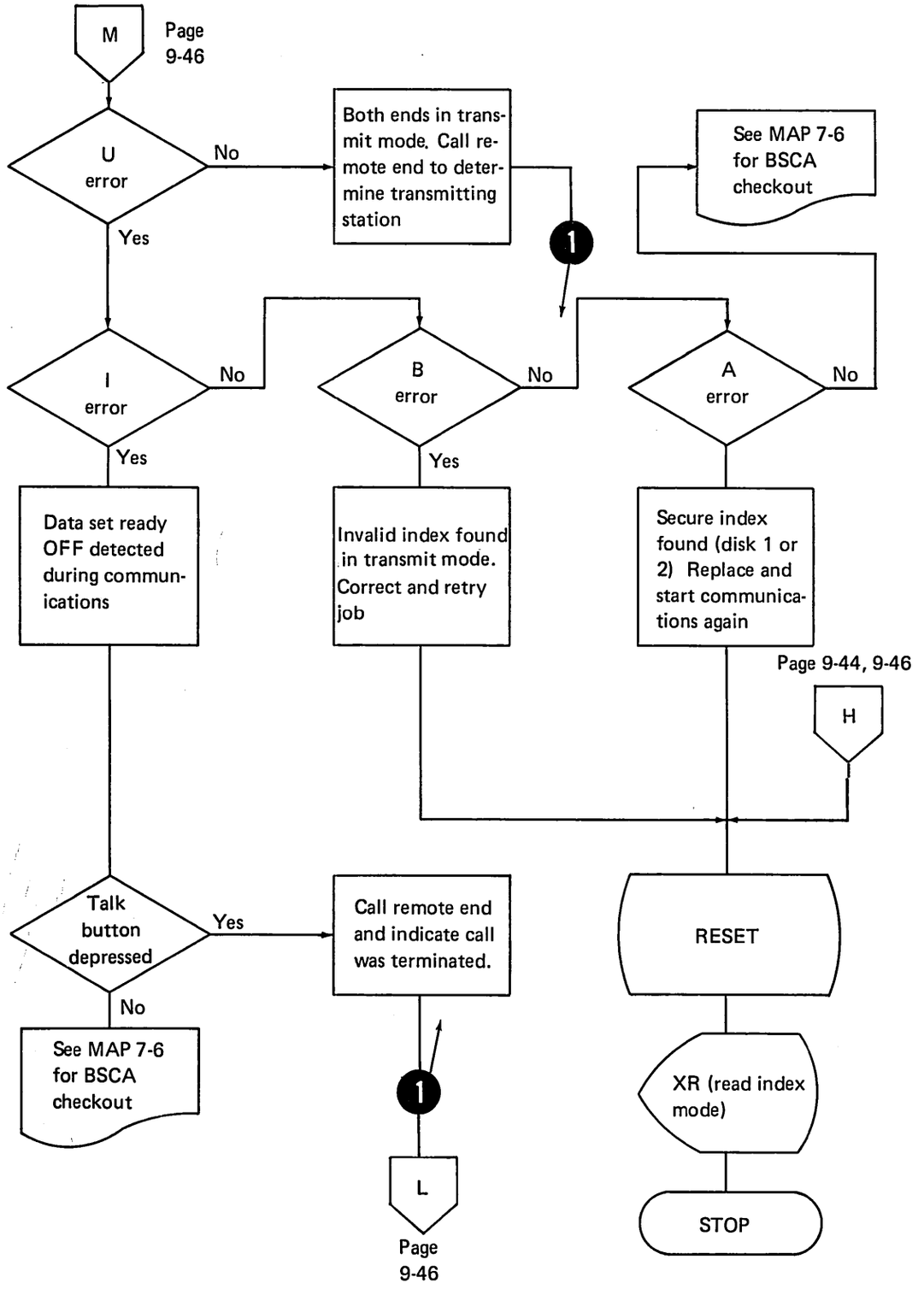
A mode indicator is displayed in positions 37 and 38 of the status line. The following shows the key required to select the mode, the mode displayed, and the meaning:

Key	Display	Meaning
C	C	Communication
T	T	Transmit
T	TI	Transmit incomplete
T	TT	Transmit complete
P	P	Transmit transparent text
P	PI	Transmit transparent incomplete
P	PT	Transmit transparent complete
R	R	Receive mode
R	RC	Receive complete
R	RJ	Receive incomplete
B	B	Transmit/receive (T/R)
B	BT	Transmit portion of T/R complete
B	BI	Transmit portion of T/R incomplete
B	BJ	Receive portion of T/R incomplete
B	BC	T/R complete
D	D	Transmit transparent/receive (TT/R)
D	DI	Transmit portion of TT/R incomplete
D	DT	Transmit portion of TT/R complete
D	DJ	Receive portion of TT/R incomplete
D	DC	TT/R complete
	%	Online test mode
	%C	Online test complete
	%T	Online test complete (transmit)
	W	Wrap test
	WI	Wrap test incomplete
	BB	Read operator ID (T/R)
	DB	Read operator ID (TT/R)
	PB	Read operator ID (transmit transparent)
	TB	Read operator ID (transmit)
	%J	Online test incomplete (receive portion)
	%I	Online test incomplete (transmit portion)

If the mode indicates an incomplete operation, check the error indicator in position 7. See *Symptom Index; Error Indicators,* 1-2.

BSCA FEATURE (Continued)





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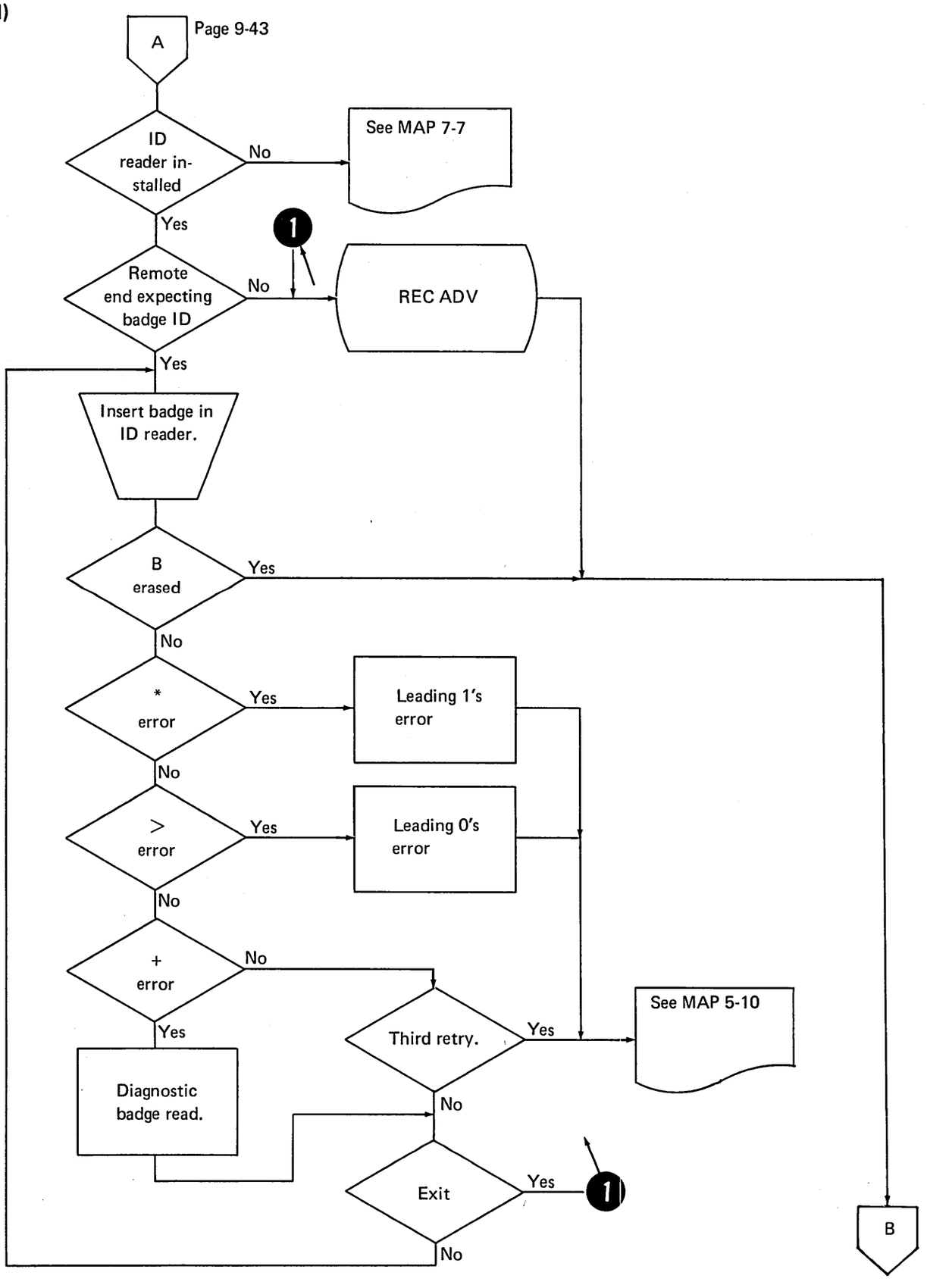
Date 9/15/74	8/1/75		

BSCA FEATURE (Continued)



BSCA TO 3872 MODEM AND 3747

The following examples all use the 3872 modem.

3741 # 1 Places the Call and Will Transmit

	3741 #1	3741 #2
1.	– Press FUNCT SEL upper	
2.	– Press COMM	
3.	– Press the M key	
4.	– Press the T key	
5.		– Press FUNCT SEL upper
6.		– Press COMM
7.		– Press the R key
8.	– Place the call	
9.		– Receive the call—auto-answer or manual
10.		– Go to data
11.	– Wait for answer tone to finish (line goes dead)	
12.	– Go to data	

3741 # 1 Places the Call and Will Receive

	3741 #1	3741 #2
1.	– Press FUNCT SEL upper	
2.	– Press COMM	
3.	– Press the M key	
4.	– Press the R key	
5.		– Press FUNCT SEL upper
6.		– Press COMM
7.		– Press the T key
8.	– Place the call	
9.		– Receive the call—auto-answer or manual
10.		– Go to data
11.	– Wait for answer tone to finish (line goes dead)	
12.	– Go to data	

3741 Places the Call and Will Transmit to the 3747

	3741	3747
1.	– Press FUNCT SEL upper	
2.	– Press COMM	
3.	– Press the M key	
4.	– Press the T key	
5.		Display at 406
6.		– Press the C key
7.	– Place the call	
8.		– Receive the call—auto-answer or manual
9.		– Go to data
10.	– Wait for answer tone to finish (line goes dead)	
11.	– Go to data	

3741 Places the Call and Will Receive From the 3747

	3741	3747
1.	– Press FUNCT SEL upper	
2.	– Press COMM	
3.	– Press the M key	
4.	– Press the R key	
5.		Display at 406
6.		– Press the C key
7.	– Place the call	
8.		– Receive the call—auto-answer or manual
9.		– Go to data
10.	– Wait for answer tone to finish (line goes dead)	
11.	– Go to data	

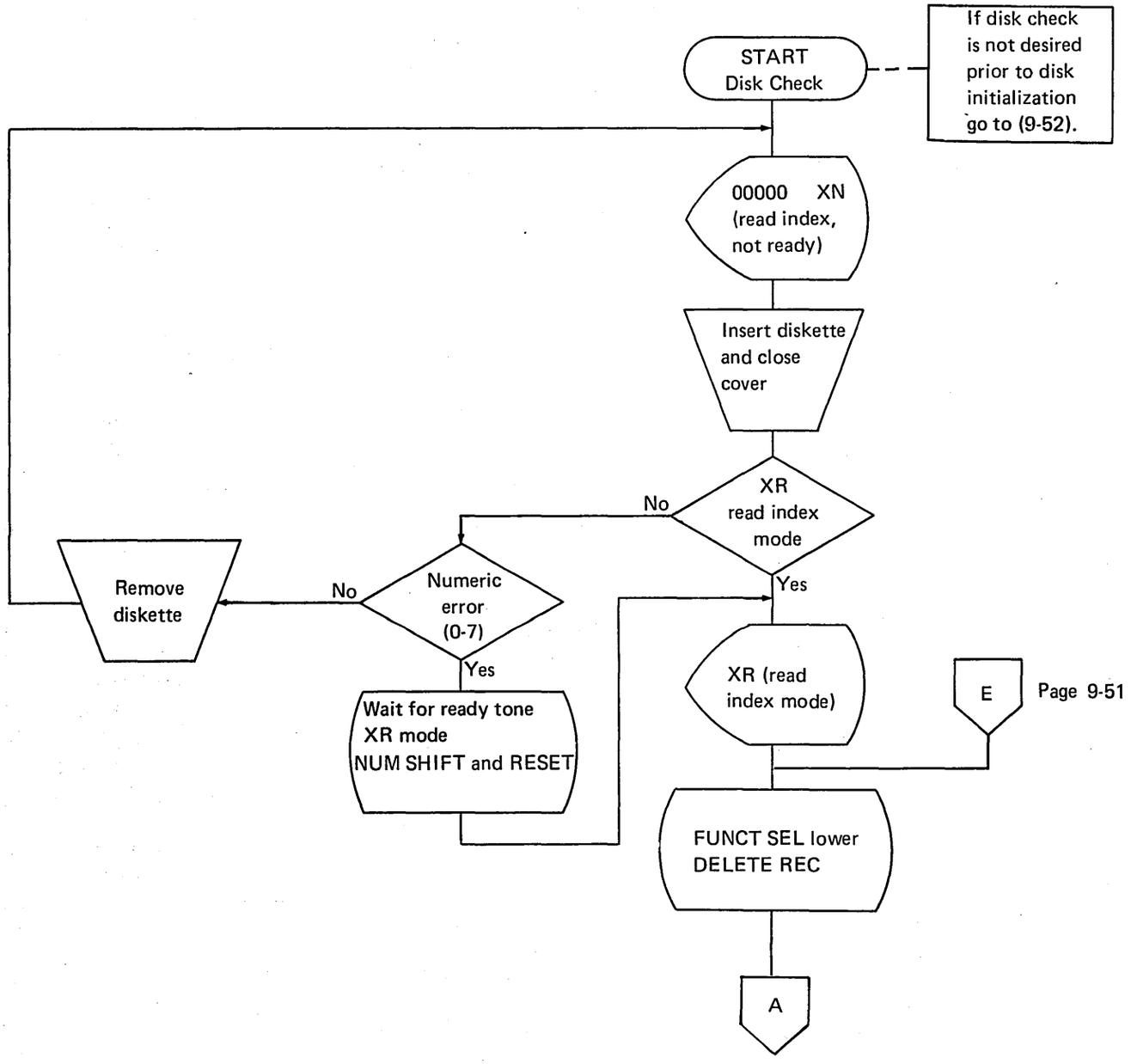
3747 Places the Call and Will Transmit to the 3741

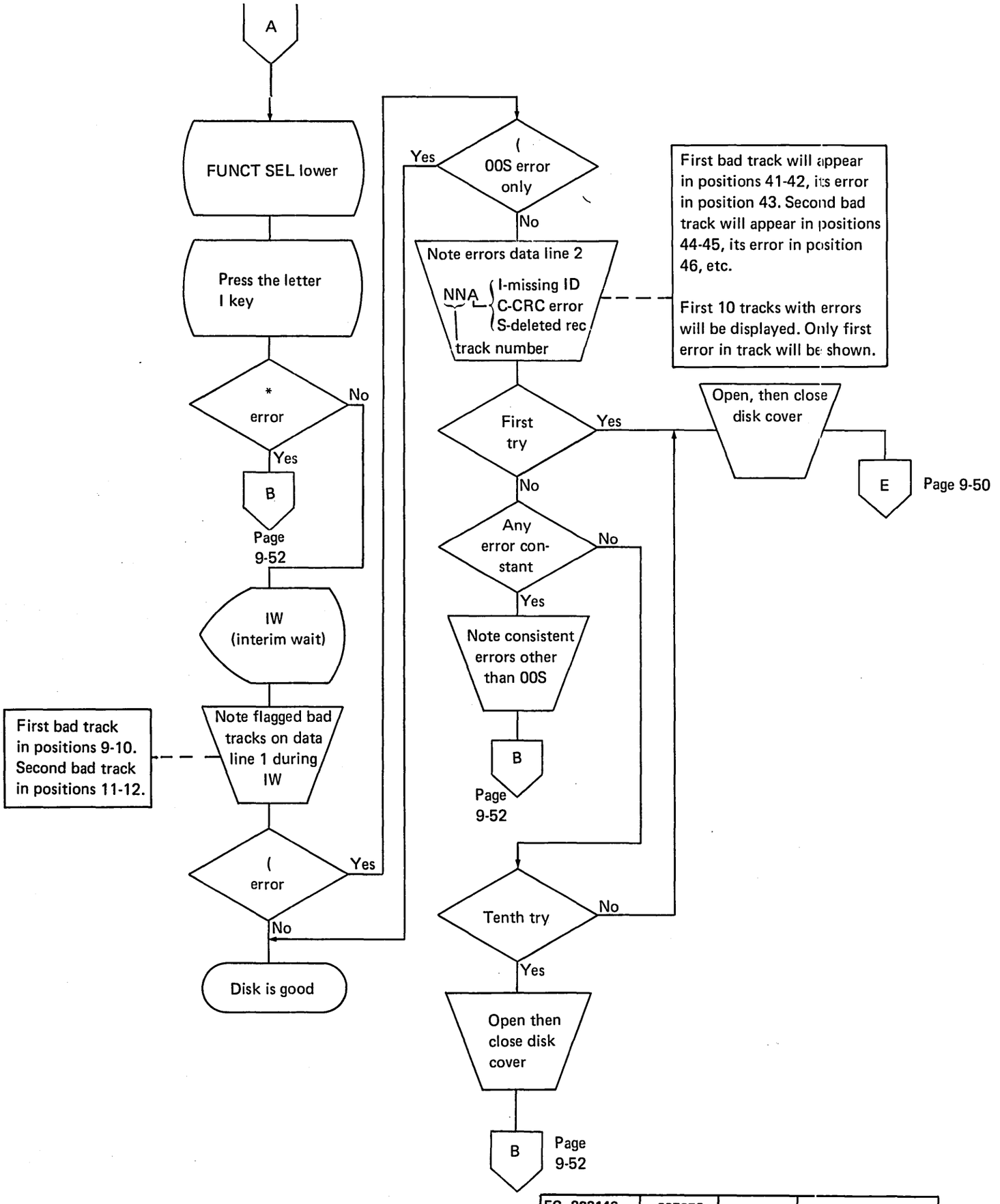
	3747	3741
1.	Display at 406	
2.		– Press FUNCT SEL upper
3.		– Press COMM
4.		– Press the R key
5.	– Place the call	
6.		– Receive the call—auto-answer or manual
7.		– Go to data
8.	– Wait for answer tone to finish (line goes dead)	
9.	– Go to data	

3747 Places the Call and Will Receive From the 3741

	3747	3741
1.	Display at 406	
2.		– Press FUNCT SEL upper
3.		– Press COMM
4.		– Press the T key
5.	– Place the call	
6.		– Receive the call—auto-answer or manual
7.		– Go to data
8.	– Wait for answer tone to finish (line goes dead)	
9.	– Go to data	

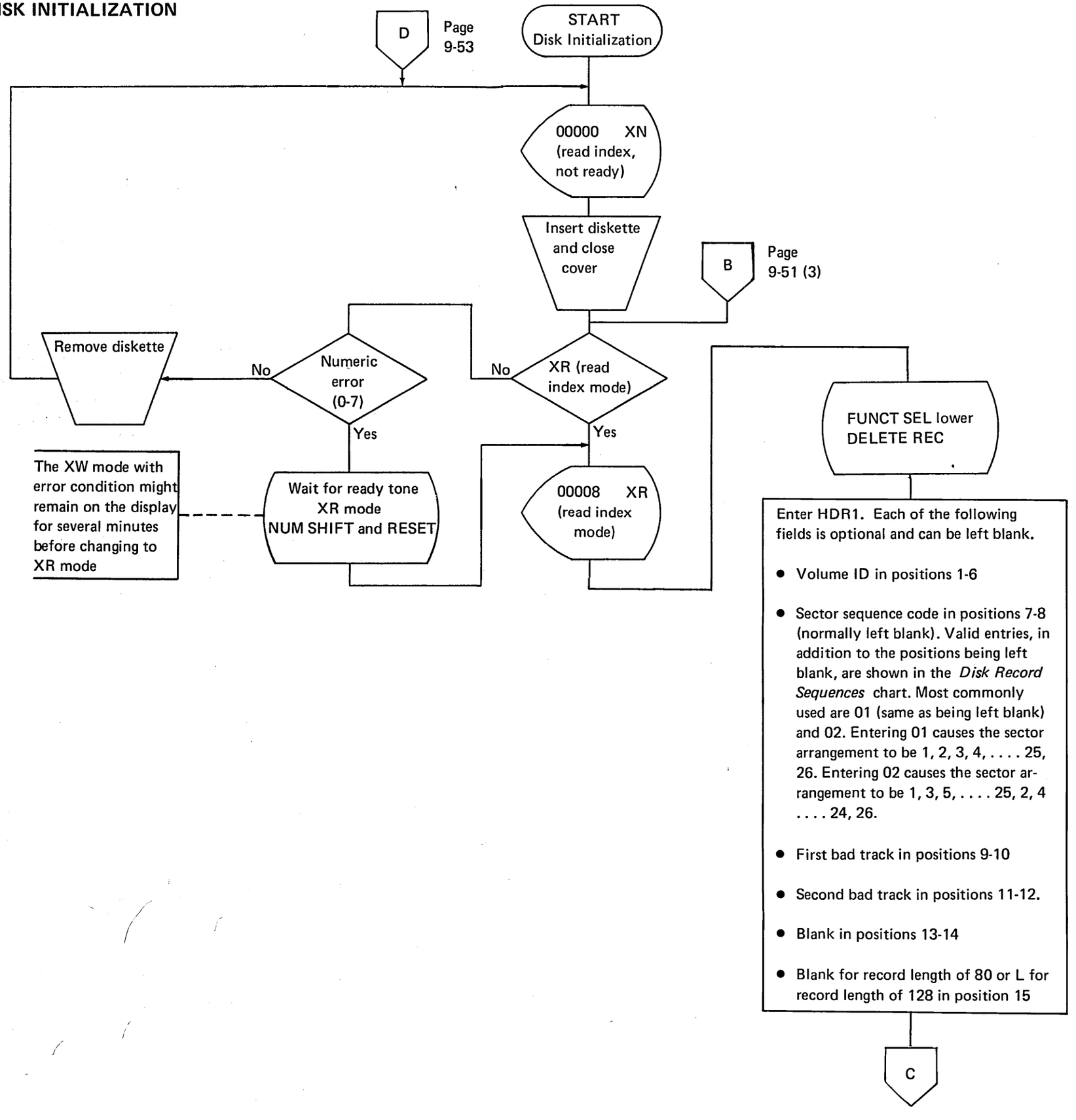
DISK INITIALIZATION (Disk Check Portion)





EC 823146	825853		PN 1619097
Date 9/15/74	11/15/74		

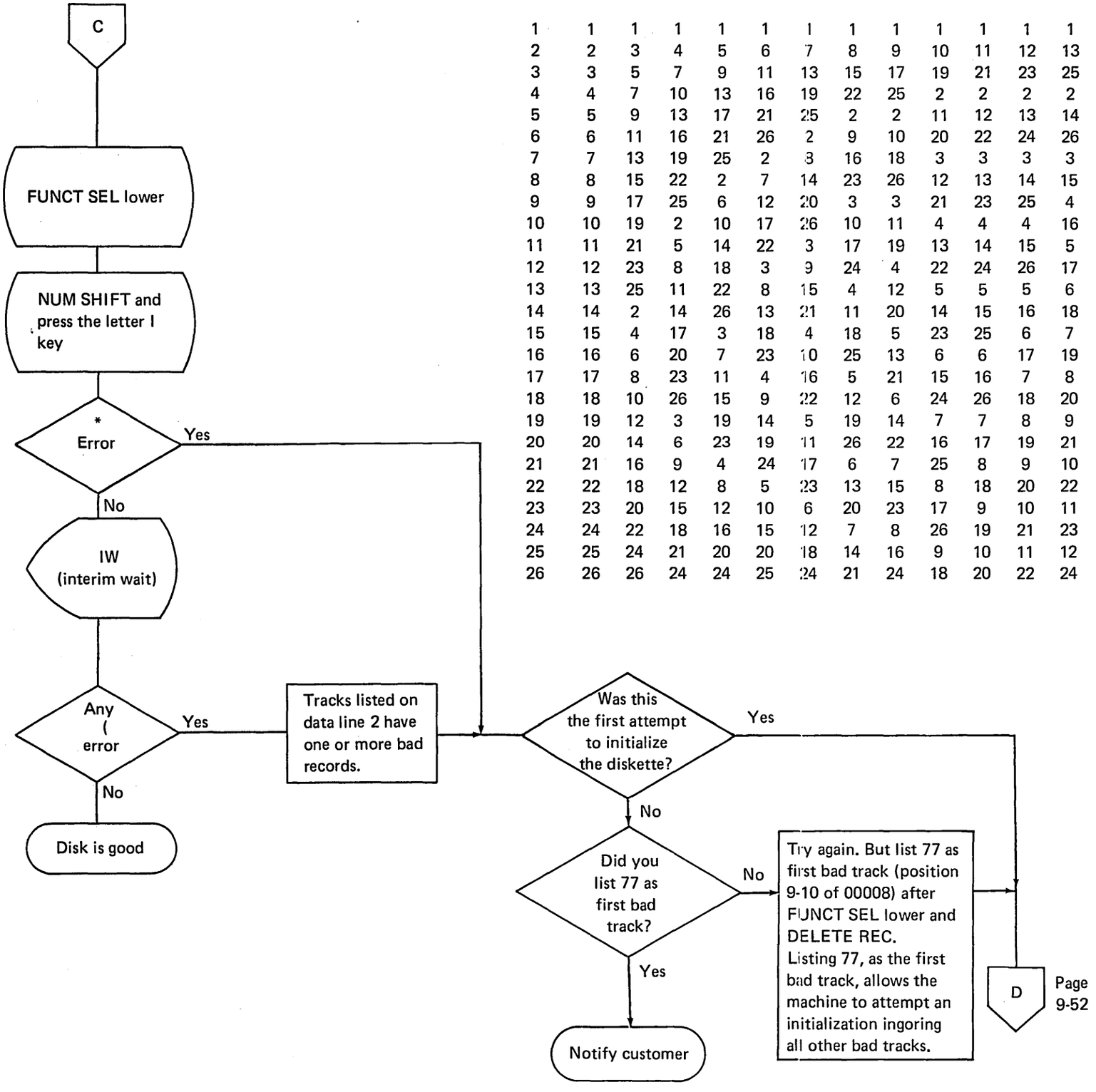
DISK INITIALIZATION



Record 00007
Positions 77 & 78

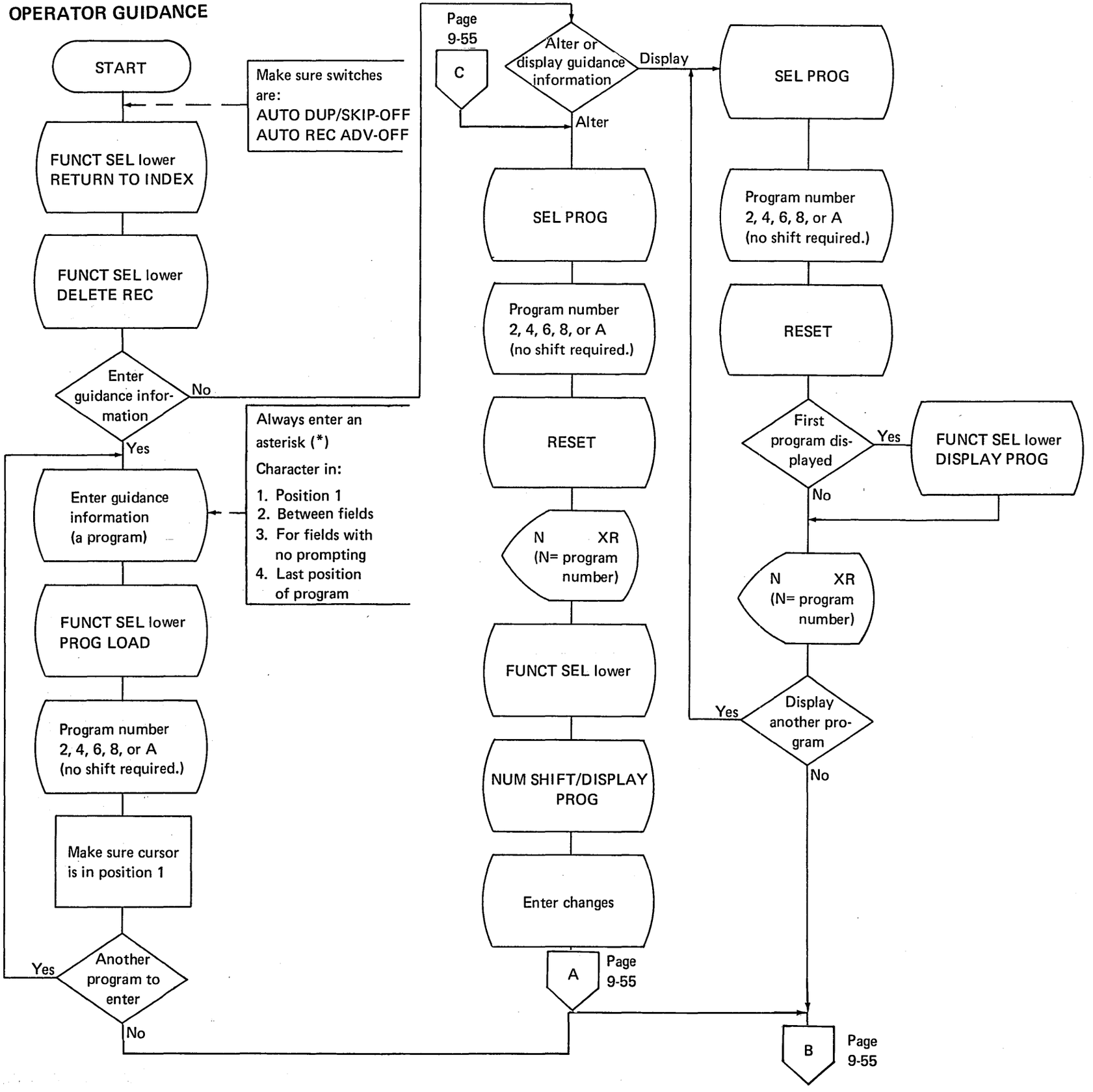
DISK RECORD SEQUENCES

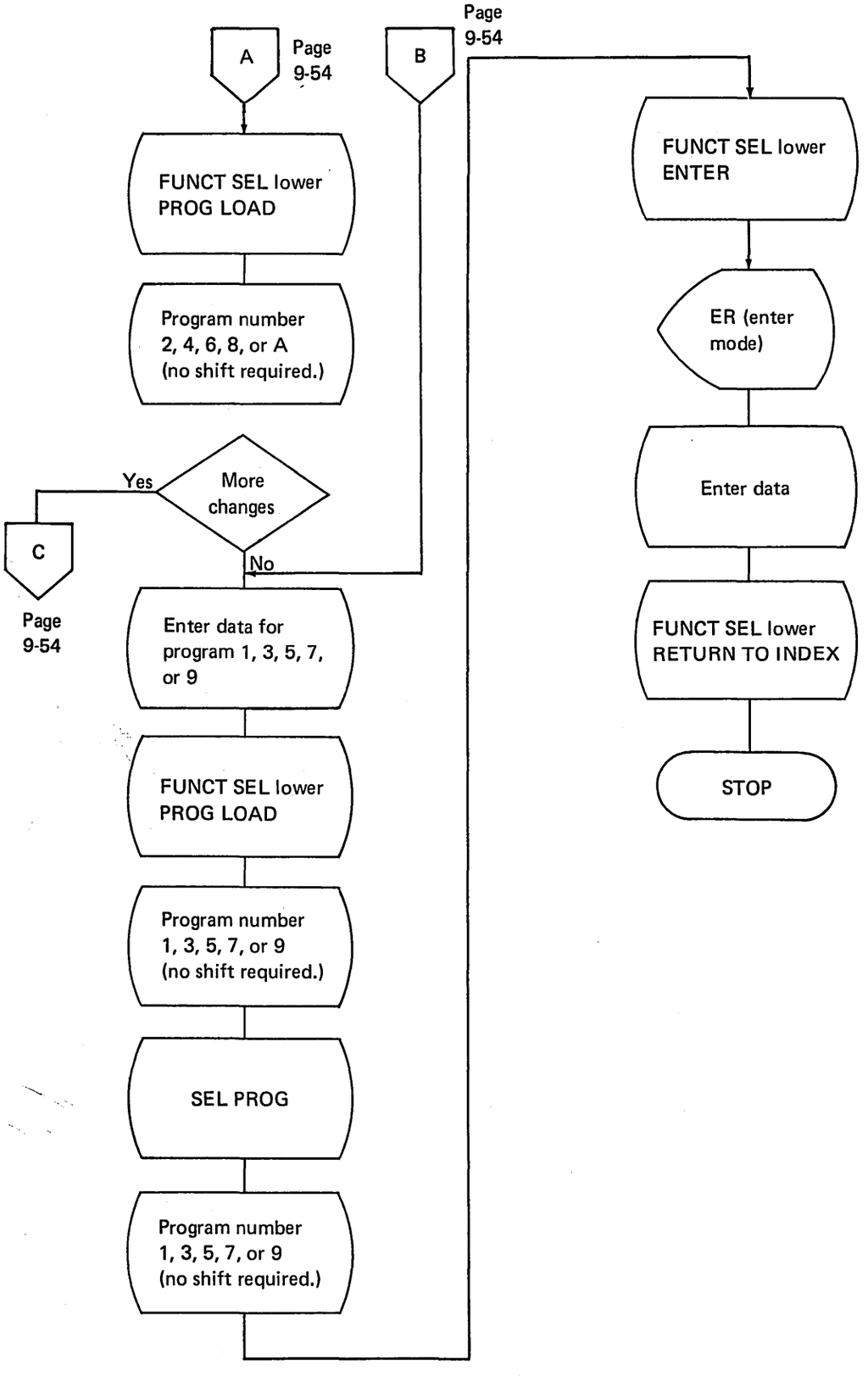
blank	01	02	03	04	05	06	07	08	09	10	11	12	13
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	3	4	5	6	7	8	9	10	11	12	13	14
3	3	5	7	9	11	13	15	17	19	21	23	25	2
4	4	7	10	13	16	19	22	25	2	2	2	2	15
5	5	9	13	17	21	25	2	2	11	12	13	14	3
6	6	11	16	21	26	2	9	10	20	22	24	26	16
7	7	13	19	25	2	8	16	18	3	3	3	3	4
8	8	15	22	2	7	14	23	26	12	13	14	15	17
9	9	17	25	6	12	20	3	3	21	23	25	4	5
10	10	19	2	10	17	26	10	11	4	4	4	16	18
11	11	21	5	14	22	3	17	19	13	14	15	5	6
12	12	23	8	18	3	9	24	4	22	24	26	17	19
13	13	25	11	22	8	15	4	12	5	5	5	6	7
14	14	2	14	26	13	21	11	20	14	15	16	18	20
15	15	4	17	3	18	4	18	5	23	25	6	7	8
16	16	6	20	7	23	10	25	13	6	6	17	19	21
17	17	8	23	11	4	16	5	21	15	16	7	8	9
18	18	10	26	15	9	22	12	6	24	26	18	20	22
19	19	12	3	19	14	5	19	14	7	7	8	9	10
20	20	14	6	23	19	11	26	22	16	17	19	21	23
21	21	16	9	4	24	17	6	7	25	8	9	10	11
22	22	18	12	8	5	23	13	15	8	18	20	22	24
23	23	20	15	12	10	6	20	23	17	9	10	11	12
24	24	22	18	16	15	12	7	8	26	19	21	23	25
25	25	24	21	20	20	18	14	16	9	10	11	12	13
26	26	26	24	24	25	24	21	24	18	20	22	24	26



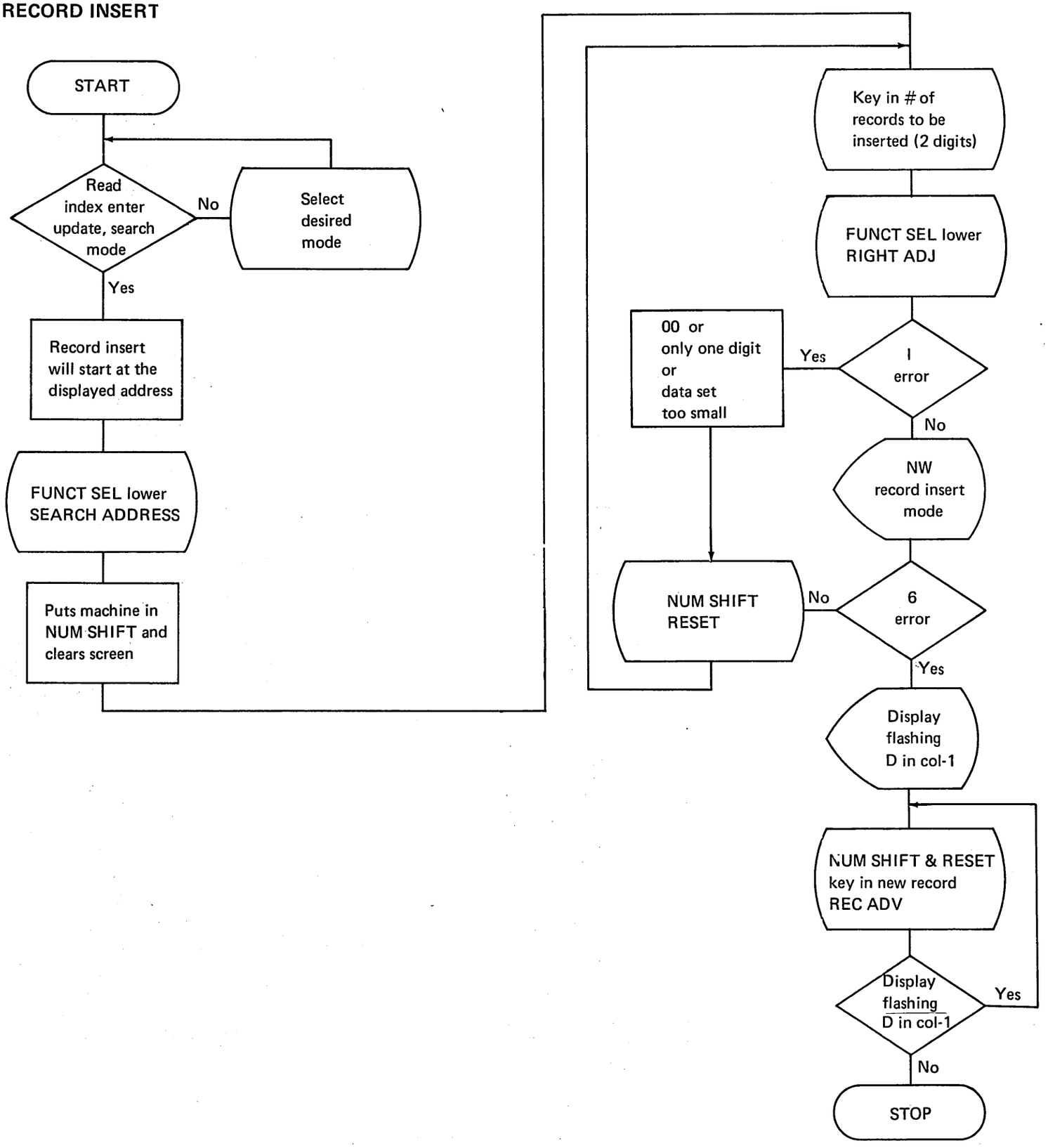
EC 823146	825853	826065	PN 1619099
Date 9/15/74	11/15/74	8/1/75	

OPERATOR GUIDANCE

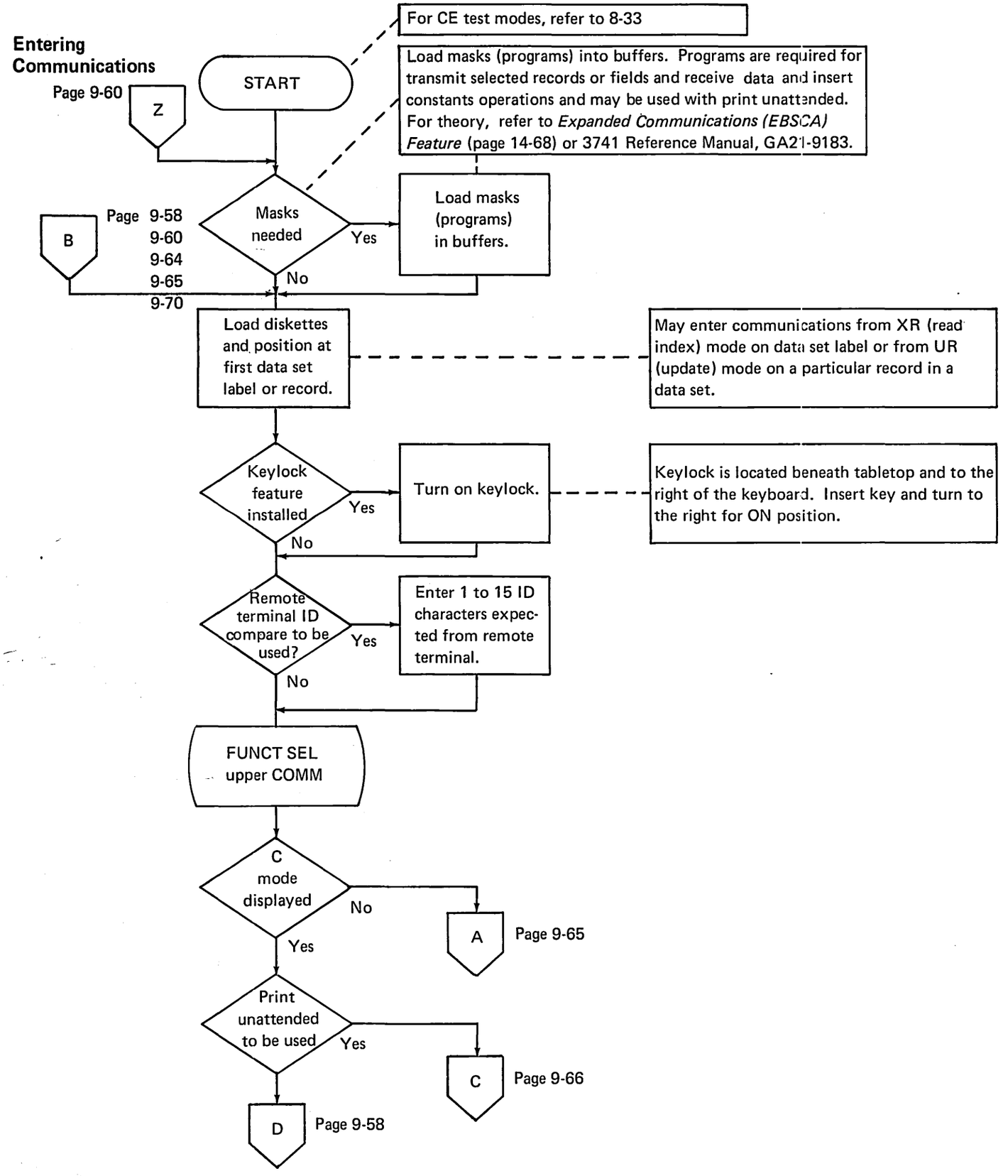



A
Page 9-54
B
Page 9-54
FUNCT SEL lower PROG LOAD
Program number 2, 4, 6, 8, or A (no shift required.)
More changes
Yes
C
Page 9-54
No
Enter data for program 1, 3, 5, 7, or 9
FUNCT SEL lower PROG LOAD
Program number 1, 3, 5, 7, or 9 (no shift required.)
SEL PROG
Program number 1, 3, 5, 7, or 9 (no shift required.)
FUNCT SEL lower ENTER
ER (enter mode)
Enter data
FUNCT SEL lower RETURN TO INDEX
STOP

RECORD INSERT

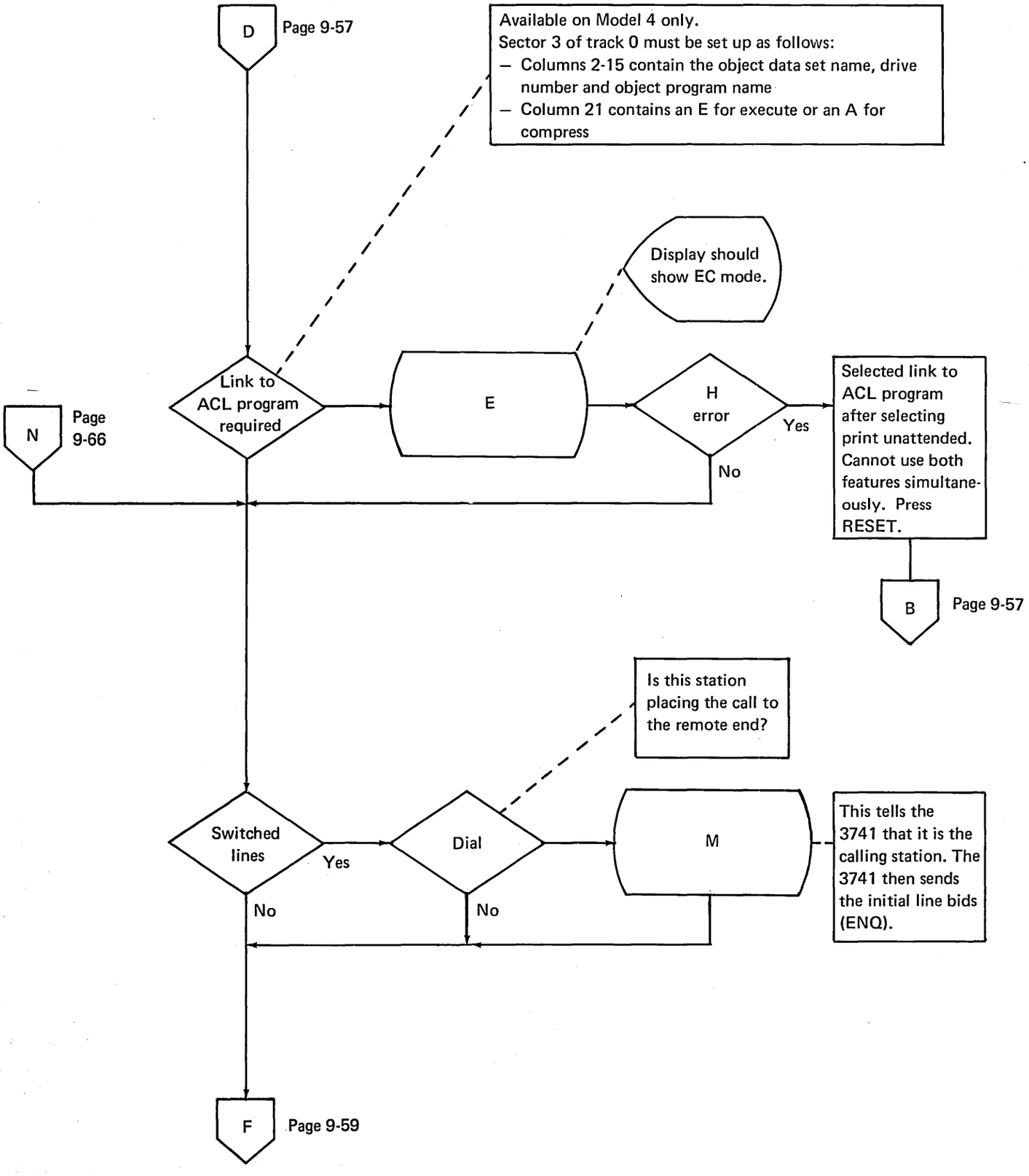


EXPANDED COMMUNICATIONS (EBSCA) FEATURE OPERATIONS FLOWCHARTS

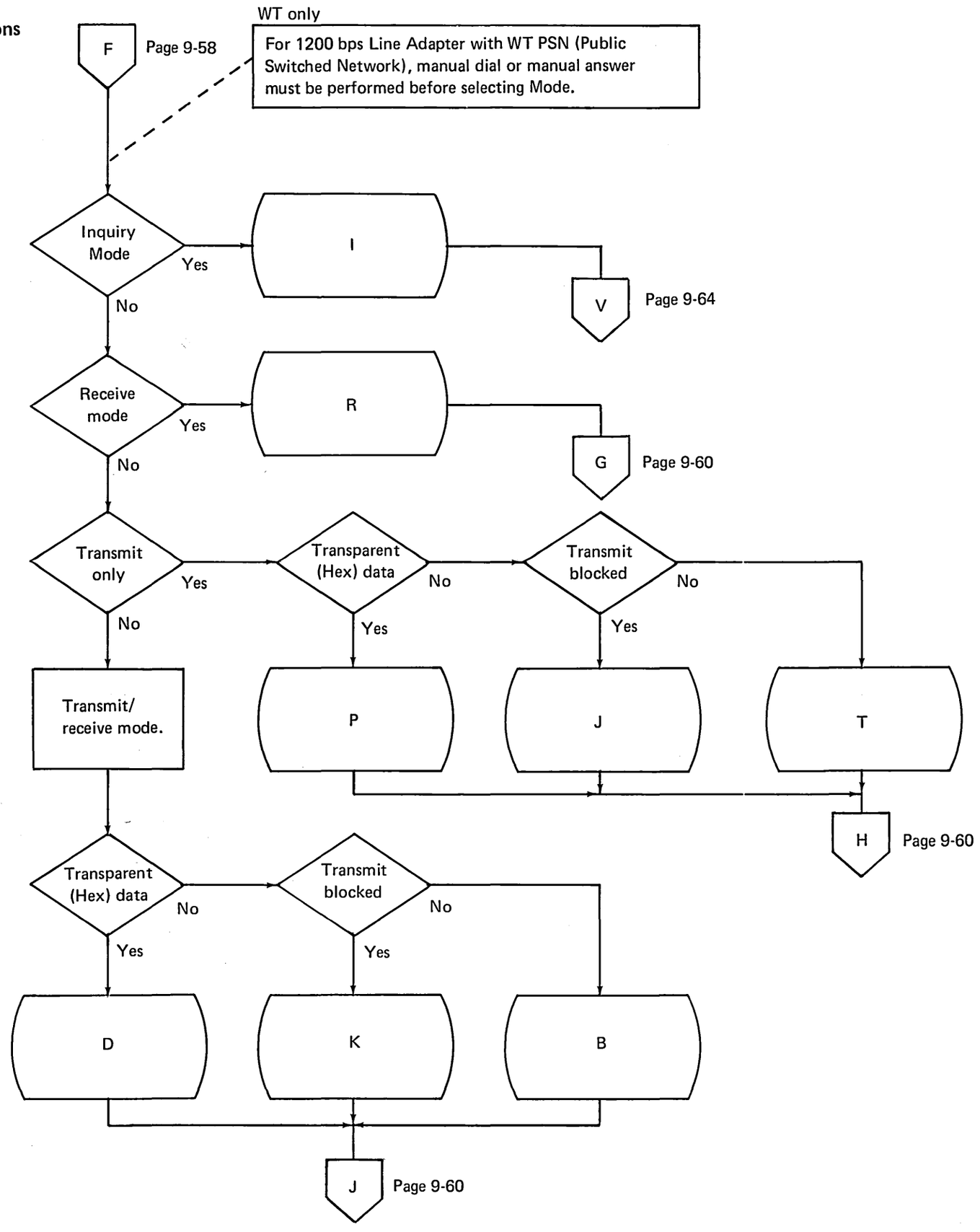


EC 823146	826065		PN 1619103
Date 9/15/74	8/1/75		

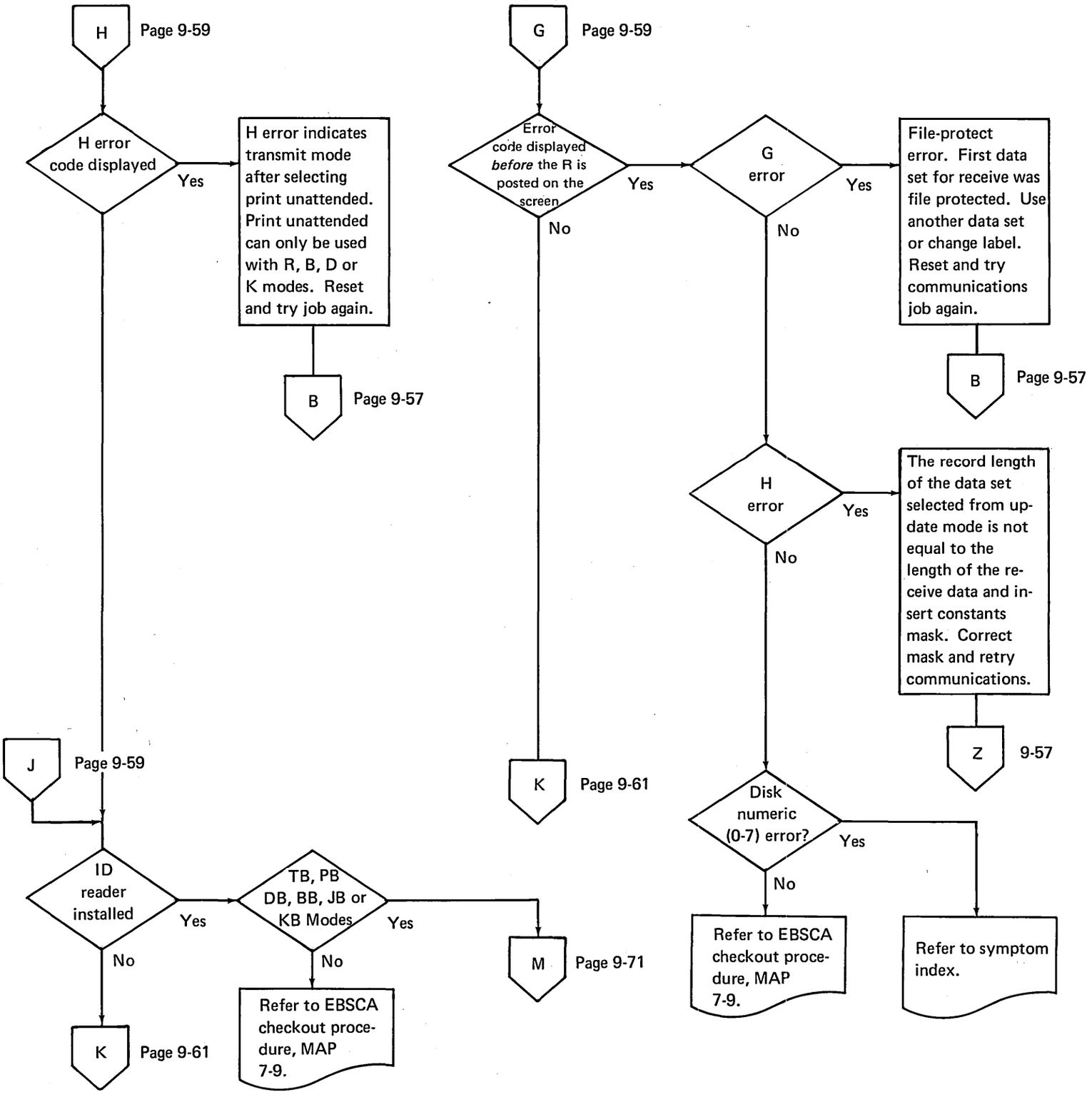
Set-Up Communications

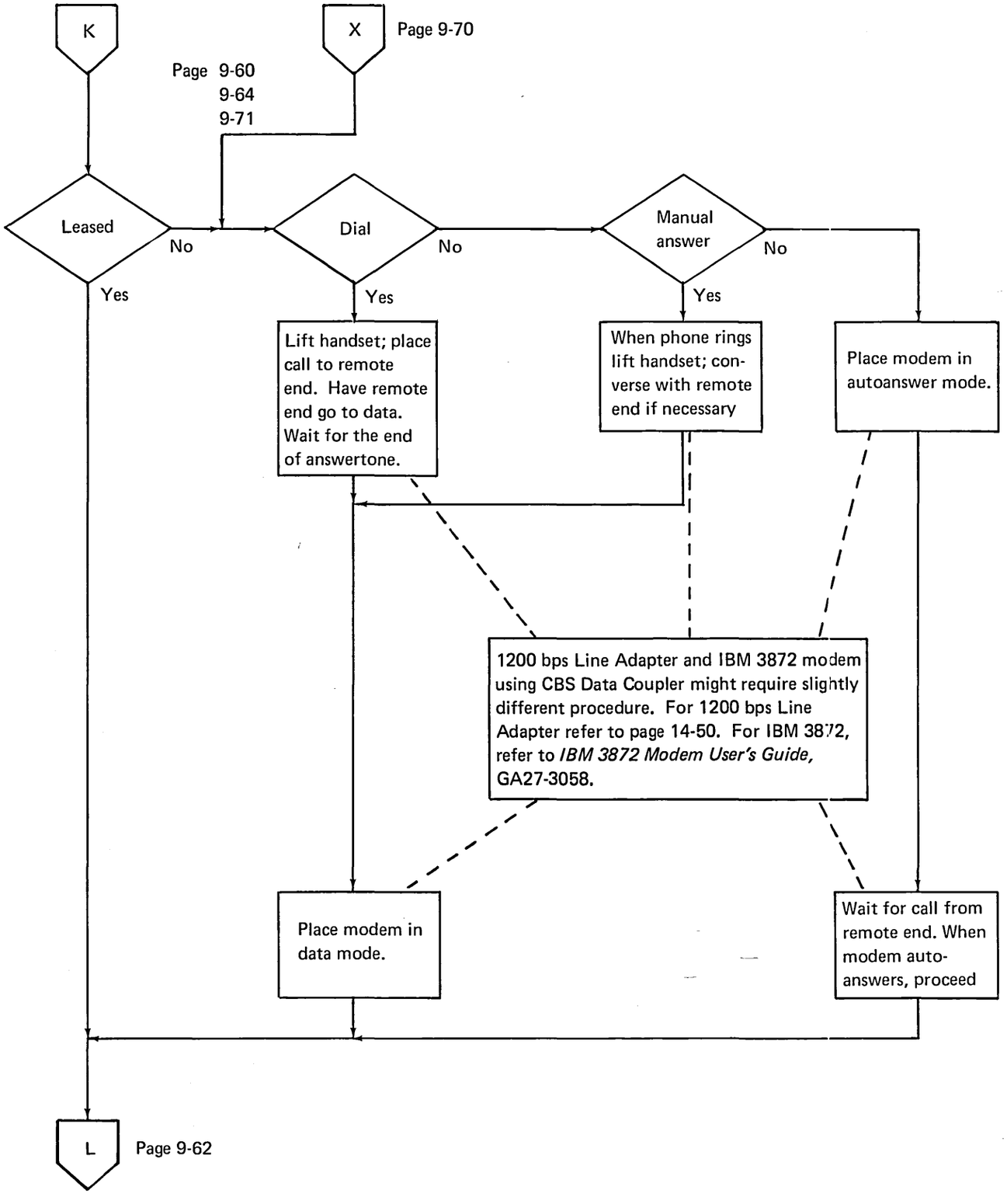


Select Communications Mode



Select Communications Mode (Continued)




K
X
Page 9-70
Page 9-60
9-64
9-71
Leased
No
Dial
No
Manual answer
No
Yes
Yes
Yes
Lift handset; place call to remote end. Have remote end go to data. Wait for the end of answertone.
When phone rings lift handset; converse with remote end if necessary
Place modem in autoanswer mode.
1200 bps Line Adapter and IBM 3872 modem using CBS Data Coupler might require slightly different procedure. For 1200 bps Line Adapter refer to page 14-50. For IBM 3872, refer to IBM 3872 Modem User's Guide, GA27-3058.
Place modem in data mode.
Wait for call from remote end. When modem auto-answers, proceed
L
Page 9-62

Communications Link-Up

'Data terminal ready' (DTR) and 'data set ready' (DSR) both being ON indicate that both the 3741 and the modem are ready to begin communicating

L Page 9-61

DTR & DSR both ON

No

Check the following:

1. Modem power.
2. Modem cable connected.
3. Feature half planar jumper 4 jumpered correctly (refer to Installation 16-4).

Use EBSCA checkout procedure, MAP 7-9.

Yes

Remote device links up and disk address begins incrementing.

Data transfer begin

No

Any error code posted

No

Failure to link-up could indicate:

1. Incorrect use of M key to indicate calling station on switched lines. (For use of M key, refer to *Expanded Communications (EBSCA) Feature,* page 14-68).
2. Incorrect operation of remote device.
3. Communication line or modem problem.
4. Incorrect ID used for terminal ID or wrong address used if multipoint.

Refer to EBSCA checkout procedure, MAP 7-9.

Yes

Yes

P Page 9-63

Q Page 9-67

EBSCA Error Logout

When in R, T, P, B, D, J, K, % mode or I mode after pressing FUNCT SEL upper and S, or when in W mode in tests 1, 2, 3, or 4, the bottom line on the display shows the following:

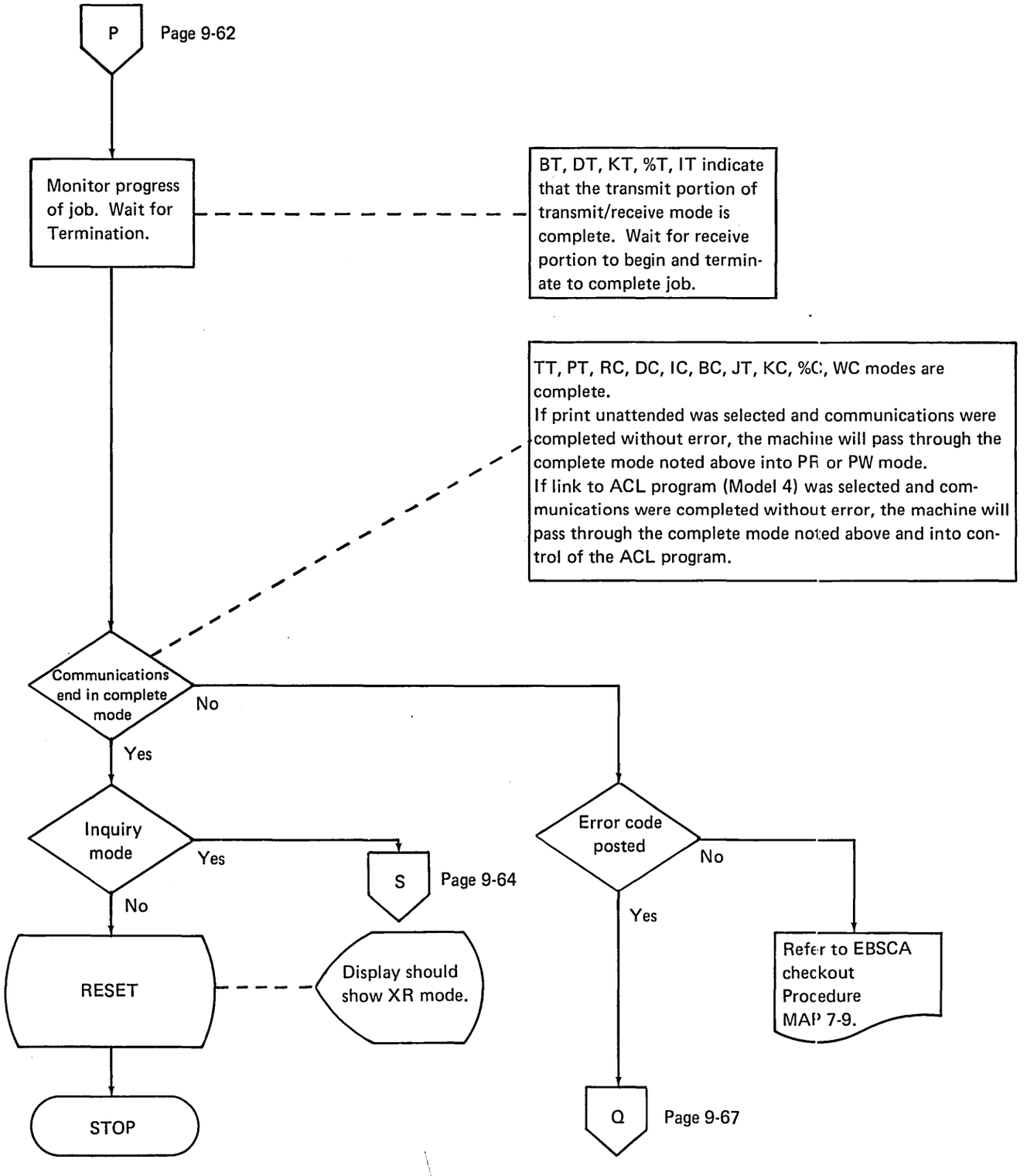
Mode determined by operation.

001 0 A A 01001

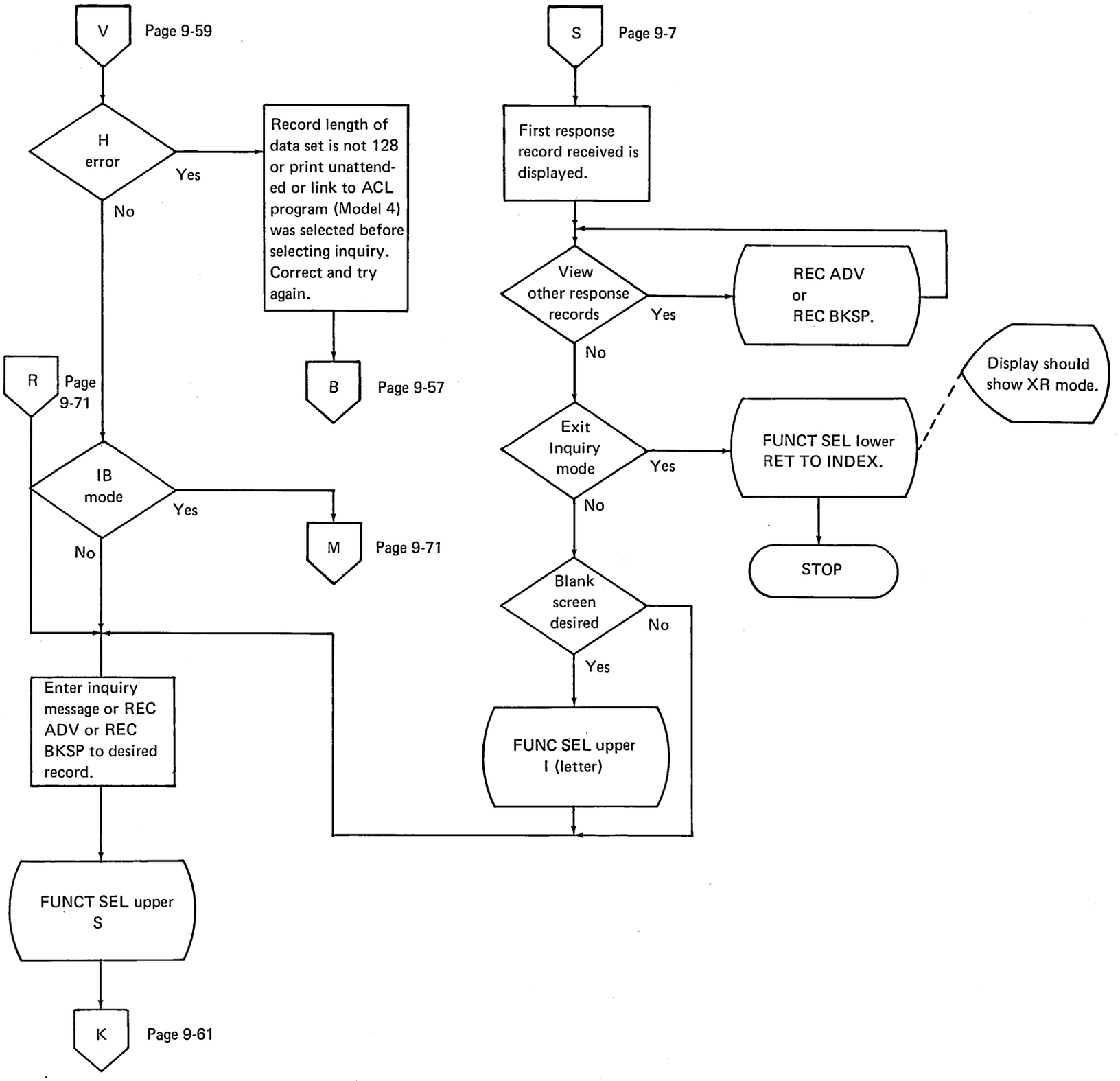
* 1	Data terminal ready.	1
* 4	Data set ready.	1
* 7	Request to send.	0
* 10	Clear to send.	0
** 14 - 16	CRC checks in receive.	001
** 19 - 21	NAKs received in transmit.	004
** 24 - 26	Two second time-outs.	000
** 29 - 31	Three second time-outs.	001

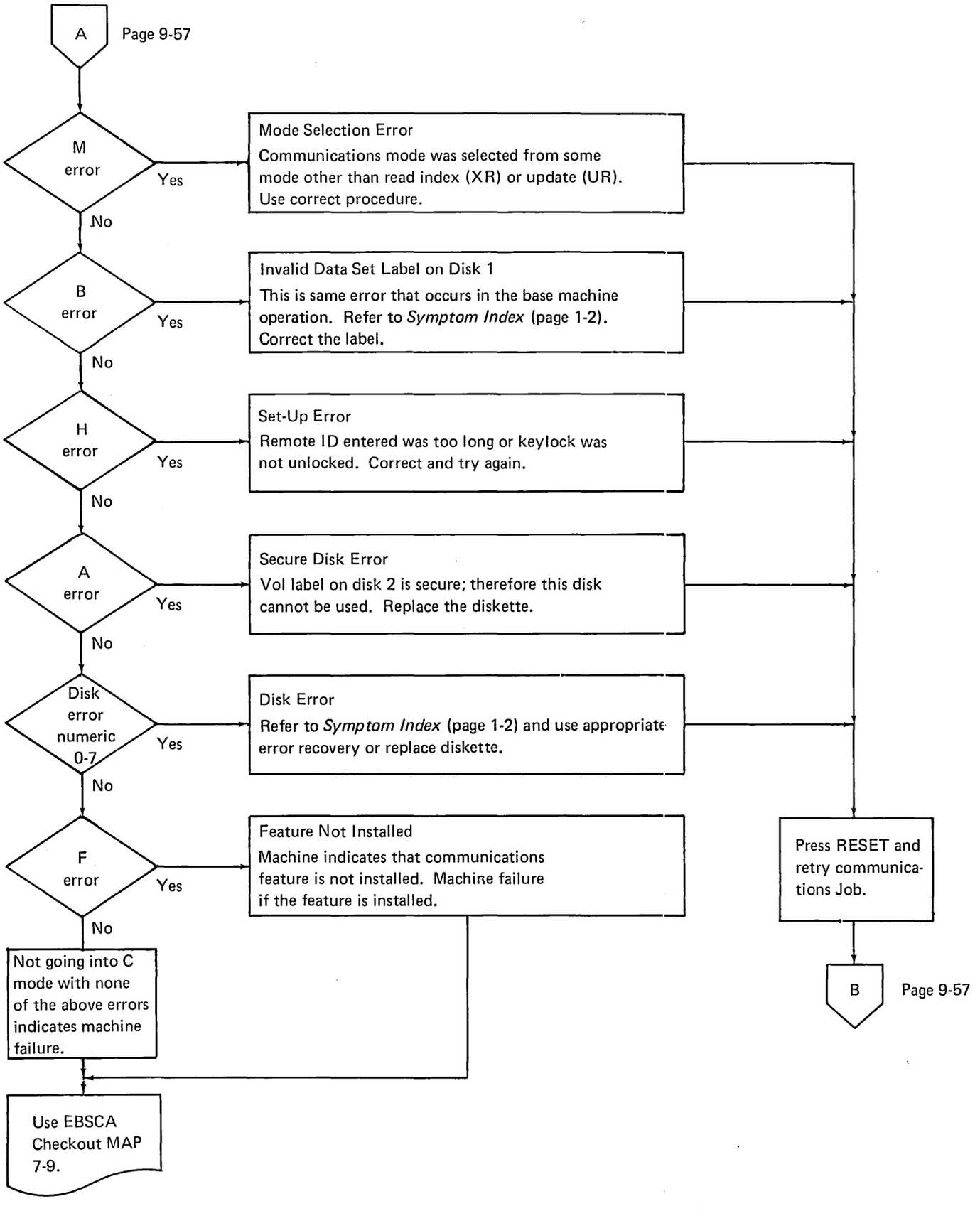
* *Note:* 1 indicates on; 0 indicates off.

** *Note:* Three position decimal counter.

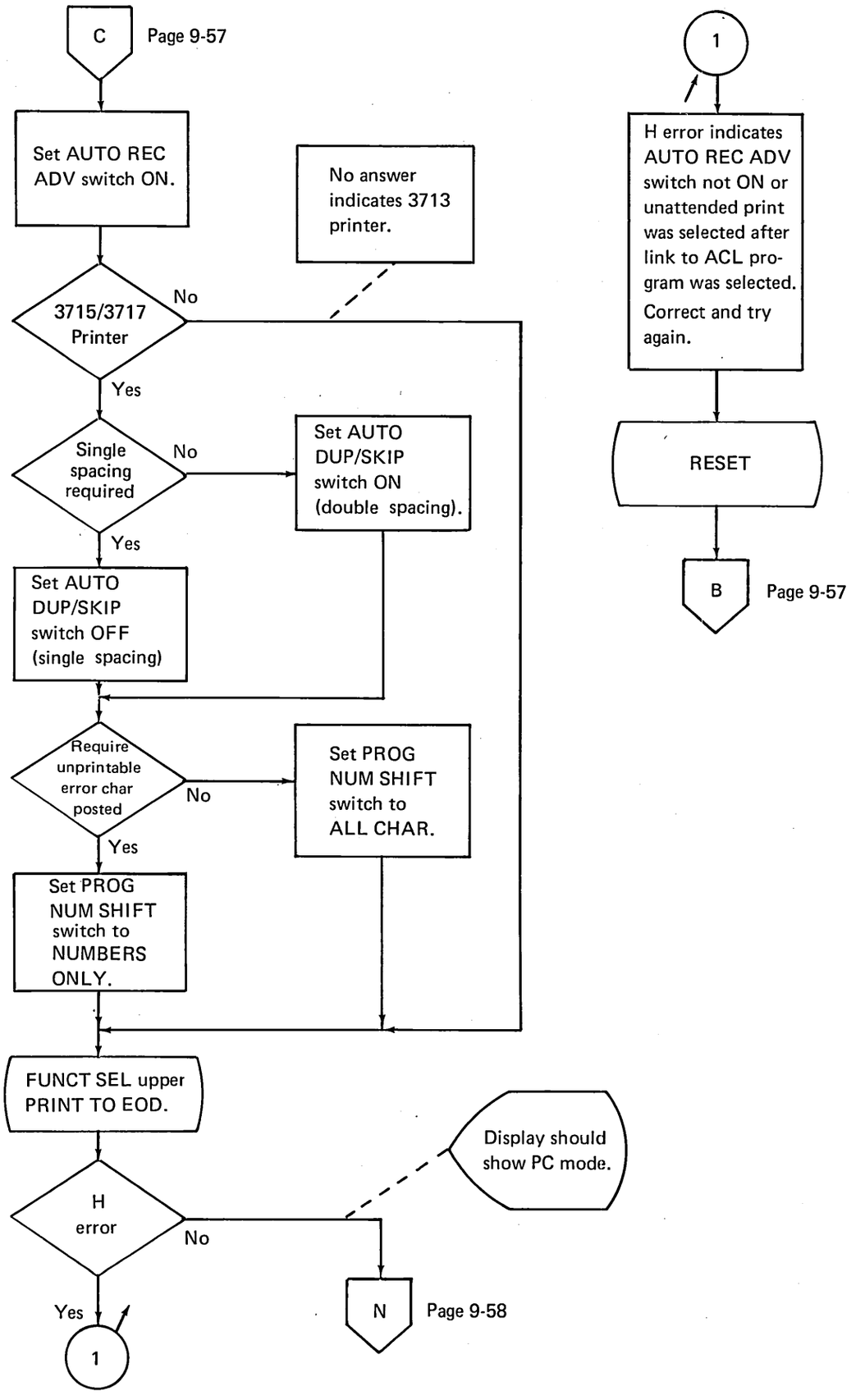

P
Page 9-62
Monitor progress of job. Wait for Termination.
BT, DT, KT, %T, IT indicate that the transmit portion of transmit/receive mode is complete. Wait for receive portion to begin and terminate to complete job.
TT, PT, RC, DC, IC, BC, JT, KC, %C, WC modes are complete.
If print unattended was selected and communications were completed without error, the machine will pass through the complete mode noted above into PR or PW mode.
If link to ACL program (Model 4) was selected and communications were completed without error, the machine will pass through the complete mode noted above and into control of the ACL program.
Communications end in complete mode
No
Yes
Inquiry mode
Yes
No
S
Page 9-64
RESET
Display should show XR mode.
STOP
Error code posted
No
Yes
Refer to EBSCA checkout Procedure MAP 7-9.
Q
Page 9-67

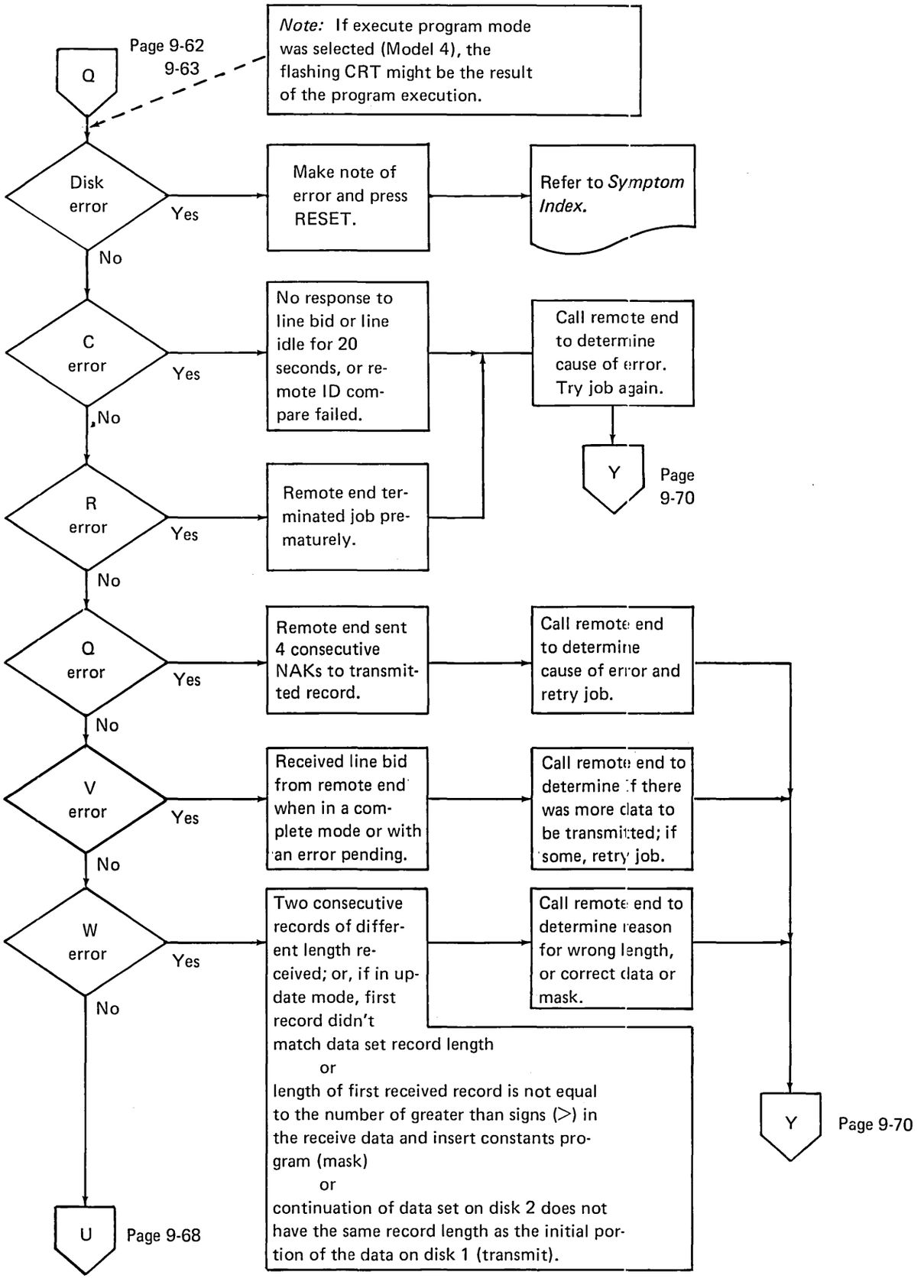
Inquiry


V
Page 9-59
H error
Yes
No
Record length of data set is not 128 or print unattended or link to ACL program (Model 4) was selected before selecting inquiry. Correct and try again.
B
Page 9-57
R
Page 9-71
IB mode
Yes
No
M
Page 9-71
Enter inquiry message or REC ADV or REC BKSP to desired record.
FUNCT SEL upper S
K
Page 9-61
S
Page 9-7
First response record received is displayed.
View other response records
Yes
No
REC ADV or REC BKSP.
Exit Inquiry mode
Yes
No
FUNCT SEL lower RET TO INDEX.
STOP
Display should show XR mode.
Blank screen desired
No
Yes
FUNC SEL upper I (letter)

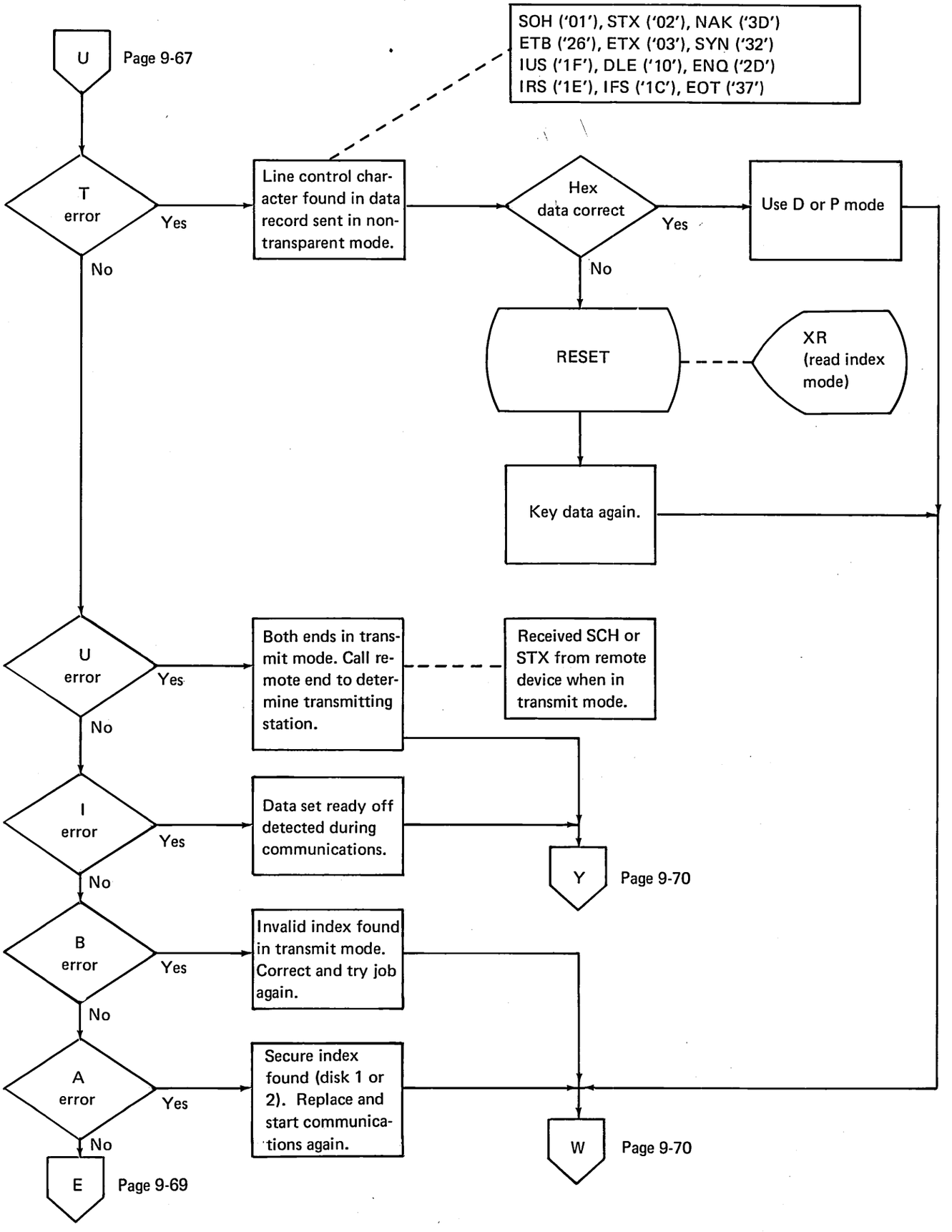

A
Page 9-57
M error
Yes
Mode Selection Error
Communications mode was selected from some mode other than read index (XR) or update (UR). Use correct procedure.
No
B error
Yes
Invalid Data Set Label on Disk 1
This is same error that occurs in the base machine operation. Refer to *Symptom Index* (page 1-2). Correct the label.
No
H error
Yes
Set-Up Error
Remote ID entered was too long or keylock was not unlocked. Correct and try again.
No
A error
Yes
Secure Disk Error
Vol label on disk 2 is secure; therefore this disk cannot be used. Replace the diskette.
No
Disk error numeric 0-7
Yes
Disk Error
Refer to *Symptom Index* (page 1-2) and use appropriate error recovery or replace diskette.
No
F error
Yes
Feature Not Installed
Machine indicates that communications feature is not installed. Machine failure if the feature is installed.
No
Not going into C mode with none of the above errors indicates machine failure.
Use EBSCA Checkout MAP 7-9.
Press RESET and retry communications Job.
B
Page 9-57

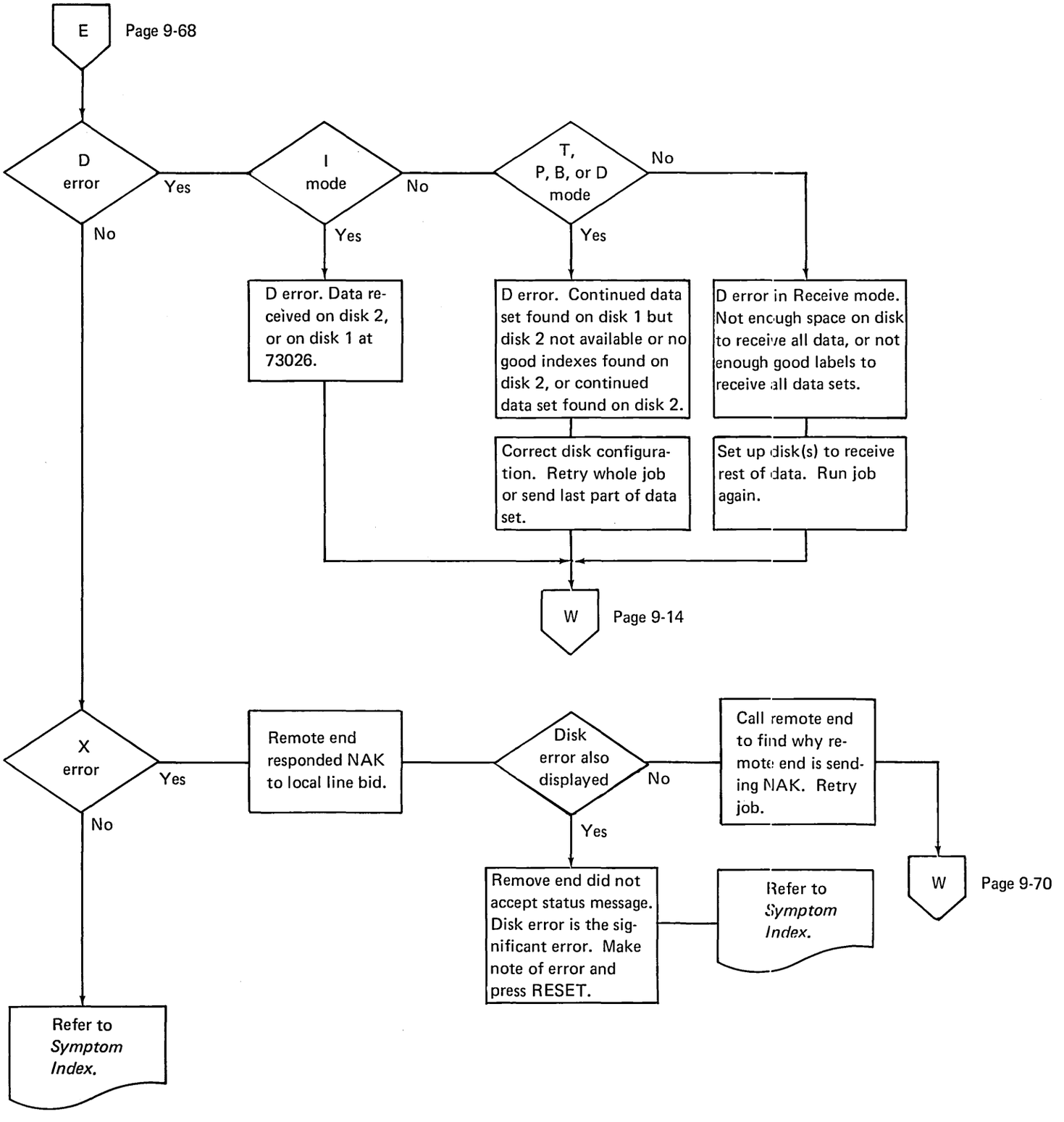
Print Unattended



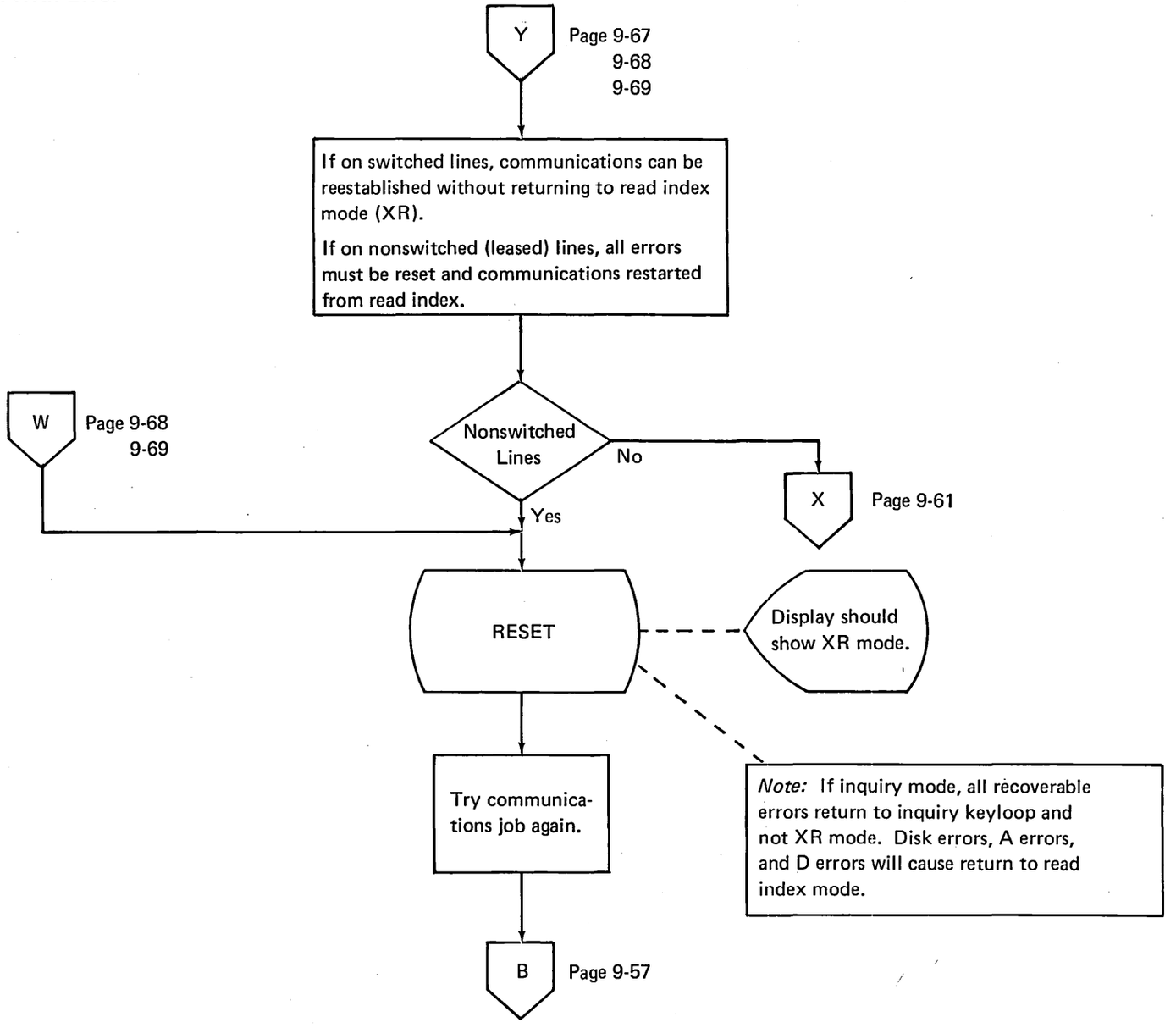

Page 9-62
9-63
Q
Note: If execute program mode was selected (Model 4), the flashing CRT might be the result of the program execution.
Disk error
Yes
Make note of error and press RESET.
Refer to *Symptom Index.*
No
C error
Yes
No response to line bid or line idle for 20 seconds, or remote ID compare failed.
Call remote end to determine cause of error. Try job again.
Y
Page 9-70
No
R error
Yes
Remote end terminated job prematurely.
No
Q error
Yes
Remote end sent 4 consecutive NAKs to transmitted record.
Call remote end to determine cause of error and retry job.
No
V error
Yes
Received line bid from remote end when in a complete mode or with an error pending.
Call remote end to determine if there was more data to be transmitted; if some, retry job.
No
W error
Yes
Two consecutive records of different length received; or, if in update mode, first record didn't
match data set record length
or
length of first received record is not equal to the number of greater than signs (>) in the receive data and insert constants program (mask)
or
continuation of data set on disk 2 does not have the same record length as the initial portion of the data on disk 1 (transmit).
Call remote end to determine reason for wrong length, or correct data or mask.
Y
Page 9-70
No
U
Page 9-68

Error Codes (Continued)

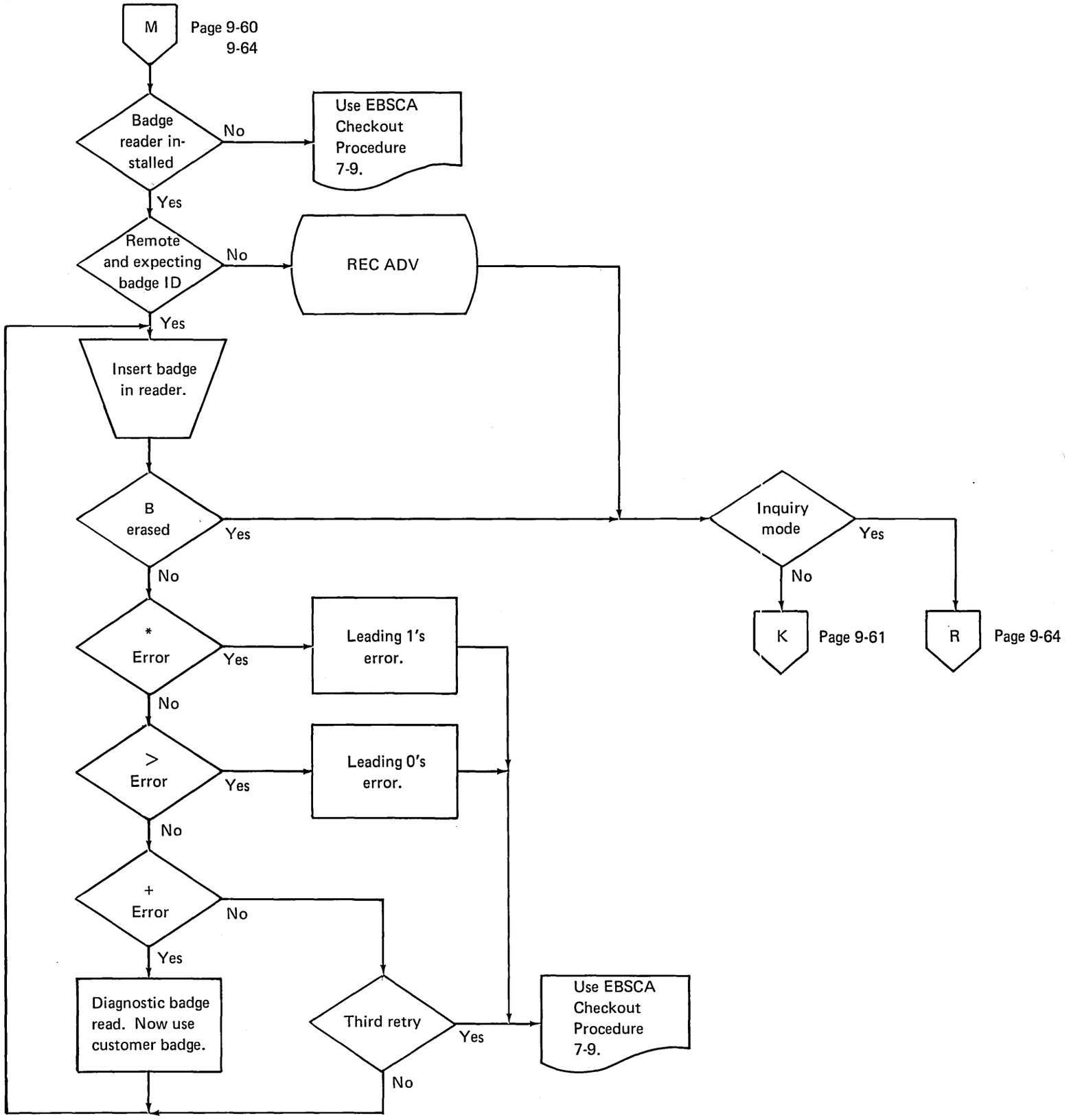



E
Page 9-68
D error
Yes
No
I mode
No
Yes
T, P, B, or D mode
No
Yes
D error. Data received on disk 2, or on disk 1 at 73026.
D error. Continued data set found on disk 1 but disk 2 not available or no good indexes found on disk 2, or continued data set found on disk 2.
D error in Receive mode. Not enough space on disk to receive all data, or not enough good labels to receive all data sets.
Correct disk configuration. Retry whole job or send last part of data set.
Set up disk(s) to receive rest of data. Run job again.
W
Page 9-14
X error
Yes
No
Remote end responded NAK to local line bid.
Disk error also displayed
No
Yes
Call remote end to find why remote end is sending NAK. Retry job.
W
Page 9-70
Remove end did not accept status message. Disk error is the significant error. Make note of error and press RESET.
Refer to *Symptom Index.*
Refer to *Symptom Index.*

Termination With Error



ID Reader



EC 823146			PN 1619117
Date 9/74			

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DATA RECORDER ATTACHMENT TABLE OF CONTENTS

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Set Up for Card I/O (ONLINE) Mode . . . 9-90

Format Control Characters

Control Character	Meaning
xA	Format data field: Loads the buffer from the record with the number of characters specified by the number preceding the A format control character.
N&	Identifies card read/punch format programs: All card read/punch format programs must have an N& (ampersand) in positions 001 and 002.
xB	Format data field with suppression of leading zeros: Loads the buffer from the record with the number of characters specified by the number preceding the B format control character, but loads blanks instead of leading zeros.
xX	Insert blanks: Loads the buffer with the number of blanks preceding the X format control character.
xY	Skips characters from the record: Skips over, with no action, the number of characters in the record specified by the number preceding the Y format control character. *Note:* It is not permissible to skip beyond the record boundaries.
xF	Reverse skips characters from the record: Skips over, in reverse direction (towards position 001) with no action, the number of characters in the record specified by the number preceding the F format control character. *Note:* It is not permissible to skip beyond the record boundaries.
N or ⌀	No-op: No operation is performed. *Note:* Position 001 of the card read/punch programs must contain an N.
Q	Terminates format program: This format control character must be used at the end of every format program.
xI	Insert characters: Loads the characters following the I into the buffer. The number preceding the I format control character indicates the number of characters to be loaded to the buffer.
C	Read or punch a card: A card is read or punched before the format control program is terminated. *Note:* The pointers in program buffer 9 and the current record buffer are reset to position 001 each time a C is encountered in the format control program. That is, when the format control program contains the format control character C, the format control defined after the C must start from position one of the buffer.

Note: The x represents a variable value (from 1 to 128) that is the multiple of the control characters to be executed. If a control character is preceded by a blank, N, or another control character, the multiple is assumed to be one.

Data Recorder Programs

Construction

1. N& (ampersand) must be in positions 001 and 002 of the program level.

2. Any of the format control characters may follow (9-1).

3. A Q must be the last character in the program level.

Note: For punch operations, if a format control program positions the data beyond column 80 (on the IBM 129) or 96 (on the IBM 5496) in the buffer, that data is not punched and no error code is displayed.

Loading

See page 9-33 for flowchart.

1. Loading is accomplished the same as for printer programs:
   a. Press: FUNCT SEL lower
      RETURN TO INDEX
      FUNCT SEL lower
      DELETE RECORD
      Key in the Data Recorder program
   b. Press: FUNCT SEL lower
      PROG LOAD
      Any number from 1 through 8

Selecting

1. Manual selection —
   a. When the direct selection of the storage program level of the Data Recorder program is wanted, do the following:
      1) Program level A *must* be loaded with the following in positions 001-009:
         :12345678
      2) With the program level A coded as above then if the Data Recorder program is to be selected; simply select the program level where it was stored.
      3) For example: If you loaded your Data Recorder program into program level 5, then press SEL PROG and the 5 key to obtain your Data Recorder program.
   b. When indirect selection of the Data Recorder program is desired, do the following:
      1) Program level A *must* be loaded in a manner that when a certain keying program is selected the Data Recorder program level number is in the position of program level A corresponding to the keying format level.

Note: This allows the operator to select a program level for entering or updating data. Then when the operator initiates a card read or punch operation, the card read or punch format control program assigned in program level A is automatically used. After the Data Recorder operation is completed, the selected key entry program level is again active.

      2) With program level A coded as above (where YYY is a number from 1 to 128) the YYY character in the record determines the program level to be selected.
      3) For example, if program level A is coded as follows:
         %07ϕϕ
      Then the seventh character (counting blanks) will be used to select the program level. If the seventh character is a number from 1 through 8, then that level number will be selected. If the seventh character is not a number from 1 through 8, then program level 1 is selected.

This Data Recorder format control program level would be automatically selected for all Data Recorder operations if program level 5 was being used for keying format control.

Cursor position	001	002	003	004	005	006	007	008	009
Program level A	:	X	X	X	X	X	X	X	X
Corresponding manually selected keying format program level number		1	2	3	4	5	6	7	8

2. Automatic selection —
   a. When automatic selection of a Data Recorder program level is desired to do the following:
      1) Load program level A as follows:

Cursor position	001	002	003	004	005
Program level A	%	Y	Y	Y	ϕ

Note: The % sign must be in position 001 of program level A, followed by any number from 1 through 128 and position 005 must be blank. The number can be written as a 1-, 2-, or 3-digit number (1, 01, or 001). If positions 002, 003, and 004 are blank the default value is 1.

Example: Refer to *Selecting,* step 1b, on page 9-74.

If program level A is coded as follows:

Cursor position	001	002	003	004	005	006	007	008	009
Program level A	:		2			1			
Corresponding manually selected keying format program level number		1	2	3	4	5	6	7	8

The following conditions exist for the above example:

1. If program level 5 is manually selected, program level 1 will automatically be used for all Data Recorder operations and program level 5 will be used for all key entry operations.

2. If program level 2 is manually selected, program level 2 will be used for all Data Recorder operations and program level 0 will be used for all key entry programs.

3. If program level 1 is manually selected, no Data Recorder formatting will occur (even if program level 1 is a Data Recorder program). There must be a value coded in the appropriate position of program level A before Data Recorder programs can be selected.

Sample Programs Section for Data Recorder

Punching

– Put the Data Recorder online.
Load diskette.
Load deck of blank cards in the Data Recorder hopper. (The IBM 129 needs two cards fed.)

– Sample 1: To punch the record displayed on the CRT do the following:

Press: FUNCT SEL lower
N
FIELD COR

This section does not alter any data on the disk. To punch the same record again press:

FIELD COR

To get out of single punch mode do the following:

Press: FUNCTION SELECT lower
S

– Sample 2: To punch a card with some data that is not on the disk and is not wanted on the disk do the following:

Press: FUNCTION SELECT lower
N

Key in: I PUNCH EXACTLY WHAT IS WRITTEN ON THE CRT WITHOUT CHANGING THE DATA ON DISK.

Press: FIELD CORR

To get out of a single punch mode do the following:

Press: FUNCTION SELECT lower
S

– Sample 3: To punch a reocrd with format control do the following:

Press: FUNCTION SELECT lower
DELETE REC

Key in: N&5A5X5Y10F26A4X8IALPHABETQ
└── Identifies the program as a Data Recorder program

Press: FUNCT SEL lower
PROG LOAD
1
FUNCT SEL lower
DELETE REC

Key in: :1
└── Use Data Recorder program 1 if program level 1 is selected.
└── Means program will be manually selected.

Press: FUNCT SEL lower
PROG LOAD
A
FUNCT SEL lower
RETURN TO INDEX
FUNCT SEL lower
N
FUNCT SELECT lower
ENTER

Key in: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Press: RECORD BKSP
SEL PROG
1
FIELD CORR

The record punched will be:

ABCDE ABCDEFGHIJKLMNOPQRSTUVWXYZ ALPHABET

To get out of single punch mode and to program level 0, do the following:

Press: FUNCTION SELECT lower
S
SEL PROG
0

– Sample 4: To punch a record or records under search content with format control:

Load program level 3 with the following:

N&10A5X10A5X6A3XAQ

Load program level A with the following:

:1ØØ5ØØ3Ø

The "3" here means that program level 7 must be manually selected if Data Recorder program in program level 3 is to be used.

Load program level 7 with the following:

U . . . . (26 periods) . . . . . NE

Press: FUNCTION SELECT lower
RETURN TO INDEX
FUNCTION SELECT lower
ENTER

Key in: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Press: REC ADV
SEL PROG
7 Key

Press the following keys in order:

2
3
4
5
6
7
8
9

Press: FUNCTION SELECT lower
RETURN TO INDEX
FUNCTION SELECT lower
SEARCH CONTENT

Key in: ØØØØ (26 blanks) ØØØØ5

Press: REC BKSP
SEL PROG
7
FUNCTION SELECT upper
PUNCH TO EOD

The 3741 searches until finding a record that fits the search mask and then punches it out under format control. Then it returns to index.

– Sample 5: To punch an entire data set do the following:

Create or use an existing data set on the diskette. Start at the data set label and then:

Ensure that the AUTO REC ADV switch is on.

Press: FUNCTION SELECT upper
PUNCH TO EOD

This punches all the records from the disk onto cards. Then returns to index and displays the data set label of data just punched.

– Sample 6: To punch part of a data set do the following:

Create or use an existing data set on the diskette. Ensure the AUTO REC ADV switch is on. Then advance to the record that is the first to be punched.

After the first record to be punched is displayed:

Press: FUNCTION SELECT upper
PUNCH TO EOD

Reading

Put the Data Recorder online (9-80). Load the diskette to be written on. Load the deck of data cards into the Data Recorder hopper. (The IBM 129 needs two cards fed.)

– Sample 1: To read a card without entering or changing the data on the diskette, do the following:

Press: FUNCTION SELECT lower
V
FIELD CORR

This causes a card to be read and its contents displayed on the screen. If this data is to be entered onto the disk at the location the disk is at simply:

Press: REC ADV

If you want to read another card:

Press: FIELD CORR

To get out of single read mode:

Press: FUNCTION SELECT lower
S

– Sample 2: To read in a deck of cards under format control.

Create a deck of 10 cards all with the alphabet in the first 26 columns.

Load program level 5 with the following:

N&A10X10AX15A3X9ICOSTØ$26F2AI.2AQ

Load program level A with the following:

:Ø5

The 5 means that if program level 2 is selected all Data Recorder operations will use program level "5".

Place the deck of 10 cards followed by an EOF card (?* in the first two columns) into the data recorder hopper. (The 129 needs two cards fed.)

Locate the data set label of the data set to be written into or create space for a data set of 10 records or more. Ensure that the AUTO REC ADV switch is on.

Press: SEL PROG
2
FUNCT SEL upper
READ TO EOF

This will read all the cards into the disk with format control. Then when it sees the EOF card it will return to index.

– Sample 3: To read in multiple data sets do the following:

Create or use two or more data set labels with adequate space for entry of data records. Ensure the AUTO REC ADV switch is on. Obtain the deck of data to be entered in the first data set. Follow it with an EOD card (?/ in the first two columns). Next put the deck of data to be entered into the second data set followed by an EOF card. Place all cards in the Data Recorder hopper. (The IBM 129 needs two cards fed.)

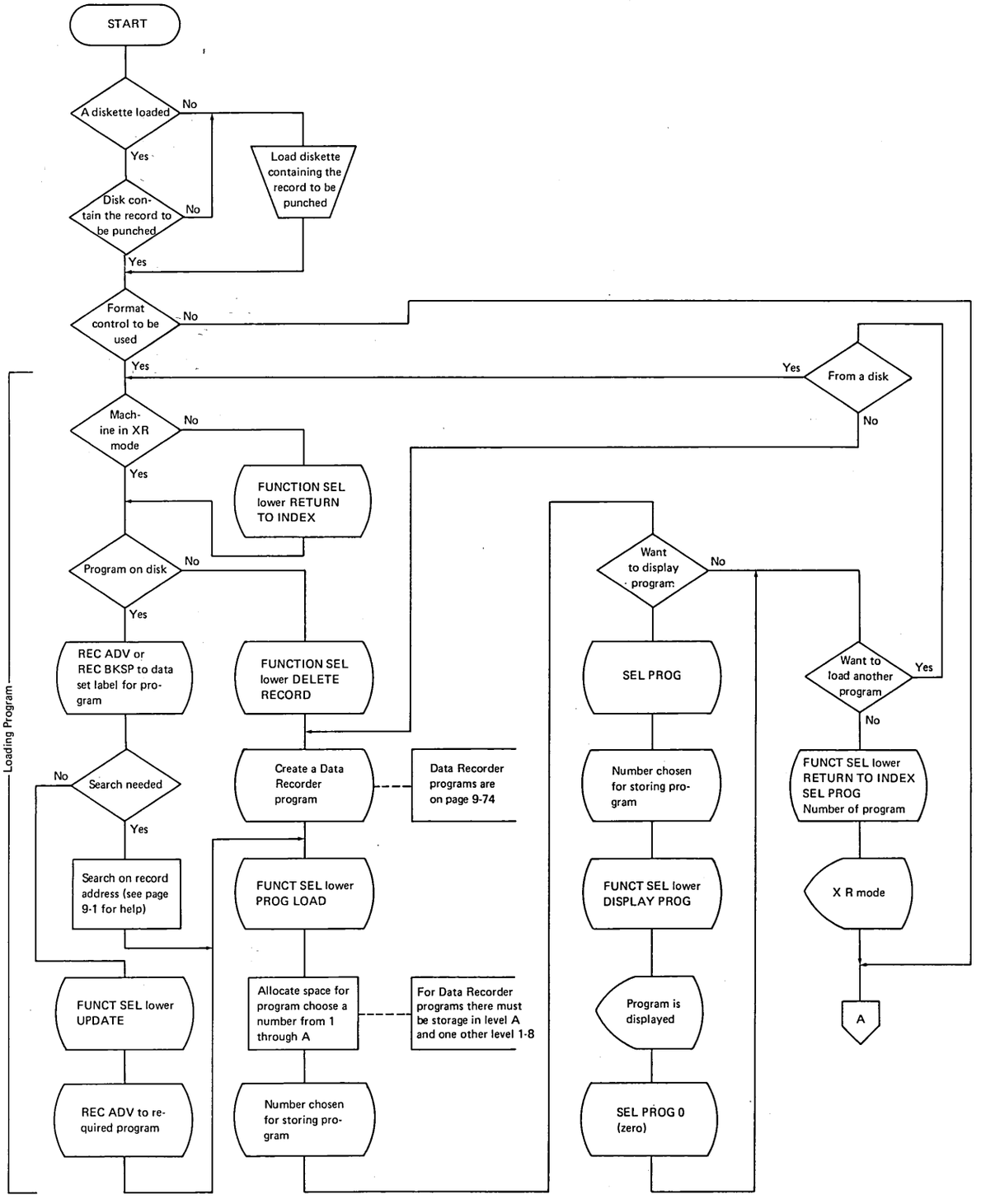
Display the Data Set label of the first data set to be filled.

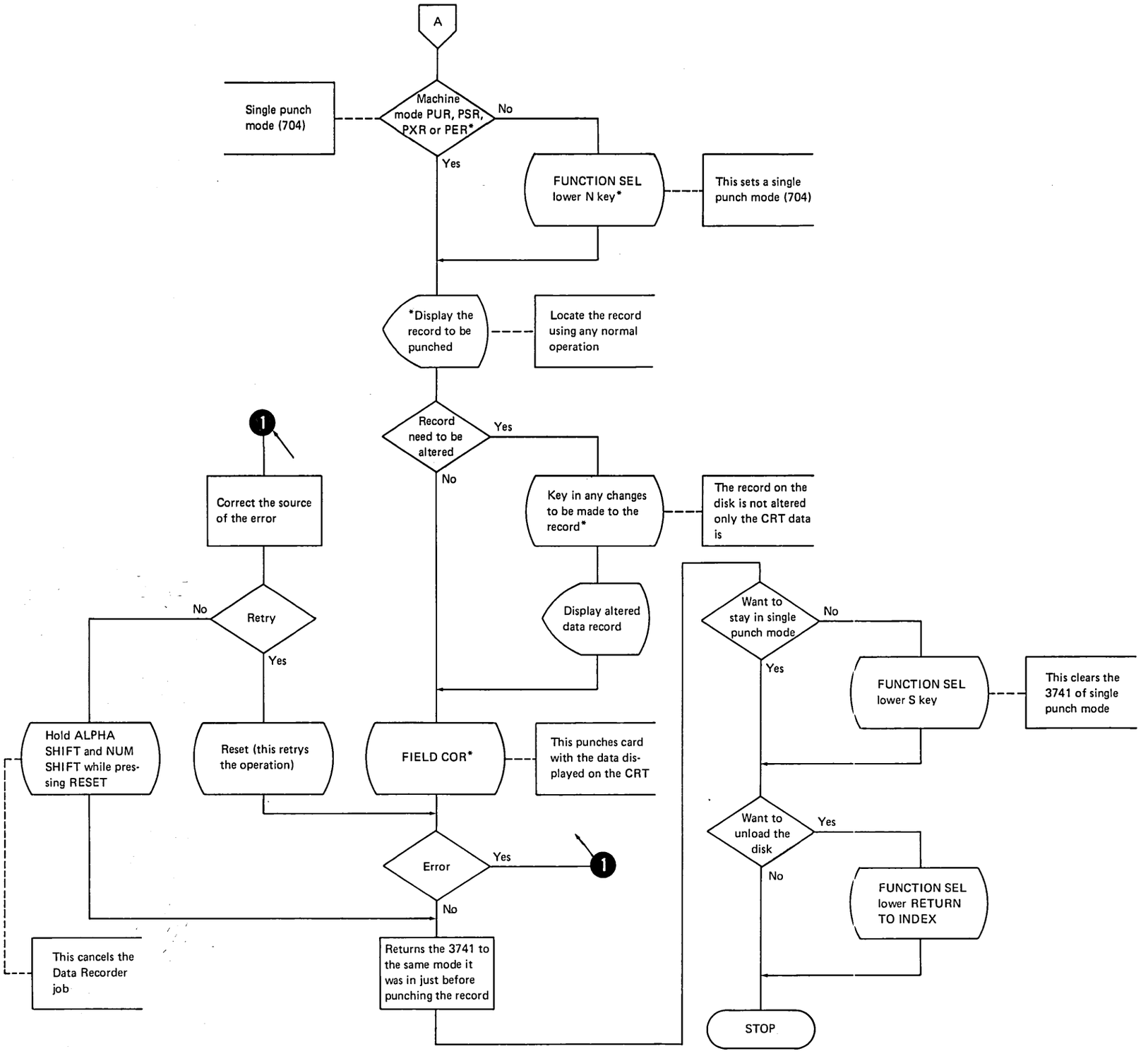
Press: FUNCT SEL upper
READ TO EOF

This will read the cards up to the EOD card into the first data set. Then the 3741 will search for the next unprotected data set and will read all the cards up to the EOF card into it.

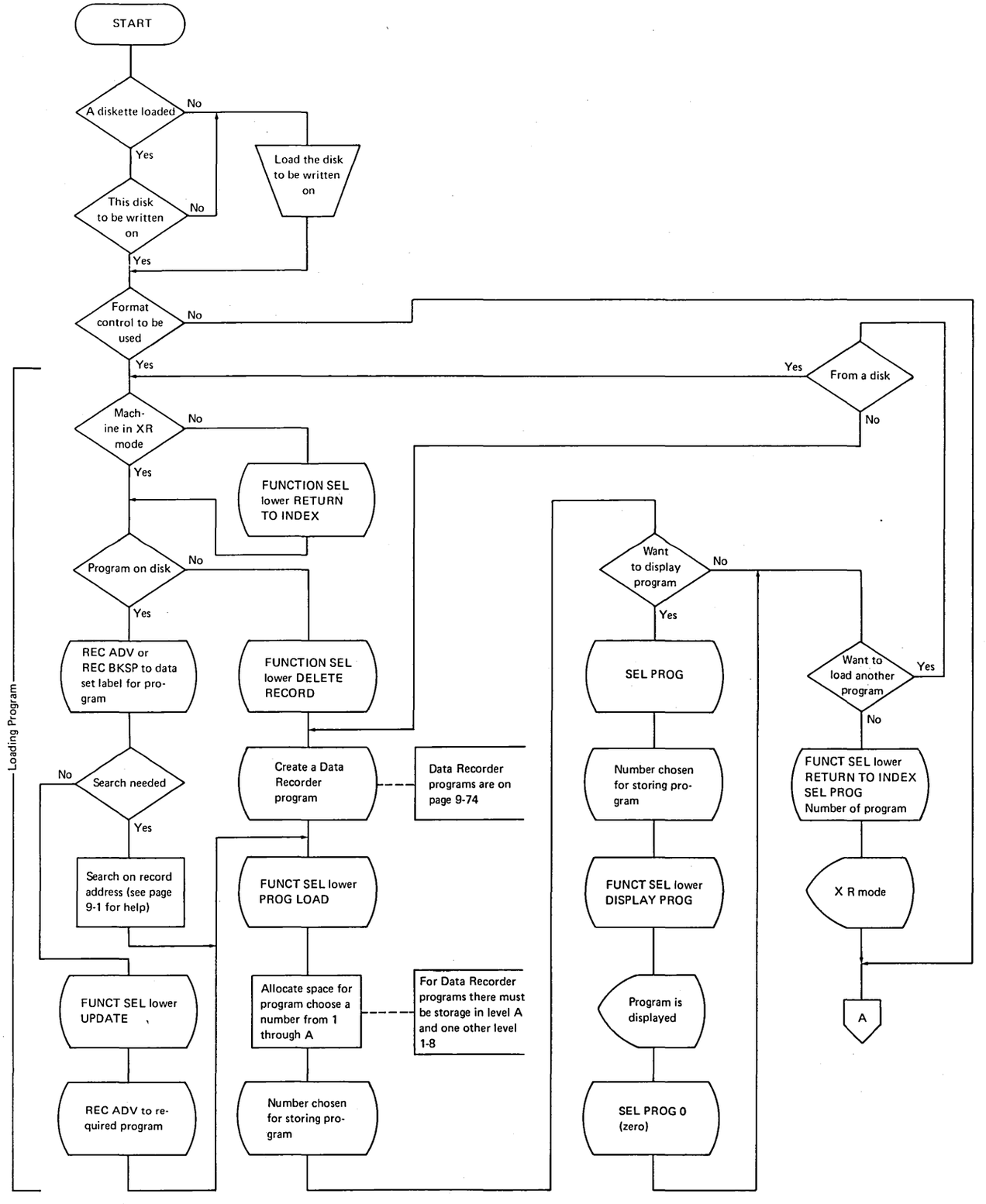
Operation Flowcharts

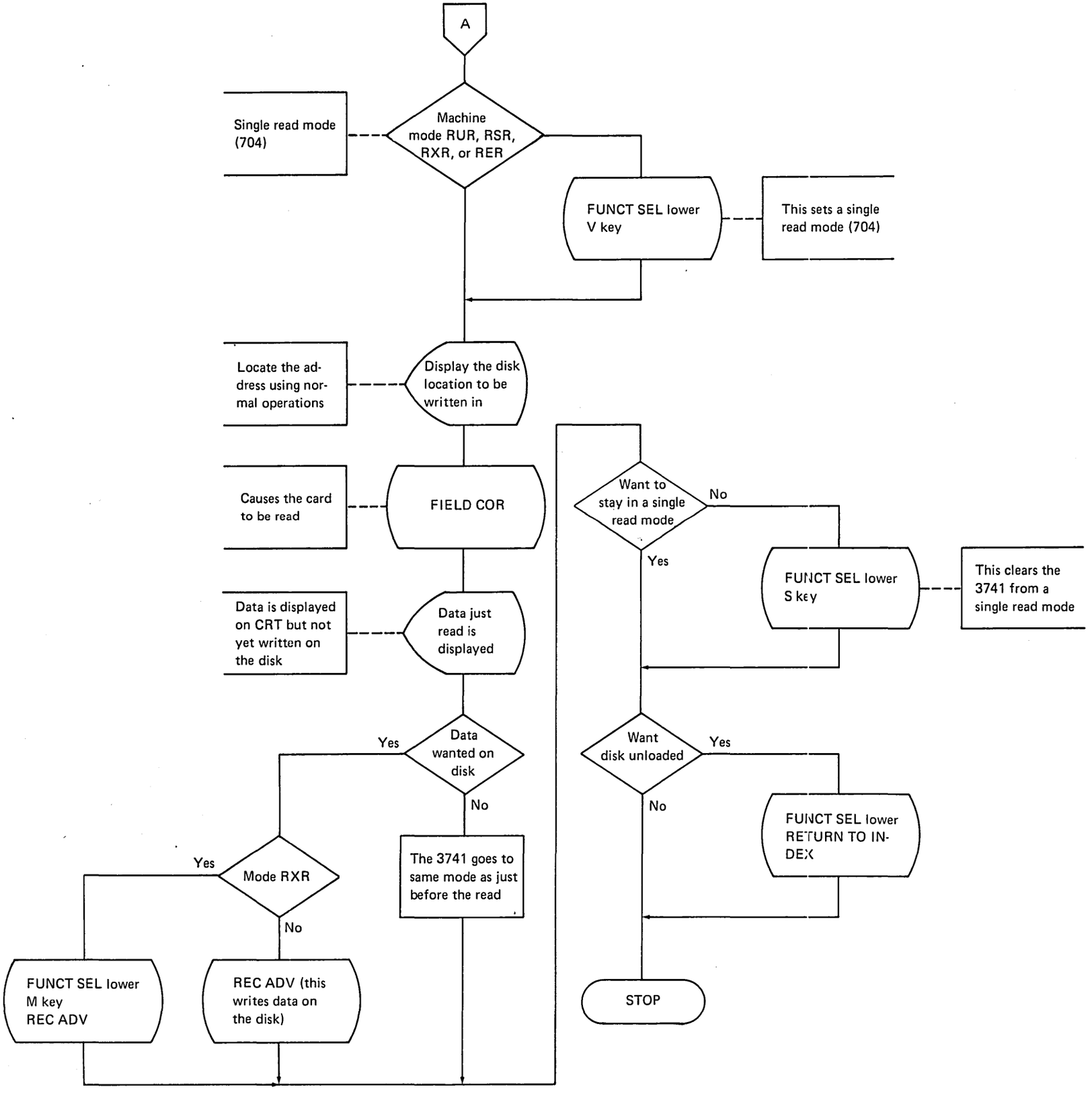
Punch a Record



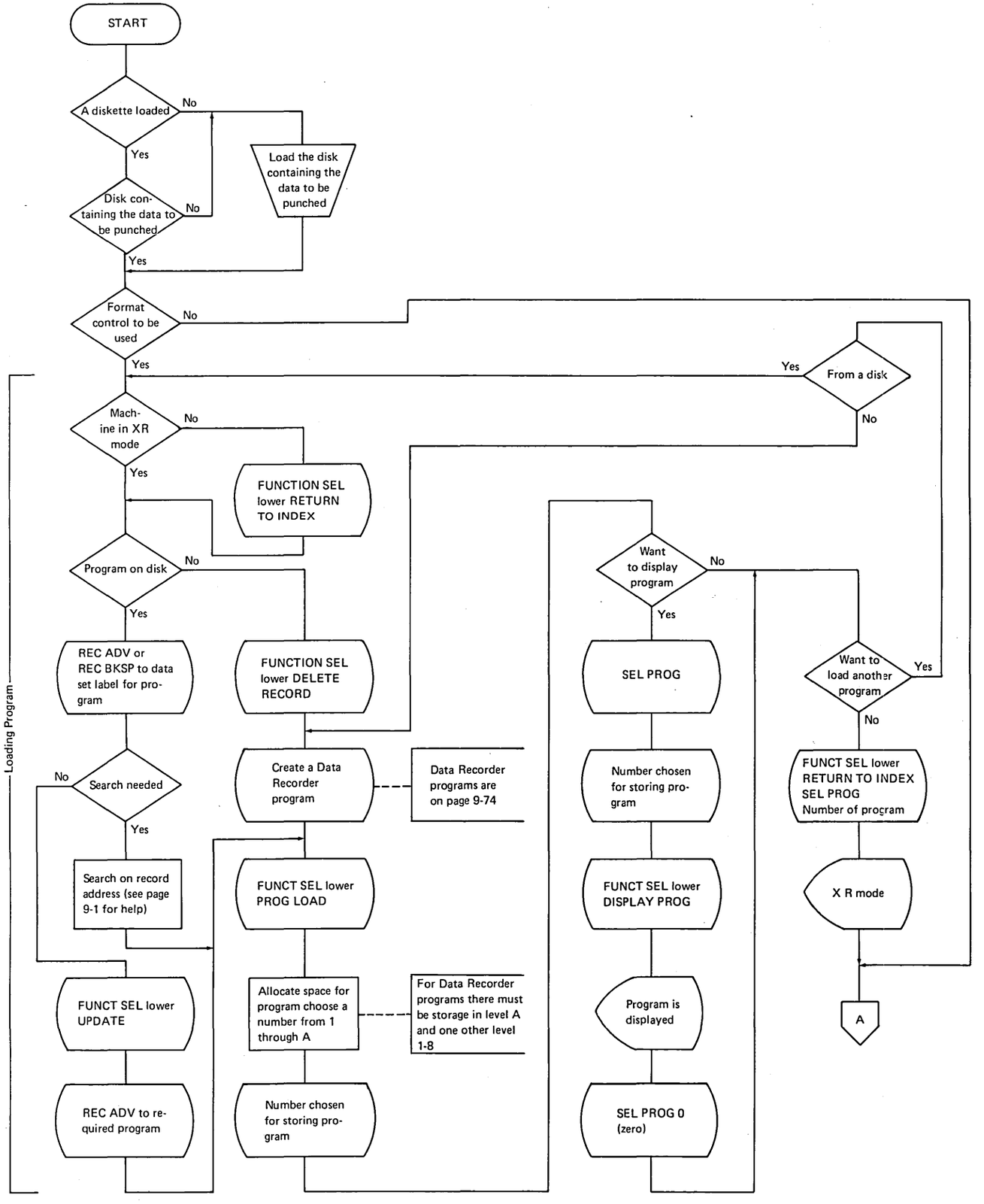

A
Single punch mode (704)
Machine mode PUR, PSR, PXR or PER*
No
Yes
FUNCTION SEL lower N key*
This sets a single punch mode (704)
*Display the record to be punched
Locate the record using any normal operation
Record need to be altered
Yes
No
1
Correct the source of the error
Key in any changes to be made to the record*
The record on the disk is not altered only the CRT data is
Retry
No
Yes
Display altered data record
Want to stay in single punch mode
No
Yes
FUNCTION SEL lower S key
This clears the 3741 of single punch mode
Hold ALPHA SHIFT and NUM SHIFT while pressing RESET
Reset (this retrys the operation)
FIELD COR*
This punches card with the data displayed on the CRT
Want to unload the disk
Yes
No
Error
Yes
1
No
FUNCTION SEL lower RETURN TO INDEX
This cancels the Data Recorder job
Returns the 3741 to the same mode it was in just before punching the record
STOP

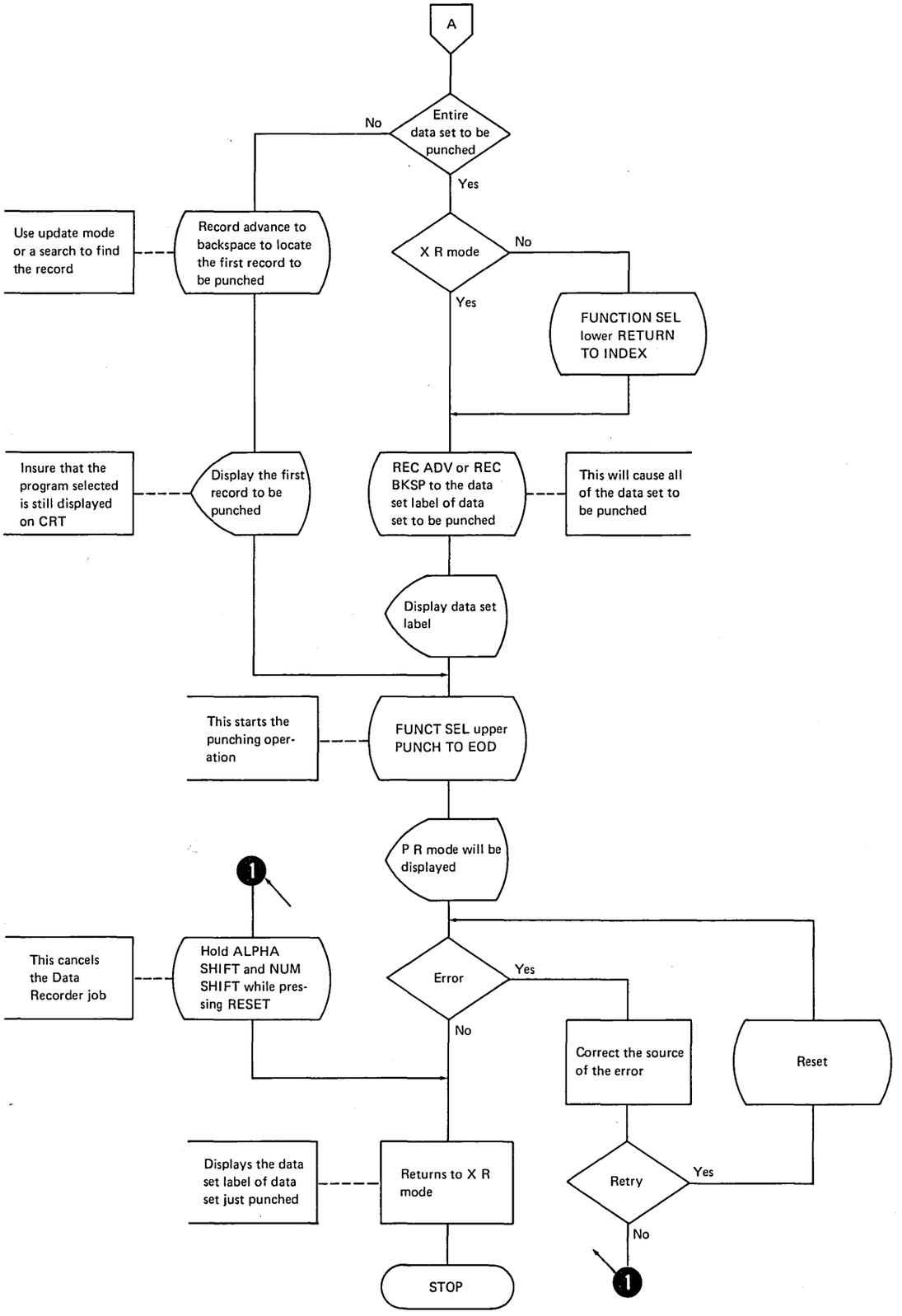
Read a Card


START
A diskette loaded
No
Yes
Load the disk to be written on
This disk to be written on
No
Yes
Format control to be used
No
Yes
From a disk
Yes
No
Mach-ine in XR mode
No
Yes
FUNCTION SEL lower RETURN TO INDEX
Program on disk
No
Yes
REC ADV or REC BKSP to data set label for program
FUNCTION SEL lower DELETE RECORD
Want to display program
No
Yes
SEL PROG
Want to load another program
Yes
No
Loading Program
No
Search needed
Yes
Create a Data Recorder program
Data Recorder programs are on page 9-74
Number chosen for storing program
FUNCT SEL lower RETURN TO INDEX SEL PROG Number of program
Search on record address (see page 9-1 for help)
FUNCT SEL lower PROG LOAD
FUNCT SEL lower DISPLAY PROG
X R mode
FUNCT SEL lower UPDATE
Allocate space for program choose a number from 1 through A
For Data Recorder programs there must be storage in level A and one other level 1-8
Program is displayed
A
REC ADV to required program
Number chosen for storing program
SEL PROG 0 (zero)


A
Machine mode RUR, RSR, RXR, or RER
Single read mode (704)
FUNCT SEL lower V key
This sets a single read mode (704)
Display the disk location to be written in
Locate the address using normal operations
FIELD COR
Causes the card to be read
Data just read is displayed
Data is displayed on CRT but not yet written on the disk
Data wanted on disk
Yes
No
Mode RXR
Yes
No
The 3741 goes to same mode as just before the read
FUNCT SEL lower M key REC ADV
REC ADV (this writes data on the disk)
Want to stay in a single read mode
No
Yes
FUNCT SEL lower S key
This clears the 3741 from a single read mode
Want disk unloaded
Yes
No
FUNCT SEL lower RETURN TO INDEX
STOP

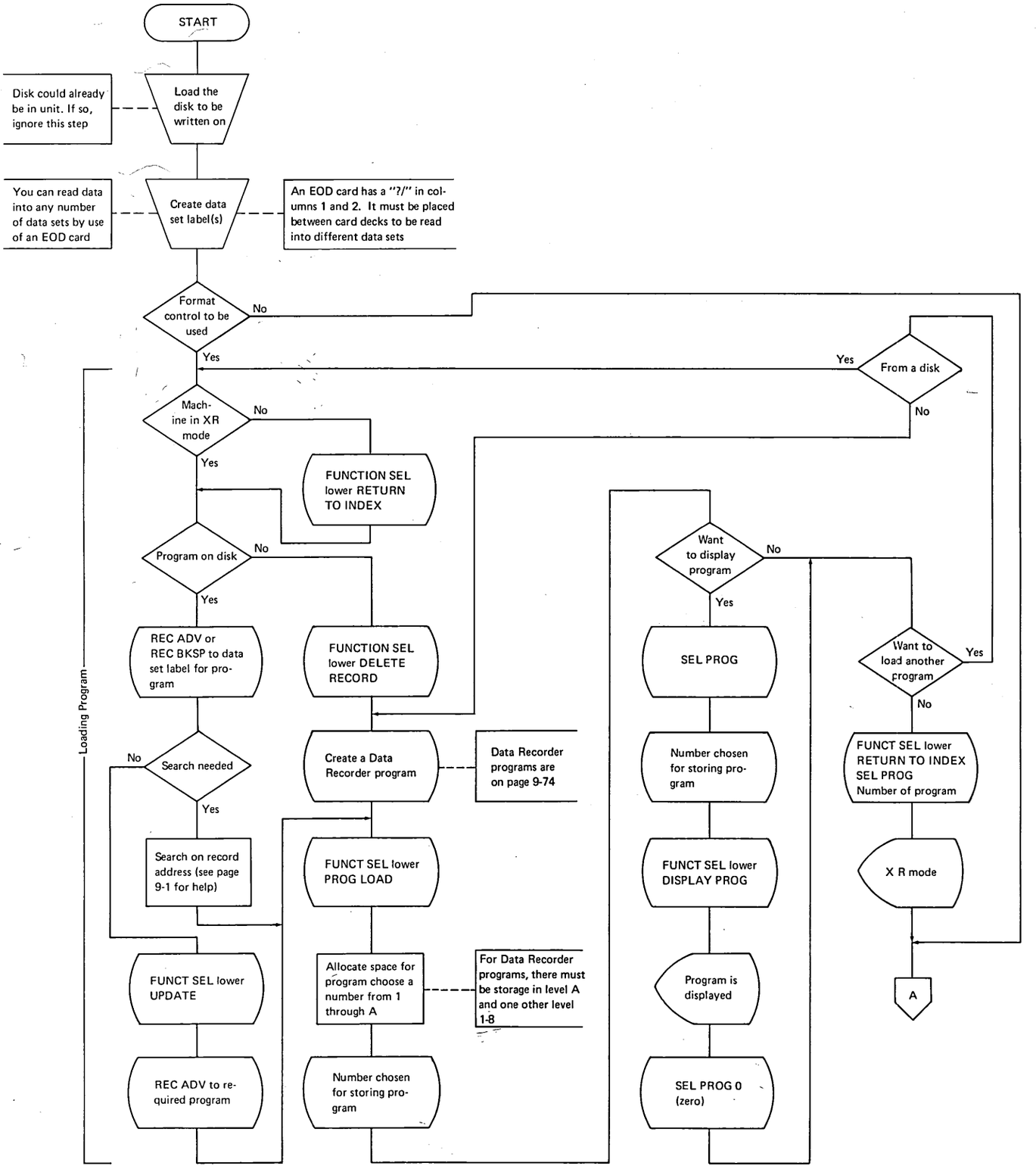
Punch a Data Set (all or in part)

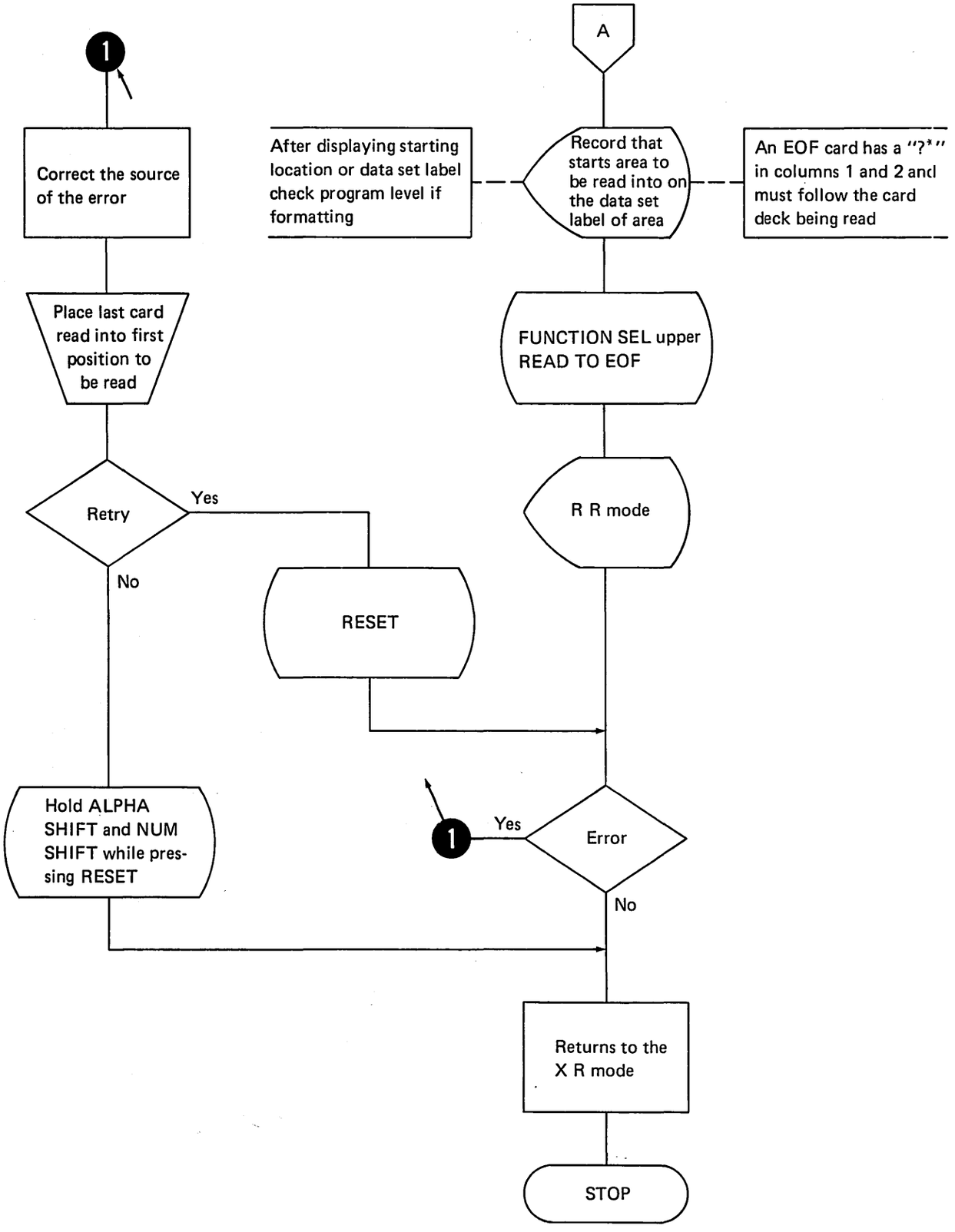




EC 825853	826065		PN 1619436
Date 11/15/74	8/1/75		

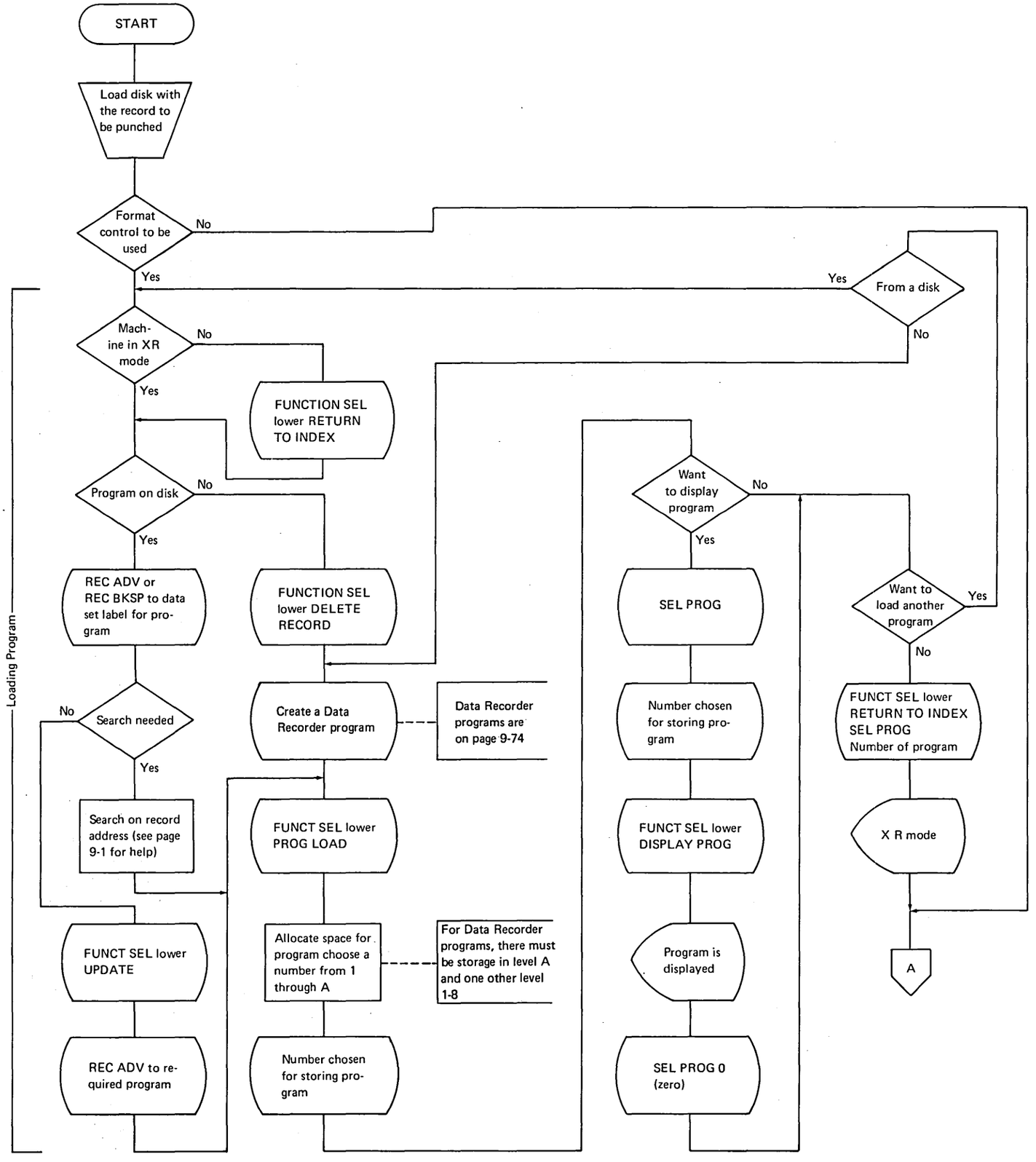
Read a Data Set (or Data Sets)

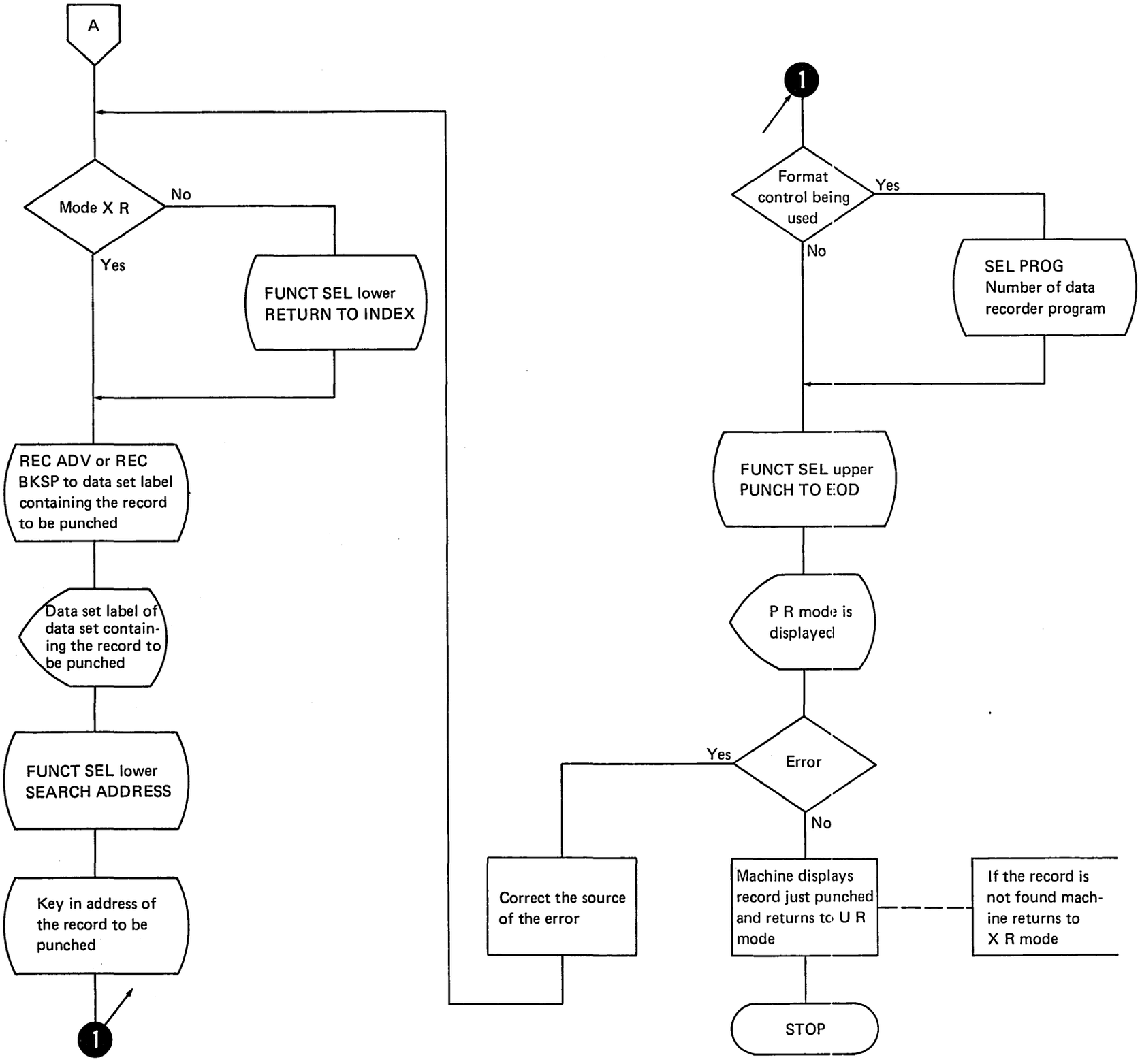




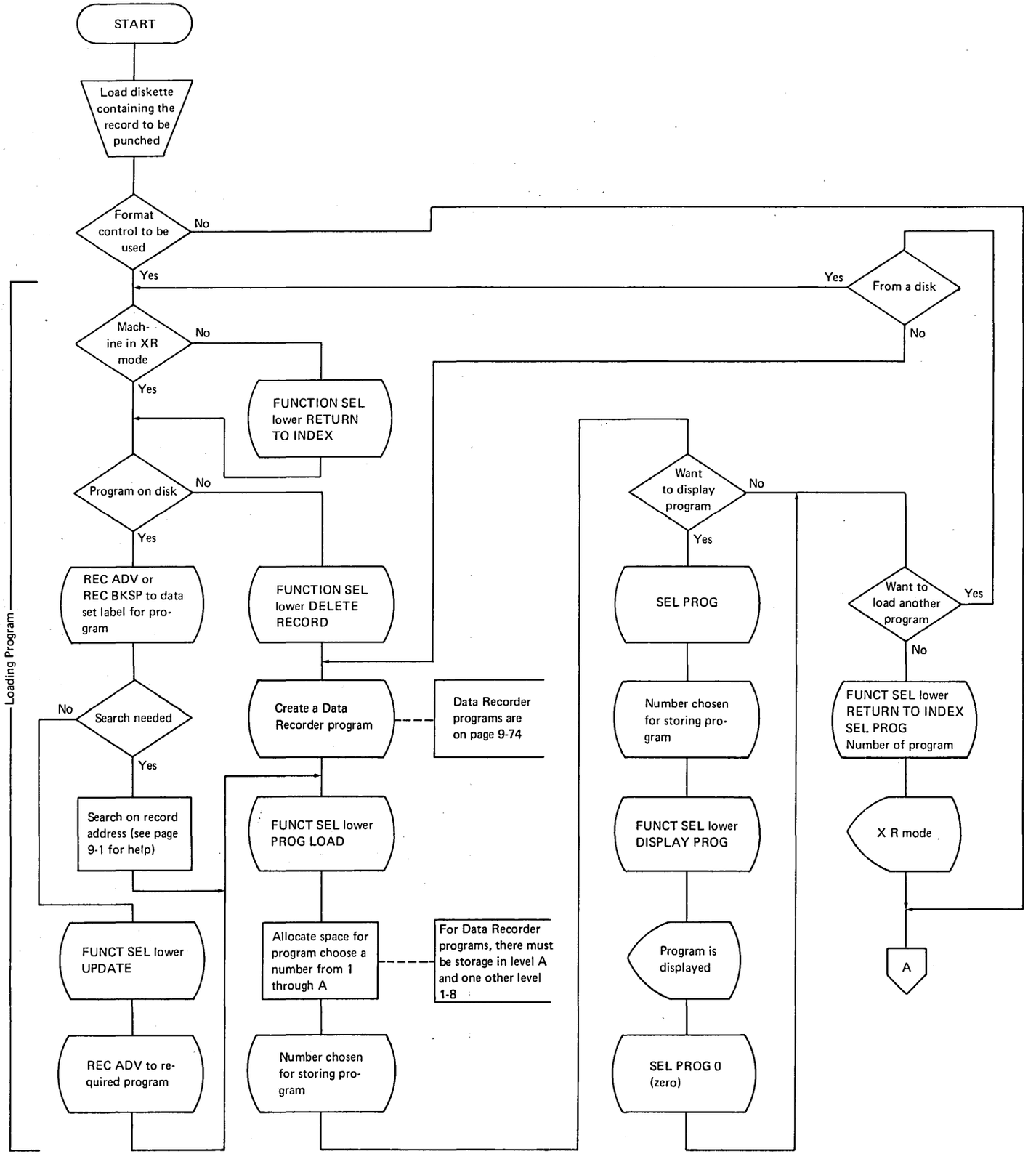
EC 825853			PN 1619438
Date 11/15/74			

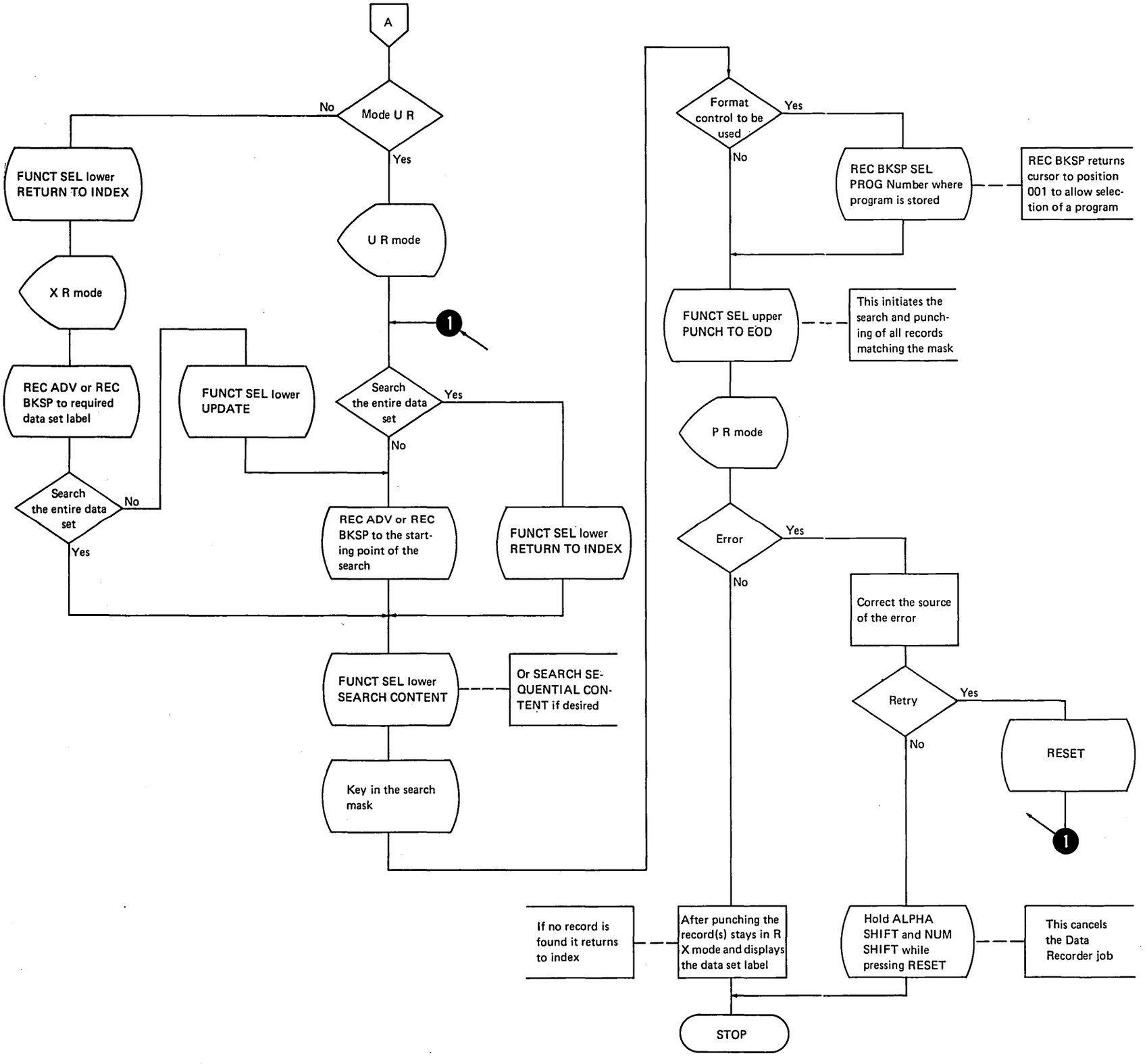
Punch a Record Using Search Address




A
Mode X R
No
Yes
FUNCT SEL lower
RETURN TO INDEX
REC ADV or REC
BKSP to data set label
containing the record
to be punched
Data set label of
data set contain-
ing the record to
be punched
FUNCT SEL lower
SEARCH ADDRESS
Key in address of
the record to be
punched
1
1
Format
control being
used
Yes
No
SEL PROG
Number of data
recorder program
FUNCT SEL upper
PUNCH TO EOD
P R mode is
displayed
Yes
Error
No
Correct the source
of the error
Machine displays
record just punched
and returns to U R
mode
If the record is
not found mach-
ine returns to
X R mode
STOP

Punch a Record (or Records) Using Search Content




A
Mode U R
No
Yes
FUNCT SEL lower RETURN TO INDEX
U R mode
X R mode
1
REC ADV or REC BKSP to required data set label
FUNCT SEL lower UPDATE
Search the entire data set
Yes
No
Search the entire data set
No
Yes
REC ADV or REC BKSP to the starting point of the search
FUNCT SEL lower RETURN TO INDEX
FUNCT SEL lower SEARCH CONTENT
Or SEARCH SEQUENTIAL CONTENT if desired
Key in the search mask
Format control to be used
Yes
No
REC BKSP SEL PROG Number where program is stored
REC BKSP returns cursor to position 001 to allow selection of a program
FUNCT SEL upper PUNCH TO EOD
This initiates the search and punching of all records matching the mask
P R mode
Error
Yes
No
Correct the source of the error
Retry
Yes
No
RESET
1
If no record is found it returns to index
After punching the record(s) stays in R X mode and displays the data set label
Hold ALPHA SHIFT and NUM SHIFT while pressing RESET
This cancels the Data Recorder job
STOP

Set Up for Card I/O (ONLINE) Mode

IBM 129

1. Set the SPL FEAT switch OFF, and power up.

2. Run all cards out of the transport using the CLEAR switch.

3. Set the:
   SPL FEAT switch ON.
   PROGRAM MODE dial to DATA READ.
   REC ADV switch to AUTO.
   CHARACTER MODE switch to 64.

4. The PRINT switch can be either ON or OFF.

5. Press the FEED key twice, and the VER RES key, to feed two cards into the read station. The 129 must have two cards fed into the read station to operate.
   - To power up with the SPL FEAT switch ON causes an 8A jam error.
   - To power up with cards in the transport causes an 88 jam error.
   - A switch not correctly set, while attempting to operate in Data Recorder (ON LINE) mode, causes an error.
   - To take the 129 OFFLINE, set the SPL FEAT switch OFF.

IBM 5496

1. Set the:
   TERMINAL switch to TERMINAL.
   PUNCH/VERIFY switch to PUNCH.
   REC ADV switch to AUTO.
   PROGRAM switch to OFF.

2. The PRINT switch can be either ON or OFF.

3. All other switch settings are optional; they have no function in the Data Recorder (ON LINE) mode.
   - A switch incorrectly set, while attempting to operate in Data Recorder (ON LINE) mode, causes an A1 error.
   - Error Recovery
     To clear a FD CHK error, clear the transport, set the TERMINAL switch to MANUAL, and press REL. Then set the TERMINAL switch to TERMINAL.
   - To take the 5496 OFFLINE, set the TERMINAL switch to MANUAL.

IBM 3741

Switches

1. AUTO DUP switch and CHARACTER switch can be either ON or OFF.

2. The AUTO REC ADV switch must be ON for a PUNCH to EOD or a READ to EOF. If the switch is OFF during a PUNCH to EOD or READ to EOF, one record will be punched or read. Then the REC ADV key will punch or read a card each time it is pressed.

3. The keyboard has the same function as normal.

4. RESET:
   a. Pressing just RESET will reset the error and if the error is retriable, will retry the operation.
   b. Pressing and holding NUM SHIFT while pressing RESET (Models 3 and 4 only) will skip the Data Recorder operation.
   c. Pressing and holding ALPHA SHIFT while pressing RESET (Models 3 and 4 only) will cancel all Data Recorder operation to the end of the job.
   d. Pressing and holding both ALPHA SHIFT and NUM SHIFT while pressing RESET (double shifted reset) will cancel the entire job. For PUNCH to EOD or READ to EOF, the display returns to X R mode. For single read or punch mode, the display does not change.

Clearing

1. Clear single punch mode or single read mode by pressing FUNCT SEL lower and S.

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Format Control Characters

Control Character	Meaning
xA	Format data field: Loads the buffer from the record with the number of characters specified by the number preceding the A format control character.
N&	Identifies read/write format programs: All read/write format programs must have an N& (ampersand) in positions 001 and 002.
xB	Format data field with suppression of leading zeros: Loads the buffer from the record with the number of characters specified by the number preceding the B format control character, but loads blanks instead of leading zeros.
xX	Insert blanks: Loads the buffer with the number of blanks preceding the X format control character.
xY	Skips characters from the record: Skips over, with no action, the number of characters in the record specified by the number preceding the Y format control character. *Note:* It is not permissible to skip beyond the record boundaries.
xF	Reverse skips characters from the record: Skips over, in reverse direction (towards position 001) with no action, the number of characters in the record specified by the number preceding the F format control character. *Note:* It is not permissible to skip beyond the record boundaries.
N or ⌀	No-op: No operation is performed. *Note:* Position 001 of the read/write programs must contain an N.
Q	Terminates format program: This format control character must be used at the end of every format program.
xI	Insert characters: Loads the characters following the I into the buffer. The number preceding the I format control character indicates the number of characters to be loaded to the buffer.
C	Read or write: A record is read or written before the format control program is terminated. *Note:* The pointers in program buffer 9 and the current record buffer are reset to position 001 each time a C is encountered in the format control program. That is, when the format control program contains the format control character C, the format control defined after the C must start from position one of the buffer.

Note: The x represents a variable value (from 1 to 128) that is the multiple of the control characters to be executed. If a control character is preceded by a blank, N, or another control character, the multiple is assumed to be one.

I/O Adapter Programs

Construction

1. N& (ampersand) must be in positions 001 and 002 of the program level.

2. Any of the format control characters may follow (9-91).

3. A Q must be the last character in the program level.

Loading

See page 9-33 for flowchart.

1. Loading is accomplished the same as for printer programs:
   a. Press: FUNCT SEL lower
      RETURN TO INDEX
      FUNCT SEL lower
      DELETE RECORD
      Key in the I/O Adapter program
   b. Press: FUNCT SEL lower
      PROG LOAD
      Any number from 1 through 8

Selecting

1. Manual selection —
   a. When the direct selection of the storage program level of the I/O Adapter program is wanted, do the following:
      1) Program level A *must* be loaded with the following in positions 001-009:
         :12345678
      2) With program level A coded as above, then if the I/O Adapter program is to be selected, simply select the program level where it was stored.
      3) For example: If you loaded your I/O Adapter program into program level 5, press SEL PROG and the 5 key to obtain your program.
   b. When indirect selection of the I/O Adapter program is desired, do the following:
      1) Program level A *must* be loaded in a manner that when a certain keying program is selected the program level number is in the position of program level A corresponding to the keying format level.

Note: This allows the operator to select a program level for entering or updating data. Then when the operator initiates a read or write operation, the read or write format control program assigned in program level A is automatically used. After the operation is completed, the selected key entry program level is again active.

This I/O Adapter format control program level would be automatically selected for all I/O Adapter operations if program level 5 was being used for keying format control.

Cursor position	001	002	003	004	005	006	007	008	009
Program level A	:	X	X	X	X	X	X	X	X
Corresponding manually selected keying format program level number		1	2	3	4	5	6	7	8

2) With program level A coded as above (where YYY is a number from 1 to 128) the YYY character in the record determines the program level to be selected.
3) For example, if program level A is coded as follows:
   %07bb
   Then the seventh character (counting blanks) will be used to select the program level. If the seventh character is a number from 1 through 8, then that level number will be selected. If the seventh character is not a number from 1 through 8, then program level 1 is selected.

2. Automatic selection —
   a. When automatic selection of an I/O Adapter program level is desired to do the following:
      1) Load program level A as follows:

Cursor position	001	002	003	004	005
Program level A	%	Y	Y	Y	b

Note: The % sign must be in position 001 of program level A, followed by any number from 1 through 128 and position 005 must be blank. The number can be written as a 1-, 2-, or 3-digit number (1, 01, or 001). If positions 002, 003, and 004 are blank the default value is 1.

Example: Refer to *Selecting,* step 1b, on page 9-92.

Example: (Refer to Manual indirect selection of the I/O Adapter program.)

If program level A is coded as follows:

Cursor position	001	002	003	004	005	006	007	008	009
Program level A	:		2			1			
Corresponding manually selected keying format program level number		1	2	3	4	5	6	7	8

The following conditions exist for the above example:

1. If program level 5 is manually selected, program level 1 will automatically be used for all I/O Adapter operations and program level 5 will be used for all key entry operations.

2. If program level 2 is manually selected, program level 2 will be used for all I/O Adapter operations and program level 0 will be used for all key entry programs.

3. If program level 1 is manually selected, no I/O Adapter formatting will occur (even if program level 1 is an I/O Adapter program). There must be a value coded in the appropriate position of program level A before I/O Adapter programs can be selected.

Sample Programs

Writing a Record

- Make the attachment ready
- Press: FUNCT SEL lower
  DELETE RECORD
- Enter device address
- Enter mode (3 or 4)
- Enter record length, if less than that on data set label (columns 6, 7, and 8)
- Press FUNCT SEL lower and X

- Sample 1: To write the record displayed on the CRT do the following:

  Press: FUNCT SEL lower
  N
  FIELD COR

  This section does not alter any data on the disk. To write the same record again press:

  FIELD COR

  To get out of single write mode do the following:

  Press: FUNCT SEL upper
  T

- Sample 2: To write a record with some data that is not on the disk and is not wanted on the disk do the following:

  Press: FUNCT SEL lower
  N

  Key in: I WRITE EXACTLY WHAT IS WRITTEN ON THE CRT WITHOUT CHANGING THE DATA ON DISK.

  Press: FIELD COR

  To get out of a single write mode do the following:

  Press: FUNCT SEL upper
  T

- Sample 3: To write a record with format control do the following:

  Press: FUNCT SEL lower
  DELETE REC

  Key in: N&5A5X5Y10F26A4X8IALPHABETQ
  - N& — Identifies the program as an I/O Adapter program

  Press: FUNCT SEL lower
  PROG LOAD
  1
  FUNCT SEL lower
  DELETE REC

  Key in: :1
  - :1 — Use I/O Adapter program 1 if program level 1 is selected.
  - Means program will be manually selected.

  Press: FUNCT SEL lower
  PROG LOAD
  A
  FUNCT SEL lower
  RETURN TO INDEX
  FUNCT SEL lower
  N
  FUNCT SEL lower
  ENTER

  Key in: ABCDEFGHIJKLMNOPQRSTUVWXYZ

  Press: RECORD BKSP
  SEL PROG
  1
  FIELD COR

  The record written will be:

  ABCDE ABCDEFGHIJKLMNOPQRSTUVWXYZ ALPHABET

  To get out of single write mode and to program level 0, do the following:

  Press: FUNCT SEL upper
  T
  SEL PROG
  0

- Sample 4: To write a record or records under search content with format control:

  Load program level 3 with the following:

  N&10A5X10A5X6A3XAQ

  Load program level A with the following:

  :1ϕϕ5ϕϕ3ϕ

  The "3" here means that program level 7 must be manually selected if the I/O Adapter program in program level 3 is to be used.

  Load program level 7 with the following:

  U . . . . (26 periods) . . . . . NE

  Press: FUNCT SEL lower
  RETURN TO INDEX
  FUNCT SEL lower
  ENTER

  Key in: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Press: REC ADV
SEL PROG
7

Press the following keys in order:

2
3
4
5
6
7
8
9

Press: FUNCT SEL lower
RETURN TO INDEX
FUNCT SEL lower
SEARCH CONTENT

Key in: ⍽⍽⍽⍽ (26 blanks) ⍽⍽⍽⍽5

Press: REC BKSP
SEL PROG
7
FUNCT SEL upper
N (write to EOD)

The 3741 searches until finding a record that fits the search mask and then sends it out under format control. Then it returns to index.

– Sample 5: To write an entire data set do the following:

Create or use an existing data set on the diskette. Start at the data set label and then:

Ensure that the AUTO REC ADV switch is on.

Press: FUNCT SEL upper
N (write to EOD)

This sends all the records from the disk to the attachment. Then returns to index and displays the data set label of data just written.

– Sample 6: To send part of a data set do the following:

Create or use an existing data set on the diskette. Ensure the AUTO REC ADV switch is on. Then advance to the record that is the first to be sent.

After the first record to be sent is displayed:

Press: FUNCT SEL upper
N (write to EOD)

Reading a Record from Attachment

Put the I/O Adapter online (9-98). Load the diskette to be written on. Make the attachment ready.

– Press: FUNCT SEL lower
DELETE RECORD
– Enter device address
– Enter mode 3 or 4

– Sample 1: To read a record without entering or changing the data on the diskette, do the following:

Press: FUNCT SEL lower
V
FIELD COR

This causes a record to be read and its contents displayed on the screen. If this data is to be entered onto the disk at the location the disk is:

Press: REC ADV

If you want to read another record:

Press: FIELD COR

To get out of single read mode:

Press: FUNCT SEL upper
T

– Sample 2: To read in a group of records under format control.

Load program level 5 with the following:

N&A10X10AX15A3X9ICOST⍽$26F2AI.2AQ

Load program level A with the following:

:⍽5

The 5 means that if program level 2 is selected all I/O Adapter operations will use program level "5".

Locate the data set label of the data set to be written into or create space for a data set for the number of records to be read. Ensure that the AUTO REC ADV switch is on.

Press: SEL PROG
2
FUNCT SEL upper
V (read to EOF)

This will read all the records into the disk with format control. When the 3741 sees the EOF record if in mode 4, or the EOJ-in if in mode 3, it returns to index.

– Sample 3: To read in multiple data sets do the following:

Create or use two or more data set labels with adequate space for entry of data records. Ensure the AUTO REC ADV switch is on. Receive the data to be entered in the first data set. Follow it with an EOD record if in mode 4 or an EOJ-in if in mode 3.

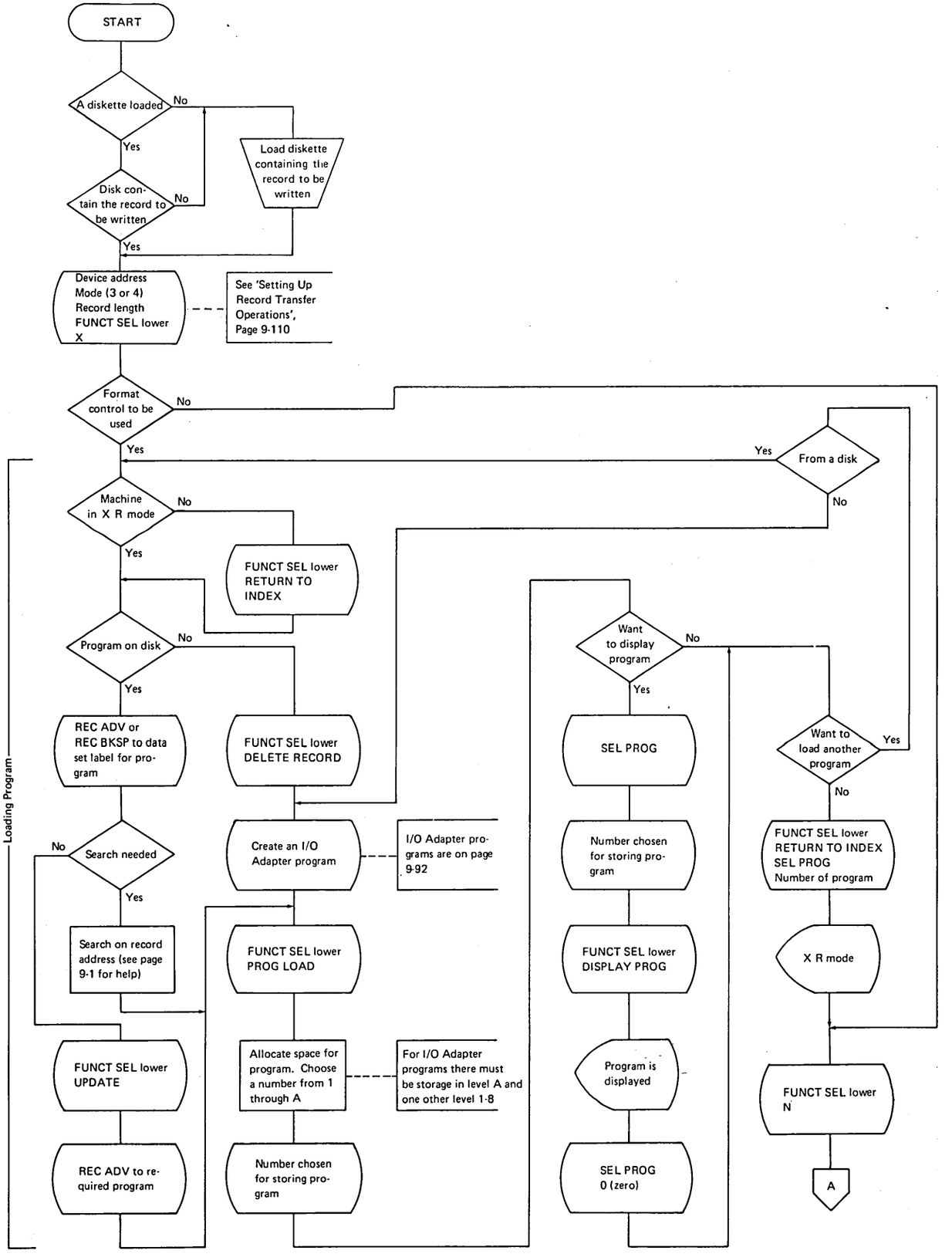
Display the Data Set label of the first data set to be filled.

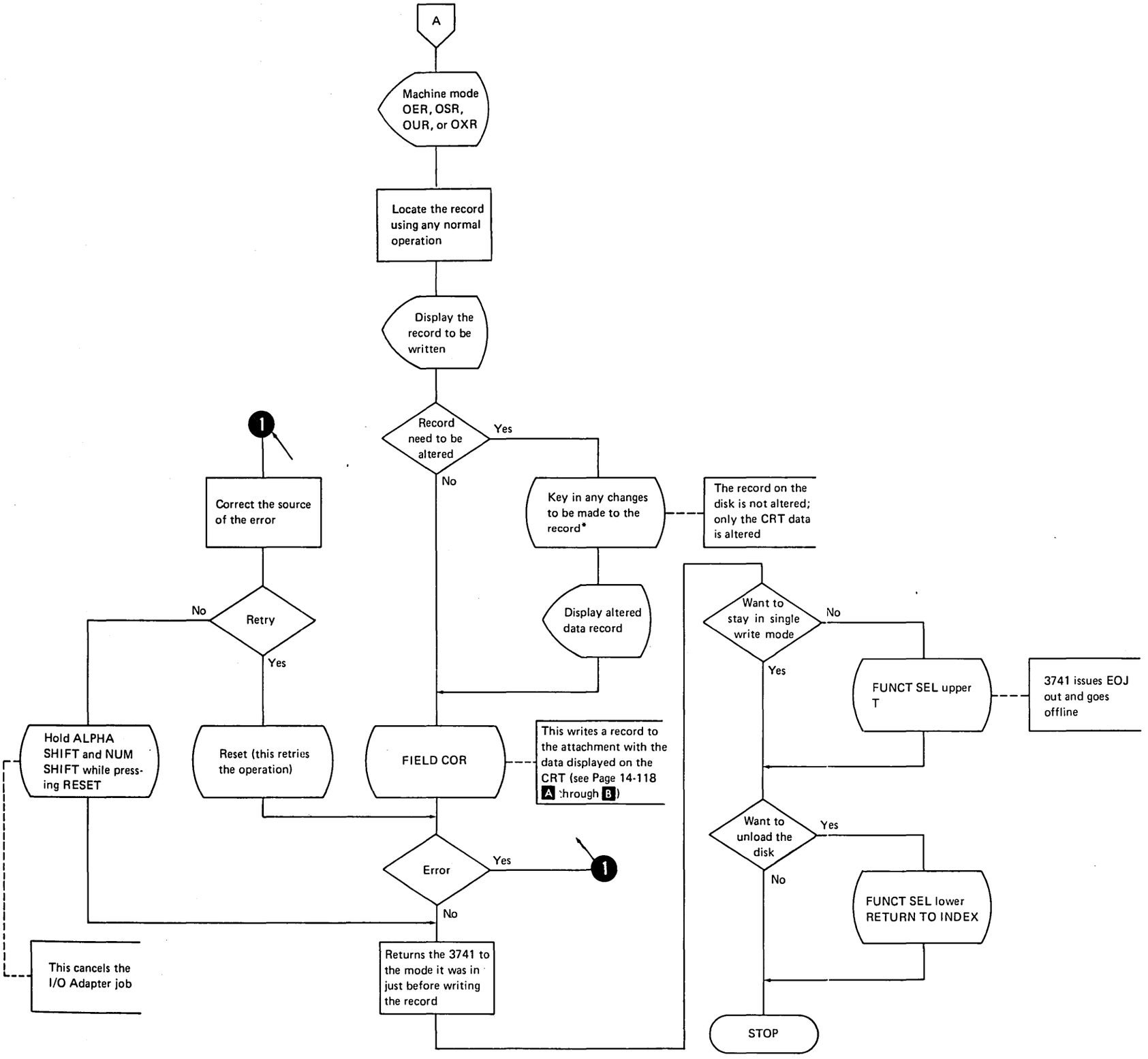
Press: FUNCT SEL upper
V (read to EOF)

This will read the records up to the EOD record if in mode 4 or EOJ-in if in mode 3 into the first data set. Then, the 3741 searches for the next unprotected data set and reads into it all records up to the EOF record if in mode 4 or EOJ-in if in mode 3.

Operation Flowcharts

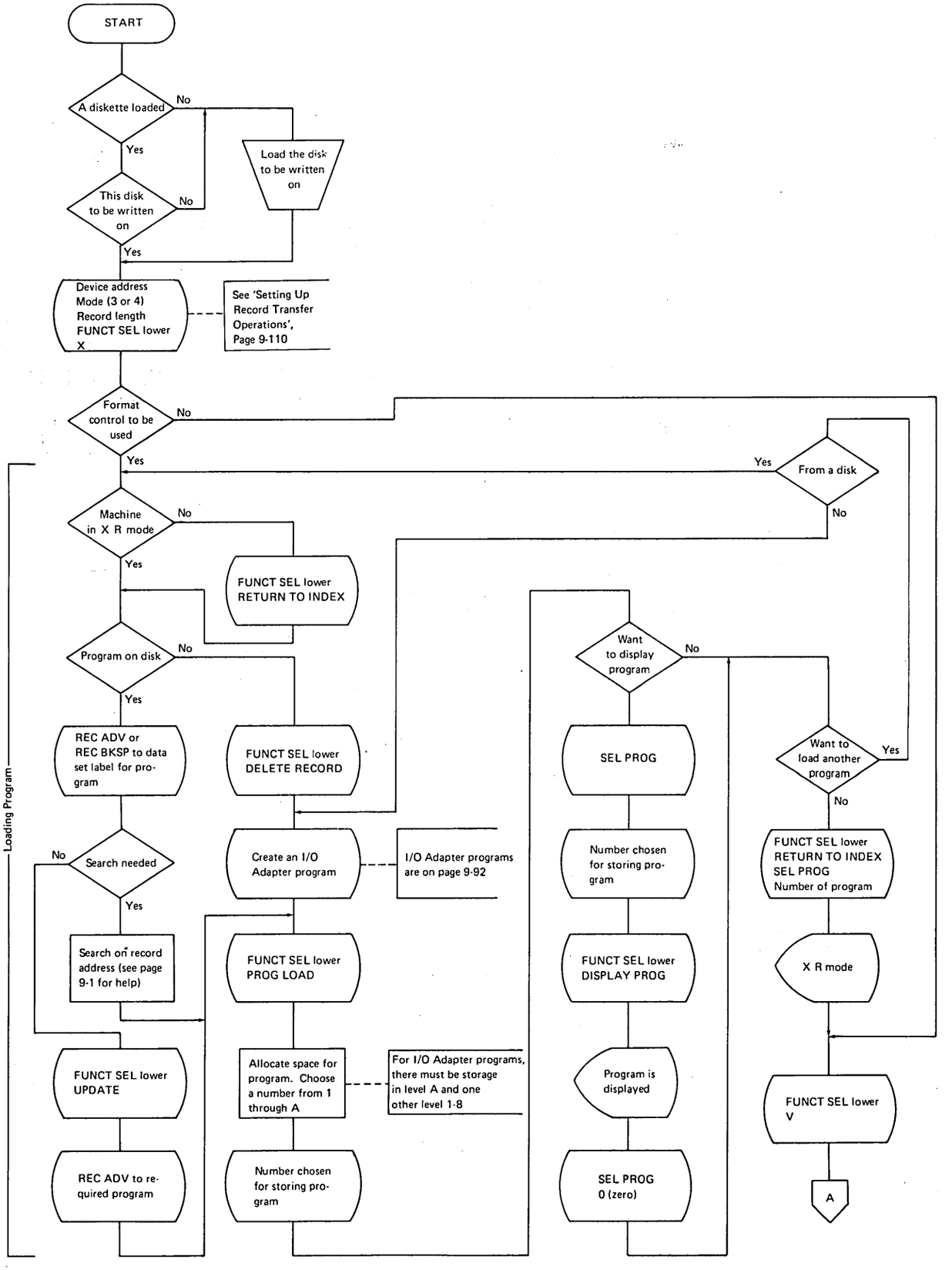
Write a Record to Attachment

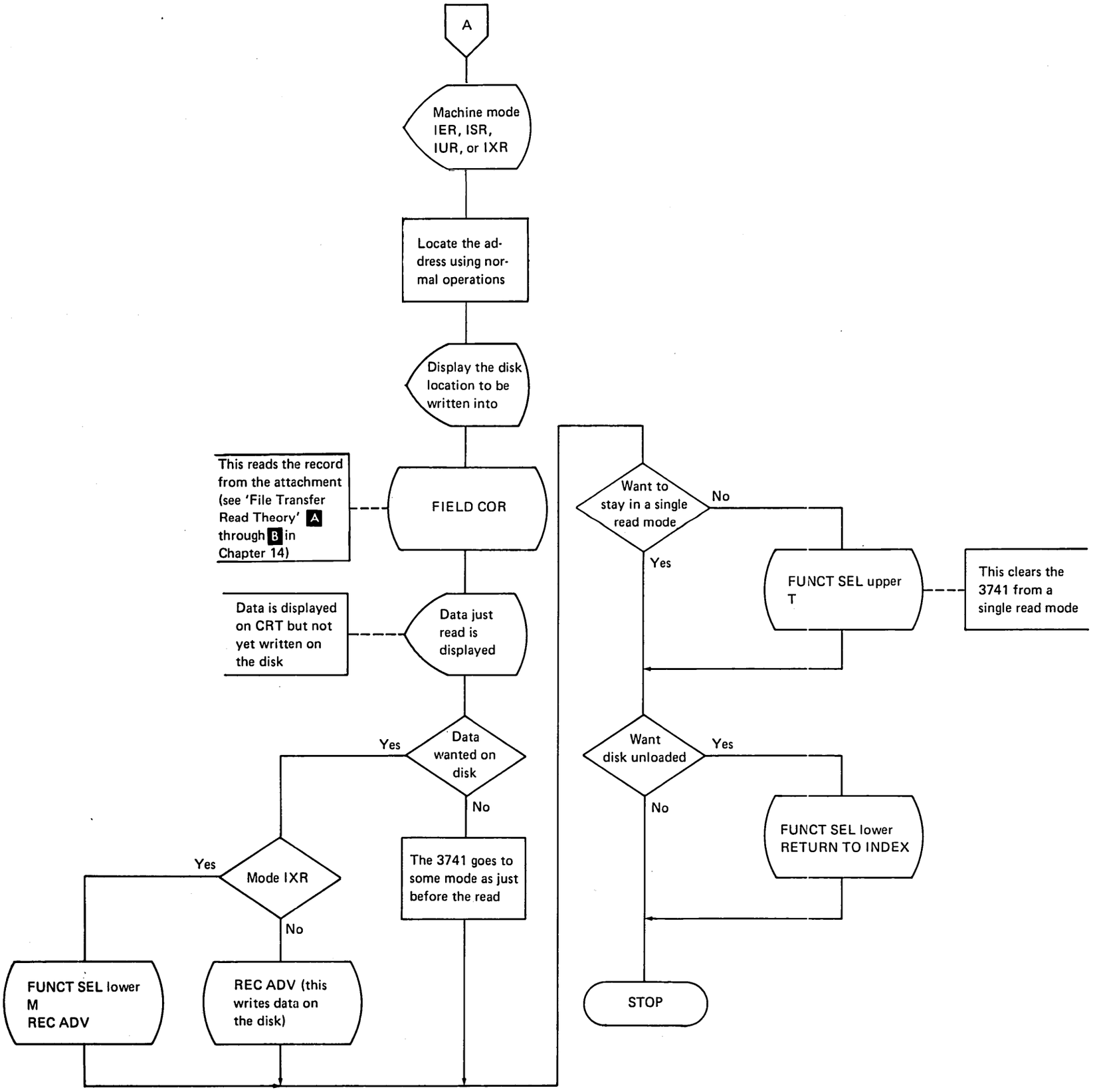




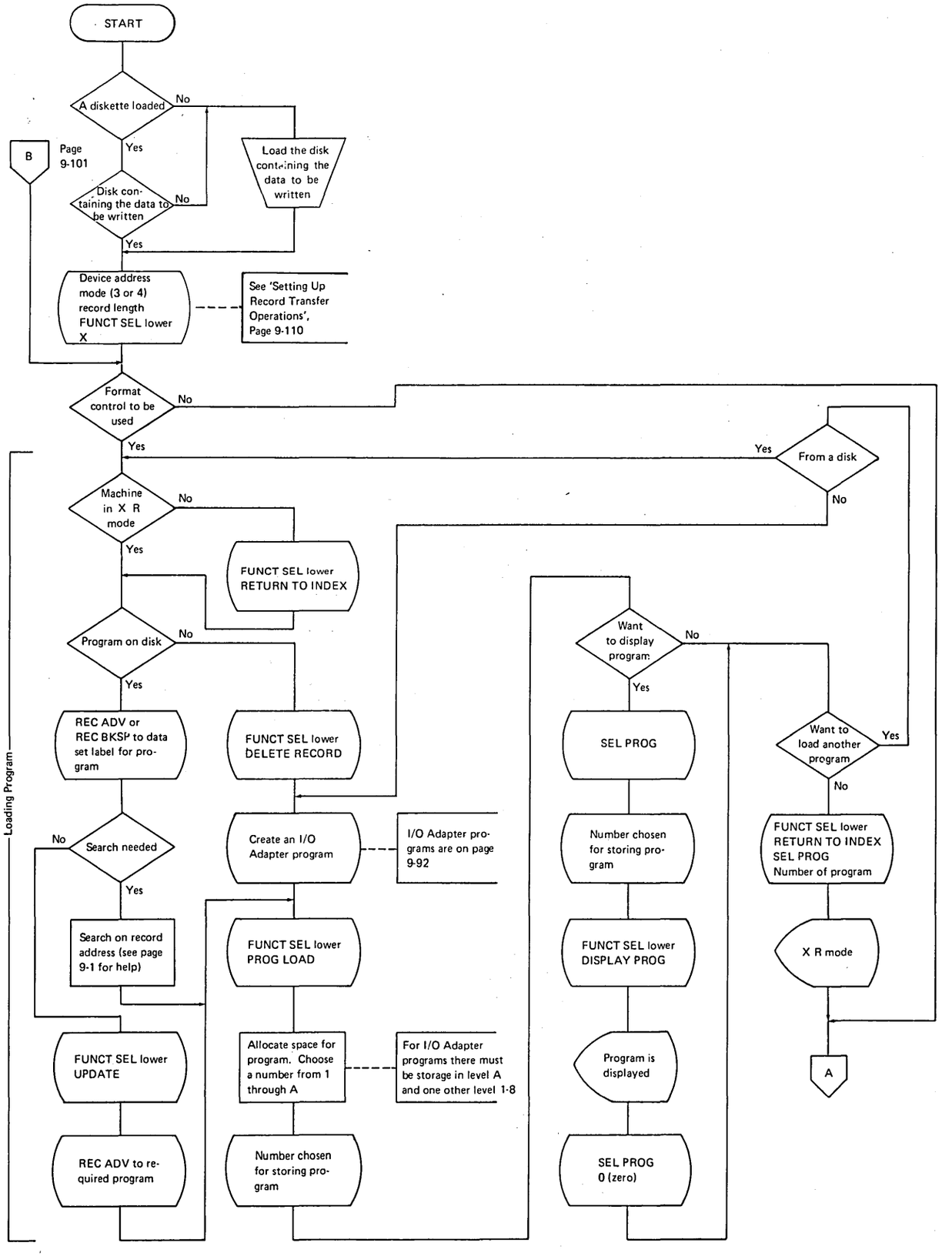
EC 825958			PN 1619494
Date 3/21/75			

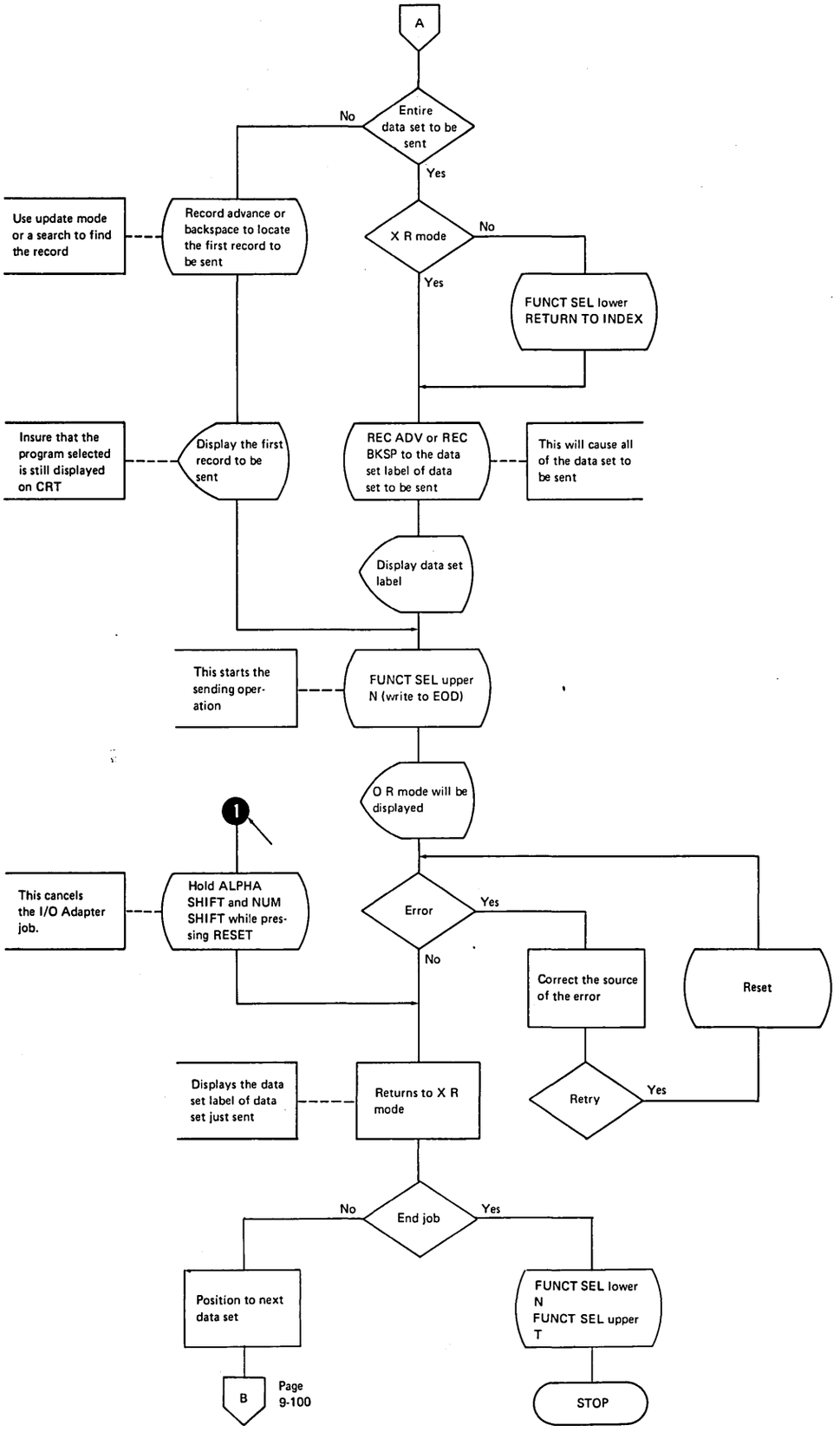
Read a Record from Attachment




A
Machine mode IER, ISR, IUR, or IXR
Locate the address using normal operations
Display the disk location to be written into
This reads the record from the attachment (see 'File Transfer Read Theory' A through B in Chapter 14)
FIELD COR
Data is displayed on CRT but not yet written on the disk
Data just read is displayed
Yes
Data wanted on disk
No
Yes
Mode IXR
No
The 3741 goes to some mode as just before the read
FUNCT SEL lower M REC ADV
REC ADV (this writes data on the disk)
Want to stay in a single read mode
No
Yes
FUNCT SEL upper T
This clears the 3741 from a single read mode
Want disk unloaded
Yes
No
FUNCT SEL lower RETURN TO INDEX
STOP

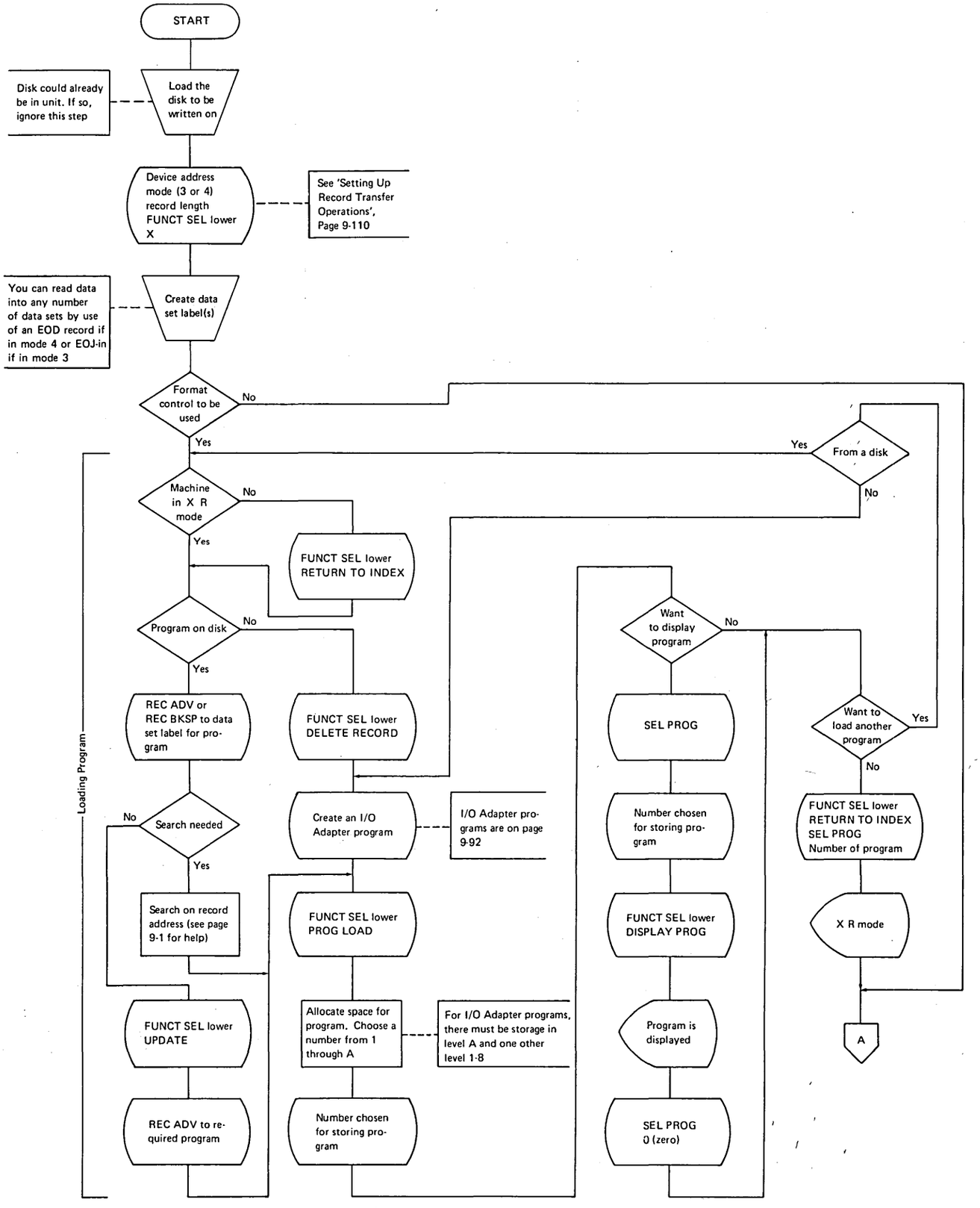
Write a Data Set (All or in Part) to Attachment

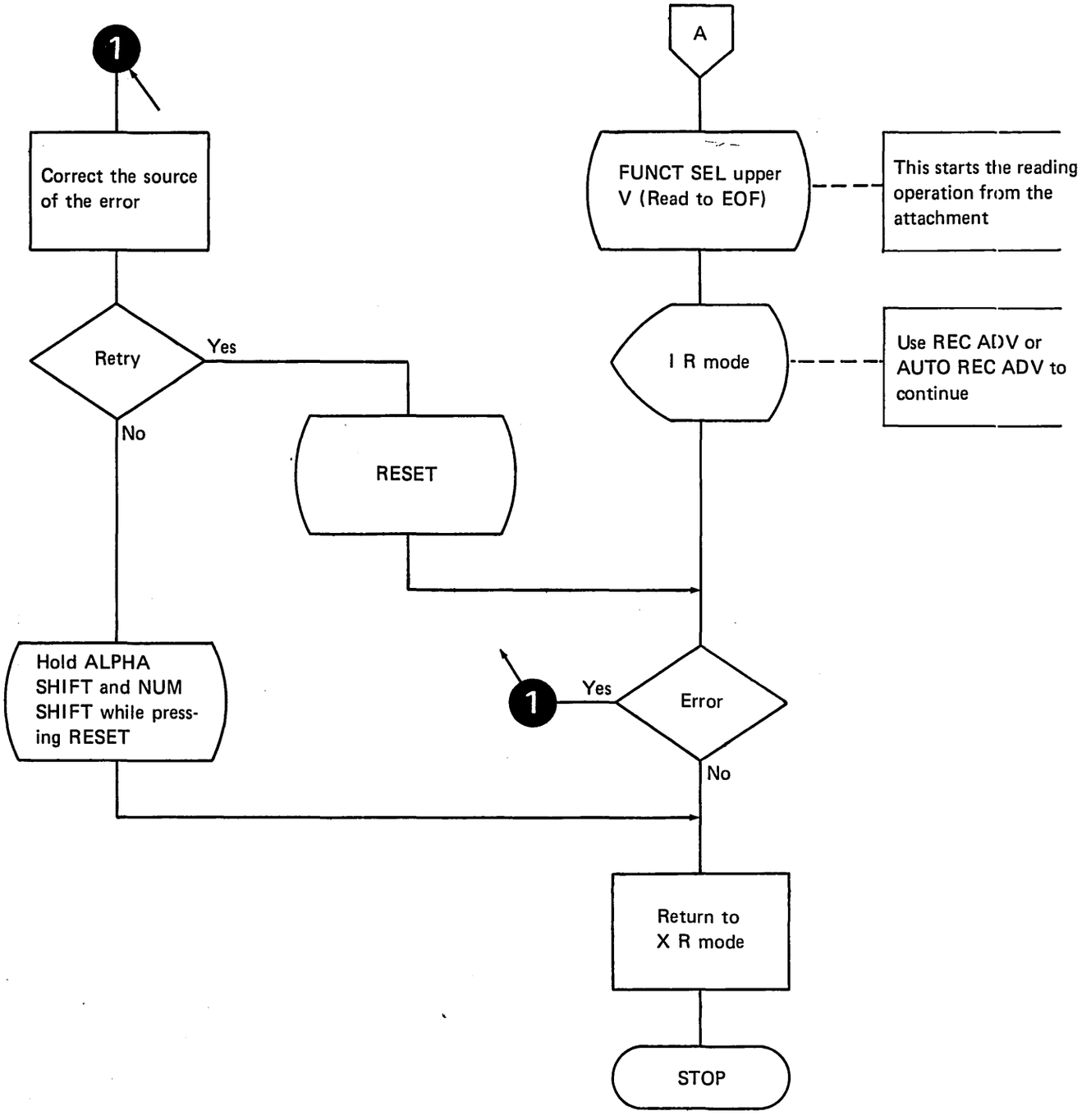




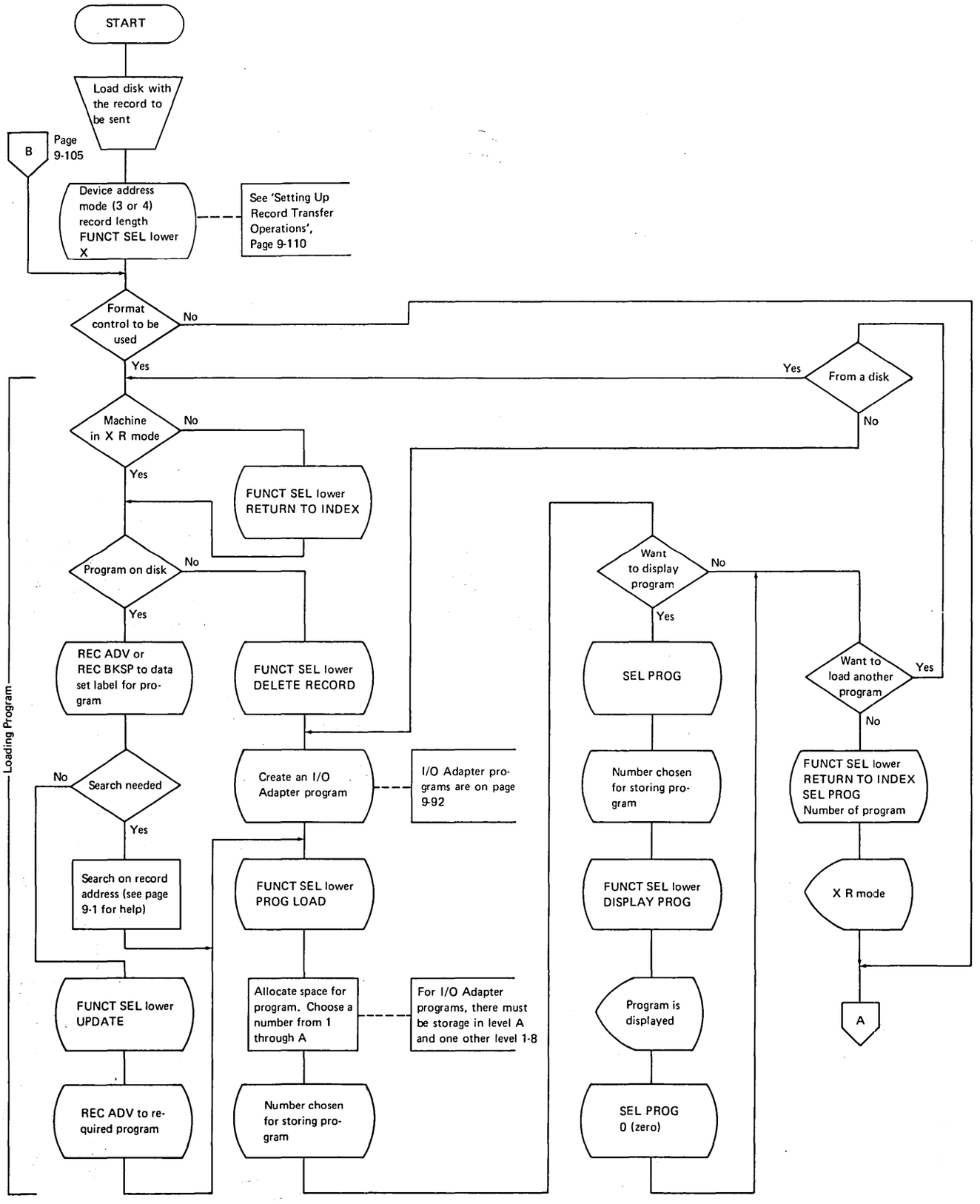
EC 825958			PN 1619498
Date 3/21/75			

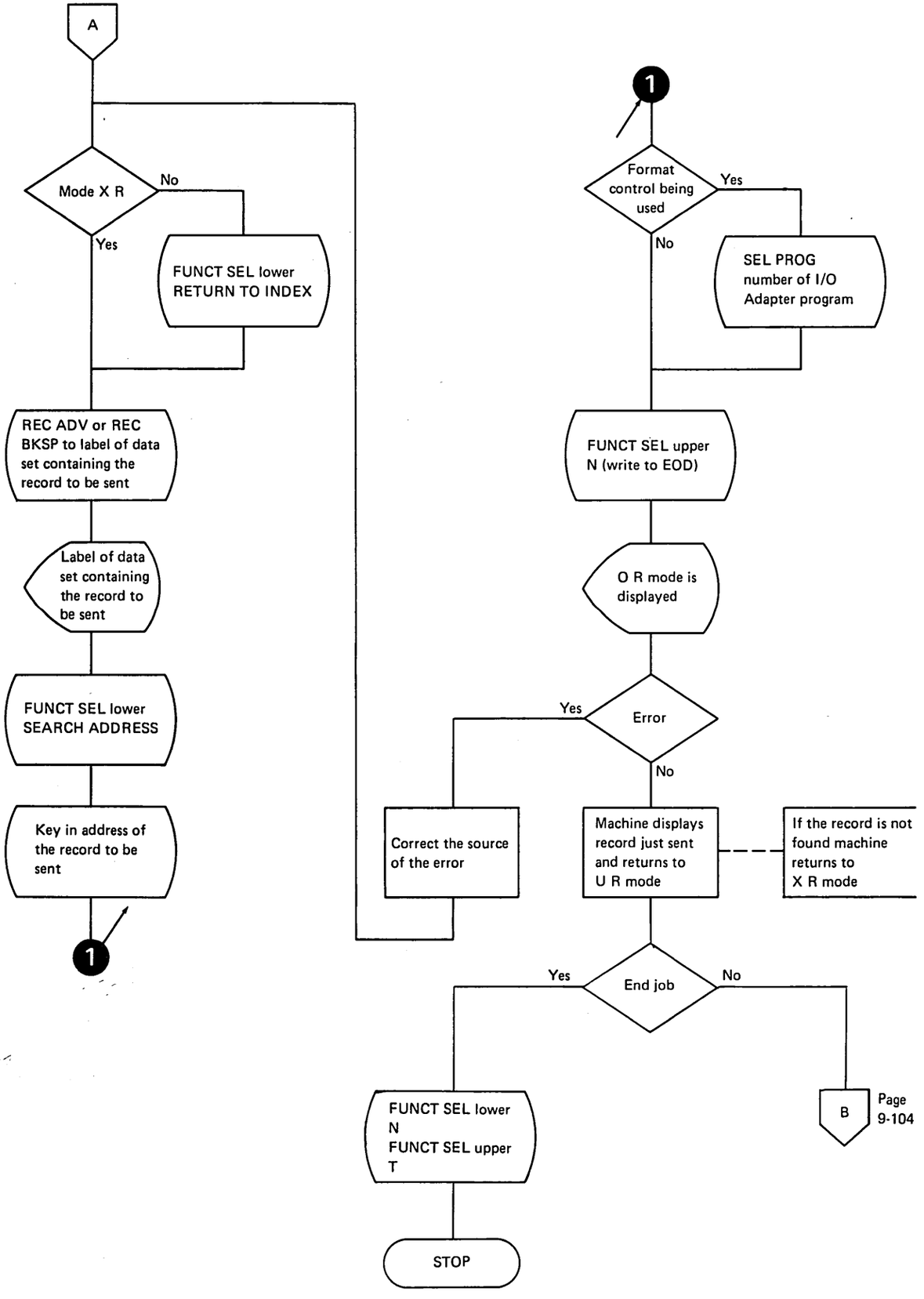
Read a Data Set (or Data Sets) from Attachment



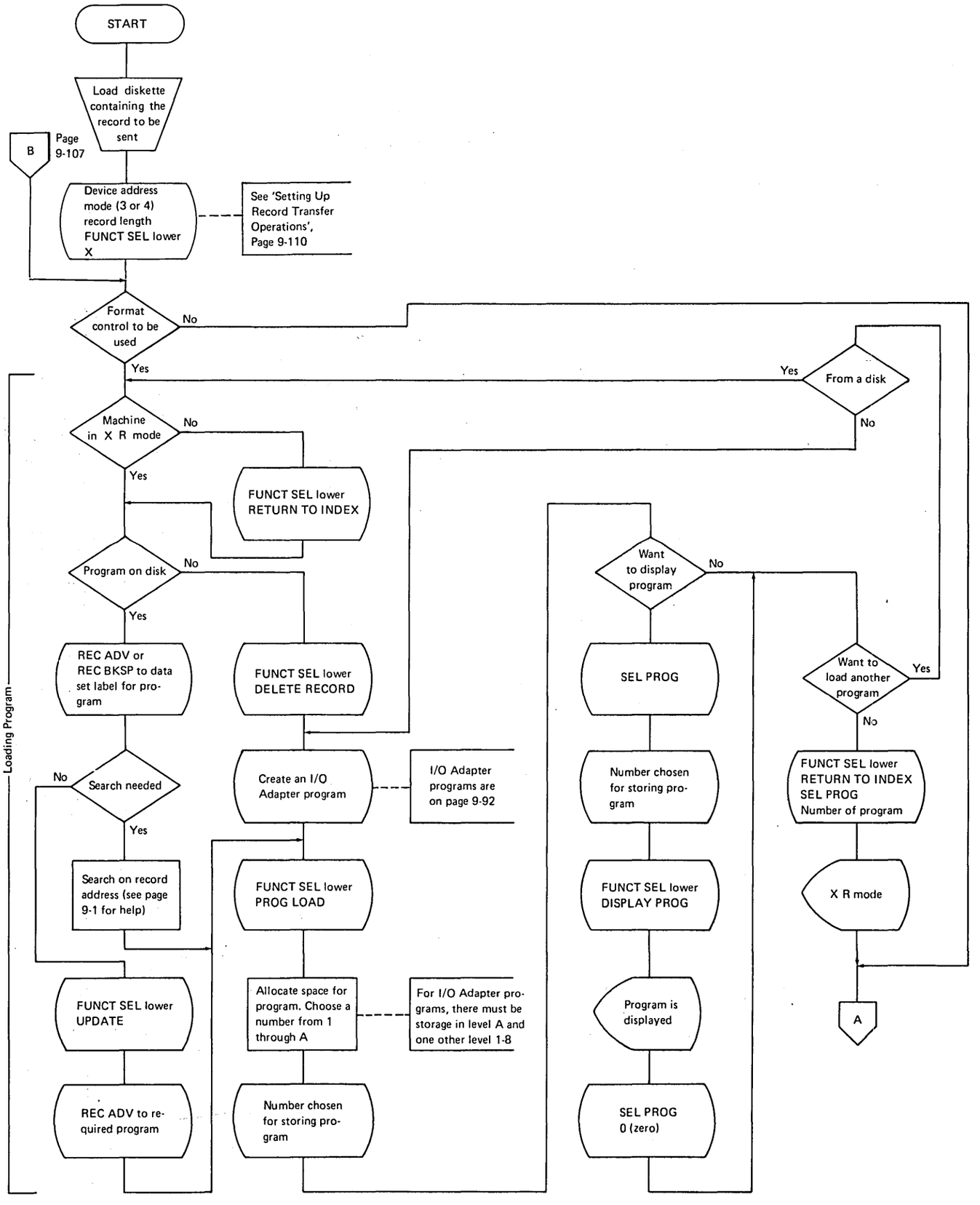

1
Correct the source of the error
Retry
Yes
No
RESET
Hold ALPHA SHIFT and NUM SHIFT while pressing RESET
A
FUNCT SEL upper V (Read to EOF)
This starts the reading operation from the attachment
I R mode
Use REC ADV or AUTO REC ADV to continue
1
Yes
Error
No
Return to X R mode
STOP

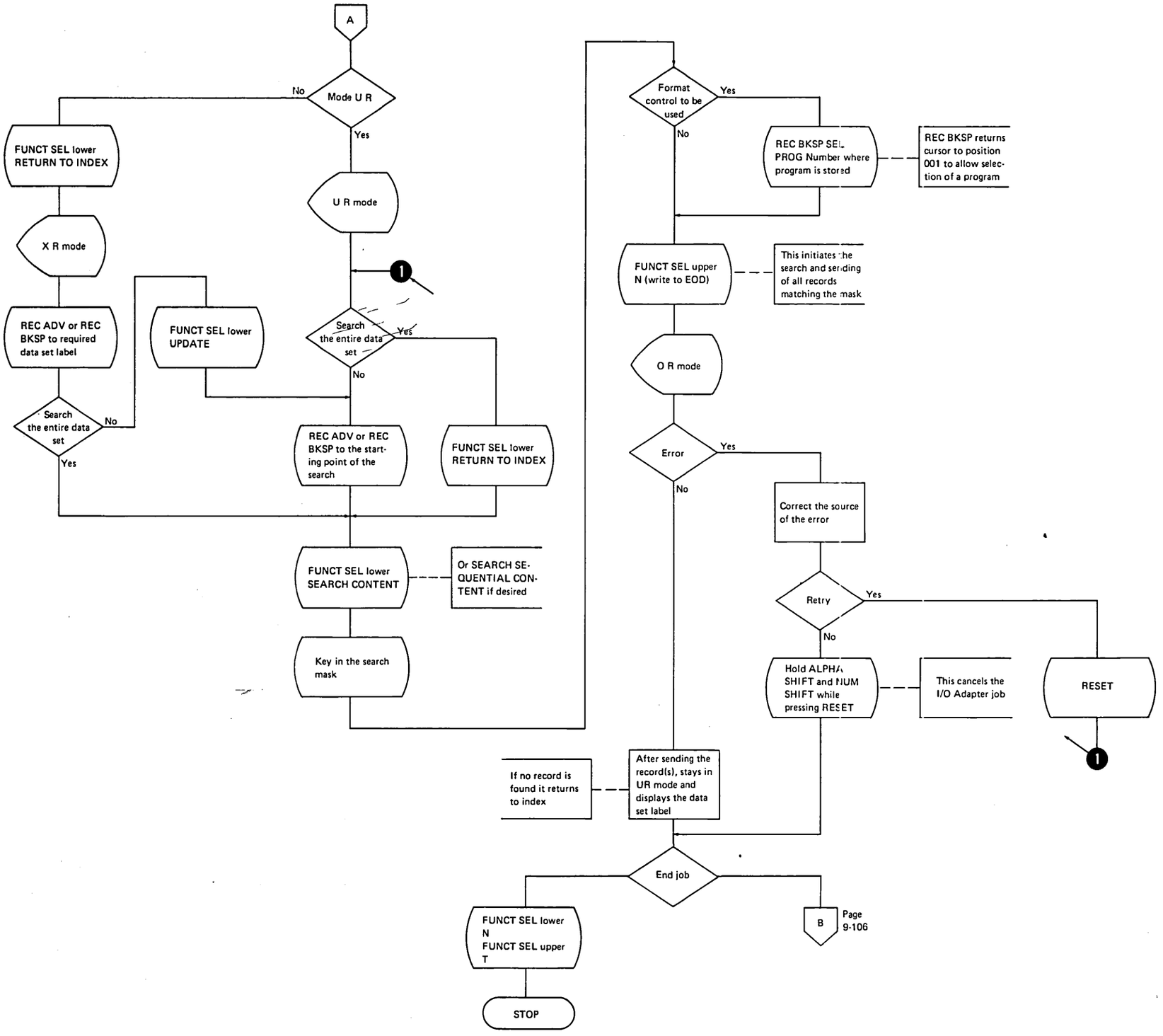
Write a Record to Attachment Using Search Address



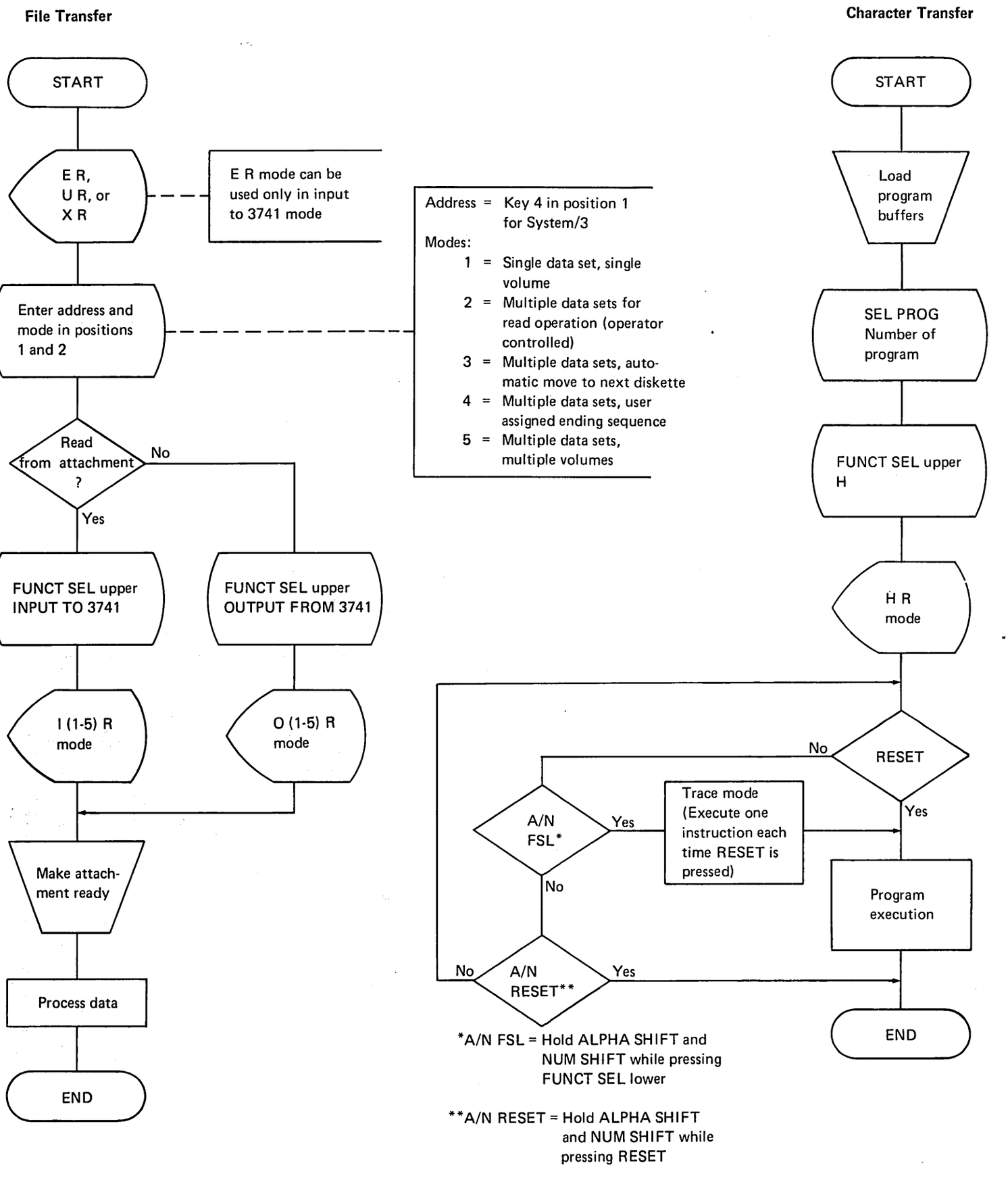

A
Mode X R
No
Yes
FUNCT SEL lower
RETURN TO INDEX
REC ADV or REC
BKSP to label of data
set containing the
record to be sent
Label of data
set containing
the record to
be sent
FUNCT SEL lower
SEARCH ADDRESS
Key in address of
the record to be
sent
1
1
Format
control being
used
Yes
No
SEL PROG
number of I/O
Adapter program
FUNCT SEL upper
N (write to EOD)
O R mode is
displayed
Yes
Error
No
Correct the source
of the error
Machine displays
record just sent
and returns to
U R mode
If the record is not
found machine
returns to
X R mode
Yes
End job
No
FUNCT SEL lower
N
FUNCT SEL upper
T
STOP
B
Page
9-104

Write a Record (or Records) to Attachment Using Search Content





EC 825958			PN 1619504
Date 3/21/75			

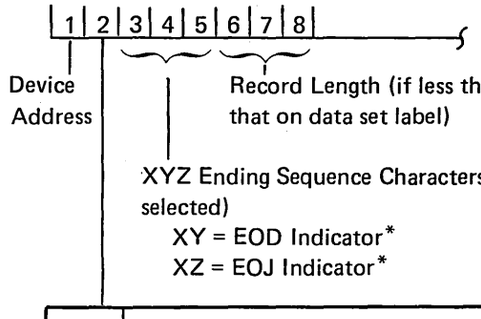

File Transfer
Character Transfer
START
E R, U R, or X R
E R mode can be used only in input to 3741 mode
Address = Key 4 in position 1 for System/3
Modes:
1 = Single data set, single volume
2 = Multiple data sets for read operation (operator controlled)
3 = Multiple data sets, automatic move to next diskette
4 = Multiple data sets, user assigned ending sequence
5 = Multiple data sets, multiple volumes
Enter address and mode in positions 1 and 2
Read from attachment ?
No
Yes
FUNCT SEL upper INPUT TO 3741
FUNCT SEL upper OUTPUT FROM 3741
I (1-5) R mode
O (1-5) R mode
Make attachment ready
Process data
END
START
Load program buffers
SEL PROG Number of program
FUNCT SEL upper H
H R mode
RESET
No
Yes
A/N FSL*
Yes
No
Trace mode (Execute one instruction each time RESET is pressed)
Program execution
A/N RESET**
No
Yes
END
*A/N FSL = Hold ALPHA SHIFT and NUM SHIFT while pressing FUNCT SEL lower
**A/N RESET = Hold ALPHA SHIFT and NUM SHIFT while pressing RESET

Summary of File Transfer Operations (Read or Write)

Mode	Drive	Termination	Writing (3741 to Attachment)	Reading (Attachment to 3741)
1	1	Automatic	Single data set only	Single data set only
2	1	Manual: FUNCT SEL upper, T Use mode 1 on last data set for automatic termination Automatic at EOJ when reading	Multiple data sets with operator intervention between data sets. Operator can position disk to next data set and continue.	Multiple data sets with operator intervention between data sets. Each data set is automatically closed. Operator can position to next data set and continue.
3	1 or 2	Manual: FUNCT SEL upper, T Automatic at EOJ when reading	Multiple data sets processed automatically. The multivolume indicator of the label controls when the end of a data set is indicated. A blank or L indicates the end of a data set, a C causes data from the next disk (drive 1 or 2) to be sent as part of the same data set.	Multiple data sets are processed automatically. The multivolume indicator of the label is updated along with the EOD address. A blank is inserted if the data is contained on one disk, a C is inserted if the data is continued on another disk, and an L is inserted in the last data set label of continued data. Continuation to drive 2 or back to drive 1 is automatic if these drives are made ready at the proper times.
4	1 or 2	Manual: FUNCT SEL upper, T Automatic at XZ message when reading	Multiple data sets processed automatically as in mode 3 except for special records inserted by the 3741. These records are created as a result of an operator action. During job setup, the characters XYZ are entered on the display. At the end of a data set, a record with XY is sent to the system. At the end of job, a record with XZ is sent.	Multiple data sets are processed automatically, as in mode 3. The 3741 will recognize special end-of-data and end-of-job records indicated by operator options.
5	1 or 2	Manual: FUNCT SEL upper, T Automatic at EOJ when reading	Multiple data sets processed automatically in a similar manner to a diskette to tape job on the 3747. A blank or C in the multivolume indicator of the label causes the next data set on this disk or the next disk to be sent as part of the current data set. An L causes an end-of-data indicator to be sent to the system.	Multiple data sets processed automatically similar to tape to diskette job on the 3747. No changes are made to the multivolume indicator of the label when the end-of-data indicator is received from the system. If EOE is reached before an end-of-data indicator, the operator can continue to receive by readying another label.

Setting Up Record Transfer Operations

- Enter device address in position 1.
- Enter mode (3 or 4) in position 2.
- For mode 4, enter XYZ ending sequence characters in positions 3, 4, and 5.
- If record length is less than that on data set label, enter record length in positions 6, 7, and 8.
- Press: FUNCT SEL lower
  X



Mode	Writing	Reading
3	3741 sends EOD-OUT when EOD on data set label is reached. 3741 sends EOJ-OUT when operator enters device address and presses: FUNCT SEL upper T	Attachment sends EOD-IN when attachment EOD is reached. Attachment sends EOJ-IN when attachment end-of-job is reached.
4	3741 sends EOD indicator characters when EOD on data set label is reached. 3741 sends EOJ indicator characters when operator presses: FUNCT SEL lower N FUNCT SEL upper T	Attachment sends EOD indicator characters when EOD on data set label is reached. Attachment sends EOJ indicator characters when EOD on last data set label is reached.

* The EOD or EOJ indicator characters are sent as the first two characters of an extra record following the last data record.

Setup for I/O Adapter (ONLINE) Mode

Attached Device

Refer to the operator guide of the attached device for setup procedures.

IBM 3741

Switches

1. AUTO DUP switch and CHARACTER switch can be either ON or OFF.
2. The AUTO REC ADV switch must be ON for a WRITE to EOD or a READ to EOF. If the switch if OFF during a WRITE to EOD or READ to EOF, one record will be sent or read. Then one record will be sent or read each time REC ADV is pressed.
3. The keyboard has the same function as normal.
4. RESET:
   a. Pressing just RESET will reset the error and if the error is retriable, will retry the operation.
   b. Pressing and holding NUM SHIFT while pressing RESET (Models 3 and 4 only) will skip the I/O Adapter operation.
   c. Pressing and holding ALPHA SHIFT while pressing RESET (Models 3 and 4 only) will cancel all I/O Adapter operation to the end of the job.
   d. Pressing and holding both ALPHA SHIFT and NUM SHIFT while pressing RESET (double shifted reset) will cancel the entire job. For WRITE to EOD or READ to EOF, the display returns to X R mode. For single read or write mode, the display does not change.

Clearing

1. Clear single write mode or single read mode by pressing FUNCT SEL upper and T.

INTRODUCTION – How to use

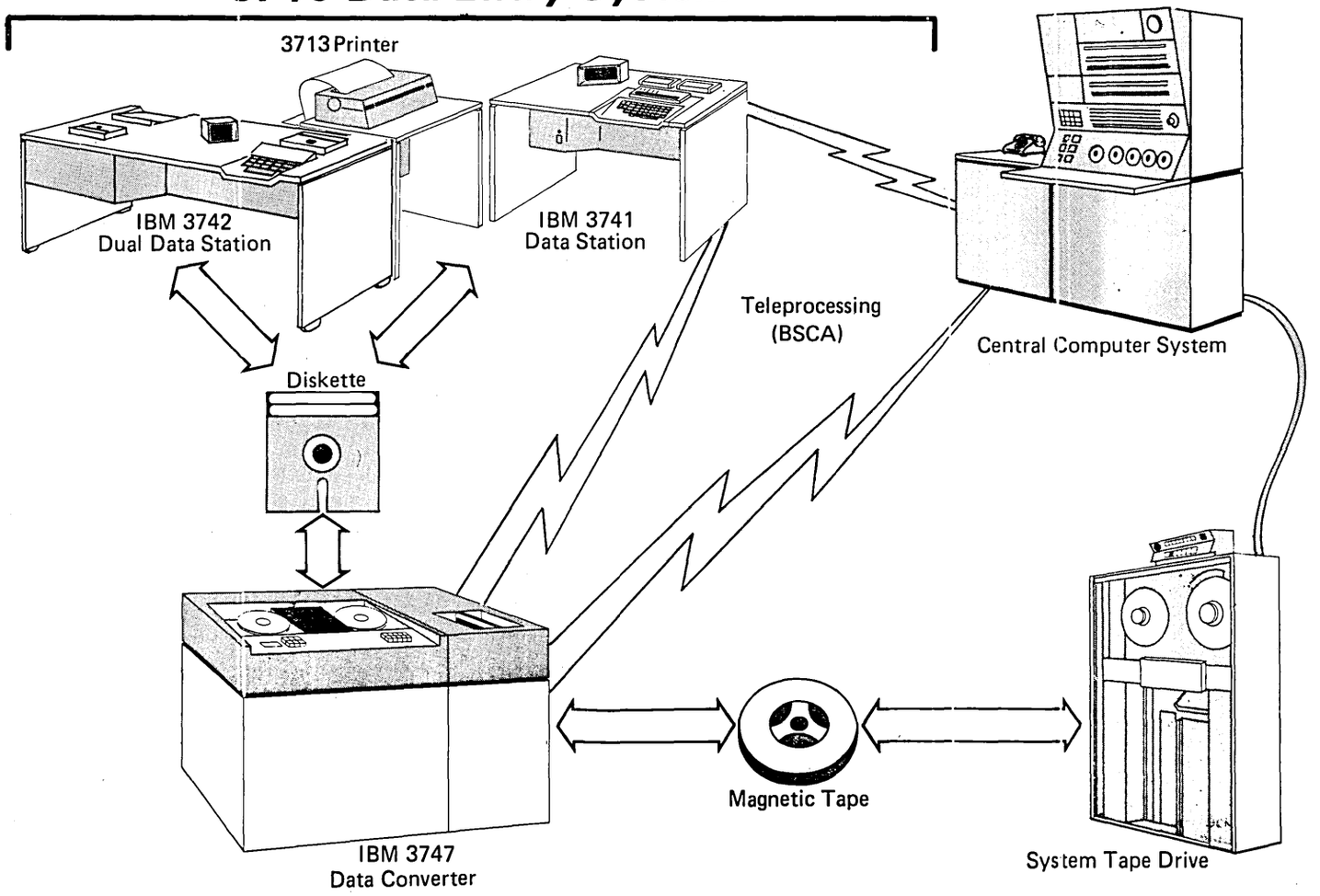
The IBM 3740 Data Entry System is a family of devices that provides a key-to-disk-to-tape data handling capability. This is performed in two stages. During the first stage, the data is keyed onto a small flexible magnetic disk via one of the data stations. During the second stage, the data on the disk 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 one 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.

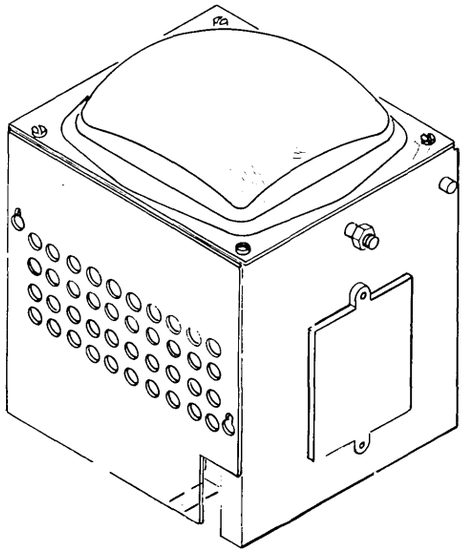
3740 Data Entry System



IBM 3741 FUNCTIONAL UNITS

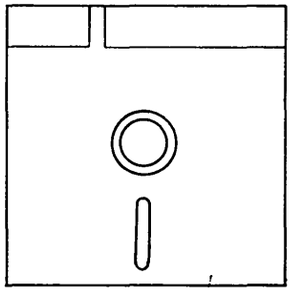
Display

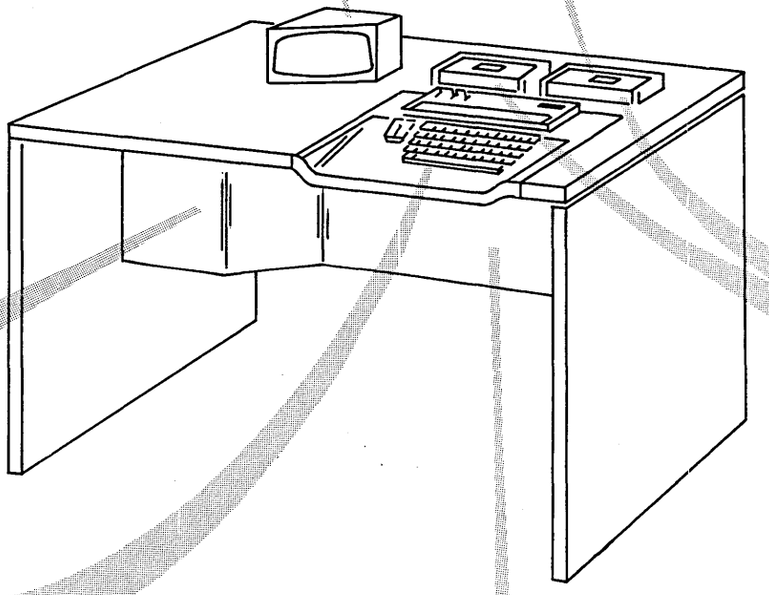
Provides a visual display of machine status, data, and operator guidance information.



Diskette

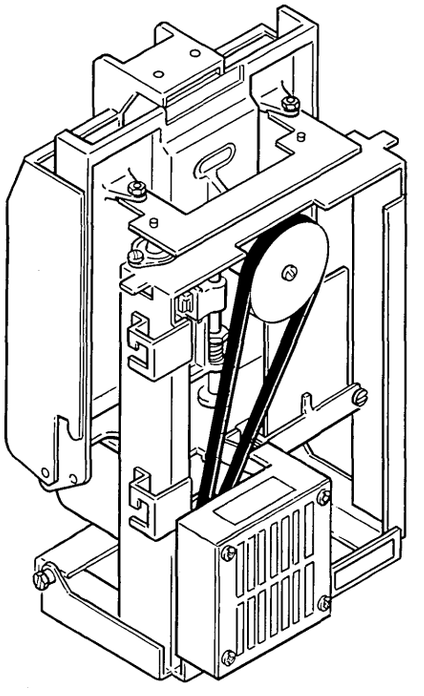
Recording medium for the disk drive (customer purchased).





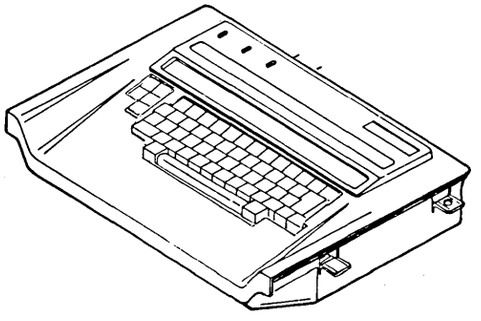
Disk Drive 1
Disk Drive 2

Reads and writes data and control information on the disk.



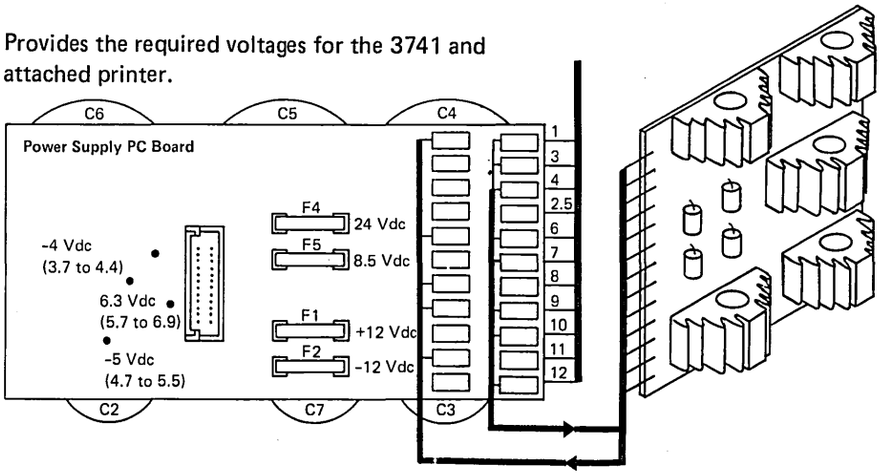
Keyboard

Provides the operator an interface to the machine.



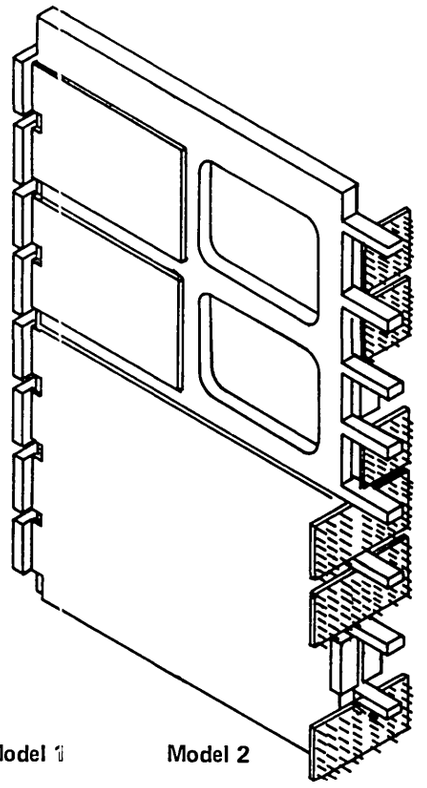
Power Supply

Provides the required voltages for the 3741 and attached printer.



MPU

Provides control and monitoring circuitry for the keyboard, display, BSCA, printer, and disk drive.



IBM 3741 FUNCTIONAL CHARACTERISTICS AND FEATURES

Functional Characteristics

Function	Model 1	Model 2
Ten program storage areas	Standard	Standard
Enter	Standard	Standard
Program chaining	Standard	Standard
Update	Standard	Standard
Record length (1 to 128 characters)	Standard	Standard
Search EOD	Standard	Standard
Search data address	Standard	Standard
Search content	Standard	Standard
Search sequential content	Standard	Standard
Operator guidance	Standard	Standard
BSCA	Not available	Standard

Features	Model 1	Model 2
ROS Feature Card		
Feature Group A Production statistics Verify Self-check (moduli 10 and 11) Field totals (online) Field totals (offline) Disk initialization	Optional	Optional
Expansion feature (Feature E) Printer adapter Second disk adapter	Optional	Optional
Record insert	Optional	Optional
Second disk hardware	Optional	Optional
Printer hardware	Optional	Optional
Proof keyboard	Optional	Optional
Expanded communications (EBSCA)	Not available	Optional
Expanded communications (EBSCA) with Multipoint	Not available	Optional
Synchronous clock	Not available	Optional
Terminal identification	Not available	Optional
Keylock	Not available	Optional
ID Reader card	Not available	Optional
1200 BPS line adapter (leased)	Not available	Optional
1200 BPS line adapter (switched)	Not available	Optional
Katakana (five additional program storage areas)	Optional	Optional
Data Recorder Attachment	Optional	Optional
I/O Adapter	Optional	Optional

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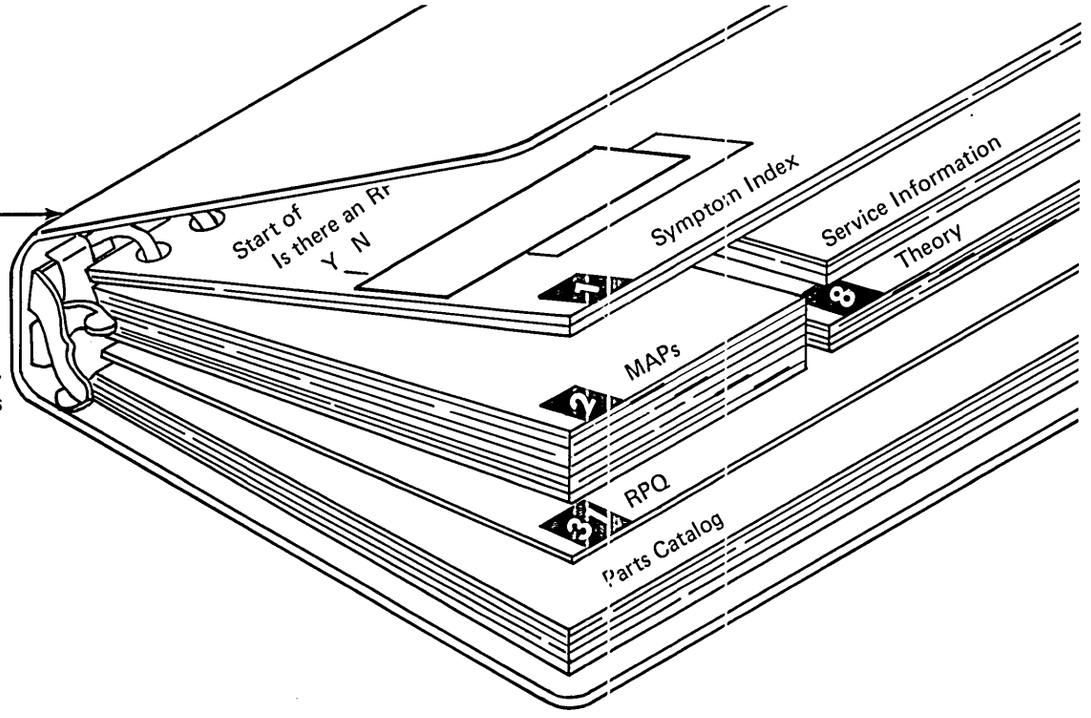
HOW TO USE THIS MANUAL

The manual contains all documents necessary to maintain the 3741 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.

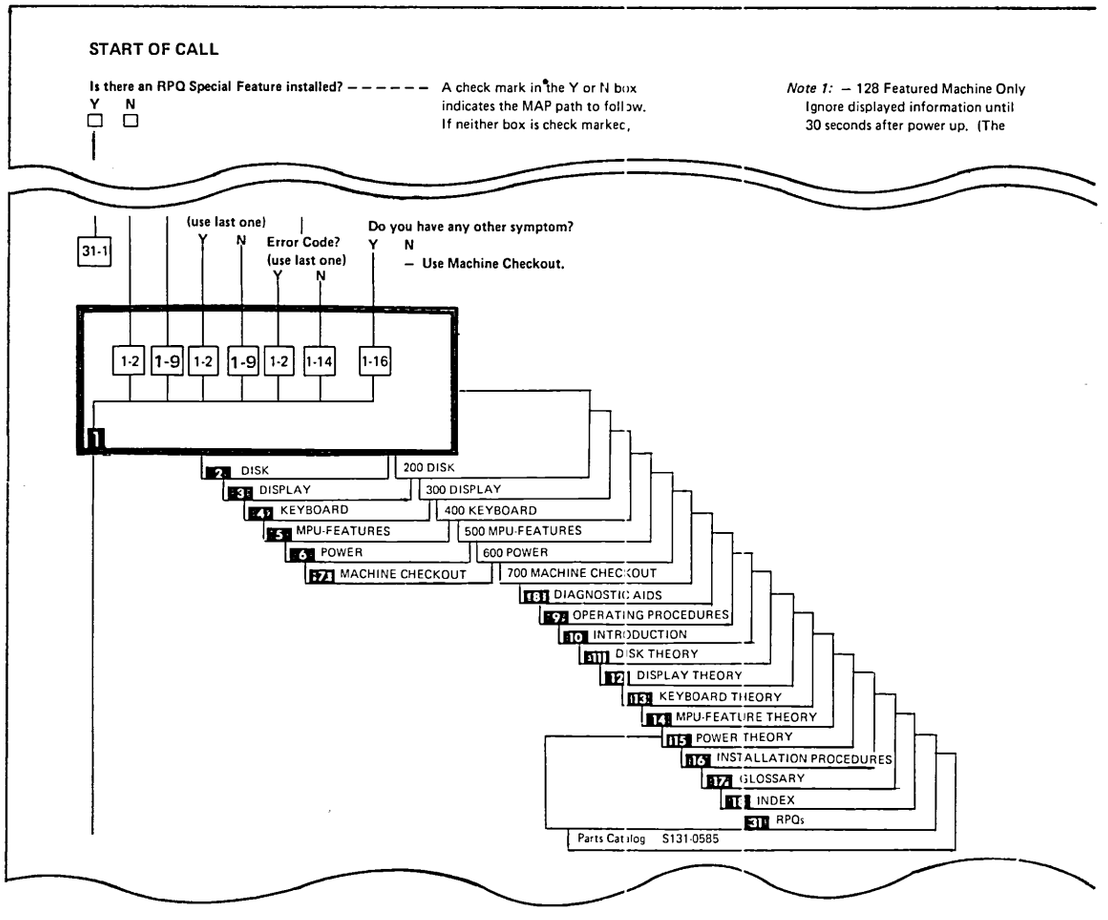
Start of Call guides you to the correct Maintainance Analysis Procedure (MAP) via the *Symptom Index,* or to the *Machine Checkout* procedure.

1 Symptom Index

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. Other

The order of listing the categories indicates the importance level of symptoms. The index—indeed the whole maintainance philosophy—is based on this arrangement of symptoms.



1. Error Codes are displayed as shown along the left edge of the index pages. In the space to the right of each code you find 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 due to automatic retry procedures, changeable and slow to stabilize.

SYMPTOM INDEX

ERROR CODE DESCRIPTION

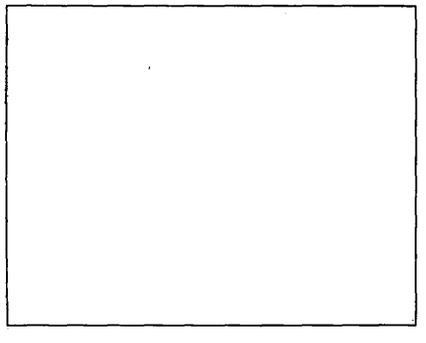
Code Display Position 7	8	9	10	Diagnostic MAP	Description	Cause	Operating Procedure
A				2-1	Data set non-accessible	– The data set accessibility code field in the data set label or in the volume label has a non-blank character.	– Remove the diskette.
B				2-1	Bad data set label	– One of the following conditions existed when you attempted to select a mode from track 00: 1. The last record read and currently displayed is from track 00, records 01 through 07. 2. Position 4 of the header field in the data set label does not contain a 1. 3. The data set label is flagged with a control address mark (such as is required for a deleted record). – BOE is less than track 01, record 01.	– Press RESET and REC ADV. – Press RESET and enter a 1 in position 4, press FUNCT SEL lower, M, and REC ADV. – Enter H in position 1, press FUNCT SEL lower, M, and REC ADV. – Press RESET and enter the correct BOE. Then press FUNCT SEL lower, M, and REC ADV.
						...ord 26.	– Press RESET and enter the correct EOE. Then press FUNCT SEL lower, M, and REC ADV.
						...ct.	– Press RESET and enter the correct entries. Then press FUNCT SEL lower, M, and REC ADV.
							– Press RESET and enter the correct entries. Then FUNCT SEL lower, M, and REC ADV.

2. Symptoms observed on the display are shown as pictures of the display. Each symptom has an associated MAP reference and descriptive information.

Format example only.
Content not necessarily valid.

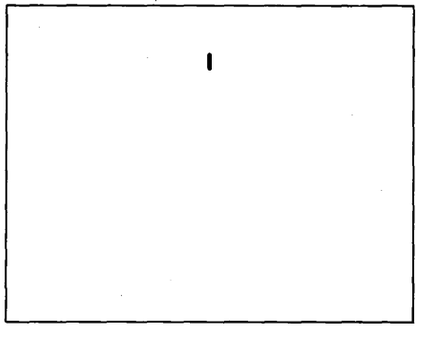
DISPLAY AND DISPLAY UNIT SYMPTOMS

Symptom: Blank CRT or brightness fades to blank.
Brightness control: Turned up (caution)



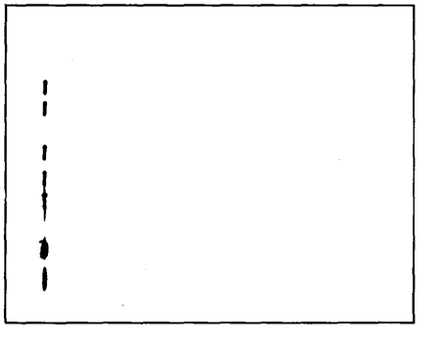
MAP 3-2

3 Symptom: Vertical bar – can be in any location on display.
Brightness control: Turned up (caution)



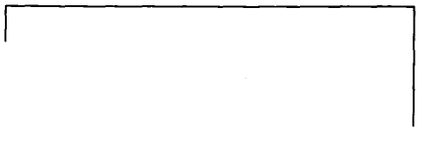
MAP 3-5

5 Symptom: Multiple vertical bars.
Brightness control: Turned up (caution)



MAP 3-5

2 Symptom: Spot – can be in any location on display.
Brightness control: Turned up (caution)



4 Symptom: Multiple vertical spots.
Brightness control: Turned up (caution)

6 Symptom: All characters resemble cursors.
Brightness control: Normal

Page 1-13 contains information vital to the correct use of the display unit symptom index.

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 diskette can be either unloaded or loaded. (Loaded is preferred.)

...he viewer.

...control (observe the

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 prior ity sequence and to allow referencing.

Read the symptom description with each picture to understand the illustrat...

...that could be ...

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.

All letters, numbers...

3. 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

Alphabetic Shift

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

Audio Feedback Device

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

Auto Rec Adv

4-3	
4-2	

Communications

7-7	Fails communication mode	
7-7	Fails to receive	BSCA only
7-7	Fails to transmit	
7-9	Communication terminates prematurely	Expanded
7-9	Communications set-up problems	BSCA only
7-9	Fails to establish communications with remote end.	

Compute Field Totals

4-5	Computed field totals incorrect
4-2	Fails to compute field totals

Copy

4-5	Continual copy
4-4	Copies incorrect data
4-2	Fails to copy
	Missing/extra records

Format example only.
Content not necessarily valid.

Display Data

4-4	Displays incorrect data
4-2	Fails to display data

Display Field Totals

4-2	Always displays field totals
4-4	Displays incorrect field totals
4-2	Fails to display field totals

Display Field Name

4-4	Displays incorrect field name
4-2	Fails to display field name

Display Field Program

4-4	Displays incorrect field program
4-2	

4. 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

Communications

	Communication terminates prematurely
7-7	BSCA
7-9	EBSCA
	Fails in print-unattended mode
7-5	EBSCA only
	Fails to go into communications mode
7-7	BSCA
7-9	EBSCA
	Multipoint alarm fails to sound
7-9	EBSCA
	Set-up problems
7-7	BSCA
7-9	EBSCA

Disk Drive Unit

4-12	Altered/missing data
2-6	...ddress 1 or 2 incorrect
	...blems

Keyboard

4-1	Audio feedback device works with an error
4-2	Binding key
4-6	Click only from reset
4-6	Dead keyboard
4-4	Incorrect data entered with or without audio response
4-4	Incorrect functions performed with or without audio response
4-5	Multiple characters entered for 1 keystroke
4-6	No click from any key
4-2	No data entered and no click from 1 or more keys
4-4	No data entered with or without an audio response
4-2	...function performed and no ... or more keys ...med with or

2
6

MAPs (Maintenance Analysis Procedures)

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 // Disk MAPs.

MAP 2-6 –

– This MAP helps you locate not ready problems; also disk address missing, or machine status missing or wrong.

– Check for any one of the following defects in the problem/suspect disk drive unit:

This number refers to the Drive Motor Removal/ Replacement procedure. See Section 2 in Service information.

– Belt: off or damaged (217K).
– Pulley (2): loose (217D and 217G).
– Idler assembly: defective mechanical operation (217E).
– Drive motor: binding or sticking (214).
– Cover or cover pivot (2): loose or broken (224E).

This number refers to the pivot screw labeled E on the disk-cover-locations graphic number 224. See Section 2 in Service information.

Is the disk drive unit in the failing station free of all the listed defects?
Y N
– Replace or repair the faulty part.
– Verify the fix.

Yes

Does the machine still fail?
Y N
– Select the proper IR code and cause code for the faulty part from the charts.

No

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 the installation procedure, page 16-1.
– Measure the voltages at the disk FC card (204) 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.

Format example only. Content not necessarily valid.

Off-page connector—refers you to the same indicator on the next page.

A B

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.

Engineering Change (EC) level and date.

EC 823146			PN
Date 9/15/74			

Indicates you get here from the A and B connectors on the preceding page. Notice the A connector at both the top and bottom of this page. The A line continues over because no action occurred in that path. An action changes the next off-page connector in that path to another character.

Blocks for recording the date when the preceding action was performed.

A dash (—) after an action statement indicates there is a prompting message in the column to the right.

A B

- 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.
- If the machine has 2 disk drive units, swap the disk drive 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 (204).
- Attempt loading the diskette at least twice.—
- 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 (244B).
- Verify the fix.
  DATE: [ ][ ][ ]

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

A

Format example only. Content not necessarily valid.

If the original symptom still exists when this question is asked, then the machine is still failing.

Keywords assist you in determining the correct cause code. In this case, use code 21. Refer to the listing on service page X01 of each section to find the codes for words like worn, bent, damaged, etc.

Does the machine still fail?
Y N
| Cross connectors 1-A and 1-B were loose.

- Power down.
- Replace the VFO card (211).
- Verify the fix.

Does the machine still fail?
Y N
| The VFO card was defective.

- Power down.
- Reinstall the original VFO card.
- Use MAP 5-1.

Service Pages

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.

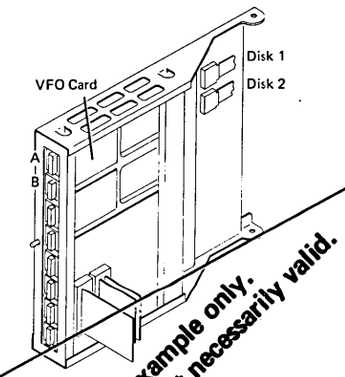
The service-aid group numbered between 301 and 399 is for use with Display MAPs, Section 3 and so on through the group numbered between 701 and 799.

Each service aid group starts with part numbers and cause codes.

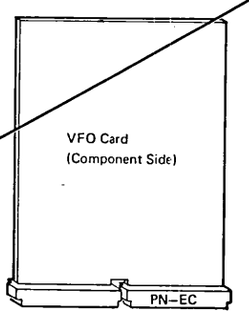
Each page has its own part number.

EC 823146			PN
Date 9/15/74			

211 VFO Card Location



214 Drive Motor

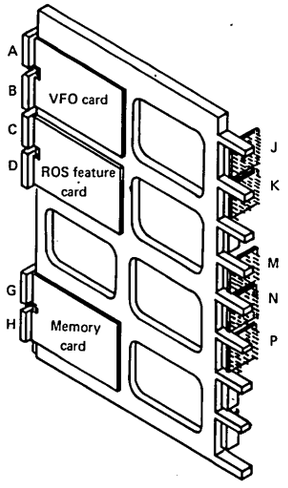


Removal and Replacement
- Power down.
- Unplug motor cable (217F).
- Remove fan guard assembly (217M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly).
- Loosen screw, mark, and remove fan blade (217L) (note blade curvature).
- Remove drive belt (217K).
- Loosen screws and remove guard plate (217J).
- Remove motor clips by loosening screws (217H).
- Remove motor through bottom of frame.
- Loosen setscrew and remove drive pulley (217G).
- To replace, reverse procedure and check for belt tracking.

Graphic identification number—this is the procedure 214 referred to in the explanation of MAPs, page 10-8.

Format example only. Content not necessarily valid.

212 MPU



213 Disk Drive Pulley and Belt

Removal
- Power down.
- Unplug motor cable (217F).
- Remove fan guard assembly (217M) by loosening screws at opposite corners (top screw must be loosened through grillwork of fan guard assembly.
- Loosen screw, mark, and remove fan blade (217L) (note blade curvature).
- Remove drive belt (217K).
- Loosen setscrew (217G) and remove pulley.

Replacement
- Align setscrew with flat surface of shaft and tighten.
- Replace belt.
- Check belt tracking (215).
- Replace fan belt and guard (note blade curvature).

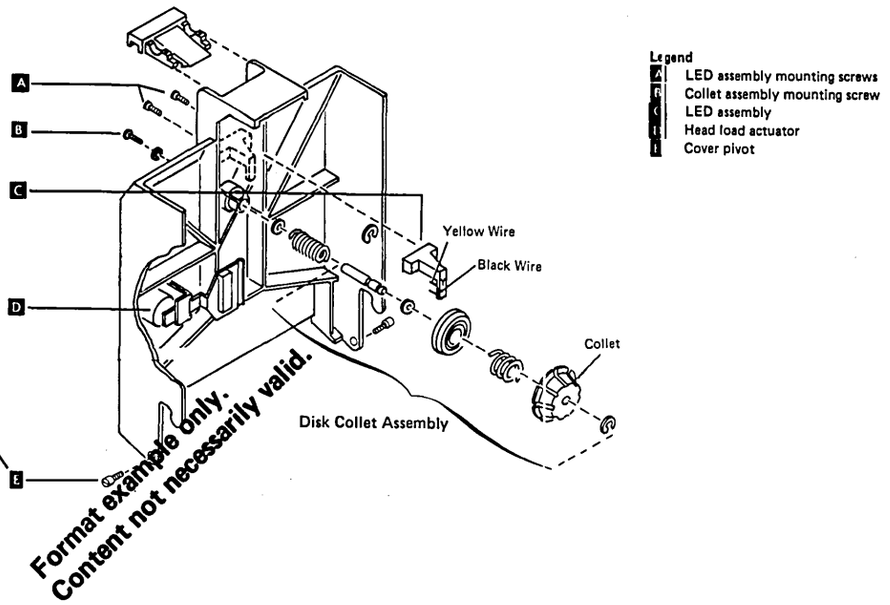
215 Idler Assembly

Removal
- Remove belt (217K).
- Remove idler assembly (217E).
- To replace, reverse procedure and check belt tracking.

Belt Tracking

Belt must be riding in center of drive pulley and hub pulley.

224 Disk Cover Locations



Graphic identification — This is the pivot screw (224E) referred to in the explanation of MAPs, page 10-8.

Service page identification — This pair of numbers reflects the range of service information on facing pages.

220-224

EC 823146			PN
Date 9/15/74			

3741 ML

EC 823146	825853		PN 1619129
Date 9/15/74	11/15/74		

7 Machine Checkout

The basic checkout procedure is used when:
- No symptom is clearly indicated,
- During installation,
- MAPs fail.

8 Diagnostic Aids

CE display mode
- Display disk speed
- Display track IDs
- Display registers

CE universal logic probe (PN 453212)
CRT jumper for raster display
Track alignment test diskette (PN 2455026)
CE meter (PN 452796) 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.

11 Theory

These sections contain the theory for the machine. There is one section for each major functional unit. The sections are: disk, display, keyboard, MPU and power supply.

15

16 Installation Procedure

This section contains the installation procedure for the base machine and the features.

17 Glossary

The glossary gives definitions of terms used in this manual.

18 Index

Alphabetical list of items contained in this manual.

31 RPQ

The manual includes this section only if an RPQ is installed on the machine.

Parts Catalog

The parts catalog is a separate manual from this one, but should be stored with this manual.

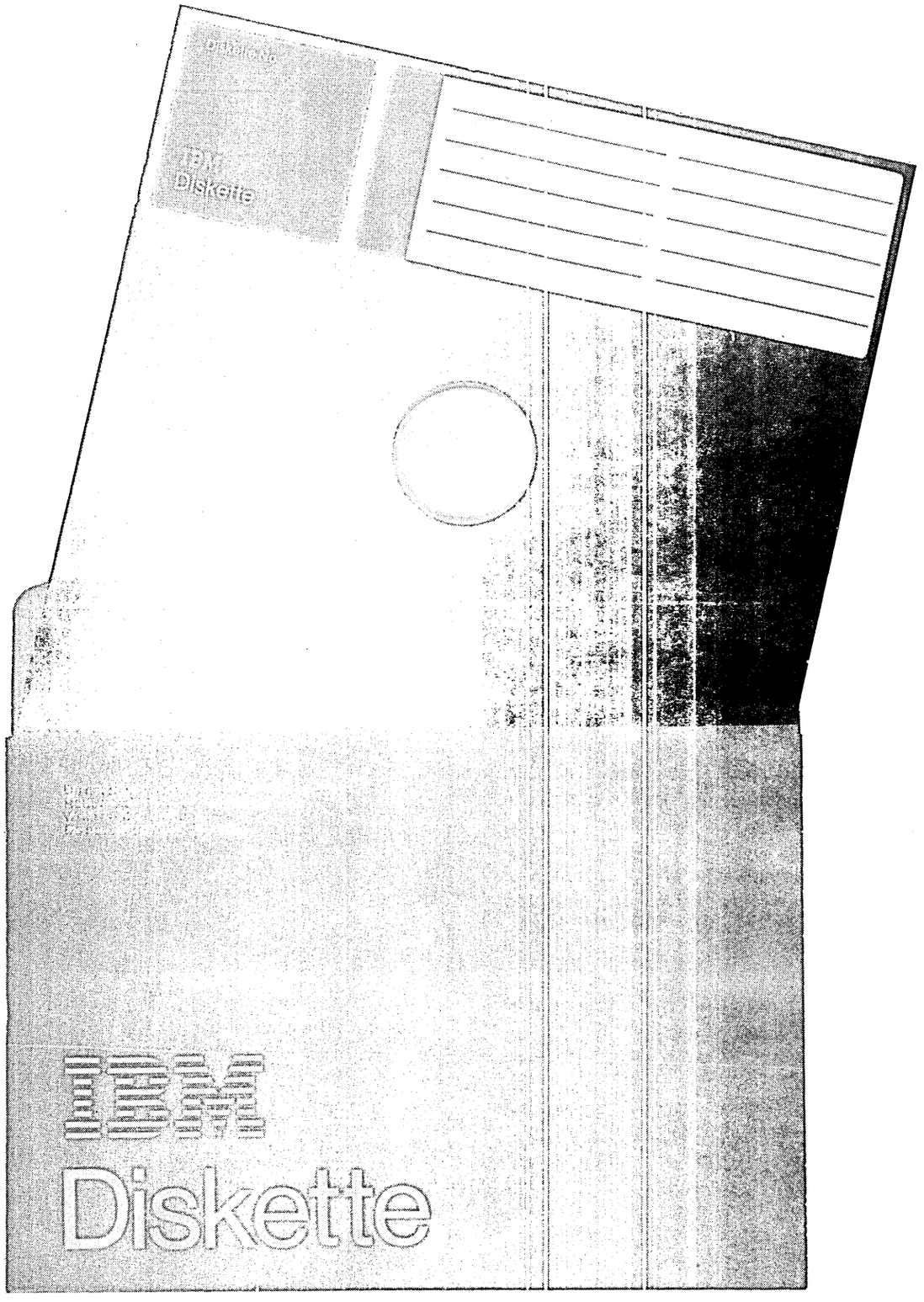
MAP RULES SUMMARY

(See *How To Use,* 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. MAP 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.
G. DEFINITIONS:
   1. DISCONNECT — Physically/electrically take apart.
   2. LOAD a diskette — Close the disk drive cover (with a diskette in the drive). Usually at the faulty station.
   3. MEASURE — Use IBM CE multimeter, PN 452796.
   4. ORIGINAL keyboard or disk drive — the keyboard or disk drive located at station with reported fault.
   5. OTHER keyboard or disk drive — opposite of original keyboard or disk drive.
   6. POWER DOWN — turn power switch OFF.
   7. 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).
   8. PROBE — use IBM Universal Logic Probe, PN 453212.
   9. RECONNECT — Physically/electrically put back together.
   10. REINSTALL — Put original part back in place of new part.
   11. REMOVE a diskette — take the diskette out of the disk drive.
   12. REPLACE — Put new part in place of original part.
   13. RESEAT — Unplug and replug into same location.
   14. UNLOAD a diskette — open the disk drive cover. (Does not mean remove.)

DISK THEORY

Diskette 11-2
Disk format description 11-2
Data set label 11-3
Disk unit field replaceable units 11-4
Operating sequence 11-8
Diskette characteristics 11-13
Disk test points 11-14



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
Record number

Disks 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

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 3741 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 3741. All disks are initialized prior to shipping to customers.

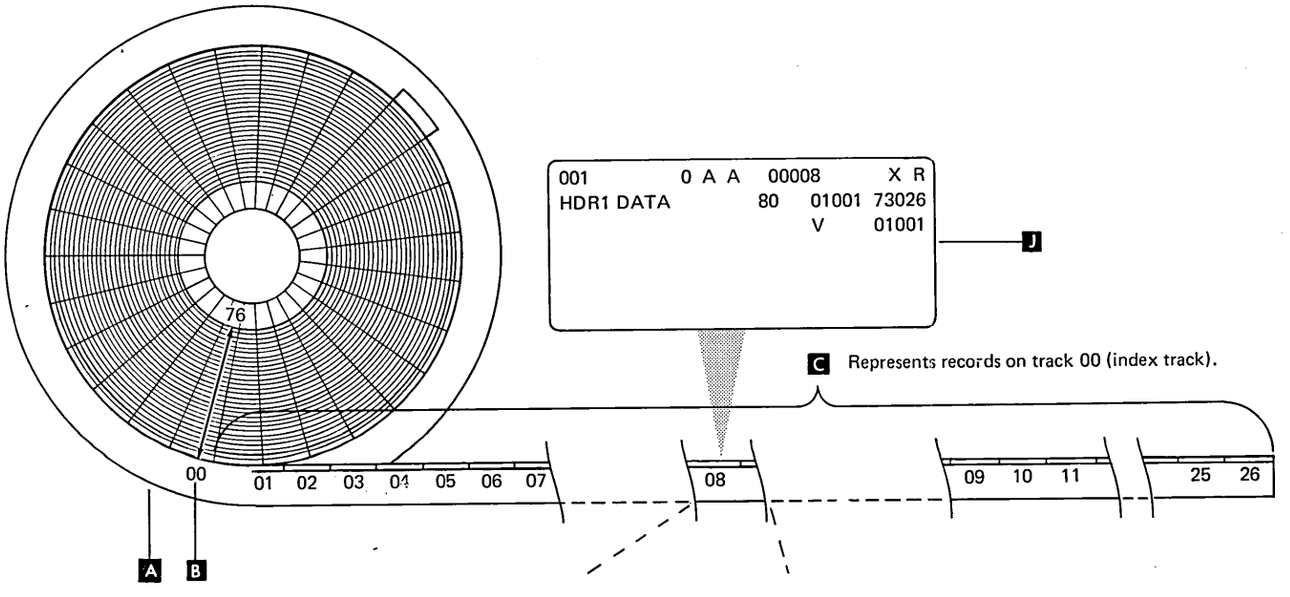
*Trademark of E.I. dupont de Nemours & Co., Inc.

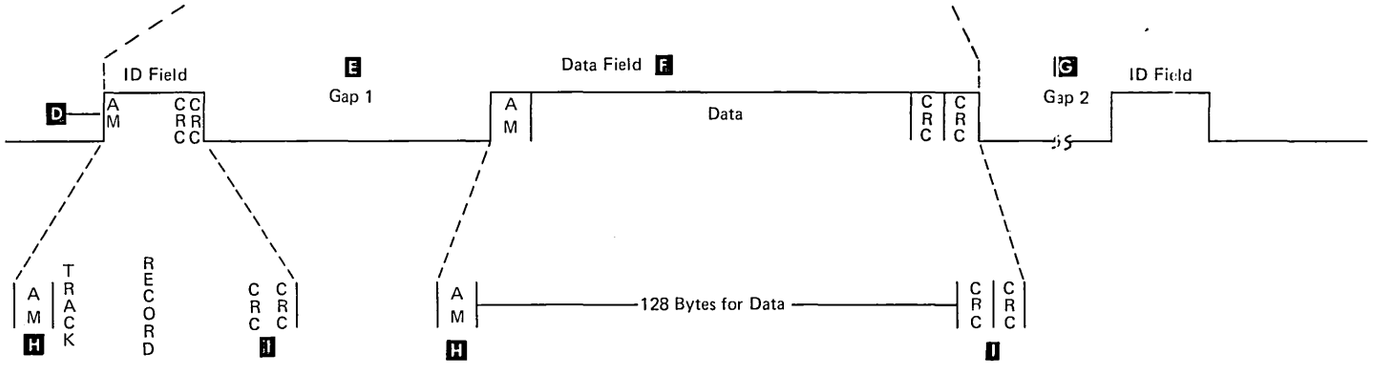
Track 00 is the index track and is reserved for descriptive information about the data on the disk. The assignment of the records on the index track is:

Record 1-2	Not used on 3741
Record 3	Reserved for write gate check
Records 4-6	Not used on 3741
Record 7	Check for accessibility
Records 8-26	Data set labels

Data set labels are used to reserve a block of records for a particular use. They also contain controls and status information about that block of records.

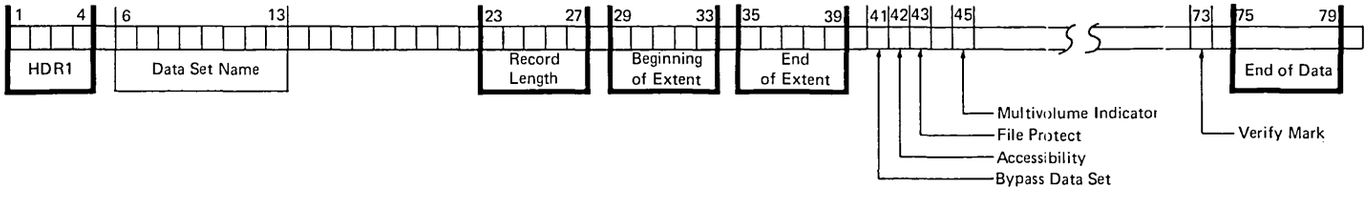
On the 3741 after power up and inserting a disk, record 00008, the first data set label, is automatically read and displayed. J The operator then can select the data set label to be used by pressing REC ADV to the location of that data set label (00008 to 00026). Any machine operation performed must occur within the selected data set.





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 3741 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. If a character is in this field, the data set cannot be processed and an A error is posted.
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.

DISK UNIT FIELD REPLACEABLE UNITS (FRUs)

Disk Drive

The disk drive provides the 3741 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 infrared 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 disk drive file control card provides circuits for the stepper motor, head load actuator, and write and erase heads. It also provides the amplifiers for the phototransistor and read head. These are all under control of the MPU.

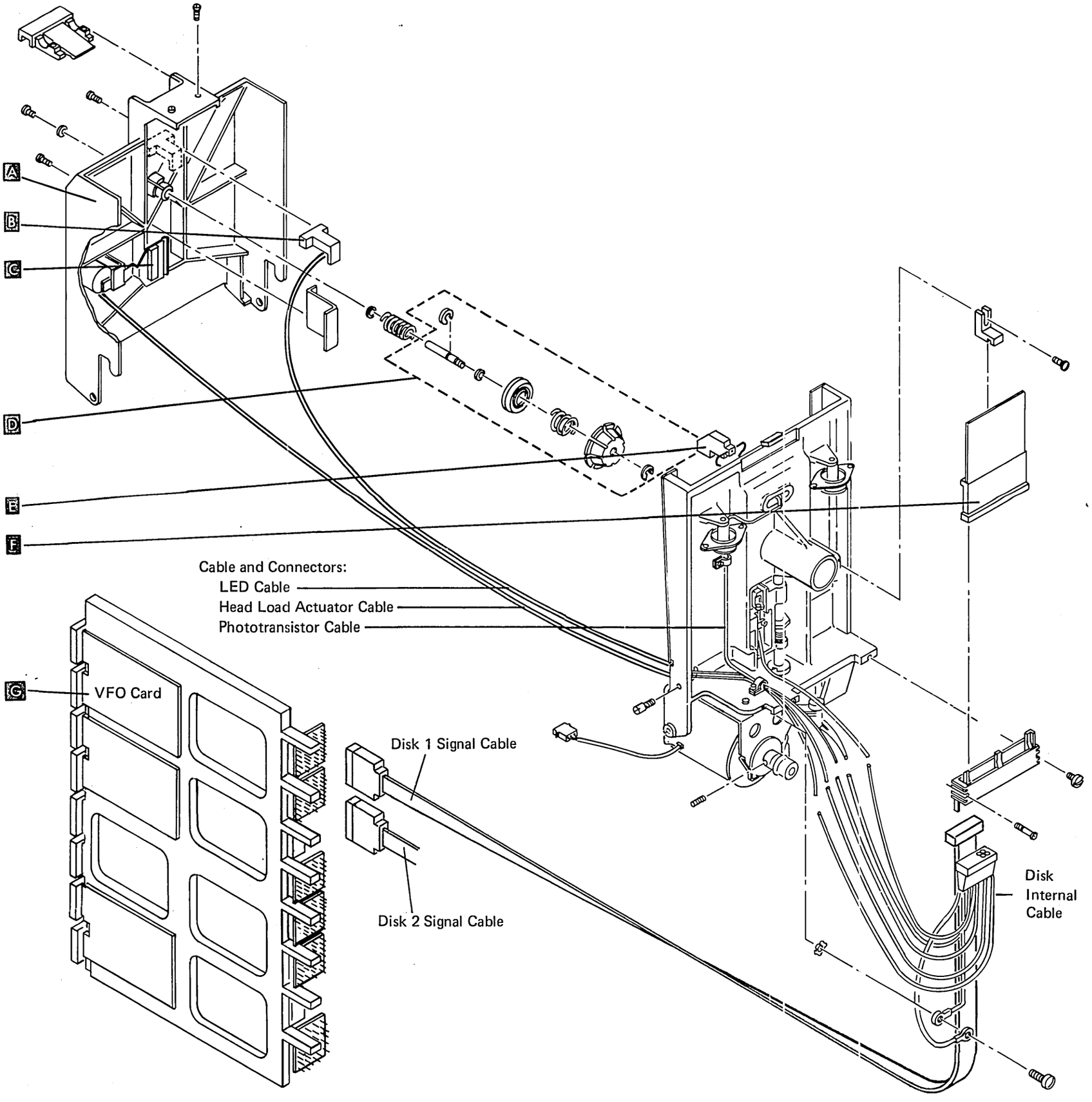
Head Load Actuator Assembly C

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.



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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^{o} in either direction under the control of access pulses. The stepper motor wheel engages the leadscrew wheel. When the stepper motor rotates 90^{o}, it causes the leadscrew to rotate 90^{o}. 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 1 track lower than track 00.

Head and Carriage Assembly M

The head and carriage assembly provides read, write, and erase functions.

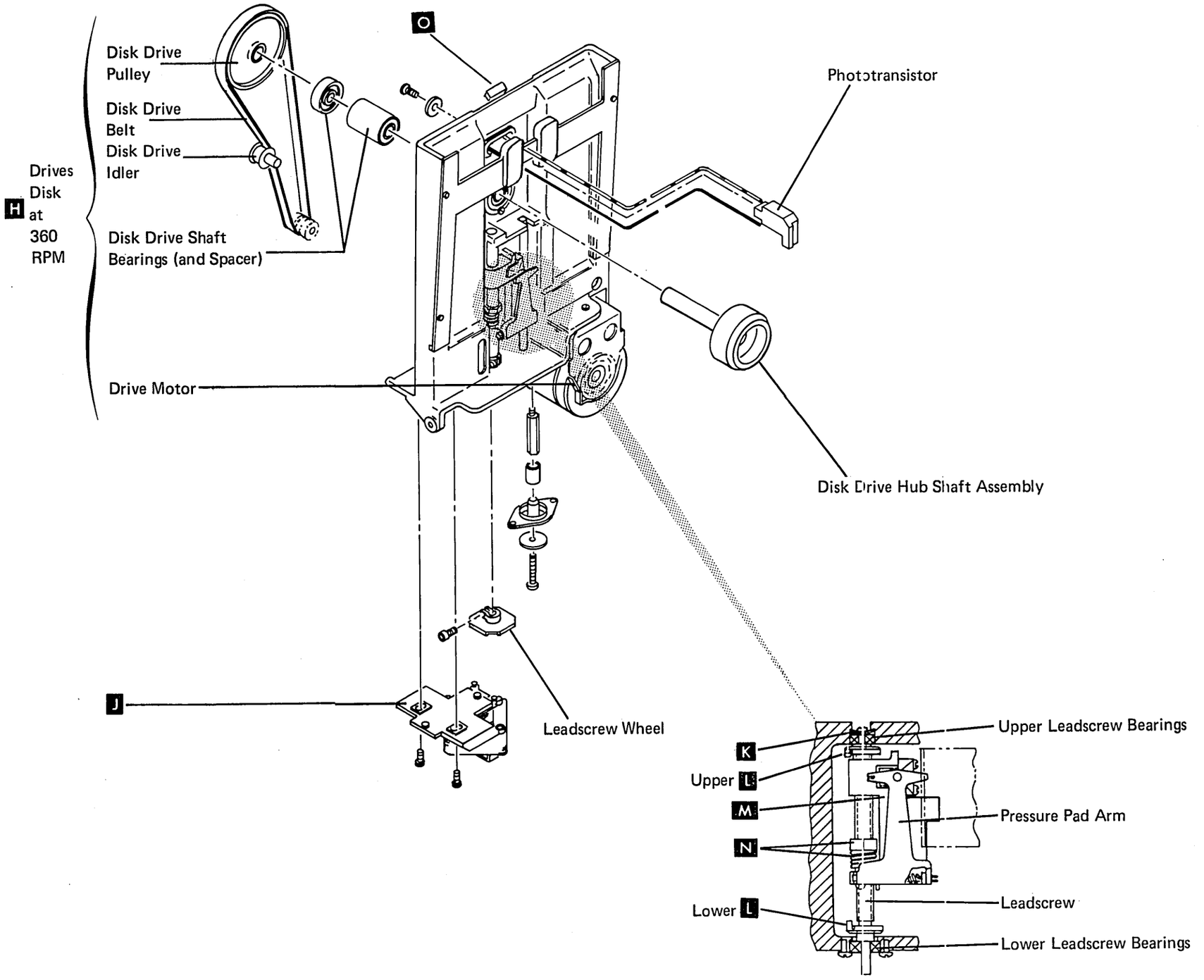
Leadscrew Nut and Spring N

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 page 11-9).

This switch prevents index pulses until a diskette is fully loaded in the disk drive. (Diskette installed and the cover latched closed.)


Disk Drive Pulley
Disk Drive Belt
Disk Drive Idler
Drives Disk at 360 RPM
H
Disk Drive Shaft Bearings (and Spacer)
O
Phototransistor
Drive Motor
Disk Drive Hub Shaft Assembly
J
Leadscrew Wheel
Upper Leadscrew Bearings
K
Upper L
M
Pressure Pad Arm
N
Leadscrew
Lower L
Lower Leadscrew Bearings

OPERATING SEQUENCE

1. Ac and dc power comes on under control of the 3741 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).

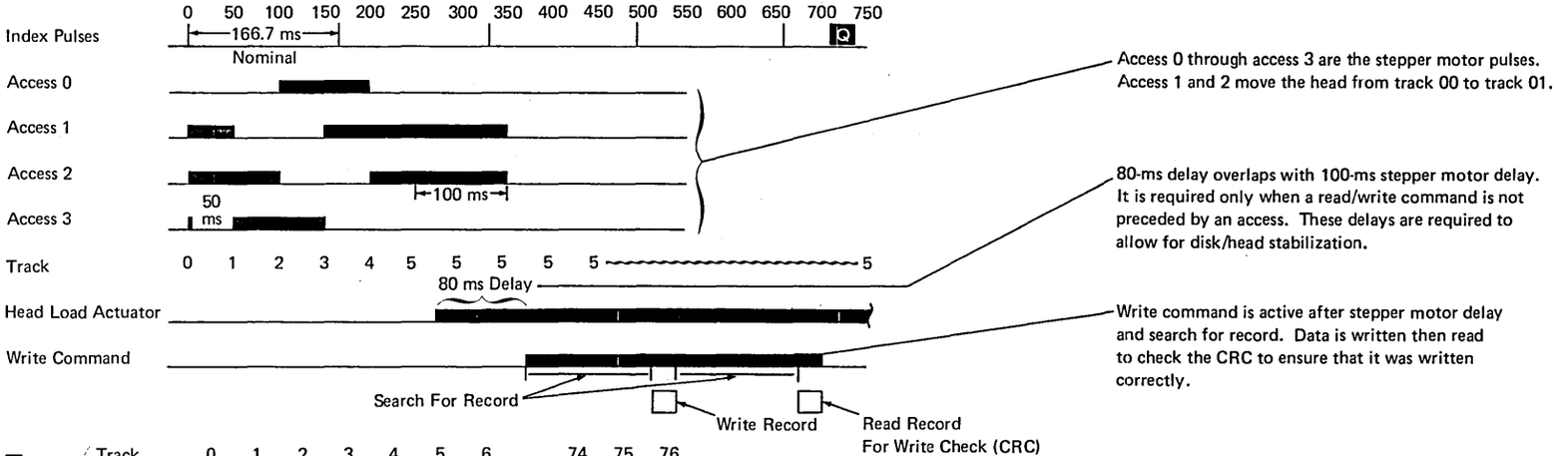
4. To initiate a read or write operation, the '+ head engage' line P is activated. This allows the pressure pad assembly K to push the disk against the head J . After 80 ms delay, data can be gated into the system.

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 below 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 two index pulses after completion of the last read, write or access operation to reduce disk wear unless another read or write command is issued.

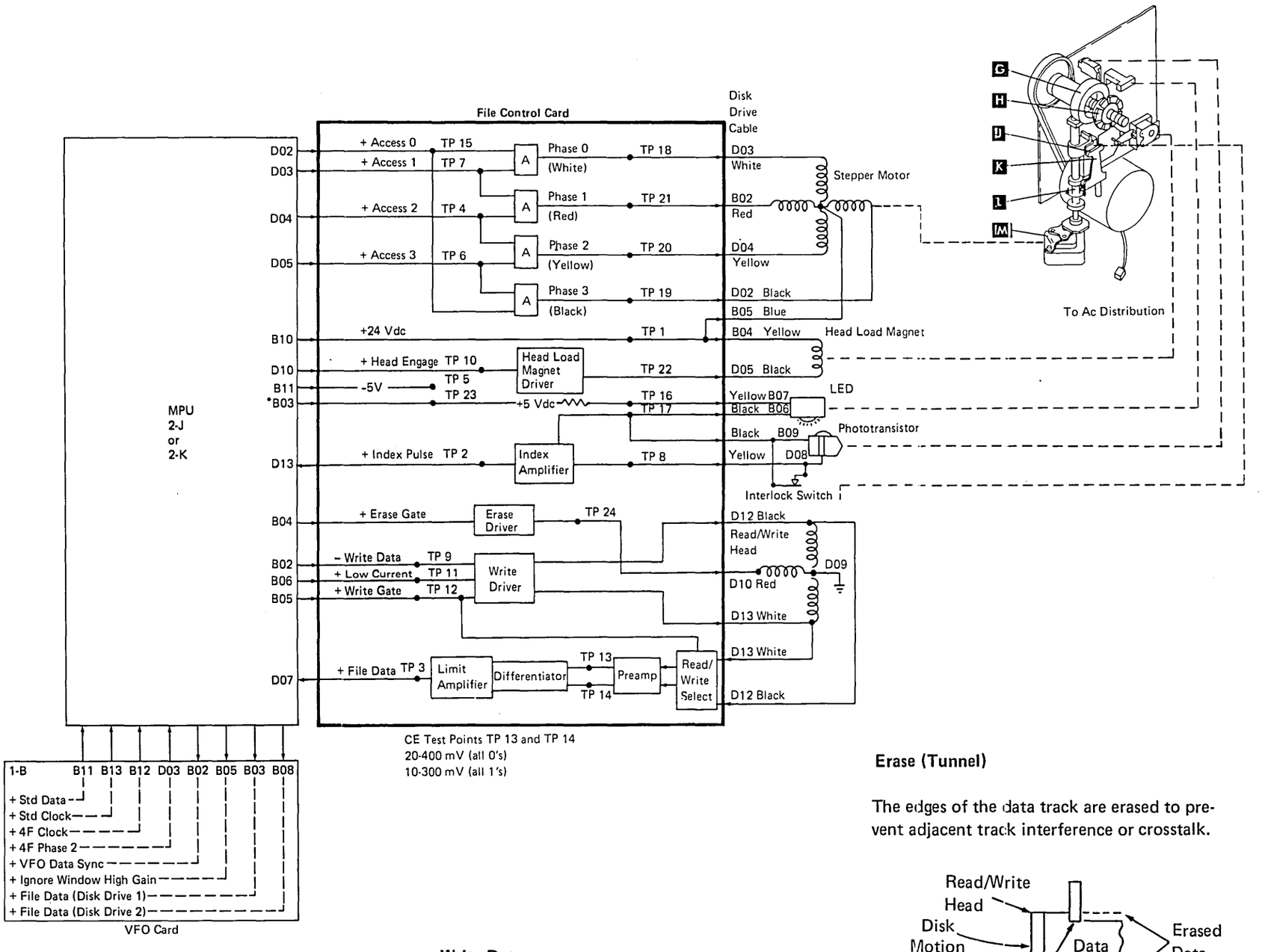
Typical Timing Sequence



F

Lines Energized	Track	0	1	2	3	4	5	6	74	75	76
	Access 0	X			X	X				X	X
	Access 1	X	X			X	X				X
	Access 2		X	X			X	X	X		
	Access 3			X	X			X	X	X	

Stepper motor is at phase 0 when read head is at track 00 or any track divisible by 4.



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.

Write Data

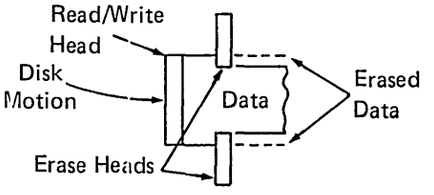
For each transition in the 'write data' line, current is switched in the read/write head, causing a flux change on the disk.

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.

Chart 1
Power on reset for disk drive.

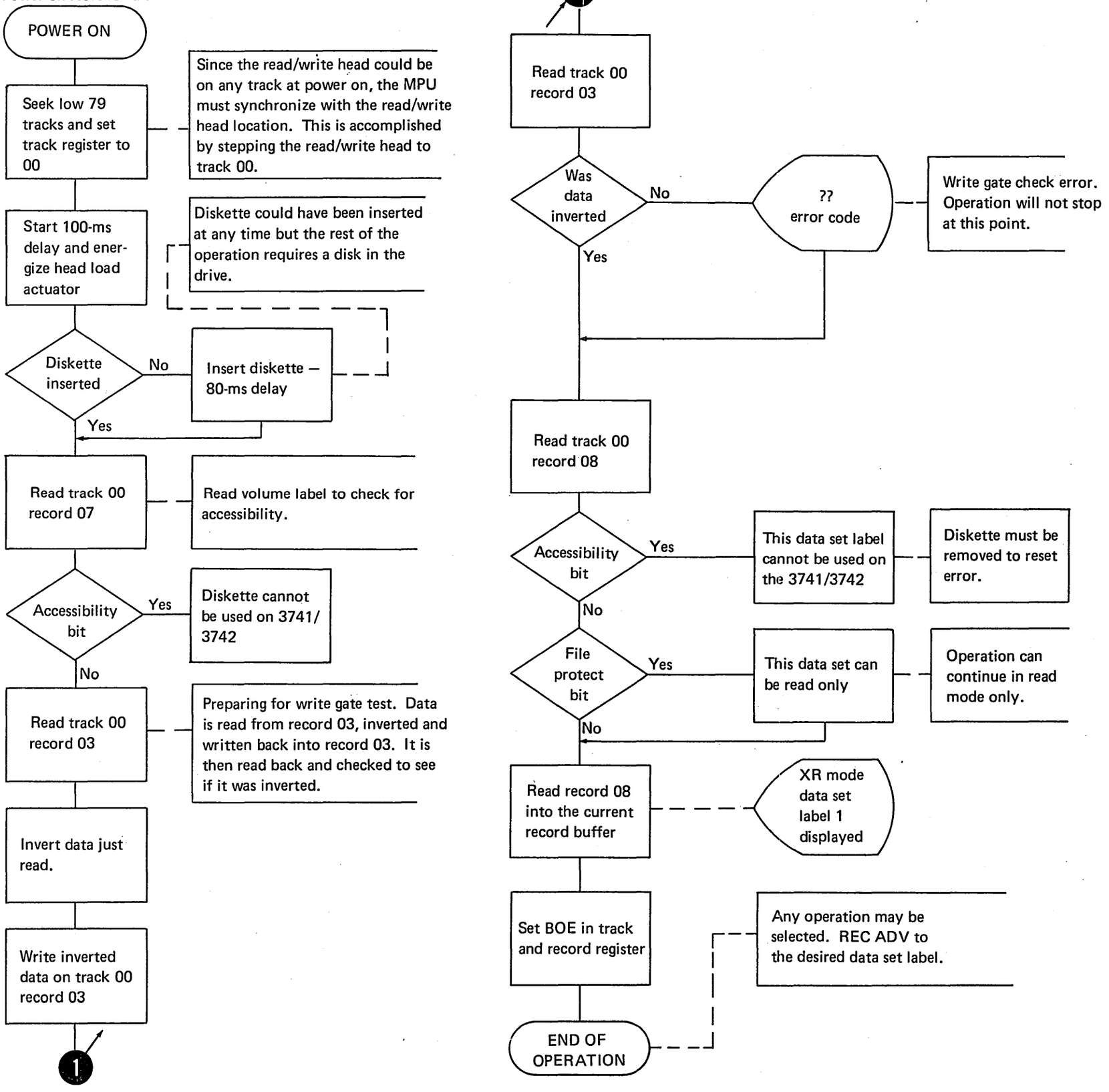


Chart 2
The following flowchart continues from Chart 1 and shows a *write operation using enter mode.* Assume data set label 1 has a BOE of 05004.

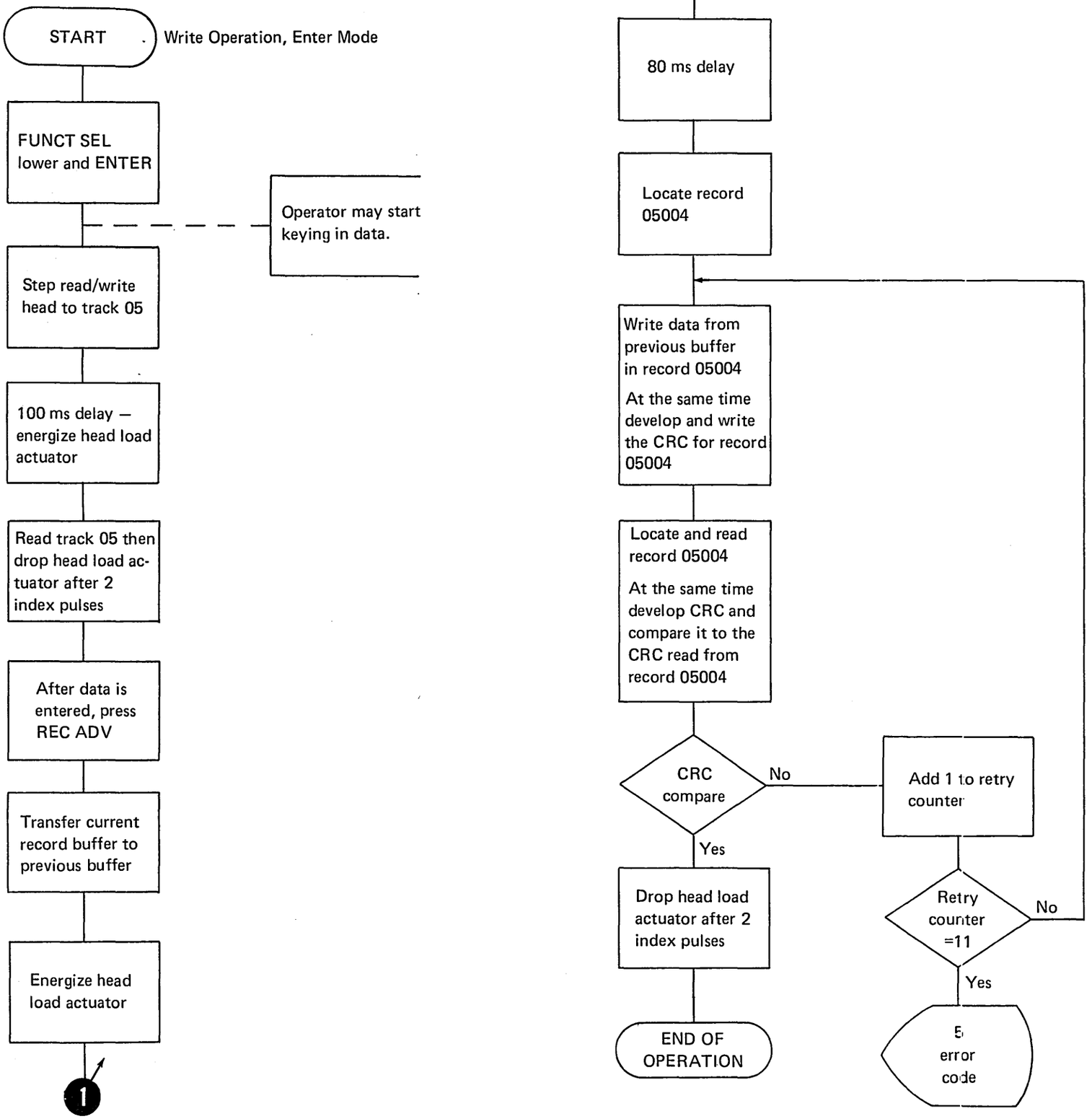


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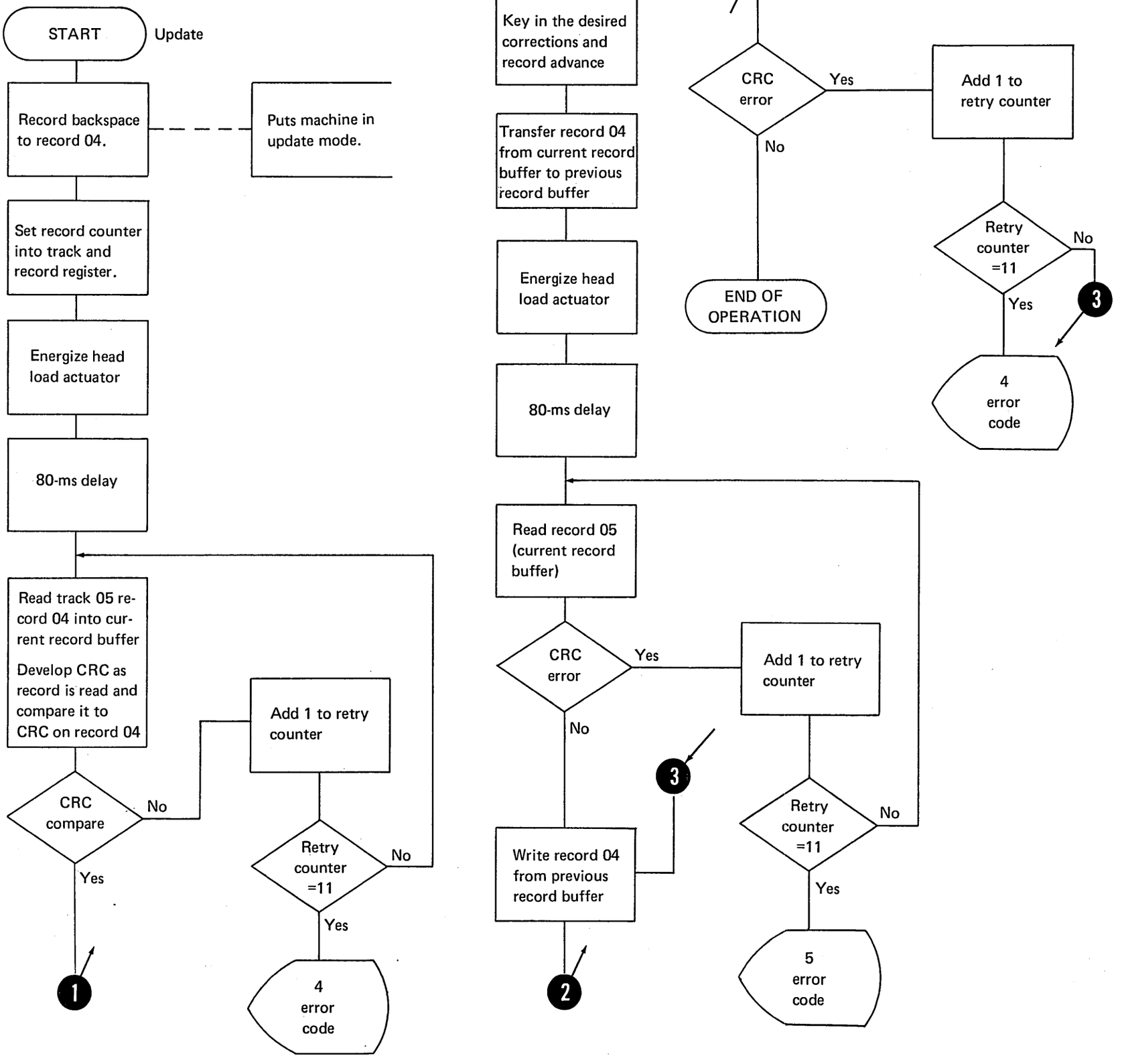
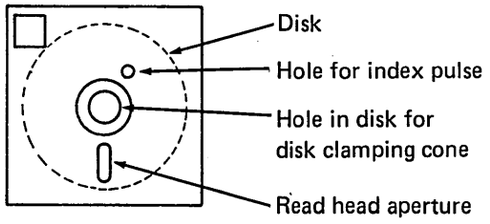
Chart 3

Assume data was entered in record 05004. The following chart shows an *update operation* updating record 05004.

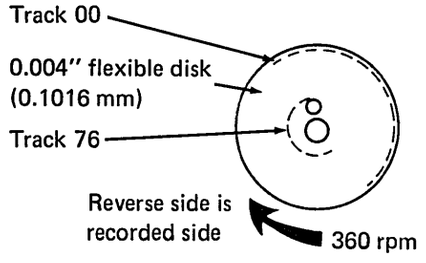


DISKETTE CHARACTERISTICS

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.

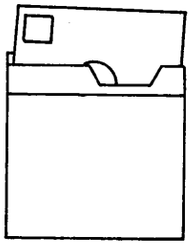
Save the carton for diskette storage and/or later shipment.

Handling

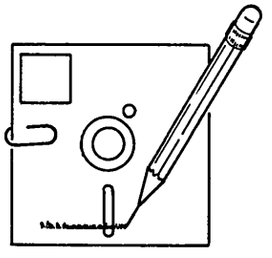
Damaged diskettes should not be inserted into the disk drive. Diskettes which are physically damaged (torn, creased, warped) or contaminated with foreign materials (eraser dust, fingerprints, cleaning fluid, etc.) may cause the disk to fail to contact the read/write head resulting in read/write errors.

Placing heavy objects on the diskettes may damage the disk.

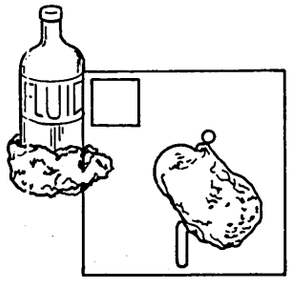
- Return diskette to envelope whenever it is removed from the disk unit.



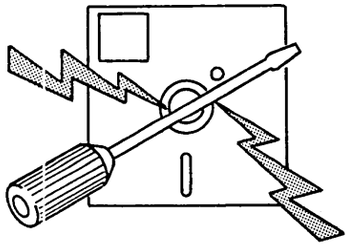
- Do not use clips. Never write on a diskette with an erasable pencil. (Erasures may cause disk failures.)



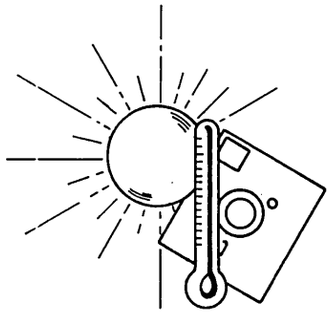
- Do not touch or attempt to clean the disk surface.



- 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 expose diskette to heat or sunlight.



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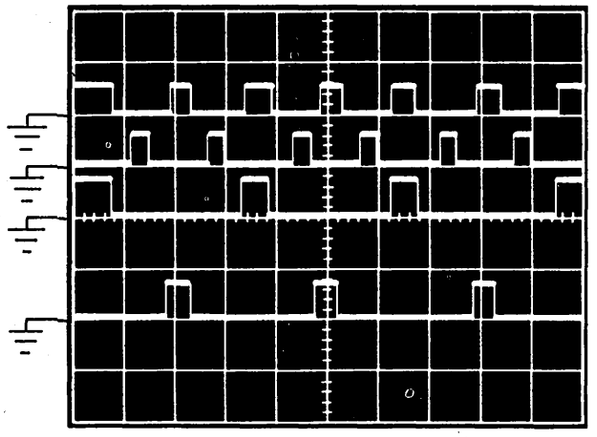
DISK TEST POINTS

Output of separated data and clock signals from the VFO card.



'+4F clock'
'+4F, phase 2'

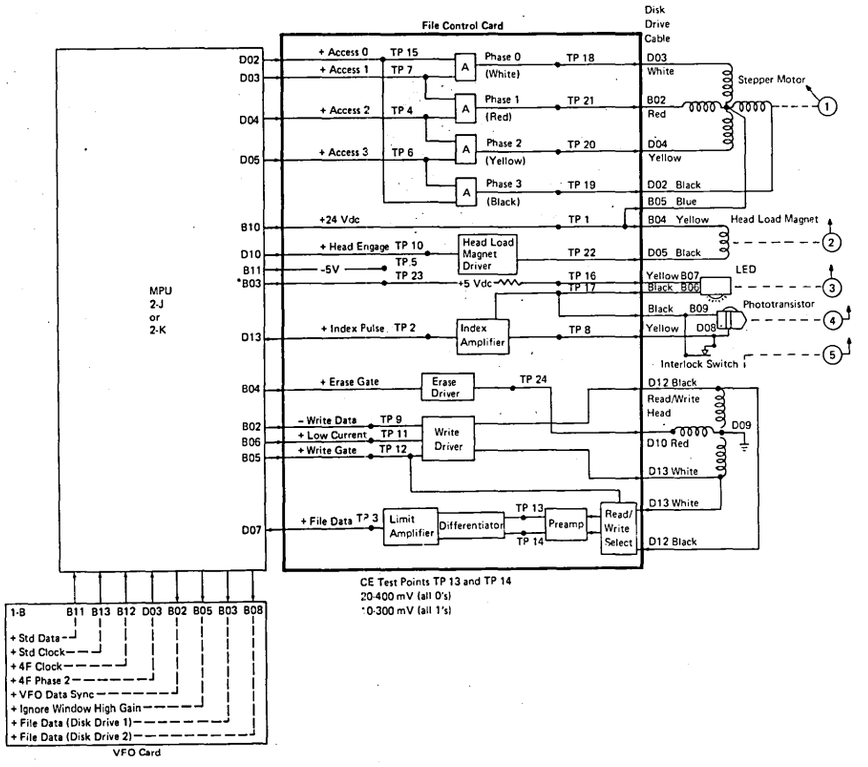
'+ Std clock'
Int (+) dc sync

'+ Std data'

Continuous — free running

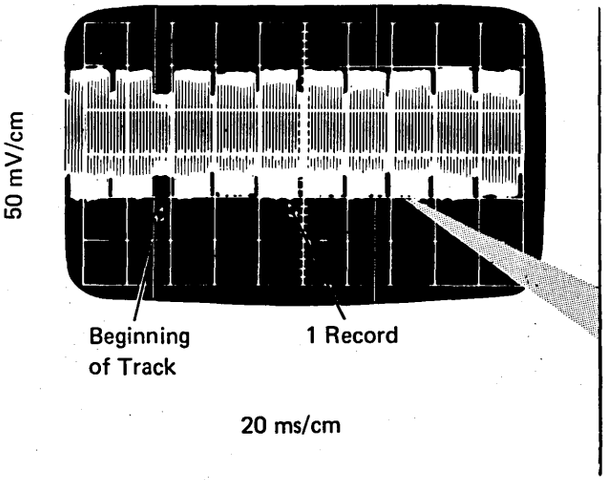
'+ Std clock' and '+ std data' signals are not always present at all locations shown due to the scope sync.

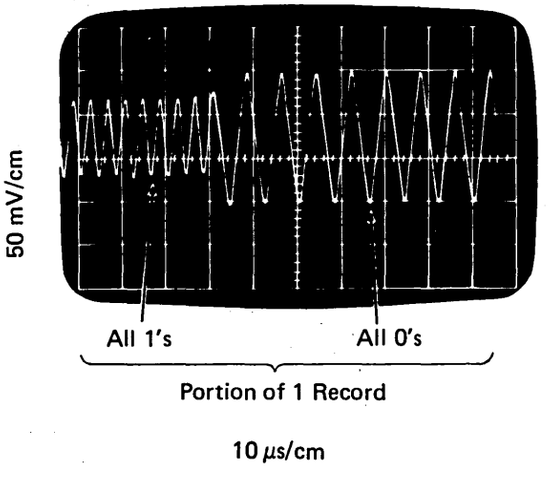
Sync trig	Int (+) dc
Sync point	1-B-B13
Sweep speed	1 μs/div
Probe point	See above
Vert amp	0.5 V/div

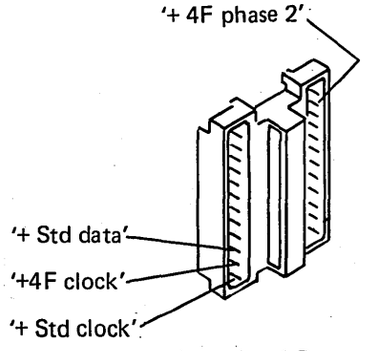


CE Test Points TP 13 and TP 14
20-400 mV (all 0's)
10-300 mV (all 1's)

Full Track Differential Read Signal at CE Test Points



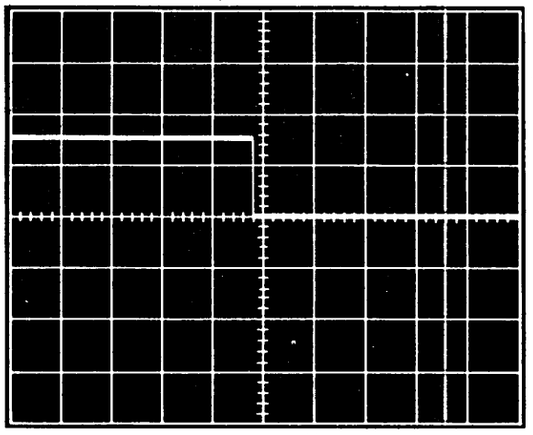




In socket 1-B cross connector for VFO card.

NOTE: Use X10 probe for all displays.

TP 2 – '+ Index pulse'

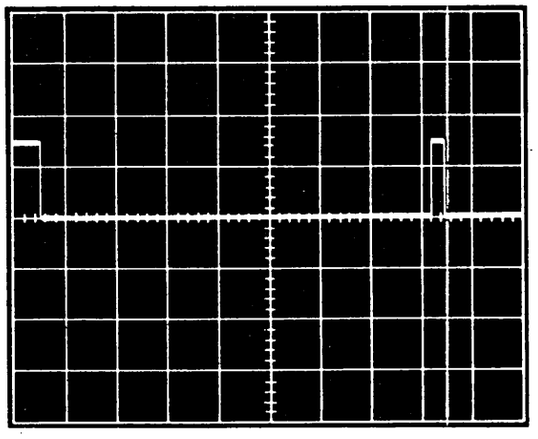


Individual pulse is approximately 5 ms.

The signal is always present with the diskette in the drive, the cover closed, and the power on.

Sync trig	Int (+) dc
Sync point	FC card TP 2
Sweep speed	1 ms/div
Probe point	FC card TP 2
Vert amp	0.2V/div

TP 2 – '+ Index pulse'

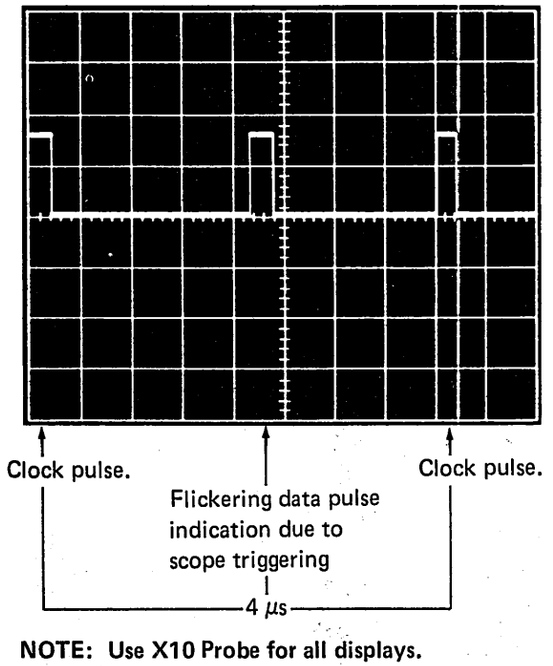


The two pulses show the disk speed time period; should be approximately 167 ms.

The signal is always present with the diskette in the drive, the cover closed, and the power on.

Sync trig	Int (+) dc
Sync point	FC card TP 2
Sweep speed	20 ms/div
Probe point	FC card TP 2
Vert amp	0.2V/div

TP 3 – '+ File data'



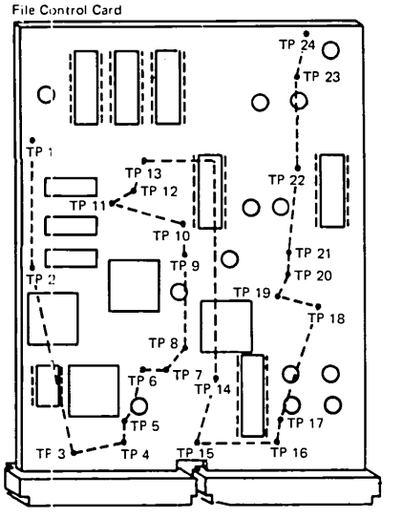
Clock pulses are always present when the machine has power on.

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.

Sync trig	Int (+) dc
Sync point	FC card TP 3
Sweep speed	0.5 μs/div
Probe point	FC card TP 3
Vert amp	0.2V/div



NOTE: Use X10 Probe for all displays.

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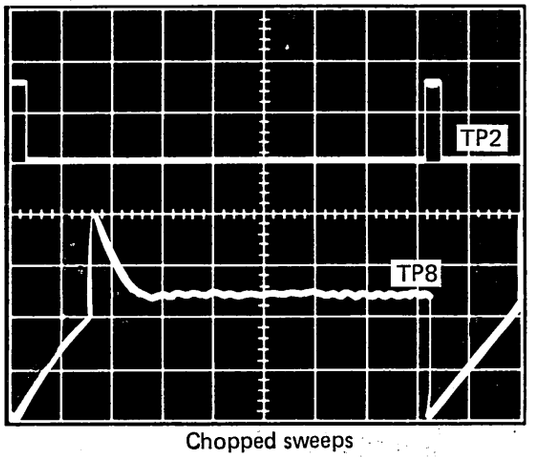
TP 8 — Phototransistor
TP 2 — '+ Index pulse'



Chopped sweeps

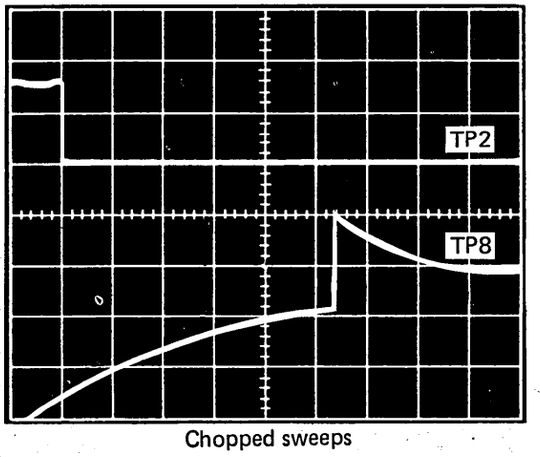
The signal is always present with the diskette in the drive, the cover closed, and the power on.

The two pulses show the disk speed time period; should be approximately 167 ms.

Sync scope Int (+) on TP 2 ('+ index pulse') to look at the complete phototransister.

Sync trig	Int (+) dc
Sync point	FC card TP 2
Sweep speed	20 ms/div
Probe point	See trace drawing
Vert amp	0.2V/div

TP 8 — Phototransistor
TP 2 — '+ Index pulse'



Chopped sweeps

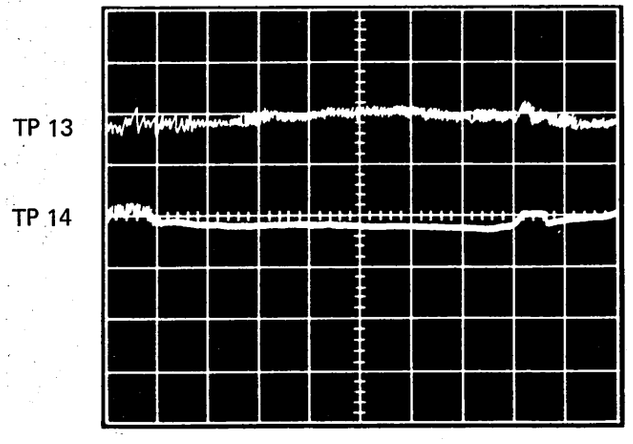
Individual pulse at each TP (test point).

'+ Index pulse' is approximately 5 ms.

Sync scope Int (+) on TP 2 ('+ Index pulse') to look at the complete phototransistor TP 8.

Sync trig	Int (+) dc
Sync point	FC card TP 2
Sweep speed	5 ms/div
Probe point	See trace drawing
Vert amp	0.2V/div

TP 13 — Preamp TP 2
TP 14 — Preamp TP 1



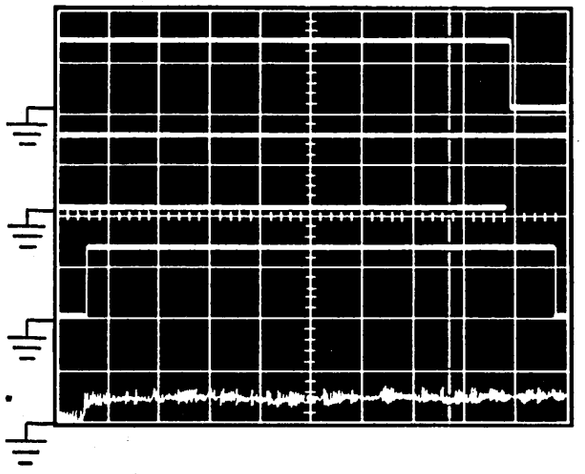
The small data signal rides +1.35V above ground.

The small data signal rides +1.4V above ground.

The power is on and the diskette is in the machine. Put in CE mode and display IDs (see Chapter 8).

Sync trig	Int (+) dc
Sync point	FC card TP 14
Sweep speed	500 ns/div
Probe point	FC card TP 13
Vert amp	20 mV/div

TP 12 — '+ Write gate'
TP 9 — 'Write data'
TP 24 — '+ Erase current'
2-J-B04 — Erase gate



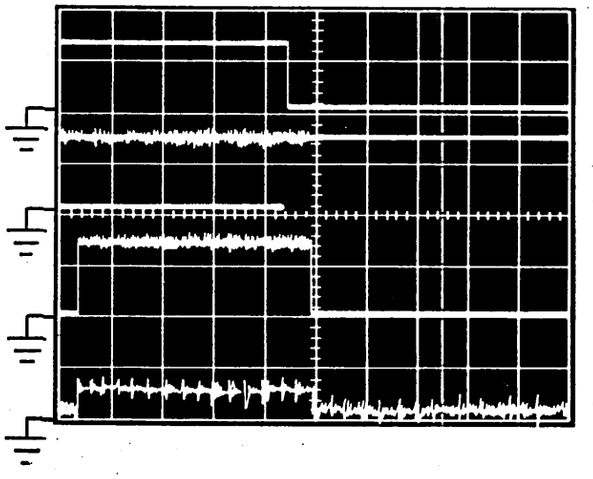
+ Write gate

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.

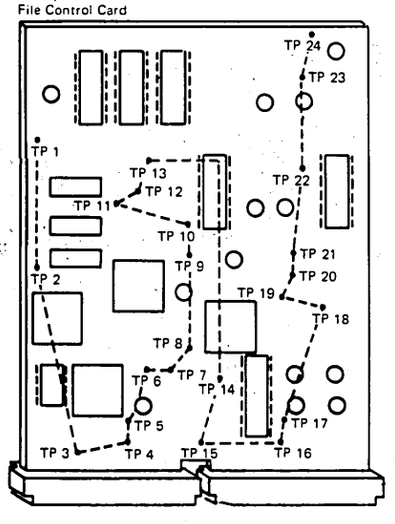
Particularly note that the 'write data' signal can end either plus or ground, depending on the transition in progress at the end of 'write gate'.

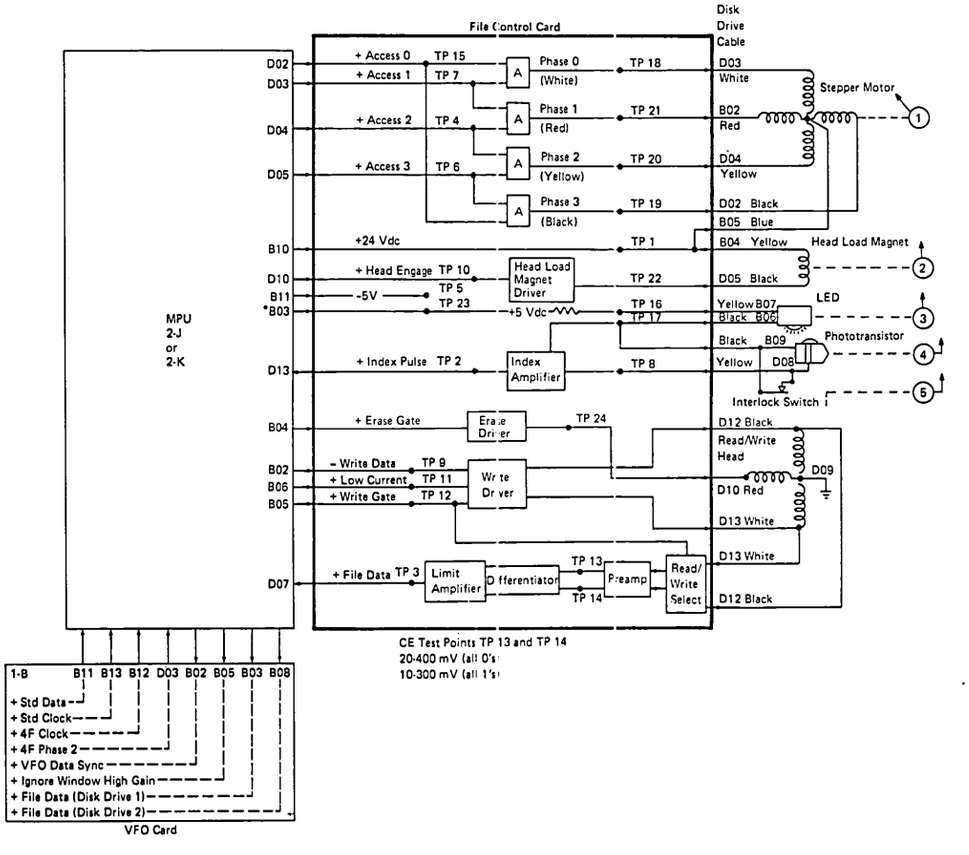
Sync trig	Int (+) dc
Sync point	FC card TP 12
Sweep speed	.5 ms/div
Probe point	See trace drawing
Vert amp	0.2V/div



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
Sync point	FC card TP 12
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.2V/div





NOTE: Use X10 Probe for all displays.

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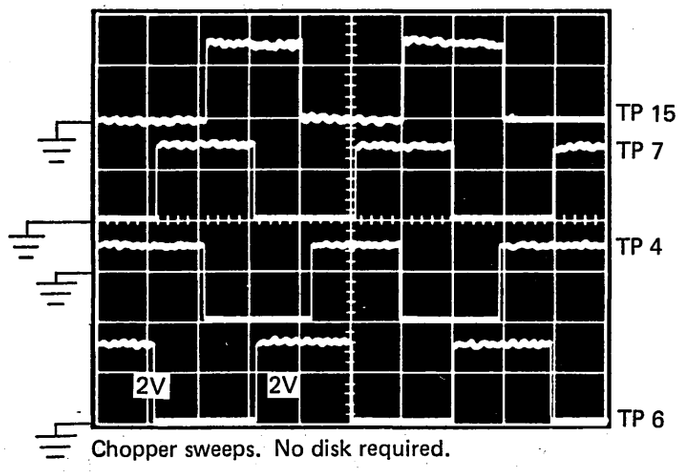
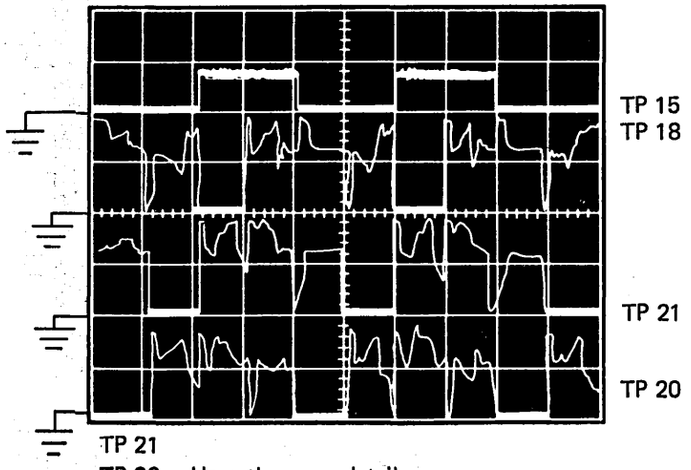
TP 15 – '+ Access 0'
TP 7 – '+ Access 1'
TP 4 – '+ Access 2'
TP 6 – '+ Access 3'
TP 18 – MC-0
TP 21 – MC-1
TP 20 – MC-2
TP 19 – MC-3

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
Sync point	FC card TP 15
Sweep speed	50 ms/div
Probe point	See trace drawing
Vert amp	0.2V/div

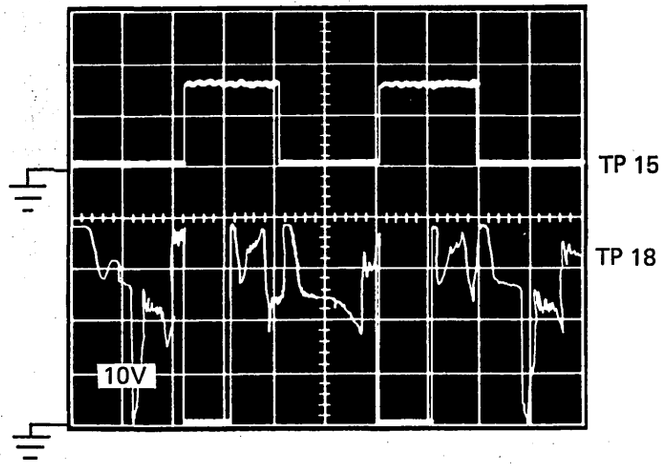
Chopper sweeps. No disk required.



TP 19 on 2 will look similar to TP 18, 21, and 20 and have reference timing to TP 6 as TP 18 has to TP 15.

Sync trig	Int (–) dc
Sync point	FC card TP 15
Sweep speed	50 ms/div
Probe point	See trace drawing
Vert amp	5V/div for sync 2V/div for other traces

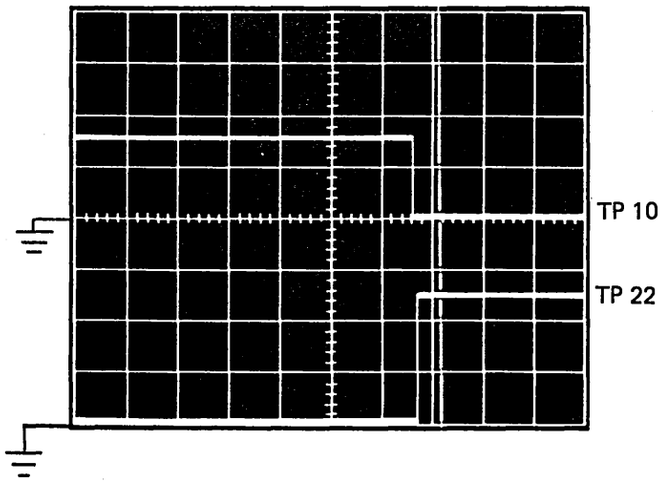
TP 21
TP 20 Have the same detail.
TP 19



For added detail of TP 18 -MC-0

Sync trig	Int (–) dc
Sync point	FC card TP 15
Sweep speed	50 ms/div
Probe point	FE card TP 18
Vert amp	0.2V/div for sync 1V/div for TP-18

TP 10 – '+ Head engage'
TP 22 – '- Head load'



Sync scope Int (+) on TP 10 '+ head engage'.

No disk in drive needed.

Picture taken at power on when head load magnet is picked and dropped (3742).

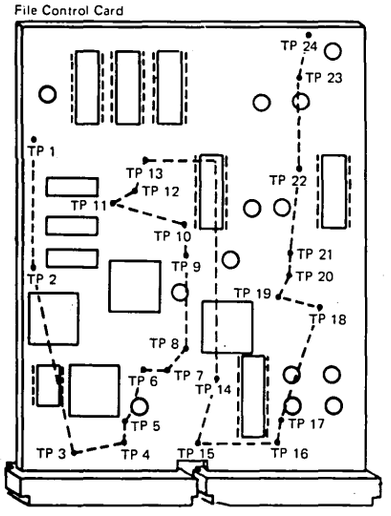
The approximate time energized is 1.35 seconds (1350 ms).

Sync trig	Int (+) dc
Sync point	FC card TP 10
Sweep speed	200 ms/div
Probe point	FC card TP 22
Vert amp	0.2V/div for sync 1V/div for TP-22

TP 16 – '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 with the CE meter.

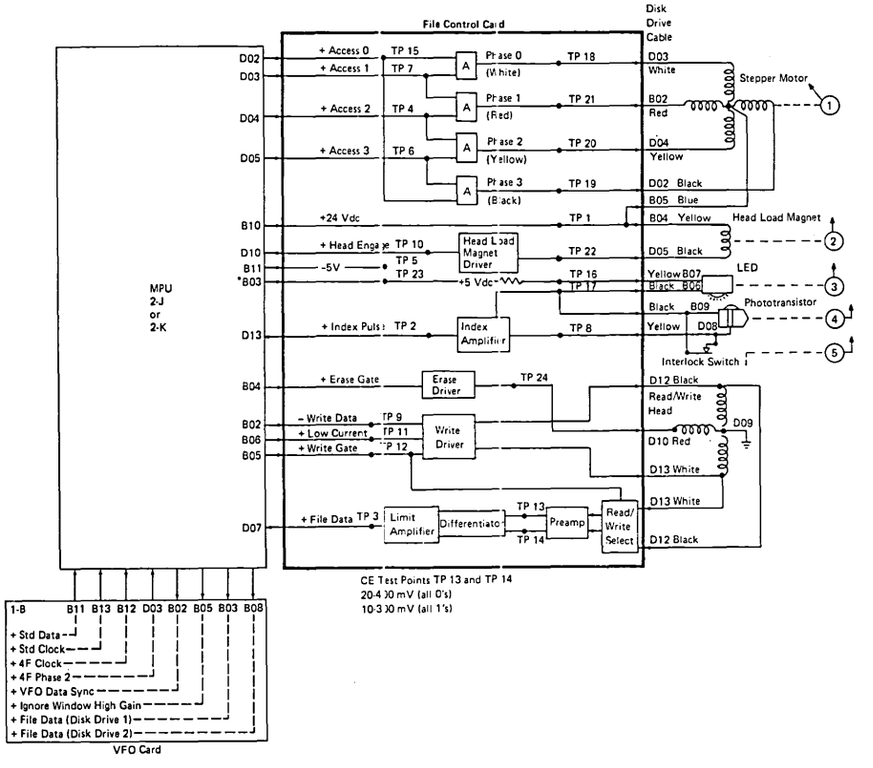
Using the oscilloscope, @500 mV/div (0.5V/div) the voltage level was observed to be about +1.2V above ground.



TP 11 – '+ Low current' -(no pictures)

TP 11 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.

NOTE: Use X10 Probe for all displays.



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DISPLAY THEORY

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Formation of characters 12-3
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Functional sequence 12-4
Circuit description 12-4
Display test points 12-6

INTRODUCTION

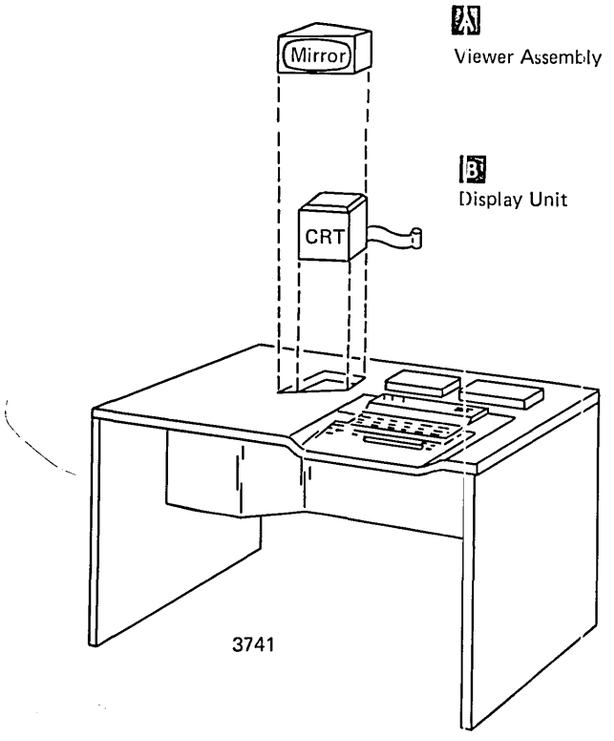
The display unit B gives the operator visual communications with the 3741 Data Station. The display is mounted vertically in the machine and can display six lines of data. C

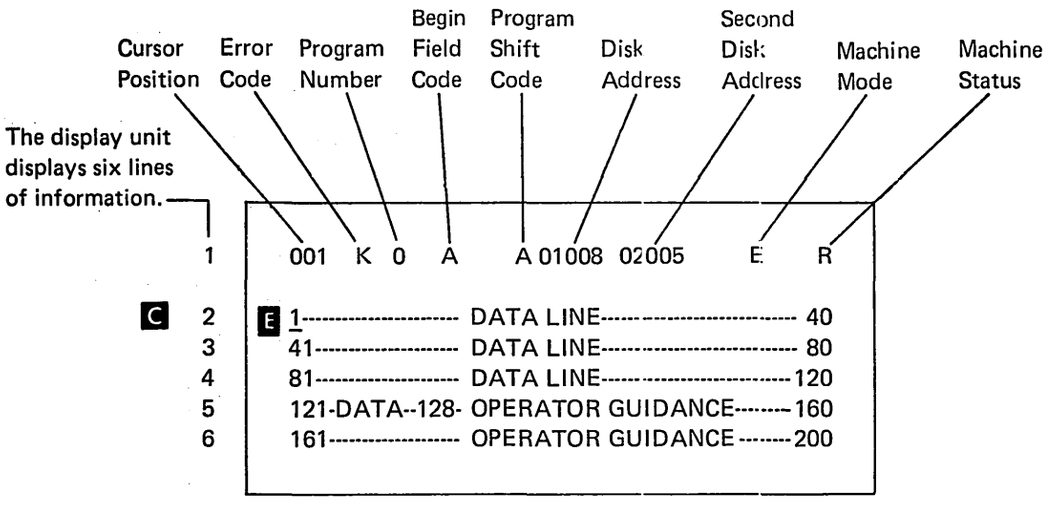
When the viewer assembly is installed, the information is displayed to the operator via a polished metal mirror. A

When the viewer assembly is removed, the information on the CRT looks like this. D

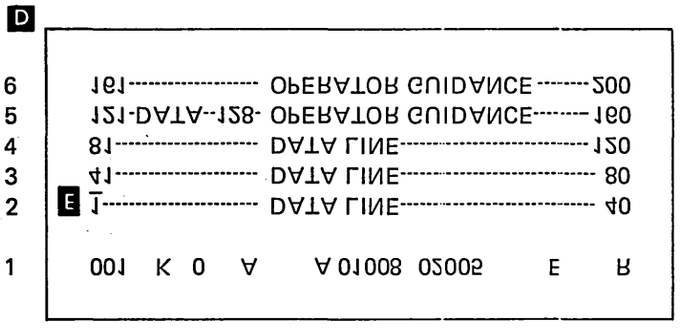
Details of information displayed are shown in Section 9 *Operating Procedures.*

The cursor is a line under the display position being operated upon. E





D



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FORMATION OF CHARACTERS

The CRT printed circuit board **C** contains the amplifiers and drivers required to generate, accelerate, deflect, and intensify the beam in the CRT **A**.

The MPU synchronizes the amplifiers and drivers so that intelligent data is displayed on the CRT screen.

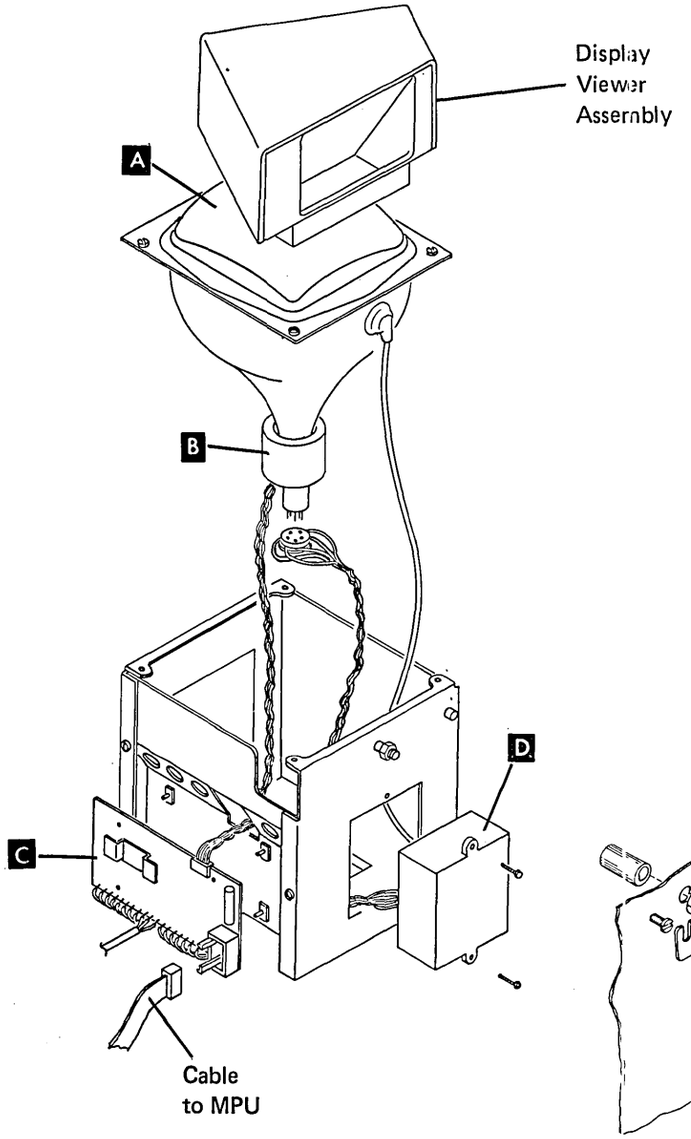
The electron beam, created by the cathode and high voltage converter **D**, is deflected by a yoke **B**. The yoke contains four separate coils. The function of each coil is:

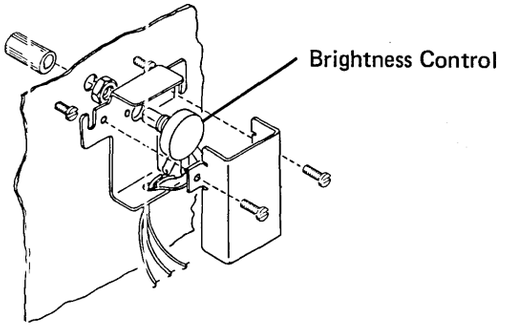
1. The vertical coil positions the beam to the line to be displayed (one of six lines).

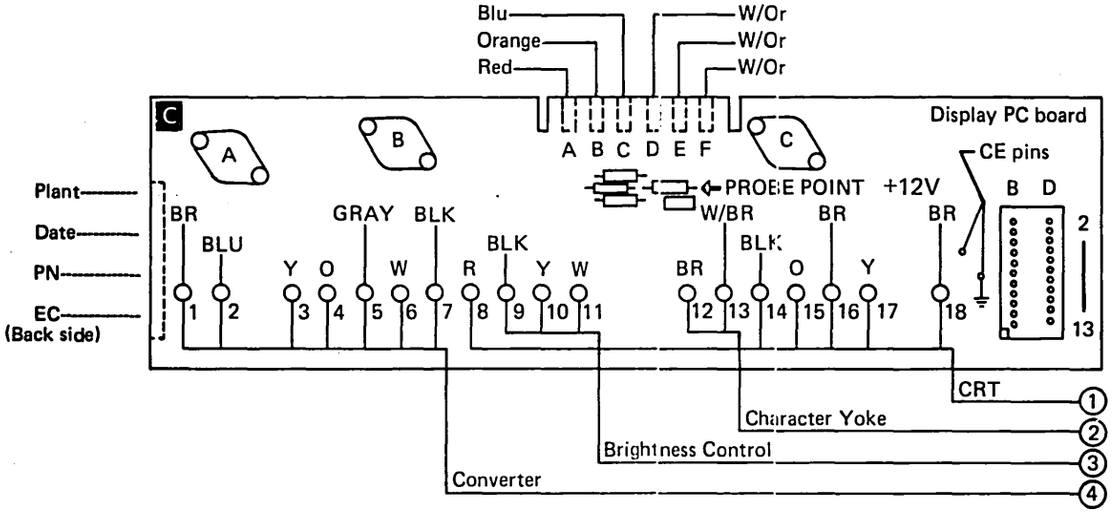
2. The horizontal coils (master and slave) deflect the beam across the CRT screen on the line selected by the vertical yoke.

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.







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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). A
2. Brightness control circuit. B
3. Video dot amplifier. D
4. Character wiggle sweep circuit. C
5. Horizontal deflection circuit. F
6. Vertical deflection (line control) circuit. E

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 E.
2. MPU then activates the horizontal deflection amplifier. This starts the beam moving across the CRT screen (left to right) F.
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 C.
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 D.

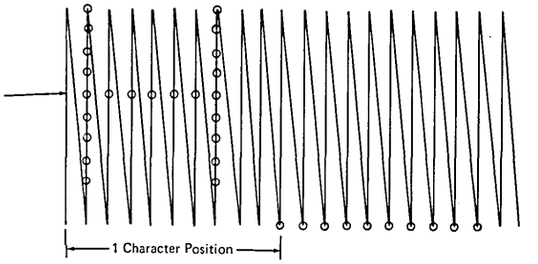
Circuit Description

The high voltage oscillator A is free running. The purpose of the oscillator and the high voltage converter G 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. B

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. D 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.* H 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 D 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 C 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 formed characters on the face on the CRT. The dot pattern for an H is shown in the following diagram. Also, show 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. On Katakana machines there are an additional 64 Katakana 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 F of the electron beam is accomplished with two horizontal coils (master I and slave J 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).

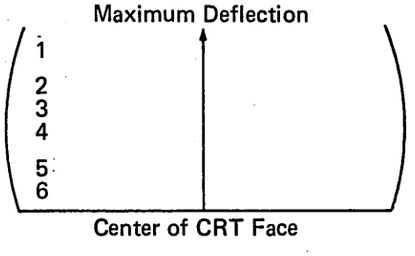
4. The horizontal deflection amplifier changes the current through the coils as follows: The master coil current decreases and the slave coil current increases. The electron beam will be at the extreme left side of the CRT screen when the slave coil current is maximum and the master coil current is minimum.

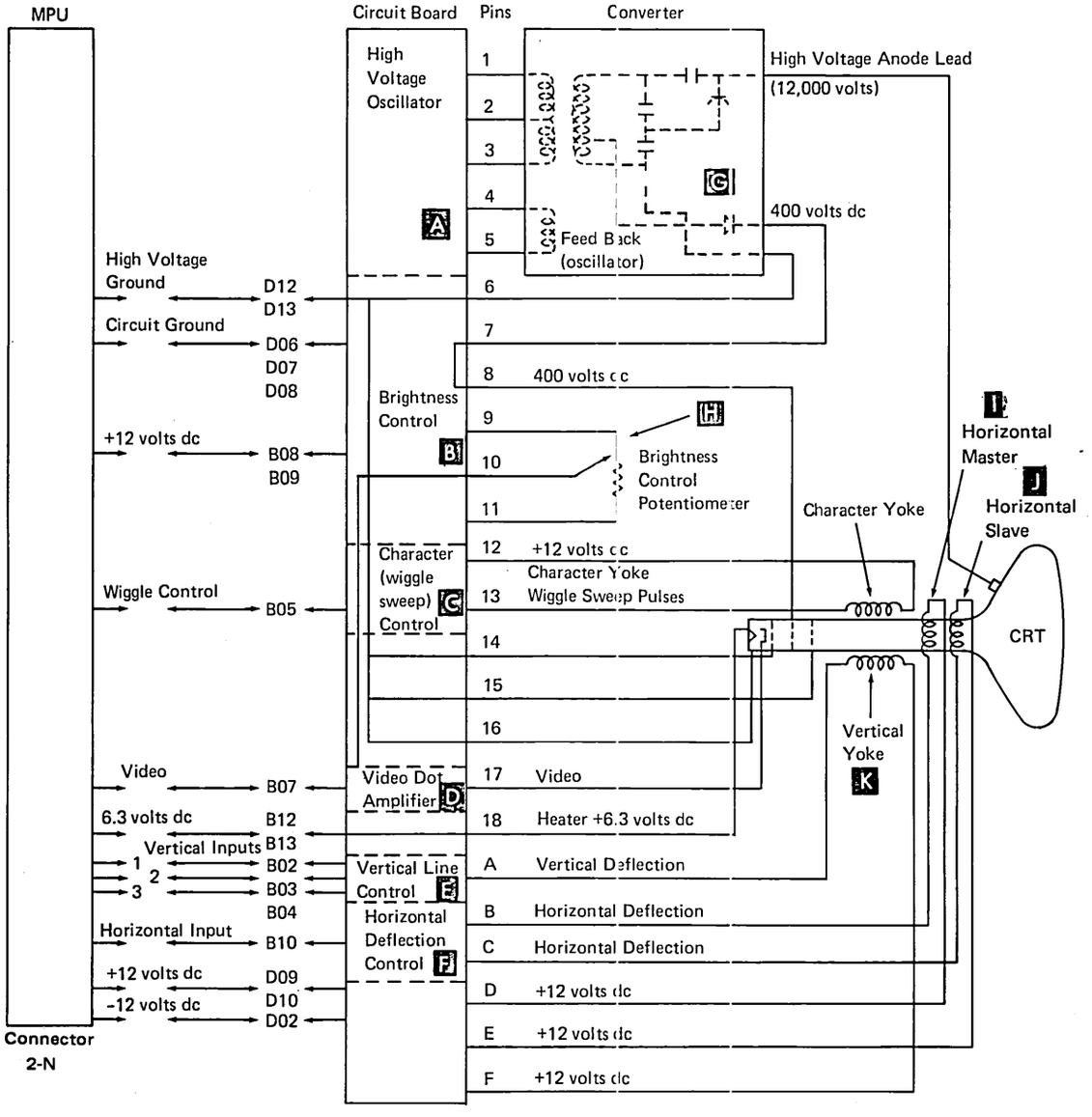
The total time to trace one horizontal line and return the electron beam to the left is 4 milliseconds. Therefore, the time required to trace or display six lines is 24 milliseconds and each line is retraced or refreshed every 24 milliseconds. The line refresh rate divided into 1 second gives a frame (picture) refreshment rate of approximately 42 times per second.

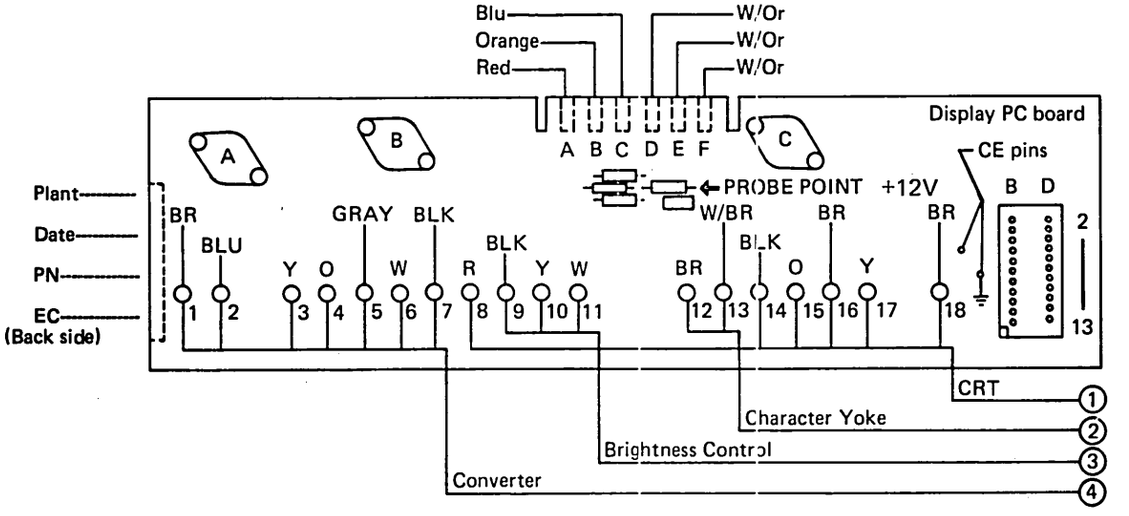
The vertical step circuit E controls the vertical location of the data line on the CRT. Three vertical inputs control the location of this line. The vertical inputs from the MPU are added by the vertical control circuitry on the CRT printed circuit board. The resulting output current is sent to the vertical coil K 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
1	-	-	-
5	-	+	+
6	+	+	+
2	-	+	-
3	+	+	-
4	-	-	+

Note: The polarity is (-) for an active signal.







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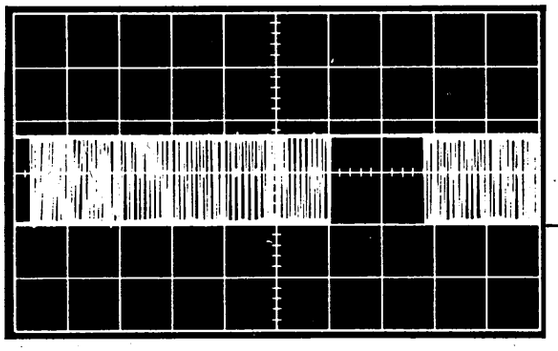
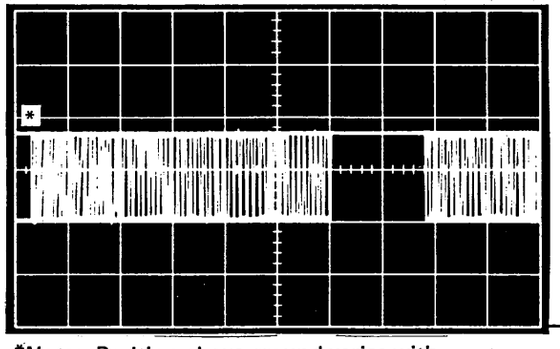
DISPLAY TEST POINTS



Note: Use X10 probe for all displays.

Video (CRT dot input)

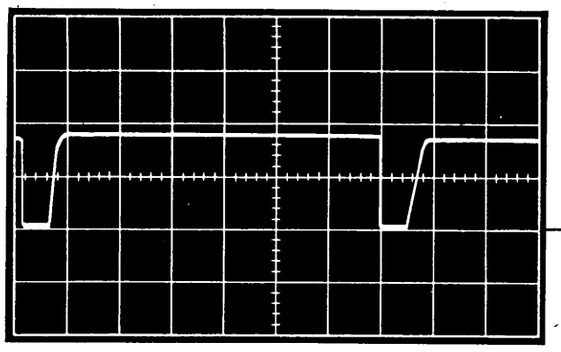
Sync trig	Int (-) dc
Sync point	None
Sweep Speed	0.5 ms/div
Probe point	Connector B07
Vert amp	0.5V/div



Video (dot amplifier)

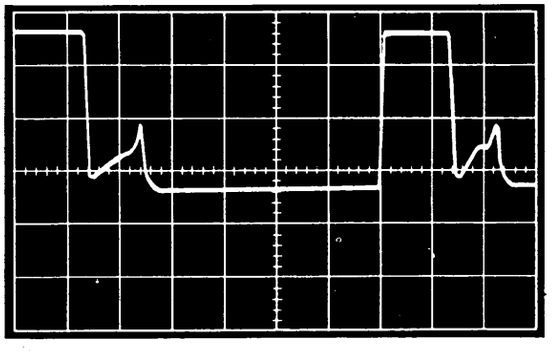
Sync trig	Int (-) dc
Sync point	None
Sweep speed	0.5 ms/div
Probe point	CRT PC board Pin 17
Vert amp	2V/div

**Note:* Position above ground varies with intensity control. Lowest position with maximum intensity.



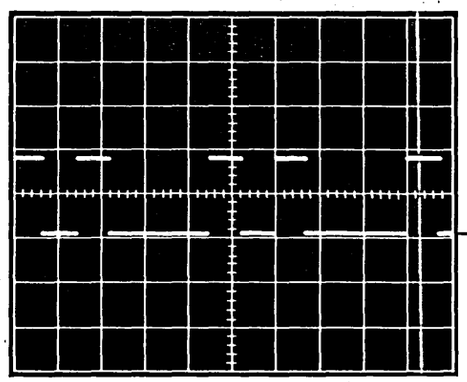
Wiggle Control

Sync trig	Int (-) dc
Sync point	None
Sweep speed	1μs/div
Probe point	Connector B05
Vert amp	0.5V/div



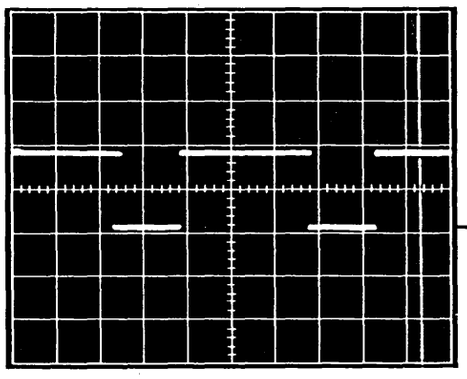
Wiggle Sweep

Sync trig	Int (+) dc
Sync point	None
Sweep speed	1μs/div
Probe point	CRT PC board Pin 13
Vert amp	1V/div



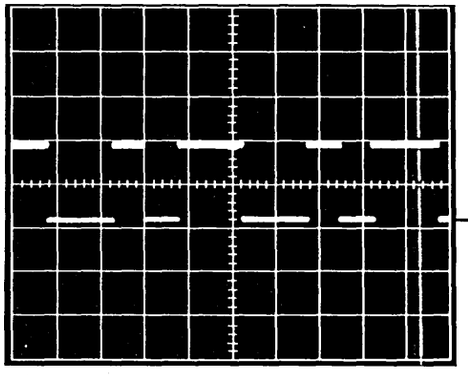
Vertical Input 1

Sync trig	Ext (+) dc
Sync point	Connector B02
Sweep speed	5 ms/div
Probe point	Connector B02
Vert amp	0.5V/div



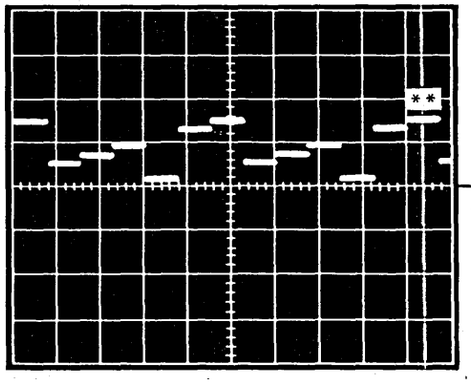
Vertical Input 2

Sync trig	Ext (+) dc
Sync point	Connector B02
Sweep speed	5 ms/div
Probe point	Connector B03
Vert amp	0.5V/div



Vertical Input 3

Sync trig	Ext (+) dc
Sync point	Connector B02
Sweep speed	5 ms/div
Probe point	Connector B04
Vert amp	0.5V/div

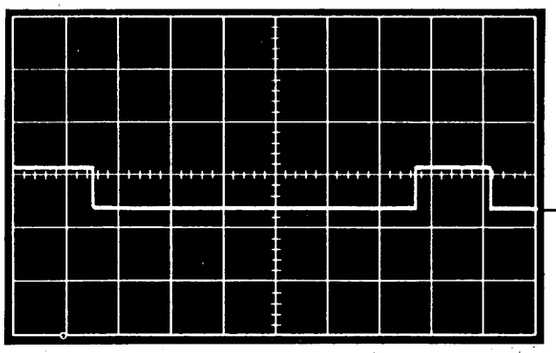


Vertical Deflection

Sync trig	(Ext (+) dc
Sync point	Connector B02
Sweep speed	5 ms/div
Probe point	Display PC board Test Point A
Vert amp	0.5V/div

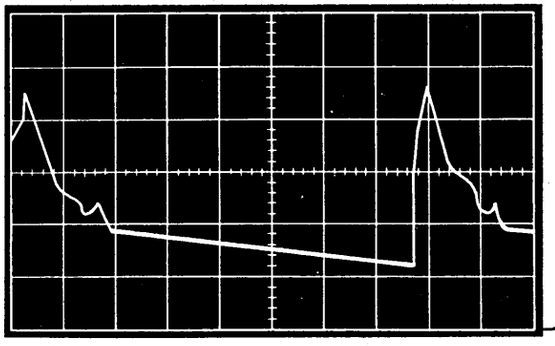
** Line 6 is top line of this pattern.
Line 1 is bottom.

NOTE: Large voltage spikes may appear at start of each step.



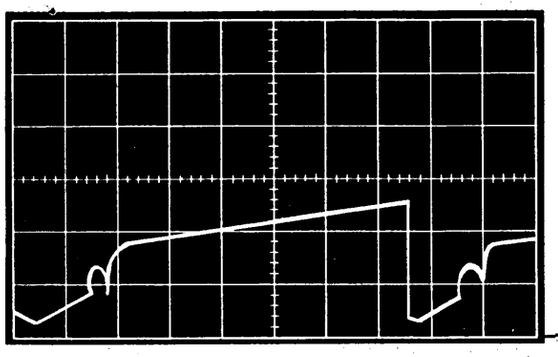
Horizontal Input (Return)

Sync trig	Int (+) dc
Sync point	None
Sweep speed	0.5 ms/div
Probe point	Connector B10
Vert amp	0.5V/div



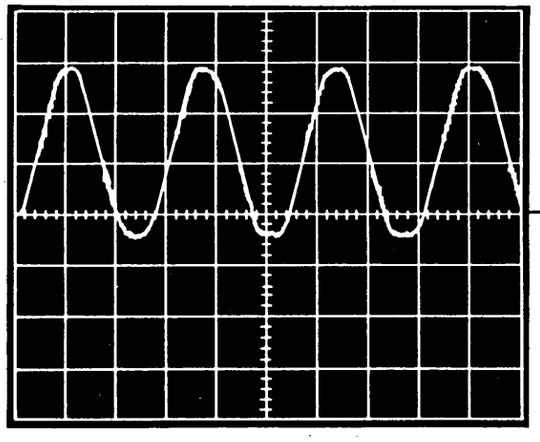
Horizontal Deflection

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	20μs/div
Probe point	CRT PC board Pin 1
Vert amp	1V/div

KEYBOARD THEORY

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INTRODUCTION

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 the selection of teleprocessing speeds, or Katakana shift.

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.

Note: This switch affects line spacing on some printers. See specific printer for details.

AUTO REC ADV (ARA)

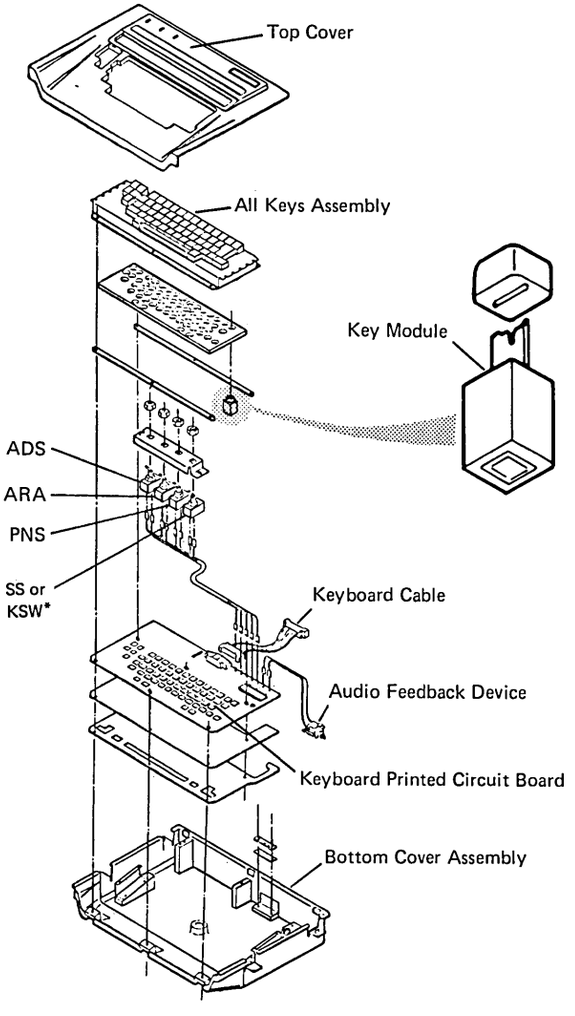
This signals the MPU that, when a complete record is entered, the MPU can automatically store the record on disk, and prepare for the next record entry.

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.

SPEED SELECT (SS)

Installed on the 3741 Model 2, World Trade only. Signals the MPU that the attached Binary Synchronous Communications Adaptor (BSCA) is running at 1200 bits per second when the switch is open or 600 bits per second with the switch closed.



* On Katakana machines only.

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. The ALPHA SHIFT, NUM SHIFT, and KANA SYMB shift keys 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.

KEYBOARD PRINTED CIRCUIT BOARD

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.

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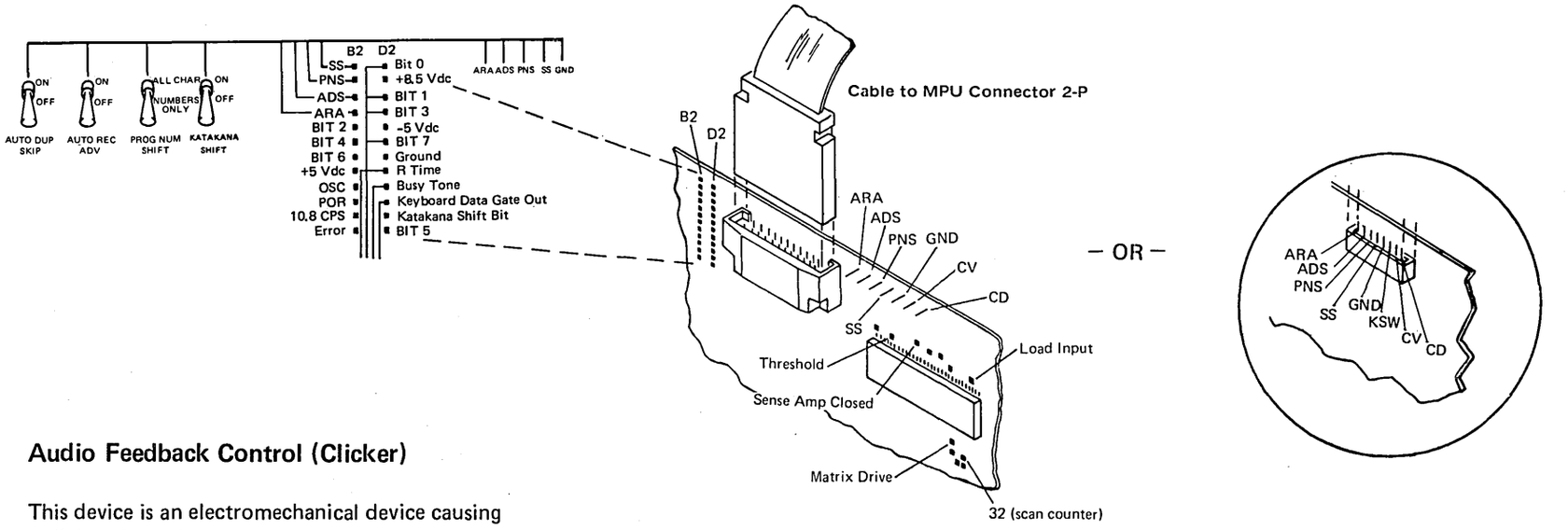


Audio Feedback Control (Clicker)

This device is an electromechanical device causing 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 can not 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 or buzz stops, the MPU signifies that it is no longer busy.

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 μs to process each key position.

These addressing and sampling schemes are accomplished in the following manner. The MPU sends oscillator pulses at 140.6 kHz 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 μs which is used to develop matrix drive pulses and to advance a scan counter.

The 6-bit binary scan counter counts from 00 to 63 continuously. At any time, the contents of this counter is the address of the key pad that the keyboard circuitry is strobing. 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" (0.152 mm) 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 four shift keys are processed somewhat differently than the rest of the keys on the keyboard. However, detection of these keys being processed 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 the ALPHA SHIFT, NUM SHIFT, or KANA SYMB shift key. 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 the ALPHA SHIFT or NUM SHIFT key 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.

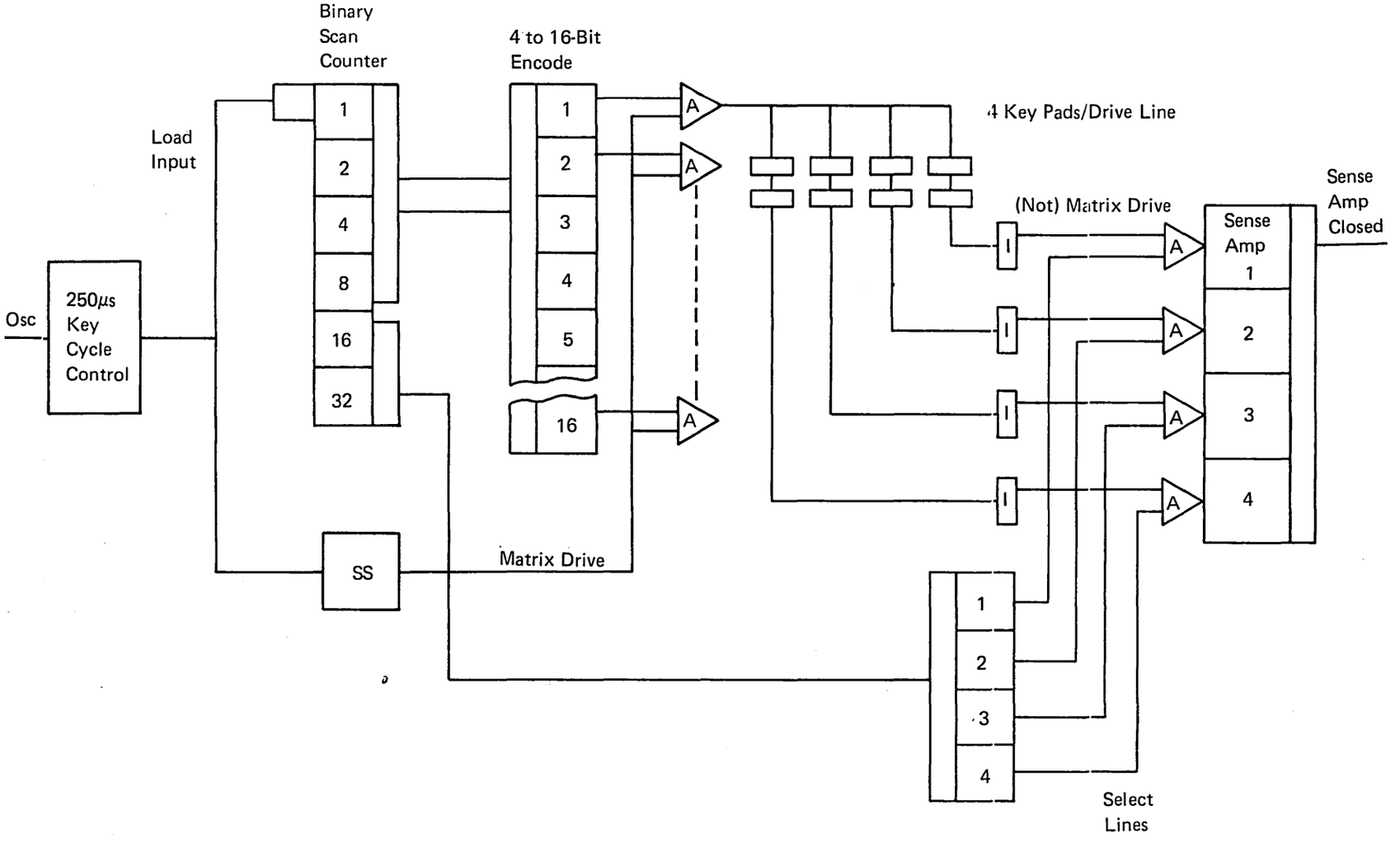
Character Repeat Function

This function provides the operator with a quick method of repetively 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

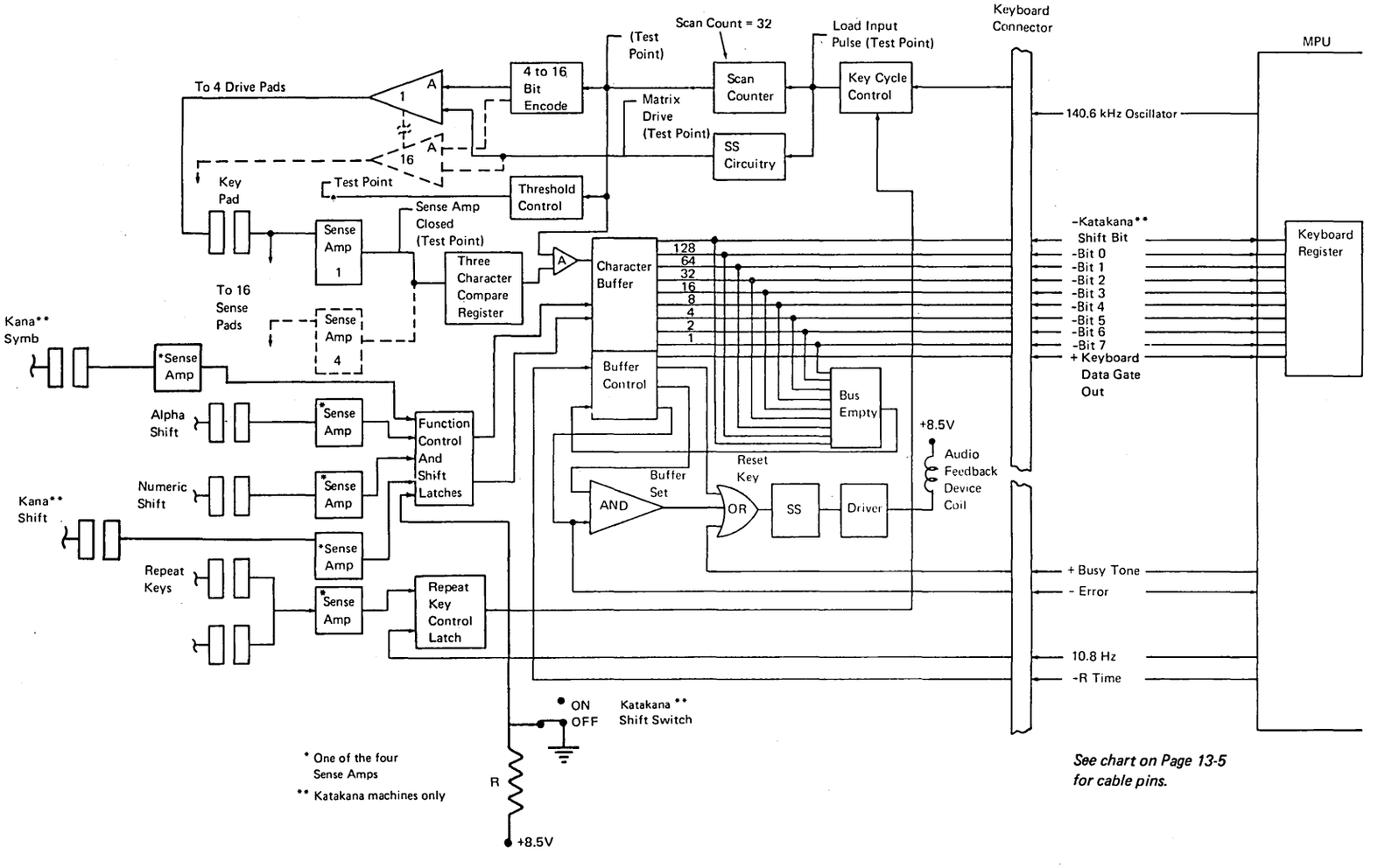
A three-character compare register is used to prevent multiple entries by a single key being pressed. If a key is pressed and held, this compare register blocks the same key code from being sent to the character buffer more than one time. Blocking continues until the character is erased from the compare 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.

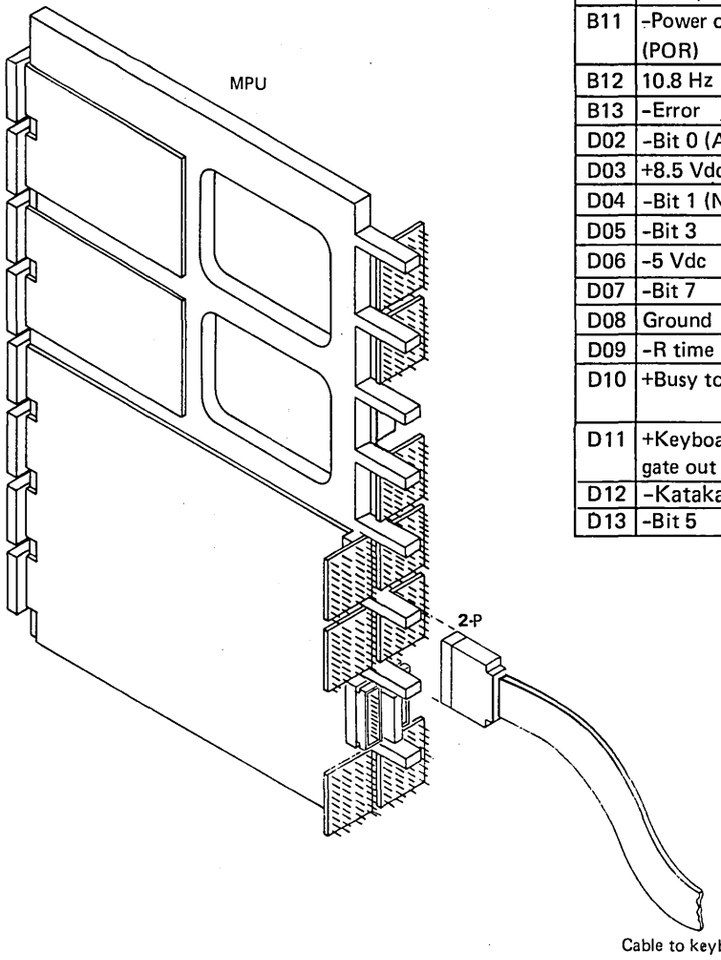
The keyboard circuitry stores the scan count plus the alpha and numeric shift bits for a character in its character buffer. It then turns on the buffer control latch and looks at all bit lines to the MPU to see if the MPU keyboard register is empty. If any one of these bit lines is at a negative level (active bit) the character stored in the character buffer is not transferred to the MPU. The bit lines can be controlled by either the MPU or the keyboard.



See chart on Page 13-5 for cable pins.

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.

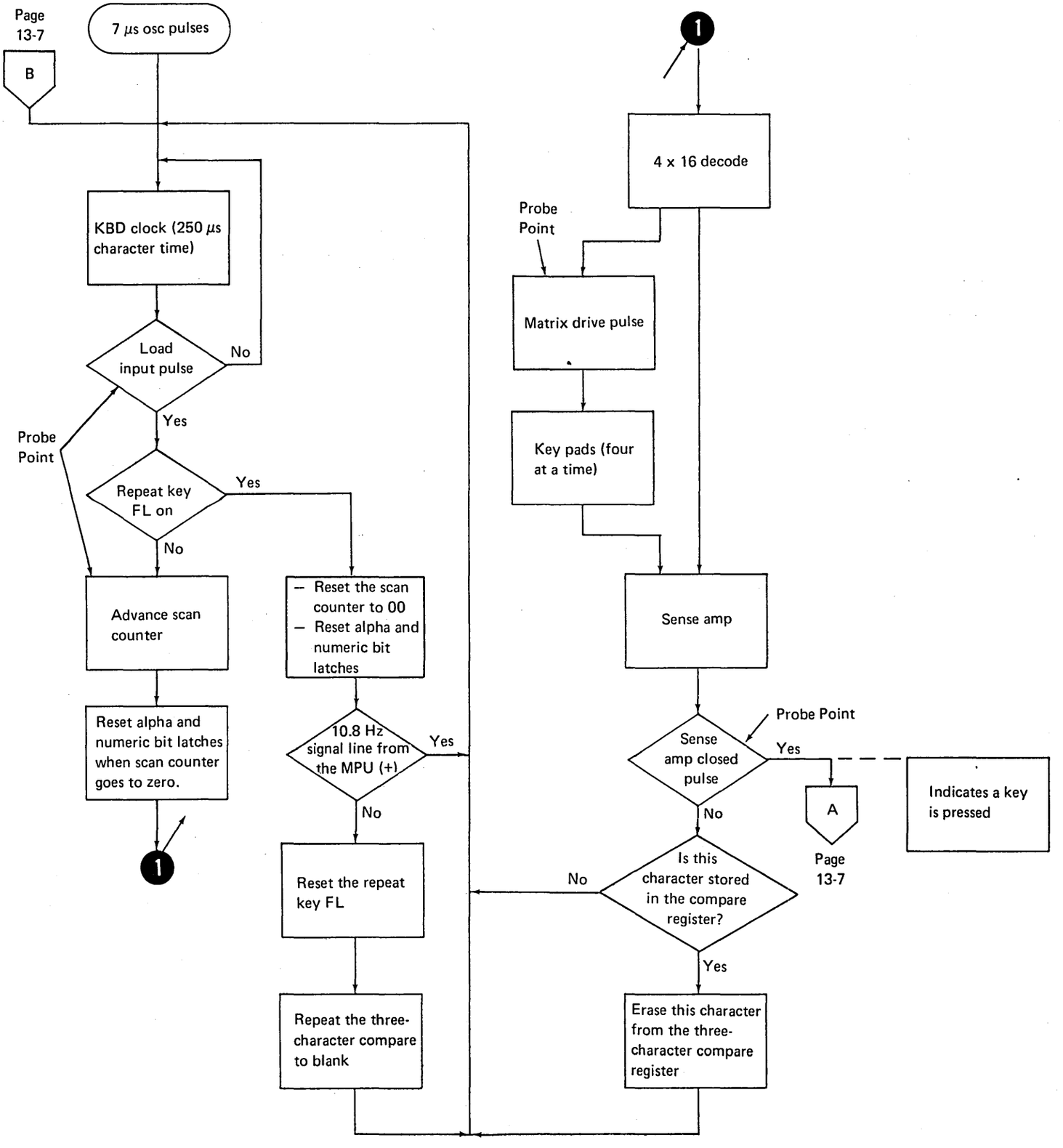
Anytime the MPU keyboard register is reset to zero (during -R time) the bus empty gate allows the buffer control to issue a 'keyboard data gate out' signal, which in turn allows data in the character buffer to be transferred to the MPU keyboard register. (Data transfer is inhibited during -R time) If 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.

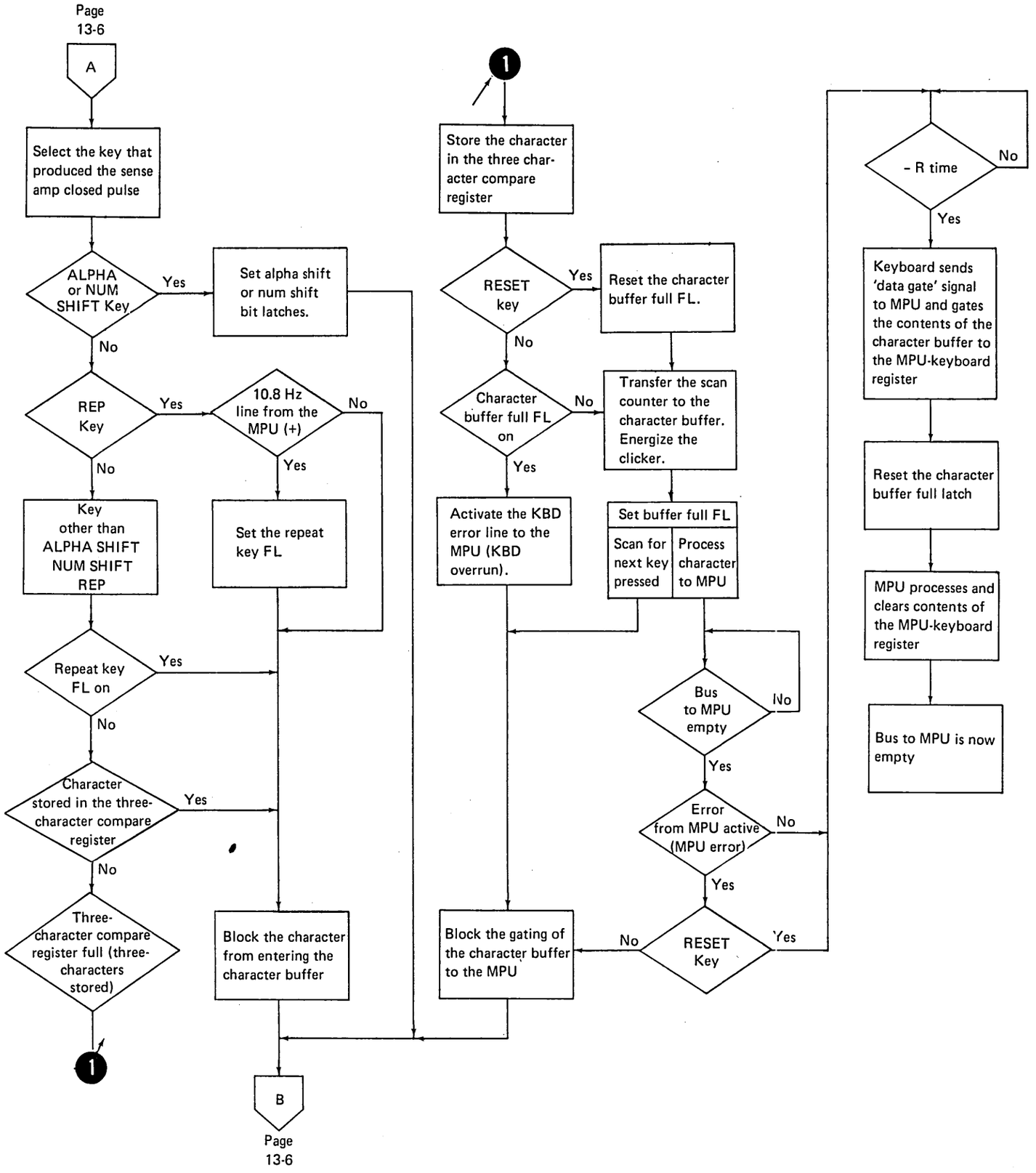


KEYBOARD CABLE PIN DEFINITIONS

B02	SPEED SELECT Switch	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.
B10	+5V 7μs oscillator	Developes 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	+Keyboard 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

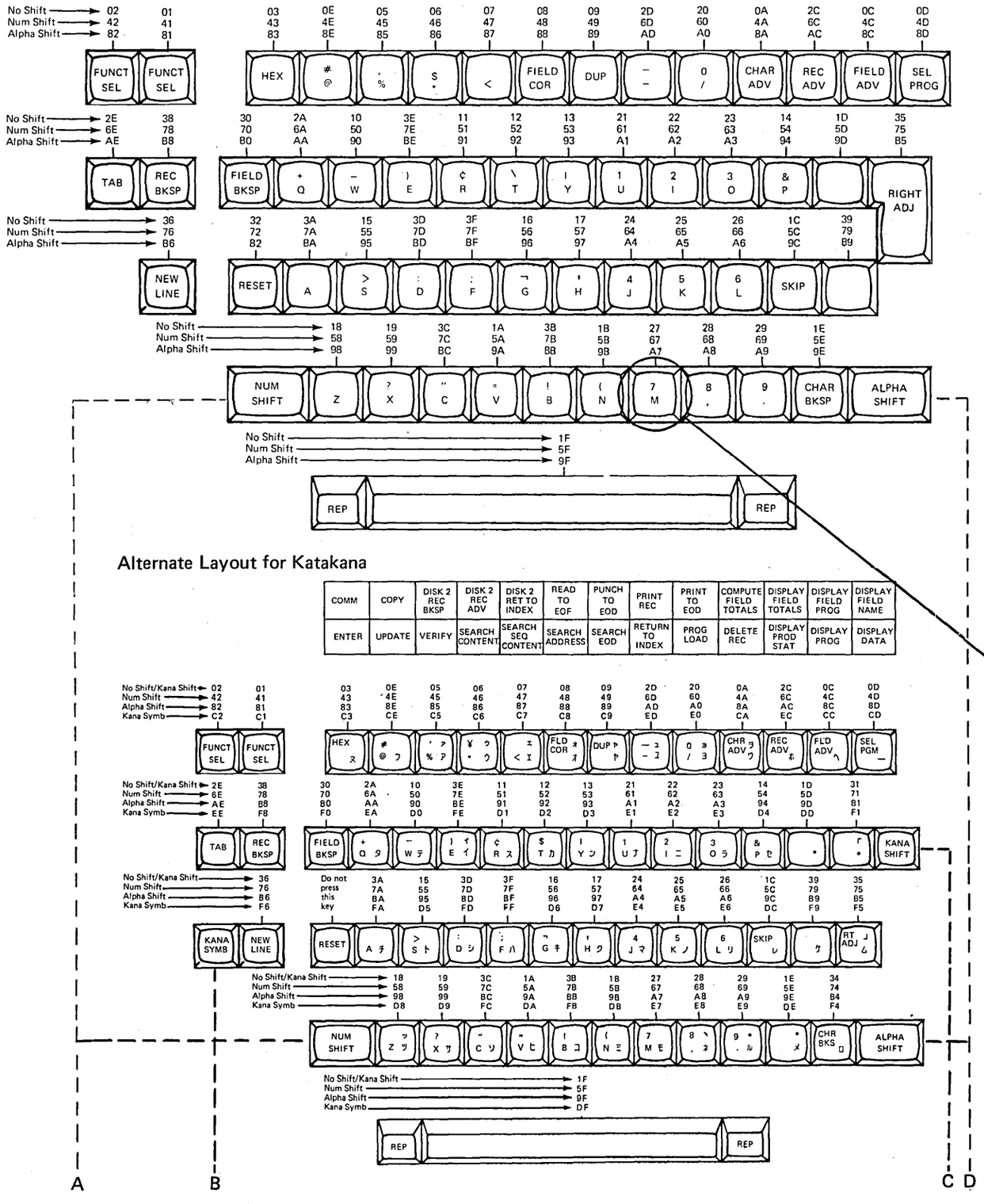



Page 13-6
A
Select the key that produced the sense amp closed pulse
ALPHA or NUM SHIFT Key
Yes
Set alpha shift or num shift bit latches.
No
REP Key
Yes
10.8 Hz line from the MPU (+)
No
Yes
No
Key other than ALPHA SHIFT NUM SHIFT REP
Set the repeat key FL
Repeat key FL on
Yes
No
Character stored in the three-character compare register
Yes
No
Three-character compare register full (three-characters stored)
Block the character from entering the character buffer
1
B
Page 13-6
1
Store the character in the three-character compare register
RESET key
Yes
Reset the character buffer full FL.
No
Character buffer full FL on
No
Transfer the scan counter to the character buffer. Energize the clicker.
Yes
Activate the KBD error line to the MPU (KBD overrun).
Set buffer full FL
Scan for next key pressed
Process character to MPU
Bus to MPU empty
No
Yes
Error from MPU active (MPU error)
No
Yes
RESET Key
No
Yes
Block the gating of the character buffer to the MPU
- R time
No
Yes
Keyboard sends 'data gate' signal to MPU and gates the contents of the character buffer to the MPU-keyboard register
Reset the character buffer full latch
MPU processes and clears contents of the MPU-keyboard register
Bus to MPU is now empty

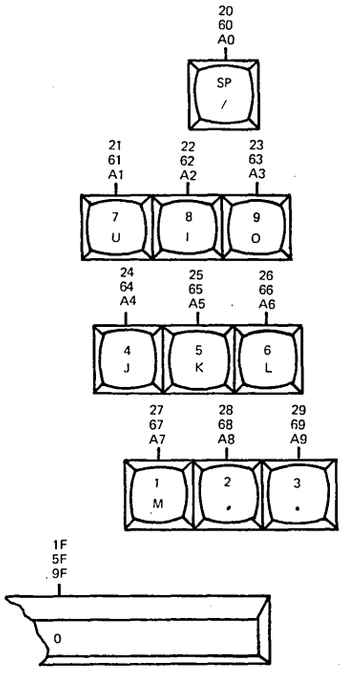
KEYBOARD INTERFACE DECODE

Objective: Decode the character M and transfer it across the data lines to the MPU.

Key Codes



Alternate layout used with proof keyboard.



Alternate Layout for Katakana

COMM	COPY	DISK 2 REC BKSP	DISK 2 REC ADV	DISK 2 RET TO INDEX	READ TO EOF	PUNCH TO EOD	PRINT REC	PRINT TO EOD	COMPUTE FIELD TOTALS	DISPLAY FIELD TOTALS	DISPLAY FIELD PROG	DISPLAY FIELD NAME
ENTER	UPDATE	VERIFY	SEARCH CONTENT	SEARCH SEQ CONTENT	SEARCH ADDRESS	SEARCH EOD	RETURN TO INDEX	PROG LOAD	DELETE REC	DISPLAY PROD STAT	DISPLAY PROG	DISPLAY DATA

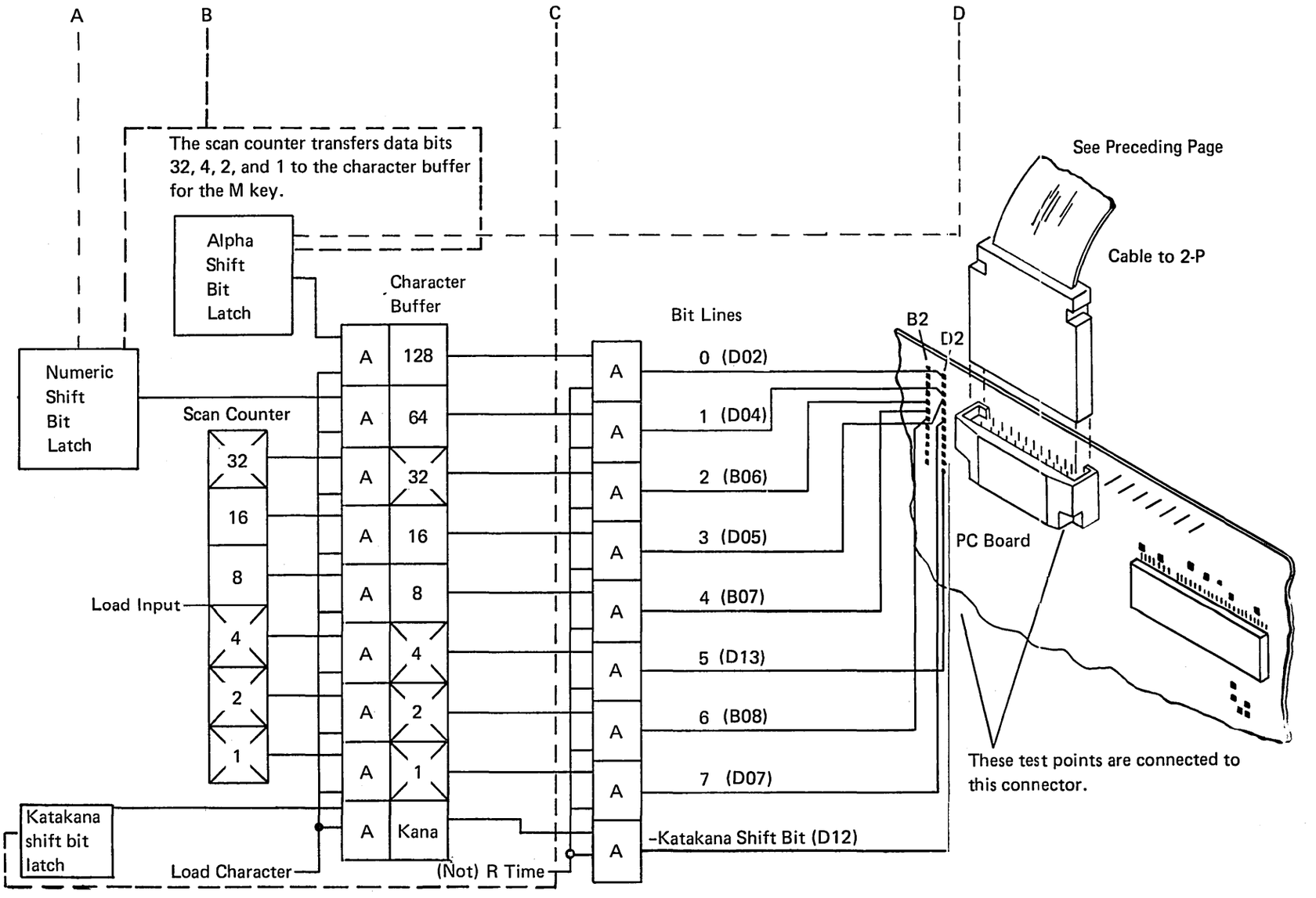
The M key is pressed.

There is a scan number associated with each key. The scan number for the M key is 39 (hex 27).

At M key scan time, the scan counter contains the binary value 39 (bits 32, 4, 2, and 1).

The character seen on the display during CE mode is the hex representation of the key address. To convert to hex, the character buffer code is divided into two segments; the upper four bits (128, 64, 32, and 16) are considered one binary number (with weight of 8. 4, 2, and 1). The lower four bits are considered a second number.

	Character Buffer Bits								
Binary Value	128	64	32	16	8	4	2	1	
Hex Value	8	4	2	1	8	4	2	1	
M Key Bits			1			1	1	1	= Scan number 39
		2				7			= Hex 27

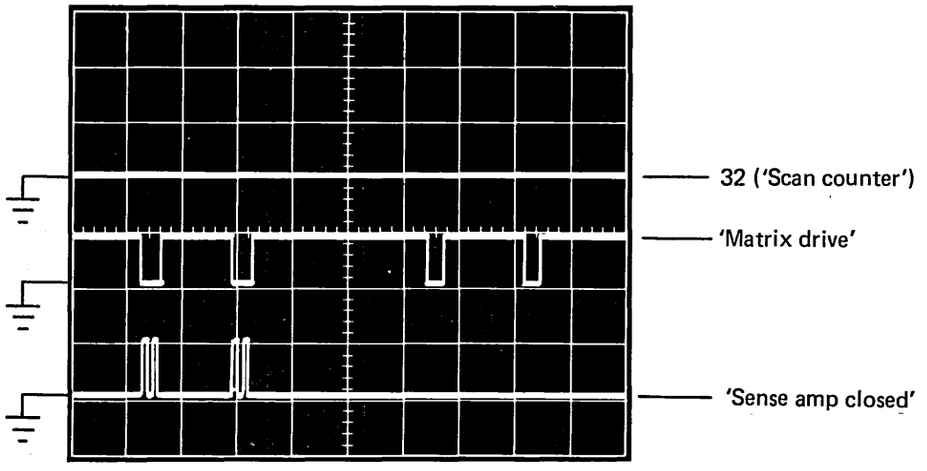


Special Keys

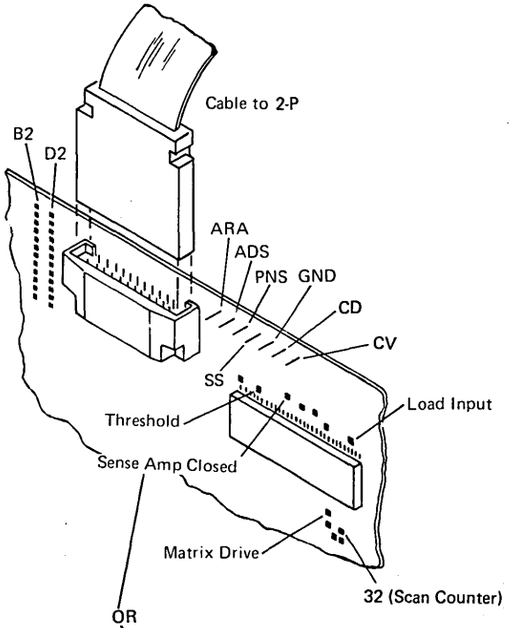
Key	Scan Number	Hex Value
ALPHA SHIFT	0	00
NUM SHIFT	4	04
RESET	50	32
REP (left)	11	0B
REP (right)	15	0F
KANA SHIFT	51	33
KANA SYMB	43	28

For the 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 (+).

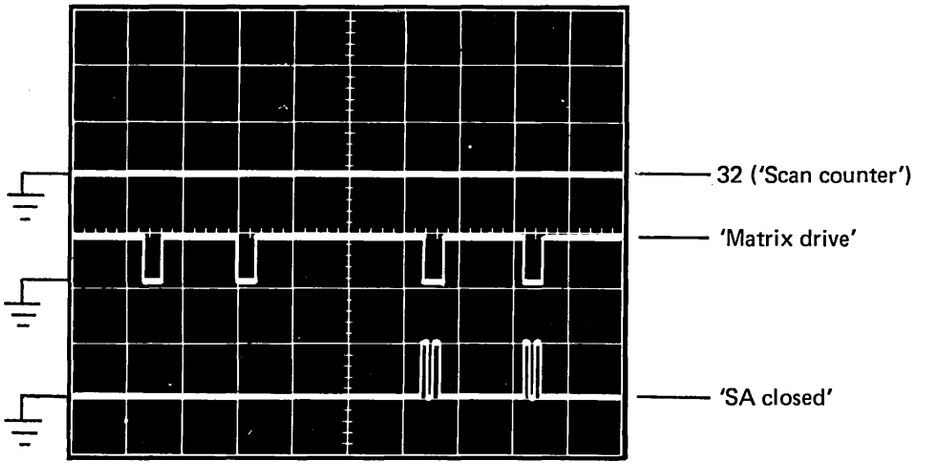
KEYBOARD TEST POINTS

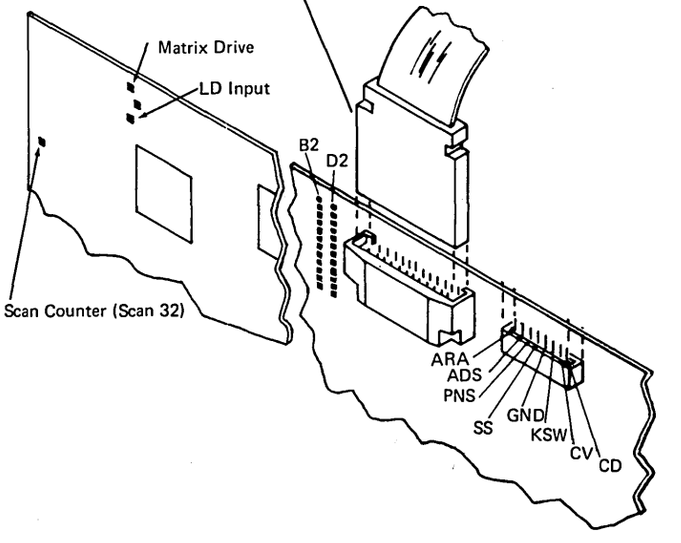


	Scan Counter Time		
ALPHA SHIFT key held down	0	Sync trig	Int (-) dc
		Sync point	32 ('Scan counter')
		Sweep speed	50μs/div
		Probe point	See above
		Vertical amp	0.5V/div

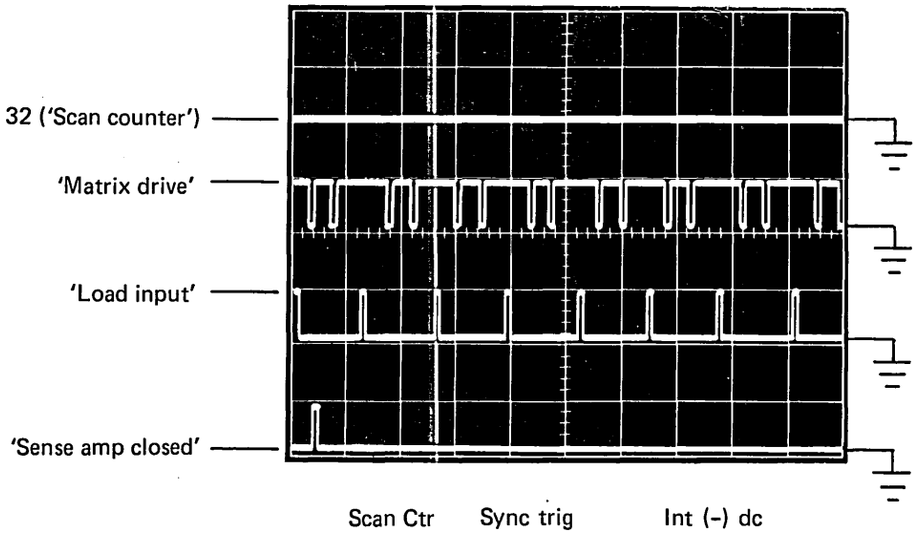


OR

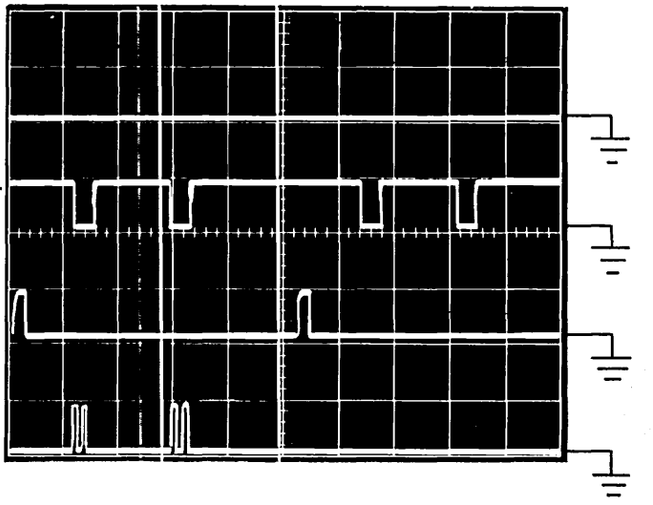




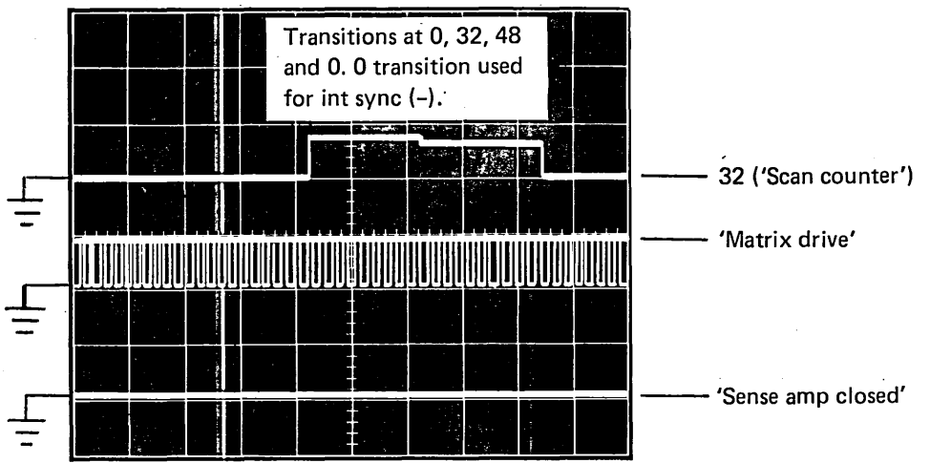
	Scan Counter Time		
FUNCT SEL lower key held down	1	Sync trig	Int (-) dc
		Sync point	32 ('Scan counter')
		Sweep speed	50μs/div
		Probe point	See above
		Vertical amp	0.5V/div



	Scan Ctr Time	Sync trig	Int (–) dc
		Sync point	32 ('Scan counter')
ALPHA SHIFT key held down.	0	Sweep speed	200μs/div
		Probe point	See above
		Vertical amp	0.5V/div

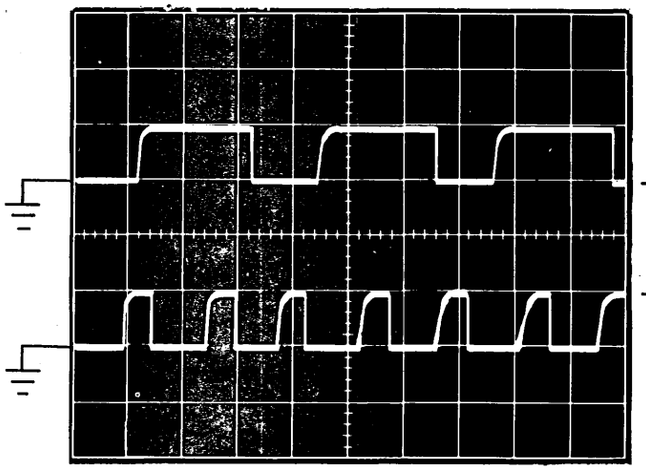


Same as to the right except that sweep speed = 50 μs.



	Scan Counter Time	Sync trig	Int (–) dc
		Sync point	'Scan counter'
F key held down.	63	Sweep speed	2 ms/div
ALPHA SHIFT		Probe point	See above
key held down.	0	Vertical amp	0.5V/div

Note: Use X10 Probe for all displays

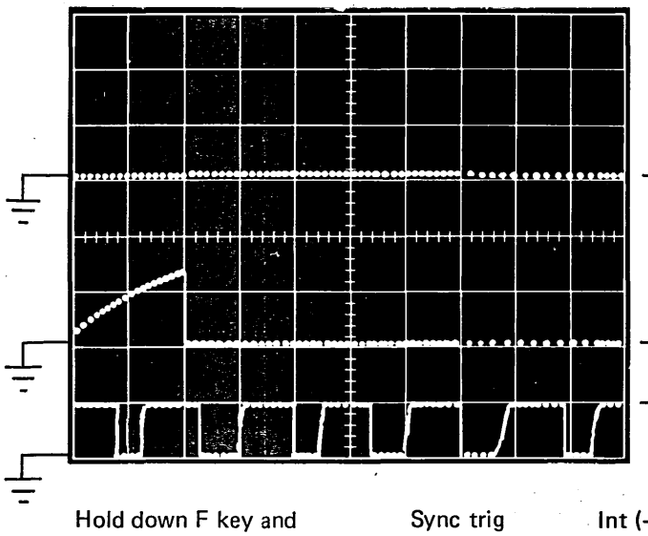


Free running signals
(-) sync on either one
(not synchronized)

D09, '-R time' from MPU

B10, 'Data Key Drive'
7.1 μs osc from display

Sync trig	Int (-) dc
Sync point	None
Sweep speed	5μs/div
Probe point	See above
Vert amp	0.5V/div



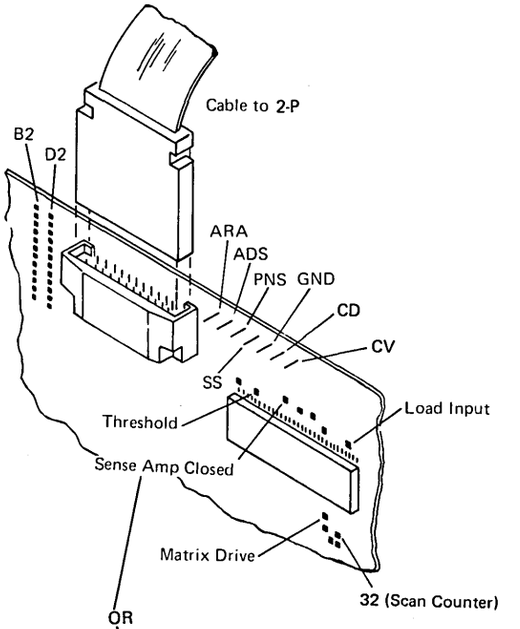
D07, '-Bit 7', (-) int sync
(could be any bit line)

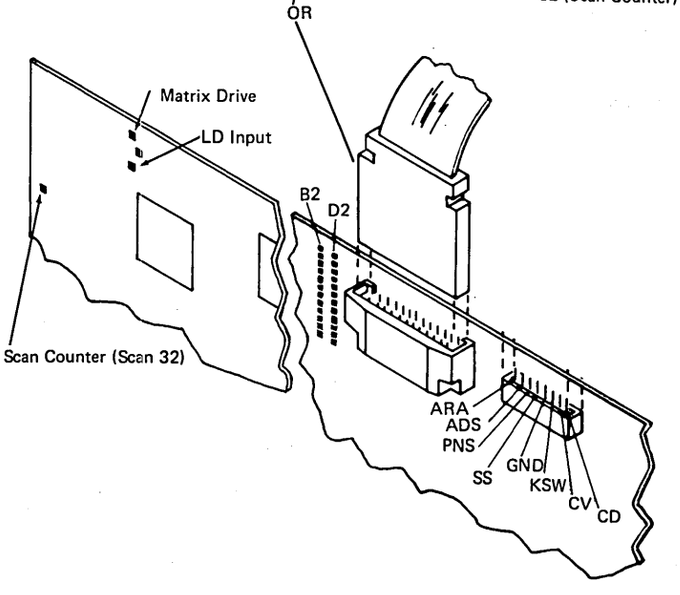
D11, 'Keyboard data
gate out'

D09, '-R time'

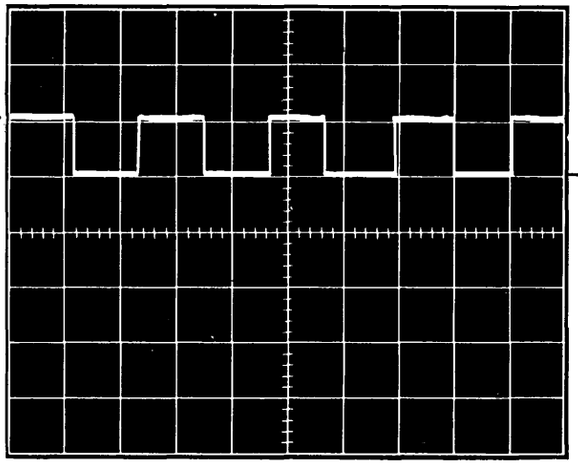
Hold down F key and
REP key

Sync trig	Int (-) dc
Sync point	D07 ('-Bit 7')
Sweep speed	10 μs/div
Probe point	See above
Vert amp	0.5V/div





D10, '+ Busy tone'
(+) int sync

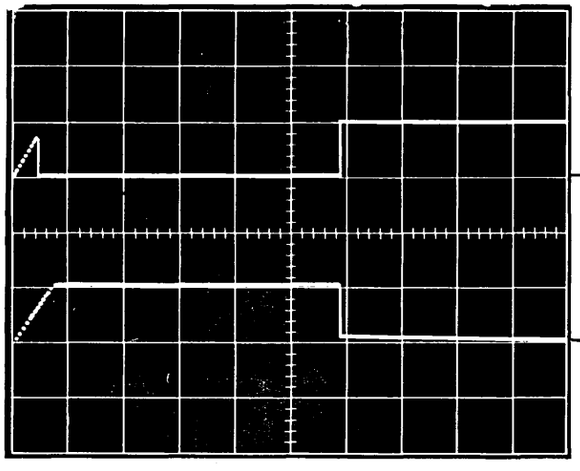


With diskette in disk drive and read/write head not in track 00, open disk drive cover.

Sync trig	Int (+) dc
Sync point	D10 '+ Busy tone'
Sweep speed	10 ms/div
Probe point	D10 '+ Busy tone
Vert amp	0.5V/div

B11, '–Power on reset'

At power supply PC board,
POR (+power on reset).
(+) int sync on POR.
Turn POWER ON switch 'on'.

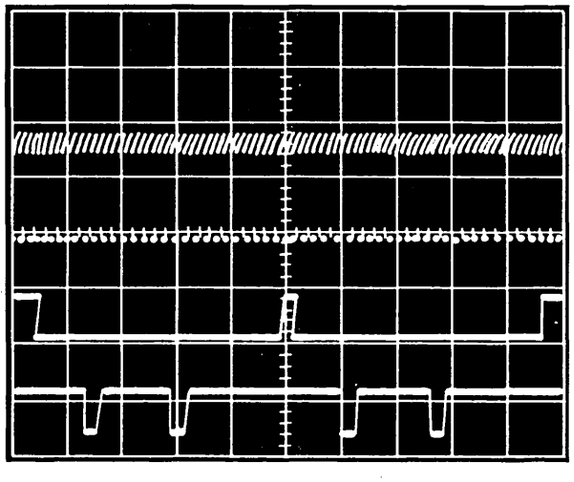


Sync trig	Int (+) dc
Sync point	POR power supply PC board
Sweep speed	200 ms/div
Probe point	See trace drawing
Vert amp	0.5V/div

B10 'Input oscillator'

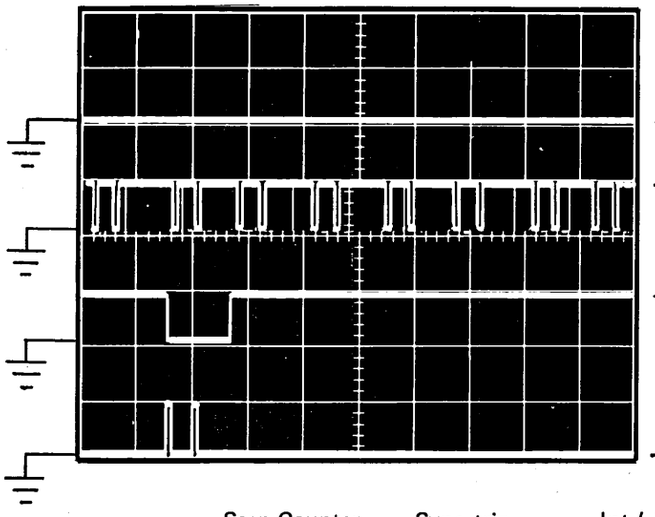
'Load input'

'Matrix drive'



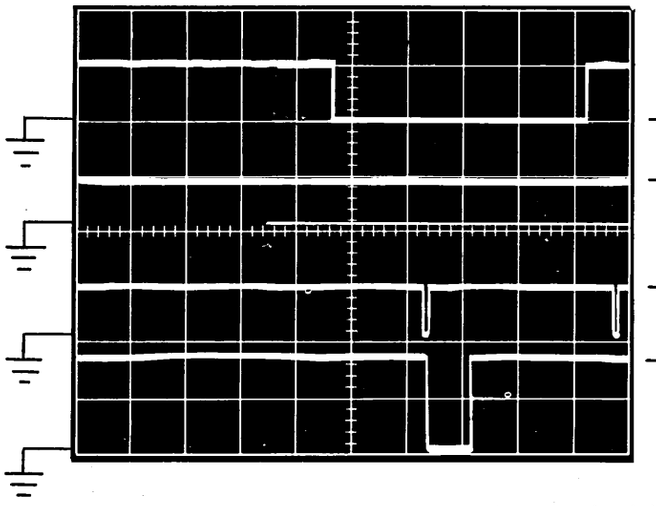
Sync trig	Ext (+) dc
Sync point	Load input
Sweep speed	50μs/div
Probe point	See trace drawing
Vert amp	0.5V/div — 'Load input'
	— 'Matrix drive'
	0.2V/div — 'Input oscillator'

Note: Use X10 Probe for all displays.



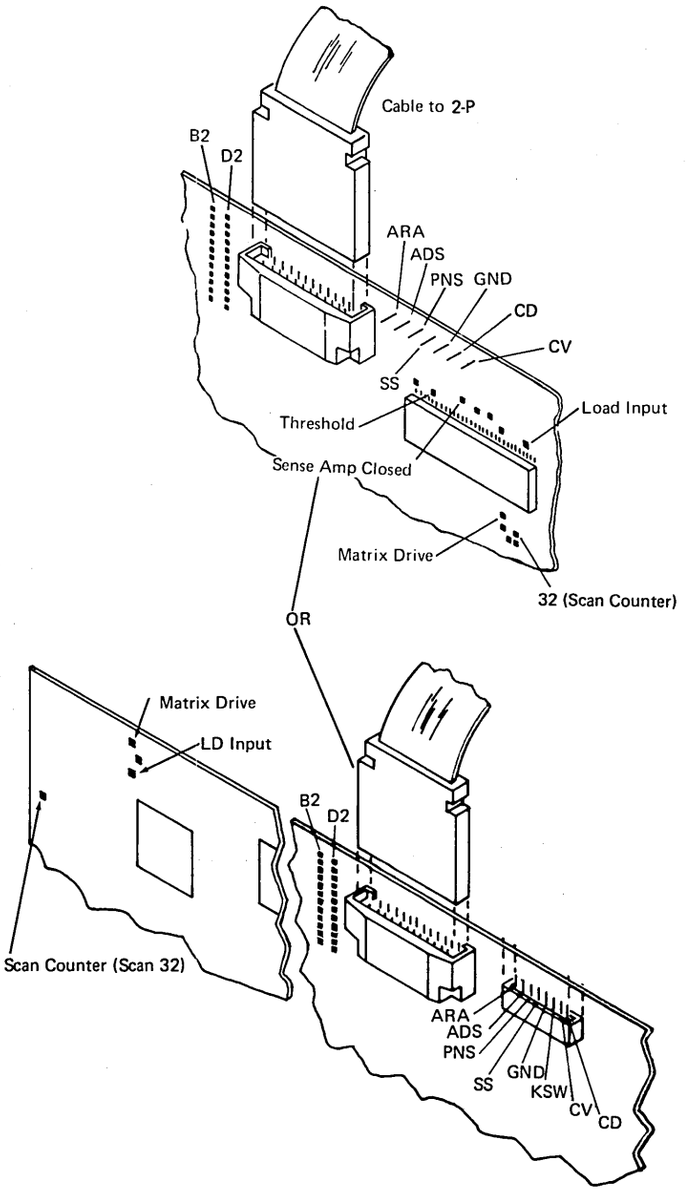
FUNCT SEL Scan Counter / Time / 1
lower held down.

Sync trig	Int (–) dc
Sync point	32 ('Scan counter')
Sweep speed	200μs/div
Probe point	See above
Vert amp	0.5V/div

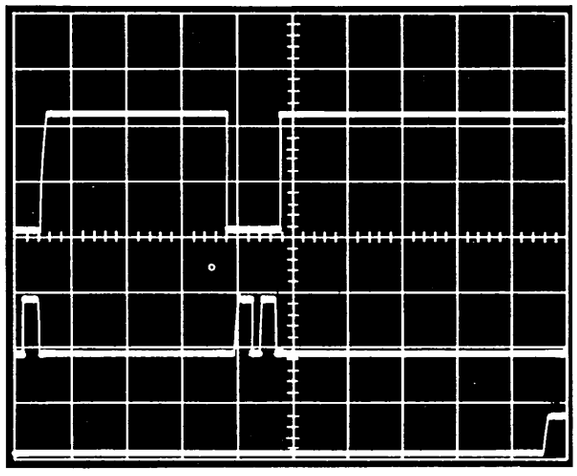


The N key held down with REP

Sync trig	Int (+) dc
Sync point	B12 ('10.8 Hz osc')
Sweep speed	10 ms/div
Probe point	See above
Vert amp	0.5V/div

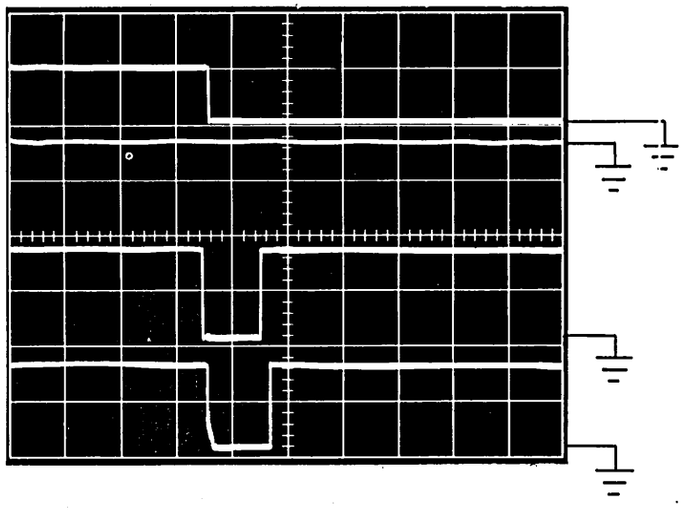


The L key held down.



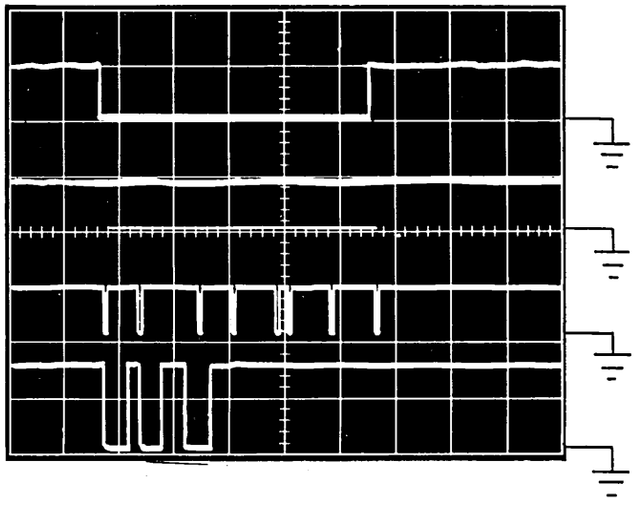
Sync trig	Int (–) dc
Sync point	'Threshold control'
Sweep speed	20μs/div
Probe point	See trace drawing
Vert amp	0.5V/div – 'Threshold control'
	0.2V/div – 'Matrix drive'

The U key held down with REP



Sync trig	Int (+) dc
Sync point	B12 test point
Sweep speed	10 ms/div
Probe point	See trace drawing
Vert amp	0.5V/div

The U, B, N, and REP keys held down simultaneously.



Sync trig	Int (+) dc
Sync point	B12 test point
Sweep speed	5 ms/div
Probe point	See trace drawing
Vert amp	0.5V/div

Note: Use X10 Probe for all displays.

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MPU Theory

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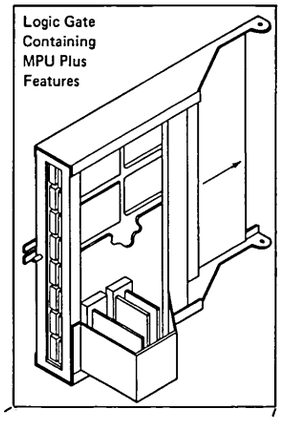

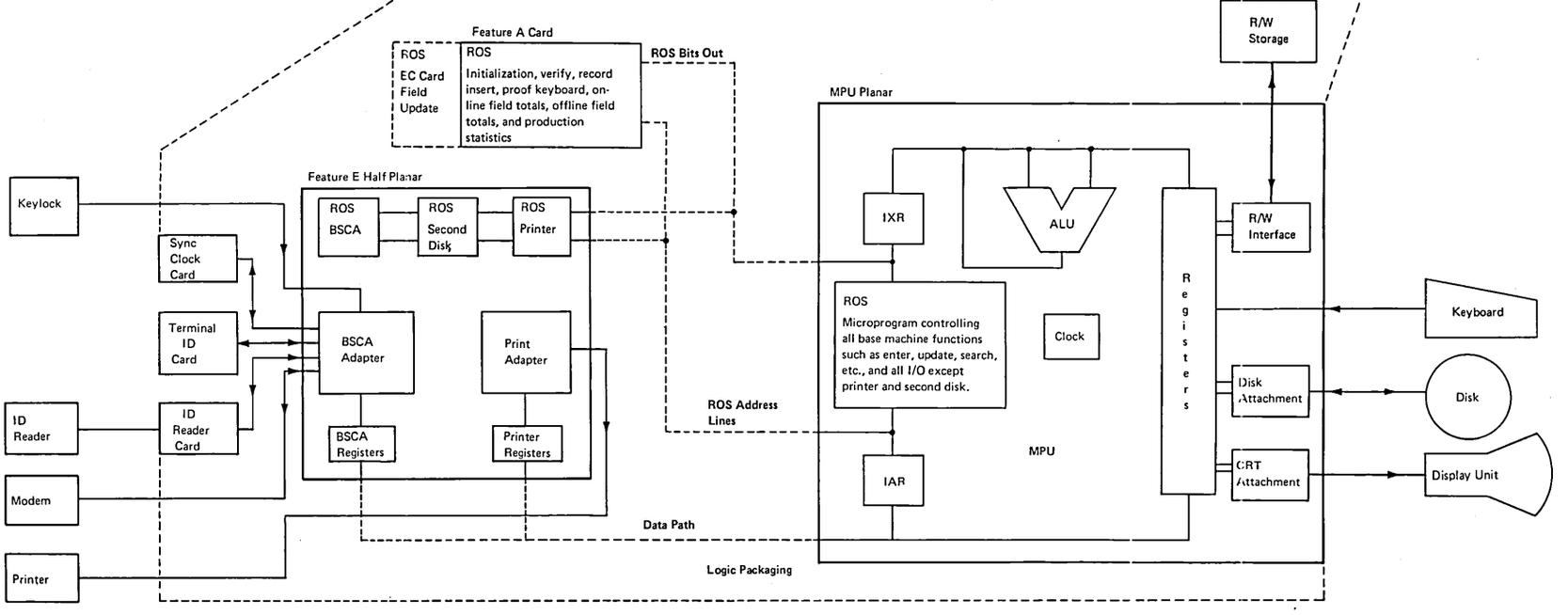

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INTRODUCTION

The MPU (microprocessing unit) is the control center of the 3741. The MPU receives data from the keyboard, controls the displaying of the data, and manages the flow of information to and from the disk units.

The keyboard, display unit, disk unit, and the power supply are external to the MPU. The MPU consists of the following functional units:
- Microcontroller (sometimes called MPU)
- R/W (read/write) storage/MPU interface
- Keyboard attachment
- Disk unit controller and VFO card
- Display unit controller
- R/W memory card

These units are on the MPU planar (a full planar). When special features are added, the MPU becomes larger. An attachment half planar, feature half planar, and Model 3/4 half planar may be included in the MPU depending on the features supplied. The addition of the feature half planar adds two functional units:
- Printer controller
- BSCA controller and associated cards

The attachment half planar adds logic for either a data recorder attachment or an I/O adapter.

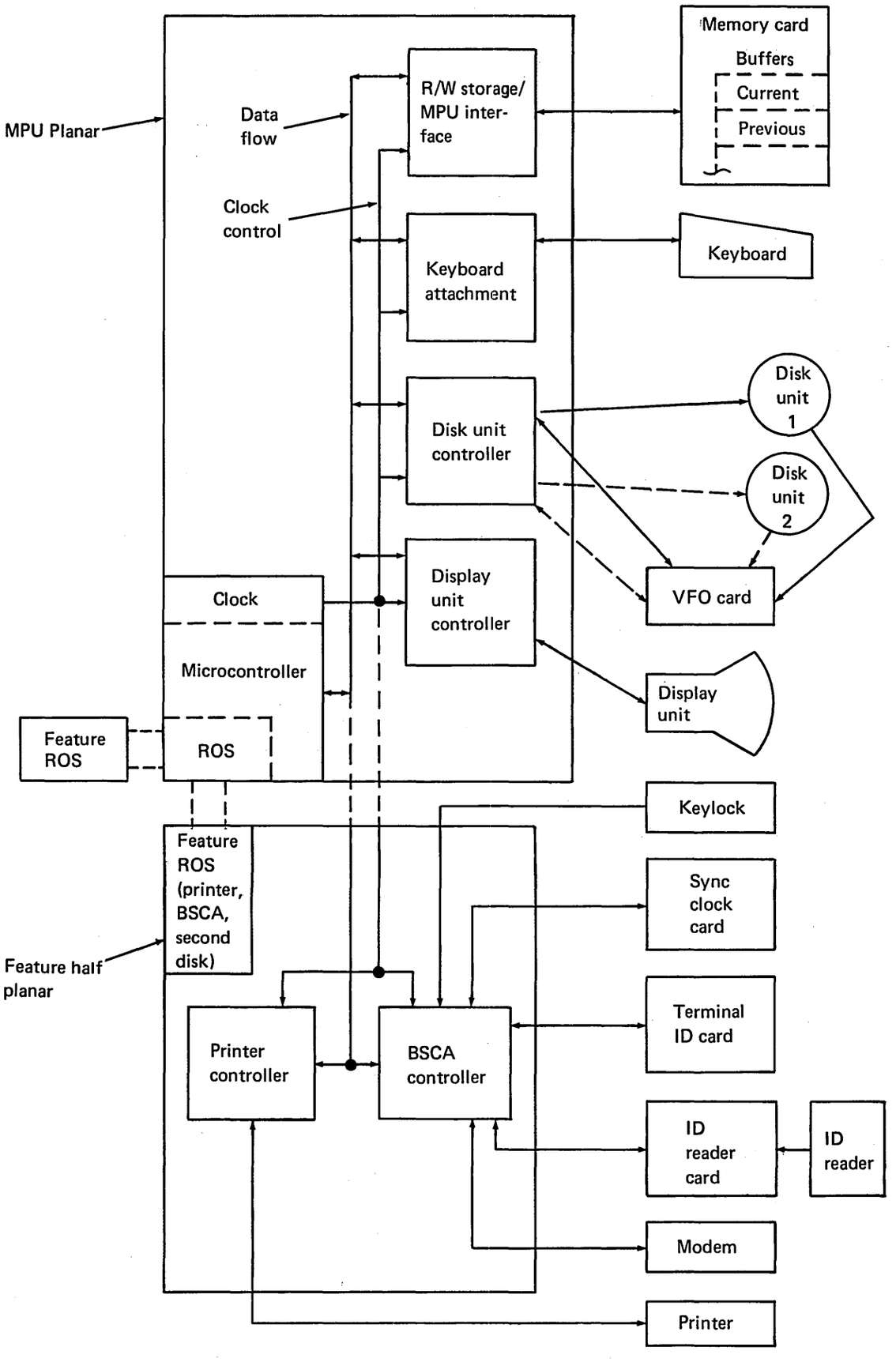
The Model 3/4 half planar supplies the logic for the IBM 3741 Programmable Work Station.

The diagram at the right shows the units and a simplified data flow. A detailed data flow diagram is on the following pages.

DATA FLOW

Keyboard to Current Buffer

- Keyboard to keyboard attachment
- Keyboard attachment to microcontroller
- Microcontroller to current buffer (under control of the R/W storage/MPU interface)



Current Buffer to Disk*

- Current buffer to disk unit controller under control of R/W storage/MPU interface.
- Disk unit controller to disk unit. All records written on the diskette 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 against 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 from the disk unit into the disk unit controller where the CRC is verified. This occurs one revolution after the write operation.

Disk Unit to Buffer*

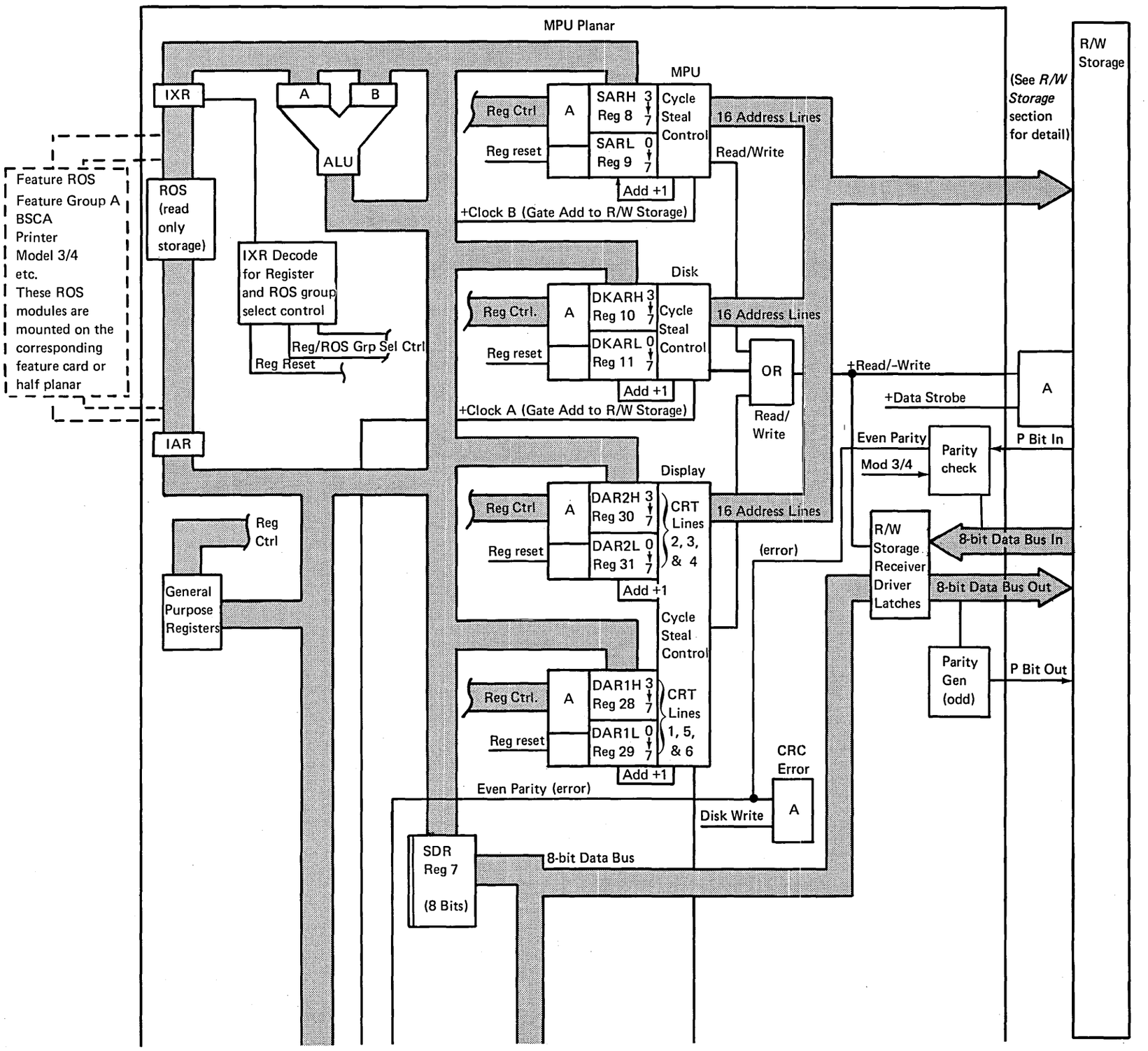
- Disk unit to disk unit controller.
- Disk unit controller to buffer under control or the R/W storage/MPU interface.

Buffer to Display Unit

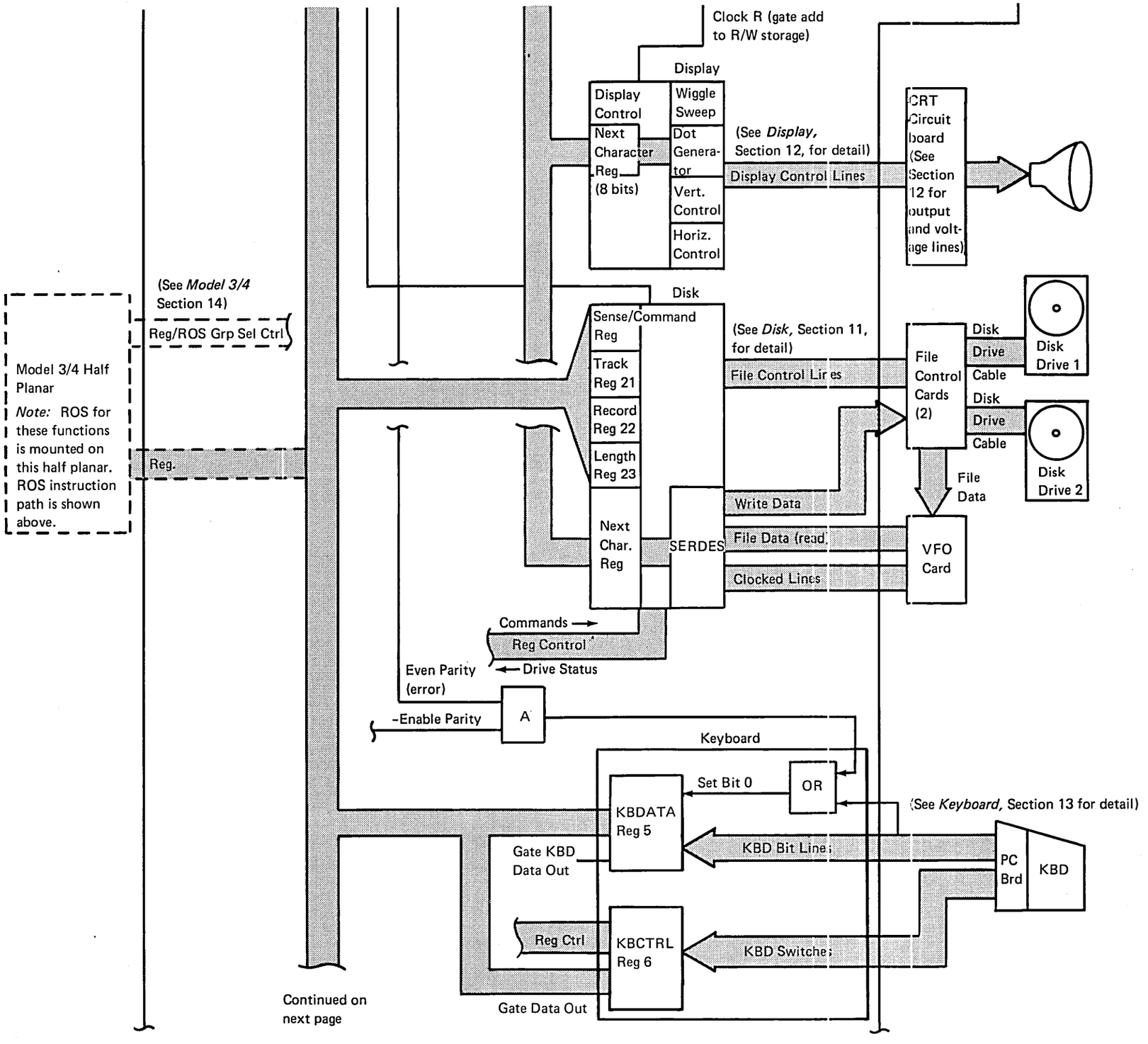
- Buffer to display unit controller.
- Display unit controller to character generator.
- Character generator to display unit controller.
- Display unit controller to display unit.

*All data flow between the disk unit and the buffer occurs in blocks of one record at a time. The actual transfer is done 1 byte at a time.

3741 System Data Flow (Part 1 of 3)



3741 System Data Flow (Part 2 of 3)



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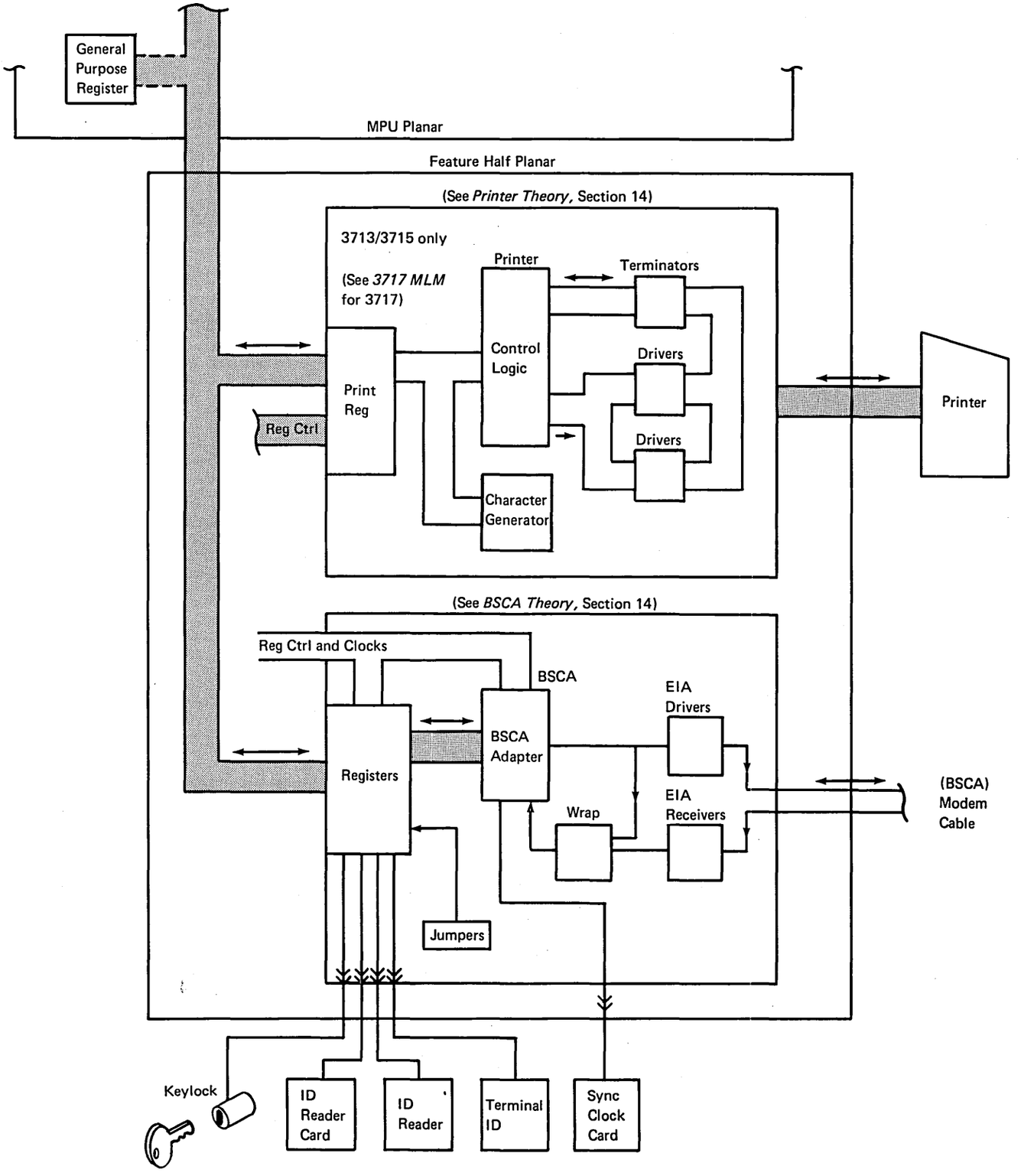
3741 System Data Flow (Part 3 of 3)



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FUNCTIONAL UNITS

Microcontroller

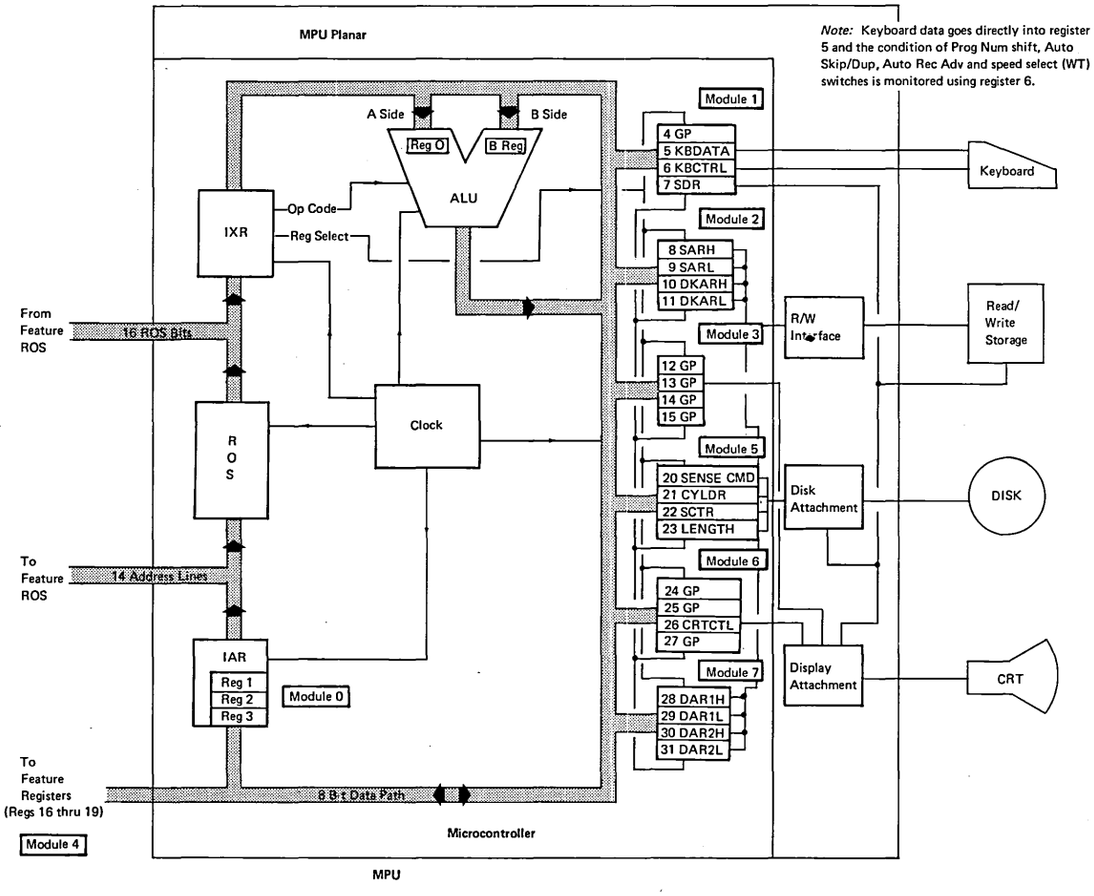
The microcontroller in the MPU is central in nearly all 3741 operations. It is a computer that is program controlled and performs internal machine operations such as testing and comparing data, checking for machine errors, operating the input and output devices, and storing and retrieving data from R/W storage.

The programs that control the microcontroller are permanently wired into read only storage (ROS) hardware modules on the planar(s). When features are added to the basic 3741, ROS that contains the microprogram routines to support the added features is added. Also, on features such as BSCA, printer, and Models 3 and 4, registers are connected to the data path for data transfer between the microcontroller and these features.

Both ROS and the microcontroller are needed to perform machine operations. One is useless without the other. Please remember that when the microcontroller is said to perform an operation, the microcontroller is controlled by a ROS on the MPU planar or one of the feature cards or half planars. The microcontroller is controlled by only one ROS program at a time as determined by the operation being performed.

The microcontroller, under control of the ROS controls all machine functions. It moves data from the keyboard into a buffer. It moves data into the display buffer and controls the display attachment. It controls the printer and BSCA operations, monitors machine and operator errors, and posts error messages on the CRT when needed.

When features are added to the 3741, hardware is usually added. For instance, feature A adds, to the logic gate, a card containing ROS programs that enable the microcontroller to perform operations such as verify, field totals, and production statistics. The counters and buffers used for these operations are storage areas within the R/W memory card already installed.



Register	Name	Function
4	GP	General purpose.
5	KBDATA	Contains the last key code entered.
6	KBCTRL	Stores 3741 control information example: Bit 0 on = AUTO DUP/ SKIP
7	SDR	Used to interface data to and from data buffer.
8	SARH	Storage address register high.
9	SARL	Storage address register low.
10	DKARH	Disk address register high.
11	DKARL	Disk address register low.
12	GP	General purpose.
↓	↓	↓
19	GP	General purpose.

Register	Name	Function
20	Sense/CMD	Disk sense and command 2nd register.
21	CYLDR	Disk cylinder address register (track number).
22	SCTR	Disk sector address register.
23	LENGTH	Holds binary length count of disk record size.
24	GP	General purpose.
25	GP	General purpose.
26	CRTCTL	CRT lines register.
27	GP	General purpose.
28	DAR1H	1st display register-high bits (CRT lines 1, 5, and 6).
29	DAR1L	1st display register-low bits (CRT lines 1, 5, and 6).
30	DAR2H	2nd display register-high bits (CRT lines 2, 3, and 4).
31	DAR2L	2nd display register-low bits (CRT lines 2, 3, and 4).

The microcontroller receives data from the keyboard through the keyboard attachment on the MPU planar. The microcontroller analyzes the data to find what is to be done with it. Control information, such as the code for the record advance key, causes the microcontroller to perform the desired function if all conditions are met. (For example, the microcontroller would record advance only if a diskette was loaded and ready.) Data information is first checked. If the data is OK for the operation, it is stored in the current record buffer of R/W storage. If the data is not OK, a keying error is displayed.

Units within the microcontroller in addition to ROS are:
- IXR (instruction decode register)
- Storage registers
- IAR (instruction address register)
- ALU (arithmetic logic unit)

ROS (Read Only Storage)

ROS is the area in the microcontroller where the controlling program routines for machine functions are permanently stored. Where extra features such as printer, second disk, BSCA, etc, are added to the basic 3741, additional ROS containing feature functions is installed. The 3741 ROS program is started every time the machine is powered-on. The first part of the program is a basic diagnostic routine (see *Power-On Sequence and Diagnostic Routine* flowchart on page 14-2.18). The power up ROS routine moves the disk head to track 00, and checks the general purpose registers and the first 2K bytes of R/W storage. The program then goes into a loop waiting for disk insertion. The instructions in the program are 16 bits long and the lines used to carry the instructions are '-ROS bits 0 thru 15'. The accessing and gating-out of the instructions is achieved by '-address bits 0 thru 14' (bit 5 not used) together with '+charge array degate address' and '+flush array'. The array pulses are originated in the clock module and should be continuously pulsing. The 'address' lines are controlled by the IAR, and their condition is dependent on the address being accessed.

The ROS on the MPU planar is contained in four separate modules and the signal '+charge array degate address' is fed to each one of these modules.

The ROS program that controls the MPU can be located on any one of several field replaceable units (FRUs). For example, when a line is to be printed, the operation starts in base machine (Model 1 or 2) mode. The base machine ROS (on the MPU planar) passes control of the MPU to the printer ROS, in the feature half planar, to print the line. When the operation is complete, the printer ROS returns control of the MPU to the base machine ROS, where the next step is started.

IXR (Instruction Decode Register)

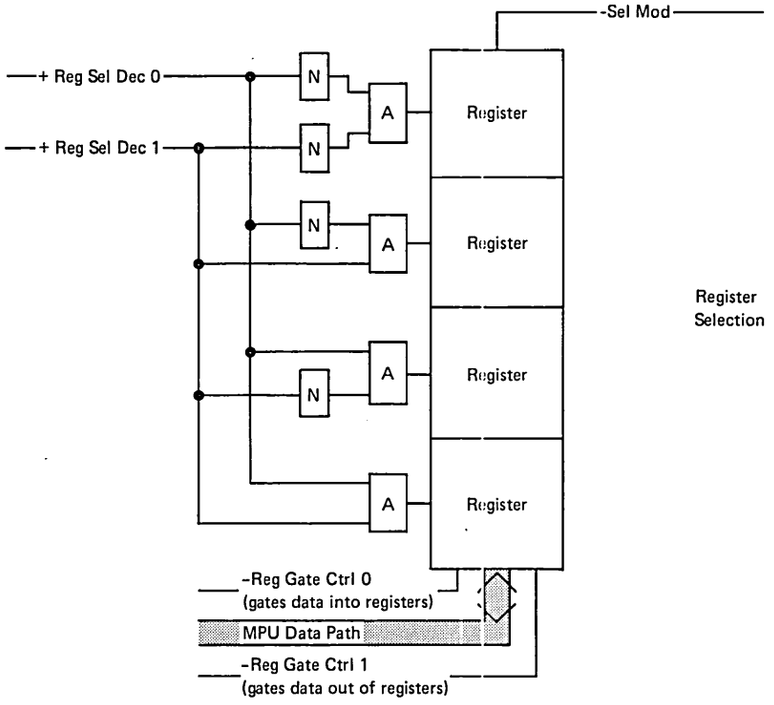
IXR accepts the 16-bit instruction from ROS, decodes it, and sets up the operation to be done. It does this by selecting the registers to be used in the instruction and then informing the arithmetic logic unit (ALU) of the type operation to be done. The register selection is done by first selecting the module that contains the register and then selecting the register within the module. The ALU is informed of the type of operation (add, subtract, etc) by the op code lines from the IXR.

Storage Registers

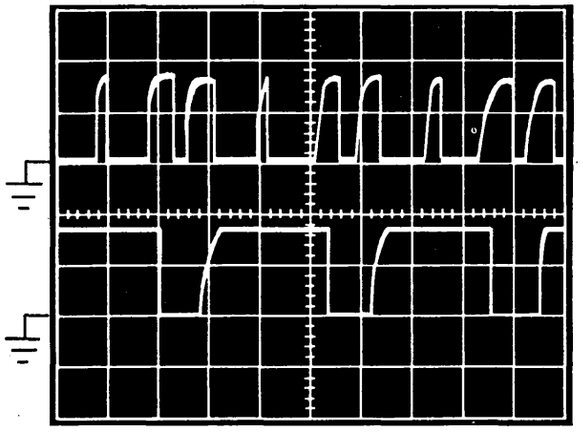
These are 8-bit temporary storage devices. Additional registers are used when feature half planars are installed. Some of the registers are used with the input/output devices and have specific functions. Others are general purpose registers used in internal microcontroller operations. Register selection is done by the IXR after it decodes the ROS instruction. The module is selected first and then the register within the module is selected by the signal lines '+reg sel dec 0' and '+ reg sel dec 1' in binary combination. Gating to the module is controlled by '-reg gate ctrl 0' and gating from the module is controlled by '-reg gate ctrl 1'. These two continuously running signals originate in the clock module.

IAR (Instruction Address Register)

The IAR sets up the accessing of ROS to be either self-incrementing or controlled by the microcontroller. Registers 1, 2, and 3 are within the IAR module and are used for this purpose. If, for example, the machine is in enter mode and CE mode is to be selected, the request is made from the keyboard. The microcontroller interprets the FUNCT SEL and data key and loads the IAR registers with a value that will give the address lines to access the CE-mode program-routine in ROS. Once in the routine, the IAR self-increments through the instructions. The address lines are common to all ROS in the machine. Feature ROS is accessed by the same IAR, and all ROS instructions are decoded by the same IXR.



Test Points

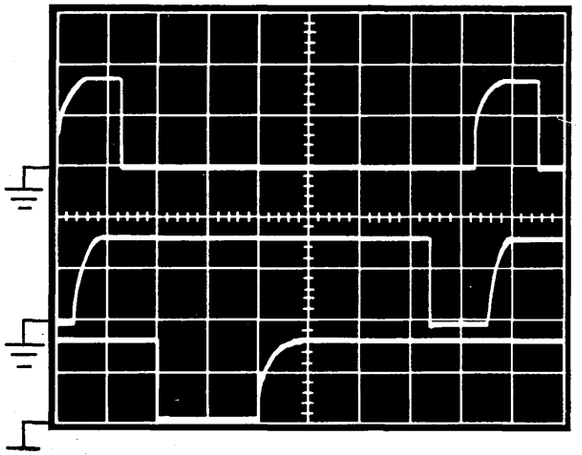


2-L-D03 — 'Reg gate ctrl 1'

2-L-D06 — 'Reg gate ctrl 0'
int sync (–)

Clock pulses
continuous while power is on.

Sync Trig	Int (+) dc
Sync Point	2-L-D06 ('-Reg gate ctrl 0')
Sweep Speed	5 μs/div
Probe Point	See above.
Vert Amp	0.5V/div



'+Charge array' — 1-C-D08
(+) Int sync

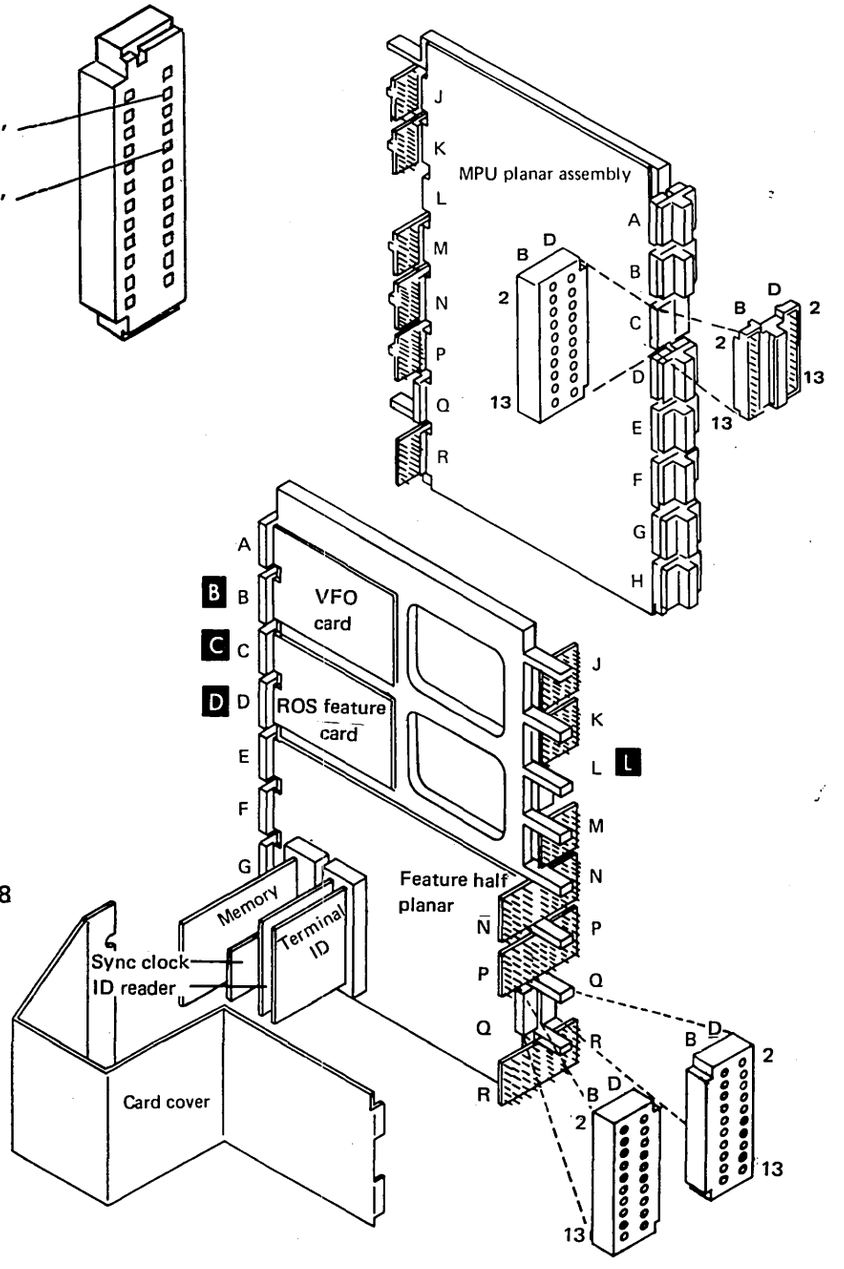
'-Reset ROS' — 1-C-B07

'+ Flush array' — 1-D-D13

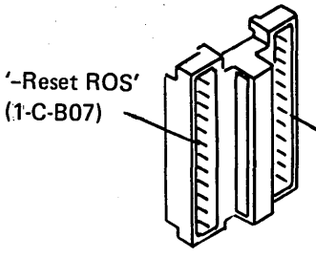
Free running while power is on.

Sync Trig	Int (+) dc
Sync Point	'+Charge array''
Sweep Speed	2 μs/div
Probe Point	See above
Vert Amp	0.5V/div

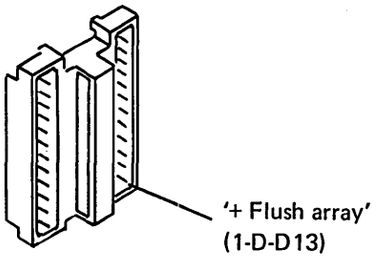
Planar Socket L



In Planar Socket C
Cross Connector



In Planar Socket D
Cross Connector

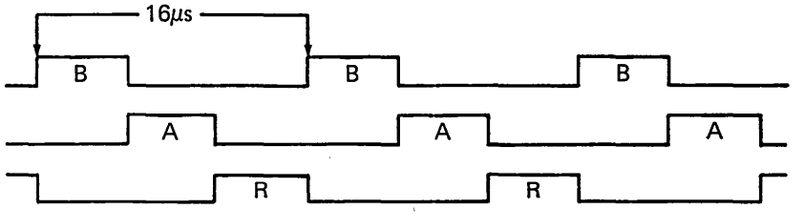


ALU (Arithmetic Logic Unit)

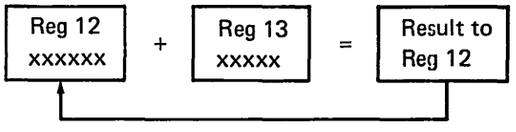
The ALU performs most of the operations done within the MPU. It contains two registers, register 0 and the B register, plus circuitry to perform all logical functions – add, exclusive or, etc. The two registers make up the A and B sides of the ALU. In an add instruction one value is set into the A side and the other value into the B side, the two values are added, and the result appears as the output of the ALU.

Machine Cycle and a Typical ALU Operation

The machine cycle is divided into three main segments (B, A, and R times).



Instruction: Add to the value in register 12 the value in register 13.



The ALU sequence of events and their timings is as follows:

R–Time (previous instruction)
. . . . The add instruction is read out of ROS and latched up in the IXR. Registers 12 and 13 are selected, and the ALU is informed that the operation will be an add.

B–Time . . . The contents of register 13 are gated to the MPU data path and into the B side of the ALU.

A–Time . . . The contents of register 12 are gated into the A side of the ALU and the result is formed.

R–Time . . . The result is gated out of the ALU to the MPU data path and into register 12. The instruction for the reset operation is gated out of ROS and latched up in the IXR.

Read/Write Memory Card

This card provides storage for the 3741. The basic machine (Models 1 and 2) has 2K of storage; Models 3 and 4 can have up to 8K. Location of the memory card is dependent on the features installed.

The storage (contained on the memory card) is divided into buffers. Some are assigned to specific uses, such as the current buffer for which data is displayed, or the previous buffer from which the data is written. Refer to the storage map in Chapter 8 for details of buffer assignment within storage.

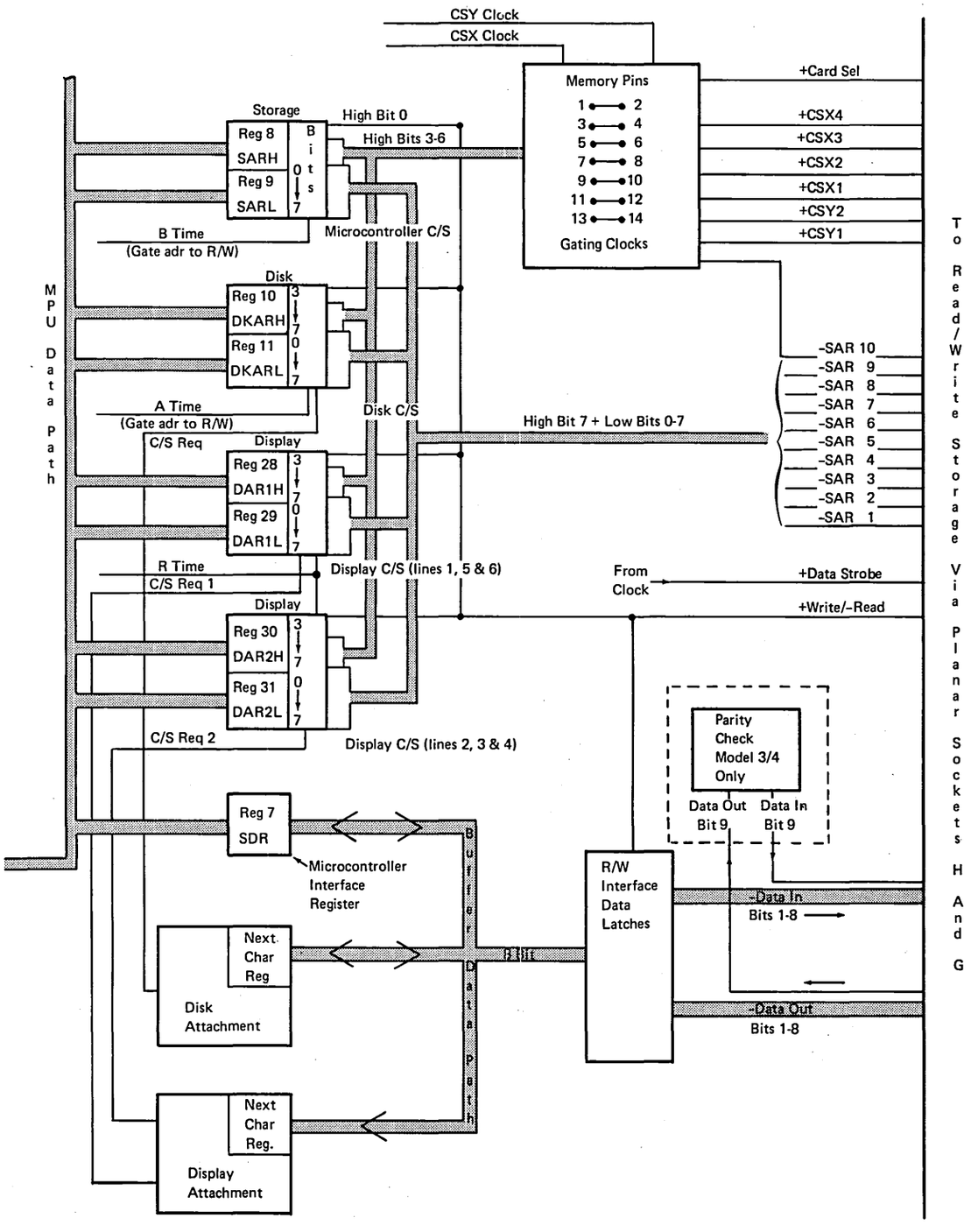
Read/Write Storage/MPU Interface and Cycle Steal

The R/W storage/MPU interface controls data transfer between storage and the microcontroller, disk unit, or display unit. Data is transferred at the request of any of these devices.

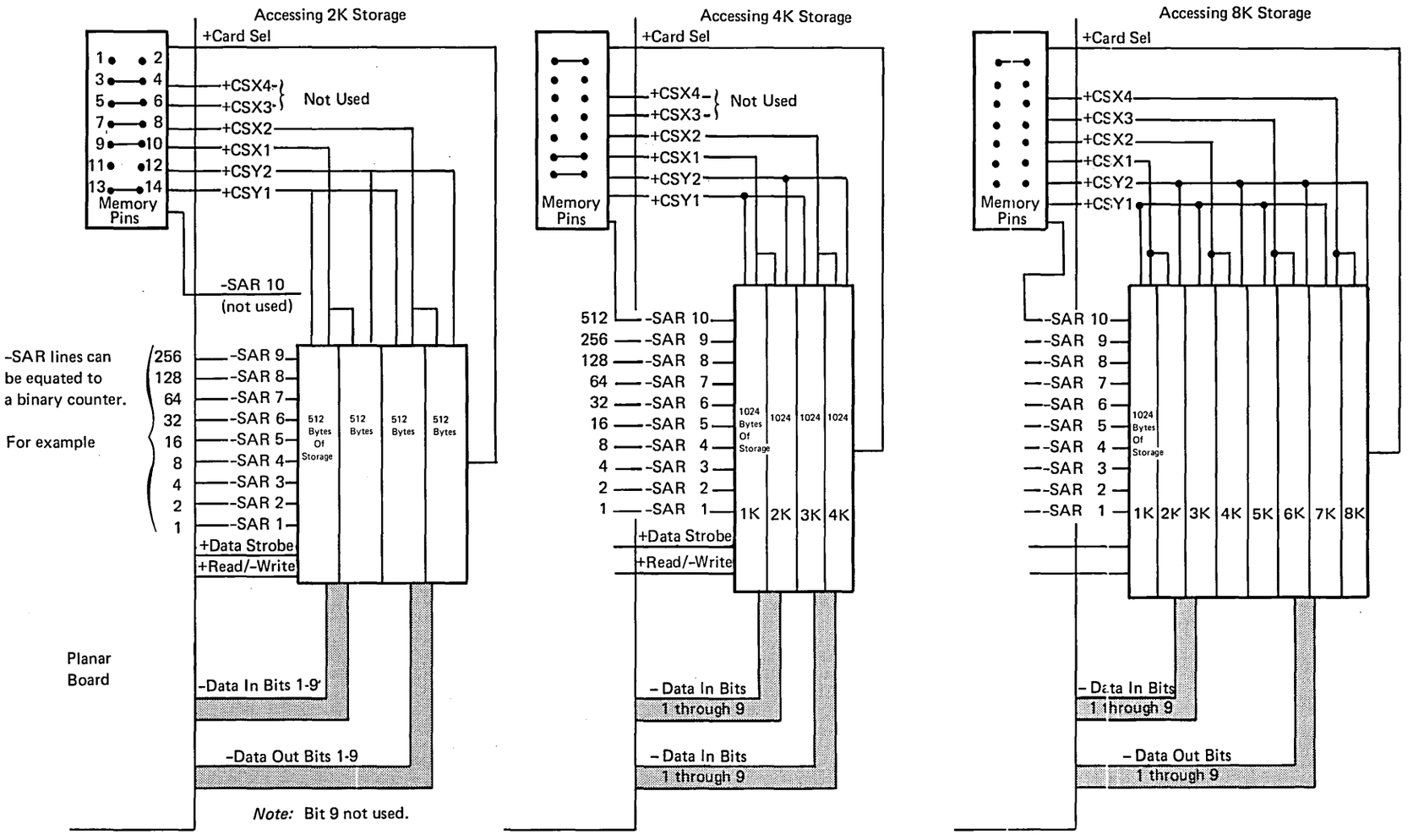
R/W storage accessing is done by means of 18 address lines controlled from registers in the microcontroller. The microcontroller, disk unit, and display unit each have their own storage address registers—a high-order bit register and a low-order bit register. See the diagram for register names. Lines 1, 5, and 6 and lines 2, 3, and 4 in the display are treated, for storage accessing purposes, as two separate devices. The outputs of these register parts are dotted together. Each device has a time allotted in which to access storage. A-time is for the disk, B-time is for the microcontroller, and R-time is for the display (the display controller controls line usage). The bits used in each register to produce '-SAR 1' through '-SAR 9' are high bit 7 and the low register bits 0 through 7. Bits 3 through 6 in the high register are gated with CSY clock, CSX clock, and the storage plugging pins to produce '-SAR 10', '+CSX 1' through '+CSX 4', '+CSY 1', '+CSY 2', '+4K CS', and '+card sel'.

Bit 0 in the high register produces '+write/-read'. If the microcontroller sets bit 0 on, data will be read from storage. If the bit is set off, the operation will be a write. Bit 1 is set on when the request to access R/W storage is made by the microcontroller. Bit 2 in the high register controls the self-incrementing of the register pair. The self-incrementing is used in a way that frees the microcontroller from the task of setting up each address in the 128-byte field in storage. The microcontroller just sets up the starting address of the record to be transferred and then can do operations in other areas of the machine. An example of this is the way the display cycle-steals from the current buffer while the operator enters data into the current buffer during enter mode.

The data flow to and from R/W storage is on the '-data bit in' and '-data bit out' lines. These lines should pulse continuously as the display is always cycle-stealing. Data flow to and from the R/W storage/MPU interface is along the buffer path to the disk and display controllers plus the microcontroller storage data register (register 7), which is used for data transfer.



Accessing Storage



R/W Memory Card (Input, Output, Address Control, and Voltage Lines)

Test Pin	Active Level (+ or –)	Line Name	Line Function
1-G-D02	–	SAR 1	These lines form a single byte address to select one byte within a 128-byte buffer.
1-H-D04	–	SAR 2	
1-G-D13	–	SAR 3	
1-G-D05	–	SAR 4	
1-H-D09	–	SAR 5	
2-H-B02	–	SAR 6	
2-G-B03	–	SAR 7	
1-H-D10	–	SAR 8	These lines select one buffer (128 bytes) within a 1K block of storage. (1K of storage contains 8 buffers.)
1-G-D09	–	SAR 9	
2-H-B06	–	SAR 10	
2-G-B07	+	CSY 1	Selects the first, third, fifth, seventh, and ninth 1K blocks of storage.
2-G-B13	+	CSY 2	Selects the second, fourth, sixth, and eighth 1K blocks of storage.
2-H-B07	+	CSX 1	Selects the first 2K byte block of storage (bytes 0000-2047).
1-H-B08	+	CSX 2	Selects the second 2K byte block of storage (bytes 2048-4095).
2-H-B10	+	CSX 3	Selects the third 2K byte block of storage (bytes 4096-6143).
1-H-D13	+	CSX 4	Selects the fourth 2K byte block of storage (bytes 6144-8191).
2-H-B11	+	Data strobe	A timing pulse from the MPU which allows reading or writing in storage.
1-H-D11		+Write/–read	A line from the MPU which selects either a read or write function in storage.
2-H-B13	+	Card select	A line from the MPU which activates the memory card.
2-G-B04	+	8.5 volts	Input voltages
2-G-B09	–	5 volts	
1-H-D12	+	5 volts	
2-H-B04	+	8.5 volts	
1-H-D07	–	Ground	
1-G-D07	–	Ground	
2-G-B06	–	Bit 1	Data bits to R/W storage. (Data bus in)
2-G-B05	–	Bit 2	
2-G-B10	–	Bit 3	
2-G-B08	–	Bit 4	
2-G-B12	–	Bit 5	
2-G-B11	–	Bit 6	
2-H-B05	–	Bit 7	
2-H-B03	–	Bit 8	
2-H-B08	–	Bit 9 (parity)	
1-G-D04	–	Bit 1	Data bits from R/W storage. (Data bus out)
1-G-D03	–	Bit 2	
1-G-D08	–	Bit 3	
1-G-D06	–	Bit 4	
1-G-D11	–	Bit 5	
1-G-D10	–	Bit 6	
1-H-D03	–	Bit 7	
1-H-D02	–	Bit 8	
1-H-D06	–	Bit 9 (parity)	

Keyboard Attachment

The keyboard attachment, located on the MPU planar, is the interface between the keyboard and the microcontroller. It stores decoded keystrokes information for use by the microcontroller.

The MPU keyboard registers (KBD DATA - register 5, and KBDCTRL - register 6) receive input from the keyboard as described under *Keyboard Character Transfer Control* in Chapter 13. Data is sent via the SDR (register 7) to the current buffer in R/W storage. The buffer contents are displayed and, if the data is OK, it can be stored by operator action.

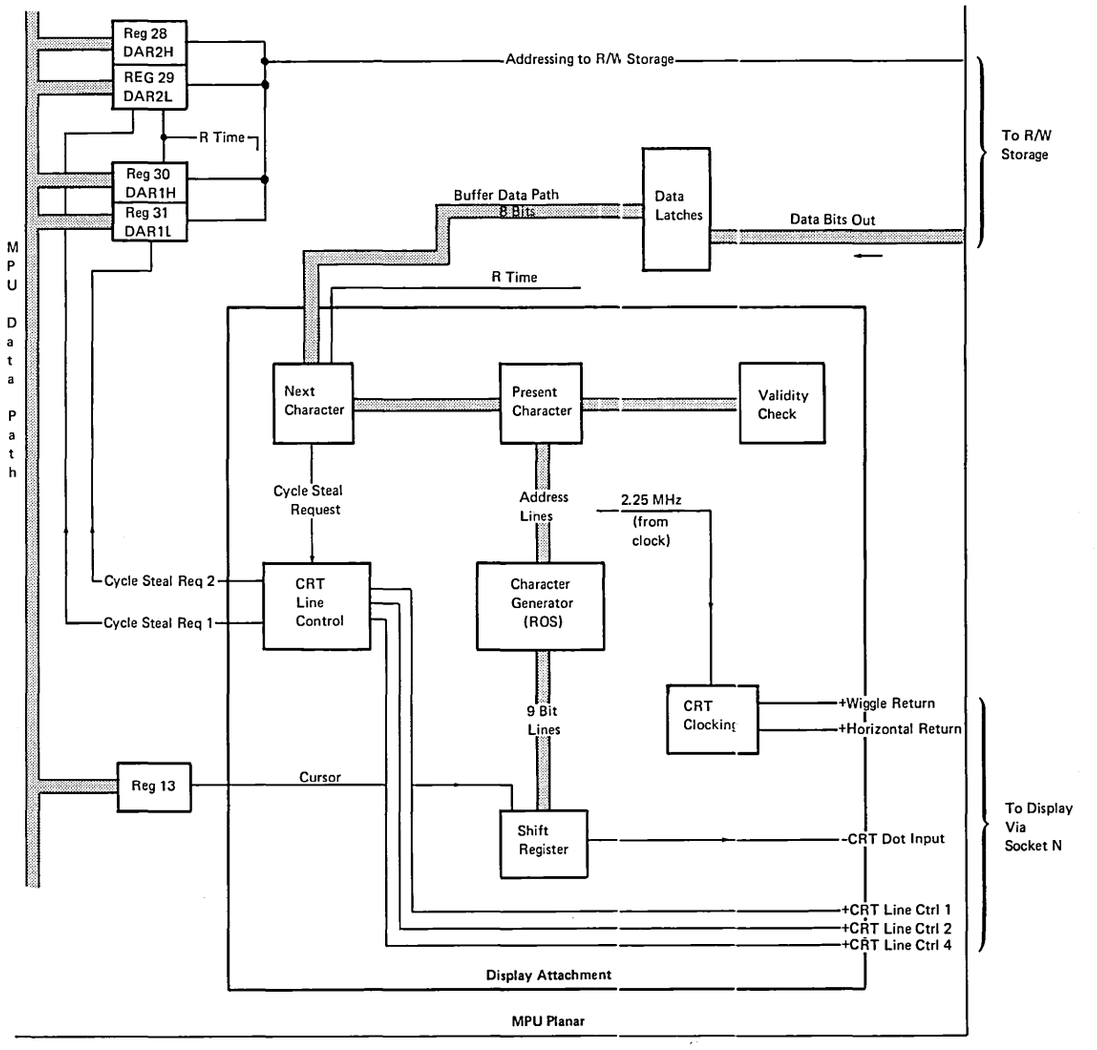
Display Attachment

The CRT displays characters sent to it from R/W storage by the microcontroller. The characters are decoded by the display attachment, and the voltage levels to the display circuit board are varied (wiggled) to make the CRT electron beam form the desired images on the screen.

The display attachment controls the displaying of data. The display unit holds six lines of data, each 40 characters long.

Characters are formed in a 7x9 matrix. Each character is moved from R/W storage by cycle-stealing. The data for the character is gated into the 'next character' register, where it is checked for validity. If the character is valid, address lines to the character generator are activated for the character. If the character is invalid (unprintable), the hex representation of the character is displayed.

The character generator is a ROS module containing all the character display patterns and having 9-bit output. For a single character, seven ROS addresses are accessed to give the 7x9 matrix pattern. This pattern is serialized in the shift register to give '-CRT dot input' as its output, and at the appropriate time the cursor, whose position is being tracked by register 13, is gated out with the data. The lines '+CRT line ctrl 1' through '+CRT line ctrl 4' control lines 1 through 6 on the display. The signals '+wiggle return' and '+horizontal return' used in the display unit originate in the display controller and run continuously. The entire display is refreshed every 23 ms.



Disk Attachment

The disk attachment interfaces between the MPU and the disk drives. Data flow is from R/W storage to disk on a write operation and from disk to R/W storage on a read, both via the attachment. The components of the disk attachment are shown in the diagram.

Serdes (Serializer/Deserializer)

This unit changes the 8-bit characters into a serial format (1 bit at a time) for sending to the diskette. The unit also works in reverse: it changes serial data into 8-bit characters when receiving from the diskette.

Disk Multiplexor

Switches the input lines to either disk drive 1 or disk drive 2 under control of 'select drive 1' or 'select drive 2'.

Write Trigger

This device uses a 500 kHz clock to gate data to the diskette for storage.

VFO Card

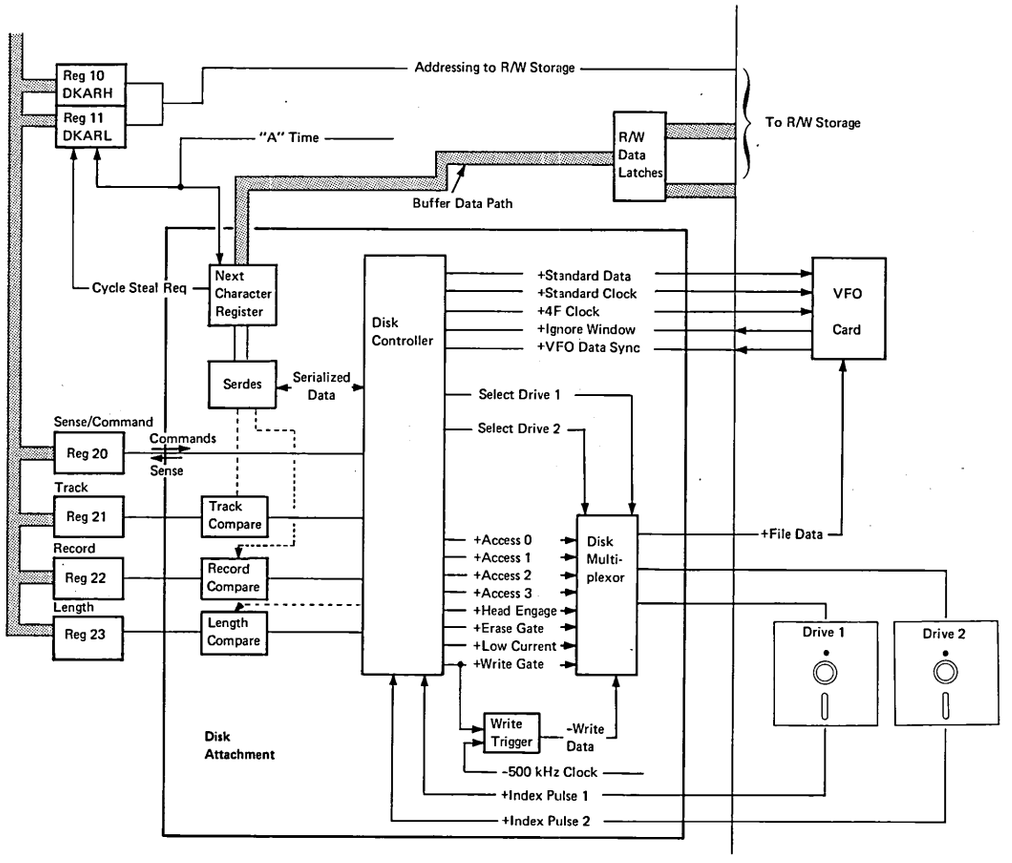
The VFO card is used by the attachment to decode the frequency-modulated output from the diskette into serial data.

Disk Controller

The disk controller is a type of microcontroller. It accepts commands from the microcontroller and executes them as independently as possible. This capability permits the microcontroller to perform operations in other areas of the machine with minimum time loss.

The disk controller is given commands such as seek higher (move the head toward the center of the diskette), seek lower, read ID (record address), read data, and write data. When the disk attachment begins to execute a command it activates a busy signal. After busy drops, the microcontroller checks drive status (sense data) to be sure that no errors occurred, and then uses the data just read (if it was a read command), issues another write or access command, or commands whatever is to be done next.

When it detects an error, the disk controller indicates the error through the drive status information. The microcontroller reissues the command in an attempt to recover. Error recovery is tried a set number of times. If a retry succeeds, the operation goes on. If not, an error code is displayed and the operation stops. On some disk errors, multiple retries occur that might take up to one minute.



The disk controller contains the track, record, length, sense/command, and next character registers. It also contains the logic for track compare, record compare, length compare, and the logic to control the erase and write gates. The track, record, and length registers are loaded by the microcontroller from the control data in the program buffer.

Track, Record, Length and Sense/Command Registers

The track and record registers contain the track and record numbers of the diskette record being addressed. The length register contains the length of the record to be processed. For seek operations, the length register contains the number of tracks that the program wishes to cross.

The seven bits in the sense/command register are: index, bad track, control address mark (CAM), length error, CRC error, ID-match, and busy. The sense/command register also indicates ready.

The *index* sense bit is the index output of the disk drive. It is used by the ROS to mark the start of a track for initializing diskettes.

The *bad track* sense bit is set if the first byte of data in an ID field is hex FF.

The *control address mark (CAM)* sense bit is set if the address mark of the selected data record is hex F8.

The *length error* sense bit is set if the record read is not padded to 128 with hex 00.

The *ID-match* sense bit is set when the ID specified by the track and record registers is found. If the correct ID is not found, the microcontroller assumes an addressing error and executes the proper error recovery procedure. For seek operations the ID-match bit indicates that the correct track was found.

The *busy* bit of the sense register is set when the command register is loaded. It stays set until the command issued is completed. When the command is completed, the busy latch is reset.

The *ready* condition is indicated in the sense register by not having all bits in the register turned on. Thus, if the selected drive is not ready, all bits in the sense/command register are forced on.

Next Character Register

The next character register is temporary storage for 1 byte of data. Data being transferred from R/W storage to diskette (write record) passes through the next character register to the serdes.

Serdes serializes the byte and presents 1 bit at a time to the disk controller for transfer to the disk unit. The data being transferred (read record) from the diskette to R/W storage travels in the reverse direction of the write record. In this case serdes deserializes data and presents a byte at a time to the next character register for transfer to R/W storage.

Commands

The disk controller receives its commands from the microcontroller, which gets commands from ROS and loads them into the sense/command register. When the disk controller receives a command, it sets itself into a busy state. When the operation specified by this command is completed, the controller resets the busy state and is ready to accept the next command. The command specifies the operation, selects the drive, and controls the write current to the drive.

The commands are: select/stop, write check, seek lower, seek higher, read data, read ID, write data, write control, write ID, set ready, reset access counter, and nothing (no-op).

The *select/stop* command resets the disk controller, engages the head, selects a drive, and resets the '+gate write' line to the drive. The select/stop command is also used to turn the write clock off when the index pulse occurs after a track has been initialized during diskette initialization by the microprogram.

The *write check* command reads the record specified by the track and record registers, and checks the CRC on the data field. If the CRC is incorrect, a CRC error is set in the sense/command register. This command also checks that all bytes after the number specified by the length register are hex 00. If they are not, a length error is set. For a write check operation, no data is transferred to or from the buffer. The check consists of verifying the CRC characters.

The *seek lower* command moves the head the number of tracks specified by the length register toward the outside edge of the diskette (to the lower numbered tracks). After the head has been moved as specified by the length register, the disk controller enters a special read mode that compares the track field of the first ID field it finds to the track register. If they match, the ID-match bit is set in the sense/command register. If the ID-match bit is not set, an address error is indicated and the microcontroller ROS program starts an error recovery procedure that rewrites the record.

The *seek higher* command is the same as the seek lower command except that it moves the head to the higher number tracks (toward the diskette center).

The *read* command engages the head, if it is not already engaged, and searches for the ID of the record specified by the track and record registers. When the correct ID is found, the disk controller reads and transfers the number of data bytes specified by the length register to R/W storage. While doing this the disk controller generates the CRC for all 128 bytes of data and checks it against the CRC written on the diskette. If it does not match, a CRC error is set in the sense/command register. It also checks that all data bytes beyond the number specified by the length register are hex 00. If they are not, a length error is set in the sense/command register.

The *read ID* command engages the head, if it is not already engaged, and then transfers data from the first ID field it finds to the buffer.

The *write data* command finds the ID field specified by the 'track and record' registers similar to the read data command. It then starts writing a sync field of all zeros while also timing a 14-byte gap from the last bit of the CRC for the preceding ID field. After the 14-byte gap, it writes a data address mark followed by the number of bytes specified by the length register. One extra buffer access is made after the number of data bytes specified are transferred. The character obtained by this access is written to pad the record to 128 bytes. While writing, the controller accumulates the CRC for the 128-byte data field and writes it after the 128th data byte.

The *write control* command, used to delete a record, is the same as the write data command except that the address mark before the data field is for control instead of for data.

The *reset access* command initializes the access counter so that the program can seek low 79 times to locate the head on track 0 when the system is powered up.

The *nothing* command is the state in which the command bits are powered up and to which they are returned after each command. It can also be loaded by the program to change the drive selected for sensing.

All of the preceding commands are executed under control of the disk controller. The disk controller includes hardware for serializing and deserializing data, for generating requests for buffer access, and for generating the CRC check; sequencing logic to control all head motion; compare circuits for locating specified ID fields; circuitry to determine read status of the selected drive; circuitry to select a specific drive; automatic track check after seek; reading and writing data; and ability to initialize the diskette.

Compare Functions

The disk controller compares the contents of the track and record registers to serdes to find the record specified by the track and record registers. The length counter counts bytes during read or write operations, and counts tracks during seek operations.

The disk controller has another circuit for comparing the length register to the length counter. The circuit determines the logical end of records and verifies that the proper number of tracks have been crossed in a seek operation.

Disk Operations

On a read data command the microcontroller loads the command into register 20 (command/sense register). The track address is loaded into register 21, the record address into register 22, and the record data length into register 23. The address of the R/W storage to be accessed is loaded into the disk cycle steal registers (registers 10 and 11).

The disk controller now takes over, the drive is selected, the head is engaged, and the controller starts comparing the addresses being read from disk. When the track and record compare with the addresses in registers 21 and 22, data is sent via the disk multiplexor VFO card, disk controller, serdes and next character register into R/W storage. The data is sent one character at a time, the number of characters being specified by register 23. During this time the MPU is periodically monitoring the operation by checking register 20, which contains sense (status) information from the controller.

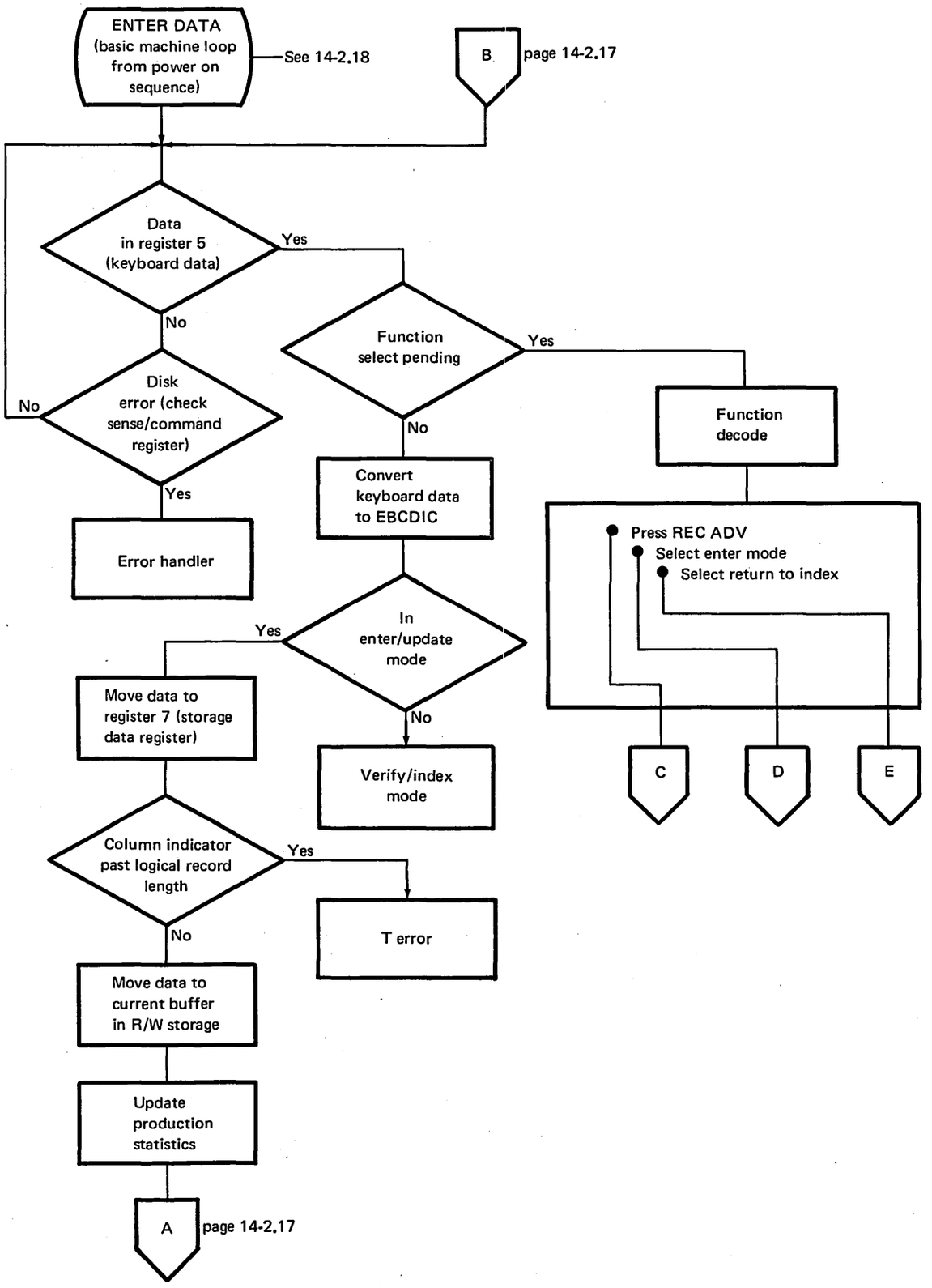
BSCA Controller

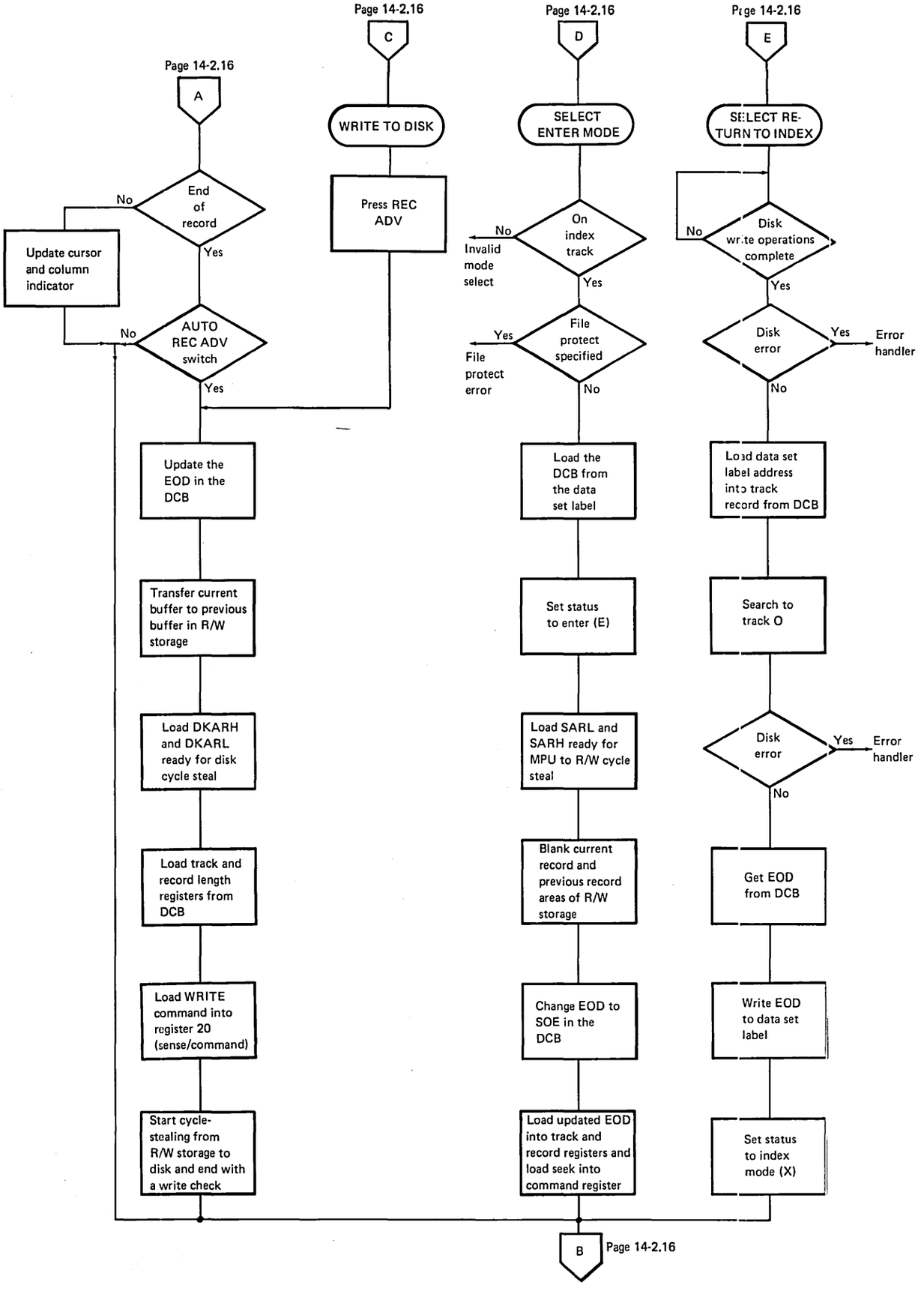
The BSCA (binary synchronous communications adapter) controller performs the functions necessary to enable the 3741 to communicate over common carrier telephone facilities to another 3741, 3747, System/3, System/360, or System/370. In a transmit mode, the BSCA controller transfers data from the diskette to the modem via the buffer, disk unit controller, and microcontroller. In a receive mode, the BSCA controller accepts data from the modem, assembles it, and transfers it to the diskette via the buffer, disk unit controller, and microcontroller. For detailed BSCA theory, see page 14-13.

OPERATIONS

ROS Microprogram Logic Flow

The flowchart shows the way the MPU, under control of the microprogram stored in ROS, manipulates the data and utilizes the I/O devices. The operations shown are *select enter, enter data, write to disk,* and *return to index.* When operations are completed, the machine goes into the basic loop waiting for keyboard input. For its control of the disk, the ROS program reserves a small portion of R/W storage called the disk control block (DCB). In the DCB are SOE, EOE, EOD, logical record length, and the home index address of the data set in use. The program also uses R/W storage to store the current record (the record being compiled) and the previous record. The CRT displays the current record. The disk, BSCA, and printer read and write from and to the previous record.




Page 14-2.16
A
Page 14-2.16
C
Page 14-2.16
D
Page 14-2.16
E
WRITE TO DISK
SELECT ENTER MODE
SELECT RE-TURN TO INDEX
End of record
No
Yes
Update cursor and column indicator
Press REC ADV
On index track
No
Invalid mode select
Yes
Disk write operations complete
No
Yes
AUTO REC ADV switch
No
Yes
File protect specified
Yes
File protect error
No
Disk error
Yes
Error handler
No
Update the EOD in the DCB
Load the DCB from the data set label
Load data set label address into track record from DCB
Transfer current buffer to previous buffer in R/W storage
Set status to enter (E)
Search to track 0
Load DKARH and DKARL ready for disk cycle steal
Load SARL and SARH ready for MPU to R/W cycle steal
Disk error
Yes
Error handler
No
Load track and record length registers from DCB
Blank current record and previous record areas of R/W storage
Get EOD from DCB
Load WRITE command into register 20 (sense/command)
Change EOD to SOE in the DCB
Write EOD to data set label
Start cycle-stealing from R/W storage to disk and end with a write check
Load updated EOD into track and record registers and load seek into command register
Set status to index mode (X)
B
Page 14-2.16

Power-On Sequence and Diagnostic Routine

Power On Switch and 2.5 Second Delay

When power is turned on, a POR pulse is generated followed by a 2.5 second delay in which power supplies, motors, and circuits reach operating levels.

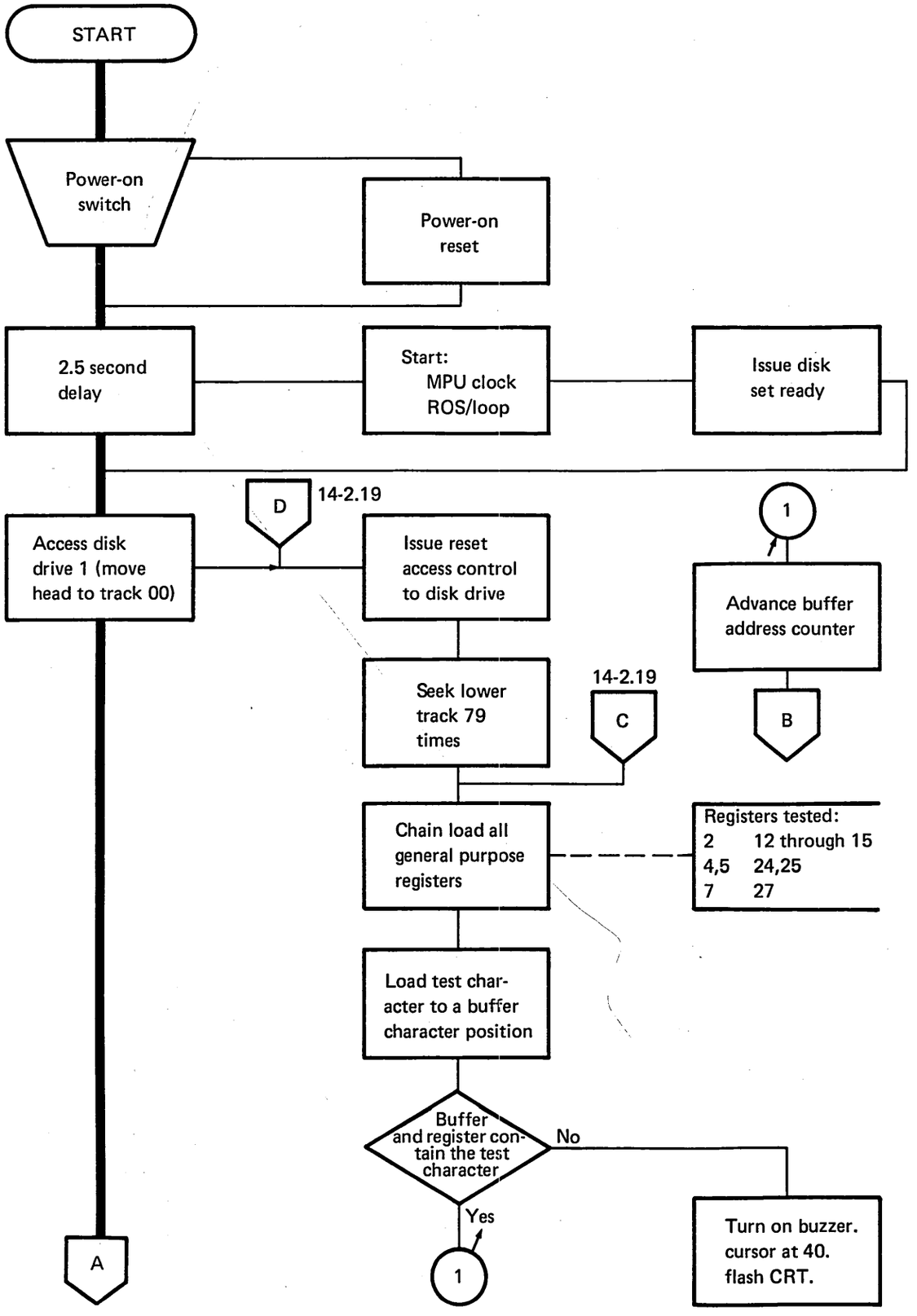
Access Disk Drive 1 and Check Out MPU and R/W Storage

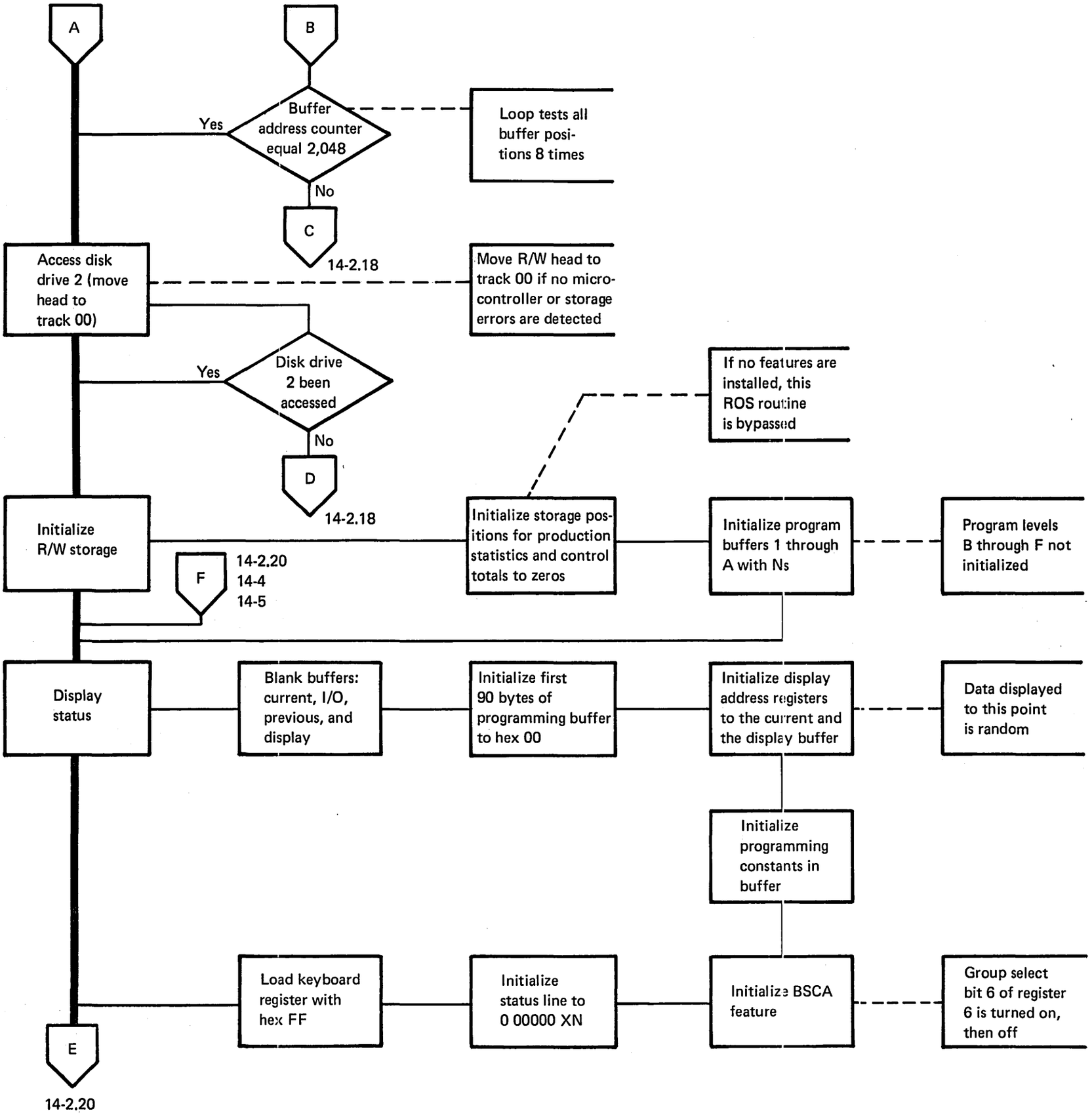
The head for disk drive 1 moves to track 00 when the ROS causes it to seek 79 times to a lower track. (This can be seen and heard.) The disk accessing is controlled by the disk controller while the MPU continues with part of the power-on sequence.

Some of the basic machine hardware is checked when the ROS shifts test characters through various registers within the MPU and then writes them into R/W storage. The MPU then checks the last register to see if each test character is OK and also checks that the test characters written into R/W storage can be read out correctly. For a failure in either case, the MPU makes the clicker buzz and the cursor flash in position 40 on the CRT. If an error occurs, eliminate feature hardware as a cause by removing FRUs. If no error occurs, the R/W storage area (buffer) is incremented and the sequence is repeated until all 2,048 positions of storage have been checked.

The test characters used are in hex, each different from the one before. If the machine stops with a display of all Hs (hex 00), the MPU planar, a cross connector, or a memory card is probably the cause. The hex 00 means that either no data was written into storage or no data can be read from storage.

A power-on sequence error display of many hex character patterns would probably indicate a problem with the MPU planar or memory card. Most addressing and data paths from the MPU to R/W storage are shared. The combinations selected by the MPU for each storage position differ.





EC 825853	826065		PN 2470457
11/15/74	8/1/75		

EC 825853	826065		PN 2470458
11/15/74	8/1/75		

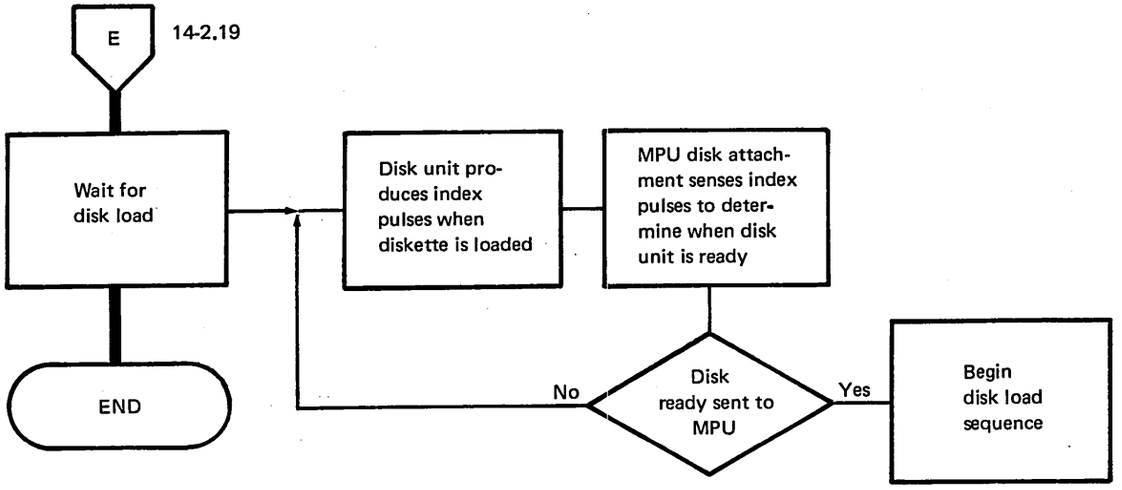
Disk Load Sequence

Objectives:
- Make sure that the access is on track 00 and that read and write commands to the disk adapter can be executed.
- Check the disk accessibility byte in record 7 of track 00.
- Check that the HDR1 label in sector 8 is formatted properly, display the label, and post index mode.

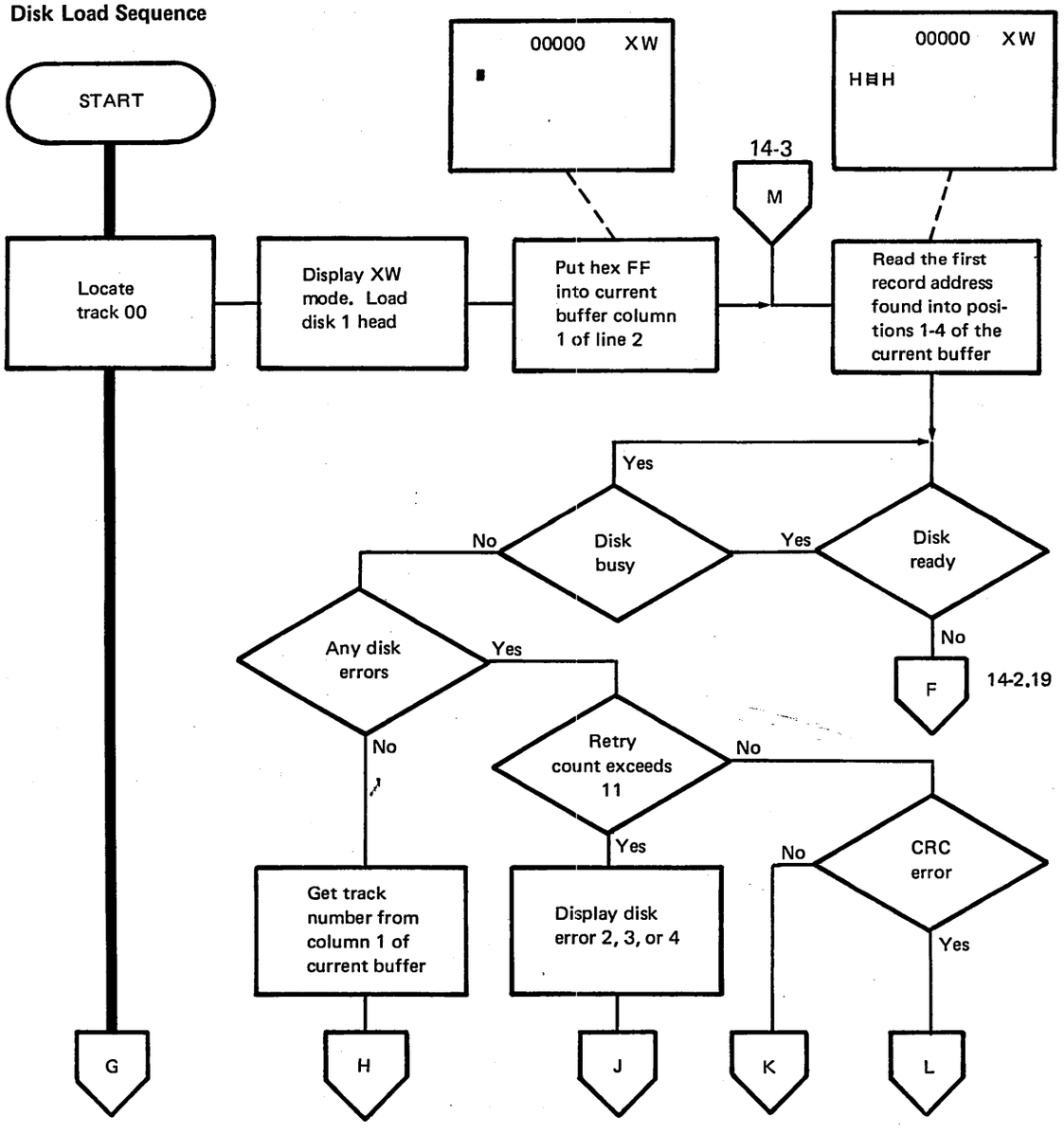
Locate Track 00

The display shows X W mode, and a hex FF is displayed in position 1 on line 2.

A read ID command is issued. If a record ID on track 00 is read on the first try, the hex format record ID overlays the FF so quickly that you might not see it. The first character in the record is then examined by the MPU to make sure that the ID is from track 00. An error detected by the disk adapter or MPU results in up to 11 retries of the operation. If the retries fail, an error code is posted. If the read is successful, the record ID is seen for a short time as hex characters in positions 1 through 4 of line 2.



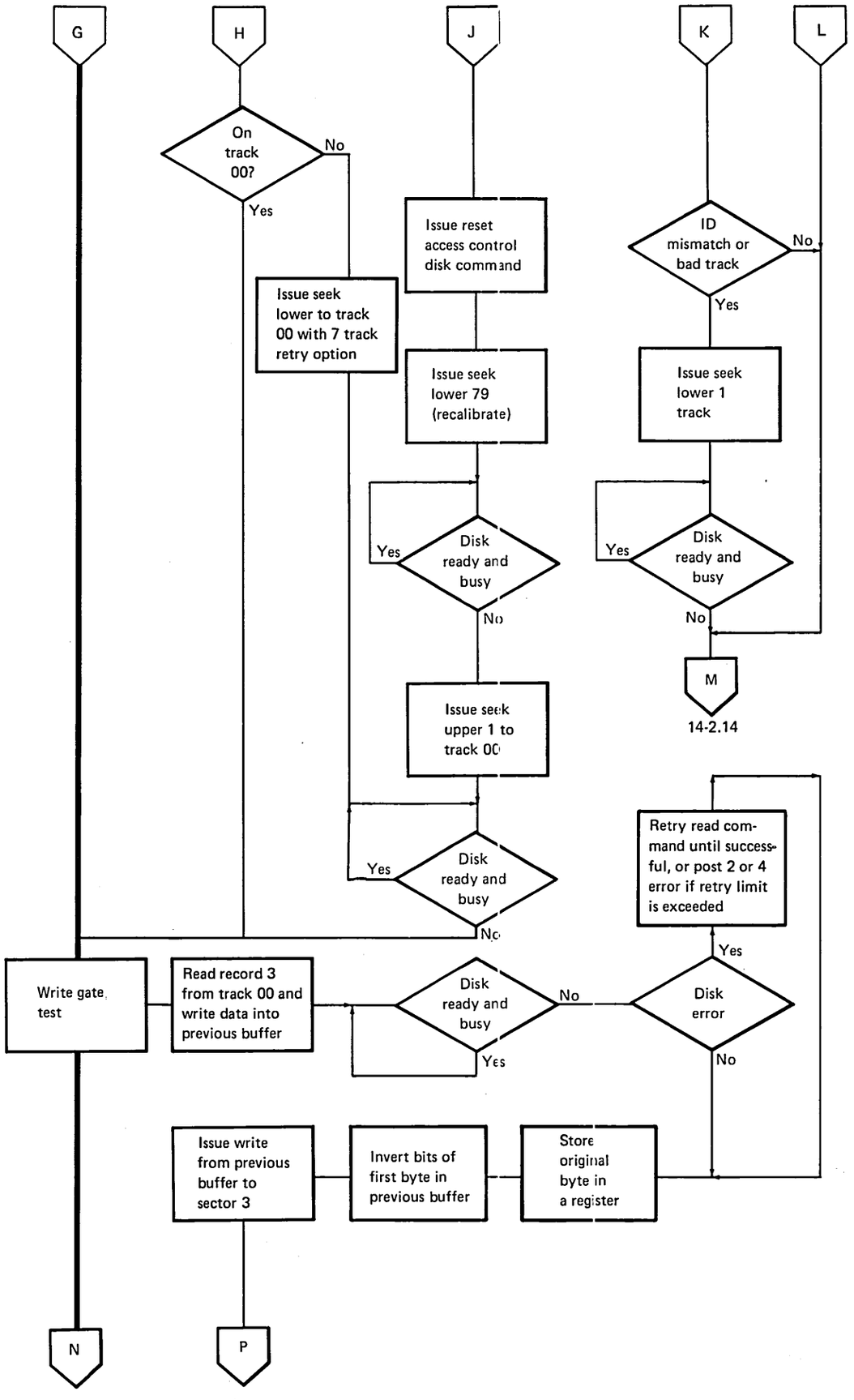
Disk Load Sequence



Write Gate Test

Record 3 of track 00 is reserved for write gate testing during the disk load sequence. The test reads record 3 into the previous buffer, inverts the bits in position 1 of the previous buffer, and writes the previous buffer into sector 3. Then it reads the contents of sector 3 back into the previous buffer. The first character in the previous buffer is checked to make sure that the write circuits wrote data onto the diskette. The first character in record 3 is inverted each time the diskette is loaded.

The usual checks for disk errors are made and retries attempted if errors are found. Hard (nonrecoverable) errors result in an error message on the status line.



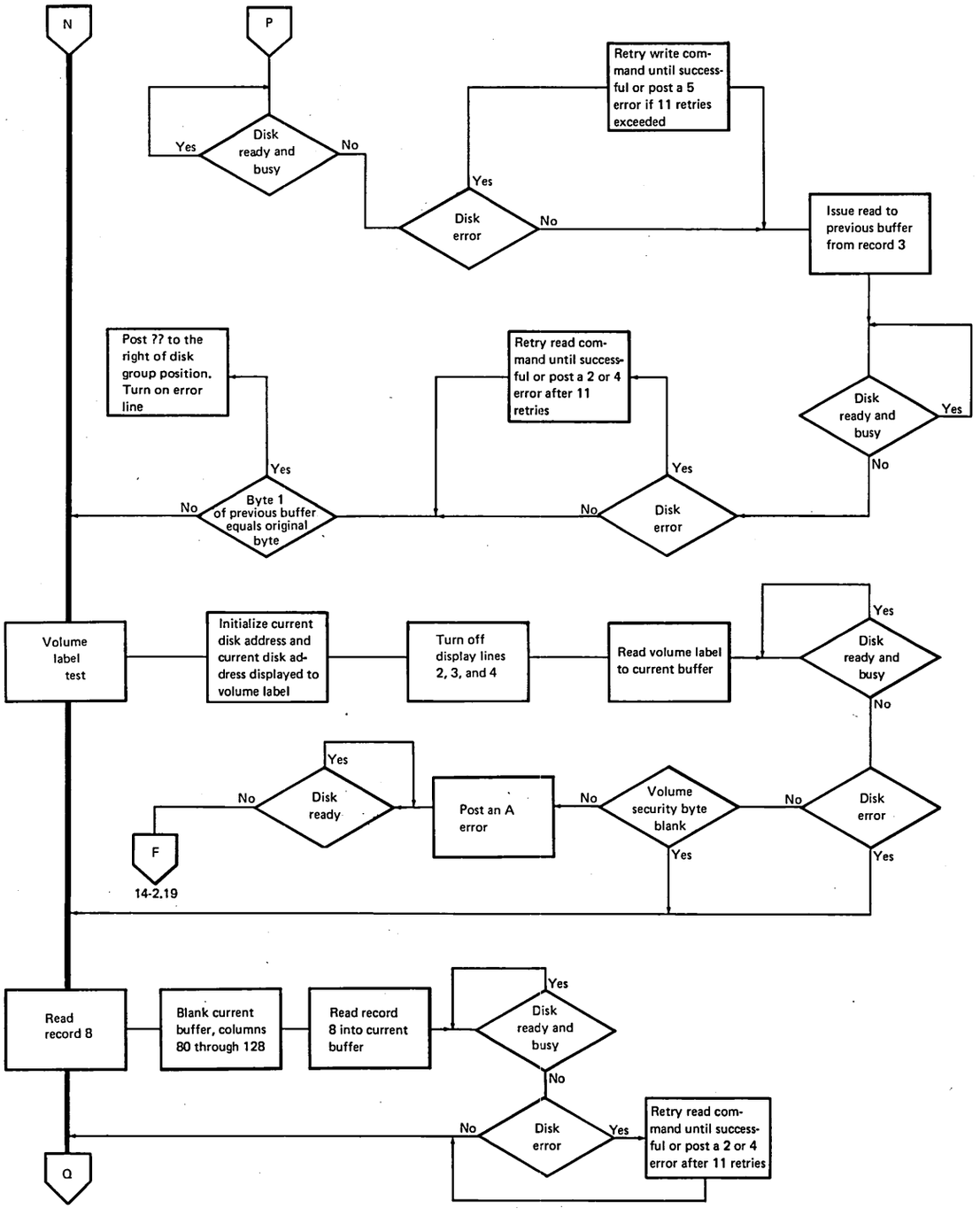
Volume Label Test

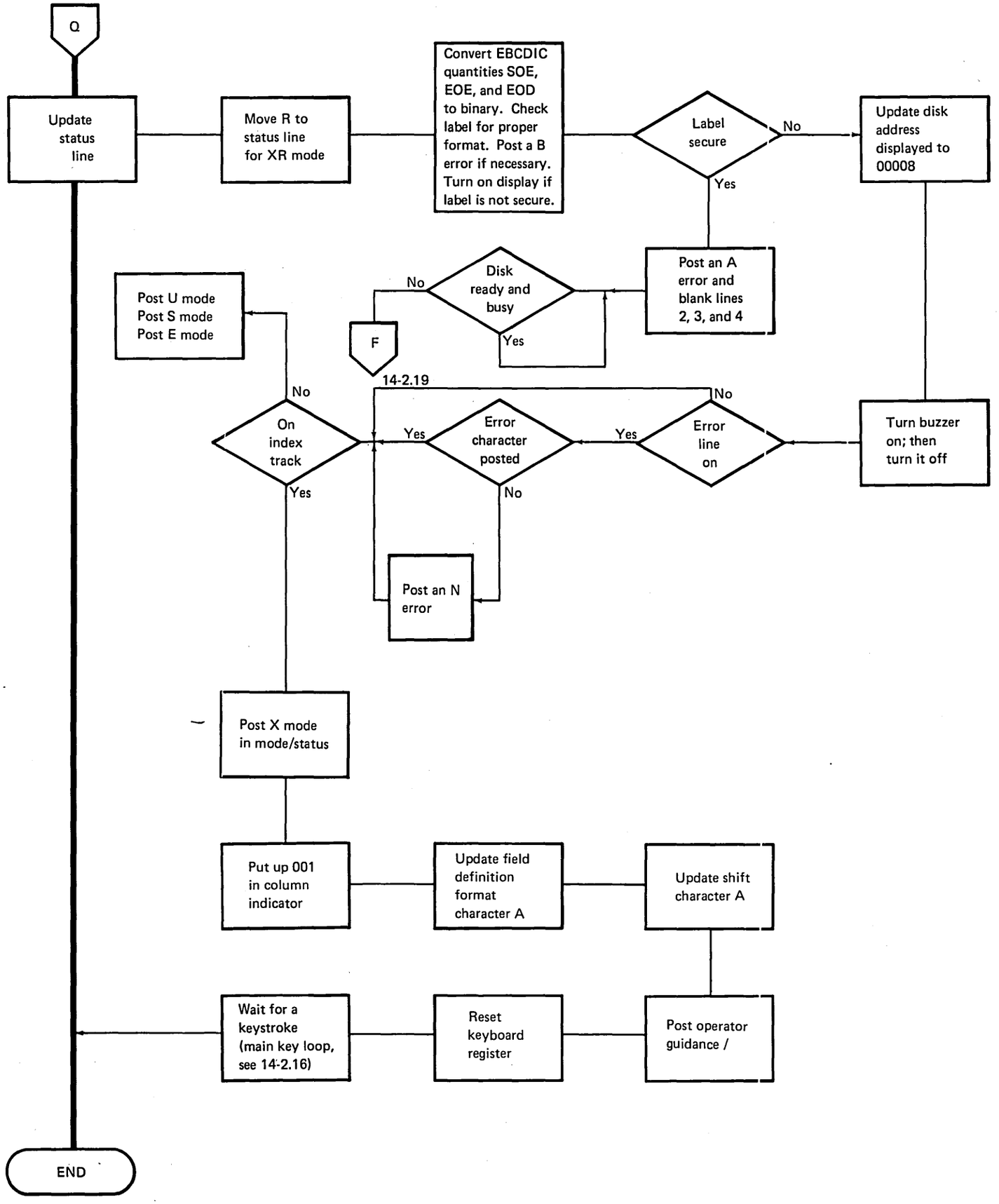
From track 00, record 7, the diskette volume label is read and the accessibility byte checked to be sure that it is OK to begin operations using this diskette. If any bit is on in the tested byte, an A error is displayed and reexecution of that part of the power-on sequence begins at the display status block (point F).

Read Record 8

Record 8 on track 00 contains the first HDR1 label on the diskette. It is read into the previous record buffer (R/W storage) and its accessibility byte is checked. If the byte is not blank, an A error is posted and lines 2, 3, and 4 are blanked out to prevent seeing the protected data set. If no hard errors are found and record 8 is OK, the HDR1 label is displayed and machine mode/ status is set to XR.

This completes the disk load sequence. Drive 2 is not checked now even if the diskette is loaded. For read/write operations see flowcharts in Chapter 11.




Q
Update status line
Move R to status line for XR mode
Convert EBCDIC quantities SOE, EOE, and EOD to binary. Check label for proper format. Post a B error if necessary. Turn on display if label is not secure.
Label secure
No
Yes
Update disk address displayed to 00008
Post an A error and blank lines 2, 3, and 4
Disk ready and busy
No
Yes
F
Post U mode
Post S mode
Post E mode
14-2.19
No
On index track
Yes
Yes
Error character posted
No
Yes
Error line on
No
Turn buzzer on; then turn it off
Post an N error
Post X mode in mode/status
Put up 001 in column indicator
Update field definition format character A
Update shift character A
Wait for a keystroke (main key loop, see 14-2.16)
Reset keyboard register
Post operator guidance /
END

3741 FUNCTIONAL CHARACTERISTICS

Program Storage Area

The 3741 contains ten program buffers. 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 128, 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.

For details about programming, see *How to Load a Program* in Chapter 9.

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 program number in position 128 of the current program. The program to be selected when record backspacing is designated by the program number in position 127 of the current program.

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 length of records written on disk is variable from 1 to 128 characters but is fixed from record to record within the data set. The record length for a data set is identified in the data set label positions 23 through 27. If record lengths are entered into the data set which are shorter than the designated record length, the 3741 will automatically write blank characters in all positions from the end of the record out to and including the specified record length position. Beyond the specified record length position, the 3741 will enter hex 00 in all positions out to and including position 128.

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.

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.

Operator Guidance

Operator guidance on the 3741 assists the operator by displaying information on the last 30 positions of lines 5 and 6 of the display. Line 5 displays the current program field or a prompting message related to that field. Line 6 displays the data entered into the current field up to the cursor position. The remaining positions are indicated by a slash. Prompting messages, up to 30 characters long can be stored in even numbered program buffers. Each prompting record is associated with the program in the next lower numbered program buffer. The first character of the prompting record must be an asterisk (*). Each prompting message within a prompting record must be followed by an asterisk. Every program field must have a corresponding prompting message in the prompting record.

3741 SPECIAL FEATURES

Feature Group A

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 (located in buffer 4 of R/W storage) 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 by the microcode when power is turned on or when the R key is pressed while production statistics are being displayed.

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.

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 digit is stored in buffer 4 of R/W storage.) The 3741 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.

Field Totals (Online)

This 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 following records. All additions and entering of totals into a record are under program control.

The online feature allows for field totals operation while the machine is in enter mode, update mode, or verify mode. Three 19-digit accumulators (located in buffer 5 of R/W storage) 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. During online field totals operation, data in these accumulators will be reset to 0 whenever that data is entered into a record. All accumulators are reset by the microcode 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.

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 (located in buffer 5 of R/W storage) 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 by the microcode 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.

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.

Record Insert

Record insertion provides the capability of opening a space within an existing data set into which records may be added. This is achieved by moving all records starting with the record at the currently displayed disk address through the EOD minus one record. The new disk address of 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 which then can be modified. Buffer 4 of R/W storage is used during this process.

Expansion Feature

This feature provides the IBM 3741 Data Station with the necessary circuits for installing a second disk unit and/or an IBM 3713, 3715, or 3717 Printer.

Second Disk

The second disk feature is provided on the 3741 to permit:

1. Duplication of a disk to save more than one copy or recover data from a disk that has developed a defect.
2. Merging of records from a disk with records from the keyboard.
3. Putting data from several disks onto one disk.
4. Extended storage for programs since programs can be loaded into program buffers from the secondary disk without removing the primary disk.
5. Extended storage for use with communications feature.

During dual disk operations, write functions can not be performed on the secondary disk. Record lengths for both disks are maintained separately. Therefore, records read from the secondary disk are extended with blank characters or shortened as required when written on the primary 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 a disk is being duplicated, 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 in one disk revolution. Program buffers are used for this operation.

3717 Printer Controller

The 3717 Printer Controller is in the 3717 Printer. For further information, see the manual contained in the 3717 Printer.

3713 Printer Controller

The printer attachment feature allows the attachment of an IBM printer. The printing can be performed with the printer format controlled by a program in a program buffer or printer control characters in the data stream. Records can also be printed with no format control with 1 record printed per line and with single or double spacing (determined by a lever in the printer). In all of the printer operations, turning AUTO REC ADV off causes printing to stop at the end of the print line with the machine staying in a printer mode. From this point, pressing REC ADV prints the next line. Pressing RESET returns the machine to its previous mode of operation if this operation did not start from the read index mode. Pressing REC ADV with AUTO REC ADV on starts the printing and allows the print function selected to be completed.

The print feature has four different modes. They are:

1. Print record—the data in the current record buffer is printed.
2. Print data set—the current data set is printed.
3. Print search content—the record found after search content is printed.
4. Print search address—the record found after search address is printed.

Data to be printed is always transferred from the previous record buffer to the printer attachment. The transfer is serial by byte.

If format control is used, data is read from the disk into the current record buffer. It is then formatted in the previous record buffer, one print line at a time. From the previous record buffer it is transferred 1 byte at a time to the printer register in the printer controller.

When the microcontroller puts a character into the printer register, the printer adapter starts the print head carrier moving to the right. It will continue moving to the right until the microcontroller puts a new line character in the printer register or until the right margin is reached. In the case of a new line, the print head carrier stops and returns to the left margin while indexing to a new line. In the case of a stop at the right margin, the paper is not indexed.

Printing is accomplished by the printer adapter selecting the vertical columns of the dot matrix in the character generator. When the last column of dots has been printed, the printer adapter generates a reset to the printer register. The microcontroller monitors the printer register, and a cleared register signals the need for the next character.

When format control is used, the character in column 1 of program level A defines the method of selecting the printer format program, as shown in the following chart:

Character in Column 1	Meaning
:	Printer format program manually selected.
%	Printer format program level defined by character in column 001 of data record.
: with program level 0 selected	Print one record per line with no format control.
% with a zero or non-numeric in column 001 of data record	Print record with no format control.
+	Print control characters are contained within data stream.
All other characters	Print one record per line with no format control.

When power is turned on '+POR' is raised (0 to 8.5 volts) and '+reset R' (clock line) is held up (+8.5 volts).

When '+POR' drops, '+reset R' becomes active and the printer does a power-up sequence to ensure that the print head carrier is at the left margin, as follows:

1. Moves the print head carrier to the right.
2. Stops the print head carrier after 'right margin N-O' is sensed.
3. Moves the print head carrier to the left at high speed.
4. Slows the print head carrier to normal speed after 'left margin slow switch N-O' is sensed.
5. Stops the print head carrier after 'left margin stop switch N-O' is sensed.

When in print mode, '-printer select' should be negative. '+reset R' is the clock on which all timings in the printer adapter are based. Data is transferred to the printer register on the data path bit lines in sockets Q and F, one character at a time.

When the microcontroller puts a character into the printer register, the printer adapter starts the print head carrier moving to the right. It will continue moving to the right until the microcontroller puts a new line character in the printer register or until the right margin is reached. In the case of a new line, the print head carrier stops and returns to the left margin while indexing to a new line. In the case of a stop at the right margin, the paper is not indexed.

Head carrier motion is maintained by pulses from the printer magnetic emitter transducer, '-forward feedback emit amplified' and '-reverse feedback emit amplified'. 'Left margin stop switch N-O' and 'right margin switch N-O' stop the print head carrier motion at the margins. 'Left margin slow switch N-O' drops the carrier out of high speed as it approaches the left margin.

Printing is accomplished by the printer adapter selecting the vertical columns of the dot matrix in the character generator. When the last column of dots has been printed, the printer adapter generates a reset to the printer register. The microcontroller monitors the printer register and a cleared register signals the need for the next character. The timing for printing of the vertical columns comes from the print magnetic emitter transducer in the printer, 'print right emit amplified'.

Paper is indexed by the printer adapter when the microcontroller puts a new line command into the printer register. (It is possible that index N-O switch failures might intermittently cause the character N to be printed.)

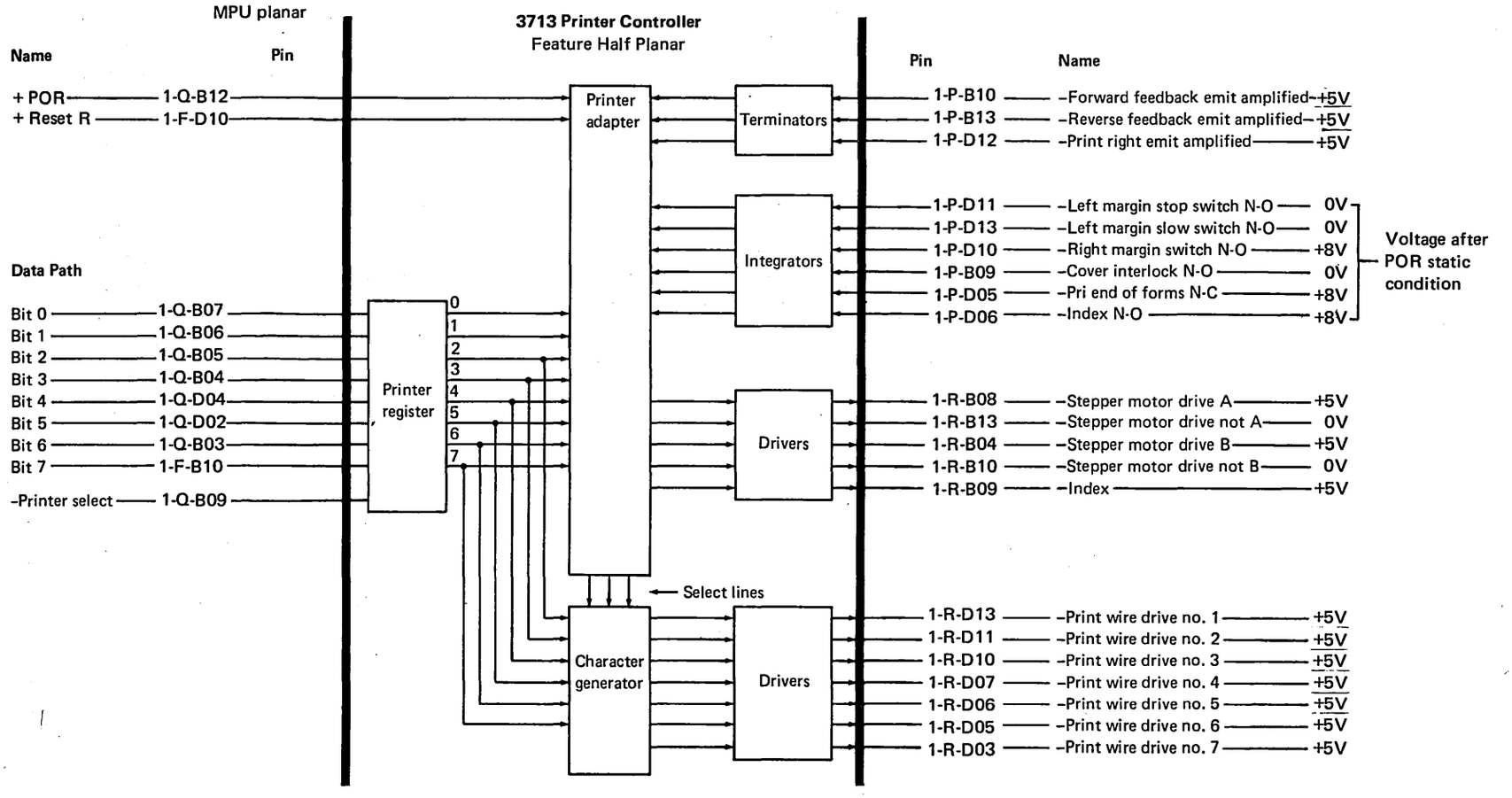
Printing is prevented, but '-index' trips printer index magnet driver until '-index N-O' is closed in the printer.

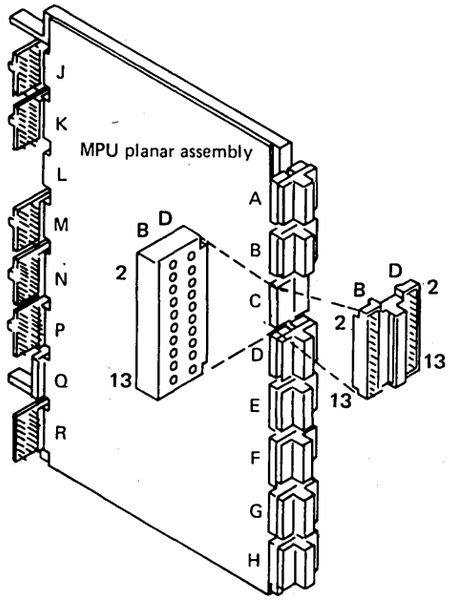
Feature Half Planar — Socket 1-P (for 3713)

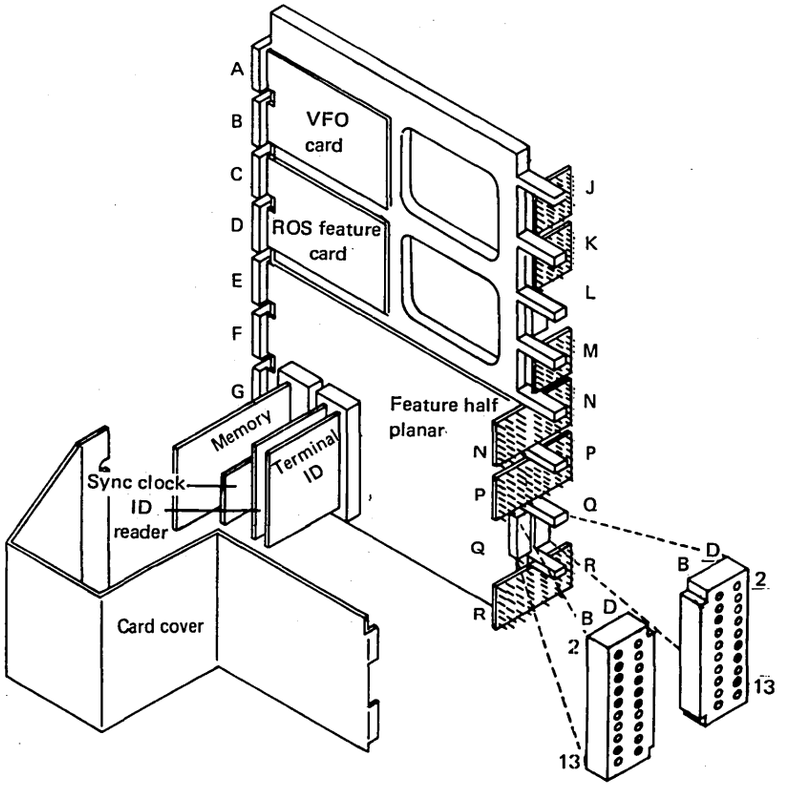
Pin	Signal
D13	Left margin slow switch N-O
D12	Print right emit amplified
D11	Left margin stop switch N-O
D10	Right margin switch N-O
D06	Index N-O
D05	PRI end of forms N-C
B13	Reverse feedback emit amplified
B10	Forward feedback emit amplified
B09	Cover interlock N-O

Feature Half Planar — Socket 1-R (for 3713)

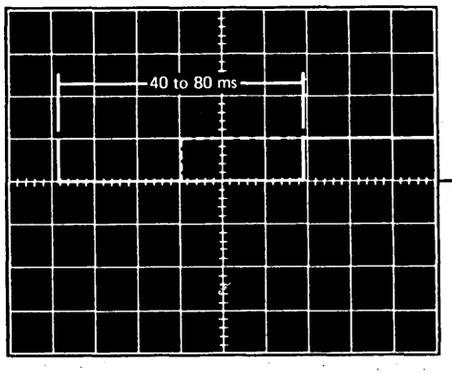
Pin	Signal
D13	Print wire drive No. 1
D11	Print wire drive No. 2
D10	Print wire drive No. 3
D07	Print wire drive No. 4
D06	Print wire drive No. 5
D05	Print wire drive No. 6
D03	Print wire drive No. 7
B13	Stepper motor drive not A
B10	Stepper motor drive not B
B09	Index
B08	Stepper motor drive A
B07	Ground
B04	Stepper motor drive B
B03	+5 Vdc
B02	-5 Vdc


MPU planar
Name
Pin
3713 Printer Controller
Feature Half Planar
Pin
Name
+ POR — 1-Q-B12
+ Reset R — 1-F-D10
Printer adapter
Terminators
1-P-B10 — -Forward feedback emit amplified — +5V
1-P-B13 — -Reverse feedback emit amplified — +5V
1-P-D12 — -Print right emit amplified — +5V
Integrators
1-P-D11 — -Left margin stop switch N-O — 0V
1-P-D13 — -Left margin slow switch N-O — 0V
1-P-D10 — -Right margin switch N-O — +8V
1-P-B09 — -Cover interlock N-O — 0V
1-P-D05 — -Pri end of forms N-C — +8V
1-P-D06 — -Index N-O — +8V
Voltage after POR static condition
Data Path
Bit 0 — 1-Q-B07
Bit 1 — 1-Q-B06
Bit 2 — 1-Q-B05
Bit 3 — 1-Q-B04
Bit 4 — 1-Q-D04
Bit 5 — 1-Q-D02
Bit 6 — 1-Q-B03
Bit 7 — 1-F-B10
-Printer select — 1-Q-B09
Printer register
0
1
2
3
4
5
6
7
Drivers
1-R-B08 — -Stepper motor drive A — +5V
1-R-B13 — -Stepper motor drive not A — 0V
1-R-B04 — -Stepper motor drive B — +5V
1-R-B10 — -Stepper motor drive not B — 0V
1-R-B09 — -Index — +5V
Select lines
Character generator
Drivers
1-R-D13 — -Print wire drive no. 1 — +5V
1-R-D11 — -Print wire drive no. 2 — +5V
1-R-D10 — -Print wire drive no. 3 — +5V
1-R-D07 — -Print wire drive no. 4 — +5V
1-R-D06 — -Print wire drive no. 5 — +5V
1-R-D05 — -Print wire drive no. 6 — +5V
1-R-D03 — -Print wire drive no. 7 — +5V


MPU planar assembly
J
K
L
M
N
P
Q
R
A
B
C
D
E
F
G
H
B
D
2
13

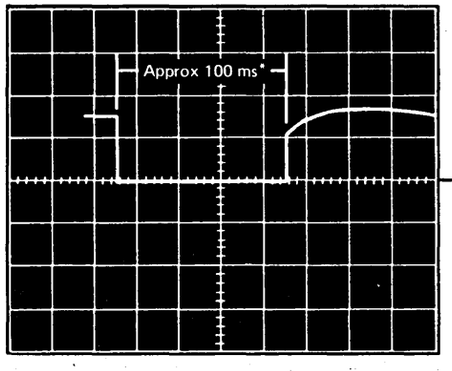

A
B
C
D
E
F
G
VFO card
ROS feature card
Memory
Terminal ID
Sync clock ID reader
Card cover
Feature half planar
J
K
L
M
N
P
Q
R
B
D
2
13

Test Points



Index

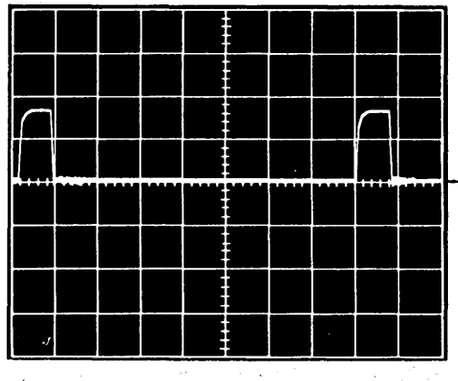
Sync trig	Int (+) dc
Sync point	1-R-B09
Sweep speed	10 ms/div
Probe point	1-R-B09
Vert amp	0.5 V/div



Left Margin Stop Switch N-O

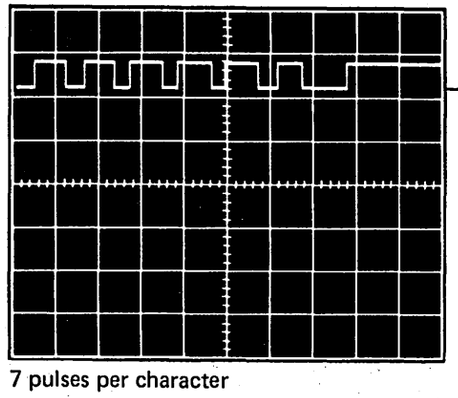
Sync trig	Int (+) dc
Sync point	1-P-D11
Sweep speed	20 ms/div
Probe point	1-P-D11
Vert amp	0.5 V/div

*Continuously running. Duration controlled by programming.



+Reset R

Sync trig	Int (+) dc
Sync point	1-F-D10
Sweep speed	2 μs/div
Probe point	1-F-D10
Vert amp	0.5 V/div



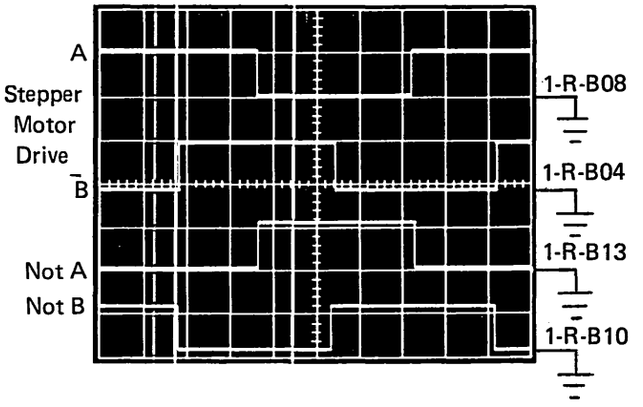
Print Right Emit Amplified

Sync trig	Int (-) dc
Sync point	1-P-D12
Sweep speed	2 ms/div
Probe point	1-P-D12
Vert amp	0.5 V/div

7 pulses per character

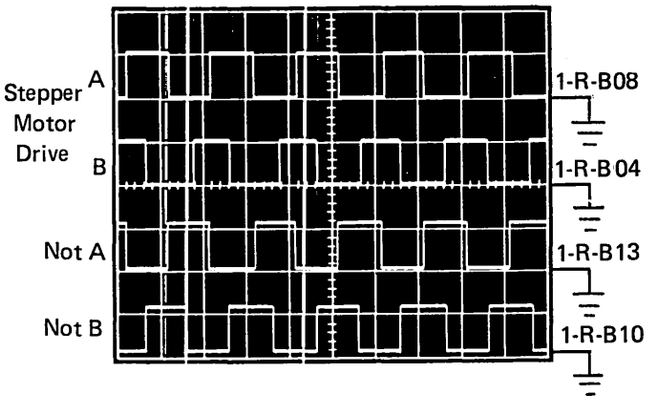
Stepper Motor Drive Lines Head Moving Left to Right

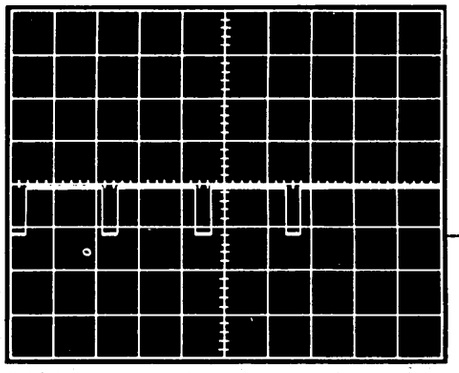
Sync trig	Int (+) dc
Sync point	1-R-B08
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div



Stepper Motor Drive Lines Head Moving Right to Left

Sync trig	Int (+) dc
Sync point	1-R-B08
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

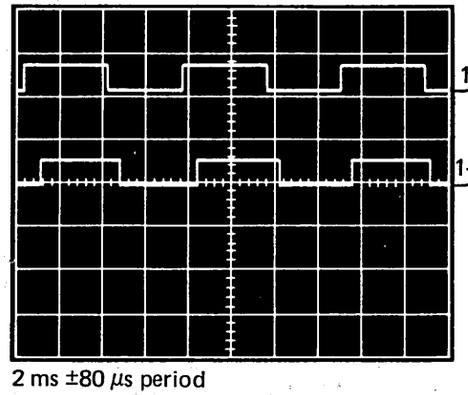




Printing an asterisk

Print Wire Drive No. 4

Sync trig	Int (–) dc
Sync point	1-R-D07
Sweep speed	2 ms/div
Probe point	1-R-D07
Vert amp	0.5 V/div



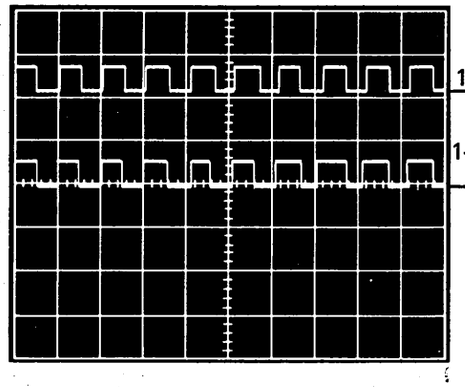
2 ms ±80 μs period

Feedback Emitter Amp Head Moving Left to Right

1-P-B10
1-P-B13

Sync trig	Int (+) dc
Sync point	1-P-B10
Sweep speed	500 μs/div
Probe point	See trace drawing
Vert amp	0.5 V/div

Upper: Forward feedback emitter amp
Lower: Reverse feedback emitter amp

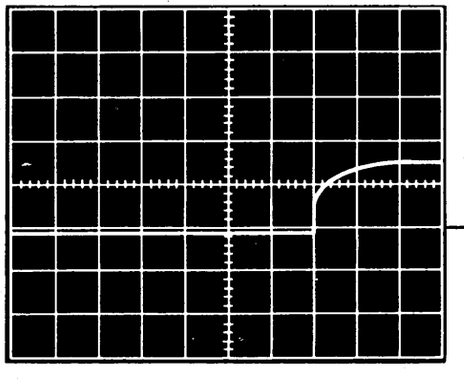


Feedback Emitter Amp Head Moving Right to Left

1-P-B10
1-P-B13

Sync trig	Int (+) dc
Sync point	1-P-B10
Sweep speed	500 μs/div
Probe point	See trace drawing
Vert amp	0.5 V/div

Upper: Forward feedback emitter amp
Lower: Reverse feedback emitter amp



Index N-O

Sync trig	Int (–) dc
Sync point	1-P-D06
Sweep speed	10 ms/div
Probe point	1-P-D06
Vert amp	0.5 V/div

Note: All scope probing should be done using the 10X probe.

3715 PRINTER CONTROLLER

When the 3741 mainline power is turned on, '+POR' is raised (0 to +8.5 volts) and '+reset R' (clock line) is held up (+8.5 volts). '+POR' is active for approximately 550 ms.

When '+POR' drops, '+reset R' becomes active. '+reset R' is the clock on which all timings in the printer adapter are based. Following the 3741 power-up sequence, the printer adapter holds the printer reset ('–printer reset') until a printer operation is selected.

When the printer is first selected and if the print head is not at the left margin position, the printer adapter causes the print head to be returned to the left margin position prior to printing.

When in print mode, '–printer select' should be negative. Data is transferred to the printer register from the microcontroller (MPU) on the data path bit lines in sockets Q and F, one character at a time.

When the microcontroller puts a character to be printed into the print register, the printer adapter detects the presence of the character and starts the print head carrier moving to the right. The head will continue moving to the right until the microcontroller puts a stop command character in the printer register. If the microcontroller does not issue a stop command, the print head will crash into the right margin stop and a printer hardware error will be posted (there is no right margin switch).

The head carrier motion is maintained by internal timings in the adapter (derived from '+reset R') which causes the print head stepper motor drive lines to sequence.

Printing is bi-directional and is accomplished by the printer adapter selecting the vertical columns of the dot matrix in the character generator. Each character printed is maintained at the output of the print register and the inputs to the printer adapter and the character generator for the time required to print the character. The timings required to select the vertical columns from the character generator come from the printer adapter. These timings are derived from the print emitter feedback (EM1, EM2 and EM3) from the printer. When the last column of dots has been printed for the char-

acter, the printer adapter generates a reset to the printer register. The microcontroller monitors the printer register and a cleared register signals the need for the next character.

Paper is indexed when a line feed command in the printer register is decoded by the printer adapter. Printing and head motion are prevented during indexing. Indexing is accomplished by adapter timings and the printer forms emitters, 'FEA and FEB'.

A carriage return command from the microcontroller causes the printer adapter to terminate the print (if printing) and the head to be returned to the left margin. If the printer is already in the left margin area, the command is immediately reset by the adapter with no printer motion.

A carriage home command causes the printer adapter to return the head to the home or park position. Head movement is the same as for the carriage return command except that the head movement continues past left margin to the home position. When in the home position, the head is withdrawn from the platen. If the head is already in the left margin area, the printer head will move to the right until away from the left margin and then return to the home or park position.

The following failures or error conditions are detected by the printer adapter. When an error condition is detected, the printer adapter inhibits the reset to the printer register and the microcontroller displays a printer hardware error (U error code upper left corner and 15 status lower left corner of display).

Printer not ready — can be caused by a printer wire check, no printer power.

End-of-forms — indicates the end of forms has arrived or that there is no paper in the printer when printing in continuous forms mode (when feeding individual forms, the end-of-forms switch is inactive). A carriage home is always performed prior to displaying this error.

Print head not moving — indicates that there is no emitter feedback from the printer when the adapter is attempting to move the head.

Print head moving too fast — indicates that the emitter feedback pulses are too close together or that the print head is moving too fast.

Print overrun — indicates that the microcontroller did not service or pass a character to the printer adapter at print time while the adapter was in print mode.

Index failure — indicates that the index was not completed or that a 'forms emitter A or B' is not present from the printer.

A printer hardware error is also displayed for a printer adapter hardware failure. In addition to these hardware failures, the microcontroller may display an invalid character error (U error and 3 status) if it detects an unprintable character in the printer register whenever the PROG NUM SHIFT switch on the keyboard is not in the ALL CHAR position.

Multiple device errors may occur while in print mode. These are displayed in the upper right hand corner of the screen such as U4, etc. U4 error denotes a disk error and a printer error both occurred. Such errors should be resolved on an individual basis.

Note: The microcontroller initiates one retry for a printer error prior to setting the error code except for an error condition during an index and the illegal character check on Model 1 and 2 only. In other words, if a wire check occurs during the printing of a line, the printer stops and retries printing the entire line. Any portion of the line that was printed is reprinted with the remainder of the line being printed assuming the retry was successful.

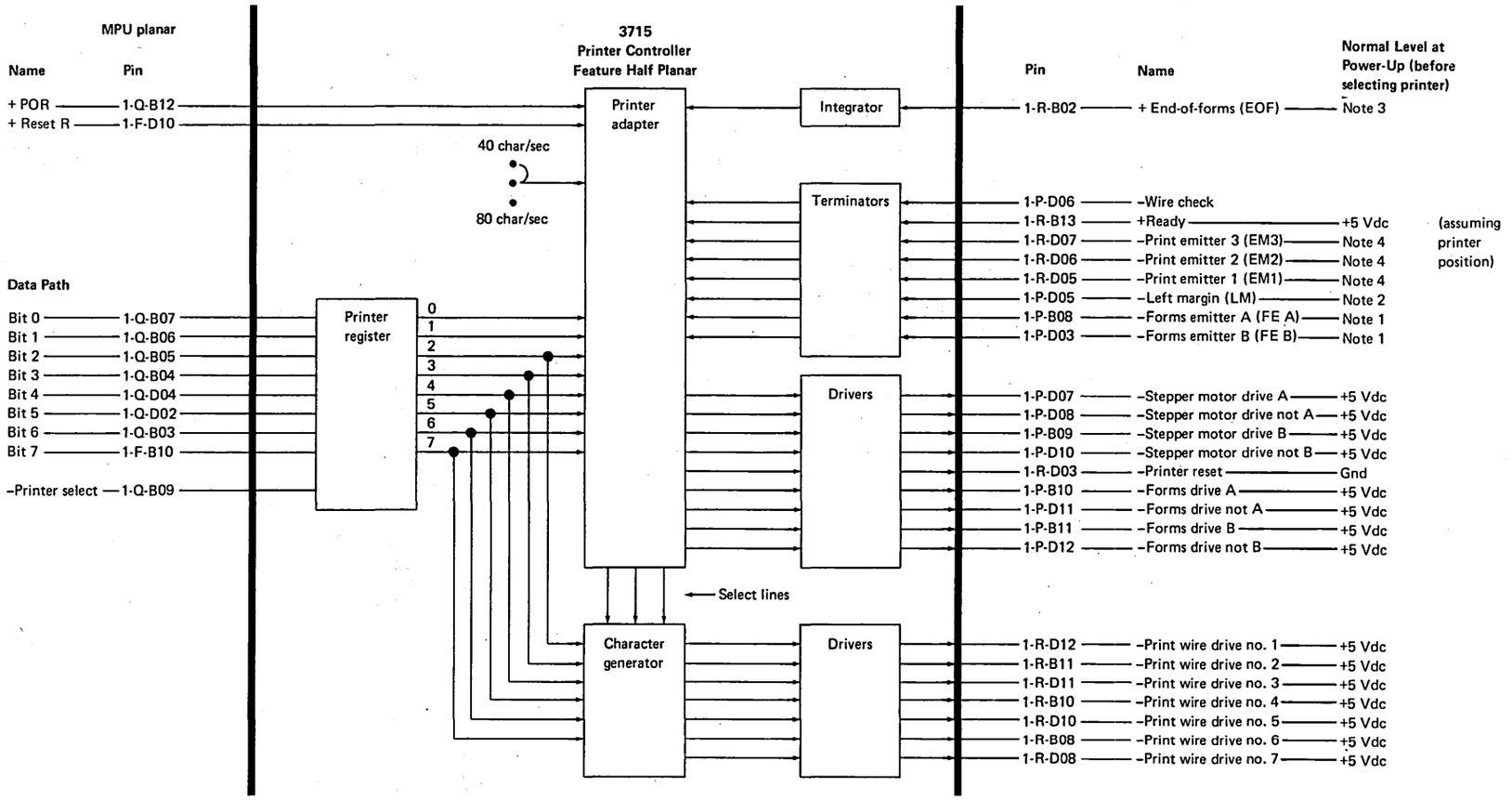
Feature Half Planar — Socket 1-P (for 3715)

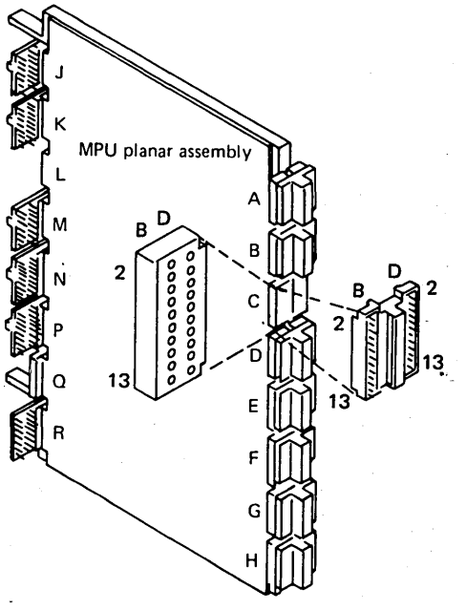
Pin	Signal
B08	–Forms emitter A (FEA)
B09	–Stepper motor drive B
B10	–Forms drive A
B11	–Forms drive B
D03	–Forms emitter B (FEB)
D05	–Left margin (LM)
D07	–Stepper motor drive A
D08	–Stepper motor drive not A
D10	–Stepper motor drive not B
D11	–Forms drive not A
D12	–Forms drive not B

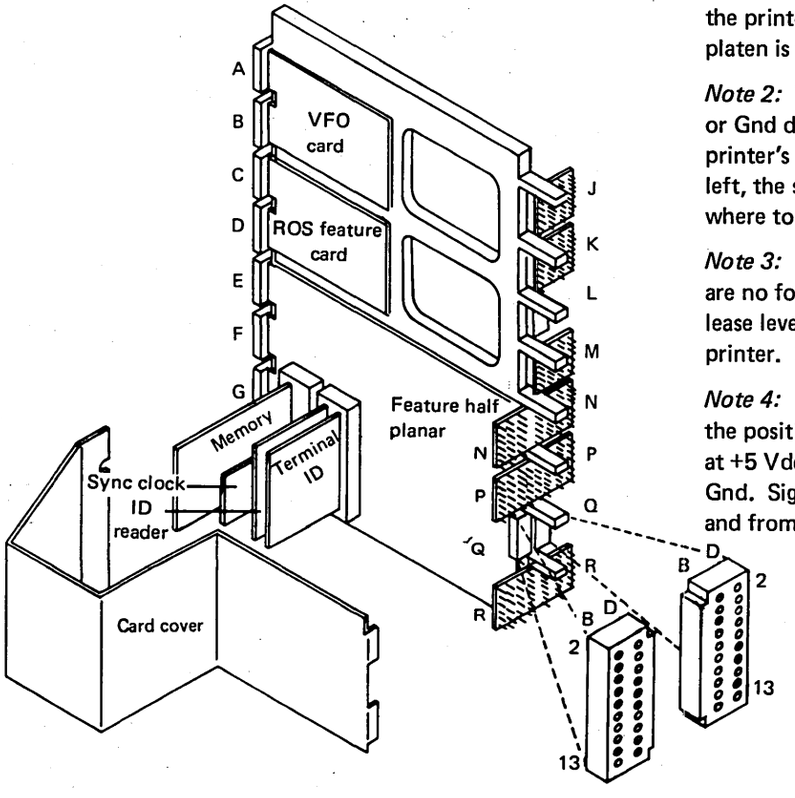
Feature Half Planar — Socket 1-R (for 3715)

Pin	Signal
B02	+End of form (EOF)
B09	--Print wire drive 6
B10	--Print wire drive 4
B11	--Print wire drive 2
B13	+Ready
D03	--Printer reset
D05	--Print emitter 1 (EM1)
D06	--Print emitter 2 (EM2)
D07	--Print emitter 3 (EM3)
D08	--Print wire drive 7
D10	--Print wire drive 5
D11	--Print wire drive 3
D12	--Print wire drive 1

EC 825853	826065		PN 1619445
Date 11/15/74	8/1/75		







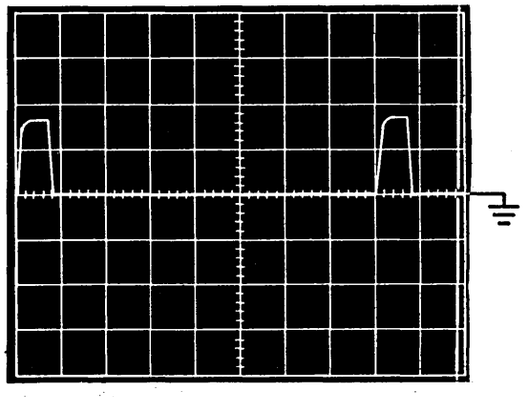
Note 1: One or both signals may be at either +5 Vdc or Gnd depending on the position of the printer platen. Lines will switch if the platen is turned.

Note 2: The signal will be at either +5 Vdc or Gnd depending on the position of the printer's head. If head is all the way to the left, the signal will be Gnd. If head is anywhere to the right, the signal will be +5 Vdc.

Note 3: The signal will be at +5 Vdc is there are no forms in the printer and the paper release lever is in the forward position on the printer. Otherwise, the signal will be at Gnd.

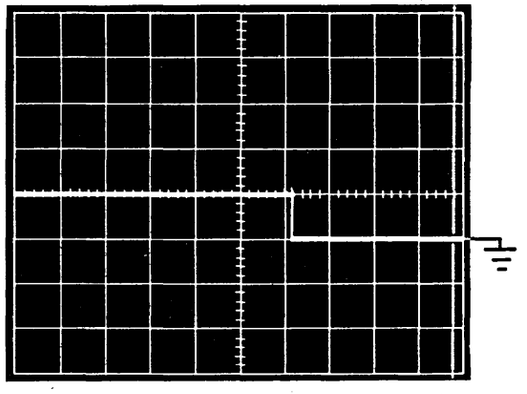
Note 4: These signals are dependent upon the position of the printer head. All may be at +5 Vdc or one and only one may be at Gnd. Signal levels vary with head positions and from printer to printer.

Test Points



+Reset R

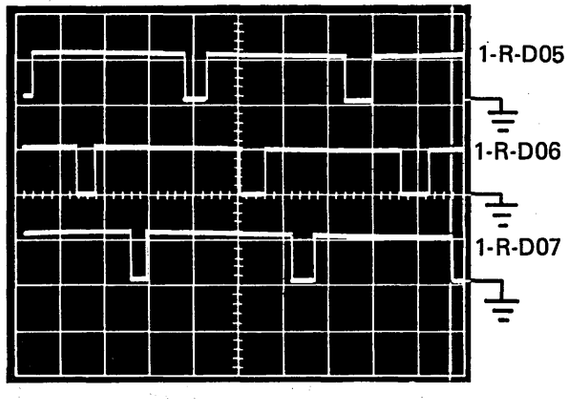
Sync trig	Int (+) dc
Sync point	1-F-D10
Sweep speed	2 μs/div
Probe point	1-F-D10
Vert amp	0.5 V/div



Left Margin

Sync trig	Int (+) dc
Sync point	1-P-D05
Sweep speed	20 ms/div
Probe point	1-P-D05
Vert amp	0.5 V/div

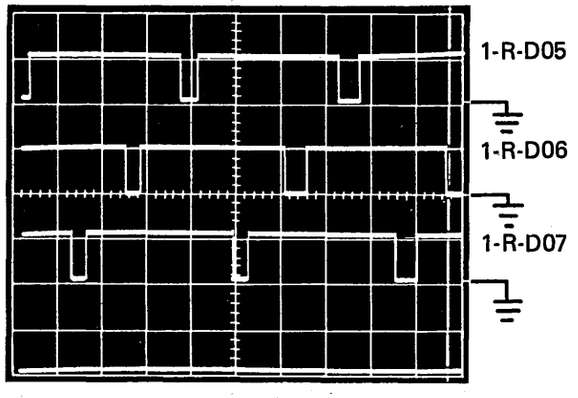
Continuously running in CE-4 diagnostic mode.



Print Emitters

Sync trig	Int (–) dc
Sync point	1-R-D05
Sweep speed	2 ms/div
Probe points	See trace drawing
Vert amp	0.5 V/div

Continuously running in forward print or CE-3 at 40 char/sec.

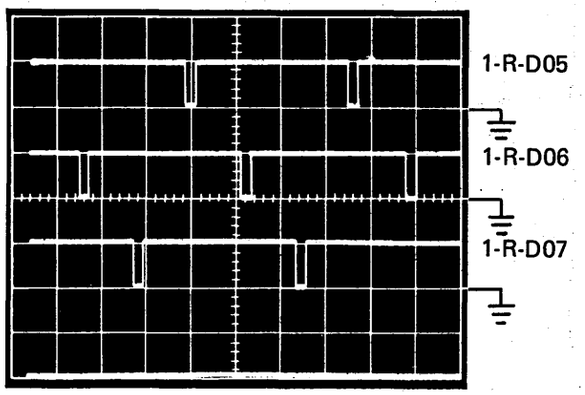


Print Emitters

Sync trig	Int (–) dc
Sync point	1-R-D05
Sweep speed	2 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

Continuously running in reverse print on CE-3 at 40 char/sec.

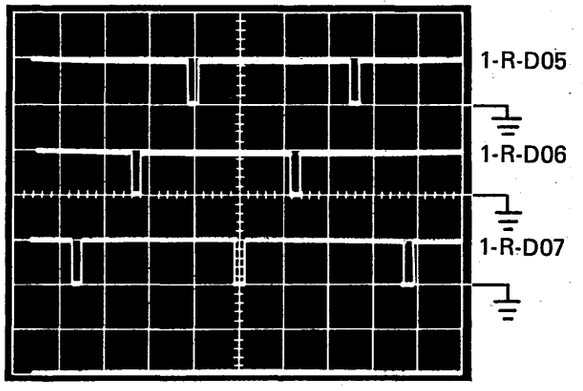
EC 825853	826065		PN 1619447
Date 11/15/74	8/1/75		



Print Emitters

Sync trig	Int (+) dc
Sync point	1-R-D05
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

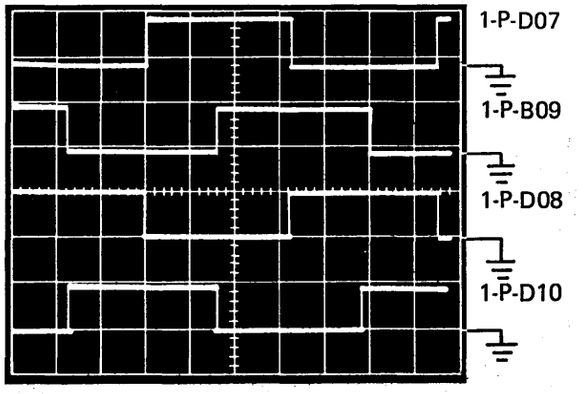
Continuously running in forward print or CE-3 at 80 char/sec.



Print Emitters

Sync trig	Int (+) dc
Sync point	1-R-D05
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

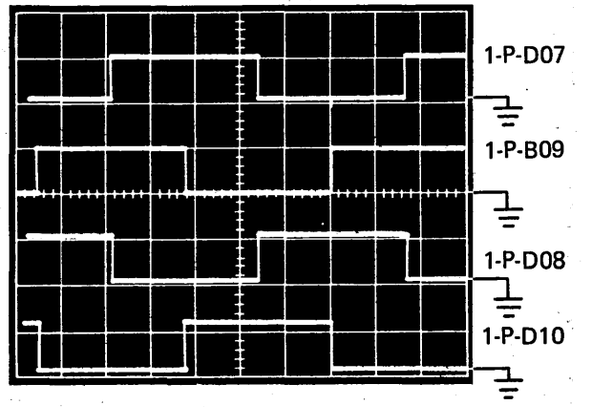
Continuously running in reverse print or CE-3 at 80 char/sec.



Stepper Motor Drive Lines
Head moving left to right

Sync trig	Int (–) dc
Sync point	1-P-D07
Sweep speed	2 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

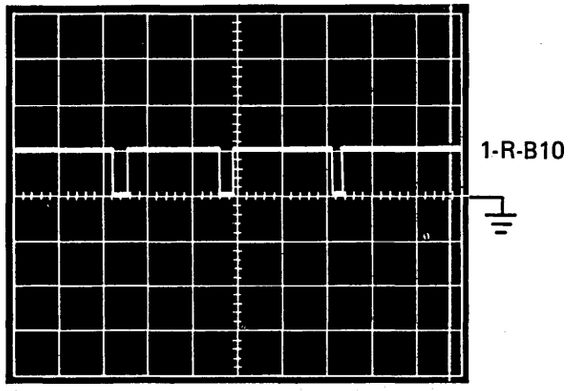
Up to speed — varies during start and stop ramp.



Stepper Motor Drive Lines
Head moving right to left

Sync trig	Int (–) dc
Sync point	1-P-D07
Sweep speed	2 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

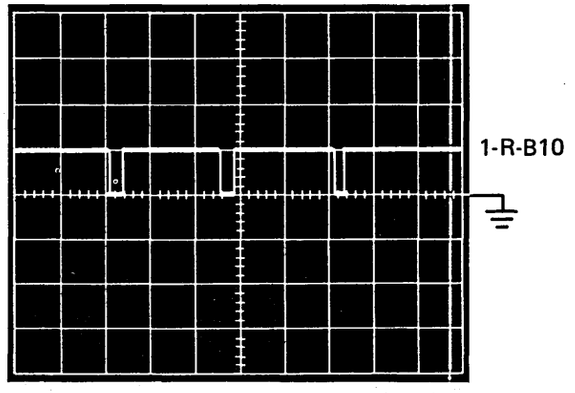
Up to speed — varies during start and stop ramp.



Print Wire Drive 4

Sync trig	Int (+) dc
Sync point	1-R-B10
Sweep speed	2 ms/div
Probe point	1-R-B10
Vert amp	0.5 V/div

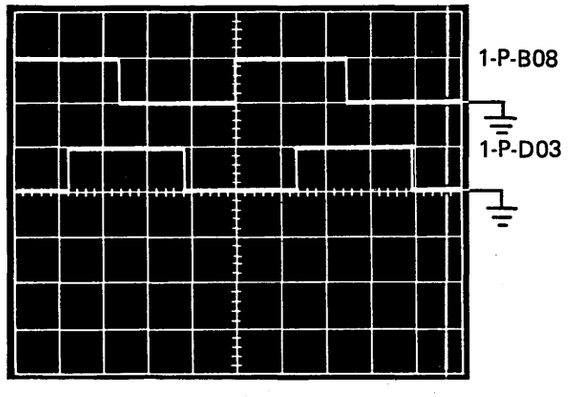
Printing an H at 40 char/sec.



Print Wire Drive 4

Sync trig	Int (+) dc
Sync point	1-R-B10
Sweep speed	1 ms/div
Probe point	1-R-B10
Vert amp	0.5 V/div

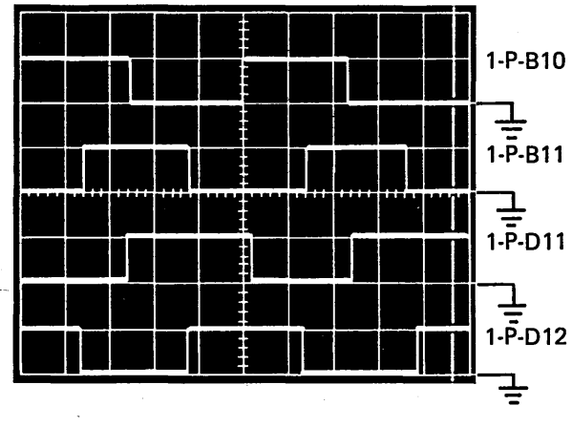
Printing an H at 80 char/sec.



Forms Emitter Feedback

Sync trig	Int (+) dc
Sync point	1-P-B08
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

Continuously running in CE-5 diagnostic mode.



Forms Emitter Drive Lines

Sync trig	Int (+) dc
Sync point	1-P-B10
Sweep speed	1 ms/div
Probe point	See trace drawing
Vert amp	0.5 V/div

Continuously running in CE-5 diagnostic mode.

Proof Keyboard Feature

The proof keyboard feature which can be installed on a 3741 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.

Katakana Feature

The Katakana feature provides the ability of entering the Katakana EBCDIC code onto the disk. The keyboard provides input of 64 Katakana characters plus 63 domestic characters. The Katakana characters are generated by the Katakana shift and the Katakana symbol functions.

Any time 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 the ALPHA SHIFT, NUM SHIFT, or KANA SYMB shift key. 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 the ALPHA SHIFT or NUM SHIFT key 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.

BSCA THEORY

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INTRODUCTION

The Binary Synchronous Communications Adapter (BSCA) allows the machine to function as a point to point terminal. The basic BSCA function allows data transmission using EBCDIC directly as the communications line code. Operation is half-duplex over private line, common carrier leased line, or a common carrier switched network. The mode of transmission is synchronous, serial-by-bit, and serial-by-character.

BSCA Controller Operation

When in communications mode the BSCA controller makes use of the MPU microcontroller, the disk unit controller, and the microcontroller/buffer interface and the display unit controller to:

1. Perform all disk functions such as read or write, write checking or checking, or updating information on the index track.

2. Transfer data between the disk unit and the BSCA controller. The transfer in transmit mode is from the disk unit to the buffer, to the BSCA controller data register, to the modem. In receive mode the flow is reversed.

3. Display status, error codes and CPU ID information for review by the operator. The five communication modes are:

T	to transmit only
P	to transmit hex data
R	to receive data only
B	to transmit data, auto-turn around and receive data
D	to transmit hex data, auto-turn around and receive

The BSCA controller also performs the serializing/deserializing function on the data transmitted or received.

An operator can select communications mode from update or index modes only. Upon selection of the communications mode from index mode, the data set label will be checked for valid extents (BOE, EOE, EOD) and for HDR1. If these conditions are met, the BSCA controller will perform the wrap test. This test verifies that data can be passed through the BSCA controller from the data register up to the modem cable drivers and back to the BSCA data register. If this test fails, a W or WI will be posted on the display in the mode indicator positions.

If no error exists, the BSCA controller will then check several features in the following order:

1. If the keylock is present, it must be unlocked.

2. If terminal ID is present, the terminal ID is read and stored in the program 9 buffer.

3. If terminal ID is present, the cursor must be at position 16 or less. All positions below the cursor are assumed to be the CPU ID and are transferred to the buffer. The CPU ID must be entered before communications mode is selected and must be 15 characters or less. If no CPU ID is entered, the BSCA controller will accept any ID from the Remote end.

4. The second disk feature will be set to record 00007 on the index track.

If a failure occurs in steps one or three, an H error is posted. Step 4 could result in posting disk errors.

The record at the current address position of disk one is reread and a C for communications is posted as the mode indicator in the status line of the display (position 38).

On switched lines and if the operator will be dialing the call, the M key must then be pressed. The T, P, R, B or D key must then be pressed to select the function desired. Pressing the M key must be omitted if the 3741 will be answering a call, or if on leased lines.

On switched lines, pressing the M key indicates to the BSCA controller that it is calling and therefore will transmit a line bid first, regardless of the mode. Not pressing the M key tells the BSCA controller to wait for a line bid. On non-switched (leased) lines the M key is not required because the station in transmit mode will transmit a line bid first.

The letter key pressed will replace the C in the status line. If the ID reader is installed, a B will be posted on the status line in position 39. The badge can then be inserted and read into the buffer or the REC ADV key can be pressed to skip the ID reader functions as in 3741 to 3741 communications.

The BSCA controller then checks the mode strap. It can be in DTR (data terminal ready) or CDSTL (connect data set to line) mode. The DTR mode is generally used for switch lines and the CDSTL generally for leased line communications.

In CDSTL mode, the BSCA controller then looks for DSR (data set ready) or the ring indicator (RI) to come up. **B** The controller then will look for a line bid (ENQ), send a line bid if the M key has been pressed, or send line bid if in transmit mode on a leased line. If the BSCA controller detects that the send answertone strap is on, the first transmission is three seconds of space (logical 0). The terminal ID and CPU ID codes are exchanged with the original line bids and responses.

In DTR mode the BSCA controller will check for data set ready(DSR) being off, then it will bring data terminal ready (DTR) up. **A** The operator will then place the call if this is the calling station. After the data set button on the modem is pressed causing DSR to come on, the controller will make or wait for a line bid and exchange ID codes. From this point on, CDSTL and DTR operation is identical and is dependent on the operator selected mode, transmit or receive.

In the T, B, D or P transmit modes, the ID reader code will be transmitted followed by data records.

If communications mode was selected from update mode, the record at the current address and all records from this one to the end of the data set will be transmitted. If this mode was selected from index mode, the current label will be checked to see that the bypass data set position (position 41) does not contain a B, before the data set is transmitted. If a B is found, the BSCA controller causes a search for another data set to be transmitted.

Transmit Mode (T or P)

The records to be sent are read from the disk into the previous record or hold buffers. A record is read into one of these buffers, the read of the next record into the other buffer is then initiated. Transmit of the first record then starts. Reading of records is controlled by the disk unit controller and the microcontroller/buffer interface while the transmitting of records is under control of the BSCA controller and the microcontroller/buffer interface. Therefore, the reading and transmitting of records takes place simultaneously. Data is transmitted one record at a time, serial by bit, serial by byte. A positive response from the receiving end will initiate the transmitting of the next record and the reading of the following record.

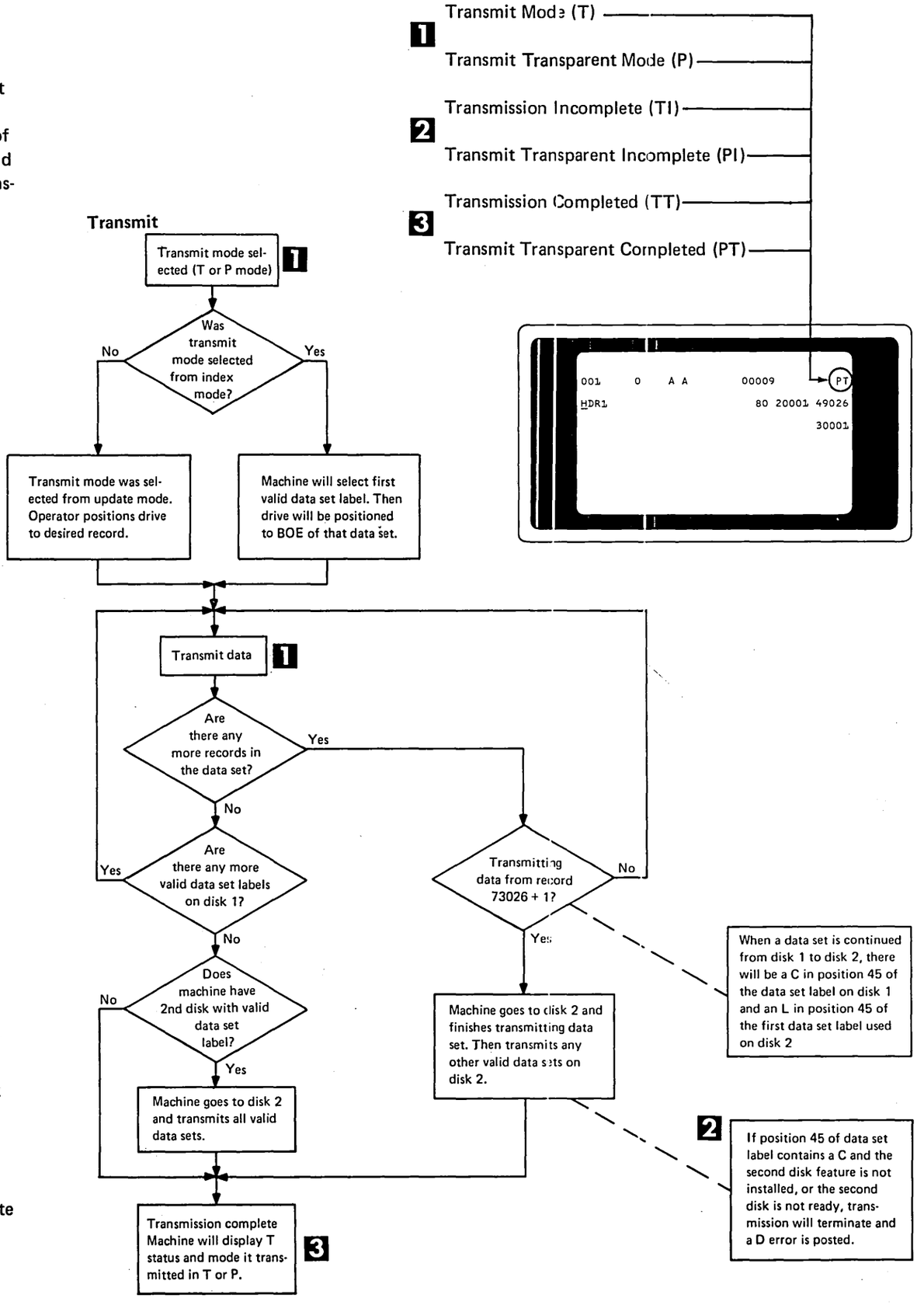
Data is transferred from the previous or hold buffer one byte at a time to the data register on the BSCA controller and from the data register it is transferred serially by bit to the transmit line.

Transmitting continues until the last record of the data set is sent. At this time, the disk is returned to the index track to look for another data set to transmit. All data sets which contain an HDR1 and do not contain a B in the bypass data set position of the label and which have a label record number higher than the one just transmitted, will be transmitted. When the second disk feature is installed, any HDR1 data set on that disk which does not contain the B in the bypass position of the label will also be transmitted.

If an invalid label is found, which is not a bypass data set, communications will be terminated with the appropriate error code displayed.

When there are no more data sets to be transmitted, the BSCA controller will send the end of transmissions sequence (EOT) and post a T in position 39 of the status line.

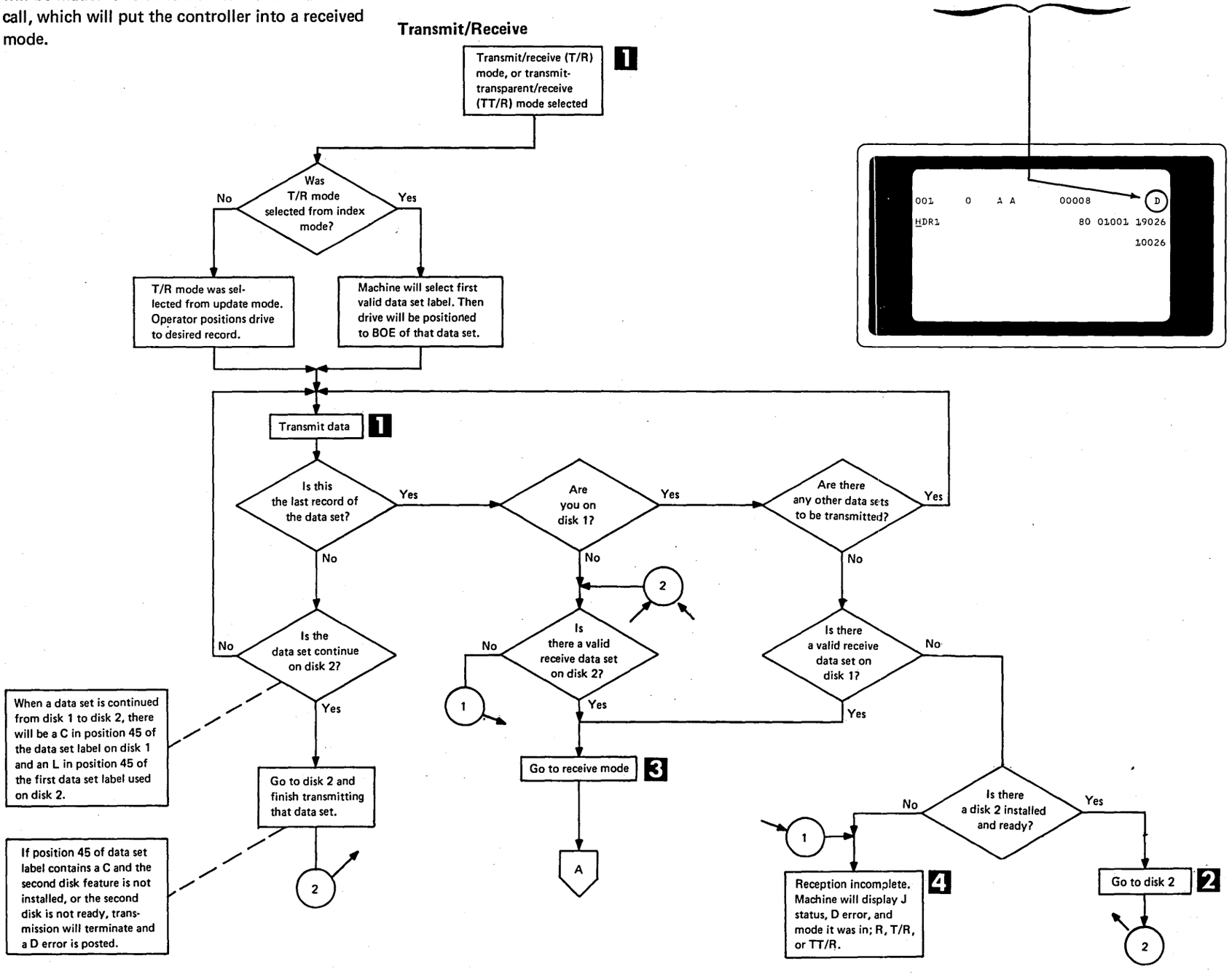
A null record is always transmitted between data sets and before the EOT sequence. If a data set is continued on disk 2, the first valid data set on disk 2 is sent as a continuation of this data set, and then transmits any other valid data sets on disk 2. If position 45 of the data set label contains a C and the second disk feature is not installed, or the second disk is not ready, transmission will terminate and a D error is posted.



Transmit/Receive (B or D)

If the mode had been B or D, the transmit sequence is identical to the T or P mode. However, when all data sets have been transmitted, the BSCA controller causes the disk to be positioned on the index track at the first valid data set label after the label corresponding to the last data set transmitted. This will become the label of the first data set received. The controller will wait 20 seconds for a line bid. If none is received, a C error will be posted on the display and a line disconnect will be made. The controller will then wait for a call, which will put the controller into a received mode.

1	Transmit Transparent/Receive Mode		(D)
	Transmit/Receive Mode	(B)	
2	Transmit Incomplete	(BI)	(DI)
3	Transmit Completed	(BT)	(DT)
4	Reception Incomplete	(BJ)	(DJ)
5	Reception Completed	(BC)	DC



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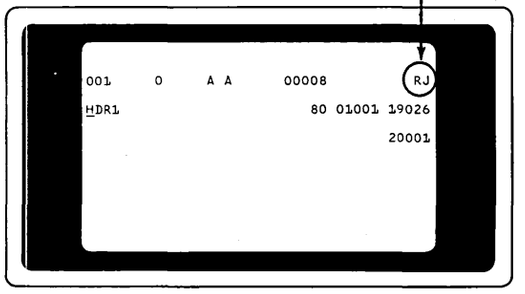
6 Receive Mode (R)

7 Reception Incomplete (RJ)

8 Reception Completed (RC)



Receive

6 Receive mode selected (R Mode)

Was receive mode selected from index mode?

No

Yes

Receive mode was selected from update mode. Operator positions drive to desired record.

Machine will select first valid data set label. Then drive will be positioned to BOE of that data set.

A

6 3 Receive data

1

Is this the last record of the data set?

Yes

No

Receiving data for record 73026 + 1?

No

Yes

Update data set label by putting C in position 45 (data set is continued on another diskette)

Are you receiving on drive 1 and is drive 2 installed and ready?

No

Yes

Start receiving on drive 2 at 01001

Reception incomplete Machine will display J status, D error, and mode it was in;R,T/R, or TT/R. 7

Does machine have 2nd disk with valid data set label?

No

Yes

Did this data set overrun from DR1 to DR2?

No

Yes

Update data set label by putting an L in position 45. (data from another diskette ended on this diskette).

Update data set label: EOD=CDA(current disk address). EOE-EOD – 1 Character length = the length of first record received. Update BOE by number of records received.

All data sets received?

Yes

Reception complete. Machine will display: C status and reception mode it was in;R,T/R, or TT/R. 5 8

No

Are there any more valid data set labels on disk 1?

No

Yes

Locate next valid data set label. Update its BOE to the EOE + 1 of the data set previously received.(The data received will be written in the first record following the EOE of the last data set received).

1

Receive Mode (R)

On switched line, in receive mode, the controller will wait 20 seconds for data. If none is received, a C error is posted on the display and a line disconnect will be made. If a call is then received, the BSCA controller goes back into the receive mode.

On non-switched line, the BSCA controller will continuously monitor the line. Data is received serial by bit, serial by character in one-record blocks. It is assembled in the BSCA controller data register and transferred one byte at a time to the previous record or hold buffers. When a complete record is assembled in one of these buffers, the following sequence takes place:

1. Start to write the record on disk.
2. Bring up RTS and wait for clear to send signal, to send response.
3. Send sync characters until write operation is completed.
4. Start write check operation.
5. Send acknowledgment on the line.
6. Wait for or receive the next record into the other buffer (hold or previous).

In this way the write operation overlaps the clear to send delay and the write check operation overlaps receive of the next record. At the end of a data set, a null record will be received, if a second data set is to be received. The 3741 will terminate the receive mode if a null data set is followed by EOT sequence or if an EOT sequence follows the data set immediately (no null record received).

After a complete data set has been received, the controller will cause the data set label to be updated in several positions. These are record length, end of extent, end of data, and beginning of extent. The record length will equal the length of the records received. EOE will be the address of the last record written. EOD is one greater than EOE. BOE is the location of the first record in the data set. BOE is unchanged on the first data set received if the operator selected receive mode. If any of the transmit modes had been utilized or more than one data set is received, BOE is set to one record address greater than the EOE of the last data set transmitted or received.

If another data set is to be received, the BSCA controller searches for the next valid data set label. It will internally establish a BOE which is equal to EOE plus one (or EOD) of the data set just received and then position the disk to receive the next data set. Disk 2, if installed, appears as an extension of disk 1. If a data set overflows from disk 1 to disk 2, a C is placed in position 45 (multivolume indicator) of the data set label on disk 1. The rest of the data set will be received on disk 2 and an L will be placed in position 45 of the first label used on disk 2. If a record is written in position 73026 on disk 1, and this is not the last record of the data set, the next record will be written on disk 2 record 01001. If in this case the second disk feature is not installed or the second disk is not in a ready state (no diskette inserted, etc.), a D error is posted, communications will be terminated, and a J will be posted in position 39 of the status line.

Any error or operator intervention will cause the 3741 BSCA controller to go to a disconnect sequence in which the error code is posted on the display and is sent to the other station as part of the error message.

The RESET key can be used to terminate communications mode at any time. If data has transferred, an S error will be posted. The controller will then proceed with the normal error disconnect sequence and take the machine out of communications mode. If the RESET key is pressed twice or is pressed following an error, the 3741 will leave communications mode immediately.

Communications Display Mode Indicators

A mode indicator is displayed in positions 37 and 38 of the status line. The following shows the key required to select the mode, the mode displayed, and the meaning:

Key	Mode Displayed	Meaning
COMM	C	Communication
T	T	Transmit
	TB	Read Operator ID (Transmit)
	TI	Transmit Incomplete
	TT	Transmit Complete
P	P	Transmit Transparent Text
	PB	Read Operator ID (Transmit Transparent)
	PI	Transmit Transparent Incomplete
	PT	Transmit Transparent Complete
R	R	Receive Mode
	RC	Receive Complete
	RJ	Receive Incomplete
B	B	Transmit/Receive (T/R)
	BB	Read Operator ID (T/R)
	BT	Transmit Portion of T/R Complete
	BI	Transmit Portion of T/R Incomplete
	BJ	Receive Portion of T/R Incomplete
	BC	T/R Complete
D	D	Transmit Transparent/Receive (TT/R)
	DB	Read Operator ID (TT/R)
	DI	Transmit Portion of TT/R Incomplete
	DT	Transmit Portion of TT/R Complete
	DJ	Receive Portion of TT/R Incomplete
	DC	TT/R Complete
J	J	Transmit Blocked Records (TBR)
	JB	Read Operator ID (TBR)
	JI	Transmit Blocked Records Incomplete
	JT	Transmit Blocked Records Complete
K	K	TBR/Receive (TBR/R)
	KB	Read Operator ID (TBR/R)
	KT	Transmit Portion of TBR/R Complete
	KI	Transmit Portion of TBR/R Incomplete
	KJ	Receive Portion of TBR/R Incomplete
	KC	Receive Portion of TBR/R Complete
I	I	Inquiry (I)
	IB	Read Operator ID–(I)
	IT	Transmission of Inquiry Message-Complete
	II	Transmission of Inquiry Message-Incomplete
	IC	Receive Inquiry Response Complete
	IJ	Receive Inquiry Responses Incomplete
	%	Online Test Mode
	%C	Online Test Complete
	%T	Online Test Complete (Transmit)
	%J	Online Test Incomplete (Receive Portion)
	%I	Online Test Incomplete (Transmit Portion)
W	W	Wrap Test
	WI	Wrap Test Incomplete
	WC	Wrap Test Complete

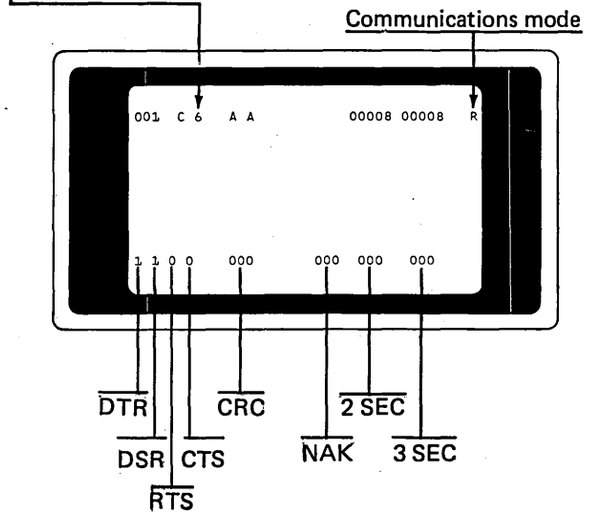
If the mode indicates an incomplete operation, check the error indicator in position 7. See *Symptom Index, Error Indicators,* 1-2. J, K, and I modes will occur only in Expanded Communications.

Communications Errors

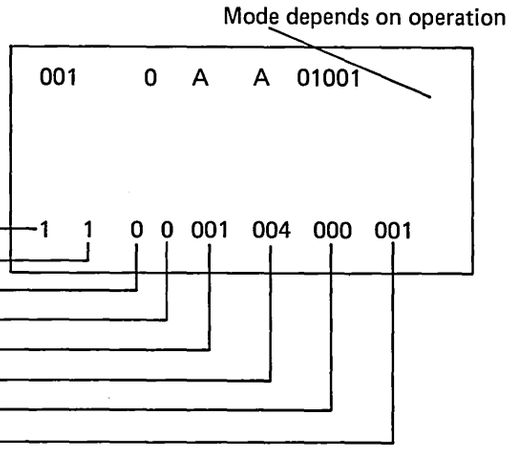
Code	Description	Cause	Operating Procedure
C	BSCA line check	– There is no activity on the communications line for 20 seconds.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
D	BSCA disk full	– Disk overflows in receive mode. – Disk index track overflows. – No valid index. – No disk 2.	– Press RESET. Load a new diskette. Enter C mode. Call remote end to re-establish linkup.
H	BSCA setup error	– Machine not in X or U mode before C mode. – Cursor is past position 16 when entering C mode. – Machine at bad index when entering C mode. – Keylock not turned on.	– Press RESET. Use correct setup procedure.
I	BSCA data set not ready	– The modem 'data set ready' line is down.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
Q	BSCA message aborted	– Received four consecutive negative responses to the same data record.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
R	BSCA remote abort	– Remote end terminates communications prematurely by sending EOT or disconnect.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
S	Operator initiated termination – BSCA	– Pressed RESET while the machine was transmitting a status message.	– Press RESET. Continue.
T	BSCA transparency error	– Detected a data link control character in the data to transmit.	– Note the displayed address. Press RESET. Correct the data on the diskette. Establish the start point on the diskette. Enter communications mode. Call remote end to establish linkup.
U	BSCA received data block	– Received a data block when in transmit mode.	– Press RESET. Place the machine in receive mode if remote end intents to transmit data.
V	BSCA received line bid	– Remote end re-established communications when local end posts complete or incomplete status.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
W	BSCA length error	– Remote end sends record length with zero characters or greater than 128 characters or a length different from the previous record sent.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.
X	BSCA negative bid response	– Received a negative response or disconnect sequence as a response to a transmitted line bid.	– Note the displayed address. Call remote end to re-establish linkup. Establish start point on diskette. Enter communications mode.

Error Code

The right position shows disk errors only; the left position shows all other errors.



BSCA Error Logout



When in T, P, B, D, or R mode, the bottom line on the display shows the following:

Position	Meaning
* 1	Data terminal ready.
* 4	Data set ready.
* 7	Request to send.
* 10	Clear to send.
**14 · 16	CRC checks in receive.
**19 · 21	NAKs received in transmit.
**24 · 26	Two-second time-outs.
**29 · 31	Three-second time-outs.

* *Note:* 1 indicates on; 0 indicates off.
** *Note:* three-position decimal counts.

The logout is displayed on the bottom line of the display during BSCA operation.

Whenever the BSCA controller turns on the data terminal ready interface line (1-N-D07), a 1 is displayed in position 1. When it turns the line off, a 0 is displayed. Likewise, when it turns on request to send (1-N-B13) a 1 displays in position 7. When it turns the line off, a 0 is displayed.

When the BSCA controller detects the data set ready (1-N-D12) interface line is on from the modem, a 1 displays in position 4. When data set ready is off, a 0 displays. Likewise, if clear to send (1-N-B10) is on, a 1 is displayed in position 10. Whenever the line goes off, a 0 is displayed.

During receive operations, a running count is maintained of all CRC checks, where transmitted block check characters (BCC) do not match those calculated by the BSCA controller. This count is displayed in positions 14, 15, and 16. This is an indication of the number of transmission blocks received with errors that required retransmission.

During a transmit mode, a count of NAKs (negative acknowledgments) that are received is displayed in positions 19, 20, and 21. These NAKs have been received from the remote station as a result of data blocks received in error or TTDs (temporary text delays).

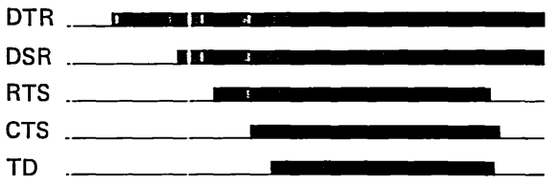
During communications, a count is maintained of 2-second time-outs in positions 24, 25, and 26. These time-outs may occur during unusually long disk operations such as a long seek. During receive operations, this would indicate the number of WACKs (wait acknowledgment) sent. In transmit mode, it would indicate the number of TTDs sent.

Also during communications a count of 3-second time-outs is displayed in positions 29, 30, and 31. These time-outs occur whenever there is a 3-second period of inactivity on the communication line. During a 20-second disconnect time-out on switched lines, this counter is incremented seven times.

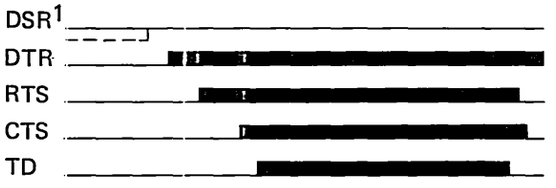
All four counters are initialized to 000 when communications mode is entered.

*When the user complains of excessive time to receive or transmit, the 2-second time-out count can be observed to verify the complaint. If there are excessive 2-second time-outs, this may be an indication of a problem in the disk unit or planar.

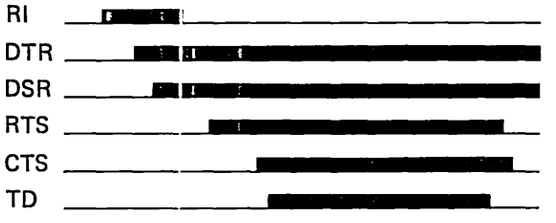
Timing Sequence — DTR Mode



Timing Sequence — CDSTL Mode



1 — DSR may be permanently on (typical of non-switched line modems)
OR



DATA FLOW

The data path and register control lines extend from the MPU planar to the feature half planar via crossover connectors and are terminated at a register. All data transfer between the BSCA controller and MPU planar is via this data path and register. The BSCA adapter interfaces to the register and also requires clock signals from the MPU planar. The BSCA adapter performs the serialize-deserialize function, timing, and control functions necessary to interface to the modem. The EIA drivers and receivers convert BSCA adapter logic levels to the required EIA levels.

Detail Cross Connectors to MPU Planar

Most data path and register control lines are routed via socket Q with a few in socket F.

When in communications mode, '–BSCA select' should be negative (down level), and '–printer select' should be positive. Data is transferred via the data path bits. D

'–Select 4', 'reg select decode 0' and '1', and '–reg gate control 0' and '1' control gating into the data register. '–Reg gate control 0' E and '1' F are clocks from the MPU.

The BSCA controller uses '–gate out' G , '–gate B' H and '+reset A' I to generate timings in sync with the microcontroller.

The BSCA controller also uses '–1 ms clock' and '+reset CS counter' to generate timings. '–1 ms clock' is a square wave with a 1-millisecond period. '+ Reset CS counter' is a 60-millisecond positive pulse that repeats every 24 milliseconds (approximately).

'+Speed select switch' will always be positive for high baud rate unless:

1. Speed select jumper is at low speed, or;
2. BAUD SELECT switch is set at 600 bps (World Trade Only).

All logic levels in sockets Q and F, are +8.5 volts except '+speed select switch' which is +5 volts.

Socket 2-Q

Pin	Signal
B02	–12 volts
B03	–Bit 6 data path
B04	–Bit 3 data path
B05	–Bit 2 data path D
B06	–Bit 1 data path
B07	–Bit 0 data path
B08	–Gate B
B09	–Printer select
B10	+Speed select switch
B11	–BSCA select
B12	+System reset (POR)
B13	–Reg gate control 0 E
D02	–Bit 5 data path D
D03	+12 volts
D04	–Bit 4 data path D
D05	–Gate out
D06	–1 ms clock
D07	–Ground
D08	None
D09	+Reg select decode 0
D10	None
D11	+Reg select decode 1
D12	+Reset A
D13	–Select 4

Socket 2-F

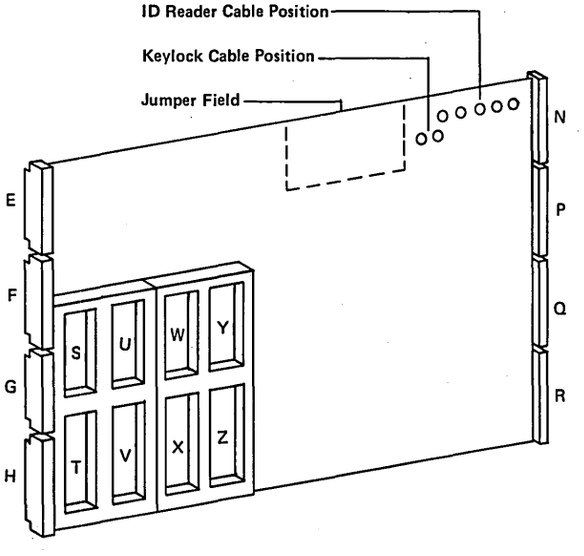
Pin	Signal
D11	+Reset CS counter
D09	+5 volts
D07	Ground
B13	+24 volts
B11	–Reg gate control 1 F
B10	–Bit 7 data path D
B08	–5 volts
B07	+8.5 volts
B06	–5 volts
B05	+Reset R

Modem Cable C

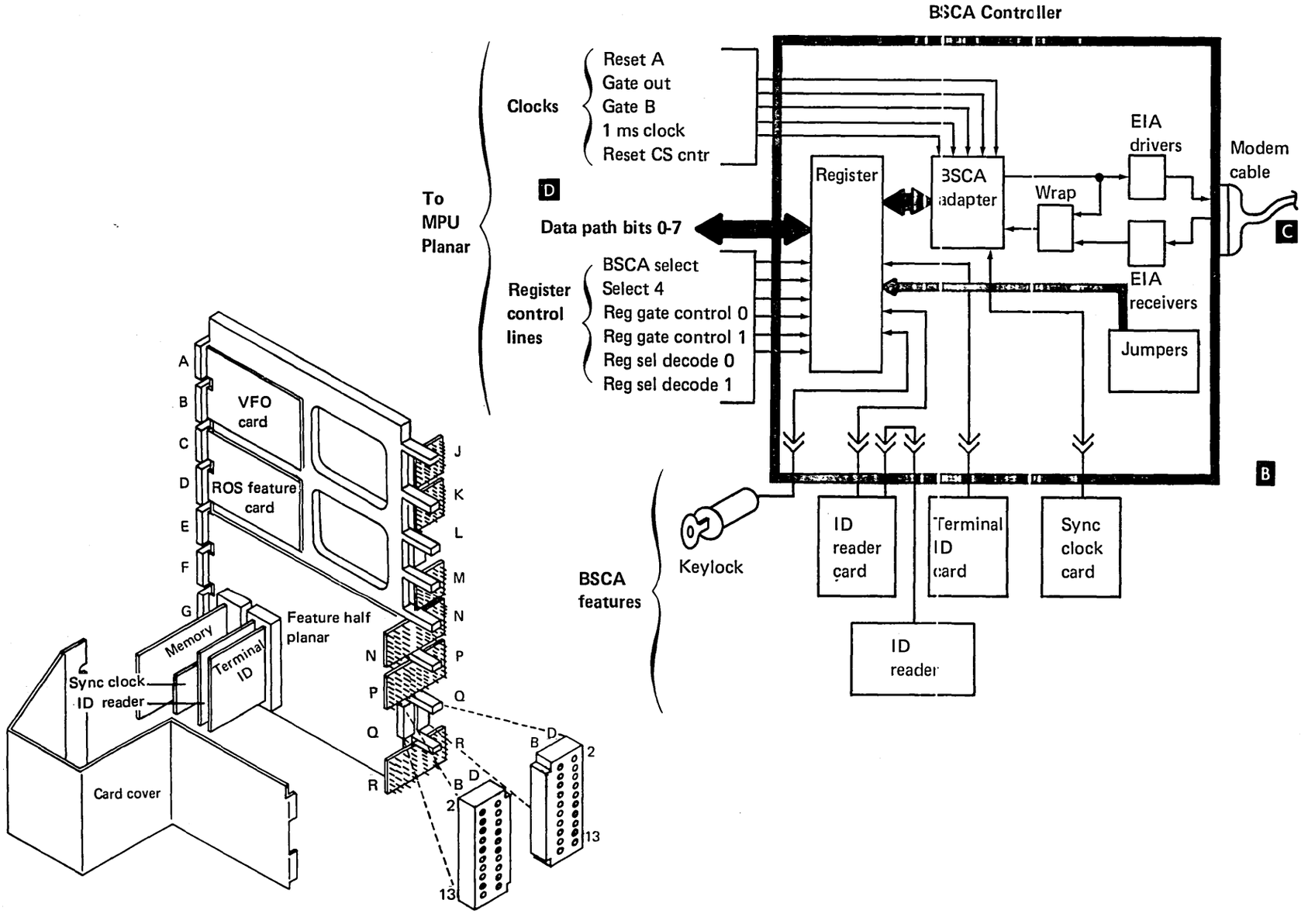
This modem cable interfaces to the BSCA at 1-N. This interface conforms to EIA-RS-232. For signal lines, '–transmit data' and '–receive data', a negative voltage is a logic 1 or mark condition. A positive voltage is a logic 0 or space. For all other lines, positive voltage indicates on, negative voltage indicates off. Positive levels may be +3 to +25 volts. Negative levels may be –3 to –25 volts.

Socket 1-N

Pin	Signal
B07	Signal ground (SG) . . . (From 3741)
B08	+ Serial clock receive (SCR) . (To 3741)
B09	+ Serial clock transmit (SCT) . (To 3741)
B10	+ Clear to send (CTS) . . . (To 3741)
B11	– Receive data (RD) . . . . (To 3741)
B12	– Transmit data (TD) . . (From 3741)
B13	+ Request to send (RTS) . (From 3741)
D02	+12 Vdc. . . . . (From 3741)
D03	+12 Vdc. . . . . (From 3741)
D04	–12 Vdc. . . . . (From 3741)
D05	–12Vdc . . . . . (From 3741)
D06	+ Transmit signal element (SCTE) . . . . . (From 3741)
D07	+ Data terminal ready (DTR) . . . . . (From 3741)
D08	+ Data signal rate select (DSRS) . . . . . (From 3741)
D10	+ Carrier detect (CD) . . . (To 3741)
D11	+ Ring Indicator (RI) . . . (To 3741)
D12	+ Data set ready (DSR) . . . (To 3741)



Feature Half Planar Socket Location



EC 823146	825853	826065	PN 1619199	3741 ML 14-25
Date 9/15/74	11/15/74	8/1/75		

BSCA LINE CONTROL CHARACTERS

Description	Mnemonic	Hex
Start of heading[1]	SOH	01
Start of text	STX	02
Intermediate block character	ITB	1F
End of transmission block	ETB	26
End of text	ETX	03
Enquiry	ENQ	2D
Negative acknowledge	NAK	3D
End of transmission	EOT	37
Synchronous Idle	SYN	32
Data link escape	DLE	10
Even acknowledge	ACK 0	10, 70
Odd acknowledge	ACK 1	10, 61
Wait before transmit	WACK	10, 6B
Disconnect	DISC	10, 37
Reverse interrupt[2]	RVI	10, 7C
Temporary text delay	TTD	02, 2D
Leading pad	PAD	AA
Trailing pad	PAD	FF

[1] 3741 treats SOH the same as STX.

[2] RVI is recognized as a positive acknowledgement by the 3741, however it will not relinquish the line.

[3] In transparent mode, STX, ITB, ETX, ETB, SYN, ENQ, TTD, and DLE are preceded by DLE.

Leading PAD (Hex AA)

Three PAD characters are sent preceding an initial bit sync pattern to ensure that the receiving station is ready to receive by the time the first SYN character is sent.

Trailing PAD (Hex FF)

In order to ensure that the last meaningful bits in a transmission are sent properly by the data set, one trailing PAD character will be sent as the last character in the transmission. The 3741 will not turn request-to-send off until the entire PAD character has been transferred to the modem. This provides one character time for the modem to complete sending the preceding meaningful characters before its transmitter can turn off.

SYN—Synchronous Idle (Hex 32)

This character is used to establish and maintain synchronization between the stations on the data link when using synchronous transmission. Two continuous SYNs are used to establish character synchronism (character phase pattern=SYN SYN=0). In BSCA, two SYN characters are sent in the data stream every 64 characters to maintain synchronization throughout the transmission. In EBSCA, two SYNs characters are sent every 82 characters to maintain synchronization.

A secondary use for the SYN character is as a time fill in the transmitted data stream when other data or control characters are not available. The message stream must be continuous per transmission in synchronous transmission method.

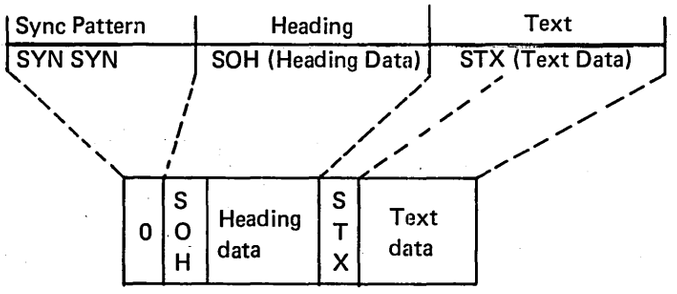
SOH—Start of Heading (Hex 01)

In general, this character precedes a block of heading characters and a heading consists of auxiliary information (such as routing and priority) necessary for the receiving station to process the text portion of the message. However, it is only sent by the 3741 preceding operator ID data and status message. It is treated as an STX by a receiving 3741.

STX—Start of Text (Hex 02)

This character precedes a block of text data.

The STX is also used to terminate a block of heading data (see example below).



NAK—Negative Acknowledgement (Hex 3D)

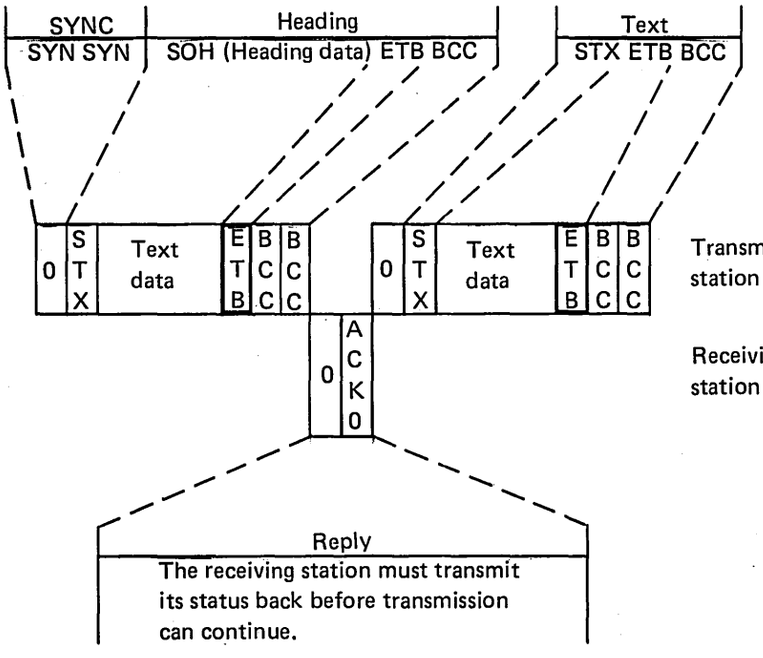
The NAK reply from a receiving station indicates that the previous message block was received in error (BCCs did not check) and the receiver is ready to accept a retransmission of the erroneous message block.

NAK is also used as a negative (not ready) reply to station selection on a multipoint data link or to a line bid on a point-to-point data link.

A NAK is a normal response to TTD (temporary text delay).

ETB—End of Transmission Block (Hex 26)

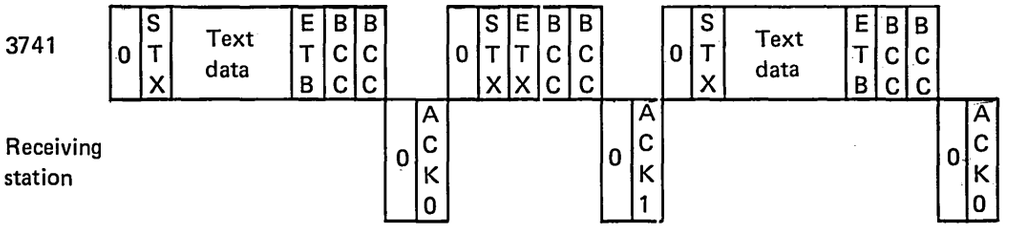
In general, the ETB character identifies the end of a block of heading or text data characters started with SOH or STX. ETB forces the receiving station to reply to the transmitting station with its response (for example, ACK 0 or ACK 1)—message received okay; NAK—message received in error, retransmit; etc.). The ETB is immediately followed by a block check character (s) BCC in the transmission so that the receiving station can perform its error checking function (see example below).



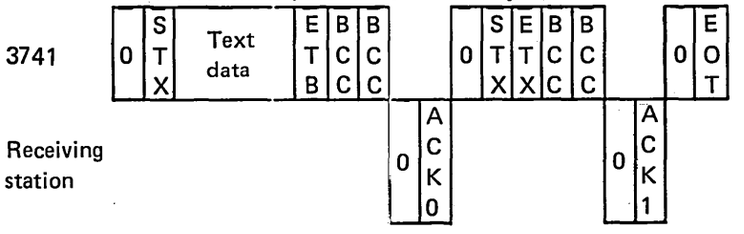
ETX—End of Text (Hex 03)

The ETX is identical to the ETB, in that it terminates a block of characters started with STX or SOH. ETX requires the receiving station to reply to the transmitted data and is followed in the transmission data stream by the BCC just as the ETB was. ETX is normally used, when multiple blocks of data are to be transmitted, to identify the last block of data. (See examples below.)

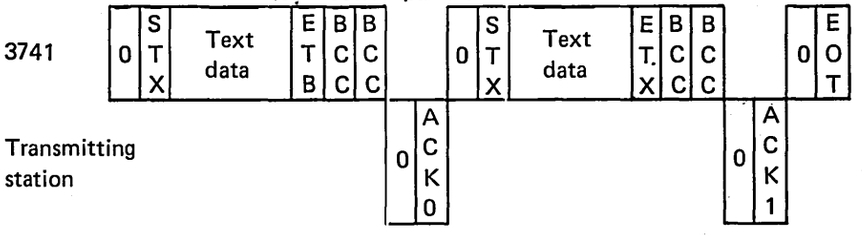
3741 Transmits (multiple data sets)



3741 Transmits (last data set—end of job)



3741 Receives (can receive either of above or the following)



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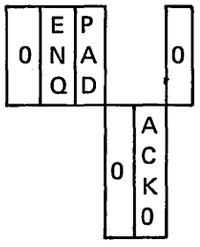
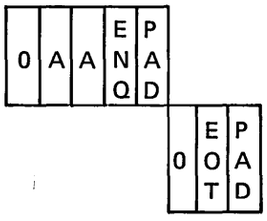
Date 9/15/74	8/1/75		

ENQ—Inquiry (Hex 2D)

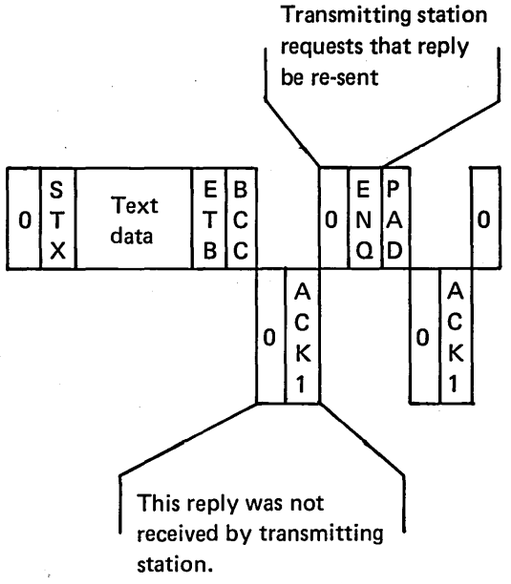
ENQ is used to bid for the line when using a point-to-point network (data link). See example below.



Another use of the ENQ control character is to indicate the end of a poll or selection sequence which solicits a response from the polled or selected station. See example below.



If the original reply was garbled or was not received by the transmitting station, the ENQ control character is also used by a transmitting station to request a repeat transmission of the reply from a receiving station to a message block. See example below.



BCC—Block Check Character

The BCC is cyclic redundancy checking (CRC). The transmitting station builds a CRC character (2 bytes) which is representative of all bits of all characters transmitted in the message block. It transmits this character as a BCC to the receiving station. This BCC character is checked against the CRC accumulation at the receiving station for an equal compare. A running count is maintained of all CRC checks where transmitted block check characters (BCC) do not match those calculated by the BSCA controller. This count is displayed in positions 14, 15, 16 of the error logout line at the bottom of the display.

EOT—End of Transmission (Hex 37)

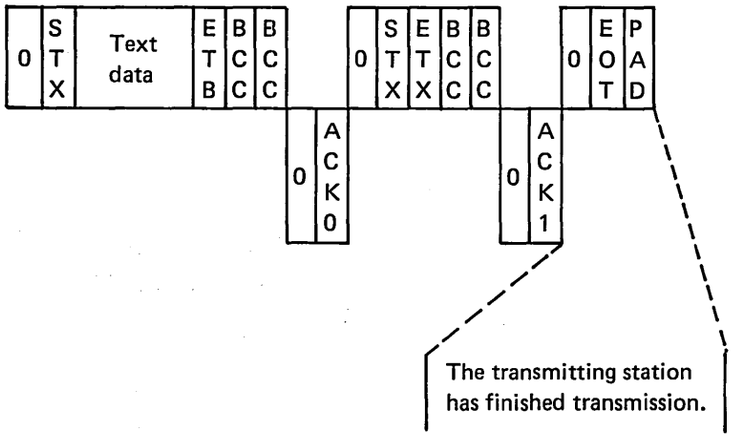
This control character signals the end of a message transmission, which may have contained one or more blocks, including text and associated headings. In a multipoint line, it causes a reset of all stations on the transmission line.

EOT is also used as:

1. An abort signal to indicate a system malfunction or situation where continuation of message transmission is impossible.

2. A response to a poll when the station being polled (invited to send) has nothing to transmit (BSCA multipoint only).

The example below is for a transmitting station ending its transmission with a normal ending.



DLE—Data Link Escape (Hex 10)

The DLE is a control character used exclusively to provide supplementary line control characters, such as WACK, ACK 0, ACK 1, RVI, and transparent mode control characters.

The DLE, when added to a normal non-control character, can be used for a two-character control sequence. This greatly expands the range of control characters in the BSC procedure.

RVI—Reverse Interrupt (Hex 10, 7C)

In general the RVI control character is a positive response used in place of the ACK 0 and ACK 1. RVI is transmitted by the receiving station to request termination of the current transmission because of a high priority message which it must transmit. Also, in the case of a multipoint network, the control station, acting as a receiver, will use this reply to gain control of the data link.

The sending station treats the RVI as a positive acknowledgment and responds by transmitting all data that prevents it from becoming a receiving station. The 3741 must finish a complete job; therefore, RVI is treated as a positive response and continues.

The RVI is a two-character control sequence consisting of the DLE as the first character in conjunction with @ in EBCDIC (DLE@). The 3741 can receive RVI and treats it as positive response. The 3741 does not transmit an RVI.

ACK 0/ ACK 1—Positive Acknowledgment
ACK 0 (Hex 10, 70)
ACK 1 (Hex 10, 61)

The ACK 0 or ACK 1 reply, when used on the proper sequence, indicates the previous message block was accepted without error and the receiver is ready to accept the next block of the transmission.

The ACK 0 and ACK 1 responses are a two-character sequence where the DLE character is used with a second character which varies depending on the transmission code being used. See chart below.

Data Link Character	EBCDIC
ACK 0	DLE '70'*
ACK 1	DLE /

*'70' indicates the hexadecimal value, it has no graphic character assigned.

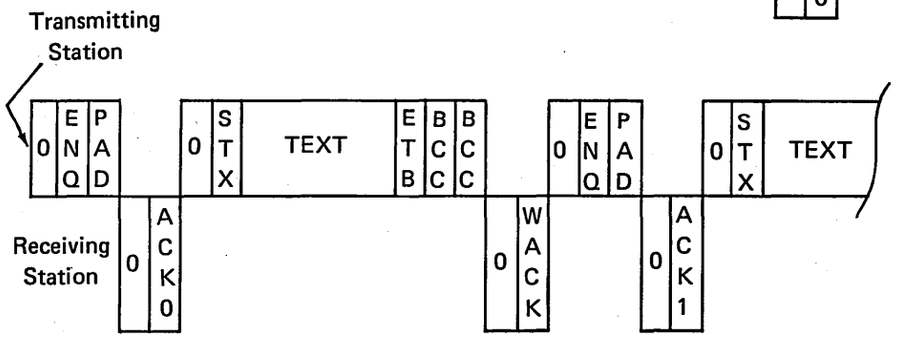
The use of the proper sequences with the acknowledgments is as important as the acknowledgment. The ACKs must be used in an alternating mode, that is ACK 1 to message 1, ACK 0 to message 2, ACK 1 to message 3, etc. This alternating positive acknowledgment is used to maintain a check on the reception of all replies by the transmitting station.

ACK 0 is also used as a positive response to a selection in the multipoint or to a line bid in point-to-point data link.

WACK—Wait Before Transmit—Positive Acknowledgment (Hex 10—, 6B)

The WACK control character is used by a receiving station to indicate a temporarily not ready to receive condition to the transmitting station. It can be sent as a response to a block of text or heading data indicating positive acknowledgment but does not send the next message. It can also be used to respond to a selection sequence on a multipoint network or a line bid on the point-to-point network.

The normal transmitting stations response to a WACK reply is to transmit the ENQ control character. When the ENQ is received, the receiving station will continue to respond (reply) with WACK until it is ready to continue. See example below.

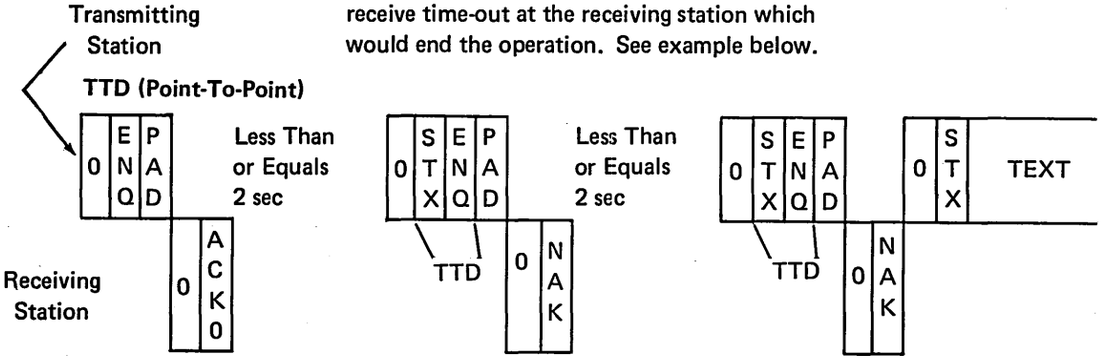


In the preceding example, the WACK/ENQ exchange can continue until the receiving station is ready to receive the next data block. If the transmitting station does not wish to continue the exchange (wait for the receiving station), it can transmit the EOT control character instead of the ENQ and thus end the operation.

Wack is a two-character sequence consisting of the DLE control character in conjunction with the comma (,). The 3741 will send WACKs in the receive mode if a 2-second time-out occurs (for example, waiting for a long disk operation to complete).

TTD—Temporary Text Delay (Hex 02 2D)

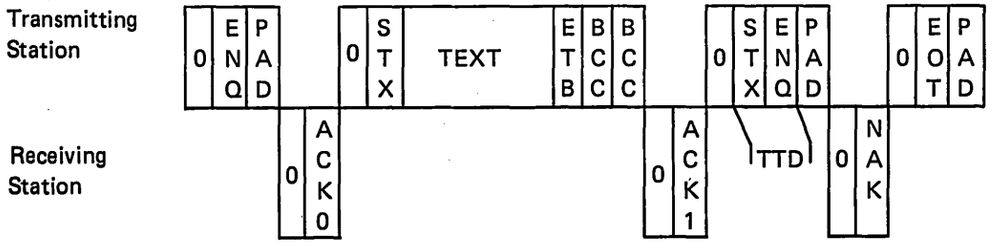
The TTD control character sequence is sent by a sending station, which has control of the transmission, when it wishes to retain the line but is not ready to transmit. The TTD control sequence (STX ENQ) is normally sent after approximately two seconds if the sending station is not capable of transmitting the next text block or initial text block or initial text block within that time. This 2-second time-out avoids the normal 3-second receive time-out at the receiving station which would end the operation. See example below.



The receiving station responds NAK to the TTD sequence and waits for transmission to begin. If the sending station is still not ready, the TTD sequence can be repeated one or more times. This delay can occur when the sending station's input device has not completely filled the buffer due to inherent machine timings.

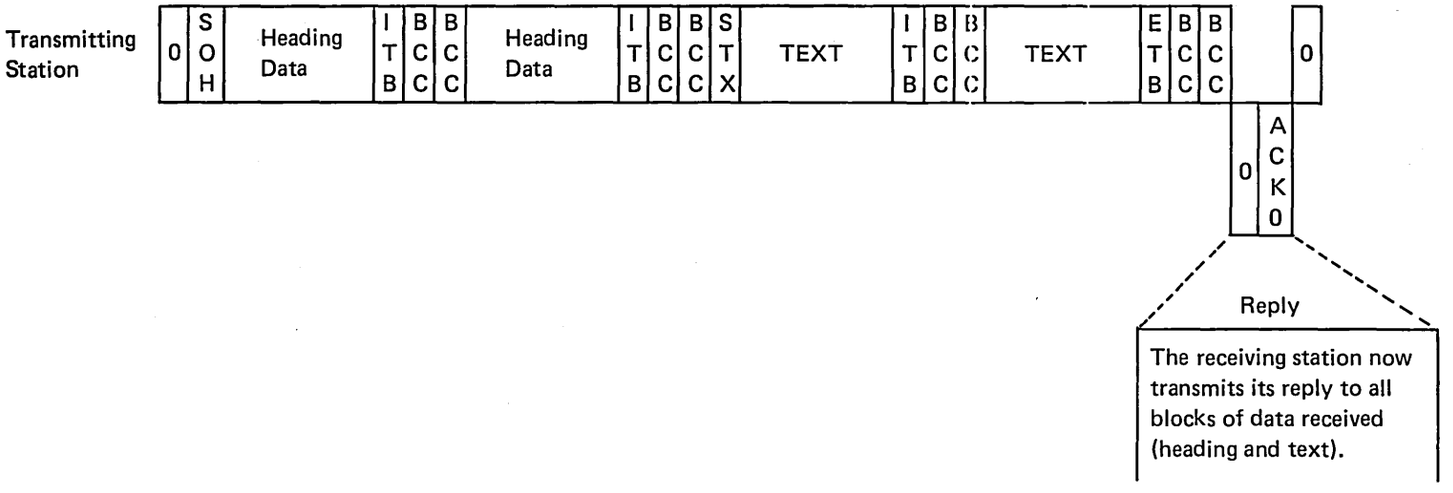
Forward Abort

Another use of the TTD control sequence is to signal the receiving station that the sending station is aborting the current transmission. After receiving NAK to this TTD sequence, the sending station sends EOT, resetting the receiving station to control mode (forward abort). See example below.



ITB—End of Intermediate Transmission Block (Hex 1F)

In general, the ITB is used to divide a message (heading or text) into blocks for error checking purposes without causing a line turnaround (reversal of transmitting station). The block check character (BCC) immediately follows the ITB in the transmission stream and allows the receiving station to perform error checking on the block of data. After the first intermediate block, the successive intermediate blocks do not have to be preceded by STX or SOH, unless there is a change in types of data transmitted (heading to text). See example below.



If any of the blocks of data/heading were received in error, the transmitting station must retransmit all blocks.

Note: The 3741 has the ability to receive the ITB control character and its associated BCC check character. The 3741 does not transmit the ITB character. When the 3741 receives ITB, it performs the block check and continue receiving data. It treates all data received in a transmission as one record.

LINE CONTROL SEQUENCE

Operations

Let's see what has to take place in order to communicate using the 3741. In the following examples we will be communicating between two 3741s (station A and station B) on a switched point-to-point line. Station A will be transmitting two records of information to station B at the following disk locations.

- BOE – 01001
- EOE – 01026
- EOD – 01003

The operator sets up station A as follows:

- Positions disk to correct data set label.
- Selects communicate.
- Presses M key (for originating station only).
- Presses T key (puts station A in transmit mode).
- Presses the talk button on the modem and calls station B.

Verbal agreement is reached as to when data is to be sent. Then the station B operator sets up as follows.

- Positions disk to the correct data set label.
- Selects communicate.
- Presses R key (places station B in receive mode).
- Presses data key on modem.

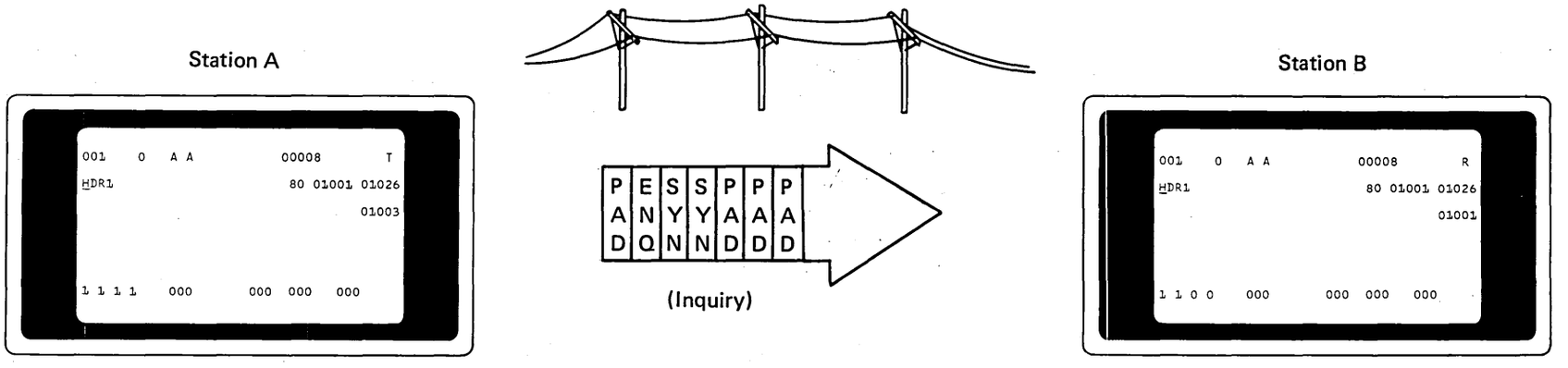
The originating station (station A) operator listens for a high-pitched tone. When the operator hears the tone change from a high-pitch to a low-pitch, the data key on the modem must be pressed. A data link has now been established and communications can begin.

Records are transmitted sequentially as they appear in a data set. Each record on the disk is transmitted as one transmission block.

The message formats are as follows:

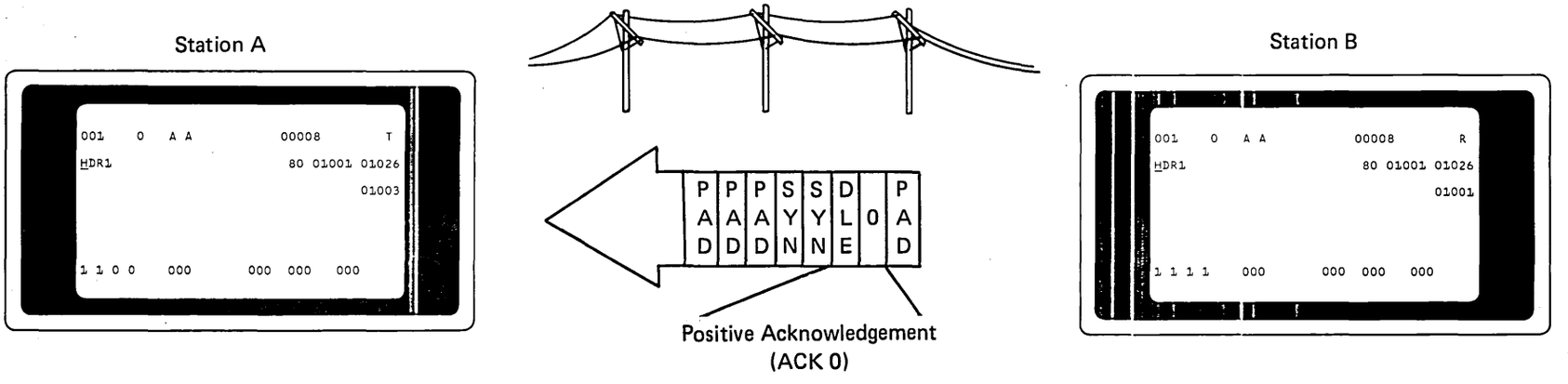
Note: When station A transmits, read the message format from right to left. When station A receives, read from left to right (against the arrow).

Station A sends an inquiry to station B.

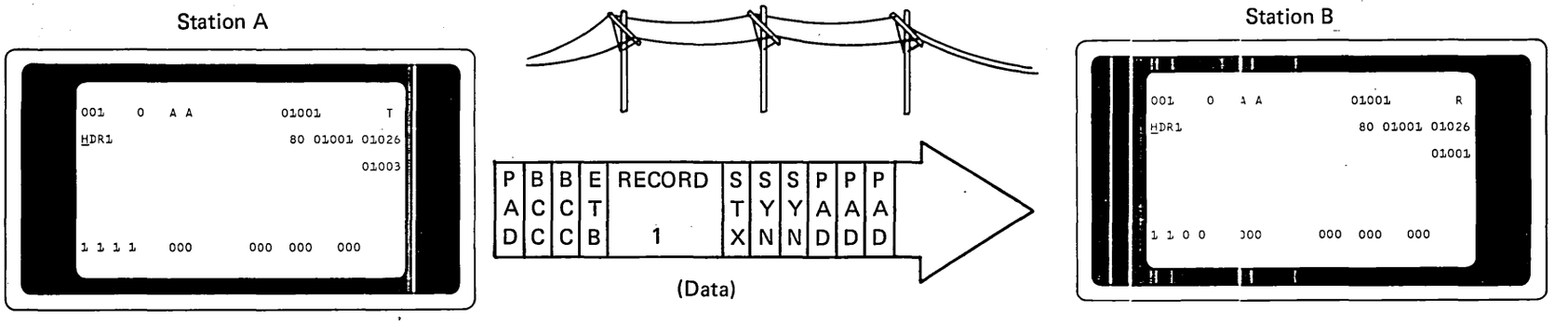


If no valid response is received within 1 second (3 seconds for EBSCA), station A retransmits the above sequence. If station A receives a NAK response to any inquiry, it will then send an EOT to relinquish line control.

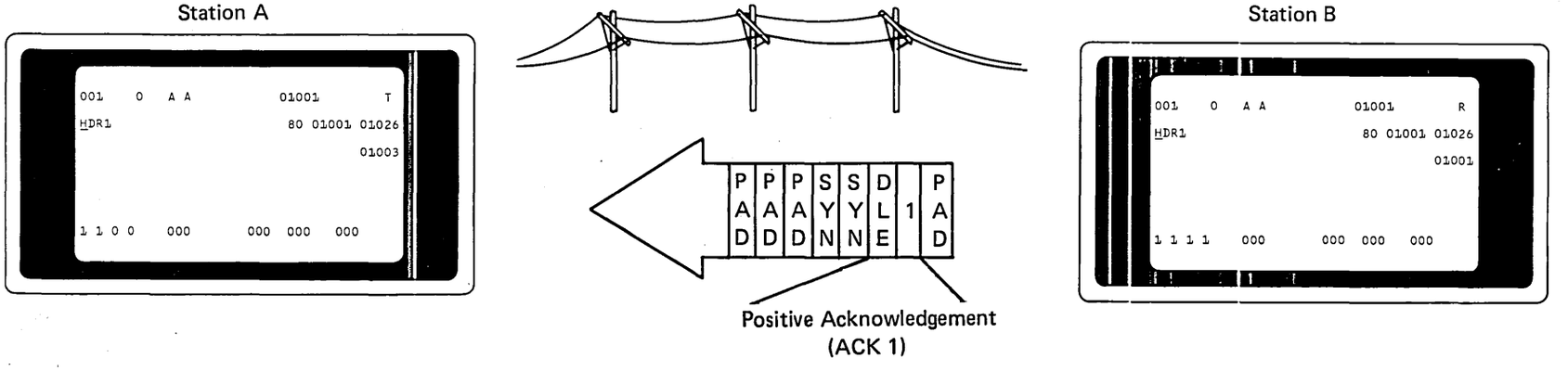
Station B will send a positive acknowledgment if it is ready to receive.



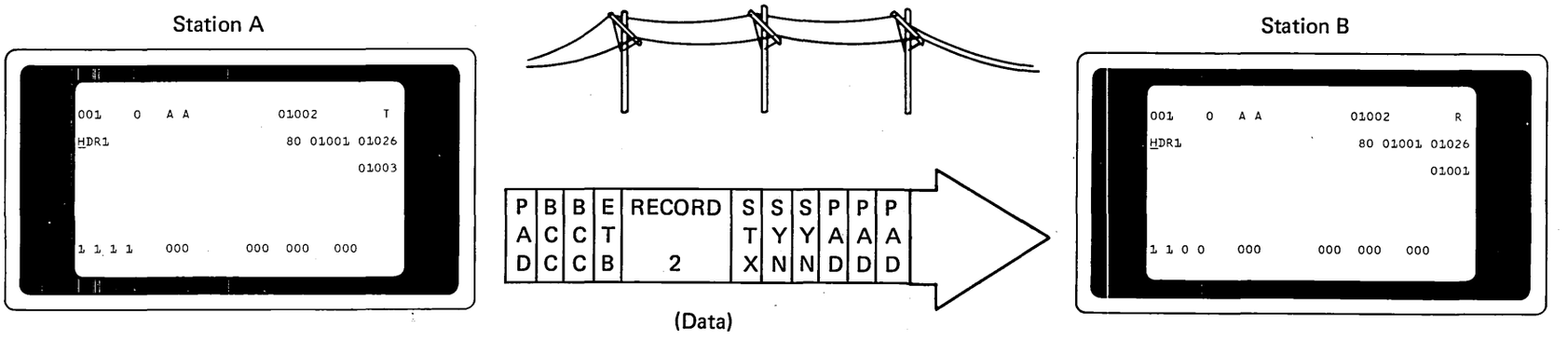
Upon reception of a positive acknowledgment from station B, station A will now send record 1 (01001)



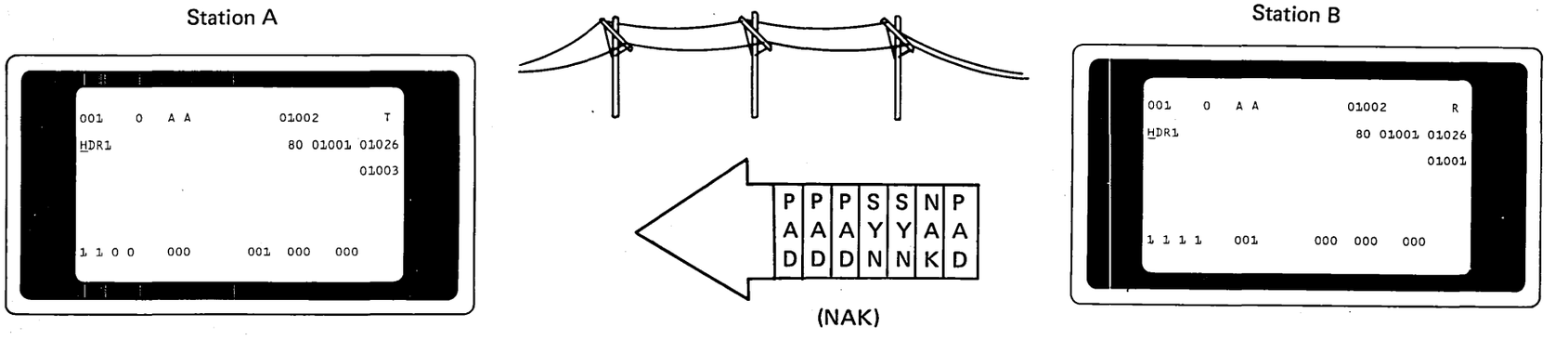
If station B receives the first record okay, it responds with an ACK1.



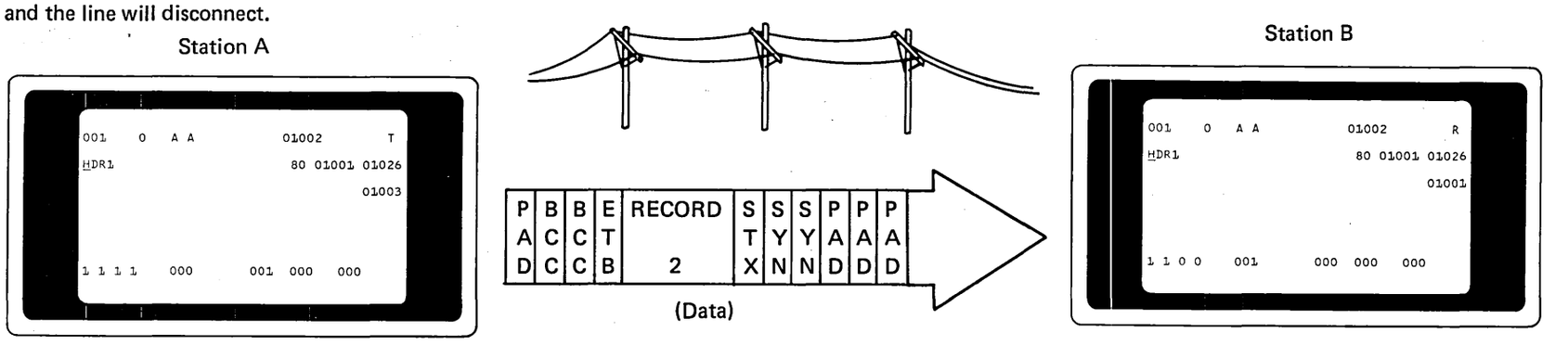
Station A now sends record 2.



Station B received the message incorrectly (BCC sent by station A does not match BCC developed at station B) and answers with a negative acknowledgment (NAK).

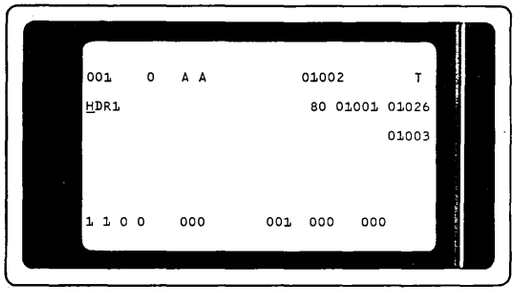


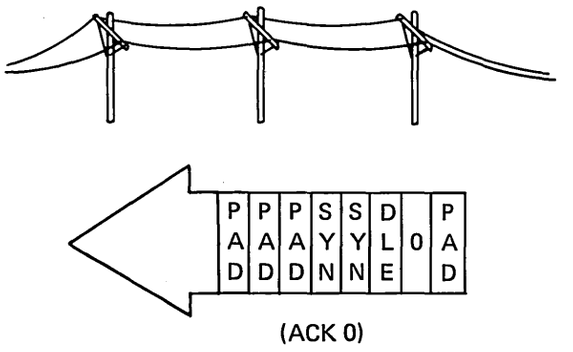
Station A will send record 2 again. A record can be retransmitted up to three times if succeeding NAK responses are received. If a NAK is received after the third retransmission, an EOT will be sent and the line will disconnect.



Station B received the record correctly this time and responds with an ACK0.

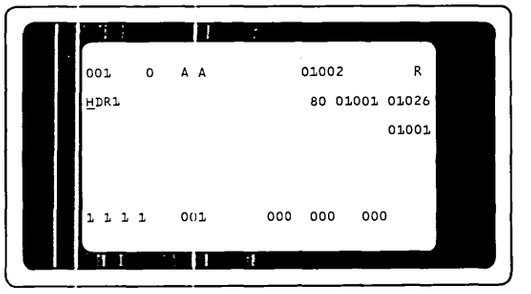
Station A





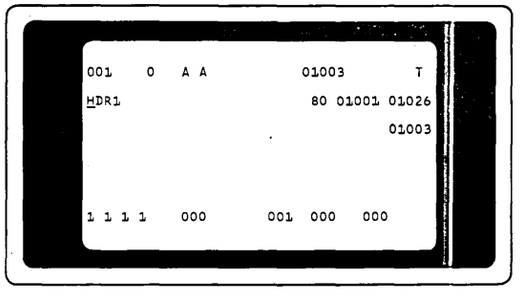
(ACK 0)

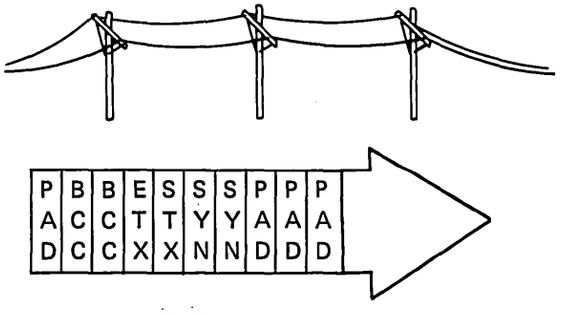
Station B



Whenever the end of data is reached (in this case 01003) on the disk and the data set label does not indicate a continued data set, the 3741 transmits a null record as follows.

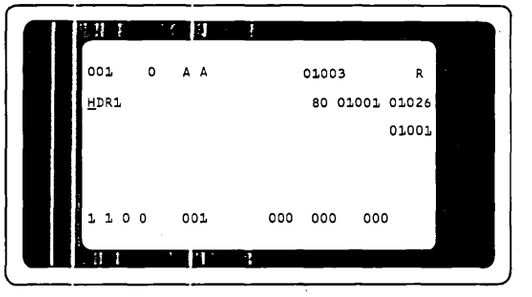
Station A





(Null)

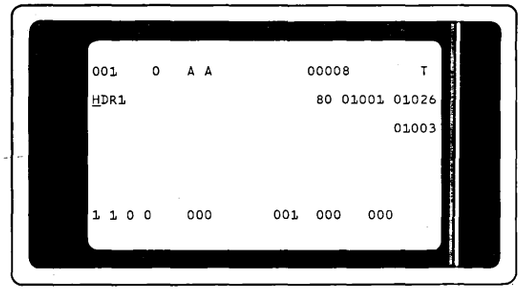
Station B

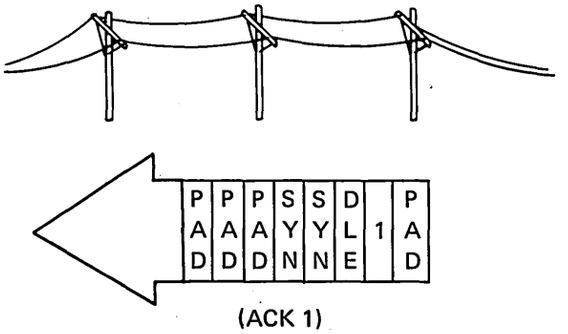


Receiving a null record causes the last recorded record address to be stored in the EOE field of the data set label and the address following the EOE to be stored in the EOD field.

If station B received the null record with no errors, it would respond with an ACK1.

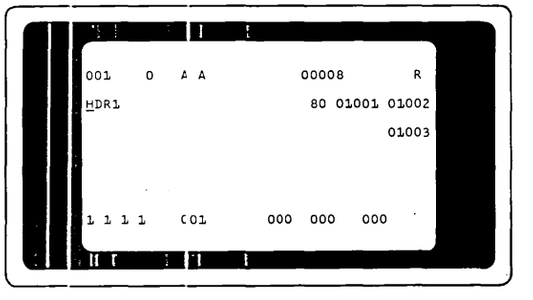
Station A



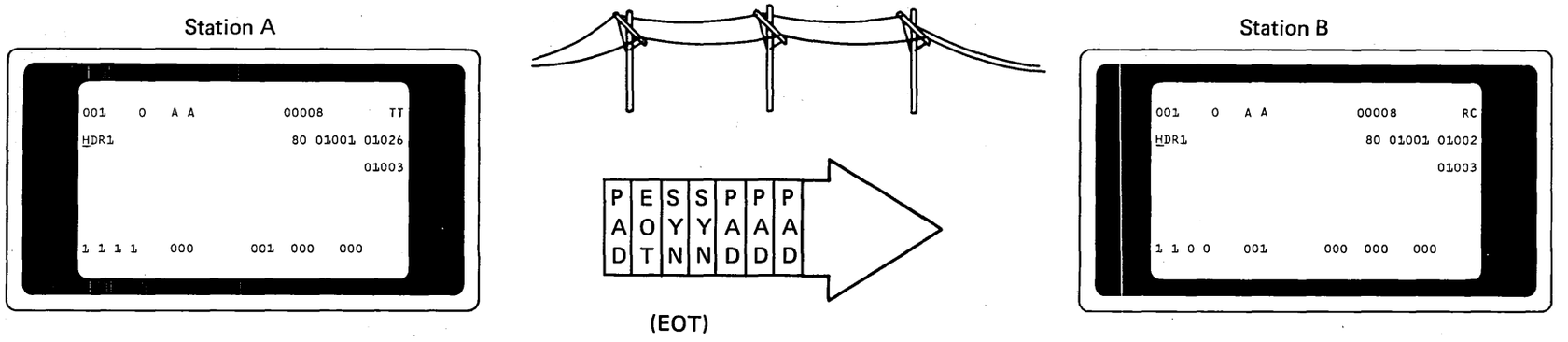


(ACK 1)

Station B



After station A transmits all data transmitted, it sends an EOT and posts a TT in positions 37 and 38 of the status line signifying transmission complete.

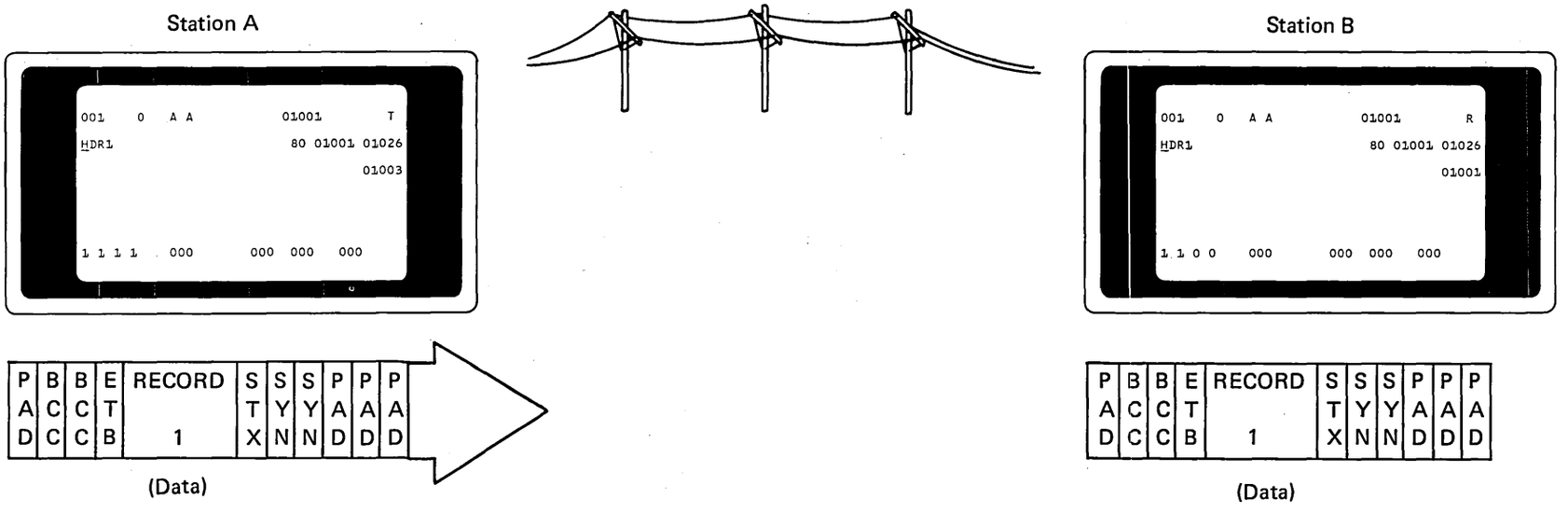


After sending an EOT, station A goes into control mode for 20 seconds and then disconnects from the line. If station A was in a transmit/receive mode and communicating with a CPU, it could transmit and then receive before disconnecting from the line.

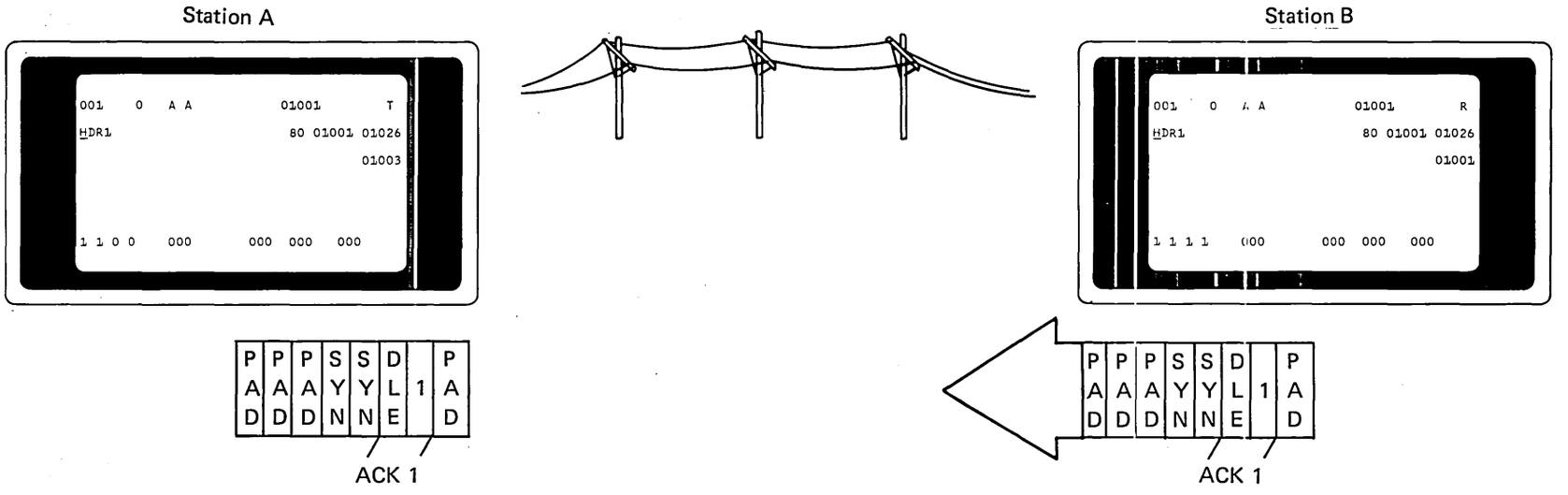
When station B receives an EOT after receiving a disk with no errors, a RC is posted on the display status line, signifying to the operator that the data was received complete. Station B then goes into control mode for 20 seconds and disconnects from the line.

The following is an example of what takes place when noise occurs during transmission of STX or ETB.

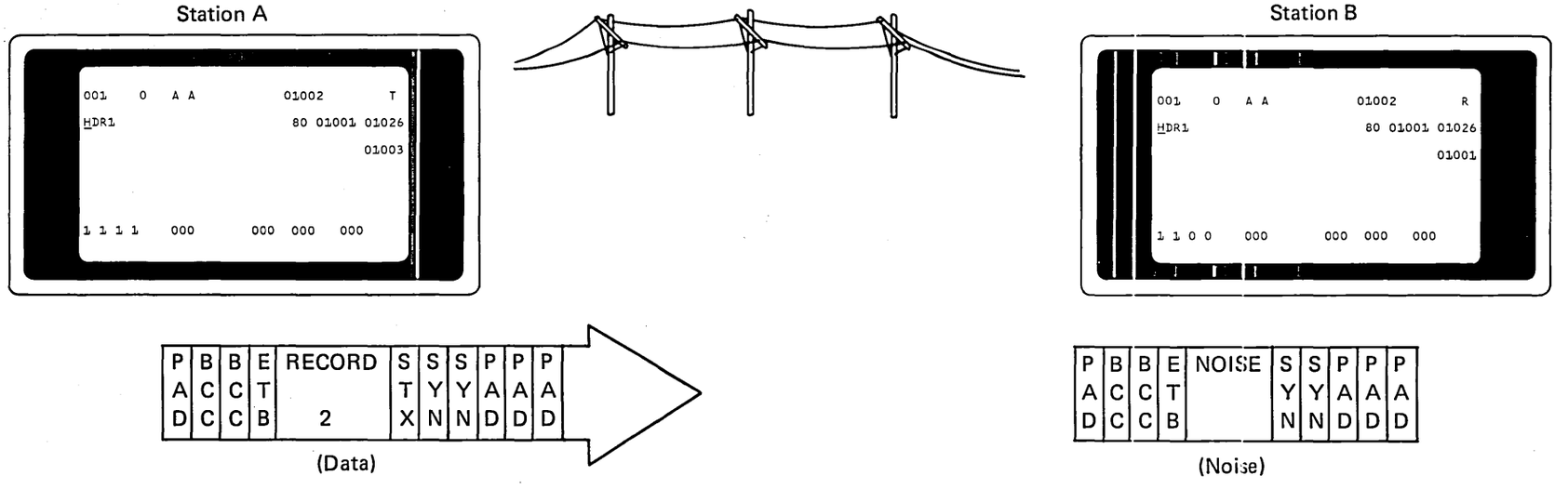
Station A sends record 1; station B receives record 1 correctly.



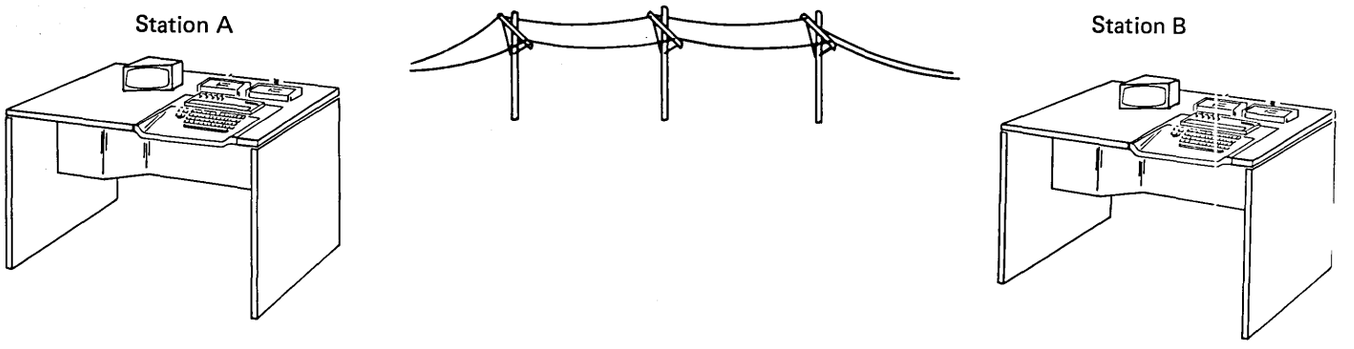
Station B responds with an ACK 1.



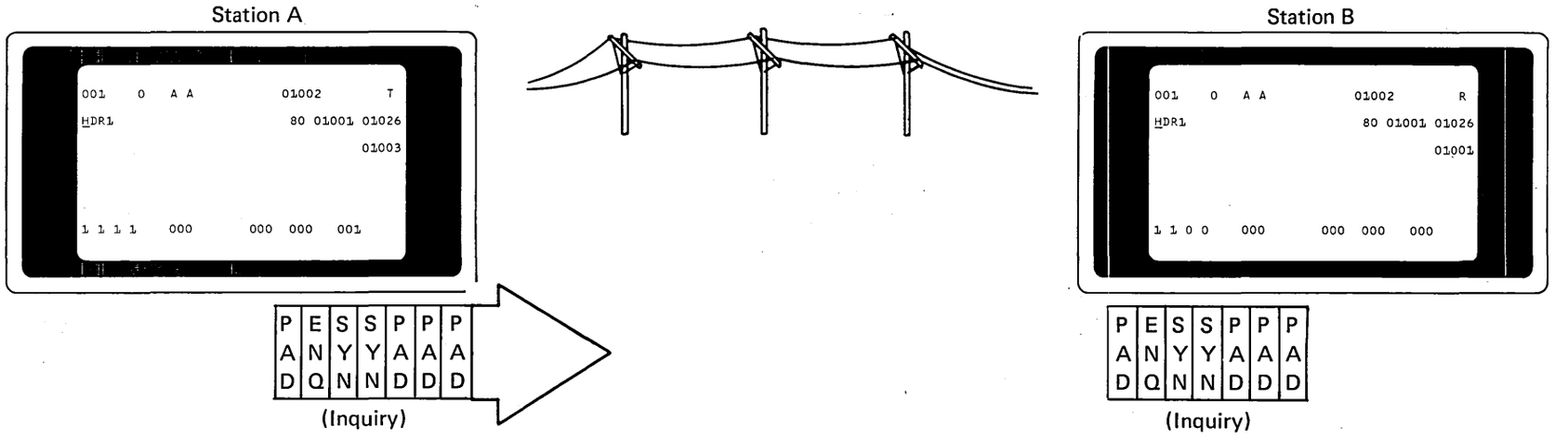
Station A sends record 2; station B fails to recognize STX and data because of noise during transmission.



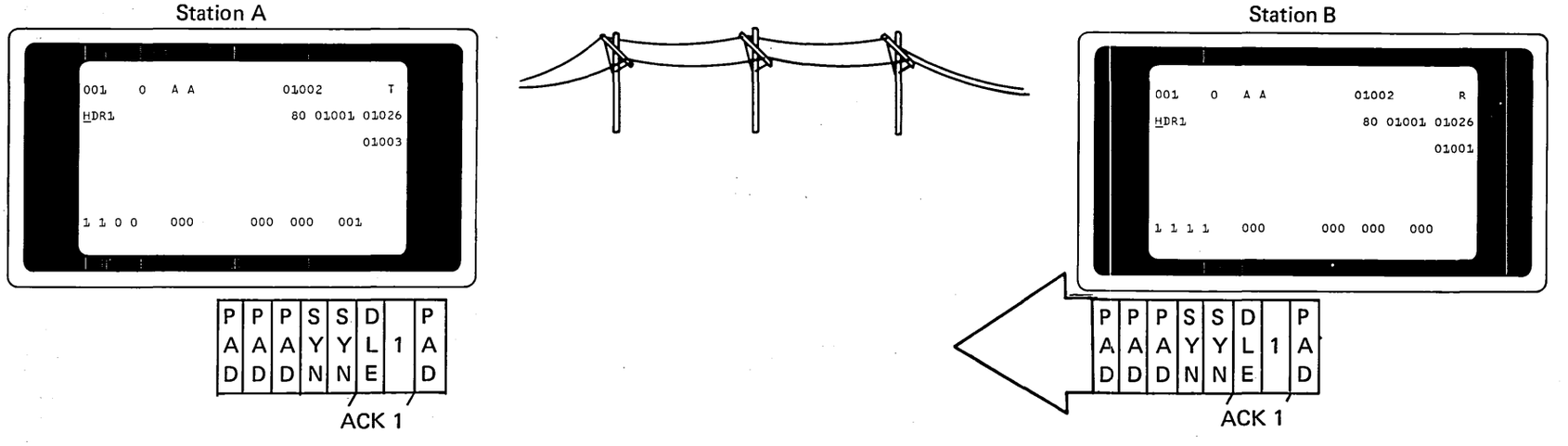
No response from station B.



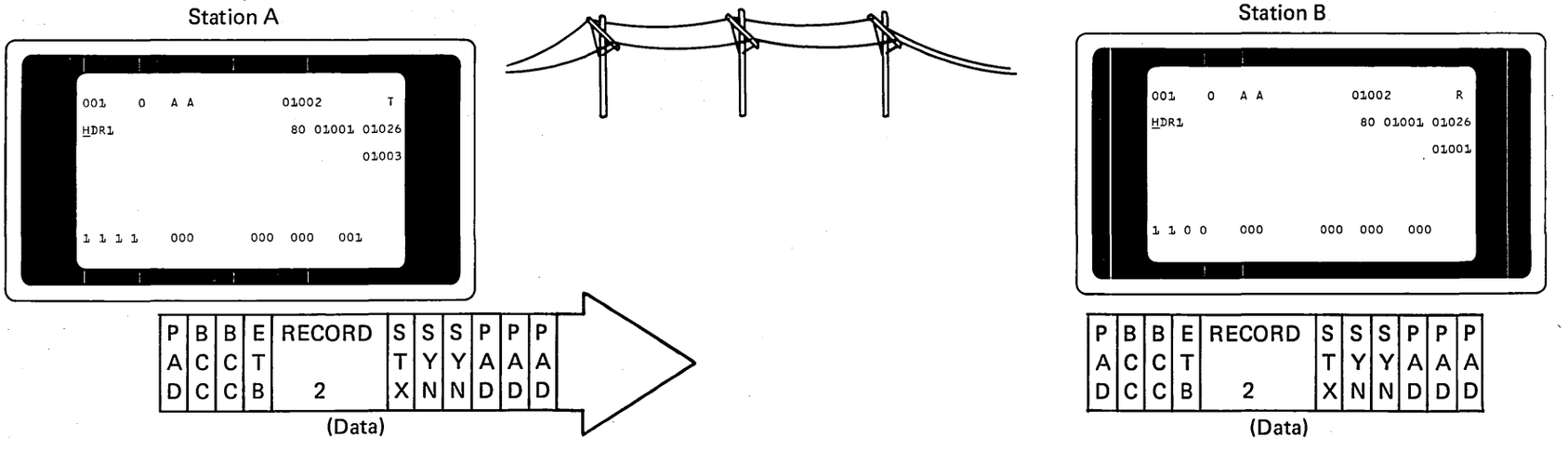
After a 3-second time-out, station A sends an inquiry.



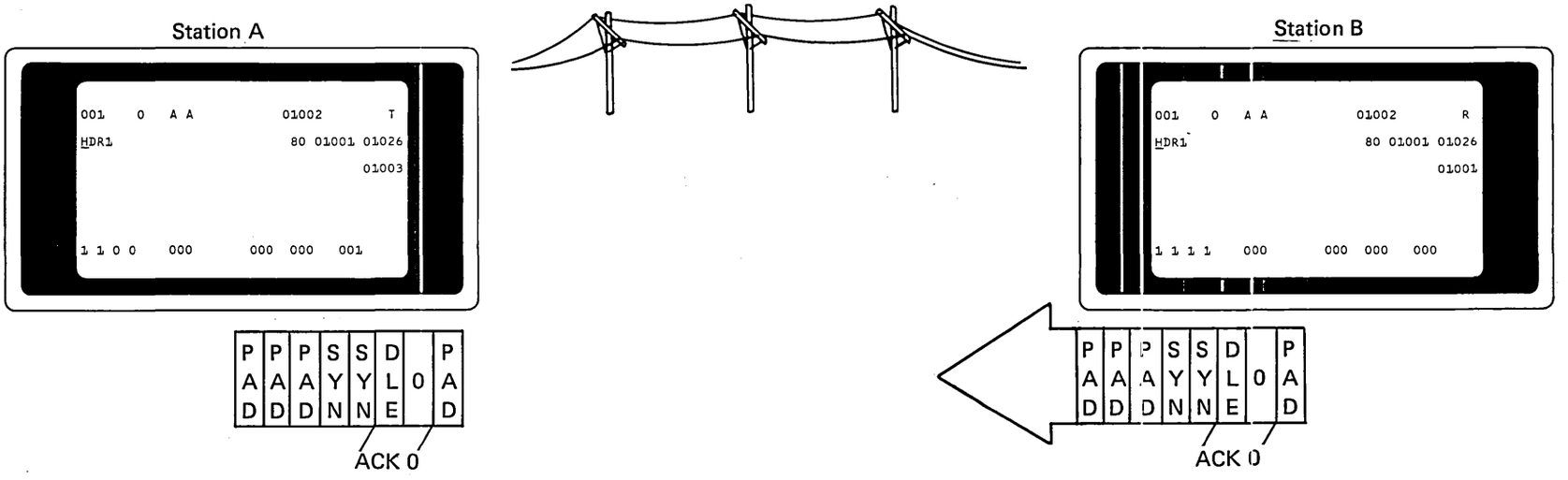
Station B responds with an ACK of the last good transmission that it received. In this example station B received record 1 correctly, but not record 2; therefore, station B responds with an ACK 1.



Station A retransmits record 2; this time station B receives record 2 correctly.



Station B responds with an ACK 0.



The previous sequence will also occur if station B (the receiving station) failed to recognize ETB.

If station B (the receiving station) received record 2 correctly but station A did not receive the response, after a 3-second time-out station A sends ENQ; station B responds with the ACK of the last good transmission (ACK 0 in the example above); then station A sends record 3 and normal transmission continues.

Status Message

A status message is a message sent to a remote station from the 3741 indicating what type of an error has been encountered. A status message is sent under the following conditions:

In a transmit mode (T, B, P, or D) after a:
- Transparency check
- Disk error
- Line check
- Message aborted

In a receive mode (B, BT, or DT) after a:
- Wrong length count
- Full disk(s)
- Line check
- Disk error

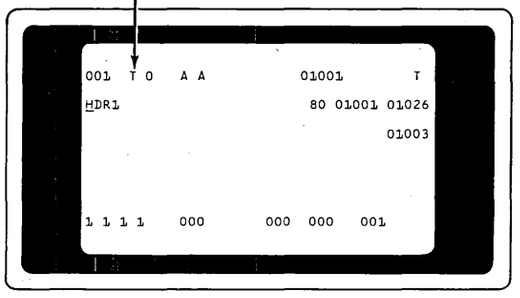
Other conditions for sending a status message are:
- After a 3741 has responded NAK to a remote station's line bid request.
- After the 3741 has prematurely terminated a transmission or reception of a message.
- When the RESET key is used to abort the transmission or reception of data.

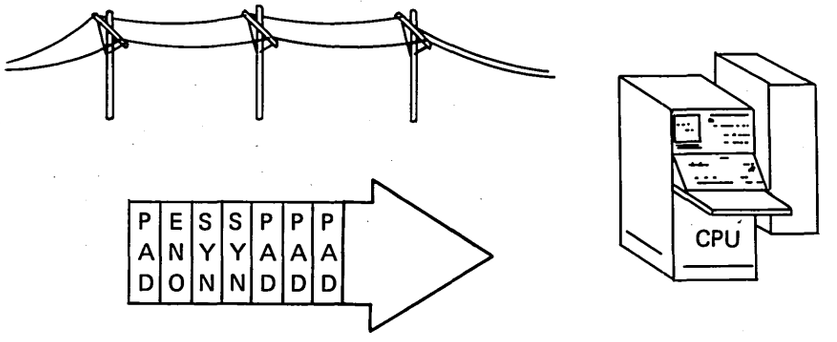
A 3741 will transmit a status message, but will ignore the reception of one. If two 3741s were communicating with each other, the status message would have no significance. If a 3741 was communicating with a CPU, the CPU could handle the received status message in several different ways, depending on system programming. One example might be to have the status message printout on the operator's console printer.

The following message formatting is used to illustrate the sending of a status message after an error condition has been encountered.

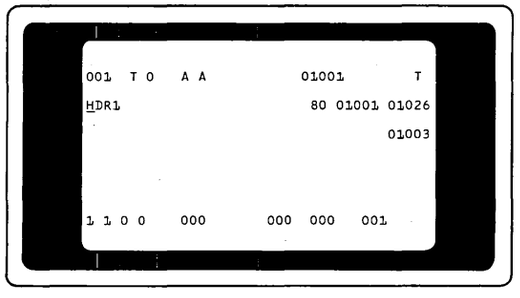
The sequence is started when one of the above error conditions exist. Let's say that we encountered a transparency check during transmission.

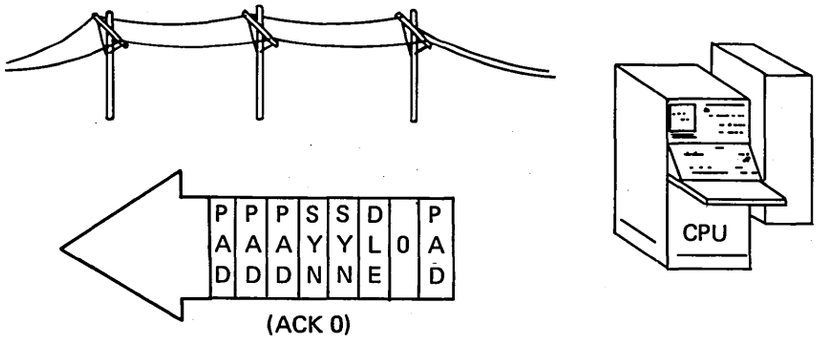
- The CRT would flash.
- A T would be displayed in position 7 of the CRT.
- The 3741 will send an EOT.
- After a 3-second time-out the following sequence will take place.



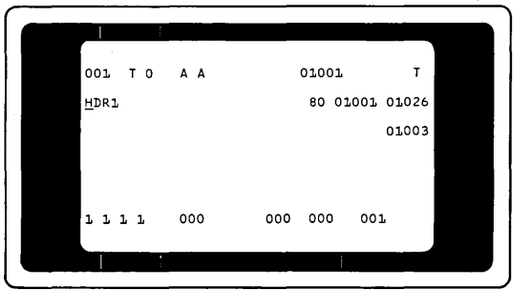


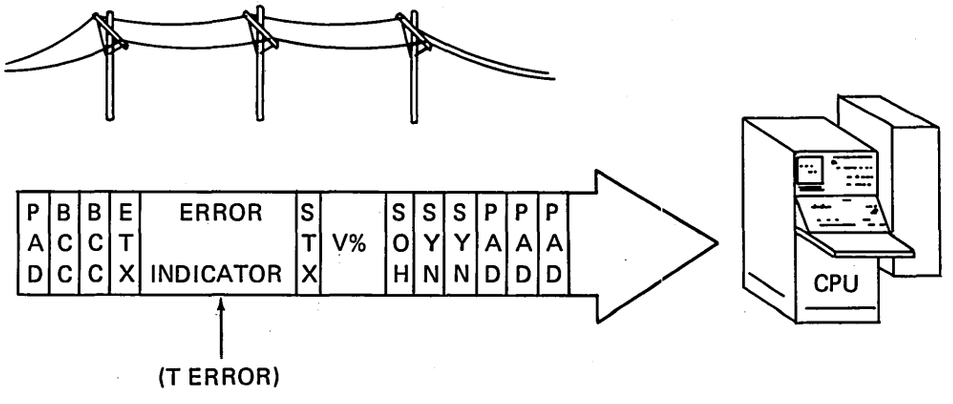
The remote station would respond with a positive acknowledgment.



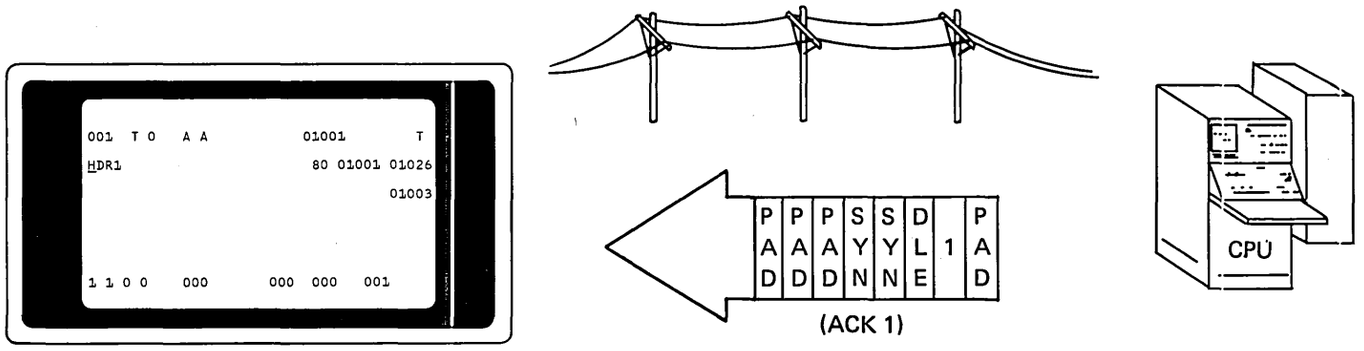


Upon the reception of an ACK 0, the 3741 will send the status message containing the error code displayed in position 7 of the CRT.

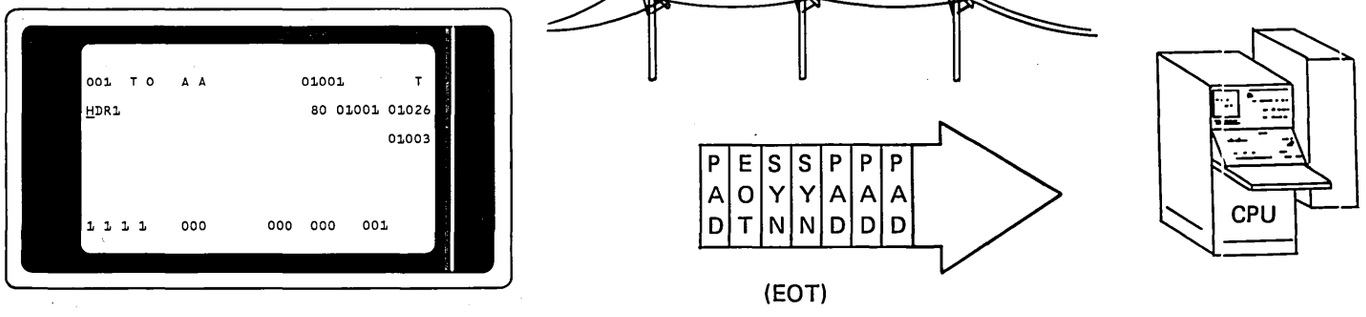




If the remote station receives the status message correctly, it responds with another positive acknowledgment.



The 3741 will then send an EOT and terminate the line.



Communications Procedure

The following procedure can be applied to all communications modes. However, if you don't have the keylock, terminal ID, and operator ID reader features, ignore the boxed steps.

It is assumed that you have your data set labels properly identified, when doing this procedure. For more information, see the *IBM 3741 Data Station Reference Manual*, GA21-9183.

1. Load the diskette.

2. Position the disk to the data set label or record where you want to start communicating

3. Do you have the keylock feature installed?

Yes	No
Turn the keylock on.	Continue to step 4.

4. Is remote ID being used?

Yes	No
Key in the remote ID characters.	Continue to step 5.

5. Press FUNCT SEL upper and COMM

6. If you have a switched network and are dialing the remote location, press M. A

   If you have a non-switched network, or are answering in a switched network, continue to step 7.

7. Press the appropriate mode key:

   Transmit— Press T
   Transmit transparent — Press P
   Transmit/Receive — Press B
   Transmit Transparent/Receive — Press D.
   Receive — Press R

8. Are you using the operator ID card reader?

Yes	No
Insert your ID card in the top slot.	Press REC ADV

9. Do you have a non-switched line?

Yes	No
End of procedure.	Continue to step 10.

10. Do you want auto-answer?

Yes	No
Press AUTO-ANSWER on the modem. End of procedure.	Continue to step 11.

11. Are you answering a call or dialing a location?

Answering	Dialing
Answer the phone and when the person at the calling station indicated she is ready, press DATA on the modem. End of procedure.	a. Press TALK on the modem. b. Dial the location you wish to communicate with. c. Continue to step 12.

12. Is the location you dialed in an autoanswer or manual answer mode?

Auto	Manual
When you hear a highpitched tone, press DATA on the modem. End of procedure.	When the person you are communicating with makes her station ready, you'll hear a high-pitched tone. Then press DATA on the modem. End of procedure.

A

3741 - Use of the M Key (BSCA)

When the 3741 is set up to operate on switched lines, the M key determines whether or not the 3741 will send the initial line bid. The M key has no function on non-switched line.

According to convention, the station placing the call (calling station) should bid the line. If the 3741 is the station placing the call, the operator setup should be:

Press FUNCT SEL upper
COMM
M
T, P, B, D, or R

The M key tells the 3741 to bid the line, independent of the mode selected or the following key strikes. If a CPU is the remote end receiving the call, it should be programmed to do a read initial.

Also, according to convention, the station receiving the call (called station) should wait for a line bid. If the 3741 is the station receiving the call, the operator setup should be:

Press FUNC SEL upper
COMM
T, P, B, D, or R

The absence of the M key indicates to the 3741 that it should wait for a line bid for 20 seconds. If the CPU is the remote station placing the call, it should be programmed to do a write initial.

Packaging

The BSCA controller is packaged on the feature half planar board.

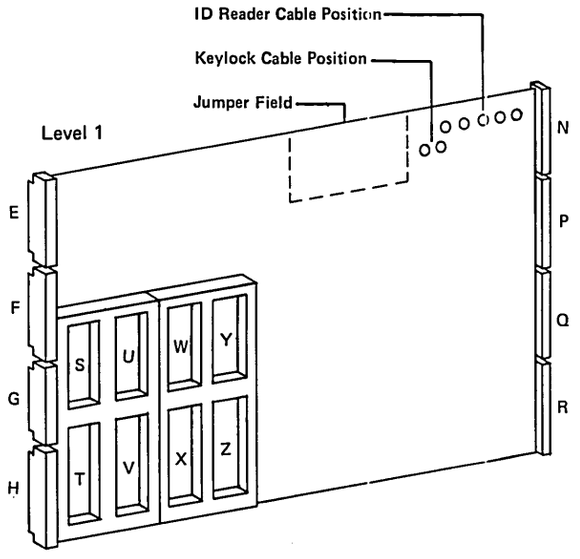
The socket positions are assigned as follows:

Socket

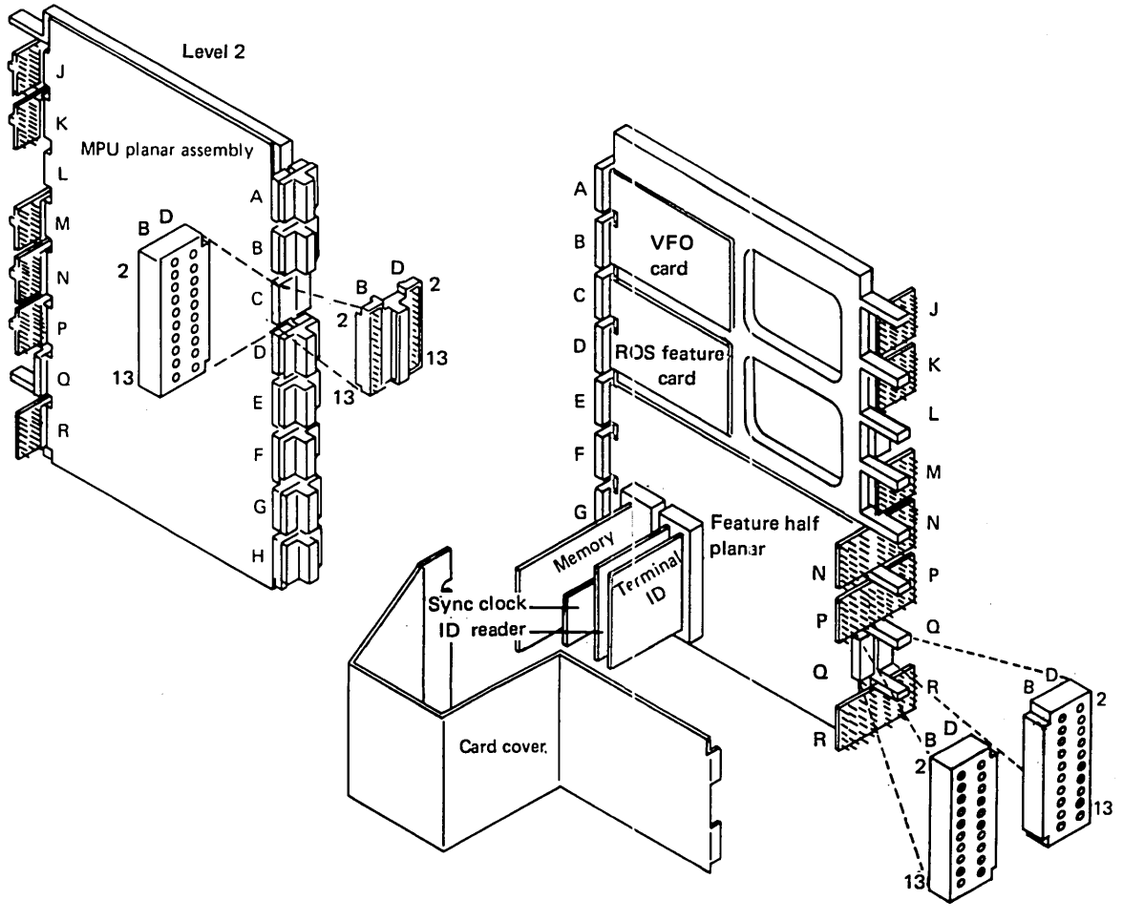
1-N – Modem cable
1-P – Printer signal cable (from printer)
1-Q – Cross connector to MPU planar board
1-R – Printer signal cable (to printer)
1-E – Cross connector to MPU planar board
1-F – Cross connector to MPU planar board
1-G – Cross connector to MPU planar board – memory
1-H – Cross connector to MPU planar board – memory
1-S – Card socket – memory
1-T – Card socket – memory
1-U – Test socket
1-V – Card socket – sync clock card
1-W – Card socket – ID reader card
1-X – Card socket – ID reader card
1-Y – Card socket – terminal ID card
1-Z – Card socket – terminal ID card

Sockets 1-P and 1-R are used only if a printer adapter is packaged on the same feature board.

Sockets 1-G, 1-H, 1-S, and 1-T are used only to provide connections for the memory card to the MPU planar. There is no direct connection between the memory card and the BSCA even though the memory card is mounted on the half planar.



Feature Half Planar Socket Locations



Modem Cable

The modem cable interfaces to the BSCA at socket 1-N. This interface conforms to EIA-RS-232. For signal lines, '–transmit data' and '–receive data', a negative voltage is a logic 1 or mark condition. A positive voltage is a logic 0 or space. For all other lines, positive voltage indicates on, negative voltage indicates off. Positive levels may be +3 to +25 volts. Negative levels may be -3 to -25 volts.

COMMUNICATIONS FEATURES

Synchronous Clock with BSCA (see page 14-79 for EBSCA)

When modems are attached that do not have their own clocking, the synchronous clock feature provides a clock to BSCA controller. The synchronous clock feature is mounted in 1-V and provides a 153.6-kHz oscillator pulse to the BSCA. From this oscillator, the BSCA generates a 1200-Hz clock for 1200 bps operation or a 600-Hz clock for 600 bps (baud rate).

When the synchronous clock card is installed in socket 1-V, the 153.6 kHz oscillator may be probed at 1-L, pin B07. The 1200 or 600 Hz clock is at 1-L, pin B11.

Speed, 600 or 1200 bps is determined by speed select jumper or speed select switch (WT) if installed.

The BSCA includes self-correction logic to synchronize clock, 1-L-B11, with received data, 1-N-B11, in receive mode.

Terminal Identification

This feature has two functions. One is to transmit a four-character terminal identification sequence. The first character of the 3741 sequence is always an EBCDIC lower case, alpha v (hex A5). The last three characters are unique to each 3741 terminal and are programmed on the feature card. The unique ID characters are pre-assigned at the factory.

The last three characters of the 3741 terminal ID sequence are programmed on this card which is installed in sockets Y and Z.

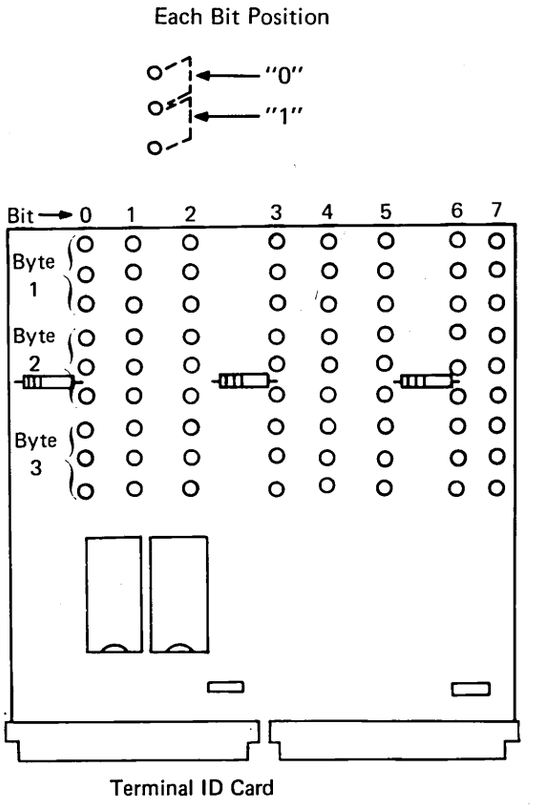
The 3741 will transmit its terminal ID during initial handshaking preceding the first ENQ or ACK 0 depending on the mode.

```
P P P S S              E P
A A A Y Y  "A"  xxx    N A
D D D N N   5          Q D
```

or

```
P P P S S              A   P
A A A Y Y  "A"  xxx    C 0 A
D D D N N   5          K   D
```

"A5" is hex representation for EBCDIC lower case V. x x x are the 3 ID characters programmed on the terminal ID feature card.



Terminal ID Card

ID Character Jumper Placement

Row	Hex	0 1 2	3 4 5	6 7		Hex	0 1 2	3 4 5	6 7
a	81				n	95			
b	82				o	96			
c	83				p	97			
d	84				q	98			
e	85				r	99			
f	86				s	A2			
g	87				t	A3			
h	88				u	A4			
i	89				v	A5			
j	91				w	A6			
k	92				x	A7			
l	93				y	A8			
m	94				z	A9			

The second function is to compare a received identification sequence of up to 15 characters to a sequence keyed by the operator.

This function compares the terminal ID sent by the remote station to the one keyed in by the operator. The operator keys this before entering communications mode. The BSCA controller detects the keyed sequence by the position of the cursor. The cursor must be positioned after the last keyed in character (15 or less). To bypass this feature, the cursor must be in position 1 when entering communications.

Keylock A

The keylock is an electrical switch that controls the selection of communications mode. This feature provides a keylock which controls selection of communications mode. With the keylock in the locked position, communications mode can not be selected. In the unlocked position, the 3741 can be placed in communications mode. Once the mode is selected, the keylock can be placed in the locked position and the terminal remains in this mode.

Operator ID Reader B

This feature is used to read an operator identification card and transmit the information to a CPU, which is programmed to accept only valid sequences.

The operator ID reader feature consists of two parts: the ID reader, which sets on the 3741 table top, and the ID reader card, which is mounted in feature half planar stockets U and X. The ID reader is ready when TB, BB, DB, or PB is displayed. As the card is inserted, the magnetically encoded data is read and the data signal is sent to the BSCA controller. The data signal is sent to the ID reader card where it is decoded. Decoded information is then transferred serially to the BSCA controller where the ID characters are assembled. After the complete ID is read, the controller will send it to a CPU.

The format of the ID reader card is:

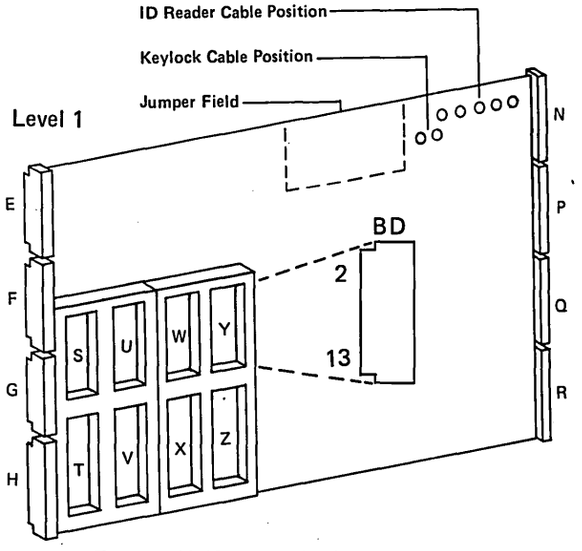
```
P P P S S S                          L E B B
A A A Y Y O  : (ID R chars) "  R T C C F
D D D N N H                          C B C C F
                                        1 2
```

OID — EOR

OID - Operator identification character
EOR - End of record character

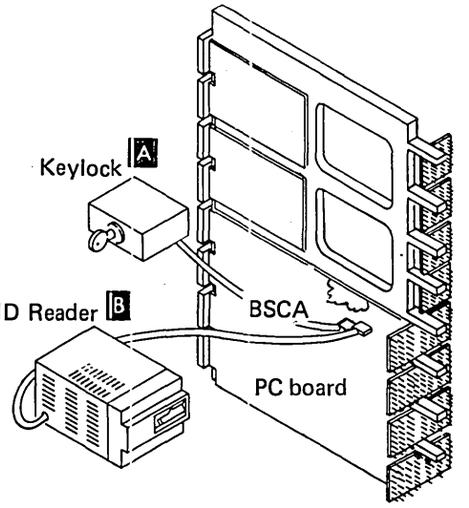
The ID reader card also provides regulated voltage to the ID reader via the feature half planar.

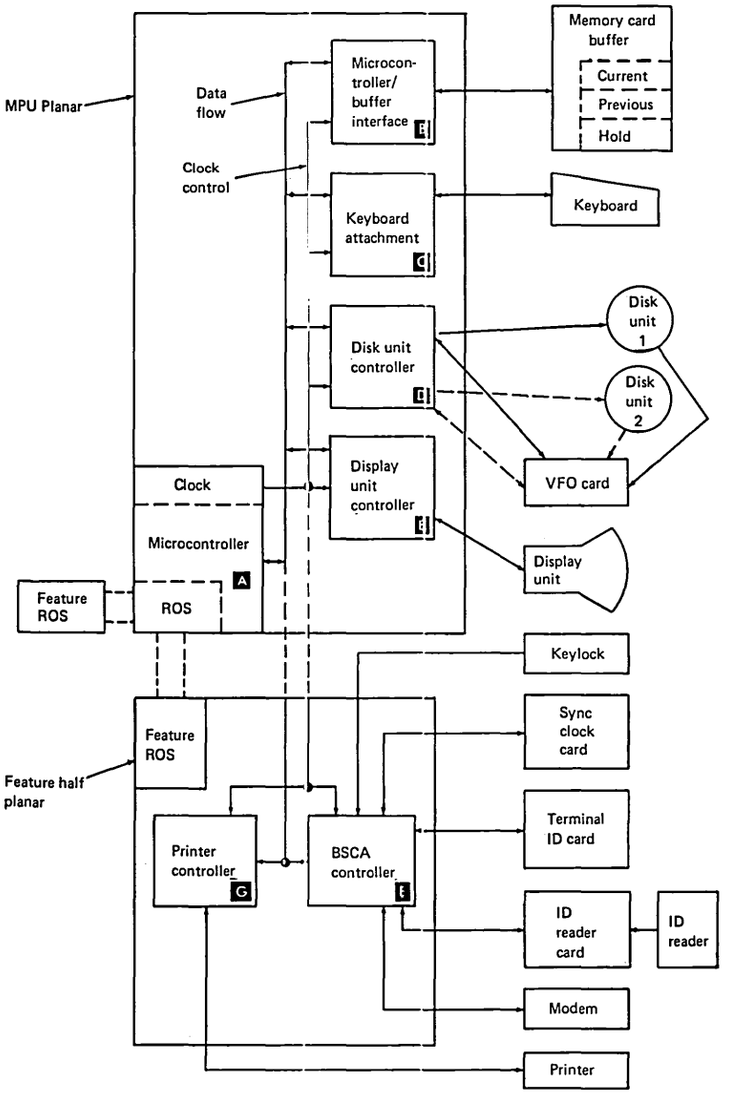
Program buffer 9 is used with this feature. This feature can be bypassed if the 3741 is transmitting to another 3741.



Feature Half Planar Socket Locations

Planar Connection	Signal Ground
1-F	B08
1-G	B08
1-H	B08
1-S	B08
1-T	B08
1-V	D13
1-W	D08
1-X	D08
1-Y	D07
1-Z	D08





EC 823146	826065		PN 1619219
Date 9/15/74	8/1/75		

EIA Interface Standard

Request to Send (RTS)

This line is keyed by the BSCA. It controls the turn on and turn off of the modulator (which of the two frequencies is emitted is controlled by the send-data line as above).

This line is ANDed with 'data set ready'. Hence, when 'request to send' and data set ready' are up, the carrier is immediately put on the transmission line. When 'request to send' or 'data set ready' is down, no carrier is emitted.

Clear to Send (CTS)

This line is keyed by the modem. Its up level tells the BSCA that the BSCA may key the 'send data' line. Its down level merely signifies that the 'request to send' line or 'data set ready' is at the down level and, hence, the transmitter has been turned off.

There are three delay options on a non-switched line, selectable by strapping associated with the 'clear to send' line. Each delay is defined as the time between up level being put on the'request to send' line and an up level appearing on the 'clear to send' line.

Data Set Ready (DSR) — Non-switched Line Only

This line is driven by the modem and is a power on indication for the line adapter.

Data Set Ready (DSR) — Switched Line Only

The on condition indicates that the modem is connected to the line and ready to exchange further control signals with the BSCA equipment to initiate the exchange of data.

The off condition indicates that the associated modem is not ready to operate. The off condition of this circuit does not impair the operation of ring indicator.

Signal Ground (SG)

This circuit provides a common ground reference for all circuits in the interface.

Carrier Detected (CD)

This line indicates the presence of carrier on the receive input. An up level will be present when carrier has been present on the 'receive input' for between 10 and 20 milliseconds. This line will drop between 5 and 15 milliseconds after carrier has dropped. The BSCA does not use this line.

Ring Indicator (RI) — Switched Line Only

Signals on this circuit indicate whether a calling signal is being received by the AA feature. The on condition indicates that a calling signal is being received. The off condition indicates that no calling signal is being received.

Data Terminal Ready (DTR)

Signals on this circuit control switching of the AA feature and the associated modem to or from the line.

The on condition (indicating that the data terminal equipment is ready to operate) prepares the AA feature to connect the associated modem to the line and maintains this connection.

When the AA feature is conditioned for automatic answering of calls, connection to the line occurs only in response to a combination of the ON condition data terminal ready and calling indicator.

The off condition causes the AA feature to drop the line (go to hook), when the transmission of data has been complete. The OFF condition of 'data terminal ready' does not inhibit the operation of calling indicator.

When data terminal ready is turned off, it is not turned on again until 'data set ready' is turned off.

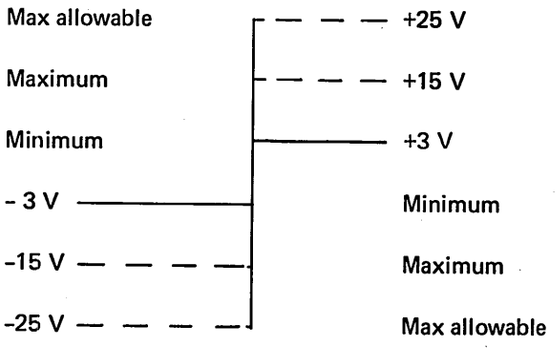
Receive Data (RD)

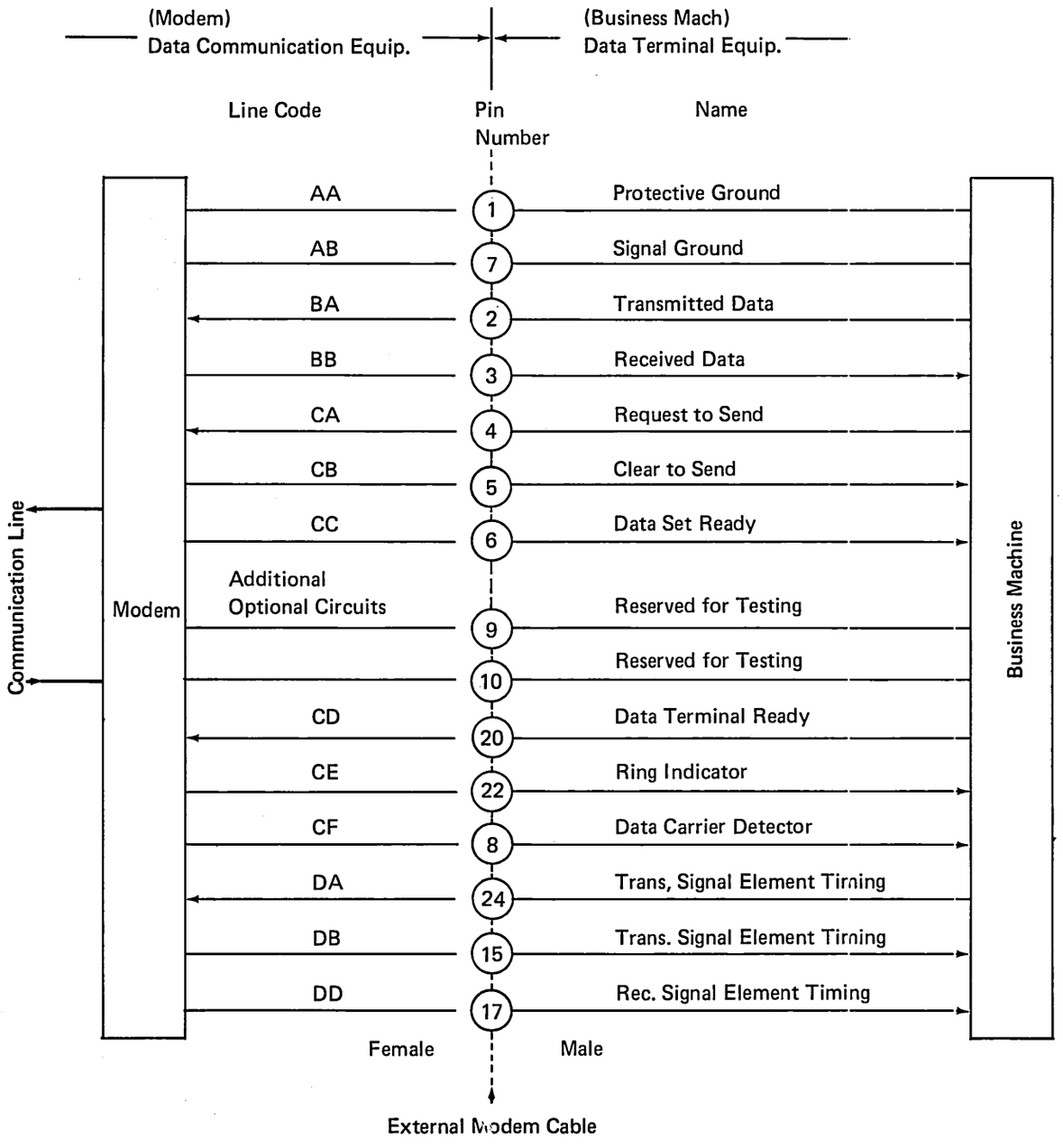
This line is keyed by the demodulator section. When space frequency is being received over the transmission line, the receive data line is at its up level. When mark frequency is being received, the receive data line is at its down level. When the received signal (mark or space) is below the threshold setting of the carrier-detect circuitry, the receive data line will be clamped to its down level. For 2-wire operation, a clamp is provided to hold the receive data line to a down level while the modem is transmitting.

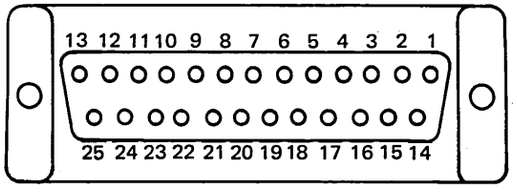
BSCA to Modem Interface

The EIA interface is used

EIA:




(Modem)
Data Communication Equip.
(Business Mach)
Data Terminal Equip.
Line Code
Pin Number
Name
AA
1
Protective Ground
AB
7
Signal Ground
BA
2
Transmitted Data
BB
3
Received Data
CA
4
Request to Send
CB
5
Clear to Send
CC
6
Data Set Ready
Additional Optional Circuits
9
Reserved for Testing
10
Reserved for Testing
CD
20
Data Terminal Ready
CE
22
Ring Indicator
CF
8
Data Carrier Detector
DA
24
Trans, Signal Element Timing
DB
15
Trans. Signal Element Timing
DD
17
Rec. Signal Element Timing
Communication Line
Modem
Business Machine
Female
Male
External Modem Cable

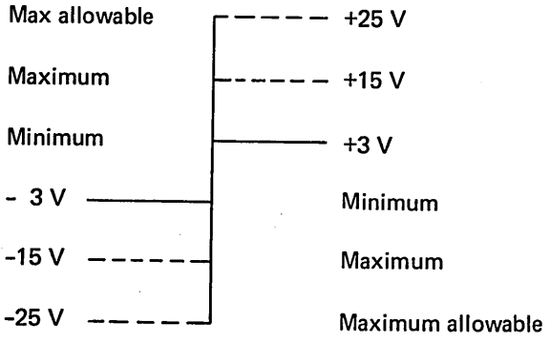

13 12 11 10 9 8 7 6 5 4 3 2 1
25 24 23 22 21 20 19 18 17 16 15 14

Modem and LCA Interface

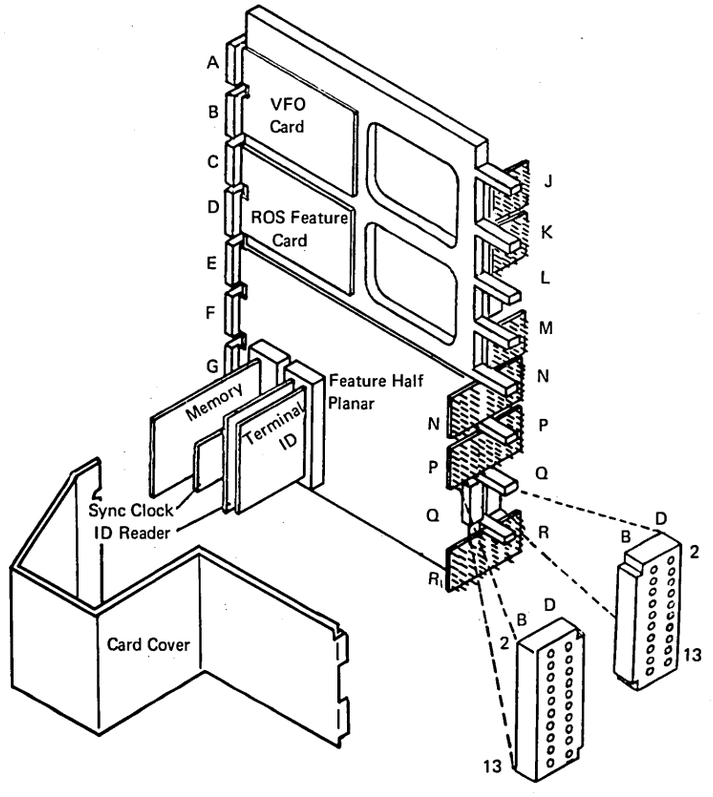
BSCA to Modem Interface

The EIA interface is used

EIA:



Feature Half Planar Socket Locations

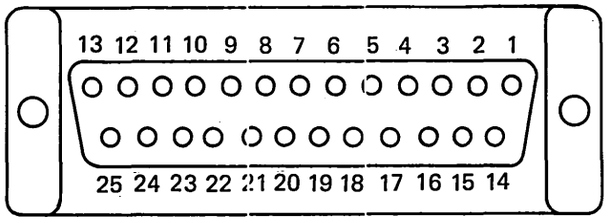


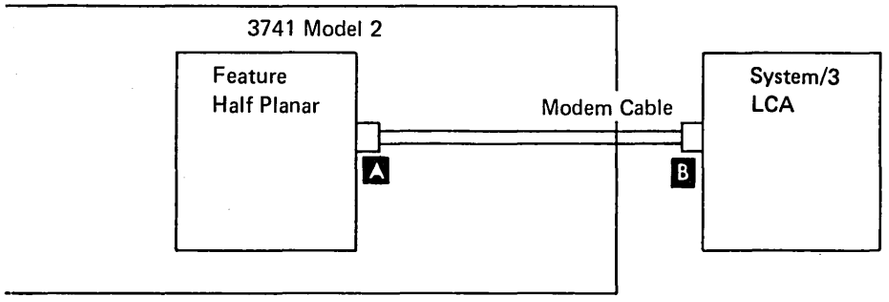
Modem Cable / BSCA Cable (all modems except 1200 bps Line Adapter)

MPU BSCA 1-N End	Lane Name	To or from 3741	Modem End
B13	Request to Send	From	4
B12	Transmit Data	From	2
B11	Receive Data	To	3
B10	Clear To Send	To	5
B09	Serial Clock Transmit	To	15
B08	Serial Clock Receive	To	17
B07	Signal Ground	From	7
D12	Data Set Ready	To	6
D11	Ring Indicator	To	22
D10	Carrier Detect	To	8
D08	Rate Selector	From	23
D07	Data Terminal Ready	From	20
D06	SCTE	From	24
FRAME	Frame Ground	From	1
D02	+12 Volts dc	From	—
D04	-12 Volts dc	From	—

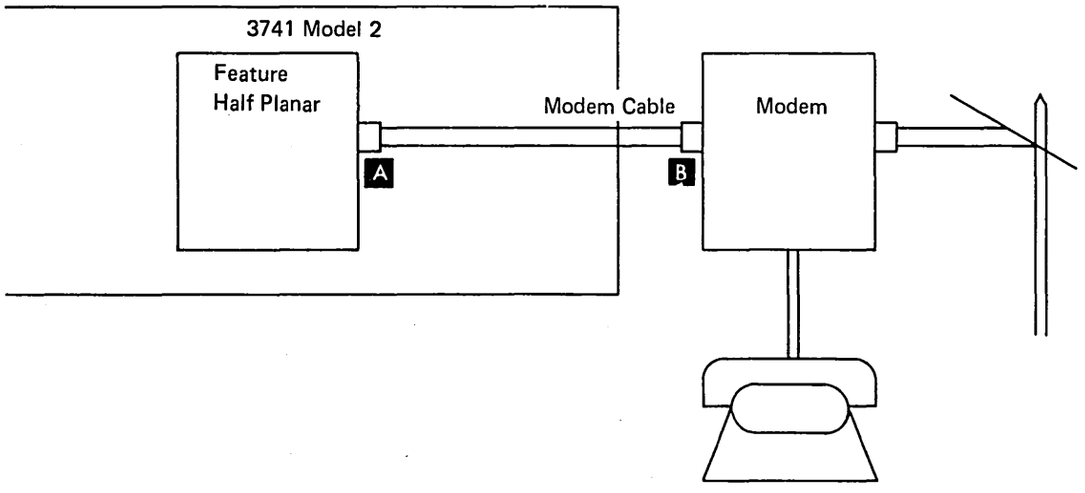
A

B





Note: A B notations refer to cable connectors.



1200 bps Line Adapter

General

The 1200 bps line adapter is an under-the-cover modem designed to operate at up to 1200 bps on World Trade or domestic non-switched lines and U.S. switched facilities.

The line adapter converts a two-level business machine signal into a signal suitable for transmission over a voice grade telephone channel. At the receiver, the line signal is converted back into a two-level business machine signal.

Information is handled serially by bit and by character. Synchronism is not maintained between information on the send data interface lead and the line signal.

Therefore, synchronous clock feature is a prerequisite for the line adapter feature.

Input Requirements

Communications Line (receiver input)

For four-wire operation, the receive and transmit lines are separate. For two-wire operation, the receive and transmit lines are jumpered together.

Receiver Sensitivity

This modem will operate properly with signals, at the receive line terminals, between -43 dBm and -8 dBm.

Receiver Input Impedance

$Z_{IN} = 600\Omega \pm 10\%$

Frequency Limitations

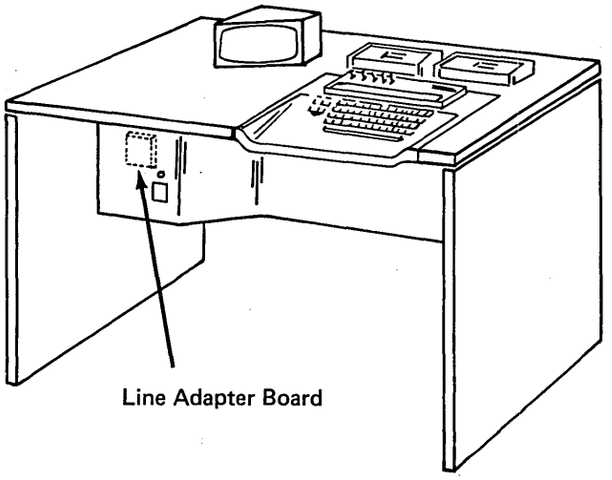
The receive frequencies are:

Mark	1300 Hz ± 10 Hz
Space	2100 Hz ± 10 Hz

There is no modem WRAP feature.

Location

The line adapter board housing the pluggable cards making up the 1200 bps line adapter is located against the right front cover of the machine as viewed from the rear. It is easily detached from the cover to allow servicing accessibility.



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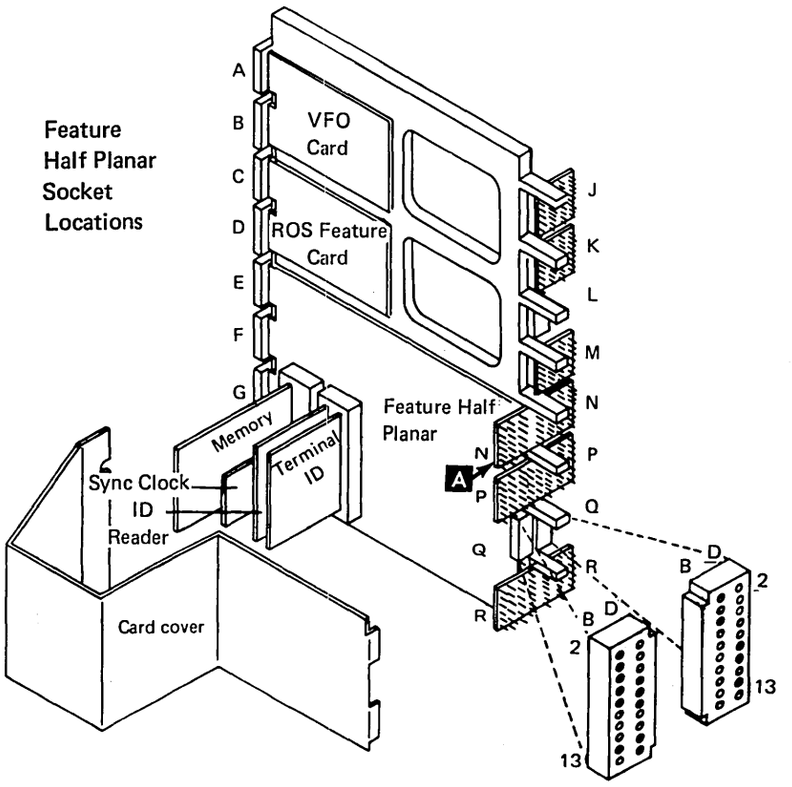
Interface — Non-switched Line (1200 bps)

Use		With	
Echo Clamp	Jumpered	Clear to Send (CTS) Delay	Jumpered
130 ms	20 to 21 and 22 to 23	200 ms	17 to 19
50 ms	20 to 21 and 22 to 24	75 ms	17 to 18
0	22 to 23	25 ms	17 to 16

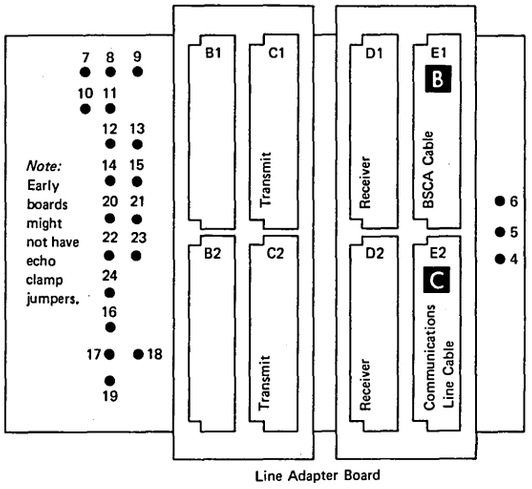
CAUTION
The short delay combinations might cause intermittent echo problems.



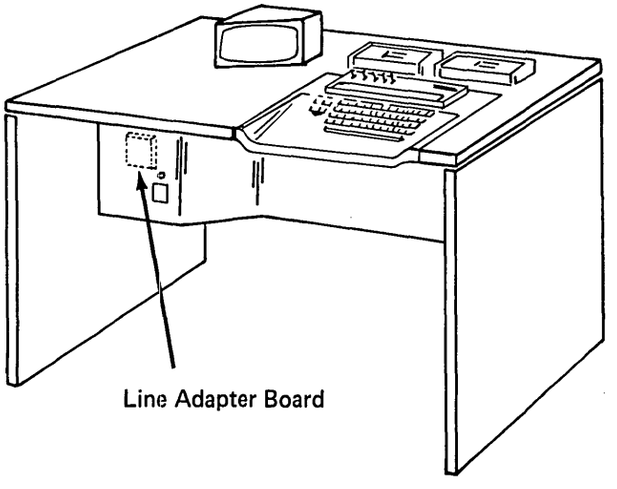
The line adapter board housing the pluggable cards making up the 1200 bps line adapter is located against the right front cover of the machine as viewed from the rear. It is easily detached from the cover to allow servicing accessibility.

2 Wire - 4 Wire

For 2 Wire	For 4 Wire
8 to 9	7 to 8
12 to 13	10 to 11
14 to 15	



Line Adapter Board

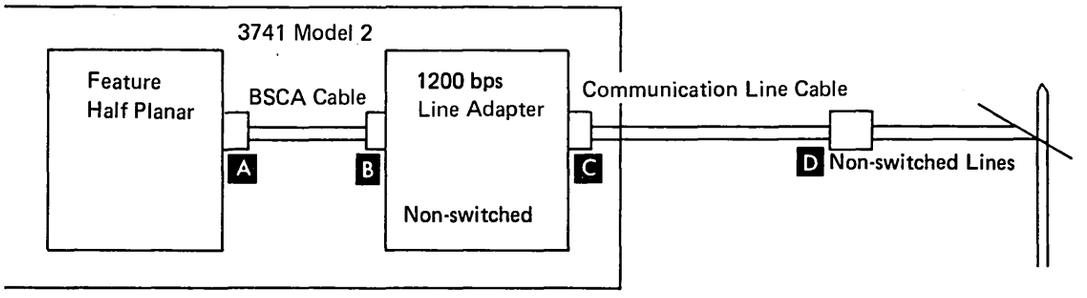


The most commonly used delay combination is 200 ms CTS with 130 ms echo clamp. Shorter delays can be used on short lines, or lines without echo suppressors. Intermittent echo problems occurring while jumpered for short delays may have to be corrected by jumpering for longer delays.

BSCA Cable

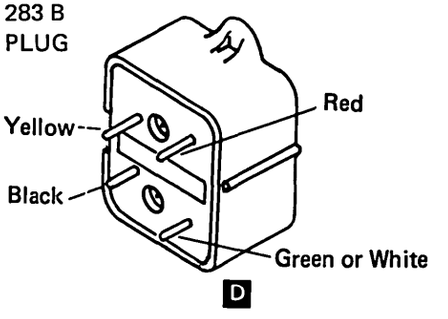
MPU BSCA 1-N End	Line Name	1200 bps Line Adapter
B13	Request to Send	D02
B12	Transmit Data	D03
B11	Receive Data	D04
B10	Clear To Send	D05
B09	Serial Clock Transmit	—
B08	Serial Clock Receive	—
B07	Signal Ground	D08
A D12	Data Set Ready	B03 B
D11	Ring Indicator	B04
D10	Carrier Detect	B05
D08	Rate Selector	—
D07	Data Terminal Ready	B08
D06	SCTE	—
FRAME	Frame Ground	—
D02	+12 Vdc	B13
D04	-12 Vdc	B11

Note: A, B, C and D notations refer to cable connectors.

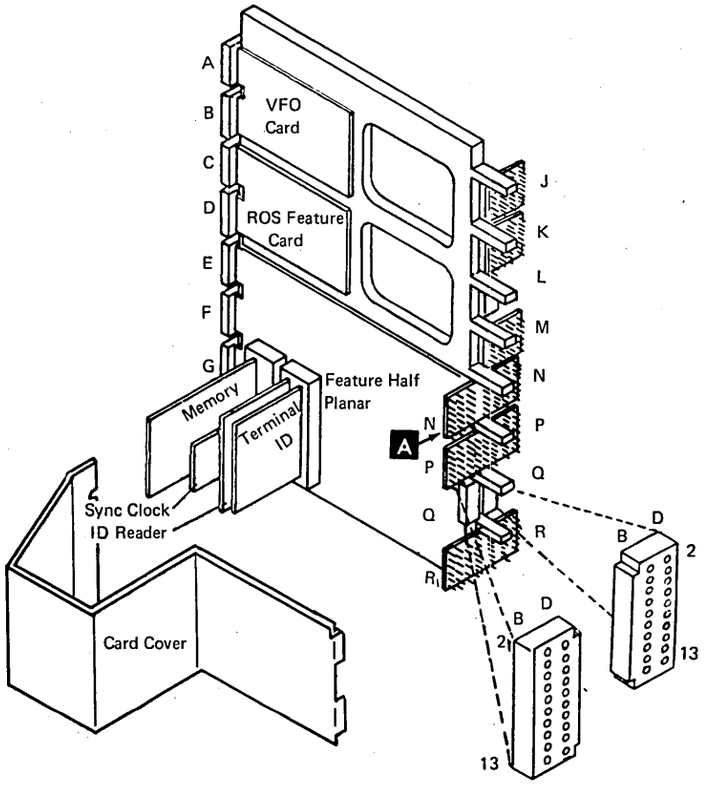


Communication Line Cable (non-switched)		
E2-D05	4W-Transmit / 2W	Red
E2-B12	4W-Transmit / 2W	Green/ or White
E2-B09	4W-Receive	Black
E2-D13	4W-Receive	Yellow

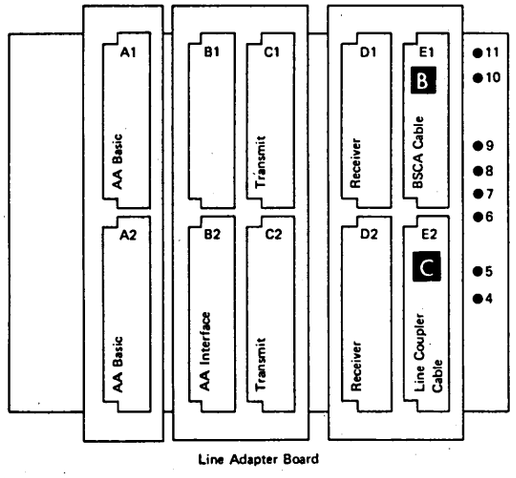
C D

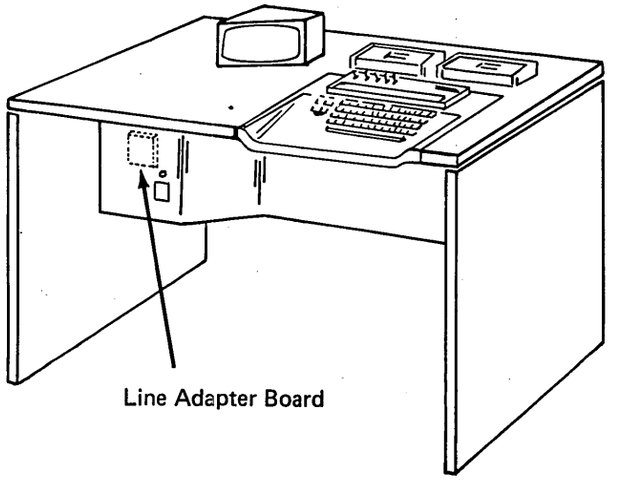


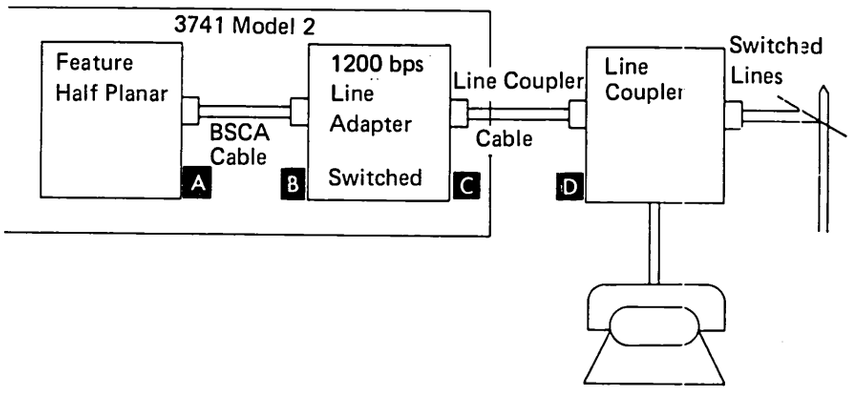
Interface — Switched Line (1200 bps)



The line adapter board housing the pluggable cards making up the 1200 bps line adapter is located against the right front cover of the machine as viewed from the rear. It is easily detached from the cover to allow servicing accessibility.







Modem Cable/BSCA Cable

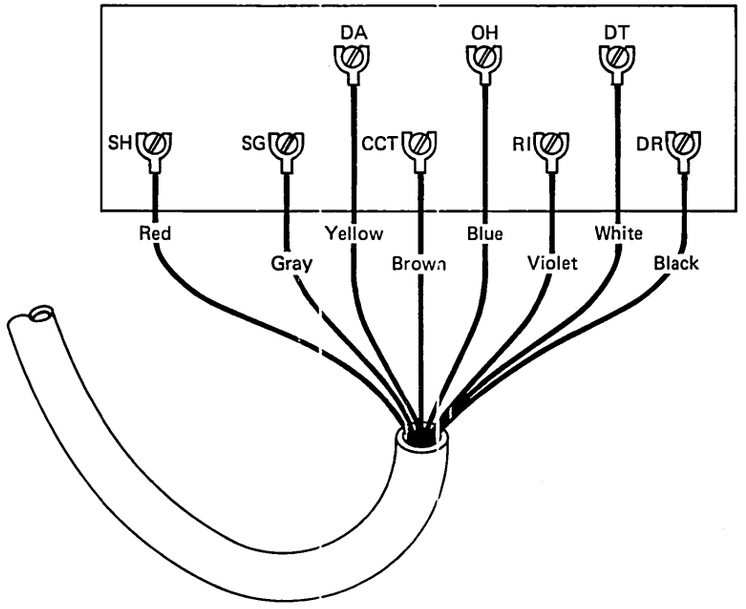
MPU BSCA 1-N End	Line Name	1200 bps Line Adapter
B13	Request to Send	D02
B12	Transmit Data	D03
B11	Receive Data	D04
B10	Clear To Send	D05
B09	Serial Clock Transmit	—
B08	Serial Clock Receive	—
B07	Signal Ground	D08
A D12	Data Set Ready	B03 B
D11	Ring Indicator	B04
D10	Carrier Detect	B05
D08	Rate Selector	—
D07	Data Terminal Ready	B08
D06	SCTE	—
FRAME	Frame Ground	—
D02	+12 Vdc	B13
D04	-12 Vdc	B11

Note: A, B, C and D notations refer to cable connectors.

Line Coupler Cable

Line Adapter	Cable		Coupler
D05	Data Tip	(DT)	White
D07	Coupler Cut Through	(CCT)	Brown
D09	Signal Ground	(SG)	Gray
C B05	Ring Indicate	(RI)	Violet D
B07	Switch Hook	(SH)	Red
B08	Data Modem Ready	(DA)	Yellow
B12	Data Ring	(DR)	Black
B13	Off Hook	(OH)	Blue

Line Adapter Cable
(provided with IBM machine)



Connection of spade clips to line coupler is *strictly* the customer's responsibility.

Interface from 3741 BSCA to 1200 bps Line Adapter

Request to Send (RTS) – From 3741

This line is keyed by the BSCA. It controls the turn on and turn off of the modulator (which of the two frequencies is emitted is controlled by the send-data line as above).

This line is ANDed with 'data set ready'. Hence, when 'request to send' and 'data set ready' are up, the carrier is immediately put on the transmission line. When 'request to send' or 'data set ready' is down, no carrier is emitted.

Clear To Send (CTS) – To 3741

The line is keyed by the line adapter. Its up level tells the BSCA that the BSCA may key the 'send data' line.

Its down level merely signifies that the 'request to send' line or 'data set ready' is at the down level and, hence, the transmitter has been turned off.

There are three delay options on non-switched line, selectable by strapping, associated with the 'clear to send' line. Each delay is defined as the time between up level being put on the 'request to send' line and an up level appearing on the 'clear to send' line.

25 ms – delay between 20 and 40 ms
75 ms – delay between 75 and 115 ms
200 ms – delay between 200 and 300 ms

On very short lines or on lines without echo suppressors, the shorter 'clear to send' delays may be used.

'Clear to send' delay can be jumpered on the non-switched line line-adapter board. It is fixed at 200 ms on the switched card.

Echo-clamp delay associated with 'clear to send', is fixed at 130 ms on adapter boards for switched lines (on early machines it is fixed at zero delay). On boards for non-switched lines, three echo-clamp delay options are available: 0 ms, 50 ms, and 130 ms, used with 'clear to send' delays of 25 ms, 75 ms, and 200 ms respectively.

Data Set Ready (DSR) – Non-switched Line Only – To 3741

This line is driven by the line adapter and is a power on indication for the line adapter.

Data Set Ready (DSR) – Switched Line Only – To 3741

The on condition indicates that the line adapter is connected to the line and ready to exchange further control signals with the BSCA equipment to initiate the exchange of data.

The off condition indicates that the associated modem is not ready to operate. The off condition of this circuit does not impair the operation of ring indicator.

Signal Ground (SG) – From 3741

This circuit provides a common ground reference for all circuits in the interface.

Carrier Detected (CD) – To 3741

This line indicates the presence of carrier on the receive input. An up level will be present when carrier has been present on the 'receive input' for between 10 and 20 milliseconds. This line will drop between 5 and 15 milliseconds after carrier has dropped. The BSCA does not use this line.

Ring Indicator (RI) – Switched Line Only – To 3741

Signals on this circuit indicate whether a calling signal is being received by the AA feature. The on condition indicates that a calling signal is being received. The off condition indicates that no calling signal is being received.

Data Terminal Ready (DTR) – From 3741 – Switched Line Only

Signals on this circuit control switching of the AA feature and the associated modem to or from the line.

The on condition (indicating that the data terminal equipment is ready to operate) prepares the AA feature to connect the associated modem to the line and maintains this connection.

When the AA feature is conditioned for automatic answering of calls, connection to the line occurs only in response to a combination of the on condition 'data terminal ready' and calling indicator.

The off condition causes the AA feature to drop the line (go to hook), when the transmission of data has been complete. The off condition of 'data terminal ready' does not inhibit the operation of calling indicator.

When 'data terminal ready' is turned off, it is not turned on again until 'data set ready' is turned off.

Receive Data (RD) – To 3741

The line is keyed by the demodulator section. When space frequency (2100 Hz) is being received over the transmission line, the receive data line is at its up level. When mark frequency (1300 Hz) is being received, the receive data line is at its down level. When the received signal (mark or space) is below the threshold setting of the carrier-detect circuitry, the receive data line will be clamped to its down level. For two wire operation, a clamp is provided to hold the receive data line to a down level while the modem is transmitting.

Transmit Data (TD) – From 3741

This line is keyed by the BSCA when data is to be transmitted. The data is presented serial-by-character and serial-by-bit. An up level on this line causes the modulator to put the space frequency (2100 Hz) on the transmission line. The down level causes the mark frequency (1300 Hz) to be put on the transmission line.

Interface from 1200 bps Line Adapter to Coupler

There are two analog interface leads to the coupler; 'data tip' and 'data ring'. The digital interface to the coupler is compatible in levels and sense to EIA RS232C/CCITT recommendation V.24.

Coupler Cut Through (CCT) – To Adapter

Signals on this lead indicate whether the coupling unit is ready for data or dialing. The up level indicates that the coupling unit is ready. The down level is present at all other times.

Switch Hook (SH) – To Adapter

Signals on this lead indicate whether an associated handset is 'off hook'. The up level is present if the handset is in use (off hook). The down level is present at all other times.

Ring Indicator (RI) – To Adapter

Signals on this lead provide an indication of ringing signals on the line. The up level indicates that a ringing voltage is present on the telephone line. The down level indicates that no calling signal is being received.

Data Modem Ready (DA) – From Adapter

Signals on this lead are used to indicate that the line adapter is ready to transmit or receive data.

Common Signal Ground – From Adapter

This lead provides a signal ground path between the line adapter and the data access arrangement.

Off Hook (OH) – To Adapter

The signals on this lead provide 'off hook' and 'on hook' signals to the line adapter. An up level (on condition) on the OH lead causes a relay to operate which completes a DC path to indicate 'off hook' to the serving central office and trip any incoming ringing signal.

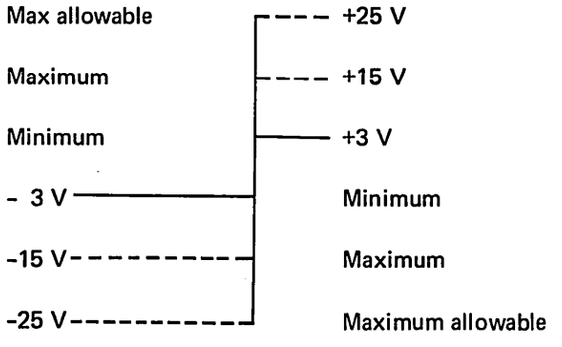
Data Tip (DT) and Data Ring (DR) – To/From Adapter

These lines provide an analog signal path between the line adapter and the coupler.

BSCA to Modem Interface

The EIA interface is used

EIA:



Operation and Configuration

Non-switched Line Operation

The non-switched line adapter consists of two cards; transmit and receive.

The transmit card takes serial binary data and converts it to frequency-shift-modulated analog data. On the board assembly, the 'echo clamp' delay is adjustable, by jumpering, to correspond with 'clear to send' delay jumpering as follows:

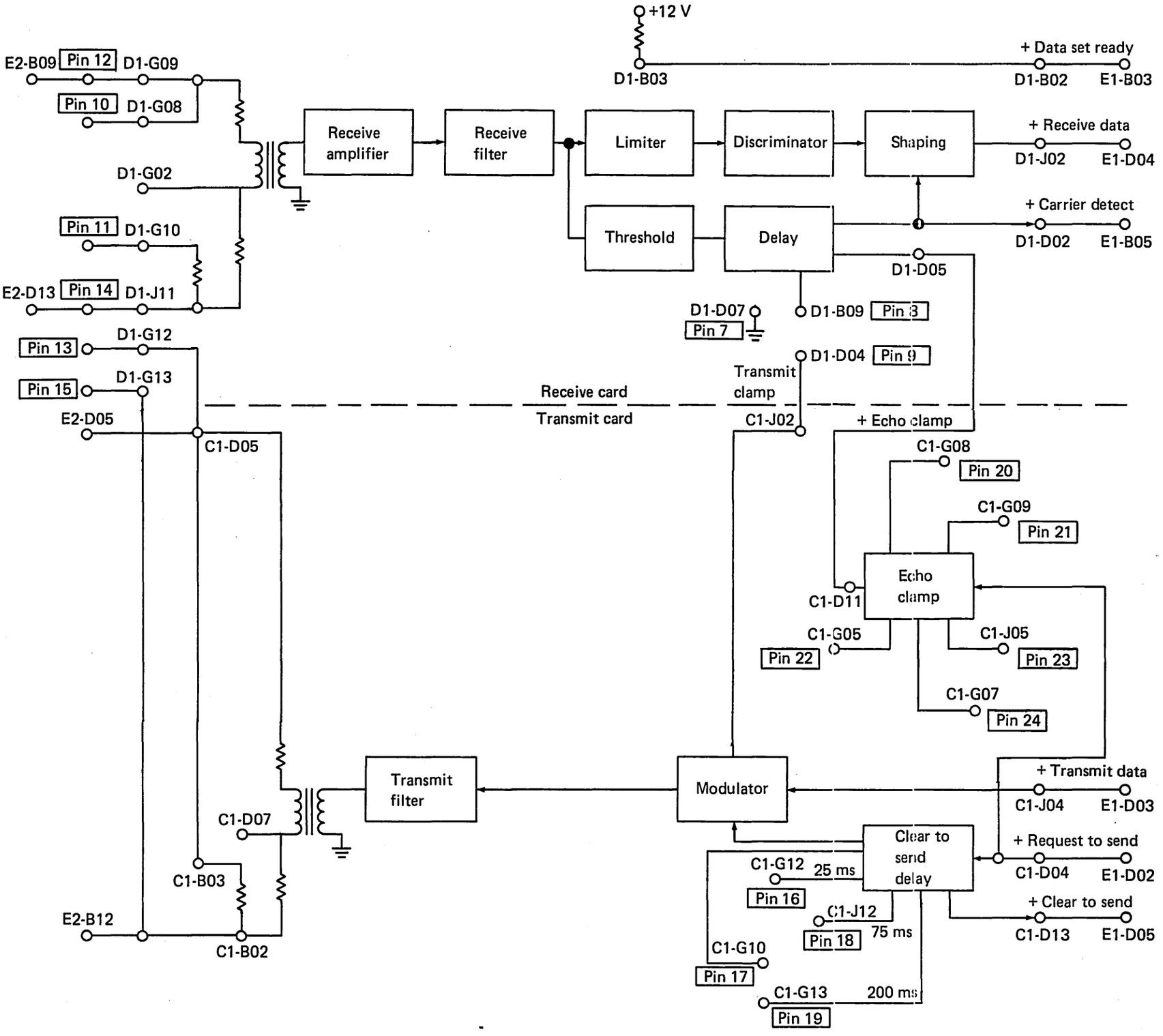
CTS Delay	Echo Clamp Delay
25 ms	0 ms
75 ms	50 ms
200 ms	130 ms

The receive card takes analog frequency-shift-key (FSK) data from the line and converts it to serial binary data. The threshold control is permanently wired for -33 dBm. Signals, whose level are less than -33 dBm, will cause 'carrier detect' to go off and clamp received data.

Jumpering is provided on the board assembly to jumper the transmitter output transformer and the receiver input transformer for two wire operation. Also for two wire operation, transmit clamp clamps the 'receive data' line while data is being transmitted.

In the non-switched line adapter, 'data set ready' is always on.

Non-switched Line



Note: Pin xx refers to pin numbers on modem board.

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Non-switched Line Configuration

The non-switched line configuration consists of the basic modem.

In the US it requires 3002 unconditioned lines or equivalent or better.

The non-switched configuration is built on the non-switched line adapter board assembly, which provides socket positions for:

Receive card	Socket D1, D2
Transmit card	Socket C1, C2
BSCA cable	Socket E1
Line cable	Socket E2

Options

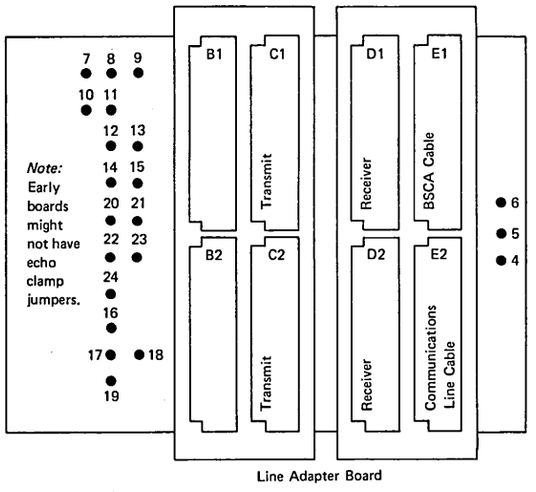
The following are fixed in the non-switched line configuration:

Half-duplex operation
0 ms echo clamp
-33 dBm receiver sensitivity

Jumpers are provided for selection of:

2-wire or 4-wire line
25, 75, or 200 ms 'clear to send delay'
0, 50, or 130 ms 'echo clamp delay'

On very short lines, or lines without echo suppressors, the shorter clear to send delays may be used.



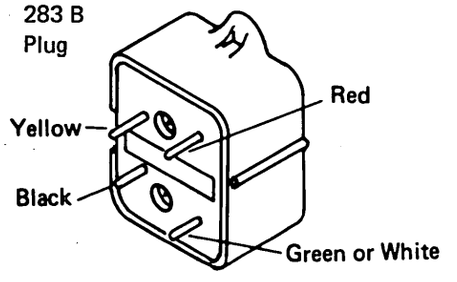
Line Adapter Board

2 Wire — 4 Wire

For 2 Wire	For 4 Wire
8 to 9	7 to 8
12 to 13	10 to 11
14 to 15	

Use		With	
Echo Clamp Delay	Jumpered	Clear to Send (CTS) Delay	Jumpered
130 ms	20 to 21 and 22 to 23	200 ms	17 to 19
50 ms	20 to 21 and 22 to 24	75 ms	17 to 18
0 ms	22 to 23	25 ms	17 to 16

CAUTION
The short delay combinations may cause intermittent echo problems.



Non-switched Line Cable		
E2-D05	4W-Transmit / 2W	Red
E2-B12	4W-Transmit / 2W	Green/ or White
E2-B09	4W-Receive	Black
E2-D13	4W-Receive	Yellow

Non-switched Line Transmit Level Adjustment Procedure

Direct attachment to a non-switched line usually required a zero dBm transmit level. If a coupler is required, the transmit level should be adjusted to that specified on the coupler.
(Use dB meter P/N 453545)
Adjust the transmitter output:

1. Turn OFF the 3741 main line power.
2. Disconnect the communication line plug and insert it into the TRANS/REC jack in the dB meter cover.
3. On the dB meter:
   a. Set the 2W-4W TRANS/REC switch to TRANS.
   b. Set the BRIDGING, 600, 324 switch to 600.
   c. Jumper the line terminals on the cover to the line terminals on the meter.
4. Jumper line adapter board pins 4, 5, and 6 together to unclamp the transmitter and turn on 'request to send'.
5. Turn power on the 3741 and the dB meter.
6. Adjust R3 on the transmitter card to attain the correct dB level (zero dB if direct attach, or to level specified on the coupler if a coupler is used).
7. Power down.
8. Remove the jumpers from the line adapter board pins.
9. Reconnect the communication line plug.

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Switched Line Operation

The switched line configuration consists of four cards; transmit, receive, AA basic, and AA interface.

The function of the transmitter and receiver cards is the same as in the non-switched configurations except:

1. Switched line is permanently wired for two-wire operation including line transformers and transmit clamp.

2. 'Clear-to-send' delay is permanently wired for 200 ms. 'Echo clamp' delay is permanently wired for 130 ms (in early machines it is wired for 0 ms).

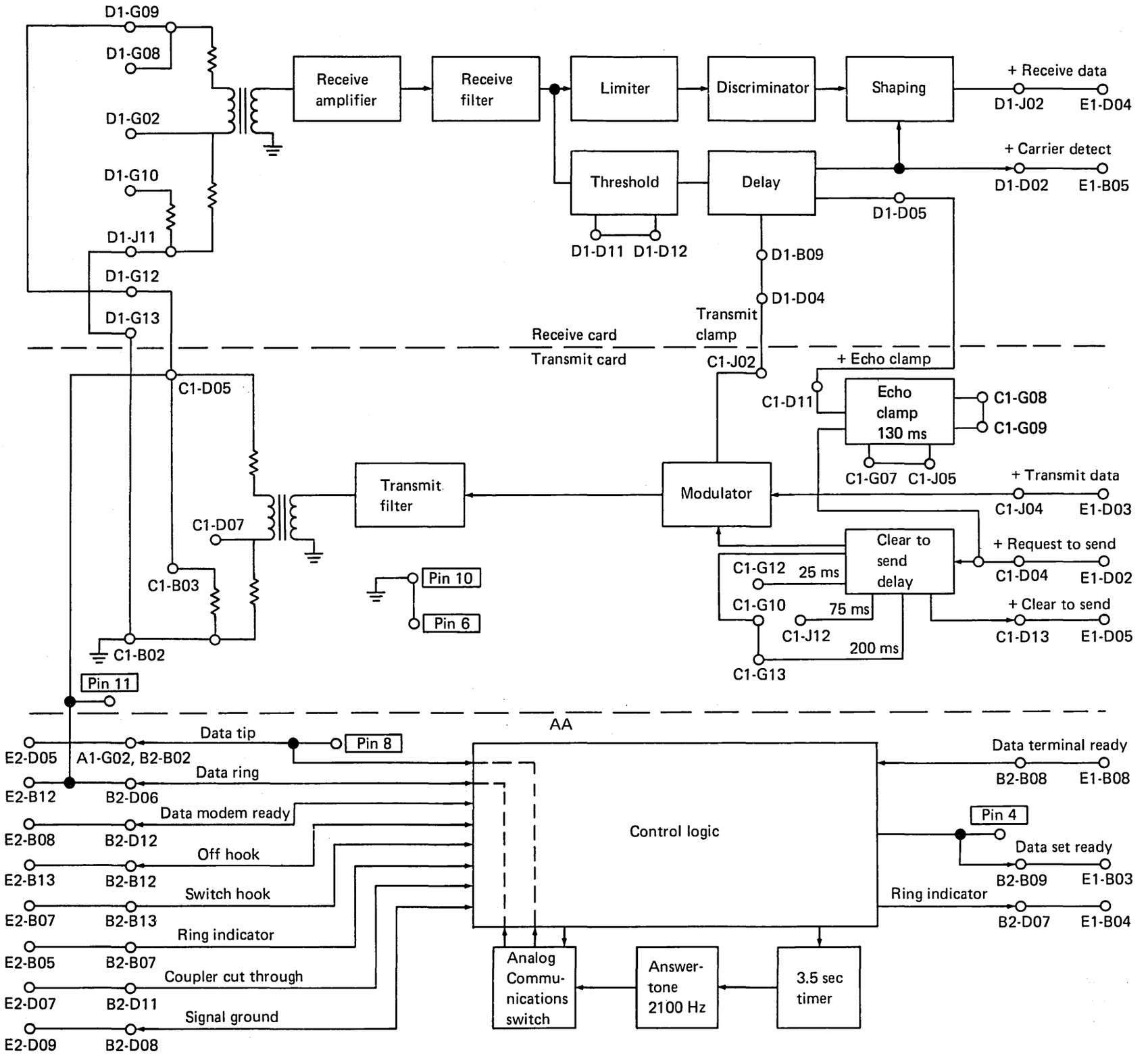
3. Threshold control is permanently wired for -43 dBm minimum level.

4. 'Data set ready' is controlled by the AA cards.

The AA cards monitor control lines from the CBS data coupler and generate signals to the BSCA and coupler. 'Data modem ready' is permanently on. 'Data terminal ready' being on from the BSCA permits AA to detect ringing signal from the coupler. AA signals 'off hook' to the coupler, answering the phone. The AA then generates a 3.5-second 2100-Hz answertone to the remote end and turns on 'Data set ready'. After the answertone is sent, the line is under control of the transmitter receiver cards.

In order to do manual answer with a CBS data coupler handset, 'data terminal ready' must be held off by not being in communications mode.

Switched Line



Note: Pin xx refers to pin numbers on modem board.

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Switched Line Configuration

The switched line configuration consists of the basic modem and autoanswer.

It is used only in U.S. and requires a common carrier type CBS automatic data coupler (series 5 or later) or equivalent. The local loop from the serving central office must be a type II loop for DATA-PHONE* or Data Access Arrangement (DAA).

The CBS coupler should be wired such that the line adapter is connected to the line when the associated telephone's handset is in its cradle (exclusion key not operated). Conversely, the exclusion key must be operated to use the handset for voice communication. The telephone set ringer should be connected on the line side of the exclusion key.

The coupler must be mounted vertically. TEST and ANS switches must be off.

The following are fixed on the switched line configuration:

Half-duplex operation
2-wire operation
200 ms 'clear to send delay'
130 ms 'echo clamp delay' (early machines are 0 ms)
-43 dBm receiver sensitivity

There are no jumper options.

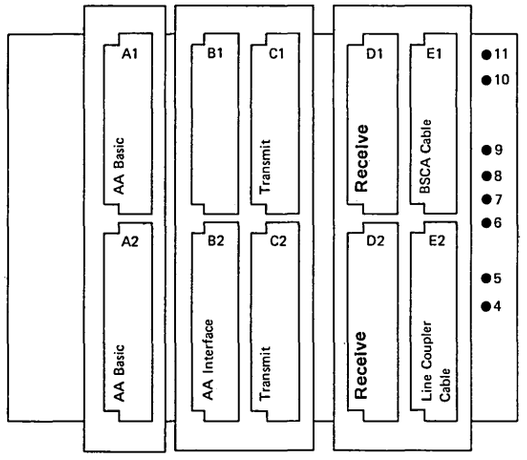
The automatic answer is designed to recognize the ringing signal from the data access arrangement, and signal 'off-hook' to the DAA if the 3741 is ready. It provides an answertone, and transfers the line to the associated line adapter.

Switched Line Adapter Board

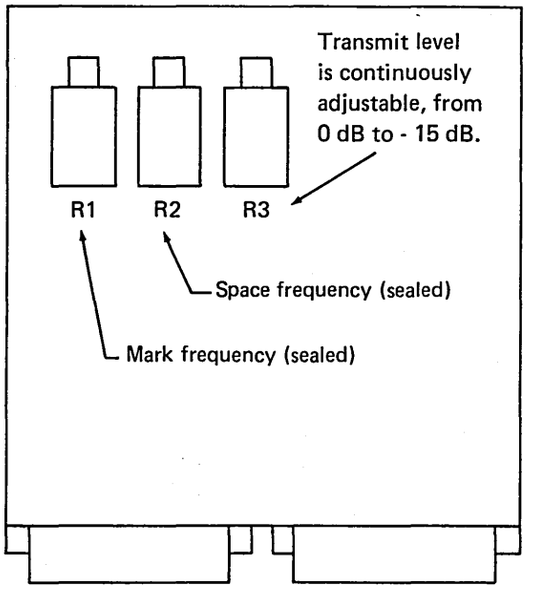
The switched line configuration is built on the switched line adapter board assembly which provides socket positions for:

Receive card	Socket D1, D2
Transmit card	Socket C1, C2
AA interface card	Socket B2
AA basic card	Socket A1, A2
BSCA cable	Socket E1
Line coupler cable	Socket E2

* American Telephone and Telegraph



Line Adapter Board

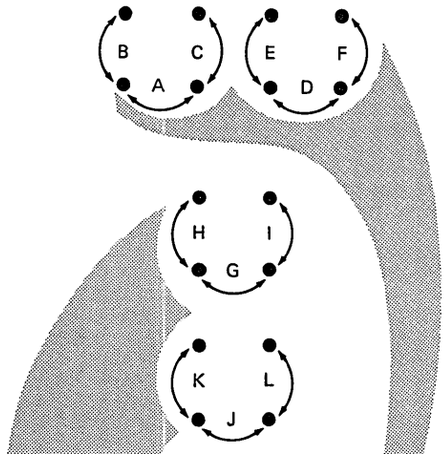


Transmit Card

Switched Line Transmit Level Adjustment Procedure

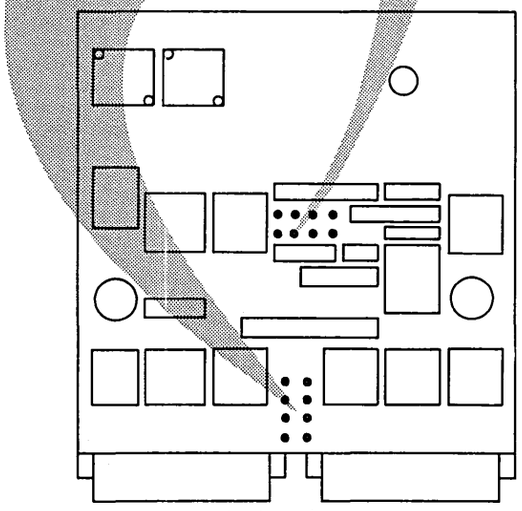
The transmit level must be adjusted at the transmit card to match the level specified for the data coupler. Also, the autoanswer basic card must be jumpered for that same transmit level.
(Use dB meter P/N 453545)
Adjust the transmitter output:

1. Turn off the 3741 main line power.
2. Disconnect the line coupler cable from line adapter board E2.
3. On the dB meter:
   a. Set the 2W-4W TRANS/REC switch to TRANS.
   b. Set the BRIDGING, 600, 324 switch to 600.
4. Remove the autoanswer interface card from line adapter board B2.
5. Jumper line adapter board pins 6, 7, 8, and 9 together to ground DT, turn on 'request to send' and unclamp the transmitter.
6. Jumper line adapter board pins 4 and 5 together to turn on 'data set ready'.
7. Connect the dB meter's black line terminal to pin 10, and the red line terminal to pin 11.
8. Turn power on the 3741 and the dB meter.
9. Adjust R3 on the transmit card to attain the correct transmit level reading on the dB meter scale.
10. Power down.
11. Remove the jumpers from the line adapter board pins.
12. Reinstall the autoanswer interface card in line adapter board B2.
13. Reconnect the line coupler cable to line adapter board E2.

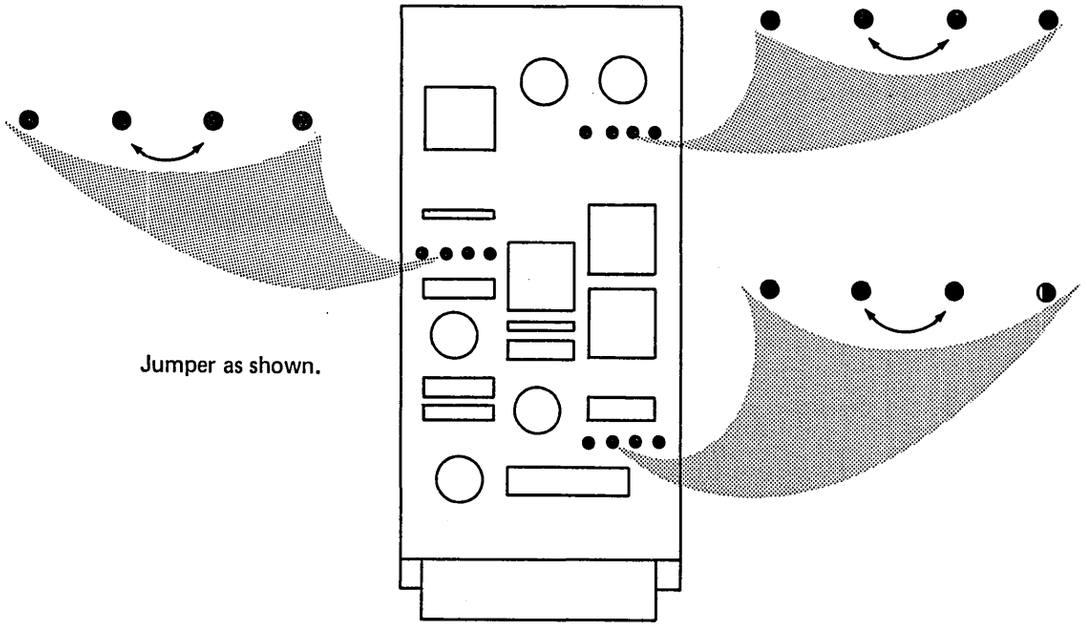


-dB level	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15
A	X		X		X		X		X		X		X		X	
B		X		X		X		X		X		X		X		X
C		X		X		X		X		X		X		X		X
D	X	X			X	X			X	X			X	X		
E			X	X			X	X			X	X			X	X
F			X	X			X	X			X	X			X	X
G	X	X	X	X					X	X	X	X				
H					X	X	X	X					X	X	X	X
I					X	X	X	X					X	X	X	X
J	X	X	X	X	X	X	X	X								
K									X	X	X	X	X	X	X	X
L									X	X	X	X	X	X	X	X

Jumper the attenuator pins in accord with this chart, to match level requirements of the line coupler.



Autoanswer Basic Card.



Jumper as shown.

Autoanswer interface card.

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Call Sequence

Manual Call Sequence

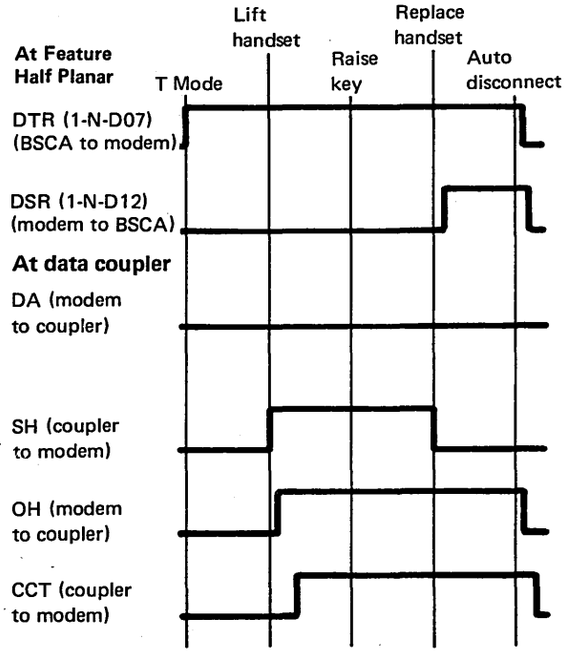
To make a manual call, the operator sets up the machine for the appropriate communications mode, T, P, R, B, or D causing the BSCA to turn on DTR. At this point the operator lifts the handset, raises the exclusion key, and places the call to the remote end. This causes SH, OH, and CCT to turn on. To go to data mode, the handset is replaced causing DSR to turn on and data transmission to take place. If there is no operator intervention, the BSCA will drop DTR causing disconnection at the completion of communication.

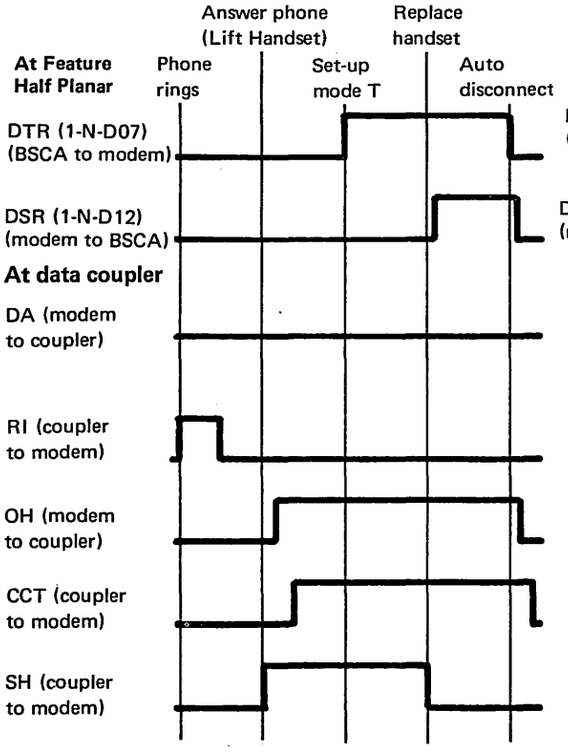
Manual Answer Sequence

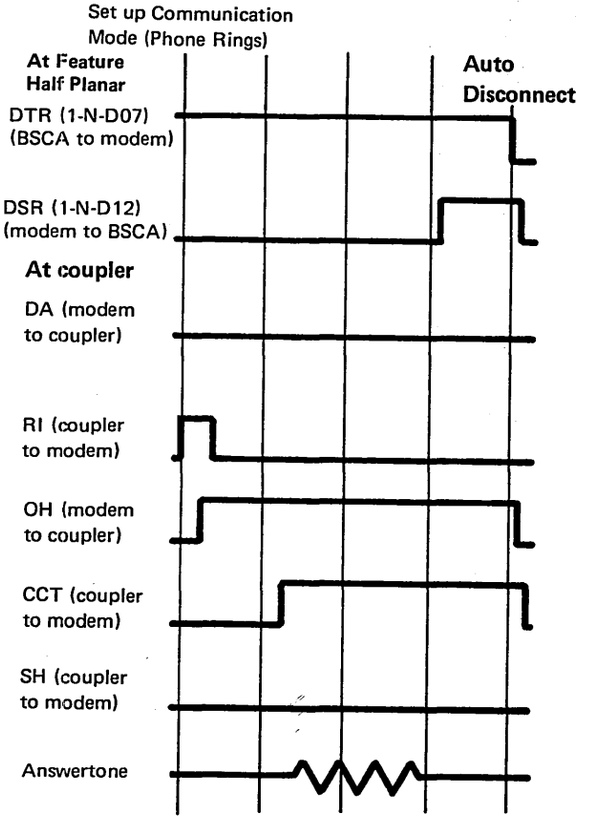
In order to perform manual answer operation, the 3741 should not be in communications mode. (If the 3741 is set up for communications before a call is received, autoanswer sequence will take place.) Lifting the handset causes the SH, OH, and CCT to turn on. After answering the phone, the operator sets up the 3741 for the appropriate communications mode T, P, B, R, or D causing DTR to turn on. To go to data mode the handset is replaced causing DSR to come on and data transmission takes place. If there is no operator intervention, automatic disconnection will occur at the completion of communications.

Autoanswer Sequence

To perform autoanswer function, the 3741 is set up in appropriate communications mode. This causes 'data terminal ready' to come on and enables the autoanswer. The autoanswer detects signals on 'ring indicator' and turns on 'off hook' to the coupler. This causes 'coupler cut through' to come on when the line adapter is connected to the line. AA then sends the answertone and turns on 'data set ready'. After data communications, the BSCA disconnects by dropping 'data terminal ready' which turns off 'off hook'.







WT PUBLIC SWITCHED NETWORK (PSN)

This feature consists of a 1200 bps line adapter (modem) and a line plate assembly (coupler).

Line Adapter Description

The modem consists of four cards: transmit, receive, equalizer, and PSN cards.

The transmit card takes serial binary data and converts it to frequency-shift modulated analog data. Binary zeros are sent as a mark frequency of 1300 Hz and binary ones are sent as a space frequency of 2100 Hz. On the transmit card, 'echo clamp' is permanently wired for 130 milliseconds (early boards are wired for zero delay). 'Clear to send delay' is permanently wired for 200 milliseconds. The maximum output transmit level is -1.8 dBm. Since the dB drop of the line plate is typically 3 dB (maximum of 5 dB), the maximum output of the line plate to the telephone lines is typically -5 dBm.

The receive card takes analog frequency-shift-key (FSK) data from the telephone lines and converts it to serial binary data. The threshold control is permanently wired for -43 dBm. Signals whose levels are less than -43 dBm will cause the received data to go to all zeros.

The equalizer card amplifies the space frequency and attenuates the mark frequency. Therefore, all evaluations of the received telephone signal should be made at the space frequency of 2100 Hz.

The PSN card monitors the 'current detect' lines from the line plate and generates 'data set ready' (DSR) and 'ring indicate' (RI) to the feature half planar. DSR comes on with 'connect data set to line' (CDSTL) or if one 'current detect' line stays on (down level) for 40 milliseconds. If both 'current detect' lines are changing state at a rate faster than 15 Hz, the RI line comes on (up level). CDSTL is buffered on the PSN card and its up level causes the line plate's relay to couple the modem's data line to the telephone lines.

The 3.5-second answertone is sent by the feature half planar before binary communications starts.

This modem is permanently wired for 2-wire operations.

Line Plate Assembly Description

The line plate assembly monitors the telephone lines and couples the modem to the telephone lines.

With 'CDSTL' at a down level ('transfer relay' off), lifting the handset (if so equipped) causes the telephone line current to flow through a optical isolation diode. If the telephone rings, alternating current flows through both optical isolation diodes. The current through these diodes causes the 'current detect' lines to go to a down level (logical one).

With CDSTL on ('transfer relay' on) the telephone lines are connected through a full-wave diode bridge and a dc isolation transformer to the modem's transmitter and receiver. The dc current through the transformer's primary and secondary should be approximately balanced for linear ac operation. This is done by adjusting the dc resistance with jumpers U4-U11 (see 533).

If no handset is used, a handset can be electrically simulated by the R-C network at U2-U3 (see 533).

EXPANDED COMMUNICATIONS (EBSCA) FEATURE

The Expanded Binary Synchronous Communications Adapter (EBSCA) feature allows the machine to function as a point to point, or multipoint tributary terminal. The basic BSCA function allows data transmission using EBCDIC directly as the communications line code. Operation is half duplex over private line, common carrier non-switched line, or a common carrier switched network. The mode of transmission is synchronous, serial-by-bit, and serial-by-character.

Operation

When in communications mode the EBSCA controller makes use of the MPU microcontroller, the disk unit controller, and the microcontroller buffer interface and the display unit controller to:

1. Perform all disk functions such as read or write, write checking or checking, or updating information on the index track.

2. Transfer data between the disk unit and the EBSCA controller. The transfer in transmit mode is from the disk unit to the buffer, to the EBSCA controller data register, to the modem. In receive mode the flow is reversed.

3. Display status, error codes and CPU ID information for review by the operator.

The communications modes are:

- T To transmit unblocked data
- P To transmit unblocked hex data
- R To receive data only (blocked or unblocked)
- B To transmit unblocked data, auto-turn around, and receive data
- D To transmit unblocked hex data, auto-turn around, and receive
- J Transmit blocked data
- K Transmit blocked data, auto-turn around and receive
- I Inquiry
- W Execute CE Test Modes

The EBSCA controller also performs the serializing/deserializing function on the data transmitted or received.

If execute program mode is to be used (model 4) Sector 3 of track 0 must be set up as follows:

- Columns 2 through 15 should contain the object data set name, drive number and object program name.

- Column 21 should contain an E for execute or an A for compress.

If print unattended operation is to be done and format A points to another format buffer, that format must be selected before entering communications.

If blocked records are to be transmitted (J or K modes) and a transmit selected fields or transmit selected records mask (program) is needed, or if blocked records are to be received and a receive data mask (program) is needed, the operator must create the mask (program) before entering communications.

The procedure for generating one of these masks (program) is similar to the procedure for creating formats. The masks can be created in format buffers 8, 9, and/or A. The first character is the definition character.

1st Char	Mask (Program)	Other Positions in the buffer
>	Receive data and insert constants	Place first character (>) wherever character from line is to be inserted. Place duplicate data at all other locations.
"	Transmit Selected Fields (1st char transmitted)	Place quote (") wherever character in that corresponding position in a data record is to be transmitted.
'	Transmit Selected Fields (1st character not transmitted)	Place quote (") wherever character in that corresponding position in data record is to be transmitted.
=	Transmit Selected Records	Place equal sign (=) wherever character in that corresponding position in data record is not to be compared. Place 'compare' characters in all other positions.

Unlike formats, there is no 'E' (ending) character in these marks (programs). The transmit masks are compared to the record length being transmitted; any other positions in the buffer are ignored. For the receive mask, the number of first character (>) must equal the number of characters being received on the line. The duplicate data ends at the first non-blank character in the mask. The last duplicate character cannot be a blank. The record length is the sum of the characters plus the duplicate data characters.

Examples of masks (programs) are given in the *3741 Data Station Reference Manual,* GA21-9183.

An operator can select communications mode from update or read index modes only. Upon selection of the communications mode from index mode or update mode, the data set label will be checked for valid extents (BOE, EOE, EOD) and for HDR1. If the extents are not valid a B error is posted. If the extents are valid the following steps occur:

1. If the keylock is present, it must be unlocked.

2. If terminal ID is present, the terminal ID is read and stored in the previous buffer. Terminal ID and multipoint features are mutually exclusive.

3. If terminal ID is present, the cursor must be at position 16 or less. All positions below the cursor are assumed to be the CPU ID, or input for wrap test 1, and are transferred to the buffer. The CPU ID must be entered before communications mode is selected and must be 15 characters or less. If no CPU ID is entered, the BSCA controller will accept any ID from the Remote end.

4. The second disk feature will be set to record 00007 on the index track.

If a failure occurs in steps 1 or 3, an H error is posted. Step 4 could result in posting disk errors.

The record at the current address position of disk 1 is read and a C for communications is posted as the mode indicator in the status line of the display (positions 38). If print unattended mode is desired, the FUNCT SEL upper followed by print EOD keys must be pressed. In this case, the AUTO REC ADV switch must be on or an H error will be posted.

If execute program mode is desired, the E key must be pressed.

Note: Unattended printing and execute program mode are mutually exclusive and attempting to select both will result in an H error.

On switched lines and if the operator will be dialing the call, the M key must then be pressed. The I, J, K, T, P, R, B, or D key must then be pressed to select the function desired. Pressing the M key must be omitted if the 3741 will be answering a call, or if on leased lines, or if using inquiry mode.

On switched lines, pressing the M key indicates to the EBSCA controller that it is calling and therefore will transmit a line bid first, regardless of the mode. Not pressing the M key tells the EBSCA controller to wait for a line bid. On non-switched line the M key is not required because the station in transmit mode will transmit a line bid first. On non-switched multipoint lines the M key is not required because the station always looks for its address first.

If inquiry mode is selected, the record length of the data set from which communications was entered must be 128. If not an H error is posted.

An H error is also posted if the operator has first pressed FUNCT SEL upper and PRINT TO EOD, and then attempts to strike one of the transmit keys (T, P, or J), the inquiry key (I), or the test mode key (W).

The letter key pressed will replace the C in the status line. If the ID reader is installed, a B will be posted on the status line in position 39. The badge can then be inserted and read into the buffer or the REC ADV key can be pressed to skip the ID reader functions as in 3741 to 3741 communications.

If the R key is pressed and if a receive data and insert constants mask is being used for the first data set and communications was entered from update mode, a check is made of the mask length (the number of dup characters plus > (greater than) signs). This length must match the record length of the current data set or an H error is posted.

The EBSCA controller then checks jumper 4. It can be in DTR (data terminal ready) or CDSTL (connect data set to line) mode. The DTR mode is generally used for switched lines and the CDSTL generally for non-switched line communications.

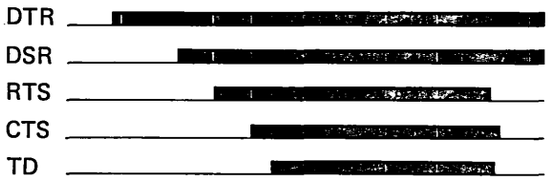
In CDSTL mode, the EBSCA controller then looks for 'data set ready' (DSR), or the 'ring indicator' (RI) to come up **B** . When either is detected, communications will proceed. If the EBSCA controller detects that the send answertone strap is on, the first transmission is three seconds of space (logical 0).

In DTR mode the EBSCA controller will check for 'data set ready' (DSR) being off, then it will bring 'data terminal ready' (DTR) up **A** . The operator will then place the call if this is the calling station. After the data set button on the modem is pressed causing DSR to come on, the controller will make or wait for a line bid and exchange ID codes. From this point on, CDSTL and DTR operation is identical and is dependent on the operator selected mode, transmit, receive.

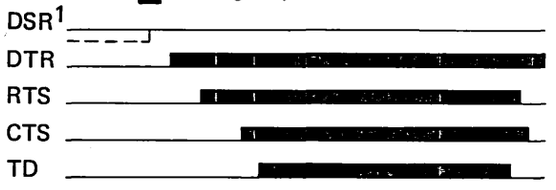
In the T, B, D, P, K, or J transmit modes, the ID reader code will be transmitted followed by data records.

If communications mode was selected from update mode, the record at the current address and all records from this one to the end of the data set will be transmitted. If this mode was selected from index mode, the current label will be checked to see that the bypass data set position (position 41) does not contain a B, before the data set is transmitted. If a B is found, the EBSCA controller causes a search for another data set to be transmitted.

A Timing Sequence — DTR Mode

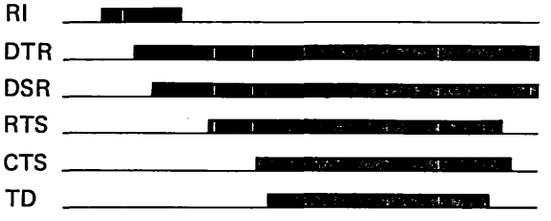


B Timing Sequence — CDSTL Mode



1 — DSR may be permanently on (typical of non-switched line modems)

OR



Transmit Mode (T or P) (Unblocked Data)

The records (1 to 128 characters) to be sent are read from the disk into the field totals or hold buffers. Reading records is controlled by the disk unit controller and the microcontroller/buffer interface. The transmitting of records is under control of the EBSCA controller and the microcontroller/buffer interface. Therefore, the reading and transmitting of records takes place simultaneously. As a record is being read into one buffer, the previous record is being transmitted from the other buffer. Data is transmitted one record at a time, serial-by-bit, serial-by-byte. A positive response from the receive end will initiate the transmitting of the next record and the reading of the following record.

Data is transferred from the field totals or hold buffer one byte at a time to the data register on the EBSCA controller. From the data register it is transferred serially by bit to the transmit line.

Transmitting continues until the last record of the data set is sent. At this time, the disk is returned to the index track to look for another data set to transmit. All data sets which contain an HDR1 and do not contain a B in the bypass data set position of the label and which have a label record number higher than the one just transmitted, will be transmitted. When the second disk feature is installed, any HDR1 data set on that disk which does not contain the B in the bypass position of the label will also be transmitted.

If an invalid label is found, which is not a bypass data set, communications will be terminated with the appropriate error code displayed.

When there are no more data sets to be transmitted, the EBSCA controller will send the end of transmissions sequence (EOT) and post a T in position 39 of the status line, resulting in TT or PT mode.

A null record is always transmitted between data sets and before the EOT sequence. If a data set is continued on disk 2, the first valid data set on disk 2 is sent as a continuation of this data set. If position 45 of the data set label contains a C and the second disk is not ready, transmission will terminate and a D error is posted.

Note: P mode must be used if hex data is to be transmitted.

Blocked Transmit Mode (J)

In this mode records are read into the hold buffer and transferred into one of two 512-byte buffers. (One 512-byte buffer consists of format buffers 1, 2, 3, and 4; the other consists of format buffers 5, 6, 7, and 8).

The mask (program) that was entered into format buffer 6 will be moved internally to another location while format buffer 8 is used for data. The mask (program) that is currently being used is loaded in the field totals buffer. If a mask is used, the records being transferred from the hold buffer are compared character for character against the mask before using transferred to a 512-byte buffer.

After each record is inserted into the 512-byte buffer, an IRS (inter-record separator) character is inserted. Only an integer number of records are stored, that is, three 128-byte records. As with T or P modes, these 512-byte buffers are transmitted alternately one being 'filled' while the other is being transmitted. After communications is complete, the masks (programs) are restored to format buffers 8, 9, and A and the field totals buffer. Except for the above, this mode is similar to T or P mode.

In this mode, in addition to data-link control characters, the IRS and IFS (inter field separator) characters can not appear in the data stream (data records).

Transmit/Receive Mode (B, D, or K)

If the mode is B, D, or K, the transmit sequence is identical to the T, P, or J mode respectively. However, when all data sets have been transmitted, the EBSCA controller causes the disk to be positioned at EOE + 1 of the last transmitted data set. The first received data set label is the first valid data set label after the last data set transmitted. On switched lines, the controller will wait 20 seconds for a line bid. If none is received, a C error will be posted on the display and a line disconnect will be made. The controller will then wait for a call, which will put the controller into a receive mode. On leased lines there is no time out, "C" error, or disconnect.

Receive Mode (R)

Data is received serially by bit, serially by character in blocks. It is assembled in the EBSCA controller data register and transferred one byte at a time to one of two 512-byte buffers as used to transmit mode (J).

Receive mode can receive blocked or non-blocked data. The non-blocked data (1-128 character/block) will alternately be put in the format buffers 2 and 6.

In the blocked mode (1-512 characters/block), data will be alternately put into the two 512-byte buffers (defined in blocked transmit mode (J)). The IRS character sent after each record is not put into the buffer. A 512-byte buffer does not have to be full to overlap to the other buffer. Therefore, any block length from 1-512 can be received.

While data is being received into one 512-byte buffer, the data in the other 512-byte buffer is being moved to the disk (hold) buffer a record at a time. When the disk buffer is full, the write, write check, and increment are started. If a buffer of data is received before the previous buffer has been written to disk, WACKs will be sent at two-second intervals. This is to keep the line up until the response to the block of data can be sent. In this way all forming of records and disk operations are overlapped with the receiving of data.

After a complete data set has been received, the controller will cause the data set label to be updated in several positions. These are record length, end of extent, end of data and beginning of extent. The record length will equal the length of the records received. EOE will be the address of the last record written. EOD is one greater than EOE. BOE is the location of the first record in the data set. BOE is the location of the first record in the data set. BOE is unchanged on the first data set received if the operator selected receive mode. If any of the transmit modes has been utilized or more than one data set is received, BOE is set to one record address greater than the EOE of the last data set transmitted or received. The multivolume indicator is also updated.

If another data set is to be received, the EBSCA controller searches for the next valid data set label. It will internally establish a BOE which is equal to EOE plus one (or EOD) of the data set just received and then position the disk to receive the next data set. Disk 2, if installed, appears as an extension to disk 1. If a data set overflows from disk 1 to disk 2, a C is placed in position 45 (multivolume indicator) of the data set label on disk 1. The rest of the data set will be received on disk 2 and an L will be placed in position 45 of the first label used on disk 2. If a record is written in position 73026 on disk 1, and this is not the last record of the data set, the next record will be written on disk 2 record 01001. If in this case the second disk feature is not installed or the second disk is not in a ready state, (no diskette inserted, etc.), a D error is posted, communications are terminated, and a J is posted in position 39 of the status line.

Any error or operator intervention will cause the EBSCA controller to go to a disconnect sequence in which the error code is posted on the display and is sent to the other station as part of the status message.

Inquiry Mode

Inquiry mode is basically an attended transmit-receive mode. It can be selected from the index track, in which case a seek to BOE will occur, the screen will be blanked, and the internal EOD will be set equal to BOE. It can also be selected from update mode, in which case only the screen will be blanked.

The operator enters a message of length 1-128 characters, and presses FUNCT SEL upper and S. The record will be written to disk at the internal EOD. When the 3741 is polled by the CPU, it will send the inquiry message. Then after the CPU selects the 3741, or immediately the CPU will send the responses to the inquiry message. The responses may be a different length than the inquiry message, but they will all be written on the disk at length 128.

All responses are combined into the one data set. Therefore, a null data set is ignored in inquiry mode, and the update to the data set label is down when an EOT is received. After the update, the code is returned to the inquiry key loop with the disk positioned at the first response received. The operator may key in another message, or look at the responses received.

The transmission of the inquiry message is done in unblocked mode. The receiving of the responses can be blocked or unblocked. However, there isn't any masking in inquiry mode.

Inquiry is supported for operation on a multipoint line using multipoint line control. However, it is still possible to select inquiry mode on point-to-point lines and not have an error posted.

The RESET key during the transmitting or receiving of data under inquiry mode will not exit EBSCA, but will return the code to the inquiry key loop, except when a D error is posted.

RESET Key

The RESET key can be used to terminate communications mode at any time. If data has transferred, an S error will be posted. The controller will then proceed with the normal error disconnect sequence and take the machine out of communications mode. If the RESET key is pressed twice or is pressed following an error, the 3741 will leave communications mode immediately. (See inquiry mode for exceptions.)

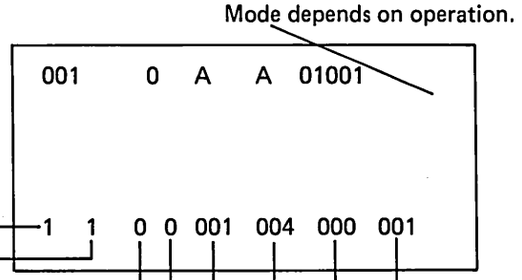
EBSCA CE Test Mode (W)

This mode is used if any of the six CE tests are to be executed. The test number to be executed must be entered in column 1 of the CRT before entering communications. If test 1 is selected, columns 2 through 15 contain the data to be transmitted.

See *Diagnostic Aids Expanded Communications (EBSCA) Test Procedures* in Section 8, for details about the test modes.

EBSCA Error Logout

When in R, T, P, B, D, J, K, % mode or I mode after FUNCT SEL upper and S are pressed, or when in W mode in tests 1, 2, 3, or 4, the bottom line on the display shows the following:



Position	Meaning								
* 1	Data terminal ready.	1	1	0	0	001	004	000	001
* 4	Data set ready.								
* 7	Request to send.								
* 10	Clear to send.								
**14 · 16	CRC checks in receive.								
**19 · 21	NAKs received in transmit.								
**24 · 26	Two-second timeouts.								
**29 · 31	Three-second timeouts								

* *Note:* 1 indicates on; 0 indicates off.
** *Note:* Three-position decimal counts.

The logout is displayed on the bottom line of the display during EBSCA operation.

Whenever the EBSCA controller turns on the data terminal ready interface line (1-N-D07), it displays a 1 in position 1. When it turns off, it displays a 0. Likewise, when it turns on request 1-N-B13 to send it displays a 1 in position 7. When it turns it off, it displays a 0.

When the EBSCA controller detects the 'data set ready' (1-N-D12) interface line is on from the modem, it displays a 1 in position 4. When 'data set ready' is off it displays a 0. Likewise, if 'clear to send' (1-N-B10) is on, it displays a 1 in position 10. Whenever it goes off, it displays a 0.

Note: When short records are transmitted in blocked (J or K) mode, 'clear to send' may not be logged on or may be on only a short time. This is because the controller is busy reading and buffering records. The actual operation of 'clear to send' may be checked at the modem cable interface (1-N-B10).

During receive operations, a running count is maintained of all CRC checks, where transmitted block check characters (BCC) do not match those calculated by the EBSCA controller. This count is displayed in positions 14, 15, and 16. This is an indication of the number of transmission blocks received with errors that required retransmission.

During a transmit mode, a count of NAKs (negative acknowledgments) that are received is displayed in positions 19, 20, and 21. These NAKs have been received from the remote station as a result of data blocks received in error, TTDs (temporary text delays), or remote NAKs to a line bid.

During communications, a count is maintained of two-second time-outs in positions 24, 25, and 26. These time-outs may occur during unusually long disk operations such as a long seek. During receive operations, this would indicate the number of WACKs (wait acknowledgment) sent. In transmit mode, it would indicate the number of TTDs sent.

Also during communications, a count of three-second time-outs is displayed in positions 29, 30, and 31. These time-outs occur whenever there is a three-second period of inactivity on the communication line. During a 20-second disconnect time-out on switched lines, this counter is incremented seven times.

All four counters are initialized to 000 when communications mode is entered or on any subsequent call after an error has occurred.

EBSCA Line Control Sequences

Line Bid

3741 Transmits

```
P P P S S E P
A A A Y Y N A
D D D N N Q D
```

Response to Line Bid

3741 Transmits

```
P P P S S A   P
A A A Y Y C 0 A
D D D N N K   D
```

Transmitted Unblocked Record

3741 Transmits

```
P P P S S S (Record E b b P
A A A Y Y T 1 to 128 T c c A
D D D N N X Chars)   B c c D
```

Transmitted Null Record

After the 3741 transmits the last record of a data set, it will send a null record to the remote end to signify the end of the data set:

```
P P P S S S E b b P
A A A Y Y T T c c A
D D D N N X X c c D
```

Transmitted Blocked Record

3741 Transmits

```
P P P S S S (Record   I (Record   I   E b b P
A A A Y Y T 1 to 128  R 1 to 128  R   T c c A
D D D N N X Chars)    S Chars)    S   B c c D
```

Status Message

Whenever the 3741 terminates communications on an error (except remote abort, negative line bid response and modem not ready) it will attempt to send a status message to the remote end:

```
                                      S
      P P P S S E P   P P P S S S     T (error   E b b P   P P P S S E P
3741  A A A Y Y N A   A A A Y Y O % V T char)    T c c A   A A A Y Y O A
      D D D N N Q D   D D D N N H     X          X c c D   D D D N N T D

Remote    P P P S S A   P                          P P P S S A   P
End       A A A Y Y C 0 A                          A A A Y Y C 1 A
          D D D N N K   D                          D D D N N K   D
```

BSCA Line Control Characters

Description	Mnemonic	Hex
Start of heading[1]	SOH	01
Start of text	STX	02
Inter-record separator	IRS	1E
Intermediate block character	ITB	1F
End of transmission block	ETB	26
End of text	ETX	03
Enquiry	ENQ	2D
Negative acknowledge	NAK	3D
End of transmission	EOT	37
Synchronous idle	SYN	32
Data link escape	DLE	10
Even acknowledge	ACK 0	10, 70
Odd acknowledge	ACK 1	10, 61
Wait before transmit	WACK	10, 6B
Disconnect	DISC	10, 37
Reverse interrupt[2]	RVI	10, 7C
Temporary text delay	TTD	02, 2D
Leading pad	PAD	AA
Trailing pad	PAD	FF

In transparent mode, STX, ITB, ETX, ETB, SYN, ENQ, TTD, and DLE are preceded by DLE.

[1] 3741 treats SOH the same as STX.

[2] RVI is recognized as a positive acknowledgment by the 3741, however it will not relinquish the line.

Data Flow

The data path and register control lines extend from the MPU planar to the feature half planar via cross connectors and are terminated at a register. All data transfer between the EBSCA controller and MPU planar is via this data path and register. The EBSCA adapter performs the serialize-deserialize function, timing, and control functions necessary to interface to the modem. The EIA drivers and receivers convert EBSCA adapter logic levels to the required EIA levels. The microprogram to drive the EBSCA controller is contained in Read Only Storage (ROS) mounted on the EBSCA ROS card and interfaces to the MPU planar and feature half planar ROS at 1-E and 1-F.

Modem Cable

The modem cable interfaces to the BSCA at 1-N. This interface conforms to EIA-RS-232 in the US, and CCITTv.24 in WT. For signal lines, '–transmit data' and 'receive data', a negative voltage is a logic 1 or mark. For all other lines, positive voltage indicates on, negative voltage indicates off. Positive levels may be +3 to +25 volts. Negative levels may be –3 to –25 volts.

'+ Test mode' and '+ test clock' are held negative during normal communications. '+ Test mode will go positive during test modes 2 and 3. '+ Test clock' is allowed to run when '+ test mode' is positive. '+Test clock' has a 1-millisecond period.

Socket 1-N	Line Name	Modem Cable Half Planar End	Modem Cable Modem End
B13	Request to send	D02	4
B12	Transmit data	D03	2
B11	Receive data	D04	3
B10	Clear to send	D05	5
B09	Serial clock transmit	D06	15
B08	Serial clock receive	D07	17
B07	Signal ground	D08	7
D12	Data set ready	B03	6
D11	Ring indicator	B04	22
D10	Carrier detect	B05	8
D08	Rate selector	B07	23
D07	Data terminal ready	B08	20
D06	SCTE	B09	24
	Frame ground	FRAME	1
D02	+12 Vdc	B13	—
D04	-12 Vdc	B11	—
D13	Test mode	B02	18
D09	Test clock	B06	25

Detail Cross Connectors to MPU Planar

Most data patch and register control lines are routed via socket Q with a few in socket F.

When in communications mode, '–BSCA select' should be negative (down level), and '–printer select' should be positive. Data is transferred via the data path bits D.

'–Select 4', 'reg select decode 0' and '1', '–reg gate control 0' and '1' control gating into the data register. '–Reg gate control 0' E and '1' F are clocks from the MPU.

The EBSCA controller uses '-gate out' G, '–gate B' H, '+reset A' J, and '-reset-gate B' to generate timings in sync with the micro-controller.

The EBSCA controller also uses '-1 ms clock' and '+reset CS counter' to generate timings. '1 ms clock' is a square wave with a 1-millisecond period. '+Reset CS counter' is a 60-millisecond positive pulse that repeats every 24 milliseconds (approx-imately).

EBSCA controller uses '-10.8 Hz' to generate time-outs.

'+Speed select switch' will always be positive for high baud rate unless:

1. Speed select jumper is at low speed, or
2. BAUD SELECT switch is set at 600 bps (WT Only).

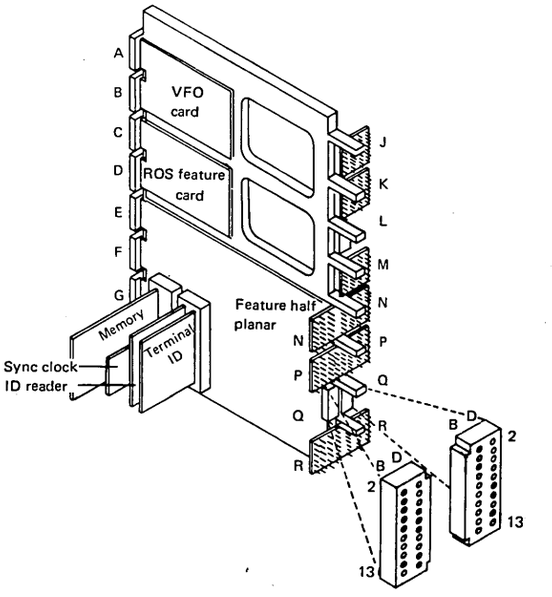
All logic levels in sockets Q and F, are +8.5 volts except '+speed select switch', which is +5 volts.

'-EBSCA ROS reset' is generated on the feature half planar from '-BSCA select' and '-ROS reset' and is the reset to the EBSCA ROS card. When '-BSCA select' is off, the '-EBSCA ROS reset' holds the ROS card reset (inactive). When communications mode is selected, the '-EBSCA ROS reset' is allowed to toggle.

Socket 2-Q – MPU Planar Cross Connector

Pin	Signal
B02	-12 volts
B03	-Bit 6 data path
B04	-Bit 3 data path
B05	-Bit 2 data path
B06	-Bit 1 data path
B07	-Bit 0 data path
B08	-Gate B H
B09	-Printer select
B10	+Speed select switch
B11	-BSCA select
B12	+System reset (POR)
B13	-Reg gate control 0 E
D02	-Bit 5 data path D
D03	+12 volts
D04	-Bit 4 data path D
D05	-Gate out G
D06	-1 ms clock
D07	-Ground
D08	-Reset gate B
D09	+Reg select decode 0
D10	-Gate A
D11	+Reg select decode 1
D12	+Reset A J
D13	-Select 4

D

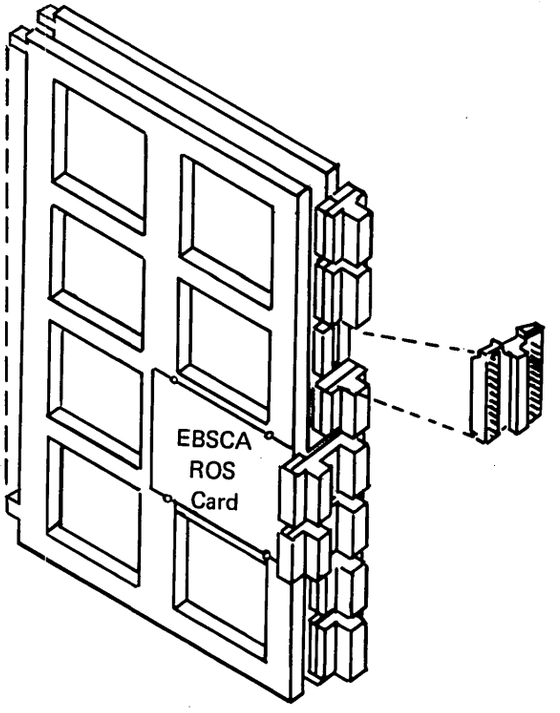


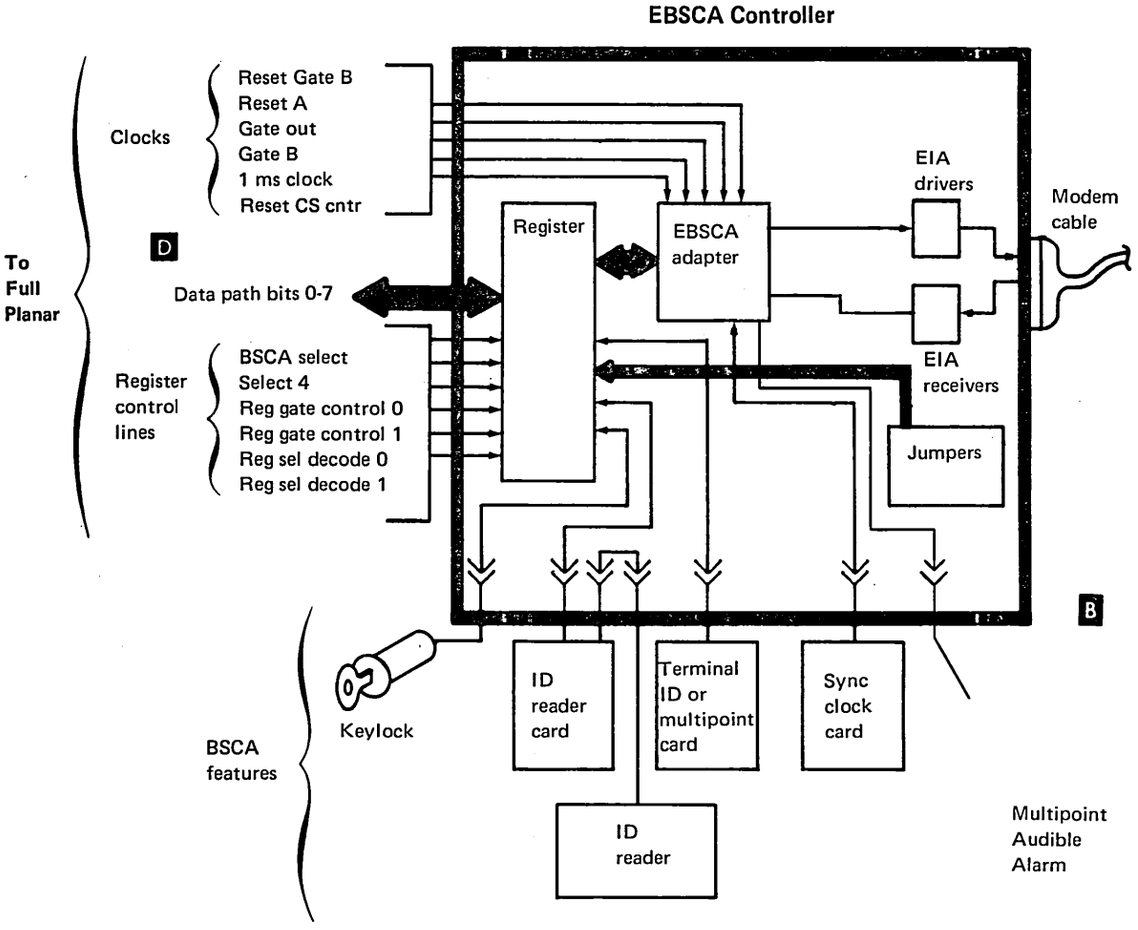
Socket 2-E – MPU Planar Cross Connector Signal

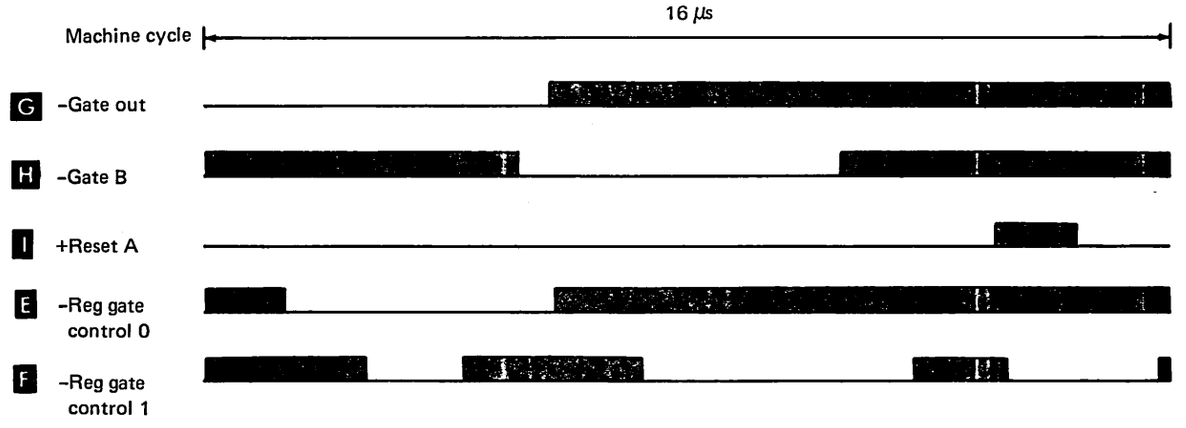
Pin	Signal
B02	ROS reset pin

Socket 2-F – MPU Planar Cross Connector

Pin	Signal
D11	+Reset CS counter
D09	+5 volts
D07	Ground
B13	+24 volts
B12	-10.8 Hz
B11	-Reg gate control 1 F
B10	-Bit / data patch D
B08	-5 volts
B07	+8.5 volts
B06	-5 volts
B05	+Reset R
B03	-EBSCA ROS reset







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EBSCA Packaging

The EBSCA controller is packaged on the feature half planar and EBSCA ROS card.

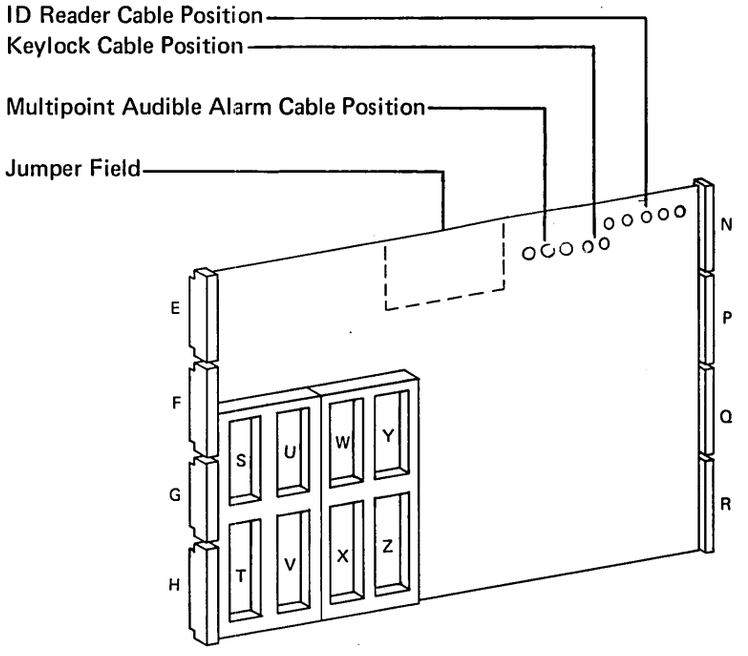
The socket positions are assigned as follows:

Socket

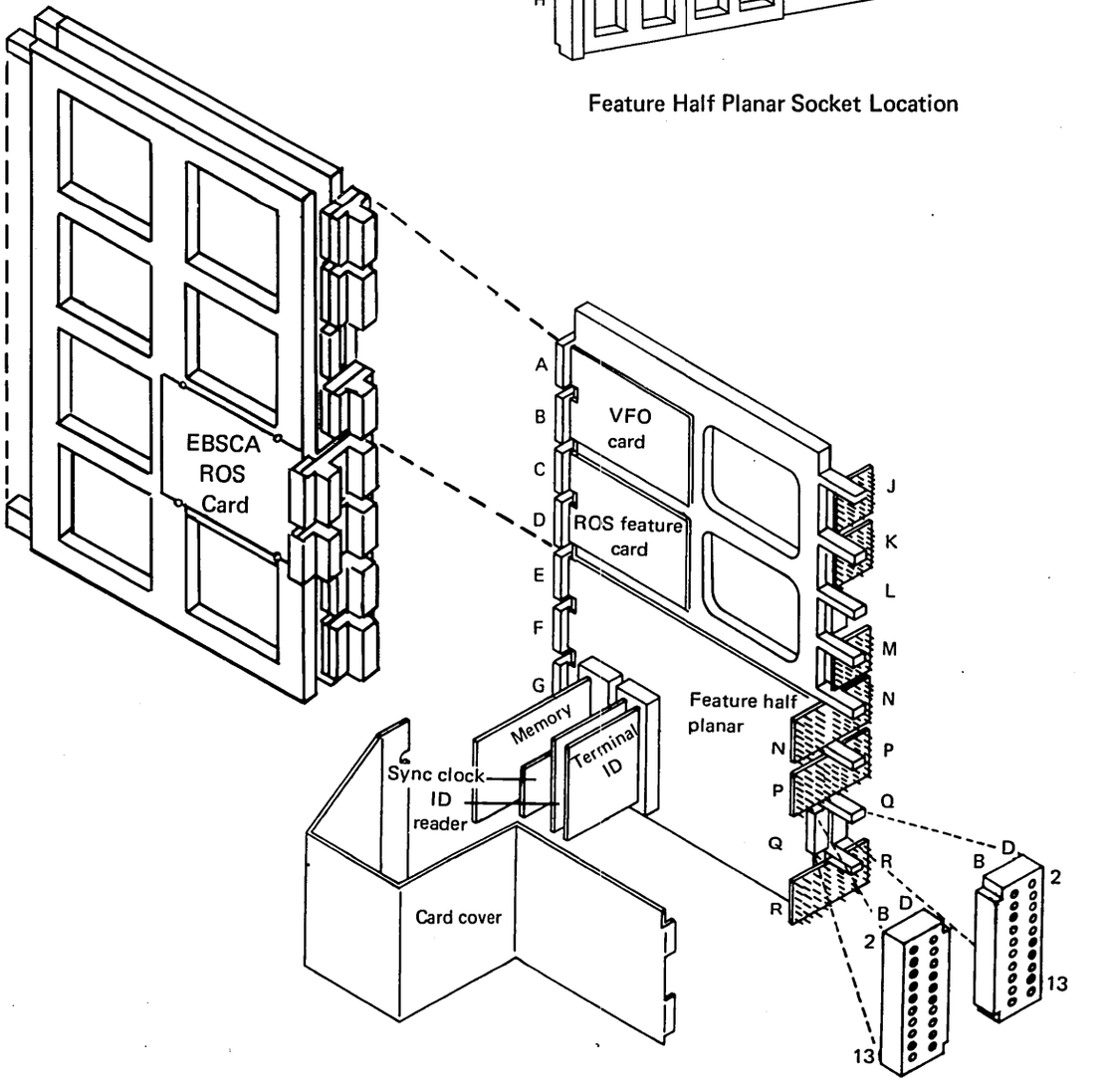
- 1-N - Modem cable
- 1-P - Printer signal cable
- 1-Q - Cross connector to MPU planar
- 1-R - Printer signal cable
- 1-E - Cross connector to MPU planar and EBSCA ROS card
- 1-F - Cross connector to MPU planar and EBSCA ROS card
- 1-G - Cross connector to MPU planar (memory)
- 1-H - Cross connector to MPU planar (memory)
- 1-S - Card socket (memory)
- 1-T - Card socket (memory)
- 1-U - Test socket
- 1-V - Card socket (sync clock card)
- 1-W - Card socket (ID reader card)
- 1-X - Card socket (ID reader card)
- 1-Y - Card socket (terminal ID or multipoint card)
- 1-Z - Card socket (terminal ID or multipoint card)

Sockets 1-P and 1-R are used only if a printer adapter is packaged on the same feature board.

Sockets 1-G, 1-H, 1-S, and 1-T are used only to provide connections for the memory card to the MPU planar. There is no direct connection between the memory card and the EBSCA even though the memory card is mounted on the feature half planar.



Feature Half Planar Socket Location



3741 Model 2 Features with EBSCA

Synchronous Clock

When modems are attached that do not have their own clocking, the synchronous clock feature provides a clock to EBSCA controller. The synchronous clock feature is mounted in 1-V and provides a 153.6-kHz oscillator pulse to the EBSCA. From this oscillator, the EBSCA generates a 1200-Hz clock for 1200-bps operation or a 600-Hz clock for 600-bps (baud rate) operation.

When the synchronous clock card is installed in 1-V, the 153.6-kHz oscillator may be probed at 1-U-B07. The 1200- or 600-Hz clock is at 1-U-B02.

Speed, 600 or 1200 bps, is determined by speed select jumper or speed select switch (WTC) if installed.

The BSCA includes self-correction logic to synchronize clock (1-U-B02) with received data, (1-N-B11) in receive mode.

Terminal Identification

This feature has two functions. One is to transmit a four-character terminal identification sequence. The first character of the 3741 sequence is always an EBCDIC lower case, alpha v (hex A5). The last three characters are unique to each 3741 terminal and are programmed on the feature card. The unique ID characters are pre-assigned at the factory.

The last three characters of the 3741 terminal ID sequence are programmed on this card, which is installed at 1-Y and 1-Z on the feature half planar.

The 3741 will transmit its terminal ID during initial handshaking preceding the first ENQ or ACK 0 depending on the mode.

```
P P P S S        E   P
A A A Y Y  A     xxxN  A
D D D N N  5       Q   D
OR
P P P S S  A       A   P
A A A Y Y  5     x x x C 0 A
D D D N N          K   D
```

A5 is hex representation for EBCDIC lower case V. x x x are the 3 ID characters programed on the terminal ID feature card.

The second function is to compare a received identification sequence of up to 15 characters to a sequence keyed by the operator.

This function compare the terminal ID sent by the remote station to the one keyed in by the operator. The operator keys this before entering communications mode. The BSCA controller detects the keyed sequence by the position of the cursor. The cursor must be positioned after the last keyed in character (15 or less). To bypass this feature, the cursor must be in position 1 when entering communications. Terminal identification and multipoint features are mutually exclusive on EBSCA.

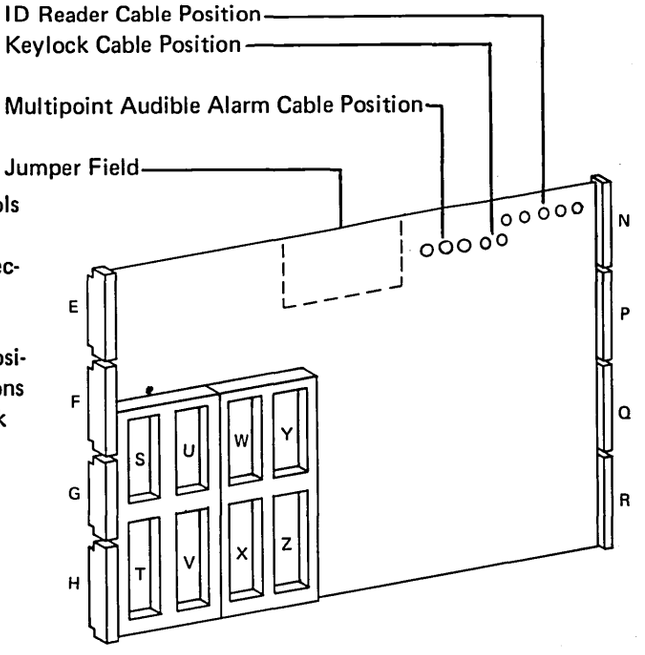
Keylock

The keylock is an electrical switch that controls the selection of communication mode. This feature provides a keylock which controls selection of communications mode. With the keylock in the locked position, communications mode can not be selected. In the unlocked position, the 3741 can be placed in communications mode. Once the mode is selected, the keylock can be placed in the locked position and the terminal remains in this mode.

Operator ID Card Reader

This feature is used to read an operator identification card and transmit the information to a CPU, which is programmed to accept only valid sequences.

The operator ID card reader feature consists of two parts: the ID reader, which sets on the 3741 table top, and the ID reader card, which is mounted in 1-W and 1-X. The ID reader is ready when TB, JB, KB, IB, BB, DB, or PB is displayed. As the card is inserted, the magnetically encoded data is read, and the data signal is sent to the EBSCA controller. The data signal is sent to the ID reader card where it is decoded. Decoded information is then transferred serially to the EBSCA controller where the ID characters are assembled. After the complete ID is read, and the line connection made with the CPU, the controller transmits the ID.



Feature Half Planar Socket Location

The format of the transmitted ID reader card is:

```
P P P S S                          L E B B
A A A Y Y O : (ID R chars) "       R T C C
D D D N N H                        C B C C
                                     1 2
          OID                EOR
```

OID – Operator Identification Character
EOR – End of Record Character

The ID reader card also provides regulated voltage to the ID reader via the feature half planar.

This feature can be bypassed, if the 3741 is transmitting to another 3741, by pressing the REC ADV key.

Multipoint Feature

The multipoint feature allows the EBSCA controller to function as a tributary station on a multipoint or multidrop line.

The multipoint feature assumes one of two states: message transfer state or control state. In message transfer state, the feature continuously monitors the line for EOT. When it sees EOT, it changes to control state and monitors for its polling or selection address. When the feature is in control state, seeing STX, SOH, or DLE-STX on the line or a three-second time-out without seeing SYN-SYN (character sync) causes the feature to go back to message transfer state, another EOT must be seen before the feature will respond to its polling or selection address. The feature assumes the message transfer state when powering up.

The multipoint address card provides jumpers for the multipoint poll address and driver circuits for the audible alarm. The desired poll address character (hex C0 to hex FF) is chosen from the chart. The corresponding selection address characters is given next to the poll address character. Note that they differ by a hex 40. The polling address for the terminal is the poll character repeated twice and the polling sequence that must be sent to 3741 is:

```
P P S S           E P
A A Y Y 'C1' 'C1' N A
D D N N           Q D
```

'C1' used as example.

The selection sequence for the same terminal is:

```
P P S S           E P
A A Y Y '81' '81' N A
D D N N           Q D
```

If the 3741 is polled (polling sequence), the control station is looking for data and the 3741 must be in a transmit mode (T, P, D, B, J, or K) to respond positively. If the 3741 is selected (selection sequence), the control station wants to transmit data and the 3741 must be in a receive mode (R or receive portion of B, D, or K modes) to respond positively.

The multipoint feature monitors the line differently depending on whether the 3741 is in communications mode or not. If the machine is in communications mode, the microprogram in ROS exercises the EBSCA controller and monitors the line. If the machine is not in communications mode, (if it is in enter, verify, or update, for instance), the EBSCA controller still monitors the line. If the controller receives a valid selection sequence while in control state, it responds:

```
P P P S S   N   P
A A A Y Y   A   A
D D D N N   K   D
```

If the controller receives a polling sequence, it responds:

```
P P P S S   E   P
A A A Y Y   O   A
D D D N N   T   D
```

If the controller receives a polling sequence after having responded NAK to a selection sequence, it responds with status:

```
P P P S S S     S   E B B P
A A A Y Y O % V T / T C C A
D D D N N H     X   X C C D
```

The slash (/) as the error indicator indicates that the machine is offline and cannot respond affirmatively.

At the time the controller detects the selection sequence it sounds the audible alarm for about five seconds. This is to indicate that the master station has data to send (selection) and that the operator should put the terminal into receive mode. The alarm is not sounded on the polling sequence. In this case, it is assumed that if there is data to send, the operator has set the machine up in the appropriate transmit mode and is waiting for the poll.

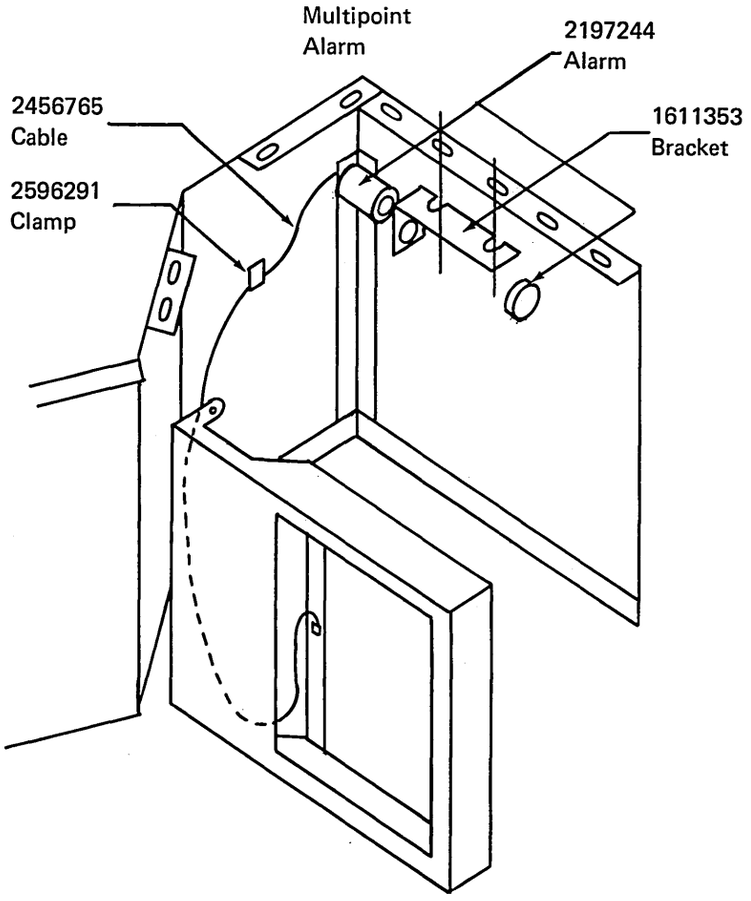
Multipoint Addressing

For a given polling character, the corresponding select character is defined.

Poll Char	Poll Hex	Sel Hex	Binary	Poll Char	Poll Hex	Sel Hex	Binary
	C0	80	1100 0000		E0	A0	1110 0000
A	C1	81	1100 0001		E1	A1	1110 0001
B	C2	82	1100 0010	S	E2	A2	1110 0010
C	C3	83	1100 0011	T	E3	A3	1110 0011
D	C4	84	1100 0100	U	E4	A4	1110 0100
E	C5	85	1100 0101	V	E5	A5	1110 0101
F	C6	86	1100 0110	W	E6	A6	1110 0110
G	C7	87	1100 0111	X	E7	A7	1110 0111
H	C8	88	1100 1000	Y	E8	A8	1110 1000
I	C9	89	1100 1001	Z	E9	A9	1110 1001
	CA	8A	1100 1010		EA	AA	1110 1010
	CB	8B	1100 1011		EB	AB	1110 1011
	CC	8C	1100 1100		EC	AC	1110 1100
	CD	8D	1100 1101		ED	AD	1110 1101
	CE	8E	1100 1110		EE	AE	1110 1110
	CF	8F	1100 1111		EF	AF	1110 1111
	D0	90	1101 0000	0	F0	B0	1111 0000
J	D1	91	1101 0001	1	F1	B1	1111 0001
K	D2	92	1101 0010	2	F2	B2	1111 0010
L	D3	93	1101 0011	3	F3	B3	1111 0011
M	D4	94	1101 0100	4	F4	B4	1111 0100
N	D5	95	1101 0101	5	F5	B5	1111 0101
O	D6	96	1101 0110	6	F6	B6	1111 0110
P	D7	97	1101 0111	7	F7	B7	1111 0111
Q	D8	98	1101 1000	8	F8	B8	1111 1000
R	D9	99	1101 1001	9	F9	B9	1111 1001
	DA	9A	1101 1010		FA	BA	1111 1010
	DB	9B	1101 1011		FB	BB	1111 1011
	DC	9C	1101 1100		FC	BC	1111 1100
	DD	9D	1101 1101		FD	BD	1111 1101
	DE	9E	1101 1110		FE	BE	1111 1110
	DF	9F	1101 1111		FF	BF	1111 1111

Binary value jumpered on card
Select character in HEX
Poll character in HEX
Poll character

Multipoint Alarm



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Pages 14-83 through 14-100 are not used.

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DATA RECORDER ATTACHMENT THEORY

Refer to the *IBM 129 Theory-Maintenance Manual,* SY09-1005, or to the *IBM 5496 Theory-Maintenance Manual,* SY31-0220.

Read Operation

1. Operator keys the 3741 to perform either a read to EOF or a single card read.

2. The MPU (microprocessing unit of the 3741 base machine) then:
   a. Resets the data recorder attachment and the data recorder by setting 'I/O POR'.
   b. Signals the data recorder attachment to send a 'read command' signal to the data recorder.

3. The data recorder attachment sends 'read command' (Figure 1) to the data recorder. This signal accomplishes the same result as the pressing of the READ key on the data recorder.

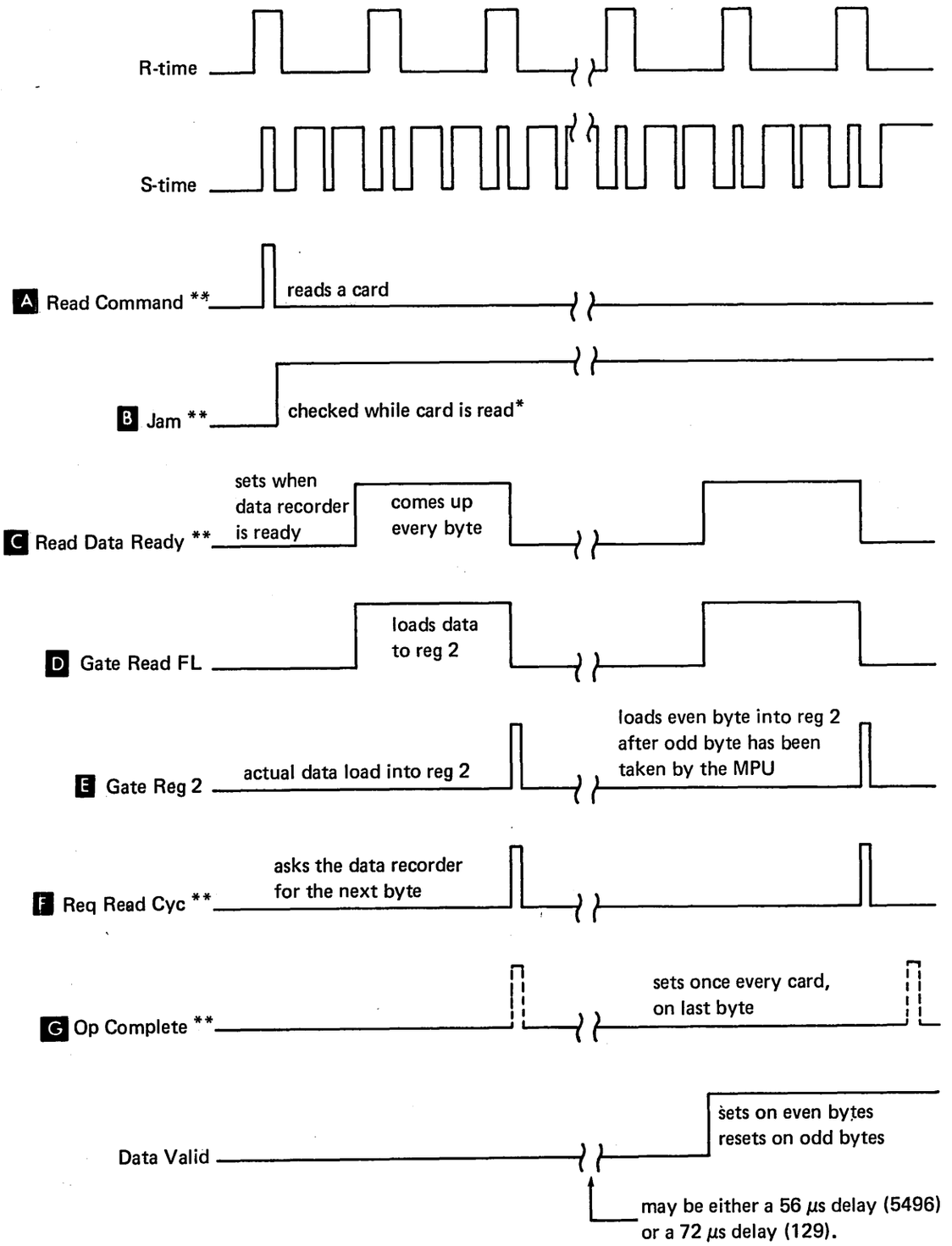
4. The data recorder then:
   a. Reads an entire card, storing the data in its buffer.
   b. While reading the card, checks for jams and raises 'transport jam' if one is detected (Figure 1). The data recorder (129) displays an 88 or 8A, or (5496) sets the FD CHK light to indicate a hopper or transport jam.
   c. After the reading is complete the data recorder places the first byte* of data on 'data bus out'.
   d. Sets 'read data ready'. This tells the data recorder attachment that a byte of data is on the lines ready to be taken.

*One byte of data is either an 8-bit EBCDIC code (IBM 129) or a 6-bit BCD code (IBM 5496). (Refer to the translation table, Figure 2).

Service Note: If 'read data ready' never comes up, or is not detected by the data recorder attachment, the MPU remains in a loop. The 3741 display shows no error code, and both machines will be locked up. To recover from this problem, turn the data recorder offline. (Set the IBM 5496 TERMINAL switch to the MANUAL position, or the IBM 129 SPL FEAT switch OFF.) This sets an A1 error on the 3741 and takes the MPU out of its loop.

5. The data recorder attachment then captures the data (1 byte) in latches by:
   a. Setting the gate read FL (Figure 1). This loads the data *to* register 2 of the data recorder attachment.
   b. As the data byte is latched up by the 3741, the data is sent back to the data recorder, via 'data bus in' for comparison with what the data recorder actually sent. If a data byte does not match, 'read non compare' is set by the data recorder and this causes an A3 error to be set on the 3741.
   c. Setting the 'gate register 2' (Figure 1). This is the actual data load *into* register 2 of the data recorder attachment.
   d. Setting 'request read cycle'. 'Request read cycle' resets 'read data ready' to request another byte of data from the data recorder.

6. The data recorder then:
   a. Puts the second byte (next byte) of data on 'data bus out'.
   b. Sets 'read data ready' for the second time. The second 'read data ready' comes up in 56 μs for the IBM 5496 and in 72 μs for the IBM 129 after the first.
   c. Searches for the third (next) byte of data.



*The IBM 5496 reads a card in 2500 ms and the IBM 129 reads a card in 921 ms.
**Interface line.

Figure 1. Timing Chart (Two-Byte Read)

Character	Character Description	S/3 BCD	EBCDIC
	Blank	None	40
1	One	1	F1
2	Two	2	F2
3	Three	12	F3
4	Four	4	F4
5	Five	1 4	F5
6	Six	24	F6
7	Seven	124	F7
8	Eight	8	F8
9	Nine	1 8	F9
:	Colon	2 8	7A
#	Number	12 8	7B
@	Commercial A	48	7C
'	Apostrophe	1 48	7D
=	Equal	248	7E
"	Quotation	1248	7F
0	Zero	A	F0
/	Slash	1 A	61
S	S	2 A	E2
T	T	12 A	E3
U	U	4 A	E4
V	V	1 4 A	E5
W	W	24 A	E6
X	X	124 A	E7
Y	Y	8A	E8
Z	Z	1 8A	E9
&	Ampersand	2 8A	50
,	Comma	12 8A	6B
%	Percent	48A	6C
_	Underscore	1 48A	6D
>	Greater than	248A	6E
?	Question mark	1248A	6F
–	Dash	B	60
J	J	1 B	D1
K	K	2 B	D2
L	L	12 B	D3
M	M	4 B	D4
N	N	1 4 B	D5
O	O	24 B	D6
P	P	124 B	D7
Q	Q	8 B	D8
R	R	1 8 B	D9
!	Exclamation	2 8 B	5A
$	Dollar	12 8 B	5B
*	Asterisk	48 B	5C
)	Parenthesis (right)	1 48 B	5D
;	Semi-colon	248 B	5E
¬	Logical not	1248 B	5F
]	Right brace	AB	D0
A	A	1 AB	C1
B	B	2 AB	C2
C	C	12 AB	C3
D	D	4 AB	C4
E	E	1 4 AB	C5
F	F	24 AB	C6
G	G	124 AB	C7
H	H	8AB	C8
I	I	1 8AB	C9
¢	Cent	2 8AB	4A
.	Period	12 8AB	4B
<	Less than	48AB	4C
(	Parenthesis (left)	1 48AB	4D
+	Plus	248AB	4E
|	Vertical bar	1248AB	4F

Figure 2. Translation Table

7. While the data recorder is searching for the next data byte, the data recorder attachment:
   a. Places the first data byte into register 2 of the attachment.
   b. Latches up the second data byte by repeating steps 5a and 5b.
   c. Waits for the signal from the MPU that the MPU is ready for the next data byte to be sent.

8. The MPU then:
   a. Checks the '129 attached' line to see which data recorder is attached. If the 129 is attached, the data sent is in EBCDIC code. The 3741 also operates in EBCDIC code and, thus, no translation is required. If the 5496 is attached, the data sent is in BCD code and must be translated to EBCDIC (Figure 2) by the MPU.
   b. Places the data byte into the 3741 current record buffer, after translation if required.
   c. Signals the data recorder attachment that the MPU is ready for the next byte to be sent to it.

9. The data recorder attachment then sends the second (next) data byte to the MPU.

10. The MPU repeats step 8.

11. The data recorder then:
   a. Puts the next data byte on 'data bus out'.
   b. Sets the 'read data ready' line again.

12. The data recorder attachment now waits approximately 3 ms while the MPU services the other devices (such as the diskette).

13. Steps 5 through 12 are repeated until the data recorder:
   a. Senses the last data byte entering the data recorder I/O buffer.
   b. Sets 'op complete'. This signals that the transmission of data has ended.
   c. If the 3741 is a Model 3 or 4, see note 2 below.

   Service Note: If 'op complete' never comes up or is not detected by the data recorder attachment for some reason, the MPU will remain in a loop. For recovery, see the service note at step 4 on page 14-101.

14. If doing a read-to-EOF operation, skip step 15.

15. This step is for single card read operation. At this point the data just read is in the 3741 current record buffer and displayed on the 3741 CRT. The operator must press REC ADV to write the data onto the diskette.

16. As soon as 'op complete' is activated, the 3741 data recorder attachment sends another read command to the data recorder. While the next card is being read, the 3741 executes an AUTO REC ADV which writes the data onto the diskette in the data set displayed when the read to EOF was initiated.

17. Then the data recorder attachment, the data recorder, and the MPU repeat steps 4 through 16 until an EOF or EOD card is read (notes 3 and 4).

Punch Operation

1. The operator keys the 3741 to perform either a punch to EOD or a single card punch.

2. The MPU then:
   a. Resets the data recorder attachment and the data recorder by setting 'I/O POR'.
   b. Signals the data recorder attachment that a punch operation is to follow.
   c. Checks the '129 attached' line (page 14-105) to see which data recorder is attached. If the 129 is attached, the EBCDIC data byte needs no translation. If the 5496 is attached, the EBCDIC data byte must be translated to BCD (Figure 2).
   d. Translates the data byte if necessary.
   e. Places the data into register 2 of the data recorder attachment.
   f. Signals the data recorder attachment that the data byte is ready to be sent to the data recorder.

3. The data recorder attachment then:
   a. Loads the data byte onto 'data bus in' lines.
   b. Compares the data byte on 'data bus in' to the data byte in register 2. If a data byte does not match, the data recorder attachment sets an A3 error code.
   c. Sets 'punch data ready'.

   Service Note: If 'punch data ready' never comes up, or is not detected by the data recorder, the MPU remains in a loop. The 3741 display shows no error code, and both machines will be locked up. To recover from this problem, turn the data recorder offline. (Set the IBM 5496 TERMINAL switch to MANUAL, or the IBM 129 SPL FEAT switch to OFF.) This sets an A1 error on the 3741 and takes the MPU out of its loop.

Notes:
1. The data recorder attachment effectively reads 2 bytes of data every 5.3 or 5.7 ms, depending on the data recorder attached.
2. During the read operation on a Model 3 or 4, The MPU leaves the read operation after every 6 bytes of data to check whether other devices, such as the diskette or printer, need immediate action. This is how the data recorder attachment time-shares with the Model 3/4 devices. Refer to *Read Instruction* in the *IBM 3741 Data Station Programming Reference Manual,* GA21-9194.

Notes (continued):
3. An EOF (end of file) card is any card with ?* in the first two columns. This card signals the 3741 that the last card has been read and the job is ended.
4. An EOD (end of data set) card is any card with ?/ in the first two columns. This card signals the 3741 to end the data set now being used and to start a new data set with the next card read.

4. The data recorder then:
   a. Latches up the data byte into its buffer.
   b. Sets 'punch busy', which resets 'punch data ready'.
   c. Holds 'punch busy' up until the data recorder is ready to receive another byte of data.

5. The MPU gates the next data byte into register 2 (steps 2c through 2f).

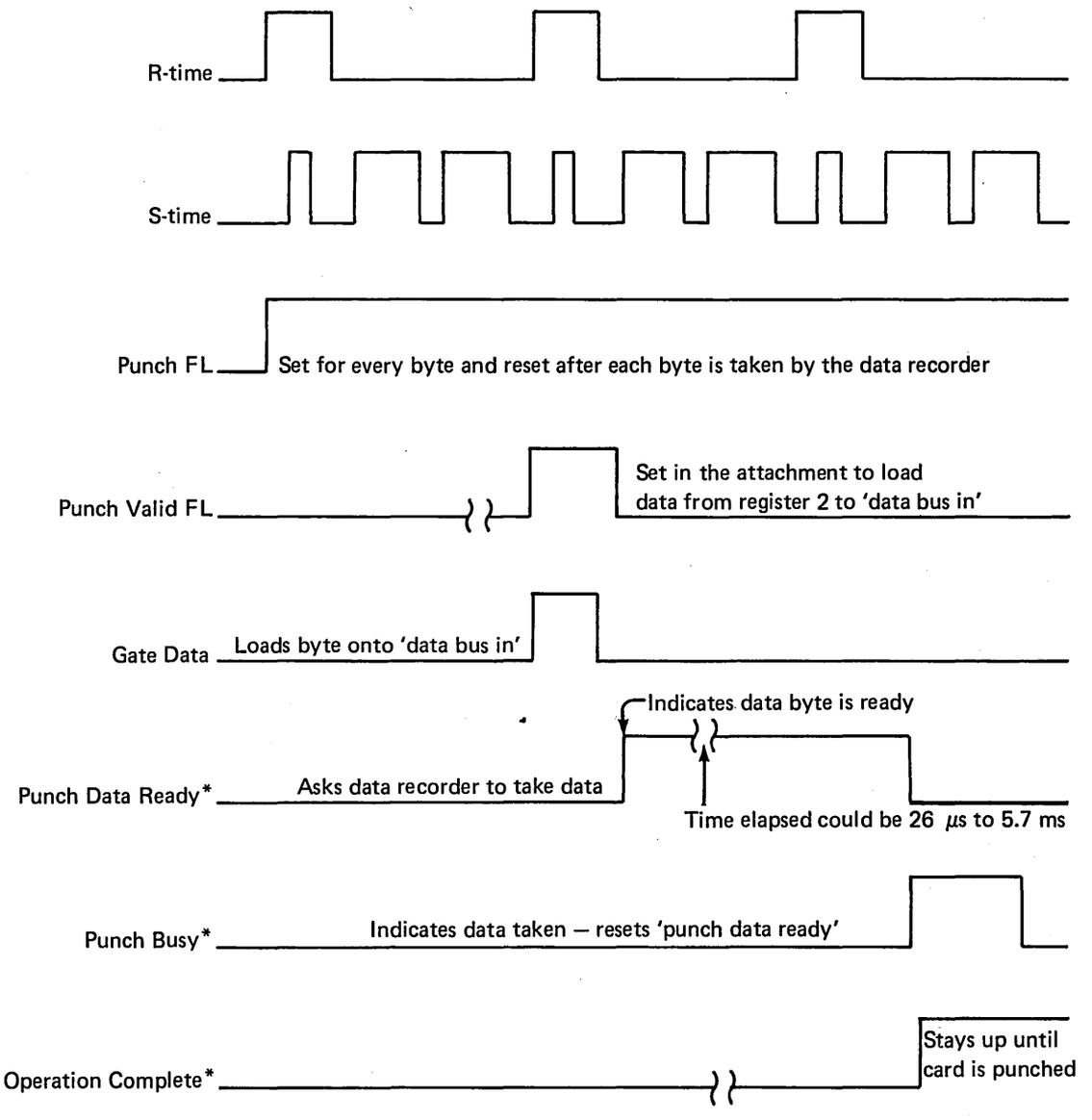
6. The data recorder attachment then waits for 'punch busy' to reset.

7. Now steps 3 through 6 repeat until the data recorder obtains enough data to punch a card (for a 3741 Model 3 or 4, see note below). The data recorder then:
   a. Sets 'op complete'. This tells the data recorder attachment to stop operations until the card is punched.
   b. Punches the card.
   c. As long as 'op complete' is activated, the MPU is checking for card jams and data-recorder-not-ready errors.
   d. Activates 'command reset' after the card is completely punched. This resets 'op complete' and signals the data recorder attachment that another card can be punched.

If you are doing a punch to EOD, continue; if you are doing a single card punch, the operation is complete.

8. When 'op complete' falls (step 7d), the MPU can initiate another transfer of data to the data recorder (steps 2 through 7). This is continued until the EOD is reached for the data set the cards are being punched from.

   Note: During the punch operation on the Model 3 or 4, the MPU leaves the punch operation every 3 bytes of data to check the other Model 3/4 devices. This allows time-sharing during a punch operation. Refer to *Punch Instruction* in the *IBM 3741 Data Station Programming Reference Manual,* GA21-9194.



*Interface lines between 3741 and data recorder.
See 14-106 or 14-107 for pins

Control Nomenclature (Interface Lines)

Data Bus In

These eight lines are the data input to the data recorder. The IBM 129 uses all eight lines for EBCDIC characters. The IBM 5496 uses six lines (bits 1, 2, 4, 8, A and B) for System/3 BCD characters.

Punch Data Ready

By activating this line, the data recorder attachment indicates that it has put data on 'data bus in' for the data recorder.

Read Command

The data recorder attachment activates this line to start a reading operation. This simulates the pressing of the READ key or button on the data recorder.

Request Read Cycle

When the data recorder attachment senses the 'read data ready' signal, it activates this line, which allows the data recorder to search its storage for the next data byte.

I/O Compare Command

This signal tells the data recorder to allocate time for comparison of data read to data returned from the data recorder attachment.

I/O POR

By activating this line, the data recorder is reset.

Data Bus Out

Thses eight lines are data output from the data recorder. The IBM 129 sends an eight-bit EBCDIC byte on these lines and the IBM 5496 sends a six-bit System/3 BCD byte.

Command Reset

The 5496 sends this 1-μs signal to the 3741 after the card leaves the read/punch station. The 129 sends this 1-μs signal to the 3741 after the 80-byte data transfer from or to the 129 and after the card leaves the read/punch station.

Online and Ready

By activating this line, the data recorder indicates that all switches are set correctly for online operation of the data recorder.

Hopper Jam

The data recorder activates this line if a card fails to feed or register. The failure may be caused by a jam, an empty hopper, or a full stacker.

Transport Jam

This line indicates that a card failed to exit the read/punch station at the proper time. The IBM 129 also activates this signal when it is powered up when in online mode. If this signal is not functioning, the 3741 will not know a jam occurred and multiple cards may be fed.

Operation Complete

The data recorder activates this line for both read and punch operations after the last byte of data was sent or received.

Read Non Compare

During a read operation, the 3741 wraps each byte of read data back to the data recorder for compare. If the data fails to match the sent data, this line is activated.

Read Data Ready

This signal indicates that a byte of data is on 'data bus in' and the 3741 can take the byte at any time.

129 Attached

The IBM 129 ties this line active to allow the 3741 to differentiate between an IBM 129 and an IBM 5496.

Punch Busy

The data recorder activates this line when it has received the byte of data from the 3741 on a punch operation. When the line is deactivated, the 3741 can send another byte of data.

Register Gate Control 0

The register gate control lines from planar socket 1-L are used as clocks for the data recorder attachment. 'Reg gate control 0' is R-time **A**.

Register Gate Control 1

This is S-time for the data recorder attachment **B**.

Reg Select Decode 1 and Reg Select Decode 0

These lines select the register that is to be used by the MPU for data recorder operations.

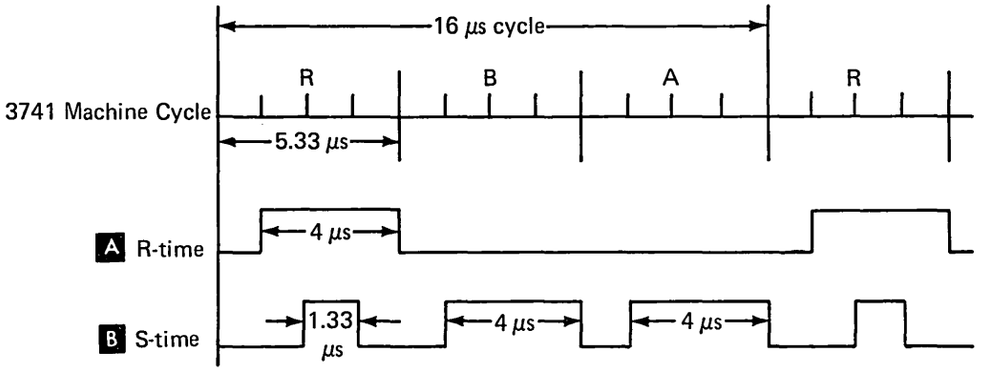
Select Module 3A

This line selects the module containing the registers that facilitate the data recorder attachment.

Reg Group Select Other

This line, along with the four previously mentioned register control lines, enables the MPU to control the data recorder attachment register module.

Data Recorder Attachment Clocks



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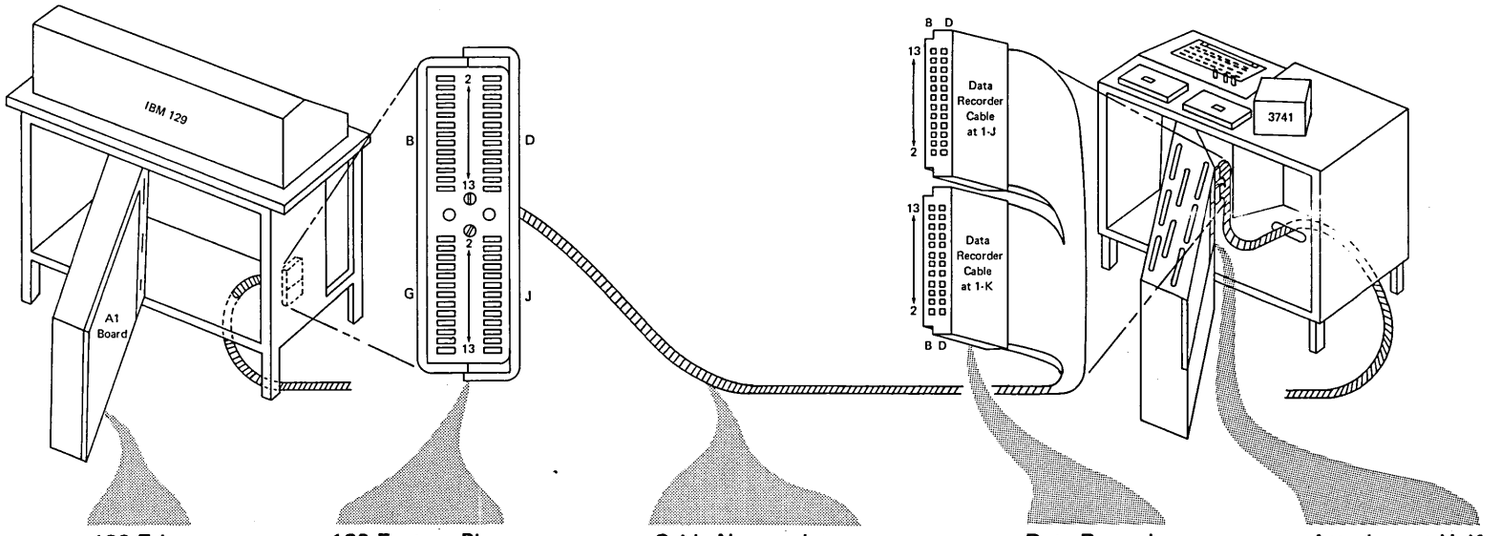
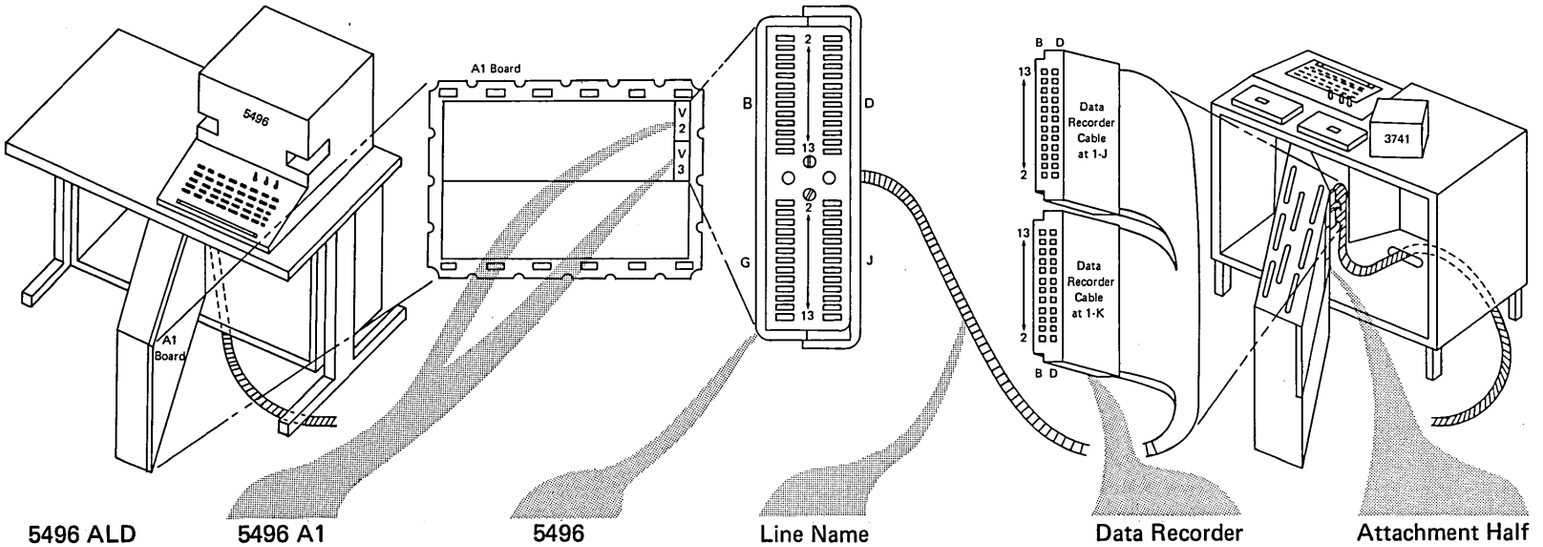
IBM 129 CABLE/CONNECTOR/PIN CHART



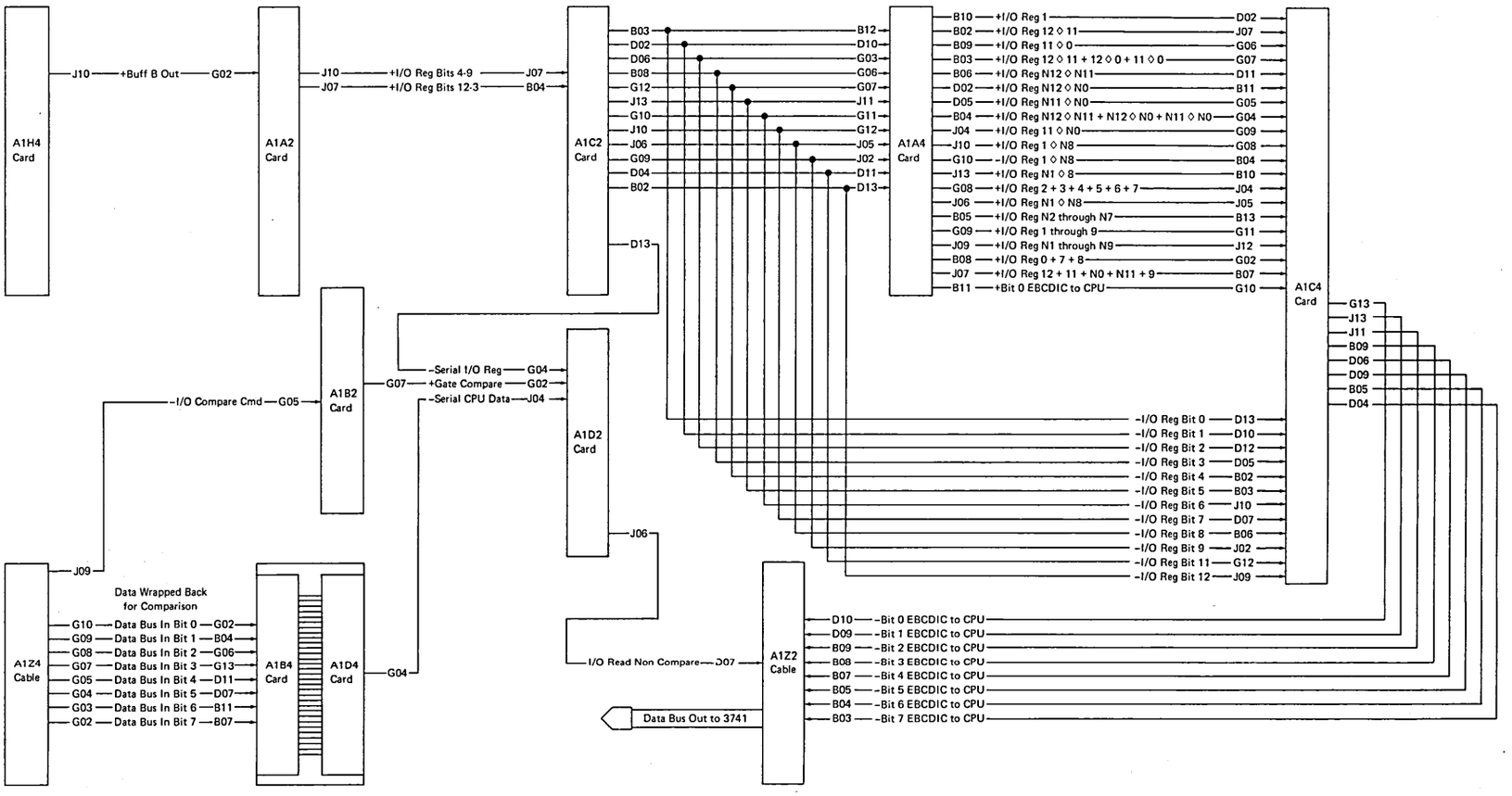
129 FE ALD Reference	129 Edge Connectors	129 Feature Plug & Cables	Cable Nomenclature	Data Recorder Cable Pin No.	Attachment Half Planar Sockets
SY132GN4	Z2 A-A1E6A04	B03	Data Bus Out – Bit 7	1-K B03	1-K-D12
SY132GG4	A-A1E6B04	B04	Data Bus Out – Bit 6	B04	1-K-D11
SY132GA4	A-A1E6C04	B05	Data Bus Out – Bit 5	B05	1-K-D10
SY131GL4	A-A1E6E04	B07	Data Bus Out – Bit 4	B07	1-K-D08
SY131GC4	A-A1F6A04	B08	Data Bus Out – Bit 3	B08	1-K-D07
SY130GL4	A-A1F6B04	B09	Data Bus Out – Bit 2	B09	1-K-D06
SY130GD4	A-A1F6B02	D09	Data Bus Out – Bit 1	D09	1-K-B06
SY130CG4	A-A1F6C02	D10	Data Bus Out – Bit 0	D10	1-K-B05
SY031GJ4	A-A1F6C04	B10	Read Data Ready	B10	1-K-D05
SY012GH4	A-A1G6A04	B13	Online and Ready	B13	1-K-D02
SY030GM4	A-A1E6D02	D06	Op Complete	D06	1-K-B09
SY040GD4	A-A1E6B02	D04	Hopper Jam	D04	1-K-B11
SY020GG4	A-A1E6C02	D05	Punch Busy	D05	1-K-B10
SY041DC4	A-A1E6E02	D07	Read Non Compare	D07	1-K-B08
SY040GL4	A-A1D6E02	D02	Transport Jam	D02	1-K-B13
SY122SA4		D12	129 Attached	D12	1-K-B03
SY040GM4	A-A1F6E04	B12	Command Reset	B12	1-K-D03
SY100CB6	Z4 A-A1L6D04	G02	Data Bus In – Bit 7	1-J B02	1-J-D13
SY100CB3	A-A1L6E04	G03	Data Bus In – Bit 6	B03	1-J-D12
SY100CB7	A-A1M6A04	G04	Data Bus In – Bit 5	B04	1-J-D11
SY100CB2	A-A1M6B04	G05	Data Bus In – Bit 4	B05	1-J-D10
SY100CB4	A-A1M6D04	G07	Data Bus In – Bit 3	B07	1-J-D08
SY100CB1	A-A1M6E04	G08	Data Bus In – Bit 2	B08	1-J-D07
SY100SA2	A-A1N6A04	G09	Data Bus In – Bit 1	B09	1-J-D06
SY100SA1	A-A1N6B04	G10	Data Bus In – Bit 0	B10	1-J-D05
SY031CB5	A-A1N6A02	J09	I/O Compare Command	D09	1-J-B06
SY032CC1	A-A1M6D02	J07	Request Read Cycle	D07	1-J-B08
SY032CC4	A-A1M6C02	J06	Read Command	D06	1-J-B09
SY020CC5	A-A1N6E04	G13	Punch Data Ready	B13	1-J-D02
SY041CC7	A-A1N6E02	J13	I/O POR	D13	1-J-B02

IBM 5496 CABLE/CONNECTOR/PIN CHART

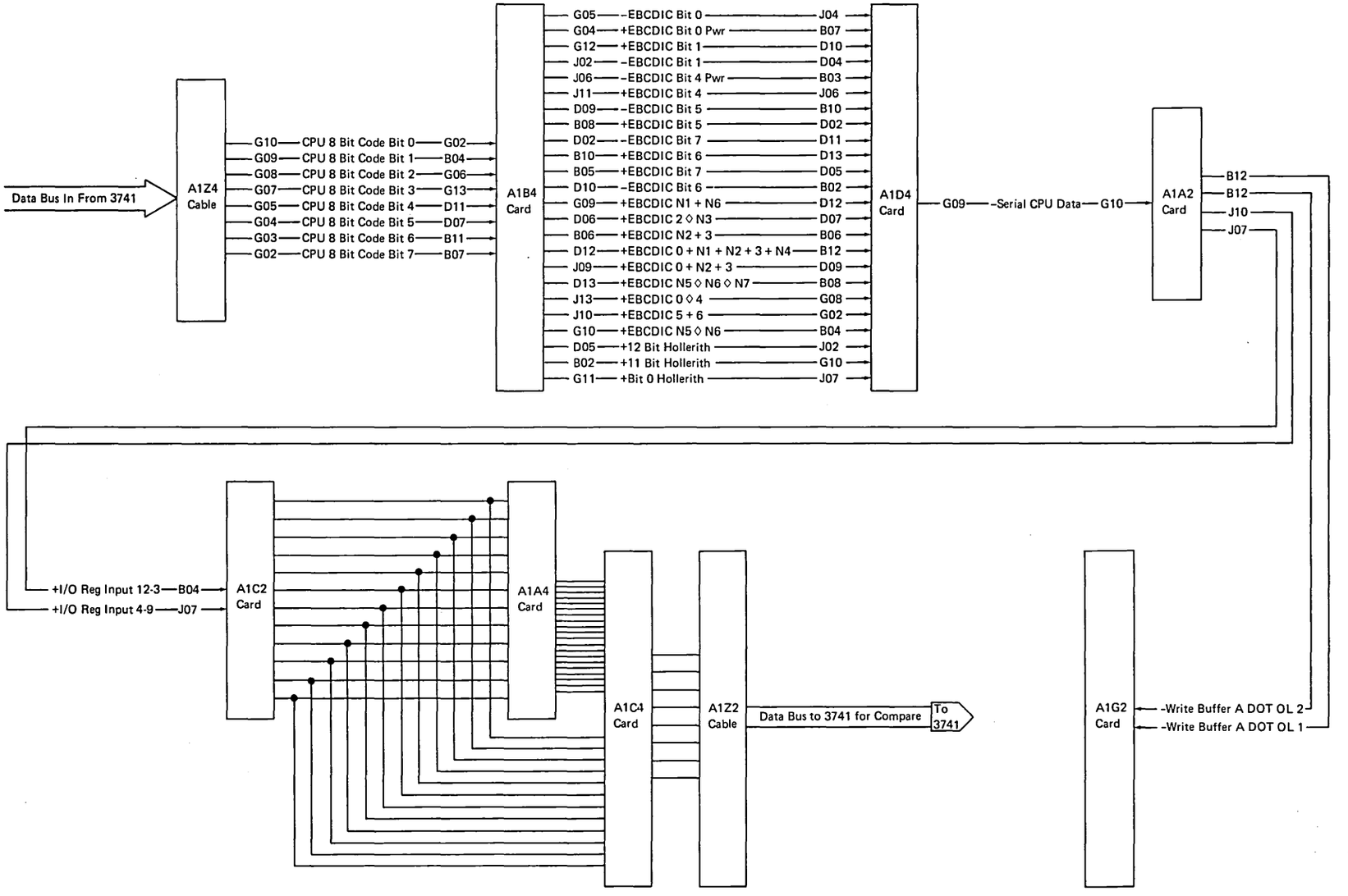


5496 ALD Reference	5496 A1 Connector	5496 Feature Plug	Line Name	Data Recorder Cable Pin No.	Attachment Half Planar Socket
KL021TH4	V3 B03	B03	Data Bus Out 1	1-K B03	1-K-D12
KL021TJ4	B04	B04	Data Bus Out 2	B04	1-K-D11
KL021TK4	B05	B05	Data Bus Out 4	B05	1-K-D10
KL021TL4	B07	B07	Data Bus Out 8	B07	1-K-D08
KL021TM4	B08	B08	Data Bus Out A	B08	1-K-D07
KL021TN4	B09	B09	Data Bus Out B	B09	1-K-D06
KL041TG4	B10	B10	Read Data Ready	B10	1-K-D05
KL011TA4	B13	B13	Online and Ready	B13	1-K-D02
KL041SU4	D06	D06	Op Complete	D06	1-K-B09
KL011SK4	D04	D04	Hopper Jam	D04	1-K-B11
KL051TD4	D05	D05	Punch Busy	D05	1-K-B10
KL041ST4	D07	D07	Read Non Compare	D07	1-K-B08
KL011SJ4	D02	D02	Transport Jam	D02	1-K-B13
KL011SY4	B12	B12	Command Reset	B12	1-K-D03
KL021SA4	V2 B02	G02	Data Bus In 1	1-J B02	1-J-D13
KL021SB4	B03	G03	Data Bus In 2	B03	1-J-D12
KL021SC4	B04	G04	Data Bus In 4	B04	1-J-D11
KL021SD4	B05	G05	Data Bus In 8	B05	1-J-D10
KL021SF4	B07	G07	Data Bus In A	B07	1-J-D08
KL021SG4	B08	G08	Data Bus In B	B08	1-J-D07
KL041SA6	D09	J09	I/O Compare Command	D09	1-J-B06
KL041SA2	D07	J07	Request Read Cycle	D07	1-J-B08
KL031SA4	D06	J06	Read Command	D06	1-J-B09
KL051SB4	B13	G13	Punch Data Ready	B13	1-J-D02
KL011TC4	D13	J13	I/O POR	D13	1-J-B02

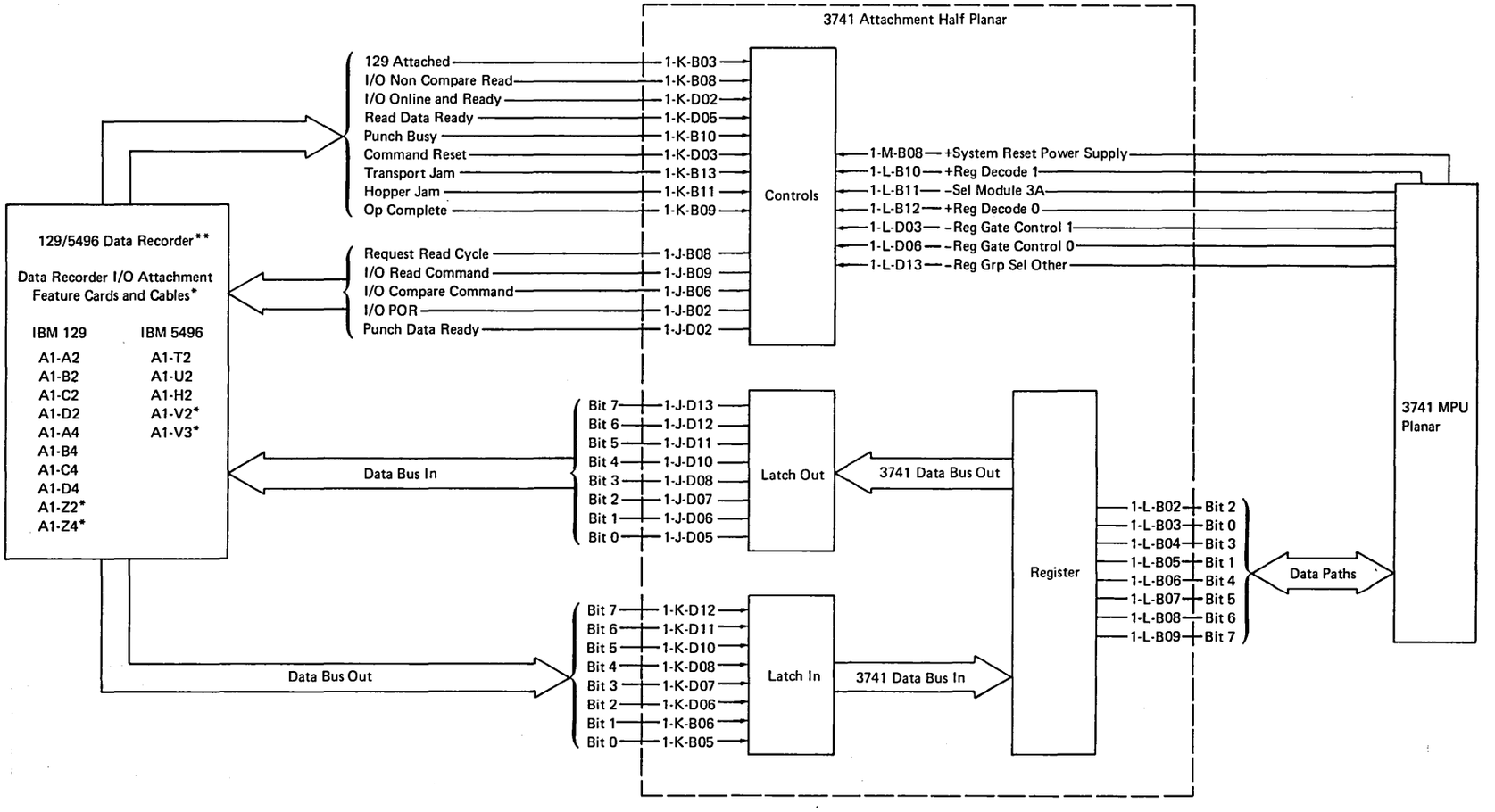
READ TRANSLATION AND COMPARE



PUNCH DATA TRANSLATION



3741 DATA RECORDER ATTACHMENT DATA FLOW



** Refer to FEALD in IBM 129 or IBM 5496 for circuits of the cards in the data recorder.

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Introduction

This feature permits operator-attended exchange of data between the diskette in an IBM 3741, and any of a group of I/O devices, or a System/3.

General Description

The 3741 I/O adapter is on a half planar, mounted in the upper level-one position on the logic gate. It is mutually exclusive with the data recorder feature. It uses the microprogrammed control unit to provide the timing and controls needed to attach the 3741 Data Station to an attachment. On models 3 and 4, the I/O adapter extends the instruction set. The I/O adapter is connected to the attachment by a cable that is available in 20- or 40-foot (6100 or 12200 mm) lengths.

Logical elements include ROS modules, a register module (unique group-select registers, numbers 16-19*), receivers/drivers, and logic necessary to communicate with the attachment.

Operation

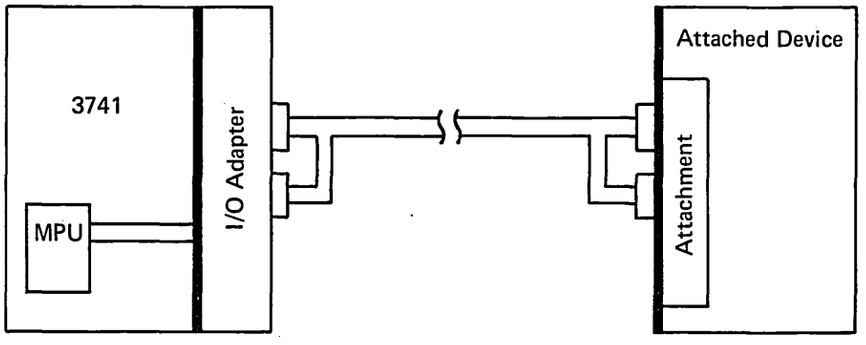
The input to 3741 and output from 3741 operations are called read from attachment and write to attachment respectively.

Three modes of data transfer are available: by character, by record, or by file. These modes of transfer can be used when moving data in either direction between the 3741 and the attachment.

Character transfer: Allows the user to control read/write operations character by character. The instructions are loaded into any of the Model 1 or 2 format buffers to control character transfers.

Record transfer: Allows processing one record at a time with formatting. Records can be up to 128 characters long.

File transfer: Processes strings of one or more records that may be on one disk or on several disks. No formatting is done in this mode.



*Registers 16-19 are numbered 0-3 in the I/O adapter.

Data Flow

Bits 5 and 6 of register 6 (the keyboard-control register) are set to 00 to select registers 0, 1, 2, and 3. These group-select registers are used to transfer sense information, control information, and data back and forth across the interface. Transfer is serial-by-byte. When transferring files, 13 format buffers of the basic 3741 buffered storage are used to maintain the full data rates. Because the format buffers are used for this operation, they must be reloaded before resuming jobs that require formatting on the basic 3741.

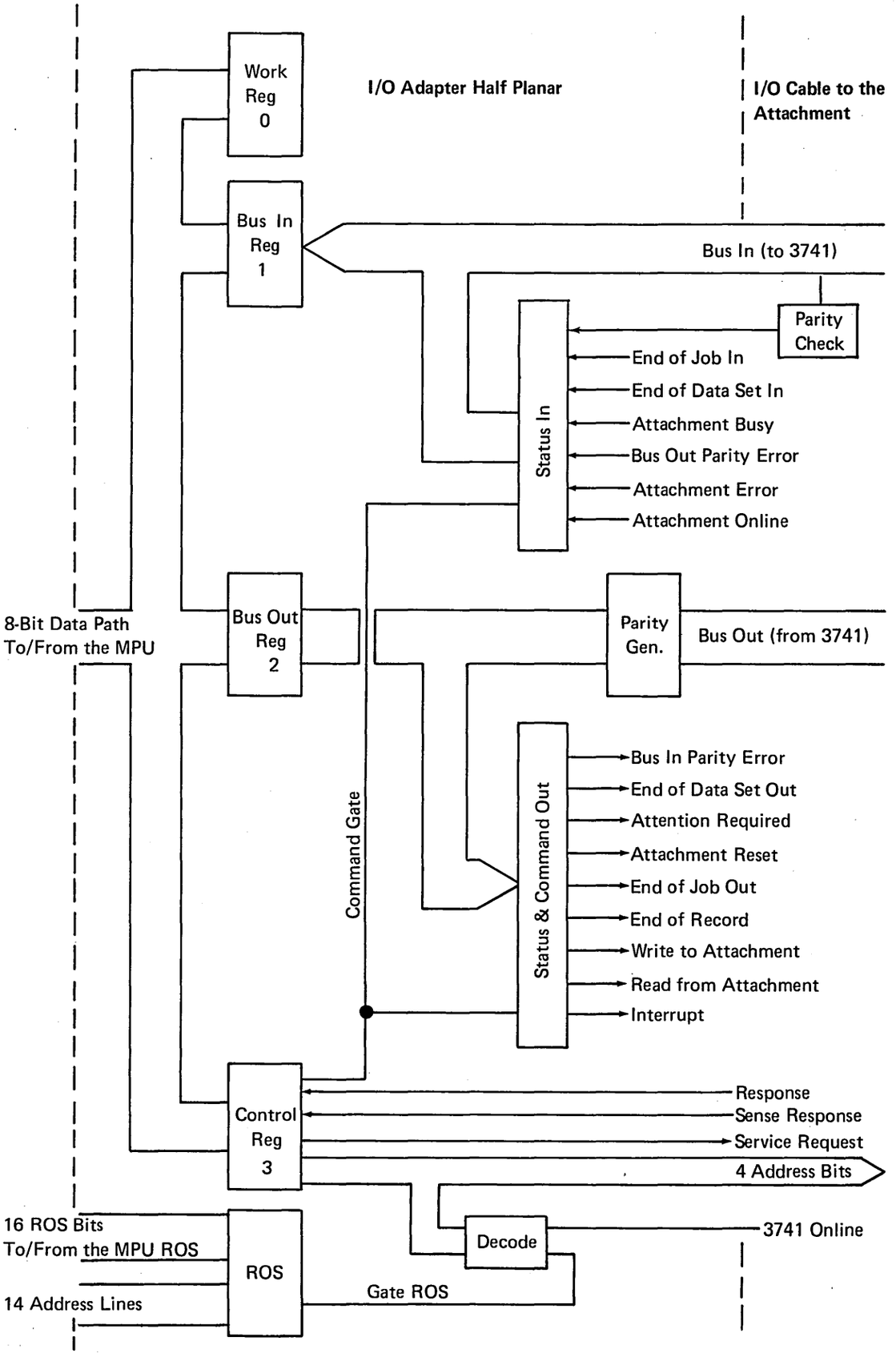
Microprogramming for the I/O adapter directs the data flow. For output from the 3741, data moves from the diskette to the storage buffers, to the bus-out register (2), and on to the I/O cables. For input to the 3741, data moves from the attachment to the bus-in register (1), to storage buffers, and then to the diskette.

Sense and control use register 3 and the bus-in and bus-out registers.

When the I/O adapter is used with model 1 or 2, the I/O adapter ROS is usually selected as follows:

Decoding ROS addresses does the initial selection. Later instructions in the I/O adapter code enter an XA into register 3. This sets a latch that holds the I/O adapter selected. When the microprogram exits the I/O adapter ROS, an XO is entered into register 3 to reset the latch.

When the I/O adapter is used on a model 3 or 4, the I/O adapter ROS is selected by a signal called '–group select 4' from the model 3/4 half planar.



Input Lines

Attachment Error

This line is used by the attachment to notify the 3741 of a device program that requires a record to be restarted or re-sent. The line causes the 3741 to display an 86 error in columns 9 and 10 of the status line and wait.

The operator can either:

1. Press RESET (to cause the 3741 to activate 'attachment reset') and (if sending data to attachment) NUM SHIFT with RESET, ALPHA SHIFT with RESET, or RESET to cause the 3741 to retransmit the record on which the attachment error occurred.
   If receiving data from the attachment, the 3741 treats the next record received as a retransmission and places it in the next sequential location on the disk.

2. Hold ALPHA SHIFT and NUM SHIFT, and press RESET to take the 3741 offline and return the read/write head to the index track.

Attachment Busy

This line from the attachment notifies the 3741 that the attachment is temporarily unable to exchange data. The line is active in response to the 3741 'read from attachment', 'write to attachment', 'EOJ out', 'EOD out', and '3741 attention required' lines. The 3741 waits for 'attachment busy' to drop before activating 'read from attachment', 'write to attachment', 'EOJ out', 'EOD out', or '3741 attention required' lines again.

End of Data Set In

This line is a response to 'read from attachment'. In file-transfer mode 1, the 3741 returns the read/write head to the index track, updates the EOD of the data set, and goes offline. In file-transfer mode 2, the 3741 returns the read/write head to the index track, updates the EOD of the data set, but stays online expecting the operation to continue on another data set or diskette. In file-transfer modes 3 and 5, the 3741 returns the read/write head to the index track, updates the EOD of the data set, and positions the read/write head to the next valid HDR1 label to continue the processing. In file-transfer mode 4, if 'end of data set in' is detected, and 87 error is displayed in columns 9 and 10. The job must be cancelled.

End of Job In

This line is a response to a 3741 'read from attachment'. The 3741 updates the EOD of the data set and goes offline. If 'end of job in' is detected when in file-transfer mode 4, an 88 error is displayed in columns 9 and 10. The job must be cancelled.

Bus Out Parity Error

This line is a response to 'service request' or 'end of record'. The 3741 responds with 'write to attachment' and retransmits the record. If the parity error occurs on the third try, the 3741 displays an 81 error. The job must be cancelled.

Response

During a read operation, 'response' notifies the 3741 that there is data on bus in, ready for sampling. During a write operation, 'response' notifies the 3741 that the data on bus out has been sampled and can be replaced.

Note: 'Response' is the expected answer to all I/O adapter commands. 'Response' always takes precedence over 'sense response'.

Sense Response

'Sense response' indicates to the 3741 that, because of conditions within the attachment, operator and/or automatic recovery procedures are needed at the 3741.

Bus-in Bits

Bus in bits 0 through 7 and parity carry data if 'read from attachment' is active.

Output Lines

Attachment Reset

This line is activated when a new operation is initiated but the attachment is offline. The 3741 does not check for either 'response' or 'sense response' if this line is active. After the line is deactivated, the 3741 waits until the attachment comes online before 'read from attachment' or 'write to attachment' is activated. 'Attachment reset' is not activated if the attachment is online when a new data transfer is to start.

'Attachment reset' is activated if the 'attachment error' line is active during data processing. (See *Attachment Error* for details.)

Read from Attachment

The 'read from attachment' line is activated at the start of each record to be received by the 3741. The line is active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 activates 'service request'. If 'sense response' is received, the 3741 checks the status lines from the attachment. Valid status lines in addition to 'attachment online' are:

'attachment error'
'attachment busy'
'end of data set in'
'end of job in'

If none of these lines are active after 'sense response' comes up following 'read from attachment', the 3741 displays the contents of registers 1, 2, and 3 in hex. The register contents show what occurred. The job must be cancelled.

Write to Attachment

'Write to attachment' is activated at the start of each record to be sent to the attachment. The line is active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 activates 'service request'. If 'sense response' is received, the 3741 checks the status lines from the attachment. Valid status lines, in addition to 'attachment online', are:

'attachment error'
'attachment busy'

If none of these lines are active after 'sense response' is activated, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

Service Request

This line is activated when the 3741 is ready to receive or transmit a character. The line is active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 activates 'service request' or, if the last character of a record has been received or sent, EOR (end of record). If 'sense response' is received, the 3741 checks the status lines from the attachment.

When 'service request' is active, valid status lines are:

'attachment online' only (indicates record-length error), or

'attachment online' plus any of the following:

'attachment error'
'bus in parity error' (forces 'sense response')
'bus out parity check' (occurs only if 'write to attachment' is active).

If any other status lines are active, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

End of Record

'End of record' is activated after all characters of a record have been received or transmitted. The line is active until 'response' or 'sense response' is activated by the attachment. When 'response' is received, the 3741 activates 'read from attachment' or 'write to attachment' if more records are to be received or transmitted. If all records have been sent, the 3741 activates 'end of data set out', 'end of job out', or '3741 attention required' as the next command. If 'sense response' is received, the 3741 checks the status lines from the attachment.

While 'end of record' is active, valid status lines from the attachment are:

'attachment online' only (indicates record-length error), or

'attachment online' plus any of the following:

'attachment error'
'bus out parity check' (occurs only if 'write to attachment' is active).

If any other status lines are active, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

Bus In Parity Error

This line is activated after 'service request' if a data byte with bad parity is received during a read operation. The line stays active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 tries to receive the record two more times. If the error occurs after the third try, an 82 error is displayed, and the job must be cancelled. If 'sense response' is received, the 3741 checks the status lines from the attachment.

'Attachment online' only status means a record-length error. If any other status lines are active, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

End of Data Set Out

This line can be activated after either 'end of record' or '3741 attention required'. It is used in file-transfer modes 3 and 5 only during a write operation. The line stays active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 activates any of the following lines:

'write to attachment'
'end of job out'
'3741 attention required'

If 'sense response' is received, the 3741 checks the status lines from the attachment. The only valid status line, in addition to 'attachment online', is 'attachment busy'.

If any other status lines are active after 'sense response' is received, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

End of Job Out

This line can be activated after 'end of record', 'end of data set out', or '3741 attention required' during a write operation. The line is active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 goes offline and returns the read/write head to the index track. If 'sense response' is received, the 3741 checks the status lines from the attachment. The only valid status from the attachment, in addition to 'attachment online', is 'attachment busy'.

When other lines are active after 'sense response', the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

3741 Attention Required

The '3741 attention required' line can be activated after 'end of record' or 'end of data set out'. The line is active until 'response' or 'sense response' is received from the attachment. If 'response' is received, the 3741 can activate:

'read from attachment'
'write to attachment'
'end of data set out'
'end of job out' or
'3741 attention required'

If 'sense response' is received, the 3741 checks the status lines from the attachment. The only valid status line, in addition to 'attachment on-line', is 'attachment busy'.

If other lines are active, the 3741 displays the contents of registers 1, 2, and 3 in hex. The job must be cancelled.

Interrupt

This line, never active by itself, becomes active with any of the following:

'bus in parity error'
'end of data set out'
'3741 attention required'
'end of job out'
'end of record'
'write to attachment'
'read from attachment'

3741 Online

This line is the output of a latch that is set by XA in register 3, and reset by XB in register 3.

3741 Ready/Busy

The '3741 ready/busy' line is a condition derived from the presence of a valid address; when an attachment address goes active, the 3741 is assumed ready. The transition to not ready constitutes the busy signal.

Bus-out Bits

Bus-out bits 0 through 7 and parity carry data on 'bus out' when 'write to attachment' is active.

Address

Address bits 4, 5, 6, and 7 identify the device (card reader, paper tape reader, System/3, etc.) that is to receive or transmit data.

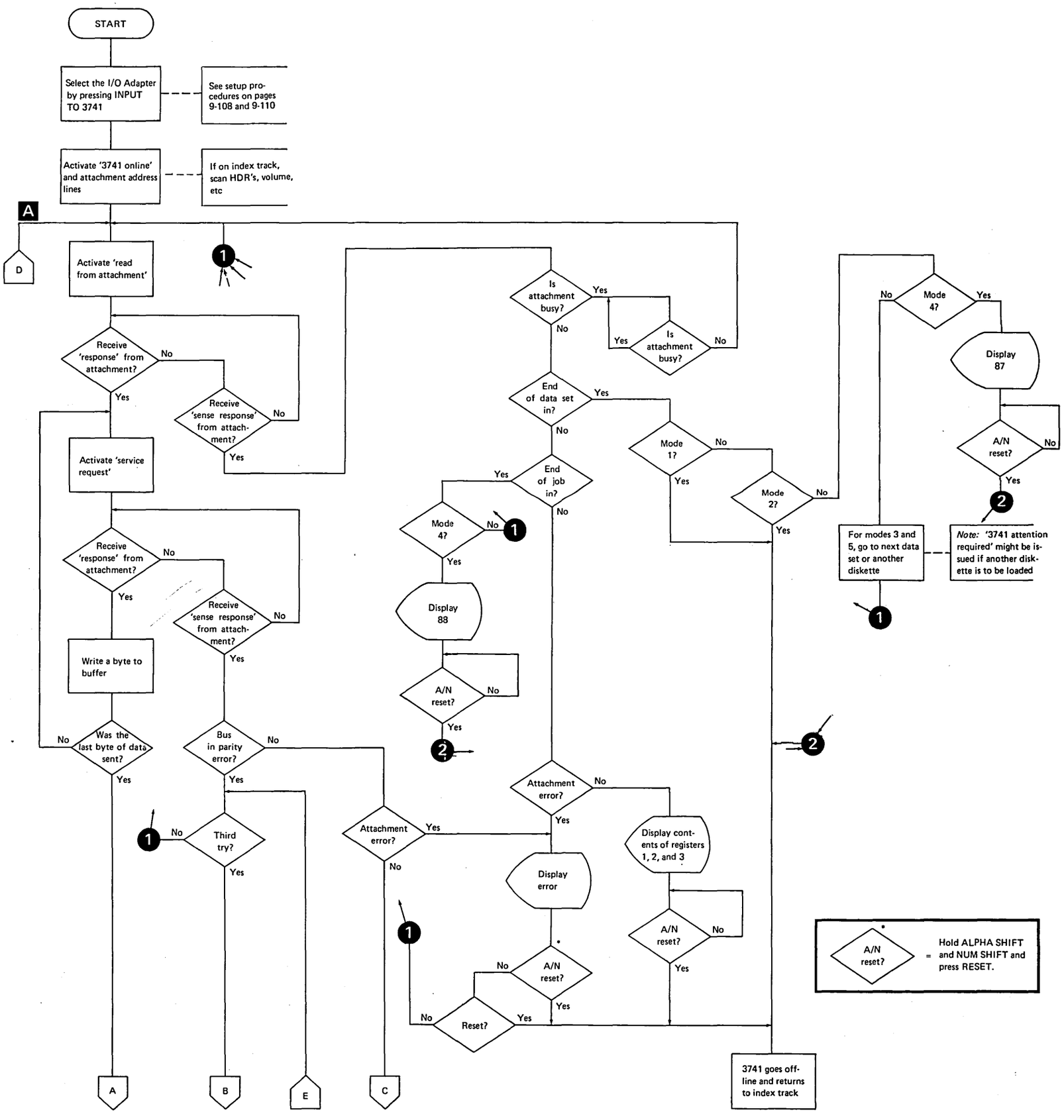
THEORY OF OPERATION

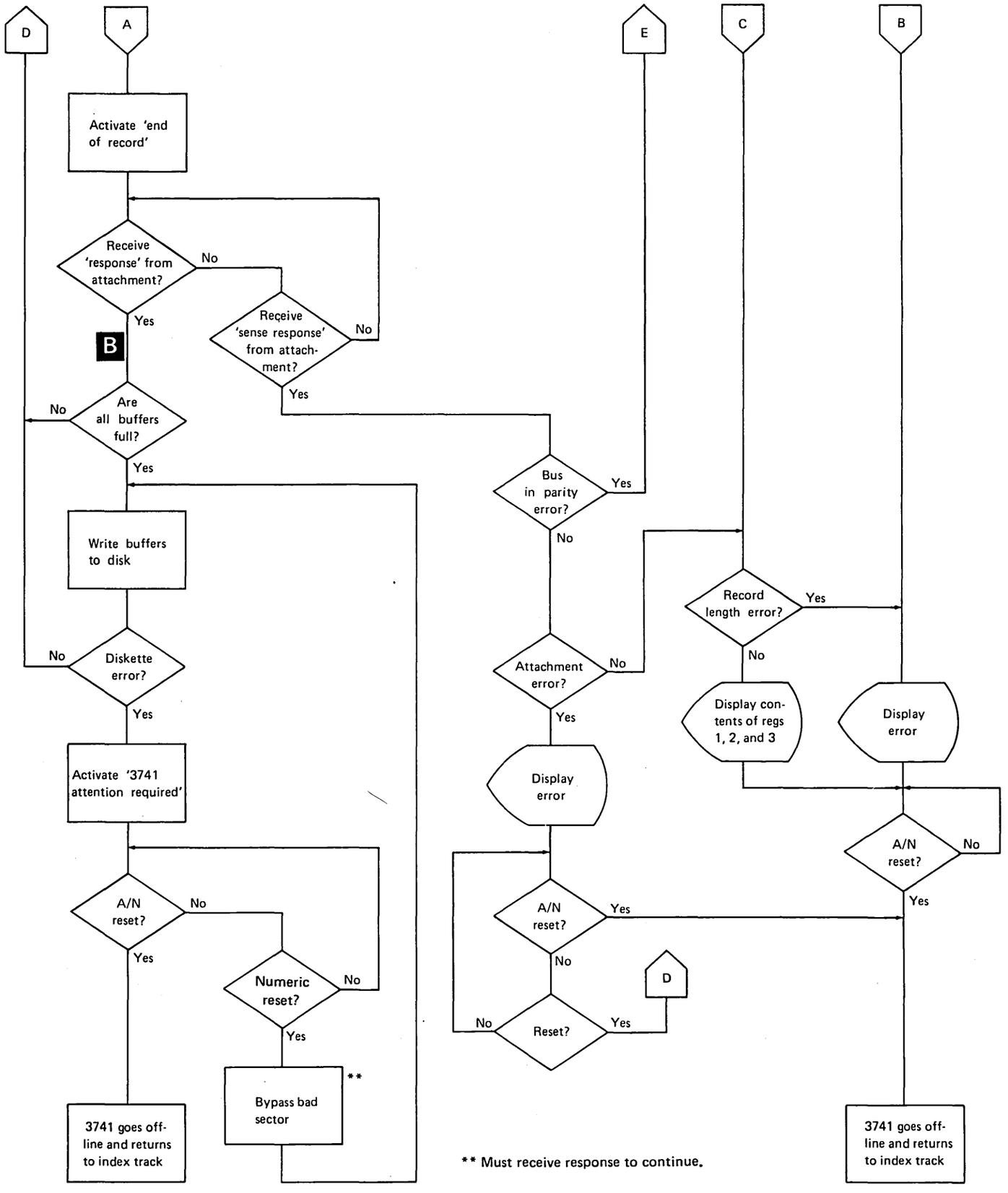
Data exchange between the attachment and 3741 is possible in three modes: character transfer, record transfer, and file transfer. As the names imply, the transfers occur character-by-character, record-by-record, or file-by-file, respectively.

Record Transfer Read/Write Theory

The details of operations for character transfer and file transfer, while exchanging data, are shown in the following flowcharts. Record transfer internal operations are the same as those for file transfer. However, the setup procedures are different. The setup is included in the record transfer flowcharts (see I/O Adapter Operating Procedures, page 9-91). The internal operations are described between points A and E of the file transfer flowcharts.

File Transfer Read from Attachment Theory

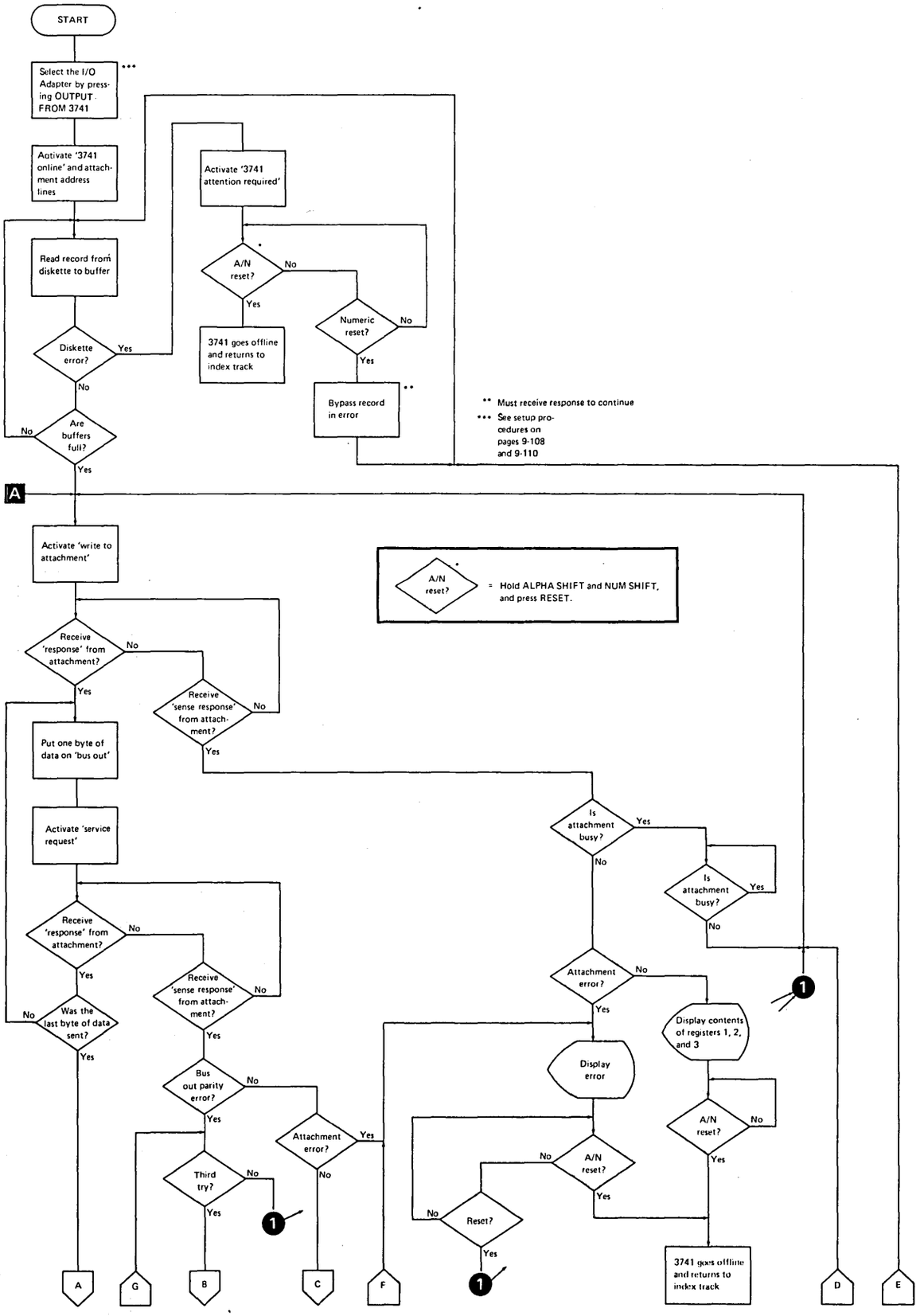


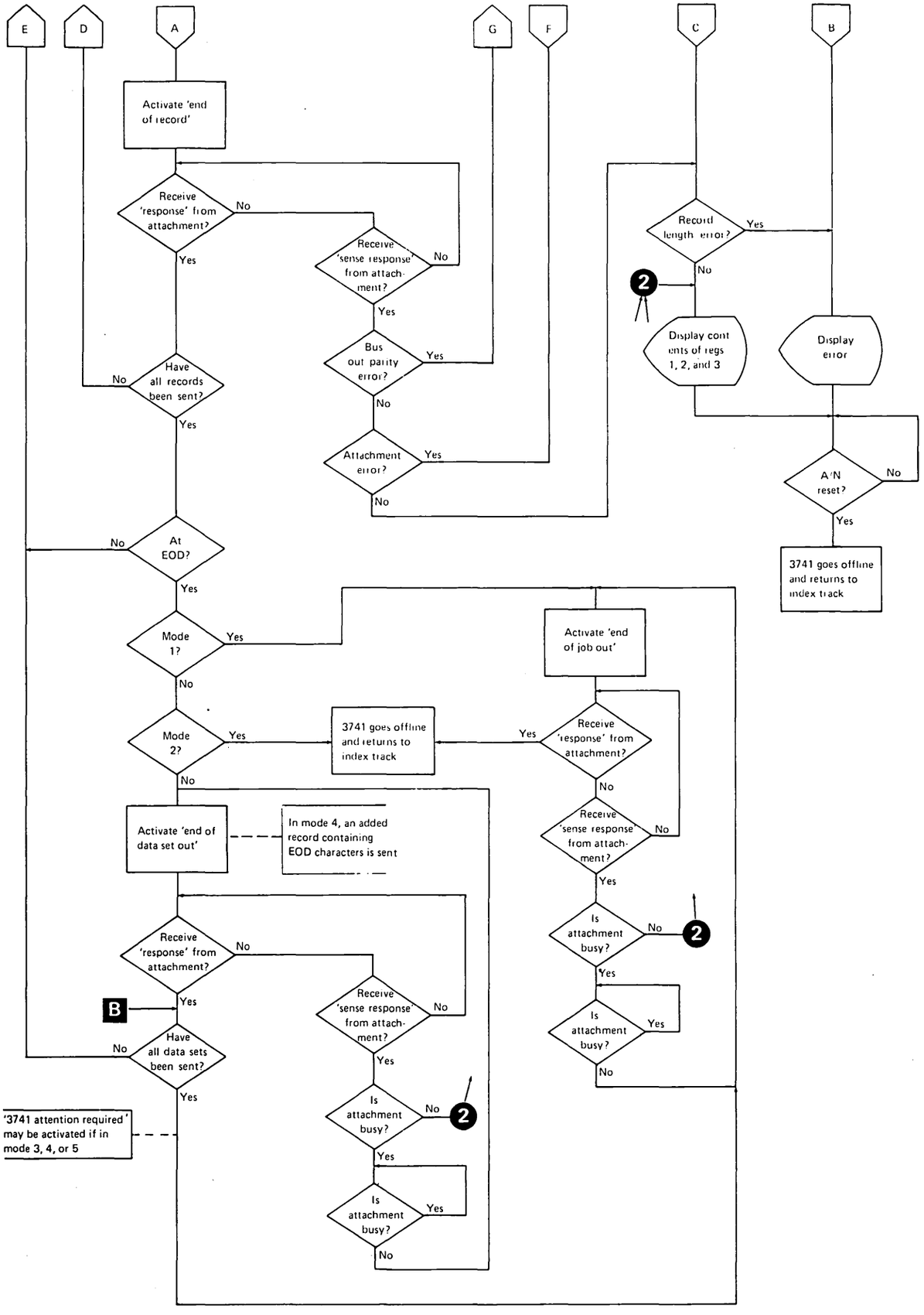


** Must receive response to continue.

EC 825958			PN 1619514
Date 3/21/75			

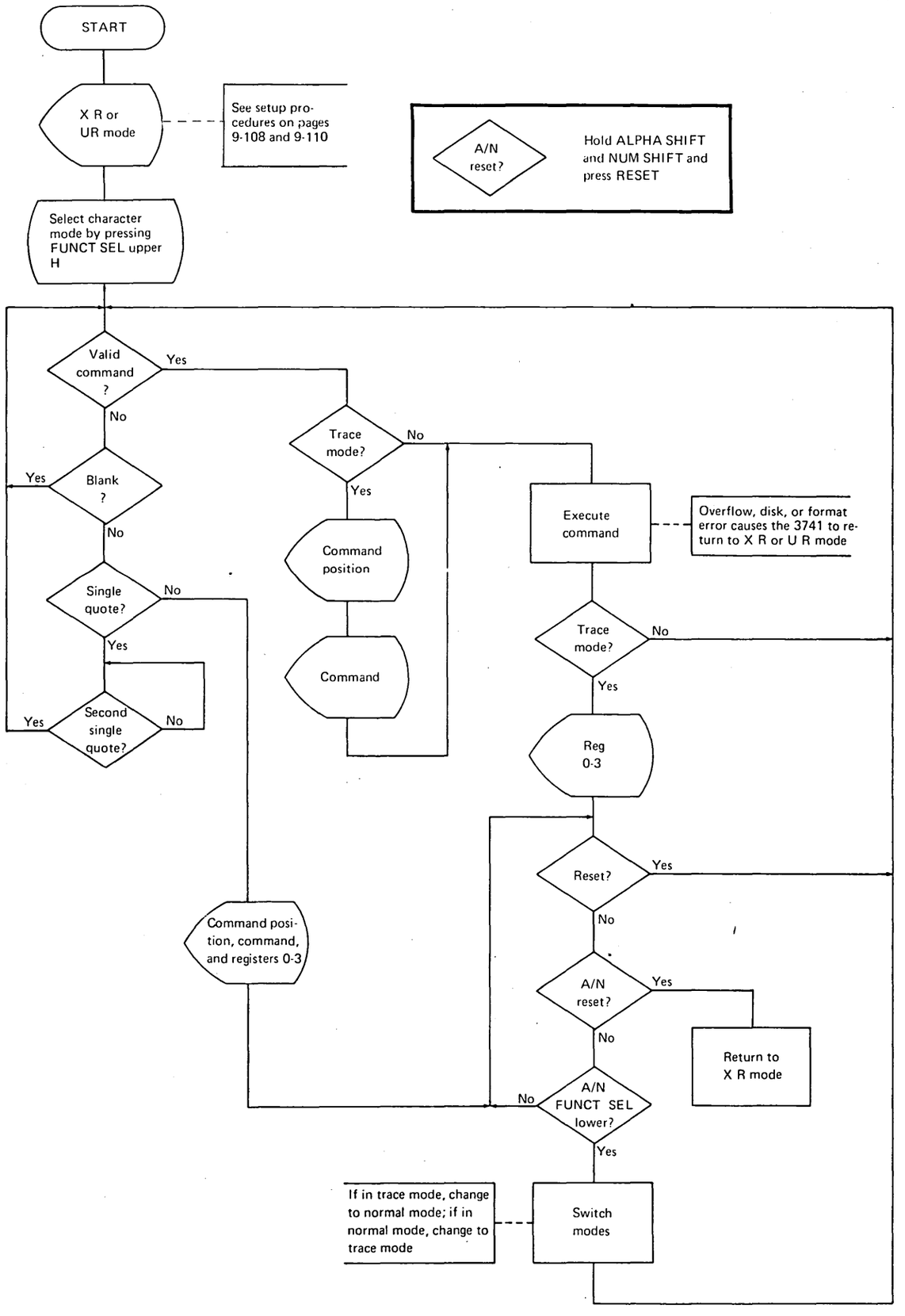
File Transfer Write to Attachment Theory





EC 825958			PN 1619516
Date 3/21/75			

Character Transfer Read/Write Theory



POWER THEORY

Power Supply Field Replaceable Units (FRUs) 15-1
Ac Voltage Distribution for Original Power Supply with Diode Board . . . 15-2
Power On 15-2
Ac Voltage Distribution for Revised Power Supply with No Diode Board . . 15-4
Printed Circuit Board for Original Power Supply with Diode Board . . . 15-6
Printed Circuit Board for Revised Power Supply with No Diode Board . . 15-7
Dc Voltage Distribution 15-8

POWER SUPPLY FIELD REPLACEABLE UNITS (FRUs)

Capacitor (ac) (C-1) A

Keeps ac output from the transformer at a constant level.

Power On Switch B

Switches ac input from the attachment cord to the primary of the transformer.

Attachment Cord C

Supplies customer ac input voltage to the power on switch.

Transformer D

Transforms high voltage input ac to low voltage output, which supplies the input to the dc voltage supply.

Power Supply (ac) Cable F

Distributes input ac voltage from the power on switch to TB-1 and disk 1. Also connects frame ground to the power on switch.

Line Filter (ac) G

Feed-through capacitors filter line noise to frame ground.

ID Reader (ac) Cable H

Distributes input ac from TB-1 to the ID reader.

Primary Fuse Holder (ac) J

Holds fuse to protect transformer.

Printer (ac) Cable K

Distributes ac voltage to the printer.

Printer (dc) Cable L

Distributes dc voltage to the printer.

Fuses (dc) M

Protects +24 Vdc, +8.5 Vdc, +12 Vdc, and -12 Vdc output from an overload.

Power Supply (dc) Cable N

Connects the power supply PC board dc voltages to the MPU.

Power Supply PC Board P

Develops and distributes dc voltage to the machine.

Disk (ac) Cable R

Distributes input ac from TB-1 to disk 2.

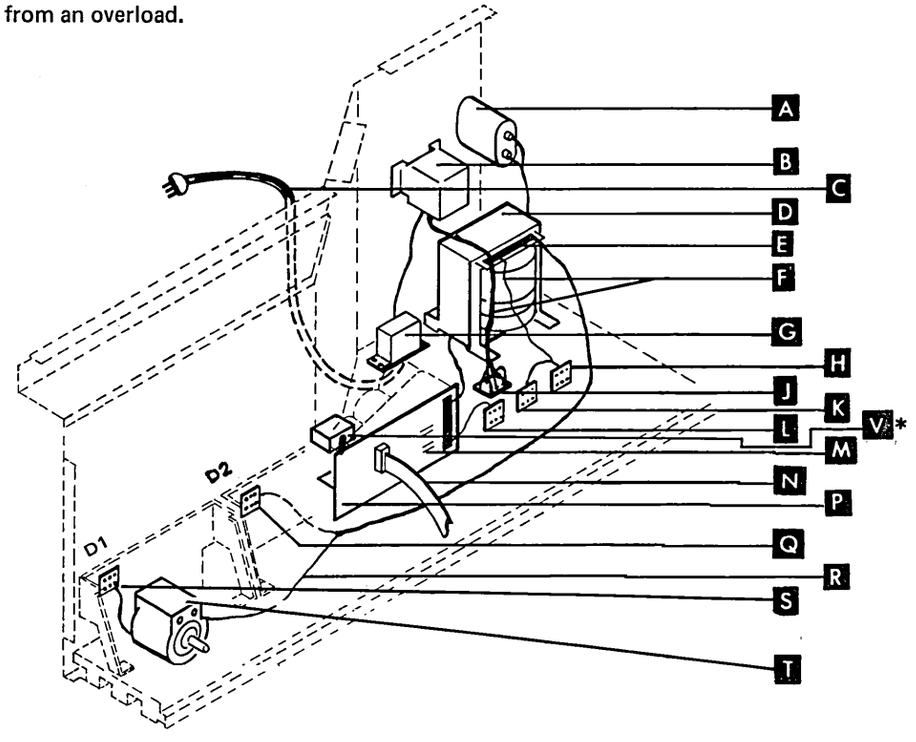
Disk Drive Motor T

Turns the disk within the disk drive unit. The disk turns in order to read or write on the disk.

Circuit Breaker CB1 V *

If installed, protects the +5 Vdc output from overloads.

*Not installed on all machines.



AC VOLTAGE DISTRIBUTION FOR ORIGINAL POWER SUPPLY WITH DIODE BOARD

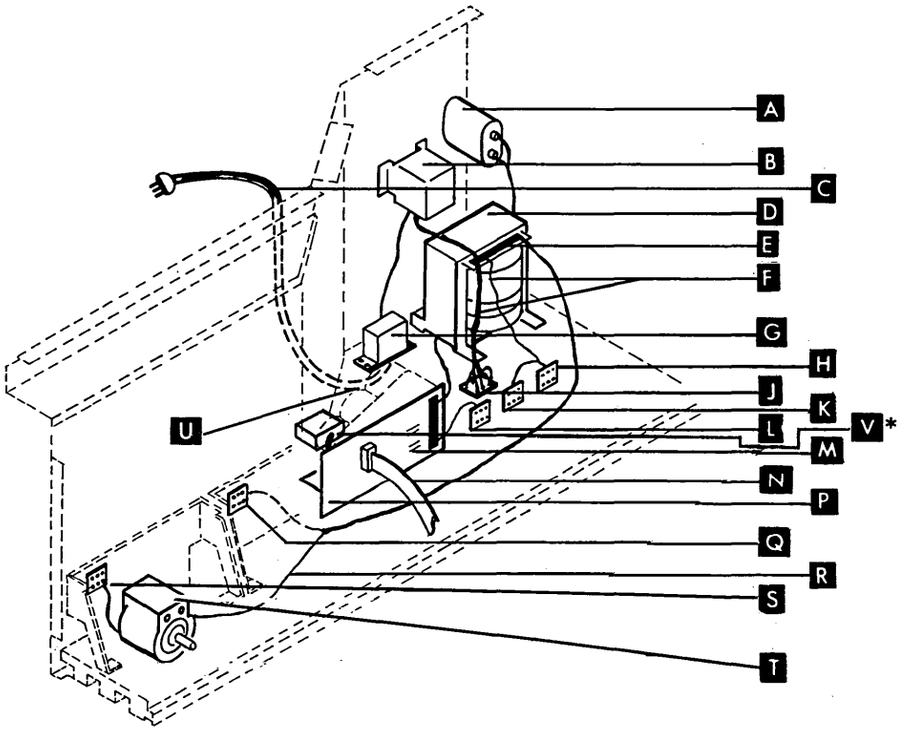
This distribution is for the original power supply having a diode board U. See pages 15-4 and 15-5 for the revised power supply.

Power On

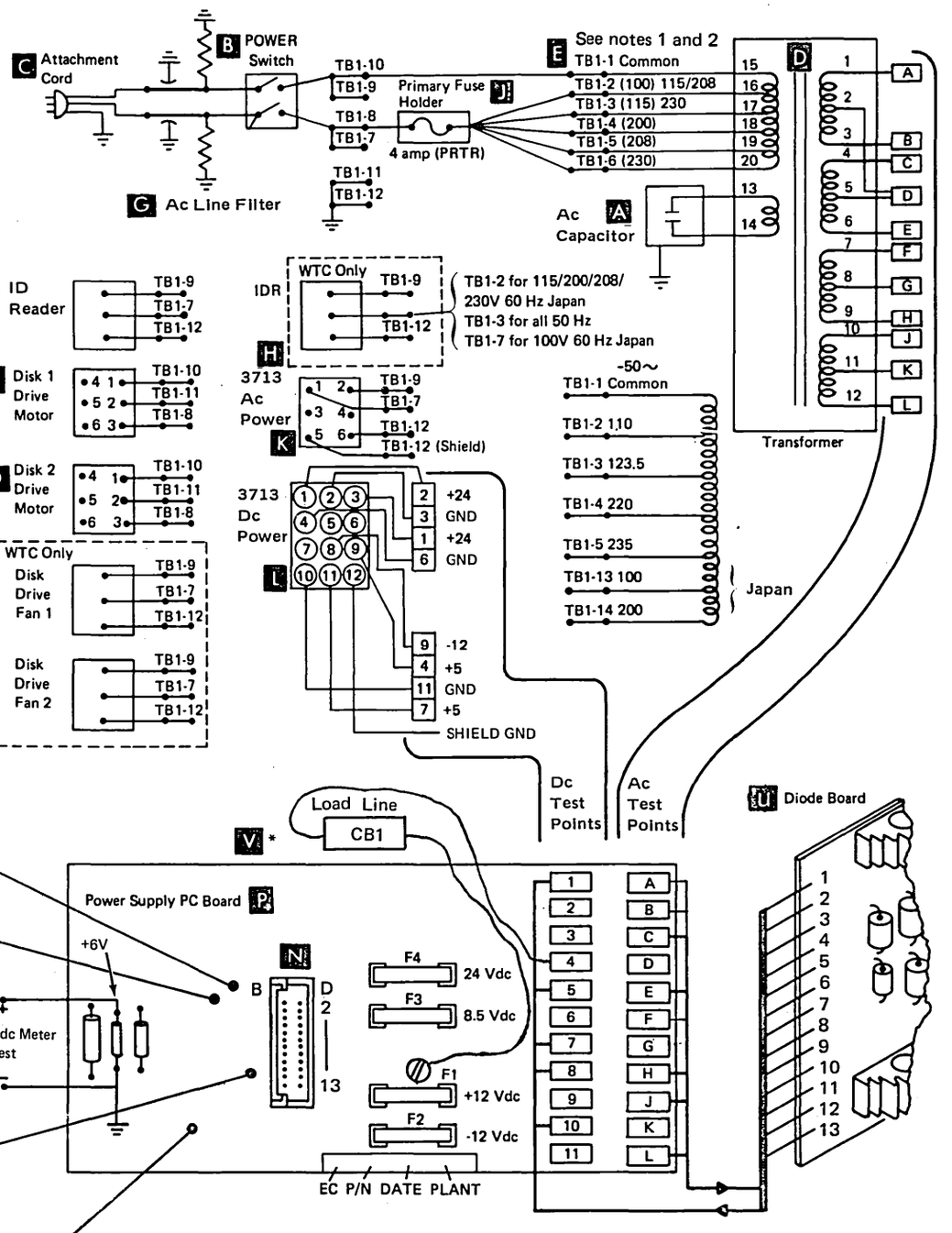
– Plug the attachment cord into the properly rated ac outlet C.

Ac Voltage	Range	Frequency
115	10%	60 Hz
204/230 100/110/123.5	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. B
– Alternating current is sent through the primary fuse to the transformer. D
– TB-1 E distributes ac power through cables to H K S Q the ID reader, printer, and disks 1 and 2.
– The capacitor C1 A makes the transformer D provide regulated ac input voltage to the dc supplies.
– The power supply PC board P, along with capacitors 2-7 and the rectifier board, develops all dc voltages.



*Not installed on all machines



'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.

The -5 Vdc supply is the source for the -4 Vdc supply. The -5 Vdc drops 1 Vdc across a silicone diode which provides the -4 Vdc.

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 overvoltage blows the F2 fuse. A -5 Vdc undervoltage blows the 8.5 Vdc fuse. A differential amplifier detects an overvoltage between -5.6 Vdc to 6.0 Vdc, or an undervoltage of -3 Vdc.

Notes:

1. Numbers in parentheses apply to WTC 60 Hz only.
2. Various transformers are used; check part numbers (601) before changing taps.

*Not installed on all machines

EC 823146	825853	826065	PN 1619277
Date 9/15/74	11/15/74	8/1/75	

AC VOLTAGE DISTRIBUTION FOR REVISED POWER SUPPLY WITH NO DIODE BOARD

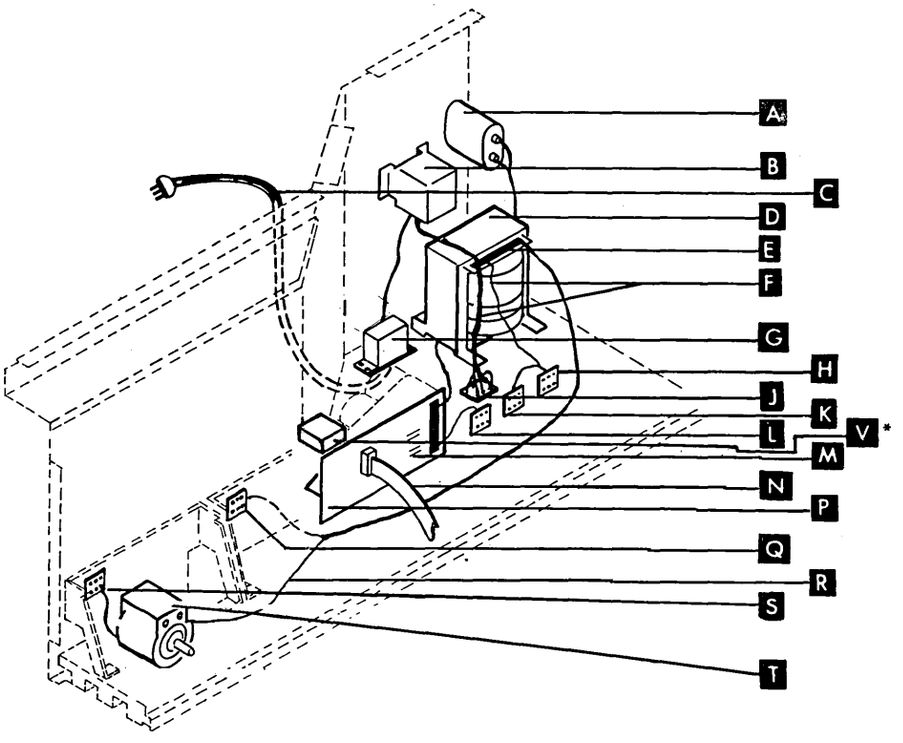
This distribution is for the revised power supply having no diode board. See pages 15-2 and 15-3 for the original power supply.

Power On

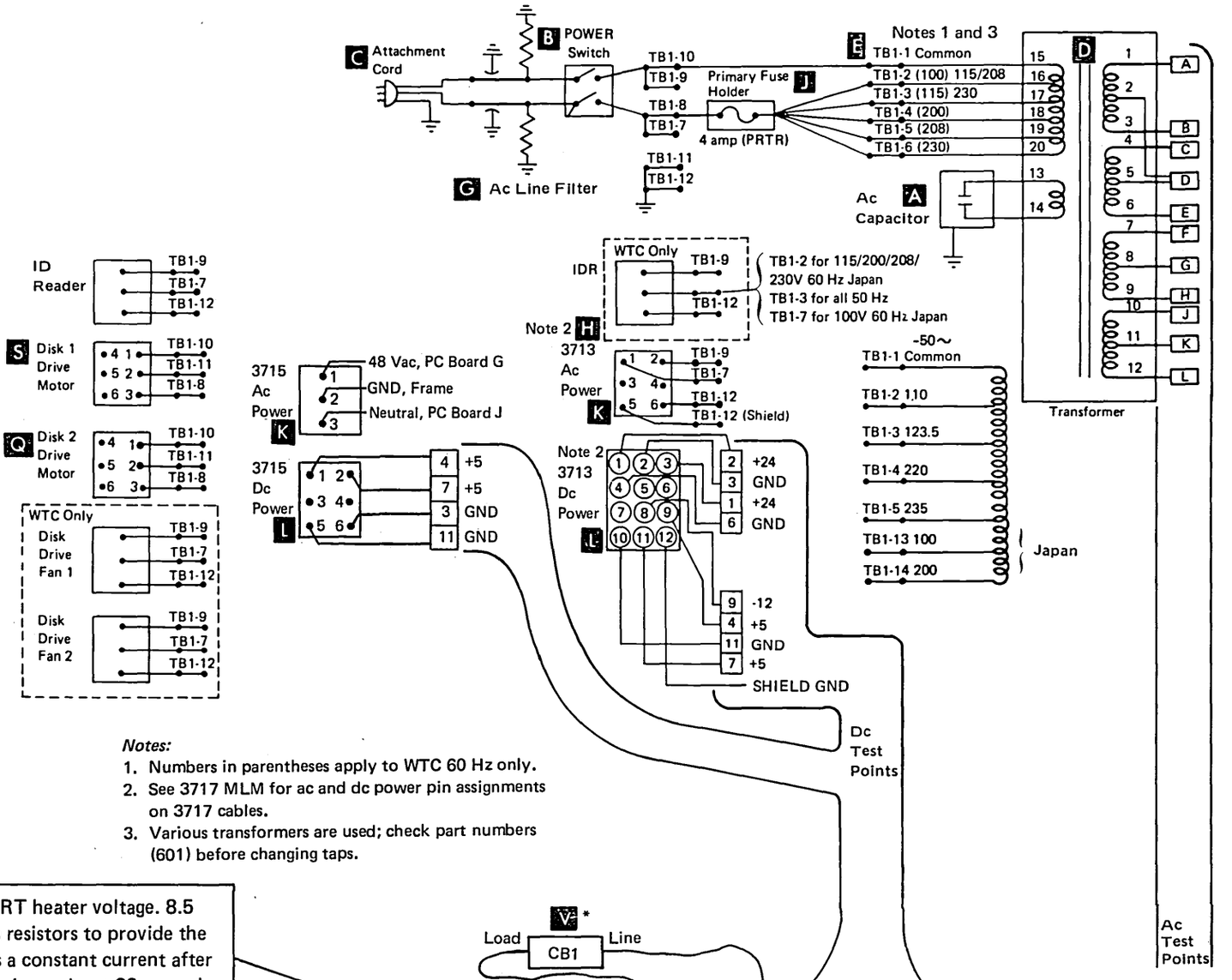
– Plug the attachment cord into the properly rated ac outlet C

Ac Voltage	Range	Frequency
115	10%	60 Hz
204/230 100/110/123.5	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. B
– Alternating current is sent through the primary fuse to the transformer. D
– TB-1 E distributes ac power through cables to H K S Q the ID reader, printer, and disks 1 and 2.
– The capacitor C1 A makes the transformer D provide regulated ac input voltage to the dc supplies.
– The power supply PC board P, along with capacitors 2-7 and the rectifier board, develops all dc voltages.



*Not installed on all machines



Notes:

1. Numbers in parentheses apply to WTC 60 Hz only.
2. See 3717 MLM for ac and dc power pin assignments on 3717 cables.
3. 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. A clamp limits overvoltage to 6.5V.

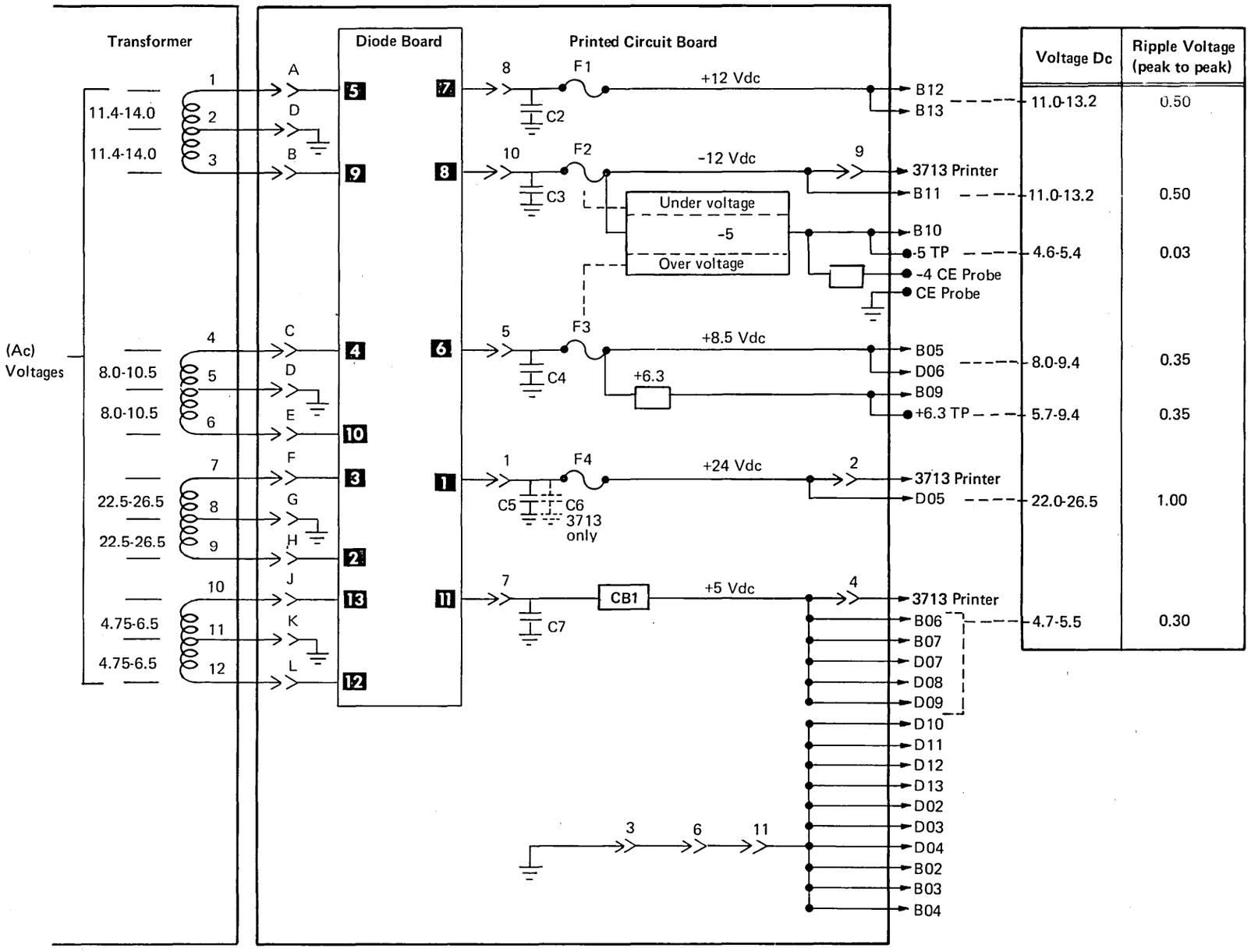
'Power on reset' is at down level for 550 ms.

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

EC 823146	825853	826065	PN 1619279
Date 9/15/74	11/15/74	8/1/75	

PRINTED CIRCUIT BOARD FOR THE ORIGINAL POWER SUPPLY WITH DIODE BOARD

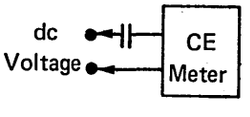


Ripple Measurement

Ripple voltage can be measured most accurately with an oscilloscope.

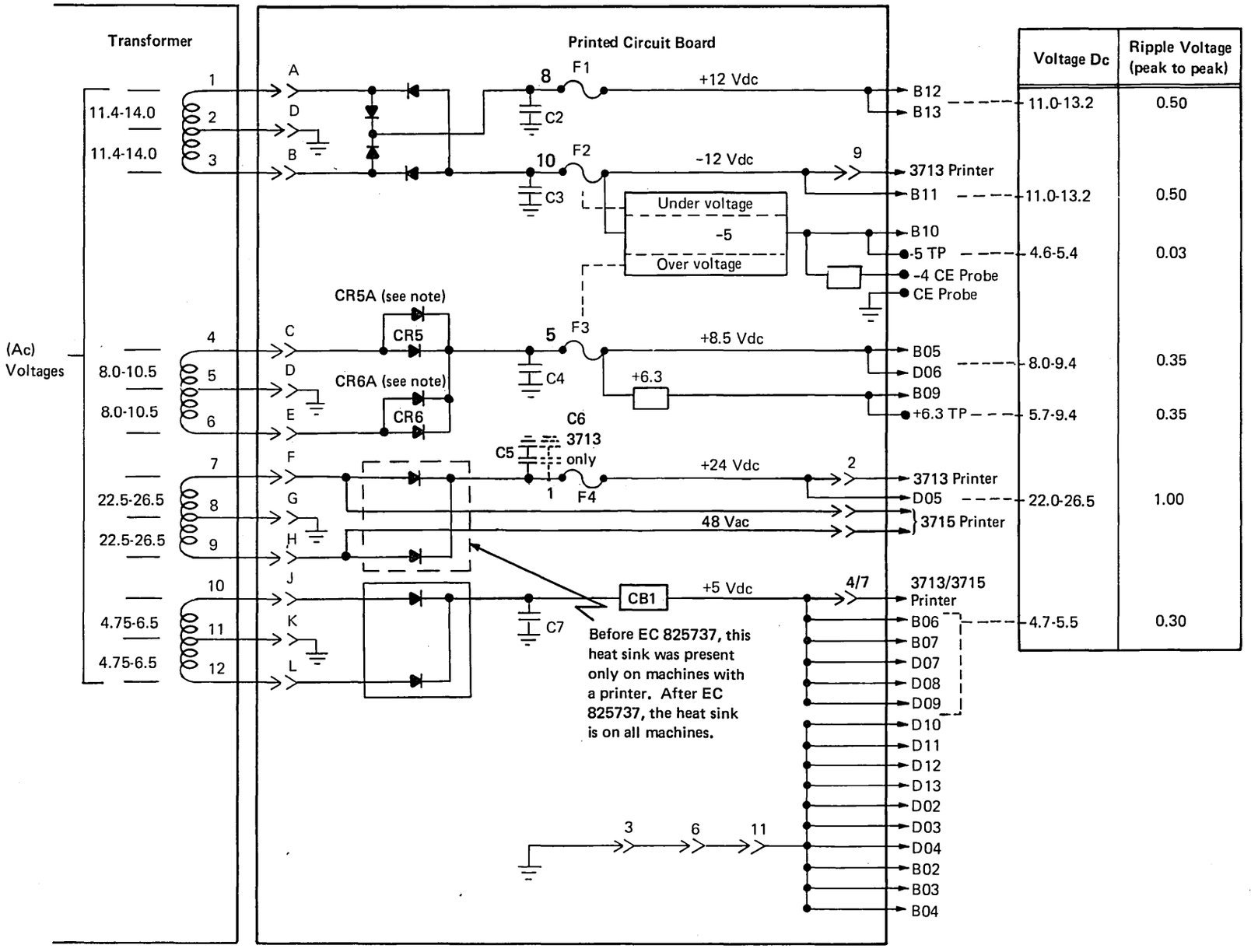
An alternate way to get an indication of ripple voltage is with a CE meter.

1. Connect a capacitor (.22 mF or larger, 50 Vdc or higher) in series with one of the meter leads. (Capacitor not furnished.)
2. Set the meter range to 15V ac.
3. Connect one meter lead to the dc voltage in question, the other lead to frame ground. (Remember, a capacitor is in series with one of the leads.)
4. The meter needle should not leave zero on the meter scale if ripple voltage is within limits.



P/N 452796

PRINTED CIRCUIT BOARD FOR THE REVISED POWER SUPPLY WITH NO DIODE BOARD



Note: CR5A and CR6A are present only on power supplies at EC level 825737 or later.

Note: for 3717 printer, see 3717 MLM.

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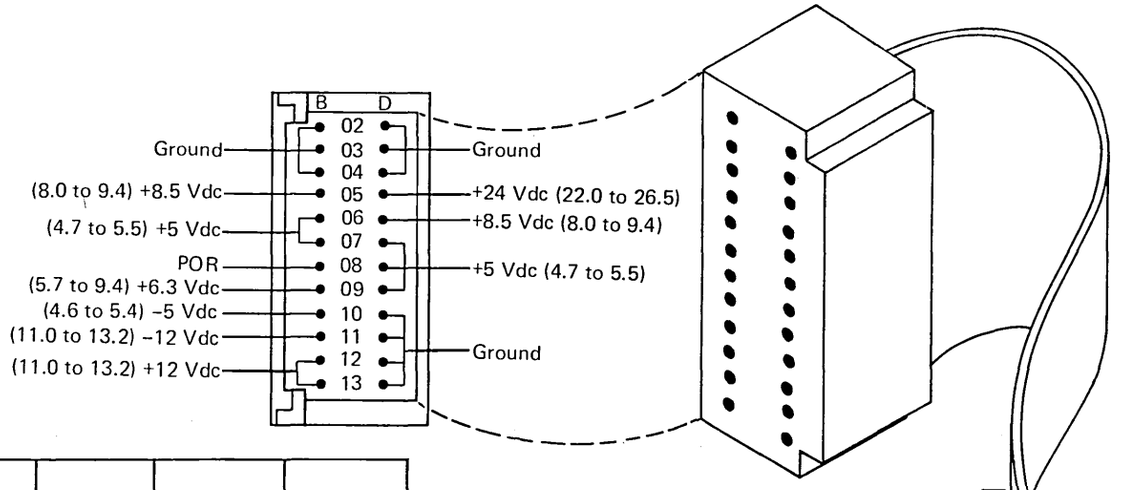
DC VOLTAGE DISTRIBUTION

Power Supply DC Cable

The power supply dc cable Z carries dc voltages to the connector 2-M on the MPU.

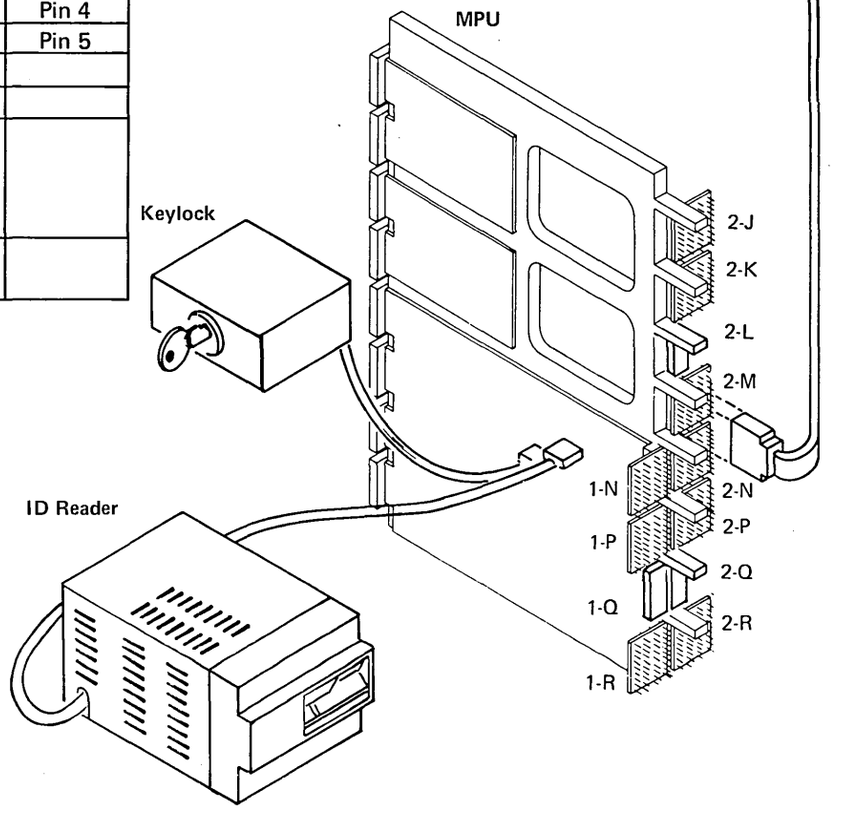
The MPU sends signals and dc voltages from:
Connector 2-J to disk 1.
Connector 2-K to disk 2.
Connector 2-N to display unit.
Connector 1-N to BSCA.
Connectors 1-P and 1-R to printer.
Connector 2-P to keyboard.
Connector on MPU planar to ID reader.

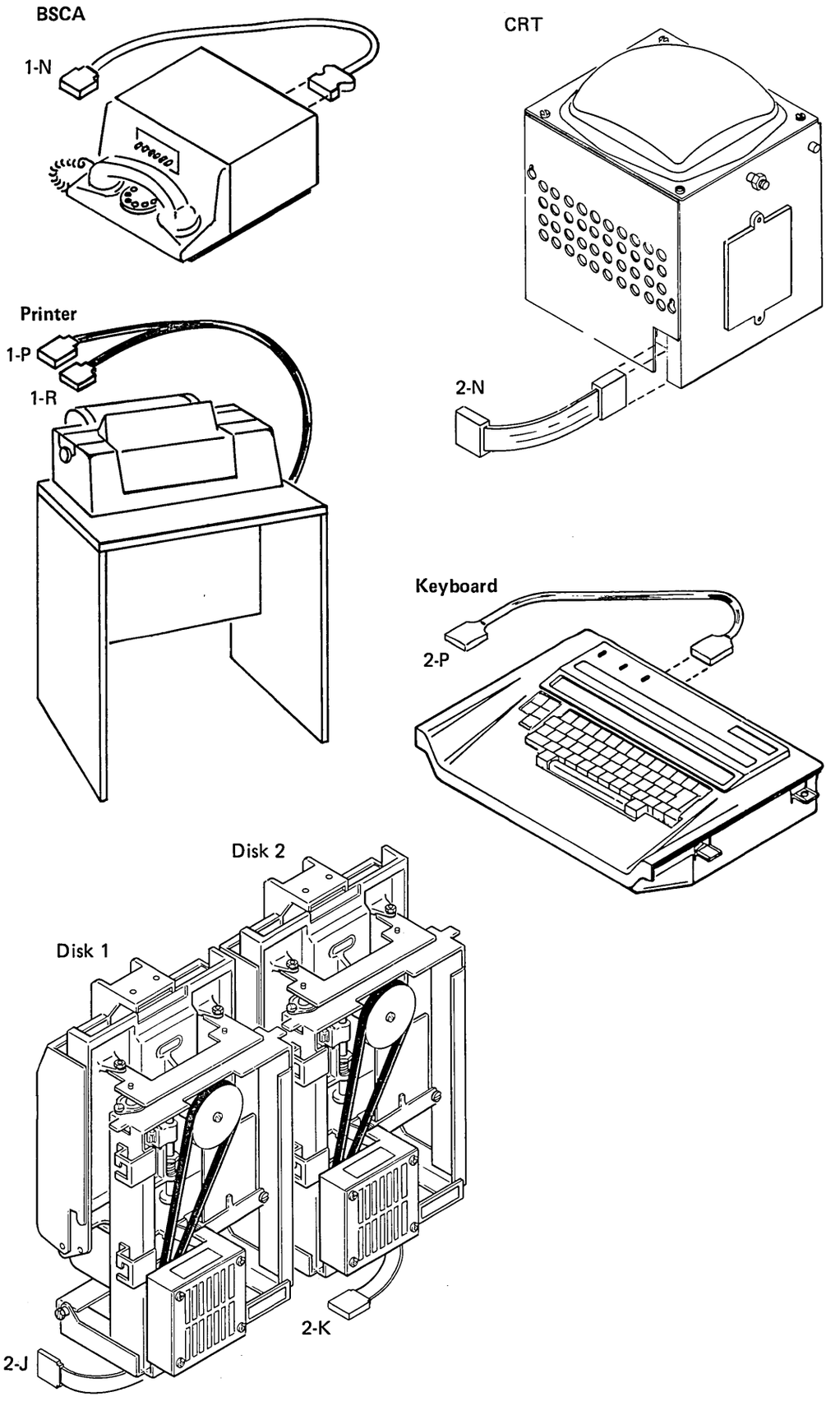


Voltages and Pin Numbers To and From MPU

Voltages	BSCA	3713 Printer*	3715 Printer	Disk 1 & 2	CRT	Keyboard	ID Reader
-5				2-J or 2-K-B11		2-P-D06	
+5		DC7 DC4	DC7 DC4	2-J or 2-K-B03		2-P-B09	
+6.3					2-N-B12 2-N-B13		
+6.8							Pin 4
-7.5							Pin 5
+8.5						2-P-D03	
-12	1-N-D13	DC9			2-N-D02		
+12	1-N-B12				2-N-D09 2-N-D10 2-N-B08 2-N-B09		
+24		DC1 DC2		2-J or 2-K-B10			

*See 3717 MLM for 3717 pin assignments.





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INSTALLATION PROCEDURE

3741 INSTALLATION

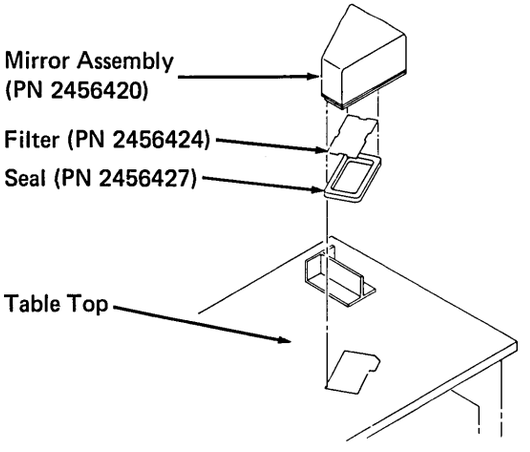
CRT Safety

See the CRT Safety notice on the inside of the front cover of the maintenance library (page 0-3).

Mirror Installation

Unpack the mirror assembly (part no. 2456420) from its container and install as follows:

- Install the seal (part no. 2456427) making sure that the seal does not obstruct the area being displayed on the CRT face.
- Install the filter (part no. 2456424) on top of the seal.
- Align the mirror assembly (part no. 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. A
- If the line voltage and tag do not agree, consult an IBM Installation Planning Representative.

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 ECS if MLC records are incorrect.

Power On Check

1. Make sure the MAINLINE switch is OFF.
2. Check the machine record card to find if an RPQ is to be installed. (If so, go to Section 31 and learn the purpose of the RPQ. Do not install now.)
3. If a printer is to be installed:
   a. For a 3713 printer, go to page 16-2 and perform steps 1-12.
   b. For a 3715 printer, use the installation instructions shipped with the 3715.
   c. For a 3717 printer, use the installation instructions in the 3717 MLM.
4. If the data recorder attachment or the I/O adapter is to be installed, go to page 16-10 and perform all appropriate procedures.
5. Connect the mainline cord to the customer's outlet.
6. Turn on the MAINLINE switch.
7. Observe the machine for signs of overheating or smoke. Turn off the MAINLINE switch immediately if any abnormal conditions are noted.
8. Check that the disk drive hub and drive belt are turning.
9. Use the *Machine Checkout* to check the machine operation and performance (per machine record card):

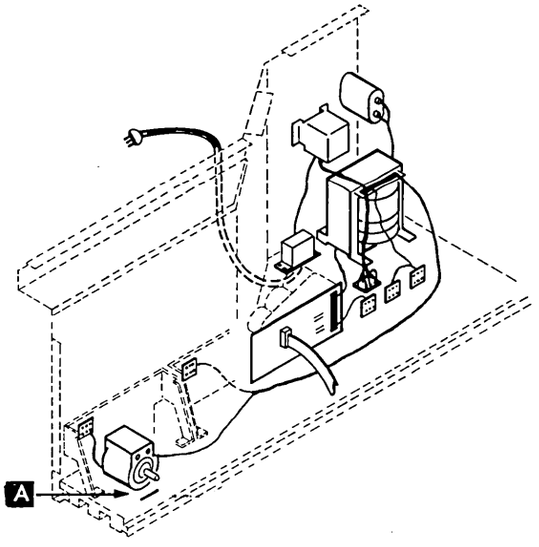
Base machine	MAPs 7-1 and 7-2
Data recorder attachment	MAP 7-20
Feature Group A	MAP 7-3
Feature Group E	MAP 7-4
I/O adapter	MAP 7-21
Printer	MAP 7-5

10. Power down.
11. If BSCA, Expanded Communications Feature, or 1200 bps Line Adapter is to be installed, go to page 16-3.
12. Go to page 0-4 in this manual and enter the required information about the machine.
13. If RPQ is to be installed, go to Section 31.

Completion of Installation

The machine serial number is inside the cover, on the frame, below the disk unit. A

- Be sure that all safety shields are installed that are removed during this installation.
- Place the ML in the storage area of the machine.
- Fill out the IR and report the installation according to local procedures.
- The feature diagnostic diskette(s), is a CE tool. The other diskette and operations manuals belong to the customer.



Packing Instructions

Note: For packing instructions and supplies, see BM 7360738.

(Continued on next page.)

Packing Instructions (Continued)

CAUTION
The 3741 weighs 240 pounds (109 kg).

- Install the disk drive shipping blocks.
- 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.
  - Rear cover to legs.
  - Power cord to table top.
  - If a ID reader is installed on the 3741, tape it to the table top.
  - If a keylock is installed, place the key in an envelope and tape the envelope to the top of the mirror assembly.
- Place the 3741 on the shipping pallet and locate the 3741 glides in the shipping pallet recesses.
- Using the corner protectors, tape the 3741 to the shipping pallet with six wraps of nylon filament tape.
- Cover the 3741 with the polyethylene bag and apply the labels.

Specifications

Dimensions:

	F	S	H
Inches	42	25-1/4	34
Centimeters	107	64	87

Weight: 240 lb (109 kg)

Heat Output: 850 Btu/hr (215 kcal/hr)

Power Requirements:

kVA	0.4
Phases	1
Voltage	115,208, or 230 (±10%)

Environment Operating:

Temperature	60° to 90°F (16° to 32°C)
Relative Humidity	8 to 80%
Maximum Wet Bulb	73°F (23°C)

3741 Cleaning

For cleaning, use only a mild soap and water solution. Do not use IBM cleaning fluid.

3713 PRINTER INSTALLATION

Note: If your printer is a 3713, use this procedure; if it's a 3717, use the procedure in the 3717 MLM.

Installing the printer attachment circuitry and associated hardware allows a printer to function with the 3741 Data Station.

Be sure to read and perform the printer unpacking instructions.

Safety

Remove all electrical power from the machine by unplugging the mainline cord.

Cable Installation (Refer to page 15-8 for helpful graphics.)

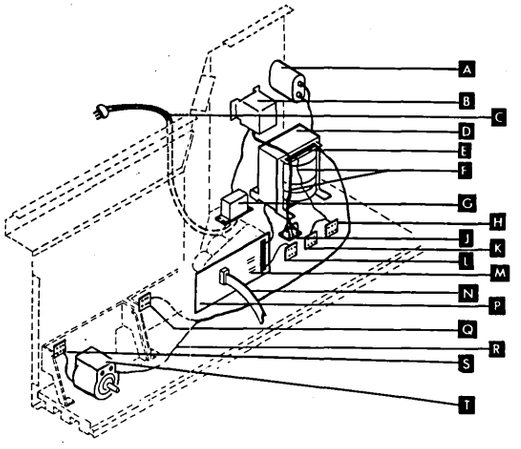
1. Remove safety shield from the power supply.
2. Loosen the screws and remove the power supply as far as the cables permit.
3. Route the printer attachment cables (part of the printer) through the hole in the bottom of the machine, (hole farthermost from the rear of the machine).

   If necessary to move the power supply to allow more working space, remove the dc distribution cable connector (2456461) from the power supply PS1 connector N and the frame ground wire.

   Excess cable length should not be stored in the printer cabinet.
4. Assemble cable clamp (2456397) to the printer attachment cables and the machine frame using screw (19944), and nut (257189). Attach the ground straps.
5. Route the printer signal cable (two cable arms with connectors 01CB or 1-P and 01CD or 1-R) to the logic gate. Use the existing clamps.
6. Plug the printer signal cable connector 01CB or 1-P to feature PC board socket 01CB or 1-P and cable connector 01CD or 1-R to socket 01CD or 1-R.
7. Refasten the power supply in its original location.

   If removed in step 3, reconnect the dc distribution cable connector to power supply connector PS1 and the frame ground wire.
8. Connect the connector end of the printer ac cable (2456479) to the printer attachment cable connector (six positions). K
9. Connect the connector end of the printer dc cable (2456483) into the twelve position connector of the printer power attachment cable. L
10. Mount the safety shield (from step 1) in front of the power supply.
11. Place the jumper, for the feature half planar position 1, on yes.
12. Close the logic gate and replace the back cover.

After the printer has been installed and located, return to page 16-1, step 4 under "power on check."



Test Procedure

1. Use the feature half planar checkout procedure MAP 7-4 of the 3741 MLM.
2. Use the printer, checkout procedure MAP 7-5 of the 3741 MLM.

COMMUNICATIONS INSTALLATION

BSCA (Binary Synchronous Communications Adapter), 1200 bps Line Adapter, Expanded Communications (EBSCA) Feature, and Multipoint Feature.

BEGIN

Power off

IS 1200 bps line adapter installed ?

Yes

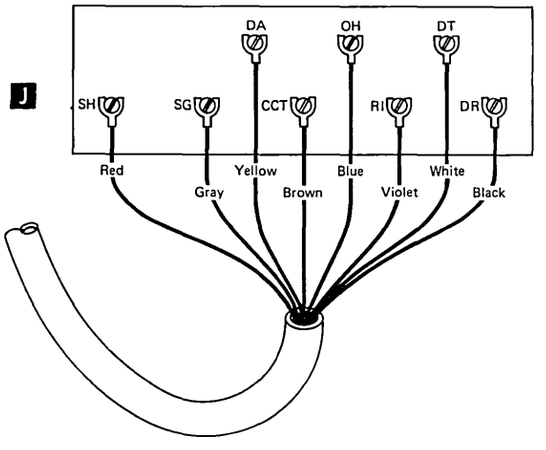
If 1200 bps Line Adapter (non-switched) is installed, adjust transmit level (page 16-7), place adapter board jumpering on autoanswer cards (page 16-8 C), and connect cable to line. If 1200 bps Line Adapter (switched) is installed, adjust transmit level (page 16-6) check jumpering on autoanswer cards (page 16-8 C), and have the customer arrange for connecting cable J to coupler. If WTC PSN feature is installed, have customer connect to telephone lines and then use the adjustment procedure on MAP 5-23.

No

Connect modem cable to modem

Place feature half planar jumpers in proper location for modems, communications facilities, and features installed (page 16-4).

Line Adapter Cable
(provided with IBM machine)



Is expanded communications installed ?

Yes

Is multipoint feature installed ?

Yes

Jumper desired polling address for this station on multipoint card (page 16-9 R . Note polling address on page 0-4.

No

Go to checkout 7-6

No

Go to checkout 7-9

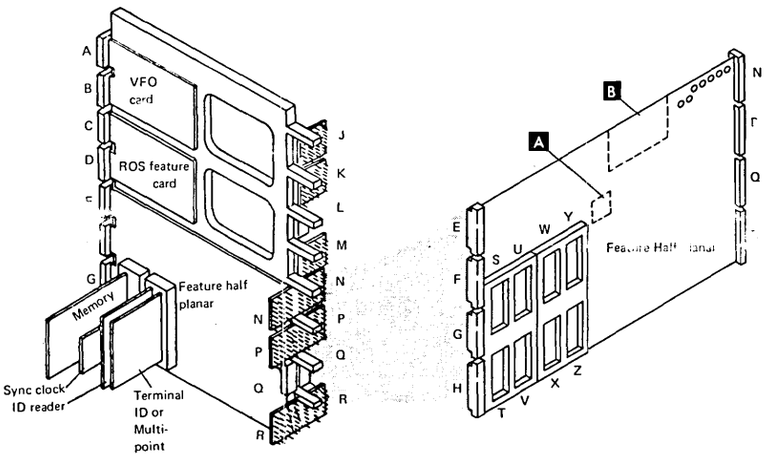
Feature Half Planar Jumpers

Key items for correct jumpering:

- All pin rows might not be present. Missing rows are labeled *none* in the chart.
- Machines with BSCA or EBSCA (Models 2 and 4) are the only ones having pins 2 through 8.
- Because row numbering does not always start at row 1, it is best to start counting from row 7, which always has 2 pins (BSCA and EBSCA machines).
- Record the jumpering for the machine on the chart for future reference.

The chart shows the jumpering for each 3741 model and printer combination. To use the chart, select the printer number (or no printer) in the first column. Then follow the row across the chart to the 3741 model number of this machine. For Models 2 and 4, select BSCA or EBSCA.

IBM modem cross referencing is shown on the facing page.



Printers:

3715 (jumper horizontally)
40 characters per second (cps) = 3715 – 1
80 cps = 3715 – 2
N = Printer is not installed.
Y = Printer is installed.

3717 Jumpering is not needed.

1. 3713
   No = Printer is not installed.
   Yes = Printer is installed.

2. BSCA speed select
   A = Low speed (600 bps).
   B = High speed (1200 bps) or baud select switch (WT) or modem clocking (1200, 2000, 2400 bps).

3. Keylock
   Yes = Keylock is installed.
   No = Keylock is not installed.

	B	A	B	A							
	3741 Models 1 and 3		3741 Models 2 and 4 (BSCA/EBSCA)								
		1		BSCA 1	2	3	4	5	6	7	8
No Printer				None	• A B	Yes No	C D	Yes No	E F	•	None
				EBSCA 1	2	3	4	5	6	7	8
				None	• A B	None	C D	Yes No	E F	•	No Yes
				BSCA 1	2	3	4	5	6	7	8
3713				No Yes	A B	Yes No	C D	Yes No	E F	•	None
		1		EBSCA 1	2	3	4	5	6	7	8
		No Yes		No Yes	A B	None	C D	Yes No	E F	•	No Yes
				BSCA 1	2	3	4	5	6	7	8
3715			40 cps 80 cps No Yes	None	A B	Yes No	C D	Yes No	E F	•	None
				EBSCA 1	2	3	4	5	6	7	8
	40 cps 80 cps No Yes		40 cps 80 cps No Yes	None	A B	None	C D	Yes No	E F	•	No Yes
				BSCA 1	2	3	4	5	6	7	8
3717	Jumper plugging is not needed on the 3717 because the jumpers are within the printer cables.			None	A B	Yes No	C D	Yes No	E F	•	None
				EBSCA 1	2	3	4	5	6	7	8
				None	A B	None	C D	Yes No	E F	•	No Yes

4. BSCA line control
   C (up position) = Connect data set to line (CDSTL). Normal for non-switched lines.
   D (down position) = Data terminal ready (DTR). Normal for switched lines.

BSCA line control determines in what order the data terminal ready interface line and the data set ready interface line are monitored at the EIA interface.

If jumper 4 is in position C (CDSTL), it will hold the 'data terminal ready' interface line in the off condition until it detects that either 'data set ready' or 'ring indicator' is on. The BSCA controller will then turn on the 'data terminal ready' interface line.

Connect data set to line philosophy is used on some WTC switched line modems. Turning on the 'data terminal ready' interface line after seeing 'ring indicator' come on causes the phone to be answered (autoanswer). If manual call or manual answer is used, pushing the data button causes 'data set ready' to come on. The BSCA controller then must turn on the 'data terminal ready' interface line to hold the connection. Turning on the 'data terminal ready' interface line before the call is made or answered causes the modem to seize the line connection thereby disabling the hand set.

The 3741 also uses this position for non-switched line modems where 'data set ready' is ON all the time. This will bypass the check for 'data set ready' being OFF before proceeding in communications (3872 non-switched, WE 202D3, WE 201B3).

If jumper 4 is in position D (DTR), the BSCA controller uses a different sequence. It first checks 'data set ready' to see if it is OFF before it will turn the 'data terminal ready' line on. If data set ready is on when data terminal ready is OFF, an error condition is assumed and the operation ceases. (This is why position C must be used if data set ready is always ON.) If data set ready is OFF, the BSCA controller will turn the 'data terminal ready' line ON. In this case, the 'data terminal ready' interface line conditions the modem for autoanswer or data mode. After the modem does autoanswer or the operator pushes the data button on, the modem turns on 'data set ready' and communication proceeds (3872 switched, WE202C9, WE201A3).

Do not confuse the 'data terminal ready' position (down position) of the jumper with the 'data terminal ready' interface line. They are not physically connected. The jumper position merely determines in what sequence the interface lines are manipulated by the BSCA controller.

5. Send answertone
   Yes = Data terminal must send answertone (WT only, where data terminal is required to send answertone).
   No = Data terminal does not send answertone (modem generates answertone).

6. BSCA line facility
   E (up position) = Switched
   F (down position) = Non-switched

The BSCA controller makes the following changes based on this jumper:

Switched (up position)

- Controller sends line bids (ENQ) if the M key was used in the setup. Waits for line bid if M key was not used.
- Controller will retry 15 times when sending line bids.
- Controller will wait only 20 seconds to receive line bids.
- Controller will send DISC (DLE EOT) sequence before disconnecting.
- Controller can be called to restart communications on a recoverable error that has caused communications to terminate.

Non-switched (down position)

- Controller sends line bids (ENQ) if in T, P, B or D mode. Waits for line bids if R mode.
- Controller will retry infinitely to send line bids.
- Controller will wait forever to receive line bids.
- Controller does not send DISC.
- Operator intervention is required on error condition that has terminated communications.

7. ID reader test pins
   No jumper required.

8. Multipoint installed
   No = Multipoint feature not installed.
   Yes = Multipoint feature is installed.

   Note: All jumper positions might not be present.

IBM Modem Cross-Reference

Modem	Speed Select	CDSTL/ DTR	Send Answer-tone	Non-switched/ Switched	Sync Clock Required
Jumper	2	4	5	6	–
IBM 3976-III	B	D	No	E	Yes
IBM 3976-III	B	C	No	F	Yes
IBM 3872	B	D	No	E	No
IBM 3872 1200 bps	B	C	No	F	No
Line Adapter 1200 bps	B	C	No	F	Yes
Line Adapter WTC PSN	B	D	No	E	Yes
Line Adapter System/3	B	C	Yes	E	Yes
LCA System/3	B	C	No	F	No
Local EIA RPQ	B	C	Yes	F	No

Note: DTR – Data Terminal ready
CDSTL – Connect data set to line

Switched Line Transmit Level Adjustment Procedure

The transmit level must be adjusted at the transmit card H to match the level specified for the data coupler. Also, the autoanswer basic card must be jumpered for that same transmit level (page 16-8 C).

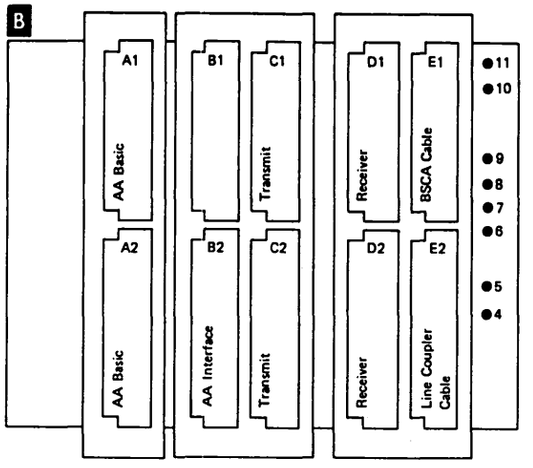
Adjust the transmit output:

(Place line adapter in service position, page 16-8 A).

1. Turn off the 3741 mainline power.
2. Disconnect the line coupler cable from line adapter board E2 B .
3. On the dB meter:
   a) Set the 2W-4W TRANS/REC switch to TRANS.
   b) Set the BRIDGING 600, 324 switch to 600.
4. Remove the autoanswer interface card from line adapter board B2.
5. Jumper line-adapter-board pins 6, 7, 8, and 9 together B . This causes 'data tip' to be grounded, 'request to send' to be on, and the transmitter to be unclamped.
6. Jumper line-adapter-board pins 4 and 5 together to turn on 'data set ready' B .
7. Connect the dB meter's black line terminal to pin 10, and red line terminal to pin 11 B .
8. Turn power on the 3741 and the dB meter.
9. Adjust R3 on the transmit card to attain the correct transmit level reading on the dB meter scale H .
10. Power down.
11. Remove the jumpers from the line-adapter-board pins B .
12. Reinstall the autoanswer interface card in line adapter board B2 B .
13. Reconnect the line coupler cable to line adapter board E2 B .
14. Return to installation flowchart 16-3.

If transmit card 5863763 is used and transmit level must be kept below -1.8 dBm (most WT applications), do not use any jumper on the transmit card H . If transmit level above -1.8 dBm is desired, two program pins on card should be jumpered together before adjusting pot for transmit level. This note applies only to card 5863763 not card 5862858. (Leave jumper installed.)

B

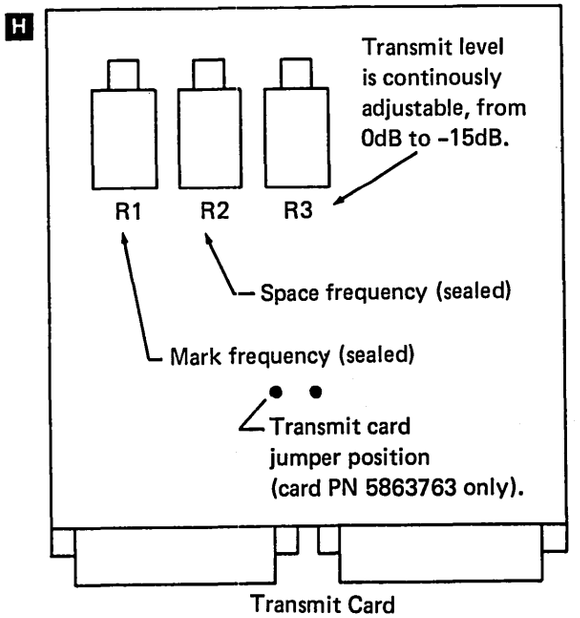


Switched Line Adapter Board

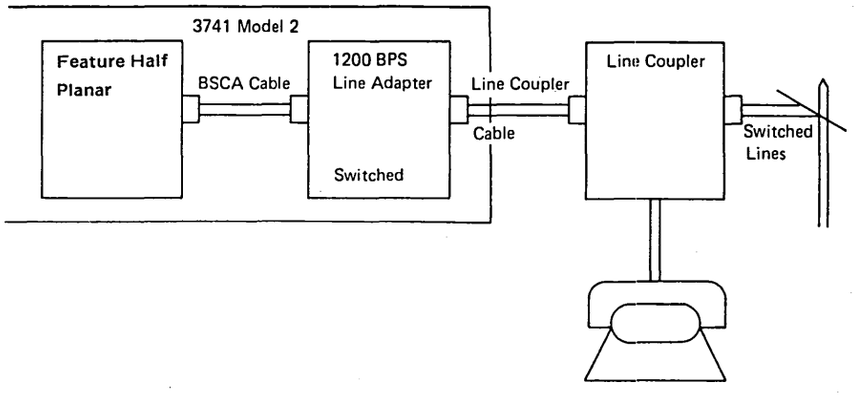
Line Coupler Cable

Line Adapter	Cable		Coupler
D05	Data Tip	(DT)	White
D07	Coupler Cut Through	(CCT)	Brown
D09	Signal Ground	(SG)	Gray
B05	Ring Indicate	(RI)	Violet
B07	Switch Hook	(SH)	Red
B08	Data Modem Ready	(DA)	Yellow
B12	Data Ring	(DR)	Black
B13	Off Hook	(OH)	Blue

H



Transmit Card



G Non-switched (Leased) Line Transmit Level Adjustment Procedure

Direct attachment to a leased line usually requires a zero dB transmit level.

Place line adapter in service position (page 16-8 A).

Adjust the transmit output:

1. Turn off the 3741 mainline power.
2. Disconnect the communication line plug and insert it into the TRANS/REC jack in the dB meter cover. X
3. On the dB meter:
   a) Set the 2W-4W TRANS/REC switch to TRANS.
   b) Set the BRIDGING 600, 324 switch to 600.
   c) Jumper the line terminals on the cover to the line terminals on the meter.
4. Jumper line-adapter-board pins 4, 5, and 6 together to unclamp the transmitter and turn on 'request to send.' B
5. Turn power on the 3741 and the dB meter.
6. Adjust R3 on the transmit card to attain the zero dB output level on the meter scale. H
7. Power down.
8. Remove the jumpers from the line-adapter-board pins. B
9. Reconnect the communication line plug.
10. Return to installation flowchart 16-3.

If transmit card 5863763 is used and transmit level must be kept below -1.8 dBm (most WT applications), do not use any jumper on the transmit card H . If transmit level above -1.8 dBm is desired, two program pins on card should be jumpered together before adjusting pot for transmit level. This note applies only to card 5863763 not card 5862858. (Leave jumper installed.)

D Non-switched Line Adapter Board Jumpering

Jumpers are provided for selection of:

2-wire or 4-wire line
25, 75, or 200 ms clear to send delay

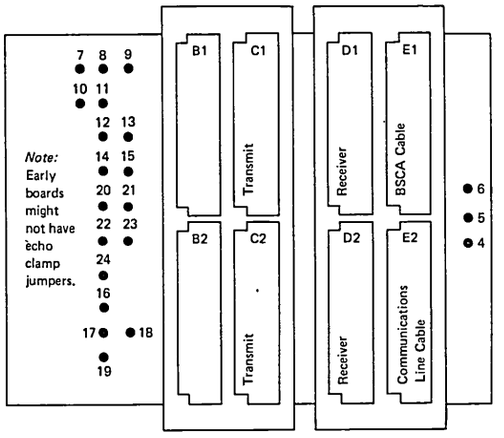
On very short lines, or lines without echo suppressors, the shorter clear to send delays may be used.

On the line adapter board B place the following jumpers:

2 Wire - 4 Wire

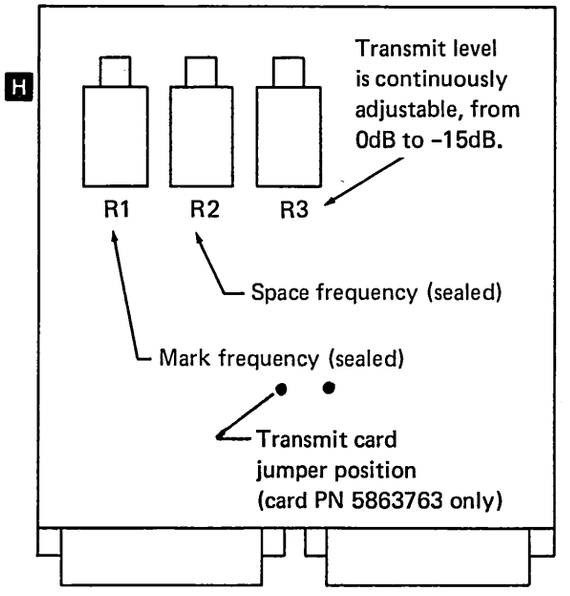
For 2 Wire	For 4 Wire
8 to 9	7 to 8
12 to 13	10 to 11
14 to 15	

Use		With	
Echo Clamp Delay	Jumpered	Clear to Send (CTS) Delay	Jumpered
130 ms	20 to 21 and 22 to 23	200 ms	17 to 19
50 ms	20 to 21 and 22 to 24	75 ms	17 to 18
0	22 to 23	25 ms	17 to 16

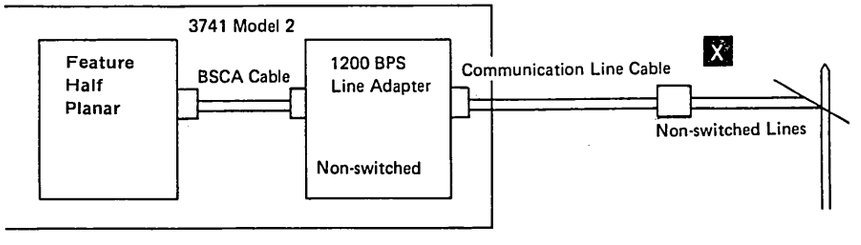


Non-switched (Leased) Line Adapter Board B

CAUTION
The short delay combinations might cause intermittent echo problems.



Transmit Card



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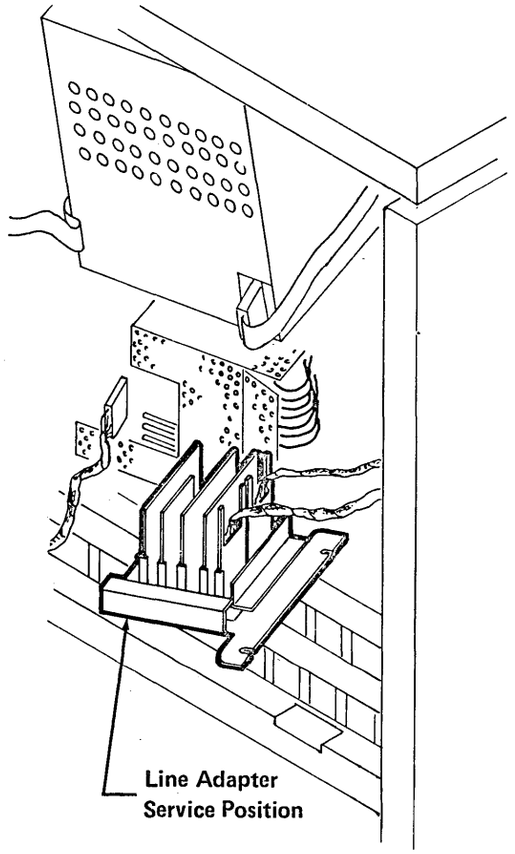
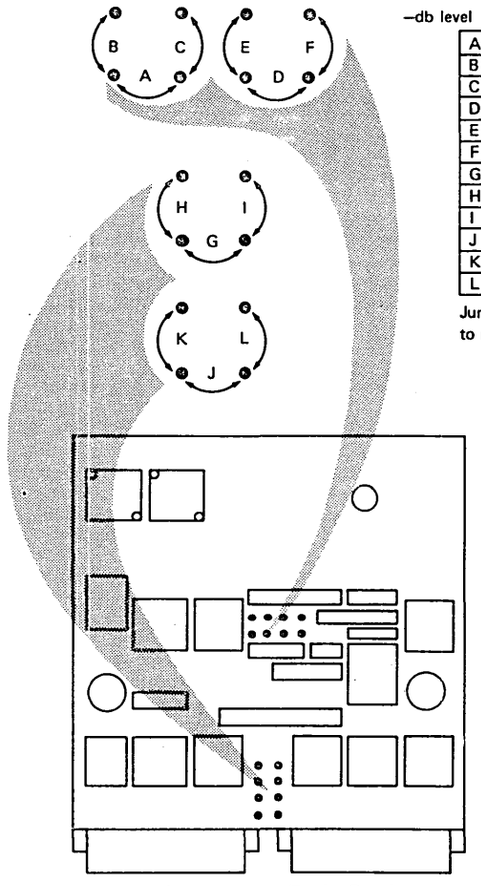
Date	9/15/74	8/1/75		

A **1200 bps Line Adapter Service Position**



C Autoanswer basic card must be jumpered to same level as transmit card was set.

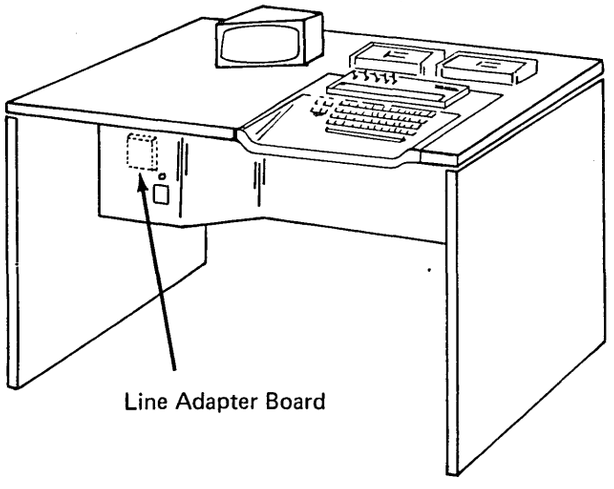
Autoanswer interface card must be jumpered as shown.

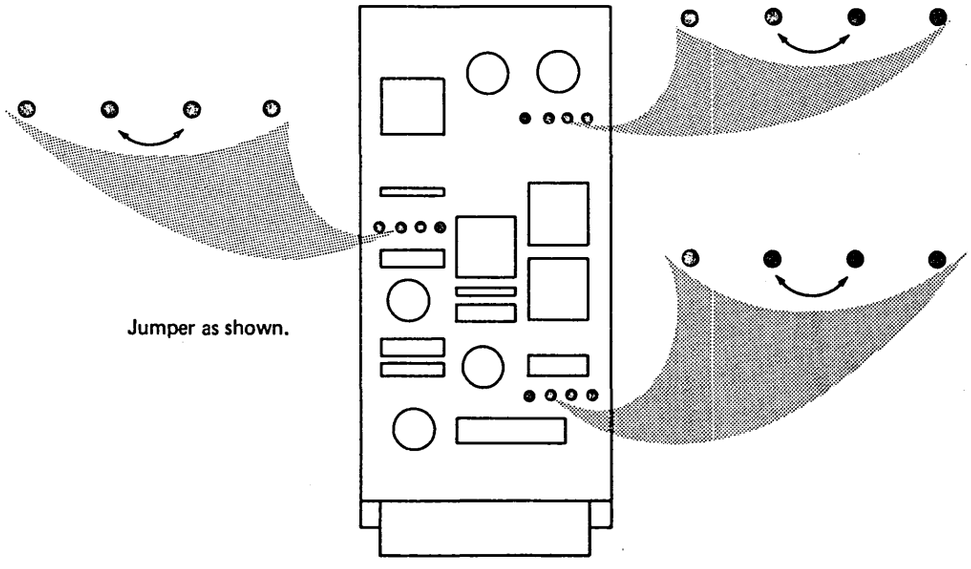


Autoanswer Basic Card.

–db level	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15
A	X		X		X		X		X		X		X		X	
B		X		X		X		X		X		X		X		X
C		X		X		X		X		X		X		X		X
D	X	X			X	X			X	X			X	X		
E			X	X			X	X			X	X			X	X
F			X	X			X	X			X	X			X	X
G	X	X	X	X					X	X	X	X				
H					X	X	X	X					X	X	X	X
I					X	X	X	X					X	X	X	X
J	X	X	X	X	X	X	X	X								
K									X	X	X	X	X	X	X	X
L									X	X	X	X	X	X	X	X

Jumper the attenuator pins in accord with this chart, to match level requirements of the line coupler.

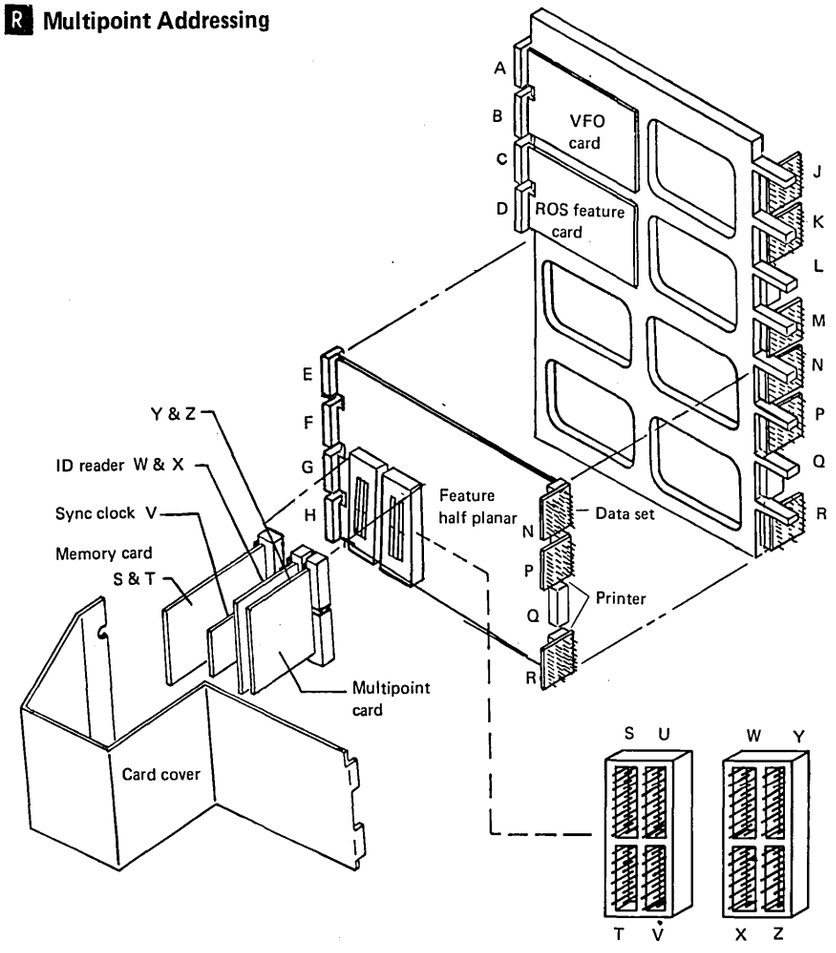


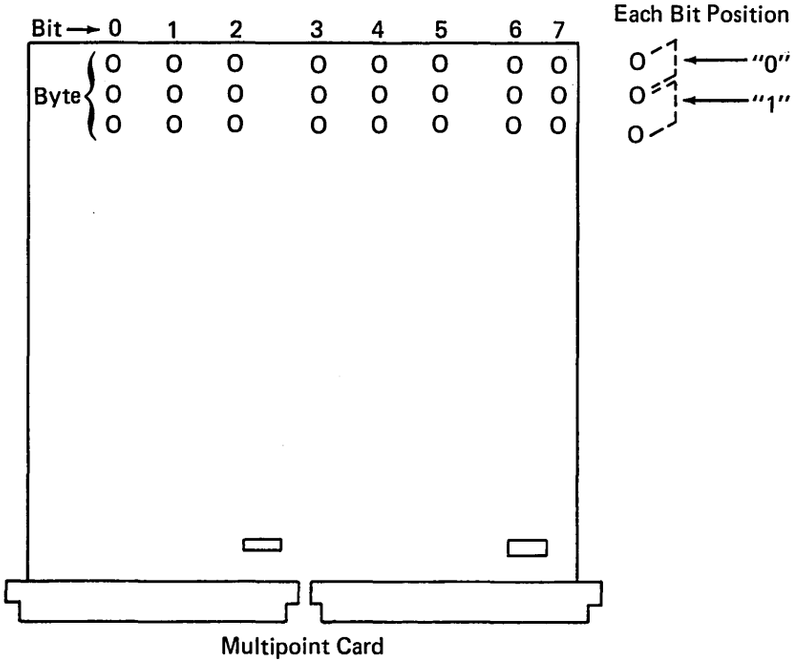


Jumper as shown.

Autoanswer interface card.

R Multipoint Addressing





For a given polling character, the corresponding select character is defined.

Poll Char	Poll Hex	Sel Hex	Binary	Poll Char	Poll Hex	Sel Hex	Binary
	C0	80	1100 0000		E0	A0	1110 0000
A	C1	81	1100 0001		E1	A1	1110 0001
B	C2	82	1100 0010	S	E2	A2	1110 0010
C	C3	83	1100 0011	T	E3	A3	1110 0011
D	C4	84	1100 0100	U	E4	A4	1110 0100
E	C5	85	1100 0101	V	E5	A5	1110 0101
F	C6	86	1100 0110	W	E6	A6	1110 0110
G	C7	87	1100 0111	X	E7	A7	1110 0111
H	C8	88	1100 1000	Y	E8	A8	1110 1000
I	C9	89	1100 1001	Z	E9	A9	1110 1001
	CA	8A	1100 1010		EA	AA	1110 1010
	CB	8B	1100 1011		EB	AB	1110 1011
	CC	8C	1100 1100		EC	AC	1110 1100
	CD	8D	1100 1101		ED	AD	1110 1101
	CE	8E	1100 1110		EE	AE	1110 1110
	CF	8F	1100 1111		EF	AF	1110 1111
	D0	90	1101 0000	0	F0	B0	1111 0000
J	D1	91	1101 0001	1	F1	B1	1111 0001
K	D2	92	1101 0010	2	F2	B2	1111 0010
L	D3	93	1101 0011	3	F3	B3	1111 0011
M	D4	94	1101 0100	4	F4	B4	1111 0100
N	D5	95	1101 0101	5	F5	B5	1111 0101
O	D6	96	1101 0110	6	F6	B6	1111 0110
P	D7	97	1101 0111	7	F7	B7	1111 0111
Q	D8	98	1101 1000	8	F8	B8	1111 1000
R	D9	99	1101 1001	9	F9	B9	1111 1001
	DA	9A	1101 1010		FA	BA	1111 1010
	DB	9B	1101 1011		FB	BB	1111 1011
	DC	9C	1101 1100		FC	BD	1111 1100
	DD	9D	1101 1101		FD	BD	1111 1101
	DE	9E	1101 1110		FE	BE	1111 1110
	DF	9F	1101 1111		FF	BF	1111 1111

Binary value jumpered on card
Select character in HEX
Poll character in HEX
Poll character

Select a unique poll character for your 3741 and jumper the binary representation on the multipoint card. The poll sequence will then be that character sent twice followed by ENQ. The select sequence will be the corresponding select character sent twice followed by ENQ.

DATA RECORDER OR I/O ADAPTER ATTACHMENT INSTALLATION

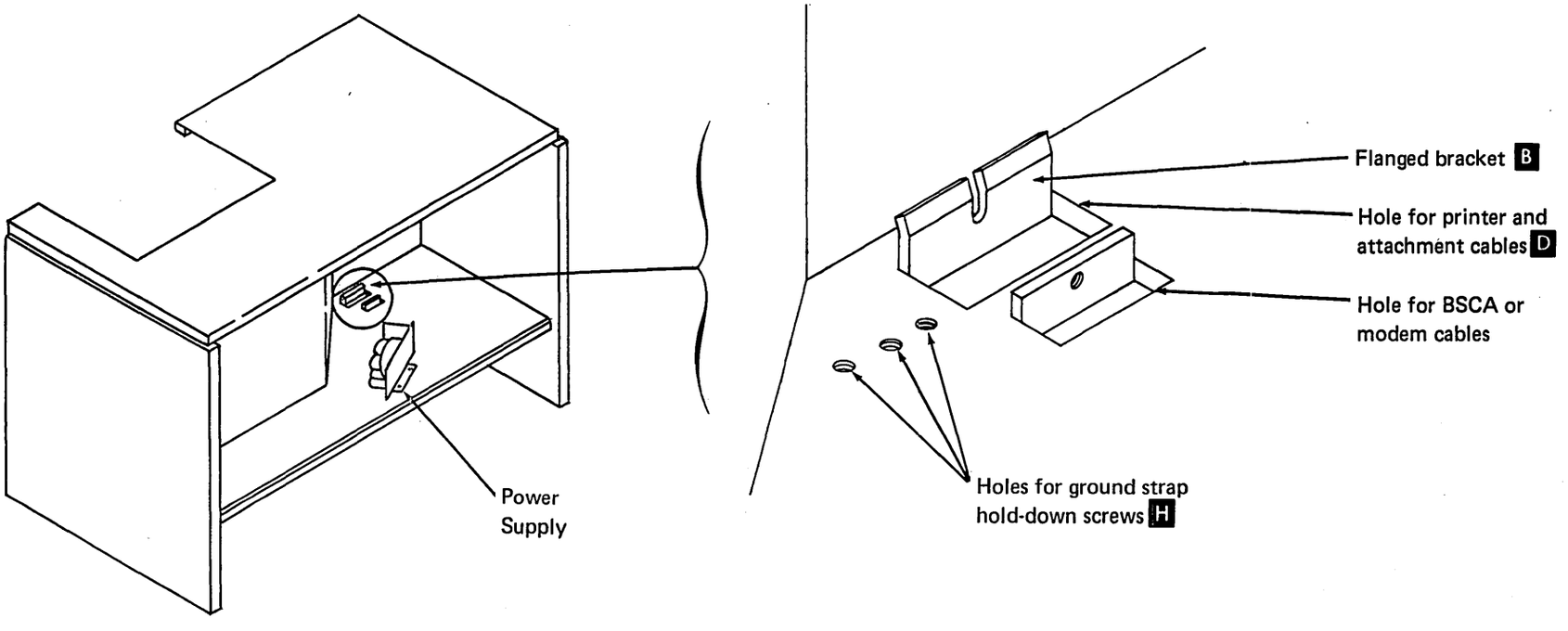
Installing the data recorder or I/O adapter attachment circuitry and associated hardware allows a data recorder or I/O adapter to function with the 3741 Data Station. Normally, only the cable at the remote end must be installed.

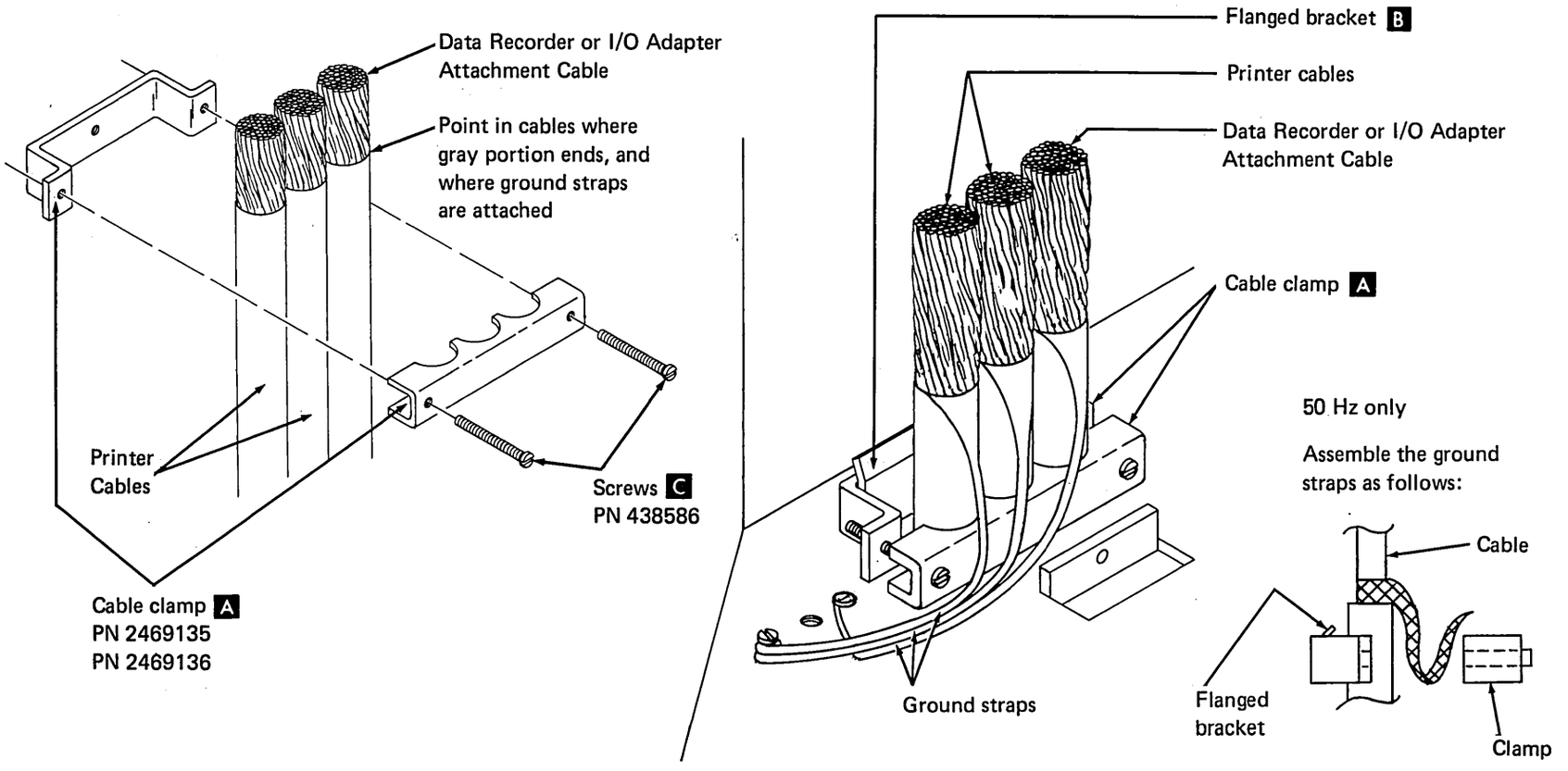
Safety

Remove all electrical power from the machine by unplugging the mainline cord.

Cable Installation at 3741 (Normally Installed at the Factory)

1. Remove the back cover of the 3741 and open the gate.
2. Remove the safety shield from the power supply.
3. Loosen the two screws holding the power supply and disconnect the power supply ground strap. Then move the power supply as far as the cables will allow.
4. If a printer has not been attached, skip to step 7.
5. Remove the screw and nut from the cable clamp and remove the printer attachment cable ground straps.
6. Pull all of the gray covered portion of the printer attachment cables out of the machine.
7. Route the data recorder or I/O adapter attachment cable, one paddle at a time, through the hole **D** and to the right of the printer cables **E** if there. This is a tight fit with the printer cables inserted.
8. Pull the data recorder or I/O adapter attachment cable through the hole until the gray portion is about a foot inside the machine.
9. If a printer has not been attached, skip to step 11.
10. Pull the gray portion of the printer cables about a foot inside the machine.
11. Loosely assemble the cable clamp **A** to the cable or cables, just get the two screws **C** started. The data recorder or I/O adapter cable goes to the right of the printer cables. See 50 Hz note **F** .
12. Pull the cables back out of the machine until the cable clamp rests on the flanged bracket **B** .
13. Slide the cable clamp over the flanged bracket and secure it by tightening the two screws **C** .
14. Screw the ground straps to the machine base.
15. Route the cable or cables behind the power supply (toward the machine front).
16. Refasten the power supply in its original position.
17. Screw the power supply ground strap on the base.
18. Mount the power supply safety shield removed in step 2.





Attachment Half Planar Installation (Normally Installed at the Factory)

1. Remove the bar and card cover from the gate.
2. Remove the VFO and ROS feature cards. Do this by removing the cross connectors from planar sockets 1-A, 1-B, 1-C, and 1-D. Then remove all canoe paddle clips.
3. If the feature half planar is installed, remove the canoe paddle clips from along its top edge.
4. Attach the cable interface connectors (2731011) to the attachment half planar sockets A and B. This is where the 1-J and 1-K positions will be when the 1/2 planar is installed.
5. Install the attachment half planar in the gate. It goes in the top half of level 1 (504Q).
6. Reconnect the cross connectors at planar sockets 1-A, 1-B, 1-C and 1-D.
7. Install the new cross connectors (1809903) at planar sockets 1-M and 1-L. The power cable going to socket 2-M will have to be unplugged and replugged after the 1-M cross connector is installed.
8. Attach the attachment cable at 1-J and 1-K.
9. Put the card guides on the VFO and ROS feature cards and install the VFO card (504). Then install, if used, the ROS feature card (504). These cards for the data recorders are backward from the SLD usual card positions.
10. Install the bar on the gate; then install the card covers.
11. Close the gate and install the machine back cover.

Cable Installation at Data Recorders

1. Remove the 129 back cover or the 5496 front cover.
2. Remove the screen covering the hole in the machine bottom that covers the data recorder cable entrance.
3. Install the cable into the data recorder and screw it into place (see the theory-maintenance manual for the data recorder to find the feature plug location).
4. Attach the data recorder cable ground strap to the data recorder frame and reinstall the screen covering cable entrance.
5. Reinstall the covers.

Cable Installation at System/3

Refer to the I/O adapter part of the System/3 installation procedures.

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GLOSSARY

AC, ac—Alternating current.

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.

Amplifier—A device to expand something, or make it greater, or more intense; as sound, power, or force.

Analysis—A study of the content of, or reason for, something.

Anode—The collector element in an electronic tube.

Assume—To accept as correct.

Assumption—The act of assuming.

Audio Response—The sound produced by the clicker.

Auto Feedback Device—A mechanical and electrical device producing an audible signal to the operator that a key entry was accepted by the machine.

Autoanswer—Automatic answer.

Bad Spot—(I/O Adapter only) A diskette sector on which data cannot be recorded (the area is damaged or defective). This area is indicated by a control address mark and an F in the first position of the data field.

BOE—Beginning of Extent: A 5-character field (positions 29 through 33) which identifies the position of the first record of the data set.

Boundary—Something that indicates, or fixes, a limit or extent.

BPS—Bits 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.

Cathode—The emitter element in an electronic tube.

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.

Contaminate—To make less useful by introducing undesirable elements.

Contamination—That which contaminates.

Control Address Mark—An indicator (to the hardware) that precedes the data field of a record on the diskette.

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.

Create—Make.

Crossfoot Total—Add a group of numbers in several different orders to make sure the total is correct.

CRT—Cathode Ray Tube.

CPU—Central Processing Unit.

Dampen—Make moist.

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.

DC, dc—Direct current.

Deleted Record—A diskette sector from which data has been deleted. This area is indicated by a control address mark and a D in the first position of the data field.

Desensitize—Make less able to sense.

Deserialized—Signals received one after another are made into characters.

Disconnect—Take apart physically or electrically.

Disk—A flat circular object.

Diskette—A soft disk in a paper cover.

Display Viewer—The display viewer reflects the display unit information to the operator.

DTR—Data Terminal Ready.

DSR—Data Set Ready.

EBCDIC—Extended Binary Coded Decimal Interchange Code.

EBSCA—Expanded Binary Synchronous Communications Adapter.

EC—Engineering Change.

ECA—Engineering Change Announcement.

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 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.

FE—Field Engineering.

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.

Fuzzy—Not clearly readable.

Gross—Large, immediately seen.

Hash Total—A sum of fields used only for checking of one or more other fields. The 3741 field totals feature provides the ability to create a 'Hash Total' for a group of records.

Hex—Hexidecimal Code.

History—A record of.

ID—Identification.

IDR—Identification Reader.

Initialize—Make a blank disk useful by writing on it certain data out of ROS.

Intermittent—Coming and going at intervals.

IR—Incident Report.

Jittery—The display unit information is hard to read because it moves up and down and side to side.

Keying—Entering data through a keyboard.

KBD—Keyboard.

Label—A descriptive word or phrase.

LED—Light Emitting Diode: Activates the phototransistor which detects index pulses on the disk unit.

Linkup—Connection.

Lint—Short cloth fibers.

Load (a diskette)—Close a disk drive cover (with a diskette in the drive).

Log Out—Additional status information, displayed on the bottom line of the CRT, during BSCA communications.

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.

Measure—Use IBM CE multimeter, PN 452796.

Medium—The disk.

Memory—A high density field effect transistor (FET) memory, used by the microprocessor unit (MPU).

Mismatch—Not alike, different.

MPU—A microprocessing unit which receives, controls, and manages the flow of information for the machine.

Original (keyboard or disk drive)—The unit located at the station with the reported fault.

Other (keyboard or disk drive)—The opposite of the original keyboard or disk drive.

Overheated—Too hot.

PC Board—A printed circuit board is an electrical circuit mounted on a board to distribute signals and voltages.

Periodically—At the end of each regulated equal length of time.

Planar Board—The microprocessing unit electronic board.

PN—Part number.

POR—Power On Reset: A signal occurring during power on, used to reset all circuits to an operational starting point.

Power Down—Turn the power switch off.

Power Up—Turn the power switch on. Always wait at least 5 seconds after a power down before powering up to allow for proper power on reset (POR).

Premature—Too soon; before the proper time.

Probe—Use IBM Universal Logic Probe, PN 453212.

Prong—A thin projection.

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.

Reconnect—Put back together physically or electrically.

Record—A consecutive string of 128 or less bytes (characters) on the disk. Some or all of the characters may be blank.

Recover—Bring back, or get back.

Remove (a diskette)—Take the diskette out of the disk drive.

Replace—Put a new part in place of original part.

Reinstall—Put original part in place of a new part.

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.

RFT—Request for Test.

Ripple—Unsteady, irregular, wavy.

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.

R/W—Read/Write.

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.

Symptom— An indication.

Sync—Synchronous, or synchronize.

TTL—Transistor-Transistor Logic.

TP—Test Point.

Unload (a diskette)—Open the disk drive cover (does not mean remove).

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.

Update—To bring up to date; to make current.

Vac—Volts ac.

Vdc—Volts dc.

VFO-Video Frequency Oscillator.

Vibrate—To rapidly change from one form, or position, or state, to another, as a bell vibrates when struck.

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.