

IBM

Field Engineering
Maintenance Diagrams

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2821 Integrated Control Unit

63 sheets
~170 pages

Second Edition December, 1968

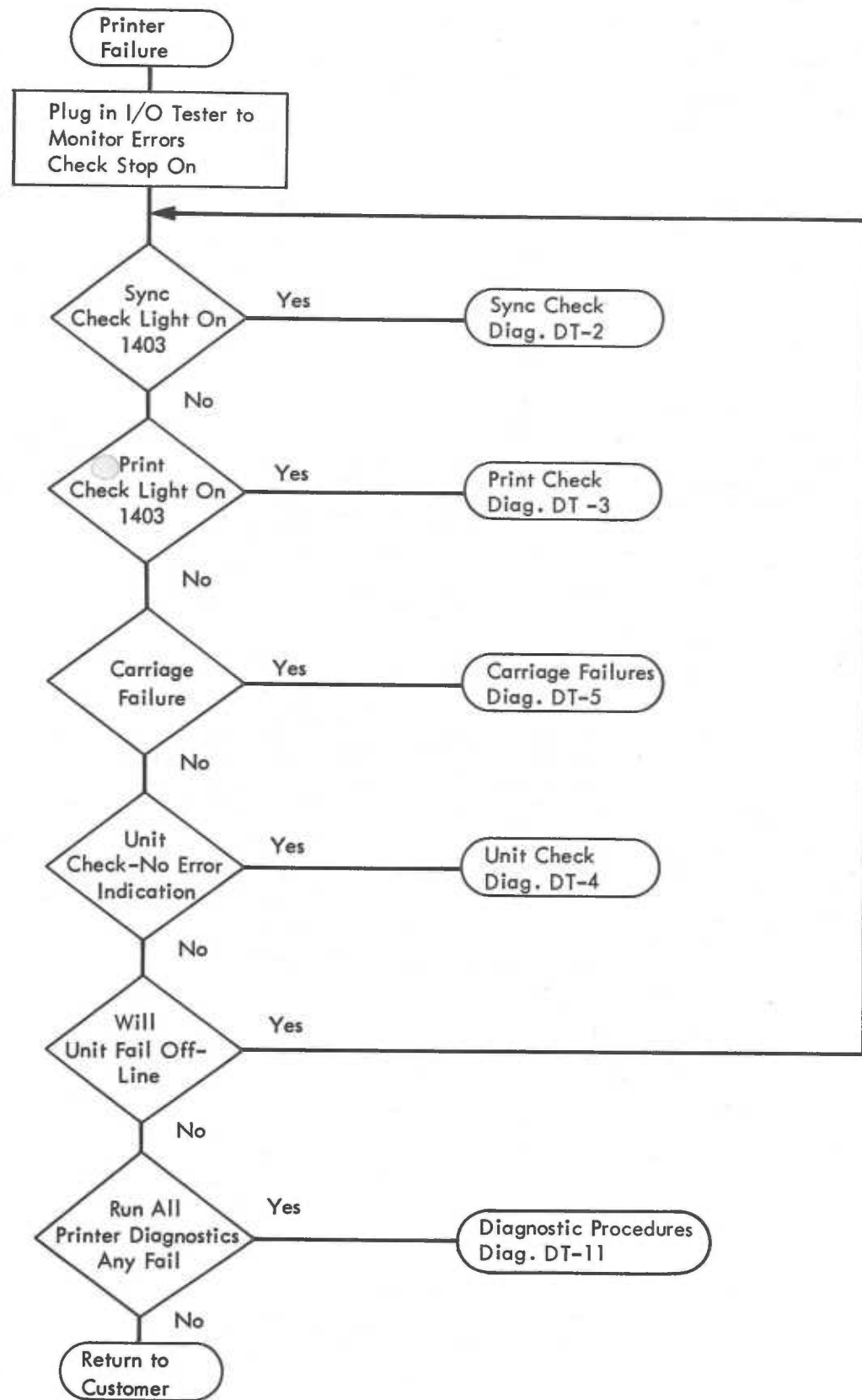
This is a reprint of Y24-3503-0 incorporating changes released in FE Supplement to EC level 131804, Form Number Y24-0077, dated May 5, 1968 and FE Supplement to EC level 125674, Form Number Y24-0061 dated September 22, 1967.

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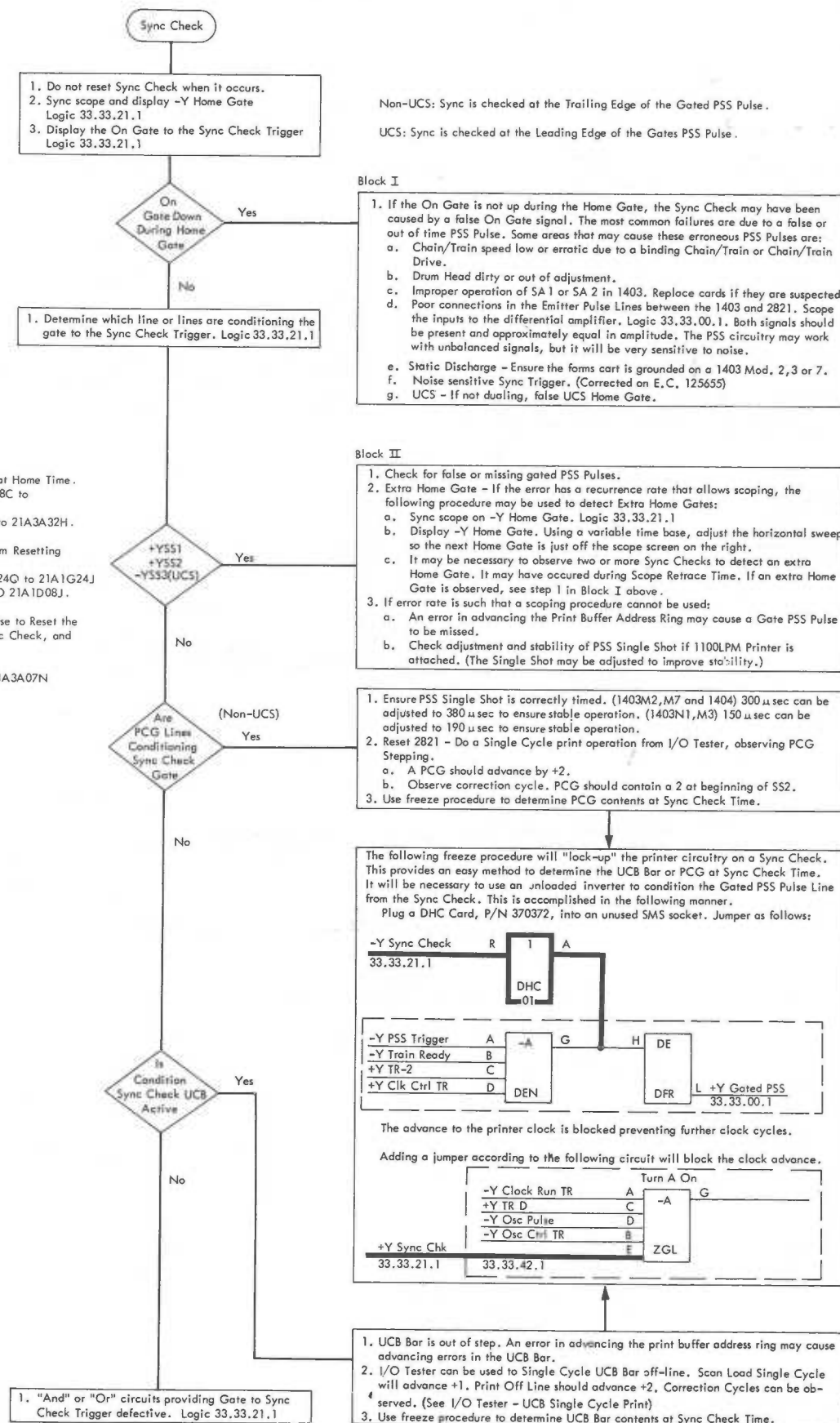
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Address comments regarding this publication to this address.

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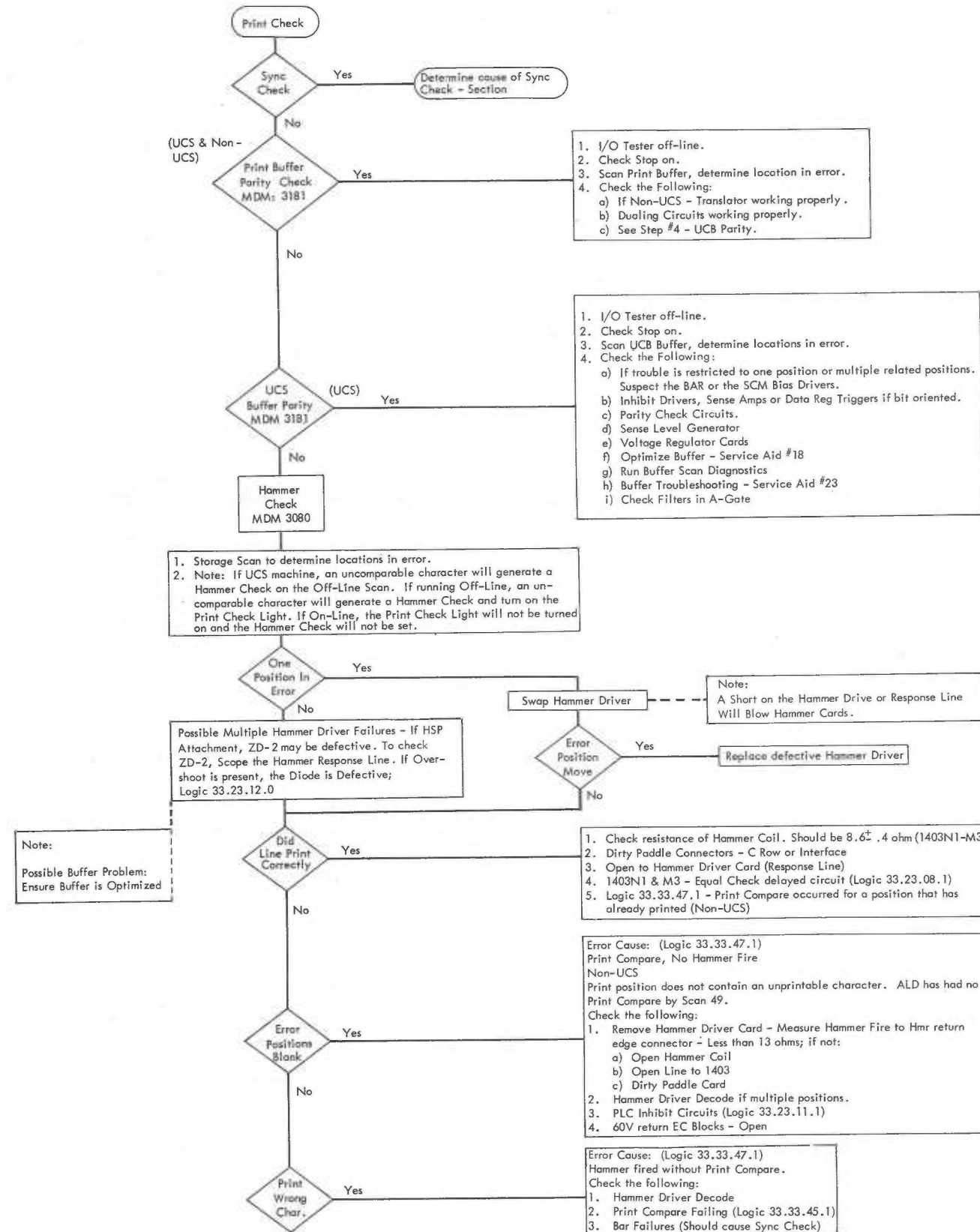
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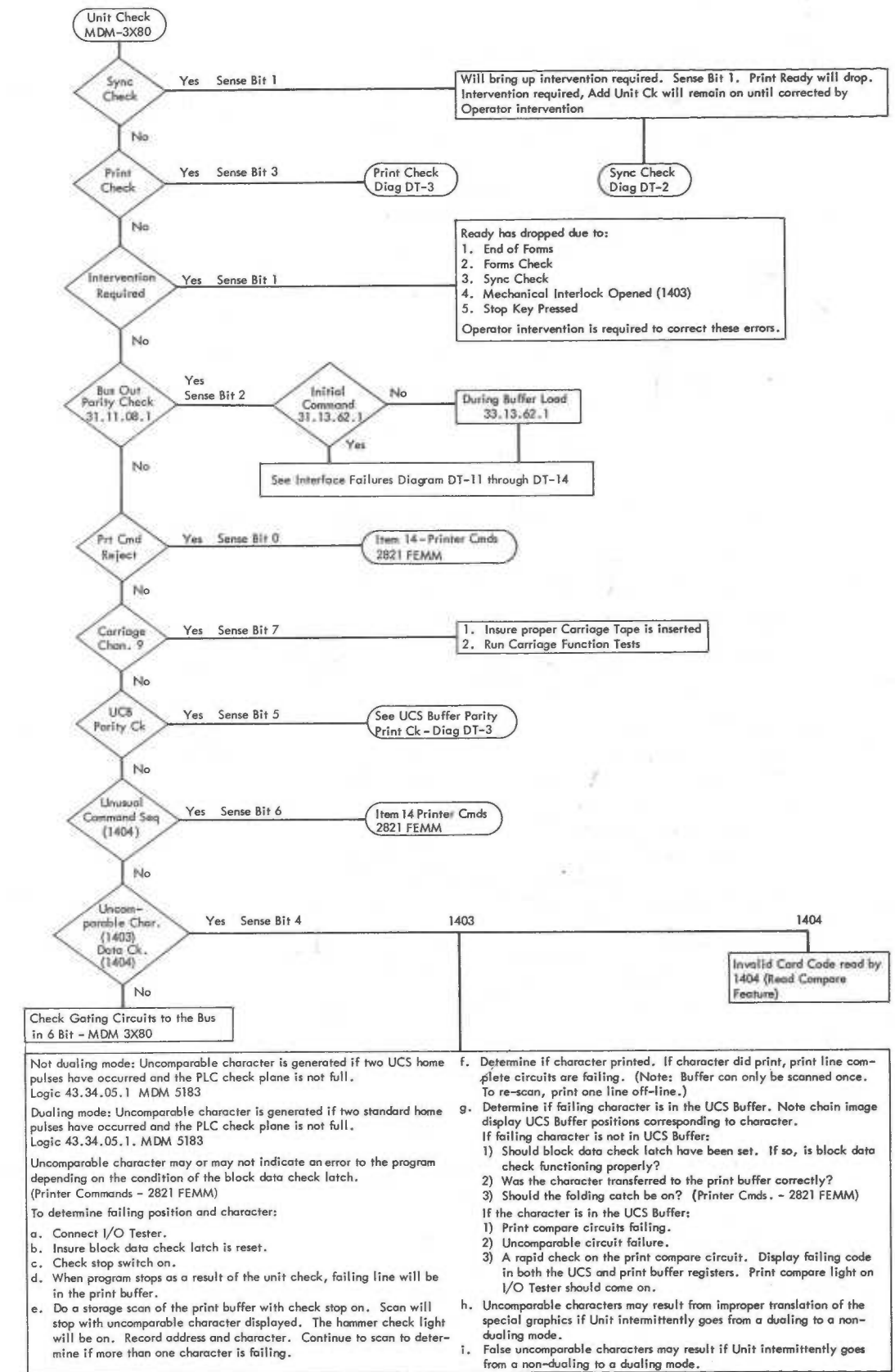
DT-1 Printer Error Analysis



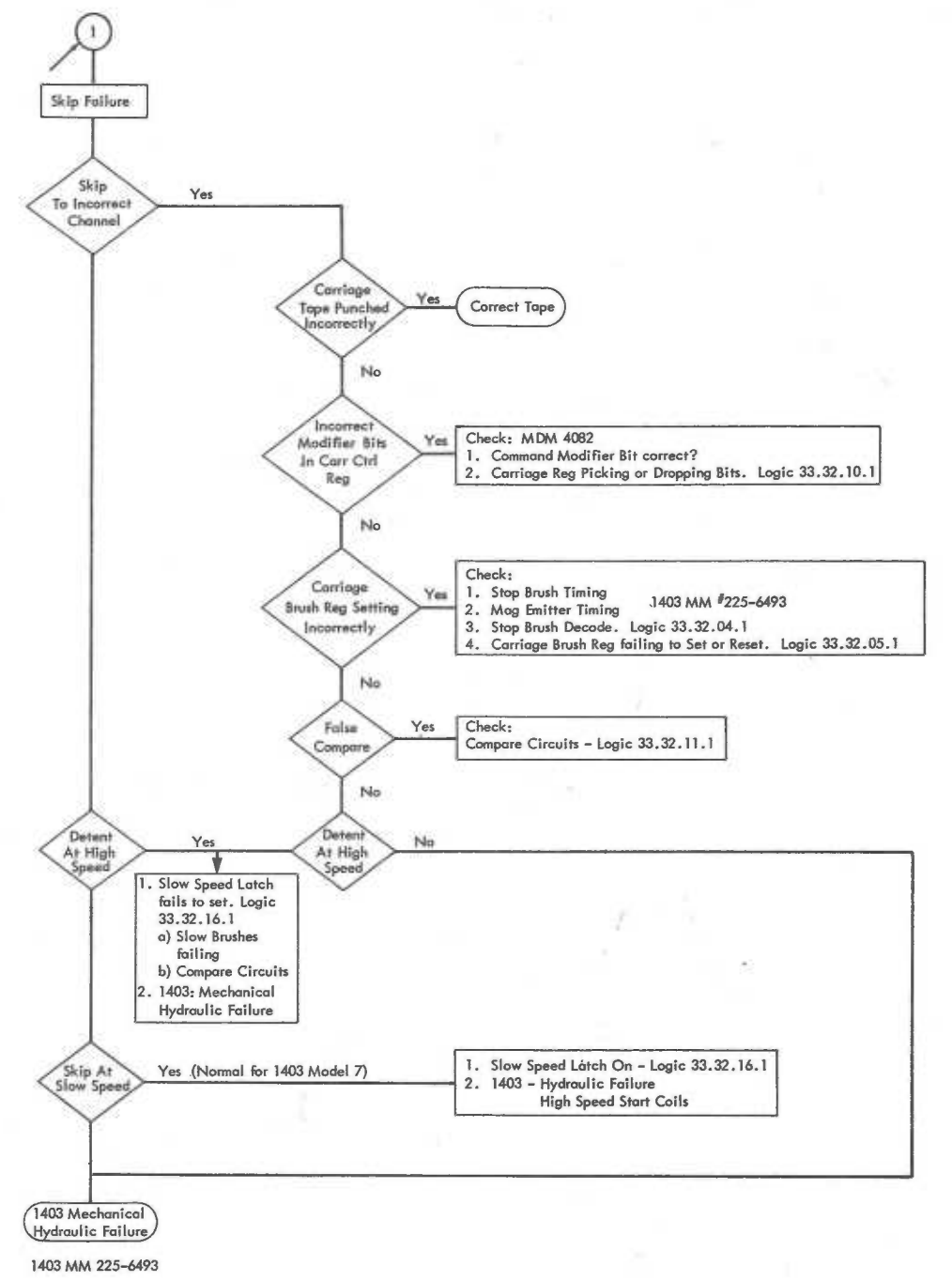
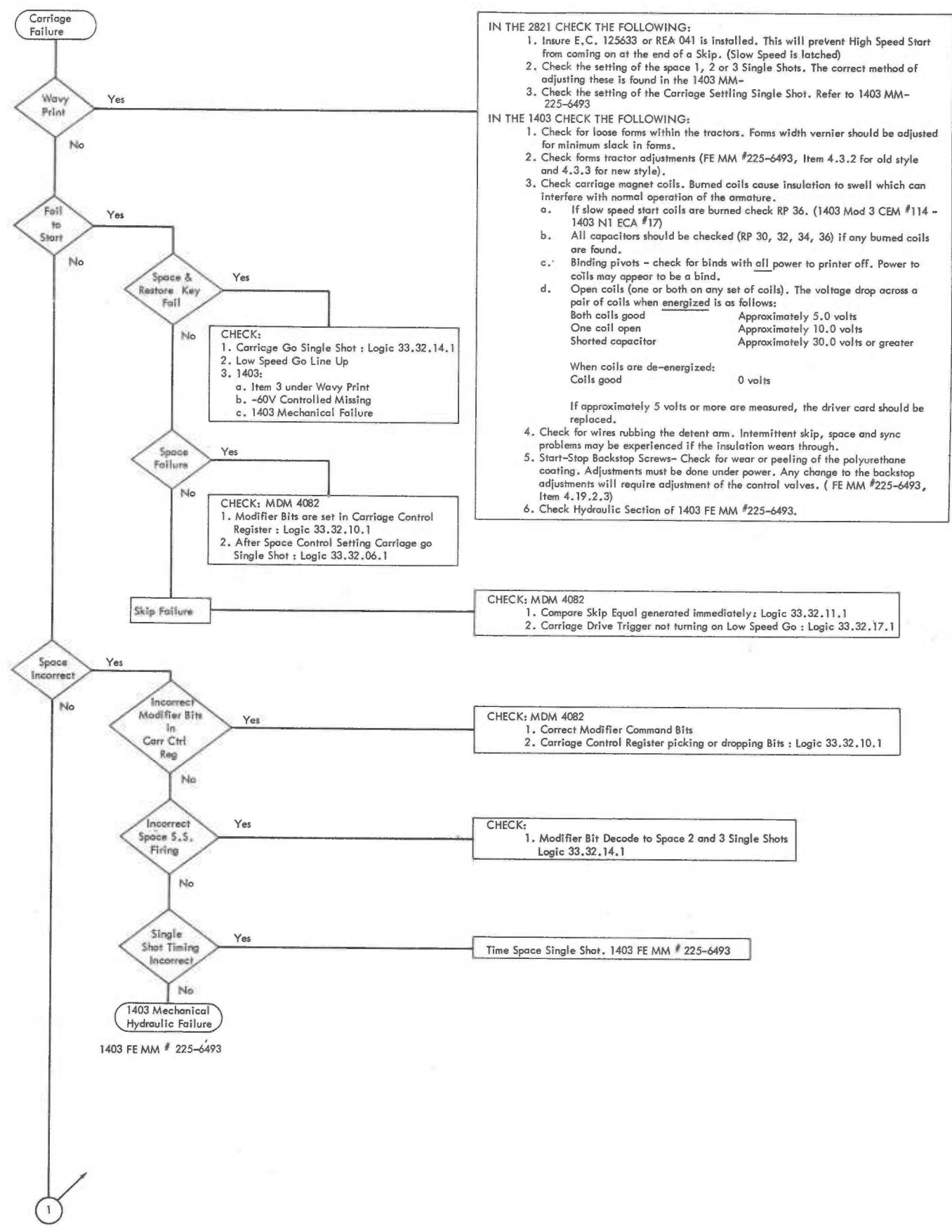
DT-2 Sync Check



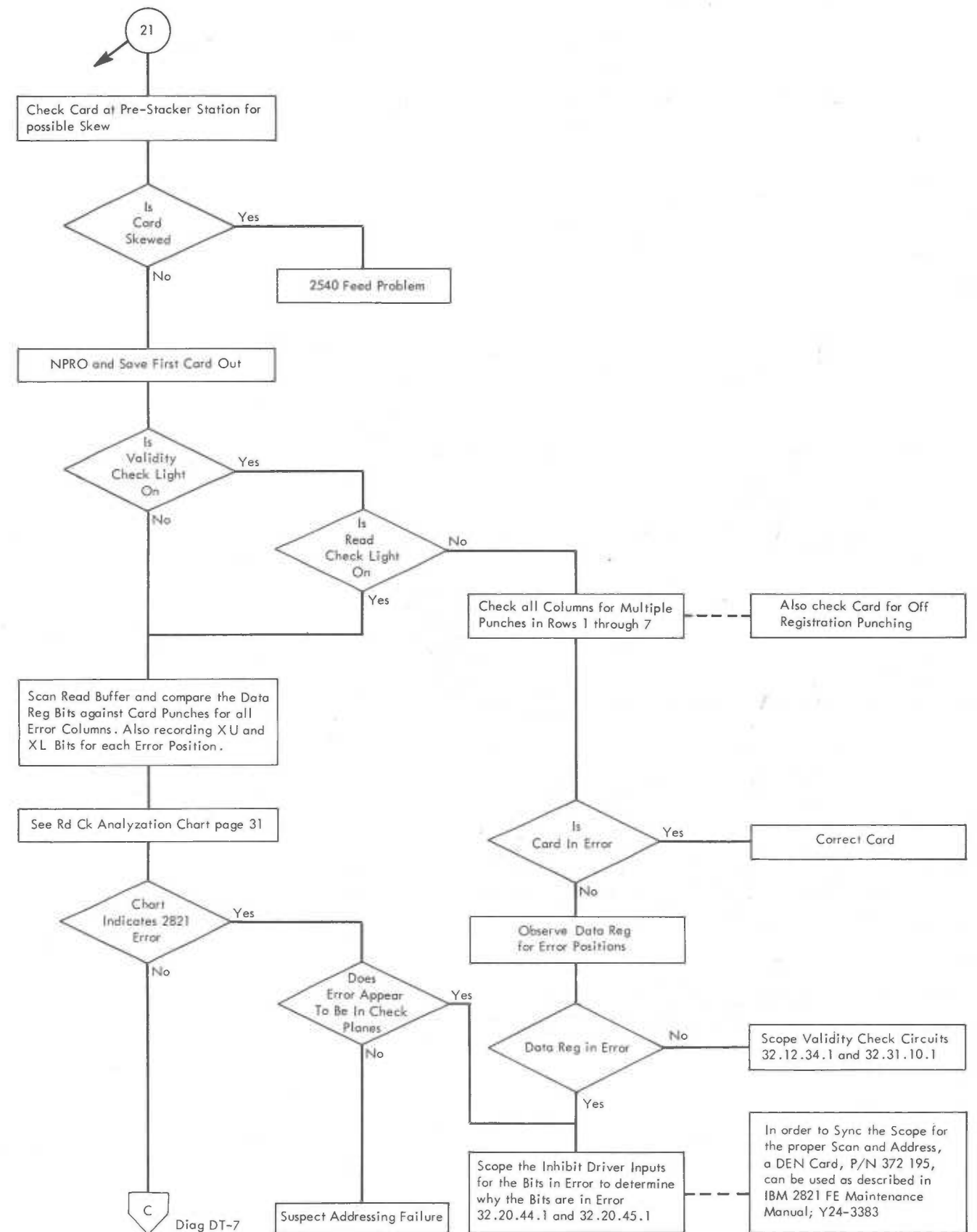
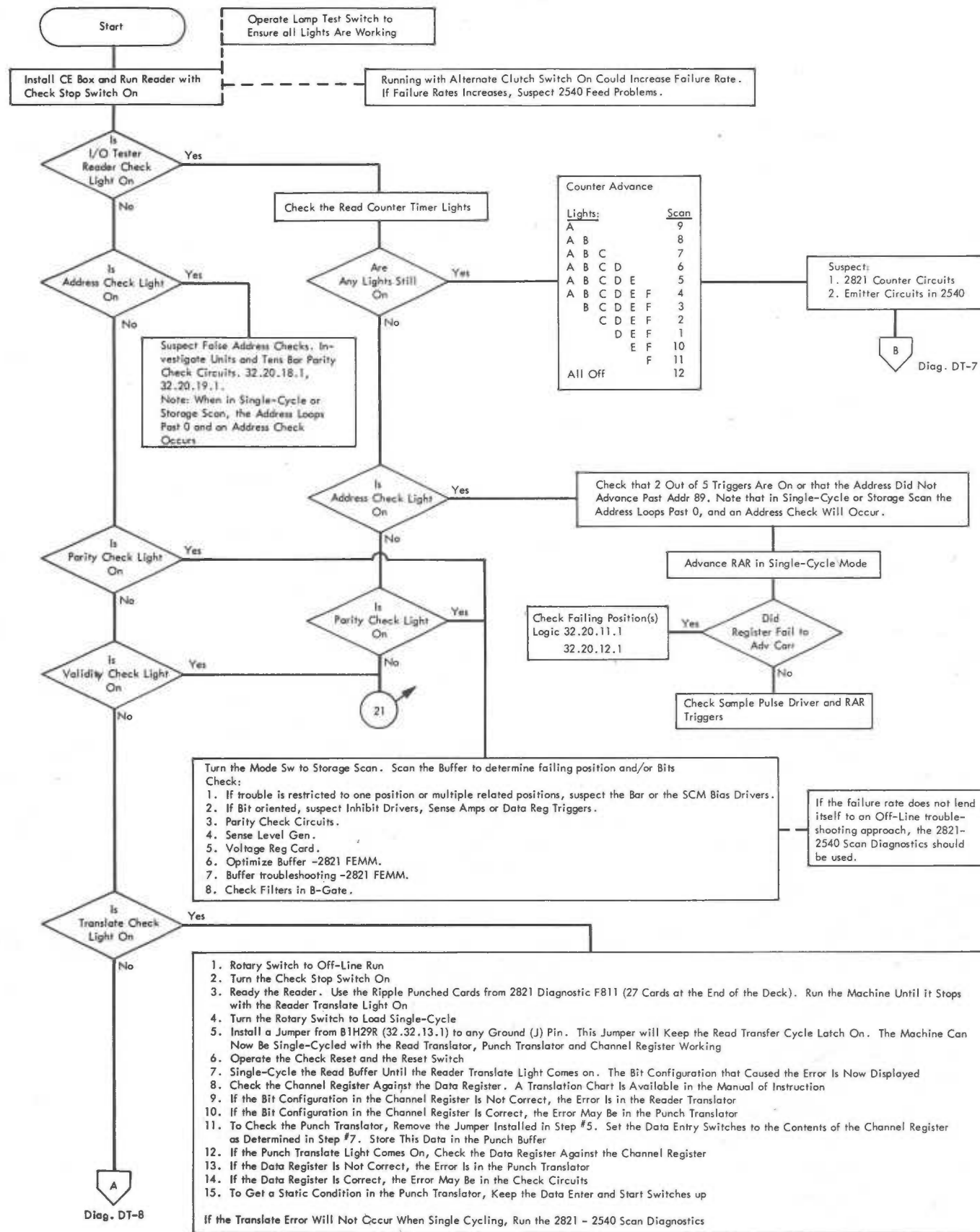
DT-3 Print Check



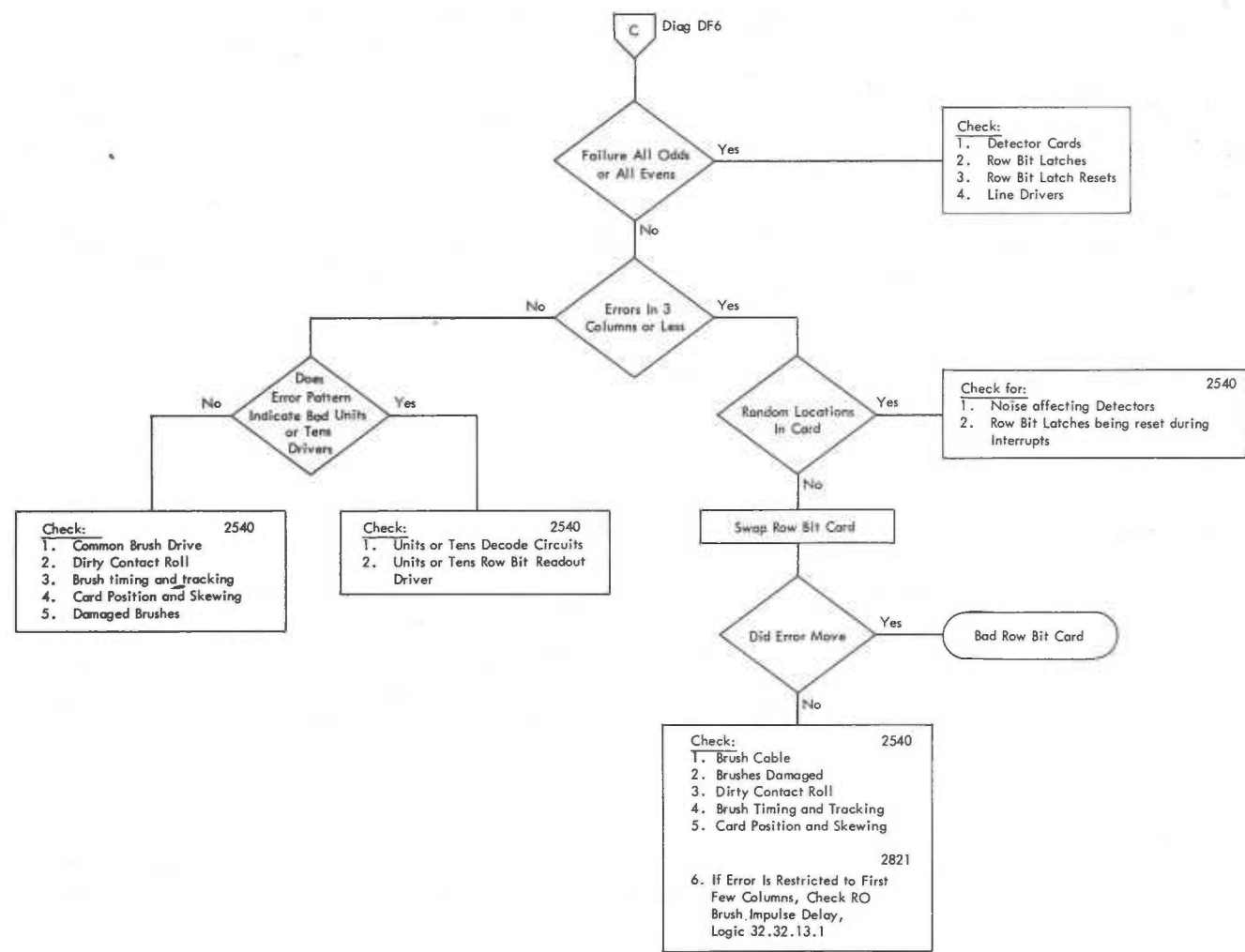
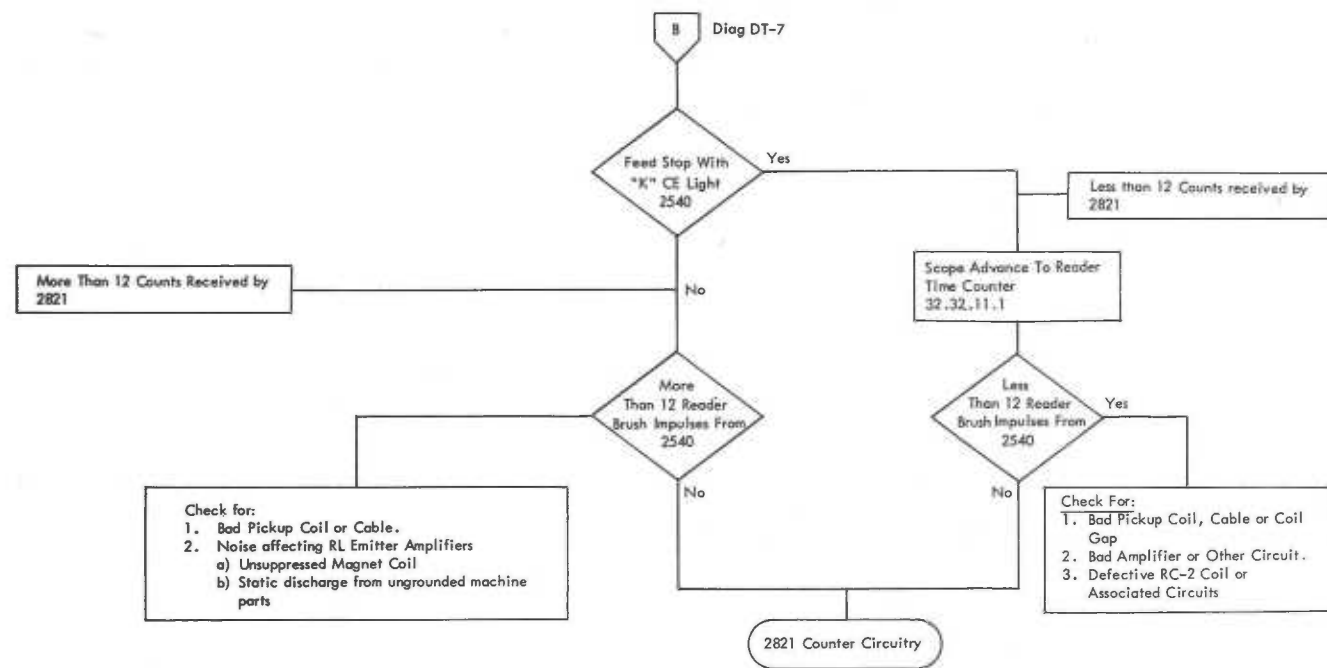
DT-4 Unit Check



DT-5 Carriage Failure



DT-6 Reader Error Analysis - Reader Check - Validity Check Part 1



READ CHECK ANALYZATION CHART

This chart is only valid if there is at least one punch in the error column and there is not a parity error or double failure in one position of the buffer. More than one error card should be analyzed to help localize the problem.

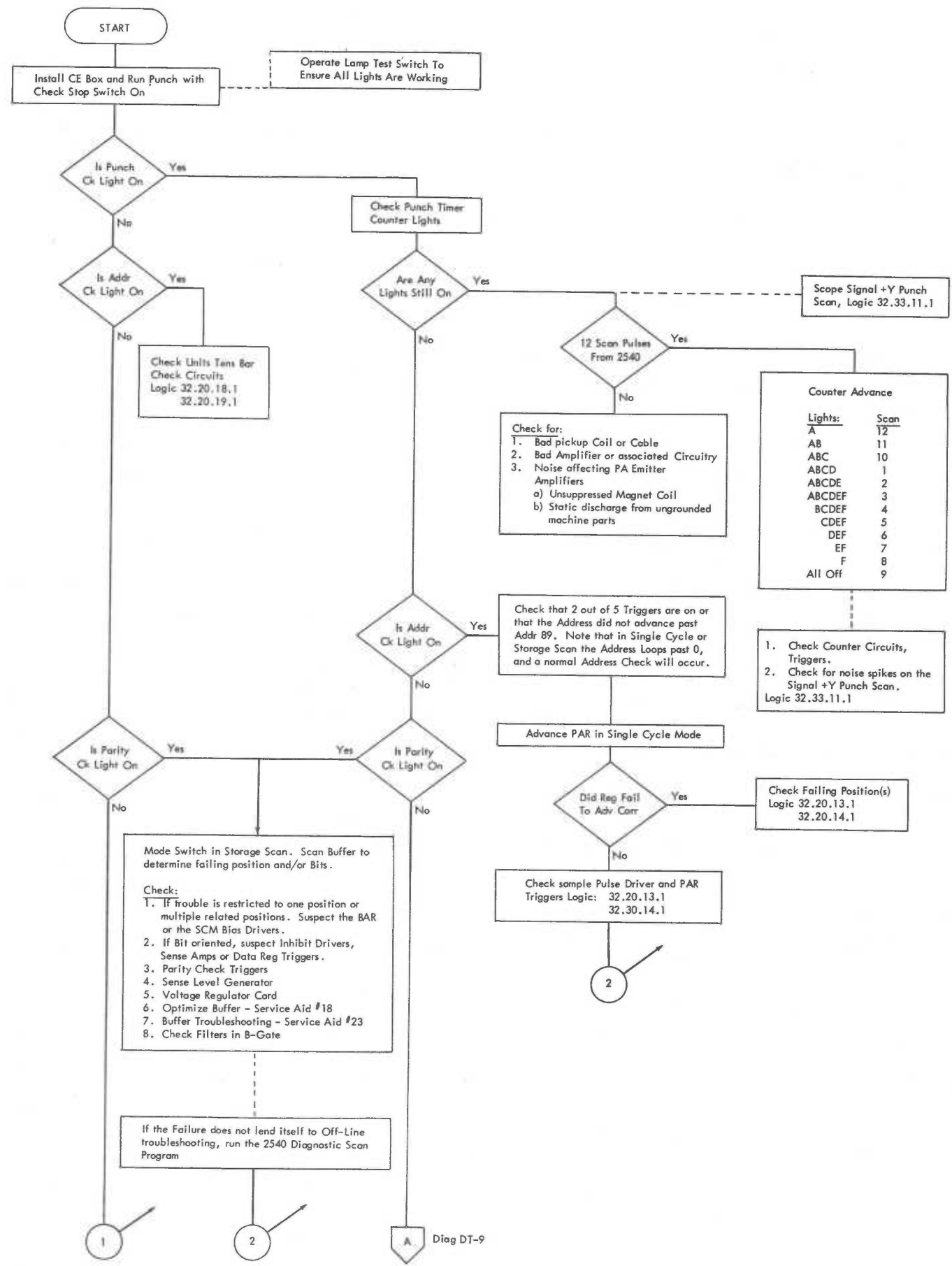
DATA REG STATUS	XU BIT	XL BIT	SUSPECTED FAILURE
Data Reg Correct	On	On or Off	2821 Problem - XU Plane failed to Reset or picked Bits after Reset
Data Reg Blank	On	On or Off	A) 2540 Problem - No RD2 Pulses B) 2821 Problem - Address Reg Failure - See Note 2
Correct or Incorrect	Off	Off	2821 Problem - False Read Checks Note: Could be a multiple problem, but False Read Checks should be fixed first
Data Reg Incorrect	Off	On	A) 2540 Problem - Missing RD2 Pulses B) 2821 Problem - Address Reg Failure - See Note 2
Data Reg Correct	Off	On	A) 2540 Problem - Missing or extra RD1 Pulses - See Note 1 B) 2821 Problem - Address Reg Failure - See Note 2 C) 2821 Problem - XL or YL Plane failure.

This chart is only valid if there are no punches in the error column, and there is not a parity error or double failure in one position of the buffer. More than one error card should be analyzed to help localize the problem.

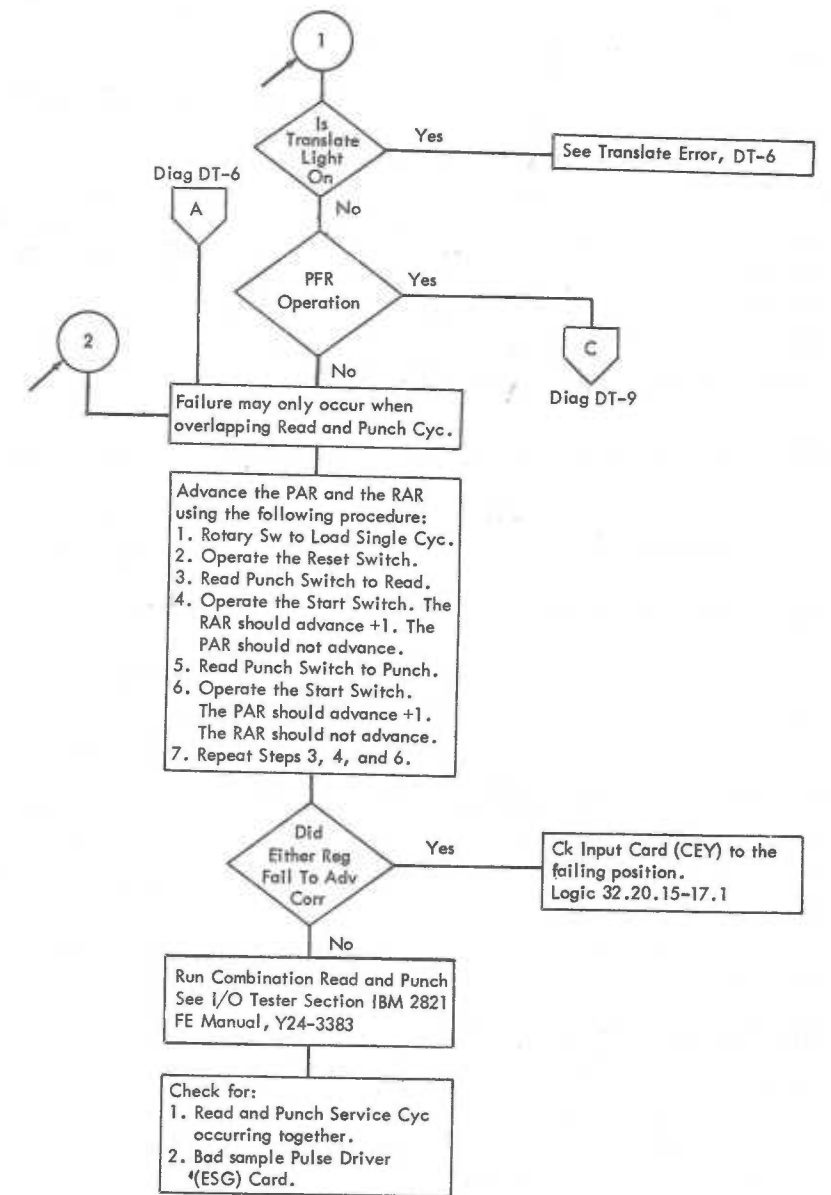
DATA REG STATUS	XU BIT	XL BIT	SUSPECTED FAILURE
Data Reg Blank	On	On	A) 2540 Problem - Picked up an Odd Number of RD1 Pulses - See Note 1 B) 2821 Problem - Address Reg Failure - See Note 2
Data Reg Blank	Off	On	2821 Problem - XL or YL Plane picked up a Bit
Data Reg Not Blank	On	On or Off	2821 Problem - Failing to Reset XU Plane Note: This is a multiple problem, but failure to Reset XU should be fixed first.
Data Reg Not Blank	Off	On	2540 Problem - Picked up an Odd Number of RD2 Pulses
Blank Or Not Blank	Off	Off	2821 Problem - False Read Checks
Data Reg Blank	On	Off	A) 2540 Problem - Picked up Even Number of RD1 Pulses - See Note 1 B) 2821 Problem - Address Reg Failure - See Note 2 C) 2821 Problem - XU or YU Planes picked a Bit

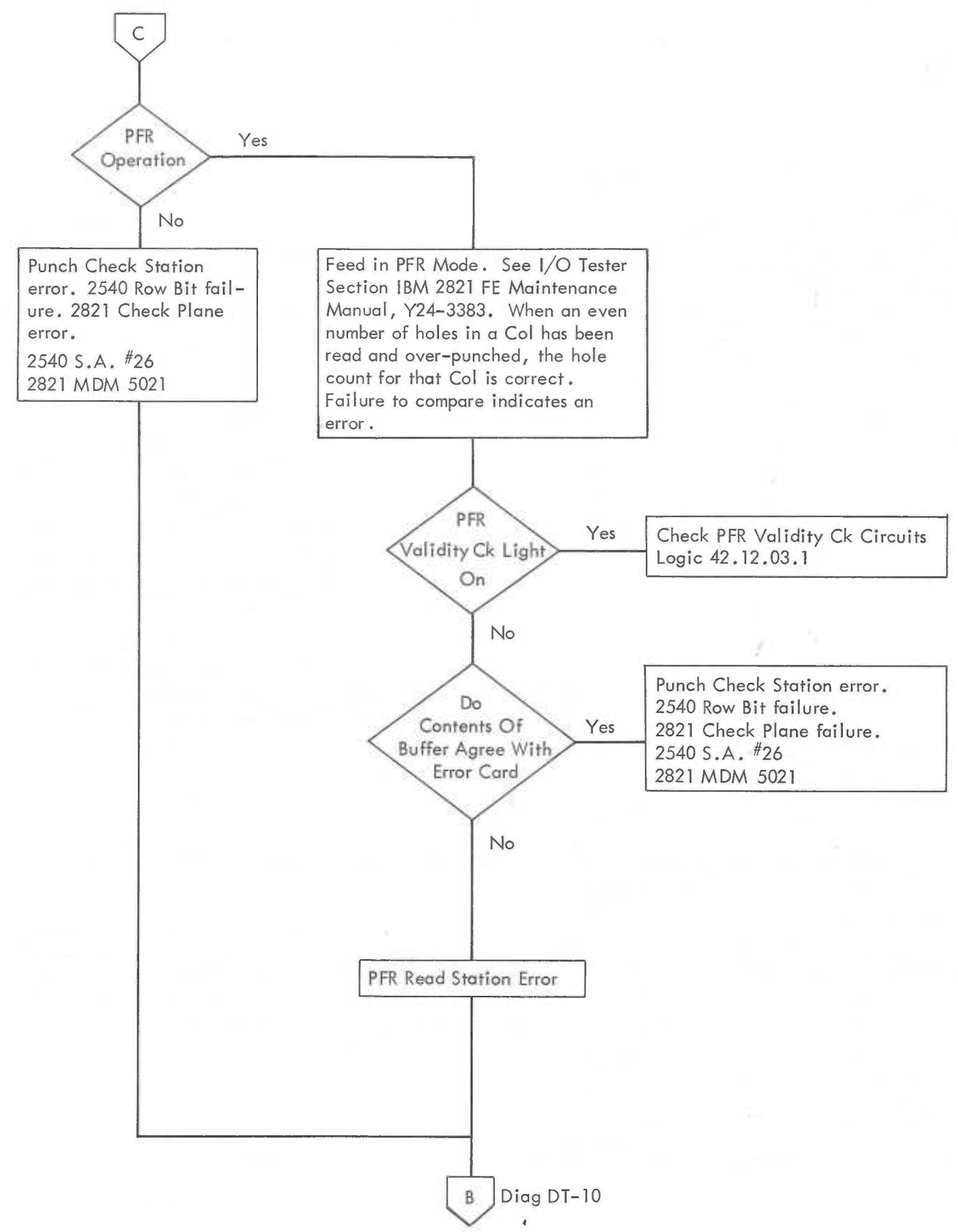
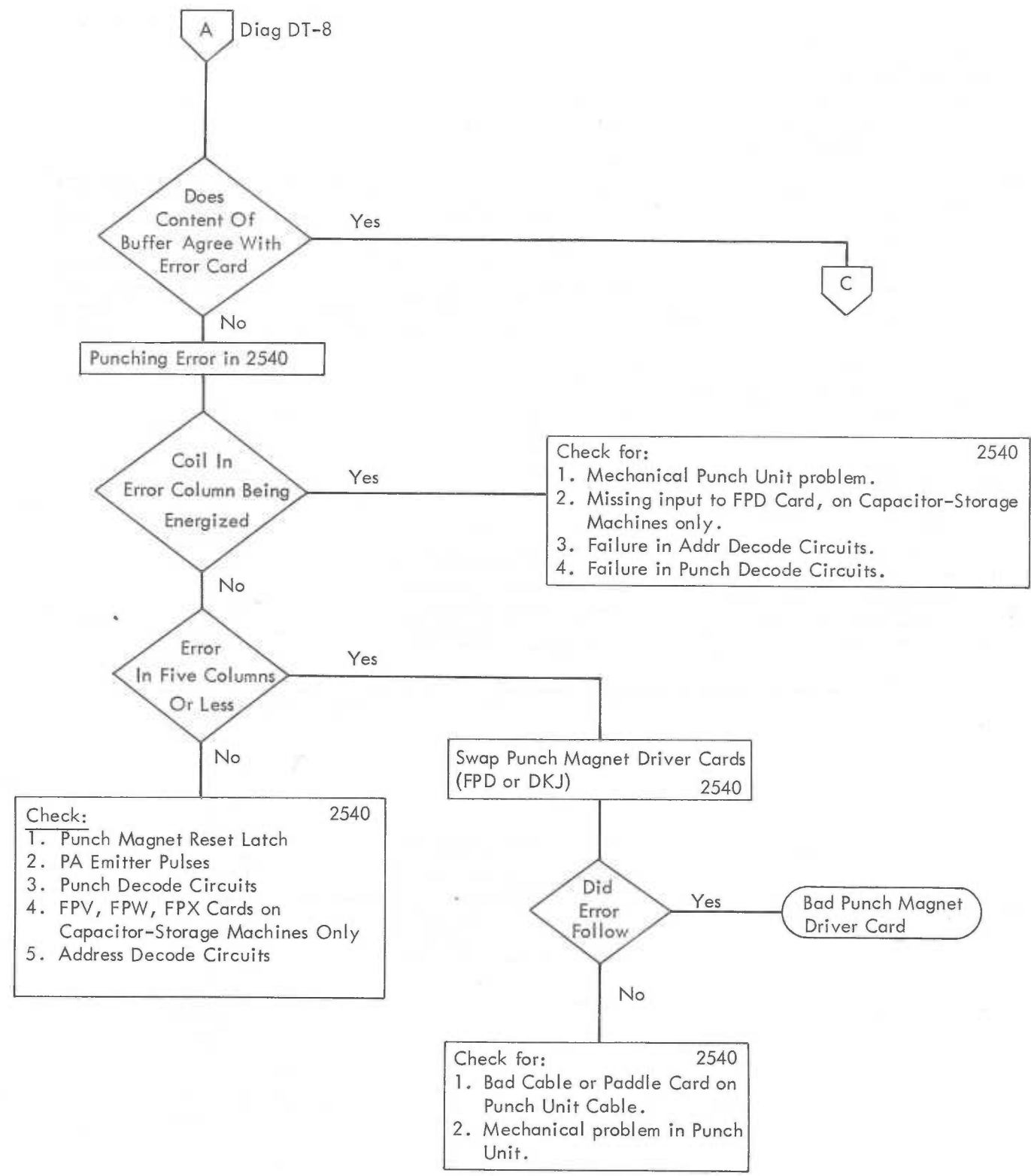
Note 1: Using an Extender, reverse the RD1 and RD2 Pulses (21B3G02 Pin B with Pin C). Read cards which are identically punched. An error will probably occur on the first card read. Check Reset and continue reading. If the Data Reg. status changes, the problem is probably in the 2540. See DT-7 entry C

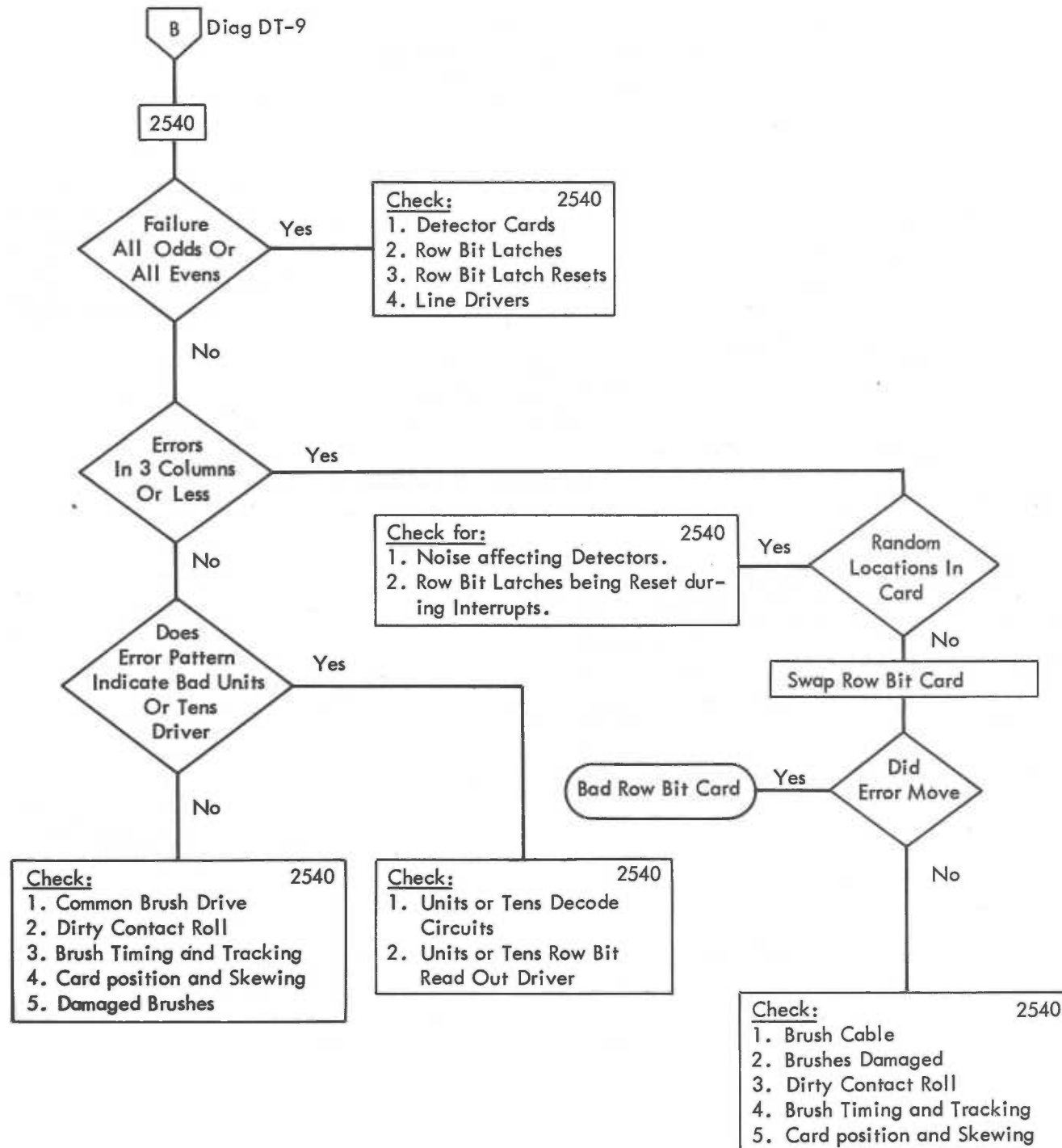
Note 2: Jumper "-Y Data Reg 8", "-Y RD Ctr B", and "+Y RD Ctr C" into the inputs of a DEN Card, part 372195, as described in Service Aid #23. Scope the output of the AND Circuit. Read cards which have 8's punched in every column (error stop off). If output of the AND Circuit ever goes plus, the Address Register probably failed. Some position was probably addressed twice because there should never be an 8 in the Data Register during 8-time service cycles.



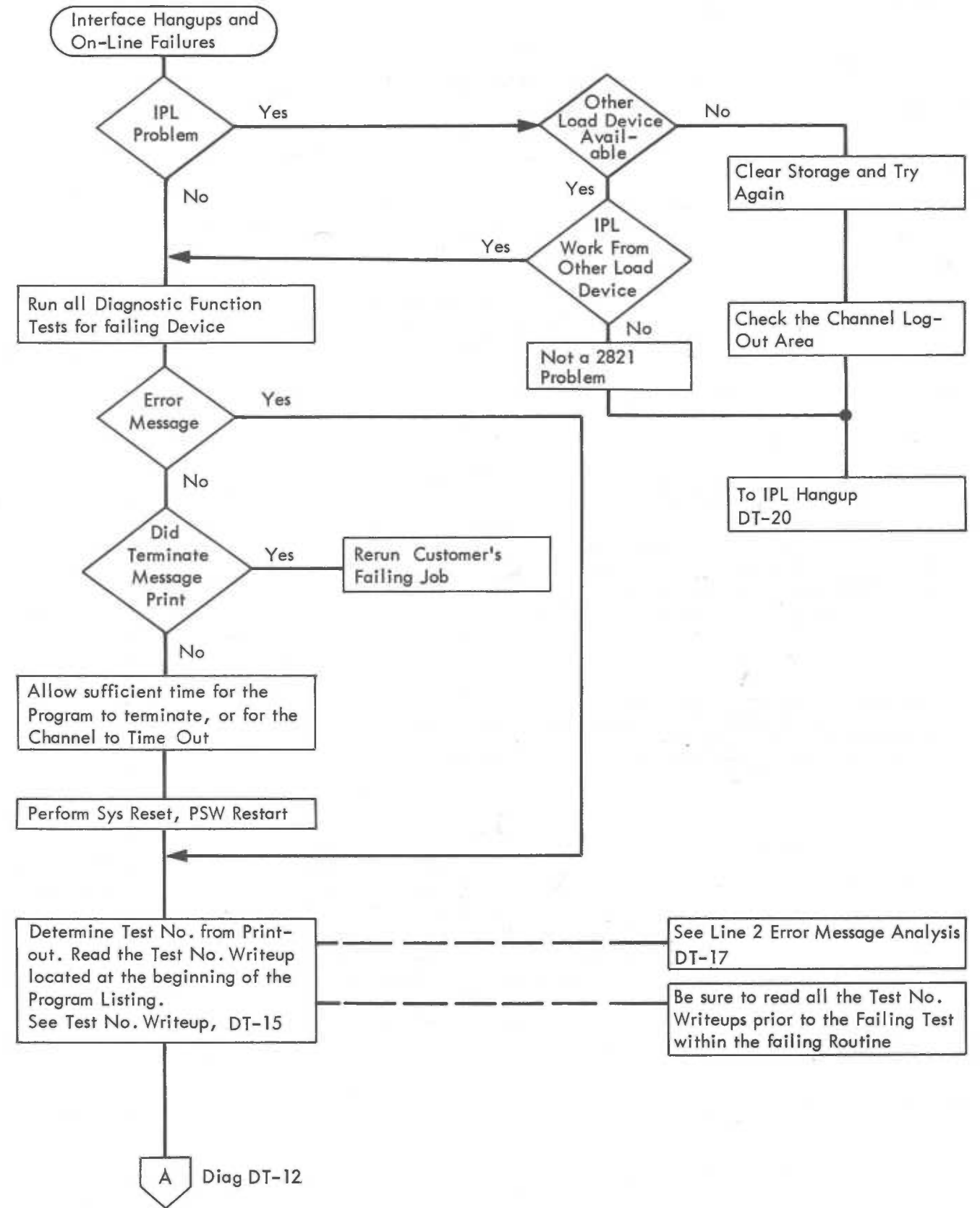
DT-8 Punch Check Part 1



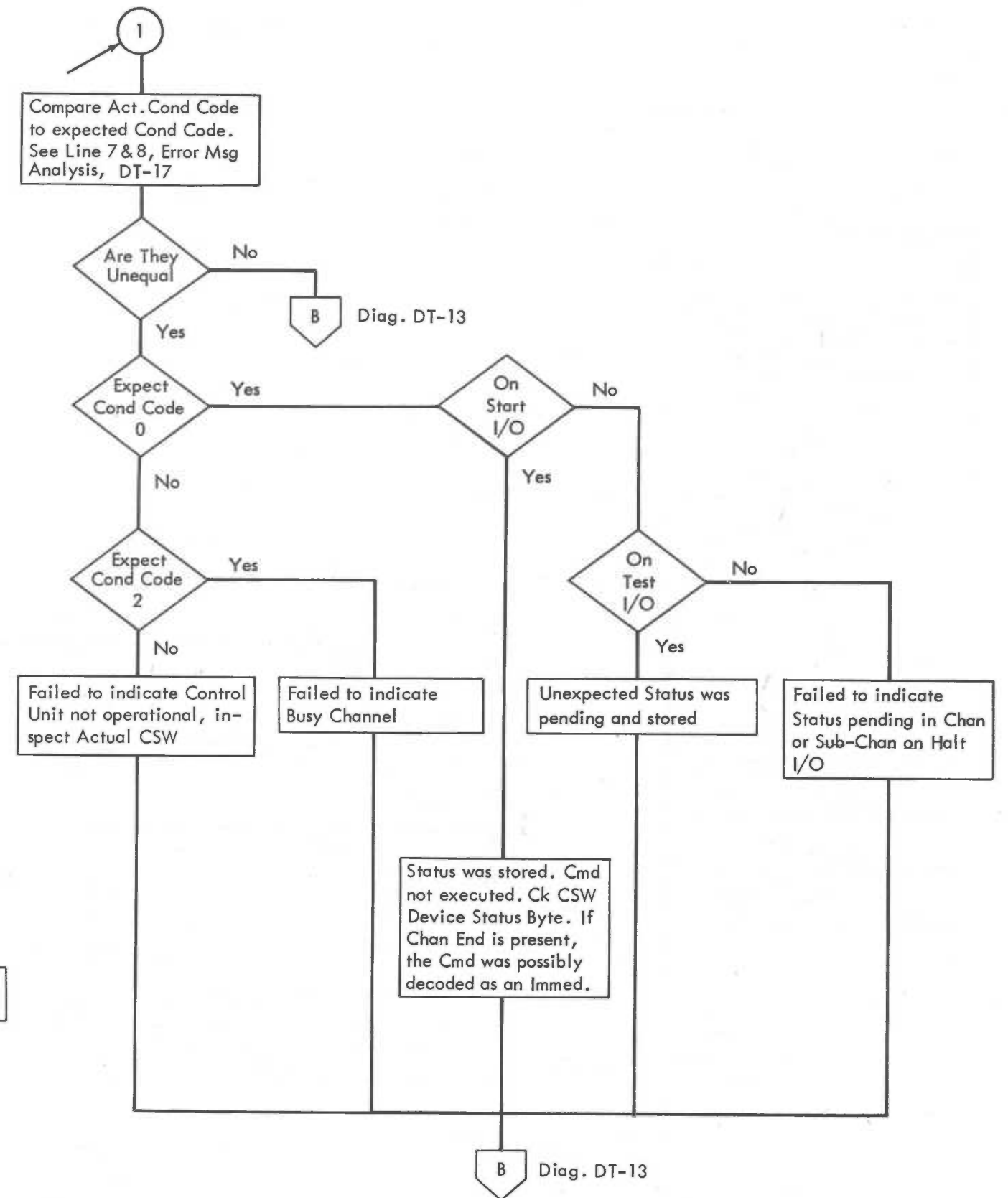
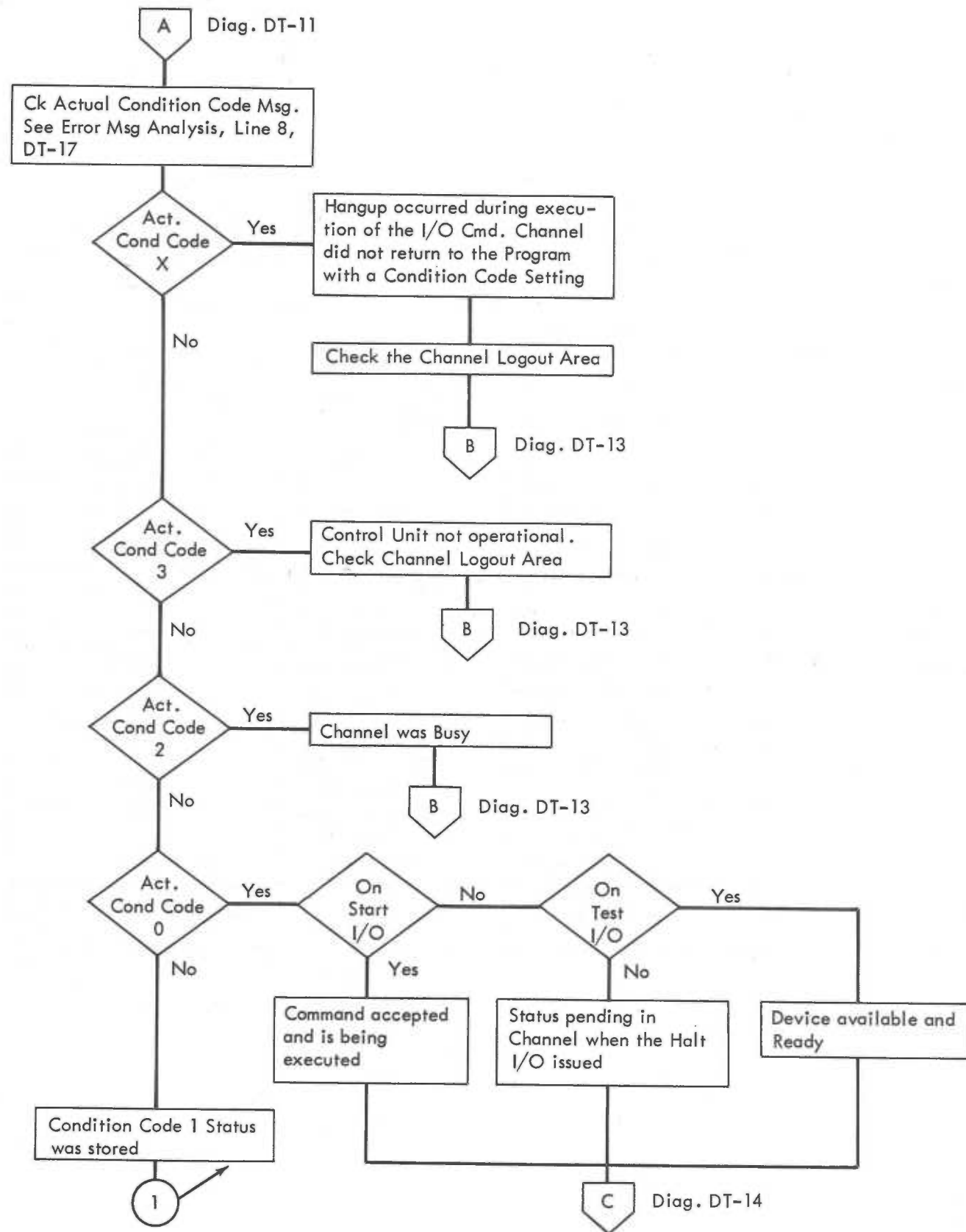




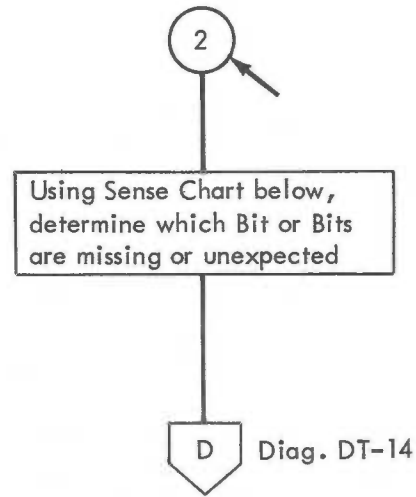
DT-10 Punch Check Part 3



DT-11 Interface and Diagnostic Failures Part 1



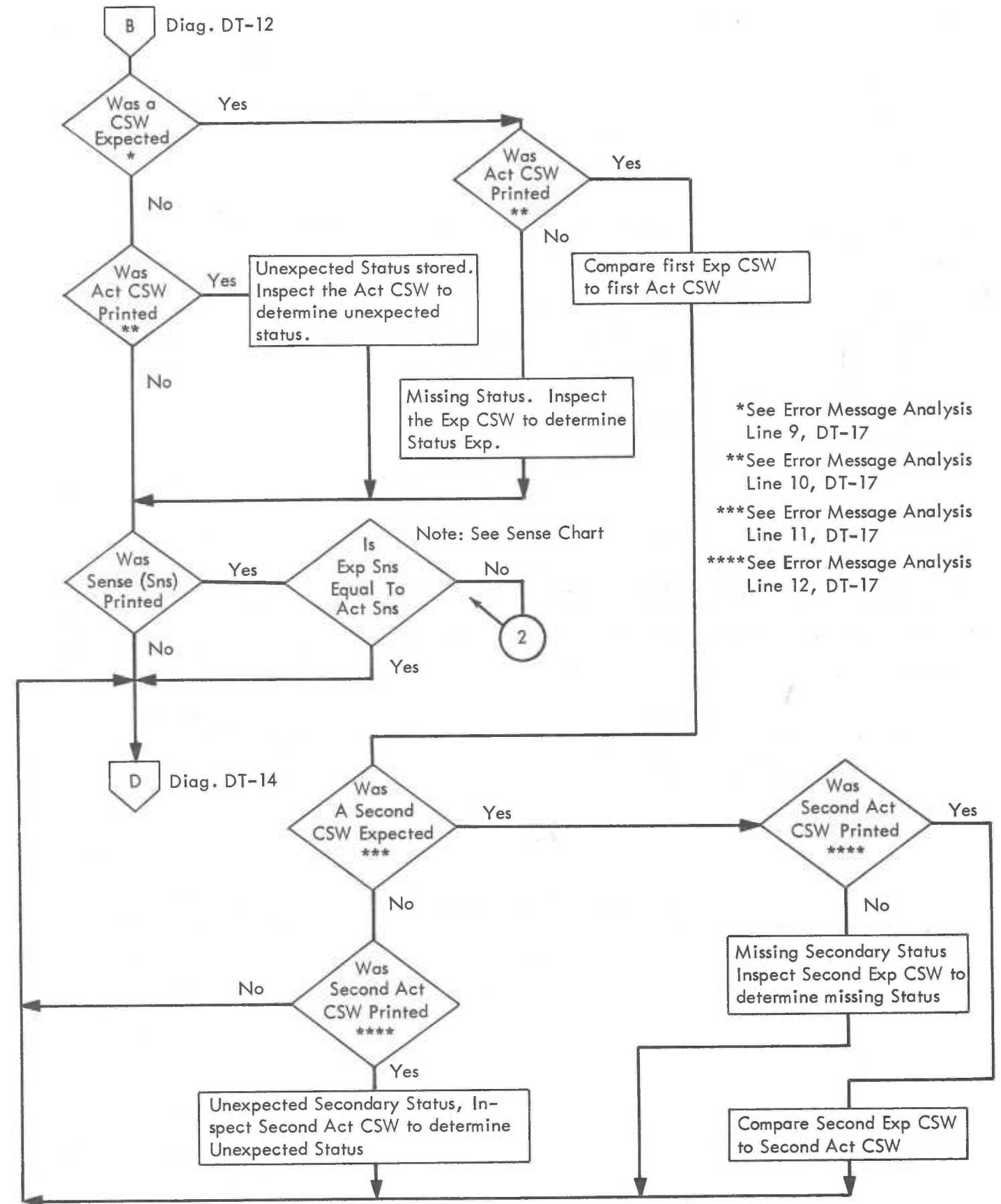
DT-12 Interface and Diagnostic Failures Part 2



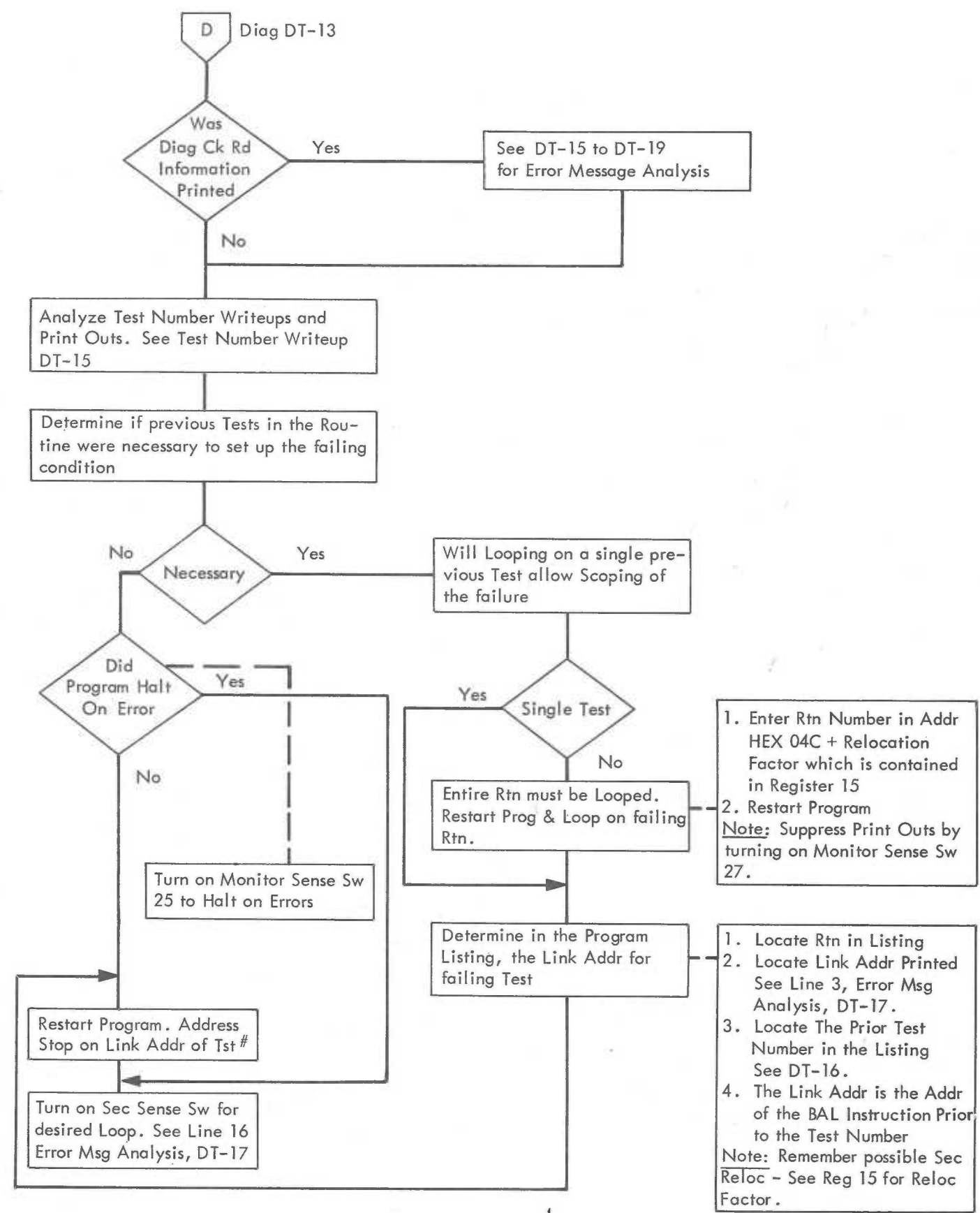
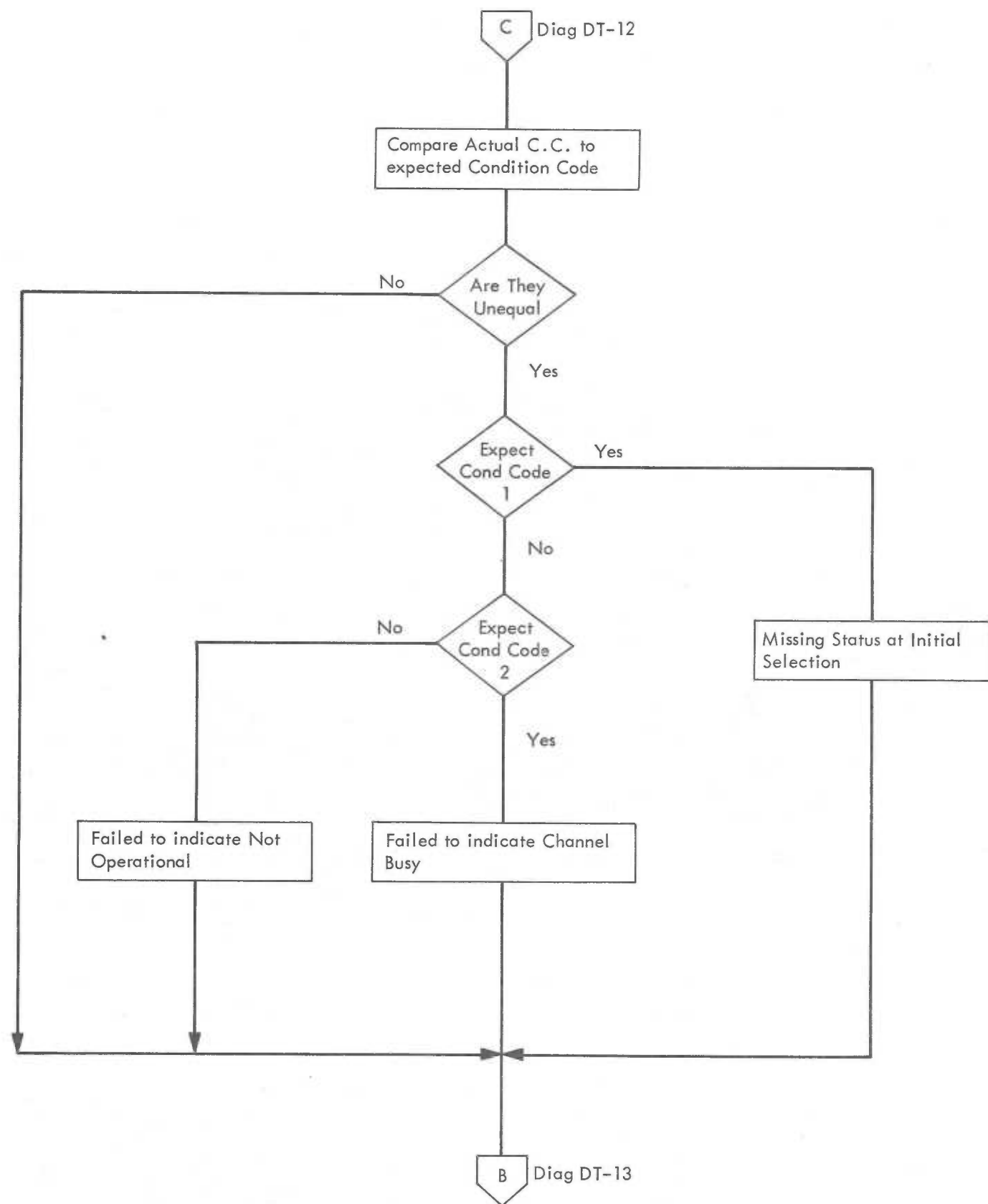
SENSE CHART

SENSE BIT	DEVICE TYPE	MEANING	REFERENCE
0	Reader Punch Printer	Command Reject Command Reject Command Reject	MDM Page 3020 MDM Page 3020 MDM Page 3X80 *Note 1
1	Reader Punch Printer	Intervention Req Intervention Req Intervention Req	Logic 32.12.34.1 Logic 32.13.33.1 MDM Page 3X80 *Note 1
2	Reader Punch Printer	Bus Out Check Bus Out Check Bus Out Check	MDM Page 3020 MDM Page 3020 MDM Page 3X80 *Note 1
3	Reader Punch Printer	Equipment Check Equipment Check Equipment Check	MDM Page 3040 MDM Page 3060 MDM Page 3X80 *Note 1
4	Reader Punch UCS Printer 1404 CF Mode	Data Check Data Check Data Check Data Check	MDM Page 3040 MDM Page 3060 MDM Page 5183 MDM Page 3381
5	UCS Printer	UCS Parity Check	MDM Page 3181
6	Reader Punch with PFR 1404 CF Mode	Unusual Cmd Seq Unusual Cmd Seq Unusual Cmd Seq	Logic 32.12.33.1 Logic 42.12.02.1 MDM Page 3381
7	Printer	Channel 9	Logic 33.13.61.1 Logic 33.13.85.1

*Note 1 - The X in the MDM Page number varies depending on the Printer Feature. See MDM Table of Contents, Page 0401, Sheet 1, for appropriate digit.



*See Error Message Analysis Line 9, DT-17
 **See Error Message Analysis Line 10, DT-17
 ***See Error Message Analysis Line 11, DT-17
 ****See Error Message Analysis Line 12, DT-17



DT-14 Interface and Diagnostic Failures Part 4

ROUTINE 04

0130 - OPERATION ATTEMPTED

LOAD UCS BUFFER WITH 15 SETS OF 16 CHARACTERS FO THRU TO FF.
 EXPECTED RESPONSE
 EXPECT CHANNEL END AND THEN DEVICE END.

0140 - OPERATION ATTEMPTED

ISSUE A BLOCK DATA CHECK COMMAND.
 EXPECTED RESPONSE
 EXPECT CHANNEL END DEVICE END TOGETHER. BLOCK DATA CHECK LATCH SHOULD BE SET ON.

0150 - OPERATION ATTEMPTED

ISSUE A PRINT COMMAND.
 EXPECTED RESPONSE
 THE PRINT AREA IS FILLED WITH CHARACTER -A- WHICH DOES NOT COMPARE TO WHAT IS IN THE UCS BUFFER. EXPECT CHANNEL END AND THEN DEVICE END WITH N O DATA CHECK IN THE SENSE BYTE DUE TO THE BLOCK DATA CHECK LATCH BEING ON FROM TEST 0140 ABOVE.

0160 - OPERATION ATTEMPTED

ISSUE ALLOW DATA CHECK COMMAND.
 EXPECTED RESPONSE
 EXPECT CHANNEL END DEVICE END TOGETHER AND SETTING THE BLOCK DATA CHECK LATCH O F F.

0170 - OPERATION ATTEMPTED

ISSUE A PRINT COMMAND.
 EXPECTED RESPONSE
 THE PRINT AREA IS FILLED WITH CHARACTER -A- WHICH DOES NOT COMPARE TO WHAT IS IN THE UCS BUFFER. EXPECT CHANNEL END THEN DEVICE END WITH UNIT CHECK. EXPECT DATA CHECK IN THE SENSE BYTE DUE TO BLOCK DATA CHECK LATCH BEING SET OFF FROM TEST 0160 ABOVE.

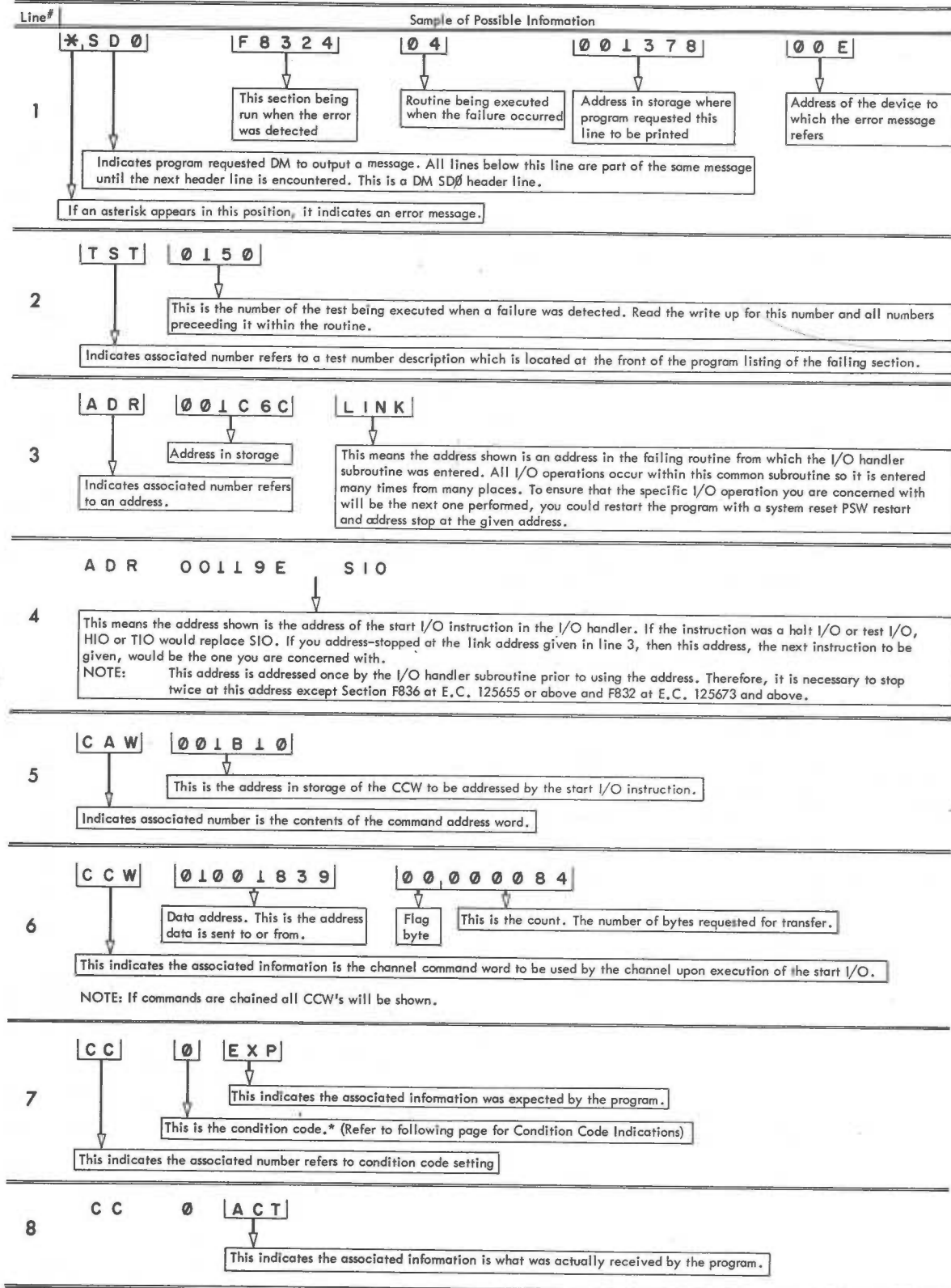
DT-15 Diagnostic Printout Analysis--Test Number Descriptions

ROUTINE 04- LOAD UCS BUFFER WITH A 16 CHARACTER SET. ISSUE BLOCK DATA CHECK COMMAND -73-. PRINT A LINE OF CHARACTERS WHICH WILL NOT COMPARE. EXPECT NO DATA CHECK. ISSUE ALLOW DATA CHECK COMMAND -7B-. PRINT LINE AGAIN' EXPECT DATA CHECK.

001C40	04	ROUTO4	DC	X'04'	ROUTINE NUMBER
001C41	000CC8		DC	AL3(ROUTO5-SECNO)	ADDRESS OF NEXT ROUTINE
001C44	45 40 F 778		BAL	R4,INIT	BR. TO INITIALIZE
001C48	45 50 F 8C0		BAL	R5,ECONMY	GO TO LOAD UCS ROUTINE
001C4C	0130		DC	X'0130'	T E S T N U M B E R
001C4E	41 A0 F CAO		LA	R10,BLOCK	LOAD CCW ADDRESS
001C52	45 B0 F 10E		BAL	R11, ISIO	BR. TO ISSUE SIO
001C56	4A00		DC	XL2'4A00'	CONTROL SWITCHES
001C58	0140		DC	X'0140'	T E S T N U M B E R
001C5A	F100		DC	X'F100'	EXP COND CODE AND SENSE
001C5C	FCC0		DC	AL2(NORM-SECNO+REG)	EXP CSW ADDRESS
001C5E	92 C1 F 839		MVI	PRAR,C'A'	FILL PRINT AREA WITH -A-
001C62	D2 82 F 83A F 839		MVC	PRAR+1(131),PRAR	
001C68	41 A0 F B10		LA	R10,PRINTA	LOAD PRINT CCW ADDRESS
001C6C	45 B0 F 10E		BAL	R11,ISIO	BR. TO ISSUE SIO
001C70	3C00		DC	XL2'3C00'	CONTROL SWITCHES
001C72	0150		DC	X'0150'	T E S T N U M B E R
001C74	F000		DC	X'F000'	EXP COND. CODE AND SENSE
001C76	FCB0		DC	AL2(ZEIDER-SECNO+REG)	EXP CSW ADDRESS
001C78	41 A0 F CAB		LA	R10,ALLOW	LOAD CCW ADDR.
001C7C	45 B0 F 10E		BAL	R11,ISIO	BR. TO ISSUE SIO
001C80	4A00		DC	XL2'4A00'	CONTROL SWITCHES
001C82	0160		DC	X'0160'	T E S T N U M B E R
001C84	F100		DC	X'F100'	EXP COND. CODE AND SENSE
001C86	FCC0		DC	AL2(NORM-SECNO+REG)	EXP CSW ADDRESS
001C88	41 A0 F B10		LA	R10,PRINTA	LOAD CCW ADDRESS
001C8C	45 B0 F 10E		BAL	R11,ISIO	BR. TO ISSUE SIO
001C90	3C00		DC	XL2'3C00'	CONTROL SWITCHES
001C92	0170		DC	X'0170'	T E S T N U M B E R
001C94	F008		DC	X'F008'	EXP COND CODE AND SENSE
001C96	FB18		DC	AL2(PCLCSW-SECNO+REG)	EXP ADDR OF CSW
001C98	0A D6	EXIT04	SVC	X'D6'	ROUTINE EXIT
001CA0	73 001839 0000 0001	BLOCK	CCW	X'73',PRAR,X'00',1	
001CA8	7B 001839 0000 0001	ALLOW	CCW	X'7B',PRAR,X'00',1	
001CB0	00001B18	ZEIDER	DC	A(PCLCSW)	
001CB4	08000000		DC	X'08000000'	
001CB8	00000000		DC	XL4'0'	
001CBC	04000000		DC	X'04000000'	
001CC0	00000000	NORM	DC	XL4'0'	
001CC4	0C000000		DC	X'0C000000'	
001CC8			CNOP	0,4	

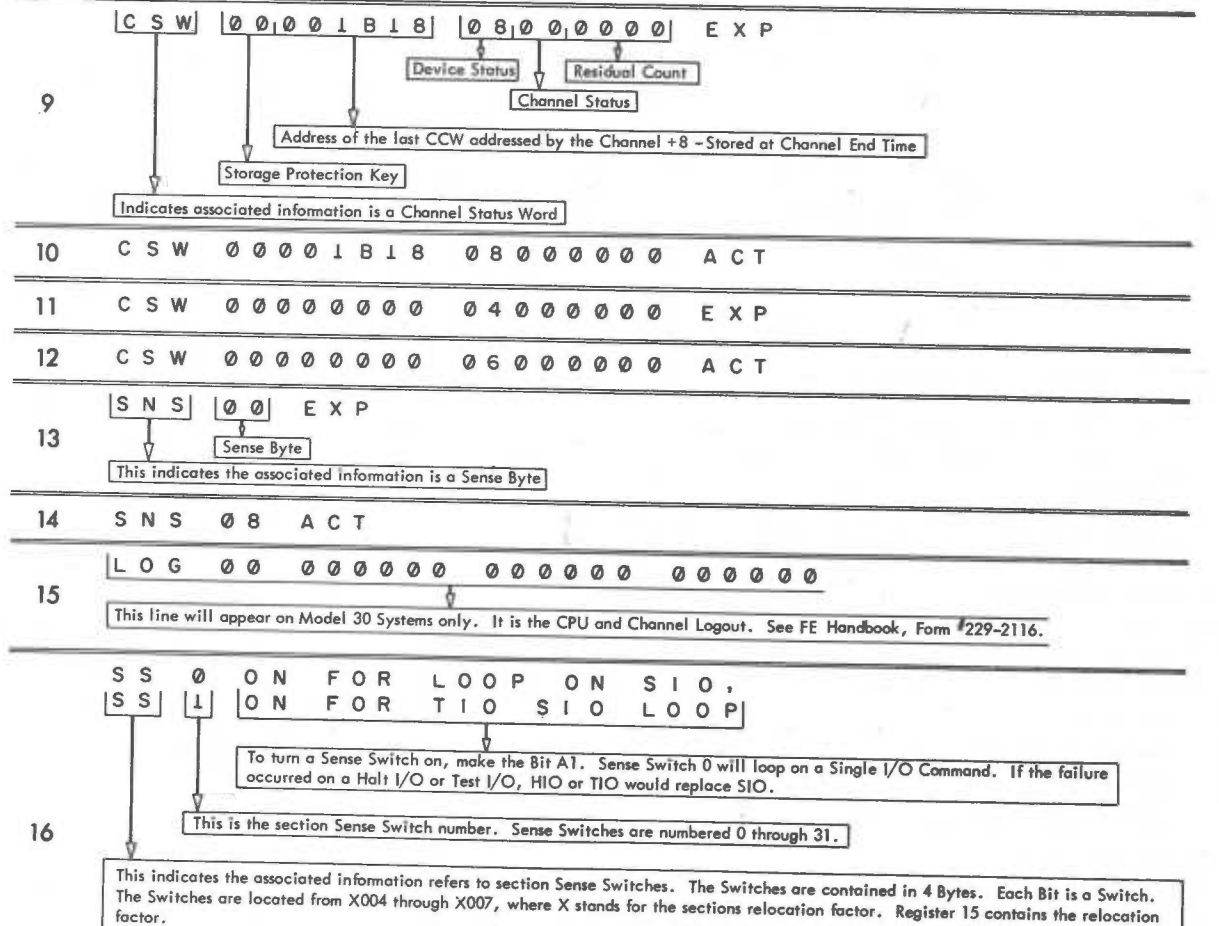
DT-16 Program Listing

The following Diagnostic Message Print Outs are applicable to 2821-1403 Diagnostics at EC 125655 and above. This applies to all 2821's shipped after 4/1/67. The Field B/M to update installed machines will be available June 1967. The 2821-2540 Diagnostics are being revised to use this output message format. The revised diagnostics will be available 3rd Quarter 1967.



* CONDITION CODE INDICATIONS

Code	Operation	Indication
0	Test I/O Start I/O Halt I/O	Device is ready, idle, and has no status to present. Device has accepted the Command, and the Channel and Device are proceeding with its execution. Status is pending in the Channel or Sub-channel.
1	Test I/O Start I/O	The CSW has been stored and must be inspected to determine cause. The CSW has been stored and must be inspected to determine the cause. Channel End alone indicates a Control Command has been accepted, and the Device is proceeding with its execution.
2	Halt I/O Test I/O Start I/O	The Channel or Sub-channel is busy. The Channel or Sub-channel is busy.
3	Halt I/O Test I/O Start I/O	The Channel or Sub-channel is busy. The equipment being addressed is not operational. The equipment being addressed is not operational.
X	Halt I/O All	The equipment being addressed is not operational. This indicates that the Channel hung up during execution cycles of the I/O Command, and did not set a Condition Code or return to Instruction Cycles without a malfunction reset.

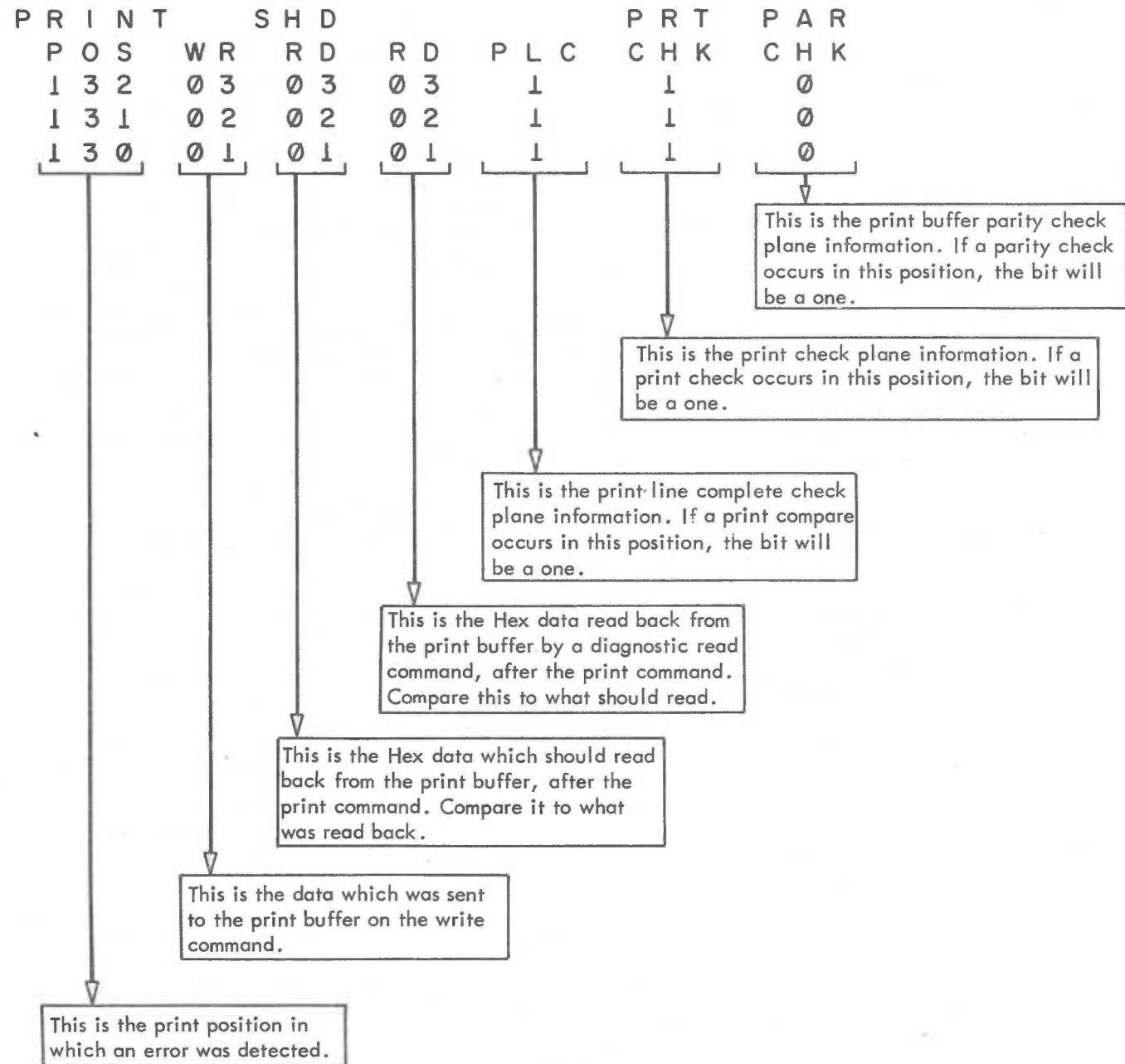


NOTE:

Analyze the test number write up to determine if these loops will reproduce the failure. If other operations are needed to set up the failing condition. The entire routine may be looped instead. Enter the routine number in X04C, and perform a System Reset, PSW Restart to loop the routine. If analysis indicates a Single Test will reproduce the failure, but the program did not halt on error, or the actual failure appears to have occurred on a previous test and was just detected by this test, perform a System Reset PSW Restart and address stop at the Link Address described on line 3 before turning on the section Sense Switch.

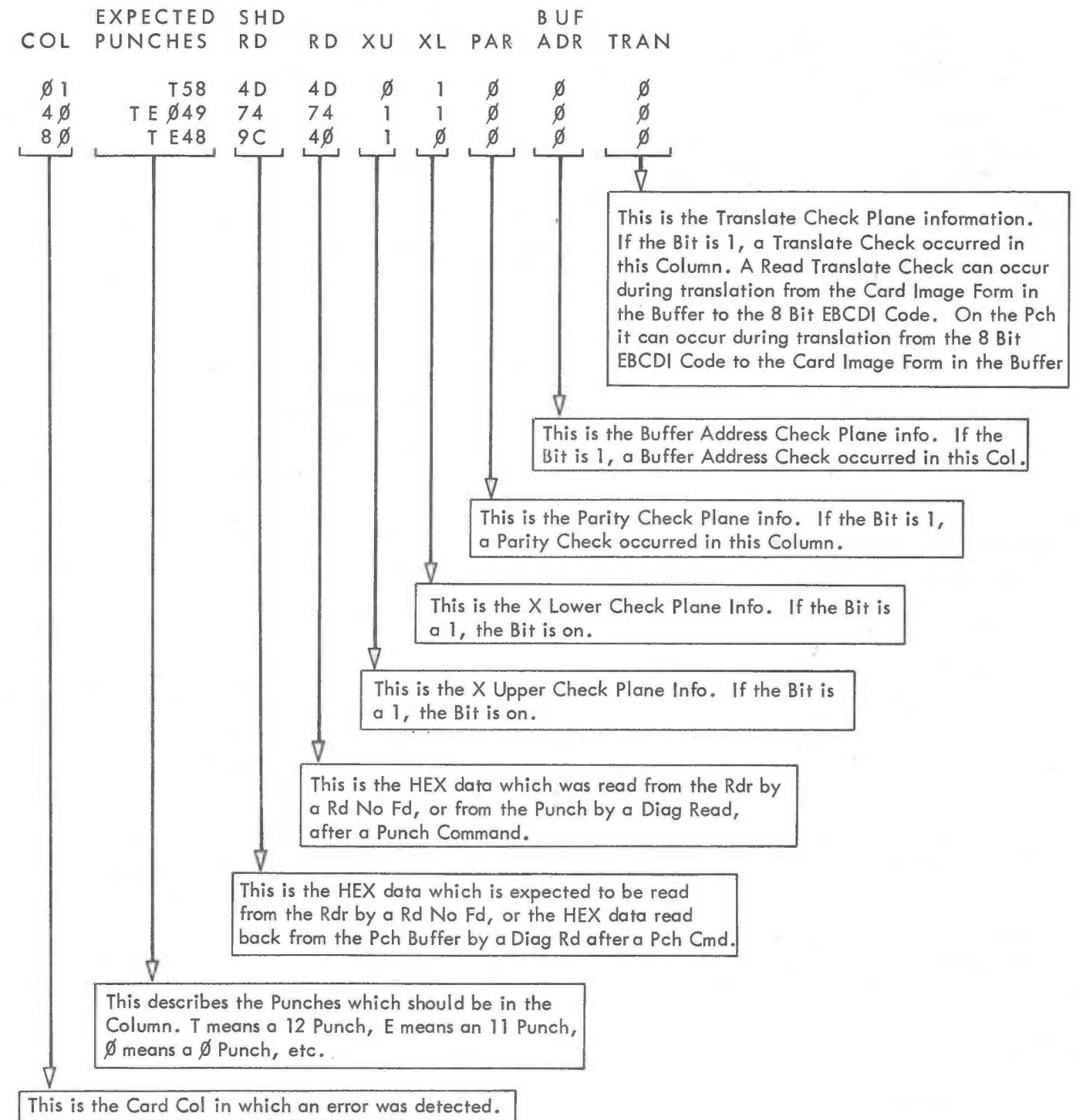
UCS ADDR 001 TO 016 CONTAIN 00 THRU 0F REST BLANKS

This line will appear in section F836 - ripple print. It describes the pattern in the UCS buffer when the failure occurred. In this example UCS positions 001 thru 016 (Decimal) would contain the following characters (Hex) 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B, 0E, and 0F. The rest of the UCS buffer contains blanks. The print data buffer will contain the indicated characters in a ripple pattern.



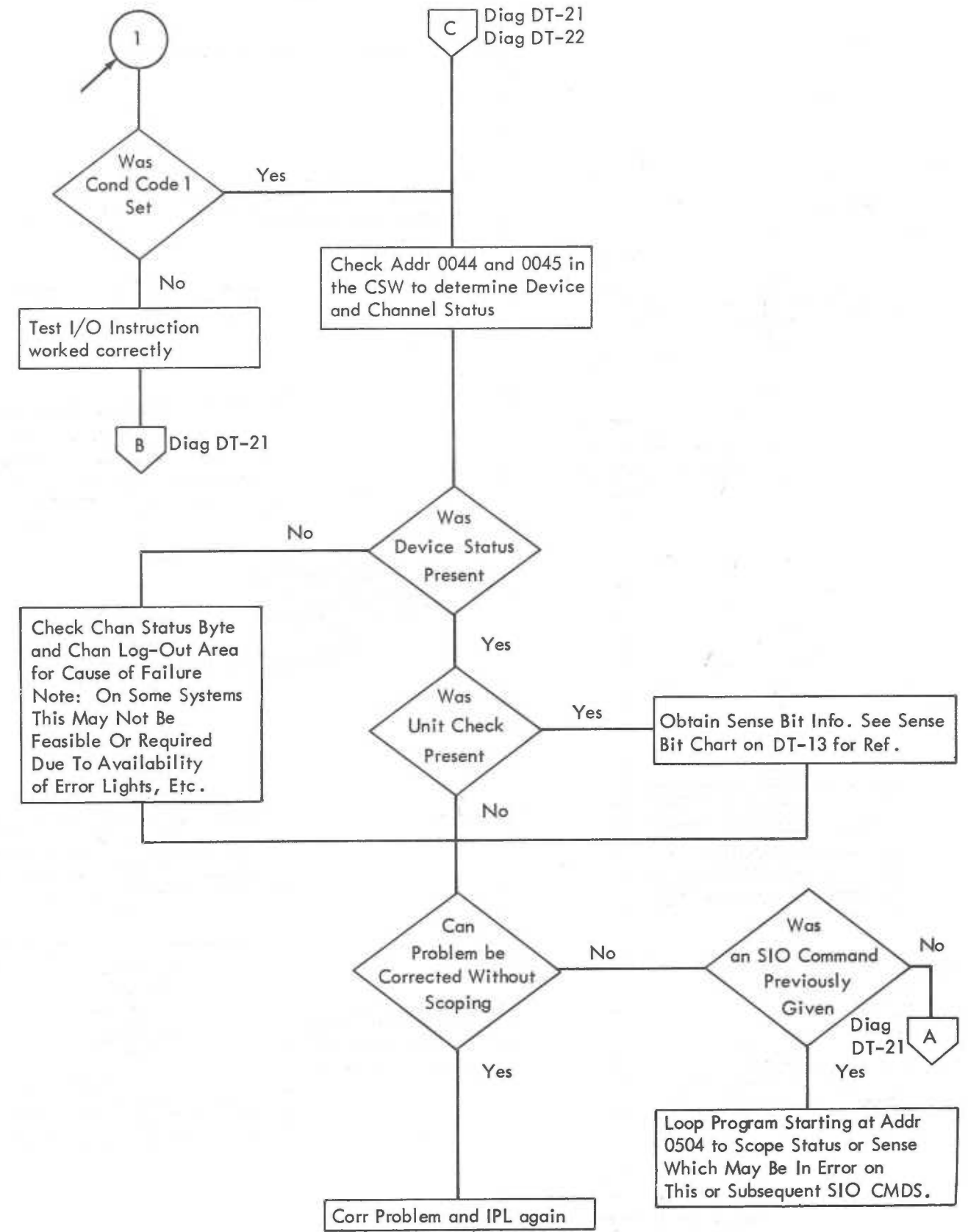
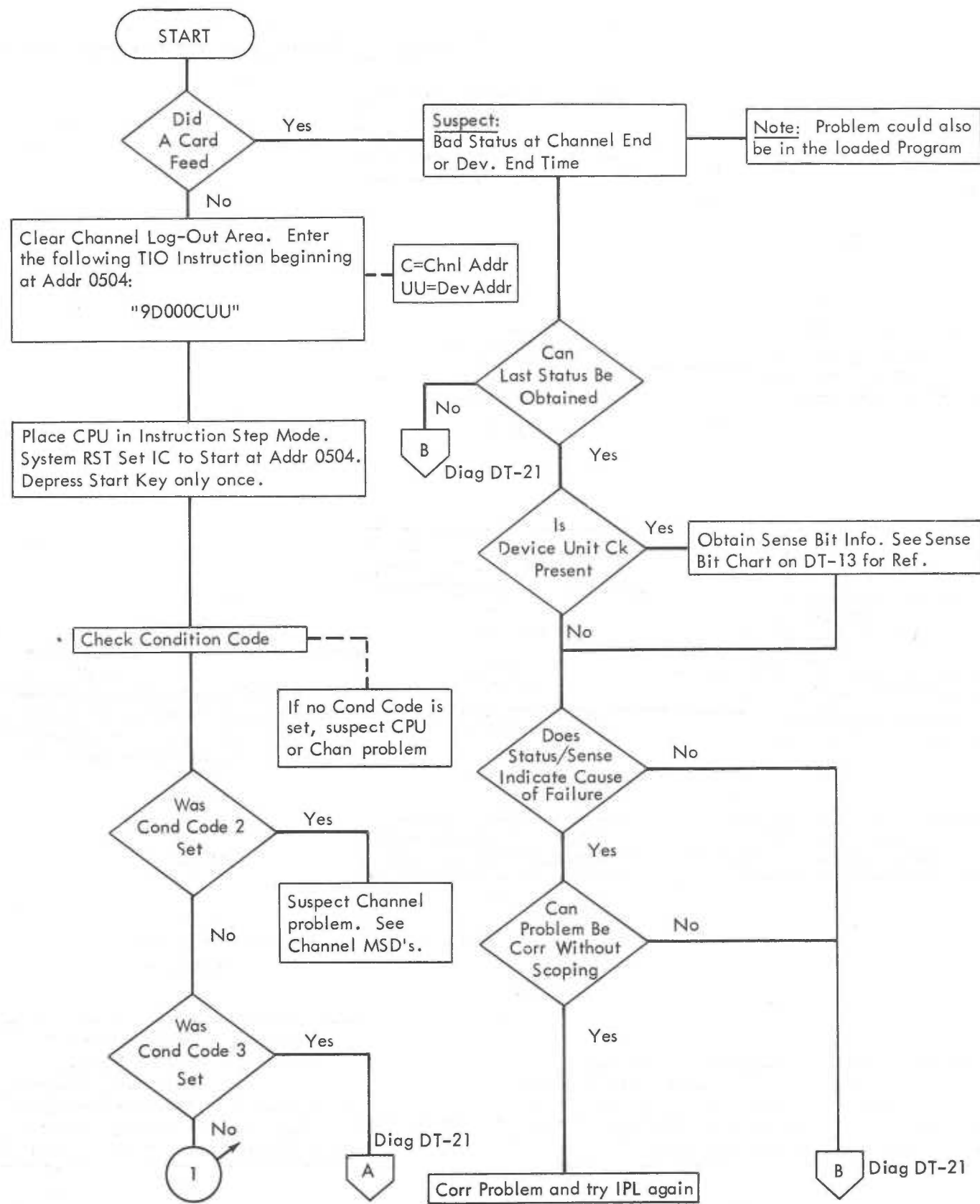
DT-18 UCS Error Message Sample

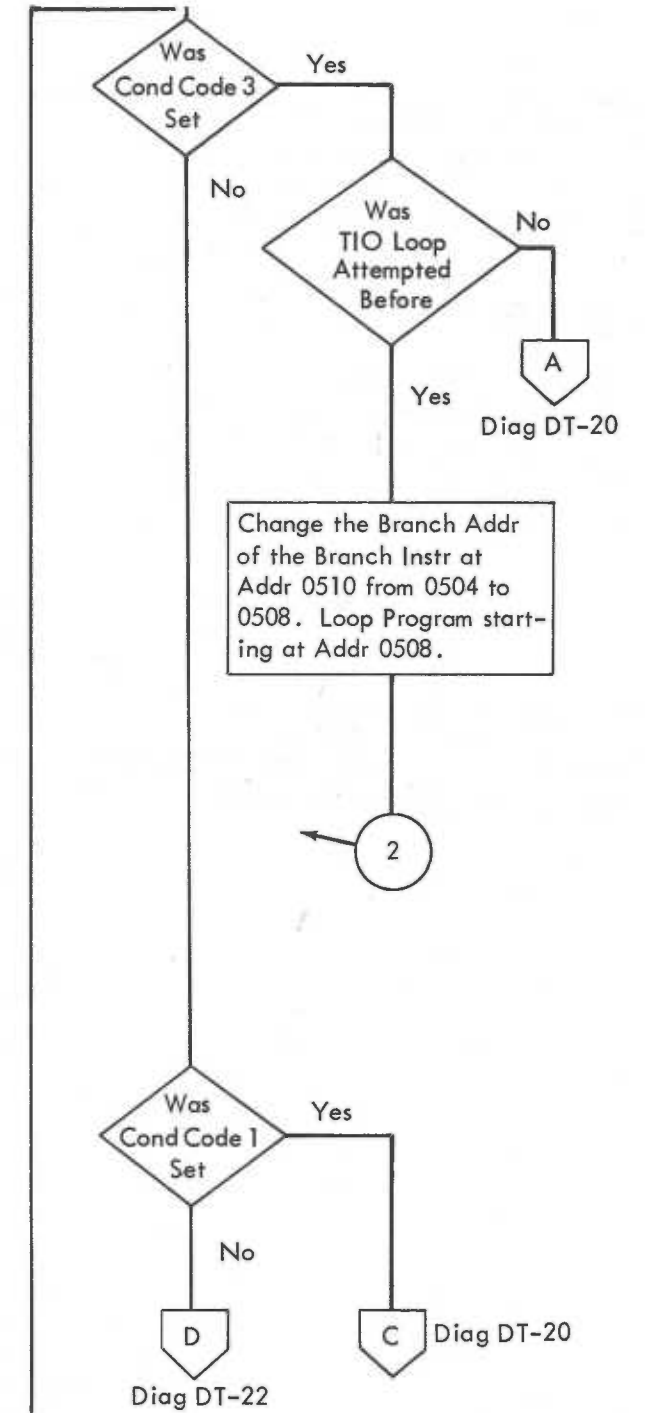
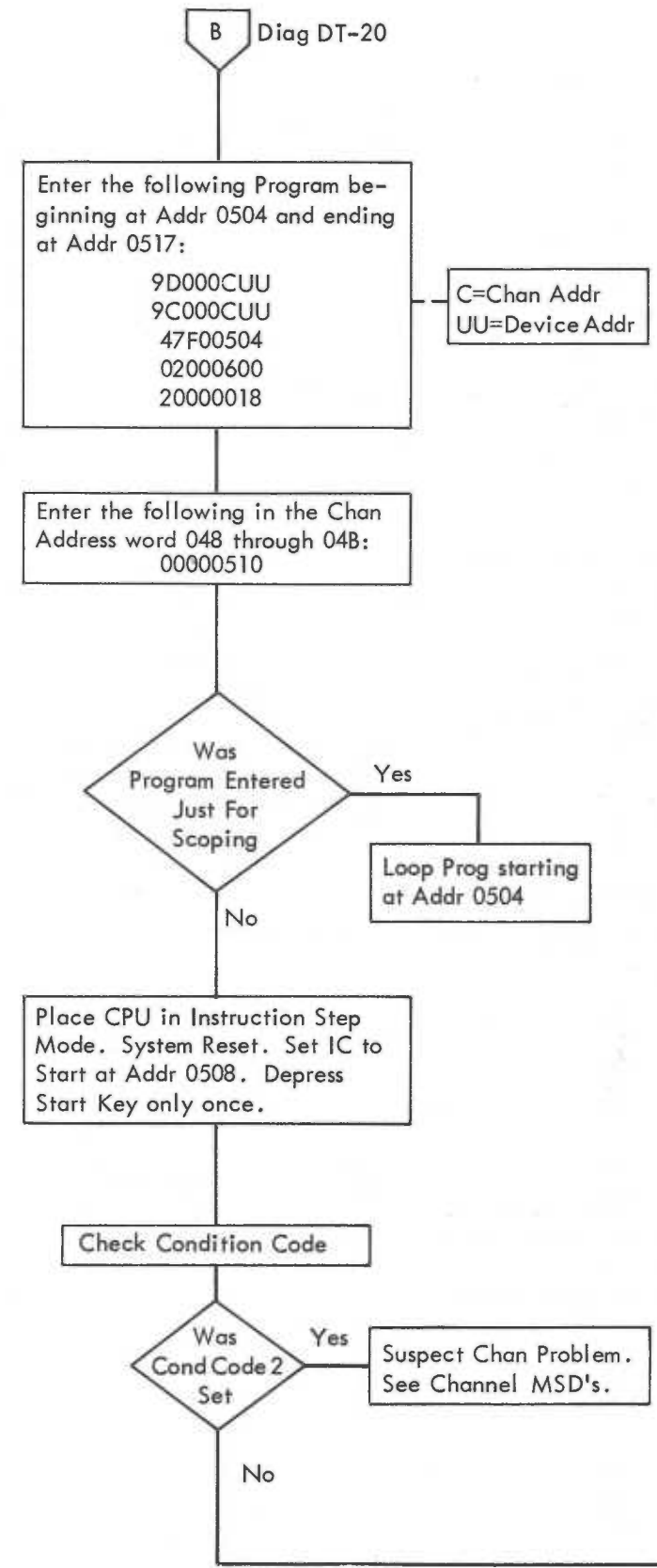
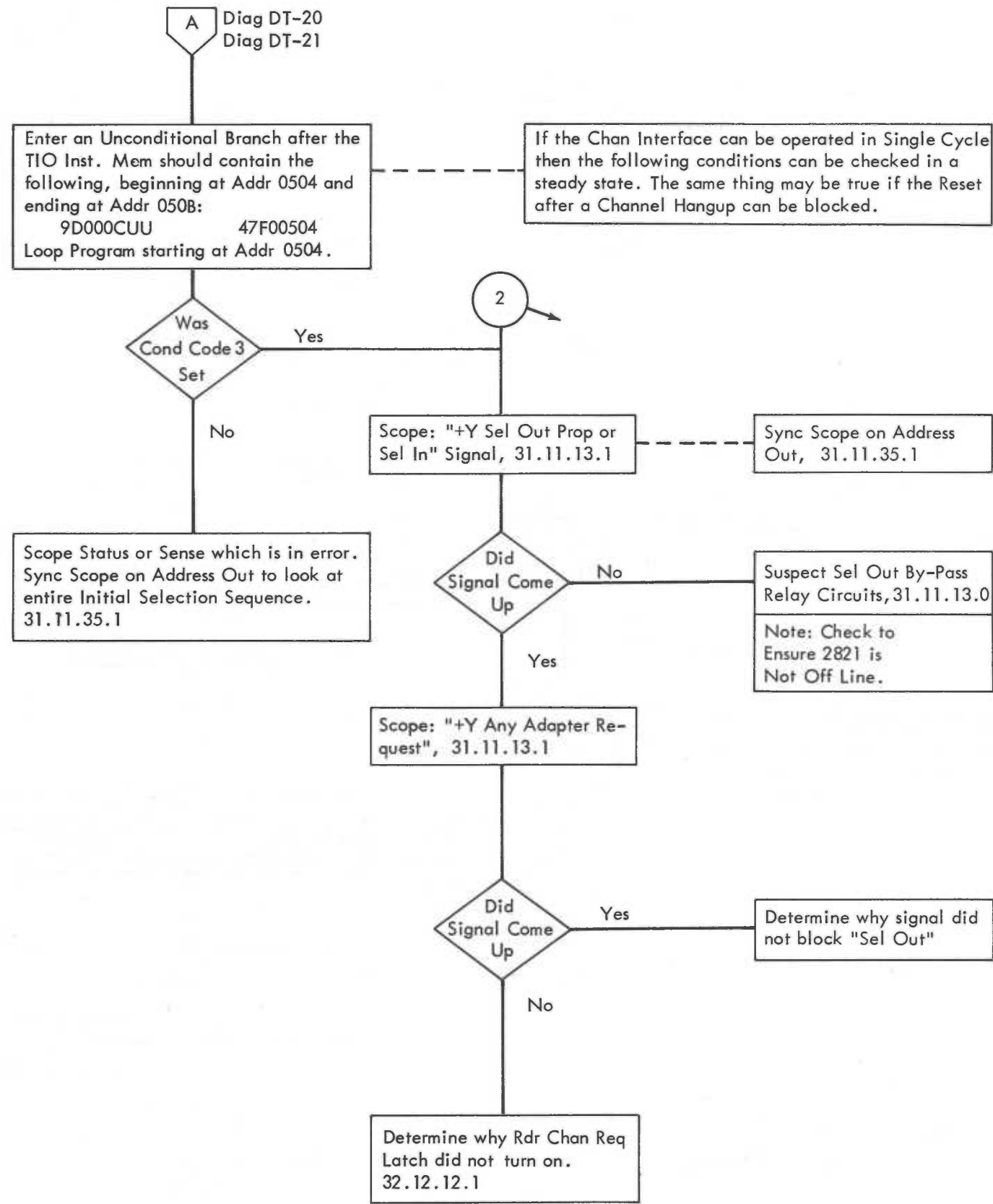
This is a sample error message from the Ripple Read Test. The same headings are used in the Ripple Punch Test.

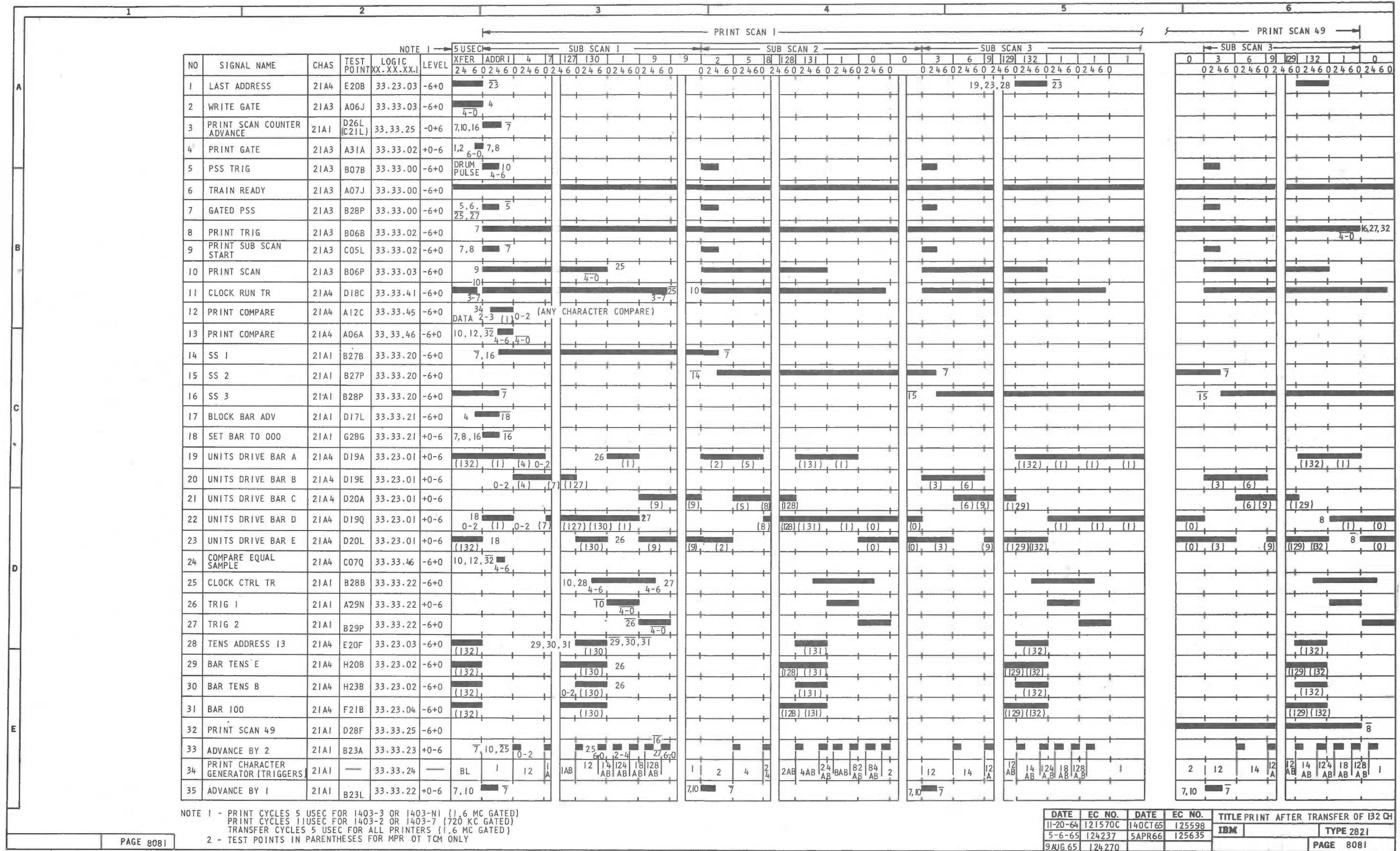


Analyze the above printout and refer to suspected failure charts for isolation. Reader Chart, Reader Chart, DT-7 Punch Chart, Punch Chart, DT-8

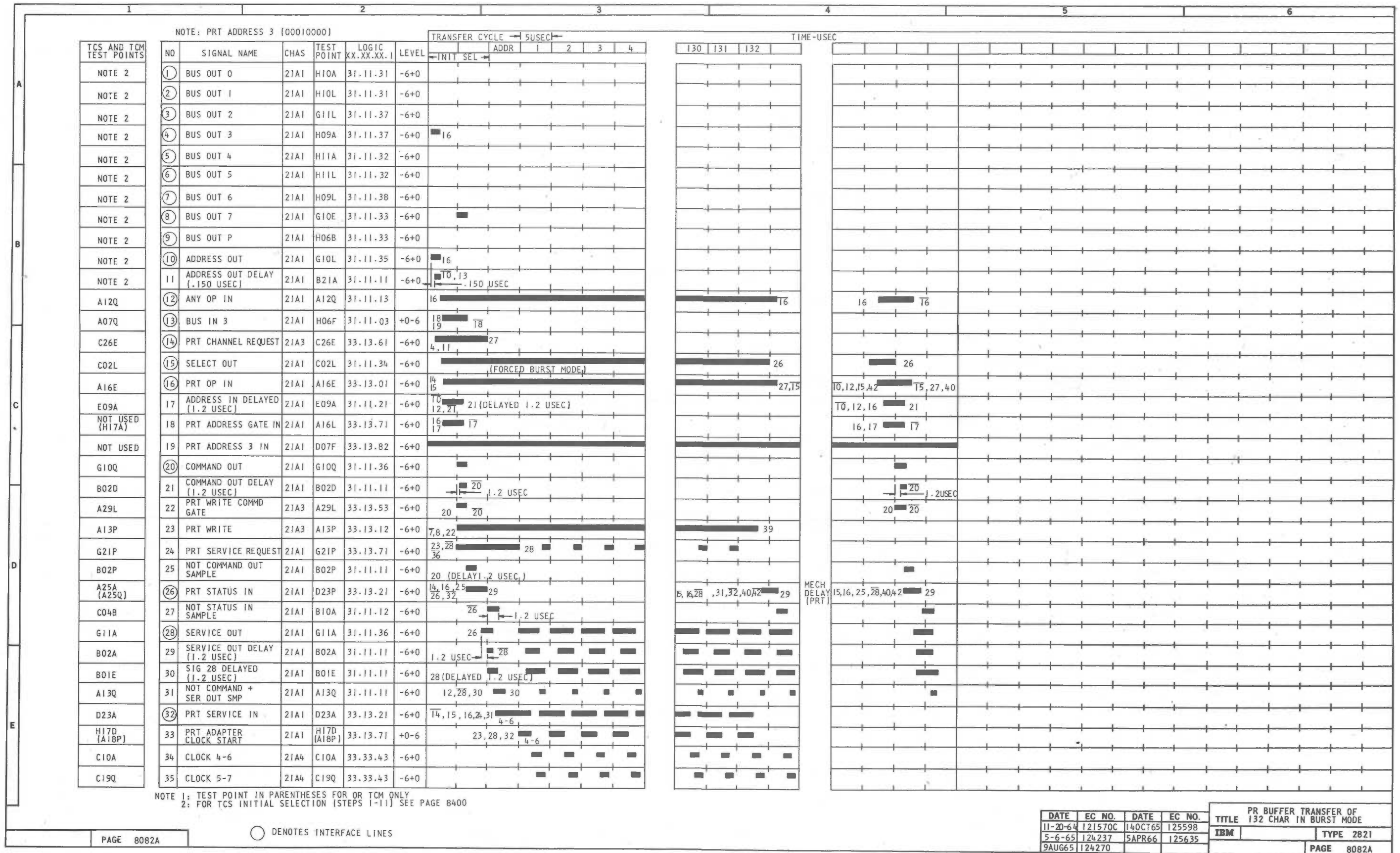
DT-19 Ripple Read Test and Ripple Punch Test--Sample Error Message







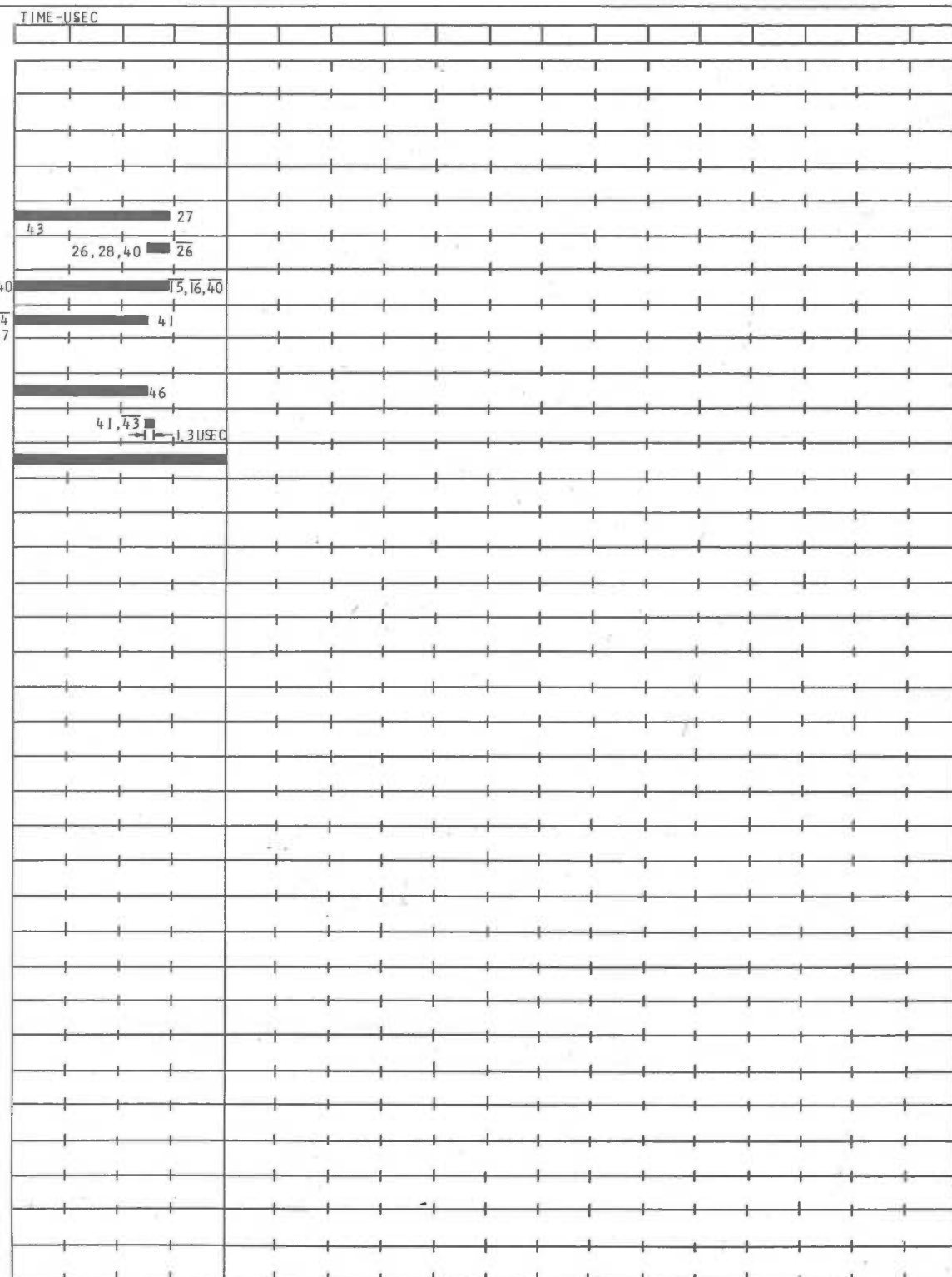
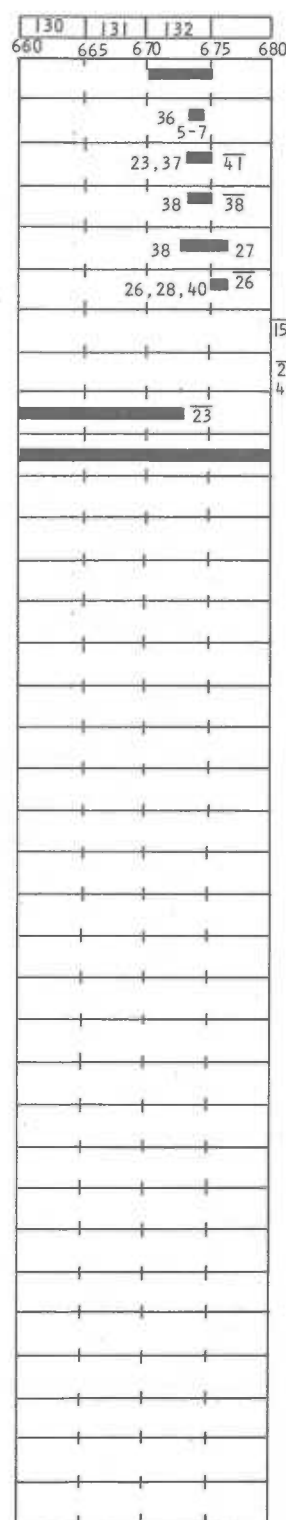
TC-9 Print After Transfer of 132 Characters



TCS & TCM TEST POINTS
E20B
A09L
B16L (F17E)
C06B
A-E24C-(E29C) B-F10L-(H10L)
B21P (C23A)
A-C03L-(D12F) B-H27C-(E10F)
A18G
A16P
D30L (D19E)
C23D (G20D)
C31H

NOTE: PRT ADDRESS 3

NO	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL	ADDR			
						1	2	3	4
36	LAST ADDRESS	21A4	E20B	33.23.03	-6+0				
37	ADDR 132 SMP	21A4	A09L	33.23.03	-6+0				
(38)	PRT CHANNEL END	21A1	B16L (F17E)	33.13.54	-6+0				
39	RESET PRT COMMAND LATCHES	21A3	C06B	33.13.11	+0-6				
40	PRT INTERRUPT REQ PRT A+B INTERRUPT REQ	21A1	A25A0 (A25Q)	33.13.32 33.13.33	-6+0				
41	PRT STATUS SELECTIVE RST	21A1	B21P (C23A)	33.13.51	+0-6				
(42)	PRT ADAPTER REQ PRT ADAPTER REQ A+B	21A1	F21D	33.13.32 33.13.33	-6+0				
(43)	PRT DEVICE END	21A1	A18G	33.13.54	-6+0				
44	PRT COMD STORED	21A3	A16P	33.13.11	-6+0	23			
45	PRT BUSY	21A1	D30L (D26C)	33.13.51	-6+0	14,44			
46	NOT PRT DEVICE END SMP	21A1	G19R	33.13.54	+0-6				
47	PRT COMPLETE	21A3	C31H	33.33.03	-6+0				
48									
49									
50									
51									
52									
53									
54									
55									
56									
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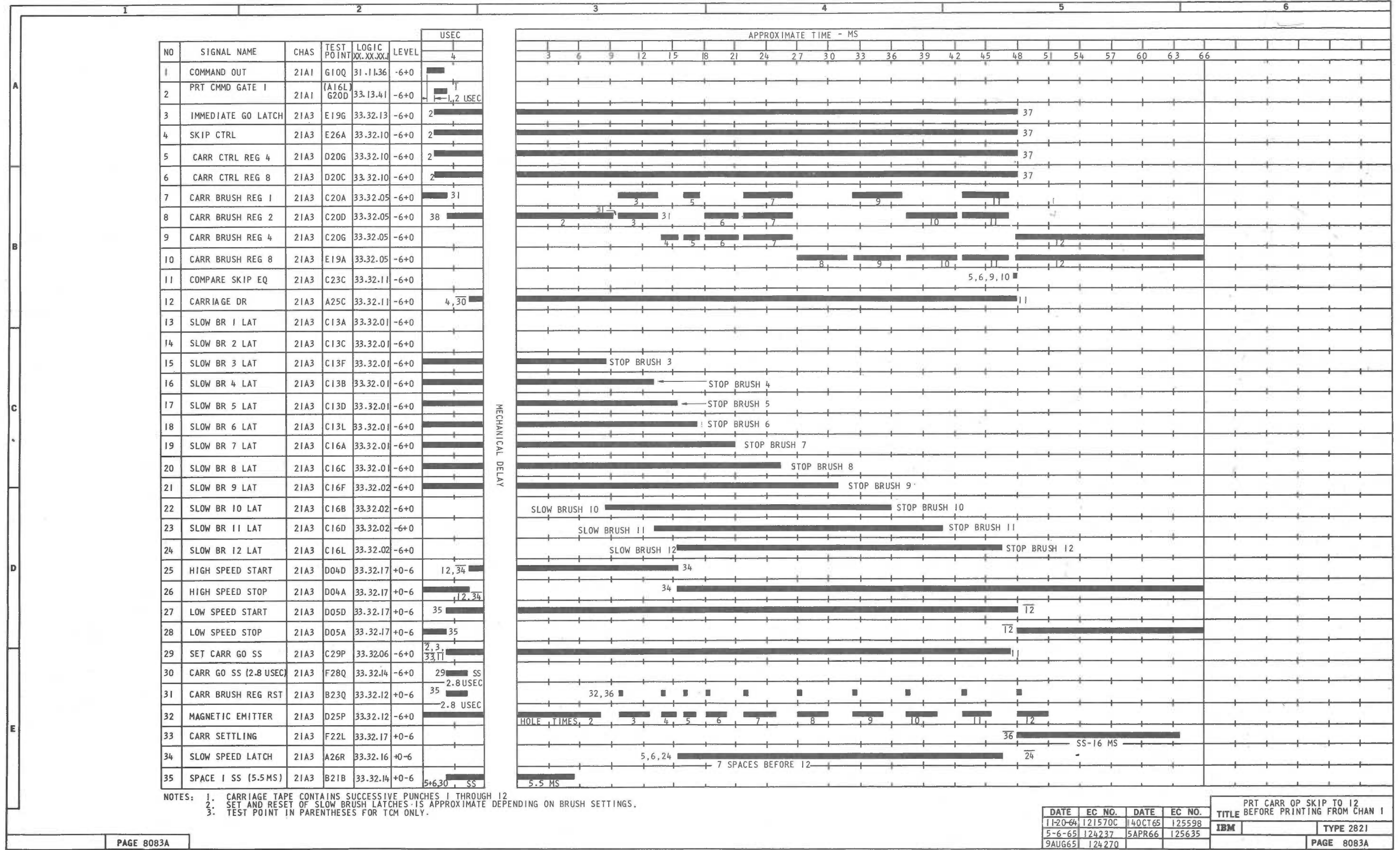


○ DENOTES INTERFACE LINES
 NOTES: TEST POINTS IN PARENTHESES FOR MPR OR TCM ONLY.

DATE	EC NO.	DATE	EC NO.	TITLE
11-20-64	121570C	14OCT65	125598	PR BUFFER TRANSFER OF 132 CHAR IN BURST MODE
5-6-65	124237	5APR66	125635	IBM
9AUG65	124270			TYPE 2821

PAGE 8082B

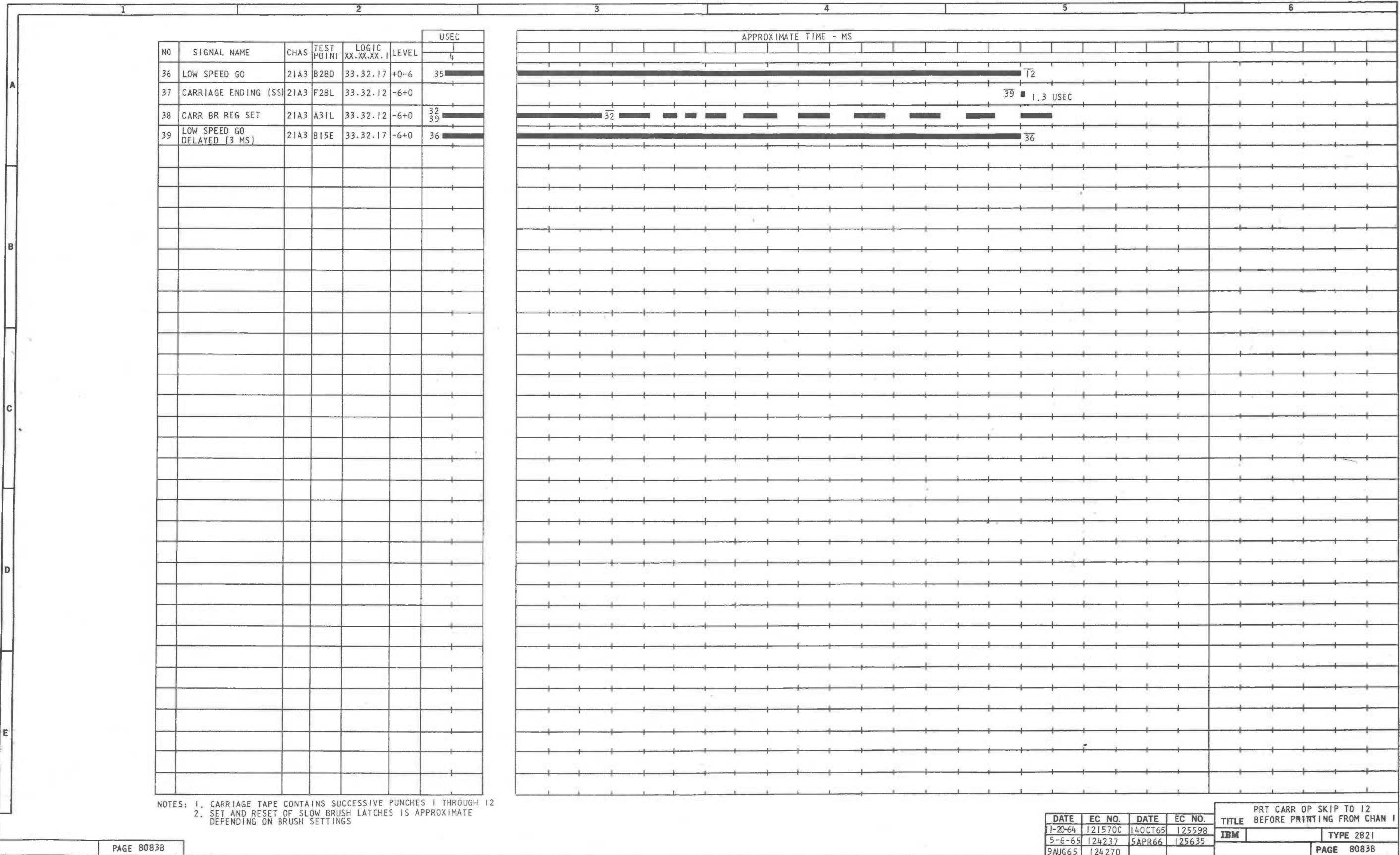
2821 FEMDM (7/67) TC-11



NOTES: 1. CARRIAGE TAPE CONTAINS SUCCESSIVE PUNCHES 1 THROUGH 12.
 2. SET AND RESET OF SLOW BRUSH LATCHES IS APPROXIMATE DEPENDING ON BRUSH SETTINGS.
 3. TEST POINT IN PARENTHESES FOR TCM ONLY.

DATE	EC NO.	DATE	EC NO.	TITLE
11-20-64	121570C	14OCT65	125598	PRT CARR OP SKIP TO 12 BEFORE PRINTING FROM CHAN 1
5-6-65	124237	5APR66	125635	IBM
9AUG65	124270			TYPE 2821

TC-12 Printer Carriage Operation - Skip to Channel 12 from Channel 1 Before Printing (Sheet 1)



NO	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL	USEC
36	LOW SPEED GO	21A3	B28D	33.32.17	+0-6	35
37	CARRIAGE ENDING (SS)	21A3	F28L	33.32.12	-6+0	
38	CARR BR REG SET	21A3	A31L	33.32.12	-6+0	32 39
39	LOW SPEED GO DELAYED (3 MS)	21A3	B15E	33.32.17	-6+0	36

NOTES: 1. CARRIAGE TAPE CONTAINS SUCCESSIVE PUNCHES 1 THROUGH 12
 2. SET AND RESET OF SLOW BRUSH LATCHES IS APPROXIMATE DEPENDING ON BRUSH SETTINGS

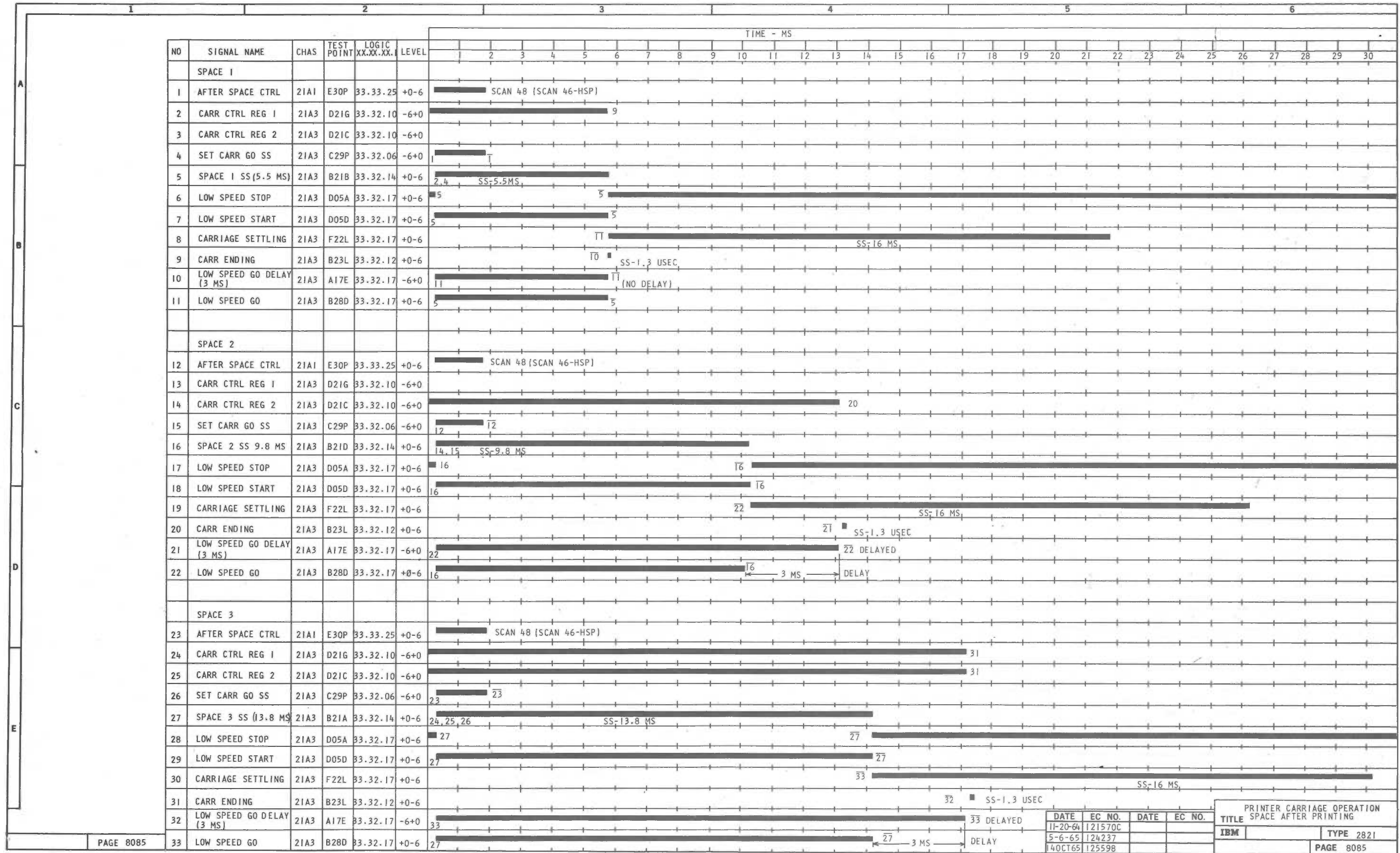
DATE	EC NO.	DATE	EC NO.
1-20-64	121570C	14OCT65	125598
5-6-65	124237	5APR66	125635
9AUG65	124270		

PRT CARR OP SKIP TO I2	
TITLE	BEFORE PRINTING FROM CHAN 1
IBM	TYPE 2821
PAGE 8083B	

NO	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL	TIME-MS																													
						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	27	28	29	30
1	PRT CONTROL	21A3	A13A	33.13.11	-6+0	■ CHANNEL END																													
2	PRT CMMD GATE 1	21A1	(NOTE2)	33.13.41	-6+0	■																													
3	IMMED GO LATCH	21A3	E19G	33.32.13	-6+0	■ 1,9 14																													
4	CARR CTRL REG 1	21A3	D21G	33.32.10	-6+0	■ 2 14																													
5	SPACE CTRL	21A3	E26A	33.32.10	+0-6	■ 2 14																													
6	CARR SETTling	21A3	F22L	33.32.17	+0-6	■ 10 SS - 16 MS																													
7	1403 ON LINE	21A1	C23P (D29A)	33.13.51	-6+0	■																													
8	CARR GO SS(2.8 USEC)	21A3	F28Q	33.32.14	-6+0	■ 3,6 SS-2.8 USEC																													
9	STL MODE	21A3	C07A	43.32.00	+0-6	■																													
10	SPACE 1 SS (5.5 MS)	21A3	B10B	33.32.14	-6+0	■ 4,8 SS - 5.5 MS																													
11	LOW SPEED GO DELAYED (3 MS)	21A3	A17D	33.32.17	+0-6	■ 10 10																													
12	LOW SPEED START	21A3	D05C	33.32.17	+0-6	■ 10 10																													
13	LOW SPEED STOP	21A3	D05B	33.32.17	+0-6	■ 10 10																													
14	CARR ENDING	21A3	B23L	33.32.12	+0-6	■ TT SS-3 USEC																													
15																																			
16																																			
17																																			
18																																			
19																																			
20	DOUBLE SPACE					REPLACE SIG 10 WITH 9.8 MS-LOW SPEED GO DELAYED (11) FALLS 3 MS AFTER SIG 10 DROPS - SIGNALS AFFECTED BY SIG 10 MOVE ACCORDINGLY																													
21																																			
22	TRIPLE SPACE					REPLACE SIG 10 WITH 13.8 MS-LOW SPEED GO DELAYED (11) FALLS 3 MS AFTER SIG 10 DROPS - SIGNALS AFFECTED BY SIG 10 MOVE ACCORDINGLY																													
23																																			
24																																			
25																																			
26																																			
27																																			
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31																																			
32																																			
33																																			
34																																			
35																																			

NOTE 1: TEST POINT IN PARENTHESES FOR MPR OR TCM ONLY.
 2: FOR 21A1 PR-MPR AND TCS USE TEST POINT 21A1G20D.
 FOR 21A1 TCM USE TEST POINT 21A1A16L.

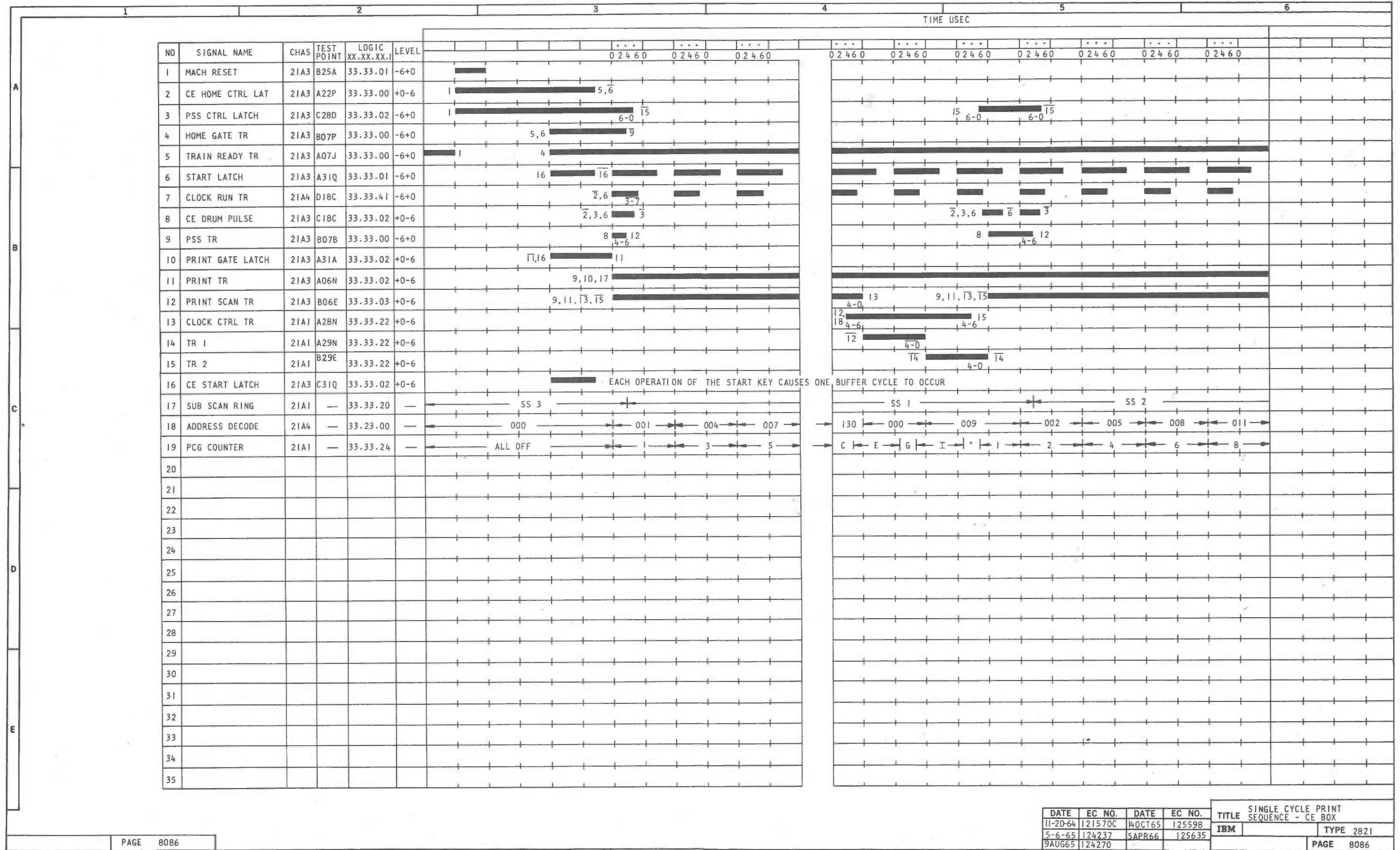
DATE	EC NO.	DATE	EC NO.	TITLE	PRINTER IMMEDIATE CARR OPERATION SINGLE SPACE
11-20-64	121570C	14OCT65	125598	IBM	TYPE 2821
5-6-65	124237	5APR66	125635		
9AUG65	124270				PAGE 8084



DATE	EC NO.	DATE	EC NO.
11-20-64	121570C		
5-6-65	124237		
14OCT65	125598		

PRINTER CARRIAGE OPERATION	
SPACE AFTER PRINTING	
TITLE	TYPE
IBM	2821
PAGE 8085	

TC-15 Printer Carriage Operation - Space After Printing



TC-16 Single Cycle Print Sequence - CE Box

NO	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX	LEVEL	SS1													SS2		SS3		SS1		SS2		SS3		PRINT SCAN X	LAST PRINT SCAN				
						240	ADDR1	3	5	7	9	11	13	85	87	UP DATE	UP DATE 2	2	3	87	89	UP DATE	UP DATE 2	2	3	3	4	88			90	UP DATE	UP DATE 2	
1	GATED PSS	21A3	B28P	33.33.00	-6+0	PSS TR													PSS TR, CLK CTR 5,24															
2	SS1	21A1	B27B	33.33.20	-6+0	4																												
3	SS2	21A1	B27P	33.33.20	-6+0																													
4	SS3	21A1	B28P	33.33.20	-6+0	1																												
5	TRAIN READY	21A3	A07J	33.33.00	-6+0	HOME GATE																												
6	UNITS I TR	21A2	H20P	43.34.25	-6+0	1,19													0-2												NOTE			
7	TENS I TR	21A2	H20B	43.34.25	-6+0	15,16,22													16,22												NOTE			
8	UNITS A	21A2	G15B	43.34.21	-6+0	10													25												NOTE			
9	UNITS B	21A2	G16B	43.34.21	-6+0	8													25												NOTE			
10	UNITS C	21A2	G17B	43.34.21	-6+0	25													9		25										NOTE			
11	UNITS D	21A2	G18B	43.34.21	-6+0	26													26												NOTE			
12	TENS A	21A2	H15B	43.34.23	-6+0																										NOTE			
13	TENS B	21A2	H16B	43.34.23	-6+0														28												NOTE			
14	TENS C	21A2	H17B	43.34.23	-6+0	28													13												NOTE			
15	TENS D	21A2	H18B	43.34.25	-6+0	14													28												NOTE			
16	TENS E	21A2	H19B	43.34.25	-6+0														28												NOTE			
17	MOD +2	21A2	G23C	43.34.11	+0-6	18													2-6												RESET BY	3, 18		
18	PRINT TR	21A3	B06B	33.33.02	-6+0	1																												
19	PRINT SCAN	21A3	B06P	33.33.03	-6+0	PSS, START																												
20	BLOCK LINE FULL	21A2	F23F	43.34.05	+0-6	1,4 (ANY)PLC INH													PLC INH		5-0													
21	LINE FULL TR	21A2	G20A	43.34.05	+0-6																													
22	CLOCK CONTROL TR	21A1	B28B	33.33.22	-6+0														19,27		24													
23	TR 1	21A1	A27A	33.33.22	+0-6														4-5		4-5													
24	TR 2	21A1	A28J (B29P)	33.33.22	-6+0																													
25	ADV UNITS TR ABC (0.6 USEC PULSES)	21A2	G13A	43.34.12	+0-6	11,18													0-2														NOTE	
26	ADV UNITS TR D (0.6 USEC PULSES)	21A2	H13A	43.34.12	+0-6	18													0-2														NOTE	
27	TENS ADDRESS I3	21A4	E20F	33.23.03	-6+0	BAR TENS B, BAR TENS E, BAR 100																											NOTE	
28	ADV TENS ADDR REG (0.6 USEC PULSES)	21A2	G14A	43.34.21	+0-6	10,11,25													23														NOTE	

NOTE: TEST POINT IN PARENTHESIS FOR MPR OR TCM ONLY

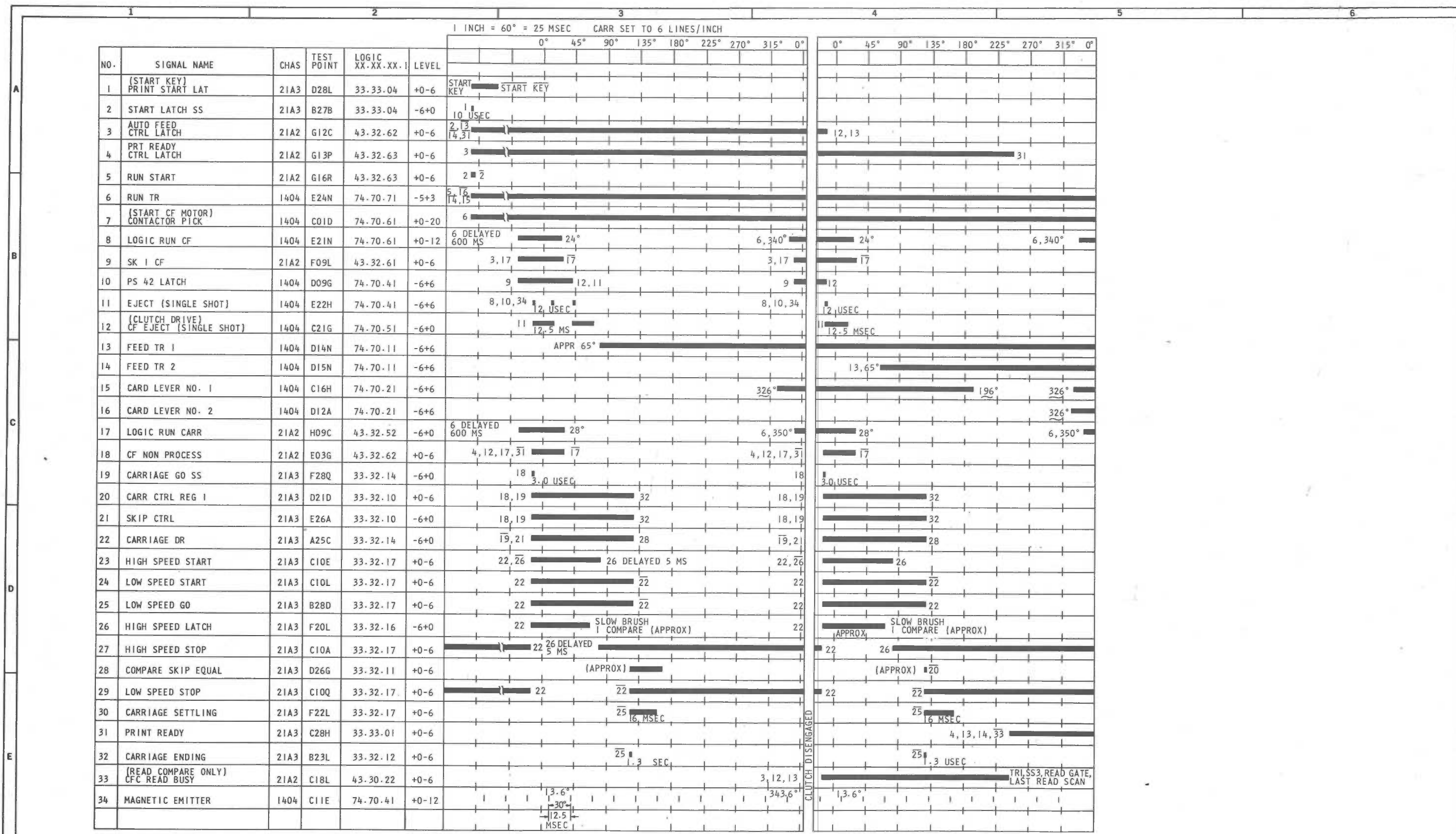
NOTE 1. VARIES WITH CHAIN FORMAT.

DATE	EC NO.	DATE	EC NO.	TITLE	UCB PRINT OPERATION
1 JUN65	121570Z	5 APR66	125635	IBM	TYPE 2821
9 AUG65	124270				
14 OCT65	125598				PAGE 8180

TCM & TCB TEST POINTS		NO.	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XXXU	LEVEL	GATE LOAD FORMAT	LOAD FORMAT → 5USEC ←	MECH DELAY
		①	BUS OUT LINES	21A1				ADDR CMMD	INITIAL SEL → 240 ADDR 1 2 3 4 237 238 239 240	
G10L		②	ADDRESS OUT	21A1	G10L	31.11.35	-6+0	■	DATA DATA DATA	
B21A		3	ADDRESS OUT DELAY (.150 USEC)	21A1	B21A	31.11.11	-6+0	→ .150 USEC		
C26E		4	PRINT CHANNEL REQUEST	21A3	C26E	33.13.61	-6+0	1,3 24		
C02L		⑤	SELECT OUT	21A1	C02L	31.11.34	-6+0	■		
A16E		⑥	PRINT OP IN	21A1	A16E	33.13.01	-6+0	4,5 5,24		
F10E		⑦	ADDRESS IN	21A1	E09A	31.11.21	-6+0	6,7 11 DELAYED 1.2USEC		
NOT USED		8	PRT ADDRESS GATE IN	21A1	A16L	33.13.71	-6+0	6,7 7		
		⑨	PRT BUS IN	21A1				ADDR STATUS		
G10Q		⑩	COMMAND OUT	21A1	G10Q	31.11.36	-6+0	■	STATUS (NOTE 2)	
B02D		11	COMMAND OUT DELAY (1.2 USEC)	21A1	B02D	31.11.11	-6+0	→ TO 1.2 USEC		
B02P		12	NOT COMMAND OUT SMP	21A1	B02P	31.11.11	-6+0	TO 23 DLYD		
A16P		13	PRT COMMAND STORED	21A3	A16P	33.13.11	-6+0	■		
H22E (D19E) B01E (A16L)		14	PRINT BUSY	21A1	H22E (D26C)	33.13.51	-6+0	4,13 32		
A13P		15	PRT COMMAND GATE I	21A1	G20D	33.13.41	-6+0	4,7,11,14 11 DLYD 1.2USEC		
G21P		17	PRT SERVICE REQUEST	21A1	G21P	33.13.71	-6+0	■		
A02C (G25P)		18	RESET TRAIN READY	21A1	A02C (G25P)	43.34.15	+0-6	■		
A07J		19	TRAIN READY	21A3	A07J	33.13.00	-6+0	■		
E25F (A24B)		20	CONDITION LOAD FORMAT	21A1	A25C	43.34.15	-6+0	1,15		
E23C (E28R)		21	PO PRT NO-OP	21A1	E23C	43.34.15	+0-6	1,20 T		
E24Q (H25A)		22	LOAD FORMAT	21A1	E24Q	43.34.15	-6+0	1,15,20		
A16L (A25Q)		⑳	PRT STATUS IN	21A1	D23P	33.13.21	-6+0	4,12 25 DELAYED 1.2 USEC		
F22D		24	NOT STATUS IN SAMPLE	21A1	E24L	31.11.12	-6+0	23 → 1.2USEC		
G11A		㉑	SERVIC OUT	21A1	G11A	31.11.36	-6+0	■		
D23A		㉒	PRT SERVICE IN	21A1	D23A	33.13.21	-6+0	4,5,6,17,25		
E21B (A18P)		27	PRT ADAPTER CLOCK START	21A1	E21B (A18P)	33.13.71	+0-6	16,25,26 4-5		
E21A (G26R)		28	END LOAD FORMAT	21A1	E21A (G26R)	43.34.15	-6+0	■		
H22L (F17E)		29	PRT CHANNEL END	21A1	H22L (F17E)	33.13.54	-6+0	21 23,25		
A-G25L-(E29C) B-A24L-(H10L)		30	PRT INTERRUPT REQUEST (PRT INTERRUPT A+B REQ)	21A1	D30A (A25Q)	33.13.32 (33.13.33)	-6+0	29 24		
A18G		31	PRT DEVICE END	21A1	A18G	33.13.54	-6+0	21 23,25		
G20D		32	NOT PRT DEVICE END SAMPLE	21A1	G19R	33.13.54	+0-6	3T → 1.3USEC		
E13A		33	SET ADDRESS REG TO 240	21A2	E13A	43.34.11	-6+0	1,15,20 T5		
E19A		34	ADDRESS 240	21A2	E19A	43.34.12	-6+0	33 27		
A-D23D-(D12F) B-E20D-(E10F)		35	PRT ADAPTER REQUEST (PRT ADAPTER REQ A+B)	21A1	D23D	33.13.32 (33.13.33)	-6+0	■		

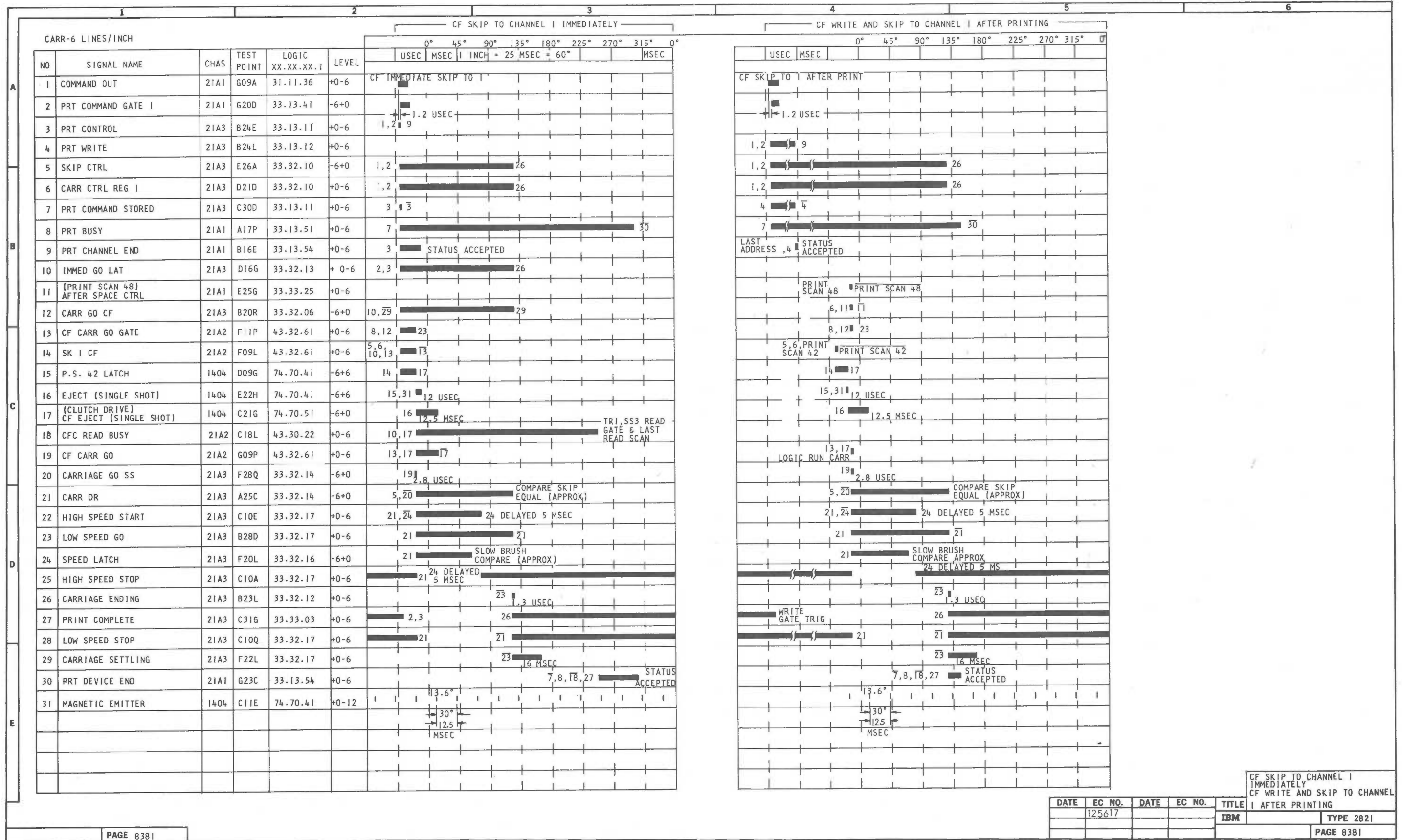
NOTE 1: PERFORM GATELOAD FORMAT COMMAND FOLLOWED BY A LOAD FORMAT COMMAND
 NOTE 2: A COMMAND OUT RESPONSE TO PRINTER SERVICE IN MAY END THE OPERATION IF THE CHANNEL RECOGNIZES THE LAST CHARACTER BEFORE THE CONTROL UNIT
 NOTE 3: TEST POINTS IN PARENTHESIS FOR MPR OR TCM ONLY

DATE	EC NO.	DATE	EC NO.	TITLE GATE & LOAD FORMAT COMMANDS
1 JUN65	1215702	5 APR66	125635	IBM TYPE 2821
9 AUG65	124270			
14 OCT65	125598			

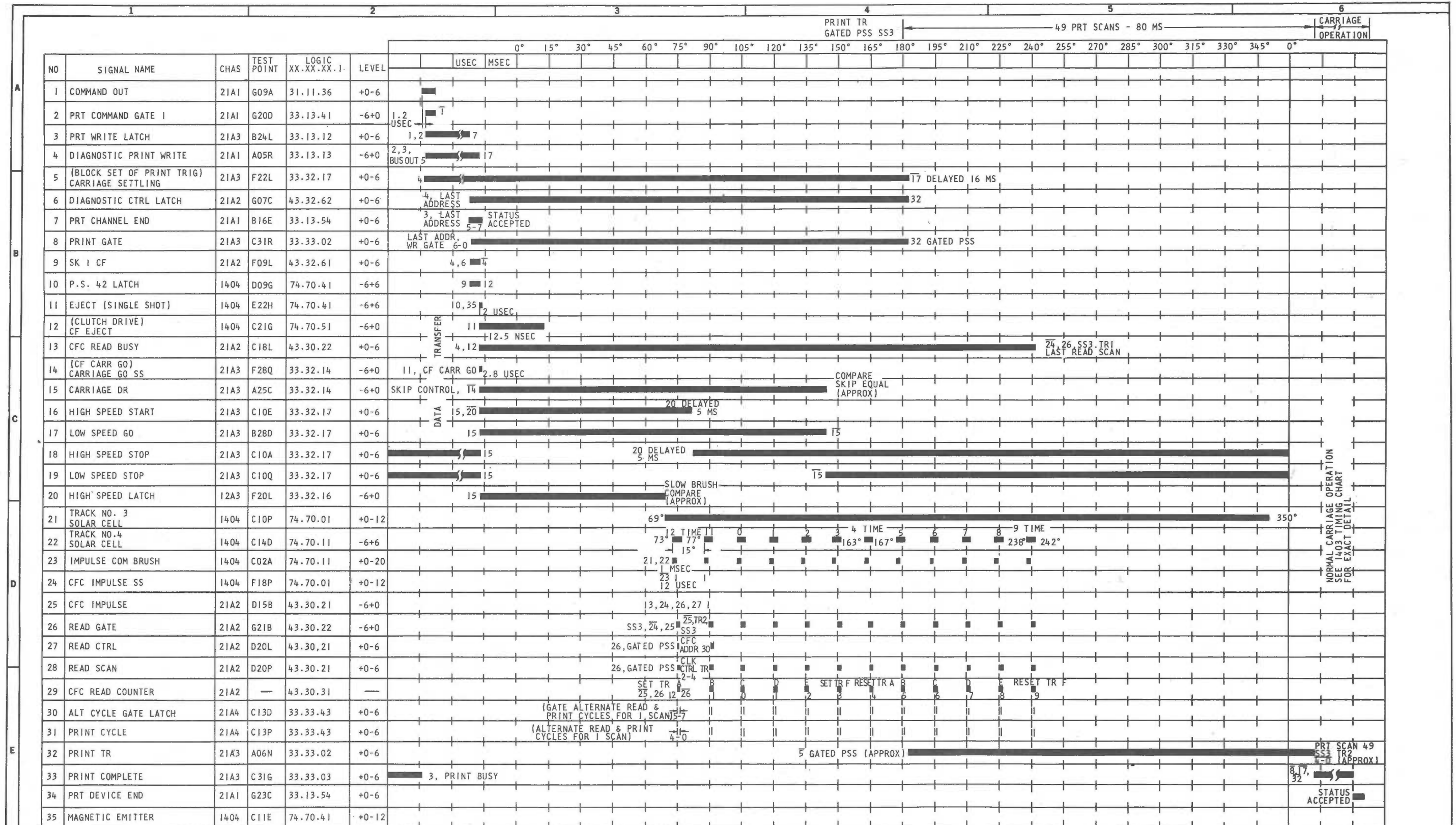


DATE	EC NO.	DATE	EC NO.	TITLE	CF INITIAL CARD RUN IN
	125617			IBM	TYPE 2821
					PAGE 8380

TC-19 CF Initial Card Run-In



DATE	EC NO.	DATE	EC NO.	TITLE
	125617			CF SKIP TO CHANNEL 1 IMMEDIATELY CF WRITE AND SKIP TO CHANNEL 1 AFTER PRINTING
				IBM
				TYPE 2821
				PAGE 8381

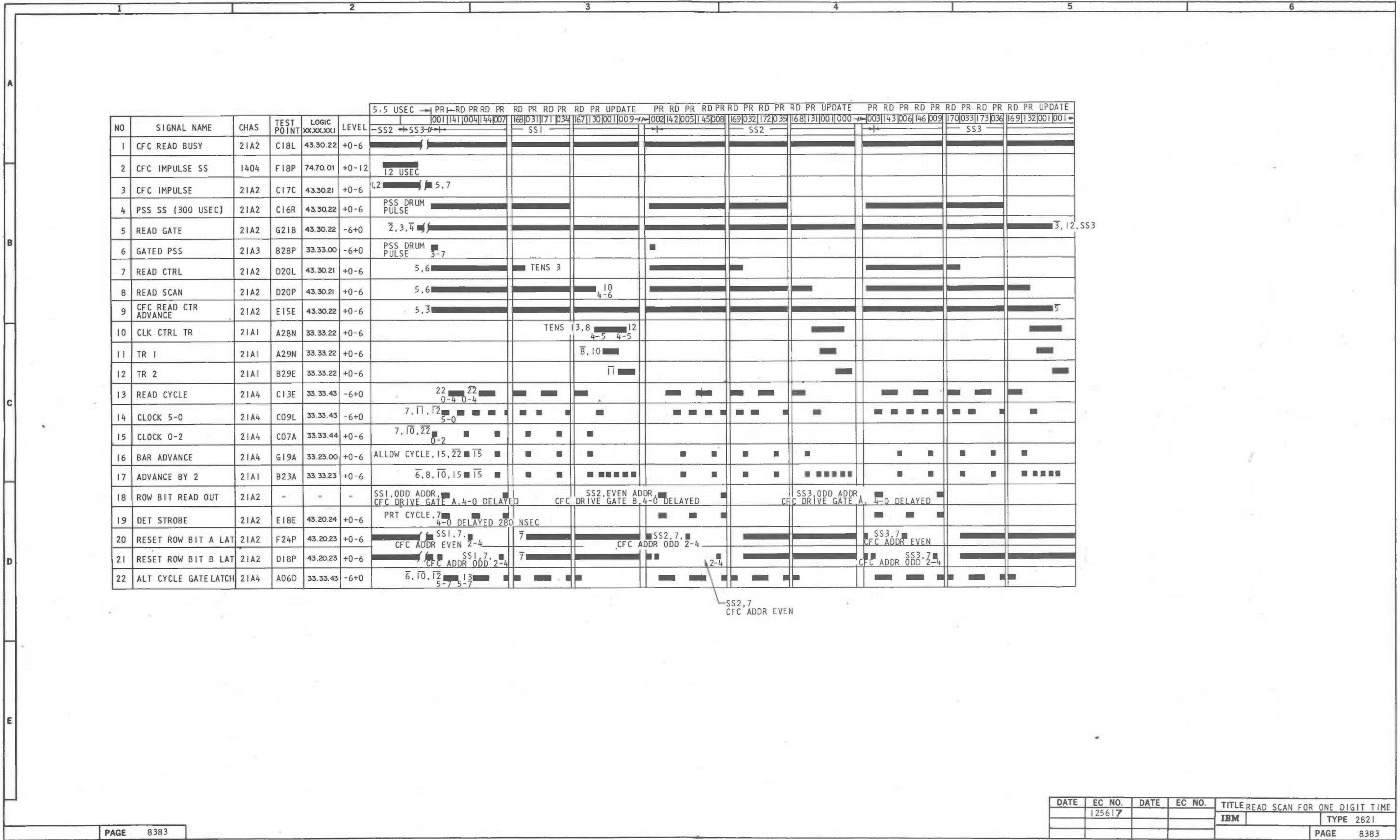


NOTE: CARD(S) FED 12 EDGE FIRST
CARRIAGE SET TO 6 LINES/INCH

PAGE 8382

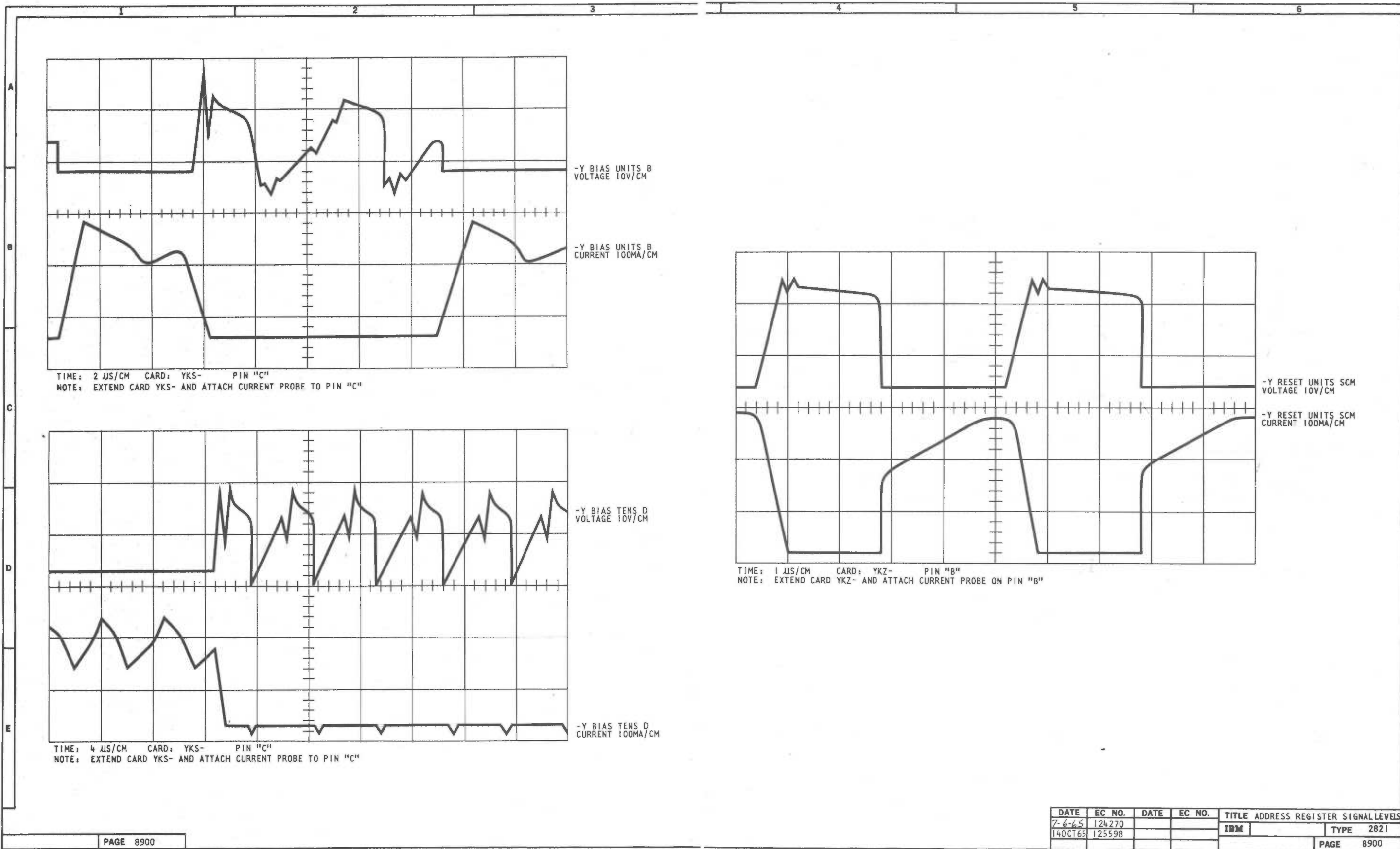
DATE	EC NO.	DATE	EC NO.	TITLEREAD DURING FEED & WRITE CMND
	125617			IBM
				TYPE 2821
				PAGE 8382

TC-21 Read During Feed and Write Command



SS2,7
CFC ADDR EVEN

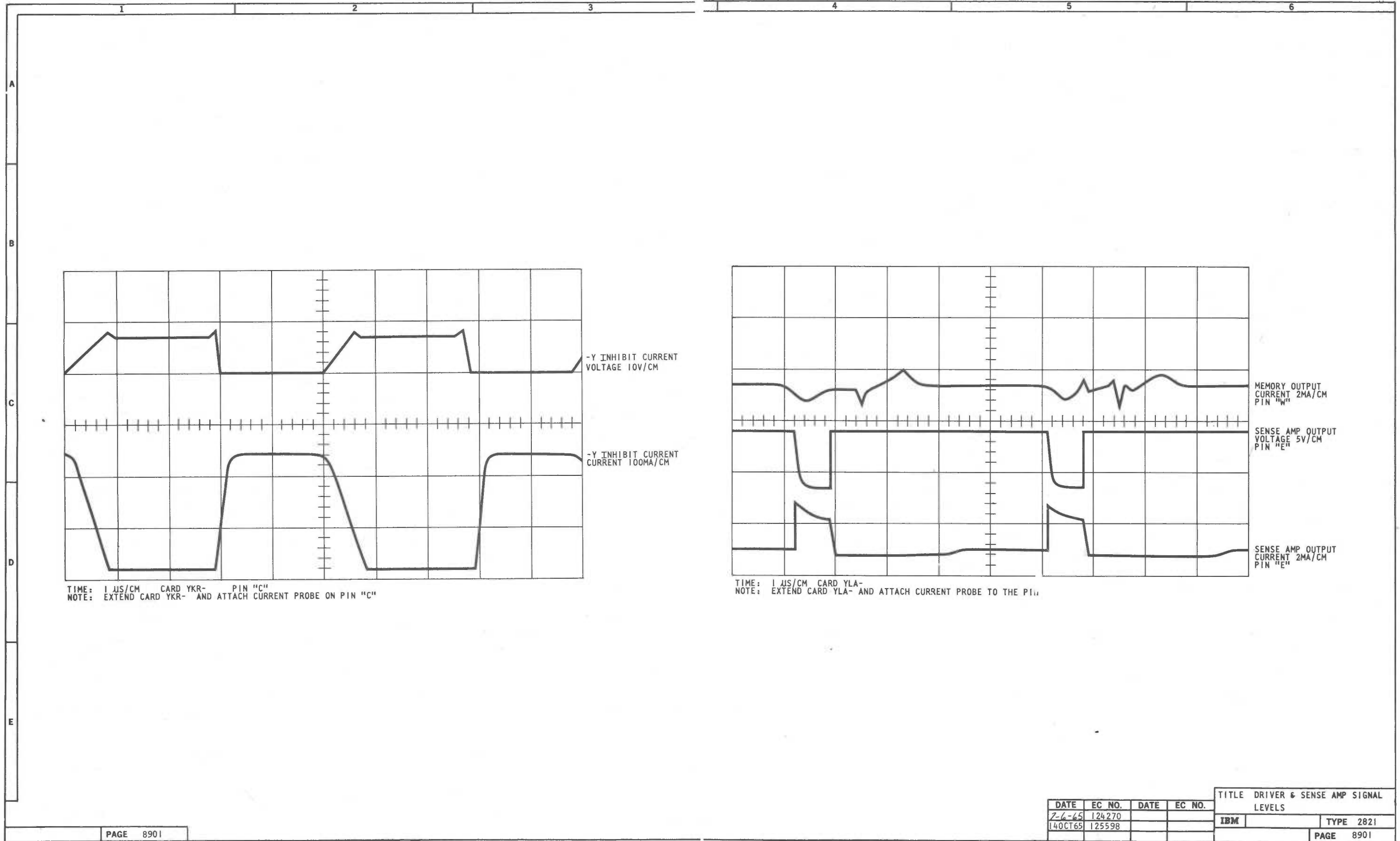
TC-22 Read Scan for One Digit Time



2821 FEMDM (7/67) SD-1

DATE	EC NO.	DATE	EC NO.	TITLE	ADDRESS REGISTER	SIGNAL LEVELS
7-6-65	124270			IBM		TYPE 2821
14OCT65	125598					PAGE 8900

SD-1 Address Register Signal Levels



DATE	EC NO.	DATE	EC NO.	TITLE
7-6-65	124270			DRIVER & SENSE AMP SIGNAL LEVELS
14OCT65	125598			IBM TYPE 2821
				PAGE 8901

SD-2 Driver and Sense Amplifier Signal Levels

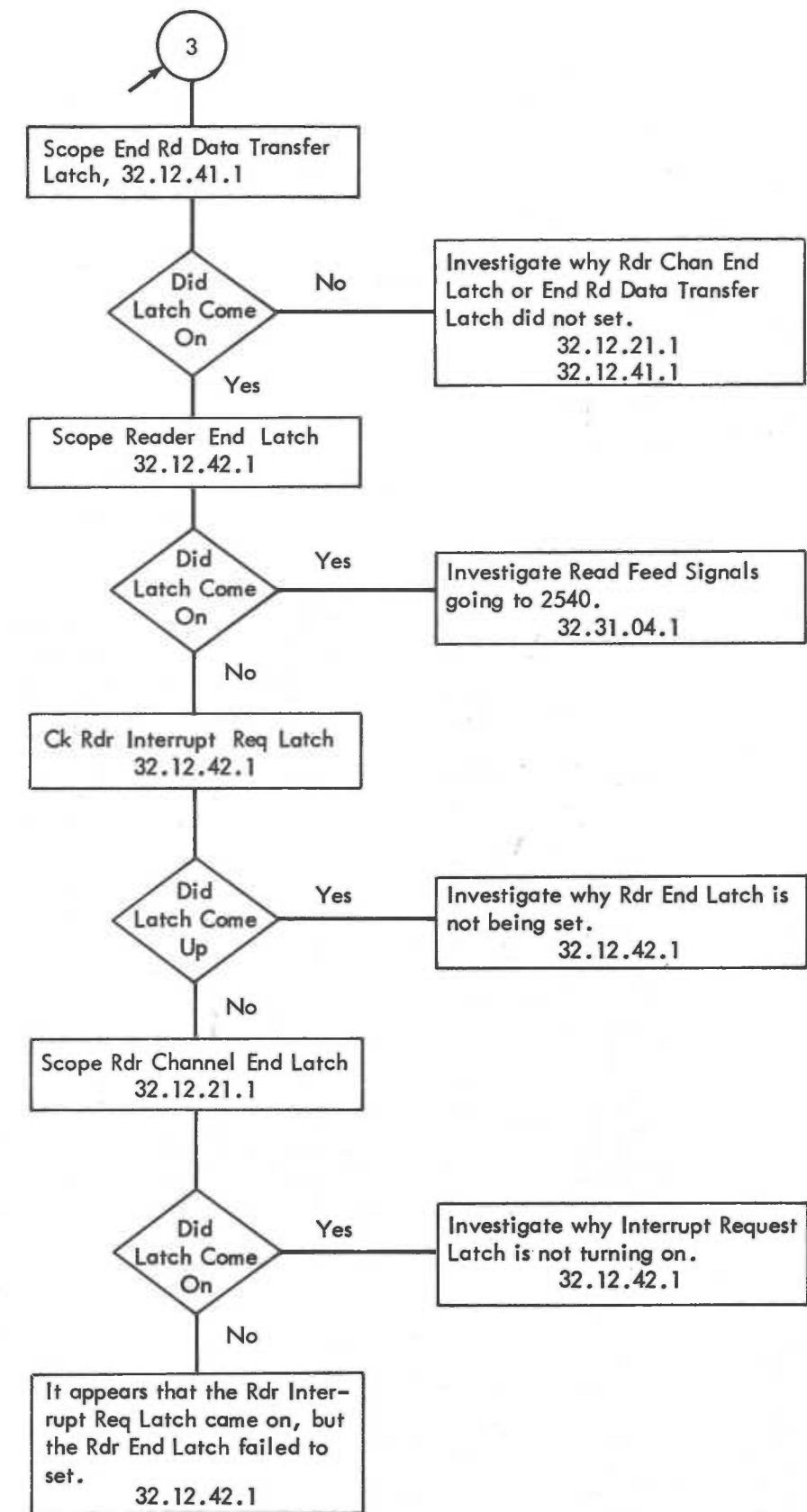
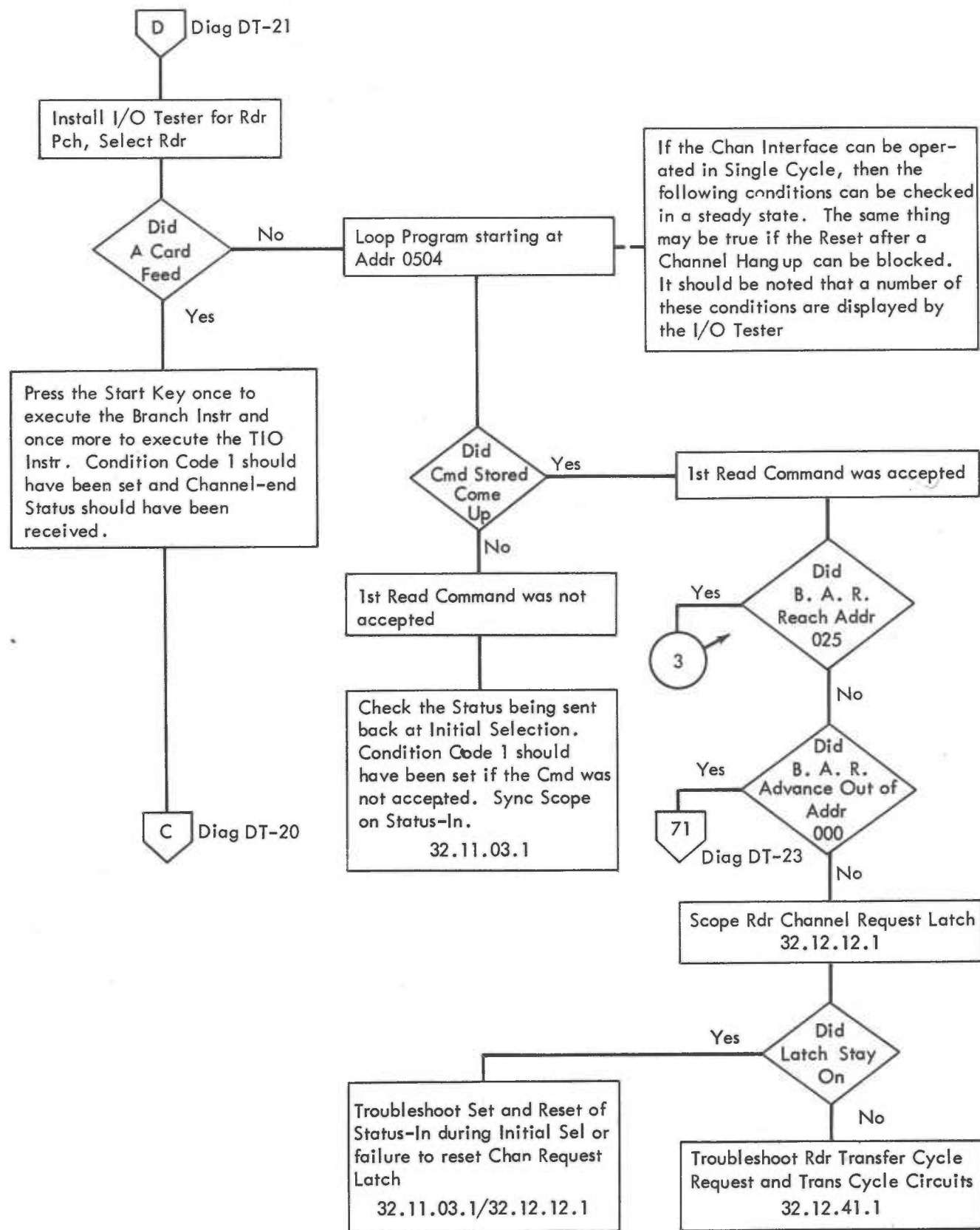
838000		SINGLE SHOT AND DELAY TIMINGS			2821	9000
ASSURE THE FOLLOWING ARE SET ACCORDINGLY. SYNC POINTS WILL NOT BE REQUIRED EXCEPT ON VARIABLE DELAY CARDS. WHEN CHECKING DELAY CIRCUITS, SYNC EXTERNAL POSITIVE ON THE INPUT PIN AND OBSERVE THE OUTPUT PIN FOR CORRECT AMOUNT OF DELAY. ALL SETTINGS HAVE A PLUS 10, MINUS 0% TOLERANCE EXCEPT WHERE NOTED.						
A	GATE	OUTPUT LOCATION	TYPE	DESCRIPTION	SETTINGS	LOGIC LOCATION
	*21A2	D18B	SS	-Y BLOCK LINE FULL - UCS ONLY 600 LPM	57.0 MSEC	43.34.05
	*21A2	D18B	SS	-Y BLOCK LINE FULL - UCS ONLY 1100 LPM	21.0 MSEC	43.34.05
	21A3	A08B	SS	-Y P.S.S. TRIG 600 LPM	300.0 USEC	33.33.00
B	21A3	A08B	SS	-Y P.S.S. TRIG 1100 LPM	150.0 USEC	33.33.00
	21A3	B09B	SS	-Y CARR. SETTling	16.0 MSEC	33.32.17
	**21A3	B10B	SS	-Y SPACE 1 -TAG READING -	5.5 MSEC	33.32.14
	**21A3	B11B	SS	-Y SPACE 2	9.8 MSEC	33.32.14
	**21A3	B12B	SS	-Y SPACE 3	13.8 MSEC	33.32.14
	21A3	B14B	SS	-Y CARR. GO	2.8 USEC	33.32.14
C	21A3	B14B	SS	-Y CARR. GO *CF	3.0 USEC	33.32.14
	21A3	B16B	SS	-Y CARR. ENDING	1.3 USEC	33.32.12
	21A3	B18B	SS	-Y CARR. BRUSH REG. RESET	2.8 USEC	33.32.12
	21A3	B18B	SS	-Y CARR. BRUSH REG. RESET *CF	2.0 USEC	33.32.12
	21A3	B08E	DLY	-Y SENSE AMP VARIABLE DELAY - B08F INPUT	15.0 USEC	33.33.00
	21A3	B15E	DLY	-Y VARIABLE DELAY - B15F INPUT - 2 OR 3 SPACE OPERATION	3.0 MSEC	33.32.17
	21A3	B27E	DLY	-Y END OF FORMS DELAY - B27F INPUT -	10.0 USEC	33.33.01
D	21A3	D22E	DLY	-Y FORMS CHECK DELAY - D22F INPUT -	9.0 MSEC	33.32.11
	21A4	B22B	SS	-Y SINGLE CYCLE	10.0 USEC	33.23.11
	S.T.L. MODE ONLY					
	21A3	D12B	SS	-Y S.T.L. GO	12.0 MSEC	43.32.00
	***21A3	D16B	SS	-Y S.T.L. CARR. SETTling	9.0 MSEC	43.32.01
	***** 21A3		---	RATE LIMITER	-----	33.32.17
	READER PUNCH					
E	21B1	H28E	DLY	-Y SCAN DELAY READER - H28F INPUT	150.0 USEC	32.32.13
	**** 21B4	E23E	DLY	-Y RDR. TIME OUT DELAY - E23F INPUT - 1400 COMPAT. ONLY	6.5 MSEC	42.14.01
F	*	± .5 MSEC				
	**	CARRIAGE CONTROL SINGLE SHOT TIMINGS:				
		1. SUBTRACT THE ACTUAL TIMING OF THE 5.5 MSEC SINGLE SHOT FROM 21.4 MSEC FOR MODEL 2 OR 7 PRINTERS (600 LPM) OR 20.8 MSEC FOR MODEL 3, OR N1 PRINTERS (1100 LPM) TO DETERMINE THE ACTUAL TIMING OF THE 16 MSEC SINGLE SHOT.				
		2. THE ACTUAL TIMING OF SPACE 2 AND SPACE 3 SINGLE SHOTS DEPENDS UPON GOOD PRINT ALIGNMENT. SEE 1403 FIELD ENGINEERING MAINTENANCE MANUAL, FORM 225 - 6493 - 4 OR HIGHER FOR ADJUSTMENT PROCEDURES.				
G	***	THE COMBINED TIMINGS OF THE S.T.L. 12.0 - MSEC AND 9 - MSEC SINGLE SHOTS SHOULD EQUAL 21.4 MSEC FOR MODEL 2 OR 7 PRINTERS AND 20.8 MSEC FOR MODEL 3 OR N1 PRINTERS. ADJUST THE 9 - MSEC SINGLE SHOT TO OBTAIN THIS TIMING.				
	****	SET THE PROCESSOR INTO A COMPATIBILITY LOOP OF READ PRINT-PRINT AND BRANCH BACK TO READ. INTERNAL SYNC PLUS ON PIN E23F AND ADJUST FOR A 6.5-MSEC PULSE.				
	*****	INSTALL A CARRIAGE TAPE WITH A CHANNEL-1 PUNCH EVERY 66 LINES (11 INCHES). SET UP A PRINT-AND-SKIP OPERATION ON THE I/O TESTER. THE DATA REGISTER CAN BE FILLED WITH BLANKS AND THE PAPER REMOVED FROM THE 1403 (THE END OF FORMS CONTACTS SHOULD BE HELD DOWN WITH A PUNCHED CARD). THE CARRIAGE SHOULD BE ENGAGED.				
H	SCOPE THE LOW-SPEED START SIGNAL (LOGIC 33.32.17.1). THE TIME BETWEEN THE RISE OF ONE LOW-SPEED START SIGNAL AND THE RISE OF THE NEXT ONE SHOULD BE SET TO 315 MILLISECONDS BY ADJUSTING THE POT ON THE RATE LIMITER CARD JUST INSTALLED.					
	IF THIS CANNOT BE ACHIEVED, SET THE POT AT THE POT LIMIT. IN NO CASE SHOULD THE SETTING BE LESS THAN 315 MILLISECONDS OR MORE THAN 330 MILLISECONDS.					
	NOTE: THE MAXIMUM AND MINIMUM TIME DELAY FROM PIN "L" TO PIN "E" FOR CARD CAPS DGC-, DGD-, DGF-, AND DGH- ARE: MAXIMUM TIME DELAY = (NOMINAL VALUE) + (NOMINAL VALUE) (.05) MINIMUM TIME DELAY = (NOMINAL VALUE) - (NOMINAL VALUE) (.05)					
J						

Interface	
Burst Proceed	SLD-29 C2
Byte Counter 1	SLD-29 D2
Channel Register	SLD-30 E2
Interleave Proceed	SLD-29 C2
Not Command Out Sample	SLD-28 A4
Not Service Out Sample	SLD-28 B4
Reader-Punch Service In	SLD-30 C3
Reader-Punch Status In	SLD-30 C6
Test I/O	SLD-28 E5
I/O Tester	
Reader-Punch	
Block Punch Feed	SLD-11 D2
Block Read Feed	SLD-11 E2
CE Start Latch	SLD-11 B2
Punch Complete	SLD-11 D2
Punch Feed	SLD-11 D3
Read Complete	SLD-11 C2
Read Feed	SLD-11 C2
Read Service Cycle	SLD-11 C6
Read Transfer Cycle	SLD-11 B6
Read Transfer Cycle Request	SLD-11 B3
Reader-Punch Adapter Reset	SLD-11 C4
Reset RAR	SLD-11 B3
Printer	
CE Address Set Control	SLD-20 D1
CE Carriage Set Control	SLD-20 D5
CE Home Control Latch	SLD-19 B1
CE Start Latch	SLD-19 A1
Clock Run Trigger	SLD-19 E2
Hammer Check Latch	SLD-20 E5
Home Gate	SLD-19 B5
Immediate Go	SLD-20 B1
Print Gate Latch	SLD-19 D6
Print Ready	SLD-20 E4
Print Trigger	SLD-19 E6
Printer Adapter Reset Latch	SLD-20 E1
PSS Control Latch	SLD-19 B1
PSS Trigger	SLD-19 A5
Train Ready	SLD-19 C5
Write Gate	SLD-19 C4
Reader	
0 Bit Modifier	SLD-13 D2
1 Bit Modifier	SLD-13 D2
9 Read Service Cycle	SLD-32 A2
Adapter Request	SLD-32 B6
Adapter Reset	SLD-32 C5
Address Check	SLD-2 D2
Allow Cycle	SLD-13 E4
Address Register	UDC-4 C2, SLD-13 B5
Block RAR Advance	SLD-13 D4, SLD-33 C5
Bus Out Check	SLD-1 B5
Busy	SLD-13 E4
Channel End	SLD-10 A3, SLD-12 A2, SLD-12 A5
Channel Register	UDC-5 D3, SLD-12 E5
Channel Register Full	SLD-12 C5
Channel Request	SLD-32 D3
Check Planes	UDC-4 B4
Command Reject	SLD-1 C5
Data Check	SLD-2 D4
Data Check Gate	SLD-2 E3
Data Register	UDC-4 B4, SLD-12 E4
Data Register BAR Check	SLD-2 C2
Delta Read Service Cycle Request	SLD-13 D5, SLD-33 B5
Device End	SLD-10 A4, SLD-13 C2
End Read Data Transfer	SLD-12 B2
Equipment Check	SLD-2 A4
Interrupt Request	SLD-13 A1
Intervention Required	SLD-32 B3
Operational In	SLD-32 D5
Punch Select	SLD-12 B6
Queued	SLD-32 A3
RAR Units Triggers	SLD-34
RAR Tens Triggers	SLD-34
Read Check	SLD-2 B2
Read Check Read	UDC-5 B1
Read Complete	SLD-13 B2
Reader Control	SLD-12 A5

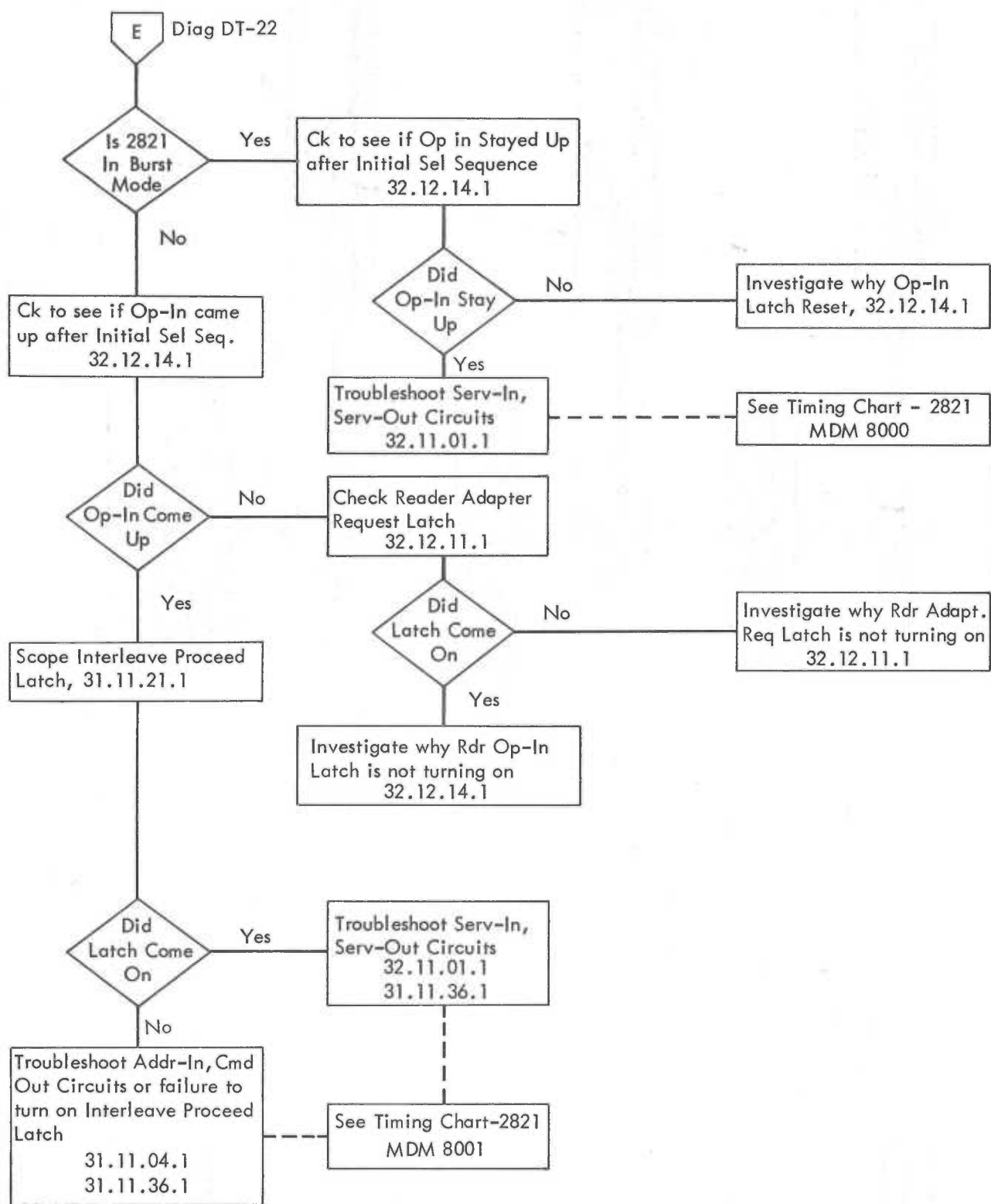
Latch or Trigger Name	Logic	Type	Figure and Location				
			Basic	CF	PRST	UCB	MPR
Load Format	43.34.15	FL				SLD-21 B3	
Mod +2	43.34.17	FL				SLD-42 E2	
Not Command Out Sample	31.11.11	FL	SLD-28 A4				
Not Service Out Sample	31.11.11	FL	SLD-28 B4				
PSS Control	33.33.02	FL	SLD-19 B1				
PCG	33.33.24	TR	UDC-6				
			SLD-17 B3				
			SLD-41				
Print Adapter Request	33.13.32	FL	SLD-37 B6				
Print Adapter Reset	33.13.32	FL	SLD-20 E1				
			SLD-37 D5				
Print Buffer Address Register	33.23.02	TR	UDC-6 D3			UDC-7 D3	
			SLD-16 C6			SLD-22 C2	
			SLD-17 D2				
			SLD-40				
			SLD-46				
			SLD-47				
Print Buffer Data Register	33.23.06	TR	UDC-6 C5			UDC-7 C5	
			SLD-16 C4			UDC-8 A4	
	33.13.62	FL				SLD-22 B3	
Print Bus Out Check	33.13.62	FL	SLD-4 C4			SLD-5 D4	
			SLD-7 D4				
Print Busy	33.13.51	FL	SLD-16 E3				
Print Channel End	33.13.54	FL	SLD-10 D3			SLD-21 C3	
			SLD-16 B3				
Print Channel Request	33.13.62	FL	SLD-37 D2				
Print Clock	33.33.42	TR	UDC-6 D3			UDC-7 D3	
			SLD-15 C6			SLD-21 D5	
			SLD-17 D2			SLD-22 C2	
Print Clock Run	33.33.41	TR	SLD-16 C5			SLD-21 C5	
			SLD-17 C1			SLD-22 C1	
			SLD-19 E2				
Print Command Chained	43.34.14	FL				SLD-6 E5	
Print Command Reject	33.13.62	FL	SLD-4 B4			SLD-5 C4	SLD-7 C4
			SLD-8 C4				
Print Complete	33.33.03	FL	SLD-18 A4	SLD-24 A3	SLD-26 A5		
Print Control	33.13.11	FL	SLD-16 B1				
Print Device End	33.13.54	FL	SLD-10 E3	SLD-24 A5	SLD-26 A5		
			SLD-18 A5				
Print Gate	33.33.02	FL	SLD-17 D3			SLD-22 D3	
			SLD-19 D6				
Print Interrupt Request	33.13.32	FL	SLD-37 E5				
Print Intervention Required	33.13.56	FL	SLD-4 A4			SLD-5 A4	SLD-7 A4
			SLD-37 E2				
Print Op In	33.13.01	FL	SLD-39 D3				
Print Parity Check	33.32.10	FL	SLD-4 C2	SLD-8 B2		SLD-5 C2	SLD-7 C2
Print Queued	33.13.51	FL	SLD-38 B4				
Print Ready	33.33.01	FL	SLD-4 A3			SLD-5 A3	SLD-7 A3
			SLD-20 E3				
Print Scan	33.33.03	TR	SLD-17 E5			SLD-22 E5	
Print Scan Counter	33.33.25	TR	UDC-6 A2				
Print Sense	33.13.11	FL	SLD-10 D2				
Print Service In	33.13.21	FL	SLD-39 B5				
Print Status In	33.13.21	FL	SLD-39 D5				
Print Sub Scan	33.33.00	TR	SLD-19 A5				
Print Trigger	33.33.02	TR	SLD-17 E4			SLD-22 E4	
			SLD-19 E5				
Print Unit Check	33.13.56	FL	SLD-4 A4	SLD-8 D4		SLD-5 B4	SLD-7 C4
Print Write	33.13.12	FL	SLD-16 A3			SLD-21 A4	
Print Write Data Available	33.13.71	FL	SLD-16 B5			SLD-21 B4	
			SLD-39 C2				
Print Write Gate	33.33.03	TR	SLD-16 C4			SLD-21 E4	
			SLD-19 C3				
Punch Adapter Request	32.13.11	FL	SLD-35 A6				
Punch Adapter Reset	32.13.11	FL	SLD-35 C5				
Punch Address Register	32.20.14	TR	UDC-4 D2				
			SLD-15 D5				
			SLD-37				
Punch Buffer Full	32.33.25	FL	SLD-15 E4				
Punch Bus-Out Check	32.13.31	FL	SLD-1 E4				
Punch Channel End	32.13.21	FL	SLD-10 C3				
			SLD-14 A4				
Punch Channel Request	37.13.12	FL	SLD-35 C2				
Punch Check Read	42.11.01	FL	UDC-5 A2				
Punch Command Reject	32.13.31	FL	SLD-1 E4				

Latch or Trigger Name	Logic	Type	Figure and Location				
			Basic	CF	PRST	UCB	MPR
Punch Complete	32.31.07	FL	SLD-11 D2 SLD-15 E2				
Punch Data Check PFR	42.12.03	FL	SLD-3 B5				
Punch Device End	32.13.22	FL	SLD-3 B3 SLD-10 D4 SLD-15 E2				
Punch End	32.13.42	FL	SLD-14 A5				
Punch Equipment Check	32.13.33	FL	SLD-5 D5				
Punch Feed	32.13.32	FL	SLD-11 D3				
Punch Insert Blocks	32.33.25	FL	SLD-15 E5 SLD-35 E6				
Punch Interrupt Request	32.13.42	FL	SLD-14 B4 SLD-35 A2				
Punch Intervention Required	32.13.33	FL	SLD-35 E1				
Punch Last Address	32.33.18	FL	SLD-14 C3 SLD-35 B5				
Punch Not Ready	32.13.42	FL	SLD-33 B3				
Punch Op In	32.13.12	FL	SLD-35 D5 SLD-38 D2				
Punch PFR Transfer Cycle	42.13.27	FL	SLD-36 D5				
Punch PFR Validity	42.12.03	FL	SLD-3 A5				
Punch Queued	32.13.42	FL	SLD-35 A3				
Punch Scan Emit	32.33.18	FL	SLD-15 D2 SLD-35 C5				
Punch Sense	32.13.02	FL	SLD-10 C1				
Punch Service Cycle	32.33.17	FL	UDC-4 A5 SLD-11 E5 SLD-15 C2 SLD-36 C3				
Punch Stacker Inhibit 1	32.33.21	FL	SLD-3 C2				
Punch Stacker Inhibit 2	32.33.21	FL	SLD-3 D3				
Punch Stacker Inhibit 3	32.33.32	FL	SLD-3 E4				
Punch Time Counter	32.33.11	TR	UDC-4 B4 SLD-15 A4				
Punch Transfer Cycle	32.33.17	FL	UDC-4 E2 UDC-5 E2 SLD-11 E5 SLD-14 C5 SLD-36 B3				
Punch Unit Check	32.13.22	FL	SLD-1 D4				
Punch Write	32.13.02	FL	SLD-14 A2				
Read Check	32.30.53	FL	SLD-2 B2				
Read Check Read	42.11.01	FL	UDC-5 B2				
Read Complete	32.31.07	FL	SLD-11 C2 SLD-13 B1				
Read Data or Bar Check	32.20.53	FL	SLD-2 C2				
Read Feed	32.12.40	FL	SLD-11 C2				
Read Translate Check	32.20.79	FL	SLD-2 C5				
Read Validity Check	32.12.34	FL	SLD-2 E4				
Reader Adapter Request	32.12.11	FL	SLD-32 B6				
Reader Adapter Reset	32.12.11	FL	SLD-32 C5				
Reader Address Register	32.20.12	TR	UDC-4 C2 SLD-13 C5 SLD-34				
Reader Bus-Out Check	32.12.31	FL	SLD-1 B5				
Reader Busy	32.12.21	FL	SLD-13 E4				
Reader Channel End	32.12.21	FL	SLD-10 A3 SLD-12 A2				
Reader Channel Request	32.12.12	FL	SLD-32 D3				
Reader Command Reject	32.12.32	FL	SLD-1 C5				
Reader Control	32.12.02	FL	SLD-12 A5				
Reader Data Check	32.12.34	FL	SLD-2 E4				
Reader Data Check Gate	32.12.34	FL	SLD-2 E4				
Reader Device End	32.12.22	FL	SLD-10 A4 SLD-13 C2				
Reader End	32.12.42	FL	SLD-13 B2				
Reader Equipment Check	32.12.34	FL	SLD-2 A4				
Reader Interrupt Request	32.12.42	FL	SLD-13 A1				
Reader Intervention Required	32.12.34	FL	SLD-32 B3				
Reader Op In	32.12.14	FL	SLD-32 D5				
Reader-Punch Data Register	32.20.31	TR	UDC-4 B3 SLD-12 E4 SLD-14 D2 SLD-15 A3 SLD-31				
Reader-Punch Select	32.20.17	TR	SLD-12 B6				

Latch or Trigger Name	Logic	Type	Figure and Location				
			Basic	CF	PRST	UCB	MPR
Reader-Punch Service-In	32.11.01	FL	SLD-30 C3				
Reader-Punch Status-In	32.11.03	FL	SLD-30 C6				
Reader Queued	32.12.42	FL	SLD-32 A3				
Reader Read	32.12.02	FL	SLD-12 B2				
Reader Ready	32.12.42	FL	SLD-13 E2				
Reader Sense	32.12.02	FL	SLD-10 A2				
Reader Service Cycle Request	32.32.13	FL	SLD-13 D6 SLD-33 A6				
Reader Service Cycle	32.32.13	FL	UDC-4 B1 SLD-11 D5 SLD-13 D4 SLD-33 C3				
Reader Timer Counter	32.32.11	TR	UDC-4 A1 SLD-13 A4				
Reader Transfer Cycle	32.32.13	FL	UDC-5 C2 SLD-11 C5 SLD-12 C5 SLD-33 C3				
Reader Transfer Cycle Request	32.31.09	FL	SLD-11 B3				
Reader Unit Check	32.12.22	FL	SLD-1 A5				
Reader 0 Bit Mod	32.12.03	FL	SLD-13 D1				
Reader 1 Bit Mod	32.12.03	FL	SLD-13 D1				
Reset RAR	32.31.07	FL	SLD-11 B3				
Skip-Space	33.32.10	FL	SLD-18 C3	SLD-24 D2	SLD-27 B2		
Slow Speed	33.32.16	FL	SLD-18 C5		SLD-26 C5		
Suppress Data	31.11.35	FL	SLD-29 C4				
Sync Check	33.33.21	TR	SLD-4 A2 SLD-5 B2			SLD-7 B2	
Tape Control STL 1,2,3,and 8	43.32.01	FL			SLD-27 E2		
Test I/O	31.11.21	FL	SLD-28 E5				
Train Ready	33.33.00	TR	SLD-19 C5				
Transfer Cycle Request	32.31.11	TR	UDC-4 C1 SLD-12 B3 SLD-14 B3 SLD-36 C2				
UCB Buffer Address Register	43.34.23	TR				UDC-7 B3 SLD-42 SLD-43	
UCB Data Register	43.34.33	TR				UDC-8 C5 SLD-22 A3 SLD-44	
UCB Home	43.34.05	TR				SLD-45 D3	
UCB Parity Check	43.34.37	FL				SLD-6 C5	
Uncomparable Character	43.34.05	TR				SLD-45 C4	
Update TR-1	33.33.22	TR	SLD-17 E1			SLD-22 E1	
Update TR-2	33.33.22	TR	SLD-17 E2			SLD-22 E2	
9-Read Service Cycle	32.12.32	FL	SLD-32 A2				



DT-22 Hang-Up Condition During IPL Sheet 3



DT-23 Hang-Up Condition During IPL Sheet 4

MDM - MAINTENANCE DIAGRAM MANUALS

THE MAINTENANCE DIAGRAM MANUAL STRUCTURE IS DESIGNED TO PERMIT ENTERING AT ANY POINT THAT BEST FITS THE EXPERIENCE AND KNOWLEDGE LEVEL OF THE CE. EACH ENTRY POINT (CLASS OF DIAGRAM) PROVIDES SUFFICIENT INFORMATION AT THAT LEVEL TO ENABLE FURTHER DEFINITION AND ISOLATION OF THE PROBLEM. LINKAGE BETWEEN THE DIAGRAMS WILL FACILITATE CONTINUITY TO LEAVE OR RE-ENTER THE DIAGRAM STRUCTURE. THE STRUCTURE CONSISTS OF THE FOLLOWING:

- A. UNIT DATA AND CONTROL DIAGRAM (UDCD)
- B. ERROR CHECK ANALYSIS DIAGRAM (ECAD)
- C. I/O OPERATIONS DIAGRAM
- D. SIMPLIFIED LOGIC DIAGRAM (SLD)
- E. FLOW CHARTS
- F. TIMING CHARTS
- G. X - Y RECORDINGS

UNIT DATA AND CONTROL DIAGRAM (UDCD)

SUPPLEMENTS THE SYSTEM DATA FLOW DIAGRAM AND ASSISTS IN MALFUNCTION ANALYSIS BY PROVIDING DATA TO ISOLATE ERRORS TO A GENERAL AREA OF THE MACHINE.

ERROR CHECK ANALYSIS DIAGRAMS (ECAD)

ASSISTS IN ERROR ANALYSIS BY INDICATING THE LOGIC THAT PRODUCES THE ERROR CONDITION. THE DIAGRAM CONTAINS SUFFICIENT DATA TO GUIDE THE CE TO AN OPTIMUM STARTING POINT, IN THE EVENT THAT SCOPING IS NECESSARY AND TO ENABLE HIM TO DETERMINE THE CONDITIONS EXISTING AT THAT POINT BEFORE GOING TO THE ALD'S.

I/O OPERATION DIAGRAM

THE I/O OPERATIONS DIAGRAMS ARE DRAWN TO SHOW THE OVERALL FUNCTIONS OF THE OPERATION. THEY CONTAIN THE FOLLOWING:

- A. OBJECTIVES OF OPERATION AS DESCRIBED IN THE INSTRUCTION MANUAL.
- B. ONLY THOSE PORTIONS OF THE MACHINE THAT ARE USED DURING THE OPERATION DESCRIBED.
- C. DATA FLOW LINES.
- D. INDICATORS AND ERROR CHECKS.
- E. REGISTERS, SWITCHING CIRCUITS, AND CONTROL CIRCUITS.

SIMPLIFIED LOGIC DIAGRAMS (SLD)

THE SIMPLIFIED LOGIC DIAGRAMS INDICATE THE AND/OR LOGIC, OF THE COMPLEX AREAS OF THE SYSTEM WHERE THE ALD TENDS TO CONFUSE AND MISLEAD.

FLOW CHARTS

THE FLOW CHARTS PROVIDE:

- A. OBJECTIVES OF OPERATION.
- B. CONTROL FLOW (HEAVY LINES)
- C. AUXILIARY CONTROLS.
- D. DATA OBJECTIVES.
- E. NOTES TO CLARIFY A CONFUSING POINT.

TIMING CHARTS

EACH TIMING CHART CONTAINS THE FOLLOWING:

- A. A SYNC POINT (IF AVAILABLE).
- B. TEST POINT FOR EACH ENTRY ON TIMING CHART.
- C. VOLTAGE LEVELS FOR EACH TEST POINT.
- D. A TIMING BAR INDICATING LINE NAME DURATION.
- E. ALD PAGE REFERENCE FOR EACH TEST POINT.
- F. ALD LINE NAME FOR EACH TEST POINT.
- G. DATA SETUP PROCEDURES NECESSARY TO PRODUCE THE INDICATED TIMING CHART.
- H. THE LINE NUMBERS THAT CORRESPOND TO THE STANDARD INTERFACE LINES, ENCIRCLED FOR QUICK REFERENCE OF OPERATIONAL SEQUENCE.
- J. RISE AND FALL TIMES KEYED TO THE NUMBER OF THE LAST LINE AND/OR STORAGE DEVICE THAT CONDITIONED OR CAUSED THE REPRESENTED ACTION. THE CLOCK TIMINGS ARE USUALLY REPRESENTED BY THE TIME SCALE AND SHALL NOT BE CONSIDERED IN DETERMINING THE KEY NUMBER.
- K. IMPORTANT AND CRITICAL TIMING DURATIONS AND TIMING RELATIONSHIPS (SINGLE SHOTS, DELAYS, ETC.)

X - Y RECORDINGS

THE X - Y RECORDINGS ARE EXTREMELY USEFUL FOR WAVEFORM ANALYSIS IN COMPLEX OR UNUSUAL CIRCUITS. EACH X - Y RECORDING OR ITS EQUIVALENT CONTAINS THE FOLLOWING:

- A. A SYNC POINT.
- B. TEST POINT FOR EACH WAVEFORM.
- C. VOLTAGE LEVEL FOR EACH TEST POINT.

PAGE NUMBERING FOR BASIC 2821

X000 - X019	COMMON
X020 - X039	READER-PUNCH COMMON
X040 - X059	READER
X060 - X079	PUNCH
X080 - X099	PRINTER

PAGE NUMBERING FOR 2821 FEATURES

X1XX	UCB
X2XX	MPR
X3XX	CF
X4XX	TCS
X5XX	TCB
X6XX	TCM
X7XX	PRST

DATE	EC NO	DATE	EC NO	DATE	EC NO
11OCT65	125598	1MAY66	125636	22MAR67	125672
30NOV65	125601	16JUN66	125646		
18JAN66	125617	18JUL66	125648		
11MAR66	125633	4OCT66	125655		

LOGIC NUMBER	LOGIC NAME	EC NUMBER
<u>UNIT DATA FLOW</u>		
2020	DATA FLOW READER-PUNCH	125598
2021	DATA FLOW READER-PUNCH	125648
2080	DATA FLOW PRINTER	125598
2180	DATA FLOW-PRINTER UCB	125633
2181	DATA FLOW-UNIVERSAL CHARACTER BUFFER	125598
<u>ERROR CHECK ANALYSIS DIAGRAMS</u>		
3020	READER-PUNCH ERROR CHECK	125633
3040	READER SENSE BIT 3 AND BIT 4	125617
3060	PUNCH SENSE BIT 3 AND BIT 4	125672
3080	PRINTER ERROR CHECK	125672
3180	UCB PRINTER ERROR CHECKS	125672
3181	UCB PARITY CHECK	125648
3280	MPR PRINTER ERROR CHECKS	125672
3380	PRINTER ERROR CHECKS - CF	125672
3381	PRINTER ERROR CHECKS - CF	125633
<u>I/O OPERATIONS DIAGRAMS</u>		
4000	SENSE-READER-PUNCH AND PRINTER	125672
4020	I/O TESTER OP-RDR/PCH	125648
4040	READER COMMANDS	125633
4041	READER COMMANDS	125648
4060	PUNCH COMMANDS	125633
4061	PUNCH COMMANDS	125633
4080	PRINTER COMMANDS	125672
4081	PRINTER COMMANDS	125672
4082	CARRIAGE OPERATION	125672
4083	I/O TESTER OP-PRT	125636
4084	I/O TESTER OP-PRT	125672
4180	UCB LOAD FORMAT COMMAND	125672
4181	UCB PRINTER COMMAND	125672
4380	CARD FEED CONTROLS	125648
4381	CARRIAGE OP - CF	125672
4382	CARD-FEED-READ CONTROLS	125617
4780	CARRIAGE OP 1 - PRST	125672
4781	CARRIAGE OP 2 - PRST	125672
<u>SIMPLIFIED LOGIC DIAGRAMS</u>		
5000	COMMON INTERFACE	125672
5001	COMMON INTERFACE	125672
5020	READER-PUNCH COMMON INTERFACE	125646
5021	ROW BIT CHECK CONTROL	125617
5040	READER INTERFACE CONTROLS	125636
5041	READ SELECT SERVICE AND TRANSFER	125617
5042	READER ADDRESS REGISTER (RAR)	125601
5060	PUNCH INTERFACE CONTROLS	125633
5061	PUNCH SELECT-SERVICE AND TRANSFER	125648
5062	PUNCH ADDRESS REGISTER (PAR)	125636
5080	PRINTER INTERFACE	125672
5081	PRINTER INTERFACE	125672
5082	PRT BUFFER ADDRESS REGISTER (BAR)	125636
5083	PRINT CHARACTER GENERATOR	125648
5180	UCB BUFFER ADDRESS REGISTER-UNITS	125655
5181	UCB BUFFER ADDRESS REGISTER-TENS	125655
5182	UCB DATA REGISTER	125598
5183	UCB LINE FULL-UNPRINTABLE CHARACTER	125601
5380	STORAGE ADDRESS REGISTER (BAR)-UNITS	125617
5381	STORAGE ADDRESS REGISTER (BAR)-TENS	125636
5382	READ ROW BIT ADDRESSING	125601
5383	READ ROW BIT LATCHES	125601
<u>FLOW CHARTS</u>		
6000	INITIAL SELECTION SEQUENCE	125598
6001	DATA TRANSFER-BURST MODE	125598
6002	DATA TRANSFER-DATA INTERLEAVE MODE	125598
6040	READER DATA TRANSFER-BURST MODE	125633
6041	READER FEED OPERATION	125601
6060	PUNCH DATA TRANSFER-BURST MODE	125601
6061	PUNCH OP-AFTER PUNCH DATA TRANSFER	125601
6080	BASIC PRT TRANSFER OP-BURST MODE	125601
6081	PRT OP AFTER TRANSFER OF 132 CHAR	125601
6082	CARRIAGE CONTROL OPERATION	125601
6180	UCS LOAD FORMAT COMMANDS	125601
6181	UCS PRT OP AFTER TRANS OF 132 CHAR	125601
6380	1404 INITIAL CARD RUN IN	125617
6381	CF SKIP TO CHANNEL 1 IMMEDIATELY	125617
6382	CF WRITE AND SKIP TO CHANNEL 1 AFTER PRINTING	125617
6383	CF FEED AND WRITE COMMAND	125617
6384	CFC READ DURING CARD FEED	125617
6385	CFC READ DATA TRANSFER (BURST MODE)	125617

DATE	EC NO	DATE	EC NO	DATE	EC NO
11OCT65	125598	1MAY66	125636		
30NOV65	125601	16JUN66	125646		
18JAN66	125617	18JUL66	125648		
11MAR66	125633	4OCT66	125655		
		22MAR67	125672		

A A

LOGIC NUMBER LOGIC NAME EC NUMBER

B B

TIMING CHARTS

8000	BASIC INTERFACE TIMING-BURST MODE	125598
8001	INTERFACE-DATA INTERLEAVE 1 BYTE MODE	125598
8040	READER READ COMMAND-BURST MODE	125598
8041	2540 READER AFTER 1ST 3 FEED CYCLES	125635
8060	PUNCH WRITE COMMAND-BURST MODE	125598
8061	2540 PUNCH AFTER 1ST 3 FEED CYCLES	125635
8080	PRINT WRITE COMMAND-BURST MODE	125598
8081	PRINT AFTER TRANSFER OF 132 CHAR	125635
8082	PR BUFF TRANS OF 132 CHAR IN BURST MODE	125635
8083	OP SKIP TO BEFORE PR FROM CHAN 1	125635
8084	PRINT IMMEDIATE CARR OR SINGLE CYCLE	125598
8085	PRINT CARR OP SPACE AFTER PRINT	125635
8086	SINGLE CYCLE PRINT SEQUENCE-CE BOX	125635
8180	UCB PRINT OPERATION	125635
8181	UCB GATE AND LOAD FORMAT COMMANDS	125617
8380	CF INITIAL CARD RUN IN	125617
	CF SKIP TO CHAN 1 IMMED	125617
8381	CF WR AND SKIP TO CHAN 1 AFTER PRINTING	125617
8382	READ DURING FEED AND WRITE COMMD	125617
8383	READ SCAN FOR ONE DIGIT TIME	125617

C C

X - Y RECORDINGS

8900	ADDRESS REGISTER SIGNAL LEVELS	125598
8901	DRIVER + SENSE AMP SIGNAL LEVELS	125598

D D

9000	SINGLE SHOT AND DELAY TIMINGS	125672
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E E

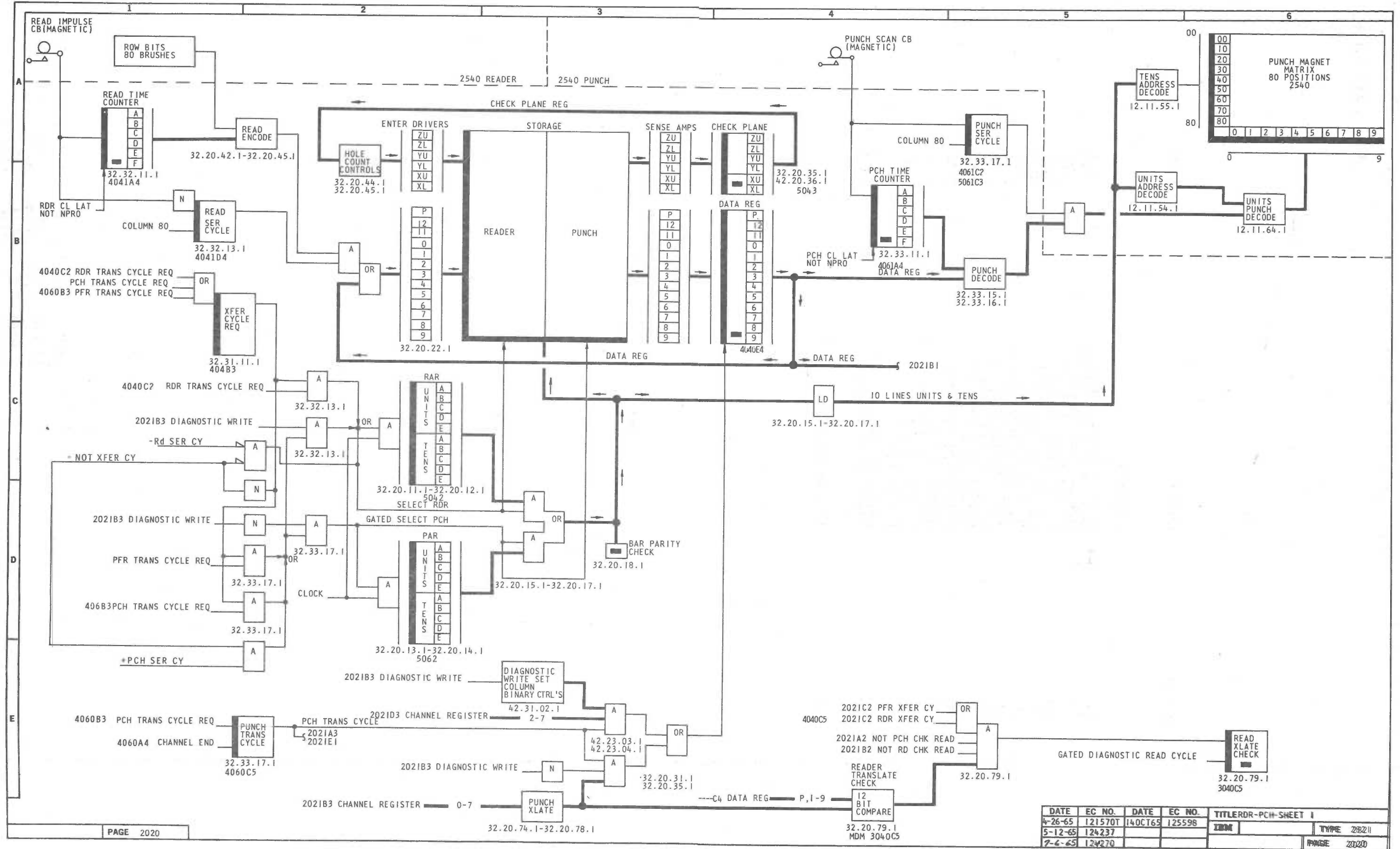
F F

G G

H H

J J

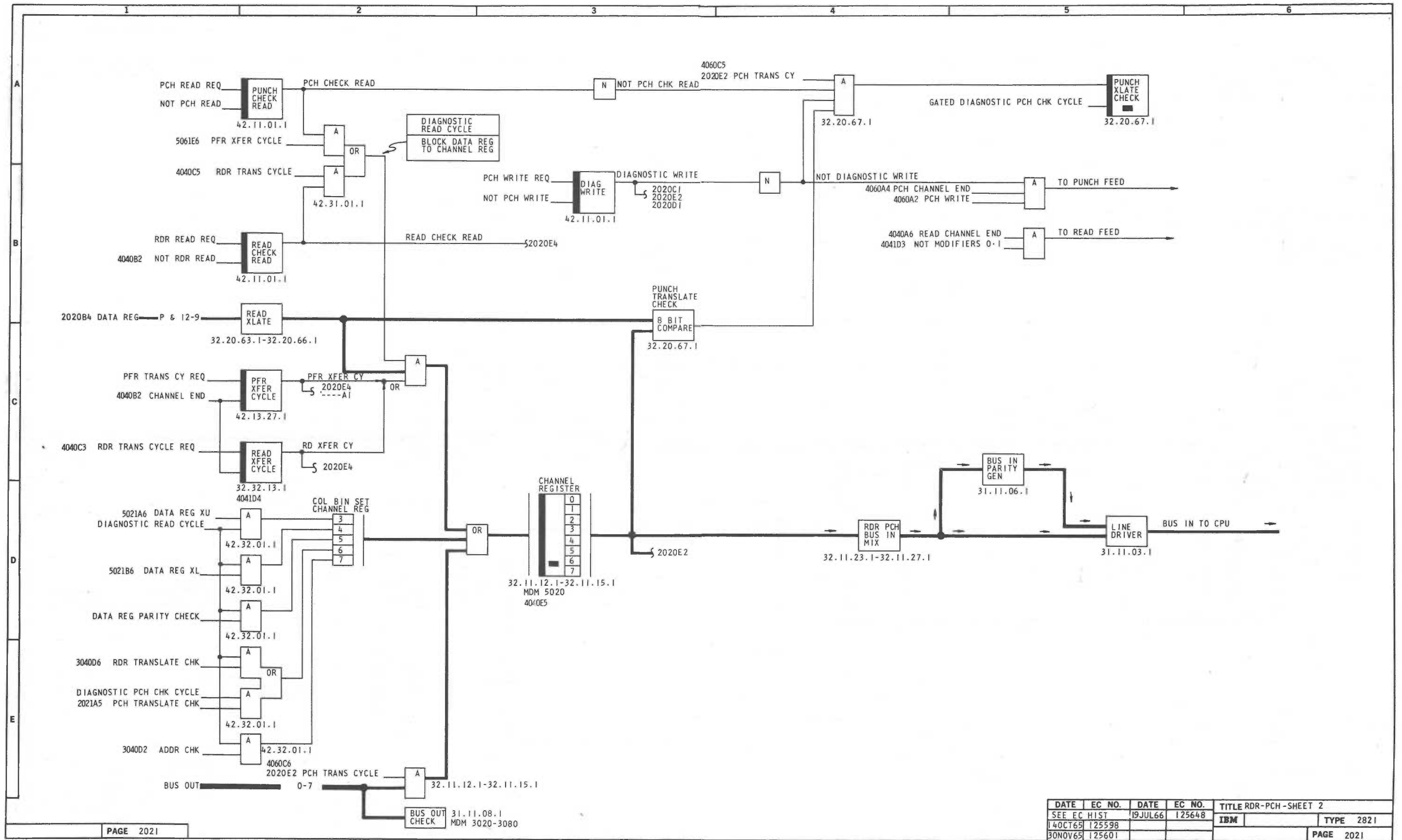
DATE	EC NO	DATE	EC NO	DATE	EC NO
11OCT65	125598	1MAY66	125636	22MAR67	125672
30NOV65	125601	16JUN66	125646		
18JAN66	125617	18JUL66	125648		
11MAR66	125633	4OCT66	125655		



PAGE 2020

DATE	EC NO.	DATE	EC NO.	TITLERDR-PCH-SHEET 1
4-26-65	121570T	14 OCT 65	125598	IBM TYPE 2821 PAGE 2020
5-12-65	124237			
7-6-65	124270			

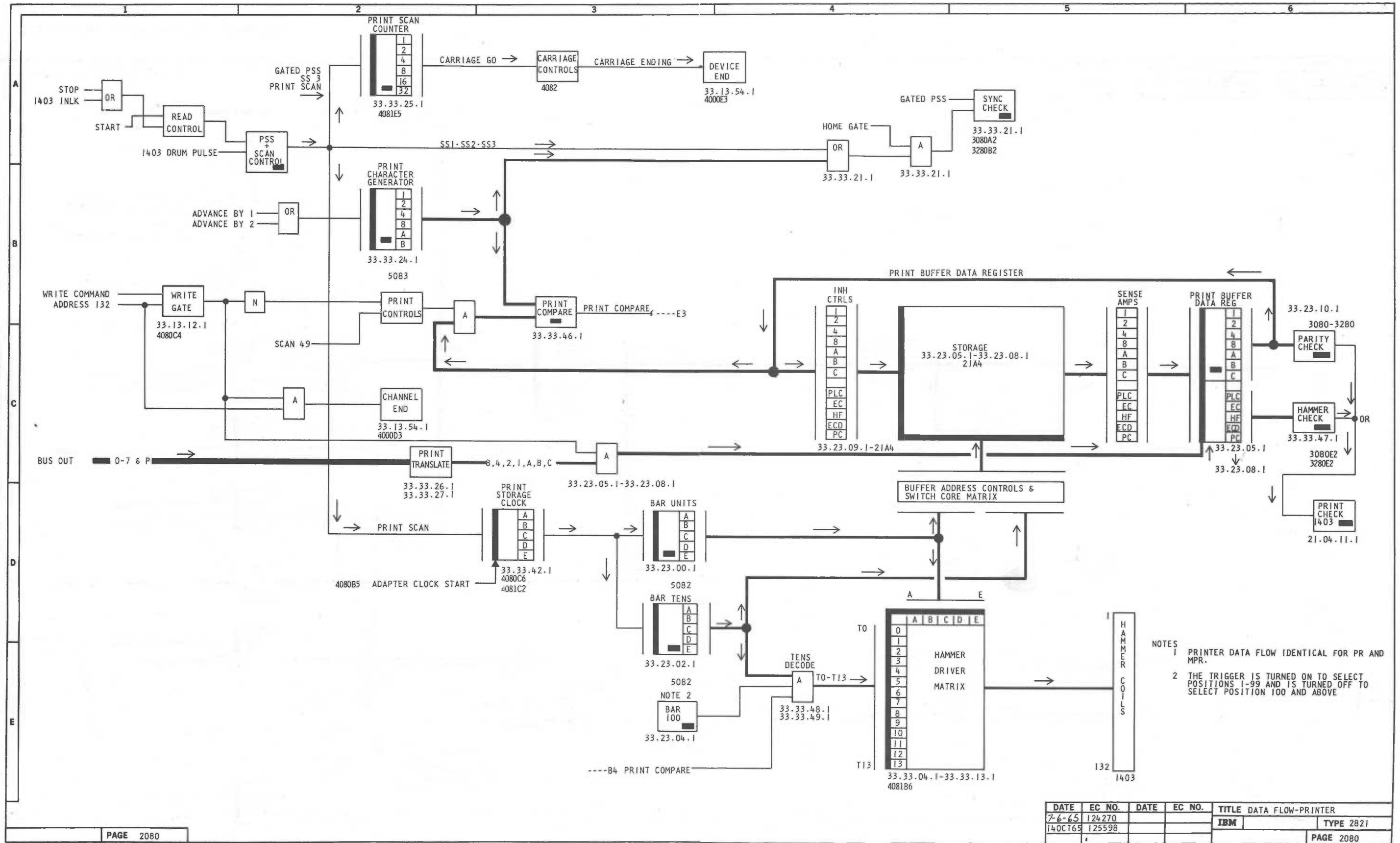
UDC-4 Reader-Punch Data Flow (Sheet 1)



DATE	EC NO.	DATE	EC NO.	TITLE
SEE EC HIST		19JUL66	125648	RDR-PCH-SHEET 2
14OCT65	125598			IBM
30NOV65	125601			TYPE 2821
				PAGE 2021

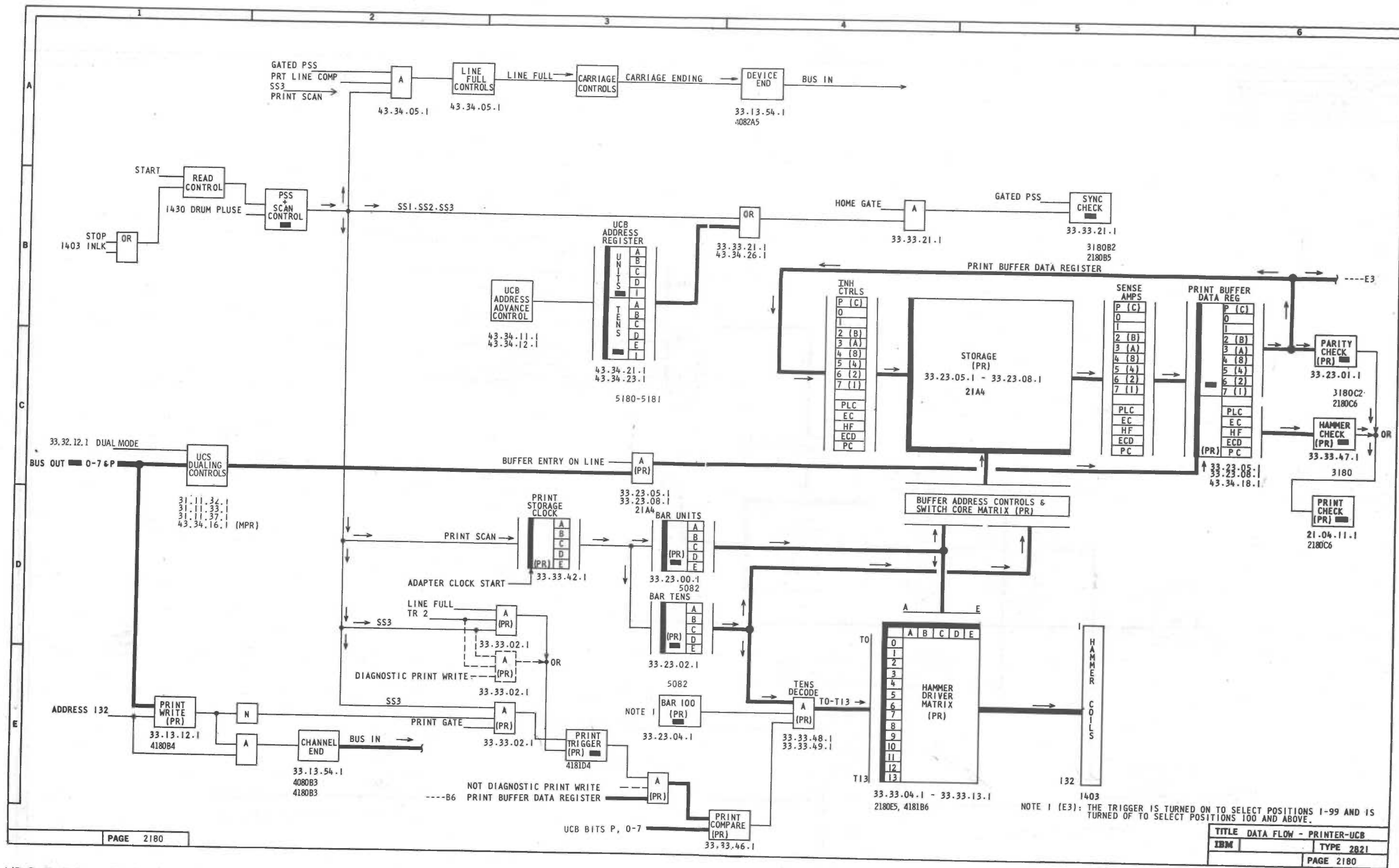
UDC-5 Reader-Punch Data Flow (Sheet 2)

2821 FEMDM (7/67) UDC-5



DATE	EC NO.	DATE	EC NO.	TITLE
7-6-65	124270			DATA FLOW-PRINTER
14OCT65	125598			IBM TYPE 2821
				PAGE 2080

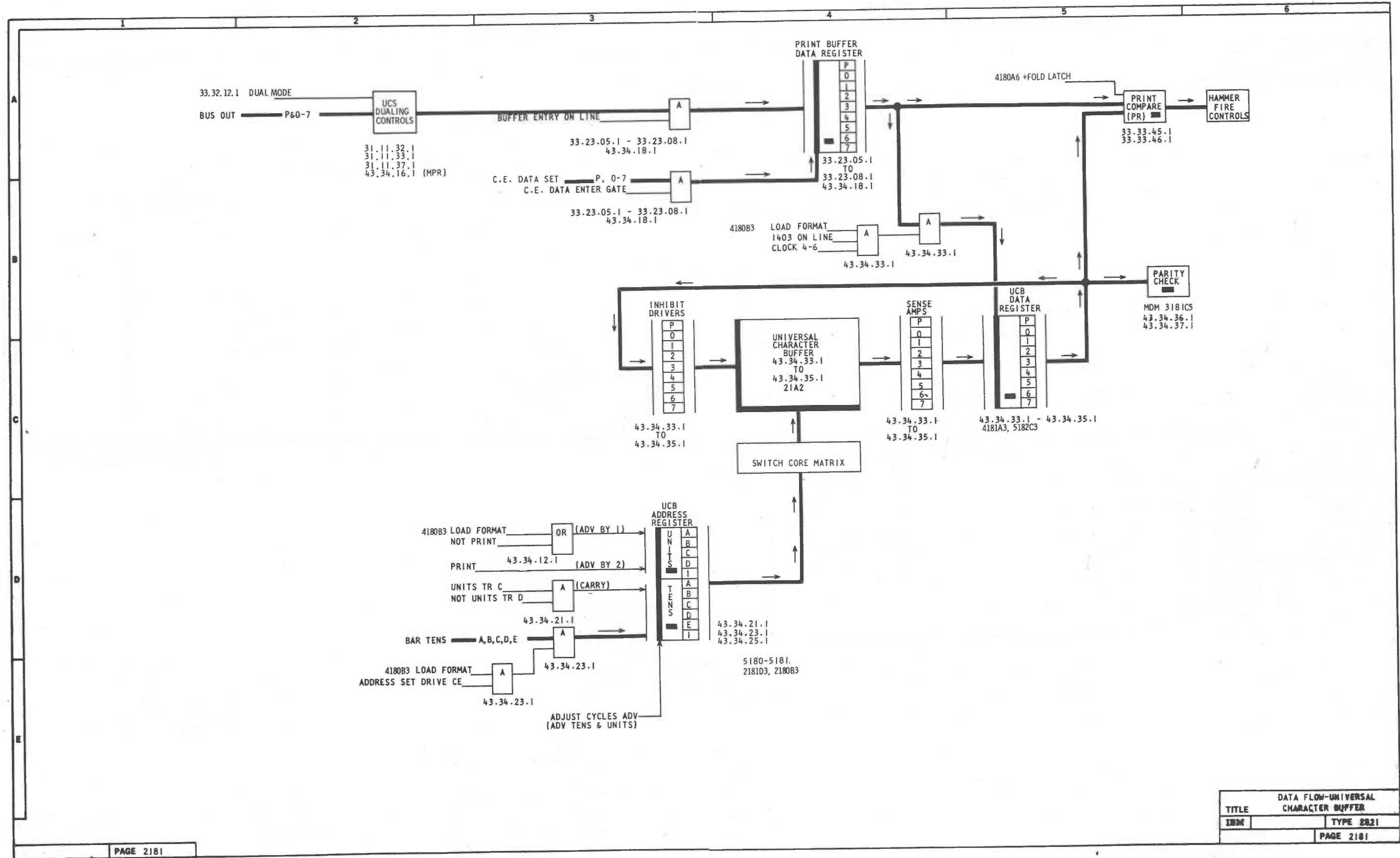
UDC-6 Printer Data Flow



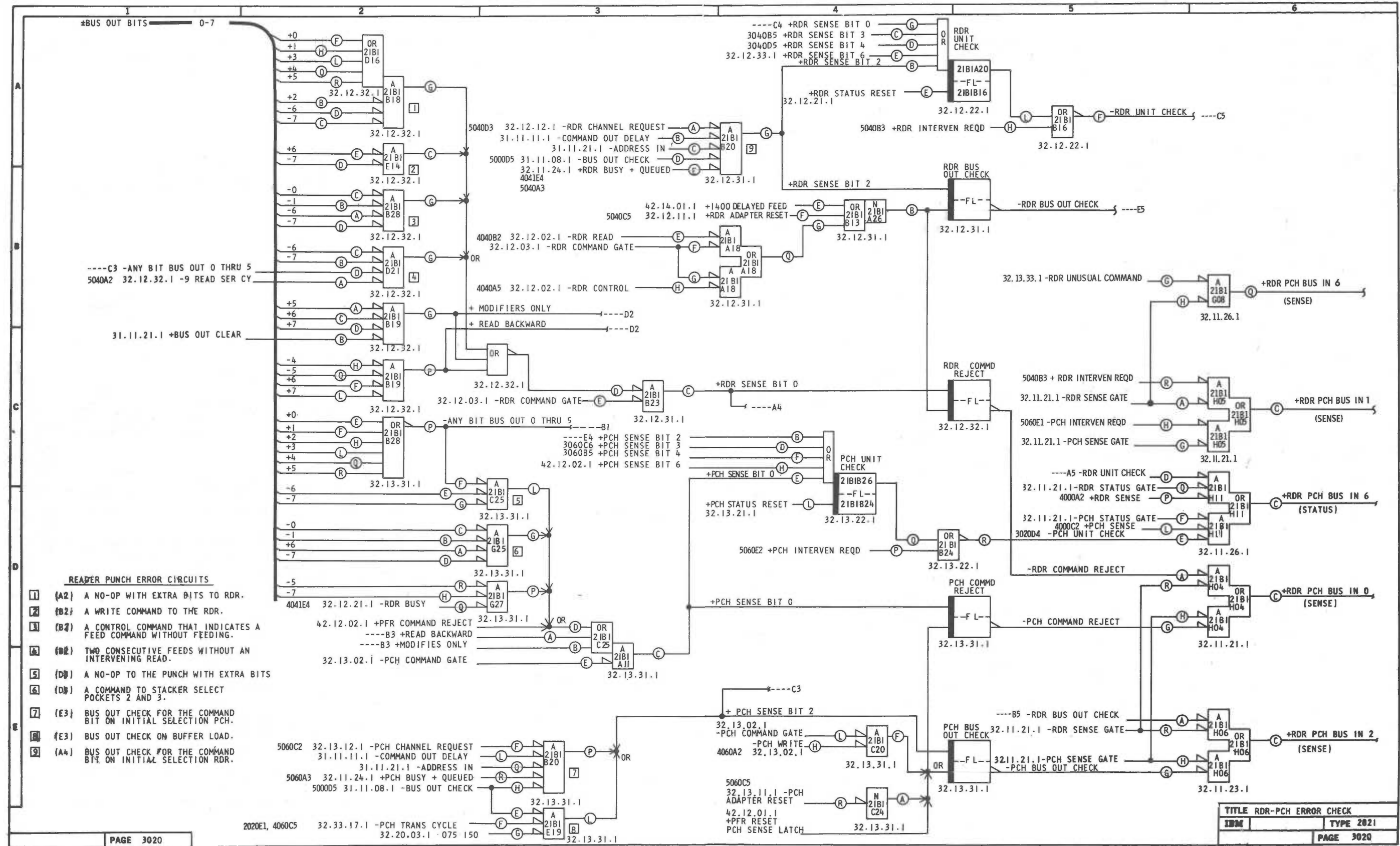
TITLE	DATA FLOW - PRINTER-UCB
IBM	TYPE 2821
	PAGE 2180

UDC-7 Printer Data Flow - UCB

2821 FEMDM (9/67) UDC-7



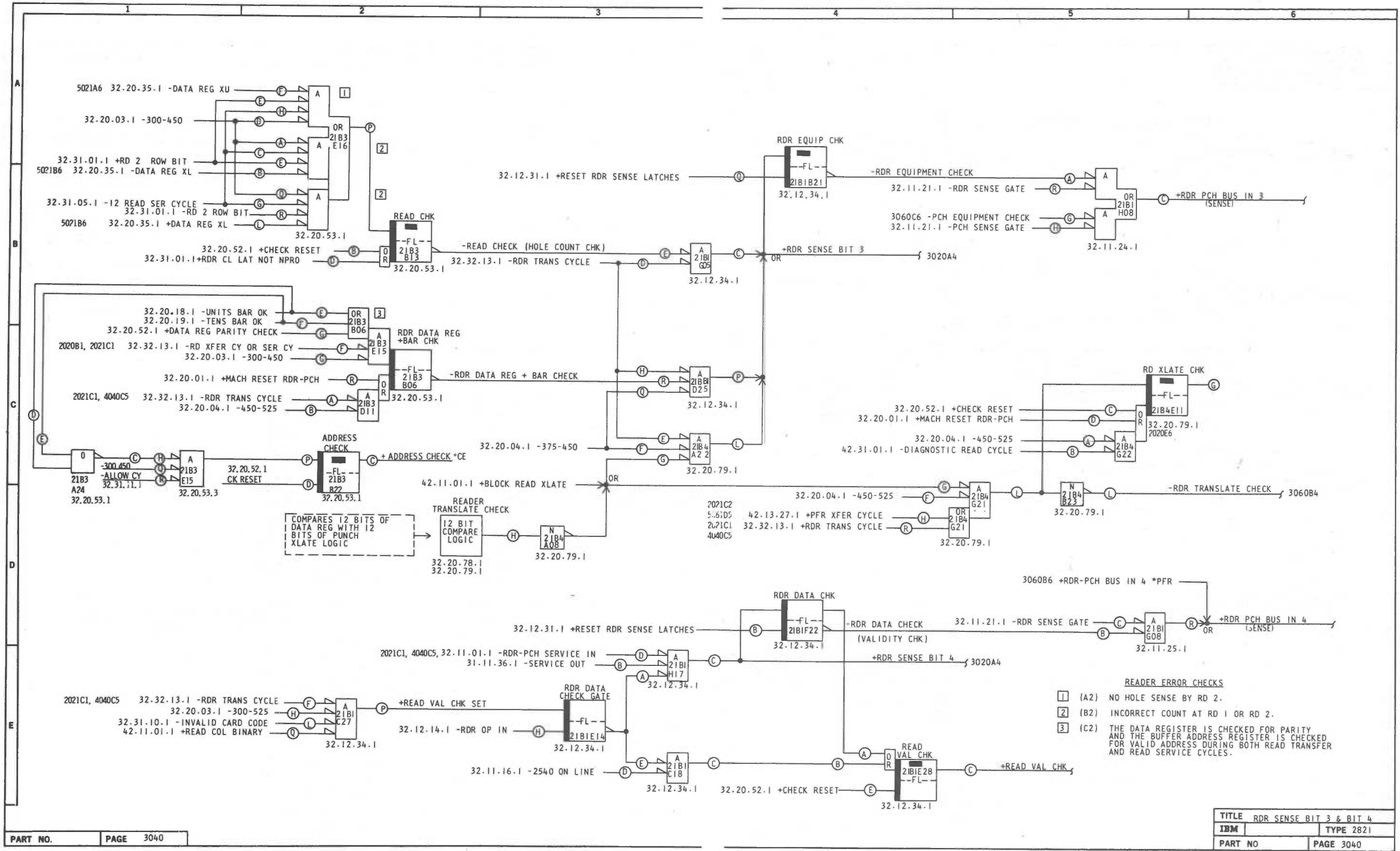
UDC-8 Universal Character Buffer Data Flow



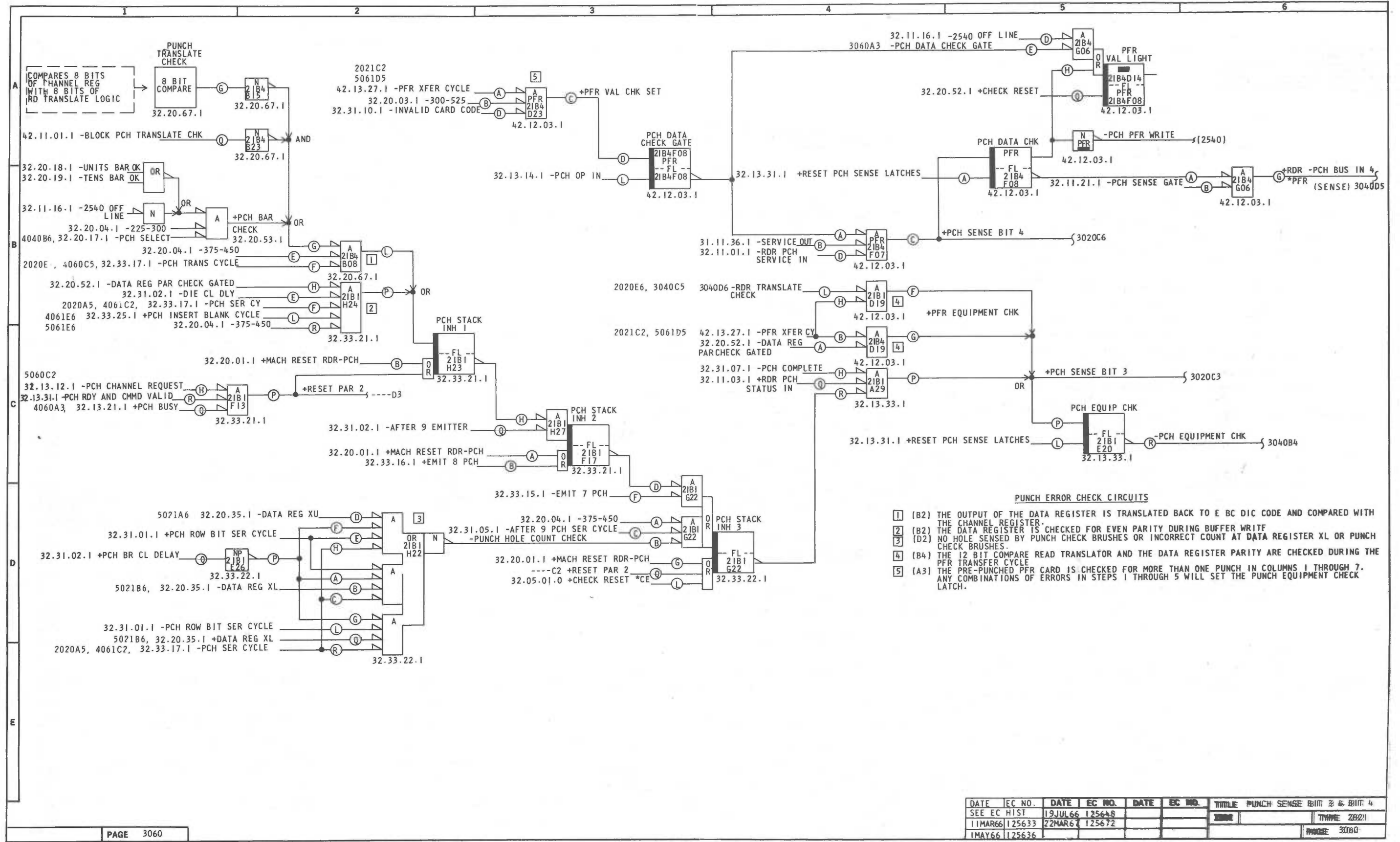
- READER PUNCH ERROR CIRCUITS**
- 1 (A2) A NO-OP WITH EXTRA BITS TO RDR.
 - 2 (B2) A WRITE COMMAND TO THE RDR.
 - 3 (B7) A CONTROL COMMAND THAT INDICATES A FEED COMMAND WITHOUT FEEDING.
 - 4 (B8) TWO CONSECUTIVE FEEDS WITHOUT AN INTERVENING READ.
 - 5 (D0) A NO-OP TO THE PUNCH WITH EXTRA BITS
 - 6 (D0) A COMMAND TO STACKER SELECT POCKETS 2 AND 3.
 - 7 (E3) BUS OUT CHECK FOR THE COMMAND BIT ON INITIAL SELECTION PCH.
 - 8 (E3) BUS OUT CHECK ON BUFFER LOAD.
 - 9 (A4) BUS OUT CHECK FOR THE COMMAND BIT ON INITIAL SELECTION RDR.

SLD-1 Reader-Punch Error Check

2821 FEMDM (9/67) SLD-1



SLD-2 Reader Sense Bit 3 and Bit 4

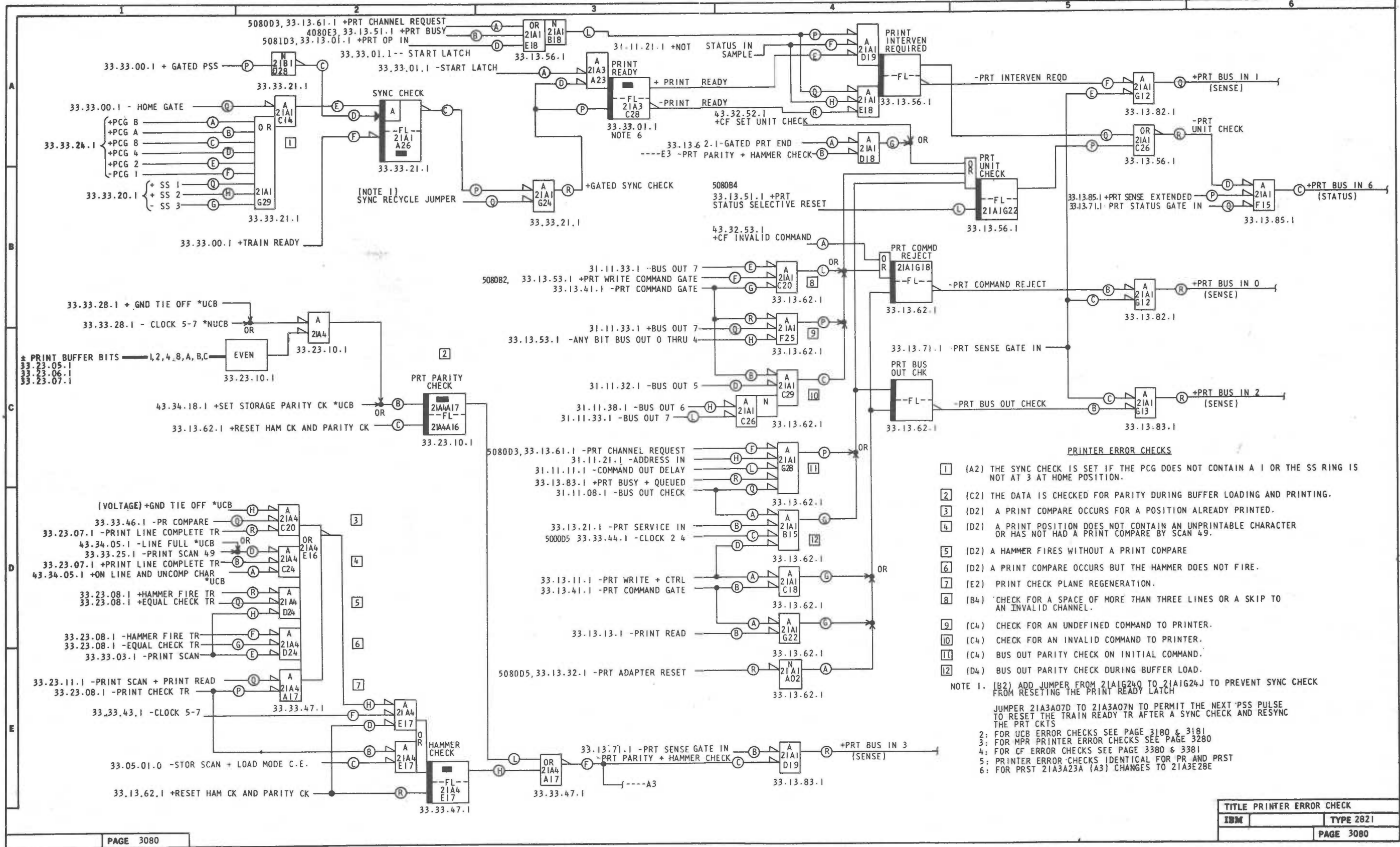


- PUNCH ERROR CHECK CIRCUITS**
- 1 (B2) THE OUTPUT OF THE DATA REGISTER IS TRANSLATED BACK TO E BC DIC CODE AND COMPARED WITH THE CHANNEL REGISTER.
 - 2 (B2) THE DATA REGISTER IS CHECKED FOR EVEN PARITY DURING BUFFER WRITE.
 - 3 (D2) NO HOLE SENSED BY PUNCH CHECK BRUSHES OR INCORRECT COUNT AT DATA REGISTER XL OR PUNCH CHECK BRUSHES.
 - 4 (B4) THE 12 BIT COMPARE READ TRANSLATOR AND THE DATA REGISTER PARITY ARE CHECKED DURING THE PFR TRANSFER CYCLE.
 - 5 (A3) THE PRE-PUNCHED PFR CARD IS CHECKED FOR MORE THAN ONE PUNCH IN COLUMNS 1 THROUGH 7. ANY COMBINATIONS OF ERRORS IN STEPS 1 THROUGH 5 WILL SET THE PUNCH EQUIPMENT CHECK LATCH.

DATE	EC NO.	DATE	EC NO.	DATE	EC NO.	TITLE	PUNCH SENSE BIT 3 & BIT 4
SEE EC HIST		19JUN66	125648				TYPE 2821
11MAR66	125633	22MAR67	125672				PAGE 3060
1MAY66	125636						

SLD-3 Punch Sense Bit 3 and Bit 4

2821 FEMDM (7/67) SLD-3



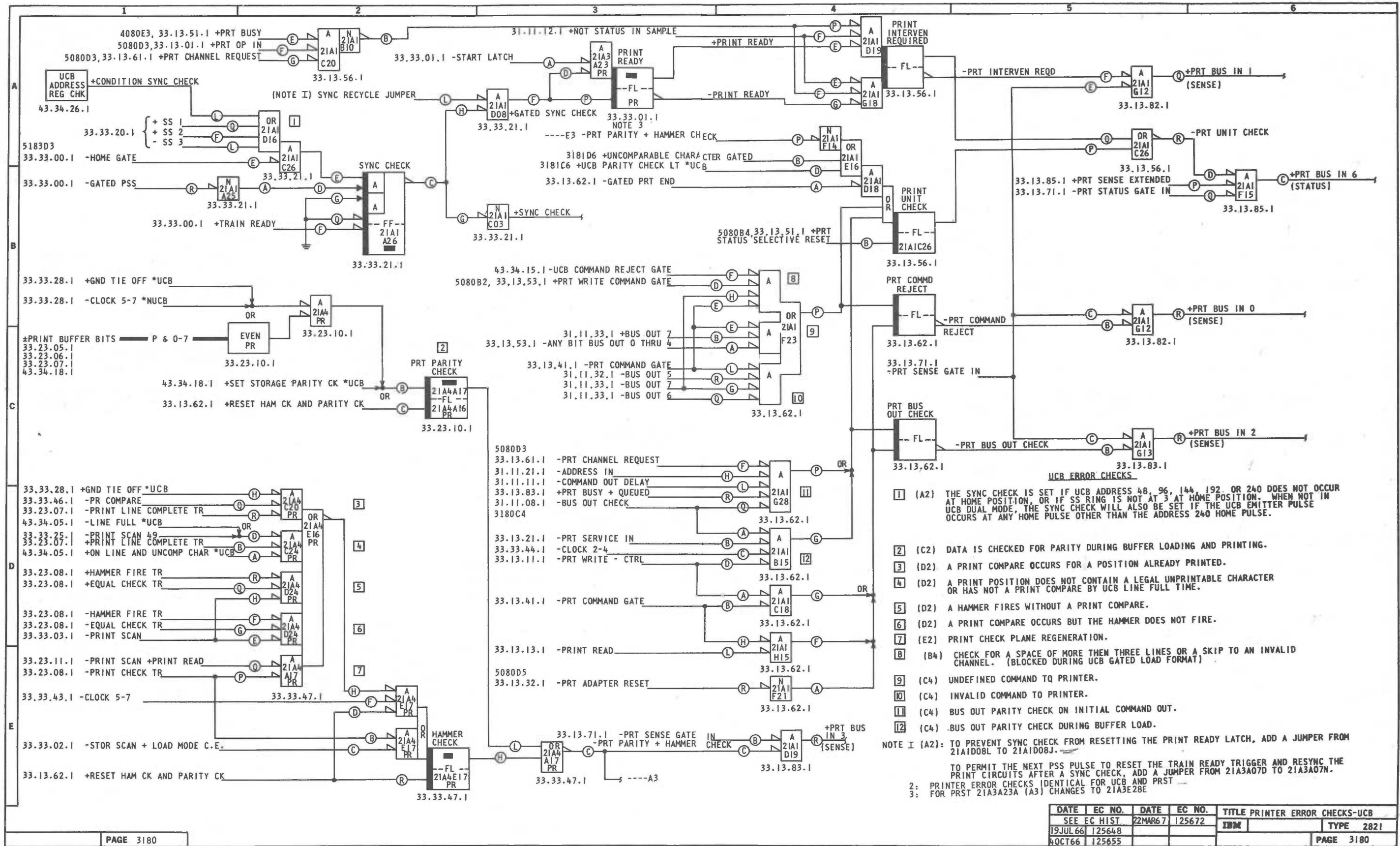
PRINTER ERROR CHECKS

- 1 (A2) THE SYNC CHECK IS SET IF THE PCG DOES NOT CONTAIN A 1 OR THE SS RING IS NOT AT 3 AT HOME POSITION.
 - 2 (C2) THE DATA IS CHECKED FOR PARITY DURING BUFFER LOADING AND PRINTING.
 - 3 (D2) A PRINT COMPARE OCCURS FOR A POSITION ALREADY PRINTED.
 - 4 (D2) A PRINT POSITION DOES NOT CONTAIN AN UNPRINTABLE CHARACTER OR HAS NOT HAD A PRINT COMPARE BY SCAN 49.
 - 5 (D2) A HAMMER FIRES WITHOUT A PRINT COMPARE
 - 6 (D2) A PRINT COMPARE OCCURS BUT THE HAMMER DOES NOT FIRE.
 - 7 (E2) PRINT CHECK PLANE REGENERATION.
 - 8 (B4) CHECK FOR A SPACE OF MORE THAN THREE LINES OR A SKIP TO AN INVALID CHANNEL.
 - 9 (C4) CHECK FOR AN UNDEFINED COMMAND TO PRINTER.
 - 10 (C4) CHECK FOR AN INVALID COMMAND TO PRINTER.
 - 11 (C4) BUS OUT PARITY CHECK ON INITIAL COMMAND.
 - 12 (D4) BUS OUT PARITY CHECK DURING BUFFER LOAD.
- NOTE 1. (B2) ADD JUMPER FROM 21A1G24Q TO 21A1G24J TO PREVENT SYNC CHECK FROM RESETTING THE PRINT READY LATCH

JUMPER 21A3A07D TO 21A3A07N TO PERMIT THE NEXT PSS PULSE TO RESET THE TRAIN READY TR AFTER A SYNC CHECK AND RESYNC THE PRT CKTS
 2: FOR UCB ERROR CHECKS SEE PAGE 3180 & 3181
 3: FOR MPR PRINTER ERROR CHECKS SEE PAGE 3280
 4: FOR CF ERROR CHECKS SEE PAGE 3380 & 3381
 5: PRINTER ERROR CHECKS IDENTICAL FOR PR AND PRST
 6: FOR PRST 21A3A23A (A3) CHANGES TO 21A3E28E

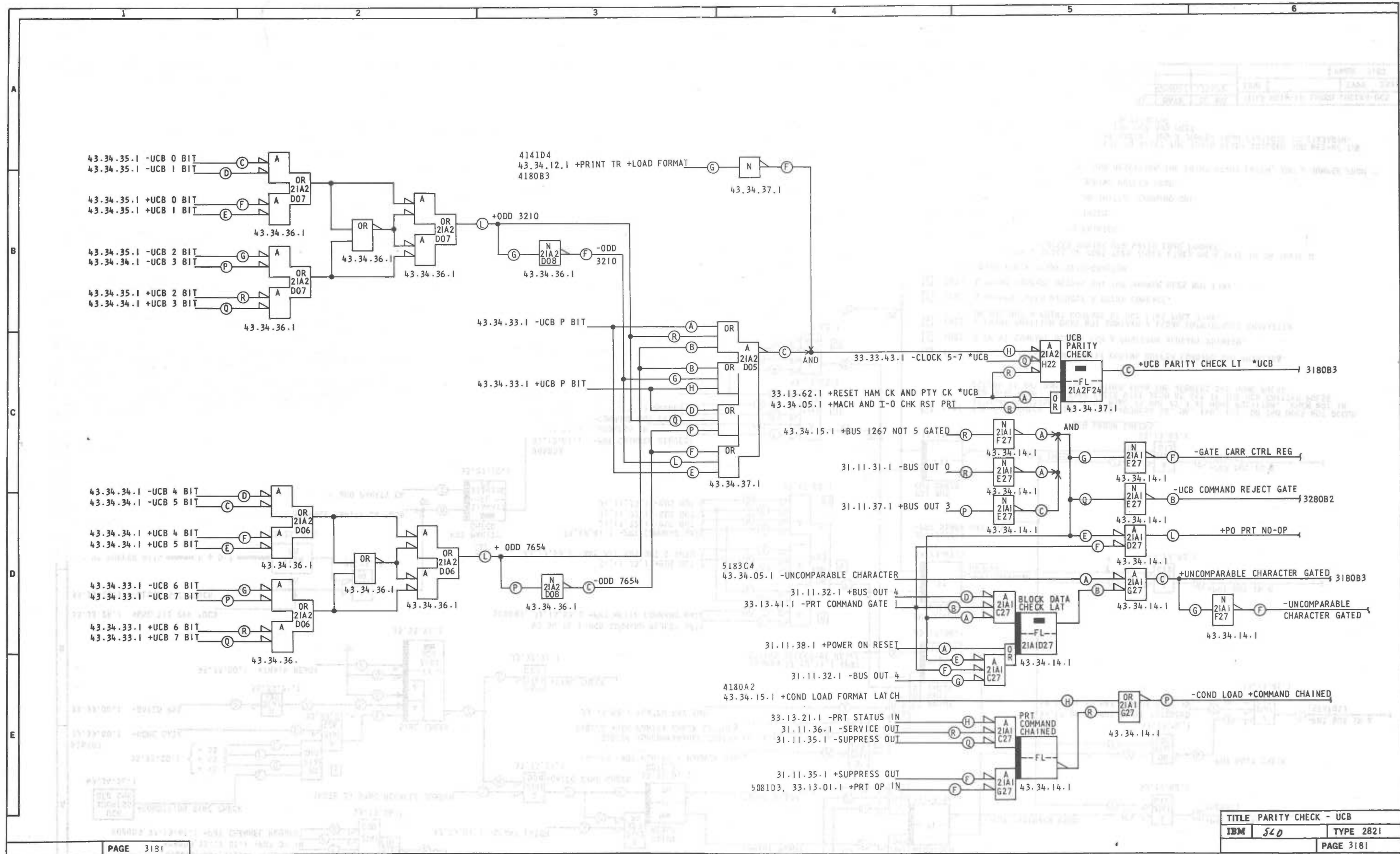
TITLE PRINTER ERROR CHECK	
IBM	TYPE 2821
PAGE 3080	

SLD-4 Printer Error Check

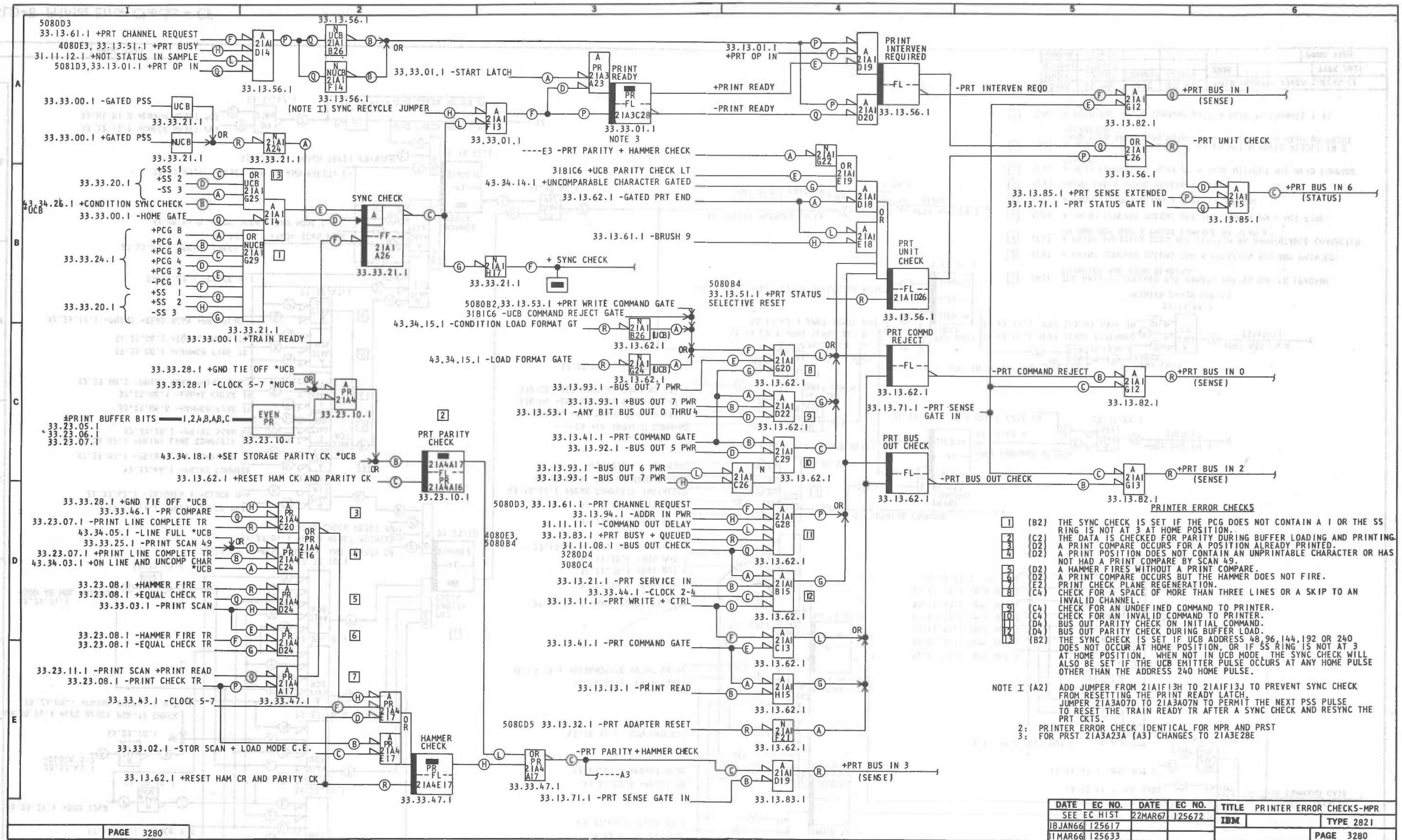


- UCB ERROR CHECKS**
- 1 (A2) THE SYNC CHECK IS SET IF UCB ADDRESS 48, 96, 144, 192, OR 240 DOES NOT OCCUR AT HOME POSITION, OR IF SS RING IS NOT AT 3 AT HOME POSITION. WHEN NOT IN UCB DUAL MODE, THE SYNC CHECK WILL ALSO BE SET IF THE UCB EMITTER PULSE OCCURS AT ANY HOME PULSE OTHER THAN THE ADDRESS 240 HOME PULSE.
 - 2 (C2) DATA IS CHECKED FOR PARITY DURING BUFFER LOADING AND PRINTING.
 - 3 (D2) A PRINT COMPARE OCCURS FOR A POSITION ALREADY PRINTED.
 - 4 (D2) A PRINT POSITION DOES NOT CONTAIN A LEGAL UNPRINTABLE CHARACTER OR HAS NOT A PRINT COMPARE BY UCB LINE FULL TIME.
 - 5 (D2) A HAMMER FIRES WITHOUT A PRINT COMPARE.
 - 6 (D2) A PRINT COMPARE OCCURS BUT THE HAMMER DOES NOT FIRE.
 - 7 (E2) PRINT CHECK PLANE REGENERATION.
 - 8 (B4) CHECK FOR A SPACE OF MORE THEN THREE LINES OR A SKIP TO AN INVALID CHANNEL. (BLOCKED DURING UCB GATED LOAD FORMAT)
 - 9 (C4) UNDEFINED COMMAND TO PRINTER.
 - 10 (C4) INVALID COMMAND TO PRINTER.
 - 11 (C4) BUS OUT PARITY CHECK ON INITIAL COMMAND OUT.
 - 12 (C4) .BUS OUT PARITY CHECK DURING BUFFER LOAD.
- NOTE I (A2):** TO PREVENT SYNC CHECK FROM RESETTING THE PRINT READY LATCH, ADD A JUMPER FROM 21A1D08L TO 21A1D08J.
- TO PERMIT THE NEXT PSS PULSE TO RESET THE TRAIN READY TRIGGER AND RESYNC THE PRINT CIRCUITS AFTER A SYNC CHECK, ADD A JUMPER FROM 21A3A07D TO 21A3A07N.
- 2: PRINTER ERROR CHECKS IDENTICAL FOR UCB AND PRST
 3: FOR PRST 21A3A23A (A3) CHANGES TO 21A3E28E

DATE	EC NO.	DATE	EC NO.	TITLE
SEE EC HIST		22MAR67	125672	PRINTER ERROR CHECKS-UCB
19JUL66	125648			IBM
4OCT66	125655			TYPE 2821

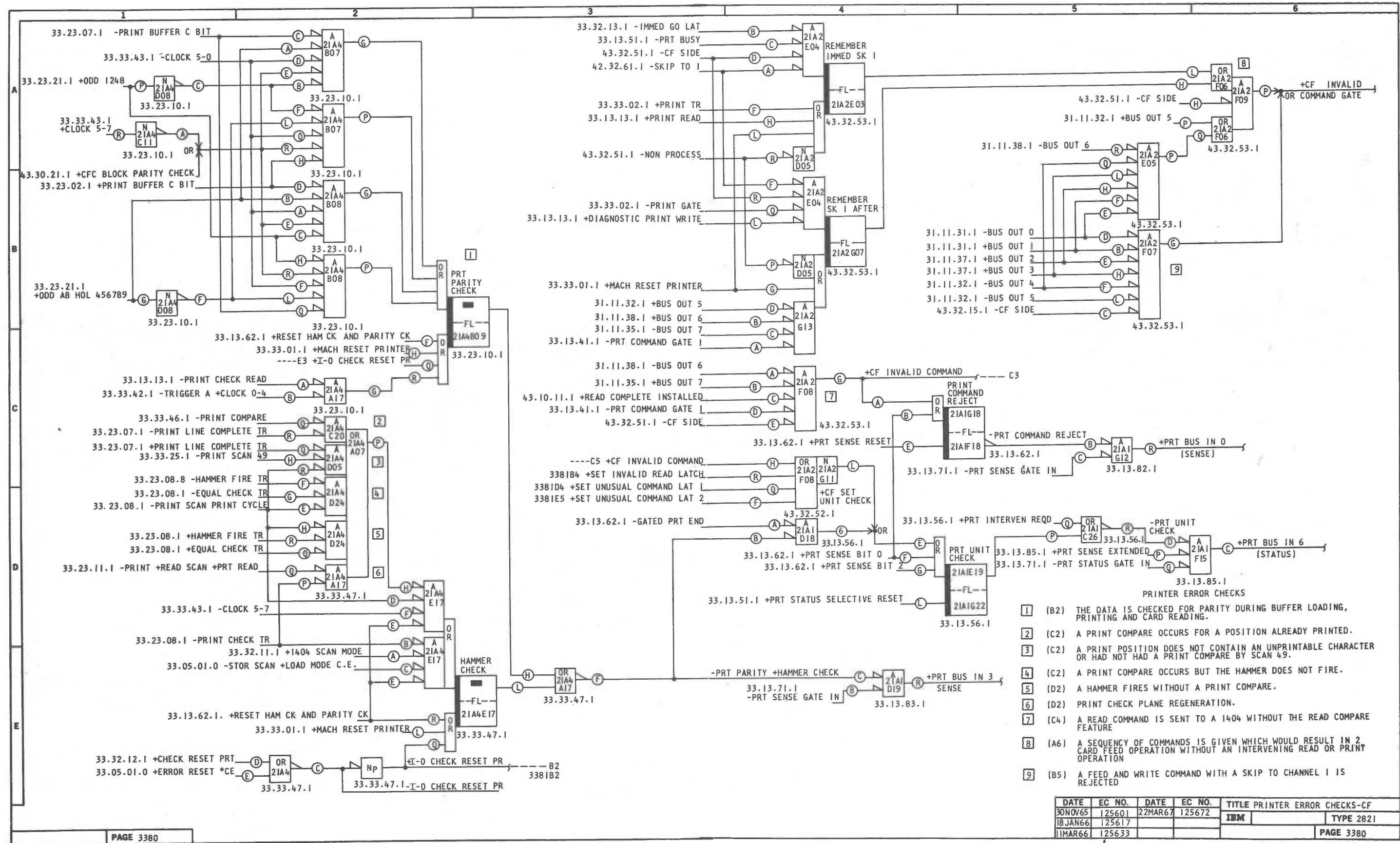


SLD-6 Parity Check - UCB



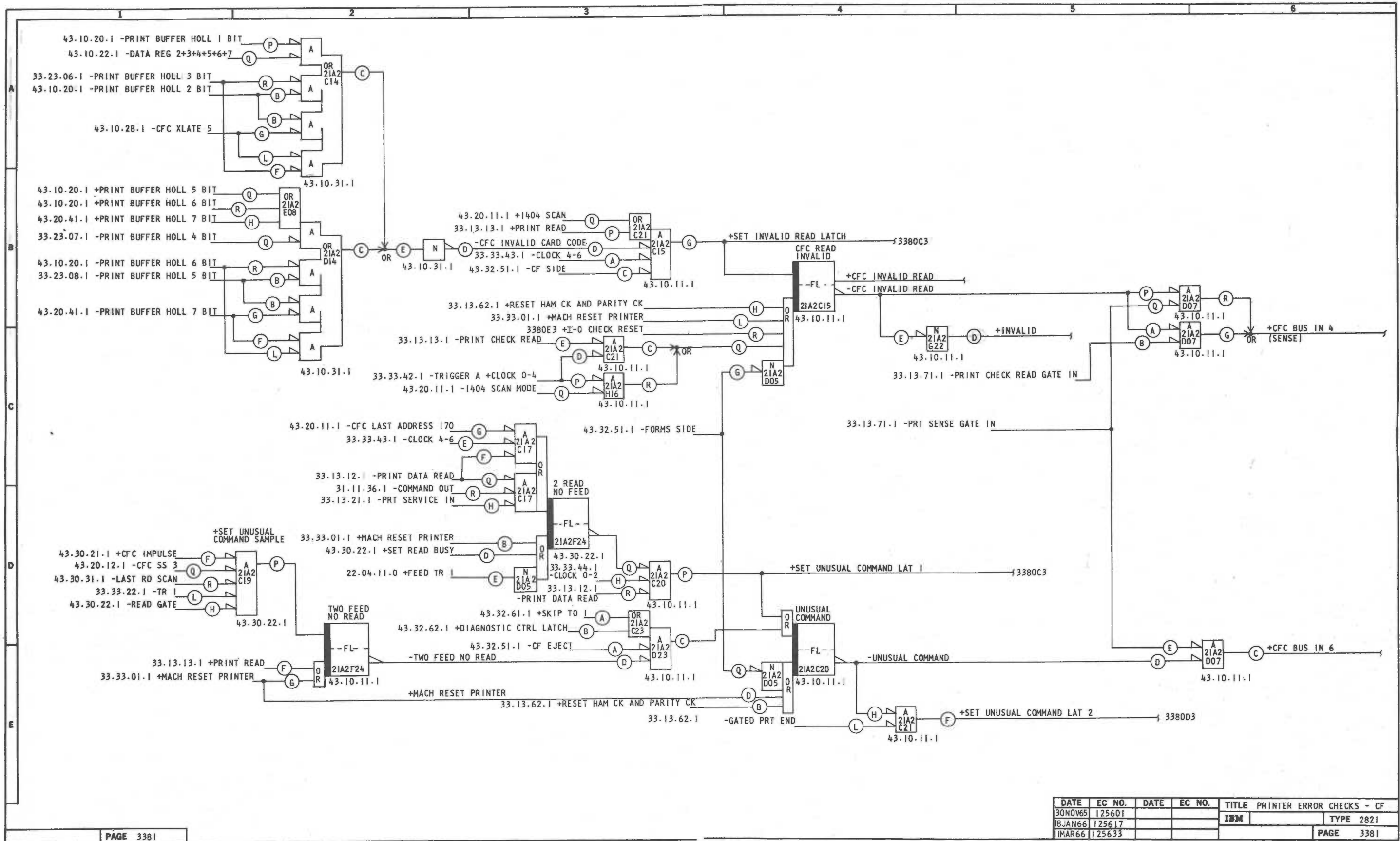
- PRINTER ERROR CHECKS**
- 1 (B2) THE SYNC CHECK IS SET IF THE PCG DOES NOT CONTAIN A 1 OR THE SS RING IS NOT AT 3 AT HOME POSITION.
 - 2 (C2) THE DATA IS CHECKED FOR PARITY DURING BUFFER LOADING AND PRINTING.
 - 3 (D2) A PRINT COMPARE OCCURS FOR A POSITION ALREADY PRINTED.
 - 4 (D2) A PRINT POSITION DOES NOT CONTAIN AN UNPRINTABLE CHARACTER OR HAS NOT HAD A PRINT COMPARE BY SCAN 49.
 - 5 (D2) A HAMMER FIRES WITHOUT A PRINT COMPARE.
 - 6 (D2) A PRINT COMPARE OCCURS BUT THE HAMMER DOES NOT FIRE.
 - 7 (E2) PRINT CHECK PLANE REGENERATION.
 - 8 (C4) CHECK FOR A SPACE OF MORE THAN THREE LINES OR A SKIP TO AN INVALID CHANNEL.
 - 9 (C4) CHECK FOR AN UNDEFINED COMMAND TO PRINTER.
 - 10 (C4) CHECK FOR AN INVALID COMMAND TO PRINTER.
 - 11 (D4) BUS OUT PARITY CHECK ON INITIAL COMMAND.
 - 12 (D4) BUS OUT PARITY CHECK DURING BUFFER LOAD.
 - 13 (B2) THE SYNC CHECK IS SET IF UCB ADDRESS 48, 96, 144, 192 OR 240 DOES NOT OCCUR AT HOME POSITION, OR IF SS RING IS NOT AT 3 AT HOME POSITION. WHEN NOT IN UCB MODE, THE SYNC CHECK WILL ALSO BE SET IF THE UCB EMITTER PULSE OCCURS AT ANY HOME PULSE OTHER THAN THE ADDRESS 240 HOME PULSE.
- NOTE I (A2) ADD JUMPER FROM 21A1F13H TO 21A1F13J TO PREVENT SYNC CHECK FROM RESETTING THE PRINT READY LATCH.
 JUMPER 21A3A07D TO 21A3A07N TO PERMIT THE NEXT PSS PULSE TO RESET THE TRAIN READY TR AFTER A SYNC CHECK AND RESYNC THE PRT CKTS.
- 2: PRINTER ERROR CHECK IDENTICAL FOR MPR AND PRST
 3: FOR PRST 21A3A23A (A3) CHANGES TO 21A3E28E

DATE	EC NO.	DATE	EC NO.	TITLE
SEE EC HIST		22MAR67	125672	PRINTER ERROR CHECKS-MPR
18JAN66	125617			IBM
11MAR66	125633			TYPE 2821



- PRINTER ERROR CHECKS
- 1 (B2) THE DATA IS CHECKED FOR PARITY DURING BUFFER LOADING, PRINTING AND CARD READING.
 - 2 (C2) A PRINT COMPARE OCCURS FOR A POSITION ALREADY PRINTED.
 - 3 (C2) A PRINT POSITION DOES NOT CONTAIN AN UNPRINTABLE CHARACTER OR HAD NOT HAD A PRINT COMPARE BY SCAN 49.
 - 4 (C2) A PRINT COMPARE OCCURS BUT THE HAMMER DOES NOT FIRE.
 - 5 (D2) A HAMMER FIRES WITHOUT A PRINT COMPARE.
 - 6 (D2) PRINT CHECK PLANE REGENERATION.
 - 7 (C4) A READ COMMAND IS SENT TO A 1404 WITHOUT THE READ COMPARE FEATURE
 - 8 (A6) A SEQUENCE OF COMMANDS IS GIVEN WHICH WOULD RESULT IN 2 CARD FEED OPERATION WITHOUT AN INTERVENING READ OR PRINT OPERATION
 - 9 (B5) A FEED AND WRITE COMMAND WITH A SKIP TO CHANNEL 1 IS REJECTED

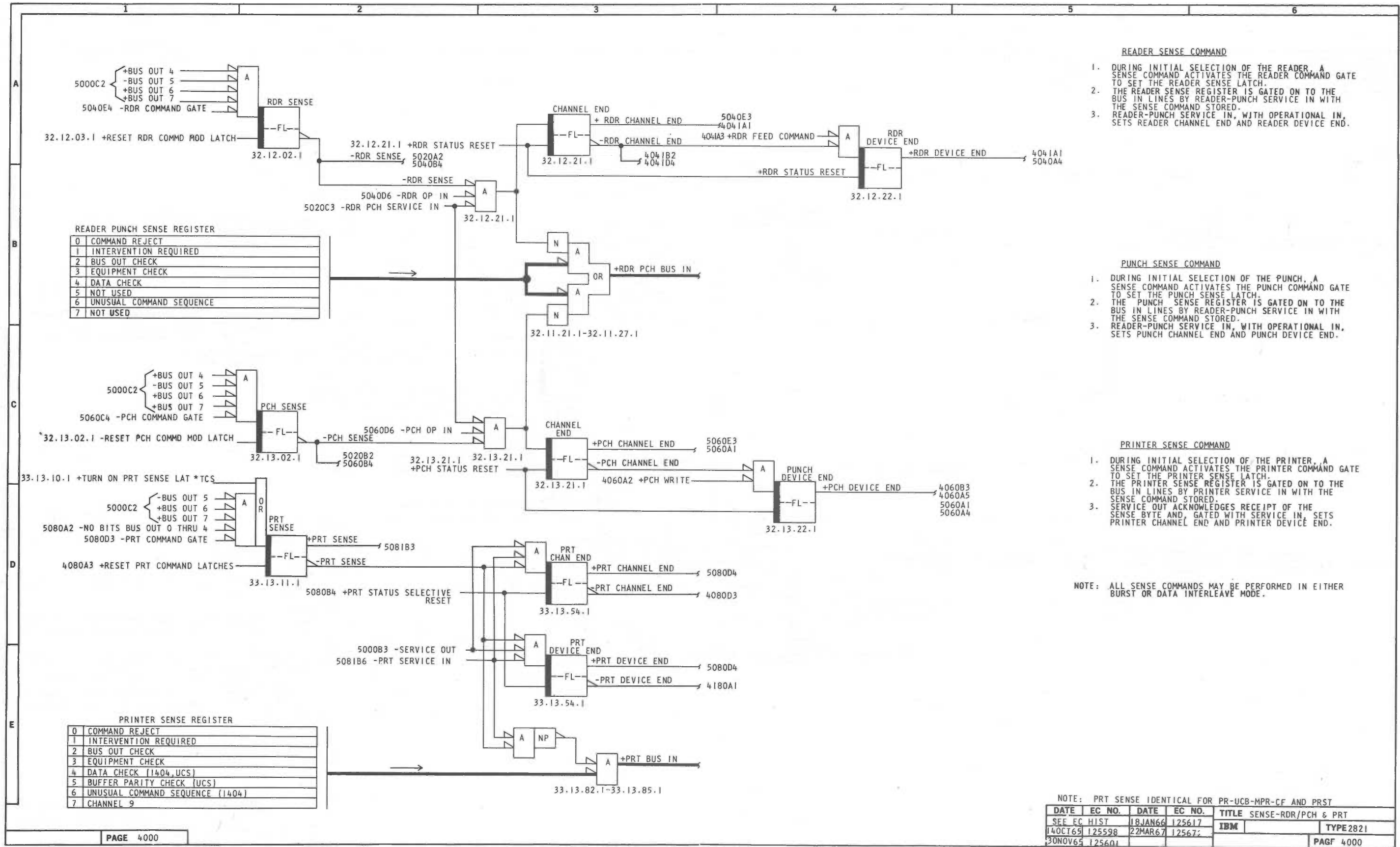
DATE	EC NO.	DATE	EC NO.	TITLE
30NOV65	125601	22MAR67	125672	PRINTER ERROR CHECKS-CF
18JAN66	125617			IBM
11MAR66	125633			TYPE 2821



DATE	EC NO.	DATE	EC NO.	TITLE	PRINTER ERROR CHECKS - CF
30NOV65	125601			IBM	TYPE 2821
18JAN66	125617				
1MAR66	125633				PAGE 3381

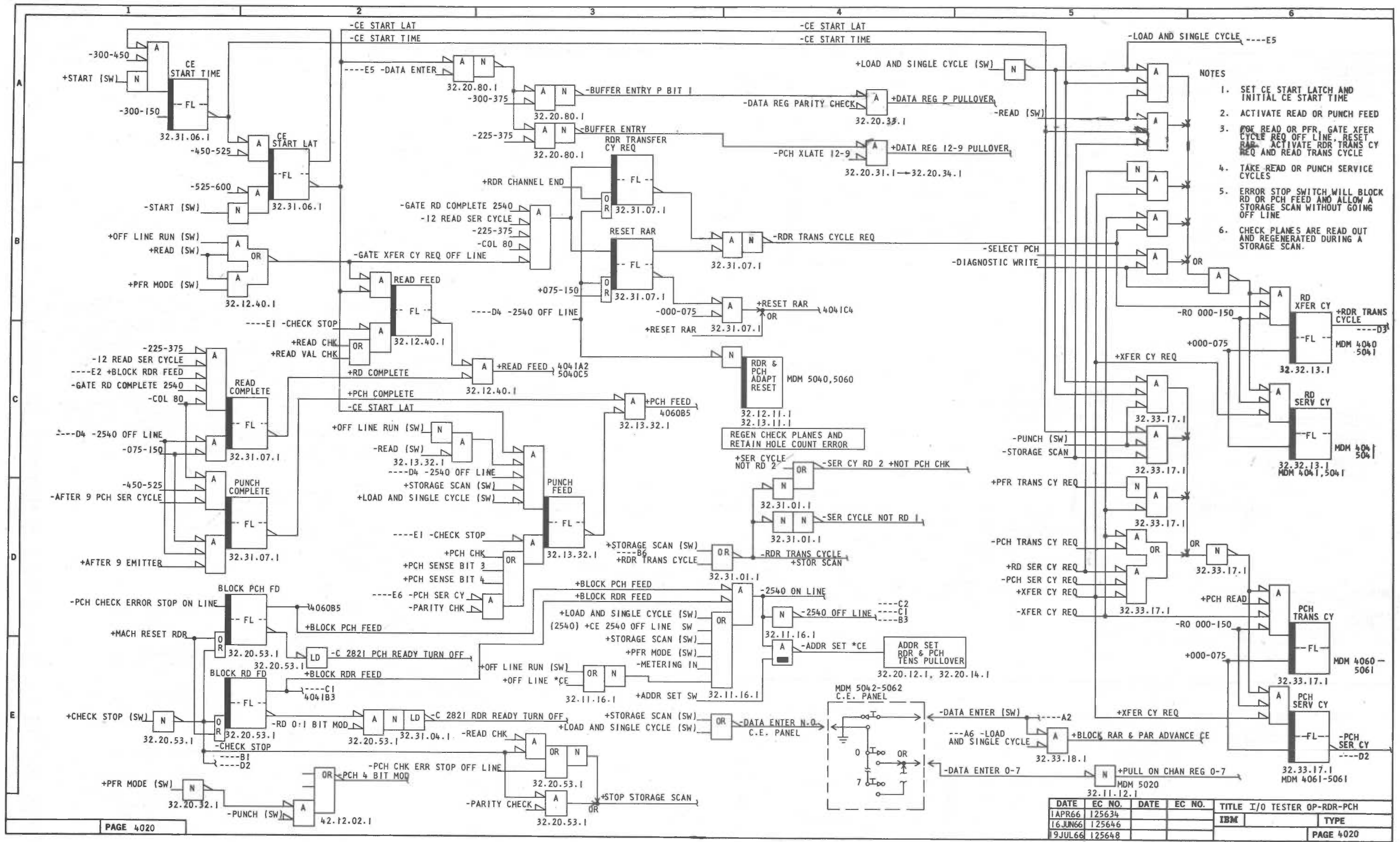
2821 FEMDM (7/67) SLD-9

SLD-9 Printer Error Checks - CF



NOTE: PRT SENSE IDENTICAL FOR PR-UCB-MPR-CF AND PRST

DATE	EC NO.	DATE	EC NO.	TITLE
14OCT65	125598	18JAN66	125617	SENSE-RDR/PCH & PRT
30NOV65	125601	22MAR67	125672	IBM
				TYPE 2821
				PAGE 4000

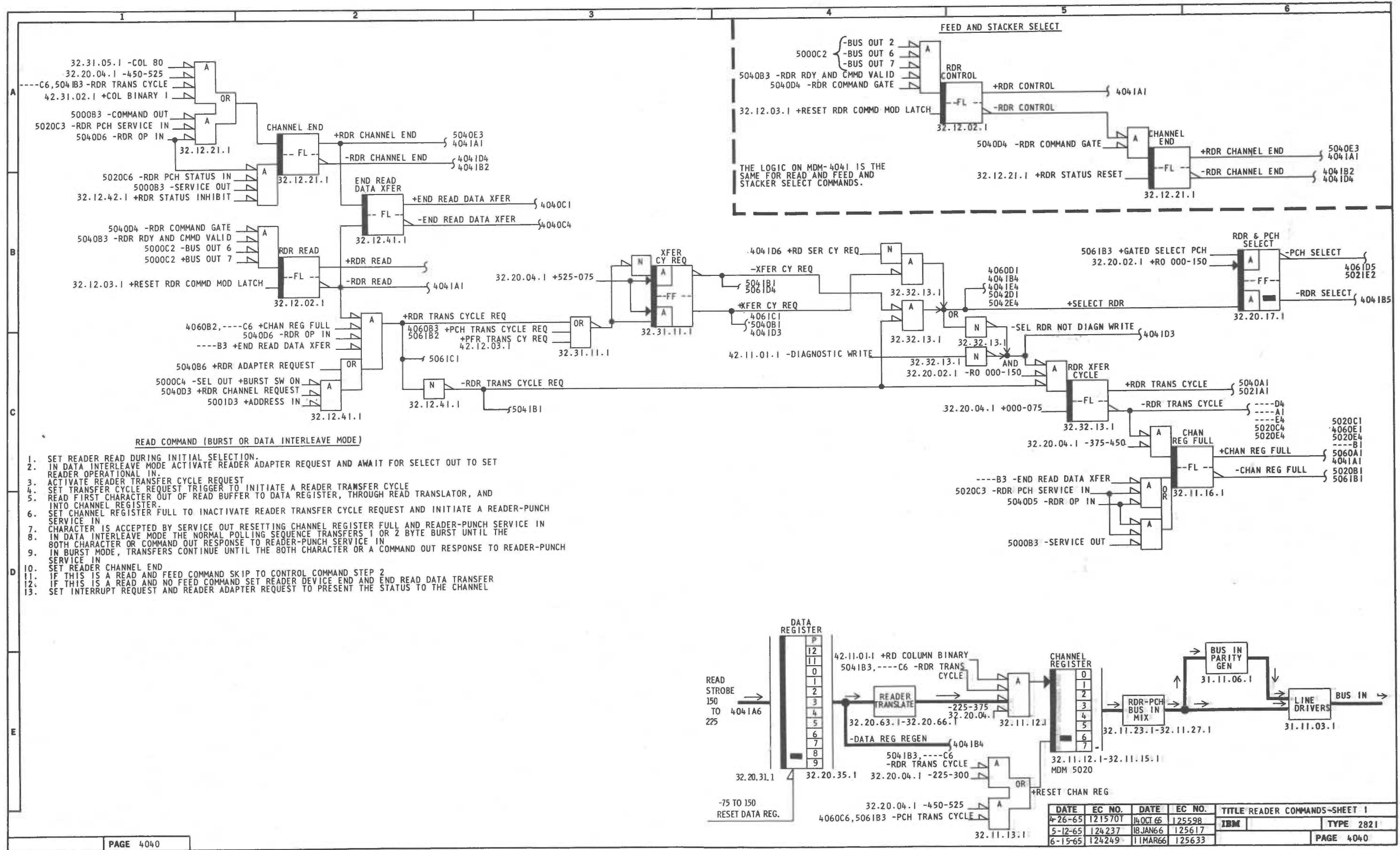


- NOTES
1. SET CE START LATCH AND INITIAL CE START TIME
 2. ACTIVATE READ OR PUNCH FEED
 3. PFR READ OR PFR, GATE XFER CYCLE REQ OFF LINE, RESET RAR - ACTIVATE RDR TRANS CY REQ AND READ TRANS CYCLE
 4. TAKE READ OR PUNCH SERVICE CYCLES
 5. ERROR STOP SWITCH WILL BLOCK RD OR PCH FEED AND ALLOW A STORAGE SCAN WITHOUT GOING OFF LINE
 6. CHECK PLANES ARE READ OUT AND REGENERATED DURING A STORAGE SCAN.

DATE	EC NO.	DATE	EC NO.	TITLE	I/O TESTER	OP-RDR-PCH
1 APR 66	125634			IBM		TYPE
16 JUN 66	125646					
9 JUL 66	125648					

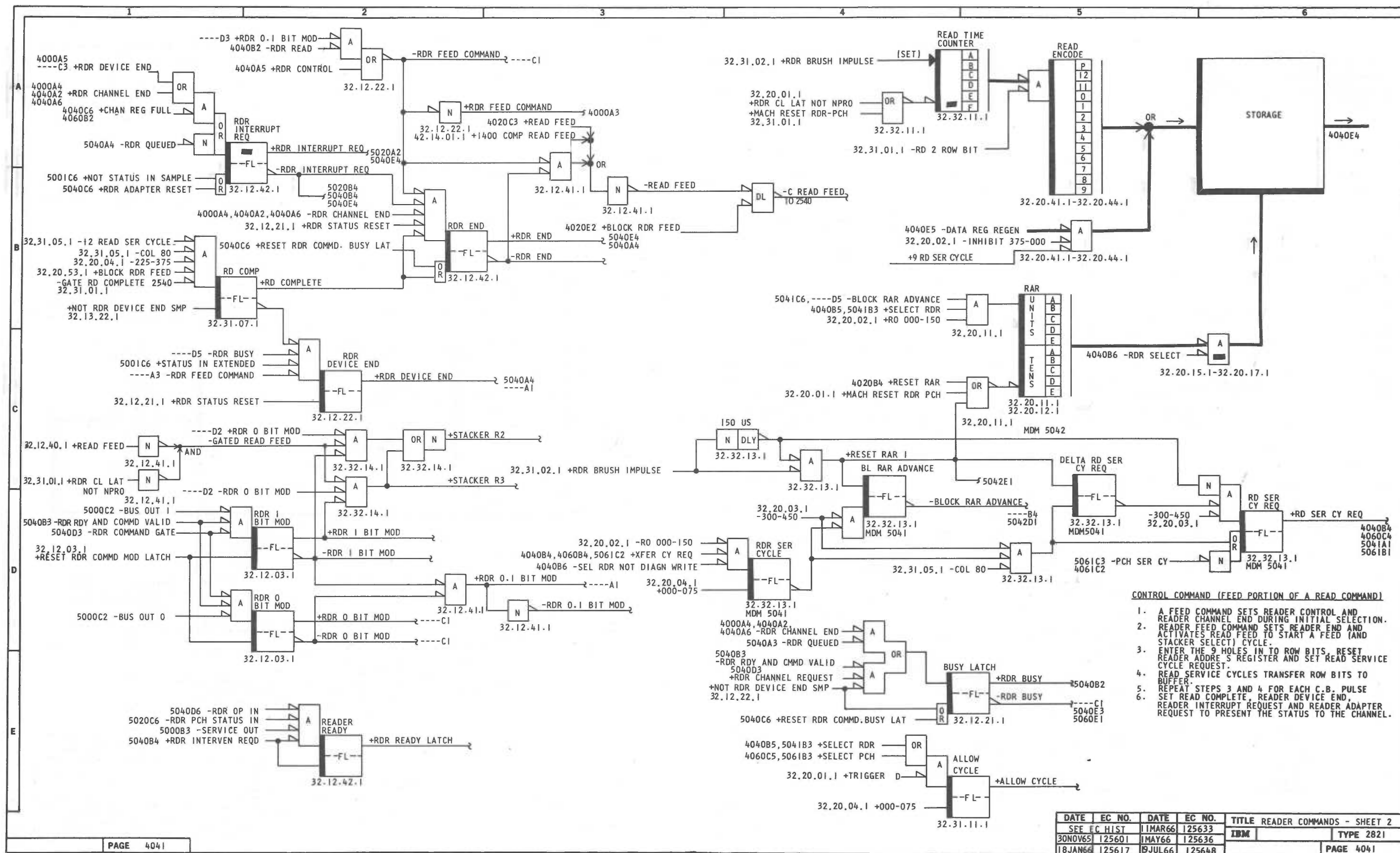
2821 FEMDM (7/67) SLD-11

SLD-11 I/O Tester Operation - Reader - Punch



DATE	EC NO.	DATE	EC NO.	TITLE
4-26-65	1215701	14 OCT 65	125598	READER COMMANDS-SHEET 1
5-12-65	124237	18 JAN 66	125617	IBM
6-15-65	124249	11 MAR 66	125633	TYPE 2821

PAGE 4040

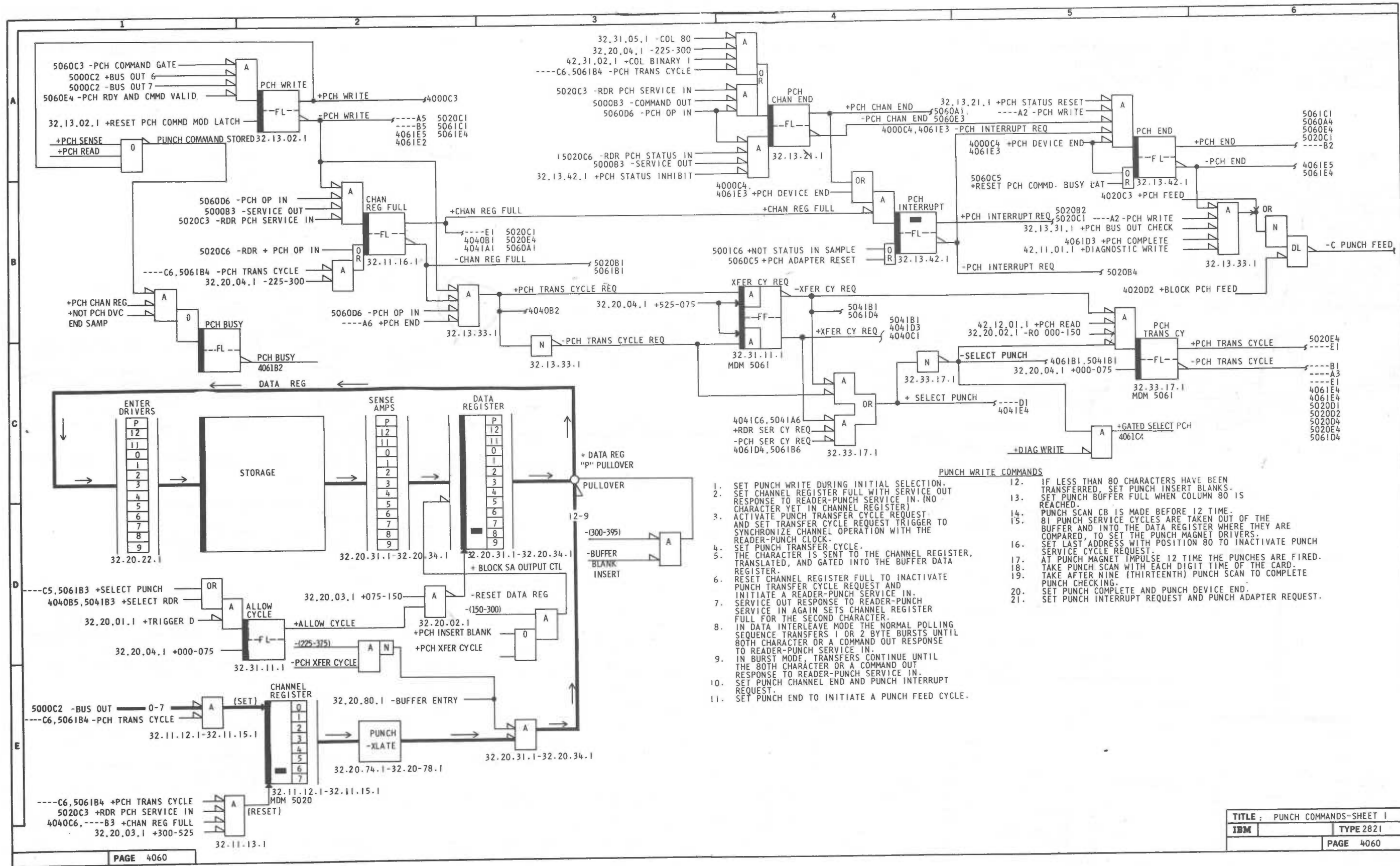


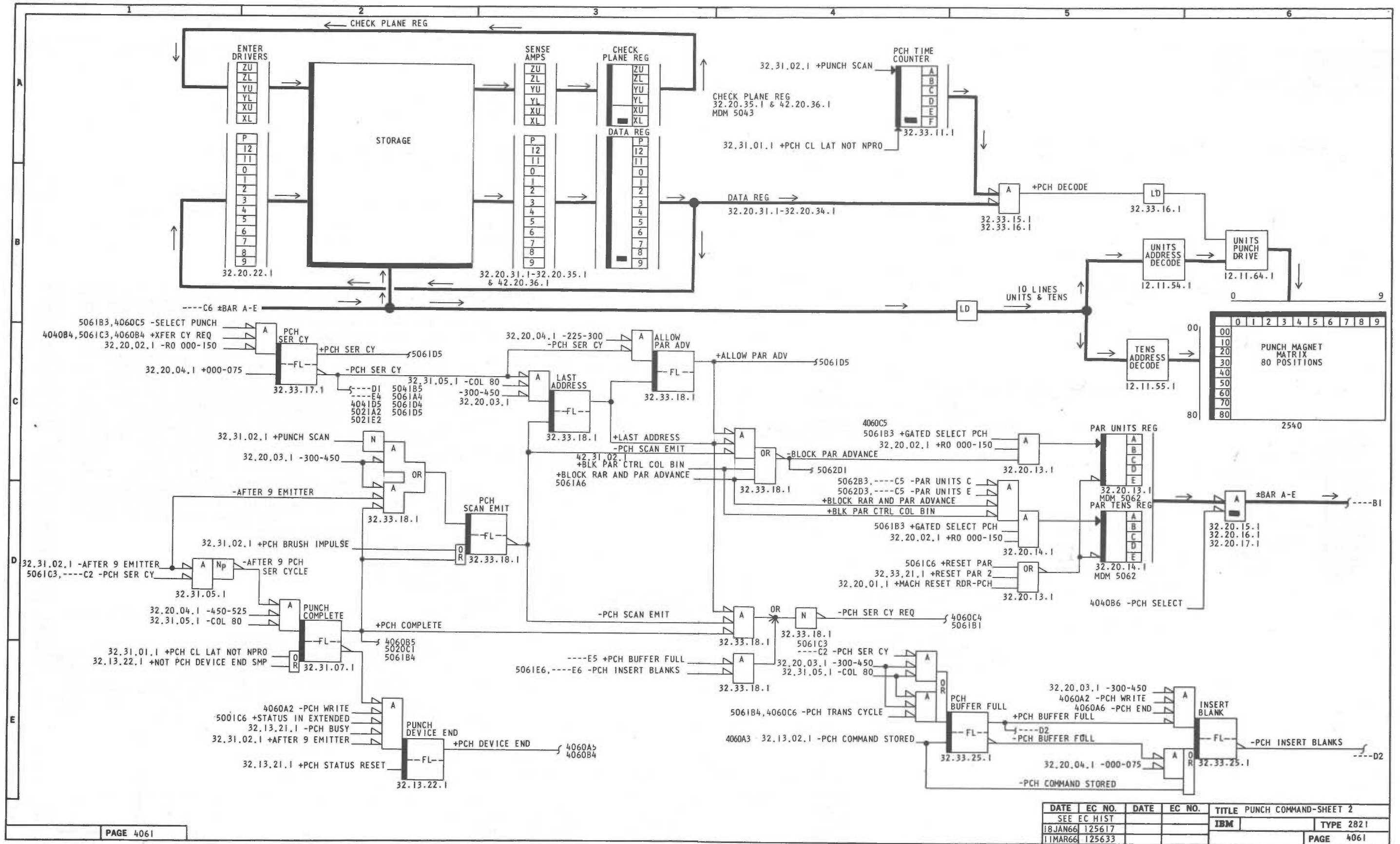
CONTROL COMMAND (FEED PORTION OF A READ COMMAND)

1. A FEED COMMAND SETS READER CONTROL AND READER CHANNEL END DURING INITIAL SELECTION. READER FEED COMMAND SETS READER END AND ACTIVATES READ FEED TO START A FEED (AND STACKER SELECT) CYCLE.
2. ENTER THE 9 HOLES IN TO ROW BITS. RESET READER ADDRESS REGISTER AND SET READ SERVICE CYCLE REQUEST.
3. READ SERVICE CYCLES TRANSFER ROW BITS TO BUFFER.
4. REPEAT STEPS 3 AND 4 FOR EACH C.B. PULSE SET READ COMPLETE, READER DEVICE END, READER INTERRUPT REQUEST AND READER ADAPTER REQUEST TO PRESENT THE STATUS TO THE CHANNEL.

DATE	EC NO.	DATE	EC NO.	TITLE
30NOV65	125601	11MAR66	125633	READER COMMANDS - SHEET 2
18JAN66	125617	19JUL66	125648	

SLD-13 Reader Commands (Sheet 2)



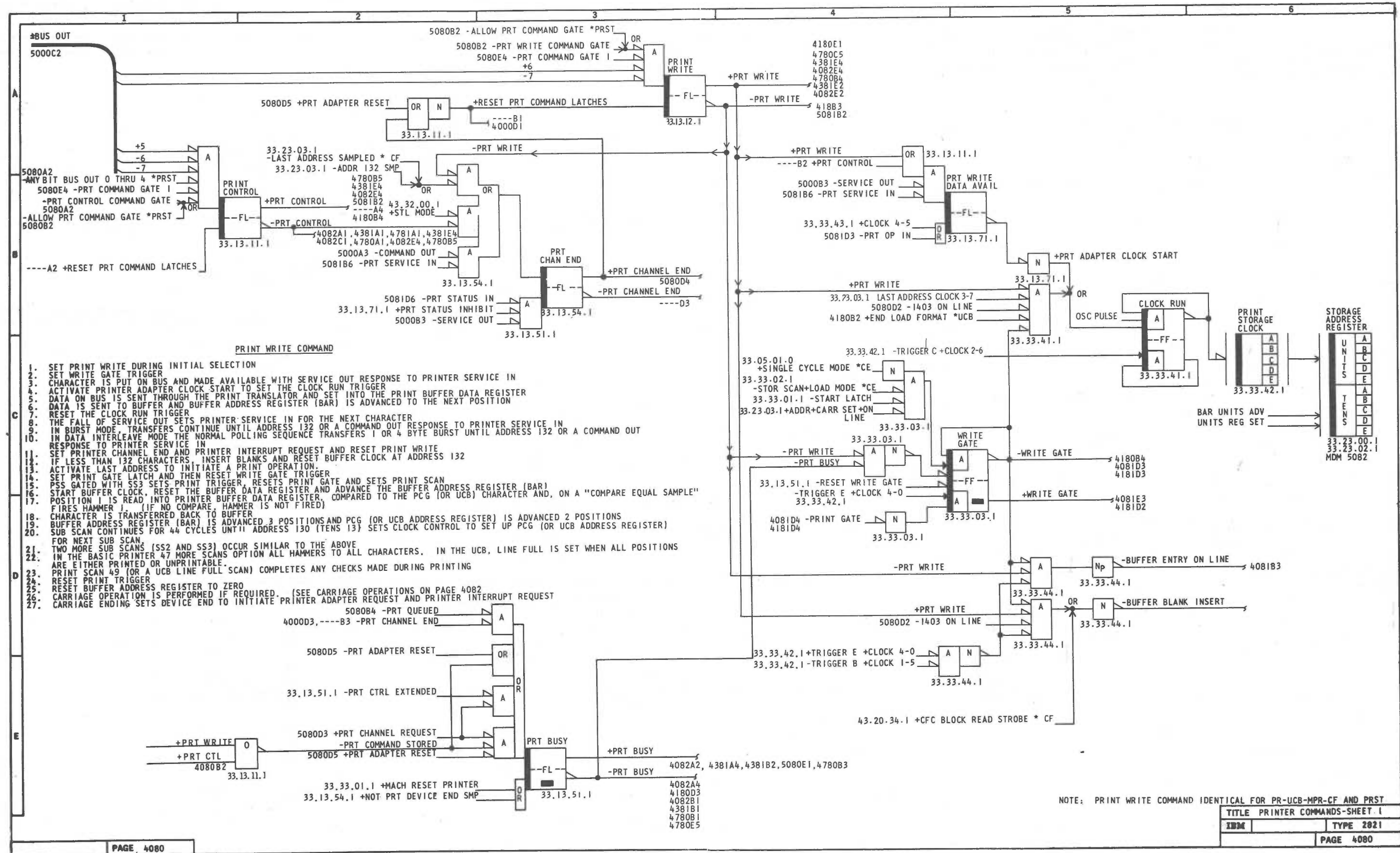


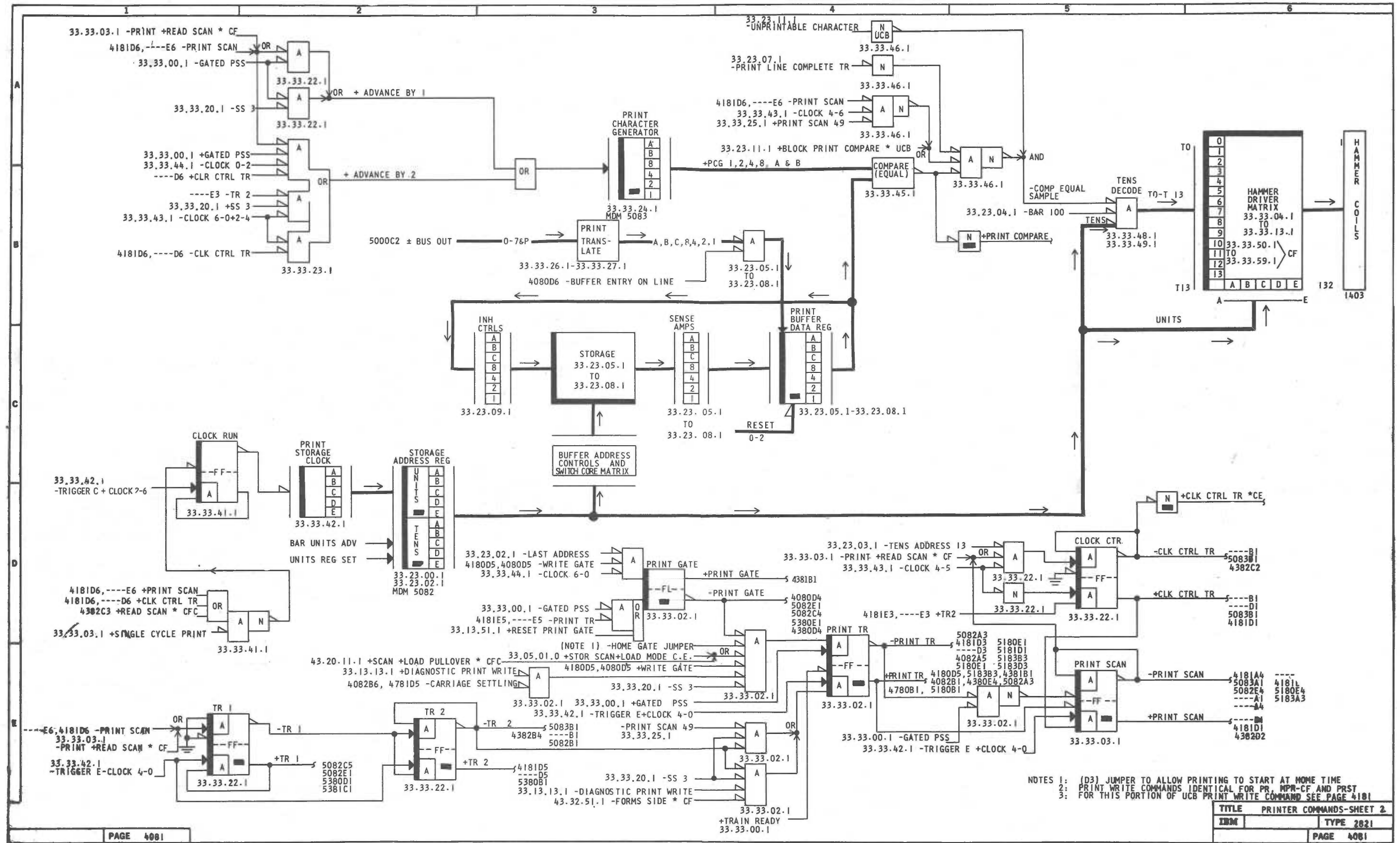
DATE	EC NO.	DATE	EC NO.	TITLE
18JAN66	125617			IBM
11MARG66	125633			

PUNCH COMMAND-SHEET 2
TYPE 2821
PAGE 4061

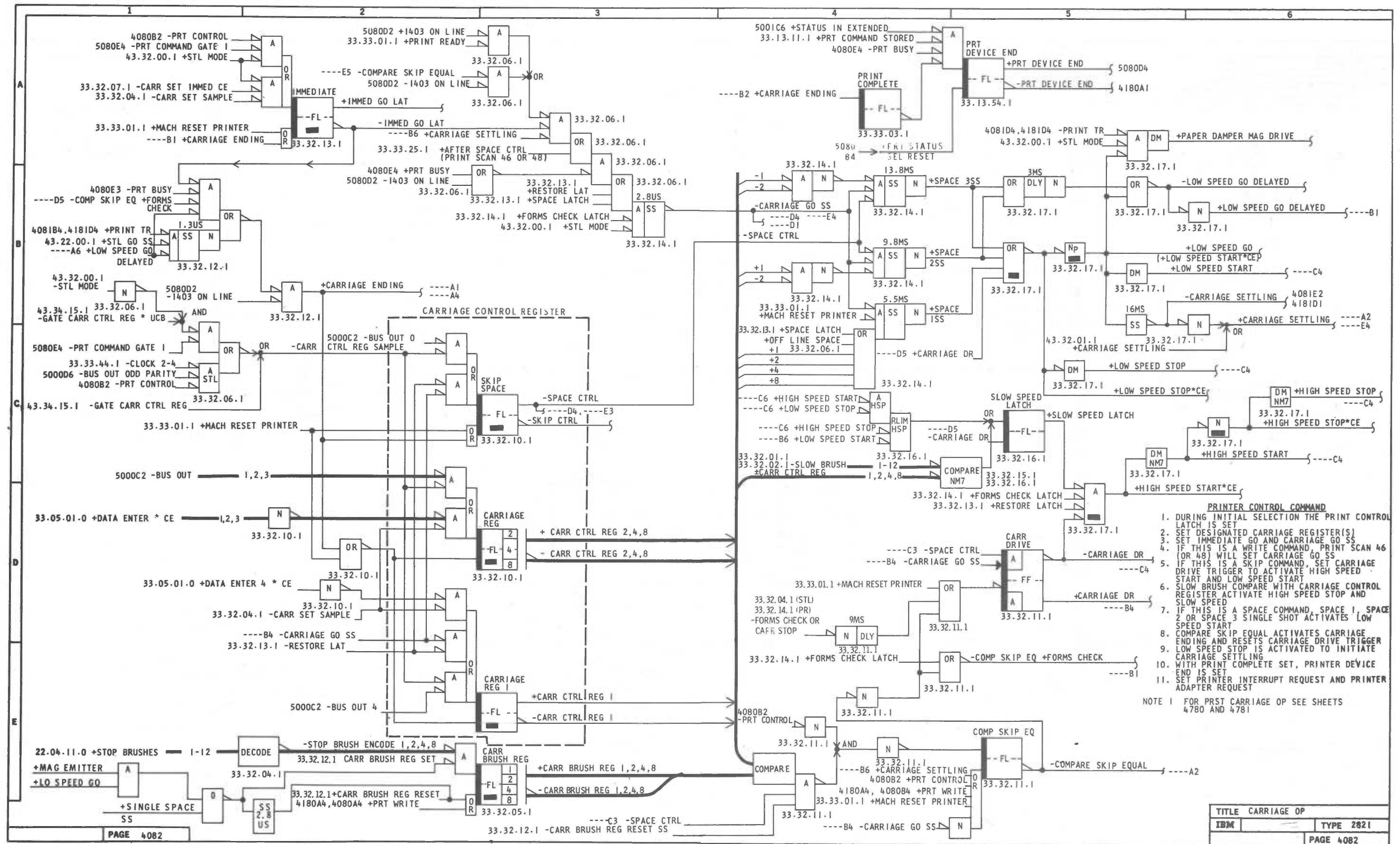
SLD-15 Punch Commands (Sheet 2)

2821 FEMDM (7/67) SLD-15

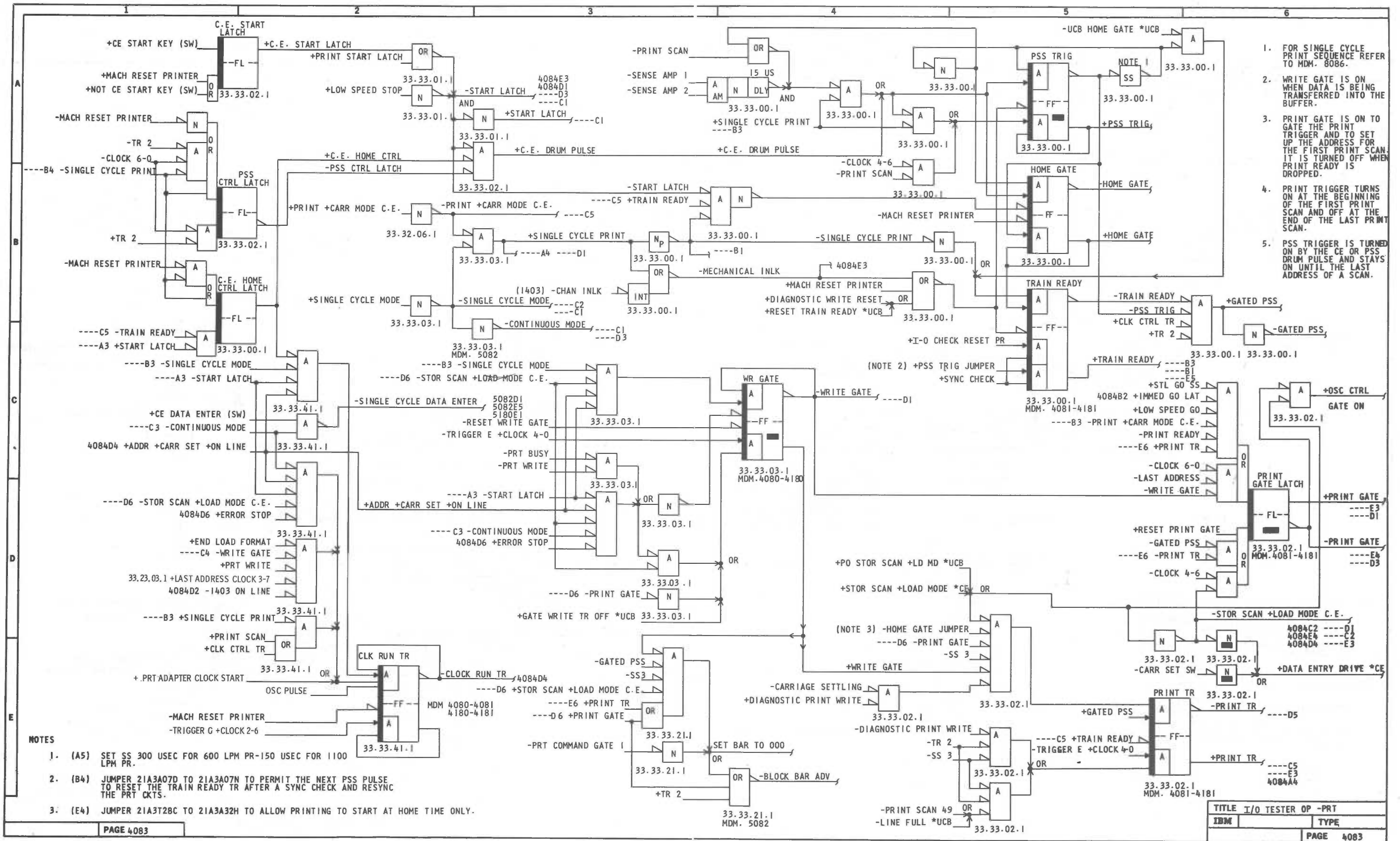




2821 FEMDM (9/67) SLD-17



SLD-18 Carriage Operations



1. FOR SINGLE CYCLE PRINT SEQUENCE REFER TO MDM. 8086.
2. WRITE GATE IS ON WHEN DATA IS BEING TRANSFERRED INTO THE BUFFER.
3. PRINT GATE IS ON TO GATE THE PRINT TRIGGER AND TO SET UP THE ADDRESS FOR THE FIRST PRINT SCAN. IT IS TURNED OFF WHEN PRINT READY IS DROPPED.
4. PRINT TRIGGER TURNS ON AT THE BEGINNING OF THE FIRST PRINT SCAN AND OFF AT THE END OF THE LAST PRINT SCAN.
5. PSS TRIGGER IS TURNED ON BY THE CE OR PSS DRUM PULSE AND STAYS ON UNTIL THE LAST ADDRESS OF A SCAN.

NOTES

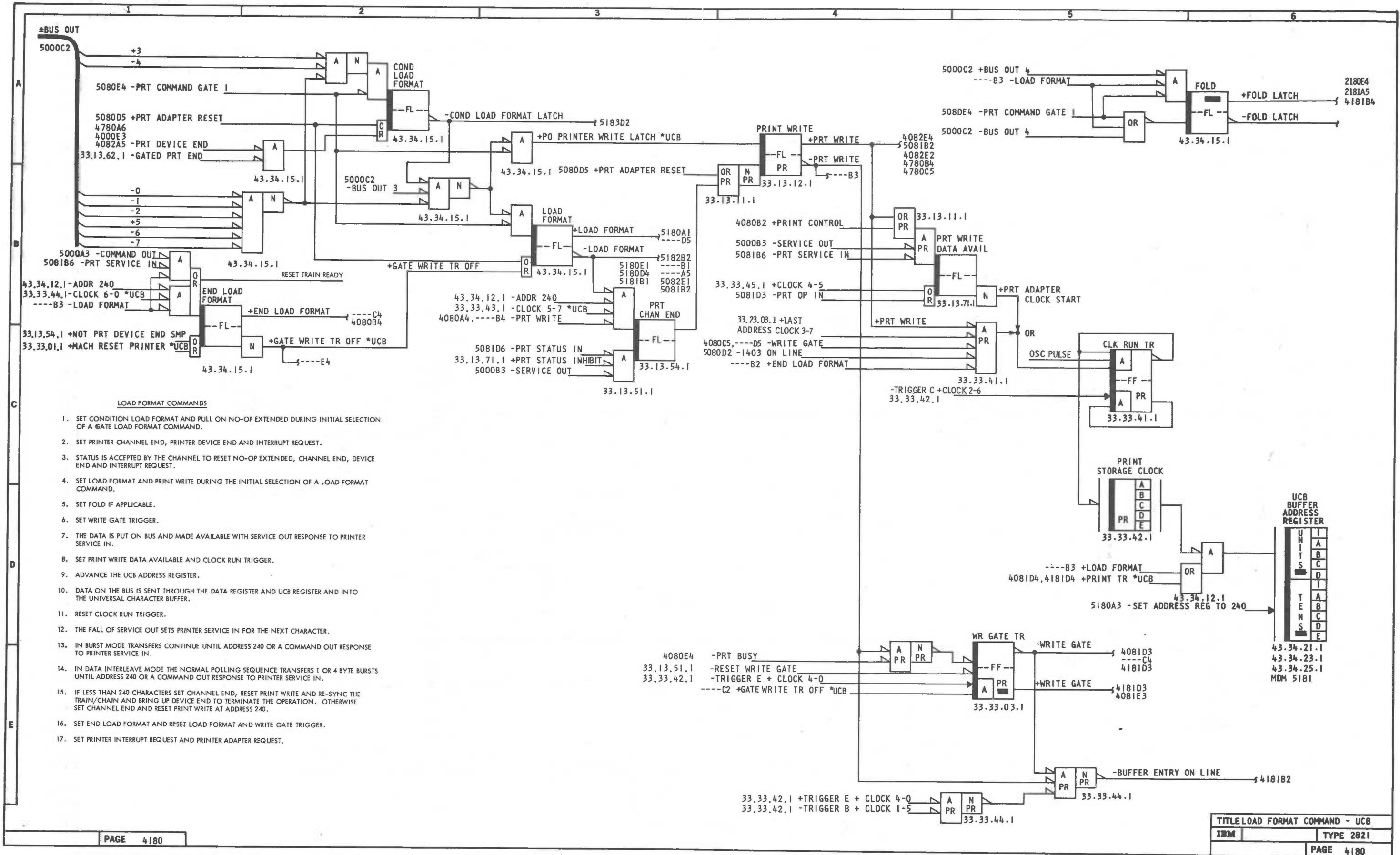
1. (A5) SET SS 300 USEC FOR 600 LPM PR-150 USEC FOR 1100 LPM PR.
2. (B4) JUMPER 21A3A07D TO 21A3A07N TO PERMIT THE NEXT PSS PULSE TO RESET THE TRAIN READY TR AFTER A SYNC CHECK AND RESYNC THE PRT CKTS.
3. (E4) JUMPER 21A3T28C TO 21A3A32H TO ALLOW PRINTING TO START AT HOME TIME ONLY.

PAGE 4083

TITLE	I/O TESTER OP -PRT
IBM	TYPE
PAGE 4083	

2821 FEMDM (9/67) SLD-19

SLD-19 I/O Tester Operations - Printer

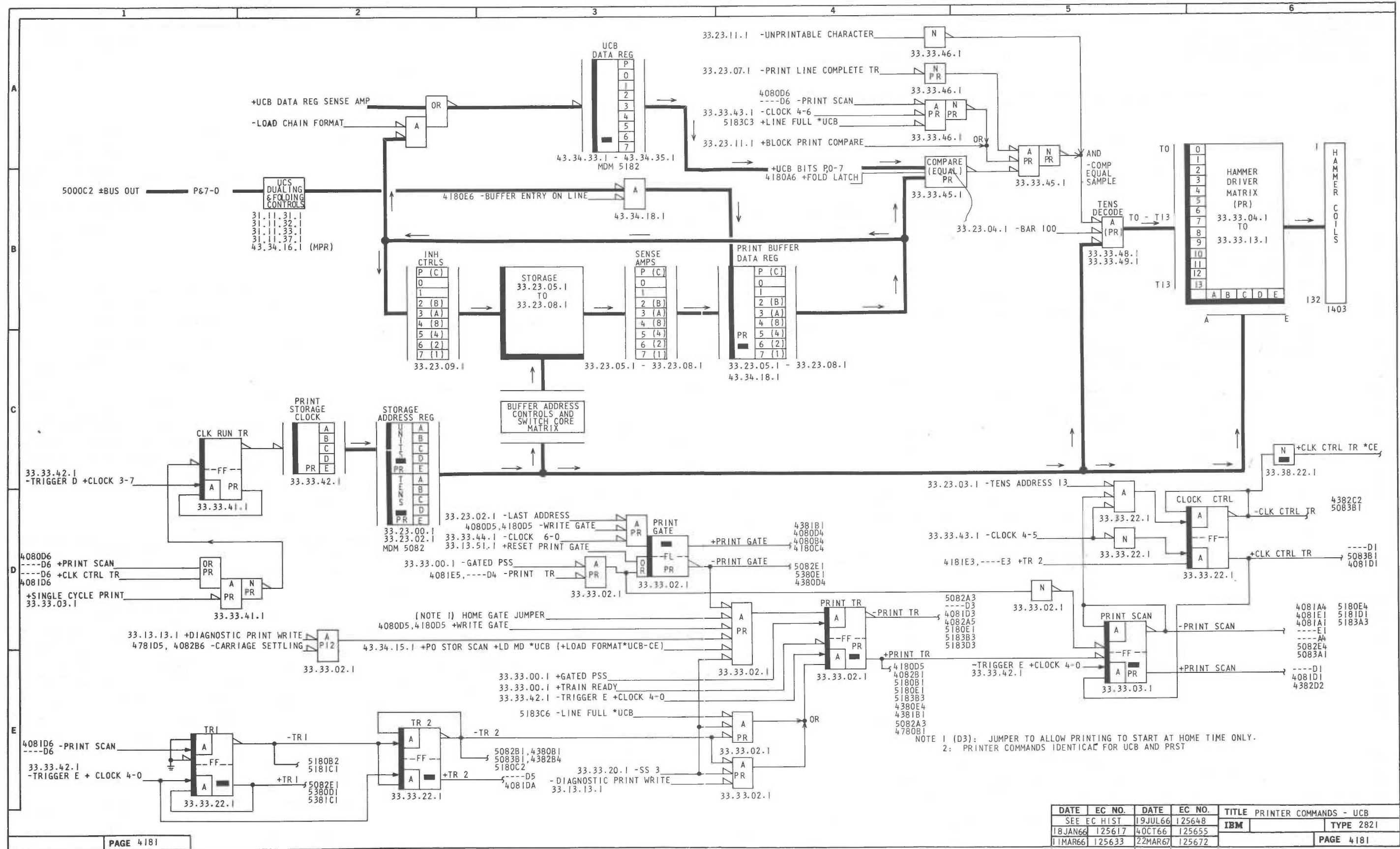


LOAD FORMAT COMMANDS

1. SET CONDITION LOAD FORMAT AND PULL ON NO-OP EXTENDED DURING INITIAL SELECTION OF A GATE LOAD FORMAT COMMAND.
2. SET PRINTER CHANNEL END, PRINTER DEVICE END AND INTERRUPT REQUEST.
3. STATUS IS ACCEPTED BY THE CHANNEL TO RESET NO-OP EXTENDED, CHANNEL END, DEVICE END AND INTERRUPT REQUEST.
4. SET LOAD FORMAT AND PRINT WRITE DURING THE INITIAL SELECTION OF A LOAD FORMAT COMMAND.
5. SET FOLD IF APPLICABLE.
6. SET WRITE GATE TRIGGER.
7. THE DATA IS PUT ON BUS AND MADE AVAILABLE WITH SERVICE OUT RESPONSE TO PRINTER SERVICE IN.
8. SET PRINT WRITE DATA AVAILABLE AND CLOCK RUN TRIGGER.
9. ADVANCE THE UCB ADDRESS REGISTER.
10. DATA ON THE BUS IS SENT THROUGH THE DATA REGISTER AND UCB REGISTER AND INTO THE UNIVERSAL CHARACTER BUFFER.
11. RESET CLOCK RUN TRIGGER.
12. THE FALL OF SERVICE OUT SETS PRINTER SERVICE IN FOR THE NEXT CHARACTER.
13. IN BURST MODE TRANSFERS CONTINUE UNTIL ADDRESS 240 OR A COMMAND OUT RESPONSE TO PRINTER SERVICE IN.
14. IN DATA INTERLEAVE MODE THE NORMAL POLLING SEQUENCE TRANSFERS 1 OR 4 BYTE BURSTS UNTIL ADDRESS 240 OR A COMMAND OUT RESPONSE TO PRINTER SERVICE IN.
15. IF LESS THAN 240 CHARACTERS SET CHANNEL END, RESET PRINT WRITE AND RE-SYNC THE TRAIN/CHAIN AND BRING UP DEVICE END TO TERMINATE THE OPERATION. OTHERWISE SET CHANNEL END AND RESET PRINT WRITE AT ADDRESS 240.
16. SET END LOAD FORMAT AND RESET LOAD FORMAT AND WRITE GATE TRIGGER.
17. SET PRINTER INTERRUPT REQUEST AND PRINTER ADAPTER REQUEST.

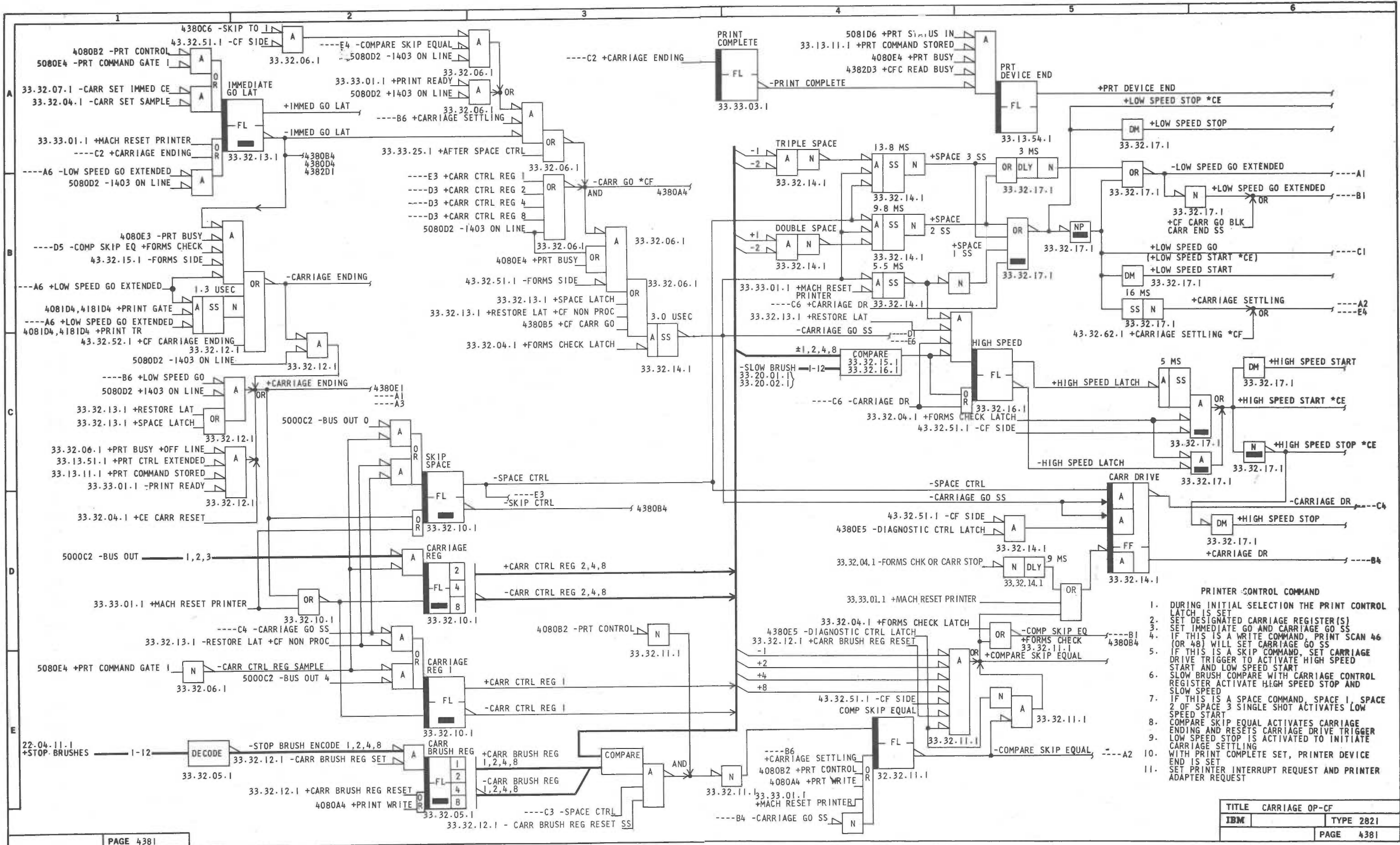
TITLE LOAD FORMAT COMMAND - UCB	
IBM	TYPE 2821
PAGE 4180	

2821 FEMDM (5/68) SLD-21



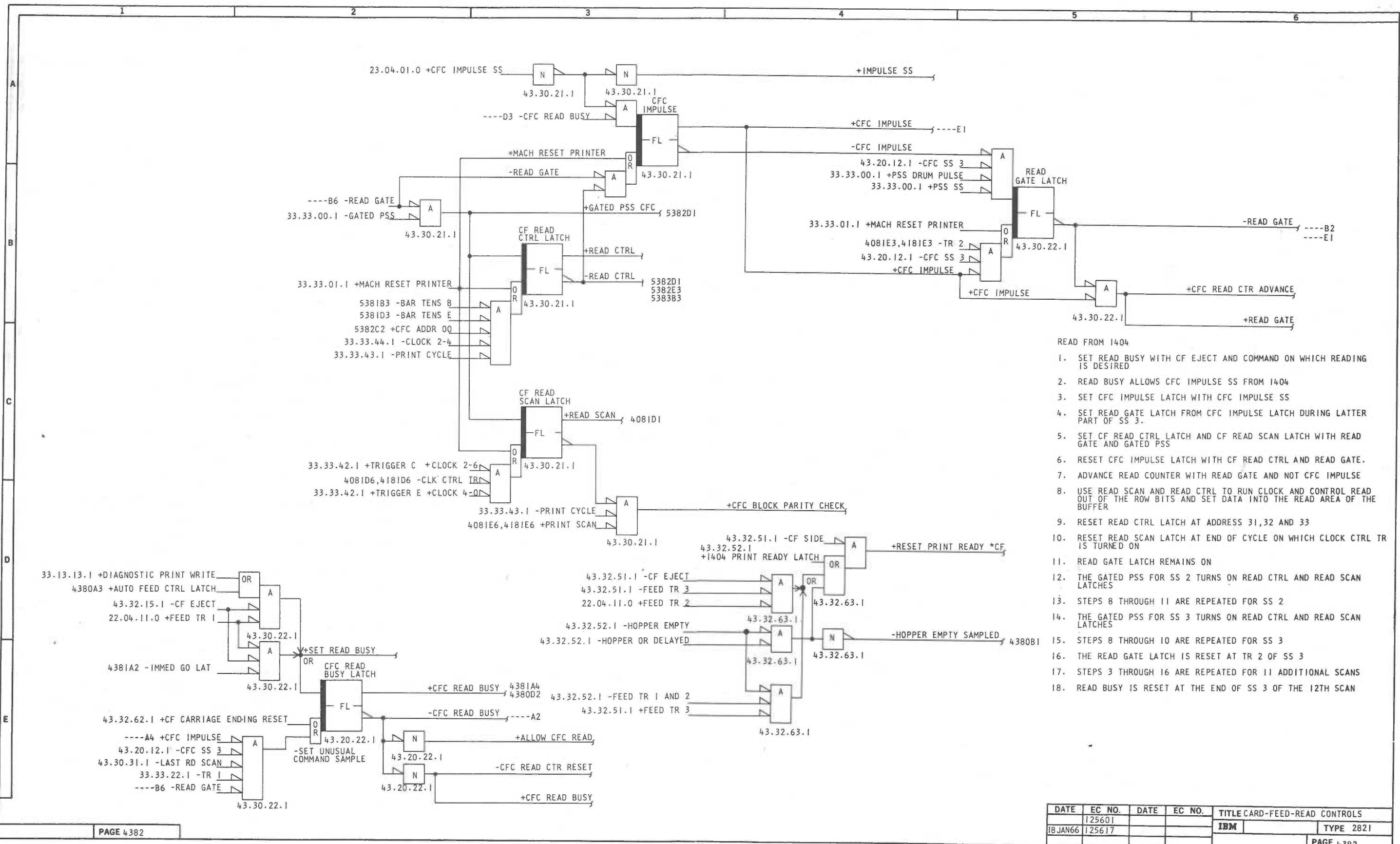
DATE	EC NO.	DATE	EC NO.	TITLE
SEE EC HIST	19JUL66	125648		PRINTER COMMANDS - UCB
18JAN66	125617	4OCT66	125655	IBM TYPE 2821
11MAR66	125633	22MAR67	125672	

SLD-22 Printer Commands - UCB



- PRINTER CONTROL COMMAND**
1. DURING INITIAL SELECTION THE PRINT CONTROL LATCH IS SET
 2. SET DESIGNATED CARRIAGE REGISTER(S)
 3. SET IMMEDIATE GO AND CARRIAGE GO SS
 4. IF THIS IS A WRITE COMMAND, PRINT SCAN 46 (OR 48) WILL SET CARRIAGE GO SS
 5. IF THIS IS A SKIP COMMAND, SET CARRIAGE DRIVE TRIGGER TO ACTIVATE HIGH SPEED START AND LOW SPEED START
 6. SLOW BRUSH COMPARE WITH CARRIAGE CONTROL REGISTER ACTIVATE HIGH SPEED STOP AND SLOW SPEED
 7. IF THIS IS A SPACE COMMAND, SPACE 1, SPACE 2 OF SPACE 3 SINGLE SHOT ACTIVATES LOW SPEED START
 8. COMPARE SKIP EQUAL ACTIVATES CARRIAGE ENDING AND RESETS CARRIAGE DRIVE TRIGGER
 9. LOW SPEED STOP IS ACTIVATED TO INITIATE CARRIAGE SETTling
 10. WITH PRINT COMPLETE SET, PRINTER DEVICE END IS SET
 11. SET PRINTER INTERRUPT REQUEST AND PRINTER ADAPTER REQUEST

TITLE	CARRIAGE OP-CF
IBM	TYPE 2821
	PAGE 4381

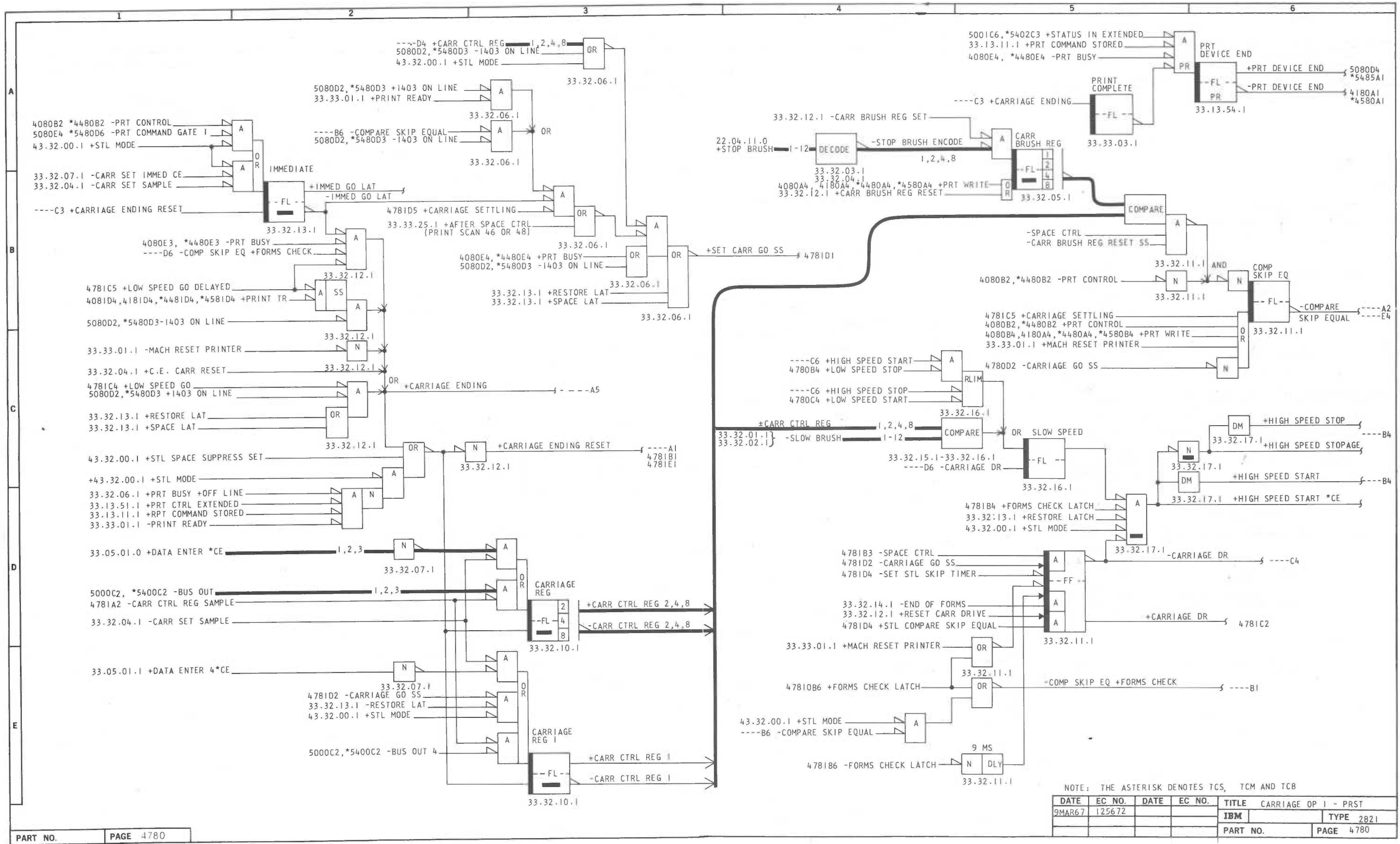


- READ FROM 1404
1. SET READ BUSY WITH CF EJECT AND COMMAND ON WHICH READING IS DESIRED
 2. READ BUSY ALLOWS CFC IMPULSE SS FROM 1404
 3. SET CFC IMPULSE LATCH WITH CFC IMPULSE SS
 4. SET READ GATE LATCH FROM CFC IMPULSE LATCH DURING LATTER PART OF SS 3.
 5. SET CF READ CTRL LATCH AND CF READ SCAN LATCH WITH READ GATE AND GATED PSS
 6. RESET CFC IMPULSE LATCH WITH CF READ CTRL AND READ GATE.
 7. ADVANCE READ COUNTER WITH READ GATE AND NOT CFC IMPULSE
 8. USE READ SCAN AND READ CTRL TO RUN CLOCK AND CONTROL READ OUT OF THE ROW BITS AND SET DATA INTO THE READ AREA OF THE BUFFER
 9. RESET READ CTRL LATCH AT ADDRESS 31,32 AND 33
 10. RESET READ SCAN LATCH AT END OF CYCLE ON WHICH CLOCK CTRL TR IS TURNED ON
 11. READ GATE LATCH REMAINS ON
 12. THE GATED PSS FOR SS 2 TURNS ON READ CTRL AND READ SCAN LATCHES
 13. STEPS 8 THROUGH 11 ARE REPEATED FOR SS 2
 14. THE GATED PSS FOR SS 3 TURNS ON READ CTRL AND READ SCAN LATCHES
 15. STEPS 8 THROUGH 10 ARE REPEATED FOR SS 3
 16. THE READ GATE LATCH IS RESET AT TR 2 OF SS 3
 17. STEPS 3 THROUGH 16 ARE REPEATED FOR 11 ADDITIONAL SCANS
 18. READ BUSY IS RESET AT THE END OF SS 3 OF THE 12TH SCAN

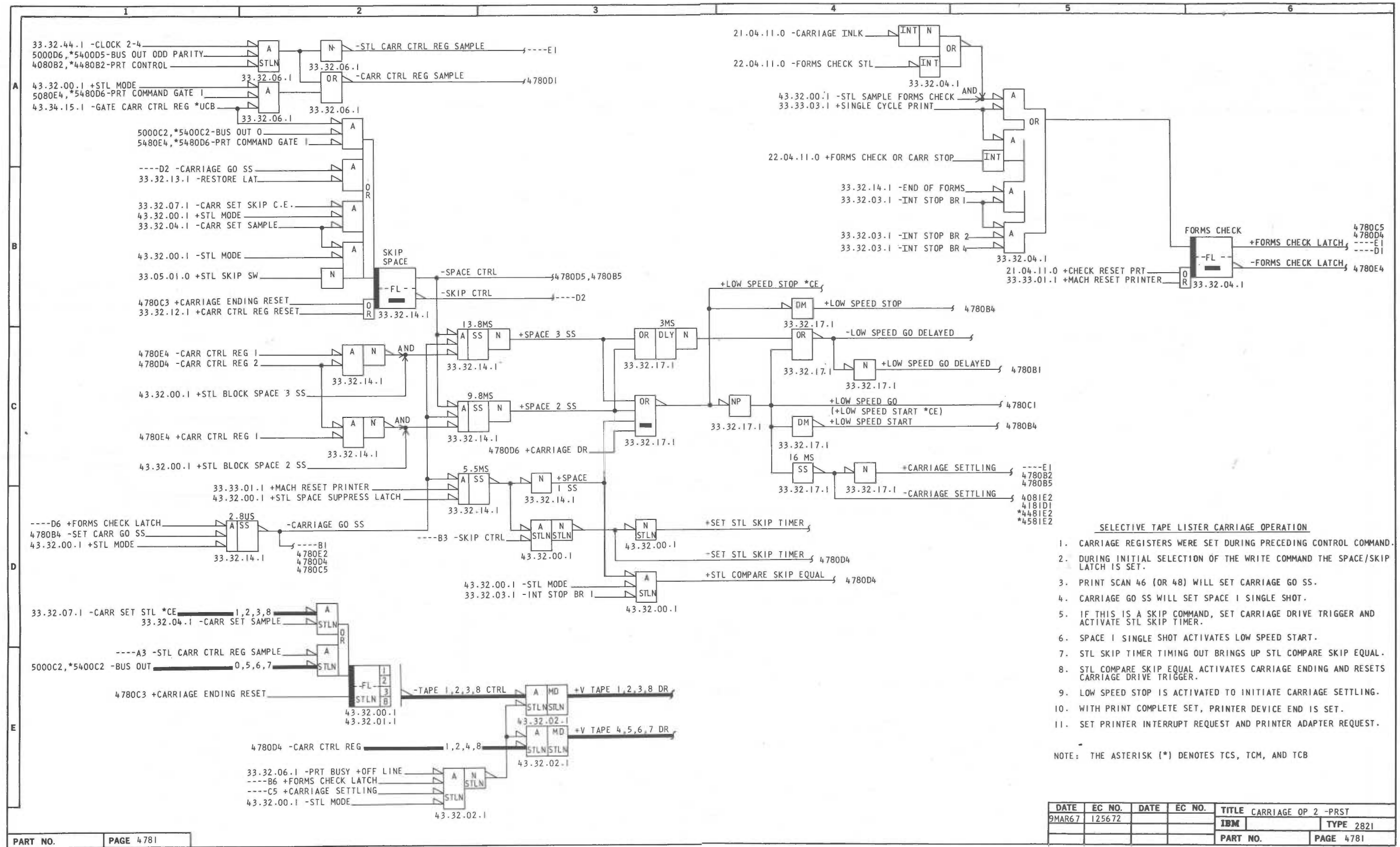
DATE	EC NO.	DATE	EC NO.	TITLE CARD-FEED-READ CONTROLS
	125601			
18JAN66	125617			IBM TYPE 2821
				PAGE 4382

SLD-25 Card - Feed - Read Controls

2821 FEMDM (7/67) SLD-25



SLD-26 Carriage Operation 1 - PRST

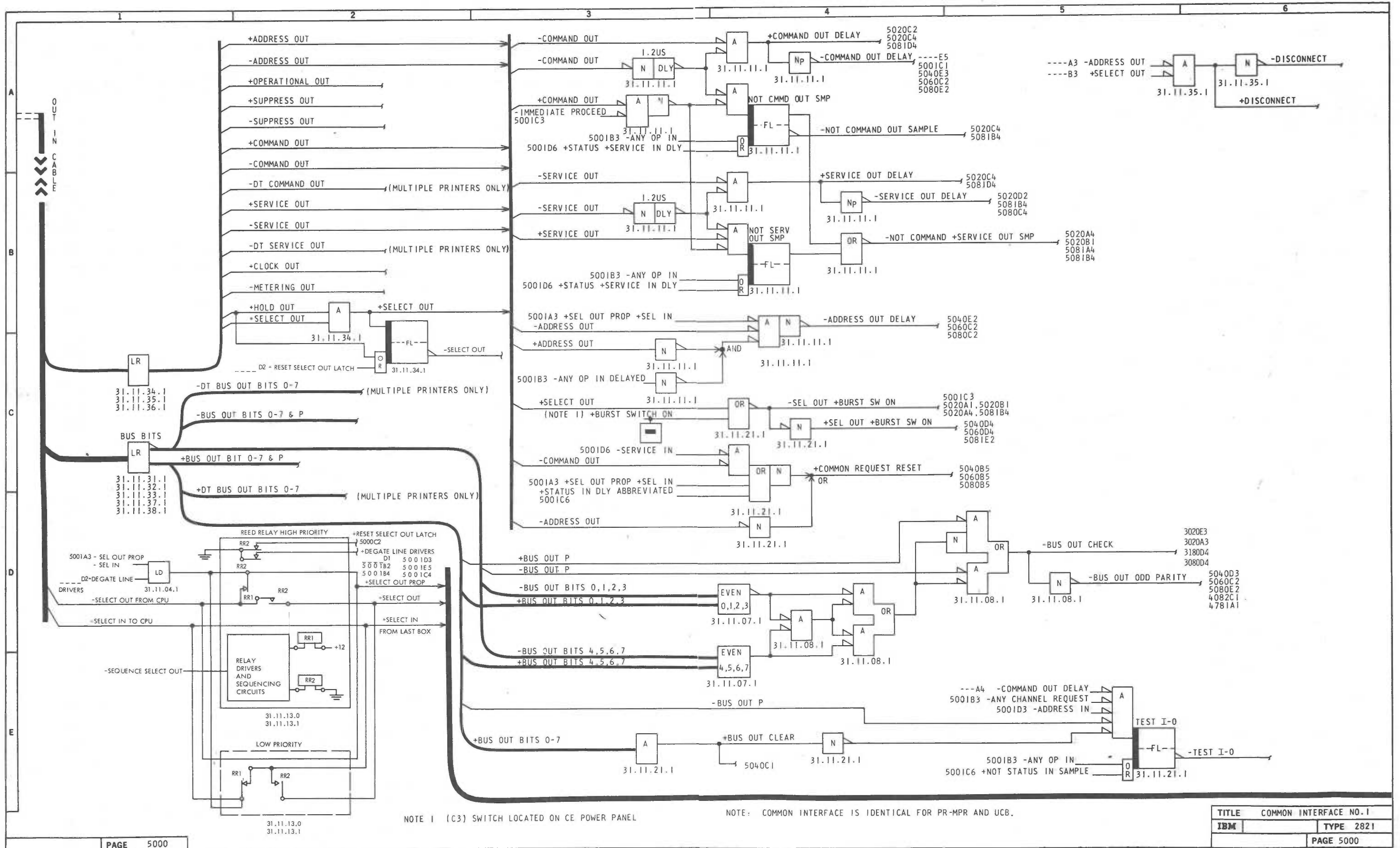


SELECTIVE TAPE LISTER CARRIAGE OPERATION

1. CARRIAGE REGISTERS WERE SET DURING PRECEDING CONTROL COMMAND.
2. DURING INITIAL SELECTION OF THE WRITE COMMAND THE SPACE/SKIP LATCH IS SET.
3. PRINT SCAN 46 (OR 48) WILL SET CARRIAGE GO SS.
4. CARRIAGE GO SS WILL SET SPACE 1 SINGLE SHOT.
5. IF THIS IS A SKIP COMMAND, SET CARRIAGE DRIVE TRIGGER AND ACTIVATE STL SKIP TIMER.
6. SPACE 1 SINGLE SHOT ACTIVATES LOW SPEED START.
7. STL SKIP TIMER TIMING OUT BRINGS UP STL COMPARE SKIP EQUAL.
8. STL COMPARE SKIP EQUAL ACTIVATES CARRIAGE ENDING AND RESETS CARRIAGE DRIVE TRIGGER.
9. LOW SPEED STOP IS ACTIVATED TO INITIATE CARRIAGE SETTling.
10. WITH PRINT COMPLETE SET, PRINTER DEVICE END IS SET.
11. SET PRINTER INTERRUPT REQUEST AND PRINTER ADAPTER REQUEST.

NOTE: THE ASTERISK (*) DENOTES TCS, TCM, AND TCB

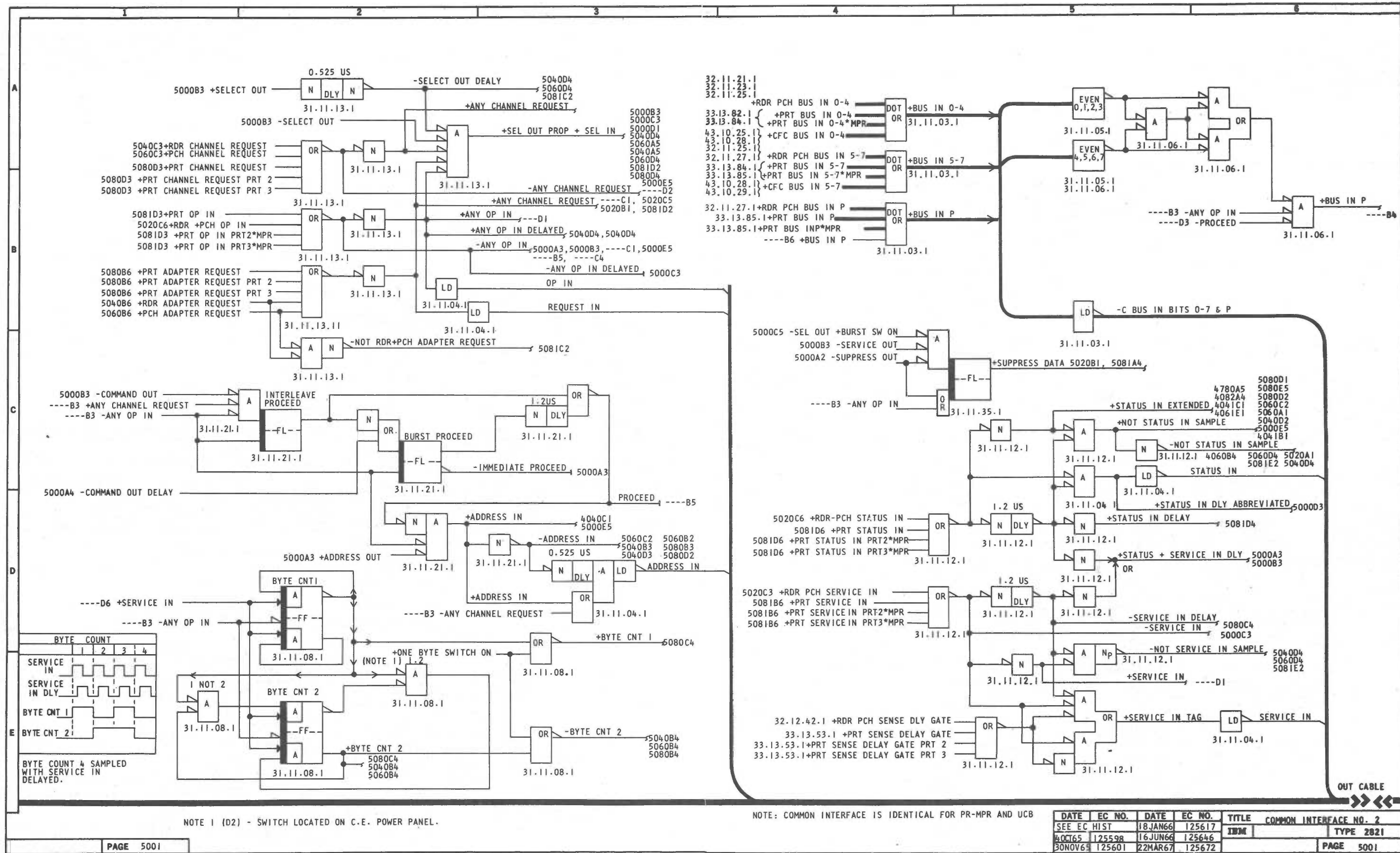
DATE	EC NO.	DATE	EC NO.	TITLE
9MAR67	125672			CARRIAGE OP 2 -PRST
				IBM
				TYPE 2821
				PART NO.
				PAGE 4781

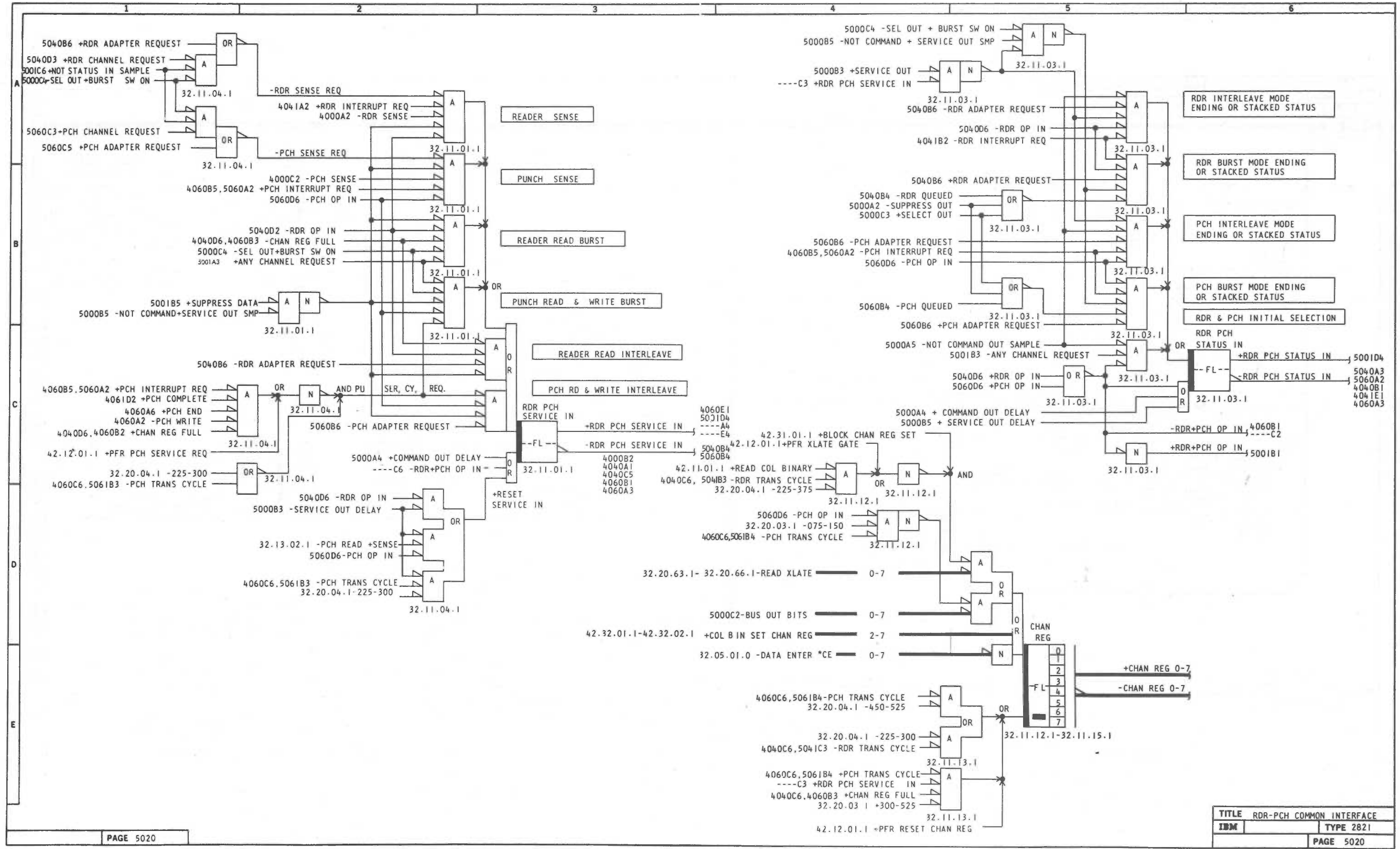


NOTE 1 (C3) SWITCH LOCATED ON CE POWER PANEL

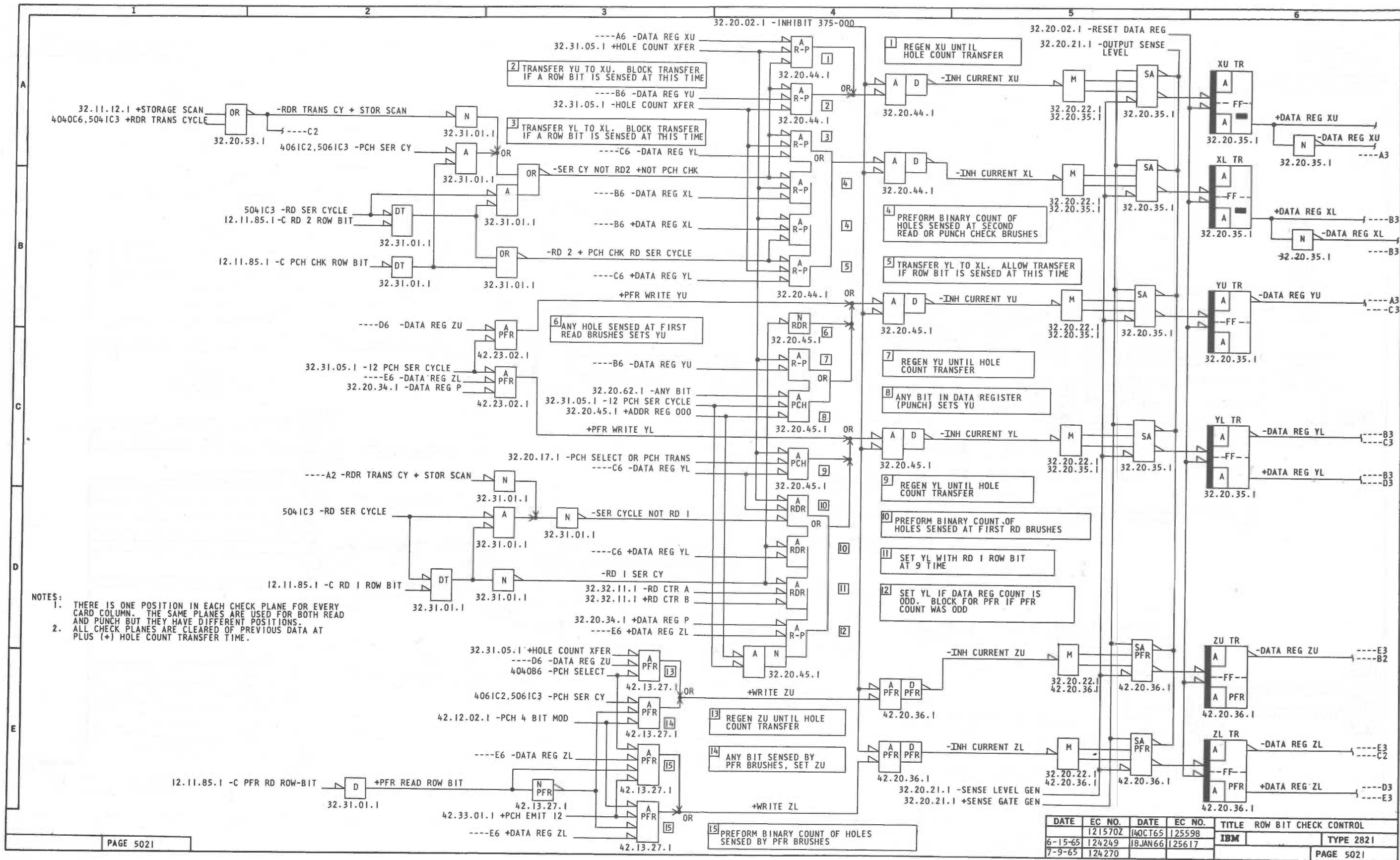
NOTE: COMMON INTERFACE IS IDENTICAL FOR PR-MPR AND UCB.

TITLE	COMMON INTERFACE NO.1
IBM	TYPE 2821
PAGE 5000	





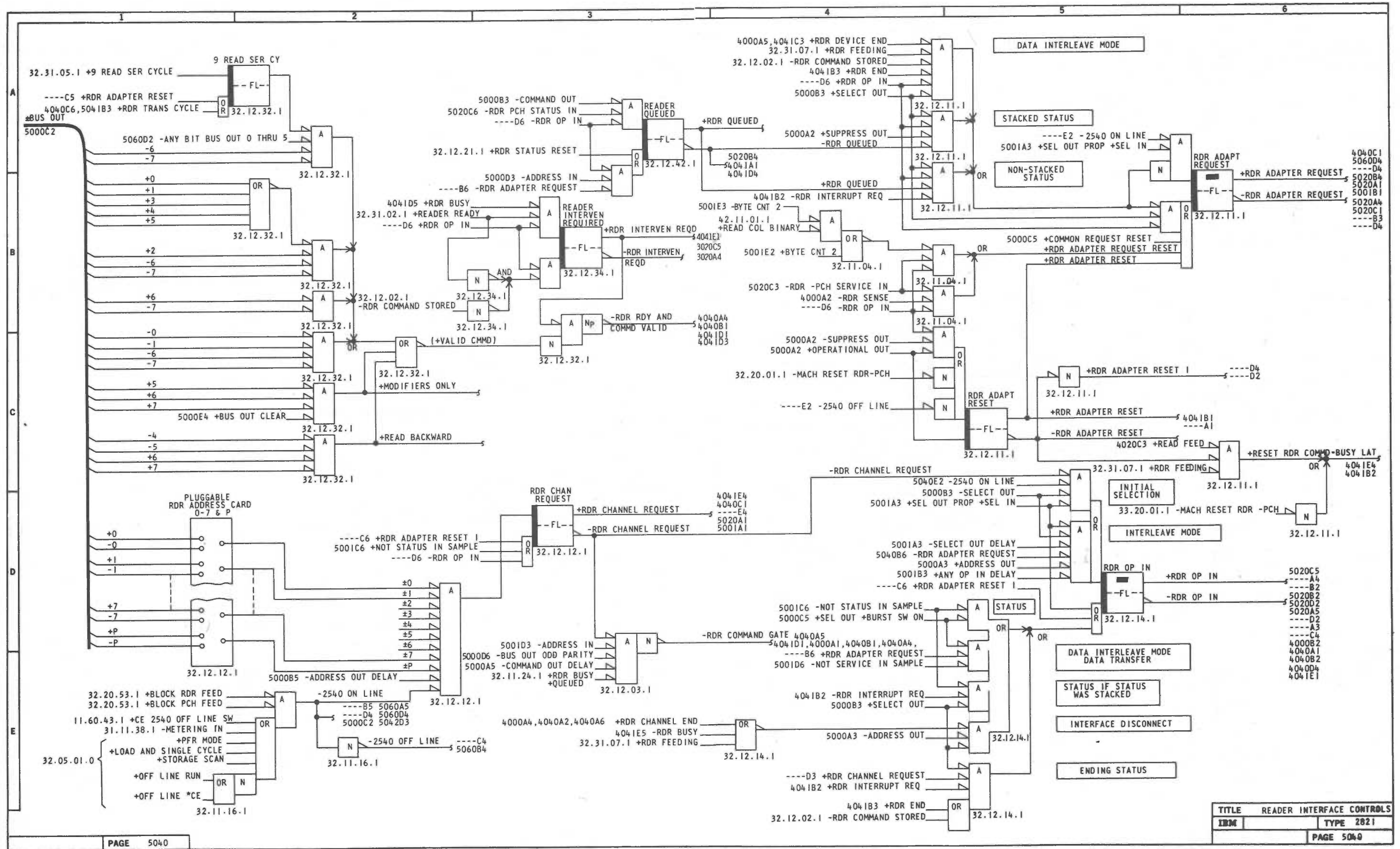
SLD-30 Reader-Punch Common Interface



NOTES:
 1. THERE IS ONE POSITION IN EACH CHECK PLANE FOR EVERY CARD COLUMN. THE SAME PLANES ARE USED FOR BOTH READ AND PUNCH BUT THEY HAVE DIFFERENT POSITIONS.
 2. ALL CHECK PLANES ARE CLEARED OF PREVIOUS DATA AT PLUS (+) HOLE COUNT TRANSFER TIME.

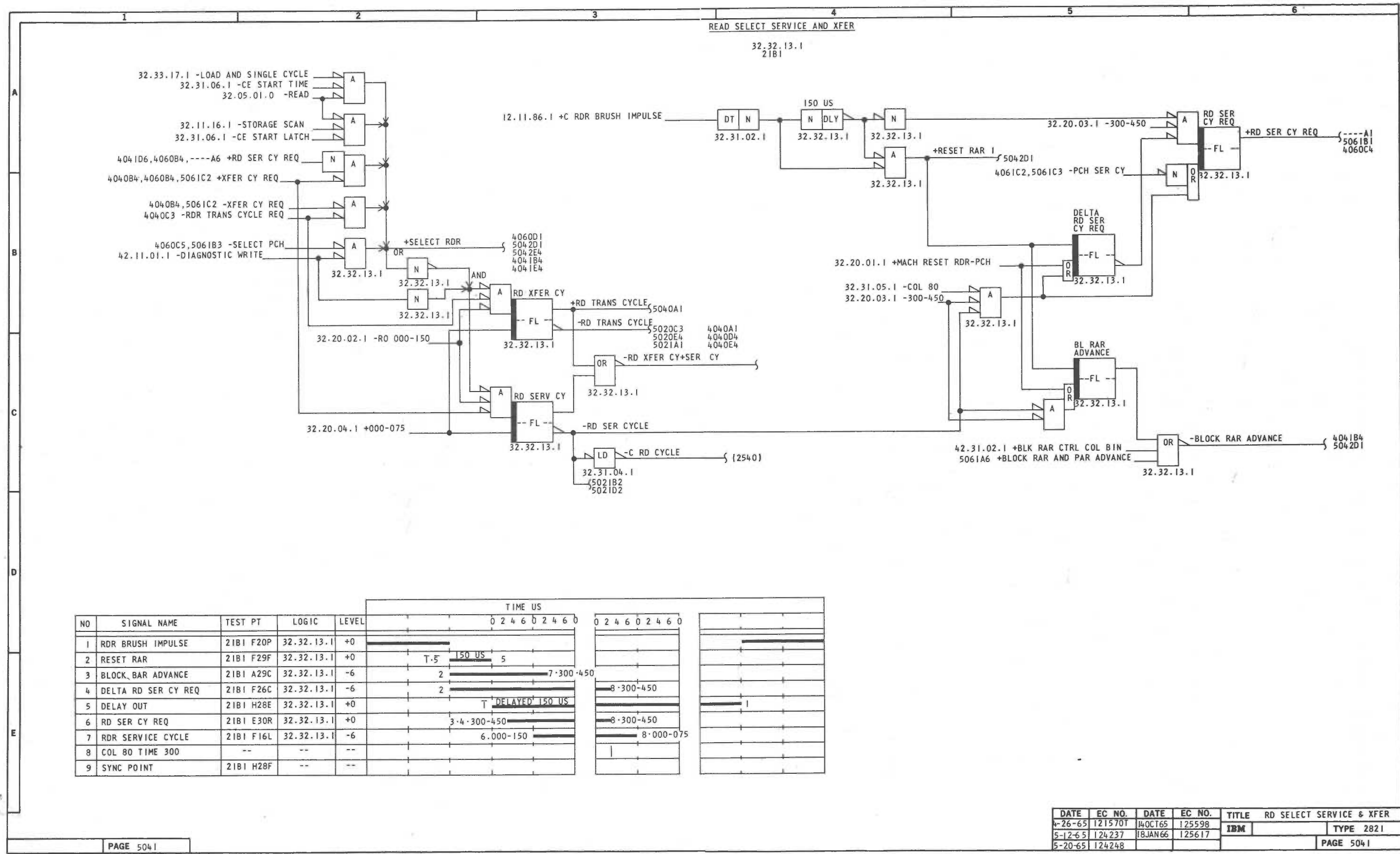
DATE	EC NO.	DATE	EC NO.	TITLE	ROW BIT CHECK CONTROL
121570Z	140CT65	125598		IBM	TYPE 2821
6-15-65	124249	18JAN66	125617		
7-9-65	124270				PAGE 5021

SLD-31 Row Bit Check Control



TITLE	READER INTERFACE CONTROLS	
IBM		TYPE 2821
		PAGE 5040

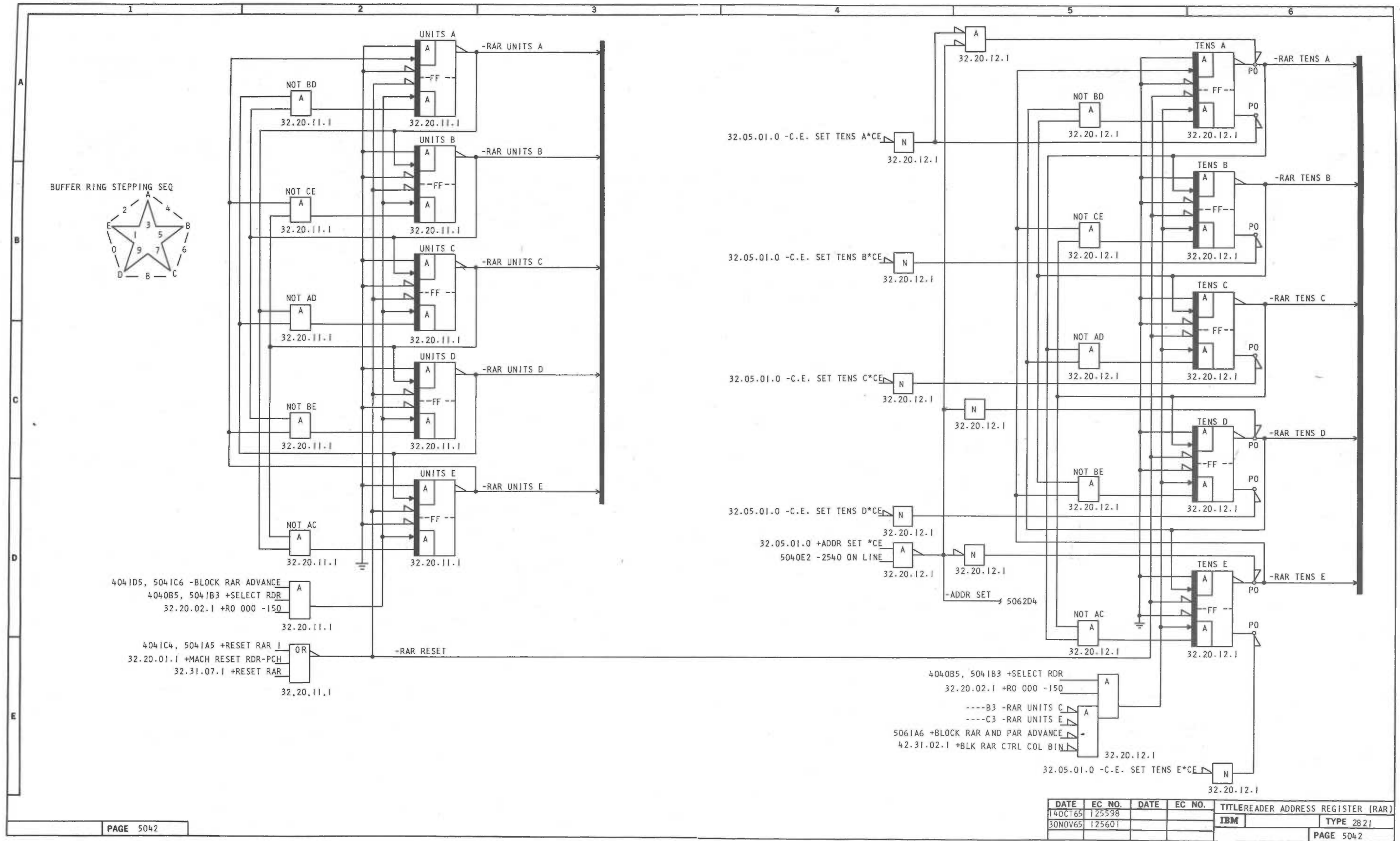
SLD-32 Reader Interface Controls



NO	SIGNAL NAME	TEST PT	LOGIC	LEVEL	TIME US	
					0 2 4 6 0 2 4 6 0	0 2 4 6 0 2 4 6 0
1	RDR BRUSH IMPULSE	21B1 F20P	32.32.13.1	+0	[Pulse]	
2	RESET RAR	21B1 F29F	32.32.13.1	+0	T.5 150 US 5	
3	BLOCK BAR ADVANCE	21B1 A29C	32.32.13.1	-6	2 7.300-450	
4	DELTA RD SER CY REQ	21B1 F26C	32.32.13.1	-6	2 8.300-450	
5	DELAY OUT	21B1 H28E	32.32.13.1	+0	T DELAYED 150 US	
6	RD SER CY REQ	21B1 E30R	32.32.13.1	+0	3-4.300-450 8.300-450	
7	RDR SERVICE CYCLE	21B1 F16L	32.32.13.1	-6	6.000-150 8.000-075	
8	COL 80 TIME 300	--	--	--	1	
9	SYNC POINT	21B1 H28F	--	--		

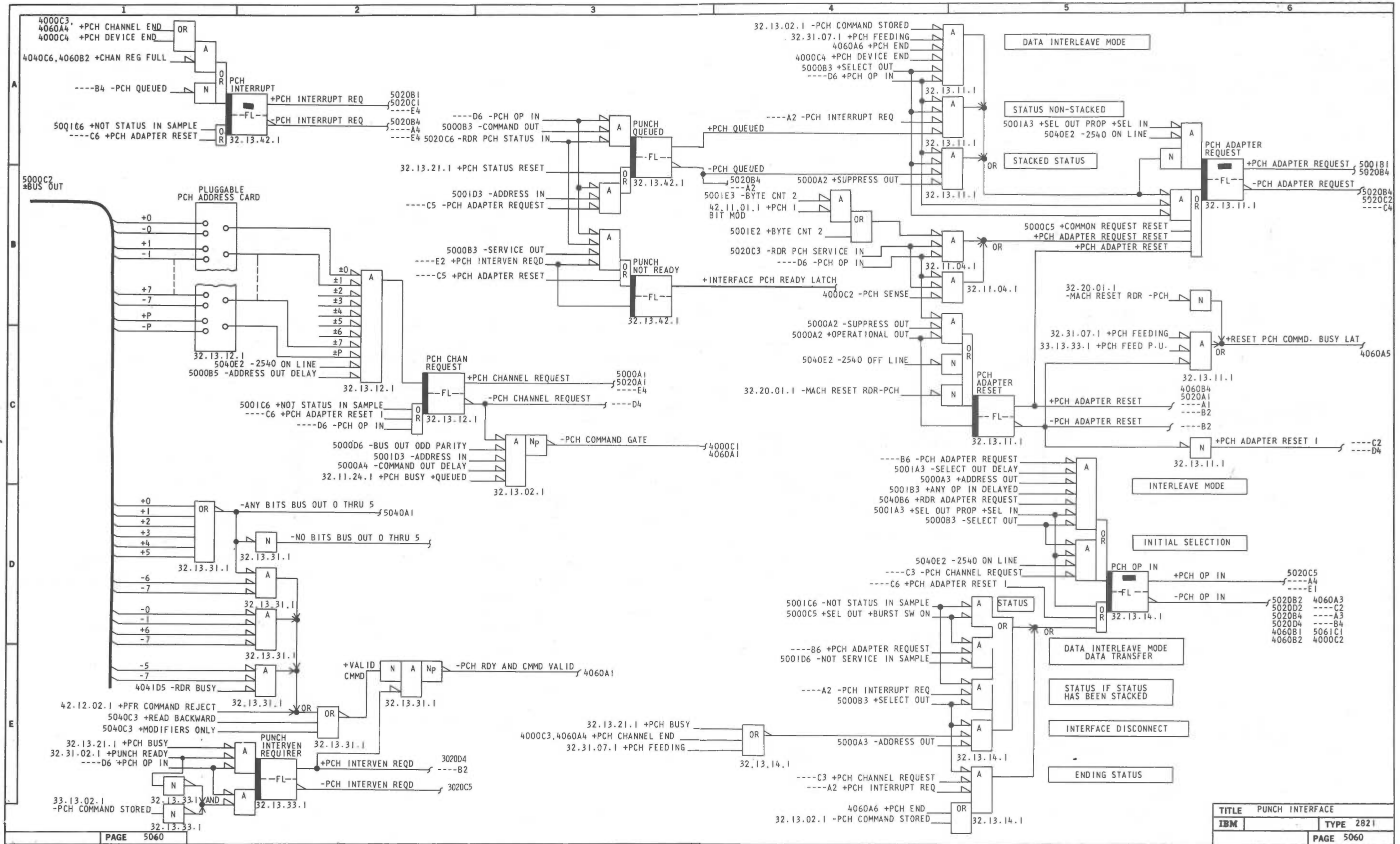
DATE	EC NO.	DATE	EC NO.	TITLE
4-26-65	1215701	14OCT65	125598	RD SELECT SERVICE & XFER
5-12-65	124237	18JAN66	125617	IBM
5-20-65	124248			

2821 FEMDM (7/67) SLD-33



DATE	EC NO.	DATE	EC NO.	TITLE
14OCT65	125598			READER ADDRESS REGISTER (RAR)
30NOV65	125601			IBM
				TYPE 2821
				PAGE 5042

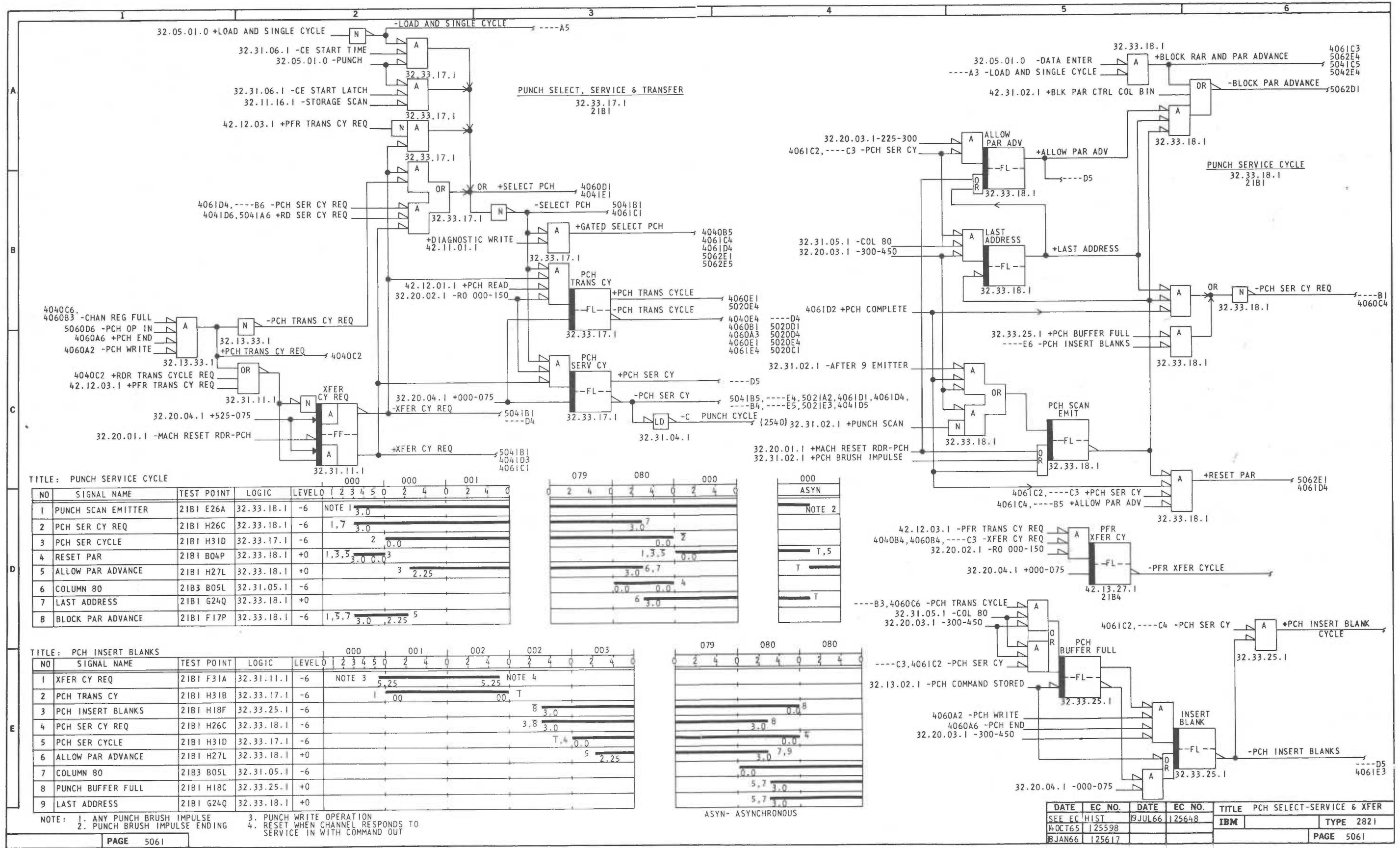
SLD-34 Reader Address Register (RAR)



TITLE PUNCH INTERFACE	
IBM	TYPE 2821
PAGE 5060	

2821 FEMDM (9/67) SLD-35

SLD-35 Punch Interface



TITLE: PUNCH SERVICE CYCLE

NO	SIGNAL NAME	TEST POINT	LOGIC	LEVEL	000	001
1	PUNCH SCAN EMITTER	21B1 E26A	32.33.18.1	-6	NOTE 1	3.0
2	PCH SER CY REQ	21B1 H26C	32.33.18.1	-6	1,7	3.0
3	PCH SER CYCLE	21B1 H31D	32.33.17.1	-6	2	0.0
4	RESET PAR	21B1 B04P	32.33.18.1	+0	1,3,5	0.0
5	ALLOW PAR ADVANCE	21B1 H27L	32.33.18.1	+0	3	2.25
6	COLUMN 80	21B3 B05L	32.31.05.1	-6		
7	LAST ADDRESS	21B1 G24Q	32.33.18.1	+0		
8	BLOCK PAR ADVANCE	21B1 F17P	32.33.18.1	-6	1,5,7	3.0, 2.25

TITLE: PCH INSERT BLANKS

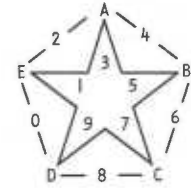
NO	SIGNAL NAME	TEST POINT	LOGIC	LEVEL	000	001	002	002	003
1	XFER CY REQ	21B1 F31A	32.31.11.1	-6	NOTE 3	5.25	5.25	NOTE 4	
2	PCH TRANS CY	21B1 H31B	32.33.17.1	-6	1	0.0	0.0	T	
3	PCH INSERT BLANKS	21B1 H18F	32.33.25.1	-6			8	3.0	
4	PCH SER CY REQ	21B1 H26C	32.33.18.1	-6			3.8	3.0	
5	PCH SER CYCLE	21B1 H31D	32.33.17.1	-6			T,4	0.0	
6	ALLOW PAR ADVANCE	21B1 H27L	32.33.18.1	+0			5	2.25	
7	COLUMN 80	21B3 B05L	32.31.05.1	-6					
8	PUNCH BUFFER FULL	21B1 H18C	32.33.25.1	+0					
9	LAST ADDRESS	21B1 G24Q	32.33.18.1	+0					

NOTE: 1. ANY PUNCH BRUSH IMPULSE
 2. PUNCH BRUSH IMPULSE ENDING
 3. PUNCH WRITE OPERATION
 4. RESET WHEN CHANNEL RESPONDS TO SERVICE IN WITH COMMAND OUT

DATE	EC NO.	DATE	EC NO.	TITLE
SEE EC HIST		19 JUL 66	125648	PCH SELECT-SERVICE & XFER
4 OCT 65	125598			IBM
8 JAN 66	125617			TYPE 2821

PAGE 5061

BUFFER RING STEPPING SEQ.



4061C4, 5061A6 -BLOCK PAR ADVANCE
 5061B3 +GATED SELECT PCH
 32.20.02.1 +RO 000-150

5061C6 +RESET PAR
 32.33.21.1 +RESET PAR 2
 32.20.01.1 +MACH RESET RDR -PCH

5061B3. +GATED SELECT PCH
 32.20.02.1 +RO 000-150

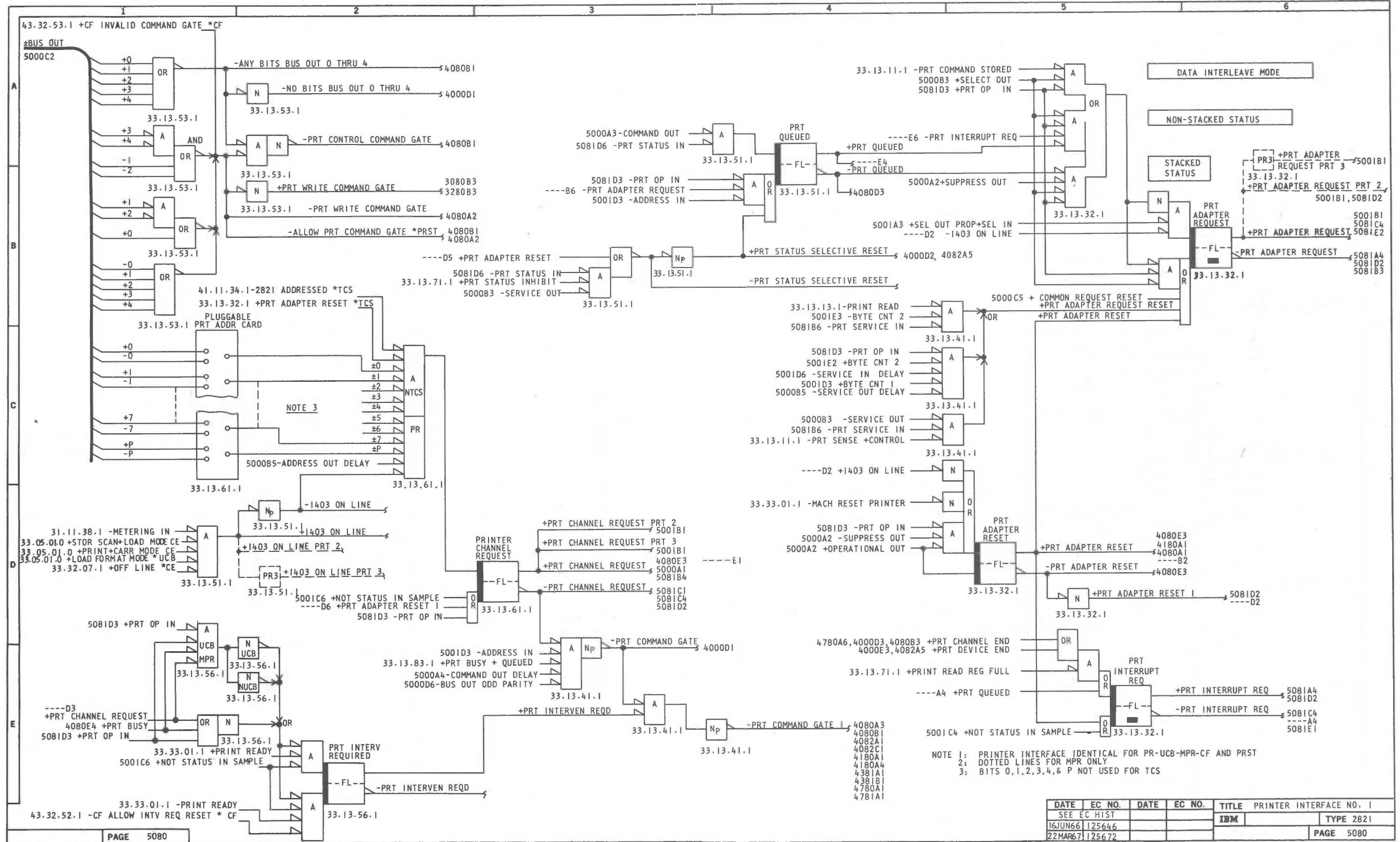
----B3 -PAR UNIT C
 ----D3 -PAR UNITS E

5061A6 +BLOCK PAR AND PAR ADVANCE
 42.31.02.1 +BLK PAR CTRL COL BIN

32.05.01.0 -CE SET TENS E*CE

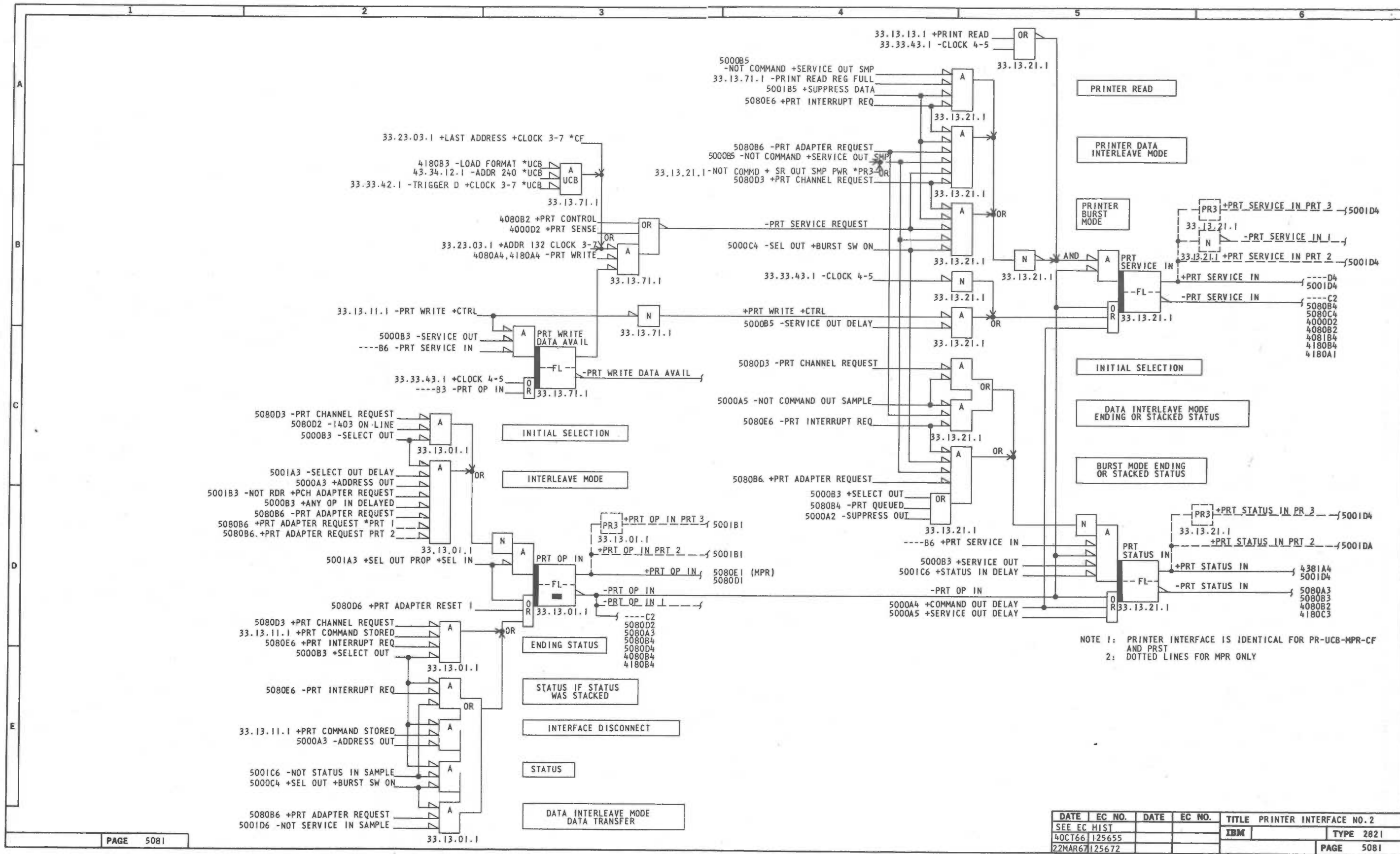
DATE	EC NO.	DATE	EC NO.	TITLE PUNCH ADDRESS REGISTER (PAR)
14OCT65	125598			IBM
30NOV65	125601			TYPE 2821
	125636			PAGE 5062

SLD-37 Punch Address Register (PAR)

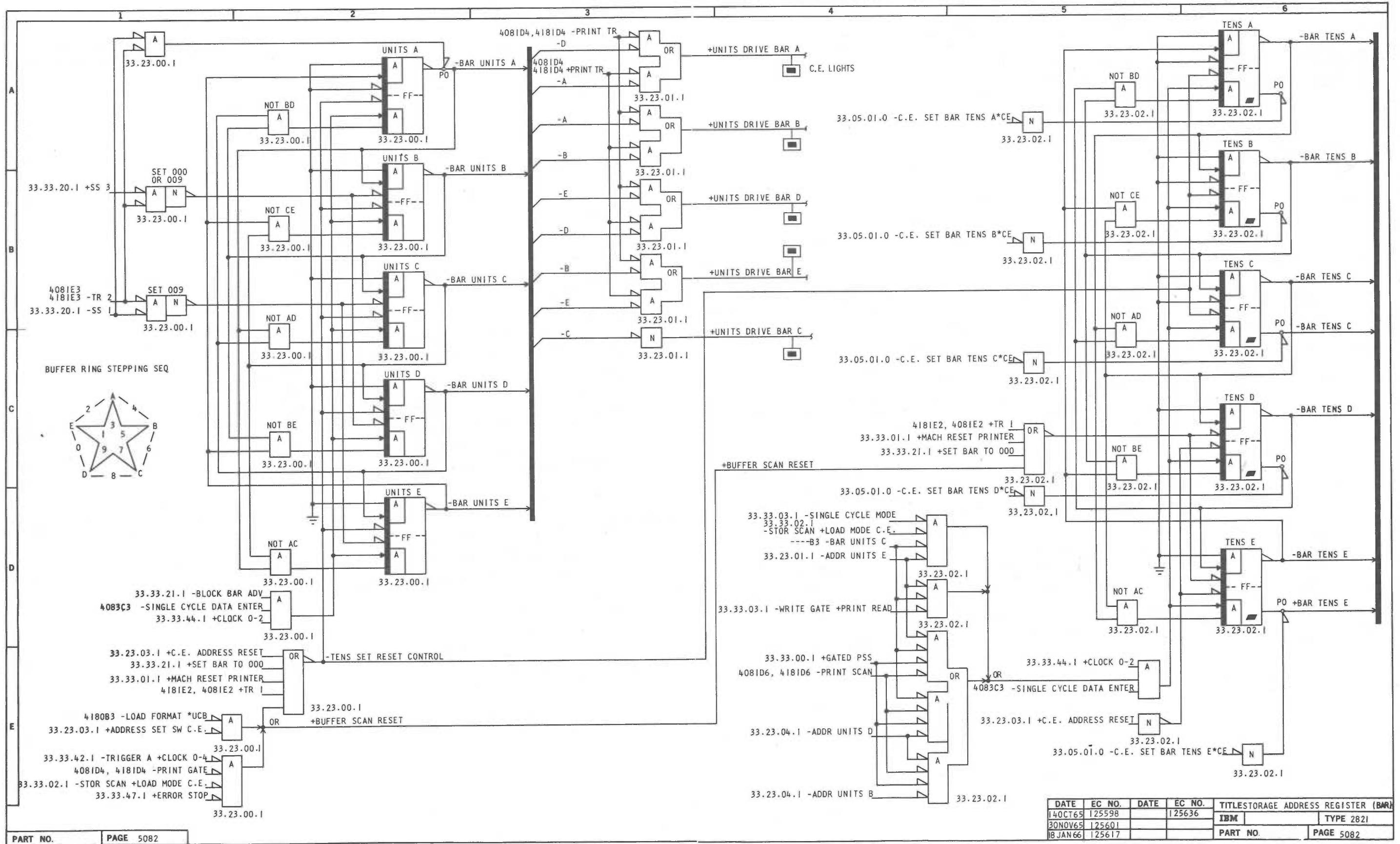


NOTE 1: PRINTER INTERFACE IDENTICAL FOR PR-UCB-MPR-CF AND PRST
 2: DOTTED LINES FOR MPR ONLY
 3: BITS 0, 1, 2, 3, 4, & P NOT USED FOR TCS

DATE	EC NO.	DATE	EC NO.	TITLE	PRINTER INTERFACE NO. 1
SEE EC HIST				IBM	TYPE 2821
16JUN66	125646				
22MAR67	125672				PAGE 5080



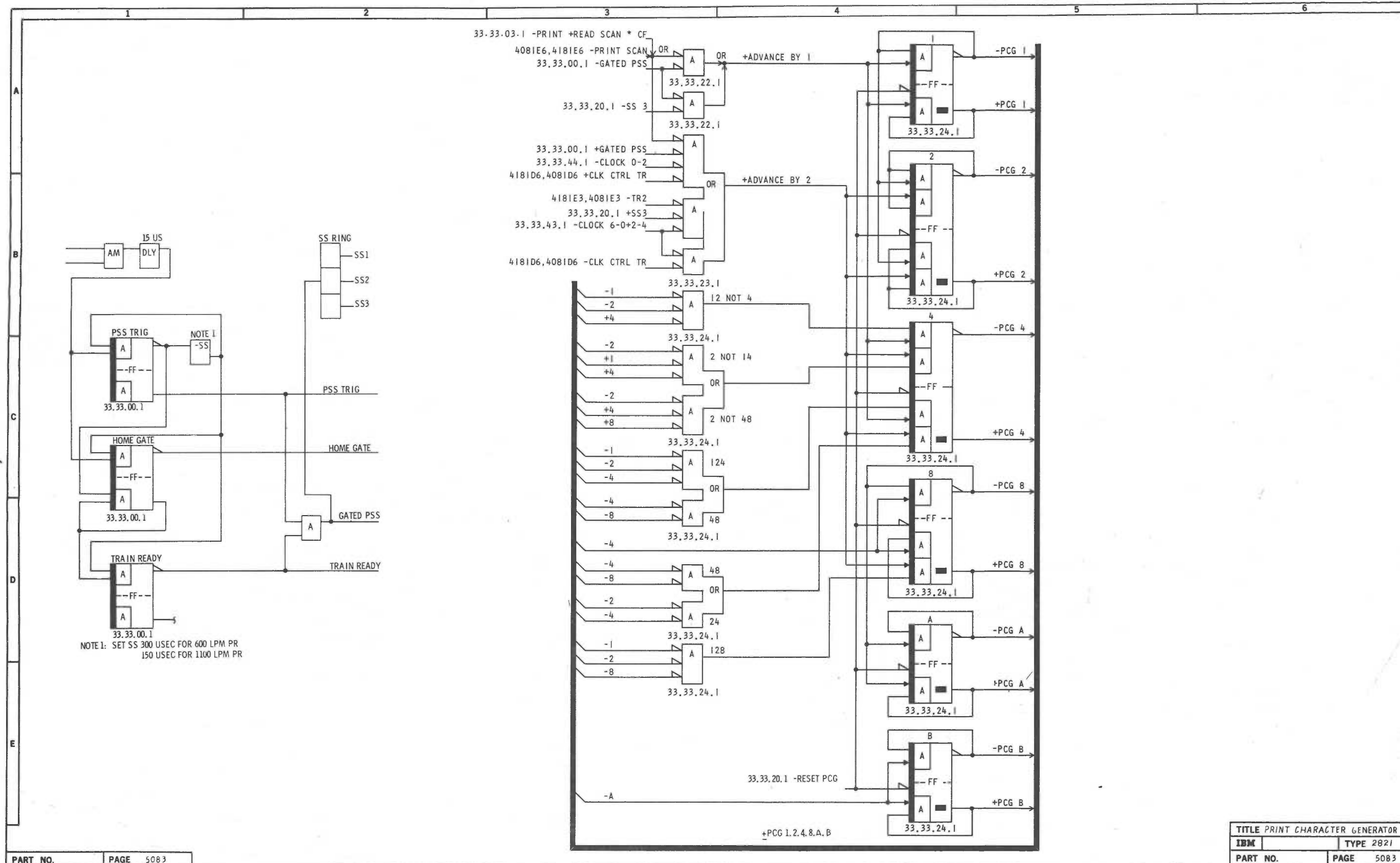
SLD-39 Printer Interface Number 2



DATE	EC NO.	DATE	EC NO.	TITLE
14OCT65	125598		125636	STORAGE ADDRESS REGISTER (BAR)
30NOV65	125601			IBM TYPE 2821
18JAN66	125617			PART NO. PAGE 5082

SLD-40 Storage Address Register (BAR)

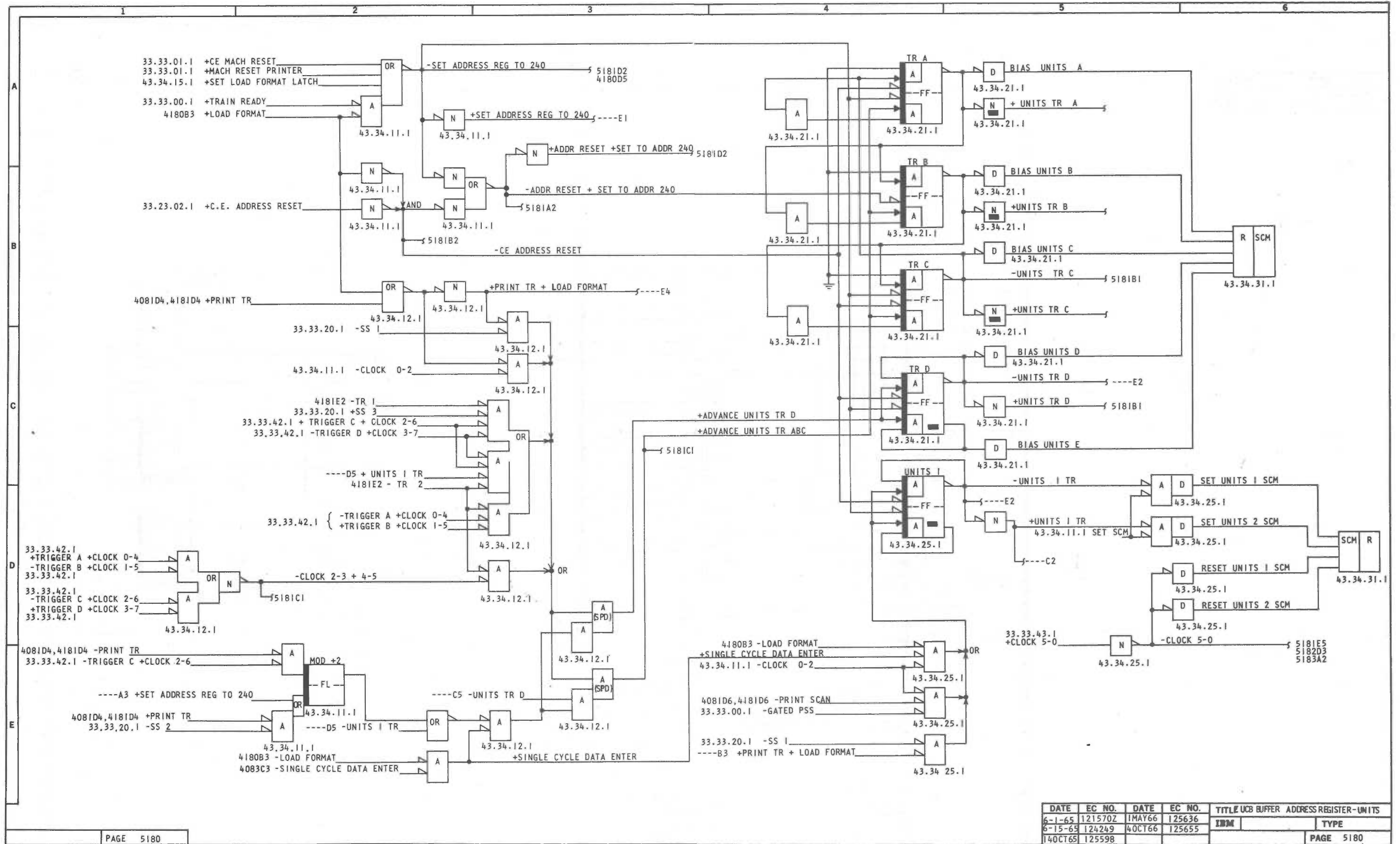
2821 FEMDM (9/67) SLD-41



PART NO. PAGE 5083

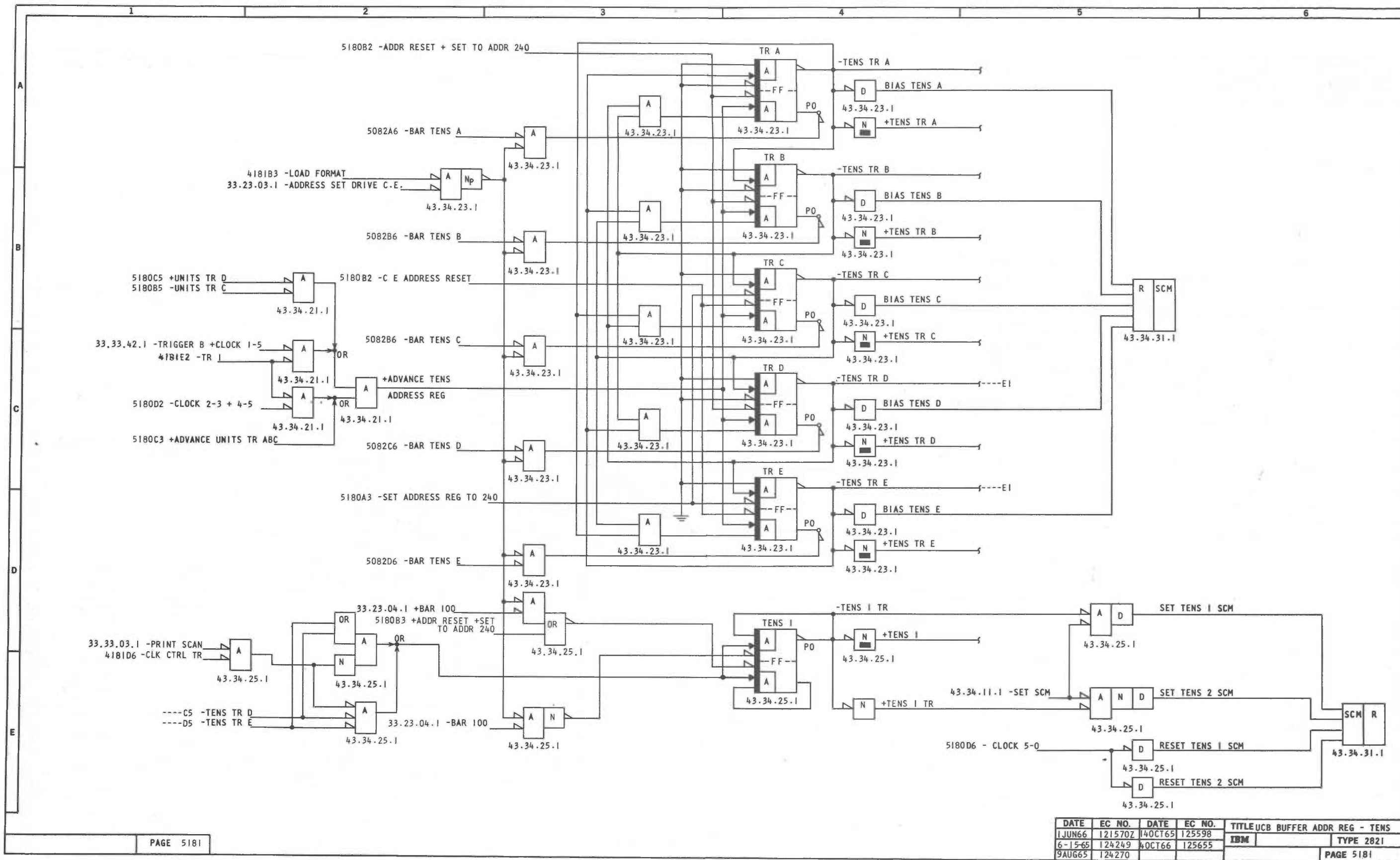
TITLE PRINT CHARACTER GENERATOR	
IBM	TYPE 2821
PART NO.	PAGE 5083

SLD-41 Print Character Generator



DATE	EC NO.	DATE	EC NO.	TITLE	UCB BUFFER	ADDRESS REGISTER-UNITS
6-1-65	121570Z	1MAY66	125636	IBM		TYPE
6-15-65	124249	4OCT66	125655			
14OCT65	125598					

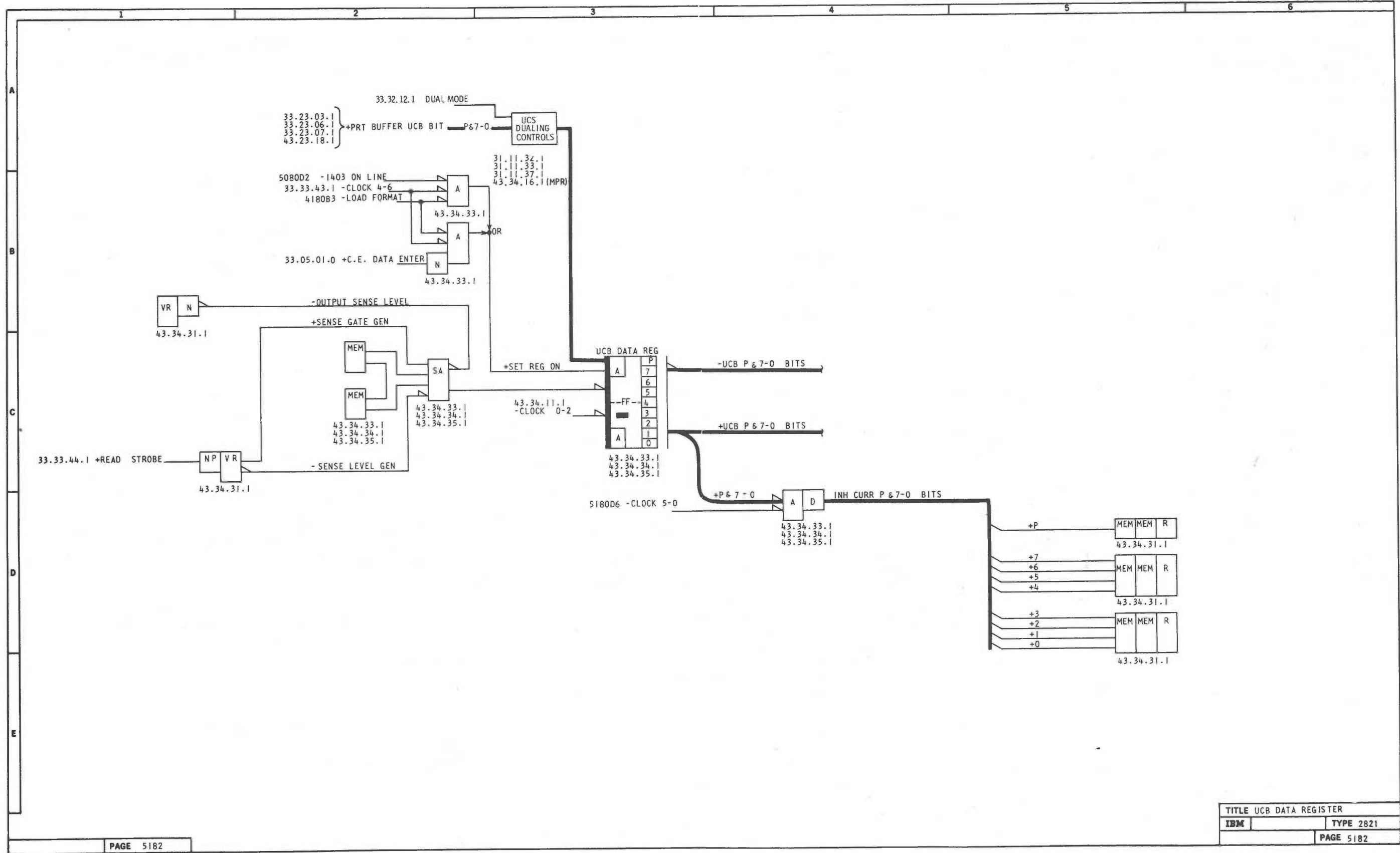
SLD-42 UCB Buffer Address Register - Units



DATE	EC NO.	DATE	EC NO.	TITLE
1 JUN 66	121570Z	14 OCT 65	125598	UCB BUFFER ADDR REG - TENS
6-15-65	124249	4 OCT 66	125655	IBM
9 AUG 65	124270			TYPE 2821
				PAGE 5181

SLD-43 UCB Buffer Address Register - Tens

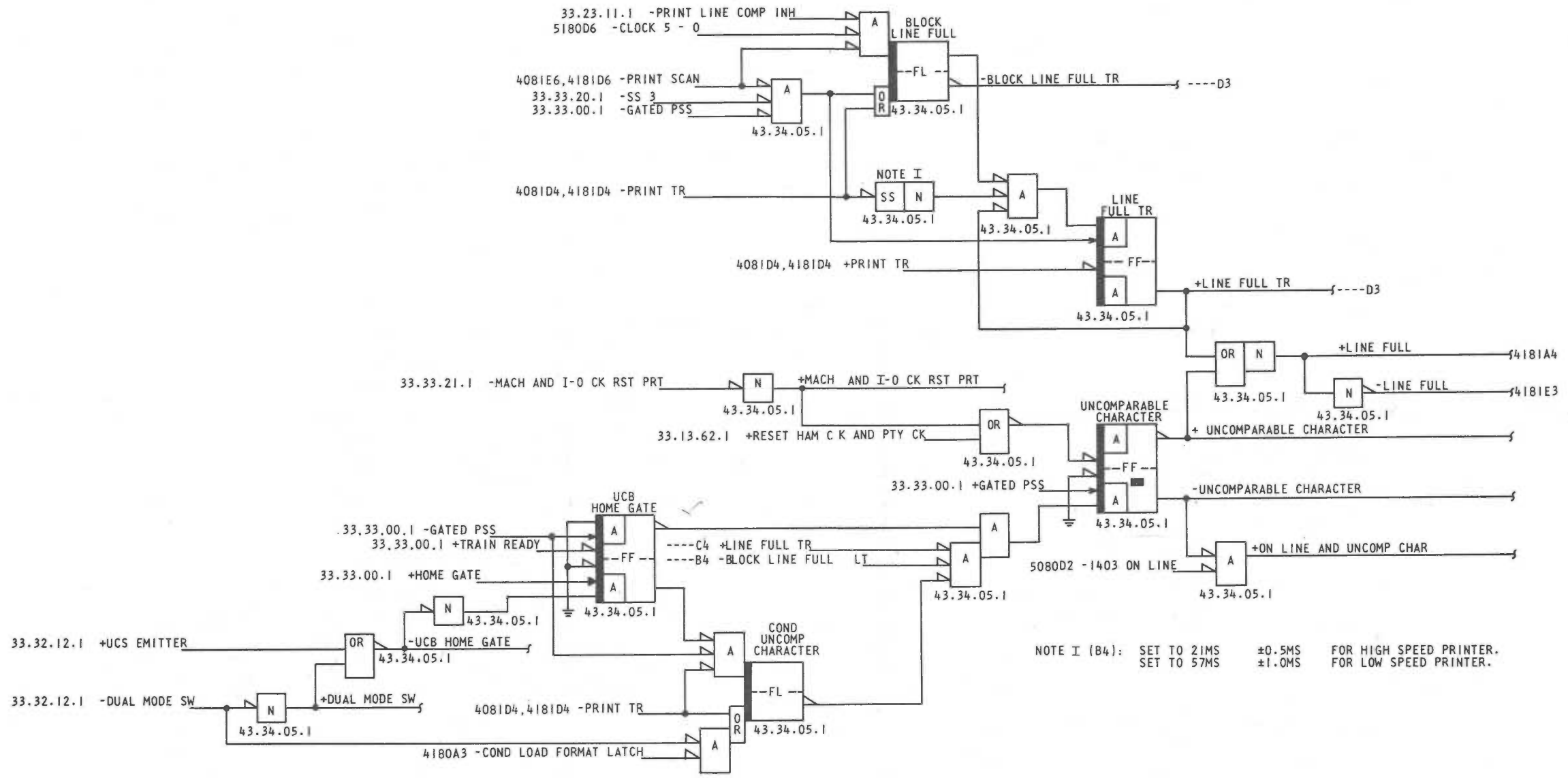
2821 FEMDM (7/67) SLD-43



TITLE UCB DATA REGISTER	
IBM	TYPE 2821
PAGE 5182	

SLD-44 UCB Data Register

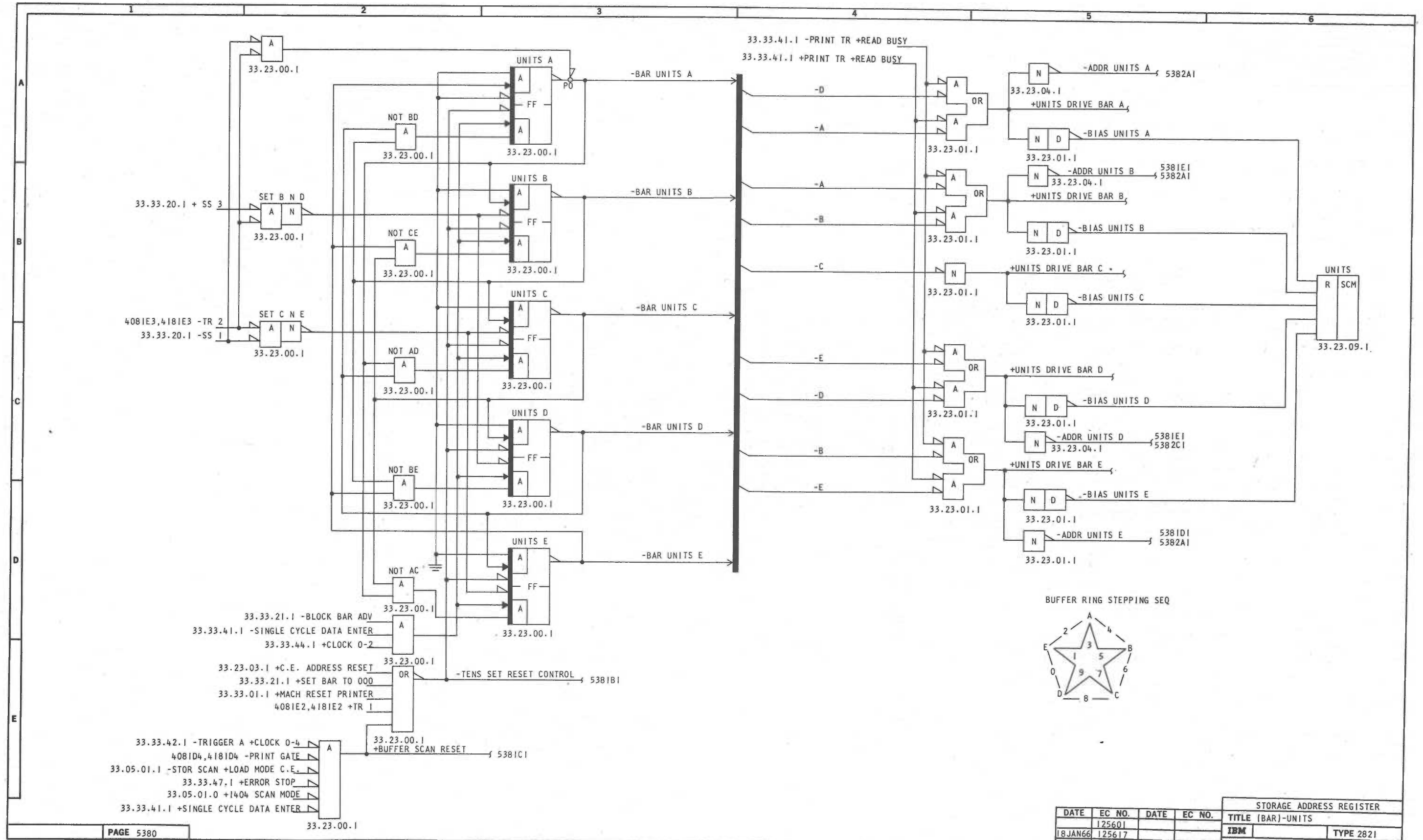
A
B
C
D
E



SLD-45 UCB Line Full and Unprintable Character

2821 FEMDM (5/68) SLD-45

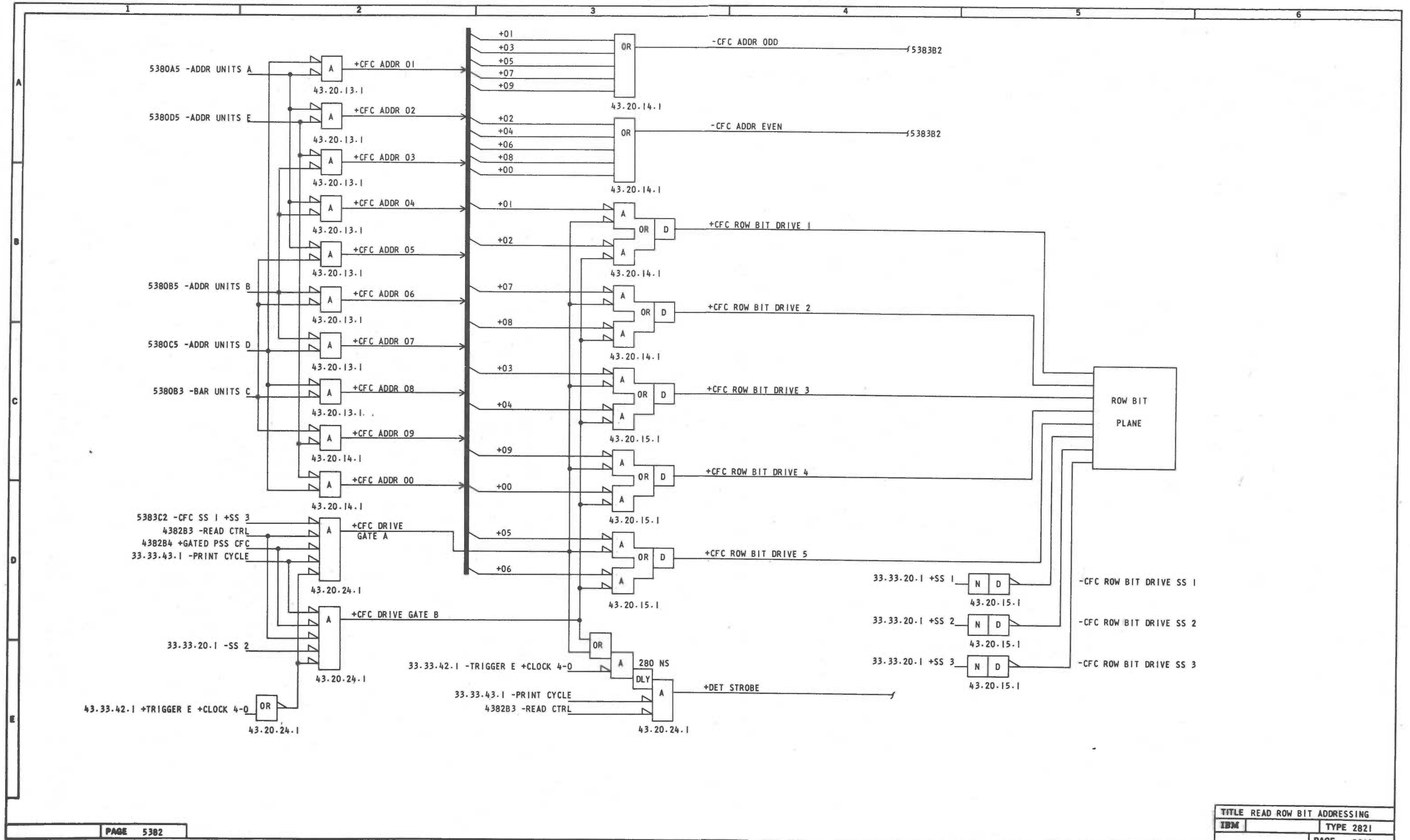
SLD-46 2821 FEMDM (7/67)



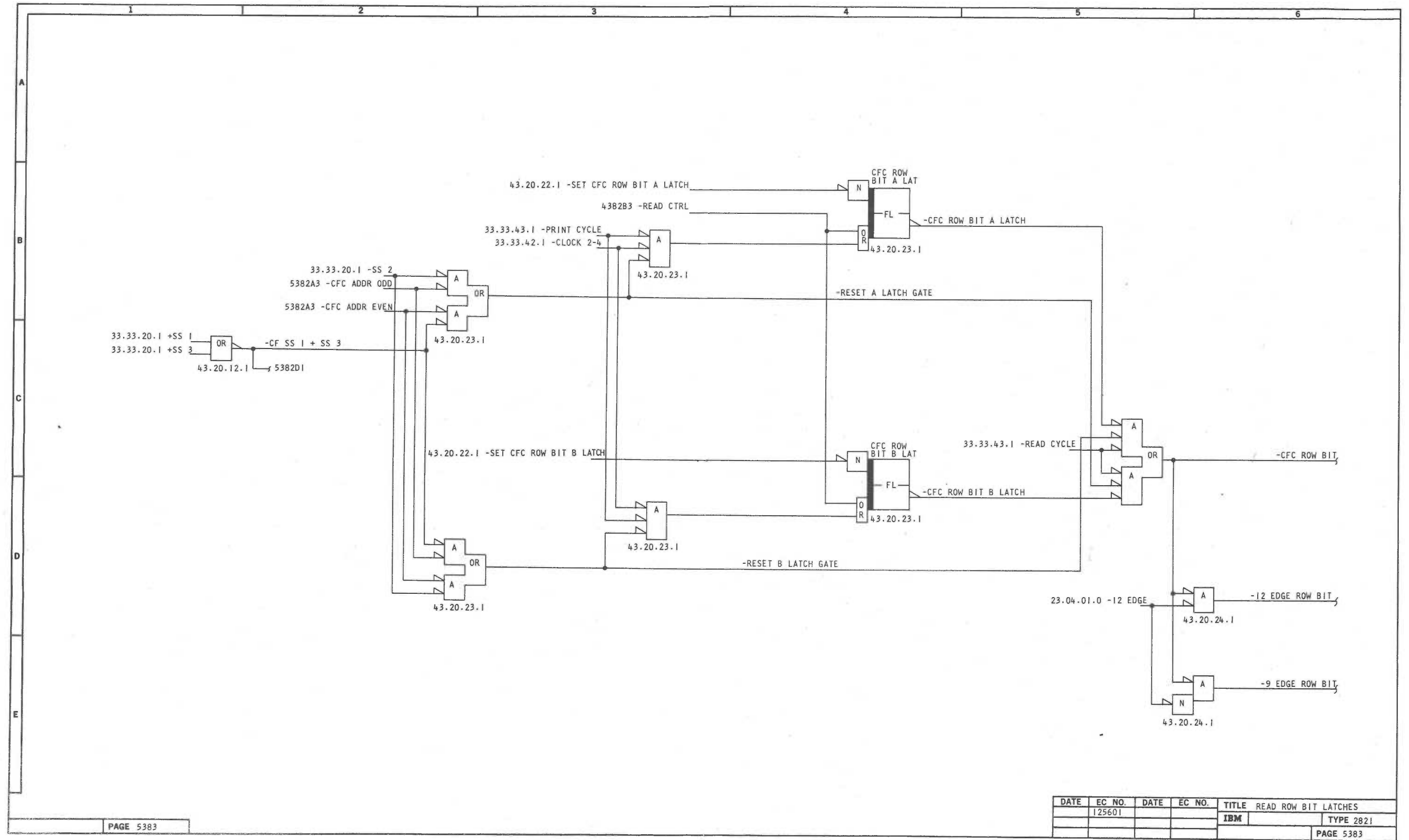
STORAGE ADDRESS REGISTER			
DATE	EC NO.	DATE	EC NO.
18JAN66	125601		
	125617		

TITLE (BAR)-UNITS	TYPE 2821
IBM	
PAGE 5380	

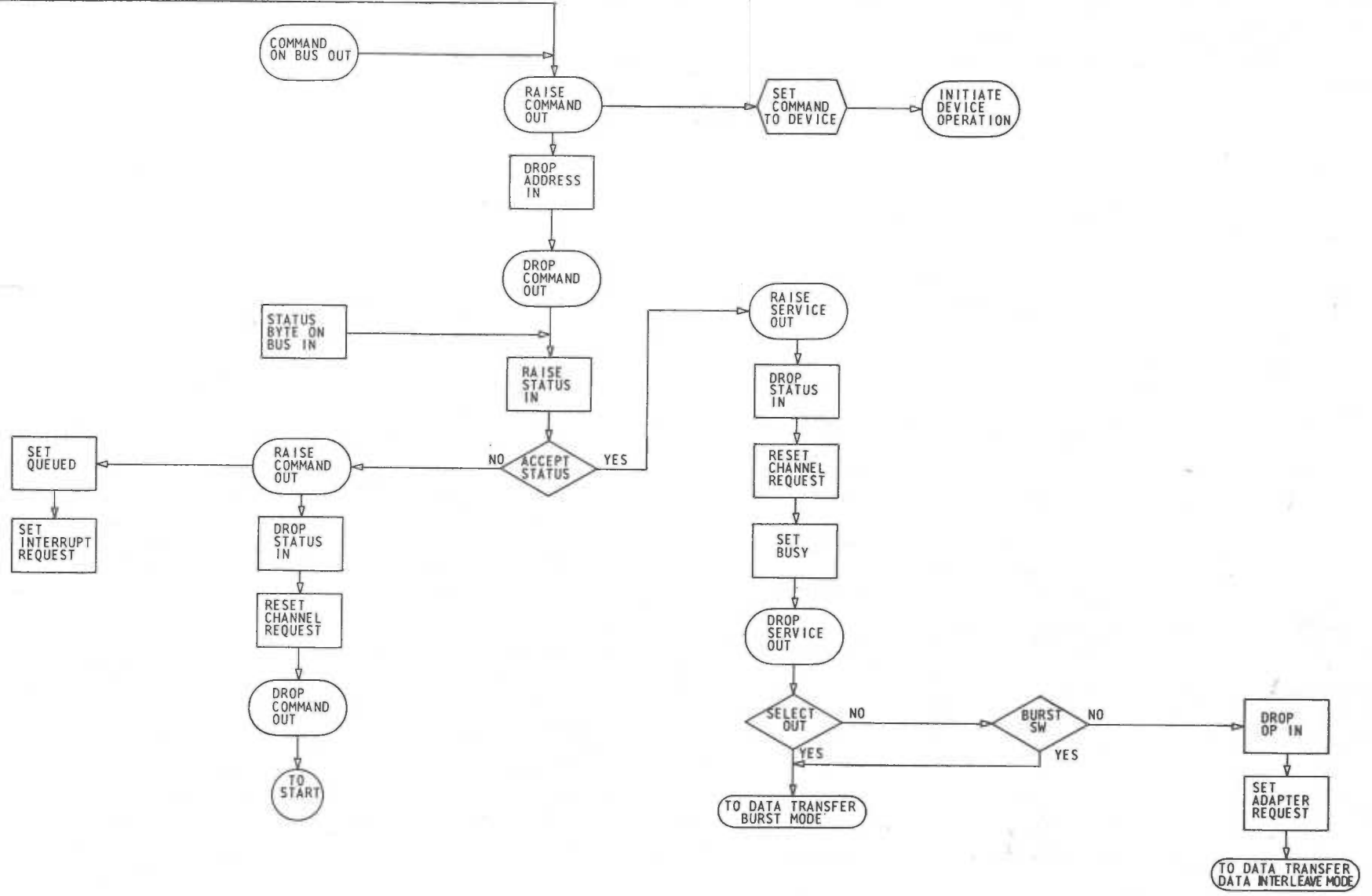
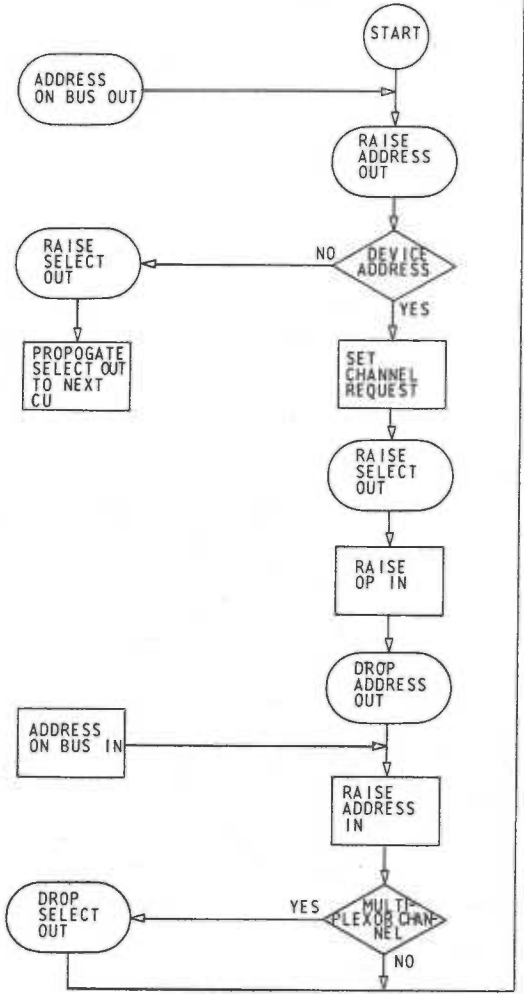
SLD-46 Storage Address Register (BAR) - Units



SLD-48 Read Row Bit Addressing



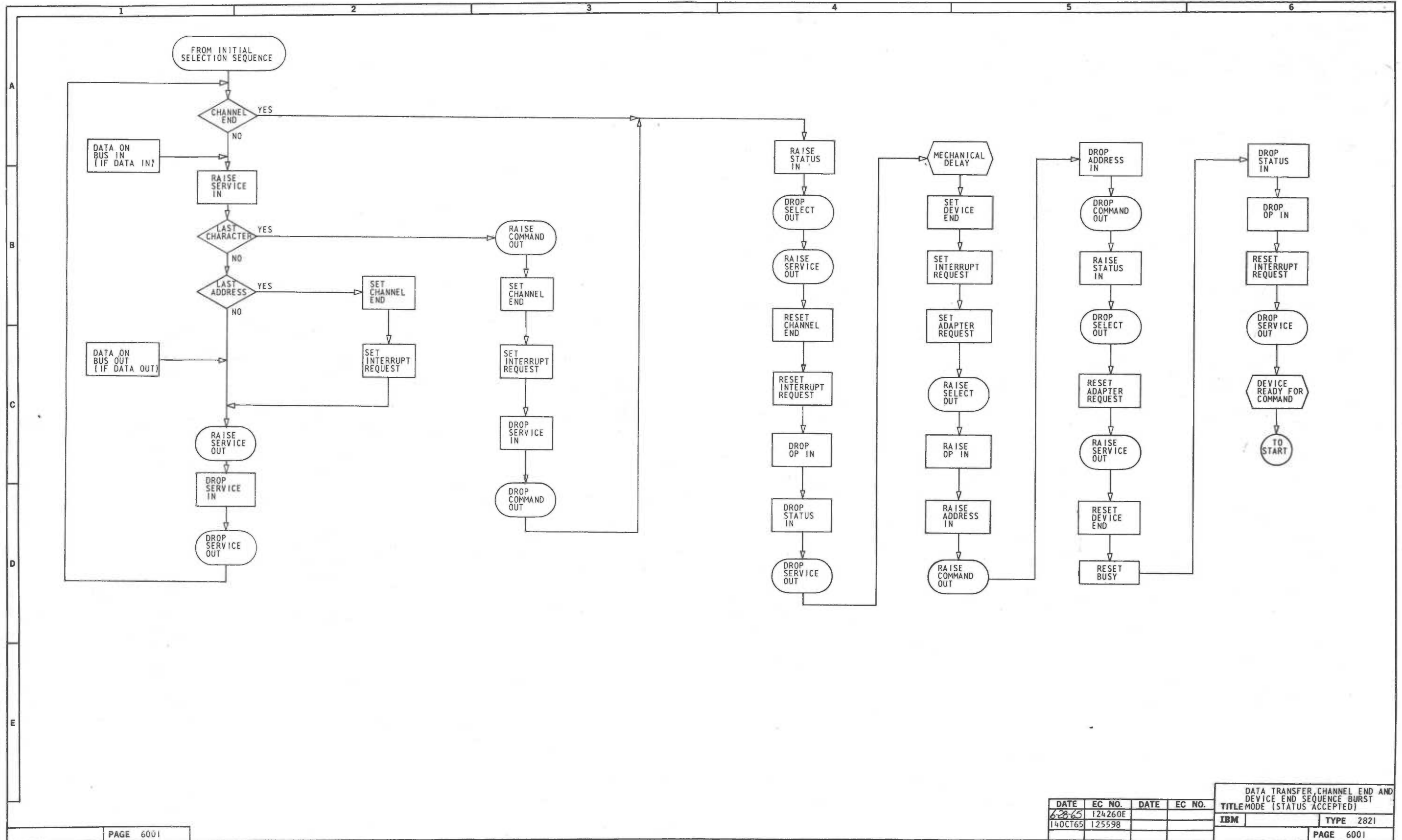
DATE	EC NO.	DATE	EC NO.	TITLE	READ ROW BIT LATCHES
	125601			IBM	TYPE 2821
					PAGE 5383



DATE	EC NO.	DATE	EC NO.	INITIAL SELECTION SEQUENCE	
6/28/65	124260E			TITLE BURST OR DATA INTERLEAVE MODE	
14OCT66	125598			IBM	TYPE 2821
					PAGE 6000

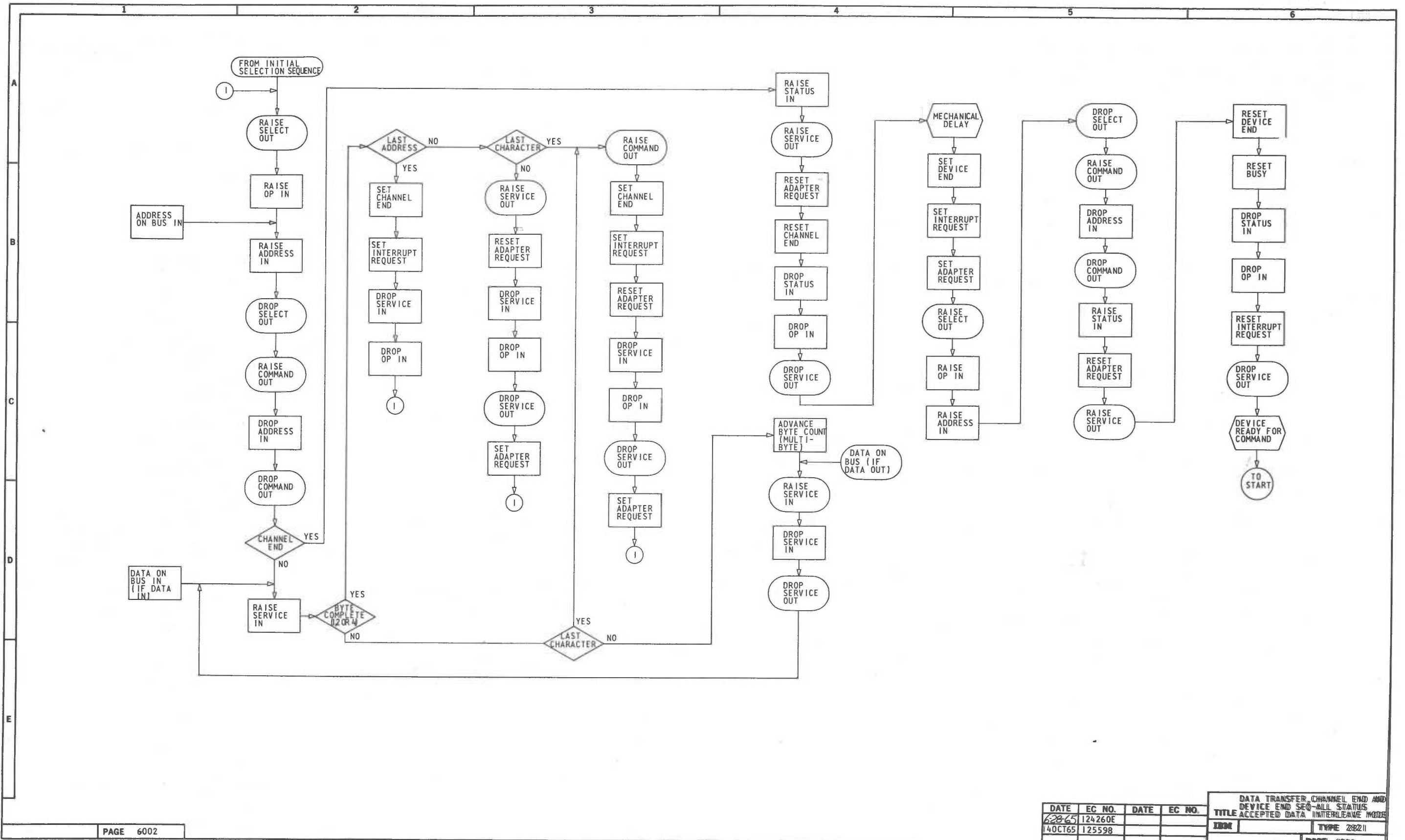
DF-1 Initial Selection Sequence - Burst or Interleave Mode

2821 FEMDM (7/67) DF-1



DATE	EC NO.	DATE	EC NO.	DATA TRANSFER, CHANNEL END AND DEVICE END SEQUENCE BURST TITLE MODE (STATUS ACCEPTED)	
6-28-65	124260E			IBM	TYPE 2821
14OCT65	125598				PAGE 6001

DF-2 Data Transfer, Channel End, and Device End Sequence - Burst Mode (Status Accepted)

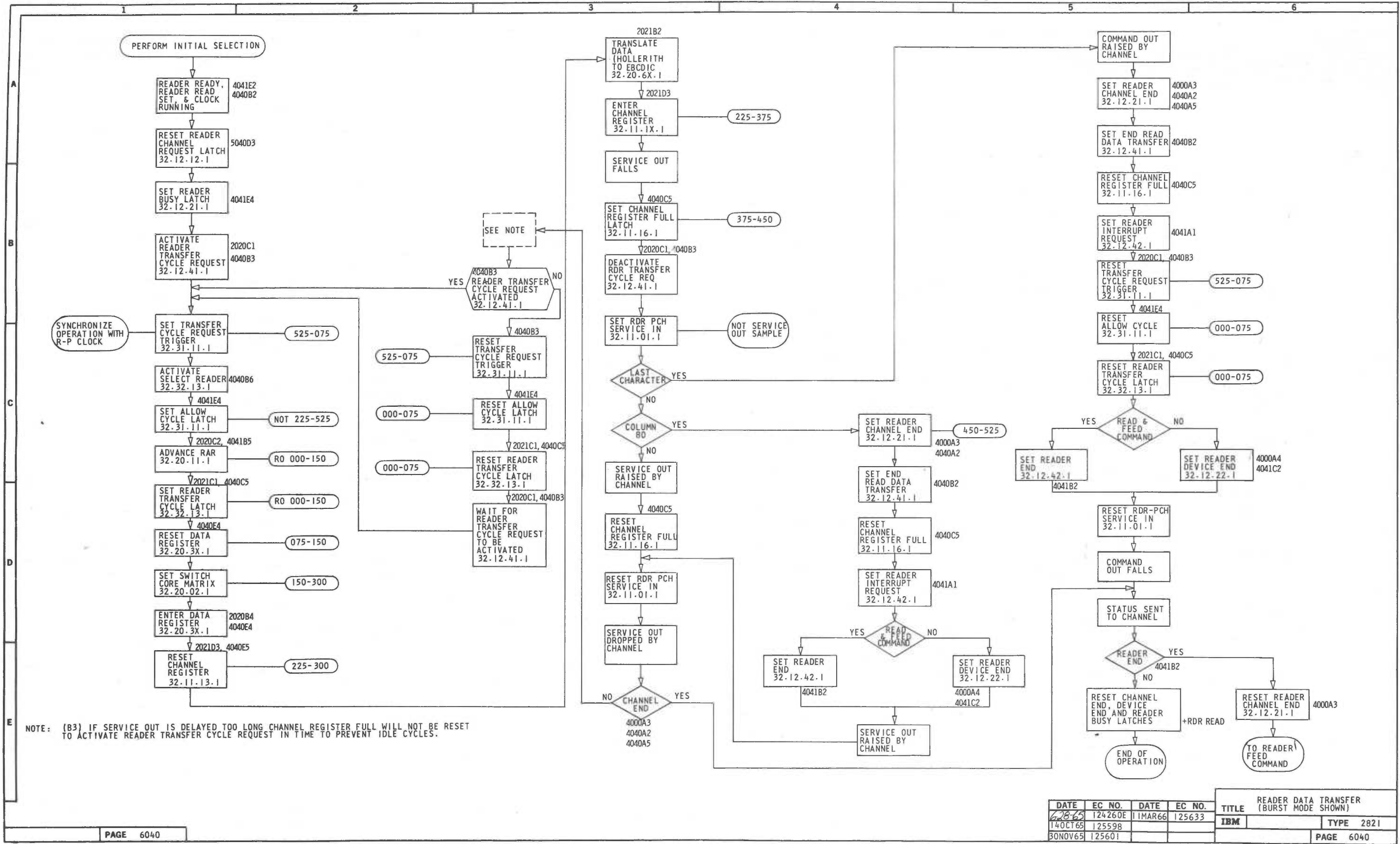


DATE	EC NO.	DATE	EC NO.	TITLE
62865	124260E			DATA TRANSFER, CHANNEL END AND DEVICE END SEQ-ALL STATUS ACCEPTED DATA INTERLEAVE MODE
140CT65	125598			INDI TYPE 288211

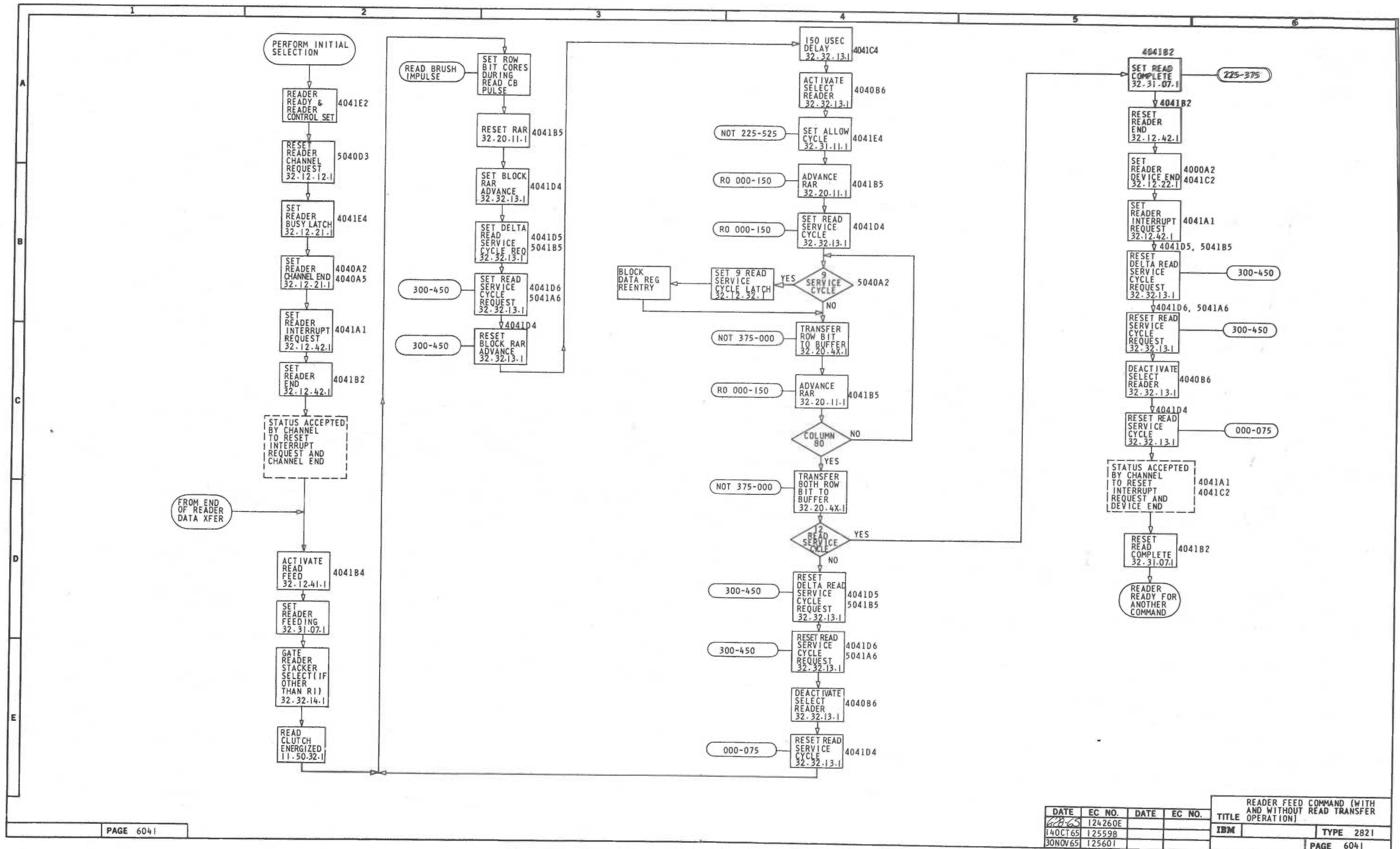
PAGE 6002

DF-3 Data Transfer, Channel End, and Device End Sequence - All Status Accepted Interleave Mode

2821 FEMDM (7/67) DF-3

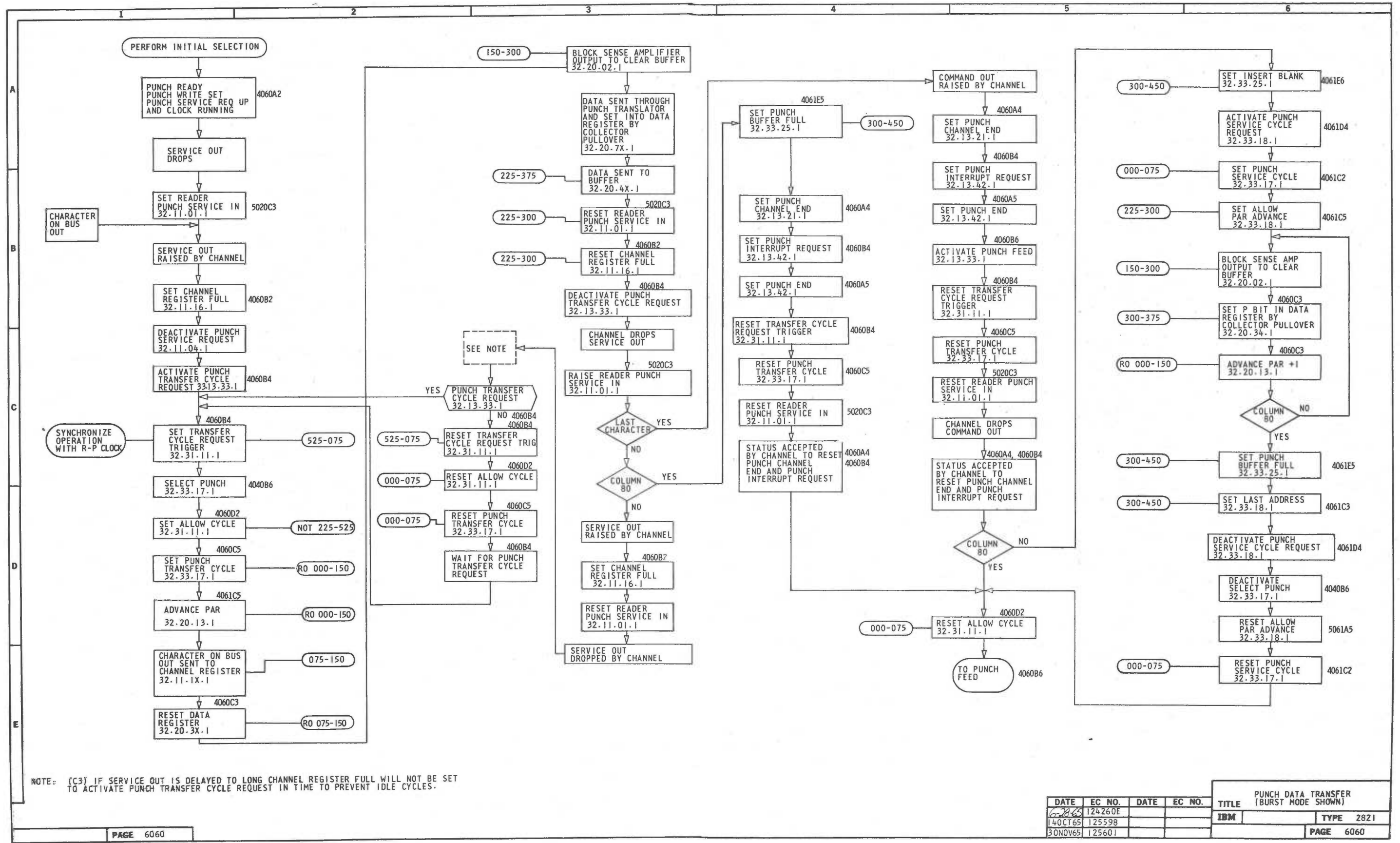


DF-4 Reader Data Transfer (Burst Mode Shown)

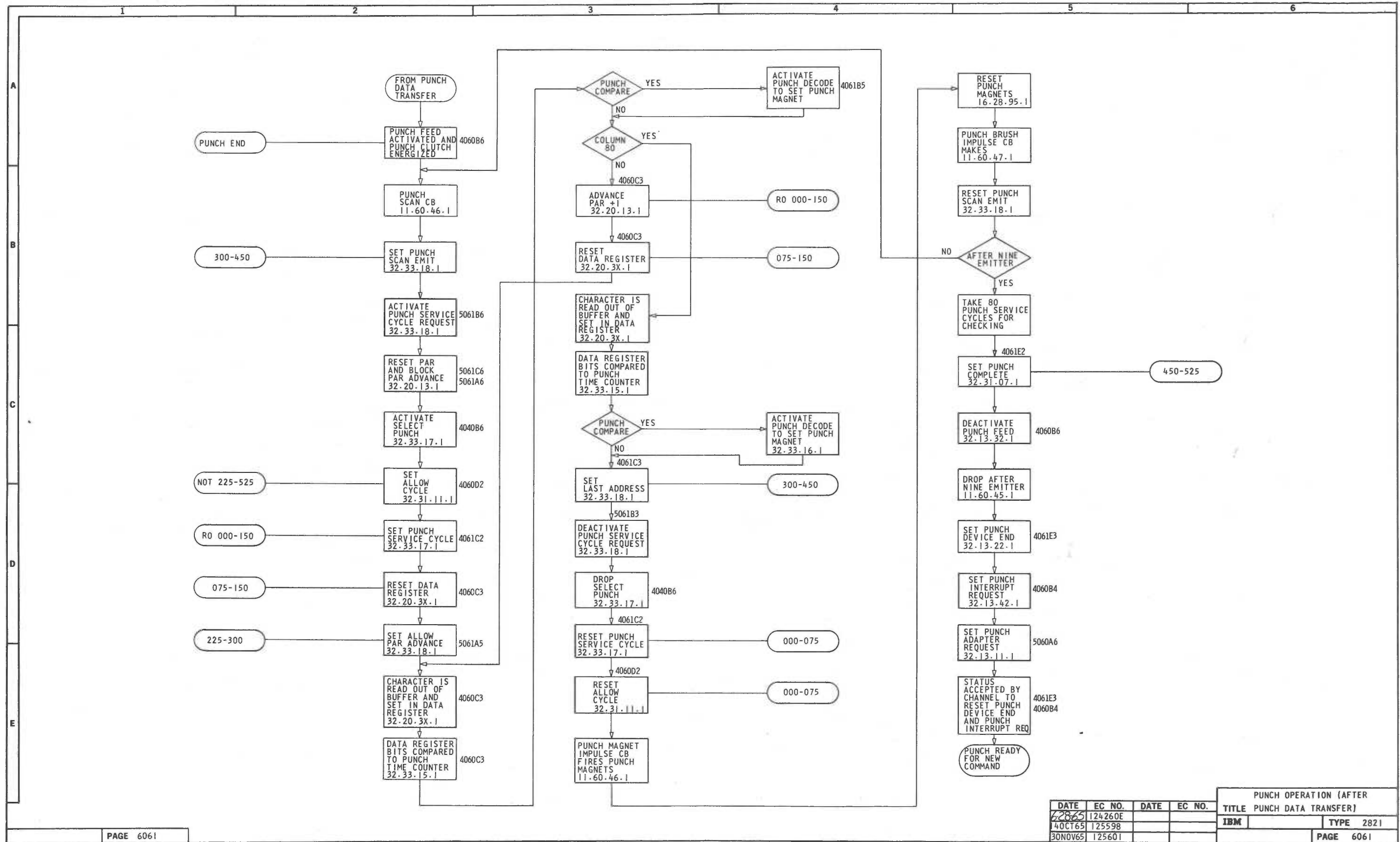


DATE	EC NO.	DATE	EC NO.	TITLE	TYPE
688-65	124260E			READER FEED COMMAND (WITH AND WITHOUT READ TRANSFER OPERATION)	2821
14OCT65	125598			IBM	
30NOV65	125601				

DF-5 Reader Feed Command (With and Without Read Transfer Operation)

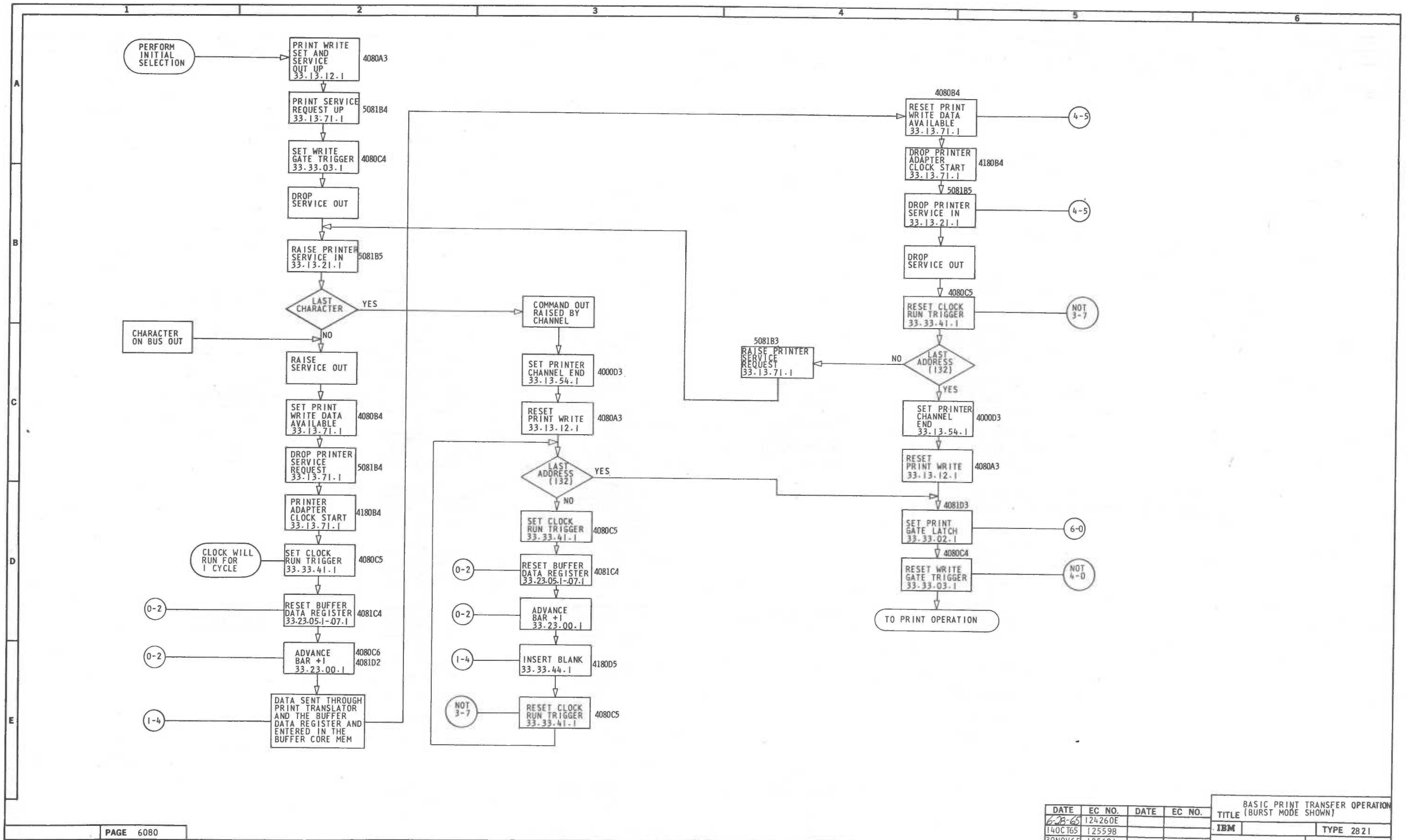


DATE	EC NO.	DATE	EC NO.	TITLE	
14OCT65	124260E			PUNCH DATA TRANSFER (BURST MODE SHOWN)	
30NOV65	125598				
	125601				
				IBM	TYPE 2821
				PAGE 6060	

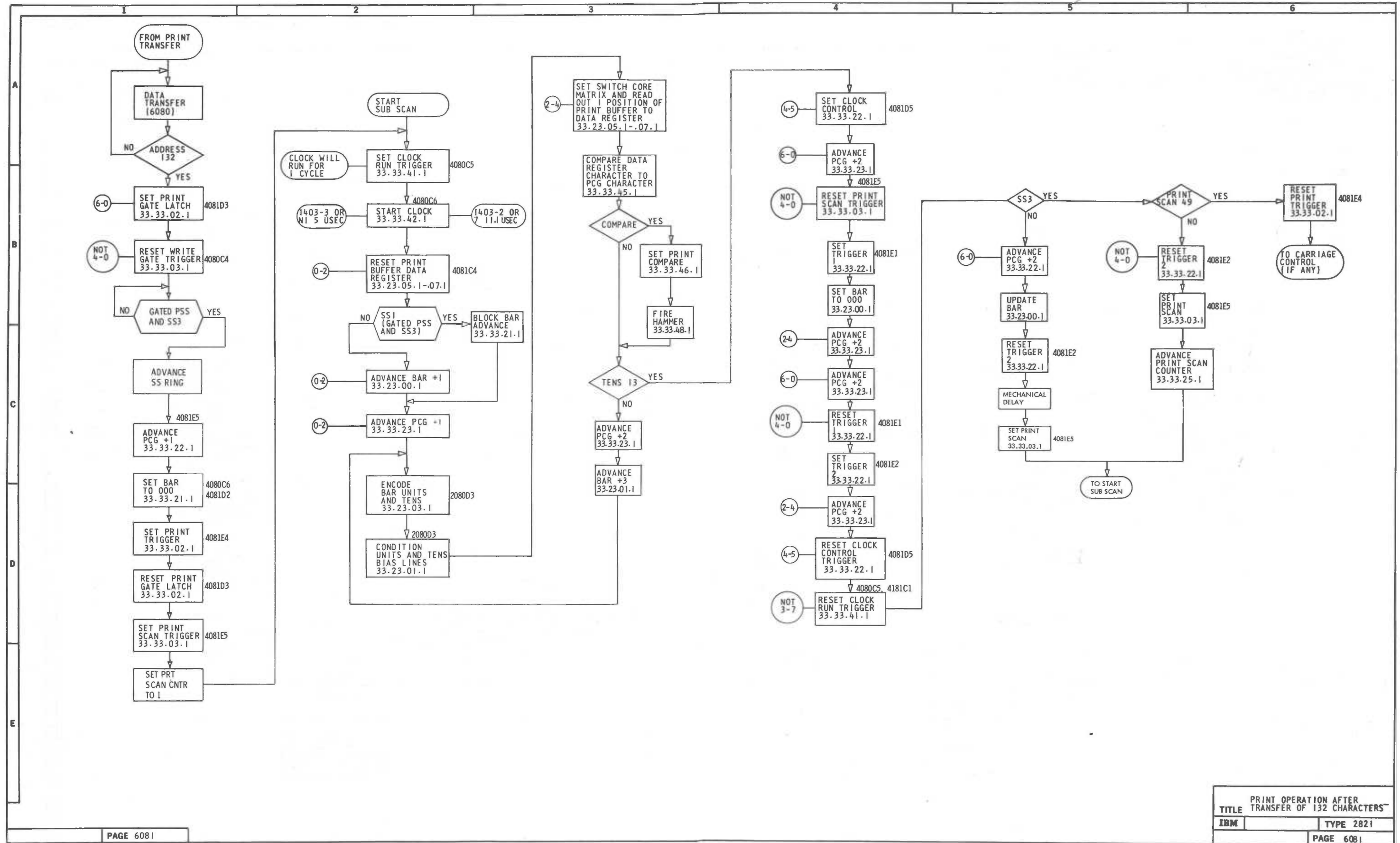


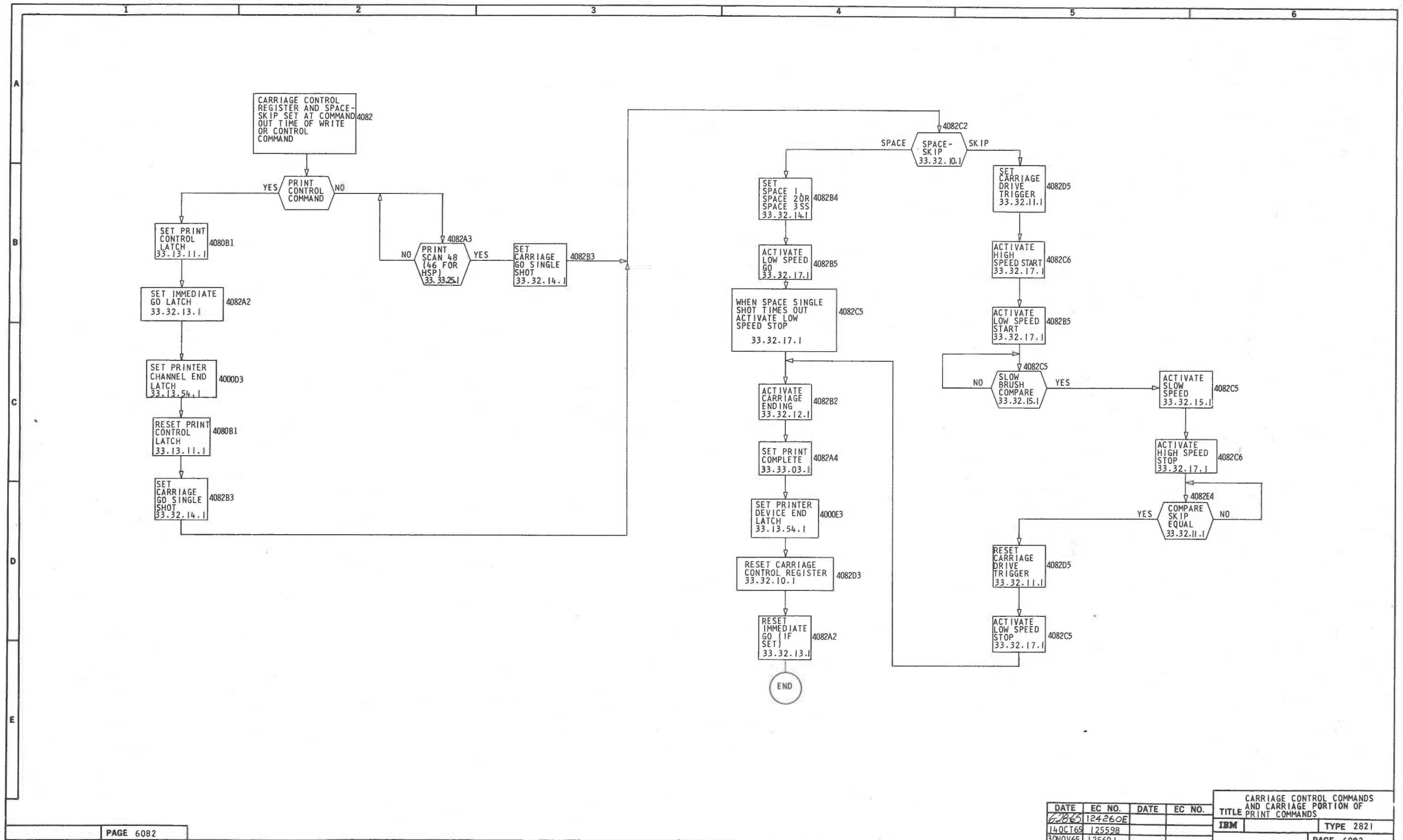
DATE	EC NO.	DATE	EC NO.	PUNCH OPERATION (AFTER PUNCH DATA TRANSFER)	
6/28/65	124260E			IBM	TYPE 2821
4OCT65	125598				
30NOV65	125601				PAGE 6061

DF-7 Punch Operation (After Punch Data Transfer)



DF-8 Basic Print Transfer Operation (Burst Mode Shown)





DATE	EC NO.	DATE	EC NO.	CARRIAGE CONTROL COMMANDS AND CARRIAGE PORTION OF TITLE PRINT COMMANDS	
6/18/65	124260E			IBM	TYPE 2821
14 OCT 65	125598				
30 NOV 65	125601				PAGE 6082

DF-10 Carriage Control Commands and Carriage Portion of Print Commands

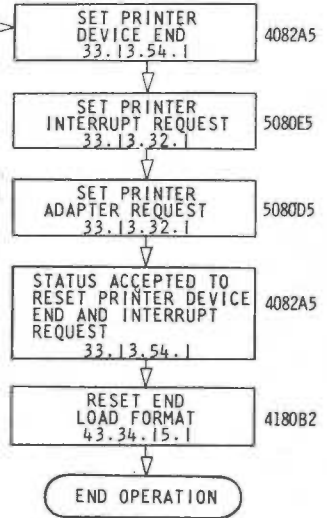
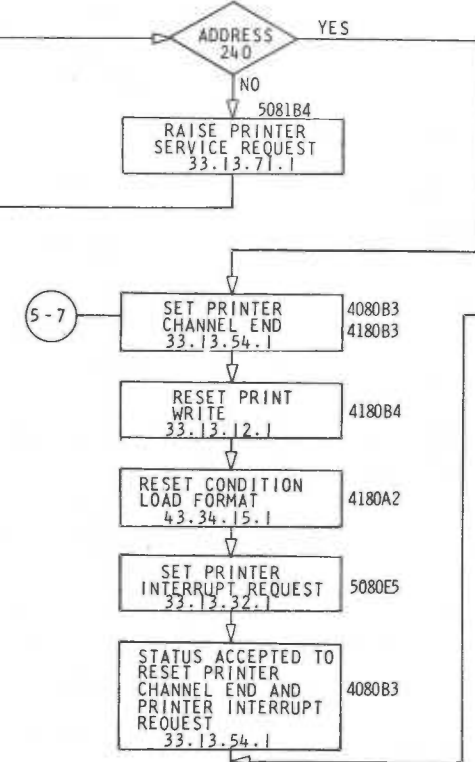
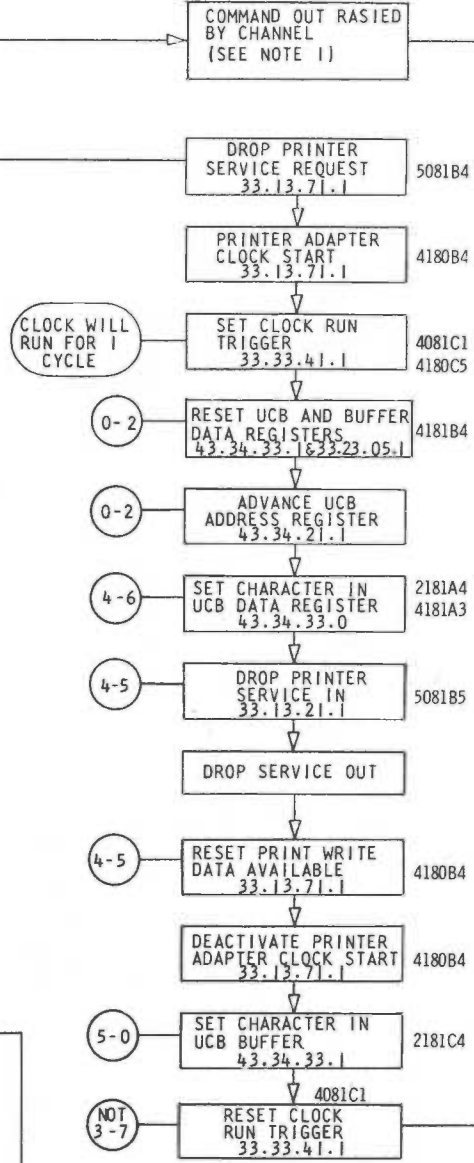
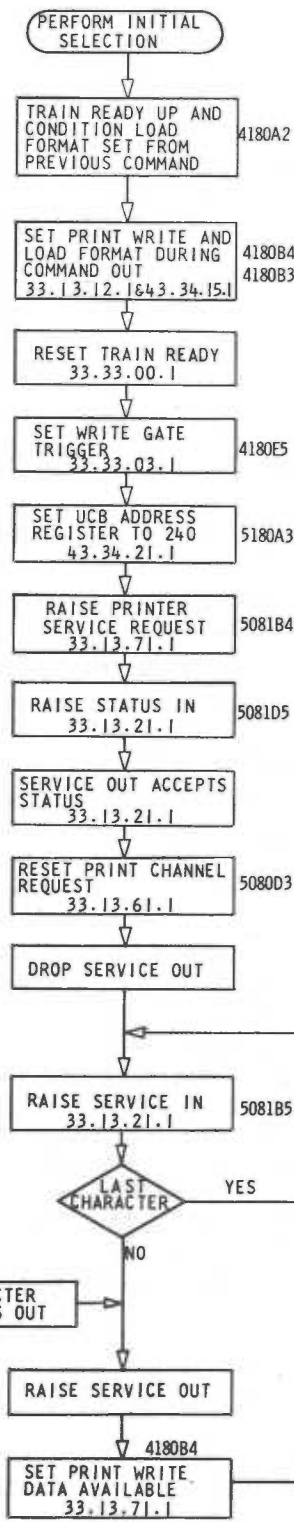
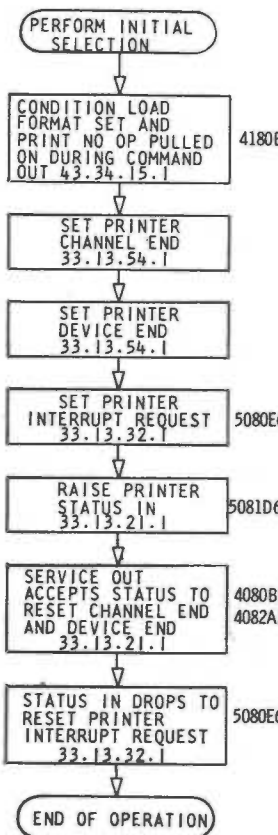
GATE LOAD FORMAT COMMAND

LOAD FORMAT COMMAND

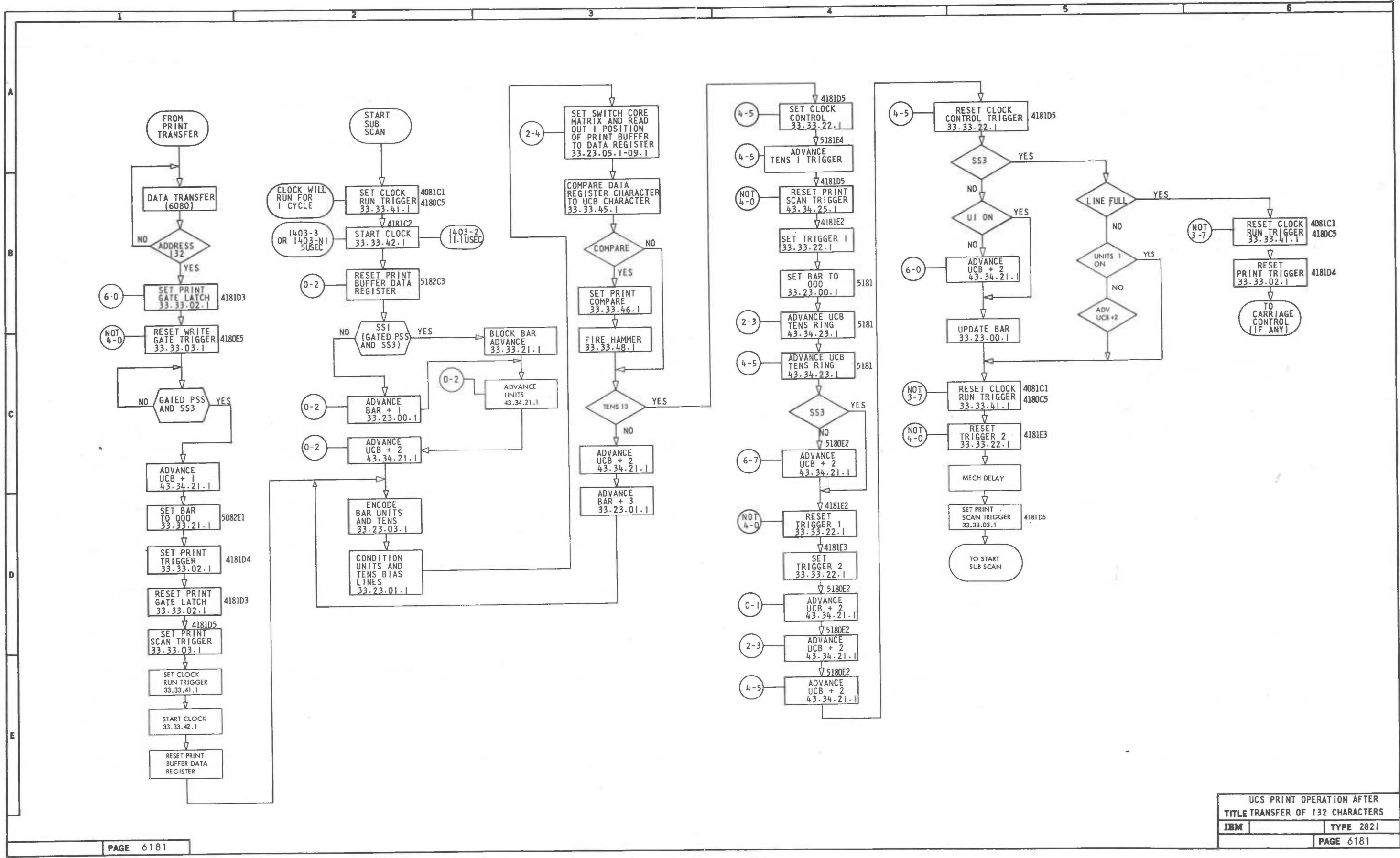
COMMAND OUT RASIED BY CHANNEL (SEE NOTE 1)

SET PRINTER CHANNEL END 33.13.54.1
 RESET PRINT WRITE 33.13.12.1
 RESET CONDITION LOAD FORMAT 43.34.15.1
 SET PRINTER INTERRUPT REQUEST 33.13.32.1

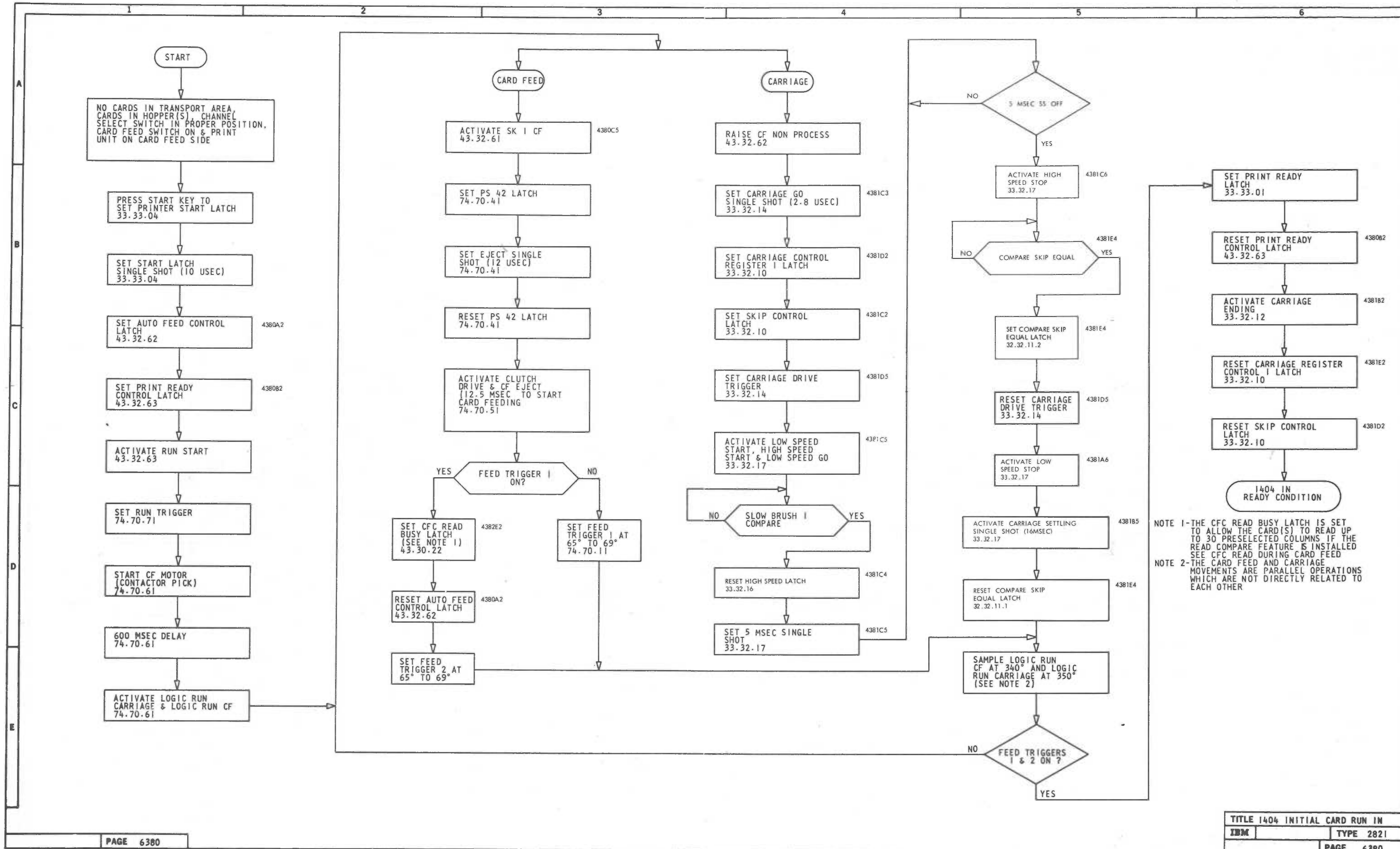
STATUS ACCEPTED BY CHANNEL TO RESET PRINTER CHANNEL END AND PRINTER INTERRUPT REQUEST 33.13.54.1



NOTE 1:
 IF COMMAND OUT HAS BEEN RAISED PRIOR TO ADDRESS 240, THE UCS LOAD OPERATION WILL TERMINATE. BUFFER POSITIONS ABOVE THE LAST ADDRESS LOADED WILL REMAIN UNCHANGED.

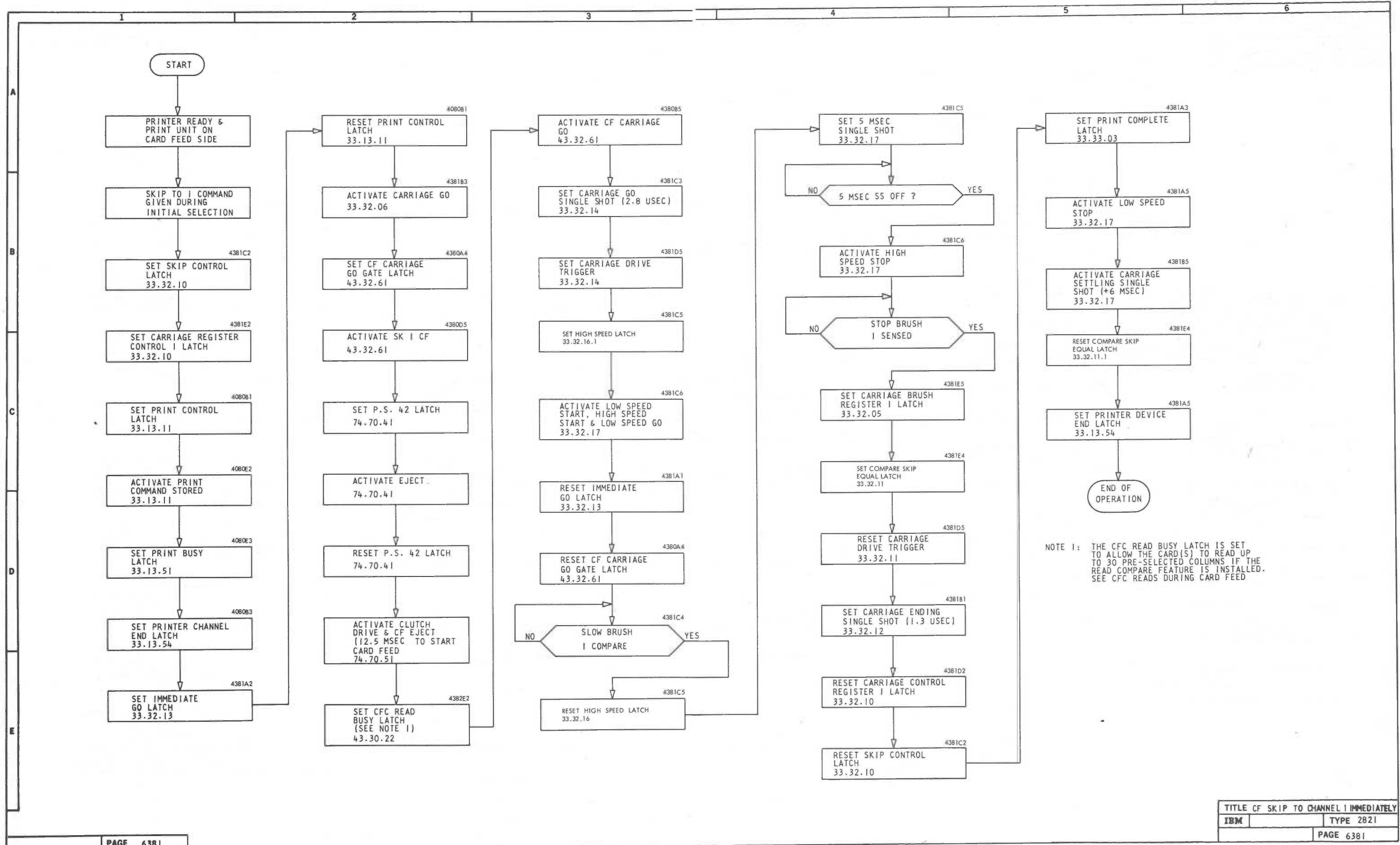


DF-12 UCS Print Operation After Transfer of 132 Characters



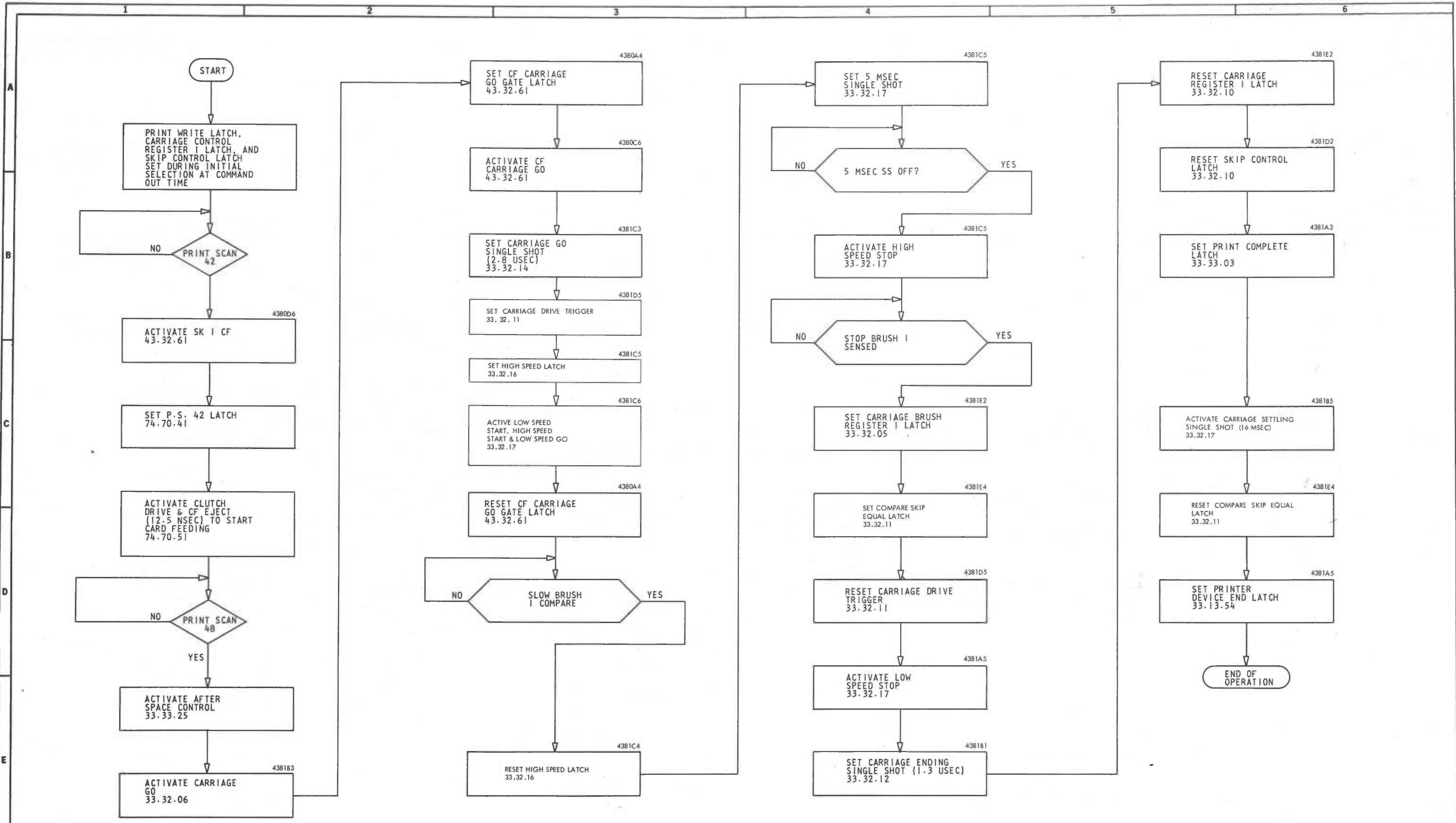
NOTE 1-THE CFC READ BUSY LATCH IS SET TO ALLOW THE CARD(S) TO READ UP TO 30 PRESELECTED COLUMNS IF THE READ COMPARE FEATURE IS INSTALLED SEE CFC READ DURING CARD FEED

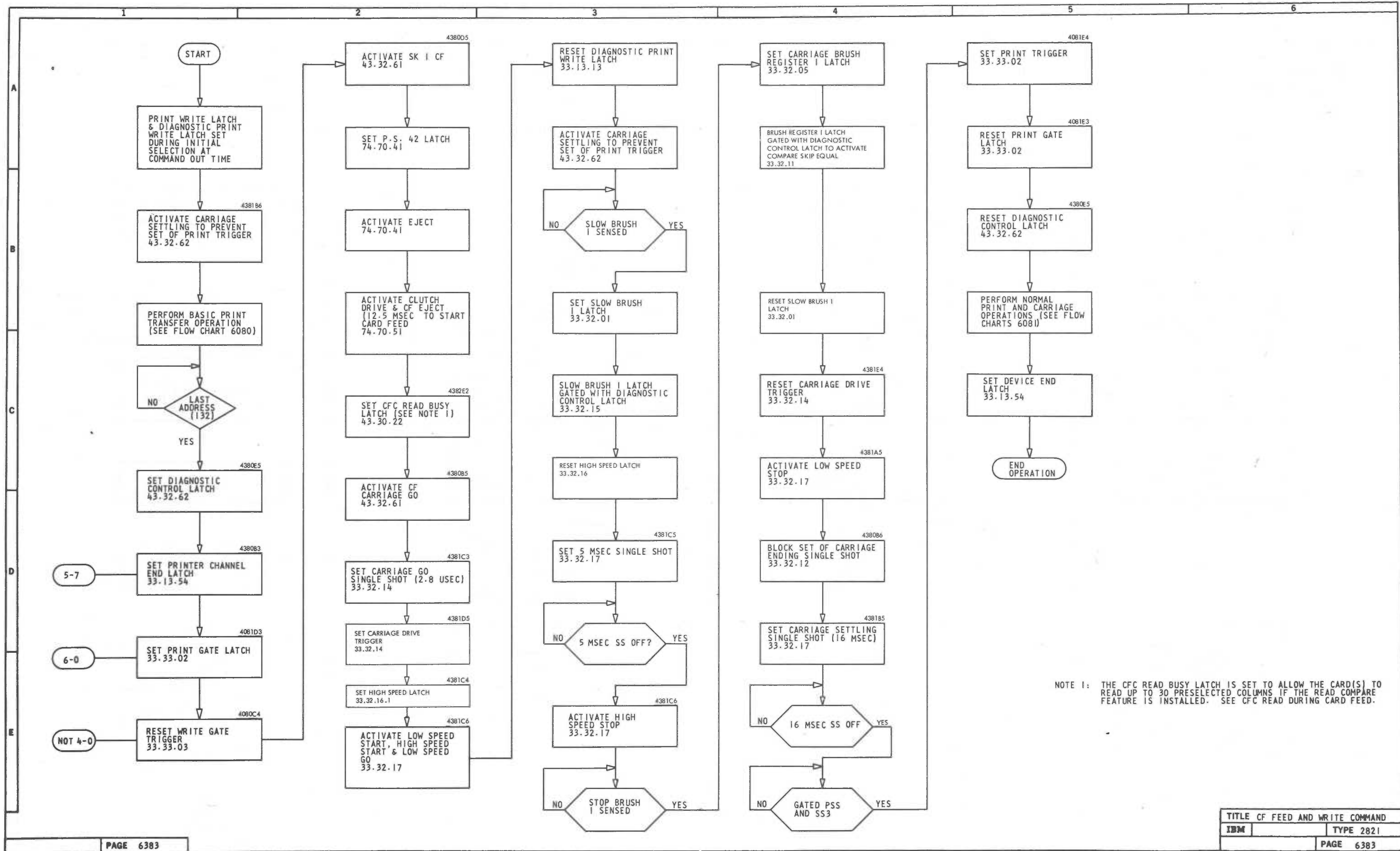
NOTE 2-THE CARD FEED AND CARRIAGE MOVEMENTS ARE PARALLEL OPERATIONS WHICH ARE NOT DIRECTLY RELATED TO EACH OTHER



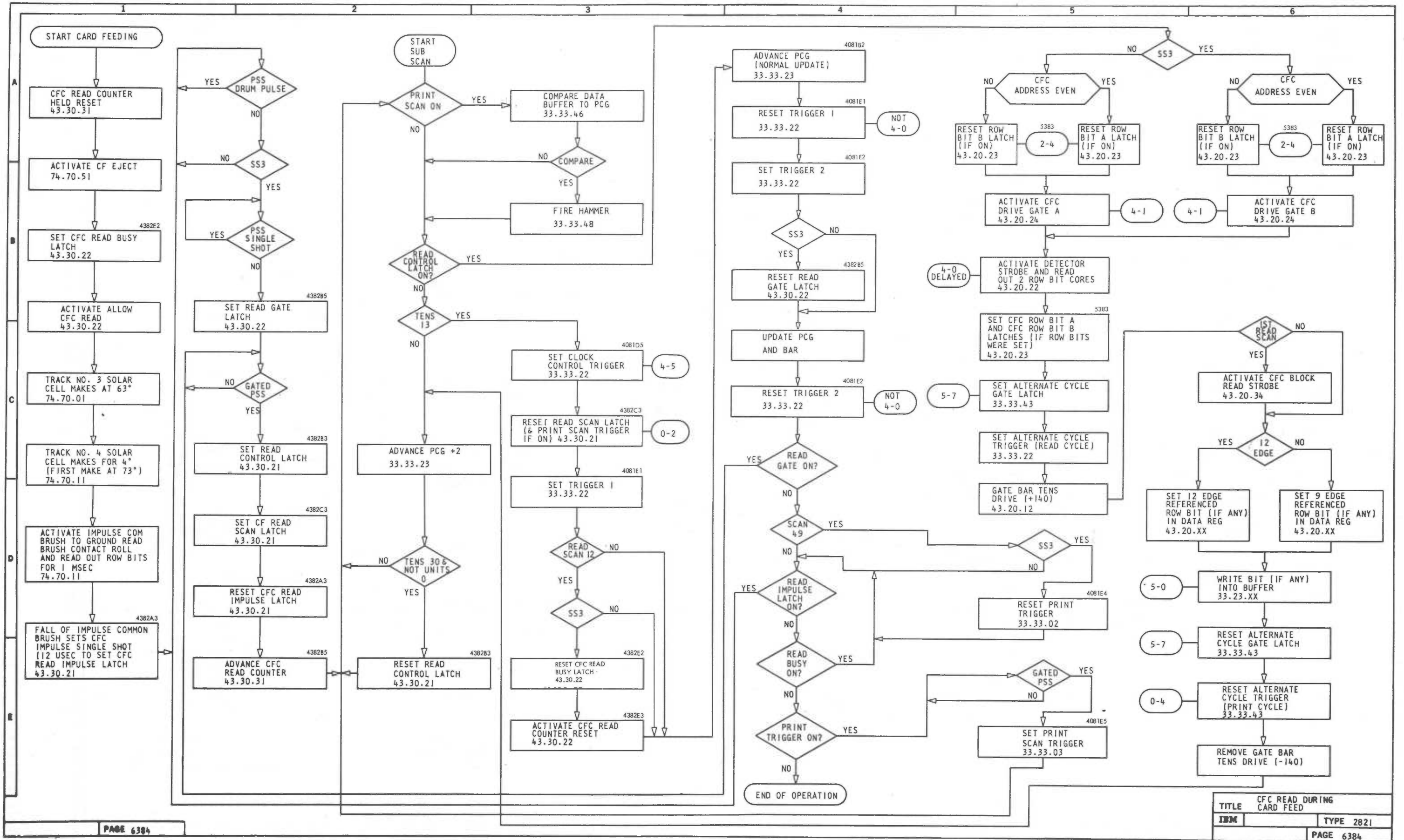
NOTE 1: THE CFC READ BUSY LATCH IS SET TO ALLOW THE CARD(S) TO READ UP TO 30 PRE-SELECTED COLUMNS IF THE READ COMPARE FEATURE IS INSTALLED. SEE CFC READS DURING CARD FEED.

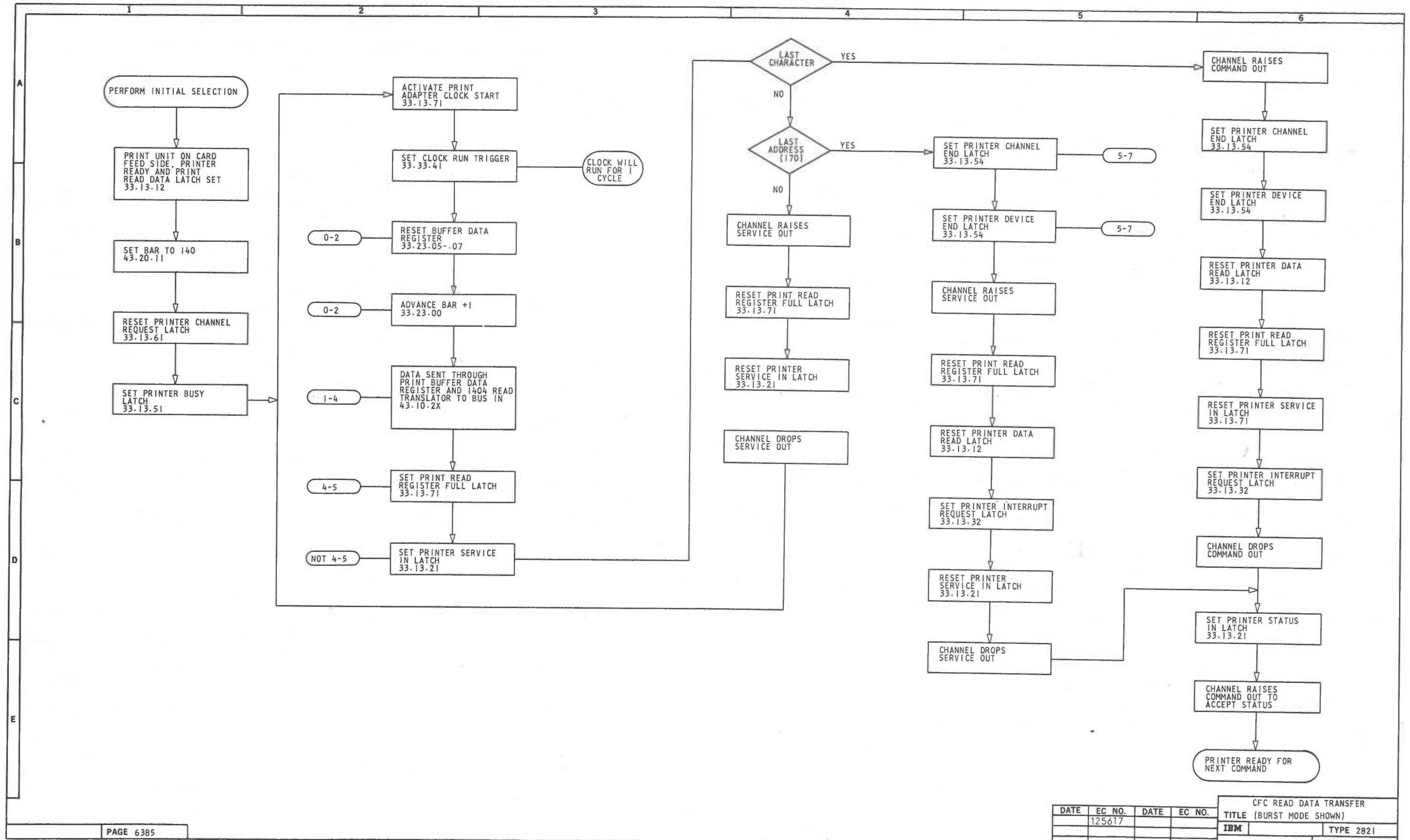
DF-14 CF Skip to Channel 1 Immediately





NOTE 1: THE CFC READ BUSY LATCH IS SET TO ALLOW THE CARD(S) TO READ UP TO 30 PRESELECTED COLUMNS IF THE READ COMPARE FEATURE IS INSTALLED. SEE CFC READ DURING CARD FEED.

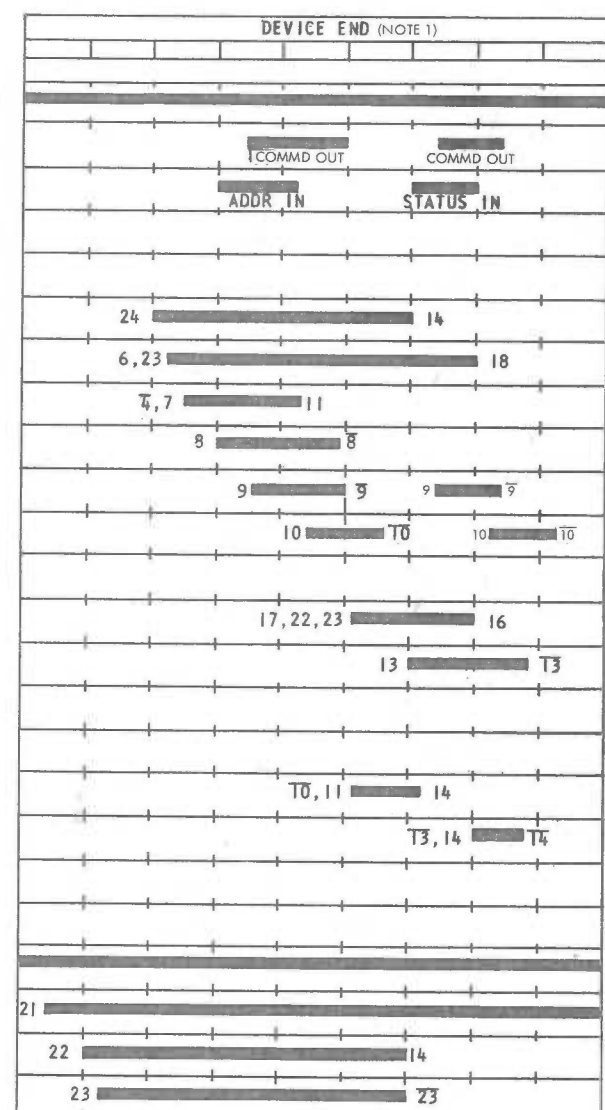
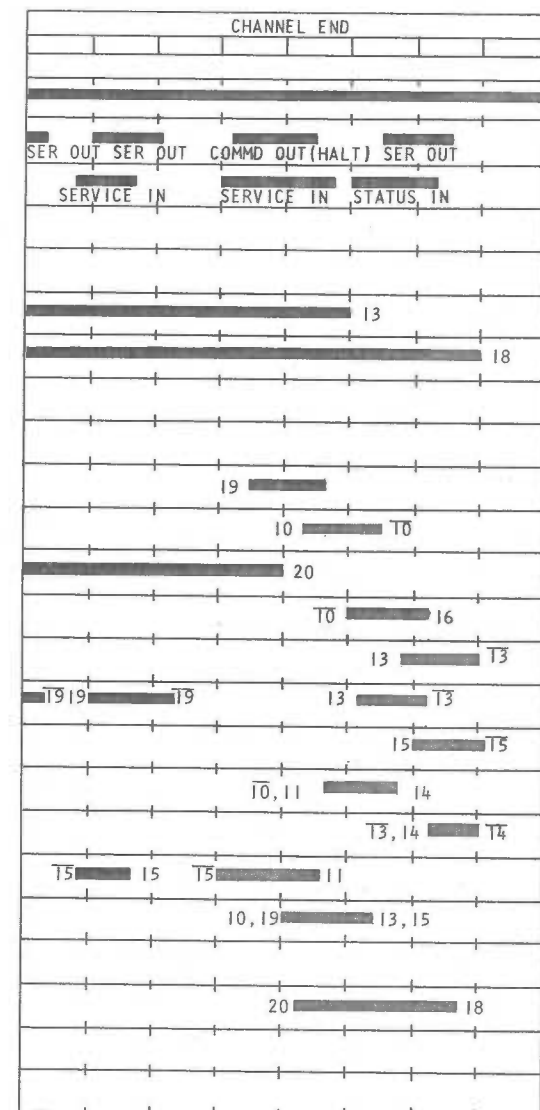




CFC READ DATA TRANSFER					
DATE	EC NO.	DATE	EC NO.	TITLE (BURST MODE SHOWN)	
	125617			IBM	TYPE 2821
					PAGE 6385

DF-18 CFC Read Data Transfer (Burst Mode Shown)

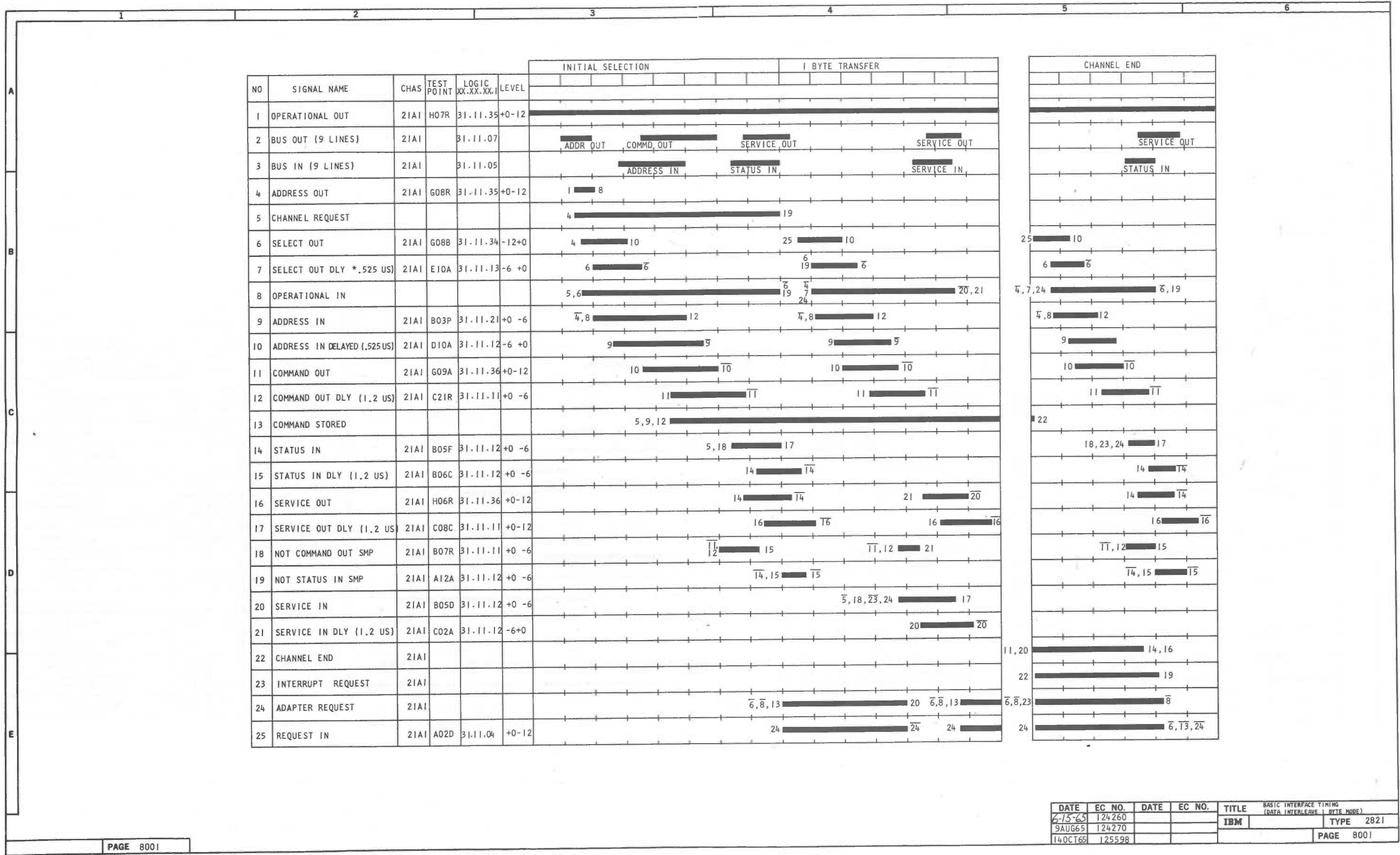
NO.	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL	INITIAL SELECTION					
						1	2	3	4	5	6
1	OPERATIONAL OUT	21A1	H07R	31.11.35	+0-12	[Timing diagram for Operational Out]					
2	BUS OUT (9 LINES)	21A1		31.11.07		[Timing diagram for Bus Out]					
3	BUS IN (9 LINES)	21A1		31.11.05		[Timing diagram for Bus In]					
4	ADDRESS OUT	21A1	G08R	31.11.35	+0-12	[Timing diagram for Address Out]					
5	CHANNEL REQUEST					[Timing diagram for Channel Request]					
6	SELECT OUT	21A1	G08B	31.11.34	-12+0	[Timing diagram for Select Out]					
7	OPERATIONAL IN					[Timing diagram for Operational In]					
8	ADDRESS IN	21A1	B03P	31.11.21	+0-6	[Timing diagram for Address In]					
9	ADDRESS IN DELAYED(525US)	21A1	D10A	31.11.12	-6+0	[Timing diagram for Address In Delayed]					
10	COMMAND OUT	21A1	G09A	31.11.36	+0-12	[Timing diagram for Command Out]					
11	COMMAND OUT DLY (1.2US)	21A1	C21R	31.11.11	+0-6	[Timing diagram for Command Out Dly]					
12	COMMAND STORED					[Timing diagram for Command Stored]					
13	STATUS IN	21A1	B05F	31.11.12	+0-6	[Timing diagram for Status In]					
14	STATUS IN DLY (1.2US)	21A1	B06C	31.11.12	+0-6	[Timing diagram for Status In Dly]					
15	SERVICE OUT	21A1	H06R	31.11.36	+0-12	[Timing diagram for Service Out]					
16	SERVICE OUT DLY (1.2US)	21A1	C08C	31.11.11	+0-12	[Timing diagram for Service Out Dly]					
17	NOT COMMAND OUT SMP	21A1	B07R	31.11.11	+0-6	[Timing diagram for Not Command Out Smp]					
18	NOT STATUS IN SMP	21A1	A12A	31.11.12	+0-6	[Timing diagram for Not Status In Smp]					
19	SERVICE IN	21A1	B05D	31.11.12	+0-6	[Timing diagram for Service In]					
20	CHANNEL END	21A1				[Timing diagram for Channel End]					
21	DEVICE END	21A1				[Timing diagram for Device End]					
22	INTERRUPT REQUEST	21A1				[Timing diagram for Interrupt Request]					
23	ADAPTER REQUEST (NOTE 2)	21A1				[Timing diagram for Adapter Request]					
24	REQUEST IN (NOTE 2)	21A1	A02D	31.11.04	+0-12	[Timing diagram for Request In]					



MECHANICAL MOTION

NOTE 1: CHART SHOWS CHANNEL STACKING DEVICE-END STATUS ON A CONTROL UNIT INITIATED SEQUENCE. WHEN THIS OCCURS, CHANNEL NORMALLY ACCEPTS DEVICE-END STATUS DURING A CHANNEL INITIATED SELECTION SEQUENCE.

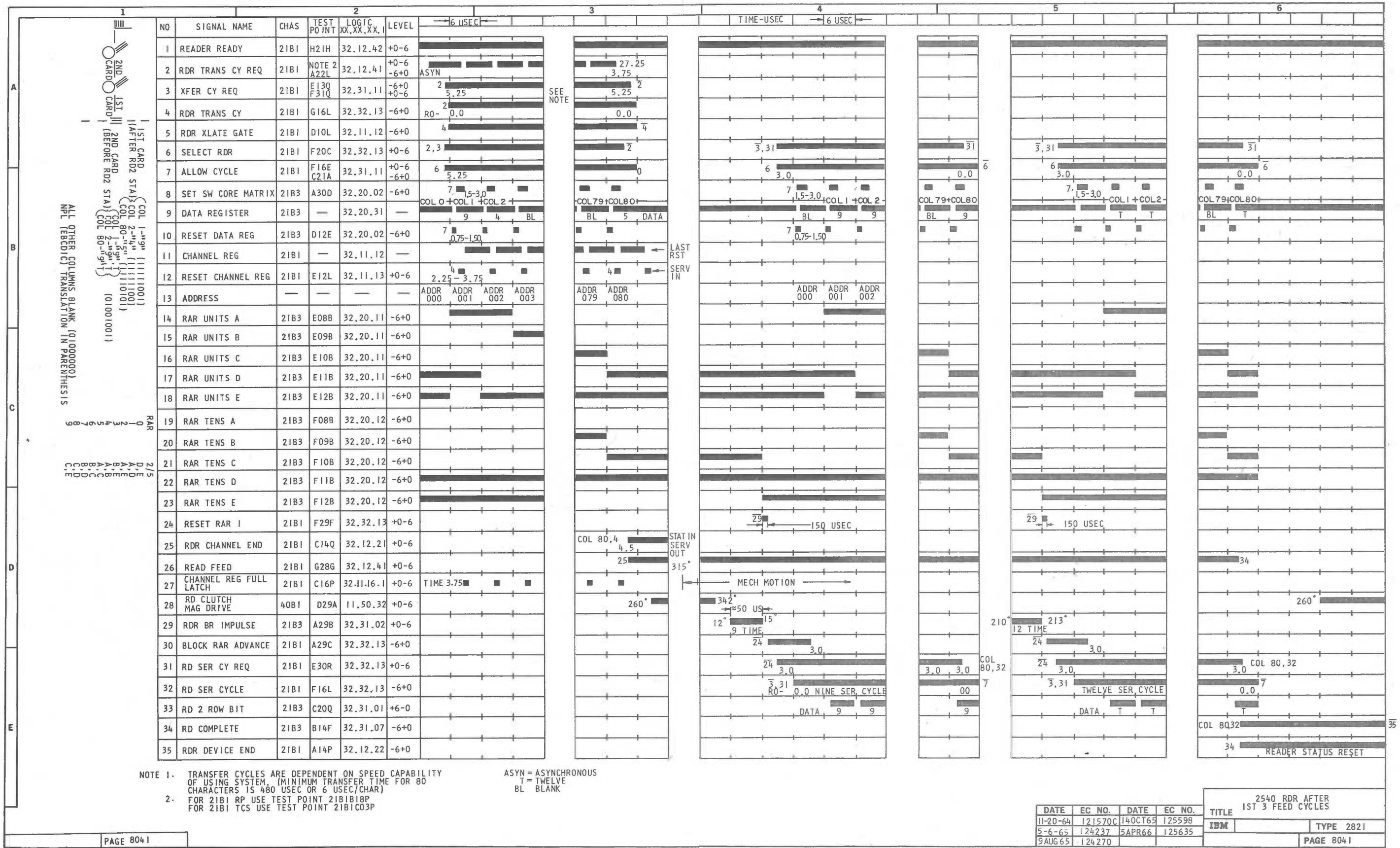
NOTE 2: AFTER STATUS IS STACKED, ADAPTER-REQUEST AND REQUEST-IN BECOME ACTIVE AGAIN IF SUPPRESS-OUT IS DOWN.



DATE	EC NO.	DATE	EC NO.	TITLE	BASIC INTERFACE TIMING (DATA INTERLEAVE 1 BYTE MODE)
6-15-63	124260			IBM	TYPE 2821
9AUG65	124270				
14OCT65	125598				PAGE 8001

TC-2 Basic Interface Timings (Data Interleave 1 Byte Mode)

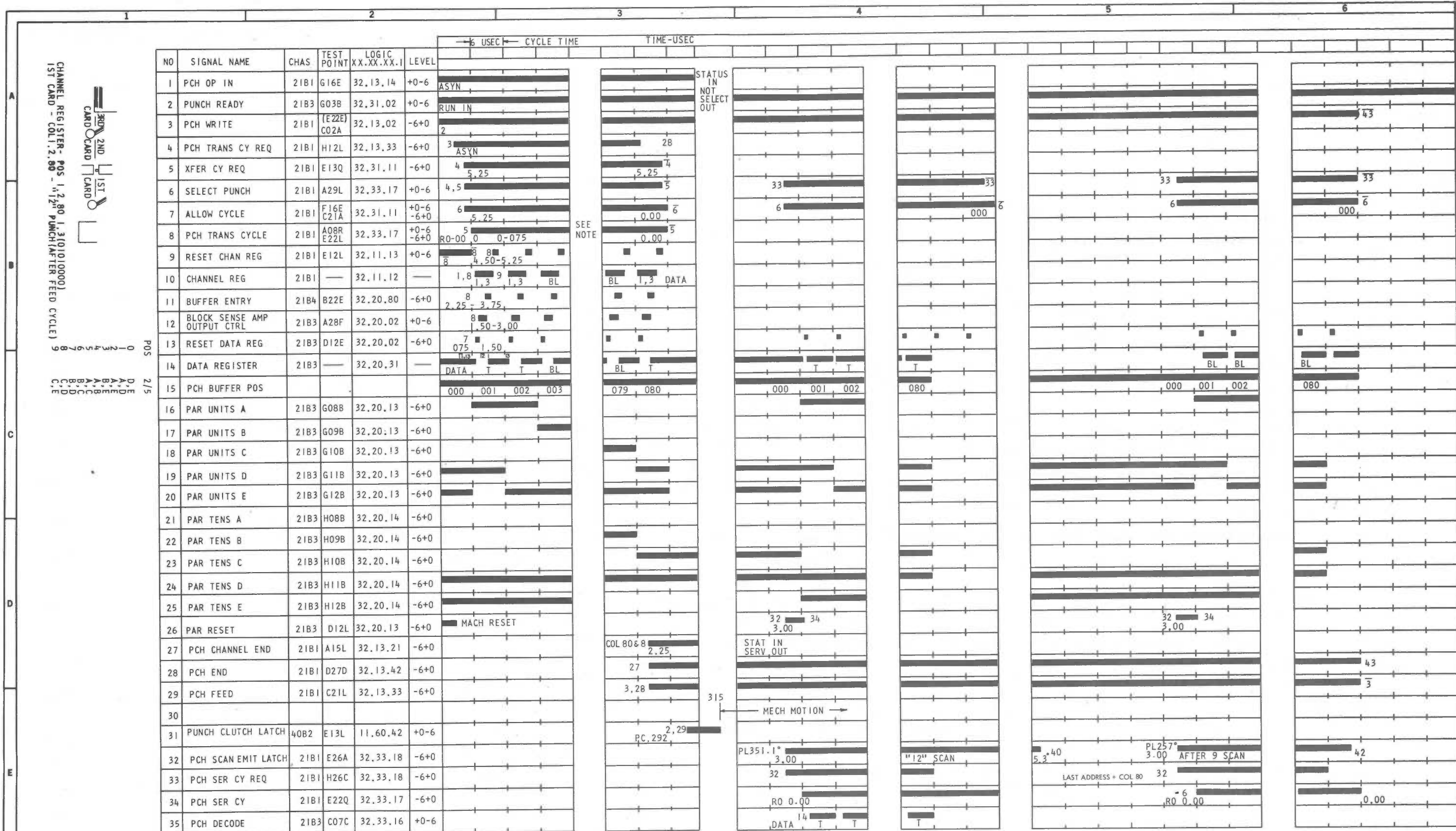
NO.	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL	Timing Diagram																							
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	OPERATIONAL OUT	21A1	H07R	31.11.35	+0-12	[Timing Diagram Data]																							
2	BUS OUT (9 LINES)	21A1		31.11.07		[Timing Diagram Data]																							
3	BUS IN (9 LINES)	21A1		31.11.05		[Timing Diagram Data]																							
4	ADDRESS OUT	21A1	G08R	31.11.35	+0-12	[Timing Diagram Data]																							
5	RDR CHANNEL REQUEST	21B1	E08E	32.12.12	+0-6	[Timing Diagram Data]																							
6	SELECT OUT	21A1	G08B	31.11.34	-12+0	[Timing Diagram Data]																							
7	RDR OP IN	21B1	F16A	32.12.14	+0-6	[Timing Diagram Data]																							
8	ADDRESS IN	21A1	B03P	31.11.21	+0-6	[Timing Diagram Data]																							
9	ADDRESS IN DELAYED(525US)	21A1	D10A	31.11.12	-6+0	[Timing Diagram Data]																							
10	COMMAND OUT	21A1	G09A	31.11.36	+0-12	[Timing Diagram Data]																							
11	COMMAND OUT DLY (1.2US)	21A1	C21R	31.11.11	+0-6	[Timing Diagram Data]																							
12	RDR READ	21B1	A05R	32.12.02	+0-6	[Timing Diagram Data]																							
13	RDR-PCH STATUS IN	21B1	B09P	32.11.03	+0-6	[Timing Diagram Data]																							
14	STATUS IN DLY (1.2US)	21A1	B06C	31.11.12	+0-6	[Timing Diagram Data]																							
15	SERVICE OUT	21A1	H06R	31.11.36	+0-12	[Timing Diagram Data]																							
16	SERVICE OUT DLY (1.2US)	21A1	C08C	31.11.11	+0-12	[Timing Diagram Data]																							
17	NOT SERVICE OUT SMP	21A1	B04P	31.11.11	+0-6	[Timing Diagram Data]																							
18	NOT COMMAND OUT SMP	21A1	B07R	31.11.11	+0-6	[Timing Diagram Data]																							
19	NOT STATUS IN SMP	21A1	A12A	31.11.12	+0-6	[Timing Diagram Data]																							
20	RDR-PCH SERVICE IN	21B1	A10P	32.11.01	+0-6	[Timing Diagram Data]																							
21	SERVICE IN DLY (1.2US)	21A1	C02A	31.11.12	-6+0	[Timing Diagram Data]																							
22	RDR TRANS CYCLE REQ	21B1	B18P	32.12.41	+0-12	[Timing Diagram Data]																							
23	RDR TRANS CYCLE	21B1	H29R	32.32.13	+0-6	[Timing Diagram Data]																							
24	CHANNEL REGISTER	21B1				[Timing Diagram Data]																							
25	CHAN REG FULL LATCH	21B1	C16P	32.11.16	+0-6	[Timing Diagram Data]																							



TC-4 2540 Reader After First Three Feed Cycles

NO.	SIGNAL NAME	CHAS	TEST POINT	LOGIC XX.XX.XX.1	LEVEL						
1	OPERATIONAL OUT	21A1	H07R	31.11.35	+0-12						
2	BUS OUT (9 LINES)	21A1		31.11.07			ADDR OUT	COMM OUT	SERVICE OUT	SERVICE OUT	SERVICE OUT
3	BUS IN (9 LINES)	21A1		31.11.05			ADDRESS IN	STATUS IN	SERVICE IN	SERVICE IN	SERVICE IN
4	ADDRESS OUT	21A1	G08R	31.11.35	+0-12	1	7				
5	PCH CHANNEL REQUEST	21B1	E08L	32.13.12	+0-12	4			16		
6	SELECT OUT	21A1	G08B	31.11.34	-12+0	4					
7	PCH OP IN	21B1	G16E	32.13.14	+0-6	5,6					
8	ADDRESS IN	21A1	B03P	31.11.21	+0-6	4,7			11		
9	ADDRESS IN DELAYED(525US)	21A1	D10A	31.11.12	-6+0	8			8		
10	COMMAND OUT	21A1	G09A	31.11.36	+0-12	9			9		
11	COMMAND OUT DLY (1.2US)	21A1	C21R	31.11.11	+0-6	10			T0		
12	PCH WRITE	21B1	A08C	32.13.02	+0-6	5,8,11					
13	RDR PCH STATUS IN	21B1	B12P	32.11.03	+0-6	5,18			16		
14	STATUS IN DLY (1.2US)	21A1	B06C	31.11.12	+0-6	14			14		
15	SERVICE OUT	21A1	H06R	31.11.36	+0-12	13		21	21	21	21
16	SERVICE OUT DLY (1.2US)	21A1	C08C	31.11.11	+0-12	15		T5	15	T5	15
17	NOT SERVICE OUT SMP	21A1	B04P	31.11.11	+0-6	T5,16		22	T5,16	22	T5,16
18	NOT COMMAND OUT SMP	21A1	B07R	31.11.11	+0-6	T0,11		14			
19	NOT STATUS IN SMP	21A1	A12A	31.11.12	+0-6	T3,14		14			
20	PCH SERVICE REQ	21B1	A23P	32.11.04	+0-12	12,23			23	12,23	23
21	RDR PCH SERVICE IN	21B1	A10P	32.11.01	+0-6	17,20			17,20		
22	SERVICE IN DLY (1.2US)	21A1	C02A	31.11.12	-6+0	21			21	21	21
23	CHAN REG FULL LATCH	21B1	C16P	32.11.16	+0-6	15,21			15,21		
24	PCH TRANS CYCLE REQ	21B1	C27G	32.13.33	+0-6	7,12,23			7,12,23		
25	XFER CY REQ	21B1	A25E	32.31.11	+0-6	24					
26	PCH TRANS CYCLE	21B1	A08R	32.33.17	+0-6	25					
27	CHANNEL REGISTER	21B1									

DATE	EC NO.	DATE	EC NO.	PUNCH WRITE COMMAND	
6-15-65	124260			TITLE	(BURST MODE)
9AUG65	124270			IBM	TYPE 2821
14OCT65	125598			PAGE 8060	



CHANNEL REGISTER - POS 1, 2, 80, 1, 310, 10, 1000001
 1ST CARD - COL 1, 2, 80 - 1, 2, 80 PUNCH AFTER FEED CYCLE 9

POS 0 1 2 3 4 5 6 7 8 9
 D/E A/B A/B A/B A/B A/B A/B A/B A/B A/B
 C/E B/D B/D B/D B/D B/D B/D B/D B/D B/D

NOTE 1. TRANSFER CYCLES ARE DEPENDENT ON SPEED CAPABILITY OF USING SYSTEM (MINIMUM TRANSFER TIME FOR 80 CHARACTERS IS 480 USEC OR 6 USEC/CHAR) ASYN = ASYNCHRONOUS T = TWELVE PUNCH
 2. TEST POINTS IN PARENTHESES FOR TCS ONLY BL = BLANK

TC-6 2540 Punch After First Three Feed Cycles (Sheet 1)

CHANNEL REGISTER - POS 1, 2, 80 - 1, 3 (01010000)
 1ST CARD - COL 1, 2, 80 - 1, 2 PUNCH (AFTER FEED CYCLE)

3RD CARD
 2ND CARD
 1ST CARD

POS 0 1 2 3 4 5 6 7 8 9

D 1/5
 A
 B
 C
 D
 E

