IBM®

Customer Engineering

Manual of Instruction

7400 Printer

Printed in U.S.A.

G. IBM 7400 PRINTER

CONTENTS

FOREWORD

This manual is intended for use in training Customer Engineers in the operations of the IBM 7400 Printer used with the IBM 7070 System.

Because the 7400 uses the same printing device as the IBM 407 Accounting Machine and the IBM 922 Tape-Controlled Carriage, the mechanical principles of the units are not explained in this manual. Reference is made to the 407 Customer Engineering Manual of Instruction, Form 225-8090 for coverage in these areas.

Reference is made to the IBM 7070 Data Processing System Reference Manual, Form A24-7003, for coverage of the control panel; operating keys, lights, and switches; and the functions of the 7400 in the 7070 System.

With the exception of print command, only those circuits directly controllable from the 7400 are discussed.

1.0.00 INTRODUCTION

The IBM 7400 Printer is the printer output for the IBM 7070 system. The machine prints at the rate of 150 lines per minute. It is equipped with the IBM 922 Tape-Controlled Carriage for flexible control of paper spacing and skipping.

2.0.00 MECHANICAL AND FUNCTIONAL PRINCIPLES

The IBM 7400 consists of the same printing device as the IBM 407 Accounting Machine. See the 407 Customer Engineering Manual of Instruction, Form 225-8090. The functions of the IBM 7400 in the 7070 system; the control panel; and operating keys, lights, and switches are discussed in the IBM 7070 Data Processing System Reference Manual, Form A24-7003.

3.0.00 PRINTER CIRCUIT DESCRIPTION

In the following material, only those circuits directly controllable from the 7400 are discussed (except Print Command). Circuits which originate in the input-output synchronizer are discussed in the section on output synchronizer operation.

3.1.00 PRINTER CIRCUITS

3.1.01 Power-On Circuits

When the 7400 main line switch is turned on, circuits must be completed as follows:

1. AC power to drive motor, blower motor and transformer.
2. DC power from rectifier output.

    a. - 20 v to relay commons (Sec. 7 B)
    b. + 47 v to line terminals.

Power-On Sequence

1. HD 2 (2A) picks when PC 100 (2B) is connected to - 20 volts.
2. HD 2 points (2A) allow HD 4 to be energized when master power switch (1A) is turned on.
3. Master power switch energizes HD 4.
4. HD 4 points energize HD 3.
5. HD 3 and HD 4 points supply 208 and 230 volts AC to transformer and drive motor.
6. R 339, - 20 v Interlock (2B), picks through Ind Op Switch off, Manual Command N/C point, R 401-1 N/C and + side of line.
7. R 399-4 (2B), picks R 402, - 20 v Line.
8. R 402-3, 4 provide - 20 v (PC 100) to the common of relays which are picked from the input-output synchronizer (7B).
9. When R 402-1 N/O (2A) closes, HD 1 (2A) is energized.
10. HD 1 points (1A) connect + DC voltage to the line.

3.1.02 Calculate Interlock and Drive Clutch

Depression of the 7400 Start Key results in energizing the drive clutch and the calculate interlock relay, R 394, to turn control of printing over to the input-output synchronizer. This control may be released either by a machine error, by the carriage running out of paper, or by depression of the stop key.

Calculate Interlock and Drive Clutch Sequence

1. Start key (6B) picks R 394 (and R 472) through lower N/C manual command switch, and R 387-2 N/C to line.
2. R 394 holds (6B) through R 386-2 N/C, R 394-3 N/O, and either R 387-2 N/C or R 305-3 N/O to the line.
3. R 472, drive clutch (6B), is picked with R 394 by the start key. R 472 holds under control of the R 394-2 N/O point (6B).
4. The R 472 B point (4A) picks R 473, idling control, to energize the drive clutch.

3.1.03 Print Command Control (Figure 3.1-1)

After the 7400 start key is depressed and calculate interlock is on, control of printing is by signal from the input-output synchronizer.

Print Command Sequence

1. R 394-4 N/O, calculate interlock, closes (7B) to allow R 292, print command, to pick when signalled from the synchronizer. R 292 holds through R 292-4 (6A) and provides translate signs, translate control information, and the Sign RO Signal to the synchronizer.
2. R 292-1 (6A) closes to pick R 396, active cycles, and R 387, print.
3. R 387, print (6A), holds through CR 75 until after the end of print setup time in the following 7400 cycle. The start RO pulses are sent to the synchronizer through CR3 and 5 while R 387 holds.
4. R 396, active cycles (6A), is picked by R 292-1 (6A). The use of R 396 is discussed in a later section.

3.1.04 Non Print

Any signalled print operation can be suppressed by a CI impulse to the non-print hubs.

Non-Print Sequence of Operation

1. R 391, Non-Print, is picked by a CI pulse (9A).
2. Non-Print, R 391, holds until the end of the non-print cycle under control of CR90, shunted by active cycles, R 396-7.
3. R 391-3 N/O (6B) completes a circuit to send an immediate interrupt signal to the synchronizer.
4. R 391-4 (9A) switches the master CB pulses directly to CR11 and 12 so that spacing and overflow can take place during a non-print cycle.
5. R 391-2 (6A) drops R 475, print cam control. Opening the normally closed points of R 475 (35 A and 37 A) accomplish the following:

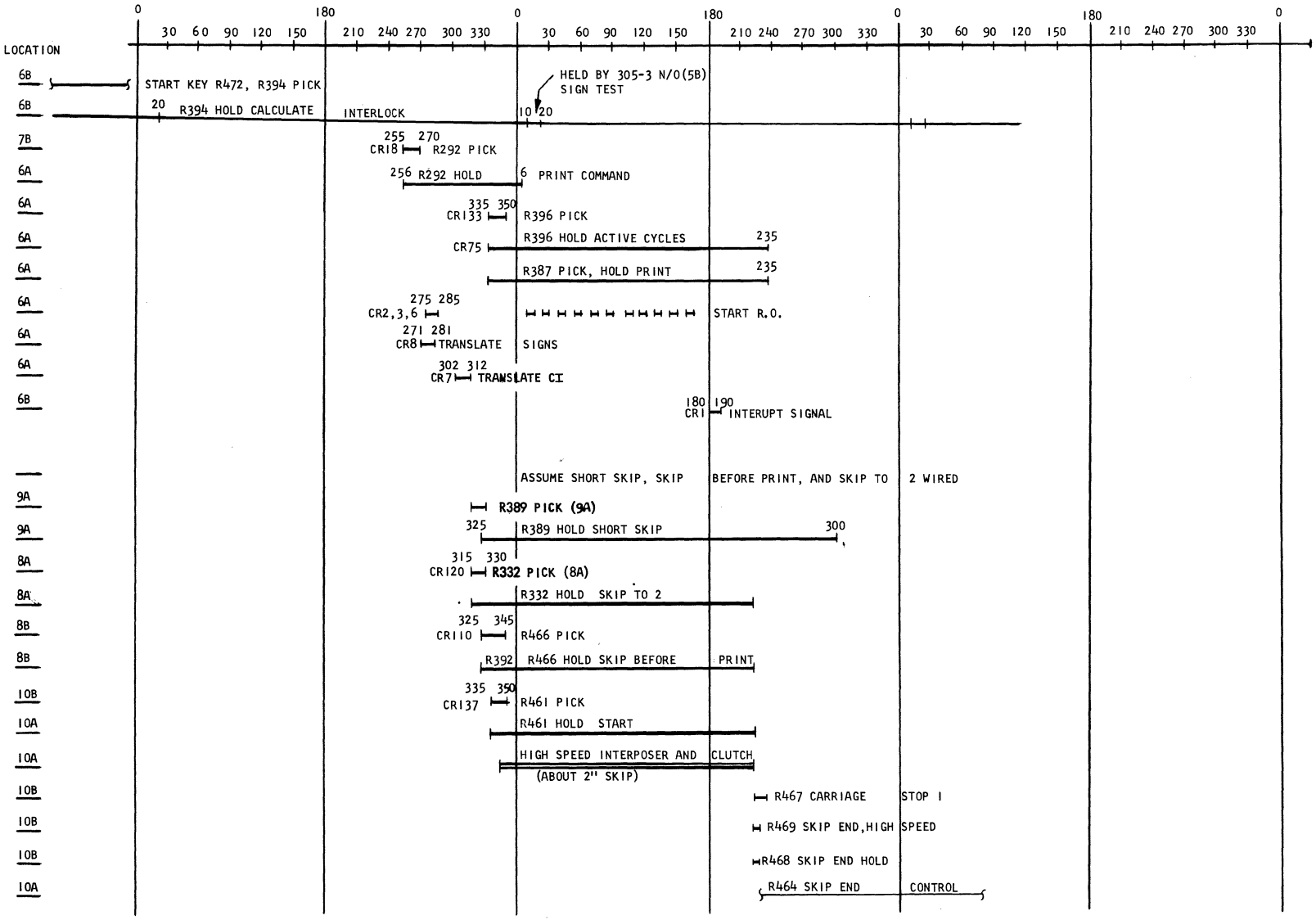


FIGURE 3.1-1 PRINT COMMAND CONTROL

a. Prevent sign exit pulses (30B).
b. Prevent digit impulses from DI hub (14A).
c. Block character emitter operation (13A).
d. Block alteration switch impulses.
e. Prevent N, 0XRN, 0XRP, and 0XRC pulses (35).

3.1.05 Manual Command Jack

When the manual command jack is inserted (5B), the customer engineer may cause a print cycle without a signal from the synchronizer.

Manual Command Jack Sequence of Operation

1. Upper N/C command jack point (5B) transfers to drop R 399, - 20 v Interlock, and in turn R 402, - 20 v line. This drops the - 20 v line to the fuse common of the relays which are picked from the 7070 input-output synchronizer (7B).
2. The N/O command jack point (7B) closes to shunt R 402-1 N/O (2A) and pick HD 1 to supply + 47 v DC to the line terminals.
3. The lower N/C command jack point opens to drop the normal start key circuit to R 472 and R 394.
4. The CE start switch (6B) completes the circuit to pick R472, drive clutch, and R 394,calculate interlock, through R 402-2 N/C and R 399-1 N/C.
5. The manual command switch completes a circuit from L5 (5A) through R 399-1 N/C (5B), manual command switch (not shown), R 394-6 N/O and CR 10 to pick R 292, print command. The hold coil of R 292 is used for the pick in this case.

3.2.00 CARRIAGE CIRCUIT DESCRIPTION

Functional and mechanical principles of the 922 carriage are discussed in the IBM 407 Customer Engineering Manual of Instruction, Form 225-8090. The carriage circuits for the IBM 407 and 7400, are similar in many respects. The basic spacing and skipping circuits are summarized in the following material.

3.2.01 Single and Double Space

Normal line spacing is controlled by CR 12, M 110° B 125° (9A). Spacing on the first line to be printed or on the first line after a skip is suppressed by the R 460 BU points (9A). Note that R 460 (8A) is not picked until after space time of the first print cycle and that it holds (8B) until the next skip begins. Spacing signals from CR12 occur only on on print cycles since CR12 is connected to the master CB's through R 475 points, print cam control (Sec. 37 A).

Sequence of Circuit Operation for Single Space

1. CR 12 (9A) picks R 461 PL, start.
2. R 461 holds under control of R 467 A, carriage stop (10A).
3. R 461 B (10A) energizes the carriage clutch through R 458 BL N/O.
4. The carriage CB (9A), through R 458 AL N/O and R 461 AU N/O (10B), picks R 467, Carriage Stop 1.
5. R 467 A (10A) drops R 461 and the clutch magnet.

Sequence of Circuit Operation for Double Space

A control-information impulse to the double-space hubs (10B) causes a double rather than a single space.

1. CI pulse picks R 347 (10B), Double Space 1.
2. R 347 holds (10A) until dropped by a skip operation.
3. R 461 PL, start, is picked in the usual way by CR12, 110° - 125°. R 461 B (10A) energizes the clutch magnet.
4. First make of the carriage CB picks R 345 (10B),Double Space 2. R 345-1 holds R 345 for duration of carriage CB.
5. R 345-3 N/O (10B) picks R 346, Double Space 3, which holds through R 346-1 and R 464 B N/C, skip end control.
6. Second make of the Carriage CB picks R 467, carriage stop, through R 347-2 N/O, R 345-1 N/C and R 346-2 N/O.
7. R 467 A (10A) drops R 461 and the clutch magnet.
8. R 461 B N/C (10A) picks R 464, skip end control.
9. R 464 B N/C (10B) opens to drop R 346, Double Space 3.

3.2.02 Selective Spacing

Single, double, or triple spacing in any combination may be accomplished by the spacing of punches in Channel 11 of the tape. The selective-space hubs (10B) must be connected.

Sequence of Circuit Operation for Selective Spacing

1. R 346, Double Space 3 (10B), holds through R 464 B N/C, skip end control.
2. R 461 PL and the clutch are operated in the usual way.
3. Spacing occurs until the carriage brush senses the 11 hole.
4. R 467, Carriage Stop 1, is picked through the 11 hole, R 345-1 N/C and R 346-2 N/O.
5. R 461 and the clutch are dropped in the usual manner.

3.2.03 Space Suppress

1. Control Information Impulse picks R 456, space suppress. R 456 holds through CR 83, 320° to 140°.
2. R 456 B N/C (9A) prevents impulse to start, R 461.
3. R 456 AL N/C drops R 347, Double Space 1.

3.2.04 Extra Space After Print

1. A control-information impulse picks R 457, Extra Space After Print. R 457 holds until 275° of the next print cycle.
2. R 457 B (7B) picks R 470, space or skip after. R 470 holds until 10° through CR 89.
3. R 470 B N/O (9A) and CR 137 pick R 461, start, at 335°, to cause the extra space after printing.

3.2.05 Manual Single Space

1. Space key picks R 461 PU, start.
2. R 461 AL (10A) holds R 461 through R 467 A N/C, carriage stop.
3. R 461 B N/O (10A) picks clutch magnet. (R 458, All Skips, is energized except when skipping).
4. R 463, space interlock, picks when R 461 holds (10A). R 463 holds through the space key and R 463 B N/O (10A). This prevents a second pick of R 461 PU with one depression of the space key.
5. The carriage CB, through R 458 AL N/O, picks R 467, carriage stop.
6. R 467 A (10A) drops R 461 and the clutch magnet.
7. R 461 AU (10B) drops R 467.

3.2.06 Carriage Restore and Carriage Stop

Circuit Sequence for Carriage Restore

1. Restore key (10B) picks R 462, restore.
2. R 462 AL (10B) picks R 461 PU, start.
3. R 461 holds (10A) under control of R 467 A, carriage stop. R 462 holds under control of R 461 AL, start.
4. The "1" hole in the carriage tape picks R 467, Carriage Stop 1, through R 462 BU N/O.

Circuit Sequence for Carriage Stop

1. Stop key (10B) picks R 344.
2. Carriage CB picks R 467, Carriage Stop 1, through R 344-2 N/O (9B) and R 344-4 N/O.
3. R 344-3 (5B) shunts the stop key to pick R 386, key stop.

3.2.07 Skipping

Skipping is signalled by a control-information impulse wired to one of the ten skip-to hubs shown in wiring diagram Section 8A. The skip operation may take place either before or after printing, under control of the skip-before-print jackplugs (8A). Skipping continues until stopped by the appropriate hole in the carriage tape. For short skips of less than 2 inches, the machine interlock may be cancelled, and skipping may be done without interrupting the normal printing speed of the machine. This is accomplished by wiring CI pulses to the short-skip hubs (9A).

Several representative examples of skipping are included in the following material. Figure 3.1-1 shows a short-skip operation. Figure 3.2-1 shows long skips both before and after printing.

Example: Skip to 2 (8A), Assume Short Skip and

Skip Before Print are wired (Figure 3.1-1)

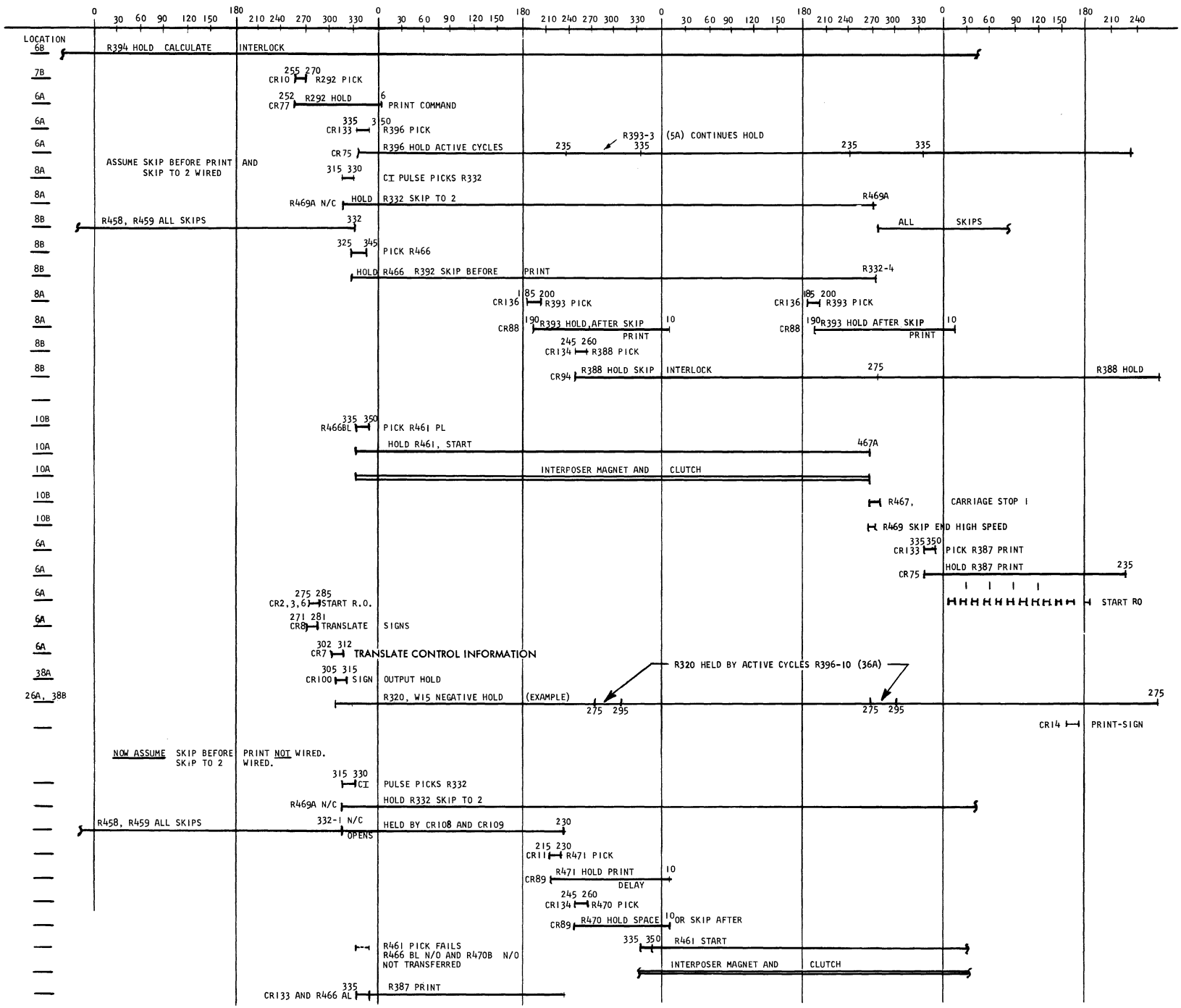


FIGURE 3.2-1 CARRIAGE LONG SKIP SEQUENCE

1. Control-information impulse, picks R 332, Tape Channel Control 2 (8A).
2. R 332 (8A) holds through R 332-1 N/O and R 469 A, Skip End.
3. R 332-1 N/O also picks R 466, Skip Before Print (8B), through skip-before-print jackplug and R 332-3 N/O.
4. R 466 and R 392, Skip Before Print, are held through R 332-4 until end of skip.
5. R 466 BL N/O (9A) and CR 137 pick start, R 461.
6. R 461, start, holds (10A) and operates clutch as usual.
7. R 467, carriage stop (10B), picks when carriage brush 2 makes through hole in tape, R 332-2 N/O and, R 458 AL N/C.
8. Short Skip, R 389 (9A), picks at CI time with Skip to 2. R 389 (9A) holds through CR 90 shunted by R 396 - 7 N/O, active cycles.
9. R 387, Print (6A), picks through R 389-2 N/O, (shunts 466 AL N/C now open) and R 292-1 N/O without loss of a 7400 machine cycle.

Example: Skip to 2 (8A) Skip Before Print is wired. Short Skip is not wired.

See Figure 3.2-1 for the sequence of operation.

Steps 1 - 7 --- See steps 1 - 7 in the preceding example.

8. R 387 Print (6A), fails to pick since R 466 AL is transferred and neither short skip is picked.

9. R 393, After Skip Print (8A), is picked when short skip is not wired. R 393 holds (8A).
10. R 396, active cycles (6A), is picked through R 393-4 N/O and R 292-1 N/C. R 396 holds through R 393-3 N/O until R 393 drops after the end of skip.
11. R 387, print (6A), is repicked through R 466 AL, R 393-4 N/O and R 292-1 N/C after the end of skip.
12. R 396, active cycles (6A), holds the following during the skip before print for as many cycles as necessary:

a. Negative Relays (Sec. 36)
b. Unload Relays (Sec. 36)
c. Field Selectors and Co-Selectors (Sec. 11)

Example: Skip to 2. Skip before Print and Short Skip are not wired.

See Figure 3.2-1 for the sequence of operation.

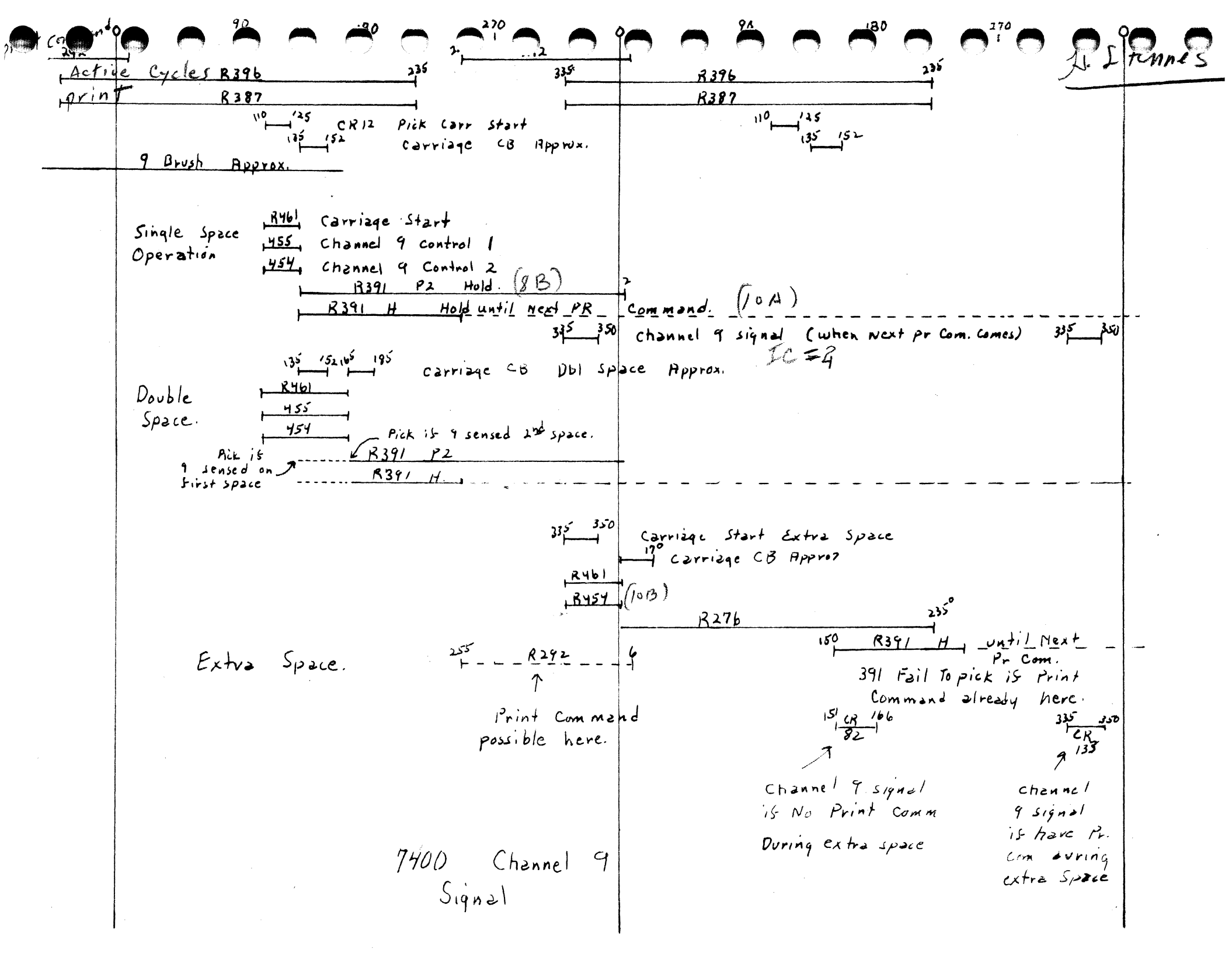
1. R 332, Skip to 2, is picked by a CI pulse (8A). R 332 holds under control of R 469 A, Skip End.
2. Because R 466, Skip Before Print, is not picked, R 458 and R 459 hold beyond the normal CR108 break time of 332° to 230° of the print cycle (8B).
3. The R 466 BL N/O point (9A) prevents the before-print skip; however, spacing before print takes place in the usual manner through CR 12, R 470 B N/C and R 466 BL N/C.
4. R 387, print (6A), picks through R 466 AL N/C. This results in the printing of one line from the output buffer.
5. R 470, space or skip after (8B), is picked when CR134 makes at 245° of the print cycle through R 471 B, print delay and R 458 BU N/C.

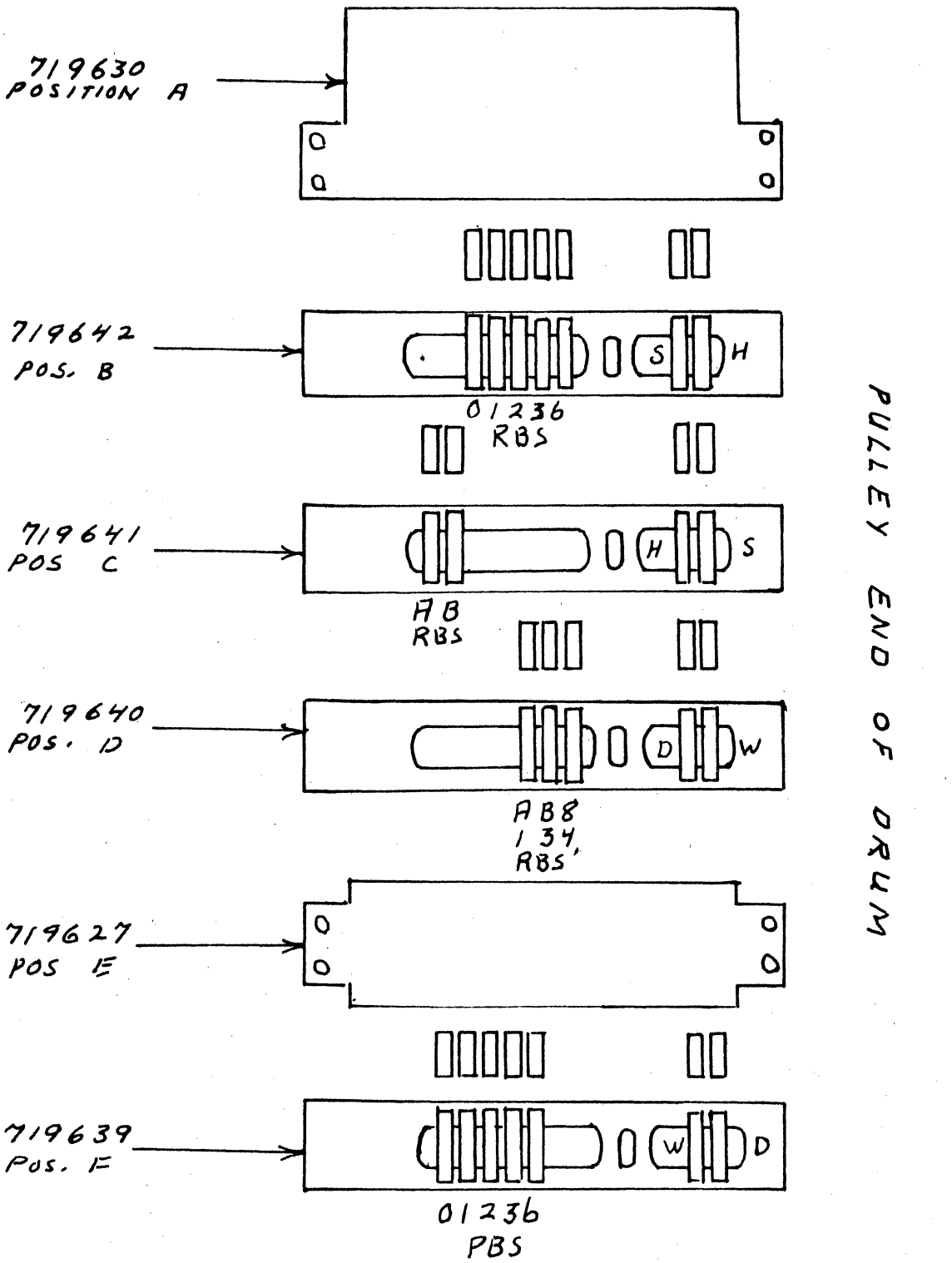
6. The R 470 B N/O point (9A) completes a circuit to start skipping at 335° of the print cycle.
7. R 388, skip interlock (8B), picks and holds during each cycle as long as All Skips is down.
8. The R 388-3 point (7B) prevents another print command until after the end of the skipping operation.

Example: Overflow

When a 12 punch is read by the carriage brush, a skip-to-one operation is started as follows:

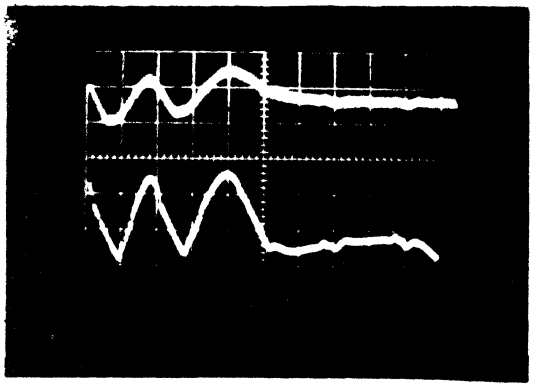
1. A 12 hole in the carriage tape picks R 465, Overflow (10B).
2. R 465 holds (6B) with First Line Suppress, R 460.
3. CR 11 (9A) picks R 471 (9A) and R 331, Skip to 1 (8A), through R 465 AU N/O and control panel wire from Overflow to Skip to 1.
4. Skip to 1 takes place in the usual way. First Line Suppress, R 460, and overflow, R 465, are dropped with R 458 and R 459.
5. R 388, skip interlock, picks each cycle to prevent further print commands until the end of the skipping operation.


Command
Active Cycles R396
Print R387
CR12 Pick Carr Start
Carriage CB Approx.
9 Brush Approx.
Single Space Operation
R461 Carriage Start
455 Channel 9 control 1
454 Channel 9 Control 2
R391 P2 Hold. (8B)
R391 H Hold until Next PR Command. (10A)
Channel 9 signal (when Next pr Com. comes)
IC=4
Carriage CB Dbl Space Approx.
Double Space.
Pick is 9 sensed 2nd space.
Pick is 9 sensed on first space
R391 P2
R391 H.
Carriage Start Extra Space
Carriage CB Approx
R461
R454 (10B)
R276
R391 H until Next Pr Com.
Extra Space.
R292
Print Command possible here.
391 Fail To pick is Print Command already here.
Channel 9 signal is No Print Comm During extra space
Channel 9 signal is have Pr. Com during extra Space
7400 Channel 9 Signal
A. Stunnes

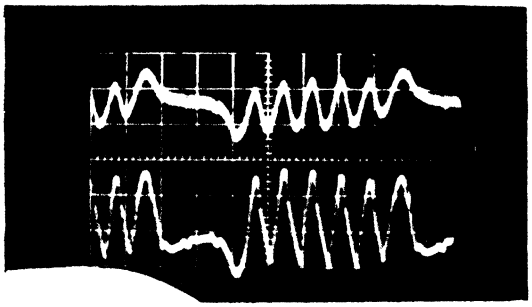

719630
POSITION A
719642
POS. B
S
H
01236
RBS
719641
POS C
H
S
AB
RBS
719640
POS. D
D
W
ABB
134,
RBS'
719627
POS E
719639
Pos. F
W
D
01236
PBS
PULLEY END OF DRUM

DRUM LAYOUT

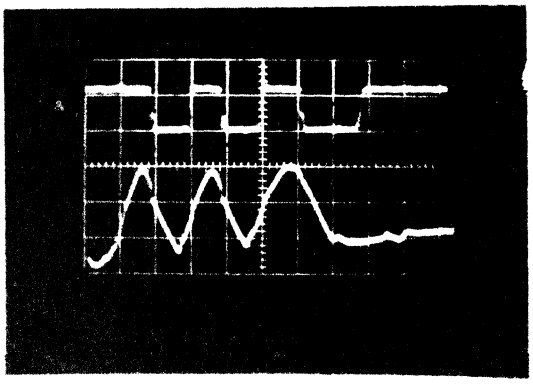
1. Head Output
   .2 volts per CM
   2 usec. per CM
2. Sense Amplifier Output
   5 volts per CM
   2 usec. per CM



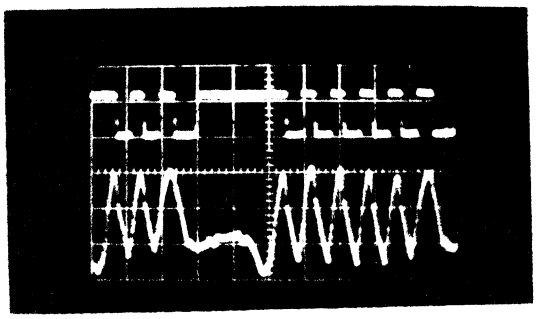
1. Head Output
   .2 Volts per CM
   5 usec per CM
2. Sense Amplifier Output
   5 Volts per CM
   5 usec. per CM



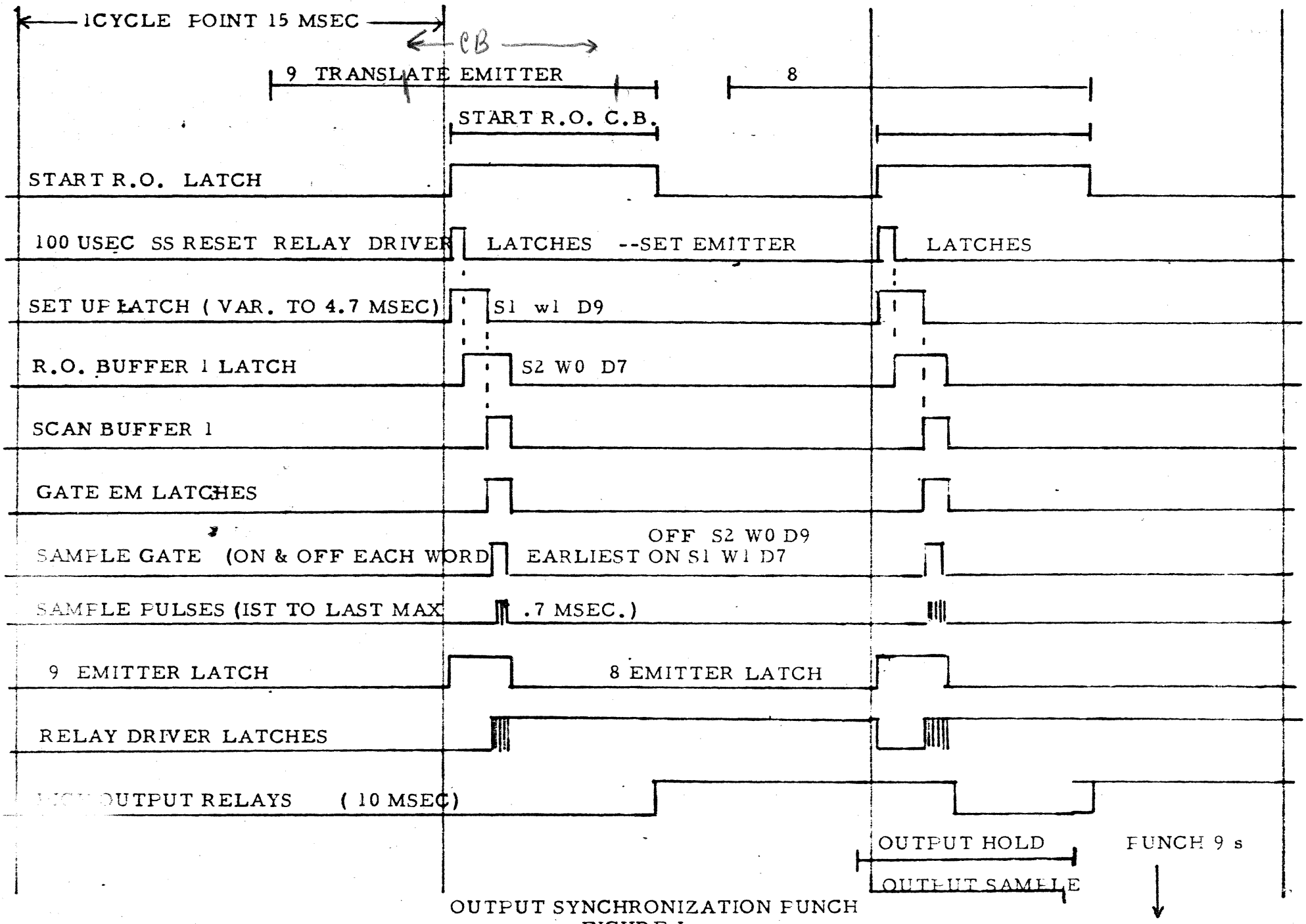
1. Drum Sense Shaper
   2 usec. per CM
   2 Volts per CM
2. Sense Amplifier Output
   2 usec per CM
   5 Volts per CM



1. Drum Sense Shaper
   5 usec. per CM
   2 Volts per CM
2. Sense Amplifier Output
   5 usec. per CM
   5 volts per CM



Foil # 912.3



OUTPUT SYNCHRONIZATION PUNCH
FIGURE I