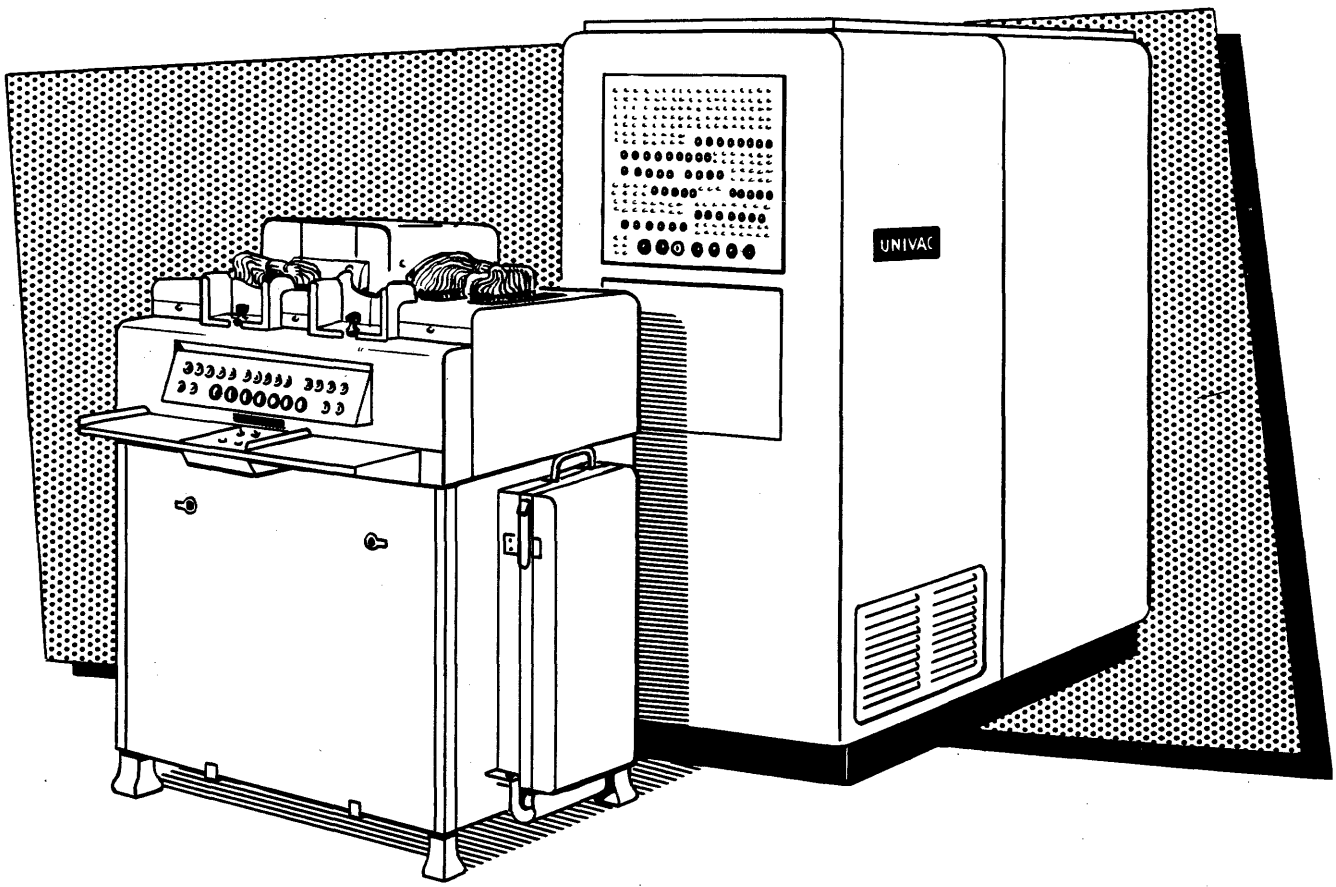
UNIVAC® FILE-COMPUTER DATA AUTOMATION SYSTEM



80 COLUMN CARD UNIT

ANOTHER SERVICE OF

MANAGEMENT SERVICES AND OPERATIONS RESEARCH

Remington Rand Univac

DIVISION OF SPERRY RAND CORPORATION

P R E L I M I N A R Y M A N U A L

80 COLUMN CARD UNIT

UFC

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Management Services & Operations Research
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Division of Sperry Rand Corporation

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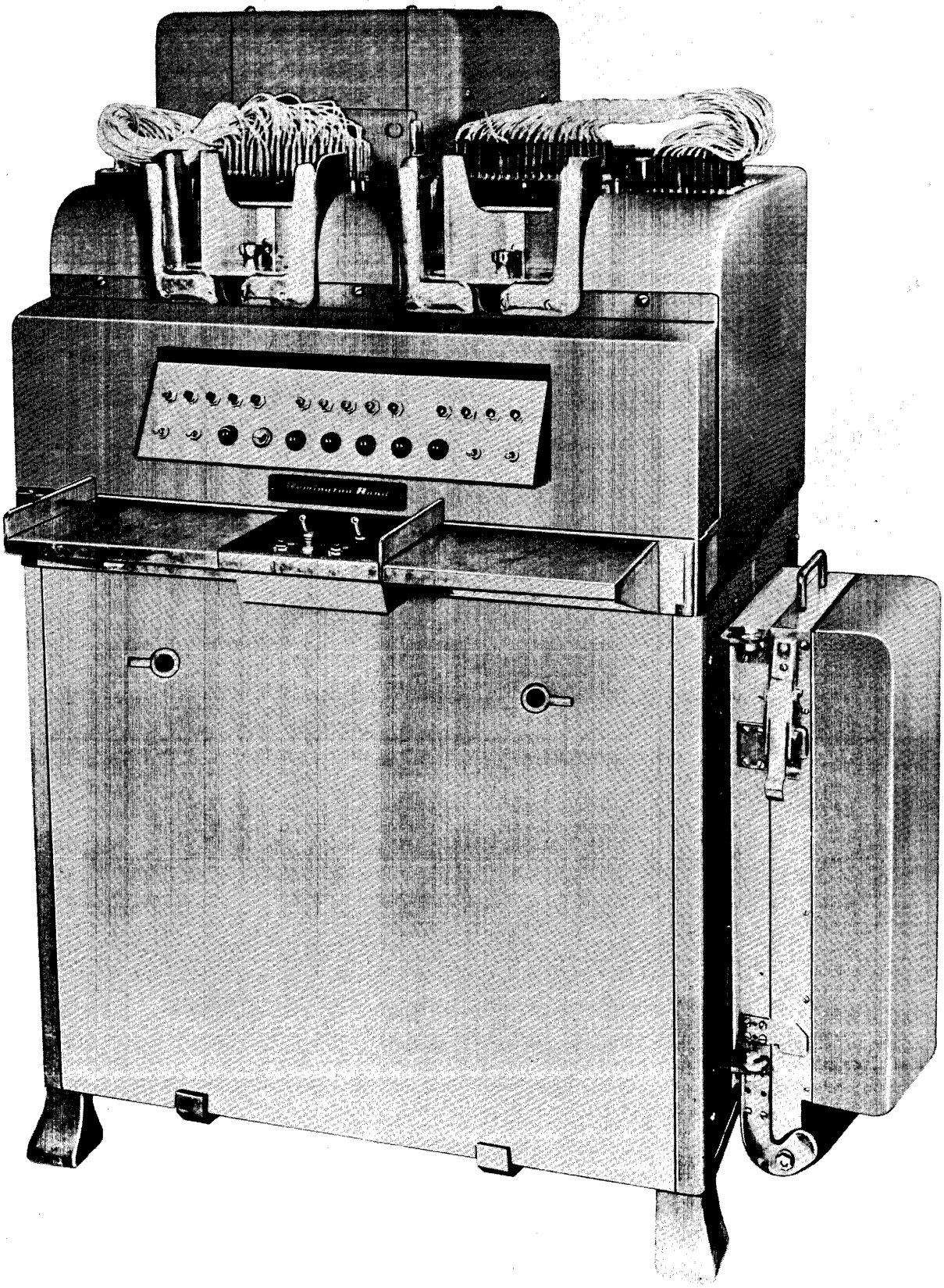


INTRODUCTION

The File-Computer

The Univac File-Computer, a medium sized member of the Remington Rand family of electronic computers, is distinguished by its building-block versatility. A central computer, at the present time, may be combined with 1 to 10 large capacity, random access storage drums, and from 1 to 10 input-output units.

Input-Output Devices

Each of the input-output devices is designed for a specific purpose; any one or all of them may be added to the computer to accomplish desired applications. Perhaps the most important feature of the input-output units is their ability to share operating time with the storage drums and the central computer so that all may operate simultaneously under control of a single program. An instruction to an input-output unit or instructions to several input-output units may be initiated without causing delay in the computer's execution of logical or arithmetic operations. A program from any source is therefore available in the operating memory of the computer at any required time, and all data processed by the program is either stored in the central computer or sent to an output device.

The 80 Column Card Unit

One of the input-output devices available for use in a Univac File-Computer System is the 80 Column Card Unit with Post-Read Checking and Post-Punch Checking. The complete unit includes the card processor and an adaptor. The card processor has two channels, a Read Channel and a Punch Channel each with separate input hoppers and separate output hoppers. This manual describes the operation of the 80 Column Card Unit, and contains computer programming examples, wiring examples, instructions and other pertinent information.

Purpose of the 80 Column Card Unit

Many firms, renting or purchasing a Univac File-Computer, use an 80 column card in their current tabulating installations. Since their company data processing operations are already geared to this card, many of these firms prefer to use the 80 column card in computing operations. The 80 Column Card Unit is designed for this purpose.

The two major features of the 80 Column Card Unit are listed below:

1. the ability to read input data recorded on 80 column tabulating cards in standard 80 column card code, translate this code into Univac 7 level code, and record the data in any desired format in the computer memory;

2. the ability to accept output data from the computer, translate it from Univac 7 level code to standard 80 column card code, and punch this data in standard 80 column tabulating cards.

Additional features of the 80 Column Card Unit include checking of the card reading, checking of the card punching, advancing the stack of cards in either of the two input hoppers independently of each other, detecting control punches, generating constant data, and providing selectors for possible variations in all of these functions.

The unit may be used in the manner listed below:

1. as a tabulating card input unit (reading from two stacks of cards simultaneously);

2. as a card output unit punching data into only one stack of cards;

3. as a combined input-output unit reading from one stack of cards, and punching into a second stack,

4. as a combined input-output unit, reading from the first stack and simultaneously reading from the second stack, but punching into the card from which it read in the second stack.

The 80 Column Card Unit is controlled entirely by computer commands transmitted over the computer-to-I/O control lines except during (manual) run-in and run-out. The Unit may alter the program by signals to the computer resulting from conditions such as control punches in the cards, failure of sensing to check a card run-out in the input hopper, or certain other conditions.

Method of Operation

Each channel in the 80 Column Card Unit has 5 processing card stations as shown in Figure 1.

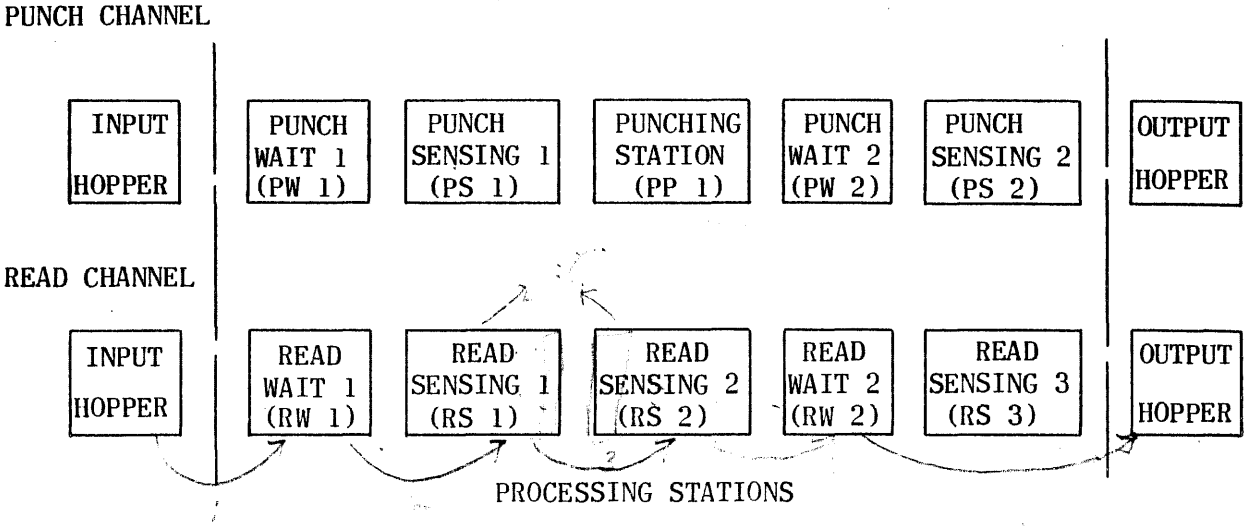


Fig. 1

The Unit operates in cycles, each card cycle being initiated by a "Program Complete" (PC) command originating from the computer program. This command indicates that the processing of a card has been completed, and that either or both of the two following acts may take place:

1. the results of computation should now be punched in an output card or;
2. data should now be read in from the next card.

In a card cycle, the cards may advance through one processing station. To advance a card from Read Wait 1 (RW1) or Punch Wait 1 (PW1), commands called, "Trip Read Feed" (TRF) and "Trip Punch Feed" (TPF) are required in addition to a Program Complete signal. The Unit is so constructed that cards cannot be held in the unit after they have passed the ~~RW1~~ RS1 or ~~PW1~~ PS1 stations. Five card cycles are required to move a card from the input hopper to its respective output hopper. One card cycle requires 400 milliseconds; the total processing time required for one card is 2,000 milliseconds; and the effective rate in either channel is 150 cards per minute since cards can move through all five stations in a channel simultaneously.

The operation of the 80 Column Card Unit consists of certain basic operations performed in a standard sequence, which may be modified by control commands and plugboard patching. The various types of operation are divided into two categories called Mode I and Mode II.

Mode I

In Mode I the Read Channel functions as the input of the Unit, and the Punch Channel functions as the output of the Unit. Cards are read in the Read Channel, while blank or prepunched cards are fed through the Punch Channel to receive the output data.

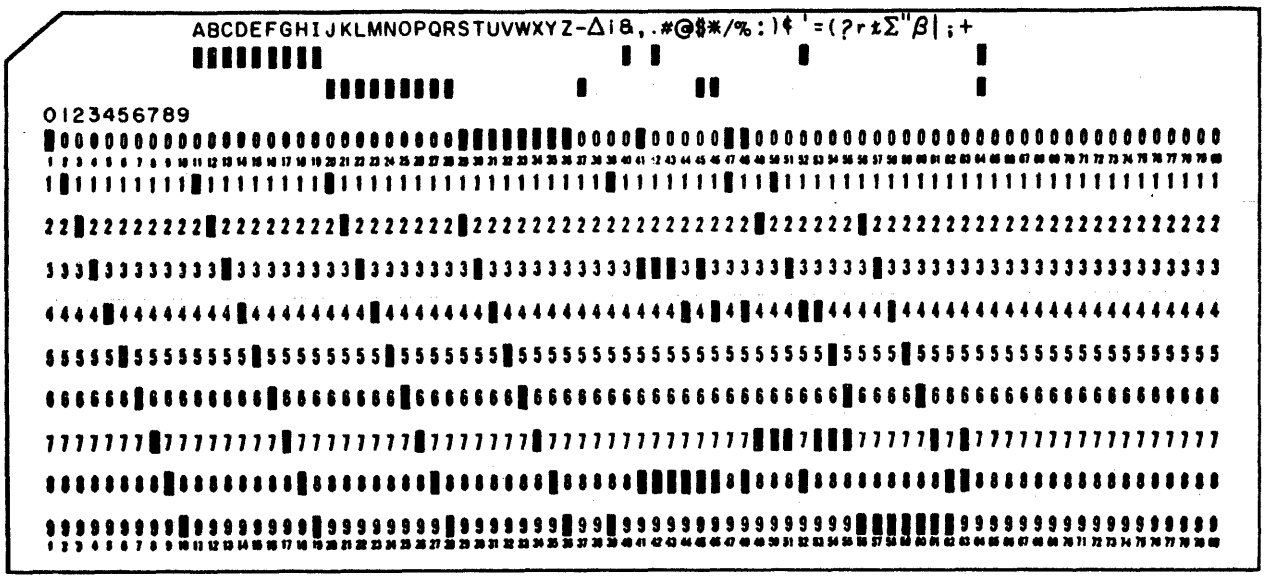
Mode II

In Mode II both the Read Channel and the Punch Channel may function as inputs to the computer. ~~However~~, The Read Channel operates as a card reader only, while the Punch Channel operates as a card reader with the additional ability to punch in the same card from which it read.

INPUT MEDIA

The 80 Column Card Unit accepts as input media only 80 column tabulating cards which are divided vertically into 4 zones. The top card zone is called the "12" zone, the second is called the "11" or "X" zone, the third is called the "0" zone and the fourth, which contains the numbers 1-9, is called the numeric zone.

Letters and characters are formed by combining one punch in the same card column. The letter A, for example, is formed by a "12" punch combined with "1" punch, the letter B by a "12" punch combined with a "2" punch. Please refer to Figure 2 for a graphic illustration. The Unit translates the 64 combinations of punches shown in Figure 2, into Univac 7 level code as shown in Figure 3.



80 Column Card and Codes

Fig. 2

XS3 / ZONE	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	
00	1 (ignore) 9-1	0 (space) no punch	0 — 11	1 0 0	0 1 1	1 2 2	1 3 3	0 4 4	0 5 5	1 6 6	1 7 7	0 8 8	1 9 9	0 ' 12-4-8	0 8 12	1 / 0-1	PARITY CHARACTER CARD CODE
01	0 ¬ 9-2	1 , 0-3-8	1 . 12-3-8	0 ; 9-8	1 A 12-1	0 B 12-2	0 C 12-3	1 D 12-4	1 E 12-5	0 F 12-6	0 G 12-7	1 H 12-8	0 I 12-9	1 # 3-8	1 ↓ 7-3	0 @ 4-8	PARITY CHARACTER CARD CODE
10	0 ↑ 9-3	1 " 9-5	1) 9-7	0) 7-1	1 J 11-1	0 K 11-2	0 L 11-3	1 M 11-4	1 N 11-5	0 O 11-6	0 P 11-7	1 Q 11-8	0 R 11-9	1 $ 11-3-8	1 * 11-4-8	0 ? 7-6	PARITY CHARACTER CARD CODE
11	1 Σ 9-4	0 β 9-6	0 : 7-2	1 + 7-8	0 / 0-1	1 S 0-2	1 T 0-3	0 U 0-4	0 V 0-5	1 W 0-6	1 X 0-7	0 Y 0-8	1 Z 0-9	0 % 0-4-8	0 = 7-4	1 11-12	PARITY CHARACTER CARD CODE

Facilities for the translation of the codes shown cross-hatched are optional (approximately 6 chassis). In most cases each character and its corresponding Univac code is that which is used for other Univac Printers and Typers.

Discussion

The 80 Column Card Unit is able to execute any of the following six control commands: Program Complete, Trip Read Feed, Trip Punch Feed, No Check-Punch, Skip, and Stop. The Program Complete is the only command which initiates any action. The other five commands are referred to as conditioning commands since they are not executed until a "Program Complete" is received by the 80 Column Card Unit.

Program Complete

The Program Complete command* initiates a card cycle in the 80 Column Card Unit when received with, or subsequent to, either Trip Read Feed, or Trip Punch Feed, or both. A Program Complete command should never be transmitted to the 80 Column Card Unit alone.

Trip Read Feed

The Trip Read Feed command* conditions the Unit so that when the next (or concurrent) Program Complete is received a card will advance from Read Wait 1 station through Read-Sensing 1 station during the next card cycle.

Trip Punch Feed

The Trip Punch Feed command* conditions the Unit so that when the next (or concurrent) Program Complete is received a card will advance from Punch Wait 1 station through Punch-Sensing 1 station during the next card cycle.

No Check-Punch

No Check-Punch command conditions the Unit so that when the next (or concurrent) Program Complete is received checking will be suppressed when the associated card in the punch channel moves through the Punch-Sense 2 station if the operation is Mode I. In a Mode II operation checking is suppressed when the card initiating the No Check command* moves through the Punch-Sense 2 station. In either mode, checking will be delayed until the proper card is in the sensing station.

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* The computer initiates the command as a result of calculation on card data.

Skip

The Skip command* conditions the Unit in either mode, so that when the next (or concurrent) Program Complete is received, the skipping of punching will be delayed until the proper card is in the Punch Punch 1 station.

Stop

The Stop command* conditions the Unit so that when the next (or concurrent) Program Complete is received the Unit stops before executing any other computer initiated instructions.

Timing

General: The mechanical construction of the System is such that it can cycle at a top speed of 150 cards per minute in both Channels.

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* The computer initiates the command as a result of calculation on card data.

COMMUNICATION BETWEEN THE COMPUTER AND THE 80 COLUMN CARD UNIT

Discussion

The exchange of control information between the computer and the 80 Column Card Unit is accomplished through a Demand Station. A complete exposition of the Demand Station concept is included in the UFC Model 1 Programmer's Manual.

In the UFC Model 0 System, two sets of control lines are used: Input-Output to Computer (I/O-to-C) control lines and Computer to Input-Output (C-to-I/O) control lines. In the UFC Model 1 System, three sets of control lines are used: the same two as above and High Speed Input-Output to Computer (HS I/O-to-C) control lines.

Demand

The 80 Column Card Unit is "On Demand" when the computer originates a Demand In signal, and remains On Demand until another I/O Unit is demanded or a Master Clear is given.

As a result of the Demand In signal, the low speed computer to input-output control lines, and the input-output to computer control lines are connected to the specified I/O Unit. The demand circuits are so constructed that a Demand In signal does not immediately reach the 80 Column Card Unit. Thus if, with an external program, a step out pulse is bussed to a computer to input-output control line, and to a Demand In the pulse over computer to input-output control line will either, affect the Unit if it is on demand at the time the pulse originated, or, (if it is not on demand at the time the pulse originated) the signal over the computer to input-output control line will be lost.

Ready Or Not Ready Status

The 80 Column Card Unit may be regarded as being in a "Ready" condition at that time when the input transfer is completed. The table below (Table I) lists the conditions governing the Ready (or Not Ready) status of the Unit in either Mode I or II.

TABLE I

MODE I - READY STATUS

	CYCLE TIME	FUNCTION	COMMENT
1.	Any time in the card cycle	Program Complete	Causes Unit to assume "Not Ready" status. It then remains in "Not Ready" status until next input transfer is complete.
2.	015-020 ms*	Input Transfer Complete	"Not Ready" to "Ready" Unit remains in "Ready" status until next "Program Complete" is received.

* After point in card cycle where Program Complete can actually take effect. This allows 380-385 ms., for computation, if computation is not begun until the 80 Column Card Unit is ready.

MODE II - READY STATUS

	FUNCTION	COMMENT
1.	Program Complete	Causes Unit to assume "Not Ready" status.
2.	Completion of Punch Channel Input Transfer	"Not Ready" to "Ready" Unit remains "Ready" until next DEMAND and track switch occur.
3.	Demand and Track Switch	"Ready" to "Not Ready" the track switch makes the Read Channel I/O track available for input transfer and Punch Channel data available for computation.
4.	Completion of Read Channel Input Transfer	"Not Ready" to "Ready" Unit remains "Ready" until next Program Complete is received.
5.	Program Complete	"Ready" to "Not Ready" starts repetition of cycle described in 1-4.

Demand Out

A Demand Out pulse requires three conditions: 1) a Demand In pulse, 2) the 80 Column Card Unit must be in the Ready status, and 3) there can be no special conditions present in the High Speed Control lines.

Special Out

A Special Out, like a Demand Out, requires three conditions: 1) a Demand In pulse, 2) the 80 Column Card Unit in the Ready status, and 3) there must be a special condition present in the (HS) I/O-to-C control lines. The (HS) I/O-to-C control lines are available only in the UFC Model 1. Part of the demand station circuitry consists of four (HS) I/O-to-C control lines designated as W, X, Y, and Z, over which control signals can be sent from the 80 Column Card Unit to the computer.

(HS) I/O-to-C control lines may be activated (through patchcord wiring) on the 80 Column Card Unit plugboard by signals resulting from the sensing of control holes in the card, end of file conditions, or error conditions. If an (HS) I/O-to-C control line has been activated, the regular Demand Out is inhibited, and a special out signal results, notifying the computer to test high speed control lines storage in order to determine which high speed control line was activated.

Input-Output To Computer Control Lines (I/O-to-C)

Input-output to Computer (I/O-to-C) control lines are used to send signals which can vary the program from the Input-Output Unit to the computer plugboard. These signals are continued until the end of the card cycle, in which they were initiated. The I/O-to-C control line signal on the computer plugboard lasts until either the 80 Column Card Unit goes off demand or until the end of the card cycle in which the signal was initiated, depending upon which condition occurs first. At the end of the card cycle, the 80 Column Card Unit automatically discontinues the I/O-to-C control line signals, causing the activated selectors to be dropped out.

In a Mode I operation the I/O-to-C control line signals are not discontinued until a Trip Read Feed command is received by the 80 Column Card Unit and executed. This enables selectors in the computer, which are picked up directly from I/O-to-C control lines, to remain in a select position when multiple cards are punched.

Input-Output To Computer High Speed Control Lines

In the demand circuitry of the UFC Model 1 there are four HSCLs over which program-altering signals may be sent from the I/O Unit to the Computer, hence the primary purpose of the HSCLs is to notify the computer when a special condition, such as a control hole sensing an end of file, or an error condition is detected by the 80 Column Card Unit. Circuits in the 80 Column Card Unit "remember" these signals until it is time to send them to the computer, and similar circuits in the computer will remember the signals received.

In a Mode I operation the high speed control line signals are not discontinued until a Trip Read Feed command is received by the 80 Column Card Unit and executed. Thus, any conditions set up in the computer's high speed control line memory are preserved by resetting the memory at the beginning of each cycle when multiple cards are punched.

With each "Demand In" the HSCL memory in the computer is cleared. At such time that the 80 Column Card Unit assumes a ready status the demand signal probes to see if any high speed control lines are active. If any of the lines are active a "Demand Out" is inhibited and a "Special Out" results. The resulting Special Out may then be used to instruct the computer program to examine HSCL memory to determine which line or lines were activated. The HSCL memory in the 80 Column Card Unit is cleared with the next Program Complete signal, indicating that the current translation is complete.

Computer-To-Input-Output Control Lines (C-to-I/O)

Computer to Input-Output (C-to-I/O) control lines are used to send control signals from the computer to the Input-Output Unit. For these signals to be received, the 80 Column Card Unit must be On Demand. When the signals are received on the 80 Column Card Unit plugboard they may be wired to an appropriate command hub. If this command is one of the conditional functions (see Instruction Repertoire), it is "remembered" by the Unit until the Program Complete signal is received and executed. The Program Complete signal takes effect immediately, or it is "remembered" by the Unit until that point in the card cycle when it can take effect.

Since the UFC Model 0 has only one I/O track for each demand station, the Computer and the input-output unit alternately share an input-output track address. When the 80 Column Card Unit is used with the Univac File-Computer, Model 0, an additional track is cabled to the correspondingly numbered demand position to which the 80 Column Card Unit is connected; in this manner the central computer, and the 80 Column Card Unit can use the same input-output track address simultaneously. Track switching, which may be affected only when the 80 Column Card Unit is On Demand, is accomplished by patchwiring a Demand Out or step out hub to C-to-I/O control line "J". C-to-I/O control line "J" serves this function only when the 80 Column Card Unit is used with the Univac File-Computer, Model 0.

Cycle Delays

Cycle delays are provided, on the plugboard of the 80 Column Card Unit, for delaying I/O-to-C and C-to-I/O control signals which are to be used in later card cycles. For example, the signals resulting from the detection of control holes, (identifying card types), at the Read-Sensing 1 station would require cycle delays to delay these program altering signals until the time that calculations are performed on data from this card. Assuming a Mode I operation 2 cycle delays would be required when either high speed or low speed I/O-to-C lines are used.

STARTING AND STOPPING THE 80 COLUMN CARD UNIT

Discussion

In either mode of operation starting or "run-in" is automatic while stopping or "run-out" is manual. The term "run-out" is used in this manual to describe the procedure employed, depending upon the computer program, to move the card, containing the results of the last computation, into the appropriate output hopper of the 80 Column Card Unit. Starting and stopping in both modes are discussed in detail below.

Mode I Run-In

Depressing the start button on the control panel of the 80 Column Card Unit, (after a Unit Master Clear), initiates an automatic run-in which establishes the proper relationship between the first read channel card and the first punch channel card. During run-in the 80 Column Card Unit assumes a Not Ready status. The Unit remains in a Not Ready status until the completion of the following events:

1. data from the first read channel card is transferred to the track currently connected to the 80 Column Card Unit,

2. an automatic track switch occurs making this data available to the computer,

3. data from the second read channel card is transferred to the other track, which is now connected to the 80 Column Card Unit as a result of the automatic track switch (2 above).

When the 80 Column Card Unit assumes the Ready status, signifying completion of the events listed above, the first read channel card is located at the Read Wait 2 station and the first punch channel card is located at the Punch Wait 1 station. Note that the first punch channel card is three cycles behind the corresponding read channel card.

If results from calculations on the data from the first read channel card are to be punched into the first punch channel card, the proper commands at the end of calculations must include a Program Complete, a Trip Read Feed, and a Trip Punch Feed, in addition to a Track Switch.

Mode I Run-Out

When the Read Channel input hopper is empty, indicating that the last read channel card is in the Read Wait 1 station, the 80 Column Card Unit will stop at the end of the cycle in which this condition (end of file) was detected. If there are no more cards to be processed the operator sets the End of File Read Feed switch (on the control panel of the 80 Column Card Unit) to "on".

This switch setting causes a continuous signal to be emitted from the EOFRF hub on the plugboard of the 80 Column Card Unit, in addition to enabling the unit to continue cycling even though there are no cards feeding from the input hopper. The EOFRF hub when patched by plugboard wiring through three read feed cycle delays to an I/O-to-C control line will signal the computer that it is processing the last read channel card. Depressing the Resume button on the control panel of the 80 Column Card Unit, after setting the End of File switch, causes the 80 Column Card Unit to resume operation.

The Computer will use this signal to vary the computer program for the last card so that when the last computation is complete, a Track Switch, a Program Complete, a Trip Punch Feed, and a Stop Command will be transmitted to the 80 Column Card Unit, instead of a Program Complete, Trip Read Feed, Trip Punch Feed, and Track Switch. The last punch channel card to be punched is at the Punch Wait 1 station ready to move through the Punch-Sensing 1 station when the cycling of the unit is stopped as a result of this Stop command. The four card cycles required to move the last punch card containing results of the last computation, into the output hopper, are manually initiated from the control panel of the 80 Column Card Unit by depressing the C-to-I/O button, on the control panel of the Unit, once and the manual Trip Punch Feed button three times. The computer programs (external and internal) designed to illustrate the method described above for Mode 1 run-out may be found in examples 7 and 8 of Computer Routines.

If desired, an alternate method of manual run-out may be employed, where the EOFRF hub is patchwired through four cycle delays to a high or low speed control line. In this instance the signal will be used to vary the computer program after the last read channel card has been computed so that a Program Complete and Stop command will be transmitted to the 80 Column Card Unit instead of a Program Complete, Trip Read Feed, and Trip Punch Feed, and Track Switch. The last punch channel card to be punched is at the Punch-Sensing 1 station when the cycling of the unit is stopped as a result of the Stop command. The three card cycles, that are required to move the last punch card (containing the results of the last computation) into the output hopper, are manually initiated from the control panel of the 80 Column Card Unit by depressing the manual Trip Punch Feed button three times. The computer program (external) designed to illustrate this method for Mode I run-out may be found in example 8 of Computer Routines.

If multiple cards are to be punched for any card being read, determination of the end of the run must come from both the 80 Column Card Unit, and the computer program. The 80 Column Card Unit determines if there are any more cards to be read (end of file condition has been reached in the read channel) and the computer program determines if there are any more cards to be punched.

Mode II Run-In

The start button, on the control panel of the 80 Column Card Unit (after a Unit Master Clear), initiates an automatic run-in causing the Unit to cycle

until the input transfer of data from the first punch channel card is complete, and data from the first read channel card has been delivered to read channel input storage (buffer A). Up to this time the 80 Column Card Unit has been in a Not Ready status. Upon completion of the above the unit assumes a Ready status. The data from the first punch channel card is then available for computation. Unlike the Mode I run-in, there is no automatic track switch. It must, therefore, be initiated by the computer program. The data from the first punch channel card may be computed, and the results punched in the same card, before any calculations are made on the first read channel card or the data from the first punch channel card may be computed upon, after which a track switch is initiated making the read channel data available for computation. After completion of computation on the read channel data, another track switch is initiated making the results of computation on the punch channel data available for output transfer.

Mode II Run-Out

When feeding operations are not intermittent in either channel, the run-out procedure is determined by the last end of file condition to be detected by the 80 Column Card Unit.

The End of File hubs (EOFRF & EOFPF) on the plugboard of the 80 Column Card Unit provide signals which are patchwired through cycle delay hubs to Input-Output-to-computer control lines. These signals notify the computer program when either input hopper is empty so that the program may be altered accordingly.

Read Channel

When the read channel input hopper is empty, indicating that the last read channel card is in the Read Wait 1 station, the 80 Column Card Unit will stop at the end of the cycle in which this condition (end of file read feed) was detected. If there are no more cards to be processed in this channel, the operator sets the End of File Read Feed switch to on. This setting causes a continuous signal to be emitted from the EOFRF hub on the plugboard of the 80 Column Card Unit, in addition to enabling the unit to continue cycling even though there are no cards feeding from the input hopper. Depression of the Resume button, after setting the End of File switch, causes the 80 Column Card Unit to resume its operation.

When the EOFRF hub is patchwired through 2 cycle delays the signal will be received by the computer after the last read channel card has been processed by the computer program, and just before the beginning of calculation on punch channel data. The End of File signal may then be used to vary the computer program, by setting connectors or energizing selectors, so that the part of the computer program concerned with read channel calculations may be skipped.

Read Channel Run-Out

If the End of File Read Feed occurs after the End of File Punch Feed, indicating that the last calculation will be performed on data from a read channel card, the EOFRF signal may be used to vary the computer program so that a Program Complete, and Stop command in addition to a Track Switch will be transmitted to the 80 Column Card Unit after computation. The operator may, by depressing the Manual Trip Read Feed button twice, move the last read channel card into the read channel output hopper.

Punch Channel

When the punch channel input hopper is empty, indicating that the last punch channel card is in the Punch Wait 1 station, the 80 Column Card Unit will stop at the end of the cycle in which this condition (End of File Punch Feed) was detected. If there are no more cards to be processed in this channel the operator sets the End of File Punch Feed switch to on. This switch setting causes a continuous signal to be emitted from the EOFPF hub on the plugboard of the 80 Column Card Unit. Depressing the Resume button after setting the End of File switch causes the 80 Column Card Unit to resume its operation. When the EOFPF hub is patchwired through one cycle delay the signal will be received by the computer just before computation is begun on the last punch channel card. The End of File signal may then be used to vary the computer program so that, in subsequent cycles, the part of the computer program, dealing with punch channel calculations, may be skipped.

Punch Channel Run-Out

If the End of File Punch Feed occurs after the End of File Read Feed, indicating that the last calculation will be performed on data from a punch channel card, the EOFPF signal may be used to vary the computer program so that Program Complete, Trip Punch Feed, and Stop commands in addition to a Track Switch will be transmitted to the 80 Column Card Unit after computation. The operator may, by depressing the C-to-I/O button on the control panel of the 80 Column Card Unit once, and the Manual Trip Punch Feed button twice, move the last punch channel card into the punch channel output hopper.

The computer program, flow chart, and wiring diagram designed to illustrate the method described above for Mode II Run-Out may be found in example 10 of Computer Programming Exit Routine for Mode II Manual Run-Out.

Timing

In Mode I a maximum card processing rate of 150 cards per minute may be obtained provided:

1. the computation time does not exceed 400 milliseconds when computation is begun before the 80 Column Card Unit is ready,

2. the computation time does not exceed 380-385 milliseconds when computation is begun after the 80 Column Card Unit is ready.

However, when computation time is less than the time cited above for each case, the card processing rate is not increased since 150 cards per minute is the maximum card processing rate. If the computation time exceeds the time cited above for each card, the cycle time (from which the card processing rate may be calculated) must be determined by an actual systems test of the unit with the computer, since the cycle time is a function of many variables.

ERROR DETECTION AND RECOVERY

Checking of Sensing

Provision is made in the 80 Column Card Unit for checking the sensing and punching of data recorded in the cards. If an error occurs the Unit stops at the end of the card cycle in which the error occurred. Indicator lights on the display panel of the adapter unit show:

1. the compare station (Read-Sensing 2 or Punch-Sensing 2) at which the error occurred;

2. the buffer position "Word and Character" which is involved;

3. the rows of the card which are involved.

Before the Unit can resume operation the error circuits must be manually cleared from the control panel. Depressing the appropriate card control reset button (RS2) causes a signal to be emitted at the appropriate error hub (RS2-1, RS2-2, PS2) on the plugboard of the 80 Column Card Unit. Depressing the resume button clears the error circuits and enables the Unit to continue cycling. The error signal, resulting from depressing the appropriate card control reset button may be used to notify the Computer, via I/O-to-C control lines, that a comparison error has occurred, and the computer program can then be varied as required. (Use of the checking features in error recovery is discussed in more detail under computer programming.) The absence of a card in Read-Sensing 2 or Punch-Sensing 2 automatically suppresses checking.

FEED FAILURE

Discussion

Read Wait 1 and Punch Wait 1 errors indicate the failure of the 80 Column Card Unit to advance a card from an input hopper to its respective wait station. The 80 Column Card Unit will stop at the end of the card cycle in which this condition was detected.

MODE I

Read Wait 1

If the condition detected is the result of a card jam in the input hopper of the read channel, a Read Wait 1 error results. After removing the jammed card from the input hopper and replacing the cards, the operator may, by depressing the appropriate card control reset button (RW1), cause the RW1 error hub on the plugboard of the 80 Column Card Unit to emit. Depressing the resume button clears the error circuits and enables the unit to continue operation.

However, since this condition has caused a gap in the flow of cards in the read channel, (i.e., no card in the RS1 station) input transfer of data from the card preceding the gap (the card at the RS2 station) is inhibited. This condition makes it necessary to vary the computer program in the second cycle, after the occurrence of the card jam, if high speed or low speed I/O→C control lines are to be active during the calculation of the card preceding the card jam. The program flow chart shown in Figure 4 is designed to handle this case.

Patchwiring the Read Wait 1 error hub through 2 read feed cycle delays will cause entry to a subroutine which causes a track switch; thus, enabling computation on the data from the card presently at the Read Wait 2 station. After computation, the following control commands are transmitted to the 80 Column Card Unit over C→I/O control lines: Program Complete, Trip Read Feed, and Trip Punch Feed in addition to a track switch. The special out, that occurs with the demand used to transmit these control commands, is used to set a connector (1b in the flow chart) which will skip calculation in the next card cycle, i.e., the third card cycle after the card jam. The skip calculation subroutine is programmed so that the punching of data, previously punched and still contained on the input-output track connected to the computer during the skip calculation subroutine, will be inhibited.

Punch Wait 1

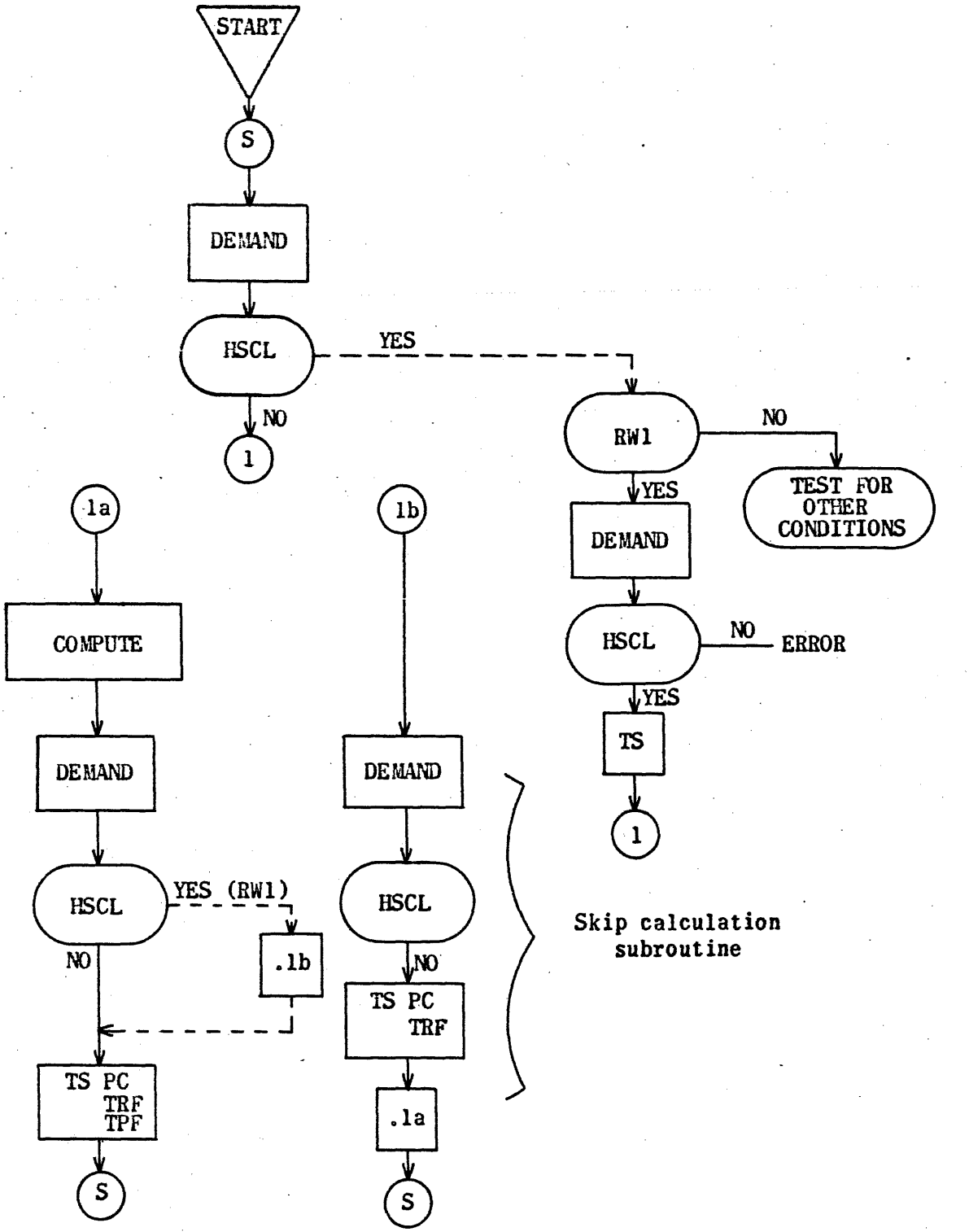
A card jam in the input hopper of the punch channel of the 80 Column Card Unit results in a Punch Wait 1 error. Although similar to a Read Wait 1 error, this condition may be handled entirely from the control panel of the 80 Column Card Unit in a Mode I operation.

The operator, after removing the jammed card from the input hopper and replacing the cards, will depress the Manual Trip Punch Feed button on the control panel. As a result, the card in the punch channel input hopper is advanced to the station. Since the Manual Trip Punch Feed was not accompanied by a Manual Trip Read Feed, only that card at the Read-Sensing 1 station and those cards preceding it are advanced. Note that the card at the Read Wait 1 station is not advanced. The 80 Column Card Unit will continue operation for one cycle; and then stop. The operator may, by depressing the resume button, cause the 80 Column Card Unit to continue its normal operation.

The procedure described above is employed to delay, until the following card cycle, the output transfer of that data which resulted from computation on the card located at the Read Wait 2 station at the time the 80 Column Card Unit stopped after detecting the Punch Wait 1 error. In this manner, the punching of data resulting from calculations on the card at the Read Wait 2 station is inhibited until the gap in the card flow is past the Punch Punch 1 station.

MODE II

The computer program flow chart shown in Figure 5 illustrates the skipping of computation when the procedure described below for handling Read Wait 1 and Punch Wait 1 errors is employed.



NOTE: The Read Wait 1 error hub (RW1) is patchwired through 2 read feed cycle delays.

Feed Failure - Mode I

Fig. 4

Read Wait 1

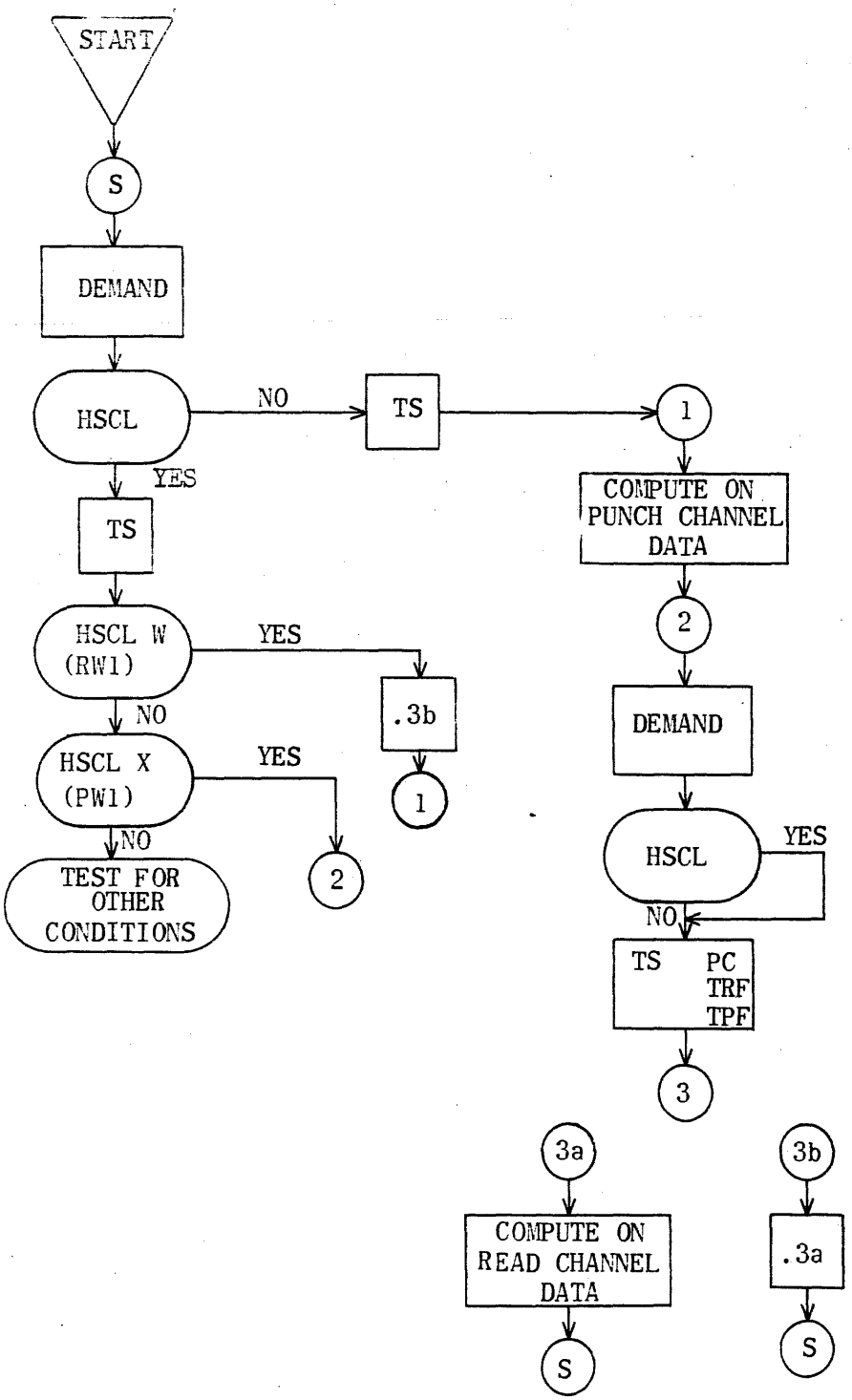
If the condition detected is the result of a card jam in the input hopper of the read channel, a Read Wait 1 error results. After removing the jammed card from the input hopper and replacing the cards, the operator may, by depressing the appropriate card control reset button (RW1), cause a signal to be emitted from the RW1 hub on the plugboard of the 80 Column Card Unit. Depressing the resume button will clear the error circuits and enable the Unit to continue operation.

Since this condition has caused a gap in the flow of cards in the read channel (i.e., no card in the RS1 station) both input transfer to the read channel input storage and the subsequent transfer to the I/O track are inhibited in the following cycle which results from the depression of the resume button. Thus, the read channel computation in the next cycle should be skipped. The programmer may accomplish this by patchwiring the Read Wait 1 error hub, through one cycle delay, to a high speed I/O-to-C control line, which is used to signal the computer to skip read channel calculation in the next cycle.

Punch Wait 1

If the condition detected is the result of a card jam in the input hopper of the punch channel, a Punch Wait 1 error results. After removing the jammed card from the input hopper and replacing the cards the operator may by depressing the appropriate card control reset button (PW1) cause a signal to be emitted from the PW1 hub on the plugboard of the 80 Column Card Unit. Depressing the resume button will clear the error circuits and enable the Unit to continue operation.

Since this condition has caused a gap in the flow of cards in the punch channel (i.e., no card in the Punch-Sense 1 station) input transfer to the punch channel input storage and the subsequent transfer to the I/O track is inhibited in the cycle following which results from depression of the resume button. As a result, it is desirable to skip punch channel calculations in the current cycle. This may be accomplished by patchwiring the Punch Wait 1 error hub through one punch feed cycle delay to a high speed or low speed control line, which is used to signal the computer that punch channel computations are to be skipped in this cycle.



(a) KEY: TS = Track Switch
PC = Program Complete
TRF = Trip Read Feed
TPF = Trip Punch Feed

(b) RW1 hub is patchwired through one cycle delay to HSCL W

(c) PW1 hub is patchwired through one cycle delay to HSCL X

Feed Failure Mode II

Fig. 5

CONNECTION PANEL (Plugboard)

The 80 Column Card Unit includes a plugboard as part of its control system. The plugboard permits format control, checking of sensing and punching, synthetic punching, editing, and various control operations. Table II lists the hubs found on the plugboard. Groups of hubs described in Table II are listed as either emitting (E) or receiving (R). When groups of hubs, such as those that make up the poles of a selector, are used to reroute current, they are recorded as both receiving and emitting (R/E). Row time is defined as the time taken to sense the 12 rows of the 80 column card (12-11, 0-9).

Under types of current, the following types are available on the plugboard of the 80 Column Card Unit.

Current	Abbreviation Used
7 volt (20 microseconds) Clock Pulse	7V(20us.)CP
7 volt (variable) Pulse	7V(var.)P
10 volt (continuous) Power	10V(cont.)P
50 volt (continuous) Power	50V(cont.)P
50 volt (10 milliseconds) Enable	50V(10ms.)E
50 volt (15 milliseconds) Enable	50V(15ms.)E
50 volt (variable) Enable	50V(var.)E

Table II Description of Connection Panel Hub Functions

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Read-Sensing Station One (RS1)	(19-58) (j-k)	E	50V(10ms.)E	80	Represents the card columns read for assignment of data to input storage positions. Patchwired to read-input storage positions.
Read-Input Storage	(9-68) (h-i)	R	50V(10ms.)E	120	Represents the input storage positions used for the assignment of data in card columns to input storage.
Read-Sensing Station Two (RS2)	(19-58) (r-s)	E	50V(10ms.)E	80	Represents the card columns containing data which is to be compared with data recorded in read-input storage positions, (patchwired to read-check positions).
Read-Check	(9-68) (t-u)	R	50V(10ms.)E	120	Used to arrange the data from the card columns in input storage format for checking purposes.
Read-Sensing Station Three (RS3)	(19-58) (f-g)	E	50V(10ms.)E	80	Represents card columns which may be patchwired to punch-input storage positions to simulate reading and punching in the same card in a Mode I operation, (see example in Wiring Instructions section).

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Punch-Sensing Station One (PS1)	(19-58) (b-c)	E	50V(10ms.)E	80	Represents card columns read in punch channel for assignment of data to punch-input storage positions, (Buffer M).
Punch-Input Storage	(9-68) (b-e)	R	50V(10ms.)E	120	In Mode I these hubs are most frequently used to receive data read from RS3 station in read channel for transfer to Buffer M where it is merged with computed data from the computer so as to simulate reading and punching in the same card. In Mode II these hubs assign data read from the card at the PS1 station of the punch channel to the desired input storage positions in Buffer M, (see Mode I and Mode II Card Flow Diagrams).
Output Storage	(9-68) (J-K)	E	7V(20us.)CP	120	Represents the output storage positions used for assignment of data to card columns for punching.
Storage Punching	(19-58) (C-F)	R	7V(20us.)CP	80 Bussed Pair	Used to assign data, contained in output storage positions, to card columns for punching.
Control Punching	(19-58) (A-B)	R	50V(10ms.)E 50V(15ms.)E	80	Provides a method of punching control data or constant data in card columns. (Patchwired from position emitters).

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Punch-Sensing Station Two (PS2)	(19-60) (Q-R)	E	50V(10ms.)E	80	Represents the card columns containing data which is to be compared with data stored in Buffer M.
Punch-Check	(9-68) (O-P)	R	50V(10ms.)E	120	Used to arrange data from the card columns in a Buffer M format for checking purposes.
Read-Check Suppress	(10-68) (v)	R	7V(20us.)CP or 10V(cont.)P	59	Used to suppress checking of data read at read sensing station 1 and stored in read-input storage positions. Patchwired from read-check clock positions.
All	(9) (v)	E	10V(cont.)P	1	Used to suppress all checking of data read into input buffer.
Read-Check Clock	(9-68) (w-x)	E	7V(20us.)CP	120	Represents read-input storage positions where checking is to be suppressed.
Punch-Check Suppress	(10-68) (N)	R	7V(20us.)CP or 10V(cont.)P	59	Used to suppress checking of data read at punch-sensing station 1, and stored in punch-input storage positions.
All	(9) (N)	E	10V(cont.)P	1	Used to suppress all checking of sensing and punching in punch channel.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Punch-Check Clock	(9-68) (L-M)	E	7V(20us.)CP	120	Represents punch-input storage positions where checking is to be suppressed.
Mode	(5-7) (A) I, II	E R	10V(cont.)P	3	Used to determine the mode of operation of the input-output unit.
Position Extractor In (A & B)	(5-6) (f)	R	50V(10ms.)E	2	Provides the programmer with a method of detecting control holes in a given card column. When the position extractor "IN" hub is wired to a card column sensing hub such as a punch-sensing station 1 hub, a current is emitted from a 0-12 position extractor hub or hubs corresponding to the hole or holes punched in the control column being sensed. These hubs may then be wired to selector pickups or I/O-to-C control lines to vary the computer program.
Position Extractor	(5-6) (R-X) (a-e)	E	50V(10ms.)E	12 (per distr.)	
Selector Control	(3-4) (T-X) (a-g)	E	50V(15ms.)E	12 Bussed Pair	Current emitted from these hubs may be used to pick up selectors. Selectors picked up in this manner are picked up before the beginning of the row time denoted by the selector control hub wired to the selector pickup so that the corresponding row read may be affected.

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Position Emitter	(3-4) (H-S)	E	50V(10ms.)E	12 Bussed Pair	Provides a means of punching card code bits (12-11, 0-9) in a punch channel card without requiring storage of corresponding card code bit.
Program Complete (PC)	(8) (C-D)	R	7V(var.)P	2	The program complete command initiates a card cycle in the 80 Column Card Unit when received with, or subsequent to, either trip read feed, or trip punch feed, or both. A program complete command should never be transmitted to the 80 Column Card Unit alone.
Trip Punch Feed (TPF)	(10) (C-D)	R	7V(var.)P	2	The trip punch feed command conditions the unit so that when the next (or concurrent) program complete is received, a card will advance from punch wait 1 station through punch-sensing 1 station during the next card cycle.
Trip Read Feed (TRF)	(9) (C-D)	R	7V(var.)P	2	The trip read feed command conditions the unit so that when the next (or concurrent) program complete is received a card will advance from read wait 1 station through read-sensing 1 station during the next card cycle.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Skip (SP)	(11) (C-D)	R	7V(var.)P	2	The skip command conditions the unit so that, in either mode, the skipping of punching will be delayed until the proper card is in the Punch Punch 1 station.
No Check Punch (NCP)	(12) (C-D)	R	7V(var.)P	2	No check punch command conditions the unit so that when the next or concurrent program complete is received checking will be suppressed when the associated card in the punch channel moves through the punch sense 2 station, if the operation is Mode I. In a Mode II operation checking is suppressed when the card initiating the no check command* moves through the punch sensing 2 station. In either mode checking will be delayed until the proper card is in the sensing station.

* The computer initiates the command as a result of calculation on card data.

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Stop	(13) (C-D)	R	7V(var.)P	2	Used to stop the operation of the I/O unit with current program complete. Usually patchwired from a condition detected by computer.
Stop	(7-8) (h)	R	50V(10ms.)E 50V(15ms.)E	2	Used to stop the operation of the I/O unit with the next program complete. Usually patchwired from a condition detected by the I/O unit.
Computer→I/O Control Lines (C→I/O)	(8-17) (A-B)	E	7V(var.)P	10 Bussed Pair	Used to send control signals from central computer to input-output unit.
I/O→Computer Control Lines (I/O→C)	(3-4) (h-s)	R	50V(10ms.)E 50V(15ms.)E 50V(var.)E	12 Bussed Pair	Used to transmit control signals from input-output unit to the computer. These signals may be used on the computer control plugboard to pick up selectors.
S.P. out High Speed I/O →Computer (HSCL)	(10-11) (j-m)	R	50V(10ms.)E 50V(15ms.)E 50V(var.)E	4 Bussed Pair	Used to transmit control signals from input-output unit to the computer. These signals set the incoming control line storage so that the next internal program step may be selected.
All Points Emitter	(5-6) (g)	E	50V(10ms.)E	2 Bussed Hubs	Emits a current at every row time, (i.e., twelve 12-ms., signals per card cycle).

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
SC-12	(19-20) (q)	E	50V(15ms.)E	2 Bussed Hubs	Emits signal just before and during row 12 time.
SC-11	(21-22) (q)	E	50V(15ms.)E	2 Bussed Hubs	Emits signal just before and during row 11 time.
SC-0-9	(21-22) (X) (23-24) (q)	E	50V(before row 0 and through row 9 time)	2 Bussed Hubs	Emits one prolonged signal just before and throughout the 0 through 9 interval of row time.
B+	(23-24) (X)	E	50V(cont.)P	3 Bussed Hubs	Used to hold a selector or a column split selector in for more than one card cycle.
Selector Memory	(12-14) (E-H)	R/E	7V(var.)P 50V(var.)E	4 sets of 3 1 in 2 out	Used to convert enable received over C-to-I/O lines to interrupted B+ which in turn may be used to pick up selectors.
Selector Pickup	(1-2) (E-X) (a-x)	R	50V(cont.)P 50V(10ms.)E 50V(15ms.)E 50V(var.)E	44 Bussed Pair	Used to energize or "pickup" the corresponding selector. Energizes selector for one card cycle only.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Selectors	(28-57) (l-q) (26-60) (S-X) (20-49) (C-I)	R/E	any type	20 two Pole 24 five Pole	Used to route a current one of two ways. Current entering common hub comes out either at the select or nonselect pole depending on whether or not the particular selector is energized or "picked up".
Alternate Switch	(5-7) (B-D)	R/E		3 single Pole	Used in a manner similar to other selectors except that they are manually picked up by switches on the control panel.
Unibus	(12-16) (j-m) (12-16) (u-x)	in R out E	50V(10ms.)E 50V(15ms.)E 7V(var.)P	8 sets of 5 4 in 1 out	Used where several sources are to be directed to a common destination. Diode protection in hubs prevents back circuits. It is similar to an "or" gate. Different current levels such as 50V and 7V may not be patched to the same unibus.
Cycle Delay	(5-8) (i-s) (10-17) (n-s) (8-11) (E-G)	in R out E	50V(10ms.)E 50V(15ms.)E 50V(var.)E 50V(var.)E		Used to delay I/O-to-C and C-to-I/O control signals in addition to the control signals originating and terminating in 80 Column Card Unit, for one cycle. Cycle delays may be patchwired in series to delay control signals for more than one card cycle.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Cycle Delay Control (Conv. Cyc. Del. to TRF/TPF)	(15-16) (G-H)	R/E	50V(cont.)P	6 sets of 2 ea.	Used to control emission of signals from cycle delay out hubs of the correspondingly lettered group (A-F). The bottleplugging of the 2 hubs associated with each group of cycle delays causes the out hubs, of any cycle delays wired, to emit at the beginning of the next cycle when a program complete is accompanied by either or both trip commands. Cycle delay control hubs not bottleplugged will emit only when control commands are accompanied by a trip read feed command.
End of File Read Feed (EOFRF)	(18) (j-h)	E	50V(cont.)E	2	Used to signal end of file condition in the read channel. No card in the input hopper of the read channel causes an indicator to light on the control panel and the unit to stop at the end of the cycle in which the condition was detected. Setting the end of file read feed switch to "on" will cause a signal to be emitted from the end of file read feed (EOFRF) hub on the plugboard, in addition to enabling the unit to continue cycling when there are no more cards in the read channel input hopper.

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
End of File Punch Feed (EOFPF)	(17) (j-k)	E	50V(cont.)P	2	Used to signal end of file condition in the punch channel. No card in the input hopper of the punch channel causes an indicator to light on the control panel and the unit to stop at the end of the cycle in which the condition was detected. Setting the end of punch feed switch to "on" will cause a signal to be emitted from the end of file punch feed (EOFPF) hub on the plug-board, in addition to enabling the unit to continue cycling when there are no more cards in the punch channel input hopper.
Read Wait One (RW1)	(18) (r-s)	E	50V(var.)E	2	Used to signal failure of the unit to advance a card from the read channel input hopper to the read wait 1 station. No card in the read wait 1 station causes an indicator to light on the display panel of the adapter and the unit to stop at the end of the cycle in which the condition was detected. Depressing the appropriate card control reset button (RW1) on the control panel of the 80 Column Card Unit will cause a signal to be emitted from the read wait 1 hub on the plugboard.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Punch Sensing Two (PS2)	(18) (p-q)	E	50V(var.)E	2	Used to signal a comparison error in card in punch sensing 2 station. This error will cause an indicator to light on the display panel of the adapter and the unit to stop at the end of the cycle in which the error was detected. Depressing the appropriate card control reset button (PS2) on the control panel of the 80 Column Card Unit will cause a signal to be emitted from the punch sensing 2 hub on the plugboard.
Read Sensing Two-1 (RS2-1)	(18) (n-o)	E	50V(var.)E	2	Used to signal a comparison error when the program complete initiating the cycle in which the error occurred was accompanied by a trip read feed (i.e., when there is a card at the read sensing 1 station). This error will cause an indicator to light on the display panel of the adapter, and the unit to stop at the end of the cycle in which the error was detected. Depressing the appropriate card control reset button (RS2) on the control panel of the 80 Column Card Unit will cause a signal to be emitted from the read sensing two-1 hub on the plugboard.

Nomenclature	Plugboard Coordinates	Current R or E	Type	No. of Hubs	Predominant Programming Use
Read Sensing Two-2 (RS2-2)	(18) (1-m)	E	50V(var.)E	2	Used to signal a comparison error when the program complete initiating the cycle in which the error occurred was not accompanied by a trip read feed i.e., when there is no card at the read sensing 1 station (intermittent feeding in the read channel).
Punch Wait One (PW1)	(17) (1-m)	E	50V(var.)E	2	Used to signal failure of the unit to advance a card from the punch channel input hopper to the punch wait 1 station. No card in the punch wait 1 station causes an indicator to light on the display panel of the adapter and the unit to stop at the end of the cycle in which the condition was detected. Depressing the appropriate card control reset button (PW1) on the control panel of the 80 Column Card Unit will cause a signal to be emitted from the punch wait 1 hub on the plugboard.

Nomenclature	Plugboard Coordinates	R or E	Current Type	No. of Hubs	Predominant Programming Use
Pick Up	(19-27) (o-p) (17-25) (v-w)	R	50V(15ms.)E	18 Bussed Pair	Used to pick up the correspondingly numbered column-split selector. It will energize the column-split selector only as long as current is received at pick up. Thus if a row (12, 11, 0-9) in selector control is wired to pick up, selector will be in select position for approximately 15ms., which is enough time to affect that row.
Column-Split Selector	(19-27) (1-n) (17-25) (s-u)	R/E	any	18 single Pole	Used in same manner as selector described in another section of this table.

WIRING INSTRUCTIONS FOR 80 COLUMN CARD UNIT CONNECTION PANEL

The following examples illustrate the basic patch cord wiring necessary to accomplish format control, checking control, editing, detecting of control information for the computer, and sending of control information to the computer.

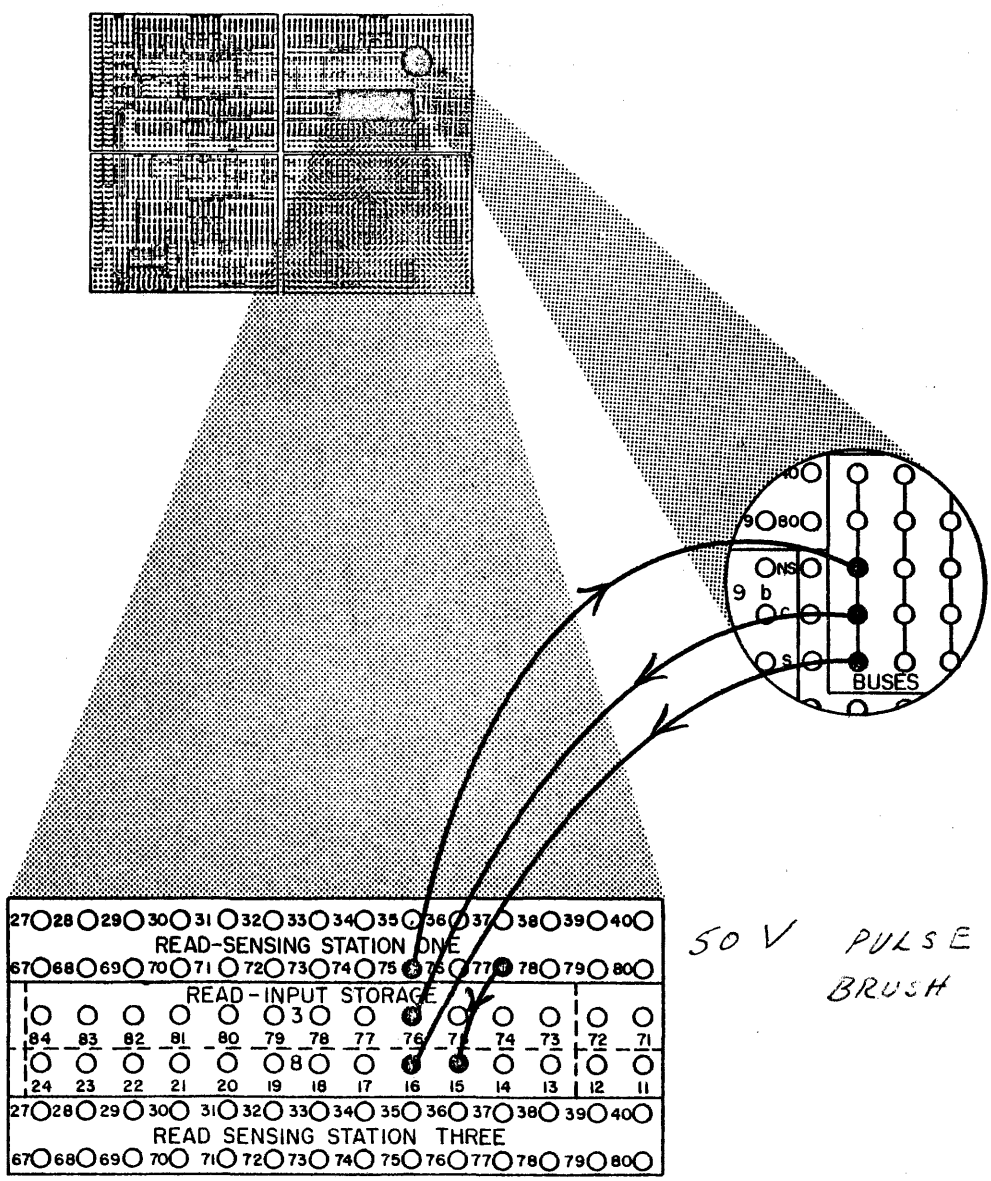
By using these procedures in various combinations, numerous programming requirements can be fulfilled.

Subject: The assignment of data in card columns to Read-Input storage positions in Mode I or II.

Problem: To store data in card column 77 in Read-Input storage position 15; to store data in card column 75 in Read-Input storage positions 76 and 16.

Procedure: a. Patchwire Read-Sensing station one hub 77 to Read-Input storage hub 15.

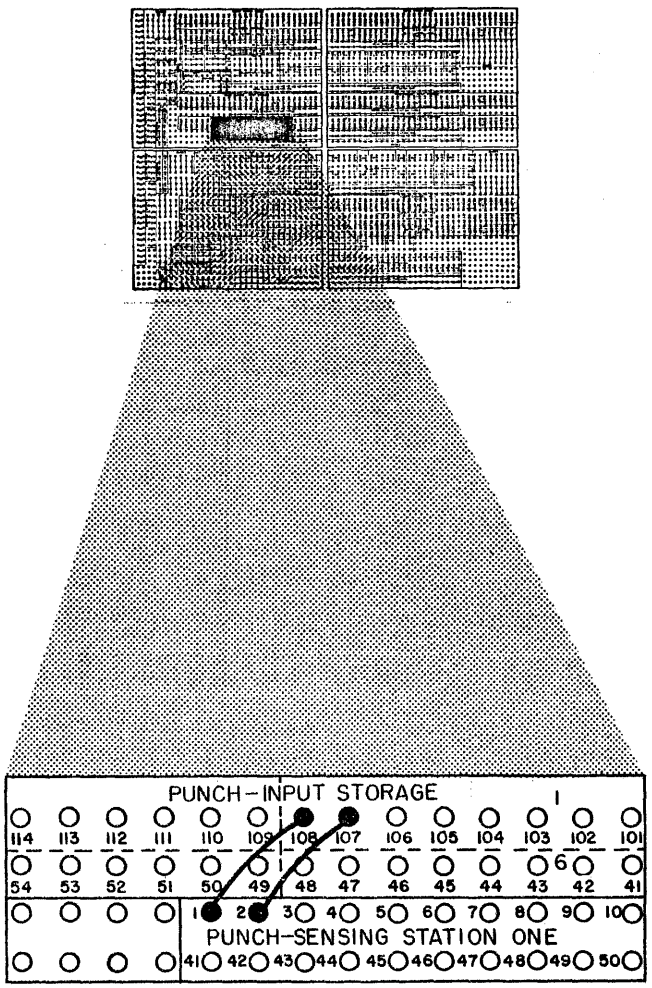
b. Patchwire Read-Sensing station one hub 75 to a bus which is patchwired to Read-Input storage positions 76 and 16.



Subject: <u>The assignment of data in the card columns to Punch-Input storage positions in Mode I or II.</u>

Problem: To store data in card column 1 and 2 in Punch-Input storage positions 108 and 107. (Buffer M).

Procedure: a. Patchwire Punch-Sensing station one (hubs 1 and 2) to Punch-Input storage positions 108 and 107 respectively.



Subject: The assignment of numeric data and sign overpunched in the same card column to input storage positions in Mode I or II.

Note: In those cases where the data in a given card column is always numeric, zone 11 or 12 may be used to pack the sign of any field. When this system of packing is used, a minus sign is represented customarily by an 11 punch and a plus sign by the absence of an 11 punch in the card column.

Problem: Card column 43 contains numeric data and the sign of that data. Store the numeric portion of the data contained in card column 43 in Read-Input storage* position 110 and the sign portion of that column in Read-Input storage position 109.

Procedure:

a. Patchwire selector control hub 11 to one ofbussed pair of pickup hubs of column-split selector number 2.

b. Patchwire Read-Sensing station hub 43 to the common of column-split selector number 2.

c. Patchwire nonselect (numeric portion) hub of column-split selector number 2 to Read-Input storage position 110.

d. Patchwire select (sign) hub of column-split selector number 2 to Read-Input storage position 109.

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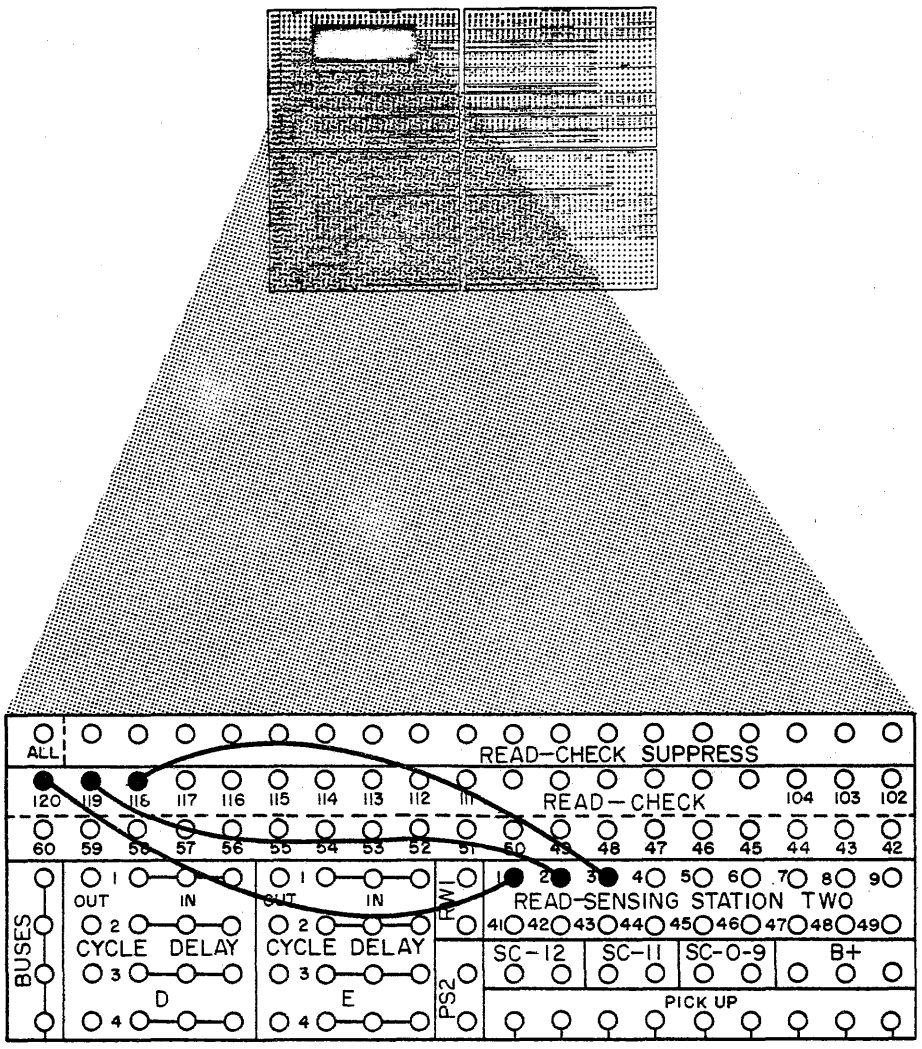
* The procedure described above may also be employed in the assignment of numeric data and sign overpunched in the same card column, to Punch-Input storage positions.

Subject: <u>The checking of data stored in Read-Input storage positions in Mode I or II.</u>

Note: Data contained in the Read-Input storage positions is checked at the Read-Sense station two. Since the data originally sensed is now in Read-Input storage positions, the card columns sensed for checking purposes must be assigned to corresponding positions because the comparison is made on an input storage basis.

Problem: Data in card columns 1-3 have been transferred to Read-Input storage positions 120-118 respectively. It is desired to check the reading of card columns delivered to Read-Input storage positions 120-118.

Procedure: a. Patchwire Read-Sensing station two (hubs 1-3) to Read-Check hubs 120-118 respectively.

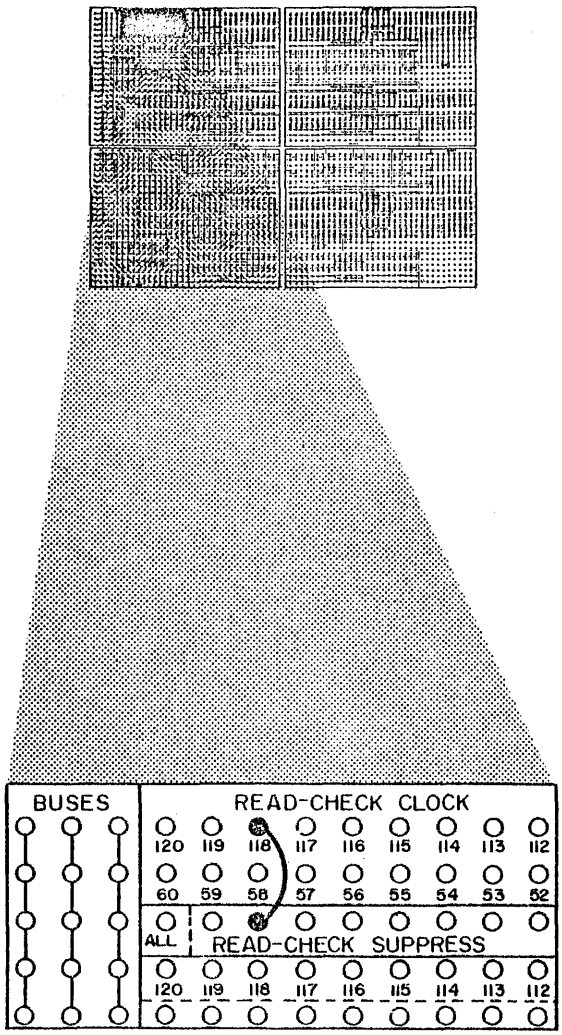


Subject: The suppressing of checking of noncritical data transferred from card columns to Read-Input storage positions in Mode I or II.

Problem: Suppress the checking of data from card column 3 wired to Read-Input storage position 118.

Procedure: a. Patchwire Read-Check clock hub 118 to any Read-Check suppress hub.

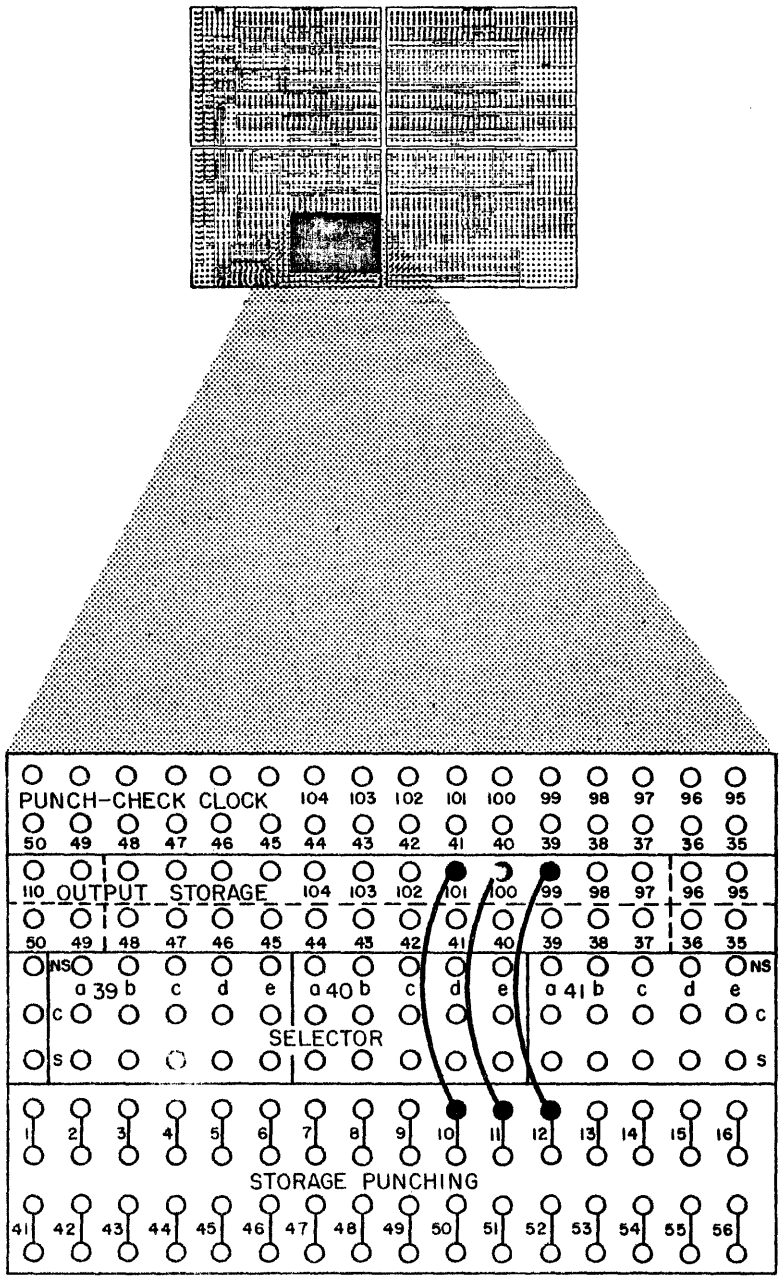
Note: Suppression of all checking may be accomplished by patchwiring the "all" hub to any Read-Check suppress hub.



Subject: <u>The assignment of data in output storage positions to storage punching positions for punching in card columns in Mode I or II.</u>

Problem: Punch the data contained in output storage positions 101-99, in card columns 10-12 respectively.

Procedure: a. Patchwire output storage positions 101-99 to storage punching hubs 10-12 respectively.



Subject: The handling of the sign position in output.

Note: In most cases the algebraic sign of the result of an arithmetic process, when positive, will be represented in the computer by a space code. Exceptions are explained on pages II-154 and II-165, of the Model 1 Specifications Manual.

Usually the sign position associated with a given field is recorded in a card column as an overpunch. An eleven overpunch in the card column will then identify the field as negative (-), and the absence of an 11 punch will identify the field as positive (△, space).

Problem: Output storage position 52 contains numeric data (0-9) and output storage position 51 contains the sign (△ or -) of the data in output storage position 52. Assign the numeric data to card column 2 with the sign recorded as an overpunch in column 2.

Method One

Procedure:
a. Patchwire output storage 52 to in of unibus 8.
b. Patchwire output storage 51 to in of unibus 8.
c. Patchwire the out of unibus 8 to storage punching hub 2.

Method Two

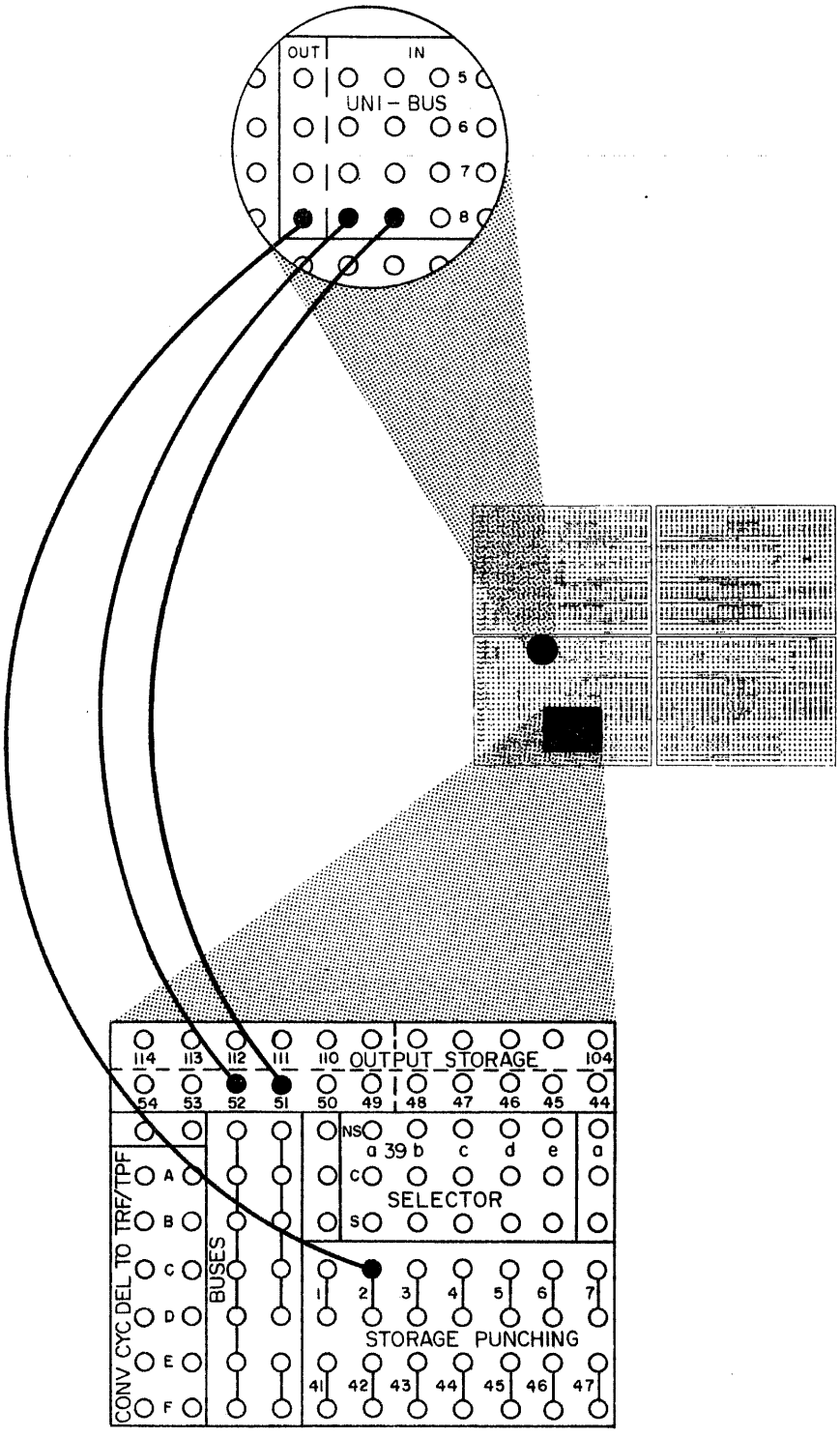
a. Patchwire selector control hub zero to selector pickup hub 39.

b. Patchwire output storage hub 51 to the nonselect hub of selector 39a.

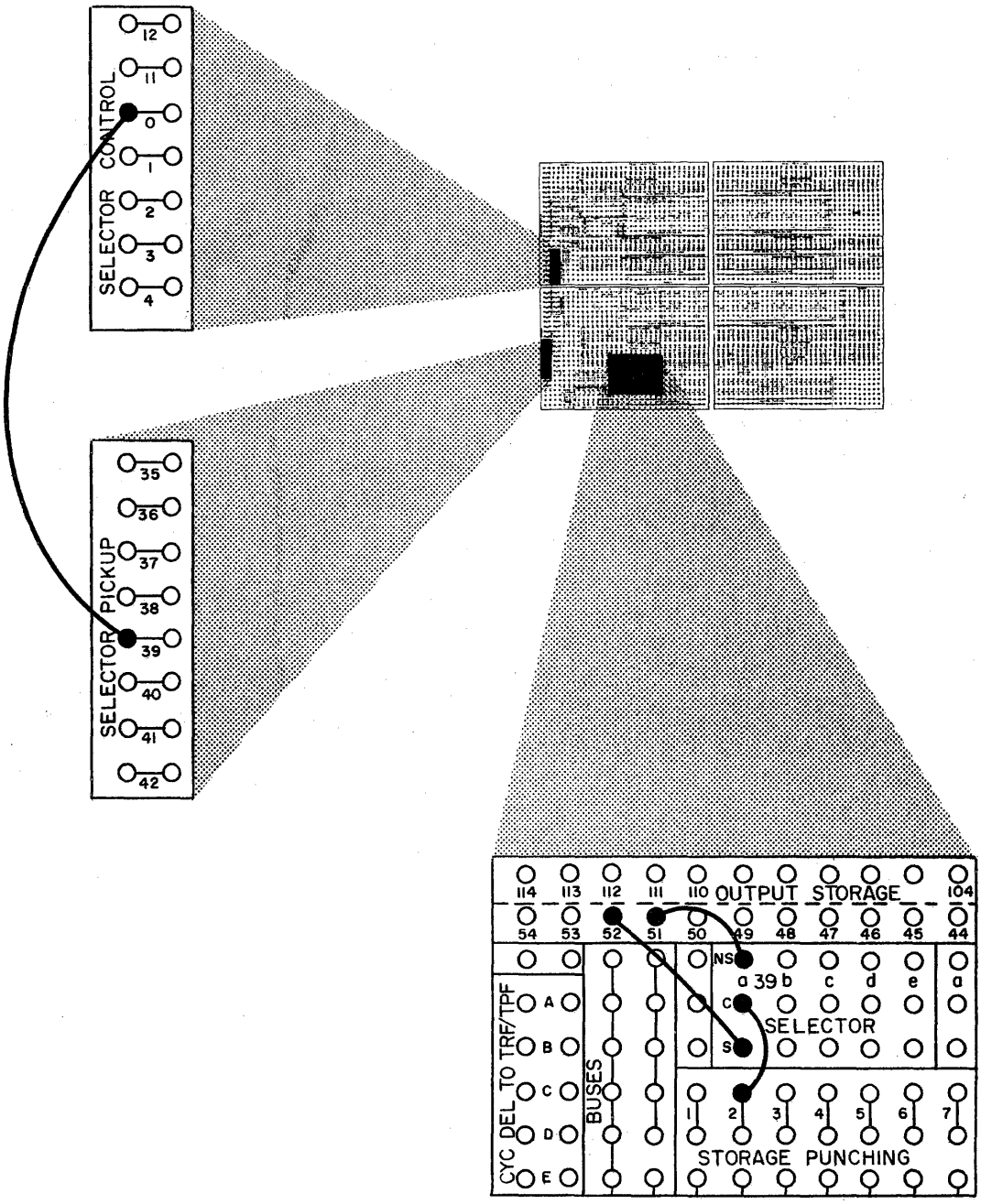
c. Patchwire output storage hub 52 to the select hub of selector 39a.

d. Patchwire the common of select hub selector 39a to storage punching hub 2.

METHOD ONE


OUT
IN
UNI - BUS
5
6
7
8
114
113
112
111
110
OUTPUT STORAGE
104
54
53
52
51
50
49
48
47
46
45
44
NS
a 39 b
c
d
e
a
A
B
C
D
E
F
SELECTOR
S
CONV CYC DEL TO TRF/TPF
BUSES
1
2
3
4
5
6
7
STORAGE PUNCHING
41
42
43
44
45
46
47

METHOD TWO


SELECTOR CONTROL
12
11
0
1
2
3
4
SELECTOR PICKUP
35
36
37
38
39
40
41
42
114 113 112 111 110 OUTPUT STORAGE 104
54 53 52 51 50 49 48 47 46 45 44
NS
a 39 b c d e a
C
S
SELECTOR
CYC DEL TO TRF/TPF
A
B
C
D
E
BUSES
1 2 3 4 5 6 7
STORAGE PUNCHING

Subject: The assignment of constant data, generated by the I/O unit, to Punch Input storage positions for subsequent punching in card columns in Mode I.

Note: In the example below the position emitter hubs could have been patched to control punching hubs. However, the method outlined in the example below is recommended because checking of the generated data punched may be accomplished. Checking of generated data punched is not possible when emitters are patched to control punching hubs.

Caution should be exercised when patching position emitter hubs to Punch-Input storage position since the assigning of generated data to Punch-Input storage positions where data has previously been assigned will destroy both the significance of the data originally stored in that position and the incoming data. Briefly, only unused positions in Punch-Input storage should be wired from position emitters.

In addition, the locations used for assignment of constant data must contain space codes in the corresponding input-output track locations during the output transfer of computed data. It should, however, be understood that these input-output track locations may be used on input provided they are cleared to space codes prior to the output transfer.

Problem: Store the data 9/27/57 in Punch-Input storage positions 41-37.

Procedure:

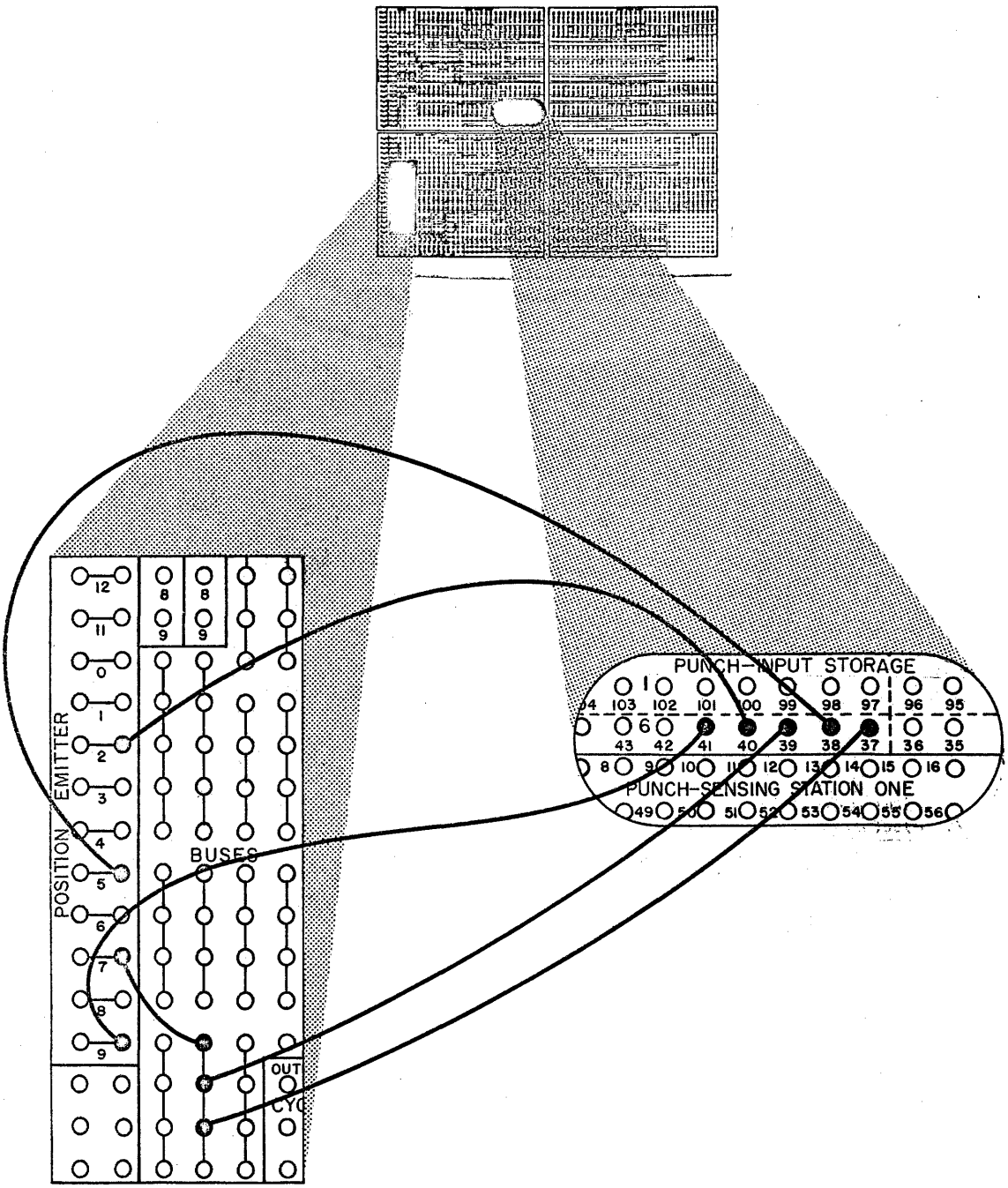
a. Patchwire position emitter hub 9 to Punch-Input storage hub 41.

b. Patchwire position emitter hub 2 to Punch-Input storage hub 40.

c. Patchwire position emitter hub 7 to Punch-Input storage hub 39.

d. Patchwire position emitter hub 5 to Punch-Input storage hub 38.

e. Patchwire position emitter hub 7 to Punch-Input storage hub 37.

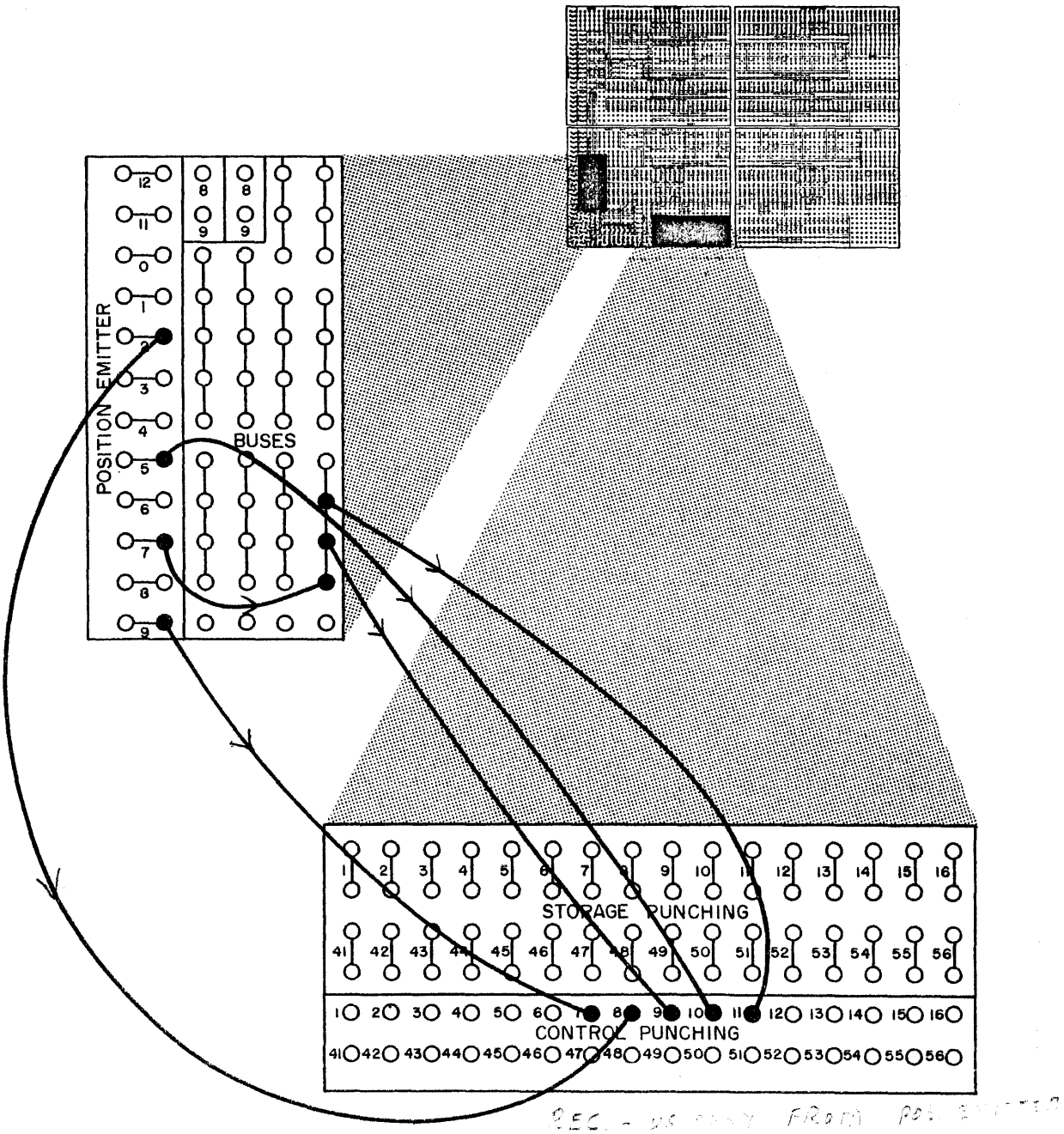

PUNCH-INPUT STORAGE
104 103 102 101 100 99 98 97 96 95
43 42 41 40 39 38 37 36 35
8 9 10 11 12 13 14 15 16
PUNCH-SENSING STATION ONE
49 50 51 52 53 54 55 56
POSITION EMITTER
12 11 0 1 2 3 4 5 6 7 8 9
8 8 9 9
BUSES
OUT
CYC

Subject: <u>The assignment of constant data, generated by the I/O unit, to punching positions for punching in card columns in Mode II.</u>

Note: In the example below punching of the generated, constant data cannot be checked, since the generated data is not contained in the output storage against which the check is made.

Problem: Punch date 9/27/57 in card columns 7-11 of each card in punch channel.

Procedure:
a. Patchwire position emitter hub 9 to control punching hub 7.
b. Patchwire position emitter hub 2 to control punching hub 8.
c. Patchwire position emitter hub 7 to control punching hub 9.
d. Patchwire position emitter hub 5 to control punching hub 10.
e. Patchwire position emitter hub 7 to control punching hub 11.

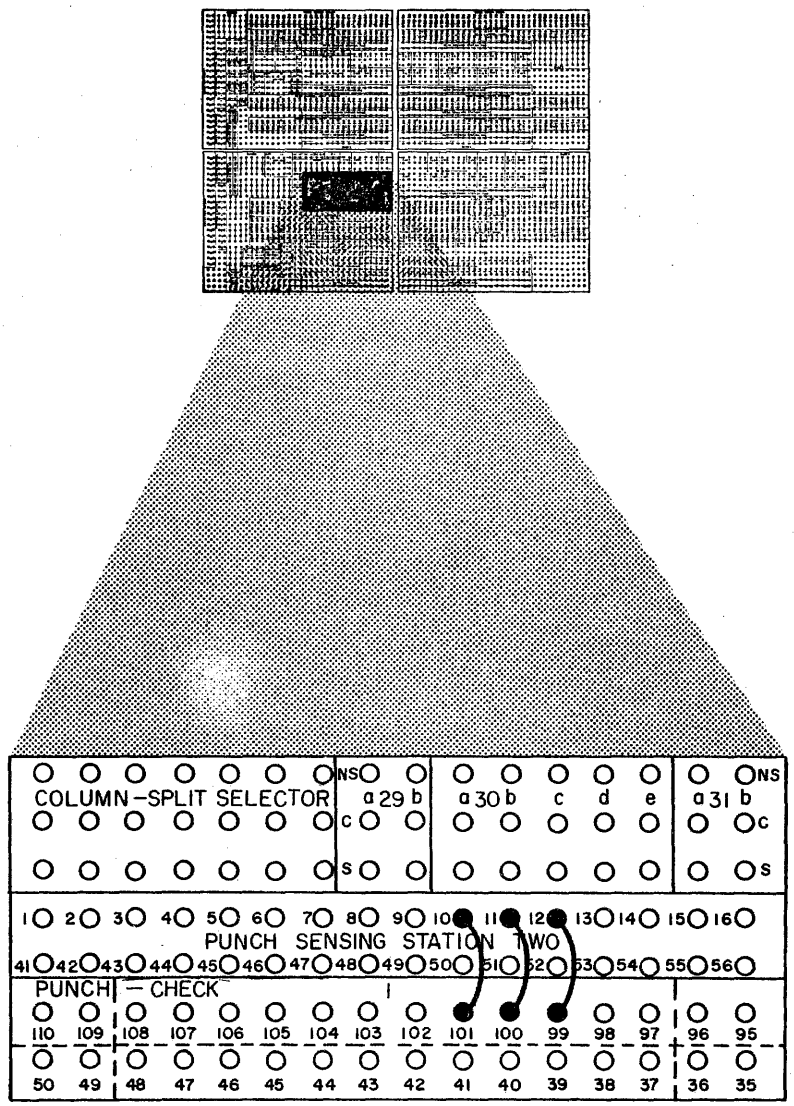


Subject: The checking of sensing and punching in the punch channel in Mode I or II.

Note: The checking of data punched in card columns from output storage positions is very similar to the checking of data in card columns transferred to Read-Input storage positions. Comparison is based on the output storage format, hence, data in those card columns sensed for checking purposes must be assigned to checking positions corresponding to output storage positions. In a Mode II operation, data sensed at Punch-Sensing station one and delivered to Punch-Input storage positions may also be checked.

Problem: Check punching of output storage positions 101-99 punched in card columns 10-12.

Procedure: a. Patchwire Punch-Sensing station two (hubs 10-12) to Punch-Check hubs 101-99 respectively.



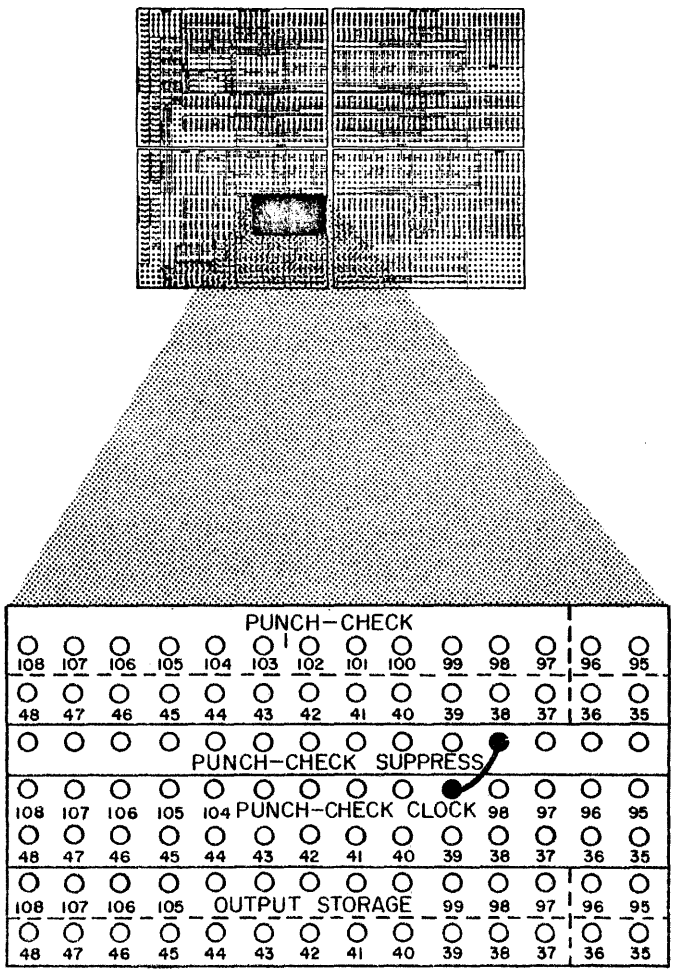
Subject: The suppression of checking of noncritical data punched in card columns of card in punch channel in Mode I or II.

Note: In certain instances it may be desirable to suppress checking of data punched in card columns from output storage positions. Assume, for example that in some operation an employee's plant number of one digit is punched in a certain card column from output storage. An error occurring in the punching of this character in the individual's card would cause the I/O unit to stop at the completion of the current cycle. Since (in this assumed operation) the error is of a relatively unimportant nature, and an error detection in this phase of the checking would unnecessarily delay processing, it might be considered advisable for the programmer to suppress checking of that card column containing the employee plant number.

Suppression of all Punch-Checking may be accomplished by patchwiring the "all" hub to any Punch-Check suppress hub.

Problem: Suppress checking of employee's plant number in output storage position 99 and punched in card column 12.

Procedure: a. Patchwire Punch-Check clock hub 99 to any Punch-Check suppress hub.

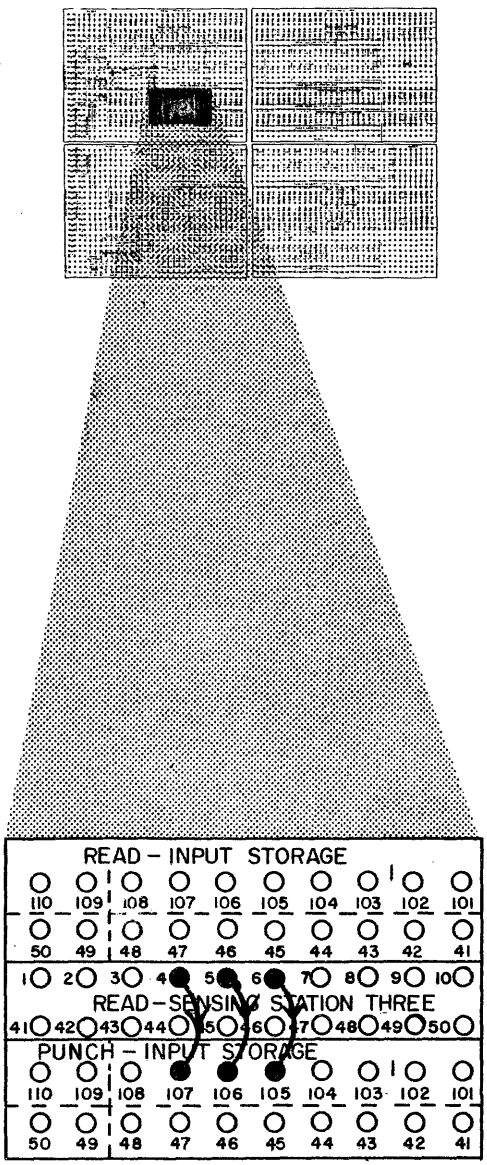


Subject: <u>The punching of identifying data from the read channel card (which is not relevant to computation) into the corresponding punch channel card which is three cycles behind in Mode I when feeding is not intermittent in either channel.</u>

Note: This method of handling data, <u>not</u> relevant to computation, facilitates the handling of data needed in computing since this input data, to the computer, may be assigned usually to input storage positions on a word basis. This is desirable because packed data will require field patterns for addressability.

Problem: Store the nonrelevant data contained in card columns 4-6 of read channel card, in Punch-Input storage positions 107-105 for subsequent punching in columns 4-6 of punch channel card.

Procedure: a. Patchwire Read-Sensing station three (hubs 4-6) to Punch-Input storage hubs 107-105 respectively.



MODE I -
RS 3 & PS 1 - SAME FUNCT.

Subject: The sensing of a control hole in a card column of a card in the read channel in order to vary the computer program in Mode I.

Problem: Card column 7 may contain the following punches identifying each card as one of the following:

a. 1 punch in column 7 - order card
b. 9 punch in column 7 - store summary card

Notify the computer via a high speed control line as to which type of card is coming in so that program variance may be affected. Activate HSCL X if column 7 contains a 1 and HSCL, W and X if column 7 contains a 9.

Procedure:

a. Patchwire Read-Sensing station one hub 7 to Position Extractor in hub (B).

b. Patchwire Position Extractor hub 1 to in of unibus 5.

c. Patchwire Position Extractor hub 9 to any bus.

d. Patchwire from bus to in hub of uni-bus 5 and in of cycle delay 3, group C.

e. Patchwire the out of cycle delay 3 to the in of cycle delay 2, group C.

f. Patchwire the out of cycle delay 2, group C to high speed control line W.

g. Patchwire the out of uni-bus 5 to the in of cycle delay 6, group C.

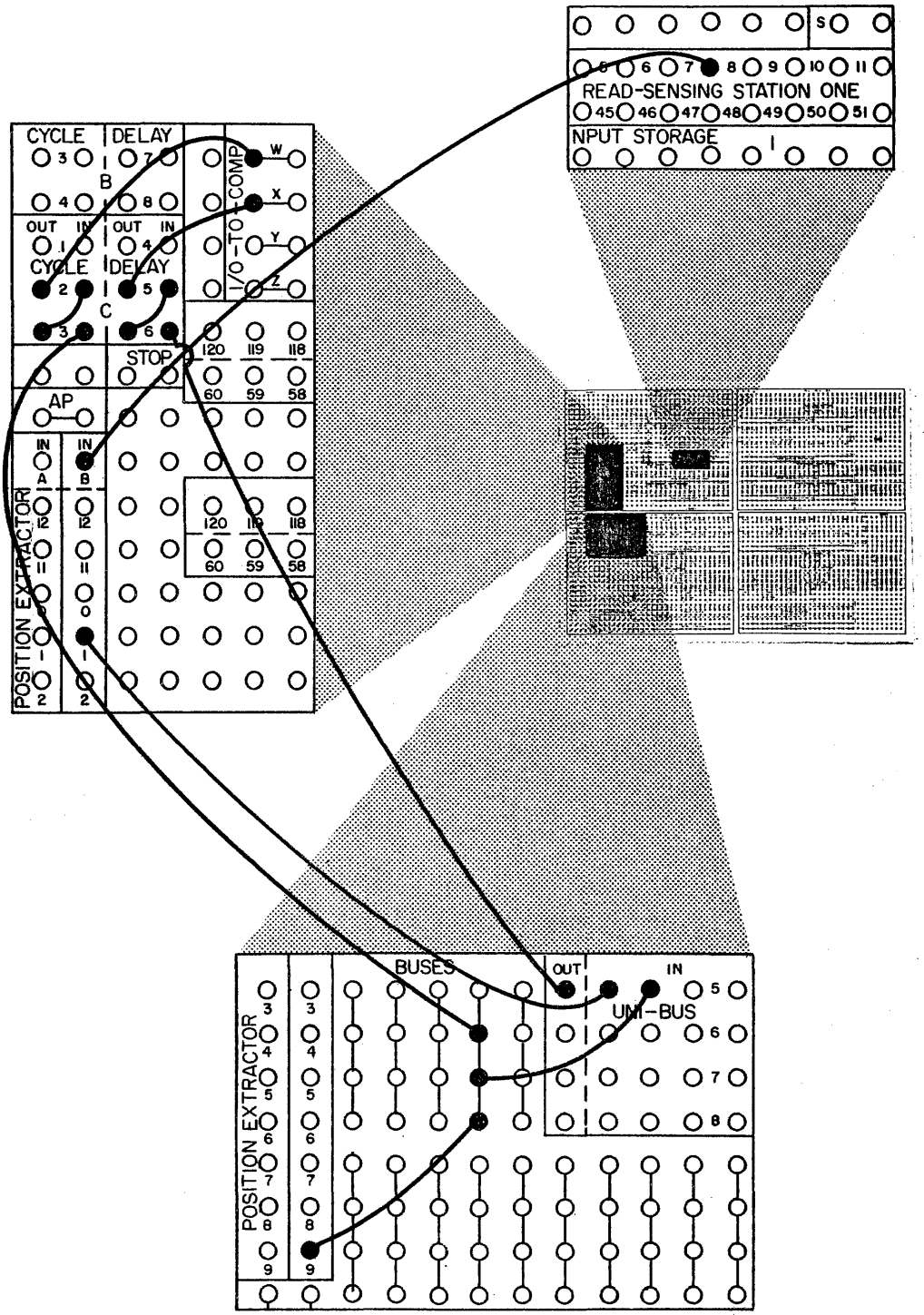
h. Patchwire the out of cycle delay 6 to the in of cycle delay 5, group C.

i. Patchwire the out of cycle delay 5 to high speed control line X.

Comment: In instances where the operation of the read feed is continuous, i.e., a card is advanced in the read channel with each card cycle, control holes may be sensed at the Read-Sensing station two. If the operation of the read feed is intermittent, i.e., a card is not advanced in the read channel with each card cycle, control holes must be sensed at the Read-Sensing station one.

The table shown below lists the number of cycle delays necessary to affect program variance when control holes are detected at the station shown on the left.

Sensing Station	Control Line	No. Cycle Delays
Read-Sensing One (RS1)	HSCL	2
Read-Sensing One (RS1)	I/O→C (Low Speed)	2
Read-Sensing Two (RS2)	HSCL	1
Read-Sensing Two (RS2)	I/O→C (Low Speed)	1



Subject: The sensing of a control hole in a card column of a card in the punch channel in order to vary the computer program in Mode II. Since sensing of data in card columns and computation both take place in the same cycle, no cycle delay is necessary when either high speed control lines or low speed control lines are used to vary the computer program depending upon presence of control hole sensed in card control column.

Problem: Activate HSCL Z if there is a 3 punch in card column 6, and HSCL Y if there is a 4 in column 6.

Procedure:

a. Patchwire Punch-Sensing station one hub 6 to common of column-split selector 2.

b. Patchwire selector control hub 3 to pick up of column-split selector 2.

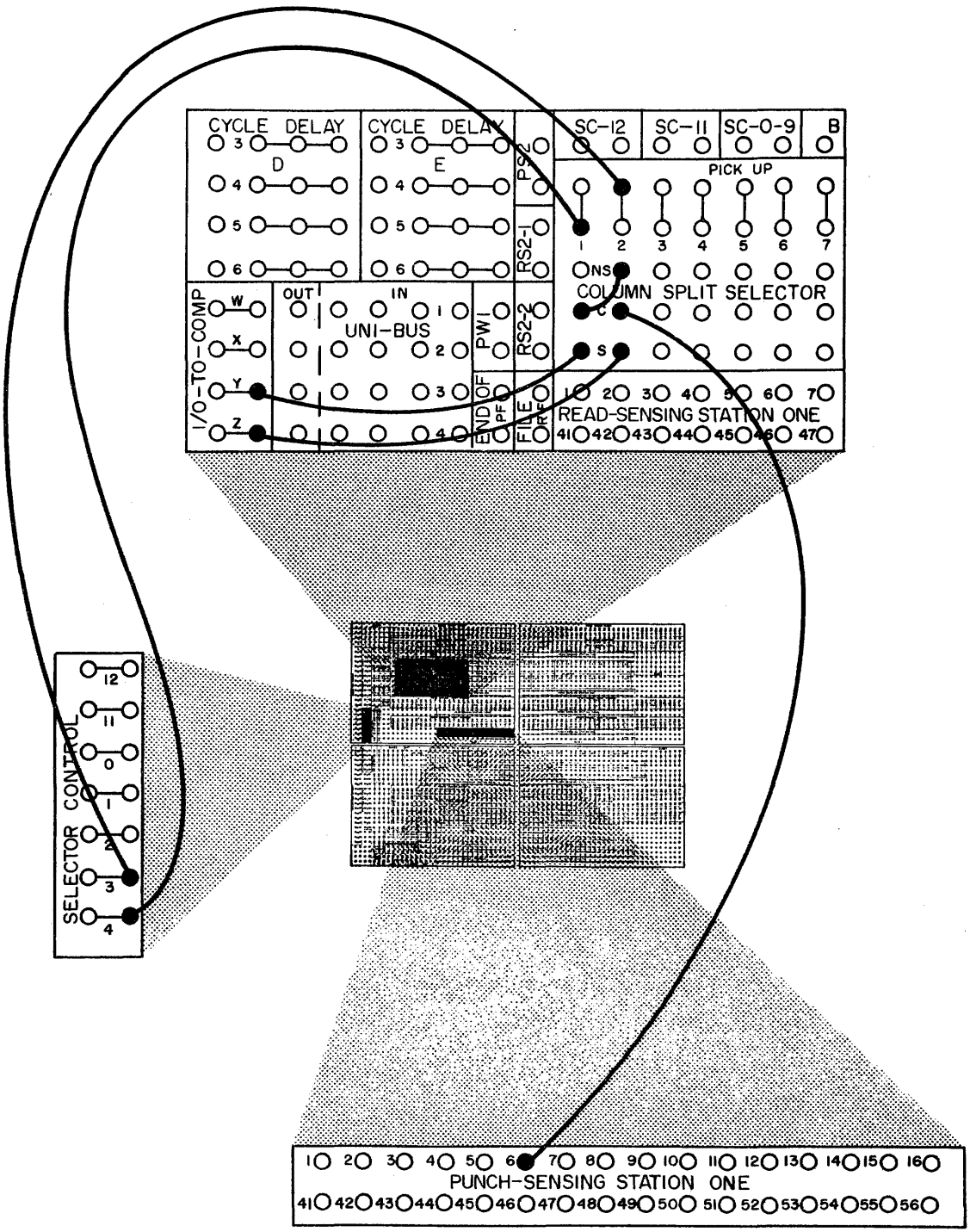
c. Patchwire selector control hub 4 to pick up of column-split selector 1.

d. Patchwire nonselect hub of column-split selector number 2 to the common of column-split selector number 1.

e. Patchwire the select hub of column-split selector number 2 to HSCL Z.

f. Patchwire the select hub of column-split selector number 1 to HSCL Y.

Note: The nonselect hub of column-split selector number 1 may be wired to the common of another column-split selector. This selector may be picked up by a selector control hub corresponding to the control punch used to identify a third type of card.


CYCLE DELAY
D
CYCLE DELAY
E
PS2
RS2-1
RS2-2
PWI
END OF FILE
SC-12
SC-11
SC-0-9
B
PICK UP
NS
COLUMN SPLIT SELECTOR
C
S
I/O-TO-COMP
W
X
Y
Z
OUT
IN
UNI-BUS
READ-SENSING STATION ONE
SELECTOR CONTROL
PUNCH-SENSING STATION ONE

Subject: The assignment of data contained in output storage positions to card columns and the checking of punching; both determined by the presence of a control hole in a card in the read channel, when feeding in the read channel is not intermittent in Mode I.

Problem: Output storage positions 89-85 are to be punched in columns 70-74 if there is an 11 punch in column 9, or in columns 75-79 if there is no 11 punch in column 9.

Procedure:

a. Patchwire Read-Sensing station one (hub 9) to the common of column-split selector number 8. Using a column-split selector instead of a Position Extractor enables other data (numeric only) to be packed in card column 9.

b. Patchwire SC-11 hub to pickup of column-split selector number 8.

c. Patchwire the select side of column-split selector number 8 to the in of cycle delay 1, group D.

d. Patchwire the out of cycle delay 1 to the in of cycle delay 2, group D.

e. Patchwire the out of cycle delay 2 to the in of cycle delay 3, group E.

f. Patchwire the out of cycle delay 3 to the in of cycle delay 4, group E.

g. Patchwire the out of cycle delay 4 to the in of a bus.

h. Patchwire one hub of bus to in of cycle delay 5, group D.

i. Patchwire the out of cycle delay 5, to the in of cycle delay 6, group D.

j. Patchwire the out of cycle delay 6 to selector pickup hub 42.

k. Patchwire another hub of the bus to selector pickup hub 44.

l. Patchwire output storage positions 89-85 to the common hubs a-e respectively of selector 44.

m. Patchwire the select hubs corresponding to a-e of selector 44 to storage punching hubs 70-74 respectively.

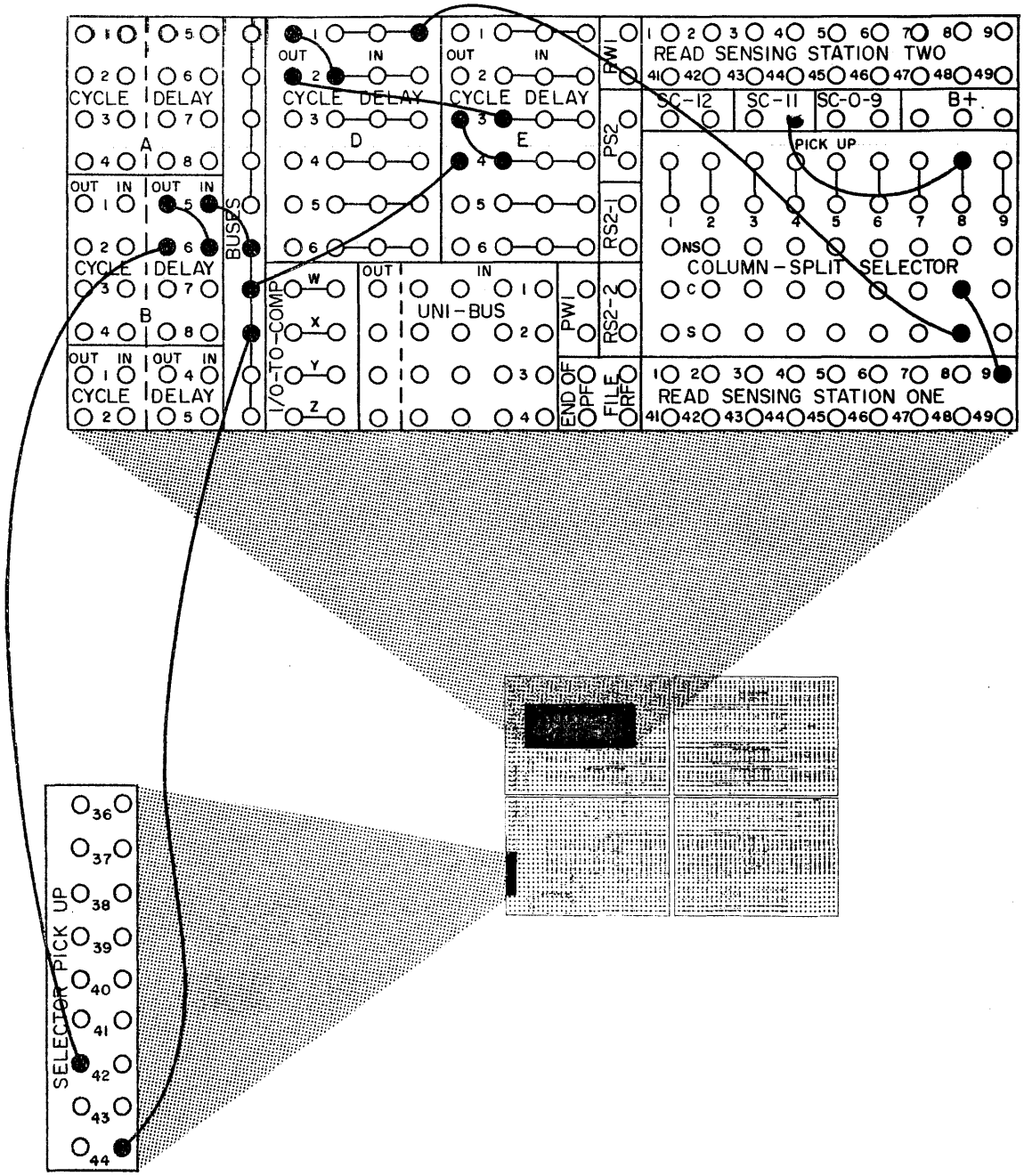
n. Patchwire the nonselect hubs a-e to output hubs 75-79 respectively.

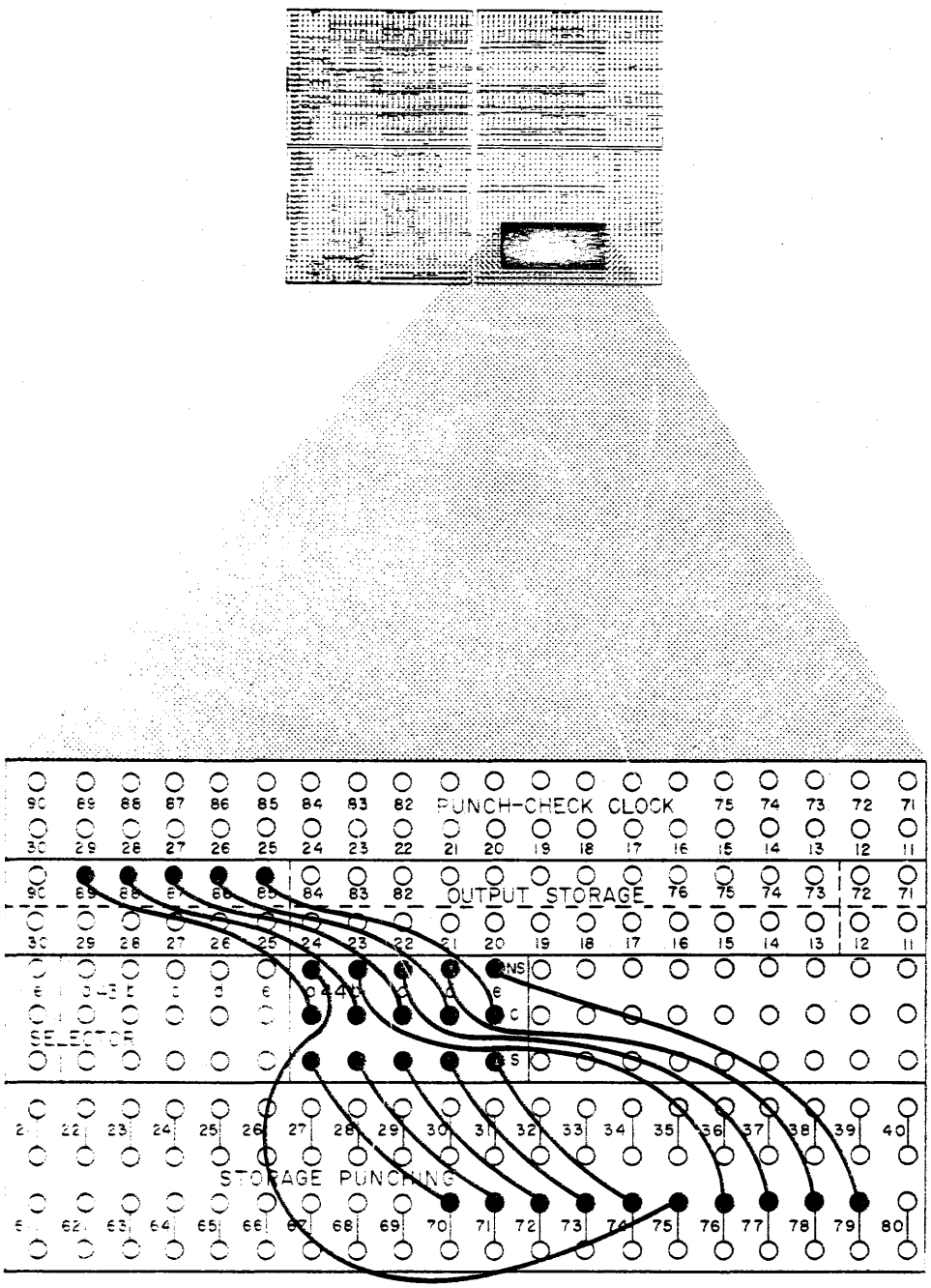
o. Patchwire Punch-Check positions 89-85 to the common hubs a-e respectively of selector 42.

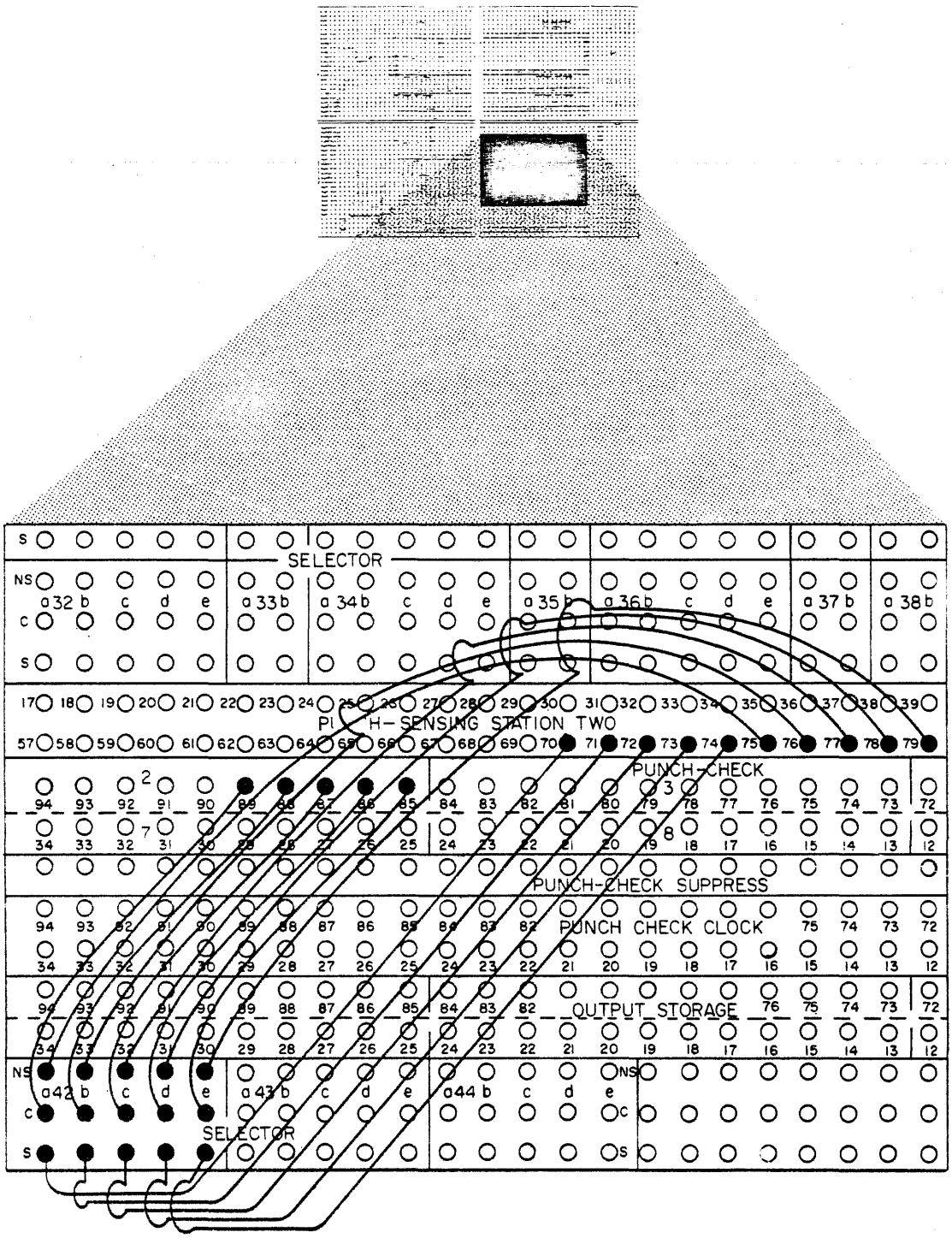
p. Patchwire the select hubs corresponding to a-e of selector 42 to Punch-Sensing station two hubs 70-74 respectively.

q. Patchwire the nonselect hubs a-e to Punch-Sensing station two hubs 75-79 respectively.

Note: Four cycle delays were necessary to accomplish the desired result in the above example. A reference to Mode I, Card and Data Flow, will reveal the reason for this. Card A, the source of the control hole sensed, is at Read-Sensing station one during cycle 2. Card A', corresponding to Card A in the read channel, is at the Punch Punch station one during cycle 6. It follows that a control hole sensed at the Read-Sensing station one must be delayed 4 cycles to vary the punching in the corresponding card in the punch channel.


CYCLE DELAY
A
B
D
E
OUT
IN
BUSES
I/O-TO-COMP
W
X
Y
Z
UNI-BUS
PWI
PS2
RS2-1
RS2-2
END OF FILE
OPR
READ SENSING STATION TWO
SC-12
SC-11
SC-0-9
B+
PICK UP
NS
COLUMN-SPLIT SELECTOR
READ SENSING STATION ONE
SELECTOR PICK UP


PUNCH-CHECK CLOCK
OUTPUT STORAGE
SELECTOR
STORAGE PUNCHING


SELECTOR
PUNCH-CHECK
PUNCH-CHECK SUPPRESS
PUNCH CHECK CLOCK
OUTPUT STORAGE
SELECTOR

EXAMPLES OF COMPUTER ROUTINES

The following examples demonstrate routines through which the computer exchanges control information with the 80 Column Card Unit. Each example illustrates a given type of operation and is explained by a flow chart. In all of the following examples, it may be assumed that the run-in has been completed, and that the 80 Column Card Unit has assumed a Ready status. These illustrations are not intended to include all possible methods, but merely to illustrate possible alternatives.

In UFC Model 1 operations, each demand station has two input-output tracks, which are alternately connected to either the computer or the input-output Unit, hence, the computer and the input-output unit can simultaneously address the same input-output track address assigned to the particular demand station.

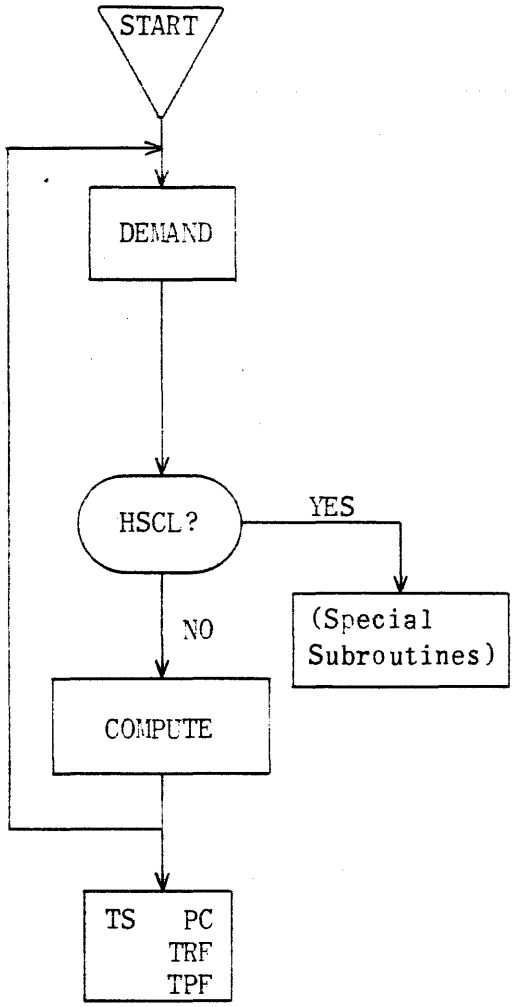
The Model 1 external applications illustrated on the following pages are also applicable to Model 0 applications, when an additional track is cabled to the correspondingly numbered demand position to which the 80 Column Card Unit is connected. However, it should be remembered that since the Univac File-Computer, Model 0 does not contain high speed control line storage the program is varied by using I/O-to-C control lines (which are energized by special conditions detected by the 80 Column Card Unit) to energize selectors in the computer. Also, track switching is accomplished by bussing the last step out pulse to C-to-I/C sign "J".

In either operation, it is desirable to design the computer program so that the central computer is not delayed while the input-output unit performs its functions.

In the following examples, represented in flow chart format, the table below lists the abbreviations used to represent control commands and the computer-to-I/O control lines over which these commands are transmitted.

COMMAND	CONTROL LINE
TS = Track Switch	J (In Model 0 operations)
PC = Program Complete	A
TRF = Trip Read Feed	B
TPF = Trip Punch Feed	C
Stop	D
SK = Skip	E

Example 1
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - UFC Model 1 External Program



Comments

Start to Demand In establishes connection with proper I/O track. Synchronizes start of computer program with completion of automatic run-in.

Demand in puts the I/O unit on demand. C-to-I/O line and low speed I/O-to-C lines are connected between the computer and the specified I/O unit.

In this case the I/O unit will be ready when the automatic run-in is complete or (after the initial cycle) when the input transfer is complete. If the I/O unit is not ready there is a delay until it goes ready. This delay is a minimum of 15-20 milliseconds.

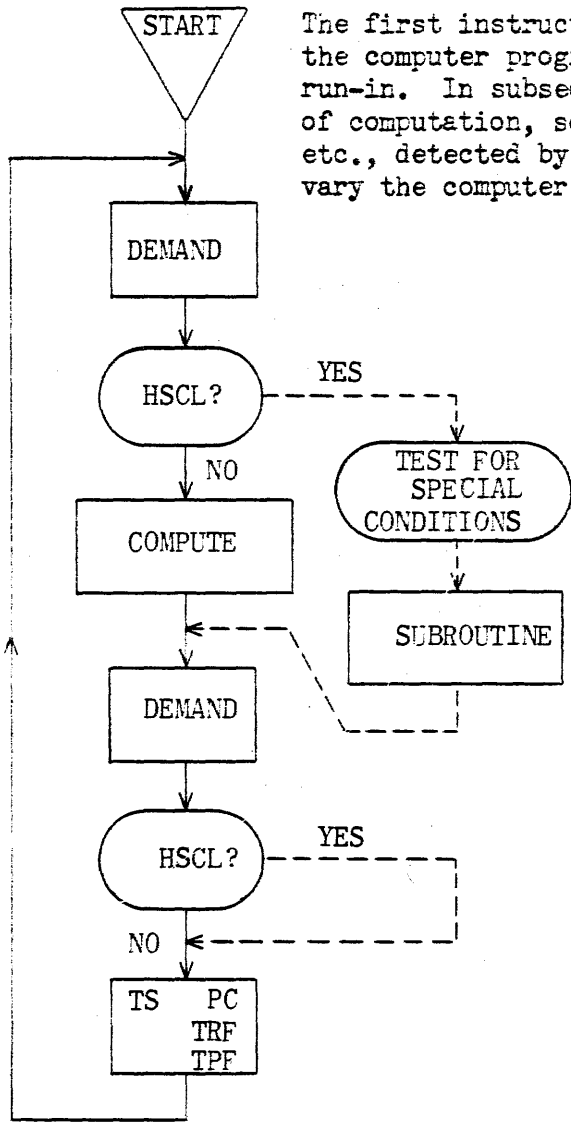
When the I/O unit is ready a test is made to see if any HSCLs have been activated. If not a demand out results, and the computation can begin. If a special out results, any one of several subroutines (which are not discussed here) can be entered.

When the computation is complete the last step out pulse is bussed to demand in, to the C-to-I/O lines activating the specified functions (TRF, TPF, PC), and to Track Switching. The Track Switch makes the output data available to the I/O unit. Up to this time the I/O unit has been on demand and ready, therefore, it received and accepted the TRF, TPF, and PC signals. The PC signal causes the unit to go not ready. The demand in circuits contain a built in delay so that when the demand in signal reaches the I/O unit it finds the unit not ready. The unit remains not ready until that point in the card cycle when the next input transfer is completed.

This method of demanding provides an interlock which prevents any computation on data until the error circuits have been checked.

Example 2
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - Internal Program

Comments



The first instruction is a demand to synchronize start of the computer program with the completion of the automatic run-in. In subsequent cycles this demand delays the start of computation, so that the error condition, control holes, etc., detected by the 80 Column Card Unit may be used to vary the computer program before computation is begun.

A special out can lead to various subroutines depending on which HSCLs are activated. A demand out starts the main program.

385-380 milliseconds are available for computation.

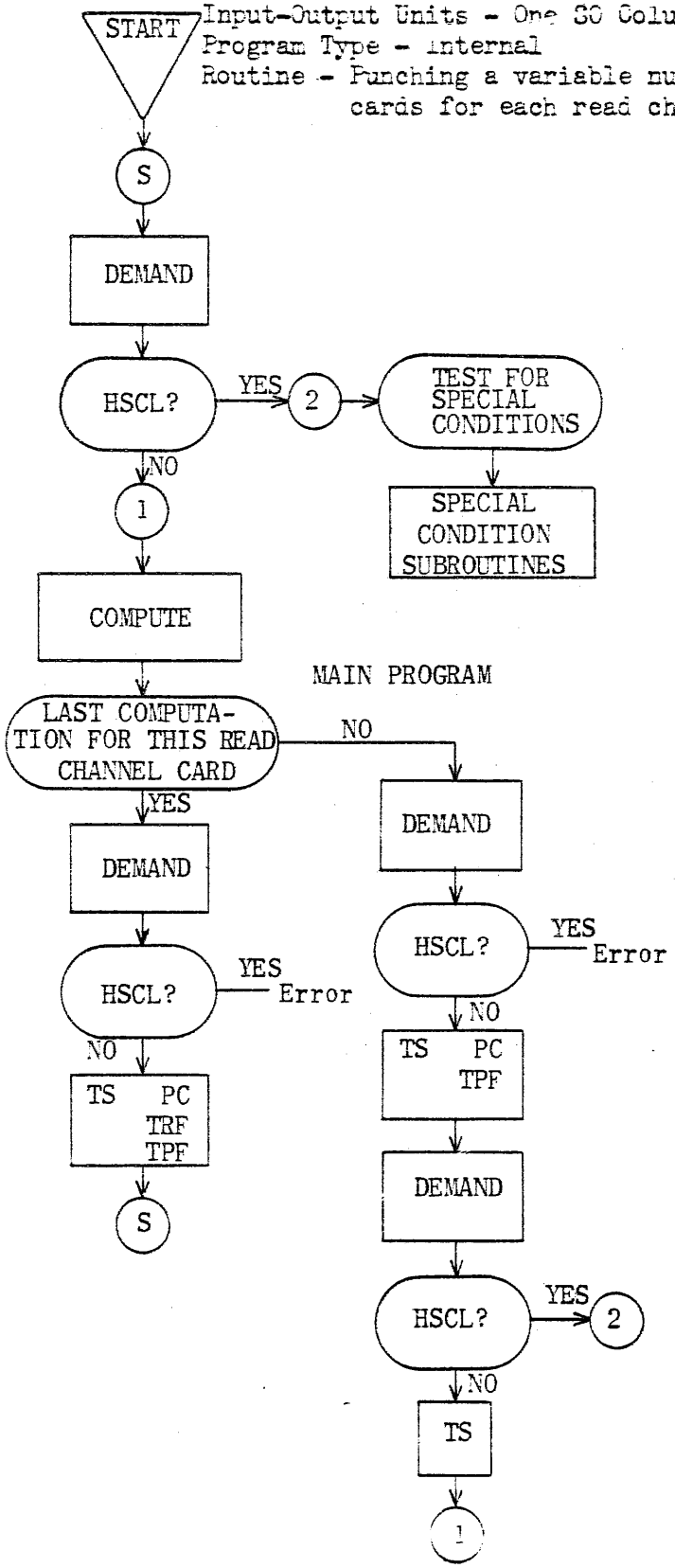
The second demand instruction is used to initiate the next card cycle. If an error condition is detected in a card cycle, the control commands sent (PC, TRF, TPF) to the 80 Column Card Unit are inhibited, causing the unit to stop. Depressing the appropriate card control reset button will clear the error circuit. Depressing the resume causes the control commands to be executed, and the unit to continue cycling.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No / Page 1 of 1
Application: Mode I (Internal)	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
130	040	555	215	DE	Δ	Demand 80 Column Card Unit to start program after Run-in.	1
							2
121						{ Compute	3
							4
191							5
192	140	554	ΔΔΔ	DE	Δ	Demand 80 Column Card Unit TS, PC, TRF, TPF	6
193	ΔΔΔ	992	130	UJ	Δ	Return Jump to IW 130 TO begin next cycle.	7
							8
							9
							10
						Note: Register C was used as a	11
						Redundent address for the V	12
						section of IW 193 to minimize	13
						access time for this operand.	14
							15
							16
							17
							18
							19
							20
							21
							22
							23
							24
							25
							26
							27
							28
							29
							30
							31
							32
							33
							34
							35
							36
							37
							38
							39
							40

Example 3
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - Internal
Routine - Punching a variable number of punch channel cards for each read channel card



Comments

The flow chart illustrated demonstrates one method of punching a variable number of cards for each read channel card which is read.

Only comments which have not been notated in previous examples are included.

A double Track Switch is required at these points to prevent the data from the next read channel card from being destroyed by output data.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 1 of 1
Application: Mode I - Variable Punching	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
111	Δ	000	000	020	ΔΔΔ	Constant	1
							2
130	040	555	215	DE	Δ		3
							4
131	04Z	ΔΔΔ	70Z	BT	Δ	Block Transfer Data from I/O TRACK 4 to Track 70Z	5
							6
132	701	ΔΔΔ	995	AT	L	Send First Address to GSAB & Read Unit Record	7
							8
133	701	111	701	ΔΔ	Δ	Increase Address by 20 since L=1	9
							10
134	701	702	ΔΔΔ	CP	9	Compare updated address to last Address (Terminal) & set condition	11
							12
135	982	ΔΔΔ	07Z	BT	Δ	Block Transfer contents of GSB to I/O TRACK 04Z	13
							14
136	ΔΔΔ	992	140	JP	Δ	Jump to IW if increased address is greater than the last address.	15
							16
137	140	552	ΔΔΔ	DE	Δ	Demand 80 Column Card Unit TS, PC, TPF	17
							18
138	141	555	215	DE	Δ	Demand 80 column Card Unit & TS	19
							20
139	ΔΔΔ	992	132	UJ	Δ	Jump to IW 132	21
							22
140	140	554		DE	Δ	Demand 80 Column Card Unit TS, PC, TRF, TPF	23
							24
141	ΔΔΔ	992	130	UJ	Δ	Jump to IW 130	25
							26
							27
							28
							29
							30
							31
							32
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							36
							37
							38
							39
							40

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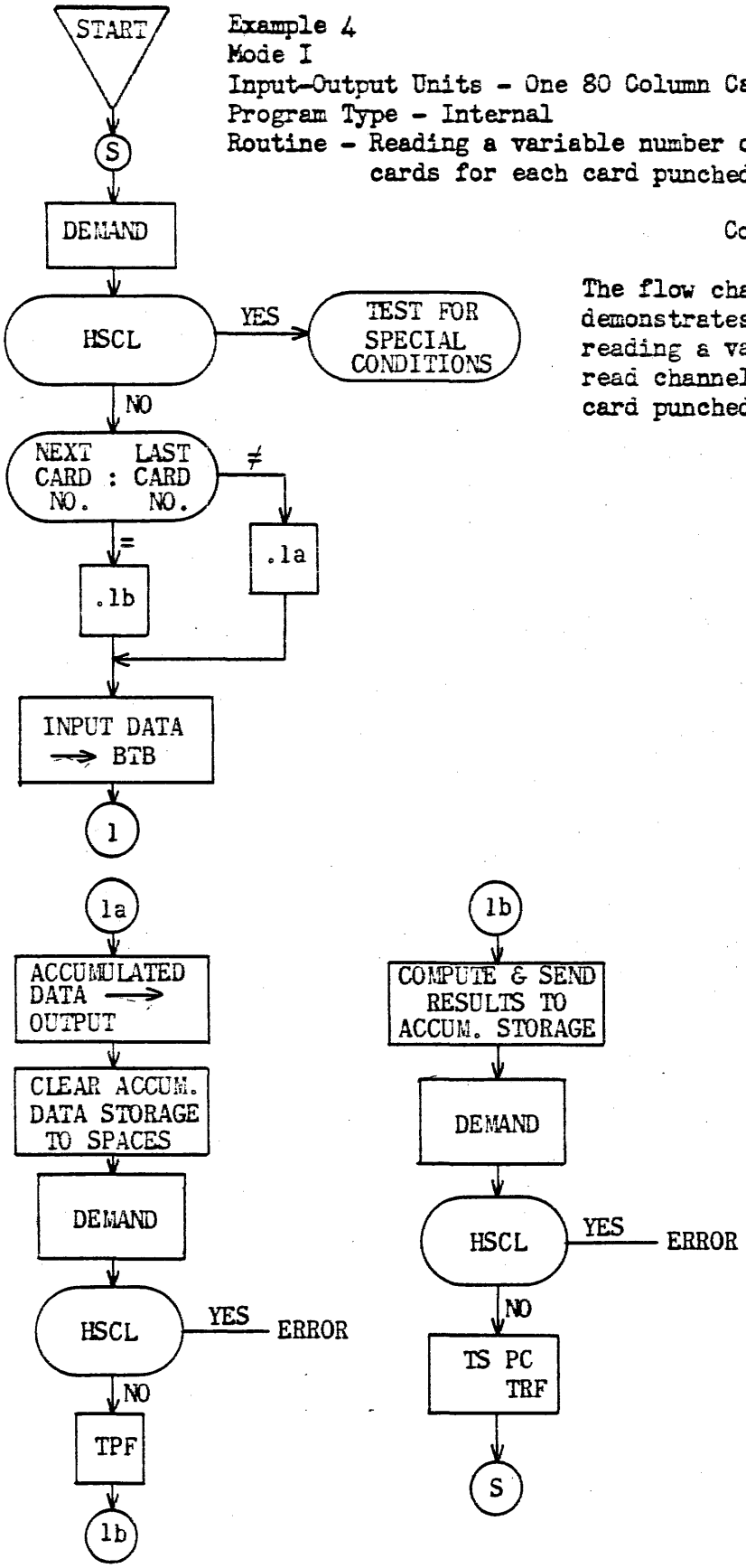

Example 4
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - Internal
Routine - Reading a variable number of read channel cards for each card punched.

Comments

The flow chart illustrated demonstrates one method of reading a variable number of read channel cards for each card punched.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page ___ of ___
Application	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
120	040	555	215	DE	Δ	Demand 80 Col. Card Unit at Demand Station	1
						4- since Mode I operation is assumed no.	2
						TS is necessary	3
131	041	101	ΔΔΔ	CP	9	Next card no=Last Card No. set Conditional	4
						Storage	5
132	042	ΔΔΔ	102	BT	Δ	Transfer Input Data on I/o track To 878	6
133	ΔΔΔ	992	140	JZ	Δ	If Conditional Storage is set to 0 go	7
						to IW 140	8
134	980	ΔΔΔ	041	AT	Δ	{ Transfer Accumulations to output	9
135	981	ΔΔΔ	042	AT	Δ	{ Storage for punching	10
136	988	ΔΔΔ	043	AT	Δ	{	11
137	138	165	140	UJ	Δ	Set Connector 2 x o 26	12
138	140	554		DE	Δ	T.S & Send PC, TRF, TPF, to 80 Column	13
						Card Unit	14
139	166	165	130	UJ	Δ	Resets Connector 26 to 2A & Jump to	15
						IW 130 for NI	16
140						{ Compute & Send Results to	17
↕						{ Accumulation storages (980, 981, 988)	18
						{	19
164							20
165	ΔΔΔ	992	166	UJ	Δ	Represents Variable Connector 2 in Flow	21
						Chart	22
166	140	558		DE	Δ	T.S. & Send PC, TRF to 80 Column	23
						Card Unit	24
167	ΔΔΔ	992	130	UJ	Δ	Jump Back to IW 130 For N Exit	25
						Instruction	26
							27
							28
							29
							30
							31
							32
							33
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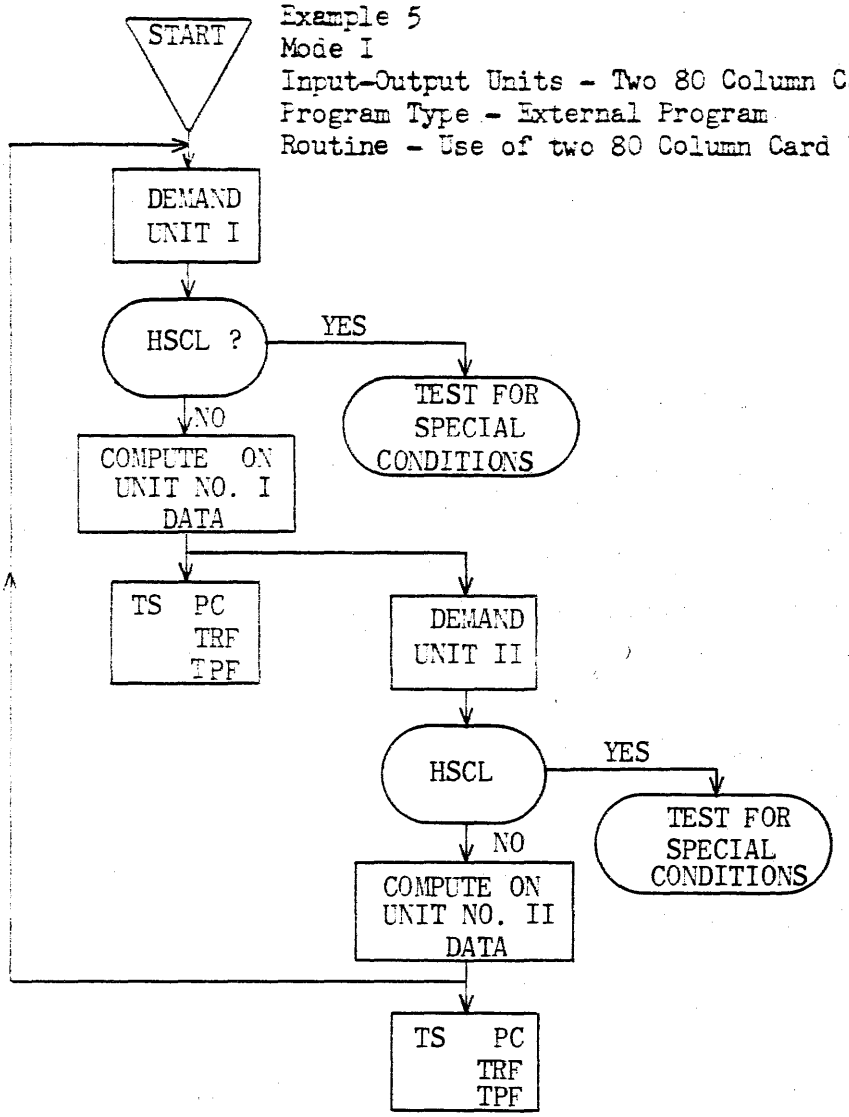
Example 5
Mode I
Input-Output Units - Two 80 Column Card Units
Program Type - External Program
Routine - Use of two 80 Column Card Units

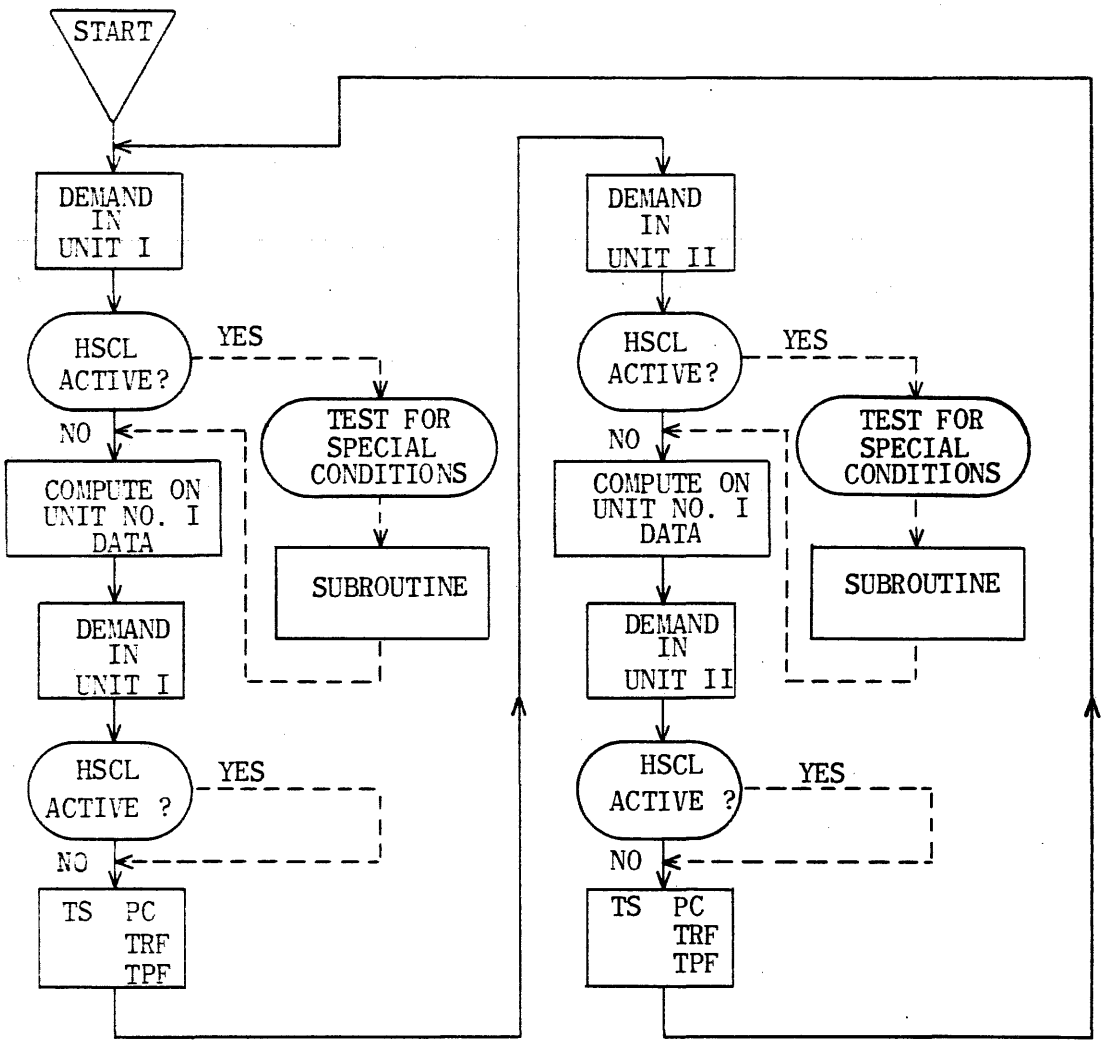


Comments

Both 80 Column Card Units will be immediately ready after demanding if the computations on Units 1 and 2 equal 400 or more milliseconds.

The step out hub of the last computing step for unit number 1 data is bussed to Track Switch and C-to-I/O lines activating Trip Read Feed, Trip Punch Feed, and Program Complete for Unit 1, and also to demand in for Unit 2. Since there is a delay built into the demand circuits the signals bussed to the C-to-I/O lines reach Unit 1 before it is taken "off demand" and Unit 2 goes "on demand".

The comments contain information which pertains particularly to this problem, and have not been mentioned in previous problems.



Example 6
Mode I
Input-Output Units - Two 80 Column Card Units
Program Type - Internal
Routine - Use of two 80 Column Card Units

Comments

The flow chart and the code sheet on the following page illustrates the internal program necessary in using two 80 Column Card Units alternately. The special routines desired might be the one in Example 8 which illustrates the exit routine for one 80 Column Card Unit, or the one in Example 12 which illustrates the routine for Read-Sense 2 error recovery.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 1 of 1
Application: Model I - 2-80 Column Card Units	Checked by / Date	Revisions by / Date	Revisions by / Date	Date installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
130	040	555	215	DE	Δ	Demand 80 Column Card Unit at Demand Station 4	1
131						Compute	2
							3
191							4
192	140	554	193	DE	Δ	Demand 80 Column Card Unit TS, PC, TRF, TPF	5
193	050	655	215	DE	Δ	Demand I/o unit at demand station 5	6
194						Compute	7
							8
254							9
255	150	554	256	DE	Δ	Demand 2nd 80 Column Card Unit TS,	10
						PC, TRF, TPF	11
256	ΔΔΔ	992	130	UJ	Δ	Jump to IW 130	12
							13
							14
							15
							16
							17
							18
							19
							20
							21
							22
							23
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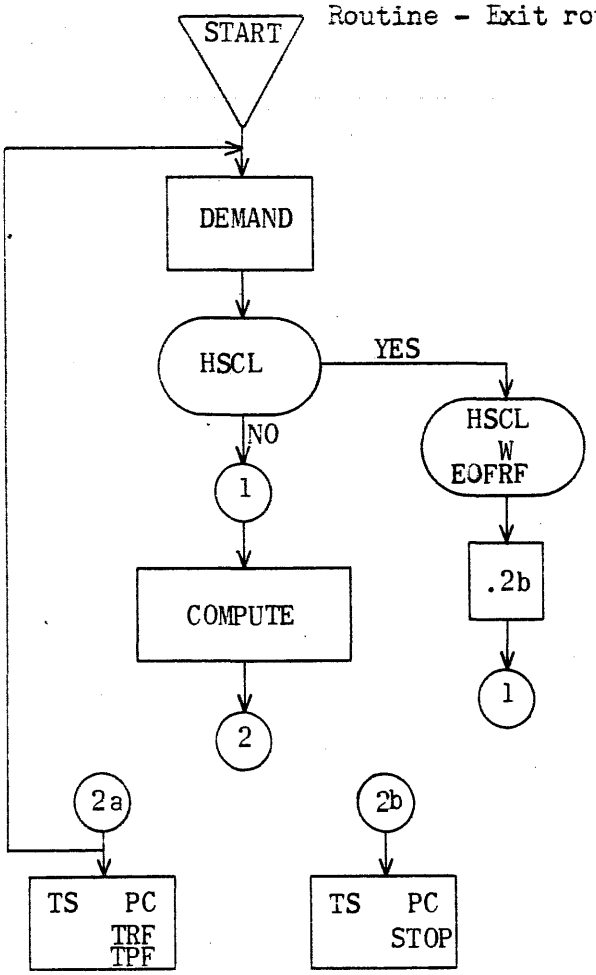
Example 7
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - External Program
Routine - Exit routine for Mode I manual run-out



Comments

The End of File Read Feed is patch-wired through three read feed cycle delays to HSCL-W so that a special out will result with the demand in substep that starts computation on the last read channel card.

The card containing the results of the last computation may be manually run-out by depressing the C-to-I/O button on the control panel of the 80 Column Card Unit once and the Manual Trip Punch Feed button 3 times.

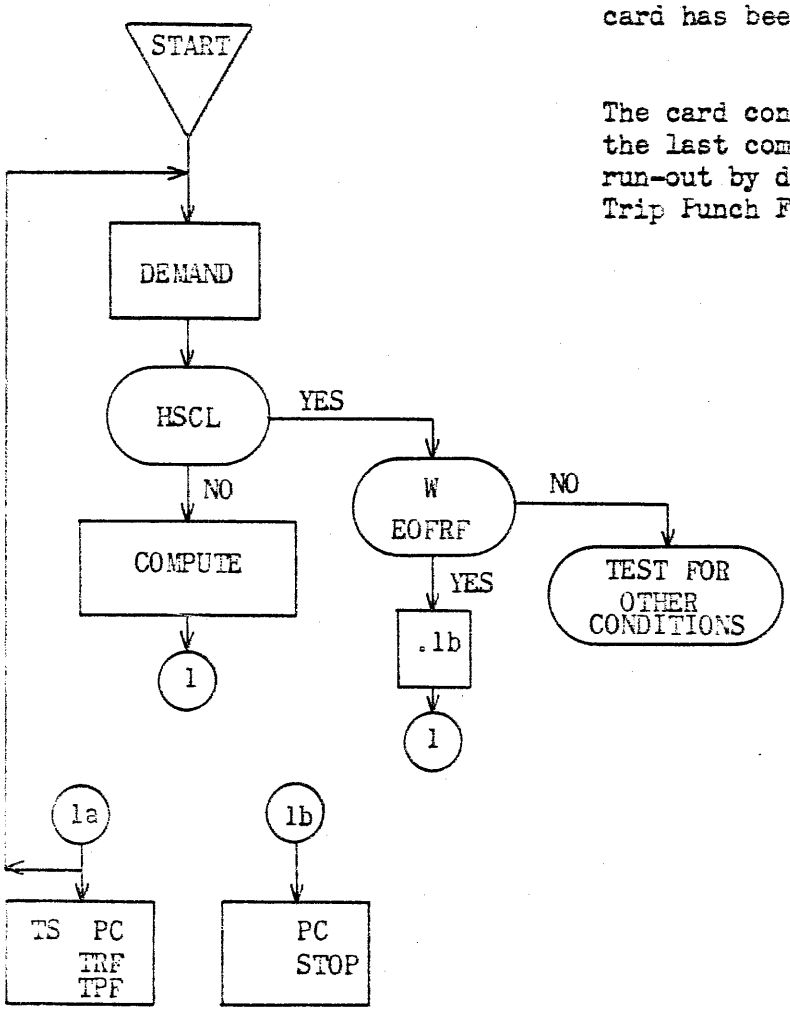
Note: Since the program illustrated is external, connector 2 represents a selector and .2b represents the selector pickup for the corresponding selector. 2a represents the nonselect position and 2b represents the select position.

Example 8
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - External Program
Routine - Exit routine for Mode I manual run-out

Comments

The End of File Read Feed is patch-wired through four read feed cycle delays to HSCL-W so that a special out will result with the demand in substep after the last read channel card has been computed.

The card containing the results of the last computation may be manually run-out by depressing the Manual Trip Punch Feed button 3 times.

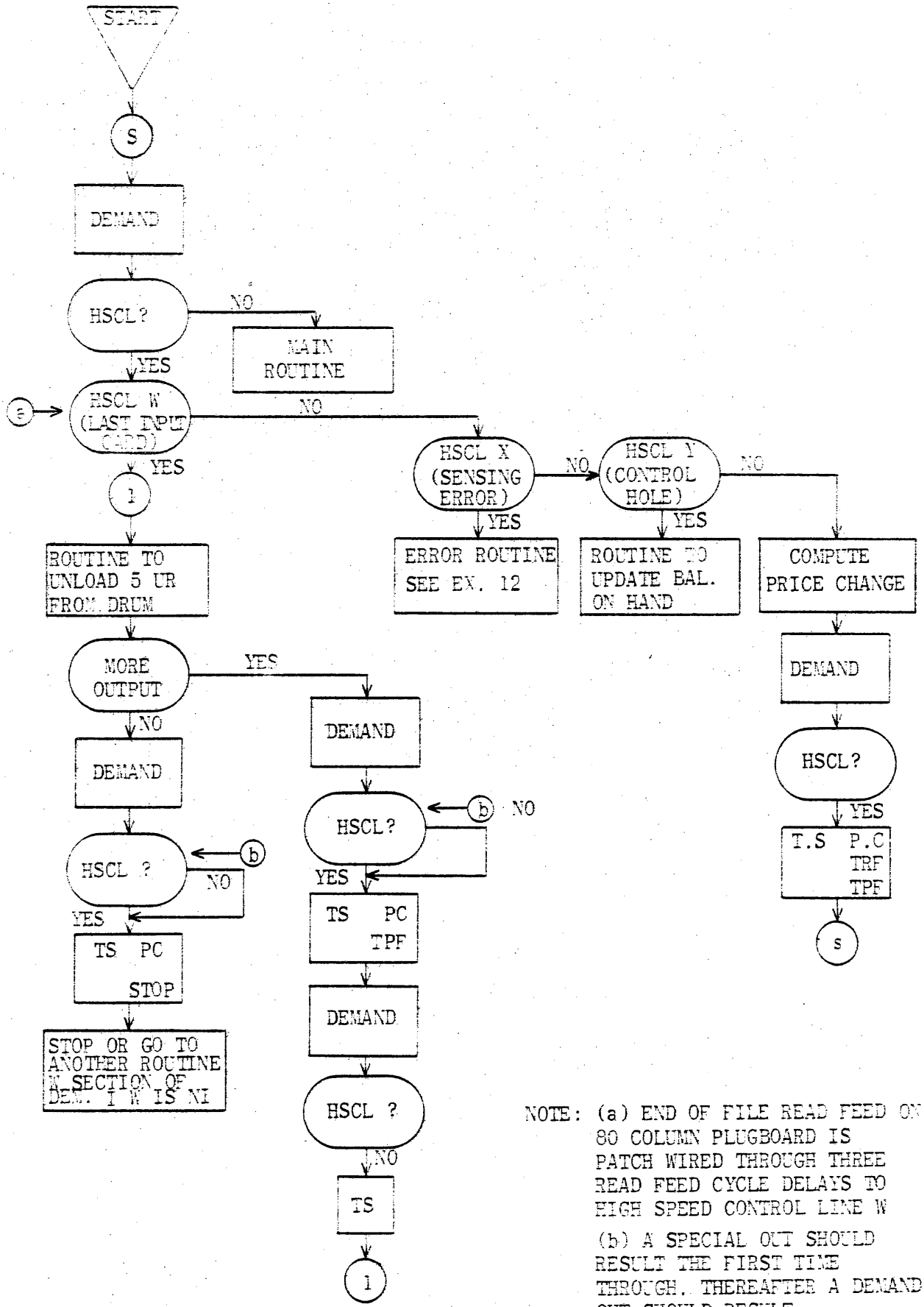


Example 9
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - Internal Program
Routine - Exit routine for Mode I manual run-out

Comments

The flow charts shown in Example 8 on the following pages illustrate a special case using the last card to unload certain records from general storage. In the event that the last card is not unique (i.e., like or similar to those preceding it) the End of File Read Feed signal may be used to set a connector, or activate a selector, so that after computation, Program Complete Trip Punch Feed and stop commands, in addition to a Track Switch, will be sent to the 80 Column Card Unit (as in the preceding example).

In either case, the card containing the results of the last computation may be manually run-out by depressing the C-to-I/O button, on the control panel of the 80 Column Card Unit once and the Manual Trip Punch Feed button 3 times.



NOTE: (a) END OF FILE READ FEED ON 80 COLUMN PLUGBOARD IS PATCH WIRED THROUGH THREE READ FEED CYCLE DELAYS TO HIGH SPEED CONTROL LINE W

(b) A SPECIAL OUT SHOULD RESULT THE FIRST TIME THROUGH. THEREAFTER A DEMAND OUT SHOULD RESULT.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 1 of 1
Application: Mode I - Exit Routine	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
215	04 W	AAA	300	TI	A	Test HSCL for W. If active this is the last read	1
						Channel Card which is to unload SUR from Gen. Storage	2
216	04 X	AAA	350	TI	A	Test for Sensing ERROR	3
217	04 Y	AAA	400	TI	A	Test for Control hole	4
218						Compute price change if a HSCL is active &	5
						it is none of the above it must be Z which	6
250						in this case indicates a price change	7
251	141	554	130	DE	A	Demand 80 Column Card Unit TS, PC, TPF, TPF - Since	8
						Special out will occur Return to IW 130	9
300	600	000	000	LA	L	Load GSAR with address of 1st UR to be unloaded	10
301	300	801	300	AD	A	Increment Address yielding address of next UR	11
302	300	800	AAA	CP	9	Compare incremented address to address of 6th	12
						UR (0000100) Set Cond'n. Stge.	13
303	98Z	AAA	04Z	BT	A	Block transfer contents of GSB to I/O Track	14
						04	15
304	AAA	992	307	JZ	A	If last UR (54) has been unloaded Jump to IW 307	16
305	141	552	306	DE	A	Demand 80 Column Card Unit - TS, PC, TPF -	17
						Special out should occur	18
306	141	555	300	DE	A	Demand 80 Column Card Unit & T.S. - Since	19
						Special out will occur Return to IW 300	20
307	80C	800	300	SB	A	Places Zeros in U, V, & W Sections of IW 300	21
308	141	566		DE		Demand 80 Column Card Unit TS, PC,	22
						Stop W section may Contain	23
						beginning address of another Routine.	24
							25
800	000	001	000	LA	L	Constants	26
801	000	000	200	000			27
							28
							29
							30
							31
							32
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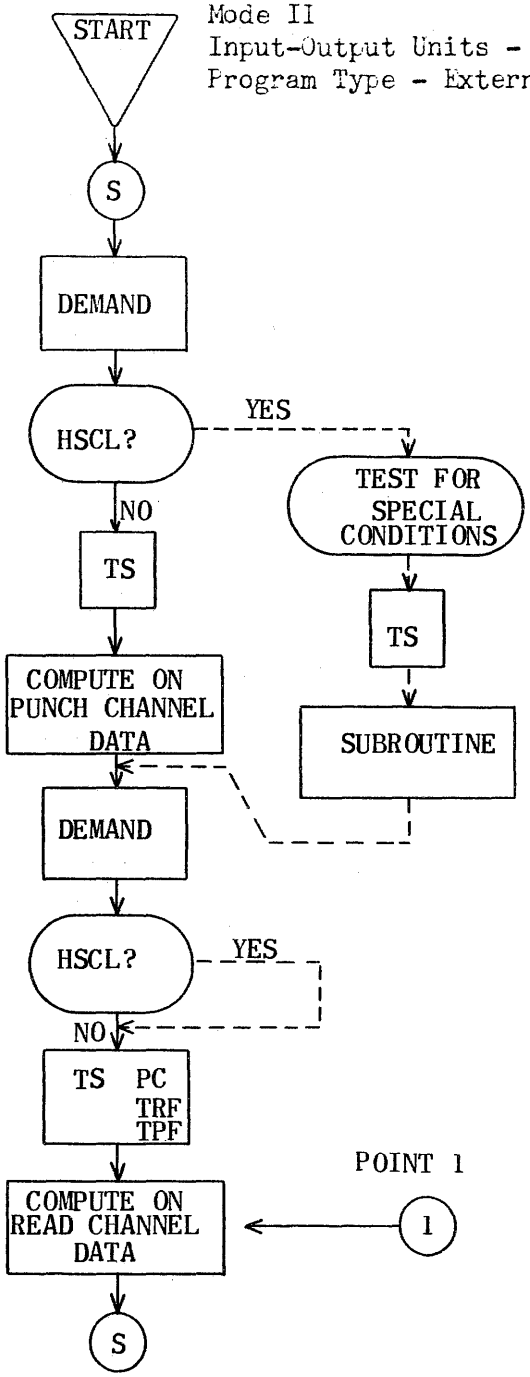
							40

Example 10
Mode II
Input-Output Units - One 80 Column Card Unit
Program Type - External or Internal program



Comments

The demand instruction synchronizes the Track Switch with the completion of input transfer of punch channel data.

A special out may result from a special condition detected in either channel. Therefore, if the special condition detected is pertinent to read channel computation, it must be remembered until point ① where it will be used. In an internal program, this is done by setting connectors.

This demand may be eliminated in an external program (providing the programmer knows that computations between the Track Switches will always exceed 17.5 ms.,) by bussing from the out of the last punch channel computation step to the required C-to-I/O lines, to the Track Switch hub, and to the in of the first read channel computation step. The Program Complete sets the 80 Column Card Unit to not ready.

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 1 of 1
Application: Model 1 - Interrupt Program	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
130	141	555	677	DE	L	Demand 60 Column Card Unit & TC to make punch channel information avail. to computer	1 2
131						Compute on Punch Channel Data	3 4
159							5
160	143	554	161	DE	L	Demand 60 Column Card Unit, TS, PC, TRF, TPF	6 7
161						Compute on Read Channel Data	8 9
199							10
							11
							12
177	1+	77	130	UJ	L	Return to IW 130 to begin next cycle	13
							14
							15
							16
							17
							18
							19
							20
							21
							22
							23
							24
							25
							26
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Example 11
Mode II
Input-Output Units - One 80 Column Card Unit
Program Type - Internal Program
Routine - Exit routine for Mode II manual run-out

Comments

Either channel may be the first to run-out of cards in a Mode II operation as explained previously in the section "Communication Between The Computer And The 80 Column Card Unit". The exit routine should be programmed to handle either case. The flow chart, program chart, and plugboard wiring diagram on the following pages illustrate one method of handling End of File condition in a Mode II type operation. (1) The Mode II run-out procedure described in an earlier section of this manual is applicable when this exit routine is employed. (2) The following paragraphs describe the plugboard wiring.

End of File Read Feed (EOFRF)

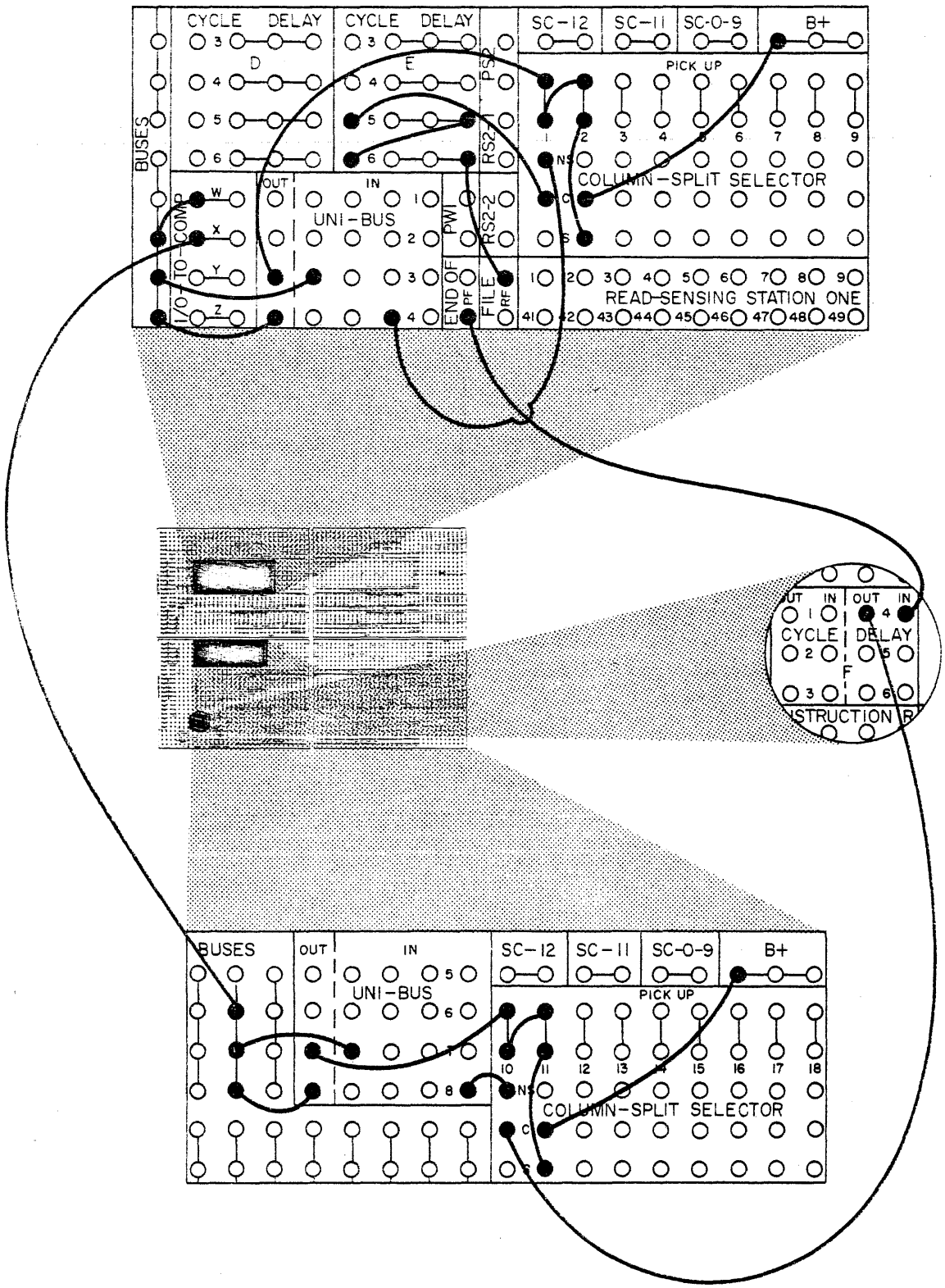
The End of File Read Feed hub is patchwired through two cycle delays to the common hub of column-split selector number one. The two cycle delays cause the EOFRF signal to be delayed so that it will be received by the computer after the last data in the read channel has been computed. The nonselect hub of column-split selector number one is patchwired to the in of unibus four, the out is bussed to high speed control line W, and to an in hub of unibus three. The out of unibus three is patchwired to the "pickup" associated with column-split selector number one. The unibus arrangement described above is used to prevent undesirable back circuits. The select hub of column-split selector number one is not wired thus disconnecting the EOFRF signal from high speed control line W and preventing a special out, resulting from an EOFRF signal, from occurring with every demand after an EOFRF. Column-split selector number two, in this example, is used as a holding control i.e., since the "pickups" of the selectors are bussed, the pickup of column-split selector number one causes the B+ to be routed to the pickup causing both selectors to remain in that position once they are picked up.

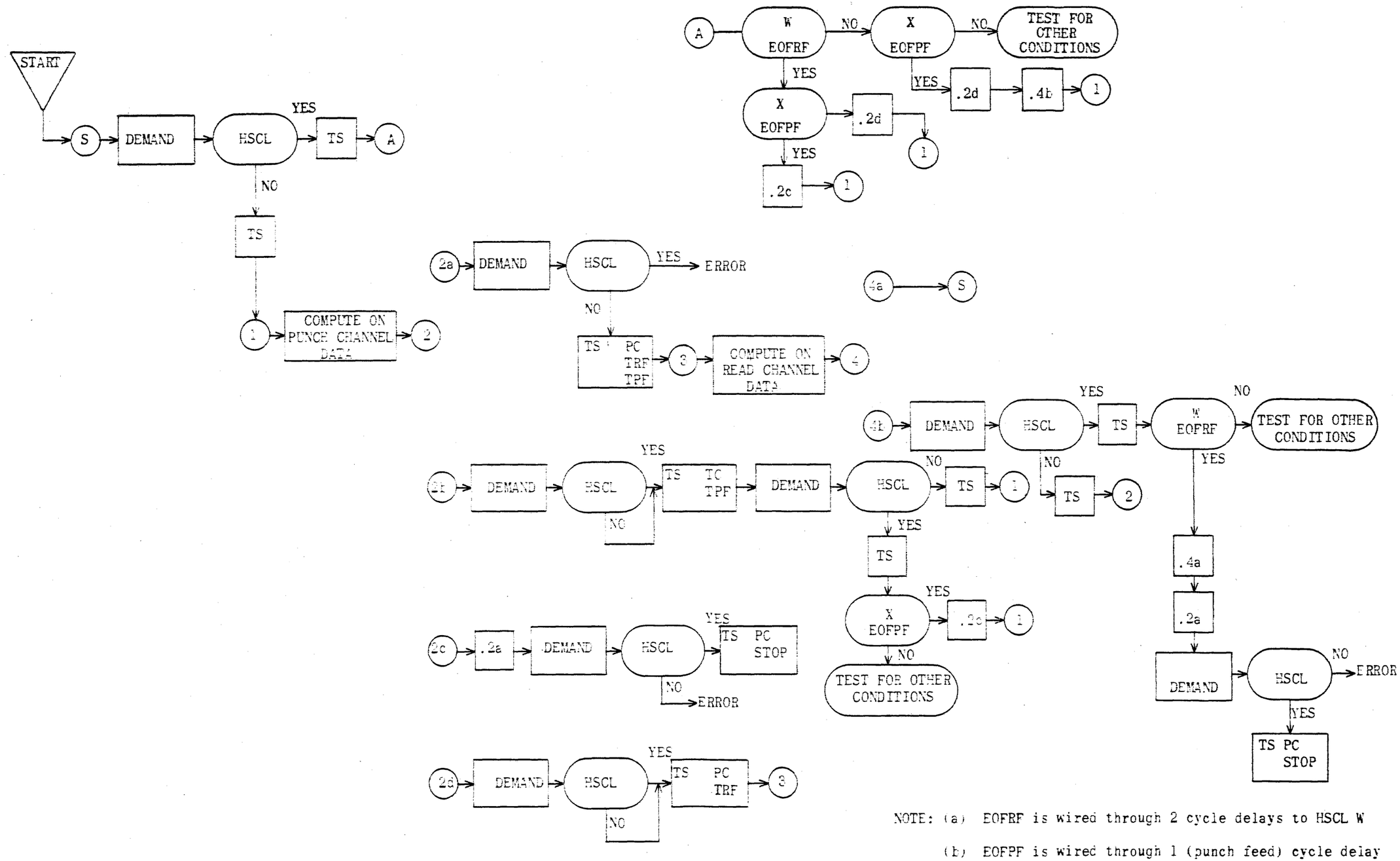
End of File Punch Feed (EOFPF)

The End of File Punch Feed hub is patchwired through a one cycle delay to the common of column-split selector number ten. The one cycle delay causes the EOFPF signal to be received by the computer before the calculation has begun on the last punch channel card. Column-split selector and unibuses are employed in the same manner as those associated with the End of File Punch Feed.

Batch Processing

If it should be desirable to employ batch processing the routing of B+ through an alternate switch, prior to patching to the commons of the selectors used as holding contacts (2 and 12), will enable the programmer after master clearing the 80 Column Card Unit to interrupt the source of B+ to the selector pickups, which will cause them to revert to the nonselect position. The input hoppers may now be refilled, and after run-in, processing may begin on the next batch.


CYCLE DELAY
D
CYCLE DELAY
E
SC-12
SC-11
SC-0-9
B+
PICK UP
BUSES
PSP
RS2
RS2-2
PWI
END OF FILE
PF
RF
OUT
IN
UNI-BUS
I/O TO COMP
W
X
Y
Z
COLUMN-SPLIT SELECTOR
NS
C
S
READ-SENSING STATION ONE
CYCLE DELAY
F
INSTRUCTION R
BUSES
OUT
IN
UNI-BUS
SC-12
SC-11
SC-0-9
B+
PICK UP
COLUMN-SPLIT SELECTOR



NOTE: (a) EOFRF is wired through 2 cycle delays to HSCL W

(b) EOFPF is wired through 1 (punch feed) cycle delay to HSCL X

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by	Revisions by	Revisions by	Program No.
	Date	Date	Date	Page 1 of 2
Application	Checked by	Revisions by	Revisions by	Date Installed
Mode II - Exit Routine	Date	Date	Date	by

Instruction Location	INSTRUCTION WORD U	V	W	PR S/C	REMARKS	LINE NO.
130	141	555	477	DEA	Demand 80 Column Card Unit TS	1
131					Compute on Punch Channel Data	2
						3
159						4
160	992	992	161	UJA	Represent Connector 2	5
161	140	554	161	DEA	Demand 80 Column Card Unit TS,	6
					PC, TRF, TPF. Since Special Out should	7
					not occur, W section stores constant	8
162					Compute on Read Channel Data	9
						10
196						11
197	ΔΔΔ	992	130	UJA	Return to IW 130 to begin next cycle	12
477	04W	ΔΔΔ	480	TIA	Test for EoFRF	13
478	04X	ΔΔΔ	710	TIA	Test for EoFRF (.2d)	14
479	ΔΔΔ	992	483	UJA	Test for other conditions	15
480	04X	ΔΔΔ	482	TIA	Test for EoFPF when there is an	16
					EOFRF	17
481	ΔΔΔ	992	679	UJA	EOFRF	18
482	ΔΔΔ	992	700	UJA	EOFRF and EOFPF (.2c)	19
679	680	160	131	UJA	Sets Connector 2 to 2b	20
680	141	552	681	DEA	Demand 80 Column Card Unit TS, PC, TRF	21
681	141	555	683	DEA	Demand 80 Column Card Unit TS	22
682	992	992	131	UJA	Return Jump to IW 131	23
683	04X	ΔΔΔ	700	TIA	Test for End of File Punch Feed after EoFRF	24
684	992	992	479		Test for other conditions if NSCL	25
					& not active.	26
						27
700	701	160	131	UJA	Set Connector 2 to 2c	28
						29
						30
						31
						32
						33
						34
						35
						36
						37
						38
						39
						40

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 2 of 2
Application: Mode II - Exit Routine	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
701	160	161	160	SW	Δ	Resets Connector 2 to 2a used when	1
						processing is done in batches.	2
702	141	562	---	DE	Δ	Demand 80 Column Card Unit TS, PC, TPF,	3
						Stop Address in w section of IW may	4
						be used to Reset PAK for entry to another	5
						program or 2 in S/C of IW will cause	6
						Computer to stop.	7
710	711	160	131	UJ	Δ	Set Connector 2 to 2a & Jump to IW 130	8
711	141	558	712	DE	Δ	Demand 80 Column Card Unit TS, PC, TRE	9
712	713	197	162	UJ	Δ	Set Connector 4 to 4b Jump to IW 162	10
713	141	ΔΔΔ	715	DE	Δ	Demand 80 Column Card Unite TS	11
714	ΔΔΔ	992	711	UJ	Δ	Jump to IW 711	12
715	04W	ΔΔΔ	717	TI	Δ	Test for EOFRF after EOFPF	13
716	992	992	479	UJ	Δ	Test for other Conditions	14
717	130	197	718	UJ	Δ	Reset Connector 4 to 4a	15
718	160	161	160	SW	Δ	Reset Connector 2 to 2a	16
719	141	556	---	DE	Δ	Demand 80 Column Card Unit TS, PC,	17
						stop. Address in w section of	18
						IW may be used to Reset PAK	19
						for entry to another Routine.	20
							21
							22
							23
							24
							25
							26
							27
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Example 12
Mode II
Input-Output Units - One 80 Column Card Unit
Program Type - Internal Program
Routine - Reading 300 cards a minute from both channels

Comments

The routine, illustrated in the flow chart, wiring diagram, and code sheets on the following pages, is designed to read cards from both the read and punch channels at a rate of approximately 300 cards per minute, depending upon the computation time required for each card. The maximum computation time allowed for each card, if a reading rate of 300 cards per minute is to be maintained, is approximately 115 milliseconds.

The routine illustrated on the following pages requires the first two Read Channel cards to be blank. During run-in, (i.e., computer run-in which is not to be confused with I/O Unit run-in) the data from the first five punch channel cards are delivered to intermediate storage tracks 80Z-84Z. The data from the first two read channel cards (blank) are delivered to intermediate storage tracks 71Z and 72Z. The next three read channel cards containing data are then delivered to intermediate storage tracks 70Z-72Z.

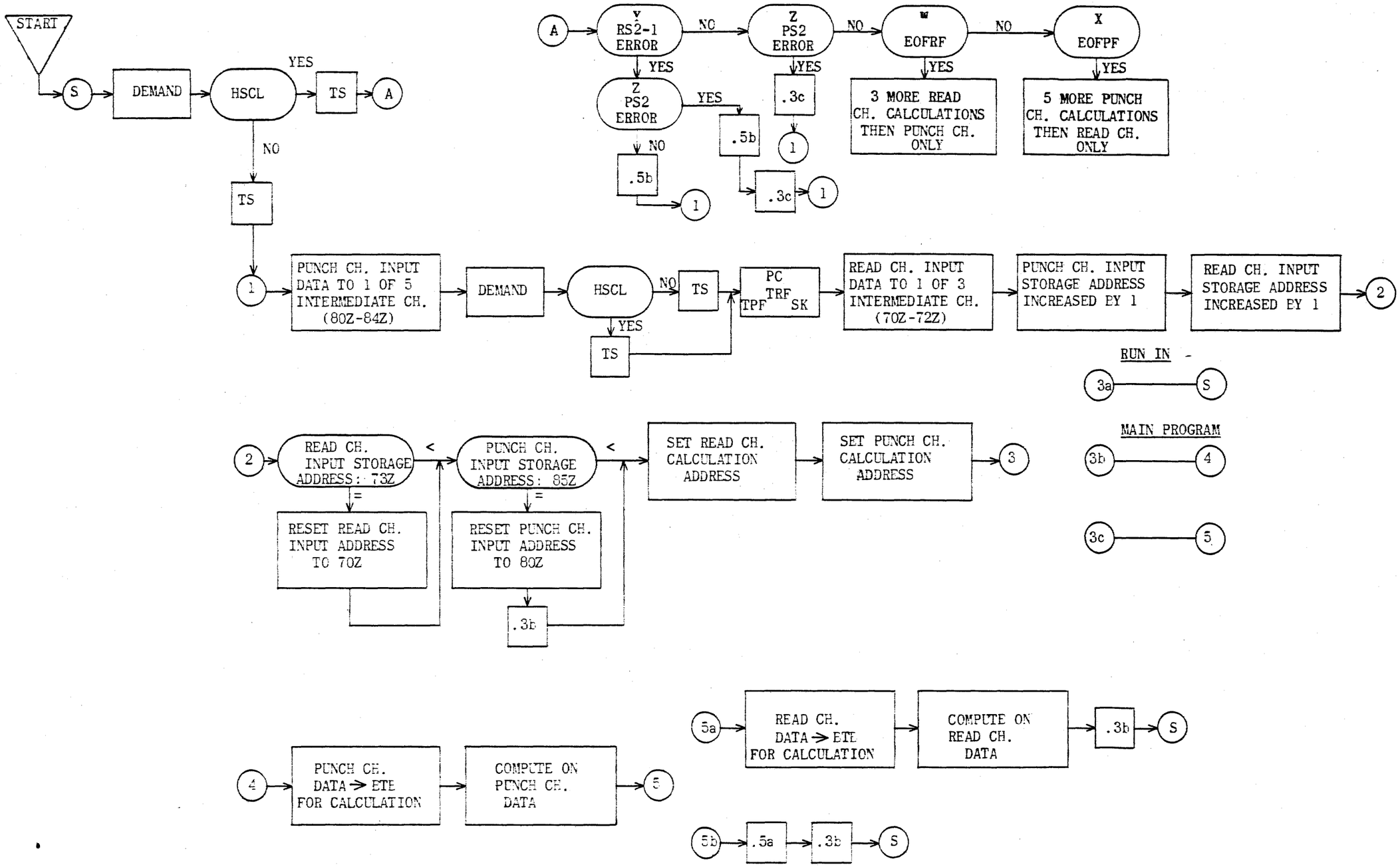
Input data transmission to intermediate storage tracks are sequenced as follows:

First Punch Channel Card (data) --→ 80Z
First Read Channel Card (blank) --→ 71Z
Search Punch Channel Card (data) --→ 81Z
Search Read Channel Card (blank) --→ 72Z
Third Punch Channel Card (data) --→ 82Z
Third Read Channel Card (data) --→ 70Z
Fourth Punch Channel Card (data) --→ 83Z
Fourth Read Channel Card (data) --→ 71Z
Fifth Punch Channel Card (data) --→ 84Z
Fifth Read Channel Card (data) --→ 72Z

The completion of the above events terminates the run-in by setting a connector (3b in the flow chart) which will cause entry to the main program. It will be observed, from the flow chart, that a read and punch channel calculation address is set after each transmission of data to an intermediate storage track. This is done so that, upon entry into the main program, calculations will be performed on that data contained on the intermediate storage track which is to receive input data in the next card cycle. The overlaying of data upon data, which has not yet been calculated, is prevented in this manner.

Data from cards in both channels are checked for sensing errors prior to computation, so that computation may be skipped on an incorrectly sensed card. In addition, the 80 column plugboard program, instructed by patchwiring, will cause the Unit to stop at the time the error card is received in the output hopper. This precedure enables the programmer to examine the error card for the defect, and to take appropriate action as dictated by the nature of the error.

If the programmer should find it necessary to confine the program entirely to the computer plugboard because of a lack of internal storage for instruction words, a demand substep may be inserted just prior to the punch and read channel data calculation sequence. When special condition hubs, such as those for sensing errors and end of file conditions, are patchwired to low speed I/O-to-C control lines to pickup selectors on the computer plugboard (in order to vary the program), the step out of the "set punch channel calculation address" step may be bussed to the demand substep, and through a program select, before entry into a selector chain represented by connectors 2a, 2b and 2c in the flow chart. Two tracks for read channel data and four tracks for punch channel data are required when an external demand is utilized in this manner.


START
S
DEMAND
HSCL
YES
TS
A
NO
TS
1
PUNCH CH. INPUT DATA TO 1 OF 5 INTERMEDIATE CH. (80Z-84Z)
DEMAND
HSCL
NO
TS
YES
TS
PC TRF TPF SK
READ CH. INPUT DATA TO 1 OF 3 INTERMEDIATE CH. (70Z-72Z)
PUNCH CH. INPUT STORAGE ADDRESS INCREASED BY 1
READ CH. INPUT STORAGE ADDRESS INCREASED BY 1
2
A
V RS2-1 ERROR
NO
Z PS2 ERROR
NO
W EOFRF
NO
X EOFPF
YES
Z PS2 ERROR
YES
.5b
NO
.5b
1
.3c
YES
1
.3c
1
YES
3 MORE READ CH. CALCULATIONS THEN PUNCH CH. ONLY
YES
5 MORE PUNCH CH. CALCULATIONS THEN READ CH. ONLY
RUN IN
3a
S
MAIN PROGRAM
3b
4
3c
5
2
READ CH. INPUT STORAGE ADDRESS: 73Z
<
PUNCH CH. INPUT STORAGE ADDRESS: 85Z
<
SET READ CH. CALCULATION ADDRESS
SET PUNCH CH. CALCULATION ADDRESS
3
=
RESET READ CH. INPUT ADDRESS TO 70Z
=
RESET PUNCH CH. INPUT ADDRESS TO 80Z
.3b
4
PUNCH CH. DATA → BTE FOR CALCULATION
COMPUTE ON PUNCH CH. DATA
5
5a
READ CH. DATA → BTE FOR CALCULATION
COMPUTE ON READ CH. DATA
.3b
S
5b
.5a
.3b
S

Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 1 of 2
Application: Mode II Read	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / By

Instruction Location	INSTRUCTION WORD V	W	PF	S/C	REMARKS	LINE NO.
110	000	001	00	0		1
111	000	000	001	46 L		2
112	042	AAA	852	BTA	Constants	3
114	042	AAA	802	BTA		4
115	042	AAA	732	BTA		5
116	042	AAA	702	BTA		6
						7
140	141	555	417	DEA	Demand TS - Special out to Step 417	8
141	042	AAA	(802)	BTA	Transfer Punch Channel Input Data to 1 of 5	9
					intermediate Storage Tracks (802 - 852)	10
142	141	55F	143	DEA	Demand TS - PC, TRE, TPE	11
143	042	AAA	(712)	BTA	Transfer Read Channel Input data to 1 of 32	12
					intermediate storage TRACKS (702 - 702)	13
144	143	141	162	51	Transfer Control to plugboard Step 51	14
51	V	110	V	ADA	52 Modify W section of Instruction	15
					Word (IW) 141	16
52	4	110	V	ADA	53 Modify W section of IW 142	17
53	4	115	AAA	CP	Br 1 (= → Step #54) (- → Step #55)	18
54	116	AAA	4	AT	55 Reset W section of IW 143 to 702	19
55	V	112	AAA	CP	Br 2 (= → Step #56) (- → Step #58)	20
56	114	AAA	V	AT	57 Reset W section of IW 141 to 802	21
57	4	46 EA	AAA	CP	NI Load A+B Registers in Preparation	22
					for NI	23
58	111	AAA	PAK	AT	57 Send 146 → PAK	24
145	150	149	146	4JA	146 Sets 3 to 36	25
146	990	991	162	S4A	Set Read Channel Calculation Address	26
147	150	141	AAA	59	Transfer Control to plugboard Step 59	27
59	4	V6EA		CP	NI Load A+B Registers in preparation	28
					for NI	29
148	990	991	150	S4A	Set Punch Channel Calculation Address	30
149	AAA	992	(140)	4JA	Return to IW 140 for NI on Run-in	31
150	(802)	AAA	102	BTA	Transfer Punch Channel Data to BTB	32
151					for computation	33
					Compute on Punch Channel Data	34
160						35
161	162	161	(162)	4JA	Resets 5 to 5a	36
162	(702)	AAA	102	BTA	Transfer Read Channel Data to BTB	37
					for computation	38
						39
						40

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Model 1 UNIVAC® File-Computer Program Chart

Customer	Programmed by / Date	Revisions by / Date	Revisions by / Date	Program No. / Page 3 of 3
Application	Checked by / Date	Revisions by / Date	Revisions by / Date	Date Installed / by

Instruction Location	INSTRUCTION WORD U	V	W	PR	S/C	REMARKS	LINE NO.
163							1
						Compute on Read Channel Data	2
172							3
173	144	149	140	UJ	A	Resets Connector 3 to 36	4
							5
							6
417	047	440	419	TI	A	Test HSCL "Y" for RS2-1 ERROR	7
418	042	440	424	TI	A	Test HSCL "Z" for PS2 ERROR when there is no	8
						RS2-1 ERROR	9
419	042	440	421	TI	A	Test HSCL "Z" for PS2 ERROR when there	10
						is a RS2-1 ERROR	11
420	440	992	422	UJ	A	Entry to this IW indicates a RS2-1 ERROR	12
421	423	422	422	UJ	A	Entry to this IW indicates a RS2-1 &	13
						PS2 ERROR to	14
422	173	161	141	UJ	A	Set Connector 5 to 56	15
423	141	422	424	UJ	A	Resets W section of IW 422 to 141	16
424	141	149	141	UJ	A	Set Connector 2 to 3C	17
							18
							19
							20
							21
							22
							23
							24
							25
							26
							27
							28
							29
							30
							31
							32
							33
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							35
							36
							37
							38
							39
							40

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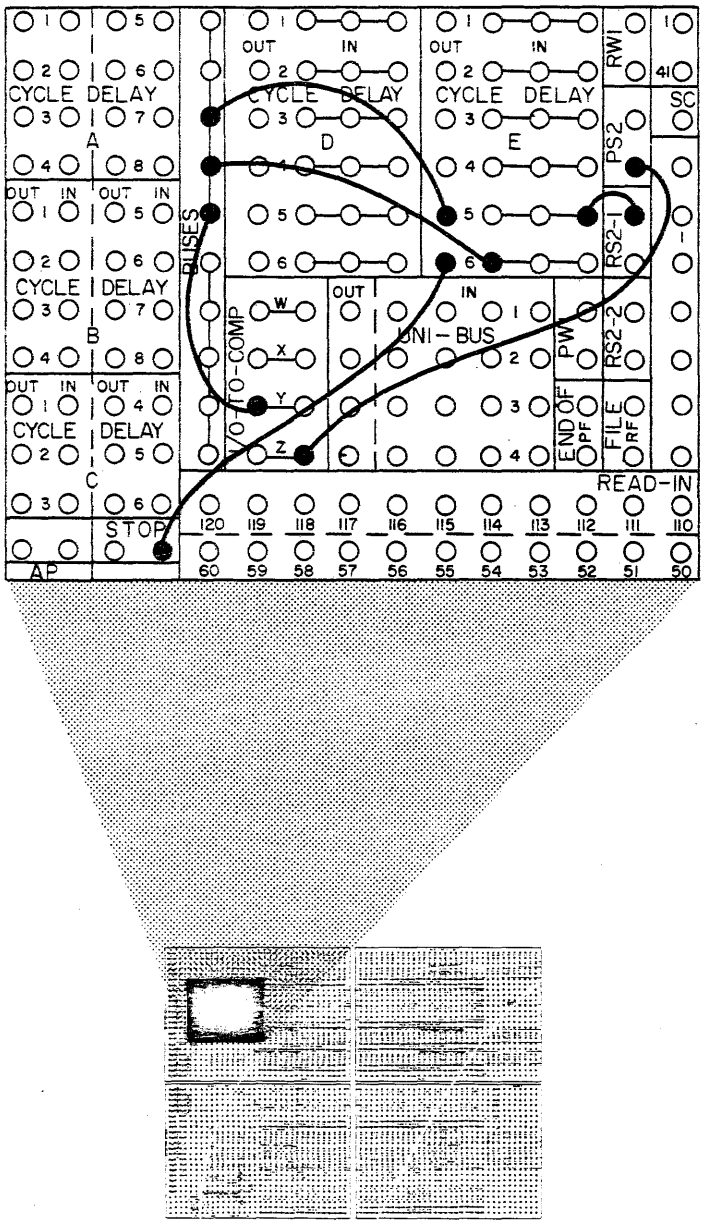

CYCLE DELAY
A
B
C
D
E
OUT IN
PULSES
TO-COMP
W
X
Y
Z
UNI-BUS
PW
END OF FILE
PF
RF
RS2-1
RS2-2
PS2
RWI
SC
READ-IN
STOP
AP
120 119 118 117 116 115 114 113 112 111 110
60 59 58 57 56 55 54 53 52 51 50

Example 13
Mode I
Input-Output Units - One 80 Column Card Unit
Program Type - Internal Program
Routine - Read-Sense two error recovery

Comments

The flow chart and wiring diagram designed to handle this condition are on the following pages. The 80 Column Card Unit will stop at the end of the card cycle in which the error occurred as previously stated in the section dealing with Error Detection and Recovery. The operator may, by referring to lights on the adapter display panel of the 80 Column Card Unit determine the type of error detected by the Unit.

If the error detected was the result of a faulty comparison at the Read-Sensing 2 station, a CMP R error will be indicated on the display panel of the adapter, the operator may, by reading the COMPARE R neons, determine the buffer position (word and character) which do not agree.

In the event that a Trip Read Feed command accompanied the control information initiating the cycle in which the error was detected, an error signal will be emitted from the RS2-1 hub on the 80 column plugboard when the RS2 card control reset button is depressed. If the control information, initiating the cycle in which the error was detected, did not contain a Trip Read Feed command (intermittent feeding of read channel cards) the error signal will be emitted from the RS2-2 hub on the 80 column plugboard, when the RS2 card control reset button is depressed.

In either case (RS2-1 or RS2-2) if the error could not significantly affect the results, it may be expeditious to process the card without correcting the error. If the error needs correcting before processing, provision must be made to skip calculation on the card so that it may be corrected and processed later. In Mode I operation, the following example illustrates one method of handling sensing errors.

Problem: If the error resulted from incorrect sensing of data in card columns 15-30, process the card as usual* and also punch a 12 in card column 41 (a column containing numeric data). If the error is in any other column, skip calculation on the card; stop the 80 Column Card Unit when the error card is received in the output hopper.

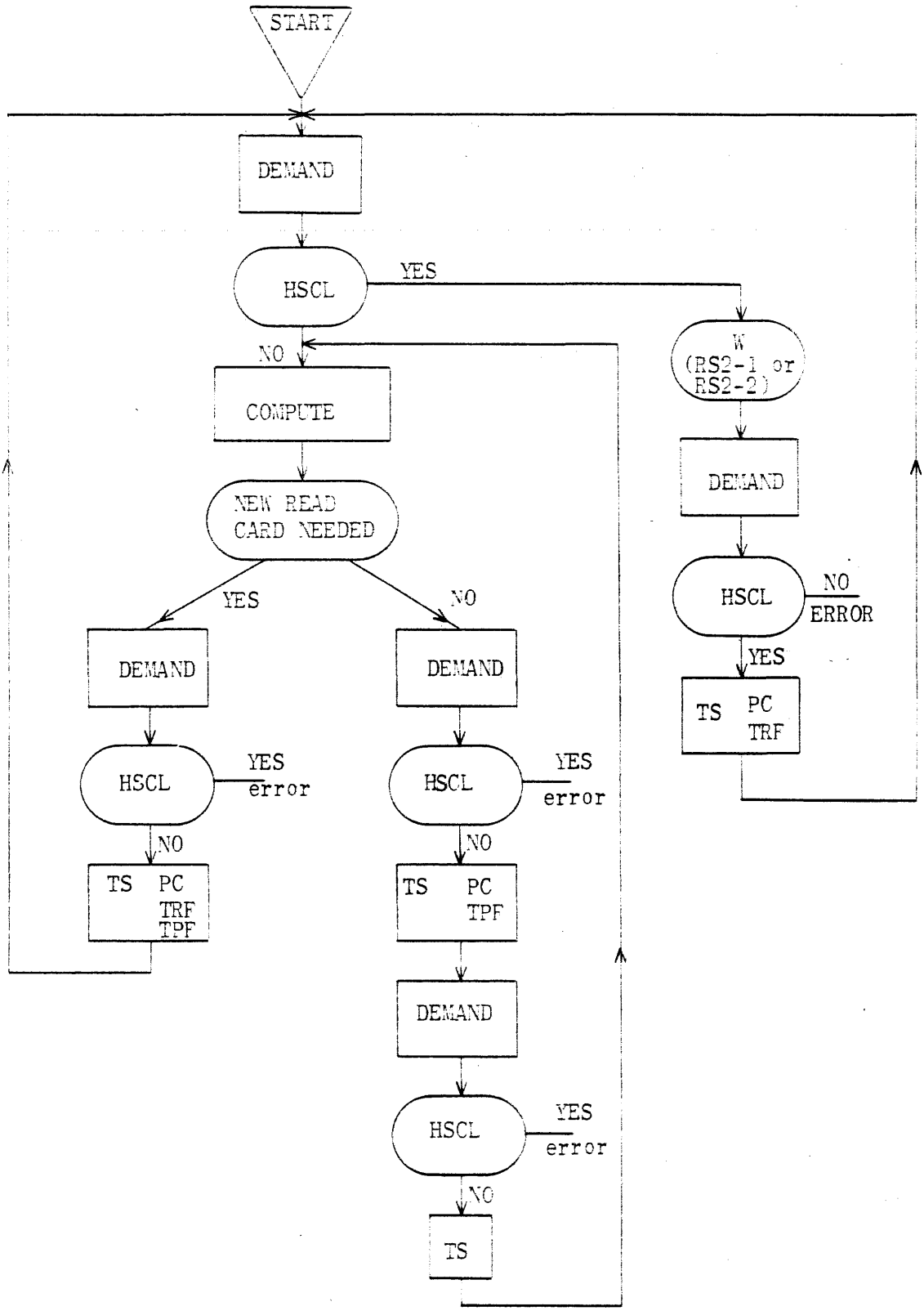
---

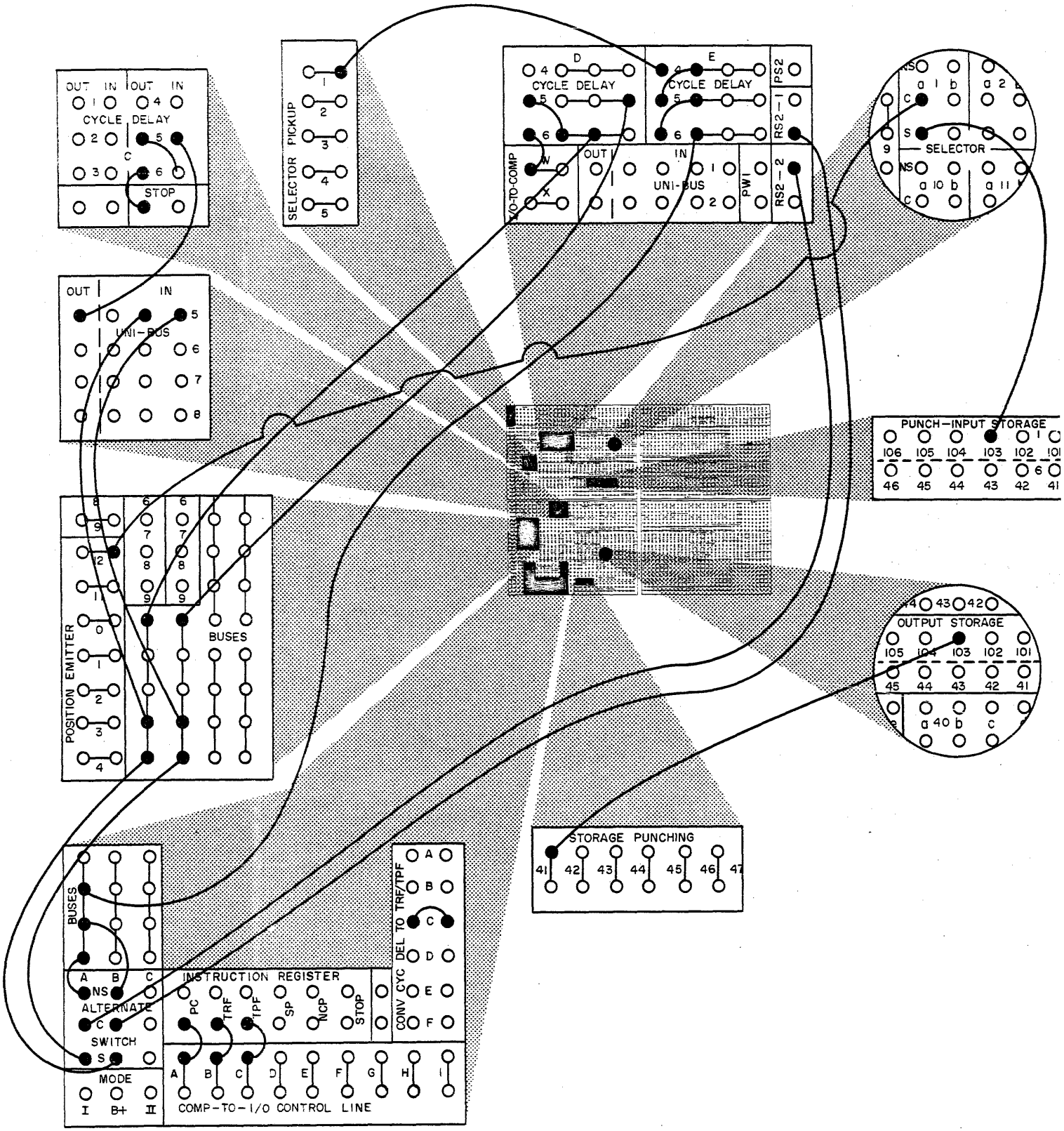
* As an example of a noncritical error, assume that columns 15-30 contain an address to be inserted in a field in a URA. This address is not to be used until several runs later. Other data on the card is used to update balances in the URA as part of this run. Thus, the updating data must be corrected immediately if in error, but the address can be corrected at any time before the run in which it is used. It may prove to be expeditious to separate the address errors (by marking them with an overpunch) and correct them (if there are any) as part of a later run rather than slowing down the particular run in which they occurred.

If either a RS2-1 or a RS2-2 comparison error was detected the operator may, by referring to the COMPARE R neons on the adapter display panel, determine the buffer position (word and character) in which the error arrived. From this information the operator may determine the card column or columns which were incorrectly sensed.

If the error occurred in card columns 15-30 the operator would set alternate switches 1 and 2 to the nonselect positions causing a 12 to be punched in card column 41. If the error were in any other column the alternate switches would be set to the select positions. This will cause the activation of HSCI W, which instructs the computer to skip calculations on the error card, in addition to stopping the 80 Column Card Unit when the error card is received in the output hopper.

After determining the proper position for the alternate switches the operator may, by depressing the appropriate card control reset button (RS2), cause a signal to be emitted at the appropriate Read-Sense error hub (RS2-1 or RS2-2). Depressing the resume button clears the error circuits and enables the unit to continue normal operation.


START
DEMAND
HSCL
YES
NO
COMPUTE
NEW READ CARD NEEDED
YES
NO
DEMAND
HSCL
YES error
NO
TS PC TRF TPF
DEMAND
HSCL
YES error
NO
TS PC TPF
DEMAND
HSCL
YES error
NO
TS
W (RS2-1 or RS2-2)
DEMAND
HSCL
NO ERROR
YES
TS PC TRF


OUT IN OUT IN
CYCLE DELAY
STOP
SELECTOR PICKUP
D
CYCLE DELAY
E
CYCLE DELAY
PS2
RS2-1
I/O-TO-COMP
OUT
IN
UNI-BUS
PWI
RS2-2
SELECTOR
OUT
IN
UNI-BUS
PUNCH-INPUT STORAGE
106 105 104 103 102 101
46 45 44 43 42 41
POSITION EMITTER
BUSES
OUTPUT STORAGE
105 104 103 102 101
45 44 43 42 41
STORAGE PUNCHING
41 42 43 44 45 46 47
BUSES
A B C
NS
ALTERNATE
C
SWITCH
S
MODE
I B+ II
INSTRUCTION REGISTER
PC TRF TPF SP NCP STOP
CONV CYC DEL TO TRF/TPF
A B C D E F
A B C D E F G H I
COMP-TO-I/O CONTROL LINE

EQUIPMENT LOGIC

Although many of the problems in this manual can be handled without understanding the logic involved in the two modes, the fullest utilization of the 80 Column Card Unit depends on the programmer's comprehension of the logic of the Unit. This discussion of the logic behind each mode is presented with that end in mind.

MODE I

In Mode I the read channel functions as the input to the Unit while the punch channel functions as the output. Figure 6 and Table III show the sequence of the more important functions from a programming viewpoint, and should be read and studied in conjunction with each other to assist in understanding the process.

Table III - Equipment Logic in Tabular Form Mode I

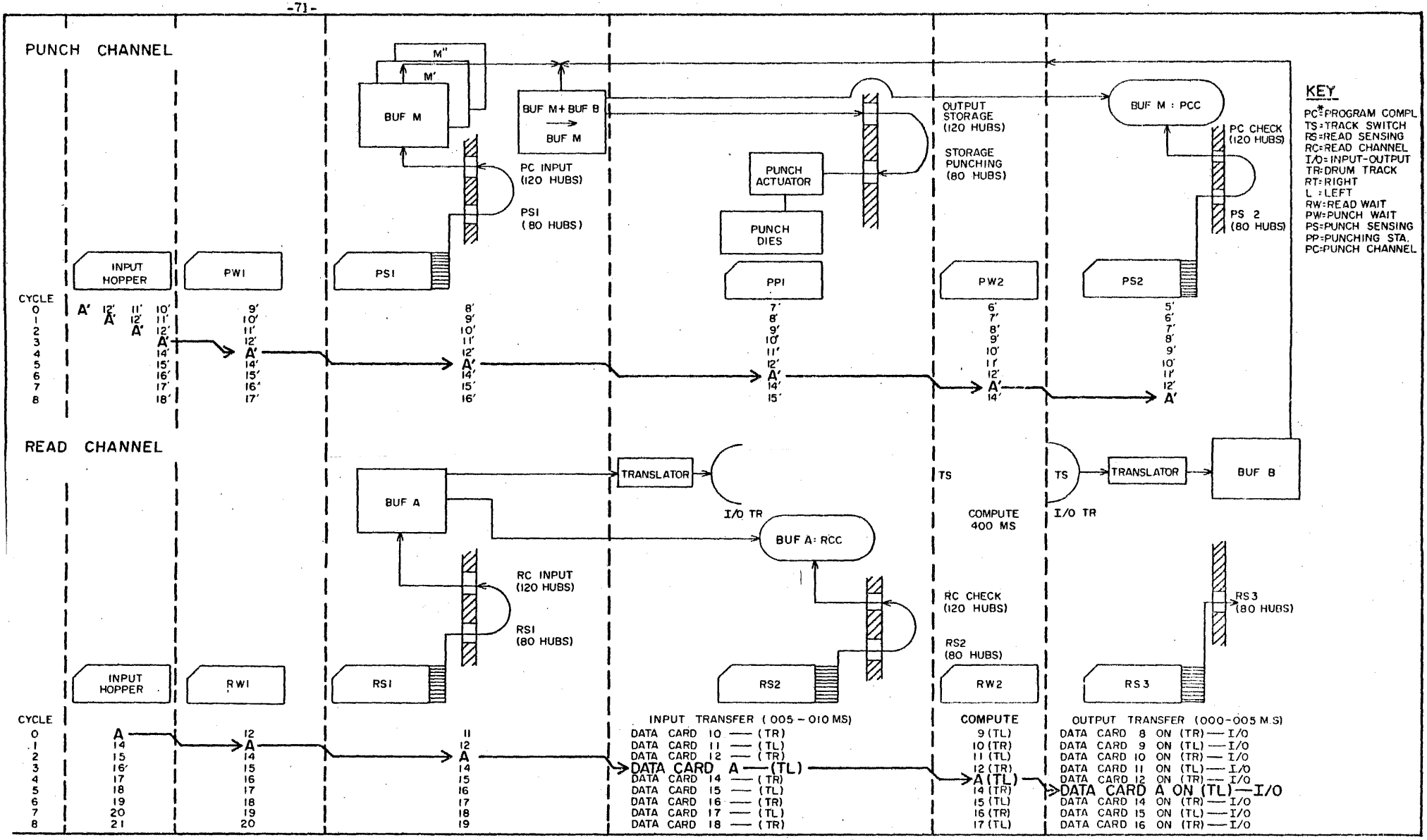
Cycle	Read Feed	Punch Feed
1	Card A is in the input hopper. The 1st Program Complete and Trip Read Feed signals are received initiating Cycle 1.	
1	Card A moves into the RW1 station where it is positioned and held.	Card A' moves into PW1, is positioned and held when the 1st Program Complete and Trip Read Feed signal is accompanied by a Trip Punch Feed.
2	The 2nd Program Complete and Trip Read Feed signals received initiates Cycle 2, causing the card to start moving into the RS1 station.	
2	Card A moves under the brushes at RS1 and is sensed, one row at a time, starting with row 12. The data sensed is brought out to the plugboard at 80 hubs labeled RS1 which correspond to the 80 columns of the card. Format and editing is possible at this time as the hubs may be patchwired to any of 120 hubs labeled Read-Input Storage hubs. When patchwired in this manner data flows behind the plugboard into a 120 character core buffer called buffer A. Read-Input Storage positions which are not wired record "no punch" in the corresponding position of buffer A; that is, any previous data in those positions is erased. The data in this buffer is in card code.	
3	The 3rd Program Complete and Trip Read Feed received initiates Cycle 3. Card A starts into the RS2 station.	

Cycle	Read Feed	Punch Feed
3	Data from Card A, in Read-Input Storage positions flow from buffer A through the translater, which converts it to Univac 7 level code and onto the input-output track connected to the card unit. The data flows onto the drum consecutively from the least significant character of word 9 through the most significant character of word 0.	
3	Card A moves under the brushes at RS2 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled RS2 hubs which correspond to the 80 columns of the card. These hubs may be patchwired to any of 120 hubs labeled Read-Check hubs. The circuitry of the unit is so constructed that when patchwired in this manner, data flows back behind the plugboard to a one bit comparator where it is compared with the corresponding bit position from buffer A. If an error is detected, the card unit stops at the end of the cycle.	
4	The 4th Program Complete and Trip Read Feed signal received initiates Cycle 4, causing Card A to start moving into the RW2 station. An automatic Track Switch makes data from Card A available to computer.	
4	The computer may now operate on data from Card A.	
5	The 5th Program Complete and Trip Read Feed signals received, initiates Cycle 5. Card A starts moving through the RS3 station. A Track Switch makes the output results available to I/O unit.	A Trip Punch Feed signal received at this time will cause Card A' to start moving from the PW1 station into the PS1 station.

Cycle	Read Feed	Punch Feed
5	An output transfer takes place where 120 characters on the I/O track connected to the card unit are consecutively read, starting with the least significant digit of word 9 first. The data flows through a translator which converts each character to 80 column card code. From the translator the data flows into a 120 character core buffer called buffer B. Data is now in card code in output storage positions.	Card A' is moving toward the brushes in PS1.
5	Card A moves under the brushes at RS3 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs, labeled RS3, corresponding to the 80 columns of the card.	Card A' moves under the brushes at PS1 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs, labeled PS1, corresponding to the 80 columns of the card.
	This data can be used at the programmers descretion.	Note: Card A' is primarily used for receiving the output information resulting from calculations on Card A. Thus it may be a blank card or contain a small amount of prepunched data. PS1 hubs patchwired into any of the 120 Punch-Input Storage hubs allows data to flow back behind the plugboard into a 120 character core buffer called buffer M. This information is in Punch-Input Storage positions in card code.

Cycle	Read Feed	Punch Feed
5	Card A is moving into the output hopper.	At this time buffer B and buffer M are combined in buffer M. If both buffers have data in any identical storage positions, the result after the combination is a merge of the data in these identical positions. For example, if buffer B position 30 contained a G (12 and a 7); and buffer M contained a 6; the resulting combination in buffer M would be 12, 7, 6. Thus the output data from Card A in buffer B is combined with any data in buffer M (probably from Card A') and put in buffer M.
6		The 6th Program Complete and Trip Punch Feed signals received from the computer initiates card Cycle 6. Card A' starts moving into the punching station (PP1).
6		During this time 12 clock enables are sent to each of 120 hubs labeled Output Storage corresponding to the 120 positions in buffer M. If any of the data in buffer M is to be punched in the card, the enables from those positions must be wired to the desired column in the Storage Punching Section. The enable then flows behind the plugboard and allows the data from the corresponding position in buffer M to set up the appropriate punch actuator. Buffer M is not altered by this process.
6		The contents of buffer M is punched in Card A' and only those positions wired to punch are recirculated to buffer M.

Cycle	Read Feed	Punch Fe
7		The 7th Program Compl Punch Feed signals fr puter initiate Cycle moves into PW2 and is until next Program Co is received.
8		The 8th Program Complete and Trip Punch Feed signal from the computer initiate Cycle 8. Card A' moves into the PS2 station.
8		Card A' moves under the brushes at PS2 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled PS2 corresponding to the 80 columns of the card. When PS2 hubs are patchwired to any of the 120 Punch-Check hubs the data numbered in card columns will be compared with the corresponding position of buffer M. In this manner the sensing and punching of Card A' are checked. (Note: Buffer M is actually a 360 character buffer so that cards following A' will be read into second and third sections of M. As Card A' data is now read out of M the first section can be used for the 3rd card following Card A'.)



MODE I CARD AND DATA FLOW

FIGURE 6

MODE II

In Mode II both the READ FEED and the PUNCH FEED may function as inputs to the Unit. The Read Feed operates only as a card reader while the Punch Feed operates as a Read Punch Unit with the ability to punch in the same card from which it read.

Figure 7 and Table IV show the sequence of the more important functions from a programming viewpoint, and should be read and studied in conjunction with each other to assist in understanding the process.

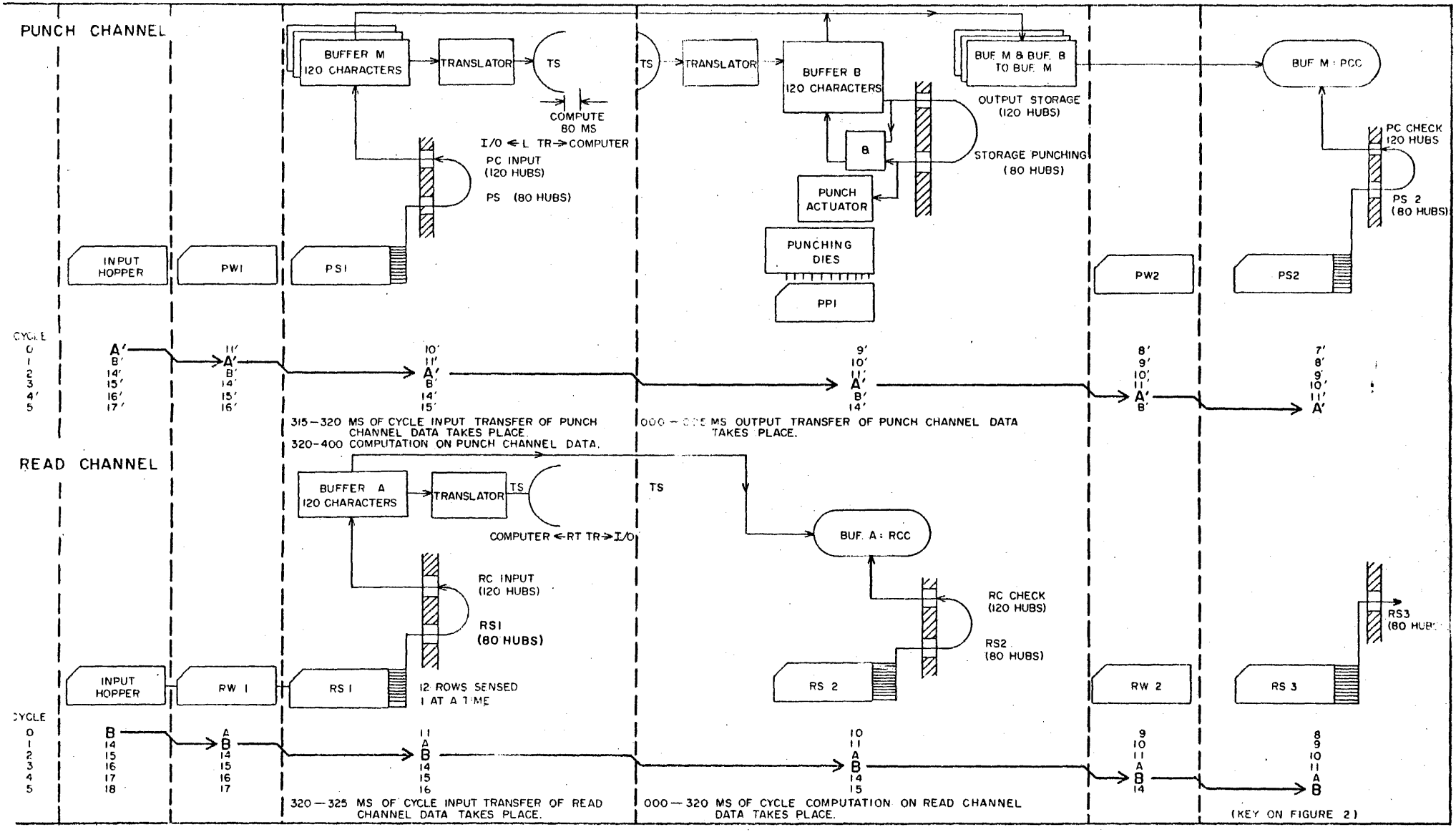
Table IV - Equipment Logic in Tabular Form Mode II

Cycle	Punch Feed	Read Feed
1	Card A' is in the input hopper. The 1st Program Complete and Trip Punch Feed signals received, initiate Cycle 1. Card A' starts moving into the PW1 station.	Card B is in the input hopper. When the 1st Program Complete and Trip Read Feed signals are accompanied by a Trip Read Feed card B starts moving into the RW1 station.
1	Card A' is moved into PW1, positioned and held.	Card B is moved into RW1, positioned and held.
2	2nd Program Complete and Trip Punch Feed signal received, initiates Cycle 2. Card A' moves into PS1 station (Unit goes "not-ready" when the Program Complete signal is received).	Card B moves into RS1 when a Trip Read Feed signal was also received with the Program Complete.
2	Card A' moves under the brushes at PS1 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled PS1, and numbered 1-80 corresponding to the 80 columns on the card. Format arrangement and editing is possible at this time as the data may be patchwired to any of 120 hubs labeled Punch-Input Storage, numbered from 1-120 corresponding to the 120 character positions on the input-output track. Data flows behind the plugboard into a 120 character core buffer called buffer M. The data in this buffer is in card code.	Card B moves under the brushes at RS1 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled RS1 and numbered 1-80 corresponding to the 80 columns on the card. Format arrangement and editing is possible at this time as the data may be patchwired to any of 120 hubs labeled Read-Input Storage and numbered from 1-120 corresponding to 120 character positions on the input-output track. Data flows behind the plugboard into a 120 character core buffer called buffer A. The data in this buffer is in card code. Read-Input Storage positions which are not wired record "no punch" in the corresponding positions of buffer A; and, when translated to Univac code, result in a space code being recorded in that position.

Cycle	Punch Feed	Read Feed
2	Data contained in buffer M is translated to Univac code and recorded on the input-output track connected to the unit.	Waiting
2	Unit goes "Ready". Demand and Track Switch take effect. Card A' data becomes available to computer.	Track to receive Card B data becomes available to input-output unit.
2	Compute on data from Card A'; if any data resulting from Card A calculations is to be punched into Card A'. Transfer computed data to output track.	Input transfer of data from Card B takes place. Card B data flows from buffer A through translator onto input-output track connected to the Unit. Unit goes "Ready" when input transfer complete.
3	3rd Program Complete, Trip Punch Feed, and Track Switch signals received initiate Cycle 3. Card A' moves into PP1 station. Card A' output data becomes available to input-output unit.	When a Trip Read Feed signal is also received, Card B moves into the RS2 station. Card B data becomes available to computer.
3	Output transfer of calculations on Card A' occurs. Card A' output data flows from input-output track connected to the Unit through a translator into a 120 character core buffer called buffer B. The entire 120 characters on the output track are thus recorded in buffer B in output storage positions in card code.	Computation begins on data from Card B. (Note: Computation on the previous card, Card A, occurred 1 cycle earlier, or at Card A' time 400 ms on this chart.)
3	During row 12 time 120 enables are generated, one at each of 120 clock times, and are brought to the plugboard at 120 hubs labeled Output Storage, and numbered corresponding to the 120 Output Storage positions represented in buffer B. Any positions which are to be punched are patchwired to the desired punching column as represented by one of the 80 hubs	Card B moves under the brushes at RS2 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled RS2 and numbered 1-80 corresponding to the 80 columns on the card. These hubs may be patchwired to

Cycle	Punch Feed	Read Feed
	in the Storage Punching section of the plugboard. The enables then allow the data from the specified storage positions to set up the punching actuator for row 12 in the specified columns. The circuitry is so constructed that positions in buffer B which are not wired for punching are cleared to the "no punch" or "space code" state.	any of 120 hubs labeled Read-Check hubs. The circuitry of the unit is so constructed that when wired in this manner, the data flows to a one bit comparator where it is compared with the corresponding bit position from buffer A. (Note: Data coming from buffer A for comparison is the data read into buffer A from Card B--i.e., the same card that is now at RS2.) If there is an error the card unit stops at the end of the cycle.
3	The above operation occurs 12 times; once for each row on the card. Thus at the end of row time all punching actuators are set according to results of computations on Card A'. Card A' is being positioned under the punching dies.	
3	Computation starts on Card B'.	Computation on Card B is complete. Note: Computation and checking of sensing take place at the same time.
3	Card A' is punched.	Waiting
4	The 4th Program Complete and Trip Punch Feed signals received initiate Cycle 4. Card A' starts into the PW2 station.	When a Trip Read Feed signal is also received, Card B starts into RW2 station.
4	Card A' waiting.	Card B waiting.
5	The 5th Program Complete and Trip Punch Feed signals received initiate Cycle 5. Card A' starts into PS2 station.	When a Trip Read Feed signal is also received Card B starts into RS3 station.

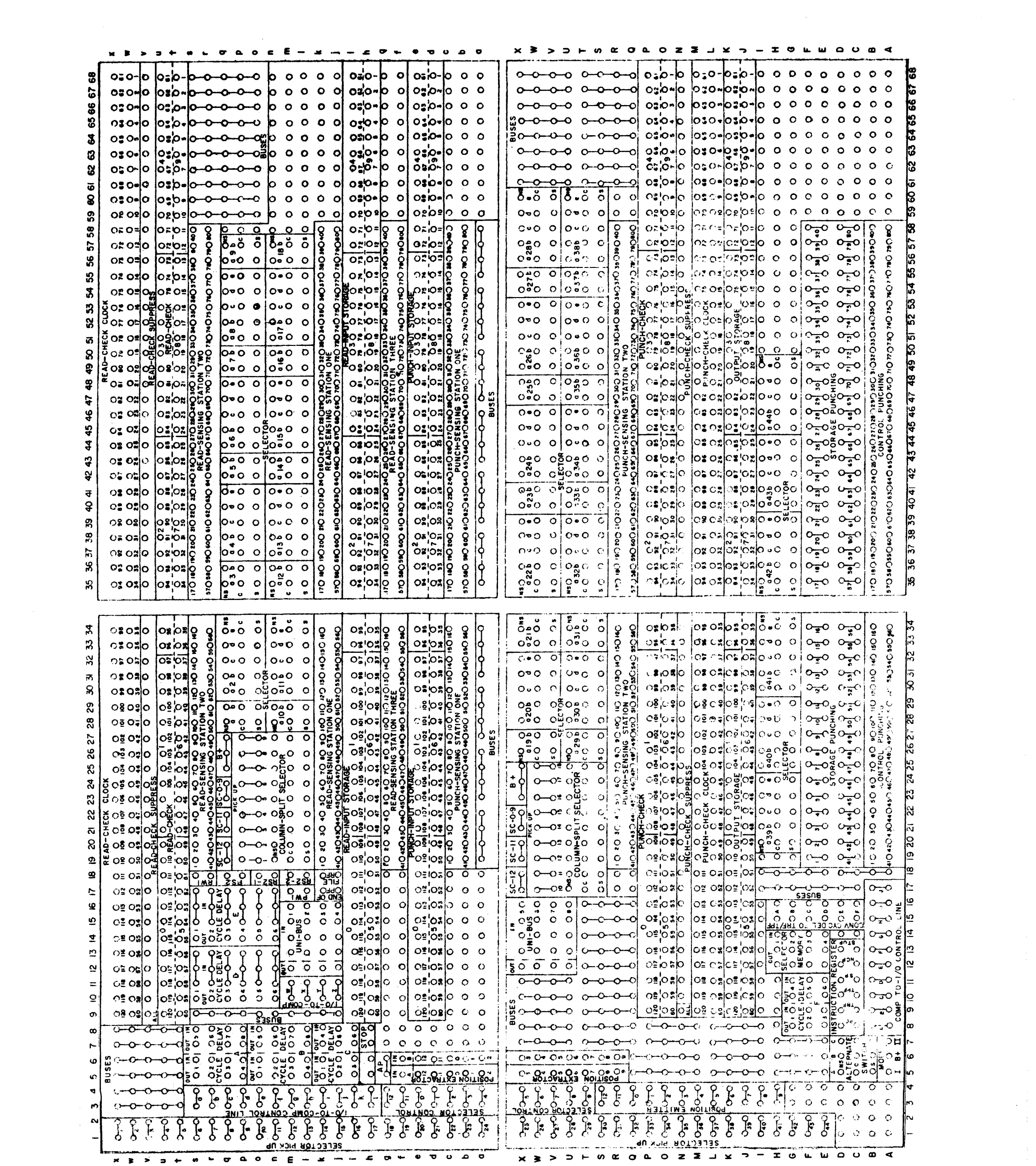
Cycle	Punch Feed	Read Feed
5	Card A' moves under the brushes at PS2 where it is sensed one row at a time starting with row 12. Data sensed is brought out to the plugboard at 80 hubs labeled PS2 corresponding to the 80 columns of the card. When patchwired to any of the 120 Punch-Check hubs, data will be compared with data in the corresponding position of buffer M. (Note: Buffer M is actually a 360 character buffer so that cards following A' will be read into the second and third sections of buffer M. As Card A' data is now read out of the first section of M, this section can be used to record the data from the 3rd card (Card 15') following Card A'.) Thus the sensing and punching of Card A' are checked at this time.	

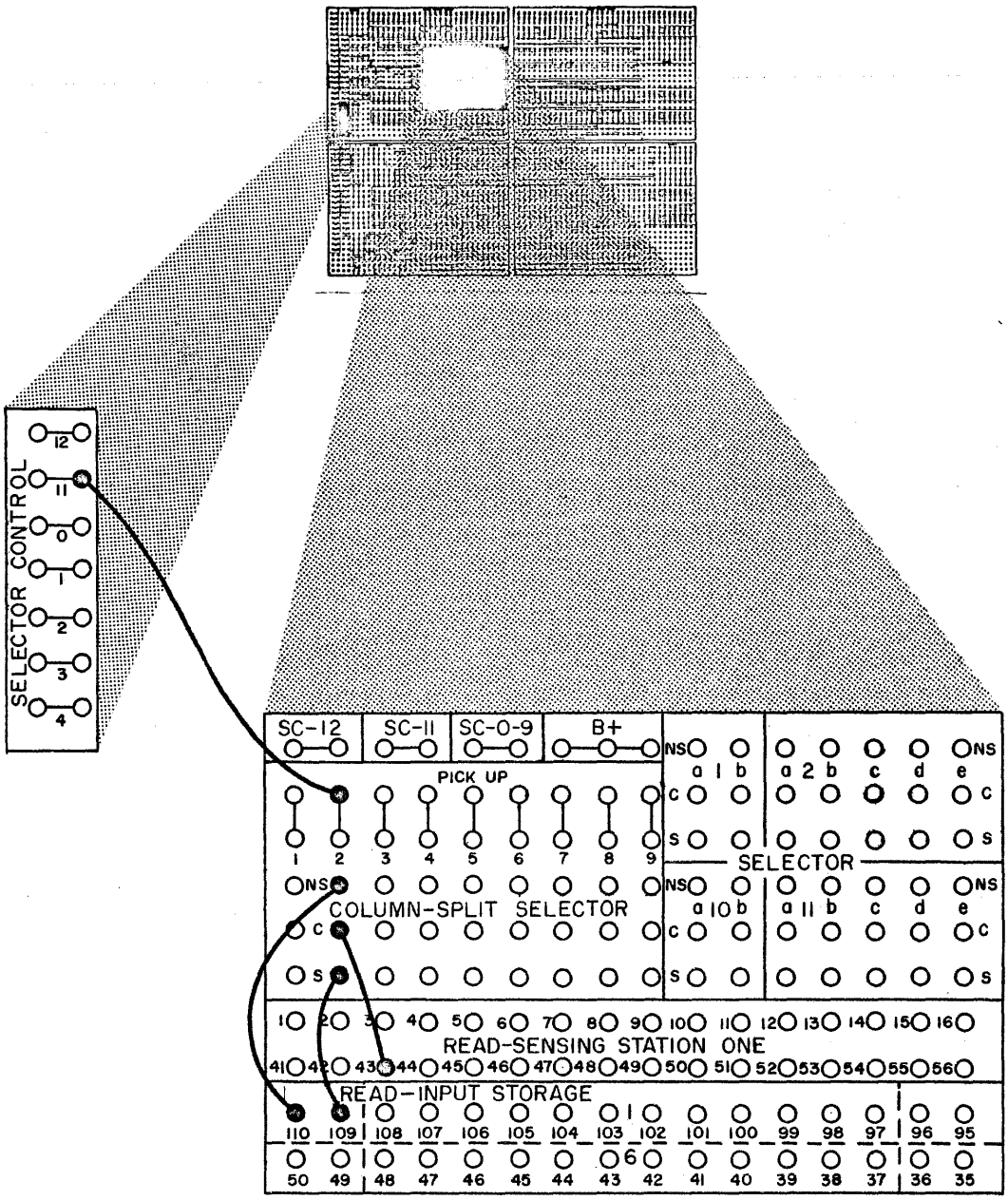


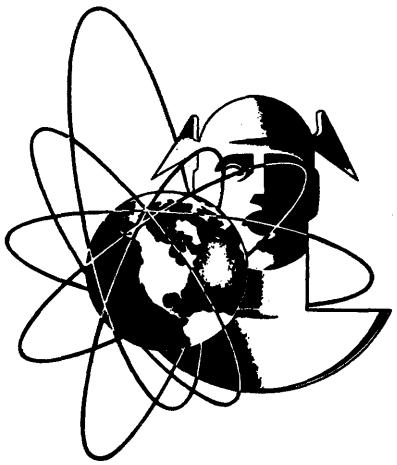
MODE II CARD AND DATA FLOW

FIGURE 7

Figure 8. Plugboard


READ-CHECK CLOCK
READ-CHECK SUPPRESS
READ-CHECK
READ-SENSING STATION TWO
READ-SENSING STATION ONE
READ-SENSING STATION THREE
SELECTOR
PUNCH-INPUT STORAGE
PUNCH-SENSING STATION TWO
PUNCH-SENSING STATION ONE
PUNCH-CHECK
PUNCH-CHECK CLOCK
PUNCH-CHECK SUPPRESS
OUTPUT STORAGE
PUNCH-SENSING STATION THREE
READ-INPUT STORAGE
COLUMN-SPLIT SELECTOR
BUSES
STOP
AP
CYCLE DELAY
UNI-BUS
STORAGE PUNCHING
CONTROL PUNCHING
SELECTOR PICK UP
POSITION EXTRACTOR
POSITION EMITTER
I/O-TO-COMP CONTROL LINE
SELECTOR CONTROL
COMP TO I/O CONTROL LINE


SELECTOR CONTROL
12
11
0
1
2
3
4
SC-12
SC-11
SC-0-9
B+
PICK UP
1 2 3 4 5 6 7 8 9
COLUMN-SPLIT SELECTOR
NS
c
s
SELECTOR
a 1 b
a 2 b c d e
a 10 b
a 11 b c d e
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
READ-SENSING STATION ONE
41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
READ-INPUT STORAGE
110 109 108 107 106 105 104 103 102 101 100 99 98 97 96 95
50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35



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