IBM®

Customer Engineering

Manual of Instruction

7150 Console Control Unit

D. IBM 7150 CONSOLE

CONTENTS

FOREWORD

This manual is intended for use in training Customer Engineers in the operation of the IBM 7150 Console used with the IBM 7070 System. Illustrations accompany the text. In most cases, the sections, sub-sections, and items contained within this manual, are written so that the preceding information serves as a building block for subsequent study.

Each program controlled operation is discussed in detail and is accompanied by operation flow charts and sequence charts. Major signals, key timings, and logic locations are also provided.

Future engineering changes may cause minor discrepancies in some of the timings given in sequence charts and other charts (signal, timing and location). They should not change the philosophy of the operations unless the changes are of a major nature and constitute revisions to data flow and operation sequence.

ILLUSTRATIONS

IBM 7150 CONSOLE

1.0.00 INTRODUCTION

1.1.00 PURPOSE

The 7150 Console is a unit of the 7070 Data Processing System. The console contains the major operating lights, keys, and switches used in operating the system. By means of its associated typewriter, the console can request and receive information from the rest of the system.

2.0.00 PHYSICAL COMPONENTS OF THE 7150 CONSOLE

The 7150 Console is made up of two units: (1) the typewriter, and, (2) the Operator's Console Switch and Light Panel.

2.1.00 TYPEWRITER (Figure 2.1-1)

The console typewriter is a standard Model B typwriter equipped with 26 upper-case alphabetic characters. In addition, there are ten numeric characters and eight special characters.

2.2.00 TYPEWRITER KEYBOARD CONTROL KEY AREA (Figure 2.1-1)

At the right end of the typewriter keyboard area is a section containing various control keys. The keys are arranged as shown in Figure 2.1-1. The following is a brief statement of the basic use of each key:

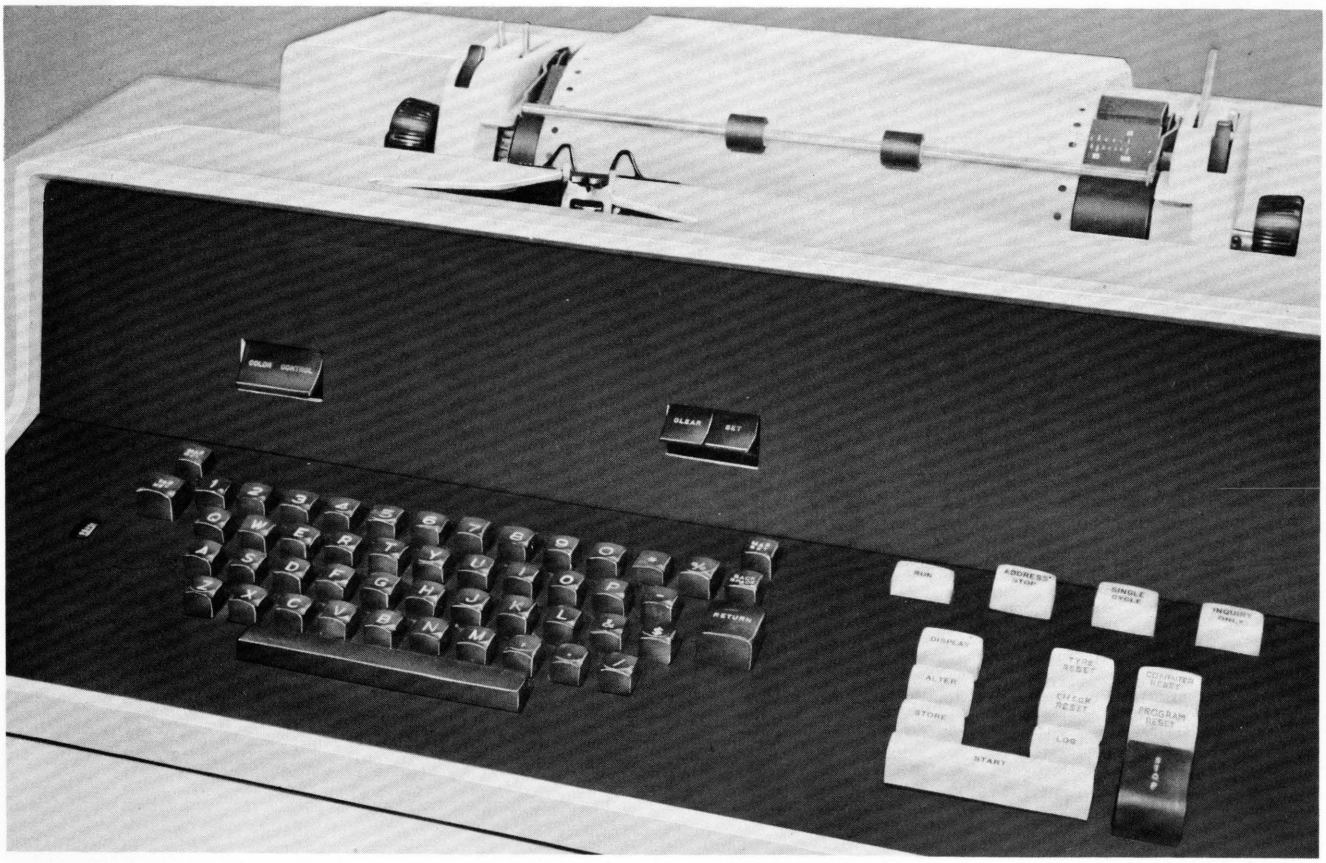

FIGURE 2.1-1 CONSOLE TYPEWRITER KEYBOARD AND CONTROL KEY AREA

2.2.01 Run Key

When depressed, and followed by a start-key depression, it initiates the running of a stored program operation.

2.2.02 Address Stop Key

When depressed, the program advances until a D-address or address in instruction counter is equal to address stop switch setting. prints IC & Prog Reg.

2.2.03 Single Cycle Key

When depressed a start key depression advances the program one step at a time. As each step is completed, the contents of the instruction counter and program counter are typed out.

2.2.04 Inquiry Only Key

When depressed, requests from inquiry stations can be processed without delay. when program is running.

2.2.05 Display Key

This key is operative when the system is in manual status (program stopped). When depressed, an alphabetic word is typed in its two-digit numeric representation. Numeric representation is typed under originally typed alphabetic word.

2.2.06 Alter Key

This key is operative when the system is in manual status. When depressed, a complete word can be typed and later used to replace the contents of a previously specified address. Word is typed in red directly under present contents of previously specified address.

2.2.07 Store Key

This key is operative when the system is in Manual Status and an Alter operation has been previously completed. When depressed, a complete keyed word enters a previously specified address, a red pound sign (#) is typed if store operation is completed and the typewriter carriage returns. If in error, the keyboard check light is illuminated.

2.2.08 Start Key

With the run key previously depressed, a depression of the start key changes the status of the machine from manual status to run status and begins executing instruction.

2.2.09 Stop Key

When the stop key is depressed while the system is running, the program is stopped and the contents of the instruction counter and program register are typed out. In addition, the status of the machine is changed from run status to manual status.

2.2.10 Log Key

When the log key is depressed while the program is stopped (manual status), manual typing can take place without (1) a keyboard error check when typing alphabetic characters or, (2) typing a reply after the first four key strokes. With the program running, a program call for using the typewriter overrides the manual typing operation.

2.2.11 Computer Reset Key

This key is operative when the system is in manual status. When depressed, the computer reset key resets the program controls forces a check reset, and resets all the registers.

2.2.12 Program Reset Key

This key is operative when system is in manual status. When depressed, the program reset key performs the same functions as the computer reset key except for the resetting of the instruction counter and the program register.

2.2.13 Reset Key

This key is operative when system is in manual status. When depressed, the reset key resets any detecting circuit that has stopped the 7070.

2.2.14 Type Reset Key.

Depressing the type reset key (when the typewriter is typing from a TYP instruction and program is running) stops the typing operation at the end of the word being typed. A red asterisk (*) is then typed, followed by a carriage return and the dropping of any interlocks set up during the typing operation. The contents of the instruction counter and program register are then typed out.

2.3.00 OPERATOR'S CONSOLE SWITCH AND LIGHT PANEL (Figure 2.3-1)

The Operator's console switch and light panel is used by the operator to

1. determine the status of various operations and detect certain errors.
2. control power to the system.
3. direct the use of the address-stop feature and the Interrupt Control feature.

A brief description of the various switches, buttons, and lights used on the Console Panel follows.

FIGURE 2.3-1 OPERATOR'S CONSOLE SWITCH AND LIGHT PANEL

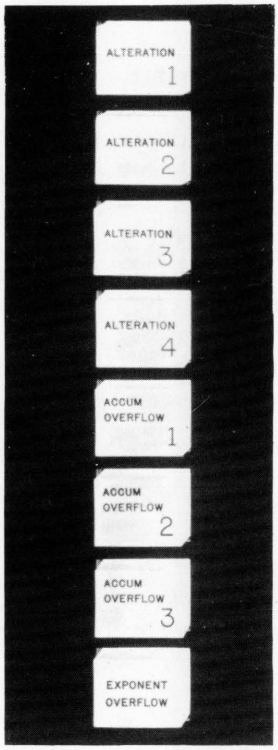

FIGURE 2.3-2 ALTERATION AND OVERFLOW SWITCHES

2.3.01 Switches

Alteration Switches (1, 2, 3, 4) Figure 2.3-2

The alteration switches are turned on and off manually and are interrogated by the program. The setting of a switch determines the next programming operation.

Accumulator Overflow Switches (1, 2, 3) Figure 2.3-2

When in the normal position, any one of the accumulator overflow switches conditions the stopping of the machine if an overflow occurs in that particular accumulator. When in their operated position, the switches allow the machine to run in the event of an accumulator overflow. The associated indicating light comes on regardless of the switch setting.

Exponent Overflow Switch (Figure 2.2-2)

When in its normal position, the exponent overflow switch conditions the stopping of the machine whenever a floating-point overflow occurs. When it is in the operated position, the switch allows the machine to run in the event of a Floating-Point overflow. The associated indicating light comes on regardless of the switch setting.

Emergency Pull Switch (Figure 2.3-3)

When operated, the emergency-pull switch immediately removes all power from the entire system. The switch is to be used in an EMERGENCY ONLY.

Address Stop Switches (4) (Figure 2.3-4)

The address-stop switches are used in conjunction with the address stop-mode switch. The switches are set up to the address at which it is desired to stop the program.

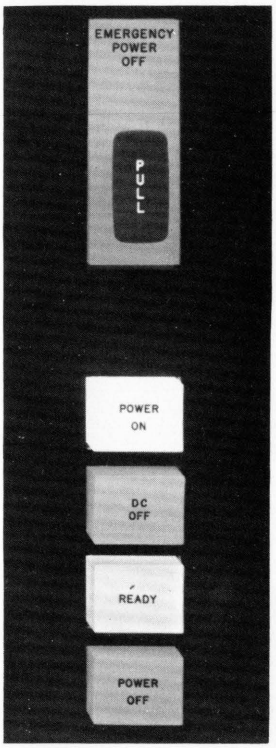

FIGURE 2.3-3 MAIN POWER KEYS AND LIGHTS

Unit - Record Priority Control Switches (4) (Figure 2.3-4)

There are four priority channel switches; a set of two switches is used for Channel A and an identical set is used for Channel B.

One of the switches, called the synchronizer-selection switch uses three switch positions. When the switch is in the normal position, a priority routine is started as soon as "set" unit-record machine stacking latch is sensed. When set to position one or two, (Tape Synchronizer 1 or 2), the switch signifies that a priority routine may start when "set" unit-record machine stacking latch is sensed and the proper tape synchronizer is available for use.

The other switch, called the card buffer selection switch, uses seven switch positions. The interrupt feature is not used when the switch is set to the Off position. The R/I 1, 2 or 3 positions indicate which unit-record machine is transmitting input data. The R/O 1, 2 or 3 positions indicate which unit-record machine is receiving output data.

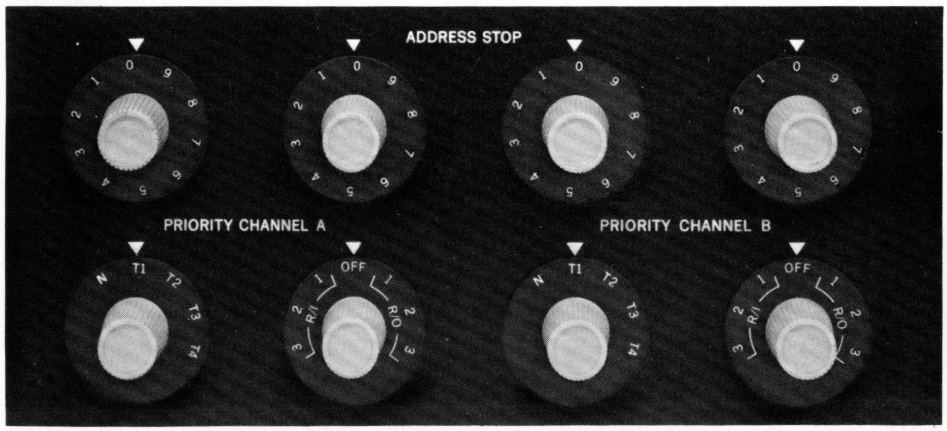

FIGURE 2.3-4 ADDRESS STOP AND UNIT - RECORD PRIORITY CONTROL SWITCHES

2.3.02 Keys (Figure 2.3-3)

Power On Illuminated Key

Depression of this key initiates a controlled sequence of power application to the system. The illuminated portion of the key comes on and remains on until the power off key is depressed.

DC Off Key (Figure 2.3-3)

Depression of this key removes the DC power from the system in a normal interlocked sequence. DC power can be reapplied to the system by depressing the power on key.

Power Off Key (Figure 2.3-3)

Depression of this key removes all electrical power from the system in a normal interlocked sequence.

2.3.03 Lights

Status Lights (3) (Figure 2.3-5)

The status lights signify which type of operation the machine is performing.

Operating Lights (4) (Figure 2.3-5)

The operating lights signify which unit in the system, if any, is operating.

Program Advance (Figure 2.3-5)

The light is on whenever stored-program instructions are being executed. The light flashes on and off when the program is stopped for more than 2 seconds by means other than a stop key depression.

Inst Counter (Figure 2.3-5)

The light is turned on when the stored program is stopped and the next instruction is to come from the instruction counter.

Address (Figure 2.3-5)

The light is turned on when the stored program is stopped and the next instruction is to come from the address in the instruction, as in a branch operation.

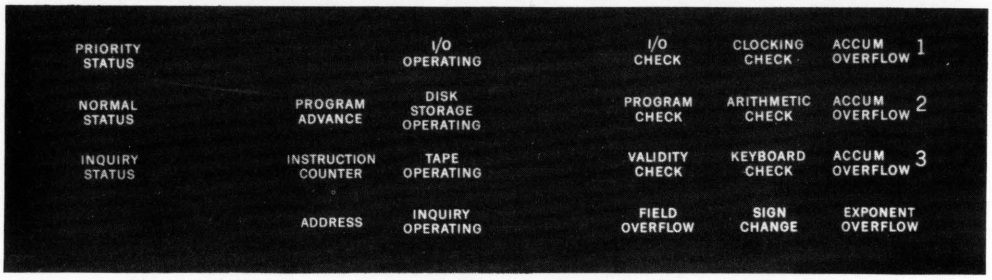

FIGURE 2.3-5 OPERATOR'S CONSOLE PANEL LIGHTS

Checking Lights (6) (Figure 2.3-5)

The checking lights signify what type of error has occurred.

Field Overflow Light (Figure 2.3-5)

The field overflow light comes on whenever an add-to-memory overflow occurs. An Op Code Command or a depression of the reset key extinguishes the light.

Sign Change Light (Figure 2.3-5)

The sign change light comes on whenever there is a sign change during a programmed store or add-to-storage type of operation.

Accumulator Overflow Lights (1, 2, 3) (Figure 2.3-5)

The accumulator overflow lights come on whenever an accumulator overflow occurs, regardless of its associated accumulator overflow switch setting. An Op Code Command or a depression of the reset key extinguishes the light.

Exponent Overflow Light (Figure 2.3-5)

The exponent overflow light comes on whenever a floating point overflow occurs, regardless of its associated exponent overflow switch setting. An Op Code Command or a depression of the reset key extinguishes the light.

Ready Light (Figure 2.3-3)

This light, when on, indicates that all necessary power for operation of the system is being supplied.

3.0.00 DATA FLOW (Figure 3.1-1)

3.1.00 CONSOLE OUTPUT

Output data from the 7150 Console can originate from (1) the typewriter, (2) the typewriter keyboard control area, and, (3) the operator's console switch and light panel.

3.1.01 Typewriter Output

Information originating from the typewriter is converted into a two-out-of-five coding as it is typed. On the way to the console control area it is checked for numeric word form. From the console control area the information enters the 7601 A & P control unit. The information can then be used for (1) address analysis operations or, (2) operations involving data transfers along the arithmetic bus or the information bus.

3.1.02 Typewriter Keyboard Control Area Output

Output from the typewriter keyboard control area is in the form of signals. The signals are sent through the console control area and then enter the A & P unit, where the signals are used to initiate the operations called for by the keyboard control switches.

3.1.03 Operator's Console Switch and Light Panel Output

Output from the operator's console area follows the same data flow path as the output from the keyboard control area. In addition, signals from the power supply section of the operator's console control the various power supplies scattered throughout the system.

3.2.00 INPUT TO CONSOLE

Incoming signal information enters the 7150 Console area along the same flow paths used in output. Incoming typewriter data, however, must enter the console area from the magnetic drum. The information to be typed is read on the drum from the arithmetic word buffer register. The information is then read off the drum and sent to the typewriter through the console control area.

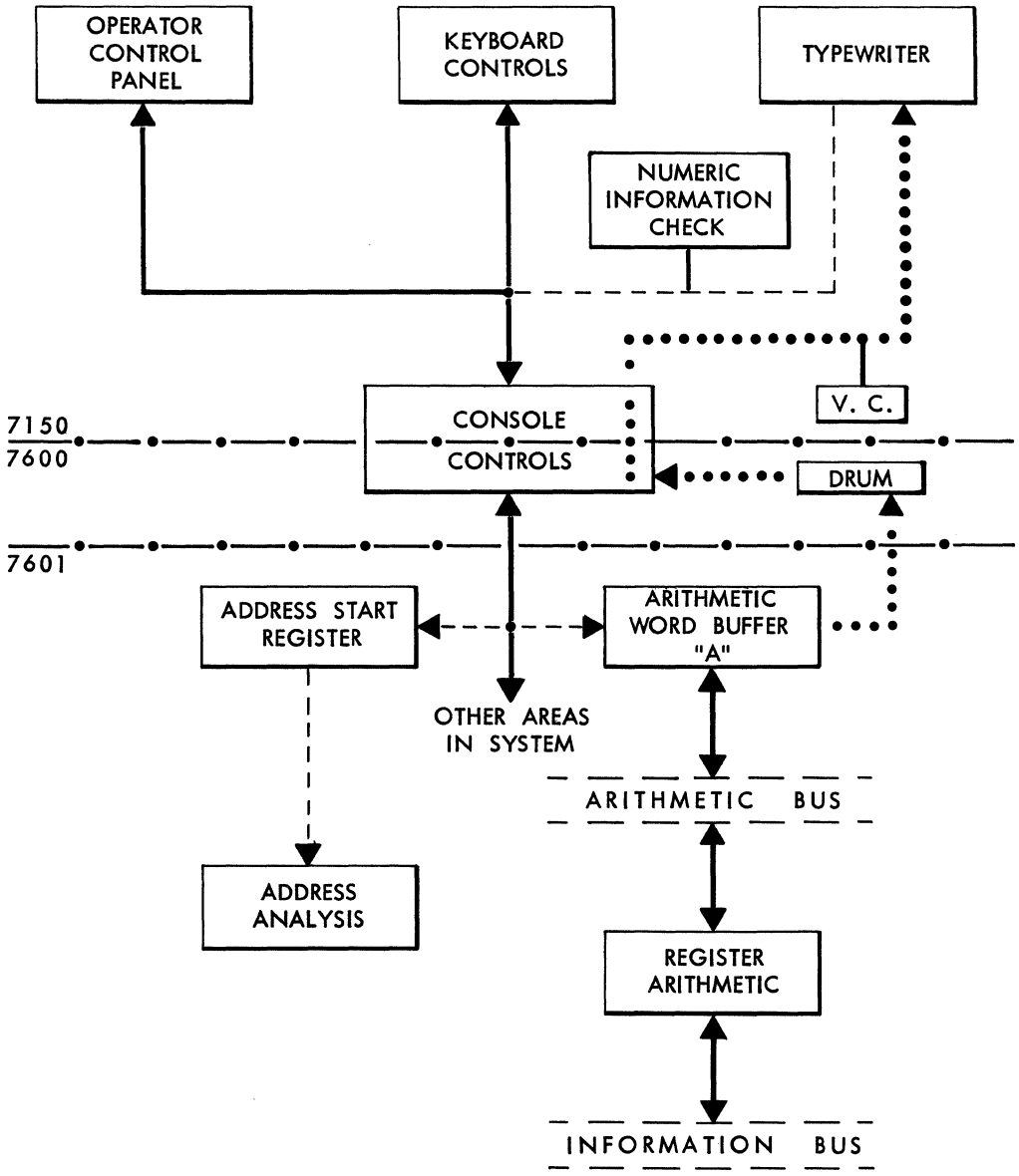

FIGURE 3.1-1 7150 CONSOLE DATA FLOW

4.0.00 TYPEWRITER KEYBOARD CONTROL CIRCUITS

The keys located in the typewriter keyboard control panel can be grouped into four categories. The areas are:

1. Program Operation Key Area
2. Program Control Key Area
3. Reset Key Area
4. Typing Control Key Area

The program operation switch area contains four keys. Three of the keys control the running of the program; the other key controls the operation of the inquiry station.

The program control key area contains the start and stop keys. With the program running, a depression of the stop key changes the status of the machine from run status to manual status.

The reset key area contains four reset keys which are used to reset various components and features of the system.

The typing control key area contains:

1. The circuitry used by the typewriter to "Request" the contents of a specified address.
2. The circuitry used to type out the contents of a specified address.
3. The circuitry which allows the typing of an alphabetic word.
4. Switch circuitry which changes alphabetic characters into their numeric representation for typing.
5. Switch circuitry which is used to modify the contents of a specified address.
6. Switch circuitry which allows typing without making an automatic address "Request".

4.1.00 PROGRAM OPERATION KEY AREA

As previously stated, the program operation key area contains four keys. The inquiry only key controls the operation of the inquiry station. The single cycle key, address stop key and run key control the running of the program. Before these three keys can deliver power to the start key, any alter operation or type-out operation in process must be completed.

4.1.01 Inquiry Only Key

When the inquiry only key is depressed, the stored program does not run and an inquiry can be processed. A depression of the key latches it in its depressed position and mechanically unlatches any other depressed keys located in the program operation

key area. The inquiry only key normally open point, now closed, originates a circuit; (1) to illuminate the inquiry status light on tne operator's console switch and light panel, and (2) to the A & P area to set up the necessary circuitry for operating on inquiry requests.

4.1.02 Run Key

The depression of the run key latches it in its depressed position and unlatches any other depressed keys in the program operation key area.

The run key normally open A point in 17.00.15 when closed by depression of the key, delivers power to the Start Key B point. It is through this circuit that the status of the system can be changed from manual status (program stopped) to run status (program running). The normally open C point (17.00.15) originates a signal, called Run which combines with other signals to continue picking the instruction latch (42.40.05) after the initial start key depression.

4.1.03 Address Stop Key

The depression of the address stopkey latches it in its depressed position and unlatches any other depressed key in the program operation key area.

The address stop key, when depressed, closes two normally open points. Point B delivers power to the start key so that a start key depression starts the program running and initiates the address search. Point C activates the same circuit, called Run as the Run Key C point. The Run signal line combines with other pulses to keep the program running until the address set up in the address stop switches equals (1) the D-address or, (2) the address in the instruction counter. When the equal reading is accomplished, the address stop latch in 47.00.12 is turned On, stopping the program. Stopping the program causes the contents of the instruction counter and the program register to type out during a print out display on stop operation.

4.1.04 Single Cycle Key

Depression of the single cycle key latches it in its depressed position and unlatches any other depressed key in the program operation key area. Point B of the single cycle key delivers power to the start key B point. A depression of the start key, therefore, picks the instruction latch in 42.40.05. Point C of the single cycle key activates a signal line, called Single Cycle, which allows the system to execute only one instruction at a time. After each instruction is completed, the contents of the instruction counter and program register are automatically typed out. Continued steady depression of the single cycle key results in the execution of one instruction followed by an automatic type out of the instruction counter and program register contents.

4.2.00 PROGRAM CONTROL KEY AREA

4.2.01 Start Key (Figure 4.2-1)

The start key is made up of two normally-open points and one normally-closed point. The normally-open A point is used when the program is operating in the single cycle mode. Closing the A point initiates a circuit which eventually picks the instruction latch in logic 42.40.05.

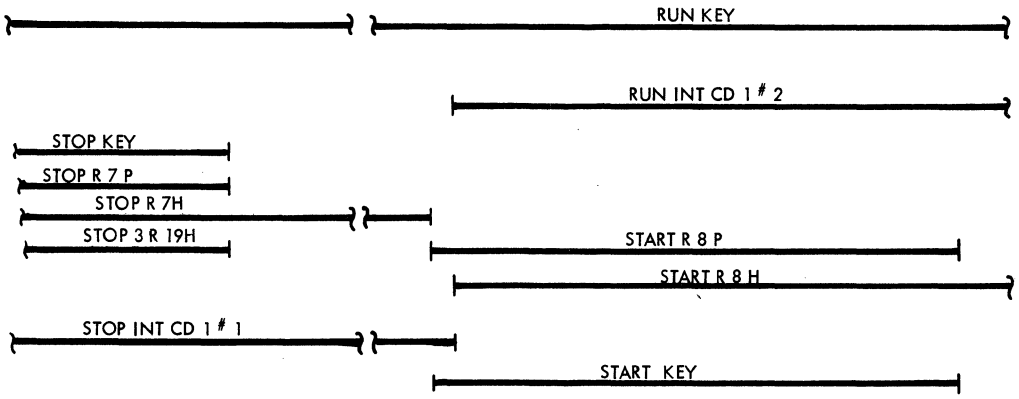

FIGURE 4.2-1 DEPRESSION OF START KEY WITH PROGRAM STOPPED

The normally-open B point is dependent upon the closing of the single cycle key contact, the run key contact, or the address stop key contact for power. When either of these switches is operated, the closing of the start key normally-open B point picks the start relay, R8. The picking of R8 closes R8-2N/O (Sec. 16A) and originates a signal, called Start Cond to Integrator Card 1 # 2 (Sec. 25A) and from there to logic 17.03.01. In logic 17.03.01, a line called CPR Start goes into the system to initiate the starting of the program in 42.40.05. In this logic, the start key circuit, labeled start, picks the instruction latch.

The normally-closed D point is used in the hold circuit for the Stop relay, R7. The D point, when opened, drops R7. If the start key is held in its depressed position while single cycling, the program will continue to advance, one program step at a time. As each program advance is completed, the contents of the instruction counter and program register are typed.

4.2.02 Stop Key (Figures 4.2-2, 4.2-3)

The operation performed by a depression of the stop key is dependent upon the status of the program. Because the operations vary, the use of specific stop key points is discussed with (1) program running, and, (2) program previously stopped.

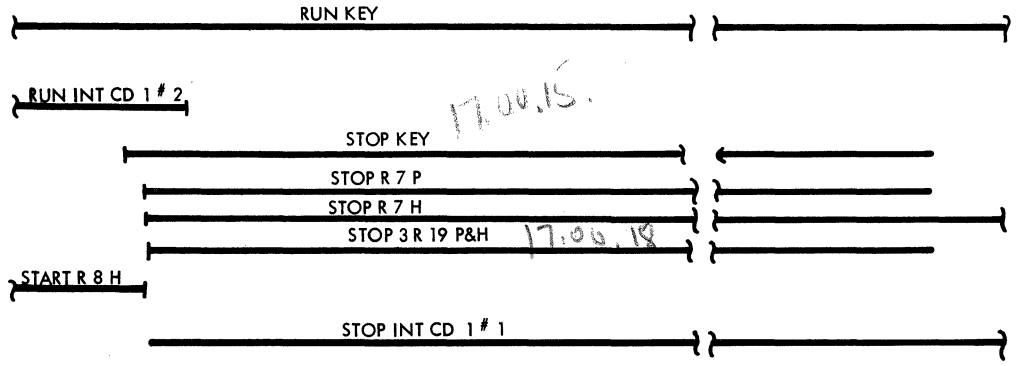

FIGURE 4.2-2 DEPRESSION OF STOP KEY WITH PROGRAM RUNNING

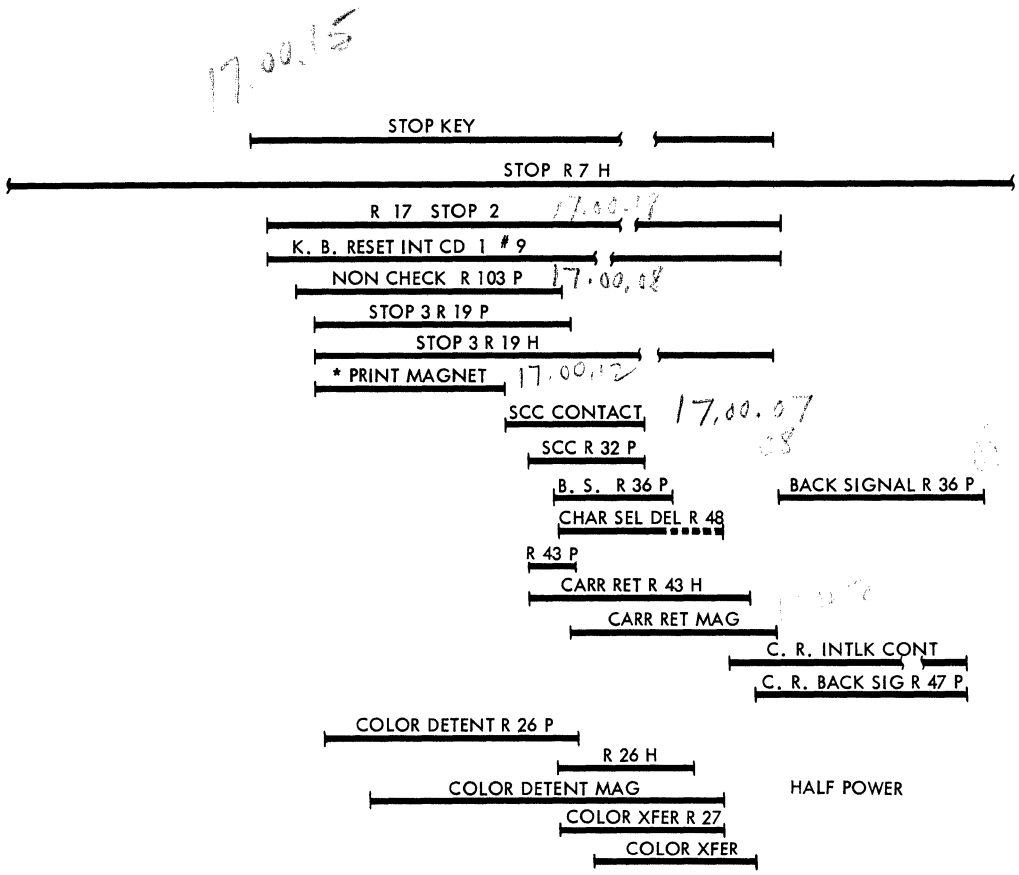

FIGURE 4.2-3 DEPRESSION OF STOP KEY WITH PROGRAM STOPPED

Program Running (Figure 4.2-2)

Depressing the stop key closes the normally-open B point and completes a circuit to pick the stop relay, R7. Because the program is running and the start relay, R8, is up, it is also possible to complete the circuit to the hold coil of the Stop 3 relay, R19, through a Stop Key A point in 17.00.17. R19 and R7 cause the drop of R8. The normally-closed D point is not used in this operation. The automatic typing of the contents of the instruction counter and program register also occurs. This operation, called Print-Out display on Stop, is described in Section 5.1.00 of this Manual.

Program Previously Stopped (Figure 4.2-3)

In this situation, the stop relay, R7, is still being held up from the previous stop key depression. Other manual status operations may have taken place since the first stop key depression. The stop key normally-closed D point, when opened by operation of the stop key, breaks the hold circuit to the Display and Alter relays.

The stop key normally-open B point, when closed, initiates the following operations:

1. Keyboard is reset.

   a. Stop 2 relay, R17, is picked,
   b. KB Reset Signal delivered to Int. Cd 1 #9.

2. Red asterisk prints.

   a. R17 picks Character Sel Non-Chk relay, R103.
   b. R103 picks following relays:
      1) Stop 3 relay, R19
      2) Color Detent relay, R26 (R26 picks Color Detent Magnet and color Transfer relay, R27. R27, in conjunction with R26, transfers ribbon back to black after printing.)
      3) Asterisk print magnet

3. Carriage Return after Typing

   a. Asterisk typebar closes Selector Common Contact (SCC)
   b. SCC picks following relays:
      1) Back Signal relay, R36
         a) Char Sel Del relay, R48
   c. 2) Carriage Return relay, R43 (R43 picks carriage return magnet) R47.
   d. R47 picks Back Signal relay, R36.

4.3.00 Reset Key Area

The reset, computer reset and program reset keys are all operative when the program is stopped and the system is in Manual Status. The type reset key is used during a typing operation when the system is in Run status.

4.3.01 Reset Key (Figure 4.3-1)

The reset key is used to reset the detecting circuits which stopped the 7070. A reset key depression also turns off any checking light that may have been illuminated on the Operator's Console Switch and Light Panel.

In 17.00.15, a signal line called Reset is activated by a reset key depression. The signal is then integrated and picks various console reset latches. The resultant output from the console logic sends signals to the various systems components. For a listing of the various components which are affected, refer to Figure 4.3-1.

4.3.02 Computer Reset Key (Figure 4.3-1)

The computer reset key is used to reset the program controls and all registers. Depression of the key also electronically forces a reset key operation.

In 17.00.15, as signal called COMP RES is activated by a computer reset key depression. The signal is integrated and picks various console reset latches. The resultant output from the console logic sends signals to all affected system areas for resetting the various components. Refer to Figure 4.3-1 for a listing of the various components which are reset by a computer-reset-key depression.

4.3.03 Program Reset Key (Figure 4.3-1)

The program reset key is used to reset the program controls and all registers, with the exception of the three accumulators and the program register.

DEVICE	Condition Of Device After Pressing Key		
	Computer Reset	Program Reset	Reset
Instruction Counter	Filled with zeros	Filled with zeros	NC (No Change)
Program Register	Filled with + zeros	Positions 6-9 filled with zeros	"
Accumulator 1	" " " "	NC (No Change)	"
Accumulator 2	" " " "	"	"
Accumulator 3	" " " "	"	"
Input/Output Error Latch	Set OFF	"	"
Program Error Latch	" "	Set OFF	Set OFF
Validity Error Latch	" "	" "	" "
Clocking Error Latch	" "	NC	NC
Arithmetic Error Latch	" "	Set OFF	Set OFF
Keyboard Error Latch	NC (No Change) ④	NC ④	NC ④
Field Overflow Indicator Latch	Set OFF	Set OFF if STOP/SENSE switch was at STOP	Set OFF if STOP/SENSE switch was at STOP
Field Overflow Stop/Sense Switch	Set to STOP	NC	NC
Sign Change Indicator Latch	Set OFF	Set OFF if STOP/SENSE switch was at STOP	Set OFF if STOP/SENSE switch was at STOP
Sign Change Stop/Sense Switch	Set to STOP	NC	NC
Accumulator 1 Overflow Indicator Latch	Set OFF	Set OFF	Set OFF
Accumulator 2 Overflow Indicator Latch	" "	" "	" "
Accumulator 3 Overflow Indicator Latch	" "	" "	" "
Low Indicator Latch	" "	" " ①	" " ①
Equal Indicator Latch	" "	" " ②	" " ②
High Indicator Latch	" "	" " ③	" " ③
Floating Point Overflow Indicator Latch	" "	NC	NC
Floating Point Underflow Ind. Latch	" "	"	"
Input/Output Check Light	Turned OFF	"	"
Program Check Light	" "	Turned OFF	Turned OFF
Validity Check Light	" "	" "	" "
Field Overflow Light	" "	Turned OFF if STOP/SENSE SW. was at STOP	Turned OFF if STOP/SENSE SW. was at STOP
Clocking Check Light	" "	NC	NC
Arithmetic Check Light	" "	Turned OFF	Turned OFF
Keyboard Check Light	NC ④	NC ④	NC ④
Sign Change Light	Turned OFF	Turned OFF if STOP/SENSE SW. was at STOP	Turned OFF if STOP/SENSE SW. was at STOP
Accumulator 1 Overflow Light	" "	Turned OFF	Turned OFF
Accumulator 2 Overflow Light	" "	" "	" "
Accumulator 3 Overflow Light	" "	" "	" "
Exponent Overflow Light	" "	NC	NC
(all) Stacking Latches	Set OFF	"	"
Interrupt Mode Latch	" "	"	"
Priority Mask Register	Filled with 1's	"	"
Magnetic Tape Units	Reset	Reset	Reset
Disk Storage Units	"	NC	NC
Inquiry Stations	"	"	"
Input/Output Synchronizers	Erased	"	"

① if Equal and/or High latches were also ON.
② if Low and/or High latches were also ON.
③ if Low and/or Equal latches were also ON.
④ use STOP key to reset.

Figure __. Functions of Computer Reset, Program Reset, and Reset Keys

RESET KEY	PROGRAM RESET KEY	COMPUTER RESET KEY	OPERATIONS
X	X	X	Reset program to instruction address
	X	X	Reset IC to 0000
		X	Reset PR and accumulators to plus zeroes
		X	Reset system clocks and clocking error
X	X	X	Reset Validity error
X	X	X	Reset Arithmetic error
X	X	X	Reset Program error
		X	Reset Input/Output (this reset includes erasing the output buffers)
X	X	X	Reset syncs and tapes
		X	Reset RAMAC controls
		X	Reset Manual Inquiry
		X	Reset to normal status and reset interrupt mode latch, reset mask register to prohibit all interrupts, reset stacking latches
		X	Reset sign change sense/stop switch to stop
X	X	X	Reset field sign error if field sign sense/stop set to stop
		X	Reset overflow sense/stop switch to stop
X	X	X	Reset field overflow latch if overflow sense/stop set to stop
X	X	X	Reset accumulator overflow latch if associated console switch set to stop
X	X	X	Reset floating overflow latch if console switch set to stop
		X	Reset all condition latches as defined as Interrupt Indicator Storage
X	X	X	Reset high, low, and equal latches if error caused by two, three, or none of them being set

FIGURE 4.3-1 FUNCTIONS OF 7070 RESET KEYS

In 17.00.15, a signal called Program Reset is activated by a program-reset-key depression. The signal is integrated and turns on various console reset latches. The resultant output from the console logic sends signals to all affected system areas for resetting the various components. Refer to figure 4.3-1 for a listing of components which are reset by a program reset key depression.

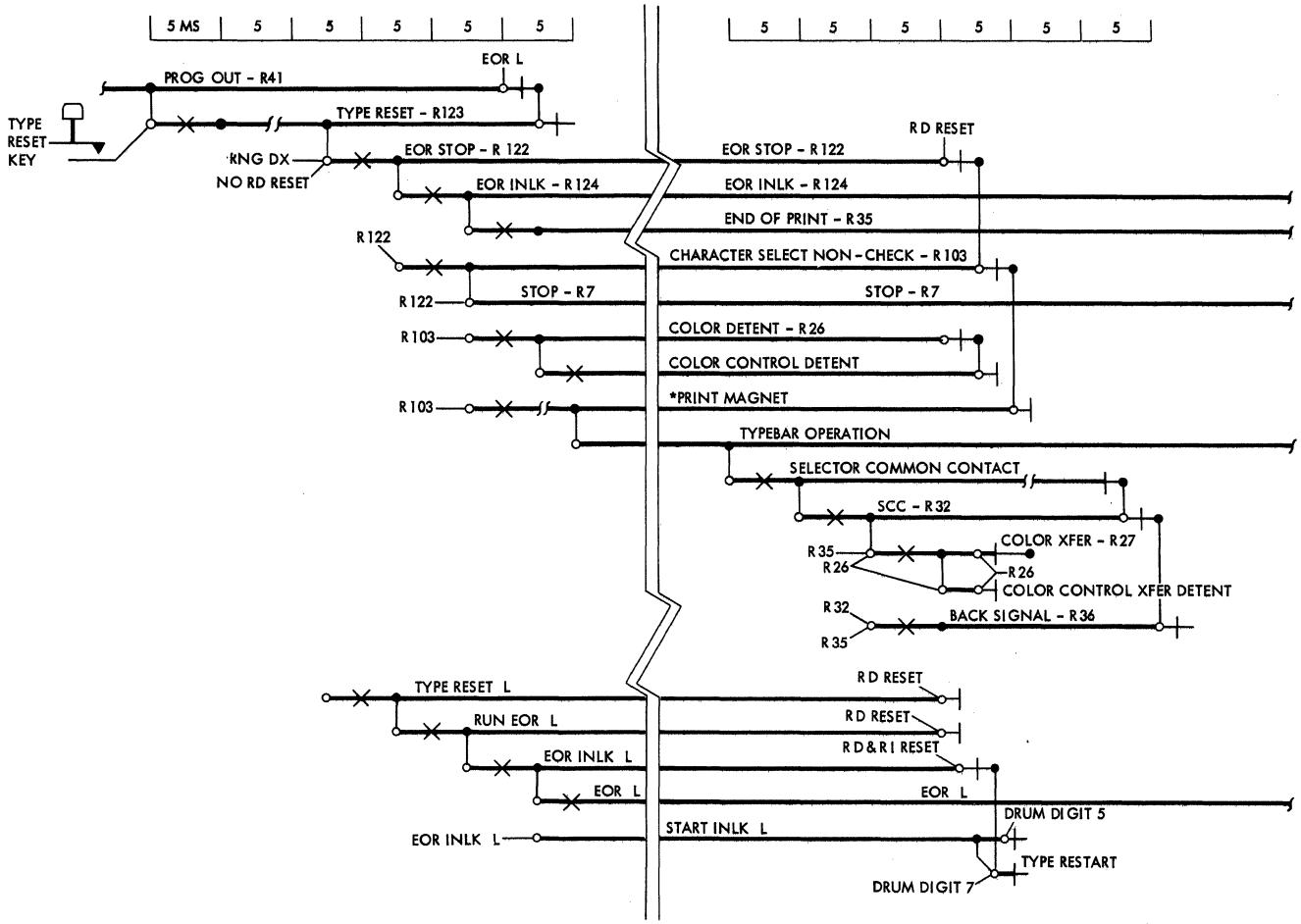

FIGURE 4.3-2 TYPE RESET KEY DEPRESSION

4.3.04 Type Reset Key (Figure 4.3-2)

The type reset key is operative whenever the console typewriter is typing as a result of reading a TYP instruction while the system is in Run status. Depression of the key stops the typing operation at the end of the word being typed. A red asterisk (*) is then typed, the carriage returns, and all interlocks set up by the typing operation are released. The contents of the instruction counter and program register are then typed.

A type reset key depression results in the following operations.

1. Typing operation stopped at end of word being typed.

2. Red asterisk is typed.

3. Print out display on stop operation initiated.

Typing Operation Stopped at End of Word Being Typed

Depression of the type reset key picks the type reset relay, R123, in 17.00.18 when a typing operation is being performed (R41 picked). As soon as the console digit ring reaches the Digit-X position (signifies word is completely typed out), the On output of R123 combines with other conditions and picks the type reset latch in 17.04.02. The On output of the type reset latch (1) starts dropping the various interlocks which were picked up during the typing operation, and (2) sets up circuitry used for typing the red asterisk.

The On output of the type reset latch initiates circuitry to pick the run end of record latch, the end of record interlock latch and the end of record latch. These latches drop the interlocks which have been set up during the typing operation.

Whenthe EOR Inlk L was picked, its On output picked the Start Inlk L. As the asterisk typing cycle nears an end, an RD + D1 reset signal turns Off the EOR Inlk L. The Off output of the EOR Inlk L then combines with the On output of the Start Inlk L at drum digit 7 time to activate the type restart signal line. The Type Restart signal is needed to activate the circuitry used in a print out display on stop operation.

Another line of the On output of the type reset latch (EOR Stop) picks the EOR Stop Relay R122, in 17.00.03. R122 picks the EOR Interlock Relay, R124, in 17.00.18 and the character select non-check relay, R103, in 17.00.08. R124 picks the end of print relay, R35. R124 and R35 remain picked until a carriage return operation is initiated.

Red Asterisk is Typed

R103 points (1) pick the asterisk print magnet, (2) pick the color detent relay, R26, in 17.00.06, and (3) combine with an R122 point to pick the stop relay, R7.

1. The asterisk print magnet is energized by an R103 point, as previously stated. The energization of the print magnet activates the typebar assembly, and the asterisk type bar moves toward the platen.

2. The color detent relay, R26, in picking, energizes the color control detent which shifts the ribbon from black to red.

During the typebar travel, the selector common contact closes, picking the SCC Relay, R32. R32 points then (1) combine with R26 and R35 points to pick the color Xfer Relay, R27, which energizes the color control Xfer Detent and shifts the ribbon from red to black, and, (2) combine with an R35 point to pick the Back Signal Relay, R36. The On outputs of R32 (SCC) and R36 (BS) now combine and result in a signal called RD Reset. The RD Reset signal was discussed before when a combination of RD Reset and a Drum Digit 1 Pulse was used to turn Off the EOR Inlk L and thereby activate the type restart signal line to the A and P area.

3. The On output of R7 goes to the A and P area where it combines with other pulses to turn on the A & P's CPU Stop L in 47.00.03. The On output of the A & P's CPU Stop L turns On the A & P's display on Stop L in 47.05.01, which, in turn, turns On the A & P's Print Out on Stop L in 47.05.01. The On output of the A & P's PO on Stop L comes back to the console to pick the console's CPU Stop L in 17.04.02. From this point on, an entire print out display on stop operation occurs (Section 5.1.00 of this Manual).

4.4.00 TYPING CONTROL KEY AREA

The keys in the typing control key area are used to (1) alter all or any part of the contents of a specific word, or (2) display an alphabetic word in its two digit numeric representation instead of its alphabetic form.

Before alteration of any word can take place, the present contents of that word must be brought out to the console typewriter and typed. The contents of a word (Address "Reply") are automatically typed as a result of manually typing the word's address (Address "Request").

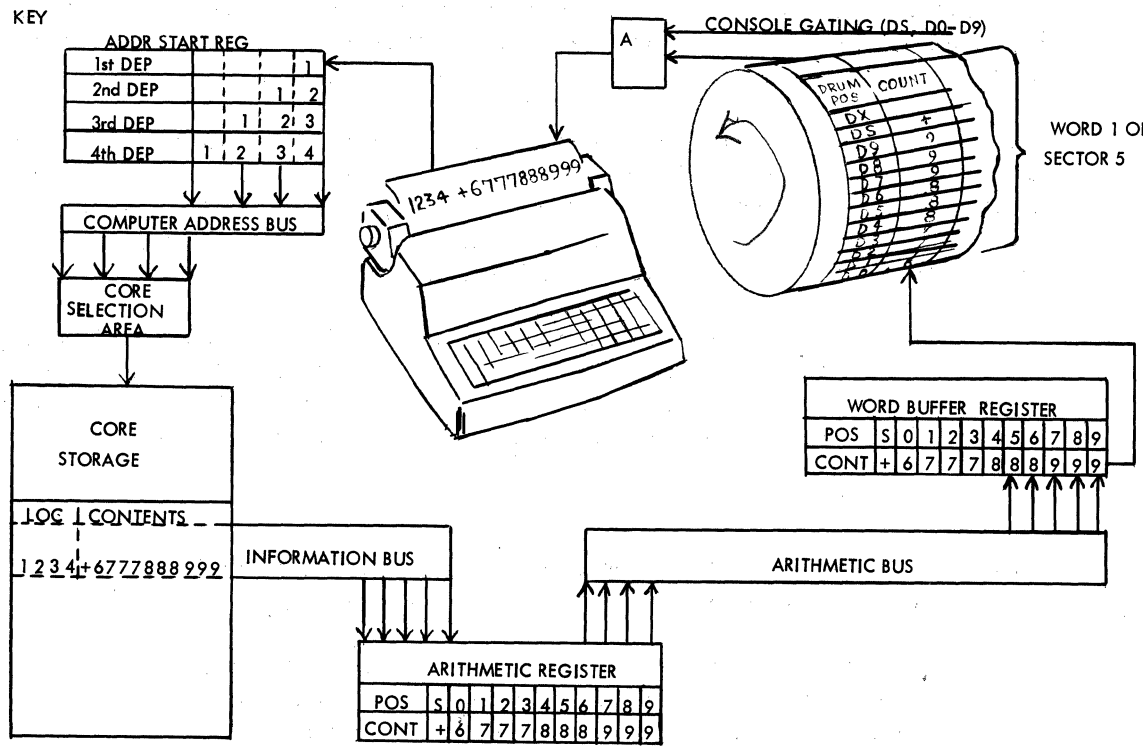

FIGURE 4.4-1 DATA FLOW OF ADDRESS "REQUEST" AND "REPLY"

4.4.01 Typing of Address "Request" and Address "Reply" (Figure 4.4-1)

When typed, the address request enters the address start register, after which it enters the address selection control area of core storage via the computer address bus.

The contents of the specific word requested (Address "Reply") are brought out of the core storage area and transferred to the arithmetic register via the information bus. From the arithmetic register, the address "reply" is transferred into the word buffer register by way of the arithmetic bus.

From the word buffer register, the address "reply" is shifted to the right and serially read onto the drum. The units digit of the address "reply" is stored in drum digit position nine, and the high-order digit is stored in drum digit position zero.

The drum attempts to send the address "reply" to the console typewriter every drum cycle, but the drum output is gated by a console digit ring. The console digit ring runs as follows: DX, DS, DO through D9. Because of this, the contents of the address "reply" are presented for typing from high-order digit to units digit.

Step 1 - Manually Type Address "Request" (Figures 4.4-2 and 4.4-3)

The manual typing of an address "request" automatically sets up the necessary circuitry to allow that "request" to enter the address start register.

Depression of a typewriter character key results in the closing of the associated typewriter contacts. The contact output is in a two-out-of-five bit configuration and can be used by the A & P unit without any further translation. The two-out-of-five bit configuration picks the manual type latch. The output of this latch is used in:

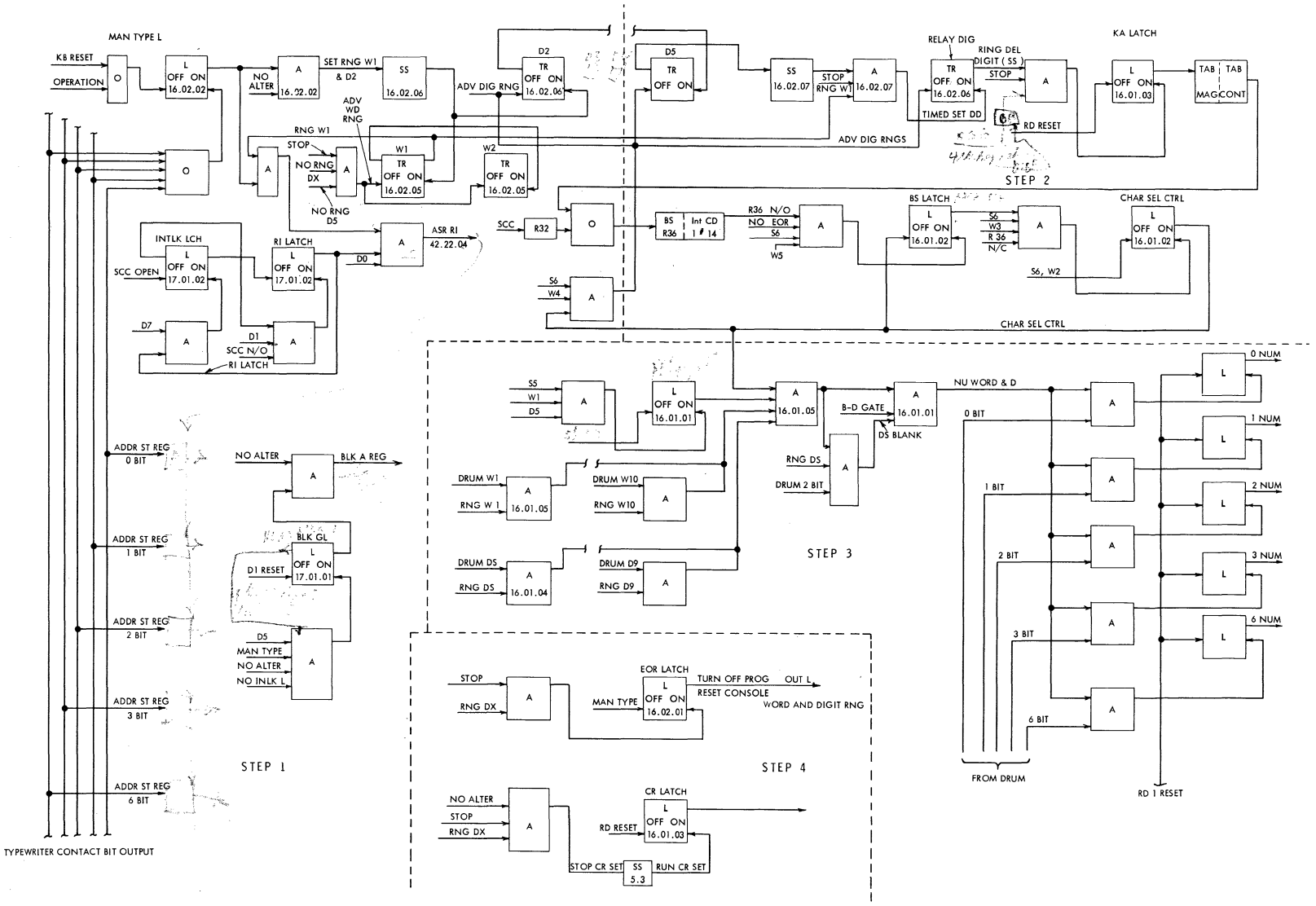

FIGURE 4.4-2 POSITIVE LOGIC CHART - ADDRESS "REQUEST" AND "REPLY"

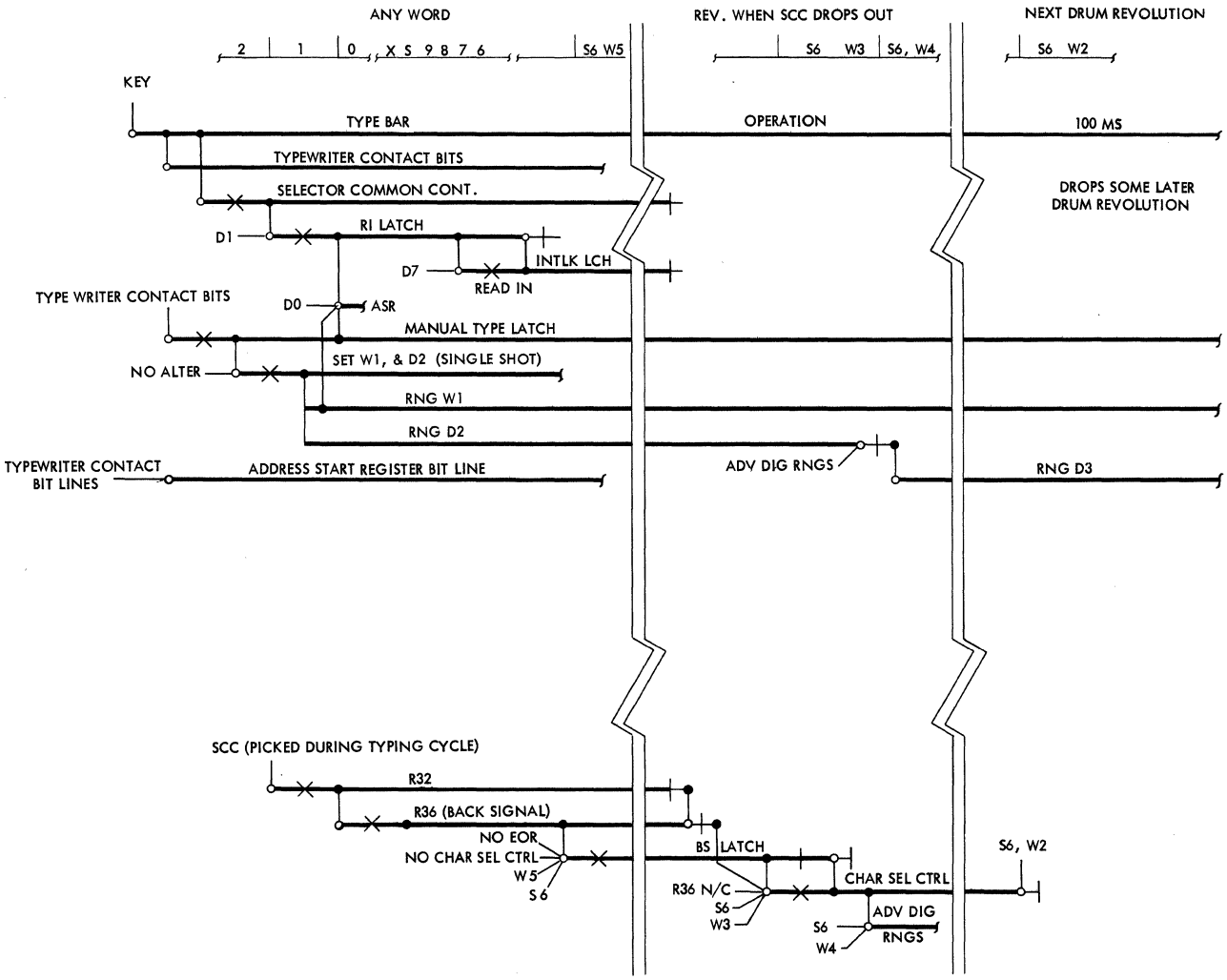

FIGURE 4.4-3 OPERATION CHART - TYPEWRITER KEY DEPRESSION

1. The gating of the bit pulses into the address start register (ASR).

2. Setting Console Ring Word 1 and Console Ring Digit 2.

3. Picking the blanking latch to blank out the address start register.

4. Reset the end of record latch (EOR Latch) OFF.

Typewriter Key Depression Closes Associated Typewriter Contacts (17.00.20)

1.	Manual Type Latch Picked	16.02.02
	a. Combine with RI Latch timing for Address Start Reg Read-In Gate	17.01.02
	b. Set Console Ring Word 1 and Console Ring Digit 2	16.02.02
	c. Combine with other pulses to turn on blanking latch	17.01.01
	d. Reset EOR Latch	16.02.01

A typewriter character key depression also closes the Selector Common Contact (SCC). The SCC (1) combines with drum timing to pick the read-in latch, and, (2) picks the SCC Relay, R 32. The read-in latch furnishes the initial gating for the bit pulses which are entering the address start register. The RI latch combines with SCC and D7 to pick the Intlk Latch. The Intlk latch keeps the RI latch dropped out for the rest of the key depression. The SCC Relay, R32, picks the back signal Relay, R36, which in turn picks the back signal latch at S6, W5 time. R32 and R36 stay up as long as the SCC N/O point is closed. At the first Sector 6, Word 3 time following the dropout of the SCC and relay R32 and R36, the character select control latch picks up. Character select control initiates a pulse at Sector 6, Word 4 time to advance the console digit ring.

Typewriter Key Depression Closes Selector Common Contact N/O Point (17.00.07)

1.	Combines with D1 (drum time) to turn on Read-In latch.	17.01.02
	a. RI Latch combines with D0 (drum time) to mix with 1a above	17.01.02
2.	Initiates circuitry to pick Back Signal latch	16.01.02
	a. Back Signal latch assists in picking Character Select Control Latch	16.01.02
	1) Char Sel Ctl assists in advancing Console Digit Ring	16.01.02

The manual typing for all four positions of the address "request" occurs as just outlined. Because the address "request" is typed high-order digit first, the address start register must receive the high-order digit in the units position of the register. Then, just before receiving the next digit, a left shift occurs. The left shift moves each digit one position to the left and leaves the units position empty and ready to accept the new digit. As the fourth and last address "request" digit is being transferred, the high-order address "request" digit is shifted to the high-order position of the address start register.

Step 2 A - Automatic Tab Operation (Figures 4.4-2 and 4.4-4)

To assure spacing between the address "request" and its associated address "reply" an automatic tab operation is initiated as soon as the address "request" typing is completed. The length of the spacing is completely dependent upon the setting of the typewriter tab stop by the operator.

The console digit ring is used to signal the end of the address "request" typing and start the tab operation. During the first typing cycle, the console digit ring was set to Ring Digit 2. As the first typing cycle ended, the console digit ring was advanced to Ring Digit 3. The ring continues to advance through the succeeding typing cycles. At the end of the fourth typing cycle, Ring Digit 5 turns off and the turn-off pulse is used to turn on the Delay D trigger. As soon as the back signal relay, R36, drops following the fourth typing cycle, the output from the Delay D trigger turns on the keyed address latch. The keyed address latch picks the typewriter tab magnet and starts the tab operation.

The turn-off pulse from Ring Digit 5 is also used to advance the console word rings. The console word ring advances to Ring Word 2. With Ring Word 2 on, Word 2 of Sector 5 can now be gated to bring the address "reply" into the typewriter to be typed.

Before the fourth typing cycle ends, a signal, called Console Keyed Address End, is initiated and sent to the A & P unit. The signal initiates the circuitry necessary to transfer the address "request" from core storage to the word buffer register.

Additional Action Resulting from Fourth Key Depression

1.	Ring Digit 5 is turned off	16.02.06
	a. Delay D trigger is turned on	16.02.06
	1) Keyed address latch is picked	16.01.03
	a) Typewriter tab magnet is picked	17.00.03
	b. Combines to Advance Console Wd Rings	16.02.07
2.	Console Keyed Address Signal	17.01.01

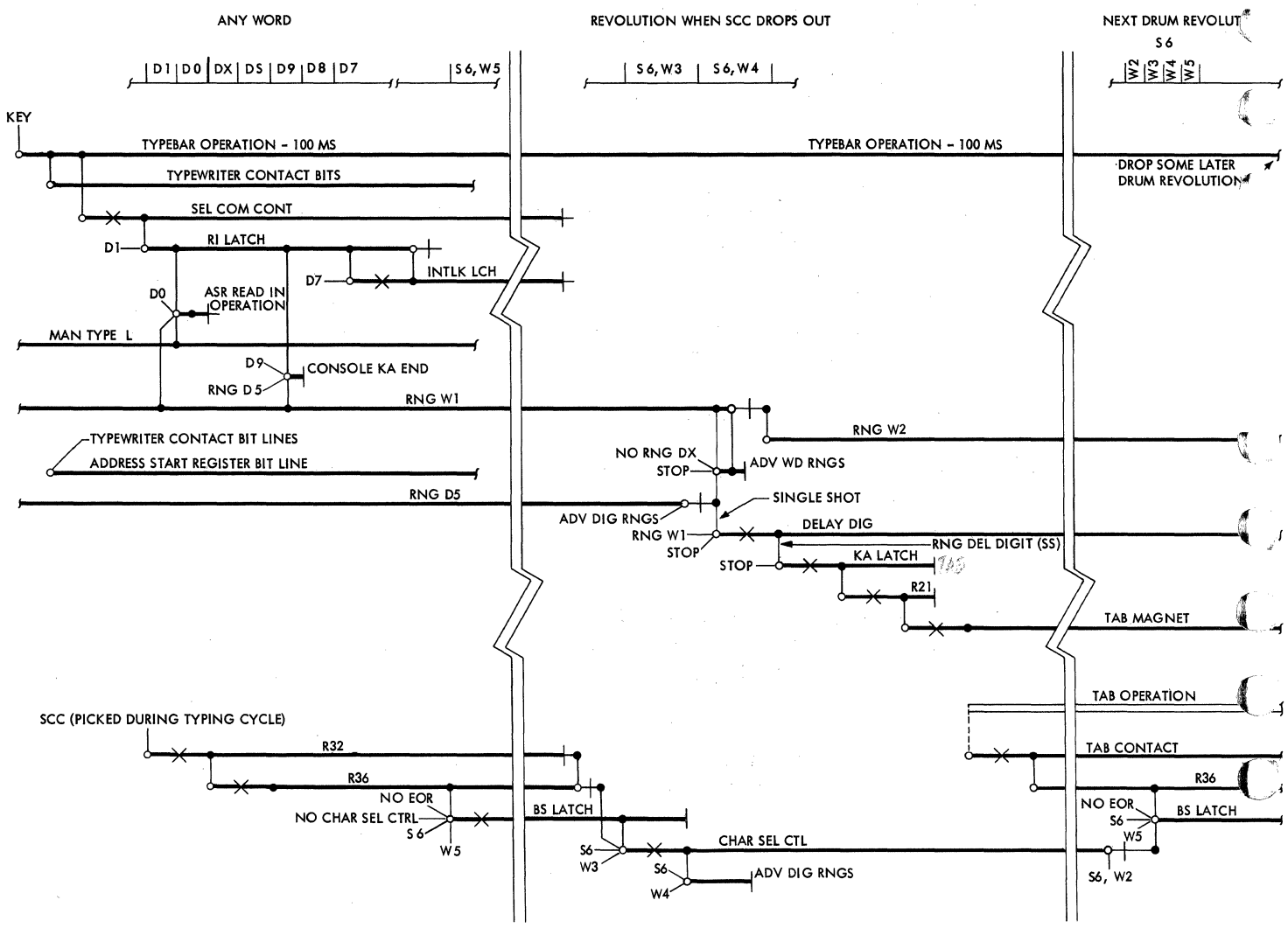

FIGURE 4.4-4 OPERATION CHART - FOURTH KEY DEPRESSION AND AUTOMATIC TAB OPERATION

An interlock is initiated during the tab operation so that no other typewriter operation can start until the tab is over. When the tab magnet is energized, a normally-open tab contact closes and picks the back signal relay, R36. R36 picks, as before, the back signal latch at S6, W5 time. As long as R36 remains picked, there can be no development of the character select control signal. This signal is needed in the transfer of the address "reply" from the drum to the typewriter.

Tab Operation. The tab operation causes the following:

1.	Tab contact closed		17.00.07
	a.	Back Signal Relay (R36) picked	17.00.08
		1) R36 combines to pick Back Signal latch	16.01.02

Step 2 B - Address "reply" Transfer to Drum (Figures 4.4-2, 4.4-4 and 4.4-5)

While the typewriter is going through the last manual typing cycle and the following automatic tab operation, the address "reply" is transferred from core storage into Sector 5, Word 2 of the drum.

When the address "reply" reaches the word buffer register, a signal, called Op Type, is sent to the console. Op Type combines with other pulses to (1) initiate circuitry to erase the console drum buffer area (Sector 5, Word 1-10), (2) initiate and complete the address "reply" transfer from word buffer register to drum (Sector 5, Word 2) on the drum cycle following the erase operation, and (3) turn on the program-out latch. Turning on the program out latch picks the program out relay, R41. R41 points drop the keylock magnet, which locks up the typewriter keyboard, and cuts off the typewriter contact output. The manual type latch can then be reset off by the operation signal.

Step 3 - Typing of Address "Reply" (Figures 4.4-2, 4.4-6 and 4.4-7)

The transfer of the address "reply" to the drum is completed before the tab operation ends. Because of this, the typing of the address "reply" starts on the revolution following the advance of the console digit ring from Delay D to Rng DS. The console digit rign ring advances during the first Sector 6 time following the dropout of the tab magnet and its associated relays.

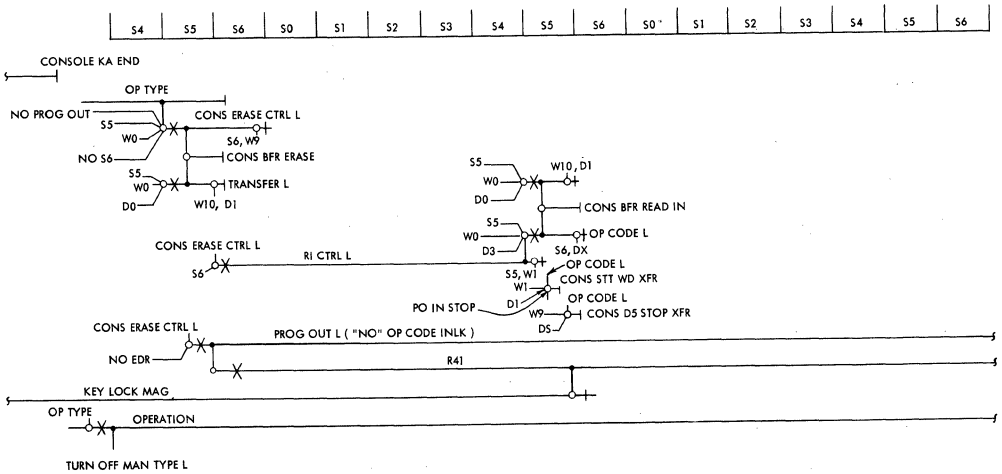

FIGURE 4.4-5 OPERATION CHART - ADDRESS "REPLY" TRANSFER TO DRUM

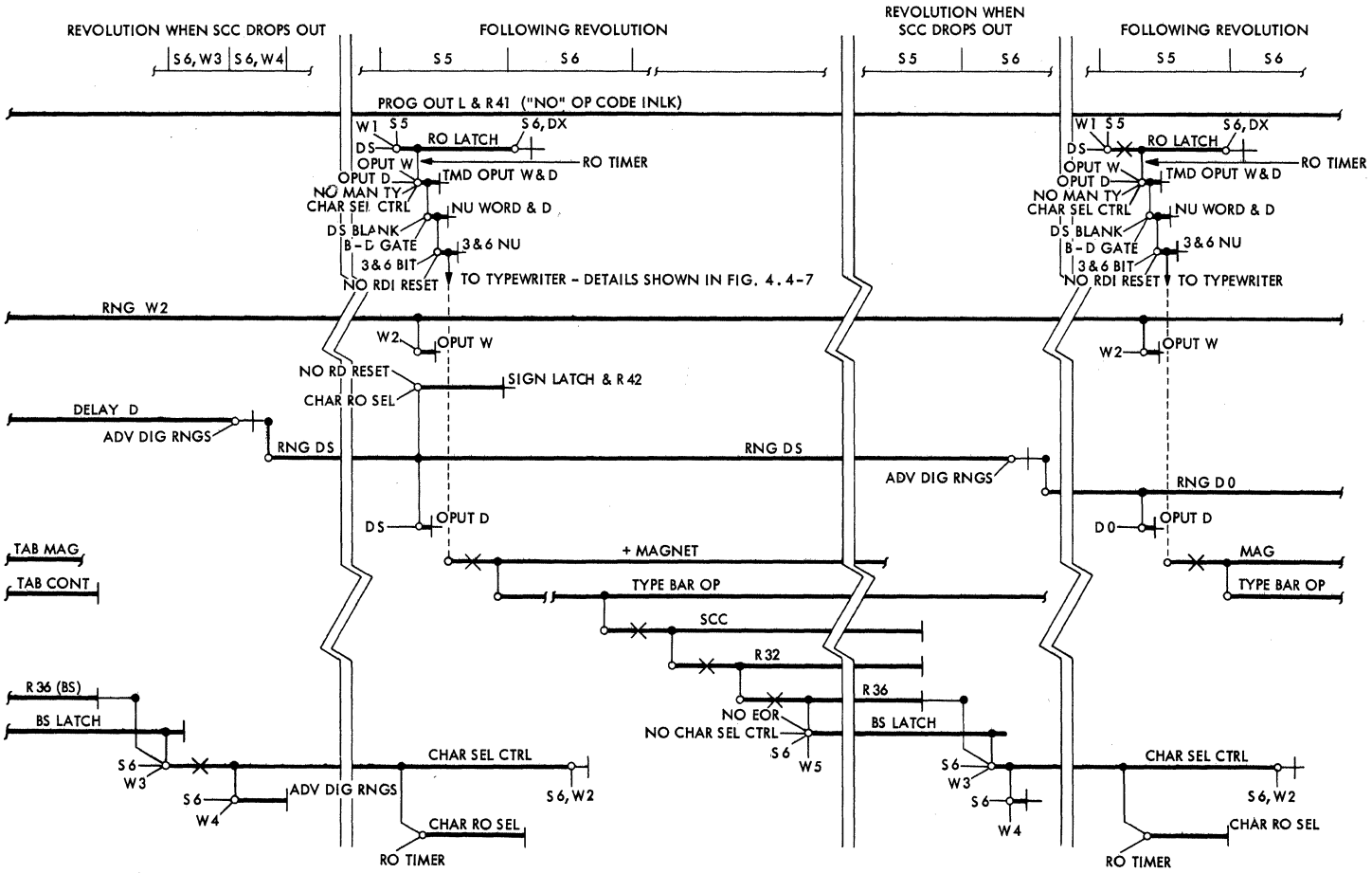

FIGURE 4.4-6 OPERATION CHART - TYPING DS AND D0 POSITIONS OF ADDRESS "REPLY"

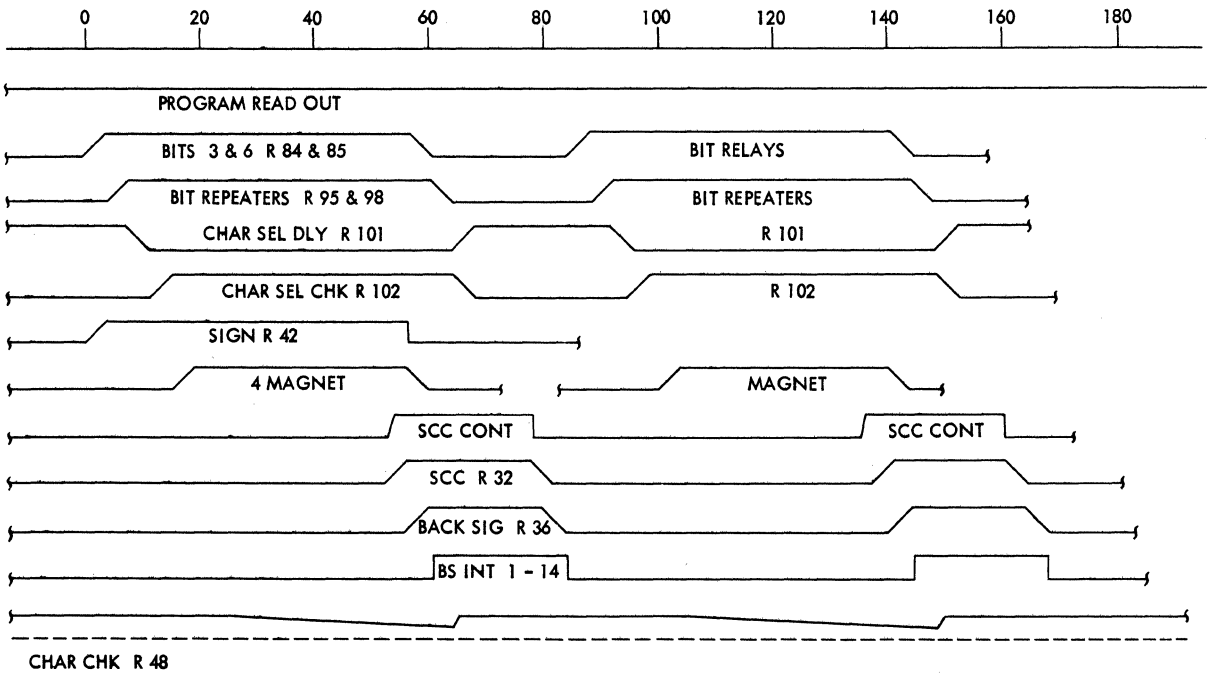

FIGURE 4.4-7 SEQUENCE CHART - SIGN AND DIGIT TYPING

The following drum-console timing pulses serve as the gating which any bit must pass through on its way from the drum to the console typewriter:

1. Read out Latch - comes up during S5 time.

2. Output Word - a gating made from mixing the console ring word and drum word.

3. Output Digit - a gating made from mixing the console ring digit and drum digit.

4. No Manual Type.

5. Character Select Control

A combination of the preceding pulses produces a gate called Timed Output W and D which is further gated with a Drum B-D Gate and a DS Blank Pulse. The resultant output is called Numeric Word and Digit (NU Word + D) which combines with the actual drum to turn on the specified numeric latches. The latch on output is delivered to the typewriter bit relays.

For the digit sign position, a Sign Latch Gate (R42) is also setup as shown in Figure 4.4-6.

In the typewriter, the relays are picked as shown in Figure 4.4-7. The originally picked bit relays pick the bit repeater relays. The bit repeater relays drop out the character select delay relay, R101. R101, when dropped, in combination with a checking matrix of bit repeater relay points, picks the character select check relay, R102. The R102 points:

1. Complete the circuit to the proper typewriter magnet which activates the cam and typebar assembly.

2. Drop the character check relay, R48.

R48 takes 100 ms to drop out, but before that time R102 drops out, allowing R48 to repick. If R48 was allowed to completely drop out, signifying no pick of R102 during a typing cycle, a circuit is generated to pick the pound sign (#) typewriter magnet. During the typebar flight, the selector common contact makes and picks the SCC Relay, R32. R32 picks the back signal relay, R36. R36 turns on the back signal latch at S6, W5 time. When the SCC opens, R32 and R36 drop. The back signal latch then helps set up the next typing cycle assisting in the pick of Character Select Ctrl at S6, W3 which then advances the console digit ring at S6, W4 time.

Step 4 - End of Operation and Automatic Carriage Return (Figure 4.4-8)

Typing the last digit of an address "reply" results in the advance of the console digit ring from Rng D9 to Rng DX. Rng DX combines with Stop to turn on the end of record latch (EOR Latch). The EOR latch turns off the program out latch and resets the console word and digit rings. The program out latch allows R41 to drop out. When R41 drops, the keylock magnet picks up and unlocks the typewriter keyboard.

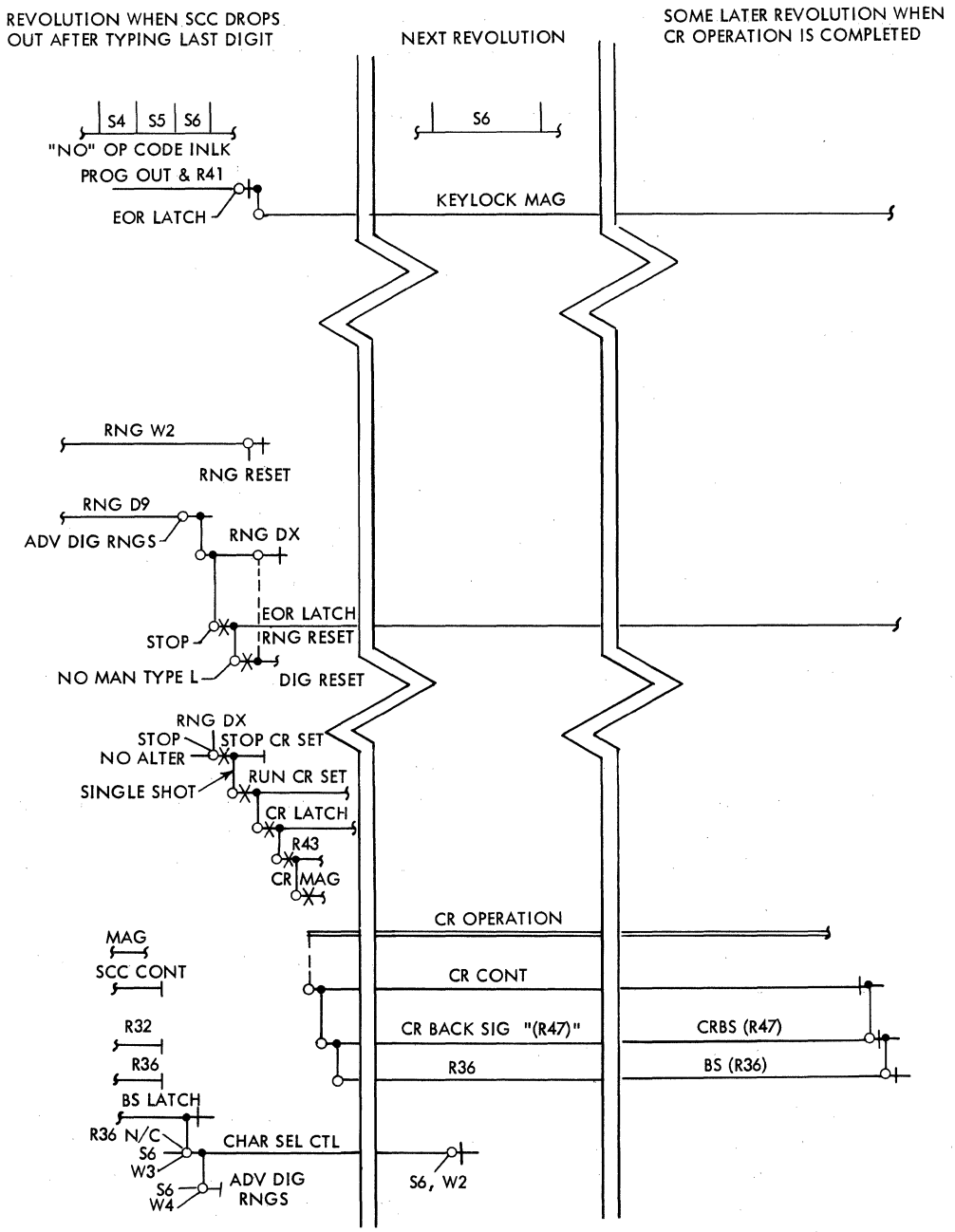

FIGURE 4.4-8 OPERATION CHART - EOR OPERATION AND CARRIAGE RETURN

Rng DX also combines with No Alter and Stop to activate a Stop CR Set Line in 16.01.03. The Stop CR Set produces a 5.3 MS pulse in 17.03.01, called Run CR Set which turns ON the CR Latch in 16.01.03. The ON output of CR latch picks the carriage return relay, R 43. R 43 then picks the carriage return magnet. As the carriage return magnet is energized, the CR Contact closes and picks the CR Back Signal Relay, R 47. R 47 picks the back signal relay, R 36, but the BS latch cannot be picked since the end-of-record Latch is picked.

Rng DX picks the following:

1. EOR latch
   a. Turns off program-out latch
      1) Drops R 41. Keylock magnet picked.
   b. Resets console word and digit rings

2. Carriage Return Relay, R 43
   a. Picks CR Magnet which closes CR Contact
      1) CR Contact picks CR Back Signal Relay, R47
         a) R47 picks Back Signal Relay, R36

4.4.02 TYPING ALPHABETIC ADDRESS "REPLY"

Any alphabetic address "reply" (has a three in the sign position) automatically types the alphabetic characters rather than the numeric characters. As shown in the following table, each alphabetic character is a combination of two numeric characters. The letter H, for instance, is represented by a six in the digit zero (zone) position and an eight in the digit one (numeric) position.

ALPHABETIC REPRESENTATION

Alph. Character	H		O		U		N		D		A
Num Representation	6	8	7	6	8	4	7	5	6	4	3
Drum Digit Pos.	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DS

Drum Revolution → Past Read Heads

The digit zero, two, four, six and eight positions are referred to as the zone position of any one particular alphabetic representation. The digit one, three, five, seven and nine positions are referred to as the numeric position of any one particular two-digit alphabetic representation. The numeric combinations used to represent alphabetic and numeric characters in an alphabetic word can be found in the Input/Output Section of the CE Instruction Manual, (Book F of Volume 1 Figure 3.1-2).

To type an alphabetic word in the proper sequence, it is necessary to read off the digit one-zero combination first, followed by the digit three-two combination, and so on. The console digit ring is used to gate the drum pulses so that they are sent to be typed as just outlined. In this particular case, the console digit ring is advanced two digit ring positions during an advance cycle. The positions of the console digit ring that are used are the following: DS, D1, D3, D5, D7, D9. These positions, with the exception of the DS position, correspond to every numeric position of all the two-digit alphabetic representations in any one alphabetic word. The console digit ring, therefore, allows only the numeric position of a two-digit alphabetic representation to enter the typewriter. The logic used is as shown in Figure 4.4-9.

Due to drum rotation, the numeric position of any character is read off the drum one drum digit time ahead of the associated zone position. Some of the gating pulses generated during the transfer of the units position are also used to initiate the gating pulses needed during the next drum digit time when reading the associated zone position.

Step 1 - Alpha Sign Recognized, (Figure 4.4-9, 10, 11)

The alpha sign (zero and three bit) is transferred from the drum to the console in the same manner the plus sign was transferred for the numeric word. The same drum -

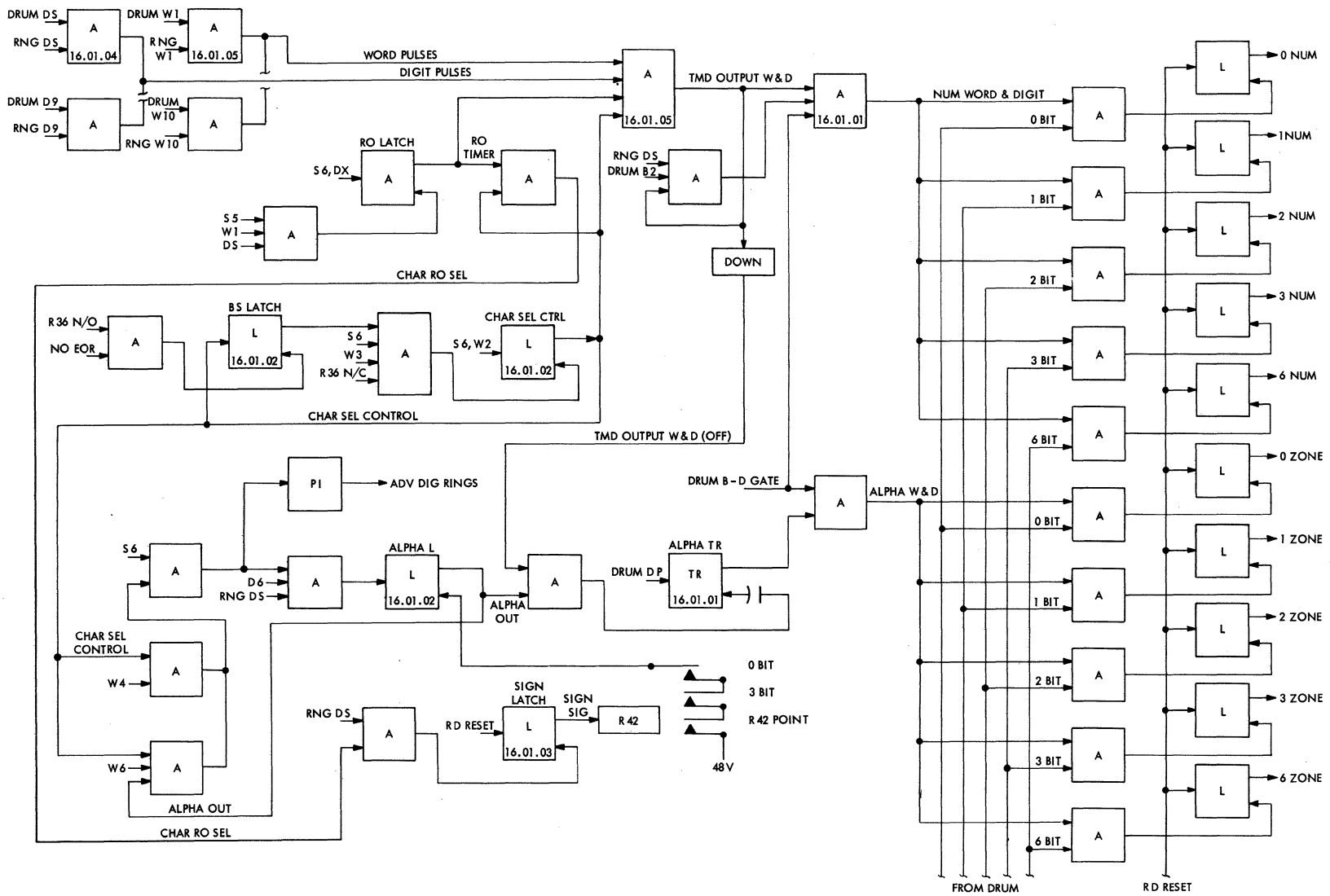

FIGURE 4.4-9 POSITIVE LOGIC CHART - ALPHABETIC WORD TRANSMISSION

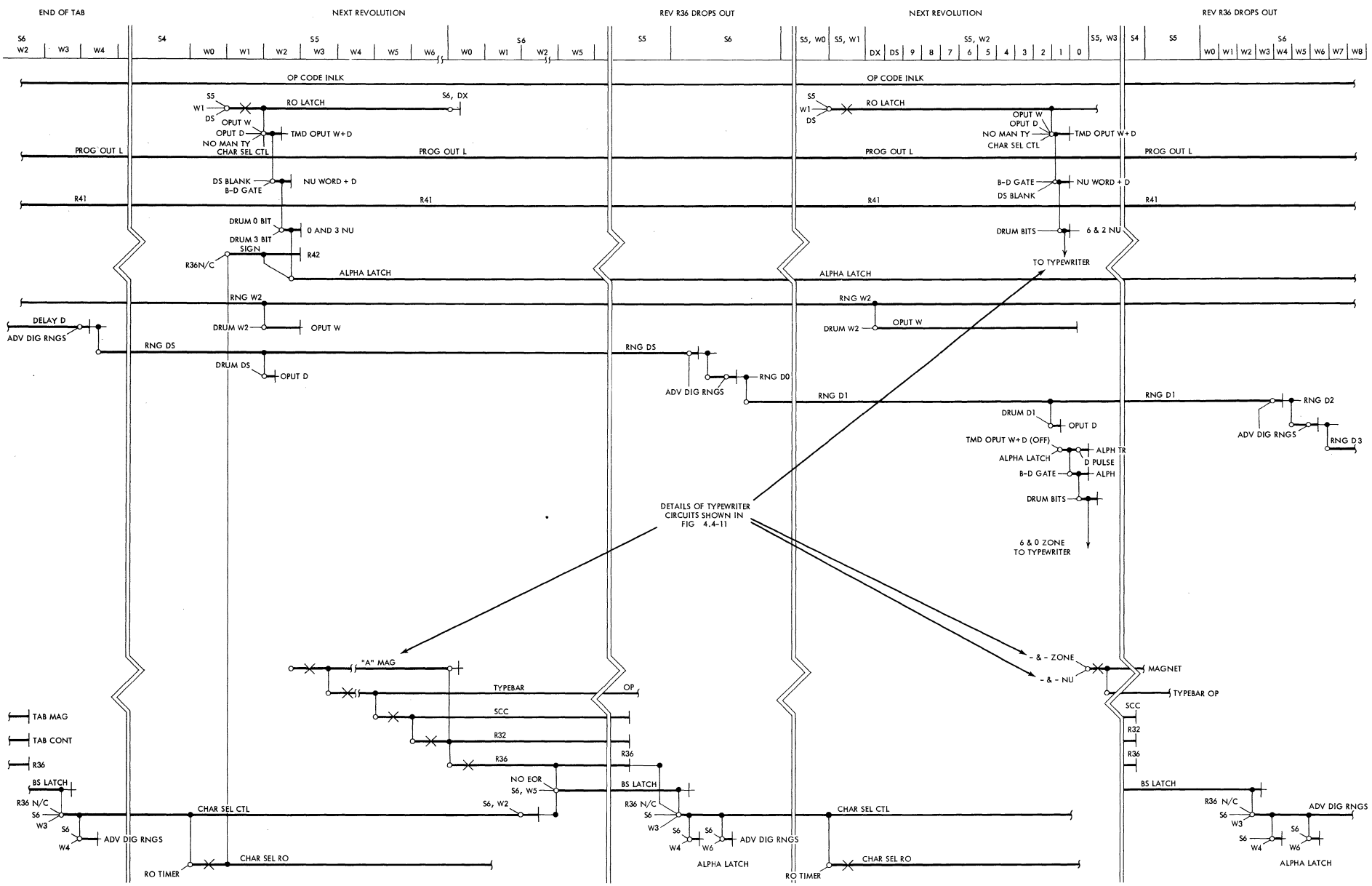

FIGURE 4.4-10 OPERATION CHART - SETUP AND TYPING OF SIGN AND ALPHABETIC CHARACTERS

console timing pulses are used, but the results of the transfer are different. The alpha sign bits (zero and three) pick the related numeric bit and bit-repeater relays. The bit-repeater relay points then combine with the sign latch (R42) points and (1) turn on the alpha latch, and, (2) pick the "A" Typewriter Magnet.

Recognition of Alpha Sign in DS Position

1.	Alpha Sign (0-3 bits) pick numeric bit and bit-repeater relays	17.00.08
	a. Bit repeater relays and sign latch turn on alpha latch	16.01.02
	b. Numeric bit repeater relays and sign relay (R42) pick "A" Typewriter Magnet	17.00.10

Step 2 - Advance Console Digit Ring Two Positions (Figures 4.4-9, 10)

The typing of any character picks the Selector Common Contact (SCC) and the other associated relays during the typing cycle. As soon as the SCC and its related relays drop out, the back signal latch mixes with the next Sector 6, Word 3 pulse and turns on character select control. Character select control mixes with a Sector 6, Word 4 pulse and advances the console digit ring from the digit sign position to the digit zero position. At Sector 6, Word 6 time another console digit ring advance pulse is generated. This second digit ring advance pulse is available whenever the alpha latch is picked. The pulse advances the console digit ring from the digit zero position to the digit one position.

Step 3 - Transfer Drum Digit Pulses (Figures 4.4-9, 10, 11)

At S5, W2, D1 time of the drum revolution immediately following the advance of the console digit ring, the drum digit position 1 bits transfer to the typewriter. Drum digit position 1 contains the numeric position bits of the two-digit alphabetic representation. The same drum-console timing gates used in the transfer of the digit sign position are again used.

One of the gates, called Timed Output Word and Digit (TMD OPUT W+D), is also used to turn on the alpha trigger. When TMD OPUT W+D goes down (at end of drum digit one time), it mixes with alpha latch (ON) and turns on (capacitive spike) the alpha trigger. The alpha trigger is dropped at the next Drum D Pulse time, but the ON state output is mixed with a Drum B-D Gate to generate an Alphabetic Word and Digit Gate (ALPHA W+D) from B to D time of Drum Digit Zero. The Alpha W+D Gate then gates any drum bits located in Drum Digit Zero Position (the Zone Position) into the typewriter.

Both the Drum D 1 and D 0 bits pick up their associated bit and bit-repeater relays, which, in turn, pick the designated typewriter magnet.

The console digit ring advances at the end of the typing cycle and repeats the transfer of information from drum to console until an end of record is sensed. The end of operation and automatic carriage return for an alphabetic word is exactly the same as for a numeric word (refer to Step 4 of Section 4.4.01 and Figure 4.4-8).

4.4.03 Display Key

To alter any alphabetic character, the two-digit numeric representation of that particular alphabetic character must be typed. To facilitate the altering of an alphabetic word, it is desirable to translate the alphabetic characters, which make up the word, into

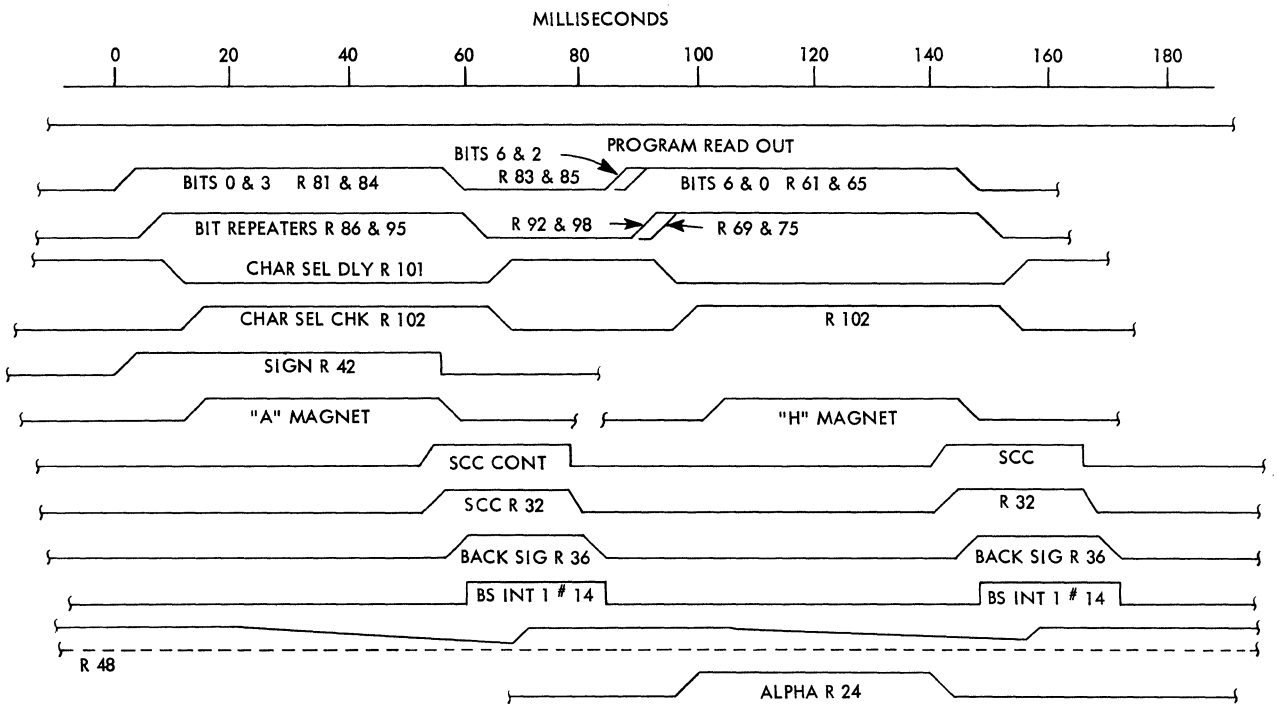

FIGURE 4.4-11 SEQUENCE CHART - ALPHABETIC CHARACTER TYPING

their two digit numeric representation. Then the necessary changes can be made with a minimum of reference to a coding chart.

The display key is used to allow the two-digit numeric representation, which makes up an alphabetic character, to type instead of the alphabetic character. Every word written on the drum is in numeric form. The alphabetic character is formed by combining two adjacent drum digit positions as described in Section 4.4.02.

The main job of the display key and its associated circuitry, therefore, is to keep the drum digit positions from combining to form any alphabetic characters in a word.

Depressing the display key causes the following:

1. Automatically tab typewriter so that numeric characters are printed directly under the alphabetic form of the word.

2. Print the 3 which comes from Drum DS Position to signify word as alphabetic.

3. Type Alphabetic Word in its numeric representation.

Step 1 - Automatically Tab Typewriter

Depressing the display key picks the display relay, R11. Rll holds through its one point until a carriage return operation is initiated. The R11-2 point originates the display signal which goes to 16.02.02 and turns on the Delay D Trigger of the console digit ring and Ring Word 2 of the console word ring. With the Delay D Trigger on, the keyed address latch is turned on and the tab operation occurs. As in any tab operation, the closing of the tab contact picks the back signal relay, R36. R36 then turns on the back signal latch.

When the tab contact opens up and R36 drops, the back signal latch assists in turning on the character select control latch during the next S6, W3 time. The latch remains on until the following S6, W2 time. At S6, W4 time following the pick of the character select control latch, the console digit ring advances from D Delay to ring digit sign position.

Step 2 - Print a 3 to Signify Alphabetic Word

With character select control still on, the Drum 0 and 3 bits transfer from the drum to the typewriter at S5, W2, DS time. The drum console gating pulses are described in Step 3 of Section 4.4.01, and Figure 4.4-6 is used.

The drum bits pick the associated bit and bit-repeater relays. The bit-repeater relay points and the sign relay, R42, normally combine to originate the pulse used to turn on the alpha latch. In this instance, however, R11 is picked and the R11-3 N/C point in 17.00.08 prevents the turn on of the alpha latch. The R11-3 N/O point, in combination with the R11-4 N/O point in 17.00.13, pick the 3 Typewriter Magnet.

The 3 typebar closes the selector common contact which then picks the SCC Relay, R32. R32 picks the back signal relay, R36, and R36 assists in turning on the BS latch as soon as character select control drops out (S6, W2). As soon as the SCC and its related relays drop (R32 and R36), the BS latch assists in again turning on the character select control latch With character select control picked, the console digit ring is advanced (S6, W4) from the ring digit sign position to the ring digit zero position.

Step 3 - Type Alphabetic Word in its Numeric Representation

R11, which was picked in Step 2, stays picked until a carriage return operation is initiated. With R11 picked, the alpha latch in 16.01.02 can not be turned on. Therefore, whenever character select control is on, the transfer of drum bits takes place during the specified digit time of Sector 5, Word 2. The drum-console gating pulses as described in Step 3 of Section 4.4.01 and Figure 4.4-6 are used. The transfer of information continues until the end of record latch is turned on. The end of the transfer operation and the automatic carriage return are as described in Step 4 of Section 4.4.01and Figure 4.4-8.

4.4.04 Alter Key (Figures 4.4-12, 4.4-13, 4.4-14)

Before the alter key can be used, the present contents of the address to be altered must be brought out of the system and typed. The circuitry used in the transfer is described in Step 3, Section 4.1.01 of this manual.

The alter key can then be used to set up the circuitry necessary for altering all or part of the contents of the address typed. The altered word is typed in red directly under the previously typed out address contents. The sign figure is typed first, followed by the digit position zero figure through the digit position nine figure. The whole word must must be typed, because the original address contents are blanked out. If only part of the address word needs altering, the rest of the word is retyped as shown directly above in the previously typed out address contents (address "reply").

Depression of the alter key causes the following:

1. Automatic tab by typewriter.

2. Allows manual typing to enter the word buffer register.

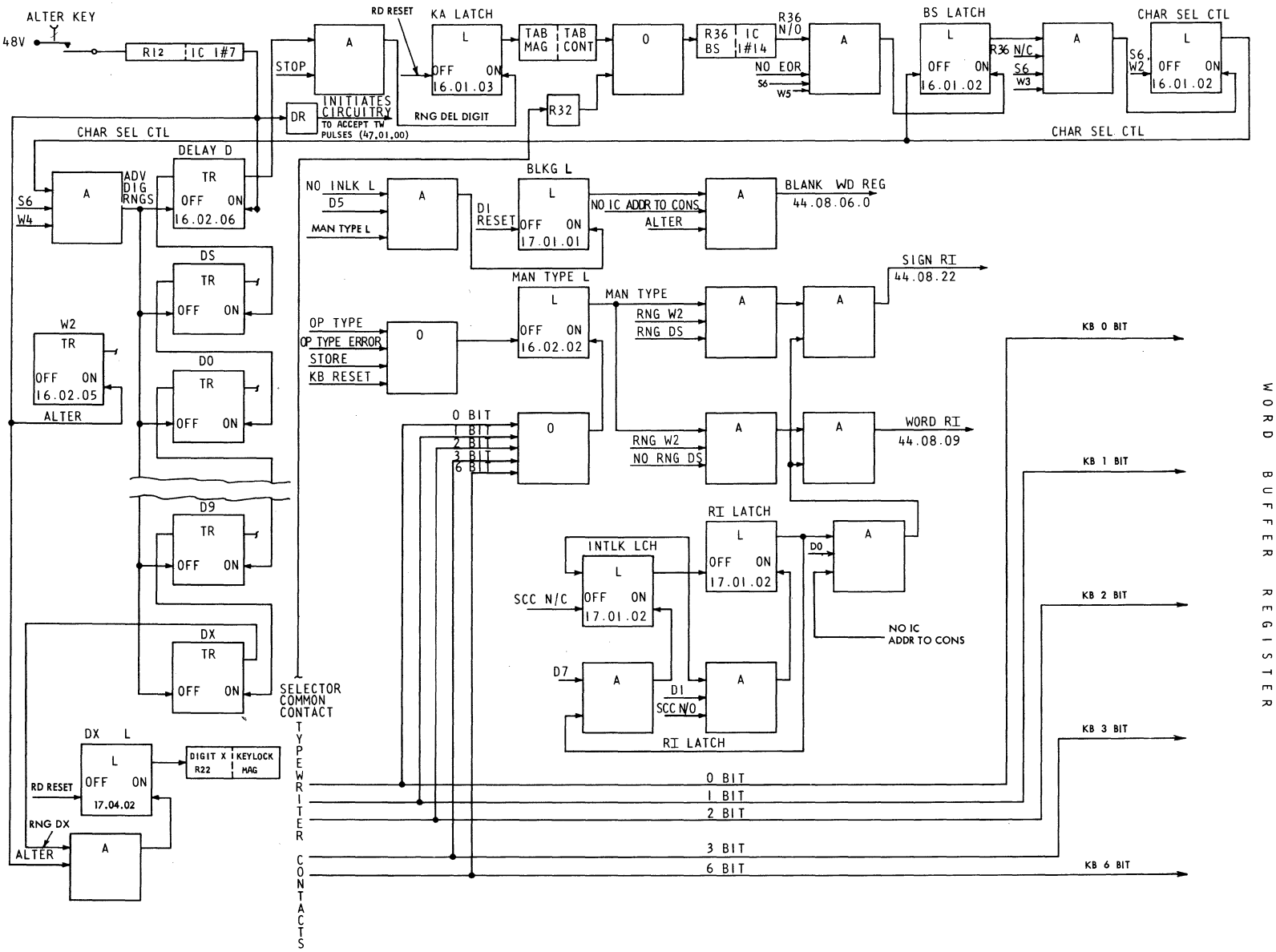

FIGURE 4.4-12 POSITIVE LOGIC CHART - ALTER OPERATION

3. Lockup of typewriter after 11 character-key depressions.

Step 1 - Automatic Tab by Typewriter (Figures 4.4-12, 4.4-13)

Depressing the alter key picks the alter relay, R12. R12 holds until the end of a store operation. An alter signal is generated and turns on the console ring word two trigger and the delay D trigger. With the delay D trigger on, the keyed address latch picks and the tab operation occurs. Initiation and termination of the tab operation is identical to the tab operations previously described in this section of the manual. In addition, the Alter Kev also (1) initiates the circuitry to blank out the word buffer register, and, (2) shifts the typewriter ribbon from black to red so that the altered contents are typed in red.

As in previous tab operations, the opening of the tab contact initiates the circuitry to advance the console digit ring. In this instance, the console digit ring advances from the delay D position to the digit sign position.

Step 2 - Manual Typing Enters Word Buffer Register (Figures 4.4-12, 4.4-13)

The manual typing of the altered word sets up the necessary circuitry to allow the word to enter the word buffer register.

Depressing a typewriter character key closes the associated typewriter contacts. The contact output picks the manual type latch. The manual type latch on output combines with the following:

1. Console Ring Word 2 and Console Ring Digit Sign (both previously turned on), RI Latch ON output at D0 time and No IC Address to console to gate the sign position bits into the word buffer register (Sign RI - 44.08.22).

2. Console Ring Word 2 and No Console Ring Digit Sign (Normal condition except during digit sign time), RI Latch ON output at D0 time and No IC Address to console to gate bits of all other positions, except digit sign, into the word buffer register (Word RI-44.08.09).

The depression of a typewriter character key and the operation of its associated typebar also closes the Selector Common Contact (SCC). The uses made of the SCC are the same as outlined in Step 1, Section 4.4.01 of this manual.

Step 3 - Lockup of typewriter after 11 key depressions (Figure 4.4-14)

As the last digit of the altered word is typed, the console digit ring advances from ring digit nine position to the Ring Digit X Position. The Ring Digit X ON output combines with an alter signal pulse to pick the DX latch. The On output of the DX latch picks the DX relay, R22; which, in turn, drops the keylock magnet. With the keylock magnet dropped, no manual typing can occur. In addition, the Console Rng DX combines with Stop to pick the end of record latch.

The console remains in alter status until a carriage return is initiated. The normal way of ending the operation is by initiating a store operation. During a store operation, an automatic carriage return is initiated.

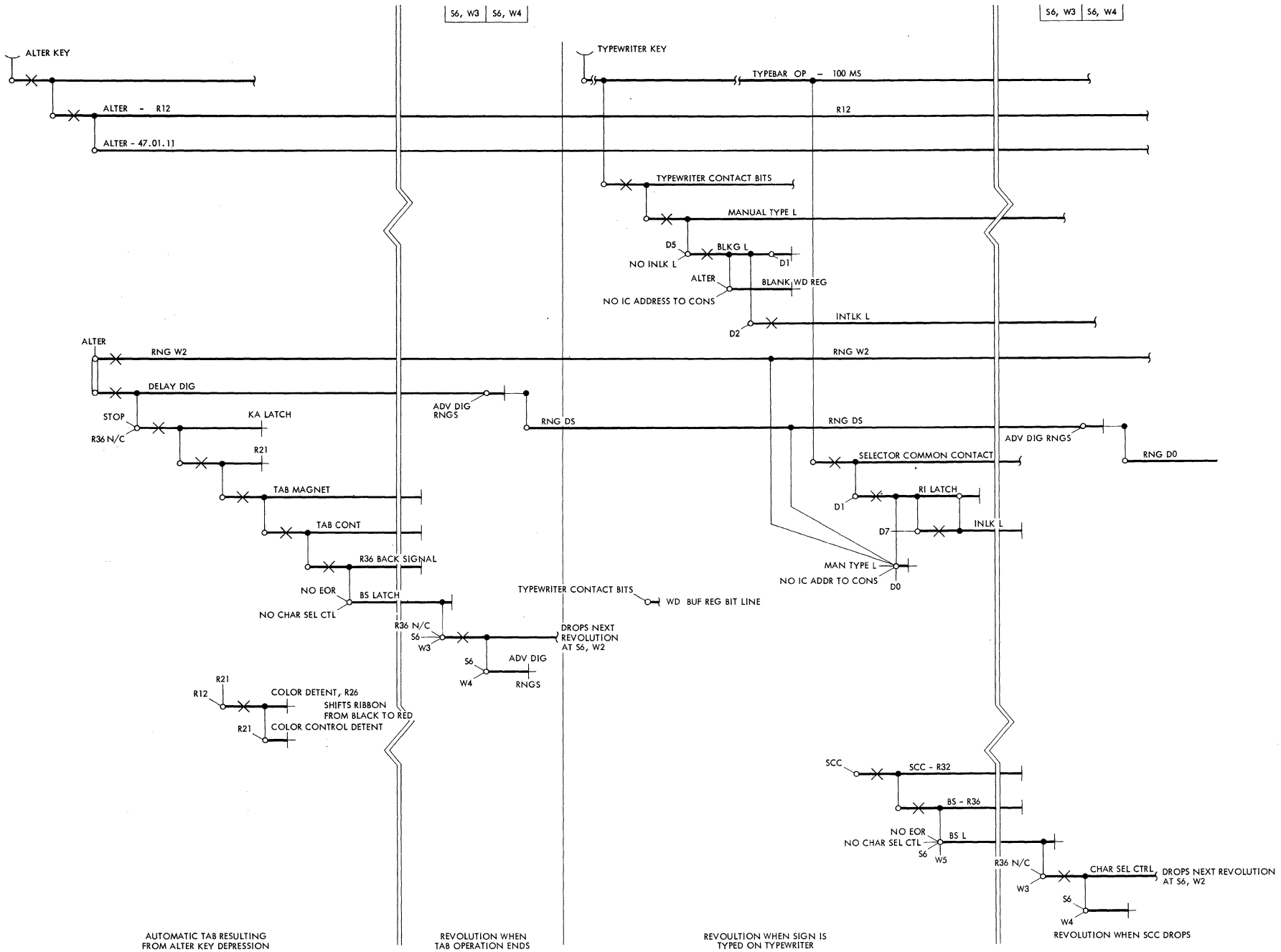

FIGURE 4.4-13 OPERATION CHART - ALTER OPERATION

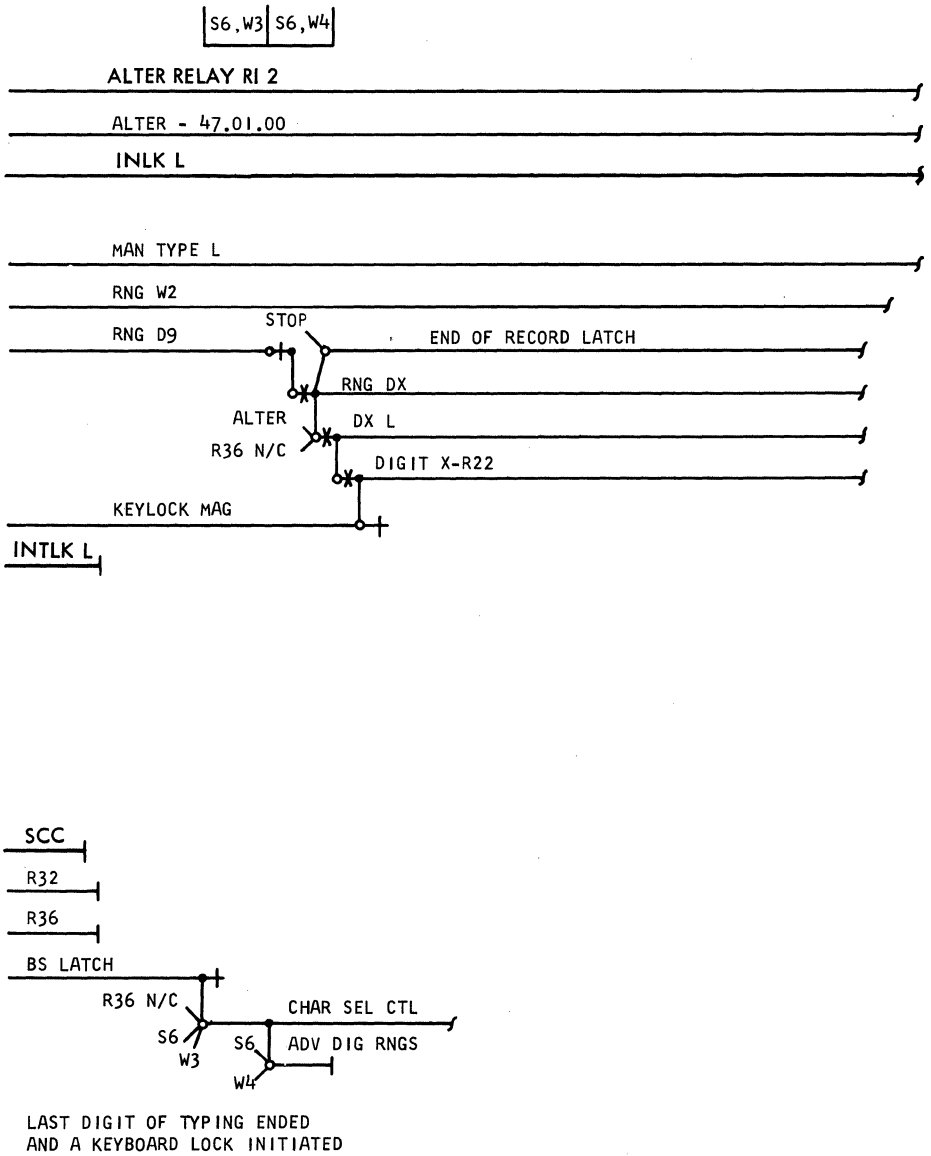

FIGURE 4.4-14 OPERATION CHART - END OF ALTER OPERATION

4.4.05 Store Key (Figure 4.4-15)

The store key initiates the circuitry necessary to transmit the previously typed altered word from the word buffer register into the specified address location. The altered word was manually typed, and entered the word buffer register, during an alter operation. If no other console operation has taken place since that time, the console is, technically, still in an alter operation. The alter signal normally is terminated during a store operation. The address location was specified earlier when the location was manually typed on the console typewriter during an address "request" operation.

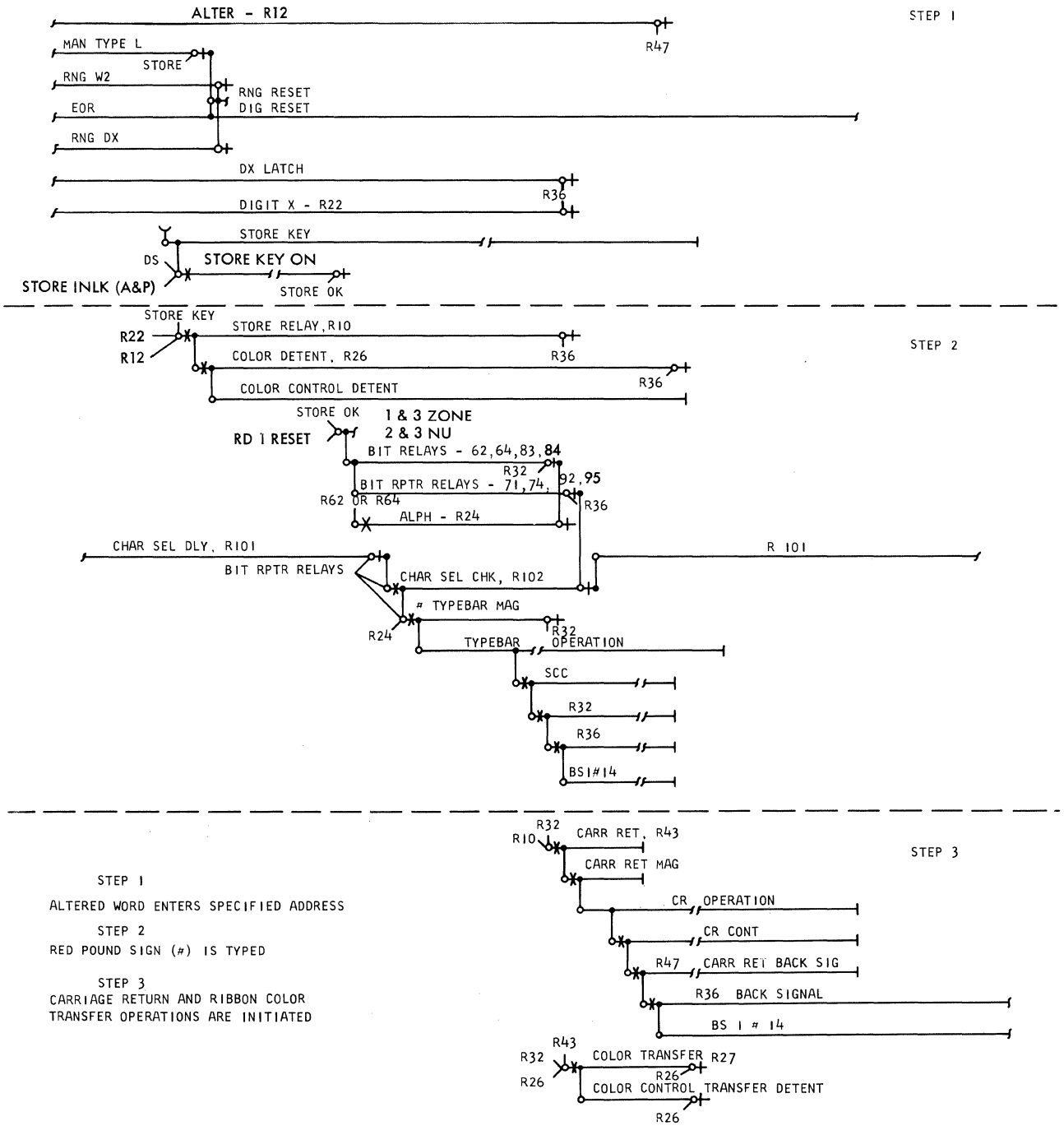

FIGURE 4.4-15 OPERATION CHART - STORE KEY OPERATION

Depression of the store key causes the following:

1. Altered word enters specified address.

2. A red pound sign (#) is typed.

3. Carriage return and ribbon color transfer operations are initiated.

Step 1 - Altered Word Enters Specified Address

A depression of the store key picks the store relay, R10, and generates a store signal pulse. The store-signal pulse assists in the picking of the store latch which (1) turns off the manual type latch (With the Man Type L off, the console word and digit rings are reset), (2) turns on the keyboard error latch if store operation is not completed by digit one time, and, (3) signals the A & P unit to start the word transfer.

The transfer signal sent to the A&P is called Store Key On. The signal initiates the setting up of the circuitry necessary to parallel transfer the altered word from the word buffer register to the specified address location.

As soon as the transfer is complete, a Store OK Pulse is generated. The Store OK Pulse (1) turns off the store latch, and (2) combines with other conditions to generate the bit pulses needed to print a pound sign (#).

Step 2 - Type Red Pound Sign

The color detent relay, R26, and the color control detent were previously picked when the alter relay, R10, picked. The ribbon, therefore, is already positioned to type in red.

The Store OK Pulse, signifying a completed transfer, combines with an RD 1 reset signal (Down Condition) to generate the needed bit pulses. The bit pulses pick the associated bit and bit-repeater relays. The zone bit relays also pick the alphabetic relay, R24. The bit-repeater relays cause the character select delay relay, R101, to drop, which, in turn, allows the character select check relay, R102, to pick.

With all the necessary conditions now met, the # typewriter magnet is energized, and the associated push rod activates the cam and typebar assembly. As the # typebar moves forward, the SCC closes and picks the SCC Relay, R32. R32 initiates the following actions:

1. Drops the bit relays.

2. Drops pulse to the # typewriter magnet.

3. Picks the back signal relay, R36.

4. Initiate the circuitry for an automatic carriage return and a ribbon transfer from red to black.

Bit Relays Drop. Both the zone and the numeric bit relays are dropped as a result of picking R32. The zone-bit relays, by dropping, also cause the drop out of the Alpha Relay, R24.

Open Circuit to # Typewriter Magnet. By opening the circuit to the # typewriter magnet halfway through the typebar operation, the push rod has sufficient time to return to its normal position and allow the cam lever assembly to latch up at the end of the operation.

Back Signal Relay, R36, Picked. Picking R36 causes the drop out of the following Latches and Relays: DX latch; DX relay, R22; store key relay, R10; and the bit-repeater relays (which, in turn, cause R102 to drop and R101 to pick).

Step 3 - Carriage Return and Ribbon Transfer Operations

When R32 originally picked, R10 was also still picked. These two pulses combine to pick the carriage return relay, R43. With R43 picked, (1) the CR magnet is energized, initiating a carriage return operation, and, (2) a ribbon transfer is started R43, in conjunction with R26 and R32 points, pick the color transfer relay, R27. R27, in turn, picks the color control transfer detent. With both color relays picked (R26 and R27) and both color detents energized (color control and color control transfer), the ribbon shifts from red to black.

During the CR operation, the SCC opens dropping R32, which, in turn, causes R36 to drop. When R36 drops, the hold on R26 is broken, which drops R26, R27, the color control detent magnet, and the color control transfer detent magnet.

In addition, a CR contact closes during the CR operation. Closing of the CR contact allows the carriage return back signal relay (CRBS), R47, to pick. R47 drops (1) the alter relay, R11, and its signal pulse; and, (2) R43 and its associated CR Magnet. In addition R47 also repicks the BS Relay, R36.

4.4.06 Log Key

Operation of the log key allows manual typing of all characters to take place without resulting in a keyboard error condition.

Depression of the log key opens the log key D point in 17.00.15 and drops the stop relay, R7. With the R7-5 N/O point in 17.00.18 open, the typewriter contact common line is inactive, and the closing of the various contacts does not create any signals.

5.1.00 Print Out Display on Stop (Figures 5.1-1, 5.1-2)

As stated in Section 5.13.00 of the Arithmetic and Program Manual, the following conditions cause the 7070 to stop and the contents of both the instruction counter and program register automatically type out.

1. Programmed Stop
2. Console Stop
3. Address Stop
4. Single Cycle Stop
5. Stop Key
6. Any Error
7. Clocking Error
8. Address Circuit Error

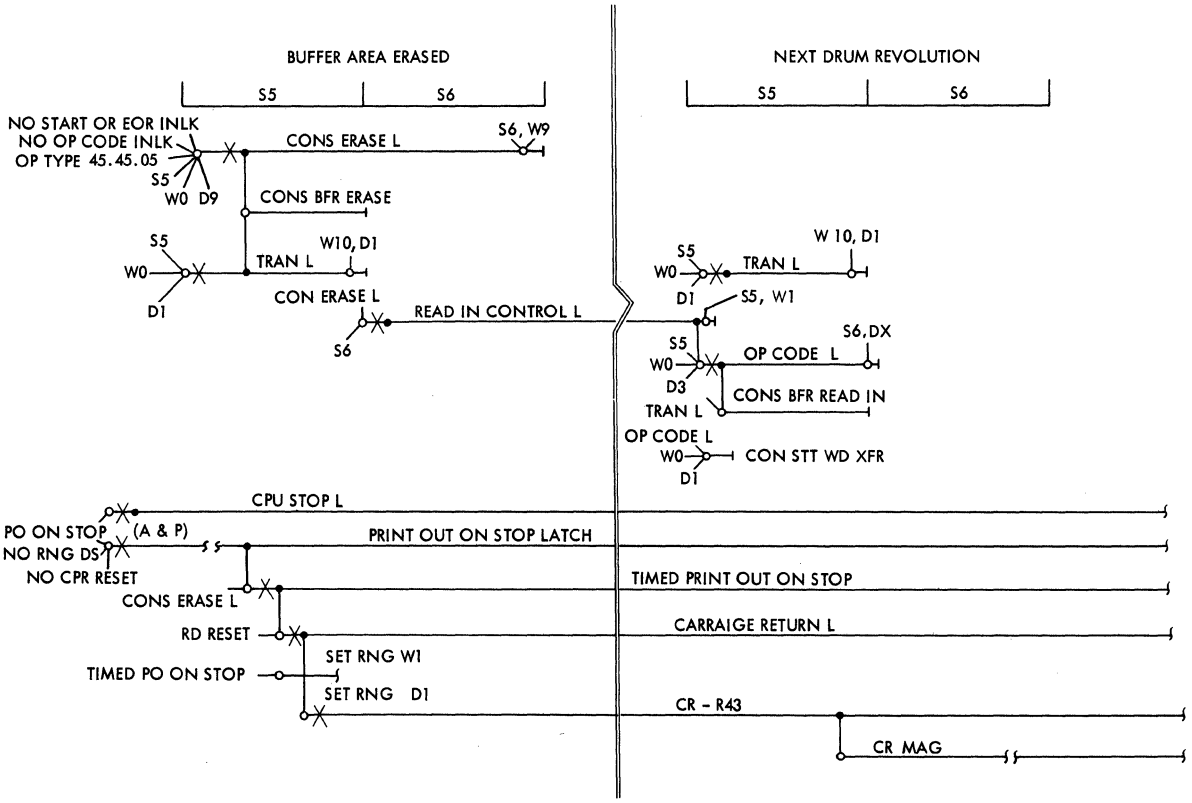

FIGURE 5.1-1 OPERATION CHART - TRANSFER OF IC AND PR CONTENTS TO DRUM

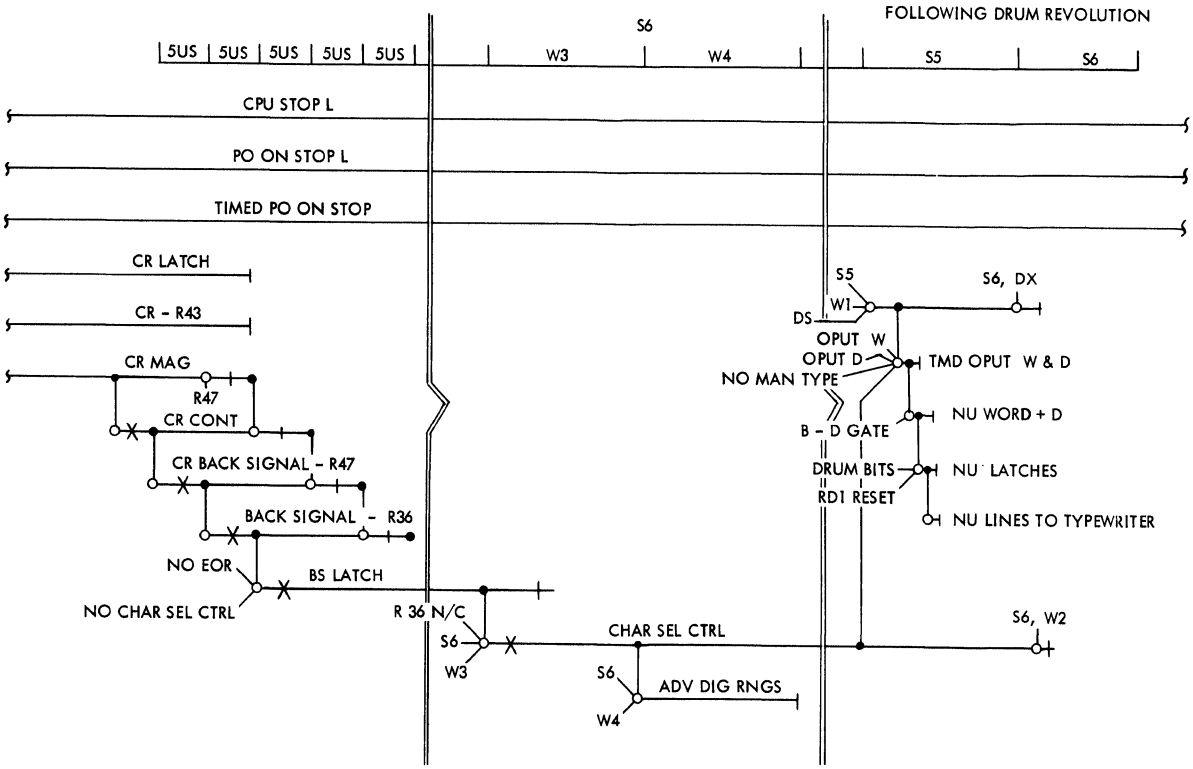

FIGURE 5.1-2 OPERATION CHART - TYPING OF IC AND PR CONTENTS

Upon recognition of one of these conditions, the operation in progress is completed, and the contents of the instruction counter and program register are typed out. When the operation in progress is ended, the program register contains the instruction just performed and the instruction counter contains the address of the next instruction.

At the end of the data cycle, the A&P stop latch is picked. The A&P stop latch, in turn, picks the PO on stop latch in 47.05.01. The ON output of the PO on stop latch picks the Console CPU stop latch and the Console PO on stop latch. The On output of the Console PO on stop latch (1) sets console word ring W1 and Digit Ring D1, and, (2) combines with other conditions to initiate a carriage-return operation.

Before the start of the CR operation, an Op Type Signal is sent to the console. At Sector 5, Word zero time, the Op Type Signal combines with other conditions to turn on the console erase latch. The On output of the console erase latch then combines with the On output of the transfer latch (S5, W0, D1 - W10, D1), resulting in an output called Console Buffer Erase. The console buffer erase signal initiates the circuitry which erases the console buffer area of the drum.

At Sector 6 time, the read in control latch is picked. The On output of the latch turns on the Op Code Latch at S5, W0, D3 time. The On output of the Op Code Latch combines with (1) the On output of the transfer latch to generate a signal called console buffer read in which initiates the circuitry to allow recording in the console drum buffer area, and (2) No Print Out In Stop at W0, D1 time to generate a signal called console start word transfer. The Con Stt Wd Xfr Signal initiates the circuitry used to transfer the information from the word buffer register to the console drum buffer area.

The information is stored in the console drum buffer area by the time the previously mentioned carriage return operation is completed. Word One of the console drum buffer area contains the contents of the instruction counter in digit positions 2-5, while Word Two contains the contents of the program register in digit positions X-0.

At the end of the carriage return operation, the console digit ring is advanced from Ring D1 to Ring D2, and transmission of Word One can now take place.

The signals necessary to gate the drum information for typing are the same as previously developed for typing the address "reply" (Refer 4.4-6). The four digits which make up the instruction counter contents are typed out one digit at a time. As the fourth and last digit of the IC contents are typed, a Rng D5 Adv Pulse activates a 25 usec single shot in 16.02.07. The output from the single shot combines with Ring Word 1 (RNG W1) and Stop to set ring digit delay (Timed Set DD). The same pulse combination also combines with a No Rng DX pulse to advance the console word ring. The console word and digit rings are now ready to allow the PR contents (stored in word two of the console drum buffer area) to be typed out.

The typing of the PR contents proceeds exactly as previously described for the typing of the IC contents.

As the last digit of the PR contents is typed, the console digit ring is advanced from Rng D9 to Rng DX as shown in Figure 4.4-8 of this manual. The ending of the operation occurs exactly as previously described and illustrated in Section 4.4.02 of this Manual.

5.2.00 PRINT OUT ON OP CODE

A Print Out On Op Code operation is a programmed typing operation under control of record control words. An Op Type Signal is sent to the console when the first word to be typed reaches the word buffer register. The Op Type Signal combines with other pulses and initiates a typewriter buffer erase operation and a carriage return operation. The word transfer from WBR to the typewriter buffer area takes place during the next drum revolution and is initiated by a CON STT WD XFR Signal. Development of the erase and the word transfer signals is accomplished as previously described in Section 5.1.00 of this Manual.

Up to a total of 10 words may be transferred from the WBR into the typewriter buffer area. A signal, called Type Buffer Full, is generated at Sector 5, Word 10 time. The type buffer full signal stops the data transfer.

Because the RCW circuitry has not signaled an end to the operation, it can be assumed that an undetermined number of words must still be typed out. To accomplish the transfer and typing of these words, the recycle latch in 16.02.01 is used. When a group of 10 words has been typed, the Console Word Ring 10 Pulse combines with a space signal (made up of Console Ring DX, No Alph, Run and Char RO Sel signals) to pick the recycle latch.

The ON output of the recycle latch drops the Op Code Inlk Signal line to the Console Erase Latch, allowing an Op Type Signal at Sector 5, Word 0, Digit 9 time to turn ON the console erase latch in 17.03.02. The erasing of the typewriter buffer and subsequent transfer of data follows the pick of the erase latch.

5.3.00 AUTOMATIC CARRIAGE RETURN AT END OF PLATEN (Figure 5.3-1)

During the escapement portion of a typing cycle, the end of line contact closes. The end of line contact picks, in coincidence with the drop of R36, the end-of-line relay, R20.

The next character of typing takes place. During the typing cycle, the SCC Relay, R32, is energized. An R32 point then combines with an R20 point to pick the carriage-return relay, R43. R43 points energize the CR Magnet, initiatiating a carriage-return operation.

During the CR operation, the CR contact closes and picks the carriage return back signal relay, R47. R47 points (1) pick the BS Relay, R36, and, (2) drop the CR relay, R43. With R43 dropped, the CR magnet also drops out.

The opening of the CR contact signals the end of the CR operation and R47 drops out. When R47 drops out, R36 and the BS Pulse also drop out. With R36 dropped, normal typing is resumed.

5.4.00 CONSOLE ERROR CONDITIONS

Possible console error conditons which are associated with console operation are classified in the following categories:

1. Manual typing errors.

2. Validity error on transfer from an addressable location to the console.

3. Failure to store altered word correctly.

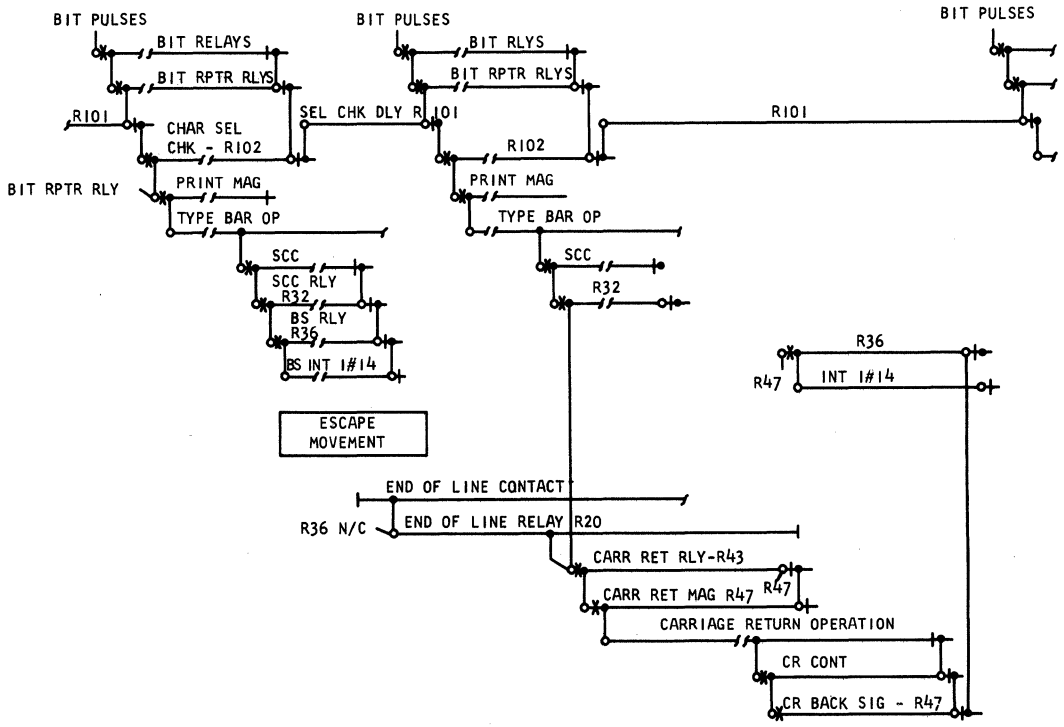

FIGURE 5.3-1 OPERATION CHART - AUTOMATIC CARRIAGE RETURN AT END OF PLATEN

5.4.01 Manual Typing Errors

The depression of any typewriter character key closes the associated typewriter contacts in 17.00.37. With one exception, the depression of an alphabetic or special character key causes a keyboard check error condition, locking up the typewriter and stopping the typing operation.

The exception occurs during an alter operation. At console digit sign time, during an alter operation, any one of the three signs may be typed without causing a keyboard check error condition. The three signs are: plus (+), minus (-), and alphabetic (A).

5.4.02 Validity Error on Transfer From An Addressable Location to the Console

Any validity error or associated circuitry failure which occurs during a word transfer from an addressable location to the console typewriter activates the typewriter bit print feature. The bit-print feature automatically types out every bit present in the invalid character and identifies each bit as a zone or numeric bit, whichever the case may be. Operation of bit print is described in detail in Section 5.5.00 of this Manual.

Depending on the area where the invalid character detection took place, one of the checking lights on the operator's console light and switch panel may be illuminated.

For information on the operation of the A & P area during the above validity error, refer to Section 5.12.05 of the A & P Section of the Manual.

5.4.03 Failure to Store Altered Word Correctly

When a store operation is initiated, the store latch is picked at DS time. By the following D1 time the operation should be completed and a Store OK Signal received to signify correct completion. If an error occurs and the Store OK Signal is not generated, the KB Error Latch in 17.04.02 is picked at D1 time.

5.5.00 BIT PRINT

The bit-print feature of the console typewriter enables the operator or the Customer Engineer to determine which character bit(s) were missing, or what extra character bits were present when the character was transferred from the drum to the typewriter. The bit-print feature words equally well for both alphabetic and numeric characters. In either case, the bits that were present during the transfer are typed. A red asterisk is typed first, designating an error condition. Then the zone bits, are typed, if the character is alphabetic, followed by the automatic typing of a letter Z # to identify the previously typed bits as zone bits. The numeric bits are typed next, followed by the automatic typing of a letter D to identify the previously typed bits as numeric (digit) bits. When all the available bits have been typed, it is then possible to determine the missing or extra bits.

5.5.01 Alphabetic Bit Print (Figure 5.5-1)

Every alphabetic character is made up of two numeric numbers, each of which is represented by two bits of the two-out-of-five bit code. The zone portion of the character sends zone bits to the console where the associated zone-bit relays are located. In the same manner, the numeric portion of the character sends numeric bits to the console where the associated numeric-bit relays are located. Therefore, two zone-bit relays and two numeric-bit relays should be picked for each alphabetic character to be typed.

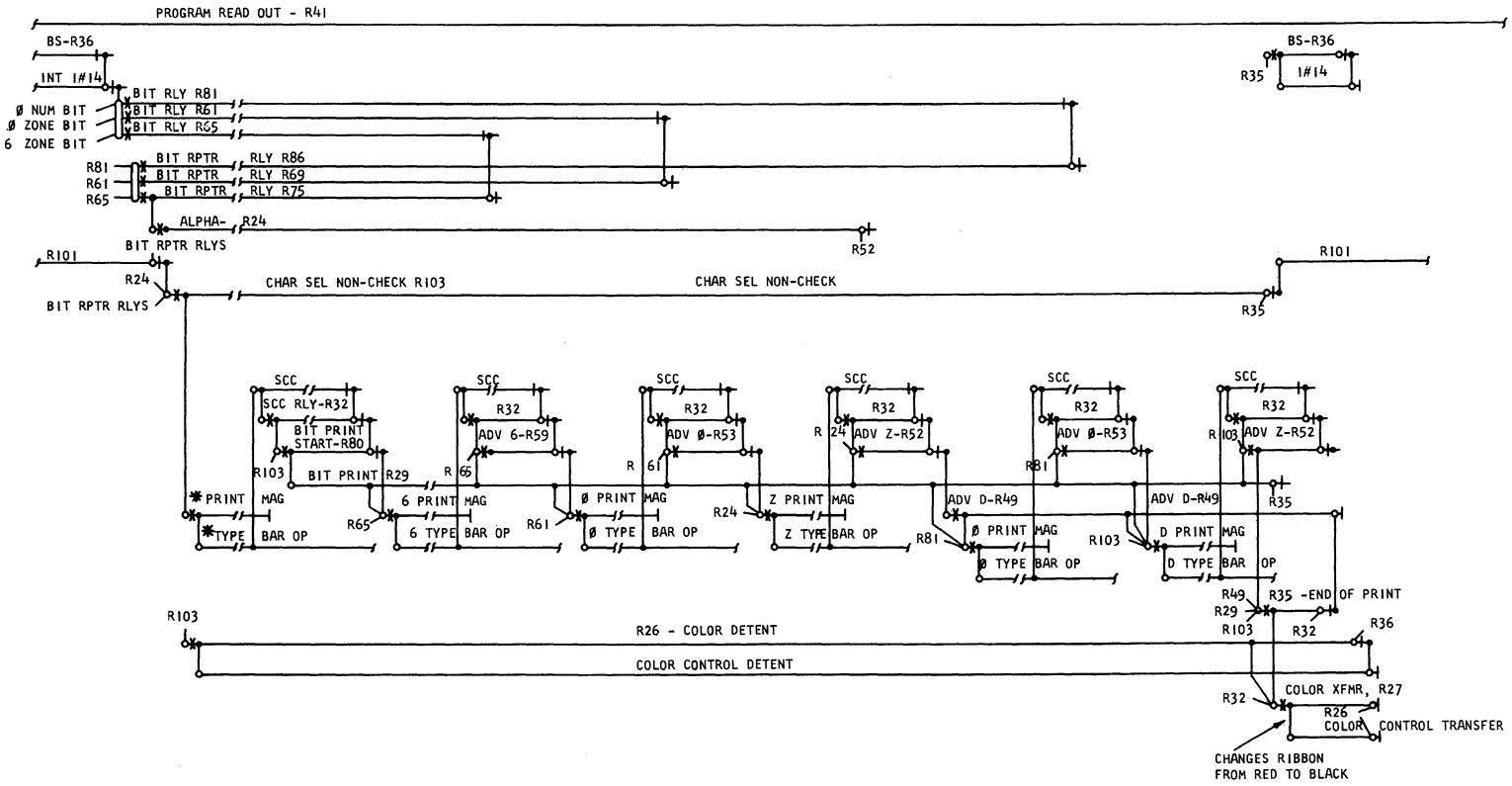

FIGURE 5.5-1 TYPING OF RED ERROR ASTERISK AND TRANSFERRED BITS

The character select non-check relay, R103, is picked whenever there are (1) more or less than two zone-bit repeater relays picked, or, (2) more or less than two numeric-bit repeater relays picked.

One Bit Missing

The transfer of bits from the drum to the associated bit relays in the console is a normal transfer as previously described in other sections of this manual of instruction. In this particular instance, two zone-bit relays and one numeric bit relay are picked, signifying a missing numeric bit The bit relays pick the associated bit-repeater relays. In the case of an alphabetic character, any one zone-bit repeater picks the alpha relay, R24. The bit-repeater relays also drop the character slect delay relay, R101. With R101 down, either R102 or R103 can be picked. The character select check relay, R102, signifies a correct operation. In this case, though, the character select non-check relay, R103, is picked.

Type Red Asterisk R103 points complete circuits to (1) the asterisk print magnet, and, (2) the color detent relay, R26. R26 energizes the color control detent magnet, and the ribbon then shifts from black to red in time for the asterisk to be typed in red.

During the asterisk typing cycle, the Selector Common Contact (SCC) closes and picks its associated relay, R32 R32 opens the circuit to the asterisk print magnet and combines with R103 to pick up the bit-print start relay, R80. R80 then picks the bit-print relay, R29.

Type Zone Bits When the SCC opens during the asterisk typing cycle, R32 drops out, which then causes R80 to drop out. With R80 dropped out, R29 and R65 (6 zone-bit relay) combine to energize the 6 print magnet.

During the "six" typing cycles, the SCC closes and picks its associated relay, R32. R32 combines with R29 and R65 to pick the advance six relay, R59. R59 opens the circuit to the hold of R65, and R65 drops the associated bit-repeater relay, R75.

When the SCC opens during the six typing cycle, R32 drops. With R32 down, the circuit to R59 is broken, and the down condition combines with R29 and R61 (0 zone-bit relay) to energize the zero-print magnet.

During the zero typing cycle, the SCC closes and picks its associated relay, R32. R32 combines with R29 and R61 to pick the advance-zero relay, R53. R53 opens the circuit to the hold of R61, and R61 drops the associated bit-repeater relay, R69.

Type Letter Z When the SCC opens during the zero typing cycle, R32 drops out. With R32 down, the circuit to R53 is broken and the down conditon combines with R29 and the alpha relay, R24, to energize the Z print magnet.

During the Z typing cycle, the SCC closes and picks its associated relay, R32. R32 combines with R24 and R29 to pick the advance Z relay, R52. R52 drops out the alpha relay, R24

Type Numeric Bits When the SCC opens during the Z typing cycle, R32 drops out. With R32 down, the circuit to R52 is broken which, in turn, picks the advance D relay, R49. R49 combines with R29 and R81 (0 numeric-bit relay) to energize the zero-print magnet.

During the zero typing cycle, the SCC closes and picks its associated relay, R32. R32 combines with R29 and R81 to pick the advance-zero relay, R53 R53 opens the circuit to the hold of R81 and R81 drops the associated bit-repeater relay, R86.

Type Letter D When the SCC opens during the zero typing cycle, R32 drops out. With R32 down, the circuit to R53 is broken and the down condition combines with R29, R49 and R103 to pick the D print magnet.

End Operation During the D typing cycle, the SCC closes and picks its associated relay, R32. R32 combines with R29 and R103 to pick the advance Z relay, R52. R52 then combines with R49, R29 and R103 to pick the end of print relay, R35. R35 (1) drops the bit print relay, R29, and the character select non-check relay, R103, (2) picks the back signal relay, R36, and, (3) combines with R26 and R32 to pick the color transfer relay, R27. R27 then energizes the color control transfer detent magnet, and the ribbon shifts from red to black.

When the SCC opens during the D typing cycle, R32 drops out. With R32 down, the circuits to R52, R35 and R36 are broken. With R35 down, R49 also drops out. The dropping of R36 causes the drop out of R26, which drops out the color control detent magnet, R27, and the color control transfer detent magnet The next character can now be typed.

All Bits Missing

If all the bits are missing, the asterisk is still typed, followed by the typing of the characters Z and D.

Extra Bits

The presence of extra zone or numeric bits still causes the pick up of the character select non-check relay, R103. All the bits, including the extra bits, are typed. The transferred zone bits type first in the following order: 6, 3, 2, 1, 0. Any of the bits not transferred cause the circuitry to bypass that area and act on the next bit that was transferred. Typing of the asterisk, the letters Z and D, and ending the operation occur exactly as previously described.

5.5.02 Numeric Bit Print (Figure 5.5-1)

During the typing of any numeric character there should be two bit relays and two bit-repeater relays picked. The character select non-check relay, R103, picks whenever there are more or less than two numeric-bit repeater relays picked.

With R103 picked, the red asterisk is typed exactly as described in alphabetic bit print (Section 5.5.01). During the asterisk typing cycle, the bit print start relay, R80, and the bit-print relay, R29, are picked. As soon as R29 picks up, the advance D relay, R49, also picks. R49 then combines with R29 and a bit relay to energize the print magnet for the following typing cycle.

The typing of the D and the end of operation occur exactly as described in alphabetic bit print (Section 5.5.01).

Extra Bits

Extra bits are typed as described in extra bits of Section 5.5.01. The typing of the extra bits is preceded by an asterisk and followed by character D.

All Bits Missing

If all the bits are missing, the asterisk is still typed, followed by the typing of the character D.

6.0.00 OPERATOR'S CONSOLE SWITCH AND LIGHT PANEL CIRCUITS (Figure 2.3-1)

The operator's console panel contains the various controls and associated signalling devices used by the operator to control the 7070 System. The surface of the console panel is black with the various indicating light titles etched in the panel. When the indicating light behind the panel is illuminated, the indicating light title stands out clearly against the black background. All of the indicating lights are located in the upper center section of the console panel. The switches for address stop and unit-record priority control are located below the indicating lights. The main power keys and lights are located on the right edge of the console panel. On the left edge of the panel are the illuminated keys for the alteration switches, accumulator and exponent overflow.

6.1.00 ALTERATION SWITCHES (Figure 2.3-2)

The top four illuminated switches on the left side of the operator's console panel are the alteration switches. Depression of any one switch illuminates the switch (Section 17.00.22) and latches it in its depressed position. With an alteration switch latched in its depressed position, an interrogation of the switch (+51 BAS) causes the program to branch. Another depression of the switch unlatches it and the light is turned Off.

When the switch is latched in its depressed position, an intergrated signal called Alt 1 (could be 2, 3 or 4) Sense originates in 17.00.22 and goes to 45.70.02 in the A & P section where the interrogation actually takes place. Refer to section 5.8.10 of the A & P Manual for a more detailed description of the operation.

6.2.00 OVERFLOW SWITCHES (Figure 2.3-2)

The remaining four illuminated switches located on the left side of the operator's console panel are overflow switches. The bottom switch is the exponent overflow switch, while the other three are associated with the three accumulators.

The overflow switches operate in the same manner as the alteration switches. Depression of the switch illuminates it and latches it in its depressed position. When the switch is latched in its depressed position, another depression unlatches it and the switch light is turned off.

6.2.01 Accumulator Overflow Switches (1, 2, 3)

The accumulator overflow switches are used to:

1. Stop the machine when an accumulator overflow occurs.

2. Set an internal overflow indicator for later interrogation by the program. The internal accumulator overflow indicator can be set when an accumulator overflows.

Stop Machine

If an accumulator overflow switch is not latched in its depressed position (switch light is Off), an overflow in the associated accumulator stops the machine. An integrated signal line called A1 (could also be A2 or A3) OFL STOP originates in 17.00.22 and com-

bines with other conditions in 44.42.05 to stop the machine. The associated accumulator overflow indicating light is also turned On.

Set Internal Overflow Indicator

A depression of an accumulator overflow switch latches it in its depressed position (switch light is turned On) and causes the drop of the associated OFL STOP Signal to the A & P unit. The absence of the associated OFL STOP signal (from the 7150 Console) causes the internal accumulator overflow indicator to be turned On when the accumulator overflows. The programmed operations continue, however, and the later interrogation of the internal accumulator overflow indicator is described in section 5.8.07 of the A & P Manual. The associated accumulator overflow indicating light is also illuminated, indicating the On condition of the internal accumulator overflow indicator.

6.2.02 Exponent Overflow Switch (Figure 2.3-2)

The exponent overflow switch has the same function for an exponent overflow during a floating point arithmetic operation as the accumulator overflow switches have for an accumulator overflow.

If the exponent overflow switch is not latched in its depressed position (switch light is turned Off), an exponent overflow condition causes the machine to stop. An integrated signal line called EXP STOP originates in 17.00.22 and combines with other conditions in 44.92.01 to stop the machine. The exponent overflow indicating light is also turned On.

With the exponent overflow switch latched in its depressed position (switch light is turned On), the EXP STOP signal line is dropped. The absence of the EXP STOP signal line (from the 7150 Console) causes an internal exponent overflow indicator to be turned on when an exponent overflow condition occurs. The programmed operations continue, however, but the exponent overflow indicating light is illuminated, indicating the On condition of the internal exponent overflow indicator.

6.3.00 STATUS LIGHTS (Figure 2.3-5)

The illumination of any one of the following status lights indicates the status the system is presently operating in.

6.3.01 Priority Status

The priority (interrupt) status light is illuminated whenever an interrupt routine is performed. By the time the light is illuminated, the instruction counter contents and the condition latch settings have been stored in their respective storage locations.

6.3.02 Normal Status

The normal status light is illuminated whenever the program is running and is not in priority (interrupt) status. A NO INTR MODE Signal is used to activate the line which illuminates the light.

6.3.03 Inquiry Status

The inquiry status light is illuminated whenever the inquiry only switch on the typewriter keyboard control panel is depressed. Depressing the inquiry only switch closes

a switch contact which activates the INQ ONLY Signal Line and illuminates the inquiry status light.

6.4.00 OPERATING LIGHTS (Figure 2.3-5)

The operating lights, when illuminated, indicate which units are being used by the system. The input/output, disc storage, tape and inquiry operating lights flash briefly when the unit is being used and the program is running. When the operation can not be completed for some reason, the light, which is On, alerts the operator to the unit which was in use when the failure occurred.

6.4.01 I/O Operating

The input/output operating light is illuminated whenever a unit-record machine is operational. Any of the read, write, punch, or type codes will illuminate the light.

6.4.02 Disk Storage Operating

The disk storage operating light is illuminated whenever a disk seek, read, or write operation is initiated. The disk arm release code (-95, DAR) has no effect.

6.4.03 Tape Operating

The tape operating light is illuminated whenever any operation involving the tape unit is initiated. Tape end of file off, tape select, and tape skip op codes have no effect.

6.4.04 Inquiry Operating

The inquiry operating light is illuminated whenever an inquiry read or an inquiry write operation is initiated.

6.4.05 Program Advance

The program advance light is illuminated whenever stored program instructions are being executed. If there is no program advance after a two second interval, the light starts flashing On and Off.

The flashing can be ended by a program advance or a depression of the stop key on the typewriter keyboard control panel.

The light is also illuminated when the program goes into an instruction cycle. The pulse used is called PROG ADV. The circuitry is designed to accept the PROG ADV Signals (when the program is running) and provide a steady pulse to the light for illumination. When the program stops, however, the steady PROG ADV Signal is altered so that there is an alternating pulse to the light for illumination.

6.4.06 Instruction Counter

The instruction counter light is illuminated whenever the program is stopped during a data cycle, and no branching operations are specified. The light remains On until the start key on the typewriter keyboard control panel is depressed.

6.4.07 Address

The address light is illuminated whenever the program is stopped during a data cycle and a branching operation is specified (branch conditions are also indicated). The light remains On until the start key on the typewriter keyboard control panel is depressed.

6.5.00 CHECKING LIGHTS (Figure 2.3-5)

The checking lights are used to indicate which unit has discovered an error. The processing of the program is stopped, and the program advance operating light starts flashing as previously described in Section 6.4.04 of this manual.

6.5.01 Input/Output (I/O) Check

The I/O checking light is illuminated whenever an error is detected in the operation of any of the machines which transmit data to and from the drum buffer area. Improper control panel wiring, as well as internal machine checks, cause the light to turn On.

6.5.02 Program Check

The program check light is illuminated whenever a programming error (invalid address, invalid op code, etc.) or a program processing error (failure to process correct op code) occurs.

6.5.03 Validity Check

The validity check light is illuminated whenever a system data transfer error occurs. This includes flow of data to and from core storage, to and from registers and accumulators, and between the 7070 System and the drum buffer area.

6.5.04 Clocking Check

The illumination of the clocking check light indicates an internal timing circuit failure in the 7070. Clocking errors can easily affect any totals being developed; therefore, the program should be restarted at some point prior to the beginning of the affected total developement.

6 5.05 Arithmetic Check

The arithmetic check light is illuminated whenever a machine error or a programming error occurs in the arithmetic circuits. Like the clocking error, an arithmetic error can affect any totals being developed. Restart of the operation, therefore, should be at a point prior to the start of the affected total development.

6.5.06 Keyboard Check

The illumination of the keyboard check light indicates an error in operation of the console typewriter keyboard. When the console is in manual status (manual typing into system), the depression of any alphabetic typewriter key (except +, - or A at console ring digit sign time) picks the KB Error Relay, R123, and illuminates the keyboard check light. The keyboard check light is also illuminated when (1) the depression of too many or too few keys occur during an alter operation, or (2) the store key is depressed, and no store cycle takes place.

6.5.07 Sign Change

The illumination of the sign change light indicates the On condition of the internal sign - change indicator. The sign - change indicator is turned On when operating under field control, and a change in sign of the memory location is sensed due to the operation being performed. A Branch If Sign Change instruction (-03, BSC) turns Off the indicator and the sign change light.

6.6.00 OVERFLOW LIGHTS (Figure 2.3-5)

The illumination of any of the following overflow lights indicate that the associated internal overflow indicator has been turned On.

6.6.01 Accumulator Overflow 1, 2 and 3

An accumulator overflow light is illuminated whenever its associated accumulator has a carry available at C11 time during an accumulator operation. A carry at C11 time indicates an attempt to carry from the tenth position of the accumulator to the eleventh position.

6.6.02 Field Overflow

The field overflow light is illuminated whenever the data entering a core storage location is greater than field control specifies. A Branch If Field Overflow (+41, BFV) turns OFF (1) the internal field overflow indicator, if it is ON, and, (2) the field overflow light.

6.6.03 Exponent Overflow

The exponent overflow light is illuminated whenever the internal exponent overflow indicator is turned On during a floating-decimal operation.

6.7.00 POWER KEYS AND LIGHTS (Figure 2.3-5)

The power keys and lights are located along the right hand edge of the operator's console panel. They are the main power On and Off controls for the IBM 7070 System.

6.7.01 Emergency Power Off

When the emergency power off switch is pulled, all power is immediately shut off. The switch is to be used ONLY in case of emergency.

6.7.02 Power On Illuminated Key

Be depressing the power on key, full machine power is furnished to the 7070 System. When the key is depressed, its illuminated portion is lit, indicating that power has been supplied to the system. Power can be turned Off only be depressing the power off key.

6.7.03 Ready Light

The ready light is illuminated whenever the 7070 is ready for operation. After the power on key is depressed, there is a slight delay before the ready light is illuminated, because the various components are supplied power in a specific sequence. The ready

light is illuminated immediately if the power on key is depressed while the system is in a DC Off status.

6.7.04 DC Off Key

Depressing the DC off key turns off the DC power only and is used when the machine is to be idle for a short time. Depression of the key causes the ready light to turn Off, but the illuminated portion of the power on key remains on.

6.7.05 Power Off Key

By depressing the power off key, the ready and power on key lights are turned Off, and all power is removed from the system.

6.8.00 ADDRESS STOP SWITCHES (Figure 2.3-4)

There are four address stop switches located in the lower center portion of the console control panel. If the contents of a particular address are to be examined, the program is stopped when that address is specified by the address stop switches. Automatic typing of the specific word contents is then accomplished. (print-out display on stop, section 5.1.00) Each dial may be set to any digit (0-9), and the setting is shown in a small window above the switch. The switch points originate the two-out-of-five bit coding for the digit being indicated (section 17.00.24).

6.9.00 PRIORITY CHANNEL SWITCHES

The priority channel switches are located immediately below the address stop switches on the typewriter console control panel. There are four switches. The two switches on the left are associated with Priority Channel A, and the other two switches on the right are associated with Priority Channel B. The left-hand switch in each priority channel grouping is the tape synchronizer selection switch. The right switch in each priority channel grouping is the card buffer selection switch.

6.9.01 Synchronizer Selection Switch

When an operation between a tape unit and a unit-record machine is to be performed, the tape synchronizer selection switch specifies which tape synchronizer channel will be used for the data transfer. The switch may be set in any one of three positions.

N (Normal) Setting the switch at N (Normal) allows the system to enter into a priority routine upon the sensing of a "set" unit-record machine stacking latch.

T1 (Tape Synchronizer Channel 1) With Tape Synchronizer Channel 1 specified, the priority routine can start only after the unit-record machine stacking latch is "set", and Tape Synchronizer Channel 1 is available for use.

T2 (Tape Synchronizer Channel 2) Same as T1 setting except that Tape Synchronizer Channel 2 is specified.

6.9.02 Card Buffer Selection Switches

The card buffer selection switches are used to assign the priority channel controls (A and B) to the desired card readers, punches, or printers. The switch may be set to any one of seven positions.

Off With the switch set to this position, no unit-record machine is being used to transmit or receive data.

RI (Read In) 1, 2, 3 The setting of the switch to one of these positions indicates which unit-record machine is transmitting input data.

RO (Read Out) 1, 2, 3 The setting of the switch to one of these positions indicates which unit-record machine is receiving output data.