PART VI

FLEXOWRITER MODEL FPC

Figure 1-1 FPC-5, Non Programatic, 3 Bank, D.C.

Figure 1-2 FPC-8, Non Programatic, 4 Bank, S.C.

PURPOSE

The Flexowriter Model FPC was designed to prepare tape to punch tabulating cards automatically as a by-product of document writing.

There are two Model FPC Flexowriters, namely: Model FPC5 and Model FPC8.
(Figures 1-1 & 1-2.)

The Model FPC5 was designed to punch a five unit binary code in a tape eleven-sixteenths of an inch in width. This tape is used to actuate a card punch machine for automatically punching tabulating cards. This tape may also be used for wire transmission purposes, because the codes are assigned to the same manner to all letters, figures and typing functions as they are in the Flexowriter Model FC (see Part III).

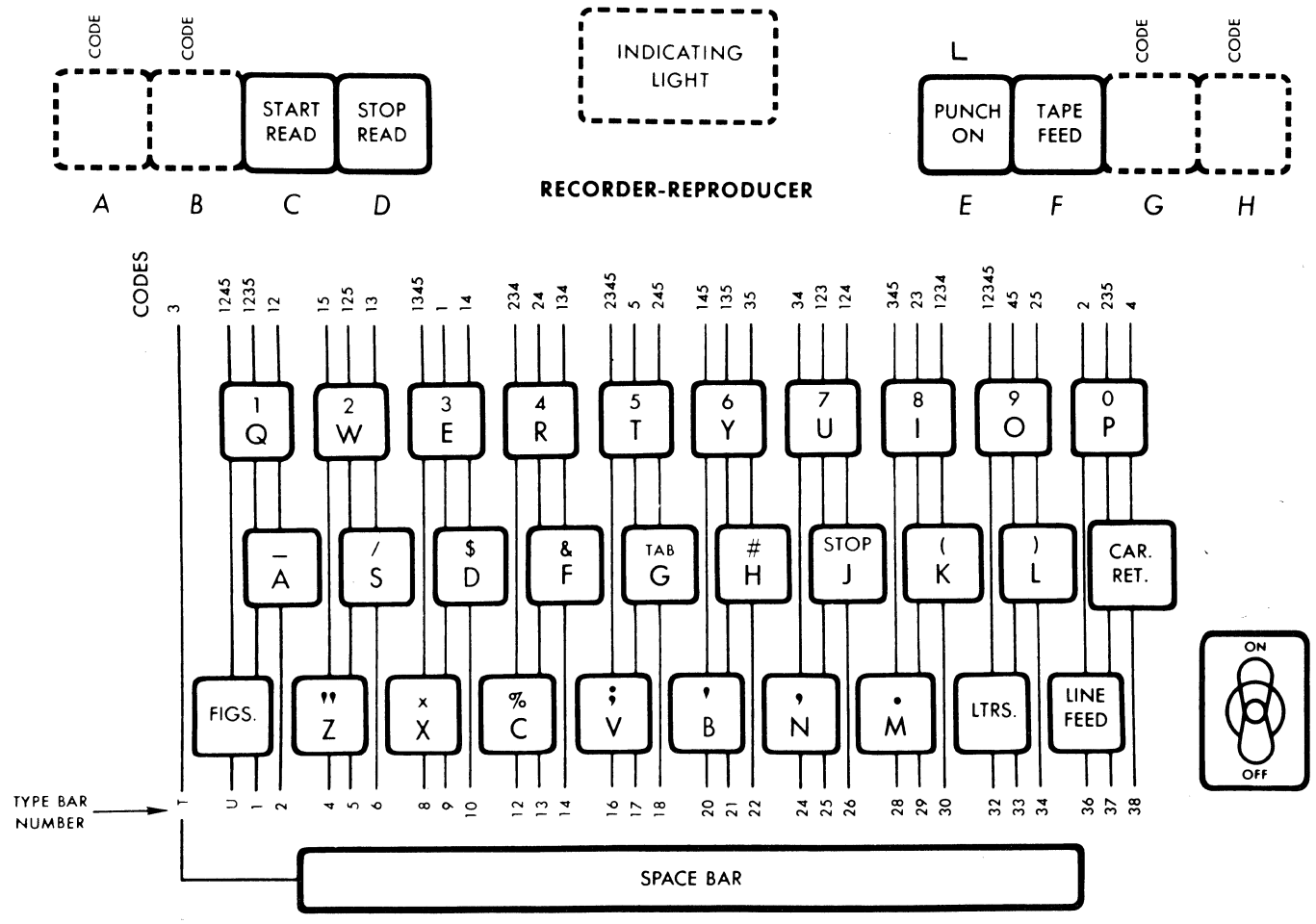


Figure 1-3 Keyboard Chart - Model FPC5

The Model FPC8 was designed to punch an eight unit binary code in a tape one inch in width. This tape is used to actuate a tape controlled card punch for automatically punching tabulating cards.

The above machines are available in three combinations, namely: Recorder, Reproducer or Recorder-Reproducer. (See Part I, Section 2, Flexowriter Combinations.)

BASIC FUNCTIONAL PRINCIPLES

The operation of a keylever in the Model FPC has the same operational results as described in Part II, Section 1. The major differences between the two Model FPC machines are as follows:

MODEL FPC5

This model is the same as the Model FC described in Part III except for the following: The number fourteen keylever position (Figures) is used for a card eject code on the older Model FPC5's. (The new style keyboard for the Model FPC5 is shown in Figure 1-3.) Thus, the F key in figures position will punch a code in the tape which will cause the card ejection in the card punch machine, but will not return the carriage on the Flexowriter. This arrangement is necessary because it may require two or more lines of typing on the Flexowriter to complete one tabulating card, therefore, it is not always desired to eject a card at each carriage return.

The "letters" shift key, besides its normal function of shifting the type basket to the letters position, is used also as a code delete key on the Model FPC5. As on nearly all Flexowriters, the delete code consists of a hole punched in every code position, therefore, because of the limited number of code combinations (five unit code-32 combinations), the letters shift code is the code having all five code positions punched.

When using the letters shift key for deleting an error, it is important to remember that the LTRS key always returns the type basket to LTRS position. Therefore, when deleting figures or special characters, the basket should be shifted back to Figs position to continue typing.

The number eighteen keylever position (Figures) is normally used for tab operation on the Model FPC-5. (See Part I, Section 5, Special Features, pp. 5 - 19.) Therefore, if numerical information is being typed, it is necessary after deleting a code to depress the figures key.

MODEL FPC8

There are two keyboard arrangements available in this model, single and double case. Both are used to produce a paper tape as a by-product of typing and this tape is used to automatically operate a card punch machine.

SINGLE CASE MACHINE

The keyboard chart for the single case machine is shown in Figure 1 - 4. The A - Z characters and 0 - 9 numerals

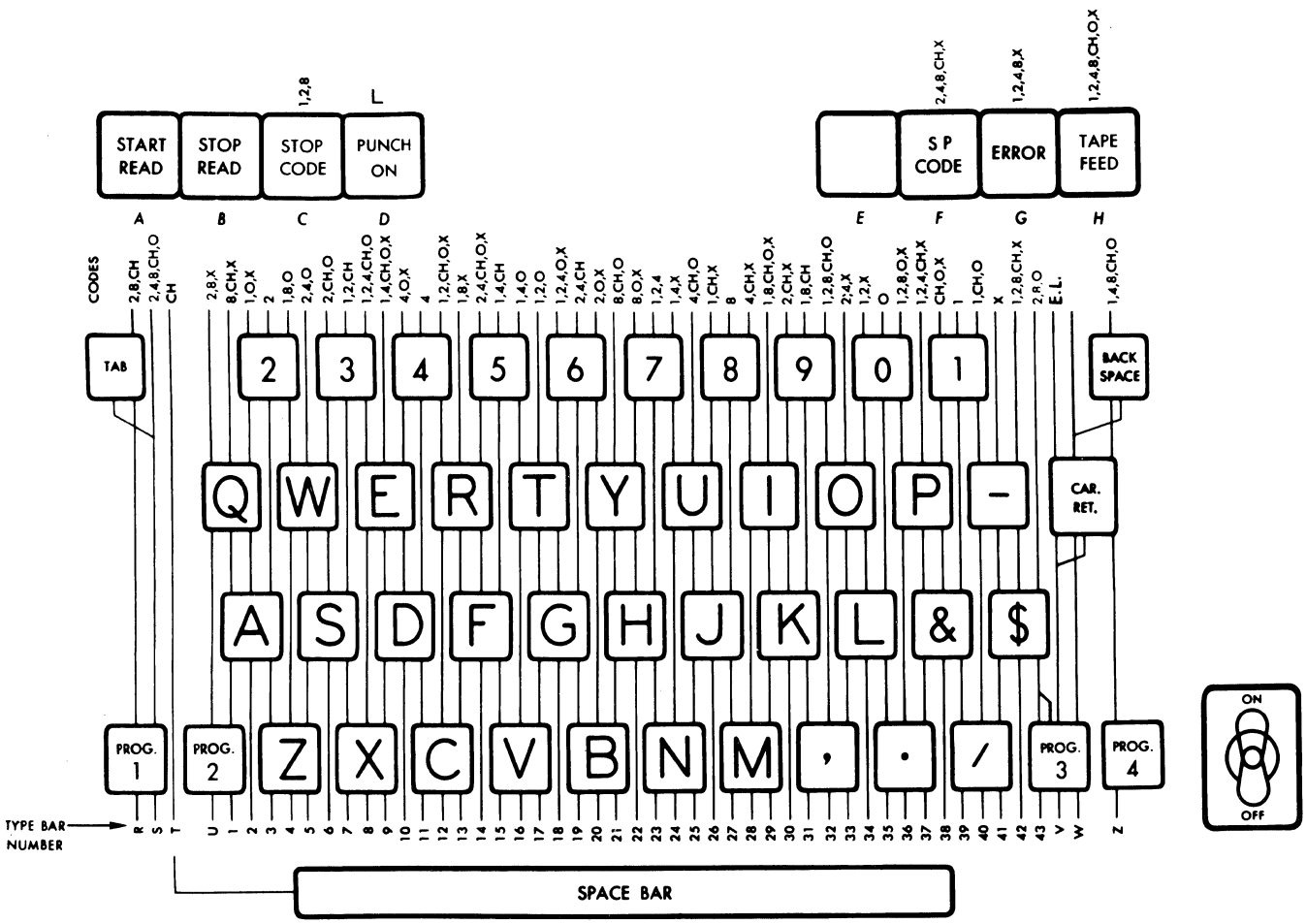


Figure 1-4 Keyboard Chart - Model FPC8 - S.C.

are arranged as on any standard keyboard. Depression of a keylever prints a character on a document and simultaneously punches a corresponding code into the tape. On this particular keyboard, characters are capital letters only.

Six key positions (Positions 32, 36, 38, 40, 41, and 42) are used for printing, punctuation and special characters. The period, comma, diagonal, ampersand, dollar, and dash are standard; however, these characters may be substituted with others depending upon application requirement.

The carriage return, tab and space key positions all perform their respective functional operations of the writing machine, plus punching a corresponding code in the tape. Backspace is an uncoded function.

PROGRAM CODES

Four key positions (R, U, 43 and Z) are primarily to punch a code in the tape for the purpose of automatically controlling the card punch machine. These keylever operations do not cause any functional or

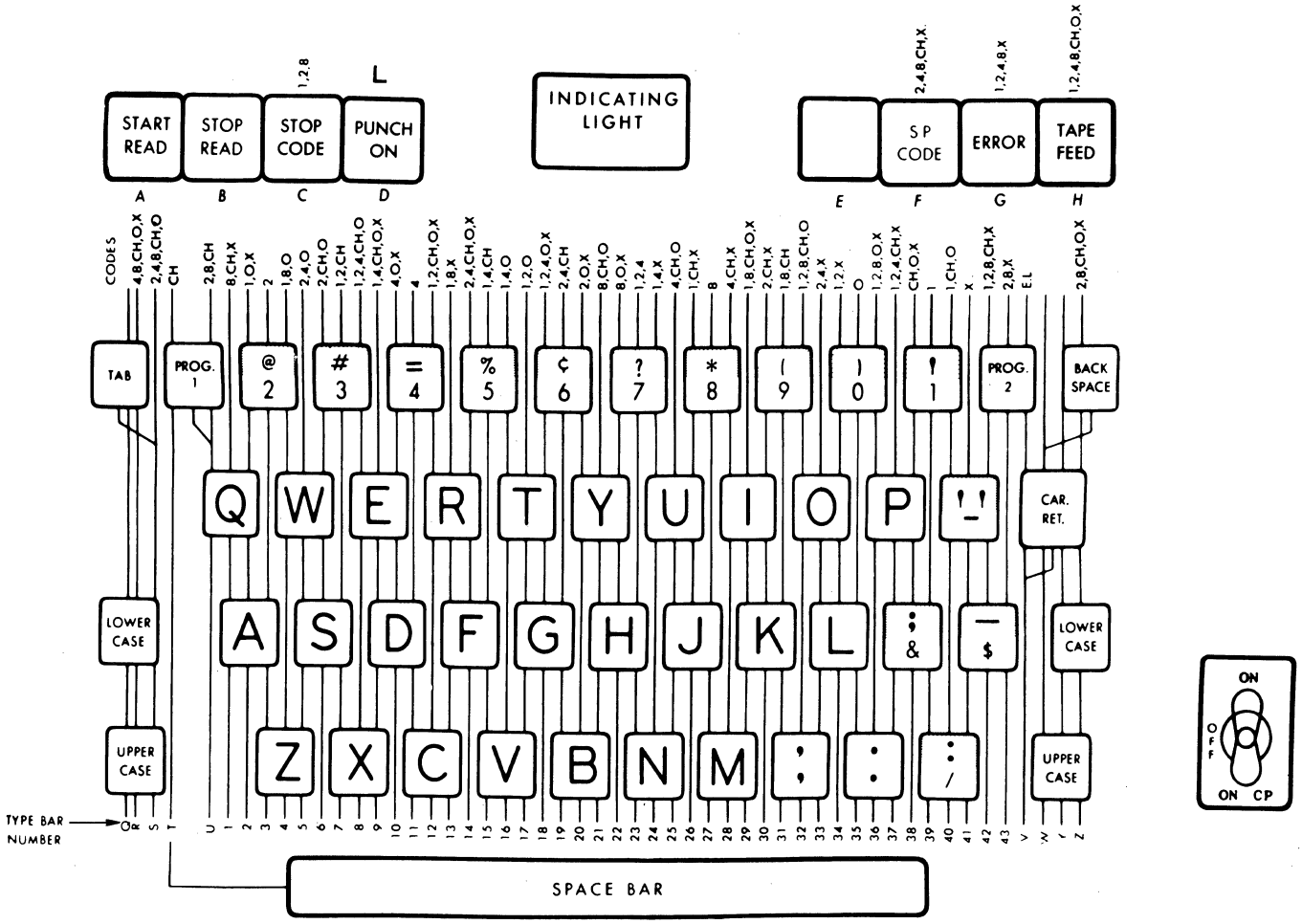


Figure 1-5 Keyboard Chart - Model FPC8 - D.C.

character operation of the writing machine.

There are seven switches located on the control panel, one of which (S P code) is used for card punch control codes.

Error Code - This switch, when depressed, will punch a code in the tape for the purpose of conditioning the card punch machine to ignore the card codes.

Start and Stop Read - The start and stop read switches on the control panel are used to control the tape reader operation.

The Punch On, Tape Feed and Stop Code switches are used for controlling punch operation.

DOUBLE CASE MACHINE

The keyboard chart for the Model FPC8 double case machine is shown in Figure 1-5. The A-Z characters and 0-9 numerals are arranged as on any standard keyboard.

Various signs and symbols may be used in the upper case position on keys

in positions 3, 7, 11, 15, 19, 23, 27, 31, 35, 38, 40, 41 and 42. The characters in these upper case positions on the key buttons are filled in with red (the codes for the characters in red will not be punched in the tape when the C.P. light is on).

Position U is used as a functional key only and cannot be used for a character position.

The double case machine is the same as the single code machine with the exception of the following:

The double case machine uses a type basket shift mechanism.

A.C.P. (card punch) tape switch is provided as part of the power switch. When this switch is in "On" Position and the "Punch On" switch is on, any character operation on the keyboard will be recorded in the tape. When the power switch is in the "On C.P." position and Punch On switch is operated, the C.P. light will be on. Under these conditions all characters with red key buttons will not have their respective codes recorded in the tape.

CODE SYSTEM

Model FPC5 - The code system used in this model is the same as used for the Model FC explained in Part III. The only exception is the key position 14.

When the type basket is in figures position, key position 14 will punch a code in the tape only. It will not print a character.

Model FPC8 - Six of the eight channels used in the Model FPC8 tape are used for Flexowriter controls for automatic typing, functional codes to control the card punch, and to code letters, figures and punctuation. The two remaining channels are used, one for a check channel, the other for an end line channel (see Figure 1-6).

Figures 1-7, 1-8, 1-9, and 1-10 show the various code patterns in the tape. Figure 1-7 shows the standard character codes, while Figure 1-8 shows the punctuation and special character codes. Figure 1-9 shows the control codes for automatic Flexowriter operation, and Figure 1-10 shows the funtional codes which control the

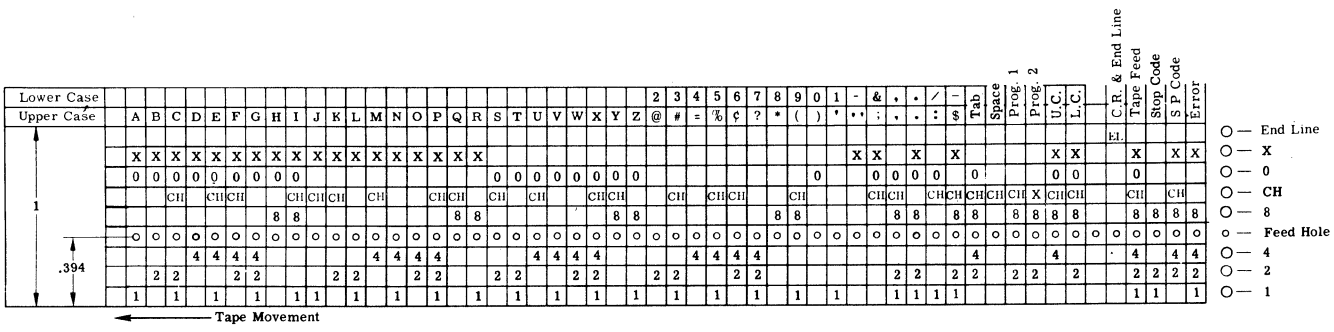


Figure 1-6 Coded Tape - Model FPC8

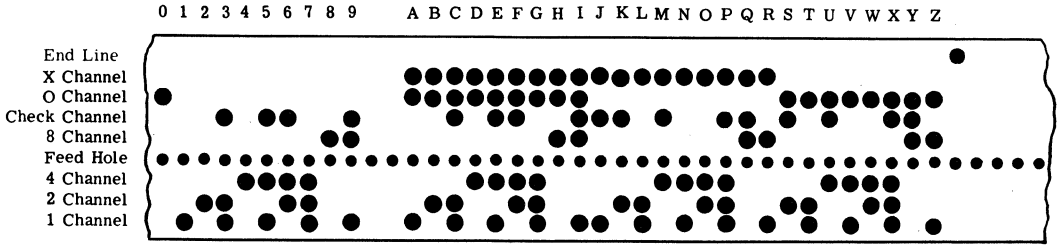


Figure 1-7 Standard Character Codes

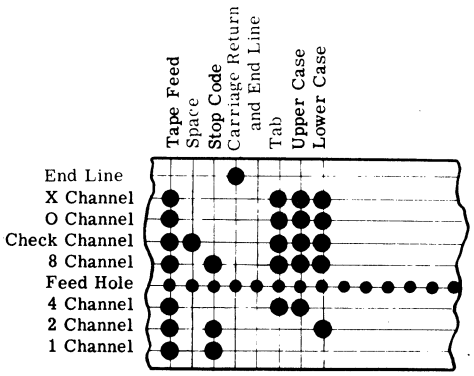


Figure 1-8 Punctuation and Special Character Codes

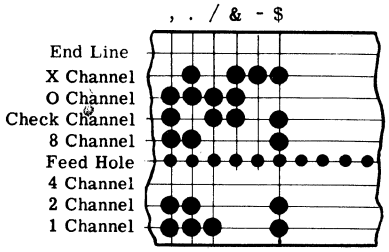


Figure 1-9 Control Codes - Flexowriter Operation

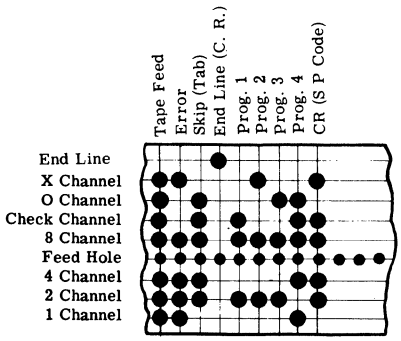


Figure 1-10 Control Codes - Card Punch

card punch. Note the coding arrangement used for the standard character codes as shown in Figures 1-4, 1-5, & 1-7. This is a simplified arrangement designed for ease of reading codes in tape or cards. The numerals, for example, use those particular channels whose sum equal the numeral value, i.e., the code for numeral 7 is 1, 2, 4.

The check channel is automatically punched in the tape with an even number of code bits, i.e., the code for numeral 9 is 1, 8, therefore, the check channel is added to make this an odd code (it is necessary to have odd codes for proper operation of the card punch machine). The alphabet codes are arranged in the same manner as the numerals, except the O, X channels are used to distinguish between the first 9 letters and the next 9, etc. For example, the first letter of the alphabet is A, which has a code of 1, O, X. The second letter of the alphabet is B, which has a code of 2, O, X. The tenth letter is J and in this case the code is 1, Ch, (the 1, X code would be an even number, therefore, the check channel is used).

MAINTENANCE OF UNITS

The Model FPC machines (Recorder-Reproducers) consist of five major units, namely: writing machine, code selector, tape punch, tape reader and code translator. These units are all basically the same as the units described in Part II, Sections 2 through 7 with addendums. Therefore, the maintenance procedures and adjustments will be the same for each, with the exception of the following:

WRITING MACHINE

Model FPC5 - This Model is the same as the Model FC (Part III) except for key-lever position 14. This key position, when the basket is in figures position, is designated as the card eject key.

Model FPC8 - The single case machine does not use a shift mechanism. Key positions R and Z are used for code punching operation only (Program 1 code and Program 4 code). The Program 4 code punching mechanism is shown in Figure 2 - 1.

The Program 3 keylever (Program 2 - Double Case) is shown in Figure 2 - 2. The

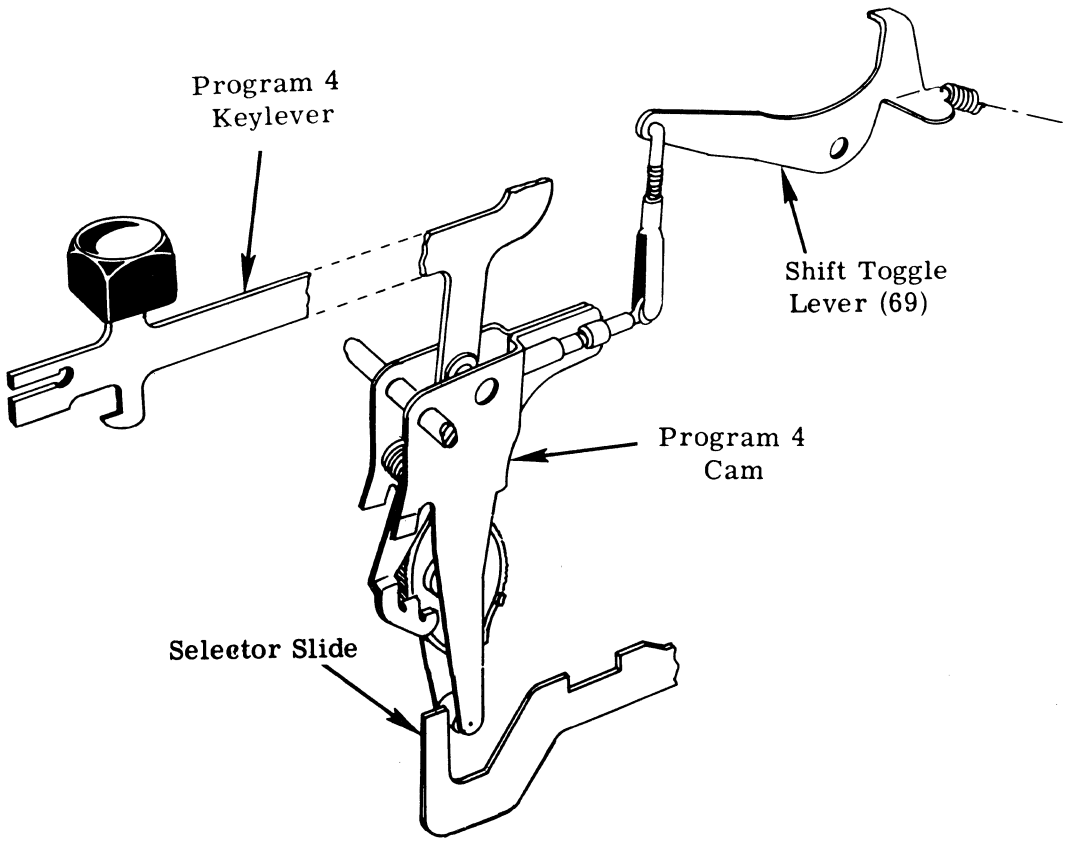


Figure 2-1 Program 4 Code Punching Mechanism

keylever, cam and bellcrank function in the same manner as in standard operation. Notice, however, the type bar and toggle assembly is not used. Also, a spring is attached to the upper leg of the bell-crank for the purpose of loading the cam for good positive operation.

The Program 2 keylever (Program 1 - Double Case) mechanism is shown in Figure 2 - 3. Note that the bellcrank for the "U" position has two pivot holes for the cam to bellcrank connecting link. Note also, this link being in this position will not allow enough movement of the typebar to release the escapement mechanism.

All of the Model FPC writing machine component adjustments and maintenance procedures may be found in Part II, Section 2.

CODE SELECTOR

The code selectors for the Model FPC machines are basically the same as the

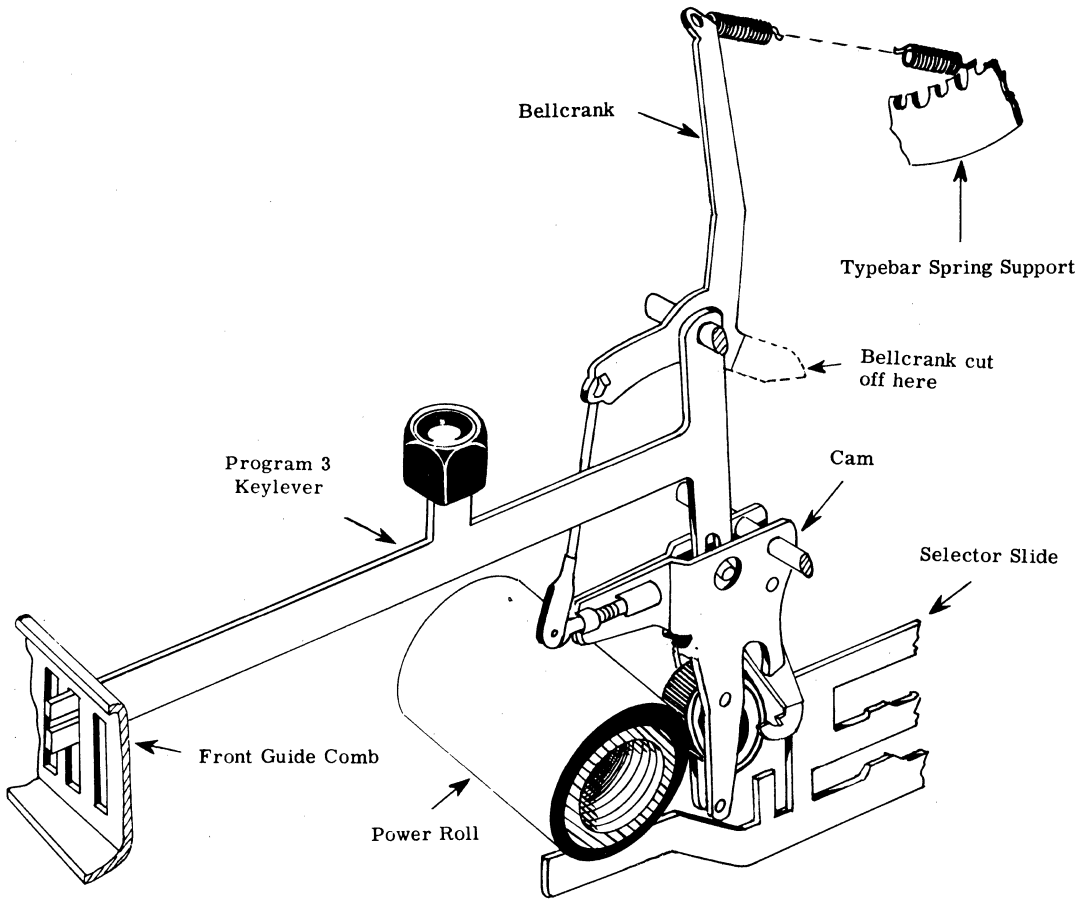


Figure 2-2 Program 3 Code Punching Mechanism

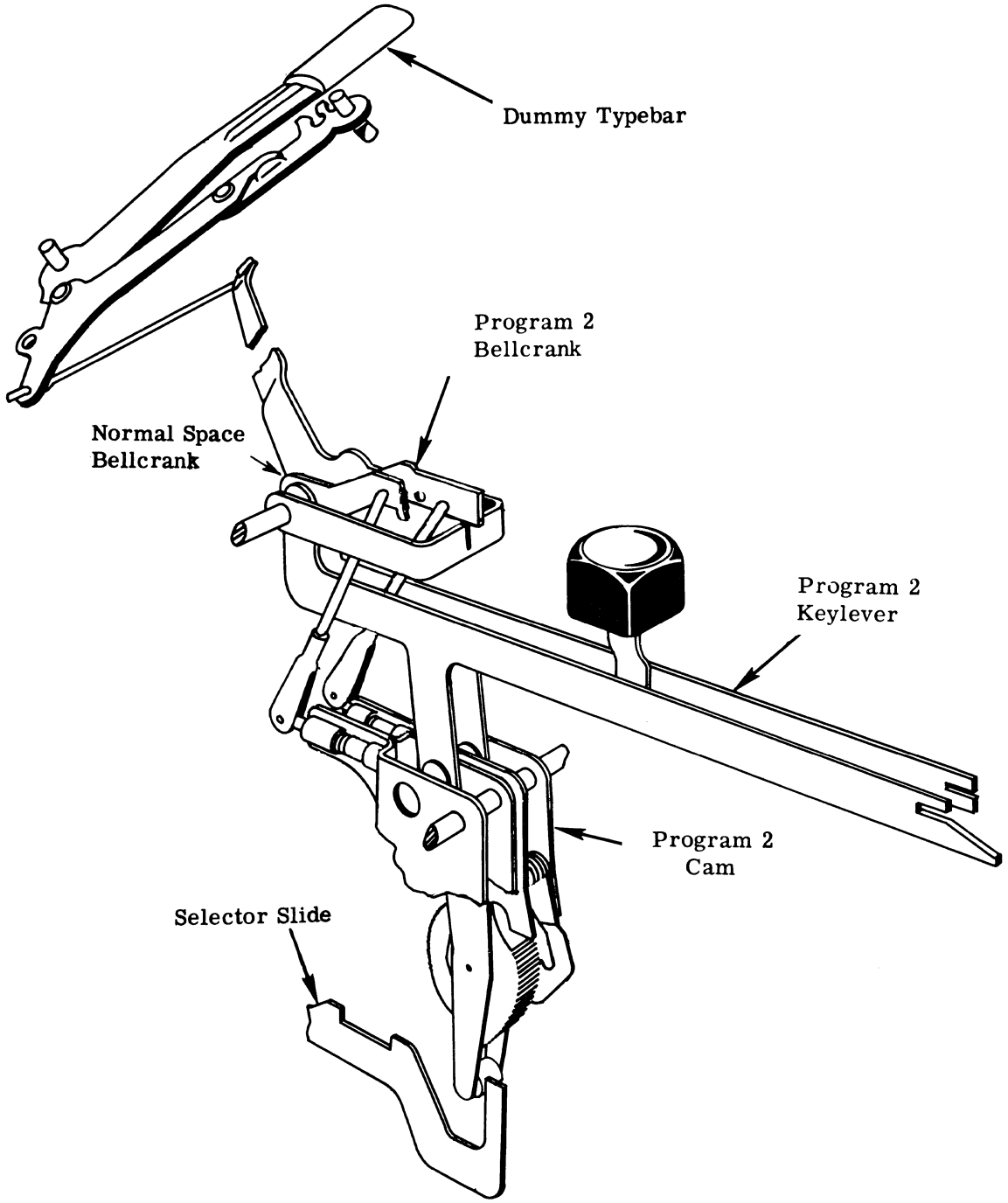


Figure 2-3 Program 2 Code Punching Mechanism

FRONT SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
1	1G	8-9 C-3-4-5	4-8-CH-0-X
3	3C	 C-5	CH
5	25C	 C-2-4-5	2-8-CH
7	31D	8-9 C-1	1-0-X
9	17G	8- C-1-4	1-8-0
11	33G	8 C-2-5	2-CH-0
13	37D	8 C-1-2-3-5	1-2-4-CH-0
15	33C	8-9 C-3	4-0-X
17	17H	8-9 C-1-2-5	1-2-CH-0-X
19	19G	8-9 C-2-3-5	2-4-CH-0-X
21	21E	8 C-1-3	1-4-0
23	23E	8-9 C-1-2-3	1-2-4-0-X
25	35C	8-9 C-2	2-0-X
27	27G	8-9 C-4	8-0-X
29	23C	9 C-1-3	1-4-X
31	15D	9 C-1-5	1-CH-X
33	33H	9 C-3-5	4-CH-X
35	19D	9 C-2-5	2-CH-X
37	37K	8 C-1-2-4-5	1-2-8-CH-0
39	39G	9 C-1-2	1-2-X
41	51C	8-9 C-1-2-4	1-2-8-0-X
43	35G	7-8-9 5	CH-0-X
45	45L	7-8 1-5	1-CH-0
47	47D	7-9 1-2-4-5	1-2-8-CH-X
49	21C	10 C	E.L.
51	13E	8-9 C-2-4-5	2-8-CH-0-X

REAR SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
2	10F	8 C-2-3-4-5	2-4-8-CH-0
4		 Dummy	
6	8B	9 C-4-5	8-CH-X
8	8G	7 2	2
10	10E	8 C-2-3	2-4-0
12	44D	7 1-2-5	1-2-CH
14	14H	8-9 C-1-3-5	1-4-CH-0-X
16	16F	7 3	4
18	18G	9 C-1-4	1-8-X
20	28D	7 1-3-5	1-4-CH
22	34C	8 C-1-2	1-2-0
24	26E	7 2-3-5	2-4-CH
26	46D	8 C-4-5	8-CH-0
28	40F	7 1-2-3	1-2-4
30	30D	8 C-3-5	4-CH-0
32	32J	7 4	8
34	34G	8-9 C-1-4-5	1-8-CH-0-X
36	36H	7 1-4-5	1-8-CH
38	24J	9 C-2-3	2-4-X
40	40H	7-8 	0
42	42H	9 C-1-2-3-5	1-2-4-CH-X
44	14E	7 1	1
46	34E	7-9 C-2-3-4	X
48	34K	9 C-2-4	2-8-X
50		DUMMY	

Figure 2-4 Selector Coding Model FPC8 - D.C.

selector explained in Part II, Section 3 with the exception of the selector slide coding and contact adjustment. The selector slide coding for the two FPC8 machines are shown in Figure 2 - 4 and 2 - 5.

Selector Slide and SCC Contact Adjustment. The selector slides and selector contacts are adjusted to give a satisfactory pulse to the code and clutch magnets, but when adjusting, it should be remembered that too long a make time of the SCC will cause the punch error relay to pick up, thus locking the keyboard.

1. Adjust the SCC to .050", plus .008", minus .002". The normal or start setting should be .050". If any keylever fails to punch, the selector slide must be brought closer to (but not choke off) the cam. If the keylever still fails to punch, the SCC is to be closed but not below the minimum of .048".

2. Any selector slides that cause the punch error relay to pick up must be adjusted away from the cam.

3. If it was not necessary to bring SCC closer than .050", and many slides tend to operate the punch error relay, the SCC should be opened toward its maximum of .058".

The adjustment of SCC between a minimum of .048" and a maximum of .058" should eliminate as much individual slide adjustment as possible.

TAPE PUNCH

The tape punch for the Model FPC machines have the same description and sequence of operation as the Model II punch explained in Part II, Section 5, with addendums. However, the Model FPC5 uses a five code unit punch and the Model FPC8 uses an eight code unit punch. Also, the PLC contacts are a break-before make and should be adjusted to have a .005" to .010" follow on the make contact.

TAPE READER

The operation, description and maintenance of the Model FPC tape readers are basically the same as the reader described in Part II, Section 6 with the exception of the following:

Model FPC5 - Same as tape reader in Part III, Section 2.

Model FPC8 - The contact stack-up arrangement on the single and double case machines is as follows:

RC1 - 1 break (1B), 1 transfer (1C)
RC2 - 1 make 1 transfer (1A, 1C)
RC3 - 3 make (3A)
RC4 - 1 make, 1 transfer (1A, 1C)
RC5 - 1 make (1A)
RC6 - 3 make (3A)
RC7 - 1 break, 2 make (1B, 2A)
RC8 - 2 make (2A)

The contact adjustment for the Model FPC8 readers is as follows:

1. Place a piece of blank tape in the reader. Rotate the cam shaft until the pins touch the bottom of the tape. Adjust all normally open contact points to a gap of .020" to .025".

FRONT SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
1	25C	C-2-4-5	2-8-CH
3	3C	C5	CH
5	23D	9 C-2-4	2-8-X
7	31D	8-9 C-1	1-0-X
9	17G	8 C-1-4	1-8-0
11	33G	8 C-2-5	2-CH-0
13	37D	8 C-1-2-3-5	1-2-4-CH-0
15	33C	8-9 C-3	4-0-X
17	17H	8-9 C-1-2-5	1-2-CH-0-X
19	19G	8-9 C-2-3-5	2-4-CH-0-X
21	21E	8 C-1-3	1-4-0
23	23E	8-9 C-1-2-3	1-2-4-0-X
25	35C	8-9 C-2	2-0-X
27	27G	8-9 C-4	8-0-X
29	23C	9 C-1-3	1-4-X
31	15D	9 C-1-5	1-CH-X
33	33H	9 C-3-5	4-CH-X
35	19D	9 C-2-5	2-CH-X
37	37K	8 C-1-2-4-5	1-2-8-CH-0
39	39G	9 C-1-2	1-2-X
41	51C	8-9 C-1-2-4	1-2-8-0-X
43	43L	8-9 C-5	CH-0-X
45	15F	8 C-1-5	1-CH-0
47	51H	9 C-1-2-4-5	1-2-8-CH-X
49	21C	10 C	E.L.
51	41D	8 C-1-3-4-5	1-4-8-CH-0

REAR SLIDE

Pos. No.	Slide No.	Cam Surface	Character & Function Code
2	10F	8 C-2-3-4-5	2-4-8-CH-0
4		Dummy	
6	8B	9 C-4-5	8-CH-X
8	22F	C-2	2
10	10E	8 C-2-3	2-4-0
12	38C	C-1-2-5	1-2-CH
14	14H	8-9 C-1-3-5	1-4-CH-0-X
16	28A	C-3	4
18	18G	9 C-1-4	1-8-X
20	48D	C-1-3-5	1-4-CH
22	34C	8 C-1-2	1-2-0
24	32F	C-2-3-5	2-4-CH
26	46D	8 C-4-5	8-CH-0
28	28H	C-1-2-3	1-2-4
30	30D	8 C-3-5	4-CH-0
32	14D	C-4	8
34	34G	8-9 C-1-4-5	1-8-CH-0-X
36	36F	C-1-4-5	1-8-CH
38	24J	9 C-2-3	2-4-X
40	48E	8 C	0
42	42H	9 C-1-2-3-5	1-2-4-CH-X
44	18D	C-1	1
46	30E	9 C	X
48	42E	8 C-2-4	2-8-0
50		Dummy	

Figure 2-5 Selector Coding Model FPC8 - S.C.

2. Remove the tape from the reader and adjust all normally closed contact points to a gap of .020" to .025".

3. Adjust the reader common contact (RCC) to close at approximately the same time as the code contacts. This is accomplished by allowing the pins to move up slowly and at the point of closing of the make contacts, adjust the common contact to close also.

4. Adjust the reader tape contact (RTC) to a gap of .020" to .025".

5. Check to see that the two contact points on each strap engage their mating contact points simultaneously.

CODE TRANSLATOR

The Model FPC code translator is basically the same as the translator described in Part II, Section 7, except for the permutation bar coding arrangement. Figure 2-6 shows the coding arrangement for a Model FPC8 D.C. translator.

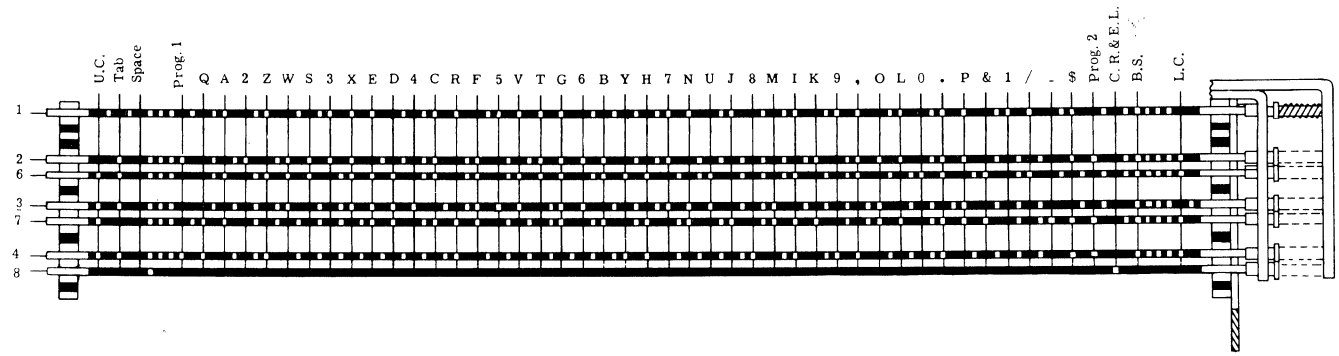


Figure 2-6 Translator Coding

CIRCUIT DESCRIPTION

The following circuit description is for the Model FPC-8 (Double Case). The Model FPC-5 uses the same wiring diagram as the Model FC (Part III, Section 3). The Model FPC-8 (Single Case) is essentially the same as the Model FPC-8 Double Case machine.

The wiring diagram used in this description is for the Model FPC-8 1041201 (shown in Figure 3 - 1 Part VI).

The Power Circuits for both Model FPC machines are the same as explained in Part II, Section 8, Page 8 - 5.

PUNCH CIRCUITS

Key Lock Magnet Circuit - The key lock magnet (LKL) is controlled by the punch tape contact (PTC) when the punch on Switch (S6) is in the ON position as is the case in other machines. Thus, if the PTC contact should open the keyboard would lock, even though negative input to the punch would not be broken.

Punch Checking Circuit - To prevent the possibility of obtaining a typed character without its corresponding code being punched in the tape a punch checking circuit is used. This circuit causes the keyboard to become locked when the anti-repeat relay remains energized for too long a period of time. Conditions that would cause the anti-repeat relay to remain energized would be, sticking selector slides, malformed slides, excessive manual keyboard speed (improper keyboard operation), etc.

When the SCC closes in response to keyboard operation, a circuit will be complete to the punch clutch: - DC, TC6, S6 (operate), SCC, TA39 - 40, JPP, PLC, JPR, TA12, K2, 14 and 13, K3 - 1 and 2, TA35 - 36, JPK, LPC, JPX - JPY, TC5, to + DC. The punch lock contacts (PLC) transfer during punch operation and complete a circuit to the anti-repeat relay K2 and break the punch magnet and clutch circuits. When the PLC returns to normal, if the selector common contact (SCC) is still closed, K2 is held energized by its own make contacts 17 and 18. K2 will pick up in 8 - 12 milliseconds after PLC closes, K3 (punch error relay) will pick-up in 11 milliseconds after K2 has been energized. Thus, if the anti-repeat holding circuit is maintained by the SCC for more than 11 milliseconds, the K3 will become energized and open the key lock magnet circuit. The punch error relay K3 is picked up: DC, TC6, S6, SCC, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 15 and 16, K7 - 4 and 3, K6 - 4 and 3, K5 - 4 and 3, K3 coil, TC5 to + DC.

The holding circuit for K3: - DC, TC6, S6, TA23, K4 - 4 and 3, K3 - 13 and 14, K3 coil, TC5 to + DC.

The key lock magnet (LKL) de-energizes when K3 - 3 and 4 contacts open. Also, K3 contacts 5 and 6 will open the holding circuit to K2.

In order to de-energize the K3 relay, it is necessary to depress the tape feed switch S10. This will cause K4 contacts

3 and 4 and breaking the holding circuit to K3.

PLC is a break - before - make contact so that K2 will not have an over-long pick up. It would otherwise be possible for SCC to open, breaking the K2 holding circuit, and yet have the pick up circuit through PLC still in force.

See Section 2, "Selector Contact Adjustment".

C.P. Tape Circuit - The S1 switch located on the right hand side frame is normally used as the power switch on most machines. However, on the Model FPC-8, this switch is used for both the power supply and the "card punch" tape circuit. The S1 switch is a DPDT, center off type of switch.

When the punch on switch S6 is in the "on" position, any typing on the keyboard will be recorded in the tape. However, if the S1 switch is placed in the "on C.P." position (with S6 on), and the type basket is in upper case position, the operation of the numerals, dash, diagonal, ampersand or dollar key-levers will not cause the punch to record their respective codes in the tape.

To accomplish the above condition the numerals, dash, diagonal, ampersand and dollar selector slides are coded with a number seven (7) position cam surface, but do not have a common (SCC) cam surface. Therefore, due to the fact that the SC7 contact is in series with the CSC (case shift contact), when the CSC is open (basket in upper case), there is no circuit to the punch magnets.

For example, the numeral 7 keylever position selector slide is coded 1 - 2 - 3 - 7 and the code for this position is 124. If the type basket is in the upper case position, the CSC contact will be open, breaking the circuit to the LP1, LP2 and LP3 punch magnets. However, if the type basket is in the lower case position, the CSC contact will be closed and the circuit to the LP1, LP2 and LP3 punch magnets is as follows: from - D.C., TC6, S6, CSC, SC7, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 13 and 14, K3 - 1 and 2, TA35 - 36, SC1 - SC2, SC3, JPA - JPB - JPC, LP1 - LP2 - LP3, TC5, + DC. Also, the clutch magnet (LPC) is energized by the same circuit up to TA35 - 36, at which point it goes through JPK, LPC, TC5, to + DC.

A C.P. Tape indicating light is located on the front control panel which turns on when the S1 switch is in the "on C.P." position.

Tape Feed Circuit - When the code delete switch S10 is depressed, the code 1 - 2 - 4 - 8 - Ch - 0 - X is punched in the tape continuously for as long as the S10 switch is held depressed. This is accomplished by energizing the K4 relay, which in turn will complete circuits to the LP1 through LP7 punch magnets, plus the clutch magnet LPC. The circuit to the K4 relay is as follows: from - DC, TC6, S6, N/O

S10, TA13, K2 - 1 and 2, K4 coil, TC5, to + DC.

A sensitive make contact (K4 - 1 and 2) is used to insure that the K4 relay will be held energized until after the punch cycle starts. This is necessary for positive energizing of all seven punch magnets no matter how short the impulse to the K4 relay might be (i.e. the operator just flicking the tape feed switch S10). This holding circuit is as follows: from - DC, TC6, S6, TA23, K2 - 11 - 12, K4 - 1 and 2, K4 coil, TC5, to + DC. The holding circuit to K4 is broken during the punch cycle when the ARR contacts operate.

The circuits to the seven punch magnets (LP1 through LP7) is as follows: from - DC, TC6, S6, TA23, K4 - 4 and 5, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 13 and 14, K3 - 1 and 2, K4 - 6 and 7, 8 and 9, 11 and 12, 13 and 14, 15 and 16, 17 and 18. 19 and 20, TA1 - 2, TA3 - 4, TA5 - 6, TA7 - 8, TA9 - 10, TA31 - 32, TA33 - 34, JPA, JPB, JPC, JPD, JPE, JPF, JPH, LP1 -LP2 - LP3 - LP4 - LP5 - LP6 - LP7 -, JPX/ JPY, TC5 to + DC.

The tape feed switch when held depressed will give continuous operation of the punch. The clutch magnet is energized each cycle of the punch through the same circuit.

Stop Code Circuit - When the stop code switch (S5) is depressed, the code 128 is punched in the tape. This is accomplished by energizing the K7 relay, which in turn will complete circuits to the LP1, LP2 and LP4 punch magnets. The circuit to the K7 relay is as follows: from - DC., TC6, S6 N/O S5, TA18, K7, coil, TC5, to + DC.

The circuit to the LP1, LP2 and LP4 punch magnets are as follows: from - DC, TC6, S6, TA23, K7 - 6 and 5, TA39 - 40, JPP, N/C transfer PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, K7 - 11 and 12 - 13 and 14 - 15 and 16, TA1 and 2 - 3 and 4 - 7 and 8, JPA - JPB - JPD, LP1 - LP2 - LP4, JPX JPY, TC5, to +DC.

The clutch magnet circuit is as follows: from - DC, TC6, S6, TA23, K7 - 6 and 5, TA39 - 40, JPP, N/C transfer PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to +DC.

There will be only one stop code (128) punched for each operation of the stop code switch S8. This is due to the anti-repeat circuit as described under the Error Code Circuit.

Error Code Circuit - When the error switch (S9) is depressed, the code 1248X is punched in the tape. This is accomplished by energizing the K6 relay, which in turn will complete circuits to the LP1, LP2, LP3, LP4, and LP7, punch magnets. The circuit to the K6 relay is as follows: from - DC, TC6, S6, S9, TA17, K6 coil, TC5, to +DC.

The circuits to the punch magnets are as follows: from - DC, TC6, S6, TA23,

K6 - 7 and 6, TA39 - 40. JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, K6 - 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20, TA - 1 and 2 - 3 and 4 - 5 and 6 - 7 and 8 - 33 and 34, JPA - JPB - JPC - JPD - JPH, LP1 - LP2 - LP3 - LP4 - LP7, JPX - JPY, TC5, to +DC.

The clutch magnet circuit is as follows: from - DC, TC6, TA23, K6 - 7 and 6, TA39 - 40 - JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to + DC.

There will be only one error code (1248X) punched for each operation of the S9 switch. This is due to the anti-repeat circuit, wherein the anti-repeat relay (K2) picks up during the punch cycle, breaking the circuits to the punch mangets and the clutch magnet (K2 - 13 and 14). The K2 is held energized, through the following circuit: from - DC, TC6, S6, TA23, K6 - 7 and 6, K3 - 5 and 6, K2 - 17 and 18, K2 coil, TA21, TC5, to +DC. Therefore, as long as S9 is held depressed K6 will remain energized, maintaining a holding circuit to K2.

Note that K3 (punch error relay) will not pick up because K6 - 3 and 4 will be open.

SP Code Circuit - When the (Special) code switch S8 is depressed, the code 248CHX is punched in the tape. This is accomplished by energizing the K5 relay, which in turn, will complete circuits to the LP2, LP3, LP4, LP5, and LP7 punch magnets.

The K5 relay circuit is as follows: from - DC, TC6, S6, S8, TA14, K5 coil, TC5, to +DC.

The punch magnet circuits are as follows: from - DC, TC6, S6, TA23, K5 - 7 and 6, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2 K5 - 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20 TA3 and 4 - 5 and 6 - 7 and 8 - 9 and 10 - 33 and 34, JPB - JPC - JPD - JPE - JPH, LP2 - LP3 - LP4 - LP5 - LP7, JPX - JPY, TC5, to +DC.

The clutch magnet circuit is as follows: from - DC, TC6, S6, TA23, K5 - 7 and 6, TA39 - 40, JPP, PLC, JPR, TA12, K2 - 14 and 13, K3 - 1 and 2, TA35 and 36, JPK, LPC, JPX - JPY, TC5, to +DC.

There will be only one SP code (248CHX) punched for each operation of the SP code switch S8. This is due to the anti-repeat circuit as described under the Error Code Circuit.

READER AND TRANSLATOR CIRCUITS

Start and Stop Code Circuit - When the S3 start read switch is depressed, a circuit is completed to the K23 read control relay as follows: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S3, TA19, K3 - 11 and 12, K23 coil, TC5 to +DC. When K3 picks-up, a holding circuit is established as follows: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S4, TA20, K23 - 1 and 2, K3 - 11 and 12, K23 coil.

TC5, to + DC. Thus, with K23 held energized, when the S3 switch is released a circuit is completed to the reader magnet (LR) as follws: from - DC, TC6, JRL, RTC, the N/C transfer of RC1 - RC2 and RC4, JRR, S3, CRTC, TA29, K22 - 2 and 1, K23 - 6 and 5, TA28, JRK, LR, JRX -JRY, TC5, to + DC. When the reader magnet is energized, reader operation takes place. The reader magnet will remain energized until the stop read switch (S4) depressed, the start read switch (S3) is depressed, or a stop code (1 - 2 - 8) is read.

When a stop code is read, reader contacts RC1, RC2 and RC4 operate, breaking the holding circuit to the K23 relay. Thus, with the K23 de-energized, the reader magnet circuit is broken. To resume operation after reading a stop code, it is necessary to depress and release the start read switch S3.

A normally open contact on RC3, RC6, RC7, also used in the K23 holding circuit is order utilize as many code combinations as possible. For example, if the 1 - 2 - 8 code units are to be used, as long as one of code units 4, 0 or X is used, the K23 relay will not drop out.

Delay Control Circuit - It is essential to have an automatic delay control circuit incorporated in the reproducing operation in order to delay the operation of the tape reader until a function in the Writing Machine has been completed. There are two functions which require more operating time than the regular characters. These functions are: carriage return (EL Code) and tabular (2 - 4 - 8 - Ch - O Code). When the EL code is read by the reader a circuit is completed to the delay control relay (K22) as follows: from - DC, TC6, JRL, RTC, RC1, RC8, JRM, TA30, K23 - 3 and 4, K22 coil, TC5, to + DC.

When K22 is energized, strap 2 breaks with strap 1 and makes with strap 3. Thus, the energizing circuit to the reader magnet (LR) is broken, de-energizing the reader magnet and stopping reader operation. Also, due to K22 - 2 and 3 making, a holding circuit to K22 coil is established (the original pick-up circuit to K22 will be open when RC8 contact returns to normal).

If we assume the CR code EL was read in the reader, then, at the same time the above mentioned circuit was complete to K22, a circuit would also be complete to the translator magnet LT8, and the translator clutch magnet LTC. Therefore, translator operation would take place, pulling down the CR keylever and starting a carriage return function. The operation of the carriage return mechanism would open contacts CRTC, thus breaking the holding circuit to K22. The K22 contact (straps 1, 2 and 3) would return to its normal position, but the circuit to the reader magnet will not be complete until the carriage returns to the left hand margin and the clutch toggle unlocks. When this happens, the

CRTC contact closes completing the energizing circuit to the reader magnet, starting reader operation again.

When the tab code 2 - 4 - 8 - Ch - O) is read by the reader the delay control relay (K22) is energized as follows: from - DC, TC6, JRL, RTC, RC1, RC3, RC7, RC6, RC4, RC2, JRM, TA30, K23 - 3 and 4, K22 coil, TC5 to + DC. Thus, when K22 is energized, the same delaying action of the reader takes place as explained for carriage return.

CIRCUIT DESCRIPTION

The following circuit description is for the Flexowriter Edge-Card Programatic Model FPC-5, 4 bank, and based on schematic wiring diagram 1041120, (Figure 4-1).

The Power Circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet

When the power switch (S1) is in the "On" position, the key lock magnet (LKL) is energized as follows: -DC, TC6, JL11, JL12, JPL, PTC, JPM, TA16, K3-3 and 4, TA15, LKL magnet coil, TC5, to DC +. Notice that this circuit is through a normally closed contact of the punch error relay (K3 - 3 and 4). If the K3 (Punch Error) relay is energized the Key Lock Magnet circuit is broken, and the keyboard will lock.

PUNCH CONTROL CIRCUITS

Punch All

With the punch switch (S2) in the ALL position, the Flexowriter is conditioned to record all codes in the tape. When the punch control relay (K9) is energized, circuits to the punch magnets and to the punch clutch may be completed simultaneously. K9 is energized as follows: -DC, TC6, S2 (inside-ALL). JL22, JL21, TB33, K9 coil, TC5, +DC. A DC circuit is complete to the punch on indicating light when K9 is energized: -DC, TC6, TA26, K9- 1 and 2, TB36, Lamp I, TC5, +DC.

Punch Magnet Circuit

When a keylever, other than On 1-On 2, or Punch OFF is depressed, one or more of the selector code contacts will close, followed by the selector common contact (SCC), energizing the punch magnets and clutch.

For an example circuit, assume that the "E" character keylever was depressed. A DC circuit would be completed to the LP1 magnet: -DC, TC6, SCC, TA24, K10-4 and 5, K4- 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3 - 2 and 1, TA1, SC1, TA2, K10-7 and 8, K9- 5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC.

The circuit to the punch clutch is in parallel with that to the code magnets: -DC to K9-3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC.

Note: Selector contact SC7 is the "common" contact for punching On 1 - On 2, and Punch Off codes.

Punch Select

With the punch switch (S2) in the SEL position the Flexowriter is conditioned to type only, until the On 1 keylever is depressed. In SEL (basket in Figs. position), On 1 turns on the Flexowriter punch but

does not record the code in the tape. Succeeding keylever operations will be recorded, however, until Punch Off is depressed.

When On 1 is depressed the punch select relay (K16) is energized: -DC, TC6, SC6 (operate strap transferred), CSC 22 and 23 (basket in Figs. position), TB34, K16 coil, TC5, +DC. The holding circuit for K16 relay: -DC, TC6, S2 (inside - SEL), punch off contacts (POC) 1 and 2, TB35, K16 - 4 and 5, K16 coil, TC, +DC. With K16 energized a circuit will be complete to the punch control relay, K9: -DC, TC6, POC- 4 and 3, TB40, K16- 15 and 14, TB31, JL22, JL21, TB33, K9 coil, TC5, +DC.

When it is necessary to turn the punch off, the Punch Off keylever is depressed, breaking the holding circuit to the K16 relay at contacts POC- 1 and 2. The holding circuit for the punch control relay (K9) will be broken when K16- 14 and 15 open.

ANTI-REPEAT CIRCUIT

*See Punch Checking Circuit

Punch Checking Circuit

Sticking selector slides, malformed slides and excessive manual keyboard speed (improper Keyboard operation) make is possible to obtain a typed character without its corresponding code if the selector common contacts (SCC) remain closed too long. To prevent this, a punch checking circuit becomes operative if the anti-repeat relay (2) is held energized.

When the K2 relay is energized and the PLC contacts have returned to normal, a circuit will be complete to the punch error relay (K3): -DC, TC6, SCC, TA24, K10- 4 and 5, K4- 13 and 14, TA17, JPP, PLC, JPR, JL14, JL5, TA14, K2- 15 and 16, K10- 2 and 1, K8- 3 and 4, K7- 3 and 4, K6- 3 and 4, K3 coil, TC5, +DC. The holding circuit for K3: -DC, TC6, TA26, K5-4 and 3, K4-7 and 6, K3- 15 and 16, K3 coil, TC5, +DC. Contacts 5 and 6 of the K3 relay break the K2 holding circuit: contacts 1 and 2 break the punch circuits: contacts 3 and 4 open the circuit to the keylock magnet (LKL) and the keyboard becomes inoperative. Tape Feed operation is required to drop out K3 and unlock the keyboard.

It should be noted, that because a long operator is used to operate the SCC contacts, the pulse to the anti-repeat relay may not be long enough to actually pickup the anti-repeat relay. However, it is not essential that the anti-repeat relay actually picks-up on each operation, because as stated, if there is a long pulse to the anti-repeat relay, then a circuit will be complete to the punch error relay, thus locking up the keyboard.

Tape Feed - Card Feed Circuit

Depression of the Tape Feed panel switch

(S10) will punch a five channel LTRS (or delete) code when tape is in the punch. With a card in the punch, depression and release of the Tape Feed switch will allow the card to feed through the punch automatically (with a blank code only) until the control hole in the next card permits the card feed micro-switch to restore.

When the S10 switch is depressed with tape in the punch, the tape feed relay (K5) is energized: -DC, TC6, operated S10, JPU/JPV (jumpered on non card punches), TA22, K4- 4 and 3, K2- 2 and 1, K5 coil, TC5, +DC.

The tape feed relay (K5) is held: -DC, TC6, TA26, K2- 12 and 11, K5- 1 and 2, K5 coil, +DC. With K5 energized, circuits will be complete to the punch clutch magnet and to the punch magnets: -DC, TC6, TA26, K5- 4 and 5, K10- 4 and 5, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K5- 11 and 12 - 13 and 14 - 15 and 16 - 17 and 18 - 19 and 20, K10- 7 and 8 - 11 and 12 - 14 and 15 - 17 and 18, K11- 1 and 2, K9- 5 and 6 - 7 and 8 - 9 and 10 - 11 and 12 - 13 and 14, TB2 - 3 - 4 - 5 - 6, LP1 - 2 - 3 - 4 - 5, JPX/JPY, TC5, +DC. LPC is energized: from - DC, to K3- 2 and 1, K9- 3 and 4, TB1, JPK, LPC, TC5, +DC. The holding circuit provided for K5 insures that all code magnets will be energized regardless of when the Tape Feed switch is released. When K2 is energized, its contact 11 and 12 will open, breaking the K5 holding circuit K2 will have a holding circuit, however, through its contact 17 and 18 only until K5 drops out opening its contact 5 and 4.

With a card in the punch, the operate strap of the card feed micro-switch will be transferred, so that when the S10 switch is depressed the card feed relay (K4) will be energized: -DC, TC6, N/0 S10, JPU, card feed micro-switch, JPW, TA21 K4 coil, TC5 +DC. K4 is held: (a), -DC TC6, TA26, K2- 12 and 11, K4- 18 and 19, K4 coil, TC5 +DC, and (b), -DC, TC6, TA26, K4- 16 and 17, TA25, JPU, card feed micro-switch, JPW, TA21, K4 coil, TC, DC. When the S10 switch is released a circuit will be made to LPC: -DC, TC6, N/C S10, TA23, K4- 15 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, TC5, +DC. The punch clutch will continue to cycle the card through the punch until either the end of a card or the control hole in the next attached card allows the card feed switch to restore. Contacts 18 and 19 of K4 allow one more punch cycle to occur after the card feed switch has restored, and thus the new card is driven to the proper punching position.

Print Restore Code Circuit

The print restore code (1-2-3-4) is

perforated in the tape when the S8 panel switch is depressed (basket in Figures). This code, when read by the reader, will restore the Flexowriter to normal printing condition only when non-print operation was initiated either by Non-Print code in the tape, or by depression of the Tape Skip panel switch.

With the S8 panel switch depressed (in Figs) the print restore code relay is energized: -DC, TC6, CSC-1 and 2, operated S8 switch, TA32, K6 coil, TC5, +DC. The K6 relay is held through contact 11 and 12 of K2. Negative DC now comes from the rectifier, TC6, TA26, K6-7 and 6, K10-4 and 5, K4-13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2-14 and 13, K3-2 and 1, to K6 make contacts and to the punch clutch and code magnets. The anti-repeat (K2) having been picked up when the PLC operate strap transferred is energized as long as the S8 panel switch is held depressed, -DC, TC6, TA26, K6-7 and 6, K10-4 and 5, K3-5 and 6, K2-17 and 18, K2 coil, TC5, +DC. Contact 3 and 4 breaks when K6 is energized and prevents the pick-up of the punch error relay regardless of how long the print restore code relay and the anti-repeat relay is energized.

Error Code Circuit

This circuit is used to punch a 1-2-4 code in the tape (basket in Figures) which, when read, will not cause any operation of the Flexowriter. Operation of the Error Code panel switch (S9) will energize the error code relay (K7): -DC, TC6, CSC 1 and 2 (Figs.), N/O S9, TA33, K7 coil, TC5, +DC. K7 is held: -DC, TC6, TA26, K2- 12 and 11, K7-1 and 2, K7 coil, TC5, +DC. Punching operation of the error code, anti-repeat operation, etc., corresponds with the print restore code punching operation explained above.

Stop Code Circuit

When the stop Code Panel switch (S7) is depressed, a feed hole only will be perforated in the tape, which, when read in the reader, will automatically stop reader operation. Operation of the S7 switch energizes the stop code relay (K8): -DC, TC6, Operated S7 switch, TA34, K8 coil, TC5 +DC. When the K8 relay is energized negative power is applied to the punch clutch in the same manner as explained in the Tape Feed circuit.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits

The Start Read Switch (S3), when depressed and released will energize the tape reader magnet (LR) and start a cycle of reader operation. To energize the reader magnet, when the S3 switch is depressed, a circuit is first completed to the reader control relay (K23): -DC, TC6, JRL (JRL con-

nected to JRV; RTC contact not in Card Reader), RTC, N/C RCC, JRR, TA9, K3-11 and 12, TA10, operated S3, TA39, K23 coil, TC5, +DC. When K23 contacts 1 and 2 close a holding circuit for K23 is maintained: -DC, TC6, JRL, RTC, N/C RCC, JRR, TA9, K3- 11 and 12, TA10, S4 switch, TA28, K23-1 and 2, K23 coil, TC5, +DC. When the S3 Switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, N/C RCC, JRR, TA9, K3-11 and 12, TA10, S3 switch, S5 switch, S6 switch, CRTC, TA19, K23-4 and 3, K21- 2 and 1, K20- 2 and 1, TA29, JRK, LR, JRX/JRY, TC5, +DC.

The reader will operate continuously until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or manually, by depressing the Stop Read switch (S4).

When the S4 switch is depressed, the holding circuit to the reader control relay (K23) is broken. Thus, when K23 contact 4 and 3 open, the reader magnet is de-energized and the reader will stop.

Translator Magnet Circuits

When a reader pin senses a code in the tape, a corresponding reader contact closes, and completes a circuit to the related translator magnet.

For an example circuit, assume that a 1-2 code is read in the reader tape. The translator magnets LT1 and LT2 will be energized: -DC, TC6, RTC (RTC omitted in Card Reader - JRL is connected to JRU circuit), JRU, TB20, K11- 11 and 12, TB19, JRT, RC1 and RC2, JRA and JRB, JTA1 and JTA2, JTA5 and JTA6, JTA5 and JTB5, TC5, to +DC. Also, the reader common contact (RCC) closes and completes a circuit to the translator clutch: -DC, TC6, RTC, RCC, JRP, JTH6, LTC, JTA5 and JTB5, TC5, to +DC.

Delay Control Circuit

It is essential to have an automatic delay control circuit incorporated in the Flexowriter in order to delay the operation of the tape reader until a function in the Writing Machine has been completed. Two functions which require more operating time than the regular characters are carriage return (4 code) and tabular (14 code UC).

When the tab code 14 (basket in upper case) is read in the reader a circuit is completed to the delay control relay #1 (K21): -DC, TC6, RTC, RC5, RC4, RC3, RC2, JRS, CSC - 13 and 14, TB18, K12 - 11 and 12, K22 - 11 and 12, K11 - 14 and 15, K21 coil, TC5, to +DC.

At the same time the above is complete to K21, (when reading tab code), a circuit would also be complete to the translator magnets LT1, LT4 and LTC. The translator would operate, pull down the tab keylever

and initiate a tabular function. The operation of the tab mechanism would open CRTC and break the holding circuit to K21. The K21 contacts would return to their normal position, but the circuit to the reader magnet would not be complete until the carriage tab-stop struck the tab lever and unlatched the tab mechanism. When this occurs, the CRTC contact closes and completes the energizing circuit to the reader magnet, starting reader operation again.

If a Carriage Return Code (4) is read, K21 will again be energized until the opening of CRTC drops out the K21 holding circuit. In this instance, K21 is energized by operation of RC4: -DC, TC6, RTC, RC5, RC4, RC3, RC2, RC1, JRM, TA20, K11 - 14 and 15, K21 coil, TC5, to + DC.

Therefore, when a tab or CR code is read by the reader, reader operation will automatically stop and will not start again until the particular function is complete.

Stop Code Circuit

When a stop code (feed hole) is read by the reader, the holding circuit for the K23 relay (read control) will be broken, thus, de-energizing the reader magnet and stopping reader operation. Normally closed contacts of RCC complete the holding circuit through K23 contact 1 and 2, to the K23 coil. Therefore, whenever a feed hole only is read by the reader, the RCC contacts operate and break the K23 holding circuit, stopping the reader.

Because RCC contacts operate on each reading cycle, normally open contacts on RC1 through RC5 provide alternate holding circuits to K23, thereby preventing K23 from de-energizing when one or more codes are read.

Tape Skip Circuit

The tape skip switch (S6) allows sections of tape to pass through the reader preventing all keylever operations with the exception of CR Letters and Figures shift. Tape cycles through the reader only until a Print Restore Code (1234 - basket in Figures) is read, which restores normal printing and punching operation automatically without stopping the reader. If carriage return codes are read during Tape Skip operation, the carriage will return and line space the form. The same applies when reading the Figures or Letters shift codes; the basket will shift when either shift code is read.

When the Flexowriter punch or Motorized punch (if connected) is on at the time of pressing the tape skip switch, only the CR Letters and Figures codes will be punched.

Operation of the Tape Skip switch (S6) will energize the reader magnet (LR) and start a cycle of reader operation. When the S6 switch is depressed, the K22 relay is energized: -DC, TC6, JRL, RTC, RCC, JRR,

TA9, K3 - 11 and 12, TA10, S3, S5, operated S6, TA18, K22 coil, TC5 to + DC. K22 is held energized: -DC, TC6, JRL, RTC, JRU, TB20, K14 - 5 and 6, K22-5 and 6, K22 coil, TC5, to + DC.

With K22 energized and the S6 switch released, the reader magnet (LR) is energized: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3-11 and 12, TA10, S3. S5, S6, CRTC, TA19, K22- 3 and 4, K21- 2 and 1, K20-2 and 1, TA29, JRK, LR, JRX and JRY, TC5 to + DC.

As the reader cycles, the reader common contact (RCC) will close and energize translator magnet 7 (LT7) and the translator clutch (LTC). Also, LT6 is energized if the basket is in Figures position.

When LT7 is energized, a permutation bar will be released in the translator and prevent the selection of any keylever except CR, Figs. and Letters shift. The circuit to LT7 is: -DC, TC6, JRL, RTC, operated RCC, JRP, TB28, K22- 16 and 15, TA40, JTB3, LT7, JTA5 and JTB5, TC5, to + DC. Also, the clutch coil circuit is: from - DC, TC6, JRL, RTC, operated RCC, JRP, TB28, JTA6, LTC, JTA5 and JTB5, TC5, to + DC.

Assuming that a carriage return code (4) is read in the reader (during Tape Skip), LTC and LT4 will be energized, and in addition LT7: -DC, TC6, JRL, RTC, JRU, TB20, K11- 11 and 12, TB19, JRT, RC4, JRD, TA4 LT4, JTA5 and JTB5, TC5, to + DC.

To delay reader operation until the carriage return function is complete, the delay control relay K21 will also be energized. This circuit is the same as explained under Delay Control Circuit with the exception of the K21 holding circuit. Contacts 3 and 4 of K22 complete the K21 holding circuit when CR code is read during tape skip.

Tape skipping operation will continue in the reader until a Print Restore code (1234) is read (basket in Figures). When this code is read, it will cause the print restore relay (K14) to pickup, dropping out the tape skip relay (K22) and energize the read control relay (K23) for further reader operation.

When the 1234 is read, the print restore relay (K14) is energized: -DC, TC6, JRL, RTC, RC5 N/C, RC4 N/0, RC3 N/0, RC2 N/0, RC1 N/0, JRW, CSC - 5 and 6, TB10, K12- 3 and 4, K15- 1 and 2, K14 coil, TC5, to + DC. K14 has no holding circuit in this instance and will drop out when the reader contacts restore. When contact 5 and 6 of K14 opened, the holding circuit to K22 was broken and the tape skip relay dropped out. At the same time, however, negative was being applied to the read control relay (K23): -DC, TC6, JRL, RTC, JRU, TB20, K14 - 13 and 14, K23 coil, TC5, to + DC. K23 is again held through its 1 and 2 contact. The circuit to LR is still complete: -DC, TC6, JRL, RTC,

RCC, JRR, TA9, K3- 11 and 12, TA10, S3, S5, S6, CRTC, TA19, K23- 4 and 3, K21- 2 and 1, K20- 2 and 1, TA29, TRK, LR, JRX and JRY, TC5, to +DC.

Since the tape skip relay is no longer energized, its open contact 15 and 16 no longer energize LT7, therefore, all characters are allowed to print and all functions allowed to operate.

Manual Non-Print Circuit

The non-print switch (S5) will also allow sections of tape to pass through the reader without causing any operation of the Flexowriter.

Tape cycles through the reader only until a stop code (feed hole) is read, for the stop code is the only code recognized during this operation. The stop code is first reproduced automatically before stopping the reader. Non-Print operation can be terminated at any time by pressing the Stop Read switch. Although, by-passed codes in the tape cause no operation of the Flexowriter, these codes can be reproduced by the Flexowriter punch or the motorized punch.

Manual operation of the Non-Print switch (S5) will energize the Non-Print relays and the read control relay: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3- 11 and 12, TA10, S3, operated S5, TB29, K15 coil of the manual non-print relay. TC5 to +DC. Also, with K15 picked up, the same circuit will be through K15- 12 and 13, coils of K10 and K11, TC5, to +DC.

When R11 picks up, the same negative that picked up K11 will energize K23 (RCR), through K11 - 10 and 9, K14 - 12 and 11, K23 coil, TC5, to +DC. Thus, with K23 energized, a holding circuit will be complete to the read control relay and to the non-print relays: -DC, TC6, JRL, RTC, RCC, JRR, TA9, K3- 11 and 12, TA10, S4, TA28, K23- 1 and 2, K23 coil.

When the non-print switch is released, the above holding circuit will keep K23, K15, K10, and K11 relays energized until a stop code (feed hole) is read, or the stop read switch is depressed. The releasing of the S5 switch will also complete a circuit to the reader magnet (LR).

As can be seen on print 1041120, when K10 and K11 non-print relays are energized, circuits to the translator magnets LT1 through LT5 cannot be energized, thereby, preventing keylever of operation.

If punching tape is required on manual non-print operation, the punch control relay (K9) will be energized and the DC potential on the reader contacts will come from the punch. Assuming that the reader is in operation (Non-Print) and that the character "E" is read, the punch magnet #1 and the clutch magnet will be energized as follows: -DC, TC6, JRL, RTC, RCC, JRP, TB28,

K10- 6 and 5, K4- 13 and 14, TA17, JPP, PTC, JPL, JL14, JL15, TA14, K2- 14 and 13, K3- 2 and 1, K11- 13 and 12, TB19, JRT, operated RC1, JRA, TB23, K10- 13 and 12, K9- 5 and 6, TB2, JPA, LP1, JPX and JPY, TC5, to + DC. Also, from contact 1 and 2 of K3, K9- 3 and 4, TB1, JPK, LPC, JPX and JPY, TC5, to + DC.

Tape duplication will occur until a stop code is read in the reader, at which time the read control and non-print relays will be dropped out. When the reader reads the feed hole (stop code), the N/C RCC opens, breaking the holding circuit to K23. As the RCC breaks the K23 holding circuit, a second RCC N/0 contact makes, establishing a temporary second holding circuit to the non-print relays (through different coils). This temporary holding of the non-print relays allows enough time for the stop code to be punched. The holding circuit is as follows: -DC, TC6, JRL, RTC, operated RCC, JRN, TB27, K11-7 and 8, K11 coil, K10 coil, also, K15- 4 and 5, K15 coil, TC5, to + DC.

When the reader pins return to non-operated position, the non-print relays will drop out.

During manual non-print operation, break contact 1 and 2 on K15 prevents the print restore relay (K14) from becoming energized, in the event the print restore code (1234 UC) is read.

If the reader has been started by Manual Non-Print operation, it may be stopped by depressing the Stop Read switch (S4). In this instance, the holding circuit for K23 will be broken at the transfer strap of S4. This is a make-before-break contact and the non-print relays will again be held (after the read control relay has dropped out) until the last code sensed by the reader has been punched and the S4 switch released.

Automatic Non-Print Circuit.

A non-print operation on the Flexowriter can be initiated automatically by a non-print code in the tape. By-passed codes will be punched if the Flexowriter punch or the motorized punch is on at the time the NP code is read. Automatic non-print operation is restored to normal printing by a PR code which does not stop the reader. This differs from the manual operation of the non-print switch which is stopped by a stop code.

Assume that the reader is in normal operation and that a non-print code (234 Figures) in the tape is read. Delay control relay #2 (K20) will be energized: -DC, TC6, JRL, RTC, RC5, RC4, RC3, RC2, RC1, JRV, CSC- 11 and 12, TB17, K12- 5 and 6, K22- 2 and 1, K20 coil, TC5, to + DC. The holding circuit for K20 is: -DC, TC6, JRL, RTC, JRU, TB20, K11- 5 and 4, K20- 4 and

3, K20 coil, TC5, to + DC.

When K20 is energized, the circuit to the reader magnet (LR) is momentarily broken (open contact K20- 1 and 2).

As the delay control relay #2 (K20) was being energized, the non-print code 234 (Figs.) was also effecting translator operation, tripping the NP keylever, and closing selector contact SC9. The automatic non-print relay (K13) will now pick-up: -DC, TC6, SC9, TA8, K23- 6 and 5, K13 coil, TC5, to +DC.

K13 is held energized through; -DC, TA26, K14- 1 and 2, K13- 1 and 2, K13 coil, TC5, to + DC.

The non-print relays are now energized: -DC, TA26, K13- 4 and 3, K14- 4 and 3, K10 and K11 coils, TC5, to + DC. Note that the manual non-print relay (K15) is not energized.

The reader magnet will again be energized when K11- 5 and 6 contacts open and drop out DCR #2 (K20).

With the non-print relays energized, the circuit to the translator magnets LT1 through LT5 are broken, thereby preventing keyboard operation.

When reading a stop code, the K23 relay does not drop out as was the case in the Manual Non-Print operation. The holding circuit for K10 and K11 also holds K23.

Non-printing continues until the reader senses the 1-2-3-4 (Figures) print restore code, which operation energizes the print restore relay: -DC, TC6, JRL, RTC, RC5, RC4, RC3, RC2, RC1, JRW, CSC - 5 and 6, TB10, K12- 3 and 4, K15- 1 and 2, K14 coil, TC5, to + DC. K14 is held energized: -DC, TC6, JRL, RTC, TC20, K11- 5 and 6, K14- 15 and 16, K14 coil, TC5, to + DC.

With K14 operated, its contacts 1 and 2 open, dropping out K13. Also, K14- 3 and 4 contacts open breaking the original circuit to K10 and K11, however a temporary holding circuit to different coils of K10 and K11 will be established through a normally open contact of RCC. This circuit will be in effect until the reading pins return to non-operate position after reading print restore code.

The K23 read control relay will not drop out when the K14 relay picks-up due to the closing of K14- 13 and 14 contact. Even though K14 drops out at the completion of the reader cycle (RCC opens, K10 and K11 drops out, K11- 5 and 6 breaks holding circuit to K14), K23 will remain energized through its own contact 1 and 2. Thus, normal reading and printing will be restored.

CIRCUIT DESCRIPTION

The following circuit description is for the Flexowriter Edge-Card Programatic Model FPC-8, single case, and is based on schematic wiring diagram 1041109. (Figure 5-1)

The Power Circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet

When the power switch (S1) is in the On position, the key lock magnet (LKL) is energized as follows: -DC, TC6, JL11, JL12, JPL, PTC, JPM, TA16, K3 - 3 and 4, TA15, LKL, TC5, +DC. Notice that this circuit is through a normally closed contact of the punch error relay (K3- 3 and 4). If the K3 relay is energized, the Key Lock Magnet circuit is broken, locking the keyboard. See Punch Checking Circuit on page 5-2.

PUNCH CONTROL CIRCUITS

Punch All

With the punch switch (S2) in the ALL position, the Flexowriter is conditioned to record all codes in the tape. When the punch control relay (K9) is energized, circuits to the punch magnets and to the punch clutch may be completed simultaneously. K9 is energized as follows: -DC, TC6, S2 (inside), JL22, JL21, TB33, K9 Coil, TC5, +DC. A D.C. Circuit is complete to the punch on indicating light when K9 is energized: -DC, TC6, TB19, K9 - 1 and 2, TB36, Lamp I, TC5, +DC.

Punch Magnet Circuit

When a keylever, other than On 1, On 2, or Off is depressed, one or more of the selector code contacts will close, followed by the selector common contact (SCC), energizing the punch magnets and clutch magnet.

For an example circuit, assume that the "1" character keylever was depressed. A D.C. circuit would be completed to the LP1 magnet: -DC, TC6, SCC, TA24, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 14 and 13, K3 - 2 and 1, TA1, SC1, TA2, K9 - 5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC.

The circuit to the punch clutch is in parallel with that to the code magnets: -DC to K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC.

Selector contact SC7 is the "common" contact for punching On 1, On 2 and Off codes.

Punch Select

With the punch switch (S2) in the SEL position the Flexowriter is conditioned to type only, until the On 1 keylever is de-

pressed. On 1 turns on the Flexowriter punch but does not record the code in the tape. Suceeding keylever operations will be recorded, however, until Punch Off is depressed.

When On 1 is depressed, the punch select relay (K16) is energized: -DC, TC6, SC8, TB34, K16 Coil, TC5, +DC. The holding circuit for K16 relay: -DC, TC6, S2 (inside), punch off contacts (POC) 1 and 2, TB 35, K16 - 4 and 5, K16, TC5, +DC. With K16 energized, a circuit will be complete to the punch control relay, K9: -DC, TC6, POC 4 and 3, TB40, K16 - 14 and 15, TB 31, JL22, JL21, TB33, K9 coil, TC5, +DC.

When it is necessary to turn the punch off, the Punch Off keylever is depressed breaking the holding circuit to the punch select relay (K16) at the contacts POC 1 and 2. The holding circuit for the punch control relay (K9) will be broken when K16 - 14 and 15 open.

Anti-Repeat Circuit

See Punch Checking Circuit

Punch Checking Circuit

Sticking selector slides, malformed slides and excessive manual keyboard speed (improper keyboard operation) make it possible to obtain a typed character without its corresponding code if the selector common contacts (SCC) remain closed too long. To prevent this, a punch checking circuit becomes operative if the anti-repeat relay (K2) is held energized.

When the K2 relay is energized and the PLC contacts have returned to normal, a circuit will be complete to the punch error relay (K3): -DC, TC6, SCC, TA24, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 15 and 16, K10 - 2 and 1, K8 - 3 and 4, K7 - 3 and 4, K6 - 3 and 4, K3 coil, TC5, +DC. The holding circuit for K3: -DC, TC6, TB19, K5 - 3 and 4, K4 - 6 and 7, K3 - 15 and 16, K3 coil, TC5, +DC. Contacts 5 and 6 of the K3 relay break the K2 holding circuit; contacts 1 and 2 break the punch circuits; contacts 3 and 4 open the circuit to the key lock magnet (LKL) and the keyboard becomes inoperative. Tape Feed operation is required to drop out K3 and unlock the keyboard.

It should be noted, that because a long operator is used to operate the SCC contacts, the pulse to the anti-repeat relay may not be long enough to actually pick-up the anti-repeat relay. However, it is not essential that the anti-repeat relay actually picks-up on each operation, because as stated, if there is a long pulse to the anti-repeat relay, then a circuit will be complete to the punch error relay, thus locking up the keyboard.

Tape Feed - Card Feed Circuit

Depression of the Tape Feed panel switch (S10) will punch a seven channel delete

code when tape is in the punch. With a card in the punch, depression and release of the Tape Feed switch will allow the card to feed through the punch automatically (with a blank code only) until the hole in the next card permits the card feed micro-switch to restore.

When the S10 switch is depressed with tape in the punch, the tape feed relay (K5) is energized: -DC, TC6, N/O S10, JPU, N/C card feed switch, JPV, TA22, K4 - 4 and 3, K2 - 2 and 1, K5 coil, TC5, +DC. With K5 energized circuits will be complete to the punch clutch magnet and to the punch magnets (except LP8): -DC, TC6, TB19, K5 - 4 and 5, K4 - 13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2 - 14 and 13, K3 - 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5, +DC and from K3 - 2 and 1, K5 - 6 and 7, 8 and 9, 11 and 12, 13 and 14, 15 and 16, 17 and 18, 19 and 20, K9 - 5 and 6, 7 and 8, 9 and 10, 11 and 12, 13 and 14, 15 and 16, 17 and 18, TB 2 - 3 - 4 - 5 - 6 - 7 - 8, LP1 - 2 - 3 - 4 - 5 - 6 - 7, JPX/JPY, TC5, +DC. A holding circuit is provided for K5 to insure that all code magnets will be energized regardless of when the Tape Feed switch is released: -DC, TC6, TB19, K2 - 12 and 11, K5 - 1 and 2, K5, TC5, +DC. When K2 is energized, its contact 11 and 12 will open breaking the K5 holding circuit. K2 will have a holding circuit, however, through its contact 18 and 17 only until K5 drops out opening its contacts 5 and 4.

With a card in the punch, the operate strap of the card feed micro-switch will be transferred, so that when the S10 switch is depressed the card feed relay (K4) will be energized: -DC, TC6, N/O S10, JPU, C.F. Micro Switch, JPW, TA21, K4 coil, TC5, +DC. K4 is held: -DC, TC6, TB19, K4 - 16 and 17, TA 25, JPU, card feed switch, JPW, TA 21, K4, TC5 + DC. When the S10 switch is released a circuit will be made to LPC: -DC, TC6, N/C S10, TA23, K4 - 15 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2- 14 and 13, K3 - 2 and 1, K9 - 3 and 4, TB1, JPK, LPC, JPX/JPY, TC5 + DC. The punch clutch will continue to cycle the card through the punch until either the end of a card or the hole in the next card allows the card feed switch to restore. Contacts 18 and 19 of K4 provide that the relay will be held long enough to energize the clutch and drive the card to the proper punching position.

Error Code Circuit

This circuit is used to punch a 1-2-4-8-X code in the tape which, when read, will not cause any operation of the Flexowriter. Operation of the Error Code panel switch (S9) will energize the error code relay (K6): -DC, TC6, N/O S9), TA32, K6 coil, TC5, +DC. With K6 energized circuits will be complete to LP1, LP2, LP3, LP4, and LP7

and the punch clutch in the same manner as explained in the Tape Feed Circuit.

As long as the S9 switch is held depressed, only one cycle of the punch can occur because the anti-repeat relay (K2) has been energized. The K2 relay will remain energized through its contacts 18 and 17, K6 - 7 and 6, and N/O S9 until the error code switch is released. The break contacts 3 and 4 of K6 prevent the punch error relay (K3) from locking the keyboard during this operation.

Print Restore Code Circuit

The print restore code (4-8-0) is perforated in the tape when the S8 panel switch is depressed. This code, when read by the reader, will restore the Flexowriter to normal printing condition only when non-print operation was initiated by a Non-Print code in the tape, or by depression of the Tape Skip panel switch.

With the S8 panel switch depressed the print restore code relay is energized: -DC, TC6, N/O, S8, TA33, K7 Coil, TC5, +DC. Punch and anti-repeat circuits correspond with the error code circuits previously explained.

Stop Code Circuit

When the Stop Code panel switch (S7) is depressed, a 1-2-8 code will be perforated in the tape, which, when read in the reader, will automatically stop reader operation. Operation of the S7 switch energizes the stop code relay (K8): - DC, TC6, N/O, S7, TA34, K8 coil, TC5, +DC. When the K8 relay is energized, the LP1, LP2 and LP4 punch magnets and clutch magnet are energized in the same manner as explained in the Error Code Circuit.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits

The Start Read switch (S3), when depressed and released will energize the tape reader magnet (LR) and start a cycle of reader operation. To energize the reader magnet, when the S3 switch is depressed, a circuit is first completed to the reader control relay (K23): -DC, TC6, JRL (JRL connected to JRV; RTC contact not in card reader), RTC, RC 1 N/C -RC2 N/C -RC4 N/C, JRR, TA10, K3-11 and 12, TA20, N/O S3, TA39, K23 coil, TC5, +DC. When K23 contacts 1 and 2 close a holding circuit for K23 is maintained: -DC, TC6, JRL, RTC, RC1-2-4 (N/C), JRR, TA10, K3-11 and 12, TA20, S4 N/C, TA28, K23-1 and, K23 coil, TC5, +DC. When the S3 switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, RC1-2-4 (N/C), TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC-1 and 2, TA19, K23-4 and 3, K21-2 and 1, K20-1 and 2, TA29, JRK, LR, JRX/JRY, TC5, +DC.

The reader will operate continuously

until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or manually, by depressing the Stop Read switch (S4).

When the S4 switch is depressed, the holding circuit to the reader control relay (K23) is broken. Thus, when K23 contacts 4 and 3 open, the reader magnet is de-energized and the reader will stop.

Translator Magnet Circuits

When a reader pin senses a code in the tape, a corresponding reader contact closes and completes a circuit to the relative translator magnet.

For an example circuit, assume that a 1-2 code is read in the reader tape. The translator magnets LT1 and LT2 will be energized: -DC, TC6, RTC (RTC omitted in Card Reader - JRL is connected to JRU circuit), JRV, TB20, K12-17 and 18, TB30, JRT, RC1 and RC2, JRA and JRB, TB22 and TB23, K10-12 and 11, K10-15 and 14, TB12 and TB13, JTA1 and JTA2, LT1 and LT2, TC5, +DC. With pin operation the reader common contact (RCC) closed and completes a circuit to the translator clutch: -DC, TC6, RTC, RCC, JRP, TB21, K10-5 and 4, TB11, JTA6, LTC, TC5, +DC.

Delay Control Circuit

It is essential to have an automatic delay control circuit incorporated in the Flexowriter in order to delay the operation of the tape reader until a function in the Writing Machine has been completed. Two functions which require more operating time than the regular characters are carriage return (EL code) and tabular (2-4-8-CH-O) code. The back space mechanism is for manual operation only (uncoded).

When Tab 2-4-8-CH-O is read in the reader a circuit is completed to the delay control relay #1 (K21): -DC, TC6, RTC, RC1, RC3, RC4, RC7, RC6, RC5, JRS, TA30, K22-11 and 12, K12-11 and 12, K21 coil, TC5, +DC. When K21 is energized, contact strap 2 breaks with 1 and makes with 3. The energizing circuit to the reader magnet (LR) is broken, thus LR drops out and the reader stops. Since the read control relay (K23) remains energized, K21 will have a holding circuit: -DC, TC6, RTC, RC1, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC 1 and 2, TA19, K23-4 and 3, K21-2 and 3, K12-11 and 12, K21, TC5, +DC.

Assuming that Tab code, 2-4-8-CH-O, was read, then, at the same time the above circuit was complete to K21, a circuit would also be complete to the translator magnets LT2, LT3, LT4, LT5, LT6 and LTC. The translator would operate, pull down the tab keylever and initiate a tabular function. The operation of the tab mechanism would open CRTC and break the holding circuit to K21. The K21 contacts would return to their normal position, but the circuit to the reader magnet would not be complete until

the carriage tab stop struck the tab lever and unlatched the tab mechanism. When this occurs, the CRTC contact closes and completes the energizing circuit to the reader magnet, starting reader operation again.

Should the reader read the CR code, EL, K21 will again be energized until the opening of CRTC drops out K21's holding circuit. In this instance, K21 is energized by operation of RC8: -DC, TC6, RTC, RC8, RC2, JRM, TB10, K12-11 and 12, K21 coil, TC5, +DC.

Therefore, when a Tab or CR code is read by the reader, reader operation will automatically stop and will not start again until the particular function is complete.

Stop Code Circuit

When a stop code 1-2-8 is read by the reader, the holding circuit for the K23 relay (read control) will be broken, thus, de-energizing the reader magnet and stopping reader operation. Normally closed contacts on RC1, RC2 and RC4 complete the holding circuit through K23 contact 1 and 2 to the K23 coil. If all three contacts (RC1, RC2 and RC4) were to open simultaneously, the K23 relay would de-energize, open contact K23-4 and 3, and break the circuit to LR. The start read switch (S3) would have to be depressed to start the reader operation again.

Normally open contacts on RC3, RC6 and RC7 provide alternate holding circuits for K23 when 1-2-8 is used in combination with other code units.

Tape Skip Circuit

The Tape Skip switch (S6) allows sections of tape to pass through the reader without operating the Flexowriter. Tape cycles through the reader only until a Print Restore Code (4-8-0) is read, which restores normal printing and punching operation automatically without stopping the reader. If carriage return codes are read during tape skip operation, the carriage will return and line space the form. When the Flexowriter punch or the motorized punch is on at the time of pressing the tape skip switch, only the carriage return code will be punched.

Operation of the Tape Skip switch (S6) will energize the reader magnet (LR) and start a cycle of reader operation. LR is energized: -DC, TC6, JRL, RTC, RC1-RC2-RC4 (N/C), JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, operated S6, TA18, K22 coil (tape skip relay), TC5, +DC. K22 relay is held energized: -DC, TC6, JRL, RTC, JRU, TB20, K14-5 and 6, K22-5 and 6, K22 coil, TC5, +DC. When the S6 switch is allowed to return to its normally closed position, the reader magnet is energized: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K22-3 and 4, K21-2 and 1, K20-2 and 1, TA29, JRK,

LR, JRX/JRY, TC5, +DC.

As the reader cycles, the reader common contact (RCC) will close and energize translator magnet 5 (LT5) and the translator clutch (LTC). When LT5 is energized, a permutation bar will be released in the translator and prevent the selection of any keylevers except carriage return. Negative power to LT5 and LTC: -DC, TC6, JRL, RTC, operated RCC, JRP, TB21, K22-16 and 15, TA40, JTB1, LT5 coil, JTA5/JTB5, TC5, +DC. Also, from -DC, TC6, JRL, RTC, operated RCC, JRP, TB21, K10-5 and 4, TB11, JTA6, LTC coil, JTA5/JTB5, TC5, +DC.

Assuming that a Carriage Return code (EL) is read in the reader, LTC and LT5 will be energized, and in addition LT8: -DC, TC6, JRL, RTC, JRU, TB20, K12-18 and 17, TB30, JRT, operated RC8, JRJ, TB29, K12-15 and 14, TB18, JTB4, LT8 coil, TC5, +DC. To delay reader operation until the carriage return function is complete, the delay control relay (K21) will also be energized: -DC, TC6, JRL, RTC, operated RC8, N/C RC2, JRM, TB10, K12-11 and 12, K21 coil, TC5, +DC. When K21 picks up it will be held: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K22-3 and 4, K21-2 and 3, K12-11 and 12, K21 coil, TC5, +DC. When the carriage return clutch toggle locks up, CRTC will open and drop out K21. When the carriage return function is complete CRTC will close and LR will again be energized.

Tape skipping operation will continue in the reader until a P. R. code 4-8-0, which when read, will cause the print restore relay to pick up, drop out the tape skip relay and energize the read control relay for further reader operation.

When 4-8-0 is read, the print restore relay (K14) is energized: -DC, TC6, JRL, RTC, N/C contact RC1, operated RC3, RC4, N/C RC7, operated RC6, N/C RC5, JRW, TB38, K15-1- and 2, K14 coil, TC5, +DC. K14 has no holding circuit in this instance and will drop out when the reader contacts restore. When contact 5 and 6 of K14 opened, the holding circuit to K22 was broken and the tape skip relay dropped out. At the same time, however, negative was being applied to the read control relay (K23): -DC, TC6, JRL, RTC, JRU, TB20, K14-13 and 14, K23 coil, TC5, +DC. K23 is again held through its 1 and 2 contact. The circuit to LR is still complete: -DC, TC6, JRL, RTC, RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, N/C S5, N/C S6, CRTC, TA19, K23-4 and 3, K21-2 and 1, K20-2 and 1, TA29, JRK, LR, JRX/JRY, TC5, +DC. Since the tape skip relay (K22) is no longer energized its open contact 15 and 16 no longer energize LT5, therefore, all characters are allowed to print.

Manual Non-Print Circuit

The non-print switch (S5) will also allow sections of tape to pass through the reader without causing any operation of the Flexowriter. Tape cycles through the reader only until a stop code (1-2-8) is read, for the stop code is the only code recognized during this operation. The stop code is first reproduced automatically before stopping the reader. Non-Print operation can be terminated at any time by pressing the Stop Read switch. Although by-passed codes in the tape cause no operation of the Flexowriter, these codes can be reproduced by the Flexowriter punch or the motorized punch.

Manual operation of the Non-Print switch (S5) will energize the non-print relays and the read control relay: -DC, TC6, JRL, RTC, N/C RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S3, operated S5, TB37, K15 coil of manual non-print relay, K15-13 and 12 (now closed), coils of K10, K11, K12, TC5, + DC. When K12 picks up, voltage will be on its contact 5 and 6, K14-11 and 12 and K23 will be energized. With K23 energized a holding circuit will be complete to the read control relay and to the non-print relays: -DC, TC6, JRL, RTC, N/C RC1-2-4, JRR, TA10, K3-11 and 12, TA20, N/C S4, TA28, K23-1 and 2, K23 coil, TC5, + DC. When the non-print switch is released negative from K23-1 and 2 will be in parallel to K14-11 and 12, K12-5 and 6, K12, K11, K10 coils, TC5, DC. The manual non-print relay (K15) and LR will be energized when K23-1 and 2 close. The energized non-print relays now prevent negative from reaching the translator, hence no printing occurs.

If punching tape is required on manual non-print operation, the punch control relay (K9) will be energized and the DC potential on the reader contacts will come from the punch. Assuming that the reader is in operation and that the character "1" is read, the punch magnets and clutch will be energized as follows: -DC, TC6, JRL, RTC, RCC, JRP, TB21, K10-5 and 6, K4-13 and 14, TA17, JPP, PLC, JPR, JL14, JL15, TA14, K2-14 and 13, K3-2 and 1, K12-18 and 19, TB30, JRT, operated RC1, JRA, TB22, K10-12 and 13, K9-5 and 6, TB2, JPA, LP1, JPX/JPY, TC5, +DC. Also, from contact 1 and 2 of K3, K9-3 and 4, TB1, JPK, LPC, JPX and JPY, TC5, + DC.

Tape duplication will occur until a stop code is read in the reader, at which time the read control and non-print relays will be dropped out. When the reader reads 1-2-8 the N/C RC1, RC2, RC4 contacts open and break the holding circuit to K23. As RC1-2-4 break, however, a contact on RCC makes and negative power is allowed to maintain the non-print relays (through different coils) until the Stop Code has

been punched. From -DC, TC6, JRL, RTC, operated RCC contact, JRN, TB39, K12-2 and 3, K12 - K11 - K10 coils, also K15 - 4 and 5, K15 coil, TC5, + DC. When the reader pins reset these relays will drop out. Break contact 1 and 2 on K15 prevented picking up the print restore relay (K14) in the event a P. R. code was non-printed.

If the reader has been started by Manual non-print operation, it may be stopped by depressing stop read. In this instance, the holding circuit for K23 will be broken at the transfer strap of S4. This is a make-before-break contact and the non-print relays and K15 will again be held (after the read control relay has dropped out) until the last code sensed by the reader has been punched and the S4 switch released.

Automatic Non-Print Circuit

A non-print operation on the Flexowriter can be initiated automatically by a non-print code in the tape. By-passed codes will be punched if the Flexowriter punch or the motorized punch is on at the time the N.P. code is read. Automatic non-print operation is restored to normal printing by a P.R. code which does not stop the reader. This differs from the manual operation of the non-print switch which is stopped by a stop code.

Assume that the reader is in normal operation and that a non-print code (4-8-CH) in the tape is read. Delay control relay #2 will be energized: -DC, TC6, JRL, RTC, N/C RC1, operated RC3, operated RC4, N/C RC7, N/C RC6, operated RC5, JRV, TA26, K22-1 and 2, K20 coil, TC5, + DC. K20 will be held: -DC, TC6, JRL, RTC, JRU, TB20, K12-8 and 7, K20-3 and 4, K20 coil, TC5, + DC. The circuit to LR will now be broken by the open contact K20-1 and 2, and the reader will momentarily stop.

As delay control relay #2 was being energized, the non-print code 4-8-CH was also effecting translator operation, tripping the N.P. keylever, and closing selector contact SC6. The automatic non-print relay (K13) will now pick up: -DC, TC6, SC6, TA27, K23-6 and 5 (only the reader magnet has dropped out), K13 coil, TC5, + DC. K13 remains locked up: -DC, TC6, TB19, K14-1 and 2, K13-1 and 2, K13 coil, TC5, + DC. The non-print relays are now energized: -DC, TC6, TB19, K13-4 and 3, K14-4 and 3, K10, K11, K12 coils, TC5, + DC. Holding circuits for these relays will be complete when K12-5 and 6 close. Note that the manual non-print relay is not energized. The reader magnet will again be energized when K12 contacts 7 and 8 open and drop out DCR #2 (K20).

Non-printing continues until the reader senses the 4-8-0 print restore code, which operation energizes the print restore relay: -DC, TC6, JRL, TRC, RC1 N/C, operated

RC3, operated RC4, N/C RC7, operated RC6, JRW, TB38, K15-1 and 2, K14 coil, TC5, +DC. K14 is held: -DC, TC6, JRL, RTC, JRU, TB20, K12-8 and 9, K14-15 and 16, K14 coil, TC5, +DC. With K14 operated its contact 1 and 2 opens dropping out K13; contacts 3 and 4, open dropping out K10, K11 and K12. When contact 8 and 9 of K12 open the holding circuit for K14 is broken, but the read control relay has been held energized and normal reading and printing is now restored.

MANUAL ADDENDUM

Date: March 26, 1958

Reference: To be inserted in Part VI, after Section 5

Subject: F P C - 8 Programatic Duplex

Purpose: Circuit Description (Wiring Diagram 1043042)

Information:

NON-DUPLEX OPERATION (Switching Codes Ignored)

Start Read - This operation can be initiated in either reader, independently, by depressing the respective start read switch. Negative will be applied to the start read switch 1: TC7, TA26, K3 - 12 and 11, JRL, STT, SRT (#2 reader), TB10, start read switch. Depression of the switch will cause RR1 (K22) to be energized but not held. RRC1 (K3) is now energized: TB10 (-), TA32, K22 - 3 and 4, K3. RRC (K2) is also energized through K22 - 1 and 2. With K2 picked up K3 will have a holding circuit through its contacts 16 and 15 and K2 - 4 and 3. K2 is held through K2-2 and 1 and the N/C Duplex Clear Switch.

When the Start Read 1 Switch is released, RDC2 (K16) is energized. Its contacts close and the reader magnet (LR) picks up; tape is read in #1 reader.

If a C.R. or Tab code is read RCD 1 (K17) will pick up and hold, drop K16 and LR and delay reader. SCRT will drop K17 when open. Termination of function will allow K16 and LR to re-energize.

Stop Read - If Stop Read switch is fully operated while the reader is operating, RSC (K18) will energize and hold, breaking the circuit to LR. Operation of either Start Read 1 or Start Read 2 switches will allow the stopped reader to continue by dropping out K18. K16 also drops out until the Start Read switch is restored. The same circuit would apply if the reader read a stop code.

Start Read 2 - If the #1 reader is reading and stopped and it is desired to read from the #2 reader, the Duplex Clear switch must first be operated and then the Start Read 2 switch. Duplex Clear switch will cause K3 and K2 in the above Start Read operation to drop out. Pressing

Start Read 2 will energize RR2 (K21) which will allow RRC2 (K4) and K2 to energize. Both relays will hold, K16 and LRC will then energize; the indicating lamp will be on.

Auto Non-Print - When a N.P. code is read SS6 closes and RANP (K7) picks up and is held. Negative on K7-15 and 16 will pick up RNP (K5, K10, K11). RDC 1 (K17) also picks up and delays the reader by dropping K16 and LR. When K5 is energized, K16 is re-energized and LR picks up again. The closure of SRC contacts provide negative through K5-3 and 2 to the reader contacts and the punch magnets.

Reading of the PR code (4, 8, 0) restores the reader to normal reader operation by energizing RPR (K8) which holds until K7 drops out. Secondary SRC contacts hold the NP relays long enough to punch the PR code.

Manual Non-Print - This operation is initiated by first operating and holding the Start Read Switch for the desired reader, then operating the Non-Print Switch, and releasing both together.

1. Press Start Read: Energize RR1, RRC1, RRC. K3 and K2 hold.

2. Press Non-Print: Energize RMNP (K6) and K5, K10, K11. NP relays will be held through K6- 4 and 5.

When both switches are released, K16 will pick up and energize LR.

The Non-Print operation will continue until the reading of a Stop Code or operation of the Stop Read Switch. If a Stop Code is read, RSC (K18) will pick up, hold, and drop out LR. K18 - 11 and 12 will also drop out the NP relays. The SRC secondary again supports the RNP's while K18 breaks their hold circuit. The Stop Code is punched. Depression of either Start Read Switch or Non-Print will drop K18 and allow reading or non-printing to continue. If, at this time, the other reader is desired, the Duplex Clear Switch must be operated first, the desired reader selected, and the Non-Print switch operated.

Skip Operations - The Flexowriter may be wired for four different skip operations.

1. Tape Skip (Connections 1 and 5) restores to normal reading on Print Restore Code. All operations are ignored except Carriage Return. Operation is initiated by depressing Start Read Switch,

the Skip Switch and allowing both to restore. Start Read Switch 1 energizes K22, K3, K2. Skip Switch energizes RS (K9) and it is held through Connection 1. Start Read Switch restored allows K16 to pick up and energize LR. Operation of LT5 allows translator selection of C.R. only. Open K9- 14 and 15 contacts prevent energizing K17 on a NP or Tab Code in Tape Skip.

Print Restore Code restores operation to normal: K8 picks up, not held, but drops K9. LT5 no longer operates and Flexowriter prints.

2. Line Skip 1 (Connections 2 and 5) restores to normal reading on Carriage Return Code. Only On 1, On 2, Off, C.R., Ltrs. and Figs. keys are selected. Operation is initiated as in Tape Skip. K9 is held through Connection 2. When a C.R. code is read K17 will pick up, delay reader and drop out K9. SCRT will drop K17 and allow normal operation to continue.

3. Line Skip 2 (Connections 2, 4 and 5) stops Flexowriter on a C.R. Code. LT5 allows key selection as in Line Skip 1. Operation is initiated as in Tape Skip. K9 is energized and held through Connection 2. When a C.R. Code is read K17 will pick up and drop out K9. In addition (through connection 4) RSC (K18) will be energized and held through the Start Read Switch. SCRT will drop out K17, but LR will be de-energized until depression of the Start Read Switch drops out K18.

4. Special Skip (Connections 3 and 6) restores to normal reading on Skip Restore Code (1-4-8). LT5 prevents selection of all keys. Operation is initialed as in Tape skip. K9 is energized and held through Connection 3. When a Skip Restore Code is read K10 will pick up and drop out K9. LT5 will no longer operate and normal operation will continue. Connection 6 allows normal delay operation on Carriage Return.

Duplex Operation (Switching Codes Recognized)

All operations are the same in Duplex as in non-Duplex except that the switching codes will be recognized and the readers will switch in the normal reading operation. The switching codes will not be recognized in Manual and Automatic Non-Print or Skip. The switching code is 1-4-8-CH-0 (5 over Z).

With negative from SRT (#2 reader) and the Duplex Switch operated

RD (K23) will be energized. Start Read operation may then be initiated in either reader.
If tape is being read in the Flexowriter Reader, read control relays K3 and K2 will be energized. When the reader reads a switch code K23- 2 and 1 will allow RS2 (K19) to pick up. K19 - 4 and 3 will then pick up K4, which will drop K3. Open K4 - 5 and 6 will also drop LR, and the Flexowriter Reader will stop. K3 - 3 and 4 will hold K4. Since K19 has no holding circuit a circuit will now be complete to the Motorized Reader (#2) clutch magnet: - DC, SRT, K2-5 and 6, K19- 2 and 1, K4 - 14 and 13, K3 - 5 and 6, K18 - 1 and 2, K16 - 3 and 4, STC, LRC, plus DC.

A switch code now read in #2 reader will energize RS 1 (K20), which will in turn energize K3. K3 will drop K4 and establish a holding circuit through K4- 4 and 3. K3 - 5 and 6 will drop LRC, but LR will be re-energized: -DC, SRT (#2), K2- 5 and 6, K20 - 1 and 2, K3 - 14 and 13, K4- 6 and 5, LR, plus DC.

General

Switch Reader Tape - In the Non Duplex condition, either reader can operate without having tape in the other reader. The SRT contacts are spring-loaded and will open without tape in the reader. Reading operation can only occur in the reader with tape.

For example, with tape in the #2 reader only, and the Start Read #2 depressed K4 and K2 would be energized and held: -DC, TC7, TA29, K3-11 and 12, TA33, SRT (#2 reader), N/C Start Read 1 Switch, operated Start Read #2 switch, K21 coil, plus DC. K4 and K2 are energized and held. Holding circuit for K2: -DC, TC7, TA29, K3-12 and 11, TA33, SRT (#2 reader) TB10, N/C Duplex Clear Switch, K2- 2 and 1, K2 coil, plus DC.

In the Duplex condition, when a switching code switches to a reader that does not have tape in it, all operations will stop. In the above, if a switching code was read in the #2 reader K4 would drop out, but K3 and K2 could not be held. However, if the Flexowriter Reader is Edge Card, switching to it when there is no tape or card in it will not stop the operation.

USED ON ASSEM. | QTY. | 1041201

ISSUE	DATE	CHANGE NO
	1-17-56	14860
	3-16-56	14860A
	3-26-56	14959

SCC - ALL EXCEPT - NUM. - DASK - DIA. - AMP - DOLLAR
SC7 - NUM. - DASH - DIAG. - AMP - DOLLAR

EL X O CH 8 4 2 1
○○○○○ • ○○○
CODE SEQUENCE

GUIDE EDGE

K2	1055841	K13	
K3	1054055	K14	
K4	1057519	K15	
K5	1057519	K16	
K6	1057519	K17	
K7	1053297	K18	
K8		K19	
K9		K20	
K10		K21	
K11		K22	1053729
K12		K23	1053728

MAIN CABLE - 1041202
RELAY WIRING - 1041203
READER WIRING - 1041204
PUNCH WIRING - 1058153

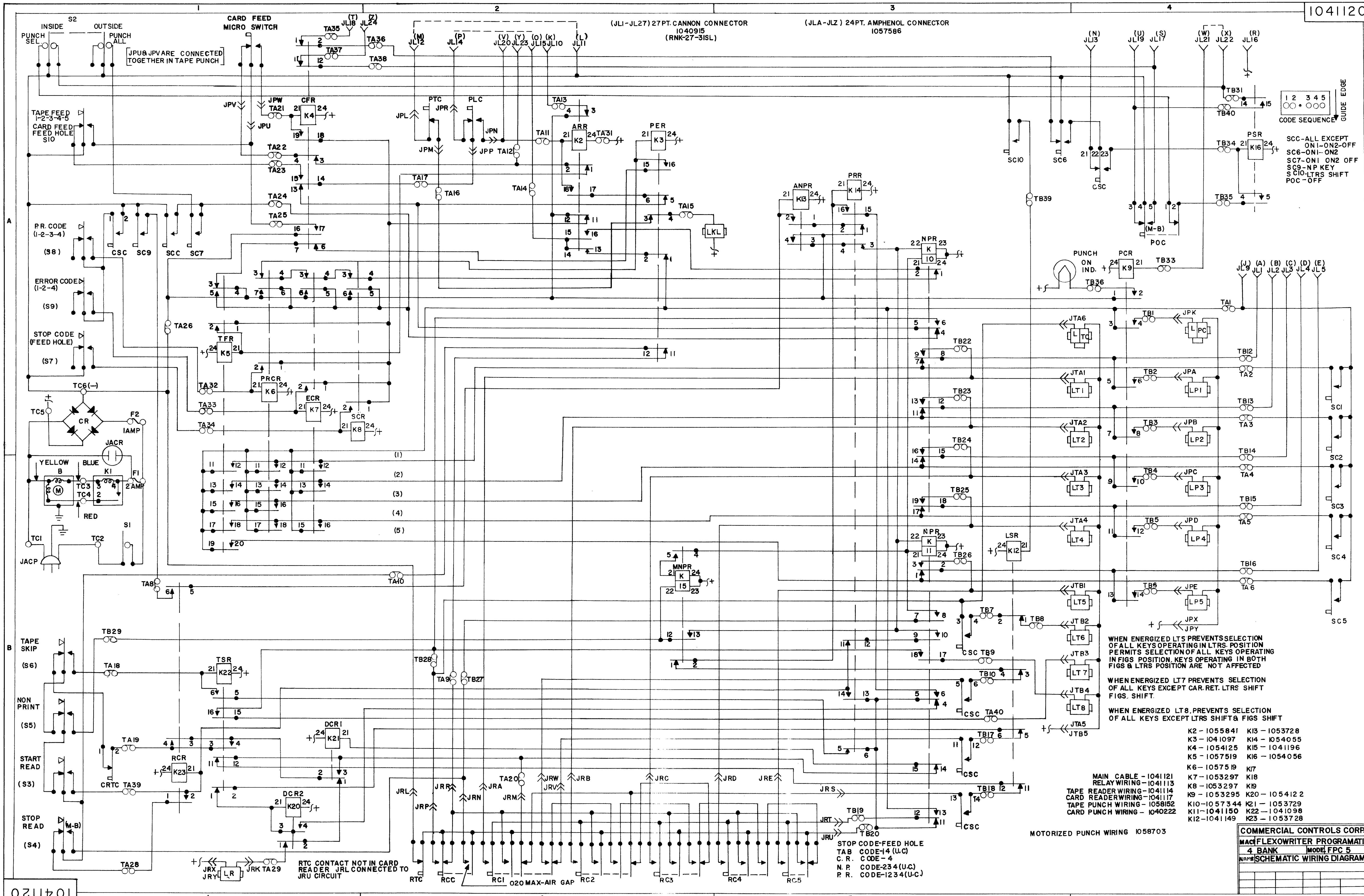
STOP CODE - 1-2-8
TAB CODE - 2-4-8-CH-0
CAR. RET. CODE EL.

MATERIAL SPECIFICATION		TOLERANCE UNLESS OTHERWISE NOTED	ALIGNMENT WITHIN TOT. IND. READING NOTE I
CASE DEPTH		DECIMALS ±.005	CONCENTRIC WITHIN TOT. IND. READING NOTE II
HARDNESS		FRACTIONS ±1/64	FLAT WITHIN TOT. IND. READING NOTE III
SURFACE TREATMENT	SPEC. No.	ANGLES ±2°	PARALLEL WITHIN TOT. IND. READING NOTE IV
	TECH. RESEARCH APPRO. DATE	CORNERS MAY BE BROKEN OUTSIDE / INSIDE	STRAIGHT WITHIN TOT. IND. READING NOTE V
			SQUARE WITHIN IN INCHES NOTE VI

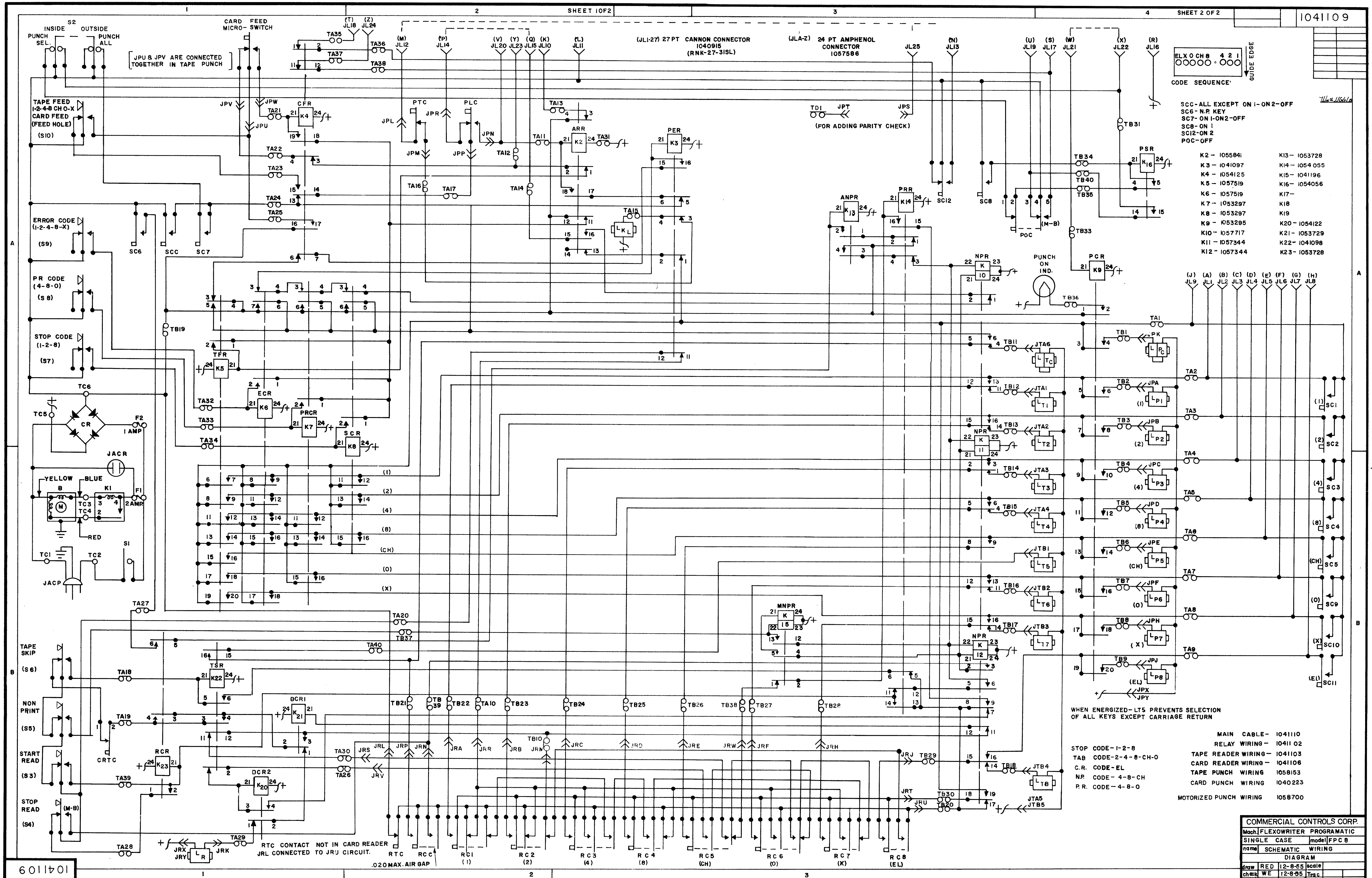
COMMERCIAL CONTROLS CORP

MACH.	FLEXOWRITER REC. REP.
	DOUBLE CASE MODEL FPC 8
NAME	SCHEMATIC WIRING DIAGRAM
DRAW.	RED 1-17-56 SCALE
CHECK	WE 1-17-56 TRAC.
APPRO.	CHECK

FORM NO.



1041120
(JL1-JL27) 27 PT. CANNON CONNECTOR
1040915
(RNK-27-31SL)
(JLA-JLZ) 24 PT. AMPHENOL CONNECTOR
1057586
JPU8 JPV ARE CONNECTED TOGETHER IN TAPE PUNCH
CARD FEED MICRO SWITCH
PUNCH SEL
INSIDE
S2
OUTSIDE
PUNCH ALL
TAPE FEED 1-2-3-4-5
CARD FEED FEED HOLE S10
P.R. CODE (1-2-3-4)
(S8)
ERROR CODE (1-2-4)
(S9)
STOP CODE (FEED HOLE)
(S7)
CSC
SC9
SCC
SC7
CFR
K4
ARR
K2
PER
K3
TFR
K5
PRCR
K6
ECR
K7
SCR
K8
ANPR
K13
PRR
K14
NPR
K10
K11
LSR
K12
MNPR
PCR
K9
PSR
K16
TSR
K22
RCR
K23
DCR1
K21
DCR2
K20
LKL
CR
F2 1AMP
F1 2AMP
JACR
YELLOW
BLUE
RED
K1
JACP
S1
TAPE SKIP
(S6)
NON PRINT
(S5)
START READ
(S3)
STOP READ
(S4)
PUNCH ON IND.
CODE SEQUENCE
GUIDE EDGE
SCC-ALL EXCEPT ON1-ON2-OFF
SC6-ON1-ON2
SC7-ON1 ON2 OFF
SC9-NP KEY
SC10-LTRS SHIFT
POC-OFF
POC
SC1
SC2
SC3
SC4
SC5
WHEN ENERGIZED LT5 PREVENTS SELECTION OF ALL KEYS OPERATING IN LTRS. POSITION PERMITS SELECTION OF ALL KEYS OPERATING IN FIGS POSITION. KEYS OPERATING IN BOTH FIGS & LTRS POSITION ARE NOT AFFECTED
WHEN ENERGIZED LT7 PREVENTS SELECTION OF ALL KEYS EXCEPT CAR. RET. LTRS SHIFT FIGS. SHIFT.
WHEN ENERGIZED LT8, PREVENTS SELECTION OF ALL KEYS EXCEPT LTRS SHIFT & FIGS SHIFT
K2 - 1055841 K13 - 1053728
K3 - 1041097 K14 - 1054055
K4 - 1054125 K15 - 1041196
K5 - 1057519 K16 - 1054056
K6 - 1057519 K17
K7 - 1053297 K18
K8 - 1053297 K19
K9 - 1053295 K20 - 1054122
K10 - 1057344 K21 - 1053729
K11 - 1041150 K22 - 1041098
K12 - 1041149 K23 - 1053728
MAIN CABLE - 1041121
RELAY WIRING - 1041113
TAPE READER WIRING - 1041114
CARD READER WIRING - 1041117
TAPE PUNCH WIRING - 1058152
CARD PUNCH WIRING - 1040222
MOTORIZED PUNCH WIRING 1058703
STOP CODE-FEED HOLE
TAB CODE-14 (U.C)
C.R. CODE - 4
N.P. CODE-234 (U.C)
P.R. CODE-1234 (U.C)
RTC CONTACT NOT IN CARD READER JRL CONNECTED TO JRU CIRCUIT
020 MAX-AIR GAP
RTC
RCC
RC1
RC2
RC3
RC4
RC5
COMMERCIAL CONTROLS CORP.
FLEXOWRITER PROGRAMATIC
4 BANK
MODEL FPC 5
SCHEMATIC WIRING DIAGRAM
1041120


1041109
SHEET 1 OF 2
SHEET 2 OF 2
CARD FEED MICRO-SWITCH
JPU & JPV ARE CONNECTED TOGETHER IN TAPE PUNCH
(JL1-27) 27 PT CANNON CONNECTOR 1040915 (RNK-27-31SL)
(JLA-Z) 24 PT AMPHENOL CONNECTOR 1057586
(FOR ADDING PARITY CHECK)
ELX O CH 8 4 2 1
CODE SEQUENCE
GUIDE EDGE
SCC-ALL EXCEPT ON 1-ON 2-OFF
SC6-N.P. KEY
SC7-ON 1-ON 2-OFF
SC8-ON 1
SC12-ON 2
POC-OFF
K2-1055841
K3-1041097
K4-1054125
K5-1057519
K6-1057519
K7-1053297
K8-1053297
K9-1053295
K10-1057717
K11-1057344
K12-1057344
K13-1053728
K14-1054055
K15-1041196
K16-1054056
K17-
K18
K19
K20-1054122
K21-1053729
K22-1041098
K23-1053728
TAPE FEED 1-2-4-8 CH O-X
CARD FEED (FEED HOLE) (S10)
ERROR CODE (1-2-4-8-X) (S9)
PR CODE (4-8-0) (S8)
STOP CODE (1-2-8) (S7)
TAPE SKIP (S6)
NON PRINT (S5)
START READ (S3)
STOP READ (S4)
PUNCH ON IND.
WHEN ENERGIZED-LT5 PREVENTS SELECTION OF ALL KEYS EXCEPT CARRIAGE RETURN
STOP CODE-1-2-8
TAB CODE-2-4-8-CH-O
C.R. CODE-EL
N.P. CODE-4-8-CH
P.R. CODE-4-8-0
MAIN CABLE-1041110
RELAY WIRING-1041102
TAPE READER WIRING-1041103
CARD READER WIRING-1041106
TAPE PUNCH WIRING 1058153
CARD PUNCH WIRING 1040223
MOTORIZED PUNCH WIRING 1058700
RTC CONTACT NOT IN CARD READER
JRL CONNECTED TO JRU CIRCUIT.
.020 MAX. AIR GAP
COMMERCIAL CONTROLS CORP.
FLEXOWRITER PROGRAMATIC SINGLE CASE
model FPC 8
SCHEMATIC WIRING DIAGRAM
draw RED 12-8-55
check WE 12-8-55
1041109