PART III

FLEXOWRITER MODEL FC

DESCRIPTION

Figure 1-1 Flexowriter Model FC

The Flexowriter Model FC was designed to type a message with the required number of carbon copies and, as a by-product of typing, to perforate a communications tape with only the message to be wire transmitted. Also, the perforated tape can be used later to reproduce additional copies if needed, to cut a stencil, to make a direct image plate or other duplicating masters.

The Model FC is available in three combinations; Recorder, Reproducer, and Recorder-Reproducer. The latter is a combination of the Recorder and Reproducer and can perform the combined functions of the two such as, messages can be typed, a communications tape punched, tape can be read to operate the Flexowriter automatically. Also, duplicate, revised or corrected tapes can be made.

The Model FC Recorder-Reproducer consists of a writing machine, code selector, tape punch, tape reader and code translator.

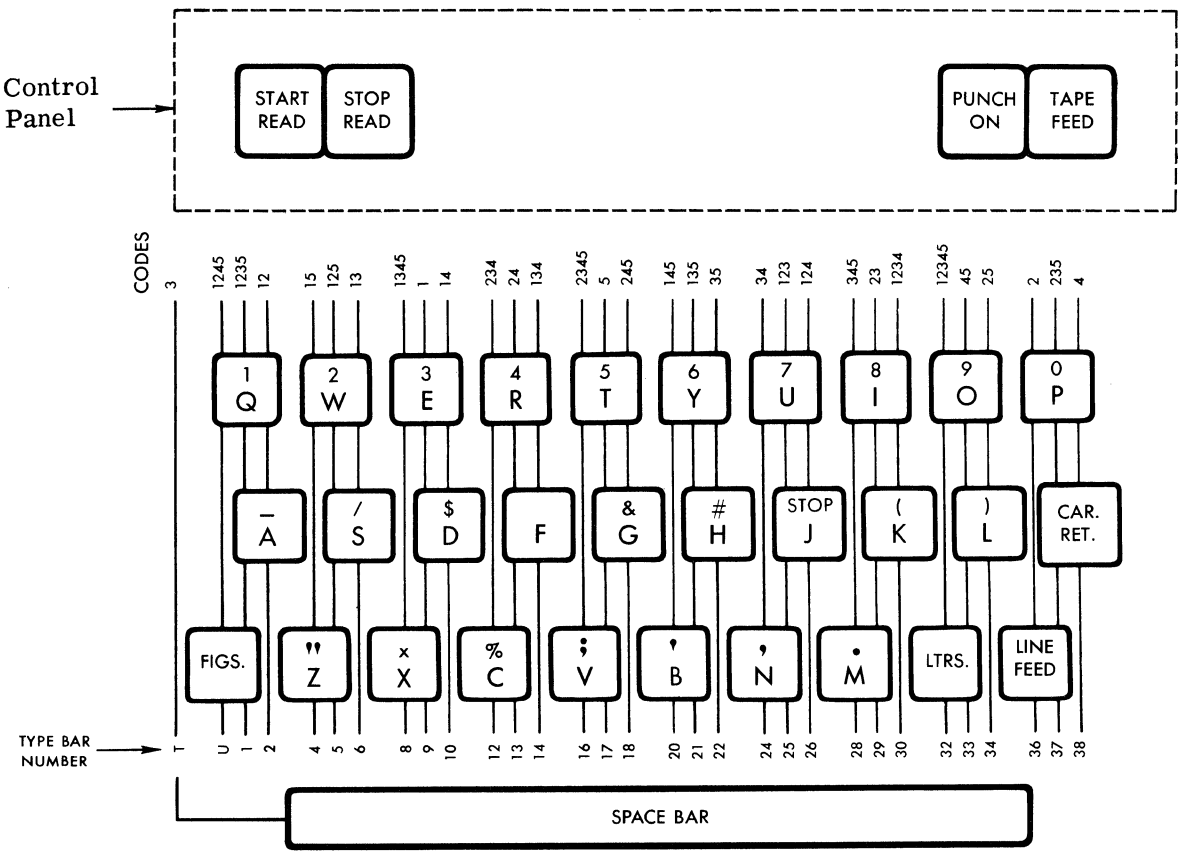


Figure 1-2 Model FC Keyboard

BASIC FUNCTIONAL PRINCIPLES

The basic functional principles of operation of the Model FC are the same as the Model FL explained in Part II, Section 1, with the exception that the Model FC uses a standard three-bank communications keyboard and a five unit binary code system. This means that only five code contacts (plus the common contact) are operated by the code selector and there are only five punch magnets and five reader contacts controlling five translator magnets.

Also, on the Model FC Recorder-Reproducer there are only two switches controlling the tape punch operation and they are the punch on switch and the tape feed switch. Both these switches perform the same function in the Model FC as in the Model FL. The start read and stop read switches control the tape reader in the same manner as in the Model FL.

KEYBOARD

The Model FC keyboard is a standard three-bank communications keyboard, a sample of which is shown in Figure 1-2. It uses a total of 31 keylever positions, 26 of which are used for character operation. Four of the remaining five positions are used for functional operation including carriage return, figures shift, letters shift and space. The operation of a keylever in the number 36 position (line feed) results in a number two code

perforated in the tape only. This keylever does not perform any function on the writing machine. The line feed function on the Flexowriter is incidental to carriage return operation.

Since there are only three rows of keylevers, they serve a dual purpose and are controlled by either the letter shift key (lower case) or the figure shift key (upper case).

Depression of the letters shift key will cause each succeeding key depression to print a letter on a document (except position numbers 36 and 38). Depression of the figures shift key will cause each succeeding key depression to print either a diget or a special character, with the exception of keylever position numbers 26, 36 and 38.

With the type basket in the upper case position (Figures) and the J keylever automatically operated, no character will be printed and the machine will automatically stop.

CODE SYSTEM

The Model FC Flexowriter uses a five unit binary code which provides 32 possible code combinations. As shown on the keyboard chart in Figure 1-2 and the tapes in Figure 1-3, 26 of these code combinations are used for characters while five others are used for functions such as, carriage return, letters shift, space and line feed (the line feed keylever operation just perforates a 2 code in the tape).

Eleven-sixteenth inch wide paper tape is used and the code holes are numbered 1-2-3-4-5 facing the leading edge of the tape (Figure 1-3). The feed hole is between the 2 and 3 code hole and is .394 inch from the right edge with its center line even with the center line of the code holes.

CONTROL PANEL

The Model FC Recorder-Reproducer control panel is shown in Figure 1-2 and consists of the following switches.

Punch On - The punch on switch controls the tape punch for automatically perforating a paper tape. When this switch is depressed, each character or function operated on the keyboard is automatically perforated in the tape in the form of a predetermined binary code.

Tape Feed - When installing a new roll of tape for punch operation, it is necessary to "feed out" the tape approximately three inches. The tape feed switch, when depressed, automatically feeds out the tape with a feed hole only.

Start Read - When this switch is depressed and released, the tape reader automatically starts

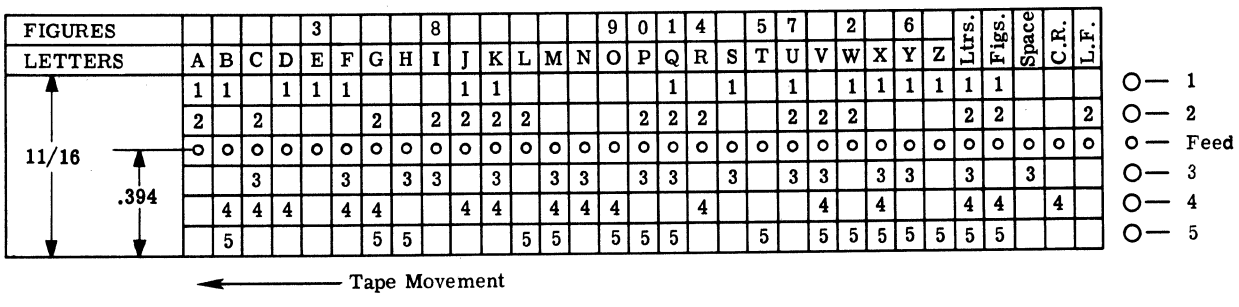


Figure 1-3 Model FC Code Chart

operation. By stepping (depressing and releasing rapidly) this switch, the tape may be moved one code position at a time.

Stop Read - When the stop read switch is depressed during automatic operation, the reader will stop operation, thus stopping automatic typing operation. In order to resume automatic operation, the start read switch must be depressed.

SPECIFICATIONS

Power Supply - The Model FC may be specified with one of the following power supplies.

Volts	Cycles	Phase	Amperes
115	DC	-	2.3
115	60	1	2.3
115	50	1	2.3
115	25	1	2.3
230	60	1	1.5
230	50	1	1.5

Weight and Dimensions - The width of the Model FC is $17\frac{1}{2}$", the depth is 20" and the height is 10". The shipping weight of all 12 inch carriage Flexowriters is approximately 115 pounds, while the unpacked weights of the three Model FC combinations are as follows:

Recorder - Reproducer - 85 lbs.

Recorder - 74 lbs.

Reproducer - 78 lbs.

Type Style - The standard type style on the Model FC is Pica Gothic which will print ten characters to the inch.

Keyboard - The Model FC may be equipped with any standard three-bank communications keyboard.

Carriage - The Model FC may be equipped with any one of the following carriages:

12 inch carriage - will accept an 11 inch wide sheet with a maximum writing line of $9\frac{1}{2}$ inches.

16 inch carriage - will accept a 15 inch wide sheet with a maximum writing line of $13\frac{1}{2}$ inches.

20 inch carriage - will accept a 19 inch wide sheet with a maximum writing line of $17\frac{1}{2}$ inches.

Platens and Ratchets - See Part II, Section 2, Page 2-56, for available platens and ratchets.

Tabulation - The Standard Model FC does not provide a tab mechanism.

Back Space - The Standard Model FC does not provide a back space mechanism.

Case Shift - The type basket shifts to select between the printing of letters and figures, with duplicate shift keys on each side of the keyboard.

Carriage Return - The Model FC has a power operated carriage return with line spacing incidental to carriage return operation. An extra line space key (position 36) is provided for punching the line feed code (2) in the tape. The left hand margin can be adjusted in increments of one letter space.

Operating Speed - The operating speed of the tape punch is approximately 850 cycles per minute and will respond to any two isolated key operations occurring at the rate of 1200 per minute.

The tape reader speed is approximately 570 cycles per minute, thus resulting in an automatic typing operation at the rate of approximately 570 characters per minute.

MAINTENANCE OF UNITS

The Model FC Recorder- Reproducer consists 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. Therefore, the maintenance procedures and adjustments will be the same for each, with the exception of the following:

WRITING MACHINE

The Model FC has a standard communications three-bank keyboard, therefore, there are only 31 keylevers, 32 cams, 26 character bellcranks and 26 character typebars.

This model may be specified with either Pica Gothic or Elite Gothic type, therefore, the machine will be equipped with a monospacing escapement only.

The standard Model FC does not have a tabular mechanism or a back space mechanism.

This model is not equipped with a color shift keylever mechanism. However, a manual color change lever protrudes through the left side of the base, permitting ribbon color change by hand.

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

CODE SELECTOR

The Model FC code selector is the same as the code selector described in Part II, Section 3, except that:

1. It has only 31 selector slides.
2. It has only five code contact operating bails (plus one common bail).

The selector coding arrangement is shown in Figure 2-1. The adjustments and maintenance procedures are the same as described in Part II, Section 3.

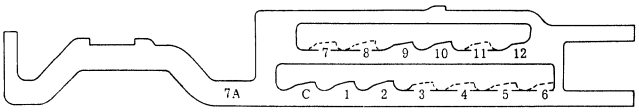
TAPE PUNCH

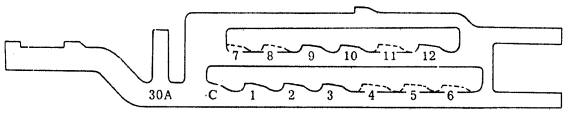
The Model FC tape punch has the same adjustments and maintenance procedure as the tape punch explained in Part II, Section 5.

TAPE READER

The Model FC tape reader is the same as the tape reader explained in Part II, Section 6, except for the following:

1. It is only capable of reading a five unit binary code, thus, it has only five reader pin contacts (plus the reader common and tape contacts).





FRONT SLIDE

Position Number	Cam Surface
1B	8-11
	C-1-2-4-5
3A	8-11
	C-3
7A	9-10-12
	C-1-2
9A	9-10-12
	C-1-5
11A	9-12
	C-1-3
13A	9-10-12
	C-1-3-4-5
15A	9-10-12
	C-1-4
17A	9-10-12
	C-2-3-4
19A	8-10-12
	C-1-3-4
21A	9-10-12
	C-2-3-4-5
23A	9-10-12
	C-2-4-5
25A	9-10-12
	C-1-4-5
27A	9-10-12
	C-3-5
29A	9-10-12
	C-3-4
31A	8-12
	C-1-2-4
33A	8-9-11-12
	C-3-4-5
35A	9-10-12
	C-1-2-3-4
39A	8-10-12
	C-2-5
41C	7-8-9-10-11-12
	C-2
43	
	Dummy
49C	
	C-4
51B	
	C-1-2-3-4-5

REAR SLIDE

Position Number	Cam Surface
2	
	Dummy
6A	9-10-12
	C-1-2-3-5
8	
	Dummy
10A	7-9-11-12
	C-1-2-5
12	
	Dummy
14A	9-10-12
	C-1
16	
	Dummy
18A	9-10-12
	C-2-4
20	
	Dummy
22A	8-10-12
	C-5
24	
	Dummy
26A	9-10-12
	C-1-3-5
28	
	Dummy
30A	9-10-12
	C-1-2-3
32	
	Dummy
34A	8-11
	C-2-3
38A	9-10-12
	C-4-5
40	
	Dummy
42A	9-10-12
	C-2-3-5
48	
	Dummy
50	
	Dummy

Figure 2-1 Selector Code Chart

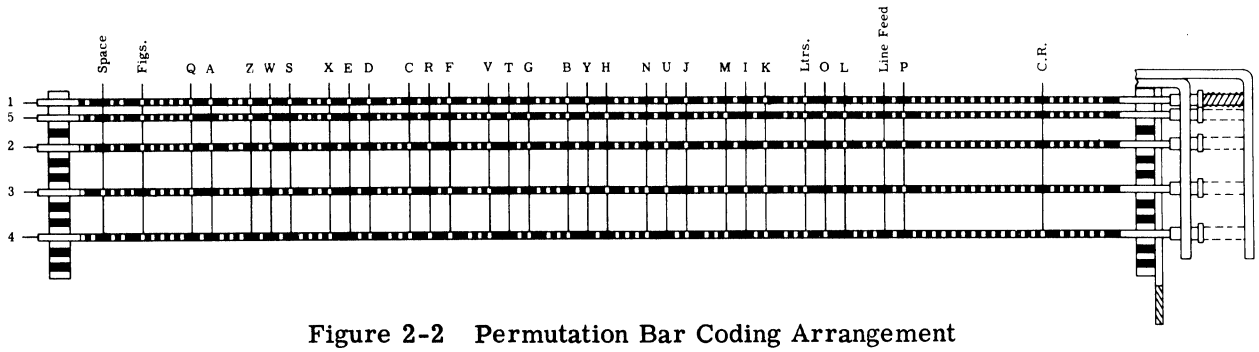


Figure 2-2 Permutation Bar Coding Arrangement

2. The contact stackup arrangement is as follows:

   RC1 - 1 break, 1 transfer (or 1B, 1C)

   RC2 - 1 break, 1 transfer (or 1B, 1C)

   RC3 - 2 make, 1 break (or 2A, 1B)

   RC4 - 1 make, 1 transfer (or 1A, 1C)

   RC5 - 1 make, 1 transfer (or 1A, 1C)

3. Contact Adjustment:

   a. Place a piece of tape (without code holes) in the reader to block all feeler pins. Turn the cam shaft (453) until the interposer bail roller engages the low dwell of cam (434). This should allow the pins to move up against the tape. With the pins in this position, adjust all the normally open contact points to a gap of .020" to .025" except the normally open RC4 contact which should be set at .030"

   b. Remove the tape from the reader and adjust all normally closed contact points to a gap of .020" to .025". Check the normally open contact points at this time to see that they are all closed with at least an appreciable movement of the stationary contact springs away from their stop strips.

   c. Replace the tape in the reader and check for additional motion of the normally closed contacts away from their stop strips after make.

   d. Adjust the RTC contacts to have a gap of .020" to .025" also, check to see that there is additional motion of the stationary strap away from the backing strap after the contact makes.

CODE TRANSLATOR

The Model FC code translator is the same as the code translator explained in Part II, Section 7, except for the following:

1. There are only 31 seekers to operate the 31 keylevers.
2. There are only five permutation slides, armatures and magnets used corresponding to each unit of the five unit binary code.

The permutation bar coding arrangement is shown in Fifure 2-2. The Model FC translator should be adjusted the same as explained in Part II, Section 7.

CIRCUIT DESCRIPTION

The following circuit descriptions for the Model FC Recorder-Reproducer are based on wiring diagram 1055640. (See Figure 3-5.)

POWER CIRCUIT

This circuit is the same as explained in Part II, Section 8, Page 8-5.

PUNCH CIRCUITS

Key Lock Magnet - This circuit is the same as explained in Part II, Section 8, Page 8-6.

Punch Magnet Circuit - This circuit is the same as explained in Part II, Section 8, Page 8-6, except the Model FC only uses five selector code contacts.

Clutch Magnet Circuit - This circuit is the same as explained in Part II, Section 8, Page 8-6.

Anti-Repeat Circuit - This circuit is the same as explained in Part II, Section 8, Page 8-7.

Tape Feed Circuit - This circuit is the same as the tape feed circuit explained in Part II, Section 8, Page 8-10.

READER AND TRANSLATOR CIRCUITS

Manual Start and Stop Circuits - The start read switch (S6), when depressed and released, will energize the reader magnet (LRM) and start a reader cycle of operation. In order to energize the reader magnet when the start read switch is depressed, a circuit is first completed to the reader control relay (K8) as follows: (Figure 3-1) from -DC, TC6, JR10, RTC, JR13, N/OS6, N/CS7, TA29, K8 coil, TA40, TC5, to +DC. The K8 relay is energized, closing all three of its

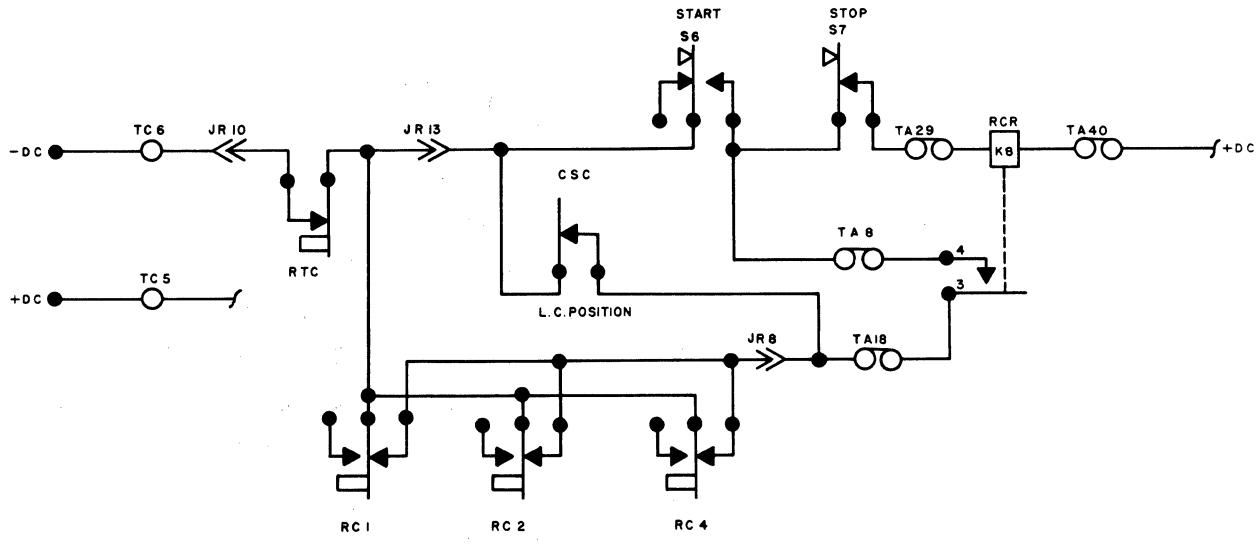


Figure 3-1 K8 Pick Up and Hold Circuit

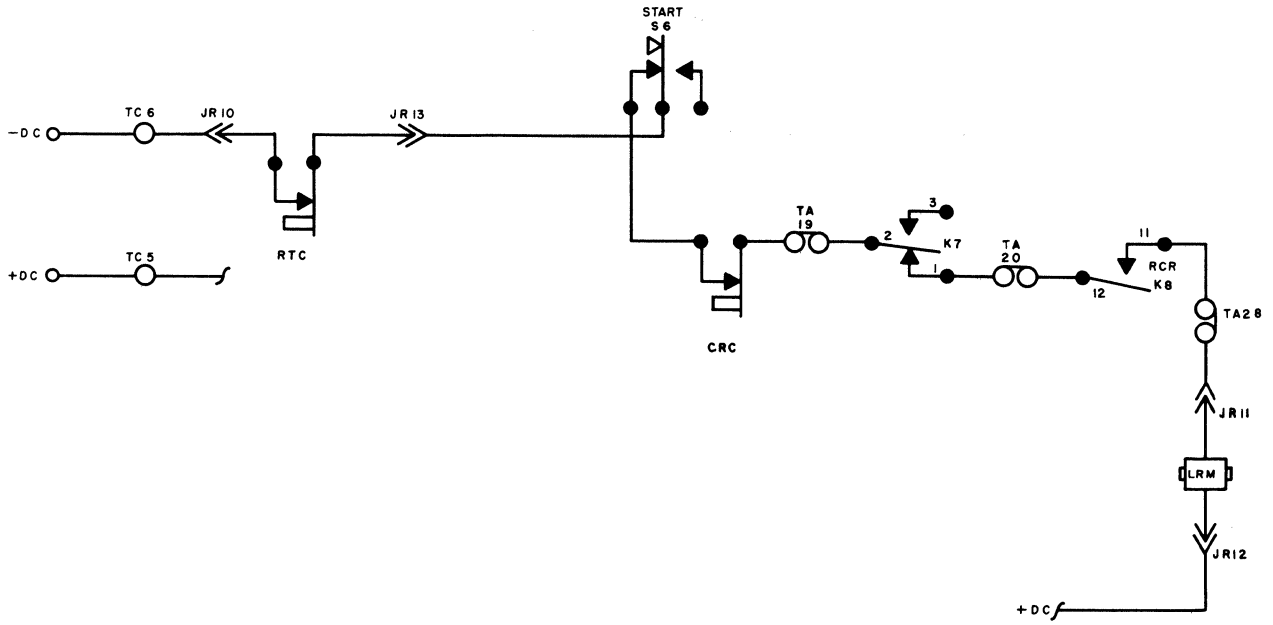


Figure 3-2 Reader Magnet Circuit

normally open contacts. When K8 contacts 3 and 4 close, a holding circuit to K8 is completed as follows: from -DC, TC6, JR10, RTC, N/CRC1, N/CRC2 and N/CRC4, JR8, TA18, K8 - 3 and 4, TA8, N/CS7, TA29, K8 coil, TA40, TC5, to +DC. There is also another contact in the K8 holding circuit called the case shift contact (CSC). These contacts are normally closed when the type basket is in the lower case position (see Stop Code Circuit).

When the S6 switch is allowed to return to its normal position, the reader magnet is energized as follows: from -DC, TC6, JR10, RTC, JR13, N/CS6, CRC, TA19, K7 - 2 and 1, TA20, K8 - 12 and 11, TA28, JR11, LRM, JR12, TC5, to +DC. (See Figure 3-2).

Once the circuit to the reader magnet (LRM) is established, it will remain energized and the reader will operate continuously until either the reader magnet circuit is broken automatically (explained under Delay Control Circuit) or by manually depressing the stop read switch (S7).

When the stop read switch (S7) is depressed, the holding circuit to the reader control relay (K8) is broken. Thus, when K8 contacts 5 and 6 open, the reader magnet is de-energized, stopping the reader operation.

Translator Magnet Circuits - When a reader pin senses a code in the tape, a corresponding reader contact closes completing a circuit to the translator magnet related to the reader contact.

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 as follows: from -DC, TC6, JR10, RTC, RC1 and RC2, JR1 and JR2, JTA1 and JTA2, LT1 and LT2, JTA5, to +DC. (See Figure 3-3.)

The reader common contact (RCC) closes during each reader cycle of operation, completing a circuit to the translator clutch magnet as follows:

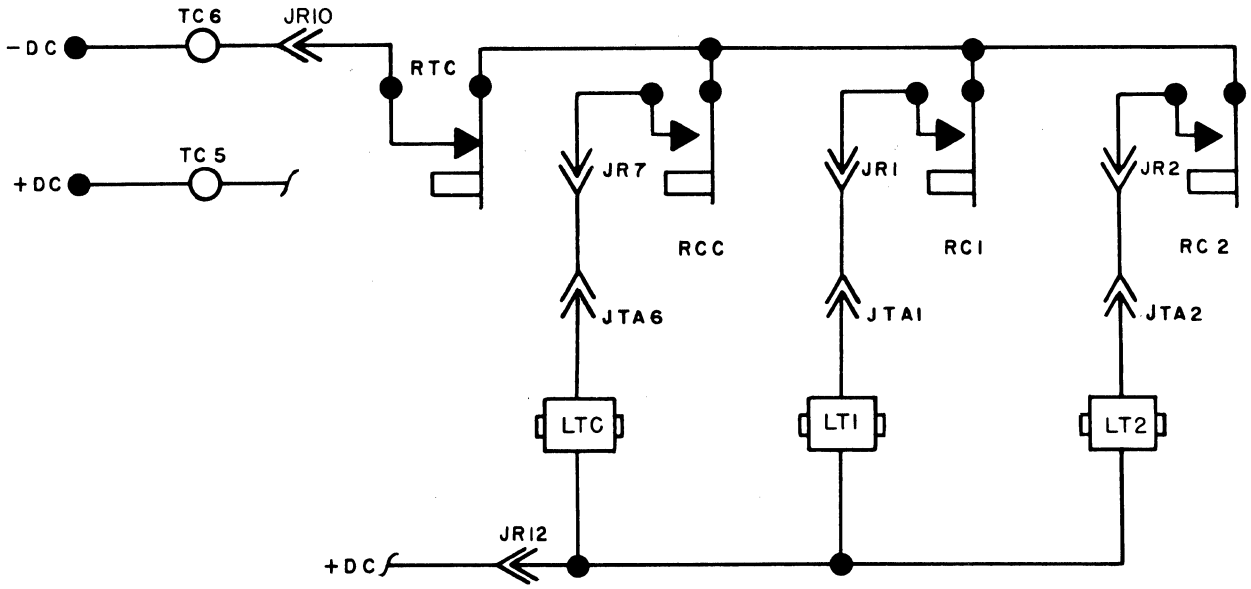


Figure 3-3 Example Translator Magnet Circuit

from -DC, TC6, JR10, RTC, RCC, JR7, JTA6, LTC, JTA5, TC5, to +DC.

Delay Control Circuit - It is essential to have an automatic delay control circuit incorporated in the Model FC in order to delay the operation of the tape reader until the carriage return function has been completed in the writing machine.

The carriage return code, which is a 4 code, when read in the reader, will operate the RC4 contacts. The operation of the RC4 contacts will energize the delay control relay (K7) as follows: (Figure 3-4) from -DC, TC6, JR10, RTC, RC5, RC3, RC1, RC2, RC4, JR9, TA9 and 10, K8 - 1 and 2, TA30, K7 coil, TA40, TA39, TC5, to +DC. When the delay control relay is energized, contact strap 2 breaks with contact 1 and makes with contact 3. The energizing circuit to the reader magnet (LRM) is broken, thus de-energizing the magnet and stopping reader operation. Also, when K7 contacts 2 and 3 make, a holding circuit to K7 is established (the original pick up circuit to K7 will be open when the RC4 contacts return to normal).

At the same time the above mentioned circuit is completed to K7, a circuit is also completed to the translator magnet LT4 and translator clutch LTC. This will cause the translator to operate, resulting in a carriage return function. The operation of the carriage return mechanism will open the CRC contacts, thus breaking the holding circuit to K7.

The K7 contacts return to normal position, but the circuit to the reader clutch magnet will not be complete until the carriage returns to the left hand margin and the clutch toggle unlocks. When this happens, the CRC contact closes, completing the energizing circuit to the reader magnet, starting the reader operation again.

Stop Code Circuit - When the type basket is in

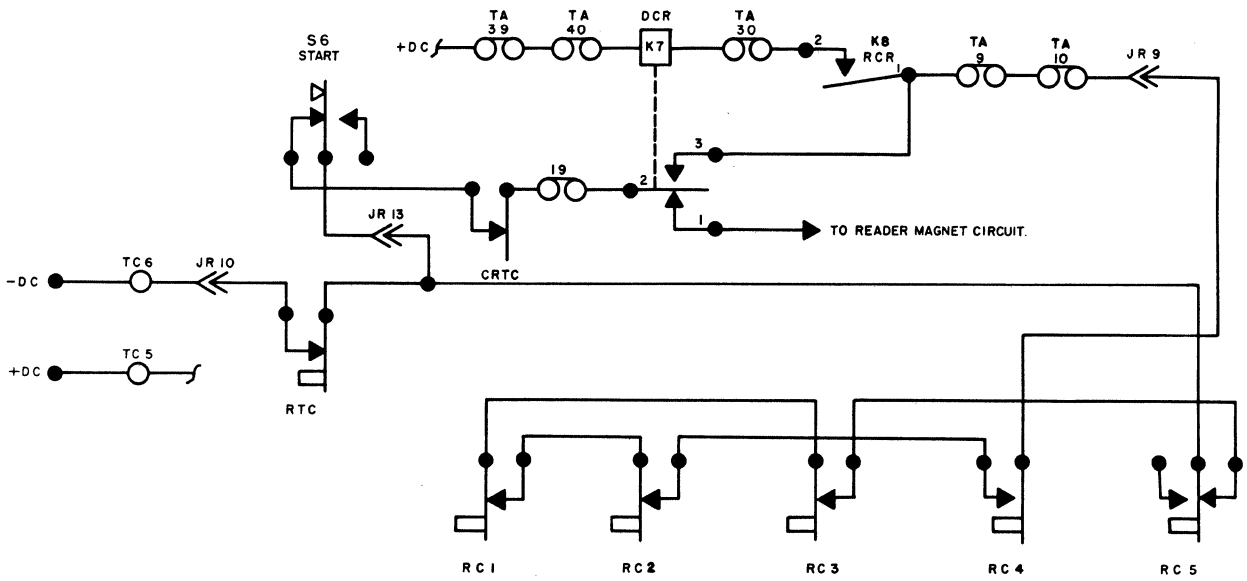
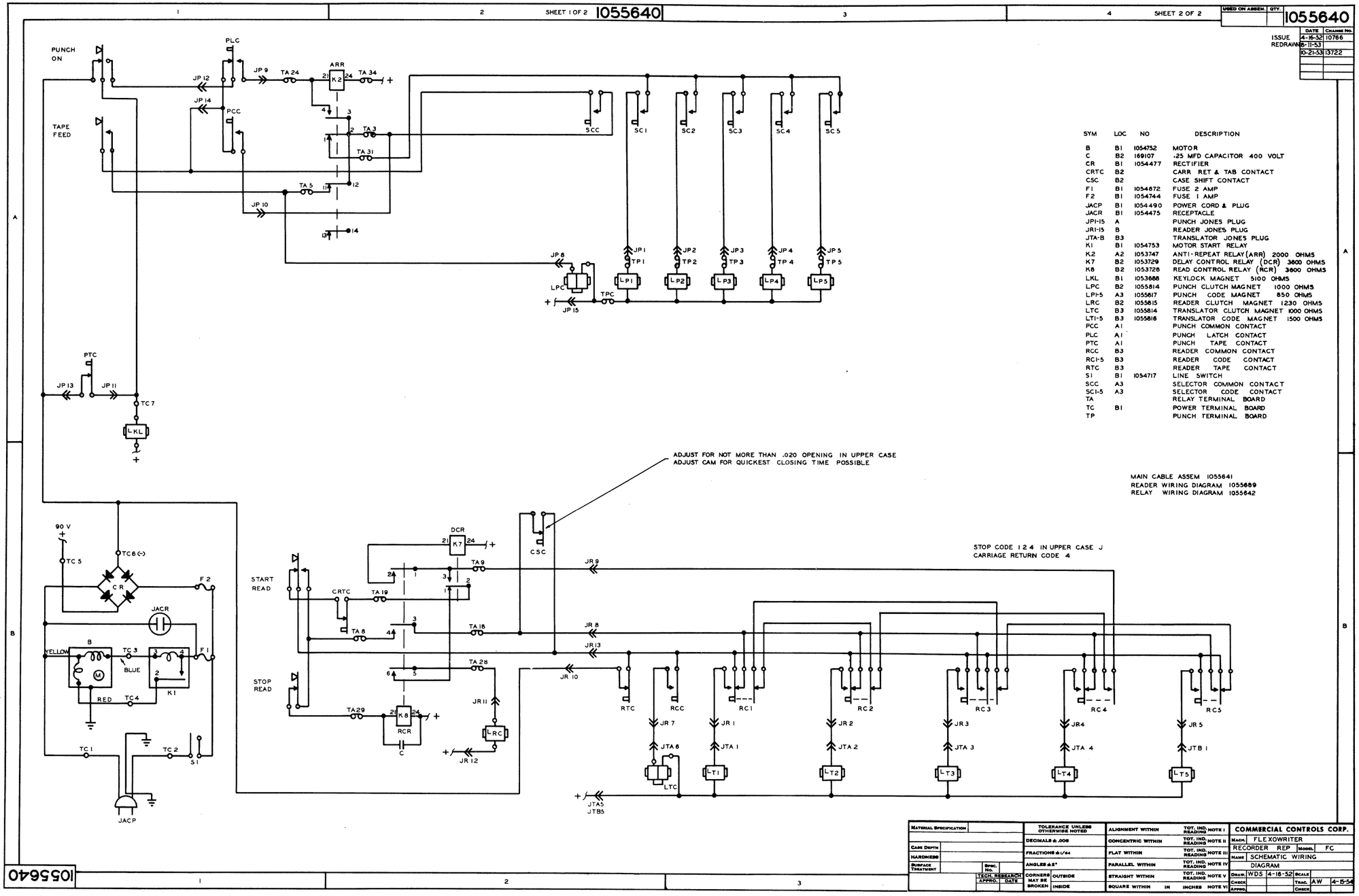


Figure 3-4 Delay Control Circuit

the upper case position and a 1-2-4 code is read by the reader, the holding circuit for the reader control relay (K8) will be broken, thus de-energizing the reader magnet and stopping the reader operation. This is a result of the K8 holding circuit being through normally closed contacts of RC1, RC2 and RC4, plus the case shift contacts (CSC). Therefore, when the type basket is in the upper case, the CSC contacts are open, and the reading of the 1-2-4 code will operate the RC1, RC2 and RC4 reader contacts, thus breaking the K8 holding circuit, de-energizing the reader magnet and stopping the reader operation. (See Figure 3-1.)

In order to resume automatic operation, the start read switch must be depressed and released.



SYM	LOC	NO	DESCRIPTION
B	B1	1054752	MOTOR
C	B2	169107	.25 MFD CAPACITOR 400 VOLT
CR	B1	1054477	RECTIFIER
CRTC	B2		CARR RET & TAB CONTACT
CSC	B2		CASE SHIFT CONTACT
F1	B1	1054872	FUSE 2 AMP
F2	B1	1054744	FUSE 1 AMP
JACP	B1	1054490	POWER CORD & PLUG
JACR	B1	1054475	RECEPTACLE
JP1-15	A		PUNCH JONES PLUG
JR1-15	B		READER JONES PLUG
JTA-B	B3		TRANSLATOR JONES PLUG
K1	B1	1054753	MOTOR START RELAY
K2	A2	1053747	ANTI-REPEAT RELAY (ARR) 2000 OHMS
K7	B2	1053729	DELAY CONTROL RELAY (DCR) 3600 OHMS
K8	B2	1053728	READ CONTROL RELAY (RCR) 3600 OHMS
LKL	B1	1053688	KEYLOCK MAGNET 5100 OHMS
LPC	B2	1055814	PUNCH CLUTCH MAGNET 1000 OHMS
LP1-5	A3	1055817	PUNCH CODE MAGNET 850 OHMS
LRC	B2	1055815	READER CLUTCH MAGNET 1230 OHMS
LTC	B3	1055814	TRANSLATOR CLUTCH MAGNET 1000 OHMS
LT1-5	B3	1055816	TRANSLATOR CODE MAGNET 1500 OHMS
PCC	A1		PUNCH COMMON CONTACT
PLC	A1		PUNCH LATCH CONTACT
PTC	A1		PUNCH TAPE CONTACT
RCC	B3		READER COMMON CONTACT
RC1-5	B3		READER CODE CONTACT
RTC	B3		READER TAPE CONTACT
S1	B1	1054717	LINE SWITCH
SCC	A3		SELECTOR COMMON CONTACT
SC1-5	A3		SELECTOR CODE CONTACT
TA			RELAY TERMINAL BOARD
TC	B1		POWER TERMINAL BOARD
TP			PUNCH TERMINAL BOARD

Figure 3-5 Model FC Wiring Diagram

Friden — *Customer Service Engineering*

INSTRUCTION REFERENCE

Date: October 26, 1954

Reference: FC-Flexowriter - Alcoa

Subject: Schematic Wiring Diagram - 1268-137

Purpose: To eliminate field Service problems.

Information:

The following explanations on the circuits involved on subject machines will enable you to eliminate these field problems.

1. Automatic Line Feed
   a. The circuit explanation for automatic line feed code after carriage return code is explained in detail in the service manual in Part I, Section 5, page 5-15.

   b. The adjustment of the selector code contacts are the same as a standard machine with the exception of the SC7 & SCC contacts. It is important to have the SC7 contact close after the SC1 through SC6 code contacts, but before the SCC contact closes.

SC1 through SC6 -	.020" approx.
SC7	.025" approx.
SCC	.030" approx.

NOTE: If the selector contacts are not adjusted as above, the following troubles could occur:

TROUBLE	REASON
Punching 24 code after 4 code instead of 2 code.	SC7 closing too soon.
Feed hole instead of 2 code.	SC7 not closing before SCC

2. Tabulation Over Character G
   a. The operation of tabulation over character G is explained in detail in the service manual in Part I, Section 5, page 5-19 (Model FC Tab Mechanism).

   b. The case shift contact referred to in the service manual is contact straps 1 & 2, on schematic 1268-137. The adjustment of this contact should be as follows:

      In letters case position, should have a gap of .020".
      In figures case position, the contacts should be made with an appreciable movement of the stationary strap (approx. .005").

NOTE: If the CSC 1 & 2 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Machine stops after reading 245 (Upper Case)	Tab operation did not take place. CSC 1 & 2 probably did not close soon enough.

3. Stop Code - Non Reproducing
   a. The stop code in this machine is 35 (figures position). When this code is read by the reader and the shift basket is in figures position, the holding circuit through CSC 7 & 8 and RC 3 & 5 to the RCR (K8) relay is broken.

      An additional case shift contact (3 & 4) is used in series with a normally open RCC contact to complete a circuit to the No. 7 translator magnet (LT7) when the basket is in figures position. Therefore, when the reader senses a 35 code when the basket is in figures position, the H keylever will not operate due to the No. 7 permutation bar coding (there is only one projection on this bar).

   b. The case shift contacts 3 & 4 should be adjusted to open as soon as possible when shifting from figures to letters position. The contacts should make with a maximum follow of .005" when shifting from letters to figures position.

NOTE: If CSC 3 & 4 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Stop Code reproducing	CSC 3 & 4 not closing soon enough.
Char. H not printing	CSC 3 & 4 not opening soon enough.

The case shift contacts 7 & 8 should be adjusted for not more than .020" gap in figures position. Also, the CSC operating cam should be adjusted for the quickest closing time (of CSC 7 & 8) as possible. (Note - if an adjustment of the CSC operating cam is made it will be necessary to recheck all other CSC adjustments.)

NOTE: If CSC 7 & 8 contact is not adjusted properly the following troubles could occur:

TROUBLE	REASON
Stop after printing Char. H	CSC 7 & 8 not closing soon enough.
Machine does not stop after reading 35 code.	CSC 7 & 8 not opening soon enough.