Identification

Flexowriter Specifications for Multics Documentation
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Purpose

This section presents a summary of the specifications
of the Friden Model 2201 Flexowriters that are being
used in the preparation of documents created in the course
of the Multics development effort. In addition, this
section also covers the use of the 2201, and the format
and appearance of the punched tape it produces.

Background

The 2201 Flexowriter serves as an alternative to the
use of TYPSET within CTSS for the preparation of documents.
As a document is typed on the Flexowriter, a punched
paper tape is prepared as a by-product. This tape may
be corrected and edited, so that a final, presumably
perfect copy may then be run off (in like manner as RUNOFF
is used in connection with TYPSET). The tapes prepared
on this machine may, at some future time, serve as input
to the 645 when the Multics equivalent of TYPSET is available.

The 2201 will incorporate all printed characters within
the ASCII character set, although four of these must
be created by an overstrike. These four are:

exclamation point	!	≡	′	bs	.
dollar sign	$	≡	S	bs	|
left brace	{	≡	(	bs	-
right brace	}	≡	)	bs	-

The actual tape codes corresponding to all characters
and function codes on the 2201 are contained in Table 1.

Although the 2201 will not right-adjust the text, it will return the carriage automatically when it is within 12 positions of the right-hand margin. This is the normal mode of operation, and is initiated by an F-11 control code. In the normal mode, the carriage return character does not punch in the tape if inadvertently typed. As a result, any subsequent editing of the text, such as adding or deleting a few words, will cause the 2201 to continue to type out lines of the proper length, since all words in a paragraph appear on the tape as one continuous string. In addition to the automatic carriage return feature, the normal mode will not permit a space to occur when the carriage is at the left-hand margin. If such happens, a switch is automatically made to the auxilliary tape reader, which contains a continuous loop of tape containing backspace codes, such that the carriage is once again reset at the left margin.

When it is desired to punch a carriage return in the tape, such as at the end of a paragraph or for tabular or formatted text, it is necessary to enter the tabulate mode, which may be done by typing an F-13 control code. Under this mode, the carriage will return only when a carriage return is either typed or read from the tape. Also, spaces at the left margin are valid. Note, for example, that at the end of paragraph, it is necessary to type the sequence

F-13   C-R   C-R   F-11

in order to separate the two paragraphs. This is analogous to the .break command in TYPSET and RUNOFF.

Like TYPSET, the 2201 system requires that a tape first be prepared, corrected and edited, and then be run off to create a final, presumably perfect copy. The 2201 views its tape reader as being identical to its keyboard, such that any function caused by the keyboard will also be caused by the tape reader when a like code is encountered.

Additional Features

The 2201's in use within Multics have several additional features which are noted here.

1) Non-print -- An F-2 code in the tape will cause the printer to be turned off, to be turned on upon the appearance of an F-3 code in the tape. However, the text on the tape that lies between the printer-off and printer-restore codes will be reproduced on a new tape, if one is being prepared. The purpose of this feature is to permit the appearance of

special codes on the tape, that might be used when
the tapes are later transferred to the computer.
However, no rules for such codes have as yet been
determined, and thus this feature is not in use
at present.

2) Punch on or off -- the punch may be turned on by an
    F-4 code, or off by means of an F-5 code,
    either from the keyboard or from a tape being read.

3) Auxilliary tape reader -- The F-9 code in a tape being
    read causes a switch to the auxilliary tape reader
    if read by the main one, or to the main reader if
    read from the auxilliary reader.

4) Stop codes -- there are two distinct machine stop codes
    which will cause reading of tape to stop when either
    code appears in the tape. The F-1 code will always
    cause the machine to stop. It should, therefore, be
    the very last code to be punched on a tape. The
    other stop code is F-12 which should be used for all
    other stops, such as a stop that will permit certain
    variable information to be entered. If a tape is
    being reproduced without being printed, the F-12
    codes will not cause a machine stop.

Editing

The four program modification switches are used during
the editing process. Switch 1 causes the machine to
stop reading, and hence reproducing, a tape when it encounters
a carriage return at the left margin, such as at the
end of a paragraph. Switch 1 also brings the machine
into Edit mode. Switch 2 down will cause the reader
to stop at the end of a line. Switches 3 and 4 are momentary
switches, and must be held down to be operative. Switch 3
down causes the reader to stop upon encountering a space
code, such as the end of a word. Switch 4 is related
to the Non-Print feature discussed above, and causes
printing of the otherwise non-printed information. Switch 2
alone (i.e., without Switch 1) causes the reader to ignore
the F-12 STOP code, and keep right on going.

Preparation of a Tape

Generally, tapes are prepared using the normal, or fill
mode of operation. When power is turned on, the machine
is in this mode. Thus, for all unformatted text, there
are no carriage returns punched in the tape, except for
headings, separations of a paragraphs, or for some formatted
text, such as a list or a tabulation. The beginning of

a tape should contain an F-4 (punch on) code followed
by an F-13 (tabulate mode) code. These should be followed
by six carriage returns, after which the title or, in
the case of an MSPM section, the standard MSPM heading
should be entered. This should be followed by at least
two carriage returns. If unformatted text is to begin
at this point, an F-11 code should be typed; else the
formatted information should be entered. Typing should
proceed according to these rules and standard practice
until the end of the page is reached. The last character
on the tape should be an F-1 machine stop code.

Each page of the text should be prepared on a separate
piece of tape. The 2201 system in use here does not
permit continuous form paper nor automatic page formatting,
as does TYPSET and RUNOFF. Because of this, it is generally
useful to leave a rather wide bottom margin on each page,
such that additions may be made without the necessity
of reformatting several ensuing pages. Each page is
prepared and run off separately, and thus may be thought
of as a complete document unto itself, at least from
an operational standpoint.

Errors. Errors caught immediately may be corrected rather
simply. The tape must be backed up the number of spaces
to be corrected, and the TAPE FEED key depressed until
at least that number of tape feed, or delete characters
have been punched. When this is done, the correct characters
may be entered, and normal typing may continue. It is
important to bear in mind that there are a number of
codes that advance the tape but which do not get printed.
For example, the upper- and lower-case shift codes, the
backspace code, the tabulate code, and any of the F-
codes. Thus, if a correction is to be made, the presence
of such codes in the tape must be considered. If an
error is not observed immediately, it is not possible
to correct it on the current pass of the tape. This
becomes an editing operation, where a new tape is reproduced
from the old, with changes and corrections made as desired.

Editing. In order to make changes in an existing tape, it
is necessary to create a new one by reproducing the correct
portions and by manually entering any changes. The first
three program modification switches described above are
employed in this process. For example, an entire paragraph
may be reproduced by placing Switch 1 down and hitting
the START READ key. Or, reproducing might be controlled
so as to stop at the end of the current word, by holding
Switch 3 down. If material is to be skipped, the Tape
SKIP key should be used instead of the START READ key,
and will be subject to the control of Switches 2 and 3
as above. Use of the TAPE SKIP key does not permit the

tape being skipped to be printed. If this is desired, an alternative method is to turn the punch off by typing an F-5 code, skip over the desired material by means of the START READ key and the appropriate program modification switches, and then turn the punch on by typing F-4. It is important to note that with the 2201 the process of editing is not as simple as with TYPSET. As a result, some additional care should be taken to see that original drafts are as correct as far as possible.

Running off a Tape. For all operations of the Flexowriter where a tape is to be punched, the 3-position PUNCH SWITCH should be in the SEL (select) position. However, when a tape is to be run off with no new tape being prepared, the switch should be in the OFF position. The tape should be loaded into the reader, the paper loaded into the platen such that only the very top edge is exposed, and all program modification switches should be up. To start the process, the START READ key should be depressed. In some instances, variable information will have to be entered, in which case an F-12 code, punched in the tape, will cause the machine to stop. After the new information has been entered, the START READ key should once again be depressed, to resume the printing operation.

References

1   Repository document # M0076, "Operating Procedures for the Model 2201 Flexowriter to Prepare Documents for Multics," by L. L. Selwyn

2   Friden, Inc., "2201 Flexowriter Operating Instructions"

3   Friden, Inc., "Technical Manual for 2201 Flexowriter"

TABLE I

AUTOMATIC WRITING MACHINE
CODE CHART

CARD PUNCH	2201	MODEL SPS/SPD
0	) — 0 (ZERO)	(ZERO) 0 —)
1	! — 1	1 — !
2	(" — 2	2 — ("
3	# — 3	3 — #
4	$ — 4	4 — $
5	= — =	5 — =
6	¢ — 6	6 — ¢
7	? — 7	7 — ?
8	* — 8	8 — *
9	(— 9	9 — (
A	a — A	a — A
B	b — B	b — B
C	c — C	c — C
D	d — D	d — D
E	e — E	e — E
F	f — F	f — F
G	g — G	g — G
H	h — H	h — H
I	i — I	i — I
J	j — J	j — J
K	k — K	k — K
L	l — L	l — L
M	m — M	m — M
N	n — N	n — N
O	o — O	o — O
P	p — P	p — P
Q	q — Q	q — Q
R	r — R	r — R
S	s — S	s — S
T	t — T	t — T
U	u — U	u — U
V	v — V	v — V
W	w — W	w — W
X	x — X	x — X
Y	y — Y	y — Y
Z	z — Z	z — Z
SPACE	SPACE	SPACE
'	" — .	. — "
,	; — /	/ — :
=	F1 (MNP STOP)	STOP
$	% — —	% — —
.	. — ,	. — ,
.	. — .	. — .
("	F2	NON-PRINT (AUX. SPACE)
%	F3	PRINT-RESTR. (AUX. ZERO)
.	F4	ON 1—ON 2 (U.C.)
□	UPPER CASE	UPPER CASE
&	; — &	& — ;
SKIP	TAB	TAB
END CARD 1	F9	CONTROL (AUX. 2)
END CARD 2	F6	PUNCH OFF
COR. TAB	F10	DATA SELECTOR (AUX. 3)
ERROR	F11	FORM FEED (AUX. L)
PI 1	= — —	PI 1 (2, 8, SP)
PI 2	' — °	PI 2 (2, 8, -)
PI 3	BACK SPACE	PI 3 OR BS (2-8-0)
PI 4	F13	PI 4 (AUX. /)
PI 5	¼ — ½	PI 5 (AUX. A)
PI 6	F12	ADDRESS IDEN. (AUX. J)
PI 7	F8	SKIP RESTORE (AUX. 1)
SP-1	LOWER CASE	LOWER CASE
SP-2	F5	ON 2
CR	F7	FC ON
TAPE FEED	TAPE FEED	TAPE FEED
END LINE	CAR. RET.	CAR. RET.

Standard Tab Card Punching Positions column headers: 12 11 0 1 2 3 4 5 6 7 8 9

Standard Tape Channel Numbers column headers: 8 7 6 5 .4 FEED 3 2 1 (EL X O CH 8 FEED 4 2 1)

CHANNEL NUMBERS