INSTRUCTIONS

Programmer's Manual
*TermiNet***300 Printer*

GENERAL ⚡ ELECTRIC

CONTENTS

Programmer's Manual
TermiNet*300 Printer

INTRODUCTION

Although this manual is called a Programmer's Manual, it can also be called an application manual or a systems engineer's manual. The purpose of this manual is to provide users with the detailed characteristics of the General Electric TermiNet 300 Printer, which are necessary to implement communications between the TermiNet 300 Printer and a computer-related system. Other manuals are available concerning the TermiNet 300 Printer; these are the Operator's Manual and the Service Manual. Each of the other manuals is directed to serve a different purpose but may be used as auxiliary information for the programmer. It is requested that comments and/or suggested revisions for these manuals be mailed to: General Electric Company, East Side Highway, Waynesboro, Virginia 22980, attention Technical Writer, Data Communication Printer Marketing.

DESCRIPTION

The TermiNet 300 Printer (Fig. 1), which will be described as a keyboard printer only, can be used with several devices. In Fig. 2, it is shown on a desk console which includes a tape reader and punch. It is not necessary to have both the reader and punch; either one, or both, may be used with the keyboard printer. An empty drawer is placed in the desk unit if one of these items is not ordered. The keyboard printer is necessary, however, for the operation of the reader and punch, as will be
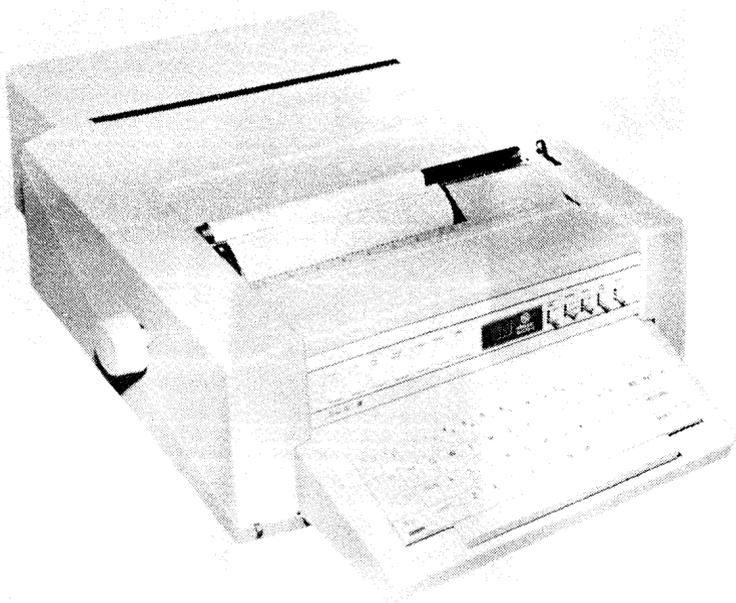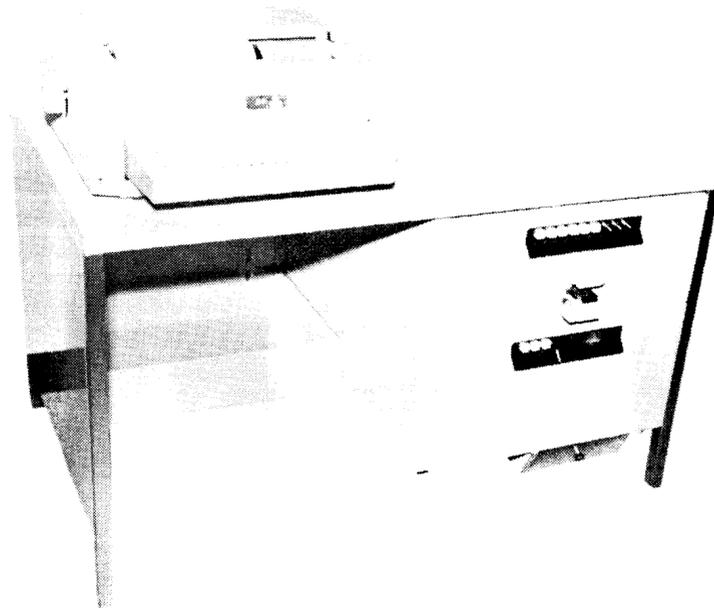
Fig. 2. TermiNet 300 Printer on desk console

seen later in this manual. The keyboard printer is the controlling item and provides the interface to the transmission circuit.

General Electric also makes a "receive only" version of the TermiNet 300 Printer. Without a transmitting capability or keyboard, this unit operates essentially the same as the TermiNet 300 in the receiving function and printout areas.

To understand the operation of the TermiNet 300 Printer, it is necessary to consider the logical layout of the machine itself and how it performs its work. Figure 3 shows a block diagram of the operating functions of the TermiNet 300 Printer. This manual does not contain a detailed explanation of how operation is achieved; but if questions arise as to the explanations given later in the manual, a referral to this block diagram may help clarify the situation.

DATA TRANSMISSION

The TermiNet 300 Printer is an asynchronous transmitting or receiving device. All transmitting or receiving between the TermiNet 300 Printer and any other device is carried on in serial form. Figure 4 shows, symbolically, the typical operation when transmitting or receiving asynchronous data in serial form.

The electrical interface between the TermiNet 300 Printer and the communication network is in accordance with RS232B. There are many varieties

Fig. 1. TermiNet 300 Printer

of data sets (modems) which are in accordance with this interface; i. e., General Electric TDM 110, 111, 114, 115, or Bell Series 103 Data Sets. The Termi-Net 300 Printer can also be used directly coupled if the interface specifications are met. Table 1 shows both the pin numbers and functions on the TermiNet 300 Printer data set connector.

Data transmission speed is variable on the TermiNet 300 Printer, depending on the position of the rate selector switch on the control panel. The three possible speeds of operation are 10, 15, or 30 characters per second. The corresponding transmission rates for these three character rates are 110 (109.95) baud, 150 baud, or 300 baud.

Each baud rate utilizes a character composed of one start bit, seven data bits, a parity bit (even parity), and either one or two stop bits. Two stop bits are used with 110-baud operation, and one stop bit is used with 150 and 300 baud operation. See Fig. 4.

TABLE 1
INTERFACE CONNECTIONS (RS232)

PIN NO.	CIRCUIT	DESCRIPTION	COMMENTS
1	AA	Protective Ground	Tied to machine frame and enclosure.
2	BA*	Transmitted Data	
3	BB	Received Data	
4	CA*	Request to Send	When on, turns on transmitter carrier of data set arranged for line turnaround or half duplex operation. When off, holds half duplex data sets in RECEIVE. Turned on by: (a) On Line button (b) Turnaround character received even if in standby** (c) DLE? received** Turned off by: (a) Low voltage (b) EOT recognized (may be strapped to have no effect) (c) Standby or Local push buttons (d) Turnaround characters sent**
5	CB	Clear to Send	Lights READY light when on unless: (a) Paper out (b) If INTERRUPT light is on (c) DLE? (wait before transmit) has been received without ACK following**
7	AB	Signal Ground	
20	CD*	Data Terminal Ready	Signals data set that TermiNet 300 Terminal is capable of receiving a call. (a) Turned off in LOCAL to prevent auto answer by data set. This will initiate disconnect in data set. (b) Turned off for 67 ms to initiate forced disconnect by data set upon recognition of DLE EOT. ** (c) Held off by paper out signal beginning as soon as CB goes off. Not affected by paper out if CB is on. (d) Off when power is off. (e) Turned on by Standby or On Line buttons except in item c and d above.

* TermiNet 300 Terminal to Data Set
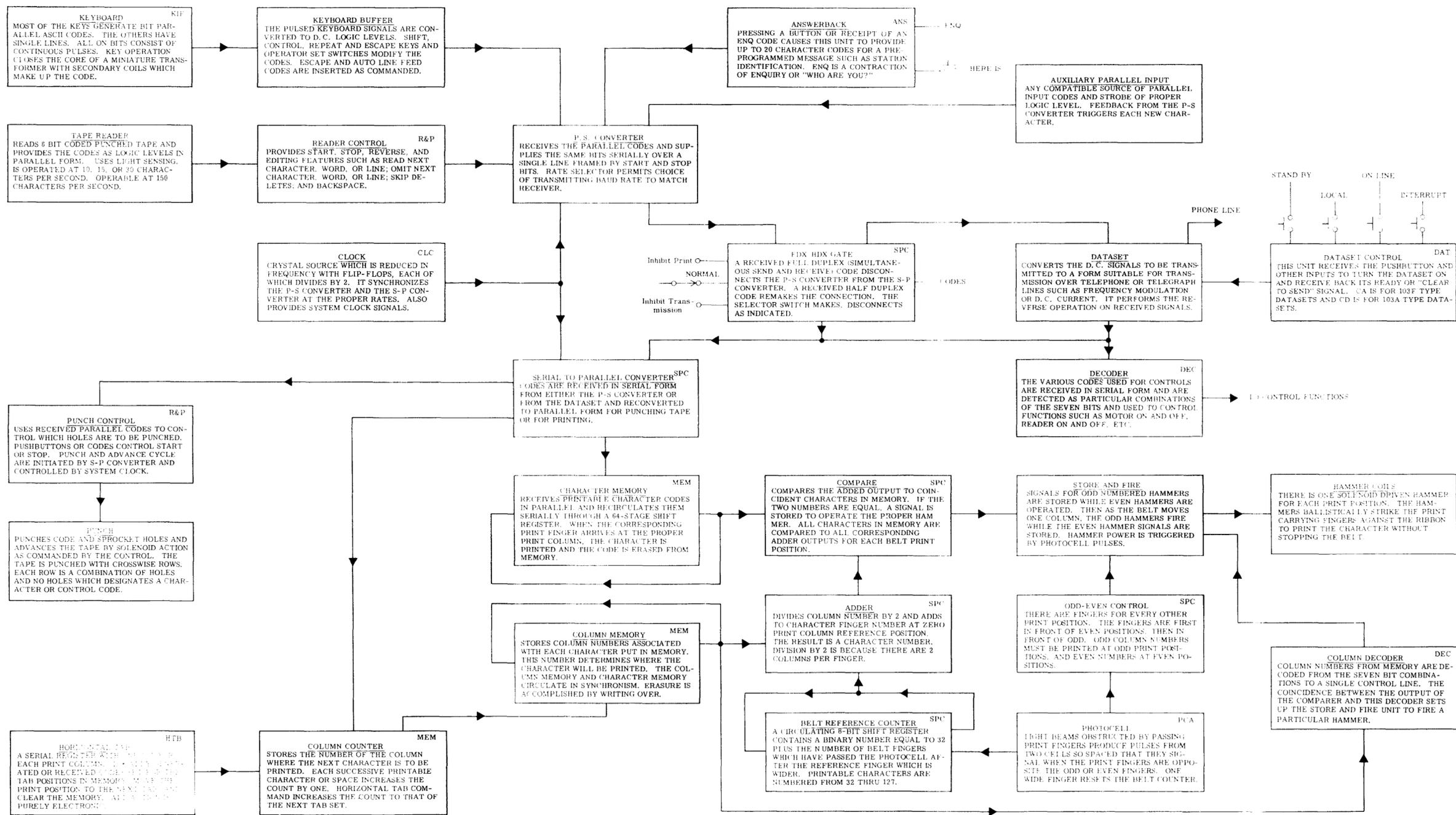** When Line Turnaround option is included

KEYBOARD   KB
MOST OF THE KEYS GENERATE BIT PAR-
ALLEL ASCII CODES. THE OTHERS HAVE
SINGLE LINES. ALL ON BITS CONSIST OF
CONTINUOUS PULSES. KEY OPERATION
CLOSES THE CORE OF A MINIATURE TRANS-
FORMER WITH SECONDARY COILS WHICH
MAKE UP THE CODE.

KEYBOARD BUFFER
THE PULSED KEYBOARD SIGNALS ARE CON-
VERTED TO D. C. LOGIC LEVELS. SHIFT,
CONTROL, REPEAT AND ESCAPE KEYS AND
OPERATOR SET SWITCHES MODIFY THE
CODES. ESCAPE AND AUTO LINE FEED
CODES ARE INSERTED AS COMMANDED.

ANSWERBACK   ANS
PRESSING A BUTTON OR RECEIPT OF AN
ENQ CODE CAUSES THIS UNIT TO PROVIDE
UP TO 20 CHARACTER CODES FOR A PRE-
PROGRAMMED MESSAGE SUCH AS STATION
IDENTIFICATION. ENQ IS A CONTRACTION
OF ENQUIRY OR "WHO ARE YOU?"

AUXILIARY PARALLEL INPUT
ANY COMPATIBLE SOURCE OF PARALLEL
INPUT CODES AND STROBE OF PROPER
LOGIC LEVEL. FEEDBACK FROM THE P-S
CONVERTER TRIGGERS EACH NEW CHAR-
ACTER.

TAPE READER
READS 8 BIT CODED PUNCHED TAPE AND
PROVIDES THE CODES AS LOGIC LEVELS IN
PARALLEL FORM. USES LIGHT SENSING.
IS OPERATED AT 10, 15, OR 30 CHARAC-
TERS PER SECOND. OPERABLE AT 150
CHARACTERS PER SECOND.

READER CONTROL   R&P
PROVIDES START, STOP, REVERSE, AND
EDITING FEATURES SUCH AS READ NEXT
CHARACTER, WORD, OR LINE; OMIT NEXT
CHARACTER, WORD, OR LINE; SKIP DE-
LETES; AND BACKSPACE.

P-S CONVERTER
RECEIVES THE PARALLEL CODES AND SUP-
PLIES THE SAME BITS SERIALLY OVER A
SINGLE LINE FRAMED BY START AND STOP
BITS. RATE SELECTOR PERMITS CHOICE
OF TRANSMITTING BAUD RATE TO MATCH
RECEIVER.

CLOCK   CLC
CRYSTAL SOURCE WHICH IS REDUCED IN
FREQUENCY WITH FLIP-FLOPS, EACH OF
WHICH DIVIDES BY 2. IT SYNCHRONIZES
THE P-S CONVERTER AND THE S-P CON-
VERTER AT THE PROPER RATES. ALSO
PROVIDES SYSTEM CLOCK SIGNALS.

FDX HDX GATE   SPC
A RECEIVED FULL DUPLEX (SIMULTANE-
OUS SEND AND RECEIVE) CODE DISCON-
NECTS THE P-S CONVERTER FROM THE S-P
CONVERTER. A RECEIVED HALF DUPLEX
CODE REMAKES THE CONNECTION. THE
SELECTOR SWITCH MAKES, DISCONNECTS
AS INDICATED.

Inhibit Print
NORMAL
Inhibit Trans-
mission

DATASET
CONVERTS THE D. C. SIGNALS TO BE TRANS-
MITTED TO A FORM SUITABLE FOR TRANS-
MISSION OVER TELEPHONE OR TELEGRAPH
LINES SUCH AS FREQUENCY MODULATION
OR D. C. CURRENT. IT PERFORMS THE RE-
VERSE OPERATION ON RECEIVED SIGNALS.

PHONE LINE
STAND BY   ON LINE
LOCAL   INTERRUPT

DATASET CONTROL   DAT
THIS UNIT RECEIVES THE PUSHBUTTON AND
OTHER INPUTS TO TURN THE DATASET ON
AND RECEIVE BACK ITS READY OR "CLEAR
TO SEND" SIGNAL. CA IS FOR 103F TYPE
DATASETS AND CD IS FOR 103A TYPE DATA-
SETS.

SERIAL TO PARALLEL CONVERTER   SPC
CODES ARE RECEIVED IN SERIAL FORM
FROM EITHER THE P-S CONVERTER OR
FROM THE DATASET AND RECONVERTED
TO PARALLEL FORM FOR PUNCHING TAPE
OR FOR PRINTING.

DECODER   DEC
THE VARIOUS CODES USED FOR CONTROLS
ARE RECEIVED IN SERIAL FORM AND ARE
DETECTED AS PARTICULAR COMBINATIONS
OF THE SEVEN BITS AND USED TO CONTROL
FUNCTIONS SUCH AS MOTOR ON AND OFF,
READER ON AND OFF, ETC.

PUNCH CONTROL   R&P
USES RECEIVED PARALLEL CODES TO CON-
TROL WHICH HOLES ARE TO BE PUNCHED.
PUSHBUTTONS OR CODES CONTROL START
OR STOP. PUNCH AND ADVANCE CYCLE
ARE INITIATED BY S-P CONVERTER AND
CONTROLLED BY SYSTEM CLOCK.

PUNCH
PUNCHES CODE AND SPROCKET HOLES AND
ADVANCES THE TAPE BY SOLENOID ACTION
AS COMMANDED BY THE CONTROL. THE
TAPE IS PUNCHED WITH CROSSWISE ROWS.
EACH ROW IS A COMBINATION OF HOLES
AND NO HOLES WHICH DESIGNATES A CHAR-
ACTER OR CONTROL CODE.

CHARACTER MEMORY   MEM
RECEIVES PRINTABLE CHARACTER CODES
IN PARALLEL AND RECIRCULATES THEM
SERIALLY THROUGH A 64-STAGE SHIFT
REGISTER. WHEN THE CORRESPONDING
PRINT FINGER ARRIVES AT THE PROPER
PRINT COLUMN, THE CHARACTER IS
PRINTED AND THE CODE IS ERASED FROM
MEMORY.

COMPARE   SPC
COMPARES THE ADDED OUTPUT TO COIN-
CIDENT CHARACTERS IN MEMORY. IF THE
TWO NUMBERS ARE EQUAL, A SIGNAL IS
STORED TO OPERATE THE PROPER HAM-
MER. ALL CHARACTERS IN MEMORY ARE
COMPARED TO ALL CORRESPONDING
ADDER OUTPUTS FOR EACH BELT PRINT
POSITION.

STORE AND FIRE
SIGNALS FOR ODD NUMBERED HAMMERS
ARE STORED WHILE EVEN HAMMERS ARE
OPERATED. THEN AS THE BELT MOVES
ONE COLUMN, THE ODD HAMMERS FIRE
WHILE THE EVEN HAMMER SIGNALS ARE
STORED. HAMMER POWER IS TRIGGERED
BY PHOTOCELL PULSES.

HAMMER COILS
THERE IS ONE SOLENOID DRIVEN HAMMER
FOR EACH PRINT POSITION. THE HAM-
MERS BALLISTICALLY STRIKE THE PRINT
CARRYING FINGERS AGAINST THE RIBBON
TO PRINT THE CHARACTER WITHOUT
STOPPING THE BELT.

ADDER   SPC
DIVIDES COLUMN NUMBER BY 2 AND ADDS
TO CHARACTER FINGER NUMBER AT ZERO
PRINT COLUMN REFERENCE POSITION.
THE RESULT IS A CHARACTER NUMBER.
DIVISION BY 2 IS BECAUSE THERE ARE 2
COLUMNS PER FINGER.

ODD-EVEN CONTROL   SPC
THERE ARE FINGERS FOR EVERY OTHER
PRINT POSITION. THE FINGERS ARE FIRST
IN FRONT OF EVEN POSITIONS, THEN IN
FRONT OF ODD. ODD COLUMN NUMBERS
MUST BE PRINTED AT ODD PRINT POSI-
TIONS, AND EVEN NUMBERS AT EVEN PO-
SITIONS.

COLUMN MEMORY   MEM
STORES COLUMN NUMBERS ASSOCIATED
WITH EACH CHARACTER PUT IN MEMORY.
THIS NUMBER DETERMINES WHERE THE
CHARACTER WILL BE PRINTED. THE COL-
UMN MEMORY AND CHARACTER MEMORY
CIRCULATE IN SYNCHRONISM. ERASURE IS
ACCOMPLISHED BY WRITING OVER.

COLUMN DECODER   DEC
COLUMN NUMBERS FROM MEMORY ARE DE-
CODED FROM THE SEVEN BIT COMBINA-
TIONS TO A SINGLE CONTROL LINE. THE
COINCIDENCE BETWEEN THE OUTPUT OF
THE COMPARER AND THIS DECODER SETS
UP THE STORE AND FIRE UNIT TO FIRE A
PARTICULAR HAMMER.

BELT REFERENCE COUNTER   SPC
A CIRCULATING 8-BIT SHIFT REGISTER
CONTAINS A BINARY NUMBER EQUAL TO 32
PLUS THE NUMBER OF BELT FINGERS
WHICH HAVE PASSED THE PHOTOCELL AF-
TER THE REFERENCE FINGER WHICH IS
WIDER. PRINTABLE CHARACTERS ARE
NUMBERED FROM 32 THRU 127.

PHOTOCELL   PCA
LIGHT BEAMS OBSTRUCTED BY PASSING
PRINT FINGERS PRODUCE PULSES FROM
TWO CELLS SO SPACED THAT THEY SIG-
NAL WHEN THE PRINT FINGERS ARE OPPO-
SITE THE ODD OR EVEN FINGERS. ONE
WIDE FINGER RESETS THE BELT COUNTER.

HORIZONTAL TAB   HTB
A SERIAL REGISTER WITH
EACH PRINT COLUMN. IS OPER-
ATED OR RESET BY
TAB POSITIONS IN MEMORY. AT THE
PRINT POSITION TO THE NEXT TAB OR
CLEAR THE MEMORY. ALL IS
PURELY ELECTRONIC.

COLUMN COUNTER   MEM
STORES THE NUMBER OF THE COLUMN
WHERE THE NEXT CHARACTER IS TO BE
PRINTED. EACH SUCCESSIVE PRINTABLE
CHARACTER OR SPACE INCREASES THE
COUNT BY ONE. HORIZONTAL TAB COM-
MAND INCREASES THE COUNT TO THAT OF
THE NEXT TAB SET.

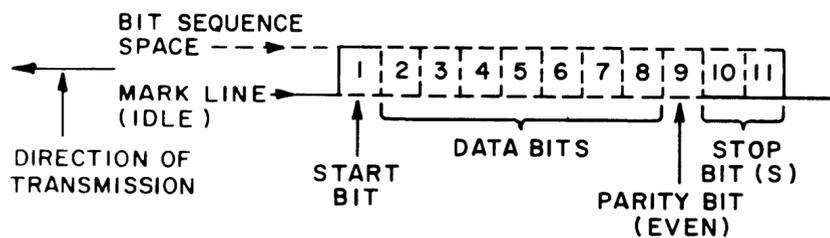*Fig. 3. Block diagram of operating functions*

Fig. 4. Typical character bit pattern

CODE DEFINITION

The TermiNet 300 Printer uses the United States of America Standard Code for Information Interchange (USASCII) only. For ease of reference, this code chart is shown in Fig. 5a. A rearrangement of this code in octal form is shown in Fig. 5b. Each of the 128 USASCII codes can be transmitted by depressing one or two keys on the TermiNet 300 Printer.

b4	b3	b2	b1	Column→ / Row↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	–	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	~
1	1	1	1	15	SI	US	/	?	O	—	o	DEL

Fig. 5a. USASCII code chart

3RD OCTAL DIGIT

1ST AND 2ND OCTAL DIGITS	0	1	2	3	4	5	6	7
00	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL
01	BS	HT	LF	VT	FF	CR	SO	SI
02	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB
03	CAN	EM	SUB	ESC	FS	GS	RS	US
04	SP	!	"	#	$	%	¢	'
05	(	)	*	+	,	–	.	/
06	0	1	2	3	4	5	6	7
07	8	9	:	;	<	=	>	?
10	@	A	B	C	D	E	F	G
11	H	I	J	K	L	M	N	O
12	P	Q	R	S	T	U	V	W
13	X	Y	Z	[	\	]	^	—
14	\	a	b	c	d	e	f	g
15	h	i	j	k	l	m	n	o
16	p	q	r	s	t	u	v	w
17	x	y	z	{	|	}	~	DEL

Fig. 5b. Octal form of USASCII code chart

Legend for Figs. 5a and 5b

Octal Nos.		USASCII Code		Function
020	004	DLE	EOT	Disconnect
020	077	DLE	?	Wait Before Transmit
021		DC1		Paper Tape Reader On
022		DC2		Tape Punch On
023		DC3		Paper Tape Reader Off
024		DC4		Tape Punch Off
033	060	ESC	0	Paper Tape Reader Reverse
033	061	ESC	1	Horizontal Tab Set
033	062	ESC	2	Horizontal Tab Clear
033	072	ESC	:	Enable Print
033	073	ESC	;	Inhibit Print, Allow Transmission
033	110	ESC	H or h	Printer Motor On
033	112	ESC	J or j	Printer Motor Off
033	113	ESC	K or k	Auxiliary Device On
033	114	ESC	L or l	Auxiliary Device Off

The following tabulation further clarifies code definition and also defines the keyboard interface with the codes.

7 Bit Code	7 Bits Plus Parity	TermiNet 300 Character	TermiNet 300 Key(s)
000	000	NUL	CTL `
001	201	SOH	CTL a
002	202	STX	CTL b
003	003	ETX	CTL c
004	204	EOT	CTL d
005	005	ENQ	CTL e
006	006	ACK	CTL f
007	207	BEL	CTL g
010	210	BS	BS
011	011	HT	HT
012	012	LF	LF
013	213	VT	VT
014	014	FF	FF
015	215	CR	RETURN
016	216	SO	CTL n
017	017	SI	CTL o
020	220	DLE	CTL p
021	021	DC1	CTL q
022	022	DC2	CTL r
023	223	DC3	CTL s
024	024	DC4	CTL t
025	225	NAK	CTL u
026	226	SYN	CTL v
027	027	ETB	CTL w
030	030	CAN	CTL x
031	231	EM	CTL y
032	232	SUB	CTL z
033	033	ESC	ESC †
034	234	FS	CTL ¦
035	035	GS	CTL }
036	036	RS	CTL ~
037	237	US	CTL —
040	240	SP	Space bar
041	041	!	Shift 1
042	042	"	Shift 2
043	243	#	Shift 3
044	044	$	Shift 4
045	245	%	Shift 5
046	246	&	Shift 6
047	047	'	Shift 7
050	050	(	Shift 8
051	251	)	Shift 9
052	252	*	Shift :
053	053	+	Shift :
054	254	,	,
055	055	-	-
056	056	.	.
057	257	/	/
060	060	0	0
061	261	1	1
062	262	2	2
063	063	3	3
064	264	4	4
065	065	5	5
066	066	6	6
067	267	7	7
070	270	8	8
071	071	9	9
072	072	:	:
073	273	;	;
074	074	<	Shift ,
075	275	=	Shift -
076	276	>	Shift .
077	077	?	Shift /
100	300	@	Shift `
101	101	A	Shift a
102	102	B	Shift b
103	303	C	Shift c
104	104	D	Shift d
105	305	E	Shift e
106	306	F	Shift f
107	107	G	Shift g
110	110	H	Shift h
111	311	I	Shift i
112	312	J	Shift j
113	113	K	Shift k
114	314	L	Shift l
115	115	M	Shift m
116	116	N	Shift n
117	317	O	Shift o
120	120	P	Shift p
121	321	Q	Shift q
122	322	R	Shift r
123	123	S	Shift s
124	324	T	Shift t
125	125	U	Shift u
126	126	V	Shift v
127	327	W	Shift w
130	330	X	Shift x
131	131	Y	Shift y
132	132	Z	Shift z
133	333	[	Shift {
134	134	\	Shift ¦
135	335	]	Shift }
136	336	^	Shift ~
137	137	_	—
140	140	`	`
141	341	a	a
142	342	b	b
143	143	c	c
144	344	d	d
145	145	e	e
146	146	f	f
147	347	g	g
150	350	h	h
151	151	i	i
152	152	j	j
153	353	k	k
154	154	l	l
155	355	m	m

†The ESC key will not generate the ESC code unless depressed simultaneously with another key. The ESC code can also be generated by CTL }.

7 Bit Code	7 Bits Plus Parity	TermiNet 300 Character	TermiNet 300 Key(s)
156	356	n	n
157	157	o	o
160	360	p	p
161	161	q	q
162	162	r	r
163	363	s	s
164	164	t	t
165	365	u	u
166	366	v	v
167	167	w	w
170	170	x	x
171	371	y	y
172	372	z	z
173	173	{	{
174	374	¦	¦
175	175	}	}
176	176	~	~
177	377	DEL	DEL

TERMINET/TELETYPE CODE COMPARISON

For a comparison of TermiNet and Teletype codes, refer to Table 2.

SPECIAL COMMENTS ON TERMINET 300 CODES

In the descriptions following, "receipt" or "when received" refers to signals received, not those generated at the keyboard or on local tape. "Recognition" refers to signals received or to signals generated locally. The codes listed are 7-Bit Codes.

NOTE: *In some cases, the codes are stored. There is no permanent memory in the TermiNet 300 Printer and this memory will be lost if power is completely removed from the printer.*

003   END-OF-TEXT (ETX) – LINE TURNAROUND OPTION

ETX will "turn the line around" on half-duplex systems, when recognized. Otherwise, ETX will be treated the same as any other character.

004   END-OF-TRANSMISSION (EOT)

When recognized, this code causes the condition of the terminal to go to "Standby" if the original condition was "On Line". If the terminal was in "Local", the EOT code will stop the printer. The EOT will also turn off the data set lead CP (Request to Send). (It is possible to have the TermiNet 300 Printer wired so that the code EOT has no effect.)

005   ENQUIRY (ENQ) – ANSWERBACK OPTION

Receipt of this code will trigger the answerback, when answerback is included. (The answerback can contain up to 20 characters.) In addition, if line turnaround option is used, ENQ will trigger either ACK or NAK, depending on the status of the terminal, and cause a line turnaround. (The ACK or NAK will immediately follow the last character of the answerback.)

006   ACKNOWLEDGEMENT (ACK) – LINE TURNAROUND OPTION

ACK will "turn the line around" on half-duplex systems, when recognized. (On other systems, the ACK will be treated just as any other character.) ACK also reflects the terminal status as being positive or good.

007   BELL OR ALARM (BEL)

When recognized, this code sounds an audible alarm for approximately 0.5 second. Any BEL received during a 0.5-second alarm will be ignored; i.e., successive BEL codes do not generate a cumulative time value of tone.

010   BACKSPACE (BS)

Recognition of this code moves the printing position one print column to the left. See TIMING.

011   HORIZONTAL TAB (HT) – OPTION

Recognition of HT causes the next printing action to take place where the next tab has been set. Tabs can be set at any position on the print line. The tab set farthest to the left is used as the left-hand margin. The time required for moving from a character position to any tab set to the right of that character position is less than one character time. When power is turned off, all tabs will be dropped; this is not true when in "Standby"

012   LINE FEED (LF)

Recognition of this code advances the printer's paper one or two lines, depending on the position of the LINE FEED switch on the console of the TermiNet 300. See TIMING.

015   CARRIAGE RETURN (CR)

Recognition of CR returns the print character position to the left-hand margin. The left-hand margin is hardware fixed except

TABLE 2
TERMINET/TELETYPE CODE COMPARISON CHART

N(10)	N(8)	N(2)	CHARACTER	TELETYPE MODEL 33	TERMINET 300	N(10)	N(8)	N(2)	CHARACTER	TELETYPE MODEL 33	TERMINET 300
0	000	0000000	NUL	CTRL Shift P	CTL (Grave accent)	64	100	1000000	@	Shift P	Shift (Grave accent)
1	001	0000001	SOH	CTRL A	CTL A	65	101	1000001	A	A	Shift A
2	002	0000010	STX	CTRL B	CTL B	66	102	1000010	B	B	Shift B
3	003	0000011	ETX	CTRL C	CTL C	67	103	1000011	C	C	Shift C
4	004	0000100	EOT	CTRL D	CTL D	68	104	1000100	D	D	Shift D
5	005	0000101	ENQ	CTRL E	CTL E	69	105	1000101	E	E	Shift E
6	006	0000110	ACK	CTRL F	CTL F	70	106	1000110	F	F	Shift F
7	007	0000111	BEL	CTRL G	CTL G	71	107	1000111	G	G	Shift G
8	010	0001000	BS	CTRL H	BS	72	110	1001000	H	H	Shift H
9	011	0001001	HT	CTRL I	HT	73	111	1001001	I	I	Shift I
10	012	0001010	LF	LINE FEED	LF	74	112	1001010	J	J	Shift J
11	013	0001011	VT	CTRL K	VT	75	113	1001011	K	K	Shift K
12	014	0001100	FF	CTRL L	FF	76	114	1001100	L	L	Shift L
13	015	0001101	CR	RETURN	RETURN	77	115	1001101	M	M	Shift M
14	016	0001110	SO	CTRL N	CTL N	78	116	1001110	N	N	Shift N
15	017	0001111	SI	CTRL O	CTL O	79	117	1001111	O	O	Shift O
16	020	0010000	DLE	CTRL P	CTL P	80	120	1010000	P	P	Shift P
17	021	0010001	DC1	CTRL Q	CTL Q (RDR ON)	81	121	1010001	Q	Q	Shift Q
18	022	0010010	DC2	CTRL R	CTL R (PCH ON)	82	122	1010010	R	R	Shift R
19	023	0010011	DC3	CTRL S	CTL S (RDR OFF)	83	123	1010011	S	S	Shift S
20	024	0010100	DC4	CTRL T	CTL T (PCH OFF)	84	124	1010100	T	T	Shift T
21	025	0010101	NAK	CTRL U	CTL U	85	125	1010101	U	U	Shift U
22	026	0010110	SYN	CTRL V	CTL V	86	126	1010110	V	V	Shift V
23	027	0010111	ETB	CTRL W	CTL W	87	127	1010111	W	W	Shift W
24	030	0011000	CAN	CTRL X	CTL X	88	130	1011000	X	X	Shift X
25	031	0011001	EM	CTRL Y	CTL Y	89	131	1011001	Y	Y	Shift Y
26	032	0011010	SUB	CTRL Z	CTL Z	90	132	1011010	Z	Z	Shift Z
27	033	0011011	ESC	CTRL Shift K	CTL (Opening brace)	91	133	1011011	[	Shift K	Shift (Opening brace)
28	034	0011100	FS	CTRL Shift L	CTL (Vertical line)	92	134	1011100	\	Shift L	Shift (Vertical line)
29	035	0011101	GS	CTRL Shift M	CTL (Closing brace)	93	135	1011101	]	Shift M	Shift (Closing brace)
30	036	0011110	RS	CTRL Shift N	CTL (Tilde)	94	136	1011110	(Circumflex)	Shift N	Shift (Tilde)
31	037	0011111	US	CTRL Shift O	CTL (Underline)	95	137	1011111	(Underline)	Shift O	(Underline)
32	040	0100000	SP	(Space bar)	(Space bar)	96	140	1100000	(Grave accent)	N/A	(Grave accent)
33	041	0100001	!	Shift 1	Shift 1	97	141	1100001	a	N/A	A
34	042	0100010	" (Quotation mark)	Shift 2	Shift 2	98	142	1100010	b	N/A	B
35	043	0100011	#	Shift 3	Shift 3	99	143	1100011	c	N/A	C
36	044	0100100	$	Shift 4	Shift 4	100	144	1100100	d	N/A	D
37	045	0100101	%	Shift 5	Shift 5	101	145	1100101	e	N/A	E
38	046	0100110	&	Shift 6	Shift 6	102	146	1100110	f	N/A	F
39	047	0100111	' (Apostrophe)	Shift 7	Shift 7	103	147	1100111	g	N/A	G
40	050	0101000	(	Shift 8	Shift 8	104	150	1101000	h	N/A	H
41	051	0101001	)	Shift 9	Shift 9	105	151	1101001	i	N/A	I
42	052	0101010	*	Shift :	Shift :	106	152	1101010	j	N/A	J
43	053	0101011	+	Shift ;	Shift ;	107	153	1101011	k	N/A	K
44	054	0101100	, (Comma)	,	,	108	154	1101100	l	N/A	L
45	055	0101101	-	-	-	109	155	1101101	m	N/A	M
46	056	0101110	.	.	.	110	156	1101110	n	N/A	N
47	057	0101111	/	/	/	111	157	1101111	o	N/A	O
48	060	0110000	0	0	0	112	160	1110000	p	N/A	P
49	061	0110001	1	1	1	113	161	1110001	q	N/A	Q
50	062	0110010	2	2	2	114	162	1110010	r	N/A	R
51	063	0110011	3	3	3	115	163	1110011	s	N/A	S
52	064	0110100	4	4	4	116	164	1110100	t	N/A	T
53	065	0110101	5	5	5	117	165	1110101	u	N/A	U
54	066	0110110	6	6	6	118	166	1110110	v	N/A	V
55	067	0110111	7	7	7	119	167	1110111	w	N/A	W
56	070	0111000	8	8	8	120	170	1111000	x	N/A	X
57	071	0111001	9	9	9	121	171	1111001	y	N/A	Y
58	072	0111010	:	:	:	122	172	1111010	z	N/A	Z
59	073	0111011	;	;	:	123	173	1111011	(Opening brace)	N/A	(Opening brace)
60	074	0111100	<	Shift .	Shift .	124	174	1111100	(Vertical line)	N/A	(Vertical line)
61	075	0111101	=	Shift -	Shift -	125	175	1111101	(Closing brace)	ALT MODE	(Closing brace)
62	076	0111110	>	Shift .	Shift .	126	176	1111110	(Tilde)	N/A	(Tilde)
63	077	0111111	?	Shift /	Shift /	127	177	1111111	DEL	RUBOUT	DEL

when the horizontal tab option is present, at which time the tab set farthest to the left is defined to be the left-hand margin.

020   DATA LINK ESCAPE (DLE)

DLE is used in combination with other codes to provide the following capabilities:

020 004   DLE EOT - DISCONNECT –
LINE TURNAROUND OPTION

When recognized, these codes initiate the automatic disconnect sequence by turning the "Data Terminal Ready" signal to the "Data Set Off" until "Data Set Ready" is off. The Terminal will also be placed in the "Standby" mode.

020 077   DLE ? - WAIT BEFORE TRANS-
MIT – LINE TURNAROUND OPTION

Receipt of these codes constitutes a "Wait Before Transmit" condition. These codes will de-energize the "Ready" lamp. The Terminal automatically responds to DLE ? with the code ENQ.

021   DC1 – RDR "ON"

DC1 is used when received to turn the tape reader ON.

022   DC2 – PCH "ON"

DC2 is used when received to turn the tape punch ON.

023   DC3 – RDR "OFF"

When this code is read from a tape, the reader stops and DC3 is not transmitted. If restarted on this same code, the first character transmitted will be DC3. A DC3 from the keyboard will not stop the local reader. To stop a remote reader, use a "Break" or "Interrupt."

024   DC4 – PCH "OFF"

DC4 is used when received to turn the tape punch OFF.

025   NEGATIVE ACKNOWLEDGEMENT (NAK) –
LINE TURNAROUND OPTION

NAK results in "line turnaround". Receipt of NAK has exactly the same effect as receiving "Break" or "Interrupt". That is, the "Interrupt" light becomes illuminated and the keyboard is deactivated.

If the line turnaround option is included, the Terminal will indicate negative terminal status by NAK and positive or good status by ACK when ENQ is received.

Negative terminal status will exist if the Terminal is in any form of "Alarm" condition such as paper out or tape out. See MEANING AND EFFECT OF LIGHTS AND SWITCHES for definition of "Alarm" conditions.

033   ESCAPE (ESC)

ESC is used in combination with other codes (by striking two keys simultaneously) to provide the following capabilities:

033 060   ESC 0

This code, when recognized, will cause the paper tape reader to reverse if the reader is stopped. The reader will reverse until a stop code (023) or end-of-tape condition is detected. If the paper tape hold-down lever is up, the reader is deactivated and will not respond to the code. If the tape reader is reading when it receives the code, it will continue until it reaches a stop code. Then, the reader will be immediately reversed. The local tape reader will act on this code only if it is ON.

033 061   ESC 1 - HORIZONTAL TAB SET –
OPTION

If the horizontal tab option is present, recognition of ESC 1 will set a tab at the print column position where this code is recognized.

033 062   ESC 2 - HORIZONTAL TAB CLEAR
– OPTION

If the horizontal tab option is present, recognition of ESC 2 will clear all tabs which have been set.

033 072   *ESC: – ENABLE PRINT

ESC:, when received, will restore normal print operation; that is, it will restore the condition caused by receipt of ESC;. This is the normal condition in that data is printed or punched, or both, concurrently with either transmitting or receiving. See ESC;.

033 073   *ESC; INHIBIT PRINT, ALLOW
TRANSMISSION

ESC;, when recognized, will separate locally generated codes from the printer. This will

---

* ESC:, ;, H and J may be wired as a group to operate only when received.

allow two-way simultaneous data flow (full duplex); also, the effect to an operator will be that of suppressing printing. See ESC:.

033 110   *ESC H(h) — PRINTER MOTOR ON

Used, when recognized, to turn the printer motor ON. ESC H may be wired to operate only when received.

033 112   *ESC J(j) — PRINTER MOTOR OFF

Used, when recognized, to turn the printer motor OFF. ESC J may be wired to operate only when received.

033 113   ESC K(k) - AUXILIARY DEVICE ON. OPTION

ESC K, when received, turns the auxiliary device on.

033 114   ESC L(l) - AUXILIARY DEVICE OFF. OPTION

ESC L, when received, turns the auxiliary device off.

* ESC:, :, H and J may be wired as a group to operate only when received.

BREAK OR INTERRUPT

The function to transmit or receive and act on an Interrupt is as follows:

● Transmitting — A 268-millisecond spacing signal.

● Receiving — Is identified as one full character of spacing including the start and stop bit(s). The effect of receiving the break is to stop the keyboard and tape reader operations. To restore the keyboard, depress the lighted INTERRUPT button. The tape reader may be restarted by depressing the reader's RUN button or by the receipt of DC1.

KEYBOARD OPERATION

The TermiNet 300 keyboard (see Fig. 6) has a total of 62 keys, including the space bar, which are available to the operator. The following paragraphs discuss those keys on the keyboard where there may be some question as to their operation.
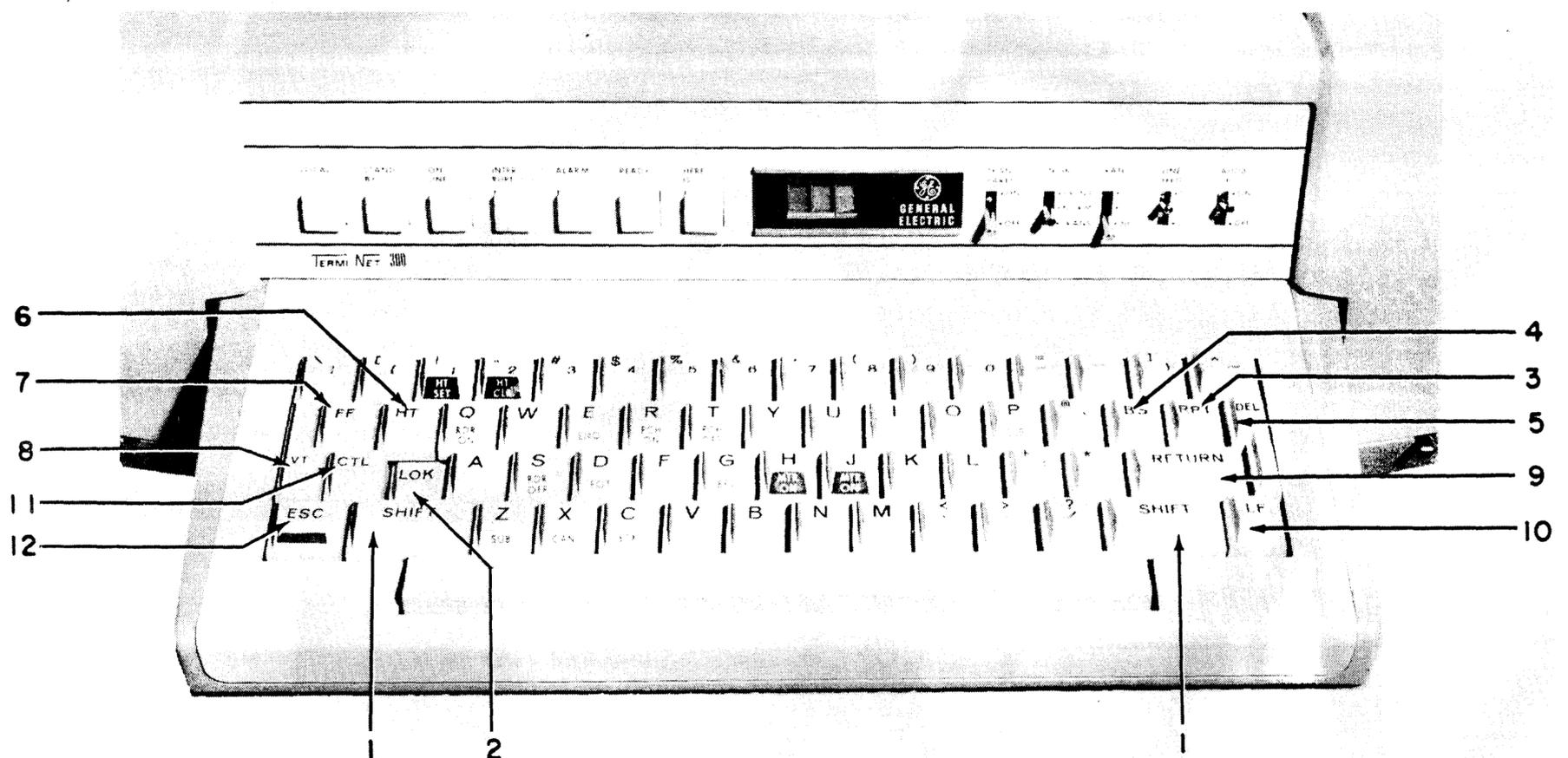
Fig. 6.   Keyboard

1. SHIFT KEY

There are two large keys labeled SHIFT on each side of the keyboard. These keys operate very similar to a normal typewriter shift key. On the alphabetic keys, the SHIFT key is the difference between lower case and upper case. On the other keys where there are two symbols, the SHIFT key determines whether the lower or upper symbol will be printed and/or transmitted. There are obviously some keys on the keyboard which will not be affected by the shift key. These keys are the keys labeled FF, HT, VT, CTL, LOK, ESC, BS, RPT, DEL, RETURN, LF.

2. LOK

The LOK key provides a mechanical function only. That is, locking the shift key in the SHIFT position. When depressed, the LOK key will stay depressed until released by the SHIFT key directly below it. This is the only key that releases the LOK.

3. RPT

The REPEAT key causes any key which is depressed to be repeated at the rate of approximately five characters per second.

4. BS

The BACKSPACE key generates the backspace "BS" code shown in the USASCII chart. The Termi-Net 300 Printer logic recognizes this code to move the printing one position to the left. If the tape punch is on, the BS code will be punched, but the punch will not be backspaced.

5. DEL

The DELETE key is used to generate the DEL code in the USASCII chart.

6. HT

The HORIZONTAL TABULATION key generates the HT code in the USASCII chart. The tabulation feature will be discussed later as an option.

7. FF

The FORM FEED key generates the FF code shown in the USASCII chart.

8. VT

The VERTICAL TABULATION key generates the VT code in the USASCII chart.

9. RETURN

The RETURN key on the right-hand side of the keyboard generates the CR code in the USASCII chart.

If the AUTOMATIC LINE FEED switch is in the ON position on the front panel of the TermiNet 300, two codes will be generated when the RETURN key is pressed. These two codes are CR and LF, in that order. The codes are generated with the one keystroke being the only operator motion necessary. The effect of the CR code on the printer mechanism will be to return printing to the No. 1 position. The only exception to this is when the tabs have been set; then, the CR code will move printing to the tab closest to the No. 1 print position.

10. LF

The LINE FEED key generates the LF code in the USASCII chart. The effect of the Line Feed code on the printer is to advance the paper one line for each code. If the LINE FEED switch on the front panel of the TermiNet 300 is set in the No. 2 position, then double spacing will occur.

11. CTL

The CONTROL key modifies the bit configuration of other keys. Commonly used non-printing codes which are generated by using the CONTROL key are labeled on the front face of alphabetic keys used; i.e., if you depress the CONTROL key and then press the Q key, you will generate the USASCII code DC 1 (reader ON). The CONTROL key then has, in effect, modified the normal bit configuration of Q to provide the non-print DC 1. Any of the non-print control codes can be generated by depressing the appropriate alphabetic key simultaneously with control, but only the most commonly used codes are labeled on the front face of the key button.

12. ESC

The ESCAPE key does not operate in the same manner as the CONTROL or SHIFT key. The ESCAPE key is color coded with a maroon bar, and is easy to correlate with other keys which are also color coded. Whenever the ESCAPE key is depressed and another key is then depressed, two characters are automatically generated. The first of the two characters is the USASCII code ESC, and the second character is the character of the second key being depressed. Two code sequences are used for several functions in the TermiNet 300 Printer. In all cases, to generate these two code sequences, the keyboard operation is to depress the ESCAPE key and then the appropriate second key to accomplish the function desired. In each case, two codes will be generated, with the ESCAPE code being the first, immediately followed by the code of the second key depressed.

TIMING

Table 3 represents the basic timing of the TermiNet 300 Printer.

TABLE 3
BASIC TIMING

	Character Rates Per Second		
	10	15	30
Bits per second	109.95	150.00	300.00
Bit time	9.10MS	6.67MS	3.33MS
Character time	100.05MS	66.67MS	33.33MS
Number of stop bits	2	1	1

In addition to the timing considerations of Table 3, certain operations of the TermiNet 300 Printer require a time delay to allow for completion of execution. These time intervals are needed when the Terminal is receiving data. If the time intervals are not provided, characters can be lost. There are two ways to provide the required time delays:

1. By an actual time delay. This is preferred for two reasons:

    a. The time delay affords a period of time for the Terminal to resynchronize.

    b. With time delays, unnecessary characters will not be punched in the paper tape.

2. By using "fill" characters, to provide the required time for a line feed or other operation.

Table 4 and its examples indicate the required time and/or fill characters that can be used to provide the delays. The paper tape reader on the TermiNet 300 Printer automatically provides these delays.

TABLE 4
TIME DELAYS

FUNCTION	INTERVAL BETWEEN	APPROX. INTERVAL IN MILLISECONDS	NON-PRINTING FILL CHARACTERS REQUIRED		
			30CPS	15CPS	10CPS
Normal Line Feed	Commanding last character on old line and first character on new line	300	6	1	0
Consecutive Line Feeds	Consecutive executions of line feed code	58	2	1	0
Backspace	Printing and then reprinting in the same position	222	6	3	2
Startup*	Commanding motor ON and printing	420	12	6	4
Shutdown**	Last data character and commanding motor OFF	222	6	3	2

*Startup - The TermiNet 300 Printer will normally go from a non-printing or "Standby" state to a printing or "On Line" state under code control. The two-code sequence for Motor On is ESC h or H. A time delay of 420 ms should be allowed before data transmission can begin.

A special version of the printer can be supplied where the printing motor will be commanded "On" whenever the data set CB lead (Clear to Send) is activated. In this case, 420 ms delay is necessary between that signal and data flow.

**Shutdown may be accomplished by either ESC j or J or by EOT.

EXAMPLES

FUNCTION	30 CPS	15 CPS	10 CPS
Normal Line Feed	...data...CR, LF, 6 fill char	...data...CR, LF.. fill, data	...data...CR, LF
Consecutive Line Feeds	LF, fill, fill, LF, fill, fill, etc.	LF, fill, LF, fill, etc.	LF, LF, LF
Backspace	BS, 6 fill char, ***reprint	BS, 3 fill char, ***reprint	BS, 2 fill char, ***reprint

***If Backspace code is used more than once, it may take the place of fill characters; e.g., at 30 cps, to type and underscore "A N D" send "A, N, D, BS, BS, BS, fill, fill, fill, fill, -, -, -"

MEANING AND EFFECT OF LIGHTS AND SWITCHES

The lights and switches on the front panel of the TermiNet 300 Printer which are available to the operator are shown in Fig. 7. These lights and switches, from left to right, perform the following functions.

1. LOCAL

As long as power is applied to the TermiNet 300 Printer, the LOCAL button will turn the printer motor on. This will allow local operation to be complete, but will not allow a data set to answer a call. For an exact description of the effect of Local on the data set leads, refer to Table 1.

2. STANDBY

Whenever the TermiNet 300 Printer is in "Standby", the STANDBY button is lit and the unit is completely operational, but the printer motor is not running. All electronic functions are operable and the TermiNet 300 Printer will respond to a data call.

3. ON LINE

The ON LINE push button is lit when the Terminal is accessible or connected to the communication link and the printer motor is running. The only difference between the "On-line" and the "Standby" condition is whether or not the printer motor is running.

4. INTERRUPT

If the INTERRUPT button on the front panel is depressed, a BREAK or INTERRUPT signal is transmitted. This signal is a 268-millisecond spacing signal. When this button is operated locally, the INTERRUPT light will not turn on. If an interrupt or BREAK signal is received, the INTERRUPT light turns on. The TermiNet 300 Printer identifies a BREAK or INTERRUPT signal as one full character of spacing including the start and stop bit time. The printer can continue printing after receipt of a break or interrupt. However, the keyboard is de-energized until corrective action has been taken. The corrective action necessary in this case is to depress the lighted INTERRUPT switch, which will restore the TermiNet 300 Printer to its normal condition.
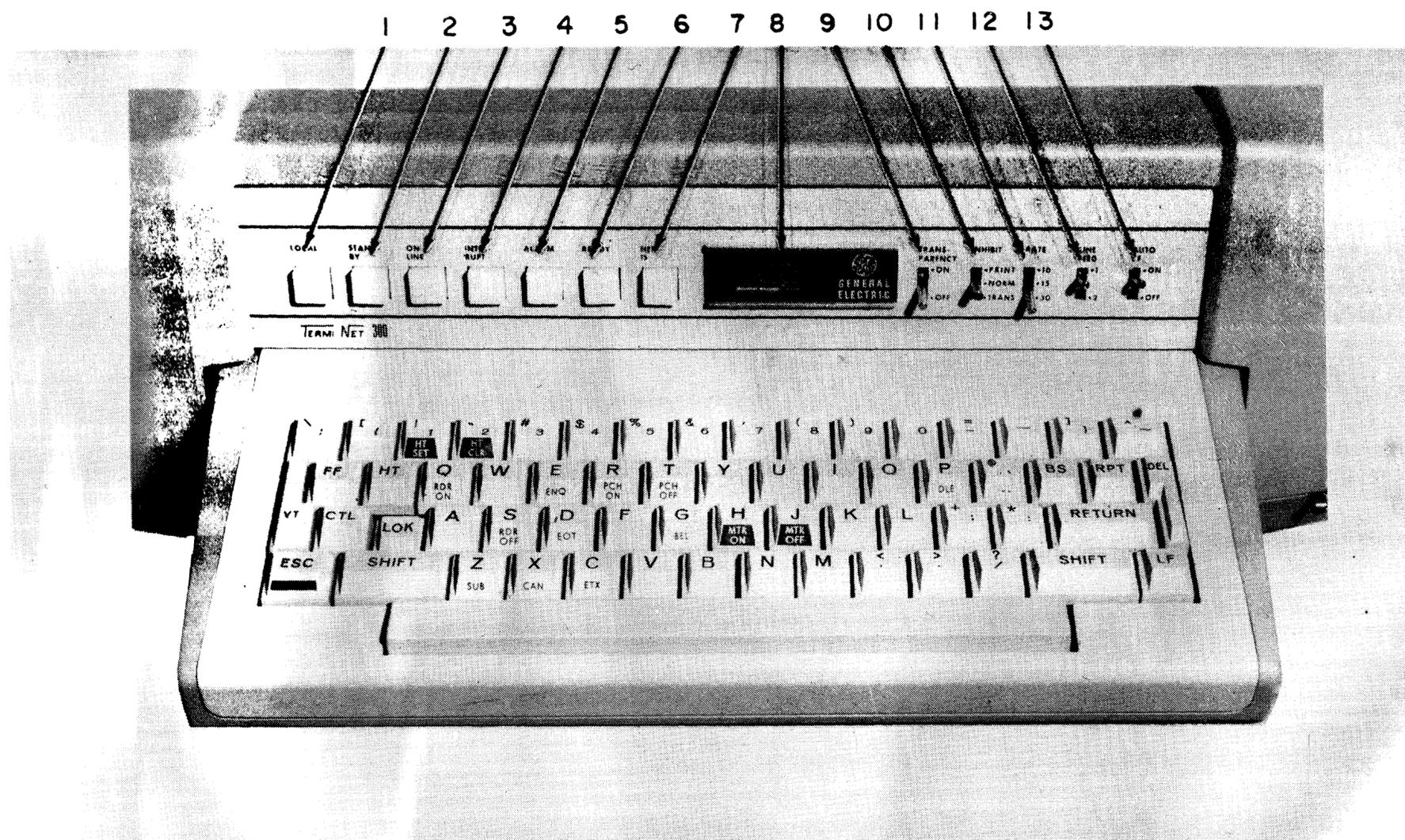
Fig. 7. Lights and switches on front panel of printer

5. ALARM

This is a light only. The light will be energized when an "Alarm" condition is encountered. The "Alarm" condition must be removed or corrected, to allow the ALARM light to be de-energized.

Following is a description of the "Alarm" conditions and the remedial actions required to restore equipment operation.

Causes of Alarm

a. PAPER OUT

A sensor determines when the paper supply on the roll inside the machine is depleted.

b. PAPER SHIELD UP

c. TAPE OUT

A sensor determines when the paper tape for the punch is depleted.

d. PRINT BELT UNDERSPEED

When the speed of the belt which carries the type pieces drops below approximately 5 percent from nominal.

e. UNDERVOLTAGE

When the input voltage drops below 105 volts.

Alarm Action

a. Printer or Punch Paper Out –

(1) ALARM light turns on.

(2) Motor stops, unit goes to "Standby".

(3) "Alarm" sounds momentarily.

(4) A "break" signal is transmitted.

(5) Paper tape reader will stop if being used.

b. Underspeed on Print Belt – Same as paper out, except ALARM light does not come on.

c. Undervoltage – There is no assurance that any action will take place, depending on the severity of the undervoltage. All steps given for paper out will be attempted.

6. READY

a. If "Line Turnaround" option is not included, the READY light will be lit when data connector pin No. 5 (clear to Send) comes on.

b. If "Line Turnaround" option is included, the READY light is controlled by "Turnaround" control characters or "Wait Before Transmit" characters. See CODE DEFINITION Section.

7. HERE IS

The HERE IS switch activates the answerback contained in the local machine.

8. DIGITAL DISPLAY

DIGITAL DISPLAY indicates where the next character is to be printed. Display follows printer action, not keyboard.

9. TRANSPARENCY

Refer to the description of options.

10. INHIBIT

The INHIBIT switch in the center position (NORMAL) will provide normal operation; that is, when information is either transmitted or received, it is printed simultaneously.

When in the SUPPRESS PRINT position, information generated by either the keyboard or the tape reader will be transmitted but not printed.

When in the SUPPRESS TRANSMISSION position, information generated by the keyboard or tape reader will be printed but not transmitted.

11. RATE

The RATE switch controls character and bit transmission and receiving rate. The tape punch and reader are also controlled by this switch.

12. LINE FEED

The LINE FEED switch controls single or double line advance when acting on the LF code.

13. AUTO LF

This switch controls the keyboard generated data. When ON, it generates the LF code automatically after each CR when the RETURN key is depressed. When OFF, only the single code CR is generated when the RETURN key is depressed.

POWER ON-OFF

The POWER ON-OFF switch is located at the right rear of the TermiNet 300 Printer, and is used for turning power "on" or "off". On ASR versions, there is also a POWER ON-OFF switch on the right-hand surface of the desk knee hole.

CAPS ONLY

The CAPS ONLY switch is located on the rear surface of the machine. When ON, keyboard operation simulates that of a Teletype M33 or M35; i.e., no lower-case characters are produced by the keyboard. The position of this switch does not affect received data.

OPTIONS

HORIZONTAL TABULATION

The optional tabulation feature is a single printed-circuit card which may or may not be used without affecting any other operation.

Tab Setting — A tab is set at any print position where the two codes ESC (Escape) — 1 (one) are recognized. Any number of tabs can be set on a print line.

Tab Clearing — Recognizing ESC 2 clears all tabs.

Operation:

When the CR code is recognized, the printer moves to the tab set farthest left on the print line. If no tabs are set, the printer goes to position one.

When the HT code is recognized, the printer moves to the next tab set to the right. No delay is required between data characters, HT, and new data characters.

> **NOTE:** *When power has been removed from printer, all tabs will be dropped. This does not apply if printer has gone to the STANDBY condition.*

ANSWERBACK

The answerback option is a single printed-circuit card that can contain up to 20 characters of information usually used for machine identification. The method of coding the answerback is described in the Service Manual.

The answerback is activated upon receiving the ENQ (Enquiry) code or depressing the HERE IS button.

Timing — The answerback begins transmitting after receiving the Enquiry code.

LINE TURNAROUND

The Line Turnaround is a single printed-circuit card. Following are the functions included.

1. Line Turnaround — Recognizes control codes to change state of data set lead CA. The following codes are acted upon for this function:

    ACK
    ETX
    NAK

2. Wait Before Transmit — Control READY lamp by DLE? — ENQ exchange.

3. Mandatory Disconnect — Forced disconnect on recognizing DLE-EOT.

4. Recognize NAK as equivalent to "Break" or "Interrupt".

5. Terminal Status — Respond to ENQ with ACK or NAK to show Terminal status. If answerback is included, ACK or NAK will be last character, added to answerback.

CHARACTER PARITY ERROR DETECTION

This option is a single printed-circuit board and operates as follows:

If a data character is recognized with incorrect character parity (add), the following action takes place:

1. A "Break" is transmitted.

2. Alarm sounds.

3. INTERRUPT light is energized and stays on.

4. If tape reader is running, it stops.

5. The unit goes to the "Standby" condition, and the INTERRUPT light turns off only when depressed. The keyboard is disabled while INTERRUPT is lit.

This parity error option may be strapped to light only the INTERRUPT light.

UPPER AND LOWER CASE SWITCH

The UPPER AND LOWER CASE switch is accessible from the rear of the printer. It affects keyboard operation only. When OFF, keyboard operation is normal. When ON, unshifted alphabetic keys are generated as shifted (upper case). The purpose of this switch is to make the TermiNet 300 Printer keyboard similar to Teletype M33 and M35 keyboards. Looking at the USASCII code chart, the effect of this switch is to move Column 6 to 4 and Column 7 to 5 except for Delete which is unchanged.

16

HIGH SPEED TRANSMISSION

One of the rate positions can be marked 120 to indicate the ability to transmit tape at the rate of 120 characters per second (1200 baud).

All printing is inhibited during this operation and the unit goes to the "Standby" condition.

PARALLEL INTERFACE

In the description below:

Logic "1" is more negative than -10 volts and a maximum negative voltage of -27 volts.

Logic "0" is between "0" and "-1" volts.

All incoming signals to the TermiNet 300 Printer must be capable of driving a 10 K load. Any positive voltage applied to this interface may cause serious equipment damage.

All outputs from the TermiNet 300 Printer will have a source impedance of less than 2000 ohms. Outputs from the TermiNet 300 Printer will be short-circuit protected.

Definition of Signals

The auxiliary device interface requirements are shown in Table 5. The logic status of a barred signal is "1"; the logic status of an unbarred signal is "0".

Sequence of Operation

USASCII INPUT:

AINH line should be at "0".

If the transparency switch is included on the TermiNet 300 Printer, the switch position should be OFF.

If printing is desired, all timing characteristics of the TermiNet 300 Printer must be satisfied.

The auxiliary device may be turned ON by its own local control or by receiving from the transmission line "ESC K" or "ESC k". Devices may be turned off by local control or recognizing "ESC L" or "ESC l". This means the ESC L sequence will have effect either when received from the transmission line or when generated locally.

Closed-loop Operation

Auxiliary device data are presented to the TermiNet 300 Printer on input lines AI1 through AI8.

Upon presentation of the data, a strobe is to be supplied from the auxiliary device. (See GENERAL NOTES.)

The TermiNet 300 Printer responds with $\overline{ASTIN}$ when it is ready for the next data character. Input strobes to the TermiNet 300 Printer should occur after the end of $\overline{ASTIN}$.

Open-loop Operation

Auxiliary device data are presented to the TermiNet 300 Printer on input lines AI1 through AI8.

Data must be held for a minimum time as specified in Table 5. The data rate must be less than the transmission rate.

NON-USASCII INPUT:

AINH line should be at "1". This logic affects the TermiNet 300 Printer to inhibit printing and recognition of all control codes (either transmitted or received), but punching will be allowed. Auxiliary device ON and OFF codes will not be recognized. The transparency switch, if included, should be in the OFF position.

Either closed- or open-loop operation is the same as with USASCII Input.

General Notes

MECHANICAL CONFIGURATION

Connector: Type D, 25-pin female

Cord Length: 6 feet

When the auxiliary device is active no other data input should be used; i.e., keyboard, tape reader or answerback.

If the auxiliary device is presenting 8 bits of data, the strobe supplied by the device should go to $\overline{AISWIP}$. If the auxiliary device is presenting 7 bits of data and wants the TermiNet 300 to add the 8th bit as even parity, $\overline{AISWOP}$ should be used.

Any time a "Break" signal is received the ATOFF lead will be energized.

Character rate will be determined by the RATE SELECTOR switch on the front panel of the TermiNet 300 Printer.

The auxiliary device may provide a signal to the TermiNet 300 Printer on lead AUXRDY. The TermiNet 300 Printer will treat this the same as a "paper out" and the resetting must be in the auxiliary device.

TRANSPARENCY SWITCH

The transparency option is a front panel switch. When used, the effect of this switch is to allow the transmitting or receiving of non-USASCII codes.

This TRANSPARENCY switch is used with either a tape reader and punch or with an auxiliary device that uses non-USASCII codes. All decoding is inhibited. Remote control of the punch or reader is not possible but a received "Break" will stop a transmitting tape reader.

TABLE 5

AUXILIARY DEVICE INTERFACE REQUIREMENTS

INPUTS FROM AUXILIARY DEVICE		MINIMUM DURATION
$\overline{AI1}$ - $\overline{AI7}$	7 data bits	Open Loop: One baud bit* + 48 microseconds after strobe begins
$\overline{AI8}$	8th or parity bit	Closed Loop: Until 15 microseconds after $\overline{ASTIN}$ begins
$\overline{AISWOP}$	Strobe for data to which TermiNet is to add parity bit	15 microseconds
$\overline{AISWIP}$	Strobe for data where $\overline{I8}$ is to be used as 8th bit	15 microseconds
AUXRDY	Auxiliary device ready signal	15 microseconds
AINH	Inhibit printing and control function decoding, permit punching and transmitting	Static
OV	Isolated signal ground	Static

OUTPUTS TO AUXILIARY DEVICE		MINIMUM DURATION
$\overline{ASTIN}$	This signals auxiliary device to present new data	One baud bit
ATON	Turnon–the Escape sequence (ESC K or k) provides a momentary signal to turn auxiliary device on	12 microseconds
ATOFF	Turnoff–the Escape sequence (ESC L or l) or receipt of a break provides a momentary signal to turn auxiliary device off	12 microseconds

* One Baud Bit: one bit time at the data transmission rate.

ADDENDUM 1 TO GEK-15002A

USE OF "FILL" CHARACTERS

WITH THE TermiNet* 300 PRINTER AND ACCESSORIES

Because certain non-printing operations (for example, Linefeed) require a finite amount of time, data being printed must be delayed so that it will not be lost when the non-printing operations occur. Also an operation must be delayed, such as motor off, so that characters in memory can be printed. These time delays can be provided by using "fill" characters. In general, a "fill" character can be defined as any character in the ASCII code that does not cause an equipment action but takes time to process. The Time Delay and "Fill" Character Table on the last page lists those operations that require a time delay, the associated time, and the number of "fill" characters required if used. As explained in the following text, some of the necessary delays are provided automatically by TermiNet equipment. Also, when using TermiNet equipment, some delays can be obtained by methods other than using the number of "fill" characters specified in the table.

USING YOUR LOCAL TermiNet PAPER TAPE READER, PRINTING LOCALLY OR TRANSMITTING TO A REMOTE PRINTER

<u>AUTOMATIC DELAYS</u>

When reading a paper tape with your local Reader, the Reader automatically pauses (supplies a delay) for the following operations:

- Linefeed

- Backspace

- Carriage Return

- Escape Function

- Shutdown as a result of codes ESC j or ESC J

Note

The automatic delay supplied for Carriage Return is not needed if using only TermiNet Printers. However, the delay is needed if you are transmitting information to a Terminal that has a mechanical Carriage Return or some other Carriage Return method that takes an appreciable amount of time.

INSERTING DELAYS WHEN MAKING A PAPER TAPE FOR THE TermiNet PAPER TAPE READER

When making a paper tape to be read by your local Reader, follow the procedures
for the Printer operations listed below to obtain the necessary delays.

Note

> The procedures below call for codes ESC~ to obtain
> delays. However, any Escape and character combination
> that does not adversely affect your system can be used.
> ESC~ is most often used and is recommended. The delay
> time is generated because each Escape and character com-
> bination that is read will cause the Reader to stop for
> approximately 300 milliseconds. This method of using an
> Escape and Character Combination (e.g., ESC~) to gen-
> erate time delays is only applicable when using the Termi-
> Net Paper Tape Reader.

Consecutive Linefeeds - Follow the first LF with ESC~ , then enter as many
consecutive LF's as required.

Note

X represents printable character.

    Example: X X X X LF ESC~ LF LF LF LF LF LF X X X X

Startup As a Result of ESC H - Follow the startup code (ESC h or ESC H) with
ESC~ ESC~ .

    Example: ESC H ESC~ ESC~ X X X

Shutdown As a Result of Control Code EOT - Precede EOT with ESC~ .

    Example: X X X ESC~ EOT

Single Vertical Tab or Form Feed - Precede the VT or FF with ESC~ and follow
the VT or FF with one ESC~ for every 12 lines or less of form movement.

    Example: Vertical Tab, 5 lines - X X X LF CR ESC~ VT ESC~ X X X

    Example: Form Feed, 28 lines - X X X LF CR ESC~ FF ESC~ ESC~ ESC~ X X X

Consecutive Vertical Tabs or Form Feeds - Precede the first VT or FF with ESC~ and
follow the first VT or FF with one ESC~ for every 12 lines or less of form
movement; then follow with "blocks of codes" for the consecutive VT or FF movements.
Each of these consecutive "blocks of codes" should consist of a VT or FF followed
by one ESC~ for every 12 lines or less of form movement.

Example: Vertical Tab, 10 lines, Vertical Tab, 8 lines, Vertical Tab, 25 lines.

X X X LF CR | ESC~ VT ESC~ | VT ESC~ | VT ESC~ ESC~ ESC~ | X X X
            | VT#1 - 10 lines | VT#2 - 8 | VT#3 - 25 lines |
            | lines |

MAGNETIC TAPE CASSETTE ACCESSORY (TCA)

NECESSARY DELAYS FOR THE PRINTER

For printing locally or when transmitting to a Printer, the TCA provides the
necessary delays for all Printer operations except Carriage Return and Vertical
Tab and Form Feed. For Vertical Tab and Form Feed, use the formula for "fill"
characters in the Time Delay and "Fill" Character Table.

If you are using your TCA with a TermiNet 300 Printer, you will not need a delay
for Carriage Return. However, if you are sending information to a Terminal
with a mechanical Carriage Return or some other Carriage Return method that
takes an appreciable amount of time, you must use "fill" characters to supply
a delay as specified by the manufacture of the Terminal to which you are trans-
mitting.

Note

A 300 millisecond delay should be sufficient in most
cases. For an approximate 300 millisecond delay, use
nine (9) "fill" characters at 30 cps, five (5) "fill"
characters at 15 cps, and three (3) "fill" characters
at 10 cps.

WRITING AT 120 CPS

When writing at 120 cps, there must be a "fill" character at the beginning of
data to be written. This allows the TCA to come up to speed before the valid data
is written; otherwise the first character of valid data would be lost. The "fill"
character is not recorded.

If it is anticipated that a tape being made will be used to make a second tape
in another TCA (at 120 cps), a "fill" character should be written at the beginning
of data. If a third tape is made from the second tape, two (2) fill characters
should be written on the first tape.

For Example: Tape 1 is written from the keyboard at 30 cps (or less) with
two (2) "fill" characters.

 - Tape 1 is used to write Tape 2 (in another TCA) at 120 cps. Since one (1)
    "fill" character is lost, Tape 2 has one (1) "fill" character.

 - Tape 2 is used to write Tape 3 (in another TCA) at 120 cps. The "fill"
    character is lost and Tape 3 has no "fill" characters.

 - If Tape 3 was used to make a fourth tape, the first character of data would
    be lost.

From the preceding example, you can conclude that the anticipated number of times the data is rewritten in the manner described will dictate the number of "fill" characters that should be written on the first tape.

OUTSIDE DATA SOURCE

If data to your Printer is from a source other than your local Reader or TCA, "fill" characters (or data pauses) should be used for all Printer operations shown in the Time Delay and Fill Character Table.

The time delay figures listed in the table should cover any system configuration. It is possible, in certain systems, to reduce some of the time delay requirements listed. However, each possible situation within a customer's system would have to be studied to make certain it would work. It is not recommended that any time requirement be shortened as the time gain would be minimal and the possibility of errors would be great. If unusual circumstances warrant consideration of an exception to the time delays specified, DCPD Engineering, Waynesboro, Virginia, should be consulted.

Note

The Time Delay and "Fill" Character Table
supersedes Table 4 in GEK-15002A.

TIME DELAY AND "FILL" CHARACTER TABLE
FOR THE TermiNet 300 PRINTER

PRINTER OPERATION	INTERVAL BETWEEN	APPROXIMATE INTERVAL IN MILLISECONDS	NON-PRINTING FILL CHAR. 30 cps	15cps	10 cps	PLACEMENT OF FILL CHAR.
Normal Single Linefeed*	Last char. on old line and first char. on new line.	300	6	2	0	After line feed code
Repeated line feeds	(a) Last char. on old line & second LF code.	350	8	3	1	After first line feed code.
	(b) Subsequent LF codes.	67	2	1	0	After the second & subsequent line feed codes.
Backspace**	Printing and then reprinting in same position.	230	6	3	2	After the backspace code.
Startup***	Commanding motor on and printing.	430	12	6	4	After "Motor On" code.
Shutdown****	Last data char.	300	9	4	3	Between last data character and "Motor Off" code.
Vertical Tab & Form Feed	VT or FF command and 1st character	300 + (25 x No. of Lines) = Required Time Delay in Milliseconds $$\frac{300 + (25 \times No.\ of\ Lines)}{Characters\ per\ Second} = Number\ of\ Fill\ Characters$$				

*If there is no CR, one "fill" character should be added to that shown.

**If BACKSPACE code is used more than once, it may take the place of "fill" characters; e.g., at 30 cps, to type and underscore "AND", send A N D BS BS BS fill fill fill - - - . The delay is required to insure hammers have recovered from the previous actuation.

***The TermiNet 300 Printer will go from a motor off state to a printing or "ON LINE" state in response to the two code sequence ESC h or H, or also in the case of automatic motor on from the Dataset. The delay is required to allow the motor to come up to speed.

****The TermiNet 300 Printer will go from a printing "ON LINE" state to a motor off state in response to the two code sequence ESC j or J, by the EOT code (when strapped), or also in the case of automatic motor off from the Dataset. The delay that precedes the motor off command is required to allow time to print any characters that are in memory waiting for the proper registration of the hammers and belt.

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