TELEPRINTER 1000 (KSR/RO)

DESCRIPTION

1. GENERAL

1.01 This section covers the Teleprinter 1000 (KSR/RO) manufactured by the Digital Equipment Corporation (DEC).

1.02 Whenever this section is reissued, the reason(s) for reissue will appear in this paragraph.

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1.03 Descriptive information covering the teleprinter is contained in the attached reprint of the practice prepared by DEC.

1.04 Maintenance information is contained in Section 574-550-300. Installation information is contained in Section 574-550-200.

TELEPRINTER 1000 (KSR/RO)
DESCRIPTIVE PRACTICE

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1. INTRODUCTION
GENERAL DESCRIPTION

1.01 The Teleprinter 1000 (KSR/RO) Descriptive Practice describes the major components of the KSR and RO teleprinters, as well as the codes generated by the teleprinters, the response of the teleprinter when receiving control functions, and the transmission protocol followed.

1.02 The Teleprinter 1000 KSR and RO operate in one of two modes (Figure 1). The teleprinters may be used as an interactive peripheral when communicating in the on-line mode. When operating on-line, all data typed on the KSR keyboard is transmitted immediately, and data sent to the teleprinters is printed as it is received. In local mode the teleprinters are effectively disconnected from the communication line, and data from the keyboard is printed as it is typed.

1.03 The Teleprinter 1000 contains the following major components:

KSR	RO
Printer	Printer
Logic board	Logic board
EIA communication port	EIA communication port
Keyboard	

1.04 The KSR and RO teleprinters feature a bidirectional, dot matrix printer with the ability to print up to 120 characters per second. The printed characters are formed using a seven by seven dot print matrix. This print matrix is capable of printing 94 ASCII characters, including both upper- and lowercase characters. The teleprinters use sprocket-feed paper which may only advance, backward paper motion is not allowed. The ribbon is automatically advanced during the print operation.

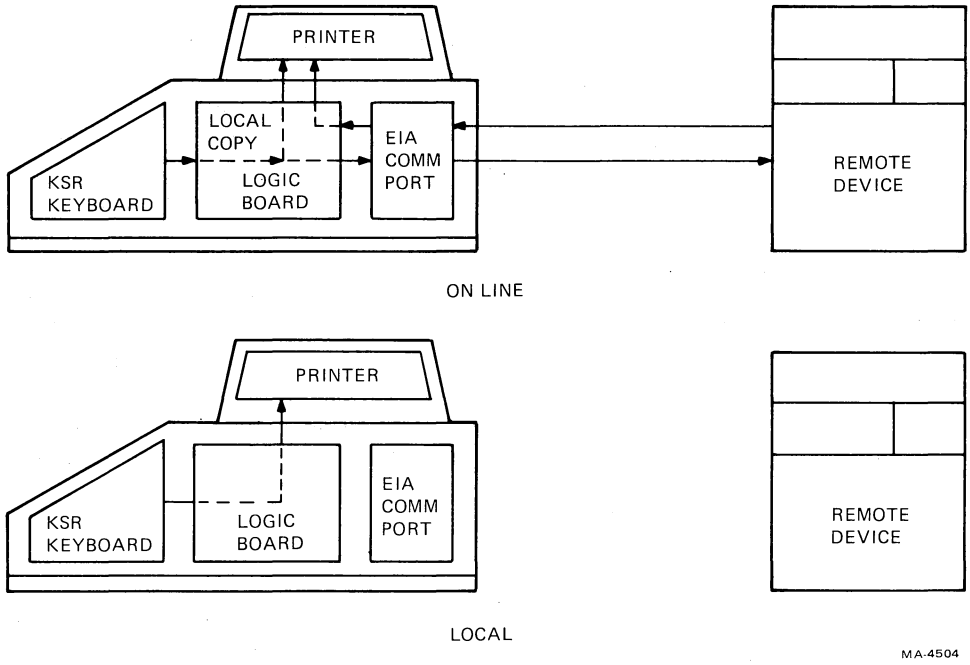


Fig. 1 – Teleprinter Operation

1.05 The logic board receives data from the KSR keyboard and converts it to ASCII characters. These characters are transmitted by the EIA communication port. The logic board also transfers data from the EIA communication port or KSR keyboard, to be printed by the printer. The keyboard and printing functions are independent within the Teleprinter 1000. Additionally, the logic board contains the electronically held SET-UP features, used to configure the teleprinters to a specific operational environment.

1.06 The Teleprinter 1000 contains a communication port which is compatible to Electronic Industry Association (EIA) specification RS-232-C and International Telegraph and Telephone Consultive Committee (CCITT) recommendations V.24 and V.28. The Teleprinter 1000 KSR and RO can interface to Bell 103JR, 202JT and 212AR data sets.

1.07 The keyboard of the Teleprinter 1000 KSR has a key arrangement and sculptured keys similar to an office typewriter. The keyboard contains 65 keys used to input data and control system functions. The keyboard has the ability to generate all 128 ASCII characters. An additional 18 key auxiliary keypad is used to provide rapid numeric data input. Characters typed on the keyboard are printed only when echoed to the printer. The keys of the Teleprinter 1000 KSR are defined by functionality as follows:

Alphanumeric keys
Control code keys
Auxiliary keypad keys

1.08 The character codes used by the Teleprinter 1000 KSR are presented throughout this practice using the ASCII character representation, followed by the hexadecimal representation. For a more detailed discussion of the character presentation refer to Paragraph 2.01.

ALPHANUMERIC KEYS

1.09 Figure 2 identifies the codes generated by the main keyboard. The shifted codes generated by the keyboard are shown above the keyboard legends; the unshifted codes are shown below the legends. These keys operate as standard typewriter keys, as well as generate codes transmitted by the Teleprinter 1000 KSR.

1.10 The teleprinter generates lowercase codes unless the CAPS LOCK key or one of the SHIFT keys is pressed. The SHIFT key is pressed to allow the teleprinter to generate uppercase codes for the alphabetic, numeric and special symbol keys. The SHIFT key does not effect the auxiliary keypad keys.

1.11 The CAPS LOCK key enables the teleprinter to generate uppercase alphabetic codes, regardless of the position of the SHIFT keys. The numeric and special symbol keys of the main keyboard and the auxiliary keypad are not effective by the CAPS LOCK key. The CAPS LOCK key locks into position when pressed. To release the key, press it again.

CONTROL CODE KEYS

1.12 Figure 3 identifies the keys used to generate control characters. The control characters are generated by the user from the keyboard. The user may use a dedicated key or the CTRL key in conjunction with other keyboard keys. The dedicated keys allow the user to generate commonly used control characters by pressing a single key. The shaded keys shown in Figure 3 are dedicated control character keys and do not require use of the CTRL key.

NOTE: Refer to Paragraph 2.0 for a detailed discussion of control functions.

AUXILIARY KEYPAD KEYS

1.13 When the alternate keypad mode feature is disabled, the auxiliary keypad is used for rapid numeric data entry and the PF keys transmit codes whose functions may be defined by the remote system software (refer to Paragraph 2.5.2). The numeric and punctuation keypad keys generate codes identical to the unshifted codes of the corresponding main keyboard keys. The ENTER key normally generates the same codes as the RETURN key on the main keyboard. When the alternate keypad mode feature is selected, the auxiliary keypad generates escape sequences which may have special meaning to the remote system software (refer to Paragraph 2.5.2).

KEYBOARD INDICATORS

1.14 Figure 4 identifies the indicators of the Teleprinter 1000 KSR. Figure 5 identifies the keypad indicators of the Teleprinter 1000 RO. The keyboard indicators alert the user to the current conditions of the teleprinter. The following paragraphs describe the function of each indicator.

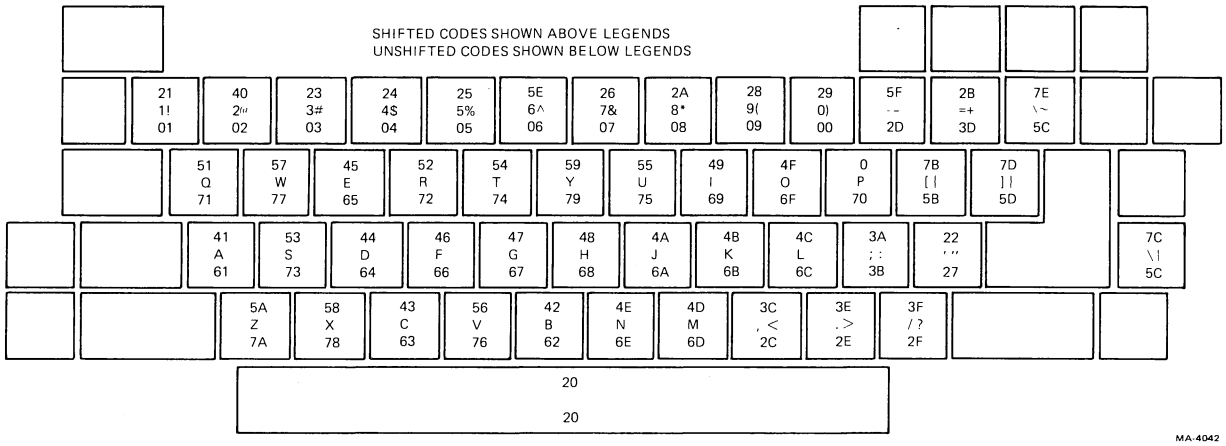


Fig. 2 – Printable Characters

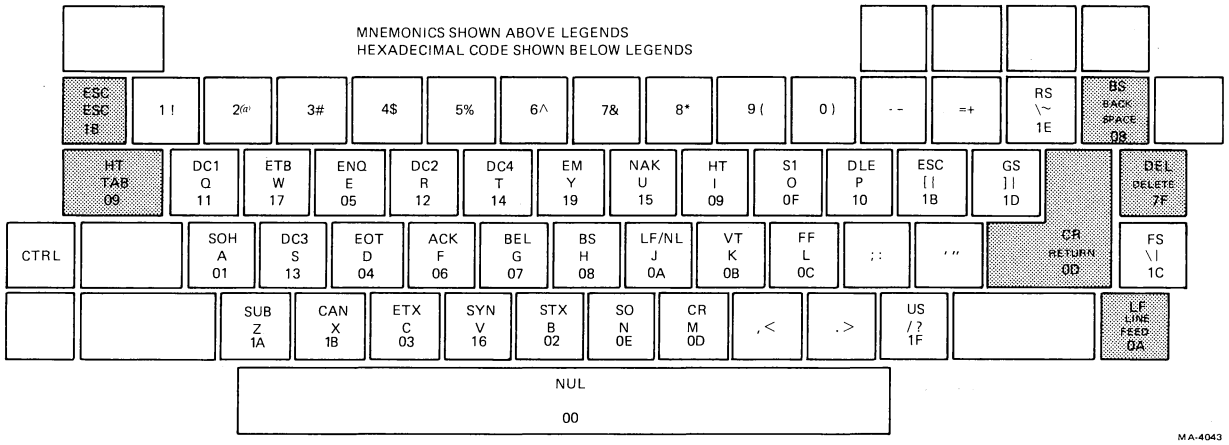


Fig. 3 – Control Characters Generated

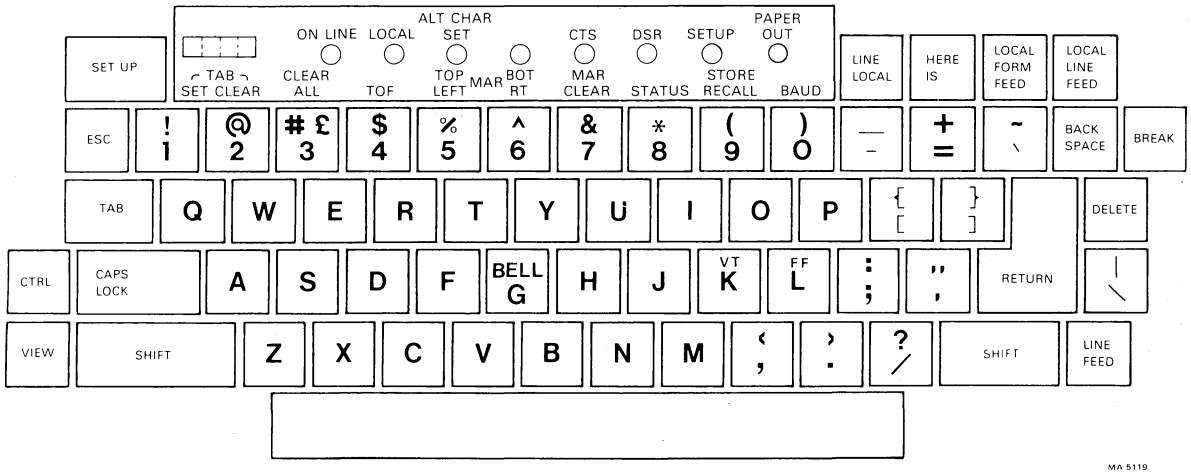


Fig. 4 – KSR Keyboard Indicators

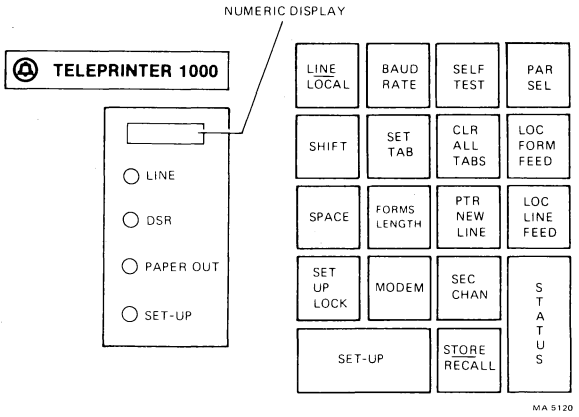


Fig. 5 – RO Keypad Indicators

Numeric Display

1.15 When not in SET-UP mode, the numeric display indicates the next column in which a character will be printed. In SET-UP mode, the numeric display shows the current line number, form length, etc. according to the SET-UP feature selected.

ON LINE Light (or LINE)

1.16 The ON LINE light indicates that the teleprinter can send and receive messages.

LOCAL Light (KSR Only)

1.17 The LOCAL light indicates the teleprinter is off-line. When off-line, the teleprinter cannot send or receive messages, but can print whatever is typed on the keyboard. When in LOCAL, the teleprinter cannot receive data from the EIA communication port.

CTS Light (KSR Only)

1.18 The CTS indicator lights when the teleprinter senses the ON condition of the data set ready (from the data set) and request to send (from the teleprinter) circuits.

DSR Light

1.19 The DSR indicator lights when the teleprinter senses the ON condition of data set ready. This ON condition (generated by the data set) indicates that the data set is in data mode and not in the test, talk, or dial modes.

SET-UP Light

1.20 The SET-UP indicator flashes when the teleprinter is in SET-UP mode. The SET-UP mode is used to alter the operation of the teleprinter by choosing from a wide variety of built-in features. These features are selected using keyboard entries while in SET-UP mode.

PAPER OUT Light

1.21 The PAPER OUT indicator flashes to indicate that the teleprinter is not ready to operate, due to one or more of the following conditions:

Teleprinter is out of paper
The cover is open
The print head is jammed.

AUDIBLE SIGNALS AND ALARM INDICATIONS

1.22 The Teleprinter 1000 KSR and RO use high and low pitch bell tones to alert the user of the operating conditions within the teleprinter. The bell tones are also used to draw the user's attention to alarm indications. Table A lists the bell tone and alarm indications generated by the Teleprinter 1000 KSR and RO.

TABLE A
AUDIBLE SIGNALS AND ALARM INDICATIONS

BELL TONE	CAUSE
Low pitch bell tone each time character a character is typed (KSR only)	The user is typing faster than the controller module can accept data. The data typed will be lost.
Low pitch bell tone and the (⅀) character printed	The controller module is receiving data from the EIA communication port faster than it can be printed. Data may be lost when this occurs.
One high pitched bell tone	The right margin is being approached.
High pitched bell tone(s)	A bell character has been received by the controller module.
Bell tone while in SET UP mode	An invalid SET UP command has been performed.
Bell tone and flashing Paper Out indicator	The teleprinter is out of paper or the print head is jammed.

2. CONTROL FUNCTIONS
GENERAL

2.01 Control functions provide control of the printing, processing, transmission, and representation of data. The control functions of the Teleprinter 1000 KSR and RO are implemented through the use of control characters, escape sequences, control sequences and control strings. Control functions are both sent and received by the teleprinter.

2.02 Control functions can be used to temporarily alter the SET-UP features of the Teleprinter 1000. In this way, a remote device can command the teleprinter to temporarily change SET-UP features, such as form settings, tab stop settings, margins, operational modes, etc., during operation.

CHARACTER SET

2.03 A character set consists of standard codes used to represent data exchanged between equipment. The character set of the Teleprinter 1000 KSR and RO conforms to the American National Standard Code for Information Interchange (ASCII). The ASCII character set contains both graphic (printable) and control characters. The ASCII character set is shown in Table B. Additionally, the character set is shown with the hexadecimal equivalent to allow two references for each character presented within this practice. The standard 7-bit representation, with b7 the high order bit and bl the low order bit, is shown in the following example.

Example: The bit representation for the letter K is:

Bit Representation							Hexadecimal Representation
b7	b6	b5	b4	b3	b2	bl	
1	0	0	1	0	1	1	4B

TABLE B
ASCII CHARACTER SET (HEXADECIMAL)

HEX CODE	CHARACTER	HEX CODE	CHARACTER	HEX CODE	CHARACTER
00	NUL	2C	,(comma)	58	X
01	SOH	2D	-(dash)	59	Y
02	STX	2E	.(period)	5A	Z
03	ETX	2F	/	5B	[
04	EOT	30	0	5C	\
05	ENQ	31	1	5D	]
06	ACK	32	2	5E	^
07	BEL	33	3	5F	—
08	BS	34	4	60	'(accent)
09	HT	35	5	61	a
0A	LF	36	6	62	b
0B	VT	37	7	63	c
0C	FF	38	8	64	d
0D	CR	39	9	65	e
0E	SO	3A	:(colon)	66	f
0F	SI	3B	;(semicolon)	67	g
10	DLE	3C	<	68	h
11	DC1	3D	=	69	i
12	DC2	3E	>	6A	j
13	DC3	3F	?	6B	k
14	DC4	40	@	6C	l
15	NAK	41	A	6D	m
16	SYN	42	B	6E	n
17	ETB	43	C	6F	o
18	CAN	44	D	70	p
19	EM	45	E	71	q
1A	SUB	46	F	72	r
1B	ESC	47	G	73	s
1C	FS	48	H	74	t
1D	GS	49	I	75	u
1E	RS	4A	J	76	v
1F	US	4B	K	77	w
20	SP	4C	L	78	x
21	!	4D	M	79	Y
22	"	4E	N	7A	z
23	#	4F	O	7B	{
24	$	50	P	7C	|
25	%	51	Q	7D	}
26	&	52	R	7E	~
27	'	53	S	7F	DEL
28	(	54	T		
29	)	55	U		
2A	*	56	V		
2B	+	57	W		

CONTROL CHARACTERS

2.04 A control character is a single character whose occurrence in a particular context initiates, modifies, or stops a control function. A control character is in the hexadecimal range of 00 through 1F and 7F.

Control Characters Generated (KSR Only)

2.05 The Teleprinter 1000 KSR has the ability to generate every control character listed in Table C. These characters are generated by the user from the keyboard. The user may use a dedicated key, or the CTRL key simultaneously with another key, to generate a control code. The dedicated key allows the user to generate commonly used characters by pressing a single key. The control characters listed in Table C are generated independently of the SHIFT and CAPS LOCK keys.

2.06 When half duplex communication with coded control channel turnaround is selected, (modem selections 3 and 4), the proper turnaround character is appended to the code(s) generated by the RETURN or ENTER keys.

TABLE C
GENERATED CONTROL CHARACTERS (KSR ONLY)

CONTROL CHARACTER	CHARACTER MNEMONIC	CODE TRANSMITTED	KEY USED WITH CTRL KEY	DEDICATED KEY
Null	NUL	00	Space Bar	
Start Of Heading	SOH	01	A	
Start Of Text	STX	02	B	
End Of Text	ETX	03	C	
End Of Transmission	EOT	04	D	
Enquiry	ENQ	05	E	
Acknowledge	ACK	06	F	
Bell	BEL	07	G	
Back Space	BS	08	H	BACK SPACE
Horizontal Tabulation	HT	09	I	TAB
Linefeed	LF	OA	J	LINE FEED
Vertical Tabulation	VT	OB	K	
Form Feed	FF	OC	L	
Carriage Return*	CR	OD	M	RETURN (ENTER)
Shift Out	SO	OE	N	
Shift In	SI	OF	O	
Data Link Escape	DLE	10	P	
Device Control 1	DC1 or XON	11	Q	
Device Control 2	DC2	12	R	
Device Control 3	DC3 or XOFF	13	S	
Device Control 4	DC4	14	T	
Negative Acknowledge	NAK	15	U	
Synchronous Idle	SYN	16	V	
End Of Transmission Block	ETB	17	W	

TABLE C (CONT)
GENERATED CONTROL CHARACTERS (KSR ONLY)

CONTROL CHARACTER	CHARACTER MNEMONIC	CODE TRANSMITTED	KEY USED WITH CTRL KEY	DEDICATED KEY
Cancel Previous Word Or Character	CAN	18	X	
End Of Medium	EM	19	Y	
Substitute	SUB	1A	Z	
Escape	ESC	1B	!	
File Separator	FS	1C	\	
Group Separator	GS	1D	{	
Record Separator	RS	1E		
Unit Separator	US	1F	?	
Delete	DEL	7F		DELETE

*The auto line feed SET-UP feature of the Teleprinter 1000 KSR alters the way in which the carriage return and line feed control characters are generated. When the auto line feed SET-UP feature is enabled, the RETURN and ENTER keys cause the generation of both a line feed and carriage return; when disabled only the RETURN and ENTER keys generate a carriage return.

Control Characters Received

2.07 The control characters recognized by the Teleprinter 1000 KSR and RO are shown in Table D and described in the following paragraphs. All other control codes cause no action to be taken.

TABLE D
RECEIVED CONTROL CHARACTERS

CONTROL CHARACTER	CHARACTER MNEMONIC	CODE RECEIVED
Null	NUL	00
End Of Text	ETX	03
End Of Transmission	EOT	04
Enquiry	ENQ	05
Bell	BEL	07
Backspace	BS	08
Horizontal Tabulation	HT	09
Line Feed	LF	0A
Vertical Tabulation	VT	OB
Form Feed	FF	OC
Carriage Return	CR	OD
Data Link Escape	DLE	10
Cancel	CAN	18
Substitute	SUB	1A
Escape	ESC	1B
Delete	DEL	7F

2.08 Null or Delete (NULL OR DEL) – Null and delete characters are used for timing and cause no operation. These characters are disposed of without occupying space in the input buffer of the teleprinter. The null and delete characters may be used as fill characters to decrease the effective data reception speed of the teleprinter (Paragraph 3.37).

2.09 End of Text (ETX) – If the Teleprinter 1000 is operating in half duplex, using ETX as the channel turnaround character, the end of text character is recognized as a request for data transmission in the opposite direction. If the Teleprinter 1000 is operating in any other full or half duplex mode, the ETX character has no effect.

2.10 End of Transmission (EOT) – If the Teleprinter 1000 is operating in half duplex using EOT as the channel turnaround character, the end of transmission character is recognized as a request for data transmission in the opposite direction. When the auto disconnect SET-UP feature is ON and the Teleprinter 1000 is operating in any other full or half duplex mode, the EOT character is recognized as a channel disconnect request. For a channel disconnect request in half duplex with EOT as the channel turnaround character, refer to Data Link Escape (DLE) (Paragraph 2.19).

2.11 Enquiry (ENQ) – The Teleprinter 1000 automatically transmits its answerback message upon reception of ENQ.

2.12 Bell (BEL) – The bell character sounds a bell tone. No more than eight bell codes can be stored in the Teleprinter 1000 input buffer at any one time; additional bell codes will not be stored.

2.13 Backspace (BS) – The backspace character decrements the active column. If the active column is at the left margin, the backspace character is ignored. (Refer to Paragraph 2.37 for active column description).

2.14 Horizontal Tabulation (HT) – The horizontal tabulation character advances the active column to the next horizontal tab stop. The tab stop must be greater than the current active column, but no greater than the right margin. If there is no such tab stop and a tab code is received, the active column is advanced to the column after the right margin.

2.15 Line Feed (LF) – The line feed character increments the active line. If the active line is at the bottom margin and a line feed code is received, the active line is set to the top margin of the next page. If printer new line mode is enabled, the active column is set to the left margin.

2.16 Vertical Tabulation (VT) – The vertical tabulation character advances the active line to the next vertical tab stop. The tab stop must be greater than the current active line but no greater than the bottom margin. If there is no such tab stop, the active line is set to the top margin of the next page. If printer new line mode is enabled, the active column is set to the left margin.

2.17 Form Feed (FF)– The form feed character advances the active line to the top margin of the next page, which may or may not be the physical top of the form. If printer new line mode is enabled, the active column is set to the left margin.

2.18 Carriage Return (CR) – The carriage return character moves the active column to the left margin. If carriage return is selected as the printer new line character, the active line is incremented.

2.19 Data Link Escape (DLE) – If the Teleprinter 1000 is operating in half duplex mode using EOT as the channel turnaround character, the data link escape (DLE) character is used as part of a disconnect sequence. The data link escape character, when received or transmitted immediately prior to an EOT, causes the EOT to be interpreted as a disconnect request. If the Teleprinter 1000 is operating in any other full or half duplex mode, the DLE character has no effect.

2.20 Cancel (CAN) – The cancel character terminates any pending control or escape sequence and causes the sequence to be ignored.

2.21 Substitute (SUB) – Characters received with parity errors are converted to the SUB character. If characters are lost due to input buffer overflow, a SUB character is placed in the input buffer at that point by the teleprinter. The SUB character is printed as the graphic symbol . The SUB character also has the effect of a cancel character.

2.22 Escape (ESC) – The escape character is interpreted as introducing a control or escape sequence. Control and escape sequences are described in detail in Paragraph 2.23.

CONTROL AND ESCAPE SEQUENCES

2.23 All of the control and escape sequences used by the Teleprinter 1000 are a subset of these specified in ANSI X3.64 1977, ANSI X3.4 1977 and ANSI X3.41 1974. None of the characters in the escape or control sequences is printed. When the end of the sequence is found (or an error occurs), the Teleprinter 1000 reverts to its normal printing mode. If a control or escape sequence is received by the teleprinter that it does not support, it is ignored. If the CAN (18) character or SUB (1A) character occurs, the current control or escape sequence is aborted. A sequence that has been only partially processed when the Teleprinter 1000 enters SET-UP mode will be completed when SET-UP modes is exited. Control and escape sequences may also be entered from the KSR keyboard when the teleprinter is in local mode.

2.24 In the control and escape sequences in this practice, the graphic characters of the sequences are shown using the ASCII character set followed by the hexadecimal representation. The case of the characters used in a sequence is significant and must be transmitted exactly as documented. These characters are spaced apart for clarity only.

2.25 The escape character, hexadecimal 1B, is designated as ESC. Numeric parameters are shown explicitly or designated as n or n_1, n_2, etc. The numeric parameters are interpreted as unsigned decimal integers, with the most significant digit transmitted first. Leading zeros are allowed but are not necessary. The ** character is used to indicate variable parameters used within the hexadecimal representation of the sequence.

2.26 Control characters (characters with hexadecimal codes 00 through 1F) may be imbedded anywhere within a sequence. The occurrence of imbedded control characters is technically an error condition. However, the ability to imbed control characters allows the XON and XOFF characters to be interpreted properly without effecting the control or escape sequence. Therefore, recovery from an imbedded control character is the execution of the control character as soon as it is encountered by the teleprinter. The processing of the control sequence then continues with the next character received. The exceptions are: if the character ESC occurs, or if the current control or escape sequence is aborted and a new one commences beginning with the ESC just received.

Control and Escape Sequence Definitions

2.27 The following paragraphs describe the terms used in the Teleprinter 1000 control and escape sequences.

2.28 **Control Sequence Introducer (CSI)** – This escape sequence providas supplementary controls, and is itself a prefix effecting the interpretation of a limited number of contiguous characters. The CSI for the Teleprinter 1000 is ESC[(hexadecimal 1B 5B).

2.29 **Intermediate Character** – This is character whose bit combination precedes a final character in a control or escape sequence.

2.30 **Numeric Parameter (n)** – A numeric parameter is a decimal number represented as a string of ASCII characters. The decimal numbers have a range of 0 (hexadecimal 30) to 9 (hexadecimal 39).

2.31 **Default** – A value of 0 is assumed when no explicit parameter value is specified.

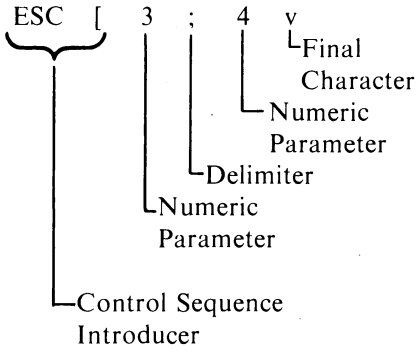
2.32 **Delimiter** – This character is used to fix the boundaries of an entity.

2.33 **Final Character** – This is character whose bit combination terminates an escape or control sequence.

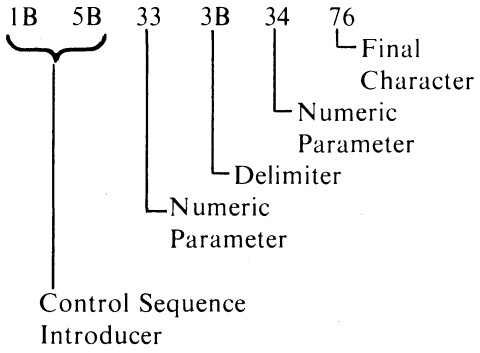
Sequence Example

2.34 The following sequence is used to set vertical tab stops to lines three and four.

ASCII
Representation of Sequence



Hexadecimal
Representation of Sequence



2.35 The following paragraphs describe the escape and control sequences recognized by the Teleprinter 1000. The sequences are arranged in the following order.

Printable Character Set (Paragraph 2.36)
Active Column and Active Line (Paragraph 2.37)
Printer New Line Mode (Paragraph 2.40)
Horizontal Pitch (Paragraph 2.41)
Horizontal Margins (Paragraph 2.43)
Horizontal Tabs (Paragraph 2.45)
Vertical Pitch (Paragraph 2.46)
Forms Length (Paragraph 2.47)
Vertical Margins (Paragraph 2.48)
Vertical Tabs (Paragraph 2.50)
Product Identification (Paragraph 2.51)
Alternate Keypad Mode (Paragraph 2.52)

ASCII/UK PRINTABLE CHARACTER SETS

2.36 The Teleprinter 1000 is capable of sending and receiving (printing) two distinct character sets; the United States character set (ASCII), and the United Kingdom character set (UK). The ASCII and UK character sets contain both control characters and printable characters (Paragraph 2.03). The character sets differ only by one character. The # character of the ASCII code is replaced by the £ character of the UK character set. The sequences listed in Table E select either the ASCII or UK character sets.

TABLE E
CHARACTER SET SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC (A 1B 28 41	Select UK character set
ESC (B 1B 28 42	Select ASCII character set

ACTIVE POSITION (ACTIVE COLUMN AND ACTIVE LINE)

2.37 The active position is the position into which the next printable character will be placed. This position is determined by the active column and active line position. The active column is the column where the next printable character will normally be printed. The active line is the line where the next character will normally be printed. Column and line numbers begin with one. Printable characters normally increment the active column position. Line feeds normally increment active line.

2.38 Active position is not directly linked to the physical position of the Teleprinter 1000 print head and paper mechanism. In general, the active column is only recorded when a character is actually printed. Any previous history of active column value is not significant. The active line is different because it may only be advanced, since backward paper motion is not allowed. When the Teleprinter 1000 is idle, the active and physical positions are identical.

2.39 In the Teleprinter 1000, bell characters have only an active line attribute. They are not guaranteed to be sounded at any particular column within a line. In addition to the normal position control characters (space, backspace, carriage return, line feed, horizontal tab, vertical tab, and form feed), the sequences listed in Table F modify the active position.

TABLE F
ACTIVE POSITION SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [n ’ 1B 5B ** 60	Set active column to column n
ESC [n a 1B 5B ** 61	Advance active column by n columns
ESC E 1B 45	Set active column to left margin and increment active line
ESC D 1B 44	Increment active line (active column unchanged)
ESC [n d 1B 5B ** 64	Set active line to line n
ESC [n e 1B 5B ** 65	Advance active line by n lines

NOTE: The ** character is used to represent variable parameters within the hexadecimal representation of a sequence.

PRINTER NEW LINE MODE

2.40 Printer new line mode is controllable both by the user and the programmer. If printer new line mode is enabled the characters, line feed, vertical tab, and form feed, each return the active column to the left margin in addition to their normal functions. Printer new line mode may be enabled by the user selecting choice 2 (line feed) in the printer new line character

SET-UP command. The mode is disabled any time the user selects choice 1 (none) or choice 3 (carriage return) in the printer new line character SET-UP command. The sequences listed in Table G control printer new line mode.

TABLE G
PRINTER NEW LINE SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [2 0 h 1B 5B 32 30 68	Enable printer new line mode
ESC [2 0 l 1B 5B 32 30 6C	Disable printer new line mode

HORIZONTAL PITCH

2.41 Horizontal pitch determines the width of printed characters as well as their spacing. The Teleprinter 1000 has eight different horizontal pitches. The horizontal pitch settings availabe are: 5, 6, 6.6, 8.25, 10, 12, 13.2, and 16.5 characters per inch. Any combination of pitches may be used on a single print line. Changing horizontal pitch modifies the active column. The resulting new active column is that of the first volumn boundary at or to the right of the physical position of the previous active column in the old pitch. It is calculated as:

$$\text{Newcol} = 1 + \frac{(\text{Oldcol} - 1) \times \text{Oldpitch}}{\text{Newpitch}}$$

where

Newcol = new active column

Newpitch = new pitch in chars/inch

Oldcol = old active column

Oldpitch = old pitch in chars/inch

2.42 The preceding calculation uses integer division. Any remainder or fractional part of the quotient is discarded. The sequences listed in Table H alter the horizontal pitch setting.

TABLE H
HORIZONTAL PITCH SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [w 1B 5B 77	10 char/inch
ESC [0 w 1B 5B 30 77	10 char/inch
ESC [1 w 1B 5B 31 77	10 char/inch
ESC [2 w 1B 5B 32 77	12 char/inch
ESC [3 w 1B 5B 33 77	13.2 char/inch
ESC [4 w 1B 5B 34 77	16.5 char/inch
ESC [5 w 1B 5B 35 77	5 char/inch
ESC [6 w 1B 5B 36 77	6 char/inch
ESC [7 w 1B 5B 37 77	6.6 char/inch
ESC [8 w 1B 5B 38 77	8.25 char/inch

HORIZONTAL MARGINS

2.43 Printing is permitted only within the inclusive left and right margins. A carriage return character sets the active column to the left margin. Attempting to move the active column left of the left margin sets the active column equal to the left margin. If the auto new line SET-UP feature is enabled, attempting to move the active column more than one column right of the right margin executes an auto new line. If the auto new line SET-UP feature is disabled, an error bell sounds and the character or command which attempted the motion is discarded. Horizontal margins may be set as long as the following is true.

$1 \leqslant \text{left margin} \leqslant \text{right margin} \times \text{max column}$

NOTE: Max column is a function of horizontal pitch.

2.44 Max column = 13.2 inches × horizontal pitch where the product is rounded down to the nearest column. The sequences listed in Table I alter the left and right margin settings.

TABLE I
HORIZONTAL MARGIN SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [n s 1B 5B** 73	Set left margin to column n
ESC [n ; 0 s 1B 5B ** 3B 30 73	Set left margin to column n
ESC [; n s 1B 5B 3B ** 73	Set right margin to column n
ESC [0 ; n s 1B 5B 30 3B ** 73	Set right margin to column n
ESC [n_1 ; n_2 s 1B 5B ** 3B ** 73	Set left margin to column n_1 and set right margin to column n_2

HORIZONTAL TABS

2.45 The Teleprinter 1000 has 217 possible horizontal tab stops, one for each column. Tab stops are associated with column numbers, not physical positions on the paper. Thus, changing horizontal pitch will also change the physical position of tab stops. Each stop may be set or cleared independently. Setting a stop already set has no effect; the same is true for clearing a stop already clear. Tab stops may be set or cleared without regard to margins or horizontal pitch. The sequences listed in Table J alter the horizontal tab stop setting.

TABLE J
HORIZONTAL MARGIN SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC H 1B 48	Set horizontal tab stop at active column
ESC 1 1B 6C	Set horizontal tab stop at active column
ESC [g 1B 5B 67	Clear horizontal tab stop at active column
ESC 0 g 1B 30 67	Clear horizontal tab stop at active column.
ESC [2 g 1B 5B 32 67	Clear all horizontal tab stops
ESC [3 g 1B 5B 33 67	Clear all horizontal tab stops
ESC 2 1B 32	Clear all horizontal tab stops
ESC [n u 1B 5B ** 75	Set horizontal tab stop at column n
ESC [n_1 n_2 u 1B 5B ** 60 ** 75	Set horizontal tab stops at column n_1 and at column n_2
ESC n_1 ; n_2 ; n_x u 1B ** 3B ** 3B ** 75	Set horizontal tab stops at columns n_1; $n_2 \ldots n_x$ ($x \leq 16$)

VERTICAL PITCH

2.46 Vertical pitch determines the spacing between the lines printed. The Teleprinter 1000 is equipped with six vertical pitch settings. The vertical settings available are: 2, 3, 4, 6, 8 and 12 lines per inch. The height of printed characters is not effected by this feature. Changing vertical pitch does not effect active line number, but it does clear vertical margins. In addition, changing vertical pitch alters the form length and the position of the vertical tabs. The sequences listed in Table K alter the vertical pitch setting.

TABLE K
VERTICAL PITCH SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [z 1B 5B 7A	6 lines per inch
ESC [0 z 1B 5B 30 7A	6 lines per inch
ESC [1 z 1B 5B 31 7A	6 lines per inch
ESC [2 z 1B 5B 32 7A	8 lines per inch
ESC [3 z 1B 5B 33 7A	12 lines per inch
ESC [4 z 1B 5B 34 7A	2 lines per inch
ESC [5 z 1B 5B S5 7A	3 lines per inch
ESC [6 z 1B 5B 36 7A	4 lines per inch

FORM LENGTH

2.47 Form length is defined in lines, not physical units. Therefore, changing vertical pitch will alter the physical form length. Forms may be from 1 to 168 lines in length. Changing form length clears vertical margins and defines the current line as line one. The sequence listed in Table L sets the vertical form length.

TABLE L
FORM LENGTH SELECTION SEQUENCE

SEQUENCE	FUNCTION
ESC [n t 1B 5B ** 74	Set form length to n lines Set top margin to line 1 Set bottom margin to line n Set active line to line 1

VERTICAL MARGINS

2.48 Printing is permitted only on lines within the inclusive top and bottom margins. When vertical pitch or form length are changed, these margins are cleared; that is, the top margin is set to line one and the bottom margin is set to the form length. The following must be true to successfully set new vertical margins.

Top margin must be greater than or equal to 1.
Bottom margin must be less than or equal to the top margin.
Form length must be greater than or equal to the bottom margin.
Whenever the active line is less than the top margin or active line is greater than the bottom margin, the active line is set to the top margin.

2.49 For example, a line feed performed at the bottom margin will execute a form feed. The sequences listed in Table M set the top and bottom margins.

TABLE M
VERTICAL MARGIN SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC [n r 1B 5B ** 72	Set top margin to line n
ESC [; n r 1B 5B 3B ** 72	Set bottom margin to line n
ESC [n_1 ; n_2 r 1B 5B ** 3B ** 72	Set top margin to line n_1 and set bottom margin to line n_2

TABLE N
VERTICAL TABS SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC J 1B 4A	Set vertical tab stop at active line
ESC 3 1B 33	Set vertical tab stop at active line
ESC [1 g 1B 5B 31 67	Clear vertical tab stop at active line
ESC [4 g 1B 5B 34 67	Clear all vertical tab stops
ESC 4 1B 34	Clear all vertical tab stops
ESC [n v 1B 5B ** 76	Set vertical tab stop at line n
ESC [n_1 ; n_2 v 1B 5B ** 3B ** 76	Set vertical tab stops at line n_1 and at line n_2
ESC [n_1 ; n_2 ; n_x v 1B 5B ** 3B ** 3B ** 76	Set vertical tab stops at lines n_1, n_2,...n_x ($x \leqslant 16$)

VERTICAL TABS

2.50 The Teleprinter 1000 has 168 vertical tab stops which can be set and cleared. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Thus, changing vertical pitch changes the printing position of vertical tabs. The sequences listed in Table N set or clear vertical tab stop settings.

PRODUCT IDENTIFICATION

2.51 The Teleprinter 1000 automatically transmits a response to the request for a product identification (device attributes) sequence. The sequences listed in Table O define the request sequences received by the teleprinter and the response of the Teleprinter 1000 to the product identification sequence.

TABLE O
PRODUCT IDENTIFICATION REQUEST AND RESPONSE SEQUENCE

SEQUENCE	FUNCTION
ESC [c 1B 5B 63	Teleprinter 1000 transmits ESC [? 2 c 1B 5B 3F 32 63
ESC [0 c 1B 5B 30 63	Teleprinter 1000 transmits ESC [? 2 c 1B 5B 3F 32 63

ALTERNATE KEYPAD MODE (KSR ONLY)

2.52 Alternate keypad mode is controllable by both the user and the programmer. The user modifies the alternate keypad feature during SET-UP mode. The

programmer uses the control sequences listed in Table P. If alternate keypad mode is disabled, the top four keys of the keypad transmit codes whose functions may be defined by the remote system software (refer to Table Q for the actual codes generated). The remaining keypad keys generate codes identical to the unshifted codes of the corresponding numeric and punctuation keys of the main keypad.The ENTER key generates codes that correspond to the RETURN key on the main keyboard. Table Q lists the codes generated by the auxiliary keypad keys.

TABLE P
ALTERNATE KEYPAD MODE
SELECTION SEQUENCES

SEQUENCE	FUNCTION
ESC = 1B 3D	Enable alternate keypad mode
ESC > 1B 3E	Disable alternate keypad mode (Enter numeric keypad mode)

TABLE Q
ALTERNATE KEYPAD CODES

KEY	CODE TRANSMITTED	
	NUMERIC MODE	ALTERNATE KEYPAD MODE
PF 1	ESC O P	ESC O P
PF 2	ESC O Q	ESC O Q
PF 3	ESC O R	ESC O R
PF 4	ESC O S	ESC O S
ENTER	Same as RETURN key	ESC D M
' (comma)	' (comma)	ESC O l
- (dash)	- (dash)	ESC O m
. (period)	. (period)	ESC O n
0 (number)	0 (number)	ESC O p
1	1	ESC O q
2	2	ESC O r
3	3	ESC O s
4	4	ESC O t
5	5	ESC O u
6	6	ESC O v
7	7	ESC O w
8	8	ESC O x
9	9	ESC O y

3. COMMUNICATION

GENERAL

3.01 The communication SET-UP features of the Teleprinter 1000 are used to match the teleprinter with the requirements of the communication channel and remote device. The communication SET-UP features cannot be altered by the remote device. The SET-UP features of the Teleprinter 1000 are presented in the following order.

Answerback (Paragraph 3.02)
Auto Answerback (Paragraph 3.03)*
Auto Disconnect (Paragraph 3.04)
Baud Rate (Paragraph 3.06)
Buffer Control (Paragraph 3.07)
Break Enable (Paragraph 3.09)*
Half Duplex Initial Calling State (Paragraph 3.10)*
Local Echo (Paragraph 3.11)*
Modem (Paragraph 3.12)
Parity and Data Bits (Paragraph 3.14)
Secondary Channel (Paragraph 3.15)
XON/OFF (Paragraph 3.16)

*KSR only

ANSWERBACK

3.02 The answerback SET-UP feature is a message of up to 30 characters used to identify the Teleprinter 1000 to the remote device. This message may be transmitted automatically in response to the reception of the ENQ control character or manually from the KSR keyboard when the user presses the HERE IS key.

AUTO ANSWERBACK

3.03 The auto answerback SET-UP feature is used to automatically transmit the answerback message directly after the Teleprinter 1000 is enabled for transmission. Transmission is enabled when one or more of the following conditions is met:

(a) Carrier Detect (CD) circuit is ON
(b) Secondary Carrier Detect (SRLSD) Circuit is ON
(c) The 300 ms time out condition takes place after the request to send circuit is turned ON

AUTO DISCONNECT

3.04 This SET-UP feature is used to automatically disconnect the communication channel when one of the following conditions is detected.

(a) The teleprinter detects a fault condition
(b) The user initiates a channel disconnect sequence from the keyboard by typing CTRL D
(c) The remote device requests a channel disconnect by sending the EOT control character. When half duplex communication using EOT as the channel turnaround character, the disconnect sequence is DLE EOT.

3.05 The Teleprinter 1000 can detect the following fault conditions:

Out of paper
Cover is open
Print head jams.

BAUD RATE

3.06 The baud rate SET-UP feature is used to select the speed of data transfer (in bits per second) to and from the Teleprinter 1000. The baud rate SET-UP feature is used to select simultaneous transmit and receive baud rates as listed in Table R or split baud rates (different transmit and receive baud rates) as listed in Table S.

TABLE R
SIMULTANEOUS BAUD RATES

RECEIVE AND TRANSMIT BAUD RATE	NUMBER OF STOP BITS
50	2
75	2
110	2
134.5	1
150	1
200	1
300	1
600	1
1200	1
1800	1

TABLE S
SPLIT BAUD RATE SETTINGS (KSR ONLY)

RECEIVE BAUD RATE	TRANSMIT BAUD RATE	NUMBER OF STOP BITS
600	75	2
	150	1
	600	1
1200	75	2
	150	1
	1200	1

BUFFER CONTROL

3.07 When the Teleprinter 1000 receives a character (other than fill characters, NUL and DEL), the character is stored in the teleprinter's input buffer. When the printer is ready, characters are taken from the input buffer and printed. If the printer falls behind by more than about 1000 characters, the input buffer overflows and data is lost. There are three ways to avoid buffer overflows.

(a) Send data only as fast as it can be printed. When receiving data at 1200 baud or less, the Teleprinter 1000 can keep up with normal character code reception. Very short lines and multiple form feeds cannot be printed this fast. Fill characters may be used to slow the effective data transmission speed in these cases. Fill time formulas are given in Paragraph 3.33

(b) Limit the length of the message to the Teleprinter 1000 input buffer size. If the buffer is empty at the beginning of transmission, a message of about 1000 characters may be sent without causing a buffer overflow.

(c) Use XON/XOFF control characters or restraint mode (Paragraphs 3.16 and 3.21). Using XON/XOFF or restraint mode, the Teleprinter 1000 can signal the data source when to pause in sending data and when to resume. This allows maximum throughput and eliminates the need for fill character calculations and message size limits.

3.08 When using XON/XOFF or restraint mode, the Teleprinter 1000 constantly monitors the number of characters stored in its input buffer. When the num-

ber of characters exceeds an upper limit, the Teleprinter 1000 signals the data source to pause temporarily. Meanwhile, the printer continues to take characters out of the input buffer. When the number of characters remaining in the input buffer is less than a lower limit, the Teleprinter 1000 signals that transmission may resume. The values used for the high and low limits are listed in Table T.

TABLE T
BUFFER LIMITS

SET-UP CHOICE B	LOW LIMIT	HIGH LIMIT
0 (small)	50 characters	60 characters
1 (large)	256 characters	576 characters

BREAK ENABLE

3.09 This SET-UP feature is used to enable the Teleprinter 1000 to transmit a break signal. The break signal will automatically be transmitted in response to a fault condition, or manually transmitted by typing the BREAK key on the KSR keyboard. The fault conditions which will cause transmission of the break signal include paper out, head jam, cover open. The transmission of the break signal may cause the communication circuit to disconnect. The auto disconnect SET-UP feature may also be used to disconnect the communication circuit. If the break enable SET-UP feature is disabled, the break signal cannot be transmitted.

HALF DUPLEX INITIAL CALLING STATE

3.10 The half duplex initial calling state SET-UP feature determines if the Teleprinter 1000 will begin transmitting or receiving data directly after being enabled for transmission. Transmission is enabled when:

(a) Carrier detect (CD) circuit is on
(b) Secondary carrier detect (SRLSD) circuit is on
(c) The 300 ms time out condition takes place after the request to send circuit is turned on

LOCAL COPY

3.11 The majority of communication systems echo the characters transmitted by the teleprinter, back to the teleprinter to be printed. This provides visual feedback to the user of the data entered from the keyboard. However, this is a function of the remote device or data set and not a function of full or half duplex communication. If the remote device or data set does not echo the characters transmitted by the teleprinter, the local echo SET-UP feature can be enabled to provide this feedback.

MODEM

3.12 Within the modem SET-UP feature there are five selections. Modem selections 1 and 2 are used to enable full duplex communication, while selections 3, 4 and 5 are used to select half duplex communication. Modem SET-UP feature choices are:

(1) Full duplex without modem control
(2) Full duplex with full modem control
(3) Half duplex with supervisory control
(4) Full duplex with ETX character disconnect
(5) Half duplex with EOT character turnaround.

3.13 Refer to the half and full duplex communication discussions (Paragraphs 3.17 through 3.32) for further information on the operation of the modem selections.

PARITY AND DATA BITS

3.14 The parity and data bits SET-UP feature is used to simultaneously select the type of character parity used to detect errors and the number of bits per character. Table U lists the combinations of parity type and bits per character used by the Teleprinter 1000.

TABLE U
PARITY AND DATA BITS

NUMBER OF DATA BITS	PARITY RECEIVED	PARITY TRANSMITTED
7	Ignore	Mark
7	Ignore	Space
7	Ignore	Odd
7	Ignore	Even
7	Odd	Odd
7	Even	Even
7	None	None
8	None	None
8	Odd	Odd
8	Even	Even

SECONDARY (REVERSE) CHANNEL

3.15 The secondary (reverse) channel SET-UP feature is used for the transmission of supervisory or control signals. The secondary channel may be used in either half or full duplex communication. In full duplex communication, the secondary channel can be used for either data set speed selection or restraint mode operation. In half duplex operation, the secondary channel may be used to transmit supervisory information. Refer to Paragraphs 3.21 and 3.25 for further information on the use of secondary channels.

XON/XOFF

3.16 The XON/XOFF SET-UP feature is used to monitor the input buffer of the Teleprinter 1000. When this feature is enabled, the teleprinter automatically transmits the XOFF control code to request a pause in the transmission of data. The teleprinter will automatically transmit the XON control code when ready to receive further data transmissions. The Teleprinter 1000 also sends a pause request when the printer is not ready due to error conditions or user actions. Running out of paper or detecting a print head jam can cause a pause request to be sent. The user may induce a pause request by opening the cover, entering SET-UP mode, or typing CTRL S (XOFF). To resume transmission the user types CTRL Q (XON).

FULL DUPLEX COMMUNICATION

3.17 Full duplex operation is a method of communicating which allows two devices to transmit and receive data simultaneously. There are two basic types of full duplex operation; full duplex with data set/modem control and full duplex without data set/modem control. Both types of operation allow simultaneous transmission and reception of data. The Teleprinter 1000 generates both the Data Terminal Ready and Request to Send signals. The full duplex with data set/modem control selection requires valid modem signals before enabling communication. With full duplex without data set/modem control selected, transmission and reception of data is always enabled.

3.18 The modem SET-UP feature is used to select the type of communication used by the Teleprinter 1000. When the modem SET-UP feature selection = 1, the teleprinter operates using full duplex communication without data set/modem control. This selection is used when there are no meaningful data set/modem signals being sent to the Teleprinter 1000, with the exception of receive data. The teleprinter constantly turns ON both the data terminal ready and request to send circuits. The primary situations for the use of this selection are:

(a) Null modem operation (local connection to another device other than a data set/modem)

(b) Full duplex data sets/modems where data set ready or carrier detect are not available.

NOTE: If the modem SET-UP feature = 1, the paper out, head jam, cover open, or any other channel disconnect associated with data terminal ready, will not be provided by the teleprinter.

3.19 When the modem SET-UP feature selection = 2, the teleprinter operates using full duplex communication with full data set/modem control. Some of the equipment commonly used in this selection are:

(a) Bell 103 data sets or equivalent data set/modems that emulate 103 modems with regard to data set ready, carrier detect and the ring indicator circuits

(b) Bell 212A modems or equivalent with speed control circuits.

3.20 When on-line in this mode, Data Terminal Ready is always ON, except during the 70 ms or 3.5 second channel disconnects (Paragraph 3.24). The teleprinter will not be ready to receive or transmit data until a valid teleprinter/modem link is established using the proper modem signals.

FULL DUPLEX SECONDARY CHANNEL

3.21 When using either full duplex mode, the secondary channel may be selected. The secondary channel is used either for input buffer control or data set/modem speed control. Buffer control is enabled in the Teleprinter 1000 when the secondary channel SET-UP feature = 1, thus selecting restraint mode. With restraint mode selected the teleprinter controls the secondary request to send circuit to signal the approach of an input buffer overflow. When the input buffer is ap proaching an overflow condition, the teleprinter turns OFF the secondary request to send circuit. If the remote device suspends transmission, the teleprinter will eventually process the data held in the input buffer. When the buffer is sufficiently empty, the teleprinter will turnON the secondary request to send circuit. The remote system should monitor the secondary carrier detect circuit to determine the input buffer condition of the teleprinter when transmitting data.

3.22 When the secondary channel is used to control data set/modem speed selection, restraint mode is disabled. The secondary channel circuits exchange speed information between the Teleprinter 1000 and the data set/modem. The speed indicator and speed select circuits are controlled when secondary channel SET-UP feature = 0. The Teleprinter 1000 will turn on the secondary request to send circuit if the user selected baud rate is 1200 baud or higher. The Teleprinter 1000 will use an operating baud rate of 1200 baud if the secondary carrier detect signal is turned ON by the data set/modem.

FULL DUPLEX BREAK

3.23 A full duplex break places a space on the send data circuit for 250 ms, if transmission is enabled. If transmission is disabled, the break will remain pending until transmission is enabled or a disconnect is generated.

FULL DUPLEX HANG UP

3.24 Hanging up the phone to disconnect from the communication channel is accomplished by turning OFF the data terminal ready circuit for 70 ms, and resetting all EIA control circuits to their initial state. There are four conditions that can cause a channel disconnect to occur.

(a) Connection is not established within 20 seconds of a ring indication. (Connection is defined as the data set ready and carrier detect circuits ON.)

(b) Connections are established, and either the ring indicator is turned ON, data set ready turns OFF, or carrier detect turns OFF for five seconds.

(c) An EOT control character is received while the auto disconnect SET-UP feature is selected.

(d) The user generates a long break disconnect with the SHIFT and BREAK keys on the KSR keyboard. This produces a space condition on the transmit data circuit and turns OFF the data terminal ready circuit for 3.5 seconds.

HALF DUPLEX

3.25 Half duplex operation is a method of communicating which allows two devices to transmit and receive data in both directions, one direction at a time. Due to the "one at a time" definition of half duplex, a method of determining which device is transmitting and which device is receiving at any point in time is required. Each time the transmitter and receiver exchange functions, the channel is "turned around." This basically consists of switching which device turns the request to send line ON. The request to send circuit is used to control the transmit/receive mode of the data set/modem. The ON condition of the request to send circuit enables the generation of a carrier signal.

3.26 Also, when echo suppressors are on the channel, it is necessary to turn them around in order to attenuate in the opposite direction. The Teleprinter 1000 incorporates three methods of controlling channel turnaround. In supervisory control mode, the remote device controls all channel turnarounds by manipulating the secondary control circuits. Secondary channel is mandatory for this mode. The two other methods (coded control with secondary channel and coded control without secondary channel) allow the transmitting device to control channel turnaround, using specific control characters. If secondary channel is used, these circuits provide confidence that the receiving device is active.

3.27 Modem 3 – This is the first of three half duplex modes, commonly referred to as supervisory mode. The host controls all channel turnarounds by controlling the primary and secondary channels. The Teleprinter 1000 responds by switching between receive and transmit states and indicating that state to the host. No turnaround characters are sent or interpreted with this mode. Secondary channel is mandatory for this mode, therefore setup S is ignored.

3.28 There are two turnaround characters currently in use - EOT or ETX. These characters initiate the channel turnaround when received or transmitted. Any character sent after the turnaround character will be lost. To eliminate the user from generating the turnaround control code, the teleprinter will automatically send the control code after the RETURN key is typed.

3.29 Modem 4 – In this half duplex mode, channel direction is controlled by the transmitting device. When an EOT character is sent from the transmitter (host or teleprinter), both ends change state. An EOT is sent after a carriage return code, via the RETURN or ENTER key on the Teleprinter 1000. This causes a turnaround without having the user to enter the control code. A disconnect will be generated whenever a DLE/EOT pair is received or transmitted.

INITIAL DIRECTION DETERMINATION

3.30 When the teleprinter is initially connected to the communication channel, data can neither be transmitted nor received. When the teleprinter is called, the ring circuit will turn ON before data set ready. In auto answer mode most data set/modems will answer the call (go off hook) before turning ON data set ready, although some modems allow data set ready to turn ON after a couple of rings, but before the call is answered. With this sequence the teleprinter attempts to establish receive mode. If the teleprinter user is initiating the call, data set ready will turn ON when the modem is placed into data mode. Since data set ready is ON without a ring indicator the teleprinter attempts to enter transmit mode.

HALF DUPLEX BREAK

3.31 The half duplex break operates in three modes:

(a) Transmit mode (request to send ON), which is a space on the transmit data circuit for 250 ms.

(b) Receive mode (request to send OFF), which is a space on the secondary request to send circuit for 250 ms. When operating with coded-no reverse channel the break ignored when in receive mode.

(c) While switching modes, if neither receive nor transmit is enabled, the break will not be processed until a definite channel direction is established.

HALF DUPLEX HANG UP

3.32 Hanging up the phone to disconnect from the channel is accomplished by turning OFF data terminal ready for 70 ms, and resetting all control circuits to their initial state. There are five conditions that will cause a data terminal ready channel disconnect.

(a) Connection is not established within 20 seconds of indication. (Connection is defined by the data set ready and secondary request to send circuits ON.)

(b) When initiating a call with the secondary channel, secondary carrier detect is not turned ON within five seconds.

(c) Channel turnaround is not completed within five seconds.

(d) Valid channel direction is established and the ring circuit turns ON or data set ready turns off.

(e) A fault condition with auto disconnect selected.

FILL TIME FORMULAS

3.33 When receiving data at 1200 baud or less, the Teleprinter 1000 can keep up with normal character code reception. Very short lines and multiple form feeds cannot be printed this fast. Fill characters (NUL and DEL) may be used to slow the effective data transmission speed in these cases. Fill characters do not enter the receive buffer of the teleprinter. They are used by the remote device for data transmission timing.

3.34 The print head and form movements (vertical and horizontal) of the printer are directly related to the fill time required to slow down the effective throughput of the data. The full time requirements of these movements can then be converted to the number of fill characters needed.

3.35 The number of fill characters required after a command to perform horizontal and/or vertical movement can be found using the following fill character formula:

$$\text{number of fill characters required} = \frac{\text{fill time required}}{\text{character transmission rate}}$$

FILL TIME REQUIRED

3.36 Horizontal Movement includes horizontal tabs and horizontal positioning sequences. Convert the distance moved to the actual number of columns moved using the following formula:

$$\text{number of columns moved} = (\text{horizontal pitch}) \times (\text{number of inches moved})$$

3.37 Allow 15 ms for each of the first ten columns (30 ms for double-width pitches: 5, 6, 6.6, 8.25) and 5.5 ms for each additional column (11 ms for double-width pitches: 5, 6, 6.6, 8.25) to determine the fill time requirement.

3.38 Vertical Movement includes line feeds, vertical tabs, form feeds, and vertical positioning sequences. Convert the number of lines moved to the actual distance moved using the following formula:

$$\text{Inches moved} = \frac{\text{number of lines moved}}{\text{Vertical pitch}}$$

3.39 Allow 33 ms for the first line moved up to 1/6 inch and 135 ms for each additional inch to determine the fill time requirement.

CHARACTER TRANSMISSION TIME

3.40 The character transmission time of the fill characters (at different baud rates and stop bit selections) is listed in Table V.

TABLE V
FILL CHARACTER EXECUTION TIMES

BAUD RATE	NUMBER OF STOP BITS	EXECUTION TIME
50	2	200 ms
75	2	133 ms
110	2	90 ms
134.5	1	66 ms
150	1	60 ms
200	1	45 ms
300	1	30 ms
600	1	15 ms
600	2	16 ms
1200	1	7.5 ms
1200	2	8.3 ms