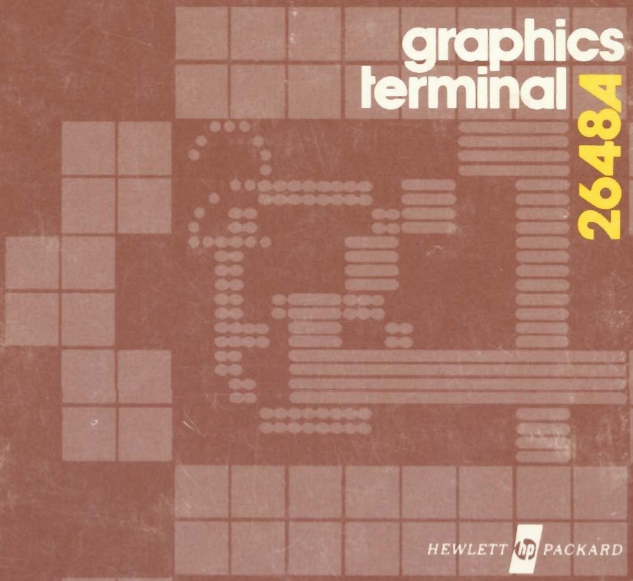
quick reference guide

graphics terminal 2648A



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KEY	CODE	FUNCTION
CNTL + ←	ESC 4	Set left margin
CNTL + →	ESC 5	Set right margin
CLEAR DSPLY	ESC J	Clear memory from cursor position to end of memory
CNTL + CLEAR DSPLY	ESC K	Clear line from the cursor to end of line
HOLD UP	ESC S	Scroll the display up one line
HOLD DOWN	ESC T	Scroll the display down one line
NEXT PAGE	ESC U	Display the next 24 lines of memory
PREV PAGE	ESC V	Display the previous 24 lines of memory
CNTL + f1	ESC & d	Turn on display enhance (see page 6)
CNTL + f2	ESC [	Start an unprotected field
CNTL + f3	ESC]	End an unprotected field or transmit-only field
CNTL + f4	ESC W (on)	Turn format mode on. Only unprotected fields can be modified.
CNTL + f5	ESC X (off)	
CNTL + f6	ESC {	Start transmit-only field
———	ESC 6	Alphabetic only field
———	ESC 7	Numeric only field
———	ESC 8	Alphanumeric field

KEY	CODE	FUNCTION
ALPHANUMERIC DISPLAY CONTROL		
↑	ESC A	Cursor up
↓	ESC B	Cursor down
→	ESC C	Cursor right
←	ESC D	Cursor left
BACK SPACE	BS (H^C)	Cursor left one space
CNTL + ↖	ESC F	Cursor home down
— — —	ESC G	Cursor return
↖	ESC h	Cursor home (excluding transmit-only fields)
— — —	ESC H	Home cursor (including transmit-only fields)
RETURN	CR (M^C)	Move cursor to left margin
— — —	LF (J^C)	Move cursor down one line
TAB	HT (I^C) ESC I	Forward cursor to next tab position
CNTL + TAB or CNTL + BACK SPACE	ESC i	Back tab
SET TAB	ESC 1	Set tab at the current cursor column
CLEAR TAB	ESC 2	Clear the tab at the current cursor column
CNTL + CLEAR TAB	ESC 3	Clear all tabs

KEY	CODE	FUNCTION
EDITING		
INSERT LINE	ESC L	Insert a blank line
DELETE LINE	ESC M	Delete line containing cursor
DELETE CHAR	ESC P	Delete character at cursor
CNTL + DELETE CHAR	ESC O	Delete character with wraparound from next line
INSERT CHAR & indicator	ESC Q (on) ESC R (off)	Insert succeeding inputs at cursor
CNTL + INSERT CHAR	ESC N (on) ESC R (off)	Character Wraparound Mode. Insert succeeding inputs at cursor with wraparound to next line.
, f4	— — —	Toggles EDIT mode

KEY	CODE	FUNCTION
TERMINAL CONTROL GROUP		
ESC	ESC ([c)	Leads off an ASCII escape sequence
CNTL	— — —	Used to generate ASCII control codes and alternate key functions
CAPS LOCK	ESC&k0C (off) ESC&k1C (on)	Upper-case alphabetical lock
MEMORY LOCK & indicator	ESC l (on) ESC m (off)	Memory overflow protect; display lock
AUTO LF	ESC&k0A (off) ESC&k1A (on)	Line Feed with each terminal carriage return
REMOTE	ESC&k0R (off) ESC&k1R (on)	Remote (on-line) operations; otherwise, off-line operation
BLOCK MODE	ESC&k0B (off) ESC&k1B (on)	Block Mode: data displayed but not transmitted until requested; otherwise, terminal is in Character Mode and data transmitted as typed
ENTER	— — —	Enables block transfers
BREAK	— — —	Transmits BREAK signal to interrupt computer
TRANSMIT indicator	— — —	Data link exists
DISPLAY FUNCTIONS & indicator	ESC Y (on) ESC Z (off)	Control functions disabled and displayed
CNTL + DISPLAY FUNCTIONS	ESC y (on) ESC Z (off)	Monitor Mode: display all codes received from data comm lines
RESET TERMINAL	ESC g	(First press): frees the keyboard and clears I/O operations
RESET TERMINAL	ESC E	(Second press): sets the terminal to power-on state
+ ENTER	ESC x	Data Comm Self-Test
TAPE TEST	ESC z	Terminal Self-Test (no tape test)

KEY	CODE	FUNCTION
	ADDITIONAL FUNCTIONS	
———	ENQ (E^C)	Enquiry from the computer
———	ACK (F^C)	Acknowledge — response to ENQ
———	BEL (G^C)	Bell
———	ESC)	Define alternate character set: @, A, B, C
———	SO (N^C)	Turn on alternate character set
———	SI (O^C)	Turn off alternate character set
———	DC1 (Q^C)	Block transfer trigger
———	DC2 (R^C)	Block transfer enable from terminal
———	RS ($\blacktriangle^C$)	Record separator
———	US ($\_^C$)	Unit separator
———	ESC @	Delay one second
———	ESC `	Cursor sensing (screen relative)
———	ESC a	Cursor sensing (absolute)
———	ESC b	Keyboard enable
———	ESC c	Keyboard disable
———	ESC d	Block transfer enable from computer (See DC2)
———	ESC e	Fast binary read
———	ESC f	Modem hang-up
CNTL NEXT PAGE	ESC j (on) ESC k (off)	Display user-defined soft keys
———	ESC ▲	Terminal status
———	ESC ~	Extended status request

KEY	CODE	FUNCTION
	TERMINAL CONTROL	
———	ESC & a <parameters>	Cursor addressing
Example:	Cursor to 12th row 35th column (+, − for relative) Esc & a 12r 35C	
———	ESC & b <parameters> or ESC & c <parameters>	HP diagnostics ONLY
CNTL f1 , <@ through O>	ESC & d <enhancement>	Turn on display enhancement where: enhancements = @ through O
Example:	Select half-bright, blinking, and underline. Esc & d M	

	Enhancement Character														
	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Half-Bright									x	x	x	x	x	x	x	x
Under-line					x	x	x	x					x	x	x	x
Inverse Video			x	x			x	x			x	x			x	x
Blinking		x		x		x		x		x		x		x		x
End Enhancement	x															

KEY	CODE	FUNCTION

TERMINAL CONTROL (Cont.)

— — —	ESC & f <parameters>	Define soft keys

where:

<parameters> = {0-8}k { 0 (local) / 1 (normal) / 2 (transmit only) } a {1-80}l <text string>

Example: Assign the string "HELLO-MYACNT ↵" to the f1 key. The key should function as normal keyboard input.

Ec & f 1 k 2 a 13 L HELLO-MYACNT ↵

— — —	ESC &f <key #>E	Execute the soft key. Key # = 0-8

KEY	DEFAULT	PROGRAMMABLE
RETURN	CR	
f1	ESC p to computer	
f2	ESC q to computer	
f3	ESC r to computer	
f4	ESC s to computer	Up to 80-character sequence for each key (local, transmit or both)
f5	ESC t to computer	
f6	ESC u to computer	
f7	ESC v to computer	
f8	ESC w to computer	

KEY	CODE	FUNCTION
— — —	ESC & g <parameters>	Simulate PA, PF keys (see *Reference Manual*)
— — —	ESC & k <parameters>	Define latching keys

where:

<parameter> = 0 (up) / 1 (down) { a (Auto LF) / b (Block Mode) / c (Caps Lock) / r (Remote) }

Example: Block Mode up Remote up Auto LF down Caps Lock down

Ec & k 1 a 0 b 1 c 0 R

DEVICE CONTROL

ESC & p <parameters>

,	f1	ESC &p 1S	Assigns LEFT TAPE as source device
,	f2	ESC &p 2S	Assigns RIGHT TAPE as source device
,	f3	ESC &p 3S	Assigns DISPLAY as source device
,	f5	ESC &p 1D	Assigns LEFT TAPE as destination device
,	f6	ESC &p 2D	Assigns RIGHT TAPE as destination device
,	f7	ESC &p 3D	Assigns DISPLAY as destination device
,	f8	ESC &p 4D	Assigns PRINTER as destination device

NOTE: One source and multiple destinations can be set up with the same sequence

Example: , f5 , f7 , f8 Ec &p 1s3d 4D

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KEY	CODE	FUNCTION
DEVICE CONTROL (Cont.)		
, f1	ESC &p xs xd M	All files (current position) from source device are transferred to destination device
, f2	ESC &p xs xd F	One File (current position) from source device is transferred to destination device.
, f3	ESC &p xs xd B	One line (current position) from source device is transferred to destination device.

NOTE: x is variable to indicate source and destination device codes.
1 = Left Tape, 2 = Right Tape,
3 = Display, 4 = Printer

Example:

Copy all files from right tape to left tape and display.

Esc &p 2s 1d 3d M

KEY	CODE	FUNCTION
INSERT LINE	ESC &p 9C	Turn-off tape Write-Backspace-Read Mode
DELETE LINE	ESC &p 10C	Turn-on tape Write-Backspace-Read Mode
, f5 , f5 or f6	ESC &p 1u 0C or ESC &p 2u 0C	Rewinds LEFT TAPE Rewinds RIGHT TAPE
, f6 , f5 or f6	ESC &p 1u 5C or ESC &p 2u 5C	Write a FILE MARK on LEFT TAPE Write a FILE MARK on RIGHT TAPE
, TAPE TEST	ESC &p 1u 7C ESC &p 2u 7C	Tests left tape unit Tests right tape unit
, f7 , ±n, or f5	ESC &p (±n)p 1u 1C or	Positions LEFT TAPE to a relative (±n) LINE
f6	ESC &p (±n)p 2u 1C	Positions RIGHT TAPE to a relative (±n) LINE

KEY	CODE	FUNCTION
, f8 , ±n, or f5	ESC &p (±n)p 1u 2C or	Positions LEFT TAPE to a relative (±n) or absolute (n) FILE
f6	ESC &p (±n)p 2u 2C	Positions RIGHT TAPE to a relative (±n) or absolute (n) FILE
, CNTL f1	ESC &p1M	Compare data between source and destination (All)
or f2	ESC &p1F	(File)
or f3	ESC &p1B	(Line)
CNTL READ	— — —	Read page without DC handshake
, CNTL READ	— — —	Read tape beyond end-of-data mark
CNTL TAPE TEST , f5 or f6	ESC &p 1u 4C or ESC &p 2u 4C	Conditions left or right tape
TAPE TEST	— — —	Tape Self-Test (tests cartridges)
, SPACE BAR	— — —	Display file, inches remaining for each tape
READ	— — —	In REMOTE, transfers data from source device to computer. In LOCAL, transfers one file from source device to DISPLAY.
RECORD	— — —	In REMOTE, transfers data from computer to destination device. In LOCAL, transfers one file from DISPLAY to destination device
ENTER	— — —	In REMOTE, enables block transfers. In LOCAL, operates same as RECORD
— — —	ESC & s <parameters>	Define strap settings

Example: Remove Q strap, install P strap

Esc & s 0q 1P

GRAPHICS CONTROL SEQUENCES

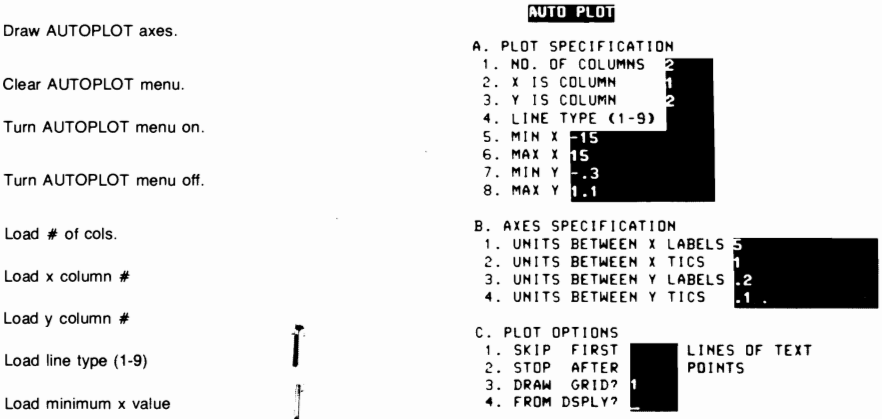
ESC * <control sequence>
- a = Autoplot
- d = Display control
- l = Graphics text label
- m = Mode control
- p = Plot control
- s = Status
- t = Compatibility mode

AUTOPLOT

ESC * a <parameters>

KEY	CODE	FUNCTION
AUTO PLOT	a	Turn AUTOPLOT on.
AUTO PLOT or STOP	b	Turn AUTOPLOT off.
SHIFT AXES	c	Draw AUTOPLOT axes.
— — —	d	Clear AUTOPLOT menu.
SHIFT AUTOPLT MENU	f	Turn AUTOPLOT menu on.
SHIFT AUTOPLT MENU	g	Turn AUTOPLOT menu off.
— — —	<# of cols> h	Load # of cols.
— — —	<x col> i	Load x column #
— — —	<y col> j	Load y column #
— — —	<line type> k	Load line type (1-9)
— — —	<min x> l	Load minimum x value
— — —	<max x> m	Load maximum x value
— — —	<min y> n	Load minimum y value

KEY	CODE	FUNCTION
— — —	<max y> o	Load maximum y value
— — —	<x labels> p	Load x label increment
— — —	<x tics> q	Load x tic increment
— — —	<y labels> r	Load y label increment
— — —	<y tics> s	Load y tic increment
— — —	<# of lines> t	Load heading lines to be skipped
— — —	<# of points> u	Load # of points to plot
— — —	<grid?> v	Load grid command (1/0)
— — —	<display?> w	Load display plot command (1/0)
— — —	z	NOP



Example: The following example programs the terminal to accept and plot 10 points (in the range 1 to 100) sent from the computer.

```
Et*ad2h1i2j1k11100m1n100o20p10q20r10s10u1v0wcA
```

KEY	CODE	FUNCTION
	DISPLAY CONTROL	
	ESC • d <parameters>	
SHIFT CLEAR	a	Clear graphics memory
— — —	b	Set graphics memory
SHIFT G DSP	c	Turn on graphics display
SHIFT G DSP	d	Turn off graphics display
SHIFT A DSP	e	Turn on alphanumeric display
SHIFT A DSP	f	Turn off alphanumeric display
ZOOM	g	Turn on zoom
ZOOM	h	Turn off zoom
ZOOM IN or ZOOM OUT	<size> i	Set zoom size (1-16)
— — —	<x,y> j	Set zoom position
G CURSOR	k	Turn on graphics cursor
G CURSOR	l	Turn off graphics cursor
SHIFT RB LN	m	Turn on rubber band line
SHIFT RB LN	n	Turn off rubber band line
— — —	<x,y> o	Move graphics cursor absolute
◄ , ▲ , ► , or ▼	<x,y> p	Move graphics cursor incremental

KEY	CODE	FUNCTION
— — —	q	Turn on alphanumeric cursor
— — —	r	Turn off alphanumeric cursor
SHIFT TEXT	s	Turn on graphics text mode
STOP	t	Turn off graphics text mode
— — —	z	NOP

Example: Clear the graphics display, position the cursor at x=100, y=100, turn the cursor on, and zoom to 4 times.

Esc • d a 100,100o k 4i G

GRAPHICS LABEL

ESC • l <text label><CR>, <LF>, <CR><LF>, or <ETX>

Example: Send the text "X=TIME, Y=TEMP"

Esc • l X=TIME, Y=TEMP CR LF

KEY	CODE	FUNCTION

VECTOR DRAWING MODE

ESC * m <parameters>

KEY	CODE	FUNCTION
— — —	<mode> a	Select drawing mode (0-4)*
— — —	<line type> b	Select line type (1-11)**
— — —	<pattern><scale> c	Define line pattern (2 bytes)
— — —	<pattern> d	Define area shading pattern (8 bytes)
— — —	<x1,y1,x2,y2> e	Fill area, absolute
— — —	<x1,y1,x2,y2> f	Fill area, relocatable
— — —	<x,y> j	Set relocatable origin
— — —	k	Set relocatable origin to current pen position
— — —	l	Set relocatable origin to graphics cursor position
SHIFT T SZE	<size> m	Set graphics text size (1-8)
SHIFT T ANG	<rotation> n	Set graphics text orientation (1-4)
SHIFT T ANG	o	Turn on text slant
SHIFT T ANG	p	Turn off text slant
— — —	<1-9> q	Set graphics text origin
— — —	r	Set graphics defaults
— — —	z	NOP

* 0 (no effect), 1 (clear), 2 (set), 3 (complement), 4 (jam)

** 1 (————————)
2 (user line pattern)
3 (user area pattern)
4 (– - – - – - –)
5 (— — — -)
6 (– – – – –)
7 (.....)
8 (—·—·—·—·—)
9 (--- --- --- -)
10 (– – – — – – — –)
11 (point plot)

Example: Select the set drawing mode, a graphics text size of 2 and slanted. Set the text to be center justified.

```
ESC * m 1a 2m o 4Q
```


KEY	CODE	FUNCTION

PLOTTING COMMANDS

ESC * p <parameters>

KEY	CODE	FUNCTION
— — —	a	Lift the pen
— — —	b	Lower the pen
— — —	c	Use graphics cursor as new point
— — —	d	Draw a point at the current pen position and lift the pen
— — —	e	Set relocatable origin to the current pen position
— — —	f	Data is ASCII absolute
— — —	g	Data is ASCII incremental
— — —	h	Data is ASCII relocatable
— — —	i	Data is absolute
— — —	j	Data is short incremental
— — —	k	Data is incremental
— — —	l	Data is relocatable
— — —	z	NOP

Example: Draw a box 25 units wide and 10 units high, beginning at x=100, y=50.

```
ESC * p a f 100 50 g 25,0 0,10 -25,0 0, -10Z
```

KEY	CODE	FUNCTION

GRAPHICS STATUS

ESC * s <parameter> ^

———	1	Read device I.D.
———	2	Read pen position
———	3	Read graphics cursor position
———	4	Read cursor position and wait for key
———	5	Read display size
———	6	Read graphics capabilities
———	7	Read graphics text status
———	8	Read zoom status
———	9	Read relocatable origin
———	10	Read reset status
———	11	Read area shading
———	12	Read dynamics

Example: Read text status.

ESC * s 7 ^ DC1

KEY	CODE	FUNCTION

COMPATIBILITY MODE

ESC * t <parameter> ,,

———	<0/1/2> a	Set graphics input terminator (0=CR, 1=CR EOT, 2=none)
———	<0/1> b	Set Page Full Break strap (0=out, 1=in)
———	<0/1> c	Set Page Full Busy strap 0=out, 1=in)
———	z	NOP

Keyboard Interface switches:

P open = Scaled compatibility mode.
Q open = Unscaled compatibility mode.

Example: Select a CR input terminator and set the Page Full Busy strap.

ESC * t 0a 1C

BIT 7 6 5 4 3 2 1	CONTROL (CNTL) CHARACTERS 000	001	DISPLAYABLE CHARACTERS 010	011	100	101	110	111	ESCAPE SENT FIRST 010	011	100	101	110	111
0000	@ 0 N_U NUL	P 16 D_L DLE	SP	0	@	P	`	p	SP	0	@ DELAY 1 SEC	P DELETE CHAR	` CURSOR RELATIVE SENSE	p f_1
0001	A 1 S_H SOH	Q 17 D_1 DC1	!	1	A	Q	a	q	!	1 SET TAB	A ↑ CURSOR UP	Q INSERT CHAR ON	a CURSOR ABSOLUTE SENSE	q f_2
0010	B 2 S_X STX	R 18 D_2 DC2	"	2	B	R	b	r	"	2 CLEAR TAB	B ↓ CURSOR DOWN	R INSERT CHAR OFF	b KEYBOARD ENABLE	r f_3
0011	C 3 E_X ETX	S 19 D_3 DC3	#	3	C	S	c	s	#	3 CLEAR ALL TABS	C → CURSOR RIGHT	S ROLL UP	c KEYBOARD DISABLE	s f_4
0100	D 4 E_T EOT	T 20 D_4 DC4	$	4	D	T	d	t	$	4 SET LEFT MARGIN	D ← CURSOR LEFT	T ROLL DOWN	d ENTER	t f_5
0101	E 5 E_Q ENQ	U 21 N_K NAK	%	5	E	U	e	u	%	5 SET RIGHT MARGIN	E RESET TERMINAL	U NEXT PAGE	e BINARY READ	u f_6
0110	F 6 A_K ACK	V 22 S_Y SYN	&	6	F	V	f	v	& PARA METER SEQUENCE	6 START ALPHA FIELD	F CURSOR HOME DOWN	V PREV PAGE	f MODEM DIS CONNECT	v f_7
0111	G 7 BEL	W 23 E_B ETB	'	7	G	W	g	w		7 START NUMERIC FIELD	G CURSOR RETURN	W FORMAT MODE ON	g SOFT RESET	w f_8
1000	H 8 B_S BS	X 24 C_N CAN	(	8	H	X	h	x	(	8 START ALPHNUM FIELD	H HOME CURSOR (SEE NOTE 3)	X FORMAT MODE OFF	h HOME CURSOR (SEE NOTE 3)	x DATA COM SELF TEST
1001	I 9 H_T HT	Y 25 E_M EM	)	9	I	Y	i	y	DEFINE CHAR SET)	9	I HORI ZONTAL TAB	Y DISPLAY FUNCTIONS ON	i BACK TAB	y MONITOR MODE ON
1010	J 10 L_F LF	Z 26 S_B SUB	*	:	J	Z	j	z	GRAPHICS SEQUENCE *	:	J CLEAR DSPLY	Z DISPLAY FUNCTIONS OFF	j SOFT KEY DISPLAY ON	z TERMINAL SELF TEST
1011	K 11 V_T VT	[27 E_C ESC	+	;	K	[	k	{	+	;	K ERASE TO END OF LINE	[START UNPROTECT FIELD	k SOFT KEY DISPLAY OFF	{ START XMIT ONLY FIELD
1100	L 12 F_F FF	\ 28 F_S FS	,	<	L	\	l	¦	,	<	L INSERT LINE	\	l MEMORY LOCK ON	¦
1101	M 13 C_R CR	] 29 G_S GS	–	=	M	]	m	}	–	=	M DELETE LINE	] END UNPROTECT FIELD	m MEMORY LOCK OFF	}
1110	N 14 S_O SO	^ 30 R_S RS	.	>	N	^	n	~	.	>	N INSERT CHAR W/WRAP ON	^ TERM PRIMARY STATUS	n	~ SEND SECOND-ARY STATUS
1111	O 15 S_I SI	_ 31 U_S US	/	?	O	_	o	■	/	?	O DELETE CHAR W/WRAP	_ INSERT NON-DISP TERMINATR	o	DEL

Example: J is bits 1001010; Control J is LF line feed; Escape (ESC) followed by J is CLEAR DISPLAY

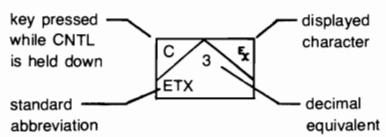
LEGEND

NOTES:

1. LOWER CASE LETTER, LOWER CASE SYMBOL, AND CONTROL CHARACTER CODES ARE GENERATED BY STANDARD TERMINAL, BUT ASSOCIATED CHARACTERS ARE NOT DISPLAYED ON THE SCREEN. PRESS TAPE TEST KEY FOR DISPLAYABLE CHARACTER SET.
2. SINGLE CHARACTER ESCAPE SEQUENCES AND CONTROL CODES NOT LISTED WITH A FUNCTION ARE NEITHER ACTED UPON NOR DISPLAYED.
3. ESC H HOMES CURSOR INCLUDING TRANSMIT-ONLY FIELDS. ESC h HOMES CURSOR EXCLUDING TRANSMIT-ONLY FIELDS.

$^{A}_{K}$ — ACKNOWLEDGE
$^{}_{Q}$ — BELL
$^{}_{B}$ — BACKSPACE
$^{}_{U}$ — CANCEL LINE
$^{}_{R}$ — CARRIAGE RETURN
$^{}_{L}$ — DATA LINK ESCAPE
■ — DELETE
D_1 — DEVICE CONTROL 1
D_2 — DEVICE CONTROL 2
D_3 — DEVICE CONTROL 3
D_4 — DEVICE CONTROL 4
E_M — END OF MEDIUM
E_Q — ENQUIRY
E_T — END OF TRANSMISSION
E_C — ESCAPE
E_B — END OF TRANSMISSION BLOCK
E_X — END OF TEXT
F_F — FORM FEED
F_S — FILE SEPARATOR
G_S — GROUP SEPARATOR
H_T — HORIZONTAL TABULATION
L_F — LINE FEED
N_K — NEGATIVE ACKNOWLEDGE
R_S — RECORD SEPARATOR
S_I — SHIFT IN
S_O — SHIFT OUT
SP — SPACE
S_H — START OF HEADING
S_X — START OF TEXT
S_B — SUBSTITUTE
S_Y — SYNCHRONOUS IDLE
U_S — UNIT SEPARATOR
V_T — VERTICAL TABULATION

Control Character Legend:



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