                    TELNET Command at Host LL

The attached writeup documents the use of the TELNET command at Host
LL for uses under the CP/CMS time-sharing system. This command
provides for use in a HALF DUPLEX or FULL DUPLEX mode and can be used
with ASCII codes or with EBCDIC codes (i.e., transparent mode). The
keyboard conventions allow for entering all ASCII codes using a
CONTROL character followed by another character for the codes not
present on an IBM 2741 terminal. In addition a number of local
TELNET control commands have been defined which allows the mode of
operation to be changed, the redefinition of special characters, the
sending of TELNET control codes, as well as for obtaining input from
a file instead of from the terminal. These later features provide
for a rudimentary file transfer facility.

This material has not been reviewed for public release and is
intended only for use with the ARPA network. It should not be quoted
or cited in any publication not related to the ARPA network.

    TELNET

Purpose:

    To access another terminal oriented system on the ARPA network.

Format:

    TELNET host <tag> RESUME   EBCDIC   HALFDUP
               1   OPEN   ASCII   FULLDUP

    host - either the hexadecimal code for a foreign network service site
    or a standard mnemonic for a foreign site. See Figure 1

    tag - the identifier foe the local connections to the network. The
    tag is used together with the address of the virtual machine
    descriptor table (UTABLE) to form local socket numbers which are used
    in the network protocol.

    RESUME - used to reactivate communications with a foreign site after
    having previously left the TELNET command leaving the connections
    open.

EBCDIC - to communicate with EBCDIC codes. The default is network ASCII.

HALFDUP - to operate under a half duplex protocol, i.e. with a locked keyboard.

The EBCDIC HALFDUP the protocol assumes that the TELNET break code (circle C) will be received to indicate when the keyboard should be locked for input.

In ASCII HALFDUP the keyboard will lock after a line of input and will unlock after one or more lines have been received for output. An external interrupt will also unlock a locked keyboard.

The default is full duplex where the keyboard is always unlocked for input. A null line is required to temporarily lock the keyboard in order to receive output.

Usage

A number of hosts on the ARPA network provide TELNET service. A Network Virtual Terminal (NVT) has been specified so that using sites can write one TELNET program which maps a local terminal into the NVT to access any serving site on the network. Once communication has been established between a using site and a serving site, keyed input is sent to the serving system and output from the serving site, when received, is typed on the local terminal.

The NVT protocol requires that the keyboard be capable of entering all of the 128 ASCII codes together with a number of the TELNET control codes. To support an NVT with an IBM 2741 terminal, it is necessary to adapt a control convention for entering codes which are not associated with single keys on the keyboard. In addition, since CP/CMS processes input from a 2741 on a line at a time terminated with a newline, a means must be establish for entering a sequence of characters for transmission which is not terminated with a newline code.

When TELNET is initiated the message

    ENTER CONTROL CHARACTER

is typed. A non-blank character should then be entered which defines the character which, in combination with another character, will be used to enter codes not associated with single keys. The control character is also used for other special control functions as described below.

Codes

   The NVT usually requires that characters be transmitted in an eight
   bit ASCII code. Since the TELNET command is written to process
   EBCDIC codes ASCII codes received are translated into ASCII before
   being sent to a serving site. Figure 2 gives the complete definition
   of EBCDIC indicating the EBCDIC controls and EBCDIC graphics. Figure
   3 gives the codes for the ASCII controls and graphics. The complete
   mapping between 8-bit EBCDIC codes and 8-bit network ASCII codes is
   shown in Figure 4. The EBCDIC newline code (NL) is mapped into the
   ASCII codes for the pair of characters CR-IF.

   The following ASCII/EBCDIC mapping is used for the non-EBCDIC
   graphics:

                      ASCII   EBCDIC

             TILDE (7E) = (A1) NOT
               BAR (7C) = (6A) OR
        BACK SLASH (5C) = (EO)
             CARAT (5E) = (71)
             GRAVE (6O) = (79)
        LEFT BRACE (7B) = (8B)
       RIGHT BRACE (7D) = (9B)
      LEFT BRACKET (5B) = (AD)
     RIGHT BRACKET (5D) = (BD)

   The ASCII control DC3 (X' 13') maps to the EBCDIC control TM (X' 13').
   The ASCII control NUL (X' oo') is sent to the terminal as the
   EBCDIC code for NULL (X' oo') and is not mapped into an IDLE (X' 17').

   The TELNET control hide-your-input is mapped into the EBCDIC code for
   bypass (print supress) and the TELNET control noecho is mapped into
   the EBCDIC code for restore (print restore). If the TELNET control
   for echo is received, a message is printed and it is mapped into an
   IDLE. Similarly, if the TELNET control for break is received, a
   message is printed and it is mapped into an IDLE unless operation is
   in EBCDIC HALFDUP mode in which case the break is used to indicate
   that any received characters should be printed and the keyboard
   unlocked for input. If a data mark or an interrupt is received, no
   action is taken except to print a message to notify the user of this
   occurance.

Input

   When the control character is entered, the following character is
   mapped into a different code than that which it is normally mapped
   into, except when the following character is a space or a character
   not defined to have a meaning when preceded by the control character.
   Figure 5 gives the mapping of the characters on a 2741 keyboard when
   preceded by a control character. The following 2741 keyboard
   characters do not have a different meaning when preceded by the
   control character.

      $ # * % &
      + - = _
      /. , : ;
      ! | ? (cent sign)

      SPACE
      BACKSPACE
      TAB

   When a character is mapped into its control code, the control
   character is mapped into the code for IDLE. If the control character
   is entered as the last character before the newline key is entered,
   the sequence of characters entered is transmitted without the newline
   code. That is, the newline code is not transmitted when it is
   preceded by the control character.

   When the 2741 keyboard is unlocked for input, characters received
   cannot be typed until the keyboard is locked again. After a line is
   entered, received characters can then be typed. When operating in
   full duplex or ASCII half duplex, a null line entered will allow
   received characters to be typed but will not cause the new line code
   to be transmitted. To cause a null line, i.e., just the new line
   code to be transmitted, the control character should be entered as
   the only character in the input line. In EBCDIC HALFDUP a null line
   entered will cause a null line to be transmitted.

Output

   ASCII output received from the NVT is converted into EBCDIC with the
   sequences CR-LF converted into IDLE-NL. The EBCDIC characters are
   then sent to the terminal. Note that not all 128 ASCII codes when
   converted to EBCDIC will print on a 2741. Of the 95 ASCII graphics
   and the 8 ASCII controls which are defined for the NVT printer, the
   following are not visible or audible:

```
CARAT
     GRAVE
     BACK SLASH
     LEFT BRACE
     RIGHT BRACE
     LEFT BRACKET
     RIGHT BRACKET
     ASCII CONTROL BELL (BEL)
     ASCII CONTROL VERTICAL TAB (HT)
     ASCII CONTROL FORM FEED (FF)
     ASCII CONTROL CARRIAGE RETURN (CR)
```

Figure 6 shows how the EBCDIC codes from X' 40' through X' FF' will appear on a 2741 terminal. Figure 7 shows how the EBCDIC codes will appear when printed with a PN train on the offline printer and Figure 8 shows how these codes appear when printed with a TN train.

Controls:

If the first character in an input line is the control character and the next character is a space, the rest of the line is interpreted as a TELNET control command. A control command consists of a control word and parameters separated by spaces. Controls are defined which permit TELNET controls to be transmitted to the serving site, allow input to come from a file or output to go to a file, allow CMS functions or transient commands to be issued,redefine the control character or TELNET mode, close connections still open, as well as controls to support a reader, punch, and printer with RJS operation. The controls are described below.

CONTROL x

    Where x is the new control character

CLOSE

    To close all connections and quit

QUIT

    To leave TELNET

EBCDIC

    To go into transparent mode, i.e., no translation

ASCII

   To translate input and output to network ASCII

Break

   To send the TELNET break code

SYNC

   To send the TELNET data mark code and an interrupt

AATN

   To send a TELNET break and a SYNC

HIDE-YOUR-INPUT

   To send the TELNET hide you input code

NOECHO

   To send the TELNET noecho code

ECHO

   To send the TELNET echo code

CMS command arg1...argN

   To issue CMS core resident function or transient command.

INPUT fn ft

   * TERMIN

   **

To get input from a file If fn is defaulted, input is reset to come
from the terminal. If fn is * file input resumes after the last line
read. After an EOF, the next line read will be the first line of the
file.

An external interrupt while input is coming from a file will cause
the line number of the next line to be read from the file to be typed
and input to be reset to come from the terminal.

```
OUTPUT fn OFF  TERM    INPUT     INOUT

     *  ON NOTERM  NOINPUT  OUTPUT
```

To write output to the file "fn TERMOUT". If fn is defaulted,
output is reset to go to the terminal. If fn is *, file OUTPUT is
resumed with the same options as were last used.

For Output to the Terminal:

   If the last character is a CR, a line with just the control
   character is typed on the next line (with a NL)

   If the last character is not a NL or a CR, the line is typed
   without a NL (i.e., with TYPE).

For Output to a File:

   If just a NL is in the line, just the control character is sent to
   the file.

   If the last CHAR is not NL or CR, the control character is added
   after the last character, except if 130 characters must be sent to
   the file.

   If the last CHAR is a CR, it is included in the file.

   OFF causes all output to be discarded.

   ON is the default, and causes output to the terminal.

   TERM causes output to also go to the terminal.

   NOTERM is the default, and causes output to go the file but not to
   the terminal.

   OUTPUT is the default and causes just terminal output to be put to
   the file "FN termout".

   INPUT causes both terminal input but not output to be put to the
   output file.

   NOINPUT is defaulted and causes input to not go to the file.

  PURGE

   To purge all output currently received by the NCP.

*****NOT YET IMPLEMENTED*****

  READER fn ft

     * READER

     To send a job to the RJS system at UCLA's CCN.

     If fn and ft are defaulted, input will come from the card reader.

  PRINTER fn ft

     * PRINTER

     To receive printer output from the RJS system at UCLA's CCN.

     To receive punch output from the RJS system at UCLA's CCN.

     If fn and ft are defaulted, output goes to the printer.

  PUNCH fn ft

     * PUNCH

     If fn and ft are defaulted, output goes to the punch.

HOST	SITE	MACHINE	SYSTEM	HOST NUMBER		
				DEC	OCT	HEX
ARC	SRI	PDP-10	NIC	2	2	02
UCSB	UCSB	360/75	OS/MVT	3	3	03
UTAH	UTAH	PDP-10	TENEX	4	4	04
MULTICS	MIT	H-645	MULTICS	6	6	06
SDC	SDC	370/155	ADEPT	8	10	08
HARV	HARVARD	PDP-10	4S72	9	11	09
LL	LL	360/67	CP/CMS	10	12	0A
CASE	CASE	PDP-10	10/50	13	15	OD
CMU	CMU	PDP-10	TOPS-10	14	16	0E
ILLIAC	AMES	360/67	TTS/360	16	18	10
CCN	UCLA	360/91	OS/MVT	65	101	41
SRI	SRI-AI	PDP-10	TENEX	66	102	42
BBNA	BBN	PDP-10	TENEX	69	105	45
DMCG	MIT	PDP-10	ITS	70	106	46
RAND	RAND-RCC	PDP-10	TENEX	71	107	47
TX2	LL	TX-2	APEX	74	112	4A
BBNB	BBN	PDP-10	TENEX	133	205	85
MIATI	MIT	PDP-10	ITS	134	206	86

                 Serving Hosts on the APRA Network
                           Figure 1

```
            0 0   0   0   0   0   0   0   0   1   1   1   1   1   1   1   1
            1 0   0   0   0   1   1   1   1   0   0   0   0   1   1   1   1
            2 0   0   1   1   0   0   1   1   0   0   1   1   0   0   1   1
            3 0   1   0   1   0   1   0   1   0   1   0   1   0   1   0   1
      4567 +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0000 |NUL|DLE|DS |   |SP | & | - |   |   |   | - | ° |   |   |   | 0 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0001 |SOH|DC1|SOS|   |   |   | / |   | a | j | ° | ¹ | A | J |   | 1 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0010 |STX|DC2|FS |SYN|   |   |   |   | b | k | s | ² | B | K | S | 2 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0011 |ETX|TM |   |   |   |   |   |   | c | l | t | ³ | C | L | T | 3 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0100 |PF |RES|BYP|PN |   |   |   |   | d | m | u | ⁴ | D | M | U | 4 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0101 |HT |NL |LF |RS |   |   |   |   | e | n | v | ⁵ | E | N | V | 5 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0110 |LC |BS |ETB|UC |   |   |   |   | f | o | w | ⁶ | F | O | W | 6 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      0111 |DEL|IL |ESC|EOT|   |   |   |   | g | p | x | ⁷ | G | P | X | 7 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1000 |GE |CAN|   |   |   |   |   |   | h | q | y | ⁸ | H | Q | Y | 8 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1001 |RLF|EM |   |   |   |   |   |   | i | r | z | ⁹ | I | R | Z | 9 |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1010 |SMM|CC |SM |   | ¢ | ! |   | : |   |   |   |   |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1011 |VT |CU1|CU2|CU3| . | $ | , | # | { | } | └ | ┘ |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1100 |FF |IFS|   |DC4| < | * | % | @ | ≤ | □ | ┌ | ┐ |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1101 |CR |IGS|ENQ|NAK| ( | ) | _ | ' | ' | ⟩ | [ | ] |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1110 |SO |IRS|ACK|   | + | ; | > | = | ⁺ | ± | ≥ | ≠ |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
      1111 |SI |IUS|BIL|SUP|   | ¬ | ? | " | + | ▪ | ● | - |   |   |   |   |
           +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+

                +---+---+---+---+---+---+---+---+
                | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
                +---+---+---+---+---+---+---+---+
                        Code Structure
```
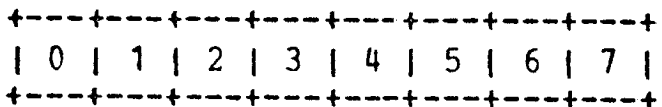
Extended Binary-Coded Decimal Interchange Code (EBCDIC)

FIGURE 2

```
                  8 0    0    0    0    0    0    0    0
                  7 0    0    0    0    1    1    1    1
                  6 0    0    1    1    0    0    1    1
                  5 0    1    0    1    0    1    0    1
        4321   +---+---+---+---+---+---+---+---+
        0000   |NUL|DLE|SP | 0 | @ | P |   | p |
               +---+---+---+---+---+---+---+---+
        0001   |SOH|DC1| ! | 1 | A | Q | a | q |
               +---+---+---+---+---+---+---+---+
        0010   |STX|DC2| " | 2 | B | R | b | r |
               +---+---+---+---+---+---+---+---+
        0011   |ETX|DC3| # | 3 | C | S | c | s |
               +---+---+---+---+---+---+---+---+
        0100   |EOT|DC4| $ | 4 | D | T | d | t |
               +---+---+---+---+---+---+---+---+
        0101   |ENQ|NAK| % | 5 | E | U | e | u |
               +---+---+---+---+---+---+---+---+
        0110   |ACK|SYN| & | 6 | F | V | f | v |
               +---+---+---+---+---+---+---+---+
        0111   |BEL|ETB| ' | 7 | G | W | g | w |
               +---+---+---+---+---+---+---+---+
        1000   |BS |CAN| ( | 8 | H | X | h | x |
               +---+---+---+---+---+---+---+---+
        1001   |HT |EM | ) | 9 | I | Y | i | y |
               +---+---+---+---+---+---+---+---+
        1010   |LF |SUB| * | : | J | Z | j | z |
               +---+---+---+---+---+---+---+---+
        1011   |VT |ESC| + | ; | K | [ | k | { |
               +---+---+---+---+---+---+---+---+
        1100   |FF |FS | , | < | L |   | l | | |
               +---+---+---+---+---+---+---+---+
        1101   |CR |GS | - | = | M | ] | m | } |
               +---+---+---+---+---+---+---+---+
        1110   |SO |RS | . | > | N |   | n | ¬ |
               +---+---+---+---+---+---+---+---+
        1111   |SI |US | / | ? | O | _ | o |DEL|
               +---+---+---+---+---+---+---+---+


               +---+---+---+---+---+---+---+---+
               | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
               +---+---+---+---+---+---+---+---+
```

Code Structure

USA Standard Code for Information Interchange (USASCII)
FIGURE 3

ASCII DEC	ASCII OCT	ASCII HEX	SYMBOLS	EBCDIC HEX	EBCDIC DEC
0	0	(00)	NUL	(00)	00
1	1	(01)	SOH	(01)	01
2	2	(02)	STX	(02)	02
3	3	(03)	ETX	(03)	03
4	4	(04)	EOT	(37)	55
5	5	(05)	ENQ	(2D)	45
6	6	(06)	ACK	(2E)	46
7	7	(07)	BEL	(2F)	47
8	10	(08)	BS	(16)	22
9	11	(09)	HT	(05)	05
10	12	(0A)	LF	(25)	37
11	13	(0B)	VT	(0B)	11
12	14	(0C)	FF	(0C)	12
13	15	(0D)	CR	(0D)	13
14	16	(0E)	SO	(0E)	14
15	17	(0F)	SI	(0F)	15
16	20	(10)	DLE	(10)	16
17	21	(11)	DC1	(11)	17
18	22	(12)	DC2	(12)	18
19	23	(13)	DC3	(13)	19
20	24	(14)	DC4	(3C)	60
21	25	(15)	NAK	(3D)	61
22	26	(16)	SYN	(32)	50
23	27	(17)	ETB	(26)	38
24	30	(18)	CAN	(18)	24
25	31	(19)	EM	(19)	25
26	32	(1A)	SUB	(3F)	63
27	33	(1B)	CTL	(27)	39
28	34	(1C)	FS	(1C)	28
29	35	(1D)	GS	(1D)	29

30	36	(1E)	RS	(1E)	30
31	37	(1F)	US	(1F)	31
32	40	(20)	SP	(40)	64
33	41	(21)	!	(5A)	90
34	42	(22)	"	(7F)	127
35	43	(23)	#	(7B)	123
36	44	(24)	$	(5B)	91
37	45	(25)	%	(6C)	108
38	46	(26)	&	(50)	80
39	47	(27)	'	(7D)	124
40	50	(28)	(	(4D)	77
41	51	(29)	)	(5D)	93
42	52	(2A)	*	(5C)	92
43	53	(2B)	+	(4E)	78
44	54	(2C)	,	(6D)	109
45	55	(2D)	-	(60)	96
46	56	(2E)	.	(4B)	75
47	57	(2F)	/	(61)	97
48	60	(30)	0	(F0)	240
49	61	(31)	1	(F1)	241
50	62	(32)	2	(F2)	242
51	63	(33)	3	(F3)	243
52	64	(34)	4	(F4)	244
53	65	(35)	5	(F5)	245
54	66	(36)	6	(F6)	246
55	67	(37)	7	(F7)	247
56	70	(38)	8	(F8)	248
57	71	(39)	9	(F9)	249
58	72	(3A)	:	(7A)	122
59	73	(3B)	;	(5E)	94
60	74	(3C)	<	(4C)	76
61	75	(3D)	=	(7E)	126
62	76	(3E)	>	(6E)	110
63	77	(3F)	?	(6F)	111
64	100	(40)	@	(7C)	124
65	101	(41)	A	(C1)	193
66	102	(42)	B	(C2)	194
67	103	(43)	C	(C3)	195
68	104	(44)	D	(C4)	196
69	105	(45)	E	(C5)	197
70	106	(46)	F	(C6)	198
71	107	(47)	G	(C7)	199
72	110	(48)	H	(C8)	200
73	111	(49)	I	(C9)	201
74	112	(4A)	J	(D1)	209
75	113	(4B)	K	(D2)	210
76	114	(4C)	L	(D3)	211
77	115	(4D)	M	(D4)	212

78	116	(4E)	N	(D5)	213	
79	117	(4F)	O	(D6)	214	
80	120	(50)	P	(D7)	215	
81	121	(51)	Q	(D8)	216	
82	122	(52)	R	(D9)	217	
83	123	(53)	S	(E2)	226	
84	124	(54)	T	(E3)	227	
85	125	(55)	U	(E4)	228	
86	126	(56)	V	(E5)	229	
87	127	(57)	W	(E6)	230	
88	130	(58)	X	(E7)	231	
89	131	(59)	Y	(E8)	232	
90	132	(5A)	Z	(E9)	233	
91	133	(5B)	[	(AD)	173	
92	134	(5C)	(cent sign)	(4A)	74	(BACK-SLASH)
93	135	(5D)	]	(BD)	189	
94	136	(5E)		(71)	113	(CARAT)
95	137	(5F)	_	(6D)	109	
96	140	(60)		(79)	121	(GRAVE)
97	141	(61)	a	(81)	129	
98	142	(62)	b	(82)	130	
99	143	(63)	c	(83)	131	
100	144	(64)	d	(84)	132	
101	145	(65)	e	(85)	133	
102	146	(66)	f	(86)	134	
103	147	(67)	g	(87)	135	
104	150	(68)	h	(88)	136	
105	151	(69)	i	(89)	137	
106	152	(6A)	j	(91)	145	
107	153	(6B)	k	(92)	146	
108	154	(6C)	l	(93)	147	
109	155	(6D)	m	(94)	148	
110	156	(6E)	n	(95)	149	
111	157	(6F)	o	(96)	150	
112	160	(70)	p	(97)	151	
113	161	(71)	q	(98)	152	
114	162	(72)	r	(99)	153	
115	163	(73)	s	(A2)	162	
116	164	(74)	t	(A3)	163	
117	165	(75)	u	(A4)	164	
118	166	(76)	v	(A5)	165	
119	167	(77)	w	(A6)	166	
120	170	(78)	x	(A7)	167	
121	171	(79)	y	(A8)	168	
122	172	(7A)	z	(A9)	169	
123	173	(7B)	{	(8B)	139	
124	174	(7C)			(4F)	79	(BAR/OR)
125	175	(7D)	}	(9B)	155	

```
126        176        (7E)  (broken bar)    (5F)        95  (TILDE/NOT)
127        177        (7F)      DEL         (07)         7
```

ASCII	ASCII	ASCII	TELNET	EBCDIC	EBCDIC	
DEC	OCT	HEX	CONTROLS	HEX	DEC	
128	100	(80)	DATA-MARK	(80)	128	
129	101	(81)	BREAK	(38)	56	
130	102	(82)	NOP	(17)	23	IDLE
131	103	(83)	NOECHO	(14)	20	RESTORE
132	104	(84)	ECHO	(23)	35	
133	105	(85)	HIDE-YOUR INPUT	(24)	36	BYPASS

ASCII/EBCDIC Code Mappings
FIGURE 4

```
EBCDIC                          EBCDIC ASCII

CENT      (4A)  = ESC              (27)    (1B)

CTL <     (4C)  = LEFT BRACKET     (AD)    (5B)
CTL >     (6E)  = RIGHT BRACKET    (BD)    (5D)
CTL (     (4D)  = LEFT BRACE       (8B)    (7B)
CTL )     (5D)  = RIGHT BRACE      (9B)    (7D)
CTL /     (61)  = BACK SLASH       (4A)    (5C)
CTL "     (7F)  = CARAT            (71)    (5E)
CTL '     (7D)  = GRAVE            (79)    (60)

CTL 6     (F6)  = FS               (1C)    (1C)
CTL 7     (F7)  = GS               (1D)    (1D)
CTL 8     (F8)  = RS               (1E)    (1E)
CTL 9     (F9)  = US               (1F)    (1F)
CTL _     (6D)  = US               (1F)    (1F)

CTL (broken bar) (5F) = DEL                (07)    (7F)

CTL @     (7C)  = NUL              (00)    (00)
CTL A     (C1)  = SOH              (01)    (01)
CTL B     (C2)  = STX              (02)    (02)
CTL C     (C3)  = ETX              (03)    (03)
CTL D     (C4)  = EOT              (37)    (04)
CTL E     (C5)  = ENQ              (2D)    (05)
CTL F     (C6)  = ACK              (2E)    (06)
CTL G     (C7)  = BEL              (2F)    (07)
CTL H     (C8)  = BS               (16)    (08)
CTL I     (C9)  = HT               (05)    (09)
CTL J     (D1)  = LF               (25)    (0A)
```

```
CTL  K      (D2)  =  VT            (0B)     (0B)
CTL  L      (D3)  =  FF            (0C)     (0C)
CTL  M      (D4)  =  CR            (0D)     (0D)
CTL  N      (D5)  =  SO            (0E)     (0E)
CTL  O      (D6)  =  SI            (0F)     (0F)


CTL  P      (D7)  =  DLE           (10)     (10)
CTL  Q      (D8)  =  DC1           (11)     (11)
CTL  R      (D9)  =  DC2           (12)     (12)
CTL  S      (E2)  =  DC3           (13)     (13)
CTL  T      (E3)  =  DC4           (3C)     (14)
CTL  U      (E4)  =  NAK           (3D)     (15)
CTL  V      (E5)  =  SYN           (32)     (16)
CTL  W      (E6)  =  ETB           (26)     (17)
CTL  X      (E7)  =  CAN           (18)     (18)
CTL  Y      (E8)  =  EM            (19)     (19)
CTL  Z      (E9)  =  SUB           (3F)     (1A)

          EBCDIC                       EBCDIC  ASCII

CTL  1  (F1)  =  BREAK          (38)    (81)  -  CIRCLE C
CTL  2  (F2)  =  NOP            (17)    (82)  -  IDLE
CTL  3  (F3)  =  NO ECHO        (14)    (83)  -  RESTORE
CTL  4  (F4)  =  ECHO           (23)    (84)
CTL  5  (F5)  =  HIDE YOU INPUT (24)    (85)  -  BYPASS
```

DATA MARK (80) CANNOT BE ENTERED FROM THE KEYBOARD

THE FOLLOWING 2741 KEYBOARD CHARACTERS DO NOT
HAVE A MEANING AS A CONTROL:

```
$ # * % &
+ - = _
. , :
! | ? (cent sign)
SPACE
BACKSPACE
TAB
```

Keyboard Control Character Mappings
FIGURE 5 (CONTINUED)

```
•y   0 1 2 3 4 5 6 7 8 9 A B C D E F
x

4    . . . . . . . . . . . . .¢...<.(.+.|.
5    .Ɛ. . . . . . . . . . .!.$.*.).;.¬.
6    .-./. . . . . . . . . . .,.%._.>.?.
7    . . . . . . . . . . . .:.#.@.'.=."
8    . .a.b.c.d.e.f.g.h.i. . . . . .
9    . .j.k.l.m.n.o.p.q.r. . . . . .
A    . . .s.t.u.v.w.x.y.z. . . . . .
B    . . . . . . . . . . . . . . . .
C    . .A.B.C.D.E.F.G.H.I. . . . . .
D    . .J.K.L.M.N.O.P.Q.R. . . . . .
E    . . .S.T.M.V.W.X.Y.Z. . . . . .
F    .0.1.2.3.4.5.6.7.8.9. . . . .,. .
```

Hex Code X'xy' for Characters on a 2741 Terminal

```
••y   0 1 2 3 4 5 6 7 8 9
xx

06              . . . .<. . . .
07    . . . . .¢...<.(.+.|.
08    .Ɛ. . . . . . . . . .
09    .!.$.*.).;.¬. ./. . .
10    . . . . . . . .,.%._.
11    .>.?. . . . . . . . .
12    . . .:.#.@.'.=."  .a.
13    .b.c.d.e.f.g.h.i. . .
14    . . . . . .j.k.l.m.n.
15    .o.p.q.r. . . . . . .
16    . . .s.t.u.v.w.x.y.z.
17    . . . . . . . . . . .
18    . . . . .A.B.C.D.E.F.G.
19    . . . .A.B.C.D.E.F.G.
20    .H.I. . . . . . . .J.
21    .K.L.M.N.O.P.Q.R. . .
22    . . . . . . .S.T.U.V.
23    .W.X.Y.Z. . . . . . .
24    .0.1.2.3.4.5.6.7.8.9.
25    . . . . . . .
```

Decimal Code D'xxy' for Characters on a 2741 terminal

```
HT   X'05' = D'005'   Horizontal Tab
LC   X'06' = D'006'   Lower Case
RES  X'14' = D'020'   Print Restore
NL   X'15' = D'021'   New Line
BS   X'16' = D'022'   Back Space
IL   X'17' = D'023'   Idle
BYP  X'24' = D'036'   Print Bypass
LF   X'25' = D'037'   Line Feed
UC   X'36' = D'054'   Upper Case
```

Hex Code X'xy' and Decimal Code D'xxy' for 2741 Control Codes

FIGURE 6

```
•y  0 1 2 3 4 5 6 7 8 9 A B C D E F
x

0   . .A.B.C.D.E.F.G.H.I. ...<.(.+.|.
1   .&.J.K.L.M.N.O.P.Q.R. .$.*.).;.¬.
2   .-./.S.T.U.V.W.X.Y.Z. .,.%._.>.?.
3   .0.1.2.3.4.5.6.7.8.9.:.#.@.'.=.".
4   . .A.B.C.D.E.F.G.H.I. ...<.(.+.|.
5   .&.J.K.L.M.N.O.P.Q.R. .$.*.).;.¬.
6   .-./.S.T.U.V.W.X.Y.Z. .,.%._.>.?.
7   .0.1.2.3.4.5.6.7.8.9.:.#.@.'.=.".
8   . .A.B.C.D.E.F.G.H.I. ...<.(.+.|.
9   .&.J.K.L.M.N.O.P.Q.R. .$.*.).;.¬.
A   .-./.S.T.U.V.W.X.Y.Z. .,.%._.>.?.
B   .0.1.2.3.4.5.6.7.8.9.:.#.@.'.=.".
C   . .A.B.C.D.E.F.G.H.I. ...<.(.+.|.
D   .&.J.K.L.M.N.O.P.Q.R. .$.*.).;.¬.
E   .-./.S.T.U.V.W.X.Y.Z. .,.%._.>.?.
F   .0.1.2.3.4.5.6.7.8.9.:.#.@.'.=.".
```

Hex Code X'xy' for Characters on the PN train

```
••y  0 1 2 3 4 5 6 7 8 9
xx

00   . .A.B.C.D.E.F.G.H.I.
01   . ...<.(.+.|.&.J.K.L.
02   .M.N.O.P.Q.R. .$.*.).
03   .;.¬.-./.S.T.U.V.W.X.
04   .Y.Z. .,.%._.>.?.0.1.
05   .2.3.4.5.6.7.8.9.:.#.
06   .@.'.=.". .A.B.C.D.E.
07   .F.G.H.I. ...<.(.+.|.
08   .&.J.K.L.M.N.O.P.Q.R.
09   . .$.*.).;.¬.-./.S.T.
10   .U.V.W.X.Y.Z. .,.%._.
11   .>.?.0.1.2.3.4.5.6.7.
12   .8.9.:.#.@.'.=.". .A.
13   .B.C.D.E.F.G.H.I. ...
14   .<.(.+.|.&.J.K.L.M.N.
15   .O.P.Q.R. .$.*.).;.¬.
16   .-./.S.T.U.V.W.X.Y.Z.
17   . .,.%._.>.?.0.1.2.3.
18   .4.5.6.7.8.9.:.#.@.'.
19   .=.". .A.B.C.D.E.F.G.
20   .H.I. ...<.(.+.|.&.J.
21   .K.L.M.N.O.P.Q.R. .$.
22   .*.).;.¬.-./.S.T.U.V.
23   .W.X.Y.Z. .,.%._.>.?.
24   .0.1.2.3.4.5.6.7.8.9.
25   .:.#.@.'.=.".
```

Decimal Code D'xxy' for Characters on the PN train

FIGURE 7

```
•y   0 1 2 3 4 5 6 7 8 9 A B C D E F
x

0    . . . . . . . . . . . . . . . .
1    . . . . . . . . . . . . . . . .
2    . . . . . . . . . . . . . . . .
3    . . . . . . . . . . . . . . . .
4    . . . . . . . . . . .¢...<.(.+.|.
5    .&. . . . . . . . . .!.$.*.).;.¬.
6    .-./. . . . . . . . . .,.%._.>.?.
7    . . . . . . . . . . .:.#.@.'.=.".
8    . .a.b.c.d.e.f.g.h.i. .{.≤.(.+.+.
9    . .j.k.l.m.n.o.p.q.r. .}.□.).±.ª.
A    .-.º.s.t.u.v.w.x.y.z. .˪.ᴦ.[ .≥.ᴼ.
B    .0.1.2.3.4.5.6.7.8.9. .˩.˥.].≠.—.
C    . .A.B.C.D.E.F.G.H.I. . . . . . .
D    . .J.K.L.M.N.O.P.Q.R. . . . . . .
E    . . .S.T.U.V.W.X.Y.Z. . . . . . .
F    .0.1.2.3.4.5.6.7.8.9. . . . . . .
```

Hex Code X'xy' for Characters on the TN train

```
••y   0 1 2 3 4 5 6 7 8 9
xx

00    . . . . . . . . . . . .
01    . . . . . . . . . . . .
02    . . . . . . . . . . . .
03    . . . . . . . . . . . .
04    . . . . . . . . . . . .
05    . . . . . . . . . . . .
06    . . . . . . . . . . . .
07    . . . . .¢...<.(.+.|.
08    .&. . . . . . . . . .
09    .!.$.*.).;.¬.-./. . .
10    . . . . . . . . .,.%._.
11    .>.?. . . . . . . . .
12    . . .:.#.@.'.=.". .a.
13    .b.c.d.e.f.g.h.i. .{.
14    .≤.(.+.+. .j.k.l.m.n.
15    .o.p.q.r. .}.□.).±.�.
16    .-.º.s.t.u.v.w.x.y.z.
17    . .˪.ᴦ.[ .≥.ᴼ.0.1.2.3.
18    .4.5.6.7.8.9. .˩.˥.].
19    .≠.—. .A.B.C.D.E.F.G.
20    .H.I. . . . . . .J.
21    .K.L.M.N.O.P.Q.R. . .
22    . . . . . . .S.T.U.V.
23    .W.X.Y.Z. . . . . . .
24    .0.1.2.3.4.5.6.7.8.9.
25    . . . . . . . .
```

Decimal Code D'xxy' for Characters on the TN train

FIGURE 8

HT X'05' = D'005' Horizontal Tab
 LC X'06' = D'006' Lower Case
 RES X'14' = D'020' Print Restore
 NL X'15' = D'021' New Line
 BS X'16' = D'022' Back Space
 IL X'17' = D'023' Idle
 BYP X'24' = D'036' Print Bypass
 LF X'25' = D'037' Line Feed
 UC X'36' = D'054' Upper Case

Hex Code X'xy' and Decimal Code D'xxy' for 2741 Control Codes

Here were figures of:

Hex Code X'xy' for Characters on the PN train

and

Decimal Code D'xxy' for characters on the PN train

and

Hex Code X'xy' for Characters on th TN train

and

Decimal Code D'xxy' for Characters on the TN train

(These figures are available in .PDF and .PS format)

    [This RFC was put into machine readable form for entry]
[into the online RFC archives by Helene Morin, Via Genie,12/1999]