VT520/VT525 Video Terminal

Programmer Information

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Preface

Introduction

This manual provides detailed information for advanced users, consultants, and programmers. This manual has the following parts, chapters, and appendices:

- *Part I, VT520 Video Terminal*
  - *Chapter 1, Overview*
  - *Chapter 2, Set-Up*
  - *Chapter 3, Desktop Features*
- *Part II, VT520 ANSI Mode*
  - *Chapter 4, ANSI Control Functions Summary*
  - *Chapter 5, ANSI Control Functions*
  - *Chapter 6, SCO Console Emulation*
  - *Chapter 7, Character Sets*
  - *Chapter 8, Keyboard Processing*
  - *Chapter 9, Communications*
  - *Chapter 10, Printer Port*
- *Part III, VT520 ASCII Emulation*
  - *Chapter 11, ASCII Emulations and Control Functions*
  - *Chapter 12, ASCII Escape Sequences*
  - *Chapter 13, Defining and Loading ASCII Character Fonts*
- *Appendix A, VT Keyboard Legend Data*
- *Appendix B, Enhanced PC Keyboards*
- *Appendix C, ASCII Keycodes and Local Functions*
- *Appendix D, VT520 Termcap Data*
- *Appendix E, ANSI Control Function Index*

Conventions

The following conventions are used in this manual:

Set-Up features	*Terminal Set-Up menu selections appear in* boldface *type.*
Alt/Ctrl/Print Screen	*Multiple keys are separated by a slash (/) and should be pressed in combination. That is, all three keys* Alt, Ctrl, *and* Print Screen *are pressed down at the same time.*
Characters in control functions	*Control function characters are in* boldface *type. Below each character is a column/row number that indicates the character's position in a standard code table. For example:*
	ESC # 6 = *Control function*
	1/11 2/3 3/6 = Column/row numbers
Parameters	*Parameters appear in italic type.*
Note	*Provides general information.*

How to Use This Manual

The VT520 Video Terminal Programmer Information is written for four audiences: an advanced user, who needs to know more about the terminal Set-Up features; a programmer, who develops application programs; a software product support person, who provides assistance to application programmers and users; and a hardware systems engineer, who need more information on terminal connections.

Advanced User

If you have read the VT520 Video Terminal Installation and Operating Information manual and need more information on the the terminal Set-Up features, you may wish to refer to the following:

- Index
- Chapter 1 Overview—*Provides a brief summary of the product.*
- Chapter 2 Set-Up—*Describes each entry in the Set-Up menus in the order that is displayed in the terminal.*
- Chapter 3 Desktop Features—*Provides a more in-depth description of the desktop features of the terminal.*
- Chapter 6 Keyboard Processing—*Describes the differences in the types of keyboard layouts supported, local functions, and accessibility aids.*

Programmer

If you are using ANSI control functions for your program, then you may wish to start with Part II of the manual:

- Chapter 4 ANSI Control Function Summary— *Provides a tutorial section on Control Functions and information on designing and down-line loading a Soft Character set (soft font). In this chapter, the Control Functions are grouped according to the task to be performed. The information on each Control Function is very brief. If you need more information, the mnemonic at the end of the line item refers to a command section in Chapter 5.*
- Chapter 5 ANSI Control Functions—*Provides in-depth information on each control function listed in alphabetic order according to the mnemonic.*
- Chapter 2 Set-Up—*Lists the Set-Up factory defaults at the end of this chapter, with their host control code mnemonic.*

- Chapter 6 Keyboard Processing—*Describes the keyboard layouts, keyboard-to-host interface, keypad sequences, local functions, LEDs controls, languages, accents, scan codes, and control codes.*
- Chapter 9 Communications—*Describes the serial communications from the terminal to the host ports and the hardware and software handshaking.*
- Chapter 10 Printer Port—*Describes the parallel printer port and the switching sequences for the modes supported.*
- Appendix A VT Keyboard Legend Data
- Appendix B Enhanced PC Keyboard Legend Data
- Appendix D VT500 Termcap Data

If you are developing a application program for a SCO Console, then you may wish to refer to:

- Chapter 6 SCO Console Emulation—*Describes the SCO Console mode, including the Control Functions relative to the SCO Console applications.*

If you are using ASCII control functions for your program, then you may wish to start with Part III of the manual:

- Chapter 11 ASCII Emulations and Control Functions— *Provides an overview of the ASCII emulation, the coding notation, and the symbols used in the ASCII sequence tables.*
- Chapter 12 ASCII Escape Sequences—*Summarizes the ASCII escape and control sequences for the various ASCII emulation modes, according to the task to be performed.*
- Chapter 13 De ning and Loading ASCII Character Fonts – *Provides specific information on loading font banks and designing an ASCII character font.*
- Appendix C ASCII Keycodes and Local Functions

Software Product Support

If you are helping a user or programmer with an application, then you may wish to refer to the following:

- Appendix E ANSI Control Function Index—*Lists the control functions by their final character, which makes them easier to find in a program. The mnemonic at the end of the line item refers to a command in Chapter 5, listed in alphabetic order.*
- Index—*Lists control functions by mnemonic or by name and lists other subjects by topic.*
- Chapter 5 ANSI Control Functions—*Provides in-depth information on specific control functions.*
- Chapter 6 Keyboard Processing—*Lists the scan codes Make and Break sequences.*
- Appendix D VT500 Termcap Data—*Provides the Termcap information for ANSI emulations.*

Hardware Systems Engineer

If you are helping a user to install the terminal or to operate within a specific environment, then you may wish to refer to the following:

- Index—*Search by topic.*
- Chapter 1 Overview *Provides a brief summary of the product.*
- Chapter 2 Set-Up *Describes each entry in the order that is displayed in the terminal, starting with the* Actions *menu and lists the modes supported. Also lists the Set-Up factory defaults.*
- Chapter 9 Communications—*Describes the serial communications from the terminal to the host ports, pin numbers and signals, and the hardware and software handshaking.*
- Chapter 10 Printer Port—*Describes the parallel printer port, pin numbers and signals, and modes supported.*

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4.7.6 Editing Control Functions

EDITING	Control Function VT520	VT420	VT100	Mnemonic
Delete Character *Pn* *Number of characters to delete (default = 1).*	*CSI Pn P*	*same*	*same*	*DCH*
Delete Column *Pn* *Number of columns to delete (default = 1).*	*CSI Pn ' ~*	*same*	*n/a*	*DECDC*
Delete Line *Pn* *Number of lines to delete (default = 1).*	*CSI Pn M*	*same*	*same*	*DL*
Erase Character *Pn* *Number of characters to erase (Pn = 0 or 1 (default) = 1 character).*	*CSI Pn X*	*same*	*n/a*	*ECH*
Erase in Display *Ps* *Erase from . . .*	*CSI Ps J*	*same*	*same*	*ED*

User-Defined Keys	Control Function VT520	VT420	VT100	Mnemonic
User Defined Keys	*DCS Ps1; Ps2; Ps3 | D...D ST*	*same*	*n/a*	*DECUDK*[3]

Ps1	*Clear . . .*
none,0	*All UDKs before loading new values*
1	*Old UDKs only when redefined; load new UDK values.*
Ps2	*Lock . . .*
none,0	*UDKs against future redefinition*
1	*Don't lock the UDKs against future redefinition.*
Ps3	*Define . . .*
none, 0	*Shifted function key*
1	*Unshifted function key*
2	*Shifted function key*
3	*Alt unshifted function key*
4	*Alt shifted function key*
D...D	*Key1/St1/Dir;Key2/St2/Dir;.....Keyn/Stn/Dir;*
Stn	*Sequence user-defined key (UDK)*

Keyn	*VT Keyboard*	*PC Keyboard*
11	*F1*	*F1*
12	*F2*	*F2*
13	*F3*	*F3*

4.7.10 Printer Control Functions

Printer Port Function		Control Function VT520	VT420	VT100	Mnemonic
DSR - Printer Port Report			*same*	*same*	*DSR-Print*
	Request:	*CSI ? 15 n*			
	Response:	*CSI ? Ps n*			
Ps	*Printer . . .*				
10	*Ready*				
11	*Not ready*				
13	*Off line*				
18	*Busy*				
19	*On another session.*				
Media Copy - Send Screen Data through Host Port		*CSI 2 i*	*n/a*	*n/a*	-
Media Copy - Start/Stop Printer-to-Host Session					*MC*
	ANSI:	*CSI Pa i*	*same*	*same*	
	DEC:	*CSI ? Pd is¤¤¤*			

Control Function

Terminal Modes	Control Function VT520	VT420	VT100	Mnemonic
Enter/Exit VT PCTerm Mode or				

Key #	Legend (U.S.)	Scan Code Make/Break[1]
35	G	*22/A2*
36	H	*23/A3*
37	J	*24/A4*
38	K	*25/A5*
39	L	*26/A6*
40	;	*27/A7*
41	'	*28/A8*
42		*2B/AB‡*
43	Return	*1C/9C*
44	*Left* Shift	*2A/AA*
45		*56/D6‡*
46	`	

Key #	Legend (U.S.)	Scan Code Make/Break

8.17 Scan Codes Sent in PCTerm Mode for VT Keyboards

All keystrokes send scan codes except:

Key	Which sends . . .
Caps Lock F1	*Hold*
Caps Lock F2	*Print*
Caps Lock F3	*Enter Set-Up*
Caps Lock F5	*Send Break*

All keys including Shift, Alt, and Ctrl send make codes immediately upon being pressed, except the Caps Lock key. The make code for the Caps Lock key is sent after the Caps Lock key is released. The following keys send the corresponding scan codes, regardless of any modifiers that may be in effect.

Key #	Legend (U.S.)	Scan Code Make/Break
42	\	*2B/AB*
107	- [1]	*7E/FE*
124	F13	*E0 3D/E0 BD*
125	F14	

8.18 Control Codes and Keystrokes

The following codes are transmitted when the Ctrl *key is depressed simultaneously with another key.*

Table 8–12 Control Codes and Keystrokes

Legend	HEX Code Transmitted	Name
Ctrl Space		

9.2.3.9 Speed Select–SPDS

The SPDS signal is supported on the 25-pin D-sub but not on the Corporate Modular Connector.

- *If the user needs to restrict the controls to 7 bits, but still needs 8-bit graphic characters and new function keys, then the user can select* Transmit 7-bit controls *with an 8-bit host line. To get full efficiency out of new applications, select 8-bit controls and an 8-bit host line. The* 7-bit NRCS Characters *selection is compatible with 7-bit NRC-based applications.*
- *C1 controls are never available directly from the default keyboard, although they may be available indirectly through the function keys or numeric compose.*
- *When the terminal is in printer controller mode and the 7-bit character mode, upon receiving 8-bit graphic characters, the terminal immediately retransmits them through the printer port to the printer. The highest bit is not stripped off.*
- *In printer controller mode when the terminal is receiving 8-bit characters and immediately retransmitting them on a 7-bit line, the high bit is stripped off.*
- *When the screen contains 8-bit (GR) characters and is being printed on a 7-bit printer, the characters are subject to constraints, which are described in Chapter 10.*
- *Keyboard operation guidelines are described in Chapter 8.*

9.3.2 Flow Control

Flow control is a means to alternately suspend and resume the flow of characters over serial asynchronous point-to-point communication lines.

Depending on the type of flow control selected, the stop/resume transmission signal is different. Users can select a software flow control scheme, a hardware flow control scheme, or a combination software and hardware flow control scheme to meet their communication environment.

9.3.2.1 Receive Buffer

The VT520 operates at a transmission speed of up to 115.2K baud. To prevent loss of data, the receive buffer is 1024 byte. The substitute (SUB) character is substituted in the input buffer for any character with detected receive parity errors or framing errors. If the input buffer overflows, a SUB character is placed in the buffer in place of the lost characters. The SUB character is displayed as a reverse question mark.

9.3.2.2 Flow Control Selection

The VT520 supports bidirectional flow control. The flow control scheme can be selected independently for the transmit and receive direction. The user has the following choices for transmit data flow control:

- *No Flow Control*
- *XON/XOFF*
- *DTR*
- *Both*

The user has the following choices for receive flow control:

- *No Flow Control*
- *XON/XOFF in VT mode or XPC in PC term mode*
- *DSR*

- *Both*

You can select flow control methods from Set-Up or through the escape sequences, DECSFC.

9.3.2.2.1 No Flow Control *If* No Flow Control *is selected, then when the receive buffer is full, it does not send any signal; therefore, the* Hold

The VT520 re-initializes the XON/XOFF(XPC) state under the following conditions:

1. *The Clear Comm function is performed.*
2. *The completion of the NVR recall after the RECALL function is performed.*
3. *The completion of all tests in a self-test sequence is performed.*
4. *Successful completion of a connection - generally, DSR assertion.*
5. *The reception of RIS.*

9.3.2.2.3 DSR/DTR Flow Control

When Hardware ow control *is selected, DTR is asserted any time the terminal is not in self-test and the terminal's input buffer is below the flow control threshold; DTR is de-asserted when the input buffer is filled up to or beyond the threshold.*

If the terminal is a sending device, then it polls DSR before transmitting each character. If DSR is not being asserted by the receiving device, then transmission of the character is suspended until DSR is asserted.

As in the XON/XOFF software flow control, VT520 deasserts DTR when:

1. *The number of characters in the input buffer is greater than or equal to the flow control threshold (first XOFF point).*

Table 9–3 Flow Control Threshold Points

1st Flow Control Threshold	Resume Transmission Point	2nd Flow Control Threshold
64	*32*	*896*
768	*128*	*896*

9.3.2.3 Show Control Character Mode

While in show control character mode, all characters are temporarily stored in

9.4.1 Clear Communications

If the terminal appears to be "locked" in Set-Up, then select Clear communications *to clear the current session. This action:*

1. *Aborts any print operation in progress if the printer is allocated to the active session.*
2. *Aborts any escape sequence, control sequence, or device control string (DCS) processing.*
3. *Clears the keyboard buffer.*
4. *Clears the receive buffer.*
5. *Clears the transmit buffer.*

Table 11–3 Commands that Can Move the Cursor to Protected Area

Move Cursor . . .	Sequence
Up; scroll (reverse linefeed)	*ESC j*
Down; no scroll	*Ctrl/V*
To specific line	*ESC [line*
To a specific column	*ESC_column*
In current page	*ESC = line col*
To a specific page	*ESC h page*
In specific 80-column page	*ESC w @ page line col*
In specific 80-column window	*ESC -*

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13

Defining and Loading ASCII Character Fonts

This chapter defines the ASCII character fonts and describes how to load the fonts.

13.1 Character Sets

In WYSE mode and ADDS Enhanced mode, desired characters can be acquired by loading them from various built-in character sets or by designing them using a pixel pattern.*

13.1.1 PCTerm on US Keyboard

The default and only character set supported for PCTerm on the US Keyboard is the PC International character set. This is a 256-character set, of which the first 128 characters form the PC Standard character set.*

13.1.2 WYSE and ADDS Enhanced Personalities

Defining and Loading ASCII Character Fonts

Note

Changing a character set in a font bank may change the active character set if the active character set and primary/secondary character set happen to point to the same font bank.

13.2 Loading, Defining, and Selecting Character Sets

Table 13–2 shows how to load, define, and select the character sets. The word "same" in Table 13–2 signifies the same control sequences as in the WYSE 160/60 column.

Table 13–2 Loading Font Bank

	WYSE	TVI	ADDS
Load Font Bank[1]			

13.3 Designing a Character Font

Table 13–3 shows how to design a character font.

Table 13–3 Design a Character Font

Define and	WYSE				TVI			ADDS
Load a Character	**160/60**	**PCTerm**	**150/120**	**50/50+**	**950**	**925**	**910+**	**A2**
Design a character font	*ESC c A Bank Pp bb..bb Ctrl/Y*							
		n/a	*same*	*same*	*n/a*	*n/a*	*n/a*	*EnH*

The sequence in Table 13–3 defines the bb..bb string and loads it in the Pp position of the Bank font bank.

Bank is the font bank that holds a defined character set. Refer to Table 13–2.

Pp is a 2-byte Hex code in the range of 00 to 7F specifying a position in that font bank.

bb...bb is a Hex code string defining the bit pattern of the defined character. The string contains one of the following:

- *16 2-byte Hex codes for a 10 × 16 cell size character*

Load the the following character into position 31 (Hex) in Font Bank 3.

MSB LSB

Figure B–20 Russian Enhanced PC Keyboard

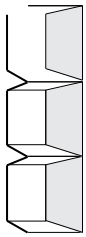

Figure B–21 SCS Enhanced PC Keyboard

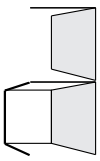

Figure B–22 Slovak Enhanced PC Keyboard

Figure B–23 Spanish Enhanced PC Keyboard

Figure B–26 Swiss-German Enhanced PC Keyboard

```
 :is=\E[1;24r\E[24;1H:\
 :r3=\E[?67h\E[64;1"p:\
 :i3=\E[?67h\E[64;1"p:\
 :k0=\E[29~:\
        :k1=\EOP:k2=\EOQ:k3=\EOR:k4=\EOS:\
        :k5=\E[17~:k6=\E[18~:k7=\E[19~:k8=\E[20~:k9=\E[21~:\
        :kb=\b:kd=\E[B:ke=\E>:kl=\E[D:\
 :kr=\E[C:ks=\E=:ku=\E[A:nd=\E[C:\
 :rc=\E8:rf=/usr/lib/tabset/vt100:\
        :se=\E[m:so=\E[7m:\
 :sr=\EM:ue=\E[m:up=\E[A:us=\E[4m:nl=\E[B:ko=do,nd,up:
#
d6|vt520|DEC VT520 :\
 :tc=vt420:
df|vt520nam|vt520-nam|v520n|DEC VT520 with no automargins:\
 :am@:tc=vt520:
```

D.1.2 Terminfo Data:

```
vt420|DEC VT420 ,
        am, mir, xenl, xon,
        cols#80, lines#24, vt#3,
        bel=^G, blink=\E[5m$<2>,
        acsc=‘‘aaffggjjkkllmmnnooppqqrrssttuuvvwwxxyyzz{{||}}~~,
        bold=\E[1m$<2>, clear=\E[;H\E[2J$<50>, cr=\r,
        csr=\E[%i%p1%d;%p2%dr, cub1=\b, cud1=\E[B, cuf1=\E[C,
        cup=\E[%i%p1%d;%p2%dH$<10>, cuu1=\E[A, dch1=\E[P,
        dl1=\E[M, ed=\E[J$<50>, el=\E[K$<3>, home=\E[H, ht=\t,
        if=/usr/lib/tabset/vt100, il1=\E[L, ind=\ED,
        is2=\E[1;24r\E[24;1H, is3=\E[?67h\E[64;1"p,
        kbs=^H, kcub1=\E[D, kcud1=\E[B, kcuf1=\E[C, kcuu1=\E[A,
        kf0=\E[29~, kf1=\EOP, kf2=\EOQ, kf3=\EOR, kf4=\EOS, kf5=\E[17~,
        kf6=\E[18~, kf7=\E[19~, kf8=\E[20~, kf9=\E[21~, kf10=\E[29~,
        rc=\E8, rev=\E[7m$<2>, rf=/usr/lib/tabset/vt100, ri=\EM,
        rmacs=\E(B$<4>, rmir=\E[4l, rmso=\E[m, rmul=\E[m,
        rs3=\E[?67h\E[64;1"p,
        rmsc=\E[?0;0r\E>\E[?3l\E[?4l\E[?5l\E[?7h\E[?8h,
        kfnd=\E[1~, kich1=\E[2~, kdch1=\E[3~,
        knp=\E[6~, kpp=\E[5~, kslt=\E[4~,
        sgr=\E[0%?%p6%t;1%;%?%p2%t;4%;%?%p4%t;5%;%?%p1%p3%|%t;7%;m%?%p9%t
            \E(0%e\E(B%;,
        sgr0=\E[m$<2>, smacs=\E(0$<2>, smir=\E[4h, smso=\E[7m,
        smul=\E[4m,
#
vt420nam|vt420-nam|v420n|DEC VT420 in vt100 emul. mode with NO AUTO WRAP mode,
 am@, use=vt420,
#
vt420pc|DEC VT420 w/PC keyboard,
 pctrm=USR_TERM:vt420pcdos:,
 kdch1=^?, khome=\E[H, kend=\E[4~,
 kf1=\E[11~,  kf2=\E[12~, kf3=\E[13~, kf4=\E[14~, kf5=\E[15~,
        kf6=\E[17~,  kf7=\E[18~, kf8=\E[19~, kf9=\E[20~, kf10=\E[21~,
        kf11=\E[23~, kf12=\E[24~,
#
 kf13=\E[11;2~, kf14=\E[12;2~, kf15=\E[13;2~, kf16=\E[14;2~,
 kf17=\E[15;2~, kf18=\E[17;2~, kf19=\E[18;2~, kf20=\E[19;2~,
 kf21=\E[20;2~, kf22=\E[21;2~, kf23=\E[23;2~, kf24=\E[24;2~,
#
 kf25=\E[23~,   kf26=\E[24~,   kf27=\E[25~,   kf28=\E[26~,
 kf29=\E[28~,   kf30=\E[29~,   kf31=\E[31~,   kf32=\E[32~,
        kf33=\E[33~,   kf34=\E[34~,   kf35=\E[35~,   kf36=\E[36~,
#
 kf37=\E[23;2~, kf38=\E[24;2~, kf39=\E[25;2~, kf40=\E[26;2~,
 kf41=\E[28;2~, kf42=\E[29;2~, kf43=\E[31;2~, kf44=\E[32;2~,
 kf45=\E[33;2~, kf46=\E[34;2~, kf47=\E[35;2~, kf48=\E[36;2~,
#
```

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DECSPPCS (select ProPrinter character set), 5–143
DECSPRTT (select printer type), 5–144
DECSR (secure reset), 5–144
DECSRC (secure reset confirmation), 5–146
DECSSCLS (set scroll speed), 5–146
DECSSDT (select status display (line) type), 5–147
DECSSL (select set-up language), 5–148
DECST8C (set tab at every 8 columns), 5–149
DECSTBM (set top and bottom margins), 5–149
DECSTGLT (Select color look-up table), 5–151
DECSTR (soft terminal reset), 5–150
DECSTRL (set transmit rate limit), 5–152
DECSTUI (set terminal unit ID), 5–153
DECSWBV (set warning bell volume), 5–154
DECSWL (single-width, single-height line), 5–154
DECSWT (Set window title), 5–156
DECSZS (select zero symbol), 5–155
DECTABSR (tab stop report), 5–157
DECTCEM (text cursor enable mode), 5–157
DECTID (select terminal ID), 5–158
DECTME (terminal mode emulation), 5–159
DECTSR (terminal state report), 5–160
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LS3 (maps G3 into GL), 5–187
LS3R (maps G3 into GR), 5–187
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