VT50 VIDEO TERMINAL PROGRAMMER'S MANUAL

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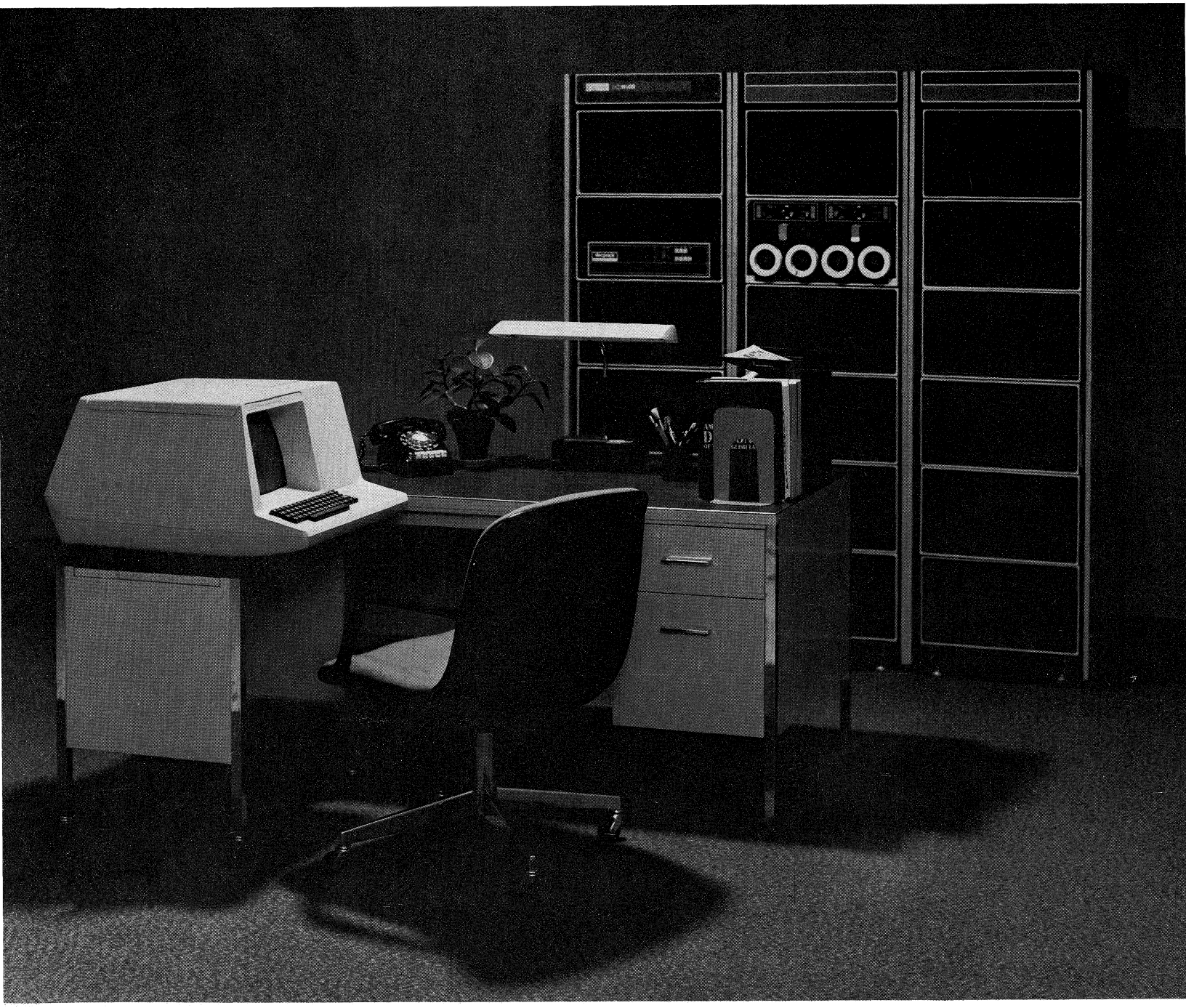

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VT50 VIDEO TERMINAL

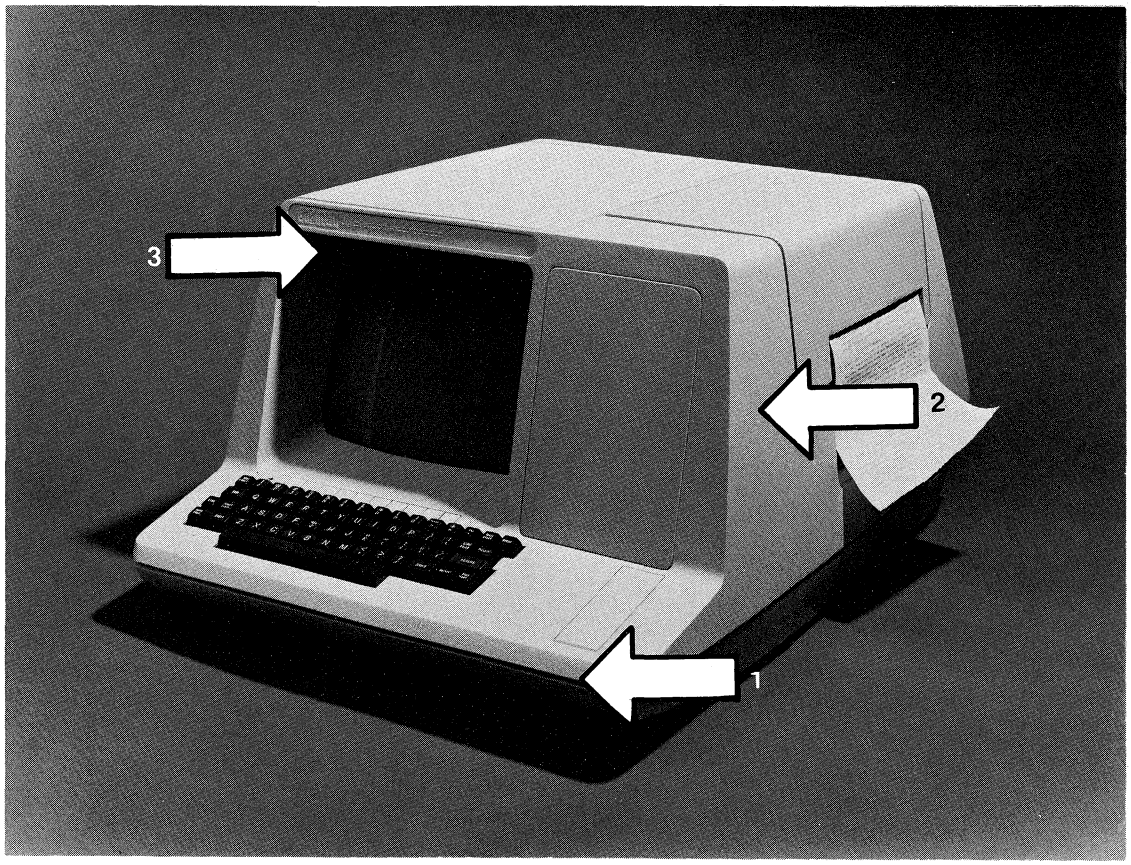
This document is a comprehensive guide to programming the VT50 Video Terminal. The first segment gives the novice user step-by-step instructions on fundamental operation. If you are already familiar with the operation of video display terminals, skim through this first segment and start at section two. The second section describes the various ways of using the VT50 for transmitting data to and receiving data from other computer devices.

Other VT50 documentation includes an Operator's Manual which is geared to the individual with no prior computer experience, and an optional System Manual which fully describes VT50 to the logic level. The System Manual can be ordered through your local DIGITAL representative.

CONTENTS

Operating the VT50
Powering-up 4
Input and the Cursor 6
Displaying More Lines 6
Changing Text on the Screen 6

Inside the VT50
Transmitting Characters and Commands 8
Receiving Characters and Commands 8
The Cursor and Memory 8
Character Processing 9
Commands and Escape Sequences 10
Interfacing with a Computer 17
Communication Rates 18
Controlling Transmission Speeds 19
Parity Checks 19
The BREAK Key 19
The Copier 20
Operating the Copier from the Keyboard 20
Transmission Rates and the Copier 20
Adjusting the Copier 21
VT50 Specifications 22



1. Set the Local/Remote Switch
This rotary switch determines whether the terminal operates:

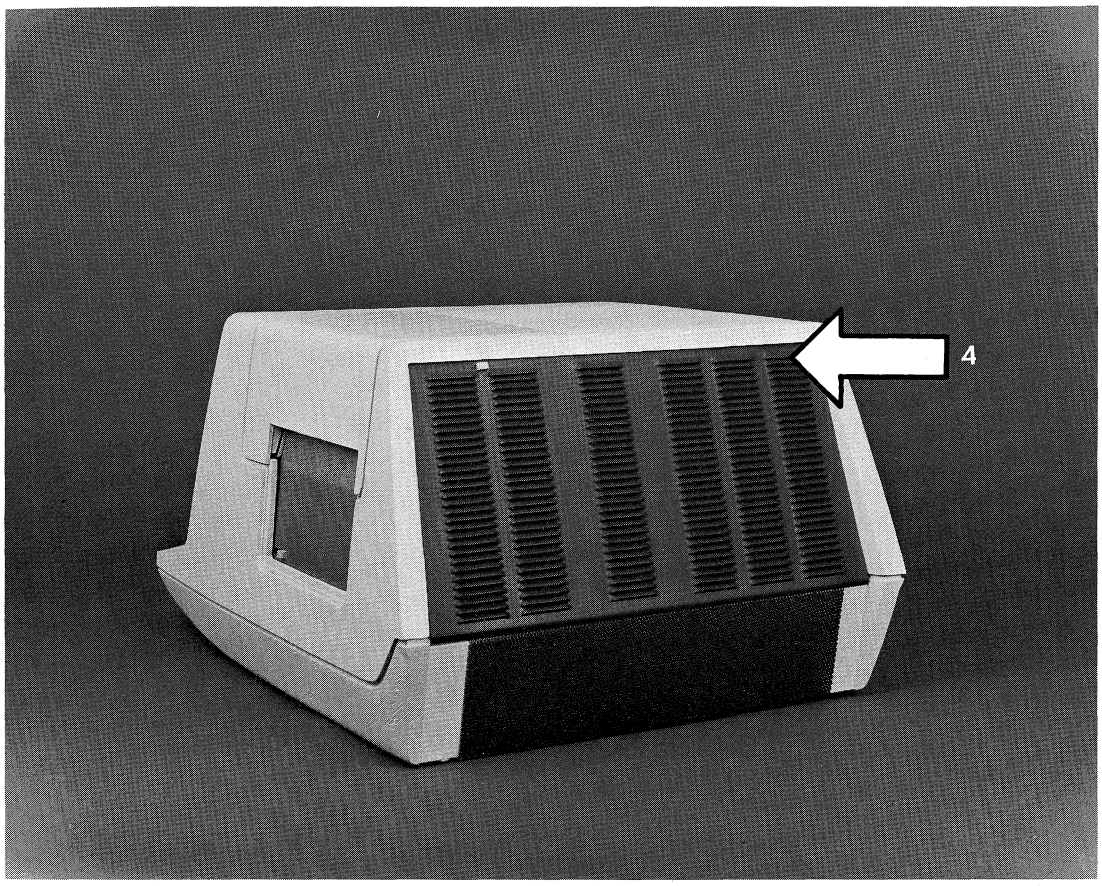
- As an independent stand-alone device (Local Mode), or
- As an on-line peripheral device, transmitting data to and receiving data from a remotely-located computer (Remote Mode).

In Local Mode, data is transmitted directly from keyboard to the screen's receiver, and no data is transmitted to a host computer.

With the exception of data transmission, a demonstration of terminal functions is identical under Remote and Local Mode. Hence, the terminal should be set in Local Mode while reviewing this document.

2. Set the Power Switch
To apply power to all components of the terminal, set the On/Off Switch to On.

3. Wait for the Blinking Cursor
After approximately one minute, the blinking cursor should appear at its home position—the upper left corner of the screen.



4. Adjusting the Intensity Control
If the blinking cursor fails to appear after one minute, the intensity control may be set too low. Similar to the brightness control on a standard television set, the intensity control should be adjusted to achieve maximum image clarity on the screen.

Input and the Cursor

The blinking cursor underlines the position where the next character displayed on the screen will appear. After a character (or space) is displayed, the cursor moves one character position to the right. Using the keyboard, transmit several displayable characters and observe this cursor movement.

Slowly type additional characters to form a longer line; when the 73rd character is displayed, a buzzer sounds. This buzzer serves the same function as a typewriter bell by alerting the operator to the right margin. The maximum line length (left to right margin) is 80 characters.

Displaying More Lines

When the cursor reaches the extreme right margin, it is locked in position until moved by a cursor control command. To move the cursor to the extreme left margin of the next line, depress the RETURN key (moves the cursor to the left margin of the current line) and the LF key (moves the cursor down one line). Because these cursor control keys act independently, they can be typed in any sequence.

If the cursor is not moved from the right margin, each new character received at the screen will replace the character currently displayed above the cursor. Type another full line. With the cursor at the extreme right margin, continue typing displayable characters to observe the character replacement.

Move the cursor to the next line and continue typing variable length lines until 12 lines are displayed. When the cursor is below line number 12, a LF (Line Feed) key will create space for a new line by moving all displayed lines up one line position. Creating space for new lines in this manner is called scrolling. Note that scrolling causes the top line to be lost as it moves off the screen. Type additional lines and watch the screen as each new Line Feed moves existing lines up.

Changing Text on the Screen

Any displayable character received at the terminal's screen is shown directly above the blinking cursor. All procedures for changing displayed text are founded upon this one invariable terminal characteristic. Hence, the ability to make a correction at any specified screen location is based upon the terminal's ability to receive and translate commands which move the cursor. Once the cursor is positioned under the desired location, a new displayable character received at the terminal will replace the existing character or fill a vacant space.

Commands that direct the terminal to move the cursor are called cursor control commands. While practicing the following cursor control commands, you should maintain the Local/Remote switch setting at Local—that is, what you type at the keyboard is transmitted directly to the screen's receiver. The Local setting permits you to move the cursor via cursor control commands in two different ways: 1) by typing labeled keys, and 2) by typing the ESC key and then typing a letter. These controls include:

Typing the key labeled:	Cursor Action
BACKSPACE	Transmits the 7-bit ASCII code (010) that, when received by the terminal, moves the cursor left one position.
RETURN	Transmits the 7-bit ASCII code (015) that, when received by the terminal, moves the cursor to the left margin of the current line.
LF (Line Feed)	Transmits the 7-bit ASCII code (012) that, when received by the terminal, moves the cursor down one line.
TAB	Transmits the 7-bit ASCII code (011) that, when received by the terminal, moves the cursor to the next TAB stop. TAB stops are set every eight spaces to the 72nd character position. After the 72nd character position, TAB moves the cursor one position to the right.

Typing the ESC* key and then typing the letter:	Cursor Action
A	Transmits the Escape Sequence (033, 101) that, when received by the terminal, moves the cursor up one line.
C	Transmits the Escape Sequence (033, 103) that, when received by the terminal, moves the cursor right one position.
H	Transmits the Escape Sequence (033, 110) that, when received by the terminal, moves the cursor to the upper left corner of the screen (Home position).
J	Transmits the Escape Sequence (033, 112) that, when received by the terminal, erases the screen from the cursor position to the bottom of the screen.
K	Transmits the Escape Sequence (033, 113) that, when received by the terminal, erases the current line from the cursor position to the right margin.

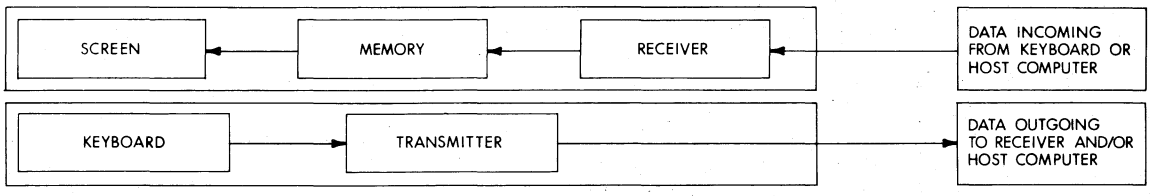
* Commands formed by ESC code (033) followed by a symbol code are called "Escape Sequences."

The previous discussion on cursor control from the keyboard is presented only to demonstrate terminal capabilities. In most applications, the VT50 terminal will be set for Remote operations and the cursor control commands will come from a host computer, as opposed to coming directly from the operator.

The operator invokes the cursor control commands by transmitting from the keyboard (to the computer) the editing commands that are recognized by the host's system software. It is the responsibility of the system software to translate commands coming from the operator into the proper cursor control commands recognized by the terminal. System software for host computers generally includes editing routines that expect to receive their own unique editing commands from the operator. In such systems, Escape Sequences received from the keyboard might not be recognized and therefore, could cause a completely different action than desired.

INSIDE THE VT50

A simple way of viewing the VT50 is as though it consists of two separate devices housed in one cabinet.



This view is supported by the fact that only two cables are attached to the back of the terminal. Data entered at the keyboard is sent on one cable, and data coming in is received through the other cable.

Transmitting Characters and Commands

The only way an operator can transmit data to a host computer is by typing keys on the keyboard. The 7-bit ASCII equivalent of the key's label is transmitted the instant a key is depressed.

Receiving Characters and Commands

Data received at the terminal is routed to an internal memory. Here it is determined whether that data input is a displayable character or a command. Displayable characters are stored and appear on the screen; commands are performed immediately.

An understanding of internal memory use—as a sorting point for input going to the screen, input going to the copier, or commands—is useful in understanding how to use the VT50 as an input/output device.

The internal memory is organized into two sections:

- A main section used by the screen—80 characters wide by 12 lines deep.
- A secondary section used for internal housekeeping—16 characters wide by 4 lines deep.

The dimensions of the main memory section and the display capacity of the screen are identical. Correspondingly, a direct positional relationship exists between each character location in memory and each character position on the screen. For example, if the number "5" is the first character displayed on the first line of the screen, the first character in the first line of the main memory contains the 7-bit ASCII code equivalent to the digit 5. Only 7-bit ASCII codes for displayable characters can be written into the main section of memory.

In the secondary portion of memory, one housekeeping function is the monitoring of all inputs. If the input is a displayable character, it goes to main memory; if it is a command, the specified action is performed.

The Cursor and Memory

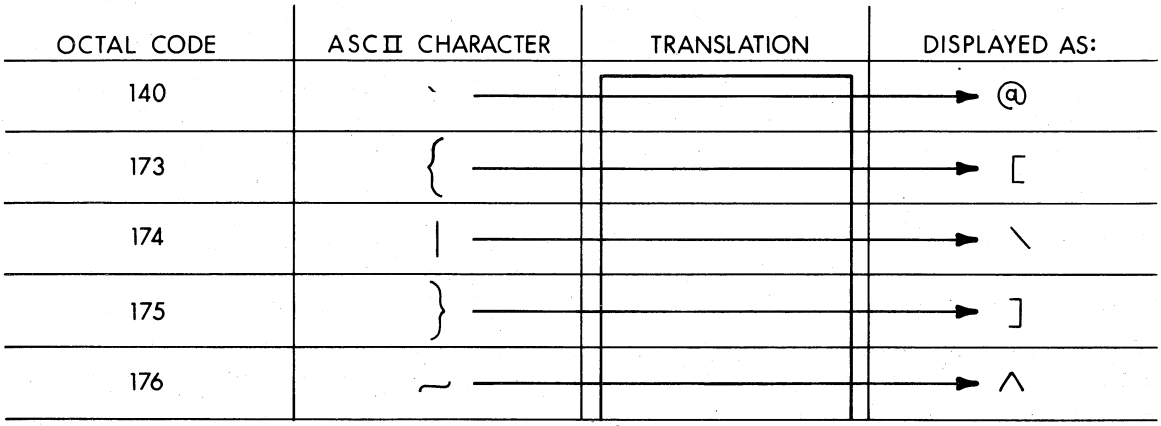
The screen position of the cursor is directly related to the character position addressed in memory. For example, if the cursor is under the first position of the first line on the screen, the next displayable character received is stored in the first character location in the top line of memory.

After a character is stored, the memory's addressing pointer is automatically incremented so the next displayable character is stored in the second position of the first line in memory. This incrementing is shown on the screen when the cursor moves right one character position. Cursor control commands are directives to the memory address pointer to store the next displayable character in a specified location of main memory.

Character Processing

As each ASCII character is received at the terminal, it is monitored to determine whether it is a displayable letter, number, or symbol (octal 040 through 176), or a control code (octal 000 through 037). Displayable characters are stored in memory to be scanned and displayed on the screen. ASCII code for both upper and lower case letters can be stored, but lower case letters are converted to upper case before they are displayed.

The algorithm for translating lower case input to upper case display is "if bit number 7 is 1, then force bit number 6 to 0." For example, a lower case "b" is received and stored in the terminal's memory as 1 100 010 (octal 142). Between the memory and the screen, octal 142 is converted to octal 102 (1 000 010)—the ASCII code for an upper case "B". This conversion algorithm means special care must be taken if octal codes 140, 173, 174, 175, or 176 are transmitted to the VT50, because these codes generate the @, [, /,], and – symbols, respectively.



If the terminal receives octal 177, it is treated as a no-op (or filler) character. This feature makes the VT50 compatible with certain application software written to interface with slower mechanical devices. For example, it takes a mechanically designed terminal much longer to effect a TAB operation than the internal clocking of a host computer. In order to preclude the condition of data backing up until mechanical functions are completed, some software programs use filler characters to take up the slack time.

An octal 177 is transmitted if you type the DEL key. If you want the key to direct a previously typed character to be deleted on the screen, the host system software must translate the incoming 177 into a sequence such as "BACKSPACE, SPACE, BACKSPACE," which is echoed to the terminal. This operation is often used with existing software.

Commands and Escape Sequences

In 7-bit ASCII, codes 000 through 037 are defined as control codes (commands). The following six control codes are recognized by the VT50:

Octal Code	Action Taken
007	Rings the buzzer.
010	Backspaces the cursor.
011	(Horizontal Tab) Moves the cursor to the next TAB stop. TAB stops are set every eight spaces to the 72nd character position. After the 72nd position, TAB moves the cursor one position to the right.
012	(Line Feed) Moves the cursor down one line.
015	Carriage return.
033	Puts the terminal in Escape Mode if the terminal is currently in normal mode. If the terminal is in Escape mode, receipt of 033 puts it back in normal mode.

A command protocol is built around the Escape code (033) to implement those commands needed by the VT50 but not found in 7-bit ASCII. Upon receiving the Escape code 033, the terminal is set to Escape mode and treats the next character received as a command. Commands created in this manner are called Escape Sequences. The VT50 recognizes the following Escape Sequences:

ESC (033) Followed By:

Octal Code	Char	Action Taken
033	ESC	Sets the terminal in normal mode if the terminal is in normal mode before the first 033 is received. Sets the terminal in Escape mode if the terminal is in Escape mode before the first 033 is received. The first 033 changes the mode, the second 033 changes it back.
101	A	Moves cursor up one line.
103	C	Moves cursor right one position.
110	H	Moves cursor to the Home position.
112	J	Erases from cursor position to end of screen.
113	K	Erases line from cursor to right margin.
132	Z	Requests the terminal to identify itself. The terminal will respond with: • ESC / A (033 057 101) if it is a VT50 with no copier. • ESC / B (033 057 102) if it is a VT50 with copier.
133	[	Enables Hold Screen Mode.
134	\	Disables Hold Screen Mode.
135	]	All lines from top of screen up to and including cursor line copied.
136	^	Enables Auto Print Mode—top line copied first.
137	—	Disables Auto Print—after lines currently being copied are finished.

The following table will be useful when writing programs that interface with the VT50. It details the processing of each 7-bit ASCII character received at the terminal.

When the VT50 is in...

...Normal Mode the next ASCII character received is treated as data.

...Escape Mode the next ASCII character received is treated as a command.

Octal Code	Char	Action Taken	Resulting Mode	Action Taken	Resulting Mode
000	NUL	None	Normal	None	Escape
001	SOH	None	Normal	None	Escape
002	STX	None	Normal	None	Escape
003	ETX	None	Normal	None	Escape
004	EOT	None	Normal	None	Escape
005	ENQ	None	Normal	None	Escape
006	ACK	None	Normal	None	Escape
007	BELL	Rings Bell.	Normal	Rings Bell.	Escape
010	BS	Backspaces Cursor.	Normal	Backspaces Cursor.	Escape
011	HT	Horizontal Tab Moves cursor to the next tab stop. Tab stops are set every eight spaces to the 72nd character position. After the 72nd position, TAB moves the cursor to the right one position.	Normal	Horizontal Tab Moves cursor to the next tab stop. Tab stops are set every eight spaces to the 72nd character position. After the 72nd position, TAB moves the cursor to the right one position.	Escape
012	LF	Moves Cursor down one line and scrolls if required.	Normal	Moves Cursor down one line and scrolls if required.	Escape
013	VT	None	Normal	None	Escape
014	FF	None	Normal	None	Escape
015	CR	Moves Cursor to left margin of current line.	Normal	Moves Cursor to left margin of current line.	Escape
016	SO	None	Normal	None	Escape
017	SI	None	Normal	None	Escape
020	DLE	None	Normal	None	Escape
021	DC1	None	Normal	None	Escape
022	DC2	None	Normal	None	Escape
023	DC3	None	Normal	None	Escape
024	DC4	None	Normal	None	Escape
025	NAK	None	Normal	None	Escape
026	SYN	None	Normal	None	Escape
027	ETB	None	Normal	None	Escape
030	CAN	None	Normal	None	Escape
031	EM	None	Normal	None	Escape
032	SUB	None	Normal	None	Escape

When the VT50 is in...

...Normal Mode the next ASCII character received is treated as data.

...Escape Mode the next ASCII character received is treated as a command.

Octal Code	Char	Action Taken	Resulting Mode	Action Taken	Resulting Mode
033	ESC	Sets terminal in Escape Mode.	Escape	Sets terminal in Normal Mode.	Normal
034	FS	None	Normal	None	Escape
035	GS	None	Normal	None	Escape
036	RS	None	Normal	None	Escape
037	US	None	Normal	None	Escape
040	Space	Displayed	Normal	None	Normal
041	!	Displayed	Normal	None	Normal
042	"	Displayed	Normal	None	Normal
043	#	Displayed	Normal	None	Normal
044	$	Displayed	Normal	None	Normal
045	%	Displayed	Normal	None	Normal
046	&	Displayed	Normal	None	Normal
047	'	Displayed	Normal	None	Normal
050	(	Displayed	Normal	None	Normal
051	)	Displayed	Normal	None	Normal
052	*	Displayed	Normal	None	Normal
053	+	Displayed	Normal	None	Normal
054	,	Displayed	Normal	None	Normal
055	−	Displayed	Normal	None	Normal
056	.	Displayed	Normal	None	Normal
057	/	Displayed	Normal	None	Normal
060	0	Displayed	Normal	None	Normal
061	1	Displayed	Normal	None	Normal
062	2	Displayed	Normal	None	Normal
063	3	Displayed	Normal	None	Normal
064	4	Displayed	Normal	None	Normal
065	5	Displayed	Normal	None	Normal
066	6	Displayed	Normal	None	Normal
067	7	Displayed	Normal	None	Normal
070	8	Displayed	Normal	None	Normal
071	9	Displayed	Normal	None	Normal
072	:	Displayed	Normal	None	Normal
073	;	Displayed	Normal	None	Normal
074	<	Displayed	Normal	None	Normal
075	=	Displayed	Normal	None	Normal
076	>	Displayed	Normal	None	Normal
077	?	Displayed	Normal	None	Normal
100	@	Displayed	Normal	None	Normal
101	A	Displayed	Normal	Moves Cursor up one line.	Normal
102	B	Displayed	Normal	None	Normal

When the VT50 is in...

...Normal Mode the next ASCII character received is treated as data.

...Escape Mode the next ASCII character received is treated as a command.

Octal Code	Char	Action Taken	Resulting Mode	Action Taken	Resulting Mode
110	H	Displayed	Normal	Moves Cursor to home position.	Normal
111	I	Displayed	Normal	None	Normal
112	J	Displayed	Normal	Erases line from Cursor to bottom of screen.	Normal
113	K	Displayed	Normal	Erases screen from Cursor to right margin.	Normal
114	L	Displayed	Normal	None	Normal
115	M	Displayed	Normal	None	Normal
116	N	Displayed	Normal	None	Normal
117	O	Displayed	Normal	None	Normal
120	P	Displayed	Normal	None	Normal
121	Q	Displayed	Normal	None	Normal
122	R	Displayed	Normal	None	Normal
123	S	Displayed	Normal	None	Normal
124	T	Displayed	Normal	None	Normal
125	U	Displayed	Normal	None	Normal
126	V	Displayed	Normal	None	Normal
127	W	Displayed	Normal	None	Normal
130	X	Displayed	Normal	None	Normal
131	Y	Displayed	Normal	None	Normal
132	Z	Displayed	Normal	None	Normal
133	⊏	Displayed	Normal	Enables Hold Screen Mode. (See page 19 .)	Normal
134	\	Displayed	Normal	Disables Hold Screen Mode. (See page 19 .)	Normal
135	⊐	Displayed	Normal	All lines from top of the screen up to and including cursor line are printed.	Normal
136	^	Displayed	Normal	Enables Auto Print with top line printed first.	Normal

When the VT50 is in...

...Normal Mode the next ASCII character received is treated as data.

...Escape Mode the next ASCII character received is treated as a command.

Octal Code	Char	Action Taken	Resulting Mode	Action Taken	Resulting Mode
137	—	Displayed	Normal	Disables Auto Print after current lines are copied.	Normal
140	\	Displayed as @	Normal	None	Normal
141	a	Displayed as A	Normal	None	Normal
142	b	Displayed as B	Normal	None	Normal
143	c	Displayed as C	Normal	None	Normal
144	d	Displayed as D	Normal	None	Normal
145	e	Displayed as E	Normal	None	Normal
146	f	Displayed as F	Normal	None	Normal
147	g	Displayed as G	Normal	None	Normal
150	h	Displayed as H	Normal	None	Normal
151	i	Displayed as I	Normal	None	Normal
152	j	Displayed as J	Normal	None	Normal
153	k	Displayed as K	Normal	None	Normal
154	l	Displayed as L	Normal	None	Normal
155	m	Displayed as M	Normal	None	Normal
156	n	Displayed as N	Normal	None	Normal
157	o	Displayed as O	Normal	None	Normal
160	p	Displayed as P	Normal	None	Normal
161	q	Displayed as Q	Normal	None	Normal
162	r	Displayed as R	Normal	None	Normal
163	s	Displayed as S	Normal	None	Normal
164	t	Displayed as T	Normal	None	Normal
165	u	Displayed as U	Normal	None	Normal
166	v	Displayed as V	Normal	None	Normal
167	w	Displayed as W	Normal	None	Normal
170	x	Displayed as X	Normal	None	Normal
171	y	Displayed as Y	Normal	None	Normal
172	z	Displayed as Z	Normal	None	Normal
173	{	Displayed as □	Normal	None	Normal
174	|	Displayed as /	Normal	None	Normal
175	}	Displayed as □	Normal	None	Normal
176	~	Displayed as >	Normal	None	Normal
177	Delete	None	Normal	None	Escape

The following tables describe the 7-bit ASCII codes transmitted by typing keys on the terminal's keyboard.

Typing the key labeled	Transmits the following 7-bit ASCII code	Typing the key labeled	Transmits the following 7-bit ASCII code
A	101	T	124
B	102	U	125
C	103	V	126
D	104	W	127
E	105	X	130
F	106	Y	131
G	107	Z	132
H	110	BACK SPACE	010
I	111	TAB	011
J	112	LF	012
K	113	RETURN	015
L	114	ESC	033
M	115	SPACE BAR	040
N	116	\	134
O	117	DELETE	177
P	120	BREAK	Does not transmit an ASCII code. Acts as a forceable interrupt (see page 19).
Q	121		
R	122		
S	123		

The keys listed above are uneffected by the SHIFT key. For example, typing both the "A" key and holding down the SHIFT key and typing "A" transmit ASCII 101.

The following keys are effected by the "SHIFT" key.

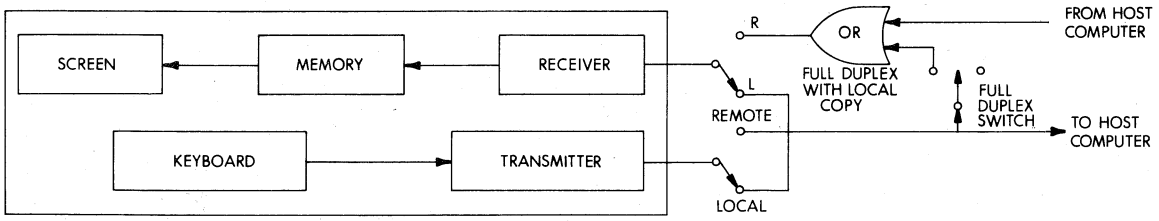
Typing the key labeled	Unshifted transmits the 7-bit ASCII code	With the SHIFT key held down transmits the 7-bit ASCII code
1	061	041 (!)
2	062	100 (@)
3	063	043 (#)
4	064	044 ($)
5	065	045 (%)
6	066	136 (^)
7	067	046 (&)
8	070	052 (*)
9	071	050 (( )
0	060	051 ( ))
-	055	137 (_)
=	075	053 (+)
[	133	135 (])
;	073	072 (:)
'	047	042 (")
,	054	074 (<)
.	056	076 (>)
/	057	077 (?)

Holding down the CTRL key affects the ASCII signal transmitted by the next key typed. It forces bits 7 and 6 to 0. For example, holding down the CTRL key and typing the letter G (107) forces 107 to be converted to 007 (BEL). The one exception is holding down the CTRL key and typing the BREAK key. This reinitializes the terminal (see page 19).

The following keys do not transmit any signal outside of the terminal. They are used to direct internal terminal activities.

Typing the key labeled...	Unshifted directs the terminal to...	With the SHIFT key held down, directs the terminal to...
CONT	Display (scroll) one new line when the terminal is in Hold-Screen Mode (see page 19).	Display (scroll) 12 new lines when the terminal is in Hold-Screen Mode (see page 19).
PRINT	Produce a hard copy image of the entire screen.	Compliments Auto-Print Mode (see page 20).

Interfacing with a Computer



The Local/Remote switch determines whether the terminal operates as an isolated device or transmits data to and receives data from a host computer. In Local Mode, the terminal is off-line; the transmitter and receiver are disconnected from the external output and input cables. Any data entered at the keyboard is sent directly through the transmitter and to the receiver for processing. Local Mode is useful in training, maintenance, and off-line use of the copier. For normal operation, Remote (on-line) Mode is used—all data entered at the keyboard is transmitted to the host computer.

The Full Duplex/Full Duplex with Local Copy switch specifies the source of data received in Remote Mode. When this switch is set to Full Duplex with Local Copy, data entered at the keyboard is transmitted to the terminal's receiver at the same time it is sent to the host computer. When the switch is set to Full Duplex, data transmitted from the keyboard goes to the computer only. This data may be transmitted from the computer back to the terminal to give the operator a visual image of the information transmitted. The echoing appears to be immediate, since the timing circuits for the terminal's transmitter and receiver are independent.

Because it permits an interactive relationship between the VT50 and the host computer, Full Duplex is the most versatile of the two settings. For example, in Full Duplex you can create your own Escape Sequences; the host computer can be programmed so that the receipt of ESC 1 (033 061) from the terminal implements one routine, ESC 2 another, and so on.

The VT50 keyboard incorporates a special provision for self-explanatory function switches. Its architecture is designed to permit the space above the top row of keys to act as a labeling area for special user-defined Escape sequences. Ten keys are available for this special coding; the labeling can be changed easily to accommodate changing functions and applications.

In addition to the static labeling capability, software will permit the screen's use as a dynamic labeling medium. Here, ribbing lines are molded into the VT50's chassis to simplify use of programmer-defined Escape Sequences and the related function names are displayed on the bottom line of the screen. The ribbing directs the operator's eyes to the proper top row key needed in each Escape Sequence. Note that if the bottom line on the screen is used for Escape Sequence function definition, subsequent scrolls will move this line up the screen. Hence, it is advisable to have system software erase the displayed label names after the operator has chosen a function.

Communication Rates

Two rotary switches on the VT50 allow you to select communication rates from 75 to 9600 baud, and the related operational modes.

Mode	Baud Rate Transmit	Receive	Switch S1*	Switch S2**
Local	9600	9600	1	G
	4800	4800	1	F
	2400	2400	1	E
	1200	1200	1	D
	600	600	1	C
	110	110	1	B
Full Duplex with Local Copy	9600	9600	2	G
	4800	4800	2	F
	2400	2400	2	E
	1200	1200	2	D
	600	600	2	C
	110	110	2	B
Full Duplex	9600	9600	3	G
	4800	4800	3	F
	2400	2400	3	E
	1200	1200	3	D
	600	600	3	C
	300	300	4	A
	150	150	5	A
	110	110	3	B
	75	75	6	A
Full Duplex (Split Speeds)	300	9600	4	G
	150	9600	5	G
	75	9600	6	G
	300	4800	4	F
	150	4800	5	F
	75	4800	6	F
	300	2400	4	E
	150	2400	5	E
	75	2400	6	E
	300	1200	4	D
	150	1200	5	D
	75	1200	6	D
	300	600	4	C
	150	600	5	C
	75	600	6	C

***Switch S1 Labels**
1 = Local
2 = ½
3 = Full Duplex
4 = 300 Baud
5 = 150 Baud
6 = 75 Baud

****Switch S2 Labels**
A = Bell 103
B = 110 Baud
C = 600 Baud
D = 1200 Baud
E = 2400 Baud
F = 4800 Baud
G = 9600 Baud

Controlling Transmission Speeds

For the purpose of writing software to interact with the VT50 terminal, the term "baud" means number of bits per second. It requires 10 bits to transmit or receive each character (one start bit, seven data bits, one parity bit, and one stop bit). Thus, at 9600 baud, the terminal can receive 960 characters per second—enough to fill the entire VT50 screen.

Normally, text is displayed on the screen as fast as it is received at the terminal. For example, if the host computer transmits 24 lines of data with 80 characters per line at 9600 baud, the first 12 lines are displayed on the screen for only one second before being replaced by the second 12 lines. To hold the first 12 lines for a visual inspection, the terminal can be placed in Hold Screen Mode (Escape Sequence 033 133). When in Hold Screen Mode, the terminal will scroll lines off the top of the screen only after being so directed by the operator. Each time the CONT key is typed, an additional scroll is permitted, and by typing SHIFT and CONT, 12 scrolls are allowed, filling the entire screen with new data.

If the terminal receives more data than it has been directed to display, it will transmit XOFF (023) and start buffering characters in a "silo" portion of terminal memory which accommodates 13 characters. And when the operator again permits scrolling by typing either CONT or the SHIFT/CONT sequence, the terminal will process the characters in the silo. As the last character in the silo is processed, the terminal sends XON (021), indicating that the computer can resume transmission.

The essential purpose of the silo is to permit a delay between the time XOFF is sent to the computer, and when the computer stops transmission. If more than 13 characters are received, the silo will overflow and the terminal will process its characters on a first-in, first-out basis. Thus, even if the computer ignores the XOFF, no characters will be lost. However, for ease of operation, Hold Screen Mode should be used only when the XON/XOFF feature is implemented in system software.

Parity Checks

The VT50 is designed to operate using even parity. Each ASCII character received or transmitted is in the form of a 10-bit data word (one start bit, seven character bits, one parity bit, and one stop bit). If the total number of bits set to one in each data word is an even number, the data word is judged to be correct under the even parity protocol. All ASCII characters are transmitted from the VT50 using the even parity protocol. While the terminal expects to receive 10-bit data words, parity is not checked on incoming ASCII codes.

The BREAK Key

The BREAK function is commonly used to forceably interrupt the flow of data coming to the VT50 terminal. It is provided for users with older software written to operate in Half Duplex. In Half Duplex, only one line exists between terminal and host computer. If the host computer has control of this line, BREAK is the only means of forcing an interrupt. However, because the VT50 has both an input and output line, the forceable BREAK is normally unnecessary.

Holding down the CTRL key and typing the BREAK key reinitializes the terminal—the screen is cleared and the cursor set to its Home position. This procedure is equivalent to switching power off and then repowering the terminal. Typing CTRL BREAK sends no signal to the host.

The Copier

An optional feature, the VT50 copier provides capability for hard copy output. It permits line-for-line images of the text appearing on the screen. Individual characters are printed by using the same 5 x 7 dot matrix used to display characters on the screen; a character width adjustment control is provided.

Operating the Copier from the Keyboard

The VT50 copier can operate in two different modes: 1) depressing the key labeled AUTO PRINT causes all lines on the screen to be copied. In order to copy changed or added information in this mode, the AUTO PRINT key must be again depressed to put the terminal back into standard mode; the screen can then be changed and Auto-Print Mode re-invoked. 2) depressing the SHIFT key and then the AUTO PRINT key puts the terminal in Auto-Print Mode. In this Mode, all lines up to but not including the line containing the cursor are copied. As subsequent Line Feeds (LF key) are performed, new lines are printed. For example, if the cursor is under the fourth line when the terminal is set to Auto-Print, only the first three lines are copied. If a Line Feed then moves the cursor to the fifth line, line number four will be copied. If the terminal is in Auto-Print Mode, again typing the SHIFT/AUTO PRINT sequence reverts it to normal non-automatic copying operation. Auto-Print Mode is disabled after the line currently being duplicated by the copier is completed.

AUTO PRINT and SHIFT/AUTO PRINT operation is in the form of a simple ON/OFF switch. Issuing either command for the first time sets the terminal to copying mode. Typing the key a second time reverts terminal operation to normal non-printing mode.

The AUTO PRINT key directs a local terminal function only; typing either AUTO PRINT or the SHIFT/AUTO PRINT sequence does not transmit a message. These copier commands are invoked by the host computer by transmitting Escape Sequence 033 135 (non-automatic copying as in the first above example); 033 136 (automatic copying as in the second above example); and 033 137 (for disabling Auto Print Mode).

Transmission Rates and the Copier

The VT50 copier prints at a maximum rate of one line per second, whereas the terminal screen can display up to 12 lines of text per second. Hence, displayed characters to be printed must be protected from any command or displayable character that would alter the screen before the copier has time to make an exact image. Any character(s) received at the terminal that would violate this condition is buffered, and an XOFF (023) is transmitted. When the current printing cycle is completed, an XON (021) is automatically transmitted to the host, and data transmission can continue. XON is transmitted only if XOFF was previously transmitted.

Adjusting the Copier

Copier Problems	Solution
Paper low—blue line shows.	Replace paper. (Lift cover, insert roll-feed from the bottom, draw the paper across both the helix and the drive rollers.) Close cover.
Paper Jammed	Lift cover, feed paper out across the helix and the drive rollers. Close cover.
No Print	Be certain that the paper has not dried, that the anode has been replaced properly, and that the anode contact is fully seated. Advance paper by keyboard or manually.
Motor doesn't work when PRINT key is depressed.	Check if cover is seated completely to interlock.
Character height is too great or small.	Be sure the paper feed is proper and the paper is not low or jammed.
Character width is too great or small.	Adjust character width lever to the desired position.
Last portion of character is missing and characters run together.	Adjust character width lever to achieve a more narrow character.
Characters faint.	Is the recommended paper being used? Be certain the anode is seated properly on the paper.
Characters blurred.	Check anode for roughness and paper feed for steadiness.

VT50 Specifications

Dimensions	Height: 360mm (14.1 in.) Width: 530mm (20.9 in.) Depth: 690mm (27.2 in.)
Weight	19.4 KG (43 Lbs.)
Environmental	Temperature: 10°C to 43°C (50°F to 110°F) Humidity: 20% to 80%
Input Voltage	100 to 126 Volts (European versions available)
Display	Format: 12 lines x 80 characters Character Matrix: 5 x 7 Character Size: 2.7mm x 5.0mm (.11 in. x .20 in.) Screen Size: 220mm x 110mm (8.7 in. x 4.3 in.)
Keyboard	Character Set: 64 standard ASCII upper case, alpha, numeric, and punctuation characters; typewriter format keyboard
Copier (optional)	Speed: 50 lines/minute Operation: Helix concept Modes: Copying screen-by-screen or continuously Paper: Electrolytic Space Required: Self-contained within the standard VT50 cabinet
Terminal Modes	Local Mode Remote Mode: Full Duplex or Full Duplex with Local Copy
Page Overflow	Upward scroll
Parity	Even or mark (no parity) selectable
Cursor	Control: Up or down one line, right or left one character, home. Type: Non-destructive, underscore
Communications	20mA current loop standard; EIA interface optional
Transmission Code	USASCII Extended through Escape sequences
Operator Controlls	Power On/Off, Intensity Control, Baud Rate Switch, Full Duplex or Full Duplex with Local Copy
Overload Protection	Thermal switch in line transformer
Transmission Rates	Switch selectable Full Duplex: 75, 110, 150, 300, 600, 1200, 2400, 4800, and 9600 Baud Full Duplex with Local Copy: 110, 600, 1200, 2400, 4800, and 9600 Baud

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