

TRS-80 VIDEOTEX SOFTWARE SPECIFICATIONS
(26-5000)

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TRS-80 VIDEOTEK SOFTWARE SPECIFICATIONS

1.000 FUNCTIONAL DESCRIPTION

1.100 MEMORY

User RAM is divided into 512 byte pages. In a 4K system the pages are numbered from 0 to 7. In a 16K system, the pages are numbered from 0 to 31. RAM addresses are mapped from 000 to 1FF (Hex), in the 4K unit; 000 to 3FF (Hex) in the 16K unit.

1.200 KEYBOARD

The keyboard is normally in the "SHIFT LOCK" mode. Any alpha key closure will generate uppercase 7 bit ASCII. Lowercase ASCII is generated by holding down the SHIFT key while pressing an alpha key. LOWERCASE ASCII can NOT be displayed by the Videotex hardware.

1.210 CONTROL CODES

Standard control codes are generated in conjunction with the DOWN ARROW key. If an alpha key is pressed while the DOWN ARROW key is held closed, a control code mapped to that alpha character is generated and transmitted. If the SHIFT key is held closed at the same time as the DOWN ARROW key, the control key function is ignored.

1.220 SPECIAL CODES

Certain keys generate control codes and other ASCII codes as a form of convenience and to activate special functions. These special codes and the key that generates them are listed below:

- SHIFT LEFT ARROW generates a RIGHT OPEN BRACKET
- SHIFT RIGHT ARROW generates a LEFT OPEN BRACKET
- BREAK key generates a CONTROL C (03 Hex)
- CLEAR key generates an ESC code (1B Hex).

1.230 KEYBOARD CODE LIST

The following is a list of all keycode generated by the Videotex terminal. Codes not listed are not supported.

HEX	DEC	FUNCTION	KEY CLOSURE	FOR	CODE
01	1	CONTROL	DOWN ARROW		A
02	2	CONTROL	DOWN ARROW		B
03	3	CONTROL	DOWN ARROW	C or	BREAK
04	4	CONTROL	DOWN ARROW		D
05	5	CONTROL	DOWN ARROW		E
06	6	CONTROL	DOWN ARROW		F
07	7	CONTROL	DOWN ARROW		G
08	8	CONTROL	DOWN ARROW		H
09	9	CONTROL	DOWN ARROW		I
0A	10	LINE FEED	DOWN ARROW		J
0B	11	CONTROL	DOWN ARROW		K
0C	12	CONTROL	DOWN ARROW		L
0D	13	CARRIAGE RET	DOWN ARROW		M
0E	14	CONTROL	DOWN ARROW		N
0F	15	CONTROL	DOWN ARROW		O
10	16	CONTROL	DOWN ARROW		P
11	17	CONTROL	DOWN ARROW		Q
12	18	CONTROL	DOWN ARROW		R
13	19	CONTROL	DOWN ARROW		S
14	20	CONTROL	DOWN ARROW		T
15	21	CONTROL	DOWN ARROW		U
16	22	CONTROL	DOWN ARROW		V
17	23	CONTROL	DOWN ARROW		W
18	24	CONTROL	DOWN ARROW		X
19	25	CONTROL	DOWN ARROW		Y
1A	26	CONTROL	DOWN ARROW		Z
1B	27	ESCAPE	CLEAR		
20	32	SPACE	SPACE BAR		
21	33	!	SHIFT 1		
22	34	"	SHIFT 2		
23	35	#	SHIFT 3		
24	36	\$	SHIFT 4		
25	37	%	SHIFT 5		
26	38	&	SHIFT 6		
27	39	'	SHIFT 7		
28	40	(SHIFT 8		
29	41)	SHIFT 9		
2A	42	*	SHIFT :		
2B	43	+	SHIFT ;		
2C	44	,	,		
2D	45	-	-		
2E	46	.	.		
2F	47	/	/		
30	48	0	0		
31	49	1	1		
32	50	2	2		
33	51	3	3		
34	52	4	4		
35	53	5	5		
36	54	6	6		
37	55	7	7		
38	56	8	8		
39	57	9	9		

3A	58	:	:
3B	59	;	;
3C	60	<	SHIFT ,
3D	61	=	SHIFT -
3E	62	>	SHIFT .
3F	63	?	SHIFT /
40	64	@	@
41	65	A	A
42	66	B	B
43	67	C	C
44	68	D	D
45	69	E	E
46	70	F	F
47	71	G	G
48	72	H	H
49	73	I	I
4A	74	J	J
4B	75	K	K
4C	76	L	L
4D	77	M	M
4E	78	N	N
4F	79	O	O
50	80	P	P
51	81	Q	Q
52	82	R	R
53	83	S	S
54	84	T	T
55	85	U	U
56	86	V	V
57	87	W	W
58	88	X	X
59	89	Y	Y
5A	90	Z	Z
5B	91	LEFT BRACKET	SHIFT LEFT ARROW
5D	93	RIGHT BRACKET	SHIFT RIGHT ARROW
5E	94	UP ARROW	UP ARROW
5F	95	BACK SPACE	LEFT ARROW
61	97	a	SHIFT A
62	98	b	SHIFT B
63	99	c	SHIFT C
64	100	d	SHIFT D
65	101	e	SHIFT E
66	102	f	SHIFT F
67	103	g	SHIFT G
68	104	h	SHIFT H
69	105	i	SHIFT I
6A	106	j	SHIFT J
6B	107	k	SHIFT K
6C	108	l	SHIFT L
6D	109	m	SHIFT M
6E	110	n	SHIFT N
6F	111	o	SHIFT O
70	112	p	SHIFT P
71	113	q	SHIFT Q
72	114	r	SHIFT R
73	115	s	SHIFT S
74	116	t	SHIFT T
75	117	u	SHIFT U
76	118	v	SHIFT V
77	119	w	SHIFT W
78	120	x	SHIFT X
79	121	y	SHIFT Y
7A	122	z	SHIFT Z

1.300 DISPLAY

The information Videotex receives is meant to be displayed on a standard color or black and white television. The Display hardware DOES NOT generate lowercase symbols for the screen. Upon POWER ON or RESET, the screen will have a GREEN background and will print alpha-numerics in black (on a color set).

1.310 DISPLAY FORMATS

Videotex uses two formats to display information on the television. Upon POWER ON or RESET, the screen is set to the ALPHA/SEMI-GRAPHICS 4 format. In this format, there are 16 lines, each line having 32 characters, for a total of 512 characters on a screen or page. The graphics mode in this format divides each character into 4 pixels, giving a screen that is 64 pixels wide and 32 pixels down. The second format is MEDIUM GRAPHICS. This causes the display to be formatted into 96 lines of 128 pixels each, for a total of 1536 bytes per screen. Medium graphics takes up 3 pages of Videotex memory.

1.320 POWER ON DISPLAYED PAGES

When power is applied to Videotex, page 5 will be displayed with the message "VIDEOTEX X.Y" along with a blue graphics symbol which is used as a cursor. If the BREAK key is pressed, page 0 will be displayed with the message "PLACE CALL" along with the cursor positioned on the first line, left justified.

1.330 CLEAN TEXT SCROLLING

Videotex will not allow single words to be broken and printed on two separate lines. If it is printing words on a line, and a word would be broken if it continued to print that word, Videotex will remove that word from the line it was printing on and display it on the next line. If it was printing on the last line of the page, it will scroll (move all text) up one line to make room on the page for the next line.

1.400 OPERATION

1.410 DUMB TERMINAL

Videotex POWERS ON or RESETS in this mode. Page 5 is selected at POWER ON or RESET and the screen reads "VIDEOTEX X.Y", where X.Y is the ROM revision identifier. The pressing of the BREAK key causes the unit to display page 0, with the prompt "PLACE CALL" being displayed. Contact with the HOST computer is achieved with a standard telephone. Once the operator hears the FSK tone in the hand set, ANY key can be pressed. The Videotex will go OFF-HOOK and the telephone is then placed ON-HOOK. The unit will indicate reception of the FSK signal by lighting the LED "DATA" lamp at the top of the case. The user

may now type data to the host computer. Data typed into the unit will not be displayed on the screen unless the HOST computer echos the characters back to the Videotex terminal. If the Videotx is communicating with a HALF DUPLEX HOST, only characters received by Videotex will be displayed on the screen.

1.420 ACCESSING THE DATA BUFFER

The data buffer may be examined only when Videotex disconnects from the telephone line. At this time, the UP ARROW and DOWN ARROW keys become re-defined. The DOWN ARROW key will access pages from page 1 to higher page numbers (goes forward in time). The UP ARROW key will cause data screens to be displayed backwards in time. If the buffer did not receive enough characters to wrap around on itself, the DOWN ARROW key will display the OLDEST information in the buffer, and the UP ARROW key will display the NEWEST information received. Either key will allow viewing of ALL screens -- including page 0, once the keys cause the display to wrap around from page 7 or 31. The UP ARROW, the DOWN ARROW, and the CLEAR keys are the only keys active in this mode. If the CLEAR key is pressed, Videotex will clear page 6, and position the cursor at the HOME location. At this point, the only way to display the pages not yet cleared is to go ON-LINE, then go OFF-LINE. If the BREAK key is pressed, page 0 will be cleared, and the "PLACE CALL" prompt will be displayed.

1.430 OFF-LINE INPUT

Videotex can store data in its RAM while it is in the OFF-LINE mode. Upon POWER ON or RESET, if any key is pressed other than the BREAK key, page 6 is cleared and that key is stored. Typing on the keyboard saves information on page 6 until it is filled. At such time, page 7 will be cleared and data will be stored there. This sequence of clearing and storing data to pages continues until the buffer wraps around to page 1 (page 0 is the display screen in this mode). This mode is used to pre-load Videotex with information and data request to minimize ON-LINE time. It is up to the HOST computer to read the pages stored in Videotex before the data buffer overwrites to these pages. The CARRIAGE RETURN key will automatically generate a line feed in this mode.

2.000 COMMUNICATIONS

Videotex uses a built-in direct connect FSK audio modem. It operates at 300 BAUD, using 1 start bit, 8 data bits, and 1 stop bit. It is Bell 103 compatible. The bits are transmitted and received in the following order:

<ST><L><1><2><3><4><5><6><M><SP>

where ST is the start bit, L is the LEAST SIGNIFICANT BIT, M is the MOST SIGNIFICANT BIT, and SP is the STOP BIT.

2.100 TYPE

Vidtotex operates in FULL DUPLEX only. While ON-LINE with a host computer, Videotex will NOT display characters typed into it unless the HOST computer echos the transmitted character back to Videotex. When certain control codes are output by Videotex, it is up to the HOST computer to echo displayable codes as an indication to the terminal user that a control code was received.

3.000 CODES

3.100 DISPLAY CONTROL CODES

The following display codes are recognized by the Videotex terminal:

HEX	FUNCTION
08	Moves cursor left (left arrow key)
09	Horizontal tab - moves cursor 7 spaces to the right (right arrow key)
0A	Line feed - moves cursor to the next line (control J)
0C	Clears the screen (control L)
0D	Carriage return - moves cursor to the beginning of the line (ENTER key)
1B	Stops transmission of characters (CLEAR key)

3.200 ESCAPE SEQUENCES

3.210 INTERROGATE SEQUENCE

If Videotex receives the sequence 1B 49 it will respond with its terminal identifier code. Videotex will transmit "RS4<CR>" or the HEX codes 52 53 34 0D. Only Videotex hardware will respond using this code message.

3.220 VIDEOTEX CONTROL FROM HOST

The HOST computer can control the Videotex cursor and the data on the screen using the following code sequences:

HEX	SEQUENCE	FUNCTION
1B	41	Moves cursor up one line
1B	42	Moves cursor down one line
1B	43	Moves cursor right one space
1B	44	Moves cursor left one space
1B	48	Moves cursor to home position (upper left hand corner of screen)
1B	4A	Clear to end of page (from current cursor position)
1B	4B	Clear to end of line (from current cursor position)
1B	59	Position cursor to new loca- tion

The two characters following this sequence force the cursor to be positioned at a new location. The first character defines the line number where the cursor is to be placed, plus HEX 20. The second number defines the character position on that line, also plus HEX 20. Example: 1B 59 24 26 will position the cursor to the fourth line, sixth character position, regardless where the cursor was at the time the sequence was received.

1B 60 Change cursor symbol
The next character the HOST sends will define the new cursor symbol. Example: 1B 60 AF will change the blue cursor to a red cursor.

1B 6A \leftarrow Clear page of data (does NOT affect cursor position)

3.230 GRAPHICS CONTROL

The HOST computer can control which display format is in use at any one time. The following sequences are recognized by Videotex:

1B 47 34	Switch to semi-graphics mode
1B 47 4D	Switch to medium-graphics mode
1B 47 4E	Switch to alpha only mode

3.231 SEMI-GRAPHICS 4 MODE

In a POWER ON or RESET state, Videotex is in the ALPHA ONLY mode. Incoming data is modified to uppercase only and the MSB of all ASCII data is blanked to 0. If instructed to display semi-graphics, incoming data is not modified, but is displayed as it is received. In this mode, graphic characters are defined as follows:

B7	B6	B5	B4	B3	B2	B1	B0

1	COLOR CONTROL			SEGMENT CONTROL			

The pixels are arranged in each character position as follows:

B3	B2
B1	B0

The bit positions are lit when that bit is set.
Color control use of bits B6 to B4:

B6	B5	B4	COLOR
---	---	---	-----
0	0	0	green
0	0	1	yellow
0	1	0	blue
0	1	1	red
1	0	0	buff
1	0	1	cyan
1	1	0	magenta
1	1	1	orange

B7 is always set to define a graphics character in semi-graphics format. B7 reset indicates an alpha-numeric character.

3.232 MEDIUM DENSITY GRAPHICS MODE

Medium density graphics is sent to the Videotex terminal in a RUN LENGTH ENCODED format. In this format, character pairs are sent which define the number of reset pixels and the number of set pixels, each offset by a base number. The base number is HEX 20. Example: 25 26 will reset 5 pixels and set 6 pixels. The pair 20 29 will reset no pixels and set 9 pixels. If these two examples were sent together, there would be 5 reset pixels and 15 set pixels. 128 pixels can be controlled with any one character. In no case can any number in the character pair exceed HEX A0. The character pair 20 20 will cause the pixel pointer to terminate the line it was pointing at and start a new line. A reset pixel is black, while a set pixel is green. There are no color controls in this mode. The only code sequence Videotex will recognize while in this mode is the command to change back to the ALPHA ONLY mode.

3.300 CONTROL CODE SEQUENCES

3.310 TRANSMISSION PAUSE

If Videotex receives a CONTROL S (DC3) it will stop transmitting data that was being sent to the HOST computer. If a DC3 is transmitted by Videotex (pressing the DOWN ARROW key and the letter S), most HOST computers will stop transmitting text.

3.320 TRANSMISSION RESUME

If the Videotex receives a CONTROL Q (DC1) it will resume transmission of the text that was paused by a CONTROL S. If a DC1 is transmitted by Videotex (pressing the DOWN ARROW key and the letter Q) the HOST computer that was paused with a DC3 will resume transmitting data.

There are two protocols included in the Videotex terminal software. They are: CHARACTER PROTOCOL and BLOCK PROTOCOL.

4.100 CHARACTER PROTOCOL

4.110 DATA BUFFER

Videotex will buffer information as it transmits or receives. The data buffer starts on page 1. When it becomes full, page 2 is cleared, and data is stored there. When page 7 (or 31) is filled, the buffer clears and writes to page 1 again (page 0 is used as the display page). If B-PROTOCOL is activated, the buffer is disabled until POWER ON or RESET. Medium density graphics are not saved in this mode.

4.200 B-PROTOCOL

B-PROTOCOL is a means for the Videotex to exchange information with a HOST computer that is error free, and error checked. B-PROTOCOL uses a block format to pass its data.

4.210 BLOCK FORMAT

The format of the block in B-PROTOCOL is defined as follows:

<DLE><N><COMMAND><TEXT><ETX><CHECKSUM>

4.211 <DLE>

DLE indicates a B-PROTOCOL transmission. DLE is 10 HEX.

4.212

B indicates the start of the block. It is an ASCII B, 42 HEX.

4.213 <N>

N is the ASCII block number. It starts at 1, and increments up to 9 each time a block is transmitted. After block 9 is transmitted, it defaults to 0. The first block sent WILL ALWAYS be N=1 block.

4.214 <COMMAND>

The command field is an ASCII string defining the function of the block. The commands are listed below in 4.300.

4.215 <TEXT>

The text field is the data required by the command field. But certain commands will not have this field. If it is necessary to transmit control codes in the text field (codes that are less than 40 HEX are considered to be control codes), these codes shall be made transparent. All control codes are preceded with <DLE> (10 HEX) and the control code is added with 40 HEX to create an ASCII character. Example: if a control A is sent in the text field, it would be converted to the following: <DLE><A> which are the HEX codes, 10 41. The ONLY control code in the text field is the DLE code.

4.216 <ETX>

The ETX field is the end of block marker. Its ASCII code is 03 HEX.

4.217 <CHECKSUM>

The checksum is a value Videotex and the HOST computer use to error check the B-PROTOCOL block. At the start of B block transmission, the checksum is set to zero. For each character in the block, starting with the BLOCK NUMBER and ending with the ETX, the following algorithm is used to calculate the checksum:

The old checksum is rotated left one bit (bit 7 is rotated back around to bit 0).

The character is ADDED to the rotated checksum.

The carry, if generated, is added to the result. This result is now the new checksum.

The checksum does not include any transparent characters (DLE). The checksum itself is sent as a transparent character (if the checksum is less than 40 HEX, it will be converted using the transparent rule). All characters that have been sent under the transparent rule are converted to their real value before they are used to generate a new checksum.

4.218 BLOCK LENGTH

The maximum block length is 512 characters. It is counted from the initial to the <CHECKSUM>. Transparent characters are NOT counted. If the ETX is not detected within this length, the block is in error and should be ignored.

4.300 B-PROTOCOL COMMANDS

Videotex will respond to any of the following commands. If any other command is received, it will transmit the following B block:

<BLOCK#><F><n><ETX><CHECKSUM>

where F and n are ASCII codes. <n> defines the page number.

4.310 READ CONTENTS OF A PAGE

If the command: <R><P><n> is used, Videotex is instructed to read the page specified by n. This command is employed to read text saved in the STORE and FORWARD mode.

Videotex will respond with:

<BLOCK#><H><TEXT><ETX><CHECKSUM>

where <TEXT> is the data on the page requested.

If a page number is requested that is greater than the unit has RAM for, Videotex will respond with:

<DLE><BLOCK#><F><C><ETX><CHECKSUM>

where F and C are ASCII characters.

ROM REV. 1.0

In this version of Videotex software, the read page command will dump a <TEXT> field that contains all the information on the requested page.

ROM REV. 1.1

With this version of Videotex software, the read page command will dump a <TEXT> field that contains the information on the requested page, but only up to a byte that has BIT 7 set (graphics character or CURSOR). The remainder of the page is NOT read.

There are no other differences in the operation of the two versions of Videotex software.

4.320 STORE DATA TO A PAGE

If the command, <P><n> is used, Videotex is instructed to store the data in the <TEXT> field in the page specified by the command. P and n are ASCII codes, and <n> defines the page number. If <n> is larger than the maximum RAM the unit contains, it will respond with:

<BLOCK#><F><C><ETX><CHECKSUM>

4.330 DISPLAY A PAGE

If the command <D><n> is used, Videotex is instructed to display the page specified by <n>. The <TEXT> field of this block would be empty. Once this instruction is received, the Videotex hardware will display page <n>. If <n> exceeds the maximum pages the unit contains, it will respond with:

<BLOCK#><F><C><ETX><CHECKSUM>

When Videotex is commanded to display a page in B-PROTOCOL, the Character Protocol cursor pointer is positioned at HOME (upper left hand corner) on the newly displayed page. If data is to be printed at this location while in B-PROTOCOL, the character pointer should be re-positioned to a section of the screen where data will not be over-written. A convenient location for the character cursor is the location of the B-PROTOCOL cursor at the end of the displayed page's data.

4.340 DUMP A BINARY PROGRAM

If Videotex receives the command: <nn> it will store the <TEXT> field in RAM starting at the address specified by <nn>. The least significant byte of the address is sent first. Example: the address Hex 2000 would be sent as 10 40 10 60. Notice the transparency rule is still in effect. This command is used to dump MC6809 machine language programs to the Videotex.

4.350 EXECUTE A BINARY PROGRAM

If Videotex receives the command: <G><nn> it will go ON-HOOK (release the telephone line) and begin running the machine language code starting at the address specified by <nn>. The least significant byte of the address is sent first. The transparency rule is in effect for the address.

4.400 HANDSHAKING

In order for B-PROTOCOL to operate effectively, certain HANDSHAKING signals must be passed between the HOST computer and Videotex. These signals are listed as follows:

4.410 POSITIVE ACKNOWLEDGE

When a block was received with the proper block number and the calculated checksum matches the checksum sent, the receiver of the block will give a positive acknowledge. It is sent as:

<DLE><n>

where <n> is the ASCII block number.

If a block is received that has a block number which is one less than that expected, the block is ignored, and a positive acknowledge is sent by Videotex.

4.420 NEGATIVE ACKNOWLEDGE

When a block is received with a block number that is incorrect, or when the calculated checksum does not match the sent checksum, the receiver of the block will give a negative acknowledge. It is sent as:

<NAK>

where <NAK> is a HEX 15.

If a <NAK> is received, the block is retransmitted.

4.430 ENQUIRE

When the HOST or Videotex receives a <ENQ>, the receiver will respond with a positive acknowledge and the number of the block it correctly received last. If the receiver has not received any blocks, it will send a positive acknowledge, followed by 0 (indicating BLOCK 0).