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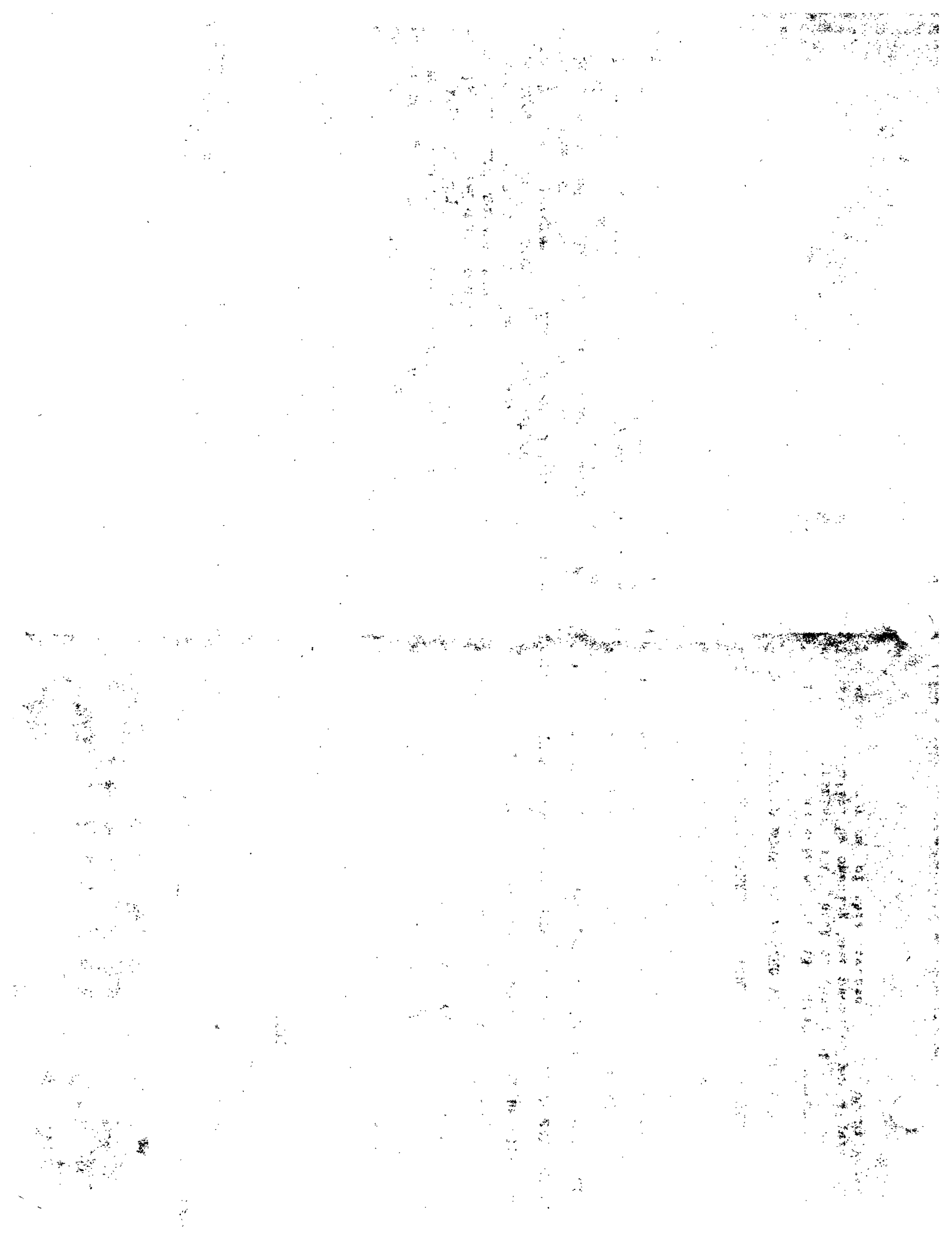
By: John Deb
For Accusonics

SUPER 19

ENHANCEMENTS FOR THE HEATH-ZENITH H19, Z19, H89, Z89, Z90

- SINGLE CHIP DIRECT REPLACEMENT - NO WIRING REQUIRED
- DEFINABLE SCROLL AREA - ANY RANGE OF 2-25 LINES
- EXPANDED TRANSMIT CAPABILITIES - CHARACTER, LINE, REGION
- SETTABLE TAB STOPS BY COLUMN OR INTERVAL, BACK TAB
- REAL-TIME CLOCK AND CALENDAR - CYCLES AUTOMATICALLY
- SUPPORTS 256 CHARACTER ROMS - 128 ADDITIONAL SYMBOLS
- 8 BIT DATA MODE - ALL 256 CODES SENT AND DISPLAYED
- 8 BIT ESCAPE SEQUENCE MODE - SINGLE CHARACTER FUNCTIONS
- TRANSPARENT MODE TO EXAMINE ALL RECEIVED CHARACTERS
- HARDWARE HANDSHAKING - SOFTWARE HANDSHAKE MAY BE DISABLED
- SLOW TRANSMIT MODE - PREVENTS DATA LOSS AT HIGH BAUD RATES
- LIGHT PEN SUPPORT - REPORTS SCREEN POSITION WHERE DETECTED
- CURSOR BLINK RATE SELECTABLE - NONE, SLOW, FAST
- SAVE CURSOR ALSO SAVES CURSOR TYPE AND VIDEO MODES
- VT100 EMULATION - SUPPORTS NEARLY ALL VT100 FEATURES
- ALL FUNCTIONS KEYS PRODUCE A DIFFERENT SHIFTED CODE
- SCROLL MODE CAN BE ENTERED ANY TIME USING THE SCROLL KEY
- WHITE BACKGROUND MODE, INTERLACED VIDEO, 38400 BAUD

NOTICE: Super19 is sold on condition that customer agrees to the license printed on the back of this package. Read this license carefully. By opening this package, you signify that you agree to the terms of this license. 60 Hz Version



This replacement terminal firmware is not merely an enhancement of the original H19 firmware, but a completely rewritten system of much expanded capabilities which supports the original features as a subset.

The standard Z19/H19 codes and features function as described in the Heath/Zenith manuals and therefore only additional functions will be explained. All new features (except those peculiar to the VT100 emulation) are supported in both Heath and ANSI modes. In the following descriptions of escape sequences, spaces are inserted for clarity only and are not part of commands.

CLOCK AND CALENDAR

The clock and calendar are set to all zeros upon power up, and thus indicate elapsed time since powerup. The clock and calendar may be set by enclosing the ASCII string with the proper escape sequence:

```
Set Time - Heath: ESC : <hh> : <mm> : <ss>   ANSI: ESC [ <hh> ; <mm> ; <ss> t
Set Date - Heath: ESC | <mm> / <dd> / <yy>   ANSI: ESC [ <mm> ; <dd> ; <yy> d
```

All <..> quantities are 1 or 2 digits, except that in Heath mode the last parameter must contain 2 digits. In Heath mode the two delimiters following the parameters may be one of the characters , : ; / or may be eliminated if all values are 2 digits. Once the time and date are set they will keep time until the power is turned off; system reset will not reset the time. If the clock is read with echo to the terminal, the time will be reset which may lose a second. The time and date sequences follow (these function locally when OFF-LINE):

```
Read Time - Heath:   ESC ;      Returns:  ESC : <hh> : <mm> : <ss>
Read Date - Heath:   ESC ~      Returns:  ESC | <mm> : <dd> : <yy>
Read Time - ANSI:    ESC t      Returns:  ESC [ <hh> ; <mm> ; <ss> t
Read Date - ANSI:    ESC d      Returns:  ESC [ <mm> ; <dd> ; <yy> d
```

SET/CLEAR TAB STOPS

Tabs may be set by current column, designated column, or specified interval as follows. The standard tab setting is an interval of 8. When setting intervals, the final interval will have tabs set at every column.

```
Heath: Set tab at column  2: ESC g !     (column 1 always set)
       Set tab at column  3: ESC g "
                      .            Character = column# + 31
                      .
       Set tab at column 79: ESC g n
       Set tab at column 80: ESC g o     (column 80 always set)
       Set tab every  5 columns: ESC g p
                      .                  Character = spacing + 107
                      .
       Set tab every 12 columns: ESC g w
       Set tab at current column: ESC g x
       Clear tab at current column: ESC g y
       Clear all tab stops: ESC g z

ANSI:  Set tab at current column: ESC H
       Clear tab at current column: ESC [ g  or  ESC [ 0 g
       Clear all tab stops:       ESC [ 3 g
       Set tab every  4 columns:  ESC [ 4 g
                      .
                      .
       Set tab every 12 columns:  ESC [ 12 g
       Set tabs at specified columns:  ESC [ <n1> ; <n2> ; <n3> .... <nn> G
                                       (where nx are actual column numbers)
```

SCROLL KEY OPERATION

The screen may be placed in scroll mode at any time by hitting the SCROLL key with the SHIFT key down. This will immediately stop the screen from scrolling. Hitting the SCROLL key will then cause a one line scroll; SHIFT-SCROLL will scroll all the currently displayed scroll lines. CTRL-SCROLL will exit scroll mode and restore continuous scrolling. The scroll mode escape sequences still function as well. Use of the scroll feature requires that handshaking be implemented with the host computer (either software or hardware.)

TRANSPARENT MODE

This mode routes all incoming characters directly to the screen, displaying control characters as corresponding graphics symbols and using reverse video to indicate that the 8th bit is on. Each of the possible 256 codes will be displayed as a unique symbol. Since all characters are displayed, no escape or control functions are executed - the characters are simply wrapped around from line to line. This mode can be toggled on or off at any time with CTRL-ESC. If this mode is forced from the host, there is no way for the host to recover.

ADDITIONAL KEYBOARD FEATURES

As shown in the keyboard code chart, all the function keys will produce a different code when used with the shift key (when used with the CTRL key they produce a local echo if the key has an editing function).

The repeat key can be disabled to prevent overruning the host input buffer. This is separate from the disable keyboard commands which prevent any key operation. In ANSI mode only, the keyboard is disabled/enabled by XOFF/XON sent from the host (some DEC software utilizes this). If the keyboard gets hung up in the disabled mode (no key click), typing CTRL-Q will reenable the keyboard.

Disable repeat key:	Heath: ESC i 8	ANSI: ESC ? 8 l
Enable repeat key:	Heath: ESC h 8	ANSI: ESC ? 8 h

SERIAL NUMBER

Each Super19 ROM contains a unique serial number which is transmitted as the answerback message when requested by a CTRL-E. This message consists of the 4 character serial code followed by a carriage return. By requesting this code the host or the application software can determine which terminal it is using and adjust its parameters accordingly.

EIGHTH BIT MODES

If parity is not enabled, the 8th bit may be handled in a variety of ways and may be inverted if desired. The modes are described below:

Heath	ANSI	8th BIT RECEIVED	8th BIT TRANSMITTED
ESC e A	ESC [0 e	ignored	set to 0
ESC e B	ESC [1 e	ignored	set to 1
ESC e C	ESC [2 e	8bit escape function	function keys send 8bit char.
ESC e D	ESC [3 e	same but 8th bit inverted	same but 8th bit inverted
ESC e E	ESC [4 e	all 8 bits displayed	all 8 display bits sent
ESC e F	ESC [5 e	same but 8th bit inverted	same but 8th bit inverted
ESC e I	ESC [8 e	force transparent mode	set to 0
ESC e J	ESC [9 e	same but 8th bit inverted	set to 1

In 8 bit data mode, the 8th bit displays the other seven bits in reverse video with the standard character set, or selects from the alternate character set if the alternate character option is enabled. In 8 bit data mode the ESC key is not sent, but causes the next key to be sent with the 8th bit on, allowing all codes to be generated from the keyboard. The ESC code itself can be generated by hitting the ESC key twice.

In 8 bit escape mode each function key sends a unique single character to the host, and a different code when used with SHIFT. Likewise all escape functions can be initiated with a single 8 bit character.

HARDWARE HANDSHAKING

Hardware handshaking is always provided - it has no effect if not implemented in software or if the signals are not wired up.

Sig.	Signal Name	Pin	Direction	Description
DTR	Data Terminal Ready	20	Out	True when H19 is powered on
RQS	Request To Send	4	Out	True when H19 can accept characters
DSR	Data Set Ready	6	In	Must be true to enable CTS sensing
CTS	Clear to Send	5	In	Must be true for the H19 to send data

If handshaking is desired on transmission to the host, the DSR line must be held high. If this is not provided by the host, simply tie it to the DTR pin which is normally high. Thus transmit handshaking is disabled if DTR and CTS are both high or both low - usual situations when handshake is not implemented. The XON/XOFF software handshaking can be eliminated by the mode sequence below:

Disable software handshake: Heath: ESC h 2 ANSI: ESC [7 h
Enable software handshake: Heath: ESC i 2 ANSI: ESC [7 l

OPTION SWITCH ASSIGNMENTS

Some minor changes have been made in the bit assignments of the two dip switches which set the initial terminal configuration.

Switch 402: Upper switch - push switch down to set on, up for off

Bit 0 - On for block cursor, off for underline cursor (same)
Bit 1 - On for slow transmit mode, off for normal (prev. disabled key click)
Bit 2 - On for line wrap-around, off for discard at end of line (same)
Bit 3 - On for auto line feed on carriage return (same)
Bit 4 - On for auto carriage return on line feed (same)
Bit 5 - On for ANSI mode, off for Heath mode (same)
Bit 6 - On for shifted keypad, off for unshifted keypad (same)
Bit 7 - On for DEC keypad codes if ANSI mode and alternate keypad mode (new)

Switch 401: Lower right switch - push down to set on

Bits: 0 1 2 3	sets baud rate.	Heath sequence:	ANSI sequence:	(non-VT100)
1 0 0 0	110 baud	ESC r A	ESC [1 I	or ESC [1 r
0 1 0 0	150 baud	ESC r B	ESC [2 I	or ESC [2 r
1 1 0 0	300 baud	ESC r C	ESC [3 I	or ESC [3 r
0 0 1 0	600 baud	ESC r D	ESC [4 I	or ESC [4 r
1 0 1 0	1200 baud	ESC r E	ESC [5 I	or ESC [5 r
0 1 1 0	1800 baud	ESC r F	ESC [6 I	or ESC [6 r
1 1 1 0	2000 baud	ESC r G	ESC [7 I	or ESC [7 r
0 0 0 1	2400 baud	ESC r H	ESC [8 I	or ESC [8 r
1 0 0 1	3600 baud	ESC r I	ESC [9 I	or ESC [9 r
0 1 0 1	4800 baud	ESC r J	ESC [10 I	or ESC [10 r
1 1 0 1	7200 baud	ESC r K	ESC [11 I	or ESC [11 r
0 0 1 1	9600 baud	ESC r L	ESC [12 I	or ESC [12 r
1 0 1 1	19200 baud	ESC r M	ESC [13 I	or ESC [13 r
0 1 1 1	38400 baud	ESC r N	ESC [14 I	or ESC [14 r

Bits: 4 5 6	initializes 8th bit mode:
0 0 0	mode A/0 - 8th bit ignored, sent as 0
1 0 0	mode B/1 - 8th bit ignored, sent as 1
0 1 0	mode C/2 - 8 bit escape mode
1 1 0	mode D/3 - 8 bit escape mode, inverted 8th bit
0 0 1	mode E/4 - 8 bit data mode
1 0 1	mode F/5 - 8 bit data mode, inverted 8th bit
0 1 1	7 bit data with odd parity, 8th bit ignored on input
1 1 1	7 bit data with even parity, 8th bit ignored on input

Bit 7: On for full-duplex operation, off for half-duplex (local echo)

CURSOR TYPES

In addition to the standard cursor commands, the specific cursor type can be selected as in the table below:

Heath	ANSI	
ESC c A	ESC [0 k	Enable cursor to previous type
ESC c B	ESC [1 k	Disable cursor
ESC c C	ESC [2 k	Fast blink underline cursor
ESC c D	ESC [3 k	Slow blink block cursor
ESC c E	ESC [4 k	Slow blink underline cursor
ESC c F	ESC [5 k	Fast blink block cursor
ESC c G	ESC [6 k	Non-blink underline cursor
ESC c H	ESC [7 k	Non-blink block cursor

CURSOR SAVE AND RESTORE

In addition to saving the current cursor position, the standard cursor save and restore commands save the cursor type, insert character mode, relative origin mode, reverse video mode, graphics mode, and character set selections. This is the preferred way to save the current state, as in the VT100. However a problem situation may arise if a program changes modes with the cursor saved.

SCROLL REGION MARGINS

The scroll region is standardly set from line 1 to line 24, with the 25th line fixed if it is enabled. However any segment from 2 to 25 lines may be designated as the scroll area:

Heath:	ESC m <top> <bottom>	where top, bottom are upper case letters A to Y, corresponding to lines 1 to 25
ANSI:	ESC [<top> ; <bottom> r	where <top>,<bottom> are actual line numbers
	ESC [r	restores standard scroll region 1 to 24

Setting the relative origin mode prevents the cursor from being positioned outside of the scroll area, with the new home (line 1, column 1) set to the 1st character in the scroll area. Only the scroll area can be erased or altered.

Set relative origin mode: Heath: ESC h 6 ANSI: ESC [? 6 h

Set absolute origin mode: Heath: ESC i 6 ANSI: ESC [? 6 l

In the absolute origin mode, the cursor may be positioned anywhere on the screen with the set cursor command and may be moved into the scroll region from the fixed region, but it cannot be moved out of the scroll region. Insert and delete operations affect only the region in which they are performed. However for VT100 and H19 compatibility, the clear screen will erase lines 1 to 24. If the cursor is on the 25th line, only that line will be cleared. If all 25 lines are set to scroll however, they will all be cleared. The ANSI clear screen does not home the cursor whereas clear screen in Heath mode does.

CRT SCREEN DISPLAY OPTIONS

The CRT screen can be configured for 24 or 25 line mode using the original mode set commands. In both sizes all or any section of the lines may scroll; the default is the top 24 lines in both cases.

The video to the entire display area may be reversed, producing black letters on a white background. Using reverse video will then produce white letters on a black background. However, this mode emphasizes the tearing on the screen caused by the updating of the display memory by the display processor.

The CRT scan may be made to interlace, thus filling in the characters better. While this may be useful for photographing the screen, this flicker produced is objectionable unless a long persistance phosphor CRT tube is used.

	Heath	ANSI
Set 25 line mode:	ESC x 1	ESC [> 1 h
Set 24 line mode:	ESC y 1	ESC [> 1 l
Set white screen:	ESC h 5	ESC [? 5 h
Set black screen:	ESC i 5	ESC [? 5 l
Set interlace mode:	ESC h 9	ESC [? 9 h
Set non-interlace mode:	ESC i 9	ESC [? 9 l

ALTERNATE CHARACTER SET

Super19 will simultaneously support a dual Font19 ROM containing two sets of 128 characters as well as an extended Font19 ROM containing 256 characters. As the extended character set mode uses all 8 bits to allow 256 characters to be displayed simultaneously, reverse video is disabled when this mode is used. The terminal initialize escape sequence will disable the extended character set but will not alter the alternate/standard 128 character set selection.

Select extended 256 character set:	Heath: ESC a	ANSI: ESC [1
Select current 128 character set:	Heath: ESC s	ANSI: ESC [B
Select alternate 128 character set:	Heath: ESC <space> H	ANSI: ESC [7 0
Select standard 128 character set:	Heath: ESC <space> D	ANSI: ESC [3 0

ANSI CHARACTER SET SELECTION

Two character set selections, G0 and G1, can be designated from one of the characters sets below. These are invoked respectively by the codes SI (CTRL-O) and SO (CTRL-N). The escape sequences for directly setting graphics mode and extended character mode simply set both the G0 and G1 selections. Note that selecting the graphics character set affects subsequently received characters, whereas the extended character set mode affects all displayed characters. The United Kingdom set (pound sign in place of #) is not implemented. The initial configuration is standard character set for both G0 and G1 with G0 selected.

Set G0	Set G1	
ESC (B	ESC) B	Standard ASCII 128 character set
ESC (0	ESC) 0	Graphics mode (lower case remapped)
ESC (1	ESC) 1	Extended character set ROM accessed
ESC (2	ESC) 2	Extended character set with graphics mode

DATA TRANSMISSION OPTIONS

When operating the terminal at high baud rates, the host computer often cannot keep up with the bursts of characters produced by the function keys and characters are lost due to overrun at the receiver UART. Setting the slow transmit mode allow characters to be sent at a maximum rate of 60 per second, thus allowing 16 msec for the host to process each character. The baud rate is unchanged within each character - space is simply added between them.

A mode option is provided which allows the terminal to operate even though the OFF-LINE key is depressed. This mode can be forced when the terminal is already off-line by sending two successive rubout characters. When used with the H89/Z89 auto-boot feature, the computer can be started up with off-line key depressed by including 2 rubouts in the boot-up routine (or in the disk label).

Half duplex/full duplex modes can now be selected by software. Half duplex mode simply echoes back to the screen all characters entered on the keyboard.

Set slow transmit mode:	Heath:	ESC h 3	ANSI:	ESC [8 h
Reset slow transmit mode:	Heath:	ESC i 3	ANSI:	ESC [8 l
Set off-line override mode:	Heath:	ESC h 4	ANSI:	ESC [9 h
Reset off-line override:	Heath:	ESC i 4	ANSI:	ESC [9 l
Set full duplex operation:	Heath:	ESC h 1	ANSI:	ESC [12 h
Set half duplex operation:	Heath:	ESC i 1	ANSI:	ESC [12 l

TRANSMIT SCREEN ROUTINES

The standard screen transmit command will transmit all the scrollable lines. The Heath transmit 25th line command will transmit all lines below the scroll region. An additional command will transmit the fixed lines above the scroll region. The transmit line command will send the entire line where the cursor resides to the host, followed by a carriage return. The transmit character command simply sends the character at the current cursor location.

Transmit scroll area:	Heath:	ESC #	ANSI:	ESC [p
Transmit top fixed area:	Heath:	ESC ^	ANSI:	ESC [j
Transmit bottom fixed area:	Heath:	ESC]	ANSI:	ESC [v
Transmit current line:	Heath:	ESC _	ANSI:	ESC [o
Transmit current character:	Heath:	ESC "	ANSI:	ESC [w

VT100 COMPATIBILITY

Most of the VT100 features have been implemented as shown in the code chart. Not supported are large characters, smooth scroll, 132 character lines, and keyboard LEDs; these requests are processed but no operation is performed. The Super19 responses to the report requests are described below:

Request device status: ESC [5 n Response: ESC [0 n (ready)
Request cursor position: ESC [6 n Response: ESC [<line> ; <column> R
Request device options: ESC [c Response: ESC [? 1 ; 0 c (no options)
Request parameters: ESC [1 x Resp: ESC [3 ;<par>;<nbits>;
;
; 1 ; x
<par>=1,4,5 for no,odd,even parity, <nbits>=7,8 bits,
=DEC baud rate code

 :	16	32	48	56	64	72	80	88	96	104	112	120
baud:	110	150	300	600	1200	1800	2000	2400	3600	4800	9600	19200

Since Heath uses the same escape sequence for setting the baud rate as the VT100 uses to set margins (ESC [... r), Super19 assumes a single parameter means a baud rate selection, two parameters set margins, and no parameters sets the default margins (1,24). Since existing programs may occasionally specify only one margin, the baud rate option is disabled in VT100 keypad mode. In all cases the alternative set baud rate sequence (ESC [... I) is functional.

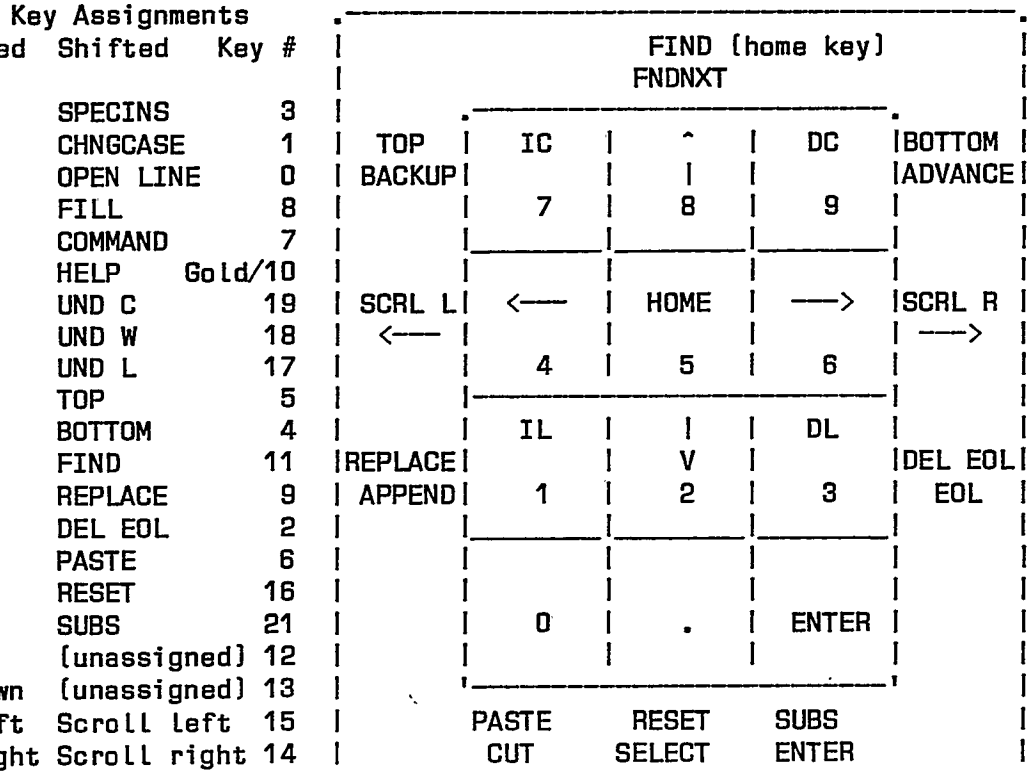
EDT EDITOR OPERATION

EDT is a frequently used editor on DEC machines. Although EDT is usable in VT52 mode with the H19 ANSI implementation, its performance is markedly improved in VT100 mode utilizing the scroll modes and reverse video. Since the keys on the H19 do not correspond to those of the VT100, a special set of key codes has been implemented to provide convenient EDT operation. Although this mode may be selected by an escape sequence when in ANSI alternate keypad mode (possibly in the login command file), it will be entered automatically if the DEC dipswitch is set on. A template is provided which may be copied and placed around the keys. A new help file could be created on the host computer using H19 graphics and key positions, or the HELP key can be reassigned to read and display the help file (requires a startup command file). The SHIFT key may be used to get the second key function instead of prefixing the key with the GOLD key.

Set VT100 keypad mode (ANSI): ESC [3 h Reset VT100 keypad mode: ESC [3 l

EDT Super19 Key Assignments

Key	Unshifted	Shifted	Key #
f1	CHAR	SPECINS	3
f2	WORD	CHNGCASE	1
f3	LINE	OPEN LINE	0
f4	SECT	FILL	8
f5	PAGE	COMMAND	7
ERASE	GOLD	HELP	Gold/10
BLUE	DEL C	UND C	19
RED	DEL W	UND W	18
WHITE	DEL L	UND L	17
IC/7	BACKUP	TOP	5
DC/9	ADVANCE	BOTTOM	4
HOME	FNDNXT	FIND	11
IL/1	APPEND	REPLACE	9
DL/3	EOL	DEL EOL	2
0	CUT	PASTE	6
.	SELECT	RESET	16
ENTER	ENTER	SUBS	21
up/8	curs.up	(unassigned)	12
down/2	curs.down	(unassigned)	13
left/4	curs.left	Scroll left	15
right/6	curs.right	Scroll right	14



SPECINS	CHNGCASE	OPENLINE	FILL	COMMAND	HELP	UNDEL C	UNDEL W	UNDEL L
CHAR	WORD	LINE	SECTION	PAGE	GOLD	DEL C	DEL W	DEL L

LIGHT PEN

Upon strobing the CRT controller light pen input with a low to high transition, the current position is latched in the controller. Executing the read light pen command will set the cursor to the corrected location on the screen which can then be read with the sense cursor command. If a switch is not present on the light pen, the cursor must set and read repeatedly until a new position is noted. If the light pen has a slow response the cursor will be placed beyond the pen; if the light pen has a large acceptance angle the cursor may be sensed ahead of the pen position, which may compensate for response delay. In order for the light pen to respond, the screen must be white at that point. Use reverse video characters or set the terminal to white screen mode.

Set cursor to light pen register location: Heath: ESC ! ANSI: ESC [

INSTALLATION INSTRUCTION

If you have a H89/Z89/Z90/H88 computer, you must gain access to the terminal logic board (rear printed circuit board) by raising or removing the CPU board. The ROM to be replaced is a 24 pin IC at a position corresponding to ARKANSAS on a US map and designated as U422 on the terminal logic board beneath an empty socket U423. On new "A" series machines the ROM location is designated U437 and the empty socket U436. Carefully remove the ROM by prying equally on both ends and save it for possible future reference. Before installing the Super19 ROM, the pins must be bent slightly to be at right angles to the body of the ROM. This is best done by pushing the side of the ROM against a hard metal surface (such as the top of the disk drive), thus bending 12 pins at once. Carefully insert the ROM in the socket with the notched end toward the edge of the terminal board. Inspect carefully to see that all the pins have been inserted in the socket. Take care to properly replace any cables removed.
Be sure to ground your body, as static charge can damage the keyboard encoder.

When powering up the system, if strange noises are heard or if the terminal does not function when OFF-LINE, immediately power down, remove the ROM and check for bent pins, and reinsert. Sometimes the pins get folded under the IC.

If you have an early terminal with ROMs in both sockets U422 and U423, both ROMs must be removed and the following jumpers must be changed to supply proper power and signals to the new ROM. These are located below and to the left of location U422. Jumpers at JP23 need not be removed.

Jumper Strip	Remove jumpers:	Install jumpers:
JP20	1-2	2-3
JP21	3-4	1-2 and 4-5
JP22	2-3 and 5-6 and 7-8	1-2 and 4-5 and 6-7

Initially set the dipswitches as follows:

Lower switch (S401): 2-3 down (on) for 9600 baud (0 also for 19200 baud)
7 down (on) for full-duplex
others up (off)

Upper switch (S402): 0-6 up (off)
7 down (DEC key codes when in ANSI alternate keypad mode)

If escape sequences are getting garbled at high terminal baud rates, set slow transmit mode with switch position 1 or with the escape sequence.

The firmware was optimized for fastest speed in continuous scroll mode. The flashing at the top of the screen when line feeding with the 25th line enabled has been reduced, but occasionally a brief flash of displaced characters may be noted — a consequence of CRT controller algorithm used.

At baud rates in excess of 9600 baud handshaking is required. The host must either respond to XON/XOFF or must implement hardware handshaking.

The 60 Hz/50 Hz option has be eliminated — a special Super19 ROM is available which has the display and clock adjusted for 50 Hz operation.

Character generator ROMS are available in standard configurations such as Greek/math, multilingual, APL, VT100 graphics, and 160 by 100 pixel graphics. Also, software will be available for the user to design custom character sets.

SUPER19 *FUNCTION KEY AND KEYPAD CODES*

FUNC KEY	STD. CHAR	SHIFTED KEYPAD MODE HEATH	SHIFTED KEYPAD MODE ANSI	SHIFTED KEYPAD MODE 8BIT	ALTERNATE KEYPAD MODE HEATH	ALTERNATE KEYPAD MODE ANSI	ALTERNATE KEYPAD MODE 8BIT	SHIFTED ALTERNATE KP HEATH	SHIFTED ALTERNATE KP ANSI	SHIFTED ALTERNATE KP 8BIT	DEC VT100 KEYBOARD MODE UNSHIFTED	DEC VT100 KEYBOARD MODE SHIFTED(GOLD)	VT100 KEY
1/IL	1	ESC L	ESC [L	L	ESC ? q	ESC O q	1	ESC L	ESC [L	L	ESC O y	ESC O P ESC O y	9
2/down	2	ESC B	ESC [B	B	ESC ? r	ESC O r	2	ESC B	ESC [B	B	ESC [B	ESC O P ESC [B	down
3/DL	3	ESC M	ESC [M	M	ESC ? s	ESC O s	3	ESC M	ESC [M	M	ESC O r	ESC O P ESC O r	2
4/left	4	ESC D	ESC [D	D	ESC ? t	ESC O t	4	ESC D	ESC [D	D	ESC [D	ESC O P ESC [D	left
5/HOME	5	ESC H	ESC [H	H	ESC ? u	ESC O u	5	ESC H	ESC [H	H	ESC O R	ESC O P ESC O R	PF3
6/right	6	ESC C	ESC [C	C	ESC ? v	ESC O v	6	ESC C	ESC [C	C	ESC [C	ESC O P ESC [C	right
7/IC (ins on)7	7	ESC @ ESC O	ESC [4 h ESC [4 l	@ O	ESC ? w	ESC O w	7	ESC @ ESC O	ESC [4 h ESC [4 l	@ O	ESC O u	ESC O P ESC O u	5
8/up	8	ESC A	ESC [A	A	ESC ? x	ESC O x	8	ESC A	ESC [A	A	ESC [A	ESC O P ESC [A	up
9/DC	9	ESC N	ESC [P	N	ESC ? y	ESC O y	9	ESC N	ESC [P	N	ESC O t	ESC O P ESC O t	4
0	0	0	0	0	ESC ? p	ESC O p	0	ESC ? p	ESC O p	-	ESC O v	ESC O P ESC O v	6
.	.	.	.	.	ESC ? n	ESC O n	.	ESC ? n	ESC O n	.	ESC O n	ESC O P ESC O n	.
ENTER	CR	CR	CR	CR	ESC ? M	ESC O M	/	ESC ? M	ESC O M	?	ESC O M	ESC O P ESC O M	ENTER
BLUE FUNCTION KEY					ESC ? P	ESC O P	P	ESC $	ESC O $	$	ESC O l	ESC O P ESC O l	,
RED FUNCTION KEY					ESC ? Q	ESC O Q	Q	ESC %	ESC O %	%	ESC O m	ESC O P ESC O m	-
WHITE FUNCTION KEY					ESC ? R	ESC O R	R	ESC &	ESC O &	&	ESC O S	ESC O P ESC O S	PF4
f1 FUNCTION KEY					ESC ? S	ESC O S	S	ESC '	ESC O '	'	ESC O s	ESC O P ESC O s	3
f2 FUNCTION KEY					ESC ? T	ESC O T	T	ESC (	ESC O (	(	ESC O q	ESC O P ESC O q	1
f3 FUNCTION KEY					ESC ? U	ESC O U	U	ESC)	ESC O)	)	ESC O p	ESC O P ESC O p	0
f4 FUNCTION KEY					ESC ? V	ESC O V	V	ESC *	ESC O *	*	ESC O x	ESC O P ESC O x	8
f5 FUNCTION KEY					ESC ? W	ESC O W	W	ESC +	ESC O +	+	ESC O w	ESC O P ESC O w	7
ERASE FUNCTION KEY					ESC ? J	ESC [J	J	ESC E	ESC [2 J	E	ESC O P (GOLD)	ESC O Q	PF1/PF2

(underline designates 8th bit is set true)

(cursor key mode uses "O" for "[")

SUPER19 ESCAPE CODES REV 2.2 1/10/83

	FUNCTION (* = NEW)	8 BIT CODE VALUES ASCII	OCTAL	HEX	ESCAPE SEQUENCE (follows ESC) HEATH	ANSI	DEC (shift)
*	DUAL CHAR. SET SELECT	<space>	240	A0	<space>	[#0	
*	READ LIGHT PEN ADDRESS	!	241	A1	!	[@	
*	TRANSMIT CHARACTER	"	242	A2	"	[w	
*	TRANSMIT SCROLL REGION	#	243	A3	#	[p	
*	SHIFTED BLUE KEY	$	244	A4	$	O$	
*	SHIFTED RED KEY	%	245	A5	%	O%	
*	SHIFTED WHITE KEY	&	246	A6	&	O&	
*	SHIFTED F1 KEY	'	247	A7	'	O'	
*	SHIFTED F2 KEY	(	250	A8	(	O(	
*	SHIFTED F3 KEY	)	251	A9	)	O)	
*	SHIFTED F4 KEY	*	252	AA	*	O*	
*	SHIFTED F5 KEY	+	253	AB	+	O+	
*	ALTERNATE KP SHIFT "."	,	254	AC			
*	ALTERNATE KP SHIFT "0"	-	255	AD			
	ALTERNATE KEYPAD "."	.	256	AE	?n	On	On
	ALTERNATE KEYPAD "ENTER"	/	257	AF	?M	OM	OM
	ALTERNATE KEYPAD "0"	0	260	B0	?p	Op	Ov
	ALTERNATE KEYPAD "1"	1	261	B1	?q	Oq	Oy
	ALTERNATE KEYPAD "2"	2	262	B2	?r	Or	[B (OB)
	ALTERNATE KEYPAD "3"	3	263	B3	?s	Os	Or
	ALTERNATE KEYPAD "4"	4	264	B4	?t	Ot	[D (OD)
	ALTERNATE KEYPAD "5"	5	265	B5	?u	Ou	OR
	ALTERNATE KEYPAD "6"	6	266	B6	?v	Ov	[C (OC)
	ALTERNATE KEYPAD "7"	7	267	B7	?w	Ow	Ou
	ALTERNATE KEYPAD "8"	8	270	B8	?x	Ox	[A (OA)
	ALTERNATE KEYPAD "9"	9	271	B9	?y	Oy	Ot
*	SET CLOCK	:	272	BA	:#:#:#	[#;#;#t	
*	READ CLOCK	;	273	BB	;	t	
	SET ANSI MODE	<	274	BC	<	[?2l (set HEATH mode)	
	SET ALTERNATE KEYP MODE	=	275	BD	=	=	
	RESET ALTERNATE KP MODE	>	276	BE	>	>	
*	ALTERNATE KP SHIFT ENTER	?	277	BF			
	INSERT CHARACTER MODE ON	@	300	C0	@	[4h	
	CURSOR UP	A	301	C1	A	[A	
	CURSOR DOWN	B	302	C2	B	[B	
	CURSOR RIGHT	C	303	C3	C	[C	
	CURSOR LEFT	D	304	C4	D	[D	
	CLEAR ENTIRE SCREEN	E	305	C5	E	[2J	OQ
	GRAPHICS MODE ON	F	306	C6	F	[10m	
	GRAPHICS MODE OFF	G	307	C7	G	[11m	
	CURSOR HOME	H	310	C8	H	[H	
	REVERSE INDEX	I	311	C9	I	M	
	ERASE TO END OF PAGE	J	312	CA	J	[J	OP
	ERASE TO END OF LINE	K	313	CB	K	[K	
	INSERT LINE	L	314	CC	L	[L	
	DELETE LINE	M	315	CD	M	[M	
	DELETE CHARACTER	N	316	CE	N	[P	
	INSERT CHAR MODE OFF	O	317	CF	O	[4l	
	BLUE KEY	P	320	D0	P	OP	Ol
	RED KEY	Q	321	D1	Q	OQ	Om
	WHITE KEY	R	322	D2	R	OR	OS
	F1 KEY	S	323	D3	S	OS	Os
	F2 KEY	T	324	D4	T	OT	Oq
	F3 KEY	U	325	D5	U	OU	Op
	F4 KEY	V	326	D6	V	OV	Ox
	F5 KEY	W	327	D7	W	OW	Ow
*	VERTICAL INDEX	X	330	D8	X	D	
	SET CURSOR	Y	331	D9	Y##	[#;#f or [#;#H	
	IDENTIFY AS VT52	Z	332	DA	Z		

	SET HOLD SCREEN MODE	[	333	DB	[	[>3h
	RESET HOLD SCREEN MODE	\	334	DC	\	[>3l
	XMIT BOTTOM FIXED REGION	]	335	DD	]	[v
*	XMIT TOP FIXED REGION	^	336	DE	^	[j
*	TRANSMIT CURRENT LINE	_	337	DF	_	[o
*	BACK TAB	`	340	E0	`	[E
*	EXTENDED 256 CHAR. SET	a	341	E1	a	[[1 / []1
	ERASE FROM BOP	b	342	E2	b	[1J
*	SET CURSOR TYPE	c	343	E3	c#	[#k
*	DUPLICATE CHARACTER	d	344	E4	d	[F
*	SET 8TH BIT MODE	e	345	E5	e#	[#e
*	INSERT SINGLE SPACE	f	346	E6	f	[N
*	SET/CLEAR TAB STOPS	g	347	E7	g#	H, [g, [3g, [#G
*	SET MODE BIT [group 2]	h	350	E8	h	[#h
*	RESET MODE BIT [group 2]	i	351	E9	i	[#l
	SAVE CURSOR AND MODES*	j	352	EA	j	[s or 7
	RESTORE CURSOR AND MODES*	k	353	EB	k	[u or 8
	ERASE LINE	l	354	EC	l	[2K
*	SET SCROLL REGION	m	355	ED	m##	[#;#r
	REPORT CURSOR POSITION	n	356	EE	n	[6n
	ERASE FROM START OF LINE	o	357	EF	o	[1K
	REVERSE VIDEO ON	p	360	F0	p	[7m
	REVERSE VIDEO OFF	q	361	F1	q	[m
	SET BAUD RATE	r	362	F2	r#	[#r or [#I
*	STANDARD 128 CHAR. SET	s	363	F3	s	[[B / []B
	SHIFTED KEYPAD MODE	t	364	F4	t	[>6h
	UNSHIFTED KEYPAD MODE	u	365	F5	u	[>6l
	WRAP AT END OF LINE MODE	v	366	F6	v	[?7h
	DISCARD AT END OF LINE	w	367	F7	w	[?7l
	SET MODE BIT	x	370	F8	x#	[>#h
	RESET MODE BIT	y	371	F9	y#	[>#l
	INITIALIZE CRT	z	372	FA	z	[z or c
	ENABLE KEYBOARD	{	373	FB	{	[2l
*	SET DATE	|	374	FC	|#/#/#	[#;#;#d
	DISABLE KEYBOARD	}	375	FD	}	[2h
*	READ DATE	~	376	FE	~	d
*	NEWLINE [LF+CR]	<rubout>	377	FF	<rubout>	E

	MODE SET/RESET ESCAPE SEQUENCES	HEATH	ANSI
	KEYBOARD DISABLE/ENABLE		[2h / [2l
*	ENABLE/DISABLE VT100 KEYPAD MODE		[3h / [3l
	INSERT CHARACTER MODE ON/OFF		[4h / [4l
*	FULL/HALF DUPLEX	h1 / i1	[12h / [12l
*	DISABLE/ENABLE XON/XOFF PROTOCOL	h2 / i2	[7h / [7l
*	ENABLE/DISABLE SLOW TRANSMIT MODE	h3 / i3	[8h / [8l
*	ENABLE/DISABLE OFF-LINE OVERRIDE	h4 / i4	[9h / [9l
*	ENABLE/DISABLE ALTERNATE CURSOR KEYS		[?1h / [?1l
	ENABLE VT52 MODE [either sequence]		[?2h / [?2l
*	BLACK ON WHITE/WHITE ON BLACK	h5 / i5	[?5h / [?5l
*	RELATIVE/ABSOLUTE ORIGIN MODE	h6 / i6	[?6h / [?6l
	WRAP/DISCARD AT END OF LINE	h7 / i7	[?7h / [?7l
*	ENABLE/DISABLE REPEAT KEY	h8 / i8	[?8h / [?8l
*	ENABLE/DISABLE INTERLACED SCAN	h9 / i9	[?9h / [?9l
	ENABLE/DISABLE 25TH LINE	x1 / y1	[>1h / [>1l
	DISABLE/ENABLE KEY CLICK	x2 / y2	[>2h / [>2l
	ENABLE/DISABLE HOLD SCREEN MODE	x3 / y3	[>3h / [>3l
	BLOCK/UNDERSCORE CURSOR	x4 / y4	[>4h / [>4l
	DISABLE/ENABLE CURSOR	x5 / y5	[>5h / [>5l
	KEYPAD MODE SHIFTED/UNSHIFTED	x6 / y6	[>6h / [>6l
	ENABLE/DISABLE ALTERNATE KEYPAD	x7 / y7	[>7h / [>7l
	ENABLE/DISABLE AUTO LF UPON CR	x8 / y8	[>8h / [>8l
	ENABLE/DISABLE AUTO CR UPON LF	x9 / y9	[>9h / [>9l
			[or [20h / [20l]

APPLICATION NOTE #1 - READING THE SUPER19 TIME AND DATE

The Super19 returns the time and date in a manner similar to the cursor position report, i.e. the escape sequence necessary to restore the time or date to the value read. If the time or date is read with the standard read calls, the system will echo the string back to the terminal, which will reset the time or date to the value read without any display. This could possibly lose a second in the clock if the time changed between the read and the echo. Also the normal input request will not terminate until a carriage return is hit from the keyboard. To display the time or date, the first two characters of the returned escape sequence must be bypassed; the remaining 8 characters are normal ASCII.

Using Microsoft BASIC, the clock can be read with a single line:

```
PRINT CHR$(27);";";MID$(INPUT$(10),3)
```

The escape character (27) and the semicolon request the terminal to send the 10 character sequence. The INPUT$ function reads in character mode without echo.

To save the time in a string, the following code could be used:

```
100 PRINT CHR$(27);";";
110 T$=MID$(INPUT$(10),3
```

Benton Harbor BASIC has no character mode input. The system must be put in this mode with POKE. Also the input must be terminated with a carriage return. This can be forced by requesting the terminal serial number (returns 4 characters followed with a carriage return). An example follows:

```
100 P$=CHR$(27)+";"+CHR$(5)
110 POKE 8406,129
120 INPUT P$;T$
130 POKE 8406,0
140 PRINT MID$(T$,3,8)
```

Similarly, the code may be implemented in the Heath assembler:

```
        LXI     B,129*256+129   character mode, no echo
        XRA     A               affect console mode
        SCALL   .CONSL
        SCALL   .CLRCO          clear out typeahead buffer
        MVI     A,27            escape
        SCALL   .SCOUT
        MVI     A,';'           read clock
        SCALL   .SCOUT
        LXI     H,BUF           input buffer pointer
        MVI     B,10            character counter
LOOP    SCALL   .SCIN           wait for input character
        JC      LOOP
        MOV     M,A             store character
        INX     H               next character
        DCR     B
        JNZ     LOOP            if more characters
        MVI     M,10            terminate string with newline
        LXI     H,BUF+2         display time
        SCALL   .PRINT
        .
        .
BUF     DS      11              input buffer
```

The date may be read in the same manner except substituting tilde (~) for the semicolon.