VT132

Quick Reference Guide

Version 1.0.0

The High Nibble

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For the more significant bits

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1. Introduction

The VT132 terminal module is an RC2014 compliant module which makes it possible to use a RC2014 as a stand-alone computer as it provides keyboard input and VGA display output.

It also provides WiFi modem emulation which enables the use of a terminal program (like Kermit or QTerm on CP/M) for transferring data, controlling a remote computer or logging into a BBS.

This Quick Reference Guide lists the options and commands needed for everyday use of the VT132.

For a more in-depth look into details, please consult the VT132 website provided by TheHighNibble:

```
https://thehighnibble.com/vt132/
```

1.1. Key symbols

The following key symbols are used that may need explanation:

⇥	Tab
⏎	Enter
⎵	Space
⌫	Backspace
⇧	Shift
←, →, ↑, ↓	Cursor keys

2. The Terminal

The main function of the VT132 is the terminal. It functions as a VT100 terminal but is also capable of ANSI color sequences and can also display DOS ANSI.SYS compatible sequences.
Alternative personalities like ADM-3A or VT-52 are also available.

2.1. Keys in Terminal Mode

Key	Function
Alt + SysRq	Open Setup Screen
Alt + Esc	Open Quick Settings Menu (left Alt only)
Ctrl + J	Send LINEFEED key
ScrollLock	NO SCROLL function, like Ctrl + S / Ctrl + Q

2.2. The Quick Settings Menu

Use these keys to navigate inside this menu:

Key	Function
Esc	Close Quick Settings Menu (at top level)
⎵ ↵ →	Make selection, enter menu
Esc ← ⌫	Go back one level

- Selecting an action (ie. not a menu or checkbox/radio button) will execute this action and close the menu.

- You can press the <u>underlined</u> key to select an option.

The following **menu options** are available:

- Actions:
    - Clear display
    - Soft reset
    - Reset terminal: The same as 0 in Set-Up menus, resets the terminal to a defined state.
    - Reboot: Reboots the microcontroller of the VT132
    - Clean NVR: *factory reset* the VT132 by deleting all terminal and modem settings

- Terminal Type:
    - Emulation Mode: change personality
    - 7-bit NRCS characters: enable/disable NRCS[1] mode

- ASCII emulation:
    - Select a pre-defined emulation *profile*
    - White/Green/Amber/Blue screen all sets: DEC Codepage, Bold = Bright + Thick, ANSI color palette (except Amber: VGA palette), 80x24 screen
    - Ansi.sys sets: Codepage 437, Home on Clear, VGA color palette, 80x25 screen

- Keyboard: Select the keyboard layout (US/UK/German/Italian)

- Modem: Enable modem locally
    - When enabling this setting, the modem part cannot be accessed via the serial connection
    - Instead, when switching from ONLINE to LOCAL mode, you can talk directly to the modem (bypassing the connected computer)

- On-Line: switch between ONLINE and LOCAL mode (for using the modem, see above)

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[1]National Replacement Character Set: When enabled, some characters are replaced with language specific characters, eg. Umlauts in German

3. Set-Up Mode

3.1. Keys in Set-Up Mode

Key	Function
`F1`	Show/hide help
`5`	Advance to the next screen
`⇆`	Move cursor to the next tab stop
`↵`	Move cursor to the beginning of the line
`⇧`+`C`	On Set-Up B: reset NVRAM to factory defaults on next boot
`⇧`+`S`	Save the settings to NVS
`⇧`+`R`	Recall settigns from NVS

3.2. The Set-Up Screens

The Set-Up screens imitate the same functions on a real DEC VT100 terminal.

3.2.1. Set-Up A

This page shows the tab stops at the bottom of the screen.

Key	Function
⇧ + T	Reset all tab stop to default
2	Set / clear tab stop at cursor position
3	Clear all tab stops
4	Toggle online / local mode
9	Toggle 80 / 132 columns per line

- In **online mode**, the terminal is connected to the computer via the serial port.

- In **local mode**, the terminal can be used to connect directly to the modem using the *Quick Settings menu* (see 2.2 on page 7).

3.2.2. Set-Up B

On this page, various configuration *bits* can be set. Use the cursor to navigate above the bit and press ⑥ to toggle it. Use ⇆ and ↵ to move quicker.

These bits are available:

Bit	Function
Scroll	Use smooth scrolling
Auto Repeat	Press longer on a key and the input will be repeated
Screen Inv.	Invert the screen colors (to eg. black on white)
Cursor	Change cursor shape (block / line)
Margin Bell	Ring the bell when cursor is on right margin
Keyclick	Every keypress will make a clicking sound
Ansi/VT52	If disabled, VT52 personality is used
Auto Xon/off	Use Xon/Xoff as flow control
US/UK	Switch between US and UK keyboard layout
Wrap Around	Characters will flow to the next line at the end of a line
New Line	Pressing ↵ sends CR + LF instead of only CR
Interlace	Enable a *scanline effect*
Parity Odd/Even	Not used
Parity	Not used
Bits 7/8	Not used
Backspace DEL/BS	Send DEL or BS when pressing `Backspace`
Bold is Bright	If bold text is displayed bright
Bold is Thick	If bold text is displayed **thick**
Set ANSI.SYS Compliance	The terminal will be more compatible to DOS `ANSI.SYS`
Set NumLock on Reset	Enable NumLock on bootup

Please note:

- Use keys 7 and 8 to set the baudrate used on the terminal serial port, it is shown in the lower right.

- US/UK switch will replace # with £

- The Ansi/VT52 bit is for VT100 compatibility, as it reacts to ESC[?21 (start VT52 mode) and ESC< (return to ANSI mode, ie. ANSI/VT100 personality). Changing the personality to VT52 disables this bit, all other will enable it.

- The bits for **bold** text are applied to text with the attribute ESC[1m.

- *ANSI.SYS Compliance* makes the cursor go home (ESC[H) on a clear screen request (ESC[2J), and makes some of the lower ASCII characters (between 0x00-0x1F) visible.

3.2.3. Set-Up C

This screen is a VT132 enhancement over the VT100 functionality.
You can also see the version number and the memory utilization (with help disabled).

You can change the following settings:

Key	Function
2	Select codepage (DEC or Codepage 437)
3	Select lines per screen (24, 25 or 30)
6	Toggle ANSI or VGA color palette
7	Set default foreground color
8	Set default background color

Please note:

- Codepage 437 is not available in 132 column mode.

- When switching to 30 line mode, WiFi cannot be started due to memory constraints. Also, if WiFi is already started, 30 line mode is not available (the option toggles between 24 and 25 lines then).

- To set the colors, move the cursor above the desired color on the bottom left of the screen.

- The current default foreground/background color is displayed on the last line of the screen by the word `Default`.

- The current screen size is displayed on the last line of the screen.

3.2.4. Set-Up D

This screen is a VT132 enhancement over the VT100 functionality.

Key	Function
6	Set the keyboard layout
7	Toggle MCS/NRCS
↑ ↓	Change Personality

Please note:

- To change the keyboard layout, move the cursor above the desired label and press 6 .

- When enabling NRCS, certain characters in the lower 127 characters are replaced with country-specific characters according to the selected keyboard layout.

- The current keyboard layout and personality is shown in the last line of the screen.

- Selecting *WordStar/VT100* will enable WordStar cursor movement sequences for the cursor keys instead of standard ANSI cursor sequences *(ANSI/VT100)*.

4. The Modem

4.1. Background

The VT132 modem part is designed to provide a modified Hayes AT compatible command set for connecting over WiFi via TCP/IP sockets with an optional Telnet protocol layer.

- The original AT command set was strictly in upper case. This is because the bit sequence of the ASCII values for A and T have a specific property that enables autobaud detection of the connection to the data terminal equipment (DTE).

- **The modem only responds to AT commands in upper case.**

- Commands are terminated by ⏎ [1] usually generated by the ⏎ (Enter or Return) key on your keyboard.

- Commands can by edited, before pressing ⏎, using ← [2] to erase the previous character entered. You may need to configure the terminal to generate <BS> when you press the ← (backspace) key on your keyboard.

- The AT command processor is based on a finite state machine (FSM). If you type anything that is not recognized by the rules of the FSM you will immediately see an Error message.

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[1]carriage return, Ctrl +M, 0x0D, decimal 13
[2]backspace, Ctrl +H, 0x08, decimal 8

4.2. Communication

4.2.1. Baudrate

To set the baudrate of the modem, press the **Prog** button on the VT132 module. After each press of this button, the modem outputs its new baud rate to the serial port – so you can press this button repeatedly until you can read your baud rate.

4.2.2. Serial Port

To communicate with the VT132 modem, you can use either the pins of the RC2014 extended bus (Rx2, Tx2) or the 6 pin header labelled *Modem Port B*.

See section A.2 on page 25 *(Jumper settings and headers)* for details.

4.3. Modem commands

4.3.1. Standard commands

All commands (except AT by itself, A/ and +++) need to have (uppercase) AT prefixed.

Command	Function
AT	Test, answers OK
A/	Repeat last command (immediate)
$	Show Help
I or I0	Show modem model string
I1	Show firmware version string
I2	Show firmware build chain version string
Z	Modem soft reset
&F	Restore factory defaults (does not store to NVRAM)
&W	Write settings to NVRAM
D*host:port*	Open connection to *host:port*, port defaults to 23
+ + +	Escape from data mode to command mode
O	Return to data mode
H	Hangup
&A	Enable Answer mode
A	Answer an incoming call
S*n*	Select register *n* as current register
?	Query current register
=*r*	Set value of register to *r*
S*n=r*	Set value of register *n* to *r*, eg. S15=1
&K or &K0	Disable RTS/CTS flow control
&K1	Enable RTS/CTS flow control

4.3.2. WiFi commands

Command	Function
+W?	Show WiFi status
+W=*sss,ppp*	Connect to WiFi SSID *sss* using password *ppp*
+W$	Show WiFi IP address
+W#	Show Wi-Fi MAC address
+W+	(Re)connect to WiFi
+W−	Disconnect from WiFi
+B?	Query Baud Rate used on serial port
+B=*n*	Set Baud Rate on serial port (4800, 9600, 14400, 19200, 38400, 57600, 115200)
+T?	Query Telnet TERM environment variable
+T=*ttt*	Set Telnet TERM environment variable

4.3.3. OTA update commands

Command	Function
+U=*url*	Set custom URL to fetch image from
+U?	Query for new version online and show status
+U^	Upgrade to queried version if it is newer
+U!	Force upgrade even if queried version is the same or older
+U$	Show OTA partition status

4.3.4. Enable Telnet mode

Use ATS15=1 to enable Telnet mode.

4.4. S Registers

The modem has a total of 51 S registers, S0 to S50.

Most of them are undefined and unused. The following table lists all defined registers that are used by the VT132 modem part.

Register	Default	Function
S0	0	Number of rings before Auto-Answer (0-255, 0 = never)
S1	0	Ring Counter (0-255 rings)
S14	23	TCP/IP Port for Answer Mode (0-65535)
S15	0	Telnet Protocol for Data Mode (0/1)
S16	3	Negotiate Telnet SGA (0/1/2/3)
S17	3	Negotiate Telnet ECHO (0/1/2/3)
S18	0	Negotiate Telnet BIN (0/1/2/3)
S19	3	Negotiate Telnet NAWS (0/1/2/3)
S20	80	NAWS Negotiate Columns (0-255)
S21	24	NAWS Negotiate Rows (0-255)
S22	3	Negotiate Telnet TERMINAL-TYPE (0/1/2/3)
S39	0	RTS/CTS Flow Control (0/1, set by AT&K)

0/1:   0 - disabled, 1 - enabled

0/1/2/3:   0 - Won't/Don't, 1 - Will, 2 - Do, 3 - Will/Do

4.5. Messages

4.5.1. Dial response messages

The following table shows the responses to the dial command `ATDhost:port`

Response	Reason
NO DIALTONE	no Wi-Fi connection has been established with an AP
ALREADY IN CALL	a connection is already established ('Dialed' or 'Answered') with another host
ERROR	no hostname is provided
NO ANSWER	no socket can be opened to the remote *hostname:port*
CONNECT	a socket connection is opened with *hostname:port*
CONNECT TELNET	a Telnet connection is opened with *hostname:port*

4.5.2. Query Wi-Fi status messages

The following table shows the responses to the **Query WiFi status** command AT+W?

Response	Reason
WIFI NOT STARTED	no Wi-Fi connection has been attempted since power-on or hardware reset
WIFI IDLE	Wi-Fi status is queried during a connection attempt
WIFI NO SSID	no AP with the given SSID/password is found following the AT+W+ or AT+W=...commands
WIFI CONNECTED	connection successful to an AP with the AT+W+ or AT+W=...commands
WIFI CONNECT FAILED	tba
WIFI CONNECTION LOST	lost connection with the AP
WIFI DISCONNECTED	unsuccessful connection attempt, or a successful disconnection with the AT+W- command

4.6. Telnet

4.6.1. Telnet options

The VT132 supports the following Telnet options:

- SGA (Suppress Go Ahead)

- ECHO

- BIN (Binary Transmission)

- NAWS (Negotiate About Window Size)

- TERMINAL-TYPE

Each Telnet Option is negotiated via a request/response exchange described as *Do/Don't* (request) and *Will/Won't* (response). Trying to understand how these work for each Option usually requires reading the RFC and extreme patience and experimentation.

Usually you either want an Option completely **On** (Do/Will) or **Off** (Don't/Won't).

Setting the supported Options and their default values are defined via specific S Registers 4.4 on page 19.

In summary the defaults are:

Option	Default	Description
SGA	Do/Will	Required for the NVT to work character by character and not in linemode
ECHO	Do/Will	tba
BIN	Don't/Won't	To operate as an NVT, binary mode is not required. File transfer protocols like KERMIT and XMODEM do their own binary encoding
NAWS	Do/Will	The remote host can learn your terminal windows size in characters, the default is 80 x 24 set in S20 and S21 respectively
TERMINAL-TYPE	Do/Will	The remote host can learn your terminal type, the default is vt100

The TERMINAL-TYPE must be known by the remote system to be recognised.

When connecting to telnetd on MacOS I use vt100+ from the terminfo database which provides support for color over and above the standard vt100 terminal type, making text applications like htop work as expected and in color.

4.6.2. Enabling Telnet Protocol

Telnet protocol is **not** enabled by default. To enable it, set the S Register S15 to 1 manually:

- Enable Telnet using: ATS15=1
- Disable Telnet using: ATS15=0

The Telnet protocol is applied to both **outgoing** connections 'Dialed' with ATD and **incoming** connections 'Answered' with ATA or Auto-answer.

4.7. **Answer Mode**

Listening for incoming TCP/IP socket connections is **not enabled** by default.

- To **enable** listening for incoming TCP/IP socket connections you must manually enter AT&A to *Enable Answer Mode*.

- Answer Mode will remain enabled, and can only disabled by an ATZ (Soft Reset), hardware reset or power-cycle.

- Incoming TCP/IP socket connections will cause the modem to respond with RING, repeated every three (3) seconds.

- As each RING occurs the Ring Counter in S1 is incremented by one (1).

- The user can *Answer* the incoming call at any time with ATA and the modem will accept the TCP/IP socket connection and enter **Data Mode**.

- If the **Number of rings before Auto-Answer** is set in S0 to a number greater than zero (0 = never) and S1 is greater-then-or-equal to S0 the modem will *Auto-answer*: accept the TCP/IP socket connection and enter **Data Mode**.

- If Telnet protocol is enabled by ATS15=1 then the Telnet Protocol will be negotiated with the remote host after the modem enters **Data Mode**.

- The user can *Hangup* an incoming call by sending the Escape Sequence +++ (with guard times) to return to **Command Mode** and then sending ATH to *Hangup*.

- A Hangup ATH will reset the Ring Counter in S1 to zero (0).

A. Hardware

A.1. Installation

To install the VT132 in an RC2014 or a compatible system, place it in a standard or extended bus socket.

If your backplane does not offer an extended bus, the modem cannot be used via bus pins, instead the modem 6 pin header has to be used. The extended bus pins are not used for other purposes.

On a new VT132, the NVR (Non-volatile RAM) is not initialized.

At power-on or reset, following the **Wait** message, a new VT132 will display **Error** along with a series of bells. This is expected because the NVR has not been initialized. Once you write settings to the NVR, this error should not persist.

A.2. Jumper settings and headers

The board features the following jumpers:

Jumper	Function
JP1 RxA	Connect terminal to port A on bus pins
JP2 TxA	
JP3 RxB	Connect modem to port B on ext. bus pins
JP4 RxB	
JP5 Pwr FTDI	Connect Power to FTDI +5V pin
JP6 Pwr Modem	Connect Power to modem header +5V pin

Enabling JP1 and JP2 is highly advised, as the VT100 terminal serial connection is not available on a 6 pin header.

If you want to provide power to, or take power from either of the 6 pin headers then JP5 and JP6 will provide power or isolate the `Vcc` pin in the `FTDI Program` and `Modem Port B` 6 pin headers respectively.

Warning: You should normally only connect one power source to the system at a time.

FTDI Program		Modem Port B	
Pin	**Function**	**Pin**	**Function**
1	GND	1	GND
2	not connected	2	CTS
3	Vcc (+5V)	3	Vcc (+5V)
4	Tx	4	Tx
5	Rx	5	Rx
6	not connected	6	RTS

If your RC2014 serial module uses the RTS/CTS pins, you can disable JP3+4 and use jumper wires to connect the **Modem Port B** of the VT132 to your serial module, as no bus pins are assigned to RTS/CTS.

The **FTDI Program** header outputs debug messages from the ESP32 microcontroller. You can connect another terminal (or a PC) to watch the debug output. The output uses 115200 baud, 8 data bits, no parity, 1 stop bit (8-N-1).

It is also possible to flash the ESP32 via this header. To enable the *programming mode*, press and hold **Reset**, press and hold **Prog**, release **Reset** and release **Reset**. Another firmware can now be uploaded, eg. via `esptool`.

A.3. Buttons

The VT132 module offers two buttons:

- Reset

- Prog

The hardware **Reset** button on the PCB reboots the ESP32 (EN line reset). This will cause both the VT100 terminal and the modem to reset. Any unsaved settings (terminal and/or modem settings) will be lost.

Note: The computer connected to the VT132 will not be reset, so after the reset, you will be in the same program as before.

The hardware **Prog** button is used to switch the baud rate of the modem. After each press of this button, the modem outputs its new baud rate to the serial port - so you can press this button repeatedly until you can read your baud rate.

B. Firmware Updates

B.1. Over-the-Air Updates

To update the firmware of the VT132 to the latest version, a OTA update function is implemented via modem AT commands (see also in section 4.3.3 on page 18).

You can use a terminal program like QTERM or KERMIT or use the LOCAL mode and talk directly to the modem, see section 2.2 on page 7 for the *Quick Settings Menu.*

To get the latest official version, which is hosted on GitHub, use the following AT commands and steps:

- AT+W+ or AT+W=*ssid , pwd* to join your Wi-Fi network

- AT+U\$ to see what firmware version you are currently running *(optional)*

- AT+U? to query GitHub for the latest firmware image (essential!)

- The answer shows the version number and an indicator to tell if the version found online is [OLDER], [SAME] or [NEWER] than the currently installed version

- AT+U^ to perform the upgrade to the newer version

- *Alternatively:* AT+U! to force the upgrade, if the version found online is older or the same

- During the process of downloading and installing, dots will be output to indicate progress until OK shows that it is finished

- Use AT+U\$ to see what version will be run after the reset *(optional)*

- Perform a hardware reset or power cycle to start the new version

Please note:

Once you have entered the Query OTA Update command AT+U? the VT132 should not be expected to operate "normally" until you perform a hardware reset or reboot of the VT132.

This is because the Query OTA Update command opens and creates a number of files and large data structures in memory that may conflict with normal operation and these can only be closed and released by a hardware reset or reboot.

Security notes:

- OTA Updates from GitHub are performed using the HTTPS protocol.

- Security certificates (Root CA) for GitHub and Amazon S3 (where GitHub stores release binary files) are embedded in the firmware.

- HTTPS requests to servers that use any other Root CA certificate will fail to authenticate.

- The VT132 makes this request as an https client and does not implement an http or https server.

C. Escape-Sequences

The following Escape-Sequences are supported by the VT132 Terminal.

The VT132 in VT100 mode supports sequences from the real DEC VT100, but also some sequences from later models like VT102, VT220, VT510 or VT520.

Also, sequences from VT52 are available in VT52 mode of the VT100 personality (and using the VT52 personality); these are shown at the end.

Furthermore, some sequences that are used by ANSI.SYS (from DOS) are available.

Sequences from other personalities are not shown in this Guide.

C.1. VT100(+) sequences

Sequence	Function
Cursor Movement:	
ESC [*row* ; *column* H	Move cursor to position
ESC [*row* ; *column* f	Move cursor to position
ESC [*n* D	Cursor Backwards
ESC [*n* B	Cursor Down
ESC [*n* C	Cursor Forward
ESC [*n* A	Cursor Up
ESC [*n* d	Move cursor to the indicated row
ESC [*n* G	Move cursor to the indicated column
ESC 7	Save Cursor position and attributes
ESC 8	Restore Cursor position attributes
ESC D	Index (move cursor down or scroll)
ESC E	Move cursor to start of next line
ESC M	Reverse Index
Text insertion / deletion:	
ESC [J	Erase screen from cursor down
ESC [0 J	Erase screen from cursor down
ESC [1 J	Erase screen from cursor up
ESC [2 J	Erase entire screen
ESC [K	Erase line from cursor right
ESC [0 K	Erase line from cursor right
ESC [1 K	Erase line from cursor left
ESC [2 K	Erase entire line
ESC [*n* P	Delete *n* Characters on Current Line
ESC [*n* X	Erase *n* Characters on Current Line
ESC [*n* @	Insert *n* Characters (Spaces)
ESC [*n* L	Insert *n* Lines
ESC [*n* M	Delete *n* Lines

Sequence	Function
Scrolling:	
ESC [*n*; *n* r	Set Top and Bottom line of scroll region
ESC [*n* S	Scroll Up *n* Lines
ESC [*n* T	Scroll Down *n* Lines
Tab stops:	
ESC H	Set tab stop at cursor
ESC [g	Clear tab stop at cursor
ESC [0 g	Clear tab stop at cursor
ESC [3 g	Clear all tab stops
Text Attributes:	
ESC # 3	Double Height Line - Top Half
ESC # 4	Double Height Line – Bottom Half
ESC # 5	Single Width / Single Height Line
ESC # 6	Double Width / Single Height Line
ESC [0 m	Attributes Off
ESC [1 m	Bold or Increased Intensity
ESC [2 m	Dim (Decreased Intensity)
ESC [22 m	Disable Bold and Dim
ESC [3 m	Italic
ESC [23 m	Disable Italic
ESC [4 m	Underscore
ESC [24 m	Disable Underline
ESC [5 m	Blink
ESC [25 m	Disable Blink
ESC [7 m	Inverse
ESC [27 m	Disable Inverse
ESC [8 m	Blank (Invisible)
ESC [28 m	Disable Blank

Sequence	Function
Color:	
ESC [n m	Set Foreground Color (n = 30...37)
ESC [39 m	Set Current Foreground Color as Default
ESC [n m	Set Background Color (n = 40...47)
ESC [49 m	Set Background Color as Default
ESC [n m	Set Bright Foreground Color (n = 90...97)
ESC [n m	Set Bright Background Color (n = 100...107)
Color numbers:	
0	Black
1	Red
2	Green
3	Yellow (Brown)
4	Blue
5	Magenta
6	Cyan
7	White
Selective Erase:	
ESC [1 " q	Protect from Selective Erase
ESC [0 " q	Unprotect from Selective Erase
ESC [2 " q	Unprotect Selective Erase
ESC [? s J	Selective Erase on Screen (like ESC[J)
	s: 0: to end of screen, 1: to top of screen,
	2: whole screen
ESC [? s K	Selective Erase in Line (like ESC[K above)
	s: 0: to left, 1: to right, 2: whole line

Sequence	Function
Switches, x = h / l to enable / disable:	
ESC [4 x	Insert Mode
ESC [20 x	† Line Feed/New Line Mode
ESC [? 1 x	Cursor Keys Mode
ESC [? 2 l	† Start VT52 mode (ESC < returns)
ESC [? 3 x	‡ 132/80 Column Mode
ESC [? 4 x	† Scrolling Mode
ESC [? 5 x	† Screen Mode
ESC [? 6 x	Origin Mode
ESC [? 7 x	† Autowrap Mode
ESC [? 8 x	† Auto Repeat Mode
ESC [? 9 x	† Interlace Mode
ESC [? 12 x	Set Blinking Cursor
ESC [? 25 x	Set Cursor Visible
ESC [? 40 x	Allow switching 80/132 Mode
ESC [? 42 x	NRCS Mode
ESC [? 45 x	Reverse-wraparound Mode
ESC [? 47 x	Use Alternate Screen Buffer
ESC [? 67 x	Backarrow Key Mode
ESC [? 1047 x	Use Alternate Screen Buffer
ESC [? 1048 x	Save/Restore Cursor
ESC [? 1049 x	S/R Cursor and Use Alternate Screen
ESC =	Keypad Application Mode
ESC >	Keypad Numeric Mode

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‡ Controls an option on Set-Up A, see section 3.2.1 on page 10
† Controls an option on Set-Up B, see section 3.2.2 on page 11

Sequence	Function
Set Cursor Style (␣ = Space, 0x32):	
ESC [0 ␣ q	Blinking Block
ESC [1 ␣ q	Blinking Block (default)
ESC [2 ␣ q	Steady Block
ESC [3 ␣ q	Blinking Underline
ESC [4 ␣ q	Steady Underline
ESC [5 ␣ q	Blinking Bar
ESC [6 ␣ q	Steady Bar
ESC c	Reset (like Power Cycle)
ESC [!	Soft Terminal Reset
ESC # 8	Screen Alignment Display (fill screen with *E*s)
ESC ␣ F	Send C1 Control Character as 7-Bit Escaped Characters
ESC ␣ G	Send C1 Control Character as 8-Bit Characters
ESC [x ” p	Select Conformance Level[1]
Select Character Set:	
ESC (A	G0 - Unitied Kingdom Set
ESC (B	G0 - ASCII Set
ESC (0	G0 - Special Grapahics
ESC (1	G0 - Alt Standard Character Set
ESC (2	G0 - Alt Special Graphics
ESC) A	G1 - Unitied Kingdom Set
ESC) B	G1 - ASCII Set
ESC) 0	G1 - Special Grapahics
ESC) 1	G1 - Alt Standard Character Set
ESC) 2	G1 - Alt Special Graphics
ESC * n	Select Character Set G2 (n = A,B,0,1,2)
ESC + n	Select Character Set G3 (n = A,B,0,1,2)

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[1]For details, see VT510 manual: `https://www.vt100.net/docs/vt510-rm/DECSCL.html`

Sequence	Function
Terminal Query Sequences:	
ESC [6 n	Request Cursor Position
ESC [*row* ; *column* R	*To Host:* Cursor Position Report
ESC [5 n	Request Operating Status
ESC [0 n	*To Host:* Terminal in good operating condition
ESC [3 n	*To Host:* Terminal has a malfunction
ESC Z	Identify Terminal
ESC [c	Query Device Atttibutes
ESC [0 c	Query Device Atttibutes
ESC [? 1 ; *n* c	*To Host:* Device Attributes
	VT132 will reply: ESC [? 64 ; 1 ; 6 ; 22 c
	64 = class 4 device, 1 = 132 columns,
	6 = Selective Erase, 22 = ?

C.2. VT52 sequences

These VT52 sequences are available in VT100 mode:

Sequence	Function
ESC A	Cursor Up
ESC B	Cursor Down
ESC C	Cursor Right
ESC D	Cursor Left
ESC F	Enter Graphics Mode
ESC G	Exit Graphics Mode
ESC H	Cursor to Home
ESC I	Reverse Line Feed
ESC J	Erase to End of Screen
ESC K	Erase to End of Line
ESC Y *row column*	Move cursor to position
ESC Z	Identify
ESC / Z	*To host:* response
ESC =	Enter Alternate Keypad Mode
ESC >	Exit Alternate Keypad Mode
ESC <	Enter ANSI Mode

C.3. ANSI.SYS sequences

Sequence	Function
ESC [s	save cursor state (position and attributes)
ESC [u	restore cursor state (position and attributes)