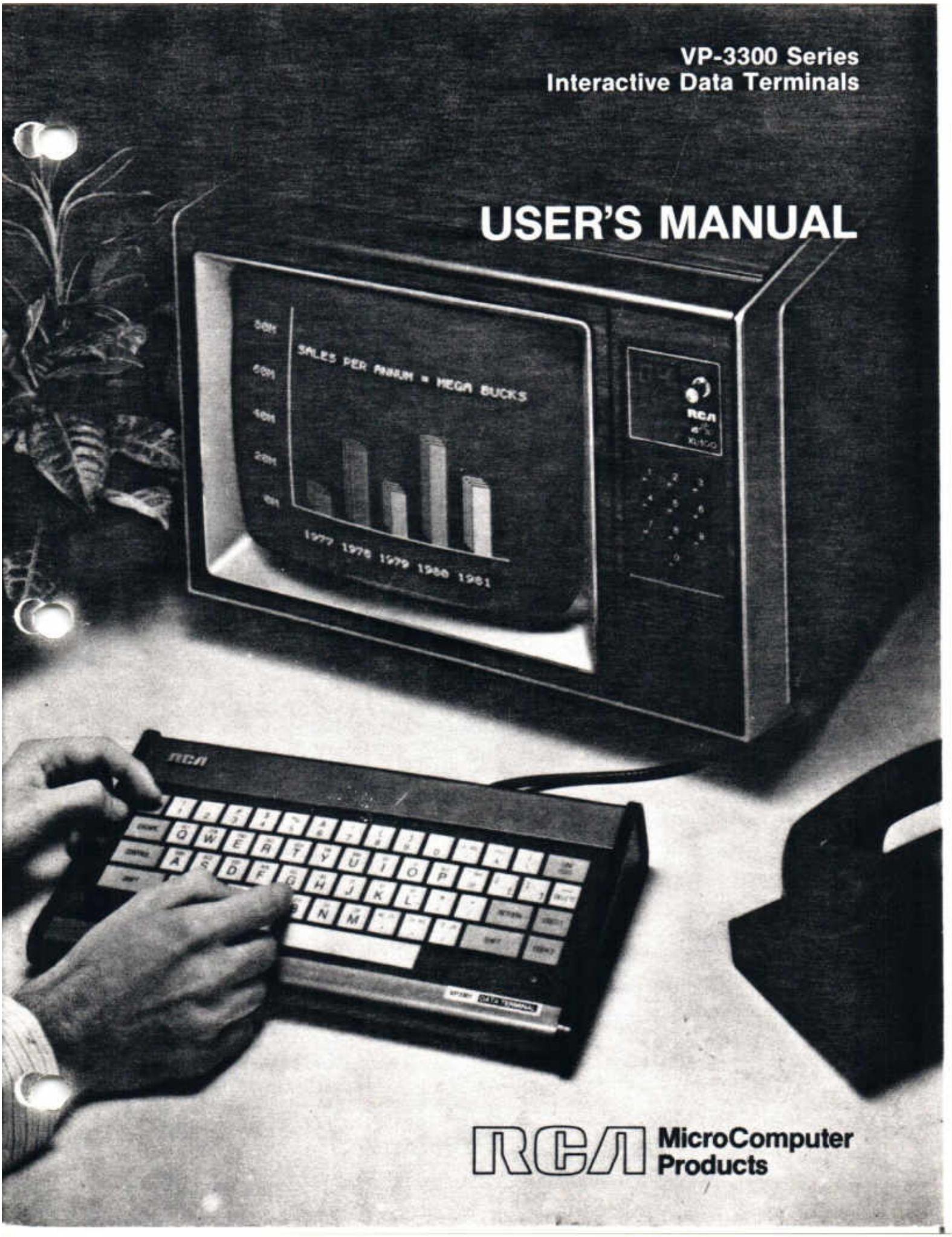
VP-3300 Series
Interactive Data Terminals

USER'S MANUAL



RCA MicroComputer Products

VP3300 SERIES
INTERACTIVE DATA TERMINAL
USER'S MANUAL

RCA MicroComputer Products
New Holland Avenue
Lancaster, PA 17604
USA

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71L296/VP-300

NOTICE

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with these instructions, may cause interference to radio and television reception. It has been tested and found to comply with the limits for a computing device in accordance with the specifications in Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient the receiving antenna.

2. Move this equipment, or the device this equipment is attached to, away from the receiver.

3. Plug the power source for this equipment into a different outlet so that the power source and receiver are on different branch circuits.

4. If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions.

The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

The VP3301 Interactive Data Terminal has been type tested as a Class B computing device in accordance with Subpart J of Part 15 of the FCC Rules.

The VP3303 has been approved by the FCC as a TV Interface Device.

CONTENTS

SECTION 1

FEATURES

Features of the VP3300

The VP3300 series of Interactive Data Terminals (including the VP3301 and VP3303) are professional quality terminals suitable for a wide variety of industrial, educational, business and personal applications requiring interactive communication between computers and users. Microprocessor intelligence and LSI (Large Scale Integration) video control circuitry bring performance, features and flexibility at low cost.

This versatile terminal can be interconnected with standard RS-232C modems for communication across ordinary telephone lines. The VP3300 is compatible with most time-sharing and data base computer information networks, which provide a wealth of information and computing power beyond imagination.

The character display format for the VP3300 is 40 characters by 24 lines, or 20 characters by 12 lines, both software controllable. Each, or all, characters may be displayed in one of eight colors (or eight levels of brightness on a B/W display). The display background may be one of eight colors (or eight levels of brightness on a B/W display). There are 128 resident displayable characters, or the characters can be redefined - Greek letters and other foreign alphabets, graphic symbols, graphic building blocks, playing card suits, unique character fonts, and even "little green men". Reverse video feature creates visual emphasis on single or multiple character, words or lines.

The VP3300 communications interface is industry standard asynchronous RS-232C or 20mA current loop, with six switch selectable baud rates. Switch selectable configuration control includes: line/local, upper case only, full/half duplex, data word formatting, display resolution default, plus two control code options.

A built in tone generator, used for aural keypress feedback, can be programmed for an end of line bell, error indication, or even music! The VP3300 even has a programmable white noise generator which allows unusual sound effects like explosions to be created.

The VP3300 utilizes modern flexible-membrane key switches, with a light positive activation pressure. A finger positioning overlay combined with the positive keypress action provides a natural operator feel. The unitized keyboard surface is impervious to liquids and dust particles, and CMOS circuitry provides high noise immunity, making the VP3300 particularly suitable for use in hostile environments.

The VP3381 has base-band video output which can be connected directly to a 525 line color or black and white video monitor. An RF modulator can be used for connection to a standard color or black and white TV set.

The VP3383 has an RF modulator video output, in addition to a base-band output, which allows it to be played through a conventional black and white or color television receiver.

SECTION 2

SPECIFICATIONS

VP3300 SPECIFICATIONS

KEYBOARD

Format: 58-key typewriter format - includes two user keys (switch closures).

Key Switches: Flexible membrane, polycarbonate material.

Rollover: Two key.

User Keys: Two SPST, normally open, momentary switches (30V, 0.1A, 1W max.).

Key Life: Greater than 5-million operations.

Audio: Provides aural keypress feedback. Also provides bell and error indication. Programmable frequency and amplitude. White noise also available.
VP3301: Built in speaker, adj. level, on/off switch.
VP3303: Uses television speaker. Also has external audio output.

Code: ASCII (American Standard Code for Information Interchange).

Character Set:
Standard Upper/Lower Case - 128 codes generated:
95 printable characters
33 control characters

Upper Case Only (Switch Selectable) - 102 codes generated:
69 printable characters
33 control characters

Break Key: Causes continuous transmission of binary state zero.

DISPLAY

Screen Format: Software selectable, 24 lines of 40 characters or 12 lines of 20 characters, one page of data. Switch selectable default.

Character Font: 5 x 6 dot matrix in a 6 x 8 character block, descenders for lower case.

Resident Character Set: 52-upper and lower case alphabetic characters, 10-numerals, 32-punctuation and math characters,

32-control characters (Switch selectable control character display for programming convenience).

User Definable Characters: Any character can be user defined as a 6 x 8 bit pattern through a command control sequence. A maximum of 128 characters may be defined at any given time.

Cursor: Blinking reverse video. May be set to non-blinking or turned off with a control command sequence.

Reverse Video: Single control characters, or command control sequences, turn reverse video on and off permitting one or multiple character, word or line reverse images.

Character Color/Intensity: Choice of 8 colors or 8 levels of brightness.

Background Color/Intensity: Choice of 8 colors or 8 levels of brightness.

Video: Composite color video signal, NTSC compatible. 1.0v p-p into 75-ohm termination.
Video Connector - VP3301, RCA phono plug (female).
VP3303, 5-pin DIN plug (female).

RF Output (VP3303): NTSC compatible signal. 75 ohm impedance. Antenna isolator box with 75 to 300 ohm balun supplied. RCA phono plug (female) connector.
Video carrier - 61.25 MHz, Channel 3
67.25 MHz, Channel 4

USER CONTROL

Switch Selectable: Baud rate, current loop/RS-232C, line/local, upper case only, full/half duplex, parity bit selection, 1 or 2 stop bits, control execute ON/OFF, control display ON/OFF, screen format default.

Control Characters: Backspace (BS), downline (LF), upline (VT), forespace (NAK), return (CR), horizontal tab (HT), bell (BEL), clear screen (FF), home (SUB), reverse video on (SI), reverse video off (SO).

Command control Sequences: Character color or brightness, background color or brightness, locate cursor, clear to end of screen, clear to end of line, define character bit pattern, keyboard ON/OFF, display format, cursor ON/OFF/BLINK, display ON/OFF, tone generation, noise generation, define command delimiter (ESC is default), keyboard tone ON/OFF, line color, literal character implant, backspace, downline, upline, forespace, clear screen, home, reverse video ON/OFF/LINE.

INDICATORS

Clear to Send: LED on when "clear to send" is true, acts as power on indicator when "clear to send" not used.

Bell: Audible tone.

Error: Beeping audible tone indicates input overrun.

DATA FORMAT - TRANSMIT

Method: Asynchronous; serial by bit; serial by character.

Code: ASCII; 1 start bit, 7 data bits, 1 parity bit (odd, even, mark or space), 1 or 2 stop bits.

Mode: Switch selectable half or full duplex, line/local operation.

EIA Data Rate: 110, 300, 1200, 4800, 9600, 19.2K baud; switch selectable.

CL Data Rate: 110, 300, 1200 baud; switch selectable.

Control Signals: Request to send (output signal), clear to send (input signal), EIA RS-232C compatible.

DATA FORMAT - RECEIVE

Method: Asynchronous; serial by bit, serial by character.

Code: ASCII; 1 start bit, 7 data bits, 1 parity bit - ignored, 1 or 2 stop bits.

Mode: Switch selectable.

EIA Data Rate: 110, 300, 1200, 4800, 9600, 19.2K baud; switch selectable (Clear to receive signal must be used for data rates greater than 1200 baud).

CL Data Rate: 110, 300, 1200 baud, switch selectable.

Character Rate: 500 characters per second max.

Control Signals: Clear to receive (output signal), EIA RS-232C compatible.

COMMUNICATIONS INTERFACE

EIA: RS-232C compatible, -12V to +12V nominal output signal voltage.

Current Loop: 20mA to 60mA max, voltage capability of 30V max.

Mode: EIA or CL, switch selectable.

Connector: 25 pin, female, subminiature "D" type.

PHYSICAL

Size: 13.1" L x 7" D x 2" H.

Shipping Weight: 5 lbs. approx.

POWER

Input: 8.3V DC @ 900mA nom. from included 120V, 60 Hz wall receptacle type power supply.

Switch: Power ON/OFF.

ENVIRONMENTAL

Temperature:
  Operating: 0 to 50 degrees C.
    (Power Supply: 0 to 30 degrees C.)
  Storage: -40 to +85 degrees C.

Humidity: 90% RH @ 30 degree C, non-condensing.

Vibration: 3-axes:
  .3" p-p, 5 to 14 Hz
  3g. 14 Hz to 2K Hz

Shock: 3-axes: 50g. 11 m sec, 1/2 sine wave.

SECTION 3

INSTALLATION and TURN ON PROCEEDURE

Installation and Initial Turn On

INTERCONNECTIONS

1. With the power off (push-button power switch out), plug the power connector into the terminal power socket and plug the power transformer into a 110v A.C. outlet.

2. Video Hookup: Determine your desired system configuration and follow the appropriate guidelines.

   A) RF Television Signal (VP3303 Only) - See TV INTERFACE CONNECTION instructions.

   B) Direct Video (VP3301 or VP3303) - Using a user supplied video cable, connect the terminal's video output (phono plug for VP3301, 5-pin DIN for VP3303) to a 525 line color or black and white video monitor. See SECTION 7 for wiring details.

3. Connect the interface cable from the computer, modem or other device to the COMPUTER INTERFACE connector on the terminal. The interface cable connector should be a male, 25-pin "D"-type (VP-626 or equivalent). See SECTION 7 for details on INTERFACING the VP3300.

4. Set the configuration switches for the desired terminal configuration. See SECTION 6 on CONFIGURATION SWITCHES for more information.

5. Turn the terminal on by pushing the power switch in.

6. Within a few seconds, a blinking cursor should appear in the upper left hand corner of a blank video screen.

7. The terminal is now ready for operation. Consult the following sections of this manual for specific operating details.

TV INTERFACE CONNECTION (VP3303)

IMPORTANT NOTICE

The VP3303 has been FCC approved as a TV Interface Device. Installation and use other than described within this manual may violate certain FCC regulations.

CONNECTING the VP3303 to a STANDARD TV SET

The VP3303 is equipped with an RF modulator which allows the video information generated to be displayed on Channel 3 or Channel 4 of a standard black and white or color television receiver by connecting directly to the television's antenna terminals.

Before you make the antenna connections read this important word of caution.

Please follow antenna connection instructions carefully. If you connect the output of the Modulator directly to an antenna or make parallel antenna and Modulator output connections at the antenna terminal of your TV it may broadcast a signal. Broadcasting an unauthorized signal could violate certain regulations of the Federal Communications Commission regarding the operation of TV interface devices. So check and recheck your connections against those in the diagrams that follow.

Your VP3303 is provided with an antenna isolation switch box (see Figure 3-1). It does two things - isolates your tv antenna from the VP3303's RF signal, and it allows you to select either the terminal or your antenna as the input for your television receiver.

If you do not wish to receive normal TV broadcasts on the television set that is being used for the VP3303 display, follow the instructions in connection GUIDE 1. If normal TV reception is desired, use connection GUIDE 2, 3 or 4 depending upon your present antenna connection configuration. See the following series of diagrams to determine the best connection hookup for your particular

television and antenna combination.

NOTE: If your television set is used on a subscription cable system, consult your cable company for installation assistance.

After the VP3303 has been attached to the television receiver and the power has been applied, set the Channel Select switch on the rear of the terminal to CH 3 and tune the TV set to Channel 3. Fine tune the television receiver, if required, and note the quality of the video picture from the VP3303. Next, set the Channel Select switch of the VP3303 to CH 4 and the TV set to Channel 4. Again note the picture quality. Determine which channel provides a better picture and leave the switch in that position. It should not be necessary to change the switch setting again, unless the system is moved to another location.

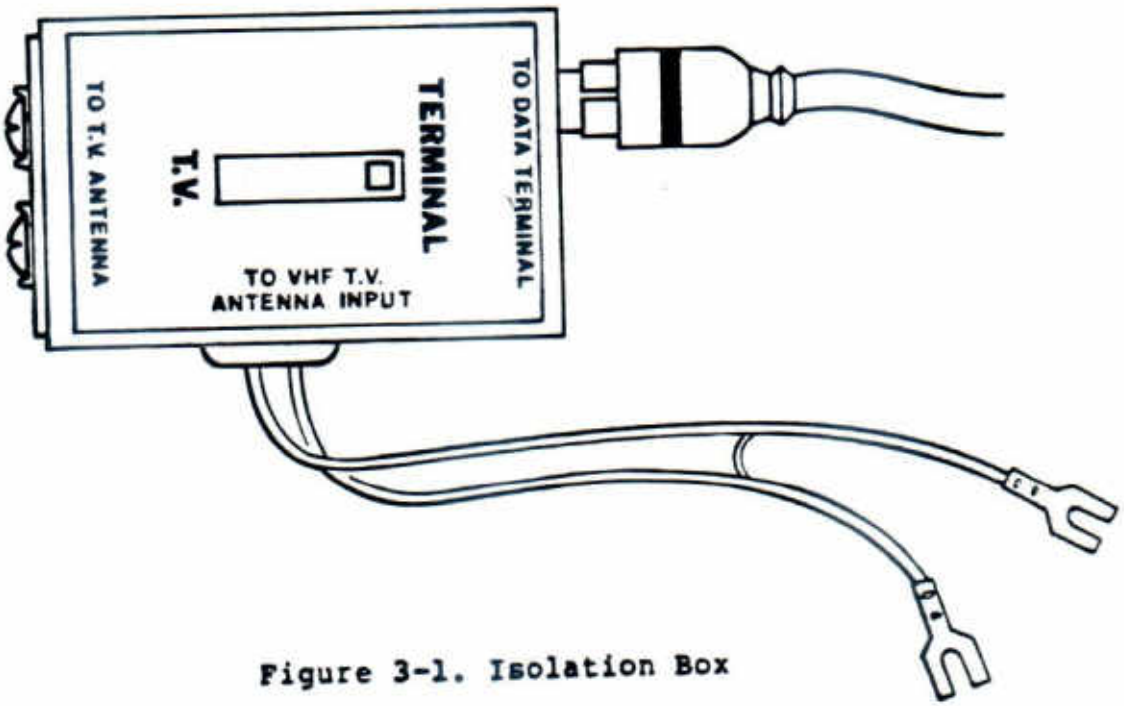
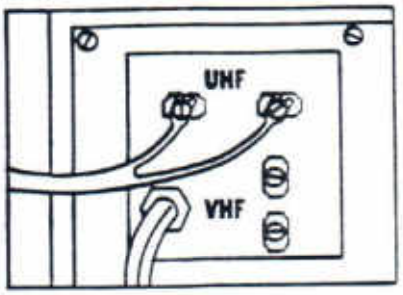


Figure 3-1. Isolation Box

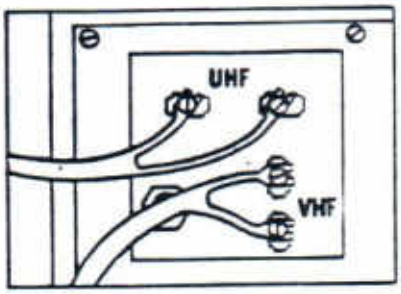
ANTENNA CONNECTIONS:

There are various kinds of antenna hook-ups. Look at the back of your TV set to see what kind you have. Then compare it with the following diagrams to determine which installation Guide(s) you'll need to use.

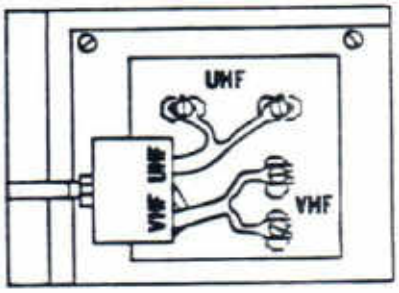
If your outside antenna is connected to your TV set with a 75 ohm (round) cable: follow GUIDE 2.



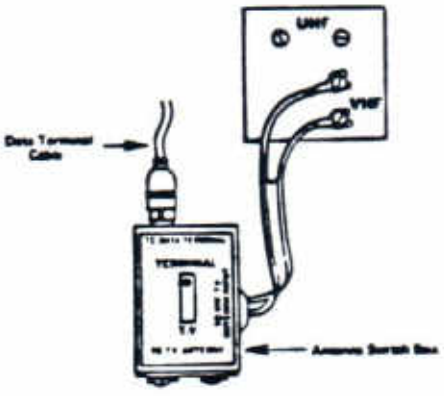
If your ouside OR indoor antenna is connected to your TV set with a 300 ohm (flat) twin-lead cable: follow Guide 3.



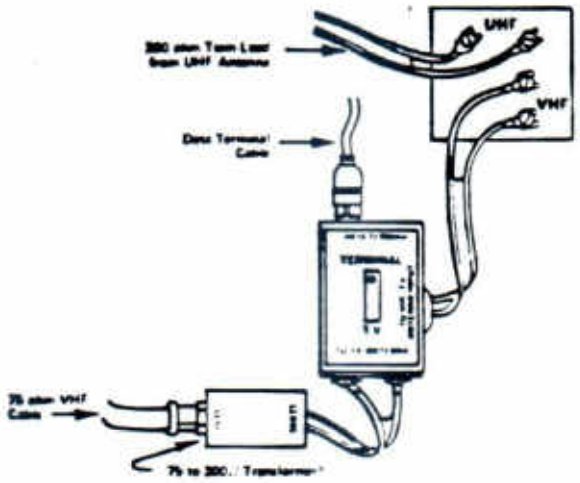
If your outside antenna uses a Signal Splitter to provide VHF and UHF inputs from a 75 ohm (round) cable to the 300 ohm antenna terminals of your TV set: follow GUIDE 4.



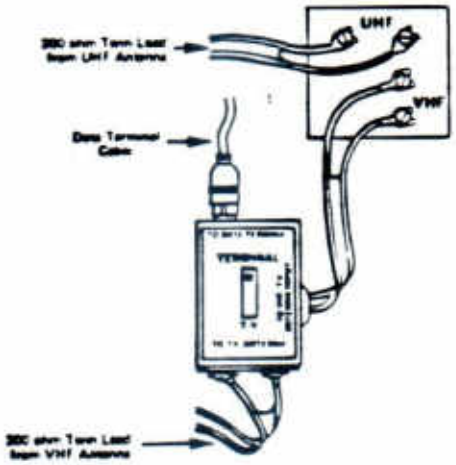
GUIDE 1: Data Terminal Only - No Reception of Television Broadcasts.



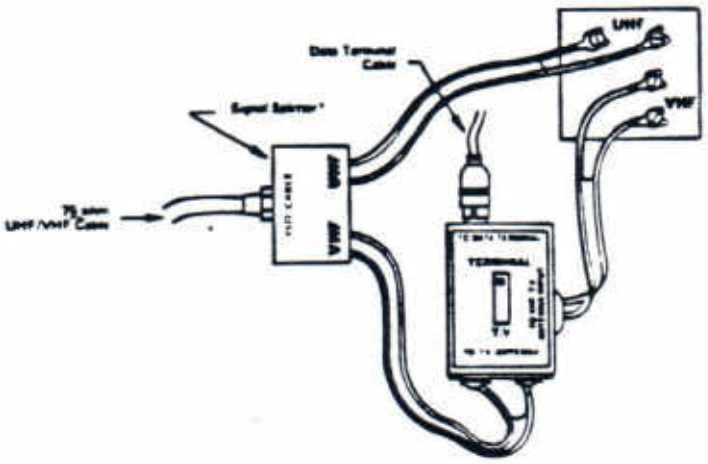
GUIDE 2: 300 ohm UHF Twin-Lead, 75 ohm VHF Cable.



GUIDE 3: 300 ohm UHF and VHF Twin-Lead Cables.



GUIDE 4: Single 75 ohm UHF/VHF Cable.



VIDEO IMAGING PROBLEMS

The VP3300 terminal is designed to generate a rectangular video image which will fill most of the display screen. The horizontal and vertical adjustment controls on the video display unit should be used to center the video image.

Depending upon the condition of the video display unit, it may not be possible to perfectly center the image, or certain areas of the video display may appear distorted. If these conditions seem severe, consult a qualified service technician to correct the problems.

SECTION 4

DATA TERMINAL PRIMER

A VP3300 Data Terminal Primer

The VP3300 is an Interactive Data Terminal (IDT) which can be used for the input and output of information to and from a computer.

VP3300 vs a Teletypewriter

In the early days of computers, the most common type of data terminals were electromechanical teletypewriters. Information was entered into the computer by an operator typing at its mechanical keyboard. As data characters were entered, the teletypewriter transmitted them to the computer and noisily printed them mechanically on paper. When the computer sent data to the teletypewriter, it was printed, again noisily on paper.

Similar to a teletypewriter, but far more advanced, the VP3300 has a flexible membrane keyboard from which the operator can enter data and information into a computer. However, instead of having a mechanical printer which types the information on paper, the VP3300 contains sophisticated circuitry that allows it to display the information electronically on a video CRT (Cathode Ray Tube) screen. The noise and mechanical problems inherent in the earlier devices have been completely eliminated, forever!

The VP3300 has many advantages:

Faster-- The new flexible membrane keyboard on the VP3300 allows easy and fast data entry. Also, the VP3300 can receive data from the computer at rates of up to 1920 characters per second.

Quieter-- The VP3300 has no mechanical parts that produce noise. Its operation can be made as silent as the operator desires.

Smaller-- The VP3300's small size makes it ideal for use in places and applications where other terminals would never fit. By designing a terminal which is separated from its video screen, freedom of placement and portability have been achieved.

Dependable-- There are no moving parts on the VP3300, except some of the configuration and mode switches. The flexible membrane keyboard is dust and water proof, providing maintenance free operation even in hostile environments, and the VP3300 contains solid state circuitry to ensure reliable operation.

Considering all of these advantages, the VP3300 represents one of the most modern solutions to the data entry and information display demands of today. The VP3300 is an efficient, dependable, portable terminal that has been developed with maximum convenience in mind for the operator.

How the VP3300 Works

To gain an understanding of how the VP3300 works, it can be broken down into five main functional units as illustrated in the following diagram:

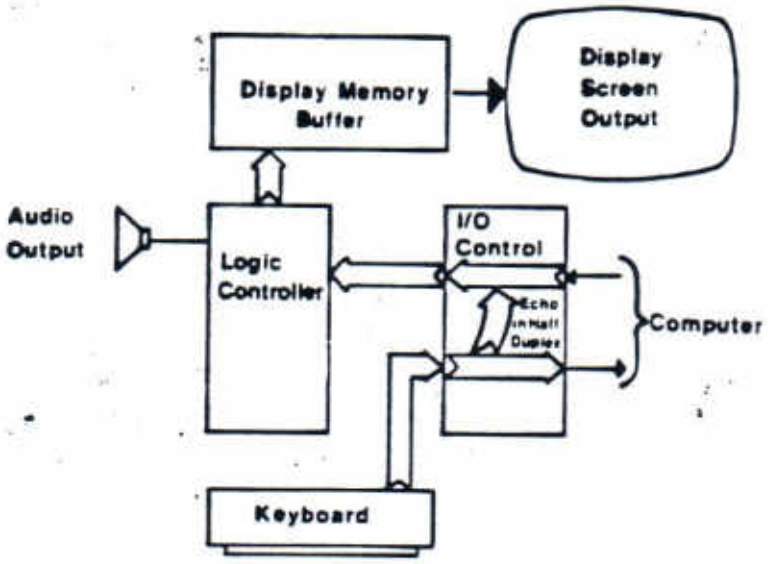


Figure 4-1. VP3300 Block Diagram

Keyboard-- The keyboard on the VP3300 is arranged similarly to that of a standard typewriter. There are keys for alphabetic and numeric characters, keys for punctuation and symbolic characters, plus some special keys for computer controls. Whenever a key is pressed, the VP3300 generates a representation of the character in an electronic code (ASCII code), which is understood by both the VP3300 and the computer to which it is attached. After the code has been generated, it is sent to the VP3300's Input/Output Controller where, depending upon the configuration mode, it is sent to either the computer or the VP3300's Logic Controller, or both.

Input/Output Controller-- The Input/Output Controller is the section of the VP3300 which interfaces or links the flow of information and data back and forth between the VP3300 and computer.

There are three major modes of Input/Output operation. In the LOCAL mode, the VP3300 is linked only to itself. This mode allows the terminal to be operated locally without communicating to a computer, and can be used to experiment with and learn about the VP3300's features.

In the LINE mode the VP3300 is linked to the computer. If in the FULL DUPLEX mode, all characters typed on the keyboard are transmitted by the Input/Output Controller to the computer. The computer should echo the characters back to the terminal, which then are sent to the VP3300's Logic Controller for processing. In the HALF DUPLEX mode, the Input/Output Controller sends the characters to the computer, but unlike the FULL DUPLEX mode, they are sent directly to the Logic Controller of the VP3300.

Logic Controller-- The VP3300's central processing takes place in the Logic Controller section. This section receives character data from the Input/Output Controller and interprets them as either special control functions or as information to be displayed on the video screen.

Display Memory Buffer-- The VP3300 has an internal buffer memory where the data and information for display on a video screen are stored. This buffer can hold up to 960 characters for text and graphic displays. Part of this Display Memory Buffer is used to provide the color and reverse video features of the VP3300.

Display Screen Output-- The video output of the VP3300 allows users to determine the most suitable display device for their applications. The information contained in the Display Memory Buffer is transmitted to a video screen where it is continuously displayed by an electronic beam. Depending upon the type and quality of the video device, the VP3300 can provide sharp and clear alphanumeric characters and symbols, along with detailed graphic images in full color. The VP3300 can display either 24 lines of 40 characters each or 12 lines of 20 characters, under the control of user applications and requirements.

Commmunications interfaces:

The VP3300 has been designed to accept the two most common industry-standard communication interfaces, so it can be used with nearly all computer systems. The user can select between either the 20mA current loop or the EIA RS-232C standard interface, depending upon system requirements. These communication standards allow the

VP3300 to connect directly to computers in local installations, or to communicate over telephone data networks to distant computers using a modem or acoustic data coupler.

Selectable Data Transmission Rates

Because of the differing data communication requirements of computer systems, the VP3300 can be operated at various baud rates. In the EIA mode, the available baud rates are 110, 300 and 1200 without communication hand-shaking, or 4800, 9600 and 19200 baud with hand-shaking. In the 20mA current loop mode, the VP3300 can operate at 110, 300 and 1200 baud. The various baud rates can be selected by setting switches on the VP3300's convenient configuration panel.

The Cursor

The VP3300 has a special display block referred to as the CURSOR location. When power is applied to the VP3300, the cursor will appear as a blinking bright box in the upper left-hand corner of the display screen (called the HOME position). The cursor indicates the active screen location, where the next character or graphic element will be displayed. As characters are entered into a line, the cursor moves towards the right, always indicating the location that will receive the next character. If the cursor is placed on top of an existing character, the character will appear in reverse video image.

When the last position on a line is reached, the cursor will automatically advance to the first location on the next lower line. When the bottom line of the display has been filled, the entire screen will SCROLL one line upwards, and the cursor will be positioned in the first location of the new last line. Data which has been scrolled off the top of the screen will no longer be displayed by the VP3300.

Certain special control codes, sequences, or keys can be used to move the cursor around to any desired location on the display screen. These commands are non-destructive in that as the cursor moves about, the characters it may move over are not destroyed.

The RETURN key positions the cursor at the first character location on the current line. The key marked LINE FEED causes the cursor to move to the next lower line, remaining in the same character position.

Through use of the FORESPACE and BACKSPACE control functions, the cursor can be moved along lines, one character location at a time. If the cursor is backspaced

past the first location of a line, it will be moved to the last position of the previous line. Similarly, if the cursor is forespaced beyond the last position on a line, it will be moved to the first location on the next line.

The cursor can be moved upward and downward from line to line with the UPLINE and DOWNLINE control functions. The upline function will move the cursor upward one line at a time. When the cursor reaches the top line of the display, it will WRAP-AROUND to the bottom line. The downline control function acts like a LINE FEED, which causes the cursor to move downward one line, until the last line is reached, at which time the entire screen will scroll upward one line.

The cursor is also positioned with the HOME and CLEAR screen commands. Home and clear both cause the cursor to be returned to the first location on the first line, but in addition, CLEAR causes the display screen to be filled with space characters.

The VP3300 also has the ability to access any screen location through direct control of cursor addressing. This feature allows complete control over the positioning of characters and graphics for use in a wide variety of applications.

SECTION 5

OPERATING INSTRUCTIONS

KEYBOARD OPERATION

The VP3300 terminal keyboard is used to enter data for transmission to an external computing device. Each key has an ASCII code assigned to it that is generated when the key is pressed. The VP3300 also has an auto-repeat feature that will rapidly resend each character if its key is held down for longer than a second.

NOTE

Whenever typing on the keyboard (except in LOCAL MODE) the code generated is transmitted from the VP3300. However, depending upon the configuration mode (either FULL or HALF DUPLEX) the characters may not appear on the video screen unless they are ECHOED back by the controlling device.

The display generator of the VP3300 contains character representations for all 128 ASCII codes. However, depending upon the settings of the configuration switches, only some of these characters may actually be displayed on the video screen. Refer to SECTION 6 on CONFIGURATION SWITCHES for more details.

SPECIAL FUNCTION KEYS

Some of the keys on the VP3300 have special functions associated with them. Instead of displaying a character when they are pressed, they provide certain control features which make using the VP3300 easy.

RETURN Key

When this key is pressed, a code is generated that causes the cursor to move to the first location on the current line. Many computer systems and programs use this RETURN code to indicate that a user has completed the entry

of information, which then is available for processing by the computer. Sometimes you may see reference to an ENTER key, but the RETURN key has the same function on the VP3300.

LINE FEED Key

This key causes the cursor to move downward on the screen to the next line. The information on the screen will remain stationary until the last line on the screen is reached. At this point the screen will scroll upward one line and the cursor will be positioned in the same location on a new bottom line.

SHIFT Keys

The SHIFT keys on the VP3300 act similarly to the shift keys on standard typewriters. By pressing either SHIFT key along with any other key, the upper case alphabetic character will be generated. On keys with alternate characters, the upper one will be chosen.

NOTE

When the UC/U&LC switch is set to the UC only position, the SHIFT keys will have no effect on alphabetic characters, the shifted (capitalized) characters will always be generated. For other non-alphabetic keys, the SHIFT keys always works as explained above.

DELETE Key

When this key is pressed, the VP3300 generates a non-displayable code, and the video screen will not be effected. This DELETE fuction (sometimes referred to as RUBOUT) is often used as a delete previous character command for computers. If the SHIFT key is pressed along with this key an underline code is generated.

SPACE Bar

The space bar along the bottom of the keyboard causes a space code to be generated and a space character will be displayed on the video screen.

CONTROL Key

This key is used simultaneously with other keys to generate control codes which are used to send special commands back and forth to the computer or auxiliary device. These special commands will be explained in detail later under the heading CONTROL COMMANDS.

ESCAPE Key

The ESCAPE key generates a special control code which has specific functions depending upon the computing device to which the VP3300 is connected. This code can also be used to initiate a series of special VP3300 features which are discussed in the CONTROL COMMANDS part of this section.

BREAK Key

When this key is pressed an interrupt condition is generated and is sent to the computer.

NOTE

As long as the BREAK key is held down the BREAK condition will be generated. If it is held down for an extended period, the computer may disconnect from the VP3300.

USER Keys

These keys provide switch contacts that can be connected to various devices or used to create unique system configurations. See the part of SECTION 7 pertaining to USER KEY HOOKUP for more detailed information.

CONTROL COMMANDS

The VP3300 has many special features and functions which can be regulated through the use of CONTROL CODES (CTRL) or ESCAPE (ESC) command sequences. These commands allow the VP3300 to be controlled by either the keyboard or external computer, enabling dynamic utilization of the various operating modes.

Some of the commands require supplemental parameters in order for their particular features to be implemented. If incomplete or invalid commands are given, the VP3300 will abort the attempt to decipher the command and return to displaying data on the video screen.

The following descriptions will show the command formats and explain the necessary parameters when they are required.

- - -

NOTE: In this section certain syntax conventions apply for the commands listed. The command formats illustrated contain spaces only for ease of understanding. DO NOT INCLUDE SPACES IN ACTUAL USE. Also, special characters have been used to represent certain types of command parameters and arguments. A 'c' stands for any valid ASCII character. A 'd' refers to any ASCII decimal digit (0-9). And an 'h' is used to represent any ASCII hexadecimal digit (0-9, A-F). If you are unfamiliar with BINARY numbers and HEXADECIMAL notation, you should consult APPENDIX A dealing with these topics to clarify the information presented in this part.

Particular attention should be placed on whether the commands require upper or lower case characters for valid recognition. For the ESC command sequences, upper or lower case characters must be used as indicated or else errant operation will occur.

The CTRL commands are valid for both the upper case only and the upper/lower case modes of operation on the VP3300. It is not necessary to use the SHIFT key in order for them to function properly. See APPENDIX E for a chart detailing all of the control codes generated by the VP3300 for various key press combinations.

- - -

OPERATING MODE COMMANDS

This group of commands enables control over the main operating modes of the VP3300.

```
Display  OFF = ESC ESC D 0
         ON  = ESC ESC D 1
```

The VP3300's display can be turned on or off by command. This command can be useful in applications where it is desireable to turn the video screen off, fill the display with data, and then turn the screen back on to present the information all at once.

```
Resolution  LOW (20 x 12) = ESC ESC R 0
            HI  (40 x 24) = ESC ESC R 1
```

The VP3300 video resolution can be controlled through program command. In the HI-RES mode the video sceen contains 40 characters on 24 rows for an effective dot resolution of 240 dots horizontal by 192 dots vertical. In the LOW-RES mode there are 20 characters on 12 lines giving an effective dot resolution of 120 by 96.

```
Reverse Video  OFF = ESC ESC S 0
               ON  = ESC ESC S 1
          SO (OFF) = CTRL/N
          SI (ON)  = CTRL/O
```

In addition to the normal character display mode, the VP3300 has the ability to create reverse video images. This feature allows the creation of contrasting screen areas, which can be used to highlight and draw attention towards sections of the video display. When reverse video is enabled, it remains in effect until another command is given to turn it off. Thus, through use of this command it is possible to turn reverse video on for single or multiple character, words, or lines of information.

In addition to ESC sequences, the reverse video feature of the VP3300 can be manipulated with CTRL codes. The SI command causes reverse video to be enabled, and the SO command turns reverse video off.

Keyboard OFF = ESC ESC K 0
ON = ESC ESC K 1

The keyboard on the VP3300 can be turned on or off under program command, giving control over expected input and preventing unwanted BREAK conditions from interrupting program execution.

NOTE

If the keyboard ever becomes locked off when input is desired, switching into LOCAL mode will allow entering the command sequence manually to turn it back on. Then switching back to LINE mode should return control to the program.

Define Command Delimiter = ESC ESC X c

This command was included in the VP3300 to enable system freedom and flexibility. On some systems and in some applications the ESC command may not be suitable as a control sequence character. By using this command, any appropriate ASCII control code (except CR, LF, and BEL) can be used to replace the ESC for command sequence control. The c should be the valid ASCII control code desired.

CURSOR MANIPULATION COMMANDS

These commands allow the cursor to be controlled and moved around the video screen.

Cursor OFF = ESC ESC C 0
ON = ESC ESC C 1
NO-BLINK = ESC ESC C 2

This command allows the cursor to be turned off, turned on to blink, or turned on non-blinking. This ability to control the cursor's mode can be used to satisfy user preference and needs in special applications.

Backspace = ESC D
BS = CTRL/H

This command moves the cursor position non-destructively one character to the left. If the cursor is backspaced past the first location on a line, it will be placed in the last position of the previous line.

Forespace = ESC C
NAK = CTRL/U

This command causes the cursor to be moved one position to the right non-destructively. If the cusor is forespaced past the last location on a line, it will be placed on the first position of the next line.

Upline = ESC A
VT = CTRL/K

This code causes the cursor to move one line upward non-destructively. If the cursor position is on the top line, this command will cause the cursor to wrap-around to the bottom line.

Downline = ESC B
LF = CTRL/J <LINE FEED>

The cursor position is moved down one line non-destructively. When the cursor reaches the bottom line, this command causes the video screen to scroll upward one line leaving the cursor in the same position on the new line created.

NOTE that the LINE FEED key produces the same code as LF.

Carriage Return CR = CTRL/M <RETURN>

CR causes the cursor to be returned non-destructively to the first position of the current line.

NOTE that the RETURN key on the VP3300 generates the same code as CR.

Horizontal Tab HT = CTRL/I

Causes the cursor to move non-destructively to the next TAB position. In HI-RES mode (40x24) the TAB stops are set at every 8th location on a line, giving a total of [illegible] stops across the video screen. In the LOW-RES mode (20x12) TAB

stops are defined at every 4th position, also giving 5 stops across the video screen.

The TAB function is very useful in applications where columns of data and special formatting of information is needed. Numerical outputs are normally arranged with TAB stops to make the display of information easier to read and understand.

Home Cursor = ESC H
SUB = CTRL/Z

When this command is used the VP3300 will non-destructively HOME the cursor to the first location on the top line. The screen will not be cleared.

Address Cursor = ESC Y cc

This command allows the cursor to be located anywhere on the screen under computer control. This feature can be very important when the VP3300 is connected to intelligent programs that can utilize cursor addressing to speed up and enhance the display of information.

When using cursor addressing the video screen is organized as a grid of locations. The HOME position at the upper left hand corner of the display is defined as the origin, that is, the 0,0 location.

The c's stand for two characters that are used to pass the row and column locations to the terminal. These characters range from the ASCII code for 'SPACE' to 'G'. If an invalid address is specified (i.e. the row or column data is too large) the cursor will be homed to the upper left hand corner of the screen. See Table 5-1 fo a list of the ASCII characters and their equivalent decimal offset used for cursor addressing.

The following figure illustrates the cursor coordinates for several important locations on the video screen for both the HI-RES and (LOW-RES) display formats.

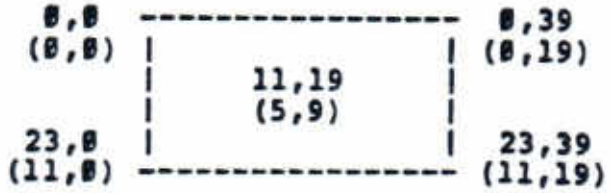


Figure 5-1. Cursor Address Coordinates

Decimal Offset Value Desired	ASCII Character To Use	Decimal Offset Value Desired	ASCII Character To Use
0	SPACE	21	5
1	!	22	6
2	"	23	7
3	#	24	8
4	$	25	9
5	%	26	:
6	&	27	;
7	'	28	<
8	(	29	=
9	)	30	>
10	*	31	?
11	+	32	@
12	,	33	A
13	-	34	B
14	.	35	C
15	/	36	D
16	0	37	E
17	1	38	F
18	2	39	G
19	3	40	H
20	4		

Table 5-1. ASCII Character Decimal Offsets

SCREEN MAINTENANCE COMMANDS

The commands in this group are useful for cleaning and maintaining the video screen.

Clear Entire Screen = ESC j
FF = CTRL/L

This command will cause the VP3300 to fill the video screen with space characters and HOME the cursor to the first position on the top line.

Clear to End of Screen = ESC J

This command causes the VP3300 to fill the video screen from the current cursor position to the end of the screen with space characters. The cursor position is left unchanged.

Clear to End of Line = ESC K

When this command is executed, the current line is filled with space characters from the cursor to the end. The cursor position remains the same.

COLOR and GRAPHICS COMMANDS

This group of commands permit complete control over the color graphics features of the VP3300.

Background Color = ESC ESC B h

This command allows the background color of the VP3300 to be defined. At power up the terminal is set into a black and white mode and to use color a command must be given to explicitly enable the feature.

The h indicates that an ASCII hex character is required for valid color recognition, and the colors available are divided into two groups, color and scales. There are eight different background colors that can be combined with eight different foreground colors (see Foreground Color below) to provide various color combinations. Consult Table 5-2 to determine the correct code to use for each color background.

There are also eight scale modes where the defined color is available in eight varying levels of brightness. In these modes, only one color can be displayed on the video screen at a time. However, there will be eight different brightness levels of the color available for use. Refer to Table 5-3 for the codes needed to enable the color scale modes.

Foreground Color = ESC ESC F d

The foreground colors of the VP3300 can be set using the same 8 color codes as the background color command (see Table 5-2). The foreground color stays in effect until it is redefined, thus allowing individual characters, groups of characters, or entire screens to be colored with a minimum of control overhead.

When the VP3300 is operating in one of the scale modes (see Background Color above) or in a black and white situation, the Foreground Color command will generate varying levels of video brightness instead of different colors. Use the chart in Table 5-4 to determine the desired level of video brightness.

Char	Color
0	Black
1	Green
2	Blue
3	Aqua
4	Red
5	Yellow
6	Magenta
7	White

Char	Scale
8	Gray-Blk
9	Greens
A	Blues
B	Aquas
C	Reds
D	Yellows
E	Magentas
F	Gray-Wht

Char	Brightness
0	Darkest
2	Very Dark
4	Dark
6	Med Dark
1	Med Light
3	Light
5	Very Light
7	Lightest

Tables 5-2, 5-3 and 5-4. Color, Scale and Brightness Codes

Line Color = ESC ESC L d c

This command allows the color or brightness of previously displayed characters to be redefined without effecting the current foreground color or brightness selection. The command uses d as the desired color or brightness code and c as the ASCII character equivalent for the run length number of locations on a line, from the cursor to change. Refer to Table 5-2 or Table 5-4 in order to obtain color and brightness code information.

Run length encoding is an efficient way to indicate the number of characters, or locations, to be included in the operation. The maximum valid run length code for the VP3303 is the number of character locations on a line. Any values larger than the line length are interpreted as meaning to the end of the line. See Table 5-1 for a chart indicating the appropriate ASCII character to use for different run length encoding offsets.

Line Reverse Video = ESC ESC S 2 c

This command works similar to the Line Color command, except that instead of colors this command works with the reverse video feature. This allows an easy method for highlighting certain portions of the display screen or this feature can be used to create blinking video areas for attention getting information.

The c represents the ASCII character equivalent for the run length number of locations on a line, from the cursor, to reverse. It should be noted that if a character is already in the reverse mode when this command is given, it will reverse again, thereby allowing flashing character

sequences to be generated. See Table 5-1 for ASCII character equivalents for run length encoding offsets.

Pattern Change = ESC ESC P c hhhhhhhhhhhhhhhh

This command allows the use of customized character fonts and graphics. With this feature it is possible to create displays that convey information through graphic elements and forms. The c is the ASCII character that is to have its pattern changed and the h's are sixteen ASCII hex digits that define the pattern formation.

The character matrix of the VP3300 is made up of a 6x8 dot grid. For standard alphanumerics, the characters are created in a 5x6 dot matrix allowing a column of dots between adjacent characters and two rows of dots between character rows. Consult APPENDIX D for a chart of the bit patterns for the ASCII characters provided in the VP3300 and see APPENDIX B for information dealing with the creation of custom character fonts and video graphics.

Implant Literal Character = ESC ESC I c

This command allows the use of non-displayable control codes for storing graphic character fonts and being able to insert them onto the display screen. The c is the ASCII character that will be implanted at the current cursor location in the same manner that displayable characters are handled.

English Character Set = ESC ESC E

This command will reset the English alphanumeric character set to its original condition. This command is useful when character bit patterns have been changed for special purpose graphics or character fonts and then they must be reset to their original patterns. It should be noted that when this command is executed, the bit patterns for every character are returned to normal. Any special patterns that have been created are erased.

AUDIO CONTROL COMMANDS

These commands allow control over the operation of the tone and noise generators of the VP3300.

Bell BEL = CTRL/G

This code causes the VP3300 to chime for 1 second. This feature allows the controlling system to announce certain events and will attract attention even if the video screen is not being watched.

Keyboard Tone OFF = ESC ESC T 0
ON = ESC ESC T 1

This command is used to turn the keyboard tone on and off. It can be utilized to allow the MUSIC mode complete freedom, which will be explained next.

Music = ESC ESC M hhhh

This command can be used to program the VP3300 to generate musical tunes or special tones for various purposes. The four h's represent frequency and amplitude control data expressed as ASCII hex characters. The possible tones that can be generated cover an 8 octave frequency range, and through controlling the amplitude envelopes, many different instruments and sound effects can be created.

In order to use the MUSIC feature of the VP3300 correctly, the keyboard tone should be disabled. Otherwise, the tones generated may terminate prematurely. See the explanation of KEYBOARD TONE for proper use of that command.

The first pair of ASCII hexadecimal digits for this command are used to select the tone or note desired. The third digit is used to enable the tone generator and to select the appropriate octave within which the tone resides. The following formula can be used to determine any desired frequency tone by selecting the proper octave frequency input and dividing by a tone selection count.

$$\text{TONE} = \frac{\text{Octave Frequency Input}}{\text{Tone Selection} + 1}$$

NOTE: The high bit of the octave selection digit will turn the tone generator off whenever the bit is set. Thus, any octave value greater than seven will disable the generation of tones. We recommend using the hex digit '8' to explicitly turn the tones off.

The last digit is used to select the relative level of loudness (amplitude), at which the tone will be played. There are sixteen possible levels of loudness available, from no volume to full volume output.

Tables 5-5, 5-6, and 5-7 deal with the frequency and amplitude values available for the VP3300. Consult APPENDIX C for specific information concerning the generation of musical notes on the VP3300.

<- 1st digit ->				<- 2nd digit ->			
<===== TONE SELECTORS ====>							
-	SEL 6	SEL 5	SEL 4	SEL 3	SEL 2	SEL 1	SEL 0
-							

Table 5-5. Tone Selection Format

<-- 3rd digit ->				<- 4th digit ->			
TONE<= OCTAVE =>				<= LOUDNESS =>			
off/on	OCT 4	OCT 2	OCT 1	AMP 8	AMP 4	AMP 2	AMP 1

Table 5-6. Octave and Loudness Format

OCT FREQ SEL4	OCT FREQ SEL2	OCT FREQ SEL1	INPUT FREQ (Khz)
0	0	0	1.80
0	0	1	3.60
0	1	0	7.20
0	1	1	14.40
1	0	0	28.80
1	0	1	57.60
1	1	0	115.20
1	1	1	230.40

Table 5-7. Octave Frequency Selection

Noise = ESC ESC N hh

In addition to music, the VP3300 can also generate a variety of noises. These noises can be programmed for unusual sounds like explosions and roars for games or special applications. The noise and music tones can be used together to form whatever type of sounds are required. The two h's specify frequency and amplitude values similar to the MUSIC command above. Consult Table 5-8 and Table 5-9 for specific white noise (WN) related values.

<-- 1st digit ->				<-- 2nd digit -->			
WN <=	FREQ	=>		<= AMPLITUDE =>			
off /on	SEL 4	SEL 2	SEL 1	AMP 8	AMP 4	AMP 2	AMP 1

Table 5-8. Noise and Amplitude Format

WN FREQ SEL4	WN FREQ SEL2	WN FREQ SEL1	TOP OF WN FREQ RANGE (Khz)
0	0	0	.225
0	0	1	.450
0	1	0	.900
0	1	1	1.800
1	0	0	3.600
1	0	1	7.200
1	1	0	14.400
1	1	1	28.800

Table 5-9. Noise Frequency Selection

VP3300 ERROR CONDITIONS

The VP3300 has been designed for maximum ease of operation and in most operating situations there is not much that can go wrong. However, there are certain error conditions that can occur if improper operation or interfacing takes place.

INPUT OVER-RUN

In the event that the VP3300 receives data from an external device too rapidly for it to be processed properly, the VP3300 will generate several short error beeps to indicate that an over-run has occurred. This condition generally happens only when trying to operate the terminal at rates greater than 1200 baud without proper handshaking signals. If this error happens, look for faults in the interfacing or handshaking signals between external devices and the VP3300.

OUTPUT OVER-RUN

Normally, the VP3300 will transmit characters to external devices when a key is pressed. However, should the device not be expecting to receive data from the terminal, or in the event that handshaking signals have become faulty, the VP3300 will automatically lock-out the keyboard to prevent further data entry.

If this condition happens because of normal system operation, that is the external device does not want data from the terminal, the VP3300 will automatically unlock the keyboard when data entry is again possible. However, if this condition should occur and improper operation is suspected, check for faulty interfacing or handshaking signals between the VP3300 and external device.

RESETTING THE VP3300

Sometimes the terminal may enter an undesired mode of operation caused either by communication problems or by improper use of command sequences. The terminal can be reset by turning the power off briefly. However, the VP3300 will come back up in its normal power on default condition, so it must be re-programmed for any special modes of operation required.

SECTION 6

CONFIGURATION SWITCHES

Configuration Switches

Located on the left-hand end panel of the VP3300 is a narrow slot which allows access to recessed configuration switches. The sixteen switches are used to set-up various operating modes when the VP3300 is connected to different types of equipment.

The switches are labeled to facilitate using them properly. Consult the figure below for reference as the switches and their functions are discussed.

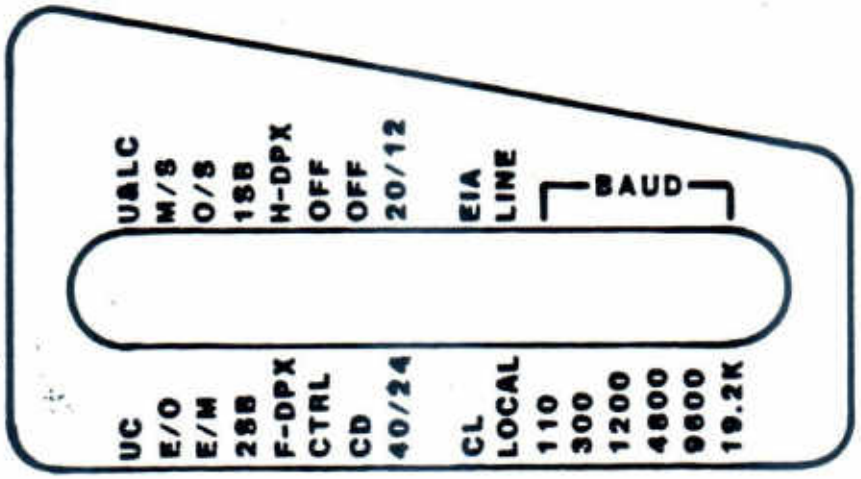


Figure 6-1. Configuration Switches

UC U&LC

The first switch (going from back to front) is marked UC U&LC and is used to select between either an uppercase only or an upper and lower case mode of operation. The function of this switch only effects the way that keypresses are encoded. In the upper and lower case position, the keypad generates 128 different ASCII codes and the two SHIFT keys function normally for all keys. When the switch is in the uppercase only position, the alphabetic keys generate upper case character ASCII codes only and the SHIFT keys have no effect on them. In either case mode, the SHIFT keys will operate correctly on other two function keys.

E/O M/S

This switch is used to determine the status of the eighth data bit sent from the VP3300. When E/O is selected the terminal will generate an EVEN or ODD parity bit depending upon the position of the next switch. When M/S is selected the eighth bit is set either to MARK or SPACE depending upon the position of the next switch.

E/M O/S

This switch works in conjunction with the previous one and is used to determine the exact status of the eighth bit. When E/M is selected either EVEN parity or a MARK condition will be generated and when O/S is chosen either ODD parity or a SPACE condition will be selected.

2SB 1SB

This switch is used to select either 1 or 2 STOP BITS for formatting the data words used in communications interfacing.

F-DPX H-DPX

The function of this switch is to select between either FULL or HALF DUPLEX operation. In the HALF DUPLEX mode, any displayable character that is typed on the VP3300 is displayed on the video screen while it is transmitted to the computer. When FULL DUPLEX operation is selected the terminal only transmits the character data. The computer must ECHO the data back inorder for it to be displayed by the VP3300.

CTRL OFF

This switch is used to enable the control features of the VP3300. When the switch is turned to OFF all the features are disabled, allowing the VP3300 to act like a DUMB TERMINAL. (Only CR, LF and BEL function when CTRL is OFF)

CD OFF

This switch only functions when the CTRL switch is OFF. If CD is selected CONTROL CODES will be displayed on the video screen. If the switch is positioned to off, then the CONTROL CODES are not displayed. This feature is useful when programs are being developed to verify that proper command sequences are being created to utilize the VP3300's

features. (NOTE: CR, LF and BEL are not displayed if this feature is enabled)

40/24 20/12

The purpose of this switch is to select the default video screen format that appears when the VP3300 is powered on. When 40/24 is selected the HI-RES character display is chosen and 20/12 selects the LO-RES display format. In either case, the display format can be changed through program control. See the section on CONTROL COMMANDS for more details.

CL EIA

This switch is used to select either the 20mA CURRENT LOOP or the RS-232C EIA communications standard. Consult SECTION 6 on INTERFACING for specific information on proper use of these standards.

LOCAL LINE

This switch is used to control the operation of the VP3300. In the LOCAL mode, the terminal is only talking to itself, any outside information is ignored. In the LINE mode, the VP3300 is ready to communicate to external devices.

BAUD SWITCHES

The last six switches are used to select the appropriate data communications speed. BAUD RATES from 110 to 19,200 can be selected and the switches must only be used one at a time. Consult the user information for the system you will be using to determine the proper BAUD RATE needed.

SECTION 7

INTERFACING

DATA CHARACTER FORMAT

The VP3300 uses ASCII (American Standard Code for Information Interchange) as its language to communicate with external computing devices. The ASCII code is a standardized seven-bit method of transferring information by assigning unique character values to the various bit-patterns (see APPENDIX E for a table of ASCII codes).

The VP3300 sends and receives the ASCII data in an asynchronous manner, which means that each character is communicated as a single, self-contained message, that consists of the seven-bit character code, an eighth bit added for parity status, a preceeding start bit and either one or two trailing stop bits. The parity bit is used to facilitate checking for communication errors and its status is determined by the setting of the configuration switches. The stop bit(s) are used to signal the end of a single character transmission and the configuration switches determine whether one or two of them are generated.

NOTE: The VP3300 does not check the status of the parity or stop bit(s) on data it receives. These bits are only important for the data that is being sent from the VP3300. See the following diagram for a representation of the serial data format.

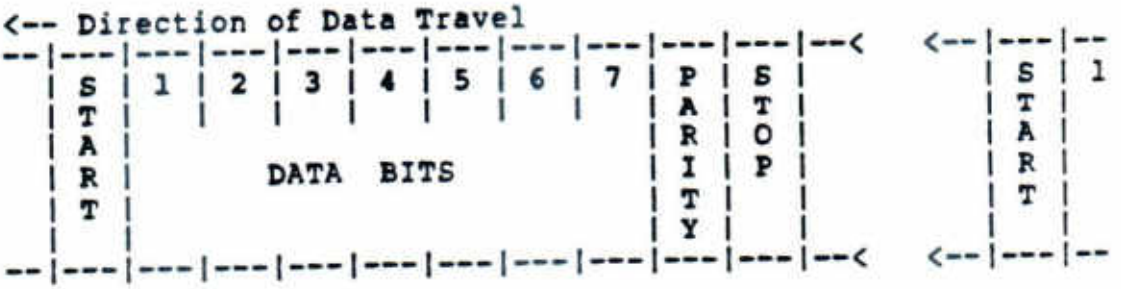


Figure 7-1. Serial Data Format

HANDSHAKING SIGNALS

The VP3300 uses three EIA level handshaking signals to enable data communication transfers at speeds of greater than 1200 baud. the following list describes these signals and explains their use.

1. REQUEST to SEND (RTS)- This signal generated by the VP3300 is used to tell the external computing device that the terminal has data it wants to send.

2. CLEAR to SEND (CTS)- This signal is generated by the external device in response to the RTS signal from the VP3300. When the terminal receives the CTS signal it knows that the computer is ready to receive data, and only then will the VP3300 send data.

   When the CTS handshaking signal is used, the LED lamp on the VP3300 will provide a visual indication of CTS status. The LED will glow when CTS is in a true (ready) state and it will be off when CTS is false (not ready). If the CTS signal is not used, the VP3300 will assume that it always has a true CTS condition.

3. CLEAR to RECEIVE (CTR)- This signal is generated by the VP3300 and indicates when the terminal is ready to receive new data from the external device. This CTR signal MUST be used for data communication rates greater than 1200 baud to insure valid communication between the VP3300 and external device.

USER KEY HOOKUP

The VP3300 has two user definable keys located on the lower right hand corner of the keyboard. These keys are light touch momentary contact, normally open, single-pole, single throw electrical push-button switches. Each switch is a separate circuit and is rated at 30v, .1A, 1W Max.

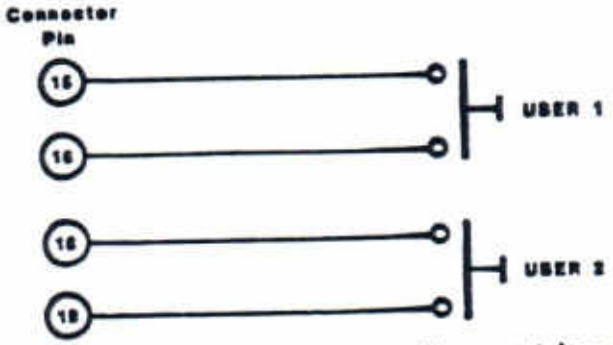


Figure 7-2. User Key Connections

EIA RS-232C COMPATIBLE SIGNALS

Pin designations:

PIN	SIGNAL NAME	BELL SYSTEM CODE
1	Frame Ground	AA
2	Transmit Data	BA
3	Receive Data	BB
4	Request To Send	CA
5	Clear To Send	CB
7	Signal Ground	AB
20	Clear To Receive	--

Table 7-1. EIA Pin Connections

EIA RS-232C Signal Convention:

NOTATION	INTERCHANGE VOLTAGE	
	NEGATIVE	POSITIVE
Binary State Condition Function	1 Marking OFF	0 Spacing ON

Table 7-2. EIA Signal Conventions

TYPICAL EIA HOOKUP

A typical hookup of the VP3300 to an external EIA device (such as a modem or computer) requires the following pin-out connections:

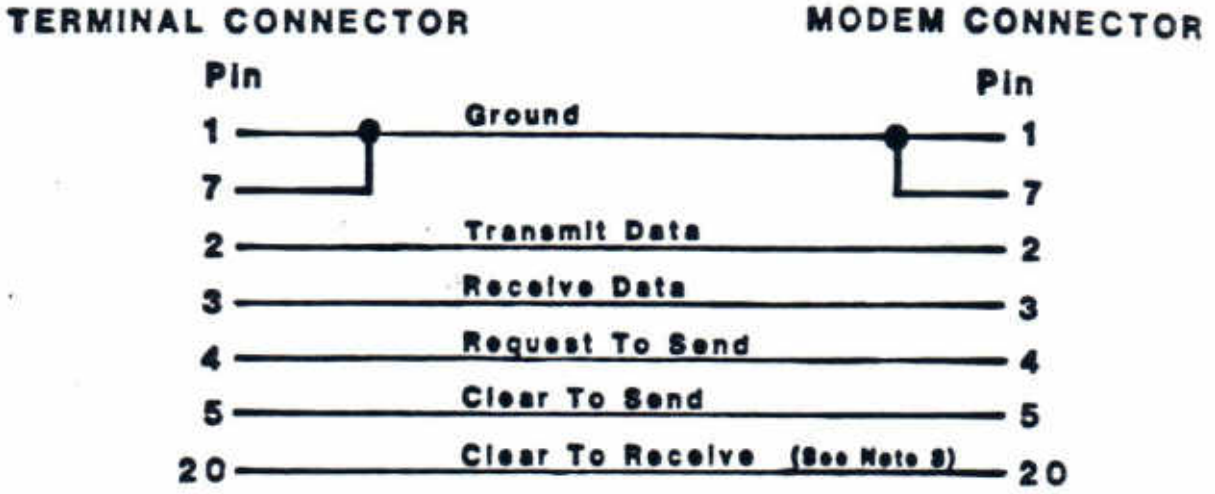


Figure 7-3. EIA Hookup

NOTES:

1. Both terminal and EIA connectors are male, 25-pin "D"-type connectors (VP-626 or equivalent).

2. An assembled six foot length cable assembly (wired as illustrated above) may be purchased from an RCA VP3300 dealer by ordering cable assembly VP-627.

3. Some EIA modems and computing equipment require a DATA TERMINAL READY signal on Pin 20 of their EIA connector instead of the CLEAR TO RECEIVE signal provided by the VP3300. In order to properly use such equipment, connect Pin 11 of the VP3300 Interface connector to Pin 20 of the EIA device connector.

20mA CURRENT LOOP INTERFACE

If the VP3300 is to be connected to a system using the 20mA current loop standard, the following pin-out connections should be made:

PIN NUMBER	SIGNAL TYPE
17 24	TRANSMIT (BIPOLAR)
23 25	RECEIVE (BIPOLAR)

Table 7-3. 20mA Interface Connections

TYPICAL 20mA HOOKUP

The following diagrams show typical installation hookups for the 20mA current loop:

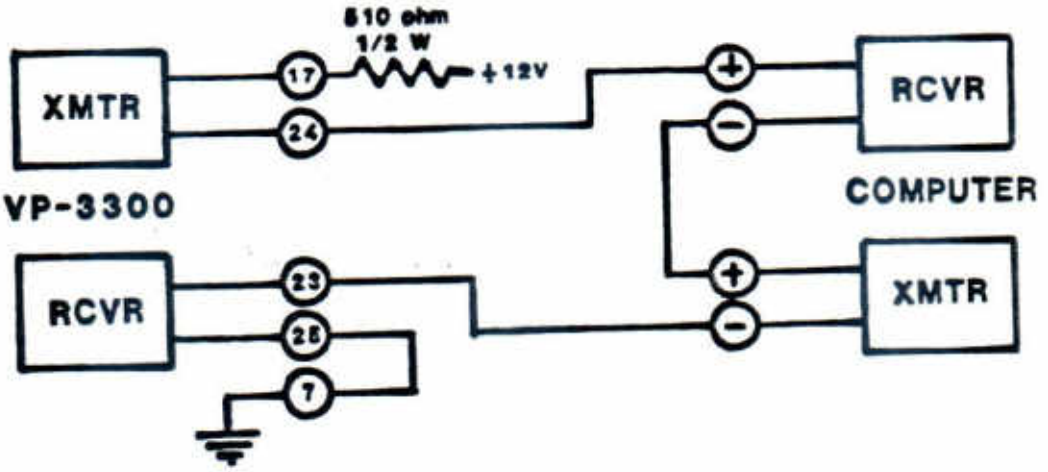


Figure 7-4. Half Duplex, Active Circuit

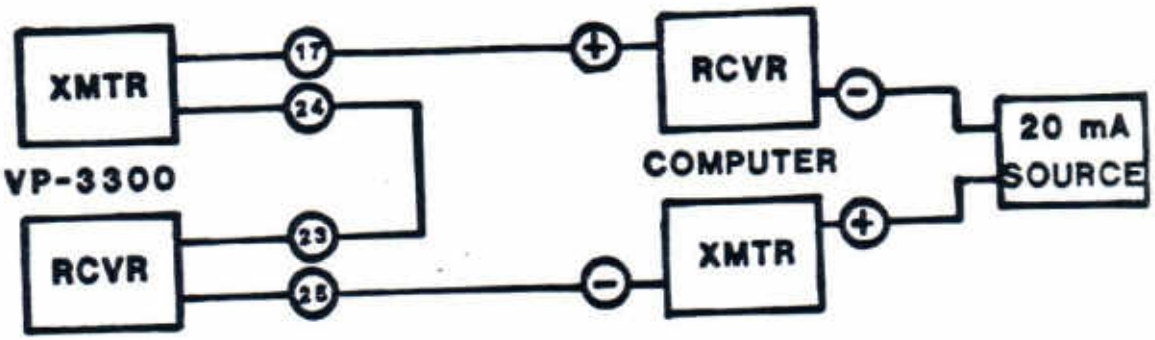


Figure 7-5. Half Duplex, Passive Circuit

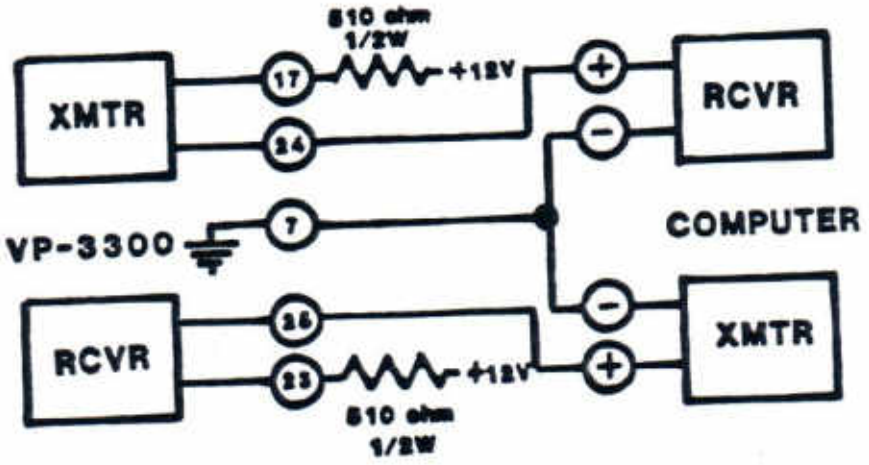


Figure 7-6. Full Duplex, Active Circuit

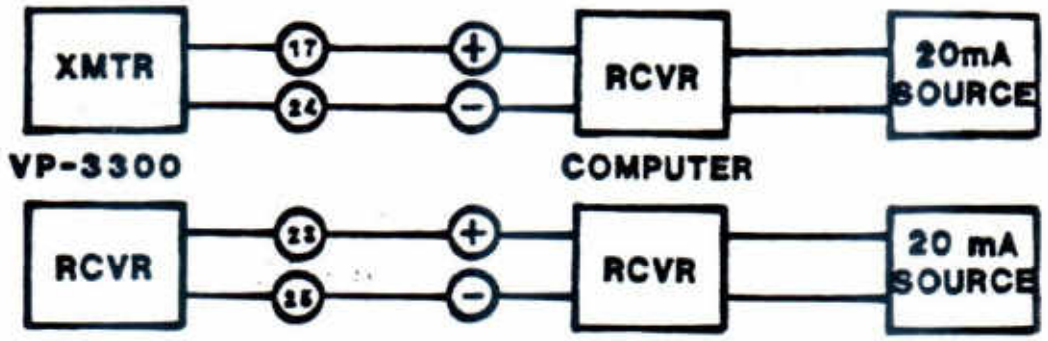


Figure 7-7. Full Duplex, Passive Circuit

VP3303 AUDIO/VIDEO CONNECTOR

The external audio and direct base-band video connector on the VP3303 is a 5-pin DIN female plug. The audio output can be used to drive down to an 8 ohm load (for connection to a speaker), or it can be used to drive the input of an audio amplifier. The audio volume control on the VP3303 can be used to adjust the signal level required. (Always set the volume control to minimum, counter-clockwise, when first applying signal to an external input. Then increase the signal slowly by turning the volume control clockwise, until a good quality audio output is attained.)

The video output provides a composite NTSC compatible signal, which can be used to drive the input of a 525 line color or black and white video monitor with 75 ohm impedance. The video cable used should be of high quality (RG-59 or equivalent) to ensure good signal transmission from the VP3303 to the video monitor.

The following diagram provides the pin connections for the external connector.

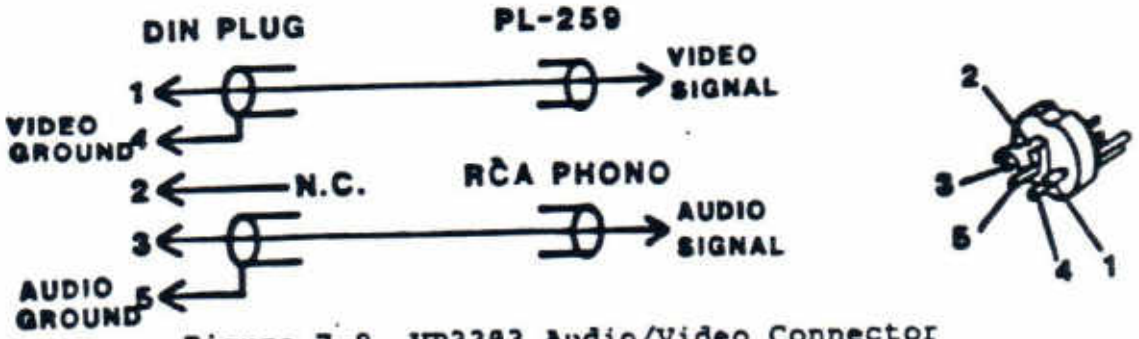


Figure 7-8. VP3303 Audio/Video Connector

NOTE:
An assembled 6-foot cable with the correct 5-pin DIN connector and with a PL259 video connector and RCA phono plug (male) for audio is available from a VP3303 dealer as cable assembly part VP-629.

VP3301 VIDEO CONNECTOR

The video connector of the VP3301 is an RCA phono plug (female). This connector provides a composite NTSC compatible video signal which can drive a 525 line color or black and white monitor with 75 ohm impedance. A high quality video cable (RG-59 or equivalent) should be used to ensure that a good video signal is transmitted from the VP3301 to the video monitor.

See the following figure for wiring details.

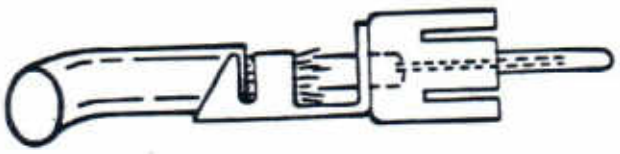


Figure 7-9. VP3301 Video Connector

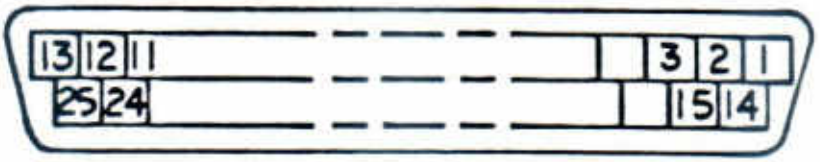
NOTE:
An assembled 6-foot video cable with an RCA phono plug (male) on one end and a PL259 connector on the other end is available from an RCA VP3301 dealer by ordering cable assembly VP-628.

INTERFACE CONNECTOR WIRING

The following chart lists the pin-out for the COMPUTER INTERFACE connector on the VP3300:

PIN NUMBER	SIGNAL TYPE
1	GROUND
2	EIA TRANSMIT DATA
3	EIA RECEIVE DATA
4	EIA REQUEST TO SEND
5	EIA CLEAR TO SEND
6	- - -
7	GROUND
8	- - -
9	- - -
10	- - -
11	DATA TERMINAL READY (+5V)
12	- - -
13	- - -
14	- - -
15	USER 1 SWITCH
16	▪ ▪ ▪
17	20mA CL TRANSMIT (BIPOLAR)
18	USER 2 SWITCH
19	▪ ▪ ▪
20	EIA CLEAR TO RECEIVE
21	FACTORY TEST POINT
22	FACTORY TEST POINT
23	20mA CL RECEIVE (BIPOLAR)
24	20mA CL TRANSMIT (BIPOLAR)
25	20mA CL RECEIVE (BIPOLAR)

Table 7-4. Connector Pin-out



MATING CONNECTOR:
25-PIN MALE "D" CABLE CONNECTOR
VP-626 OR EQUIVALENT

CAUTION: Inserting cable connector with power applied may cause permanent damage.

Figure 7-10. Connector - Rear Vi...

APPENDIX A

BINARY NUMBERS AND HEXADECIMAL NOTATION

BINARY NUMBERS

The VP3300 contains integrated circuits, wires, resistors, capacitors and many other components. However, even with all of these specialized parts the terminal only understands and recognizes two types of information - ON and OFF. This two state method of encoding information is known as BINARY information, and it is necessary to at least be familiar with this type of notation in order to utilize all the featutes of the VP3300.

In the world of BINARY, there are only two types of information - 1 or 0, YES or NO, ON or OFF. Each piece of information taken by itself represents one BINARY DIGIT or BIT.

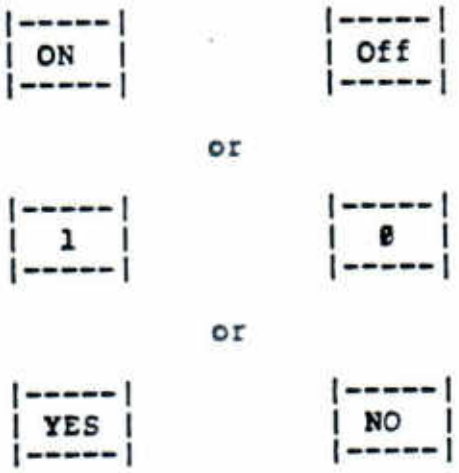


Figure A-1. Binary Bits

All of the information inside the VP3300 is a collection of these BITS. Most of the data is arranged in groups of eight bits known collectively as a BYTE. In the terminal these BYTES can represent characters, data, numbers or commands.

Figure A-2. A Byte is Eight Bits

Each of these bits in a byte can contain either 1 or 0, allowing a total of 256 different possible combinations.

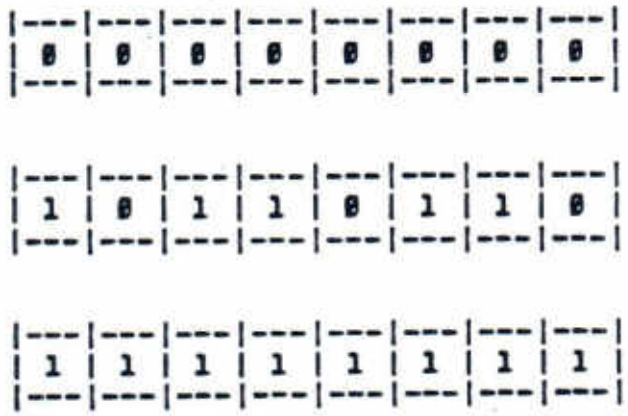


Figure A-3. Some Possible Bytes

Since binary numbers arranged as strings of 1's and 0's are hard to read and write, a different numbering system is commonly used to represent binary data. The HEXADECIMAL system is based on groups of four bits. So, instead of a byte being represented by eight different numbers, in hexadecimal notation only two are needed. In order to read these HEX numbers easily, a byte is broken into two NYBBLES of four bits each.

Figure A-4. Nybbles

In the hexadecimal system there are sixteen different possible combinations of 1's and 0's. These combinations correspond to the hexadecimal digits 0 to 9 and A to F.

0	0	0	0	0		1	0	0	0	8
0	0	0	1	1		1	0	0	1	9
0	0	1	0	2		1	0	1	0	A
0	0	1	1	3		1	0	1	1	B
0	1	0	0	4		1	1	0	0	C
0	1	0	1	5		1	1	0	1	D
0	1	1	0	6		1	1	1	0	E
0	1	1	1	7		1	1	1	1	F

Figure A-5. Hexadecimal Numbers and Bits

When bytes are represented in hex format, two digits are used to signify the high order and low order nybbles respectively, allowing a much easier method of transferring the data than by having to list the individual bits.

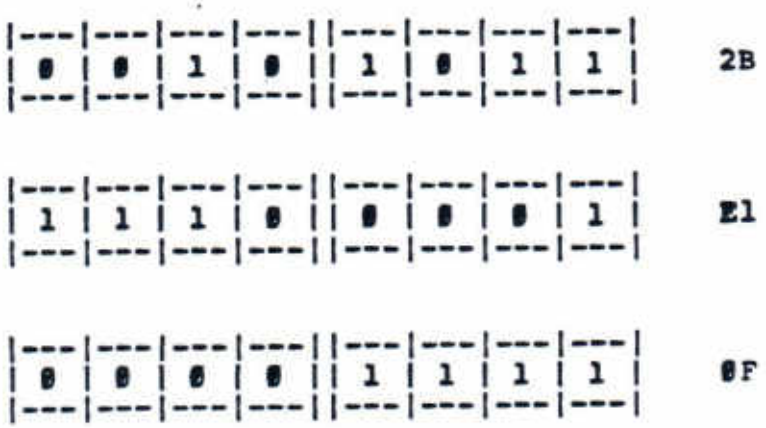


Figure A-6. Hexadecimal Bytes

The above brief introduction to binary and hexadecimal numbers should give enough information to begin exploring the features of the VP3300. If you should require more detailed and tutorial type material, check with your local computer store dealer or library for additional information.

APPENDIX B

GENERATING VIDEO GRAPHICS

VIDEO GRAPHICS

The video display of the VP3300 is organized as a grid of character locations. In the HI-RES mode there are 40 locations on 24 lines. In the LOW-RES mode there are 20 character locations on 12 lines. Each of these locations can contain any of the possible 128 ASCII character codes. The VP3300 will generate a pattern of pixel (bit) dots on the video screen that correspond to the pre-defined character bit-map pattern matrix for each respective ASCII code in the screen memory.

An English character set is pre-programmed into the VP3300 at power on. However, in some applications these standard characters and symbols may not be appropriate for the type of information and data being displayed. With the VP3300, customized character sets and graphic elements can be created, providing an unlimited number and arrangements of specialized images.

Each character location in the VP3300 is formed from a matrix array of 6 X 8 pixel dots (6 horizontally and 8 vertically). The PATTERN CHANGE command sequence can be used to alter the bit-map pattern for any or all of the 128 ASCII codes. After any of the characters have had their pattern changed, the new pattern will be displayed if and when the ASCII code is sent into a screen location.

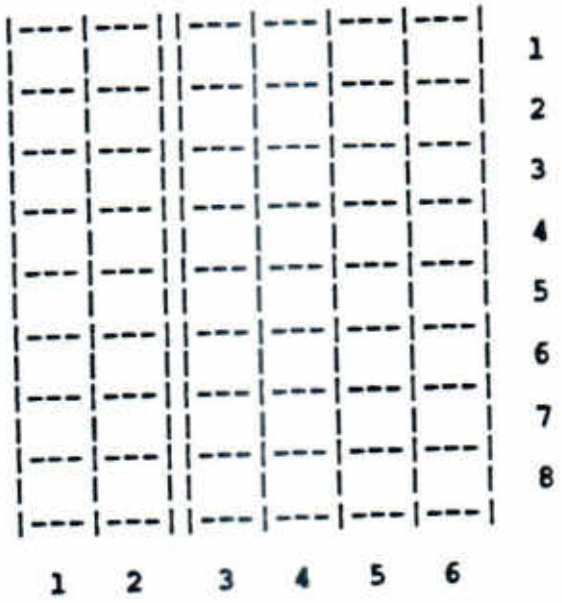


Figure B-1 Character Matrix

In order to thoroughly understand the way patterns are changed, let's run through an example. Suppose we want to create an image that looks like a box. The first thing we should do is draw out what we want on a piece of graph paper that has been marked off into 6 X 8 grid blocks.

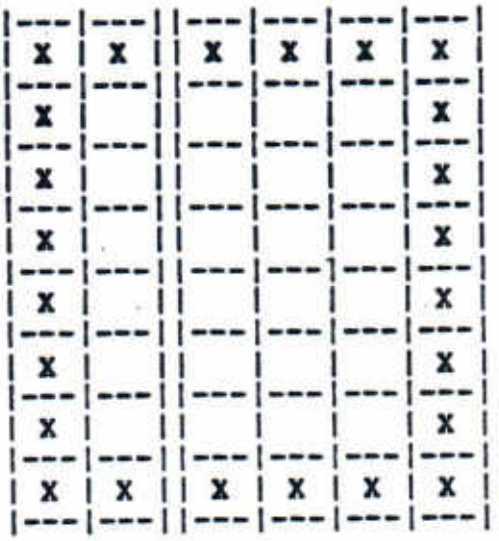


Figure B-2. Example Graph Layout

Now that we have figured what pattern we need and have drawn it in a grid, we must convert our graph into data for the PATTERN CHANGE command. The command requires us to give it a hexadecimal representation of the pattern we want. So the next step is to convert our graph to hex numbers. By consulting Figure A-5 of BINARY and HEX bit patterns we can easily determine our pattern's representation by substituting 1 bits for all the grid areas where dots are desired and 0 bits for the areas where no dots are needed. It should be noted that the two most significant bits of each graphic data byte are not used when patterns are created on the VP3300. In order to make translation of graphic information into hexadecimal data bytes easier, assume that the two unused bits are set to 0.

0	0	1	1	1	1	1	1	3F
0	0	1	0	0	0	0	1	21
0	0	1	0	0	0	0	1	21
0	0	1	0	0	0	0	1	21
0	0	1	0	0	0	0	1	21
0	0	1	0	0	0	0	1	21
0	0	1	0	0	0	0	1	21
0	0	1	1	1	1	1	1	3F

Figure B-3. Hexadecimal Data for Graphic Example

At this point we have all the graphic information coded into hexadecimal format for the CHANGE PATTERN command. Now, we must decide which character we wish to look like the box. Let's use the '!' as the new box code. By substitutting the appropriate data into the command string we can now alter the pattern.

ESC ESC P ! 3F21212121213F

That's all there is to it. You can try it yourself by switching into LOCAL mode and keying in the above sequence. From now on, until you change it youself or power back on, the ! will look like a box.

With this brief example, you can now create any special images you desire for various graphic effects. Several characters can be re-defined as a group to create even larger images.

After patterns have been changed, the standard English set can be reloaded by using the ENGLISH CHARACTER SET command, making it easy to switch from graphic formats back to text display formats.

APPENDIX C

PLAYING MUSIC

MAKING THE VP3300 PLAY MUSIC

The VP3300 is a most unusual data terminal. As you already may know it is possible to make it beep and whistle. This section will explain the necessary information needed to turn the VP3300 into a musical instrument.

In order to utilize the music playing feature, familiarity with hex notation is assumed. The tone generator inside the terminal is controlled by a special command which tells it what tone to play. The tone command contains two bytes of information, providing frequency, octave, and loudness information (see Tables 5-5, 5-6, and 5-7). The first two hex digits determine the tone (or note) which is to be played. The following chart lists the proper codes for musical notes of the even tempered scale:

NOTE	(ACCURACY)	HEX CODE
A	(+.70%)	40
Ab/G#	(+.49%)	44
G	(+.64%)	48
Gb/F#	(-.21%)	4D
F	(+.57%)	51
E	(+.43%)	56
Eb/D#	(-.47%)	5C
D	(+.07%)	61
Db/C#	(-.09%)	67
C	(+.07%)	6D
B	(-.32%)	74
Bb/A#	(-.35%)	7B

Table C-1. Musical Note Values

The next hex digit determines the octave within which the note is generated. The high bit of the nybble turns the tone on and off. The next chart shows the relative positioning of the octaves on the musical scale:

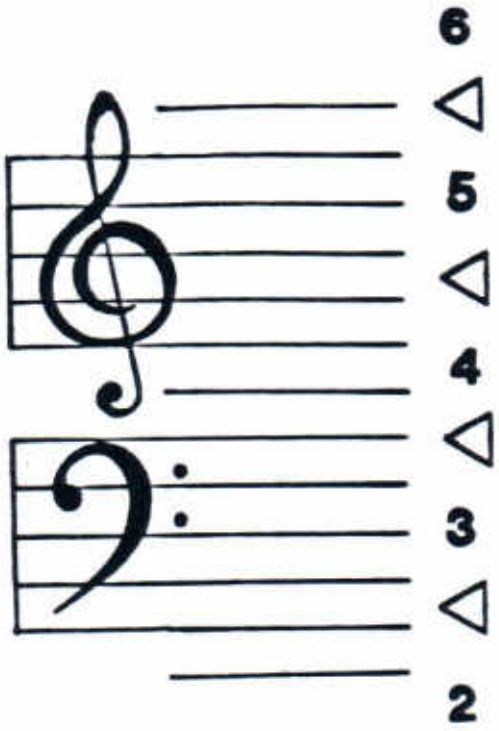
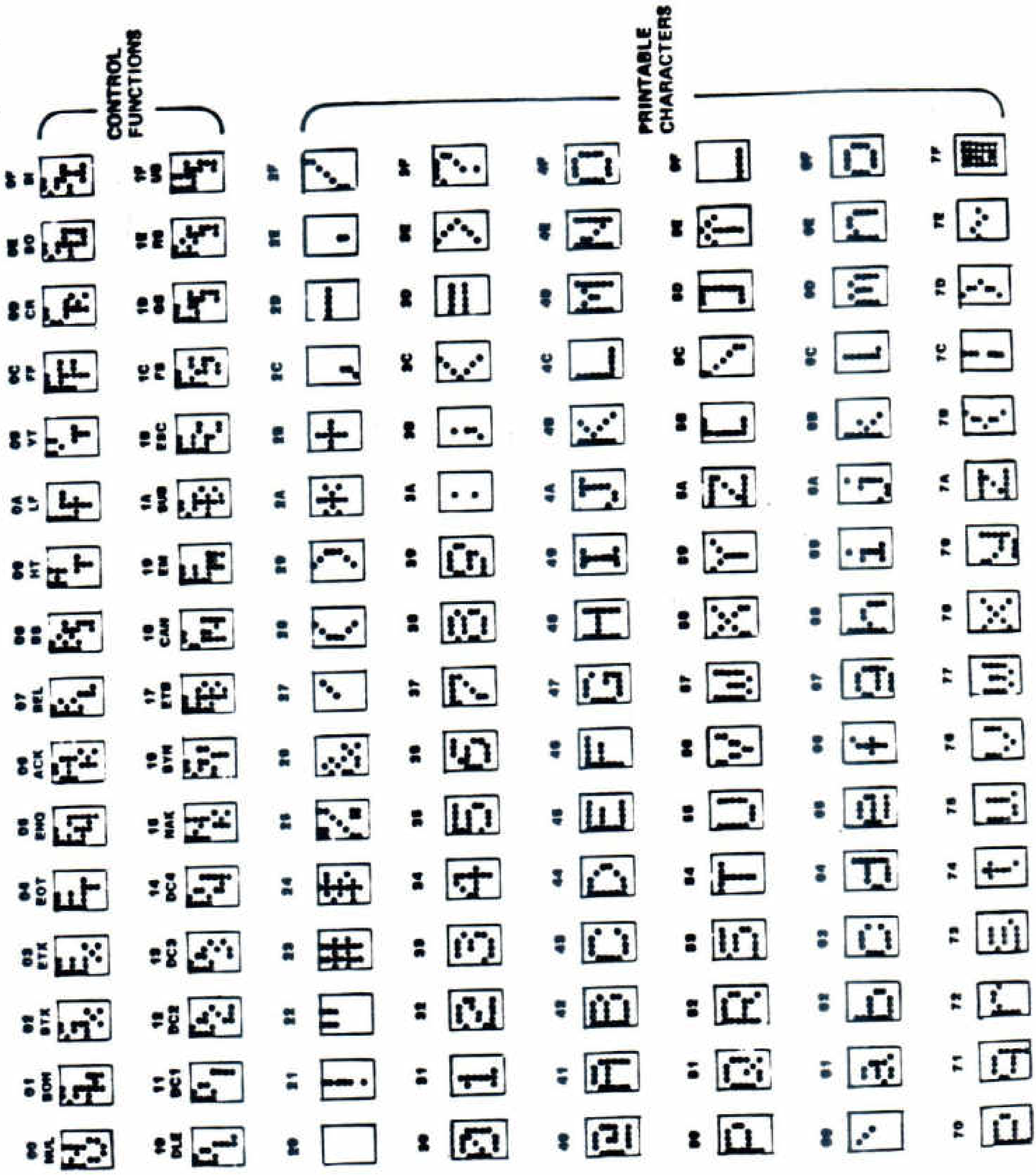


Figure C-1. Octave Range Selection

The last hex digit contains the amplitude loudness information. Values from 0 to F are valid with 0 being no volume and F being full volume . With modulation of volume levels different musical instruments can be mimicked or strange sounds created. Have fun!

APPENDIX D

CHARACTER BIT-MAP PATTERNS


CONTROL FUNCTIONS
PRINTABLE CHARACTERS

APPENDIX E

ASCII TABLES

Key / Output Character Table

Keyboard Key	0 0 0	0 0 1	0 1 X	1 0 #	1 Control 1 Shift X UC - U & LC
A	a	A	A	SOH	SOH
B	b	B	B	STX	STX
C	c	C	C	ETX	ETX
D	d	D	D	EOT	EOT
E	e	E	E	ENQ	ENQ
F	f	F	F	ACK	ACK
G	g	G	G	BEL	BEL
H	h	H	H	BS	BS
I	i	I	I	HT	HT
J	j	J	J	LF	LF
K	k	K	K	VT	ESC
L	l	L	L	FF	FS
M	m	M	M	CR	GS
N	n	N	N	SO	RS
O	o	O	O	SI	US
P	p	P	P	DLE	DLE
Q	q	Q	Q	DC1	DC1
R	r	R	R	DC2	DC2
S	s	S	S	DC3	DC3
T	t	T	T	DC4	DC4
U	u	U	U	NAK	NAK
V	v	V	V	SYN	SYN
W	w	W	W	ETB	ETB
X	x	X	X	CAN	CAN
Y	y	Y	Y	EM	EM
Z	z	Z	Z	SUB	SUB

Keyboard Key	0 0 0	0 0 1	0 1 X	1 Control X Shift X UC - U &LC
0	0	0	0	NUL
1	1	1	!	NUL
2	2	2	"	NUL
3	3	3	#	NUL
4	4	4	$	NUL
5	5	5	%	NUL
6	6	6	&	NUL
7	7	7	'	NUL
8	8	8	(	NUL
9	9	9	)	NUL
			*	NUL
:	:	:	+	NUL
;	;	;	<	FS
,	,	,	=	GS
-	-	-	>	RS
.	.	.	?	US
/	/	/	@	NUL
[	[	{	ESC	
\	\	|	FS	
]	]	}	GS	
^	^	~	RS	
DEL	DEL	-	US	
@	@	`	NUL	
SP	SP	SP	SP	
CR	CR	CR	CR	
LF	LF	LF	LF	
ESC	ESC	ESC	ESC	
BREAK	N1	N1	N1	

1 - Key Pressed
0 - Key Not Pressed
X - Don't Care
\# - U & LC Selected
@ - UC Selected
N1 - Continuous transmission of binary state zero

Character / ASCII Code Table: ASCII (Without Parity)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOH	STX	ETX	EOT	ENQ	ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
1	DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS	US
2	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	-
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	:	}	~	DEL

Examples: A is Code 41, Carriage Return OD

APPENDIX F

KEYSWICH LAYOUT


ESCAPE
CONTROL
SHIFT
SHIFT
DELETE
RETURN
USER 1
USER 2

APPENDIX G

COMMAND SUMMARY

OPERATING MODES

Display -OFF	- - -	ESC ESC C 0
-ON	- - -	ESC ESC C 1
Resolution -LOW	- - -	ESC ESC R 0
-HI	- - -	ESC ESC R 1
Reverse Video -OFF	CTRL/N	ESC ESC S 0
-ON	CTRL/O	ESC ESC S 1
Keyboard -OFF	- - -	ESC ESC K 0
-ON	- - -	ESC ESC K 1
Define Command Delimiter	- - -	ESC ESC X c

CURSOR MANIPULATION

Cursor -OFF	- - -	ESC ESC C 0
-ON	- - -	ESC ESC C 1
-NO BLINK	- - -	ESC ESC C 2
Backspace	CTRL/H	ESC D
Forespace	CTRL/U	ESC C
Upline	CTRL/K	ESC A
Downline	CTRL/J <LINE FEED>	ESC B
Carriage Return	CTRL/M <RETURN>	- - -
Tab	CTRL/I	- - -
Home	CTRL/Z	ESC H
Address Cursor	- - -	ESC Y cc

SCREEN MAINTENANCE

Clear Entire Screen	CTRL/L	ESC j
Clear to End of Screen	- - -	ESC J
Clear to End of Line	- - -	ESC K

COLOR and GRAPHICS

Background Color	- - -	ESC ESC B h
Foreground Color	- - -	ESC ESC F d
Line Color	- - -	ESC ESC L d c
Line Reverse Video	- - -	ESC ESC S 2 c
Pattern Change	- - -	ESC ESC P ch...h
Implant Character	- - -	ESC ESC I c
English Character Set	- - -	ESC ESC E

AUDIO CONTROL

Bell	CTRL/G	- - -
Keyboard Tone -OFF	- - -	ESC ESC T 0
-ON	- - -	ESC ESC T 1
Tone Generator	- - -	ESC ESC M hhhh
Noise Generator		ESC ESC N hh

Where: c = ASCII Character
d = Decimal Digit (0-9)
h = Hex Digit (0-9, A-F)