

WANG

CS

2536DW Interactive Terminal User's Guide

Computer System (CS) Series

2536DW Interactive

Terminal User's Guide

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PREFACE

This manual is your introduction to the Wang Model 2536DW Interactive Terminal. The manual is for Wang Computer System (CS) or Wang 2200 users and/or system administrators.

The manual is organized as follows:

Chapter 1 provides a brief overview of the terminal's features and system maintenance.

Chapter 2 includes a discussion of the terminal's controls, the set-up configuration, the monitor, and the keyboard. Chapter 2 also tells how to enter and edit data, and how to activate a screen dump.

Chapter 3 provides information on control codes, character display attributes, alternate character sets, the PRINT BOX function, repeating keys, the self-identification message, and box graphics. Each feature is illustrated by examples and short programs.

Chapter 4 deals with terminal/host interfacing, including both local and remote terminal connection.

Appendix A provides the 2536DW Interactive Terminal specifications.

Appendix B describes preventive maintenance and environmental considerations.

Appendix C provides information on control codes and character sets.

Appendix D tells how to change the transmission rate of the terminal and terminal processor.

Appendix E gives instructions for setting the device address of the terminal processor.

Appendix F provides information on setting the device address on the 22C32 Triple Controller.

This manual is intended to be used with the user's manual for your system, as well as the user's manual for each optional peripheral device attached to the system.

CHAPTER 1 INTRODUCTION

1.1 OVERVIEW

The Wang Model 2536DW Interactive Terminal, shown in Figure 1-1, enables you to communicate with your Wang Computer System (CS) Series, MicroVP Series, or 2200 Series. You can tilt the monitor to a comfortable viewing angle and adjust the brightness to accommodate lighting conditions, your natural line of vision, and preferred working posture. A 4-ft (1.2 m) cable connects the monitor to a lightweight, low-profile, Wang Professional Computer (PC)-style, detachable keyboard. Both the monitor and the keyboard surfaces have matte finishes to minimize glare.

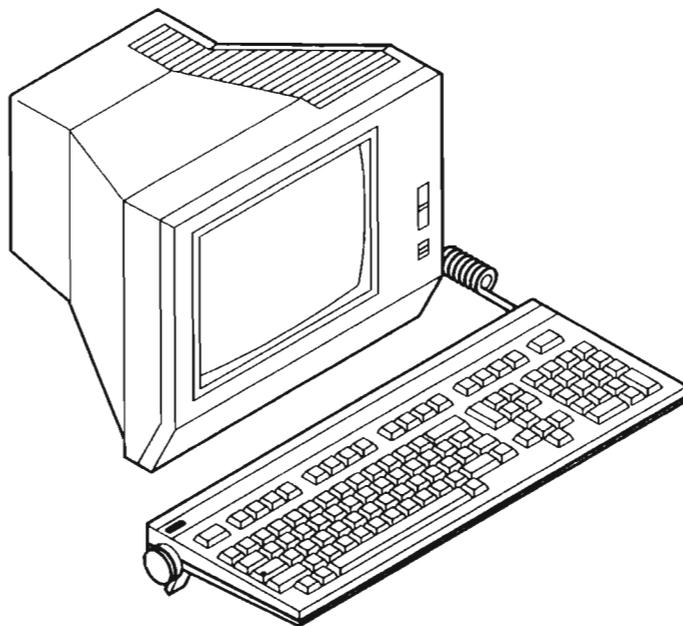


Figure 1-1. The Wang Model 2536DW Interactive Terminal

The 2536DW Interactive Terminal allows you to create highlighted displays with special character display attributes such as:

- Bright or normal
- Blinking or nonblinking
- Underlined or nonunderlined
- Reversed video or normal video

You can use one or more character display attributes for each character displayed. The terminal's monitor can display both box and character graphics.

The 2536DW Interactive Terminal can support its own local printer. You can initiate a dump of the screen to the local printer from the keyboard, resulting in a printout of the standard characters present on the screen. When you use a Wang matrix printer as the local printer, highlighted displays, boxes, and special graphics figures of the terminal are included in the screen dump printout.

When you use the 2536DW Interactive Terminal with the Wang Model 2236MXE Terminal Processor, you can save the terminal's screen contents in a variable of a BASIC program. The screen can then be reproduced on the system printer, saved in a disk file, or transmitted to another system.

You can perform data processing applications, graphics applications, and word processing functions at the 2536DW Interactive Terminal. Word processing functions are executed by the Wang CS Series, MicroVP Series, or 2200 Series Word Processing (WP) software package. The software is document-oriented, allowing you to create, edit, and/or print complete documents as well as individual pages.

Among the features of the CS Series, MicroVP Series, or 2200 Series WP software package are:

- Operator prompts and automatic word wraparound
- Automatic indexing for superscripts and subscripts
- Automatic centering, indenting, and decimal alignment
- Global searching and replacing
- Text moving
- Text copying
- Right-margin justification

Text editing capabilities include the insertion and deletion of characters, words, lines, paragraphs, or entire sections of text. A special feature is the WP Plus Glossary, which allows you to record commonly used words, phrases, or standard paragraphs, that you can recall and display on the screen with only two keystrokes.

1.2 UNPACKING, INSPECTING, AND INSTALLING THE TERMINAL

Special factory packing techniques require that a Wang service representative unpack, inspect, and install the 2536DW Interactive Terminal. When the system arrives, call the Wang Customer Engineering Office and request that this service be performed. Failure to follow this procedure voids the warranty.

The Wang service representative checks that all equipment has been delivered, inspects each unit for possible shipping damage, connects each device in the system, and performs tests to verify the proper operation of all system components.

If your system includes modems and telephone lines, this equipment should be installed before the Wang equipment is delivered. The Wang service representative will connect the Wang equipment to the modems. The modem vendor or phone company, however, must connect all modems to the proper transmission lines. (For further details, refer to Chapter 4.)

Refer to Appendix B for information on preventive maintenance and recommended operating environments.

CHAPTER 2 OPERATING THE 2536DW INTERACTIVE TERMINAL

2.1 OVERVIEW

This chapter provides you with information on how to operate the 2536DW Interactive Terminal. The chapter also includes information on how to power on the terminal, configure the terminal, and how to enter and edit data.

2.2 THE 2536DW INTERACTIVE TERMINAL CONTROLS

The 2536DW Interactive Terminal controls enable you to adjust the terminal to suit your needs. The terminal's sliding power switch is located on the front of the terminal. When the slide is in the (1) position (or higher), the terminal's power is on. When the slide is in the (0) position (all the way down), the terminal's power is off.

The voltage setting switch is located on the rear panel to the left of the power cord jack. Figure 2-1 shows the back panel of the terminal. Your Wang service representative will ensure that this switch is set to the voltage appropriate to your location.

Warning: Do not change the setting on the voltage switch. Depending on the line voltage appropriate to your country, the setting is either 115 volts or 230 volts.

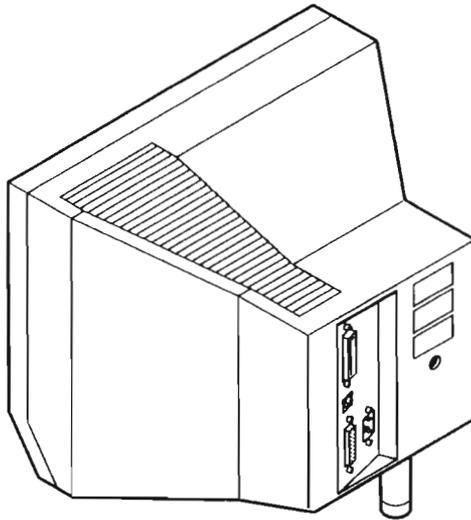


Figure 2-1. Back Panel of the Terminal

2.2.1 Terminal Power On

When you power on the terminal, the terminal microprocessor performs a self-diagnostic test to ensure that the terminal is functioning properly. If the diagnostic test finds a terminal fault, the terminal alarm sounds once and an error message and error code are displayed on the screen. If this happens, turn the terminal off, wait several seconds, then turn it on again. If the error recurs, notify a Wang service representative.

After successful execution of the terminal diagnostic on an initial start-up of the terminal, the terminal displays a copyright notice and its self-identification message at the top of the screen. The self-identification message indicates the current version of the terminal microprogram, the communication rate, and the communication character format. (If the terminal is attached to a 2236MXE Terminal Processor, the self-identification message is displayed and erased fairly quickly.) If the terminal is already warm, a video screen diagnostic appears and disappears before the self-identification message is displayed. To attach a terminal to a partition, press the SHIFT and RESET keys simultaneously.

2.2.2 The 2536DW Workstation Configuration Menu

Perform the following steps to access the 2536DW Workstation Configuration menu:

1. Power on the terminal.

2. When the beep sounds, hold the SHIFT key down and press the 2ND key.
3. Release the SHIFT key, then release the 2ND key. Press the RESET key.

The 2536DW Workstation Configuration menu (Figure 2-2) is displayed on the monitor after the terminal diagnostics are run.

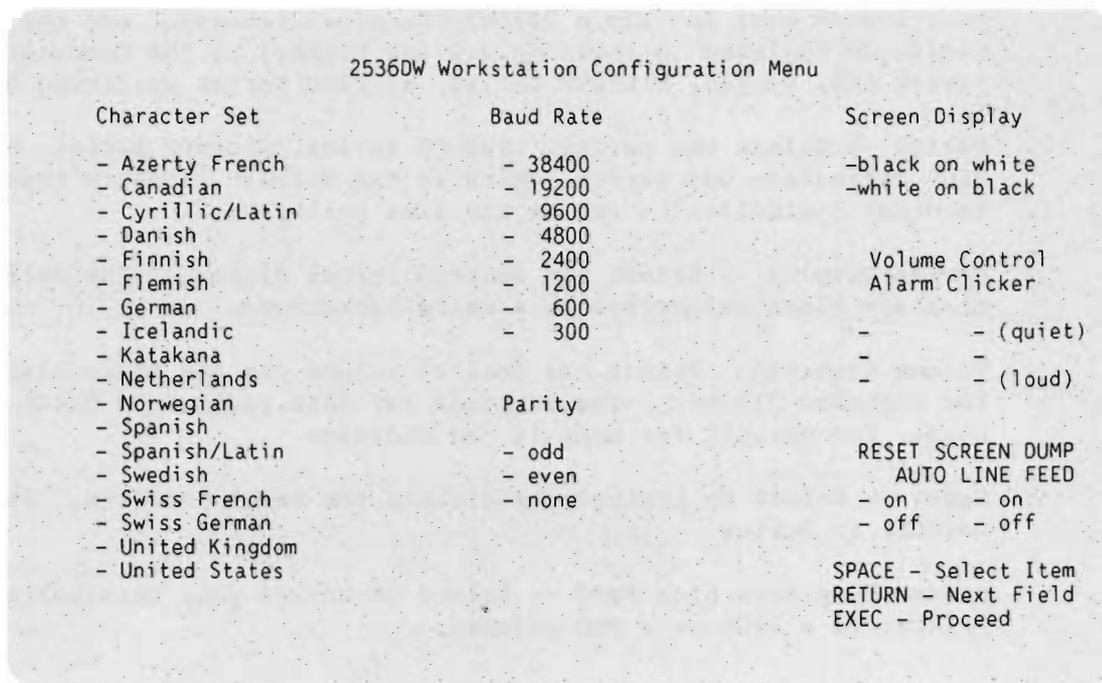


Figure 2-2. 2536DW Workstation Configuration Menu

You use the 2536DW Workstation Configuration menu to select the options that configure the terminal. Use the RETURN key or the TAB key to move between fields. Use the space bar to select items within a field. The acceptance block and bold display of the item indicate the current selection. When you complete the proper settings, press the EXEC key to enter Terminal mode. The selections that you make are saved and used as the new defaults the next time you power on the terminal.

The following list describes options you have when the terminal is in Terminal mode.

Character Set -- Select the language for your terminal that corresponds to your keyboard. The default is United States.

Baud Rate -- Select the baud rate at which you wish the terminal to communicate. Ensure that the terminal controller is set to the same rate. For the terminal to run at the maximum rate of 38,400 baud, your system must include a 2236MXE Terminal Processor and the MXE microcode included in revision 3.2 (or higher) of the Computer System (CS) Series, MicroVP Series, or 2200 Series Operating System.

Parity -- Select the parity. The CS Series, MicroVP Series, and 2200 Series use Odd Parity, which is the default. Ensure that the terminal controller is set to the same parity.

Screen Display -- Select the desired screen display. The default displays black characters on a white background.

Volume Control -- Select the desired volume for the Audio Alarm and the Keyboard Clicker. The settings for both range from Quiet to Loud. The default for both is the Midrange.

Reset -- Select to activate or disable the reset function. The default is Active.

Screen Dump Auto Line Feed -- Select ON unless your terminal's printer is a 2200 or a PMO printer.

2.3 THE MONITOR

The 2536DW Interactive Terminal includes a 12-in. (30.5 cm) diagonally measured monitor. The monitor displays a full 128-character set, including:

- Uppercase and lowercase alphabetic characters
- Some foreign language characters
- Special symbols
- Underlining

The monitor also displays an alternate character set of graphics characters and box graphics. All characters can be displayed using one or more of several character display attributes.

The monitor has a 25-line, 80-character-per-line capacity (2,000 character positions) for full-screen operator prompting and verification of keyed characters. A slide switch on the monitor controls the brightness of the image and powers the monitor on/off. The maximum display speed is approximately 2,000 characters per second (at 38,400 baud).

A cursor resembling an underscore indicates the location on the display where the next character will appear. In addition to controlling cursor movement and positioning from the keyboard, you can use a number of codes to manipulate the cursor under program control for special format displays.

The terminal also allows you to program underscores, character attributes, and box graphics. These special features can simplify full-screen operator prompting and can highlight portions of a screen display. Refer to Chapter 3 for more information.

Clean the screen periodically with a soft cloth dampened with mild soap and water. Never spray liquid directly on the workstation. Do not use an alcohol pad or abrasive compound, because these can damage the screen and adjacent areas.

Warning: Due to the danger of high voltage, do not attempt to remove the cover of the console. Call a Wang service representative if maintenance is required.

2.4 THE KEYBOARD

The terminal keyboard (Figure 2-3) is similar to a standard typewriter keyboard and numeric keypad. You can use the keyboard to enter data, write programs, perform calculations, enter commands to the processor, and perform word processing.

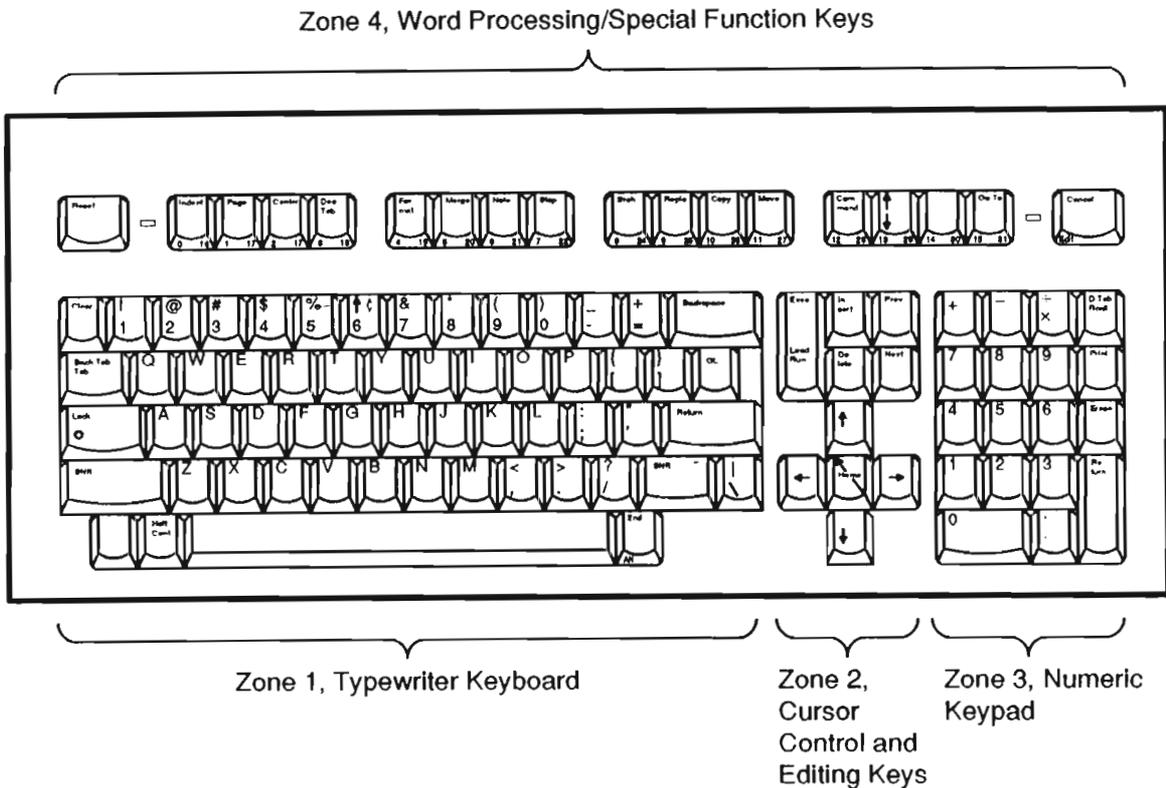


Figure 2-3. 2536DW Interactive Terminal Keyboard

2.4.1 Zone 1: Typewriter Keyboard

Zone 1 is similar to a standard typewriter keyboard and contains the following keys:

- Alphanumeric characters
- Special characters (#, \$, %)
- Numeric operators (+, *, /, -)
- Programming keys, HALT, CONT (Continue)
- CLEAR, and the Backspace, TAB, GL, RETURN, and SHIFT keys.

The GL key provides Special Function 124 when unshifted and 125 when shifted.

The TAB key provides Special Function 126 when unshifted and 127 when shifted (refer to the description of Zone 4).

2.4.2 Zone 2: Cursor Control and Editing Keys

Zone 2 contains the following keys:

- Editing keys (INSERT and DELETE)
- Location keys (NEXT and PREV)
- Cursor control keys (up, down, right, and left)
- EXEC and LOAD RUN key
- HOME key

2.4.3 Zone 3: Numeric Keypad

Zone 3 is a standard 10-key numeric pad for rapid entry of numeric characters. You can type digits using the numeric keypad in this zone or you can use the alphanumeric keys in Zone 1. This zone also includes the ERASE, PRINT, D TAB/RCALL, and RETURN keys.

2.4.4 Zone 4: Word Processing/Special Function Keys

Zone 4 contains the 16 Word Processing/Special Function keys at the top of the keyboard. When you use WP, these Function keys simplify document creation and revision. For example, the CENTER key automatically centers a line of text, the MOVE key moves text within a document, and the REPLC key replaces one character-defined sequence with another.

The Word Processing keys also serve as Special Function keys that you can set to perform program-defined functions. Because each of these keys may be pressed in conjunction with the SHIFT key, a total of 32 Special Function keys is available. The keys are numbered 0 to 15 (without the SHIFT key) and 16 to 31 (with the SHIFT key). Simultaneously pressing a key numbered 0 to 15 and the SHIFT key accesses a key from 16 to 31. Each key is labeled with the function key number. The TAB key and the GL key in Zone 1 can also be used as Special Function keys.

You can use Special Function keys to perform a variety of tasks (e.g, start program execution or subroutines) or to enter a predefined text string. The function of each Special Function key is shown by a screen prompt and on the label strip located immediately below the row of Function keys. To perform a given task, a Special Function key must be defined with a DEFFN' statement in the currently loaded program. The Special Function keys are also used to load the operating system during Master Initialization.

Upper/Lower
Case
Toggle

When you press the SHIFT key while pressing the 2ND key, the right hand LED lights to indicate that the keyboard is in upper/lowercase mode. You can toggle between uppercase mode and upper/lowercase mode by pressing the SHIFT key while pressing the 2ND key.

Several types of function keys handle control functions. When you press the LOCK key, uppercase alphabetic characters are produced, whether the keyboard is shifted or unshifted. Shifted numeric keys produce symbols and special characters. Unless you press the LOCK key, the keyboard functions as a standard typewriter, producing uppercase and special characters when shifted, and producing lowercase and numeric characters when unshifted.

When you press the RESET key (located in the upper left corner of the keyboard) when in uppercase mode only, the following sequence of events occurs:

- Program execution immediately stops
- Listing and input/output (I/O) operations stop
- The monitor clears
- The cursor returns to the home position
- The monitor displays the partition-ready message
- The terminal returns to Console Input mode

The RESET key is also used during Master Initialization and hardware diagnostic operations.

Notes: Do not use the RESET key to end program execution, since it could clear necessary variables. Use the HALT key for this purpose. As a protective feature, the RESET and HALT keys are active only if pressed in conjunction with the SHIFT key.

*On a CS Series, MicroVP Series, or 2200 Series multi-user system, the RESET key affects **only** the partition to which the terminal is currently attached.*

2.4.5 Keyboard Features

The keys are ideally suited for high-speed typing or data entry. All keys provide adjustable audio feedback when they are touched with sufficient pressure to ensure entry of a character. A program-controlled audio alarm with adjustable volume alerts you when special conditions occur.

The keyboard enables you to underline characters. On non-English versions of the keyboard, you can accent characters. Each character and Special Function key on the keyboard repeats when you hold the key down. The keyboard clicker sounds each time the repeated character is transmitted.

The keyboard includes the following special features:

Keyboard clicker -- The clicker provides audio feedback when you press a key. You can adjust the volume of the keyboard clicker during terminal configuration using the 2536DW Terminal Configuration menu (see Figure 2-2).

N-key rollover -- The N-key rollover feature helps eliminate errors during high-speed typing. This feature permits you to press a new key and to display that character on the screen while you are still holding down a previous key. This process can continue for any number of keys. Each new key that is pressed takes precedence over any keys already held down.

Terminal alarm -- The alarm provides audio feedback to indicate that errors or special conditions have occurred, such as when you press an undefined Special Function key or type beyond that specified field. You can use the 2536DW Workstation Configuration menu to adjust the volume of the terminal alarm.

The keyboard can produce both uppercase and lowercase characters for data processing and word processing applications. It can also produce uppercase characters only for data processing applications.

The keyboard displays three light emitting diodes (LEDs):

- On the LOCK key. Indicates that alphabetic characters are displayed in uppercase.
- On the RESET key. Used for diagnostic purposes.
- Near the CANCEL key. Indicates that the keyboard is in upper/lowercase mode.

2.4.6 Operation of Keyboard Modes

Table 2-1 lists the characters produced when the keyboard keys are pressed in unshifted and shifted modes, with the uppercase mode only, and with the uppercase/lowercase mode.

Table 2-1. Operation of Keyboard Modes

	Uppercase Mode	Upper/Lowercase Mode
Unshifted Operation	Alpha Keys - Uppercase Punctuation - Lowercase Numerics - Lowercase (numbers) Special Function - 0 to 15 CONTINUE - Active HALT - Inactive RESET - Inactive ERASE - From cursor position LOAD RUN - RUN PRINT - Produces PRINT Statement CANCEL - Screen dump	Alpha Keys - Lowercase Punctuation - Lowercase Numerics - Lowercase (numbers) Special Function - 0 to 15 CONTINUE - Active HALT - Inactive RESET - Inactive ERASE - From cursor position position LOAD RUN - RUN PRINT - Produces PRINT Statement
Shifted Operation	Alpha Keys - Uppercase Punctuation - Uppercase Numerics - Uppercase (symbols) Special Function - 16 to 31 CONTINUE - Inactive HALT - Active RESET - Active ERASE - Line Erase LOAD RUN - LOAD PRINT - Inactive CANCEL - Remote screen dump	Alpha Keys - Uppercase Punctuation - Uppercase Numerics - Uppercase (symbols) Special Function - 16 to 31 CONTINUE - Inactive HALT - Active RESET - Inactive ERASE - Line Erase LOAD RUN - LOAD PRINT - Local Screen Dump

2.5 ENTERING AND EDITING DATA

You can use the 2536DW Terminal editing keys to modify program lines, immediate mode lines, and data entered in response to input statements. The editing keys are used to:

- Recall a text line or data value for editing
- Move the cursor to the character to be changed
- Insert space for new characters
- Delete characters

The RETURN key is typically used to terminate the entry of a data item and signal the host to process the entered data. The Special Function keys can also be used to terminate an entry, if so defined by the user program. Touching an undefined Special Function key sounds the audio alarm, but does not otherwise affect system operation.

The keys used for editing and the editing functions performed by these keys are described in Table 2-2. Text entry and editing are usually limited to the field being edited, although it is possible for an application program to redefine the functions of the editing keys.

Table 2-2. Editing Keys and Their Functions

Key	Zone	Function
Cursor Control Keys	2	Move the cursor a single space to the left or right, or up or down one line (if the current text occupies more than one line).
RECALL	3	Recalls (for editing) a specified program line, data value, or Immediate mode statement from memory.
INSERT	2	Expands a field for additional text and data entry by inserting a space character at the current cursor position.
DELETE	2	Deletes the character at the current cursor position.
ERASE	3	If the SHIFT key is not pressed, erases the line from the cursor position to the end of the line. If the SHIFT key is pressed, erases the entire line.
BACKSPACE	1	Moves the cursor one position to the left and erases the character in that position.

You can use the terminal for program editing functions when it is in Edit mode. Press the EDIT key to put the terminal in Edit mode. The Edit mode may also be entered under program control.

In the Edit mode, Special Function keys 4 to 15 become system-defined edit keys. The remaining Special Function keys, except for the FN key, are disabled. The editing functions are described in Table 2-3. To leave the Edit mode and reactivate the user-defined Special Function keys, terminate the entry of the field by pressing the RETURN key, or press the EDIT key again.

In a CS Series, MicroVP Series, or 2200 Series MVP configuration, line editing functions are performed by the terminal processor, and a blinking cursor indicates that the system is in Edit mode.

Table 2-3. Edit Mode Keys and Their Functions

Special Function Key	Function
4	Moves the cursor to the end of the field.
5	Moves the cursor to the next line (if the text occupies more than one line).
6	Moves the cursor to the previous line (if the current text occupies more than one line).
7	Moves the cursor to the beginning of the field.
8	Erases the line from the cursor position to the end of the field.
9	Deletes the character at the current cursor position.
10	Expands a field for additional text and data entry by inserting a space character at the current cursor position.
11	Moves the cursor five spaces to the right.
12	Moves the cursor one space to the right.
13	Moves the cursor one space to the left.
14	Moves the cursor five spaces to the left.

(continued)

Table 2-3. Edit Mode Keys and Their Functions (continued)

Special Function Key	Function
15	Recalls (for editing) a specified program line, data value, or Immediate mode statement from memory.
EDIT	Enters and exits Edit mode.

2.6 THE TERMINAL PRINTER

Printers can be attached to the 2536DW Interactive Terminal by means of a printer controller in the host or directly to the terminal with a cable. A printer attached through the host is referred to as a system printer because it is typically available to any partition. A printer attached directly to a terminal is called a terminal printer because it is only available to partitions assigned to the terminal.

You can use the terminal printer in the same manner as the system printer, except that you can access the terminal printer only by programs initiated at the terminal to which it is attached. The device address is fixed at /204. You can use the terminal printer for screen dumps. You can plug any supported Wang printer or plotter with a 36-pin Wang Centronics-parallel cable connection into the printer connector on the terminal.

The BASIC-2 Multi-User Operating System permits only the current foreground partition to access the terminal's monitor and keyboard. The terminal printer, however, may be used by any foreground or background partition assigned to the terminal. The \$RELEASE TERMINAL statement releases the terminal monitor and keyboard from the current foreground partition, but does not affect the terminal printer or the partition outputting to it.

Programmers can use the \$OPEN statement to maintain exclusive control of the printer to prevent the intermixed output that may result if printing is attempted from two partitions at the same time. If the \$OPEN statement is used in the foreground partition, you can halt the print job by pressing the SHIFT and RESET keys simultaneously. This clears the printer buffers of the terminal processor and the terminal and releases the printer from its exclusive state.

Background printing is not recommended for terminals using communication rates less than 1,200 baud since character echoing may be delayed noticeably.

2.7 THE SCREEN DUMP

The screen dump feature of the 2536DW Interactive Terminal allows you to obtain a hard copy record of the screen. There are two methods of producing a screen dump:

Local screen dump -- The terminal printer prints the current screen.

Remote screen dump -- The contents of the current screen are put into a BASIC program, where a programmer can process the screen. You can use this method to print the screen with the system printer or to save the screen in a disk file for later processing.

Note: You can save the contents of the screen to a variable only when you use the terminal with a Wang 2236MXE Terminal Processor.

2.7.1 Local Screen Dump

The local screen dump feature allows you to obtain a hard copy record of the screen by using a printer attached to the terminal. Local screen dump is a temporary off-line terminal operation that you initiate. A program can neither initiate nor detect the activation of a local screen dump.

You can use a local screen dump to obtain a hard copy record of the screen even after the program has stopped with an error or after a failure of the host.

Note: You must not initiate a local screen dump while the terminal printer is in use.

If you initiate a local screen dump while a program is using the printer, the local screen dump output is printed on a separate page, and printing is resumed without the deletion of any characters. The Configuration screen includes the option of having an Auto Line Feed after each line.

To perform a local screen dump, press the SHIFT and PRINT keys. The screen dump proceeds as follows:

1. Continue to press the PRINT key. A click sounds. The screen freezes with the image to be dumped.
2. Continue to press the PRINT key until a second click sounds. The screen dump is activated. (If you release the PRINT key before you hear the second click, the screen is unfrozen.)
3. The screen image is transmitted to the printer, preceded by a carriage return and form feed.

4. The local screen dump ends with another form feed.
5. Processing of output from the host resumes. (No data is lost, even if the host attempts output to the monitor or printer while the local screen dump is in progress.)

During a local screen dump, the keyboard remains active, except for the RESET and SHIFT keys. Press the RESET key to terminate the screen dump and leave the screen intact. Press the SHIFT and RESET keys simultaneously to terminate the local screen dump and clear the screen.

If the local screen dump fails, make sure the printer is selected and properly connected and try again. If the local screen dump still fails, press the CLEAR button on the printer.

When you use the local screen dump feature with a Wang matrix printer such as the Wang Model 2245/160 matrix printer, the screen is printed with box and character graphics intact, as they appear on the screen. Refer to Chapter 3 for a description of the 2536DW Interactive Terminal's graphics capabilities.

When you use a Wang printer other than a 2245 matrix printer for a local screen dump, a subset of the monitor character set is used for the printout. The U.S. version of the 2536DW Interactive Terminal screen dumps all characters between HEX(20) and HEX(7E), including all uppercase and lowercase characters on the keyboard. Underlined characters are printed without underlines. The character set used for a local screen dump varies among the international versions of the 2536DW Interactive Terminal. However, the following general rules apply:

- Any character not in the local screen dump character set is printed as #.
- Display attributes are ignored. All characters are printed in the same font and pitch. (Refer to Section 3.3.)
- Character set graphics are printed as #. (Refer to Section 3.4.)
- Box graphics are ignored. (Refer to Section 3.5.)

Note: *Since printing is interrupted when a screen dump is requested, the screen dump page will be inserted into a report already printing. Although screen dumps eject a page before and after a dump, the printout in progress may be temporarily halted in the middle of a page. For some documents, this may be acceptable, but for preprinted forms such as invoices or statements, a screen dump that interrupts current printing may cause problems.*

2.7.2 Remote Screen Dump

When used with a Model 2236MXE Terminal Processor, the 2536DW Interactive Terminal lets you store an image of the currently displayed screen in a BASIC variable. The screen can then, for example, be printed on the system printer or saved in a disk file for later processing.

You can initiate a remote screen dump manually or by means of a BASIC program. You can press the SHIFT and EDIT keys simultaneously, which attaches the terminal to a partition previously made available for screen input. A BASIC program reads the screen of the terminal attached to the partition by executing the INPUT SCREEN command.

2.7.3 The INPUT SCREEN Command

The INPUT SCREEN statement reads the screen of the terminal attached to the current partition and stores an image of the screen in the alpha variable. Each character on the screen and its associated display attributes are represented in the screen image. Display attributes of the terminal are described in Chapter 3.

***Note:** You can use the INPUT SCREEN statement only with the 2236MXE Terminal Processor. If you attempt to execute the INPUT SCREEN statement on the terminal with a controller other than the 2236MXE, an error will result.*

INPUT SCREEN can only be executed by a foreground partition (a partition with a terminal attached). If a background partition with a terminal assigned to it executes INPUT SCREEN, execution is suspended until the terminal is attached and the partition becomes a foreground partition.

To read the terminal screen attached to the current partition, use a BASIC command of the following form:

General Form:

```
INPUT SCREEN alpha variable
```

Example of valid syntax:

```
INPUT SCREEN A$()
```

During screen input, the terminal sends a total of 4080 bytes (characters) to the alpha variable. Therefore, the alpha variable should be at least 4,080 characters in length in order to receive a full screen. The screen image stored in the alpha variable consists of the following items:

- Terminal self-identification message
- Current cursor position
- Characters currently displayed
- Display attributes for each character

The first 78 bytes contain the self-identification message. This message identifies the type of terminal and its character set. The next two bytes identify the cursor location: the first byte identifies the row position; the second byte identifies the column position. Rows are numbered 0 to 24. Columns are numbered 0 to 79.

The next 2,000 bytes in the alpha variable represent the characters currently displayed (25 rows by 80 columns). The terminal uses the character codes of the Alternate Character Set (see Figure 3-11). Codes are sent row by row, starting at the first character in the first row. The 25th row of characters is all zeros.

Each character has an associated attribute byte describing how the character is displayed. The 2,000 bytes representing the characters are followed by 2,000 bytes representing the display attributes. The 25th row of display attributes is for the box graphics. A display attribute has the following format:

Bit 80 = 1 if character graphic
Bit 40 = 1 if reverse video
Bit 20 = 1 if blinking
Bit 10 = 1 if bright
Bit 08 = 1 if underline
Bit 04 = 1 if left horizontal box graphic segment
Bit 02 = 1 if vertical box graphic segment
Bit 01 = 1 if right horizontal box graphic segment

2.7.4 Operator-Initiated Screen Input

Executing INPUT SCREEN in a partition that has previously executed a \$RELEASE PART command notifies the operating system that this partition is available to receive screen input initiated by a terminal operator. Execution is suspended until a request for screen input is received.

To initiate screen input, press the SHIFT and EDIT keys simultaneously for at least two seconds. The operating system attaches the terminal to a partition waiting to receive screen input. If a partition is not available, the INPUT SCREEN request remains pending until a partition becomes available or until you abort the request by pressing the RESET key or by pressing the SHIFT and RESET keys simultaneously. Pressing the RESET key terminates the screen dump and resets your foreground partition.

To handle more than one screen input concurrently, you can set up multiple partitions to receive screen input. The operating system selects an available partition for each screen input. Once the terminal has been attached to a partition, the INPUT SCREEN statement resumes execution.

When INPUT SCREEN has been executed, the partition remains assigned to the terminal but becomes a background partition. You can use the #TERM function to identify the terminal from which the screen input was executed. The partition from which INPUT SCREEN was evoked becomes the foreground partition again and normal processing of output from the host resumes. No data is lost, even if the host attempts output to the monitor or printer while screen dump is in process.

As soon as the screen data has been processed, you can make the partition that executed the INPUT SCREEN command available for another screen input by re-executing the \$RELEASE PART and INPUT SCREEN statements.

The following program outlines how a program to receive screen input might be structured.

```
0010 DIM A$(68)60
0020 REM release partition from any terminal
      : $RELEASE PART
0030 REM wait for screen input
      : INPUT SCREEN A$()
0040 REM process screen input ...
0050 GOTO 10
```


CHAPTER 3 PROGRAMMING THE 2536DW INTERACTIVE TERMINAL

3.1 OVERVIEW

Programmable features of your 2536DW Interactive Terminal include:

- Control of cursor movement
- Character display attributes
- Box graphics
- Alternate character sets (including character graphics)

The BASIC-2 BOX function allows easy implementation of the box graphics feature.

All other features are programmed by sending a series of one or more control codes to the terminal. Although the BASIC-2 HEX function is used for most examples in this chapter, cursor control can be stored and transmitted to the terminal in alpha variables.

The HEX function is a literal string used to describe one or more characters in terms of their hexadecimal representations. The HEX codes are composed of a pair of hexadecimal digits (the integers 0 to 9 and the letters A to F). There is no limit to the number of characters which can be described in a single HEX function. Because a HEX literal describes complete characters, a HEX literal must consist of an even number of hexadecimal digits.

Any character can be represented by a HEX literal (refer to Appendix C). Usually, however, HEX literals are used to describe characters not found on the keyboard or codes that perform control functions.

3.2 THE MONITOR CONTROL CODES

The following is a list of monitor control codes used by the 2536DW Interactive Terminal.

HEX(00) to HEX(0F) -- Reserved by the terminal for controlling such features as cursor movement, display attributes, and the terminal alarm. HEX 00 represents a null action.

HEX(0E) and HEX(0F) -- Used for controlling the character attributes.

HEX(02) -- Introduces the start of a multibyte sequence.

The various uses of these codes are detailed in the following sections. (HEX(0B) and HEX(04) are reserved for future use.)

All remaining codes are used to control cursor appearance and movement. Appendix C contains a complete chart listing the monitor control codes and their respective actions.

Note: Programs that use these codes in a manner other than that documented in this manual may not be compatible with future Wang Computer System (CS) Series, MicroVP Series, or 2200 Series monitors.

3.2.1 Cursor Control Codes

The PRINT AT function positions the cursor at a specified row and column on the screen. The PRINT HEX function sends cursor control codes to the terminal. For example, either PRINT AT (0,0) or PRINT HEX(01) moves the cursor to the top left corner of the screen. The following cursor controls are available:

HEX Value	Action
HEX(01)	Moves the cursor to the home position (top left corner of the CRT)
HEX(03)	Clears the screen and returns the cursor to the home position
HEX(05)	Turns the cursor on
HEX(02050F)	Causes the cursor to blink
HEX(06)	Turns the cursor off
HEX(08)	Moves the cursor to the left one space without erasing any characters (nondestructive backspace)
HEX(09)	Moves the cursor to the right one space without erasing any characters (nondestructive space)
HEX(0A)	Moves the cursor down one line (line feed)
HEX(0C)	Moves the cursor up one line
HEX(0D)	Moves the cursor to the beginning of the current line (carriage return)

You can combine HEX codes in a single statement to perform several functions. Each function is executed as it occurs in the sequence. For example, the statement HEX(030A0909) clears the screen and returns the cursor to the home position (03), inserts a line feed (0A), and indents two spaces to the right (0909). PRINT and PRINTUSING statements automatically issue a carriage return and a line feed if they are not terminated with a comma or a semicolon. To observe the effect of several control codes, execute the following example program:

```
CLEAR
10 PRINT HEX(03)
20 PRINT "EXAMPLE 1 - EXAMPLES OF CONTROL CODES"; HEX(0A0A)
30 PRINT "WANG LABORATORIES, INC."; HEX(0D0A); "ONE INDUSTRIAL
AVENUE"; HEX(0D0A); "LOWELL, MASSACHUSETTS"; HEX(0A)
40 PRINT "WANG LABORATORIES, INC."; HEX(0A); "ONE INDUSTRIAL
AVENUE"; HEX(0A); "LOWELL, MASSACHUSETTS"; HEX(0A)
RUN
```

The HEX(03) in Line 10 clears the screen and returns the cursor to the home position. The title "Example 1 - Examples of Control Codes" is then printed starting at screen position (0,0). The HEX(0A0A) in Line 20 issues two line feeds before displaying any output.

The displays produced by Lines 30 and 40 differ (see Figure 3-1). Line 30 issues both a carriage return and a line feed, HEX(0D0A). The display produced is a neatly formatted address. Line 40, however, issues only a line feed, HEX(0A). Since HEX(0A) moves the cursor down one line from its current position, a staggered address is produced.

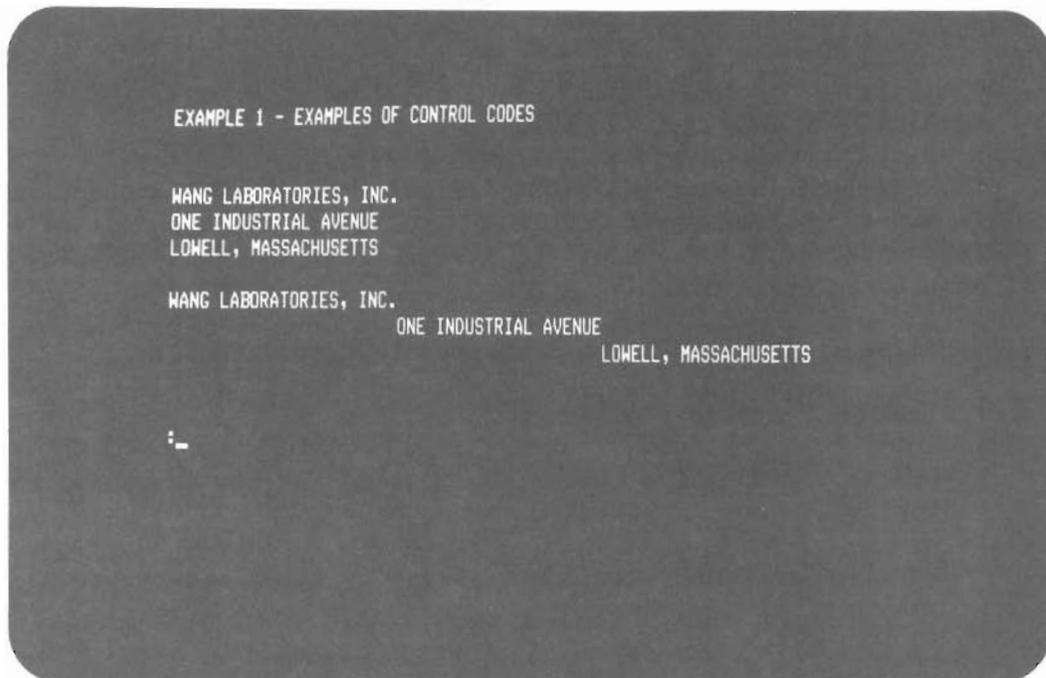


Figure 3-1. Examples of Control Codes

3.2.2 Cursor Appearance

The blinking cursor sequence is sent to the terminal with a PRINT HEX(02050F) statement, and is used in applications that take in data on a character-by-character basis with KEYIN. The MicroVP Operating System uses the blinking cursor to indicate the Edit mode. For programs using a display monitor, a more aesthetically pleasing display may result if the cursor is turned off with a HEX(06). The operating system use of the blinking cursor cannot be overridden. The operating system turns on the cursor and sets it to blinking or steady as appropriate when the following conditions occur:.

- An INPUT or LINPUT statement is executed
- Console Input is entered by executing STOP or END
- Pressing the HALT or RESET keys

3.2.3 The Audio Alarm

The terminal's audio alarm can be programmed to beep by issuing a PRINT HEX(07) to the monitor. You can cause the terminal to produce several beeps by selecting a pause between beeps with the SELECT P command. The digit following P specifies the length of the pause in increments of 1/6 second. The following example causes the terminal audio alarm to sound three times with 1/3 second pause between beeps.

```
CLEAR
10 SELECT P 2
20 FOR I=1 to 3
30 PRINT HEX (070D)
40 NEXT I
RUN
```

3.3 CHARACTER DISPLAY ATTRIBUTES

To highlight information on the screen, the 2536DW Interactive Terminal provides several display attributes that you can select for any character displayed on the screen. The following display attributes are available:

Bright -- Characters are displayed in high intensity.

Blink -- Characters blink.

Reverse Video -- The character is light and the character background display is dark (white on black mode).

Underline -- Characters are displayed with an underscore.

3.3.1 HEX Codes Used to Invoke Display Attributes

Immediately after power-on, the terminal displays characters in normal intensity, i.e., nonbright, nonblinking, normal video (dark characters on light background for black on white mode), and nonunderlined.

The power-on default meaning of HEX(0E) is bright, nonblinking, normal video, and nonunderlined. For further information on the default meaning of HEX(0E), refer to Section 3.3.4.

The display attribute used is determined by sending a command of the following form to the monitor:

```
        HEX(02 04 xx yy 0E)
    or
        HEX(02 04 xx yy 0F)
```

where:

02 04 = The control code sequence that indicates to the terminal that special character display attributes are to be selected.

xx yy = The HEX codes that specify the display attributes to be selected, where:

xx = 00 for normal intensity, no blink
02 for bright, no blink
04 for normal intensity, blinking
0B for bright, blinking

yy = 00 for normal video, no underline
02 for reverse video
04 for underline
0B for reverse video, underline

0E or 0F = A terminator character that causes the display attributes selected by xx yy to be turned on or off. HEX(0E) turns the selected attributes on; HEX(0F) turns them off.

3.3.2 Turning On Character Display Attributes

To highlight portions of the display area, a program must execute the appropriate HEX(0204...) sequence *before* the character or string of characters that require an attribute is output. A sequence ending in 0E, e.g., HEX(020400020E), selects and turns on an attribute. A sequence ending in 0F, e.g., HEX(020402040F), selects an attribute, but does not turn it on. Execute the following program to see the possible display attributes, i.e., bright, blinking, underline, and reverse video.

```

CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 2 - THE DISPLAY ATTRIBUTES"
20 PRINT
30 PRINT HEX(020402000E); "THE STAR IS BRIGHT."
40 PRINT
50 PRINT HEX(020400040E); "PLEASE UNDERLINE YOUR NAME."
60 PRINT
70 PRINT HEX(020400020E); "DO YOU LIKE REVERSE VIDEO?"
80 PRINT
90 PRINT HEX(020404000E); "THE EMERGENCY LIGHT IS BLINKING."
100 PRINT HEX(0F)
RUN

```

Each HEX statement is located before output to be highlighted and each HEX sequence ends with an 0E. (See Figure 3-2.)

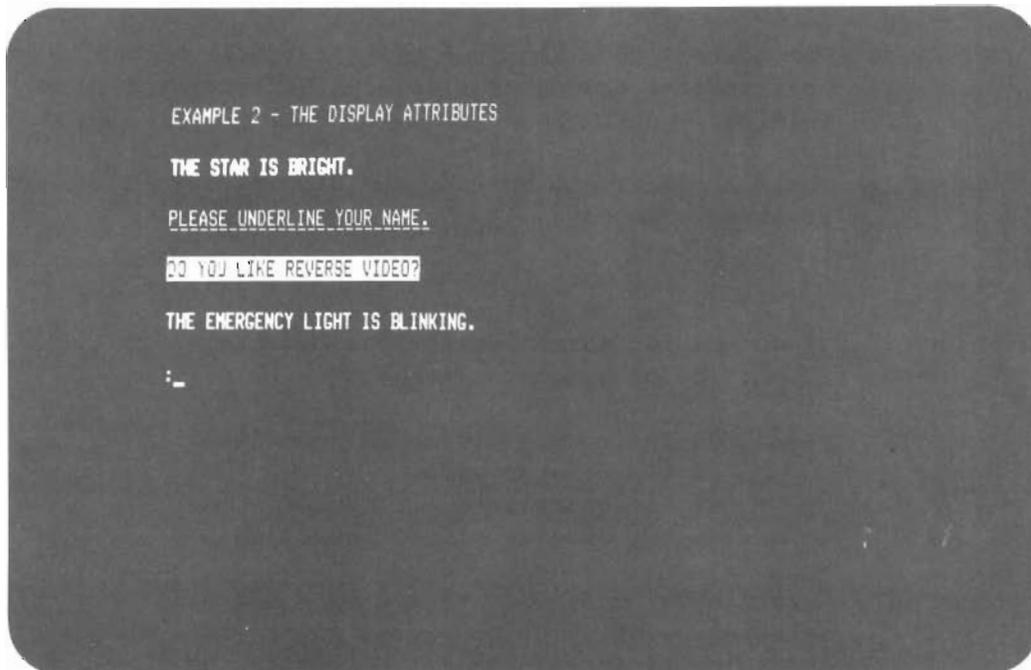


Figure 3-2. The Display Attributes

If you use the appropriate code, any combination of one or more attributes is possible. The following HEX sequences and their respective screen displays are examples of the possible combinations of attributes.

`PRINT HEX(020402020E)` -- For a bright, reverse video display.

PRINT HEX(020402040E) -- For a bright display with underline.

PRINT HEX(02040B0B0E) -- For a bright, blinking, underlined, reverse video display.

By placing the HEX(0204...) sequence in the appropriate position, you can modify the previous example to highlight only the key words that describe an attribute. Also, instead of using the PRINT statement to insert blank lines between each displayed sentence, you can use the control code for line feed, HEX(0A). In the following example, the location of the HEX sequence and the resulting screen display (Figure 3-3) differs from the example illustrated in Figure 3-2.

```
CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 3 - HIGHLIGHTING KEY WORDS"
20 PRINT HEX(0A)
30 PRINT "THE STAR IS "; HEX(020402000E); "BRIGHT."
40 PRINT HEX(0FOA)
50 PRINT "PLEASE "; HEX(020400040E); "UNDERLINE"; HEX(0F); " YOUR
NAME."
60 PRINT HEX(0A)
70 PRINT "DO YOU LIKE THE "; HEX(020400020E); "REVERSE VIDEO?"
80 PRINT HEX(0FOA)
90 PRINT "THE EMERGENCY LIGHT IS "; HEX(020404000E); "BLINKING."
100 PRINT HEX(0F)
RUN
```

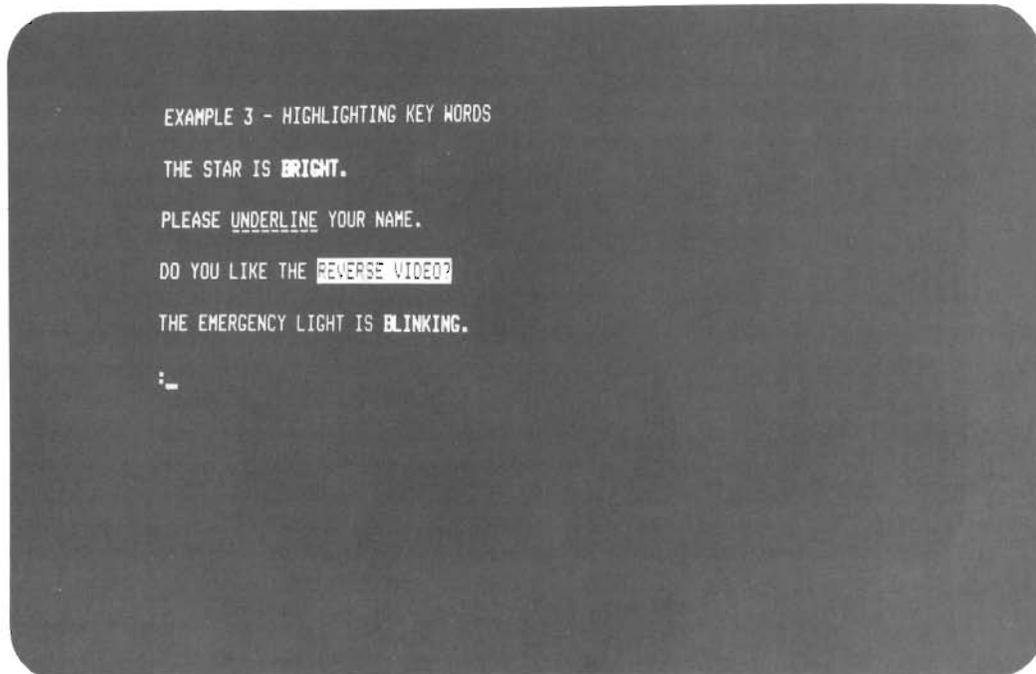


Figure 3-3. Highlighting Key Words

3.3.3 Turning Off Character Display Attributes

Once the selected attribute is turned on, it remains in effect until it is turned off. The following example is one of several ways to turn an attribute off:

```
CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 4 - THE USE OF HEX(0F)"; HEX(0A)
20 PRINT HEX(020402000E); "WE HAVE SELECTED THE BRIGHT ATTRIBUTE."
30 PRINT "THE LIGHT IS VERY BRIGHT."
40 PRINT "THE ATTRIBUTE REMAINS IN EFFECT UNTIL IT IS TURNED OFF."
50 PRINT "ALL THESE LINES ARE BRIGHT."; HEX(0A)
60 PRINT "HEX(0F)"; HEX(0F); " IS USED TO TURN OFF AN ATTRIBUTE."
RUN
```

The HEX sequence in Line 20 selects and activates the attribute "bright intensity" (normal video, no blink, no underline). The attribute remains in effect for as many lines as desired. (See Figure 3-4.) Each of the four literals in Lines 20 to 50 appear on the screen in bright intensity. In this example, the HEX(0F) in Line 60 is used to turn off the selected attribute and restore normal intensity. An isolated HEX(0F) *always* turns off a selected attribute and restores normal intensity.

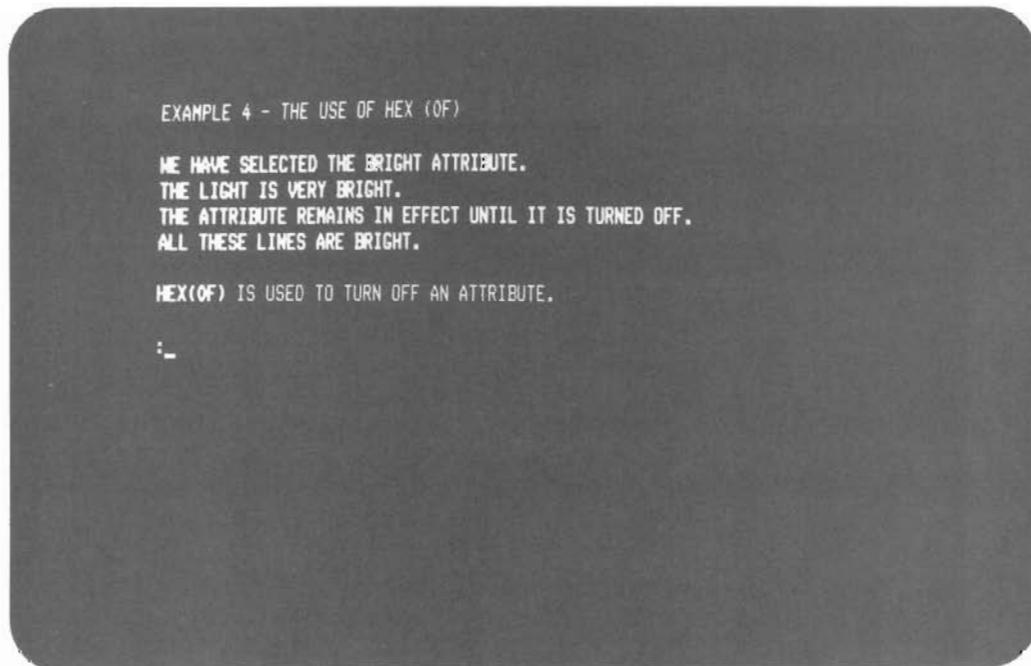


Figure 3-4. The Use of HEX(0F)

Another way to turn off a selected attribute is to select another attribute. As demonstrated in the following example, each new HEX(0204...) sequence turns off the previous attribute.

```
CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 5 - SELECTING ANOTHER ATTRIBUTE"; HEX(0A)
20 PRINT HEX(020402000E); "THIS LINE IS BRIGHT."; HEX(0A)
30 PRINT HEX(020400040E); "OUR SECOND LINE IS UNDERLINED."
40 PRINT "THIS LINE IS ALSO UNDERLINED."; HEX(0A)
50 PRINT HEX(020400020E); "NOW WE HAVE SELECTED REVERSE VIDEO.";
HEX(0A)
60 PRINT HEX(0F); "NORMAL INTENSITY RESTORED."
RUN
```

The HEX sequence in Line 20 selects and activates the attribute "bright intensity." Therefore, the sentence "This line is bright." appears on the CRT screen in bright intensity. The new HEX sequence in Line 30 selects and activates the attribute "underline," thus turning off the bright intensity attribute. The literals in Lines 30 and 40 are be underlined when displayed on the screen. Similarly, the HEX sequence in Line 50 selects and activates the attribute "reverse video," thus turning off the underline attribute. Finally, the HEX(0F) in Line 60 turns off the attribute and restores normal intensity. (See Figure 3-5.)

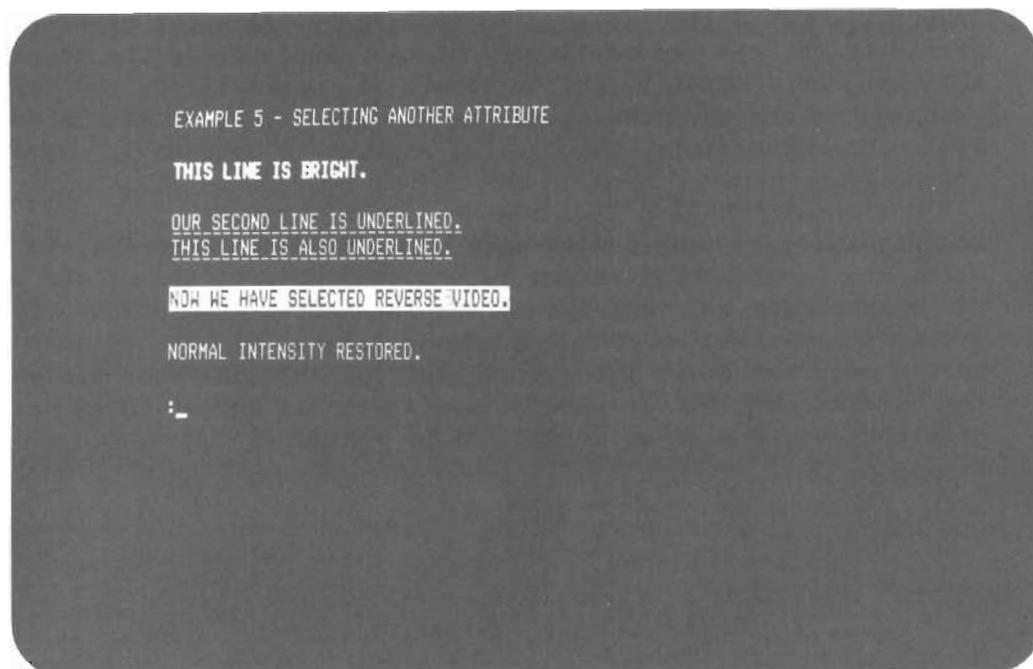


Figure 3-5. Selecting Another Attribute

3.3.4 The Use of Isolated HEX(OE)

You can use an isolated HEX(OE) to activate the *last* attribute selected by a HEX(0204...) sequence. When an attribute is turned on in this manner, the attribute remains in effect for a maximum of one text line. An automatic carriage return, a programmed carriage return issued with a HEX(0D), or a HEX(0F) turns the attribute off. The use of the isolated HEX(OE) is illustrated by the following sample program:

```
CLEAR
 5 PRINT HEX(03)
10 PRINT "EXAMPLE 6 - TESTING ISOLATED HEX(OE)"
20 PRINT
30 PRINT HEX(020400020E); "SELECTING REVERSE VIDEO"; HEX(0F)
40 PRINT
50 PRINT "HOW MUCH OF THIS LINE "; HEX(OE); "APPEARS IN REVERSE
VIDEO?"
60 PRINT "NOTICE THAT NORMAL INTENSITY HAS BEEN RESTORED. WHY?"
70 PRINT
80 PRINT HEX(OE); "REVERSE VIDEO HAS BEEN REACTIVATED."; HEX(0DOA);
"WHAT HAPPENED WHEN WE PROGRAMMED A CARRIAGE RETURN?"
RUN
```

Line 30 selects and activates reverse video, then immediately turns the attribute off after one line. The HEX(0F) statement turns the attribute off and restores normal intensity.

The first literal of Line 50 appears on the screen in normal intensity, until the isolated HEX(OE) reactivates the reverse video attribute for the second literal of the line. Since the attribute was activated by a HEX(OE), the attribute is turned off by the implied carriage return produced by not ending the statement with a comma or semicolon. Therefore, the literal in Line 60 appears in normal intensity.

The attribute is reactivated with the HEX(OE) in Line 80. In this case, the programmed carriage return, HEX(0D), turns off the reverse video attribute and restores normal intensity. The HEX(0A) in Line 80 issues a line feed so that the second literal of Line 80 does not strike over the first literal of Line 80. HEX(0A) does not deactivate the current attribute. (See Figure 3-6.) In any of these cases, the attribute could also be turned off by a HEX(0F).

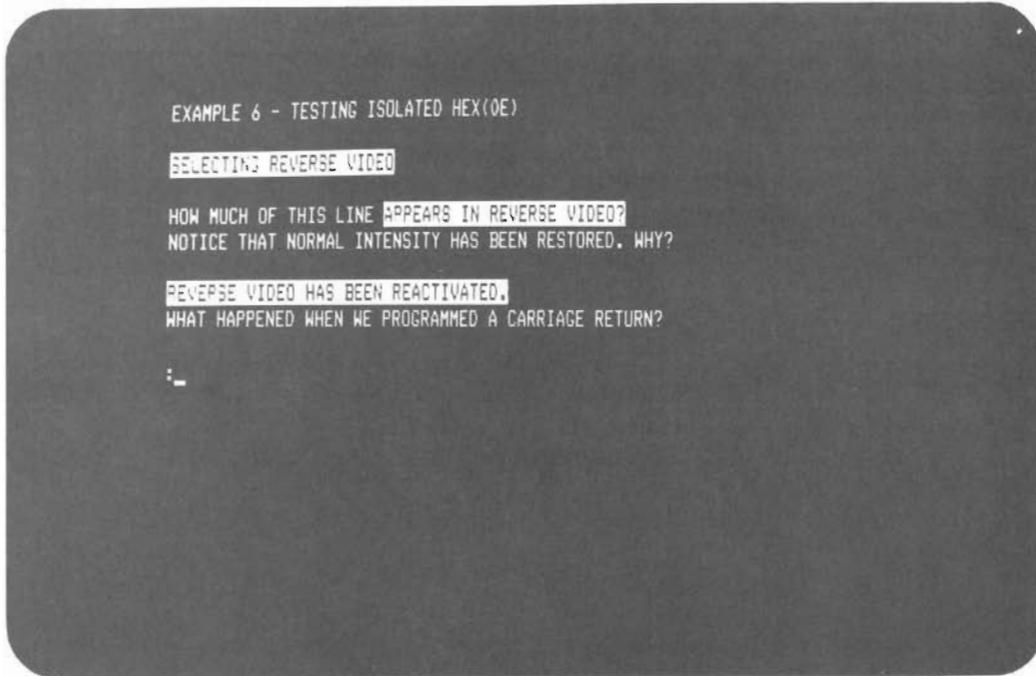


Figure 3-6. Testing Isolated HEX(0E)

The isolated HEX(0E) can be used to highlight portions of one or more lines that require the same attribute, as in the following example.

```
CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 7 - USE OF ISOLATED HEX(0E)"; HEX(0A)
20 PRINT HEX(020400040E); "THIS ENTIRE SENTENCE IS UNDERLINED.";
HEX(0FOA)
30 PRINT "ONLY THE WORD "; HEX(0E); "ATTRIBUTE"; HEX(0F); " IS
UNDERLINED."; HEX(0A)
40 PRINT "PART OF THIS LINE "; HEX(0E); "IS UNDERLINED."
RUN
```

Statement 20 selects and activates the underline attribute for the first line of output. The beginning of Statement 30 appears in normal intensity without underline, but the HEX(0E) reactivates the last attribute selected (in this case, underline). After one word, the attribute is again turned off and the remainder of the sentence appears in normal intensity. The HEX(0E) in Statement 40 reactivates the underline attribute for the last part of the sentence. Since a HEX(0E) is used to reactivate the attribute, the underline attribute is turned off by the automatic carriage return. (See Figure 3-7.)

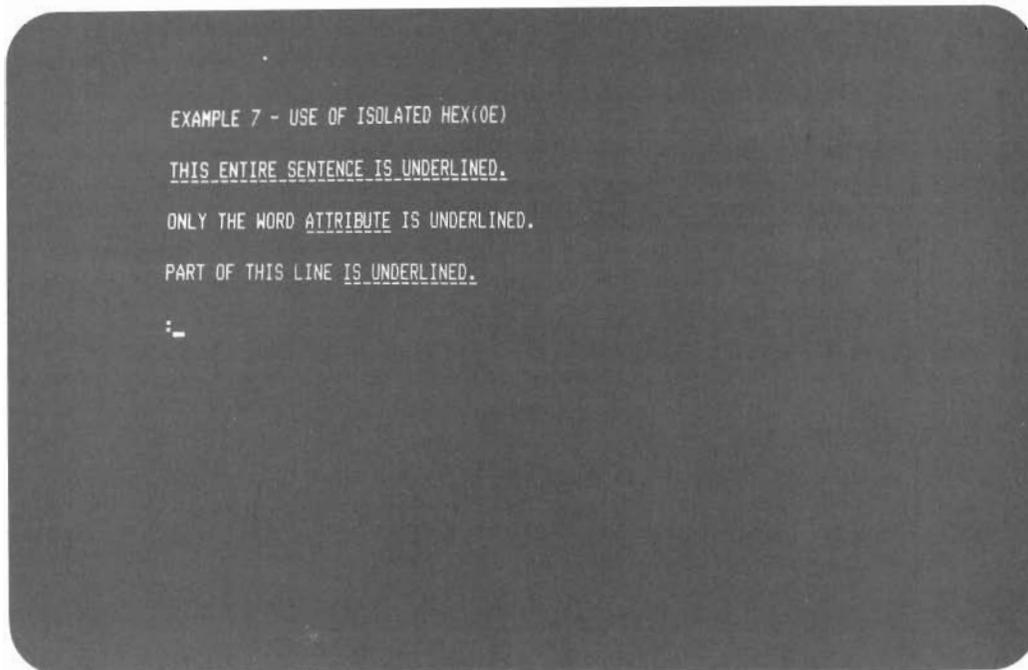


Figure 3-7. Use of Isolated HEX(0E)

3.3.5 Sequences Ending in 0F

A HEX sequence that ends with an 0F instead of an 0E, e.g., HEX(020400040F), selects an attribute but does not activate it. In the following example, normal intensity is activated.

```
CLEAR
5 PRINT HEX(03)
10 PRINT "SEQUENCES ENDING IN 0F"; HEX(0A)
20 PRINT HEX(020400020F); "WE HAVE SELECTED THE REVERSE VIDEO
ATTRIBUTE, BUT WE HAVE NOT ACTIVATED IT."
30 PRINT "NORMAL INTENSITY IS ACTIVATED INSTEAD."
RUN
```

3.3.6 Using Screen Clear and Character Display Attributes

As illustrated by the following example program, the control code HEX(03) clears the screen and returns the cursor to the home position, but does not affect the attribute currently in use.

```

CLEAR
5 PRINT HEX(03)
10 PRINT HEX(020400020E); "SELECTING REVERSE VIDEO"
20 SELECT P 9
30 PRINT "THESE TWO LINES WILL APPEAR ONLY BRIEFLY."; HEX(0A)
40 SELECT P
50 PRINT HEX(03)
60 PRINT "EXAMPLE 8 - EFFECT OF SCREEN CLEAR ON ATTRIBUTES"; HEX(0A)
70 PRINT "SCREEN CLEAR - HEX(03) - WILL NOT EFFECT THE CURRENT
ATTRIBUTE."; HEX(0A)
80 PRINT "NOTICE THAT REVERSE VIDEO IS STILL IN EFFECT."
90 PRINT HEX(0F)
RUN

```

Line 10 selects and activates the reverse video attribute for the first two lines. Line 20 causes a 1.5 second pause after the text of Line 30 is output so that the text of Lines 10 and 30 remains on the screen long enough to be read. Line 40 selects "pause off" for the remainder of the program. A screen clear, which clears the screen to black, is issued by Line 50. The reverse video stays in effect even though a screen clear is issued. The three lines of text (Lines 60, 70, and 80) all appear on the screen in reverse video. (See Figure 3-8.) The HEX(0F) in Line 90 turns off the reverse video attribute and restores normal intensity.

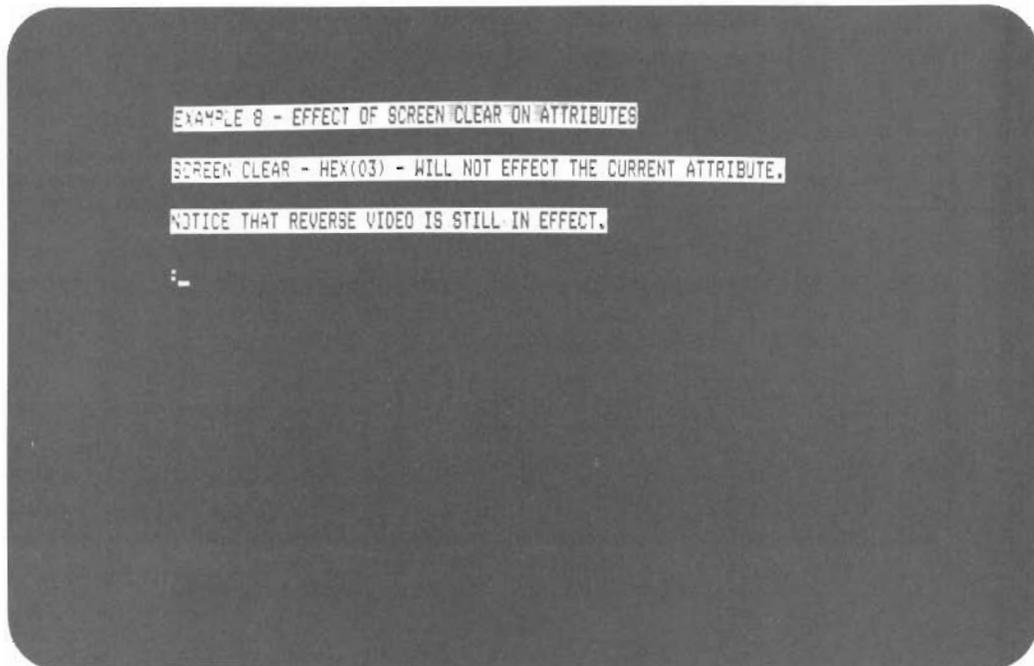


Figure 3-8. Effect of Screen Clear on Display Attributes

3.3.7 Reverse Video Spaces

Reverse video spaces are black, not white (black on white mode). The following example shows how black spaces appear on the screen when you use PRINT TAB statements. If the reverse video attribute is turned on, tabbing any number of spaces produces black spaces on the screen. To prevent the appearance of black spaces, tab the required number of spaces before turning on the reverse video attribute. Note the different location of the HEX(0204...) sequence with respect to the TAB statement in Lines 20 and 30. Observe the screen display produced by each statement. (See Figure 3-9.)

```
CLEAR
5 PRINT HEX(03)
10 PRINT "EXAMPLE 9 - REVERSE VIDEO SPACES"; HEX(0A)
20 PRINT HEX(020400020E); TAB(25); "NOTE THE WHITE REVERSE VIDEO
SPACES"; HEX(0F0A)
30 PRINT TAB(25); HEX(020400020E); "REVERSE VIDEO"; HEX(0F)
RUN
```

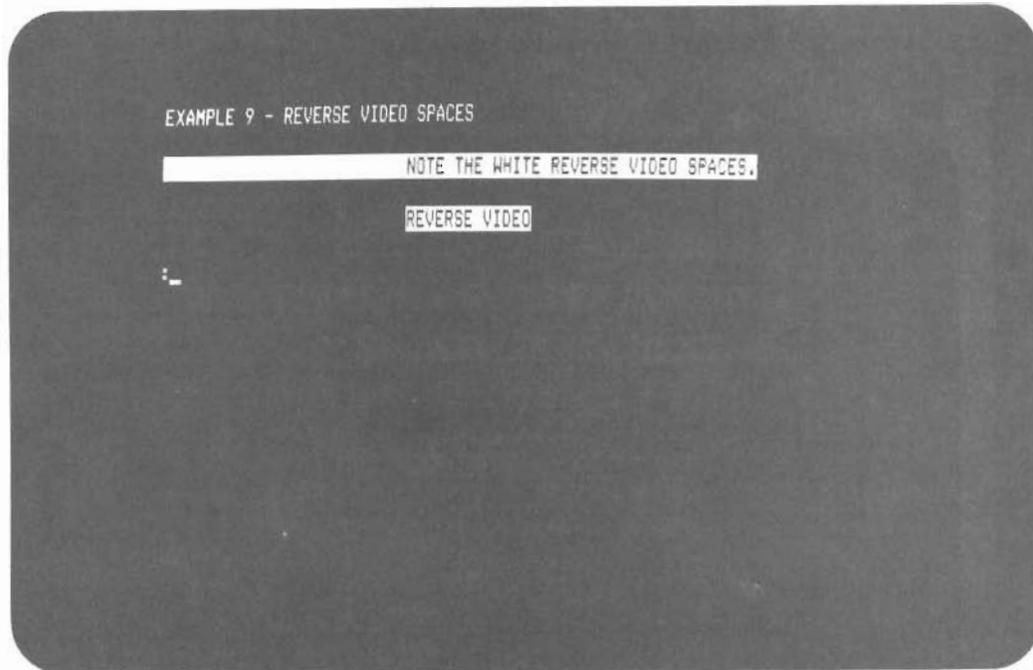


Figure 3-9. Reverse Video Spaces

3.3.8 Special Uses of Alternate Display Attributes

The following list contains the special uses of alternate display attributes.

- LIST D

The host sends out a HEX(0E) at the beginning of each REM% statement in the program. Thus, comment statements appear in the most recently selected alternate display attribute.

- 100 PRINT "PROMPT";: LINPUT HEX(0E), A\$: PRINT A\$

The field to be entered appears in the most recently selected alternate display attribute. When an entry is terminated with a carriage return, the alternate attribute is cancelled, so the PRINT statement prints A\$ in normal intensity.

- 150 PRINT HEX(0E); "PROMPT"; HEX(0F);

160 LINPUT A\$

Only the prompt appears in the most recently selected alternate attribute.

3.3.9 Summary of Display Attribute Rules

The following list summarizes the general rules that govern the use of display attributes.

- HEX(02 04 xx yy 0E) selects and activates a display attribute. Attributes activated in this manner are turned off only by HEX(0F) or by another HEX(0204...) sequence. The attribute is *not* turned off by carriage return, HEX(0D). Thus, it is possible to highlight a portion of one or several lines.
- HEX(02 04 xx yy 0F) selects, but does *not* activate, a display attribute. Normal intensity is activated instead.
- An isolated HEX(0E) activates the attribute selected by the last HEX(0204...) sequence for a maximum of one text line. The attribute remains in effect until the occurrence of either an automatic carriage return, a programmed HEX(0D), or a HEX(0F).

- HEX (02 04 xx yy OE) takes precedence over an isolated HEX (OE). If an attribute is selected and activated by HEX (02 04 xx yy OE), a subsequent HEX(OE) will *not* cause the attribute to be turned off by the next carriage return.
- An isolated HEX(OF) always turns off the alternate attribute and restores normal intensity.
- Screen clear, HEX(03), clears the screen to white (black on white mode), but otherwise has no effect on the meaning of HEX(OE) or the attribute currently in effect. Likewise, scrolling the screen scrolls in a white (black on white mode) line, but otherwise has no effect on attributes.
- Reverse video spaces are black, not white. Zoned format PRINT statements (PRINT, PRINT TAB, and the third parameter of PRINT AT) use spaces to clear the screen. These statements will leave black areas on the screen when reverse video is activated.
- Turning the terminal on and using the RESET key cause normal intensity characters to be selected and the meaning of HEX(OE) to be defined as high intensity.
- The system considers all codes HEX(00) to HEX(OF) to occupy no space on the output medium. Thus, attribute selection sequences do not cause the system to issue automatic carriage returns or throw off the column count used by TAB and zoned format PRINT statements.
- Control codes HEX(00) to HEX(OF) do not have attributes. It is not possible to change the attribute of a character by passing the cursor through it with a PRINT AT statement.
- The meaning of isolated HEX(OE) is maintained by the terminal, *not* the partition. If a program gives up control of the monitor with \$RELEASE TERMINAL, there is a good chance that a program in another partition will change the meaning of HEX(OE) in the course of using attributes.

3.4 SELECTION OF CHARACTER SETS

The 2536DW Interactive Terminal offers two character sets: the normal character set (see Table 3-1) and the alternate character set (see Table 3-2). The following sequence is used for selecting either character set.

HEX (02 02 xx 0F)

where:

02 02 = The control code sequence that indicates to the terminal that a character set will be selected.

xx = A HEX code specifying the character set to select.

If xx = 00 Selects the normal character set. The codes HEX(90) to HEX(FF) are underlined versions of characters from HEX(10) to HEX(7F).

If xx = 02 Selects the alternate character set. The codes HEX(80) to HEX(FF) represent the graphic characters and symbols.

If xx = 04 Selects the CS Series, MicroVP Series, or 2200 Series WP character set.

0F = A terminator character that signals the end of the character selection sequence.

Table 3-1. The Normal Character Set

		High-order HEX Digit														
		1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Low-order HEX Digit	0	â	Space	0	@	P	°	p	Space	â	_	0	@	P	°	p
	1	ê	!	1	A	Q	a	q	◆	ê	!	1	A	Q	a	q
	2	î	“	2	B	R	b	r	▶	î	“	2	B	R	b	r
	3	ô	#	3	C	S	c	s	◀	ô	#	3	C	S	c	s
	4	û	\$	4	D	T	d	t	→	û	\$	4	D	T	d	t
	5	ä	“	5	E	U	e	u	└	ä	“	5	E	U	e	u
	6	ë	&	6	F	V	f	v	|	ë	&	6	F	V	f	v
	7	ï	'	7	G	W	g	w	⋯	ï	'	7	G	W	g	w
	8	ö	(	8	H	X	h	x	'	ö	(	8	H	X	h	x
	9	ü	)	9	I	Y	i	y	'	ü	)	9	I	Y	i	y
	A	à	·	:	J	Z	j	z	^	à	·	:	J	Z	j	z
	B	è	+	:	K	l	k	§	■	è	+	:	K	l	k	§
	C	ù	,	<	L	\	l	£	!!	ù	,	<	L	\	l	£
	D	Ä	-	=	M	|	m	é	!	Ä	-	=	M	|	m	é
	E	Ö	.	>	N	|	n	ç	ß	Ö	.	>	N	|	n	ç
	F	Ü	/	?	O	—	o	e	‘	Ü	/	?	O	—	o	e

Table 3-2. The Alternate Character Set

		High-order HEX Digit															
		1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Low-order HEX Digit	0	â	Space	0	@	P	°	p	.	•			☐	☐	☐	☐	
	1	ê	!	1	A	Q	a	q	◆	◇			☐	☐	☐	☐	
	2	î	"	2	B	R	b	r	▶	▲			☐	☐	☐	☐	
	3	ô	#	3	C	S	c	s	◀	▼			☐	☐	☐	☐	
	4	û	\$	4	D	T	d	t	→	↓			☐	☐	☐	☐	
	5	á	·	5	E	U	e	u	└	┘			☐	☐	☐	☐	
	6	ë	&	6	F	V	f	v	|	√			☐	☐	☐	☐	
	7	ï	'	7	G	W	g	w	..	°			☐	☐	☐	☐	
	8	ö	{	8	H	X	h	x	'	¡			☐	☐	☐	☐	
	9	ü	}	9	I	Y	i	y	'	¡			☐	☐	☐	☐	
	A	ä	•		J	Z	j	z	^	Δ			☐	☐	☐	☐	
	B	é	+	:	K	|	k	§	■	□			☐	☐	☐	☐	
	C	ü	,	<	L		l	£	!"				☐	☐	☐	☐	
	D	Ä	-	=	M	|	m	é	¡				☐	☐	☐	☐	
	E	Ö	•	>	N	|	n	ç	ß				☐	☐	☐	☐	
	F	Ü		>	O	—	o	ç	•				☐	☐	☐	☐	

You can use the underline character set to underline any character of either character set (refer to Section 3.3). Either character set may differ from the sets shown in Tables 3-1 and 3-2 on foreign language versions of the 2536DW Interactive Terminal. All versions of the terminal are capable of producing uppercase alphabetic, numeric, and most of the special characters used in BASIC programming.

When you select a character set, note the following items:

- With the exception of the HEX(80) code, the characters represented by the codes HEX(10) to HEX(8F) are identical in the normal and alternate character sets.

- In the alternate character set, the codes HEX(9C) to HEX(BF) are presently undefined and are reserved for future expansion. If you use these codes, your program may not be compatible with upgraded and/or future versions of the terminal.

The 64 graphic characters HEX(C0) to HEX(FF) are represented by all the combinations of sixths of a character space, where the character space is divided as shown in Figure 3-10. When displayed, graphic characters fill the entire character position. For this reason, adjacent areas of two graphic characters touch. In this way continuous lines (bars) of light or dark areas can be displayed on the screen. When combined with display attributes, character graphics are useful for the construction of bar graphs, histograms, and other special displays.

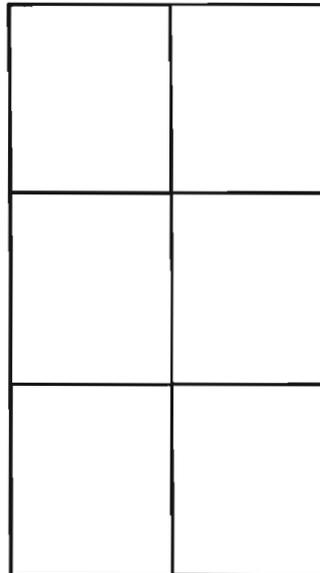


Figure 3-10. Division of a Character Space

3.4.1 Examples of the Character Sets

The following statement selects codes 90-FF to represent normal characters 10-7F with underline. An underlined word, for example, COMPONENT, is displayed on the screen.

```
PRINT HEX(02 02 00 0F); HEX(D5 CE C4 C5 D2 CC C9 CE C5 C4)
```

The following statement selects the alternate character set and displays three character boxes of decreasing heights (). These are the characters most useful for constructing vertical bar graphs.

```
PRINT HEX(02 02 02 0F); HEX(FF FC FO);
```

3.4.2 Summary of Character Set Selection

The rules concerning the use of character set selection are summarized as follows:

- HEX(02 02 00 0F) selects the normal character set. The codes HEX(90) to HEX(FF) are defined as the normal characters HEX(10) to HEX(7F) with underline.
- HEX(02 02 02 0F) selects the alternate character set. The codes HEX(80) to HEX(FF) represent the graphic characters and other special symbols.
- The normal character set is selected upon entering Terminal mode.
- Carriage return does *not* affect character set selection.
- As with attributes, the character set selection sequences affect the interpretation of characters at the time they are received by the terminal. Therefore, you can use underlined and graphic characters in different areas of the same display. Once on the screen, a character is modified only when the terminal user strikes over it with another character or by screen clear.
- You can use all display attributes (described in Section 3.3) with both the normal and alternate character sets.

3.5 PRINT BOX FUNCTION

The 2536DW Interactive Terminal provides box graphics for the Wang BASIC-2 language.

General Form:

```
BOX (height, width)
```

where:

height = Expression specifying the height of the box; each unit is the height of a character space.

width = Expression specifying the width of the box; each unit is the width of a character space.

3.5.1 Purpose

The BOX function is used within a PRINT statement to draw or erase a box or line on a screen that has box graphics capability. The first expression specifies the height of the box; the second expression specifies the width of the box. The signs of the arguments determine whether lines are drawn or erased. Positive signs (+) instruct the system to draw lines. Negative signs (-) instruct the system to erase lines.

If the box height is zero, the system draws or erases a horizontal line, depending on whether the width is positive or negative. A width of zero causes a vertical line to be drawn or erased depending on whether the height is positive or negative. The BOX function positions the box so that its upper left hand corner is at the current cursor position. Drawing a box does not move the cursor.

Examples

Statement	Print Function
PRINT BOX (3, 4);	Draws a 3 x 4 box
PRINT BOX (-3, -4);	Erases a 3 x 4 box
PRINT BOX (0, 7);	Draws a horizontal line 7 units long
PRINT BOX (-7, 0);	Erases a vertical line 7 units long
PRINT AT (5, 10); BOX (1, 6); " TITLE"	Displays TITLE enclosed in a box

In the last example, in order to include the field TITLE, the box must be one character wider than the length of the field, and the left edge of the box must be one character position to the left of the field to be enclosed. To box a field in general, use the statement:

```
PRINT BOX (1, LEN(A$)+1); " "; A$
```

where:

A\$ is the given field

LEN(A\$) is the length of the field A\$

You can use box graphics to highlight entry fields as shown in the following example.

```
CLEAR  
10 PRINT "PROMPT"; BOX(1, 17);:LINPUT A$  
RUN
```

3.5.2 Box Graphics

The 2536DW Interactive Terminal can display continuous horizontal or vertical lines, enabling forms to be drawn or information to be separated by lines or boxes. Horizontal lines are drawn at the top of a character space. The horizontal line unit is a line segment the width of a character space, positioned from the middle of one character space to the middle of the next character space. Horizontal lines are displayed between rows of characters.

```
PRINT AT(10,15); BOX (0,5); "HELP"  
RUN
```

HELP

The vertical line unit has the height of a character space. Vertical lines are drawn through the middle of a character space; the line coexists with the character at that location. (Because the height and width of a character space do not use the same units of measurement, boxes are not drawn proportionally, but these measurements enable you to easily box fields of characters.)

Figures 3-11 and 3-12 illustrate the placement of box graphic lines. Figure 3-11, which shows the smallest possible box, was produced by the statement `PRINT BOX(1,1); "AB"`. It illustrates the placement of horizontal and vertical box graphic lines relative to the character position.

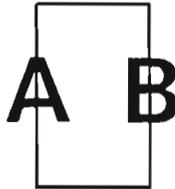


Figure 3-11. Box Graphic Line Placement Relative to Character Position

Figure 3-12, which was produced by the statement `PRINT BOX(1,1); HEX(0202020F); HEX(E1CC)`, demonstrates where box graphic lines appear relative to character set graphic characters.

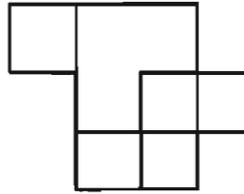


Figure 3-12. Box Graphic Line Placement Relative to Graphic Character Set

The terminal can display box graphics and characters on the same screen. In Character mode, only the characters and their attributes can be modified, while box graphics remain intact. For example, within a boxed area used to highlight a prompt, the prompt can be rewritten a number of times without altering or erasing the box itself. The one exception to this rule is screen clear, `HEX(03)`, which clears both characters and box graphics. During a box graphics sequence, characters and their attributes are undisturbed.

Because the Character and Box Graphic modes are independent, it is easy to update portions of either display. The third argument of `PRINT AT` is useful for clearing portions of the display. Though slower than screen clear, the statement `PRINT AT (0,0,)` is useful for clearing the characters from the screen without disturbing the box graphics.

3.6 THE TIMING OF REPEATING KEYS

A key repeats if held down for more than 1/3 second. The microprocessor in the terminal automatically adjusts the repeat key rate according to the rate at which characters are being echoed to the monitor.

After the initial key repeats, the next repeat of the key is delayed until

- At least one character is output to the monitor in response to the last key sent.
- Output to the monitor has ceased for either 1/15 second or two characters times the terminal data rate, whichever is greater.

In most situations, this repeat key strategy prevents operators from typing ahead between fields by holding down a repeat key. In some situations, it may be desirable to use KEYIN to intentionally clear the keyboard buffer of unwanted keystrokes that may have come in between fields.

3.7 THE SELF-IDENTIFICATION MESSAGE

The sequence HEX(0208090F) causes the terminal to transmit to the user program the information displayed on the screen at power-on (with the exception of the copyright notice). After the use of a HEX(0208090F) sequence, the terminal "types" the self-identification message. The application program does not distinguish the message from operator keystrokes. The terminal keyboard is disabled during the transmission of the message. The following example is a typical self-identification message, consisting of several fields separated by spaces.

```
*2536DW R0101 19200B 8+0 (USA)
```

where:

2536DW	is the model number, preceded by an asterisk
R0101	is the revision number of terminal firmware and keyboard table, preceded by R
19200B	is the data rate, followed by B (baud)
8+0	is the number of data bits (7 or 8); E is even parity, O is odd parity, N is no parity
(USA)	is the version of the keyboard and character set, enclosed in parentheses

The recommended procedure for obtaining the self-identification message from a terminal is with an INPUT statement:

```
05 DIM M$64
10 PRINT "WHAT KIND OF TERMINAL DO YOU HAVE (Default = 2536DW)?"
20 M$ = "2536DW" : INPUT HEX(0208090F), M$
```

3.8 REINITIALIZE TERMINAL

Because the meanings of codes HEX(80) to HEX(FF) differ among international versions of the terminal, the reinitialize sequence is not only necessary, but it is also helpful. The reinitialize sequence, HEX(020D0C030F), restores the terminal to its power-on state. Specifically, the sequence:

- Clears the screen, returns the cursor to the home position, and turns the cursor on.
- Selects normal intensity characters.
- Selects bright as the attribute to be activated by HEX(0E).
- Selects the default character set for that version of terminal.

The PRINT HEX(020D0C030F) sequence comprises control characters that are typically used to initialize devices. For example, this sequence causes a screen clear on older monitors, such as the 2236D, and causes a form feed on most printers.

3.9 USING KEYIN AND DEAD KEYS

The terminal keyboard supports dead key operations for underlining and, for foreign keyboards, accenting characters. Dead keys are keys that do not advance the cursor when pressed. The terminal keyboard has visible accent and underline operations. The underline or accent code is sent to the host preceded by a HEX(FF) code that flags the next code as a special character.

KEYIN interprets a dead key as two characters: a HEX(FF) followed by the American Standard Code for Information Interchange (ASCII) code for the underline. The keystroke following a dead key generates the ASCII code for the underlined character. Programs that use KEYIN typically use the HEX(FF) as a signal to display the bare underline without advancing the cursor and store the bare underline mark without advancing the buffer pointer. The keystroke following the dead key then overstrikes the bare underline with the underlined character that the operator intended to enter.

The sequence HEX(FF08) is generated when a dead key is followed by a backspace, and signals the program to remove the bare underline generated by the dead key, without moving the cursor.

Foreign language and underline characters whose codes are above HEX(80) are sent to the host with the Special Function (ENDI) bit on, in order to distinguish them from text atoms. Foreign language characters thus cause KEYIN to branch to the second line number specified on the KEYIN statement. The statement KEYIN C\$, 10, 20 branches to Line 10 for the following types of keystrokes:

- Text characters, including backspace, whose ASCII codes are in the range HEX(00) to HEX(7F)
- Text atom keys, such as CLEAR, LOAD, RUN, CONTINUE, whose codes are HEX(80) to HEX(F9)
- Line Erase, HEX(E5)
- Dead key to follow signal, HEX(FF)

The sample KEYIN statement branches to Statement 20 for the following types of keystrokes:

Special Function keys -- HEX(00) to HEX(7F)

Edit key -- HEX(F0)

Foreign language and underlined characters -- Codes in the range HEX(80) to HEX(FF)

The operating system handles dead keys in field-oriented statements like LINPUT and INPUT. When you use KEYIN or \$GIO to bypass the operating system and redefine keys, it becomes your responsibility to properly handle dead keys.

3.10 ACCESSING THE 25TH ROW

The 25th Row is accessible by using the HEX sequence (020Cxx) where xx is as follows:

xx = 00 -- Sets the display to 80 columns x 24 rows. If a clear screen command is sent, only the top 24 lines are cleared. If the cursor is on the 25th line when the clear screen command is invoked, the cursor is positioned to home.

xx = 01 -- Sets the display to 80 columns x 25 rows. When initially invoked, blanks are written to the 25th line, and the cursor returns to its location before sending the HEX sequence. The screen scrolls in the same manner as the 24-row display, except that it scrolls when a linefeed is sent to the 25th row instead of the 24th row. If a clear screen is sent, all 25 lines are cleared.

xx = 02 -- The 25th row becomes a status line. When invoked, the following sequence takes place:

- a. The 25th row has blanks written to it to ensure removal of old data.
- b. The next 80 characters sent to the screen are written to the 25th row, unless a carriage return terminates the write earlier.
- c. Once the write is complete, the cursor returns to its location before sending the HEX sequence. The write to status line is available in either the 24-row or 25-row display. If used with a 25-row display, the status line scrolls with the rest of the screen. If used with a 24-row display, the status line remains as a separate "window."

A PRINT BOX to the 24th row requires the use of a 25th row to hold certain character attributes. Therefore, if a PRINT BOX is executed to the 25th row, the screen scrolls because there is no 26th line to hold those character attributes.

CHAPTER 4 LOCAL AND REMOTE TERMINAL/HOST INTERFACE

4.1 OVERVIEW

The following chapter provides you with information on local and remote terminal/host interface. The chapter also includes information on using modems, establishing a connection, and troubleshooting.

4.2 LOCAL CONNECTION

Figures 4-1 through 4-3 illustrate how the 2536DW Interactive Terminals can be attached to the CS Series, MicroVP Series, and 2200 Series systems using the Wang 2236MXD Terminal Processors, the Wang 2236MXE Terminal Processors, and the Wang 22C32 Triple Controllers.

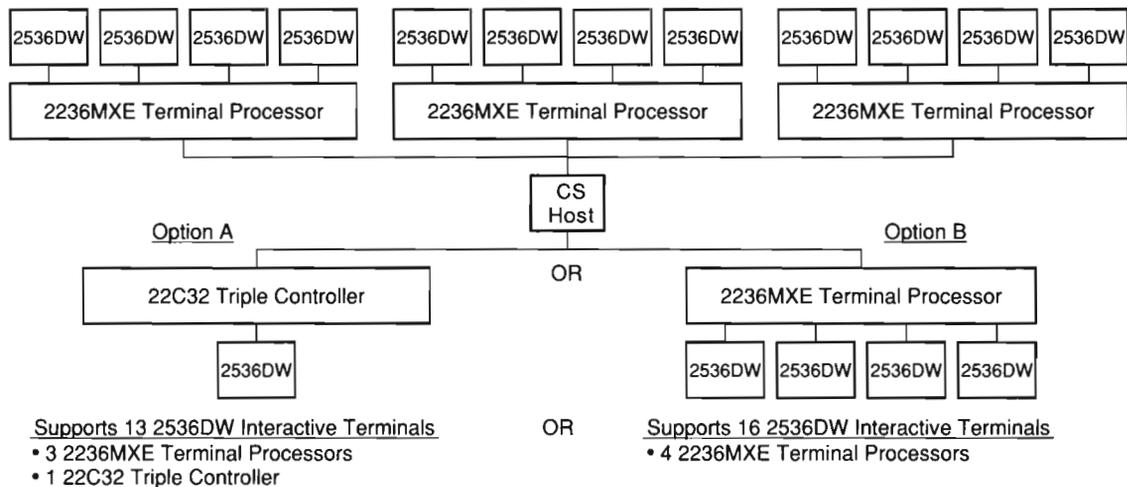


Figure 4-1. Attaching 2536DW Interactive Terminals to CS Series Hosts

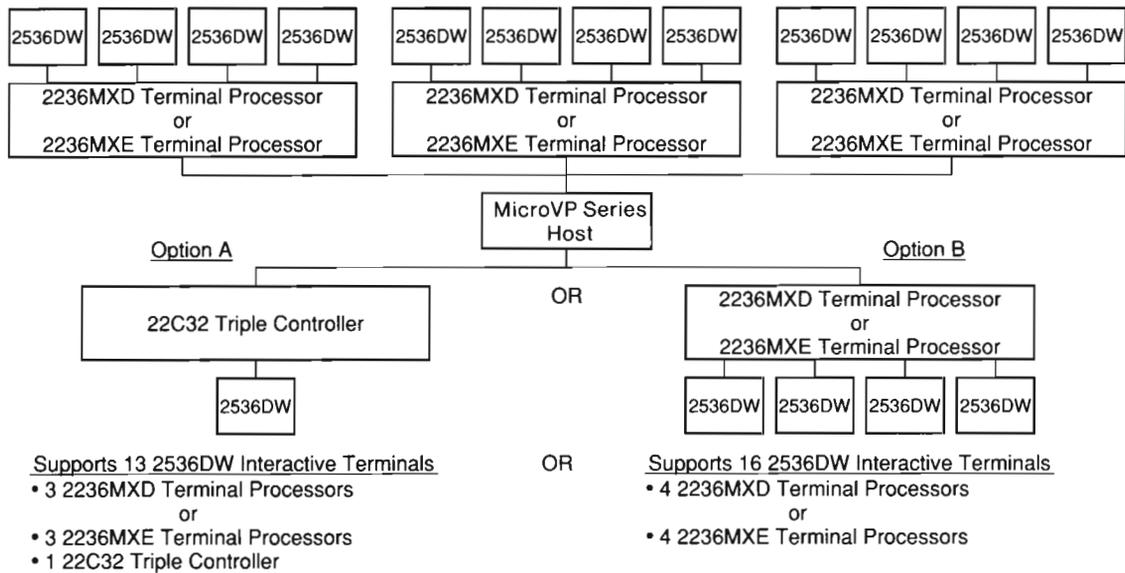


Figure 4-2. Attaching 2536DW Interactive Terminals to MicroVP Series Hosts

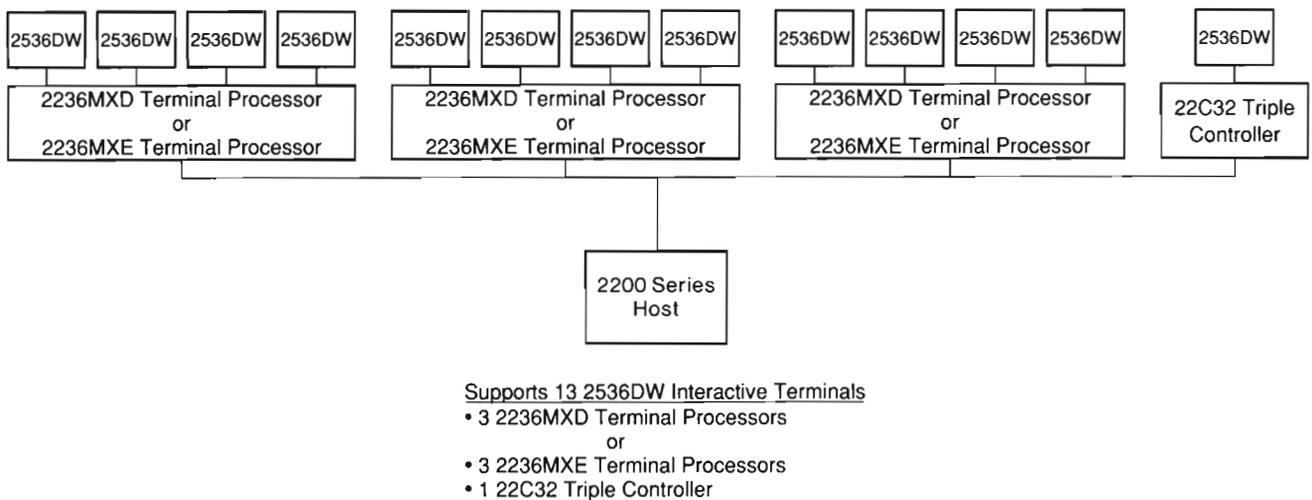


Figure 4-3. Attaching 2536DW Interactive Terminals to 2200 Series Hosts

You can attach the 2536DW Interactive Terminal locally to the CS Series, MicroVP Series, or 2200 Series host computer at distances up to 2,000 ft (608 m), or remotely via modems and telephone lines. Communication between the terminal and the host is asynchronous and full-duplex, with selectable line speeds ranging from 300 to 38,400 bits per second (bps) using a 2236MXE Terminal Processor. To accelerate communications between the terminals and the host, the system performs automatic data compression on information transmitted to each terminal. The following are possible local connections:

Local Connection -- For distances up to 25 ft (7.6 m), transmission rates of 38.4K bps (with a 2236MXE Terminal Processor) are available with direct connection by means of a Wang-supplied cable. A local connection is the standard configuration.

Extended-Local Connection -- For distances from 25 ft (7.6 m) to 2,000 ft (608 m), optional Wang-supplied cables provide direct extended-local connection with transmission rates of 38.4K bps using a 2236MXE Terminal Processor. (Refer to Appendix A for a list of available cable lengths.)

The 22C32 Triple Controller has a fixed transmission rate of 19,200 bps. A terminal attached to that controller must be local (direct connections up to 2,000 ft from the host). With the 2236MXD or 2236MXE Terminal Processor, however, transmission rates on a terminal can range from a minimum of 300 bps to a maximum of 19,200 bps. (The 2236MXE has a maximum rate of 38,400 bps.) Possible transmission rates include 300, 600, 1,200, 2,400, 4,800, 9,600, and 19.2K bps. (19.2K equals about 1,750 characters per second). Both the Model 2236MXD and 2236MXE Terminal Processors and the terminals connected to them must be set at the same data transmission rate. The procedure for setting the transmission rate is discussed in Appendix D.

4.3 USING MODEMS FOR REMOTE CONNECTIONS

The 2236MXD or 2236MXE Terminal Processor installed on the host makes remote connection of the 2536DW Interactive Terminal to the host possible. With the addition of modems, the 2236MXD or 2236MXE Terminal Processor can communicate with the 2536DW Interactive Terminals over virtually unlimited distances. Speeds ranging from 300 to 9,600 bps can be attained by using modems and communications lines supplied by various common carriers and modem vendors.

When the 2236MXD or 2236MXE Terminal Processor is used to transfer information from the host to the terminals over common carrier lines, the digital signals of the processor must be translated into corresponding analog signals at the sending end and then translated to digital form at the receiving end. The same transformation must be performed on information transferred from the terminal to the host. Modems convert data from one form to another. Modems are devices which first MODulate the digital signals and then DEModulate the resultant analog signals.

The Wang WA3451 modem, which can operate at 300 and 1,200 bps, is the recommended modem for data processing using the 2536DW Interactive Terminal with switched-line remote terminal connection. Since 1200 bps is generally too slow for remote use of WP, the remote terminal connection of a 2536DW Interactive Terminal by means of a WA3451 modem is not recommended for use with CS Series, MicroVP Series, and 2200 Series WP software.

***Note:** Since CS Series, MicroVP Series, and 2200 Series Word Processing (WP) software requires 28K of user memory per terminal, the maximum number of 2536DW Interactive Terminals that can simultaneously operate WP varies with available user memory.*

For remote terminal operation, one modem is needed at each end of the connection. One modem must be located at the site of the 2236MXD or 2236MXE Terminal Processor, and the other modem must be located at the site of the terminal. Both modems must be the same model or, if they are different models, compatible, in order to permit the remote terminal configuration to function. The speed, type of communication, and number of bits must be identical for both modems and appropriate for a CS Series, MicroVP Series, or 2200 Series system remote terminal connection.

The type of modem used and the speed of transmission depend largely on the distance which the signals will travel between the modems. The following are possible remote connections:

Short-Haul Connection -- For distances from 2,000 ft (608 m) to 5 miles (8 kilometers), short-haul modems are used with either private or leased lines. A maximum speed of 9,600 bps can be maintained. Equipment designed for long-haul applications can also be used to establish short-haul connections.

Long-Haul Connection -- For distances greater than 5 miles (8 kilometers), either switched or leased switch lines can be used for signal transmission. Depending on the type of line used, obtainable speeds range from 300 to 1,200 bps.

Switched lines are accessed through the common carrier's switching system by telephone dialing. The speed on switched lines is usually limited to 1,200 bps because the switching apparatus can introduce noise on the line. A leased line presents a faster, but more costly, alternative to a switched line.

A leased line is a communications line leased from a common carrier in the area for the exclusive use of the lessee. When a leased line is used to transmit signals, the line is run directly from the host to the terminal location and no switching occurs. Information about leased lines and their cost can be obtained from the common carrier in your area.

Communication between the 2236MXD or 2236MXE Terminal Processor and the remote terminal uses an asynchronous serial protocol and is full-duplex, enabling data to travel simultaneously from the terminal processor to the terminal and from the terminal to the terminal processor. Therefore, modems used in this system must be full-duplex, capable of asynchronous transmission, and must support an 11-bit character.

Asynchronous modems can be either hardwired or acoustically coupled to communications lines. (See Figure 4-4.)

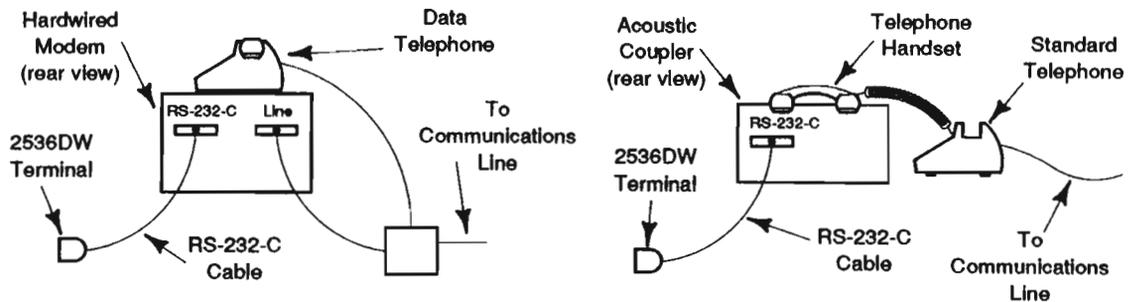


Figure 4-4. Hookup of Hardwired Modem and Acoustic Coupler

Hardwired modems are attached directly to the communications line. A hardwired modem can be attached to a telephone used for dialing a switched line or it can be the sole device attached to a leased line. When a switched line is used, the modem at the host site should be equipped with automatic answer and automatic disconnect capabilities. These features allow communication with remote terminals to be automatically established when the remote station dials the central site and to be automatically terminated when the remote station hangs up. Acoustic couplers can be used only with switched lines. Hardwired modems can be used with either switched or unswitched (leased) lines.

Although each modem should be able to transmit as either an originating or an answering modem, only one modem of each type is required. Typically, the originating modem is located at the remote site and the answering modem is located at the host (or local) site. This setup allows the remote terminal to initiate the communication. It is possible, however, to set up modems in the opposite manner.

To summarize, the modems used must be:

- Asynchronous.
- Full-duplex.
- Same or compatible model.

- Capable of transmitting at least 11 bits per character: one start bit, eight data bits, one parity bit, and at least one stop bit.
- Capable of the desired transmission speed.
- Suitable for the type of line being used.
- Set to the same transmission speed. (The processor and terminal must be able to operate at this speed.)

When choosing modems for a CS Series, MicroVP Series, or 2200 Series system remote terminal connection, it is critical to bear these requirements in mind. Failure to ensure speed compatibility among all components in a communications link is one of the most common sources of errors encountered in telecommunications.

4.4 LINE AND MODEM COMBINATIONS

There are four recommended combinations of lines and modems. In each case, the line speed depends upon the available telecommunications equipment (modems, phones, and lines).

- Switched line, with hardwired modems at both sites. Available line speeds usually do not exceed 1,200 bps. This combination is the most common option. (See Figure 4-5.)
- Switched line, with an acoustic coupler at the remote site and a hardwired modem at the central site. Available line speeds usually do not exceed 1,200 bps. (Refer to Figure 4-6.)
- Leased line, with hardwired modems at both sites. Available line speeds usually do not exceed 9,600 bps. (Refer to Figure 4-7.)
- Short-haul line (leased line), using short-haul modems at both the remote and central sites. Available line speeds usually do not exceed 9,600 bps. (Refer to Figure 4-8.)

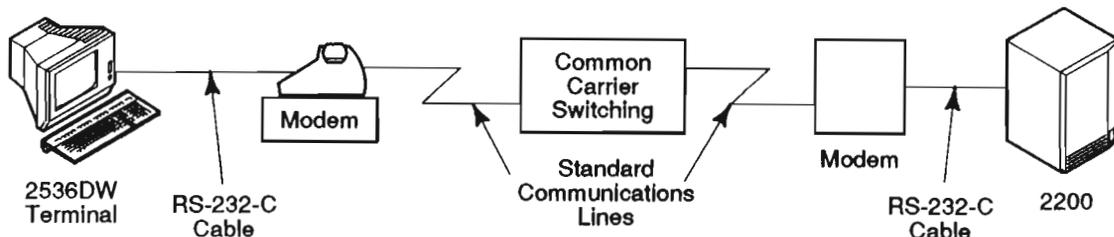


Figure 4-5. Switched Line and Hardwired Modems

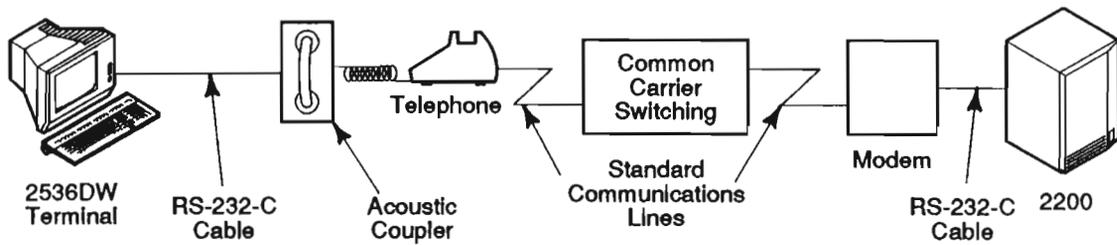


Figure 4-6. Switched Line, Acoustic Coupler, and Hardwired Modem

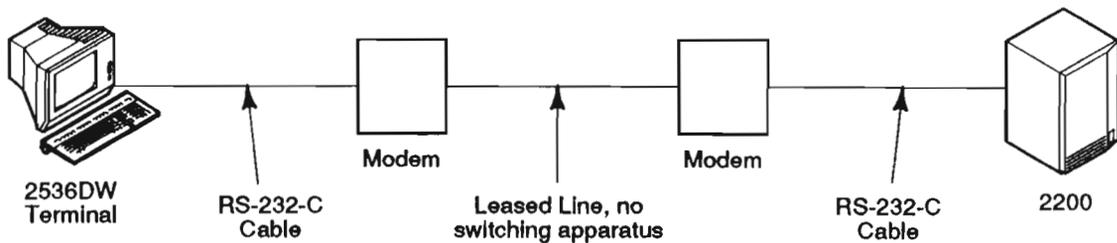


Figure 4-7. Leased Line and Hardwired Modems

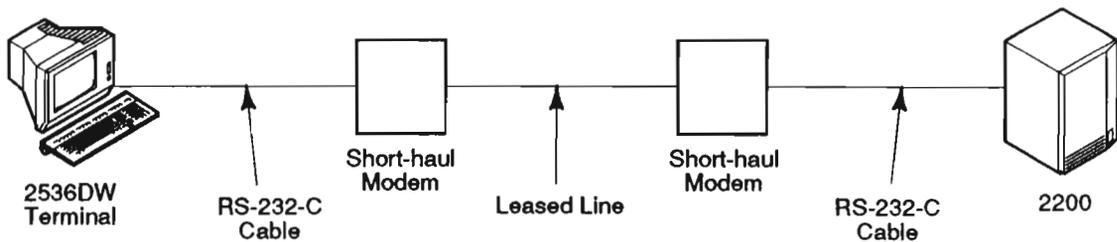


Figure 4-8. Short-Haul Line and Short-Haul Modems

The 2536DW Interactive Terminal allows communication at 1,200 bps over switched lines between most points in the continental United States. Over long distances, the protocol used between the terminal and the controller fails because of communication channel propagation delays. Therefore, there are some restrictions on the maximum distance a terminal can be located from the controller.

Consult the common carrier for detailed propagation delay specifications before attempting communication via international phone lines, especially satellite channels. Similar restrictions apply to the use of digital data services, such as packet switching networks and line multiplexing devices (statistical multiplexers).

4.5 STOP SENDING COMMAND

It is not necessary for the terminal, or the printer attached to it, to keep up with the data stream coming in over the communication line. If the monitor or printer falls behind the capability of the terminal to buffer the data, the terminal sends a Stop Sending command character to the processor.

Over long communications lines, the time it takes for the Stop Sending command to reach the processor becomes significant. In this case, although the terminal has sent a Stop Sending command, there is some delay before the processor receives the command character. Because of the delay, the processor receives the Stop Sending command after it has transmitted characters to the terminal. This delay between the cause of an event (the need to send a Stop Sending command) and the effect of an event (terminal processor awaits command) is called hysteresis.

Non-Wang communication equipment (modems, communication channel, etc.) cannot impose more than 64 characters of hysteresis round trip between the terminal and the processor if terminal buffer overruns are to be prevented. The 64 characters may be the result of time delays and/or digital buffering. (If data is lost over a long communication line, try lowering the data rate.) The most common situation is the case in which a time delay is caused by a long communication line. The allowable network hysteresis can be expressed in terms of time:

$$\text{Time in seconds} = \frac{(64 \text{ char}) * (11 \text{ bits/char})}{(\text{DATA RATE in bits/second})}$$

At 1,200 bps, 64-character time results in a character echoing delay of about 1/2 second. It is not wise to push the terminal to its 64-character limit, because the keystroke echoing time begins to become objectionable.

4.6 SETTING UP THE DATA LINK

Once you have selected the transmission speed, type of line, and location of the remote terminal, you can set up the remote terminal system. You must purchase, rent, or lease a modem from a vendor. The modem vendor or the common carrier providing the line must connect non-Wang modems to the communications line. Wang Laboratories, Inc., is not responsible for providing this service. The vendor or common carrier supplying the modem should establish all modem switch settings at the time of installation. Transmission rate switches on the terminal and the 2236MXD or 2236MXE Terminal Processor should be set by a Wang service representative at the time of installation. It should not be necessary to set any switches when the communications link is established.

When the modems are installed, contact a Wang service representative, who connects the 2236MXD or 2236MXE Terminal Processor and the 2536DW Interactive Terminal to the modems. The connection must be made with RS-232-C-compatible cable, but *not* with the standard processor/terminal connecting cable. The RS-232-C cable is available in several lengths. Refer to Appendix A.

Two cables are required for each remote terminal. One cable is connected directly between a port on the terminal processor and the modem at the central site, and the other cable is connected between the terminal and the modem at the remote site. (See Figure 4-9.)

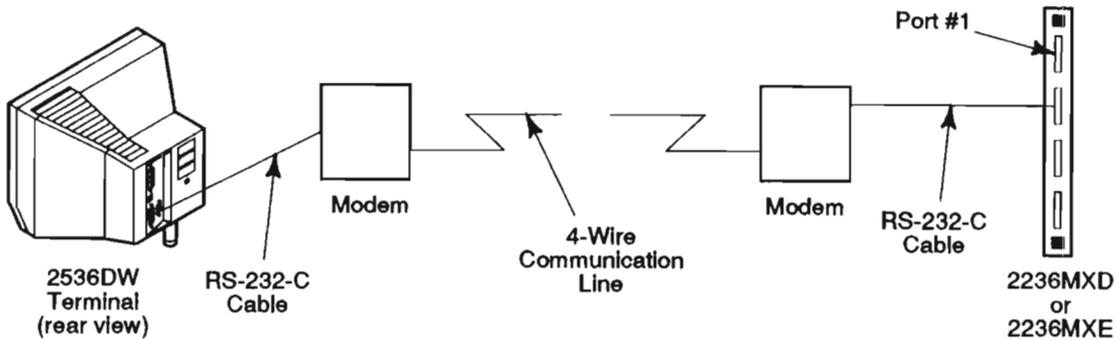


Figure 4-9. Cable Connections for Remote Terminal Operation

A special communications controller or emulation software is not necessary to operate the remote terminal since all appropriate electronics are built into the processor and terminal. The terminal connected to Port 1 of the primary terminal processor is designated as Terminal 1. *Do not use Port 1 on the primary terminal processor to support a remote terminal.* Terminal 1 should reside in the same area as the host because this terminal acts as the system console for Master Initialization when the system is turned on and is responsible for reporting and correcting system errors.

4.7 ESTABLISHING COMMUNICATION

Once the installation process is complete and the modems are set for asynchronous, full-duplex operation, and all components are set to the same transmission rate, the remote terminal setup is complete. The next step is to establish communication between the remote terminals and the host. Once communication is established, the remote terminals can be used as though they were locally connected terminals.

4.7.1 Acoustic Coupler Setup

One common setup involves an acoustic coupler at the remote site, a switched line, and a hardwired modem at the host. To establish communication:

1. The operator at the terminal site turns on the power to all equipment and dials the number of the line to which the terminal processor's modem is attached.
2. If the modem attached to the terminal processor is not an automatic answering model, an operator at the central site answers the telephone and readies the central site by pressing the telephone button which sets that end of the link to the Data mode and allows the modem to begin transmission. If the modem has an automatic answer feature, the line is "picked up" without operator intervention.
3. The terminal operator hears a high-pitched tone on the telephone and places the telephone handset in the cups of the acoustic coupler. (The orientation of the telephone handset must conform to the explanation noted on the modem itself or contained in the accompanying instructions.)
4. An indicator on the acoustic coupler illuminates when a proper connection has been made.
5. The screen displays the READY (BASIC-2) message. If no message appears, the terminal operator can press the RESET key to display the message.

4.7.2 Hardwired Modems Setup

If hardwired modems are used at both ends of a switched communications link, the procedure for establishing communication between the remote terminals and the host resembles the procedure used when an acoustic coupler is located at the remote site. When hardwired modems are located at both sites, however, the operator at the terminal site:

1. Presses the talk button before dialing the number.
2. Listens for the high-pitched tone.
3. Presses the button on the telephone for the Data mode to establish communication.
4. An indicator on the modem lights up when the proper connection has been made.

If the modem at the host site does not have an automatic answer feature, operator intervention at that site is necessary to establish the link.

4.7.3 Leased Line Setup

In the case of a leased line, the modems are always active and the line is always open. No special procedures are necessary to establish a communications link.

4.8 COMMUNICATION LINK TROUBLESHOOTING

If a link cannot be established, perform the following procedures:

1. Ensure that all power switches at both the remote and central sites are set to ON (including power to modems). Check that the CS Series, MicroVP Series, or 2200 Series system is operational and ensure that its configuration includes at least one partition assigned to the terminal processor port corresponding to the remote terminal. Check that all connections are intact and that the modem at the central site is plugged into the correct port on the terminal processor.
2. Check that the transmission speeds selected for both modems, the terminal processor port to which the central modem is attached, and the terminal are in agreement. Refer to Appendix D for information on changing the transmission speed.
3. Examine the Data Set Ready (modem ready) indicator on each modem to ensure that a connection was made. If the indicator is not lit, follow the normal procedure for establishing the telecommunications link. If this approach fails, continue with Procedure 4.
4. The terminal depends on the terminal processor for character echo. Each keyed character is transmitted to the terminal processor, which then sends the same character back to the monitor for display. No screen output will appear on a remote monitor if data is not being sent back to the terminal from the terminal processor.

It is useful to isolate the terminal from the terminal processor to determine if the terminal is functioning properly. Most modems have test settings called "local test" or "loop back." These settings allow the terminal to send characters from the keyboard to the modem, which then transmits these characters directly to the monitor. (These tests may be performed by you or by the modem supplier.) If these tests generate screen output, the line itself or the equipment at the host site may be the source of the problem. If tests at the host site indicate no local trouble, call the common carrier who supplied the communications line.

If no echo is observed at either the remote or the host site after performing this procedure, contact the modem supplier to have the modems tested. If the modems are operational, contact the common carrier and determine whether the communications line is functioning properly. The common carrier can test modem operation from a central site, in which case a field visit is not required.

5. If the remote site is free from problems, check the modem and the terminal processor at the host. Use the method in Step 4 to check the modem, using a local terminal and the RS-232-C-compatible cable. To test the terminal processor, configure the system with one partition for each terminal port on the system and then, using standard terminal cable, attach a local terminal to each port in succession.

If the modem test fails, contact the modem vendor. If the terminal processor does not function properly, contact a Wang service representative.

6. If all other components are functioning properly, yet no link can be established, contact a Wang service representative.

APPENDIX A 2536DW INTERACTIVE TERMINAL SPECIFICATIONS

SPECIFICATIONS

The following sections describe the specifications for the 2536W Interactive Terminal.

Monitor

Height

11.5 in. (29.2 cm)

Depth

10.8 in. (27.4 cm)

Width

13.0 in. (33.0 cm)

Weight

15.0 lb (6.8 kg)

Display Size

12 in. diagonal (30.5 cm)

Character Display

25 lines, 80 characters per line

Character Height

0.16 in. (0.41 cm)

Character Width

0.09 in. (0.23 cm)

Character Set

The character set contains 128 characters including uppercase and lowercase letters; each character is assigned one or more attributes for high- or low-intensity display, blinking, reverse video, or underlining. An alternate character set consisting of 64 graphics characters and other special symbols is supplied. Display of line segment (box) graphics is possible independently of either character set.

Keyboard

Height

1.7 in. (4.3 cm)

Depth

7.8 in. (19.8 cm)

Width

18.3 in. (46.5 cm)

Weight

4.5 lb (2 kg)

Features

The typewriter keyboard can generate 93 different American Standard Code for Information Interchange (ASCII) characters, including uppercase and lowercase letters, numbers, and symbols. Also included are a numeric keypad, several Program Control keys, and 18 user-definable Special Function keys: 16 numbered keys along the top of the keyboard and two keys labeled TAB and GL located in Zone 1 of the alphanumeric keyboard. Each Special Function key can be used with the SHIFT key for a total of 36 Special Function keys.

Operating Environment

Temperature

60°F to 90°F (15°C to 32°C)

Relative Humidity (noncondensing)

20% to 80% (allowable)

35% to 65% (recommended)

Power Requirements

115 or 230 Vac \pm 10%

50 or 60 Hz \pm 1.0 Hz

100 W, 60 W typical

Communication Mode

Asynchronous, full-duplex

Transmission Rates

During power-on, the 2536DW Terminal Configuration menu is displayed and provides selections of 300, 600, 1,200, 2,400, 4,800, 9,600, 19.2K or 38.4K baud. (In order for the terminal to run at 38.4K baud, a 2236MXE Terminal Processor and the MXE microcode included in revision 3.2, or higher, of the Computer System (CS) Series, MicroVP Series, or 2200 Series Operating System are required.)

Character Format

When communicating with a CS Series, MicroVP Series, or 2200 Series system:

1 start bit, 1 stop bit
8 data bits plus odd parity
(11 bits per character)

Other selectable character format:

1 start bit, 1 stop bit
8 data bits, no parity
(10 bits per character)

Terminal/Host Direct Connection Cables

Standard

One 8-ft (2.4 m) cable connects the terminal to the power source. One 25-ft (7.6 m) direct connection (standard) cable connects the terminal to the host.

Optional

Cabling is available in 100 ft (30.4 m) increments for direct connection up to 1,000 ft (304 m) or in 250 ft (76 m) increments from 1,250 ft (380 m) to 2,000 ft (608 m). Table A-1 lists the optional direct connection cables and their corresponding part numbers.

Table A-1. Direct Connection Cables

Length in Feet	Length in Meters	Part Number
50	15.2	120-2342-1
100	30.4	120-2342-2
200	60.8	120-2342-3
300	91.2	120-2342-4
400	121.6	120-2342-5
500	152	120-2342-6
600	182.4	120-2342-7
700	212.8	120-2342-8
800	243.2	120-2342-9
900	273.6	120-2342-10
1,000	304	120-2342-11
1,250	380	120-2342-12
1,500	456	120-2342-13
1,750	532	120-2342-14
2,000	608	120-2342-15

Modem Cables

Modem cables are available in lengths of 12 ft (3.7 m) with extensions of 25 ft (7.6 m) and 50 ft (15.2 m). Combined cable distance, however, from Wang equipment to a modem is 50 ft (15.2 m) maximum according to Electronic Industries Association (EIA) standards. Table A-2 lists the optional modem cables and their corresponding part numbers.

Table A-2. Modem Cables

Length in Feet	Length in Meters	Part Number
12	3.7	220-0332
25	7.6	220-0333
50	15.2	220-0334

APPENDIX B PREVENTIVE MAINTENANCE AND ENVIRONMENTAL CONSIDERATIONS

B.1 PREVENTIVE MAINTENANCE

It is recommended that the equipment be serviced semiannually. A Maintenance Agreement is available to ensure that this service is automatically performed. If you do not obtain a Maintenance Agreement, you must arrange for all servicing. A Maintenance Agreement protects your investment and offers the following benefits:

Preventive Maintenance -- The equipment is inspected semi-annually for worn parts, and adjusted, lubricated, cleaned, and updated with any engineering changes. Preventive maintenance minimizes downtime by anticipating repairs before they are necessary.

Fixed Annual Cost -- When you buy a Maintenance Agreement, only one purchase order for service is issued for an entire year and you receive one annual billing. More frequent billing can be arranged.

Contact your local Sales/Service Office for more information regarding Maintenance Agreements.

Note: Wang Laboratories, Inc., neither honors maintenance agreements for, nor guarantees, any equipment modified by the user. Damage to equipment incurred as a result of such modification is the financial responsibility of the user.

B.2 ENVIRONMENTAL CONSIDERATIONS

Recommended Operating Environment -- The recommended operating environment is:

Temperature -- 60°F to 90°F (15°C to 32°C).

Relative Humidity -- 35% to 65%, noncondensing.

Dust -- No accumulation should be obvious in a 24-hour period.

Power -- Grounded, noise-free, dedicated 115 or 230 Vac \pm 10%, 50 or 60 Hz \pm 1.0 Hz

Interference -- All sources of static electricity, extreme magnetism, and EMI should be controlled.

Temperature -- When the recommended temperature range is exceeded, both component failure rates and the loss of data through distortion of data storage materials are likely to increase.

Airborne Contaminants -- Airborne contaminants can accumulate rapidly on the circuit boards and their components, forming a film which not only prevents adequate heat dissipation from the electronic elements, but also creates leakage paths, causing errors in the system signals. Additionally, dust causes excessive wear in the disk read/write heads and the oxide coatings of storage media. The filters of all heating, ventilating, and air conditioning (HVAC) equipment should be cleaned or replaced regularly. In areas where these filters do not sufficiently remove airborne contaminants, an electrostatic air filter should be installed.

Humidity -- Low humidity increases the probability of static buildup, causes oxide shed in data storage materials, and increases the static charge imparted to carpets and clothing. When the operator comes in contact with the system, the resultant static discharge, which could be several thousand volts, will also cause system errors or destruction of data. High humidity rapidly deteriorates paper stock and magnetic disks and tape. Humidifiers or dehumidifiers should be installed in the environment's HVAC systems as required.

Static -- Carpeting that is to be installed should be a nonstatic variety. Static carpeting that is already installed must be treated with nonstatic spray, or an electrically conductive mat should be installed under the system operating area and be properly connected to an earth ground to prevent static buildup.

Electromagnetic Interference (EMI) -- Computers and peripherals are susceptible to malfunction due to electromagnetic interference (EMI) from devices such as radio transmitters and industrial motors. EMI can enter the system by conduction through wiring and cabling or by direct radiation. An illustration of EMI is a television which becomes full of "snow" when a car with a poorly tuned engine idles outside (radiated EMI) or someone turns on a hair dryer or vacuum cleaner in the next room (conducted EMI).

To minimize such interference, the 3-prong AC power line should be dedicated to the system, grounded, properly installed in a steel conduit, and isolated from interference-generating devices such as office machines, fluorescent lighting, motors, and HVAC units. If these devices are located near the system area, they must be relocated, repaired, or filtered to ensure that they do not disturb the system. (EMI filters, isolation transformers, and line conditioners should be installed on the system's AC power line.) In cases of high residual EMI, it may also be necessary to shield all peripheral cables.

**APPENDIX C
CONTROL CODES AND CHARACTER SETS**

Tables C-1 through C-4 show the control codes, the character set, and the alternate character set for the monitor of the 2536DW Interactive Terminal. In the normal character set, the codes HEX(90) to HEX(FF) are underlined versions of characters from HEX(10) to HEX(7F). Thus, adding HEX 80 to a nonunderlined character's HEX value yields the HEX code of its underlined counterpart.

Table C-1. The Screen Control Codes

HEX	Action
00	Null
01	Moves cursor to the home position (top left corner of the CRT)
02	Start of multibyte control sequence
03	Clears the screen and returns the cursor to the home position
04	Reserved
05	Turns the cursor on
06	Turns the cursor off
07	Audio alarm
08	Moves the cursor to the left one space without erasing any characters (nondestructive backspace)
09	Moves the cursor to the right one space without erasing any characters (nondestructive space)
0A	Moves the cursor down one line (line feed)
0B	Reserved
0C	Moves the cursor up one line
0D	Moves the cursor to the beginning of the current line (carriage return)
0E	Activates attribute
0F	Attribute off; restores normal intensity

Table C-2. The Multibyte Control Codes

HEX Sequence	Action	Section Reference
0202...0F	Character set control	3.4
0204...0E/0F	Attribute control	3.3
02050F	Blinking cursor	3.2
0208090F	Request self-identification message	3.7
020D0C030F	Reinitializes terminal to power on state	3.8
020Cxx	Accessing the 25th row	3.10

Table C-3. The Normal Character Set

		High-order HEX Digit														
		1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Low-order HEX Digit	0	â	Space	0	@	P	°	p	Space	â	_	0	@	P	°	p
	1	ê	!	1	A	Q	a	q	◆	ê	!	1	A	Q	a	q
	2	î	"	2	B	R	b	r	▶	î	"	2	B	R	b	r
	3	ô	#	3	C	S	c	s	◀	ô	#	3	C	S	c	s
	4	û	\$	4	D	T	d	t	→	û	\$	4	D	T	d	t
	5	ä	°	5	E	U	e	u	└	ä	°	5	E	U	e	u
	6	ë	&	6	F	V	f	v	|	ë	&	6	F	V	f	v
	7	ï	'	7	G	W	g	w	⋯	ï	'	7	G	W	g	w
	8	ö	(	8	H	X	h	x	'	ö	(	8	H	X	h	x
	9	ü	)	9	I	Y	i	y	'	ü	)	9	I	Y	i	y
	A	à	*	:	J	Z	j	z	^	à	*	:	J	Z	j	z
	B	è	+	;	K	l	k	§	■	è	+	;	K	l	k	§
	C	ù	,	<	L	\	l	£	!!	ù	,	<	L	\	l	£
	D	Ä	-	=	M	l	m	é	l	Ä	-	=	M	l	m	é
	E	Ö	.	>	N	l	n	ç	ß	Ö	.	>	N	l	n	ç
	F	Ü	/	?	O	←	o	€	¶	Ü	/	?	O	←	o	€

Table C-4. The Alternate Character Set

		High-order HEX Digit															
		1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Low-order HEX Digit	0	â	Space	0	@	P	°	p	.	•			☐	☐	☐	☐	
	1	ê	!	1	A	Q	a	q	◆	◇			☐	☐	☐	☐	
	2	î	”	2	B	R	b	r	▶	▲			☐	☐	☐	☐	
	3	ô	#	3	C	S	c	s	◀	▼			☐	☐	☐	☐	
	4	û	\$	4	D	T	d	t	—	↓			☐	☐	☐	☐	
	5	ä	“	5	E	U	e	u	└	┘			☐	☐	☐	☐	
	6	ë	&	6	F	V	f	v	|	√			☐	☐	☐	☐	
	7	ï	’	7	G	W	g	w	”	°			☐	☐	☐	☐	
	8	ö	(	8	H	X	h	x	’	↓			☐	☐	☐	☐
	9	ü	)	9	I	Y	i	y	˘	↓			☐	☐	☐	☐
	A	à	•	:	J	Z	j	z	^	Δ			☐	☐	☐	☐	
	B	é	+	:	K	l	k	§	■	□			☐	☐	☐	☐	
	C	ù	,	<	L	l	l	£	!!				☐	☐	☐	☐	
	D	Ä	-	=	M	l	m	é	↓				☐	☐	☐	☐	
	E	Ö	•	>	N	↑	n	ç	ß				☐	☐	☐	☐	
	F	Ü		?	O	—	o	€	•				☐	☐	☐	☐	

APPENDIX D CHANGING THE TRANSMISSION RATE OF THE TERMINAL AND TERMINAL PROCESSOR

D.1 OVERVIEW

Caution: Equipment modifications made by the user may void the warranty and maintenance agreement. Any damage to equipment caused by unauthorized modifications or attachments is the user's responsibility.

The data transmission rate set at a terminal *must* equal the baud rate set at the terminal processor's plug for that terminal. If a terminal is attached to a modem, the transmission speed of the terminal must be within the range supported by the modem.

D.2 CHANGING THE TRANSMISSION RATE OF THE 2536DW INTERACTIVE TERMINAL

To change the data transmission rate of the 2536DW Interactive Terminal, perform the following procedure:

1. Slide the power switch to the On position.
2. Select the appropriate baud rate from the 2536DW Workstation Configuration menu (Figure D-1) by using the space bar to select the baud rate and then pressing the EXEC key to enter Terminal mode.

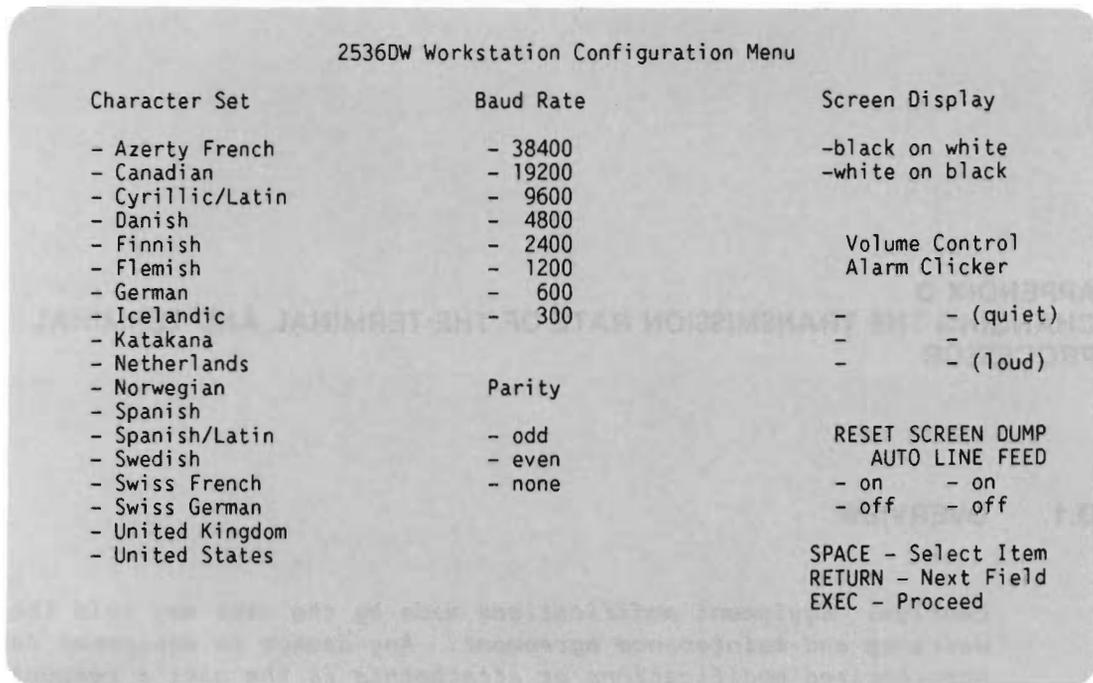


Figure D-1. 2536DW Workstation Configuration Menu

3. The Computer System (CS) Series, MicroVP Series, and 2200 Series use odd parity; however, EVEN and NO are selectable. If using a 10-bit modem, parity may be dropped.
4. The terminal displays its power-on message [2536DW R0101 19200B 8+0 (USA)] so that you can verify the switch settings. (Refer to Section 3.7)

D.3 CHANGING THE TRANSMISSION RATE OF THE 2236MXD TERMINAL PROCESSOR

With all switch types, one end of the switch is marked On (1). (Figure D-2 illustrates the three types of switches.)

Push-in switch -- Has two white squares, one above and one below each switch's number. When a square at the On end is pressed in, the switch is on and the opposite square projects out.

Slide switch -- Requires a sliding motion toward either the On or Off position.

Rocker switch -- Operates similarly to the push-in switch. When one end of the switch is pushed in, the opposite end projects out.

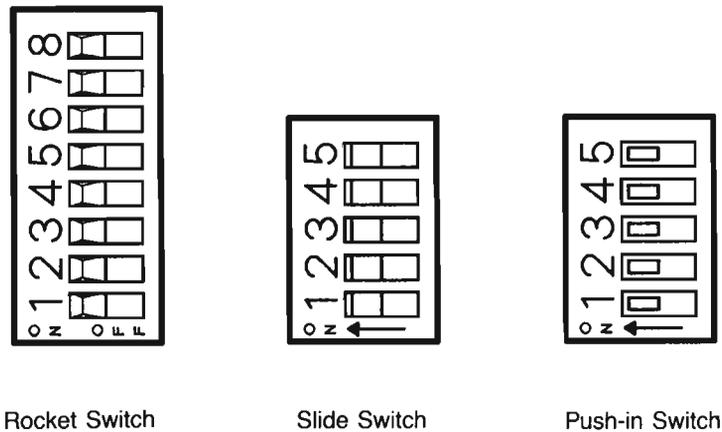


Figure D-2. The Three Types of Switches

To change the transmission rate of the 2236MXD Terminal Processor, perform the following procedure:

1. Power off the system by turning off all terminals and printers, then all disk drives, and finally, the host system.
2. Loosen the retaining screws that attach the terminal processor to the host computer. Using the two handles on top of the processor, pull the processor board straight up and out of the host input/output (I/O) port.
3. Locate the three 8-bank switches on the processor board used to set the transmission rate (See Figure D-3). Note that the processor may have any of the three switch types. Follow the instructions for setting the type of switch that is installed on the processor.

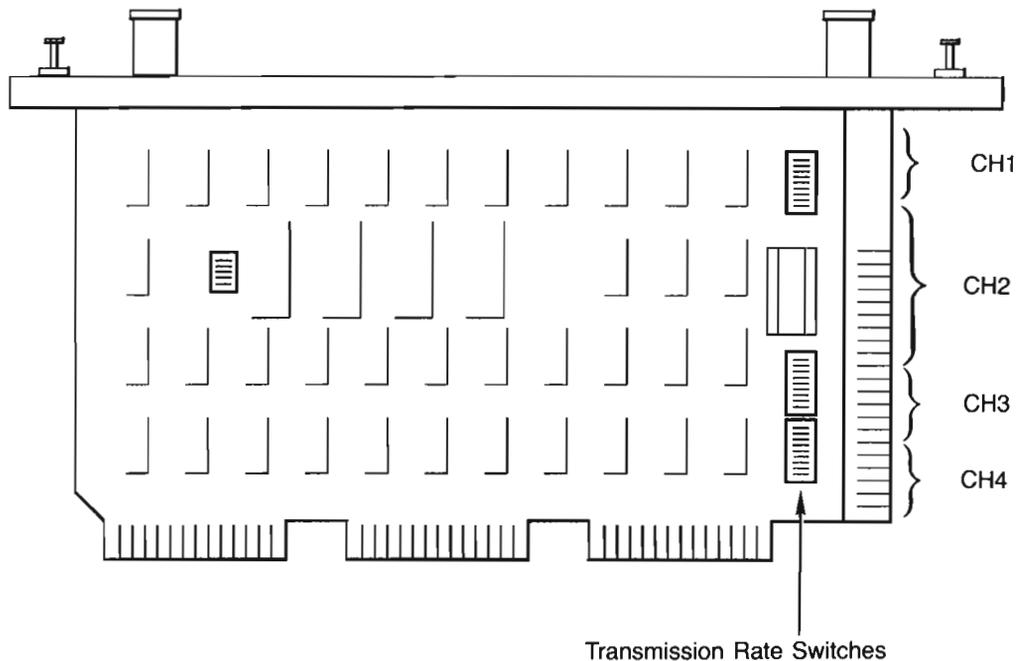


Figure D-3. The Transmission Rate Switch Settings on the 2236MXD Terminal Processor

4. The switch position labeled "4800 baud" actually specifies 19.2K bits per second (bps) in normal operation. If 4,800 bps operation is required, then the board must be physically modified because the 19.2K bps and 4,800 bps rates are mutually exclusive. Contact a Wang service representative for further details.
5. For each terminal, set the corresponding processor switch to the same data transmission rate set on the terminal. The 24 switches are divided into four sets (one set for each terminal). Each set is divided into six switches (one switch for each data rate of each terminal). (See Figure D-3.)
6. After setting the switches, replace the terminal processor in the host computer's I/O port and tighten the retaining screws.
7. Power on the system by turning on the host system, then all disk drives, and finally, all printers and terminals.

D.4 CHANGING THE TRANSMISSION RATE OF THE 2236MXE TERMINAL PROCESSOR

To change the transmission rate of the 2236MXE Terminal Processor, perform the following procedure:

1. Power off the system by turning off all terminals and printers, then all disk drives, and finally, the host system.
2. Loosen the retaining screws that attach the terminal processor to the host. Using the two handles on top of the processor, pull the processor board straight up and out of the host computer's I/O port.
3. Locate the two 8-bank switches on the processor board used to set the transmission rate. (See Figure D-4.) Note that the processor may have any of the three switch types. Follow the instructions for setting the type of switch that is installed on the processor.

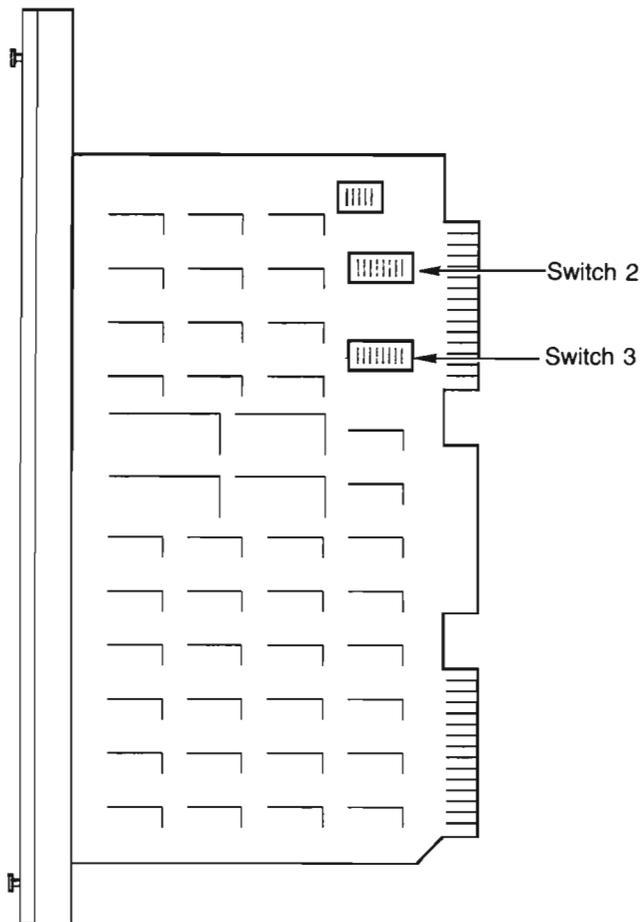


Figure D-4. The Transmission Rate Switch Settings on the 2236MXE Terminal Processor

- Referring to Figure D-4, note that:

Settings 1 to 4 on Switch 3 -- Set the transmission rate of Port 1

Settings 5 to 8 on Switch 3 -- Set the transmission rate of Port 2

Settings 1 to 4 on Switch 2 -- Set the transmission rate of Port 3

Settings 5 to 8 on Switch 2 -- Set the transmission rate of Port 4

If you use more than one processor board, note that the corresponding settings on the second and third boards set the transmission rates for Ports 5 to 8 and 8 to 12, respectively.

- For each terminal, set the corresponding processor switch to the same data transmission rate set on the terminal. Table D-1 shows the switch settings for each transmission rate.

Table D-1. Transmission Rate Switch Settings for the 2236MXE Terminal Processor

Transmission Rate bps	Hex	Switch Settings			
		1 5	2 6	3 7	4 8
110	0	off	off	off	off
134.5	1	on	off	off	off
150	2	off	on	off	off
200	3	on	on	off	off
300	4	off	off	on	off
600	5	on	off	on	off
1,200	6	off	on	on	off
2,400	8	off	off	off	on
4,800	A	off	on	off	on
9,600	C	off	off	on	on
19,200	D	on	off	on	on
38,400	E	off	on	on	on

- After setting the switches, replace the terminal processor in the host computer's I/O port and tighten the retaining screws.
- Power on the system by turning on the host computer, then the disk processing unit (DPU), all disk drives, and finally, all printers and terminals.

APPENDIX E SETTING THE DEVICE ADDRESS OF THE TERMINAL PROCESSOR

E.1 OVERVIEW

Caution: Equipment modifications made by the user may void the warranty and maintenance agreement. Any damage to equipment caused by unauthorized modifications or attachments is the user's responsibility.

Device address settings for the 2236MXD or 2236MXE Terminal Processors are shown in Table E-1.

Table E-1. Physical Device Address of the Terminal Processor

Number of Terminals	Number of Processors Required	Address Setting of 2236MXD or 2236MXE Terminal Processor
1 to 4	1	The address of the primary processor is always set at address /00. The processor also reserves addresses 01 to 07.
5 to 8	2	The address of the second processor (for terminals 5 to 8) is always set at address /40. The processor also reserves addresses 41 to 47.

(continued)

Table E-1. Physical Device Address of the Terminal Processor (continued)

Number of Terminals	Number of Processors Required	Address Setting of 2236MXD or 2236MXE Terminal Processor
9 to 12	3	The address of the third processor (for terminals 9 to 12) is always set at address /80. The processor also reserves addresses 81 to 87.
13 to 16	4	The address of the fourth processor (for terminals 13 to 16) is always set at address /C0. The processor also reserves addresses C1 to C7.

Note: Unlike other peripheral processors, the physical device address set on the 2236MXD or 2236MXE Terminal Processor is not the address specified in a program for access to the terminal monitor, keyboard, and terminal printers. The programmable device addresses for all terminals are CRT /005, keyboard /001, and local printers /004. The operating system translates these programmable addresses into the appropriate physical processor addresses.

With all switch types, one end of the switch will be marked On (1). (See Figure D-2 for an illustration of the three types of switches.)

Push-in switch -- Two white squares, one above and one below each switch's number. When a square at the On end is pressed in, the switch is on and the opposite square projects out.

Slide switch -- Requires a sliding motion toward either the On or Off position.

Rocker switch -- Operates similarly to the push-in switch. When one end of the switch is pushed in, the opposite end projects out.

E.2 THE 2236MXD TERMINAL PROCESSOR

To set the 2236MXD Terminal Processor's physical device address, perform the following procedure:

1. Power off the system by turning off all terminals and printers, followed by all disk drives and accessories, and finally, the host system.
2. Loosen the retaining screws that attach the processor to the host. Using the two handles on top of the processor, pull the processor board straight up and out of the host input/output (I/O) port.
3. Locate the 5-bank switch on the 2236MXD Terminal Processor used to set the device address. (See Figure E-1.) Note that the processor may have any of the three switch types. Follow the instructions for setting the type of switch that is installed on the processor.

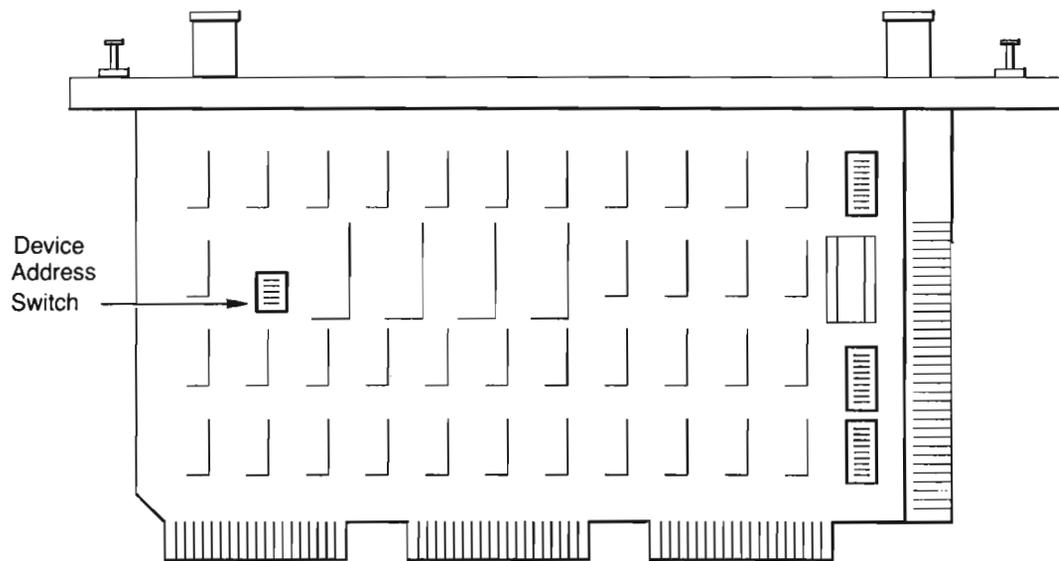


Figure E-1. The Device Address Switch on the 2236MXD Terminal Processor

4. For each processor, set the device address as required.

To set the address at /00 -- Place all switches in the Off position. See Figure E-2. (An address of /00 indicates the primary terminal processor, which controls Terminals 1 to 4.)

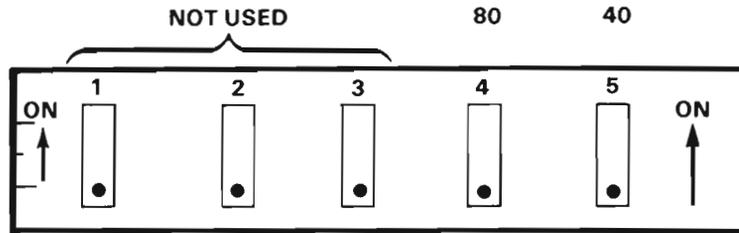


Figure E-2. Device Address /00

To set the address at /40 -- Place the 40 switch in the On position; place all other switches in the Off position. See Figure E-3. (An address of /40 indicates that there are two terminal processors. The second processor, which must be set at /40, controls Terminals 5 to 8.)

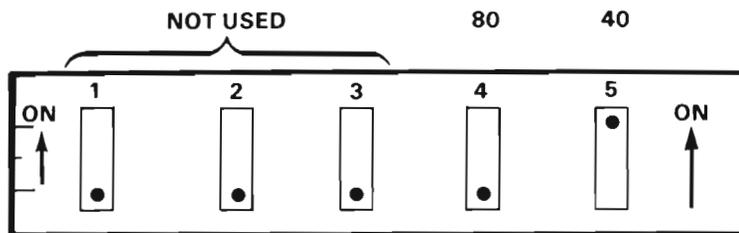


Figure E-3. Device Address /40

To set the address at /80 -- Place the 80 switch in the On position; place all other switches in the Off position. See Figure E-4. (An address of /80 indicates that there are three terminal processors. The third processor, which must be set at /80, controls Terminals 9 to 12.)

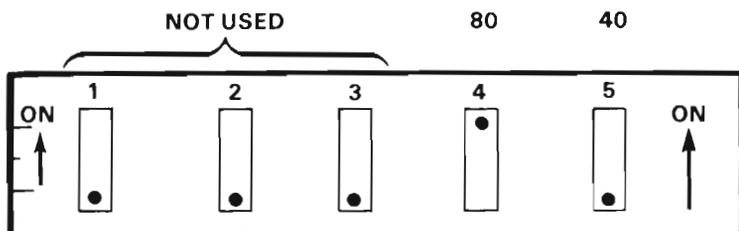


Figure E-4. Device Address /80

To set the address at /C0 -- Place the 40 switch and the 80 switch in the On position; place all other switches in the Off position. See Figure E-5. (An address of /C0 indicates that there are four terminal processors. The fourth processor, which must be set at /C0, controls Terminals 13 to 16.)

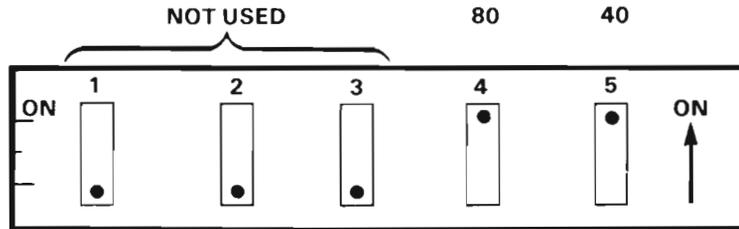


Figure E-5. Device Address /C0

5. After setting the address, reinsert the processor in the host I/O port and tighten the retaining screws.
6. Power on the system by turning on the host system, all disk drives and accessories, and finally, all printers and terminals.

Note: Addresses 01 to 07, 41 to 47, 81 to 87, and C1 to C7 are reserved for the terminal processor and **cannot** be used for any other device.

E.3 THE 2236MXE TERMINAL PROCESSOR

To set the 2236MXE Terminal Processor's physical device address, perform the following procedure:

1. Power off the system by turning off all terminals and printers, then all disk drives and accessories, and finally, the host system.
2. Loosen the retaining screws that attach the processor to the host. Using the two handles on top of the processor, pull the processor board straight up and out of the host I/O port.
3. Locate the 4-bank switch on the 2236MXE Terminal Processor used to set the device address. (See Figure E-6.) The processor may have any of the three switch types. Follow the instructions for setting the type of switch installed on the processor.

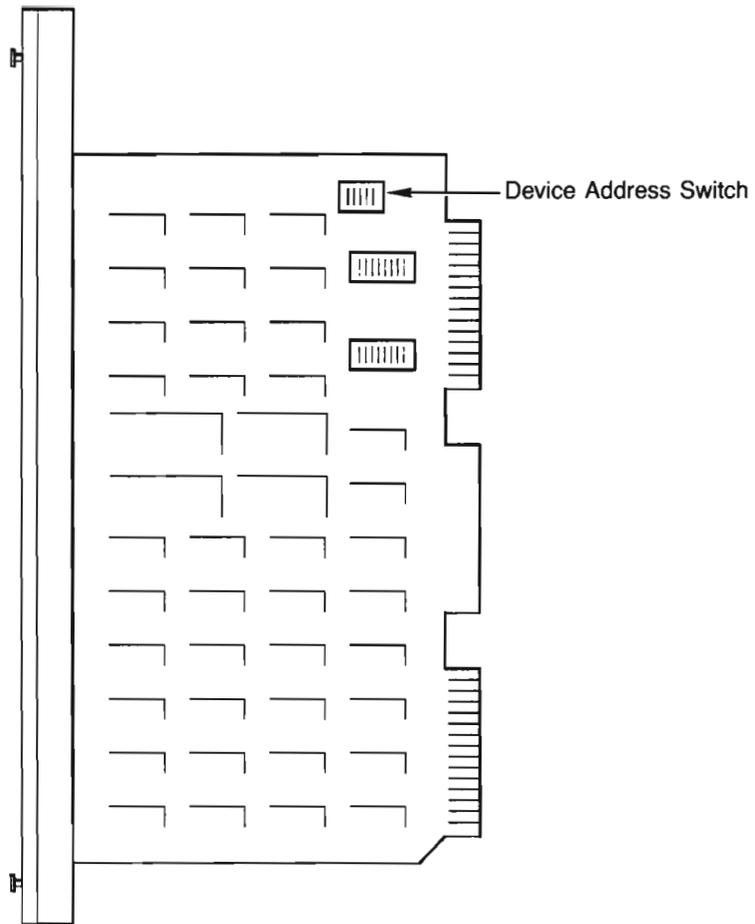


Figure E-6. The Device Address Switch on the 2236MXE Terminal Processor

4. For each processor, set the device address as required.

To set the address at /00 -- Place all switches in the Off position. See Figure E-7. (An address of /00 indicates the primary terminal processor, which controls Terminals 1 to 4.)

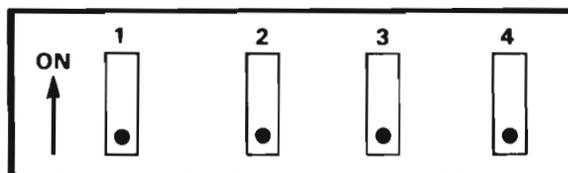


Figure E-7. Device Address /00

To set the address at /40 -- Place Switch 1 in the On position; place all other switches in the Off position. See Figure E-8. (An address of /40 indicates that there are two terminal processors. The second processor, which must be set at /40, controls Terminals 5 to 8.)

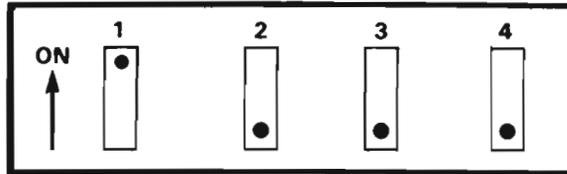


Figure E-8. Device Address /40

To set the address at /80 -- Place Switch 2 in the On position; place all other switches in the Off position. See Figure E-9. (An address of /80 indicates that there are three terminal processors. The third processor, which must be set at /80, controls Terminals 9 to 12.)

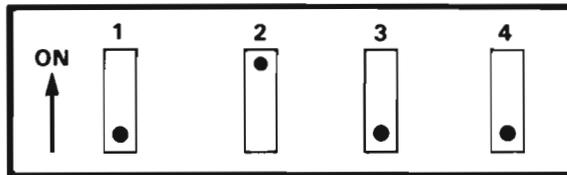


Figure E-9. Device Address /80

To set the address at /C0 -- Place Switches 1 and 2 in the On position; place all other switches in the Off position. See Figure E-10. (An address of /C0 indicates that there are four terminal processors. The fourth processor, which must be set at /C0, controls Terminals 13 to 16.)

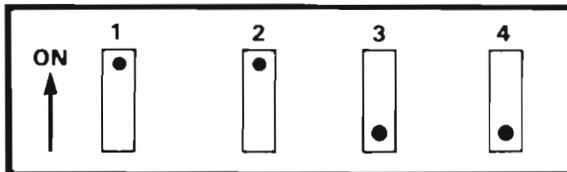


Figure E-10. Device Address /C0

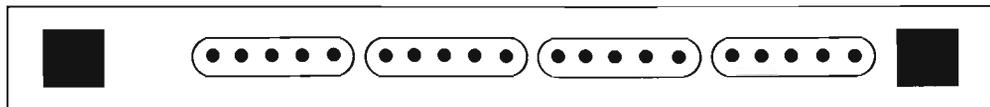
5. After setting the address, reinsert the processor in the host's I/O port and tighten the retaining screws.
6. Power on the system by turning on the host computer, followed by all disk drives and accessories, and finally, all printers and terminals.

E.4 DETERMINING THE NUMBER ASSIGNED TO THE JACKS

If the processor connectors are not numbered, they can be easily distinguished and identified. On the 2236MXE Terminal Processor, there is a light emitting diode (LED) next to Port 1 on the board.

On the 2236MXD Terminal Processor, the two connectors nearest the handles on top of the processor are always offset so that the plug on one end is closer to the handle than the plug on the other end of the processor. The jack that is closest to the handle has the highest number. The jack numbers descend sequentially from the end closest to the handle to the opposite end of the processor board. (See Figure E-11.)

Plug 4,8, or 12



Plug 1,5, or 9

Figure E-11. Determining the Number Assigned to the Jacks on the 2236MXD Terminal Processor

APPENDIX F SETTING THE DEVICE ADDRESSES ON THE 22C32 TRIPLE CONTROLLER

Caution: Equipment modifications made by the user may void the warranty and maintenance agreement. Any damage to equipment caused by unauthorized modifications or attachments is the user's responsibility.

The 22C32 Triple Controller has three switch banks for setting the device addresses of the printer, disks, and terminal. The disk switch bank is closest to the cable connectors, the printer switch bank is next, and the terminal switch bank is the farthest away (when there are only five switches in the bank). (See Figure F-1.)

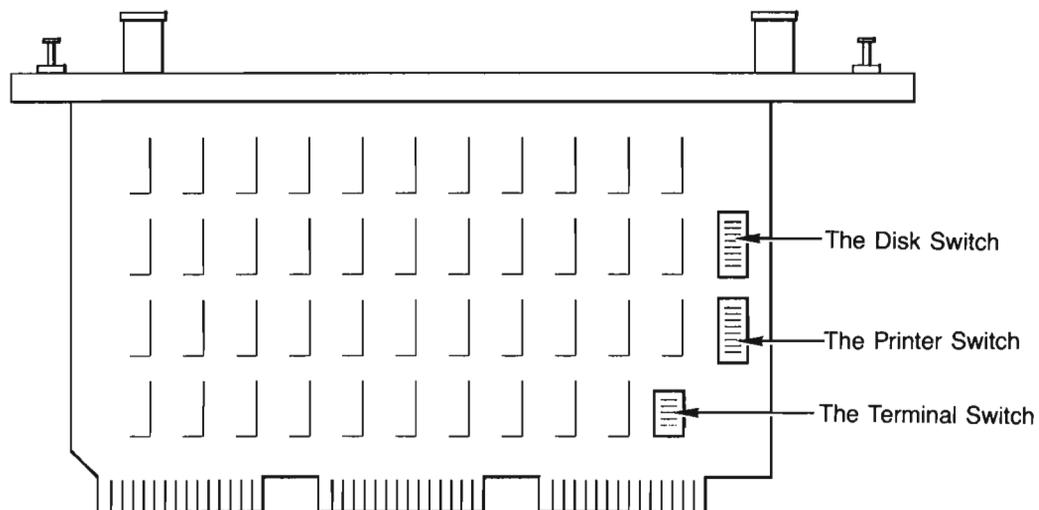


Figure F-1. The Device Address Switches on the 22C32 Triple Controller

With all switch types, one end of the switch will be marked On (1). (See Figure D-2 for an illustration of the three types of switches.)

Push-in switch -- Two white squares, one above and one below each switch's number. When a square at the On end is pressed in, the switch is on and the opposite square projects out.

Slide switch -- Requires a sliding motion toward either the On or Off position.

Rocker switch -- Operates similarly to the push-in switch. When one end of the switch is pushed in, the opposite end projects out.

The standard disk address is 10. However, you can set the address to 20 or 30 if more than one disk is attached to the system. (See Figure F-2.)

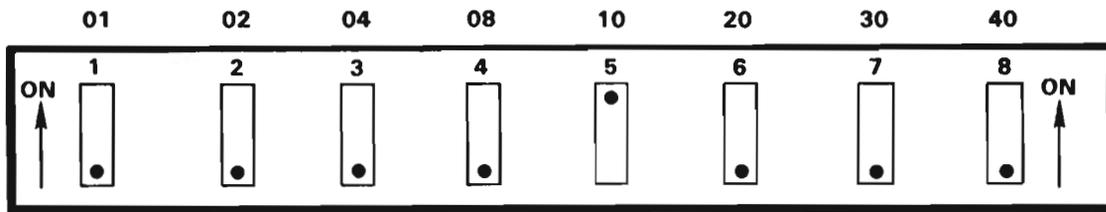


Figure F-2. Disk Address 10

The standard printer address is 15. However, if more than one printer is attached to the host, Addresses 16 or 17 can be used. (See Figure F-3.)

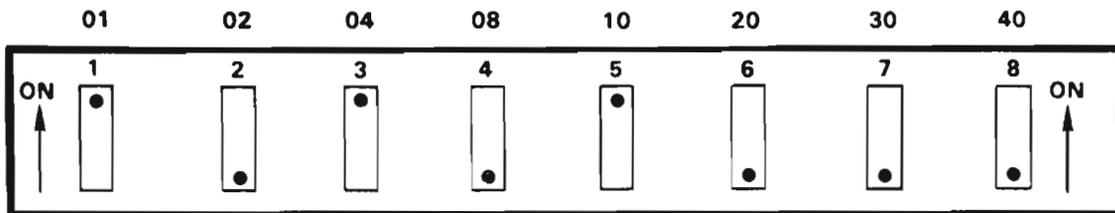


Figure F-3. Printer Address 15

When setting the address of the terminal, place Switch 1 in the On position. If Switch 1 is in the Off position, the terminal controller is disabled.

On single-terminal systems, the 40 and 80 bits of the switch are always placed in the Off position (the controller then responds to Addresses 01 to 07). See Figure F-4.

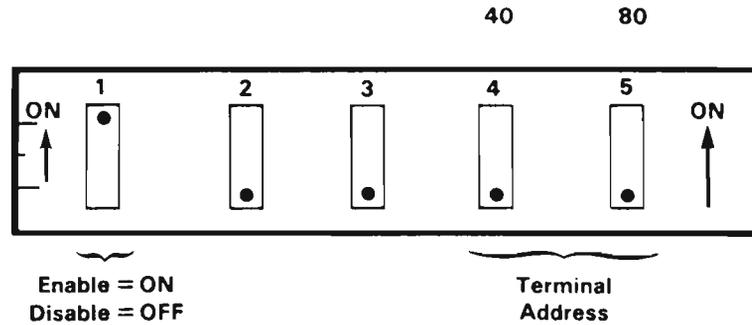


Figure F-4. Switches Set for Terminal 1

On 5-terminal systems, use the 22C32 Triple Controller for the fifth terminal. Set the switches so that the 40 bit is On and the 80 bit is Off (the controller then responds to Addresses 41 to 47). See Figure F-5.

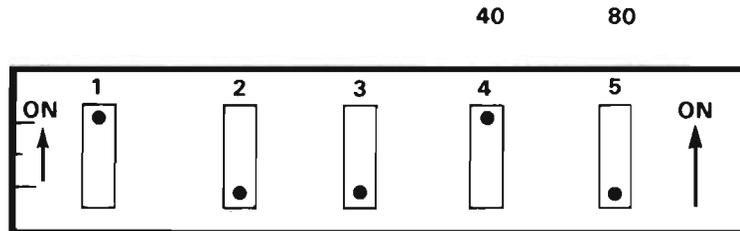


Figure F-5. Switches Set for Terminal 5

On 9-terminal systems, use the 22C32 Triple Controller for the ninth terminal. Set the switches so that the 80 bit is On and the 40 bit is Off (the controller then responds to Addresses 81 to 87). See Figure F-6.

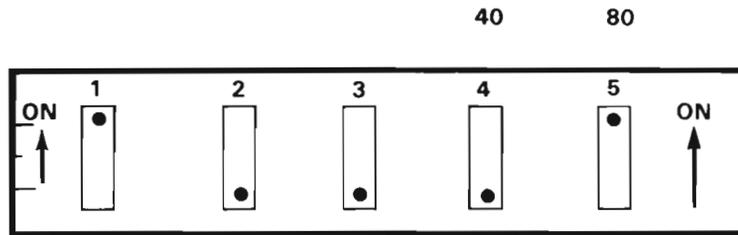


Figure F-6. Switches Set for Terminal 9

On 13-terminal systems, use the 22C32 Triple Controller for the 13th terminal. Set the switches so that both the 40 and 80 bits are On (the controller then responds to Addresses C1 to C7). See Figure F-7.

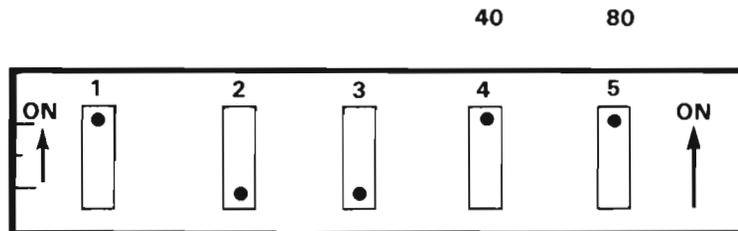


Figure F-7. Switches Set for Terminal 13

Note: Unlike other peripheral controllers, the physical device address set on the terminal controller is not the address specified in a program for access to the terminal monitor, keyboard, and terminal printers. The programmable device addresses for all terminals are CRT /005, keyboard /001, and local printers /004. The operating system translates these programmable addresses into the appropriate physical controller address.

To set the physical device address of the 22C32 Triple Controller, perform the following procedure:

1. Turn off all terminals and printers, followed by all disk drives and their accessories, and finally, the host system.
2. Loosen the retaining screws that attach the controller to the host. Using the two handles on top of the controller, pull the controller board straight up and out of the host input/output (I/O) port.

3. Locate the appropriate switch on the controller board used to set each device address. Any of the three switch types may be used on the controller. Follow the instructions for setting the type of switch that is installed on the controller.
4. Set the device addresses as required. (See Figures F-2 to F-7.)
5. After setting the addresses, reinsert the controller in the host computer's I/O port and tighten the retaining screws.
6. Power on the system by turning on the host computer, followed by the Disk Processing Units (DPUs), all disk drives, and finally, all printers and terminals.

Notes: Addresses 01 to 07, 41 to 47, 81 to 87, and C1 to C7 are reserved for the 2236MXE Terminal Processor and 22C32 Triple Controller and **cannot** be used for any other devices.

The transmission rate of the 22C32 Triple Controller is preset at 19.2K bits per second (bps) and cannot be modified.

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