

WANG

Model 2233 Line Printer User Manual



Model 2233 Line Printer User Manual

**1st Edition — August 1981
Copyright © Wang Laboratories, Inc. 1981
700-6854**



LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL. (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

Disclaimer of Warranties and Limitation of Liabilities

The staff of Wang Laboratories, Inc., has taken due care in preparing this manual; however, nothing contained herein modifies or alters in any way the standard terms and conditions of the Wang purchase agreement, lease agreement, or rental agreement by which this equipment was acquired, nor increases in any way Wang's liability to the customer. In no event shall Wang Laboratories, Inc., or its subsidiaries be liable for incidental or consequential damages in connection with or arising from the use of this manual or any programs contained herein.

Wang Laboratories, Inc., assumes no responsibility for wiring the male connector, furnished with this interface controller board, to any non-Wang equipment. In no event shall Wang Laboratories, Inc., or its subsidiaries be liable for any damages in connection with or arising from the wiring operation of non-Wang equipment interfaced to a Wang system.



LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851, TEL. (617) 459-5000, TWX 710 343-6769, TELEX 94-7421

PREFACE

This manual describes the Model 2233 Line Printer and instructs the user in its operation. It is assumed that the user is familiar with the Wang 2200 Series product line and the BASIC language. Those users not acquainted with the capabilities of BASIC should refer to *Programming in BASIC* for an introduction to the language and to the Wang *BASIC-2 Language Reference Manual* for a description of the functions and attributes of the Wang BASIC-2 language.

Chapter 1 of this manual contains general information on the operational features of the Model 2233 Line Printer. Chapter 2 describes methods of selecting the printer for output. Chapters 3, 4, and 5 illustrate various techniques for formatting output. Chapter 3 demonstrates the use of BASIC-2 statements to format printed output; Chapter 4 illustrates the use of Hex codes to control a wide variety of format and character attributes; and Chapter 5 discusses loading and unloading the Direct Access Vertical Format Unit.

The Appendices include printer and paper specifications and a chart of Hexadecimal codes.

CONTENTS

CHAPTER 1 OVERVIEW

1.1	Introduction	1-1
1.2	Unpacking and Inspection	1-2
1.3	Installation	1-2
1.4	Controls and Indicators	1-3
	ON/OFF Switch and POWER Indicator	1-3
	SELECT Switch and Indicator	1-3
	LINE FEED Switch	1-3
	TOP OF FORM Switch	1-4
	FORM OVERRIDE Switch and Paper Out Indicator	1-4
	CLEAR Switch and Malfunction Indicator	1-4
	Diagnostic Error Indicators	1-4
	SERVO Fuse Indicator	1-5
	Diagnostic Test	1-5
1.5	Power-On Procedure	1-5
	System Power-On Procedure	1-5
	Model 2233 Line Printer Power-On Procedure	1-5
1.6	Ribbon Cartridge Replacement	1-6
1.7	Paper Insertion	1-8
1.8	Print Adjustment	1-10
1.9	Fuse Replacement	1-11

CHAPTER 2 DEVICE SELECTION

2.1	The SELECT Statement	2-1
	Device Type	2-1
	Unit Address	2-3
	Line Length	2-4
2.2	Selecting the Printer	2-6
	Print	2-6
	List	2-7
	Console Output	2-7
2.3	Special Techniques	2-8
2.4	Combining SELECT Parameters	2-9
2.5	Deselecting the Model 2233	2-9

CHAPTER 3 FORMATTING OUTPUT

3.1	Introduction	3-1
3.2	PRINT, PRINTUSING, and HEXPRINT Statements	3-1
	Zoned Format	3-1
	Packed Format	3-2
	PRINTUSING Statement	3-4
3.3	The Tab Function	3-5

CONTENTS (continued)

CHAPTER 4	PRINTER CONTROL CODES		
4.1	The Hex Function	4-1	
	Character Codes	4-1	
	Control Codes	4-1	
4.2	Line Feed Control Codes	4-2	
	Automatic Line Feed/Line Feed Size Control	4-2	
	Line Feed: HEX(0A)	4-3	
	Partial Line Feed: HEX(020Add0F)	4-4	
4.3	Enhanced Printed Output	4-5	
	Underscore	4-5	
	Expanded Print	4-6	
	Both Underscore and Expanded Print	4-7	
4.4	Miscellaneous Control Codes	4-8	
	Audio Alarm: HEX(07)	4-8	
	Carriage Return: HEX(0D)	4-8	
	Delete: HEX(7F)	4-9	
	Diagnostic: HEX(02010201000F)	4-9	
	Power-On Reset: HEX(020D0C030F)	4-9	
	Select Character Font: HEX(0202aa0F)	4-9	
	Select Pitch: HEX(02090102aabb0F)	4-10	
	Top-of-Form: HEX(0C)	4-10	
CHAPTER 5	DIRECT ACCESS VERTICAL FORMAT UNIT (DAVFU)		
5.1	Introduction	5-1	
5.2	Vertical Format Control Utility (@2273VFU)	5-1	
	Accessing the Utilities Menu	5-1	
	Vertical Format Control Utility	5-2	
	Loading a Utility-Defined Vertical Format	5-2	
5.3	Formatting Using the DAVFU	5-2	
	Load DAVFU: HEX(021Ddddd ... 1EOF)	5-2	
	Examples	5-3	
5.4	DAVFU Control Codes	5-5	
	Vertical Skip: HEX(0201021Fxx0F)	5-5	
	Vertical Tab: HEX(0B)	5-6	
5.5	DAVFU Errors	5-6	
APPENDICES			
Appendix A	Hexadecimal Codes	A-1	
Appendix B	Specifications	B-1	
B.1	Model 2233 Line Printer Specifications	B-1	
B.2	Paper Specifications	B-2	
Appendix C	Hex Digit Representation of Bit Patterns	C-1	
INDEX		INDEX-1	

FIGURES

Figure 1-1	The Model 2233 Line Printer	1-1
Figure 1-2	Rear Panel	1-2
Figure 1-3	Front Control Panel	1-3
Figure 1-4	Diagnostic Error Codes	1-4
Figure 1-5	Overview of Printer	1-6
Figure 1-6	Ribbon Cartridge Removal	1-7
Figure 1-7	Print Head Carriage	1-7
Figure 1-8	Pin-Feed Gate	1-8
Figure 1-9	Inserting Paper on Tractor Pins	1-9
Figure 1-10	Forms Thickness Lever Adjustment	1-10

TABLES

Table 5-1	DAVFU Data Loading Format	5-3
Table 5-2	Sample DAVFU Tabulation Scheme	5-4

CHAPTER 1

OVERVIEW

1.1 INTRODUCTION

This manual describes the operation and features of the Model 2233 Line Printer (refer to Figure 1-1). The Model 2233 is an bidirectional impact printer that utilizes free-flight head technology to generate printed characters in matrix form.

Two fonts may be selected under software control. The characters in Font 1 are printed in a 9 by 9 dot matrix at 10-pitch, and those in Font 2 are printed in a 7 by 9 dot matrix in 10-pitch or 12.2-pitch. Pitch selection within Font 2 may be performed by a special control sequence.

The Model 2233 produces a 132-character line at 10-pitch and a 158-character line at 12.2-pitch, printing 100 10-pitch characters per second and 120 12.2-pitch characters per second. High-speed copy can be produced with 6 or 8 lines per inch (2.4 or 3.2 lines per centimeter). When required, characters can be expanded or underscored for enhanced output (refer to Section 4.3). The complete ASCII, 96-character set for the printer is given in Appendix A.

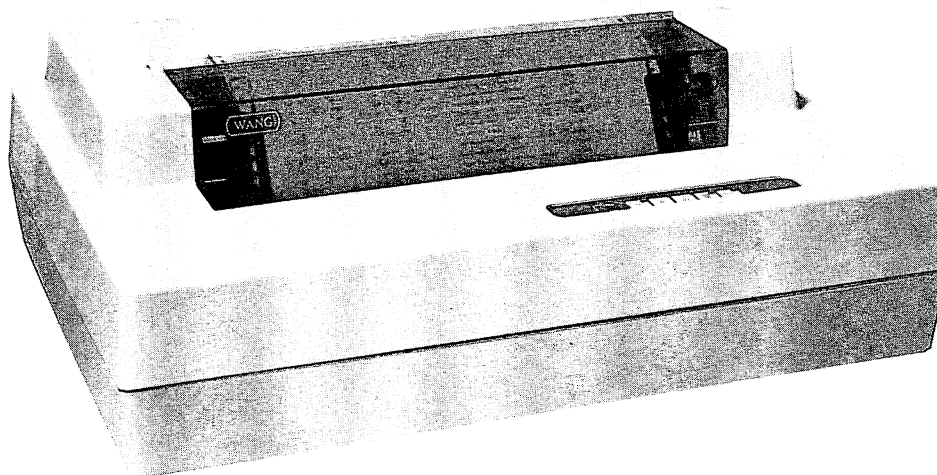


Figure 1-1. The Model 2233 Line Printer

A full-line buffer receives data transmitted from the system Central Processing Unit (CPU) to the printer and increases throughput by overlapping CPU and printer operations. This buffer allows the printer to retain data while temporarily deselected for a paper change.

The distance between the pin-feed mechanisms is adjustable, enabling the use of continuous-form paper in widths from 3.5 to 14.9 inches (8.9 to 37.8 centimeters). Format can be controlled by a variety of BASIC-2 commands and a series of printer control codes. A Direct Access Vertical Format Unit (DAVFU) can be loaded under program control to establish vertical format.

1.2 UNPACKING AND INSPECTION

The Model 2233 must be unpacked, inspected, and installed by a qualified Wang Service Representative. Failure to follow this procedure will void the warranty.

1.3 INSTALLATION

Your Wang Service Representative uses the following procedure to install the printer.

1. The Printer Controller Board is installed in the 2200MVP or 2200VP CPU chassis. The screws should be fully tightened. The printer controller is self-contained in the 2200LVP and 2200SVP.
2. The 36-pin interface connector is plugged into the printer controller board. The screws should be fully tightened.
3. The printer power connector cord is plugged into a wall outlet (refer to Figure 1-2). Refer to Appendix B for power specifications.

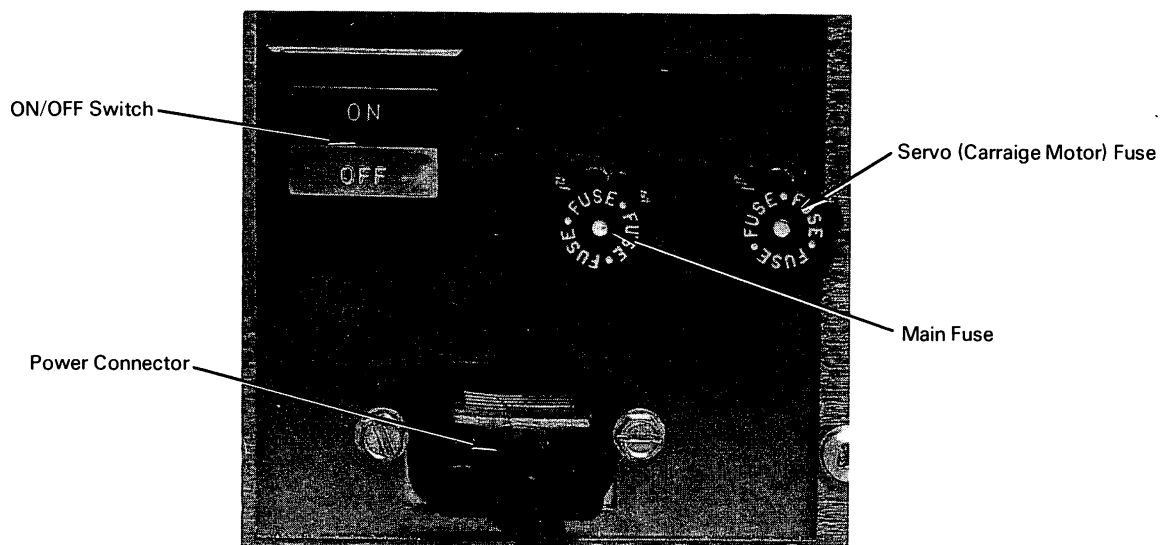


Figure 1-2. Rear Panel

1.4 CONTROLS AND INDICATORS

The Model 2233 Line Printer contains switches that control the manual operations of the printer and a series of indicators that signal printer status (refer to Figure 1-3).

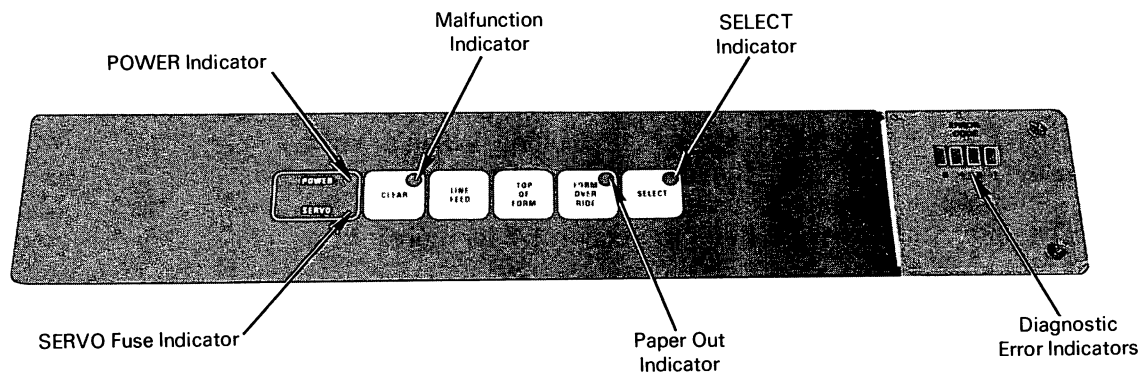


Figure 1-3. Front Control Panel

ON/OFF Switch and POWER Indicator

The ON/OFF switch is located in the left corner of the printer's rear panel. To turn the printer on, press the ON side of the rocker switch. The POWER indicator illuminates on the front control panel. To turn the printer off, press the OFF side of the rocker switch. The POWER indicator is extinguished.

SELECT Switch and Indicator

The SELECT switch is located on the front control panel. When pressed once, the SELECT switch places the printer in the ready position to receive data from the CPU. When the printer is able to receive data, the indicator at the upper right corner of the SELECT switch is illuminated.

NOTE

Though the SELECT indicator is illuminated and the printer is enabled to receive data, it must still be selected as the system printing device by the execution of a SELECT statement. Refer to Chapter 2 for instructions on how to select the Model 2233 for output.

Pressed a second time, the SELECT switch deselects the printer and extinguishes the indicator. Thus, the SELECT switch can be used to halt printing temporarily without causing data loss in the print buffer (for example, when aligning forms or changing the ribbon).

LINE FEED Switch

The LINE FEED switch is located on the front control panel. When this switch is pressed and released, paper is advanced one line; when the switch is held down, paper advances continuously. This switch operates only when the printer is deselected and the SELECT indicator is extinguished.

TOP OF FORM Switch

The TOP OF FORM switch is located on the front control panel. This switch operates only when the printer is deselected and the SELECT indicator is extinguished. When the TOP OF FORM switch is pressed, paper is automatically advanced to the top of the next page. Refer to Section 1.7 and Chapter 5 for instructions on setting the top-of-form position.

FORM OVERRIDE Switch and Paper Out Indicator

The FORM OVERRIDE switch, located on the front control panel, is used to complete printing a page after the printer has sensed a paper-out condition. When out of paper, the printer stops and the Paper Out indicator is illuminated. The user can complete the page that was in the printer when printing was interrupted by repeatedly pressing the FORM OVERRIDE switch. Each time this switch is pressed, the printer prints one line. Refer to Section 1.7 for more information on changing paper.

In addition to signalling that the printer is out of paper, the Paper Out indicator may be illuminated when the Print Head Retraction lever is advanced to the forward position.

CLEAR Switch and Malfunction Indicator

The CLEAR switch is located on the front control panel. Pressing this switch clears the printer line buffer. The CLEAR switch operates only when the printer is deselected (i.e., the SELECT indicator is extinguished).

The CLEAR switch may also be used to extinguish the diagnostic error indicators (refer to the following "Diagnostic Error Indicators" section).

The Malfunction indicator is located at the upper right corner of the CLEAR switch. It is illuminated when the printer cover is raised or a printer power-on diagnostic error occurs.

Diagnostic Error Indicators

An illuminated Malfunction indicator may signal a variety of printer diagnostic errors such as a PROM error or a Vertical Format Unit (VFU) loading error. When these errors occur, a sequence of four diagnostic error indicators to the right of the control panel is illuminated. These errors and their corresponding indicator sequences are described in Figure 1-4.

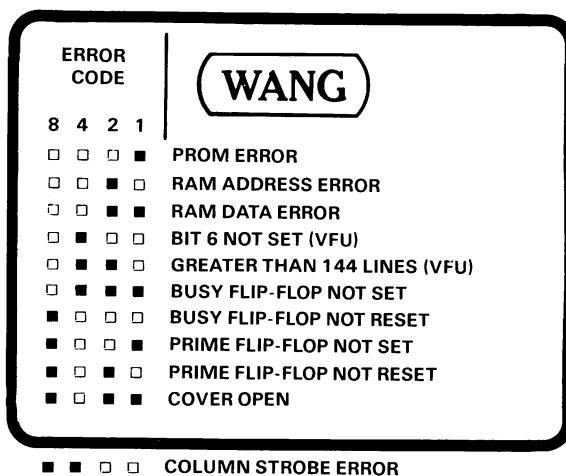


Figure 1-4. Diagnostic Error Codes

SERVO Fuse Indicator

When illuminated, the SERVO Fuse indicator, located at the far left of the printer's front control panel, indicates that the carriage motor fuse has blown. Refer to Section 1.9 for a discussion of fuse replacement.

Diagnostic Test

The process of deselecting the printer, pressing and holding down the FORMS OVERRIDE switch, and pressing the LINE FEED switch triggers a built-in, 5-line diagnostic test to aid in print intensity adjustments and form alignment. Line 1 consists of a row of vertical bars (|). Lines 2 and 3 consist of the words TAB, located at the beginning of the lines, and TEST, located at the end of the lines. Line 4 consists of a full line of underlined ASCII characters, and Line 5 consists of a staircase pattern that tests the firing of each pin in the print matrix.

Compare the five lines of characters produced by your printer with the following printout. If the comparison shows that your printout has characters or parts of characters missing, or other defects, notify your Wang Service Representative.

TAB	TEST
TAB	TEST
!"#%&'()*+,-./0123456789:;<=>@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!"#\$%&'()*+,-./0123456789:;<=>@ABCDE	

1.5 POWER-ON PROCEDURE

System Power-On Procedure

To power on the 2200 system, perform the following steps.

1. Ensure that all power cords are connected to a source of electrical power and all peripheral cables are connected to your Wang system CPU.
2. Turn on all power switches in the sequence specified in the system's central processing unit introductory manual. When the system is turned on, Master Initialization occurs; memory is cleared of all programs and variables and the addresses of primary devices are set to their default values.

Model 2233 Line Printer Power-On Procedure

To power on your printer, perform the following steps.

1. Ensure that the printer is connected to its controller port and is plugged into a source of electrical power.
2. Ensure that a ribbon cartridge is properly loaded in the printer (refer to Section 1.6).

3. Press the ON side of the rocker switch located at the upper left corner of the rear of the printer (refer to Figure 1-2). This procedure will illuminate the POWER indicator on the printer's front control panel (refer to Figure 1-3).
4. Insert paper into the printer according to the procedures detailed in Section 1.7.

CAUTION

Never operate the printer without paper.

5. Set the Forms Thickness lever for good print quality (refer to Section 1.8).
6. Select the printer to receive data from the CPU by pressing the SELECT switch on the front control panel. The SELECT indicator on the switch will be illuminated.
7. Specify the device address of the printer in a BASIC-2 SELECT statement to select the printer to print output. Detailed information on device selection may be found in Chapter 2.

1.6 RIBBON CARTRIDGE REPLACEMENT

The ribbon cartridge is replaced using the following procedures.

1. Turn the printer off.
2. Raise the printer cover to the upright position. Pull up on the Support Bar so that the cover is firmly latched (refer to Figure 1-5).

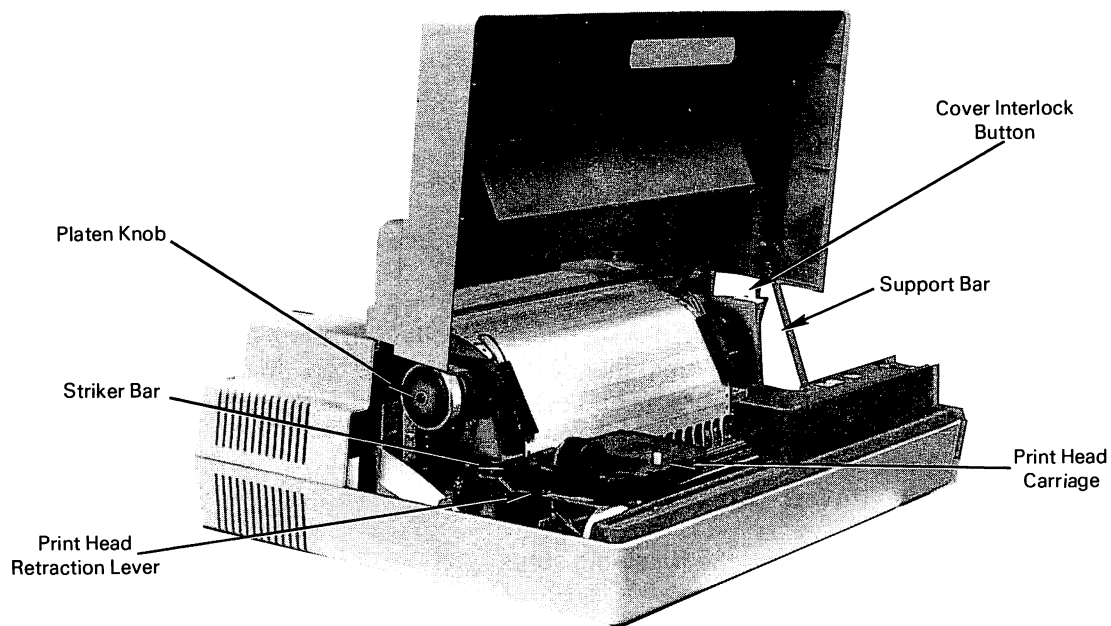


Figure 1-5. Overview of Printer

3. Locate the Print Head Retraction lever to the left of the print head carriage (refer to Figure 1-5). Pull the Print Head Retraction lever towards the front of the printer so that the print head is removed from the platen.
4. Remove the exposed ribbon from the print head, rotating the cartridge spindle, as required, to loosen the ribbon.
5. Remove the old cartridge by pushing down upon the metal clasp on the front of the print head carriage, grasping the cartridge by its sides and lifting it from the print head carriage (refer to Figure 1-6).

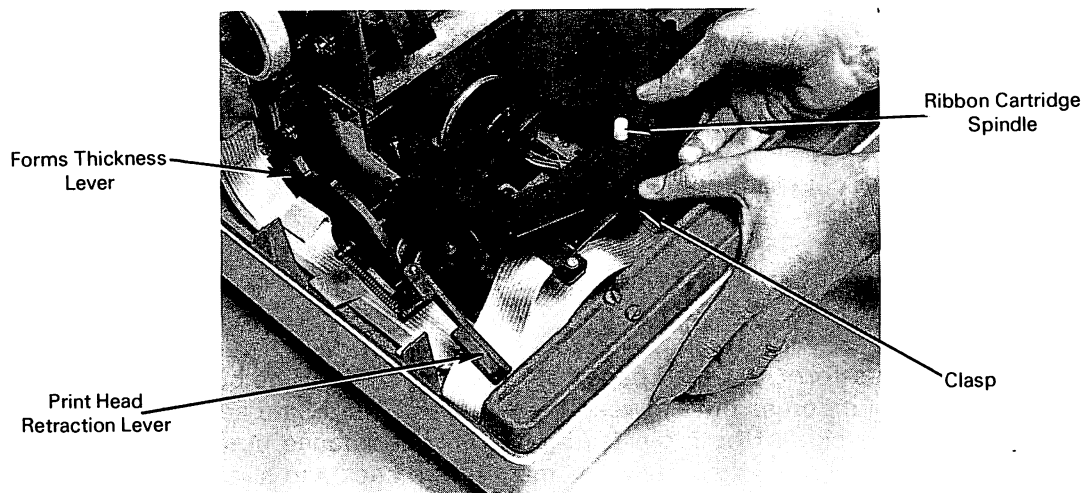


Figure 1-6. Ribbon Cartridge Removal

6. Place the new cartridge in the print head carriage, positioning it to rest on the carriage. Rotate the cartridge spindle as required to tighten the ribbon, and insert the exposed ribbon behind the ribbon guide and between the platen and the print head. Guide the cartridge into the two plastic braces on the rear of the print head carriage, and snap it so that it is firmly seated in the metal clasp on the front of the carriage.

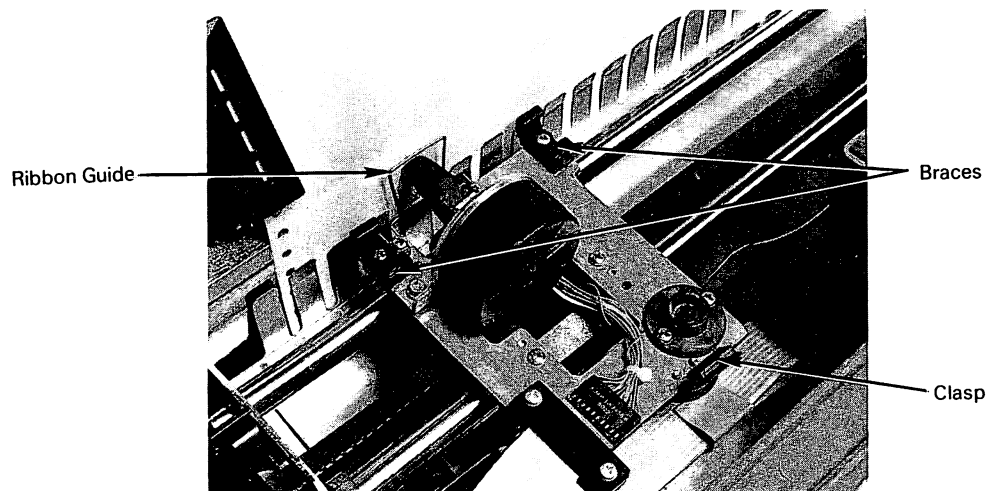


Figure 1-7. Print Head Carriage

7. Readjust the Print Head Retraction lever to point to the platen.

8. Supporting the printer cover, press down on the Support Bar. The Support Bar unlocks and folds to the back of the printer. Lower the printer cover onto the printer.
9. Turn power on to resume operation.

Note that the Print Head Retraction lever is separate from the Forms Thickness lever, located adjacent to it in the printer. When the ribbon is replaced, the Print Head Retraction lever is the only lever that has to be moved. Operation of the Forms Thickness lever is discussed in Section 1.8.

1.7 PAPER INSERTION

Paper is inserted in the Model 2233 printer using the following procedures.

1. Deselect the printer.
2. Raise the printer cover to the upright position. Pull up on the Support Bar so that the cover is firmly latched (refer to Figure 1-5).
3. Pull the Print Head Retraction lever towards the front of the printer so that the print head is removed from the platen (refer to Figure 1-6).
4. Push continuous-form, pin-feed paper into the slot at either the bottom or bottom front of the printer until it comes out between the pin-feed gates. Gate adjustment levers are provided on the outside of both pin-feed gates. If the distance between the pin-feed gates must be adjusted, press the gate adjustment levers back and slide the gates to the proper positions (refer to Figure 1-8). Slide paper through the slot at the base of the printer cover to rest flat on the back of the printer.

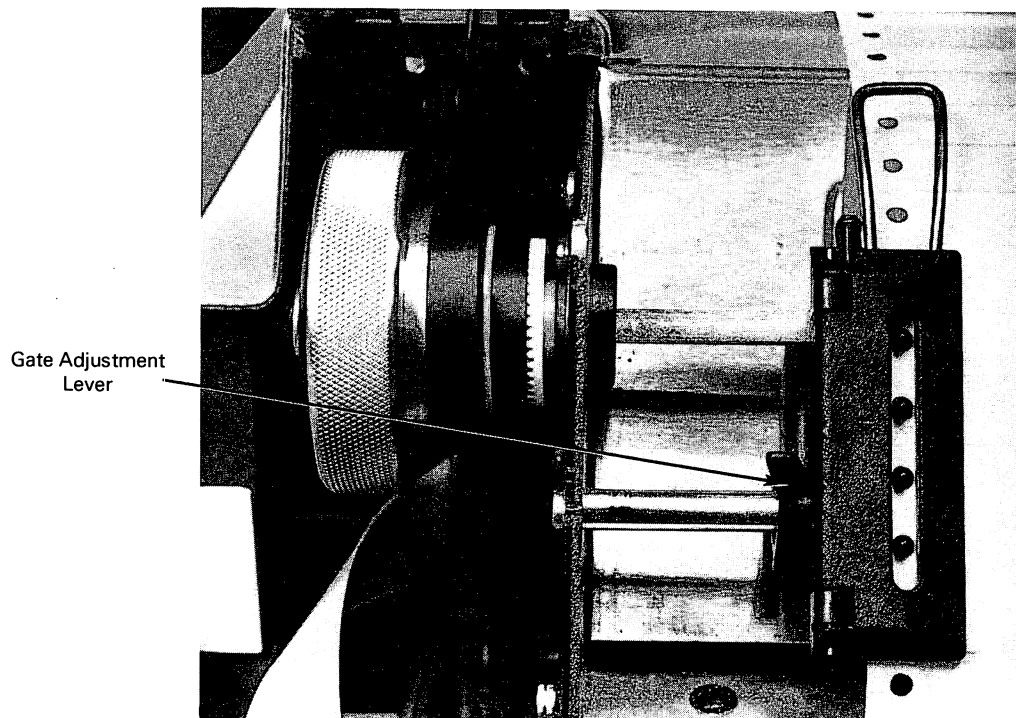


Figure 1-8. Pin-Feed Gate

5. Open the pin-feed gates (refer to Figure 1-9). Gently pull the paper and engage the first four holes evenly on tractor pins beneath both pin-feed gates.
6. After the paper is in position, close the pin-feed gates, and reposition the Print Head Retraction lever towards the rear of the printer.
7. For proper vertical positioning of paper, use the platen knob located to the far left of the platen and manually roll paper until the desired top-of-form position is reached (refer to Figure 1-5). Two marks are engraved on the striker bar to aid in paper adjustments. The top mark should be aligned to the perforation in continuous form paper; the bottom mark should be aligned to the bottom of a line of printed characters. Fine vertical adjustments can be made when the platen knob is pulled out and rotated.
8. To set top-of-form at the desired vertical position, pull up the white cover interlock button located to the right of the platen (refer to Figure 1-5). Holding out the platen knob, press the TOP OF FORM switch. Subsequently, when the TOP OF FORM switch is pressed, paper is automatically advanced to the top of the next form. Top-of-form position can also be set programmably by the Direct Access Vertical Format Unit (DAVFU). Refer to Chapter 5 for information on how to load and unload the DAVFU.

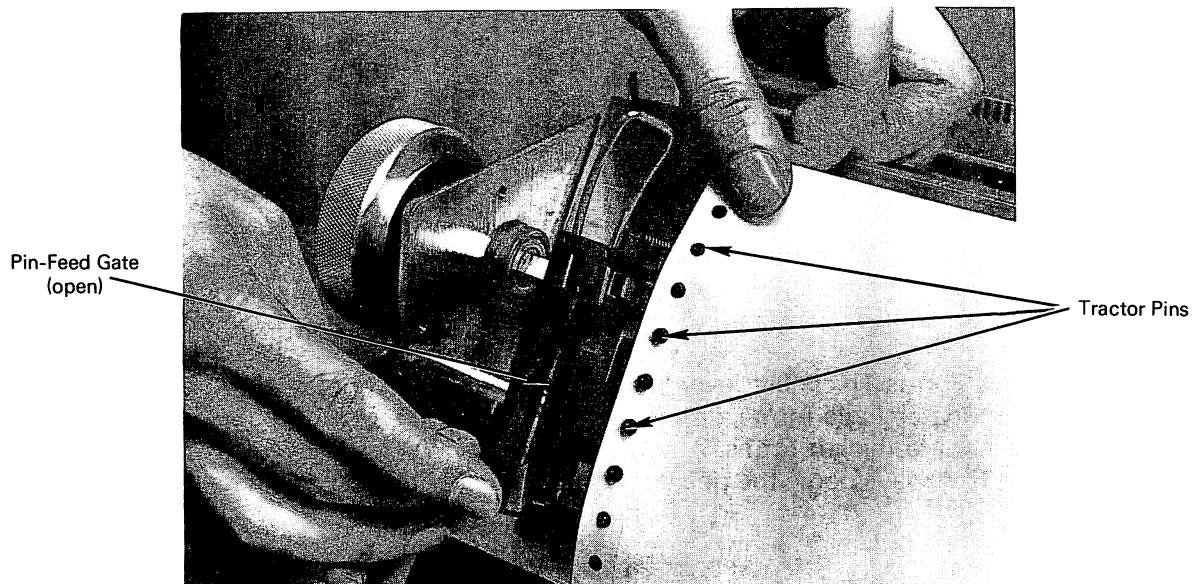


Figure 1-9. Inserting Paper on Tractor Pins

9. Pulling out the platen knob, press the TOP OF FORM switch to automatically advance the paper until the Vertical Format Unit reaches the specified top-of-form encoded in the DAVFU. The default page length is 66 lines. Refer to Chapter 5 for a discussion of DAVFU operations.
10. Close the printer cover and reselect the printer to begin printing.

CAUTION

Ensure that the pin-feed gates are closed when replacing the printer cover.

When the printer detects the end of paper, it stops and the PAPER OUT indicator is illuminated. The page may be completed by deselecting the printer and pressing the FORM OVERRIDE switch once for each line to be printed until the printer is out of paper. The paper may now be changed. Reselect the printer to continue printing after inserting fresh paper.

NOTE

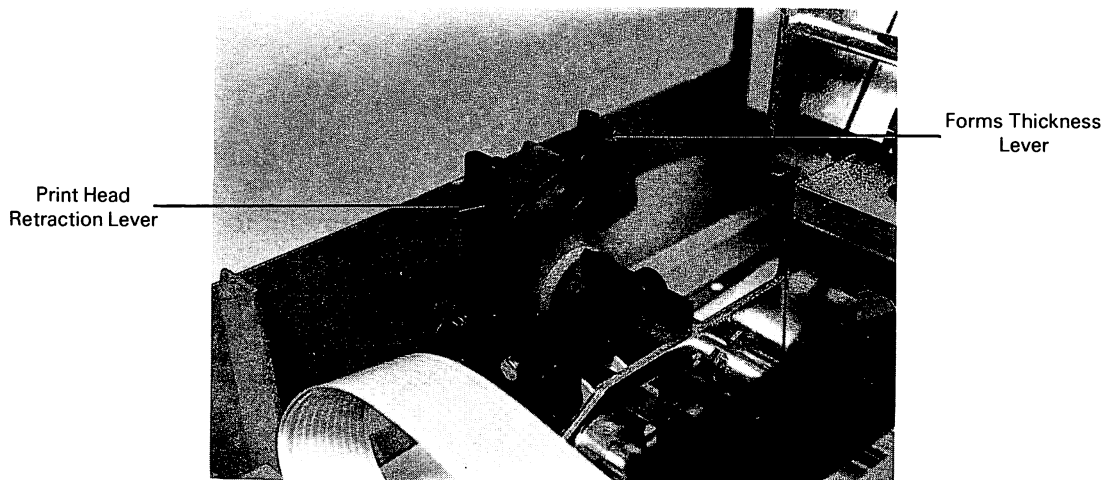
When changing paper, deselect the printer. Do not press the CLEAR switch; doing so erases the current line in the printer buffer.

1.8 PRINT ADJUSTMENT

The printer cover can be opened for making adjustments to the print head (adjusting print head gap or disengaging paper at the print head). When the cover is raised, the Malfunction indicator and the Cover Open diagnostic light sequence are illuminated, the carriage motor is turned off, and the print head can be moved manually. Once the cover is closed, the printer is ready for normal operation.

To adjust the print intensity for different form thicknesses, perform the following procedures.

1. Check that the printer has paper.
2. Raise the cover of the printer until it sits firmly in the upright position.
3. Locate the Forms Thickness lever to the left of the print head carriage (refer to Figure 1-10). Notice that the Forms Thickness lever has position notches numbered 1 to 9 for print adjustments. When the lever is placed in the lower-numbered positions, the print head moves closer to the platen. When the lever is positioned towards the front of the printer, the print head moves away from the platen.
4. Position the Forms Thickness lever towards the rear of the printer to darken the imprint and to accommodate single forms, or towards the front of the printer to lighten the imprint and to accommodate thicker forms. A normal setting for single-copy, fan-fold paper would be either 2 or 3. Always begin the positioning procedure with the lever at its foremost position.



5. When the print head has been properly adjusted, close the printer cover. The printer operates only when the cover is closed.

If, during printer operation, the paper does not feed smoothly due to its catching on the front surface of the print head, be sure that the print head is properly adjusted.

1.9 FUSE REPLACEMENT

Two fuses are located on the rear panel of the line printer (refer to Figure 1-2). The fuse farthest to the left monitors main line current, while the fuse farthest to the right controls current to the carriage motor.

A fuse can be changed by twisting the bad fuse out of the socket and replacing it with a new fuse. Use only fuses of the specified rating listed in Appendix A.

WARNING

Ensure that the printer is off when changing a fuse.

A servo fuse error is generally caused by a paper or ribbon jam. To recover from this condition, shut off the power, remove the jammed paper or replace the broken ribbon, replace the burned fuse, and turn the printer power on.

If the new fuse also burns out, contact your Wang Service Representative.

CHAPTER 2 DEVICE SELECTION

2.1 THE SELECT STATEMENT

The SELECT statement must be used by the operator to select the Model 2233 as the output device. A SELECT statement can be used either in the Immediate mode or as a statement within a program. When used to select the Model 2233, the SELECT statement requires a PRINT, LIST, or CO command and a 3-digit Device Address code (xyy) consisting of a Device Type (x) and a Unit Address code (yy). Line length can also be specified in the SELECT statement. Each of the parameters of the SELECT statement is described in the following example.

Example 1:

```
100 SELECT PRINT 215 (132)
```

Device Type ———→ 2
Unit Address ———→ 15
Line Length ———→ (132)

If line length is not specified in a SELECT statement, the line length defaults to 80 characters, the standard width of the Cathode Ray Tube (CRT). In a system with a 64-column CRT, the line length defaults to 64 characters.

Example 2:

```
SELECT PRINT 215 (132)
```

```
10 PRINT "*****THE MODEL 2233 LINE PRINTER PRINTS 132  
CHARACTERS PER LINE WHEN 10-PITCH IS SELECTED!*****"  
RUN
```

Output (reduced):

```
*****THE MODEL 2233 LINE PRINTER PRINTS 132 CHARACTERS PER LINE WHEN 10-PITCH IS SELECTED!*****  
***
```

Device Type

The system uses the Device Type digit in the Device Address code to identify the I/O class for a device and to specify control procedures for communicating with that device. Since the various peripheral devices used in a system often require different control procedures to perform an input/output operation, the programmer must indicate to the system which type of I/O device is being used.

The Model 2233 automatically prints the characters in the buffer and executes a carriage return at the end of a line (132 10-pitch characters or 158 12.2-pitch characters). After the printer responds to the carriage return command, it automatically executes a line feed.

Because Device Type 2 addresses devices that automatically execute a line feed after a carriage return, this device type is normally used in statements selecting the Model 2233 for output. When this device type is specified, printer output is single-spaced.

Example (Device Type 2):

```
10 SELECT PRINT 215 (80)
20 FOR R = 1 TO 5
30 PRINT "MODEL 2233 OUTPUT AS DEVICE TYPE 2"
40 NEXT R
RUN
```

Output:

```
MODEL 2233 OUTPUT AS DEVICE TYPE 2
MODEL 2233 OUTPUT AS DEVICE TYPE 2
MODEL 2233 OUTPUT AS DEVICE TYPE 2
MODEL 2233 OUTPUT AS DEVICE TYPE 2
MODEL 2233 OUTPUT AS DEVICE TYPE 2
```

Device Type 0 usually addresses a device that does not automatically execute a line feed after a carriage return: for example, a CRT. When used, this device type causes a line feed after each carriage return executed by the printer. Since the Model 2233 itself also generates a line feed after a carriage return, when selected with Device Type 0, the printed output is double-spaced.

Example (Device Type 0):

```
10 SELECT PRINT 015 (80)
20 FOR J = 1 TO 5
30 PRINT "MODEL 2233 OUTPUT AS DEVICE TYPE 0"
40 NEXT J
RUN
```

Output:

```
MODEL 2233 OUTPUT AS DEVICE TYPE 0

MODEL 2233 OUTPUT AS DEVICE TYPE 0

MODEL 2233 OUTPUT AS DEVICE TYPE 0

MODEL 2233 OUTPUT AS DEVICE TYPE 0

MODEL 2233 OUTPUT AS DEVICE TYPE 0
```


Example 1 (Device Type 4):

```
10 SELECT PRINT 415
20 FOR A = 1 TO 15
30 PRINT "AABBCCDDEEFFGGHHIIJJKLLMMNNOOPPPQRRSSTTUUVVWWXXYYZZ"
40 NEXT A
RUN
```

Output (reduced):

[illegible]

Example 2 (Device Type 4):

```
SELECT PRINT 415 (124)
10  FOR B = 1 TO 5
20  PRINT "AABBCC"
30  PRINT HEX(OD)
40  NEXT B
RUN
```

Output:

AABBCC
AABBCC
AABBCC
AABBCC
AABBCC

Refer to Section 2.3 for information on special printing techniques available by selecting the printer with various device type codes.

Unit Address

When the Model 2233 is used as a system printer, it is attached to the printer controller board installed in the system CPU, and usually assigned Unit Address 15. If a second Wang printer is used as a system printer on the same CPU, it is usually assigned Unit Address 16 by the Wang Service Representative who installs the system.

If the Model 2233 is used as the local printer of a Model 2236DE Interactive Terminal, it is attached directly to the rear panel of the terminal and may be accessed at Unit Address 04 (for example, SELECT PRINT 204).

Line Length

The Line Length parameter is an optional parameter in a SELECT PRINT, SELECT LIST, or SELECT CO statement. This parameter specifies the number of characters to be sent to the printer before the system issues a carriage return and resets the internal line count. The user normally varies the line length to accommodate paper of different widths.

The maximum number of characters per line that can be printed on the Model 2233 is either 132 or 158, depending on pitch selection (10-pitch or 12.2-pitch). In the SELECT statement, line length is indicated in the parentheses following the 3-digit Device Address code. For example:

SELECT PRINT 215 (158)	Selects the Model 2233 for printing operations and sets the line length to 158.
SELECT LIST 215 (132)	Selects the Model 2233 for listing operations and sets the line length to 132.
SELECT CO 215 (80)	Selects the Model 2233 for console output and sets line length to 80.

If a line length is not specified for PRINT, LIST, or CO operations, either the default line length or the last line length selected for each of these operations is used. Note that the default line length set during Master Initialization is 80 characters. The maximum line length specified in a SELECT statement is 255. However, the use of a line length greater than 132 (10-pitch) or 158 (12.2 pitch) is not recommended. A longer line count typically produces two carriage returns: one performed automatically by the printer when a full line of characters has been printed, and another issued by the system when the line count specified in the SELECT PRINT statement is exceeded.

Example:

```
10  REM EXAMPLE OF USING A LINE LENGTH GREATER THAN 132 CHARACTERS
    AT 10-PITCH
20  SELECT PRINT 215 (132)
30  PRINT "'CORACIIIFORM' - OF OR RELATING TO AN ORDER (CORACIIIFORMES)
    OF ABOREAL NONPASSERINE BIRDS INCLUDING THE ROLLERS, KINGFISHERS, AND
    HORN BILLS — WEBSTER'S SEVENTH NEW COLLEGIATE DICTIONARY"
    RUN
```

Output (reduced):

```
'CORACIIIFORM' - OF OR RELATING TO AN ORDER (CORACIIIFORMES) OF ABOREAL NONPASSERINE BIRDS INCLUDING THE ROLLERS, KINGFISHERS, AND HOR
NBILLS -- WEBSTER'S SEVENTH NEW COLLEGIATE DICTIONARY
```

The CPU uses the Line Length parameter to generate an automatic carriage return when a line exceeds the specified line length and no carriage return has been supplied by the program. The CPU maintains a tally of the number of characters sent to the printer (line count). If this line count equals the current value of the line length before the output line is complete, the CPU issues a carriage return command to the printer and resets the line count to zero. The printer continues the interrupted output on the next line.

Example 1:

```
5  REM EXAMPLE OF USING A LINE LENGTH LESS THAN THE MAXIMUM NUMBER
   OF CHARACTERS IN THE PRINT LINE
10  SELECT PRINT 215 (5)
20  PRINT "THE MODEL 2233 PRINTS UP TO 158 CHARACTERS PER LINE"
RUN
```

Output:

```
THE M
ODEL
2233
PRINT
S UP
TO 15
8 CHA
RACTE
RS PE
R LIN
E
```

Example 2:

```
SELECT PRINT 215 (20)
10  PRINT "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
RUN
```

Output:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ
UVWXYZ
```

When the system receives a PRINT statement with no trailing comma or semicolon, it executes a carriage return after the contents of the printer buffer are printed. If the line count has not yet reached the line length specified in the SELECT statement, the system automatically resets the line count to zero for the start of a new line.

Example:

```
10  REM EXAMPLE OF PRINT STATEMENTS WITH NO TRAILING COMMA OR
   SEMICOLON
20  SELECT PRINT 215 (30)
30  PRINT "BEAR LEFT"
40  PRINT "HOLIDAY HOTEL"
RUN
```

Output:

```
BEAR LEFT
HOLIDAY HOTEL
```

The line count is reset to zero under any one of the following conditions.

- The line count equals the line length.
- A SELECT PRINT statement is executed.
- A CLEAR command is executed.
- A PRINT, PRINTUSING, or HEXPRINT statement is executed.
- The system is reset.
- The system is master initialized.

2.2 SELECTING THE PRINTER

Print

SELECT PRINT 215

This statement selects the printer at Device Address 215 for all PRINT, PRINTUSING, or HEXPRINT statements entered in Program mode. All subsequent printed output is generated by the system printer until another device is selected.

NOTE

When your system is first turned on, print operations are seen on the CRT, the primary device for such operations. Therefore, it is necessary to execute a SELECT statement to direct the output of PRINT statements to the printer.

The SELECT PRINT statement can be entered as a program statement or independently as an Immediate mode statement.

Example 1 (Program Mode SELECT):

```
10 SELECT PRINT 215
20 PRINT "X", "2X"
30 FOR X = 1 TO 50 STEP 10
40 PRINT X, X*2
50 NEXT X
```

Example 2 (Immediate Mode SELECT):

```
SELECT PRINT 215
10 PRINT "X", "2X"
20 FOR X = 1 TO 50 STEP 10
30 PRINT X, X*2
40 NEXT X
```

Output for Examples 1 and 2:

X	2X
1	2
11	22
21	42
31	62
41	82

NOTE

Though the printer is selected for printed output with SELECT PRINT 215, printout resulting from PRINT statements entered in the Immediate mode will still appear on the CRT unless the printer is selected for console output.

List

SELECT LIST 215

The default address for LIST operations is 005, the CRT. The SELECT LIST 215 statement, entered in Immediate mode, selects the printer at Device Address 215 for all program listing operations.

Example:

```
SELECT LIST 215
5  DIM A$52
17 REM AN EXAMPLE USING THE PRINTER FOR LISTING
20 A$="THE MODEL 2233 PRINTER CAN BE SELECTED FOR LISTING."
30 PRINT A$
999 END
LIST
```

Output:

```
5 DIM A$52
17 REM AN EXAMPLE USING THE PRINTER FOR LISTING
20 A$ = "THE MODEL 2233 PRINTER CAN BE SELECTED FOR LISTING."
30 PRINT A$
999 END
```

Console Output

SELECT CO 215

This statement selects the printer at Device Address 215 for all console output operations. Console Output (CO) includes all system displays, such as the READY message; output from STOP and END statements; any data keyed in on the keyboard and entered into the CPU; and all output from Immediate mode operations, TRACE statements, and error messages.

NOTE

On 2200 multi-user systems such as the 2200MVP and 2200LVP, all CO operations are always directed to the CRT (Device Address 005). On these systems, when the printer is selected for console output, TRACE output alone is sent; all other CO operations remain directed to the CRT.

As an example, enter the following command in Immediate mode.

```
SELECT CO 215
```

Press the RETURN key, then the RESET key. The following appears on the printer.

```
:READY
```

Subsequently, all information entered into the CPU via the keyboard will be printed on the printer.

2.3 SPECIAL TECHNIQUES

Device Type 2 is usually used with the Model 2233. When the printer is selected with this Device Type for LIST, PRINT, or CO operations, normal single-spaced output is produced. Device Type 0 can also be used with the Model 2233 to obtain double-spaced output. Carriage returns followed by line feeds are initiated by the CPU at the end of each program text line, as well as whenever the line count equals the selected line length. After the Model 2233 executes a carriage return, it supplies another line feed, producing the double spacing after each printed line.

Example (Double Spacing Using Device Type 0):

```
SELECT LIST 015
10 FOR E = 1 TO 10
20 PRINT "AAAAAAAAAABBBBBBBBBBCCCCCCCCDDDDDDDDDEEEEEEEEEEEEEEEEEFF
FGGGGGGGGGHHHHHHHHHHIIIIIIJJJJJJJJJJKKKKKKKKKK?"
30 NEXT E
LIST
```

Output:

```
15 FOR E = 1 TO 10
20 PRINT "AAAAAAAAAABBBBBBBBBBCCCCCCCCDDDDDDDDDEEEEEEEEEEEEEEEEEFF
HHHHHHHHHHIIIIIIIIJJJJJJJJJJKKKKKKKKKK?"
30 NEXT E
```

Although Device Type 4 is intended for use with Wang plotter peripherals, it has limited application with other types of peripherals. Device Type 4 can be of use with the Model 2233 Line Printer to produce double-spaced program listings. When listing a program with Device Type 4, a program statement overlapping onto more than one print line is single-spaced; however, each new program statement is double spaced. Thus, a more readable double-spaced output is achieved with Device Type 4. However, with this exception, it is recommended that the Model 2233 normally be selected with Device Type 2 or 0. For normal printing of a program output, Device Type 4 should not be used.

Example (Double Spacing Using Device Type 4):

```
SELECT LIST 415
10 FOR E = 1 TO 10
20 PRINT "AAAAAAAAAABBBBBBBBBBCCCCCCCCDDDDDDDDDEEEEEEEEEEEEEEEEEFF
FGGGGGGGGGHHHHHHHHHHIIIIIIJJJJJJJJJJKKKKKKKKKKLLLLLLLLLLLLMMMMMMMMMM
NNNNNNNNNNNOOOOOOOOOOOPPPPPPPPPQQQQQQQQQRRRRRRRRRRSSSSSSSSSS?"
30 NEXT E
LIST
```

Output (reduced):

```
10 FOR E = 1 TO 10
20 PRINT "AAAAAAAAAABBBBBBBBBBCCCCCCCCDDDDDDDDDEEEEEEEEEEEEEEEEEFFGGGGGGGGGGHHHHHHHHHHIIIIIIJJJJJJJJJJKKKKKKKKKKLLLLLLLLLLLLMMMMMMMMMM
NNNNNNNNNNNOOOOOOOOOOOPPPPPPPPPQQQQQQQQQRRRRRRRRRRSSSSSSSSSS?"
30 NEXT E
```

2.4 COMBINING SELECT PARAMETERS

It is possible to combine parameters in a SELECT statement.

Example:

```
SELECT PRINT 215 (100), LIST 215 (80), CO 215 (112)
```

However, it is not possible to select two output devices for the same operation. For example, the following statement produces listing of programs on the CRT (Device Address 005) only.

```
SELECT LIST 215, LIST 005
```

2.5 DESELECTING THE MODEL 2233

To deselect the printer, use one of the following methods.

1. Select another device for PRINT, LIST, or CO, by using the SELECT statement.
2. Master initialize the system. Master Initialization selects the CRT for all LIST, PRINT, and CO operations.
3. Enter CLEAR and press RETURN. This returns PRINT and LIST operations to the device currently selected for CO. If the printer is the current CO device, either Step 1 or 2 must be used to deselect it.
4. Press the SELECT switch. This is the only method of deselection that does not lose the data in the printer buffer. This method should be used when temporary deselection is required; for example, when changing the paper or ribbon cartridge. The printer SELECT indicator will be extinguished, and the printer can then be reselected by pressing the SELECT switch again.

CHAPTER 3 FORMATTING OUTPUT

3.1 INTRODUCTION

Several methods of formatting output are available to the Model 2233 Line Printer. These include use of a variety of hexadecimal codes to control such functions as carriage return and margin setting and a Direct Access Vertical Control Unit to control full page format. These methods will be discussed in detail in Chapters 4 and 5. Chapter 3 discusses formatting using the PRINT command and variations (PRINT, PRINTUSING, and HEXPRINT) and the Tab function.

3.2 PRINT, PRINTUSING, AND HEXPRINT STATEMENTS

The PRINT, PRINTUSING, and HEXPRINT statements are used with the Model 2233 in the same manner as the CRT. However, whereas the CRT provides only five 16-character print zones per line, the printer provides over eight.

Zoned Format

When selected for 10-pitch output, the Model 2233 has a line length of 132 characters, divided into 8 zones of 16 characters each, and 1 zone of 4 characters. The zones constitute Columns 0-15, 16-31, 32-47, 48-63, 64-79, 80-95, 96-111, 112-127, and 128-131, respectively.

When selected for 12.2-pitch, the Model 2233 has a line length of 158 characters, divided into 11 zones of 16 characters each and 1 zone of 12 characters. The zones constitute Columns 0-15, 16-31, 32-47, 48-63, 64-79, 80-95, 96-111, 112-127, 128-143, and 144-157, respectively.

If commas separate elements in a PRINT statement, each element begins a new zone. When the system encounters a comma preceding a print element, it outputs spaces until reaching the first character position of the next zone and then outputs the value of the print element starting at that position.

Example (Printing in Zoned Format with Commas):

```
20 SELECT PRINT 215 (132)
30 PRINT "COLUMNS 0-15", "COLUMNS 16-31", "COLUMNS 32-47"
RUN
```

Output:

```
COLUMNS 0-15      COLUMNS 16-31      COLUMNS 32-47
```

Example (Skipping over Zones with Commas):

```
20 SELECT PRINT 215 (132)
30 PRINT "ACCOUNT NO.",,,,"BALANCE DUE"
40 PRINT "(COLUMNS 0-15)",,,,"(COLUMNS 48-63)"
50 PRINT 10082,,153.19
RUN
```

Output:

```
ACCOUNT NO.
(COLUMNS 0-15)
10082
```

```
BALANCE DUE
(COLUMNS 48-63)
153.19
```

NOTE

In zone printing on the Model 2233, ensure that the last zone does not exceed the legal length (either 4 or 12 characters depending on pitch selection). For instance, in a 10-pitch format, if the information for the last zone exceeds four columns, then the information is printed in the first zone of the next line.

Example:

```
10 SELECT PRINT 215 (124)
20 PRINT "NO.",1.2,3.4,5.6,7.8,9.0,8.4,10.2,
"BALANCE DUE NOW"
RUN
```

Output (reduced):

```
NO.      1.2    3.4    5.6    7.8    9    8.4    10.2
BALANCE DUE NOW
```

In the previous example, the ninth element in Line 20 exceeded four characters in length and thus was printed in the next line.

Packed Format

If semicolons separate elements in a PRINT statement, the output appears in a packed format, with no spaces between items. In packed format, no additional blanks are added to the print line; blanks in the print line occur only when they are an intrinsic part of an alpha or numeric value.

Example 1 (Packed Format):

```
SELECT PRINT 215
10 A=1234: B = -5678
20 PRINT "ABC"; "DEF"
30 PRINT A; B
RUN
```

Output:

```
ABCDEF
1234 -5678
```

Example 2 (Packed Format):

```
20 SELECT PRINT 215 (132): DIM A$18
30 A$= " CARDBOARD CHALET" P$= " $53,000"
40 PRINT "STYLE: "; A$; " PRICE: "; P$
RUN
```

Output:

```
STYLE:  CARDBOARD CHALET  PRICE:  $53,000
```

NOTE

A semicolon at the end of a PRINT statement suppresses the normal line feed at execution.

Example 3 (Packed Format):

```
10 SELECT PRINT 215
20 PRINT "FAR-";
30 PRINT "OFF"
RUN
```

Output:

```
FAR-OFF
```

Example (Formatting with PRINTUSING Statement):

```
20 SELECT PRINT 215 (132): DIM A$18
30 A$= "CARDBOARD CHALET": P=53000
40 PRINTUSING 50, A$,P
50 % STYLE: ##### PRICE: $##,###
RUN
```

Output:

```
STYLE: CARDBOARD CHALET  PRICE:  $53,000
```

Example (HEXPRINT Statement):

```
20 SELECT PRINT 215 (132)
30 A$="ABC DEF GHI JKL"
40 HEXPRINT A$
RUN
```

Output:

```
4142432044454620474849204A4B4C20
```

PRINTUSING Statement

To print columns of information across a line, or print numeric and/or alphanumeric values according to an exact image, the PRINTUSING statement can be used to specify the print format. For a complete discussion of the PRINTUSING statement, refer to the Wang *BASIC-2 Language Reference Manual*.

Example 1:

```
10 X=1:Y=2:Z=3
20 PRINTUSING 30,X;Y;Z
30 % #.#
RUN
```

Output:

```
1.0 2.0 3.0
```

Example 2:

```
100 PRINTUSING 200
200 % PROFIT AND LOSS STATEMENT
RUN
```

Output:

```
PROFIT AND LOSS STATEMENT
```

Example 3:

```
50 A$="H. CASTORP - -":T=9237.51
100 PRINTUSING 200,A$,T
200 % PATIENT ##### TOTAL MEDICAL EXPENSES $###,###.##
RUN
```

Output:

```
PATIENT H. CASTORP TOTAL MEDICAL EXPENSES $9,237.51
```

Example 4:

```
10 X=2.3:Y=27.123
20 PRINTUSING 30,X,Y
30 % ANGLE -##### LENGTH = +###.#
RUN
```

Output:

```
ANGLE          2.300000 LENGTH = +27.1
```

3.3 THE TAB FUNCTION

The Tab function has the following format, where xx = an integer, variable, or expression representing a number of character positions.

TAB(xx);

The Tab function can be used to position the print location prior to typing a character. When a PRINT statement containing a Tab function is executed, the Model 2233 skips to the column specified by the integer portion of the Tab function, and then prints the indicated argument.

Example 1:

```
SELECT PRINT 215(132)
10 PRINT TAB(49);"MASTER SEWERAGE PLAN"
20 PRINT: PRINT
30 PRINT TAB(14);"STREET";TAB(44);"LINE FEET";TAB(84);"PIPE DIA.";TAB(104);
   "CONNECTIONS"
RUN
```

Output (reduced):

```
                                MASTER SEWERAGE PLAN

STREET                        LINE FEET                PIPE DIA                CONNECTIONS
```

In the previous example, MASTER SEWERAGE PLAN is printed starting at Column 75; likewise, the headings in Line 30 are printed at the specified tab settings.

If the value of the TAB(x); expression is greater than the selected line length, the printer moves to the next line and completes the PRINT statement starting at Column 0.

Example 2:

```
10 SELECT PRINT 215
20 A=25
30 PRINT TAB(A);"TANK MODEL";TAB(3*A);"CREW SIZE"
RUN
```

Output:

```
                                TANK MODEL

CREW SIZE
```

NOTE

If the carriage position in the line being printed is greater than the TAB(); argument, the tab is ignored. For example, in the following statement the TAB(5); is ignored.

```
10 PRINT "123456789"; TAB(5); "No."
```

When using the Tab function to print numeric values in column format, an additional column to the left of the value is allocated for the sign (+ or -). If this column is not used for positive numbers, actual printing begins at column after the column specified in the function.

Example:

```
10 SELECT PRINT 215 (80)
20 PRINT TAB(10);"POWER";TAB(20);"VALUE"
30 FOR N=-1 TO 10
40 PRINT TAB(10);N;TAB(20);(-2)↑ N
50 NEXT N
RUN
```

Output:

POWER	VALUE
-1	-.5
0	1
1	-2
2	4
3	-8
4	16
5	-32
6	64
7	-128
8	256
9	-512
10	1024

CHAPTER 4

PRINTER CONTROL CODES

4.1 THE HEX FUNCTION

The Hex function is used within the BASIC program to output any character or function within the ASCII character set (refer to Appendix A). Hex codes are also used to control vertical tabulation of output from within a BASIC program, regardless of the vertical formatting device chosen by the user. In addition, hex codes are used to load the Direct Access Vertical Format Unit (DAVFU).

Character Codes

The Hex function is used in a BASIC program to output characters on the printer (both those that do and do not appear on the standard keyboards) or to execute special printer control codes. The Hex function has the following format.

HEX(hh[hh][...])

Each h equals a hex digit (0—9) or letter (A—F). An even number of characters must always appear in a Hex function; spaces are not allowed. Refer to Appendix A for a complete listing of hexadecimal character codes and control codes.

Hex codes for characters and/or printer control can be combined. For example, enter and run the following program.

```
10 SELECT PRINT 215
20 PRINT HEX (410D0A42)
RUN
```

Since the character code for A is HEX(41) and for B is HEX(42), and the control codes for carriage return and line feed are HEX(0D) and HEX(0A) respectively, the following is printed.

A

B

Control Codes

When the Model 2233 receives a hex code for a printable character, it simply places the code into the print buffer. Unless the buffer is full, no immediate action is taken. However, certain special hex codes do not enter the buffer, but instead cause immediate action by the printer. These special codes are the printer control codes.

NOTE

When hex codes are combined in a single statement line, most control codes are executed before character codes.

Several features of the Model 2233 Printer have been defined in terms of multi-character control code sequences beginning with HEX(02) and ending in a HEX(0E) or HEX(0F). These code sequences enable, turn on and off, and disable certain attributes and functions in a manner similar to that used by the 2236DE and 2236DW Terminals.

4.2 LINE FEED CONTROL CODES

Automatic Line Feed/Line Feed Size Control

When powered on, or when a Power-On Reset control sequence [HEX(020D0C030F)] is executed, the Model 2233 defaults to an automatic line feed of six lines per inch after a carriage return. However, several codes are provided to the programmer to suppress or enable the automatic line feed, with or without altering the line feed size.

Automatic line feed can be disabled by the sequence HEX(020A0F) without changing the currently selected line feed size. Subsequently, use of the sequence HEX(020A0E) will enable the automatic line feed without changing the currently selected line feed size.

Line feed size, conversely, can be altered while suppressing or enabling the automatic line feed function. Line feed size can be set to either six or eight lines per inch using the following control codes.

HEX(020A0101060E) or HEX(020A0101060F) for 6 lines per inch

where: OE = enable automatic line feed
OF = suppress automatic line feed

HEX(020A0101080E) or HEX(020A0101080F) for 8 lines per inch

where: OE = enable automatic line feed
OF = suppress automatic line feed

NOTE

The printer executes these sequences before printing unprinted data that may be in the line buffer.

Changing line feed size has a direct effect on the DAVFU. When changing line feed size, it is necessary to load an appropriate VFU format before attempting to print. As a result, line feed size cannot be changed within a page. The user should first execute a top-of-form command before loading the proper VFU and setting the corresponding line feed size.

Example:

```
10 REM TOP OF FORM: PRINT HEX(0C)
20 REM LOAD VFU CREATED BY VERTICAL FORMAT CONTROL UTILITY
30 DIM T$(128)2
40 DATA LOAD DC OPEN T "SAMPLE" REM "SAMPLE": = NAME OF VFU FILE
50 DATA LOAD DC T$( )
60 $GIO/204, (A000,G$) T$( ): REM "204" IS PRINTER ADDRESS
70 REM SELECT 8 LPI, ENABLE AUTO LINE FEED: PRINT HEX(020A0101080E)
80 FOR X = 1 TO 10: PRINT "ABOUT LIMNOLOGY":NEXT X
90 REM DISABLE LINE FEED: PRINT HEX(020A0F)
100 FOR X = 1 TO 10: PRINT "by Brian James Cruise": NEXT X
RUN
```

Output:

```
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
ABOUT LIMNOLOGY
by Brian James Cruise
```

Line Feed: HEX(0A)

The Line Feed control code advances the paper one line. Line feed codes embedded within a print line are executed before the data in that line is printed.

Example:

```
10 PRINT "WATCH"; HEX(0A); "YOUR"; HEX(0A); "STEP"
RUN
```

Output:

(2 line feeds)

WATCHYOURSTEP

Partial Line Feed: HEX(020Add0F)

The Partial Line Feed command control sequence allows the programmer to define partial line feed increments. This feature enables the printing of superscripts and subscripts. The sequence has the following format.

HEX(020Add0F)

where: dd = 00 for no line feed
02 for 1/4 line feed
04 for 1/2 line feed
08 for 3/4 line feed

This sequence, when embedded in a print line, is executed before any data is printed. Whenever a normal line feed is executed after a partial line feed, the paper is moved to the start of the next line feed position. For example, if the sequence HEX(020A080F) has caused a feed of 3/4 line, the next full line feed command would move the platen the remaining 1/4 line. When using this sequence to print superscripts and subscripts, it is necessary to first disable the automatic line feed feature.

Example:

```
10 SELECT PRINT 204
20 PRINT "THE EQUATION FOR Z IS:"
30 REM SUPPRESS AUTO LINE FEED: PRINT HEX(020A0F)
40 REM PRINT SUPERSCRIPITS: PRINT " 2 2"
50 REM ADVANCE 1/2 LINE: PRINT HEX(020A040F)
60 REM PRINT BASE LINE: PRINT "Z = X + Y - 2*(X+Y)"
70 REM ADVANCE 1/2 LINE: PRINT HEX(020A040F)
80 REM PRINT SUBSCRIPTS: PRINT " 3"
90 REM REACTIVATE AUTO LINE FEED: PRINT HEX(020A0E)
100 REM MOVE TO NEXT FULL LINE POSITION: PRINT
110 REM PRINT NEXT LINE: PRINT "TO CONTINUE WITH THIS LINE OF THOUGHT"
```

Output:

```
THE EQUATION FOR Z IS:
Z =  $X_3^2 + Y^2 - 2*(X+Y)$ 
TO CONTINUE WITH THIS LINE OF THOUGHT
```

4.3 ENHANCED PRINTED OUTPUT

The Model 2233 employs three methods of enhancing printed output: underscore, horizontal expansion, and a combination of both. The means used to specify the method of enhancing output is similar to that used with the 2236DE Display Terminal. The same control code sequence beginning with HEX(02) can be used to specify enhanced output for both the Model 2233 Line Printer and the Model 2236DE Terminal.

The control code sequence has the following format.

HEX(0204nnaabbOE) or HEX(0204nnaabbOF)

where: nn = any hex value
aa = 00 to disable underscore
04 or 0B to enable underscore

bb = 00 to disable expanded print
02 or 0B to enable expanded print

OE = enable attributes defined by nn, aa, and bb immediately; do not disable attributes until an isolated HEX(OF) code, a Power-On Reset sequence, or another select attribute sequence is received

OF = activate attributes defined by nn, aa, and bb only upon receiving an isolated HEX(OE) code; disable attributes when an isolated HEX(OF) or HEX(OD) code is received

The flexibility of this control code sequence in enabling and disabling a combination of the underscore and expanded print attributes is illustrated in the following sections.

Underscore

A HEX(02040004000E) or HEX(0204000B000F) sequence immediately turns on the underscore attribute and leaves it on until an isolated HEX(OF) is executed.

Example (Immediate Use of Underscore):

```
10 PRINT HEX(02040004000E)
20 PRINT "THE LAZY DUCK"
30 PRINT "JUMPS OVER THE"
40 PRINT HEX(OF); "QUICK BLACK DOG."
RUN
```

Output:

```
THE LAZY DUCK
JUMPS OVER THE
QUICK BLACK DOG.
```

A HEX(02040004000F) or HEX(0204000B000F) sequence, however, will not immediately turn on the underscore attribute. Instead, underscore is turned on only when the printer receives an isolated HEX(OE) code. The attribute is turned off by either an isolated HEX(OF) code or a carriage return [HEX(OD)].

Example (Underscoring Individual Lines):

```
10 PRINT HEX(02040004000F)
20 PRINT "THE VIKINGS SAILED"
30 PRINT HEX(0E); "IN OCEAN-GOING CARGO SHIPS"
40 PRINT "CALLED KNORRS."
RUN
```

Output:

```
THE VIKINGS SAILED
IN OCEAN-GOING CARGO SHIPS
CALLED KNORRS.
```

Example (Underscoring Partial Lines):

```
10 PRINT HEX(02040004000F)
20 PRINT "THE ISLAND OF "; HEX(0E); "MALTA"; HEX(0F); " RECEIVES LITTLE RAINFALL
DURING"
RUN
```

Output:

```
THE ISLAND OF MALTA RECEIVES LITTLE RAINFALL DURING
```

Either implementation of the underscore attribute may be turned off by execution of a disable underscore code sequence [i.e., HEX(02040000000E)]. This sequence, in addition to turning off the underscore feature, redefines HEX(0E) and HEX(0F) as null codes, causing the printer to ignore an isolated HEX(0E) or HEX(0F) until the attribute is again enabled.

Expanded Print

The "bb" portion of the control code sequences described previously for the underscore feature is used to select expanded print. This attribute is controlled in exactly the same manner as the underscore feature. When selected for expanded print, the Model 2233 prints a line of up to 66 expanded (double-width) characters at 10-pitch or up to 79 expanded characters at 12.2-pitch.

A HEX(02040000020E) or HEX(020400000B0E) sequence immediately turns on the expanded print attribute and leaves it on until an isolated HEX(0F) is executed.

Example (Immediate Use of Expanded Print):

```
10 PRINT HEX(02040000020E)
20 PRINT "FRIENDLY"
30 PRINT "PHARMACY"
40 PRINT HEX(0F); "J. Jones, Prop."
RUN
```

Output:

```
FRIENDLY
PHARMACY
J. Jones, Prop.
```

A HEX(02040000020F) or HEX(020400000B0F) sequence does not immediately turn on the expanded print attribute. Instead, expanded print is turned on only when the printer receives an isolated HEX(0E) code. This use of the HEX(0E) code is identical to its implementation when the printer is powered on. When the printer is powered on or when a Power-On Reset code sequence [HEX(020D0C030F)] is issued, an isolated HEX(0E) code turns on expanded print. The expanded print attribute may be turned off by either an isolated HEX(0F) code or a carriage return [HEX(0D)].

Example (Expanding Individual Lines):

```
10 PRINT HEX(02040000020F)
20 PRINT "MICROTUBULES ARE PRESENT IN EVERY"
30 PRINT HEX(0E); "EUKARYOTIC (Nucleated)"
40 PRINT "CELL"
RUN
```

Output:

```
MICROTUBULES ARE PRESENT IN EVERY
EUKARYOTIC (Nucleated)
CELL
```

Example (Expanding Partial Lines):

```
10 PRINT HEX(02040000020F)
20 PRINT HEX(0E); "ANDEAN BEANS, "; HEX(0F); " HOWEVER, ARE SNOW-COVERED THE
ENTIRE"
RUN
```

Output:

```
ANDEAN BEANS, HOWEVER, ARE SNOW-COVERED THE ENTIRE
```

Either implementation of the expanded print attribute may be turned off by execution of a disable underscore code sequence [i.e., HEX(02040000000E)]. This sequence, in addition to turning off the expanded print feature, redefines HEX(0E) and HEX(0F) as null codes, causing the printer to ignore an isolated HEX(0E) or HEX(0F) until the attribute is again enabled.

Both Underscore and Expanded Print

Both the underscore and expanded print attributes can be activated in a similar manner. The code sequences HEX(02040004020E) or HEX(02040004020F) [and HEX(0204000B0B0E) or HEX(0204000B0B0F)], respectively, select both attributes to be activated as described previously.

Either attribute may be turned off and disabled by execution of the appropriate disable attribute code. Execution of a HEX(02040000020E) sequence disables the underscore attribute only. Execution of a HEX(02040002000E) sequence disables the expanded print attribute only.

Example:

```
10 PRINT HEX(020400004020F)
20 PRINT HEX(0E); "THIS LINE IS UNDERSCORED AND EXPANDED"
30 PRINT HEX(020400000020E)
40 PRINT "THIS LINE IS EXPANDED ONLY"
50 PRINT "THIS "; HEX(0F); "LINE BEGAN AS EXPANDED"
RUN
```

Output:

```
THIS LINE IS UNDERSCORED AND EXPANDED
THIS LINE IS EXPANDED ONLY
THIS LINE BEGAN AS EXPANDED
```

4.4 MISCELLANEOUS CONTROL CODES

Audio Alarm: HEX(07)

The Audio Alarm code generates an audible tone about one second in duration.

Example:

```
40 X = 2
50 ON X GO TO 700, 800
700 END
800 PRINT HEX(07); "CHANGE PAPER": STOP
RUN
```

Output:

```
(one-second tone)
CHANGE PAPER
```

Carriage Return: HEX(0D)

The Carriage Return code prints the current contents of the line buffer and advances the paper one line.

Example:

```
10 PRINT "INTERNATIONAL SALES"
20 PRINT HEX(0D0D0D)
30 PRINT "LONDON", "ZURICH", "BELGRADE"
RUN
```

Output:

```
INTERNATIONAL SALES
```

```
LONDON
```

```
ZURICH
```

```
BELGRADE
```

NOTE

If the automatic line feed has been suppressed (refer to Section 4.2), the paper will not be advanced one line following the carriage return.

Delete: HEX(7F)

The Delete code clears all characters from the print buffer.

Example:

```
10 PRINT "THIS IS THE FIRST LINE!";  
20 PRINT HEX(7F);  
30 PRINT "THIS IS THE SECOND LINE!"  
RUN
```

Output:

THIS IS THE SECOND LINE!

Diagnostic: HEX(02010201000F)

This Diagnostic code triggers a built-in, 5-line diagnostic test to aid in print intensity adjustments and form alignment. These five lines may also be generated by deselecting the printer, pressing and holding down the FORMS OVERRIDE switch, and pressing the LINE FEED switch. Refer to Section 1.4 for a description of these diagnostics.

Power-On Reset: HEX(020D0C030F)

This control code prints the current contents of the line buffer, executes a form feed, moves the print head to the power-on position at the left end of the carriage, and restores all printer defaults (such as top-of-form, pitch, and line feed).

Select Character Font: HEX(0202aa0F)

The standard Model 2233 contains two fonts: a 10-pitch font and a 12.2-pitch font. When the printer is powered on, or when a Power-On Reset sequence [HEX(020D0C030F)] is executed, the font selected is Font 1 (10-pitch). Either font may be selected by using the following code sequence.

HEX(0202aa0F)

where: aa = 00 for Font 1
02 for Font 2

When changing from Font 1 to Font 2, the user should also reselect the pitch. Refer to the following subsection.

Example:

```
10 REM SELECT FONT 1: PRINT HEX(0202000F); "FUEL CONSUMPTION"
20 REM SELECT FONT 2: PRINT HEX(0202020F)
30 REM SELECT 12.2-PITCH: PRINT HEX(020901020C000F); "WILL REMAIN A
BIG TARGET OF ENGINE DEVELOPMENT"
RUN
```

Output:

```
FUEL CONSUMPTION
WILL REMAIN A BIG TARGET OF ENGINE DEVELOPMENT
```

Select Pitch: HEX(02090102aabb0F)

The standard Model 2233 contains a 10-pitch font and a 12.2-pitch font. When the printer is powered on or when a Power-On Reset sequence is executed, Font 1 (10-pitch) is automatically selected. If the user then selects Font 2 (12.2-pitch), the output appears, not as 12.2-pitch, but as a pseudo-10-pitch that prints 10 characters per inch using the 12.2-pitch font. Pitch selection inside Font 2 is controlled by the Select Pitch sequence. This sequence has the following format.

HEX(02090102aabb0F)

where: aabb = 0A00 for 10-pitch
 0C00 for 12.2-pitch

The user can select 12.2-pitch by executing the Select Font sequence HEX(0202020F) to select Font 2 and the Select Pitch sequence HEX(020901020C000F) to select 12.2 pitch within Font 2. The resulting output will consist of characters from the 12.2-pitch font printed 12.2 characters per inch. To select 10-pitch output after Font 2 has been selected, execute the Select Pitch sequence HEX(020901020A00). The resulting output will consist of characters from the 12.2-pitch font printed 10 characters per inch.

Example (Font 1 and Pitch Selection Within Font 2):

```
10 DIM A$35
20 A$ = "ONE GREAT CHANGE IN THE CITY'S ROLE"
30 REM SELECT FONT 1 (10-PITCH): PRINT HEX(0202000F)
40 PRINT A$
50 REM SELECT FONT 2 (DEFAULTS TO PSEUDO 10-PITCH): PRINT HEX(0202020F)
60 PRINT A$
70 REM SELECT 12.2-PITCH: PRINT HEX(020901020C000F)
80 PRINT A$
90 REM SELECT 10-PITCH: PRINT HEX(020901020A000F)
100 PRINT A$
```

Output:

```
ONE GREAT CHANGE IN THE CITY'S ROLE
ONE GREAT CHANGE IN THE CITY'S ROLE
ONE GREAT CHANGE IN THE CITY'S ROLE
ONE GREAT CHANGE IN THE CITY'S ROLE
```

Top-of-Form: HEX(0C)

This code advances the paper to the next top-of-form position. The position is determined by a tab in the first line of Channel 1 of the DAVFU.

CHAPTER 5

DIRECT ACCESS VERTICAL FORMAT UNIT (DAVFU)

5.1 INTRODUCTION

Vertical formatting determines the number of lines to be printed and the amount of blank space to be left between lines on a page of output. Most applications require a form that is 11 inches (27.9 centimeters) long, with output single-spaced or double-spaced. A program, stored in the printer, determines the type of vertical formatting to be used through its defaults or from information supplied by the user. Vertical formatting for the Model 2233 is controlled by the 12-channel Direct Access Vertical Format Unit (DAVFU). This method is described in the following sections.

When the printer is powered on or when a Power-On Reset sequence [HEX(020DOC030F)] is executed, the DAVFU defaults to 6 lines per inch and 66 lines per page. The user can control line feed size by using the Set Line Feed Size command sequence described in Section 4.2. When changing line feed size, the user must load an appropriate VFU format before attempting to print. Line feed size cannot be changed within a page. The user should first execute a Top-of-Form command before loading the proper VFU format and setting the corresponding line feed size.

Vertical formatting may be accomplished in three ways. For most applications, use of Hex codes for tabulation to VFU default tab stops will suffice. For more complicated applications, such as forms that necessitate frequently changing vertical format, the user may choose between writing a DAVFU program or using the Vertical Format Control utility (@2273VFU) on the system platter. Because writing a DAVFU load operation is a somewhat complicated process, the utility is recommended. The Vertical Format Control utility can establish most formats that can be written, and may be accessed and used according to the procedures described in Section 5.2. The procedures for writing a DAVFU formatting program are discussed in Section 5.3.

5.2 VERTICAL FORMAT CONTROL UTILITY (@2273VFU)

Accessing the Utilities Menu

Utilities can be accessed through a Utility menu which is available through the system platter. The following two commands will display this menu.

SELECT DISK xxx (where xxx = the disk device address of the system utilities)

LOAD RUN

Utilities requiring operator-entered information will display a series of prompts requesting this information. In all cases, type in the necessary response and press the RETURN key; the utility will then request additional information or perform the required procedure.

Vertical Format Control Utility

The Vertical Format Control utility (@2273VFU) allows the user to define and edit the vertical format of the Model 2233 Line Printer DAVFU without the difficulty of programming long code sequences. The user can create, edit, test, and save format data on disk for loading into the DAVFU. Each time the utility is used, the user indicates whether to load a previously created format file or create a new one.

In creating a new vertical format, the user responds to operator prompts and specifies the number of lines per page, the number of lines per inch, and the location of the bottom-of-form. Once the operator supplies this information, an $N \times 12$ grid appears on the CRT screen, where N is the specified number of lines and 12 is the number of channels of the DAVFU. The operator can edit the format by entering tabs indicating top-of-form in Channel 1 of Line 1 and bottom-of-form in Channels 1 and 2 after the last line to be printed. Also, the user can set tabs in the channels of other lines to indicate vertical stops.

Loading a Utility-Defined Vertical Format

Programmers can load a vertical format created by the Vertical Format Control utility by executing the following sequence of statements in the program.

```
DIM T$(128)2
DATA LOAD DC OPEN T "Filename" (where Filename = name of user file)
DATA LOAD DC T$( )
$GIO/xyy, (A000,G$) T$( ) (where xyy = printer address)
```

5.3 FORMATTING USING THE DAVFU

The Direct Access Vertical Format Unit consists of a format memory and associated control codes. The DAVFU is particularly useful for the printing of special forms or printing reports requiring more than one vertical format. Formatting information is supplied by a user-written program and loaded into the DAVFU before printing. This program overrides previous formatting information resident in the Vertical Format Unit.

Load DAVFU: HEX(021Ddddd ... 1EOF)

If the Vertical Format Control utility is not used to load the DAVFU, it is necessary to write a program defining the vertical format control sequence. The DAVFU has 12 channels and a maximum length of 144 lines. In the formatting sequence, each print line on the form should be represented by 2 bytes (16 bits), with particular bits used to indicate every channel having a tab stop for that particular line. A byte is represented by a 2-digit Hex code. Therefore, each line of the form should be represented by a 4-digit Hex code. A table of the Hex codes that represent bit patterns may be found in Appendix C. The bit representation for each channel of the DAVFU may be found in Table 5-1. The variable C_n is used, where C = channel and n = number.

The following Hex sequence format should be used for all DAVFU loading operations.

HEX(021Ddddd ... 1EOF)

where: dd = standard DAVFU byte pairs

Every sequence must begin with HEX(021D), the Hex code for DAVFU load. This code should be followed with the top-of-form code, 4140, placing a 1 bit in the Channel 1 of the first line. No other tab stops should appear in either byte of the first line. Channel 1 should be used exclusively to mark top-of-form and bottom-of-form.

In a DAVFU formatting program, the Bit 40 should be on for both bytes of each format line code. (If this is not done, the diagnostic error sequence "VFU Bit 6 Not Set" will be illuminated.) For example, a line with the Hex sequence 4040 has no tabs in any channel. As another example, the Hex sequence 4264 has Bit 40 on and a tab stop in Channel 2 (02) of the first byte. The second byte is composed of Bit 40 plus a tab stop in Channel 12 (40 + 20 = 60) and Channel 9 (04) in the second byte.

Table 5-1. DAVFU Data Loading Format

	1st Half of Byte 1				2nd Half of Byte 1				1st Half of Byte 2				2nd Half of Byte 2			
BIT POSITION	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	80	40	20	10	08	04	02	01	80	40	20	10	08	04	02	01
CHANNEL NUMBERS	0	1	C6	C5	C4	C3	C2	C1	0	1	C12	C11	C10	C9	C8	C7
START CODE	0	0	0	1	1	1	0	1	(See Byte 1)							
FIRST LINE (Top-of-form required)	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
SECOND LINE (continue as needed)	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0
BOTTOM-OF-FORM	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0
SKIP LINE (optional)	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
TOP OF FORM	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0
STOP CODE	0	0	0	1	1	1	1	0	(See Byte 1)							

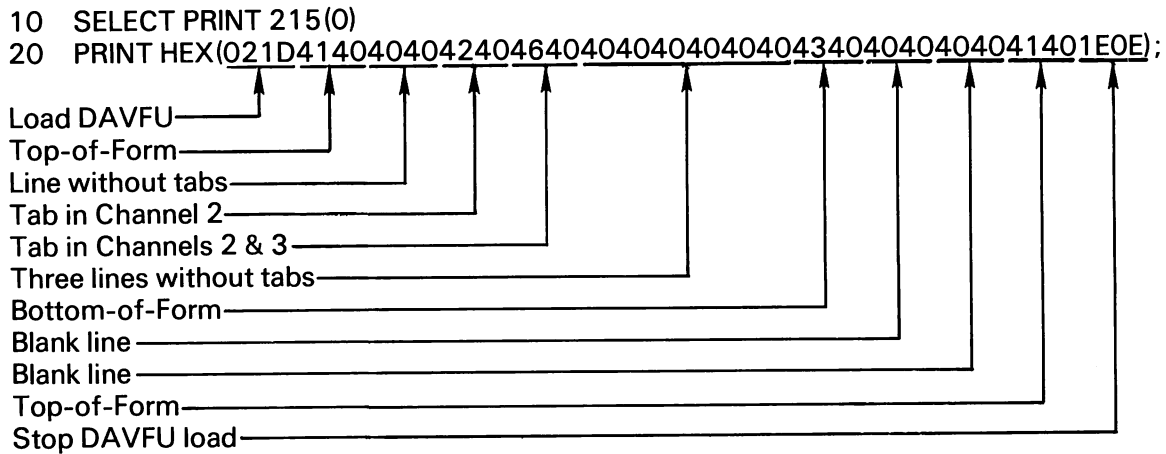
Top-of-form should be followed by a succession of 2-byte codes, each representing a line until the desired form length is reached. Bottom-of-form is represented by a tab in Channels 1 and 2 of the code representing the desired last line of text. This code is 4340 (40 bit is on, and 01 + 02 = 03). When the bottom-of-form is reached, the printer automatically skips to the next top-of-form. Since bottom-of-form actually indicates the final printed line, it is necessary to insert several more blank lines (4040) until the last physical line on the form is reached. At this line (Line 66, for example) another top-of-form code (4140) should be inserted. The Hex code (1E) should then terminate the DAVFU load.

The entire string of codes in the DAVFU load operation must contain an even number of digits; otherwise the printer will enter a DAVFU-memory-not-loaded condition. To prevent this occurrence, break up the formatting sequence with a series of Hex code statements.

Examples

The following is an example of a DAVFU formatting program for the VP, MVP, LVP, and SVP. Each Hex code or 2-byte code has been labeled according to a specific function. Obviously, regular users would not require a form with so few print lines.

Example 1:



The following sample DAVFU program calls for 15 lines of text printed on a 20-line form, with different tabbing formats set in Channels 2, 3, 9, and 11. Table 5-2 illustrates the tabulation scheme for the 12 channels and 20 lines of the program in Example 2.

Example 2:

```

10 SELECT PRINT 215(0)
20 PRINT HEX(021D41404240444042444040464040504240444042
40405446404040424043404040404040404041401E);

```

Table 5-2. Sample DAVFU Tabulation Scheme

Line	Channel Numbers												Code
	1	2	3	4	5	6	7	8	9	10	11	12	
1	T												4140
2		T											4240
3			T										4440
4		T							T				4244
5													4040
6		T	T										4640
7											T		4050
8		T											4240
9			T										4440
10		T											4240
11									T		T		4054
12		T	T										4440
13													4040
14		T											4240
15	T	T											4340
16													4040
17													4040
18													4040
19													4040
20	T												4140

Example 2 will work effectively for those using a 2200VP, MVP, LVP or SVP system, as long as the programmer specifies a line length of 0 in the SELECT statement and follows the stop DAVFU load code sequence with a semicolon. These actions suppress any carriage returns that the system might otherwise generate.

When a formatting program is created for a form with 66 vertical lines, it may become unwieldy, leaving far more room for error. Therefore, users may want to break down their DAVFU formatting programs in the following fashion.

```

10  SELECT PRINT 215(0)
20  PRINT HEX(021D);      :REM START OF DAVFU LOAD
30  PRINT HEX(4140);      :REM TOP-OF-FORM
40  PRINT HEX(4240);      :REM LINE TWO - TAB STOP IN CHANNEL 2
50  PRINT HEX(4440);      :REM LINE THREE - TAB STOP IN CHANNELS 2 & 3
60  PRINT HEX(4244);      :REM LINE FOUR - TAB STOP IN CHANNELS 2 & 9
.
.
.
170 PRINT HEX(4340);      :REM LINE 15 - BOTTOM-OF-FORM
180 PRINT HEX(4040);      :REM LINE 16 - BLANK LINE
.
.
.
210 PRINT HEX(4140);      :REM CLOSING TOP-OF-FORM
220 PRINT HEX(1E);        :REM STOP DAVFU LOAD

```

A less cumbersome means of loading the same program is the BASIC \$GIO command. When using the \$GIO command, a programmer should assume that the DAVFU formatting sequence is an array and dimension it as DIM A\$(128)2. The first byte of A\$() should be HEX(02), the escape code; the second byte of A\$() should be HEX(1D), the DAVFU loading command; the third byte should have the value HEX(4140), the top-of-form code; and so on. The proper command for loading the DAVFU program in this manner is:

```

10  $GIO/215 (A000,G$) A$()

```

Because the programmer can reference a particular channel from within a print routine, the DAVFU formatting program can be used to output data requiring different formats. The various channels of the DAVFU are referenced by using the Vertical Skip control code as described in Section 5.4.

5.4 DAVFU CONTROL CODES

Vertical Skip: HEX(0201021Fxx0F)

The Vertical Skip command allows the programmer to skip a specified number of lines on a form or to the next tab stop in a specified DAVFU channel. The Vertical Skip command sequence has the following format.

```

HEX(0201021Fxx0F)

```

where: xx = 0a to advance the platen to the next tab stop defined in Channel a (a must be a Hex digit from 1 to C)

xx = 1a to advance the platen a lines (a must be a Hex digit from 0 to F)

Vertical Tab HEX (0B)

This Vertical Tab code advances the paper to the next preset vertical tab location in Channel 2. Channel 2 is defined as the vertical tab channel.

5.5 DAVFU ERRORS

A number of error conditions may arise when attempting to load the DAVFU. Such errors result in a failure to load the DAVFU, causing the printer to go off-line. In some cases, an error code is displayed by the diagnostic error indicators (refer to Figure 1-4). The following conditions are error conditions.

- Attempting to create a formatting program over 144 lines in length without specifying the end of the load with a bottom-of-form code or dummy top-of-form code. (In this instance, the "VFU Greater Than 144 Lines" diagnostic error sequence will be illuminated.)
- Neglecting to set Bit 40 to 1 in each byte. (In this instance, the "VFU Bit 6 Not Set" diagnostic error sequence will be illuminated.)
- Loading a program with an odd number of data bytes between the HEX codes 1D and 1E.
- Neglecting to follow the DAVFU start code 1D with a top-of-form code (4140) in the next byte.

APPENDIX A HEXADECIMAL CODES

HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER
HEX(01)	Not Applicable	HEX(39)	9	HEX(5D)	I
HEX(02)	Escape Code	HEX(3A)	:	HEX(5E)	↑
HEX(03)	Not Applicable	HEX(3B)	;	HEX(5F)	—
HEX(07)	Alarm	HEX(3C)	<	HEX(60)	`
HEX(08)	Not Applicable	HEX(3D)	=	HEX(61)	a
HEX(0A)	Line Feed	HEX(3E)	>	HEX(62)	b
HEX(0B)	Vertical Tab	HEX(3F)	?	HEX(63)	c
HEX(0C)	Form Feed	HEX(40)	@	HEX(64)	d
HEX(0D)	Carriage Return	HEX(41)	A	HEX(65)	e
HEX(0E)	Enhanced Print	HEX(42)	B	HEX(66)	f
HEX(0F)	Enhanced Print	HEX(43)	C	HEX(67)	g
HEX(20)	Space	HEX(44)	D	HEX(68)	h
HEX(21)	!	HEX(45)	E	HEX(69)	i
HEX(22)	"	HEX(46)	F	HEX(6A)	j
HEX(23)	#	HEX(47)	G	HEX(6B)	k
HEX(24)	\$	HEX(48)	H	HEX(6C)	l
HEX(25)	%	HEX(49)	I	HEX(6D)	m
HEX(26)	&	HEX(4A)	J	HEX(6E)	n
HEX(27)	/	HEX(4B)	K	HEX(6F)	o
HEX(28)	(	HEX(4C)	L	HEX(70)	p
HEX(29)	)	HEX(4D)	M	HEX(71)	q
HEX(2A)	*	HEX(4E)	N	HEX(72)	r
HEX(2B)	+	HEX(4F)	O	HEX(73)	s
HEX(2C)	,	HEX(50)	P	HEX(74)	t
HEX(2D)	-	HEX(51)	Q	HEX(75)	u
HEX(2E)	.	HEX(52)	R	HEX(76)	v
HEX(2F)	/	HEX(53)	S	HEX(77)	w
HEX(30)	0	HEX(54)	T	HEX(78)	x
HEX(31)	1	HEX(55)	U	HEX(79)	y
HEX(32)	2	HEX(56)	V	HEX(7A)	z
HEX(33)	3	HEX(57)	W	HEX(7B)	{
HEX(34)	4	HEX(58)	X	HEX(7C)	|
HEX(35)	5	HEX(59)	Y	HEX(7D)	}
HEX(36)	6	HEX(5A)	Z	HEX(7E)	~
HEX(37)	7	HEX(5B)	[	HEX(7F)	delete
HEX(38)	8	HEX(5C)	\		

APPENDIX B SPECIFICATIONS

B.1 MODEL 2233 LINE PRINTER SPECIFICATIONS

Size

Height	9.5 in. (24.1 cm)
Height (with stand)	36.8 in. (93.5 cm)
Depth	20.9 in. (53.1 cm)
Depth (with stand)	27.0 in. (68.6 cm)
Width	27.0 in. (68.6 cm)

Weight

68.0 lb (30.6 kg)

Speed

120 cps (12.2-pitch)

100 cps (10-pitch)

Character Configuration

7 x 9 dot matrix (12.2-pitch)

9 x 9 dot matrix (10-pitch)

10 or 12 characters per inch (4 or 4.8 characters per centimeter) horizontally

6 or 8 lines per inch (2.4 or 3.2 lines per centimeter) vertically

Character Set

Full ASCII 96-character set, uppercase and lowercase

Line Width

132 characters per line (10-pitch)

158 characters per line (12.2-pitch)

Ribbon

Cartridge ink ribbon, recirculating

Switches/Indicators

ON/OFF, SELECT, FORM OVERRIDE, CLEAR, TOP OF FORM, and LINE FEED switches; Paper Out, Power-On, SERVO Fuse, Malfunction, and SELECT indicators

Programmable Control Functions

Automatic Line Feed/Line Feed Size Control, Line Feed, Partial Line Feed, Underscore, Expanded Print, Audio Alarm, Carriage Return, Delete, Diagnostic Test, Power-On-Reset, Select Character Font, Select Pitch, Top-of-Form, Load DAVFU, Vertical Skip, Vertical Tab

Cable

12.0 ft (3.7 m) cable with connector to CPU

Controller

Standard Wang printer/CPU interface

Power

115 or 230 VAC \pm 10%
50 or 60 Hz \pm 1 Hz
0.8 amps, 92 watts

Fuses

3.0 amp (SB) for 115 VAC
1.5 amp (SB) for 230 VAC
2.5 amp (SB) for DC carriage motor

Operating Environment

50° F to 80° F (10° C to 27° C)
35% to 65% relative humidity, noncondensing

Accessories

Optional stand (Model 8005-5)

B.2 PAPER SPECIFICATIONS

Paper Size

Maximum width 14.9 in. (37.8 cm)
Minimum width 3.5 in. (8.9 cm)
Maximum number five copies plus original

Paper Stock

Material margin-perforated, fan-fold card, or paper stock
Single-part forms 15 to 20 lb bond

Multi-part forms

2-ply	15 x 15-lb bond, 7-lb carbon
3-ply	15 x 12 x 15-lb bond, 7-lb carbon
4-ply	12 x 12 x 12 x 15-lb bond, 7-lb carbon
5-ply	12 x 12 x 12 x 12 x 15-lb bond, 5-lb carbon
6-ply	12 x 12 x 12 x 12 x 12 x 15-lb bond, 5-lb carbon

Forms Length (Continuous Forms Paper)

Maximum	24 in. (61 cm)
Minimum	1 line

Forms Thickness

Maximum in print area	0.018 in. (0.046 cm)
Over crimps in margin	0.030 in. (0.076 cm)

Sprocket Holes

Must run along both margins 0.25 ± 0.030 in. (0.64 ± 0.076 cm) from the paper edge to hole center lines.

Distance between hole centers must be 0.50 ± 0.005 in. (1.27 ± 0.013 cm), noncumulative in any 5.0 in. (12.7 cm) length.

Hole diameters must be 0.156 ± 0.005 in. (0.396 ± 0.013 cm); the two top and bottom drive holes (four per sheet) can be up to 0.2 in. (0.51 cm) in diameter to permit post or ring binding of output.

Distance between hole centers across the sheet must be uniform within 0.015 in. (0.038 cm) to a maximum of 14.37 in. (36.50 cm).

When using preprinted forms, the pinhole center in the left margin cannot be less than 0.375 ± 0.063 in. (0.953 ± 0.159 cm); the pinhole center in the right margin cannot be less than 0.375 ± 0.063 in. (0.953 ± 0.159 cm).

Fastening Multi-part Forms

For improved forms handling, use glued margins; otherwise, fasten with crimps every 2 in. (5.1 cm) along both edges.

Crimps must not come closer than 0.5 in. (1.27 cm) to the fanfold; each crimp must have four prongs, two to enter both form and carbon, and two to enter forms only.

When using forms with wide and narrow copies in the same set, the top copy should be the widest.

APPENDIX C

HEX DIGIT REPRESENTATION OF BIT PATTERNS

The following chart lists the Hex representations of bit patterns used in writing a vertical format code.

Bits	Hex Digit
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

INDEX

@2273VFU	C-1
Audio Alarm	4-8
Automatic Line Feed	4-2 to 4-3
Buffer	1-2, 4-9
Carriage Motor Fuse	1-2, 1-5, 1-11
Carriage Return	4-8 to 4-9
Character Codes	4-1
Character Set	A-1
CLEAR Switch	1-4
Control Codes	4-1 to 4-10, 5-2 to 5-6
Control Panel	1-3 to 1-5
Delete Code	4-9
Deselection	2-9
Device Type	2-1 to 2-3
Device Type 0	2-2
Device Type 2	2-2
Device Type 4	2-3
Diagnostic Error Indicators	1-4
Diagnostic Test	1-5, 4-9
Direct Access Vertical Format	5-1 to 5-6
Double-Spaced Output	2-2, 2-8
Environment	B-2
Error Codes	1-4 to 1-5, 5-6
Expanded Print	4-6 to 4-8
Forms Thickness Lever	1-10 to 1-11
Fuses	1-2, 1-5, 1-11
Hex Function	4-1 to 4-2
Hexadecimal Codes	4-1 to 4-10, A-1
HEXPRINT Statement	3-3
Humidity	B-2
Inspection	1-2
Installation	1-2
Line Feed Control Code	4-2 to 4-4
Line Length	2-4 to 2-6
Load DAVFU	5-2 to 5-5
Malfunction Indicator	1-4
Multi-part Forms	B-3
ON/OFF Switch	1-3
Packed Format	3-2 to 3-4
Paper Insertion	1-8 to 1-10
Paper Out Indicator	1-4, 1-10
Paper Specifications	B-2 to B-3

INDEX (continued)

Pin-Feed Gates	1-8 to 1-9
Pitch Selection	4-9 to 4-10
Platen Knob	1-6, 1-9
Power Indicator	1-3
Power-On	1-5 to 1-6
Power-On Reset Code Sequence	4-9
Print Head Carriage	1-7, 1-8, 1-10
Print Head Retraction Lever	1-7, 1-10 to 1-11
PRINT Statement	3-1 to 3-4
PRINTUSING Statement	3-4
 Ribbon Cartridge Replacement	1-6 to 1-8
Ribbon Guide	1-7
 SELECT CO Statement	2-7 to 2-8
SELECT PRINT Statement	2-6 to 2-7
SELECT Statement	2-1 to 2-9
SELECT Switch	1-3
SERVO Fuse Indicator	1-5
Size	B-1
Specifications	B-1 to B-3
Speed	1-1
 TAB Function	3-5 to 3-6
Top-of-Form	1-4
 Underscore	4-5 to 4-6, 4-7 to 4-8
Unit Address	2-3
Unpacking	1-2
 Vertical Format Control Utility	5-1 to 5-2, C-1
Vertical Skip	5-5
Vertical Tab	5-6
 Zoned Format	3-1 to 3-2

To help us to provide you with the best manuals possible, please make your comments and suggestions concerning this publication on the form below. Then detach, fold, tape closed and mail to us. All comments and suggestions become the property of Wang Laboratories, Inc. For a reply, be sure to include your name and address. Your cooperation is appreciated.

700-6854

TITLE OF MANUAL MODEL 2233 LINE PRINTER USER MANUAL

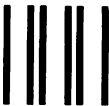
COMMENTS:

Fold

Fold



Fold

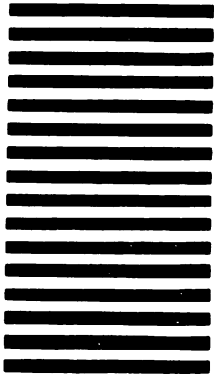


NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 16 LOWELL, MA

POSTAGE WILL BE PAID BY ADDRESSEE

**WANG LABORATORIES, INC.
ONE INDUSTRIAL AVENUE
LOWELL, MASSACHUSETTS 01851**



Cut along dotted line.

Attention: Technical Writing Department

Fold

.

()

()

()

International Representatives

Argentina
Bahamas
Bahrain
Bolivia
Botswana
Brazil
Canary Islands
Chile
Colombia
Costa Rica
Cyprus
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Finland
Ghana
Greece
Guam
Guatemala
Haiti
Honduras
Iceland
India
Indonesia
Ireland
Israel
Italy
Ivory Coast
Japan
Jordan
Kenya
Korea
Kuwait
Lebanon
Liberia
Malaysia
Malta
Mexico
Morocco
New Guinea
Nicaragua
Nigeria
Norway
Paraguay
Peru
Philippines
Portugal
Qatar
Saudi Arabia
Scotland
Senegal
South Africa
Spain
Sri Lanka
Sudan
Tasmania
Thailand
Turkey
United Arab Emirates
Uruguay
Venezuela
Zimbabwe

United States

Alabama Birmingham Mobile	Florida Coral Gables Hialeah Hollywood Jacksonville Miami Orlando Sarasota Tampa	Iowa Ankeny Kansas Overland Park Wichita Kentucky Louisville Louisiana Baton Rouge Metairie Maine Portland Maryland Baltimore Bethesda Gaithersburg Rockville Massachusetts Boston Burlington Chelmsford Lawrence Littleton Lowell Methuen Tewksbury Worcester Michigan Grand Rapids Kalamazoo Lansing	Southfield Minnesota Eden Prairie Minneapolis Mississippi Jackson Missouri Creve Coeur St. Louis Nebraska Omaha Nevada Las Vegas New Hampshire Manchester New Jersey Bloomfield Clifton Edison Mountainside Toms River New Mexico Albuquerque Santa Fe New York Albany Jericho Lake Success New York City Rochester	Syosset Syracuse Tonawanda North Carolina Charlotte Greensboro Raleigh Ohio Akron Cincinnati Cleveland Independence Toledo Worthington Oklahoma Oklahoma City Tulsa Oregon Eugene Portland Salem Pennsylvania Allentown Erie Harrisburg Philadelphia Pittsburgh State College Wayne Rhode Island Providence	South Carolina Charleston Columbia Tennessee Chattanooga Knoxville Memphis Nashville Texas Austin Dallas El Paso Houston San Antonio Utah Salt Lake City Virginia Newport News Norfolk Richmond Rosslyn Springfield Washington Richland Seattle Spokane Wisconsin Appleton Brookfield Green Bay Madison Wauwatosa
--	---	--	--	--	---

International Offices

Australia Wang Computer Pty., Ltd. Adelaide, S.A. Brisbane, Qld. Canberra, A.C.T. Perth, W.A. South Melbourne, Vic 3 Sydney, NSW	China Wang Industrial Co., Ltd. Taipei France Wang France S.A.R.L. Paris Bordeaux Lille Lyon Marseilles Nantes Nice Rouen Strasbourg	Japan Wang Computer Ltd. Tokyo Netherlands Wang Nederland B.V. IJsselstein Groningen New Zealand Wang Computer Ltd. Auckland Christchurch Wellington Panama Wang de Panama (CPEC) S.A. Panama City Puerto Rico Wang Computadoras, Inc. Hato Rey Singapore Wang Computer (Pte) Ltd. Singapore Sweden Wang Skandinaviska AB Stockholm Gothenburg	Malmö Switzerland Wang A.G. Zurich Basel Bern Geneva Lausanne St. Gallen Wang Trading A.G. Zug West Germany Wang Deutschland, GmbH Frankfurt Berlin Cologne Düsseldorf Essen Freiburg Hamburg Hannover Kassel Mannheim Munich Nürnberg Saarbrücken Stuttgart
--	---	--	--

WANG

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 459-5000. TWX 710 343-6769. TELEX 94-7421

Printed in U.S.A.
700-6854
8-81-2.5M