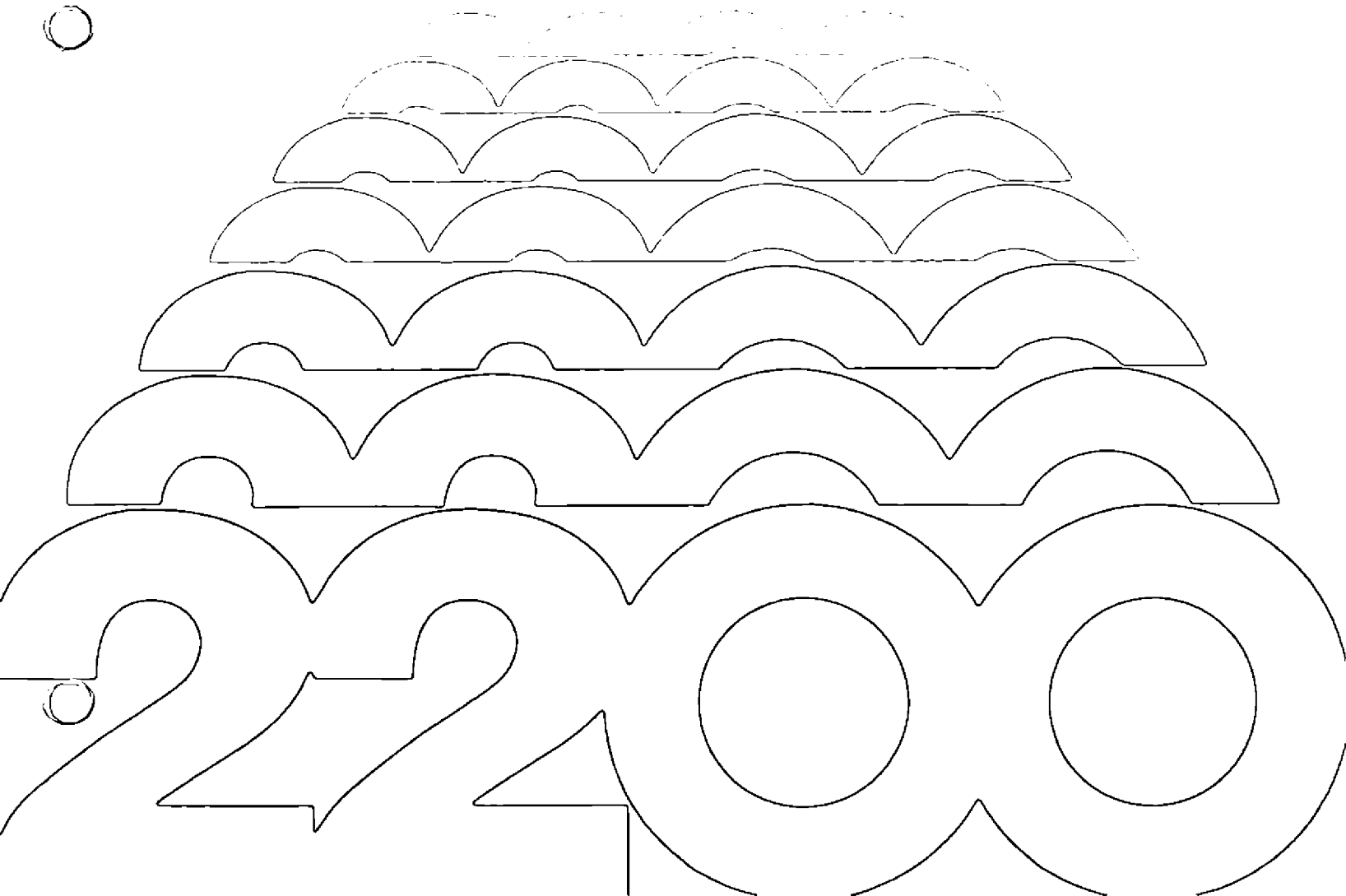




# Model 2231W Line Printer User Manual



# **Model 2231W Line Printer User Manual**

© Wang Laboratories, Inc., 1976



LABORATORIES, INC.

---

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 851-4111. 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.



LABORATORIES, INC.

---

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 851-4111. TWX 710 343-6769, TELEX 94-7421

## HOW TO USE THIS MANUAL

This manual provides answers to questions concerning the operation of the Model 2231W Line Printer. It is designed for users who are already familiar with the available Wang System and its BASIC language.

For users who are not familiar with the operation of their system, it is recommended that the BASIC Programming Manual and the Wang BASIC Reference Manual be read before proceeding with this manual.

This manual has been divided into several sections covering all the operational features of the Line Printer. Chapter 1 contains general information on the Printer. Chapter 2 describes device selection and the SELECT statement. Chapter 3 demonstrates how to format printed output. Chapter 4 describes the use of HEX codes, and Chapter 5 describes the Vertical Format Tape. Hexadecimal codes, the Printer character set and specifications are collected in the Appendices.

### NOTE:

There are two versions of the Model 2231W Line Printer: Model 2231W-1 and Model 2231W-2. Both models are identical in operation; differences in line length, buffer size, and character size are noted in this manual.

# TABLE OF CONTENTS

Page

## CHAPTER 1 : GENERAL INFORMATION

1.1	Introduction . . . . .	1
1.2	Unpacking and Inspection . . . . .	2
1.3	Installation . . . . .	2
1.4	Paper Insertion. . . . .	2
1.5	Print Adjustment . . . . .	5
1.6	Cartridge Ribbon Replacement . . . . .	5
1.7	Fuse Replacement . . . . .	6
1.8	Vertical Format Control. . . . .	6
1.9	System Turn-On Procedure . . . . .	7
1.10	2231W Turn-On Procedure. . . . .	7
1.11	Points to be Checked . . . . .	8

## CHAPTER 2: DEVICE SELECTION

2.1	The SELECT Statement . . . . .	9
2.2	Device Type Codes. . . . .	9
2.3	PRINT. . . . .	13
2.4	LIST . . . . .	13
2.5	CO (Console Output). . . . .	14
2.6	Line Length. . . . .	14
2.7	Special Techniques . . . . .	16
2.8	Combined Parameters. . . . .	16
2.9	Deselecting the Printer. . . . .	17

## CHAPTER 3: FORMATTING OUTPUT

3.1	PRINT, PRINTUSING and HEXPRINT Statements. . . . .	19
3.2	The TAB( Function. . . . .	21
3.3	The Expanded Print . . . . .	21

## CHAPTER 4: HEX CODES

4.1	The HEX Function . . . . .	23
4.2	Control Codes. . . . .	23

## CHAPTER 5: THE VERTICAL FORMAT PAPER TAPE

5.1	To Copy a Vertical Format Tape . . . . .	25
5.2	Vertical Format Tape Reader. . . . .	26
5.3	To Splice Prepared Tape. . . . .	26

## APPENDICES

Appendix A	- Hexadecimal Codes. . . . .	27
Appendix B	- Specifications for the Line Printer. . . . .	28
Appendix C	- Paper Specifications for the Line Printer. . . . .	29

INDEX . . . . .		31
-----------------	--	----

# CHAPTER 1

## GENERAL INFORMATION

### 1.1 INTRODUCTION

This manual describes the characteristics and operations of the Model 2231W Line Printer (see Figure 1.1). The Model 2231W is an impact printer that generates printed characters in a matrix form, nominally 7 x 9. There are two versions of the printer: a Model 2231W-1 and a Model 2231W-2. Aside from the differences noted in this manual, both printers have identical configurations.

The 2231W-1 can print a line up to 112 characters long; the maximum line length for the 2231W-2 is 132 characters. Both printers operate at a rate of 120 characters-per-second and can achieve a rate of 45 to 250 lines-per-minute dependent upon line length. In the 2231W-1, characters are printed six lines and 10 characters to the inch (2.4 lines/cm; 4 characters/cm). The 2231W-2 prints 12 characters to the inch (4.8 characters/cm). When required, characters can be expanded for enhanced output (see Chapter 3). The complete ASCII, 96-character set for the printer is given in Appendix A. In the 2231W-1, a 112-character buffer receives a complete line of data transmitted from the system CPU to the printer. The buffer size is 132 characters for the 2231W-2. In both models, a vertical format tape provides control for spacing on special forms. Continuous-form paper of widths from 3.5 to 13.5 inches (8.9 to 34.3 cm) can be used with the printer since the distance between the pin-feed mechanisms is continuously adjustable.

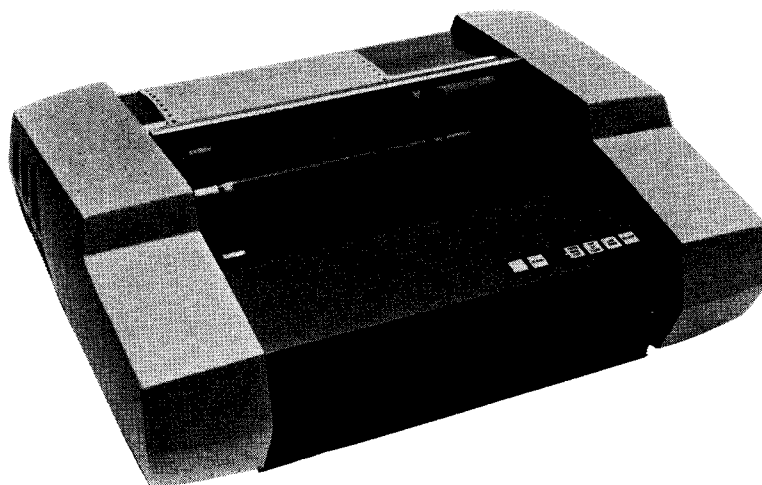


Figure 1.1 Model 2231W Line Printer

## 1.2 UNPACKING AND INSPECTION

When you receive your equipment, notify your Wang Service Representative; he should unpack and set up your Printer. Failure to notify your Wang Service Representative will void your warranty.

## 1.3 INSTALLATION

To install your Printer, your Wang Service Representative uses the following procedure:

1. The Printer Controller Board should be installed by a Wang Service Representative in the chassis of your system. Its screws should be fully tightened.
2. The 36-pin interface connector must be plugged into the Printer Controller Board and its Lock Clips placed in the up (locked) position.
3. The power cord from the Line Printer must be plugged into a wall outlet (see power requirements in Appendix B).

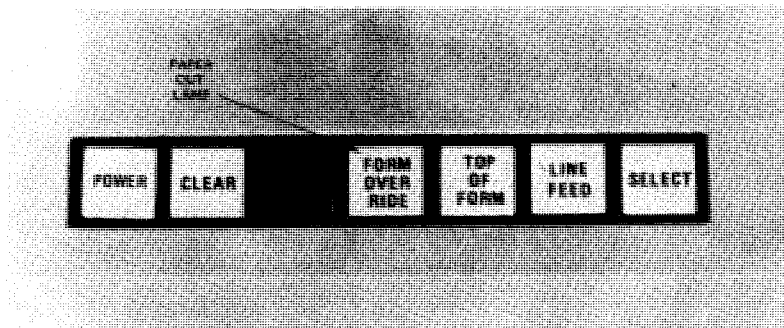


Figure 1.2 Control Panel

## 1.4 PAPER INSERTION

1. Raise the cover from the Printer. Secure the cover in the raised position with the cover rod located on the right side of the Printer.
2. Push continuous-form pin-feed paper into the slot at the bottom front of the Printer until it comes out between the pin-feed mechanisms (see Figure 1.3 and Figure 1.4). (Note: An optional slot for paper insertions is located at the bottom of the Printer.)
3. Open the pin-feed gates, insert the paper holes evenly over the pins, and close the gates. If the distance between the pin-feed mechanisms must be adjusted, unscrew the right-hand lock knob and slide the mechanism to the proper position. After the paper is in proper position, close the cover of the Printer.
4. Press the ON/OFF rocker switch at the rear of the Printer (see Figure 1.5). When the Printer is on, the power lamp (left indicator of Control Panel) is lit.
5. Press the LINE FEED switch to advance paper in the Printer.
6. Press the TOP-OF-FORM switch; this advances the paper until the Vertical Format Unit senses a Top-of-Form hole in the vertical format tape.
7. For proper adjustment of forms, particularly to bring the physical top-of-form and the Top-of-Form hole in the vertical format tape into coincidence, align paper in the Printer using the Platen Knob and then push in and hold the Platen Knob while pressing the Top-of-Form switch. This advances the vertical format tape in the Vertical Format Unit to the Top-of-Form hole. Manual adjustments of forms in the vertical direction can be made with the Platen Knob by pushing in and rotating the knob.
8. NEVER OPERATE THE LINE PRINTER WITHOUT PAPER.
9. If paper runs out while the Printer is being used, your Wang System ceases operation, an audible one-second tone is sounded, and the PAPER OUT lamp is lit. To complete printing the page, press FORMS OVERRIDE to print one line at a time until the paper (and vertical format tape) advance to Top-of-Form. The paper may now be changed. Press the FORMS OVERRIDE button to continue printing after inserting fresh paper in the Printer.

NOTE:

Do not press CLEAR when changing paper; doing so erases the current line in the Printer buffer.

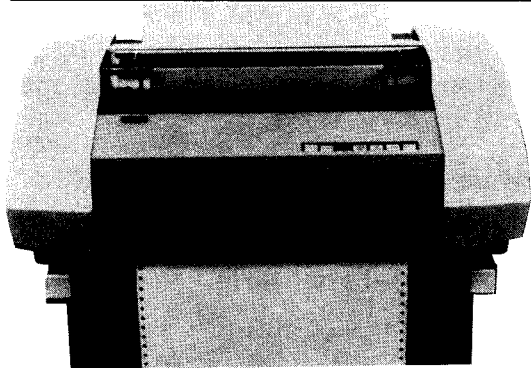


**NOTE:**

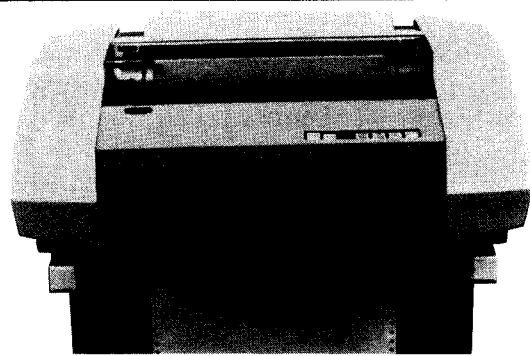
The cover of the Printer can be opened for making adjustments to the print head (adjusting print head gap or disengaging paper at the print head).

When the cover is open, power to the carriage motor is turned off; the print head can now be moved manually.

Once the cover is closed, the Printer is ready for normal operation.



(a) Front Loading Slot



(b) Bottom Loading Slot

Figure 1.3 Paper In The Loading Slots

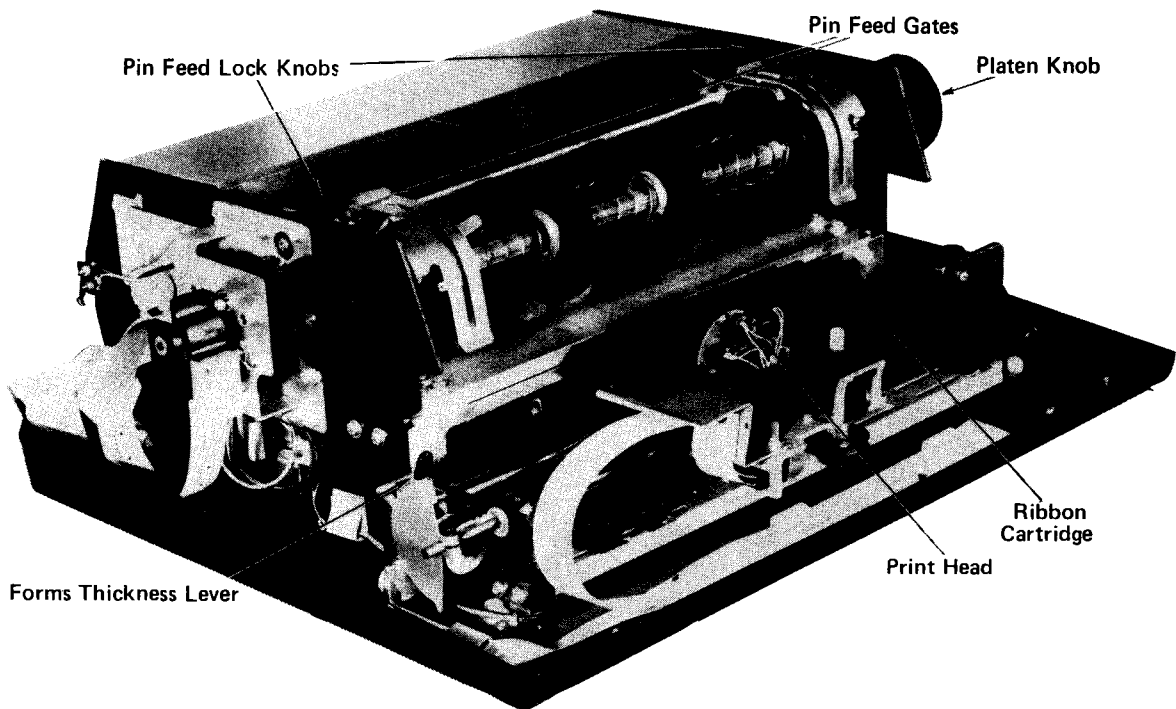


Figure 1.4 The Model 2231W Line Printer, Definition of Terms

## 1.5 PRINT ADJUSTMENT

To adjust the print blackness for different form thickness, follow the procedure detailed below.

1. The Printer must have paper in it and be turned OFF.
2. Raise the cover of the Printer and find the Print Head and the Forms Thickness Lever. (see Figure 1.4).
3. Notice that the Forms Thickness Lever has position notches marked from one to nine for different print adjustments. The lower number positions are for single forms; the higher numbers are for multiple forms.
4. Unlock the Forms Thickness Lever.
5. Turn the Forms Thickness Lever to move the head in or out; in to provide a blacker imprint and out to move the head back to accommodate thicker forms.
6. Lock the Lever to the proper adjustment position.
7. When the head has been properly adjusted, close the cover of the Printer. The Printer does not operate unless the cover is on.
8. 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 and locked in place.

## 1.6 CARTRIDGE RIBBON REPLACEMENT

1. Turn power OFF on the Printer.
2. Raise the cover of the Printer and find the Form Thickness Lever. Pull the lever completely backward to the "L" position so that the Print Head is removed from the paper.
3. Remove the exposed ribbon from the Print Head; rotate the cartridge spindle as required.
4. Remove the cartridge by grasping the sides and pulling it up from the print head carriage.
5. Place the new cartridge in Printer; guide its exposed ribbon over the Print Head while rotating the cartridge spindle as required and snap cartridge in place.
6. Readjust Forms Thickness Lever to proper Print Adjustment position.
7. Replace the cover of the Printer and turn power ON to resume operation.

## 1.7 FUSE REPLACEMENT

Two fuses (see Figure 1.5) are located on the rear panel of the Line Printer. One fuse monitors main line current while the second fuse 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. The Printer should be turned OFF when changing a fuse.

Main Fuse

Carriage Motor Fuse

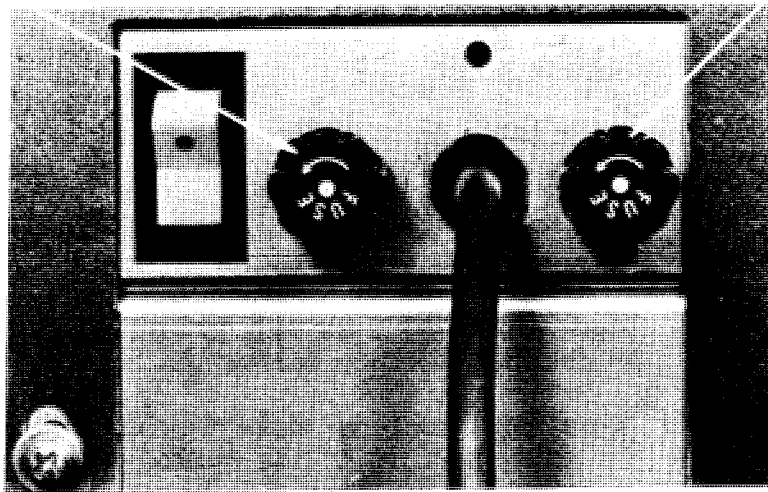


Figure 1.5 Back of Printer

## 1.8 VERTICAL FORMAT CONTROL

The mechanism which guides and controls paper movement in the Model 2231W is located on the left side of the Printer. The Vertical Format Unit (Figure 5.2) contains a tape reader which provides Vertical Tab and Top-of-Form spacing control via punched tape with holes punched in channels 5 and 7, respectively. Before operating the Printer, verify that the mylar tape is properly seated in the Vertical Format Unit.

The standard one-inch wide, eight channel, mylar tape has sprocket holes located between channels three and four, holes for Vertical Tab in channel 5, and for TOP-OF-FORM in channel 7. The sprocket holes have 1/10 inch pitch between holes. The tape reader and paper-feed mechanisms are mechanically linked so that each line feed both advances the paper one line, and the tape one sprocket hole. When the Printer receives a Vertical Tab Code (HEX(0B)), the tape is advanced to the next hole in channel 5 and the paper is advanced correspondingly. When the Printer receives a Form Feed code (HEX(0C)), or the TOP-OF-FORM Switch is pressed, the punched tape is advanced to the next hole in channel 7 and the paper advances correspondingly. On the standard tape, Vertical Tab holes are spaced six sprocket holes apart ((corresponding to a one-inch tab (2.54 cm) or six lines), and Form Feed holes, 66 sprocket holes apart (this corresponds to an eleven-inch (27.9 cm) form)). To position the tape at the Top-of-Form holes, push in and hold the Platen Knob and press the

TOP-OFF-FORM switch. The tape provided with the Printer should last the life of the Printer. Special tapes to produce unique printline spacing can be used with the printer; they must be prepared either with a Teletype<sup>®</sup> tape punch or with manual punching equipment. Problems with Vertical Format Tapes are best resolved by your Wang Service Representative.

## 1.9 SYSTEM TURN-ON PROCEDURE

1. Verify 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. When the system is turned on, Master Initialization occurs, i.e., memory is cleared of all programs and variables and the addresses of primary devices are set to their default values.

No device address is automatically set for the Printer when the system is Master Initialized. The device address for the Printer must be specified using a SELECT statement (see Chapter 2).

## 1.10 2231W TURN-ON PROCEDURE

The control panel on the front side of the Printer contains a number of switches, buttons and light indicators for controlling the manual operations of the printer (see Figure 1.2).

### ON/OFF

The ON/OFF switch is located in the rear of the printer. To turn the Printer ON, press the ON rocker switch. The Power lamp at the control panel is lit. To turn OFF the Printer, press the OFF switch; the Power lamp is turned off.

### SELECT

After turning ON the Printer, press the SELECT switch; the Select lamp is lit. SELECT places the Printer in the ready position to receive data from the CPU. The SELECT lamp is illuminated when the Printer can receive data. When the SELECT switch is depressed again, the SELECT lamp is extinguished. The SELECT switch can be used to halt printing temporarily (as when aligning forms) without causing loss of data in the print buffer; press SELECT to turn off the SELECT lamp, align forms and press SELECT again.

### LINE FEED

Paper is advanced one line when this switch is depressed briefly; if the switch is held down, paper advances continuously. This switch operates only when the Printer is in deselect mode (has not been SELECTed).

## TOP OF FORM

With the Printer ON (but not SELECTed), paper is manually advanced to top-of-form by pressing this switch. Paper advance is controlled by the Vertical Format Unit.

## FORMS OVERRIDE

When out of paper, the Printer ceases operation, an audible tone is sounded, the PAPER OUT lamp (under the FORMS OVERRIDE button) is lit and the printer stops. Press and hold down the FORMS OVERRIDE button to complete printing the line or the page and to reactivate your computer. Be sure to insert paper in the Printer before continuing operation.

## CLEAR

Depressing this switch clears the Printer line buffer if the Printer is not in SELECT mode (has not been SELECTed).

## ALARM LAMP

This lamp (between CLEAR and FORMS OVERRIDE Switches) indicates the fuse of the carriage motor has been burned open. It is generally caused by a paper or ribbon jam. To recover from this condition, shut off power (push OFF switch), fix jammed paper or ribbon, replace the burned fuse, and turn the power on again. If the new fuse burns out again, contact your Wang Service Representative.

## 1.11 POINTS TO BE CHECKED

1. The Printer must be connected to its Controller Board.
2. The Printer must be plugged into a source of electrical power.
3. The tape in the Vertical Format Unit must be correctly seated.
4. Paper must be inserted in the Printer. (Push paper into either front or bottom slots of printer, place holes over pins, and use Platen Knob to adjust forms.)
5. The Forms Thickness must be set for good print quality. It can be adjusted as described in Section 1.5 on PRINT ADJUSTMENT.
6. Turn on the Printer and your Wang system.
7. Push SELECT to enable Printer to receive data.
8. Your Line Printer is now ready to use.

## CHAPTER 2 DEVICE SELECTION

### 2.1 THE SELECT STATEMENT

The SELECT statement must be used to select the Printer as the output device. A SELECT statement can be used either in the Immediate Mode or as a statement within a program. When used with the Model 2231W, the syntax of the SELECT statement requires that it contain a PRINT, LIST or CO command and a Device Type. Line length can also be specified. Each of these SELECT parameters is described below.

Example:

```
100 SELECT PRINT 215 (112)
Device Type
Unit Address
Line Length
```

If Line Length is not specified in a SELECT statement, then the line length is set to 64, the standard width of the CRT. In a system with an 80 column CRT, the line length is set to 80.

Example :

```
:SELECT LIST 215
```

### 2.2 DEVICE TYPE CODES

Every peripheral attached to your Wang System is assigned a three-character Device Type Code. The Device Code is in the form (xyy), where x is the Device Type and yy is the Unit Address. The Device Type (x) determines which internal system I/O routines are used to control the Printer. The Model 2231W automatically executes a line feed (i.e., advances the paper to a new line) following the execution of a carriage return; it is thus usually selected with a device type of 2. Generally, carriage return commands are initiated from the Wang system CPU. The printer automatically prints characters in the buffer and executes a carriage return at the end of a 112 character line. (132-character line for the Model 2231W-2.)

Type	Operation
0	This Device Type addresses devices that do not automatically execute a line feed after a carriage return; therefore, with this Device Type, your Wang system CPU supplies a line feed after each system-generated carriage return. When this Device Type is selected for the Model 2231W output which is normally single spaced is double spaced (see Figures 2.1 and 2.2).
2	This Device Type addresses devices that automatically execute a line feed after a carriage return; it is the Device Type normally used with the Printer. With this Device Type, output is single spaced.

NOTE:

This is the standard Device Type used with the Model 2231W.

- 4 This Device Type normally addresses devices such as plotters which do not have an automatic carriage return. When addressing a printer it suppresses the character count in the CPU and the automatic carriage return issued by the CPU at the end of PRINT, PRINTUSING and HEXPRINT statements that contain no trailing punctuations. Normally when the number of characters in the buffer equals the line length in a SELECT statement, a carriage return is executed. Device 4, however suppresses this feature by not executing a carriage return when the number of characters equals the line length. The carriage return is not executed until the print buffer is full (and a line is printed) or when the carriage return code HEX (0D) is encountered in the program.

The device address (yy) of the Model 2231W Printer Controller is preset to 15 by Wang Laboratories before the unit is shipped, and must be the address used in SELECT statements dealing with the Printer. If a second printer is used on the same CPU, it is assigned device address 16 by the Wang Service Representative who installs your system. Device address 15 is used in all further examples in this manual.







### 2.3 PRINT

```
:SELECT PRINT 215
```

This statement selects the Printer with Device Type Code 215 for all program output resulting from the execution of PRINT, PRINTUSING or HEXPRINT statements. Printout resulting from PRINT statements entered in the Immediate Mode appear on the CRT unless the Printer is selected for C0 (see SELECT C0 215).

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 in the program to direct the output of PRINT statements to the Printer.

Example :

```
:10 SELECT PRINT 215   or   :SELECT PRINT 215
:20 PRINT "X","2X"     :20 PRINT "X","2X"
:30 FOR X = 1 TO 5     :30 FOR X=1 TO 5
:40 PRINT X,X*2        :40 PRINT X,X*2
:50 NEXT X             :50 NEXT X
```

When either of these programs is executed, the printed output is:

X	2X
1	2
2	4
3	6
4	8
5	10

### 2.4 LIST

```
:SELECT LIST 215
```

This statement selects the Printer with Device Type Code 215 for all program listings (LIST operations).

NOTE:

The default address for LIST operations is 005, the CRT.

Example:

To list the program in the first example above on the Printer, key in as Immediate Mode statements:

```
:SELECT LIST 215
:LIST
```

The printed output is:

```
10 SELECT PRINT 215
20 PRINT "X", "2X"
30 FOR X=1 TO 5
40 PRINT X,X*2
50 NEXT X
```

## 2.5 CO (CONSOLE OUTPUT)

```
:SELECT CO 215
```

This statement selects the Printer with Device Type Code 215 for all console output. This 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.

Example:

Key in as an Immediate Mode statement SELECT CO 215, touch the RETURN/EXECUTE Key and touch the RESET key. The output on the printer is:

```
:READY
```

All information entered into the CPU via the keyboard is now printed on the Printer.

## 2.6 LINE LENGTH

The maximum number of characters per line that can be printed on the Model 2231W-1 is 112 (132 for the Model 2231W-2). To accommodate various paper widths and special forms whose width is less than the maximum number of characters in a line, the length of the output line can be specified by enclosing the desired line length in parentheses following the Device Type Code in the SELECT statement. This number is stored in the CPU and indicates the effective line length of the selected device to the System. For example:

SELECT PRINT 215 (112)	(Selects the Model 2231W for printing and sets line length to 112.)
SELECT LIST 215 (80)	(Selects the Model 2231W for listing programs and sets line length to 80.)
SELECT CO 215 (112)	(Selects the Model 2231W for console output and sets line length to 112.)

If a line length is not specified for PRINT, LIST or CO, the last line length selected for these operations are used. Note: the default line length set during Master Initialization is 64 characters (80 characters with an 80 column CRT). The maximum line length which can be specified in a SELECT statement is 255. However, the use of a line length greater than the physical carriage width of a device is not recommended.

The Line Printer does not print each character as it is received from the CPU. The Printer has a buffer for storing each character until the CPU directs it to print a line. The signal from the CPU to print a line is a carriage return code.

The line length setting is used by your Wang system to generate an automatic carriage return when a line exceeds the specified line length and when no carriage return is supplied by the program. This prevents printout from being lost. As a line of output is printed on the Model 2231W the CPU keeps a count of the number of characters sent. If this line count equals the current value of the line length before the output line is complete, a carriage return is transmitted to the printer, the line count is reset to zero, and the unfinished output is continued on the next line. If the output is completed and a carriage return is transmitted before the line count equals the line length, the system automatically resets the line count to zero for the start of a new line (a PRINT statement with no trailing comma or semicolon causes a carriage return to be executed at the end of the output). The line count is reset to zero under any one of the following conditions:

1. The line count equals the line length.
2. A carriage return is output when a PRINT, PRINTUSING or HEXPRINT statement is executed.
3. The system is RESET.
4. A CLEAR command is executed.
5. The system is Master Initialized.
6. Whenever a SELECT PRINT statement is executed.

The following example illustrates the automatic carriage return generated by the selected line length with this program in memory (note line length is set to 5):

```
10 SELECT PRINT 215(5)
20 PRINT "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG"
```

The following output is produced at execution time:

```
THE Q  
UICK  
BROWN  
FOX  
JUMPS  
OVER  
THE  
LAZY  
DOG
```

Note that embedded spaces in the line are included in the line count.

## 2.7 SPECIAL TECHNIQUES

The normal Device Type used with the Model 2231W is type 2. When the Printer is selected with this device type for LIST, PRINT, or CO, normal single spaced output is produced. Device Type 0 can also be used with the Model 2231W. In this case, output which appears single spaced under type 2 appears double spaced. This is because both the CPU and the Printer execute line feed commands following each system-generated carriage return (see example Figure 2.2).

Device Type 4 is intended for use with Wang plotter peripherals and has limited application with other types of peripherals. It can be of use with the Model 2231W Printer in the production of double spaced program listings. Normally, when double spacing is desired, the Printer is selected with Device Type 0 (e.g., SELECT LIST 015 (20)). In this case, all LIST output is double spaced. 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 2231W executes a carriage return, it supplies another line feed, producing the double spacing after each printed line.

When LISTing a program with Device Type 4, a program statement which overlaps 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 (see Figure 2.1). However, for normal PRINTing of a program output Device Type 4 should not be used.

With this exception, it is recommended that the Model 2231W normally be selected with Device Type 2 or 0.

## 2.8 COMBINED PARAMETERS

It is possible to combine parameters in a SELECT statement.

Example:

```
SELECT PRINT 215 (100), LIST 215(80), C0215 (112)
```

However, it is not possible to select two output devices with the same parameter.

For example, the statement

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

produces listing of programs on the CRT only.

## 2.9 DESELECTING THE MODEL 2231W

To deselect the Printer, use one of the following methods:

1. Select another device for PRINT, LIST or C0 by using the SELECT statement.
2. Master Initialize (turn Power Supply OFF, then ON). Master Initialization selects the CRT for all LIST, PRINT and C0 operations.
3. Key in CLEAR and touch the RETURN/EXECUTE key. PRINT and LIST operations are returned to the device currently selected for Console Output (C0). If the Printer is currently the C0 device, either method 1 or 2 must be used to deselect it.
4. Turn off the SELECT lamp.



## CHAPTER 3 FORMATTING OUTPUT

### 3.1 PRINT, PRINTUSING AND HEXPRINT STATEMENTS

The PRINT, PRINTUSING and HEXPRINT statements are used with the Line Printer in the same manner as they are used with the CRT, although more zones are available on the printer than on the CRT.

The 2231W-1 has a line length of 112 characters, divided into seven zones of 16 characters each. The zones constitute columns 0-15, 16-31, 32-47, 48-63, 64-79, 80-95, and 96-111 respectively.

The 2231W-2 has a line length of 132 characters, divided into eight zones of 16 characters each, and one 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 (see Note on next page).

If commas separate elements in a PRINT statement, then each element begins at the start of a new zone. If semicolons separate elements in a PRINT statement, the output appears in packed format, with no spaces between items. (See the Wang BASIC Reference Manual (or BASIC-2 Language Reference Manual) for a discussion of zoned and packed format.)

Examples:

```
10 SELECT PRINT 215(112)
20 PRINT 10,20,30,40,50
```

```
Output: 10                20                30                40                50
        10 SELECT PRINT 215(112)
        20 PRINT 10;20;30;40;50
        10  20  30  40  50
```



```
10 SELECT PRINT 215(112)
20 A$ = "10"
30 HEXPRINT A$
```

Output: 3130202020202020202020202020202020

```
10 SELECT PRINT 215(112)
15 A = 10
20 PRINT USING 30, A,A,A
30 % ## ##.# ###↑↑↑↑
```

Output: 10 10.0 100E-01

NOTE:

In zone printing on the 2231W-2, it is important to make sure that information supplied to the last zone (which is only 4 characters long) does not exceed 4 columns in length. If it exceeds 4 columns, the zone is omitted and the information is presented in the first zone of the next line.

Example:

```
:10 SELECT PRINT 215 (132)
:20 PRINT 1.2, 2.3, 35.67, 90.89, 70.2, 55.6, 12.3, 67.9, 284.3
:RUN
```

Output:

```
1.2 2.3 35.67 90.89 70.2 55.6 12.3 67.9
284.3
```

In the above example the 9th print element (284.3) exceeded 4 characters in length and thus was printed in the next line.

### 3.2 THE TAB( FUNCTION

The TAB( function is used in the same manner with the Line Printer as it is used with the CRT. When a PRINT statement containing a TAB( function is executed, the Line Printer prints at the column specified by the integer portion of the TAB( expression.

Example:

```
:SELECT PRINT 215 (80)
:10 PRINT TAB(30); "NAME"
:RUN
```

Executing the above example causes the Line Printer to print NAME starting at column 30. If the carriage has already passed the specified column, the TAB is ignored. Values of TAB expressions greater than 112 are illegal. If the value of the expression is greater than the selected line length, the Line Printer moves to the next line and completes the PRINT statement.

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

Example:

```
10 SELECT PRINT 215 (80)
20 PRINT TAB (30); 10
30 PRINT TAB (30); -70
```

Executing this example prints 10 starting in Column 31 and -70 starting in column 30.

### 3.3 EXPANDED PRINT

It is possible to print expanded characters for enhanced or highlighted output on the Line Printer. This method uses HEX code (OE) (see Chapter 4 for a more detailed discussion of HEX codes).

Example:

```
: 5 SELFCT PRINT 215
:10 PRINT HEX(OE),"EXPANDED PRINT"
:RUN
```

Executing the above example causes the following to appear on the Line Printer:

**EXPANDED PRINT**

The PRINT HEX(OE) command expands the print for only one line.

The 2231W-1 performs an automatic carriage return and line feed after 56 expanded characters although the 112 character buffer is only half full. (In the 2231W-2, an automatic carriage return and line feed are performed after 66 expanded characters are printed on a line.) If more characters are sent, they are stored in the buffer but are never printed and are erased upon completion of the line.

## CHAPTER 4 HEX CODES

### 4.1 THE HEX FUNCTION

The HEX function is used in a BASIC program to output characters on the Printer that do not appear on the standard keyboards or to output special Printer Control Codes. The HEX function has the form:

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

where h = a hex digit 0 to 9 or a letter A to F. An even number of characters must always appear in a HEX statement; spaces are not allowed. (See the Wang BASIC Reference Manual for hexadecimal characters and codes.) HEX codes can be combined. For example, the following program in memory,

```
10 SELECT PRINT 215
20 PRINT HEX(2424)
30 END
```

produces:

\$\$

when run since the code for '\$' is HEX(24).

### 4.2 CONTROL CODES

When the 2231W Printer receives a hex code for a printable character, it simply places the code into its print buffer. Unless the buffer is full, no immediate action is taken. However, certain special hex codes do not enter the buffer, and instead cause immediate action by the printer. These special codes are the printer control codes.

The special Control Codes for the Printer are:

Function	Hex Code	Description
ALARM	HEX(07)	Generates an audible tone about one second in duration from the speaker at the rear of the printer.
LINE FEED	HEX(0A)	Advances paper one line.
VERTICAL TAB	HEX(0B)	Advances paper until the next hole in channel 5 of the Vertical Format Unit paper tape is reached.

FORM FEED	HEX(0C)	Advanced paper until the next hole in channel 7 of the Vertical Format Unit paper tape is reached.
CARRIAGE RETURN	HEX(0D)	Causes the line of characters stored in the printer buffer to be printed. An automatic line feed occurs after the line has been printed and the print head returns to the left side of the printer carrier.
ELONGATED CHARACTER	HEX(0E)	Prints a line up to 56 characters as expanded (double-width) characters in the 2231W-1. For the 2231W-2 a line can have up to 66 expanded characters. (See Chapter 3.)
DELETE	HEX(7F)	Clears buffer of characters sent before the '7F'.

NOTE:  
 When hex codes are combined in a single statement line, control codes are executed first.

# CHAPTER 5

## THE VERTICAL FORMAT PAPER TAPE

### 5.1 TO COPY A VERTICAL FORMAT TAPE

To produce a copy of the tape supplied with your Printer, either a Teletype or a manual punch can be used. On a Teletype, insert master tape in reader and lock it in; turn switch to START.

To produce a new master tape on a Teletype:

1. Turn LOCAL switch to extreme clockwise position.
2. Turn PUNCH switch ON.
3. Press HERE IS key several times (to generate leader).
4. For a Vertical Tab hole (in channel 5), press and hold CONTROL key, and then press P. For a Vertical Tab and Top-of-Form holes (in channels 5 and 7), press P key alone. To generate sprocket holes (one space at a time), press and hold CONTROL and SHIFT, and then press P for each hole (see Figure 5.1).
5. When new tape is complete, press HERE IS key to generate ending trailer; remove tape from reader.

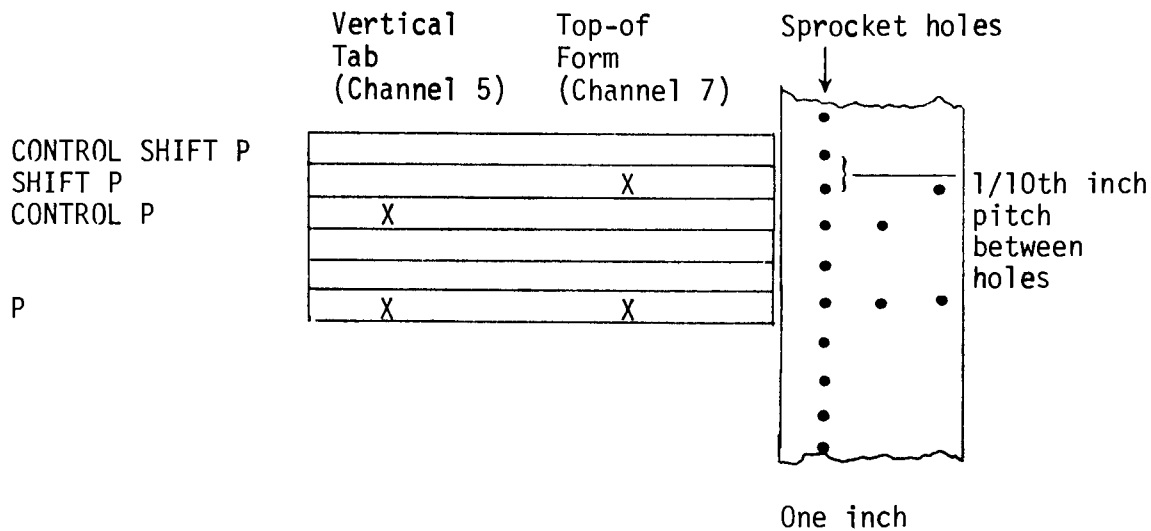


Figure 5.1 Vertical Format Tape

## 5.2 VERTICAL FORMAT TAPE READER

This is the control mechanism for Top of Form and Vertical Tabulation settings.

To replace Vertical Format Tape, raise the cover of the printer to gain access to the Tape Reader on the left side of the Printer (see Figure 5.2). Push open upper Reader Bracket and install tape ensuring that the sprocket teeth protrude through the mylar tape. Close Upper Reader Bracket.

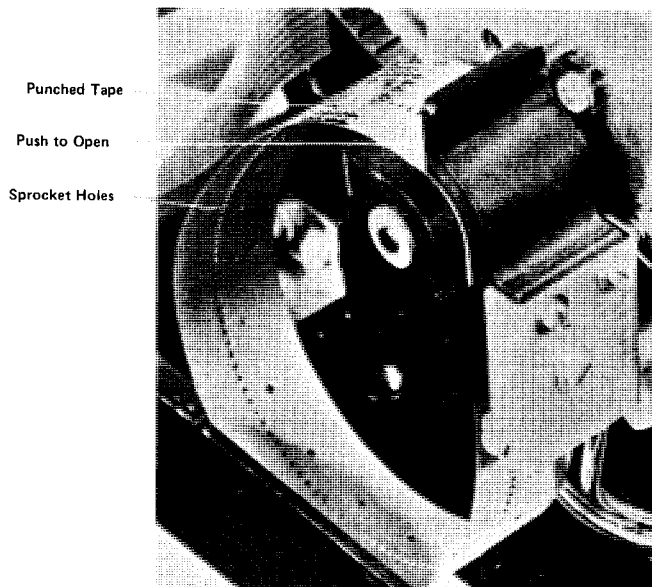


Figure 5.2 Tape Reader

## 5.3 TO SPLICE PREPARED TAPE

Overlay ends of prepared tape so that punched holes are properly spaced (see Figure 5.3); use perforated splicing tape to hold ends together.

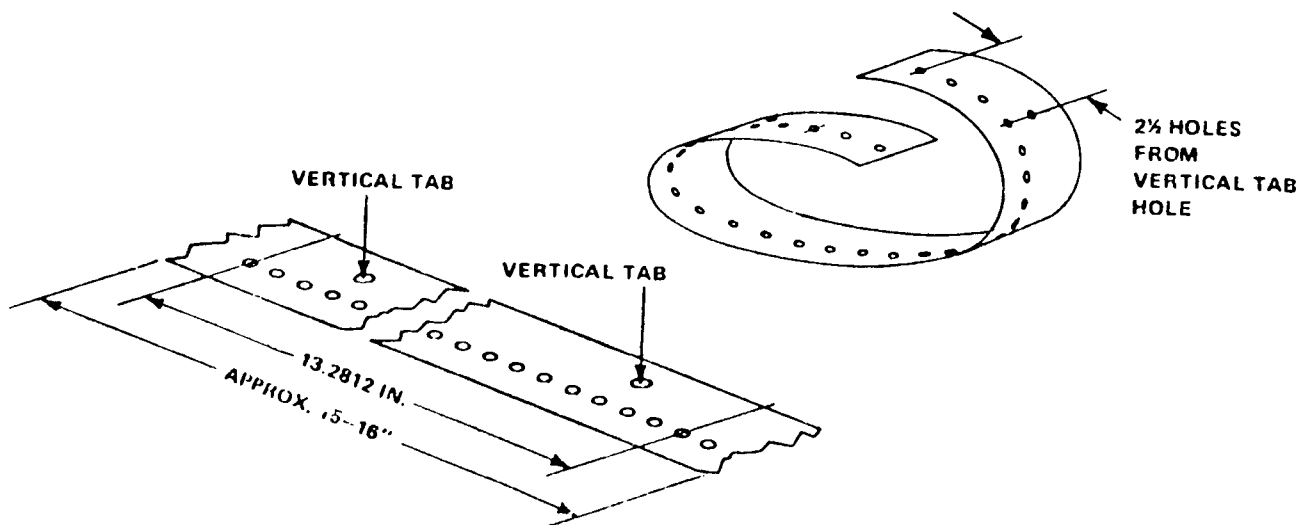


Figure 5.3 Splicing Prepared Tape

# APPENDIX A

## HEXADECIMAL CODES

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

\*ASCII DEL, a non-printable control character



## APPENDIX B SPECIFICATIONS FOR THE LINE PRINTER

Printout Speed.....	120 characters per second (45 to 250 lines per minute, dependent on line length)
Character Configuration.....	Dot Matrix: 7 (wide) x 9 (high) - normal 14 (wide) x 9 (high) - expanded Model 2231W-1 6 lines/in. (2.4/cm); 10 characters/in. (4/cm) Model 2231W-2 6 lines/in. (2.4/cm); 12 characters/in. (4.8/cm)
Line Width.....	Model 2231W-1 112 characters, maximum 56 characters, expanded Model 2231W-2 132 characters, maximum 66 characters, expanded
Character Set.....	Full alphanumeric
Duplicate Copies.....	The printer can generate a maximum of four duplicate copies in addition to the original.
Printer Size: Width.....	24 in. (61 cm)
Depth.....	18 in. (46 cm)
Height.....	10 in. (25 cm)
Weight.....	60 lb (27 kg)
Site Width.....	not less than 40 in. (1m)
Fuses.....	1.5A(SB) for 115 VAC, 8/10A(SB) for 230 VAC; 2.5A(SB) for DC carriage motor.
Power Requirements.....	115 or 230 VAC $\pm$ 10% 50 or 60 Hz $\pm$ Hz
Cable.....	12 ft (3.66m) cable with connector for the CPU plug jack.
Operating Environment.....	50°F to 90°F (10°C to 32°C), 20% to 80% relative humidity, allowable. 35% to 65% recommended.

## APPENDIX C

### PAPER SPECIFICATIONS FOR THE LINE PRINTER

(If paper does not conform to these specifications, degraded forms handling can occur.)

1. Material must be margin-perforated fanfold paper or card stock; perforations are used for guiding by pin-feed units.
2. Maximum form length is not to exceed 11 in. (27.9 cm).
3. Paper Stock:
  - a. For single part forms, use 15 to 20 lb bond (20 lb for improved forms handling).
  - b. For multipart forms use:
    - 2 ply: 15/15 lb bond, 7 lb carbon
    - 3 ply: 15/12/15 lb bond, 7 lb carbon
    - 4 ply: 12/12/12/15 lb bond, 7 lb carbon
    - 5 ply: 12/12/12/12/15 lb bond, 5 lb carbon(up to four copies in addition to the original can be used)
  - c. Form width must be:
    - 3 1/2 in. (8.9 cm) minimum.
    - 13 1/2 in. (34.3 cm) maximum (edge-to-edge).
4. Fastening of multipart forms:
  - a. Improved multipart paper handling can be achieved with glued margins.
  - b. Multipart forms must otherwise be fastened with crimps every two inches (5.1 cm) along both edges of the forms. NCR or other specialty paper can be fastened up to four parts of the form length.
  - c. Crimp must not come closer to the fanfold than 0.50 in. (1.27 cm).
  - d. Each crimp must have four prongs, two to enter both form and carbon and two to enter forms only. Card stock should be tested first.
5. Forms thickness:
  - a. Maximum in the print area: 0.018 in. (0.046 cm) (allows for four 12 lb., one 15 lb and four 7 lb carbon parts).
  - b. Over crimps in the pin-feed margin: 0.030 in. (0.076 cm).
6. Sprocket holes:
  - a. Must run along both margins 0.25 - .03 in. (0.635 - 0.076 cm) from paper edge to the hole center lines.

- b. Distance between hole centers along the margins must be  $0.5 + 0.005$  in. ( $1.27 \pm 0.013$  cm) non-accumulative in any five in. ( $12.7$  cm) length.
  - c. Hole diameters must be  $0.156 + 0.005$  in. ( $0.396 + 0.013$  cm) (the two top and bottom drive holes on each sheet (four per sheet) can be up to  $0.200$  in. ( $0.508$  cm) in diameter to permit post or ring binding of output).
  - d. Distance between hole centers across the sheet must be uniform within  $0.015$  in. ( $0.038$  cm) to a maximum of  $12-5/16$  in. ( $31.27$  cm).
7. When using forms with wide and narrow copies in the same set, the top copy should always be the fullest width.
8. For pre-printed forms:
- a. Pin-hole center to left side of left-most character cannot be less than  $3/8 + 1/16$  in. ( $1.0 \pm 2.0$  cm).
  - b. Pin-hole center to right side of last character cannot be less than  $3/8 + 1/16$  in. ( $1.0 \pm 0.2$  cm).

# INDEX

Buffer . . . . .	1, 10, 15, 23
Carriage Return . . . . .	9, 10, 24
Carriage Width . . . . .	1, 29
Cartridge Ribbon . . . . .	5
Combined Parameters . . . . .	16
Combining HEX Codes . . . . .	24
Control Panel . . . . .	2, 7
CPU . . . . .	7, 9, 10
Deselecting the High-Speed Printer . . . . .	17
Device Address . . . . .	9, 10
Device Code . . . . .	10
Device Type . . . . .	9, 10
Expanded Print . . . . .	21
FORMS OVERRIDE Switch . . . . .	8
Fuses . . . . .	6, 28
HEX Codes . . . . .	23, 27
Inspection . . . . .	2
Installation . . . . .	2
Introduction . . . . .	1
Line Length . . . . .	9, 11, 12, 14
Master Initialization . . . . .	7, 15
Output (Double Spaced) . . . . .	11, 12
Output (Single Spaced) . . . . .	11, 12
Packed Format . . . . .	19
Paper . . . . .	29
PAPER OUT Switch . . . . .	2, 8
Power ON/OFF Switch . . . . .	2, 7
Power Supply Unit . . . . .	7
PRINTUSING Statement . . . . .	19
SELECT CO Statement . . . . .	9, 14, 17
SELECT LIST Statement . . . . .	9, 11, 13, 14
SELECT Switch . . . . .	7, 8
Semicolon . . . . .	19
Splicing Prepared Tape . . . . .	26
TAB( Function . . . . .	21
Tape Reader . . . . .	6, 26
TOP OF FORM Switch . . . . .	6, 8
2200 Turn-On Procedure . . . . .	7
2231W Turn-On Procedure . . . . .	7
Unpacking . . . . .	2
Vertical Format Tapes . . . . .	6, 7, 25, 27
Vertical Tab . . . . .	6, 25
Zoned Format . . . . .	19

## PREVENTIVE MAINTENANCE INFORMATION

### MAINTENANCE

It is recommended that your equipment be serviced quarterly. A Maintenance Agreement is available to assure this servicing automatically. If no Maintenance Agreement is acquired, any servicing must be arranged for by the customer. A Maintenance Agreement protects your investment and offers the following benefits:

**Preventive Maintenance:** Your equipment is inspected quarterly for worn parts, lubricated, cleaned and updated with engineering changes, if any. Preventive maintenance minimizes "downtime" by anticipating repairs before they are necessary.

**Fixed Annual Cost:** When you buy a maintenance agreement, you issue only one purchase order for service for an entire year and receive one annual billing; more frequent billing can be obtained, if desired.

Further information regarding Maintenance Agreements can be acquired from your local Sales Service Office.

#### NOTE:

Wang Laboratories, Inc. does not guarantee or honor maintenance agreements for any equipment modified by the user. Damage to equipment incurred as a result of such modification becomes the financial responsibility of the user.

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.

700-3877C

---

TITLE OF MANUAL      **2231W LINE PRINTER USER MANUAL**

COMMENTS:

\_\_\_\_\_

Fold

\_\_\_\_\_

Fold



Fold

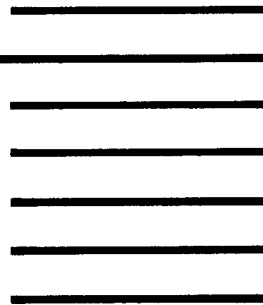


**FIRST CLASS**  
PERMIT NO. 16  
Tewksbury, Mass.

**BUSINESS REPLY MAIL**  
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

— POSTAGE WILL BE PAID BY —

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



Cut along dotted line.

Attention: Technical Writing Department

Fold

## North America:

<b>Alabama</b> Birmingham Mobile	<b>District of Columbia</b> Washington	<b>Louisiana</b> Baton Rouge Metairie	<b>New Hampshire</b> East Derry Manchester	<b>Oregon</b> Beaverton Eugene	<b>Virginia</b> Newport News Richmond
<b>Alaska</b> Anchorage	<b>Florida</b> Jacksonville Miami Orlando Tampa	<b>Maryland</b> Rockville Towson	<b>New Jersey</b> Howell Mountainside	<b>Pennsylvania</b> Allentown Camp Hill Erie Philadelphia Pittsburgh Wayne	<b>Washington</b> Seattle Spokane
<b>Arizona</b> Phoenix Tucson	<b>Georgia</b> Atlanta	<b>Massachusetts</b> Boston Burlington Littleton Lowell Tewksbury Worcester	<b>New Mexico</b> Albuquerque	<b>Rhode Island</b> Cranston	<b>Wisconsin</b> Brookfield Madison Milwaukee
<b>California</b> Fresno Inglewood Los Angeles Sacramento San Diego San Francisco San Mateo Sunnyvale Tustin Ventura	<b>Hawaii</b> Honolulu	<b>Michigan</b> Grand Rapids Okemos Southfield	<b>New York</b> Albany Buffalo Lake Success New York City Rochester Syracuse	<b>South Carolina</b> Charleston Columbia	
<b>Colorado</b> Denver	<b>Illinois</b> Chicago Morton Park Ridge Sunnyvale Rock Island	<b>Minnesota</b> Eden Prairie	<b>North Carolina</b> Charlotte Greensboro Raleigh	<b>Tennessee</b> Chattanooga Knoxville Memphis Nashville	<b>Canada</b> Wang Laboratories (Canada) Ltd. Don Mills, Ontario Calgary, Alberta Edmonton, Alberta Winnipeg, Manitoba Ottawa, Ontario Montreal, Quebec Burnaby, B.C.
<b>Connecticut</b> New Haven Stamford Wethersfield	<b>Indiana</b> Indianapolis South Bend	<b>Missouri</b> Creve Coeur	<b>Ohio</b> Cincinnati Columbus Middleburg Heights Toledo	<b>Texas</b> Austin Dallas Houston San Antonio	
	<b>Kansas</b> Overland Park Wichita	<b>Nebraska</b> Omaha	<b>Oklahoma</b> Oklahoma City Tulsa	<b>Utah</b> Salt Lake City	

## International Subsidiaries:

<b>Australia</b> Wang Computer Pty. Ltd. Sydney, NSW Melbourne, Vic. Canberra, A.C.T. Brisbane, Qld. Adelaide, S.A. Perth, W.A. Darwin, N.T.	<b>Great Britain</b> Wang Electronics Ltd. Northwood Hills, Middlesex Northwood, Middlesex Harrogate, Yorkshire Glasgow, Scotland Uxbridge, Middlesex	<b>Republic of South Africa</b> Wang Computers (South Africa) (Pty.) Ltd. Bordeaux, Transvaal Durban Capetown
<b>Austria</b> Wang Gesellschaft M.B.H. Vienna	<b>Hong Kong</b> Wang Pacific Ltd. Hong Kong	<b>Sweden</b> Wang Skandinaviska AB Solna Gothenburg Arloev Vasteras
<b>Belgium</b> Wang Europe, S.A. Brussels Erpe-Mere	<b>Japan</b> Wang Computer Ltd. Tokyo	<b>Switzerland</b> Wang S.A./A.G. Zurich Bern Pully
<b>Brazil</b> Wang do Brasil Computadores Ltda. Rio de Janeiro Sao Paulo	<b>Netherlands</b> Wang Nederland B.V. Ijsselstein	<b>West Germany</b> Wang Laboratories GmbH Berlin Cologne Duesseldorf Fellbach Frankfurt/M. Freiburg/Brsq. Hamburg Hannover Kassel Munich Nuernberg Stuttgart

## International Representatives:

Argentina	Kenya
Bolivia	Korea
Canary Islands	Lebanon
Chile	Liberia
Colombia	Malaysia
Costa Rica	Mexico
Cyprus	Morocco
Denmark	Nicaragua
Dominican Republic	Nigeria
Ecuador	Norway
Finland	Pakistan
Ghana	Peru
Greece	Philippines
Guatemala	Portugal
Iceland	Saudi Arabia
India	Spain
Indonesia	Sri Lanka
Iran	Syria
Ireland	Thailand
Israel	Tunisia
Italy	Turkey
Jamaica	United Arab Emirates
Japan	Venezuela
Jordan	Yugoslavia

# WANG

LABORATORIES, INC.

ONE INDUSTRIAL AVENUE, LOWELL, MASSACHUSETTS 01851. TEL. (617) 951-4111, TWX 710 343-8769. TELEX 94-7421

Printed in U.S.A.  
700-3877C  
10-79-2M

Price: see current list