WANG

MODEL 2231W-3
LINE PRINTER
USER MANUAL

SYSTEM 2200

MODEL 2231W-3
LINE PRINTER
USER MANUAL

WANG 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.

WANG 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-3 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.

TABLE OF CONTENTS

APPENDICES

CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes the characteristics and operations of the Model 2231W-3 Line Printer (see Figure 1-1). The Model 2231W-3 is an impact printer that generates printed characters in a matrix form, nominally 7 x 8, in a line up to 132 characters long. The printer operates at a rate of 120 characters-per-second and can achieve a rate of 45 to 250 lines-per-minute dependent upon line length. The 2231W-3 prints 14.4 characters to the inch (5.7 characters/cm). When required, characters can be expanded for enhanced output (see Chapter 3). The complete ASCII, 112-character set for the printer is given in Appendix A. A 132-character buffer receives a complete line of data transmitted from the system CPU to the printer. 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.

When the Model 2231W-3 is used with the Model 2282 Graphic CRT, it prints a copy of the plotted information on the Graphic CRT. The Model 2231W-3 can also respond to normal print operations when attached to the Model 2282 Graphic CRT.

Figure 1-1 Model 2231W-3 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 in the CPU chassis of your system by a Wang Service Representative. The controller board screws should be fully tightened.

2. When the Model 2231W-3 is used with the Model 2282 Graphic CRT, the printer's 36-pin interface connector must be plugged into the output connector of the Model 2282. Otherwise the 36-pin interface connector must be plugged into the Printer Controller Board on the CPU (or the "PRINTER" output connector in the PCS-II or 2200WS).

3. The power cord from the Line Printer must be plugged into a grounded wall outlet (see power requirements in Appendix B).

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 1-2 and Figure 1-3). (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 screw the lock knob and close the cover of the printer.

4. Press the ON/OFF rocker switch at the rear of the printer. When the printer is on, the power lamp (left indicator of Control Panel) is illuminated.

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.

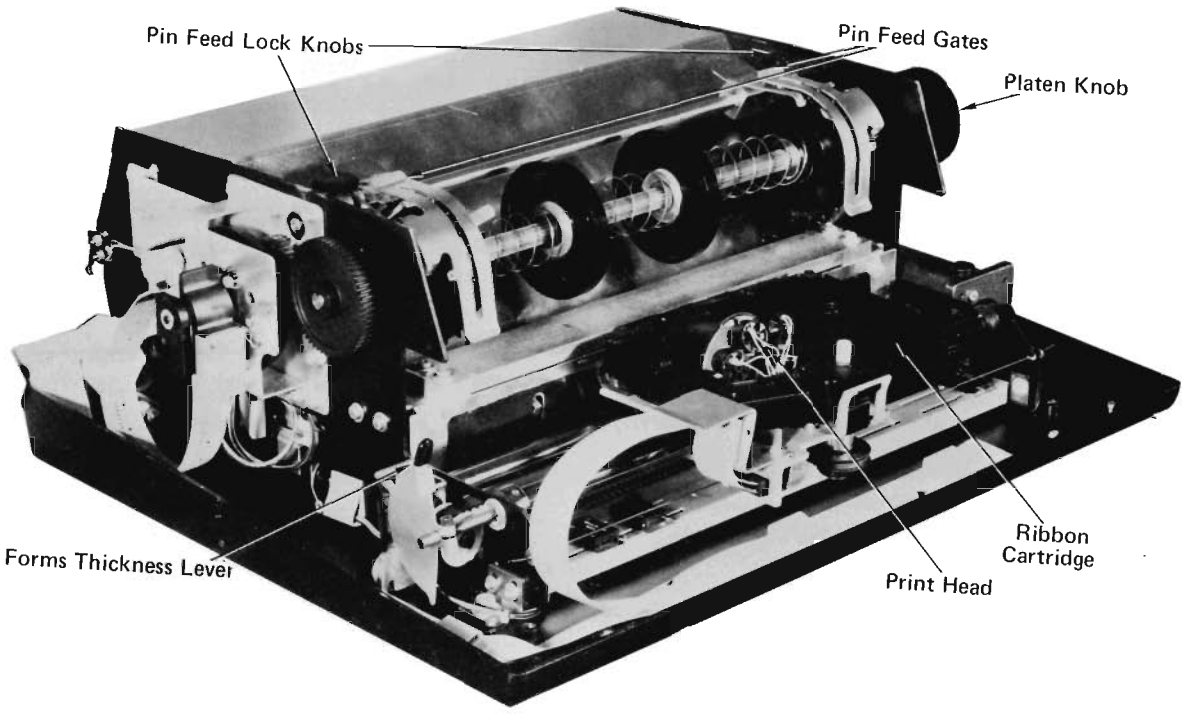


Figure 1-2. Model 2231W-3 Line Printer, Definition of Terms

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.

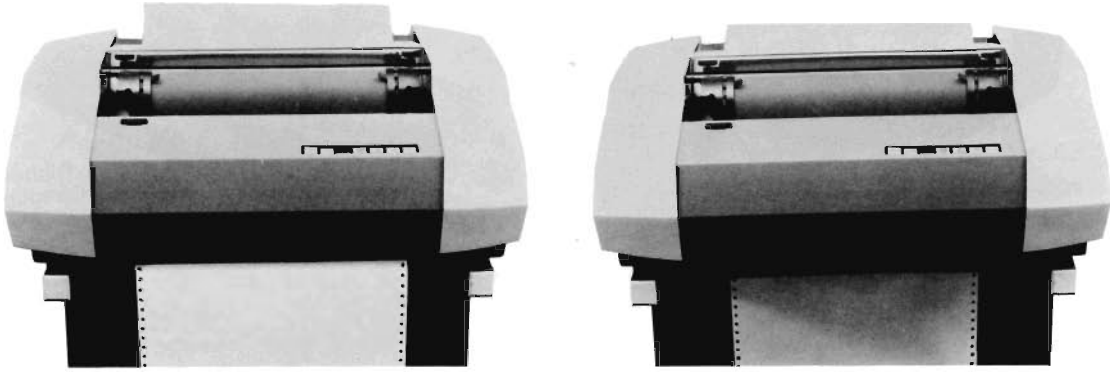
NOTE:

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 Loading Slots

1.5 PRINT ADJUSTMENT

To adjust the print blackness for different form thicknesses, 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 1-2).

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; move the lever 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, check to 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 to remove the ribbon.

4. Remove the cartridge by grasping the sides and pulling it up from the print head carriage.

5. Place the new cartridge in the 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 1-4) 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.

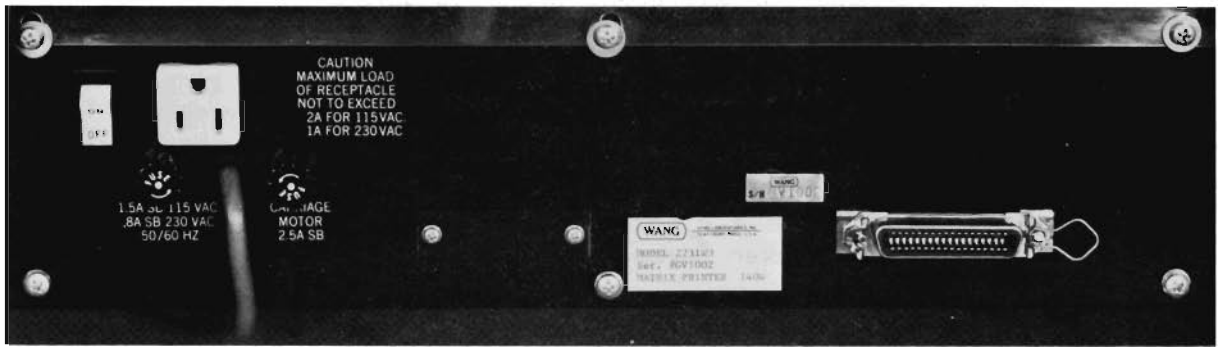


Figure 1-4 Back of Printer

1.8 VERTICAL FORMAT CONTROL

The mechanism which guides and controls paper movement in the Model 2231W-3 is located on the left side of the printer. The Vertical Format Unit (Figure 1-5) 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.

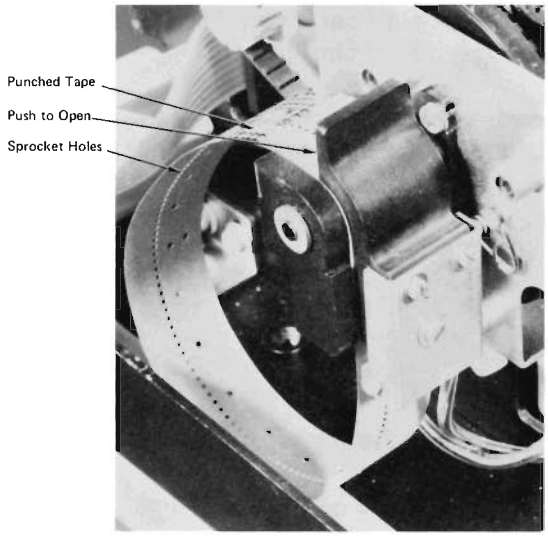


Figure 1-5. Vertical Format Unit

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-OF-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® 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-3 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 1-6).

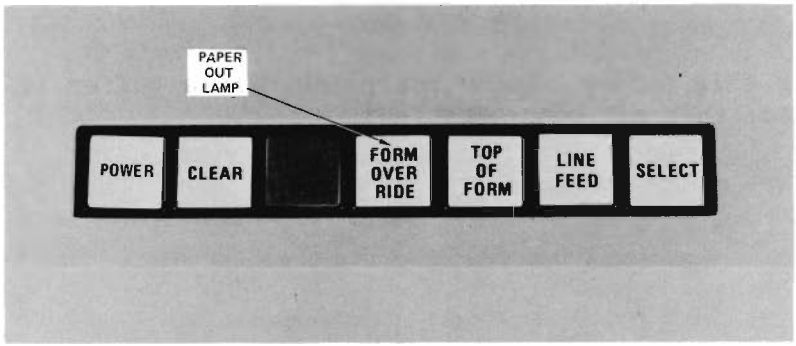


Figure 1-6. Control Panel

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 illuminated. To turn OFF the printer, press the OFF switch; the Power lamp is extinguished.

SELECT

After turning ON the printer, press the SELECT switch; the Select lamp is illuminated. SELECT places the printer in the ready position to receive data from the CPU (or from the Model 2282). 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 or plotting 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 the 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, contact your Wang Service Representative.

1.11 POINTS TO BE CHECKED

1. The printer must be connected to either the Line printer Controller Board on the CPU or the output connector on the Model 2282.

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, PRINT ADJUSTMENT.

6. Turn on the printer (also the Model 2282, if available) and your Wang system.

7. Push SELECT to enable the 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-3, the syntax of the SELECT statement requires that it contain the BASIC verb PRINT, LIST or CO, a Device Type, and a Unit Address code. Line length can also be specified.

Example:

```
100 SELECT PRINT 215 (132)
Device Type_____/ /
Unit Address_____|
Line Length _____|
```

If Line Length is not specified in a SELECT statement, then the line length defaults to the standard width of the CRT, either 64 or 80 columns.

Example:

```
:SELECT PRINT 215
:10 PRINT "THE MODEL 2231W-3 LINE PRINTER PRINTS AT A RATE OF 45 TO
    250 LINES PER MINUTE DEPENDING ON LINE LENGTH."
:RUN(EXECUTE)
```

Output:

```
THE MODEL 2231W-3 LINE PRINTER PRINTS AT A RATE OF 45 TO 250 LINES PER MINUTE DE
PENDING ON LINE LENGTH
```

2.1.1 Device Type Codes

Every peripheral attached to your Wang System is assigned a three-character Device Selection Code. The Device Selection 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-3 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 (see Device Types below). Generally, carriage return commands are initiated from the Wang System CPU. The printer, however, automatically prints characters in the buffer and executes a carriage return at the end of a 132 character line.

Type	Operation
0	Device Type 0 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-3, output which is normally single spaced is double-spaced.

Example:

```
:SELECT PRINT 015 (100)
:10 FOR I=1 TO 5
:20 PRINT "AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW"
:30 NEXT I
:RUN(EXECUTE)
```

Output:

```
AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW

AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW

AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW

AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW

AABBCCDDEEFFGGHHIIJJKKLLMMNNOOPPQQRRSSTTUUVVWW
```

2	Device Type 2 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-3.

Example:

```
:SELECT PRINT 215
:10 FOR I = 1 TO 5
:20 PRINT "01234567ABCDEFGHIJKLMNOPQRSTUVWXYZ"
:30 NEXT I
```

Output:

```
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ
0123456789ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

4. Device type 4 is intended for use with Wang plotter peripherals and has limited application with other types of peripherals. When Device Type 4 is used with PRINT operations, it suppresses the automatic carriage return normally issued by the CPU at the end of PRINT, PRINTUSING and HEXPRINT statements that contain no trailing punctuation. In this case the Line Printer initiates an automatic carriage return only when the carriage return code HEX (OD) is encountered in the program.

Example:

```
:10 SELECT PRINT 415
:20 FOR I=1 TO 5
:30 PRINT "AABBCC"
:35 PRINT HEX(OD)
:40 NEXT I
:RUN (EXECUTE)
```

Output:

```
AABBCC
AABBCC
AABBCC
AABBCC
AABBCC
```

Device type 4 can also be used with the Line Printer to produce double-spaced program listings. 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.

Example:

```
:10 REM LISTING A PROGRAM WITH DEVICE TYPE 4
:20 DIM A(25), B(25)
:30 PRINT "PASCAL'S TRIANGLE"
:40 B(1)=1: FOR I=2 TO 21: FOR J=2 TO I:
    A(J)=B(J)+B(J-1):PRINT TAB(7*J-20);
    A(J);:NEXT J: FOR J=1 TO I:B(J)=A(J):
    NEXT J:PRINT:
    NEXT I:REM THIS ENDS THE CALCULATIONS, RETURN
    TO PART 5
:50 END
:SELECT LIST 415
:LIST(EXEC)
```

Output: (reduced)

```
10  REM LISTING A PROGRAM WITH DEVICE TYPE 4

20  DIM A(25),B(25)

30  PRINT "PASCAL'S TRIANGLE"

40  B(1)=1: FOR I=2 TO 21: FOR J=2 TO I: A(J)=B(J)+B(J-1): PRINT TAB(7*J-20);A(J);: NEXT J: FOR J=1 TO I: B(J)=A(J): NEXT J: PRINT : NEXT I: REM
 THIS ENDS THE CALCULATIONS, RETURN TO PART 5

50  END
```

NOTE:

With the exception of using Device Type 4 for Listing, it is recommended that the Model 2231W-3 normally be selected with Device Type 2 or 0 for PRINT, LIST, and CO operations.

2.1.2 Unit Address

The unit address (yy) of the Line 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 Wang 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.

2.1.3 Line Length

Line Length is a CPU system parameter which specifies the number of characters to be sent out to the printer before the system automatically sends out a carriage return and resets the internal line count. The value of line length is normally less than the width of the paper in the printer. The maximum number of characters per line that can be printed on the Model 2231W-3 is 132. In the SELECT statement line length is indicated in the parentheses following the Device Selection Code. For example:

SELECT PRINT 215 (132)	(Selects the Model 2231W-3 for printing and sets line length to 132.)
SELECT LIST 215 (90)	(Selects the Model 2231W-3 for listing programs and sets line length to 90.)
SELECT CO 215 (120)	(Selects the Model 2231W-3 for console output and sets line length to 120.)

If a line length is not specified for PRINT, LIST or CO, the last line length selected for these operations is 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. A shorter line length causes a carriage return to be sent out when the line length is exceeded.

Example:

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

Output:

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

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

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 by sending 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-3 the CPU keeps a count of the number of characters sent (line count). 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.

Example:

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

Output:

```
ABCDEFGHIJKLMNOPQRST
UVWXYZ
```

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).

Example:

```
:10 REM EXAMPLE OF PRINT STATEMENT WITH NO TRAILING COMMA OR SEMICOLON
:20 SELECT PRINT 215 (30)
:30 PRINT "KEEP"
:40 PRINT "OUT"
:RUN(EXECUTE)
```

Output:

```
KEEP
OUT
```

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. A SELECT PRINT statement is executed.

2.2 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 and HEXPRINT statements entered in the Immediate Mode appears on the CRT unless the printer is selected for CO (see Section 2.4).

NOTE:

When your system is first turned on, PRINT operations are SELECTED to 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. Also, the printer SELECT switch lamp must be on.

Example:

```
:10 SELECT PRINT 215          or    :SELECT PRINT 215
:20 PRINT "N", "2 to the Nth"       :20 PRINT "N", "2 to the Nth"
:30 FOR X=0 TO 8                    :30 FOR X=0 TO 8
:40 PRINT X,2↑X                     :40 PRINT X,2↑X
:50 NEXT X                          :50 NEXT X
```

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

```
N             2 to the Nth
 0             1
 1             2
 2             4
 3             8
 4             16
 5             32
 6             64
 7             128
 8             256
```

Example:

```
:10 SELECT PRINT 215
:20 X=7: Y=2.0: Z=0.5
:30 PRINTUSING 40, X; Y; Z
:40% ##.#
:RUN(EXECUTE)
```

Output:

```
 7.0  2.0  0.5
```

Example:

```
:10 SELECT PRINT 215
:20 DIM A$ 25
:30 A$ = "THE MODEL 2231W-3 PRINTER"
:40 HEXPRINT A$
:RUN (EXECUTE)
```

Output:

```
544845204D4F44454C2032323331572D3320052494E544552
```

2.3 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(EXECUTE)
```

The printed output is:

```
10  SELECT PRINT 215
20  PRINT "N","2 to the Nth"
30  FOR X= 0 TO 8
40  PRINT X,2↑X
50  NEXT X
```

2.4 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.

2.5 COMBINED 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 with the same parameter.

For example, the statement

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

produces a listing of programs on the CRT only.

2.6 DESELECTING THE MODEL 2231W-3 FROM THE CPU

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 (turn Power Supply OFF, then ON). Master Initialization selects the CRT for all LIST, PRINT, and CO 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 (CO). If the printer is currently the CO 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-3 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.

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 for a discussion of zoned and packed format.)

Example 1:

```
:10 REM PRINTING IN ZONED FORMAT WITH COMMAS
:20 SELECT PRINT 215(132)
:30 PRINT "COLUMNS", "COLUMNS", "COLUMNS"
:40 PRINT "0 TO 15", "16 TO 31, "32 TO 47"
:RUN(EXECUTE)
```

Output:

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

Example 2:

```
:10 REM SKIPPING OVER ZONES WITH COMMAS
:20 SELECT PRINT 215(132)
:30 PRINT "STYLE NO." ,,, "QUANTITY IN STOCK"
:40 PRINT "(COLUMNS 0-15)" ,,, "(COLUMNS 48-63)"
:45 PRINT
:50 PRINT "A50-630",,, 74
:RUN(EXECUTE)
```

Output:

```
STYLE NO.                                    QUANTITY IN STOCK
(COLUMNS 0-15)                               (COLUMNS 48-63)

A50-630                                       74
```

Example 3:

```
:10 REM PRINTING IN PACKED FORMAT WITH SEMICOLONS
:20 SELECT PRINT 215(120)
:30 A$="U.S.S BOSTON": B$="MISSLE CRUISER"
:40 PRINT "NAME:"; A$, "CLASSIFICATION:"; B$
:RUN(EXECUTE)
```

Output:

```
NAME: U.S.S. BOSTON          CLASSIFICATION: MISSILE CRUISER
```

Example 4:

```
:10 REM FORMATTING WITH PRINTUSING STATEMENT
:20 SELECT PRINT 215
:30 A$="U.S.S BOSTON": B$="MISSLE CRUISER"
:40 PRINTUSING 50, A$, B$
:50% NAME-############   CLASS-################
:RUN(EXECUTE)
```

Output:

```
NAME  U.S.S. BOSTON  CLASS  MISSILE CRUISER
```

Example 5:

```
:10 REM PRINTING WITH HEXPRINT STATEMENT
:20 SELECT PRINT 215
:30 A$="ABC DEF GHI JKL"
:40 HEXPRINT A$
:RUN(EXECUTE)
```

Output:

```
41424320444546204748492O4A4B4C20
```

NOTE:

In zone printing on the 2231W-3, it is important to make sure that information supplied to the last zone (which is only four characters long) does not exceed four columns in length. If it exceeds four columns, the zone is omitted and the information is presented in the first zone of the next line.

Example:

```
:SELECT PRINT 215 (132)
:20 PRINT "LOT", 2.3, 35.67, 90.89, 70.2, 55.6, 12.3, 67.9, 284.3
:RUN(EXECUTE)
```

Output: (compressed)

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

In the above example the ninth print element (284.3) exceeded 4 characters in length and thus was printed on 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 (132)
:10 PRINT TAB (60); "MASTER RATE SCHEDULE"
:20 PRINT: PRINT
:30 PRINT TAB (40); "JOB CODE"; TAB (60);
    "DESCRIPTION"; TAB (80); "PAYRATE";
    TAB(110); "BENEFIT CODE"
:RUN(EXECUTE)
```

Output:

```
                    MASTER RATE SCHEDULE

JOB CODE          DESCRIPTION          PAY RATE          BENEFIT CODE
```

In the above example "MASTER RATE SCHEDULE" is printed starting at column 60; similarly, the headings in line 30 are printed at the specified TAB settings.

If the value of the TAB(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:

```
:10 SELECT PRINT 215
:20 A = 25
:30 PRINT TAB(A); "FIGHTER MODEL"; TAB(3*A); "MAXIMUM ALTITUDE"
:RUN(EXECUTE)
```

Output:

```
                         FIGHTER MODEL
MAXIMUM ALTITUDE
```

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
: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(EXECUTE)
```

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
```

3.3 EXPANDED PRINT

It is possible to print expanded characters for enhanced or highlighted output on the Line Printer by using the HEX code (0E) in a PRINT statement.

Example:

```
: 5 SELECT PRINT 215 (132)
:10 PRINT HEX(0E),"CODE HEX(0E) USED FOR EXPANDED PRINT"
:RUN
```

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

```
CODE HEX(0E) USED FOR EXPANDED PRINT
```

The PRINT HEX(0E) command expands the print for only one line.

The 2231W-3 performs an automatic carriage return and line feed after 66 expanded characters although the 132 character buffer is only half full. If more characters are sent, they are stored in the buffer but are never printed and are erased upon completion of the line.

The HEX code (0E) can also be used with the PRINTUSING statement. For example, the following program prints 'CODE NO.='in expanded print.

```
:10 A$ = HEX(0E)
:20 PRINTUSING 30, A$
:30% CODE NO. = ####
RUN(EXECUTE)
```

Output:

```
CODE NO.=
```

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 and 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 also be combined. For example, the following program in memory,

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

produces:

```
A

B
```

when run, since the code for 'A' is HEX(41), 'carriage return' is HEX(0D), 'line feed' is HEX(0A), and 'B' is HEX(42). (See Appendix A.)

4.2 CONTROL CODES

When the 2231W-3 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.
SET PLOT MODE	HEX(08)	Places the printer in the Plot mode. In this mode the printer accepts input from the Model 2282 Graphic CRT.
SET LINE FEED SPACING	HEX(09XX)	Sets the line feed spacing as HEX(XX) times 1/72 inches. XX can vary from 01 to 0F (1 to 15). The default value for line feed spacing is 1/6 inch (6 lines per inch). Sending a HEX (09XX) code to the printer sets the line feed spacing to HEX(XX) times (1/72) for a single print line. Subsequent lines are printed at the default spacing of 1/6 inch.

Example:

```
:10 SELECT PRINT 215
:20 PRINT HEX(090F),"LINE SPACING
                    =15/72 INCHES"
:30 PRINT "LINE SPACING = 1/6 INCHES"
:40 PRINT "LINE SPACING = 1/6 INCHES"
```

Output:

```
LINE SPACING = 15/72 INCHES
LINE SPACING = 1/6 INCHES
LINE SPACING = 1/6 INCHES
```

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)	Advances 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 66 characters as expanded (double-width) characters. (See Chapter 3.)
DELETE	HEX(7F)	Clears the buffer of characters sent before the '7F'.

> NOTE:
>
> When HEX codes are combined in a single statement line, Control Codes are executed as they occur.

Example:

```
:10 PRINT HEX(57414E47200D0A4C414253)
```

Output:

```
WANG

LABS
```

CHAPTER 5
THE VERTICAL FORMAT TAPE

5.1 HOW 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 the master tape in the reader and lock it in; turn the 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 the new tape is complete, press HERE IS key to generate ending trailer; remove the tape from the reader.

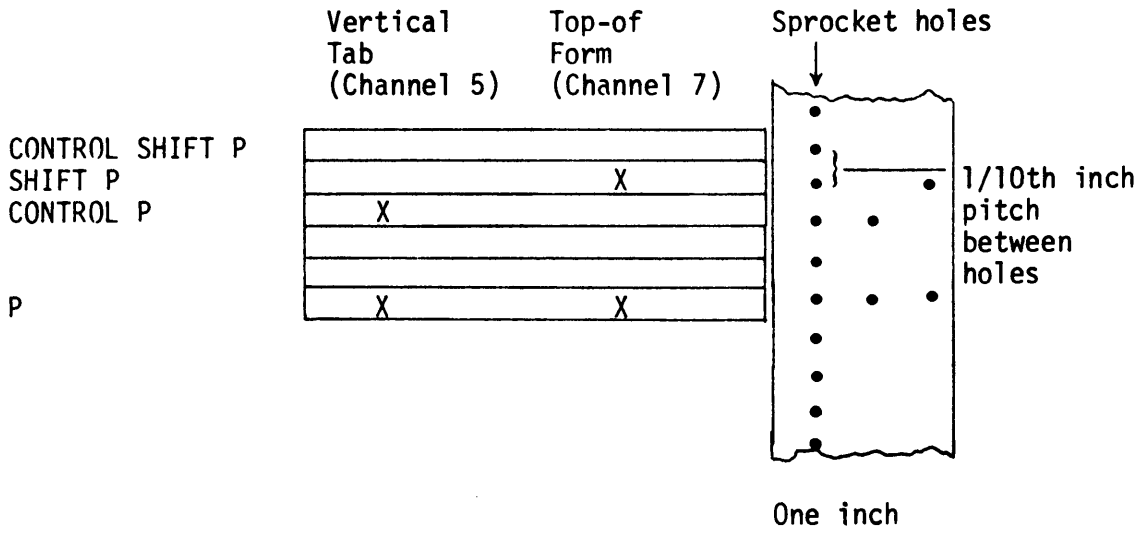


Figure 5-1 Vertical Format Tape

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. Push open the Upper Reader Bracket and install tape ensuring that the sprocket teeth protrude through the mylar tape. Close the Upper Reader Bracket.

5.3 SPLICING A PREPARED TAPE

To splice a prepared tape overlay the ends of tape so that the punched holes are properly spaced (see Figure 5-2); use perforated splicing tape to hold the ends together.

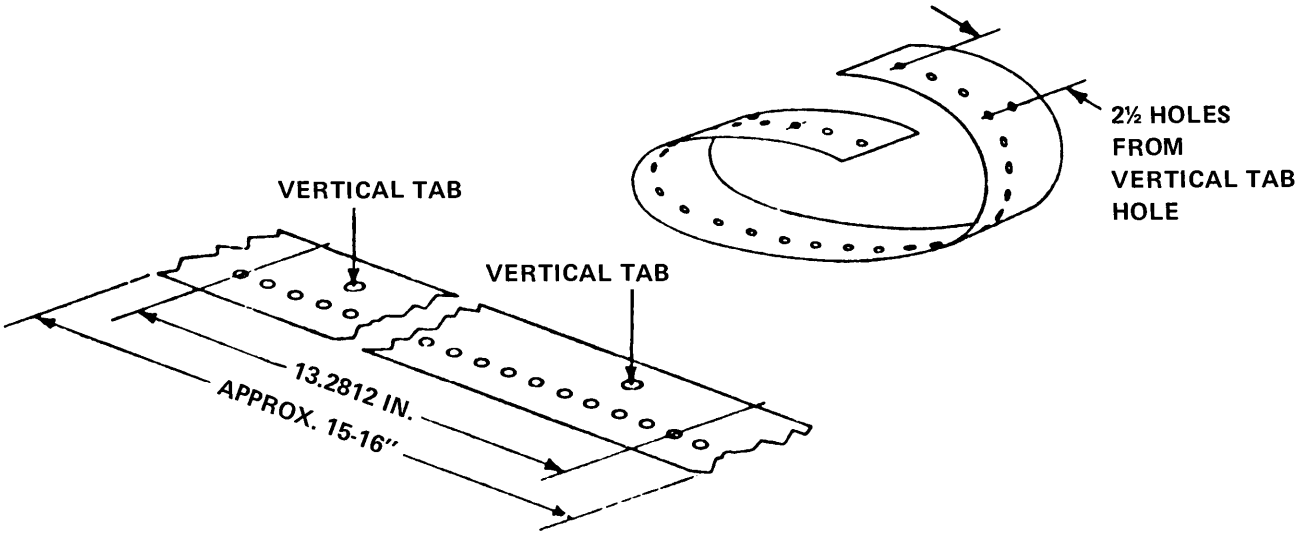


Figure 5-2. Splicing Prepared Tape

APPENDIX A HEXADECIMAL CODES

HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER
HEX(03)	Not Applicable	HEX(30)	0	HEX(58)	X
HEX(07)	Alarm	HEX(31)	1	HEX(59)	Y
HEX(08)	Set Plot Mode	HEX(32)	2	HEX(5A)	Z
HEX(09)	Line Feed Spacing	HEX(33)	3	HEX(5B)	[
HEX(0A)	Line Feed	HEX(34)	4	HEX(5C)	ß
HEX(0B)	Vertical Tab	HEX(35)	5	HEX(5D)	]
HEX(0C)	Form Feed	HEX(36)	6	HEX(5E)	↑
HEX(0D)	Carriage Return	HEX(37)	7	HEX(5F)	←
HEX(0E)	Elongated Character	HEX(38)	8	HEX(60)	°
HEX(10)	ä	HEX(39)	9	HEX(61)	a
HEX(11)	ê	HEX(3A)	:	HEX(62)	b
HEX(12)	î	HEX(3B)	;	HEX(63)	c
HEX(13)	ô	HEX(3C)	<	HEX(64)	d
HEX(14)	û	HEX(3D)	=	HEX(65)	e
HEX(15)	ä	HEX(3E)	>	HEX(66)	f
HEX(16)	ë	HEX(3F)	?	HEX(67)	g
HEX(17)	ï	HEX(40)	@	HEX(68)	h
HEX(18)	ö	HEX(41)	A	HEX(69)	i
HEX(19)	ü	HEX(42)	B	HEX(6A)	j
HEX(1A)	à	HEX(43)	C	HEX(6B)	k
HEX(1B)	è	HEX(44)	D	HEX(6C)	l
HEX(1C)	ù	HEX(45)	E	HEX(6D)	m
HEX(1D)	Ä	HEX(46)	F	HEX(6E)	n
HEX(1E)	ü	HEX(47)	G	HEX(6F)	o
HEX(1F)	Ü	HEX(48)	H	HEX(70)	p
HEX(20)	Space	HEX(49)	I	HEX(71)	q
HEX(21)	!	HEX(4A)	J	HEX(72)	r
HEX(22)	"	HEX(4B)	K	HEX(73)	s
HEX(23)	#	HEX(4C)	L	HEX(74)	t
HEX(24)	$	HEX(4D)	M	HEX(75)	u
HEX(25)	%	HEX(4E)	N	HEX(76)	v
HEX(26)	&	HEX(4F)	O	HEX(77)	w
HEX(27)	'	HEX(50)	P	HEX(78)	x
HEX(28)	(	HEX(51)	Q	HEX(79)	y
HEX(29)	)	HEX(52)	R	HEX(7A)	z
HEX(2A)	*	HEX(53)	S	HEX(7B)	§
HEX(2B)	+	HEX(54)	T	HEX(7C)	£
HEX(2C)	,	HEX(55)	U	HEX(7D)	é
HEX(2D)	-	HEX(56)	V	HEX(7E)	ç
HEX(2E)	.	HEX(57)	W	*HEX(7F)	
HEX(2F)	/				

*ASCII DEL, a non-printable control character

APPENDIX B LINE PRINTER SPECIFICATIONS

Printout Speed.....	120 characters per second (45 to 250 lines per minute, dependent on line length)
Character Configuration.....	Dot Matrix: 7 (wide) x 8 (high) - normal 14 (wide) x 8 (high) - expanded 6 lines/in. (2.4/cm); 14.4 characters/in. (5.7/cm)
Line Width.....	132 characters, maximum 66 characters, expanded
Character Set.....	ASCII 112 characters
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)
Controller.....	Standard Line Printer Controler/CPU interface. When the printer is used with the Model 2282, the Graphic CRT 36-pin interface connector plugs into the Printer Controller Board in the CPU. The Model 2231W-3 36-pin interface connector plugs into the output connector of the Model 2282.
Fuses.....	1.5 amp (SB) for 115 VAC, 8/10 amp (SB) for 230 VAC; 2.5 amp (SB) for DC carriage motor.
Power Requirements.....	115 or 230 VAC $\pm$ 10%, 50 or 60 Hz $\pm$ 1 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

(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 ± 0.013 cm) non-accumulative in any 5 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 ± 0.2 cm).

   b. Pin-hole center to right side of last character cannot be less than 3/8 ± 1/16 in. (1.0 ± 0.2 cm).

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.

INDEX

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.

700-4457

TITLE OF MANUAL: **MODEL 2231W-3 LINE PRINTER USER MANUAL**

COMMENTS:

Fold

Fold

(Please tape. Postal regulations prohibit the use of staples.)

WANG

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

Attention: Technical Writing Department

Fold

Cut along dotted line.

Printed in U.S.A.
13-1019

WANG LABORATORIES (CANADA) LTD.
240 Duncan Mill Road
Suite 506
Don Mills, Ontario M3B 1Z4
Telex: 069-66546

WANG EUROPE S.A./N.V. (European Headquarters)
250, Avenue Louise
1050 Brussels, Belgium
TELEPHONE 02/640.37.80
Telex: 12430-12398

WANG EUROPE S.A./N.V. (Belgian Sales)
350, Avenue Louise
1050 Brussels, Belgium
TELEPHONE 02/648.9.1.00
Telex: 62691

WANG DO BRASIL COMPUTADORES LTDA.
Praca Olavo Bilac No. 28
SL1801/1803
Rio de Janeiro, Centro, RJ, Brasil
TELEPHONE 232-7503, 232-7026

WANG COMPUTERS (SO. AFRICA) PTY. LTD.
Corner of Allen Rd. & Garden St.
Bordeaux, Transvaal
Republic of South Africa
TELPHONE (011) 48-6123
Telex: 960--83297

WANG INTERNATIONAL TRADE, INC.
One Industrial Avenue
Lowell, Massachusetts 01851
TELEPHONE (617) 851-4111
Telex: 94-7421

WANG SKANDINAVISKA AB
Pyramidvaegen 9A
S-171 36 Solna, Sweden
TELEPHONE 08/27 27 95
Telex: 11498

WANG COMPUTER LTD.
Shindaiso Building No. 5
2-10-7 Dogenzaka Shibuya-Ku
Tokyo, Japan
TELEPHONE (03) 464-0644
Telex: 2424909 WCL TKO J

WANG NEDERLAND B.V.
Produktieweg 1
IJsselstein, Netherlands
TELEPHONE (03408) 41.84
Telex: 47579

WANG PACIFIC LTD.
9th Floor, Lap Heng House
47-50, Gloucester Road
Hong Kong
TELEPHONE 5-274641
Telex: 74879 Wang HX

WANG INDUSTRIAL CO., LTD.
7, Tun Hwa South Road
Sun Start Tun Hwa Bldg.
Taipei, Taiwan, China
TELEPHONE 7522068, 7814181-3
Telex: 21713

WANG GESELLSCHAFT MBH
Murlingengasse 7
A-1120 Vienna, Austria
TELEPHONE 85.85.33'
Telex: 74640 Wang a

WANG GESELLSCHAFT MBH
Wiedner Haupstrasse 68
A-1040 Vienna, Austria
TELEPHONE 57.94.20
Telex: 76424 Wang a

WANG S.A./A.G.
Markusstrasse 20
Postfach 423
CH 8042 Zurich 6, Switzerland
TELEPHONE 41-1-60 50 20
Telex: 59151

WANG COMPUTER PTY. LTD.
10-14 Paul Street
Milsons Point, N.S.W. 2061
TELEPHONE 439-3511
Telex: 24569

WANG ELECTRONICS LTD.
Argyle House, 3rd Floor
Joel Street
Northwood Hills
Middlesex, HA6 INS, England
TELEPHONE (09274) 28211
Telex: 923498

WANG FRANCE S.A.R.L.
Tour Gallieni, 1
78/80 Ave. Gallieni
93170 Bagnolet, France
TELEPHONE 33.1.3602211
Telex: 680958F

WANG LABORATORIES GmbH
Moselstrasse 4
6000 Frankfurt AM Main
Postfach 16826
West Germany
TELEPHONE (0611) 252061
Telex: 04-16246

WANG DE PANAMA (CPEC) S.A.
Apartado 6425
Calle 45E, No. 9N. Bella Vista
Panama 5, Panama
TELEPHONE 69-0855, 69-0857
Telex: 3282243

WANG COMPUTER LTD.
302 Great North Road
Grey Lynn, Auckland
New Zealand
TELEPHONE Auckland 762-219
Telex: WANG LTD NZ 21538

WANG COMPUTER PTE., LTD.
Suite 1801-1808, 18th Floor
Tunas Building, 114 Anson Road
Singapore 2, Republic of Singapore
TELEPHONE 2218044, 45, 46
Telex: RS 24160 WANGSIN

WANG COMPUTER SERVICES
One Industrial Avenue
Lowell, Massachusetts 01851
TELEPHONE (617) 851-4111
TWX 710-343-6769
Telex: 94-7421

DATA CENTER DIVISION
20 South Avenue
Burlington, Massachusetts 01803
TELEPHONE (617) 272-8550

WANG LABORATORIES, INC.

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

Printed in U.S.A.
700-4457
1-78-2.5M
Price: see current list