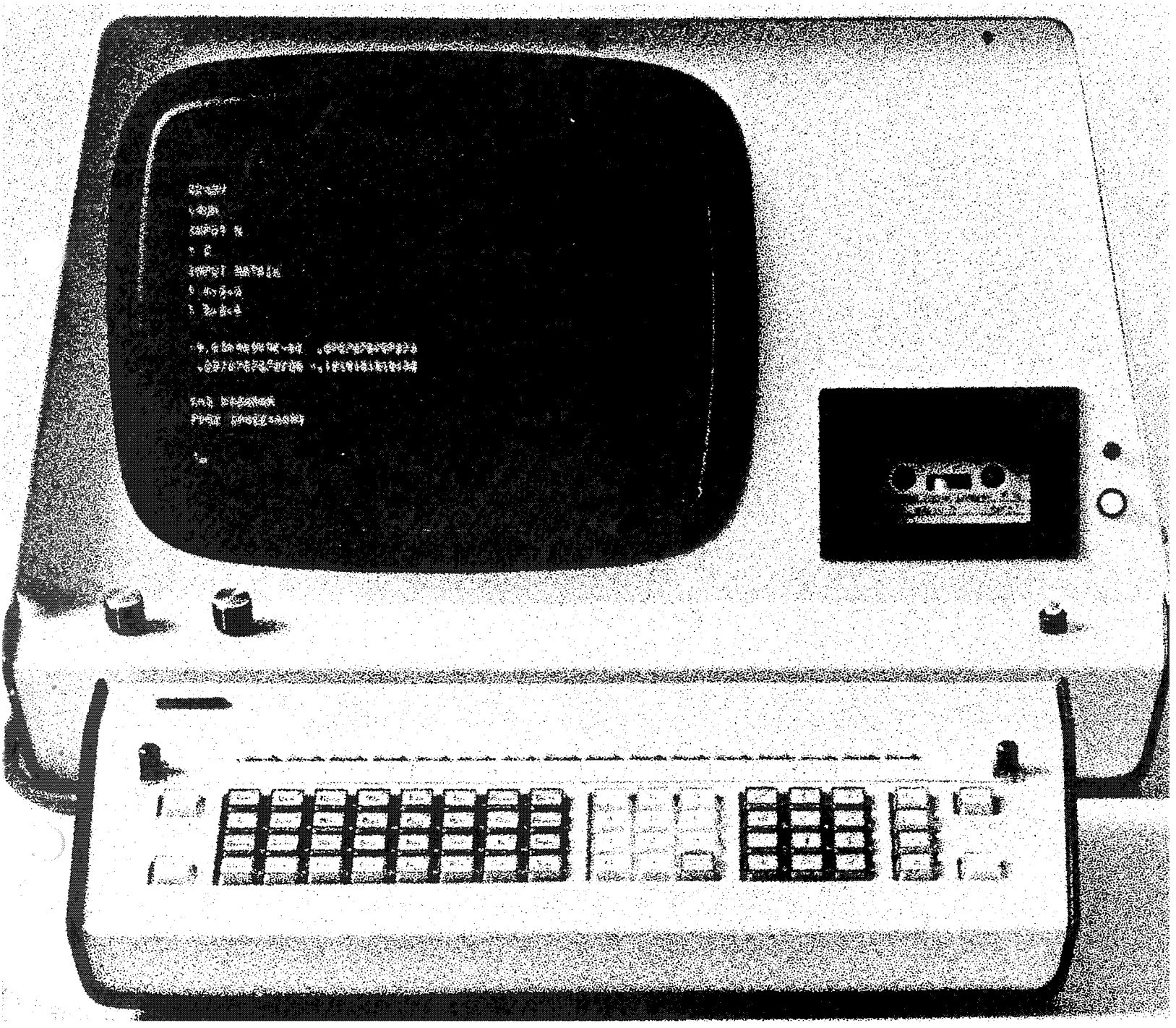
WANG

MODEL 2221W
THE LINE PRINTER



Model 2221W

The Line Printer

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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 this is the financial responsibility of the user.

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HOW TO USE THIS MANUAL

This manual provides answers to questions concerning the operation of the Model 2221W 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; Section I contains general information on the Printer; Section II describes device selection and the SELECT statement; Section III demonstrates how to format printed output; Section IV describes the use of HEX codes and Section V describes the Vertical Format Tape. Hexadecimal codes, the Printer character set and specifications are collected in the Appendices.

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INTRODUCTION

This manual describes the characteristics and operations of the Model 2221W Line Printer (see Figure 1.1). The Model 2221W is an impact printer that generates printer characters in a matrix form, nominally 9 x 9, in lines up to 132 characters long. The printer operates at a rate of 200 characters per second and can achieve a rate of 65 to 300 lines per minute dependent upon line length. Characters are printed six lines and 10 characters to the inch (2.4 lines/cm; 4.3 characters/cm). Characters can be expanded for enhanced output as needed (see Section III). The complete 96 character set for the printer is given in Appendix B. A 132-character buffer receives a complete line of data transmitted from the system CPU to the printer. A vertical format paper tape provides control for spacing on special forms. Continuous-form paper of widths from 5 to 14.0 inches (12.7 to 37.8 cm) can be used with the printer since the distance between the pin-feed mechanisms is continuously adjustable.

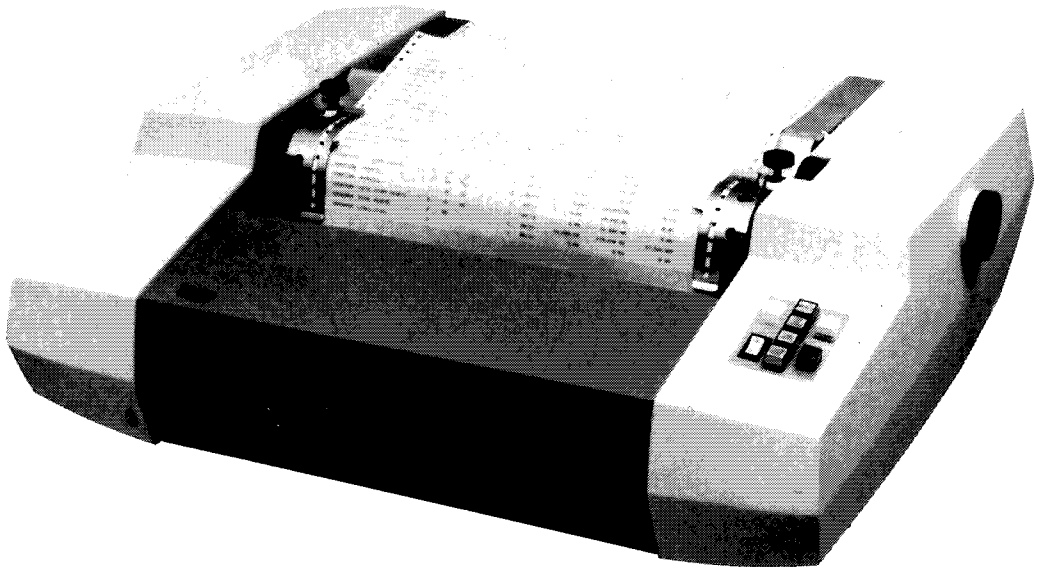


Figure 1.1 Model 2221W Line Printer

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.

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 CPU chassis of your system CPU. 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).

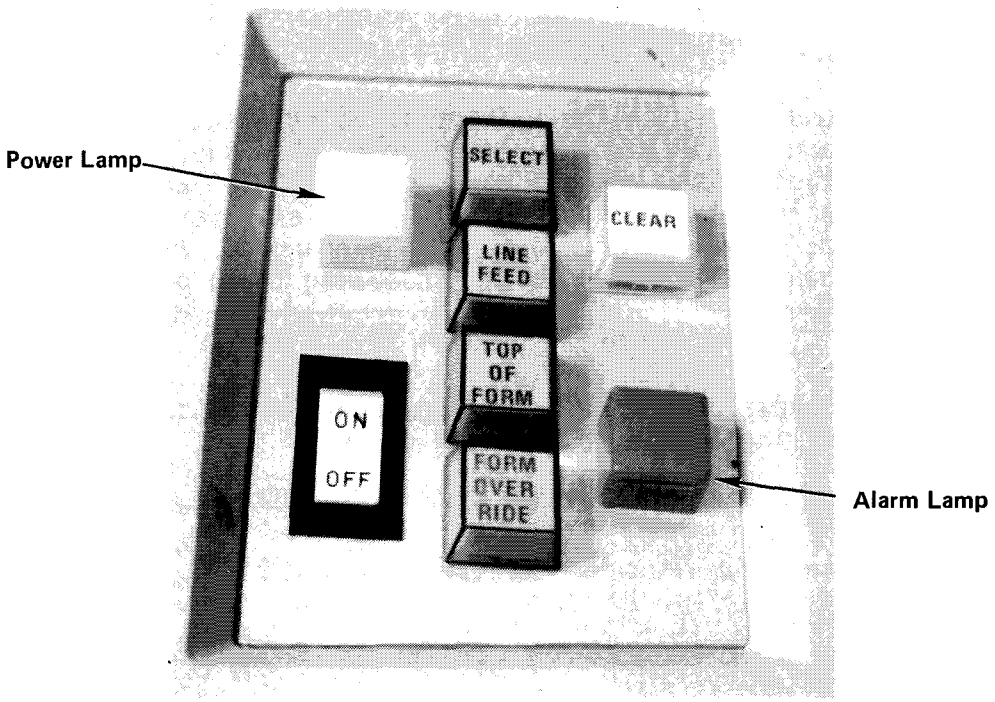


Figure 1.2 Control Panel

PAPER INSERTION

1. Push continuous-form pin-feed paper into the slot in the top of the printer until it comes out between the pin-feed mechanisms (see Figure 1.3).

2. 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.

3. A fine horizontal adjustment of forms can be made using the Vernier Knob at the top right of the printer. When the Vernier kknob is turned, both pin-feed units move simultaneously. The knob allows fine adjustment of the paper up to one-half inch in the horizontal direction.

4. Press the ON/OFF rocker switch on the Control Panel (see Figure 1.2) When the printer is on, the power lamp (upper left of Control Panel) is lit.

5. Press the LINE FEED switch to advance paper in the printer.

6. Press the TOP-OF-FORM button; thia advances the apper until the Vertical Format Unit senses a Top-of-Form hole in the Vertical format tape.

7. Use the Platen Knob to readjust paper placement, if necessary. Paper can be manually advanced for adjustment by pushing in the Platen Knob and turning it.

8. NEVER OPERATE THE HIGH-SPEED PRINTER WITHOUT PAPER.

9. If paper runs out while the Printer is being used, your Wang System ceases operation and an audible two-second tone is sounded by the Printer. To complete printing the correct 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.

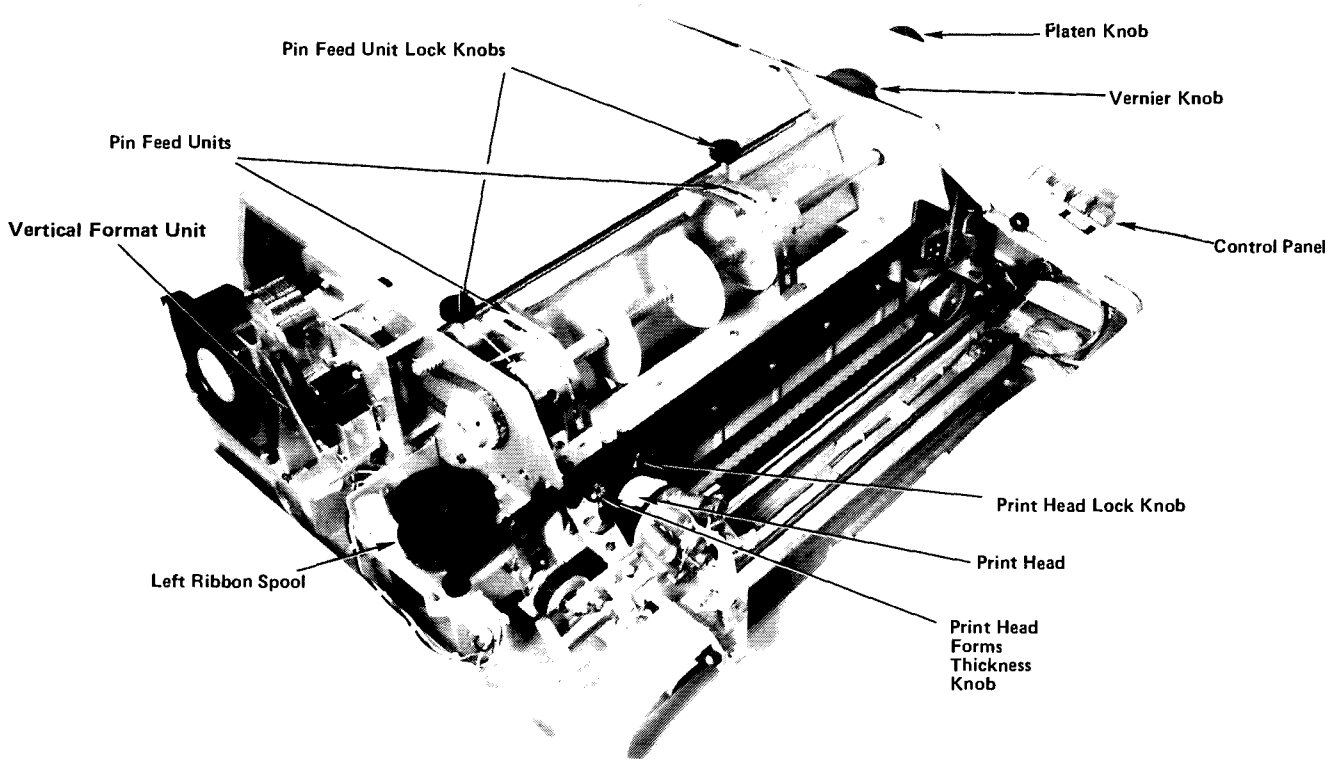


Figure 1.3 The Model 2221W Line Printer, Definition of Terms

PRINT ADJUSTMENT

To adjust the print blackness, follow the procedure detailed below.

1. The Printer must have paper in it and be turned OFF.

2. Open the front cover of the Printer and find the Print Head (see Figure 1.3).

3. Identify on it the Forms Thickness Knob and the Lock Knob. The Forms Thickness Knob is at the left of the Print Head, the Lock Knob at the right.

4. Unlock the Lock Knob on the Print Head.

5. Turn the Forms Thickness Knob to move the head in or out; in to provide a blacker imprint, out to move the head back to accommodate thicker forms.

6. Lock the adjustment by turning the Lock Knob until it stops.

7. When the head has been properly adjusted, close the front cover of the Printer. The Printer does not operate unless all covers are closed.

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.

RIBBON REPLACEMENT

1. Turn power OFF on the Printer.

2. Open the front cover of the Printer and find the Print Head Lock Knob; loosen it.

3. Turn the Forms Thickness Knob until the Print Head is away from the ribbon.

4. Push off the left and right-hand covers, they cannot be moved unless the front cover is open.

5. Compare the Ribbon Mechanism with that in the diagram (Figure 1.4) to find the parts needed and follow the path of the ribbon in the mechanism.

6. Remove caps from Ribbon Reversing Guides and lift old spools from axles.

7. Place the full new spool on the right-hand axle, and thread the ribbon through the guides, idlers and rollers. The ribbon must feed from the inner side of the spool.

8. Place the empty spool on the left-hand axle.

> Caution: Be absolutely sure that the ribbon rivets are wound onto the left-hand spool so they cannot come into contact with the print head during printer operation.

9. Replace caps on the Ribbon Reversing guides and close the side covers of the Printer.

10. Readjust the Forms Thickness Knob (see Print Adjustment) and tighten the Lock Knob.

11. Close the front cover of the Printer to resume operation.

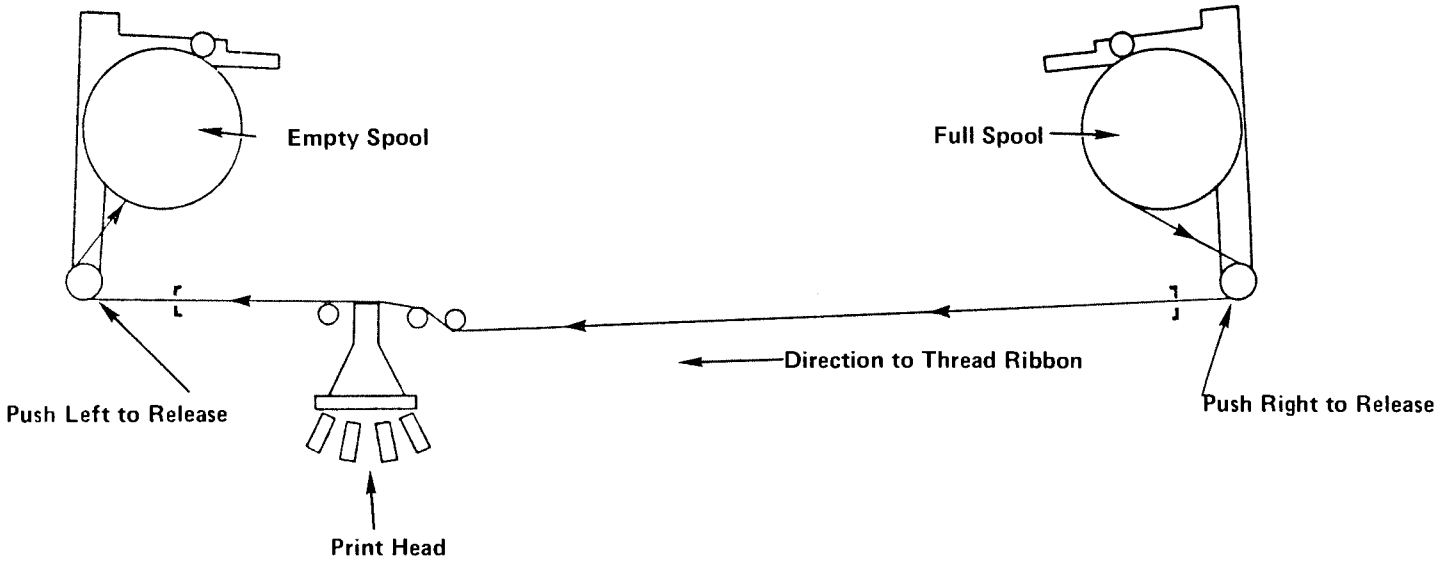


Figure 1.4. Ribbon Replacement Mechanism

FUSE REPLACEMENT

The fuse (see Figure 1.5) located on the rear panel of the Line Printer can be changed by twisting the bad fuse out of the socket and replacing it with a new fuse. This fuse is the main fuse. The circuit breaker to its left governs the print head servo.

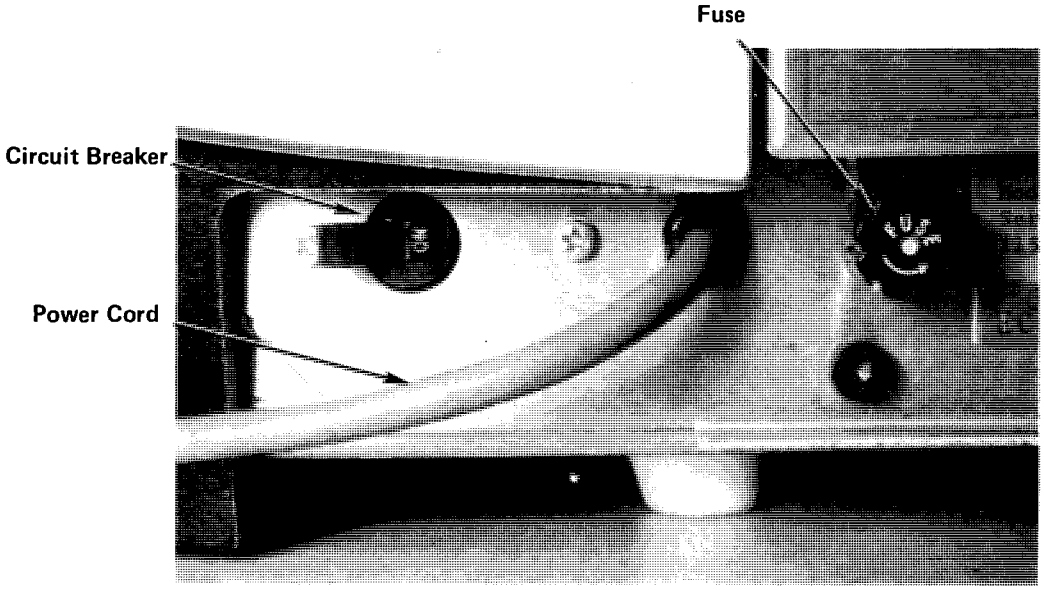


Figure 1.5. Back of Printer

VERTICAL FORMAT CONTROL

The mechanism which guides and controls paper movement in the Model 2221W is located under its left-hand cover. 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. The user can also obtain Automatic Page Eject with a specially formated Vertical Format Tape with holes in channel 2. With such a tape, paper automatically advances to the next Top-of-Form hole when the end of a document is reached. End of document is normally set at the 66th line of 11-inch forms. Automatic Page Eject passes the perforation in fan-fold paper when forms have been properly aligned. Before operating the Printer, verify that the paper 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 1 receives a Form Feed code (HEX(0C)), or the TOP-OF-FORM switch is pressed, the punched is advanced until the punched tape

reaches the next hole in channel 7. On the standard paper 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 Form Feed 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 paper tape punch or with manual punching equipment. Problems with Vertical Format Tapes are best resolved by your WANG Service Representative.

CPU 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. At turn-on the system is Master Initialized; 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 Section II).

2221W TURN-ON PROCEDURE

The control panel on the right-hand 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

To turn the Printer ON, press the ON rocker switch. The Power lamp 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 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

Clears the printer line buffer if the printer is not in SELECT mode (has not been SELECTed).

ALARM LAMP

(lower right of Control Panel)

Indicates mechanical or electronic malfunctioning, generally a paper or ribbon jam; when a malfunction occurs, there is an audible alarm tone for two seconds, then the alarm lamp is on continuously. To recover from this condition, shut off power (push OFF switch), fix jammed paper or ribbon, reset the circuit breaker on the back panel of the printer and turn the power on again. If neither paper nor ribbon jam has caused a problem, contact your Wang Service Representative.

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 paper tape in the Vertical Format Unit must be correctly seated.

4. Paper must be inserted in the Printer. (Push paper into slot in top of printer; place holes over pins; use Platen Knob to adjust forms.)

5. The Forms Thickness must be set for good print quality. It can be adjusted as described in the Section PRINT ADJUSTMENT.

6. Turn on Printer and your Wang system.

7. Push SELECT to enable Printer to receive data.

8. Your Line Printer is now ready to use.

SECTION II

DEVICE SELECTION

THE SELECT STATEMENT
DEVICE TYPE CODES
PRINT
LIST
CO
LINE LENGTH
SPECIAL TECHNIQUES
COMBINED PARAMETERS
DESELECTING THE PRINTER

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 2221W, 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 (120)
     Device Type
    Unit Address
     Line Length
```

DEVICE TYPE CODES

Every peripheral attached to your Wang System is assigned a three-character Device Type Code whether it is a separate unit or part of your console. The Device Code is in the form (xyy), where x is the Device Type and yy is the Unit Address. The Unit Type (x) determines which internal system I/O routines are used to control the Printer. The Model 2221W 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 132 character line.

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 2221W, 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 2221W.

4	This Device Type suppresses the automatic carriage return issued by your Wang system at the end of PRINT, PRINTUSING and HEXPRINT statements that contain no trailing punctuation and does not clear the print buffer. Whenever a carriage return is encountered in a program or Print line, the system automatically adds a line feed following it.

The device address (yy) of the Model 2221W Printer Controller is preset to 15 by WANG Laboratories before the unit is shipped, and must be the address used in SELECT statements used 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. The second Printer can be any of the following: Model 2261 High-Speed Printer, Model 2221W Line Printer (132 column), or Model 2231 Line Printer (80 column). Device address 15 is used in all further examples in this manual.

Figure 2.1. Sample Printout Using List with Different Device Type Codes and Line Lengths; this program was used in examples shown in Figure 2.2.

```
10 FOR I= 1 TO 10
20 PRINT "00000000001111111111222222222233333333334444444444555
555555666666666677777777778888888888999999999AAAAAAAAAABBBBBBB
BBCCCCCCCCCC/"
30 NEXT I
```


In the above example, the statement SELECT LIST 215 is used; 64 is the default value for line length.

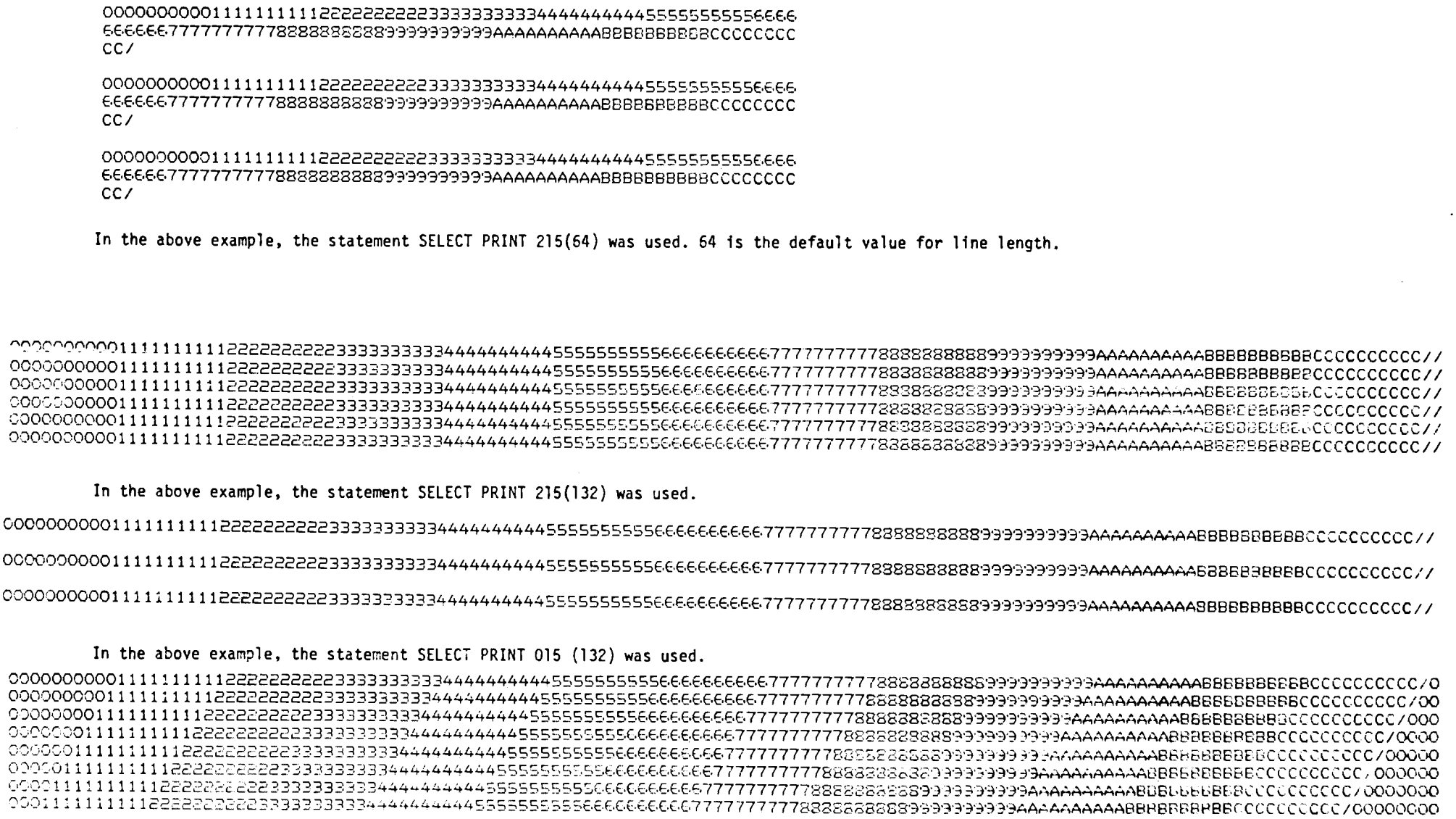
```
10 FOR I= 1 TO 10
20 PRINT "00000000001111111111222222222233333333334444444444555
555555666666666677777777778888888888999999999AAAAAAAAAABBBBBBB
BBCCCCCCCCCC/"
30 NEXT I
```

In the above example, the statement SELECT LIST 015 is used; output is double spaced.

```
10 FOR I= 1 TO 10
20 PRINT "00000000001111111111222222222233333333334444444444555555555566666666667777777777888888888899999999990AAAAAAAAAABBBBBBBBBC
CCCCCCCC/"
30 NEXT I
```

In the above example, the statement SELECT LIST 415(132) is used; output is single spaced within statement lines, double spaced between them.

Figure 2.2 Sample Printout Using Different Device Type Codes, Line Lengths and the Print Parameter



In the above example, the statement SELECT PRINT 215(64) was used. 64 is the default value for line length.

In the above example, the statement SELECT PRINT 215(132) was used.

In the above example, the statement SELECT PRINT 015 (132) was used.

In the above example, the statement SELECT PRINT 415(132)was used; actual line length was 131.

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 CO (see SELECT CO 215).

> Note:
>
> When your system is first turned on, PRINT operations are seen on the CRT, the primary device for such operations.

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
```

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
```

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.

LINE LENGTH

The maximum number of characters per line that can be printed on the Model 2221W is 132. To accommodate various paper widths and special forms whose width is less than 132 characters, 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 (132)	(Selects the Model 2221W for printing, sets line length to 132)
SELECT LIST 215 (80)	(Selects the Model 2221W for listing programs, sets line length to 80)
SELECT CO 215 (112)	(Selects the Model 2221W for console output, sets line length to 112).

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

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 2221W, 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. Wenever 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 spaces in the line are included in the line count.

SPECIAL TECHNIQUES

The normal Device Type used with the Model 2221W 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 2221W. 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 2221W 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 2221W executes a carriage return, it supplies another line feed, producing the double spacing after each printed line.

With Device Type 4, the CPU suppresses the carriage return (and therefore the accompanying line feed) normally supplied when the line count equals the selected line length. The carriage return that normally follows the end of a text line is not affected. A more readable double spaced output is therefore achieved with Device Type 4 (see Figure 2.3).

With this exception it is recommended that the Model 2221W normally be selected with Device Type 2 or 0.

COMBINED PARAMETERS

It is possible to combine parameters in a SELECT statement;

EXAMPLE:

```
SELECT PRINT 215 (100), LIST 215(80), CO215 (132)
```

but it is not possible to select two output devices with the same parameter; i.e., the statement

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

produces listing of programs on the CRT only.

DESELECTING THE MODEL 2221W

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.

SECTION III

FORMATTING OUTPUT

PRINT, PRINTUSING AND HEXPRINT STATEMENTS
THE TAB(FUNCTION
THE EXPANDED PRINT

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 there are more zones available on the printer than on the CRT.

The 2221W 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 discussion of zoned and packed format.)

Examples:

```
10 SELECT PRINT 215(132)
20 PRINT 10,20,30,40,50
```

Output: 10 20 30 40 50

```
10 SELECT PRINT 215(132)
20 PRINT 10;20;30;40;50
```

Output: 10 20 30 40 50

```
10 SELECT PRINT 215(132)
20 HEXPRINT 10,20,30,40,50
```

Output: 313020202020202020202020202020202020

```
10 SELECT PRINT 215(80)
15 A=10
20 PRINTUSING 30,A,A,A
30 % ## ##.# ###↑↑↑↑
```

Output: 10 10.0 100E-01

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 132 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); -20
```

Executing this example prints 10 starting in Column 31, and -20 starting in column 30.

EXPANDED PRINT

It is possible to print expanded characters for enhanced or highlighted output on the Line Printer. This method uses HEX code (0E) (see Section IV for a more detailed discussion of HEX codes).

Example:

```
:SELECT PRINT 215
:10 PRINT HEX(0E), "EXPANDED PRINT"
:RUN
```

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

E X P A N D E D P R I N T

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

The printer performs an automatic CR/LF 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.

SECTION IV

HEX CODES

THE HEX FUNCTION CONTROL CODES

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).

CONTROL CODES

The special Control Codes for the Printer are:

Function	Hex Code	Description
ALARM	HEX(07)	Generates an audible tone about two seconds in duration in 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)	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 Section III.)
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.

SECTION V

THE VERTICAL FORMAT

TAPE

TO COPY A VERTICAL FORMAT TAPE
VERTICAL FORMAT TAPE READER
TO SPLICE PREPARED TAPE

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, 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, then press P for each hole.

5. For an End-of-Document hole (in channel 2), press and hold CONTROL key, then press B (see Figure 5.1).

6. When new tape is complete, press HERE IS key to generate ending trailer; remove tape from reader.

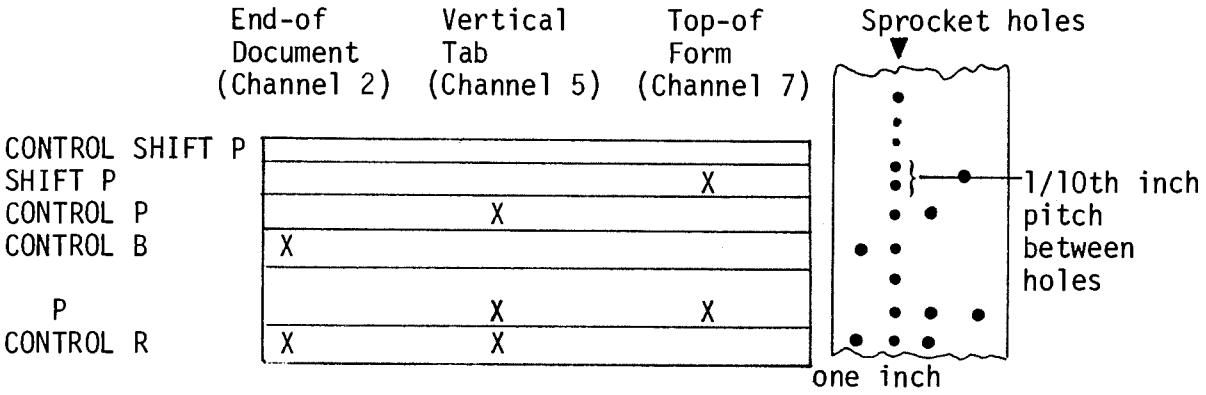


Figure 5.1 Vertical Format Tape

VERTICAL FORMAT TAPE READER

This is the control mechanism for Top of Form, End-of-Document and Vertical Tabulation settings.

To replace Vertical Format Tape, open the front cover of the printer and push off the left-hand cover to gain access to the Tape Reader (see Figure 5.2). Lift upper Reader Bracket and install tape in tray provided, ensuring that the sprocket teeth protrude through the paper tape. Close Upper Reader Bracket.

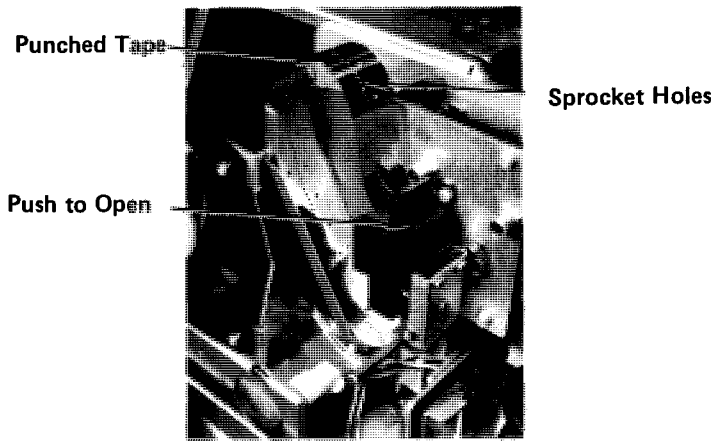


Figure 5.2 Tape Reader

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.

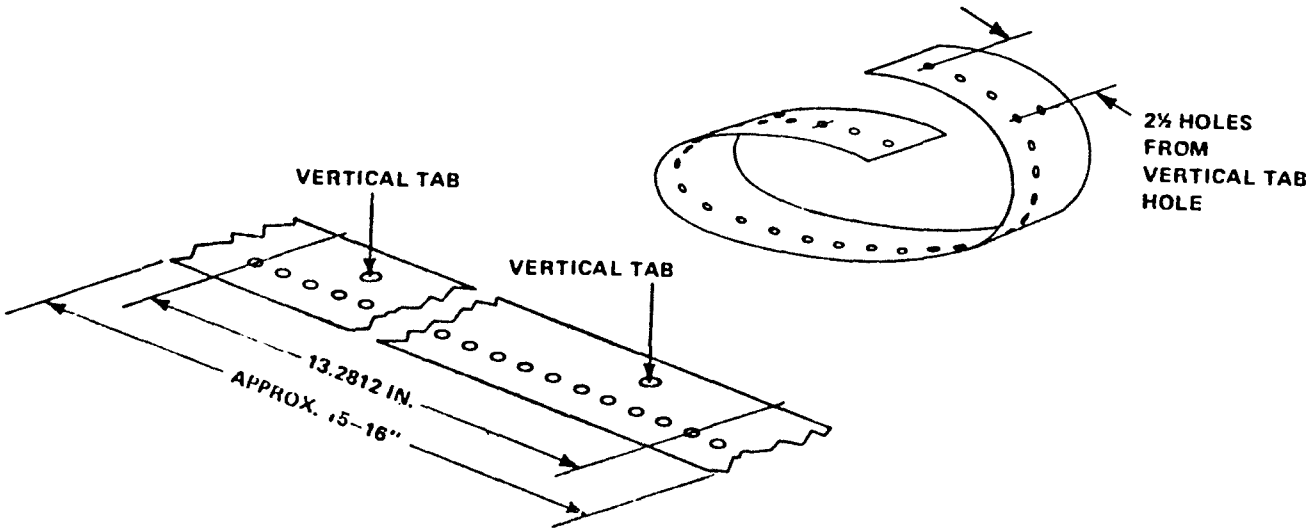


Figure 5.3 Splicing Prepared Tape

APPENDICES

APPENDIX A - HEXADECIMAL CODES

APPENDIX B - SPECIFICATIONS

APPENDIX C - PAPER SPECIFICATIONS

APPENDIX A

HEXADECIMAL CODES

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

* ASCII DEL, a non-printable control character

APPENDIX B SPECIFICATIONS

Printout Speed	200 characters per second (65 to 300 lines per minute, dependent on line length)
Character Configuration	Dot Matrix: 9(wide) x 9(high) - normal 18(wide) x 9(high) - expanded 6 lines/in (2.4/cm); 10 characters/in. (4.3/ cm)
Line Width	132 characters
Character Set	Full alphanumeric
Duplicate Copies	The printer can generate a maximum of four duplicate copies in addition to the original.
Printer Size: Width	29 in (74 cm)
Depth	25 in (64 cm)
Height	12 in (31 cm)
Weight	70 lbs (32 kg)
Site Width	not less than 50 in (1.3m) to accomodate opening side covers.
Power Requirements	115 or 230 VAC + 10% 50 or 60 Hz+ 1 cps
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), 40% to 60% relative humidity, non-condensing

APPENDIX C - PAPER SPECIFICATIONS

(If paper does not conform to these specifications, degraded forms handling can occur. **No specifications are given for card stock; try a sample before purchasing.)**

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:

      5 in. (12.7 cm) minimum
      14 7/8 in. (37.8 cm) maximum

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

   c. crimps 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.

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 $\pm$ .03 in. (0.635 $\pm$ 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 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 without 0.015 in. (0.038 cm) to a maximum of 14-1/2 in. (36.83 cm).

7. When using forms with wide and narrow copies in the same set, the top copy should always be fullest width.

8. For pre-printed forms:

   pin-hole center to left side of left-most character not less than 3/8 ± 1/16 in. (1.0 ± 0.2 cm)

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

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