WANG

MODEL 2281
PRINTER
USER MANUAL

SYSTEM 2200

MODEL 2281
PRINTER
USER MANUAL

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HOW TO USE THIS MANUAL

This manual provides answers to questions concerning the operation of the Model 2281 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 chapters covering all the operational features of the 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 and Chapter 4 describes the use of HEX codes. Hexadecimal codes, the Printer character set and specifications are collected in the Appendices.

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes the characteristics and operations of the Model 2281 Printer (see Figure 1.1). The Model 2281 uses a daisy character wheel to generate printed characters in either a 10 pitch (up to 132 characters per line) or 12 pitch (up to 157 characters per line) format. The Printer operates at a rate of 30 characters per second, printing in both forward and reverse directions. Characters can be underscored for enhanced output and can be printed in either black or red (see Chapter 3). The complete 86-character set for the printer is given in Appendix A. A full line buffer (132 or 157 characters) receives data transmitted from the system CPU to the printer. TAB CLEAR, TAB, SET TAB, BACKSPACE and UNDERSCORE operations are completely programmable for special formatting operations. The printer uses continuous-form paper of widths up to 15 in. (38 cm).

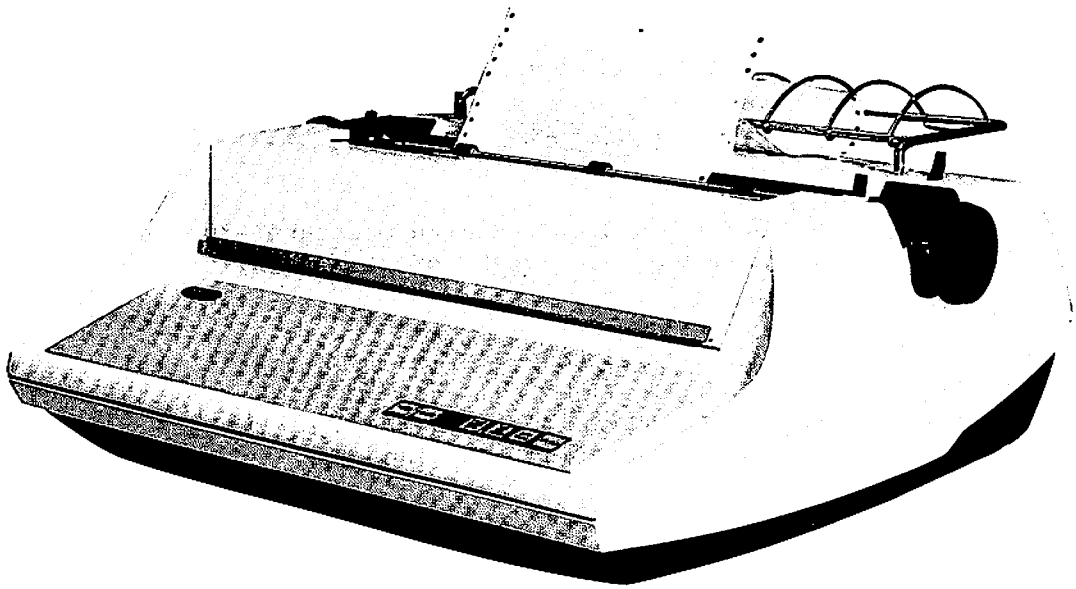


Figure 1.1 Model 2281 Printer

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. Its screws should be fully tightened. Note: In the Portable Computer System and Work Station the Printer Controller Board is internal to the system.

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).

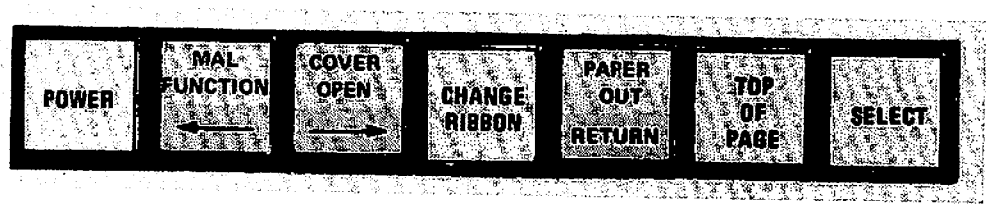


Figure 1.2 Control Panel

1.4 PAPER INSERTION

1. Insert the paper down behind the platen and turn the platen handle until the paper appears in front of it (similar to loading a typewriter).

2. Pull the paper bail forward to properly align the paper.

3. After paper is in the proper position return the paper bail and paper release to their operating positions.

4. Turn the left-hand platen adjust lever for form thickness adjustments. For single forms, the lever should be in its most forward position. For multiple forms the lever should be moved rearward.

5. Manual vertical adjustments of forms can be made by rotating the platen knob. (See Section 1.11 for Forms Alignment.)

1.5 RIBBON CARTRIDGE REPLACEMENT

1. Snap the front cover off by gently pulling upon the metal bar (left side first).

2. Pull the platen adjust lever completely backward so that the print wheel is removed from the paper.

3. Remove the exposed ribbon from the guide posts in front of the print wheel; rotate the ribbon take up knob as required.

4. Release the cartridge by pushing down on both plastic latches; remove the cartridge by pulling it up.

5. Place the new cartridge in the Printer; engage the exposed ribbon behind the guide posts and snap the cartridge in place. While pushing down, turn the ribbon take up knob approximately 1/4 turn until the ribbon engages.

6. Readjust platen adjust lever to proper Print Adjustment position.

7. To replace the cover, place the right side in position and snap the left side down to lock.

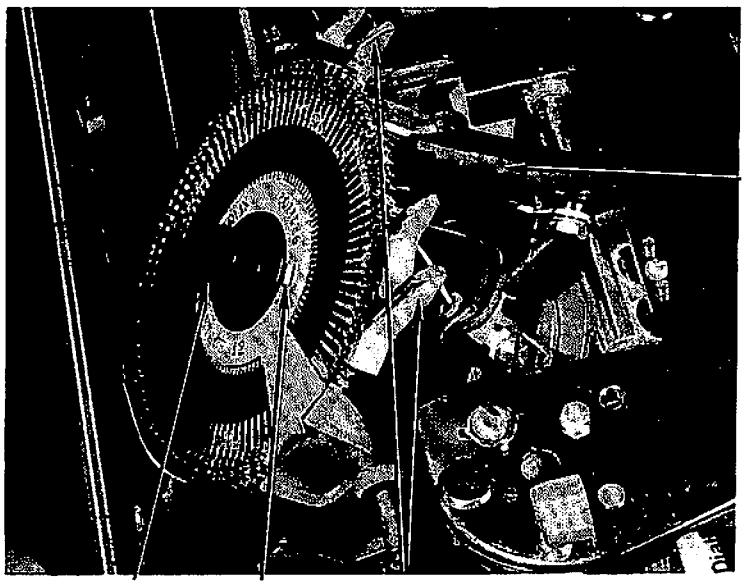


Figure 1.3 Definition of Terms

1.6 PRINT WHEEL INSERTION/REMOVAL

To insert a print wheel, follow the procedure detailed below:

1. Snap the front cover off by gently pulling on the metal bar (left side first).

2. Remove the ribbon cartridge (see Section 1.5).

3. To expose the print wheel, tilt the inner carriage assembly away from the platen by pulling the ribbon guide posts (see Figure 1.3).

4. Grasp the rubber hub and remove the print wheel.

5. To install the print wheel, push it solidly onto the end of the print wheel motor shaft. Be sure the alignment slot on the print wheel fits into the tab protruding from the shaft hub.

6. Tilt the inner carriage assembly back into operating position. Make certain the Pitch switch is set to the proper position (10-pitch or 12-pitch) to correspond to the pitch number shown on the print wheel. Replace the ribbon cartridge and printer cover as described in Section 1.5.

1.7 PRINT INTENSITY ADJUSTMENT

Three levels, or steps of print intensity, are provided on the Model 2281 to accommodate print wheel font variations as well as multiple copy printing. The print intensity switch is located inside the front cover on the right side. Print intensity levels shown on the switch are as follows:

"H" - high, used for printing multiple forms.

"M" - medium, used for printing on single sheets.

"L" - low, used for light printing to extend the life of the more delicate light type fonts.

1.8 FUSE REPLACEMENT

The main line fuse is located at the rear of the printer. The fuse is 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 the fuse.

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.

   Master Initialization automatically selects the CRT as the output device. For hardcopy output, the device address for the Printer must be specified from the keyboard using a SELECT statement (see Chapter 2).

1.10 2281 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 operations of the printer (see Figure 1.2).

ON/OFF

To turn the Printer ON, press the ON rocker switch at the rear of the printer. The Power lamp at the control panel is illuminated. To turn OFF the Printer, press the OFF switch; the Power lamp is off.

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. The SELECT lamp is illuminated when the Printer can receive data. When the SELECT switch is depressed again, the SELECT lamp is extinguished and the Printer is no longer SELECTed (deselected). The SELECT switch can be used to halt printing temporarily (as when aligning forms or changing ribbon) without causing loss of data in the print buffer.

PITCH

The Pitch toggle switch is located inside the front cover on the left side. The switch is labeled 10 and 12. To select 10 characters per inch, set the switch to the 10; to select 12 characters per inch, set the switch to the 12.

> NOTE:
>
> 10 pitch is used with a 10 pitch character wheel; 12 pitch is used with a 12 pitch character wheel.

TOP-OF-FORM

With the Printer ON (but not SELECTed), paper is automatically advanced to the top of the next form (66 line format) by pressing this switch.

The printer's internal Top-of-Form indicator is automatically reset whenever printer power is turned on or when the 2200 RESET button is pressed. When a new sheet of paper is inserted it should be manually adjusted to its Top-Of-Form position; press the RESET button or turn the printer on to reset the Top-of-Form indicator.

MALFUNCTION LAMP/ [←] SWITCH

The Malfunction lamp indicates that a printer malfunction has occurred. The malfunction is generally caused by a paper or ribbon jam. The printer should be deselected and power turned off before attempting to correct the fault. If the malfunction is not immediately remedied, contact your Wang Service Representative.

The [←] switch is used to move the print wheel carriage to the left. When this switch is touched briefly, the carriage moves to the left in one character space increments. If the switch is held down, the carriage moves continuously to the left.

RIBBON OUT LAMP

This lamp indicates that the ribbon should be changed. The printer should be deselected and a new ribbon installed. After the ribbon is changed, printing is resumed by pressing the SELECT button.

COVER OPEN LAMP/ [→] SWITCH

The Cover Open lamp goes on when the cover is off or when the cover is not on properly. Turn off the SELECT lamp before replacing the cover. After remounting the cover, press SELECT to resume printing.

The [→] switch is used to move the print wheel carriage to the right. When this switch is touched briefly, the carriage moves to the right in one character space increments. If the switch is held down, the carriage moves continuously to the right.

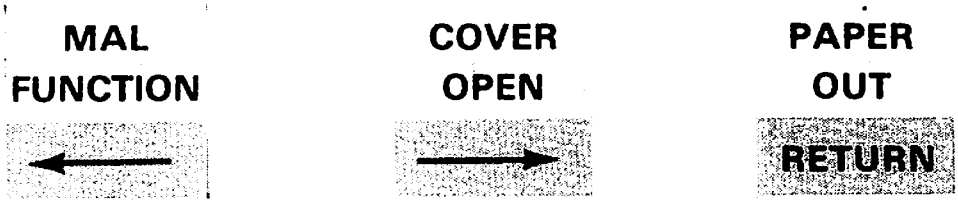
PAPER OUT LAMP/RETURN SWITCH

When out of paper, the printer ceases operation, the PAPER OUT LAMP is lit and the printer stops. Turn off the SELECT lamp before inserting more paper in the printer. If the Top-of-Form switch or Form Feed code (HEX(0C)) are to be used, the paper should be manually adjusted to the correct Top-of-Form position. Press SELECT to continue printing.

When the RETURN switch is depressed, the print wheel carriage is automatically returned to the left margin.

1.11 FORMS ALIGNMENT

The Model 2281 Printer is provided with three switches which simplify the task of aligning the print wheel with a preprinted form. These switches are located on the control panel and are labeled as follows:



The switches cause the following action:

1. When either the left or the right arrow switch is pressed briefly, the print wheel carriage moves in increments of one character space either to the left or to the right. If either switch is held down, the carriage moves continuously either to the left or to the right.

2. When the RETURN switch is pressed, the print wheel carriage is moved quickly back to the left margin.

These switches are not operational when the printer is accepting data from the 2200 computer, or when the printer is in the process of outputting a line. The switches can only be used when the printer is in an idle state (either selected or deselected).

When using forms which have preprinted lines beginning a significant distance away from the left margin, the following steps may be used to align the print wheel with the line on the form:

1. Insert the form and turn the printer ON.

2. Depress either the left or right arrow switches to move the print wheel over to the line.

3. Vertically align the print wheel with the line by using the platen knob on the right side of the printer. Push in and turn the platen knob. The platen can now be moved to bring the line in alignment with the print wheel.

4. The RETURN switch may be used to return the print wheel to the left margin.

1.12 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. Paper must be inserted in the Printer.

4. The Forms Thickness must be set for good print quality. It can be adjusted as described in Section 1.5 on PRINT INTENSITY ADJUSTMENT.

5. Turn on the Printer and your Wang system.

6. Push SELECT to enable Printer to receive data from the CPU.

7. Your Printer is now ready to use.

CHAPTER 2
DEVICE SELECTION

2.1 THE SELECT STATEMENT

The SELECT statement must be used by the user 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 2281, the syntax of the SELECT statement requires that it contain the BASIC verb PRINT, LIST or CO, a Device Type and Unit Address code. Line length can also be specified. Each of these SELECT parameters is described below.

Example:

```
100 SELECT PRINT 215(157)
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 LIST 215
```

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 2281 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. At the end of a full character line (132 or 157 characters) the printer automatically prints characters in the buffer and executes a line feed.

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 2281 output which is normally single spaced is double spaced.

Example:

```
:SELECT PRINT 015(132)
:10 for J = 1 TO 5
:20 PRINT "HAVE TICKETS READY WHEN BOARDING"
:30 NEXT J
:RUN (EXECUTE)
```

Output:

HAVE TICKETS READY WHEN BOARDING

HAVE TICKETS READY WHEN BOARDING

HAVE TICKETS READY WHEN BOARDING

HAVE TICKETS READY WHEN BOARDING

HAVE TICKETS READY WHEN BOARDING

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 2281.

Example:

```
:SELECT PRINT 215
:10 FOR I = 1 TO 5
:20 PRINT "A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY"
:30 NEXT I
:RUN (EXECUTE)
```

Output:

```
A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY
A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY
A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY
A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY
A SMALL AMOUNT SAVED REGULARLY WILL ADD UP SIGNIFICANTLY
```

4 This Device Type normally addresses devices without automatic carriage returns such as plotters. 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 punctuation. 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.

Example:

```
:SELECT PRINT 415
:10 FOR I = 1 TO 5
:20 PRINT "AS YOU KNOW,"
:25 PRINT HEX(0D)
:30 NEXT I
:RUN (EXECUTE)
```

Output:

```
AS YOU KNOW,
AS YOU KNOW,
AS YOU KNOW,
AS YOU KNOW,
AS YOU KNOW,
AS YOU KNOW,
```

2.1.2 Unit Address

The unit address (yy) of the Model 2281 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. The second Printer can be any of the following: Model 2261 High-Speed Printer, Model 2221W Line Printer, Model 2251 Printer, Model 2231W Line Printer, Model 2261W Line Printer, Model 2263 Line Printer, Model 2271 Printer, or another Model 2281 Printer. Device address 15 is used in all subsequent 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 in the Model 2281 is 157. In the SELECT statement line length is indicated in the parentheses following the Device Selection Code. For example:

SELECT PRINT 215(157)	(Selects the Model 2281 for printing and sets line length to 157.)
SELECT LIST 215(110)	(Selects the Model 2281 for listing and sets line length to 110.)
SELECT CO 215(132)	(Selects the Model 2281 for console output and sets line length to 132.)

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 (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 the printer is not recommended. A shorter line length causes a carriage return to be sent out when the line count is exceeded.

Example:

```
:10 SELECT PRINT 215(5)
:20 PRINT "THE MODEL 2281 PRINTS UP TO 157 CHARACTERS PER LINE"
:RUN (EXECUTE)
```

Output:

```
THE M
ODEL
2281
PRINT
S UP
TO 15
7 CHA
RACTE
RS PE
R LIN
E
```

The Printer does not print each character as it is received from the CPU. It 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 2281, the system 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 by the CPU 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 STATEMENTS
    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(40)
```

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 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 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(40)  or   :SELECT PRINT 215(40)
:20 PRINT "N", "2 to the Nth"  :20 PRINT "N", "2 to the Nth"
:25 PRINT                      :25 PRINT
: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 printer 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(40)
:20 X=7:Y=2.0:Z=.5
:30 PRINTUSING 40,X;Y;Z
:40 % ##.#
:RUN
```

Output:

```
7.0 2.0 0.5
```

Example:

```
:10 SELECT PRINT 215(40)
:20 A$ = "THE 2281 PRINTER"
:30 HEXPRINT A$
:RUN
```

Output:

```
544845203232383120505249 4E544552
```

2.3 LIST

```
:SELECT LIST 215
```

This statement selects the Printer with Device Type Code 215 for all 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(40)
20 PRINT "N", "2 to the Nth"
30 FOR X=0 TO 8
40 PRINT X, 2↑X
50 NEXT X
```

NOTE:

Certain CRT characters are different when printed on the Model 2281 Printer; these differences are specified in Appendix A.

Output from the Disk Catalogue Index can also be listed on the Printer.

Example:

```
:SELECT LIST 215(132)
:LIST DCF
```

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 SPECIAL TECHNIQUES

The normal Device Type used with the Model 2281 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 2281. In this case, printed output is double spaced, because both the CPU and the Printer execute line feed commands following each system generated carriage return.

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 2281 Printer in the production of special 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. (See example below.) However, for normal PRINTing of a program, output Device Type 4 should not be used.

With the exception of using Device Type 4 for Listing, it is recommended that the Model 2281 normally be selected with Device Type 2 or 0 for PRINT, LIST, and CO operations.

Example:

```
:10 REM THIS PROGRAM DEMONSTRATES DEVICE TYPE 4 FOR LISTING
:20 FOR I = 1 TO 10
:30 PRINT"0000000000111111111122222222223333333333444444444
          5555555555666666666677777777778888888889999999999";
          "AAAAAAAAAABBBBBBBBBCCCCCCCCCCDDDDDDDDDDEEEEEEEEEE"
:40 NEXT I
:SELECT LIST 415
:LIST (EXECUTE)
```

Output:

```
10 REM THIS PROGRAM DEMONSTRATES DEVICE TYPE 4 FOR LISTING
20 FOR I=1 TO 10
30 PRINT "0000000000111111111122222222223333333333444444444455555555556666666666777777777788888888889999999999";"AAAAAAAAAABBBBBBBBBCCCCCCCCCCDDDDDDDDDDEEEEEEEEEE"
40 NEXT I
```

2.6 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 listing of programs on the CRT only.

2.7 DESELECTING THE MODEL 2281 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 Model 2281 in the same manner as they are used with the CRT, although more printing zones are available on the printer than on the CRT. For instance, the 64 column CRT is divided into four zones of 16 characters each, whereas the printer can have up to nine zones of 16 characters each.

When the 10 pitch format is selected, the Model 2281 has a line length of 132 characters which is 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.

When the 12 pitch format is selected, the Model 2281 has a line length of 157 characters which is divided into nine zones of 16 characters each and one zone of 13 characters. The zones constitute columns 0-15, 16-31, 32-47, 48-63, 64-79, 80-95, 96-111, 112-127, 128-143, and 144-156, 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 0-15", "COLUMNS 16-31", "COLUMNS 32-47"
:RUN (EXECUTE)
```

Output:

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

Example 2:

```
:10 REM SKIPPING OVER ZONES WITH COMMAS
:20 SELECT PRINT 215(157)
:30 PRINT "SAMPLE#",,, "CONCENTRATION-%"
:40 PRINT 610,,,  0.15
:RUN (EXECUTE)
```

Output:

```
SAMPLE #                                                CONCENTRATION-%
 610                                                     .15
```

Example 3:

```
:10 REM PRINTING IN PACKED FORMAT WITH SEMICOLONS
:20 SELECT PRINT 215(132)
:30 A$="1976 OLDS" :B$=" TORONADO 4 DR"
:40 PRINT "MAKE:"; A$; B$
:RUN (EXECUTE)
```

Output:

```
MAKE:1976 OLDS TORONADO 4 DR
```

Example 4:

```
:10 REM PRINTUSING FORMAT
:20 SELECT PRINT 215(157)
:30 A$="4-BEDROOM CAPE" :P=45000
:40 PRINTUSING 50,A$,P
:50% ############## PRICE=$##,###
:RUN (EXECUTE)
```

Output:

```
4-BEDROOM CAPE PRICE=$45,000
```

Example 5:

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

Output:

```
4142432044454620474849204A4B4C20
```

NOTE:

In zone printing on the Model 2281, it is important to make sure that information supplied to the last zone does not exceed the legal length of the last zone (either 4 or 13 characters long depending on pitch selection). For instance, in a 10 pitch format, if the information for the last zone exceeds 4 columns then that 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, 3.4, 5.6, 7.8, 9.0, 5.2, 8.4, 0.5, 45.678
:RUN (EXECUTE)
```

Output:

```
1.2   3.4    5.6    7.8    9.0    5.2    8.4    0.5
45.678
```

In the above example the 9th element in line 20 exceeded 4 characters in length and thus was printed in the next line.

3.2 TABBING ON THE MODEL 2281 PRINTER

Tabbing on the Model 2281 Printer can be performed three ways:

1 - PRINTUSING Statement
2 - TAB(function
3 - TAB HEX Codes.

PRINTUSING Statement

When printing columns of information across a line, the PRINTUSING statement can be used to specify the print format. For example:

```
100 SELECT PRINT 215(132)
110 DATALOAD A1,A2,A3,A4
120 IF END THEN 150
130 PRINTUSING 135,A1,A2,A3,A4
135 % ###. PART NO. ##### SIZE = ##.# COLOR ##
140 GOTO 110
150 END
```

The TAB(Function

The TAB(function is used in the same manner with the Printer as with the CRT. When a PRINT statement containing a TAB(function is executed, the Model 2281 prints at the column specified by the integer portion of the TAB(expression.

Example:

```
:SELECT PRINT 215(157)
:10 PRINT TAB( 75); "MASTER SCHEDULE"
:20 PRINT :PRINT
:30 PRINT TAB(40); "EMPLOYEE"; TAB(70);
DEPARTMENT; TAB(110); "SHIFT";
TAB(120); "OVERTIME"
:RUN (EXECUTE)
```

Output:

```
                    MASTER SCHEDULE


EMPLOYEE   DEPARTMENT      SHIFT       OVERTIME
```

In the above example "MASTER SCHEDULE" is printed starting at column 75; likewise the subtitles in line 30 are printed at the specified TAB settings.

The TAB(function can also be used with disk operations as shown below:

```
100 SELECT PRINT 215(132)
110 DATALOAD X,Y
120 IF END THEN 150
130 PRINT TAB(10);X; TAB(40); Y
140 GOTO 110
150 END
```

If the value of 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(60)
:20 A=20
:30 PRINT TAB( A); "MODEL";
TAB(3*A); "HORSEPOWER"
:RUN (EXECUTE)
```

Output:

```
                    MODEL
HORSEPOWER
```

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(100)
:20 PRINT TAB(10); "POWER"
:30 FOR N = 1 TO 10
:40 PRINT TAB(10); (-2)↑N
:50 NEXT N
:RUN (EXECUTE)
```

Output:

```
POWER
-2
 4
-8
 16
-32
 64
-128
 256
-512
 1024
```

TAB HEX Codes

It can at times be more convenient to establish tab settings and then to simply tab to the preset locations in a PRINT statement. To accomplish this, three codes are available on the 2281 Printer: SET TAB - HEX(1A), TAB - HEX(09), and CLEAR TAB - HEX(19).

The set TAB code (HEX(1A)) is used to set a tab in the printer's internal tab buffer. Before setting a tab, the printer's internal line buffer pointer must be set to the correct location in the line. The TAB(function may be used to accomplish this.

Examples:

```
10 SELECT PRINT 215(132)
20 PRINT TAB(10); HEX(1A)
```

Statement 20 sets a tab at column 10 of the print line.

Care must be taken when using the TAB(function to set multiple tabs on the printer. Since the SET TAB code (HEX(1A)) does not begin with a zero hexdigit, it causes the 2200 CPU's internal line count to be incremented by one each time it is executed. To compensate for this, the succeeding TAB(function arguments must all be incremented as well.

Example:

```
10 SELECT PRINT 215(132)
20 PRINT TAB(10); HEX(1A); TAB(21); HEX(1A); TAB(102); HEX(1A)
```

Statement 20 sets tabs at columns 10, 20 and 100.

If tabs are to be set near the end of the print line, it is generally advisable to select a line length greater than 132 (10-Pitch) or 157 (12-Pitch). Otherwise the TAB(argument may become greater than the actual length and cause an unwanted carriage return code (0D) to be executed by the 2200 CPU.

Example:

```
10 SELECT PRINT 215(255)
20 FOR I = 10 TO 130 STEP 10
30 PRINT TAB(I + K); HEX(1A);
40 K = K + 1
50 NEXT I
```

This routine sets tabs at columns 10, 20, 30, 40, 50, ..., 120, 130 of the print line, although the TAB(function arguments are 10, 21, 32, 43, 54, ..., 131, 142.

Once tabs have been set by a SET TAB command, the TAB code (HEX(09)) causes the next item to be printed starting at the next tab location. Since the TAB code begins with a zero digit, it has no effect on the internal line count kept by the 2200 CPU.

Examples:

```
20 PRINT HEX(09); "PART NO."; HEX(09); "PRICE"
```

This statement causes PART NO. to be printed at the first tab location, and PRICE at the second tab location.

```
20 PRINT TAB(09); X(I); TAB(0909); Y(I)
```

This statement prints X(I) at the first tab location and Y(I) at the third location.

The CLEAR TAB command (HEX(19)) is used to remove a tab from the printer's internal tab buffer. To remove a preset tab, the printer must be positioned internally at the tab location. This may be done by using the TAB function.

Examples:

```
10 SELECT PRINT 215(157)
15 PRINT TAB(10);HEX(1A);TAB(25);HEX(1A)
   TAB(40);HEX(1A);TAB(55);HEX(1A);
   TAB(100);HEX(1A)

20 PRINT HEX(0919)
```

This statement clears the first tab from the printer's internal tab buffer.

```
20 PRINT HEX(09090919090919)
```

This statement clears the third and fifth preset tabs.

All preset tabs are automatically cleared when the printer power is turned ON. However, a simple BASIC routine, such as the one shown below, may be used to clear all tabs under program control.

Example:

Clear all possible preset tabs from all print positions (I) in the printer's tab buffer.

```
10 SELECT PRINT 215(255)
20 FOR I = 1 TO 131
30 PRINT HEX(0919);
40 NEXT I : PRINT
```

The semi-colon is placed at the end of statement 30 to suppress the normal carriage return (OD); otherwise a line advance occurs each time statement 30 is executed. A similar example for 12-pitch is:

```
10 SELECT PRINT 215 (255)
20 FOR I = 1 TO 156
30 PRINT HEX(0919);
40 NEXT I : PRINT
```

CHAPTER 4
HEX CODES

4.1 THE HEX FUNCTION

The HEX function is used in a BASIC program to output characters on the Printer (both those that do appear and do not appear on the standard keyboard) and 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 hex digits must always appear in a HEX function; spaces are not allowed. (See the Wang BASIC Reference Manual for hexadecimal characters and codes.) HEX codes for characters and/or printer control can be combined. For example, the following program in memory,

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

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 Model 2281 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 hex codes do not enter the buffer, and instead elicit an immediate response from the printer. These special codes are the printer Control Codes.

The special Control Codes for the Model 2281 are described below:

Function	Hex Code	Description
Black Ribbon (used with two-color ribbon)	HEX(05)	Causes all subsequent output, including the remaining portion of the current line, to be printed in black. The color remains black until changed by executing a HEX(06) code (change to red). Black is the default color. Example: 100 PRINT "REPORT" 100 PRINT HEX(05); "REPORT" 100 PRINT HEX(05): PRINT "REPORT" Each of the above will print "REPORT" in black.

NOTE:

If a HEX(05) code is embedded in a line, the characters to the left of HEX(05) are printed in the previously selected color; those to the right of HEX(05) are printed in black.

Example:

```
10 PRINT HEX(06)
20 PRINT "ABC ";HEX(05);"XYZ"
```

Output:

```
ABC XYZ
 ↑   ↑
red black
```

Red Ribbon (used with two-color ribbon)	HEX(06)	Causes all subsequent output, including the remaining portions of the current line, to be printed in red. The color remains red until reset by one of the following methods: a. Executing a HEX(05) code (change to black). b. Depressing the System 2200 RESET key. c. Master Initializing (power ON/OFF) the System or the printer. Example: 100 PRINT HEX(06); "REPORT" 100 PRINT HEX(06): PRINT "REPORT" Each of the above will print "REPORT" in red.

NOTE:

If a HEX(06) code is embedded in a line, the characters to the left of HEX(06) are printed in the previously selected color; those to the right of HEX(06) are printed in red. Also, when more than one color code appears in a single statement line, the last one takes precedence.

Example:

```
10 PRINT HEX(05)
20 PRINT "ASPHALT ";HEX(06);"ROSE"
```

Output:

```
ASPHALT ROSE
   ↑     ↑
 black  red
```

Example:

```
10 PRINT HEX(0D0A0605); "TITLE"
```

The above example will print TITLE in black.

NOTE:

If a HEX(06) code is used on a printer not equipped with a two-color ribbon, the 'red' output is printed without using the ribbon (as in cutting a stencil).

Backspace HEX(08)

Causes the internal line buffer pointer to be decremented by one character.

However, destructive overwriting into the line buffer is not allowed. For example, the HEX(08) in the following program

```
100 PRINT "REPORT";HEX(080808080808);
"XXXXXX" produces REPORT on the printout,
and not XXXXXX.
```

In addition, when using a HEX(08) on a line following one of the codes HEX(05), HEX(06), HEX(0A), and HEX(0D), care must be taken to ensure that the backspacing is not carried to the left of the code.

Examples:

```
100 PRINT HEX(05);"XYZ";HEX(080808);
is correct.
100 PRINT HEX(06); "XYZ";HEX(0808080808);
is not allowed.
```

TAB HEX(09)

Causes the internal line buffer pointer to be incremented to the next preset TAB location.

Example:

```
10 PRINT "NAME";TAB(20); "JOB TITLE"
15 PRINT TAB(20);HEX(1A)
20 PRINT HEX(09); "CLERK"
```

Output:

```
NAME        JOB TITLE

            CLERK
```

LINE FEED — HEX(0A)

Causes the current contents of the line buffer to be printed and advances the paper one line.

Example:

```
10 PRINT "JONES";
20 PRINT HEX(0A); "EXPRESS"
```

Output:

```
JONES
     EXPRESS
```

Vertical TAB — HEX(0B) (see note on page 33)

Advances the paper 6 lines.

Example:

```
10 PRINT "LIST OF DONORS"
20 PRINT HEX(0B); "NAME"; TAB(25); "TYPE"
```

Output:

```
LIST OF DONORS


NAME                    TYPE
```

Form Feed — HEX(0C) (see note) on page 33)

Advances the paper to the top of the next form (66 line format assumed).

Example:

```
10 PRINT "LIST OF DONORS"

:    :

:    :
250 PRINT "THIS CONCLUDES THE LIST OF
DONORS"
260 PRINT HEX(0C)
```

Carriage Return — HEX(0D)

Prints the current contents of the line buffer and advances the paper one line.

Example:

```
10 PRINT "LIST OF NAMES"
20 PRINT HEX (0D0D0D); "S. JONES"
```

Output:

```
LIST OF NAMES


S. JONES
```

Clear TAB	HEX(19)	Clears a TAB at the current location of the internal line buffer pointer.

Example:

```
20 PRINT TAB(15);HEX(1A)
30 PRINT (0919)
```

Set TAB	HEX(1A)	Sets a TAB at the current location of the internal line buffer pointer. Before setting a tab, the line buffer pointer must be set to the desired location in the line.

Example:

```
20 PRINT TAB(45);HEX(1A)
```

Underscore	HEX(5F)	Underscores the character in the line buffer at the current location of the internal line buffer pointer.

Example:

```
10 PRINT "DEPT.";
20 PRINT HEX(0808080808);
30 PRINT HEX(5F5F5F5F5F)
```

Output:

DEPT.

Note that since the Underscore code does not begin with a zero hexdigit the 2200's internal line count is incremented as each underscore is executed. If underscoring is to be done near the end of the print line, it is advisable to select a line length greater than 132 (10-pitch) or 157 (12-pitch) to prevent an unwanted carriage return from being executed by the 2200 CPU.

Example:

```
10 SELECT PRINT 215(255)
20 PRINT TAB(130);"AB";
30 PRINT HEX(08085F5F)
```

Delete	HEX(7F)	Clears the buffer of characters sent before the '7F'.

Example:

```
100 PRINT "TITLE=";
110 PRINT HEX (7F);
120 PRINT "VALUE="
```

The above example prints:

VALUE =

> **NOTE:**
>
> Control codes HEX(0B) and HEX(0C) are executed before any characters in the same PRINT line.

APPENDICES

APPENDIX A

HEXADECIMAL CODES

HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER	HEX CODE	PRINTER CHARACTER
HEX(05)*	Black Ribbon	HEX(39)	9	HEX(5D)*	)
HEX(06)*	Red Ribbon	HEX(3A)	:	HEX(5E)*	!
HEX(08)	Backspace	HEX(3B)	;	HEX(5F)*	Underscore
HEX(09)*	TAB	HEX(3C)*	(	HEX(60)*	Space
HEX(0A)	Line Feed	HEX(3D)	=	HEX(61)	a
HEX(0B)*	Vertical TAB	HEX(3E)*	)	HEX(62)	b
HEX(0C)*	Form Feed	HEX(3F)	?	HEX(63)	c
HEX(0D)	Carriage Return	HEX(40)	@	HEX(64)	d
HEX(19)*	Clear TAB	HEX(41)	A	HEX(65)	e
HEX(1A)*	Set TAB	HEX(42)	B	HEX(66)	f
HEX(1E)	¢	HEX(43)	C	HEX(67)	g
HEX(1F)*	Space	HEX(44)	D	HEX(68)	h
HEX(20)	Space	HEX(45)	E	HEX(69)	i
HEX(21)	!	HEX(46)	F	HEX(6A)	j
HEX(22)	"	HEX(47)	G	HEX(6B)	k
HEX(23)	#	HEX(48)	H	HEX(6C)	l
HEX(24)	$	HEX(49)	I	HEX(6D)	m
HEX(25)	%	HEX(4A)	J	HEX(6E)	n
HEX(26)	&	HEX(4B)	K	HEX(6F)	o
HEX(27)	'	HEX(4C)	L	HEX(70)	p
HEX(28)	(	HEX(4D)	M	HEX(71)	q
HEX(29)	)	HEX(4E)	N	HEX(72)	r
HEX(2A)	*	HEX(4F)	O	HEX(73)	s
HEX(2B)	+	HEX(50)	P	HEX(74)	t
HEX(2C)	,	HEX(51)	Q	HEX(75)	u
HEX(2D)	-	HEX(52)	R	HEX(76)	v
HEX(2E)	.	HEX(53)	S	HEX(77)	w
HEX(2F)	/	HEX(54)	T	HEX(78)	x
HEX(30)	0	HEX(55)	U	HEX(79)	y
HEX(31)	1	HEX(56)	V	HEX(7A)	z
HEX(32)	2	HEX(57)	W	HEX(7B)*	.
HEX(33)	3	HEX(58)	X	HEX(7F)*	Clear Buffer
HEX(34)	4	HEX(59)	Y		
HEX(35)	5	HEX(5A)	Z		
HEX(36)	6	HEX(5B)*	(		
HEX(37)	7	HEX(5C)*	Space		
HEX(38)	8				

*Indicates a Character that differs from the CRT Character Set.

APPENDIX B

SPECIFICATIONS FOR THE 2281 PRINTER

Printout Speed	30 characters per second
Character Configuration	12 print styles available
Line Width	132 characters/10 pitch 157 characters/12 pitch
Character Set	ASCII, 86 characters
Duplicate Copies	up to five copies in addition to the original.
Printer Size: Width	24 in. (61 cm)
Depth	22 in. (55.9 cm)
Height	14 in. (35.6 cm)
Weight	37 lb (16.8 kg)
Fuses	3.0A (SB) for 115 VAC 1.5A (SB) for 230 VAC
Power Requirements	115 or 230 VAC $\pm$ 10% 50 or 60 Hz $\pm$ 1 Hz 250 watts
Cable	12 ft (3.7m) cable with connector for CPU controller board.
Operating Environment	45°F (7°C) to 95°F (35°C) -20°F (-29°C) to 135°F (57°C) storage 10% to 80% relative humidity non-condensing 0% to 90% relative humidity, storage

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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 minimized "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.

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NOTE:

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