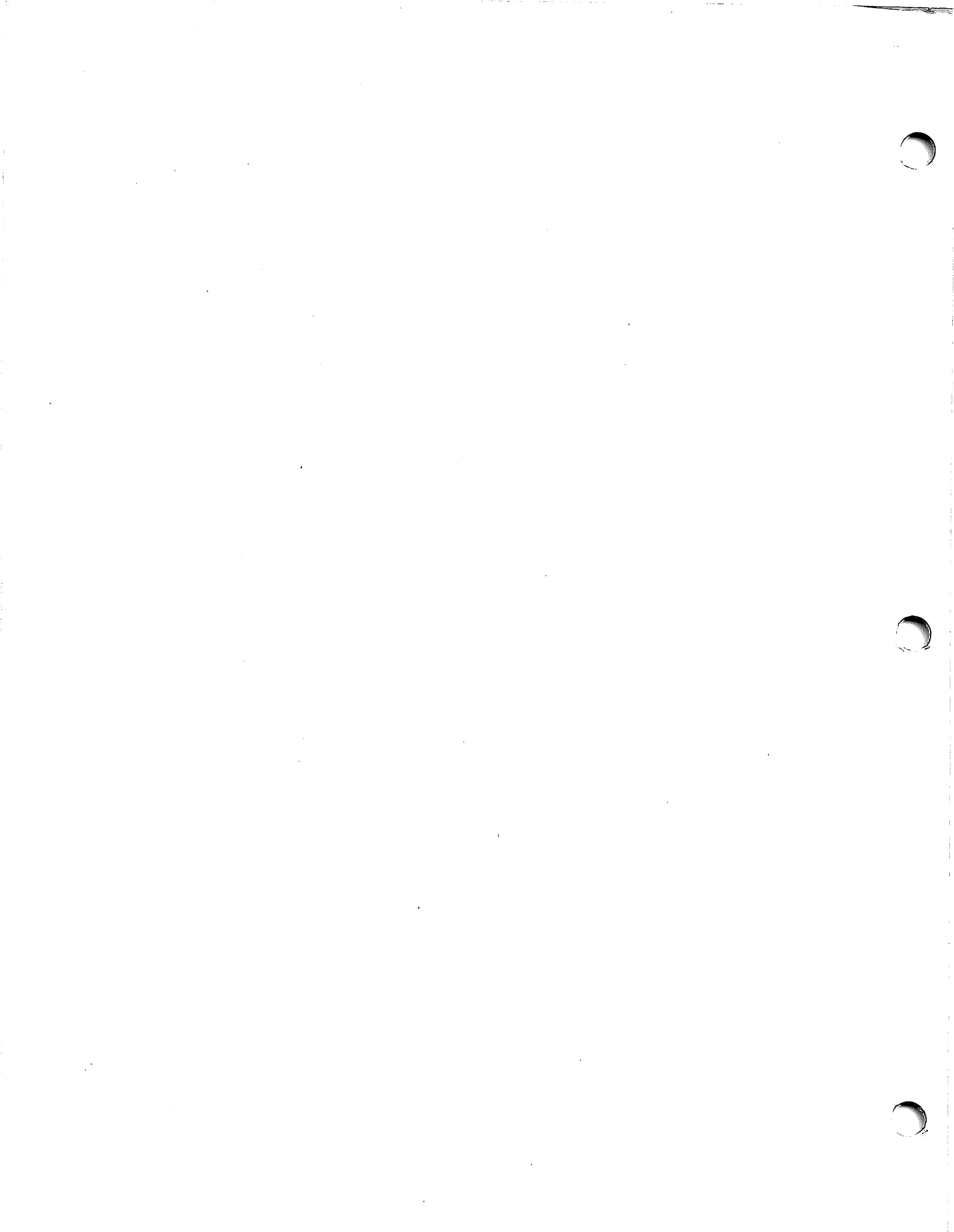




WANG

2200

**Model 2245/160 Matrix Printer
User's Guide**



2200

Model 2245/160 Matrix Printer User's Guide

1st Edition — January 1985
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PREFACE

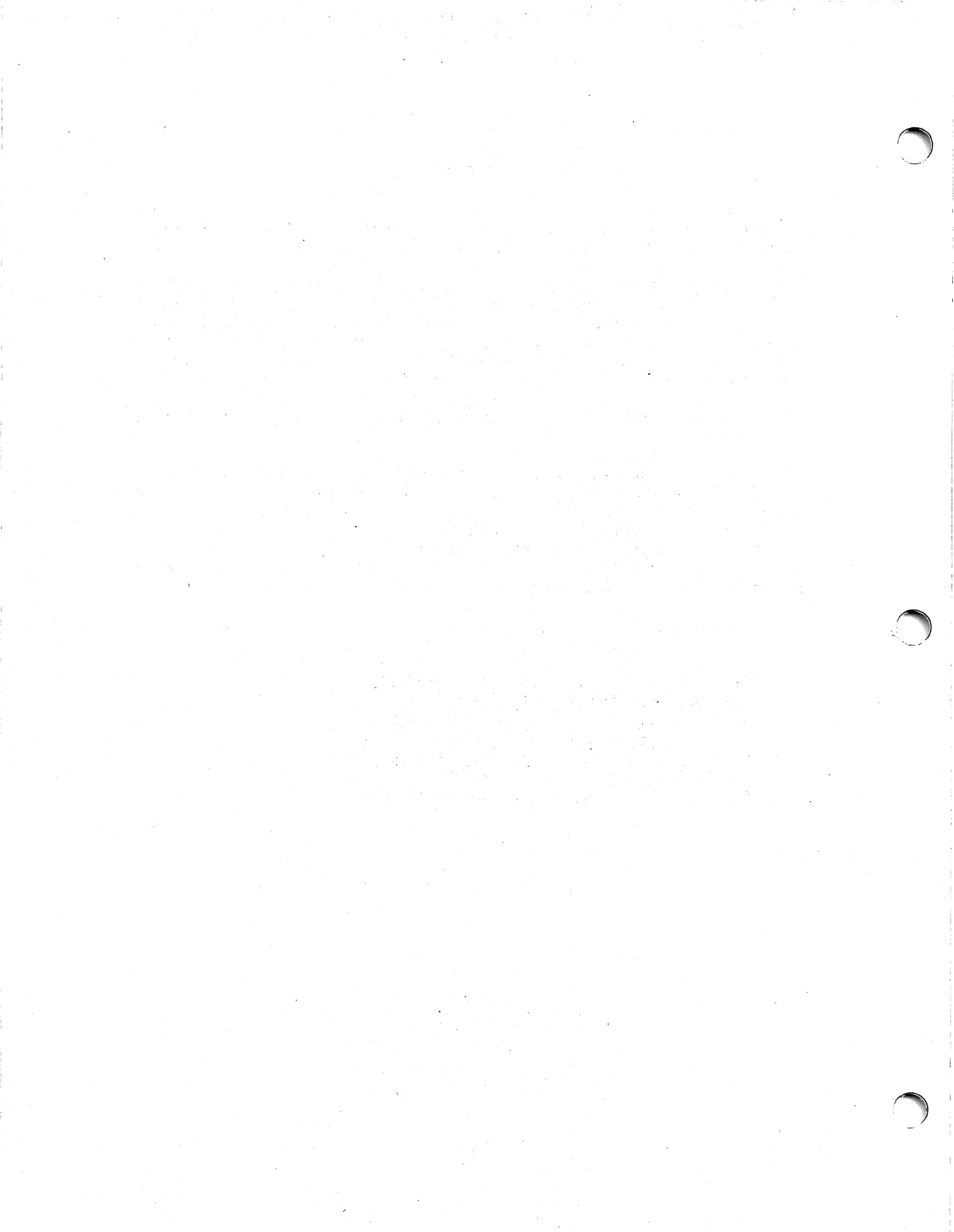
This manual is your guide to operating the Wang Model 2245/160 Matrix Printer, which is an option for Wang 2200 series systems.

Chapter 1 contains a general description of the printer and its features. Chapter 2 contains descriptions of the printer operating controls and indicators. Chapter 3 contains a printer operation summary and procedures for loading paper and replacing the ribbon cartridge. Chapter 4 contains device selection codes. Chapter 5 contains descriptions and sample programs for Text Mode control codes. Chapter 6 contains descriptions and sample programs for Download mode control codes. Chapter 7 contains descriptions and sample programs for Bit Image mode control codes.

Appendix A contains printer specifications. Appendix B contains printer maintenance procedures. Appendix C contains a listing of the mixed printing modes. Appendix D contains a summary of the printer control codes. Appendix E contains a table that lists the printer characters and their corresponding hex codes. It also contains a table of the names of the printer characters. Appendix F contains procedures for loading printer character tables and function tables.

For information about printer-related utilities and functions, refer to the following sources:

- 2200 Word Processing Operator's Guide (700-6937)
- 2200 LVP Introductory Manual (700-6164)
- 2200 MVP Introductory Manual (700-4693)
- 2200 SVP Introductory Manual (700-6163)
- 2200 BASIC-2 Multiuser Operating System Software Bulletin Release 2.6 (700-0097)
- Basic-2 Language Reference Manual (700-4080)



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CHAPTER 1 GENERAL INFORMATION

1.1 OVERVIEW

The Wang Model 2245/160 Dot Matrix Printer, shown in Figure 1-1, is an ideal system or terminal printer for use with WANG 2200 Series Systems, Models 2200 SVP, 2200 LVPC, 2200 MVP, and 2200 MVPC. This chapter describes many of the advanced features of the printer. For detailed specifications, see Appendix A.

1.2 GENERAL DESCRIPTION

The 2245/160 is a bidirectional, parallel matrix printer that operates at 160 characters per second (CPS), and uses a quick change black ink ribbon cartridge that has a life expectancy of three million characters. The unit comes with friction feed, for printing on cut sheet paper, and tractor feed for printing on pin-feed (continuous forms) paper up to 16 inches (40.6 cm) wide. An original and two copies can be printed. Two switches located under a removable cover also enable operator control of several printer functions. The printer also contains provision for printing download characters and bit-image data.



Figure 1-1. Model 2245/160 Matrix Printer

Printer Driver

The 2200 generalized printer driver program located on the 2200 system contains character tables and printer function tables for use with the 2245/160. The printer driver character set and control codes are described in the 2200 Basic-2 Multiuser Operating System Software Bulletin Release 2.6.

Transparent mode

In the transparent mode the printer driver is bypassed, and the Wang International Standard Code for Information Interchange (WISCII) character set shown in Appendix E is used for printing. WISCII is an extended version of the ASCII code set. It contains 96 ASCII characters, a wide selection of symbols, plus special characters that enable the printing of Latin alphabet languages. Printer control codes for use in the transparent mode are contained in Chapters 5, 6, and 7.

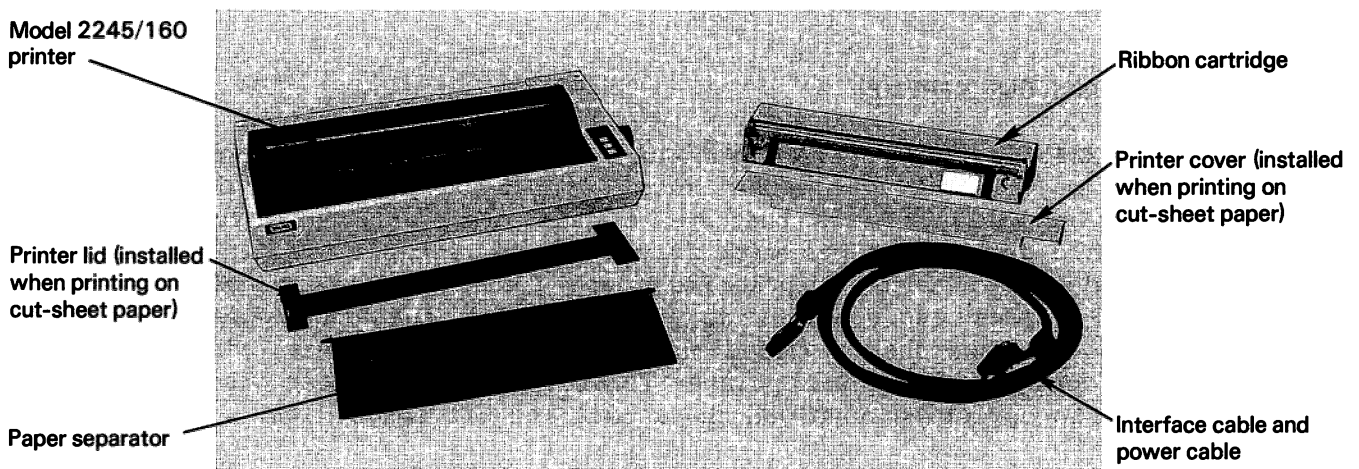


Figure 1-2. Printer and Accessories

1.3 ORDERING SUPPLIES

The use of WLC (Wang Laboratories Certified) ribbon cartridges and replacement print heads is recommended to ensure superior performance of your printer. These and other printer supplies are listed in the WLC Supplies Direct-Order Catalog. You may obtain a copy by calling 1-800-225-0234 between 8:00 am and 8:00 pm Eastern Standard Time (in Massachusetts, Alaska, and Hawaii, call [617] 256-1400). Discount information, instant order entry, and fast delivery can be obtained by calling these numbers.

NOTE

Be sure to specify Wang Model 2245/160 when ordering ribbon cartridges and print heads.

1.4 WANG MAINTENANCE AGREEMENT

Your Wang equipment requires periodic servicing to maintain its peak efficiency. The purchase of a Wang maintenance agreement is a convenient, cost-effective way to ensure that your equipment continues to perform reliably. A Wang maintenance agreement includes the following benefits:

1. Preventive Maintenance. Depending on the requirements of your particular device, a Wang service representative periodically lubricates and cleans your equipment and inspects it for worn parts. In addition, the service representative incorporates any engineering changes that are released for your device. Preventive maintenance maximizes up-time by reducing breakdowns.
2. Fixed Annual Cost. When you buy a maintenance agreement, you issue only one purchase order for service for the entire year, and you receive one annual bill. Budget billing is also available.

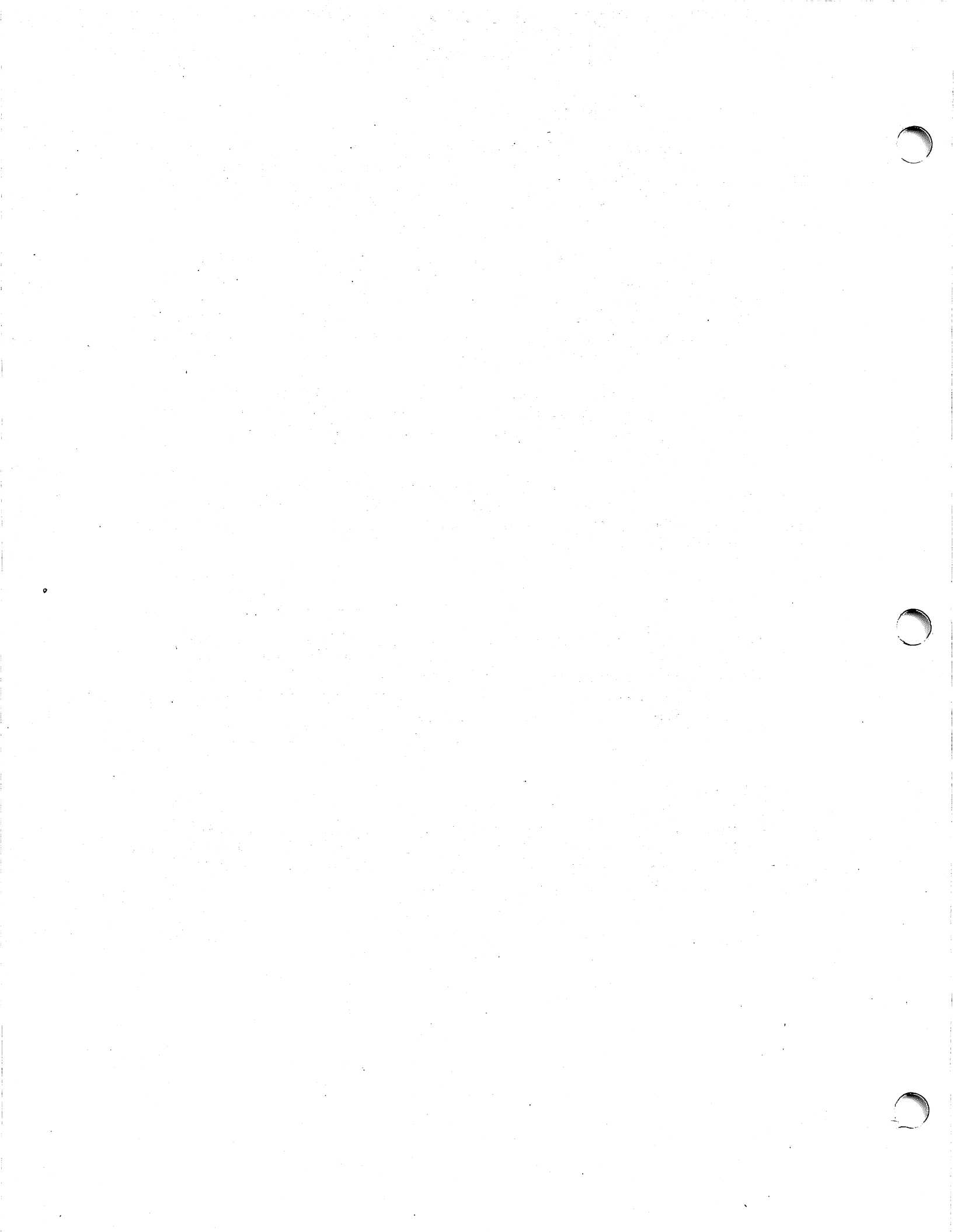
If you do not purchase a Wang maintenance agreement, you may obtain service from Wang on a per call (time-plus-materials) basis. Your local Wang Sales/Service Office can provide further information about maintenance agreements.

NOTE

Wang maintenance agreements do not include service necessitated by modifications made by persons other than authorized Wang personnel. If you modify equipment, you are financially responsible for any service required by such modification.

1.5 INSTALLATION

The Model 2245/160 must be unpacked, inspected, and installed by a Wang service representative. Upon delivery of the unit, call the Wang Service office and request that this service be performed. Failure to follow this procedure will void the warranty.



CHAPTER 2
CONTROLS AND INDICATORS

2.1 INTRODUCTION

This chapter contains a description of the printer power switch, the control panel buttons and indicators, and the dual in-line pin (DIP) switch.

2.2 ON/OFF SWITCH

The printer power switch located on the left side of the printer case is shown in Figure 2-1. Press ON (marked with a white dot) to power-up the printer. Press OFF to power-down the printer. With paper loaded in the printer, and the printer POWER switch set to ON, the POWER, READY, and ON LINE indicators light and the printer is ready to accept data from the 2200 system.

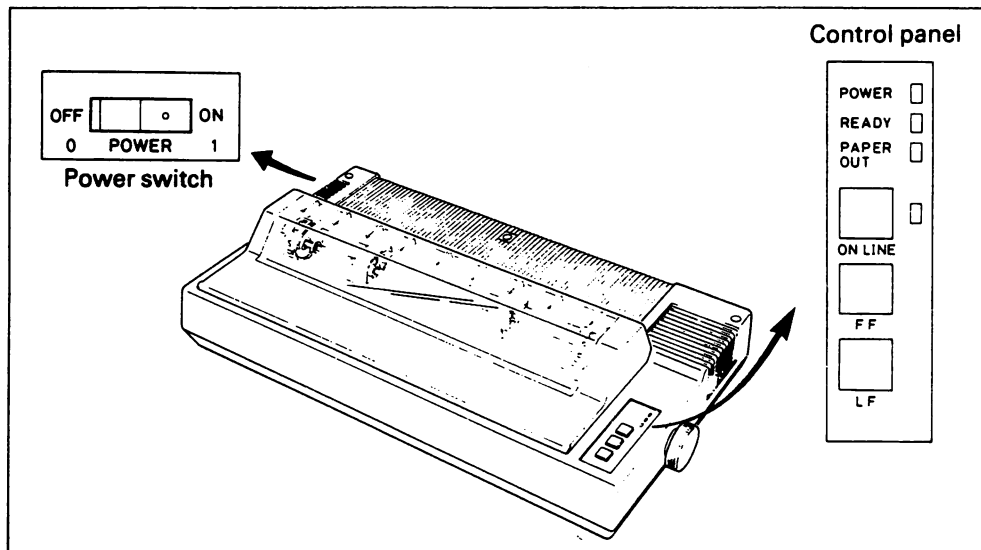


Figure 2-1. Printer Switches and Indicators

NOTE

The Top-of-Form position for continuous form paper (the line on the paper where printing begins) is automatically set when the printer POWER switch is turned on. Before turning the POWER switch ON, install paper in the printer (refer to Sections 3.5 and 3.6) and rotate the platen knob to advance the paper to the desired Top-of-Form position.

2.3 CONTROL PANEL

The control panel, shown in Figure 2-1, contains three control buttons and four indicators.

ON LINE Button

After paper has been loaded and the POWER switch is turned ON, the green LED located next to the ON LINE button illuminates, indicating that the printer is in the On-Line mode. Printing can begin only when the printer is on-line. Pressing the ON LINE button again sets the printer in the Off-Line mode and causes the green LED to go out. This button does not function during printing. The printer is automatically placed off-line if the paper supply is exhausted or if a mechanical error occurs in the printer. The Line Feed (LF) and Form Feed (FF) buttons function only when the printer is off-line.

FF (Form Feed) Button

When the FF button is pressed once, the paper is advanced to the next Top-of-Form position. This button functions only when the printer is off-line.

LF (Line Feed) Button

When the LF button is pressed, the paper advances one line at a time. This button functions only when the printer is off-line.

Indicators

The following list describes the printer indicators:

- POWER -- Illuminates while the printer is receiving AC power.
- READY -- Illuminates when the printer is ready to receive data.
- ON LINE -- Illuminates when the printer is in the On-Line mode.
- PAPER OUT -- Illuminates when the supply of pin-feed paper is near its end.

Paper-Out Detector

The paper-out detector is a switch that is located on the paper guide. When the paper supply is near the end of the last sheet of paper, the printer stops, the PAPER OUT indicator is illuminated, a beep tone sounds, and the printer is placed off-line.

Remove the paper from the printer by pressing the LF or FF switch. If you want to continue printing up to the last line of cut-sheet paper, disable the paper-end detector by setting the DIP Switch Pin 1-3 to the ON position (refer to Section 2.6).

Beeper

A beeper located inside the printer sounds for approximately 0.1 second to indicate a problem. The signal and problems are as follows:

- Four long beeps indicates a short circuit in the print head drive circuit.
- Three short and one long beep indicates abnormally high voltage.
- Three short beeps repeated twice indicates an error in the Wang 2200 system.
- Four short beeps repeated five times indicates a paper-end status.

NOTE

To correct any of the first three conditions, contact your Wang service representative. For the last condition, load a new supply of paper. Disable the paper-end status beep when using cut-sheet paper by setting DIP Switch 1-3 to the OFF position (refer to Section 2.6).

2.4 PAPER HANDLING CONTROLS

Paper-Release Lever

The paper-release lever is located on the left side of the printer, to the left of the platen. Set the lever to the forward position (toward the front of the printer) to use pin-feed paper. Set the lever to the rear position to use cut-sheet paper.

Paper-Feed Knob

Use the paper-feed knob at the right end of the printer to load paper into the printer.

CAUTION

Do not attempt to rotate the knob when the printer power is on. Do not pull out the paper in the backward direction. Damage to the printer may result.

Paper Bail

The paper bail holds paper against the platen for optimum print quality and quietness. Move the paper bail away from the platen when printing on pin-feed paper. Move the paper bail against the platen when printing on cut-sheet paper.

2.5 SELF-TEST

The printer has a self-test function that you can use to check printing quality. To perform this test, load paper into the printer, press and hold the LF button, and turn the POWER switch ON. Characters will be printed until you set the POWER switch to OFF.

2.6 SETTING DIP SWITCHES

You can select several control modes by using two Dual In-Line Package (DIP) switches located inside the printer. These switches have been set for normal operation with the Wang 2200 system prior to shipment. The following section describes how to access the switches.

CAUTION

Static electricity may damage the electronic components in the printer. Do not touch any components on the printer circuit boards other than the two DIP switches.

Removing the Switch Cover

To remove the switch cover, perform the following steps:

1. Set the POWER switch to OFF, and then unplug the power cord from the outlet.
2. Use a Phillips screwdriver to remove the screw on the switch access cover (refer to Figure 2-2).

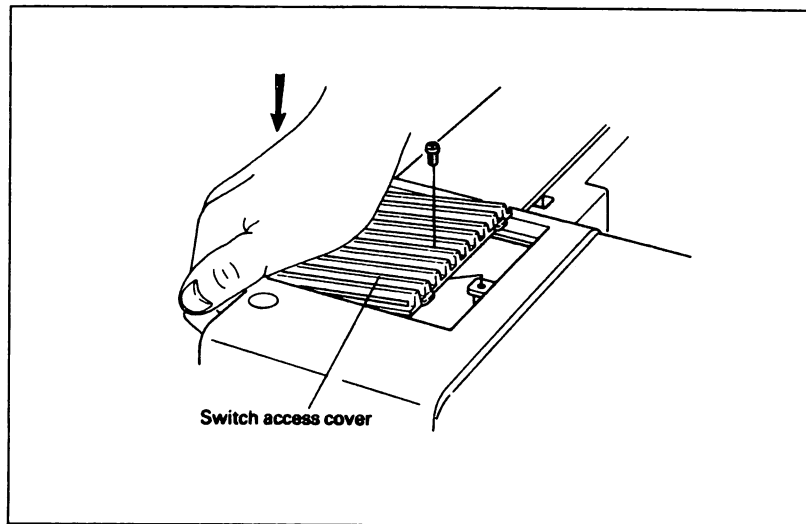


Figure 2-2. Removing the Switch Access Cover

3. Push the outer edge of the cover down as shown in Figure 2-2, and then lift it from the printer. The two DIP switches located under the access cover are shown in Figure 2-3.

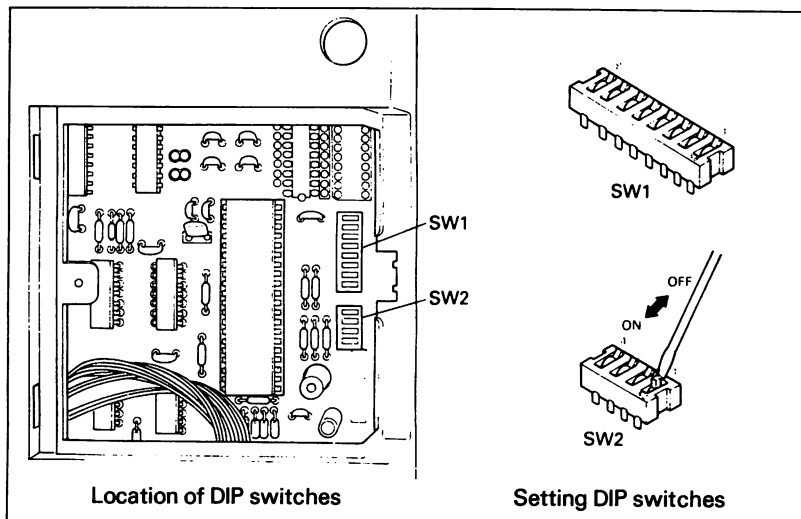


Figure 2-3. Location of DIP Switches

DIP Switch No. 1

DIP Switch No. 1 consists of eight sections (1-1 through 1-8). The function of each switch section and the preset conditions at the time of shipment are shown in Table 2-1.

Table 2-1. Functions and Conditions of DIP Switch No. 1

Switch Section	Function	OFF	ON	Factory-set Condition
1-1	Print mode at POWER ON	Pica	Condensed	OFF
1-2	ZERO font	0	∅	OFF
1-3	Paper-end detector	Enabled	Disabled	OFF
1-4	Input buffer	Disabled	Enabled	OFF
1-5	Print mode at POWER ON	Pica	Emphasized	OFF
1-6	WISCII character set	--	--	ON
1-7	WISCII character set	--	--	ON
1-8	WISCII character set	--	--	ON

SW1-1 -- When this switch is ON, the printer mode is set to the Condensed mode; when the switch is OFF, the printer mode is set to the Pica mode.

SW1-2 -- When this switch is ON, the character ∅ (zero with a slash) is printed.

SW1-3 -- Use this switch to activate or deactivate the paper-end detector. When this switch is ON, the paper-end detection function becomes invalid and the printer operates even if it is out of paper. Inputting Control Code ESC 9 reactivates the paper-end detector.

SW1-4 -- When this switch is OFF, you can download characters. Refer to Chapter 6 for information on downloading characters.

SW1-5 -- When this switch is ON, the printer is set to the Emphasized mode; when the switch is OFF, the printer is set to the Pica mode.

SW1-6, SW1-7, SW1-8 -- Use these switches to select the WISCII character set for printer operation.

DIP Switch No. 2

DIP Switch No. 2 consists of four sections (2-1 through 2-4). The function of each switch section and the preset conditions at the time of shipment are shown in Table 2-2.

Table 2-2. Functions and Conditions of DIP Switch No. 2

Switch Section	Function	OFF	ON	Factory-set Condition
2-1	Select	Ext. Select	Auto Select	ON
2-2	Beeper	Disabled	Enabled	ON
2-3	1-inch skip-over perforation	Disabled	Enabled	OFF
2-4	Automatic line feed	LF from Wang 2200 system	Auto LF with CR	OFF

SW2-1 -- When this switch is ON, the printer is in the Selected mode and no external command can deselect it.

SW2-2 -- When this switch is ON, the beeper sounds for paper out or other conditions; when this switch is OFF, the beeper does not sound.

SW2-3 -- Use this switch to set the automatic skip-over perforation function. When this switch is ON, the paper automatically advances to the first line of the next page when the remaining page length is one inch. When this switch is OFF, there will not be an automatic skip-over perforation.

SW2-4 -- When this switch is ON, a line feed is performed automatically with the receipt of each CR command. When this switch is OFF, the line feed is supplied separately by the Wang 2200 system.

Replacing the Switch Cover

Replace the switch access cover by putting the projection of the cover inside the lower case. Gently slide the cover back into place, and then use a Phillips screwdriver to reinstall the cover mounting screw (refer to Figure 2-4).

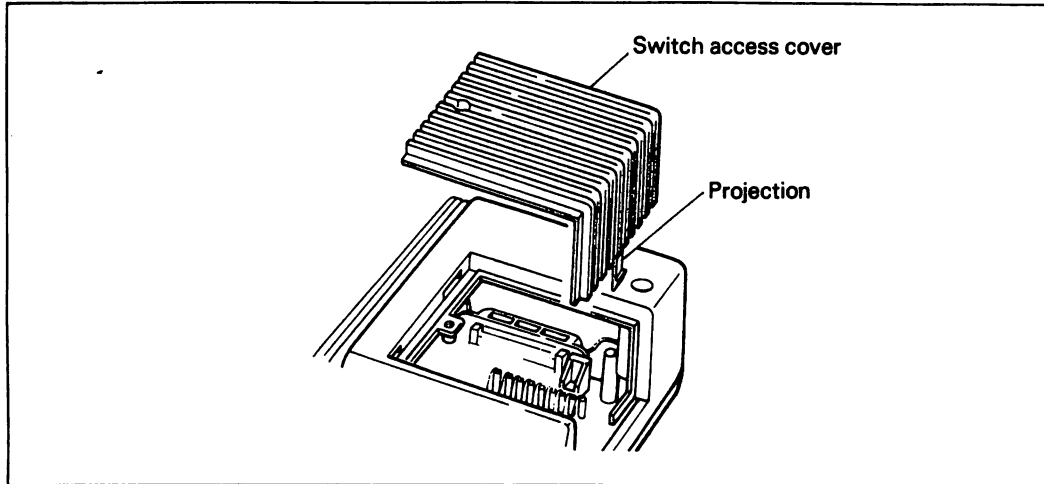


Figure 2-4. Replacing the Switch Cover

2.7 HEX DUMP MODE

In the Hex Dump mode, all program output or program listings are printed in hexadecimal code. For example, when the following print program is entered,

```
10 SELECT PRINT 004  
20 PRINT HEX(00);HEX(1B);"ABCD";HEX(46)
```

the printer output (in Hex code) is as follows:

```
00 1B 41 42 43 44 46 0D 0A
```

To enter the Hex Dump Print mode, turn the printer power ON while holding down both the LF and FF buttons. Hex Dump mode cannot be cancelled during a printing operation.

Printing in the Hex Dump mode is performed only when the printer is in the buffer-full state. The data remaining in the print buffer is printed when the printer is set to the Off-Line mode.

CHAPTER 3
PRINTER OPERATION

3.1 INTRODUCTION

This chapter contains a summary of instructions for operating the printer, as well as detailed procedures for loading paper, changing the ribbon cartridge, and for preventive maintenance.

3.2 PRINTER OPERATION SUMMARY

Printer operations are summarized in the following five steps:

1. For printing on pin-feed paper, install the paper tractor. For printing on cut-sheet paper, remove the paper tractor (refer to Section 3.4).
2. Load paper into the printer (refer to Sections 3.5 and 3.6).
3. Set the printer POWER switch to ON. The printer POWER, READY, and ON LINE indicators light up.
4. Send information to the printer from the Wang 2200 system. Some types of information that can be printed are listed in Table 3-1.

Table 3-1. Types of Printed Information

Type	Comments/References
WP documents	Uses WP Print Menu (refer to <u>The Wang 2200 Word Processing Operator's Guide</u>).
BASIC	Uses PRINT and LIST instructions (refer to the <u>BASIC-2 Language Reference Manual</u>).

5. After printing is completed, remove the printed page(s) by first pressing the ON LINE button (the indicator will go out), then pressing the LF or FF button to advance the paper.

NOTE

You can also remove paper by setting the power switch to OFF and rotating the paper feed knob to advance the paper. Do not rotate the paper-feed knob while the power is ON or attempt to pull out paper in a backward direction because you can damage the printer.

3.3 PRINTER INITIALIZATION

Each time the primary AC power source is interrupted and re-applied (i.e., by turning the POWER switch OFF and ON), printer initialization occurs. During initialization, the following sequence of events occur in the printer:

- The print head returns to its home position.
- The printer is automatically placed on-line, unless it is out of paper.
- The printer buffer is cleared; downloaded characters are cleared.
- The line spacing is set at 1/6 inch.
- The form length per page is set to 11 inches.
- The Operation mode reverts to Text mode, Pica type (10 characters/inch).

Initialization also occurs at the top of each page of a WP document.

3.4 PAPER-TRACTOR UNIT

The paper-tractor unit and paper separator must be installed on the printer when you use pin-feed paper. They should be removed from the printer when you use cut-sheet paper. Installation and removal procedures are described in the following paragraphs.

NOTE

The printer is shipped from Wang Laboratories with the paper tractor installed in the printer.

Removing the Paper-Tractor Unit and Paper Separator

To remove the paper-tractor unit and the paper separator, perform the following steps:

1. Remove the paper separator by lifting it up and back. Remove the printer cover and pull the paper bail forward, away from the platen.
2. Remove the plastic tractor unit shipping locks, located on the right and left ends of the tractor, if they are installed on the printer. The right-end lock is shown in Figure 3-1.

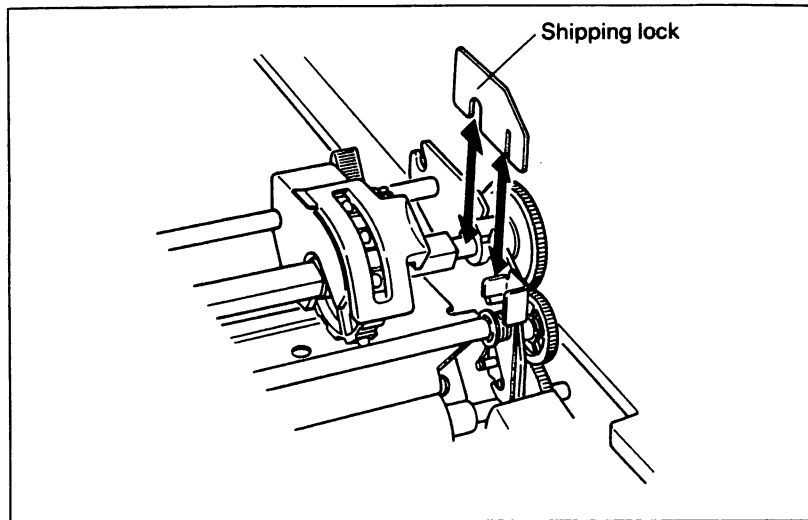


Figure 3-1. Removal of Shipping Lock

NOTE

Save the shipping locks. They prevent movement of the tractor-lock levers during shipment, and must be re-installed on the tractor before you ship the printer. You do not have to remove the shipping locks to operate the printer.

3. Push the tractor-lock levers (shown in Figure 3-3) back, then move the tractor unit back and up out of the printer.
4. Install the printer lid (refer to Figure 3-2) by fitting the lid projections into the openings on one end of the printer case. Then bend the middle of the lid up slightly and fit the other end of the lid into place. Install the printer cover (refer to Figure 3-2) by holding the cover in the vertical position, then lowering it onto the projections on the right end of the printer case, then the left end. The printer is now ready for use with cut-sheet paper.

Installing the Paper-Tractor Unit and Paper Separator

Perform the following steps to install the paper-tractor unit and the paper separator:

1. Remove the printer cover and printer lid (refer to Figure 3-2). Bend the center of the lid upward slightly to free it from the printer.

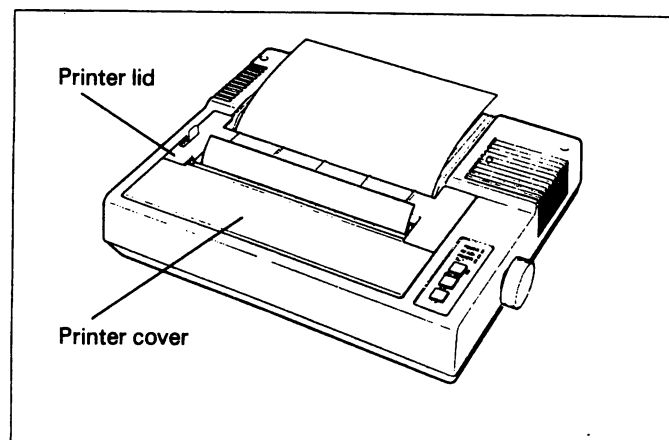


Figure 3-2. Location of Printer Cover and Printer Lid

2. Fit the notches on the end plates of the tractor frame onto the shaft located about 1 1/2 inches to the rear of the platen shaft (refer to Figure 3-3).

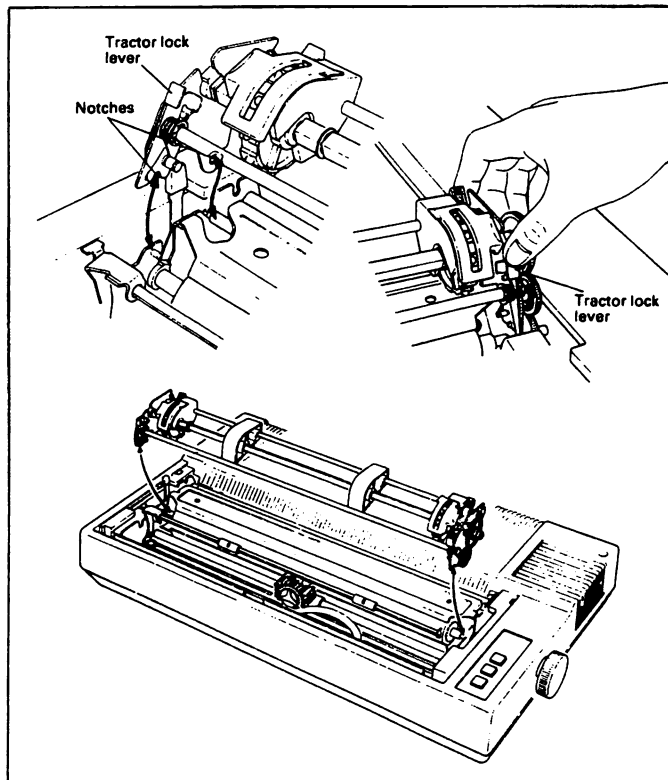


Figure 3-3. Installation of Paper Tractor

3. Push both tractor-lock levers and lower the front of the tractor unit into place.
4. Install the paper separator. Insert the projections on the separator into the two holes located at the rear of the tractor frame (refer to Figure 3-4).

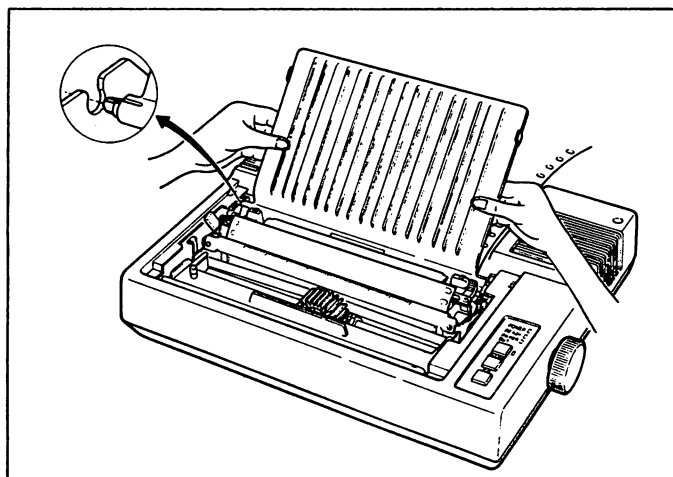


Figure 3-4. Paper Separator Installation

5. Install the printer cover (refer to Figure 3-5). The printer with paper tractor, paper separator, and cover installed is shown in Figure 3-6.

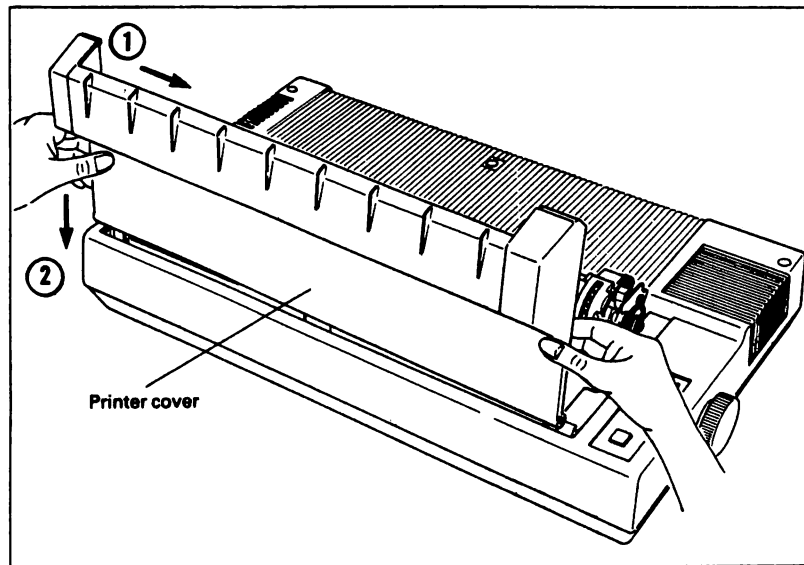


Figure 3-5. Printer Cover Installation

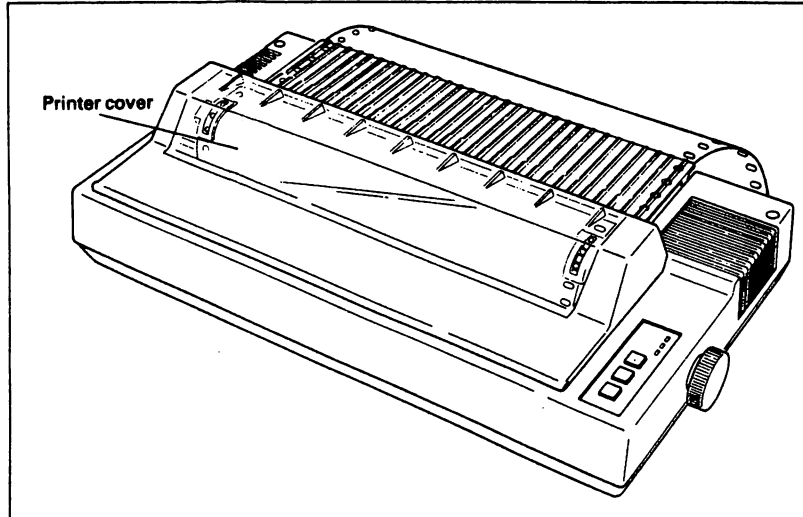


Figure 3-6. Printer Cover Installed

3.5 LOADING PIN-FEED PAPER

The printer accepts pin-feed paper from 4 inches to 16 inches wide. The tractor unit must be installed on the printer before you load pin-feed paper. Refer to Section 3.4 for instructions on installing the tractor. Perform the following steps to load paper:

1. Set the printer POWER switch to OFF, and then raise the printer cover.
2. Open the paper-holding covers, shown in Figure 3-7.

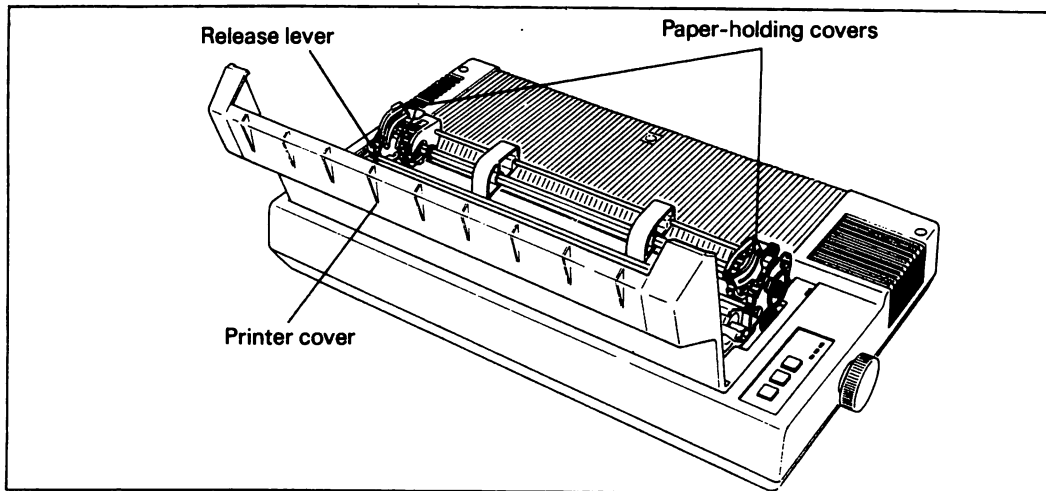


Figure 3-7. Paper-Holding Covers in Open Position

3. Pull the paper bail forward, away from the platen.
4. Pull the paper-release lever, shown in Figure 3-7, to the forward (released) position.
5. Fold the first sheet of pin-feed paper in half so that it feeds easily into the printer. Insert the paper under the paper separator and into the slot behind the paper tractor (refer to Figure 3-8).

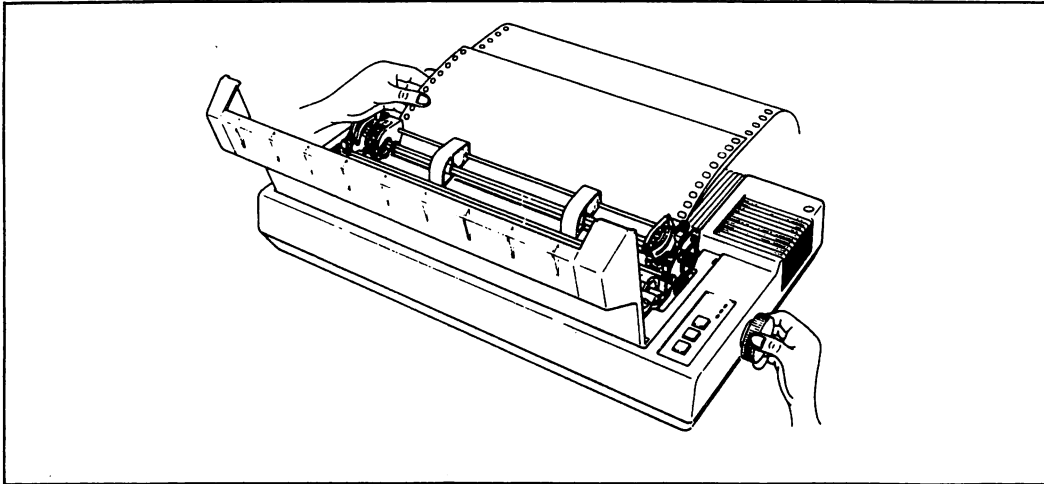


Figure 3-8. Inserting Pin-Feed Paper

6. Push the paper-release lever back. Turn the paper-feed knob clockwise until about half a sheet of paper feeds through the printer. Pull the paper-release lever forward.
7. Press the paper-feed holes of the paper onto the feeding pins, and then close the paper-holding covers. Push the paper bail back into position and adjust the tension of the paper.

NOTE

If the pins on the tractors are set too wide or too narrow to allow the paper to be pressed onto the pins, pull the right sprocket-lock lever (shown in Figure 3-7) forward, move the right sprocket to the left or right as necessary, and then push the lever back to the locked position. To align the first printed column on the paper with the first column position on the left of the paper bail, adjust the positions of both sprockets to the left or right.

9. Using the paper-feed knob, advance the paper so that a perforation between sheets is positioned just below the top of the ribbon. This sets the Top-of-Form position.
10. Close the printer cover and set the printer POWER switch to ON. The printer is now ready for use. The print area on the paper must be within the range indicated in Figure 3-9.

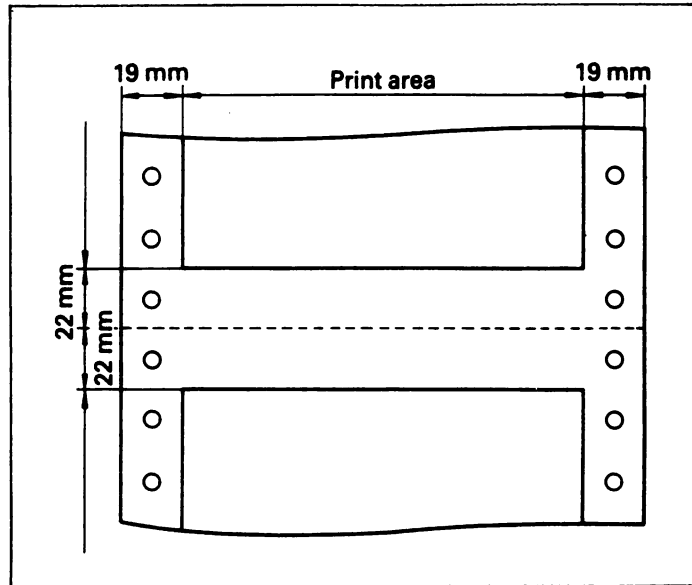


Figure 3-9. Print Area

11. To enable the printer output to fold properly, arrange the paper supply and take-up as shown in Figure 3-10.

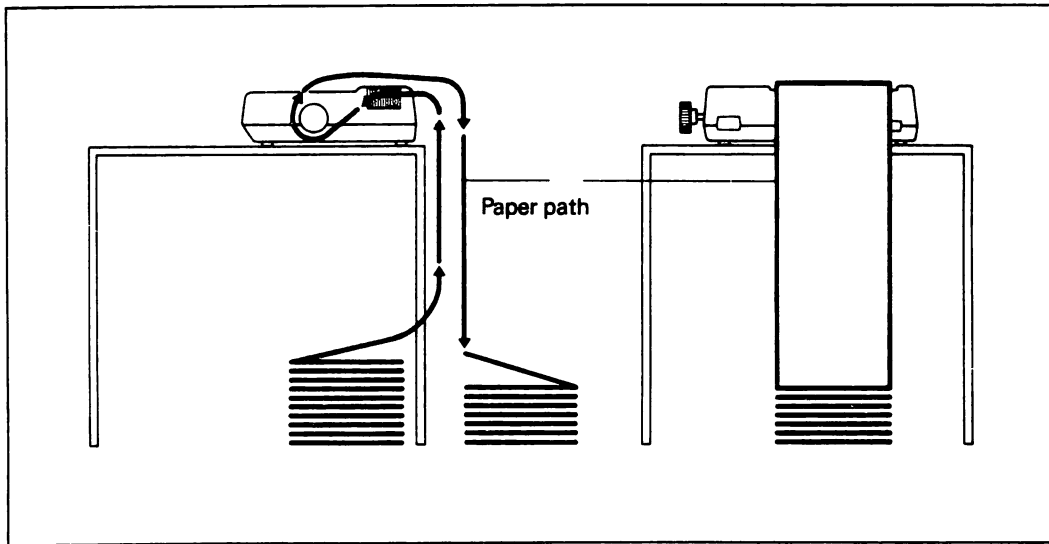


Figure 3-10. Arrangement of Paper Supply and Take-up

Removing Pin-Feed Paper

To remove pin-feed paper from the printer, use one of the following two methods:

- With the printer power ON and with the printer in the Off-Line mode, press the LF or FF button. Do not turn the paper-feed knob while the power is on. Do not attempt to pull out paper in a backward direction because you can damage the printer.
- Set the printer POWER switch to OFF, and then advance the paper through the printer by turning the paper-feed knob.

3.6 LOADING CUT-SHEET PAPER

The printer accommodates cut-sheet paper measuring from 7.25 to 14.4 inches wide by 12 inches long (18.4 cm to 36.6 cm by 30.5 cm). To simplify the paper-loading procedure, remove the paper-tractor unit and the paper separator if they are installed (refer to Section 3.4). Load paper into the printer the same as into a typewriter. Perform the following steps to load cut-sheet paper:

1. Set the POWER switch to OFF and raise the printer cover.
2. Pull the paper bail toward the front of the printer, away from the platen. Push the paper-release lever back (refer to Figure 3-11).

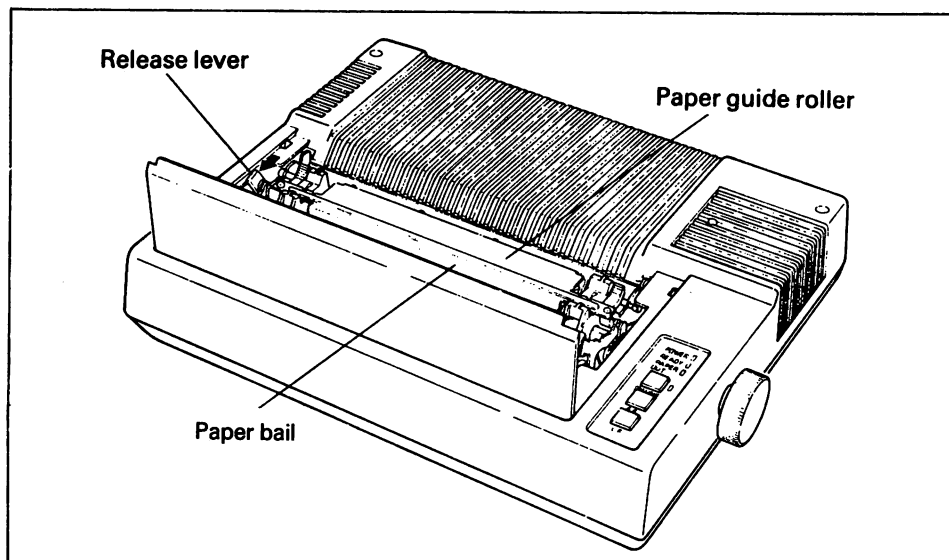


Figure 3-11. Preparing Printer for Loading Cut-Sheet Paper

3. Insert the paper into the slot behind the platen (refer to Figure 3-12). The left edge of the paper should be in line with the number 1 on the paper bail. Rotate the paper-feed knob to feed the paper to the position where you want the printing to begin.

NOTE

If you insert the paper so that it is centered on the platen, the paper-out indicator will light when the power is switched ON. Remove the paper, and then reinsert it into the printer in the correct position. You may damage the left edge of the paper if you simply slide the paper to the left.

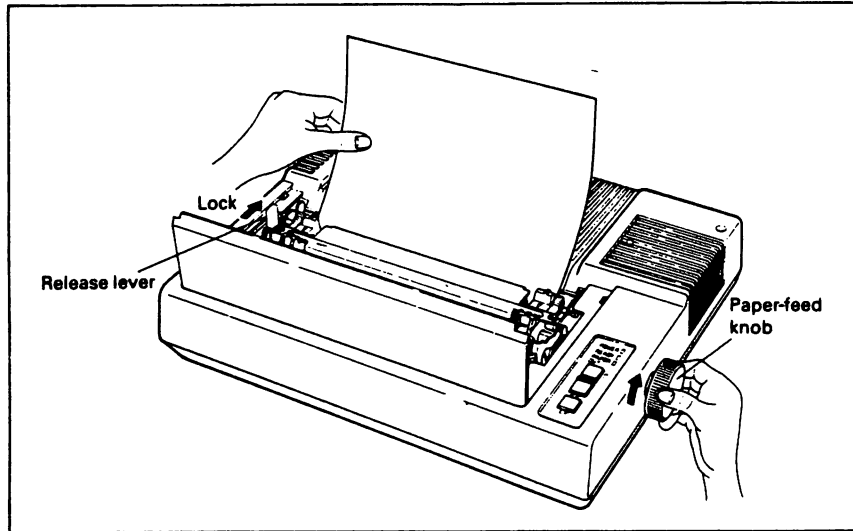


Figure 3-12. Inserting Paper into the Printer

4. Check to see that the paper is feeding properly. If it is not, remove the paper and reload it; or, you can unlock the release lever by pulling it forward, align the edges of the paper as shown in Figure 3-13, and then push the release lever back.

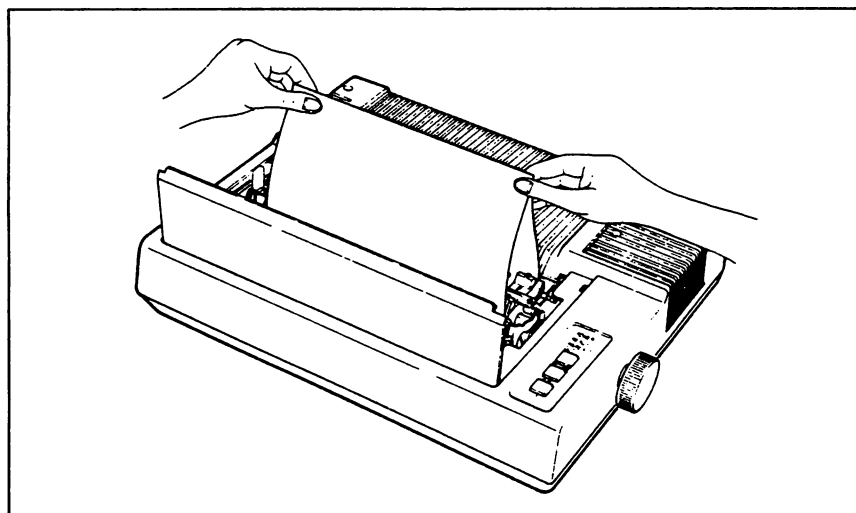


Figure 3-13. Alignment of Paper Side Edges

5. Push the paper bail back against the platen and close the printer cover.
6. The printer is now ready for use. Set the printer's POWER switch to ON. The print area on the paper must be within the limits shown in Figure 3-14.

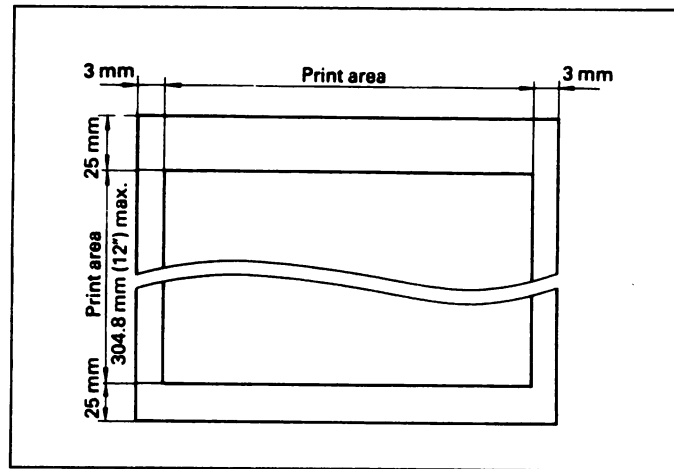


Figure 3-14. Print Area for Cut-Sheet Paper

Removing Cut-Sheet Paper

To remove cut-sheet paper from the printer, use one of the methods described in Section 3.5.

3.7 ADJUSTING FOR PAPER THICKNESS

The printer can print on single-sheet paper or multiple-sheet forms. The head-adjusting lever, shown in Figure 3-15, sets the distance between the print head and the platen. Move the lever forward to widen the gap.

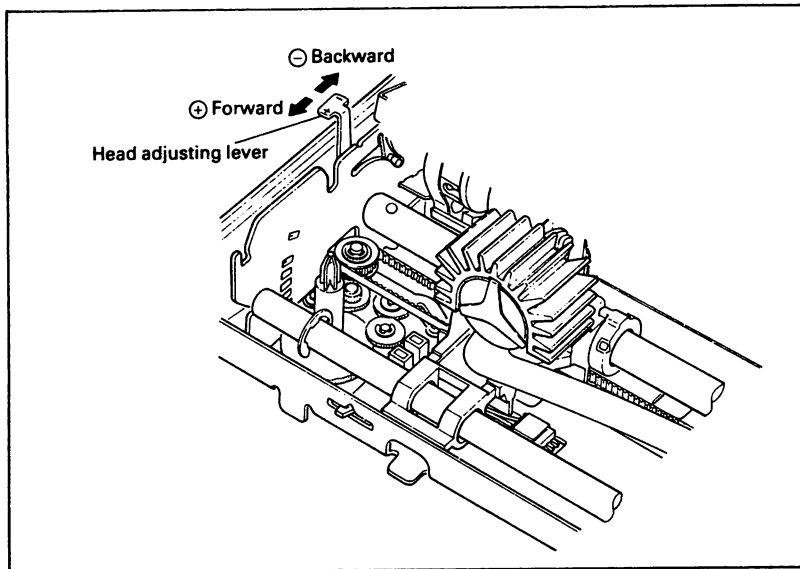


Figure 3-15. Gap Adjustment Control

Set the head-adjusting lever to accommodate the type of paper you are using. For single-sheet paper, set the lever to Position 4 (refer to Figure 3-16). When using thick single-sheet paper, set the lever to Position 5. For multipart forms, set the lever to Position 7.

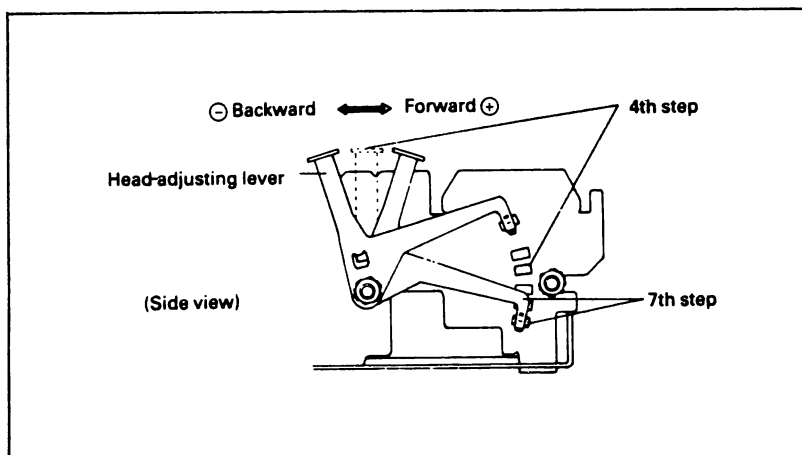


Figure 3-16. Gap Adjustment Settings

NOTE

If the printer is operated for an extended period, printed characters may become light. If this occurs, move the head adjusting lever backward (in the \- \-direction) by one step (refer to Figure 3-16). When using carbon sheets in multipart forms, be sure that no characters are printed two lines above or below the perforation.

3.8 RIBBON CARTRIDGE INSTALLATION

Use the following procedure to remove a ribbon cartridge from the printer and to install a replacement cartridge.

1. Set the printer POWER switch to OFF. To reduce the risk of damaging the printer cover, and to install the ribbon cartridge more easily, remove the cover from the printer.
2. Check to see that the paper bail is positioned against the platen. If it is in the forward position, push it back against the platen.
3. Use the handles at the ends of the cartridge to lift and remove the ribbon cartridge.
4. Remove a new ribbon cartridge from its box. Pull the ribbon outward slightly so that it is not taut.
5. Locate the projections on the ends of the ribbon cartridge. Holding the cartridge by the two top handles, lower it into the printer so that the projections enter the slots on both sides of the printer (refer to Figure 3-17A). Press both ends of the cartridge down until it is firmly seated.

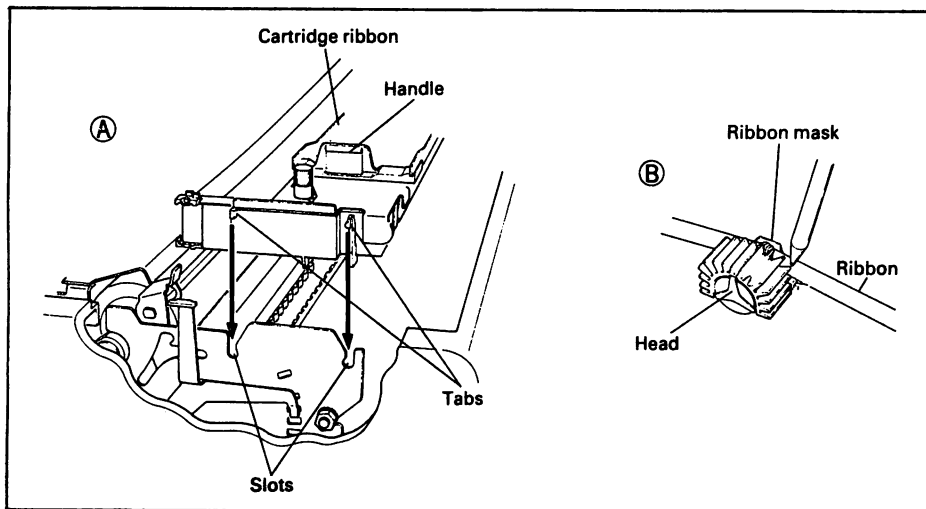


Figure 3-17. Ribbon Cartridge Installation

CAUTION

Avoid touching the print head during installation of the ribbon cartridge. If the printer has been in use for several minutes prior to the ribbon installation, the print head may be hot and may burn your fingers.

6. Use the point of a pen or pencil to lift the ribbon over the front of the print head (refer to Figure 3-17B). Rotate the ribbon-feed knob counterclockwise (as shown in Figure 3-18) to pull the ribbon down into place. If necessary, use the pen to guide the ribbon into position.

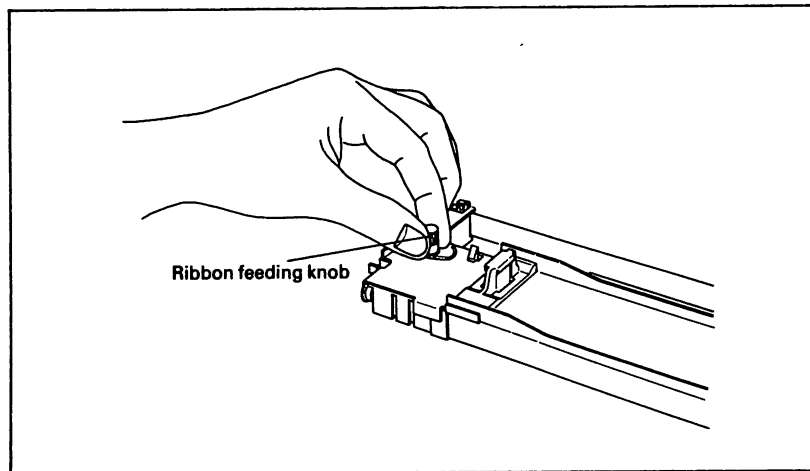


Figure 3-18. Adjusting the Ribbon Tension

7. Be sure that the ribbon is not twisted or creased, and that the cartridge is firmly seated in the slots at the ends of the cartridge. Examples of correct and incorrect ribbon position are shown in Figure 3-19.
8. Reinstall the printer cover.

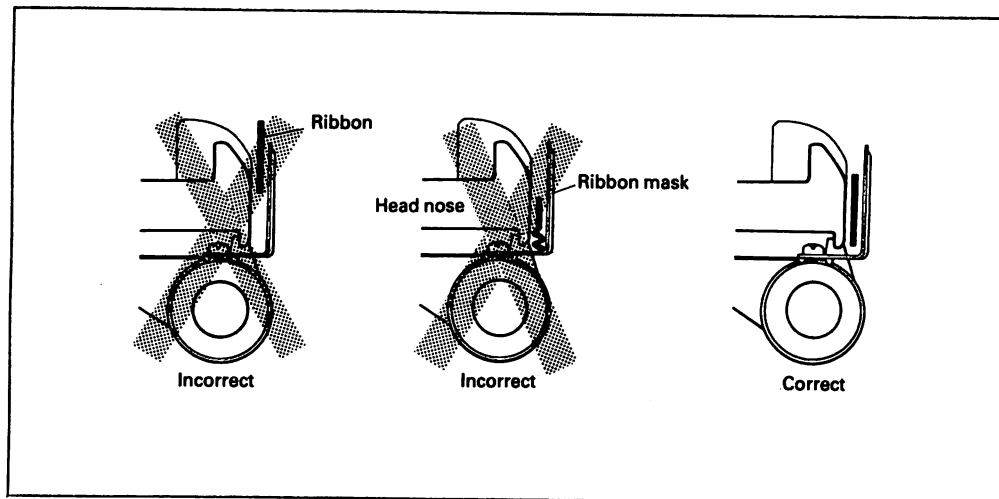


Figure 3-19. Examples of Correct and Incorrect Ribbon Position

3.9 PREVENTIVE MAINTENANCE

Cleaning your printer periodically helps to keep it printing properly. Follow the instructions in this section to wipe clean the outside of the printer and to remove dust from the inside of the printer. Perform the following preventive maintenance steps every three months:

Cleaning the Outside

1. Turn the printer power OFF, and then unplug the printer from its electric outlet.
2. Dampen a soft cloth with a mild detergent and water solution, and wipe the exterior surfaces of the printer. Wipe dry.

Cleaning the Inside

1. Turn the printer power OFF, and then unplug the printer from its electric outlet.
2. Open the printer top cover. Move the paper bail away from the platen.
3. Remove any large debris, such as torn paper, that may have fallen inside the printer. Wipe away any accumulations of paper dust using a soft brush.
4. Do not attempt to clean the printing mechanism on the printer carriage. The mechanism is delicate and you can damage it. If it is excessively dirty, have it cleaned by your Wang field support representative.

5. To properly clean the platen, Wang Laboratories, Inc. recommends that you refer this task to a Wang field support representative. Should you decide to clean the platen yourself, apply a commercial platen-cleaning solution to a cloth and wipe the platen clean. Allow the platen to dry before using the printer.

CAUTION

Use only a platen-cleaning solution. Do not use water, which is ineffective, or alcohol, which hardens rubber surfaces, or any other solvent not expressly made and sold for the purpose of cleaning printer or typewriter platens.

3.10 GENERALIZED PRINTER DRIVER

The default mode of the printer uses the 2200 generalized printer driver character set and control codes described in the 2200 BASIC-2 Multiuser operating System Software Bulletin Release 2.6. The Reverse Line feed standard control code listed in the software bulletin does not apply for the 2245/160. In addition, the Select character font, Clear Platen, and Select paper tray standard escape sequences listed in the software bulletin do not apply for the 2245/160.

A transparent mode feature bypasses the printer driver and enables you to enter WISCII characters listed in Table E-1 in BASIC programs. The transparent mode also enables you to enter control codes contained in Chapters 5, 6 and 7 in BASIC programs.

The SELECT DRIVER command enables you to establish transparent mode permanently. The following is the general form of the SELECT DRIVER command:

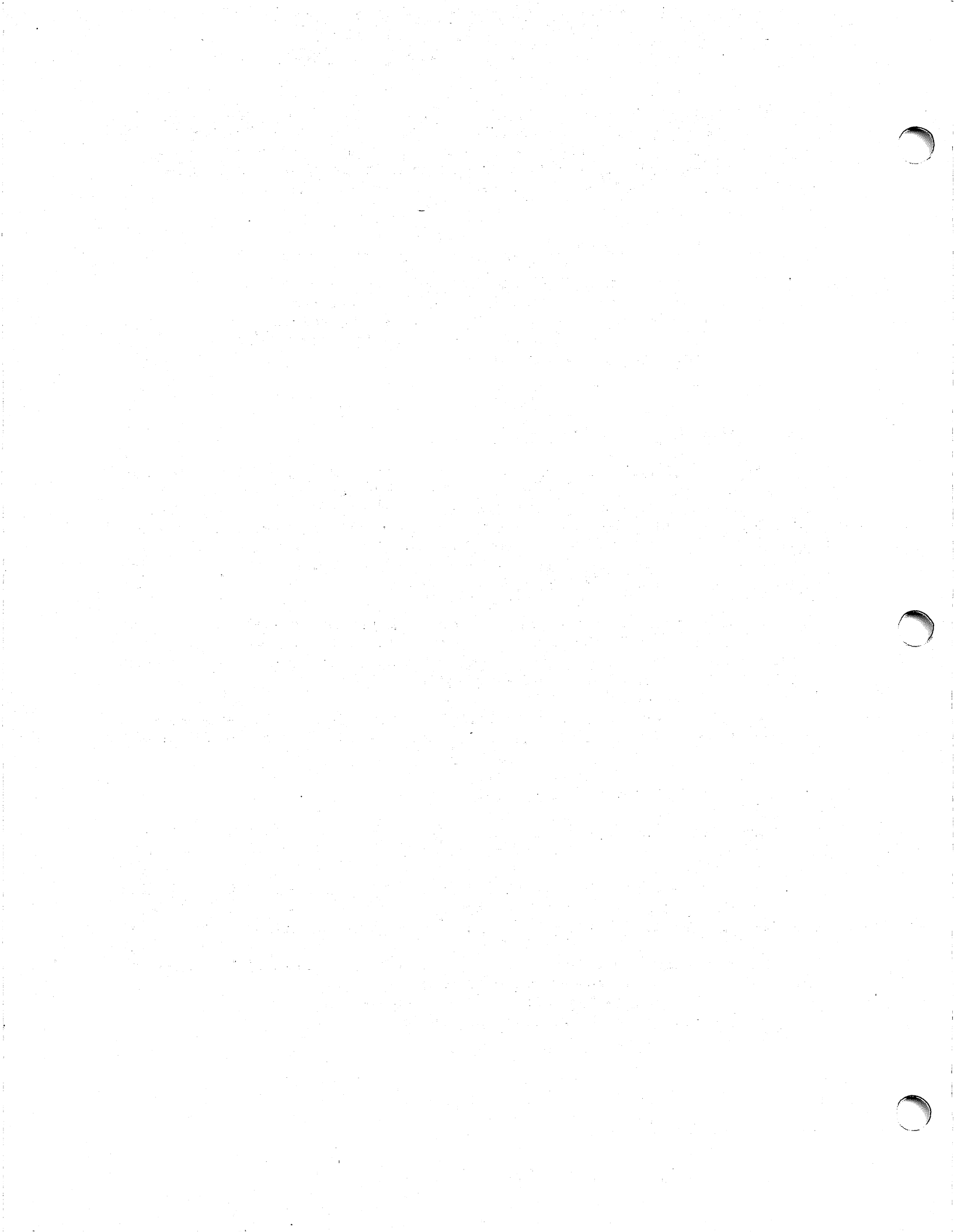
```
SELECT DRIVER device address [OFF]
```

```
Where device-address = { /taa,
                        }
                      { < alpha-variable > }
```

ON is the default state for the driver. OFF turns the driver off for the specified address until the system is reinitialized or you issue another SELECT DRIVER command for the same address without the OFF.

You can also enter the transparent mode for a specified number of bytes by using the escape sequence OD 01 cc dd...dd.

```
cc = number of bytes to pass transparently
dd...dd = the bytes to be passed
```



CHAPTER 4
DEVICE SELECTION

4.1 THE SELECT STATEMENT

The 2200 BASIC-2 language SELECT statement selects the Model 2245/160 Matrix Printer as the output device. The SELECT PRINT statement directs program mode output and immediate mode statements to the printer. The SELECT LIST statement directs program listings to the printer. Other uses for the SELECT statement are described in the Wang 2200 BASIC-2 Language Reference Manual. You can use a SELECT statement either in the Immediate mode or as a statement within a program.

When used to select the Model 2245/160 Matrix Printer, the SELECT statement requires a PRINT or LIST parameter and a 3-digit device address (xyy) consisting of a device type (x) and a unit address (yy). Line width can also be specified in the SELECT statement. Each of the parameters of the SELECT statement is shown in the following example.

Example: SELECT Statement

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

```
Device Type _____|  
Unit Address _____|  
Line Width _____|
```

Device Type

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

When Device-Type 0 is specified, the system issues a line-feed character (hex 0A) after each carriage return character (hex 0D) is output. Output is single spaced.

Example: 2245/160 as Device Type 0

```
10 SELECT PRINT 004(132)
20 FOR R = 1 TO 5
30 PRINT "MODEL 2245/160 OUTPUT AS DEVICE TYPE 0"
40 NEXT R

MODEL 2245/160 OUTPUT AS DEVICE TYPE 0
MODEL 2245/160 OUTPUT AS DEVICE TYPE 0
MODEL 2245/160 OUTPUT AS DEVICE TYPE 0
MODEL 2245/160 OUTPUT AS DEVICE TYPE 0
MODEL 2245/160 OUTPUT AS DEVICE TYPE 0
```

When Device-Type 2 is specified, the system issues a null character (hex 00) after each carriage return character (hex 0D) is output. Each PRINT statement must be terminated by a line feed character (hex 0A) to obtain single-spaced printing.

Example: 2245/160 as Device Type 2

```
10 SELECT PRINT 204(132)
20 FOR R = 1 TO 5
30 PRINT "MODEL 2245/160 OUTPUT AS DEVICE TYPE 2";HEX(0A)
40 NEXT R

MODEL 2245/160 OUTPUT AS DEVICE TYPE 2
MODEL 2245/160 OUTPUT AS DEVICE TYPE 2
MODEL 2245/160 OUTPUT AS DEVICE TYPE 2
MODEL 2245/160 OUTPUT AS DEVICE TYPE 2
MODEL 2245/160 OUTPUT AS DEVICE TYPE 2
```

Device Type 4 usually addresses a device without an automatic carriage return: for example, a plotter. When a printer is selected as Device Type 4, the automatic carriage return issued by the CPU at the end of a line is suppressed. Normally when the number of characters in the buffer equals the line width in a SELECT statement, a carriage return is executed. Device Type 4, however, suppresses this feature by not executing a carriage return when the number of characters equals the line width. The carriage return is not executed until the print buffer is full (and a line is printed) or when the carriage return character (hex 0D) is encountered in the data stream.

Unit Address

When the Model 2245/160 is used as a system printer, it is attached to the printer controller board installed in the system CPU, and usually assigned Unit Address 15. If a second Wang printer is used as a system printer on the same CPU, it is usually assigned Unit Address 16 by the Wang service representative who installs the system.

If the Model 2245/160 is used as the terminal printer, it is attached directly to the rear panel of the terminal and must be accessed at Unit Address 04 (for example, SELECT PRINT 204).

Line Width

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

The maximum number of characters per line that can be printed on the Model 2245/160 is 136 (Pica mode), 163 (Elite mode), 233 characters (Condensed mode). In the SELECT statement, line width is indicated in the parentheses following the 3-digit Device Address code. For example:

```
10 SELECT PRINT 004(42)
20 PRINT "THIS IS AN EXAMPLE OF PRINTING W
HEN A LINE LENGTH OF 42 CHARACTERS IS SPEC
IFIED IN THE SELECT PRINT STATEMENT"
```

```
THIS IS AN EXAMPLE OF PRINTING WHEN A LINE
LENGTH OF 42 CHARACTERS IS SPECIFIED IN T
HE SELECT PRINT STATEMENT
```

If a line width is not specified for PRINT, LIST, or CO operations, either the default line width or the last line width selected for each of these operations is used. Note that the default line width set during master initialization is 80 characters, the standard width of the terminal screen. In a system with a 64-column screen, the line width defaults to 64 characters.

The maximum line width that can be specified in a SELECT statement is 255. However, the use of a line width greater than 136 (Pica mode), 163 characters (Elite mode), or 233 characters (Condensed mode) is not recommended. A longer line count typically produces two carriage returns: one performed automatically by the printer when a full line of characters has been printed, and another issued by the system when the line count specified in the SELECT PRINT statement is exceeded.

The CPU uses the Line Width parameter to generate an automatic carriage return when a line exceeds the specified line width and no carriage return has been supplied by the program. The CPU maintains a tally of the number of characters sent to the printer. If the character count equals the current value of the line width before the output line is complete, the CPU issues a carriage return command to the printer and resets the character count to zero. It also increments the line count by 1 except at the end of a page, when the line count is reset to 0.

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

Example: PRINT Statement with No Punctuation

```
10 SELECT PRINT 004(30)
20 REM EXAMPLE OF A PRINT STATEMENT
   WITH NO TRAILING COMMA OR SEMICOLON
30 PRINT "LINE A"
40 PRINT "LINE B"
50 PRINT "LINE C"
```

Output:

```
LINE A
LINE B
LINE C
```

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

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

NOTE

If a PRINT statement ends with a semicolon, no carriage return is issued. The character count is updated by the number of characters sent to the printer.

4.2 SELECT PRINT

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

Example: Program Mode SELECT PRINT

```
10 SELECT PRINT 004
20 PRINT "X", "2X"
30 FOR X = 1 TO 50 STEP 10
40 PRINT X, X*2
50 NEXT X
```

Example: Immediate Mode SELECT PRINT

```
SELECT PRINT 004
10 PRINT "X", "2X"
20 FOR X = 1 TO 50 STEP 10
30 PRINT X, X*2
40 NEXT X
```

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

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

NOTE

When the printer is selected for printed output using SELECT PRINT command, printout resulting from PRINT or PRINT USING statements entered in the Immediate mode will also appear on the CRT.

4.3 SELECT LIST

The default address for LIST operations is 005, the CRT. In the following example the LIST statement (which can be entered in Immediate mode or Program mode) selects the terminal printer for program listing.

Example: Selecting the Printer for Listing

```
SELECT LIST 004
5 DIM A$55
17 REM AN EXAMPLE USING THE PRINTER FOR LISTING
20 A$="THE MODEL 2245/160 PRINTER CAN BE SELECTED FOR LISTING."
30 PRINT A$
LIST
```

Output:

```
5 DIM A$55
17 REM AN EXAMPLE OF USING THE PRINTER FOR LISTING
20 A$ = "THE MODEL 2245/160 PRINTER CAN BE SELECTED FOR LISTING"
30 PRINT A$
```

4.4 CONSOLE OUTPUT

The SELECT CO statement can be used to select the printer for all console output (CO) operations. The following statement directs console output to address 215:

```
SELECT CO 215
```

Console Output includes output of Immediate Mode PRINT and PRINTUSING statements, plus output from several other operations described in the Wang 2200 BASIC-2 Language Reference Manual.

NOTE

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

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

```
SELECT CO 215
```

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

```
:READY
```

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

4.5 COMBINING SELECT PARAMETERS

It is possible to combine parameters in a SELECT statement.

Example:

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

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

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

4.6 DESELECTING THE PRINTER

To deselect the printer, use one of the following methods, listed in order of preference.

1. Select another device for PRINT, LIST, or CO, by using the SELECT statement.
2. Press the ON LINE button on the printer. The printer will print the contents of its buffer before deselecting. This is the only method of deselection that does not lose the data in the print buffer. This method should be used when temporary deselection is required, for example, when changing the paper or ribbon cartridge. The printer ON LINE indicator will be extinguished, and the printer can then be reselected by pressing the ON LINE button again.
3. Enter the CLEAR command and press the RETURN key. This returns PRINT and LIST operations to the device currently selected for CO. If the printer is the current CO device, either Step 1 or 5 must be used to deselect it.
4. If the printer has been selected using a SELECT CO statement, press RESET at the terminal. This will reset CO to 005.
5. Master initialize the system. Master Initialization selects the CRT for all LIST, PRINT, and CO operations.

4.7 SUMMARY OF SELECT STATEMENTS

A summary of the SELECT statements used with the 2245/160 printer is contained in Table 4-1.

Table 4-1. Summary of Select Statements

Local Printer	Comments
SELECT PRINT 004 SELECT LIST 004	Single line spacing occurs in program output and program listing.
SELECT PRINT 204	Line feed command HEX(0A) must be included in print statements.
SELECT LIST 204	Line feed does not occur in program listing (refer to the following note).
<u>System Printer</u>	
SELECT PRINT 015 SELECT LIST 015	Single line spacing occurs in program output and program listing.
SELECT PRINT 215	Line feed command HEX(0A) must be included in print statements.
SELECT LIST 215	Line feed does not occur in program listing (refer to the following note).

NOTE

Printer operation listed in Table 4-1 applies with DIP switch 2 pin 4 set to OFF (this is the normal setting for this switch). DIP switch 2 is fully described in Section 3.6. With SW2 pin 4 set to ON, double line spacing occurs for SELECT PRINT 004 and SELECT LIST 004. In addition, single line spacing occurs for SELECT PRINT 204 and 215, and SELECT LIST 204 and 215.

CHAPTER 5
TEXT MODE CONTROL CODES

5.1 INTRODUCTION

You can use the Text mode control codes described in this chapter to specify print modes, margins, vertical spacing, and other printer functions in BASIC or other programs. However, these codes control the printer only when the Wang 2200 system printer driver is in Transparent mode, a feature described in 2200 BASIC-2 Multiuser Operating System Software Bulletin Release 2.6. With Transparent mode ON, the printer driver is bypassed so that all input data is passed directly to the printer. With Transparent mode OFF (the default operating mode), the printer is controlled by the printer driver, and only the matrix printer character set, control codes and escape sequences listed in the software bulletin can be added to your programs.

NOTE

The default mode for the printer is the Text mode. You can enter the Download mode using the control codes listed in Chapter 6. You can enter the Bit Image mode using the control codes listed in Chapter 7.

Decimal and Hexadecimal Notation

Printer control codes shown in parentheses in the program examples in this chapter are in hexadecimal form. The printer is provided with a set of control codes called ESC sequences. ESC Code HEX(1B) is followed by a hexadecimal number, an alphanumeric character, or a symbol that represents the particular escape function.

Sending Control Codes

Printing and other functions are controlled by entering control codes. Control codes may be broadly divided into two categories.

- 1-byte control codes
- Control codes expanded by an ESC code

In BASIC, control codes can be sent to the printer as shown in the following two examples:

To send BEL code,

```
PRINT HEX(07);
```

To send ESC 1 code,

```
PRINT HEX(1B);HEX(01);
```

5.2 CONTROL CODES IN TEXT MODE

This section contains Text mode control codes that can be entered in a BASIC or other program. The control codes are listed in numerically ascending order.

BEL

Name: BEL - Bell
Expression: HEX(07);
Function: Sounds the tone.

When the BEL code is input, the tone sounds for approximately 0.1 second.

Example: PRINT HEX(07);
(beep)

NOTE

To disable the tone, set DIP Switch 2-2 to OFF.

BS

Name: BS - Backspace
Expression: HEX(08);
Function: Prints and backspaces by one character.

With the BS code, all the data stored in the print buffer is printed and the next print start position returns to the left by one column. In the Enlarged Print mode, the print position backspaces by two Pica characters. BS is not guaranteed when the print mode has been changed.

See also DEL.

```
Example: 10 SELECT PRINT 004
          20 REM BACKSPACE
          30 PRINT "YYYYY";
          40 PRINT HEX(08);HEX(08);
          50 PRINT "====="

          YYY**===
          YYY**===
```

HT

Name: HT - Horizontal TAB
Expression: HEX(09);
Function: Executes horizontal TAB.

The HT code carries out the horizontal TAB to a predetermined position set by ESC D code. The HT code is ignored if no TAB position has been set previously by the ESC D code. In Enlarged Print mode, an HT code executes the TAB in twice the width as that of Pica Print mode.

Since the TAB set position is stored as an absolute position, this position will not change even if you change the print mode. Horizontal TAB is cancelled with an ESC 1.

See also ESC D, ESC Q, and ESC 1.

```
Example: 0123456789012345678901234567890123456789
          TAB      TAB      TAB      TAB      TAB
```

```
10 SELECT PRINT 004
20 REM HORIZONTAL TAB
30 PRINT "0123456789012345678901234567890123456789"
40 FOR I = 1 TO 5
50 PRINT HEX(09);"TAB";
60 NEXT I
70 PRINT
```

LF

Name: LF - Line Feed
Expression: HEX(0A);
Function: Advances the paper one line.

With the LF code, all the data stored in the print buffer is printed and then a line feed occurs. If no data precedes the LF code, or if all preceding data is SPACE, only a line feed is performed. The amount of line spacing can be set by ESC 0, ESC 1, ESC 2, ESC 3, or ESC A. LF cancels the Enlarged Print mode set by SC code.

See also SO, ESC 0, ESC 1, ESC 2, ESC 3, ESC A, and ESC W.

VT

Name: VT - Vertical TAB
Expression: HEX(0B);
Function: Executes vertical TAB.

With the VT code, all the data stored in the print buffer is printed and then a rapid line feed occurs at the predetermined vertical TAB position set by ESC B or ESC b. If the vertical TAB position is not predetermined, this code functions the same as the LF code. VT cancels the Enlarged Print mode set by the SO code.

TAB is always executed from the Top-of-Form position. Therefore, if another TAB is input after TAB has been executed, the print head moves to the next Top-of-Form position.

See also SO, ESC B, ESC b, ESC /, and ESC W.

Example: 10 SELECT PRINT 004
20 REM VERTICAL TAB
30 PRINT HEX(1B);HEX(42);
40 PRINT HEX(01);HEX(03);HEX(06);HEX(0A);HEX(00);
50 FOR I = 1 TO 4
60 PRINT HEX(0B);"TAB";
70 NEXT I
80 PRINT

TAB

TAB

TAB

TAB

FF

Name: FF - Form Feed
Expression: HEX(0C);
Function: Advances paper to the next Top-of-Form position.

With the FF code, all the data stored in the print buffer is printed and then the paper is advanced to the next Top-of-Form position. FF cancels the Enlarged Print mode set by the SO code.

See also ESC C and ESC CO.

CR

Name: CR - Carriage Return
Expression: HEX(0D);
Function: Starts printing.

The CR code causes all data stored in the print buffer to be printed and a carriage return to be executed.

The CR code with a line feed cancels the Enlarged Print mode set by the SO code.

See also LF.

Example: 10 SELECT PRINT 004
20 REM UNDERSCORE BY CR
30 PRINT "UNDERSCORE BY CR";HEX(0D);
40 PRINT HEX(5F5F5F5F5F5F5F5F5F5F5F5F)

 UNDERSCORE BY CR

SO

Name: SO - Shift Out
Expression: HEX(0E);
Function: Selects the Enlarged Print mode.

With the SO code, all the data that follows this code on the same line is printed in enlarged characters. SO is cancelled by line feed or by the DC4, ESC ! or ESC W codes. Pica and enlarged characters can be mixed on the same line.

See also DC4, ESC !, and ESC W.

Example: 10 SELECT PRINT 004
20 REM ENLARGED PRINT MODE WITH AUTO RESET
30 PRINT HEX(0E); "ENLARGED PRINT MODE"
40 PRINT "PICA-SIZED PRINT MODE"

ENLARGED PRINT MODE
PICA-SIZED PRINT MODE

SI

Name: SI - Shift In
Expression: HEX(OF);
Function: Selects the Condensed Print mode.

With the SI code, all the data stored in the buffer is printed and subsequent data is printed in condensed characters (17 characters per inch). SI code is cancelled by DC2 or ESC ! codes. The SI code followed by the SO code enables printing of condensed enlarged characters.

See also DC2, ESC M, and ESC !.

Example 1: 10 SELECT PRINT 004
 20 REM CONDENSED MODE
 30 PRINT HEX(OF);"CONDENSED MODE"
 40 PRINT "STILL IN CONDENSED MODE"

 CONDENSED MODE
 STILL IN CONDENSED MODE

Example 2: 10 SELECT PRINT 004
 20 PRINT HEX(OF);"CONDENSED MODE"
 30 PRINT HEX(OE);"NOW IN CONDENSED ENLARGED MODE"

 CONDENSED MODE
 NOW IN CONDENSED ENLARGED MODE

DC1

Name: DC1 - Selection of the Printer
Expression: HEX(11);
Function: Selects the printer.

The DC1 code places the printer in the selected state, enabling the printer to receive data. Code DC1 is effective only when DIP switch 2-1 is OFF.

If you enter the DC1 code during data transfer with the printer in the selected state, all the data stored before the DC1 code is ignored.

See also DC3.

```
Example 1: 10 SELECT PRINT 004
           20 REM DEVICE CONTROL 1
           30 PRINT HEX(11); "AAAAA"; HEX(13);
           40 PRINT "BBBBB"; HEX(11); "CCCCC"
```

AAAAACCCCC

```
Example 2: 10 SELECT PRINT 004
           20 REM DEVICE CONTROL 1
           30 PRINT "AAAAA"; HEX(11);
           40 PRINT "BBBBB"; HEX(13); "CCCCC"; HEX(11)
```

BBBBB

NOTE

DC1 cable is effective only when DIP Switch 2-1 is OFF.

DC2

Name: DC2 - Condensed Mode Cancel
Expression: HEX(12);
Function: Cancels Condensed Print mode.

The DC2 code cancels the Condensed Print mode set by the SI code.

See also S1 and ESC M.

Example: 10 SELECT PRINT 004
20 REM DEVICE CONTROL 2
30 PRINT HEX(0F); "CONDENSED MODE";
40 PRINT HEX(12); "====>> NOW IN PICA-SIZED MODE"

CONDENSED MODE====>> NOW IN PICA-SIZED MODE

NOTE

Although the Enlarged Print mode set by the S0 code can be cancelled by a line feed, the Condensed Print mode set by the SI code cannot.

DC3

Name: DC3 - Deselection of the Printer
Expression: HEX(13);
Function: Deselects the printer.

The DC3 code places the printer in the deselected state. In other words, it disables the printer to receive data. When the DC1 and DC3 codes are used, DIP Switch 2-1 must be OFF.

See also DC1.

DC4

Name: DC4 - Enlarged Print Mode Cancel
Expression: HEX(14);
Function: Cancels Enlarged Print mode.

The DC4 code cancels the Enlarged Print mode set by the SO code.

See also SO, ESC W, and ESC !.

Example: 10 SELECT PRINT 004
20 REM DEVICE CONTROL 4
30 PRINT HEX(OE); "ENLARGED MODE";
40 PRINT HEX(14); " NOW IN PICA-SIZED MODE"

ENLARGED MODE NOW IN PICA-SIZED MODE

NOTE

The Enlarged Print mode set by the ESC W or ESC ! code cannot be cancelled by the DC4 code.

CAN

Name: CAN - Cancel
Expression: HEX(1B);
Function: Cancels the data stored in the print buffer.

With the CAN code, all the data previously stored in the print buffer on the same line is cancelled.

See also DEL and BS.

Example: 10 SELECT PRINT 004
20 REM CANCEL
30 PRINT "ABCD"
40 PRINT "EFGH"; HEX(1B);
50 PRINT "IJKL"

ABCD
IJKL

ESC SO

Name: ESC SO - Shift Out
Expression: HEX(1B);HEX(0E);
Function: Selects the Enlarged Print mode.

Same as the SO code.

Example: 10 SELECT PRINT 004
20 REM ENLARGED MODE BY ESC SO
30 PRINT HEX(1B);HEX(0E);"ENLARGED MODE";
40 PRINT HEX(14);" NOW IN PICA-SIZED MODE"

ENLARGED MODE NOW IN PICA-SIZED MODE

ESC SI

Name: ESC SI - Shift In
Expression: HEX(1B);HEX(0F);
Function: Selects the Condensed Print mode.

Same as the SI code.

Example: 10 SELECT PRINT 004
20 REM CONDENSED MODE
30 PRINT HEX(1B);HEX(0F);"CONDENSED MODE";
40 PRINT HEX(12);" NOW IN PICA-SIZED MODE"

CONDENSED MODE NOW IN PICA-SIZED MODE

ESC !

Name: ESC ! - Print Mode Selection
Expression: HEX(1B);"!";HEX(n);
(n = 00H to 3FH)
Function: Selects a print mode.

The value of n determines each print mode (refer to Table 5-1). The ESC ! code takes precedence over other commands such as ESC E that set the print mode.

The precedence of print modes is as follows:
Emphasized > Condensed > Pica
Superscript/Subscript > Double-strike

See also SI, SO, DC2, DC4, ESC E, ESC F, ESC G, ESC H, ESC M, ESC P and ESC W.

NOTE

In Proportional Print mode, characters are always emphasized. In Elite Print mode, Emphasized and Condensed Print mode settings are ignored. ESC ! can be mixed with other ESC sequences.

Table 5-1. Mixed Print Modes

n(HEX)	En	D	Em	C	El	n(HEX)	En	D	Em	C	El
00						20	•				
01					•	21	•				•
02					•	22	•				
03					•	23	•				•
04				•	•	24	•			•	
05					•	25	•				•
06				•	•	26	•			•	
07					•	27	•				•
08			•		•	28	•		•		
09					•	29	•				•
0A			•		•	2A	•		•		
0B					•	2B	•				•
0C			•		•	2C	•		•		
0D					•	2D	•				•
0E			•		•	2E	•		•		
0F					•	2F	•				•
10		•			•	30	•	•			
11		•			•	31	•	•			•
12		•			•	32	•	•			
13		•			•	33	•	•			•
14		•		•	•	34	•	•		•	
15		•			•	35	•	•			•
16		•		•	•	36	•	•			•
17		•			•	37	•	•			•
18		•	•		•	38	•	•	•		
19		•			•	39	•	•			•
1A		•	•		•	3A	•	•	•		
1B		•			•	3B	•	•			•
1C		•	•		•	3C	•	•	•		
1D		•			•	3D	•	•			•
1E		•	•		•	3E	•	•	•		
1F		•			•	3F	•	•			•

En: Enlarged mode
D: Doublestrike mode
Em: Emphasized mode
C: Condensed mode
El: Elite mode

```

10 SELECT PRINT 004(132)
20 PRINT HEX(1B); "D"; HEX(14); HEX(00);
25 DIM A$1
30 A$ = HEX(00)
40 FOR M = 0 TO 63
50 PRINT HEX(1B); "!"; HEX(00);
60 PRINT "MODE"; M; HEX(09);
70 PRINT HEX(1B); "!"; A$;
80 PRINT "ABCDE"
90 A$=A$ ADD HEX(01)
100 NEXT M
110 END

```

MODE 0	ABCDE
MODE 1	ABCDE
MODE 2	ABCDE
MODE 3	ABCDE
MODE 4	ABCDE
MODE 5	ABCDE
MODE 6	ABCDE
MODE 7	ABCDE
MODE 8	ABCDE
MODE 9	ABCDE
MODE 10	ABCDE
MODE 11	ABCDE
MODE 12	ABCDE
MODE 13	ABCDE
MODE 14	ABCDE
MODE 15	ABCDE
MODE 16	ABCDE
MODE 17	ABCDE
MODE 18	ABCDE
MODE 19	ABCDE
MODE 20	ABCDE
MODE 21	ABCDE
MODE 22	ABCDE
MODE 23	ABCDE
MODE 24	ABCDE
MODE 25	ABCDE
MODE 26	ABCDE
MODE 27	ABCDE
MODE 28	ABCDE
MODE 29	ABCDE
MODE 30	ABCDE
MODE 31	ABCDE
MODE 32	ABCDE
MODE 33	ABCDE
MODE 34	ABCDE
MODE 35	ABCDE
MODE 36	ABCDE
MODE 37	ABCDE
MODE 38	ABCDE

MODE 39
MODE 40
MODE 41
MODE 42
MODE 43
MODE 44
MODE 45
MODE 46
MODE 47
MODE 48
MODE 49
MODE 50
MODE 51
MODE 52
MODE 53
MODE 54
MODE 55
MODE 56
MODE 57

ABCDE
ABCDE
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ABCDE

ESC-(minus)

Name: ESC-(minus) - Underlined Print Mode
Expression: HEX(1B);"-";HEX(n);
n=01H or 31H: Sets Underlined Print mode.
n=00H or 30H: Cancels Underlined Print mode.
Function: Selects/Cancels Underlined Print mode.

The ESC-01H or ESC-31H code places the printer in the Underlined Print mode. All the data following this code prints with an underline.

The ESC-00H or the ESC-30H code cancels the Underlined Print mode.

Example: 10 SELECT PRINT 004
20 REM UNDERLINED PRINT
30 PRINT HEX(1B);"-";HEX(01)
40 PRINT "THIS TEXT IS UNDERLINED"
50 PRINT HEX(1B);"-";HEX(00);
60 PRINT "THIS TEXT IS NOT UNDERLINED"

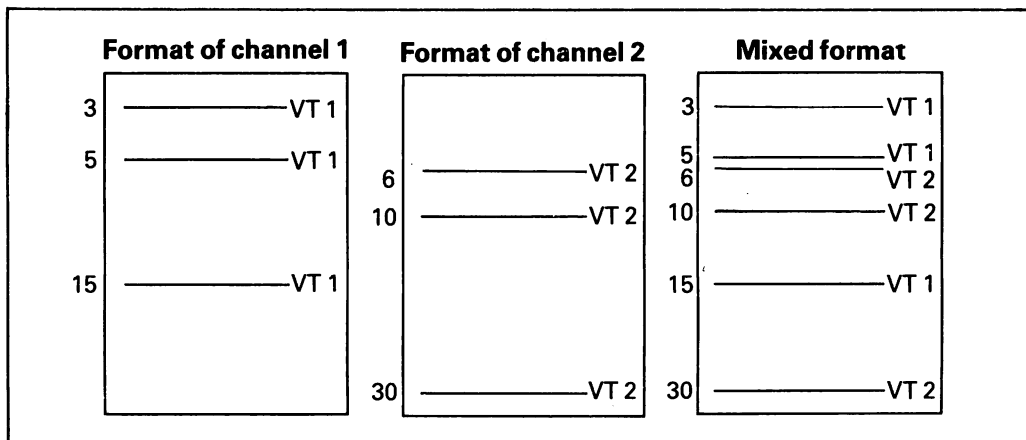
THIS TEXT IS UNDERLINED
THIS TEXT IS NOT UNDERLINED

ESC/

Name: ESC/ - VFU Channel Selection
Expression: HEX(1B);"/";HEX(n);
(n = 01H to 07H)
Function: Selects Vertical Format Unit (VFU) channel.

The ESC/ code causes the printer to execute subsequent vertical TABs using the format specified by the Channel n of VFU. Under VFU control, a page can be divided into channels within which vertical TABs can be independently set. For example, Channel 1 can be set for vertical TABs at the 3rd, 5th, and 15th lines, and Channel 2 can be set for vertical TABs at the 6th, 10th, and 30th lines.

See also VT, ESC b and ESC B.



Example:

```
10 SELECT PRINT 004
20 REM VERTICAL FORMAT
30 PRINT HEX(1B);"C";HEX(10);
40 PRINT "*---- THE FIRST TOP OF FORM ----*"
50 REM VFU CHANNEL 1
60 PRINT HEX(1B);HEX(62);HEX(01);
70 PRINT HEX(02);HEX(05);HEX(09);HEX(00);
80 REM VFU CHANNEL 2
90 PRINT HEX(1B);HEX(62);HEX(02);
100 PRINT HEX(03);HEX(07);HEX(0A);HEX(00);
110 REM SELECTS VFU CHANNEL
120 PRINT HEX(1B);"/";HEX(01);
130 GOSUB 1000
140 REM SELECTS VFU CHANNEL 2
150 PRINT HEX(1B);"/";HEX(02);
160 GOSUB 1000
170 END
1000 REM SUB-ROUTINE
1010 PRINT HEX(0C);
1020 PRINT "* ----THE NEXT TOP OF FORM---- *"
1030 FOR I = 1 TO 3
1040 PRINT HEX(0B); "THIS IS TAB ";I
1050 NEXT I
1060 RETURN
6060 PRINT HEX(1B);HEX(62);HEX(01);
```

--- THE FIRST TOP OF FORM ---

* ----THE NEXT TOP OF FORM---- *

THIS IS TAB 1

THIS IS TAB 2

THIS IS TAB 3

* ----THE NEXT TOP OF FORM---- *

THIS IS TAB 1

THIS IS TAB 2

THIS IS TAB 3

ESC 0 (zero)

Name: ESC 0(zero) - 1/8-inch Line Spacing
Expression: HEX(1B);"0";
Function: Selects 1/8-inch line spacing.

The ESC 0 code causes subsequent line spacing to be set at 1/8 inch.

See also ESC 1, ESC 2, ESC 3, and ESC A.

Example:

```
10 SELECT PRINT 004
20 REM 1/8" LINE SPACING
30 PRINT HEX(1B);HEX(30);
40 FOR I = 1 TO 4
50 PRINT "1/8 INCH LINE SPACING"
60 NEXT I
70 END
```

```
1/8 INCH LINE SPACING
1/8 INCH LINE SPACING
1/8 INCH LINE SPACING
1/8 INCH LINE SPACING
```

ESC 1

Name: ESC 1 - 7/72-inch Line Spacing
Expression: HEX(1B);"1";
Function: Selects 7/72-inch line spacing.

The ESC 1 code causes subsequent line spacing to be set at 7/72 inch.

See also ESC 0, ESC 2, ESC 3, and ESC A.

Example:

```
10 SELECT PRINT 004
20 REM 7/72" LINE SPACING
30 PRINT HEX(1B);"1";
40 FOR I = 1 TO 5
50 PRINT "7/72 INCH LINE SPACING"
60 NEXT I
70 END
```

```
7/72 INCH LINE SPACING
7/72 INCH LINE SPACING
7/72 INCH LINE SPACING
7/72 INCH LINE SPACING
7/72 INCH LINE SPACING
```

ESC 2

Name: ESC 2 - 1/6-inch Line Spacing
Expression: HEX(1B);"2";
Function: Selects 1/6-inch line spacing.

The ESC 2 code causes subsequent line spacing to be set at 1/6 inch.

See also ESC 0, ESC 1, ESC 3, and ESC A.

Example:

```
10 SELECT PRINT 004
20 REM 1/6 INCH LINE SPACING
30 PRINT HEX(1B);"2";
40 FOR I = 1 TO 4
50 PRINT "1/6 INCH LINE SPACING"
60 NEXT I
70 END
```

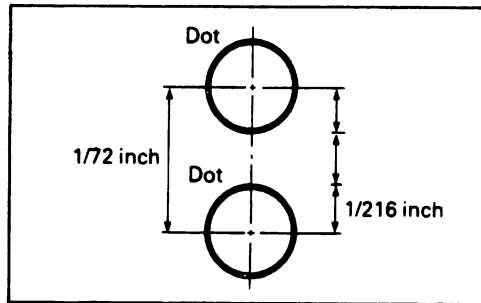


```
1/6 INCH LINE SPACING
1/6 INCH LINE SPACING
1/6 INCH LINE SPACING
1/6 INCH LINE SPACING
```

ESC 3

Name: ESC 3 - n/216-inch Line Spacing
Expression: HEX(1B);"3";HEX(n);
Function: Selects n/216-inch line spacing.
(n = 00H to FFH)

The ESC 3 (n) code causes subsequent line spacing to be set at n/216 inch. 1/216 inch corresponds to 1/3 dots.



See also ESC 0, ESC 1, ESC 2, and ESC A.

Example: Set 5/54-inch line spacing.

```
10 SELECT PRINT 004
20 REM N/216 INCH LINE SPACING
30 PRINT HEX(1B);"3";HEX(14);
40 FOR I = 1 TO 4
50 PRINT "APPROXIMATELY 20/216 INCH LINE SPACING"
60 NEXT I
70 END
```

```
APPROXIMATELY 20/216 INCH LINE SPACING
APPROXIMATELY 20/216 INCH LINE SPACING
APPROXIMATELY 20/216 INCH LINE SPACING
APPROXIMATELY 20/216 INCH LINE SPACING
```

NOTE

When n=01_H or 02_H, paper feeding accuracy is not guaranteed.

ESC 8

Name: ESC 8 - Paper-end Detector Disable
Expression: HEX(1B);"8";
Function: Disables paper-end signal.

The ESC 8 code enables the printer to print data to the last line of cut-sheet paper. With DIP Switch 1-3 on the control circuit board set to ON, the printer is placed in the ESC 8 condition when powered on. This switch is normally set to the OFF position.

See also ESC 9.

ESC 9

Name: ESC 9 - Paper-end Detector Enable
Expression: HEX(1B);"9";
Function: Enables paper-end signal.

The ESC 9 code cancels the ESC 8 condition. The printer cannot continue printing and enters Off-Line mode when nearing the bottom edge of cut-sheet paper. With DIP Switch Pin 1-3 set to OFF, the printer is placed in the ESC 9 condition when powered on.

See also ESC 8.

ESC <

Name: ESC < - One Line Unidirectional Printing
Expression: HEX(1B);"<";
Function: Prints from left to right for one line.

With the ESC < code, the print head returns to its leftmost position and data is printed unidirectionally from left to right for one line.

See also ESC U.

Example: 10 SELECT PRINT 004
20 REM HOME HEAD
30 PRINT HEX(1B);"<";
40 PRINT "THIS LINE IS PRINTED UNIDIRECTIONALLY"
50 END

THIS LINE IS PRINTED UNIDIRECTIONALLY

NOTE

The ESC < code minimizes horizontal dot displacement, which may be caused by the printing mechanism. The ESC < code causes the print head to return to its leftmost position only once, while ESC U causes all the following data to be printed unidirectionally. Although bidirectional printing usually causes little horizontal dot aberration, use these two commands when utmost precision is required.

ESC @

Name: ESC @ - Printer Initialization
Expression: HEX(1B);"@";
Function: Initializes the printer.

The ESC @ initializes the printer, and causes all the data in the print buffer to be cleared, including any download characters.

Example: 10 SELECT PRINT 004
20 PRINT HEX(0F);"BEFORE PRINTER IS INITIALIZED"
30 PRINT
40 PRINT HEX(1B);"@";
50 PRINT "AFTER PRINTER IS INITIALIZED"
60 END

BEFORE PRINTER IS INITIALIZED

AFTER PRINTER IS INITIALIZED

ESC A

Name: ESC A - n/72-inch Line Spacing
Expression: HEX(1B);"A";HEX(n);
(n = 00H to 55H)
Function: Sets n/72-inch line spacing

The ESC A code sets the amount of line feed spacing to n/72 inch. When n = 01H (i.e., 1/72 inch), the amount of line spacing equals the space between two adjacent dot wires in the print head.

See also ESC 0, ESC 1, ESC 2, and ESC 3.

Example: 10 SELECT PRINT 004
20 REM LINE SPACING BY DOTS
30 DIM A#1
40 A# = HEX(01)
50 FOR I = 1 TO 8
60 PRINT HEX(1B);"A";A#;
70 PRINT "LINE SPACING" _
80 A# = A# + HEX(01)
90 NEXT I
100 END

```
LINE SPACING LINE SPACING LINE SPACING
LINE SPACING LINE SPACING LINE SPACING
LINE SPACING LINE SPACING LINE SPACING
LINE SPACING LINE SPACING LINE SPACING
```

NOTE

The ESC A (n) code may be used at any position on a line. However, once the code is entered, the specified amount of line spacing will remain unchanged until another line spacing code is entered.

ESC B

Name: ESC B - Vertical TAB
Expression: HEX(1B);"B";HEX(n₁);HEX(n₂); . . . ;HEX(n_k);HEX(00);
(n = 01H to FEH, k = 01H to 10H)
Function: Sets the vertical TAB positions on the specified lines.

Since the current line spacing multiplied by the number of lines is stored as an absolute value for the TAB stop position, the vertical TAB setting will be performed as it has been set by this code -- even if the amount of the line spacing is changed. The maximum number of vertical tabs that can be set is 16_d (10)_H. Vertical TAB setting is terminated by the HEX(00) code.

See also VT, ESC /, and ESC b.

Example:

```
10 SELECT PRINT 004
20 REM VERTICAL TAB
30 PRINT HEX(1B);"B";HEX(01);HEX(05);HEX(09);
40 PRINT HEX(00);
50 FOR J = 1 TO 3
60 PRINT HEX(0B);"VERTICAL TAB";
70 NEXT J
80 PRINT
90 END
```

VERTICAL TAB

VERTICAL TAB

VERTICAL TAB

NOTE

If TAB positions are not set in a numerically ascending order, the TAB execution is terminated. TAB positions set by ESC B are the same as those set by ESC b channel 0.

ESC C

Name: ESC C - Form Length Setting by Number of Lines
Expression: HEX(1B);"C";HEX(n);
(n = 01H to 7FH)
Function: Sets form length by number of lines.

Form feed, skip-over perforation, etc., are carried out in accordance with the form length specified by the ESC C code. The form length is stored as an absolute length with the amount of line spacing multiplied by the specified number of lines. Therefore, the specified form length does not change after it has once been set -- even if the amount of line spacing is changed.

See also ESC C0.

Example: Set the form length to 50 lines.

```
LPRINT HEX(1B);"C";HEX(32);
```

ESC C0

Name: ESC C0 - Form Length Setting in Inches
Expression: HEX(1B);"C";HEX(00);HEX(n);
(n = 01H to 16H)
Function: Sets form length in inches.

With the ESC C0 code, the form length specified in inches is set. Form feed, skip-over perforation, etc., are carried out according to the form length set by this code.

See also ESC C.

Example: The following program shows how to set a form length to 1 inch:

```
10 SELECT PRINT 004  
20 PRINT HEX(1B);"C";HEX(00);HEX(01);  
30 PRINT "FIRST LINE OF FORM";  
40 PRINT HEX(0C);  
50 PRINT "LAST LINE OF FORM"
```

```
FIRST LINE OF FORM
```

```
LAST LINE OF FORM
```

ESC D

Name: ESC D - Horizontal TAB
Expression: HEX(1B);"D";HEX(n₁);HEX(n₂); . . . ;HEX(n_k);HEX(00);
(n = 01H to E9H, k = 01H to 20H)
Function: Sets horizontal TAB.

The ESC D code specifies the horizontal TAB stop positions.

The horizontal TAB position is stored as a value of the current character width multiplied by the specified number of columns; n denotes column position. The HT code causes the horizontal TAB position to skip to the next position and printing restarts from the next column on that line. The TAB stop positions can be specified up to 136 columns in Pica Print mode and 233 columns in Condensed Print mode.

The excess TAB positions set by ESC D are ignored. HEX(00) terminates the TAB setting(s). Omitting this code results in an incorrect printout.

See also HT.

```
Example: 10 SELECT PRINT 004
          20 REM HORIZONTAL TAB
          30 PRINT "0123456789012345678901234567890123456789"
          40 PRINT HEX(1B);"D";HEX(05);HEX(0A);HEX(0F);HEX(00);
          50 FOR I = 1 TO 3
          60 PRINT HEX(09);"TAB";
          70 NEXT I
          80 END
```

```
0123456789012345678901234567890123456789
      TAB TAB TAB
```

NOTE

The default TAB setting is every eight columns. If TAB positions are not set in numerically ascending order, ESC D is not executed.

ESC E

Name: ESC E - Emphasized Mode Setting
Expression: HEX(1B);"E";
Function: Sets Emphasized Print mode.

With the ESC E mode, all the data stored in the print buffer is printed and then the data following this code is printed in emphasized characters. Emphasized printing gives each character a stronger impression.

ESC E can be input at any column position on a line. The speed of the head carriage is reduced to 80 CPS while printing emphasized characters. This print mode can be cancelled by the ESC C or ESC ! code.

See also ESC F, ESC M, and ESC !.

ESC F

Name: ESC F - Emphasized Mode Cancel
Expression: HEX(1B);"F";
Function: Cancels Emphasized Print mode.

The ESC F code cancels the Emphasized Print mode set by the ESC E code.

See also ESC E, ESC M, and ESC !.

Example: 10 SELECT PRINT 004
 20 REM EMPHASIZED MODE
 30 PRINT HEX(1B);"E";
 40 PRINT "EMPHASIZED";
 50 PRINT HEX(1B);"F";
 60 PRINT " PICA-SIZED"
 70 END

 EMPHASIZED PICA-SIZED

ESC G

Name: ESC G - Doublestrike Mode Setting
Expression: HEX(1B);"G";
Function: Sets Doublestrike Print mode.

With the ESC G code, all the data stored in the print buffer is printed and then the data following this code is printed in Doublestrike Print mode. This feature eliminates the vertical gap between dots, thereby enhancing the print quality.

In this mode, the printer completes one line of printing with two passes of the print head, advancing the paper by about 1/216 inch between the first pass and the second pass. For this reason, the printer adjusts paper feeding to maintain the absolute length and number of lines on a page.

See also ESC H.

ESC H

Name: ESC H - Doublestrike Mode Cancel
Expression: HEX(1B);"H";
Function: Cancels Doublestrike Print mode.

The ESC H code cancels the Doublestrike Print mode set by the ESC G code.

See also ESC G.

Example: 10 SELECT PRINT 004
20 REM DOUBLE-STRIKE MODE CANCEL
30 PRINT HEX(1B);"G";
40 PRINT "DOUBLE PRINT"
50 PRINT HEX(1B);"H";
60 PRINT "NORMAL PRINT"
70 END

DOUBLE PRINT
NORMAL PRINT

ESC J

Name: ESC J - Single Line n/216-inch Line Spacing
Expression: HEX(1B);"J";HEX(n);
(n = 01H to FFH)
Function: Feeds n/216-inch line spacing for one line.

The ESC J code causes the data in the print buffer to be printed and executes n/216-inch paper feed. The set value of n is cancelled by a line feed.

See also ESC J and ESC 3.

Example: To execute 113/216-inch line spacing,

```
10 SELECT PRINT 004
20 PRINT "FIRST LINE";HEX(0D);
30 PRINT HEX(1B);"J";HEX(71);
40 PRINT "SECOND LINE (PRINTED 113/216 INCHES BELOW FIRST LINE)"
50 PRINT "THIRD LINE (WITH STANDARD LINE SPACING)"
60 END
```

FIRST LINE

SECOND LINE (PRINTED 113/216 INCHES BELOW FIRST LINE)
THIRD LINE (WITH STANDARD LINE SPACING)

NOTE

With n=01H and n=02H, paper-feeding accuracy is not guaranteed. If the value of n is set to 00H, no paper feeding occurs. The ESC 3 code sets the same n/216-inch line spacing as the ESC J code. However, in the case of the ESC 3 code, the line spacing is not cancelled by a line feed but is retained in memory.

ESC M

Name: ESC M - Elite Character Setting
Expression: HEX(1B);"M";
Function: Sets Elite characters.

The ESC M code causes the data following this code to be printed in Elite characters (12 characters per inch).

In this mode, input of the emphasized or condensed printing code does not change the print mode.

See also ESC P, SI, DC2, ESC E, and ESC F.

Example: 10 SELECT PRINT 004
20 REM ELITE-SIZED PRINT
30 PRINT "PICA-SIZED";
40 PRINT HEX(1B);"M";
50 PRINT " ELITE-SIZED"
60 PRINT HEX(1B);"!";HEX(00)
70 END

PICA-SIZED ELITE-SIZED

ESC N

Name: ESC N - Skip-Over Perforation Setting
Expression: HEX(1B);"N";HEX(n);
(n = 01H to 7FH)
Function: Sets skip-over perforation.

The ESC N code is used to set the skip-over perforation function, which specifies the number of lines "n" to be skipped at the bottom of a form. For example, if the last three lines of a form are to be skipped, the value of "n" must be entered as 03H.

When the current form length is changed by the ESC C code, the specified amount of skip-over perforation is cancelled. In this case, therefore, the ESC N code must be input again to set the amount of skip-over perforation.

A skip-over perforation value that exceeds the length of the form is ignored. For example, if you are using 11-inch paper and you set a skip-over perforation of six lines, the printer prints 60 lines from the Top-of-Form position, feed for six lines, and then continue printing from the 61st line of data at the Top-of-Form position of the next page.

When DIP Switch 2-3 is ON, 1-inch skip-over perforation is executed.

See also ESC O and ESC C.

Example: 10 SELECT PRINT 004
20 REM SKIP-OVER PERFORATION
30 PRINT HEX(1B);"C";HEX(05);
40 PRINT HEX(1B);"N";HEX(02);
50 FOR I = 1 TO 9
60 PRINT "LINE";I
70 NEXT I
80 END

LINE 1
LINE 2
LINE 3

LINE 4
LINE 5
LINE 6

LINE 7
LINE 8
LINE 9

ESC O

Name: ESC O - Skip-Over Perforation Cancel
Expression: HEX(1B);"O";
Function: Cancels skip-over perforation.

The ESC O code cancels the skip-over perforation set by the ESC N code.

See also ESC N.

Example: 10 SELECT PRINT 004
20 REM SKIP-OVER PERFORATION
30 PRINT HEX (1B); "C"; HEX (04);
40 PRINT HEX (1B); "N"; HEX (02);
50 PRINT "ABCDEFGHJKLMNOPQRSTUVWXYZ"
60 PRINT "01234567890123456789012345"
70 PRINT HEX (1B); "O";
80 FOR I = 1 TO 2
90 PRINT "ABCDEFGHJKLMNOPQRSTUVWXYZ"
100 PRINT "01234567890123456789012345"
110 NEXT I
120 END

ABCDEFGHJKLMNOPQRSTUVWXYZ
01234567890123456789012345

ABCDEFGHJKLMNOPQRSTUVWXYZ
01234567890123456789012345
ABCDEFGHJKLMNOPQRSTUVWXYZ
01234567890123456789012345

ESC P

Name: ESC P - Pica Character Setting
Expression: HEX(1B);"P";
Function: Cancels ESC M code.

With the ESC P code, the Elite Print mode set by the ESC M code is cancelled and the printer returns to Pica Print mode. Note, however, that ESC P is effective only when cancelling the ESC M code and does not cancel such modes as Enlarged or Condensed Print.

See also ESC A.

Example: 10 SELECT PRINT 004
20 REM PICA-SIZED PRINTING
30 PRINT HEX(1B);"P";
40 PRINT "PICA-SIZED CHARACTERS"
50 PRINT
60 PRINT HEX(1B);"M";
70 PRINT "ELITE-SIZED CHARACTERS"
80 PRINT
90 PRINT HEX(1B);"P";
100 PRINT "PICA-SIZED CHARACTERS"
110 END

PICA-SIZED CHARACTERS

ELITE-SIZED CHARACTERS

PICA-SIZED CHARACTERS

ESC Q

Name: ESC Q - Right Margin
Expression: HEX(1B);"Q";HEX(n);
Function: Sets right margin.

The ESC Q code specifies the right margin, i.e., the right end of the print line.

With the ESC Q code, the number of printed characters between the left margin and the right margin is fixed by the value of n. This code must be specified at the head of a line. If the value for n is above or below the limits, the command is ignored and the previous setting remains in effect. The limits for n are as follows:

Pica mode	n = 02H to 88H
Emphasized mode	n = 02H to 88H
Condensed mode	n = 04H to E9H
Elite mode	n = 03H to A3H

In Proportional Print mode, the print column width is set in Pica character size. The values for the right margin in the Enlarged Print mode will be one half of the respective values shown. If the result is a fraction, the value will be rounded down.

See also ESC 1.

Example: 10 SELECT PRINT 004
20 PRINT HEX(1B);"Q";HEX(0F);
30 PRINT "123456789012345678901234567890"
40 END

```
123456789012345  
678901234567890
```

NOTE

If ESC Q is not specified at the head of a line, the print data prior to this code may be lost.

ESC S

Name: ESC S - Superscript/Subscript Mode Setting
Expression: HEX(1B);"S";HEX(n);
n=00H or 30H: Sets Superscript Print mode.
n=01H or 31H: Sets Subscript Print mode.
Function: Sets Superscript/Subscript mode.

With the ESC S HEX(00) or ESC S HEX(30) code, all the data following this code is printed in Superscript Print mode. In this mode, a character measuring 1.6 mm high prints on the upper half of the line. ESC S can be cancelled with the ESC T code.

See also ESC T.

```
Example 1: 10 SELECT PRINT 004  
           20 REM SUPERSCRIP T MODE  
           30 PRINT HEX(1B);"E";  
           40 PRINT "Y = 5X";HEX(1B);"F";  
           50 PRINT HEX(1B);"S";HEX(00);  
           60 PRINT HEX(0F);"3"  
           70 PRINT HEX(1B);"T";HEX(12);  
           80 PRINT HEX(1B);"F";  
           90 END
```

Y = 5X³

When ESC S HEX(01) or ESC S HEX(31) is input, the data following this code is printed in Subscript Print mode. In this mode, characters measuring 1.6 mm high are printed on the lower half of a line.

ESC S code can be cancelled with the ESC T code.

See also ESC T.

Example 2:

```
10 SELECT PRINT 004
20 REM SUBSCRIPT MODE
30 PRINT HEX(1B);"E";
40 PRINT "Y = 5X";HEX(1B);"F";
50 PRINT HEX(1B);"S";HEX(01);
60 PRINT HEX(0F);"2";
70 PRINT HEX(1B);"T";HEX(12);
80 PRINT HEX(1B);"F"
90 END
```

$Y = 5X_2$

NOTE

In both the Superscript and Subscript Print modes, the printer performs unidirectional, doublestrike printing. After the first pass of the print head, the paper advances by 1/216 inch and a character is formed on completion of the second pass. The printer adjusts paper feeding to maintain the absolute length and number of lines of a page. Because of this adjustment, superscript or subscript characters may, in the worst case, be printed improperly.

ESC T

Name: ESC T - Superscript/Subscript Mode Cancel
Expression: HEX(1B);"T";
Function: Cancels Superscript/Subscript Print mode.

The ESC T code cancels the Superscript or Subscript Print mode set by the ESC S code.

See also ESC S.

ESC U

Name: ESC U - Unidirectional Printing
Expression: HEX(1B);"U";HEX(n);
n=01H or 31H Unidirectional printing
n=00H or 30H Bidirectional printing (except in Bit-Image mode)
Function: Sets/cancels unidirectional printing.

When ESC U HEX(01) or ESC U HEX(31) is input, all data following this code is printed only when the print head is moving from left to right. Unidirectional printing is effective to further improve the precision of vertical character alignment.

When the ESC U HEX(00) or ESC U HEX(30) code is input, the Unidirectional Print mode is cancelled and the printer returns to the normal Bidirectional Print mode.

See also ESC <.

Example:

```
10 SELECT PRINT 004
20 PRINT "THIS TEXT IS"
30 PRINT "PRINTED BIDIRECTIONALLY"
40 PRINT
50 PRINT HEX(1B);"U";HEX(01);
60 PRINT "THIS TEXT IS"
70 PRINT "PRINTED UNIDIRECTIONALLY"
80 PRINT HEX(1B);"U";HEX(00);
90 END
```

```
THIS TEXT IS
PRINTED BIDIRECTIONALLY
```

```
THIS TEXT IS
PRINTED UNIDIRECTIONALLY
```

ESC W

Name: ESC W - Enlarged Mode
Expression: HEX(1B);"W";HEX(n);
n=01H or 31H: Sets Enlarged Print mode
n=00H or 30H: Cancels Enlarged Print mode
Function: Sets/cancels Enlarged Print mode.

When ESC W HEX(01) or ESC W HEX(31) code is input, all the data following this code is printed in enlarged characters.

The ESC W HEX(00) or ESC W HEX(30) code causes the Enlarged Print mode set by ESC W HEX(01), ESC W HEX(31), or SO code to be cancelled. ESC W is not cancelled by a line feed.

See also SO and DC4.

Example: 10 SELECT PRINT 004
20 REM ENLARGED MODE
30 PRINT HEX(1B);"W";HEX(01)
40 PRINT "ENLARGED MODE"
50 PRINT HEX(1B);"W";HEX(00);
60 PRINT "PICA-SIZED MODE"
70 END

ENLARGED MODE
PICA-SIZED MODE

ESC b

Name: ESC b - VFU Position Setting
Expression: HEX(1B);"b";HEX(n);HEX(m₁);...HEX(m_k);HEX(00);
(n = 00H to 07H, k = 01H to 10H)
Function: Sets VFU position.

The ESC b code sets the Vertical Format Unit (VFU) position for Channel n. For details about the VFU, refer to the ESC / code. The VFU has eight channels (0 to 7). For each channel, up to 16 positions can be set within the page length. The channel is set to 0 at power ON.

The specified TAB positions must be terminated with HEX(00).

See also ESC B, VT, and ESC /.

NOTE

TAB positions in Channel 0 can also be set by ESC B.

Example: To set the vertical TABs at the 5th, 10th, and 13th lines in Channel 2,

```
10 SELECT PRINT 004
20 REM SET VERTICAL TABS
30 PRINT HEX(1B);HEX(62);
40 PRINT HEX(02);HEX(05);HEX(0A);HEX(0D);
50 PRINT HEX(00);
60 REM SELECTS CHANNEL 2
70 PRINT HEX(1B);"/";HEX(02);
80 PRINT "START";HEX(0B);"BB";HEX(0B);
90 PRINT "CC";HEX(0B);"DD"
100 END
```

START

BB

CC

DD

ESC l

Name: ESC l - Left Margin
Expression: HEX(1B);HEX(6C);HEX(n);
Function: Sets column head.

The ESC l code sets the position of the column head in the current character size. ESC Q sets the column end and ESC l sets the column head.

ESC l is performed in Proportional Print mode the same as it is in Pica Print mode. The maximum value of n is determined by the current mode. Illegal settings are ignored. The range of values for each print mode are as follows:

Pica mode	n = 00H to 86H
Emphasized mode	n = 00H to 86H
Condensed mode	n = 00H to E5H
Elite mode	n = 00H to A0H

The values for the left margin in the Enlarged Print mode are one half of the respective values shown above. If the result is a fraction, the value will be rounded down.

See also ESC Q.

Example 1: To set the left margin to the 8th column,

```
10 SELECT PRINT 004
20 REM SETS LEFT MARGIN
30 PRINT "012345678901234567890"
40 PRINT HEX(1B);HEX(6C);HEX(08);
50 PRINT
60 PRINT "THE LEFT MARGIN IS SET TO COLUMN 8"
```

```
012345678901234567890
```

```
THE LEFT MARGIN IS SET TO COLUMN 8
```

```

Example 2: 10 SELECT PRINT 004
                20 REM HORIZ TAB, LEFT MARGIN, HORIZ TAB SEQUENCE
                30 PRINT "012345678901234567890"
                40 PRINT HEX (1B); "D"; HEX (02); HEX (08); HEX (0F);
                50 PRINT HEX (00);
                60 PRINT "A"; HEX (09); "B"; HEX (09); "C"; HEX (09); "D"
                70 PRINT HEX (1B); HEX (6C); HEX (0F);
                80 PRINT "012345678901234567890"
                90 PRINT HEX (00);
                100 PRINT "E"; HEX (09); "F"; HEX (09); "G"; HEX (09); "H"
                110 END

```

```

012345678901234567890
A B      C      D
           012345678901234567890
           E      F      G      H

```

NOTE

ESC 1 causes the horizontal TAB positions previously set to be cleared. The subsequent horizontal TAB setting is carried out assuming the start column position set by ESC 1 is position 0.

ESC p

Name: ESC p - Proportional Spacing Mode
Expression: HEX(1B);"p";HEX(n);
n = 01H or 31H proportional spacing
n = 00H or 30H normal spacing
Function: Selects Proportional Spacing mode.

To print in the Proportional Spacing mode, each character is assigned a width value (unit = 1/2 dot). Proportional printing is used to obtain an easier-to-read, more esthetically pleasing print-out. In Proportional Spacing mode, BS and DEL are not accepted. Also, printing is always performed in Emphasized mode.

Example: 10 SELECT PRINT 004
20 REM PROPORTIONAL SPACING MODE
30 PRINT " NORMAL PRINT MODE"
40 GOSUB 1000
50 PRINT
60 PRINT
70 PRINT HEX(1B);HEX(70);HEX(01);
80 PRINT " PROPORTIONAL SPACING MODE"
90 GOSUB 1000
100 PRINT HEX(1B);HEX(70);HEX(00);
110 END
1000 REM SUBROUTINE
1010 PRINT "THE PRINTER IS CAPABLE OF PRINTING"
1020 PRINT "IN NORMAL PRINT MODE, OR IN"
1030 PRINT "PROPORTIONAL SPACING PRINT MODE"
1040 RETURN

NORMAL PRINT MODE
THE PRINTER IS CAPABLE OF PRINTING
IN NORMAL PRINT MODE, OR IN
PROPORTIONAL SPACING PRINT MODE

PROPORTIONAL SPACING MODE
THE PRINTER IS CAPABLE OF PRINTING
IN NORMAL PRINT MODE, OR IN
PROPORTIONAL SPACING PRINT MODE

ESC s

Name: ESC s - Half Speed Printing
Expression: HEX(1B);"s";HEX(n);
n = 01H or 31H: Sets half-speed printing.
n = 00H or 30H: Cancels half-speed printing.
Function: Sets/cancels half-speed printing.

When ESC s 01H or ESC s 31H code is input, the print speed decreases from the normal 16 inch/sec. to 8 inch/sec. This feature reduces the level of printer noise.

When ESC s 00H or ESC s 30H code is input, the print speed returns to the normal 16 inch/sec.

Example:

```
10 SELECT PRINT 004
20 REM HALF SPEED PRINTING
30 PRINT "THIS LINE IS PRINTED AT STANDARD SPEED"
40 PRINT HEX(1B);HEX(73);HEX(01);
50 PRINT "THIS LINE IS PRINTED AT HALF SPEED"
60 END
```

```
THIS LINE IS PRINTED AT STANDARD SPEED
THIS LINE IS PRINTED AT HALF SPEED
```

DEL

Name: DEL - Delete
Expression: HEX(1B);
Function: Cancels last printable data.

The DEL code causes the last printable data stored in the print buffer to be deleted. This code is ignored in the Bit-Image mode.

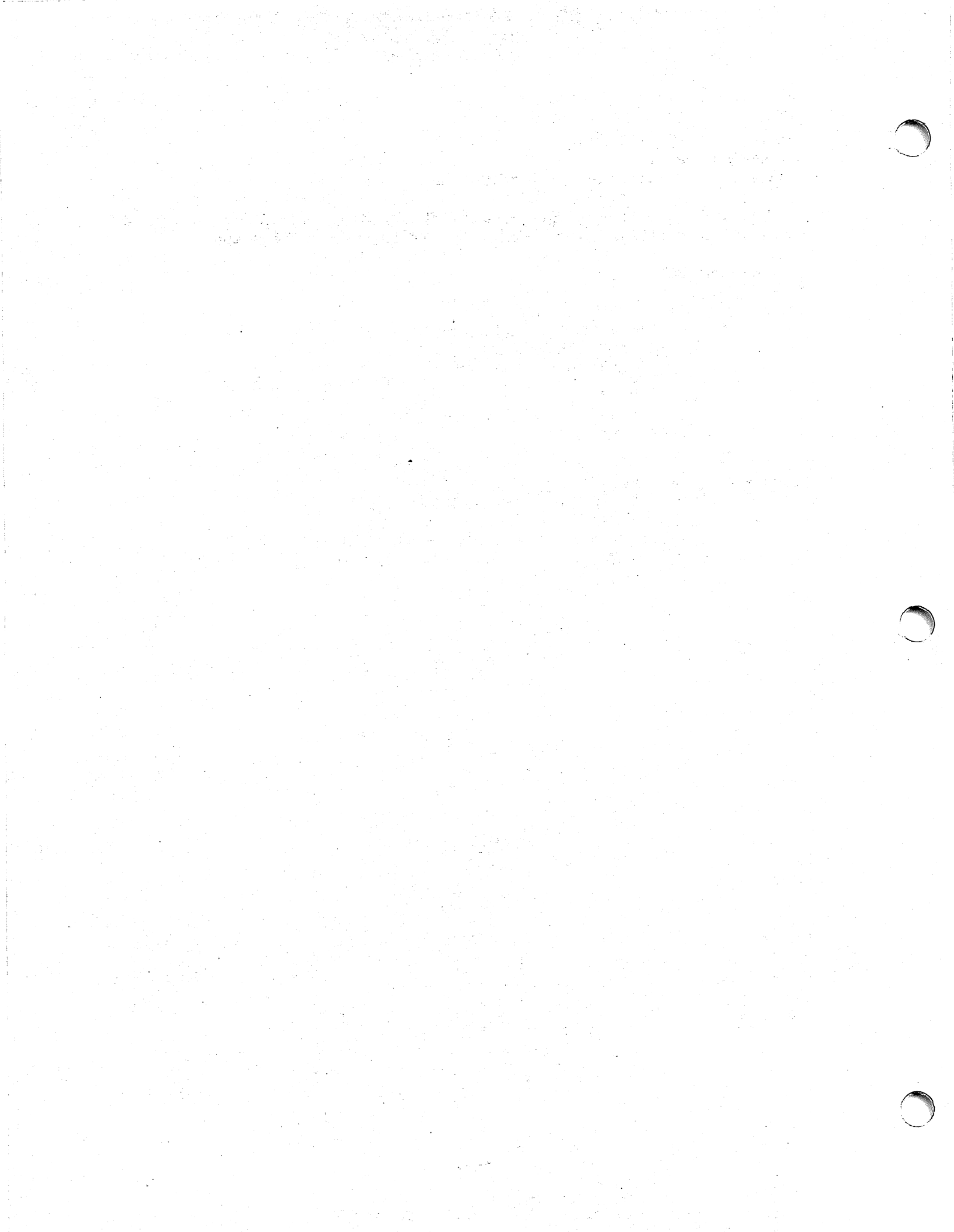
See also BS.

Example 1: 10 SELECT PRINT 004
 20 REM DELETE LAST CHARACTER
 30 PRINT "DELETE";
 40 PRINT HEX (7F); "ING";
 50 PRINT

 DELETING

Example 2: 10 SELECT PRINT 004
 20 REM DELETE THREE CHARACTERS
 30 PRINT "DELETE";
 40 PRINT HEX (7F); HEX (7F); HEX (7F);
 50 PRINT

 DEL



CHAPTER 6 DOWNLOAD MODE CONTROL CODES

6.1 INTRODUCTION

You can use Download mode control codes described in this chapter to create and print a maximum of 256 symbols or other special characters which are stored in the printer random access memory (RAM). Normally the printer uses the internal character set stored in the read only memory (ROM), which contains all of the WISCII characters listed in Table E-1. The characters in both character sets are referenced by addresses 00H to FFH.

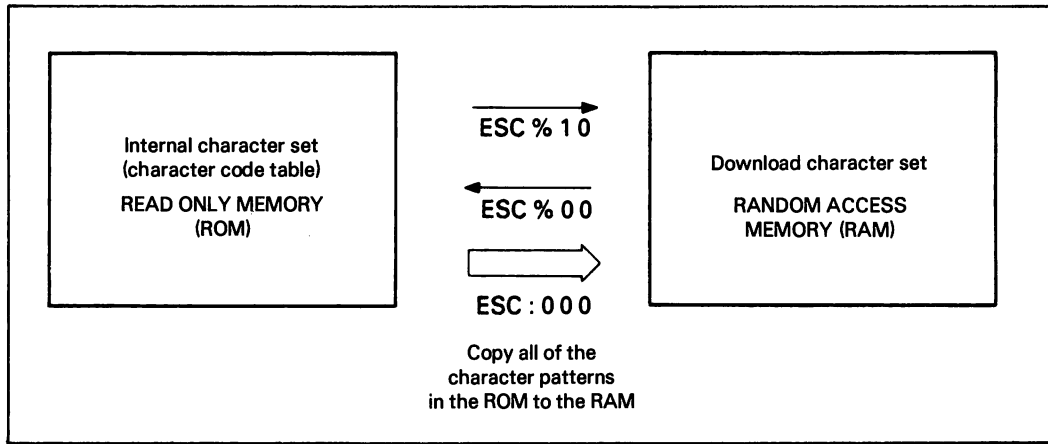
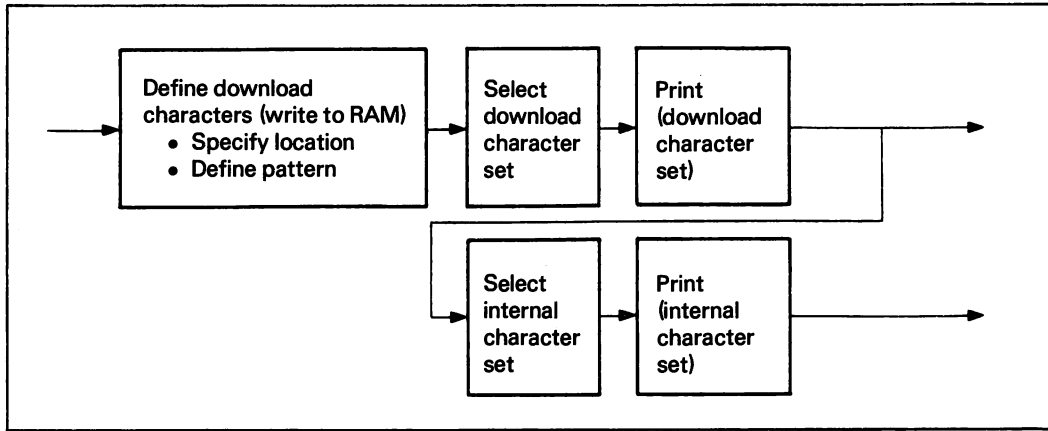
You can enter the Download mode control codes in your own programs. However, these codes control the printer only when the Wang 2200 system printer driver is in the Transparent mode, a feature described in the 2200 BASIC-2 Multiuser Operating System Software Bulletin Release 2.6. Download characters are lost when the printer is turned off and must be re-entered when power is turned on. However, programs for creating download characters can be copied to disk and re-run when needed. Download characters cannot be printed in a WP document because the printer is initialized when you enter WP, erasing all download characters.

To create download characters you must be familiar with the binary numbering system. The following section describes how a download character is created and printed.

6.2 HOW TO CREATE DOWNLOAD CHARACTERS

To write a download character to the RAM, use ESC & to specify the location of the character to be written and to send the character pattern data to the RAM.

Two additional codes are used when you write programs for printing download characters. The ESC % code specifies whether the printer uses the download (RAM) character set or the WISCII (ROM) character set to print characters. The ESC: code enables you to copy characters from the ROM character set to the RAM character set, so that you can print both WISCII and download characters directly from the download character set.



Creating and Printing Download Characters

NOTE

DIP SW 1-4 must be OFF. The factory-set condition of SW 1-4 is OFF.

6.3 CONTROL CODES IN DOWNLOAD MODE

This section describes Download mode codes that can be entered in BASIC or other programs.

ESC &

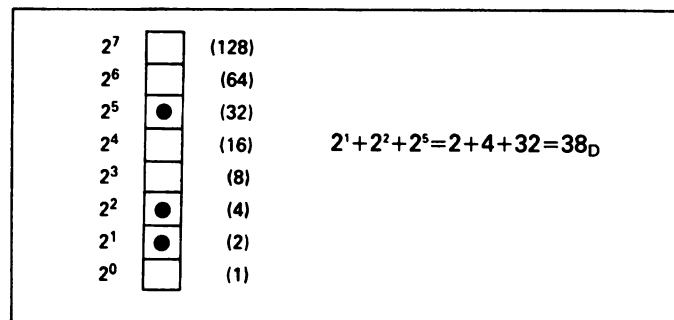
Name: ESC & - Create Download Characters
Expression: HEX(1B);"&";HEX(00);HEX(n);HEX(m);
HEX(a);HEX(p₁);HEX(p₂);HEX(p₃); . . . HEX(P₁₁);

n is equal to, or greater than 00H
m is equal to, or less than FFH

Function: Creates and copies user-defined download characters into RAM.

ESC & assigns download characters to WISCII codes n to m using character data p₁, p₂, p₃ . . . p₁₁.

The dot wires fired in printing are represented as hexadecimal character data where the dot wires correspond to the bit positions as shown. To obtain the decimal value for a dot position, first determine the binary value of the dot pattern you want, and then convert it to hexadecimal.



You can define a maximum of 12 horizontal positions in a download character. However, the 12th position is automatically set to 0. The minimum width of a download character is five positions.

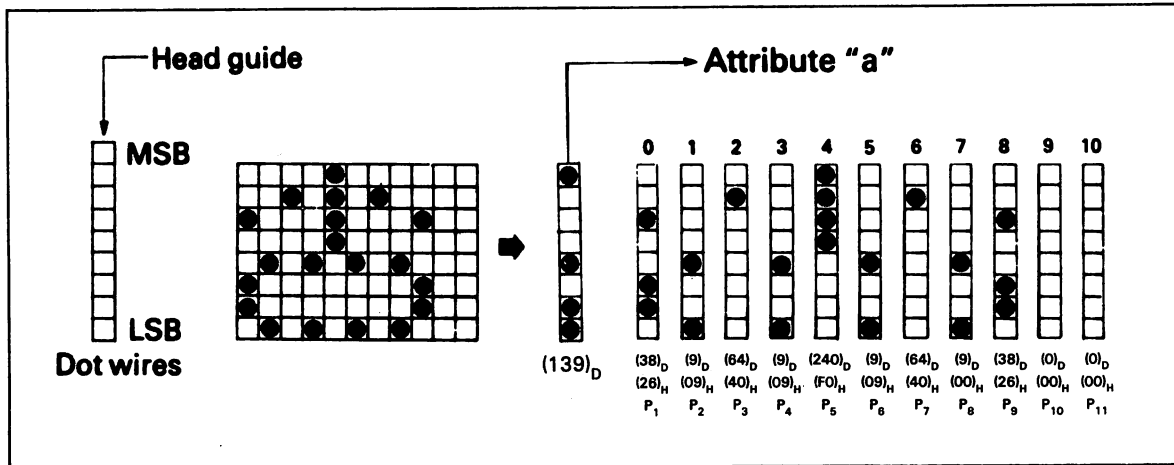
If a download character is to be assigned to only one WISCII character, then n=m. For example,

```
HEX(1B);"&";HEX(00);HEX(n);HEX(n);  
HEX(a);HEX(p1);HEX(p2); . . . HEX(p11)
```

The term "a" is an Attribute that consists of descender data and proportional data. For details, refer to the following section on obtaining Attribute "a".

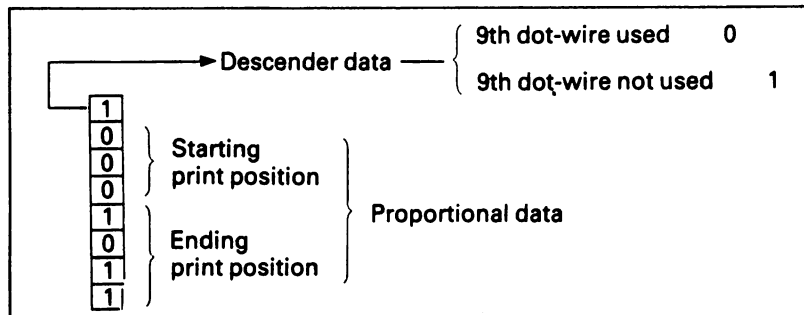
See also ESC : and ESC %.

Example: A download character such as $\text{\textcircled{a}}$ is created by entering the following values for P1 through P11.



Obtaining Attribute "a"

Attribute "a" consists of descender data and proportional data. The descender data determines whether the 9th dot will be used and the character shifted down one dot. The proportional data determines the starting and ending positions of the print area. The following diagram shows how eight binary bits are used to specify descender data and the starting and ending print positions for proportional data.



The high-order three bits of the 7-bit proportional data represent the starting print position and the remaining four bits indicate the ending print position. In the example, attribute "a" is:

$$(10001011)_2 = (139)_D = (8B)_H$$

Creating Download Characters in Proportional Mode

In proportional printing, all data is printed in emphasized characters. Compare the following printout for Pica mode and enlarged or emphasized characters for data in print positions 0 and 10. If the print area for the proportional data is specified as 0th to 10th positions, a dot at the 11th position cannot be printed.

Therefore, when creating a download character in Proportional mode, set the ending print position for the download character so that the position value is one greater than the actual position of the last data.

```
0 1 2 3 4 5 6 7 8 9 10 11
• o o o o o o o o o o • o   Pica mode
```

```
0 1 2 3 4 5 6 7 8 9 10 11
• • o o o o o o o o o • •   Enlarged or Emphasized mode
```

Note that all of download character data P_1 to P_{11} must be sent to the printer. Also, if horizontally adjacent dots are specified, they are automatically ignored.

ESC %

Name: ESC % - CG (Character Generator) Selection
Expression: HEX(1B);"%";HEX(n);HEX(00);
 n = 00H selects ROM CG
 n = 01H selects Download CG
Function: Selects the ROM CG or the download CG.

ESC % can be entered in a program before or after the ESC & code.

See also ESC &.

Example:

```
10 SELECT PRINT 004
20 PRINT HEX (1B); "&"; HEX (00); HEX (40); HEX (40);
30 PRINT HEX (8B);
40 PRINT HEX (26); HEX (0B); HEX (40); HEX (49);
50 PRINT HEX (F0); HEX (89); HEX (40); HEX (49);
60 PRINT HEX (26); HEX (00); HEX (00);
70 PRINT "#####"
80 PRINT HEX (1B); "%"; HEX (01); HEX (00);
90 PRINT "#####"
100 PRINT HEX (1B); "%"; HEX (00); HEX (00);
110 PRINT "#####"
120 END
```

```
#####
&&&&&&&
#####
```

NOTE

In lines 20 to 60 of the example, the & character is created (see ESC & for additional information on creating this character). In lines 80 and 100 the RAM and ROM character sets are selected.

ESC :

Name: ESC : (0) - ROM Character Generator (CG) Set Copy
Expression: HEX(1B);":";HEX(00);HEX(00);HEX(00);
Function: Copies ROM CG set.

With the ESC: code, characters in the ROM CG set are copied into the Download CG set.

With the ESC: code, the WISCII characters in the ROM CG can be printed while in the Download Character mode. In this case, you do not need to input ESC % 0 and ESC % 1 to select the CG.

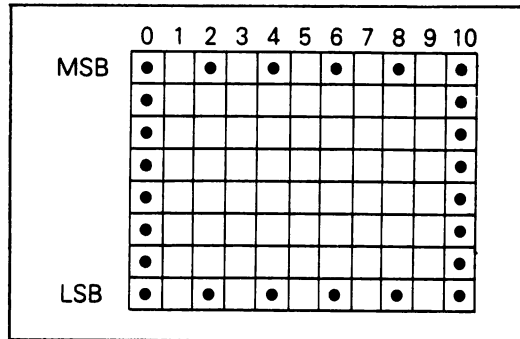
Example: 10 SELECT PRINT 004
20 PRINT HEX(1B);":";HEX(00);HEX(00);HEX(00)
30 PRINT HEX(1B);"&";HEX(00);"##";
40 PRINT HEX(8B);
50 PRINT HEX(26);HEX(0B);HEX(40);HEX(49);
60 PRINT HEX(E0);HEX(89);HEX(40);HEX(49);
70 PRINT HEX(26);HEX(00);HEX(00);
80 PRINT HEX(1B);"%";HEX(01);HEX(00);
90 DIM A\$1
100 A\$ = HEX(20)
110 FOR I = 1 TO 15
120 A\$ = A\$ ADD HEX(01)
130 PRINT A\$;
140 NEXT I
150 PRINT HEX(1B);"%";HEX(00);HEX(00);
160 PRINT HEX(0D);HEX(0A)
170 END

!"\$%&'()*+,-./

6.4 DOWNLOAD MODE SAMPLE PROGRAMS

The following examples demonstrate how to create a download character, how to specify descender data, and how to specify the proportional data.

Creating a Download Character



Explanation of the Program

This program creates a box pattern and assigns it to character @. The result is that when @ is input, the box pattern is printed.

Line No.

60-80 Copies the fonts in the ROM into the RAM area.
90-100 Moves the character pattern from the RAM when it is to be printed.
120-130 Inputs the character defining command.
150 Defines the character into @.
170 8BH is an "attribute".
180-210 Defines the box pattern.

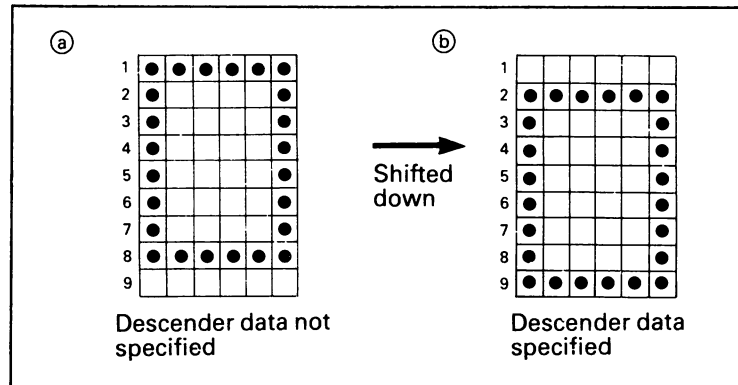
Example:

```
10 SELECT PRINT 004
20 PRINT
30 REM COPY ROM CHARACTER SET INTO DOWNLOAD CHARACTER SET
40 PRINT HEX(1B); ":"; HEX(00); HEX(00); HEX(00);
50 REM SELECTS DOWNLOAD CHARACTER SET
60 PRINT HEX(1B); "%"; HEX(01); HEX(00);
70 REM SPECIFIES THAT A SPECIAL CHARACTER WILL PRINT IN PLACE OF "@"
80 PRINT HEX(1B); "&"; HEX(00); "@@"; HEX(8B);
90 REM CREATES A BOX PATTERN
100 PRINT HEX(FF); HEX(00); HEX(81); HEX(00);
110 PRINT HEX(81); HEX(00); HEX(81); HEX(00);
120 PRINT HEX(81); HEX(00); HEX(FF);
130 PRINT "ONE BOX ----> @"
140 PRINT "FIVE BOXES ----> @@@@@"
```

```
ONE BOX ----> []
FIVE BOXES ----> [|||||]
```

Specifying Descender Data

The attribute data contains not only the descender data that determines whether or not the character is to be shifted down one dot at the time of printing, but also the proportional data that determines the size of the print area. Shifting the character down one dot at printing is accomplished by firing the 9th pin of the printer head. Therefore, a character made up of an 8-dot (vertical) pattern will be shifted down one dot and printed. The descender data is used when printing such characters as lowercase "p" and "g" of the internal character set.



The figures above show the box pattern created in the previous sample program. A is the result of printing without descender (9th dot wire not used) and B is the result of printing with descender (9th dot wire used).

When specifying the descender data in the attribute, note that the descender is specified by the most significant bit (MSB) of the attribute. When the MSB of the attribute is 0, the descender is specified and when the MSB of the attribute data is 1, the descender is not specified. For example, attribute data $(8B)_H$ does not specify the descender. In the binary equivalent of $(8B)_H$, which is 10001011, the MSB is 1. The lower 7 bits of this data are used to specify the proportional data.

Explanation of the Program

In this program, a box pattern with descender is created in the place of "A" and a box pattern without descender is created in the place of "@".

Line No.	
30	Copies the ROM character set into RAM.
50	Selects the RAM character set.
90	Specifies the two keyboard characters that will be used to print the download characters.
100-150	Creates box patterns.

Example:

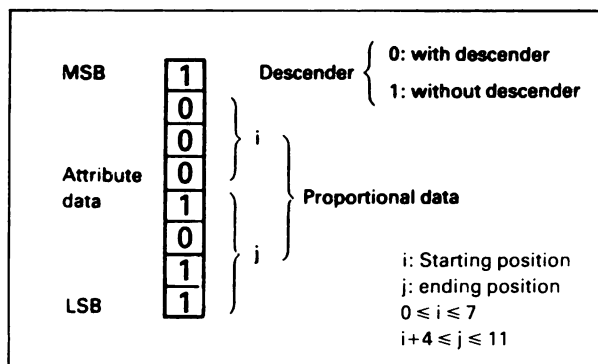
```
10 SELECT PRINT 004
20 REM COPIES ROM CHARACTERS INTO DOWNLOAD CHARACTER SET
30 PRINT HEX(1B); ":"; HEX(00); HEX(00); HEX(00);
40 REM SELECTS THE DOWNLOAD CHARACTER SET
50 PRINT HEX(1B); "%"; HEX(01); HEX(00);
60 REM CREATES A BOX PATTERN
70 PRINT HEX(1B); "&"; HEX(00);
80 REM SPECIFIES THAT SPECIAL CHARACTERS WILL PRINT IN PLACE OF @ AND A.
90 PRINT "@A";
100 REM CREATES A BOX PATTERN WITH NO DESCENDER ATTRIBUTE
110 PRINT HEX(8B); HEX(FF); HEX(00); HEX(81); HEX(00); HEX(81);
120 PRINT HEX(00); HEX(81); HEX(00); HEX(81); HEX(00); HEX(FF);
130 REM CREATES A BOX PATTERN WITH A DESCENDER ATTRIBUTE
140 PRINT HEX(0B); HEX(FF); HEX(00); HEX(81); HEX(00); HEX(81);
150 PRINT HEX(00); HEX(81); HEX(00); HEX(81); HEX(FF)
160 PRINT "ONE BOX ---->@"
170 PRINT "FIVE BOXES, TWO WITH DESCENDERS ---->@A@@"
180 END
```

```
ONE BOX ---->□
FIVE BOXES, TWO WITH DESCENDERS ---->□□□□□
```


Specifying Proportional Data

The proportional data of the attribute is used during proportional printing and specifies the starting and ending positions of the print area. This data is effective only during proportional printing.

The proportional data is all of the bits of the attribute with the exception of the MSB. Of these seven bits, the high-order 3 bits specify the starting position of the print area. The low-order 4 bits specify the ending position of the print area.

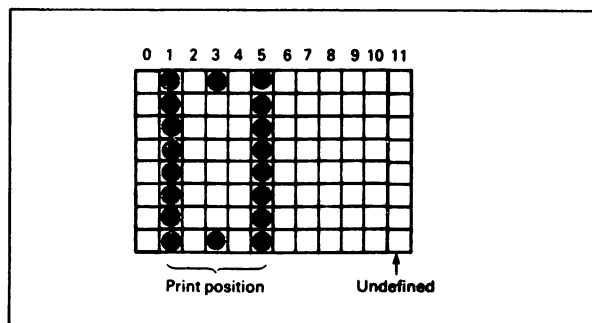


The maximum decimal value of the low-order 4 bits is 11 and the minimum width for a character is 5. If the setting of the proportional data is not within this range, the data is ignored and the width of the character is automatically set at 11.

To specify attribute a of the following box pattern, first determine if the MSB is 1 or 0. If the descender is specified (MSB = 0), the proportional data becomes the attribute. If the descender is not specified, 128_D is added to the proportional data. The binary value of *i* is 001 because the starting print position is 1. The binary value of *j* is 0101 because the ending print position is 5. The combination of *i* and *j* is 0010101, or 21 decimal.

Proportional data with descender: 21_D = 15_H = attribute a
 Proportional data without descender: 149_D = 95_H = attribute a

The print area that can be defined by the proportional data is dot positions 0 to 11. Of these, however, the user can define a maximum of 11 dot positions. The last dot position is always left blank.

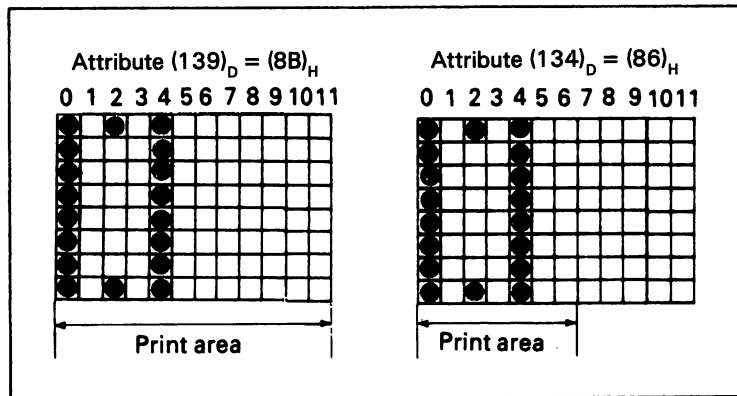


The program on the following page creates a box pattern in the proportional and non-proportional print modes.

Explanation of the Program

Line No.	
30	Copies ROM character set into RAM (download) character set.
70	Selects the RAM character set.
130-160	Creates box pattern without a proportional attribute.
180-210	Creates a box pattern with a proportional attribute.
270	Specifies non-proportional print mode.
340	Specifies proportional print mode.

In Line 130, HEX(8B) specifies the print area as the 0 to 11th positions. In line 180, HEX(86) specifies the print area as the 0 to 6th positions. Proportional data is valid only in Proportional print mode (ESC p).



Example:

```
10 SELECT PRINT 004
20 REM CREATES BOXES IN PROPORTIONAL AND NON-PROPORTIONAL MODES
30 REM
40 REM COPY FROM ROM CHARACTER SET INTO DOWNLOAD CHARACTER SET
50 PRINT HEX(1B); ":"; HEX(00); HEX(00); HEX(00);
60 REM SELECTS DOWNLOAD CHARACTER SET
70 PRINT HEX(1B); "%"; HEX(01); HEX(00);
80 REM CREATES A BOX PATTERN
90 PRINT HEX(1B); "&"; HEX(00);
100 REM SPECIFIES DOWNLOAD CHARACTERS TO BE ASSIGNED TO # AND #
110 PRINT "##";
120 REM CREATES A BOX PATTERN WITHOUT PROPORTIONAL ATTRIBUTE
130 PRINT HEX(BB);
140 PRINT HEX(FF); HEX(00); HEX(B1); HEX(00); HEX(FF);
150 PRINT HEX(00); HEX(00); HEX(00); HEX(00);
160 PRINT HEX(00); HEX(00);
170 REM CREATES A BOX GRAPHIC WITH PROPORTIONAL ATTRIBUTE
180 PRINT HEX(86);
190 PRINT HEX(FF); HEX(00); HEX(B1); HEX(00); HEX(FF);
200 PRINT HEX(00); HEX(00); HEX(00); HEX(00);
210 PRINT HEX(00); HEX(00);
220 PRINT "NON-PROPORTIONAL MODE"
230 PRINT "A BOX ---> #"
240 PRINT "FIVE BOXES ---> #####"
250 PRINT
260 PRINT "TWO OF THESE HAVE PROPORTIONAL ATTRIBUTES"
270 PRINT HEX(1B); HEX(70); HEX(01)
280 PRINT
290 PRINT "PROPORTIONAL MODE"
300 PRINT "A BOX ---> #"
310 PRINT "FIVE BOXES ---> #####"
320 PRINT
330 PRINT "TWO OF THEM HAVE PROPORTIONAL ATTRIBUTES."
340 PRINT HEX(1B); HEX(70); HEX(00);
350 END
```

NON-PROPORTIONAL MODE

A BOX ---> #

FIVE BOXES ---> #####

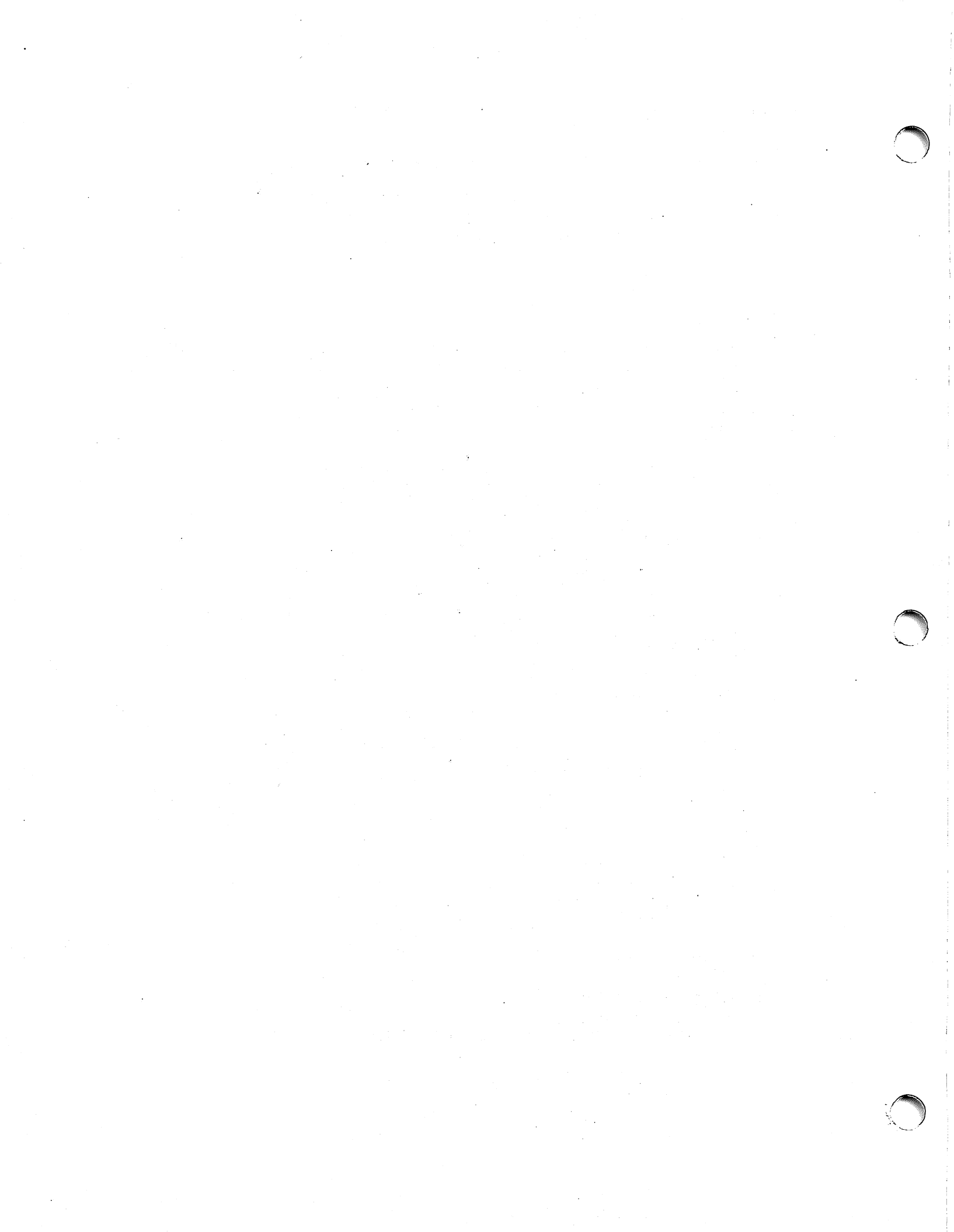
TWO OF THESE HAVE PROPORTIONAL ATTRIBUTES

PROPORTIONAL MODE

A BOX ---> #

FIVE BOXES ---> #####

TWO OF THEM HAVE PROPORTIONAL ATTRIBUTES.



CHAPTER 7
BIT-IMAGE MODE CONTROL CODES

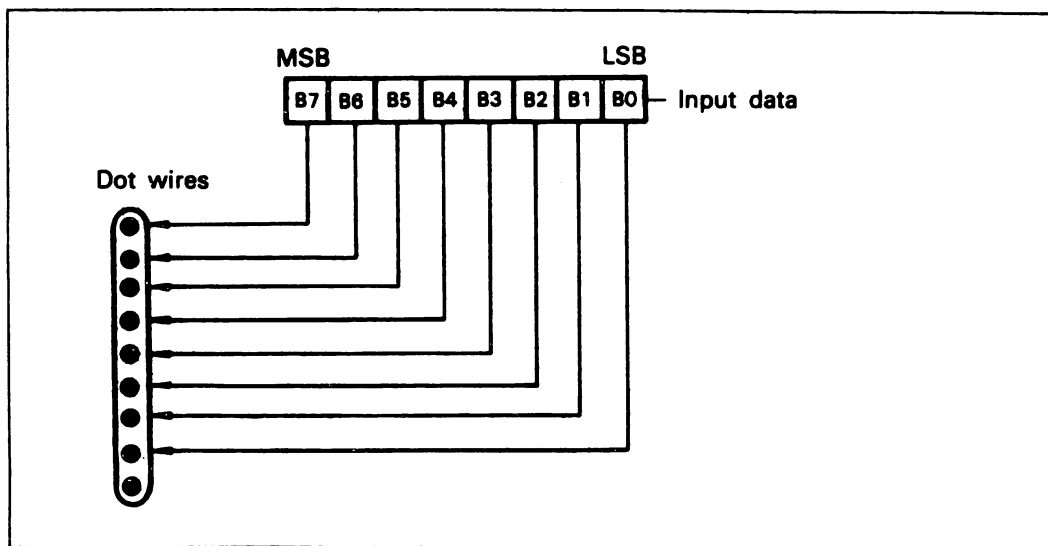
7.1. INTRODUCTION

You can use the Bit-Image mode control codes described in this chapter to print images in dot configurations from binary data contained in BASIC or other programs. The Text and Bit-Image modes are not fully independent of each other, in that parameters set in the Text mode are also effective in the Bit-Image mode.

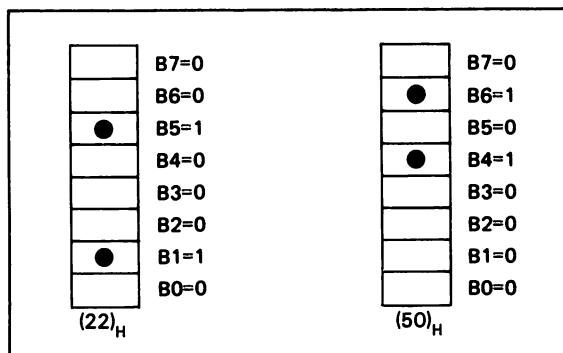
The Bit-Image codes control the printer only when the PC printer driver is in the Transparent mode, a feature described in the Wang 2200 BASIC-2 Multiuser Operating System Software Bulletin Release 2.6.

7.2 RELATIONSHIP BETWEEN BIT-IMAGE DATA AND DOT WIRES

The following illustration shows the relationship between the bit-image data and the dot wires in the print head. You can print using any combination of the eight dot wires in the print head. In the Bit-Image mode, the 9th dot wire cannot be used.

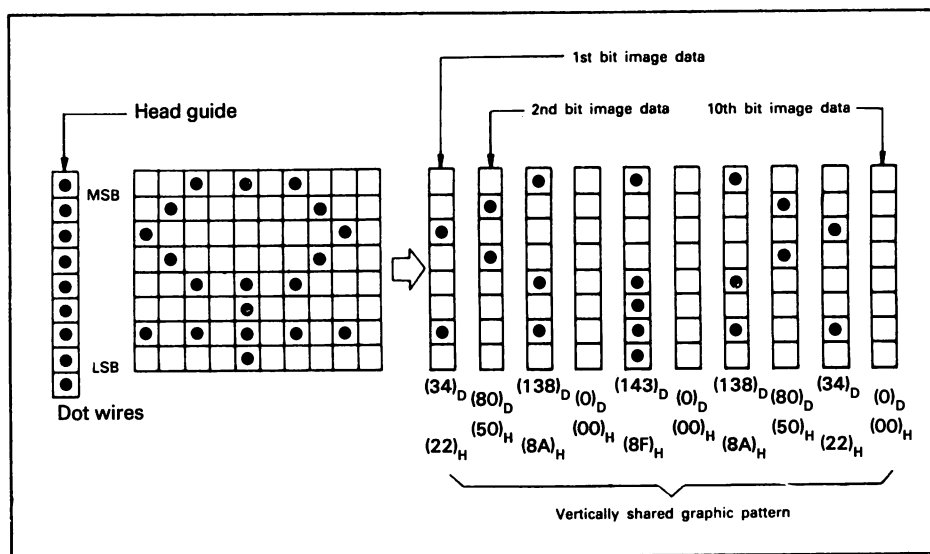


If a bit is 1, the print head fires. If a bit is 0, the print head does not fire. For example, assume that data are given as follows:



A box with "•" denotes the bit 1 and a blank box denotes the bit 0. Using Table E-1, you can convert $(00100010)_2$ from the example on the left to $(22)_H$, and $(01010000)_2$ to $(50)_H$. The hex value for each bit of image data is entered as the term d in the control codes that follow.

Example: To create the following graphic pattern, the value of d must be determined for each bit of image data. In this example, the first bit of image data d_1 is $(22)_H$, and the 10th bit d_{10} is $(00)_H$.



NOTE

The most significant bit (MSB) of the bit-image data corresponds to the dot wire at the uppermost position.

For each mode of printing, the user enters the bit-image data in the control code (d_1, d_2 etc.), and the number of dot positions (n_1, n_2) to be printed on a line. The number of dot positions occupied by the bit image data must equal n_1, n_2 . The printer stops if they are not equal. See Esc K for the method of calculating n_1 and n_2 .

7.3 CONTROL CODES IN BIT-IMAGE MODE

This section describes Bit-Image codes that can be entered in a BASIC or other program.

ESC K

Name: ESC K - Normal-density Bit-Image Mode
Expression: HEX(1B);"K";HEX(n₁);HEX(n₂);
HEX(d₁);HEX(d₂); . . . HEX(Dn₁, n₂) ← bit-image data
Function: Sets normal-density Bit-Image mode. When this code is input, the data following ESC K code is printed in dot pattern(s). The maximum number of bit-image data per line is 816 .

See also ESC L, ESC Y, ESC Z, ESC *, and ESC ?.

You can enter the graphics mode by sending the ESC K sequence and terms n₁ and n₂, which specify the number of dot positions to be printed per line. Dot positions in excess of 816 are ignored. Values n₁ and n₂ can be entered directly as integers, or can be calculated by the program.

HEX(d₁), HEX(d₂) are the bit-image data. HEX(Dn₁,n₂) is the last dot position of bit image data, which corresponds to n₁,n₂.

The values for n₁ and n₂ can be calculated as follows. In this example, the number of bit image data is 300.

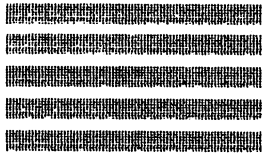
$$\begin{aligned}n_1 &= (\text{Number of data}) \text{ MOD } 256 \\ &= 300 \text{ MOD } 256 \\ &= (44)_D = (2C)_H\end{aligned}$$

$$\begin{aligned}n_2 &= \text{INT} (\text{Number of data}/256) \\ &= \text{INT} (300/256) \\ &= (1)_D = (01)_H\end{aligned}$$

n₁ is the remainder of an integer value (i.e., number of data) divided by 256, and n₂ is the quotient of an integer value (i.e., number of data) divided by 256.

Execute the following program to see an example of normal-density bit-image printing. To print 80 columns of dots n_1 is (50)_H, and n_2 is (00)_H (line 40). Since the number of dot positions to be printed must agree with n_1 , n_2 , line 45 specifies 80 columns to be printed. The data to be printed is HEX(FF), causing eight pins to fire. The resulting output is a vertical bar, repeated until the line length is 80 vertical bars.

```
10 SELECT PRINT 004
20 REM BIT IMAGE PRINT (NORMAL DENSITY)
30 FOR I = 1 TO 5
40 PRINT HEX(1B); "K"; HEX(50); HEX(00);
45 FOR N = 1 TO 80
50 PRINT HEX(FF);
60 NEXT N
70 PRINT
80 NEXT I
```



ESC L

Name: ESC L - Dual-Density Bit-Image Mode
Expression: HEX(1B);"L";HEX(n₁);HEX(n₂);
HEX(d₁);HEX(d₂); . . . HEX(Dn₁,n₂) ← Bit-image data
Function: ESC L sets Dual-Density Bit-Image mode. The maximum number of bit-image data per line is 1,632.

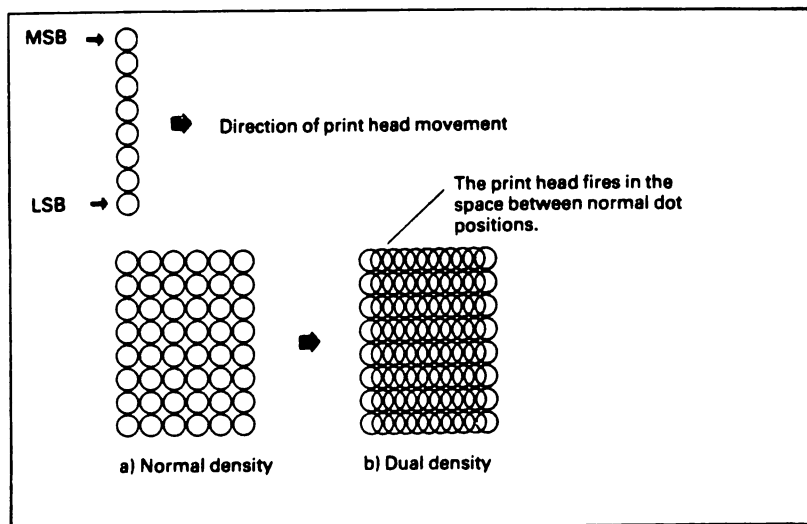
This code sets the Dual-Density Bit-Image mode. The dot pattern indicated by the bit-image data (n₁ and n₂) following ESC L is printed in dual-density. After the completion of the bit-image printing, the printer automatically returns to Text mode. For the procedure to obtain values for n₁ and n₂, refer to the description of the ESC K code.

The transfer sequence of bit-image data is the same as with ESC K (normal-density bit-image printing), except that bit-image printing can be performed in twice the dot density in the horizontal direction as compared to ESC K. In other words, bit-image data can be printed in 1,632 dot positions per line, thus producing denser graphic output. If you specify data exceeding 1,632 dot positions, the excess is ignored.

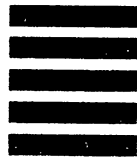
You can mix normal-density bit-image printing with dual-density bit-image printing on a line. You can also mix bit-image data with Text mode characters.

When you mix the characters in the Text mode and Dual-Density Bit-Image mode on a line, the amount by which the bit-image data decreases per character of Text data is twice that of normal-density bit-image (ESC K). The print speed decreases from the normal 16 inches per second (ips) to 8.

See also ESC K, ESC Y, ESC Z, ESC *, and ESC ?.



Example 1: 10 SELECT PRINT 004
20 REM BIT IMAGE PRINT (DUAL DENSITY)
30 FOR I = 1 TO 5
40 PRINT HEX(1B); "L"; HEX(50); HEX(00);
50 FOR N = 1 TO 80
60 PRINT HEX(FF);
70 NEXT N
80 PRINT
90 NEXT I
100 END



Example 2: 10 SELECT PRINT 004
20 PRINT HEX(1B); "L"; HEX(0A); HEX(00);
30 FOR J = 1 TO 10
40 READ A#
50 PRINT A#;
60 NEXT J
70 DATA HEX(22), HEX(50), HEX(8A), HEX(00),
HEX(8F), HEX(00), HEX(8A), HEX(50), HEX(22),
HEX(00)
80 END

♀

ESC Y

Name: ESC Y - Double-Speed, Dual-Density Bit-Image Mode
Expression: HEX(1B);"Y";HEX(n₁);HEX(n₂);
HEX(d₁);HEX(d₂); . . . HEX(Dn₁, n₂) ← bit-image data
Function: Sets Double-Speed, Dual-Density Bit-Image mode. The maximum number of bit-image data per line is 1,632.

When you enter Dual-Density Bit-Image mode (ESC L), the print speed decreases from the normal 16 ips to 8 ips. If you use ESC Y code, however, normal print speed is enabled and bit-image data of 1,632-positions/line is printed. For the procedure to obtain values for n₁ and n₂, refer to the description of the ESC K code. Horizontally adjacent dots cannot be printed in this mode.

See also ESC K, ESC L, ESC Z, ESC *, and ESC ?.

ESC Z

Name: ESC Z - Quadruple-Density Bit-Image Mode
Expression: HEX(1B);"Z";HEX(n₁);HEX(n₂);
HEX(d₁);HEX(d₂); . . . HEX(Dn₁, n₂) ← bit-image data
Function: Sets Quadruple-Density Bit-Image mode. The maximum number of bit-image data per line is 3,264.

When you enter ESC Z code, the printer performs quadruple-density bit-image printing. For the procedure to obtain values for n₁ and n₂, refer to the description of the ESC K code. Horizontally adjacent dots cannot be printed in this mode.

The print speed is 8 ips, the same as that of Dual-Density Bit-Image mode (ESC L).

See also ESC K, ESC L, ESC Y, ESC *, and ESC ?

ESC *

Name: ESC * - Bit-Image Mode Selection
Expression: HEX(1B);"*";HEX(m);HEX(n₁);HEX(n₂);
HEX(d₁);HEX(d₂); . . . HEX(Dn₁,n₂) ← bit-image data
Function: ESC * selects a Bit-Image mode.

m	Mode	Dots/inch	Head Speed (inch/sec)
00H	Normal Density	60	16
01H	Dual-Density	120	8
02H	Double-Speed, Dual-Density	120	16
03H	Quadruple-Density	240	8
04H	CRT Graphics	80	8
05H	Plotter Graphics (X Y=1:1)	72	12
06H	CRT Graphics II	90	8

For the procedure to obtain values for n₁ and n₂, refer to the description of the ESC K code.

If the value specified for m is not in the range 00H to 06H, the specified number of data is ignored. When m is 02H or 03H, the horizontally adjacent dots cannot be printed.

```
10 LPRINT HEX(1B);"*";HEX(00);HEX(00);HEX(01);
20 FOR I=1 TO 256: LPRINT "x";: NEXT
30 LPRINT "END"
```

This is the same as the following:

```
10 LPRINT HEX(1B);"K";HEX(00);HEX(01);
20 FOR I=1 TO 256: LPRINT "x";:NEXT
30 LPRINT "END"
```

See also ESC K, ESC L, ESC Y, ESC Z, and ESC ?.

NOTE

ESC K is the same as mode 0.
ESC L is the same as mode 1.
ESC Y is the same as mode 2.
ESC Z is the same as mode 3.

Example 1:

```

10 SELECT PRINT 004
20 REM MODE 0 TO MODE 6
30 DIM A$1
40 A$ = HEX(00)
50 FOR I = 1 TO 7
60 PRINT HEX(1B); "*" ; A$ ; HEX(0C) ; HEX(00) ;
70 A$ = A$ ADD HEX(01)
80 FOR J = 1 TO 12
90 READ R$
100 PRINT R$ ;
110 NEXT J
120 DATA HEX(01) , HEX(03) , HEX(07) , HEX(0F)
    , HEX(1F) , HEX(3F) , HEX(3F) , HEX(1F) , HEX(0F)
    , HEX(07) , HEX(03) , HEX(01)
130 RESTORE
140 NEXT I
150 END

```

▲▲▲▲▲▲▲▲

Example 2:

```

10 SELECT PRINT 004
20 DIM A$1
30 PRINT HEX(1B); "*" ; HEX(00) ;
40 PRINT HEX(02) ; HEX(01) ;
50 A$ = HEX(01)
60 FOR I = 1 TO 256
70 PRINT A$ ;
80 A$ = A$ ADD HEX(01)
90 NEXT I
100 PRINT HEX(0A) ; HEX(0D) ; HEX(0A)
110 END

```

.....

ESC ?

Name: ESC ? - Bit-Image Mode Assignment
Expression: HEX(1B);"?";"n";HEX(m);
N=K, L, Y or Z. (n corresponds to K, L, Y or Z in Bit-Image mode.)
m = 00H to 06H (m is the equivalent of m used in the ESC * code.)
Function: Assigns the Bit-Image modes.

The printer has seven different 8-pin Bit-Image modes. The mode assigned at power ON is specified by ESC K, ESC L, ESC Y, ESC Z, or ESC *. However, you can change the assignment of the Bit-Image mode. For example, 1:1 row:column dot printing (Plotter Graphics) can be assigned and used as ESC K.

Example: To use ESC K as the Plotter Graphics mode,
PRINT HEX(1B);"?";"K";HEX(05);

ESC^

Name: ESC - 9-pin Bit-Image mode
Expression: HEX(1B);" ";HEX(a);HEX(n₁);HEX(n₂);
HEX(d_{1F});HEX(d_{1S});HEX(d_{2F});HEX(d_{2S}) . . .
(a=00H or 01H) (F: First byte, S: Second byte)
Function: Sets 9-pin Bit-Image mode.
a dots/inch
00H 60 (normal density)
01H 120 (dual-density)

7.4 PRINTING TEXT AND BIT-IMAGE DATA ON THE SAME LINE

When you mix text data and bit-image data on a line, note that the amount of printable bit-image data decreases due to print in Text mode.

Print mode	No. of bit-image data decrease per 1 character
Pica, Emphasized	6
Condensed	3.5
Elite	5

When you set the Enlarged Print mode, the decrease in the amount of bit-image data printable per character of Text mode is twice that listed for each print mode.

Example 1:

The number of bit-image data printable on a line by the ESC K (normal-density) code after 3 condensed and 1 Pica characters have been printed is as follows:

$$816 - (3.5 \times 3) + (6 \times 1) = 799$$

(Fractions are rounded off)

3 cond. char.	1 pica character	ESC	K	Bit-image data	
3.5 x 3	6 x 1			799 max.	Tot. 816

Example 2:

The following operation is possible in mixed use of Text mode and Bit-Image mode on a line.

				n_2, n_1						n'_2, n'_1	
Data A	ESC	K	n_1	n_2	Data B	Data C	ESC	K	n_1	n_2	Data D
Text data					Bit-image data	Text data					Bit-image data

816 bit-image positions

Example 3:

The number of bit-image data printable on a line by the ESC L (dual-density) code after 3 condensed and 1 Pica characters are printed is:

$$1,599 = 1,632 - 2 \times \{ (3.5 \times 3) + (6 \times 1) \}$$

APPENDIX A
SPECIFICATIONS

SPECIFICATIONS

Physical

Height

5.9 inches (15 cm)

Base Width (with paper
feed knob)

24.5 inches (62.2 cm)

Depth

14.0 inches (35.6 cm)

Net Weight

23 pounds (10.5 kg)

Speed (Maximum)

160-cps single-line burst speed

Character Set

192-character Wang International Standard Character Set for Information Interchange (WISCII), which contains 96 ASCII characters and 96 international language characters and symbols.

Character Size

2.1 mm (W) X 3.1 mm (H)

(Pica-sized)

1.05 mm (W) X 3.1 mm (H)

(Pica-sized Condensed)

4.2 mm (W) X 3.1 mm (H)

(Pica-sized Enlarged)

1.4 mm (W) X 3.1 mm (H)

(Elite-sized)

2.8 mm (W) X 3.1 mm (H)

(Elite-sized Enlarged)

1.6 mm (H) (Superscript/Subscript)

Print Format

Horizontal (columns per line)

Pica-sized Emphasized 136

Enlarged 68

Condensed 233

Condensed Enlarged 116

Elite-sized 163

Elite-sized Enlarged 81

Line Spacing

Six lines per inch or programmable.

Print Direction

Bidirectional, with logic seeking in the text mode; unidirectional in the bit-image mode or when programmed.

Print method

Impact dot matrix

Matrix Print Head

9-pin

Paper Specifications

Continuous form

4" to 16" wide - tractor feed

Cut sheet

7.25" to 14.4" wide - friction feed

Copies

One original plus two carbon copies, total thickness not to exceed 0.012" (0.3 mm)

Paper path

Rear

Switches

POWER-OFF/ON, ON LINE, FF (Form Feed), LF (Line Feed)

Indicators

POWER, READY, PAPER OUT, ON LINE

Interface

Standard, Centronics-style 8-bit Parallel

Ribbon Cartridge

WLC black ribbon cartridge, life expectancy 3 million characters

Printer MTBF

5×10^6 lines (excluding print head)

Power Requirements

Maximum Input Power

70 volt-amperes

Voltage

120VAC $\pm 10\%$

230VAC $\pm 10\%$

Frequency

49.5 to 60.5 Hz

Cable Lengths

Power 8 ft (2.4 m)

Data 12 ft (3.6 m)

Operating Environment

Temperature

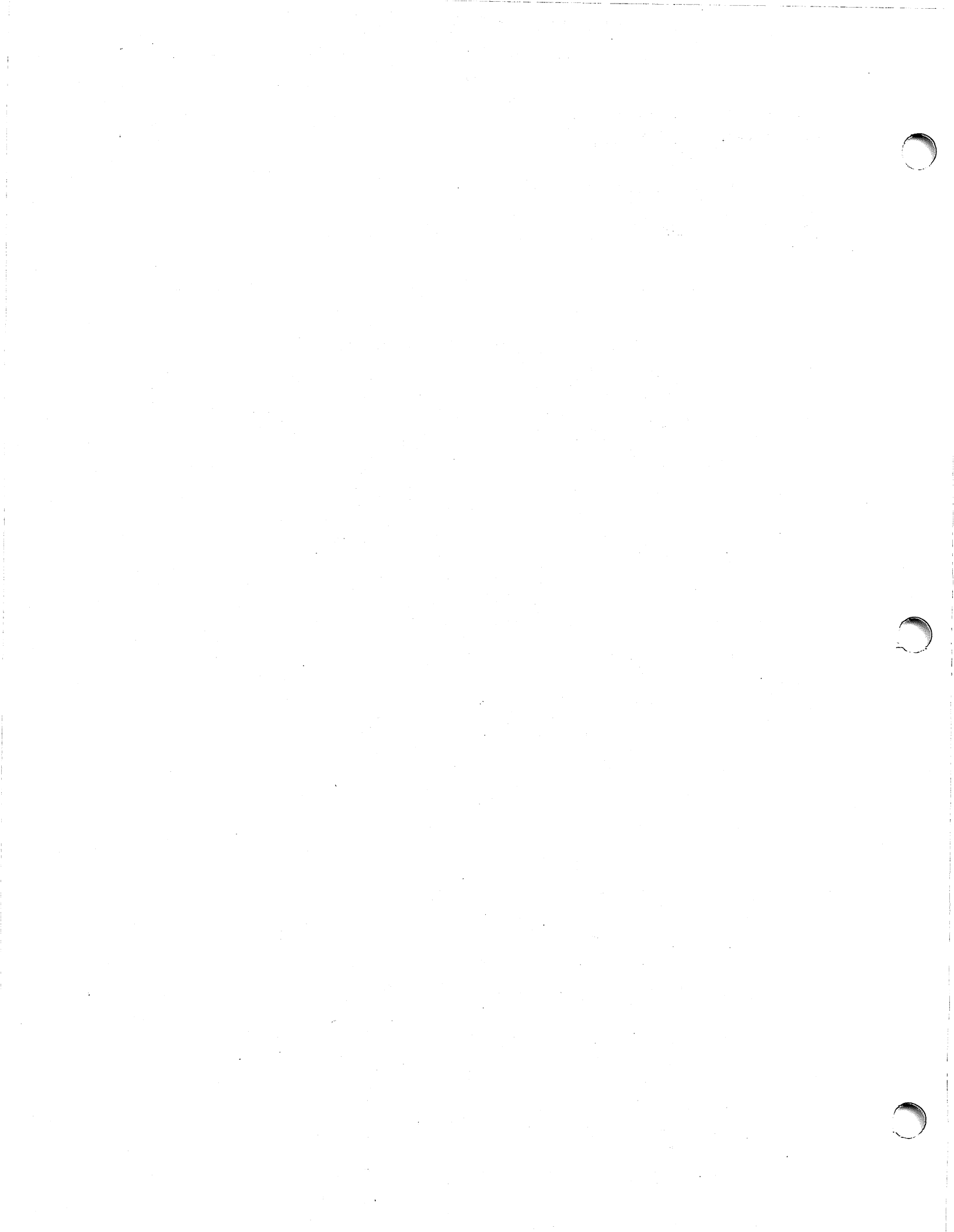
41° to 95°F (5° to 35°C)

Humidity

10 to 80%, noncondensing

Available Accessories

None



APPENDIX B
MAINTENANCE

B.1 PRINTER SERVICING

If a printer malfunction occurs, contact a Wang service representative. The only user-replaceable part in the printer is the matrix print head. Refer to Section B.2 for information on replacing the print head.

Procedures for periodic cleaning of the exterior and interior surfaces of your printer are described in Section 4.9.

B.2 PRINT HEAD REPLACEMENT

If one or more dot wires in the print head do not print satisfactorily, you can purchase a replacement print head from the Wang Supplies Division. The part number for the print head is listed in Appendix A. Use the following procedure to remove the defective print head and install a replacement.

1. Set the printer POWER switch to OFF, and then disconnect the printer power cord from the power outlet.
2. If the printer has been used in the past hour, the print head may be hot. Wait until the print head is cool before proceeding.
3. Remove the printer lid, printer cover, and ribbon cartridge.
4. Turn the head-lock lever clockwise, and then lift the print head upward a few inches (refer to Figure B-1).
5. Disconnect the print-head cable from the terminal board by supporting the terminal board with one hand and pulling the head cable straight out as shown in Figure B-1. Do not move the carriage assembly when there is no print head mounted on it. Discard the defective print head.
6. Place the new head in position on the carriage assembly and move the print-head lock lever clockwise, locking the head onto the carriage assembly.

7. Carefully insert the head cable into the connector on the terminal board.

NOTE

If the head is not firmly locked onto the carriage or if the head cable is not firmly attached to the terminal board, the print head may malfunction.

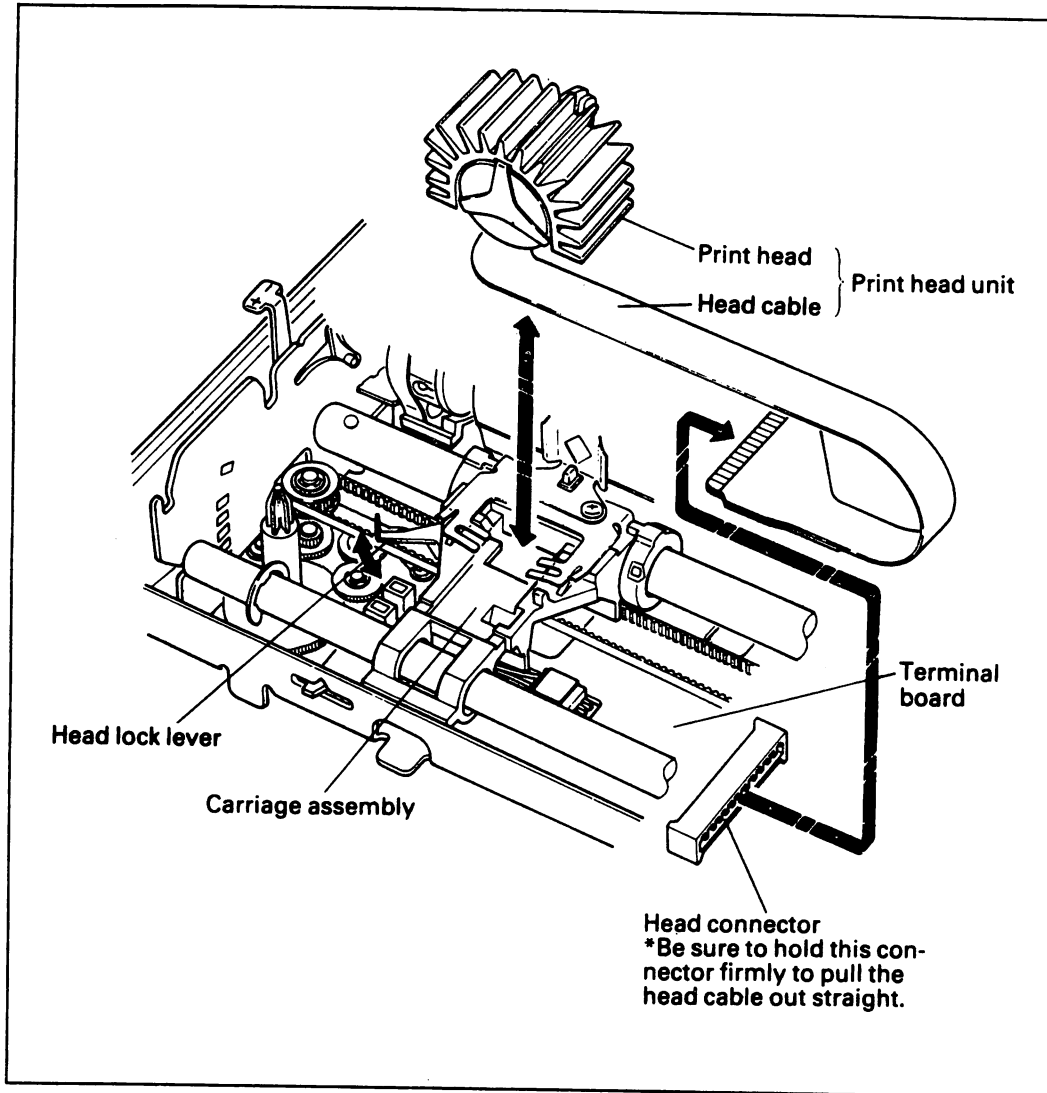


Figure B-1. Replacing the Print Head

APPENDIX C
MIXED PRINTING MODES

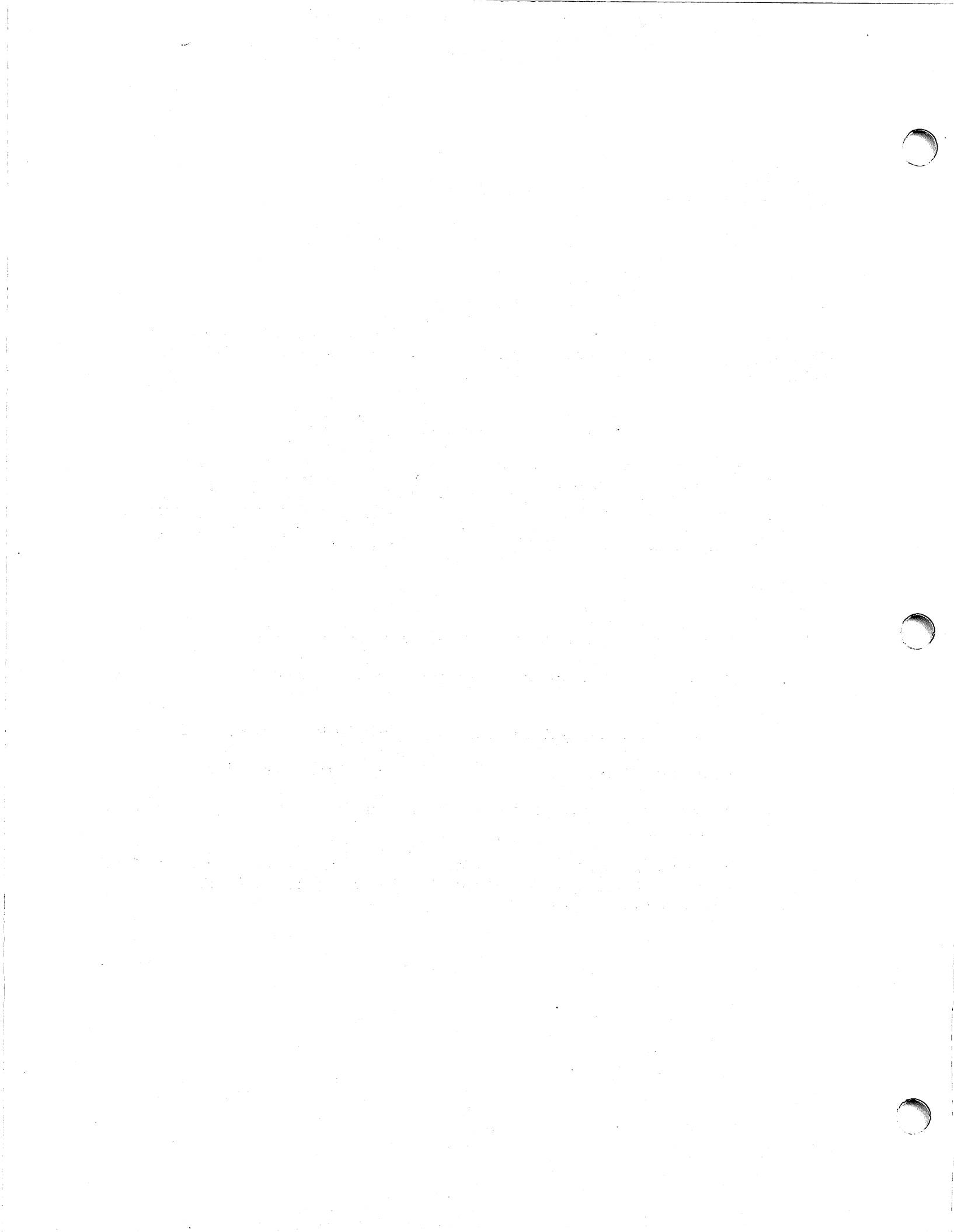
Table C-1 shows the print modes that can be used in combination with Pica and Elite print. The • symbol indicates that Mixed Print mode is available.

Table C-1. Mixed Printing Modes

Mode Pitch	En- larged	Empha- sized	Super/ Sub- script	Con- densed	Dou- bled	Under lined	Propor- tional	Italic	Uni- direc- tional
Pica	○	○	○	○	○	○	○	○	○
Elite	○	x	○	x	○	○	x	○	○

Print mode choices are subject to the following conditions:

- X indicates that pitch takes priority and Mixed Print mode is not available.
- Emphasized characters are always printed in Proportional Print mode.
- Emphasized Print mode takes priority over Condensed Print mode.
- Characters are always double-struck in Superscript/Subscript Print mode.
- Proportional mode takes priority over Superscript/Subscript Print mode. Therefore, superscript/subscript characters cannot be printed in Proportional mode.

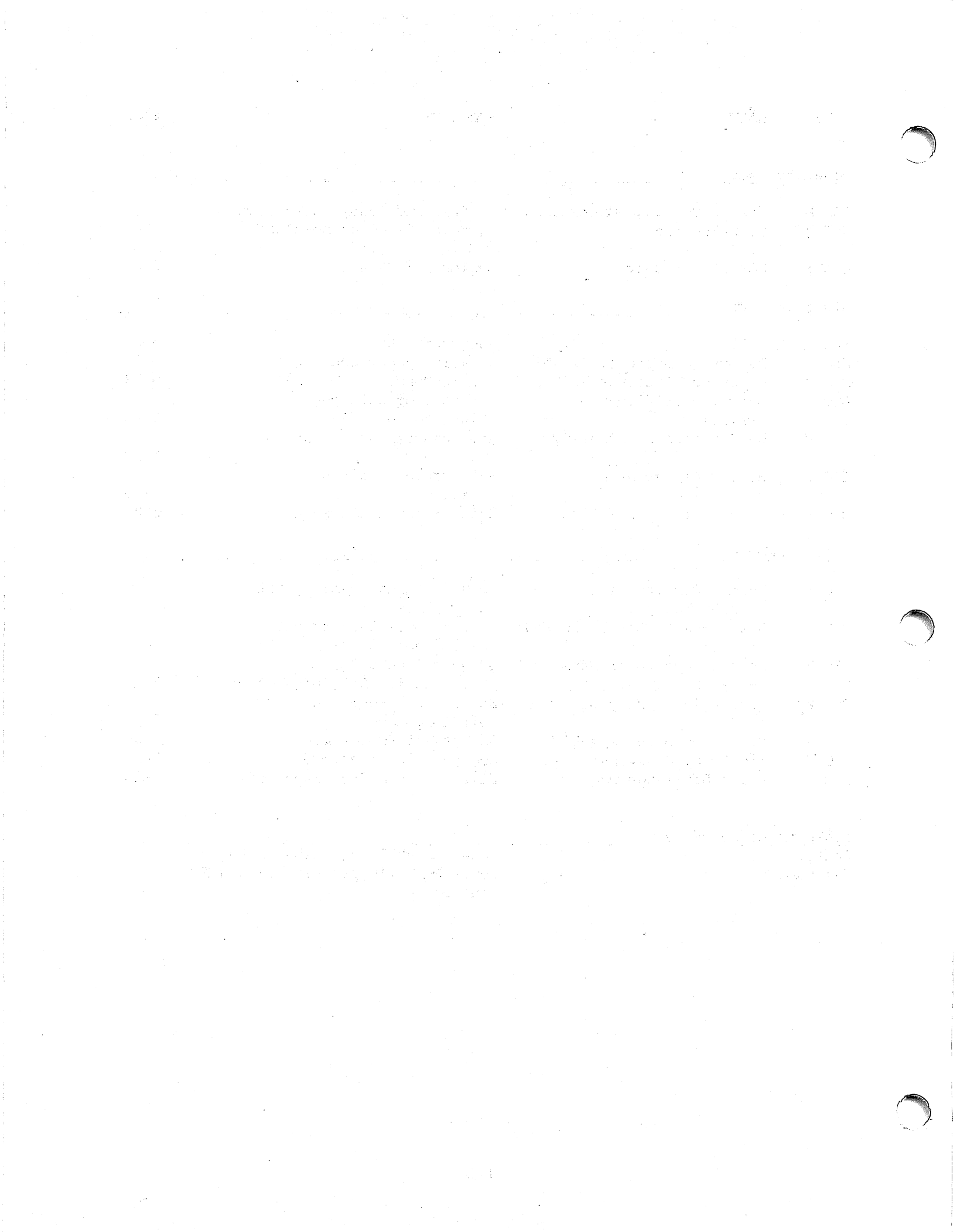


APPENDIX D
CONTROL CODES SUMMARY

CODE	NAME	FUNCTION	PAGE
<u>Print Execution</u>			
CR	Carriage Return	Starts printing	5-5
LF	Line Feed	Advances paper one line	5-4
ESC J	Single-Line n/216" Line Spacing	Selects n/216" line spacing for one print line	5-30
FF	Form Feed	Advances paper to next Top-of-Form position	5-5
<u>Print Mode</u>			
ESC M	Elite Print	Prints Elite characters	5-31
ESC P	Pica Print	Cancels ESC M code	5-34
SO	Shift Out	Prints enlarged characters	5-6
DC4	Enlarged Print Cancel	Cancels enlarged print	5-10
ESC W	Enlarged Print	Selects/cancels enlarged print	5-39
SI	Shift In	Prints condensed characters	5-7
DC2	Condensed Print Cancel	Cancels condensed print	5-9
ESC SO	Shift Out	Same as SO code	5-11
ESC SI	Shift In	Same as SI code	5-11
ESC -	Underlined Print	Selects/cancels underlined print	5-16
ESC E	Emphasized Print	Prints emphasized characters	5-28
ESC F	Emphasized Print	Cancels emphasized print	5-28
ESC G	Doublestrike Print	Prints doublestrike characters	5-29
ESC H	Doublestrike Print Cancel	Cancels doublestrike print	5-29
ESC S	Superscript/Subscript Print	Prints superscript/subscript characters	5-36
ESC T	Superscript/Subscript Print Cancel	Cancels superscript/subscript print	5-37

CODE	NAME	FUNCTION	PAGE
<u>Print Mode (Continued)</u>			
ESC !	Print Mode	Selects print mode	5-12
ESC p	Proportional Spaced Print	Prints proportional spaced characters	5-43
BS	Backspace	Prints and backspaces by one character	5-3
<u>Line Spacing</u>			
ESC 0	1/8" Line Spacing	Selects 1/8" line spacing	5-19
ESC 1	7/72" Line Spacing	Selects 7/72" line spacing	5-19
ESC 2	1/6" Line Spacing	Selects 1/6" line spacing	5-20
ESC 3	n/216" Line Spacing	Selects n/216" line spacing	5-21
ESC A	n/72" Line Spacing	Selects n/72" line spacing	5-24
<u>Format Control</u>			
HT	Horizontal TAB	Executes horizontal TAB	5-3
ESC D	Horizontal TAB	Sets TAB positions	5-27
VT	Vertical TAB	Executes vertical TAB	5-4
ESC/	VFU Channel Selection	Selects VFU channel	5-16
ESC B	Vertical TAB	Sets TAB positions	5-25
ESC b	VFU Position Setting	Sets VFU TAB positions	5-40
ESC C	Form Length Setting	Sets form length	5-26
ESC CO	Form Length Setting in Inches	Sets form length in inch increments	5-26
ESC N	Skip-over Perforation Setting	Sets skip-over perforation	5-32
ESC O	Skip-over Perforation Cancel	Cancels skip-over perforation	5-33
ESC Q	Right Margin	Sets right margin	5-35
ESC l	Left Margin	Sets left margin	5-41
<u>Input Data Control</u>			
DC1	Selection of Printer	Selects printer	5-8
DC3	Deselection of Printer	Deselects printer	5-9
DEL	Delete	Cancels last printable data	5-45
CAN	Cancel	Cancels data stored in the print buffer	5-10

CODE	NAME	FUNCTION	PAGE
Download Mode			
ESC &	Create Download Characters	Creates and loads characters	6-3
ESC %	CG Selection	Selects ROM CG or Download CG	6-5
ESC :	ROM CG Set Copy	Copies ROM CG set	6-6
Miscellaneous			
BEL	Bell	Sounds the tone	5-2
ESC 8	Paper-end Detector Disable	Disables paper-end signal	5-22
ESC 9	Paper-end Detector Enable	Enables paper-end signal	5-22
ESC <	One-Line Unidirection Printing	Prints from left most to right for one line	5-23
ESC U	Unidirectional Printing	Sets/cancels unidirectional printing	5-38
ESC s	Half Speed Printing	Sets/cancels half speed printing	5-44
ESC @	Printer Initialization	Initializes the printer	5-23
Bit Image Mode			
ESC K	Normal-Density Bit- Image Mode	Selects Normal-Density Bit- Image mode	7-3
ESC L	Dual-Density Bit-Image Mode	Selects Dual-Density Bit- Image mode	7-5
ESC Y	Double-Speed Dual-Density Bit-Image Mode	Selects Double-Speed Dual-density Bit-Image mode	7-7
ESC Z	Quadruple-Density Bit-Image	Selects Quadruple-density Bit-Image mode	7-7
ESC *	Bit-Image Mode Selection	Selects Bit-Image mode	7-8
ESC ?	Bit-Image Mode Assignment	Assigns Bit-Image mode	7-10
ESC	9-pin Bit-Image Mode	Selects 9-pin Bit-Image mode	7-10
Non-command Sequence			
Self-Test		Power ON while pressing LF button	
Hex Dump		Power ON while pressing LF and FF buttons	



APPENDIX E PRINTER CHARACTER SET

The WISCII character set contained in the printer is shown in Table E-1, together with the decimal, hexadecimal, and binary code for each character. Table E-2 contains a listing of the names of the characters.

Decimal Value

The decimal value associated with each character in Table E-1 is shown in the box in the lower right corner of each character. For example, the decimal value for A is 65.

Hexadecimal (HEX) Value

A two-digit hex code for each character is shown in table E-1. The first digit is located at the top of each column (0 through F). The second digit is located in the rows on the left side of the table. To find the hex code for any character, look for the first hex digit at the top of the column for that character; then look for the second hex digit located at the left, in the same row as the character. For example, the hex code for character A is 41.

Binary Value

The four low-order bits of the binary number for each character are listed in the column at the left side of Table E-1. The four high-order bits are listed in the row at the top of the table. For example, the binary value of A is 01000001.

Table E-1. Printer Character Set

Hex. No.	Binary No.	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0000	0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240
1	0001	DC1	!	1	A	Q	a	q		DC1	à	U	ij	Đ	đ	225	f
2	0010	DC2	"	2	B	R	b	r		DC2	â	î	ı	Y	y	226	242
3	0011	DC3	#	3	C	S	c	s		DC3	ä	ï	İ	Ş	ş	227	243
4	0100	DC4	\$	4	D	T	d	t		DC4	ä	î	ı	Á	↓	228	244
5	0101		%	5	E	U	e	u			ë	í	ı	Ó	ó	229	245
6	0110		&	6	F	V	f	v			á	ï	ı	Ù	ù	230	246
7	0111	BEL	'	7	G	W	g	w	BEL		±	ll	H	Ú	ú	231	247
8	1000	BS CAN	(	8	H	X	h	x	BS CAN	æ	ñ	ñ	Ü	ü	232	248	
9	1001	HT	)	9	I	Y	i	y	HT	ç	ô	ô	201	217	233	249	
A	1010	LF	*	:	J	Z	j	z	LF		ı	ò	ò	202	218	234	250
B	1011	VT ESC	+	;	K	[	k	{	VT ESC	ç	ó	ó	203	219	235	251	
C	1100	FF	,	<	L	\	l	|	FF		ê	ö	ö	204	220	236	252
D	1101	CR	-	=	M	]	m	}	CR		è	ç	ç	205	221	237	253
E	1110	SO	=	>	N	↑	n	~	SO		é	è	è	206	222	238	254
F	1111	SI	/	?	O	-	o	DEL SI			è	ø	ø	lb	·	239	255

Table E-2. Character Names

Hex Character Name	Hex Character Name
20 SPACE	4F O
21 EXCLAMATION	50 P
22 DOUBLE QUOTE	51 Q
23 NUMBER SIGN	52 R
24 DOLLAR SIGN	53 S
25 PERCENT	54 T
26 AMPERSAND	55 U
27 SINGLE QUOTE	56 V
28 LEFT PARENTHESIS	57 W
29 RIGHT PARENTHESIS	58 X
2A ASTERISK	59 Y
2B PLUS SIGN	5A Z
2C COMMA	5B LEFT BRACKET
2D MINUS SIGN	5C SLASH
2E PERIOD	5D RIGHT BRACKET
2F SLASH	5E UP ARROW
30 ZERO	5F UNDERSCORE
31 ONE	60 OPEN QUOTE
32 TWO	61 a
33 THREE	62 b
34 FOUR	63 c
35 FIVE	64 d
36 SIX	65 e
37 SEVEN	66 f
38 EIGHT	67 g
39 NINE	68 h
3B COLON	69 i
3B SEMICOLON	6A j
3C LESS THAN SIGN	6B k
3D EQUAL SIGN	6C l
3E GREATER THAN SIGN	6D m
3F QUESTION MARK	6E n
40 AT SIGN	6F o
41 A	70 p
42 B	71 q
43 C	72 r
44 D	73 s
45 E	74 t
46 F	75 u
47 G	76 v
48 H	77 w
49 I	78 x
4A J	79 y
4B K	7A z
4C L	7B LEFT BRACE
4D M	7C RIGHT BRACE
4E N	7E APPROXIMATE SYMBOL

Table E-2. Character Names (continued)

Hex Character Name	Hex Character Name
7F DELETE	D0 ICELANDIC THORN
A0 BLANK	D1 ICELANDIC ETH
A1 a GRAVE	D2 Y ACUTE
A2 a ACUTE	D3 S CEDILLA
A3 a UMLAUT	D4 A ACUTE
A4 a TILDE	D5 U CIRCUMFLEX
A5 E UMLAUT	D6 U GRAVE
A6 a ANGSTROM	D7 U ACUTE
A7 PLUS MINUS SIGN	D8 U UMLAUT
A8 LIGATURE a-e	D9 A TILDE
A9 c CEDILLA	DA DEGREE
AA INVERTED EXCLAMATION	DB CENT SIGN
AB INVERTED QUESTION	DC a SUPERIOR
AC e CIRCUMFLEX	DD BULLET
AD e GRAVE	DE SECTION SYMBOL
AE E ACUTE	DF PARAGRAPH SYMBOL
AF E UMLAUT	E0 ICELANDIC THORN
B0 G HACEK	E1 ICELANDIC eth
B1 IJ LIGATURE	E2 y ACUTE
B2 DOTTED I	E3 s CEDILLA
B3 I CIRCUMFLEX	E4 DOWN ARROW
B4 I GRAVE	E5 u CIRCUMFLEX
B5 I ACUTE	E6 u GRAVE
B6 I UMLAUT	E7 u ACUTE
B7 LL LIGATURE	E8 u UMLAUT
B8 N TILDE	E9 LEFT ARROW
B9 O CIRCUMFLEX	EA MONETARY SYMBOL
BA O GRAVE	EB RIGHT ARROW
BB O ACUTE	EC o SUPERIOR
BC O UMLAUT	ED a CIRCUMFLEX
BD O TILDE	EE BETA
BE O E LIGATURE	EF DOT
BF SLASHED O	F0 POUND STERLING
C0 g HACEK	F1 FLORIN
C1 ij LIGATURE	F2 YEN SYMBOL
C2 DOT-LESS i	F3 1/4
C3 i CIRCUMFLEX	F4 1/2
C4 i GRAVE	F5 3/4
C5 i ACUTE	F6 A CIRCUMFLEX
C6 I UMLAUT	F7 A GRAVE
C7 ll LIGATURE	F8 A UMLAUT
C8 n TILDE	F9 A ANGSTROM
C9 o CIRCUMFLEX	FA A E LIGATURE
CA o GRAVE	FB C CEDILLA
CB o ACUTE	FC E CIRCUMFLEX
CC o UMLAUT	FD E GRAVE
CD o TILDE	FE E ACUTE
CE oe LIGATURE	FF DELETE
CF SLASHED o	

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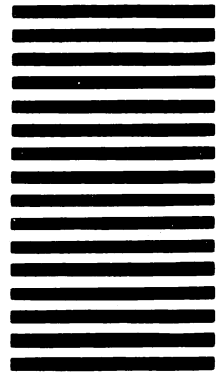


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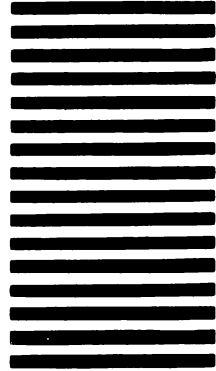


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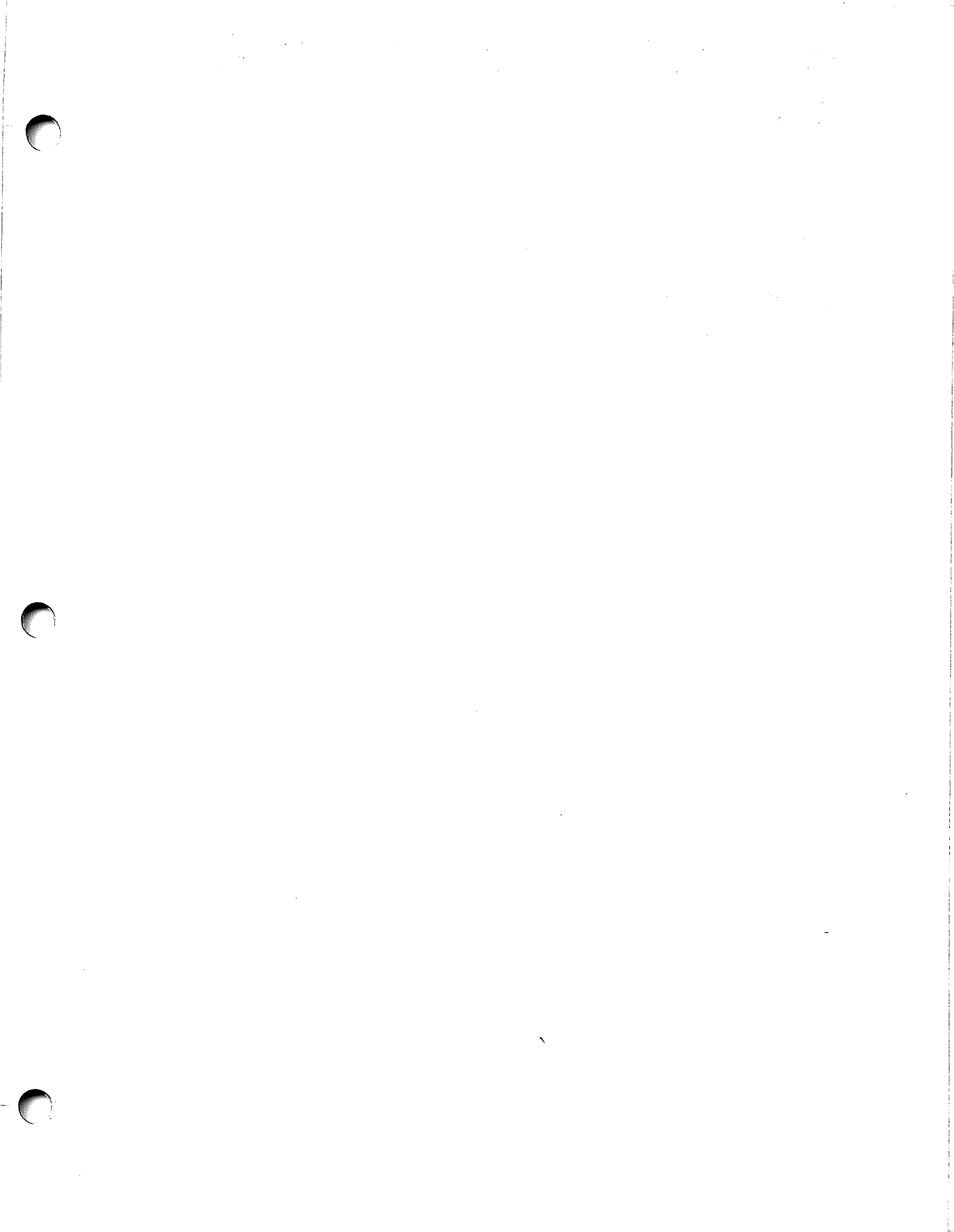
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