

Operating Instructions

Impact Dot Matrix Printer



Panasonic

Before operating this unit, please read these instructions completely.

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS PRODUCT TO RAIN OR ANY TYPE OF MOISTURE.

The serial number of the unit may be found on the label on the bottom of the unit. For your convenience, note this number below, and retain this book, along with your proof of purchase, to serve as a permanent record of your purchase in the event of a theft, or for future reference.

MODEL NO. KX-P1081 NAME OF DEALER _____
SERIAL NO. _____ DATE OF PURCHASE _____

IMPORTANT

The wires in this mains lead are coloured in accordance with the following code:

Green and yellow: Earth

Blue: Neutral

Brown: Live

As the colours of the wires in the mains lead of this apparatus may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

The wire which is coloured green and yellow must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol \perp or coloured green or green-and-yellow.

The wire which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.

The wire which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

WARNING: This apparatus must be earthed.

- This equipment is produced to BS800:1977.

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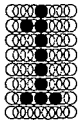
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INTRODUCTION

1.1 Product Overview

This printer is a durable, highly reliable dot matrix printer. In addition, it has a small footprint, making it ideal for a compact workstation.

This printer uses a nine pin print head to form a 9×9 dot matrix character in draft mode. In near letter quality mode, the matrix is 18×18. The standard character set consists of 96 ASCII characters which can be printed in the conventional font or in italics. DIP switches allow the user to select alternate IBM® character sets. With these sets, block graphics or line graphics are available. The user can also select 10 international character sets.

In addition to Pica (10 characters per inch) and Elite (12 characters per inch) printing, this printer can print in compressed mode of 17 characters per inch and semi-compressed mode at 15 characters per inch. Compressed mode yields a total of 137 characters per line.

In addition to the four print pitches mentioned above, this printer has proportional spacing thus, five basic printing pitches are available.

The normal printing speed is 120 characters per second (CPS). Processing speed is increased by Bi-directional printing. That is, the printer prints right-to-left as well as in the normal left-to-right manner. A logic seeking technique is also used, giving the printer a look-ahead capability which allows it to skip blank spaces at the beginning and end of a line and the blank lines between paragraphs.

A wide variety of printing styles allows the user to create unique documents and drawings. You can print characters in double width or compressed, emphasized or underlined and print super or subscripts, etc. Using Bit-mapped graphics, the printer can produce special effects ranging from company logos to photo-like images.

The printer has friction and tractor feed capabilities as standard features and handles single sheet as well as fanfold paper. This enables the user to create letters on company letterhead or print reports from the computer. The seamless ribbon can print up to three million characters and the cassette design makes changing the ribbon quick, easy and clean.

A 1024 byte buffer (1K) is provided with the standard parallel interface. Serial communications is possible through an optional RS-232C interface board which supports XON/XOFF, ETX/ACK, and DTR drop handshaking protocols.

1.2 Names of the Parts

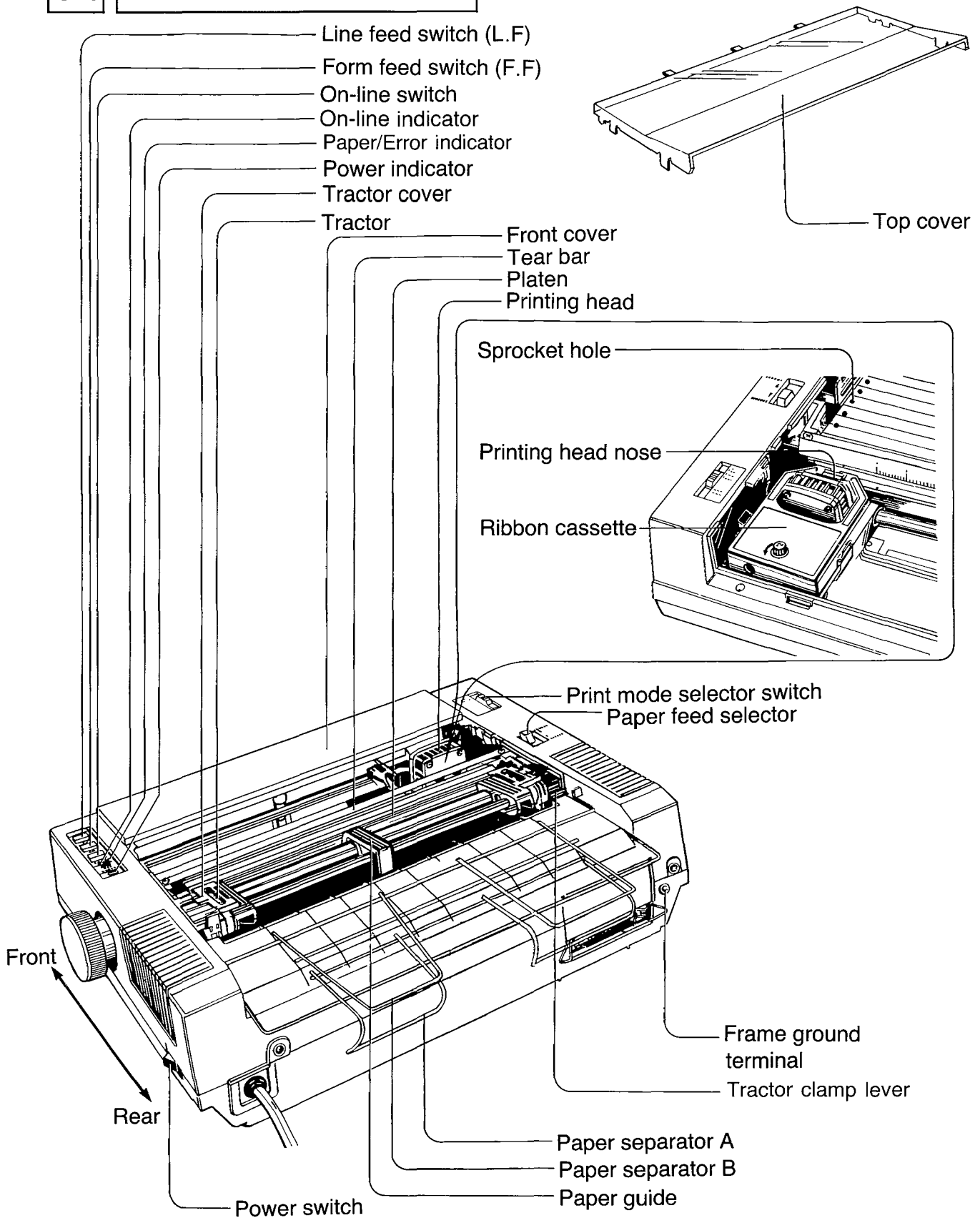
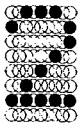


Figure 1.1 Parts Location

1.3 Specifications

Power requirements:	AC 240 V (50 Hz)	
Current:	0.6A	
Fuses:	0.8A, 2.5A	
Printing mode:	Draft, Near Letter Quality, Dot graphics	
Character set:	96 ASCII characters, 96 Italic ASCII characters, 31 International characters (10 countries), 32 Italic International characters (10 countries), 64 Block Graphics, 132 IBM-PC® special characters, 82 Italic IBM-PC special characters	
Dot configuration:	3/254 inch (0.3 mm) dot diameter	
	Draft (Pica)	NLQ
Dot alignment (Hor.×Ver.)	9×9	18×18
Dot pitch (Hor.)	1/120" (0.21 mm)	1/240" (0.11 mm)
(Ver.)	1/72" (0.35 mm)	1/144" (0.18 mm)
Character size		
Ordinary characters:	0.078 (W)×0.095 (H) in. (1.99×2.42 mm)	
Superscript/subscript characters:	0.078 (W)×0.053 (H) in. (1.99×1.36 mm)	
Number of characters per line (per inch (25.4mm)):		
	Pica	80 CPL (10 cpi)
	Elite	96 CPL (12 cpi)
	Semi Compressed	120 CPL (15 cpi)
	Compressed	137 CPL (17 cpi)
	Pica elongated	40 CPL (5 cpi)
	Elite elongated	48 CPL (6 cpi)
	Semi Compressed elongated	60 CPL (7.5 cpi)
	Compressed elongated	68 CPL (8.5 cpi)
Printing speed:		
	Draft-Pica	120 CPS
	Draft-Elite	120 CPS
	NLQ	24 CPS
Printing direction:	Text printing (Draft., NLQ): Bi-direction	
	Bit Image printing: Single-direction (left→right)	
New line time:	Approx. 100 msec [with 1/6 inch (4.2 mm) line feeding]	
Paper feed:	Tractor feed (with fanfold paper)	
	Friction feed (with single sheet)	
Paper used:	Fanfold (continuous) paper width: 3~10 inches (76~254 mm)	
	Single sheet Width: 4~9 inches (102~229 mm)	
	Height: 5~14.3 inches (127~363 mm)	
	Thickness (paper weight in pound): 11~21.5 pounds (only 1 sheet)	
Number of sheets:	3 max.	
Paper thickness:	Total thickness of sheets must be less than 1/100 in. (0.25 mm)	
Storage environment:	-4°F (-20°C) to 140°F (60°C) temperature, 10~90% humidity	
Operating environment:	41°F (5°C) to 104°F (40°C) temperature, 20~80% humidity	
Head service life:	100 million characters in draft mode	
Ribbon:	Specially designed cassette seamless ribbon	
	Ink color: Black (one color)	
	Service life: Max. 3 million characters in draft mode	
Dimensions:	15-43/50 (W)×11-1/4 (D)×4-53/100 (H) in. (403×286×115 mm)	
Weight:	Approx. 13.2 pounds (6.0 kg)	



INSTALLATION

2.1 Unpacking and Inspection

Carefully open the shipping carton and remove the contents. The carton should contain the following items:

Printer
Ribbon Cassette (1)
Paper Separators (2)
Operating Manual

Inspect the printer and accessories for damage. Report damages or shortages to the store from which the unit was purchased. Inside the front cover of this manual is an area for recording important information regarding the printer.

2.2 Site Requirements

The printer can be installed in any normal office environment. No special wiring or cooling is required. However, a minimum of 4" (10 cm) is necessary to insure proper ventilation. The printer should be placed on a flat horizontal surface away from a heater or other heat source. The printer should not be used in an excessively humid or dusty environment. Table 2.1 lists the operating requirements of the printer.

Line Voltage	AC 240 V
Frequency	50 Hz
Temperature	41~104°F (5~40°C)
Humidity	20~80%

Table 2.1 Installation Requirements

2.3 Initial Setup

Removing the printer covers

To remove the top cover (A), lift the cover in the direction shown in Figure 2.1. Remove the front cover (B) by pulling it forward and up.

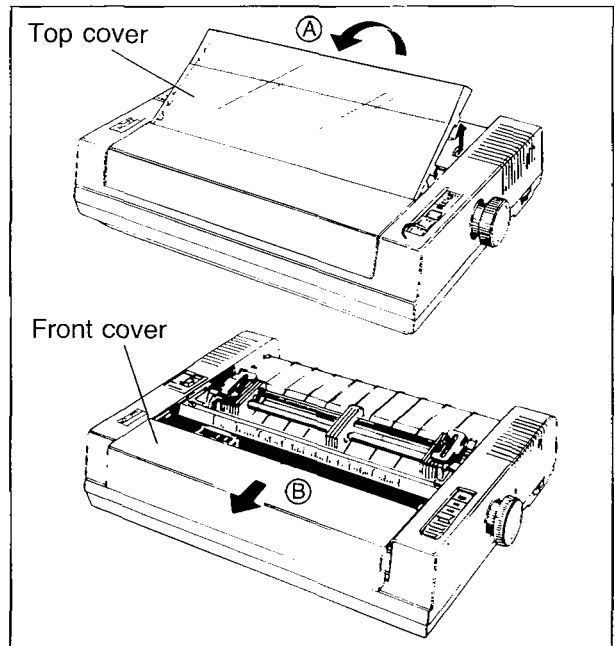


Figure 2.1 Removing the Printer Cover

- Remove the protective paper from around the platen.

Removing the Carriage stoppers

During transit the print head carriage is held in place by two carriage stoppers to prevent damage to the head. Remove them prior to operating the unit. Refer to Figure 2.2.

Be sure to replace them before transporting the unit.

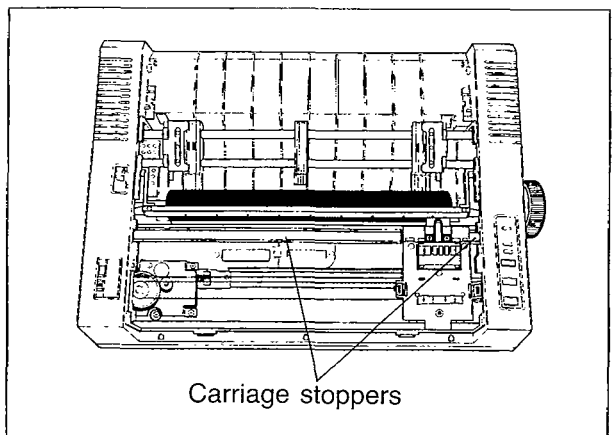


Figure 2.2 Removing the Carriage stoppers

Mounting the ribbon cassette

Make sure the printer is off. Gently slide the print head carriage toward the center of the unit. Prior to installing the cassette, remove any slack in the ribbon by rotating the knob on the cassette counterclockwise.

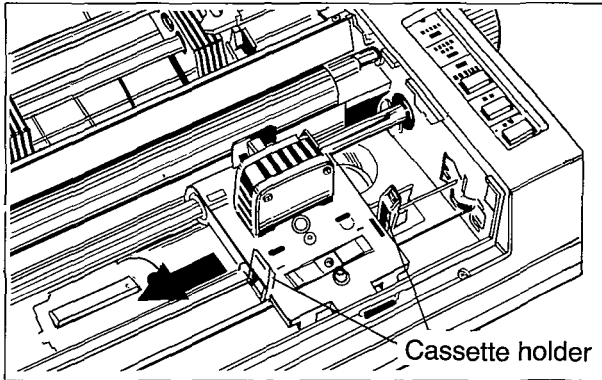


Figure 2.3A Positioning the Print Head

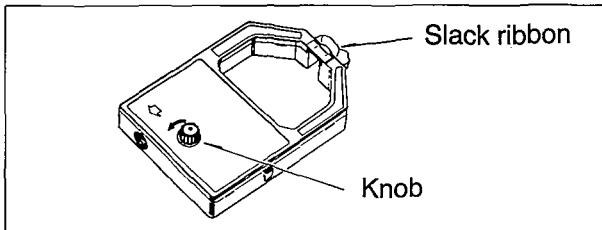


Figure 2.3B Removing the Ribbon Slack

Position the cassette over the print head and lower it in place as shown in Figure 2.3 C. Visually insure that the ribbon slips between the ribbon cover and the nose of the print head. Gently, but firmly, press down on the cassette until the two wing tabs snap into place. If the "snap" is not felt, rotate the knob slightly and press again.

NOTE: Rotate the knob to make sure that the ribbon is not twisted.

To remove the cassette, gently spread the wing tabs and lift up the cassette.

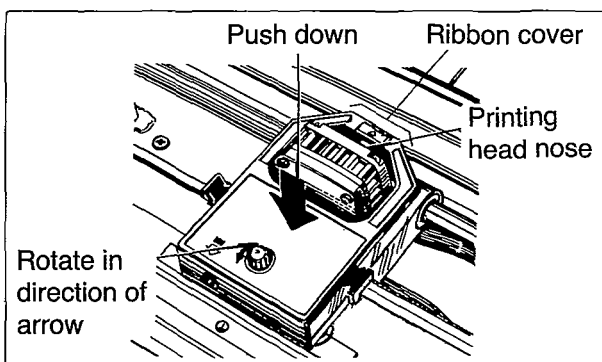


Figure 2.3C Installing the Ribbon Cassette

Mounting the paper separators

Paper separators insure the smooth flow of continuous or fanfold paper. Figures 2.4A and 2.4B show how to install the separators. First, install separator A in the holes at the top-rear of the case. Next, install separator B in the front set of holes.

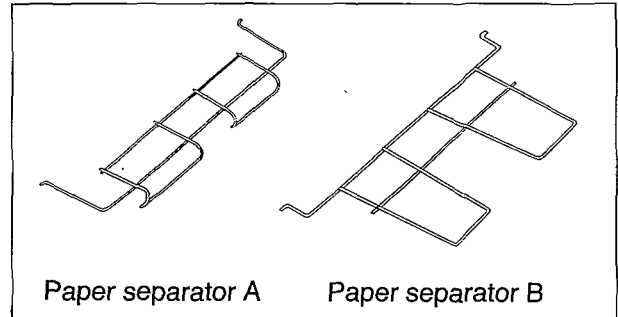


Figure 2.4A Paper Separators

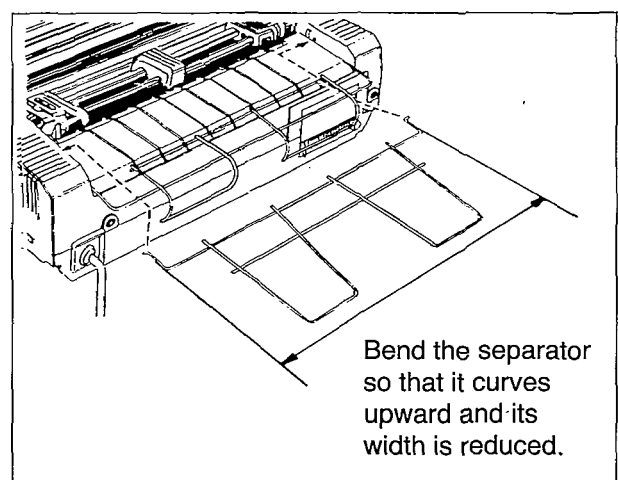
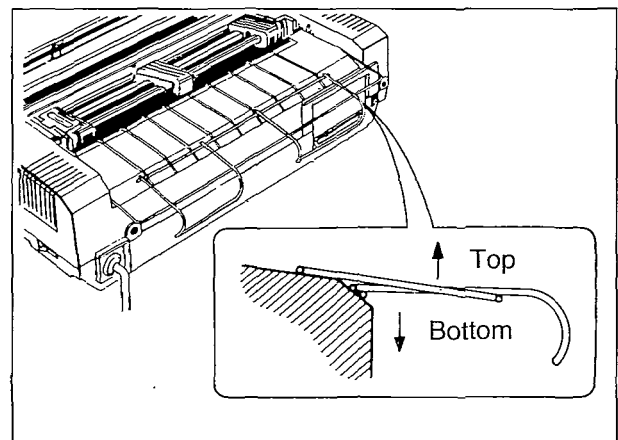


Figure 2.4B Installing the Paper Separators

Installing the paper

The printer paper feed mechanism can handle single sheets of paper or fanfold computer style paper. When using single sheets, the paper is held by pinch rollers which press the paper against the platen. For fanfold paper, the paper is pulled through the printer by the tractor mechanism.

Single Sheet

To install a single sheet of paper, follow these procedures:

- Turn the power switch ON.
- Place the PAPER FEED selector in the FRICTION position. Refer to Figure 2.5A. Raise the tear bar that is located in front of the platen.
- Feed the paper into the printer as shown in Figure 2.5B. The printer will grip the paper and rotate it about half-way around the platen.

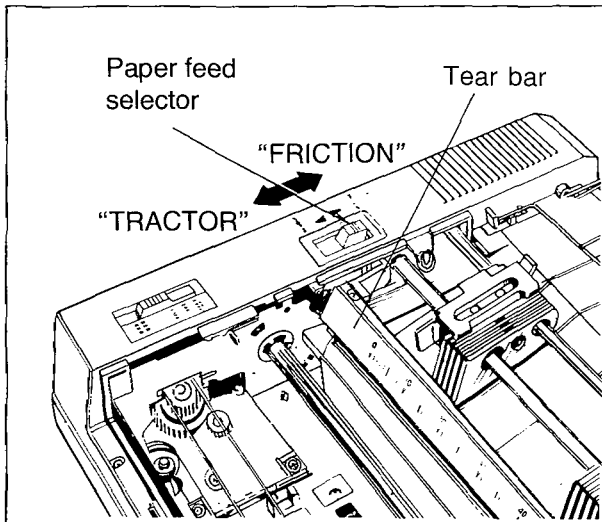


Figure 2.5A Paper Feed Selector

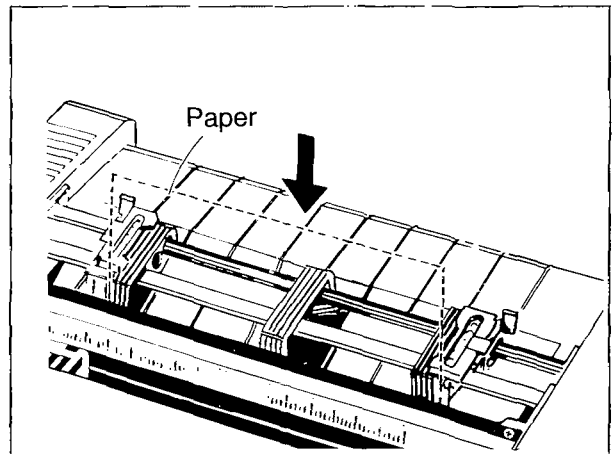


Figure 2.5B Inserting a Single Sheet

- Rotate the platen knob to advance the paper. Tuck the paper under the tear bar, then lower the bar into place.
- To align the paper horizontally or vertically, set the PAPER FEED selector to the TRACTOR position. Refer to the Figure 2.5C. This releases the pinch rollers and allows the paper to be positioned as required. Set the selector back to FRICTION before printing. Refer to Figure 2.5A.

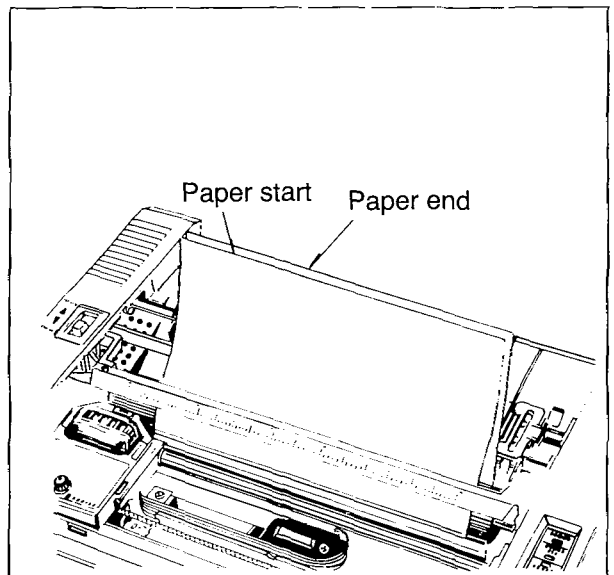


Figure 2.5C Aligning a Single Sheet

Fanfold Paper

The following steps describe how to load fanfold paper:

- Turn the power switch ON.
- Refer to Figures 2.6A and 2.6B. Unlock the tractors by pulling up on the tractor clamp levers. Slide the tractors out toward the sides and raise the covers.

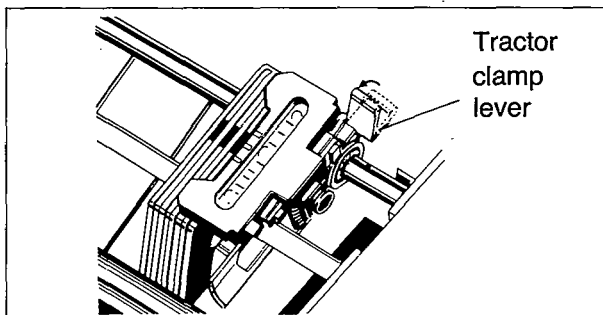


Figure 2.6A Unlocking the Tractor

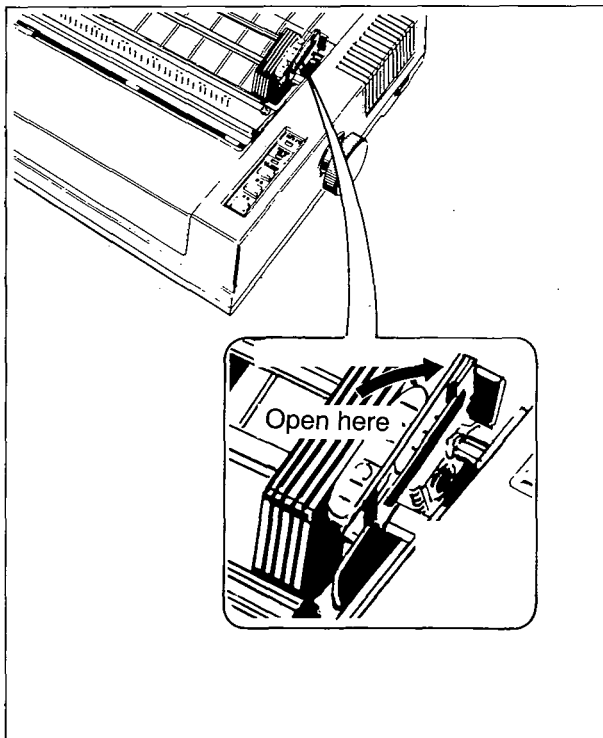


Figure 2.6B Raising the Tractor Cover

- Place the PAPER FEED selector in the FRICTION position, as you do when loading single sheets.

- Raise the tear bar that is located in front of the platen.
- Feed the paper into the printer as shown in Figure 2.6C. The printer will grip the paper and rotate it about half-way around the platen.

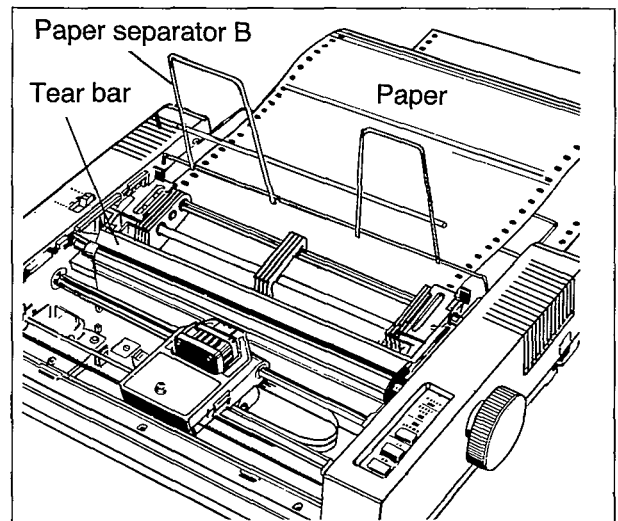


Figure 2.6C Inserting Fanfold Paper

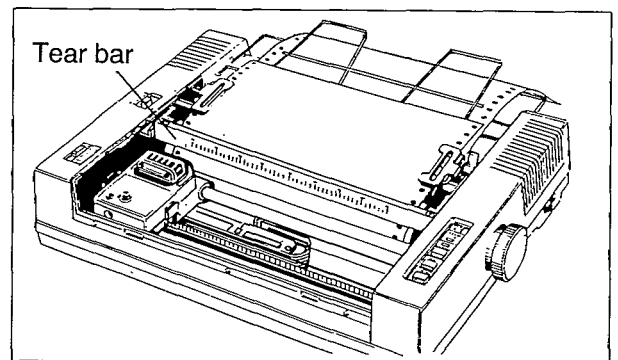


Figure 2.6D Mounting the Paper

- Rotate the platen knob to advance the paper. Tuck the paper under the tear bar, then lower the bar into place.
- Set the PAPER FEED selector to the TRACTOR position.
- Position the tractors as required to align the paper sprocket holes with the tractor pins and close the tractor covers. Refer to Figure 2.6D.
- Center the paper horizontally using the scale on the tear bar as a guide. The printer will print between 0 and 80 on the scale. Press down on the tractor clamping levers locking the tractors in places.

- To insure smooth paper flow when using fanfold paper, be sure the paper is not stacked higher than the paper separators. By feeding the paper as shown in Figure 2.7, the weight of the paper will provide reverse tension. The paper should be directly behind the printer and not off to one side.

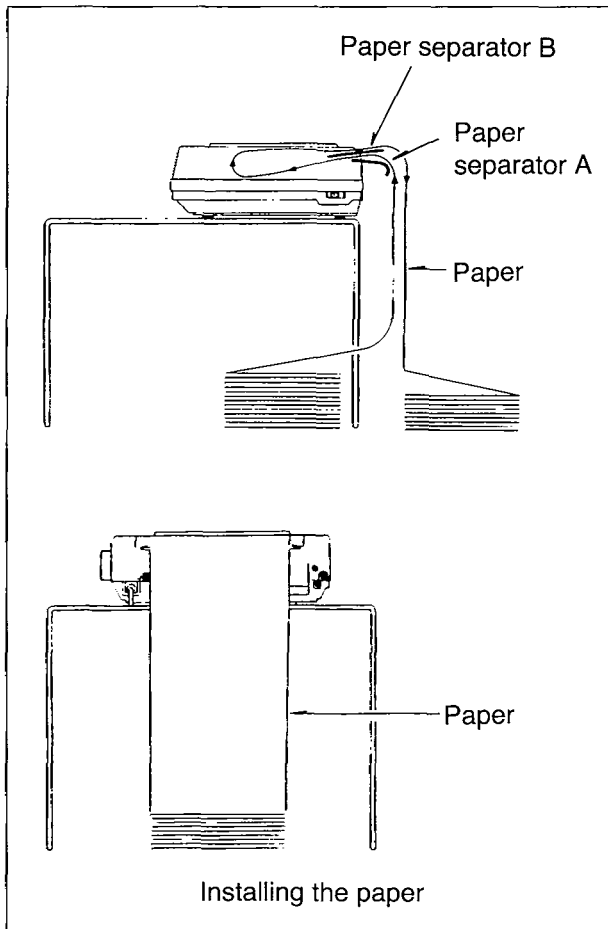


Figure 2.7 Stacking the Paper

Aligning the top of form

The printer has a line counter which keeps track of the vertical position of the print head. Each time power is turned on the line counter is reset and the current position of the head is designated as line one. This location is referred to as TOP OF FORM. When the Form Feed (FF) button is pressed, the paper will advance the length of a page. A page is defined by the Page Length Designation Command.

The first line of text will begin about $\frac{1}{8}$ " (4.2 mm) from the top of the back tension plate. (The distance between the bottom of the characters and the top of the back tension plate is about $\frac{1}{8}$ " (4.2mm))

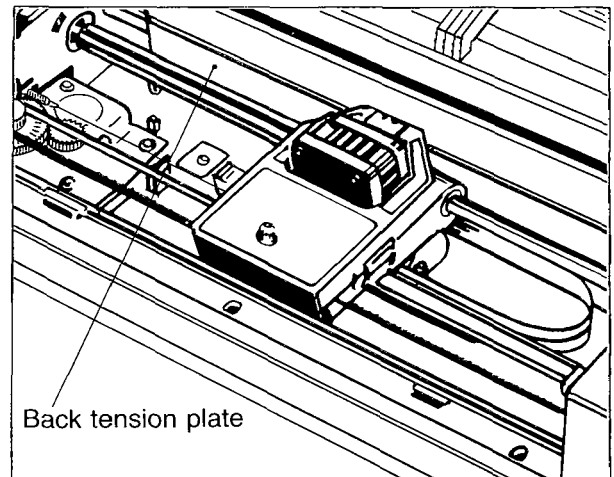


Figure 2.8 Setting the Top of Form

Adjusting the printing head gap

The distance between the printing head and platen can be adjusted to compensate for the thickness of the paper.

Figure 2.9 shows the location of the head gap lever. Move the lever towards the platen for single sheet and away from the platen for multi-part forms.

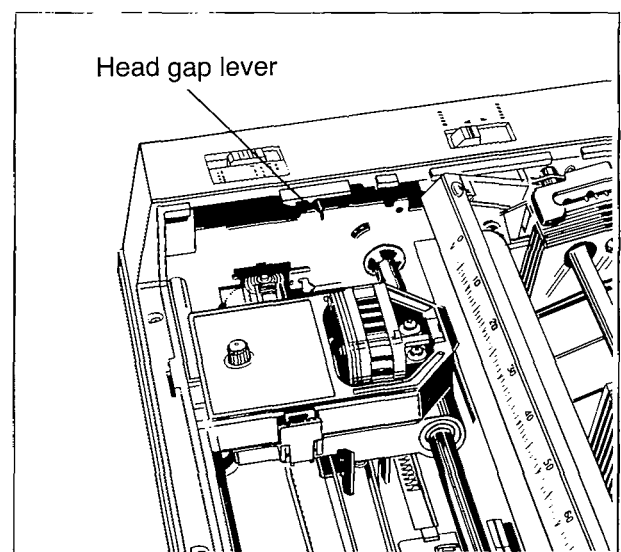
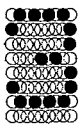


Figure 2.9 Adjusting the Print Head Gap



OPERATION

3.1 Switches and Indicators

Power switch

The power switch is located on the right side of the printer towards the rear. It is used to turn the AC power ON or OFF. When power is supplied to the printer the power indicator light on the front panel will be lit.

On-line switch

The ON LINE switch is an alternate action switch which opens and closes the communications line with the computer. When the power switch is turned on, the printer will power up in the ON LINE mode if paper is installed. If paper is not installed, the printer will power up in the OFF LINE mode. In the ON LINE mode, the printer is able to receive information from the computer and the ON LINE indicator will be lit. When OFF LINE, the indicator light will be out and the printer can no longer receive data. Refer to Figure 3.1.

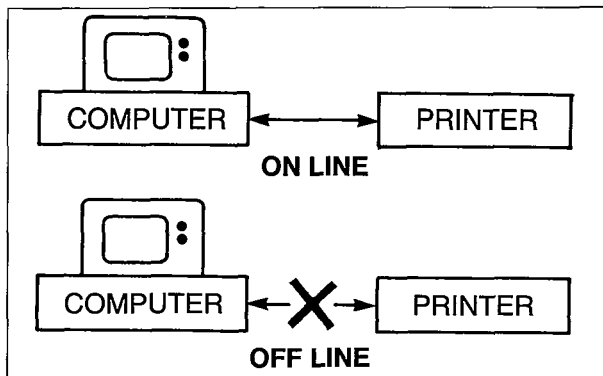


Figure 3.1 ON LINE & OFF LINE

When the printer is switched to ON LINE the following actions occur:

- the ON LINE light is lit
- the communications line is open between the printer and computer
- an ACK signal is sent out
- interface signal levels are:

Busy = Low
Select = High
Error = High

When the printer is switched OFF LINE the following actions occur:

- the ON LINE light is off
- the communications line between the printer and computer is interrupted
- interface signal levels are:
Busy = High
Select = Low
Error = Low

Form feed switch

This switch is active in both OFF LINE and ON LINE mode. Pressing the FF switch will advance the paper from its current location to the top of the next page. Then a new top of form is established.

Line feed switch

This switch is active in both OFF LINE and ON LINE mode. Pressing this switch will cause the paper to advance one line. Multiple line feed can be accomplished by holding the switch down.

Print mode selector switch

The print mode selector switch allows the user to select one of three basic printing modes: draft, near letter quality and compressed.

Mode change by this switch is effective both when the printer is OFF LINE and ON LINE mode.

- Draft-mode (Std. Pgm.) is a high speed printing mode. The printer will print bi-directionally at 120 characters per second. This mode is used for rough drafts and preliminary documents.

Mode change from this mode to another mode can be executed through ESC command.

- Near Letter Quality-mode (NLQ) allows the user to print high quality documents. The high density is achieved by a double pass of the print head.

This print mode cannot be changed to any other mode through software program.

- Compressed-mode (Comp.) In this mode 137 characters maximum can be printed per line. Therefore printing output which is designed for wide [15.5 inches (394 mm)] paper, is possible on narrow [8.5 inches (216 mm)] paper.

This print mode cannot be changed to any other mode through software program.

Refer to CHAPTER 4 for details regarding each of these modes.

Paper/Error Indicator

The PAPER/ERROR indicator light is lit when there are fewer than 1.5 inches (38 mm) remaining on the paper or when no paper is inserted, and blinks in the overload condition.

3.2 Detectors

Out of paper detector

The Out of Paper detector is located under the platen and senses the absence of paper. When the printer runs out of paper the PAPER/ERROR light is lit. The following conditions are in effect:

- the printer does not accept data from the computer
- the printer is OFF LINE and the ON LINE light is out
- the LF and FF switches are active
- the interface signal levels are:

Busy = High
Select = Low
Error = Low
PE = High

To re-establish communications with the computer, insert the paper and press the ON LINE switch.

The printer will resume printing.

Do not use transparent and semitransparent paper because they are not detected.

Overload detector

An overload condition can occur when the path of the print head is blocked. At that time the PAPER/ERROR light blinks. During this period the following conditions are in effect

- communication with the computer stops and the printer goes OFF LINE
- the front panel switches are disabled
- the interface signal levels are:

Busy = High
Select = Low
Error = Low

To reset the printer, eliminate the cause of the overload and recycle the power. The printer will resume printing.

3.3 DIP Switches

Turn the power off before setting the DIP switches. The DIP switches allow the user to set certain operating conditions of the printer. Figure 3.2 shows the location of the switches and Table 3.1 is a summary of the switch settings.

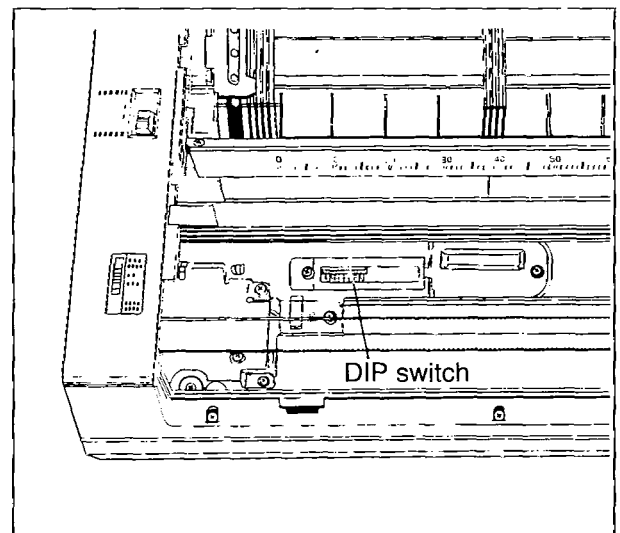


Figure 3.2 Location of DIP Switches

The switch settings are read into memory on power up. These memory locations then contain an image of the switch settings. The computer can change switch settings by downloading new commands. The International character set and the skip perforation switches, etc., can be changed in this manner. Refer to Section 4.10 for information regarding software control of the switches.

SWITCH NUMBER	FUNCTION	ON	OFF	POSITION WHEN SHIPPED
SW1	Printer Mode	Standard Mode	IBM Printer Mode	ON
SW2	Paper Out Detector	Ineffective	Effective	OFF
SW3	<u>AUTO FEED XT</u>	Fixed Internally	Not Fixed Internally	OFF
SW4	Skip Perforation	1 inch (25.4 mm) Skip	No Skip	OFF
SW5 SW6 SW7	Character Set	SW1=ON: See International Character Set Chart SW1=OFF: See IBM Printer Mode Chart		OFF OFF ON
SW8	7 bit/8 bit	7 bit	8 bit	OFF

Table 3.1 DIP Switch Settings

SW1	SW5	SW6	SW7	INTERNATIONAL CHARACTER SET
ON	ON	ON	ON	USA
	OFF	ON	ON	FRANCE
	ON	OFF	ON	ENGLAND
	OFF	OFF	ON	ENGLAND
	ON	ON	OFF	DENMARK I
	OFF	ON	OFF	SWEDEN
	ON	OFF	OFF	ITALY
	OFF	OFF	OFF	SPAIN

Table 3.2 Int'l Character Sets

IBM Printer Mode Selection				
SW1	SW5	SW6	SW7	PRINTER MODE
OFF	OFF	OFF	OFF	Graphics Printer Mode II
	—	—	ON	Graphics Printer Mode II
	—	ON	OFF	Graphics Printer Mode I
	ON	OFF	OFF	Matrix Printer Mode

(— means ON or OFF.)

Table 3.3 IBM Printer Modes

PRINTER MODE SW1

ON Standard Mode
OFF IBM Printer mode

Each printer mode has following character set.
IBM printer modes are selected by SW5, SW6, SW7 when SW1 is set OFF.

Standard Mode

ASCII = 96
International Characters = 31

IBM Matrix Printer Mode

ASCII = 96
Block Graphics = 64
International Characters = 31

IBM Graphics Printer Mode I

ASCII = 96
Special Characters = 95

IBM Graphics Printer Mode II

ASCII = 96
Special Characters = 132

Refer to Appendix A for the character set charts.

PAPER OUT DETECTOR SW2

ON Paper out detector is not active and printing is possible in paper out condition. When using single sheets printing is possible in the last 1.5 inches (38 mm) of the sheet.

OFF Paper out detector is active and printing will automatically stop at the paper out condition.

AUTO FEED XT SW3

ON A Line Feed command (LF) is added to each Carriage Return (CR).

OFF Carriage Return only.

SKIP PERFORATION SW4

ON A 3 line margin is skipped before and after the perforation between pages.

OFF Printing is continuous, NO margins around perforation.

The setting can be changed by the computer. Refer to Section 4.10.

CHARACTER SET SW5, 6 & 7.

The combination of these switch settings is used with the DIP switch 1 setting to select one of 7 International character sets or one of IBM Printer Modes. The character set diagrams are located in APPENDIX A.

The International character sets are selected when the DIP switch 1 is set to ON.

The IBM Printer modes are selected when the DIP switch 1 is set to OFF.

7/8 BIT CODE SELECTION SW8

ON=7 BIT

OFF=8 BIT

This switch selects the size of the data word. If the computer sends a 7 bit word, the printer must also be set for 7 bits. If the two settings do not agree, random errors will occur and meaningful communication will not be possible. Refer to Section 4.8 for information regarding 7 bit and 8 bit formatting.

3.4 Initialization

A. Power up sequence

The following procedures should be followed when turning the printer on:

1. Ensure the carriage stoppers have been removed.
2. Set the DIP switches as required.
3. Be sure the ribbon is installed correctly.
4. Plug the power cord into an appropriate wall outlet and turn the power ON.
5. Load the paper and set the paper feed selector.

B. Initialization

The printer is initialized under the following conditions:

- the AC power is turned on
- the PRIME signal is received
- the RESET command is received

When the printer is initialized, the following conditions are set:

- the print head goes to the home leftmost position
- the print buffer is cleared
- the receive buffer is cleared (not cleared by RESET command)
- vertical tab settings are cleared
- horizontal tabs are set every 8 columns
- the DIP switches are read and printer modes set
- print mode is subject to the position of print mode selector switch
- present form position is designated as top of form
- all modes set by control and escape commands will be cleared
- the printer goes ON LINE

3.5 Self Test

The printer has a self test feature which allows the user to test the printer independent of a computer. The mode is entered by turning on the power switch while pressing down the line feed (LF) switch. All 96 ASCII characters will be printed continuously for the full platen width until the power is turned off.

3.6 Hex. Dump

The HEX. DUMP mode is activated by turning on the power while pressing both the line feed (LF) and form feed (FF) switches. In this mode, all data received from the computer is printed in hex code rather than the normal ASCII characters. Function codes for the printer (CR, LF, HT, etc.) are not executed. To reset the mode, turn the power off, then back on.

3.7 Receive Buffer

The printer has a receive buffer of 1K bytes. This can reduce the computer's idle time caused by waiting for a printer to complete its printing. Therefore total throughput of the whole system will be increased.

3.8 Replacing the Covers

First, insert the front cover as shown in Figure 3.3A. Then push in as shown in Figure 3.3B.

Insert the top cover (Figure 3.4A) such that the tabs on the front side slip under the front cover. Then push down so that the tabs on the side snap into places (Figure 3.4B).

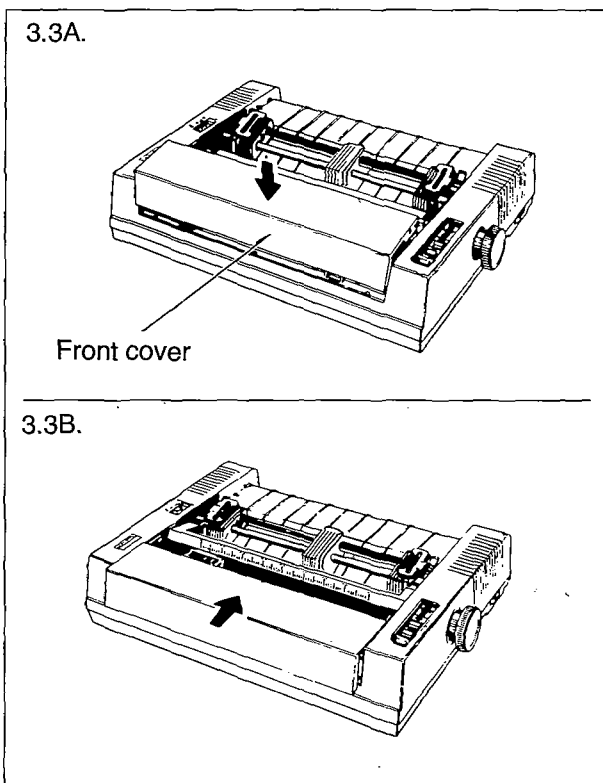


Figure 3.3 Replacing the Front Cover

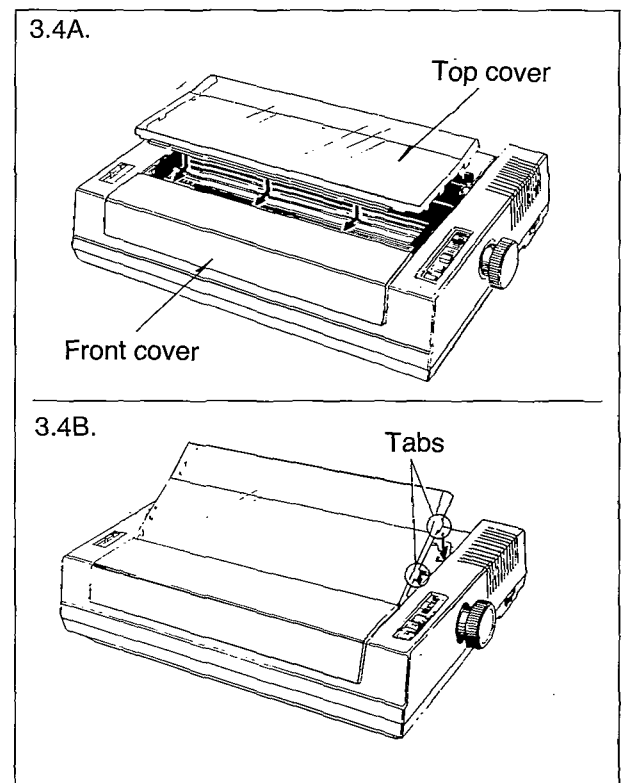
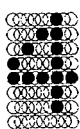


Figure 3.4 Replacing the Top Cover



SOFTWARE COMMANDS

4.1 Introduction

In order for a computer to communicate with a printer, both pieces of equipment must understand a common language or coding scheme. One such coding scheme is called ASCII (American Standard Code for Information Interchange). As an example, the ASCII code for the character "K" can be expressed in any of the following forms:

(01001011)₂—Binary
4B_{HEX}, 4B_H—Hexadecimal
75_{DEC}, 75_D—Decimal

Many computers allow you to enter ASCII codes in hexadecimal form. Most computers which support ASCII allow the input to be in decimal form. Many allow you to enter the code in either form. Once entered, the ASCII codes are converted to binary form by the computer and then sent to the printer.

In the sections which follow, you will see how to enter various ASCII codes to enable the printer to perform the functions you would like. Since the decimal equivalent of the ASCII code is most commonly used, all examples which follow will use the decimal form.

Appendix A contains the ASCII character and control command tables used by the printer.

4.2 Control Codes

The various printer functions are set through the use of control codes, which consist of one or more ASCII characters entered into the computer in a special way. These control codes often differ from printer to printer. Control codes generally fall into two categories: one-byte control codes and multi-byte control codes. The multi-byte control codes are often referred to as Escape Sequences since each code begins with the ASCII code for the ESCAPE character (ESC). Such an ESC character should not be confused with the Escape Key found on some computer keyboards.

Control codes can be sent to the printer from your computer in different ways. The three most common ways are:

- Through commercial software packages
- Directly from the keyboard
- From within a user-written program

The latter two methods will specifically reference the BASIC language, although other languages such as FORTRAN, PASCAL, etc., can also be used. We will use BASIC since it is relatively easy language to use. In addition it is the most commonly used microcomputer language.

4.3 Entering Control Codes Through Commercial Software Packages

Many computer users do not have the time, the expertise, or the interest to develop software suited for their applications. In such cases software written by professionals can be purchased. Such software should be selected not only to meet the needs of the user, but must also be compatible with both computer and printer.

Commercial software is often written with what is called a driver. A driver is that part of the software which allows the user to configure the package to the type of printer and interface being used. Once the software has been booted, the user is generally requested to supply additional information such as:

- Brand/Model of printer being used.
- Slot number in which interface card is installed.
- Baud rate, parity, etc. if a serial interface is being used.

Once the necessary information has been supplied, the software will provide the computer with the control codes and other data needed by the printer.

Many word processing packages will request that you enter the ASCII codes used by the printer for special settings such as underlining, compressed print, super- and subscript, italics, etc. In all cases you should refer to your software instruction manual for the proper use of the package with the printer.

4.4 Entering Control Codes Directly from the Keyboard

With many computers, the BASIC language is ready to use once you power up. With others, BASIC must be loaded from cassette or disk. In any case, once BASIC is ready, you may then enter the printer control commands directly from your computer keyboard.

BASIC requires the use of the PRINT command (or LPRINT, PRINT#, etc. depending on the type of BASIC your computer uses) to process and send the control commands to the printer. As part of this PRINT command, you must supply the appropriate ASCII code(s) for the CHR\$ function.

For example, the command: **LPRINT CHR\$(15)** followed by a **RETURN** will set the printer to compressed mode. Subsequent output to the printer will appear in compressed mode.

If, after issuing the above command, subsequent PRINT statements output nothing to the printer, check for one or more of the following:

- Have you indicated to the computer that output is to the printer and not the screen? For example, PR#1, causes subsequent PRINT statements on the Apple® computer to PRINT on the printer and not the screen. (LPRINT statements do the same in Microsoft® BASIC).
- Is the printer on line? If not, press the green ON LINE button on the front panel.
- Is the interface cable plugged into the computer and printer?
- When using a serial interface, is the baud rate setting on the printer the same as that on the computer or interface card?

Notice that when you enter a BASIC command directly from the keyboard, you do NOT use a line number as you would in a BASIC program. Moreover, control codes may be entered only one line at a time.

4.5 Entering Control Codes from Within a Program

Control commands may also be entered from within a BASIC program. The advantage to this technique is that you can incorporate a number of different control commands into a single program and therefore produce output with a variety of special features. This is done by RUNning your program once. In this case BASIC requires that each line in your program be preceded by a line number.

As an example, we mentioned earlier that the command **LPRINT CHR\$(15)** entered directly from the keyboard would set compressed print on the printer. From within a BASIC program, this command might be:

50 LPRINT CHR\$(15)

The remainder of this chapter will show you how to enter each of the control commands which the printer uses. All examples will be IBM-PC® BASIC programs which use LPRINT to access the printer and use decimal numbers for the ASCII codes.

NOTE:

- 1) When using the Microsoft Basic and inputting the data which includes more than 80 characters, the computer will send needless data, so that it is necessary to add the following commands at the top of the program, then send the data by PRINT #1.

```
10 WIDTH "LPT1:", 255
20 OPEN "LPT1:" AS #1
```

- 2) The Apple-II e computer can not send the (09)_{HEX} code by PRINT command. Therefore, when sending the (09)_{HEX} code in the graphic programs and so on, input POKE (49601),9.

4.6 Entering Hexadecimal Code

In the event that you will be entering ASCII codes in hexadecimal form, you must supply two extra characters per code. These are the ampersand (&) and the letter H. The example below illustrates the BASIC command to set compressed print on the printer.

Decimal	Hexadecimal
LPRINT CHR\$(15)	LPRINT CHR\$(&H0F)

Refer to Appendix A for the ASCII code table.

4.7 Single-Byte Control Codes

A number of printer control commands require only a single ASCII-coded character as part of the LPRINT statement. The command LPRINT CHR\$(15) which we discussed earlier is an example of a single-byte control command. The following 16 control commands are single-byte codes. Although not required, the semi-colon at the end of each command suppresses a line feed. Commands are listed in alphabetical order.

BACKSPACE (BS):

Prints data in print buffer and backspaces one space before printing next character.

Code: 8 DEC 08 HEX

Input Format: LPRINT CHR\$(8);

Example:

```
10 REM UNDERLINE BY BACKSPACING
20 LPRINT "ABCDE";
30 FOR I=1 TO 5
40 LPRINT CHR$(8);
50 NEXT I
60 LPRINT "_____"
70 END
```

ABCDE

Comments:

- Since BS backspaces the width of a character, the backspacing amount will depend upon the character mode set when the BS code was received.
- See Example 2, Underline Mode, Section 4.8.

CANCEL (CAN):

Clears all data in the receive buffer.

Code: 24 DEC 18 HEX

Input Format: LPRINT CHR\$(24);

Example:

```
10 REM CANCEL
20 LPRINT "CANCEL CLEARS";
30 LPRINT CHR$(24);
40 LPRINT "CANCEL CLEARS THE BUFFER"
50 END
```

CANCEL CLEARS THE BUFFER

CARRIAGE RETURN (CR):

Prints all data in buffer.

Code: 13 DEC 0D HEX

Input Format: LPRINT CHR\$(13);

Example:

```
10 REM CARRIAGE RETURN
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"0000";CHR$(13);
50 PRINT #1,"/////"
60 END
```

0000

Comments:

- If output appears as;0000 your computer probably issues an automatic line feed with a carriage return. Check your computer manual for details.
- When DIP switch 3 is ON, or AFXT signal is low, a line is fed automatically by a CR code resulting in print out which appears in above comment.

DELETE (DEL):

Deletes the last character stored in the buffer.

Code: 127 DEC 7F HEX

Input Format: LPRINT CHR\$(127);

Example:

```
10 REM DELETE
20 LPRINT "COMPUTE";
30 LPRINT CHR$(127); "ING"
40 END
```

COMPUTING

Comments:

- Ordinary text character only may be deleted. Bit image data, spacing between output generated by consecutive TABs, and character mode designations cannot be deleted.
- IBM Graphics modes have no DEL code.

DEVICE CONTROL 1 (DC1):

Selects the printer remotely, enabling it to receive data (ON LINE).

Code: 17 DEC 11 HEX

Input Format: LPRINT CHR\$(17);

Example: See DC3

Comment:

- Receipt of DC1 while the printer is deselected by DC3, enables the printer to receive data. Upon receipt of DC1 the print buffer data previously received will be lost.

DEVICE CONTROL 2 (DC2):

Releases the compressed character mode set by the SI code.

Code: 18 DEC 12 HEX

Input Format: LPRINT CHR\$(18);

Example: See SI

Comments:

- When emphasized and compressed character modes are set simultaneously, the compressed mode is ignored and emphasized characters are printed. However, when the emphasized mode is released, characters are printed in compressed mode. Use DC2 to release compressed printing.
- When the print mode selector switch is at "Comp." position, compressed mode is not released by DC2.
- In IBM printer mode DC2 also releases elite pitch printing set by ESC+:.

DEVICE CONTROL 3 (DC3):

Deselects the printer remotely, disabling it from receiving data.

Code: 19 DEC 13 HEX

Input Format: LPRINT CHR\$(19);

Example:

```
10 REM REMOTE SELECT/DESELECT
20 LPRINT "SELECT"
30 LPRINT CHR$(19);
40 LPRINT "DESELECT"
50 LPRINT CHR$(17);
60 LPRINT "SELECT"
70 END
```

```
SELECT
SELECT
```

Comment:

- All data sent in deselect status become invalid. In order to return to select status, send DC1 code.

DEVICE CONTROL 4 (DC4):

Releases the double width (elongated) mode set by SO or ESC+SO.

Code: 20 DEC 14 HEX

Input Format: LPRINT CHR\$(20);

Example: (See SO or ESC+SO)

Comment:

- DC4 does not release double width set by ESC+W+1.

ESCAPE (ESC):

First byte of each multi-byte printer control code.

Code: 27 DEC 1B HEX

Input Format: LPRINT CHR\$(27);

Example: (See section on MULTI-BYTE CONTROL COMMANDS)

Comment:

- Cannot be generated by the ESC key on certain computers.

FORM FEED (FF):

Feeds paper to next top of form position after first printing any data in the buffer.

Code: 12 DEC 0C HEX

Input Format: LPRINT CHR\$(12);

Example: (See ESC+C+0+n or ESC+C+n)

Comments:

- FF releases double width printing set by SO or ESC+SO.
- Amount of form feed depends upon page length set by the page length control command.

HORIZONTAL TAB (HT):

Executes the horizontal TAB as designated by ESC+D+n₁+n₂+...+n_x+0 or ESC+e+0+n.

Code: 9 DEC 09 HEX

Input Format: LPRINT CHR\$(9);

Example: (See ESC+D+n₁+n₂+...+n_x+0 or ESC+e+0+n)

Comments:

- If the value of the horizontal TAB is less than the present column position, HT will be ignored.
- If the value of the horizontal TAB exceeds the maximum printing width, all data within correct printing range will be printed according to the HT setting(s), and one line feed is executed.
- When in underline mode, the blank spaces between consecutive HT print positions are not underlined.
- When the printer is powered up, TAB is automatically set every 8 characters.

LINE FEED (LF):

Causes data in buffer to be printed and then executes a single line feed.

Code: 10 DEC 0A HEX

Input Format: LPRINT CHR\$(10);

Example:

```
10 REM LINE FEED
20 LPRINT "0000000000";CHR$(10);"11111"
30 END
```

```
0000000000
11111
```

Comments:

- When the new line position falls within the perforation skip area, the paper advances to the next top of form position.
- If no data precedes the LF code, if all preceding data is SPACE, only line feed is performed.
- The amount of spacing generated by LF is a function of the line spacing setting.
- Receipt of the LF code releases double width printing set by SO or ESC+SO.

NULL (NULL):

Last byte of certain multi-byte printer control codes.

Code: 0 DEC 00 HEX

Input Format: LPRINT CHR\$(0);

Example: (See section on MULTI-BYTE CONTROL COMMANDS)

SHIFT IN (SI):

Sets the compressed printing character mode.

Code: 15 DEC 0F HEX

Input Format: LPRINT CHR\$(15);

Example:

```
10 REM COMPRESSED CHARACTERS
20 LPRINT " NORMAL MODE ";
30 LPRINT CHR$(15);
40 LPRINT "COMPRESSED MODE";
50 LPRINT CHR$(18);
60 LPRINT " BACK TO NORMAL MODE "
70 END
```

NORMAL MODE COMPRESSED MODE BACK TO NORMAL MODE

Comments:

- DC2 releases the compressed character mode, and subsequent characters are printed in pica pitch.
- This command is ineffective when the printer is in 12 CPI (ELITE PITCH) mode or proportional mode.
- When the emphasized and compressed character modes are both set, compressed printing is ignored and characters are printed in emphasized mode only. However, after the emphasized mode has been released, compressed printing must still be released.
- In compressed mode, 17 characters per inch (137 characters per line) are printed.

SHIFT OUT (SO):

Sets one-line double width (elongated) printing character mode.

Code: 14 DEC 0E HEX

Input Format: LPRINT CHR\$(14);

Example:

```
10 REM DOUBLE WIDTH PRINTING
20 LPRINT "NORMAL WIDTH";CHR$(10);
30 LPRINT CHR$(14);
40 LPRINT "DOUBLE WIDTH";CHR$(10);
50 LPRINT "RELEASED BY (LF)"
60 END
```

```

NORMAL WIDTH
DOUBLE WIDTH
RELEASED BY (LF)
```

Comments:

- Double width printing set by SO is released when:
 - a LF, FF, VT is executed
 - ESC+W+0 is executed
 - the printer is initialized
 - DC4 is executed
- SO and ESC+SO are interchangeable.

VERTICAL TAB (VT):

Executes the vertical TAB as designated by ESC+B+n₁+n₂+...+n_x+0 or ESC+e+1+n.

Code: 11 DEC 0B HEX

Input Format: LPRINT CHR\$(11);

Example: (See ESC+B+n₁+n₂+...+n_x+0 or ESC+e+1+n)

Comments:

- When TABs are set with VT setting command and when there is no tab setting on a position exceeding present line, data are printed out and paper is fed to the next page's top of form. (same as FF)
- When vertical TAB has not been set by ESC+B+n₁+n₂+...+n_x+0 or ESC+e+1+n execution of VT causes data in the buffer to be printed and advances the paper one line. (same function as LF).

4.8**Multi-Byte Control Codes**

Multi-byte control codes, often called Escape control codes or Escape sequences, always begin with an ESC designation. ESC is designated by CHR\$(27) in decimal form or CHR\$(&H1B) in hexadecimal form. The ESC designation is always followed by one or more additional codes, hence, the name multi-byte control code.

In BASIC, these two or more bytes are joined (or concatenated) into a single command or string using either a plus (+) sign, a semicolon (;), or by neither symbol but rather by listing one byte after another without any spaces. BASIC on many computers allows you to use any of these formats. Refer to your BASIC manual for the proper method of string concatenation.

Table 4.1 shows equivalent methods of entering multi-byte control commands for most computers.

There is one remaining input format commonly used to reduce the keystrokes necessary to enter a multi-byte control command. As you examine the multi-byte control commands in the pages ahead, you will notice that the second byte, with the exception of ESC+SO and ESC+SI, is always a character which appears somewhere on your keyboard. In such cases, rather than enter that character's ASCII code as part of the CHR\$ function, you may simply enter that character in quotes (""). For example, to set pica pitch (ESC+P), you may enter:

```
LPRINT CHR$(27)+CHR$(80);
```

or

```
LPRINT CHR$(27)+"P";
```

As another example, to set double width printing, you may enter;

```
LPRINT CHR$(27)+CHR$(87)+CHR$(1);
```

or

```
LPRINT CHR$(27)+"W"+CHR$(1);
```

With this method, any of the three input formats shown in Table 4.1 may also be used (subject to the BASIC you are using).

Multi-byte control codes can be summarized by the following classifications:

- Character mode commands
- Word processing commands
- Bit image (graphics) mode commands
- Line spacing commands
- Paper feed commands
- Page format commands
- Data control commands
- Downloadable character commands
- Miscellaneous commands

	Two-Byte Command	Three-Byte Command
Function Name Code	Set Pica Pitch ESC+P 27,80 DEC	Set Double Width Printing ESC+W+1 27,87,1 DEC
Input Format 1 Input Format 2 Input Format 3	LPRINT CHR\$(27)+CHR\$(80); LPRINT CHR\$(27);CHR\$(80); LPRINT CHR\$(27)CHR\$(80);	LPRINT CHR\$(27)+CHR\$(87)+CHR\$(1); LPRINT CHR\$(27);CHR\$(87);CHR\$(1); LPRINT CHR\$(27)CHR\$(87)CHR\$(1);

Table 4.1 Input Formats

Character mode commands

Character mode commands enable you to control character size (number of characters per inch horizontally and vertically), character set (resident ASCII characters), character intensity (darkness), and underlining.

Character Size

Character size refers to the spacing between characters (called pitch), the height of characters, or both. In this section we will discuss pica, elite, double width, superscript and subscript printing.

While compressed and one form of double width printing rightfully belong in this section, they are single-byte control commands. Below is the list of these single-byte commands. For details, refer to Section 4.7.

Single-Byte Control Command	Function
SHIFT IN (SI)	Sets compressed printing
DEVICE CONTROL 2 (DC2)	Releases compressed printing
SHIFT OUT (SO)	Sets one-line double width printing
DEVICE CONTROL 4 (DC4)	Releases one-line double width printing

PICA PITCH:

Sets printing to 10 characters per inch (80 characters per line).
And selects draft fonts.

Name: ESC+P

Code: 27,80 DEC 1B,50 HEX

Input Format: LPRINT CHR\$(27)+"P";

Example:

```
10 REM PICA PITCH
20 LPRINT CHR$(27)+"P";
30 LPRINT "PICA"
40 FOR I=1 TO 3
50 LPRINT "ABCDE";
60 NEXT I
70 LPRINT CHR$(10);
80 END
```

```
PICA
ABCDEABCDEABCDE
```

Comments:

- Pica pitch can be changed to elite, compressed, proportional etc. by entering the appropriate control commands.
- Unless the print mode selector is at "Std. Pgm." position, this command is not operational.
- This command releases NLQ mode.

ELITE PITCH:

Sets printing to 12 characters per inch (96 characters per line). And selects draft fonts.

Name: ESC+M

Code: 27,77 DEC 1B,4D HEX

Input Format: LPRINT CHR\$(27)+"M";

Example:

```
10 REM ELITE PITCH
20 LPRINT "-----PICA-----"
30 LPRINT CHR$(27)+"M";
40 LPRINT "-----ELITE-----"
50 END
```

```
-----PICA-----
-----ELITE-----
```

Comments:

- The elite and compressed modes cannot be used together. In the elite pitch, the compressed print setting will be ignored.
- If the elite pitch designation is made after compressed or proportional spacing mode has been set, compressed or proportional spacing mode is released and the elite pitch remains in effect.
- Unless the print mode selector is at "Std. Pgm." position, this command is not operational.
- This command releases NLQ mode.

ELITE PITCH(IBM PRINTER MODE):

Sets printing to 12 characters per inch (96 characters per line).

Name: ESC+:

Code: 27,58 DEC 1B, 3A HEX

Input Format: LPRINT CHR\$(27)+" : ";

Example:

```
10 REM ELITE PITCH
20 LPRINT "-----PICA-----"
30 LPRINT CHR$(27)+" : ";
40 LPRINT "-----ELITE-----"
50 END
```

```
-----PICA-----
-----ELITE-----
```

Comments:

- The elite and compressed modes cannot be used together. In the elite pitch, the compressed print setting will be ignored.
- If the elite pitch designation is made after compressed or proportional spacing mode has been set, compressed or proportional spacing mode is released and the elite pitch remains in effect.
- When the print mode selector is at "Comp." position, this command is not operational.
- This command does not affect Draft or NLQ font modes.
- This command is not operational in Standard Mode.
- This command is released by DC2 in IBM Printer mode.

DOUBLE WIDTH PRINTING:

Sets the double width (elongated) printing character mode.

Name: Setting: ESC+W+n n=1, 49, 129, 177
 Release: ESC+W+m m=0, 48, 128, 176

Code: Setting: 27,87,n_{DEC} 1B,57,n_{HEX}
 Release: 27,87,m_{DEC} 1B,57,m_{HEX}

Input Format: Setting: LPRINT CHR\$(27)+"W"+CHR\$(1);
 Release: LPRINT CHR\$(27)+"W"+CHR\$(0);

Example: 10 REM DOUBLE WIDTH USING ESC+W+1
 20 LPRINT "NORMAL WIDTH";CHR\$(10);
 30 LPRINT CHR\$(27)+"W"+CHR\$(1);
 40 LPRINT "DOUBLE WIDTH";
 50 LPRINT CHR\$(20);CHR\$(10);
 60 LPRINT "NOT RELEASED BY LF OR DC4";CHR\$(10);
 70 LPRINT CHR\$(27)+"W"+CHR\$(0);
 80 LPRINT "RELEASED BY ESC+W+0"
 90 END

```
NORMAL WIDTH
DOUBLE WIDTH
NOT RELEASED BY LF OR DC4
RELEASED BY ESC+W+0
```

Comments:

- Double width printing set by ESC+W+1 is not released by a LF or DC4.
- Double width printing set by SO or ESC+SO is also released by ESC+W+0.

DOUBLE WIDTH PRINTING (ONE-LINE):

Sets the one-line double width (elongated) printing character mode.

Name: Setting: ESC+SO
Release 1: DC4
Release 2: ESC+W+0

Code: Setting: 27,14 DEC 1B,0E HEX
Release 1: 20 DEC 14 HEX
Release 2: 27,87,0 DEC 1B,57,00 HEX

Input Format: Setting: LPRINT CHR\$(27)+CHR\$(14);
Release 1: LPRINT CHR\$(20);
Release 2: LPRINT CHR\$(27)+"W"+CHR\$(0);

Example:

```
10 REM DOUBLE WIDTH PRINTING
20 LPRINT "NORMAL WIDTH";CHR$(10);
30 LPRINT CHR$(27)+CHR$(14);
40 LPRINT "DOUBLE WIDTH";CHR$(10);
50 LPRINT "RELEASED BY (LF)"
60 END
```

```
NORMAL WIDTH
DOUBLE WIDTH
RELEASED BY (LF)
```

Comments:

- Double width printing set by ESC+SO and SO are the same (see SO).
- One-line double width printing mode is released by line feed caused by LF, VT and FF code.

COMPRESSED PRINTING MODE:

Sets the compressed printing character mode.

Name: ESC+SI

Code: 27,15 DEC 1B,0F HEX

Input Format: LPRINT CHR\$(27)+CHR\$(15);

Comment:

- Compressed printing mode set by ESC+SI and SI are the same. (see SI)

SUPERSCRIFT PRINTING:

Sets superscript mode with characters printed on the top-half of line.
Characters are reduced to 1/2 of their original height.

Name: Setting: ESC+S+n n=0, 48, 128, 176
 Release: ESC+T

Code: Setting: 27,83,n DEC 1B,53,n HEX
 Release: 27,84 DEC 1B,54 HEX

Input Format: Setting: LPRINT CHR\$(27)+"S"+CHR\$(0);
 Release: LPRINT CHR\$(27)+"T";

Example: (See SUBSCRIPT)

Comments:

- Superscript characters are normal width.
- To print very small characters, such as exponents, set superscript and compressed modes simultaneously.
- Superscript characters cannot be printed in the near letter quality mode.
- ESC+T also releases the subscript print setting.
- See subscript comments.

SUBSCRIPT PRINTING:

Sets subscript mode with characters printed on the bottom half of line.
Characters are reduced to 1/2 of their original height.

Name: Setting: ESC+S+n n=1, 49, 129, 177
Release: ESC+T

Code: Setting: 27,83,n DEC 1B,53,n HEX
Release: 27,84 DEC 1B,54 HEX

Input Format: Setting: LPRINT CHR\$(27)+"S"+CHR\$(1);
Release: LPRINT CHR\$(27)+"T";

Example:

```
10 REM SUPER/SUB SCRIPT
20 LPRINT CHR$(27)+"-"+CHR$(1);
30 LPRINT CHR$(27)+"S"+CHR$(0);
40 LPRINT "ABCDEFGHJKLMNOP - SUPERScript"
50 LPRINT CHR$(27)+"S"+CHR$(1);
60 LPRINT "ABCDEFGHJKLMNOP - SUBSCRIPT"
70 LPRINT CHR$(27)+"T";
80 LPRINT "ABCDEFGHJKLMNOP"
90 LPRINT CHR$(27)+"-"+CHR$(0);
100 END
```

```
ABCDEFGHJKLMNOP - SUPERScript
ABCDEFGHJKLMNOP - SUBSCRIPT
ABCDEFGHJKLMNOP
```

Comments:

- Subscript characters are normal width.
- To print very small characters, such as exponents, set subscript and compressed modes simultaneously.
- Subscript characters cannot be printed in the near letter quality mode.
- ESC+T also releases the superscript print setting.
- In both the subscript and superscript mode, the printer performs double-strike, single direction printing. Following the first pass of the print head, the paper is feed 1/216 inch, and the line is printed again. The printer automatically compensates for the paper feed to maintain the proper line count.

Character Set

Character set commands enable you to access a variety of ASCII character sets available on the printer. The setting of DIP switches 1, 5, 6 and 7, as shown below, determines which character mode you may access. Within each character mode you may then input the appropriate control commands to access specific character sets.

SW1	SW5	SW6	SW7	PRINTER MODE
ON	International Character Set Selection			Standard Mode
OFF	OFF	OFF	OFF	IBM Graphics Printer Mode II
	—	—	ON	IBM Graphics Printer Mode II
	—	ON	OFF	IBM Graphics Printer Mode I
	ON	OFF	OFF	IBM Matrix Printer Mode

(— means ON or OFF.)

Appendix A contains the character sets in each of these modes.

In Standard Mode, you may access normal, italic, and international characters.

In IBM Matrix Printer Mode, you may access the character set used by the IBM Matrix Printer. This enables this printer to emulate the IBM Matrix Printer.

In IBM Graphics Printer Mode, you may access either of two different graphics modes to enable this printer to emulate the IBM Graphics Printer.

ITALIC CHARACTERS:

Selects italic character printing.

Name: Setting: ESC+4
Release: ESC+5

Code: Setting: 27,52_{DEC} 1B,34_{HEX}
Release: 27,53_{DEC} 1B,35_{HEX}

Input Format: Setting: LPRINT CHR\$(27)+"4";
Release: LPRINT CHR\$(27)+"5";

Example:

```
10 REM ITALIC SETTING/RELEASE
20 LPRINT CHR$(27)+"4";
30 LPRINT "ITALIC CHARACTERS ON"
40 LPRINT CHR$(27)+"5";
50 LPRINT "ITALIC CHARACTERS OFF"
60 END
```

ITALIC CHARACTERS ON
ITALIC CHARACTERS OFF

Comments:

- Italic characters can be printed in draft and near letter quality modes.
- Italic characters in locations 160_{DEC}–254_{DEC} (A0_{HEX}–FE_{HEX}) are printed in place of characters in locations 32_{DEC}–126_{DEC} (20_{HEX}–7E_{HEX}).

ITALIC INTERNATIONAL CHARACTERS:

Allocates locations 128_{DEC} – 159_{DEC} (80_{HEX} – 9F_{HEX}) and 255_{DEC} (FF_{HEX}) to italic international characters (effective only in Standard Mode).

Name: Setting: ESC+6
Release: ESC+7

Code: Setting: 27,54_{DEC} 1B,36_{HEX}
Release: 27,55_{DEC} 1B,37_{HEX}

Input Format: Setting: LPRINT CHR\$(27)+"6";
Release: LPRINT CHR\$(27)+"7";

Example:

```
10 REM ITALIC INTERNATIONAL CHARACTERS
20 LPRINT "ITALIC INTERNATIONAL CHARACTERS"
30 LPRINT CHR$(27)+"6";CHR$(10);
40 FOR I=128 TO 159
50 LPRINT CHR$(I);
60 NEXT I
70 LPRINT CHR$(255)
80 LPRINT CHR$(27)+"7";
90 END
```

ITALIC INTERNATIONAL CHARACTERS

àéùòí°£;¿ÀÁÂÃÄÅÇÈÉÊËÌÍÎÏÑÒÓÔÕÖ×ØÙÚÛÜÝÞ

Comments:

- Table 4.2 illustrates allocation of italic international characters to their respective locations.
- This command is effective to register fonts in the area of 128_{DEC}–159_{DEC}, 255_{DEC}.

LOCATION		CHAR.	LOCATION		CHAR.	LOCATION		CHAR.	LOCATION		CHAR.
DEC	HEX		DEC	HEX		DEC	HEX		DEC	HEX	
128	80	à	137	89	ñ	146	92	Æ	155	9B	ö
129	81	é	138	8A	ñ	147	93	æ	156	9C	ü
130	82	ù	139	8B	œ	148	94	ø	157	9D	é
131	83	ò	140	8C	Þ	149	95	ø	158	9E	é
132	84	í	141	8D	Å	150	96	..	159	9F	¥
133	85	°	142	8E	å	151	97	Ä	255	FF	ø
134	86	£	143	8F	ç	152	98	Ö			
135	87	ï	144	90	§	153	99	Ü			
136	88	ü	145	91	ß	154	9A	ä			

Table 4.2 International Italic Character Locations

INTERNATIONAL CHARACTER SET:

Selects any one of 10 international character sets.

Name: ESC+R+n $0 \leq n \leq 10$

Code: 27,82,n DEC 1B,52,n HEX

Input Format: LPRINT CHR\$(27)+"R"+CHR\$(n);

Example:

```

10 REM SELECT SPANISH CHARACTERS
20 LPRINT "PRINT SAMPLE IN SPANISH"
30 LPRINT CHR$(10);
40 LPRINT CHR$(27)+"R"+CHR$(7);
50 LPRINT "ESPA";CHR$(92);"OL"
60 END

```

PRINT SAMPLE IN SPANISH

ESPAÑOL

Comments:

- This command is not operational in IBM GRAPHICS MODE. In IBM GRAPHICS MODE, USA character set is always selected.
- Table 4.3 illustrates allocation of international characters to their respective locations.
- International character sets 0-7 can be set with DIP switches 5, 6, and 7 in Standard mode.
- Character sets 8, 9, and 10 can be accessed through software ONLY.

	n	35 _D 23 _H	36 _D 24 _H	64 _D 40 _H	91 _D 5B _H	92 _D 5C _H	93 _D 5D _H	94 _D 5E _H	96 _D 60 _H	123 _D 7B _H	124 _D 7C _H	125 _D 7D _H	126 _D 7E _H
USA	0	#	\$	@	[	\	\]	^	'	{	|	}	~
FRANCE	1	#	\$	à	°	ç	§	^	'	é	ù	è	..
	2	Ineffective											
ENGLAND	3	£	\$	@	[	\	\]	^	'	{	|	}	~
DENMARK I	4	#	\$	@	Æ	Ø	Å	^	'	æ	ø	å	~
SWEDEN	5	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	6	#	\$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	7	Pt	\$	@	í	Ñ	¿	^	'	..	ñ	}	~
JAPAN	8	#	\$	@	[	¥	]	^	'	{	|	}	~
NORWAY	9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
DENMARK II	10	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

Table 4.3 International Character Set Locations

Selects IBM Graphics printer Mode I.

Selects IBM Graphics printer Mode II.

PROGRAMMABLE PRINTER MODE:

Sets printer mode to Standard, IBM Matrix, IBM Graphics I, or IBM Graphics II mode.

Name:	ESC+m+n	$0 \leq n \leq 3$
Code:	27,109,n DEC	1B,6D,n HEX

Input Format: LPRINT CHR\$(27)+"m"+CHR\$(n);

Example:

```
10 REM PRINTER MODE SELECTION
20 LPRINT "SAMPLE OF EXTENDED ASCII CHARACTERS"
30 LPRINT "LOCATIONS 3 - 6 & 162 - 182";CHR$(10)
40 FOR I=1 TO 4
50 LPRINT CHR$(27)+"m"+CHR$(I-1);
60 ON I GOTO 70,80,90,100
70 LPRINT "Standard Mode...":GOTO 110
80 LPRINT "IBM Matrix Mode...":GOTO 110
90 LPRINT "IBM Graphics Mode I...":GOTO 110
100 LPRINT "IBM Graphics Mode II...":GOTO 110
110 FOR L=3 TO 6:LPRINT CHR$(L);:NEXT L
120 FOR L=162 TO 182:LPRINT CHR$(L);:NEXT L
130 LPRINT CHR$(10)
140 NEXT I
150 END
```

```
SAMPLE OF EXTENDED ASCII CHARACTERS
LOCATIONS 3 - 6 & 162 - 182
```

```
Standard Mode...
"##%&'(>)*+,-./0123456
```

```
IBM Matrix Mode...
~!@#%&'(>)*+,-./0123456
```

```
IBM Graphics Mode I...
óûññâð¿¬¬¼¼;«»|||
```

```
IBM Graphics Mode II...
♥♦♠♣óûññâð¿¬¬¼¼;«»|||
```

Comments:

- The value of "n" specifies the printer mode:
 - n=0: Standard
 - n=1: IBM Matrix
 - n=2: IBM Graphics I
 - n=3: IBM Graphics II
- The printer default mode is set by DIP switches 1, 5, 6 and 7.
- This command is not cleared by the printer reset command.

Character Intensity

Character intensity (or darkness) can be controlled through the use of a few special control commands. Other than the normal draft printing mode, you can access the emphasis, double printing, and near letter quality modes. Each is discussed below.

EMPHASIS MODE:

Sets printing to twice the original horizontal dot density.

Name: Setting: ESC+E
 Release: ESC+F

Code: Setting: 27,69 DEC 1B,45 HEX
 Release: 27,70 DEC 1B,46 HEX

Input Format: Setting: LPRINT CHR\$(27)+"E";
 Release: LPRINT CHR\$(27)+"F";

Example: 10 REM EMPHASIZED MODE
 20 LPRINT CHR\$(27)+"E";
 30 LPRINT "EMPHASIZED CHARACTERS"
 40 LPRINT CHR\$(27)+"F";
 50 LPRINT "NORMAL CHARACTERS"
 60 END

EMPHASIZED CHARACTERS
NORMAL CHARACTERS

Comments:

- Emphasized characters are printed at half speed (60 cps in pica pitch).
- When emphasis and compressed printing are both set, compressed printing is ignored. However, upon releasing the emphasis printing, characters will be printed in compressed form, therefore, compressed printing must be released.
- Emphasis printing is available in the pica, elite and near letter quality modes.
- When the print mode selector switch is at "Comp." position, this command is not available.

DOUBLE PRINTING MODE:

Sets printing of each line of data with two passes of the print head, feeding the paper 1/216" between the first and second pass.

Name: Setting: ESC+G
 Release: ESC+H

Code: Setting: 27,71 DEC 1B,47 HEX
 Release: 27,72 DEC 1B,48 HEX

Input Format: Setting: LPRINT CHR\$(27)+"G";
 Release: LPRINT CHR\$(27)+"H";

Example: 10 REM DOUBLE PRINT MODE
 20 LPRINT CHR\$(27)+"G";
 30 LPRINT "2-PASS MODE"
 40 LPRINT CHR\$(27)+"H";
 50 LPRINT "1-PASS MODE"
 60 END

2-PASS MODE
1-PASS MODE

Comments:

- Since super/subscript and near letter quality characters are normally printed with two passes of the print head, the double print setting has no effect.
- Double printing is available in the pica, elite and compressed modes.

Underlining

The control code for underlining enables the printer to draw a continuous line under a string of characters. You may also, however, perform broken or character-by-character underlining by using the backspacing (BS) command and a CHR\$(95).

UNDERLINING MODE:

Sets continuous underlining of characters.

Name: Setting: ESC+--+n n=1, 49, 129, 177
 Release: ESC+--+m m=0, 48, 128, 176

Code: Setting: 27,45,n DEC 1B,2D,n HEX
 Release: 27,45,m DEC 1B,2D,m HEX

Input Format: Setting: LPRINT CHR\$(27)+"-"+CHR\$(1);
 Release: LPRINT CHR\$(27)+"-"+CHR\$(0);

Example 1: 10 REM CONTINUOUS UNDERLINING
 20 LPRINT CHR\$(27)+"-"+CHR\$(1);
 30 LPRINT "CONTINUOUS UNDERLINING"
 40 LPRINT CHR\$(27)+"-"+CHR\$(0);
 50 LPRINT "NO UNDERLINING"
 60 END

CONTINUOUS UNDERLINING
NO UNDERLINING

Example 2: 10 REM BROKEN UNDERLINING
 20 LPRINT "BROKEN";
 30 FOR I=1 TO 6
 40 LPRINT CHR\$(8);
 50 NEXT I
 60 FOR I=1 TO 6
 70 LPRINT CHR\$(95);
 80 NEXT I
 90 LPRINT CHR\$(10);
 100 END

BROKEN

Comments:

- Bit image data and spaces set by the HT code, IBM Block Graphics, and IBM 12-dot special characters are not underlined.
- Pin No. 9 of print head is used for underlining.
- Since g, j, p, q, y have true descenders, they also use Pin No. 9, and will touch the underline.
- Underlining is effective in all character modes.

PRINT MODE SELECTION:

Specifies a combination of print modes.

Name: ESC+!+n $0 \leq n \leq 63$

Code: 27,33,n_{DEC} 1B,21,n_{HEX}

Input Format: LPRINT CHR\$(27)+"!"+CHR\$(n);

Example:

```
10 REM Print Mode Selection
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,CHR$(27)+"D"+CHR$(12)+CHR$(0);
50 FOR N=0 TO 63
60   PRINT #1,CHR$(27)+"!" +CHR$(0);
70   PRINT #1,"MODE:";N;CHR$(9);
80   PRINT #1,CHR$(27)+"!" +CHR$(N);
90   PRINT #1,"Print mode Combinations";CHR$(10);
100 NEXT N
110 END
```

MODE: 0	Print mode Combinations
MODE: 1	Print mode Combinations
MODE: 2	Print mode Combinations
MODE: 3	Print mode Combinations
MODE: 4	Print mode Combinations
MODE: 5	Print mode Combinations
MODE: 6	Print mode Combinations
MODE: 7	Print mode Combinations
MODE: 8	Print mode Combinations
MODE: 9	Print mode Combinations
MODE: 10	Print mode Combinations
MODE: 11	Print mode Combinations
MODE: 12	Print mode Combinations
MODE: 13	Print mode Combinations
MODE: 14	Print mode Combinations
MODE: 15	Print mode Combinations
MODE: 16	Print mode Combinations
MODE: 17	Print mode Combinations
MODE: 18	Print mode Combinations
MODE: 19	Print mode Combinations
MODE: 20	Print mode Combinations
MODE: 21	Print mode Combinations
MODE: 22	Print mode Combinations
MODE: 23	Print mode Combinations
MODE: 24	Print mode Combinations
MODE: 25	Print mode Combinations
MODE: 26	Print mode Combinations
MODE: 27	Print mode Combinations
MODE: 28	Print mode Combinations

Example: (cont'd)

```

MODE: 29      Print mode Combinations
MODE: 30      Print mode Combinations
MODE: 31      Print mode Combinations
MODE: 32      Print mode Combinations
MODE: 33      Print mode Combinations
MODE: 34      Print mode Combinations
MODE: 35      Print mode Combinations
MODE: 36      Print mode Combinations
MODE: 37      Print mode Combinations
MODE: 38      Print mode Combinations
MODE: 39      Print mode Combinations
MODE: 40      Print mode Combinations
MODE: 41      Print mode Combinations
MODE: 42      Print mode Combinations
MODE: 43      Print mode Combinations
MODE: 44      Print mode Combinations
MODE: 45      Print mode Combinations
MODE: 46      Print mode Combinations
MODE: 47      Print mode Combinations
MODE: 48      Print mode Combinations
MODE: 49      Print mode Combinations
MODE: 50      Print mode Combinations
MODE: 51      Print mode Combinations
MODE: 52      Print mode Combinations
MODE: 53      Print mode Combinations
MODE: 54      Print mode Combinations
MODE: 55      Print mode Combinations
MODE: 56      Print mode Combinations
MODE: 57      Print mode Combinations
MODE: 58      Print mode Combinations
MODE: 59      Print mode Combinations
MODE: 60      Print mode Combinations
MODE: 61      Print mode Combinations
MODE: 62      Print mode Combinations
MODE: 63      Print mode Combinations

```

Comments:

- Print modes correspond to the setting of each bit as illustrated below.

bit	7	6	5	4	3	2	1	0
"1"	Always 0	Always 0	Double width	Double printing	Emphasized	Compressed	No meaning	Elite
"0"			Normal	Normal	Normal	Normal		Pica

- If $n=49_{DEC}$ (31_{HEX}), setting bits 0, 4, 5 to "1" produces double width, double printing, elite pitch printing.
- When bits 2 and 3 are both set to "1", emphasized takes priority over compressed printing.
- $ESC+!+n$ is effective in all print modes (draft, NLQ, etc.).
- Print modes are determined by the value of "n" as illustrated in Table 4.4.
- Also refer to Table 4.11.

n	DW	DP	EM	COM	EL	n	DW	DP	EM	COM	EL
0						32	○				
1					○	33	○				○
2						34	○				
3					○	35	○				○
4				○		36	○			○	
5					○	37	○				○
6				○		38	○			○	
7					○	39	○				○
8			○			40	○		○		
9			○		○	41	○		○		○
10			○			42	○		○		
11			○		○	43	○		○		○
12			○			44	○		○		
13			○		○	45	○		○		○
14			○			46	○		○		
15			○		○	47	○		○		○
16		○				48	○	○			
17		○			○	49	○	○			○
18		○				50	○	○			
19		○			○	51	○	○			○
20		○		○		52	○	○		○	
21		○			○	53	○	○			○
22		○		○		54	○	○		○	
23		○			○	55	○	○			○
24		○	○			56	○	○	○		
25		○	○		○	57	○	○	○		○
26		○	○			58	○	○	○		
27		○	○		○	59	○	○	○		○
28		○	○			60	○	○	○		
29		○	○		○	61	○	○	○		○
30		○	○			62	○	○	○		
31		○	○		○	63	○	○	○		○

DW: Double width
 DP: Double printing mode
 EM: Emphasized mode
 COM: Compressed mode
 EL: Elite mode

Table 4.4 Print Mode Selection

NEAR LETTER QUALITY PICA PITCH MODE:

Sets Pica Pitch printing of each line of data in near letter quality font.

Name: ESC+n

Code: 27,110 DEC 1B,6E HEX

Input Format: LPRINT CHR\$(27)+"n";

Example:

```
10 REM NEAR LETTER QUALITY PICA PRINTING
20 LPRINT CHR$(27)+"n";
30 LPRINT "NEAR LETTER QUALITY PICA PRINTING"
40 LPRINT CHR$(27)+"4";
50 LPRINT "NEAR LETTER QUALITY PICA (ITALIC) PRINTING"
60 LPRINT CHR$(27)+"5";
70 LPRINT CHR$(27)+"P";
80 LPRINT "DRAFT PICA PRINT"
90 END
```

```
NEAR LETTER QUALITY PICA PRINTING
NEAR LETTER QUALITY PICA (ITALIC) PRINTING
DRAFT PICA PRINT
```

Comments:

- The near letter quality characters are printed with two passes of the print head. Therefore double printing by ESC+G or super/subscript printing by ESC+S+n is ineffective in the near letter quality mode.
- Near letter quality font is also selectable by the print mode selector switch on the top left side of the printer.
- ESC+P and ESC+M and ESC+x+m releases near letter printing and sets printing mode to draft.

NEAR LETTER QUALITY ELITE PITCH MODE:

Sets Elite Pitch printing of each line of data in near letter quality font.

Name: ESC+o

Code: 27,111 DEC 1B,6F HEX

Input Format: LPRINT CHR\$(27)+"o";

Example:

```
10 REM NEAR LETTER QUALITY ELITE PRINTING
20 LPRINT CHR$(27)+"o";
30 LPRINT "NEAR LETTER QUALITY ELITE PRINTING"
40 LPRINT CHR$(27)+"4";
50 LPRINT "NEAR LETTER QUALITY ELITE (ITALIC) PRINTING"
60 LPRINT CHR$(27)+"5";
70 LPRINT CHR$(27)+"M";
80 LPRINT "DRAFT ELITE PRINT"
90 END
```

```
NEAR LETTER QUALITY ELITE PRINTING
NEAR LETTER QUALITY ELITE (ITALIC) PRINTING
DRAFT ELITE PRINT
```

Comment:

- See ESC+n (Page 4-30) comments.

CHARACTER PITCH SELECTION:

Selects one of 4 pitch types directly.

Name: ESC+w+n

Code: 27,119,n DEC 1B,77,n HEX

Input Format: LPRINT CHR\$(27)+"w"+CHR\$(n);

Example:

```
10 REM CHARACTER PITCH SELECTION
20 FOR M=0 TO 1
30 LPRINT CHR$(27);"@";
40 IF M=0 THEN LPRINT CHR$(27)+"P";"(DRAFT)"
50 IF M=1 THEN LPRINT CHR$(27)+"n";"(NLQ)"
60 RESTORE
70 FOR N=0 TO 3
80 LPRINT CHR$(27)+"w"+CHR$(N);
90 READ A
100 LPRINT "THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE ---";A;"CPI."
110 NEXT N
120 NEXT M
130 END
140 DATA 10,12,15,17
```

```
(DRAFT)
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 10 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 12 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 15 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 17 CPI.
(NLQ)
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 10 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 12 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 15 CPI.
THIS IS A CHARACTER PITCH VARIATION PRINTING SAMPLE --- 17 CPI.
```

Comments:

- This command has priority over other character mode commands (ESC+P, ESC+M, SI etc.). Therefore, selected pitch is effective whatever current print mode is.
- When the compressed mode (ESC+w+3) is set, the emphasis mode becomes ineffective.
- This command only changes the character pitch and does not affect Draft or NLQ font modes.
- The value of n decides the pitch as shown below.

n=0, 48, 128, 176	10 CPI
n=1, 49, 129, 177	12 CPI
n=2, 50, 130, 178	15 CPI
n=3, 51, 131, 179	17 CPI
- The example above was purposely reduced in order that all characters could properly be typeset for printing of this manual.

FONT SELECTION:

Selects NLQ or Draft font.

Name:	NLQ Selection:	ESC+x+n	n=1, 49, 129, 177
	Draft Selection:	ESC+x+m	m=0, 48, 128, 176
Code:	NLQ Selection:	27,120,n <small>DEC</small>	1B,78,n <small>HEX</small>
	Draft Selection:	27,120,m <small>DEC</small>	1B,78,m <small>HEX</small>
Input Format:	NLQ Selection:	LPRINT CHR\$(27)+"x"+CHR\$(1);	
	Draft Selection:	LPRINT CHR\$(27)+"x"+CHR\$(0);	

Example:

```
10 REM FONT SELECTION
20 LPRINT CHR$(27)+"x"+CHR$(0);CHR$(15);
30 LPRINT "THIS IS A DRAFT COMPRESSED PRINTING SAMPLE."
40 LPRINT CHR$(27)+"x"+CHR$(1);
50 LPRINT "ESC+x+n COMMAND PRESERVES THE PREVIOUS PRINTING PITCH."
60 END
```

```
THIS IS A DRAFT COMPRESSED PRINTING SAMPLE.
ESC+x+n COMMAND PRESERVES THE PREVIOUS PRINTING PITCH.
```

Comment:

- This selection only decides the font type and the subsequent character printings are executed in the previous printing pitch.

PROPORTIONAL SPACING MODE:

Sets printing of each line of data using proportional spacing between characters.

Name: Setting: ESC+p+n n=1, 49, 129, 177
 Release: ESC+p+m m=0, 48, 128, 176

Code: Setting: 27,112,n DEC 1B,70,n HEX
 Release: 27,112,m DEC 1B,70,m HEX

Input Format: Setting: LPRINT CHR\$(27)+"p"+CHR\$(1);
 Release: LPRINT CHR\$(27)+"p"+CHR\$(0);

Example:

```
10 REM PROPORTIONAL SPACING MODE
20 FOR I=0 TO 1
30 IF I=0 THEN LPRINT CHR$(27)+"P";
40 IF I=1 THEN LPRINT CHR$(27)+"n";
50 FOR J=0 TO 1
60 LPRINT CHR$(27)+"p"+CHR$(J);
70 LPRINT "Draft and NLQ fonts can be printer with";
80 LPRINT "proportional space."
90 LPRINT "When draft is selected, printing is performed in";
100 LPRINT " emphasized mode."
110 NEXT J
120 LPRINT
130 NEXT I
140 END
```

Draft and NLQ fonts can be printer withproportional space.
When draft is selected, printing is performed in emphasized mode.
Draft and NLQ fonts can be printer withproportional space.
When draft is selected, printing is performed in emphasized mode.

Draft and NLQ fonts can be printer withproportional space.
When draft is selected, printing is performed in emphasized mode.
Draft and NLQ fonts can be printer withproportional space.
When draft is selected, printing is performed in emphasized mode.

Comments:

- Draft font and near letter quality font can be printed in proportional spacing mode.
- Draft font and near letter quality font have the same spacing amount, this enables printing of documents in near letter quality mode after proof reading them in draft font.
- In proportional spacing mode, draft font is printed in emphasized mode.
- ESC+p+n is ineffective in elite (12 CPI) mode.
- This command is ineffective when print mode selector switch is at "Comp." position.
- Refer to the following tables for proportional spacing in the draft and NLQ modes.

Standard ASCII Characters

ASCII code	Char.	Width
0	à	12
1	è	12
2	ù	11
3	ò	10
4	ì	8
5	é	8
6	£	12
7	í	5
8	ê	12
9	ñ	12
10	ñ	11
11	ÿ	12
12	Pl	12
13	À	12
14	á	12
15	ç	11
16	§	10
17	ß	11
18	Æ	12
19	æ	12
20	Ø	12
21	ø	12
22	·	8
23	Ä	12
24	Ö	12
25	U	12
26	ä	12
27	ö	10
28	u	11
29	É	12
30	é	12
31	¥	12
32	SPACE	12
33	!	5
34	"	8
35	#	12
36	\$	12
37	%	12
38	&	12
39	·	5
40	(	7
41	)	7
42	x	12
43	†	12
44	,	6
45	—	12
46	.	6
47	/	10
48	0	12
49	1	12
50	2	12
51	3	12
52	4	12
53	5	12
54	6	12
55	7	12
56	8	12
57	9	12
58	:	6
59	:	6
60	<	10
61	=	12
62	>	10
63	?	12

Italic ASCII Characters

ASCII code	Char.	Width
0	à	11
1	è	11
2	ù	11
3	ò	11
4	ì	8
5	é	8
6	£	12
7	í	10
8	ê	11
9	ñ	12
10	ñ	12
11	ÿ	12
12	Pl	12
13	À	12
14	á	11
15	ç	11
16	§	12
17	ß	11
18	Æ	12
19	æ	12
20	Ø	12
21	ø	11
22	·	9
23	Ä	12
24	Ö	12
25	U	12
26	ä	11
27	ö	11
28	ü	12
29	É	12
30	é	11
31	¥	12
32	SPACE	12
33	!	10
34	"	10
35	#	12
36	\$	11
37	%	12
38	&	12
39	·	6
40	(	8
41	)	8
42	x	12
43	+	12
44	,	7
45	—	12
46	.	7
47	/	10
48	0	12
49	1	12
50	2	12
51	3	12
52	4	12
53	5	12
54	6	12
55	7	12
56	8	12
57	9	12
58	:	7
59	:	7
60	<	10
61	=	11
62	>	9
63	?	11

ASCII code	Char.	Width
64	@	12
65	A	12
66	B	12
67	C	12
68	D	12
69	E	12
70	F	12
71	G	12
72	H	12
73	I	10
74	J	12
75	K	12
76	L	10
77	M	12
78	N	12
79	O	12
80	P	12
81	Q	12
82	R	12
83	S	12
84	T	12
85	U	12
86	V	12
87	W	12
88	X	12
89	Y	12
90	Z	12
91	[	11
92	\	7
93	]	11
94	,	10
95	·	12
96	·	5
97	a	11
98	b	11
99	c	11
100	d	12
101	e	11
102	f	12
103	g	11
104	h	11
105	i	9
106	j	10
107	k	11
108	l	9
109	m	11
110	n	10
111	o	11
112	p	11
113	q	11
114	r	10
115	s	11
116	t	10
117	u	11
118	v	10
119	w	13
120	x	12
121	y	12
122	z	12
123	/	10
124	·	9
125	·	10
126	Ø	12
127	Ø	12

Table 4.5 Proportional Spacing : Standard ASCII and Italic ASCII Characters
Unit : 1/120 inch (0.21 mm)

Normal Characters

ASCII code	Char.	Width
3	♥	12
4	♦	12
5	♣	12
6	♠	12
21	§	10
128	Ç	12
129	ü	11
130	é	12
131	â	12
132	ä	12
133	à	12
134	á	12
135	ç	11
136	ê	12
137	ë	12
138	è	12
139	ï	8
140	î	8
141	ï	8
142	Ä	12
143	Å	12
144	É	12
145	æ	12
146	Æ	12
147	ô	10
148	ö	10
149	ò	10
150	ù	11
151	û	11
152	ÿ	11
153	Ö	12
154	Ü	12
155	φ	11
156	£	12
157	¥	12
158	Pt	12
159	f	12
160	á	12
161	í	8
162	ó	10
163	ú	11
164	ñ	11
165	Ñ	12
166	ä	12
167	ö	12
168	¿	12
169	¡	12
170	¬	12
171	½	12
172	¼	12
173	í	5
174	«	12
175	»	12
224	α	12
225	β	12
226	Γ	12
227	π	12
228	Σ	12
229	σ	12
230	μ	12
231	γ	12
232	Φ	12
233	θ	12
234	Ω	12
235	δ	12
236	∞	12
237	φ	12
238	ε	12
239	∩	12

Italic Characters

ASCII code	Char.	Width
240	≡	12
241	±	12
242	≥	12
243	≤	12
246	∓	12
247	≈	12
248	°	8
249	■	12
250	●	12
251	√	12
252	n	8
253	2	8
254	■	12
255	SP	12

ASCII code	Char.	Width
3	♥	12
4	♦	12
5	♣	12
6	♠	12
21	§	12
128	Ç	12
129	ü	12
130	é	11
131	â	11
132	ä	11
133	à	11
134	á	11
135	ç	11
136	ê	11
137	ë	11
138	è	11
139	ï	8
140	î	10
141	ï	8
142	Ä	12
143	Å	12
144	É	12
145	æ	12
146	Æ	12
147	ô	11
148	ö	11
149	ò	11
150	ù	11
151	û	11
152	ÿ	11
153	Ö	12
154	Ü	12
155	φ	11
156	£	12
157	¥	12
158	Pt	12
159	f	12
160	á	11
161	í	8
162	ó	11
163	ú	11
164	ñ	12
165	Ñ	12
166	ä	12
167	ö	12
168	¿	11
169	¡	12
170	¬	12
171	½	12
172	¼	12
173	í	10
174	«	12
175	»	12
224	α	12
225	β	12
226	Γ	12
227	π	12
228	Σ	12
229	σ	12
230	μ	12
231	γ	12
232	Φ	12
233	θ	12
234	Ω	12
235	δ	12
236	∞	12
237	φ	12
238	ε	12
239	∩	12

ASCII code	Char.	Width
240	≡	12
241	±	12
242	≥	12
243	≤	12
246	∓	12
247	≈	12
248	°	8
249	■	12
250	●	12
251	√	12
252	n	8
253	2	8
254	■	12
255	SP	12

Table 4.6 Proportional Spacing : IBM Graphics Characters
Unit : 1/120 inch (0.21 mm)

Word Processing commands

This printer has the following 4 types of word processing commands.
Following commands are effective in Draft and NLQ mode.

Command	Function
ESC + a + 0	Left alignment
ESC + a + 1	Auto centering
ESC + a + 2	Right alignment
ESC + a + 3	Auto justification

Table 4.7 Word Processing Commands

LEFT ALIGNMENT:

Enables left alignment of a print line at left margin.

Name: ESC+a+0

Code: 27,97,0 DEC 1B,61,00 HEX

Input Format: LPRINT CHR\$(27)+"a"+CHR\$(0);

Example: (See RIGHT ALIGNMENT)

Comments:

- This command clears the modes ESC+a+1, ESC+a+2 and ESC+a+3 .
- In the default status, printer is set to this mode.
- 48, 128 and 176 can also be used instead of 0.

AUTO CENTERING:

Enables automatic centering of a print line between left and right margins.

Name: ESC+a+1

Code: 27,97,1 DEC 1B,61,01 HEX

Input Format: LPRINT CHR\$(27)+"a"+CHR\$(1);

Example: (See RIGHT ALIGNMENT)

Comment:

- 49, 129 and 177 can also be used instead of 1.

RIGHT ALIGNMENT:

Enables right alignment of a print line at right margin.

Name: ESC+a+2

Code: 27,97,2 DEC 1B,61,02 HEX

Input Format: LPRINT CHR\$(27)+"a"+CHR\$(2);

Example:

```
10 REM AUTO CENTERING , RIGHT ALIGNMENT , LEFT ALIGNMENT
20 LPRINT CHR$(27)+"Q"+CHR$(40);
30 FOR I=1 TO 4:LPRINT "1234567890";:NEXT I
40 LPRINT
50 LPRINT CHR$(27)+"a"+CHR$(1);
60 LPRINT "AUTO CENTERING"
70 LPRINT "THIS IS A SAMPLE TEXT."
80 LPRINT CHR$(27)+"a"+CHR$(2);
90 LPRINT "RIGHT ALIGNMENT"
100 LPRINT "THIS IS A SAMPLE TEXT."
110 LPRINT CHR$(27)+"a"+CHR$(0);
120 LPRINT "LEFT ALIGNMENT"
130 LPRINT "THIS IS A SAMPLE TEXT."
140 END
```

```
1234567890123456789012345678901234567890
      AUTO CENTERING
        THIS IS A SAMPLE TEXT.
              RIGHT ALIGNMENT
                THIS IS A SAMPLE TEXT.
LEFT ALIGNMENT
THIS IS A SAMPLE TEXT.
```

Comments:

- 50, 130 and 178 can also be used instead of 2.
- Above example program can be executed only in Standard mode because IBM Printer modes have no ESC+Q command.

AUTO JUSTIFICATION:

Enables automatic justification of a print line between left and right margins.

Name: ESC+a+3

Code: 27,97,3 DEC 1B,61,03 HEX

Input Format: LPRINT CHR\$(27)+"a"+CHR\$(3);

Example:

```
10 REM AUTO JUSTIFICATION
20 LPRINT CHR$(27)+"a"+CHR$(3);
30 LPRINT CHR$(27)+"Q"+CHR$(38);
40 FOR I=0 TO 2
50 IF I=0 THEN LPRINT CHR$(27)+"F"; "(DRAFT)"
60 IF I=1 THEN LPRINT CHR$(27)+"n"; "(NLQ)"
70 IF I=2 THEN LPRINT CHR$(27)+"p"+CHR$(1); "(NLQ-PROPORTIONAL SPACING)"
80 LPRINT "A SAMPLE TEXT FOR AUTO JUSTIFICATION"
90 LPRINT "THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG"
100 LPRINT "This printer has versatile features for WORD PROCESSING."
110 LPRINT CHR$(10);
120 NEXT I
130 END
```

(DRAFT)

A SAMPLE TEXT FOR AUTO JUSTIFICATION
THE QUICK BROWN FOX JUMPED OVER THE LAZY
DOG
This printer has versatile features for
WORD PROCESSING.

(NLQ)

A SAMPLE TEXT FOR AUTO JUSTIFICATION
THE QUICK BROWN FOX JUMPED OVER THE LAZY
DOG
This printer has versatile features for
WORD PROCESSING.

(NLQ-PROPORTIONAL SPACING)

A SAMPLE TEXT FOR AUTO JUSTIFICATION
THE QUICK BROWN FOX JUMPED OVER THE LAZY
DOG
This printer has versatile features for
WORD PROCESSING.

Comments:

- This command is effective in all printing modes.
- Printing is executed upon receipt of print execution commands (CR, LF, FF, etc.).
- BS and DEL are ineffective in auto justification mode.
- When the last character of a line is a period (.), auto justification is not executed.
- Auto justification is executed when data exceeds right margin and upon receipt of print execution commands (CR, LF, FF, etc.).
- Too small or too large number of characters may not be justified.
- 51, 131 and 179 can also be used instead of 3.
- Above example program can be executed only in Standard mode because IBM Printer modes have no ESC+Q command.

Bit image (Graphics) mode commands

The bit image (graphics) mode enables you to control the firing of eight pins of the print head to create virtually any graphics design you desire.

Dot density (dot resolution) refers to the maximum number of dots which can be printed on a given line. This printer enables you to access a variety of dot densities through specific control commands. The various dot densities and corresponding control commands appear in Table 4.8.

Command	Function	Dot Density (Dot/inch)
ESC+K+n ₁ +n ₂	Standard density designation	60
ESC+L+n ₁ +n ₂	Double density designation	120
ESC+Y+n ₁ +n ₂	Double speed, double density designation	120
ESC+Z+n ₁ +n ₂	Quadruple density designation	240
ESC+*+m+n ₁ +n ₂	8-Pin Mode Selection: m=0 (Standard) m=1 (Double) m=2 (Double speed, double density) m=3 (Quadruple density) m=4 m=5 m=6	60 120 120 240 80 72 90
ESC+^+m+n ₁ +n ₂	9-Pin Mode Selection: m=0 (Standard) m=1 (Double) m=2 (Double speed, double density) m=3 (Quadruple density) m=4 m=5 m=6	60 120 120 240 80 72 90
ESC+?+n+m	Bit Image Mode Assignment: n="K", "L", "Y", "Z" m=0 (Standard) m=1 (Double) m=2 (Double speed, double density) m=3 (Quadruple density) m=4 m=5 m=6	60 120 120 240 80 72 90

Table 4.8 Dot Resolution

As you can see, each graphics control command uses two bytes, n₁, and n₂, for the designation of the actual number of dots you want to print on a line. The data entered in your program must match this dot specification; if not, in all likelihood your graphics data will contain strange characters.

Determining the values of n₁ and n₂ can be accomplished in the following way. Assume that you want to print N dots on a line, where N is within the proper dot density range. Then the outcome of the division below yields the values n₁ and n₂.

$$\begin{array}{r}
 n_2 \\
 256 \overline{) N} \\
 \underline{-256 \times n_2} \\
 n_1
 \end{array}$$

That is, n_2 is the integer quotient and n_1 is the remainder. For those users with a BASIC programming background, $n_2 = \text{INT}(N/256)$ and $n_1 = N - (256 * n_2)$.

As an example, suppose we want to print 967 dots per line. Then:

$$\begin{array}{r} 3 \\ 256 \overline{) 967} \\ \underline{768} \\ 199 \end{array} \quad , \text{ so } n_2 = 3 \text{ and } n_1 = 199$$

8-Pin Bit Image Mode

Of the 9 pins in the print head, the 8-pin bit image graphics mode uses the upper eight pins only. Each pin corresponds to a power of two. By summing the powers of two corresponding to each of the pins you wish to fire, you will obtain a numerical value which instructs the printer to print one column of dots. Through such techniques in BASIC as looping, numerical values for each column on a line are input and processed. The result is one line of graphics.

Pin No.	Pins	8-Bit Interface	7-Bit Interface
1	•	$2^7 = 128$	Not used
2	•	$2^6 = 64$	$2^6 = 64$
3	•	$2^5 = 32$	$2^5 = 32$
4	•	$2^4 = 16$	$2^4 = 16$
5	•	$2^3 = 8$	$2^3 = 8$
6	•	$2^2 = 4$	$2^2 = 4$
7	•	$2^1 = 2$	$2^1 = 2$
8	•	$2^0 = 1$	$2^0 = 1$
9	•	Not used	Not used

As an example, suppose you want to fire pins 1, 2, 5, and 8 simultaneously. Then you compute the following sum:

$$\begin{aligned} \text{Input Code} &= \text{Pin 1 Code} + \text{Pin 2 Code} + \text{Pin 5 Code} + \text{Pin 8 Code} \\ &= 2^7 + 2^6 + 2^3 + 2^0 \\ &= 128 + 64 + 8 + 1 \\ &= 201 \end{aligned}$$

Thus, the value 201 is entered in the CHR\$ function in order to print a single column of dots resulting from firing pins 1, 2, 5, and 8.

For our final example, refer to the standard density designation in Table 4.8. This setting is given by ESC+K+ n_1 + n_2 . Suppose you wish to print 100 columns of dots, where every column fires pins 1 and 8 only.

You first compute the values of n_1 and n_2 .

$$\begin{array}{r} 0 \\ 256 \overline{) 100} \\ \underline{0} \\ 100 \end{array} \quad , \text{ so } n_2 = 0 \text{ and } n_1 = 100$$

Our control code ESC+K+n₁+n₂ now translates into:

```
LPRINT CHR$(27)+"K"+CHR$(100)+CHR$(0);
```

Next compute the code for firing pins 1 and 8 simultaneously;

```
Input Code=Pin 1 Code+Pin 8 Code
           =27 + 20
           =128 + 1
           =129
```

Finally, we incorporate our two calculations into the following program.

```
10 REM STANDARD DENSITY
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT#1,CHR$(27)+"K"+CHR$(100)+CHR$(0);
50 FOR I=1 TO 100
60 PRINT#1,CHR$(129);
70 NEXT I
80 PRINT#1,CHR$(10);
90 END
```

9-Pin Bit Image Mode

In the 9-pin bit image mode, all 9 pins of the print head may be fired. The 9 pins in the print head are divided into two portions, the upper 8 pins and the bottom pin.

As in the 8-pin mode, the upper 8 pins correspond to powers of two, ranging from 2⁰ to 2⁷. The firing of one or more of these 8 pins represents 1 byte of data. The 9th (bottom-most) pin represents an additional byte of data. When fired, it is represented by the value 2⁷. When not fired, it is represented by the value 0. Together, these two bytes determine the dot configuration for a single column of graphics.

Pin No.	Pins	Power of 2	Byte
1	•	2 ⁷ =128	1
2	•	2 ⁶ =64	
3	•	2 ⁵ =32	
4	•	2 ⁴ =16	
5	•	2 ³ =8	
6	•	2 ² =4	
7	•	2 ¹ =2	
8	•	2 ⁰ =1	
9	•	2 ⁷ =128	2
		NOT USED	

As an example, suppose you want to fill pins 1, 2, 5, 8 and 9 simultaneously. Then you determine the following two values:

Byte 1: Input Code =Pin 1 Code+Pin 2 Code+Pin 5 Code+Pin 8 Code
 $=2^7+2^6+2^3+2^0$
 $=128+64+8+1$
 $=201$

Byte 2: Input Code $=2^7$
 $=128$

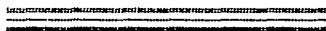
Thus, the two bytes for a single column of dots are entered as:
 CHR\$(201); CHR\$(128);

Refer to the 9-pin standard density designation in Table 4.8. This setting is given by ESC+ \wedge +m+n₁+n₂, where m=0. Suppose you wish to print 100 columns of dots, where every column fires pins 1, 2, 5, 8 and 9 as above.

As in the 8-pin example on page 4-41, n₁=100 and n₂=0. Our control code ESC+ \wedge +m+n₁+n₂ now translates into:
 LPRINT CHR\$(27)+"^"+CHR\$(0)+CHR\$(100)+CHR\$(0);

If we incorporate this information into a program, we might have the following:

```
10 REM 9-PIN STANDARD DENSITY
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT#1,CHR$(27)+"^"+CHR$(0)+CHR$(100)+CHR$(0);
50 FOR I=1 TO 100
60 PRINT#1,CHR$(201)+CHR$(128);
70 NEXT I
80 PRINT#1,CHR$(10);
90 END
```



Before proceeding with examples of each graphics control command, three important points are worth noting.

First, bit image graphics is automatically set to single direction (left to right) printing. This is done to ensure that dots are correctly aligned vertically.

Second, the graphics mode is released immediately following the printing of all bit image data. Printing will return to the text mode.

Third, any bit image data are not affected by MSB control commands.

STANDARD DENSITY GRAPHICS:

Sets standard density graphics mode (480 dots per line/60 dots per inch).

Name: ESC+K+n₁+n₂

Code: 27,75,n₁,n₂ DEC 1B,4B,n₁,n₂ HEX

Input Format: LPRINT CHR\$(27)+"K"+CHR\$(n₁)+CHR\$(n₂);

Example:

```
10 REM STANDARD DENSITY GRAPHICS
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"STANDARD DENSITY GRAPHICS";CHR$(10);
50 PRINT #1,CHR$(27)+"K"+CHR$(64)+CHR$(1);
60 FOR I=1 TO 20
70 PRINT #1,CHR$(1)+CHR$(1)+CHR$(3)+CHR$(3);
80 PRINT #1,CHR$(7)+CHR$(7)+CHR$(15)+CHR$(15);
90 PRINT #1,CHR$(31)+CHR$(31)+CHR$(63)+CHR$(63);
100 PRINT #1,CHR$(127)+CHR$(127)+CHR$(255)+CHR$(255);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

STANDARD DENSITY GRAPHICS



Comment:

- Print speed is set to 12 inches per second.

DOUBLE DENSITY GRAPHICS:

Sets double density graphics mode (960 dots per line/120 dots per inch).

Name: ESC+L+n₁+n₂

Code: 27,76,n₁,n₂ DEC 1B,4C,n₁,n₂ HEX

Input Format: LPRINT CHR\$(27)+"L"+CHR\$(n₁)+CHR\$(n₂);

Example:

```
10 REM DOUBLE DENSITY GRAPHICS
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"DOUBLE DENSITY GRAPHICS";CHR$(10);
50 PRINT #1,CHR$(27)+"L"+CHR$(144)+CHR$(1);
60 FOR I=1 TO 25
70 PRINT #1,CHR$(1)+CHR$(1)+CHR$(3)+CHR$(3);
80 PRINT #1,CHR$(7)+CHR$(7)+CHR$(15)+CHR$(15);
90 PRINT #1,CHR$(31)+CHR$(31)+CHR$(63)+CHR$(63);
100 PRINT #1,CHR$(127)+CHR$(127)+CHR$(255)+CHR$(255);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

DOUBLE DENSITY GRAPHICS



Comment:

- Print speed is set to 6 inches per second.

Sets double speed, double density graphics mode (960 dots per line/120 dots per inch).

Input Format: LPRINT CHR\$(27)+"Y"+CHR\$(n₁)+CHR\$(n₂);

```
Example: 10 REM DOUBLE SPEED DOUBLE DENSITY GRAPHICS
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"DOUBLE SPEED DOUBLE DENSITY GRAPHICS";CHR$(10);
50 PRINT #1,CHR$(27)+"Y"+CHR$(144)+CHR$(1);
60 FOR I=1 TO 25
70 PRINT #1,CHR$(1)+CHR$(1)+CHR$(3)+CHR$(3);
80 PRINT #1,CHR$(7)+CHR$(7)+CHR$(15)+CHR$(15);
90 PRINT #1,CHR$(31)+CHR$(31)+CHR$(63)+CHR$(63);
100 PRINT #1,CHR$(127)+CHR$(127)+CHR$(255)+CHR$(255);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

DOUBLE SPEED DOUBLE DENSITY GRAPHICS

Comments:

- Print speed is set to 12 inches per second.
- Horizontally adjacent dots cannot be printed.

Sets quadruple density graphics mode (1920 dots per line/240 dots per inch).

Code: 27,90,n₁,n₂ DEC 1B,5A,n₁,n₂ HEX

Input Format: LPRINT CHR\$(27)+"Z"+CHR\$(n₁)+CHR\$(n₂);

```
Example: 10 REM QUADRUPLE DENSITY GRAPHICS
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"QUADRUPLE DENSITY GRAPHICS";CHR$(10);
50 PRINT #1,CHR$(27)+"Z"+CHR$(144)+CHR$(1);
60 FOR I=1 TO 25
70 PRINT #1,CHR$(1)+CHR$(1)+CHR$(3)+CHR$(3);
80 PRINT #1,CHR$(7)+CHR$(7)+CHR$(15)+CHR$(15);
90 PRINT #1,CHR$(31)+CHR$(31)+CHR$(63)+CHR$(63);
100 PRINT #1,CHR$(127)+CHR$(127)+CHR$(255)+CHR$(255);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

QUADRUPLE DENSITY GRAPHICS
■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■

Comments:

- Print speed is set to 6 inches per second.
- Horizontally adjacent dots cannot be printed.

Selects one of seven 8-pin bit image graphics modes.

Input Format: LPRINT CHR\$(27)+"*" + CHR\$(m) + CHR\$(n₁) + CHR\$(n₂);

```

Example: 10 REM BIT IMAGE MODE SELECTION
          20 WIDTH "LPT1:",255
          30 OPEN "LPT1:" AS #1
          40 FOR M=0 TO 6
          50     PRINT #1,"IMAGE MODE =" ;M;CHR$(10);
          60     PRINT #1,CHR$(27);"*";CHR$(M);CHR$(200);CHR$(0);
          70     FOR I=1 TO 25
          80         PRINT #1,STRING$(4,CHR$(15));
          90         PRINT #1,STRING$(4,CHR$(240));
          100    NEXT I
          110    PRINT #1,CHR$(10);
          120 NEXT M
          130 PRINT #1,CHR$(10);
          140 END

```

```
IMAGE MODE = 0  
#####  
IMAGE MODE = 1  
#####  
IMAGE MODE = 2  
#####  
IMAGE MODE = 3  
#####  
IMAGE MODE = 4  
#####  
IMAGE MODE = 5  
#####  
IMAGE MODE = 6  
#####
```

Comment:

- Table 4.9 illustrates the various modes based upon the values on m .

Value of m	Mode	Dot Density	Printing Speed
0	Standard density	480 dpl/60 dpi	12 inches/sec
1	Double density	960 dpl/120 dpi	6 inches/sec
2	Double speed, double density	960 dpl/120 dpi	12 inches/sec
3	Quadruple density	1920 dpl/240 dpi	6 inches/sec
4	640 dot density	640 dpl/80 dpi	9 inches/sec
5	576 dot density	576 dpl/72 dpi	10 inches/sec
6	720 dot density	720 dpl/90 dpi	7.89 inches/sec

Table 4.9 Dot Density/Printing Speed

- Both the vertical and horizontal dot pitch in the 576 dot density mode equal 1/72 inch, thereby producing a 1:1 aspect ratio.
- The following settings are equivalent:
 - ESC+K+n₁+n₂ and ESC+*+0+n₁+n₂
 - ESC+L+n₁+n₂ and ESC+*+1+n₁+n₂
 - ESC+Y+n₁+n₂ and ESC+*+2+n₁+n₂
 - ESC+Z+n₁+n₂ and ESC+*+3+n₁+n₂

9-PIN BIT IMAGE MODE SELECTION:

Selects one of seven 9-pin bit image graphics modes.

Name: ESC+^+m+n₁+n₂ 0≤m≤6

Code: 27,94,m,n₁,n₂ DEC 1B,5E,m,n₁,n₂ HEX

Input Format: LPRINT CHR\$(27)+"^"+CHR\$(m)+CHR\$(n₁)+CHR\$(n₂);

Example:

```
10 REM 9-PIN BIT IMAGE MODE
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 FOR M=0 TO 6
50   PRINT #1,"IMAGE MODE =";M;CHR$(10);
60   PRINT #1,CHR$(27)+"^"+CHR$(M)+CHR$(180)+CHR$(0);
70   FOR I=1 TO 10
80     PRINT #1,CHR$(0)+CHR$(128)+CHR$(0)+CHR$(128);
90     PRINT #1,CHR$(1)+CHR$(128)+CHR$(1)+CHR$(128);
100    PRINT #1,CHR$(3)+CHR$(128)+CHR$(3)+CHR$(128);
110    PRINT #1,CHR$(7)+CHR$(128)+CHR$(7)+CHR$(128);
120    PRINT #1,CHR$(15)+CHR$(128)+CHR$(15)+CHR$(128);
130    PRINT #1,CHR$(31)+CHR$(128)+CHR$(31)+CHR$(128);
140    PRINT #1,CHR$(63)+CHR$(128)+CHR$(63)+CHR$(128);
150    PRINT #1,CHR$(127)+CHR$(128)+CHR$(127)+CHR$(128);
160    PRINT #1,CHR$(255)+CHR$(128)+CHR$(255)+CHR$(128);
170   NEXT I
180   PRINT #1,CHR$(10);
190 NEXT M
200 PRINT #1,CHR$(10);
210 END
```

IMAGE MODE = 0



IMAGE MODE = 1



IMAGE MODE = 2



IMAGE MODE = 3



IMAGE MODE = 4



IMAGE MODE = 5



IMAGE MODE = 6



BIT IMAGE DENSITY ASSIGNMENT:

Assigns bit image density of ESC+K, L, Y, Z.

Name: ESC+? n + m
 $n=75$ ("K"), 76 ("L"), 89 ("Y"), or 90 ("Z") (n corresponds to K, L, Y or Z in Bit Image Mode.)
 $0 \leq m \leq 6$

Code: 27,63, n , m DEC 1B,3F, n , m HEX

Input Format: LPRINT CHR\$(27)+"?"+CHR\$(n)+CHR\$(m);

Example:

```
10 REM BIT IMAGE ASSIGN
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 FOR L=1 TO 2
50   IF L=1 THEN PRINT #1,"ESC+K (STANDARD DENSITY GRAPHICS)";CHR$(10);
60   IF L=2 THEN PRINT #1,"ESC+K (QUADRUPLE DENSITY GRAPHICS)";CHR$(10);
70   IF L=2 THEN PRINT #1,CHR$(27);"?";"K";CHR$(3);
80   PRINT #1,CHR$(27);"K";CHR$(64);CHR$(1);
90   FOR I=1 TO 20
100    PRINT #1,CHR$(1);CHR$(1);CHR$(3);CHR$(3);
110    PRINT #1,CHR$(7);CHR$(7);CHR$(15);CHR$(15);
120    PRINT #1,CHR$(31);CHR$(31);CHR$(63);CHR$(63);
130    PRINT #1,CHR$(127);CHR$(127);CHR$(255);CHR$(255);
140   NEXT I
150   PRINT #1,CHR$(10);
160 NEXT L
170 END
```

ESC+K (STANDARD DENSITY GRAPHICS)



ESC+K (QUADRUPLE DENSITY GRAPHICS)



Comments:

- The user is free to change the density assignment of the bit image mode command.
- The example above was purposely reduced in order that all characters could properly be typeset for printing of this manual.

Line spacing commands

Line spacing commands enable you to set a variety of line pitch sizes.

Settings for page length, VT positions, and skip perforation remain as initially set even if line spacing is changed.

Table 4.10 below lists the various control commands for line spacing.

Line Pitch Size	Standard Mode	IBM Matrix/Graphics Mode
$\frac{1}{8}$ " (3.2 mm) $\frac{7}{72}$ " (2.47 mm) $\frac{1}{6}$ " (4.2 mm) $\frac{n}{72}$ " $\frac{n}{216}$ " $\frac{n}{216}$ " (Single line only)	ESC+0 ESC+1 ESC+2 ESC+A+n ESC+3+n ESC+J+n	ESC+0 ESC+1 ¹ ESC+A+12, ESC+2 ² ESC+A+n, ESC+2 ESC+3+n ESC+J+n ¹ If not set, default line spacing is $\frac{1}{6}$ " (4.2 mm). ² ESC+A+n must be followed by ESC+2.

Table 4.10 Line Spacing Commands

1/8 INCH LINE SPACING:

Sets line spacing to 1/8 inch.

Name: ESC+0

Code: 27,48 DEC 1B,30 HEX

Input Format: LPRINT CHR\$(27)+"0";

Example:

```

10 REM LINE SPACING = 1/8 INCH
20 LPRINT "LINE SPACING = 1/8 INCH"
30 LPRINT CHR$(27)+"0";
40 FOR I=1 TO 4
50 LPRINT "-----"
60 NEXT I
70 END

```

LINE SPACING = 1/8 INCH

Comment:

- ESC+0 sets $\frac{1}{8}$ inch (3.2 mm) paper feed in all printer modes.

7/72 INCH LINE SPACING:

Sets line spacing to 7/72 inch.

Name: ESC+1

Code: 27,49 DEC 1B,31 HEX

Input Format: LPRINT CHR\$(27)+"1";

Example:

```
10 REM LINE SPACING = 7/72 INCH
20 LPRINT "LINE SPACING = 7/72 INCH"
30 LPRINT CHR$(27)+"1";
40 FOR I=1 TO 4
50 LPRINT " _____ "
60 NEXT I
70 END
```

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

```
_____
_____
_____
_____
```

Comment:

- ESC+1 sets $\frac{7}{72}$ inch (2.47 mm) line spacing in all printer modes.

1/6 INCH LINE SPACING:

Sets line spacing to 1/6 inch.

Name: ESC+2

Code: 27,50 DEC 1B,32 HEX

Input Format: LPRINT CHR\$(27)+"2";

Example:

```
10 REM LINE SPACING = 1/6 INCH
20 LPRINT "LINE SPACING = 1/6 INCH"
30 LPRINT CHR$(27)+"2";
40 FOR I=1 TO 4
50 LPRINT " _____ "
60 NEXT I
70 END
```

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

```
_____
_____
_____
_____
```

Comment:

- ESC+2 sets $\frac{1}{6}$ inch (4.2 mm) line spacing in Standard Printer Mode only. Use ESC+A+n, n=12, to set $\frac{1}{6}$ inch (4.2 mm) line spacing and use ESC+2 to activate the ESC+A+n setting in the IBM Matrix/Graphics printer mode. The IBM mode defaults to $\frac{1}{6}$ inch (4.2 mm).

Sets programmable line spacing to $n/72$ inch.

Input Format: LPRINT CHR\$(27)+"A"+CHR\$(n);

```
Example: 10 REM LINE SPACING = n/72 INCH
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"LINE SPACING = n/72 INCH";CHR$(10);
50 FOR I=1 TO 20
60     PRINT #1,CHR$(27);"A";CHR$(I);
70     PRINT #1,"-----";CHR$(10);
80 NEXT I
90 END
```

LINE SPACING = $n/72$ INCH

[illegible]

- In the IBM Matrix/Graphics Printer Mode only, ESC+2 must be input after ESC+A+n for n/72 inch line spacing to become effective.
- n/72 inch line spacing is valid for $0 \leq n \leq 85$.

Sets programmable line spacing to $n/216$ inch.

Input Format: LPRINT CHR\$(27)+"3"+CHR\$(n);

```
Example: 10 REM LINE SPACING = n/216 INCH
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT#1,"LINE SPACING = n/216 INCH";CHR$(10);
50 FOR I=1 TO 20
60 PRINT#1,CHR$(27)+"3"+CHR$(I);
70 PRINT#1,"-----";CHR$(10);
80 NEXT I
90 END
```

LINE SPACING = n/216 INCH

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099
1990	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099

Comments:

- $n/216$ inch line spacing is valid for $0 \leq n \leq 255$.
- ESC+3+n sets $n/216$ programmable line spacing in all printer modes.

n/216 INCH SINGLE LINE SPACING:

Prints out the data in print buffer, and spaces n/216 inch.

Name: ESC+J+n

Code: 27,74,n DEC 1B,4A,n HEX

Input Format: LPRINT CHR\$(27)+"J"+CHR\$(n);

Example:

```
10 REM SINGLE LINE SPACING
20 LPRINT "      SINGLE LINE SPACING";
30 LPRINT CHR$(27)+"J"+CHR$(108);
40 LPRINT "OF ONE-HALF INCH"
50 FOR I=1 TO 3
60 LPRINT "NORMAL LINE SPACING"
70 NEXT I
80 END
```

SINGLE LINE SPACING

OF ONE-HALF INCH

NORMAL LINE SPACING
NORMAL LINE SPACING
NORMAL LINE SPACING

Comments:

- Single line, n/216 line spacing is valid for $0 \leq n \leq 255$.
- This command sets the line spacing for ONE line only. Subsequent line spacing returns to previous setting. However, the carriage does not return to the left margin position. Instead, printing of next line begins where previous printing left off.
- This command does not release one line double width mode (by SO or ESC+SO).
- ESC+J+n sets single-line $n/216$ line spacing in all printer mode.

Paper feed commands

Single line paper feeding, full page paper feeding, and skip perforation are all classified as paper feed commands. Single line paper feed (LF) and full page paper feed (FF) were discussed in Section 4.7, Single-Byte Control Codes.

SKIP PERFORATION:

Sets skip-over perforation.

Name: Setting: ESC+N+n
Release: ESC+O

Code: Setting 27,78,n DEC 1B,4E,n HEX
Release: 27,79 DEC 1B,4F HEX

Input Format: Setting: LPRINT CHR\$(27)+"N"+CHR\$(n);
Release: LPRINT CHR\$(27)+"O";

Example:

```
10 REM SKIP PERFORATION
20 LPRINT CHR$(27)+"C"+CHR$(6);
30 LPRINT CHR$(27)+"N"+CHR$(3);
40 FOR I=1 TO 3
50 LPRINT "SEE IF SKIP TAKES PLACE";I
60 NEXT I
70 LPRINT CHR$(27)+"O";
80 FOR I=4 TO 10
90 LPRINT "SEE IF SKIP TAKES PLACE";I
100 NEXT I
110 END
```

```
SEE IF SKIP TAKES PLACE 1
SEE IF SKIP TAKES PLACE 2
SEE IF SKIP TAKES PLACE 3
```

```
SEE IF SKIP TAKES PLACE 4
SEE IF SKIP TAKES PLACE 5
SEE IF SKIP TAKES PLACE 6
SEE IF SKIP TAKES PLACE 7
SEE IF SKIP TAKES PLACE 8
SEE IF SKIP TAKES PLACE 9
SEE IF SKIP TAKES PLACE 10
```

Comments:

- The value of n specifies the number of lines (or n times the current line spacing amount) to be skipped at the bottom of the form.
- This command is effective only for $1 \leq n \leq 127$. If $n \geq 128$, the value is processed as $n-128$.
- The skip perforation amount does not change even if the line spacing amount is changed following a skip perforation designation.
- The skip perforation setting is released upon receipt of the page length designation command. If DIP switch 4 is set to ON, the skip perforation amount is set to 1 inch. If DIP switch 4 is set to OFF, skip perforation is not executed unless specified with ESC+N+n.

Page format commands

Page format commands refer to the setting of the following: horizontal tabulation, vertical tabulation, page length in lines, page length in inches, left and right margins; and horizontal and vertical spacing.

HORIZONTAL TAB:

Sets horizontal tabulation to specified values.

Name: Setting: ESC+D+n₁+n₂+...+n_x+0
Release: ESC+D+0

Code: Setting 27,68,n₁,n₂,...,n_x,0 DEC 1B,44,n₁,n₂,...,n_x,00 HEX
Release: 27,68,0 DEC 1B,44,00 HEX

Input Format: Setting: LPRINT CHR\$(27)+"D"+CHR\$(n₁)+CHR\$(n₂)+...+CHR\$(n_x)+CHR\$(0);
Release: LPRINT CHR\$(27)+"D"+CHR\$(0);

Example:

```
10 REM HT SETTING
20 LPRINT "HT SETTING"
30 FOR I=1 TO 5
40 LPRINT "0123456789";
50 NEXT I
60 LPRINT CHR$(10);
70 LPRINT CHR$(27)+"D";
80 LPRINT CHR$(1)+CHR$(8)+CHR$(20)+CHR$(30)+CHR$(45)+CHR$(0);
90 FOR I=1 TO 5
100 LPRINT CHR$(9); "HT"; CHR$(48+I);
110 NEXT I
120 LPRINT CHR$(10);
130 LPRINT "HT RELEASE"
140 LPRINT CHR$(27)+"D"+CHR$(0);
150 FOR I=1 TO 5
160 LPRINT CHR$(9); "HT"; CHR$(48+I);
170 NEXT I
180 LPRINT CHR$(10);
190 END
```

```
HT SETTING
01234567890123456789012345678901234567890123456789
HT1 HT2 HT3 HT4 HT5
HT RELEASE
HT1HT2HT3HT4HT5
```

Comments:

- HT is set from the left margin position (column number 0).
- Horizontal tabs must be designated such that n₁<n₂<...<n_x.
- A maximum of 32 tabs may be set on a single line.
- The HT single-byte control command, LPRINT CHR\$(9), is used to execute the HT designation.
- Horizontal tab positions do not change even if the character pitch is altered after the HT designation.
- In the proportional spacing mode, horizontal tabulation is set in the pica pitch.
- When the left margin is changed, the new left margin becomes the start position of the horizontal tab.

HORIZONTAL TAB UNIT:

Sets horizontal tabulation every "n" positions, beginning at the left margin.

Name: ESC+e+0+n

Code: 27,101,0,n DEC 1B,65,00,n HEX

Input Format: LPRINT CHR\$(27)+"e"+CHR\$(0)+CHR\$(n);

Example:

```
10 REM HT UNIT SETTING
20 FOR I=1 TO 5
30 LPRINT "0123456789";
40 NEXT I
50 LPRINT CHR$(10);
60 LPRINT CHR$(27)+"e"+CHR$(0)+CHR$(8);
70 LPRINT CHR$(9);"TAB";
80 LPRINT CHR$(9);CHR$(9);"TAB";
90 LPRINT CHR$(9);CHR$(9);CHR$(9);"TAB"
100 END
```

```
01234567890123456789012345678901234567890123456789
          TAB          TAB          TAB
```

Comments:

- The HT unit setting is released when n=0 (ESC+e+0+0).
- HT is set every 8 columns in the default status.

VERTICAL TAB:

Sets vertical tabulation to specified values.

Name: Setting: ESC+B+n₁+n₂+...+n_x+0
Release: ESC+B+0

Code: Setting 27,66,n₁,n₂,...,n_x,0 DEC 1B,42,n₁,n₂,...,n_x,00 HEX
Release: 27,66,0 DEC 1B,42,00 HEX

Input Format: Setting: LPRINT CHR\$(27)+"B"+CHR\$(n₁)+CHR\$(n₂)+...+CHR\$(n_x)+CHR\$(0);
Release: LPRINT CHR\$(27)+"B"+CHR\$(0);

Example:

```
10 REM VT SETTING
20 LPRINT "THIS PAGE IS 10 LINES LONG"
30 LPRINT CHR$(27)+"C"+CHR$(10);
40 LPRINT CHR$(27)+"B"+CHR$(3)+CHR$(7)+CHR$(0);
50 LPRINT "1ST LINE";CHR$(11);
60 LPRINT "3RD LINE";CHR$(11);
70 LPRINT "7TH LINE";CHR$(12);
80 LPRINT CHR$(27)+"B"+CHR$(0);
90 LPRINT "1ST LINE";CHR$(11);
100 LPRINT "3RD LINE";CHR$(11);
110 LPRINT "7TH LINE"
120 END
```

THIS PAGE IS 10 LINES LONG
1ST LINE

3RD LINE

7TH LINE

1ST LINE
3RD LINE
7TH LINE

Comments:

- VT is set from the top of form position.
- Vertical tabs must be designated such that n₁<n₂<...<n_x.
- A maximum of 16 tabs may be set.
- The VT single-byte control command, LPRINT CHR\$(11), is used to execute the VT designation (see Section 4.7).
- If the amount of line spacing is changed after a VT designation, the VT positions, remain as initially set.
- VT setting is released by form length designation commands.

VERTICAL TAB UNIT:

Set vertical tabulation every "n" lines, beginning at top of form.

Name: ESC+e+1+n

Code: 27,101,1,n DEC 1B,65,01,n HEX

Input Format: LPRINT CHR\$(27)+"e"+CHR\$(1)+CHR\$(n);

Example:

```
10 REM VT UNIT SETTING
20 LPRINT "THIS PAGE IS 20 LINES LONG"
30 LPRINT CHR$(27)+"C"+CHR$(20);
40 LPRINT CHR$(27)+"e"+CHR$(1)+CHR$(6);
50 LPRINT "1ST LINE";CHR$(11);
60 LPRINT "7TH LINE";CHR$(11);
70 LPRINT "13TH LINE";CHR$(11);
80 LPRINT "19TH LINE";CHR$(12);
90 LPRINT "1ST LINE (NEXT PAGE)"
100 END
```

```
THIS PAGE IS 20 LINES LONG
1ST LINE
```

```
7TH LINE
```

```
13TH LINE
```

```
19TH LINE
```

```
1ST LINE (NEXT PAGE)
```

Comments:

- The VT unit setting is released when n=1 (ESC+e+1+1).
- The maximum length for a VT unit is the form length, and when a VT unit designation exceeds the form length, the setting is ignored.
- If the amount of line spacing is changed after a VT unit designation, the VT unit remains as initially set.
- When n=0, data is printed, but the paper is not fed.
- The VT unit setting is released by form length designation command.

FORM LENGTH (INCHES):

Sets page length in inches.

Name: ESC+C+0+n

Code: 27,67,0,n DEC 1B,43,00,n HEX

Input Format: LPRINT CHR\$(27)+"C"+CHR\$(0)+CHR\$(n);

Example:

```
10 REM FORM LENGTH (INCHES)
20 LPRINT CHR$(27)+"C"+CHR$(0)+CHR$(1);
30 LPRINT "THIS PAGE IS 1 INCH LONG";
40 LPRINT CHR$(12);
50 LPRINT CHR$(27)+"C"+CHR$(0)+CHR$(2);
60 LPRINT "THIS PAGE IS 2 INCHES LONG";
70 LPRINT CHR$(12);
80 LPRINT "NEXT PAGE"
90 END
```

THIS PAGE IS 1 INCH LONG

THIS PAGE IS 2 INCHES LONG

NEXT PAGE

Comments:

- Upon receipt of ESC+C+0+n, the present line position becomes the top of form position.
- The value of n must be in the range $1 \leq n \leq 22$. If $n=0$ or $n \geq 23$, the page length does not change.
- ESC+C+0+n releases the VT and skip perforation settings.
- The page length does not change even if the line spacing amount is changed.

FORM LENGTH (LINES):

Sets page length in number of lines.

Name: ESC+C+n

Code: 27,67,n DEC 1B,43,n HEX

Input Format: LPRINT CHR\$(27)+"C"+CHR\$(n);

Example:

```
10 REM FORM LENGTH (LINES)
20 LPRINT CHR$(27)+"C"+CHR$(3);
30 LPRINT "THIS PAGE IS 3 LINES LONG"
40 LPRINT CHR$(12);
50 LPRINT CHR$(27)+"C"+CHR$(5);
60 LPRINT "THIS PAGE IS 5 LINES LONG"
70 LPRINT CHR$(12);
80 LPRINT "NEXT PAGE"
90 END
```

THIS PAGE IS 3 LINES LONG

THIS PAGE IS 5 LINES LONG

NEXT PAGE

Comments:

- Upon receipt of ESC+C+n, the present line position becomes the top of form position.
- The value of n must be in the range $1 \leq n \leq 127$. If $n=0$, page length returns to the inch designation. If $n \geq 128$, values are processed as $n - 128$.
- ESC+C+n releases the VT and skip perforation settings.
- The page length does not change even if the line spacing amount is changed.

LEFT MARGIN:

Sets position of left margin.

Name: ESC+I+n

Code: 27,108,n DEC 1B,6C,n HEX

Input Format: LPRINT CHR\$(27)+"I"+CHR\$(n);

Example:

```
10 REM LEFT MARGIN SETTING
20 FOR I=1 TO 5
30 LPRINT "0123456789";
40 NEXT I
50 LPRINT CHR$(10);
60 LPRINT CHR$(27)+"I"+CHR$(10);
70 LPRINT "LEFT MARGIN 10"
80 LPRINT CHR$(27)+"I"+CHR$(20);
90 LPRINT "LEFT MARGIN 20"
100 END
```

```
01234567890123456789012345678901234567890123456789
      LEFT MARGIN 10
                LEFT MARGIN 20
```

Comments:

- If the value of n exceeds the right margin value, ESC+I+n is ineffective and the left margin does not change.
- Setting the left margin position clears all data in the print buffer. Do not, therefore, set the left margin before printing.
- In the proportional spacing mode, the left margin is set with pica pitch.
- Once the left margin position is set, any change in the character mode will not alter this left margin setting.

RIGHT MARGIN:

Sets position of right margin. (effective only in Standard Mode)

Name: ESC+Q+n

Code: 27,81,n DEC 1B,51,n HEX

Input Format: LPRINT CHR\$(27)+"Q"+CHR\$(n);

Example:

```
10 REM RIGHT MARGIN SETTING
20 FOR I=1 TO 5
30 LPRINT "0123456789";
40 NEXT I
50 LPRINT CHR$(10)
60 LPRINT CHR$(27)+"Q"+CHR$(40);
70 LPRINT "RIGHT MARGIN 40"
80 FOR I=1 TO 5
90 LPRINT "0123456789";
100 NEXT I
110 LPRINT CHR$(10)
120 LPRINT CHR$(27)+"Q"+CHR$(30);
130 LPRINT "RIGHT MARGIN 30"
140 FOR I=1 TO 5
150 LPRINT "0123456789";
160 NEXT I
170 LPRINT CHR$(10)
180 END
```

01234567890123456789012345678901234567890123456789

RIGHT MARGIN 40
0123456789012345678901234567890123456789
0123456789

RIGHT MARGIN 30
012345678901234567890123456789
01234567890123456789

Comments:

- The effective area of n is as shown below.

Pica mode	$2 \leq n \leq 80$
Compressed mode	$4 \leq n \leq 137$
Elongated mode	$1 \leq n \leq 40$
Elongated Compressed mode	$2 \leq n \leq 68$
- Any designation to the left of the left margin position is ignored.
- Setting the right margin clears all data in the buffer. Do not, therefore, set the right margin before printing.
- In the proportional spacing mode, the right margin is set with pica pitch.
- Once the right margin position is set, any change in the character mode will not alter this right margin setting.
- This command is operational only in Standard Mode.

HORIZONTAL SPACING:

Skips "n" spaces between present and next character positions.

Name: ESC+f+0+n

Code: 27,102,0,n DEC 1B,66,00,n HEX

Input Format: LPRINT CHR\$(27)+"f"+CHR\$(0)+CHR\$(n);

Example:

```
10 REM HORIZONTAL SPACING
20 FOR I=1 TO 5
30 LPRINT "1234567890";
40 NEXT I
50 LPRINT CHR$(10)
60 LPRINT "ESC+f+0+n";
70 LPRINT CHR$(27)+"f"+CHR$(0)+CHR$(20);
80 LPRINT "SKIP 20 SPACES"
90 END
```

12345678901234567890123456789012345678901234567890

ESC+f+0+n

SKIP 20 SPACES

Comments:

- Spacing size depends upon present character pitch.
- The value of n must be in the range $0 \leq n \leq 127$. If $n \geq 128$, the designation is executed with a spacing of $n - 128$.
- In the underline mode, spaces set by ESC+f+0+n are underlined.
- If the right margin is exceeded during horizontal spacing, excess horizontal spaces are ignored.

VERTICAL SPACING:

Advances paper "n" lines after printing data in buffer.

Name: ESC+f+1+n

Code: 27,102,1,n_{DEC} 1B,66,01,n_{HEX}

Input Format: LPRINT CHR\$(27)+"f"+CHR\$(1)+CHR\$(n);

Example:

```
10 REM VERTICAL SPACING
20 LPRINT "VERTICAL";
30 LPRINT CHR$(27)+"f"+CHR$(1)+CHR$(6);
40 LPRINT "SPACING"
50 END
```

VERTICAL

SPACING

Comments:

- Line spacing determines vertical spacing amount.
- The value of n must be in the range $0 \leq n \leq 127$. If $n \geq 128$, vertical spacing amount is $n - 128$.
- Once data is printed (immediately before vertical spacing), the paper advances n lines and printing continues in the very next column.
- The vertical spacing designation does not release double width printing.

Data control commands

Data control refers to the format of input data (7 or 8 bits), manipulation of data already in the print buffer (CAN or DEL), or the readiness of the printer to receive data (DC1 or DC3 and ESC+Q+3).

CAN, DEL, DC1 and DC3 have already been discussed in Section 4.7 Single-Byte Control Codes.

As previously explained, each individual character has a corresponding ASCII code. Such an ASCII code can be expressed in binary notation. In 7-bit binary notation, a combination of seven 0's and 1's makes up a character while in 8-bit binary notation, a combination of eight 0's and 1's makes up a character. In either case, since the rightmost bit is in the $2^0 = 1$ column, it carries the "least weight" of all bits and is called the Least Significant Bit (LSB). The leftmost bit is in the $2^6 = 64$ column (7-bit representation) or in the $2^7 = 128$ column (8-bit representation) and therefore carries the "most weight" of all bits. This bit is called the Most Significant Bit (MSB).

There are computers as well as interfaces which send only 7-bit characters (ASCII codes 0–127). With the printer, however, you may access characters with ASCII codes greater than 127. The printer software includes 3 commands to control the MSB.

MSB ON:

Sets the MSB to 1.

Name: ESC+>

Code: 27,62 DEC 1B,3E HEX

Input Format: LPRINT CHR\$(27)+">;

Example:

```
10 REM MSB TO 1
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"MSB ON";CHR$(10);
50 PRINT #1,CHR$(27);">";
60 FOR I=32 TO 126
70     PRINT #1,CHR$(I);
80 NEXT I
90 FOR I=160 TO 254
100    PRINT #1,CHR$(I);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

```
MSB ON
!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNopQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

Comments:

- ESC+> has no effect on bit image data.
- This setting can be released by ESC+#.
- The output from the sample program above was purposely reduced in order that all characters could properly be typeset for printing of this manual.

MSB OFF:

Sets the MSB to 0.

Name: ESC+=

Code: 27,61 DEC 1B,3D HEX

Input Format: LPRINT CHR\$(27)+"=";

Example:

```
10 REM MSB TO 0
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"MSB OFF";CHR$(10);
50 PRINT #1,CHR$(27);"=";
60 FOR I=32 TO 126
70     PRINT #1,CHR$(I);
80 NEXT I
90 FOR I=160 TO 254
100    PRINT #1,CHR$(I);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

```
MSB OFF
!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz[\]^_`'abcdefghijklmnopqrstu
vwxyz{|}~!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOpqrstuvwxyz{|}~`'abcdefghijklmnopqrstu
```

Comments:

- ESC+= has no effect on bit image data.
- This setting can be released by ESC+#.
- The output from the sample program above was purposely reduced in order that all characters could properly be typeset for printing of this manual.

MSB CANCEL:

Sets printer to receive 8th bit "as is".

Name: ESC+#

Code: 27,35 DEC 1B,23 HEX

Input Format: LPRINT CHR\$(27)+"#";

Example:

```
10 REM MSB AS IS
20 WIDTH "LPT1:",255
30 OPEN "LPT1:" AS #1
40 PRINT #1,"RECEIVE MSB AS IS";CHR$(10);
50 PRINT #1,CHR$(27);"#";
60 FOR I=32 TO 126
70     PRINT #1,CHR$(I);
80 NEXT I
90 FOR I=160 TO 254
100     PRINT #1,CHR$(I);
110 NEXT I
120 PRINT #1,CHR$(10);
130 END
```

```
RECEIVE MSB AS IS
!"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN O PQRSTUVWXYZ[\]^_`'abcdefghijklmnop
pqrstuvwxyz{|}~ !"#%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN O PQRSTUVWXYZ[\]^_`'
abcdefghijklmnopqrstuvwxyz{|}/~
```

Comments:

- This setting has no effect on bit image data.
- The output from the sample program above was purposely reduced in order that all characters could properly be typeset for printing of this manual.

REMOTE DESELECT PRINTER (IBM PRINTER MODE):

Deselects the printer remotely, disabling it from receiving data.

Name: ESC+Q+3

Code: 27, 81, 3_{DEC} 1B, 51, 03_{HEX}

Input Format: LPRINT CHR\$(27) + "Q" + CHR\$(3);

Example:

```
10 REM REMOTE SELECT/DESELECT
20 LPRINT "SELECT"
30 LPRINT CHR$(27); "Q"; CHR$(3);
40 LPRINT "DESELECT"
50 LPRINT CHR$(17);
60 LPRINT "SELECT"
70 END
```

```
SELECT
SELECT
```

Comments:

- All data sent in deselect status become invalid. In order to return to select status, send DC1 code.
- This command is not operational in Standard Mode.

Downloadable character commands

If the printer does not contain all of the characters which you need, you can custom design up to 40 characters. Such characters, once created, are then stored (downloaded) in the printer's RAM.

To download a character into RAM, you must first design the character. In the matrix below, the circles represent pins which may be fired. You may darken any circle provided no two adjacent horizontal circles are filled in.

2^7	○	○	○	○	○	○	○	○	○
2^6	○	○	○	○	○	○	○	○	○
2^5	○	○	○	○	○	○	○	○	○
2^4	○	○	○	○	○	○	○	○	○
2^3	○	○	○	○	○	○	○	○	○
2^2	○	○	○	○	○	○	○	○	○
2^1	○	○	○	○	○	○	○	○	○
2^0	○	○	○	○	○	○	○	○	○
	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9

Once you have designed the character, you must quantify each dot column, D_1 – D_9 , by summing the powers of two represented by each dot. Consider the design of the Greek character γ (gamma) below.

2^7	○	○	●	○	○	○	○	○	●
2^6	○	○	○	●	○	○	●	○	○
2^5	○	○	○	○	●	○	○	○	○
2^4	○	○	●	○	○	●	○	○	○
2^3	○	●	○	○	○	●	○	○	○
2^2	○	●	○	○	○	●	○	○	○
2^1	○	○	●	○	●	○	○	○	○
2^0	○	○	○	●	○	○	○	○	○
	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9

Then $D_1 = 0$

$$D_2 = 2^2 \times 2^3 = 4 + 8 = 12$$

$$D_3 = 2^1 \times 2^4 \times 2^7 = 2 + 16 + 128 = 146$$

$$D_4 = 2^0 \times 2^6 = 1 + 64 = 65$$

$$D_5 = 2^1 \times 2^5 = 2 + 32 = 34$$

$$D_6 = 2^2 \times 2^3 \times 2^4 = 4 + 8 + 16 = 28$$

$$D_7 = 2^6 = 64$$

$$D_8 = 0$$

$$D_9 = 2^7 = 128$$

The method by which the values D_1 through D_9 are entered in the control command will be discussed shortly. However, once you have designed your character, you must also determine where in RAM this information will be stored. In 8-bit mode, any of the address locations $32_{DEC}-126_{DEC}$ ($20_{HEX}-7E_{HEX}$) and $128_{DEC}-255_{DEC}$ ($80_{HEX}-FF_{HEX}$) may be used to store your character. In 7-bit mode, any of the address locations $32_{DEC}-126_{DEC}$ ($20_{HEX}-7E_{HEX}$) may be used to store your character. Once downloaded, the character you created "replaces" the original character in that address location until the download designation is released.

DOWNLOADABLE CHARACTER DEFINITION:

Defines a download character into a specified address location in RAM.

Name: Setting: $ESC+y+loc+D_1+D_2+...+D_9$ (loc = location code)
 Release: $ESC+z+loc$

Code: Setting: $27,121,loc,D_1,D_2,...,D_9_{DEC}$ $1B,79,loc,D_1,D_2,...,D_9_{HEX}$
 Release: $27,122,loc_{DEC}$ $1B,7A,loc_{HEX}$

Input Format: Setting: $LPRINT CHR\$(27)+"y"+CHR\$(loc)+CHR\$(D_1)+CHR\$(D_2)+...+CHR\$(D_9);$
 Release: $LPRINT CHR\$(27)+"z"+CHR\$(loc);$

Example:

```

10 REM STORE GAMMA IN LOCATION 67(DEC)
20 LPRINT CHR$(27)+"y"+CHR$(67);
30 LPRINT CHR$(0)+CHR$(12)+CHR$(146);
40 LPRINT CHR$(65)+CHR$(34)+CHR$(28);
50 LPRINT CHR$(64)+CHR$(0)+CHR$(128);
60 FOR I=1 TO 10
70   LPRINT CHR$(67);
80 NEXT I
90 LPRINT CHR$(10);
100 REM RELEASE GAMMA AND RETURN TO "C"
110 LPRINT CHR$(27)+"z"+CHR$(67);
120 FOR I=1 TO 10
130 LPRINT CHR$(67);
140 NEXT I
150 LPRINT CHR$(10);
160 END
  
```

```

XXXXXXXXXX
CCCCCCCCC
  
```

Comments:

- Download characters are 9 dots wide with a 3-dot space.
- Avoid using the same pin in two adjacent columns; otherwise, the pin in the second column of the pair will not be fired.

Miscellaneous commands

HOME PRINT HEAD:

Causes print head to return to its home position.

Name: ESC+<

Code: 27,60 DEC 1B,3C HEX

Input Format: LPRINT CHR\$(27)+"<";

Example:

```
10 REM HOME PRINT HEAD
20 LPRINT "COME BACK HOME"
30 LPRINT CHR$(27)+"<";
40 END
```

COME BACK HOME

RESET PRINTER:

Initializes printer, causing data in the print buffer, but not in the receive buffer, to be cleared.

Name: ESC+@

Code: 27,64 DEC 1B,40 HEX

Input Format: LPRINT CHR\$(27)+"@";

Example:

```
10 REM RESET PRINTER
20 LPRINT CHR$(27)+"W"+CHR$(1);
30 LPRINT "HELLO! GOODBYE!"
40 LPRINT CHR$(27)+"@";
50 LPRINT "HELLO! GOODBYE!"
60 END
```

HELLO! GOODBYE!
HELLO! GOODBYE!

Comment:

- Refer to Section 3.4 for an explanation of printer initialization.

HALF SPEED PRINTING:

Sets printing to half speed.

Name: Setting: ESC+s+n n=1, 49, 129, 177
Release: ESC+s+m m=0, 48, 128, 176

Code: Setting: 27,115,n DEC 1B,73,n HEX
Release: 27,115,m DEC 1B,73,m HEX

Input Format: Setting: LPRINT CHR\$(27)+"s"+CHR\$(1);
Release: LPRINT CHR\$(27)+"s"+CHR\$(0);

Example:

```
10 REM HALF SPEED PRINTING
20 LPRINT "HIGH SPEED PRINTING"
30 LPRINT CHR$(27)+"s"+CHR$(1);
40 LPRINT "HALF SPEED PRINTING"
50 LPRINT CHR$(27)+"s"+CHR$(0);
60 LPRINT "HIGH SPEED PRINTING"
70 END
```

```
HIGH SPEED PRINTING
HALF SPEED PRINTING
HIGH SPEED PRINTING
```

Comment:

- Half speed printing can be set only in the pica, elite, standard density image, double speed double density image, and 576 dots/line image modes.

SINGLE DIRECTION:

Sets single direction (left to right) printing mode.

Name: Setting: ESC+U+n n=1, 49, 129, 177
Release: ESC+U+m m=0, 48, 128, 176

Code: Setting: 27,85,n DEC 1B,55,n HEX
Release: 27,85,m DEC 1B,55,m HEX

Input Format: Setting: LPRINT CHR\$(27)+"U"+CHR\$(1);
Release: LPRINT CHR\$(27)+"U"+CHR\$(0);

Example:

```
10 REM SINGLE DIRECTION PRINTING
20 LPRINT CHR$(27)+"U"+CHR$(1);
30 LPRINT "SINGLE DIRECTION PRINTING"
40 LPRINT "SINGLE DIRECTION PRINTING"
50 LPRINT CHR$(27)+"U"+CHR$(0);
60 LPRINT "BI-DIRECTIONAL PRINTING"
70 LPRINT "BI-DIRECTIONAL PRINTING"
80 END
```

```
SINGLE DIRECTION PRINTING
SINGLE DIRECTION PRINTING
BI-DIRECTIONAL PRINTING
BI-DIRECTIONAL PRINTING
```

PAPER-END SELECTION:

Enables paper-end detector.

Name: Setting: ESC+9
 Release: ESC+8

Code: Setting: 27,57 DEC 1B,39 HEX
 Release: 27,56 DEC 1B,38 HEX

Input Format: Setting: LPRINT CHR\$(27)+"9";
 Release: LPRINT CHR\$(27)+"8";

Comments:

- Enabling of the paper-end detector causes printing to stop 1.5 inches from the bottom of the page. PE status is then established.
- Disabling of the paper-end detector causes printing to continue after paper end.
- When the paper-end detector is disabled by ESC+8, PE signal is protected (PE=Low).

4.9 Mixing Print Modes

The printer provides a variety of print modes. Table 4.11 illustrates those print modes which can and cannot be set simultaneously.

Y=Yes N=No	Pica	Elite	Semi-Compressed	Compressed (by SI)	Proportional Spacing	NLQ	Double Width	Emphasized	Double Print	Underline	Superscript	Subscript
Pica		*1	*1	*1	*1	Y	Y	Y	Y	Y	Y	Y
Elite	*1		*1	*1	*1	Y	Y	Y	Y	Y	Y	Y
Semi-Compressed	*1	*1		*1	*1	Y	Y	*6	Y	Y	Y	Y
Compressed	*1	*1	*1		*1	Y	Y	*2	Y	Y	Y	Y
Proportional Spacing	*1	*1	*1	*1		Y	Y	Y	Y	Y	Y	Y
NLQ	Y	Y	Y	Y	Y		Y	Y	*3	Y	*4	*4
Double Width	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y
Emphasized	Y	Y	*6	*2	Y	Y	Y		Y	Y	Y	Y
Double Print	Y	Y	Y	Y	Y	*3	Y	Y		Y	*5	*5
Underline	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y
Superscript	Y	Y	Y	Y	Y	*4	Y	Y	*5	Y		N
Subscript	Y	Y	Y	Y	Y	*4	Y	Y	*5	Y	N	

Table 4.11 Mixed Print Modes

- *1. Although different character pitches cannot be set simultaneously, they may be mixed on a single line.
- *2. Only emphasized characters are printed.
- *3. Since near letter quality characters are printed with a double pass, the double print designation is ineffective.
- *4. Super/Subscript cannot be printed with the near letter quality font.
- *5. Since Super/Subscript characters are printed with a double pass, the double print designation is ineffective.
- *6. The latter input mode overrides the former.

Note: All characters modes can be mixed on a single line.

4.10 DIP Switches and Control Codes

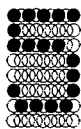
As explained in Section 3.3, DIP switch settings are read into printer memory when the printer is powered up. Certain printer functions set by these DIP switches can also be set by issuing the appropriate control commands. Table 4.12 illustrates those DIP switch functions which can also be set through software. THE CONTROL COMMAND WILL ALWAYS OVERRIDE THE CORRESPONDING DIP SWITCH SETTING(S).

SWITCH NO.	FUNCTION	SETTING				
		DIP SWITCH				SOFTWARE
SW1 SW5 SW6 SW7	Selection of International Char. Set	SW1	SW5	SW6	SW7	
	• USA	ON	ON	ON	ON	ESC+R+0
	• France	ON	OFF	ON	ON	ESC+R+1
	• England	ON	OFF	OFF	ON	ESC+R+3
	• Denmark I	ON	ON	ON	OFF	ESC+R+4
	• Sweden	ON	OFF	ON	OFF	ESC+R+5
	• Italy	ON	ON	OFF	OFF	ESC+R+6
	• Spain	ON	OFF	OFF	OFF	ESC+R+7
	Selection of printer mode					
	• Standard Mode	ON	—	—	—	ESC+m+0
	• IBM Matrix Printer Mode	OFF	ON	OFF	OFF	ESC+m+1
	• IBM Graphics Printer Mode I	OFF	—	ON	OFF	ESC+m+2
	• IBM Graphics Printer Mode II	OFF	—	—	ON	ESC+m+3
SW2	Selection of paper out detector					
	• Ineffective	ON				ESC+8
	• Effective	OFF				ESC+9
SW4	Selection of skip perforation					
	• Skip perforation (1 inch)	ON				ESC+N+6
	• No skip	OFF				ESC+O
SW8	Selection of 7/8 bit code					
	• 7-bit code	ON				ESC+=
	• 8-bit code	OFF				ESC+#

Table 4.12 Software Control of DIP Switch Functions

Note:

- Japan (ESC+R+8), Norway (ESC+R+9), and Denmark II (ESC+R+10) international character sets are software-selectable only.
- The AUTO FEED XT (SW3) setting enables the printer to issue a line feed after a carriage return. By inserting LPRINT CHR\$(10) in the appropriate portions of a program, you can also issue a line feed after a carriage return. Refer to the LF designation, Section 4.7.



INTERFACING

5.1 Parallel Interfacing

Communication with a computer is accomplished through a parallel interface based on the Centronics standard.

Specifications:

- data transfer speed: 1000 cps minimum
- synchronization: external STROBE pulse
- logic levels: TTL
- handshaking: BUSY and ACK signals
- connector type: 57-30360 (AMPHENOL) or equivalent
- cable: use a shielded cable 3 meters or less in length

When the printer is processing data, the BUSY signal is high. The printer will not accept new data from the computer. After the processing is completed, the BUSY signal goes low. (The BUSY signal is also high when the printer is OFF LINE). When this occurs, the ACK signal goes low indicating to the computer that the data has been processed and the printer is ready to accept more data. This handshaking routine occurs each time a character is sent to the printer.

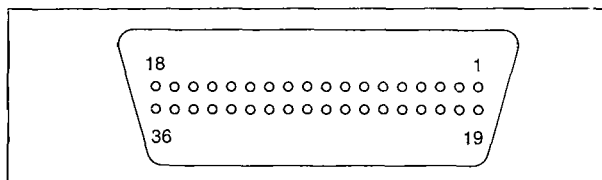


Figure 5.1 Parallel Interface Connector

Signal pin	Return side pin	Signal	Direction
1	19	STROBE	Input
2	20	DATA 1	Input
3	21	DATA 2	
4	22	DATA 3	
5	23	DATA 4	
6	24	DATA 5	
7	25	DATA 6	
8	26	DATA 7	
9	27	DATA 8	
10	28	ACK	Output
11	29	BUSY	Output
12		PE	Output
13		SLCT	Output
14		AUTO FEED XT	Input
15			
16		SG	
17		FG	
18		+5 V	Output
31	30	PRIME	Input
32		ERROR	Output
33		SG	
34			
35			
36			

Table 5.1 Connector Pin Configuration

5.2 Connector Pin Signals

Notes:

1. "INPUT" refers to a signal coming into the printer. "OUTPUT" denotes a signal exiting the printer.
2. "RETURN" denotes the return side wire of a twisted pair cable and is connected to signal ground.
3. All interface signals are at TTL levels

STROBE...STROBE

- This is a synchronizing input signal to read data into the printer.
- This signal is normally high. Data is read in when it goes low.
- The pulse must be low for at least 0.5 microsecond.

DATA 1-DATA 8

- These are the input signals which carry the 8 data bits of information.
- The signal is read in synchronization with the STROBE pulse. A high level indicates a logical "1".
- The signal must be present 0.5 microsecond before arrival of the STROBE pulse.

ACK...ACKNOWLEDGE

- This is an output signal to the computer indicating that the printer is ready to receive the next block of data. It is sent out when the BUSY signal drops from high to low. Therefore, it can be thought of as a data request pulse.
- The signal is normally high. When the condition becomes true, the signal goes low.
- The $\overline{\text{ACK}}$ signal is automatically sent whenever the printer is switched ON LINE.

BUSY

- This output signal indicates the status of the printer. The signal is high when the printer is busy and cannot receive data.
- The signal is high under the following conditions:
 1. receive buffer full
 2. printer is processing data
 3. printer is OFF LINE
 4. printer is in an error condition

PE...PAPER END

- This output signal indicates that there are only 1.5 inches (38mm) of paper remaining.
- The signal is normally low and goes high during a "Paper End" condition.

SLCT...SELECT

- SELECT is an output signal which indicates the ON LINE or OFF LINE state of the printer. The signal is high in the ON LINE state and low when OFF LINE.
- The printer enters the ON LINE state:
 1. when the printer is turned on
 2. when PRIME is received
 3. when the RESET command is received
 4. when the ON LINE switch is pressed
- The printer enters the OFF LINE state:
 1. when the printer is out of paper
 2. when the printer is switched OFF LINE

AUTO FEED XT (AFXT)

- This input signal determines if a line feed (LF) command will be added to each carriage return (CR).
- When AFXT is low, CR + LF action occurs. When AFXT is high, only a carriage return is performed.
- DIP switch SW3 can alter the response by the printer to an AFXT signal. If SW3 is ON, the printer will perform a CR + LF regardless of the level of the incoming signal. When SW3 is OFF, this automatic action is disabled.

SG...SIGNAL GROUND

- The twisted pair return wires (pins 19–30) are connected to signal ground.

FG...FRAME GROUND

- Frame ground is the same as chassis ground.

+5V

This is for evaluation only. It should not be used to supply power for external equipment.

PRIME

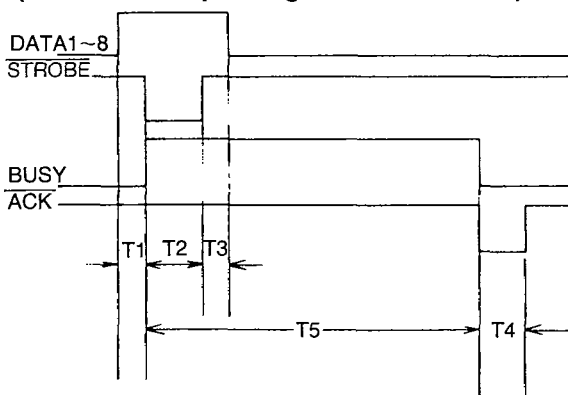
This input signal is used to initialize the printer. The signal is normally high and goes low to reset the printer. It can be received anytime during printer operation.

ERROR

This output signal is an "error" or "fault" condition. Normally high, this signal goes low when an error occurs. An error condition can be caused by:

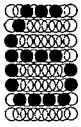
1. a "Paper End" condition
2. the printer is OFF LINE
3. an overload condition exists

Timing Chart (When normal printing code is received)



- T1 ... 0.5 μ s (Min)
- T2 ... 1 μ s (Min)
- T3 ... 0.5 μ s (Min)
- T4 ... 5 μ s (Max)
- T5 ... 1ms or less when not buffer full
1s or less when buffer full

Figure 5.2 Timing Diagram



MAINTENANCE

The printer does not require any routine maintenance. However, reasonable care of the printer will extend its life. The following preventive and periodic measures are recommended:

6.1 Preventive Maintenance

- Keep all liquids away from the printer. Accidental spillage of a liquid into the printer can cause severe damage.
- Do not block the air flow around the printer. Do not place books, paper, or other items on top of the printer.
- Special care should be taken to protect the printer if it is used in an unfriendly environment such as a machine shop, a dusty or sandy area, etc.
- When transporting the printer, be sure the carriage stoppers are in place. This will help prevent damage to the print head.
- The life of the print head can be extended by observing a few simple precautions.
- Do not operate the printer without paper and a ribbon cassette installed.
- Avoid continuous use of the same pins (under line, semi-graphics, etc.) without allowing the print head time to cool.
- Do not obstruct the movement of the print head while in operation.
- If the printer is not going to be used for an extended period, unplug the power cord.

6.2 Periodic Maintenance

Cleaning the unit is the most important action the user can perform. The frequency of cleaning is dependent upon the environment.

- Turn the power OFF.
- Clean the case and covers with a soft cloth. Use any mild commercial cleaner.

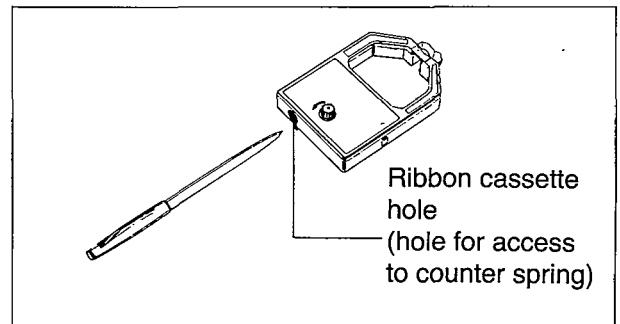
- Remove the top and front covers. Vacuum or dust the inside area of the unit. Be very careful not to damage the flex ribbon cable on the carriage drive belt.
- The platen should be cleaned with denatured alcohol only.
- If the printer should need servicing return the unit to an authorized Panasonic service center. Do not attempt to repair the unit. There are no user-repairable assemblies in the printer.

Ribbon Cassette

A single ribbon permits the printing of about 2 million characters. When the printing starts to fade, gently push the counter spring in the ribbon cassette hole with the tip of a ballpoint pen or other object. This allows the printing of an additional 1 million characters. Once the ribbon cassette is mounted onto the carriage and printing is performed for a short time, the characters become darker.

Note:

Do not push this before the printing starts to fade.



Fresh ribbon cassette

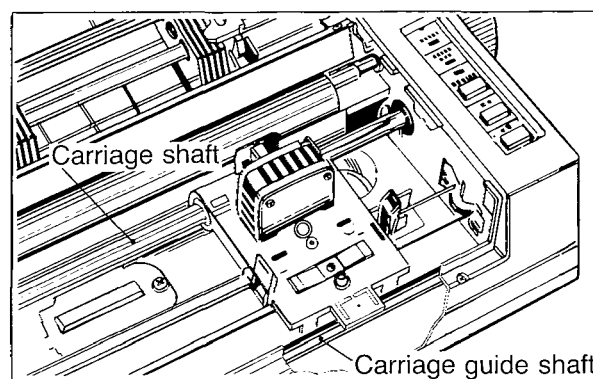
When the printing starts to fade again, replace the ribbon cassette.

Product name: Ribbon cassette

Product number: KX-P110

Wear and tear of the print head pins may cause serious damage of the ribbon and printing to fade. In such case the printer needs servicing.

- Dust and paper trash on the carriage shaft and the carriage guide shaft may obstruct the movement of the carriage. Clean them with a soft cloth. Periodical cleaning is necessary for proper operation and extended product life.



6.3 Troubleshooting

Most problems associated with the printer can be traced to improper setup, installation, or cabling. Table 6.1 will assist the user in identifying and

correcting some of the more common problems. If you need additional help, contact the store from which the unit was purchased.

SYMPTOM	POSSIBLE CAUSE	PROBABLE SOLUTION
Printer Dead	No AC Power Fuse blown	Check Power Cord Replace fuse
Power on but printer not printing	Printer not ON LINE; out of paper	Press ON LINE switch replace paper
Printer won't go ON LINE	Out of paper	Replace paper
Paper slips around platen	Paper feed selector in TRACTOR position.	Set selector to FRICTION
Head moves but does not print	Ribbon not installed correctly	Re-inset ribbon
Paper bunches up around platen	No reverse tension on paper	Set paper supply lower than printer
Continuous Paper/Error indicator flashing	OVERLOAD condition	Carriage travel path blocked; carriage stoppers not removed
Printout double-spaced or no spacing	AFXT switch improperly set	Set DIP switch SW3—as required
Cannot print ASCII characters with code above 127, italic characters printing	7 bit/8 bit switch set incorrectly on printer or interface	Set DIP switch SW8—as required
Cannot change print mode from computer	Print mode switch set incorrectly	Normal condition. Refer to Section 3.1

Table 6.1 Troubleshooting

APPENDIX A











Standard Mode Character Set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NULL		SP	0	@	P	'	p			SP	0	@	P	'	p
1		DC1	!	1	A	Q	a	q		DC1	!	1	A	Q	a	q
2		DC2	"	2	B	R	b	r		DC2	"	2	B	R	b	r
3		DC3	#	3	C	S	c	s		DC3	#	3	C	S	c	s
4		DC4	\$	4	D	T	d	t		DC4	\$	4	D	T	d	t
5			%	5	E	U	e	u			%	5	E	U	e	u
6			&	6	F	V	f	v			&	6	F	V	f	v
7			'	7	G	W	g	w			'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x	BS	CAN	(	8	H	X	h	x
9	HT		)	9	I	Y	i	y	HT		)	9	I	Y	i	y
A	LF		*	:	J	Z	j	z	LF		*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{	VT	ESC	+	;	K	[	k	{
C	FF		,	<	L	\	l	|	FF		,	<	L	\	l	|
D	CR		-	=	M	]	m	}	CR		-	=	M	]	m	}
E	SO		.	>	N	^	n	~	SO		.	>	N	^	n	~
F	SI		/	?	O	_	o	DEL	SI		/	?	O	_	o	DEL











IBM Matrix Character Set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NULL		SP	0	@	P	'	p								
1		DC1	!	1	A	Q	a	q		DC1						
2		DC2	"	2	B	R	b	r		DC2						
3		DC3	#	3	C	S	c	s		DC3						
4		DC4	\$	4	D	T	d	t		DC4						
5			%	5	E	U	e	u								
6			&	6	F	V	f	v								
7			'	7	G	W	g	w								
8	BS	CAN	(	8	H	X	h	x	BS	CAN						
9	HT		)	9	I	Y	i	y	HT							
A	LF		*	:	J	Z	j	z	LF							
B	VT	ESC	+	;	K	[	k	{	VT	ESC						
C	FF		,	<	L	\	l	|	FF							
D	CR		-	=	M	]	m	}	CR							
E	SO		.	>	N	^	n	~	SO							
F	SI		/	?	O	_	o	DEL	SI							

IBM Graphics Set G1

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NULL		SP	0	@	P	'	p			á		L	┐	α	≡
1		DC1	!	1	A	Q	a	q		DC1	í		┐	┐	β	±
2		DC2	"	2	B	R	b	r		DC2	ó		┐	┐	Γ	≥
3		DC3	#	3	C	S	c	s		DC3	ú		┐	┐	π	≤
4		DC4	\$	4	D	T	d	t		DC4	ñ	┐	┐	┐	Σ	
5			%	5	E	U	e	u			Ñ	┐	┐	┐	σ	
6			&	6	F	V	f	v			<u>a</u>	┐	┐	┐	μ	÷
7			'	7	G	W	g	w			<u>o</u>	┐	┐	┐	γ	≈
8	BS	CAN	(	8	H	X	h	x	BS	CAN	¿	┐	┐	┐	Φ	°
9	HT		)	9	I	Y	i	y	HT		┐	┐	┐	┐	θ	■
A	LF		*	:	J	Z	j	z	LF		┐		┐	┐	Ω	•
B	VT	ESC	+	;	K	[	k	{	VT	ESC	½	┐	┐		δ	√
C	FF		,	<	L	\	l	|	FF		¼	┐	┐		∞	ⁿ
D	CR		-	=	M	]	m	}	CR		í	┐	┐		∅	²
E	SO		.	>	N	^	n	~	SO		<<	┐	┐		ε	■
F	SI		/	?	O	_	o		SI		>>	┐	┐		∩	SP

IBM Graphics Set G2

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NULL		SP	0	(a	P	'	p	Ç	É	á		L	┐	α	≡
1		DC1	!	1	A	Q	a	q	ü	æ	í		┐	┐	β	±
2		DC2	"	2	B	R	b	r	é	Æ	ó		┐	┐	Γ	≥
3	♥	DC3	#	3	C	S	c	s	â	ô	ú		┐	┐	π	≤
4	♦	DC4	\$	4	D	T	d	t	ä	ö	ñ	┐	—	┐	Σ	
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	┐	┐	┐	σ	
6	♠		&	6	F	V	f	v	å	û	ä	┐	┐	┐	μ	÷
7			'	7	G	W	g	w	ç	ù	o	┐	┐	┐	γ	≈
8	BS	CAN	(	8	H	X	h	x	ê	ÿ	¿	┐	┐	┐	Φ	°
9	HT		)	9	I	Y	i	y	ë	Ö	┐	┐	┐	┐	θ	■
A	LF		*	:	J	Z	j	z	è	Ü	┐	┐	┐	┐	Ω	•
B	VT	ESC	+	;	K	{	k	{	ï	¢	½	┐	┐		δ	✓
C	FF		,	<	L	\	l	|	î	£	¼	┐	┐		∞	ˆ
D	CR		-	=	M	}	m	}	ì	¥	ì	┐	—		∅	²
E	SO		.	>	N	^	n	~	Ä	Pt	<<	┐	┐		ε	■
F	SI		/	?	O	_	o		Å	f	>>	┐	┐		∩	SP

International Character Set

	n	35 _D 23 _H	36 _D 24 _H	64 _D 40 _H	91 _D 5B _H	92 _D 5C _H	93 _D 5D _H	94 _D 5E _H	96 _D 60 _H	123 _D 7B _H	124 _D 7C _H	125 _D 7D _H	126 _D 7E _H
USA	0	#	\$	@	[	\	\]	^	'	{	|	}	~
FRANCE	1	#	\$	à	°	ç	§	^	'	é	ù	è	..
	2	Ineffective											
ENGLAND	3	£	\$	@	[	\	\]	^	'	{	|	}	~
DENMARK I	4	#	\$	@	Æ	Ø	Å	^	'	æ	ø	å	~
SWEDEN	5	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	6	#	\$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	7	Pt	\$	@	í	Ñ	¿	^	'	..	ñ	}	~
*JAPAN	8	#	\$	@	[	¥	]	^	'	{	|	}	~
*NORWAY	9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
*DENMARK II	10	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

* Accessible only through software

* Italic International Character Set

LOCATION		CHAR.	LOCATION		CHAR.	LOCATION		CHAR.	LOCATION		CHAR.
DEC	HEX		DEC	HEX		DEC	HEX		DEC	HEX	
128	80	à	137	89	Ñ	146	92	Æ	155	9B	ö
129	81	è	138	8A	ñ	147	93	æ	156	9C	ü
130	82	ù	139	8B	¤	148	94	Ø	157	9D	É
131	83	ò	140	8C	Pt	149	95	ø	158	9E	é
132	84	ì	141	8D	Å	150	96	..	159	9F	¥
133	85	°	142	8E	å	151	97	Ä	255	FF	Ø
134	86	£	143	8F	ç	152	98	Ö			
135	87	í	144	90	§	153	99	Ü			
136	88	¿	145	91	ß	154	9A	ä			

* Accessible only in Standard Mode

APPENDIX B

DIP Switch Settings

SWITCH NUMBER	FUNCTION	ON	OFF	POSITION WHEN SHIPPED
SW1	Printer Mode	Standard Mode	IBM Printer Mode	ON
SW2	Paper Out Detector	Ineffective	Effective	OFF
SW3	<u>AUTO FEED XT</u>	Fixed Internally	Not Fixed Internally	OFF
SW4	Skip Perforation	1 inch (25.4 mm) Skip	No Skip	OFF
SW5 SW6 SW7	Character Set	SW1=ON: See International Character Set Chart SW1=OFF: See IBM Printer Mode Chart		OFF OFF ON
SW8	7 bit/8 bit	7 bit	8 bit	OFF

DIP Switch Settings

SW1	SW5	SW6	SW7	INTERNATIONAL CHARACTER SET
ON	ON	ON	ON	USA
	OFF	ON	ON	FRANCE
	ON	OFF	ON	ENGLAND
	OFF	OFF	ON	ENGLAND
	ON	ON	OFF	DENMARK I
	OFF	ON	OFF	SWEDEN
	ON	OFF	OFF	ITALY
	OFF	OFF	OFF	SPAIN

International Character Sets

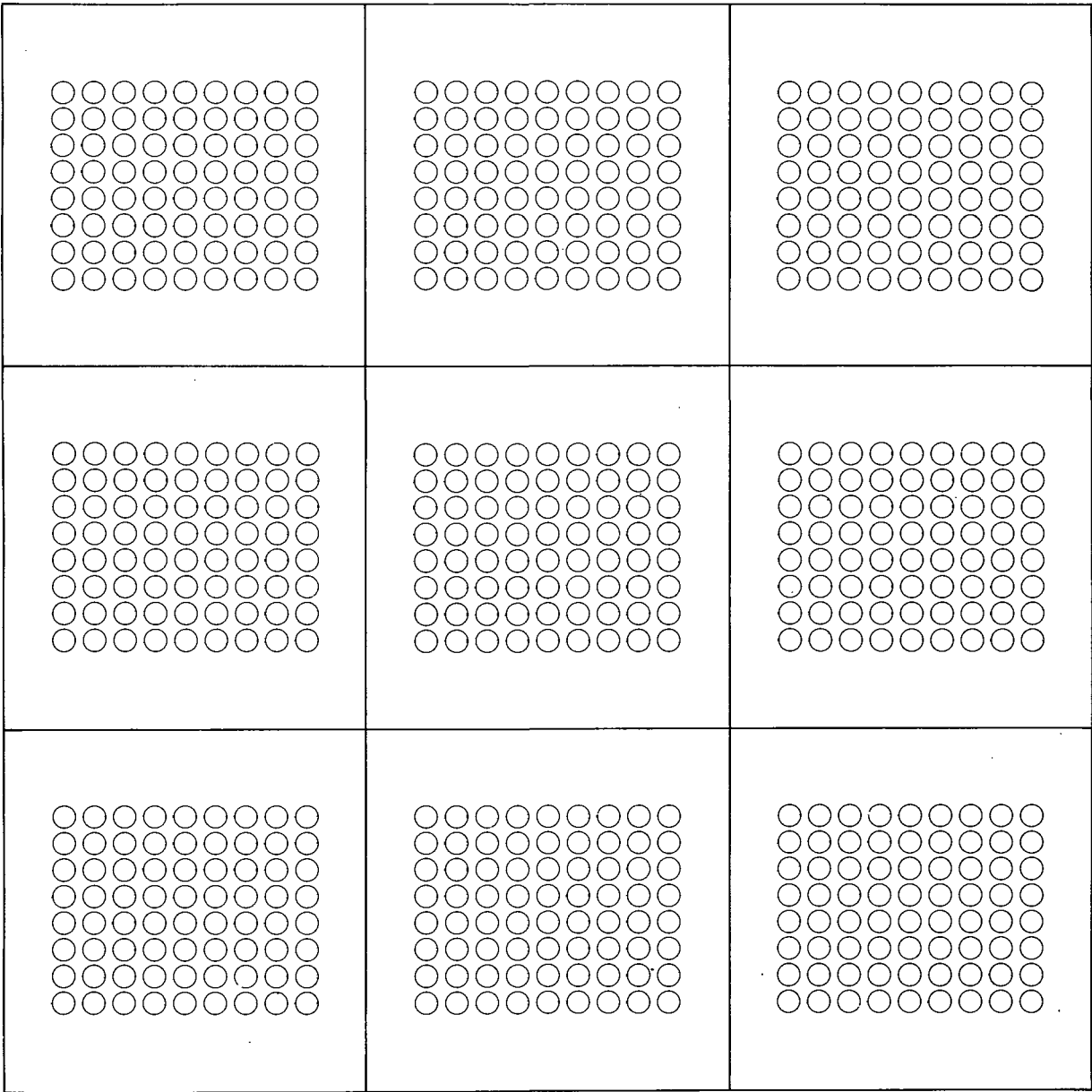
IBM Printer Mode Selection				
SW1	SW5	SW6	SW7	PRINTER MODE
OFF	OFF	OFF	OFF	Graphics Printer Mode II
	—	—	ON	Graphics Printer Mode II
	—	ON	OFF	Graphics Printer Mode I
	ON	OFF	OFF	Matrix Printer Mode

(— means ON or OFF.)

IBM Printer Modes

APPENDIX C

Download Character Matrix Blanks



Make copies of this page first.
Then use blank matrices to design your download characters.

APPENDIX D

Software Commands

CHARACTER MODE COMMANDS

Page

Name	Function	
DC2	Releases compressed printing (Releases elite pitch in IBM Printer mode)	4-5
DC4	Releases one-line double width setting	4-6
SI	Sets compressed printing	4-8
SO	Sets one-line double width printing	4-9
ESC+P	Sets pica pitch	4-11
ESC+M	Sets elite pitch	4-12
ESC+:	Sets elite pitch (IBM Printer mode only)	4-13
ESC+W+1	Sets double width printing	4-14
ESC+W+0	Releases all double width settings	4-14
ESC+SI	Sets compressed printing	4-15
ESC+SO	Sets one-line double width printing	4-15
ESC+S+0	Sets superscript mode	4-16
ESC+T	Releases sub/superscript mode	4-16
ESC+S+1	Sets subscript mode	4-17
ESC+4	Sets italic mode	4-18
ESC+5	Releases italic mode	4-18
ESC+6	Sets italic international mode (Standard mode only)	4-19
ESC+7	Releases italic international mode (Standard mode only)	4-19
ESC+R+n	Selects international character set	4-20
ESC+7	Sets IBM graphics printer mode I (IBM Printer mode only)	4-21
ESC+6	Sets IBM graphics printer mode II (IBM Printer mode only)	4-22
ESC+m+n	Sets Standard, IBM Matrix, IBM Graphics I or II character sets	4-23
ESC+E	Sets emphasis print	4-24
ESC+F	Releases emphasis print	4-24
ESC+G	Sets double printing	4-25
ESC+H	Releases double printing	4-25
ESC+--+1	Sets underline	4-26
ESC+--+0	Releases underline	4-26
ESC+!+n	Specifies a print mode combination	4-27
ESC+n	Sets NLQ (pica pitch) mode	4-30
ESC+o	Sets NLQ (elite pitch) mode	4-31
ESC+w+n	Selects a character pitch	4-32
ESC+x+1	Selects NLQ font	4-33
ESC+x+0	Sets drafts font	4-33
ESC+p+1	Sets proportional spacing mode	4-34
ESC+p+0	Releases proportional spacing mode	4-34

BIT IMAGE (GRAPHICS) MODE COMMANDS

Page

Name	Function	
ESC+K+n ₁ +n ₂	Sets standard density (480 dots/line)	4-44
ESC+L+n ₁ +n ₂	Sets double density (960 dots/line)	4-44
ESC+Y+n ₁ +n ₂	Sets double speed/double density (960 dots/line)	4-45
ESC+Z+n ₁ +n ₂	Sets quadruple density (1920 dots/line)	4-45
ESC+*+m+n ₁ +n ₂	Selects one of 8-pin bit image modes (480, 960, 1920, 640, 576, 720 dots/line)	4-46
ESC+^+m+n ₁ +n ₂	Selects one of 9-pin bit image modes (480, 960, 1920, 640, 576, 720 dots/line)	4-48
ESC+?+n+m	Assigns bit image density	4-49

Software Commands

LINE SPACING COMMANDS

Page

Name	Function	
ESC+0	Sets line spacing to 1/8"	4-50
ESC+1	Sets line spacing to 7/72"	4-51
ESC+2	Sets line spacing to 1/6"	4-51
ESC+A+n	Sets line spacing to n/72"	4-52
ESC+3+n	Sets line spacing to n/216"	4-53
ESC+J+n	Spaces n/216" (1-line only)	4-54

PAPER FEED COMMANDS

Page

Name	Function	
FF	Advances paper to next top of form position	4-6
LF	Advances paper one line	4-7
ESC+N+n	Sets skip perforation	4-55
ESC+O	Releases skip perforations setting	4-55

PAGE FORMAT COMMANDS

Page

Name	Function	
BS	Prints, then backspaces one character	4-3
HT	Executes horizontal tabulation	4-7
VT	Executes vertical tabulation	4-9
ESC+D+n ₁ +...+n _x +0	Sets horizontal tabulation	4-56
ESC+D+0	Releases horizontal tabulation	4-56
ESC+e+0+n	Sets horizontal tabulation every "n" positions	4-57
ESC+B+n ₁ +...+n _x +0	Sets vertical tabulation	4-58
ESC+B+0	Releases vertical tabulation	4-58
ESC+e+1+n	Sets vertical tabulation every "n" lines	4-59
ESC+C+0+n	Sets page length in inches	4-60
ESC+C+n	Sets page length in lines	4-61
ESC+l+n	Sets column head (Left margin)	4-62
ESC+Q+n	Sets column end (Right margin) (Standard mode only)	4-63
ESC+f+0+n	Skips "n" position on a line	4-64
ESC+f+1+n	Skips "n" lines	4-65

WORD PROCESSING COMMANDS

Page

Name	Function	
ESC+a+0	Enables left alignment	4-37
ESC+a+1	Enables auto centering	4-38
ESC+a+2	Enables right alignment	4-38
ESC+a+3	Enables auto justification	4-39

Software Commands

DATA CONTROL COMMANDS

Page

Name	Function	
CAN	Clears data in buffer	4-4
DEL	Deletes last printable character	4-4
DC1	Selects printer remotely	4-5
DC3	Deselects printer remotely	4-5
ESC+>	Sets MSB on	4-66
ESC+=	Sets MSB off	4-67
ESC+#	Cancels MSB setting	4-68
ESC+Q+3	Deselects printer remotely (IBM Printer mode only)	4-69

DOWNLOADABLE CHARACTER COMMANDS

Page

Name	Function	
ESC+y+loc+ D ₁ +D ₂ +...+D ₉	Defines download character	4-71
ESC+z+loc	Releases download character definition	4-71

MISCELLANEOUS COMMANDS

Page

Name	Function	
CR	Starts printing	4-4
ESC	First byte of multi-byte control code	4-6
NULL	Last byte of certain multi-byte control codes	4-7
ESC+<	Homes print head	4-72
ESC+@	Initializes the printer	4-72
ESC+s+1	Sets half speed printing	4-73
ESC+s+0	Releases half speed printing	4-73
ESC+U+1	Sets single direction printing	4-73
ESC+U+0	Releases single direction printing	4-73
ESC+9	Enables paper-end detection	4-74
ESC+8	Disables paper-end detection	4-74

APPENDIX E

Paper

1. Continuous paper

A list of the paper which may be used with this unit is provided below.

Width: 3~10 inches (76~254 mm) continuous paper with perforations on either side.

Quality and number of sheets: Up to 3 sheets can be used; the relationship between the paper type and number of sheets is given below.

Types of paper	Sheets	Thickness (continuous paper weight in pounds)	Remarks
Fine-quality paper	1	14~17	
Non-carbon paper	2	11~14 (17)	(17) is only for the last sheet.
	3		
Multi-layer paper with carbon	2		

- The multi-layer paper with carbon is such that the inserted carbon sheet is equivalent to a sheet of paper and so the maximum number of sheets of such paper is 2.
- The “continuous paper weight” represents the weight of the paper indicating the weight of 500 sheets [17×22 inches (432×559 mm)] in pounds.

2. Single Sheet

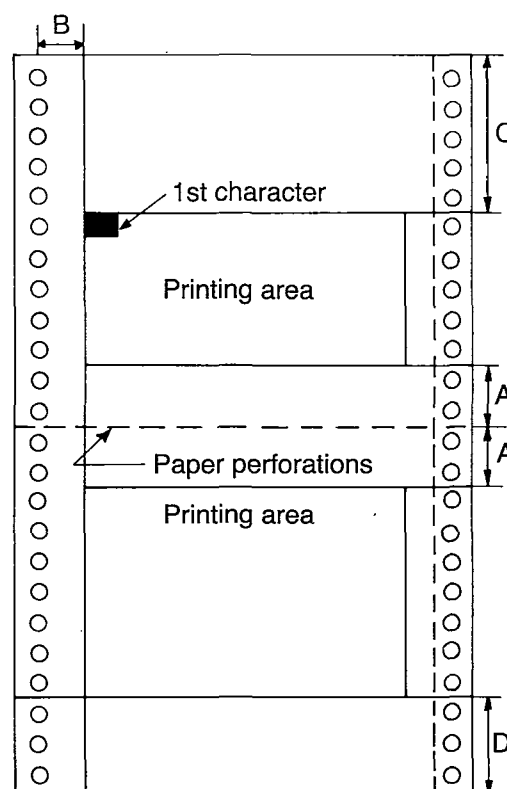
Width: 4~9 inches (102~229 mm)

Height: 5~14.3 inches (127~363 mm)

Thickness (paper weight in pound):

11~21.5 pounds (Only 1 sheet)

Printing Area



- A : 1 inch (25.4 mm)
 B : 0.95 inch (24 mm)
 C : 3.85 inches (98 mm)
 D : 1.5 inches (38 mm)

- A: the distance from the paper perforations where the lines may slip.
 B: the distance from the center of the sprocket hole, to the left edge of the leftmost character, with the tractor in its leftmost position.
 C: the distance from the top edge of the paper to the first line of printing.
 D: the distance from the bottom of the page where paper end is detected.

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