

Federal Communications Commission

Radio Frequency Interference Statement

This equipment generates and uses radio frequency energy. If it is not installed and used properly, that is, in strict accordance with the manufacturer's instructions, it may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specification in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate this equipment with respect to the receiver.
- Move this equipment away from the receiver.
- Plug this equipment into a different outlet so that this equipment and the receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-000345-4.

Note:

An unshielded plug or cable may cause radiation interference. The printer is designed for use with a properly shielded interface cable. The shield must be connected directly to the chassis of the printer.

STANDARD FEATURES

This dot matrix printer is a high-performance impact printer suitable for a wide range of use with equipment such as personal computers and small-business computers. It has the following features:

- Multiple character sets:
Alphanumerics, symbols, international characters, super- and subscripts, and graphics are available in various print modes.
- High-quality printing:
Near Letter Quality (NLQ) printing provides double-dot-density output for high print quality.
- Easy operation:
Fan-fold paper is easy to set up using the tractor and the ribbon cartridge is easy to change.
- High throughput:
High-speed printing of 180 characters/second and high-speed line feed of 120 ms/line are possible.
- A wide variety of functions:
Standard commands enable a variety of functions.
- Interface:
Besides the Centronics parallel interface, an RS-232C serial interface is available as an option.
- High reliability:
The printer incorporates a simple mechanism and highly integrated LSIs to ensure high reliability and easy maintenance.

This manual contains all the information you need, to take full advantage of the above functions.

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INTRODUCTION

Thanks for choosing this dot matrix printer. You've made a good choice.

This manual is designed to help you take full advantage of this printer. It is organized as follows; naturally, you don't need to read all of this manual if you are familiar with printers and computers.

Section 1, *Setting Up Your Printer*, describes the procedures from unpacking to test printing using the printer alone, before connecting it to your computer.

Section 2, *Connecting Your Computer*, gives information on setting the DIP switches of your printer and connecting your printer to your computer according to the relevant specifications of the computer. In the last stage of this section, you can do some printing using your computer.

Section 3, *Handling Your Printer*, illustrates paper handling procedures and operator panel controls for everyday operations of your printer.

Section 4, *Programming*, describes the functions of control codes and Escape commands so that you can use software to control your printer's various features. The last part of this section gives programming examples using BASIC.

Section 5, *Taking Care of Your Printer*, gives suggestions for keeping your printer in good condition. It also gives brief troubleshooting for some failures.

Appendixes give information on the optional featured: serial interface including the settings of serial interface board DIP switches. These also give the code tables and the summaries of printer specifications and control code functions for quick reference.

Note that there are two types of the printer: type I equivalent to IBM Graphics printer, and type F equivalent to EPSON FX-80 printer. The type is identified by a label on the rear of the printer. Some sections of this manual repeat descriptions of certain items, for example, control code and DIP switch definitions for each type although the descriptions are similar.

SECTION 1

SETTING UP YOUR PRINTER

Now, you've got your printer and unpacked the carton successfully according to the instructions on the box. First of all you would like to operate the printer to check whether and how it works. This section tells how to set up the printer before you connect it to your computer. This printer has a self test function so that the printer's main operations can be checked without a computer. This section gives step-by-step instructions for running the self test. It does not include information unnecessary for test printing.

1.1 Precautions

For best results, place your printer in the following conditions:

Environment

- As level as possible
- Free from vibration
- Away from direct sunshine or a heater
- Free from moisture or dust containing oil or iron filings

Power line

- Isolated from power lines connected to noise-generating equipment such as a large motor
- Not at too high or low voltage

In addition, be sure:

- Not to use liquids such as water or oil or small metal objects such as paper clips or pins on or near the printer, to prevent them from getting in the printer.
- Not to block the printer's air circulation vent.
- Not to obstruct the movement of the platen knob.
- Not to subject the printer to shock or vibration.

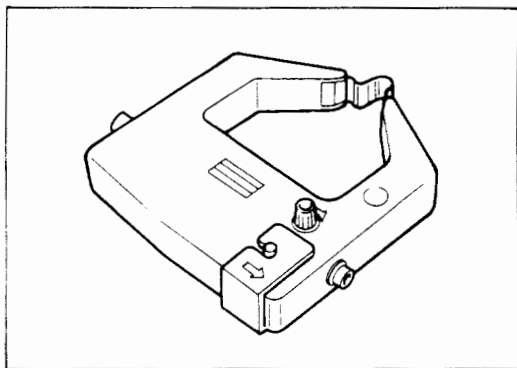
If you have any trouble with the following procedures, consult your dealer. If printer trouble occurs, turn power off immediately; using the printer when it is malfunctioning may cause more damage.

1.2 Unpacking

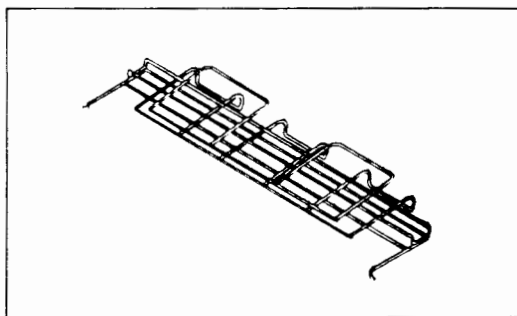
At this stage, you have already removed the printer itself from the carton according to the instructions on the carton.

- Check that the following accessories are all there. (Figure 1.1)

A. Ribbon cartridge



B. Sheet guide



C. Power cord
(For 220/240 VAC
type only)

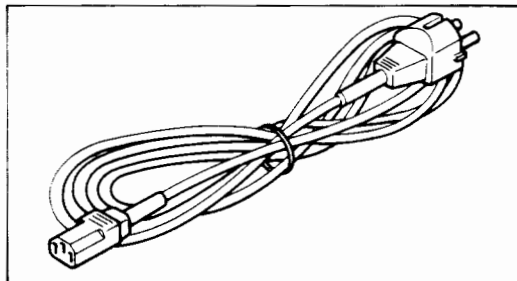


Figure 1.1 Accessories

- Open the top cover and remove the carriage unit packing, paper stopper used to keep the carriage from moving during transportation, from inside the printer. (Figure 1.2)
- Remove the plastic sheet from the top cover and protective tape from the sides of the printer.

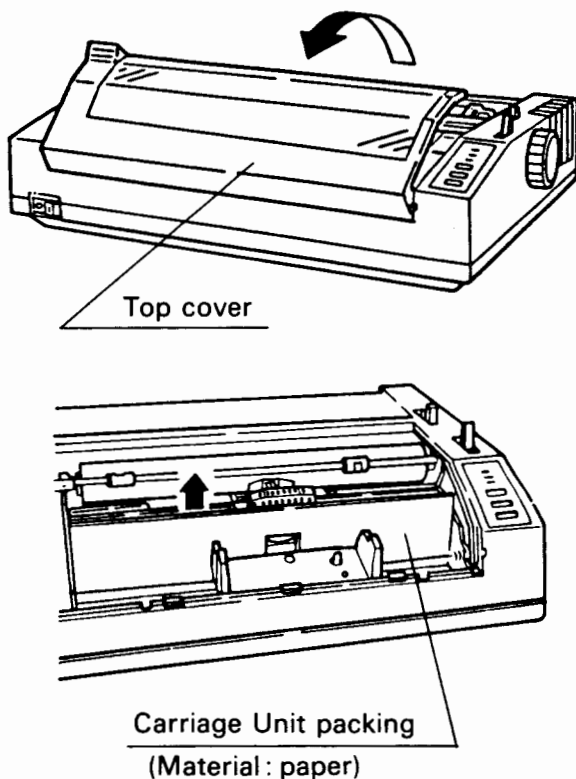


Figure 1.2 Removing the top cover and carriage unit packing

Note:

Save all the packing material for later use: storage or transportation to any other place.

1.3 Installing the Sheet Guide

Mount the sheet guide on the printer as follows to enable smooth feeding of continuous-sheet paper.

1. Lift the rear portion of the separator and remove the separator in 1, 2 order as indicated by the black arrows. (Figure 1.3)

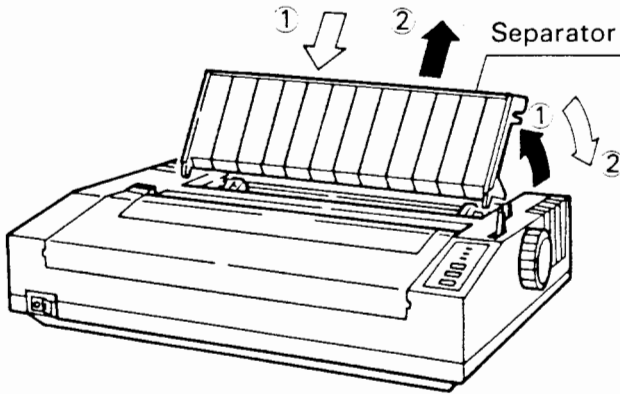


Figure 1.3 Removing paper separator

2. Lightly press the ends of the sheet guide inward, as indicated by the black arrows (Figure 1.3), and fit the ends of the sheet guide into the mounting holes on the upper case (Figure 1.4).

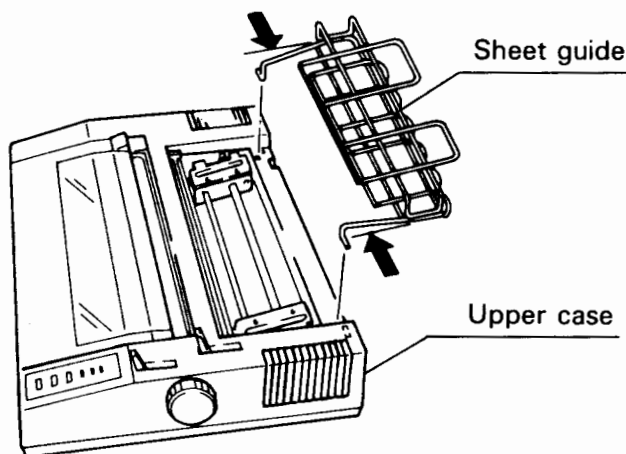


Figure 1.4 Installing the sheet guide

3. Re-install the separator in the order indicated by the white arrows in Fig. 1.3.

Now the printer appears as illustrated in Fig. 1.5. In this condition, you can use either cut-sheet or continuous-sheet paper on the printer.

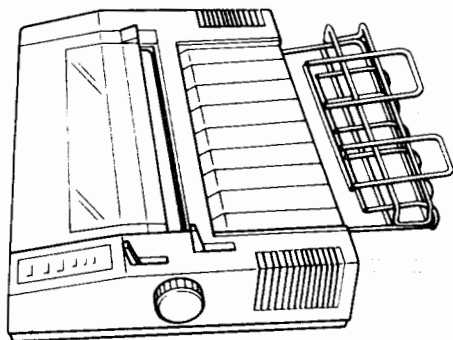


Figure 1.5 Sheet guide installed

1.4 Setting the Voltage Select Switch

If your printer is a 220/240 VAC type, this is identified by the product nameplate on the rear of the printer; set the voltage select switch located near the head gap adjustment lever to the position corresponding to the voltage supplied to your printer. (Figure 1.6)

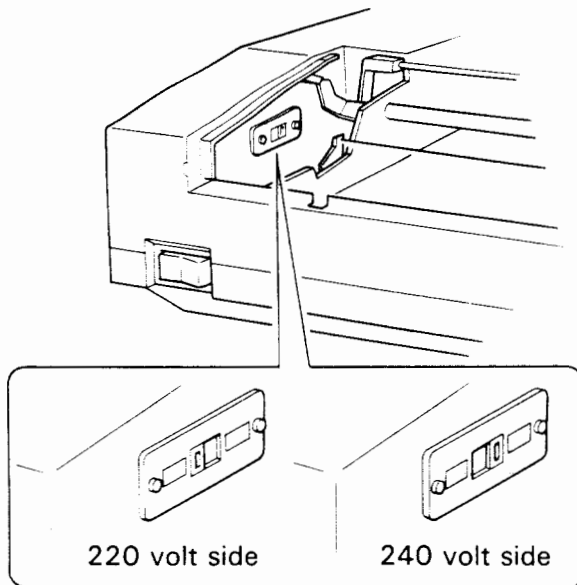


Figure 1.6 Voltage select switch

If your printer is supplied with 240 volt power, you don't have to change the switch position because the switch is set to the 240 volt side at shipment. This side prevents your printer from being damaged even if you have forgotten changing the setting. But remember to check the setting of the voltage select switch and, if necessary, change it as follows:

1. Open the top cover.
2. Use a coin or your fingernail to set the switch to the 220 or 240 volt side.
3. Close the top cover.

This printer is supplied with a cord having a 3-pin grounded plug. Check whether the outlet you will use matches the plug. If not, you must prepare a conversion adapter which connects the ground pin to ground for your safety.

Now you are ready to connect your printer to the outlet and perform the test print without your computer. Before starting, we briefly explain the names and functions of the main components of the printer which you'll use often during everyday operations. The operator panel will be explained in detail later in Section 3.3.

1.5 Getting Familiar with the Printer Main Components

This section explains the names and positions of the main parts of the printer. In the following sections, these parts will be referred to by name. Don't worry about other parts; they are shown in other figures, relevant to the procedure.

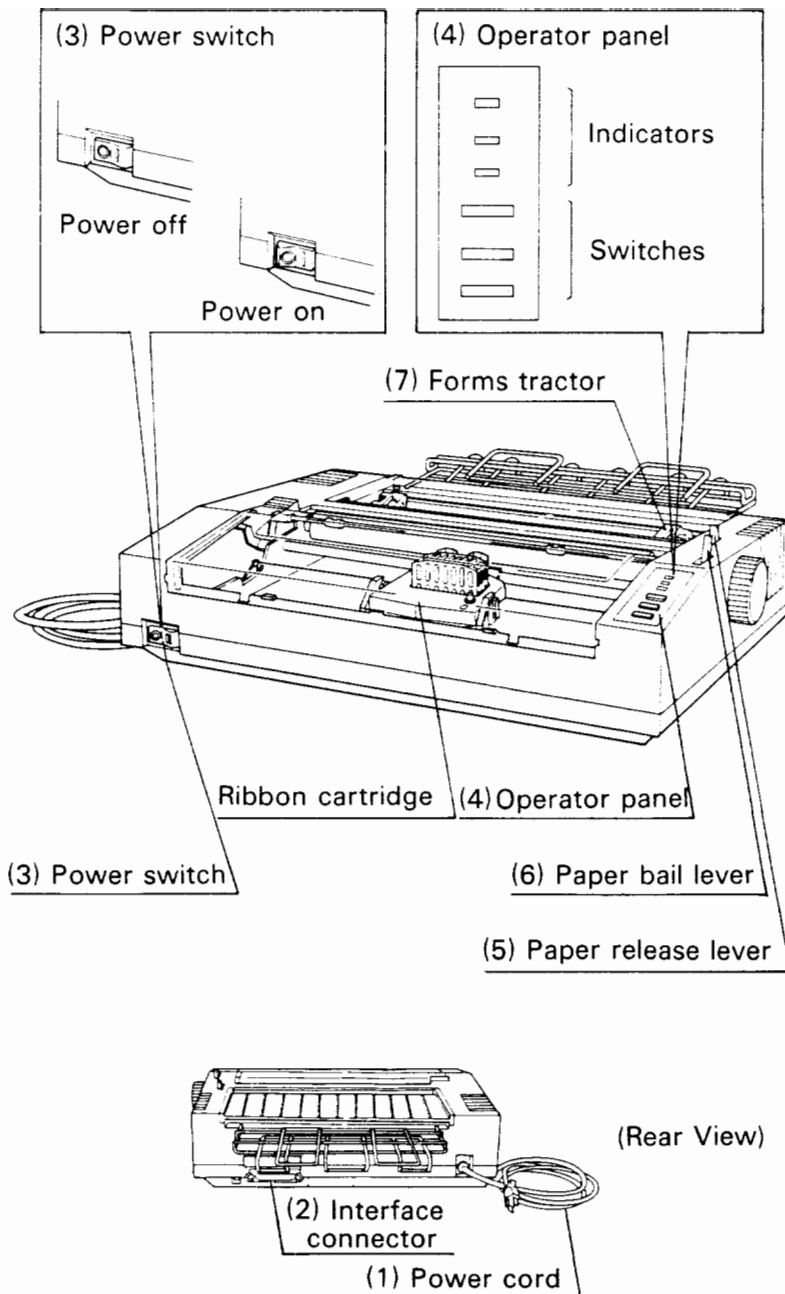


Figure 1.7 Printer components

(1) Power cord:

Supplies the printer with AC power; 115 to 120 VAC, 50/60 Hz or 220/240 VAC, 50 Hz

Notes:

1. Using any other power supply voltage or frequency may cause abnormal operation or failure.
2. Set the voltage select switch to 220 V or 240 V. (Section 1.4)


(2) Interface connector:


Connects the printer to your computer.

Notes:

1. Be sure power is off when you connect or disconnect the interface connector.
2. Check interface specification matching prior to connection. (Section 2)
3. You have to purchase an interface cable.

(3) Power switch:

Turns power on when the switch is turned toward  and lights the power lamp on the operator panel.

Turns power off when the switch is turned toward .

(4) Operator panel:

Contains the switches and indicators used to operate the printer. For details, see Section 3.3.

(5) Paper release lever:

Used to move the paper release rollers which give feed tension to paper. Set the lever toward the rear of the printer when printing cut-sheet

paper. Set it toward you when aligning or removing paper or when using the forms tractors.

(6) Paper bail lever:

Used to move the paper bail which presses the paper against the platen. Pull the lever toward you, away from the platen, to load paper. Set this lever toward the rear of the printer when printing.

(7) Forms tractor:

The forms tractors are used for continuous-sheet paper.

1.6 Running the Test Printing

Test printing will enable you to check whether your printer operates normally. The test printing can run without a computer and is easily done.

If you are in a hurry to connect your printer to your computer, you can skip this section except for installing the ribbon. However, we recommend that you try the test printing if this is the first time to operate your printer after purchasing it.

1.6.1 Installing or changing ribbon cartridge

The ribbon cartridge is shown in detail in Fig. 1.8.

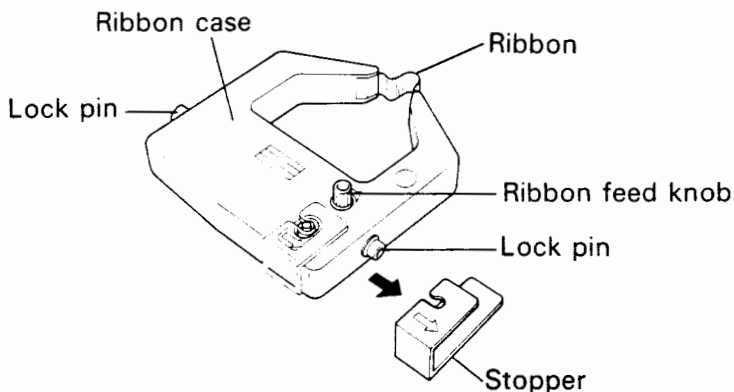


Figure 1.8 Ribbon cartridge

1. Make sure power is off.
2. Remove the stopper from the new cartridge and rotate the ribbon feed knob in the direction of the arrow (clockwise) until the ribbon is tight.
3. Open the top cover of the printer.
4. If the head is positioned too far left or right, center it manually.
5. To change ribbon cartridges, remove the old ribbon cartridge by lifting it at both sides.
6. Insert a new ribbon cartridge as follows. Put the ribbon case lock pins in along the ribbon frame guide grooves while inserting the ribbon between the print head nose and the ribbon mask. Lightly push down on the upper surface of the ribbon case to lock the ribbon cartridge in place. (Figure 1.9)

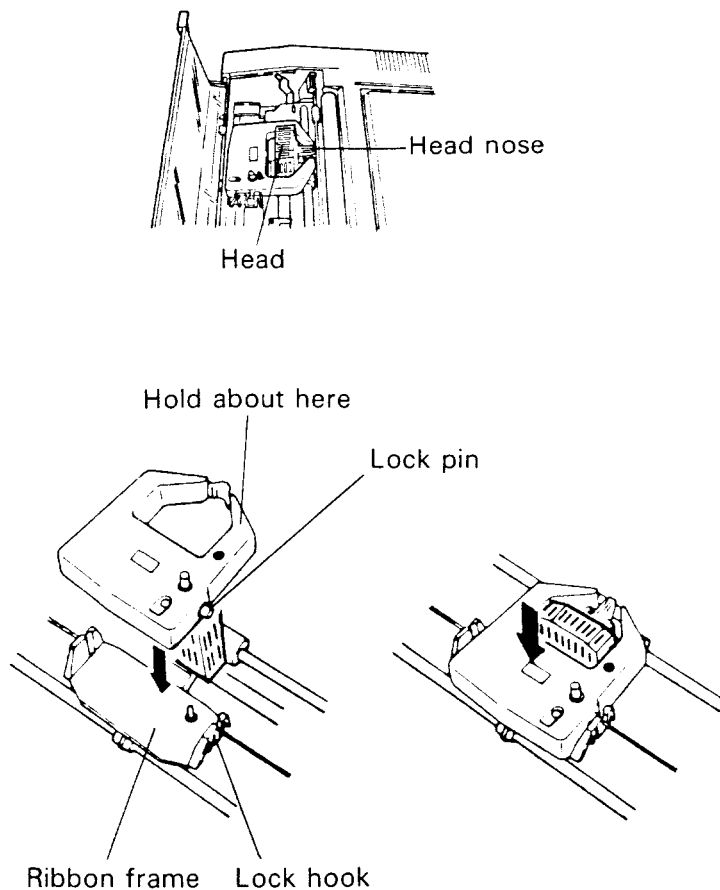


Figure 1.9 Mounting ribbon cartridge

Notes:

1. Check that the lock pins on both sides of the ribbon cartridge fit exactly into the guide grooves, and check that there is no clearance between the ribbon frame and the ribbon case.

2. Rotate the ribbon feed knob to check that the ribbon feeds properly. This also removes the slack.
3. Position the head, ribbon, and mask as shown below in Fig. 1.10.

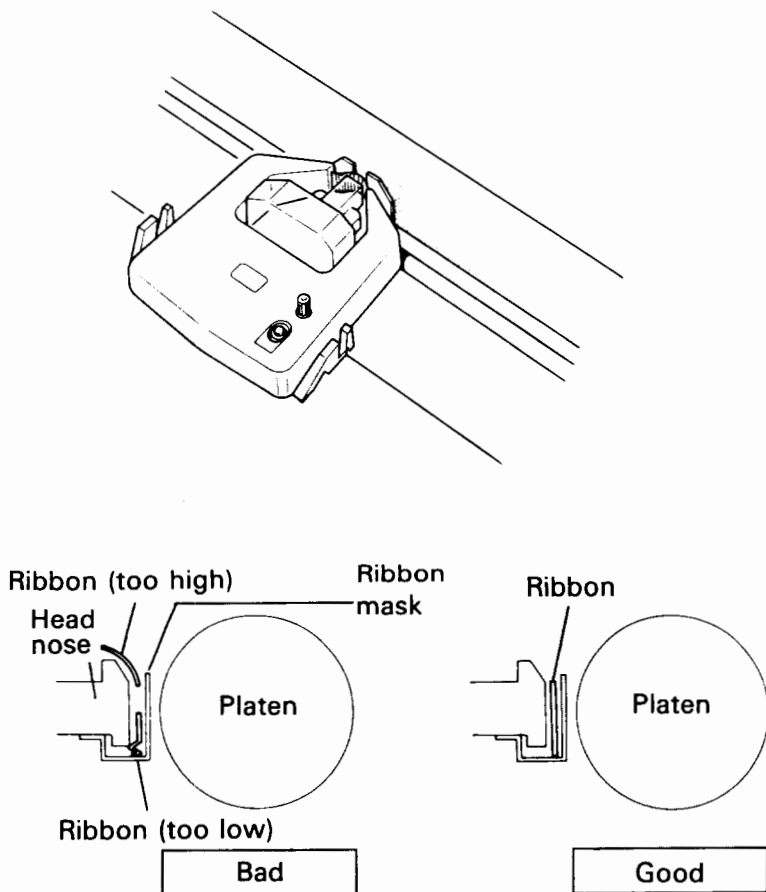


Figure 1.10 Ribbon positioning

Now, the next thing to do is to load your printer with paper. This printer can use two types of paper: cut-sheet and continuous-sheet paper. But for this test printing, you can use a piece of typewriter paper, which will be satisfactory and available anytime. If you want to use other types of paper, see Section 3.

1.6.2 Loading cut-sheet paper

Cut-sheet paper is set in the printer as follows (Figure 1.11).

Note:

If you are using typewriter paper (usually letter size) for the test printing, load it sideways because characters are printed over the full line, and the print head and platen may be damaged if the printing runs off the paper.

1. Push the paper release lever toward the rear of the printer.
2. Open the top cover.
3. Pull the paper bail lever toward you to separate the platen and bail rollers.
4. Insert the paper in the cut forms inlet and rotate the platen knob to roll the paper out.

Note:

If the paper is set slantways, pull the paper release lever toward you and align the edges of the paper in the same way as for an ordinary typewriter.

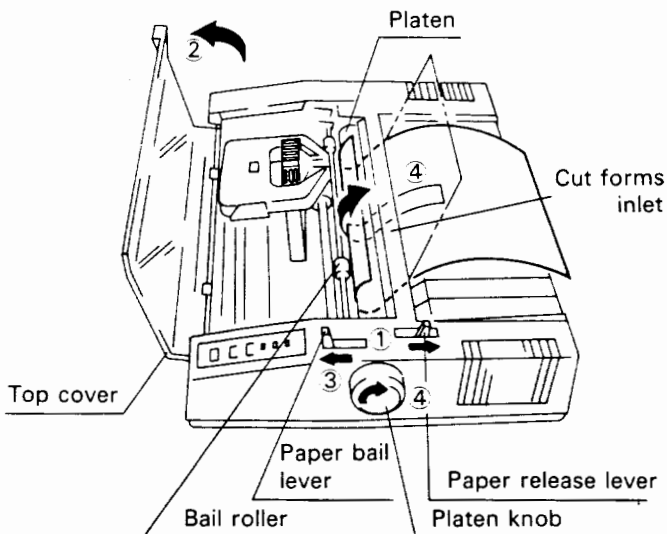


Figure 1.11 Loading cut-sheet paper (1)

Feed the paper until the top of the paper will be under the bail rollers.

5. Move the two bail rollers so that they are at both sides of the paper, and then push the paper bail lever to the rear.

6. Close the top cover.

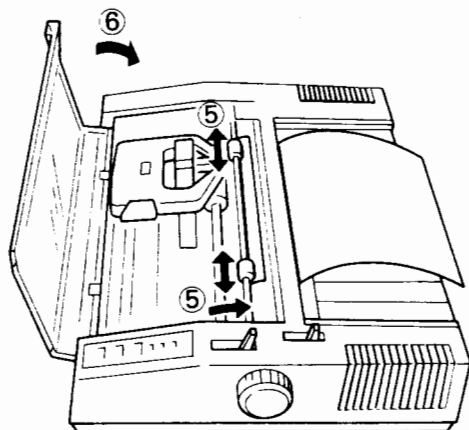


Figure 1.12 Loading cut-sheet paper (2)

Note:

The top cover is designed as a guide for setting paper. (Figure 1.13)

- The edge of the top cover meets the top edge of the paper one inch above the print start position.
- The top cover scale indicates column positions 1 to 80 at pica pitch.

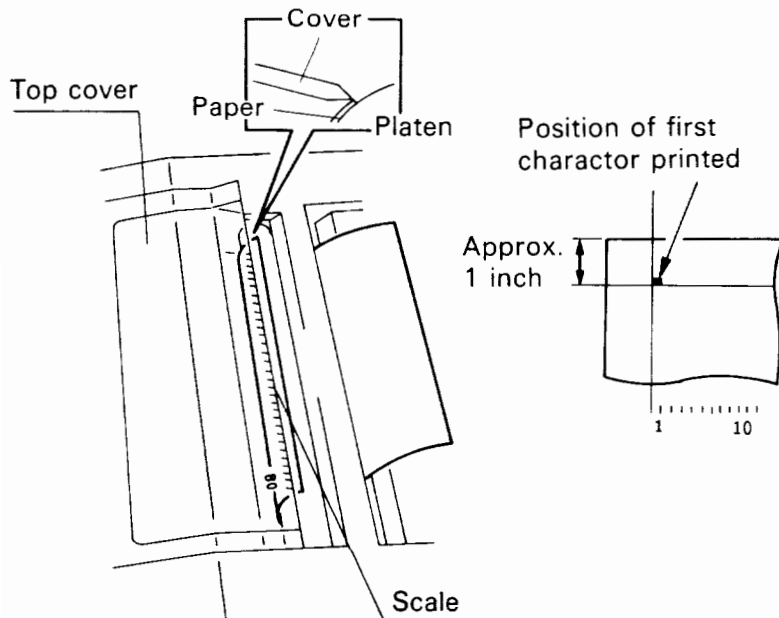


Figure 1.13 Adjusting print start position

When using typewriter paper, set the head gap adjustment lever to notch position 2. The lever is at the left side when you open the top cover. For details, see Section 3.2.

1.6.3 Printer initialization

At last you can turn your printer on and run the test printing. Plug the power cord in an outlet and turn the power switch on. If your printer has no trouble, you will see the following:

- The POWER lamp goes on.
- The printer moves the print head to its home position.
- The ON LINE lamp goes on.

The head movement mentioned above is part of printer initialization performed whenever:

- Power is turned on with the top cover closed,
- The $\overline{\text{INIT}}$ signal is received, or
- The printer reset command (ESC @) is received,

and the following actions are taken:

- The print head is returned to its home position at the left margin.
- Mode is set to online if paper is set.
- The print buffer is cleared.
- The vertical tab settings are cleared and horizontal tabs are set at 8-column intervals.
- Print mode is set for standard pica pitch.
- Line spacing is set to 1/6 or 1/8 inch.
- Page length is set to 11 or 12 inches and the current line position is used as the first line of the page.

1.6.4 Test printing

Now that you have verified that your printer has no trouble with power on, you are ready to run the test printing.

- Turn power off.
- While holding the LF (Line Feed) switch down, turn the printer on.
- The printer executes the test printing (the ONLINE switch does not light): characters are printed repeatedly, shifted one character left every line. See Fig. 1.14. The characters printed depend on the type of printer and the settings of DIP switches. See Tables 2.2 and 2.4 and Appendix D.
- The test printing stops when the printer is turned off for type F or stops automatically for type I. In the latter case, the printer enters online after the test. The test printing also stops if the paper runs out (the PAPER OUT lamp goes on and the buzzer sounds four times).

Note:

You can also stop the test printing by opening the top cover, then restart it by pressing the ONLINE switch after closing the top cover.



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SECTION 2

CONNECTING YOUR COMPUTER

By test printing, you have checked that your printer operates properly without your computer. Of course, your printer can perform some other functions (forms feeding, line feeding, etc.) in this offline state, but we will skip explanation of these operations because we think they are simple and obvious, and are explained later (Section 3).

Now you can connect your printer to your computer and instruct it to do normal printing.

This printer can communicate with a computer through two types of interfaces: parallel (Centronics) and serial (RS-232C). This section explains how to connect your printer through the parallel interface (basic feature). For connection through the serial interface (optional feature), see Appendix A. If the serial interface is installed there will be two connectors at the interface connector opening at the rear of the printer. For either interface, you have to buy an interface cable from your dealer or make one yourself.

This printer has two DIP switches (SW1: 8 circuits and SW2: 4 circuits) to be set according to particular features of your computer and some printer modes suitable for your software packages. These settings are read when the printer is first turned on, but the modes set by the settings can be changed by commands from the computer. Note that the DIP switch assignment differs between type F and type I printers. Anyway, you must read the relevant descriptions in your computer manual before selecting the settings of the DIP switches.

2.1 Setting the DIP Switches

This printer has been shipped with the DIP switches set to certain positions (see Tables 2.1 to 2.5).

The functions of the DIP switches are as follows:

2.1.1 DIP switches for type F

SW1-1:

Sets the number of characters per line to 80 or 132. When 80 is

selected, 80 characters are printed at pica pitch. When 132 is selected, 132 condensed characters are printed at a character spacing of 17.1 (120/7) characters per inch.

SW1-2:

Sets the font of zeros to O or Ø.

SW1-3:

Enables or disables the paper-out detector.

SW1-4:

Determines whether the 2K-byte RAM is used as a buffer or as a download character generator.

SW1-5:

Selects 11 or 12 inches for length of a page.

SW1-6 to -8:

Select an international character set which includes the characters peculiar to your language. For the character fonts, see Appendix D.

Table 2.1 DIP switch 1 functions (type F)

No.	Function	Selection		Factory setting
		OPEN (Off)	ON	
1	Number of columns per line	80	132	Open (Off)
2	Font 0 selection	0	Ø	Open (Off)
3	Paper out detector	Used	Unused	Open (Off)
4	Use of 2K-byte RAM (*1)	Down-load CG	Buffer	Open (Off)
5	Page length	11 inches	12 inches	Open (Off)
6	Selection of international character set			On
7	Selection of international character set	See Table 2.2.		On US ASCII
8	Selection of international character set			On

*1 The setting to use depends on whether your program or software package uses the download function.

Table 2.2 International character set selection

Country	Switch settings		
	#6	#7	#8
US	On	On	On
France	On	On	Open (Off)
Germany	On	Open (Off)	On
England	On	Open (Off)	Open (Off)
Denmark	Open (Off)	On	On
Sweden	Open (Off)	On	Open (Off)
Italy	Open (Off)	Open (Off)	On
Spain	Open (Off)	Open (Off)	Open (Off)

SW2-1:

Determines whether the printer will be set to online or offline when power is first turned on. If the switch is on, online mode is set regardless of the SLCT IN signal from the computer. If the switch is off, online mode is set if the signal is low, but offline mode is set if the signal is high. This offline mode is changed to online mode when a DC1 code is received from the computer.

SW2-2:

Enables or disables the buzzer.

SW2-3:

Determines whether printing is done in the one-inch area before and after each perforation. See Fig. 2.1.

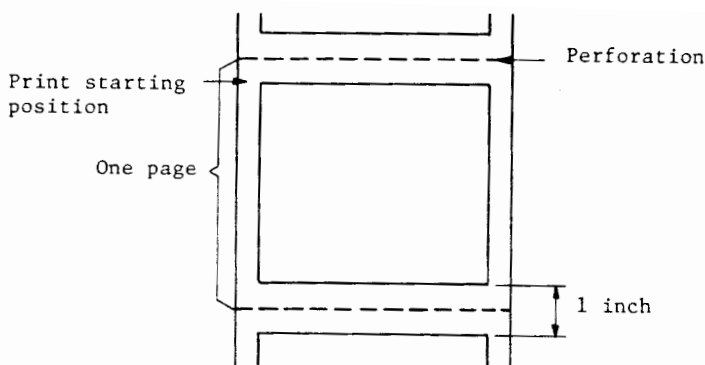


Figure 2.1 Perforation skip

SW2-4:

Determines whether a carriage return initiated by a CR code received from the computer will be automatically followed by a line feed. If the switch is on, line feed automatically follows CR. If the switch is off, line feed is not done when the AUTO FEED XT signal from the computer is high, but is done when the signal is low. Be careful of the setting of this switch when the 2K-byte buffer is used (see SW1-4) because the AUTO FEED XT signal is not sensed when a CR code is received from the computer but is sensed when the CR code is read into the print buffer from the 2K-byte buffer.

Table 2.3 DIP switch 2 functions (type F)

No.	Function	Selection		Factory setting
		OPEN (Off)	ON	
1	SLCT IN signal for online/offline switching (*1)	Enabled	Disabled. Online is set	On
2	Buzzer	Disabled	Enabled	On
3	Perforation skip (*2)	Disabled	Enabled	Open (Off)
4	Line feed by CR code (*3)	Depends on <u>AUTO FEED XT</u> signal	Done auto- matically after printing	Open (Off)

The setting to be selected depends on whether:

- *1 Your computer issues a DC1 code to select the printer.
- *2 Your program or software package instructs the printer to skip perforation.
- *3 Your computer automatically adds an LF code after a CR code for a new line at the end of a line.

2.1.2 DIP switches for type I

SW1-1:

Sets the font for zeros to 0 or Ø.

SW1-2:

Valid when SW2-3 is off and determines whether a carriage return initiated by a CR code received from the computer is automatically followed by a line feed. If SW1-2 is off, line feed is done after CR. If the switch is on, line feed depends on the AUTO FEED XT signal from the computer: done when the signal is low and not done when the signal is high.

When using the 2K-byte buffer (see SW1-5), be careful of the setting of this switch because the AUTO FEED XT signal is not sensed when a CR code is received from the computer to the 2K-byte buffer but is sensed when the CR code is read into the print buffer from the 2K-byte buffer.

SW1-3:

Determines whether a line is fed at the end of printing operation initiated by buffer full detection.

SW1-4:

Determines whether CAN codes from the computer are valid or not.

SW1-5:

Determines whether the 2K-byte RAM is used for buffer or for a download character generator.

SW1-6:

Determines whether the buzzer is enabled or disabled.

SW1-7:

Selects one of the two character generator sets, CGSET1 and CGSET2, built in the printer.

SW1-8:

Determines whether the printer is set to online or offline when power is first turned on. If the switch is on, online mode is set regardless of the SLCT IN signal from the computer. If the switch is off, mode selection depends on the SLCT IN signal: online when the signal is low and offline when the signal is high. Because this offline mode can be changed to online mode only when the printer receives a DC1 code which is not defined for type I, SW1-8 must be set to ON.

Table 2.4 DIP switch 1 functions (type I)

Switch number	Function	OPEN (OFF)	ON	Factory setting
SW1-1	Font 0 selection	0	Ø	OPEN (OFF)
SW1-2	Line feed by CR code (*1)	Done after printing if SW2-3 is off	Not done. Line feed depends on <u>AUTO FEED</u> XT signal if SW2-3 is off.	ON
SW1-3	Line feed by buffer full detection	Done after printing	Not done. Printing only.	OPEN (OFF)
SW1-4	CAN code	Valid	Invalid	OPEN (OFF)
SW1-5	Use of 2K-byte RAM (*2)	Download CG is selected	2K-byte buffer is selected	OPEN (OFF)
SW1-6	Error buzzer	Disabled	Enabled	ON
SW1-7	CG set selection	SET1 is selected	SET2 is selected	OPEN (OFF)
SW1-8	<u>SLCT IN</u> signal for online/offline switching (*3)	Enabled. Do not set to this side.	Disabled. Online is set.	ON

The setting to be selected depends on whether:

- *1 Your computer automatically adds an LF code after a CR code for a new line at the end of a line.
- *2 Your program or software package uses the download function.
- *3 Your computer issues a DC1 code to select the printer.

SSW2-1:

Selects 11 or 12 inches for length of a page.

SW2-2:

Selects 1/6 or 1/8 inches for line spacing.

SW2-3:

Determines whether a carriage return initiated by a CR code received from the computer is automatically followed by a line feed. If the switch is on, line feed is done. If the switch is off, line feed depends on SW1-2 and the AUTO FEED XT signal (see the explanation for SW1-2).

SW2-4:

Determines whether printing is done or not on the one-inch area before and after each perforation (See Fig. 2.1).

Table 2.5 DIP switch 2 functions (type I)

Switch number	Function	OPEN (OFF)	ON	Factory setting
SW2-1	Page length	11 inches	12 inches	OPEN (OFF)
SW2-2	Line spacing	1/6 inch	1/8 inch	OPEN (OFF)
SW2-3	<u>AUTO FEED XT</u> signal for auto line feed (*1)	Enabled. Line feed depends on SW1-2.	Disabled. Line feed is done unconditionally after printing.	OPEN (OFF)
SW2-4	Perforation skip of 1 inch (*2)	Disabled	Enabled	OPEN (OFF)

The setting to be selected depends on whether:

- *1 Your computer uses this signal for a new line.
- *2 Your program or software package instructs the printer to skip perforation.

If these settings match your requirements, you do not need to change the settings and can skip to Section 2.2. If not so, you must reset the corresponding DIP switches as follows:

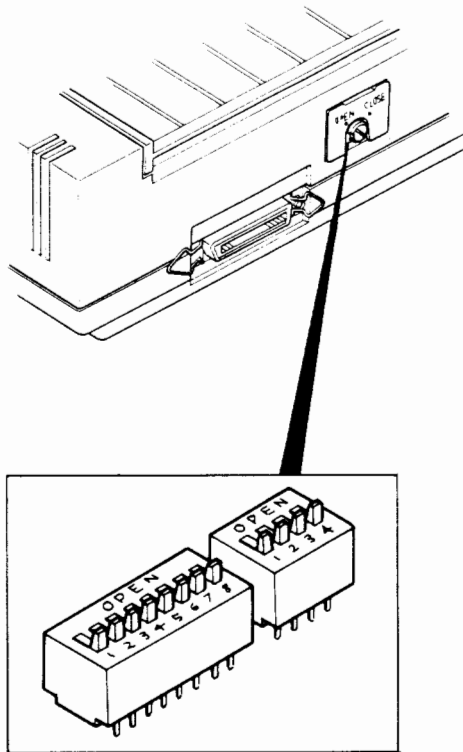


Figure 2.2 DIP switch location

1. Make sure your printer is off and unplugged.
2. Remove the separator by lifting its rear edge and remove the sheet guide by pressing the ends of the sheet guide arms inward.
3. Remove the DIP switch access cover at the rear of the printer by turning its catch counterclockwise by a coin.
4. You can see the two DIP switches (SW1: left and SW2: right) on the control circuit PC board.

Note:

If your printer is equipped with the serial interface, you will see the other two DIP switches on the serial interface PC board above the control circuit PC board.

Remember that these two sets of DIP switches are different in structure. See Appendix A for the DIP switches on the serial interface PC board.

5. Slide the switches to the desired positions by using a pointed object such as the tip of a standard screwdriver or mechanical pencil.

We recommend that you write down the desired settings for all the switches for later reference.

Table 2.6 DIP switch settings selected

Switch	Setting	Switch	Setting
SW1-1		SW2-1	
2		2	
3		3	
4		4	
5			
6			
7			
8			

6. Replace the DIP switch access cover and turn the catch clockwise.
7. Replace the sheet guide (see Section 1.3).

At this stage you can connect your printer to your computer by an interface cable.

2.2 Connecting the Interface Cable

This section explains how to connect the parallel interface. This printer has the 36-contact amphenol 57FE-40360 connector for the parallel interface at its rear. For the serial interface, see Appendix A.

1. Make sure you have the correct cable.
2. Make sure both your printer and computer are turned off and unplugged.
3. Connect one plug of the cable to your printer and the other to your computer.

Note:

For interface connection at the computer side, read the relevant descriptions in your computer manual.

4. Lock the connectors by snapping their stoppers inward.

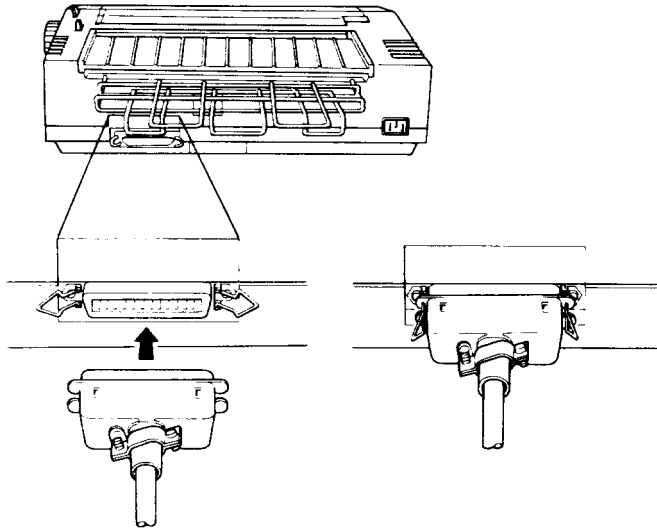


Figure 2.3 Parallel interface connection

Now you have done the settings of the DIP switches and the connection between your printer and computer. Then you can turn your computer on and do some printing from your computer.

2.3 Printing from Your Computer

You will want to check whether your printer performs properly from your computer through the interface cable. You can do this by running a simple program in BASIC or other programming languages on your computer. The following is an example when using BASIC. (You are assumed to have a basic understanding of programming and operation.)

1. Turn on your printer and computer.
2. Load your BASIC from the disk, and enter:
10 LPRINT "TESTING".

Note:

Not all versions of BASIC use LPRINT as a print statement.

3. Run the program.

4. Your printer should print TESTING on the paper.

You have checked that the interface is basically matched and alive (contact your dealer if the interface is mis-matched). However, this printer has various functions which can be performed by control codes and commands from the computer. See Section 4 for control codes and commands.

We have not detailed the operations of your printer. The next section will explain them: paper setting, head gap adjustment, operator pannel operation, etc.

SECTION 3

HANDLING YOUR PRINTER

In the preceding sections, you have seen your printer operate properly either alone or under control of your computer, but not all the functions have been checked. This printer has various functions, which are performed by yourself or by commands from your computer. This section will explain the former: how to load and position paper (cut-sheets or continuous-sheets), how to adjust the print head gap for paper thickness, and how to use the operator panel. We hope you will make yourself familiar with the operations of your printer before using your printer for your computer system.

For loading cut-sheet paper, see Section 1.6.2.

3.1 Loading Continuous-sheet Paper

Loading your printer with continuous-sheet paper is a fairly simple operation. The paper fits in only one fairly obvious track, but if you have no experience with such operation, this section gives all the details.

Load continuous-sheet paper as follows:

1. Pull the paper release lever toward you.
2. Remove the paper separator.
3. Open the top cover and pull the paper bail lever toward you to separate the platen and the bail rollers.

Note:

Adjust the gap between the print head and the platen according to the thickness of paper you are going to use. (See Section 3.2.)

4. Pull the right and left tractor lock levers toward you to free the tractors for horizontal movement.
5. Open the right and left tractor paper holders.

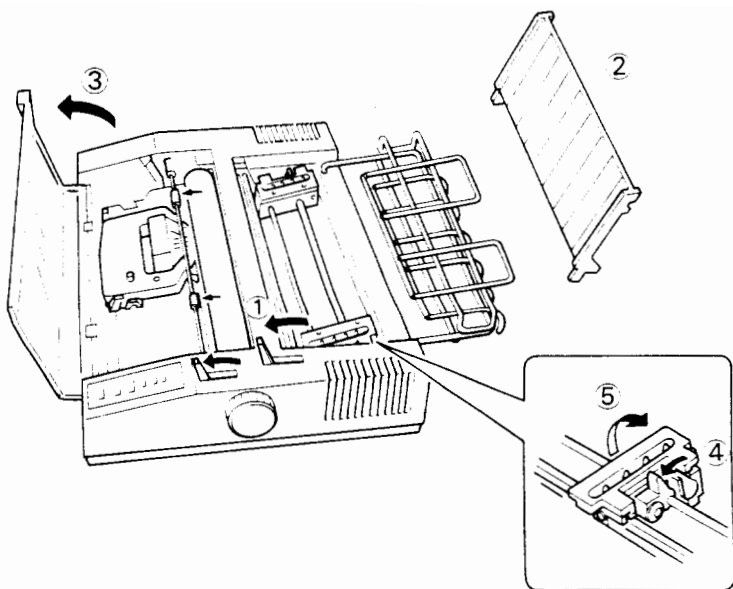


Figure 3.1 Loading continuous-sheet paper (1)

6. Insert the paper between upper and lower wire frames of the paper guide.
7. Align and set paper sprocket holes onto the tractor pins and close the paper holders.

Note:

Use the top cover scale to determine the horizontal printing position of the paper.

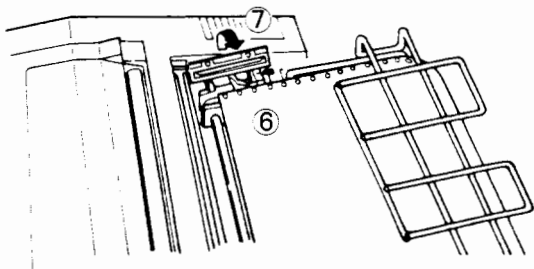


Figure 3.2 Loading continuous-sheet paper (2)

8. Rotate the platen knob to roll the paper out.

Notes:

1. Feed the paper until the top of the sheet will be under the bail rollers.
 2. Do not disturb the paper-end sensor lever and ribbon mask when rolling the paper out.
 3. Check that sprocket holes are not torn and that continuous sheets of paper feed smoothly and firmly.
 4. Check that the left-right printing position is correct.
9. Lock the tractor lock levers.

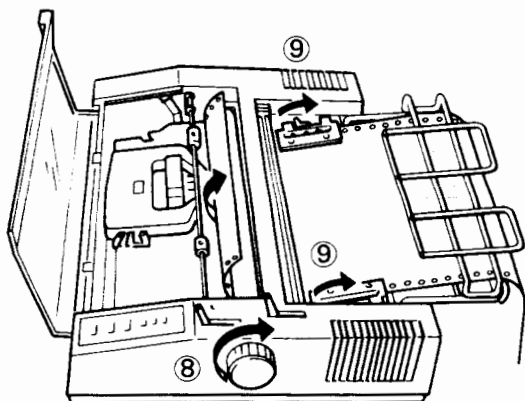


Figure 3.3 Loading continuous-sheet paper (3)

10. Move the bail rollers so that they are opposite both sides of the paper and then reset the paper bail against the platen.
11. Close the top cover.
12. Attach the paper separator.

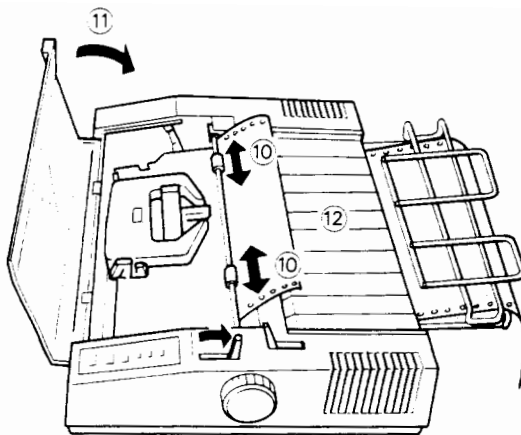


Figure 3.4 Loading continuous-sheet paper (4)

13. Adjust paper roll-out and top line print start positions. The edge of the top cover meets the end of the paper one inch above the print start position.

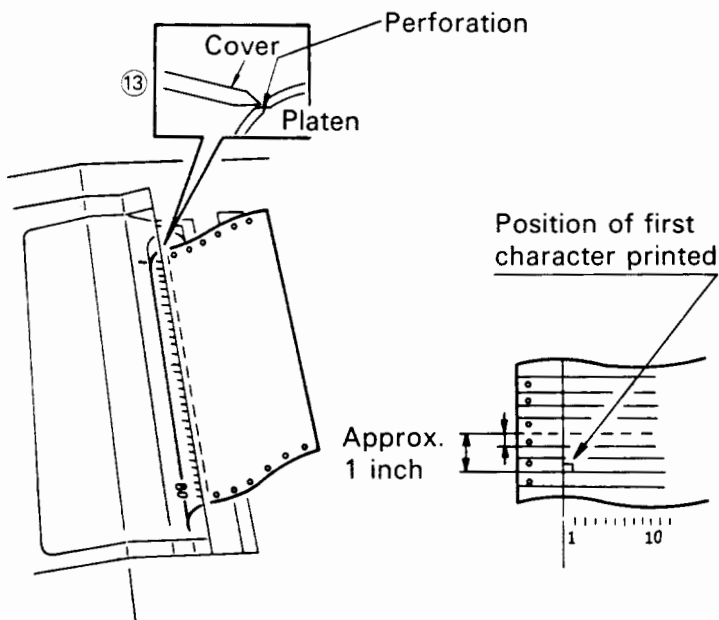


Figure 3.5 Adjusting print start position

14. Set up the paper as shown in Fig. 3.6 to ensure paper refolding.

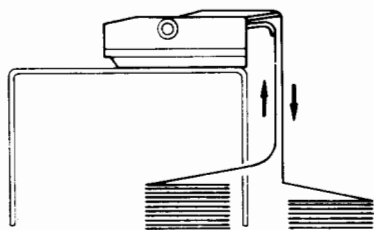


Figure 3.6 Setting up fanfold paper

3.2 Adjusting the Head Gap

You can use various types of paper, but must adjust the gap between the print head and platen according to the number of copies and the thickness of paper you are going to use. Too narrow or wide setting of the gap may damage the print head during printing. Be sure to set the head gap adjustment lever to the proper position before loading paper. Adjustment is as follows:

1. When you open the top cover, the head adjustment lever is at your left.

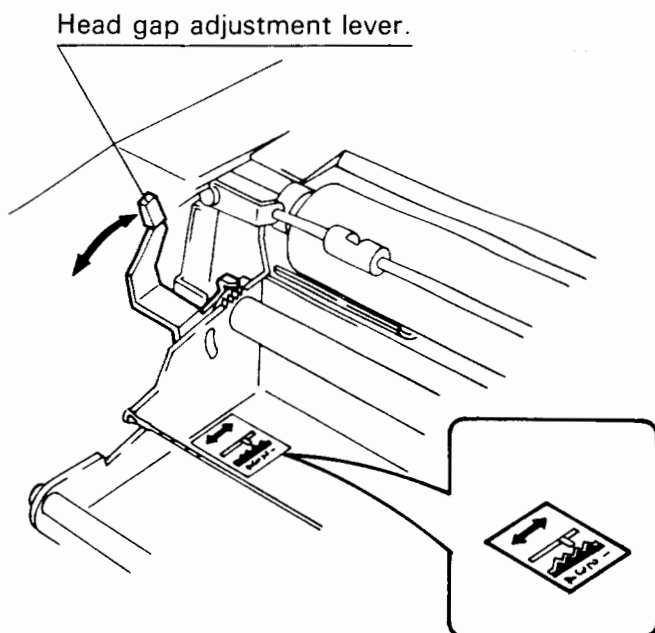


Figure 3.7 Head gap adjustment lever

For the notch positions, see the label at the bottom of the frame under the lever.

2. Select the notch position as shown below.

Table 3.1 Head gap adjustment

Paper	Notch position
Single-part	2
Two-part	2 or 3
Three-part	3

Notes:

1. When using thick paper, use a higher notch position number to allow a wider gap than shown in the above table, regardless of the number of copies.
2. Should printed characters become faint due to the use of the printer for an extended period, use a lower notch position number.

3.3 Operator Panel

This printer has an operator panel at the right of the upper cover viewed from the front. The operator panel has three indicators and three switches as shown in Fig. 3.8. In addition, a buzzer, regarded as an operator panel component, is installed near the operator panel, but cannot be seen from the outside of the printer.

Indicators:

- POWER (green) lights when power is on.
- PAPER OUT (red) lights when paper is out.
- ONLINE (green) lights when the printer is online.

Buzzer:

- The buzzer sounds to report an error condition to the operator.

Switches:

- ON LINE places the printer online or offline.
- FF (Form Feed) moves paper to the print start position of the next page.
- LF (Line Feed) moves paper to the next line.

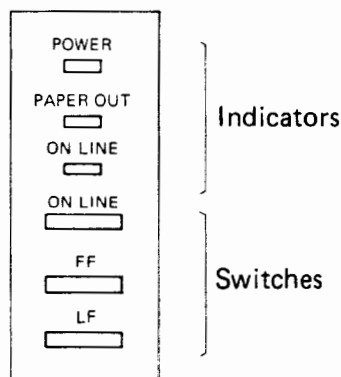


Figure 3.8 Operator panel

The following are details about the lamps, buzzer, and switches.

PAPER OUT lamp:

The PAPER OUT lamp goes on when:

- Paper runs out during printer operation or
- Power is turned on without paper.

The buzzer sounds four times. If this condition occurs during online printing, the printer stops printing at the end of the current line, and goes offline. Pressing the ON LINE switch after setting new paper places the printer online. For type F printers, note that the lamp does not light if the paper out sensor is disabled by DIP switch setting (see Section 2.1).

ON LINE lamp:

The ON LINE lamp, indicating the interface condition between your printer and computer, goes on when:

- Power is turned on with paper loaded and the top cover closed or
- The ON LINE switch is pressed when the printer is offline with other online set conditions (paper loaded and top cover closed) satisfied.

When this lamp is on, your computer communicates with your printer. Note that the lamp may not light if power is turned on with the SLCT IN signal included among online set conditions by setting a DIP switch (see Section 2.1).

Buzzer:

The buzzer sounds when:

- Paper runs out during operation,
- Power is turned on when no paper is loaded,
- A BEL code is sent from the computer, or
- A failure occurs in the print head carriage system.

For the first two cases, the PAPER OUT lamp should light; set new paper. For the next case, a certain message should be given on your printer or computer; follow the instructions. For the last case, you may find some print errors such as a spacing error; contact your dealer if this type of error occurs again after you turn power off and back on.

ON LINE switch:

By the ON LINE switch you can select online or offline mode between your printer and computer.

- Pressing this switch in online mode places the printer offline and turns the ON LINE lamp off.
- Setting online from offline mode depends on the conditions described for the ON LINE lamp. When the conditions are all satisfied, the printer goes online (the ON LINE lamp lights) after performing the mechanical reset operation to ready the printer for communication with the computer. You can see the print head carriage move to its home position when the reset operation is performed.
- If you need to change the paper or ribbon cartridge when the printer is online, first press the ON LINE switch to set the printer to offline. Do not turn power off in this case because print data in buffer would be lost. After changing, press the ON LINE switch again to set the printer to online, and the print operation will continue normally.

FF switch:

By the FF switch you can advance the paper so that the print position is moved to the predetermined first line of the next page.

- This switch is effective when the ON LINE lamp is off, even if the PAPER OUT lamp is on; but ineffective once the top cover is opened. You can use this switch to eject the paper left on the platen at paper end.
- Page length is either 11 or 12 inches. At the factory, it is set to 11 inches by a DIP switch (see Section 2.1).
- The line facing the print head when power is turned on is initially determined as the first line of the page.

After turning power on, adjust the first line to the position you want by turning the platen knob. After this initial setting, you should use the FF or LF switch to feed paper; otherwise the first line will shift.

- Holding down the FF switch provides continuous form feeding.

LF switch:

By the LF switch you can move the paper up one line.

- This switch is effective when the ON LINE lamp is off, even if the PAPER OUT lamp is on; but ineffective if the top cover is open.
- Line spacing is 1/6 inch for type F and 1/6 or 1/8 inch for type I. At the factory, it is set to 1/6 inch by a DIP switch (see Section 2.1).
- Holding down the LF switch provides continuous line feeding.

The FF and LF switches have additional convenient functions shown below.

Test printing

The LF switch executes self test printing you have already learned in Section 1.6.3.

1. While holding the LF switch down, turn power on.

2. Characters will be printed repeatedly (See the test print pattern, Figure 1.14). The print modes such as type font, the number of columns per line, line spacing, and perforation skip depend on DIP switch settings (see Section 2.1).
3. The test printing stops by turning power off for type F or stops automatically for type I. In the latter case, the printer enters online after the test printing. Test printing will also stop when paper runs out or the top cover is opened. In this case, you can restart the test printing by pressing the ON LINE switch after changing the paper or closing the top cover.

NLQ character set selecting

The FF switch can cause the printer to print characters using the NLQ character set. In this case, you don't need to issue the corresponding command from your computer.

1. While holding the FF switch down, turn power on.
2. After this, your printer outputs high-density characters generated from the NLQ character generator ROM.

Hexadecimal dump listing

The FF and LF switches can cause the printer to print hexadecimal data as it is.

This is useful to check whether your computer sends the correct codes to your printer.

1. While holding both the FF and LF switches down, turn power on .
2. After this, your printer does not use any character generator and prints all data from your computer in hexadecimal codes at the buffer full state.
3. If the amount of data is less than the buffer capacity, turn the printer to offline to print out the data.

3.4 Paper Requirements

As you know, you can use two types of paper: continuous-sheet paper fan-folded on perforations and fed by tractor pins engaging sprocket holes in the paper, cut-sheet paper fed by pressure from the platen. Continuous and cut-sheets include letter paper, typewriter paper, copy paper, post card, business forms, and other types of stock forms. However, the paper you can use is restricted on the following items because of mechanical limits.

- Paper size
- Print area
- Paper thickness and number of copies
- Paper binding method

When you want to use paper which does not meet a certain requirement, you should check thoroughly or ask your dealer whether the paper can be used with this printer.

(1) Paper size

The following sizes of paper can be used with this printer. Of course, when you use paper wider than certain limits (see *1 of the next table), the horizontal movement of the paper is restricted somewhat so that you cannot locate the left edge of the paper at the print start position.

Table 3.2 Paper size

Paper type	Size
Continuous sheet	Width: 3.5 in (88.9 mm) to 9.5 in (241.3 mm) Up to 10.5 in (266.7 mm) available (*1)
Cut sheet	Width: 100 to 257 mm Up to 297 mm available (*1) Length: 76 to 364 mm

- *1 When this size paper is used, there are restrictions on adjusting the left edge of the paper to the print start position (see item (2), print area).
297 mm is the width of an A4 sheet (210 × 297 mm) when it is used sideways.

(2) Print area

Print area specifications are not requirements of paper in themselves, but you should understand them before designing your document format and writing your program for the format.

Print area depends upon the print head stroke and the top and bottom margins of document. The print head stroke is 8 inches (80 characters at pica pitch; the corresponding column positions 1 to 80 are indicated by the top cover scale). The top and bottom margins are not absolute requirements. However, for either continuous sheet or cut sheet paper, the paper is likely to come off the platen near the perforations or top and bottom edges of paper. This causes print line deviations and ink swears, so you had better leave a margin of one inch (25.4 mm) or more from the perforations or from the top and bottom edges. (To be exact, the top margin is less than one inch because it is measured with respect to the character base line of the first print line.)

For cut sheet paper or the last sheet of continuous sheet paper, the paper-out detector senses the end of paper. Printing continues on the current line, but stops without reaching the last line of the print area. The distance between the center of the last print line and the bottom edge of the paper is as follows.

44 $\pm \frac{10}{8}$ mm for continuous sheet

42.5 $\pm \frac{10}{8}$ mm for cut sheet

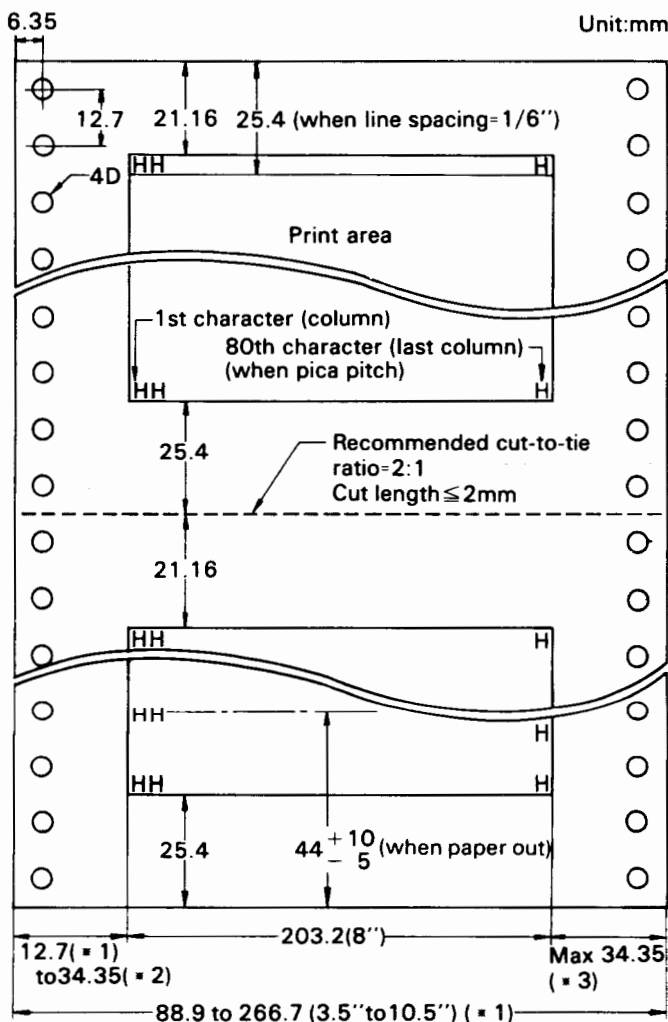
You can print this area by disabling the detector in advance (the detection signal is, however, sent to your computer). Remember to calculate the possible lines from the above value and the bottom margin and line spacing you selected, to prevent printing beyond the paper end.

Note that the print area is physically fixed in the printer so you must adjust the paper appropriately for your document format. However, if you use paper wider than:

9.5 inches (241.3 mm) for continuous sheet or
257 mm for cut sheet

you cannot design the document format in such a manner that the print start position (column 1) is at the left edge of the paper.

a. Continuous sheet print area



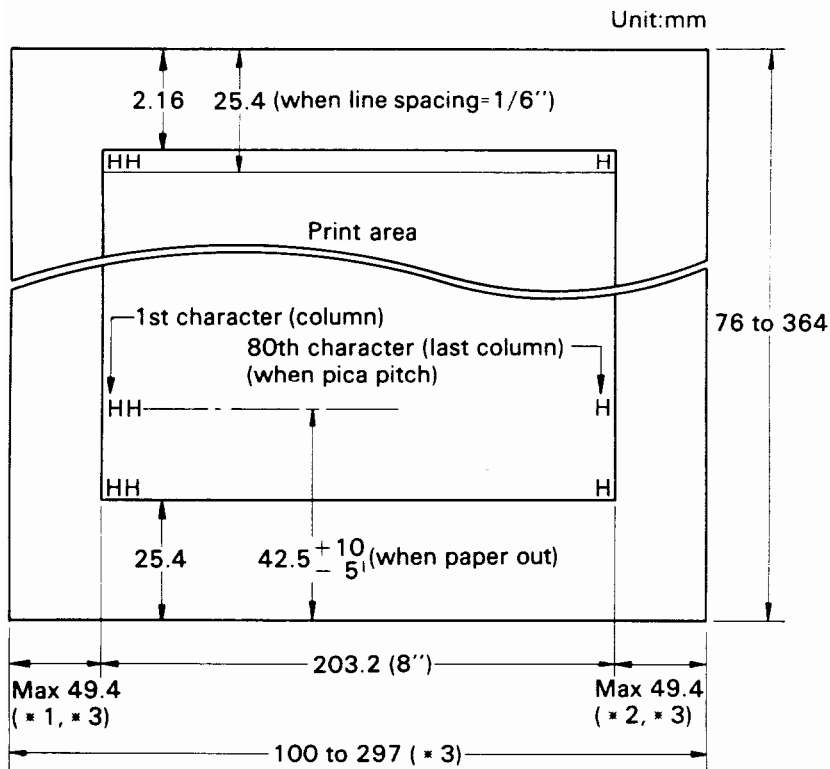
- *1 When the left tractor is set to the extreme right.
To set this position, paper width must be 9.5" or less.
- *2 When the left tractor is set to the extreme left.
- *3 When the right tractor is set to the extreme right.

Note: Tolerance is ± 2 mm for the left and right margins.

Figure 3.9 Print area (continuous sheet)

b. Cut sheet print area

Preprinting horizontal ruled lines should be avoided, because it is somewhat difficult to align the lines correctly when loading the paper.



- *1 When the paper is loaded to the extreme left position.
- *2 When the paper is loaded to the extreme right position.
- *3 When paper width is 257 to 297 mm, the left or right margin cannot be set to 0 mm.

Note: Tolerance is ± 2 mm for the left and right margins.

Figure 3.10 Print area (cut sheet)

(3) Paper thickness and number of copies

You can produce copies by using copy paper. The number of copies possible including the original is one to three, depending on the paper thickness or copy paper type (carbon coated, no carbon required (NCR), or carbon paper interleaved). In any case, total thickness must be 0.28 mm or less.

Note:

Paper thickness is indicated by ream kg, the weight of 1000 sheets, 788 mm × 1091 mm.

a. Continuous sheet

Carbon-coated, NCR, and carbon paper interleaved types can all be used; however, if carbon paper interleaved type is used, the carbon paper counts as one copy sheet, and the number of copies shown in the table is reduced by one.

**Table 3.3 Paper thickness and number of copies
(continuous sheet)**

Number of copies	Paper thickness (ream kg)	Condition
3	34, 45, 55	Only the bottom copy can be 45 or 55 kg.
2	45, 55, 70	Only the bottom copy can be 70 kg.
1	45, 55, 70	None.

b. Cut sheet

Carbon paper interleaved type cannot be used.

**Table 3.4 Paper thickness and number of copies
(cut sheet)**

Number of copies	Paper thickness (ream kg)	Condition
3	34, 45, 55	Only the bottom copy can be 45 or 55 kg.
2	34, 45, 55, 70	Only the bottom copy can be 55 or 70 kg.
1	45, 55, 70, 90	None.

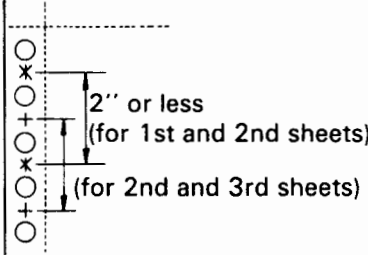


(4) Paper binding method

When you use copy paper (multipart paper), the sheets will be glued or stapled together. However, you should not use staples (either metal or paper) because staples are likely to cause print displacement and feed problems.

a. Continuous sheet

Glue on both edges of paper for binding. The following methods are applicable; however, spot gluing is recommended for the sake of flexibility.

Table 3.5 Paper binding method

Item	Spot gluing	Line gluing	
		1 line	2 lines
Positions to be glued	 <p>2" or less (for 1st and 2nd sheets)</p> <p>(for 2nd and 3rd sheets)</p>		
Evaluation	Recommended	Acceptable	
Remarks	<ul style="list-style-type: none">— Spot intervals should be 2 inches or less.— Spots should be as close to the vertical perforations as possible.— Spots should be as small as possible and be at alternate positions as shown above.		

Notes:

1. In the above figure, only the left side of paper is shown. Glue the right side in the same way.
2. Make sure that there are no bulges along the horizontal perforations. See the following examples.



3. Sprocket hole alignment tolerance is 0.4 mm or less.

b. Cut sheet

Generally, cut sheets of copy paper are bound together by (a) gluing or (b) metal-stapling (1) top, (2) side, or (3) bottom edges of sheets. For this printer, (a) gluing of (1) top edges like letter paper pads is recommended.

(5) Other notes

- Use high-quality paper.
- For cut sheet paper, use one without curl.
- Store and handle paper carefully to prevent deformation and damage.

3.5 Limitations

Every printer has its limitations. Whether you use software package programs or write your own programs, make sure that the operation of your printer satisfies the following conditions.

— Line feeding

Do not perform continuous line feeding for more than 3 minutes.

— Character spacing

Do not perform continuous character (column) spacing without printing any characters or continuous printing of lines with less than 5 characters (pica pitch) for more than 5 minutes.

— Print head duty

Do not perform continuous printing of dot patterns at over 50% duty for more than 5 minutes, whether overload is detected or not.

Note:

If the above limits are exceeded, the printer's life span may be shortened remarkably.

Up to this point, you have found that your printer can operate properly with the default mode settings and initial mode settings by the DIP switches. Of course, you can change the settings of the DIP switches to use other mode settings. But, since modes controllable by the DIP switches cannot be changed flexibly and are only part of the modes that your printer can control, you will not be satisfied with the features of your printer in the above modes only.

Your printer has various features for many applications. These features can be selected by instructions from your computer. To make the most of your printer features, you have to learn how to instruct your printer from your computer. The next section tells how to communicate with your printer. Of course, if you are not interested in the way or are already familiar with it, or if your software packages allow for these features, you don't need to read through the next section.

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SECTION 4 PROGRAMMING

Through the previous three sections you have already learned how to set up your printer, how to connect it to your computer, and how to use its control levers and operator panel. And, using a BASIC program, you've printed something.

This section tells how you can have your printer do something different. It doesn't have to print everything just as a common typewriter would. You can have it print:

D o u b l e W i d t h ,
Single Width,
Condensed Characters, or
Italics,
Underlined or not,

in a great variety of combinations.

You can also print:

~~Superscript~~ or ~~Subscript~~
to help with those chemical formulas and footnotes. At the same time, you can choose line spacing to suit your every desire, and do many other useful tricks.

For example, suppose you want to print a line, part of a line, or several lines in:

D O U B L E W I D T H .

It's easy to set things up: we'll print one line of normal printing, then tell the printer to print everything double-width until we tell it to resume normal printing again.

Turn on your computer and printer, and load BASIC. Enter the following program in BASIC.

```
LPRINT "It's a lot of fun."  
LPRINT CHR$(27);"W";CHR$(1);  
LPRINT "I want you to"  
LPRINT "HAVE A NICE DAY."  
LPRINT CHR$(27);"W";CHR$(0);  
LPRINT "Goodbye for now."
```

When you run this program, your printer should print:

```
It's a lot of fun.  
I want you to  
HAVE A NICE DAY.  
Goodbye for now.
```

Line 10 of the program tells the printer to do a line of normal printing. Line 20 tells it to print everything in double width until we cancel that order. Lines 30 and 40 then print double width. Line 50 cancels the order, so line 60 prints normal characters.

In this way, you can have your printer do many different kinds of printing. The codes, and examples of their use, are covered in this section. Also included are codes for various spacing between lines, tabbing, graphics, and many others.

Your printer is ready to output data from your computer. Printer control and print modes are predetermined as follows by the default mode settings of the printer and the initial mode settings by the DIP switches.

- 80 standard character printing at 10 characters per inch (pica pitch) or 132 condensed character printing at 17.1 characters per inch (selectable for F type only)
- Bidirectional printing at 180 characters per second
- Line spacing of 1/6 or 1/8 inch (selectable by DIP switch)
- Page length of 11 or 12 inches (selectable by DIP switch)
- Horizontal tabbing at 8-character intervals without vertical tabbing

If you are satisfied with the above settings, you don't need to read any more in this section. If you are not satisfied, that is, if you want to use certain features which your software package does not allow for, or if you want to write your own program, you have to instruct your printer in some way. This section explains how to instruct your printer.

This printer has various features which control paper feeding, carriage movement, character size and thickness, custom-defined font registration, graphics image printing, etc.

These features are enabled by control codes (function codes and extended control commands) sent from the computer to the printer. You can instruct your computer to send these codes to your printer by

entering these control codes with a certain statement defined in your software package. For example, if your software package is written in a BASIC programming language, use an LPRINT statement. Note that not all versions of BASIC use LPRINT as a print statement. Whether it is BASIC or not, read your software package manual to find out how to send control codes to the printer.

In this section, the description of each feature or control code is followed by a simple program example written in BASIC so that you can understand how the control codes are included in the program and how the printout looks. Note that we have divided the description into two parts, one for the type F printer and the other for the type I printer, although these two parts will include similar contents. The printer type is shown by a label on the rear of your printer.

4.1 Sending Control Codes to Your Printer

In the last part of Section 2, you have made your printer output "TESTING" with the basic print features by using the LPRINT statement in BASIC. To specify various print features provided in your printer when using a software package, you have to learn the trick of instructing your computer to send control codes according to your software package manual because different printers have different print features and control code systems and your software package program may not use the same control code system as your printer. Of course, you don't need to specify the print features if your software package supports your printer, that is, if the "system configuration menu" of your software package includes EPSON FX-80 or IBM GRAPHICS (each corresponding to type F and I) as the printer. You have only to specify that on the menu, and the software package will automatically send the proper control codes to your printer.

You can also specify some or all of the print features for your document by placing the corresponding control codes at certain locations in the program or text itself. Detailed procedures will be found in your software package manual.

If you want to specify some print features for the entire document and your computer runs BASIC, you can use another simple way, as follows:

1. Load BASIC.
2. Using LPRINT statements, enter the control codes corresponding to

the print features you want. For example, if you want to print 8 lines per inch, key in the following and press ENTER or CR.

```
10 LPRINT CHR$(27);"0";
```

Note :

Some BASICs use print statements different from LPRINT.

3. Run the program, and your printer will become ready with the specified print features.
4. Load and run your software package program without turning your printer off.

Note that this way is valid only if your computer does not send the INIT signal (Centronics interface pin 31 for printer initialization) to the printer when a program is loaded.

4.2 Programming with BASIC

This section gives you several points about programming. We'll use simple program examples written in the Microsoft BASIC because we assume that BASICs are the most generally understood languages. The fundamental rules will be similar for other programming languages.

To send any command or data to the printer, a print statement is used. This manual uses the LPRINT statement, but for some versions of BASICs you may have to use the PRINT #1 statement instead (in this case, you have to put PRINT and accompanying statements between an OPEN "0", #1, "LPT0" statement and CLOSE #1 statement) or other print statements in different form. Refer to your computer manual when changing the program examples for your BASIC.

The LPRINT statement can use the following three formats to send information to the printer.

LPRINT "A":	Character as it is
LPRINT CHR\$(65):	Decimal
LPRINT CHR\$(&H41):	Hexadecimal, two digits

This example shows how to send or print character "A" on your printer. (When a character string is included in quotes, the leftmost character (including a space) is located at the home position or the left margin.)

We use ASCII (American Standard Code for Information Interchange) as our printer standard code system. Appendix F shows the ASCII character set and the corresponding code numbers in decimal, hexadecimal, and binary. If your computer uses another code system, you have to prepare proper hardware or software for converting codes.

You can use any of the above three formats, but you have to use the second (or third) format to send control codes to your printer because the printer control codes include "non-printable" characters used as function codes most of which have no key on the keyboard. The function codes, ASCII codes 0 (NUL) to 31 (US), do not make the printer print any characters, but they make the printer enable the corresponding features. For example, if you want to print character "A" at double width, you use the CHR\$ function to enter the Shift Out (SO) code as follows:

```
10 LPRINT CHR$(14);"A"
```

Of course, you can use CHR\$(&H0E) instead of CHR\$(14), and CHR\$(65) or CHR\$(&H41) instead of "A", but we will use the above form in this section. Remember to use a semicolon as the delimiter. If the LPRINT line ends without a semicolon, a line feed is performed at the end of execution. If the line ends with a semicolon, it continues to the next LPRINT line without a line feed.

Once you have selected a feature like the above double-width printing feature, it is kept enabled until you send another control code to disable it or your computer sends the INIT (RESET) signal to your printer. Of course, this does not apply to some features such as form feeding on demand of control codes.

So far, we have explained some printer control codes consisting of a single function code. There is another type of printer control codes which consist of an ESCAPE code, CHR\$(27), followed by a sequence of characters. The ESCAPE code changes the nature of the characters that follow it: the first character indicates a command and the next and succeeding characters, if present, indicate variables or constants in some commands; they are not printed as characters. For example, if you want to set the right margin to column 10, you can specify this as follows:

```
10 LPRINT CHR$(27);"Q";CHR$(10)
```

After this program is executed, your printer will feed a line each time ten

characters (including spaces) are printed on one line.

We're going to end this section at this point. Although we have given you only a few suggestions on programming with BASIC, they will do for the time being. Anyway, you should start programming in accordance with the following examples to become familiar with printer control codes. We have divided control codes into the following six categories:

- Paper movement or vertical formatting
- Carriage movement or horizontal formatting
- Print modes
- Internal and download characters
- Graphics image modes
- Other features

Make sure the type of your printer by a label on the rear of the printer. When your printer is type I, skip Section 4.3.

Each command description has the following format:

- Command code and name (enclosed by a square)
- Hexadecimal and decimal codes (H and D following each parenthesized value denotes hexadecimal and decimal, respectively)
- Function
- Details
- Caution
- Notes
- Program example
- Print example (the result of program execution)

Some items following "Function" are omitted for some commands.

4.3 Control Codes for Type F

4.3.1 Paper movement or vertical formatting

(1) Line Feeding

LF (Line Feed)

Code:

(0A)H, (10)10

Function:

Effects a line feed after printing data.

Details:

The line spacing is set to 1/6 inch when the printer is initially powered, but it may be changed by ESC 0, ESC 1, ESC 2, ESC 3 + n, or ESC A + n

Resets the double-width print mode set by the SO (Shift Out) code.

Program example:

```
10 LPRINT " LF (Line Feed)"
20 LPRINT
30 LPRINT "A C E G I K M ";CHR$(10);
40 LPRINT " b d f h j l n"
50 END
```

Print example:

```
LF (Line Feed)

A C E G I K M
 b d f h j l n
```

ESC J + n (Line Feed)

Code:

(1B)H (4A)H (n)H ($0 \leq n \leq FF$)

(27)10 (74)10 (n)10 ($0 \leq n \leq 255$)

Function:

Moves the print position by $n/216$ inch vertically in the forward direction after printing preceding data.

Details:

- The form-feed setting is effective only on the current line.
- As distinct from other print commands (LF, FF, and so forth), this command starts printing at the position on the next line corresponding to the print end position on the current line without returning the print position to the left end of the next line.

Program example:

```
10 LPRINT " ESC J+n (Line Feed)"
20 LPRINT : N=65
30 FOR I=5 TO 55 STEP 10
40     LPRINT CHR$(27); "J"; CHR$(I);
50     LPRINT CHR$(N); : N=N+1
60 NEXT I
70 LPRINT
80 END
```

Print example:

ESC J+n (Line Feed)

A
B
C
D
E
F

ESC j + n (Reverse Line Feed)

Code:

(1B)H (6A)H (n)H ($0 \leq n \leq FF$)

(27)10 (106)10 (n)10 ($0 \leq n \leq 255$)

Function:

Moves the print position by $n/216$ inch vertically in the reverse direction after printing data in the print buffer.

Details:

This command performs the same operation as ESC J + n, except that a form feed occurs in the opposite direction.

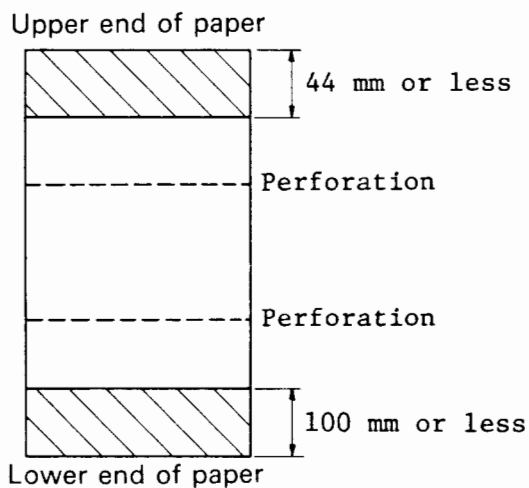
Caution:

To prevent paper jams, use of this command in a reverse-feed inhibit area should be avoided. See the following.

Notes on Reverse Form Feed:

To prevent paper jams, reverse form feed is prohibited in the shadowed areas of the paper as shown below.

With fanfold paper



With cut-sheet paper

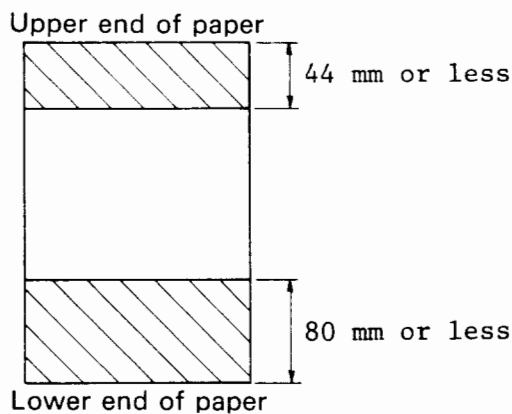


Figure 4.1 Reverse feed prohibited area

Program example:

```
10 LPRINT " ESC j+n (Reverse Line Feed)"
20 N=97 : LPRINT : LPRINT : LPRINT
30 LPRINT : LPRINT : LPRINT
40 FOR I=55 TO 5 STEP -10
50     LPRINT CHR$(27); "j"; CHR$(I);
60     LPRINT CHR$(N); : N=N+1
70 NEXT I
80 LPRINT
90 END
```

Print example:

ESC j+n (Reverse Line Feed)

a
b
c
d e f

(2) Line Spacing

ESC O (Set Line Spacing to 1/8 Inch)

Code:

(1B)H (30)H, (27)10 (48)10

Function:

Sets the line spacing to 1/8 (inch/line).

Details:

Once this command is received, line spacing subsequently performed by an LF code, or equivalent, is set to 1/8 (inch/line).

Program example:

```
10 LPRINT " ESC Ø (1/8 Inch Line Spacing)"
20 LPRINT
30 LPRINT CHR$(27);"Ø";
40 FOR I=1 TO 3
50 LPRINT "ABCDEFGHijklmn -----"
60 NEXT I
70 END
```

Print example:

```
ESC Ø (1/8 Inch Line Spacing)

ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
```

ESC 1 (Set Line Spacing to 7/72 Inch)

Code:

(1B)H (31)H, (27)10 (40)10

Function:

Sets the line spacing to 7/72 (inch/line). 7/72 inch corresponds to the vertical dot line length of capital letters.

Program example:

```
10 LPRINT " ESC 1";
20 LPRINT " (7/72 Inch Line Spacing)"
30 LPRINT
40 LPRINT CHR$(27);"1";
50 FOR I=1 TO 3
60 LPRINT "ABCDEFGHijklmn -----"
70 NEXT I
80 END
```

Print example:

ESC 1 (7/72 Inch Line Spacing)

```
ABCDEFGHIjklmn -----  
ABCDEFGHIjklmn -----  
ABCDEFGHIjklmn -----
```

ESC 2 (Escape 2) (Set Line Spacing to 1/6 Inch)

Code:

(1B)H (32)H, (27)10 (50)10

Function:

Sets the line spacing to 1/6 (inch/line).

Program example:

```
10 LPRINT " ESC 2 (1/6 Inch Line Spacing)"  
20 LPRINT  
30 LPRINT CHR$(27);"2";  
40 FOR I=1 TO 3  
50 LPRINT "ABCDEFGHIjklmn -----"  
60 NEXT I  
70 END
```

Print example:

ESC 2 (1/6 Inch Line Spacing)

```
ABCDEFGHIjklmn -----  
ABCDEFGHIjklmn -----  
ABCDEFGHIjklmn -----
```

ESC 3 + n (Set Line Spacing to n/216 Inch)

Code:

(1B)H (33)H (n)H ($0 \leq n \leq FF$),
27(10) (51)10 (n)10 ($0 \leq n \leq 255$)

Function:

Sets the line spacing to n/216 (inch/line) (in multiples of 1/3 dot).

Caution:

Line spacing accuracy may not be guaranteed when $n < 3$.

Program example:

```
10 LPRINT " ESC 3+n";
20 LPRINT " (n/216 Inch Line Spacing)"
30 LPRINT
40 LPRINT "n=1 TO 10"
50 FOR N=1 TO 10
60     LPRINT CHR$(27); "3"; CHR$(N);
70     LPRINT " -----"
80 NEXT N
90 END
```

Print example:

ESC 3+n (n/216 Inch Line Spacing)

n=1 TO 10

=====

ESC A + n (Set Line Spacing to n/72 Inch)

Code:

(1B)H (41)H (n)H ($0 \leq n \leq 55$),
(27)10 (65)10 (n)10 ($0 \leq n \leq 85$)

Function:

Sets the single-line spacing in multiples of a dot (1/72 inch).

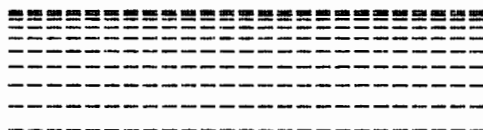
Program example:

```
10 LPRINT " ESC A+n";
20 LPRINT " (n/72 Inch Line Spacing)"
30 LPRINT
40 LPRINT "n=1 TO 10"
50 FOR N=1 TO 10
60     LPRINT CHR$(27); "A"; CHR$(N);
70     LPRINT " -----"
80 NEXT N
90 END
```

Print example:

ESC A+n (n/72 Inch Line Spacing)

n=1 TO 10



(3) Form Feeding

FF (Form Feed)

Code:

(0C)H, (12)10

Function:

Advances the printer head to the first print position on the next page.

Details:

- The page length is initially set at 11 inches when the printer is powered, but it may be changed by ESC C + n or ESC C + 0 + n.
- Resets the double-width print mode set by the SO code.

(4) Vertical Tabbing

VT (Vertical Tab)

Code:

(0B)H, (11)10

Function:

Advances the print position vertically to the specified line.

Details:

- Advances to a tab position set by a vertical tab set command (ESC B + ..., ESC b 2+ ...) after printing preceding data on receipt of a VT code.

- Performs the same action as an LF code where no vertical tab position has been set.
- Advances to the beginning of the next page when the VT code has been received at a position beyond the last (highest) existing tab position on the current page.
- Resets the double-width print mode set by the SO code.

ESC B + n1 + n2 + ... + nk + NUL (Set Vertical Tab Positions)
--

Code:

(1B)H (42)H (n1)H (n2)H ... (nk)H (00)H ($1 \leq n \leq FE$)

(27)10 (66)10 (n1)10 (n2)10 ... (nk)10 (0)10 ($1 \leq n \leq 254$)
 $(n1 \leq n2 \leq \dots \leq nk)$ ($1 \leq k \leq 16$)

Function:

Sets vertical tab positions.

Details:

- Tab positions are set in ascending order until the NUL code ((00)H) is encountered.
- The VT code is used to execute vertical tabbing.
- Vertical tab setting by ESC B ... may be considered the same way as channel 0 in ESC b
- Vertical tab settings beyond the page length are ignored.

Program example:

```
10 LPRINT " ESC B+n & VT"
20 ' Set Vertical TAB Position
30 ' and Execution
40 LPRINT
50 LPRINT CHR$(27);"C";CHR$(15);
60 LPRINT CHR$(27);"B";
70 LPRINT CHR$(2);CHR$(4);CHR$(8);CHR$(0);
80 LPRINT "----- Top of Page -----"
90 LPRINT CHR$(11);" 1st Vertical";
100 LPRINT " TAB Point"
110 LPRINT CHR$(11);" 2nd Vertical";
120 LPRINT " TAB Point"
130 LPRINT CHR$(11);" 3rd Vertical";
140 LPRINT " TAB Point"
150 END
```

Print example:

ESC B+n & VT

----- Top of Page -----

1st Vertical TAB Point

2nd Vertical TAB Point

3rd Vertical TAB Point

ESC b + n + m1 + m2 + ... + mk + NUL (Set VFU Positions)

Code:

(1B)H (62)H (n)H (m1)H (m2)H ... (mk)H (00)H ($1 \leq m \leq FE$)
(27)10 (98)10 (n)10 (m1)10 (m2)10 ... (mk)10 (0)10 ($1 \leq m \leq 254$)
(0 $\leq n \leq 7$) ($1 \leq k \leq 16$)

Function:

Sets tab positions in the vertical format unit (VFU).

Details:

- n denotes the channel number. Up to eight channels, from channel 0 to channel 7, are selectable; there may be up to 16 tab positions for each.
- Channel 0 is assumed when the printer is initially powered.
- Channels are specified by ESC / + n, and tabbing is executed by the VT code.

ESC / + n (Specify VFU Channels)

Code:

(1B)H (2F)H (n)H

(27)10 (47)10 (n)10 ($0 \leq n \leq 7$)

Function:

Specifies channel in the VFU.

Details:

Enables vertical tabbing on each channel as set by
ESC b + n + m1 + m2... + mk + NUL to be executed.

Program example:

```
10 LPRINT " ESC b+n & ESC /+n"
20 ' Set VFU Positions
30 ' and Specify VFU Channels
40 LPRINT
50 LPRINT CHR$(27);"C";CHR$(10);
60 LPRINT CHR$(27);"b";CHR$(1);' Channel 1
70 LPRINT CHR$(2);CHR$(4);CHR$(8);CHR$(0);
80 LPRINT CHR$(27);"b";CHR$(2);' Channel 2
90 LPRINT CHR$(3);CHR$(5);CHR$(9);CHR$(0);
100 FOR I=1 TO 2
110 LPRINT CHR$(27);"/";CHR$(I);
120 LPRINT "----- Top of Page Channel";
130 LPRINT I;"-----"
140 LPRINT CHR$(11);" 1st Point";
150 LPRINT CHR$(11);" 2nd Point";
160 LPRINT CHR$(11);" 3rd Point";
170 LPRINT CHR$(11);
180 NEXT I
190 END
```


Print example:

ESC b+n & ESC /+n

----- Top of Page Channel 1 -----

1st Point

2nd Point

3rd Point

----- Top of Page Channel 2 -----

1st Point

2nd Point

3rd Point

(5) Page Length Setting

ESC C + n (Set Page Length in Lines)

Code:

(1B)H (43)H (n)H ($1 \leq n \leq 7F$)

(27)10 (67)10 (n)10 ($1 \leq n \leq 127$)

Function:

Sets the page length in lines.

Details:

The page length is stored as an absolute length determined by multiplying the current single-line spacing by the number of lines (n) specified by this command.

Program example:

```
10 LPRINT " ESC C+n (Set Page Length)"
20 LPRINT
30 LPRINT CHR$(27); "C"; CHR$(6);
40 LPRINT " -----Top of Page";
50 LPRINT " (Page Length 6 Lines)"
60 LPRINT CHR$(12);
70 LPRINT " -----Top of Page";
80 LPRINT " (Page Length 6 Lines)"
90 END
```

Print example:

```
ESC C+n (Set Page Length)

-----Top of Page (Page Length 6 Lines)

-----Top of Page (Page Length 6 Lines)
```

ESC C + 0 + n (Set Page Length in Inches)
--

Code:

```
(1B)H (43)H (00)H (n)H (1 ≤ n ≤ 16)
(27)10 (67)10 (0)10 (n)10 (1 ≤ n ≤ 22)
```

Function:

Sets the page length in inches.

Details:

n denotes the number of inches in the page length.

Program example:

```
10 LPRINT " ESC C+0+n (Set Page Length)"
20 LPRINT
30 LPRINT CHR$(27); "C"; CHR$(0); CHR$(1);
40 LPRINT " -----Top of Page";
50 LPRINT " (Page Length 1 Inch)"
60 LPRINT CHR$(12);
70 LPRINT " -----Top of Page";
80 LPRINT " (Page Length 1 Inch)"
90 END
```

Print example:

```
ESC C+0+n (Set Page Length)

-----Top of Page (Page Length 1 Inch)

-----Top of Page (Page Length 1 Inch)
```

(6) Perforation Skipping

ESC N + n (Set Perforations Skip)

Code:

(1B)H (4E)H (n)H ($1 \leq n \leq 7F$)
(27)10 (78)10 (n)10 ($1 \leq n \leq 127$)

Function:

Skips the last n lines on the current page and advances the print head to the first print position on the next page.

Details:

- This command prevents the print head from falling on perforations.
- The number of skipped lines can be reset by a page length set command (ESC.C + n, ESC C + 0 + n).
- When DIP switch SW2-3 is on, the print head skips perforations by 1 inch (default assumption).

Program example:

```
10 LPRINT "  ESC N+n";
20 LPRINT " (Set Skip Perforations)"
30 LPRINT
40 LPRINT CHR$(27);"C";CHR$(5);
50 LPRINT CHR$(27);"N";CHR$(2);
60 LPRINT "Page Length 5 Lines,";
70 LPRINT "Skip Lower 2 Lines"
80 GOSUB 180
90 LPRINT "  ESC O";
100 LPRINT " (Reset Skip Perforations)"
110 LPRINT
120 LPRINT CHR$(27);"C";CHR$(5);
130 LPRINT CHR$(27);"O";
140 LPRINT "Page Length 5 Lines"
150 GOSUB 180
160 END
170 ' *** Subroutine ***
180 FOR I=1 TO 5
190   LPRINT " Skip Perforation : No.";I
200 NEXT I
210 RETURN
```

Print example:

ESC N+n (Set Skip Perforations)

Page Length 5 Lines, Skip Lower 2 Lines

Skip Perforation : No. 1

Skip Perforation : No. 2

Skip Perforation : No. 3

Skip Perforation : No. 4

Skip Perforation : No. 5

ESC O (Reset Skip Perforations)

Page Length 5 Lines

Skip Perforation : No. 1

Skip Perforation : No. 2

Skip Perforation : No. 3

Skip Perforation : No. 4

Skip Perforation : No. 5

ESC O (Reset Perforations Skip)

Code:

(1B)H (4F)H, (27)10 (79)10

Function:

Cancels the perforation skip function by resetting the number of skipped lines as set.

4.3.2 Carriage movement or horizontal formatting

(1) Back Spacing

BS (Backspace)

Code:

(08)H, (8)10

Function:

Moves the print position one character backward after printing preceding data.

Details:

- Moves the print position backward by the width of two normal-size characters when in the double-width print mode.
- Proper operation of the BS code is unpredictable when the print mode has been changed.

Program example:

```
10 LPRINT " BS (Backspace) "  
20 LPRINT  
30 LPRINT "XXXXXXXX";  
40 LPRINT CHR$(8);CHR$(8);  
50 LPRINT "-----"  
60 END
```

Print example:

```
BS (Backspace)  
  
XXXXXXXX*-----
```

(2) Carriage Return

CR (Carriage Return)

Code:

(0D)H, (13)10

Function:

Prints previously entered data.

Details:

- Effects a line feed after printing the data if the AUTO FEED XT signal (interface connector pin 14) is L or if DIP switch SW2-4 is ON.
- A CR code accompanied by LF resets the double-width print mode set by the SO code.

Program example:

```
10 LPRINT " CR (Carriage Return)"
20 LPRINT
30 LPRINT "A C E G I K M ";CHR$(13);
40 LPRINT " b d f h j l n"
50 END
```

Print example:

```
CR (Carriage Return)

A C E G I K M
b d f h j l n
```

(3) Left and Right Margin Setting

ESC l + n (Set left Margin)

Code:

(1B)H (6C)H (n)H ($1 \leq n \leq FF$)

(27)10 (108)10 (n)10 ($1 \leq n \leq 255$)

Function:

Sets the left margin (print starting position) based on the current character size setting.

Details:

- n denotes the number of print positions. The maximum number depends on the character size set. A specification beyond the maximum is ignored.
- The left margin setting is to be made before sending print data to the printer.

- In proportional-spacing mode, left margin is set in pica pitches.

Caution:

In changing the character size, notice that settings less than the width of a character are not permitted.

Program example:

```
10 LPRINT " ESC l+n (Set Left Margin)"
20 LPRINT
30 FOR I=1 TO 5
40     LPRINT CHR$(27);"l";CHR$(I+5);
50     LPRINT "ABCDEFGHJKLMN"
60 NEXT I
70 END
```

Print example:

```
ESC l+n (Set Left Margin)

  ABCDEFGHIJKLMN
   ABCDEFGHIJKLMN
    ABCDEFGHIJKLMN
     ABCDEFGHIJKLMN
      ABCDEFGHIJKLMN
```

ESC Q + n (Set Right Margin)

Code:

(1B)H (51)H (n)H ($1 \leq n \leq FF$)
(27)10 (81)10 (n)10 ($1 \leq n \leq 255$)

Function:

Sets the right margin (number of print positions) based on the current character-size setting.

Details:

- n denotes the number of print positions. The maximum number depends on the character size set. A specification beyond the maximum is ignored.
- Print widths less than the width of a double-width character are not permitted.

Specify $1 \leq n$ when in the double-width print mode; otherwise, specify $2 \leq n$.

- In proportional-spacing mode, right margin is set in pica pitches.
- When initially powered, the printer is set to print up to 132 condensed characters per line. This command permits printing of up to 137 characters per line.
- The right margin setting is to be made before sending print data to the printer.

Caution:

In changing character size, notice that settings less than the width of a character are not permitted.

Program example:

```
10 LPRINT " ESC Q+n (Set Right Margin)"
20 LPRINT
30 LPRINT CHR$(27);"Q";CHR$(10);
40 LPRINT "123456789012345678901234567890"
50 END
```

Print example:

```
ESC Q+n (Set Right Margin)

1234567890
1234567890
1234567890
```

(4) Horizontal Tabbing

HT (Horizontal Tab)

Code:

(09)H, (9)10

Function:

Advances the print position to a horizontal tab position set by ESC D + n1 + n2 ... + nk + NUL and starts printing at the position next to it. (Tabs are set at intervals of eight characters when the printer is initially powered or no tab stops have been manually set.)

Details:

- HT codes received after the last tab setting are ignored.
- Once set, tab positions remain unchanged, even if the print mode is changed.
- Advances the print position by the width of two normal-size characters at a time in the double-width print mode.
- Setting the left margin by ESC 1 + n resets the horizontal tab positions to the initial default settings.

ESC D + n1 + n2 + ... + nk + NUL (Set Horizontal Tab Positions)

Code:

(1B)H (44)H (n1)H (n2)H ... (nk)H (00)H ($1 \leq n \leq 89$)
(27)10 (68)10 (n1)10 (n2)10 ... (nk)10 (0)10 ($1 \leq n \leq 137$)
($1 \leq k \leq 32$)

Function:

Sets horizontal tab (HT) positions.

Details:

- Up to 32 horizontal tab positions can be set, beginning at the first print position as 1.
- Set n (number of positions) in ascending order. A horizontal tab setting beyond the maximum print width is ignored.
- The setting must be terminated by the NUL code ((00)H).
- Horizontal tabbing is executed by the HT code ((09)H).

- In proportional-spacing mode, horizontal tab positions are set in pica pitches.

Program example:

```

10 LPRINT " ESC D+n & HT"
20 ' Set Horizontal TAB Position
30 '                               and Execution
40 LPRINT CHR$(27);"D";CHR$(10);
50 LPRINT CHR$(20);CHR$(30);CHR$(0);
60 LPRINT
70 FOR A=1 TO 3
80     LPRINT "1234567890";
90 NEXT A
100 LPRINT
110 GOSUB 280                               'pica
120 LPRINT CHR$(9);"(Pica)"
130 B=1 : GOSUB 280 : B=0
140 LPRINT CHR$(9);"(Double-width)"
150 LPRINT CHR$(27);"M";                     'elite
160 GOSUB 280
170 LPRINT CHR$(9);"(Elite)"
180 B=1 : GOSUB 280 : B=0
190 LPRINT CHR$(9);"(Double-width)"
200 LPRINT CHR$(27);"P";
210 LPRINT CHR$(15);                          'condensed
220 GOSUB 280
230 LPRINT CHR$(9);"(Condensed)"
240 B=1 : GOSUB 280 : B=0
250 LPRINT CHR$(9);"(Double-width)"
260 LPRINT CHR$(18);
270 END
280 ' *** Subroutine ***
290 LPRINT CHR$(27);"W";CHR$(B);
300 FOR I=1 TO 2
310     LPRINT CHR$(9);"T";I;
320 NEXT I
330 LPRINT CHR$(27);"W";CHR$(0);
340 RETURN

```

Print example:

ESC D+n & HT

123456789012345678901234567890

T 1	T 2	(Pica)
T 1	T 2	(Double-width)
T 1	T 2	(Elite)
T 1	T 2	(Double-width)
T 1	T 2	(Condensed)
T 1	T 2	(Double-width)

(5) Others

ESC < (Set Head Home)

Code:

(1B)H (3C)H, (27)10 (60)10

Function:

Moves the print head to the home position at the left end.

Program example:

```
10 LPRINT " ESC < (Set Head Home)"
20 LPRINT
30 LPRINT " Set Head Home"
40 LPRINT CHR$(27); "<"
50 END
```

Print example:

ESC < (Set Head Home)

Set Head Home

ESC U + n (Set Unidirectional Print)

Code:

(1B)H (55)H (n)H, (27)10 (85)10 (n)10 (n=0, 1)

Function:

- n = 1 causes the printer to print subsequently received print data unidirectionally.

- $n=0$ causes the printer to print subsequently received print data bidirectionally.

Details:

- Unidirectional printing is suggested for print modes in which misalignment of dots due to bidirectional printing is of concern, such as printing vertical ruled lines.
- Unidirectional print is always used in the image modes.

Program example:

```

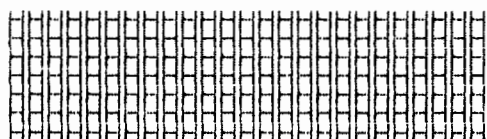
10 LPRINT "  ESC U+n";
20 LPRINT " (Set Unidirectional Print)"
30 LPRINT
40 LPRINT "Bidirectional Print"
50 GOSUB 130
60 LPRINT : LPRINT
70 LPRINT CHR$(27);"U";CHR$(1);
80 LPRINT "Unidirectional Print"
90 GOSUB 130
100 LPRINT CHR$(27);"U";CHR$(0);
110 LPRINT
120 END
130 ' *** Subroutine ***
140 LPRINT CHR$(27);"1";
150 FOR I=0 TO 6
160   LPRINT " HHHHHHHHHHHHHHHHHHHHHHHHHHHHHHH"
170 NEXT I
180 LPRINT CHR$(27);"2";
190 RETURN

```

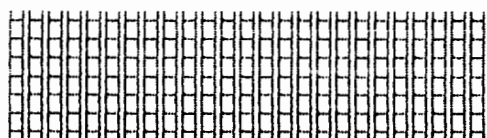
Print example:

ESC U+n (Set Unidirectional Print)

Bidirectional Print



Unidirectional Print



4.3.3 Print modes

(1) Double Width and Condensed

SO (Shift Out: Set Double-Width Print Mode)

Code:

(OE)H, (14)10

Function:

Prints print data received after this code in the double-width mode.

Details:

- This code is reset by the DC4 code, line feed codes (LF, FF, VT), ESC I + n, and ESC W + n.
- ESC SO ((1B)H + (OE)H, (27)10 + (14)10) performs the same function.

Program example:

```
10 LPRINT " SO (Set Double-width Mode)"
20 LPRINT
30 LPRINT CHR$(14); "Double-width Printing"
40 LPRINT "Normal Printing"
50 END
```

Print example:

SO (Set Double-width Mode)

Double-width Printing
Normal Printing

Program example:

```
10 LPRINT " ESC SO (Set Double-width Mode)"
20 LPRINT
30 LPRINT CHR$(27);CHR$(14);
40 LPRINT "Double-width Printing"
50 LPRINT "Normal Printing"
60 END
```

Print example:

ESC SO (Set Double-width Mode)

D**o****u****b****l****e****-****w****i****d****t****h** **P****r****i****n****t****i****n****g**
Normal Printing

DC4 (Device Control 4: Reset Double-Width Print Mode)

Code:

(14)H, (20)10

Function:

Resets the double-width print mode.

Details:

Receipt of this code resets the double-width print mode as set by the SO code.

Program example:

```
10 LPRINT "   DC4 (Reset Double-width)"
20 LPRINT
30 LPRINT CHR$(14); "Double-width ";
40 LPRINT CHR$(20); "Normal "
50 END
```

Print example:

DC4 (Reset Double-width)

D**o****u****b****l****e****-****w****i****d****t****h** Normal

ESC W + n (Set and Reset Double-Width Print Mode)

Code:

(1B)H (57)H (n)H, (27)10 (87)10 (n)10 (n=0, 1)

Function:

Prints subsequently received print data in the double-width print mode.

Details:

- n = 1 sets the double-width mode; n = 0 resets it.

- The double-width mode set by this command is not affected by a line feed.

Program example:

```
10 LPRINT " ESC W+n (Set and Reset";
20 LPRINT " Double-width Mode)"
30 LPRINT
40 LPRINT "abcdefg";
50 LPRINT CHR$(27); "W"; CHR$(1);
60 LPRINT "HIJKLMN"
70 LPRINT "OPQRSTU";
80 LPRINT CHR$(27); "W"; CHR$(0);
90 LPRINT "vwxyz "
100 END
```

Print example:

```
ESC W+n (Set and Reset Double-width Mode)

abcdefgHIJKLMN
OPQRSTUvwxyz
```

SI (Shift In: Set Condensed-Print Mode)

Code:

(OF)H, (15)10

Function:

Prints print data received after this code in the condensed-print (17.1 c/in.) mode.

Details:

- Permits condensed-character printout in the double-width mode.
- The emphasized-print mode assumes priority over the condensed-print mode.
- The condensed-character mode is reset by DC2 and ESC ! + n.
- The condensed-print mode is effective for the pica typeface only.
- ESC SI ((1B)H + (OF)H, (27)10 + (15)10) performs the same function.

Program example:

```
10 LPRINT " SI (Set Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(15);"Condensed Printing"
40 LPRINT CHR$(14);
50 LPRINT "Condensed and Double-width";
60 LPRINT " Printing"
70 LPRINT CHR$(18);"Normal Printing"
80 END
```

Print example:

```
SI (Set Condensed Mode)

Condensed Printing
Condensed and Double-width Printing
Normal Printing
```

Program example:

```
10 LPRINT " ESC SI (Set Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(27);CHR$(15);
40 LPRINT "Condensed Printing"
50 LPRINT CHR$(14);
60 LPRINT "Condensed and Double-width";
70 LPRINT " Printing"
80 LPRINT CHR$(18);"Normal Printing"
90 END
```

Print example:

```
ESC SI (Set Condensed Mode)

Condensed Printing
Condensed and Double-width Printing
Normal Printing
```

DC2 (Device Control 2: Reset Condensed-Print Mode)

Code:

(12)H, (18)10

Function:

Resets the condensed-print mode.

Program example:

```
10 LPRINT " DC2 (Reset Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(15); "Condensed ";
40 LPRINT CHR$(18); "Normal "
50 END
```

Print example:

DC2 (Reset Condensed Mode)

Condensed Normal

(2) Double Strike and Emphasized

ESC G (Set Double-Strike Mode)

Code:

(1B)H (47)H, (27)10 (71)10

Function:

Prints subsequently received print data in double-strike characters.

Details:

A double-strike character refers to a character having a double dot-density in the vertical direction.

Program example:

```
10 LPRINT " ESC G";
20 LPRINT " (Set Double-strike Mode)"
30 LPRINT
40 LPRINT "Normal Printing"
50 LPRINT CHR$(27); "G";
60 LPRINT "Double-strike Printing"
70 END
```

Print example:

ESC G (Set Double-strike Mode)

Normal Printing

Double-strike Printing

ESC H (Reset Double-Strike Mode)

Code:

(1B)H (48)H, (27)10 (72)10

Function:

Resets the double-strike mode.

Program example:

```
10 LPRINT " ESC H";
20 LPRINT " (Reset Double-strike Mode)"
30 LPRINT
40 LPRINT CHR$(27); "G"; "Double-strike ";
50 LPRINT CHR$(27); "H"; "Normal "
60 END
```

Print example:

ESC H (Reset Double-strike Mode)

Double-strike Normal

ESC E (Set Emphasized-Print Mode)

Code:

(1B)H (45)H, (27)10 (69)10

Function:

Prints subsequently received print data in emphasized characters.

Details:

- In the emphasized-print mode, characters are printed at double density in the horizontal direction.
- The emphasized print mode is reset by ESC F or ESC I + n.

- This mode is effective for pica characters only.
- The emphasized-print mode assumes priority over the condensed-print mode, but does not reset the condensed-print mode.

Program example:

```
10 LPRINT " ESC E (Set Emphasized Mode)"
20 LPRINT
30 LPRINT "Normal Printing"
40 LPRINT CHR$(27);"E";
50 LPRINT "Emphasized Printing"
60 END
```

Print example:

ESC E (Set Emphasized Mode)

Normal Printing

Emphasized Printing

ESC F (Reset Emphasized-Print Mode)

Code:

(1B)H (46)H, (27)10 (70)10

Function:

Resets the emphasized-print mode.

Program example:

```
10 LPRINT " ESC F (Reset Emphasized Mode)"
20 LPRINT
30 LPRINT CHR$(27);"E";"Emphasized ";
40 LPRINT CHR$(27);"F";"Normal "
50 END
```

Print example:

ESC F (Reset Emphasized Mode)

Emphasized Normal

(3) Elite/Pica Pitch

ESC M (Set Elite Pitch)

Code:

(1B)H (4D)H, (27)10 (77)10

Function:

Prints subsequently received print data in elite pitch (12 c/in.).

Details:

- The emphasized- and condensed-print modes are inoperative for elite pitch.
- Up to 96 characters per line can be printed with elite pitch.

Program example:

```
10 LPRINT " ESC M (Set Elite-pitch)"
20 LPRINT
30 LPRINT CHR$(27); "M";
40 LPRINT "Elite-pitch Printing"
50 END
```

Print example:

ESC M (Set Elite-pitch)

Elite-pitch Printing

ESC P (Set Pica Pitch)

Code:

(1B)H (50)H, (27)10 (80)10

Function:

Prints subsequently received print data in pica pitch (10 c/in.) by resetting the elite print mode set by ESC M (Set Elite Pitch).

Details:

- Pica pitch is the default character pitch when the printer is initially powered.
- Up to 80 characters per line can be printed with pica pitch.
- The emphasized- and condensed-print modes are not reset by this command.

Program example:

```
10 LPRINT " ESC F (Set Pica-pitch)"
20 LPRINT
30 LPRINT CHR$(27); "M"; "Elite-pitch ";
40 LPRINT CHR$(27); "P"; "Pica-pitch"
50 END
```

Print example:

ESC F (Set Pica-pitch)

Elite-pitch Pica-pitch

(4) Print Mode Selection

ESC ! + n (Set and Reset Various Print Modes)

Code:

(1B)H (21)H (n)H, (27)10 (33)10 (n)10

Function:

Allows print modes to be set.

Details:

- Allows print modes to be set according to the value of n.
- The table below gives the correspondence between the print modes and the value of n.
- Priority order
Elite pitch > Emphasized mode > Condensed mode
Superscript/subscript modes > Double-strike mode

Table 4.1 Print mode set designation

Bit	7	6	5	4	3	2	1	0
When 1			Set double-width print mode	Set double-strike mode	Set emphasized-print mode	Set condensed-print mode		Set elite pitch
	Always 0						Always 0	
When 0			Reset double-width print mode	Reset double-strike mode	Reset emphasized-print mode	Reset condensed-print mode		Set pica pitch

Program example:

```

10 LPRINT " ESC !+n (Set and Reset";
20 LPRINT " Various Print Mode)"
30 LPRINT
40 LPRINT "Print Mode"
50 FOR I=0 TO 4 : GOSUB 100 : NEXT I
60 FOR I=8 TO 9 : GOSUB 100 : NEXT I
70 FOR I=11 TO 12 : GOSUB 100 : NEXT I
80 END
90 '
100 FOR M=I TO I+48 STEP 16
110 READ A : LPRINT CHR$(27);"1";CHR$(A);
120 LPRINT CHR$(27);"!";CHR$(M);
130 LPRINT "Mode";M;
140 LPRINT CHR$(27);"!";CHR$(0);
150 NEXT M : LPRINT
160 RESTORE : RETURN
170 '
180 DATA 1,8,15,29

```


Print example:

ESC !+n (Set and Reset Various Print Mode)

Print Mode

Mode 0 Mode 16 Mode 32 Mode 48
Mode 1 Mode 17 Mode 33 Mode 49
Mode 2 Mode 18 Mode 34 Mode 50
Mode 3 Mode 19 Mode 35 Mode 51
Mode 4 Mode 20 Mode 36 Mode 52
Mode 8 Mode 24 Mode 40 Mode 56
Mode 9 Mode 25 Mode 41 Mode 57
Mode 11 Mode 27 Mode 43 Mode 59
Mode 12 Mode 28 Mode 44 Mode 60

(5) Super/Subscript and Underline

ESC S + n (Set Superscript/Subscript Modes)

Code:

(1B)H (53)H (n)H, (27)10 (82)10 (n)10 (n=0, 1)

Function:

- n=0 causes all subsequently received print data to print out in the superscript mode.
- n=1 causes all subsequently received print data to print out in the subscript mode.

Details:

- In the superscript/subscript mode, characters are printed in the character size compressed by 1/2 in the vertical direction.
- A character written immediately above and to the right of another character is called a superscript; a character written immediately below and to the right of another character is called a subscript.
- The superscript/subscript modes are reset by ESC T.

Program example:

```
10 LPRINT " ESC S+0";
20 LPRINT " (Set Superscript Mode)"
30 LPRINT
40 LPRINT "Normal ";
50 LPRINT CHR$(27); "S"; CHR$(0);
60 LPRINT "Superscript"
70 END
```

Print example:

ESC S+0 (Set Superscript Mode)

Normal ^{Superscript}

Program example:

```
10 LPRINT " ESC S+1 (Set Subscript Mode)"
20 LPRINT
30 LPRINT "Normal ";
40 LPRINT CHR$(27); "S"; CHR$(1);
50 LPRINT "Subscript"
60 END
```

Print example:

ESC S+1 (Set Subscript Mode)

Normal _{Subscript}

ESC T (Reset Superscript/Subscript Modes)
--

Code:

(1B)H (54)H, (27)10 (84)10

Function:

Resets the superscript/subscript modes.

Program example:

```
10 LPRINT " ESC T";
20 LPRINT " (Reset Superscript/Subscript)"
30 LPRINT
40 LPRINT CHR$(27);"S";CHR$(0);
50 LPRINT "Superscript";
60 LPRINT CHR$(27);"S";CHR$(1);
70 LPRINT "Subscript ";
80 LPRINT CHR$(27);"T";
90 LPRINT "Normal    "
100 END
```

Print example:

```
ESC T (Reset Superscript/Subscript)

superscriptsubscript Normal
```

ESC - + n (Set and Reset Underline Mode)

Code:

(1B)H (2D)H (n)H, (27)10 (45)10 (n)10 (n=0, 1)

Function:

- n=1 causes all subsequently received print characters to be underlined.
- n=0 resets the underline mode.

Program example:

```
10 LPRINT " ESC -+n"
20 LPRINT " (Set and Reset Underline Mode)"
30 LPRINT
40 LPRINT CHR$(27);"-" ;CHR$(1);
50 LPRINT "Underline";
60 LPRINT CHR$(27);"-" ;CHR$(0);
70 LPRINT " printing"
80 END
```

Print example:

```
ESC --n  
(Set and Reset Underline Mode)
```

Underline printing

(6) Proportional Spacing

ESC p + n (Set and Reset Proportional Spacing Mode)
--

Code:

(1B)H (70)H (n)H, (27)10 (112)10 (n)10 (n=0, 1)

Function:

Sets and resets the proportional-spacing mode.

Details:

- In the proportional-spacing mode, the character interval varies depending on characters for better readability.
- n = 1 sets the proportional-spacing mode.
- n = 0 resets the proportional-spacing mode.
- The BS and DEL codes are not acceptable in the proportional-spacing mode.
- Proportional spacing assumes priority over superscript/subscript print.
- The proportional-spacing mode is effective for pica characters only. It automatically sets the emphasized-print mode, which may be reset by ESC F.

Program example:

```
10 LPRINT " ESC p+n "  
20 LPRINT " (Set & Reset";  
30 LPRINT " Proportional Spacing Mode)"  
40 LPRINT  
50 LPRINT CHR$(27);"p";CHR$(1);  
60 LPRINT "Proportional"  
70 LPRINT " She writes in beautiful hand."  
80 LPRINT  
90 LPRINT CHR$(27);"F";  
100 LPRINT "Proportional";  
110 LPRINT " (Reset Emphasized Mode)"  
120 LPRINT " She writes in beautiful hand."  
130 LPRINT  
140 LPRINT CHR$(27);"p";CHR$(0);  
150 LPRINT "Normal"  
160 LPRINT " She writes in beautiful hand."  
170 END
```

Print example:

```
ESC p+n  
(Set & Reset Proportional Spacing Mode)
```

Proportional

She writes in beautiful hand.

Proportional (Reset Emphasized Mode)

She writes in beautiful hand.

Normal

She writes in beautiful hand.

4.3.4 Internal and download characters

(1) Internal Characters

ESC R + n (Select International Characters)

Code:

(1B)H (52)H (n)H, (27)10 (82)10 (n)10

($0 \leq n \leq 8$)

Function:

Selects the character set to suit the country specified by the value of n. For international characters of each country, see Appendix D.

Table 4.2 International character set selection

Value of n	Country
0	U.S.A.
1	France
2	Germany
3	U.K.
4	Denmark
5	Sweden
6	Italy
7	Spain
8	Japan

Program example:

```
10 LPRINT "  ESC R+n (Select";
20 LPRINT " International Character)"
30 WIDTH "LPT1:",255
40 LPRINT
50 LPRINT CHR$(15);
60 FOR I=0 TO 8
70     LPRINT "n=";I
80     LPRINT CHR$(27);"R";CHR$(I);
90     FOR J=33 TO 95
100         LPRINT CHR$(J);
110     NEXT J : LPRINT
120     FOR J=96 TO 126
130         LPRINT CHR$(J);
140     NEXT J : LPRINT
150 NEXT I
160 END
```

Print example:

ESC R+n (Select International Character)

```
n= 0
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~
n= 1
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ` a ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z é û ë
n= 2
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ä ö ü ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z ä ö ü ß
n= 3
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~
n= 4
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z € Ø Å ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z € Ø Å
n= 5
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ä ö å ü _
é a b c d e f g h i j k l m n o p q r s t u v w x y z ä ö å ü
n= 6
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ` a ^ _
ù a b c d e f g h i j k l m n o p q r s t u v w x y z à â ò è ì
n= 7
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ; ñ ¿ ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z ñ ¿
n= 8
! " $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 ; < = > ? @ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ # ] ^ _
` a b c d e f g h i j k l m n o p q r s t u v w x y z { } ~
```

ESC % + 0 + 0 (Select Internal Character Set)

Code:

(1B)H (25)H (00)H (00)H
(27)10 (37)10 (0)10 (00)10

Function:

Selects the internal character set.

Details:

On receiving this code, the printer prints using the internal character set.

Program example:

```
10 LPRINT " ESC %+0+0 (Select ROM CG)"
20 LPRINT
30 LPRINT CHR$(27); "%"; CHR$(0); CHR$(0);
40 FOR I=65 TO 90
50     LPRINT CHR$(I);
60 NEXT I
70 LPRINT
80 END
```

Print example:

ESC %+0+0 (Select ROM CG)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

ESC 4 (Select Alternate Mode)

Code:

(1B)H (34)H, (27)10 (52)10

Function:

Prints print data in the alternate (italic) mode.

ESC 5 (Reset Alternate Mode)

Code:

(1B)H (35)H, (27)10 (53)10

Function:

- Allows print data to be printed in the normal mode by resetting the alternate mode set by ESC4.
- Prints print codes (20)H to (7E)H in regular type and (A0)H to (FE)H in italic type.

Program example:

```
10 LPRINT CHR$(27);"4";
20 LPRINT " ESC 4 (Set Alternate Mode)"
30 LPRINT
40 LPRINT "Italic ";
50 LPRINT "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
60 LPRINT
70 LPRINT CHR$(27);"5";
80 LPRINT " ESC 5 (Cancel Alternate Mode)"
90 LPRINT
100 LPRINT "Normal ";
110 LPRINT "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
120 END
```

ESC 4 (Set Alternate Mode)

Italic ABCDEFGHIJKLMNOPQRSTUVWXYZ

ESC 5 (Cancel Alternate Mode)

Normal ABCDEFGHIJKLMNOPQRSTUVWXYZ

ESC 6 (Extend Print Code Area)

Code:

(1B)H (36)H, (27)10 (54)10

Function:

Extends the print code area to handle ASCII codes (80)H to (9F)H and (FF)H as printable characters.

Caution:

All codes in the function area are handled as print codes if ESC > (MSB set command) is received following ESC6.

ESC 7 (Reset Setting by ESC6)

Code:

(1B)H (37)H, (27)10 (55)10

Function:

Handles ASCII codes (80)H to (9F)H and (FF)H as those in the function area (default assumption).

Program example:

```
10 LPRINT " ESC 6";
20 LPRINT " (Set Printable Code Area)"
30 LPRINT
40 LPRINT CHR$(27);"6";
50 FOR I=128 TO 159
60 LPRINT CHR$(I);
70 NEXT I
80 LPRINT : LPRINT
90 LPRINT " ESC 7";
100 LPRINT " (Cancel Printable Code Area)"
110 LPRINT
120 LPRINT CHR$(27);"7"
130 LPRINT CHR$(135);
140 END
```

Print example:

```
ESC 6 (Set Printable Code Area)

àéùòì°£/¿ÑÑÑÑÑÀàç§ÑÑÑÑÑ"ÀÖÜäöüÉÉ£

ESC 7 (Cancel Printable Code Area)
```

ESC > (Set MSB to 1)

Code:

(1B)H (3E)H, (27)10 (62)10

Function:

Forcibly sets the most significant bit (MSB) in input data to 1.

Details:

This function is inoperative for image data.

ESC = (Reset MSB to 0)

Code:

(1B)H (3D)H, (27)10 (61)10

Function:

Forcibly sets the most significant bit (MSB) in input data to 0.

Details:

This function is inoperative for image data.

ESC # (Disable MSB Control)

Code:

(1B)H (23)H, (27)10 (35)10

Function:

Resets the MSB control as set by ESC > or ESC =.

Program example:

```
10 LPRINT CHR$(27); "I"; CHR$(1);
20 LPRINT CHR$(27); "=";
30 LPRINT "   ESC = (Set MSB=0)"
40 GOSUB 170
50 LPRINT CHR$(27); "#";
60 LPRINT "   ESC # (Cancel MSB Control)"
70 GOSUB 170 : LPRINT
80 '
90 LPRINT CHR$(27); ">";
100 LPRINT "   ESC > (Set MSB=1)"
110 GOSUB 170
120 LPRINT CHR$(27); "#";
130 LPRINT "   ESC # (Cancel MSB Control)"
140 GOSUB 170
150 END
160 '
170 RESTORE : LPRINT " ";
180 FOR I=1 TO 18
190     READ A
200     LPRINT CHR$(A);
210 NEXT I
220 LPRINT
230 RETURN
240 '
250 DATA 128,129,130,131,132,133
260 DATA 134,144,145,149,150,151
270 DATA 153,154,156,157,158,159
```

Print example:

```
ESC = (Set MSB=0)
äëùòì°£§ßø"ÄÜäÜëë¥
ESC # (Cancel MSB Control)
äëùòì°£§ßø"ÄÜäÜëë¥

ESC > (Set MSB=1)
äëùòì°£§ßø"ÄÜäÜëë¥
ESC # (Cancel MSB Control)
äëùòì°£§ßø"ÄÜäÜëë¥
```

ESC I + n (Select Control Code)

Code:

(1B)H (49)H (n)H

(27)10 (73)10 (n)10 (n=0, 1)

Function:

Handles undefined codes in the function code area (00)H to (1F)H or (80)H to (9F)H in the code table as printable characters.

Details:

- When $n = 1$, undefined codes are handled as printable characters.
- When $n = 0$, undefined codes are handled as is.
- CR, LF, and other function codes are not affected by this command. (The DC1 code, however, is handled as a printable character when $n = 1$ in modes not involving use of the DC1 or DC3 code.)
- In the table below, ESC I + 1 makes the function code area codes indicated by blanks printable.

Table 4.3 Function codes definable as printable character

Function code	Decimal	Hexa-decimal	Binary
	0	00	00000000
	1	01	00000001
	2	02	00000010
	3	03	00000011
	4	04	00000100
	5	05	00000101
	6	06	00000110
(BEL)	7	07	00000111
(BS)	8	08	00001000
(HT)	9	09	00001001
(LF)	10	0A	00001010
(VT)	11	0B	00001011
(FF)	12	0C	00001100
(CR)	13	0D	00001101
(SO)	14	0E	00001110
(SI)	15	0F	00001111
	16	10	00010000
(DC1)	17	11	00010001
(DC2)	18	12	00010010
(DC3)	19	13	00010011
(DC4)	20	14	00010100
	21	15	00010101
	22	16	00010110
	23	17	00010111
(CAN)	24	18	00011000
	25	19	00011001
	26	1A	00011010
(ESC)	27	1B	00011011
	28	1C	00011100
	29	1D	00011101
	30	1E	00011110
	31	1F	00011111

Method of printing download characters defined at function code addresses such as those for FF and LF:

International characters are defined by codes in the next table. For example, since (12)10, FF code, is associated with (35)10 in the Spanish mode, the download character defined in (12)10 can be called by (35)10 in the Spanish mode.

This method allows the printer to print out the download characters defined by function codes. (The 10 in (12)10 denotes decimal.)

Table 4.4 Function code addresses used for international characters

Decimal	35	36	64	91	92	93	94	96	123	124	125	126
U.S.A.												
FRANCE			0	5	15	16			30	2	1	22
GERMANY			16	23	24	25			26	27	28	17
U.K.	6											
DENMARK				18	20	13			19	21	14	
SWEDEN		11	29	23	24	13	25	30	26	27	14	28
ITALY				5		30		2	0	3	1	4
SPAIN	12			7	9	8			22	10		
JAPAN					31							

Program example:

```
10 LPRINT " ESC I+n (Select Control Code)"
20 LPRINT
30 LPRINT "ESC I+0 (Reset)"
40 LPRINT CHR$(27); "I"; CHR$(0);
50 LPRINT " <beep>"; CHR$(7); CHR$(0)
60 LPRINT
70 LPRINT "ESC I+1 (Set)"
80 LPRINT CHR$(27); "I"; CHR$(1);
90 LPRINT " <beep>"; CHR$(7); CHR$(0)
100 END
```

Print example:

ESC I+n (Select Control Code)

ESC I+0 (Reset)
<beep>

ESC I+1 (Set)
<beep>à

ESC % + 2 + 0 (Select NLQ Characters)
--

Code:

(1B)H (25)H (02)H (00)H
(27)10 (37)10 (2)10 (0)10

Function:

Selects the NLQ character set.

Details:

- Print data received subsequent to this code is printed by using the NLQ character set.
- Use ESC % + 0 + n to return to the internal character set.
- The proportional spacing mode and double-width mode can be specified.
- See the NLQ CG code table in Appendix D.

This printer can be equipped with NLQ CG-ROM to print NLQ characters at double density both vertically and horizontally.

NLQ characters are selected with the NLQ character set select command (ESC % + 2 + 0). These characters can be also selected when the printer is powered with the operator panel FF switch pressed.

NLQ characters cannot be printed in elite pitch or the condensed-, emphasized-, and dubblestrike- print modes.

Program example:

```
10 LPRINT " ESC %+2+0 (Select NLQ CG) "  
20 LPRINT  
30 LPRINT CHR$(27); "%"; CHR$(2); CHR$(0);  
40 FOR I=65 TO 90  
50 LPRINT CHR$(I);  
60 NEXT I  
70 LPRINT  
80 END
```

Print example:

ESC %+2+0 (Select NLQ CG)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

(2) Download Characters

ESC % + 1 + 0 (Select Download Character Set)
--

Code:

(1B)H (25)H (01)H (00)H
(27)10 (37)10 (1)10 (0)10

Function:

Selects the download character set.

Details:

- The download character set is initially blank when the printer is powered.
- On receiving this code, the printer prints using the download character set.

ESC : + 0 + 0 + 0 (Copy Character Set)

Code:

(1B)H (3A)H (00)H (00)H (00)H
(27)10 (58)10 (0)10 (0)10 (0)10

Function:

Copies the internal character set into the download character set without alteration.

Program example:

```
10 LPRINT " ESC :+0+0+0";
20 LPRINT " (Copy Character Set)"
30 LPRINT
40 LPRINT "Copy into Download CG"
50 GOSUB 130
60 LPRINT
70 LPRINT CHR$(27);": ";
80 LPRINT CHR$(0);CHR$(0);CHR$(0);
90 LPRINT "Select Download CG"
100 GOSUB 130
110 END
120 '
130 FOR I=65 TO 90
140     LPRINT CHR$(I);
150 NEXT I
160 LPRINT
170 RETURN
```

Print example:

```
ESC :+0+0+0 (Copy Character Set)

Copy into Download CG
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Select Download CG
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

ESC & + 0 + n + m + a + p1 + ... + p11 (Define Download Characters)

Code:

(1B)H (26)H (00)H (n)H (m)H (a)H (p1)H ... (p11)H

(00 ≤ n ≤ m ≤ FF)

(27)10 (38)10 (0)10 (n)10 (m)10 (a)10 (p1)10 ... (p11)10

(0 ≤ n ≤ m ≤ 255)

Function:

Defines download character patterns.

Details:

- Character codes from n to m are defined by patterns p1, p2, ..., p11. (Specify the same value for m and n to define only one character.) When m ≠ n, that is, two or more characters are to be defined, repeat a + p1 + ... + p11 for each of the characters to be defined.
- (00)H to (FF)H can be used for download character definition, but the character codes that can be printed are from (20)H to (FF)H. The ESC I + n command permits character codes from (00)H to (1F)H to be printed, excluding control codes.
- "a" refers to attribute information (described later).
- For a character, print data must be sent for all the 11 print positions even if some positions include no pins to be activated.
- Even when a character pattern includes horizontally consecutive dots, the corresponding pin is automatically activated every other print position.

Program example:

```
10 LPRINT " ESC &+n+m+a+p1+...+p11"
20 ' Define Download Character
30 LPRINT
40 LPRINT CHR$(27); "&"; CHR$(0);
50 LPRINT CHR$(33); CHR$(33);
60 LPRINT CHR$(139);
70 LPRINT CHR$(18); CHR$(4); CHR$(40);
80 LPRINT CHR$(16); CHR$(32); CHR$(12);
90 LPRINT CHR$(50); CHR$(0); CHR$(34);
100 LPRINT CHR$(0); CHR$(0);
110 LPRINT CHR$(27); "%"; CHR$(1); CHR$(0);
120 LPRINT "!!!!!!!!!!!!!"
130 END
```

Print example:

ESC &+n+m+a+p1+...+p11

XXXXXXXXXXXX

Defining download characters:

a. Print pattern

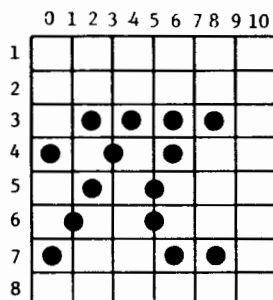


Figure 4.2 Character pattern example 1

- Consecutive activation of the same pin is automatically ignored. In this case, that pin is activated every other print position.
 - The same value must be specified for m and n to define only one character.
 - The B in (0001)B or (0010)B designates binary.
- (a) If Greek letter π in character pattern example 1 is defined for the code position of mark I, n and m becomes (21)H.
- (b) The figure below shows how binary data can be converted into hexadecimal data, where the location to be printed is designated 1 and that not be printed is designated 0.

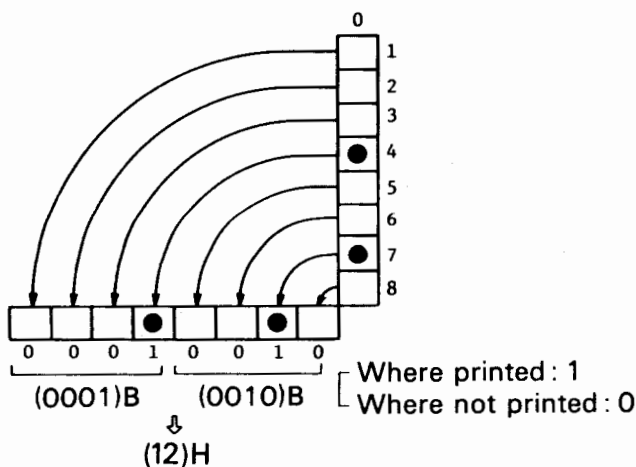


Figure 4.3 Conversion to hexadecimal (position 0)

- (c) Print data created for positions 0 to 10 by step (b) provides p1 to p11.

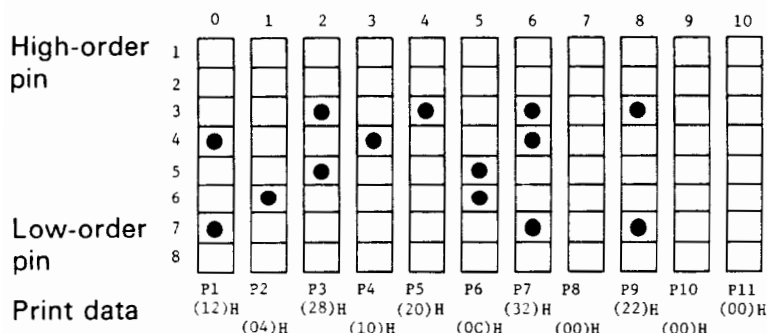


Figure 4.4 Conversion to hexadecimals (positions 0 to 10)

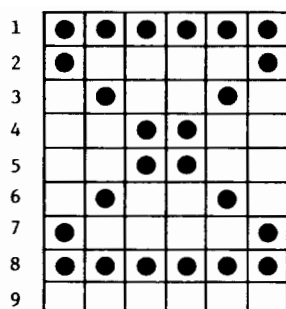
b. Attribute information

Attribute information includes descenders and proportional spacing information.

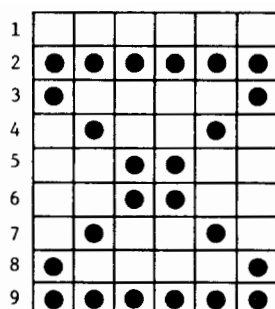
- (a) A descender is used to allow 8-bit print data, organized from pins 1 to 8, to be shifted 1 bit downward so it can print out using pins 2 to 9. It is specified in the highest-order bit of the attribute information as follows:

0: With a descender specification

1: Without a descender specification



Without a descender specification



With a descender specification

Figure 4.5 Character pattern example 2

- (b) Proportional spacing information specifies the print area in the proportional spacing print mode. It is invalid in other print modes.

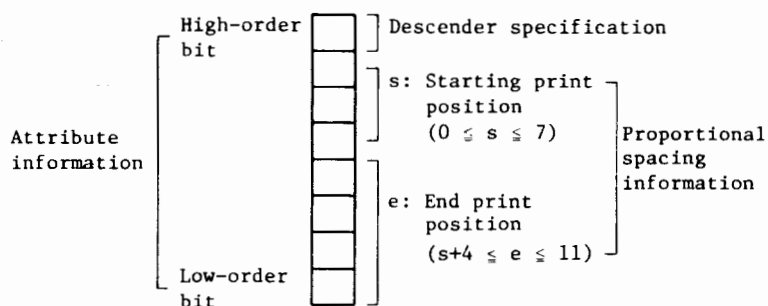


Figure 4.6 Proportional spacing information

The smallest character pattern size (width) that can be specified is 5 positions. $s=0$ and $e=B$ are automatically assumed when s or e exceeds its limit. Without a descender specification, attribute information is automatically set to (8B)H.

Proportional spacing information may specify position 11 as the maximum end print position. In this case, position 11 is blank because position 11 cannot be specified for any character pattern.

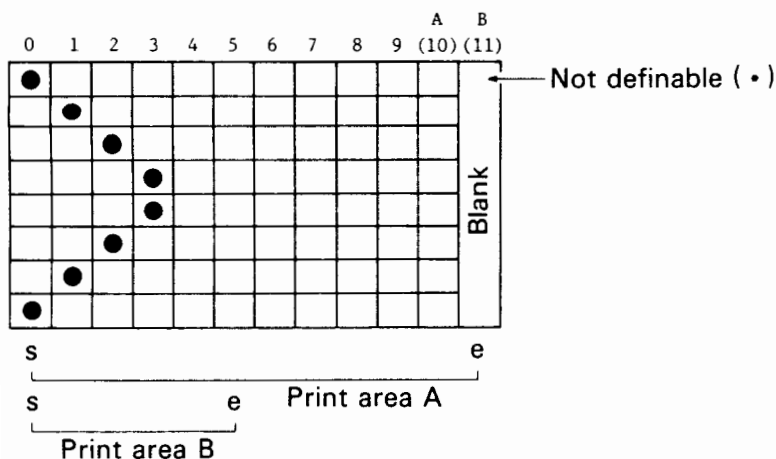


Figure 4.7 Character pattern example 3

- When the emphasized print mode is specified together with the proportional spacing mode and if the proportional information includes position 10 as the end print position, the second strike for the last print data cannot be done because its print position becomes 11 (blank position). Therefore, the end print position must be set to a value greater by one or more positions than the last print data position of the defined character pattern.

In character pattern example 3 assume two print areas : a larger print area, A, and a smaller print area, B.

In this situation the print positions are specified as follows:

A: $s = 0, e = B(11)10 \rightarrow (0B)H$

B: $s = 0, e = 5 \rightarrow (05)H$

Then, attribute information is specified as follows:

Without a descender specification

$$A: (80)H + (0B)H = (8B)H$$

$$B: (80)H + (05)H = (85)H$$

With a descender specification

$$A: (0B)H$$

$$B: (05)H$$

4.3.5 Graphics image modes

This printer provides two image modes that permit controlling each individual dot: 8- and 9-pin image modes.

(1) 8-pin image mode

The 8-pin image mode is subdivided into seven modes. Print pins 1-8 can be specified with 1-byte image data. The correspondence between the interface signals and print pins is shown below. For example, (84)H image data may be sent to print using only pins 1 and 6.

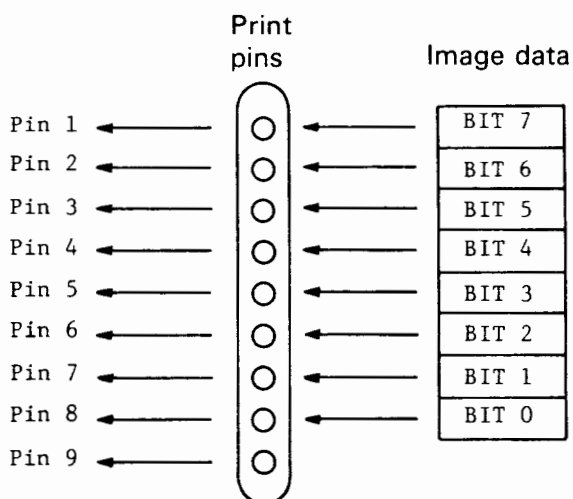


Figure 4.8 8-pin image mode pin assignment

ESC * + m + n1 + n2 (Set 8-pin Image Mode)

Code:

(1B)H (2A)H (m)H (n1)H (n2)H ($0 \leq m \leq 6$, $0 \leq n1 \leq FF$, $0 \leq n2 \leq 7$)

(27)10 (42)10 (m)10 (n1)10 (n2)10 ($0 \leq m \leq 6$, $0 \leq n1 \leq 255$, $0 \leq n2 \leq 7$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in one of the seven image modes selected by the value of m.

Table 4.5 8-pin image modes

m	Mode name	Number of image data items/line	Horizontal dot density	Print speed inch/s
0	Single-density image	480	1/60 inch	18
1	Double-density image	960	1/120 inch	9
2	Double-speed double-density image	960	1/60 inch	18
3	Quadruple-density image	1920	1/120 inch	9
4	CRT I image	640	1/80 inch	9
5	Plotter image	576	1/72 inch	10.7
6	CRT II image	720	1/90 inch	9

Details:

— ESC K + n1 + n2 (single-density image) is equal to mode 0.

ESC L + n1 + n2 (double density image) is equal to mode 1.

ESC Y + n1 + n2 (double-speed double-density image) is equal to mode 2.

ESC Z + n1 + n2 (quadruple-density image) is equal to mode 3.

— In the plotter image mode, the ratio of the vertical dot size to the horizontal dot size is 1:1.

Program example:

```
10 LPRINT " ESC *+m+n1+n2";
20 LPRINT " (Set 8-pin Image Mode)"
30 LPRINT
40 WIDTH "LPT1:",255
50 FOR I=0 TO 6
60     LPRINT "m=";I
70     LPRINT CHR$(27);"*";CHR$(I);
80     LPRINT CHR$(200 MOD 256);
90     LPRINT CHR$(INT(200/256));
100     FOR J=1 TO 200/2
110         LPRINT CHR$(170);CHR$(85);
120     NEXT J
130 LPRINT
140 NEXT I
150 END
```

Print example:

ESC *+m+n1+n2 (Set 8-pin Image Mode)

m= 0



m= 1



m= 2



m= 3



m= 4



m= 5



m= 6



ESC K + n1 + n2 (Set Single-density Image)

Code:

(1B)H (4B)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 1$)

(27)10 (75)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 1$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a single-density image.

Details:

- n1 and n2 represent the low- and high-order bytes, respectively. They are combined to denote the volume of image data.

For example, to send 300 items of image data:

$300/256 = 1$ with a remainder of 44.

Accordingly, the data to be sent should be n1 = (44)10 or (2C)H and n2 = (1)10 or (01)H.

- Up to 480 items of image data can be printed on a line. Any data specified beyond this limit is ignored. If image data is to span more than one line, this specification is required for each of the print lines.
- If characters have been printed to half a line (equivalent to 40 characters with pica pitch) the remaining part of the line allows printing of 240 items of image data.

Program example:

```
10 LPRINT " ESC K+n1+n2";
20 LPRINT " (Set Single-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"K";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90     LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC K+n1+n2 (Set Single-density Image)

Number of Data = 100

██

ESC L + n1 + n2 (Set Double-density Image)

Code:

(1B)H (4C)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 3$)
(27)10 (76)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 3$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a double-density image.

Details:

- Setting of n1 and n2 is the same as that for ESC K + n1 + n2.
- Up to 960 items of image data can be printed on a line. Any data specified beyond this limit is ignored. If image data is to span more than one line, this specification is required for each of the print lines.
- If characters have been printed to half a line (equivalent to 40 characters with pica pitch) the remaining part of the line allows printing of 480 items of image data.

Program example:

```
10 LPRINT " ESC L+n1+n2";
20 LPRINT " (Set Double-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"L";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90     LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC L+n1+n2 (Set Double-density Image)

Number of Data = 100

ESC Y + n1 + n2 (Set Double-speed, Double-density Image)

Code:

(1B)H (59)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 3$)
(27)10 (89)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 3$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a double-density image at a speed twice as fast as

ESC L + n1 + n2.

Details:

- Up to 960 items of image data can be printed on a line. The same pin cannot be operated for consecutive positions because of double-speed printing.
- Other conditions are the same as those for ESC L + n1 + n2.

Program example:

```
10 LPRINT "   ESC Y+n1+n2 "  
20 LPRINT "   (Set Double-speed";  
30 LPRINT ",Double-density Image)"  
40 LPRINT  
50 WIDTH "LPT1:",255  
60 LPRINT "Number of Data = 100"  
70 LPRINT CHR$(27);"Y";CHR$(100 MOD 256);  
80 LPRINT CHR$(INT(100/256));  
90 FOR J=1 TO 100/2  
100   LPRINT CHR$(170);CHR$(85);  
110 NEXT J  
120 LPRINT  
130 END
```

Print example:

```
ESC Y+n1+n2  
  (Set Double-speed,Double-density Image)
```

Number of Data = 100
██████████

ESC Z + n1 + n2 (Set Quadruple-density Image)
--

Code:

(1B)H (5A)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 7$)
(27)10 (90)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 7$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a quadruple-density image.

Details:

- Setting of n1 and n2 is the same as that for ESC K + n1 + n2.
- Up to 1920 items of image data can be printed on a line. The same pin cannot be operated for consecutive positions.

Program example:

```
10 LPRINT " ESC Z+n1+n2";
20 LPRINT " (Set Quadruple-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"Z";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90     LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC Z+n1+n2 (Set Quadruple-density Image)

Number of Data = 100

■■■■■

(2) 9-pin image mode

The 9-pin image mode is subdivided into two modes. Print pins 1-9 can be specified with 9-pin image data. The correspondence between the interface signals and print pins is shown below.

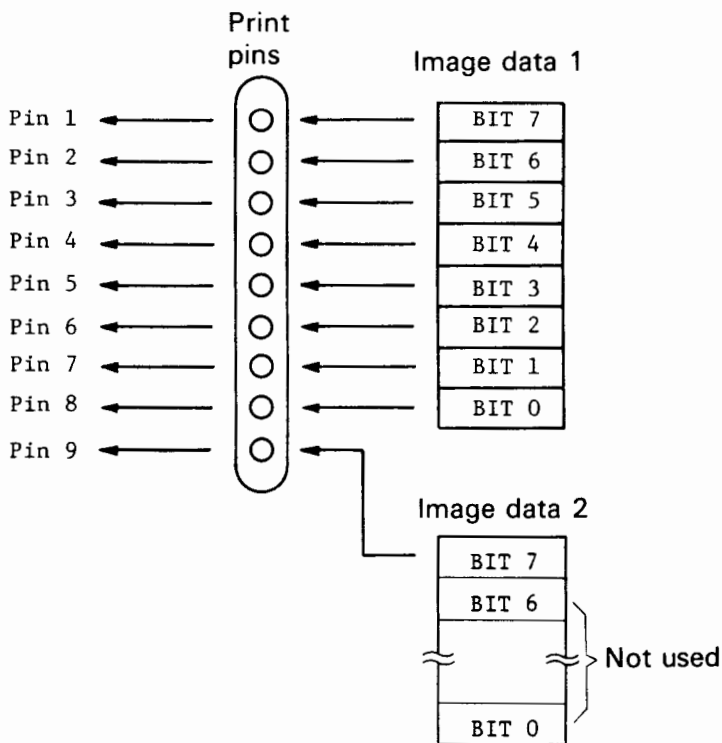


Figure 4.9 9-pin image mode pin assignment

ESC ^ + m + n1 + n2 (Set 9-pin Image Mode)

Code:

(1B)H (5A)H (n1)H (n2)H

($0 \leq m \leq 1, 0 \leq n1 \leq FF, 0 \leq n2 \leq 3$)

(27)10 (90)10 (n1)10 (n2)10

($0 \leq m \leq 1, 0 \leq n1 \leq 255, 0 \leq n2 \leq 3$)

Function:

Causes the printer to print twice the volume of data specified by n1 and n2 in one of the two 9-pin image modes selected by the value of m.

Table 4.6 9-pin image modes

m	Mode name	Number of image data items/line	Horizontal dot density	Print speed inch/s
0	Single-density 9-pin image	960	1/60 inch	18
1	Double-density 9-pin image	1920	1/120 inch	9

Details:

- Half the total number of data items to be sent after ESC ^ + m + n1 + n2 is specified by n1 and n2 because data for pins 1-9 is produced from 2-byte image data (two items of image data for each item of column data) in the 9-pin image mode. This specification differs from that for the 8-pin image mode.

Program example:

```
10 LPRINT " ESC ^+m+n1+n2";
20 LPRINT " (Set 9-pin Image Mode)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Single-density"
60 LPRINT CHR$(27);"^";CHR$(0);
70 LPRINT CHR$(200 MOD 256);
80 LPRINT CHR$(INT(200/256));
90 GOSUB 160
100 LPRINT "Double-density"
110 LPRINT CHR$(27);"^";CHR$(1);
120 LPRINT CHR$(200 MOD 256);
130 LPRINT CHR$(INT(200/256));
140 GOSUB 160
150 END
160 ' *** Subroutine ***
170 FOR I=1 TO 200/2
180     LPRINT CHR$(170);CHR$(128);
190     LPRINT CHR$(85);CHR$(0);
200 NEXT I
210 LPRINT
220 RETURN
```

Print example:

ESC ^+m+n1+n2 (Set 9-pin Image Mode)

Single-density



Double-density



4.3.6 Other features

BEL (Bell)

Code:
(07)H, (7)10

Function:
Sounds the buzzer for about 0.25 second.

Details:
The buzzer can be deactivated by opening (setting to OFF) DIP switch SW2-2..

Program example:

```
1Ø LPRINT " BEL (Bell) "  
2Ø LPRINT  
3Ø LPRINT CHR$(7);  
4Ø END
```

Print example:

BEL (Bell)

ESC 8 (Disable Paper End Sensor)

Code:
(1B)H (38)H, (27)10 (56)10

Function:
Allows the printer to continue printing by ignoring signals from the paper end sensor.

Details:

- This command provides an economical use of paper by allowing printing to the end of the paper.
- This command has the same effect as DIP switch SW1-3 being set to ON.

Program example:

```
10 LPRINT " ESC 8";
20 LPRINT " (Disable Paper End Sensor)"
30 LPRINT
40 LPRINT CHR$(27);"8";
50 END
```

Print example:

ESC 8 (Disable Paper End Sensor)

ESC 9 (Enable Paper End Sensor)

Code:

(1B)H (39)H, (27)10 (57)10

Function:

- The printer automatically enters the offline state after this command is input if a paper-end condition exists.
- This command has the same effect as DIP switch SW1-3 being set to OFF.

Program example:

```
10 LPRINT " ESC 9";
20 LPRINT " (Enable Paper End Sensor)"
30 LPRINT
40 LPRINT CHR$(27);"9";
50 END
```

Print example:

ESC 9 (Enable Paper End Sensor)

ESC i + n (Set Typewriter Mode)

Code:

(1B)H (69)H (n)H, (27)10 (105)10 (n)10 (n=0, 1)

Function:

Sets the printer in the typewriter mode when n = 1 is specified.

Details:

The typewriter mode is the mode of operation in which the printer prints each character as it is entered, and advances the paper to such position as makes the printed character visible if no input data is received for approximately 0.1 s.

When the next data is received, reverse feed is done to return the paper where it was.

$n=0$ resets the typewriter mode, allowing the printer to return to the normal mode.

Caution:

To prevent paper jams, use of this command in a reverse-feed inhibit area should be avoided. See Notes on Reverse Form Feed under the item of ESC j + n (Reverse Line Feed).

Program example:

```
10 LPRINT " ESC i+n (Typewriter Mode)"
20 LPRINT
30 LPRINT "Input Any Key";
40 LPRINT " (Cancel-Press ESC Key)"
50 LPRINT CHR$(27);"i";CHR$(1) 'set
60 A$=INKEY$
70 IF A$=CHR$(27) THEN 100
80 LPRINT A$;
90 GOTO 60
100 LPRINT CHR$(27);"i",CHR$(0) 'reset
110 END
```

Print example:

```
ESC i+n (Typewriter Mode)

Input Any Key (Cancel-Press ESC Key)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
```

ESC s + n (Half Printing Speed)

Code:

(1B)H (73)H (n)H, (27)10 (115)10 (n)10 (n=0, 1)

Function:

- n = 1 causes the printer to print characters with pica pitch at half the normal speed.
- n = 0 causes the printer to print characters with pica pitch at the normal speed.

Details:

This command is useful for muting noise during printing operation.

Program example:

```
10 LPRINT " ESC s+n (Half Printing Speed)"
20 LPRINT
30 LPRINT CHR$(27);"s";CHR$(1);
40 LPRINT " Half speed ";
50 LPRINT " abcdefghijklmnopqrstuvwxyz"
60 LPRINT
70 LPRINT CHR$(27);"s";CHR$(0);
80 LPRINT "Normal speed";
90 LPRINT " abcdefghijklmnopqrstuvwxyz"
100 END
```

Print example:

ESC s+n (Half Printing Speed)

Half speed abcdefghijklmnopqrstuvwxyz

Normal speed abcdefghijklmnopqrstuvwxyz

CAN (Cancel)

Code:

(18)H, (24)10

Function:

Cancels all the data on the same line in the print buffer.

Program example:

```
10 LPRINT "  CAN (Cancel)"
20 LPRINT
30 LPRINT "ABCDEFGH";CHR$(24);
40 LPRINT "HIJKLMN"
50 END
```

Print example:

CAN (Cancel)

HIJKLMN

DEL (Delete)

Code:

(7F)H, (127)10

Function:

Clears the previous print data in the printer buffer.

Program example:

```
10 LPRINT "  DEL (Delete)"
20 LPRINT
30 LPRINT "ABCDEFGH";CHR$(127);
40 LPRINT "HIJKLMN"
50 END
```

Print example:

DEL (Delete)

ABCDEFGHJKLMN

ESC @ (Reset Printer)

Code:

(1B)H (40)H, (27)10 (64)10

Function:

Performs a reset equivalent (*1) to the power-on reset.

*1 The input buffer (2K buffer) is not cleared.

Program example:

```
10 LPRINT " ESC @ (Reset Printer)"
20 LPRINT
30 LPRINT CHR$(27); "@";
40 END
```

Print example:

ESC @ (Reset Printer)

DC1 (Device Control 1: Set Online)

Code:

(11)H, (17)10

Function:

Sets the printer in the online state.

Details:

- The DC1 code can be used with the DC3 code to set the printer in the online or offline state.
- See the description of the DC3 code.

Program example:

```
10 LPRINT " DC1";
20 LPRINT " (Selection of the Printer)"
30 LPRINT
40 LPRINT CHR$(19); "ABCDEFGH";
50 LPRINT CHR$(17); "HIJKLMN"
60 END
```

Print example:

DC1 (Selection of the Printer)

HIJKLMN

DC3 (Device Control 3: Set Offline)

Code:

(13)H, (19)10

Function:

Sets the printer in the offline state.

Details:

- The printer can be placed in the online state by the DC1 code.
- On receipt of the DC3 code, once the printer is set in the offline state, all subsequently received data is invalidated until the DC1 code is input.
- The DC1/DC3 code functions are enabled if DIP switch SW2-1 is open (off) and if the SLCT IN signal (interface connector pin 36) is H when the printer is initially powered.

SLCT signal and online lamp indicator are not changed by the DC1/DC3 codes.

- The table below summarizes the relationship between the operator panel online switch, the SLCT IN (input signal) and DC1/DC3 codes, and the interface processing.

Table 4.7 Online conditions on interface

Online switch	<u>SLCT IN</u>	DC1/DC3	<u>ERROR</u>	BUSY	<u>ACK</u>	Input data processing
Off-line	H/L	DC1/DC3	LOW	HIGH	No pulses are output	Data entry is disabled.
Online	HIGH	DC1	HIGH	H/L	Pulses are output	Data entry is enabled Normal processing
		DC3	HIGH	H/L	Pulses are output	Data entry is enabled, but input data is discarded until the DC1 code is received
	LOW	DC1	HIGH	H/L	Pulses are output	Data entry is enabled Normal processing
		DC3	HIGH	H/L	Pulses are output	Data entry is enabled Normal processing

Program example:

```
10 LPRINT " DC3"
20 LPRINT " (Deselection of the Printer)"
30 LPRINT
40 LPRINT CHR$(17);"ABCDEFGH";
50 LPRINT CHR$(19);"HIJKLMN"
60 LPRINT CHR$(17)
70 END
```

Print example:

```
DC3
(Deselection of the Printer)

ABCDEFGH
```

4.4 Control Codes for Type I

4.4.1 Paper movement or vertical formatting

(1) Line Feeding

LF (Line Feed)

Code:

(0A)H, (10)10

Function:

Effects a line feed after printing data.

Details:

The line spacing is set to 1/6 or 1/8 inch according to the DIP switch setting when the printer is initially powered, but it may be changed by ESC 0, ESC 1, ESC 2, ESC 3 + n, or ESC A + n

Resets the double-width print mode set by the SO (Shift Out) code.

Program example:

```
10 LPRINT " LF (Line Feed)"
20 LPRINT
30 LPRINT "A C E G I K M ";CHR$(10);
40 LPRINT " b d f h j l n"
50 END
```

Print example:

```
LF (Line Feed)

A C E G I K M
 b d f h j l n
```

ESC J + n (Line Feed)

Code:

(1B)H (4A)H (n)H ($0 \leq n \leq FF$)

(27)10 (74)10 (n)10 ($0 \leq n \leq 255$)

Function:

Moves the print position by n/216 inch vertically in the forward direction after printing preceding data.

Details:

The form-feed setting is effective only on the current line.

Program example:

```
10 LPRINT " ESC J+n (Line Feed)"
20 LPRINT
30 FOR I=5 TO 30 STEP 5
40     LPRINT CHR$(27);"J";CHR$(I);
50     LPRINT " -----";
60 NEXT I : LPRINT
70 END
```

Print example:

ESC J+n (Line Feed)

```
=====
=====
=====
=====
=====
```

ESC j + n (Reverse Line Feed)

Code:

(1B)H (6A)H (n)H ($0 \leq n \leq FF$)

(27)10 (106)10 (n)10 ($0 \leq n \leq 255$)

Function:

Moves the print position by n/216 inch vertically in the reverse direction after printing data in the print buffer.

Details:

This command performs the same operation as ESC J + n, except that a form feed occurs in the opposite direction.

Caution:

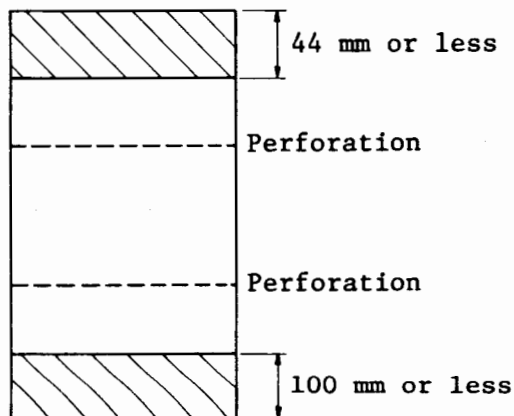
To prevent paper jams, use of this command in a reverse-feed inhibit area should be avoided. See the following.

Notes on Reverse Form Feed:

To prevent paper jams, reverse form feed is prohibited in the shadowed areas of the paper as shown below.

With fanfold paper

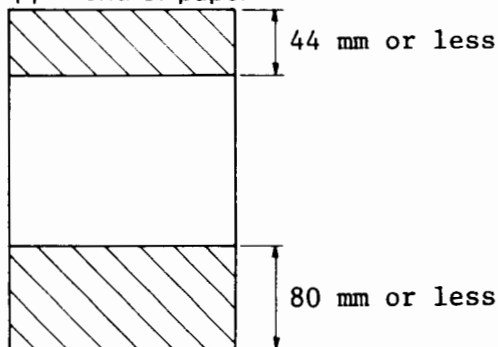
Upper end of paper



Lower end of paper

With cut-sheet paper

Upper end of paper



Lower end of paper

Figure 4.10 Reverse feed prohibited area

Program example:

```
10 LPRINT " ESC j+n (Reverse Line Feed)"
20 LPRINT : LPRINT : LPRINT
30 FOR I=30 TO 5 STEP -5
40     LPRINT CHR$(27);"j";CHR$(I);
50     LPRINT " -----";
60 NEXT I : LPRINT
70 END
```

Print example:

```
ESC j+n (Reverse Line Feed)
=====
=====
=====
=====
=====
```

(2) Line Spacing

ESC 2 (Validate Line Spacing Setting)

Code:

(1B)H (32)H, (27)10 (50)10

Function:

- Validates the line spacing of $n/72$ (inch/line) specified by ESC A + n.
- Sets the line spacing to $1/6$ (inch/line) when it is not specified by ESC A + n.

Program example:

```
10 LPRINT " ESC 2 (Set Line Spacing)"
20 LPRINT
30 FOR I=1 TO 3
40   LPRINT CHR$(27);"2";
50   LPRINT "ABCDEFGHijklmn -----"
60 NEXT I
70 LPRINT      'Set ESC A+n
80 FOR N=1 TO 10
90   LPRINT CHR$(27);"A";CHR$(N);
100   LPRINT CHR$(27);"2";
110   LPRINT " -----"
120 NEXT N
130 END
```

Print example:

```
ESC 2 (Set Line Spacing)

ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
```

```
=====
-----
-----
-----
-----
-----
```

ESC 0 (Set Line Spacing to 1/8 Inch)

Code:

(1B)H (30)H, (27)10 (48)10

Function:

Sets the line spacing to 1/8 (inch/line).

Details:

Once this command is received, line spacing subsequently performed by an LF code, or equivalent, is set to 1/8 (inch/line).

Program example:

```
10 LPRINT " ESC Ø (1/8 Inch Line Spacing)"
20 LPRINT
30 LPRINT CHR$(27);"Ø";
40 FOR I=1 TO 3
50 LPRINT "ABCDEFGHijklmn -----"
60 NEXT I
70 END
```

Print example:

```
ESC Ø (1/8 Inch Line Spacing)

ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
ABCDEFGHijklmn -----
```

ESC 1 (Set Line Spacing to 7/72 Inch)
--

Code:

(1B)H (31)H, (27)10 (40)10

Function:

Sets the line spacing to 7/72 (inch/line). 7/72 inch corresponds to the vertical dot line length of the capital letters.

Program example:

```
10 LPRINT " ESC 1";
20 LPRINT " (7/72 Inch Line Spacing)"
30 LPRINT
40 LPRINT CHR$(27);"1";
50 FOR I=1 TO 3
60 LPRINT "ABCDEFGHijklmn -----"
70 NEXT I
80 END
```

Print example:

ESC 1 (7/72 Inch Line Spacing)

```
ABCDEFGHIJKlmn =====  
ABCDEFGHIJKlmn =====  
ABCDEFGHIJKlmn =====
```

ESC 3 + n (Set Line Spacing to n/216 Inch)

Code:

(1B)H (33)H (n)H ($0 \leq n \leq FF$),
27(10) (51)10 (n)10 ($0 \leq n \leq 255$)

Function:

Sets the line spacing to n/216 (inch/line) (in multiples of 1/3 dot).

Caution:

Line spacing accuracy may not be guaranteed when $n < 3$

Program example:

```
10 LPRINT " ESC 3+n";  
20 LPRINT " (n/216 Inch Line Spacing)"  
30 LPRINT  
40 LPRINT "n=1 TO 10"  
50 FOR N=1 TO 10  
60 LPRINT CHR$(27); "3"; CHR$(N);  
70 LPRINT " -----"  
80 NEXT N  
90 END
```

Print example:

ESC 3+n (n/216 Inch Line Spacing)

n=1 TO 10

```
|||||  
|||||  
|||||  
|||||  
|||||  
|||||  
|||||  
|||||  
|||||  
|||||
```

ESC A + n (Set Line Spacing to n/72 Inch)

Code:

(1B)H (41)H (n)H ($0 \leq n \leq 55$),

(27)10 (65)10 (n)10 ($0 \leq n \leq 85$)

Function:

Sets the single-line spacing in multiples of a dot (1/72 inch).

Note:

ESC 2 must be issued to validate the line spacing set by this command.

Program example:

```
10 LPRINT " ESC A+n";
20 LPRINT " (n/72 Inch Line Spacing)"
30 LPRINT
40 LPRINT "n=1 TO 10"
50 FOR N=1 TO 10
60   LPRINT CHR$(27); "A"; CHR$(N);
70   LPRINT CHR$(27); "2";
80   LPRINT " -----"
90 NEXT N
100 END
```

Print example:

ESC A+n (n/72 Inch Line Spacing)

n=1 TO 10

```
=====
-----
-----
-----
-----
-----
-----
```

(3) From Feeding

FF (Form Feed)

Code:

(0C)H, (12)10

Function:

Advances the printer head to the first print position on the next page.

Details:

- The page length is initially set at 11 or 12 inches according to the setting of DIP switch SW2-1 when the printer is powered, but it may be changed by ESC C + n or ESC C + 0 + n
- Resets the double-width print mode set by the SO code.

(4) Vertical Tabbing

VT (Vertical Tab)

Code:

(0B)H, (11)10

Function:

Advances the print position vertically to the specified line.

Details:

- Advances to a tab position set by a vertical tab set command (ESC B + ..., ESC b + ...) after printing preceding data on receipt of a VT code.
- Performs the same action as an LF code where no vertical tab position has been set.
- Advances to the beginning of the next page when the VT code has been received at a position beyond the last (highest) existing tab position on the current page.
- Resets the double-width print mode set by the SO code.

ESC B + n1 + n2 + ... + nk + NUL (Set Vertical Tab Positions)

Code:

(1B)H (42)H (n1)H (n2)H ... (nk)H (00)H ($1 \leq n \leq FE$)
(27)10 (66)10 (n1)10 (n2)10 ... (nk)10 (0)10 ($1 \leq n \leq 254$)
(n1 \leq n2 \leq ... \leq nk) ($1 \leq k \leq 16$)

Function:

Sets vertical tab positions.

Details:

- Tab positions are set in ascending order until the NUL code ((00)H) is encountered.
- The VT code is used to execute vertical tabbing.
- Vertical tab setting by ESC B ... may be considered the same way as channel 0 in ESC b
- Vertical tab settings beyond the page length are ignored.

Program example:

```
10 LPRINT " ESC B+n & VT"
20 ' Set Vertical TAB Position
30 '                               and Execution
40 LPRINT
50 LPRINT CHR$(27);"C";CHR$(15);
60 LPRINT CHR$(27);"B";
70 LPRINT CHR$(2);CHR$(4);CHR$(8);CHR$(0);
80 LPRINT "----- Top of Page -----"
90 LPRINT CHR$(11);"    1st Vertical";
100 LPRINT " TAB Point"
110 LPRINT CHR$(11);"    2nd Vertical";
120 LPRINT " TAB Point"
130 LPRINT CHR$(11);"    3rd Vertical";
140 LPRINT " TAB Point"
150 END
```

Print example:

```
ESC B+n & VT

----- Top of Page -----

    1st Vertical TAB Point

    2nd Vertical TAB Point

    3rd Vertical TAB Point
```

ESC b + n + m1 + m2 + ... + mk + NUL (Set VFU Positions)

Code:

(1B)H (62)H (n)H (m1)H (m2)H ... (mk)H (00)H ($1 \leq m \leq FE$)
(27)10 (98)10 (n)10 (m1)10 (m2)10 ... (mk)10 (0)10 ($1 \leq m \leq 254$)
($0 \leq n \leq 7$) ($1 \leq k \leq 16$)

Function:

Sets tab positions in the vertical format unit (VFU).

Details:

- n denotes the channel number. Up to eight channels, from channel 0 to channel 7, are selectable; there may be up to 16 tab positions for each.
- Channel 0 is assumed when the printer is initially powered.
- Channels are specified by ESC / + n, and tabbing is executed by the VT code.

ESC / + n (Specify VFU Channels)

Code:

(1B)H (2F)H (n)H, (27)10 (47)10 (n)10 ($0 \leq n \leq 7$)

Function:

Specifies channel in the VFU.

Details:

Enables vertical tabbing on each channel as set by
ESC b + n + m1 + m2 ... + mk + NUL to be executed.

Program example:

```
10 LPRINT " ESC b+n & ESC /+n"
20 ' Set VFU Positions
30 ' and Specify VFU Channels
40 LPRINT
50 LPRINT CHR$(27);"C";CHR$(10);
60 LPRINT CHR$(27);"b";CHR$(1);' Channel 1
70 LPRINT CHR$(2);CHR$(4);CHR$(8);CHR$(0);
80 LPRINT CHR$(27);"b";CHR$(2);' Channel 2
90 LPRINT CHR$(3);CHR$(5);CHR$(9);CHR$(0);
100 FOR I=1 TO 2
110 LPRINT CHR$(27);"/";CHR$(I);
120 LPRINT "----- Top of Page Channel";
130 LPRINT I;"-----"
140 LPRINT CHR$(11);" 1st Point";
150 LPRINT CHR$(11);" 2nd Point";
160 LPRINT CHR$(11);" 3rd Point";
170 LPRINT CHR$(11);
180 NEXT I
190 END
```


Print example:

ESC b+n & ESC /+n

----- Top of Page Channel 1 -----

1st Point

2nd Point

3rd Point

----- Top of Page Channel 2 -----

1st Point

2nd Point

3rd Point

(5) Page Length Setting

ESC C + n (Set Page Length in Lines)

Code:

(1B)H (43)H (n)H ($1 \leq n \leq 7F$)

(27)10 (67)10 (n)10 ($1 \leq n \leq 127$)

Function:

Sets the page length in lines.

Details:

The page length is stored as an absolute length determined by multiplying the current single-line spacing by the number of lines (n) specified by this command.

Program example:

```
10 LPRINT " ESC C+n (Set Page Length)"
20 LPRINT
30 LPRINT CHR$(27); "C"; CHR$(6);
40 LPRINT " -----Top of Page";
50 LPRINT " (Page Length 6 Lines)"
60 LPRINT CHR$(12);
70 LPRINT " -----Top of Page";
80 LPRINT " (Page Length 6 Lines)"
90 END
```

Print example:

```
ESC C+n (Set Page Length)

-----Top of Page (Page Length 6 Lines)

-----Top of Page (Page Length 6 Lines)
```

ESC C + 0 + n (Set Page Length in Inches)
--

Code:

(1B)H (43)H (00)H (n)H ($1 \leq n \leq 16$)
(27)10 (67)10 (0)10 (n)10 ($1 \leq n \leq 22$)

Function:

Sets the page length in inches.

Details:

n denotes the number of inches in the page length.

Program example:

```
10 LPRINT " ESC C+0+n (Set Page Length)"
20 LPRINT
30 LPRINT CHR$(27);"C";CHR$(0);CHR$(1);
40 LPRINT " -----Top of Page";
50 LPRINT " (Page Length 1 Inch)"
60 LPRINT CHR$(12);
70 LPRINT " -----Top of Page";
80 LPRINT " (Page Length 1 Inch)"
90 END
```

Print example:

```
ESC C+0+n (Set Page Length)

-----Top of Page (Page Length 1 Inch)

-----Top of Page (Page Length 1 Inch)
```

(6) Perforation Skipping

ESC N + n (Set Perforations Skip)

Code:

(1B)H (4E)H (n)H ($1 \leq n \leq 7F$)
(27)10 (78)10 (n)10 ($1 \leq n \leq 127$)

Function:

Skips the last n lines on the current page and advances the print head to the first print position on the next page.

Details:

- This command prevents the print head from falling on perforations.
- The number of skipped lines can be reset by a page length set command (ESC C + n, ESC C + 0 + n).

- When DIP switch SW2-4 is on, the print head skips perforations by 1 inch (default assumption).

Program example:

```
10 LPRINT " ESC N+n";
20 LPRINT " (Set Skip Perforations)"
30 LPRINT
40 LPRINT CHR$(27);"C";CHR$(5);
50 LPRINT CHR$(27);"N";CHR$(2);
60 LPRINT "Page Length 5 Lines,";
70 LPRINT "Skip Lower 2 Lines"
80 GOSUB 180
90 LPRINT " ESC O";
100 LPRINT " (Reset Skip Perforations)"
110 LPRINT
120 LPRINT CHR$(27);"C";CHR$(5);
130 LPRINT CHR$(27);"O";
140 LPRINT "Page Length 5 Lines"
150 GOSUB 180
160 END
170 ' *** Subroutine ***
180 FOR I=1 TO 5
190     LPRINT " Skip Perforation : No.";I
200 NEXT I
210 RETURN
```

Print example:

ESC N+n (Set Skip Perforations)

Page Length 5 Lines, Skip Lower 2 Lines

Skip Perforation : No. 1

Skip Perforation : No. 2

Skip Perforation : No. 3

Skip Perforation : No. 4

Skip Perforation : No. 5

ESC O (Reset Skip Perforations)

Page Length 5 Lines

Skip Perforation : No. 1

Skip Perforation : No. 2

Skip Perforation : No. 3

Skip Perforation : No. 4

Skip Perforation : No. 5

ESC O (Reset Perforations Skip)

Code:

(1B)H (4F)H, (27)10 (79)10

Function:

Cancels the perforation skip function by resetting the number of skipped lines as set.

4.4.2 Carriage movement or horizontal formatting

(1) Carriage Return

CR (Carriage Return)

Code:

(0D)H, (13)10

Function:

Prints previously entered data.

Details:

- Effects a line feed after printing the data if the AUTO FEED XT signal (interface connector pin 14) is L or if DIP switch SW1-2 is OFF or SW2-3 is ON.
- A CR code accompanied by LF resets the double-width print mode set by the SO code.

Program example:

```
10 LPRINT " CR (Carriage Return)"
20 LPRINT
30 LPRINT "A C E G I K M ";CHR$(13);
40 LPRINT " b d f h j l n"
50 END
```

Print example:

```
CR (Carriage Return)

A C E G I K M
b d f h j l n
```

(2) Left and Right Margin Setting

ESC l + n (Set left Margin)

Code:

(1B)H (6C)H (n)H ($1 \leq n \leq FF$)

(27)10 (108)10 (n)10 ($1 \leq n \leq 255$)

Function:

Sets the left margin (print starting position) based on the current character size setting.

Details:

- n denotes the number of print positions. The maximum number depends on the character size set. A specification beyond the maximum is ignored.
- The left margin setting is to be made before sending print data to the printer.
- In proportional-spacing mode, left margin is set in pica pitches.

Caution:

In changing the character size, notice that settings less than the width of a character are not permitted.

Program example:

```
10 LPRINT " ESC l+n (Set Left Margin)"
20 LPRINT
30 FOR I=1 TO 5
40     LPRINT CHR$(27);"l";CHR$(I+5);
50     LPRINT "ABCDEFGH IJKLMN"
60 NEXT I
70 END
```

Print example:

ESC l+n (Set Left Margin)

ABCDEFGH IJKLMN
 ABCDEFGH IJKLMN
 ABCDEFGH IJKLMN
 ABCDEFGH IJKLMN
 ABCDEFGH IJKLMN

ESC Q + n (Set Right Margin)

Code:

(1B)H (51)H (n)H ($1 \leq n \leq FF$)
(27)10 (81)10 (n)10 ($1 \leq n \leq 255$)

Function:

Sets the right margin (number of print positions) based on the current character-size setting.

Details:

- n denotes the number of print positions. The maximum number depends on the character size set. A specification beyond the maximum is ignored.
- Print widths less than the width of a double-width character are not permitted.

Specify $1 \leq n$ when in the double-width print mode; otherwise, specify $2 \leq n$.
- In proportional-spacing mode, right margin is set in pica pitches.
- When initially powered, the printer is set to print up to 132 condensed characters per line. This command permits printing of up to 137 characters per line.
- The right margin setting is to be made before sending print data to the printer.

Caution:

In changing character size, notice that settings less than the width of a character are not permitted.

Program example:

```
10 LPRINT " ESC Q+n (Set Right Margin)"
20 LPRINT
30 LPRINT CHR$(27);"Q";CHR$(10);
40 LPRINT "123456789012345678901234567890"
50 END
```


Print example:

ESC Q+n (Set Right Margin)

1234567890

1234567890

1234567890

(3) Horizontal Tabbing

HT (Horizontal Tab)

Code:

(09)H, (9)10

Function:

Advances the print position to a horizontal tab position set by ESC D + n₁ + n₂ ... + n_k + NUL and starts printing at the position next to it. (Tabs are set at intervals of eight characters when the printer is initially powered or no tab stops have been manually set.)

Details:

- HT codes received after the last tab setting are ignored.
- Once set, tab positions remain unchanged, even if the print mode is changed.
- Setting the left margin by ESC 1 + n resets the horizontal tab positions to the initial default settings.

ESC D + n₁ + n₂ + ... + n_k + NUL (Set Horizontal Tab Positions)

Code:

(1B)H (44)H (n₁)H (n₂)H ... (n_k)H (00)H (1 ≤ n ≤ 89)

(27)10 (68)10 (n₁)10 (n₂)10 ... (n_k)10 (0)10 (1 ≤ n ≤ 137)

(1 ≤ k ≤ 32)

Function:

Sets horizontal tab (HT) positions in columns.

Details:

- Up to 32 horizontal tab positions can be set, beginning at the first print position as 1.
- Set *n* (number of positions) in ascending order. A horizontal tab setting beyond the maximum print width is ignored.
- The setting must be terminated by the NUL code ((00)H).
- Horizontal tabbing is executed by the HT code ((09)H).
- In proportional-spacing mode, horizontal tab positions are set in pica pitches.

Program example:

```
10 LPRINT " ESC D+n & HT"
20 ' Set Horizontal TAB Position
30 ' and Execution
40 LPRINT CHR$(27);"D";CHR$(10);CHR$(20);
50 LPRINT CHR$(30);CHR$(40);CHR$(0);
60 LPRINT
70 GOSUB 240 'pica
80 LPRINT CHR$(9);"(Pica)"
90 B=1 : GOSUB 290 : B=0
100 LPRINT CHR$(9);"(Double-width)"
110 LPRINT CHR$(27);"M"; 'elite
120 GOSUB 240
130 LPRINT CHR$(9);"(Elite)"
140 B=1 : GOSUB 290 : B=0
150 LPRINT CHR$(9);"(Double-width)"
160 LPRINT CHR$(27);"P";
170 LPRINT CHR$(15); 'condensed
180 GOSUB 240
190 LPRINT CHR$(9);"(Condensed)"
200 B=1 : GOSUB 290 : B=0
210 LPRINT CHR$(9);"(Double-width)"
220 LPRINT CHR$(18);
230 END
240 ' *** Subroutine ***
250 FOR A=1 TO 3
260 LPRINT "1234567890";
270 NEXT A
280 LPRINT
290 LPRINT CHR$(27);"W";CHR$(B);
300 FOR I=1 TO 2
310 LPRINT CHR$(9);"T";I;
320 NEXT I
330 LPRINT CHR$(27);"W";CHR$(0);
340 RETURN
```

Print example:

ESC D+n & HT

```
123456789012345678901234567890
      T 1      T 2      (Pica)
      T 1      T 2      (Double-width)
123456789012345678901234567890
      T 1      T 2      (Elite)
      T 1      T 2      (Double-width)
123456789012345678901234567890
      T 1      T 2      (Condensed)
      T 1      T 2      (Double-width)
```

(4) Others

ESC < (Set Head Home)

Code:

(1B)H (3C)H, (27)10 (60)10

Function:

Moves the print head to the home position at the left end.

Program example:

```
10 LPRINT " ESC < (Set Head Home)"
20 LPRINT
30 LPRINT " Set Head Home"
40 LPRINT CHR$(27); "<"
50 END
```

Print example:

ESC < (Set Head Home)

Set Head Home

ESC U + n (Set Unidirectional Print)

Code:

(1B)H (55)H (n)H, (27)10 (85)10 (n)10 (n=0, 1)

Function:

- $n = 1$ causes the printer to print subsequently received print data unidirectionally.
- $n = 0$ causes the printer to print subsequently received print data bidirectionally.

Details:

- Unidirectional printing is suggested for print modes in which misalignment of dots due to bidirectional printing is of concern, such as printing vertical ruled lines.
- Unidirectional print is always used in the image modes.

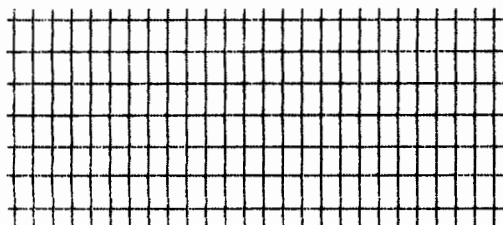
Program example:

```
10 LPRINT " ESC U+n";
20 LPRINT " (Set Unidirectional Print)"
30 LPRINT
40 LPRINT "Bidirectional Print"
50 GOSUB 130
60 LPRINT : LPRINT
70 LPRINT CHR$(27);"U";CHR$(1);
80 LPRINT "Unidirectional Print"
90 GOSUB 130
100 LPRINT CHR$(27);"U";CHR$(0);
110 LPRINT
120 END
130 ' *** Subroutine ***
140 FOR I=0 TO 6
150   FOR J=0 TO 25
160     LPRINT CHR$(197);
170   NEXT J : LPRINT
180 NEXT I
190 RETURN
```

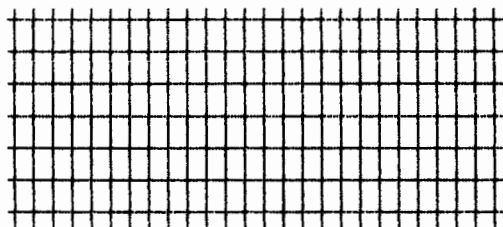
Print example:

ESC U+n (Set Unidirectional Print)

Bidirectional Print



Unidirectional Print



4.4.3 Print modes

(1) Double Width and Condensed

SO (Shift Out: Set Double-Width Print Mode)

Code:

(0E)H, (14)10

Function:

Prints print data received after this code in the double-width mode.

Details:

- This code is reset by the DC4 code, line feed codes (LF, FF, VT), ESC I + n, and ESC W + n.
- ESC SO ((1B)H + (0E)H, (27)10 + (14)10) performs the same function.

Program example:

```
10 LPRINT " SO (Set Double-width Mode)"
20 LPRINT
30 LPRINT CHR$(14); "Double-width Printing"
40 LPRINT "Normal Printing"
50 END
```

Print example:

SO (Set Double-width Mode)

Double-width Printing
Normal Printing

Program example:

```
10 LPRINT " ESC SO (Set Double-width Mode)"
20 LPRINT
30 LPRINT CHR$(27);CHR$(14);
40 LPRINT "Double-width Printing"
50 LPRINT "Normal Printing"
60 END
```

Print example:

ESC SO (Set Double-width Mode)

D**e****s****e****+****w****i****d****e****d** **P****r****i****n****t****i****n****g**
Normal Printing

DC4 (Device Control 4: Reset Double-Width Print Mode)

Code:

(14)H, (20)10

Function:

Resets the double-width print mode.

Details:

Receipt of this code resets the double-width print mode as set by the SO code.

Program example:

```
10 LPRINT " DC4 (Reset Double-width Mode)"
20 LPRINT
30 LPRINT CHR$(14); "Double-width ";
40 LPRINT CHR$(20); "Normal "
50 END
```

Print example:

DC4 (Reset Double-width Mode)

D**e****s****e****+****w****i****d****e****d** Normal

ESC W + n (Set and Reset Double-Width Print Mode)

Code:

(1B)H (57)H (n)H, (27)10 (87)10 (n)10 (n=0, 1)

Function:

Prints subsequently received print data in the double-width print mode.

Details:

— n = 1 sets the double-width mode; n = 0 resets it.

- The double-width mode set by this command is not affected by a line feed.

Program example:

```

10 LPRINT "  ESC W+n";
20 LPRINT " (Set and Reset Double-width Mode)"
30 LPRINT
40 LPRINT "abcdefg";
50 LPRINT CHR$(27); "W"; CHR$(1);
60 LPRINT "HIJKLMN"
70 LPRINT "OPQRSTU";
80 LPRINT CHR$(27); "W"; CHR$(0);
90 LPRINT "vwxyz"
100 END

```

Print example:

ESC W+n (Set and Reset Double-width Mode)

```

abcdefgHIJKLMN
OPQRSTUvwxyz

```

SI (Shift In: Set Condensed-Print Mode)

Code:

(0F)H, (15)10

Function:

Prints print data received after this code in the condensed-print (17.1 c/in.) mode.

Details:

- Permits condensed-character printout in the double-width mode.
- The emphasized-print mode assumes priority over the condensed-print mode.
- The condensed-character mode is reset by DC2 and ESC ! + n.
- The condensed-print mode is effective for the pica typeface only.
- ESC SI ((1B)H + (0F)H, (27)10 + (15)10) performs the same function.

Program example:

```
10 LPRINT " SI (Set Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(15);"Condensed Printing"
40 LPRINT CHR$(14);
50 LPRINT "Condensed and Double-width";
60 LPRINT " Printing"
70 LPRINT CHR$(18);"Normal Printing"
80 END
```

Print example:

SI (Set Condensed Mode)

Condensed Printing

Condensed and Double-width Printing

Normal Printing

Program example:

```
10 LPRINT " ESC SI (Set Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(27);CHR$(15);
40 LPRINT "Condensed Printing"
50 LPRINT CHR$(14);
60 LPRINT "Condensed and Double-width";
70 LPRINT " Printing"
80 LPRINT CHR$(18);"Normal Printing"
90 END
```

Print example:

ESC SI (Set Condensed Mode)

Condensed Printing

Condensed and Double-width Printing

Normal Printing

DC2 (Device Control 2: Reset Condensed-Print Mode)

Code:

(12)H, (18)10

Function:

Resets the condensed-print mode.

Program example:

```
10 LPRINT " DC2 (Reset Condensed Mode)"
20 LPRINT
30 LPRINT CHR$(15); "Condensed ";
40 LPRINT CHR$(18); "Normal "
50 END
```

Print example:

DC2 (Reset Condensed Mode)

Condensed Normal

(2) Double Strike and Emphasized

ESC G (Set Double-Strike Mode)

Code:

(1B)H (47)H, (27)10 (71)10

Function:

Prints subsequently received print data in double-strike characters.

Details:

A double-strike character refers to a character having a double dot-density in the vertical direction.

Program example:

```
10 LPRINT " ESC G";
20 LPRINT " (Set Double-strike Mode)"
30 LPRINT
40 LPRINT "Normal Printing"
50 LPRINT CHR$(27); "G";
60 LPRINT "Double-strike Printing"
70 END
```

Print example:

ESC G (Set Double-strike Mode)

Normal Printing

Double-strike Printing

ESC H (Reset Double-Strike Mode)

Code:

(1B)H (48)H, (27)10 (72)10

Function:

Resets the double-strike mode.

Program example:

```
10 LPRINT " ESC H";
20 LPRINT " (Reset Double-strike Mode)"
30 LPRINT
40 LPRINT CHR$(27); "G"; "Double-strike ";
50 LPRINT CHR$(27); "H"; "Normal "
60 END
```

Print example:

ESC H (Reset Double-strike Mode)

Double-strike Normal

ESC E (Set Emphasized-Print Mode)

Code:

(1B)H (45)H, (27)10 (69)10

Function:

Prints subsequently received print data in emphasized characters.

Details:

- In the emphasized-print mode, characters are printed at double density in the horizontal direction.
- The emphasized print mode is reset by ESC F or ESC ! + n.

- This mode is effective for pica characters only.
- The emphasized-print mode assumes priority over the condensed-print mode, but does not reset the condensed-print mode.

Program example:

```
10 LPRINT " ESC E (Set Emphasized Mode)"
20 LPRINT
30 LPRINT "Normal Printing"
40 LPRINT CHR$(27);"E";
50 LPRINT "Emphasized Printing"
60 END
```

Print example:

ESC E (Set Emphasized Mode)

Normal Printing

Emphasized Printing

ESC F (Reset Emphasized-Print Mode)

Code:

(1B)H (46)H, (27)10 (70)10

Function:

Resets the emphasized-print mode.

Program example:

```
10 LPRINT " ESC F (Reset Emphasized Mode)"
20 LPRINT
30 LPRINT CHR$(27);"E";"Emphasized ";
40 LPRINT CHR$(27);"F";"Normal "
50 END
```

Print example:

ESC F (Reset Emphasized Mode)

Emphasized Normal

(3) Elite/Pica Pitch

ESC M (Set Elite Pitch)

Code:

(1B)H (4D)H, (27)10 (77)10

Function:

Prints subsequently received print data in elite pitch (12 c/in.).

Details:

- The emphasized- and condensed-print modes are inoperative for elite pitch.
- Up to 96 characters per line can be printed with elite pitch.

Program example:

```
10 LPRINT " ESC M (Set Elite-pitch)"
20 LPRINT
30 LPRINT CHR$(27); "M";
40 LPRINT "Elite-pitch Printing"
50 END
```

Print example:

ESC M (Set Elite-pitch)

Elite-pitch Printing

ESC P (Set Pica Pitch)

Code:

(1B)H (50)H, (27)10 (80)10

Function:

Prints subsequently received print data in pica pitch (10 c/in.) by resetting the elite print mode set by ESC M (Set Elite Pitch).

Details:

- Pica pitch is the default character pitch when the printer is initially powered.
- Up to 80 characters per line can be printed with pica pitch.

- The emphasized- and condensed-print modes are not reset by this command.

Program example:

```
10 LPRINT " ESC P (Set Pica-pitch)"
20 LPRINT
30 LPRINT CHR$(27);"M";"Elite-pitch ";
40 LPRINT CHR$(27);"P";"Pica-pitch"
50 END
```

Print example:

```
ESC P (Set Pica-pitch)
```

```
Elite-pitch Pica-pitch
```

(4) Print Mode Selection

ESC ! + n (Set and Reset Various Print Modes)

Code:

```
(1B)H (21)H (n)H, (27)10 (33)10 (n)10
```

Function:

Allows print modes to be set.

Details:

- Allows print modes to be set according to the value of n.
- The table below gives the correspondence between the print modes and the value of n.
- Priority order
Elite pitch > Emphasized mode > Condensed mode
Superscript/subscript modes > Double-strike mode

Table 4.8 Print mode set designation

Bit	7	6	5	4	3	2	1	0
When 1	Always 0		Set double-width print mode	Set double-strike mode	Set emphasized-print mode	Set condensed-print mode	Always 0	
When 0	Always 0		Reset double-width print mode	Reset double-strike mode	Reset emphasized-print mode	Reset condensed-print mode	Always 0	
								Set elite pitch
								Set pica pitch

Program example:

```

10 LPRINT " ESC !+n (Set and Reset";
20 LPRINT " Various Print Mode)"
30 LPRINT
40 LPRINT "Print Mode"
50 FOR I=0 TO 4 : GOSUB 100 : NEXT I
60 FOR I=8 TO 9 : GOSUB 100 : NEXT I
70 FOR I=11 TO 12 : GOSUB 100 : NEXT I
80 END
90 '
100 FOR M=1 TO I+48 STEP 16
110 READ A : LPRINT CHR$(27);"1";CHR$(A);
120 LPRINT CHR$(27);"!";CHR$(M);
130 LPRINT "Mode";M;
140 LPRINT CHR$(27);"!";CHR$(0);
150 NEXT M : LPRINT
160 RESTORE : RETURN
170 '
180 DATA 1,8,15,29

```


Print example:

ESC !+n (Set and Reset Various Print Mode)

Print Mode

Mode 0 Mode 16 Mode 32 Mode 48
Mode 1 Mode 17 Mode 33 Mode 49
Mode 2 Mode 18 Mode 34 Mode 50
Mode 3 Mode 19 Mode 35 Mode 51
Mode 4 Mode 20 Mode 36 Mode 52
Mode 8 Mode 24 Mode 40 Mode 56
Mode 9 Mode 25 Mode 41 Mode 57
Mode 11 Mode 27 Mode 43 Mode 59
Mode 12 Mode 28 Mode 44 Mode 60

(5) Super/Subscript and Underline

ESC S + n (Set Superscript/Subscript Modes)

Code:

(1B)H (53)H (n)H, (27)10 (83)10 (n)10 (n=0, 1)

Function:

- n = 0 causes all subsequently received print data to print out in the superscript mode.
- n = 1 causes all subsequently received print data to print out in the subscript mode.

Details:

- In the superscript/subscript mode, characters are printed in the character size compressed by 1/2 in the vertical direction.
- A character written immediately above and to the right of another character is called a superscript; a character written immediately below and to the right of another character is called a subscript.
- The superscript/subscript modes are reset by ESC T.

Program example:

```
10 LPRINT " ESC S+0";
20 LPRINT " (Set Superscript Mode)"
30 LPRINT
40 LPRINT "Normal ";
50 LPRINT CHR$(27);"S";CHR$(0);
60 LPRINT "Superscript"
70 END
```

Print example:

ESC S+0 (Set Superscript Mode)

Normal ^{Superscript}

Program example:

```
10 LPRINT " ESC S+1 (Set Subscript Mode)"
20 LPRINT
30 LPRINT "Normal ";
40 LPRINT CHR$(27);"S";CHR$(1);
50 LPRINT "Subscript"
60 END
```

Print example:

ESC S+1 (Set Subscript Mode)

Normal _{subscript}

ESC T (Reset Superscript/Subscript Modes)
--

Code:

(1B)H (54)H, (27)10 (84)10

Function:

Resets the superscript/subscript modes.

Program example:

```
10 LPRINT " ESC T";
20 LPRINT " (Reset Superscript/Subscript)"
30 LPRINT
40 LPRINT CHR$(27); "S"; CHR$(0);
50 LPRINT "Superscript";
60 LPRINT CHR$(27); "S"; CHR$(1);
70 LPRINT "Subscript ";
80 LPRINT CHR$(27); "T";
90 LPRINT "Normal "
100 END
```

Print example:

```
ESC T (Reset Superscript/Subscript)

SuperscriptSubscript Normal
```

ESC - + n (Set and Reset Underline Mode)

Code:

(1B)H (2D)H (n)H, (27)10 (45)10 (n)10 (n=0, 1)

Function:

- n=1 causes subsequently received print characters to be underlined; however, CG graphics characters are not underlined.
- n=0 resets the underline mode.

Program example:

```
10 LPRINT " ESC -+n"
20 LPRINT " (Set and Reset Underline Mode)"
30 LPRINT
40 LPRINT CHR$(27); "-"; CHR$(1);
50 LPRINT "Underline";
60 LPRINT CHR$(27); "-"; CHR$(0);
70 LPRINT " printing"
80 END
```

Print example:

```
ESC -+n  
(Set and Reset Underline Mode)
```

Underline printing

(6) Proportional Spacing

ESC p + n (Set and Reset Proportional Spacing Mode)

Code:

(1B)H (70)H (n)H, (27)10 (112)10 (n)10 (n=0, 1)

Function:

Sets and resets the proportional-spacing mode.

Details:

- In the proportional-spacing mode, the character interval varies depending on characters for better readability.
- n = 1 sets the proportional-spacing mode.
- n = 0 resets the proportional-spacing mode.
- Proportional spacing assumes priority over superscript/subscript print.
- The proportional-spacing mode is effective for pica characters only. It automatically sets the emphasized-print mode, which may be reset by ESC F.

Program example:

```
10 LPRINT " ESC p+n "  
20 LPRINT " (Set & Reset";  
30 LPRINT " Proportional Spacing Mode)"  
40 LPRINT  
50 LPRINT CHR$(27);"p";CHR$(1);  
60 LPRINT "Proportional"  
70 LPRINT " She writes in beautiful hand."  
80 LPRINT  
90 LPRINT CHR$(27);"F";  
100 LPRINT CHR$(27);"F";  
110 LPRINT "Proportional";  
120 LPRINT " (Reset Emphasized Mode)"  
130 LPRINT " She writes in beautiful hand."  
140 LPRINT  
150 LPRINT CHR$(27);"p";CHR$(0);  
160 LPRINT "Normal"  
170 LPRINT " She writes in beautiful hand."  
180 END
```

Print example:

```
ESC p+n  
(Set & Reset Proportional Spacing Mode)
```

Proportional

She writes in beautiful hand.

Proportional (Reset Emphasized Mode)

She writes in beautiful hand.

Normal

She writes in beautiful hand.

4.4.4 Internal and download characters

(1) Internal Characters

ESC 7 (Select CG Set 1)

Code:

(1B)H (37)H, (27)10 (55)10

Function:

Selects character set 1 from the character generator.

ESC 6 (Select CG Set 2)

Code:

(1B)H (36)H, (27)10 (54)10

Function:

Selects character set 2 from the character generator.

Program example:

```
10 LPRINT " ESC 6 (Select CGSET2)"
20 LPRINT
30 LPRINT CHR$(27); "6";
40 FOR I=128 TO 159
50 LPRINT CHR$(I);
60 NEXT I
70 LPRINT : LPRINT
80 LPRINT " ESC 7 (Select CGSET1)"
90 LPRINT
100 LPRINT CHR$(27); "7"
110 LPRINT CHR$(135);
120 END
```

Print example:

ESC 6 (Select CGSET2)

QüéáááááçëëëïïïïAA&æÆööööüÿöÜç£¥&f

ESC 7 (Select CGSET1)

ESC % + 0 + n (Select Internal Character Set)

Code:

(1B)H (25)H (00)H (n)H
(27)10 (37)10 (0)10 (n)10

Function:

Selects the internal character set 1 or 2.

Details:

- The printer uses the internal character set instead of the download or NLQ character set.
- When n=0, internal character set 1 (CGSET1) is selected; when n=1, internal character set 2 (CGSET2) is selected.

Program example:

```
10 LPRINT " ESC %+0+n";
20 LPRINT " (Select Internal ROM CG)"
30 LPRINT
40 LPRINT CHR$(27);"%";CHR$(2);CHR$(0);
50 LPRINT "NLQ CG (ESC %+2+0)"
60 GOSUB 150 : LPRINT
70 LPRINT CHR$(27);"%";CHR$(0);CHR$(0);
80 LPRINT "Internal ROMCG SET1 (ESC %+0+0)"
90 GOSUB 150 : LPRINT
100 LPRINT CHR$(27);"%";CHR$(0);CHR$(1);
110 LPRINT "Internal ROMCG SET2 (ESC %+0+1)"
120 GOSUB 150 : LPRINT
130 END
140 '
150 FOR I=65 TO 68
160 LPRINT CHR$(I);
170 NEXT I : LPRINT " ";
180 FOR I=128 TO 131
190 LPRINT CHR$(I);
200 NEXT I : LPRINT " ";
210 FOR I=176 TO 179
220 LPRINT CHR$(I);
230 NEXT I : LPRINT
240 RETURN
```

Print example:

ESC % + 0 + n (Select Internal ROM CG)

NLQ CG (ESC % + 2 + 0)

ABCD Çüéà 𐀀𐀁𐀂𐀃

Internal ROMCG SET1 (ESC % + 0 + 0)

ABCD 𐀀𐀁𐀂𐀃 |

Internal ROMCG SET2 (ESC % + 0 + 1)

ABCD Çüéà 𐀀𐀁𐀂𐀃 |

ESC % + 2 + 0 (Select NLQ Characters)
--

Code:

(1B)H (25)H (02)H (00)H

(27)10 (37)10 (2)10 (0)10

Function:

Selects the NLQ character set.

Details:

- Print data received subsequent to this code is printed by using the NLQ character set.
- Use ESC % + 0 + n to return to the internal character set.
- The proportional spacing mode and double-width mode can be specified.
- See the NLQ CG code table in Appendix D.

This printer can be equipped with NLQ CG-ROM to print NLQ characters at double density both vertically and horizontally.

NLQ characters are selected with the NLQ character set select command (ESC % + 2 + 0). These characters can be also selected when the printer is powered with the operator panel FF switch pressed.

NLQ characters cannot be printed in elite pitch or the condensed-, emphasized-, and dubblestrike- print modes.

Program example:

```
10 LPRINT " ESC %+2+0 (Select NLQ CG)"
20 LPRINT
30 LPRINT CHR$(27); "%"; CHR$(2); CHR$(0);
40 FOR I=65 TO 90
50     LPRINT CHR$(I);
60 NEXT I
70 LPRINT
80 END
```

Print example:

ESC %+2+0 (Select NLQ CG)

ABCDEFGHIJKLMNOPQRSTUVWXYZ

(2) Download Characters

ESC % + 1 + 0 (Select Download Character Set)

Code:

(1B)H (25)H (01)H (00)H
(27)10 (37)10 (1)10 (0)10

Function:

Selects the download character set.

Details:

- On receiving this code, the printer prints using the download character set.
- Among codes (00)H to (FF)H, (20)H to (AF)H can be used for defining download characters and the remaining codes (00)H to (1F)H and (B0)H to (FF)H follow the internal character set code table.
- See the download CG code table in Appendix D.

ESC : + 0 + 0 + 1 (Copy Character Set)

Code:

(1B)H (3A)H (00)H (00)H (01)H
(27)10 (58)10 (0)10 (0)10 (1)10

Function:

Copies the internal character set (CGSET2) into the download character set without alteration.

Program example:

```
10 LPRINT " ESC :+0+0+1";
20 LPRINT " (Copy Character Set)"
30 LPRINT
40 LPRINT "Copy into Download CG"
50 GOSUB 130
60 LPRINT
70 LPRINT CHR$(27);": ";
80 LPRINT CHR$(0);CHR$(0);CHR$(1);
90 LPRINT "Select Download CG"
100 GOSUB 130
110 END
120 '
130 FOR I=65 TO 90
140     LPRINT CHR$(I);
150 NEXT I
160 LPRINT
170 RETURN
```

Print example:

ESC :+0+0+1 (Copy Character Set)

Copy into Download CG
ABCDEFGHIJKLMNOPQRSTUVWXYZ

Select Download CG
ABCDEFGHIJKLMNOPQRSTUVWXYZ

ESC & + 0 + n + m + a + p1 + ... + p11 (Define Download Characters)

Code:

(1B)H (26)H (00)H (n)H (m)H (a)H (p1)H ... (p11)H

($20 \leq n \leq m \leq AF$)

(27)10 (38)10 (0)10 (n)10 (m)10 (a)10 (p1)10 ... (p11)10

($32 \leq n \leq m \leq 175$)

Function:

Defines download character patterns.

Details:

- Character codes from n to m are defined by patterns p1, p2, ..., p11. (Specify the same value for m and n to define only one character.) When $m \neq n$, that is, two or more characters are to be defined, repeat a + p1 + ... + p11 for each of the characters to be defined.
- (20)H to (AF)H can be used for download character definition.
- "a" refers to attribute information (described later).
- For a character, print data must be sent for all the 11 print positions even if some positions include no pins to be activated.
- Even when a character pattern includes horizontally consecutive dots, the corresponding pin is automatically activated every other print position.

Program example:

```
10 LPRINT " ESC &+n+m+a+p1+...+p11"
20 ' Define Download Character
30 LPRINT
40 LPRINT CHR$(27); "&"; CHR$(0);
50 LPRINT CHR$(33); CHR$(33);
60 LPRINT CHR$(139);
70 LPRINT CHR$(18); CHR$(4); CHR$(40);
80 LPRINT CHR$(16); CHR$(32); CHR$(12);
90 LPRINT CHR$(50); CHR$(0); CHR$(34);
100 LPRINT CHR$(0); CHR$(0);
110 LPRINT CHR$(27); "%"; CHR$(1); CHR$(0);
120 LPRINT "!!!!!!!!!!!!!"
130 END
```

Print example:

ESC &+n+m+a+p1+...+p11

$\pi\pi\pi\pi\pi\pi\pi\pi\pi\pi$

Defining download characters:

a. Print pattern

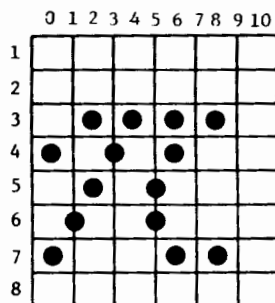


Figure 4.11 Character pattern example 1

- Consecutive activation of the same pin is automatically ignored. In this case, that pin is activated every other print position.
 - The same value must be specified for m and n to define only one character.
 - The B in (0001)B or (0010)B designates binary.
- (a) If Greek letter π in character pattern example 1 is defined for the code position of mark 1, n and m becomes (21)H.
- (b) The figure below shows how binary data can be converted into hexadecimal data, where the location to be printed is designated 1 and that not be printed is designated 0.

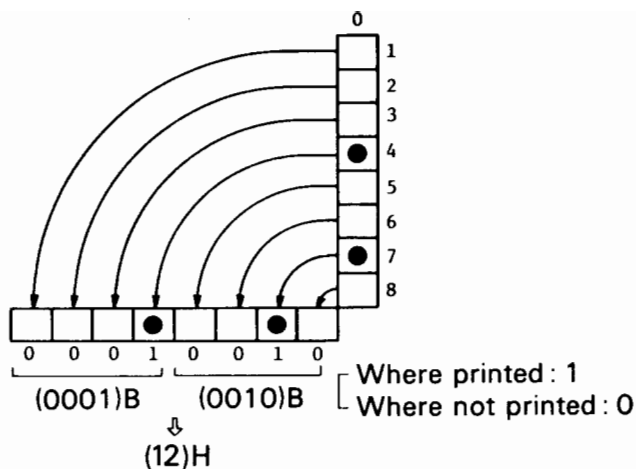


Figure 4.12 Conversion to hexadecimal (position 0)

- (c) Print data created for positions 0 to 10 by step (b) provides p1 to p11.

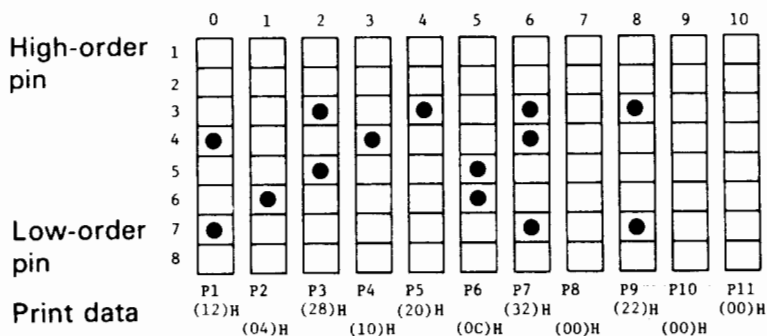


Figure 4.13 Conversion to hexadecimals (positions 0 to 10)

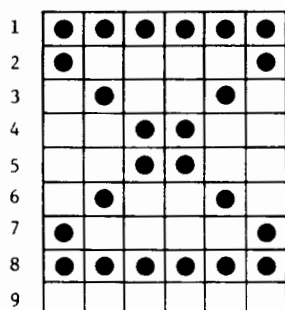
b. Attribute information

Attribute information includes descenders and proportional spacing information.

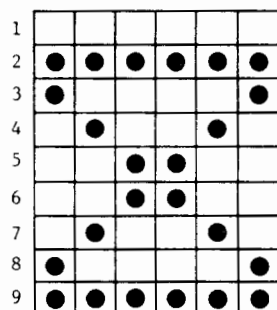
- (a) A descender is used to allow 8-bit print data, organized from pins 1 to 8, to be shifted 1 bit downward so it can print out using pins 2 to 9. It is specified in the highest-order bit of the attribute information as follows:

0: With a descender specification

1: Without a descender specification



Without a descender specification



With a descender specification

Figure 4.14 Character pattern example 2

- (b) Proportional spacing information specifies the print area in the proportional spacing print mode. It is invalid in other print modes.

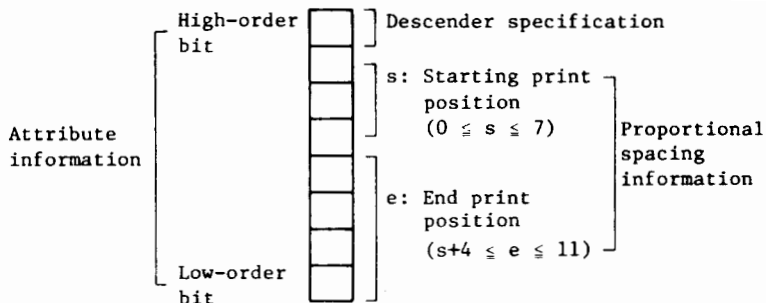


Figure 4.15 Proportional spacing information

The smallest character pattern size (width) that can be specified is 5 positions. $s=0$ and $e=B$ are automatically assumed when s or e exceeds its limit. Without a descender specification, attribute information is automatically set to (8B)H.

Proportional spacing information may specify position 11 as the maximum end print position. In this case, position 11 is blank because position 11 cannot be specified for any character pattern.

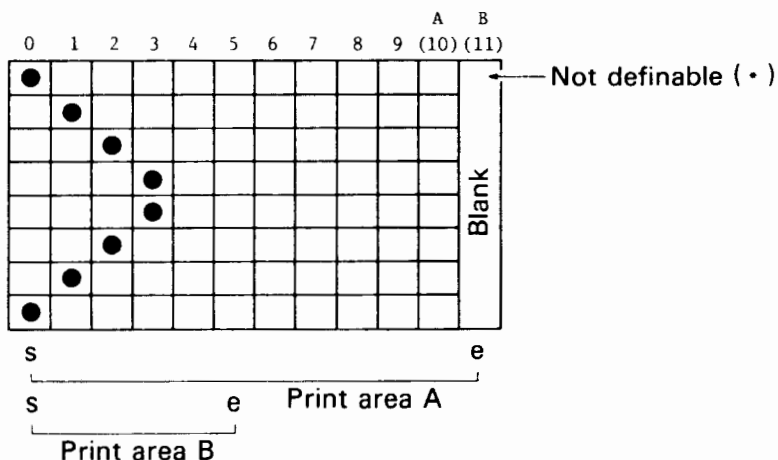


Figure 4.16 Character pattern example 3

- When the emphasized print mode is specified together with the proportional spacing mode and if the proportional information includes position 10 as the end print position, the second strike for the last print data cannot be done because its print position becomes 11 (blank position). Therefore, the end print position must be set to a value greater by one or more positions than the last print data position of the defined character pattern.

In character pattern example 3 assume two print areas : a larger print area, A, and a smaller print area, B.

In this situation the print positions are specified as follows:

A: $s = 0, e = B(11)10 \rightarrow (0B)H$

B: $s = 0, e = 5 \rightarrow (05)H$

Then, attribute information is specified as follows:

Without a descender specification

A: $(80)H + (0B)H = (8B)H$

B: $(80)H + (05)H = (85)H$

With a descender specification

A: $(0B)H$

B: $(05)H$

4.4.5 Graphics image modes

This printer provides two image modes that permit controlling each individual dot: 8- and 9-pin image modes.

(1) 8-pin image mode

The 8-pin image mode is subdivided into seven modes. Print pins 1-8 can be specified with 1-byte image data. The correspondence between the interface signals and print pins is shown below. For example, (84)H image data may be sent to print using only pins 1 and 6.

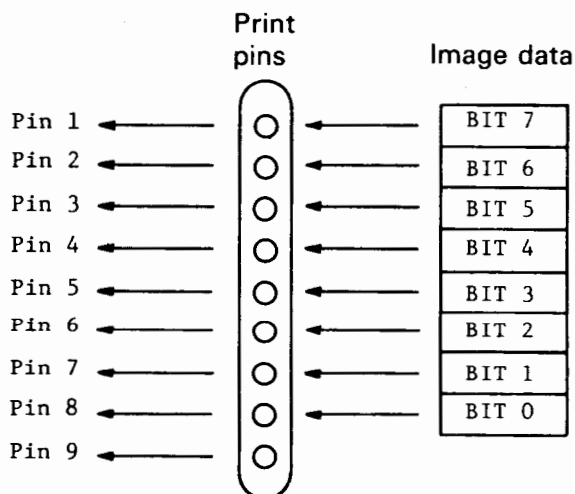


Figure 4.17 8-pin image mode pin assignment

ESC * + m + n1 + n2 (Set 8-pin Image Mode)

Code:

(1B)H (2A)H (m)H (n1)H (n2)H

($0 \leq m \leq 6, 0 \leq n1 \leq FF, 0 \leq n2 \leq 7$)

(27)10 (42)10 (m)10 (n1)10 (n2)10

($0 \leq m \leq 6, 0 \leq n1 \leq 255, 0 \leq n2 \leq 7$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in one of the seven image modes selected by the value of m.

Table 4.9 8-pin image modes

m	Mode name	Number of image data items/line	Horizontal dot density	Print speed inch/s
0	Single-density image	480	1/60 inch	18
1	Double-density image	960	1/120 inch	9
2	Double-speed double- density image	960	1/60 inch	18
3	Quadruple-density image	1920	1/120 inch	9
4	CRT I image	640	1/80 inch	9
5	Plotter image	576	1/72 inch	10.7
6	CRT II image	720	1/90 inch	9

Details:

- ESC K + n1 + n2 (single-density image) is equal to mode 0.
ESC L + n1 + n2 (double density image) is equal to mode 1.
ESC Y + n1 + n2 (double-speed double-density image) is equal to mode 2.
ESC Z + n1 + n2 (quadruple-density image) is equal to mode 3.
- In the plotter image mode, the ratio of the vertical dot size to the horizontal dot size is 1:1.

Program example:

```
10 LPRINT " ESC *+m+n1+n2";
20 LPRINT " (Set 8-pin Image Mode)"
30 LPRINT
40 WIDTH "LPT1:",255
50 FOR I=0 TO 6
60     LPRINT "m=";I
70     LPRINT CHR$(27);"*";CHR$(I);
80     LPRINT CHR$(200 MOD 256);
90     LPRINT CHR$(INT(200/256));
100     FOR J=1 TO 200/2
110         LPRINT CHR$(170);CHR$(85);
120     NEXT J
130 LPRINT
140 NEXT I
150 END
```

Print example:

ESC *+m+n1+n2 (Set 8-pin Image Mode)

m= 0



m= 1



m= 2



m= 3



m= 4



m= 5



m= 6



ESC K + n1 + n2 (Set Single-density Image)

Code:

(1B)H (4B)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 1$)

(27)10 (75)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 1$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a single-density image.

Details:

- n1 and n2 represent the low- and high-order bytes, respectively. They are combined to denote the volume of image data.

For example, to send 300 items of image data:

$300/256 = 1$ with a remainder of 44.

Accordingly, the data to be sent should be $n1 = (44)10$ or $(2C)H$ and $n2 = (1)10$ or $(01)H$.

- Up to 480 items of image data can be printed on a line. Any data specified beyond this limit is ignored. If image data is to span more than one line, this specification is required for each of the print lines.
- If characters have been printed to half a line (equivalent to 40 characters with pica pitch) the remaining part of the line allows printing of 240 items of image data.

Program example:

```
10 LPRINT " ESC K+n1+n2";
20 LPRINT " (Set Single-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"K";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90 LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC K+n1+n2 (Set Single-density Image)

Number of Data = 100



ESC L + n1 + n2 (Set Double-density Image)

Code:

(1B)H (4C)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 3$)
(27)10 (76)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 3$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a double-density image.

Details:

- Setting of n1 and n2 is the same as that for ESC K + n1 + n2.
- Up to 960 items of image data can be printed on a line. Any data specified beyond this limit is ignored. If image data is to span more than one line, this specification is required for each of the print lines.
- If characters have been printed to half a line (equivalent to 40 characters with pica pitch) the remaining part of the line allows printing of 480 items of image data.

Program example:

```
10 LPRINT " ESC L+n1+n2";
20 LPRINT " (Set Double-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"L";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90     LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC L+n1+n2 (Set Double-density Image)

Number of Data = 100

ESC Y + n1 + n2 (Set Double-speed, Double-density Image)

Code:

(1B)H (59)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 3$)

(27)10 (89)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 3$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a double-density image at a speed twice as fast as ESC L + n1 + n2.

Details:

- Up to 960 items of image data can be printed on a line. The same pin cannot be operated for consecutive positions because of double-speed printing.
- Other conditions are the same as those for ESC L + n1 + n2.

Program example:

```
10 LPRINT " ESC Y+n1+n2 "  
20 LPRINT " (Set Double-speed";  
30 LPRINT ",Double-density Image)"  
40 LPRINT  
50 WIDTH "LPT1:",255  
60 LPRINT "Number of Data = 100"  
70 LPRINT CHR$(27);"Y";CHR$(100 MOD 256);  
80 LPRINT CHR$(INT(100/256));  
90 FOR J=1 TO 100/2  
100 LPRINT CHR$(170);CHR$(85);  
110 NEXT J  
120 LPRINT  
130 END
```

Print example:

ESC Y+n1+n2
(Set Double-speed, Double-density Image)

Number of Data = 100

ESC Z + n1 + n2 (Set Quadruple-density Image)

Code:

(1B)H (5A)H (n1)H (n2)H ($0 \leq n1 \leq FF$, $0 \leq n2 \leq 7$)
(27)10 (90)10 (n1)10 (n2)10 ($0 \leq n1 \leq 255$, $0 \leq n2 \leq 7$)

Function:

Causes the printer to print the volume of data specified by n1 and n2 in a quadruple-density image.

Details:

- Setting of n1 and n2 is the same as that for ESC K + n1 + n2.
- Up to 1920 items of image data can be printed on a line. The same pin cannot be operated for consecutive positions.

Program example:

```
10 LPRINT " ESC Z+n1+n2";
20 LPRINT " (Set Quadruple-density Image)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Number of Data = 100"
60 LPRINT CHR$(27);"Z";CHR$(100 MOD 256);
70 LPRINT CHR$(INT(100/256));
80 FOR J=1 TO 100/2
90     LPRINT CHR$(170);CHR$(85);
100 NEXT J
110 LPRINT
120 END
```

Print example:

ESC Z+n1+n2 (Set Quadruple-density Image)

Number of Data = 100

(2) 9-pin image mode

The 9-pin image mode is subdivided into two modes. Print pins 1-9 can be specified with 9-pin image data. The correspondence between the interface signals and print pins is shown below.

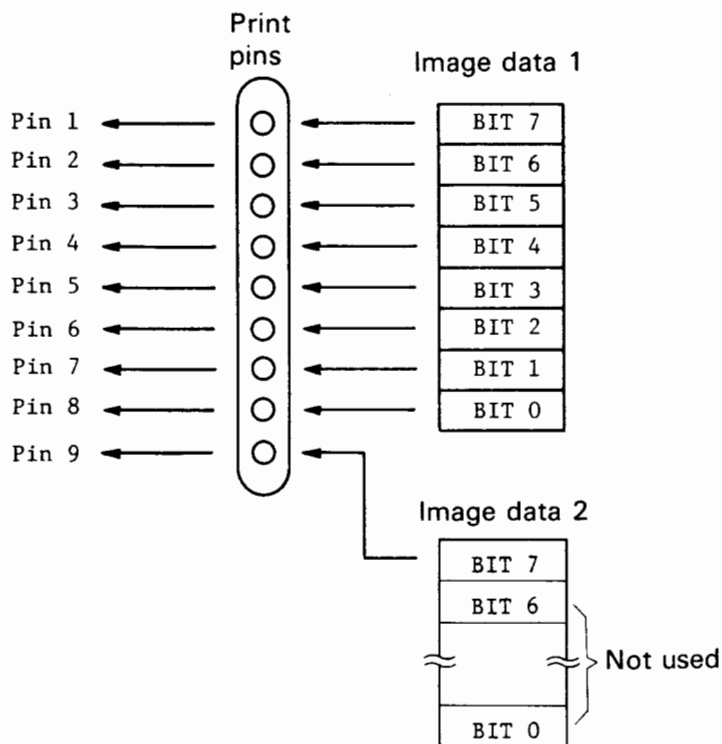


Figure 4.18 9-pin image mode pin assignment

ESC ^ + m + n1 + n2 (Set 9-pin Image Mode)

Code:

(1B)H (5E)H (m)H (n1)H (n2)H

($0 \leq m \leq 1$, $0 \leq n1 \leq FF$, $0 \leq n2 \leq 3$)

(27)10 (94)10 (m)10 (n1)10 (n2)10

($0 \leq m \leq 1$, $0 \leq n1 \leq 255$, $0 \leq n2 \leq 3$)

Function:

Causes the printer to print twice the volume of data specified by n1 and n2 in one of the two 9-pin image modes selected by the value of m.

Table 4.10 9-pin image modes

m	Mode name	Number of image data items/line	Horizontal dot density	Print speed inch/s
0	Single-density 9-pin image	960	1/60 inch	18
1	Double-density 9-pin image	1920	1/120 inch	9

Details:

- Half the total number of data items to be sent after ESC ^ + m + n1 + n2 is specified by n1 and n2 because data for pins 1-9 is produced from 2-byte image data (two items of image data for each item of column data) in the 9-pin image mode. This specification differs from that for the 8-pin image mode.

Program example:

```
10 LPRINT " ESC ^+m+n1+n2";
20 LPRINT " (Set 9-pin Image Mode)"
30 LPRINT
40 WIDTH "LPT1:",255
50 LPRINT "Single-density"
60 LPRINT CHR$(27);"^";CHR$(0);
70 LPRINT CHR$(200 MOD 256);
80 LPRINT CHR$(INT(200/256));
90 GOSUB 160
100 LPRINT "Double-density"
110 LPRINT CHR$(27);"^";CHR$(1);
120 LPRINT CHR$(200 MOD 256);
130 LPRINT CHR$(INT(200/256));
140 GOSUB 160
150 END
160 ' *** Subroutine ***
170 FOR I=1 TO 200/2
180     LPRINT CHR$(170);CHR$(128);
190     LPRINT CHR$(85);CHR$(0);
200 NEXT I
210 LPRINT
220 RETURN
```

Print example:

ESC ^+m+n1+n2 (Set 9-pin Image Mode)

Single-density

██

Double-density

██

4.4.6 Other features

BEL (Bell)

Code:

(07)H, (7)10

Function:

Sounds the buzzer for about 0.25 second.

Details:

The buzzer can be activated even when DIP switch SW1-6 is OFF.

Program example:

```
10 LPRINT " BEL (Bell)"
20 LPRINT
30 LPRINT CHR$(7);
40 END
```

Print example:

BEL (Bell)

ESC 8 (Disable Paper End Sensor)

Code:

(1B)H (38)H, (27)10 (56)10

Function:

Allows the printer to continue printing by ignoring signals from the paper end sensor.

Details:

This command provides an economical use of paper by allowing printing to the end of the paper.

Program example:

```
10 LPRINT " ESC 8";
20 LPRINT " (Disable Paper End Sensor)"
30 LPRINT
40 LPRINT CHR$(27);"8";
50 END
```

Print example:

ESC 8 (Disable Paper End Sensor)

ESC 9 (Enable Paper End Sensor)

Code:

(1B)H (39)H, (27)10 (57)10

Function:

The printer automatically enters the offline state after this command is input if a paper-end condition exists.

Program example:

```
10 LPRINT " ESC 9";
20 LPRINT " (Enable Paper End Sensor) "
30 LPRINT
40 LPRINT CHR$(27); "9";
50 END
```

Print example:

ESC 9 (Enable Paper End Sensor)

ESC i + n (Set Typewriter Mode)

Code:

(1B)H (69)H (n)H, (27)10 (105)10 (n)10 (n=0, 1)

Function:

Sets the printer in the typewriter mode when n = 1 is specified.

Details:

The typewriter mode is the mode of operation in which the printer prints each character as it is entered, and advances the paper to such position as makes the printed character visible if no input data is received for approximately 0.1 s.

When the next data is received, reverse feed is done to return the paper where it was.

n = 0 resets the typewriter mode, allowing the printer to return to the normal mode.

Caution:

To prevent paper jams, use of this command in a reverse-feed inhibit area should be avoided. See Notes on Reverse Form Feed under the item of ESC j + n (Reverse Line Feed).

Program example:

```
10 LPRINT " ESC i+n (Typewriter Mode)"
20 LPRINT
30 LPRINT "Input Any Key";
40 LPRINT " (Cancel-Press ESC Key)"
50 LPRINT CHR$(27);"i";CHR$(1) 'set
60 A$=INKEY$
70 IF A$=CHR$(27) THEN 100
80 LPRINT A$;
90 GOTO 60
100 LPRINT CHR$(27);"i",CHR$(0) 'reset
110 END
```

Print example:

```
ESC i+n (Typewriter Mode)

Input Any Key (Cancel-Press ESC Key)

ABCDEFGHIJKLMNPOQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
```

ESC s + n (Half Printing Speed)
--

Code:

(1B)H (73)H (n)H, (27)10 (115)10 (n)10 (n=0, 1)

Function:

- n = 1 causes the printer to print characters with pica pitch at half the normal speed.
- n = 0 causes the printer to print characters with pica pitch at the normal speed.

Details:

This command is useful for muting noise during printing operation.

Program example:

```
10 LPRINT " ESC s+n (Half Printing Speed)"
20 LPRINT
30 LPRINT CHR$(27);"s";CHR$(1);
40 LPRINT " Half speed ";
50 LPRINT " abcdefghijklmnopqrstuvwxyz"
60 LPRINT
70 LPRINT CHR$(27);"s";CHR$(0);
80 LPRINT "Normal speed";
90 LPRINT " abcdefghijklmnopqrstuvwxyz"
100 END
```

Print example:

ESC s+n (Half Printing Speed)

Half speed abcdefghijklmnopqrstuvwxyz

Normal speed abcdefghijklmnopqrstuvwxyz

CAN (Cancel)

Code:

(18)H, (24)10

Function:

Cancels all the data on the same line in the print buffer.

Program example:

```
10 LPRINT " CAN (Cancel)"
20 LPRINT
30 LPRINT "ABCDEFGH";CHR$(24);
40 LPRINT "HIJKLMN"
50 END
```

Print example:

CAN (Cancel)

HIJKLMN

ESC @ (Reset Printer)

Code:

(1B)H (40)H, (27)10 (64)10

Function:

Performs a reset equivalent (*1) to the power-on reset.

*1 The input buffer (2K buffer) is not cleared.

Program example:

```
10 LPRINT " ESC @ (Reset Printer)"
20 LPRINT
30 LPRINT CHR$(27);"@";
40 END
```

Print example:

```
ESC @ (Reset Printer)
```



SECTION 5

TAKING CARE OF YOUR PRINTER

This printer normally does not need maintenance work except that it will need cleaning and lubrication at certain intervals, for example, when you change the ribbon cartridge.

- Remove paper dust from the printing and feeding areas and clean the platen with Freon or solvent such as tape recorder capstan cleaner. Do not use alcohol; it damages rubber parts like the platen and rollers.

Note:

Be sure the printer is turned off and unplugged. Be careful not to damage the print head flexible cable.

- Clean and lubricate the two stay shafts which guide the carriage. This should be done about every six months but it is not mandatory.

Note:

Too much lubrication may cause poor printing due to oil on the paper or ribbon.

- If you want to clean the printer case, use a mild detergent and a soft cloth.

5.1 Simple Troubleshooting

The following table shows troubleshooting for some typical problems on the printer. For other problems, contact your dealer.

Note:

You should also check your computer and software package manuals for other suggestions.

Table 5.1 General troubleshooting

Problem	Cause	Solution
Power does not come on. (The POWER lamp does not light.)	<ul style="list-style-type: none"> – The printer is not plugged in. – Power is interrupted. 	<ul style="list-style-type: none"> – Plug the printer in.
The PAPER OUT lamp lights.	<ul style="list-style-type: none"> – Paper has run out. – Paper sticks during feeding. 	<ul style="list-style-type: none"> – Reset paper. – Remove paper and set it on tractors correctly.
Paper feeds poorly.	<ul style="list-style-type: none"> – Paper thickness is not suitable. – The pressure roller is not positioned correctly. – Paper wrinkles. – Paper tears. – Paper is set incorrectly on tractors. 	<ul style="list-style-type: none"> – Replace paper – Turn the paper release lever toward the rear of the printer for frictional feeding and toward you for tractor feeding. – Correct tractor width position. – Set the tractor width correctly for the paper. – Set the head gap adjustment lever correctly for the paper being used. – Place paper on tractors correctly.
Characters are not printed or are not clear.	<ul style="list-style-type: none"> – Ink ribbon is worn out or ambient temperature is not suitable. – The ribbon is set incorrectly. – The head gap adjustment lever position is incorrect. 	<ul style="list-style-type: none"> – Replace the ribbon cartridge. – The ink ribbon does not print well below 41°F (5°C). Warm the area around the printer. – Position the ribbon correctly between the print head and mask and check that the ribbon is being driven correctly. – Paper thickness does not match the lever position.
Characters are printed with one line split into halves, upper and lower.	<ul style="list-style-type: none"> – Input AC power voltage is low. 	<ul style="list-style-type: none"> – Correct the voltage.
The buzzer sounds for a short time after power is turned on.	<ul style="list-style-type: none"> – Paper has run out. 	<ul style="list-style-type: none"> – Set new paper.

Table 5.2 Serial interface mode troubleshooting

Problem	Cause	Solution
No response is made to transmitted data.	Baud rate mismatches. Protocol mismatches.	— Check the default switch settings on the serial board.
@ or wrong data prints.	A parity error occurs. A framing error occurs. An overflow occurs.	— Check the default switch settings on the serial board.

5.2 Repacking Your Printer

If you have to store or transport your printer, repack the printer as follows using the carton and packing materials which should be saved at unpacking.

1. Remove the interface cable, power cord (if removable type), ribbon cartridge, and sheet guide. Pack them in the original plastic bags.
2. Clean the printer if necessary.
3. Position the carriage about one-third of the way from the left margin to put the paper stopper on the carriage so it cannot move during transportation.

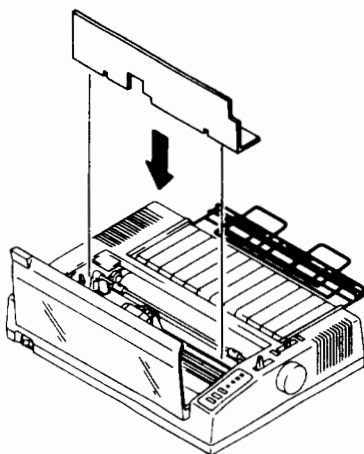


Figure 5.1 Re-installing the carriage stopper

4. Make sure that the top cover, DIP switch access cover, and the separator are closed or in place. Then tape them down.
5. Tape between the upper and lower cases of the printer.
6. Put the printer in its original plastic bag and hold it between the two polystyrol pads.
7. Lower the printer with the pads into the lower carton and place the accessories and removed parts in open spaces.
8. Put the upper carton on the lower carton and secure them with the two plastic handles.

APPENDIX A SERIAL INTERFACE

This printer has an RS-232C serial interface as an optional feature. Whether your printer is equipped with that interface, probably obvious for you, can be simply checked by the interface connector installation at the rear of your printer. When equipped, the printer has two connectors: the upper for the serial interface and the lower for the parallel interface.

This section will deal with the serial interface.

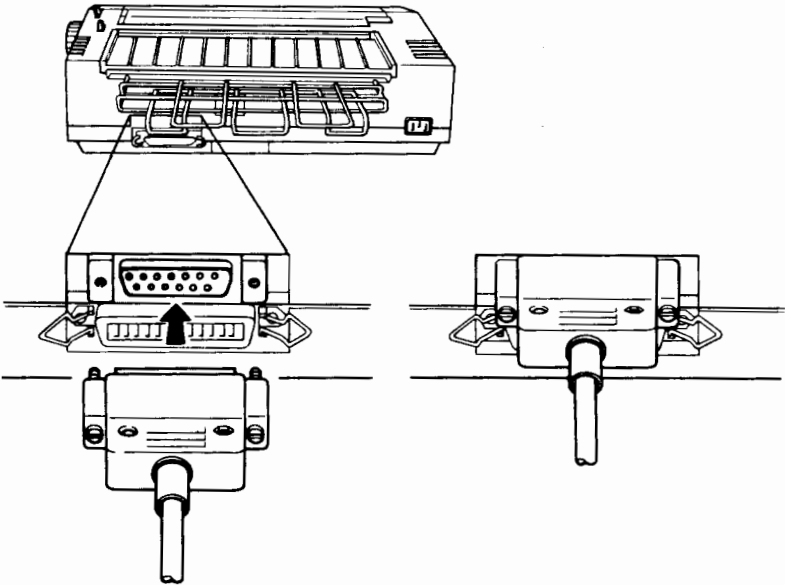


Figure A.1 Serial interface connection

A.1 Specifications

The specifications of the serial interface are as follows:

Transmission mode:
Asynchronous

Speeds:

110, 150, 200, 300, 600, 1200, 1800, 2400, 4800, and 9600 baud (selectable)

Data bits:

7 or 8 bits (selectable)

Parity bit:

Odd or even, or no parity (selectable)

Start bit:

1 bit

Stop bit:

1 or 2 bits (selectable)

Protocol:

1. DATA RDY/BSY

The DTR signal is used.

2. X-ON/X-OFF

Buffer size:

2,048 bytes

Input/Output Conditions

Signal levels:

– 3V or lower for a mark condition (logical 1)

+ 3V or higher for a space condition (logical 0)

Input circuit:

An MC1489AL is used to achieve conversion from RS-232C level to TTL level.



Figure A.2 Serial interface input circuit

Output circuit:

An MC1488L is used to achieve conversion from TTL level to RS-232C level. A 470 pF capacitor serves to mute noise on the output signal line.

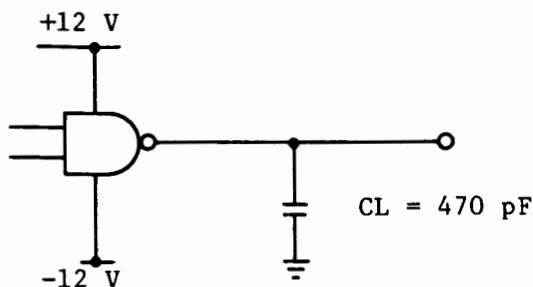


Figure A.3 Serial interface output circuit

Interface Signals and Connector Pin Assignment

Connector:

25-pin Cannon type conforming to EIA standards.

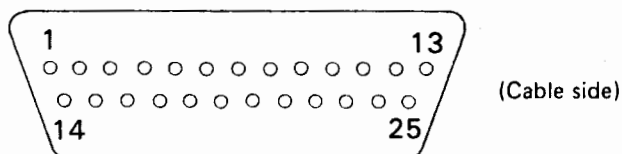


Figure A.4 Serial interface connector

Table A.1 Serial interface signals

Connector Pin number	Signal Name	Direction	Description
1	FG		Frame ground
2	TD	Out	Transmitted data
3	RD	In	Received data
6	DSR	In	Data is received when this signal is in the space state
7	SG		Signal ground (common return)
8	DCD	In	Data is received when this signal is in the space state
20	DTR	Out	Space state when the printer is ready to receive (H level); mark condition when not (L level)

Data Protocols

There are different types of protocols for the RS-232C serial interface depending on computer makers. Check your computer manual to see whether your computer uses one of the following two protocols.

(1) RDY/BSY protocol

Under this scheme, the DTR signal is set in the mark state (L level), that is, a BUSY signal is issued when the volume of data remaining in the buffer reaches 16 bytes.

The transmitter must stop transmission within 13 bytes after the DTR signal is set in the mark state (L level).

Valid data cannot be guaranteed if data is transmitted beyond the buffer capacity without regard to the DTR signal.

Buffer-full recovery timing

Data transmission is suspended when the DTR signal is set to the mark state (L level). Even in this state, printing continues. When the data length of the vacant area in the buffer exceeds 152 bytes (when SW2-4

is set to OFF), the DTR signal is reset to the space state (H level), that is, a READY signal is issued.

(2) X-ON/X-OFF protocol

Under this scheme, XOFF code (13)H is transmitted from the printer every time the print data is transmitted while the volume of data remaining in the buffer is less than 16 bytes.

Normal data processing cannot be guaranteed if data is transmitted to the printer when adequate buffer memory is not available after the XOFF code has been transmitted.

XON code is transmitted periodically (about 0.3 s) from the printer when the buffer is empty.

When the printer is first turned on, the DTR signal is set to the space state (READY) and an XON code is transmitted from the printer.

Serial Data Format

The format of serial data, 10 or 11 bits long, consists of a start bit, data bits, a parity bit, and stop bits. A bit is in the mark state when not in transmission. The data bits start with the LSB. A typical transmission of the character "K" (4B)H is shown below. (7 data bits, even parity)

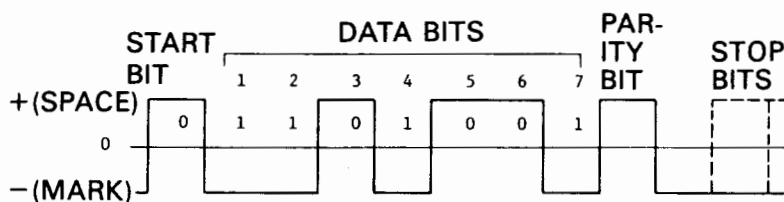


Figure A.5 Serial data format

A.2 Setting the DIP Switches

There are two DIP switches (SW1: 8 circuits and SW2: 4 circuits) on the optional serial interface PC board installed above the main PC board. You can access these switches from the rear of your printer by opening the DIP switch access cover.

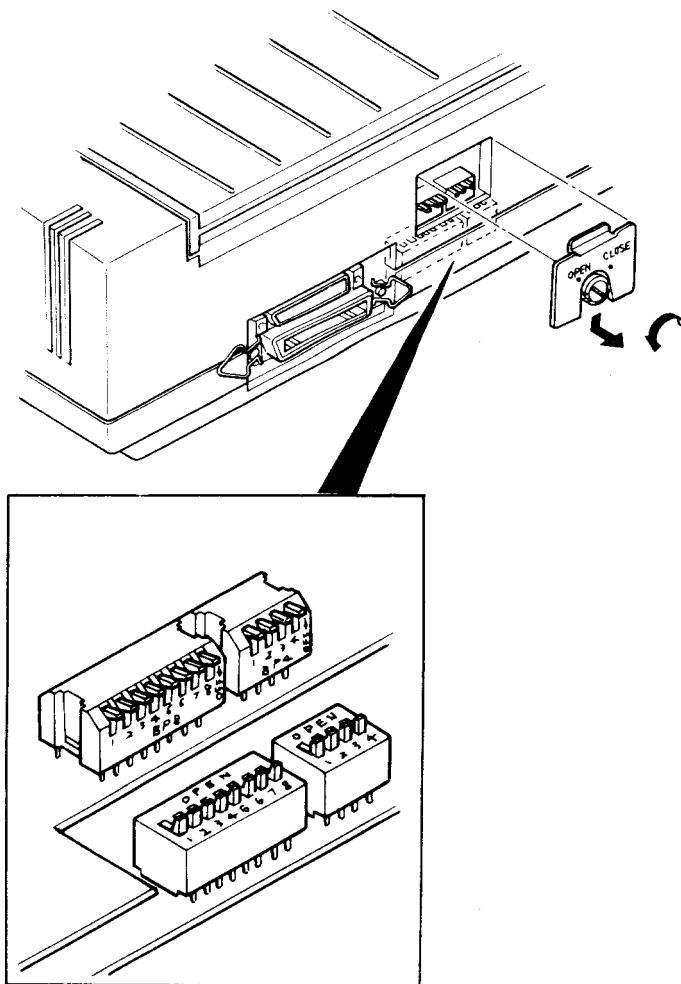


Figure A.6 DIP switch location (serial interface)

When you are going to use the serial interface, you have to disconnect the parallel interface cable, connect serial interface cable, and set the DIP switches to the positions suitable for your computer's requirements which will be found in the interface description of your computer manual or obtained from your dealer.

Note:

Do not confuse the DIP switches for the serial interface with those for the parallel interface.

The functions of the DIP switches are as follows:

SW1-1:

Selects one of the two protocols supported by this printer for data transmission with the computer.

SW1-2:

Determines whether the printer expects 7- or 8-bit data in serial data from your computer.

SW1-3:

Determines whether the printer performs parity checking. Select the setting depending on whether your computer transmits data with or without parity.

SW1-4:

Determines whether the printer uses odd- or even-parity for data checking. This setting is valid only when parity checking is enabled by SW1-3.

SW1-5 to SW1-8:

Select one of the ten transmission speeds, 110 to 9600 baud, for your printer.

SW2-1:

Determines whether the printer uses the serial interface.

Note:

Be sure to set the switch to the disabled side if you don't use the serial interface.

SW2-2:

Determines whether the printer expects one or two stop bits from your computer.

SW2-3:

Determines whether the printer sends out the DTR (Data Terminal Ready) signal as active high or low.

SW2-4:

Selects 560 or 152 bytes for the buffer recovery timing where the printer resets the DTR signal to inform the computer that the printer becomes ready to receive data.

Table A.2 DIP switch 1 settings

No.	Function	Selection		Factory setting
		OPEN (Off)	ON	
1	Data protocol	RDY/BSY	XON/XOFF	OPEN (Off)
2	Data length	8 bits	7 bits	OPEN (Off)
3	Parity check	Disable	Enable	OPEN (Off)
4	Parity bit	Odd	Even	OPEN (Off)
5	Baud rate 3	See Table A.3.		OPEN (Off)
6	Baud rate 2			OPEN (Off)
7	Baud rate 1			OPEN (Off)
8	Baud rate 0			OPEN (Off)

Table A.3 Baud rate settings

Baud rate	Switch settings			
	#5	#6	#7	#8
9600	ON	OPEN (Off)	OPEN (Off)	ON
4800	ON	OPEN (Off)	OPEN (Off)	OPEN (Off)
2400	OPEN (Off)	ON	ON	ON
1800	OPEN (Off)	ON	ON	OPEN (Off)
1200	OPEN (Off)	ON	OPEN (Off)	ON
600	OPEN (Off)	ON	OPEN (Off)	OPEN (Off)
300	OPEN (Off)	OPEN (Off)	ON	ON
200	OPEN (Off)	OPEN (Off)	ON	OPEN (Off)
150	OPEN (Off)	OPEN (Off)	OPEN (Off)	ON
110	OPEN (Off)	OPEN (Off)	OPEN (Off)	OPEN (Off)

Table A.4 DIP switch 2 settings

No.	Function	Selection		Factory setting
		OPEN (Off)	ON	
1	Serial interface enable	Enable	Disable	OPEN (Off)
2	Stop bit	1 bit	2 bits	OPEN (Off)
3	Polarity of DTR signal	Positive	Negative	OPEN (Off)
4	Buffer recovery timing	152 bytes	560 bytes	OPEN (Off)

APPENDIX B

PARALLEL INTERFACE SPECIFICATIONS

The Centronics parallel interface is the standard interface for this printer.

Transfer mode:

Handshake mode based on $\overline{\text{BUSY}}/\overline{\text{ACK}}$ signal

Connector:

Plug 57FE-30360 (AMPHENOL-DDK) or equivalent

Output circuit: SN7406 or equivalent

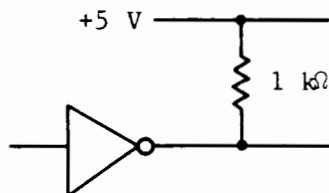
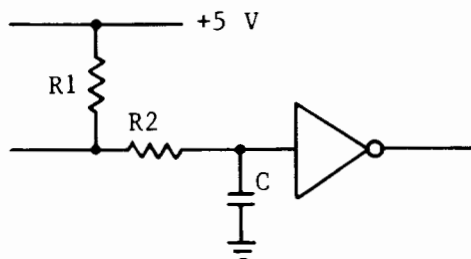


Figure B.1 Parallel interface output circuit

Input circuit: SN74LS14 or equivalent, or 8255A



	R1	R2	C
DATA 1-8	1 k Ω	0 Ω	—
$\overline{\text{AUTO FEED XT}}$			
$\overline{\text{SLCT IN}}$			
$\overline{\text{DSTB}}$	1 k Ω	100 Ω	1000 pF
$\overline{\text{INIT}}$			

Figure B.2 Parallel interface input circuit

Interface Signals and Connector Pin Assignment

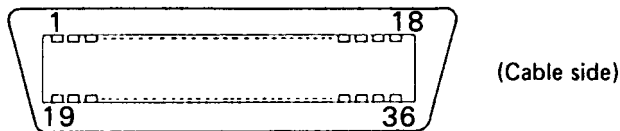


Figure B.3 Parallel interface connector

Table B.1 Parallel interface signals

Connector pin number	Return line pin number	Signal name	Direction	Description
1	19	$\overline{\text{DSTB}}$	In	<ul style="list-style-type: none"> – Strobe pulse for reading data (DATA 1-8) – Pulse width must be $0.5 \mu\text{s}$ or more at printer receive terminal – Active-low signal
2	20	DATA1	In	<ul style="list-style-type: none"> – The DATA 1-8 signals correspond to parallel data bits 1 to 8. – DATA 8 is the most significant bit. – All signals must go high at least $0.5 \mu\text{s}$ before the falling edge of the $\overline{\text{DSTB}}$ signal and must be held for at least $0.5 \mu\text{s}$ after the rising edge. – Active-high signal
3	21	DATA2	In	
4	22	DATA3	In	
5	23	DATA4	In	
6	24	DATA5	In	
7	25	DATA6	In	
8	26	DATA7	In	
9	27	DATA8	In	
10	28	$\overline{\text{ACK}}$	Out	<ul style="list-style-type: none"> – Pulse signal indicating data receive completed or data receive enable status. – Active-low signal

Table B.1 — continued

Connector pin number	Return line pin number	Signal name	Direction	Description
11	29	BUSY	Out	— Status signal indicating whether data can be received. Data cannot be received when this signal is high. Data can be received when this signal is low.
12		PE	Out	— This signal is set to high when out-of-paper status occurs.
13		SLCT	Out	— Indicates selected (online) status when the signal is high and deselected (offline) status when it is low.
14		$\overline{\text{AUTO FEED XT}}$	In	— When this signal is low, one line is fed automatically after a carriage return by the CR code.
15		NC		Reserved
16		SG1		Logic ground level (0V)
17		FG		Printer cabinet ground line.
18		NC		Reserved
19 to 30		SG1		Twisted pair cable return line.
31		$\overline{\text{INIT}}$	In	If this signal is low for over 50 μs , the printer is reset to the initial status after turning power on.

Table B.1 — continued

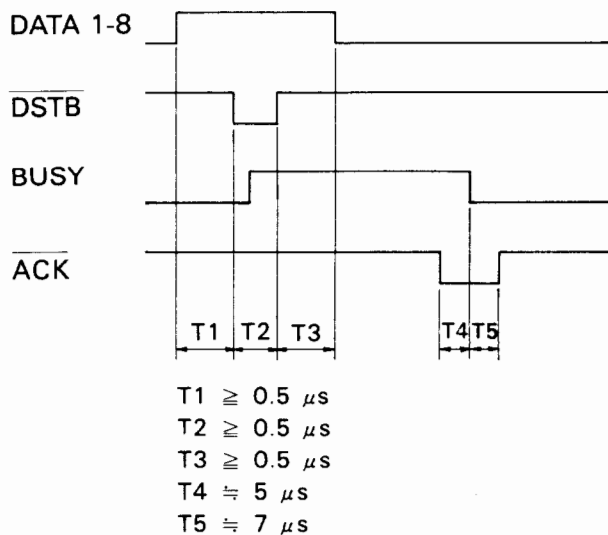
Connector pin number	Return line pin number	Signal name	Direction	Description
32		<u>ERROR</u>	Out	This signal is low under the following printer conditions: (1) Out of paper (2) Offline (3) Other printer error conditions
33		SG1		Same as pin 16
34		NC		Reserved
35		+ 5V	Out	This signal is used for testing and confirmation. It cannot be used for supplying power to external devices.
36		<u>SLCT IN</u>	In	If this signal is low at the time when power is first turned on the printer is set to selected (online) status.

Notes:

1. Direction:
"In" indicates input signal to the printer.
"Out" indicates a signal from the printer.
2. Return line:
Indicates twisted pair return line, connected to signal ground level.
3. Cable:
Use the shortest possible cable. Shielded twisted pair cable is used.

Data Transmission Timing

TYPE F



TYPE I

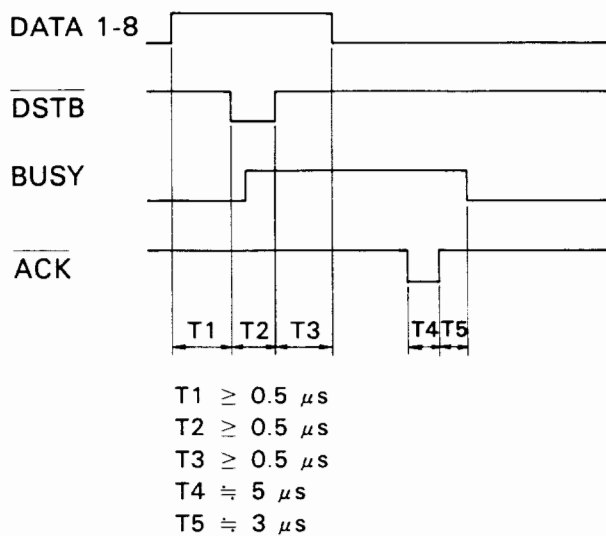


Figure B.4 Data transmission timing

APPENDIX C

PRINTER SPECIFICATIONS

Printing method

9-wire dot matrix of 0.3 mm dia.

Character set

Type F

- 96 ASCII characters, 32 international characters, 96 + 32 Italic characters, up to 255 downloadable characters
- 128 NLQ characters

Type I

- 96 ASCII characters, 41 international characters, 48 graphic characters, 16 Greek characters, 27 others, up to 144 downloadable characters
- 214 NLQ characters

Printing direction

Bidirectional, logic seeking

Dot pitch (H × V)

- 1/120 inch × 1/72 inch (pica)
- 1/180 inch × 1/72 inch (elite)
- 1/240 inch × 1/144 inch (NLQ)
- 1/240 inch × 1/72 inch (condensed)

Character pattern dot configuration (H × V)

- 9 × 7 dots (pica, elite, and condensed)
- 18 × 16 dots (NLQ)

Printing speed

- 180 characters/second (pica)
- 125 characters/second (elite)
- 25 characters/second (NLQ)
- 150 characters/second (condensed)

Print pitch

- 1/10 inch (pica)
- 1/12 inch (elite)
- 1/10 inch (NLQ)
- 1/17.1 inch (condensed)

Print line length

- 80 characters/line (pica)
- 96 characters/line (elite)
- 80 characters/line (NLQ)
- 137 characters/line (condensed)

Number of copies

- Up to 3 including original (8 lb, carbonless paper)

Ribbon

- Black, movable cartridge

Image print

- Horizontal: 60, 72, 80, 120 dots/inch
- Vertical: 72 dots/inch

Acoustic noise

- 69 dB or less

Line feed speed

- 120 ms or less at 6 LPI (Line Per Inch)

Line spacing

- 1/6, 1/8, 7/72, n/72, n/216 inch

Power source

- 110 to 120 VAC $\pm 10\%$, 50 or 60 Hz
- 220 or 240 VAC $\pm 10\%$ (switchable), 50 Hz

Power consumption

- Printing: 65 VA (test printing)
- Not printing: 25 VA

Environmental condition

- Operating temperature: 41° to 100°F (5° to 38°C)
- Operating humidity: 20% to 80% (no condensation)

Physical dimensions

- Height: 4.3 inches (110 mm)
- Width: 16.3 inches (415 mm)
- Depth: 12.2 inches (310 mm)
- Weight: 18.9 lb (8.5 kg)

Reliability

MTBF (Mean time between Failures): 4000 hours

MTTR (Mean Time to Repair): 15 minutes

Print head life: 200 million characters

Interface

Centronics and RS-232C (option)

Paper width

Continuous sheet: 3.5 to 10.5 inches (89 to 267 mm)

Cut sheet: 4 to 10 inches (100 to 257 mm)

APPENDIX D CODE TABLES

Type F

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
0			SP	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
1		DC1	DC2	DC3	DC4														
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
A																			
B																			
C																			
D																			
E																			
F																			

Type F													
HEX	23H	24H	40H	5BH	5CH	5DH	5EH	60H	7BH	7CH	7DH	7EH	
U.S.A.	#	\$	@	L	/	J	<	,	{	!	}	~	
FRANCE	#	\$	a	o	5	S	<	,	e	u	e	:	
GERMANY	#	\$	s	A	o	U	<	,	a	o	u	B	
U.K.	£	\$	@	L	\	J	<	,	{	!	}	~	
DENMARK	#	\$	@	AE	Ø	A	<	,	æ	ø	a	~	
SWEDEN	#	¤	£	A	o	A	U	e	a	o	a	u	
ITALY	#	\$	@	o	/	e	<	,	a	o	e	z	
SPAIN	£	\$	@	i	N	¿	<	,	:	n	}	~	
JAPAN	#	\$	@	L	#	J	<	,	{	!	}	~	
HEX	A3H	A4H	C0H	DBH	DCH	DDH	DEH	E0H	FBH	FCH	FDH	FEH	
U.S.A.	#	\$	@	L	/	J	<	,	{	/	}	~	
FRANCE	#	\$	a	o	5	S	<	,	e	u	e	:	
GERMANY	#	\$	s	A	o	U	<	,	a	o	u	B	
U.K.	£	\$	@	L	\	J	<	,	{	/	}	~	
DENMARK	#	\$	@	AE	Ø	A	<	,	æ	ø	a	~	
SWEDEN	#	¤	£	A	o	A	U	e	a	o	a	u	
ITALY	#	\$	@	o	/	e	<	,	a	o	e	z	
SPAIN	£	\$	@	i	N	¿	<	,	:	n	}	~	
JAPAN	#	\$	@	L	#	J	<	,	{	/	}	~	

Type I


(B) CGSET2

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL															
1			DC2		DC4	S		CAN		ESC						
2			!	"	#	\$	%	&	'	()	*	+	,	-	.
3											:	;	<	=	>	?
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																

Type I

2. DOWNLOAD CG CODE TABLE

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	NUL	DC2	DC4	5	BEL	HT	LF	VT	FF	CR	SO	SI				
0																
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																

 Definable Area

Type I

3. NLQ CG CODE TABLE

HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL															
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																

APPENDIX E CONTROL CODES

Type F

Control code	Function	Reference page
BEL	Bell	4-79
BS	Back space	4-24
HT	Horizontal tab	4-28
LF	Line feed	4-7
VT	Vertical tab	4-15
FF	Form feed	4-15
CR	Carriage return	4-24
SO	Set double-width print mode	4-33
SI	Set condensed print mode	4-35
DC1	Select printer	4-84
DC2	Reset condensed print mode	4-37
DC3	Deselect printer	4-84
DC4	Reset double-width print mode	4-34
CAN	Cancel	4-82
ESC	Make extended command	4-5
DEL	Delete	4-83
ESC SO	Same as SO	4-33
ESC SI	Same as SI	4-35

Type F

Control code	Function	Reference page
ESC ! + n	Set and reset print modes	4-41
ESC #	Disable MSB control	4-54
ESC % + 0 + 0	Select internal character set	4-50
ESC % + 1 + 0	Select download character set	4-59
ESC % + 2 + 0	Select NLQ character set	4-58
ESC & + 0 + n + m + a + p1... + p11	Define download characters	4-61
ESC * + m + n1 + n2	Set 8-pin image mode	4-68
ESC - + n	Underline mode	4-45
ESC / + n	Specify VFU channels	4-18
ESC 0	Set line spacing to 1/8 inch	4-11
ESC 1	Set line spacing to 7/72 inch	4-12
ESC 2	Set line spacing to 1/6 inch	4-13
ESC 3 + n	Set line spacing to n/216 inch	4-13
ESC 4	Select alternate mode	4-51
ESC 5	Reset alternate mode	4-51
ESC 6	Extend print code area	4-52
ESC 7	Reset ESC 6 setting	4-52
ESC 8	Disable paper end sensor	4-79

Type F

Control code	Function	Reference page
ESC 9	Enable paper end sensor	4-80
ESC : + 0 + 0 + 0	Copy character set	4-60
ESC <	Set home head	4-30
ESC =	Reset MSB to 0	4-53
ESC >	Set MSB to 1	4-53
ESC @	Reset printer	4-83
ESC A + n	Set line spacing to n/72 inch	4-14
ESC B + n1 + n2 + ... + nk + NUL	Set vertical tabs	4-16
ESC C + n	Set page length in lines	4-19
ESC C + 0 + n	Set page length in inches	4-20
ESC D + n1 + n2 + ... + nk + NUL	Set horizontal tabs	4-28
ESC E	Emphasized print mode	4-38
ESC F	Reset emphasized print mode	4-39
ESC G	Double-strike mode	4-37
ESC H	Reset double-strike mode	4-38
ESC I + n	Select control code as printable	4-55
ESC J + n	Line feed	4-8
ESC K + n1 + n2	Single-density image	4-71
ESC L + n1 + n2	Double-density image	4-72
ESC M	Elite pitch	4-40
ESC N + n	Set skip perforations	4-21

Type F

Control code	Function	Reference page
ESC O	Reset skip perforations	4-23
ESC P	Pica pitch	4-40
ESC Q + n	Set right margin	4-26
ESC R + n	Select international character set	4-48
ESC S + 0	Set superscripts	4-43
ESC S + 1	Set subscripts	4-43
ESC T	Reset superscripts/ subscripts	4-44
ESC U + n	Set unidirectional print	4-30
ESC W + n	Set and reset double-width print mode	4-34
ESC Y + n1 + n2	Set double-speed and double-density image	4-73
ESC Z + n1 + n2	Set quadruple density image	4-74
ESC ^ + m + n1 + n2	Set 9-pin image mode	4-77
ESC b + n + m1 + m2 + ... + mk + NUL	Set VFU positions	4-17
ESC i + n	Typewriter mode	4-80
ESC j + n	Print and reverse line spacing	4-9
ESC l + n	Set left margin	4-25
ESC p + n	Set and reset proportional spacing mode	4-46
ESC s + n	Set half speed	4-82

Type I

Control code	Function	Reference page
BEL	Bell	4-149
HT	Horizontal tab	4-107
LF	Line feed	4-87
VT	Vertical tab	4-95
FF	Form feed	4-94
CR	Carriage return	4-104
SO	Set double-width print mode	4-113
SI	Set condensed print mode	4-115
DC2	Reset condensed print mode	4-116
DC4	Reset double-width print mode	4-114
CAN	Cancel	4-152
ESC	Make extended command	4-5
ESC SO	Same as SO	4-113
ESC SI	Same as SI	4-115
ESC !+n	Set and reset print modes	4-121
ESC %+0+n	Select internal character set	4-129
ESC %+1+0	Select download character set	4-131
ESC %+2+0	Select NLQ character set	4-130

Type I

Control code	Function	Reference page
ESC & +0+n+m+a+p1...+p11	Define download characters	4-133
ESC *+m+n1+n2	Set 8-pin image mode	4-139
ESC -+n	Underline mode	4-125
ESC /+n	Specify VFU channels	4-97
ESC 0	Set line spacing to 1/8 inch	4-91
ESC 1	Set line spacing to 7/72 inch	4-92
ESC 2	Validate line spacing setting	4-90
ESC 3+n	Set line spacing to n/216 inch	4-93
ESC 6	Select CG set 2	4-128
ESC 7	Select CG set 1	4-128
ESC 8	Disable paper end sensor	4-149
ESC 9	Enable paper end sensor	4-150
ESC :+0+0+1	Copy character set	4-132
ESC <	Set home head	4-110
ESC @	Reset printer	4-153
ESC A+n	Set line spacing to n/72 inch	4-94
ESC B+n1+n2+...+nk+NUL	Set vertical tabs	4-95
ESC C+n	Set page length in lines	4-99

Type I

Control code	Function	Reference page
ESC C + 0 + n	Set page length in inches	4-100
ESC D + n ₁ + n ₂ + ... + n _k + NUL	Set horizontal tabs	4-107
ESC E	Emphasized print mode	4-118
ESC F	Reset emphasized print mode	4-119
ESC G	Double-strike mode	4-117
ESC H	Reset double-strike mode	4-118
ESC J + n	Line feed	4-88
ESC K + n ₁ + n ₂	Single-density image	4-141
ESC L + n ₁ + n ₂	Double-density image	4-143
ESC M	Elite pitch	4-120
ESC N + n	Set skip perforations	4-101
ESC O	Reset skip perforations	4-103
ESC P	Pica pitch	4-120
ESC Q + n	Set right margin	4-105
ESC S + 0	Set superscripts	4-123
ESC S + 1	Set subscripts	4-123
ESC T	Reset superscripts/ subscripts	4-124
ESC U + n	Set unidirectional print	4-110
ESC W + n	Set and reset double-width print mode	4-114
ESC Y + n ₁ + n ₂	Set double-speed and double-density image	4-144

Type I

Control code	Function	Reference page
ESC Z + n1 + n2	Set quadruple density image	4-145
ESC ^ + m + n1 + n2	Set 9-pin image mode	4-147
ESC b + n + m1 + m2 + ... + mk + NUL	Set VFU positions	4-97
ESC i + n	Typewriter mode	4-150
ESC j + n	Print and reverse line spacing	4-88
ESC l + n	Set left margin	4-104
ESC p + n	Set and reset proportional spacing mode	4-126
ESC s + n	Set half speed	4-151

APPENDIX F **CODE CONVERSION TABLE**

ASCII Character	Decimal	Hexa-decimal	Binary
(NUL)	0	00	00000000
	1	01	00000001
	2	02	00000010
	3	03	00000011
	4	04	00000100
	5	05	00000101
	6	06	00000110
(BEL)	7	07	00000111
(BS)	8	08	00001000
(HT)	9	09	00001001
(LF)	10	0A	00001010
(VT)	11	0B	00001011
(FF)	12	0C	00001100
(CR)	13	0D	00001101
(SO)	14	0E	00001110
(SI)	15	0F	00001111
	16	10	00010000
(DC1)	17	11	00010001
(DC2)	18	12	00010010
(DC3)	19	13	00010011
(DC4)	20	14	00010100
	21	15	00010101
	22	16	00010110
	23	17	00010111
(CAN)	24	18	00011000
	25	19	00011001
	26	1A	00011010
(ESC)	27	1B	00011011
	28	1C	00011100
	29	1D	00011101
	30	1E	00011110
	31	1F	00011111
(SP)	32	20	00100000
!	33	21	00100001

ASCII Character	Decimal	Hexa- decimal	Binary
"	34	22	00100010
#	35	23	00100011
\$	36	24	00100100
%	37	25	00100101
&	38	26	00100110
'	39	27	00100111
(40	28	00101000
)	41	29	00101001
*	42	2A	00101010
+	43	2B	00101011
,	44	2C	00101100
-	45	2D	00101101
.	46	2E	00101110
/	47	2F	00101111
0	48	30	00110000
1	49	31	00110001
2	50	32	00110010
3	51	33	00110011
4	52	34	00110100
5	53	35	00110101
6	54	36	00110110
7	55	37	00110111
8	56	38	00111000
9	57	39	00111001
:	58	3A	00111010
;	59	3B	00111011
<	60	3C	00111100
=	61	3D	00111101
>	62	3E	00111110
?	63	3F	00111111
@	64	40	01000000
A	65	41	01000001
B	66	42	01000010
C	67	43	01000011
D	68	44	01000100
E	69	45	01000101
F	70	46	01000110
G	71	47	01000111
H	72	48	01001000

ASCII Character	Decimal	Hexa- decimal	Binary
I	73	49	01001001
J	74	4A	01001010
K	75	4B	01001011
L	76	4C	01001100
M	77	4D	01001101
N	78	4E	01001110
O	79	4F	01001111
P	80	50	01010000
Q	81	51	01010001
R	82	52	01010010
S	83	53	01010011
T	84	54	01010100
U	85	55	01010101
V	86	56	01010110
W	87	57	01010111
X	88	58	01011000
Y	89	59	01011001
Z	90	5A	01011010
[91	5B	01011011
\	92	5C	01011100
]	93	5D	01011101
^	94	5E	01011110
_	95	5F	01011111
	96	60	01100000
a	97	61	01100001
b	98	62	01100010
c	99	63	01100011
d	100	64	01100100
e	101	65	01100101
f	102	66	01100110
g	103	67	01100111
h	104	68	01101000
i	105	69	01101001
j	106	6A	01101010
k	107	6B	01101011
l	108	6C	01101100
m	109	6D	01101101
n	110	6E	01101110
o	111	6F	01101111

ASCII Character	Decimal	Hexa- decimal	Binary
p	112	70	01110000
q	113	71	01110001
r	114	72	01110010
s	115	73	01110011
t	116	74	01110100
u	117	75	01110101
v	118	76	01110110
w	119	77	01110111
x	120	78	01111000
y	121	79	01111001
z	122	7A	01111010
{	123	7B	01111011
	124	7C	01111100
}	125	7D	01111101
~	126	7E	01111110
(DEL)	127	7F	01111111

Decimal	Hexa- decimal	Binary
128	80	10000000
129	81	10000001
130	82	10000010
131	83	10000011
132	84	10000100
133	85	10000101
134	86	10000110
135	87	10000111
136	88	10001000
137	89	10001001
138	8A	10001010
139	8B	10001011
140	8C	10001100
141	8D	10001101
142	8E	10001110
143	8F	10001111
144	90	10010000
145	91	10010001
146	92	10010010
147	93	10010011
148	94	10010100
149	95	10010101
150	96	10010110
151	97	10010111
152	98	10011000
153	99	10011001
154	9A	10011010
155	9B	10011011
156	9C	10011100
157	9D	10011101
158	9E	10011110
159	9F	10011111
160	A0	10100000
161	A1	10100001
162	A2	10100010
163	A3	10100011
164	A4	10100100
165	A5	10100101
166	A6	10100110
167	A7	10100111

Decimal	Hexa- decimal	Binary
168	A8	10101000
169	A9	10101001
170	AA	10101010
171	AB	10101011
172	AC	10101100
173	AD	10101101
174	AE	10101110
175	AF	10101111
176	B0	10110000
177	B1	10110001
178	B2	10110010
179	B3	10110011
180	B4	10110100
181	B5	10110101
182	B6	10110110
183	B7	10110111
184	B8	10111000
185	B9	10111001
186	BA	10111010
187	BB	10111011
188	BC	10111100
189	BD	10111101
190	BE	10111110
191	BF	10111111
192	C0	11000000
193	C1	11000001
194	C2	11000010
195	C3	11000011
196	C4	11000100
197	C5	11000101
198	C6	11000110
199	C7	11000111
200	C8	11001000
201	C9	11001001
202	CA	11001010
203	CB	11001011
204	CC	11001100
205	CD	11001101
206	CE	11001110

Decimal	Hexa- decimal	Binary
207	CF	11001111
208	D0	11010000
209	D1	11010001
210	D2	11010010
211	D3	11010011
212	D4	11010100
213	D5	11010101
214	D6	11010110
215	D7	11010111
216	D8	11011000
217	D9	11011001
218	DA	11011010
219	DB	11011011
220	DC	11011100
221	DD	11011101
222	DE	11011110
223	DF	11011111
224	E0	11100000
225	E1	11100001
226	E2	11100010
227	E3	11100011
228	E4	11100100
229	E5	11100101
230	E6	11100110
231	E7	11100111
232	E8	11101000
233	E9	11101001
234	EA	11101010
235	EB	11101011
236	EC	11101100
237	ED	11101101
238	EE	11101110
239	EF	11101111
240	F0	11110000
241	F1	11110001
242	F2	11110010
243	F3	11110011
244	F4	11110100
245	F5	11110101
246	F6	11110110

Decimal	Hexa- decimal	Binary
247	F7	11110111
248	F8	11111000
249	F9	11111001
250	FA	11111010
251	FB	11111011
252	FC	11111100
253	FD	11111101
254	FE	11111110
255	FF	11111111

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Reordering number:
B-69143 . . . C (manual with binder)