

LC-10

COLOUR PRINTER
USERS MANUAL

NOT INTENDED FOR SALE

PN 80820251

**Federal Communications Commission
Radio Frequency Interference Statement**

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, 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 specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a 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 to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the computer or printer with respect to the receiver
- Move the computer or printer away from the receiver
- Plug the computer or printer into a different outlet so that it 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 U.S. Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4.

For compliance with the Federal Noise Interference Standard, this equipment requires a shielded cable.

The above statement applies only to printers marketed in the U.S.A.

Self Declaration

Radio interference regarding this equipment has been eliminated according to Vfg 1046/1984 announced by the DBP.

DBP has been informed of the introduction of this special equipment and has been granted the right to examine the whole series.

It is the user's responsibility to see that his own assembled system is in accordance with the technical regulations under Vfg 1046/1984.

To conform to FTZ-regulations it is necessary to make all connections to the printer with shielded cable.

The equipment may only be opened by qualified service representatives.

The above statement applies only to printers marketed in West Germany.

Trademark Acknowledgements

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IBM PC, IBM Proprinter II, PC-DOS: International Business Machines Corp.

Microsoft BASIC, MS-DOS: Microsoft Corporation

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HOW TO USE THIS MANUAL

This manual is organized into five chapters and four appendixes. To learn how to make the best use of your printer you are urged to read all of chapters 1 through 5. The appendixes can be referred to as necessary.

Chapter 1 explains how to get the printer unpacked and set up. Read this chapter before you do anything else.

Chapter 2 explains the control panel. After getting set up, read this chapter and try out the procedures in it to find out how the printer works.

Chapter 3 gives tips on using word-processing programs and other commercial software with this printer. Read this chapter in conjunction with your software manual.

Chapter 4 is addressed to do-it-yourself programmers. It shows simple programming examples using DOS commands and BASIC.

Chapter 5 covers maintenance and troubleshooting. Look through this chapter to see what it contains, then refer to it as necessary later.

Appendix A lists the printer's technical specifications.

Appendix B details the functions of escape sequences and other printer commands.

Appendix C presents a BASIC program you can use to define and download new characters.

Appendix D presents tables of the printer's character sets.

FEATURES OF THE PRINTER

This printer is a compact, colour, dot-matrix printer that supports the IBM/Epson commands and character sets. An excellent partner for your personal computer, it prints text and graphics in black-and-white or six bright colours. A print sample generated by a BASIC program is included inside the back cover. With more advanced software, you can produce even more striking colour graphics. Besides colour printing, some of the features of this printer are:

- Extensive software support

Since it is compatible with the Epson and IBM printers, it works with any software that supports those printers. That includes most word-processing and graphics programs, spreadsheets, and integrated software packages.

- Embeddable commands

Commands for NLQ type styles, colour printing, bold, italic, and extra-large characters can be embedded in documents without the escape code, so you can use these features easily even if your word-processing software does not support them.

- Easy operation

Clearly understandable lamp displays and beep tones provide immediate feedback when you press the switches on the control panel. The four switches can operate in combinations to perform a surprising variety of functions, including margin setting and micro-alignment.

- Easy care and maintenance

The colour ribbon cartridge can be replaced in seconds; the print head in a few minutes.

- Versatile paper handling

Single sheets, fanfold forms, and multi-copy forms (up to triple-ply) are all accepted, and you can use either tractor or friction feed. A special feature enables you to keep fanfold forms parked in readiness while printing on other paper.

- Fast draht-quality printing

At 120 characters per second, the printer can print a page faster than you can read it. Characters are naturally shaped, with true descenders.

- High-resolution near-letter-quality printing

When you select an NLQ type style, the printer slows down and employs a dense matrix of up to 18 by 23 dots to print clear, well-formed characters.

- Large variety of type styles and sizes

The printer has one draht style and four NLQ styles (Courier, Sanserif, and Orator with small capitals or lower case), plus italics for all styles, plus condensed print, bold print, double-sized print, quadruple-sized print—see the print sample inside the back cover.

TABLE OF CONTENTS

Chapter 1	SETTING UP THE PRINTER	1
	Locating the printer	1
	Unpacking and inspection	1
	Check the carton contents	
	Setting up	3
	Mount the platen knob	
	Remove the top cover	
	Install the ribbon cartridge	
	Replace the top cover	
	Connect the printer to the computer	
	Connect the printer's power cord	
	Loading single sheets	6
	Mount the paper guide	
	Semiautomatic loading	
	Manual loading	
	Loading and parking fanfold forms	9
	Paper parking	
	Paper unparking	
	Test printing	12
	Short self test	
	Long self test	
	Interface test	
	Adjusting the printing gap	14
	DIP switch settings	14
Chapter 2	CONTROL PANEL OPERATIONS	19
	Switches and indicators	19
	Power indicator	
	On Line switch	
	Paper Feed switch	
	Print Pitch switch	
	NLQ Type Style switch	
	Power-up functions	23
	Short test pattern	
	Long test pattern	
	Stay in panel pitch	
	Stay in panel style	
	Hexadecimal dump	
	Switch combination functions	26
	Paper parking	
	Page feed	

	Top of form	
	Forward micro-feed	
	Reverse micro-feed	
	Left margin	
	Right margin	
	Clearing the buffer	
Chapter 3	USING THE PRINTER WITH COMMERCIAL SOFTWARE	31
	Installing your software	31
	Printer menu	
	Printer command options	
	Type styles	
	Page width	
	Initialization sequence	
	Setting the DIP switches	33
	Using your software	33
	Page alignment	
	Type style and pitch selection	
	Embedding printer commands	
Chapter 4	USING THE PRINTER WITH DOS AND BASIC	37
	Hard-copying the screen (MS DOS and PC-DOS)	37
	Programming the printer with DOS commands	38
	Programming the printer with BASIC	40
Chapter 5	MAINTENANCE AND TROUBLESHOOTING	47
	Cleaning the printer	47
	Replacing the ribbon	47
	Replacing the print head	48
	Troubleshooting	50
Appendix A	TECHNICAL SPECIFICATIONS	53
Appendix B	PRINTER CONTROL COMMANDS	59
	Font control commands	59
	Colour printing commands	64
	Character set commands	64
	Character size and pitch commands	66
	Vertical position commands	71
	Horizontal position commands	76
	Graphics commands	80
	Download character commands	82
	Macro instruction commands	85
	Other printer control commands	85

Appendix C	DOWNLOAD CHARACTER GENERATOR	89
	Draft character	
	NLQ character	
Appendix D	CHARACTER SETS	97
	Standard character set	98
	IBM character set #2	100
	IBM character set #1	102
	Additional character set	103
	International character sets	104
INDEX		105
REFERENCE CARD		Inside the cover

Chapter 1

SETTING UP THE PRINTER

Subjects covered in Chapter 1 include —

- Locating the printer
- Unpacking and inspection (names of parts)
- Setting up
- Loading single sheets
- Loading and parking fanfold forms
- Test printing
- Adjusting the printing gap
- Setting the DIP switches

LOCATING THE PRINTER

Give some thought to the best place to put the printer. Both the printer and computer should be used in a normal indoor environment. For best performance, we recommend:

- Place the printer on a flat surface.
- Keep it out of direct sunlight and away from heat-producing appliances.
- Use it only in temperatures where you are comfortable.
- Avoid locations with dust, grease, or high humidity.
- Supply it “clean” electricity. Don’t connect it to the same circuit as a large, noise-producing appliance such as a refrigerator.
- Make sure the line voltage is within 10% of the voltage specified on the identification plate.
- If you will be using fanfold forms, place the printer where the forms can feed up to it from below, with at least a full page hanging free.

UNPACKING AND INSPECTION

Check the carton contents

Open the carton and check each item in the box against Figure 1-1 to make sure that you have everything (there should be five items).

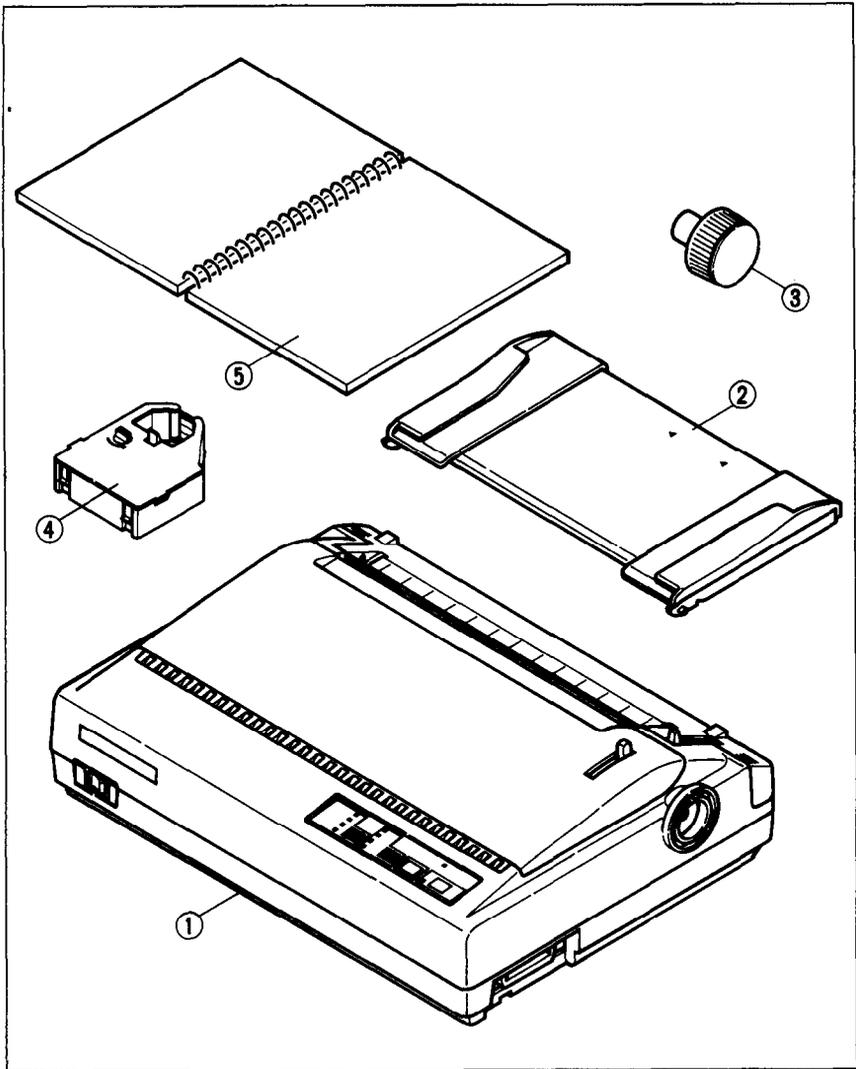


Figure 1-1. Check to make sure you have all five items: 1) Printer, 2) Paper guide, 3) Platen knob, 4) Ribbon cartridge, and 5) User's manual.

Make an external inspection of the printer. Note the locations of the following parts:

Bail lever: opens and closes the paper bail which holds the paper against the platen.

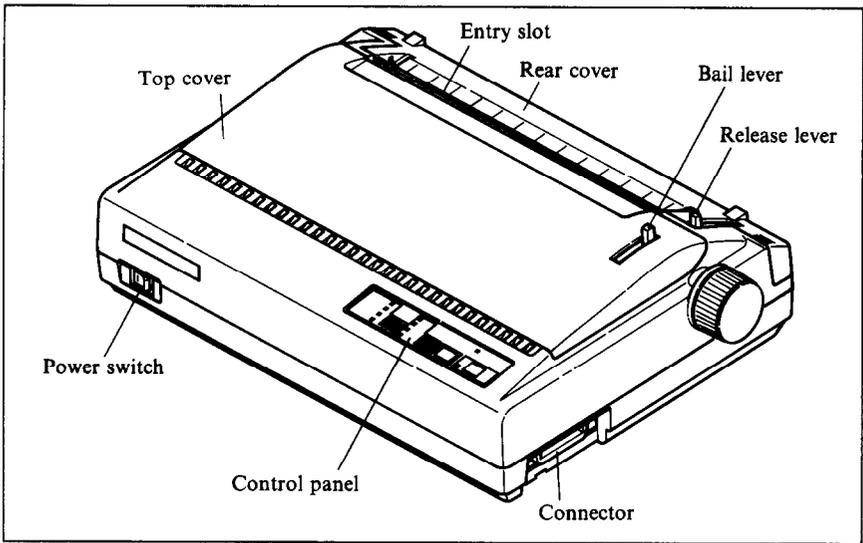


Figure 1-2. The printer's external parts

- Release lever:** releases the platen. This lever must be down for printing on single sheets, and up for fanfold forms.
- Top cover:** protects the print head and other parts.
- Rear cover:** protects the sprocket feed mechanism.
- Entry slot:** for inserting single sheets of paper.
- Control panel:** controls various printer functions.
- Power switch:** switches power on and off.
- Connector:** for connecting the computer to the printer.

SETTING UP

Mount the platen knob

The platen knob is packed into a recess of the white foam packing material which held your printer inside the packing box. Be careful to remove the knob before disposing of the packing.

Mount the platen knob on its shaft on the right side of the printer. Turn it until you can push it in all the way.

Power should always be off when you turn the platen knob. Turning the platen by hand while power is on can damage the printer's gears.

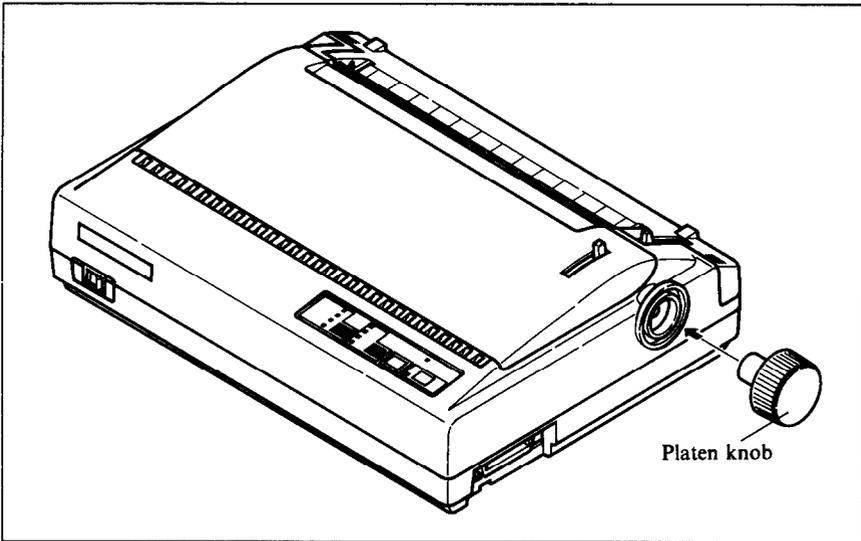


Figure 1-3. Mounting the platen knob

Remove the top cover

Lift the front edge of the printer's clear plastic top cover. Then disengage the tabs at the back of the cover and remove the cover completely.

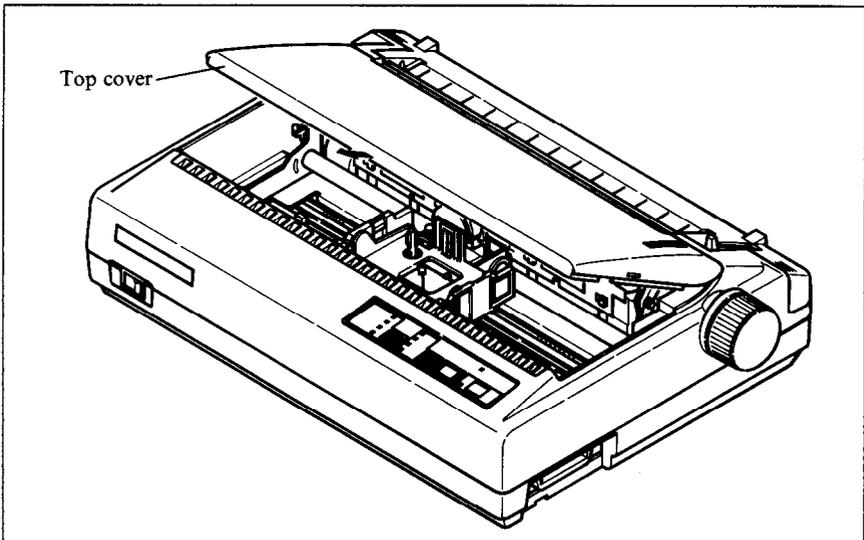


Figure 1-4. Removing the top cover

Install the ribbon cartridge

The top side of the ribbon cartridge has a handle for turning the ribbon. Turn this handle in the direction of the arrow to tighten the ribbon.

Next place the ribbon cartridge on the print head assembly, guiding the ribbon between the print head and the metal platen guard. Press down lightly on the cartridge until it locks into place.

Caution: Don't touch the brass gear on the carriage.

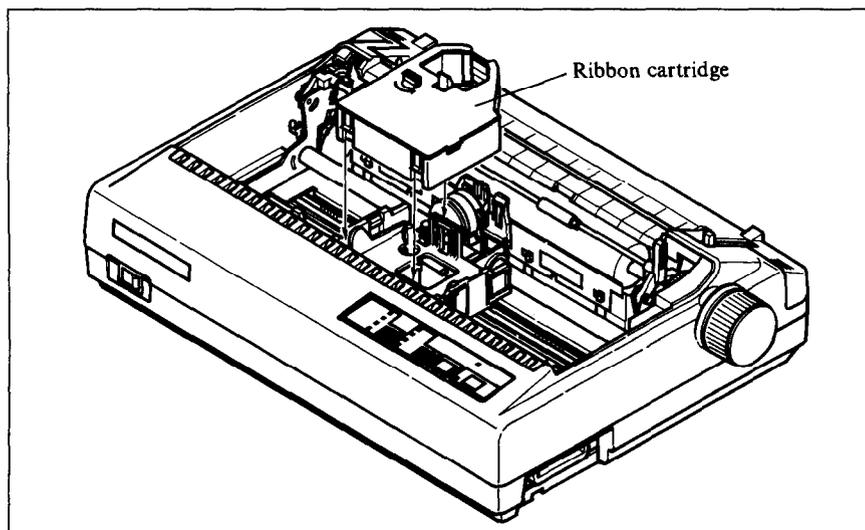


Figure 1-5. Installing the ribbon cartridge

Replace the top cover

Hold the cover upright and engage the tabs at the back. Then swing the front edge down until the cover is closed.

Leave the cover closed during normal operation. It keeps out dust and dirt and reduces the printer's operating sounds. Open the cover only to change the ribbon or make an adjustment.

Connect the printer to the computer

Connect the printer end of the interface cable to the connector socket on the right side of the printer as shown in Figure 1-6.

Make sure the computer is turned OFF, then connect the other end of the cable to your computer as described in the computer manual.

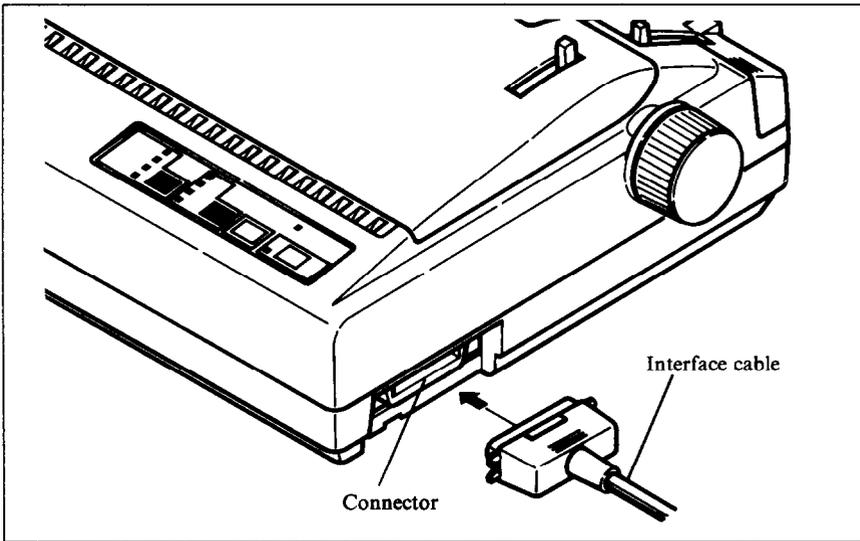


Figure 1-6. Connecting the interface cable

Connect the printer's power cord.

Check that the printer's power switch (located at the left front) is OFF. Then plug the printer's power cord into an AC wall outlet.

Never plug or unplug the power cord while the printer is turned on.

LOADING SINGLE SHEETS

This section will take you through the procedures for loading single sheets of paper.

If you are using the optional automatic sheet feeder (ASF), read the ASF instruction booklet.

Mount the paper guide

The paper guide fits into the two holes on top of the rear cover. Mount the guide and raise it to the upright position.

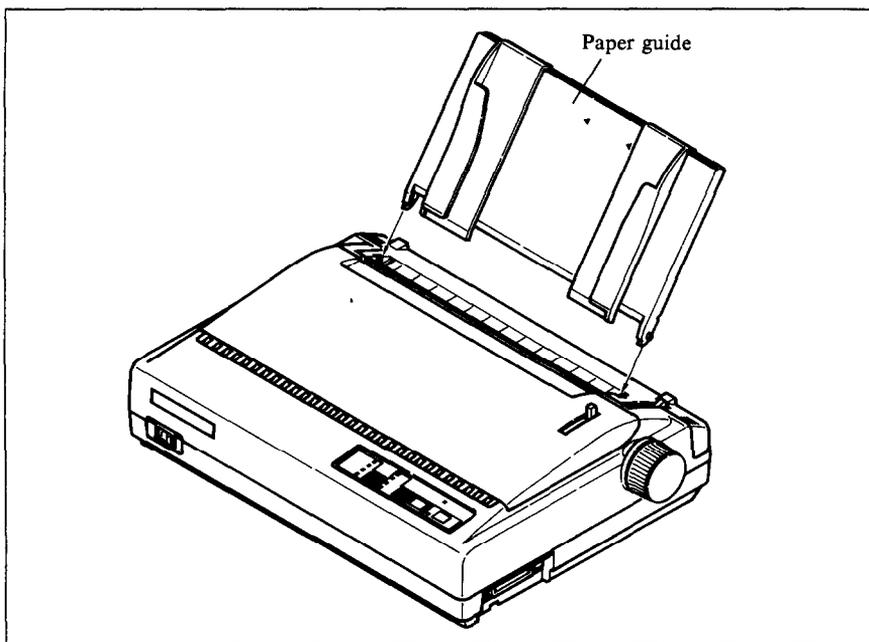


Figure 1-7. Mounting the paper guide for single sheets

Semiautomatic loading

Single sheets can be loaded manually with power off, or semiautomatically with power on. We will start the easy way with semiautomatic loading.

1. Check that the release lever is down and the bail lever back (bail closed), then switch power on. You will hear a short beep tone and the Power indicator on the control panel will flash. These are the printer's paper-out signals.
2. Place a single sheet on the paper guide and insert it down into the entry slot. You will feel a slight resistance as the paper engages the paper detector lever. Work the paper past this resistance and insert it down as far as it will go.
3. Move the bail lever forward. When the bail opens, the printer feeds the paper automatically.
4. Move the bail lever back. The paper will feed slightly forward again, ending in position to print with a top margin of about one inch.

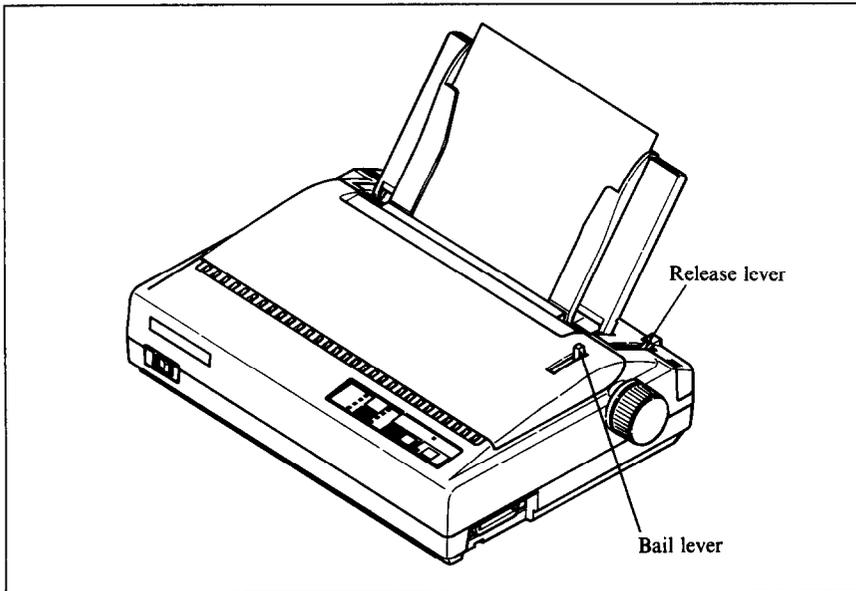


Figure 1-8. Loading a single sheet

Manual loading

It is also possible to load paper manually while the printer's power is off. The procedure is:

1. Check that printer power is off and the release lever at the back of the printer is down.
2. Insert a single sheet of paper into the entry slot as far as it will go, the same way as for semiautomatic loading.
3. Move the bail lever on top of the printer forward to open the paper bail.
4. Turn the platen knob clockwise until the front edge of the paper comes out from under the top cover.
5. If the paper is not straight, move the release lever to the up position, straighten the paper by hand, then move the release lever back down.
6. Move the bail lever back to close the paper bail.

LOADING AND PARKING FANFOLD FORMS

Fanfold forms have holes along the sides and perforations between the sheets. They are also called sprocket forms, punched forms, or just plain "computer paper". This printer accepts forms up to 10" wide. Fanfold forms are loaded, parked, and unparked as explained next.

1. Place a stack of fanfold paper behind and at least one page-length below the printer.
2. Turn the printer's power OFF.
3. Set the release lever to the up position. If there is paper in the printer, remove it. (Since the platen is released, you can just pull the paper out.)
4. Move the bail lever forward to open the bail.
5. Remove the paper guide and put it aside for the moment.
6. Remove the rear cover. Grip it by its front edge and lift upwards and backwards as in Figure 1-9.

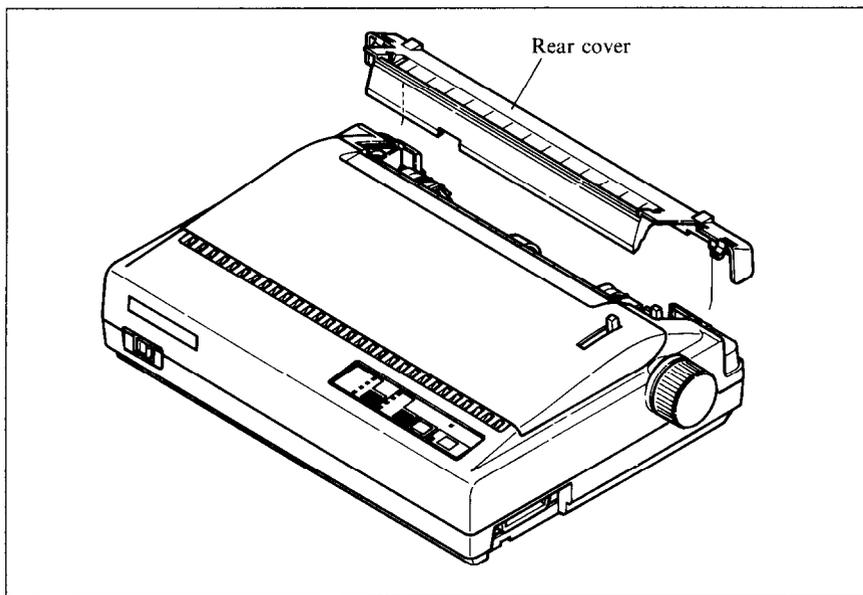


Figure 1-9. Opening the rear cover

7. Open the sprocket covers on the right and left sprocket units, as shown in Figure 1-10.
8. Flip the clamp levers down. This allows the two sprocket units to move freely right and left so you can align them with the holes in the paper.
9. Insert the front edge of the paper over the paper detector lever and tuck it in under the platen.

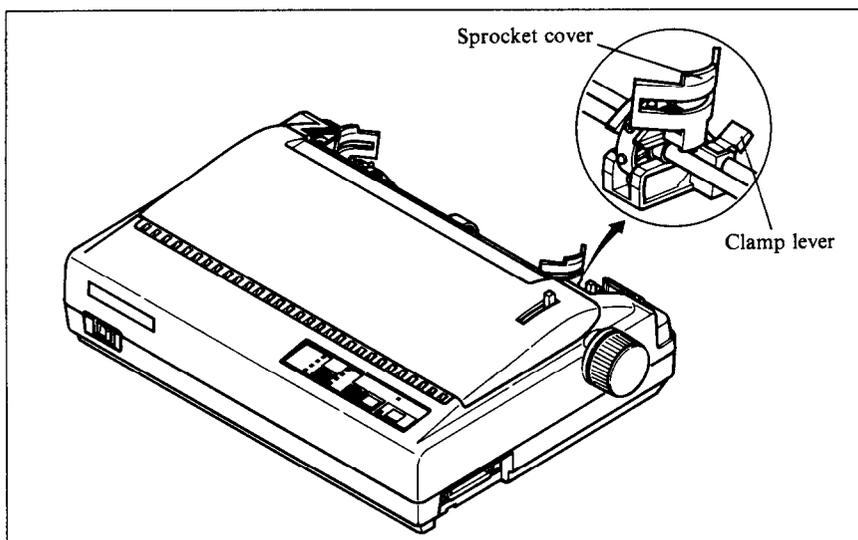


Figure 1-10. Opening the sprocket covers to expose the sprocket teeth

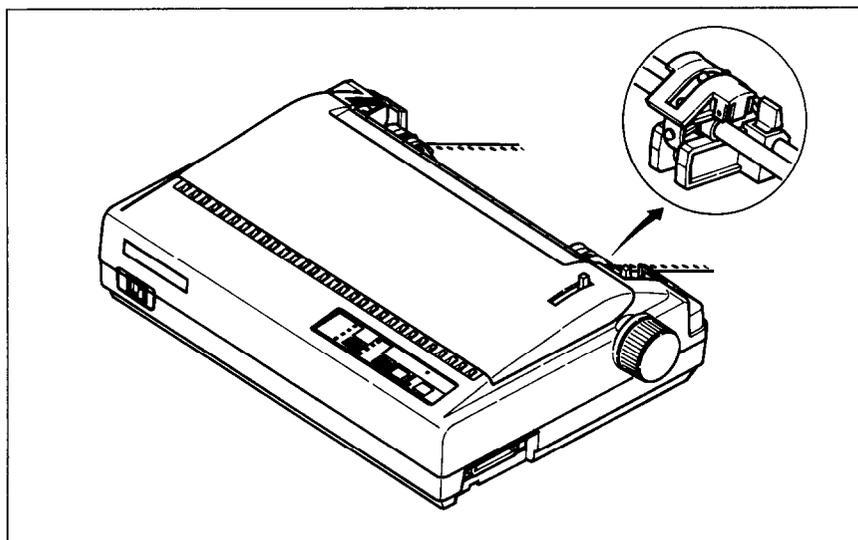


Figure 1-11. Closing the sprocket covers

10. Fit the holes in the paper over the sprocket pins. Check that the paper is even.
11. Close the sprocket covers (Figure 1-11).
12. Raise one of the clamp levers to lock one sprocket unit in place.

13. Turn the platen knob to feed the paper forward until it comes out from under the top cover.
14. Move the bail lever back to close the bail.
15. Check that the paper is feeding in flat, then raise the other clamp lever to lock the other sprocket unit.
16. Replace the rear cover. Hold it tilted upward and insert the two tabs at the bottom into their slots. Then rotate the cover forward, pressing down on the thumb pads on the left and right to snap it into place.
17. Mount the paper guide in the horizontal position shown in Figure 1-12, so that it will separate the printed from the unprinted paper.

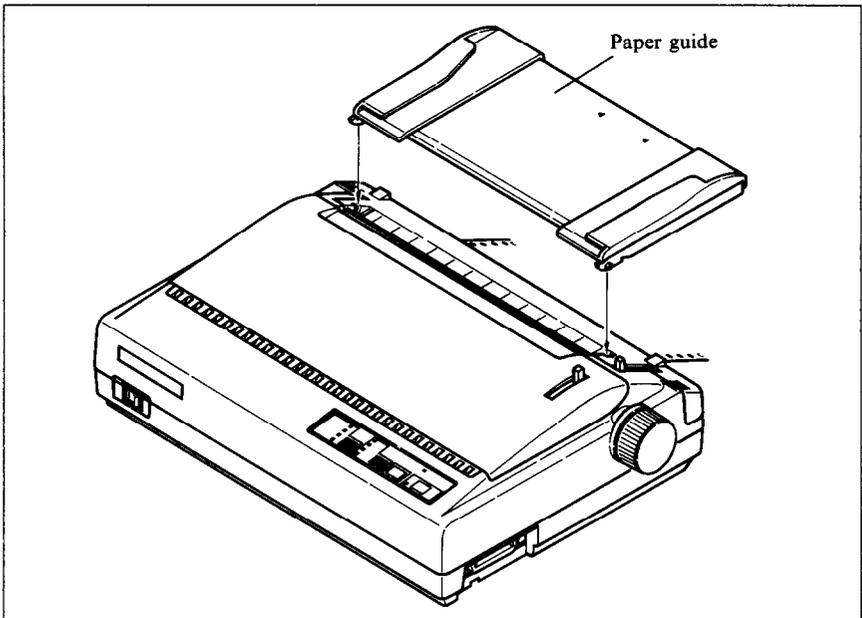


Figure 1-12. Mounting the paper guide for fanfold forms

Now you are ready to switch power on and print.

Paper parking

After loading fanfold paper, you do not have to unload it when you want to print on a single sheet. The printer will “park” it for you if you follow the procedure below.

1. Paper parking starts with power ON, fanfold paper loaded in printing position, the release lever up, and the bail lever back.
2. Press the On Line switch on the control panel to set the printer off-line (On Line indicator off).

3. Tear off the printed form at the last perforation, leaving not more than about half a page showing above the top cover. If necessary, press the Paper Feed switch to feed paper forward until a perforation is located just above the top cover, and tear there.
4. Press the Print Pitch switch on the control panel and hold it down.
5. Still holding the Print Pitch switch down, press the Paper Feed switch. The printer will automatically feed the fanfold form backward until the paper is completely free of the platen.
6. Move the release lever to the down position.
7. Mount the paper guide in the upright position.

Now you can load single sheets either semiautomatically or manually, as explained previously. The fanfold paper remains parked at the back of the printer.

When you want to resume using fanfold paper, the procedure is as follows.

Paper unparking

1. Remove all single sheets from the printer and close the paper bail.
2. Mount the paper guide in the horizontal position.
3. Move the release lever to the up position.
4. With power ON, move the bail lever forward. The printer will automatically feed the parked fanfold paper into position for printing.
5. Move the bail lever back to close the bail. Now you are ready to print.

TEST PRINTING

After loading paper, you can test the printer as described next.

Short self test

This procedure prints a seven-line "barber-pole" test pattern, each line in a different colour. The lines are eight inches wide, so the paper should be at least that wide.

1. Check that paper is in position for printing.
2. With power off, press the On Line switch on the control panel and hold it down.
3. Still holding the On Line switch down, turn the printer's power on.

The printer will automatically start printing its short test pattern. You can release the On Line switch after printing starts. To remove the paper at the end of the test, switch power OFF, then turn the platen knob. (Don't turn the platen knob while power is on.)

ADJUSTING THE PRINTING GAP

The distance between the print head and the platen can be adjusted to accommodate different paper thicknesses. To make this adjustment, remove the top cover. The adjustment lever is located near the left end of the paper bail. Pulling the adjustment lever towards you widens the gap; pushing it away from you narrows the gap.

There are four positions; you can feel the lever clicking into each position. The first position (narrowest gap) is the one most commonly used for single sheets of paper. Try different positions until you get the best printing results.

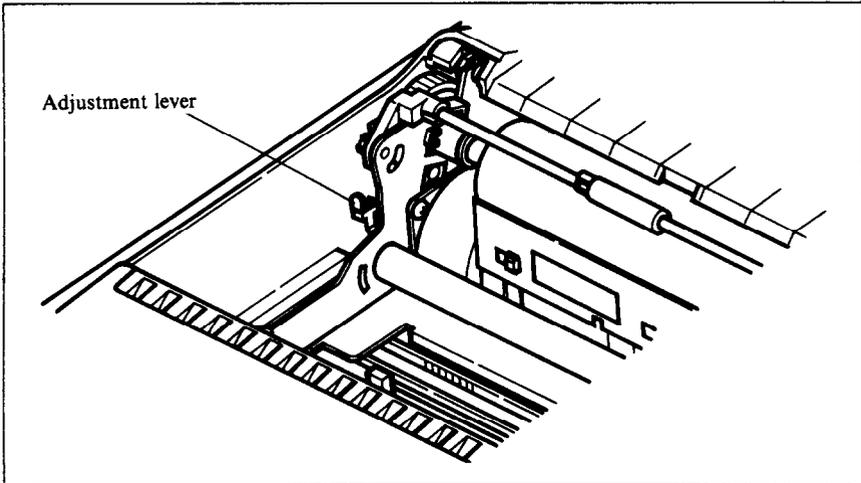


Figure 1-14. Adjusting for different thicknesses of paper

DIP SWITCH SETTINGS

When you remove the printer's cover and look inside, you will see on the green board at the bottom of the printer two groups of small switches marked DSW1 and DSW2. These are the printer's DIP (Dual In-line Package) switches. DSW1 has eight switches, named 1-1 to 1-8 from left to right. DSW2 has four switches named 2-1 to 2-4.

For all switches, the ON position is towards the back of the printer and the OFF position is towards the front. To set a DIP switch, use a ballpoint pen or other small implement to move the switch to the ON or OFF position.

The printer's power should be off when you set the DIP switches. Settings made while power is on do not take effect until power is switched off, then on again, because the printer reads the DIP switches only at power-up.

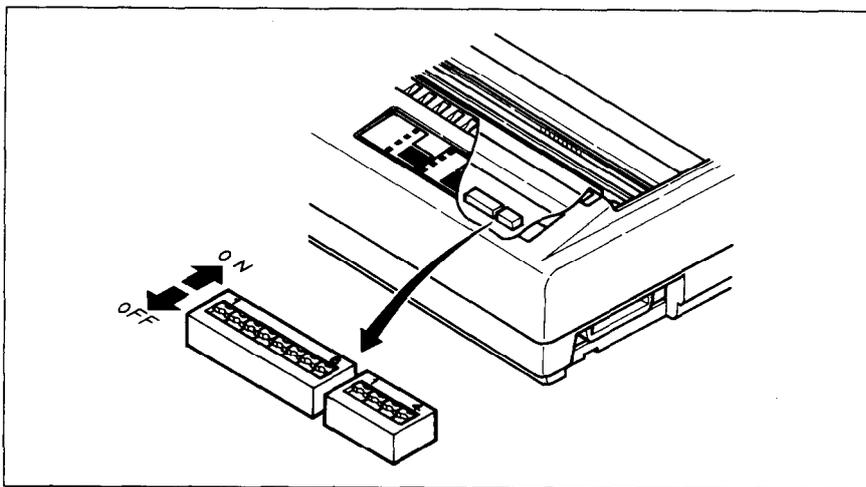


Figure 1-15. DIP switches

Switch	Function	ON	OFF
1-1	Page length	11 inches	12 inches
1-2	Auto CR	Yes	No
1-3	Orator lower case	Small caps	Lower case
1-4	Auto sheet feeder	Inactive	Active
1-5	Paper-out detector	Enabled	Disabled
1-6	Printer mode	Standard	IBM
1-7	Character set (Std. Mode)	Italics	Graphics
	Character set (IBM Mode)	Set #2	Set #1
1-8	Auto LF	No	Yes
2-1	Usage of RAM	Buffer	Download
2-2	International character set	(See below)	
2-3			
2-4			

The printer is delivered with all DIP switch set to the ON position. These are the standard settings. By changing the settings, you can alter various printer functions to match your requirements. The following questions will help you make the right settings.

Switch 1-1: Is the page length of your paper 11 inches or 12 inches?

Leave this switch ON if you will be using 11-inch forms. Move it to the OFF position if you will be using 12-inch forms.

Switch 1-2: Do you want an automatic carriage return?

Leave this switch ON. The printer will automatically perform a carriage return by moving to the left margin at each line feed. Even if your software sends a separate carriage-return code, an extra carriage return does no harm because two consecutive carriage returns are the same as one. Very few programs require this switch to be OFF.

Switch 1-3: When you select the Orator type style on the control panel, do you want lower-case letters to print as lower case (OFF) or as small capitals (ON)?

Take your pick from the samples below. Note that lower-case Orator does not have descenders for the letters g, j, p, q, and y.

ORATOR PRINTS THIS WAY WITH SWITCH 1-3 ON.
Orator prints this way with switch 1-3 OFF.

Switch 1-4: Are you going to use the automatic sheet feeder (ASF)?

To use the automatic sheet feeder, move this switch to the OFF position. Otherwise leave it ON.

Switch 1-5: Do you want the printer to stop printing about an inch from the end of the paper, or to keep printing to the bottom?

Leave this switch ON except when you need to print very close to the end of the paper. When this switch is OFF the printer ignores the paper-out detector and prints down to (and beyond) the bottom edge.

Switch 1-6: Do you want to use the printer in standard mode or IBM mode?

Select the mode compatible with your computer and software. In standard mode the printer operates like the Epson LX-800. In IBM mode it operates like the IBM Proprinter II. The ON position selects standard mode. The OFF position selects IBM mode.

Switch 1-7: The action of this switch depends on the mode chosen with switch 1-6.

If you selected standard mode, do you want italics or graphic characters?

Leave this switch ON to print italics in the standard character set. If you set this switch to the OFF position, in place of italics you will get the graphic characters, international characters, and mathematical symbols of IBM character set #2. See Appendix D, character codes 128 to 254.

If you selected IBM mode, do you want IBM character set #1 or #2?

ON selects character set #2, which is for computers with an 8-bit interface (the most common kind). OFF selects character set #1, for computers with a 7-bit interface.

Switch 1-8: Do you want an automatic line feed?

If you leave this switch at the ON position, a separate line-feed code is required to obtain a line feed.

If you move this switch to the OFF position, the printer performs both a carriage return and line feed each time it receives a carriage-return code.

Most computer systems send a line feed code, or both a carriage return and line feed, at the end of each line, so this switch should be left ON.

If you get double line spacing when you expect single spacing, or if lines overprint each other, try changing the setting of this switch.

Switch 2-1: Does your software download new characters to the printer?

To download characters this switch must be OFF. The printer then uses its RAM memory for storing character patterns and provides only a one-line print buffer. If you leave this switch ON the printer uses its RAM memory as an input buffer, allowing the computer to send data faster than the printer prints.

Switches 2-2 to 2-4: Do you want an international character set?

International character sets differ in their assignment of 14 character codes. See the character tables at the back of this manual. With the DIP switches you can select one of eight character sets as follows:

Country	2-2	2-3	2-4	Country	2-2	2-3	2-4
U.S.A.	ON	ON	ON	Denmark I *	ON	ON	OFF
France	OFF	ON	ON	Sweden	OFF	ON	OFF
Germany	ON	OFF	ON	Italy	ON	OFF	OFF
England	OFF	OFF	ON	Spain I	OFF	OFF	OFF

* Denmark/Norway when switch 1-6 is OFF and switch 1-7 is ON.

MEMO

Chapter 2

CONTROL PANEL OPERATIONS

This chapter explains how to use the control panel to:

- Pause printing
- Feed paper (fast and slow, forward and reverse)
- Select the print pitch
- Select a type style
- Print test patterns
- Prevent software from changing the panel pitch and style selections
- Print a hexadecimal dump
- Park fanfold forms
- Set the top-of-form position
- Set the left and right margins
- Clear the printer's buffer

SWITCHES AND INDICATORS

The control panel has four switches marked:

- On Line
- Paper Feed
- Print Pitch
- NLQ Type Style

The On Line, Print Pitch, and NLQ Type Style switches respond with a beep tone when pressed, and indicators beside them indicate their current status. There is also a Power indicator that lights when power is on.

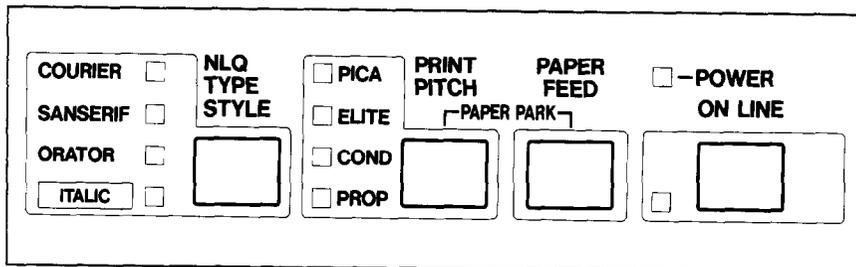


Figure 2-1. Control panel

The control panel switches can be pressed singly to perform the operations indicated by their names. Other functions can be obtained by holding these switches down when you turn the printer's power on. Still further functions can be executed by pressing the control panel switches in combination. This chapter explains all the switch and indicator functions.

Power indicator

The power indicator lights (yellow) when power is on.

When paper is not present, the power indicator flashes. A beep tone also alerts you to the need to load paper.

On Line switch

The On Line switch sets the printer on-line and off-line. The state changes each time you press the switch.

In the on-line state the printer receives data from the computer and prints the data. In the off-line state the printer stops printing and sends the computer a signal indicating that it cannot accept data.

The printer powers up in the on-line state if paper is present. If paper is not present, the printer powers up off-line with the Power indicator flashing. When you load paper the Power indicator stops flashing, but the printer remains off-line. To start printing you must press the On Line switch go on-line.

The three main times when you will want to press the On Line switch are:

- Before and after any other panel operation

The other panel switches operate only in the off-line state. First press the On Line switch to go off-line, then perform the panel operation, then press the On Line switch again to go back on-line.

- To pause during printing

If you press the On Line switch during printing, the printer stops printing and goes off-line, allowing you to check the printout or change a control panel setting. Printing resumes when you press the On Line switch again to go back on-line.

- To cut fanfold forms at the end of printing

When using fanfold forms, if you hold the On Line switch down for 2 seconds, in addition to going off-line the printer feeds the paper about two inches forward, allowing you to cut it off just below the last line printed.

When you press the On Line switch again to go back on-line, the paper feeds backward about one inch, stopping in the right place to resume printing.

Paper Feed switch

This switch operates only when the printer is off-line. If you press it once the paper feeds forward by one line. If you hold this switch down, the printer performs consecutive line feeds.

While you are feeding lines, if you also press the On Line switch, the paper will feed to the top of the next page. This is explained later.

When power is on, always use the Paper Feed switch instead of the platen knob to feed paper. Turn the platen knob only when power is off.

Print Pitch switch

This switch operates off-line to select the print pitch: the spacing between characters. The indicators to the left light (green) to indicate the selected pitch.

The printer powers up in pica pitch. To change to another pitch, press the On Line switch to go off-line, then press the Print Pitch switch repeatedly until the indicators show the pitch you want.

In Standard mode (when DIP switch 1-6 is ON), the pitch selections cycle as follows:

- Pica (10 characters per inch)
- Elite (12 characters per inch)
- Condensed pica (17 characters per inch)
- Condensed elite (20 characters per inch)
- Proportional pica
- Proportional elite

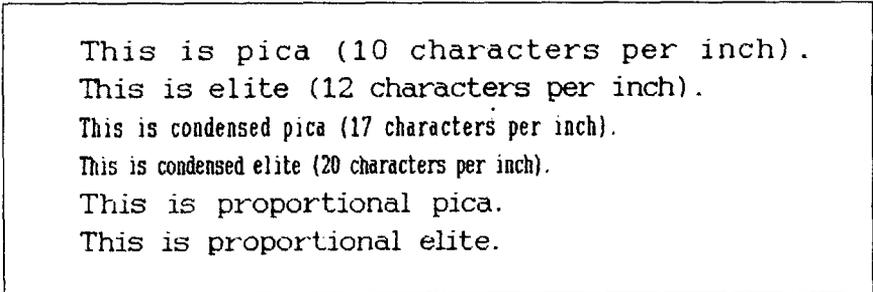


Figure 2-2. Print pitches selectable from the control panel

Samples of these pitches are shown in Figure 2-2. Note that with proportional pitch different letters occupy different widths. (For example, “i” and “l” are narrower than other letters.) Proportional pitch is attractive and space-efficient, though not always convenient when column alignment is required.

Note that you cannot select condensed proportional pitch on the control panel. You can make this selection by the printer commands <SI> <ESC> “p” 1 – see Appendix B.

In IBM mode (when DIP switch 1-6 is OFF), the pitch selections cycle as follows:

Pica	(10 characters per inch)
Elite	(12 characters per inch)
Condensed pica	(17 characters per inch)
Proportional pica	
Proportional elite	

There is no condensed elite pitch in the IBM mode.

NLQ Type Style switch

This switch selects the type style. Draft style is always selected at power-up. To change to one of the NLQ (near letter quality) styles, set the printer off-line, then press the NLQ Type Style switch repeatedly until the indicators beside the desired selection light. The selections cycle in the following order:

- Draft (all indicators off)
- Courier (NLQ)
- Courier italic (NLQ)
- Sanserif (NLQ)
- Sanserif italic (NLQ)
- Orator (NLQ)
- Orator italic (NLQ)

Samples are shown in Figure 2-3.

The Orator style is unique in two ways. First, it is a dot larger (higher) than the other styles. This makes it a good choice for labels and other text requiring high visibility. A little extra line spacing helps when Orator is used.

Second, there are two versions of the Orator type style: one prints small capitals in place of lower-case letters; the other prints lower-case letters, but without descenders. The version you get when you select Orator from the control panel depends on the DIP switches. If DIP switch 1-3 is OFF, lower-case Orator will print as lower case. Otherwise it will print as small capitals.

```

This is draft quality.
This is near-letter-quality Courier.
This is Courier italic.
This is Sanserif.
This is Sanserif italic.
THIS IS ORATOR WITH SMALL CAPITALS.
THIS IS ORATOR ITALIC WITH SMALL CAPITALS.
This is Orator with lower case.
This is Orator italic with lower case.

```

Figure 2-3. Type styles selectable from the control panel

The other type styles do not have a small-capitals option. Lower case always prints as lower case.

The type style can also be selected by printer commands given in Appendix B. Printer commands enable you to select both Orator styles, and also draft italic, which cannot be selected from the control panel.

POWER-UP FUNCTIONS

In addition to their normal functions, all the control panel switches have special functions that operate if you hold them down while switching power on.

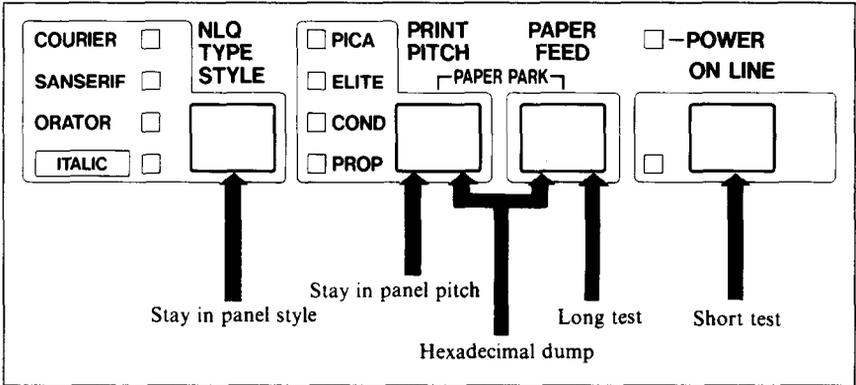


Figure 2-4. Power-up functions of control panel

Short test pattern: On Line switch

If held down during power-up, this switch prints a short test pattern (shown in Chapter 1).

Long test pattern: Paper Feed switch

If held down during power-up, this switch prints a long test pattern. The test cycles endlessly. To stop the test you must switch power off.

Stay in panel pitch: Print Pitch switch

By holding this switch down during power-up, you can prevent software interference with the print pitch selected from the control panel. You will hear an acknowledging beep as power comes on. After the beep tone, you can set the printer off-line, select a print pitch, then return to on-line and start printing. The pitch you selected will not be reset or otherwise changed by any commands your software may issue.

Stay in panel style: NLQ Type Style switch

If held down during power-up, this switch prevents software interference with the type style selected from the control panel. There will be an acknowledging beep, after which you can set the printer off-line, select a type style, then return to the on-line state and start printing. The selected type style will not be changed by any commands sent by software.

If you want to protect both the Print Pitch and NLQ Type Style settings from software changes, press both switches during power-up. There will be two acknowledging beeps.

Pressing these switches during power-up does not prevent you from making any number of changes later from the control panel.

Hexadecimal dump: Paper Feed and Print Pitch switches

This feature is useful for programmers who are debugging printing programs and want to see the actual codes the printer is receiving. (Some computers change the codes the programmer intended.)

1. Holding both the Paper Feed and Print Pitch switches down, turn power ON. A beep tone will be heard.
2. Start printing. In place of the usual printout you will get a formatted dump showing exactly what data the printer receives. Each line presents sixteen characters, their hexadecimal codes to the left and printable characters printed on the right.

- At the end of the hexadecimal dump, set the printer off-line with the On Line switch. This is necessary to print the last line.

The following BASIC program is a simple test you can run in hexadecimal mode:

```

10 FOR I=0 TO 255
20 LPRINT CHR$(I);
30 NEXT I
40 LPRINT
50 END

```

If your system passes the codes directly to the printer without changing them, you will get a printout like Figure 2-5.

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	.....
10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	.....
20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	!"#\$%&'()*+,-./
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	0123456789:;<=>?
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	@ABCDEFGHIJKLMNO
50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	PQRSTUVWXYZ[\]^_`
60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	~abcde fghijklmno
70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	pqrstuvwxyz{|}~.
80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F	.....
90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F	.....
AA	A1	A2	A3	A4	A5	A6	A7	AB	A9	AA	AB	AC	AD	AE	AF	.....
BA	B1	B2	B3	B4	B5	B6	B7	BB	B9	BA	BB	BC	BD	BE	BF	.....
CA	C1	C2	C3	C4	C5	C6	C7	CB	C9	CA	CB	CC	CD	CE	CF	.....
DA	D1	D2	D3	D4	D5	D6	D7	DB	D9	DA	DB	DC	DD	DE	DF	.....
EA	E1	E2	E3	E4	E5	E6	E7	EB	E9	EA	EB	EC	ED	EE	EF	.....
FA	F1	F2	F3	F4	F5	F6	F7	FB	F9	FA	FB	FC	FD	FE	FF	.....
OD	OA															..

Figure 2-5. Sample hexadecimal dump

Most BASICs, however, are not quite that straightforward. For example, the IBM-PC prints the following.

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	.....
0F	10	11	12	13	14	15	16	17	18	19	1B	1C	1D	1E	1F	.....
20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	!"#\$%&'()*+,-./
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	0123456789:;<=>?
40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	@ABCDEFGHIJKLMNO
50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	PQRSTUVWXYZ[\]^_`
60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	~abcde fghijklmno
70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	pqrstuvwxyz{|}~.
80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F	.....
90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F	.....
AA	A1	A2	A3	A4	A5	A6	A7	AB	A9	AA	AB	AC	AD	AE	AF	.....
BA	B1	B2	B3	B4	B5	B6	B7	BB	B9	BA	BB	BC	BD	BE	BF	.....
CA	C1	C2	C3	C4	C5	C6	C7	CB	C9	CA	CB	CC	CD	CE	CF	.....
DA	D1	D2	D3	D4	D5	D6	D7	DB	D9	DA	DB	DC	DD	DE	DF	.....
EA	E1	E2	E3	E4	E5	E6	E7	EB	E9	EA	EB	EC	ED	EE	EF	.....
FA	F1	F2	F3	F4	F5	F6	F7	FB	F9	FA	FB	FC	FD	FE	FF	.....
OD	OA															..

Figure 2-6. Sample hexadecimal dump with IBM-PC

When the IBM-PC BASIC interpreter sends hex code 0D (carriage return) it adds an extra hex 0A (line feed). Hex code 1A (end-of-file) also gets special treatment: the interpreter does not send it at all. This can cause problems in programs that generate graphics or download character data, but there is a solution. Try changing line 20 in the preceding program and adding the coding shown below.

Coding for IBM-PC with monochrome display:

```

20 GOSUB 100
100 O=INP(&H3BD) :IF O<128 THEN 100
110 OUT &H3BC,I :OUT &H3BE,5 :OUT &H3BE,4
120 RETURN

```

Coding for IBM-PC with colour adaptor:

```

20 GOSUB 100
100 O=INP(&H379) :IF O<128 THEN 100
110 OUT &H378,I :OUT &H37A,5 :OUT &H37A,4
120 RETURN

```

SWITCH COMBINATION FUNCTIONS

Several additional functions can be obtained by pressing the control panel switches in combinations.

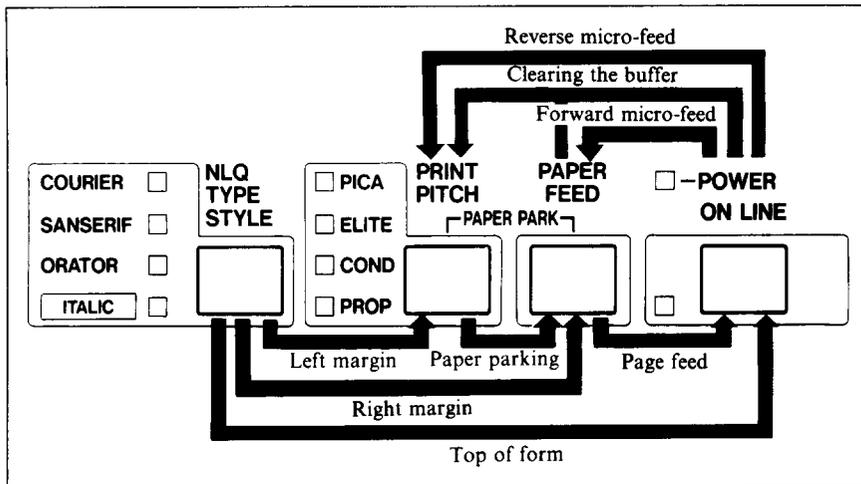


Figure 2-7. Switch combination functions of control panel

Paper parking: Print Pitch and Paper Feed switches

This procedure feeds the paper backward. It parks the fanfold form at the back of the printer so that you can switch to single-sheet feeding (by moving the release lever to the down position).

Before parking fanfold forms, tear off all but the last page, leaving less (at least three inches less) than a full page showing above the top cover.

1. Press the On Line switch to set the printer off-line.
2. Press the Print Pitch switch and hold it down.
3. Press the Paper Feed switch. The paper will be fed out backward.

Page feed: Paper Feed and On Line switches

If you are using single sheets, this operation ejects the current page. If you are using fanfold forms, it feeds to the top of the next page.

1. Press the On Line switch to set the printer off-line.
2. Press the Paper Feed switch and hold it down. The printer will start performing successive line feeds.
3. Still holding the Paper Feed switch down, press the On Line switch, then release both switches. The printer will smoothly eject the current page.

Top of form: NLQ Type Style and On Line switches

When you turn on printer power, the top-of-form position is automatically set to the current position. If this is not where you want the top of the page to be, you can change the top-of-form position as follows.

1. Press the On Line switch to set the printer off-line.
2. Move the paper to the desired top-of-form position by pressing the Paper Feed switch, or by performing a forward or reverse micro-feed.
3. Press the NLQ Type Style switch and hold it down.
4. Press the On Line switch. The printer will beep to indicate that the top-of-form position has been set.

Forward micro-feed: On Line and Paper Feed switches

For fine alignment, you can feed the paper forward in very small increments as follows:

1. Press the On Line switch to set the printer off-line.
2. Press the On Line switch again and hold it down.
3. Press the Paper Feed switch. The paper will start advancing in a series of small steps. When you want to stop, release both switches.

Reverse micro-feed: On Line and Print Pitch switches

You can also feed the paper in small increments in reverse, to return to a higher position on the same page.

Note: With fanfold forms, do not try to return to a previous page. The perforation may catch inside the printer.

1. Press the On Line switch to set the printer off-line.
2. Press the On Line switch again and hold it down.
3. Press the Print Pitch switch. The paper will start moving backwards in a series of small steps. When you want to stop, release both switches.

Left margin: NLQ Type Style and Print Pitch switches

Software almost always provides commands for controlling the margins, so you will not usually have to set them from the control panel. When necessary, however, you can set the left margin as follows.

1. Press the On Line switch to set the printer off-line.
2. Press the NLQ Type Style switch and hold it down.
3. Press the Print Pitch switch. The print head will make a short excursion from the left end, then start advancing from left to right in a series of steps, each equal to one pica character width (1/10"). When the print head reaches the desired left margin position, release both switches. The printer will beep to indicate that the margin has been set.

Right margin: NLQ Type Style and Paper Feed switches

You can also set the right margin.

1. Press the On Line switch to set the printer off-line.
2. Press the NLQ Type Style switch and hold it down.
3. Press the Paper Feed switch. The print head will travel to the right end of the carriage, then start advancing from right to left in a series of 1/10" steps. When it reaches the desired right margin position, release both switches. The printer will beep to indicate that the margin has been set.

Clearing the buffer: Print Pitch, On Line and Paper Feed switches

When DIP switch 2-1 is ON, the printer stores received data in a large memory buffer. This creates a problem when you want to abandon a printing job and restart: the printer may be holding much more data in its buffer than it has actually printed, and this unprinted data must be cleared out before restarting. Turning power off is one way to clear the buffer, but there is another way:

1. Halt the printing program on the computer. If printing stops immediately, the buffer is clear and the rest of this procedure is unnecessary. If printing does not stop, continue as follows:
2. Press the On Line switch to set the printer off-line. Printing will now stop, but there may be data remaining in the buffer.
3. Press the Print Pitch switch and hold it down.
4. Press the On Line switch and hold it down.
5. Press the Paper Feed switch and hold it down. Continue holding all three switches down. In about three seconds you will hear a beep tone signaling that the buffer has been cleared.
6. Release all three switches, make any necessary control panel settings, then set the printer back on-line.

It is essential to halt the printing program on the computer before you go off-line. Otherwise, when you go back on-line the computer will start sending data again and the printer will continue printing, with missing data where the buffer was cleared.

MEMO

Chapter 3 **USING THE PRINTER**

WITH COMMERCIAL SOFTWARE

There is an abundance of commercial software available: spreadsheet programs, word-processing programs, graphics programs, and more. This printer will work with any program that supports a Star, Epson or IBM dot-matrix printer. Before using the printer with commercial software, however, there are two things you must do:

- Install the software so that it supports the printer
- Set the printer's DIP switches to match the software

INSTALLING YOUR SOFTWARE

Most commercial software includes an installation program or routine that you can run to customize the software to fit your hardware system. Start by reading the explanation of the installation program in your software manual.

Printer menu

The installation program usually offers a menu of printers from which to choose. If you find this printer on the menu, select it.

If this printer is not listed, look for the Epson LX-800 or IBM Proprinter II. If these are not listed, look for another Star, Epson or IBM printer. A few of the choices you may see are given below in order of preference:

Star	NL-10	Epson LX-800	IBM Proprinter II
	NP-10	FX-86e	Proprinter
	NX-10/15	EX-800	Graphics Printer
	ND-10/15	LX-86	
	NR-10/15	LX-80	

Some menus are less explicit about model names but offer general descriptions such as "Star printer", "Epson printer", "IBM dot-matrix printer", "dot-matrix ASCII printer", "Centronics-type printer", "Draft printer", or "Standard printer". Any of these selections should work. If you are not sure of the right selection, it does not hurt to experiment. If you choose wrong, you will get strange printing results, but don't worry; just try a different selection. Don't pick any printer described as a daisywheel printer or laser printer.

A few installation programs may ask you not to select a printer but to describe what your printer can do. The answers to the most often asked questions are: Yes, this printer can do a backspace; and Yes, it can do a hardware form feed.

Selecting (or describing) a printer is the main step in the installation process and frequently the only step necessary. If you selected this printer or any Star, Epson or IBM printer you should be able to use software commands for all the standard printer functions, including bold or double-strike printing, underlining, subscripts, superscripts, margin control, line-spacing control, and graphics.

Printer command options

Besides the standard printer functions, however, your printer has some capabilities your software may not be aware of, including double- and quadruple-size printing and the printing of special characters assigned to control codes. Some software enables you to define these capabilities as user options in the installation process. Read your software manual to find out whether you can do this and if so, how.

The most useful thing you can do is to define a way to enter the escape code <ESC>, which is the control character with decimal character code 27 (hexadecimal 1B). This code usually cannot be keyed in directly (pressing the ESC key will not work). As an installation option, however, you may be able to assign it to a function key or a special key combination. Doing so will put the full power of the printer at your disposal.

Type styles

Some word-processing software has commands that enable you to change type styles in the middle of a document without a printing pause. To use these commands you must generally define the printer's type styles (fonts) during installation, by assigning them numbers for example. Read your software manual for details, and refer to Appendix B for the relevant printer commands.

Page width

Spreadsheet programs in particular may ask you to specify the printer's column width. The column width of this printer depends on the character pitch used:

Pica	80 columns
Elite	96 columns
Condensed pica	137 columns
Condensed elite	160 columns (Standard mode only)

The character pitch can be selected from the control panel before you start printing, or possibly by an initialization sequence as described next.

Initialization sequence

One of the installation options may be to specify the commands your software sends at the beginning of each printing job. These commands are called the "initialization sequence" or "setup string." If necessary, you can use the initialization sequence to adjust the margins to your paper size or select a particular type style or pitch. You can look up the commands you want in Appendix B.

For example, if you selected 96-column width for a spreadsheet program, it would be convenient to add an elite pitch command to the initialization sequence. Appendix B indicates that this command consists of the two characters:

<ESC> "M"

which have decimal character codes 27 and 77 (hexadecimal 1B and 4D). Your software manual or an on-screen prompt will explain how to place these codes in the initialization sequence.

SETTING THE DIP SWITCHES

After completing the installation of your software, check the setting of the printer's DIP switches, in particular DIP switch 1-6. If you selected a Star or Epson printer on the installation menu, switch 1-6 should be ON (the factory setting). If you selected an IBM printer, switch 1-6 should be OFF.

DIP switches 1-2 (auto CR), 1-7 (character set), 1-8 (auto LF), and 2-1 (RAM usage) are also related to your software. Read what your software manual has to say about carriage returns, line feeds, character sets, and downloading characters, and refer to the explanation at the end of Chapter 1.

USING YOUR SOFTWARE

With the installation and DIP switch settings correctly completed, you are ready to entrust most of the control of your printer to your software. However, there will still be some things you have to do yourself.

Page alignment

If you are printing on fanfold forms, the first thing to do before you start printing is to align the top of the forms so that printing will start at

the right position on the page, a short distance below the perforation. With power off, you can align the forms by turning the platen knob. When power is on, use the Paper Feed switch on the control panel.

Type style and pitch selection

If your software does not control the type style and pitch, you must make these selections with printer commands or panel controls. The default selections are draft style and pica pitch. To select a different style or pitch from the control panel, proceed as follows:

1. Hold the NLQ Type Style or Print Pitch switch down when you turn the printer's power on. Hold both switches down if you intend to make both settings. The printer will beep in acknowledgement as it powers up.
2. Press the On Line switch to set the printer off-line.
3. To select a type style, press the NLQ Type Style switch one or more times.
4. To select a print pitch, press the Print Pitch switch one or more times.
5. Press the On Line switch to set the printer back on-line.

Most programs begin each printing job by sending a command that resets the printer. That is why you must press the NLQ Type Style and/or Print Pitch switches as you power up. If you do not press these switches during power-up, the reset command will reset your panel selections to draft style and pica pitch.

If you want to change the type style or pitch in the middle of a printing job, one way to do this is to insert a printing pause command in your file at the point of the change. When the printer pauses, press the On Line switch to go off-line. If the change occurs in the middle of a line, the printer will print the first part of the line. Now make the change with the control panel switches, set the printer back on-line, then command your software to resume printing.

Another way is to embed printer commands in the file, as explained next.

Embedding printer commands

Many word processors and other software lack commands for changing type style, printing double-size characters, or printing in colour, and some do not even support bold printing or italics. The printer therefore has commands that can be embedded in documents to control these functions without software help. The commands consist of a capital letter enclosed in double parentheses, followed by a digit:

Type style (Font): ((F))0 Courier
((F))1 Sanserif
((F))2 Orator with small capitals
((F))3 Orator with lower case
((F))9 Draft

Size: ((S))0 Standard size
((S))1 Double width
((S))2 Double height
((S))3 Double width and height

Colour: ((C))0 Black
((C))1 Red
((C))2 Blue
((C))3 Violet
((C))4 Yellow
((C))5 Orange
((C))6 Green

Bold: ((B))0 Non-bold
((B))1 Bold

Italic: ((I))0 Non-italic
((I))1 Italic

If you want to print a title in double-size Orator with small capitals, then change to regular-size Courier for some text that includes italics, you can use these commands as follows:

File as seen on computer screen:

```
((F))2 ((S))3  
Printer Commands  
((F))0 ((S))0  
Type style, size, colour, bold print, and  
((I))1italic ((I))0commands can be embedded  
((I))1anywhere ((I))0in a document.
```

Printout:

PRINTER COMMANDS

Type style, size, colour, bold print, and
italic commands can be embedded
anywhere in a document.

When you use these commands there are several points to note:

- The type style ((F)) and italic ((I)) commands are ignored if the NLQ Type Style switch was held down when power was switched on.
- The bold command ((B))¹ gives double-strike printing. In draft mode you may prefer to use emphasized printing, which requires a software command or escape sequence.
- A line consisting of commands alone prints as a blank line.
- Software does not know that these commands are commands, so you cannot trust your software to give you the correct line width. The printed line may be considerably shorter than the line on the screen; the missing space is the space that was occupied by the commands.

One way to handle the last problem is to prepare your document without the commands, then insert them as a final step, with the margins released. The find, replace, and copy functions of word-processing software can be helpful here.

If you do not use these commands or the panel controls, the printer will print standard-size, black, draft, non-bold, non-italic characters.

The printer supports various commands in addition to the above, such as quadruple-size printing. Most of these other commands consist of the escape code followed by one or more letters or numbers. If your software enables you to place the escape code in your files, or if you were able to define this as a user option during installation, you can also embed these escape sequences. See Appendix B for further details.

After printing the first page of a long job, you may want to pause to check that the printing is correctly formatted. Press the On Line switch, setting the printer off-line. Printing will stop immediately. To resume printing, press the On Line switch again.

If you need to abandon a printing job before it is finished, your software should provide a command for this purpose. Another simple expedient is to switch the printer's power off.

Chapter 4 **USING THE PRINTER** **WITH DOS AND BASIC**

Although you will probably do most of your printing with the aid of commercial software, at times you will want to employ direct commands or programs of your own. This chapter will give you some ideas. Three subjects are covered:

- Hard-copying the screen
- Programming the printer with DOS commands
- Programming the printer with BASIC

HARD-COPYING THE SCREEN (MS-DOS AND PC-DOS)

If your computer has a PRTSC (or PrtSc) key, there is an easy way to get hard copy of the screen. Press the SHIFT and PRTSC keys. The printer will print the current screen contents. The PRTSC key works both at the system command level and while you are running application software.

Normally the PRTSC key prints only text data, but if your DOS system includes a file named GRAPHICS.COM, you can hard-copy graphics displays, by first typing the command:

A>GRAPHICS

You will find that graphics printing takes considerably more time than text printing. See your DOS manual for further information on the GRAPHICS command.

At the DOS command level, there is also a simple way to have the printer print hard copy continuously, instead of one screen at a time. Press the CTRL key, hold it down, then also press the PRTSC key. If your computer does not have a PRTSC key, press the CTRL and P keys. Nothing visible will happen, but you have just switched on the print-screen function. After this, the printer will hard-copy all text displayed. For example, try typing the directory command:

A>DIR

You will obtain a printed directory.

To switch printer output off, press CTRL-PRTSC or CTRL-P again. Each time you press this key combination, hard copy toggles from on to off or from off to on.

PROGRAMMING THE PRINTER WITH DOS COMMANDS

If your system includes the file PRINT.COM you can use the main DOS printing command. Simply type the word PRINT followed by the name of the file you want to print. To print a file named README.DOC, for example, type:

```
A>PRINT README.DOC
```

The computer may respond with the following message, asking which printer to use:

```
Name of list device [PRN]:
```

If your computer is connected to only one printer, press RETURN to select the default choice (PRN). Printing will begin and the A > prompt will reappear. You can execute other commands or programs while the file is being printed.

A single PRINT command can print two or more files. List the file names consecutively on the same line, or use wild-card characters (* and ?). Each file will be printed starting on a new page. The PRINT command also has control options. For example, you can terminate a printing job in progress with the /T option. (The printer may not stop printing immediately; it may have considerable data stored ahead in its buffer.) For the /T option, type:

```
A>PRINT/T
```

See your DOS manual for further information about the PRINT command. If your system does not include PRINT.COM, you can print files by using the PRN device name in COPY or TYPE commands such as the following:

```
A>COPY README.DOC PRN
```

```
A>TYPE README.DOC > PRN
```

COPY and TYPE do not permit you to execute other commands while the file is printing.

If you want a particular type style, print pitch, or right or left margin, you can make these settings from the control panel before you start printing. See Chapter 2.

If you print from the DOS command level very often, it will be advantageous to create a printer setup file. Then instead of setting margins etc. manually each time, you can complete the setup with a single command from your computer. For example, you can create a file containing printer commands to set the right and left margins, select near letter quality, and select elite pitch. You can find the commands in Appendix B. We suggest the following:

- Near letter quality <ESC> "x" "1"
- Elite pitch <ESC> "!" <1>
- Left and right margins <ESC> "X" <12> <92>

<ESC> "!" <1> is a powerful command that, in addition to selecting elite pitch, cancels unwanted features such as underlining which might be left from previous commands. The angle brackets around the <1> indicate character code 1, which is a control code, not the printable digit "1".

<ESC> "X" <12> <92> sets the left margin in column 12 and the right margin in column 92. This will give a 6.7-inch, 80-column printed line with a one-inch left margin. (Elite has 12 characters per inch). <12> is a control code; <92> is the character "\", as you can verify in Appendix D.

You may want to place additional commands in this file, such as line spacing and bottom margin commands. Or you may want to create a variety of setup files with a different set of commands in each.

To avoid excess line feeds, you should place the commands on one line in the setup file. You may or may not be able to generate a setup file with word-processing software; it depends on whether your software lets you enter control codes. If your system includes the file EDLIN.COM, however, you can easily create a setup file with the DOS line editor.

An appropriate name for this setup file would be NLQELITE.DAT. To use the DOS line editor, type the command EDLIN NLQELITE.DAT, then type the underlined parts of the following display. Press RETURN at the end of each line. Don't type the symbol "^". This symbol means to hold the CTRL key down while pressing the next key: for example, ^V means to type CTRL-V. ^C means to type CTRL-C, which indicates the end of the input.

```
A>EDLIN NLQELITE.DAT
New file
```

*I

```
1: *^V[x1^V[!^VA^V[X^VL\  
2: *^C
```

*E

^V indicates that the following character is a control code. ^V[enters the <ESC> code. <ESC> has character code 27, and “[” is the 27th character in ASCII sequence from A. Similarly, ^VA enters the control code <1> and ^VL enters the control code <12>. See your DOS manual if you need further information about EDLIN.

You can now set up the printer by sending it the file NLQELITE.DAT. To avoid unnecessary logging of commands, switch hard-copy output off (by pressing CTRL-PRTS if hard copy is on). To print the file README.DOC in NLQ elite type, give the following two commands:

```
A>COPY NLQELITE.DAT PRN  
A>PRINT README.DOC
```

For greater convenience you can make a batch file that will set up the printer and print any specified file with a single command. To create such a batch file with the name NLQPRINT.BAT, type in the first four lines shown next. ^Z means to press the CTRL and Z keys simultaneously. To use this file to print README.DOC, type the fifth line.

```
A>COPY CON NLQPRINT.BAT  
COPY NLQELITE.DAT PRN  
PRINT %1  
^Z  
A>NLQPRINT README.DOC
```

The first above line is a copy command from the CONsole screen to a file named NLQPRINT.BAT. The next two lines are the contents of this file. The %1 is a dummy parameter: whatever file name you type after NLQPRINT will be substituted for %1 and printed.

PROGRAMMING THE PRINTER WITH BASIC

As an example of programming the printer in Microsoft BASIC, we have listed the program for the IBM-PC that printed the sample on the foldout inside the back cover. This program runs in the printer's Standard mode (DIP switch 1-6 ON).

You will note that this program avoids the printer's double-parenthesis commands. To change colours, for example, it uses the escape sequence E\$; "r"; CHR\$(n), where E\$ is predefined as CHR\$(27), instead of the equivalent command ((C))n. The double-parenthesis commands are great for embedding in documents, but they are less convenient in programs. In their simplest form they cannot be listed; instead of listing them, the printer executes them.

```

1000 ' Set control codes
1010 E$=CHR$(27)           'Escape code
1020 D$=E$+"x0"           'Draft quality
1030 N$=E$+"x1"           'Near letter quality
1040 C$=E$+"k0"+N$        'Courier
1050 S$=E$+"k1"+N$        'Sanserif
1060 O1$=E$+"k2"+N$       'Orator with small capitals
1070 O2$=E$+"k3"+N$       'Orator with lower case
1080 H$=CHR$(9)           'Horizontal tab
1090 P$=E$+"P"           'Pica pitch
1100 ' Start printing
1110 WIDTH "LPT1:",255
1120 LPRINT E$;"D";CHR$(3);CHR$(20);CHR$(0) 'Set HT
1130 LPRINT C$;"Type styles are:"
1140 LPRINT H$;D$;"Draft characters, "
1150 LPRINT H$;C$;"Courier characters,"
1160 LPRINT H$;S$;"Sanserif characters,"
1170 LPRINT H$;O1$;"Orator with small capitals, or "
1180 LPRINT H$;O2$;"          with lower case characters,"
1190 LPRINT E$;"4";           'Select italics
1200 LPRINT H$;O2$;"and ";O1$;"italics ";S$;"for ";
1210 LPRINT C$;"all ";D$;"styles."
1220 LPRINT E$;"5"           'Cancel italics
1230 LPRINT C$;"Print pitches are:"
1240 LPRINT H$;P$;"Pica pitch, ";
1250 LPRINT H$;E$;"M";"Elite pitch,"
1260 LPRINT H$;CHR$(15); 'Condensed pitch
1270 LPRINT P$;"Condensed pica pitch, ";
1280 LPRINT H$;E$;"M";"Condensed elite pitch, ";
1290 LPRINT P$;           'Pica pitch
1300 LPRINT CHR$(18)       'Cancel condensed print
1310 LPRINT H$;E$;"p1"; 'Select proportional spacing
1320 LPRINT "Proportional spacing for all pitches,"
1330 LPRINT E$;"p0"       'Cancel proportional spacing
1340 LPRINT H$;E$;"w1";"Expanded, ";E$;"w0";
1350 LPRINT E$;"w1";"Double-height, ";E$;"w0"
1360 LPRINT H$;E$;"h";CHR$(1);"Double-sized, "
1370 LPRINT H$;E$;"h";CHR$(2);"Quad-sized.";
1380 LPRINT E$;"h";CHR$(0)
1390 LPRINT :LPRINT :LPRINT
1400 LPRINT C$;"Colour printing:"

```

```

1410 LPRINT
1420 LPRINT H$;E$;"w1";E$;"r";CHR$(1);"RED,  ";
1430 LPRINT E$;"r";CHR$(2);"BLUE,  ";
1440 LPRINT E$;"r";CHR$(3);"VIOLET,  ";
1450 LPRINT E$;"r";CHR$(4);"YELLOW,"
1460 LPRINT
1470 LPRINT H$;E$;"r";CHR$(5);"ORANGE,  ";
1480 LPRINT E$;"r";CHR$(6);"GREEN,  ";
1490 LPRINT E$;"r";CHR$(0);"and  BLACK."
1500 LPRINT E$;"w0"
1510 LPRINT E$;"Q";CHR$(47) 'Set right margin
1520 LPRINT C$;"Various line and character spacings:"
1530 LPRINT E$;"a1"      'Center text
1540 FOR I=1 TO 7
1550 LPRINT E$;"A";CHR$(I); 'Set line spacing
1560 LPRINT E$;" " ;CHR$(I); 'Increase character space
1570 LPRINT E$;"r";CHR$(I-1); 'Select colour
1580 LPRINT "THE SPACING HAS CHANGED"
1590 NEXT I
1600 FOR I=7 TO 1 STEP -1
1610 LPRINT E$;"A";CHR$(I);
1620 LPRINT E$;" " ;CHR$(I);
1630 LPRINT E$;"r";CHR$(I-1);
1640 LPRINT "THE SPACING HAS CHANGED"
1650 NEXT I
1660 LPRINT E$;"a0"      'Left justify
1670 LPRINT E$;"3";CHR$(36); 'Set 1/6" line spacing
1680 LPRINT E$;" " ;CHR$(0); 'Normal character space
1690 LPRINT :LPRINT
1700 LPRINT C$;"Other features:"
1710 LPRINT H$;E$;"E";"Emphasized";E$;"F";",, ";
1720 LPRINT E$;"G";"Double-strike";E$;"H";",, "
1730 LPRINT H$;E$;"-1";"Underlining";E$;"-0";",, ";
1740 LPRINT E$;"_1";"Overlining";E$;"_0";",, "
1750 LPRINT H$;E$;"S0";"SUPERSCRIPT";E$;"T";",, ";
1760 LPRINT E$;"S1";"SUBSCRIPT";E$;"T";",, "
1770 GOSUB 2130
1780 LPRINT H$;C$;"Download characters: ";
1790 LPRINT D$;E$;"%1";      'Select download character
1800 FOR I=1 TO 7
1810 LPRINT E$;"r";CHR$(I-1); 'Change colour
1820 LPRINT CHR$(60);      'Print download character
1830 NEXT I
1840 LPRINT E$;"%0";      'Select normal character
1850 GOSUB 2230
1860 LPRINT C$;E$;"%1";      'Select download character
1870 FOR I=1 TO 7
1880 LPRINT E$;"r";CHR$(I-1); 'Change colour
1890 LPRINT CHR$(60);      'Print download character
1900 NEXT I

```

```

1910 LPRINT E$;"r";CHR$(0);
1920 LPRINT E$;"%0" 'Select normal character
1930 LPRINT H$;C$;"Dot graphics:";
1940 DIM LOGO$(4)
1950 RESTORE 2450
1960 FOR ROW=1 TO 4
1970 FOR COL=1 TO 100
1980 READ DG
1990 LOGO$(ROW)=LOGO$(ROW)+CHR$(DG)
2000 NEXT COL
2010 NEXT ROW
2020 LPRINT E$;"A";CHR$(8); 'Set 8/72" line spacing
2030 FOR ROW=1 TO 4
2040 LPRINT H$;H$;
2050 LPRINT E$;"*";CHR$(0); 'Select normal density
2060 LPRINT CHR$(100);CHR$(0);
2070 LPRINT LOGO$(ROW)
2080 NEXT ROW
2090 LPRINT E$;"@" 'Initialize printer
2100 END
2110 '
2120 ' SUBROUTINES
2130 ' Define draft download character
2140 LPRINT D$;E$;";";CHR$(0);CHR$(0);CHR$(0);
2150 LPRINT E$;"&";CHR$(0);CHR$(60);CHR$(60);
2160 RESTORE 2340
2170 FOR M=0 TO 11
2180 READ MM
2190 LPRINT CHR$(MM);
2200 NEXT M
2210 RETURN
2220 '
2230 ' Define NLQ download character
2240 LPRINT C$;E$;";";CHR$(0);CHR$(0);CHR$(0);
2250 LPRINT E$;"&";CHR$(0);CHR$(60);CHR$(60);
2260 RESTORE 2380
2270 FOR M=0 TO 46
2280 READ MM
2290 LPRINT CHR$(MM);
2300 NEXT M
2310 RETURN
2320 '
2330 ' DATA
2340 ' Draft download character data
2350 DATA 139,124, 0, 66, 4, 64, 36, 16, 2, 16
2360 DATA 12, 0
2370 '
2380 ' NLQ download character data
2390 DATA 128, 14, 16, 38, 1, 70, 1, 70, 0,126
2400 DATA 0, 0, 70, 0, 38, 0, 22, 9, 6, 9

```

```

2410 DATA 6, 8, 6, 0, 28, 32, 14, 64, 14, 0
2420 DATA 14, 0,124, 0, 0, 12, 64, 12, 32, 14
2430 DATA 16, 14, 0, 14, 0, 12, 0
2440
2450 ' Dot graphics data
2460 DATA 0, 0, 0, 0, 1, 3, 7, 7, 7, 15
2470 DATA 14, 14, 14, 14, 14, 7, 7, 3, 3, 15
2480 DATA 15, 15, 0, 0, 0, 0, 0, 0, 0, 0
2490 DATA 0, 1, 3, 3, 7, 7, 15, 14, 14, 14
2500 DATA 14, 15, 7, 7, 7, 3, 0, 0, 0, 0
2510 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2520 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2530 DATA 1, 3, 7, 7, 7, 15, 14, 14, 14, 14
2540 DATA 14, 7, 7, 3, 3, 15, 15, 15, 0, 0
2550 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2560 DATA 0, 0, 60,255,255,255,255,255,143, 15
2570 DATA 7, 7, 7, 7, 3, 3, 3,131,193,241
2580 DATA 240,240, 0, 0, 0, 0, 0, 0, 0, 1
2590 DATA 121,253,253,255,255,255,143, 7, 7, 7
2600 DATA 31,253,252,248,248,240,192, 0, 7, 15
2610 DATA 31, 31, 15, 7, 3, 0, 0, 0, 0, 0
2620 DATA 0, 0, 0, 0, 0, 0, 0, 0, 60,255
2630 DATA 255,255,255,255,143, 15, 7, 7, 7, 7
2640 DATA 3, 3, 3,131,193,241,240,240, 0, 0
2650 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2660 DATA 0, 31, 31, 3,129,128,192,192,192,192
2670 DATA 192,224,224,224,224,240,255,255,255,255
2680 DATA 255,127, 0, 0, 0, 0, 63,127,255,255
2690 DATA 255,255,193,128,128,128,128,192,224,240
2700 DATA 252,255,255,255,127, 63, 31, 7, 7, 31
2710 DATA 254,252,248,224,128, 0, 0, 3, 7, 7
2720 DATA 7, 3, 0, 0, 0, 0, 0, 31, 31, 3
2730 DATA 129,128,192,192,192,192,192,224,224,224
2740 DATA 224,240,255,255,255,255,127, 0, 0
2750 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
2760 DATA 0,248,248,240,224,224,112,112, 56, 56
2770 DATA 56, 56, 56,120,120,240,240,224,224,192
2780 DATA 128, 0, 0, 0, 0, 0,192,224,240,240
2790 DATA 240,248,248,248,120,120, 56, 56, 56, 56
2800 DATA 48,112,224,224,224,224,240,240,248,248
2810 DATA 120,120, 56, 56, 56, 56,120,240,224,224
2820 DATA 192,128, 0, 0, 0, 0, 0,248,248,240
2830 DATA 224,224,112,112, 56, 56, 56, 56, 56,120
2840 DATA 120,240,240,224,224,192,128, 0, 0, 0
2850 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 0

```

How the program works

This program begins by assigning a number of printer commands to BASIC string variables (lines 1000 to 1090). You can find most of these commands near the beginning of Appendix B.

The WIDTH "LPT1:" 255 statement in line 1110 means infinite line width. It prevents the IBM-PC from inserting unwanted carriage returns and line feeds in graphics data.

Actual printing begins in line 1120. Using the preassigned commands, the program prints samples of its different type styles, including a line showing all styles in italics, followed by samples of the print pitches, then some double-size, quadruple-sized, and colour printing.

Next comes the central attraction of the program: a line of text printed fourteen times in expanding and contracting loops to give a multicoloured barrel effect. The work is done by five printer commands: a command setting the right margin (line 1510); a centering command (line 1530); a command to vary the line spacing (lines 1550 and 1610); a command to micro-adjust the space between characters (lines 1560 and 1620); and a colour command (lines 1570 and 1630).

Next the program returns to normal spacing and gives a demonstration of the printer's word-processing abilities: bold printing, underlining, subscripts, etc.

The row of automobiles in the next printed line is created by downloading two new character patterns, which are printed in place of the character "<" (character 60). Details can be found in Appendix C.

The final part of the program uses dot graphics to print an "S&S" logo. The dot pattern of the logo was originally laid out on graph paper, then converted to the data in lines 2460 to 2850 with the help of a calculator. Each number represents eight vertical dots. (See "Graphics Commands" in Appendix B for details. See also Figure C-1 in Appendix C.)

The pattern is printed in four rows, each eight dots high and 100 dots wide. Lines 1940 to 2010 read the dot data into a string array variable named LOGO\$. Line 2020 sets the line spacing to 8/72 inch so that the rows will connect vertically. The loop in lines 2030 to 2080 does the printing in four passes of the print head.

This program can also be run in IBM mode (DIP switch 1-6 OFF) if you change a few of the lines as shown below to allow for differences in some of the commands. You will get a cylinder instead of a barrel effect, because the IBM mode does not have any command to micro-adjust the character spacing.

Modifications for IBM mode:

```
1090 P$=CHR$(18)           'Pica pitch
1190 LPRINT CHR$(28);"4"; 'Select italics
1220 LPRINT CHR$(28);"5"; 'Cancel italics
1280 ' LPRINT H$;E$;"M";"Condensed elite pitch,";
```

```
1510 LPRINT CHR$(28);"Q";CHR$(47) 'Set right margin
1550 LPRINT E$;"A";CHR$(I);E$;"2"; 'Set line spacing
1560 ' LPRINT E$;" ";CHR$(I); 'Increase character space
1610 LPRINT E$;"A";CHR$(I);E$;"2";
1620 ' LPRINT E$;" ";CHR$(I);
2020 LPRINT E$;"A";CHR$(8);E$;"2"; 'Set 8/72" spacing
2140 LPRINT D$;CHR$(28);":";CHR$(0);CHR$(0);CHR$(0);
2240 LPRINT C$;CHR$(28);":";CHR$(0);CHR$(0);CHR$(0);
2250 LPRINT E$;"&";CHR$(0);CHR$(60);CHR$(60);
```

Chapter 5 **MAINTENANCE** **AND TROUBLESHOOTING**

Subjects covered in Chapter 5 include —

- Cleaning the printer
- Replacing the ribbon
- Replacing the print head
- Troubleshooting

Dust and heat will make any mechanism wear more quickly. The best maintenance is preventive, and the first step is correct location of the printer. This is covered in greater detail in Chapter 1, but in general an environment comfortable for humans is best for both the computer and the printer.

CLEANING THE PRINTER

Cleaning the printer regularly will prolong its service life. Use a damp cloth on the exterior every week or so. For stubborn dirt, you may moisten the cloth with alcohol or water containing a mild detergent, but be careful not to spill any liquid into the interior of the printer.

Use a soft brush to remove paper dust and lint from the interior. A small vacuum cleaner can also make this task easier, but be very careful not to bend or injure any electronic parts or wiring. The printer contains delicate electronic parts, so only clean those places where you have easy access.

REPLACING THE RIBBON

The printer uses an endless-type colour ribbon cartridge in which the ribbon is recycled automatically. When the print becomes faint, it is time to replace the ribbon cartridge.

To remove the old cartridge, take off the top cover and press the ribbon release catch toward you with your index finger. Once the ribbon is free of the print head, the cartridge lifts out easily. To fit the new cartridge, guide the ribbon between the print head and the metal platen guard, then set the cartridge in place on the carriage and press down lightly. The release catch will lock automatically. See Figure 5-1.

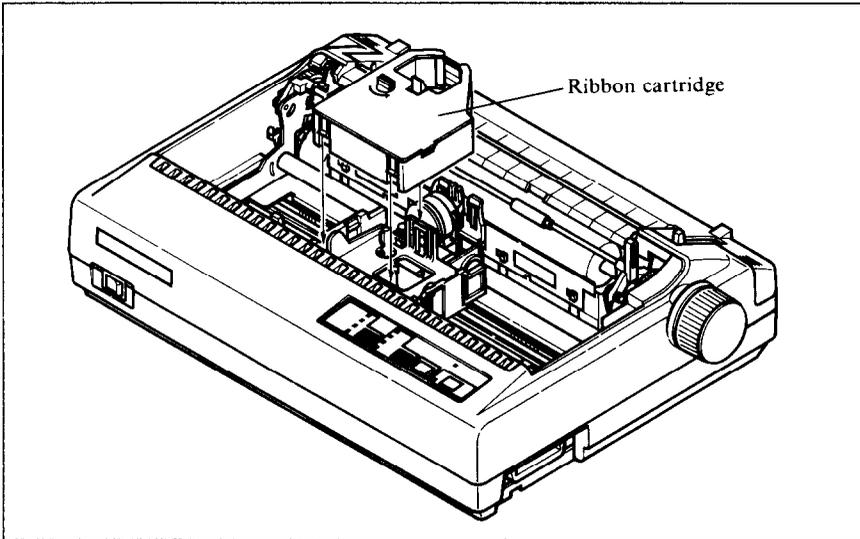


Figure 5-1. Replacing the ribbon cartridge

REPLACING THE PRINT HEAD

The dot matrix print head has a life of about 200 million dots, or years of normal use. When printing is too light even after replacing the ribbon, you'll know that the print head has reached the end of its service life. To replace the print head, follow the procedure below.

As you remove the old print head, note carefully how the cable is threaded, so that you can thread the new cable in the same way.

Caution: When replacing the print head, be careful not to touch the brass gear on the carriage.

Warning: The print head becomes hot during operation. If you have been using the printer, wait awhile so that the print head can cool off.

1. Turn power OFF and unplug the power cord.
2. Remove the top cover and ribbon cartridge.
3. Move the print head carriage toward the right until you can see the connector cover. Remove the connector cover and pull the cable free from the connector.
4. Remove the gear cover by pushing the fulcrums on both sides. At this time, take care not to lose the spring.
5. Unscrew the two screws that hold the print head in place and set them aside.

6. Disengage the cable from the tabs holding it down, then remove the print head.
7. For easy installation of the new print head, move the carriage toward the left end of the rail.
8. Place the new print head on its support, seating it on the two pins.
9. Thread the new cable the same way as the old, securing it under the tabs on the print head carriage.

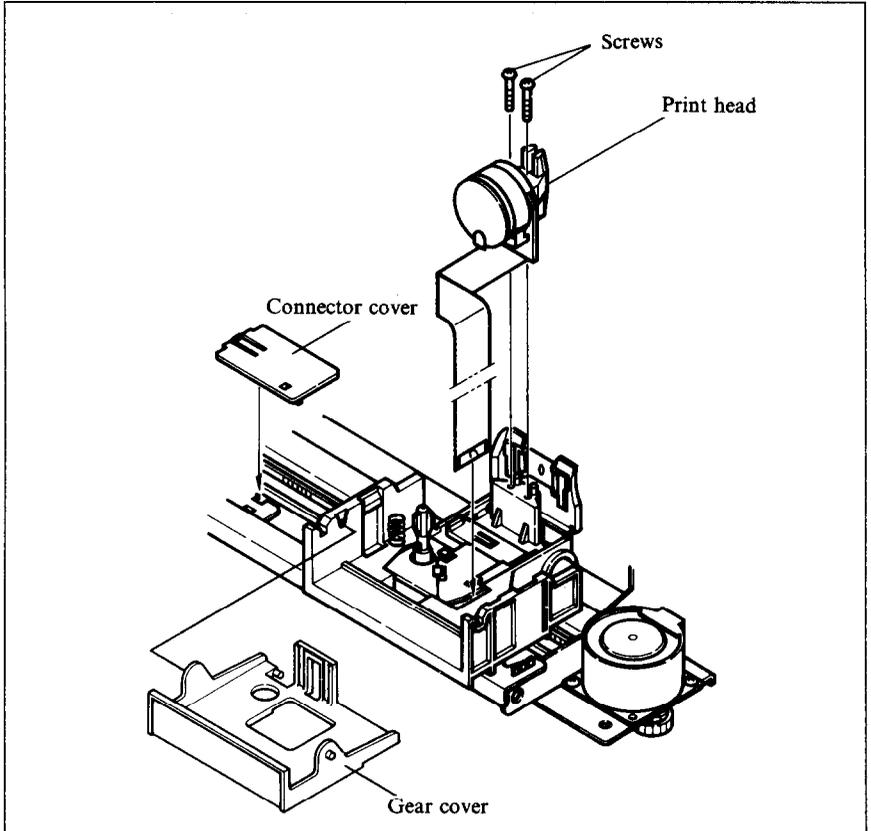


Figure 5-2. Replacing the print head

10. Plug the cable into the connector, inserting it as far as it will go.
11. Fasten the print head down with the two screws.
12. Replace the spring and the gear cover in place.
13. Move the carriage back toward the right and replace the connector cover. Slide the connector cover to the left until it locks into place.
14. Replace the ribbon cartridge and top cover, and plug the power cord back in.

TROUBLESHOOTING

■ *If the printer doesn't print:*

- Check the Power and On Line indicators. Both must be on.
- Check that the interface cable is securely plugged in at the computer and printer ends.
- Make a test print. (Turn power OFF, hold the On Line or Paper Feed switch down, then turn power ON.) If the test print succeeds, the problem is not with the printer; try a different printing command, or try using a different cable. If the test print fails, have the printer checked by a qualified serviceman.

■ *If fanfold paper becomes stuck:*

- Turn power off, take off the rear cover, remove the paper, and reload the paper as described in Chapter 1.
- Make sure the paper is placed so that it feeds into the printer straight.

■ *If label paper becomes stuck:*

- Have a qualified serviceman remove any label paper that adheres inside the printer. Do not attempt to remove it yourself.
- Avoid using label paper with any exposed adhesive areas.

■ *If printing is faint, incomplete, or unclear:*

- Check that the ribbon cartridge is installed correctly. If the ribbon cartridge is old, replace it.
- Adjust the printing gap. See Chapter 1.
- If ribbon replacement or gap adjustment does not solve the problem, replace the print head.

■ *If all text is printed on the same line:*

- Set DIP switch 1-8 to the OFF (front) position.

■ *If line spacing is twice as wide as expected:*

- Set DIP switch 1-8 to the ON (back) position.

■ *If you can't print to the end of the page:*

- This is normal. The printer's paper-out detector detects the end of the paper and stops printing about an inch above the end.
- You can make the printer ignore the paper-out detector by setting DIP switch 1-5 to the OFF (front) position, or by using the <ESC> "8" printer command.

■ ***If the printed characters don't match the characters on the screen:***

- Check DIP switches 2-2 to 2-4. When these switches are not all ON (back), an international character set is selected and some ASCII symbols are changed to other characters. See Appendix D.
- Some software is not able to display international characters on the screen. If you use an international character set you may want to paste labels on the keyboard.
- If you are using the IBM mode, check DIP switch 1-7. Some international characters and symbols do not print when this switch is OFF (front).

■ ***If some printer commands are ignored or executed incorrectly:***

- Check that the setting of DIP switch 1-6 matches the type of printer your software supports: ON (back) for Star or Epson; OFF (front) for IBM.
- A few commands are mutually exclusive. For example, you cannot get emphasized condensed printing.

■ ***If you have problems with horizontal tabulation:***

- Don't change the margins after setting tabs.
- Don't change the print pitch after setting tabs. The physical positions of the tab stops do not adjust to the new print pitch.

■ ***If you have problems with graphics:***

- If you are using commercial software, check that it supports this printer, or a Star, Epson or IBM printer, and that DIP switch 1-6 is set correctly: ON (back) for Star or Epson; OFF (front) for IBM.
- Use a hex dump to verify the codes the printer is receiving. See the graphics command descriptions in Appendix B. Some computers insert unwanted commands (such as carriage returns and line feeds) in graphics data, or change the values of certain codes.
- BASIC programs may require a WIDTH statement. Check your BASIC manual.

■ ***If you have problems with download characters:***

- Check that DIP switch 2-1 is OFF (front).
- Make the same checks as for graphics problems.

MEMO

Appendix A

TECHNICAL SPECIFICATIONS

■ *Printing Mechanism*

Printing method	Serial impact dot matrix
Printing speed	120 characters per second (draft pica) 30 characters per second (NLQ pica)
Printing direction	Draft: bi-directional or unidirectional (selectable), logic seeking NLQ and graphics: unidirectional, logic seeking
Print head	9 Pins Life: 200 million dots
Ribbon	Black/blue/red/yellow fabric ribbon cartridge Life: 1 million draft characters/colour
Paper feed	Friction and push-tractor feed Semiautomatic sheet loading
Paper feed speed	2.7 inches/second (during page feed)

■ *Interface and Emulation*

Interface	Centronics-compatible, 7 or 8 bit, TTL-level
Data buffer	8K bytes when not used for download characters 1-Line buffer when using download
Emulation modes	Epson LX-800 and IBM Proprinter II

■ *Switches and Indicators*

Power switch	Rocker switch
Control panel	4 Membrane switches, 10 LED indicators

DIP switches	12 pins
Special features	Panel pitch/style lock-in Forward and reverse micro-feed Paper parking Hexadecimal dump

■ **Colour Printing**

Colours	Black, red, blue, violet, yellow, orange, green
---------	---

■ **Dot Matrix Size**

Character matrix	9 x 9 dots (Draft pica) 18 x 23 dots (Courier and Orator pica) 18 x 18 dots (Sanserif pica, elite) 12 x 11 dots (IBM block graphics, pica) 18 x 19 dots (Courier and Orator elite) 18 x 12 dots (Condensed pica) 18 x 10 dots (Condensed elite)
Bit-image graphics	8 x 480 dots at 60 dpi (Single density) 9 x 480 dots at 60 dpi (Single density) 8 x 576 dots at 72 dpi (Plotter mode) 8 x 640 dots at 80 dpi (CRT I) 8 x 720 dots at 90 dpi (CRT II) 8 x 960 dots at 120 dpi (Double density) 9 x 960 dots at 120 dpi (Double density) 8 x 960 dots at 120 dpi (High speed) 8 x 1920 dots at 240 dpi (Quadruple density)

■ **Character Sets**

Standard character set	96 ASCII characters
IBM character set	244 characters (ASCII, international characters, symbols, block graphics)
Download characters	Max. 192 (draft) or 78 (NLQ)
International character sets	14 sets (USA, France, Germany, England, Denmark I, Denmark II, Sweden, Italy, Spain I, Spain II, Japan, Norway, Latin America, Denmark/Norway)

■ **Type Styles and Pitches**

Draft type styles	Draft, draft italic
NLQ type styles	Courier, Sanserif, Orator (with lower case or small capitals), and italic versions of these
Extra-large characters	Double width, double height, double width and height, quadruple width and height
Print pitches	Pica (10 cpi) Elite (12 cpi) Condensed pica (17 cpi) Condensed elite (20 cpi) (Standard mode only) Proportional spacing can be selected for each of the above
Line spacing	1/6 inch (standard) 1/8, <i>n</i> /72, or <i>n</i> /216 inch (programmable)
Column width	8 inches Pica: 80 characters Elite: 96 characters Condensed pica: 137 characters Condensed elite: 160 characters

■ **Paper Specifications**

Single sheets	140 to 216 mm (5.5 to 8.5 inches) wide, 0.07 to 0.10 mm thick
Fanfold paper	102 to 254 mm (4 to 10 inches) wide 0.07 to 0.10 mm thick (single-ply) Max. 0.28 mm thick (3-ply)
Number of copies	Max. 3 (original + 2 copies)

■ **Dimensions and Weight**

Dimensions	Width 384 mm (15.1 inches) Depth 287.5 mm (11.3 inches) Height 108 mm (4.3 inches)
Weight	4.7 kg (10.3 pounds)

■ Electrical Specifications

Line voltage	120 VAC \pm 10% 220 VAC \pm 10% 240 VAC \pm 10% (varies according to the country of purchase)
Line frequency	50 or 60 Hz
Power consumption	Typ. 30 W, Max. 60 W
Insulation resistance	10 megohms between AC power line and chassis
Dielectric strength	Withstands 1 kVAC rms at 50 or 60 Hz between AC power line and chassis for at least 1 minute

■ Environmental Requirements

Operating temperature	5 to 40°C (41 to 104°F)
Operating humidity	10% to 80% (no condensation)
Storage temperature	-30 to 65°C (-22 to 149°F)
Storage humidity	10% to 95% (at 40°C) (no condensation)

■ Option

Automatic sheet feeder

■ Interface Signals

Pin No.	Signal Name	Direction	Function
1	STROBE	IN	Goes from High to Low (for at least 0.5 microseconds) when data are valid.
2	DATA1	IN	Eight-bit character data. DATA8 is the most significant bit; DATA1 is the least significant bit. High is logic 1 and Low is logic 0.
3	DATA2	IN	
4	DATA3	IN	
5	DATA4	IN	
6	DATA5	IN	
7	DATA6	IN	
8	DATA7	IN	
9	DATA8	IN	
10	ACK	OUT	5-Microsecond Low pulse acknowledges receipt of data.

Pin No.	Signal Name	Direction	Function
11	BUSY	OUT	Low when the printer is ready to accept data.
12	PAPER OUT	OUT	Goes High if the printer runs out of paper. Can be held Low permanently by turning DIP switch 1-5 off.
13	SELECTED	OUT	High when the printer is on-line.
14-15	N/C		Unused
16	SIGNAL GND		Signal ground.
17	CHASSIS GND		Printer's chassis ground, isolated from signal ground.
18	+ 5VDC	OUT	External supply of + 5VDC.
19-30	GND		Twisted pair return signal ground level.
31	RESET	IN	Low input resets the printer to its power-up condition.
32	ERROR	OUT	Goes Low to signal that the printer cannot print due to an error condition.
33	EXT GND		External ground.
34, 35	N/C		Unused.
36	SELECT IN	IN	Always High.

MEMO

Appendix B

PRINTER CONTROL COMMANDS

This appendix describes the printer's control commands. The commands are arranged by function. The name of each command is followed by a table like the one below:

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "x" "l"	27 120 49	1B 78 31
	<ESC> "x" <l>	27 120 1	1B 78 01

Mode: Indicates the mode in which the command is recognized.
 Std. Standard mode (DIP switch 1-6 on)
 IBM IBM mode (DIP switch 1-6 off)
 Both Both standard and IBM modes

ASCII: Indicates the ASCII coding of the command. Control characters are enclosed in pointed brackets: For example, <0> means character code 0.

Decimal: Gives the command in decimal character codes.

Hexadecimal: Gives the command in hexadecimal character codes.

Parameters for which values must be supplied are indicated by italic letters such as *n*.

Many commands have alternative forms. Some commands use <ESC> (character code 27) in Standard mode and <FS> (character code 28) in IBM mode. Other commands have parameters that can be specified as either character codes or digit characters, like the parameter *l* in the sample command above.

FONT CONTROL COMMANDS

Select draft quality characters

Mode	ASCII	Decimal	Hexadecimal
Both	(" (" "F" ")" ") "9"	40 40 70 41 41 57	28 28 46 29 29 39
	<ESC> "x" "0"	27 120 48	1B 78 30
	<ESC> "x" <0>	27 120 0	1B 78 00
IBM	<ESC> "I" "0"	27 73 48	1B 49 30
	<ESC> "I" <0>	27 73 0	1B 49 00

Changes from near letter quality to draft quality. Ignored if the NLQ Type Style switch was pressed during power-up.

Select draft elite characters

Mode	ASCII	Decimal	Hexadecimal
IBM	< ESC > "I" "I"	27 73 49	1B 49 31
	< ESC > "I" < I >	27 73 1	1B 49 01

Changes to draft quality characters with elite pitch (12 cpi). Ignored if the NLQ Type Style switch was pressed during power-up.

Select NLQ characters

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "x" "I"	27 120 49	1B 78 31
	< ESC > "x" < I >	27 120 1	1B 78 01

Changes from draft quality to near letter quality. The initial NLQ type style is Courier unless a different style has been selected by a preceding command. Ignored if the NLQ Type Style switch was pressed during power-up.

Select NLQ type style

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "k" <i>n</i>	27 107 <i>n</i>	1B 6B <i>n</i>

Selects an NLQ type style according to the value of *n*. In draft mode, this command remains dormant and takes effect later when NLQ is selected by < ESC > "x" 1. Ignored if the NLQ Type Style switch was pressed during power-up.

- n* Type style
- 0 Courier (initial value)
 - 1 Sanserif
 - 2 Orator with small capitals
 - 3 Orator with lower case

Select Courier characters

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "F" ")" ")" "0"	40 40 70 41 41 48	28 28 46 29 29 30
IBM	< ESC > "I" "3"	27 73 51	1B 49 33
	< ESC > "I" < 3 >	27 73 3	1B 49 03
	< ESC > "I" "7"	27 73 55	1B 49 37
	< ESC > "I" < 7 >	27 73 7	1B 49 07

Changes to the Courier NLQ font. Ignored if the NLQ Type Style switch was pressed during power-up.

Select Sanserif characters

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "F" ")" ")" "1"	40 40 70 41 41 49	28 28 46 29 29 31
IBM	<ESC> "I" "2"	27 73 50	1B 49 32
	<ESC> "I" <2>	27 73 2	1B 49 02

Changes to the Sanserif NLQ font. Ignored if the NLQ Type Style switch was pressed during power-up.

Select Orator characters with small capitals

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "F" ")" ")" "2"	40 40 70 41 41 50	28 28 46 29 29 32

Changes to the Orator with small capitals NLQ font. Ignored if the NLQ Type Style switch was pressed during power-up.

Select Orator characters with lower case

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "F" ")" ")" "3"	40 40 70 41 41 51	28 28 46 29 29 33

Changes to the Orator with lower case NLQ font. Ignored if the NLQ Type Style switch was pressed during power-up.

Select italic characters

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "I" ")" ")" "1"	40 40 73 41 41 49	28 28 49 29 29 31
Std.	<ESC> "4"	27 52	1B 34
IBM	<FS> "4"	28 52	1C 34

Causes subsequent characters to be printed in italics. Ignored if the NLQ Type Style switch was pressed during power-up.

Select upright characters

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "I" ")" ")" "0"	40 40 73 41 41 48	28 28 49 29 29 30
Std.	<ESC> "5"	27 53	1B 35
IBM	<FS> "5"	28 53	1C 33

Stops italic printing and causes subsequent characters to be printed upright. Ignored if the NLQ Type Style switch was pressed during power-up.

Emphasized printing

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "E"	27 69	1B 45

Causes subsequent draft characters to be emphasized by adding extra thickness to vertical strokes.

Cancel emphasized printing

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "F"	27 70	1B 46

Cancels emphasized printing.

Double-strike printing

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "B" ")" ")" "I"	40 40 66 41 41 49	28 28 42 29 29 31
	< ESC > "G"	27 71	1B 47

Causes subsequent characters to be printed in double-strike mode with a slight vertical paper motion in between, causing a thickening of horizontal strokes.

For bold print, use of double-strike is recommended in NLQ mode, and combined use of emphasized and double-strike is recommended in draft mode.

Double-strike cannot be used with superscripts or subscripts.

Cancel double-strike printing

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "B" ")" ")" "0"	40 40 66 41 41 48	28 28 42 29 29 30
	< ESC > "H"	27 72	1B 48

Cancels double-strike printing.

Start underlining

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "." "1"	27 45 49	1B 2D 31
	< ESC > "." < 1 >	27 45 1	1B 2D 01

Causes subsequent characters to be underlined. IBM block graphics characters and spaces skipped by horizontal tabulation are not underlined.

Stop underlining

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “_” “0”	27 45 48	1B 2D 30
	<ESC> “_” <0>	27 45 0	1B 2D 00

Stops underlining.

Start overlining

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “_” “1”	27 95 49	1B 5F 31
	<ESC> “_” <1>	27 95 1	1B 5F 01

Causes subsequent characters to be overlined. Spaces skipped by horizontal tabulation are not overlined.

Stop overlining

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “_” “0”	27 95 48	1B 5F 30
	<ESC> “_” <0>	27 95 0	1B 5F 00

Stops overlining.

Superscript

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “S” “0”	27 83 48	1B 53 30
	<ESC> “S” <0>	27 83 0	1B 53 00

Causes subsequent characters to be printed as superscripts. Does not change the character pitch.

Subscript

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “S” “1”	27 83 49	1B 53 31
	<ESC> “S” <1>	27 83 1	1B 53 01

Causes subsequent characters to be printed as subscripts. Does not change the character pitch.

Cancel superscript or subscript

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “T”	27 84	1B 54

Stops printing superscripts or subscripts and returns to normal printing.

COLOUR PRINTING COMMANDS

Select printing colour

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "((" "C" ")" ") " <i>n</i>	40 40 67 41 41 <i>n</i>	28 28 43 29 29 <i>n</i>
	< ESC > "r" <i>n</i>	27 114 <i>n</i>	1B 72 <i>n</i>

Select the printing colour according to the value of *n*. Ignored if a colour ribbon is not installed. The value of *n* may be either the character code or the digit character.

<i>n</i>	Colour
< 0 > or "0"	Black
< 1 > or "1"	Red
< 2 > or "2"	Blue
< 3 > or "3"	Violet
< 4 > or "4"	Yellow
< 5 > or "5"	Orange
< 6 > or "6"	Green

CHARACTER SET COMMANDS

Select standard character set

Mode	ASCII	Decimal	Hexadecimal
Std	< ESC > "t" "0"	27 116 48	1B 74 30
	< ESC > "t" < 0 >	27 116 0	1B 74 00

Selects the standard character set. This is the power-up default in Standard mode if DIP switch 1-7 is ON. The standard character set cannot be selected in IBM mode.

Select IBM character set

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > "t" "1"	27 116 49	1B 74 31
	< ESC > "t" < 1 >	27 116 1	1B 74 01

Selects an IBM character set (character set #2 unless an < ESC > "7" command has been received). Ignored in IBM mode, since the IBM character set is selected automatically.

Select IBM character set #1

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "7"	27 55	1B 37

Selects IBM character set #1. If the standard character set is currently selected, this command remains dormant and takes effect at the next < ESC > "t" 1 command. In IBM mode, character set #1 is the power-up default if DIP switch 1-7 is OFF.

Select IBM character set #2

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "6"	27 54	1B 36

Selects IBM character set #2. If the standard character set is currently selected, this command remains dormant and takes effect at the next < ESC > "t" 1 command. In IBM mode, character set #2 is the power-up default if DIP switch 1-7 is ON.

Select international character set

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > "R" <i>n</i>	27 82 <i>n</i>	1B 52 <i>n</i>
IBM	< FS > "R" <i>n</i>	28 82 <i>n</i>	1C 52 <i>n</i>

Selects an international character set according to the value of *n*.

<i>n</i>	Character set	<i>n</i>	Character set
0	U.S.A	7	Spain I
1	France	8	Japan
2	Germany	9	Norway
3	England	10	Denmark II
4	Denmark I	11	Spain II
5	Sweden	12	Latin America
6	Italy	13	Denmark/Norway

The first eight of these character sets (from U.S.A. to Spain I) can be selected as power-up defaults by DIP switches 2-2 to 2-4.

Enable printing of all character codes

Mode	ASCII	Decimal	Hexadecimal
IBM	< ESC > "\ " <i>n1 n2</i>	27 92 <i>n1 n2</i>	1B 5C <i>n1 n2</i>

Enables printing of all characters in the IBM character set, including those assigned to character codes which are normally considered control codes. This command remains in effect for the next $n1 + n2 \times 256$ characters, where *n1* and *n2* are numbers between 0 and 255.

During this interval no control functions are executed. If a code with no assigned character is received, the printer prints a space.

Enable printing of all character codes on next character

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> “^”	27 94	1B 5E

This command operates like <ESC> “\” except that it remains in effect for only one character.

Select slash zero

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “~” “1”	27 126 49	1B 7E 31
	<ESC> “~” <1>	27 126 1	1B 7E 01

Causes subsequent zero characters to be overprinted with a slash (Ø).

Select normal zero

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “~” “0”	27 126 48	1B 7E 30
	<ESC> “~” <0>	27 126 0	1B 7E 00

Causes subsequent zero characters to be printed normally (0), without a slash.

CHARACTER SIZE AND PITCH COMMANDS

Pica pitch

Mode	ASCII	Decimal	Hexadecimal
Std.	<ESC> “P”	27 80	1B 50
IBM	<DC2>	18	12

In Standard mode, changes from elite to pica pitch (10 cpi) or from condensed elite to condensed pica (17 cpi). In IBM mode, changes from either elite or condensed to pica (10 cpi). Ignored if the Print Pitch switch was pressed during power-up.

Elite pitch

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “M”	27 77	1B 4D
IBM	<ESC> “:”	27 58	1B 3A

In Standard mode, changes from pica to elite pitch (12 cpi) or from condensed pica to condensed elite (20 cpi). In IBM mode, changes from either pica or condensed to elite (12 cpi). Ignored if the Print Pitch switch was pressed during power-up.

Condensed printing

Mode	ASCII	Decimal	Hexadecimal
Both	< SI >	15	0F
	< ESC > < SI >	27 15	1B 0F

In Standard mode, changes from pica to condensed pica (17 cpi) or from elite to condensed elite (20 cpi). In IBM mode, changes from either pica or elite to condensed (17 cpi). Ignored if the Print Pitch switch was pressed during power-up.

Cancel condensed printing

Mode	ASCII	Decimal	Hexadecimal
Both	< DC2 >	18	12

In Standard mode, changes from condensed pica to normal pica or from condensed elite to normal elite. In IBM mode, always changes to normal pica. Ignored if the Print Pitch switch was pressed during power-up.

Expanded printing

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "W" "1"	27 87 49	1B 57 31
	< ESC > "W" < 1 >	27 87 1	1B 57 01

Causes subsequent characters to be expanded to double width.

Cancel expanded printing

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "W" "0"	27 87 48	1B 57 30
	< ESC > "W" < 0 >	27 87 0	1B 57 00

Stops expanded printing and returns to normal width.

Expanded printing for one line

Mode	ASCII	Decimal	Hexadecimal
Both	< SO >	14	0E
	< ESC > < SO >	27 14	1B 0E

Causes subsequent characters in the current line to be expanded to double width. Characters return to normal width after the next line feed (< LF >). The < DC4 >, < VT >, < FF >, and < ESC > "W" 0 commands also cancel expanded printing.

Cancel one-line expanded printing

Mode	ASCII	Decimal	Hexadecimal
Both	<DC4>	20	14

Stops one-line expanded printing set with <SO> or <ESC> <SO>. Does not cancel <ESC> "W" 1.

Select proportional spacing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "p" "1"	27 112 49	1B 70 31
	<ESC> "p" <1>	27 112 1	1B 70 01
IBM	<ESC> "P" <1>	27 80 1	1B 50 01

Causes subsequent characters to be proportionally spaced. Ignored if the Print Pitch switch was pressed during power-up.

Select fixed spacing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "p" "0"	27 112 48	1B 70 30
	<ESC> "p" <0>	27 112 0	1B 70 00
IBM	<ESC> "P" <0>	27 80 0	1B 50 00

Causes subsequent characters to be printed with fixed character spacing. Ignored if the Print Pitch switch was pressed during power-up.

Select master print mode

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "!" <i>n</i>	27 33 <i>n</i>	1B 21 <i>n</i>

Selects a combined print mode according to the value of *n*. The value of *n* is the sum of the values given below for the desired characteristics. Examples: *n* = 1 gives elite; *n* = 9 (1 + 8) gives emphasized elite; *n* = 137 (1 + 8 + 128) gives underlined emphasized elite.

Function	<i>n</i> value
Underline	128
Italic [*1]	64
Expanded	32
Double strike	16
Emphasized	8
Condensed [*2]	4
Proportional [*2]	2
Elite [*2]	1

[*1] Ignored if the NLQ Type Style switch was pressed during power-up.

[*2] Ignored if the Print Pitch switch was pressed during power-up.

Increase character spacing

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > " " <i>n</i>	27 32 <i>n</i>	1B 20 <i>n</i>

Increases the space between characters by $n/240$ inches, where n is a number from 0 to 127. Used in microjustification.

Select double or quadruple size

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "h" <i>n</i>	27 104 <i>n</i>	1B 68 <i>n</i>

Selects the size of subsequent characters as shown below. Extra-high characters align along the cap-line of normal characters, with the base line temporarily moving down. Line spacing is temporarily doubled when $n = 1, 5$ or 6 and quadrupled when $n = 2$. To print correctly when $n = 3, 4, 5$ or 6 , set the line spacing to $24/216$ ($1/9$) of an inch with < ESC > "3" < 24 >, and print the same characters twice, upper half on one line, lower half on the next. For accurate alignment of the two halves, select unidirectional printing with < ESC > "U" < 1 >.

n Effect

-
- 0 Normal size
 - 1 Double-high, double-wide
 - 2 Quadruple-high, quadruple-wide
 - 3 Double-high, double-wide (Lower half only)
 - 4 Double-high, double-wide (Upper half only)
 - 5 Quadruple-high, quadruple-wide (Lower half only)
 - 6 Quadruple-high, quadruple-wide (Upper half only)

Print double-height characters

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "w" "1"	27 119 49	1B 77 31
	< ESC > "w" < 1 >	27 119 1	1B 77 01

Prints subsequent characters at double height without moving the base line, and without changing the line spacing. Temporarily cancels super/subscript and condensed printing modes.

Return to normal height

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "w" "0"	27 119 48	1B 77 30
	< ESC > "w" < 0 >	27 119 0	1B 77 00

Terminates double-height printing and prints subsequent characters at normal height. Resumes super/subscript and condensed printing if these modes were in effect before double height was selected.

Select character size

Mode	ASCII	Decimal	Hexadecimal
Both	"(" "(" "S" ")" ")" <i>n</i>	40 40 83 41 41 <i>n</i>	28 28 53 29 29 <i>n</i>

Selects a combination of character height and width according to the value of *n*, as below. Does not move the base line.

<i>n</i>	Character width	Character height
0	Single width	Single height
1	Double width	Single height
2	Single width	Double height
3	Double width	Double height

Double-height characters are always printed at near letter quality. Double height printing temporarily cancels the super/subscript and condensed printing modes, but these modes resume when the printer returns to normal height.

Select character height, width, and line spacing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "[" @ " <4> <0> <0> <0> <i>n</i> <i>m</i>	27 91 64 4 0 0 0 <i>n</i> <i>m</i>	1B 5B 40 04 00 00 00 <i>n</i> <i>m</i>

Selects a combination of character height, width, and line spacing according to the value of *n* and *m*, as below. Does not move the base line.

<i>n</i>	Line spacing	Character height
0	Unchanged	Unchanged
1	Unchanged	Single height
2	Unchanged	Double height
16	Single	Unchanged
17	Single	Single height
18	Single	Double height
32	Double	Unchanged
33	Double	Single height
34	Double	Double height
<i>m</i>	Character width	
1	Single width (same as <ESC> "W" 0)	
2	Double width (same as <ESC> "W" 1)	

Double-height characters are always printed at near letter quality. Double height printing temporarily cancels the super/subscript and condensed printing modes, but these modes resume when the printer returns to normal height.

VERTICAL POSITION COMMANDS

Set line spacing to 1/8 inch

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "0"	27 48	1B 30

Sets the distance the paper advances or reverses in subsequent line feeds to 1/8 inch.

Set line spacing to 7/72 inch

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "1"	27 49	1B 31

Sets the distance the paper advances or reverses in subsequent line feeds to 7/72 inch.

Set line spacing to 1/6 inch

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > "2"	27 50	1B 32

Sets the distance the paper advances or reverses in subsequent line feeds to 1/6 inch.

Set line spacing to $n/216$ inch

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "3" n	27 51 n	1B 33 n

Sets the distance the paper advances or reverses in subsequent line feeds to $n/216$ inch, where n is between 0 and 255. If $n = 0$, in Standard mode the line-feed distance is set to 0, but in IBM mode this command is ignored.

Set line spacing to $n/72$ inch

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "A" n	27 65 n	1B 41 n

In Standard mode, sets the distance the paper advances or reverses in subsequent line feeds to $n/72$ inch, where n is between 0 and 85. If $n = 0$, the line spacing is set to 0.

In IBM mode this command does the same except that (1) the new line spacing does not take effect until the next < ESC > "2" command, and (2) if $n = 0$, the < ESC > "A" command is ignored.

Execute <ESC> "A"

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "2"	27 50	1B 32

Sets the line spacing to the value defined by the last preceding <ESC> "A" command. Sets the line spacing to 1/6 inch if there is no preceding <ESC> "A" command.

Line feed

Mode	ASCII	Decimal	Hexadecimal
Both	<LF>	10	0A

Prints the current line and feeds the paper to the next line. If DIP switch 1-2 is ON, also moves the next print position to the left margin. See the preceding commands for the line spacing.

Reverse line feed

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> <LF>	27 10	1B 0A

Prints the current line and feeds the paper in the reverse direction to the preceding line. If DIP switch 1-2 is ON, also moves the next print position to the left margin. See the preceding commands for the line spacing. Ignored when friction feed is used.

Perform one $n/216$ -inch line feed

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "J" n	27 74 n	1B 4A n

Feeds the paper once by $n/216$ inches, where n is between 1 and 255. Does not move the print position right or left when DIP switch 1-2 is OFF. Does not change the line-spacing setting. Ignored when friction feed is used.

Perform one $n/216$ -inch reverse line feed

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "j" n	27 106 n	1B 6A n

Feeds the paper once by $n/216$ inches in the reverse direction, where n is between 1 and 255. Does not move the print position right or left when DIP switch 1-2 is OFF. Does not change the line-spacing setting. Ignored when friction feed is used.

Feed paper n lines

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "f" "1" n	27 102 49 n	1B 66 31 n
	<ESC> "f" <1> n	27 102 1 n	1B 66 01 n

Feeds the paper n lines from the current line, where n is between 0 and 127.

Set top of page at current position

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "4"	27 52	1B 34

Sets the current position as the top-of-page position. Note that this can also be done from the control panel.

Set page length to n lines

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "C" n	27 67 n	1B 43 n

Sets the page length to n lines in the current line spacing, where n is between 1 and 127 in Standard mode or between 1 and 255 in IBM mode. Changing the line spacing later does not alter the physical page length. The current line becomes the top of the page.

Set page length to n inches

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "C" <0> n	27 67 0 n	1B 43 00 n

Sets the page length to n inches, where n is between 1 and 22 in Standard mode or between 1 and 127 in IBM mode. The current line becomes the top of the page.

Set top margin

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "c" n	27 99 n	1B 63 n

Sets the top margin to $(n - 1)$ lines, where n is between 1 and 255. Printing begins on the n th line on the page. The power-up default is $n = 1$, giving no top margin.

Set bottom margin

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "N" <i>n</i>	27 78 <i>n</i>	1B 4E <i>n</i>

Sets the bottom margin to *n* lines, where *n* is between 0 and 127 in Standard mode or between 0 and 255 in IBM mode. The bottom margin is reset when you change the page length.

Cancel top and bottom margins

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "O"	27 79	1B 4F

Cancels both the top margin and the bottom margin.

Form feed

Mode	ASCII	Decimal	Hexadecimal
Both	<FF>	12	0C

Feeds the paper to the top of the next page according to the current page length, and moves the print position to the left margin. When the automatic sheet feeder (ASF) is selected (DIP switch 1-4 is OFF), this command ejects the current page.

Return to top of current page

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> <FF>	27 12	1B 0C

Feeds the paper backward to the top of the current page. Ignored when friction feed is used.

Disable paper-out detector

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "8"	27 56	1B 38

Causes the printer to disregard the signal sent by the paper-out detector, enabling printing to the bottom of the paper. Overrides the setting of DIP switch 1-5.

Enable paper-out detector

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "9"	27 57	1B 39

Causes the printer to stop printing about an inch before the end of the paper. Overrides the setting of DIP switch 1-5.

Set vertical tab stops

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "B" <i>n1 n2 ...<0></i>	27 66 <i>n1 n2 ...0</i>	1B 42 <i>n1 n2...00</i>

Cancels all current vertical tab stops and sets new vertical tab stops at lines *n1*, *n2*, etc., where *n1*, *n2*, etc. are numbers between 1 and 255. A maximum of 16 vertical tab stops can be set. The tab stops must be specified in ascending order; any violation of ascending order terminates the tab stop list. Standard termination is by the <0> control code. The vertical tab stops are set in terms of the current line spacing and do not move if the line spacing is changed later.

Set vertical tab stops every *n* lines

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "e" "1" <i>n</i>	27 101 49 <i>n</i>	1B 65 31 <i>n</i>
	<ESC> "e" <1> <i>n</i>	27 101 1 <i>n</i>	1B 65 01 <i>n</i>

Cancels all current vertical tab stops and sets new tab stops every *n* lines, where *n* is between 1 and 127.

Set vertical tab stops in channel

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "b" <i>n0 n1 n2 ...<0></i>	27 98 <i>n0 n1 n2 ... 0</i>	1B 62 <i>n0 n1 n2 ... 00</i>

Cancels all current vertical tab stops in channel *n0*, (where *n0* is between 0 and 7) and sets new vertical tab stops in this channel. (A channel is a set of vertical tab stops selected by the <ESC> "/" command.) See <ESC> "B" for parameters *n1*, *n2*, ... <0>.

Select vertical tab channel

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "/" <i>n0</i>	27 47 <i>n0</i>	1B 2F <i>n0</i>

Selects a set of vertical tab stops designated by a channel number (*n0*) from 0 to 7. The tab stops in each channel are set by <ESC> "b".

Vertical tab

Mode	ASCII	Decimal	Hexadecimal
Both	<VT>	11	0B

Feeds the paper to the next vertical tab stop and moves the print position to the left margin. Performs a line feed if no vertical tabs are set, as at power-up. Feeds to the top of the next page if vertical tabs are set but the current line is at or below the last vertical tab stop.

HORIZONTAL POSITION COMMANDS

Set left margin

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "I" <i>n</i>	27 108 <i>n</i>	1B 6C <i>n</i>

Sets the left margin at column *n* (where *n* is between 0 and 255) in the current character pitch (pica pitch if proportional spacing is selected). The left margin does not move if the character pitch is changed later. The left margin must be at least two columns to the left of the right margin and within the limits below:

Pica	$0 \leq n \leq 76$
Elite	$0 \leq n \leq 91$
Condensed pica	$0 \leq n \leq 130$
Condensed elite	$0 \leq n \leq 152$
Expanded pica	$0 \leq n \leq 38$
Expanded elite	$0 \leq n \leq 45$
Expanded condensed pica	$0 \leq n \leq 64$
Expanded condensed elite	$0 \leq n \leq 76$

The left margin can also be set from the control panel.

Set right margin

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > "Q" <i>n</i>	27 81 <i>n</i>	1B 51 <i>n</i>
IBM	< FS > "Q" <i>n</i>	28 81 <i>n</i>	1C 51 <i>n</i>

Sets the right margin at column *n* in the current character pitch (pica pitch if proportional spacing is currently selected). Column *n* becomes the last character position in the line. The right margin does not move if the character pitch is changed later. The right margin must be within the limits below:

Pica	$4 \leq n \leq 80$
Elite	$5 \leq n \leq 96$
Condensed pica	$7 \leq n \leq 137$
Condensed elite	$8 \leq n \leq 160$
Expanded pica	$2 \leq n \leq 40$
Expanded elite	$3 \leq n \leq 48$
Expanded condensed pica	$4 \leq n \leq 68$
Expanded condensed elite	$4 \leq n \leq 80$

The right margin can also be set from the control panel.

Set left and right margins

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "X" <i>n1 n2</i>	27 88 <i>n1 n2</i>	1B 58 <i>n1 n2</i>

Sets the left margin at column *n1* and the right margin at column *n2*. See the preceding commands for margin restrictions and other notes.

Carriage return

Mode	ASCII	Decimal	Hexadecimal
Both	<CR>	13	0D

Prints the current line and returns the next print position to the left margin. If DIP switch 1-8 is ON, also performs a line feed.

Set automatic line feed

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "5" <1>	27 53 1	1B 35 01

Causes the printer to perform both a carriage return and line feed each time it receives a <CR> code. This command takes priority over DIP switch 1-8.

Cancel automatic line feed

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "5" <0>	27 53 0	1B 35 00

Causes the printer to perform only a carriage return when it receives a <CR> code. This command takes priority over DIP switch 1-8.

Backspace

Mode	ASCII	Decimal	Hexadecimal
Both	<BS>	8	08

Moves the print position one column to the left. Ignored if the print position is at the left margin. This command can be used to overstrike or combine characters.

Left justify

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "a" "0"	27 97 48	1B 61 30
	<ESC> "a" <0>	27 97 0	1B 61 00

Aligns subsequent text with the left margin, leaving the right margin ragged.

Center text

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "a" "1"	27 97 49	1B 61 31
	<ESC> "a" <1>	27 97 1	1B 61 01

Centers subsequent text between the left and right margins.

Right justify

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "a" "2"	27 97 50	1B 61 32
	<ESC> "a" <2>	27 97 2	1B 61 02

Aligns subsequent text with the right margin, leaving the left margin ragged.

Set horizontal tab stops

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "D" <i>n1</i> <i>n2</i> ... <0>	27 68 <i>n1</i> <i>n2</i> ... 0	1B 44 <i>n1</i> <i>n2</i> ... 00

Cancels all current horizontal tab stops and sets new tab stops at columns *n1*, *n2*, etc. in the current character pitch (pica pitch if proportional spacing is currently selected), where *n1*, *n2*, etc. are numbers between 1 and 255. The maximum number of horizontal tab stops allowed is 32 in Standard mode and 28 in IBM mode. The tab stops must be specified in ascending order; any violation of ascending order terminates the tab stop list. Standard termination is by the <0> control code. To clear all tab stops, specify <ESC> "D" <0>.

Set horizontal tab stop every *n* columns

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "e" "0" <i>n</i>	27 101 48 <i>n</i>	1B 65 30 <i>n</i>
	<ESC> "e" <0> <i>n</i>	27 101 0 <i>n</i>	1B 65 00 <i>n</i>

Cancels all current horizontal tab stops and sets new tab stops every *n* columns, where *n* is between 1 and 127.

Reset all tab stops

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "R"	27 82	1B 52

Resets the horizontal tab stops to their power-up values in which a tab stop is set every 8 column starting at column 9. Also clears all vertical tab stops.

Horizontal tab

Mode	ASCII	Decimal	Hexadecimal
Both	< HT >	9	09

Moves the print position to the next horizontal tab stop. Ignored if there is no next horizontal tab stop in the current line. Note that when underlining is selected, spaces skipped by horizontal tabulation are not underlined.

Relative horizontal tab

Mode	ASCII	Decimal	Hexadecimal
Std.	< ESC > “\” $n1$ $n2$	27 92 $n1$ $n2$	1B 5C $n1$ $n2$
IBM	< FS > “\” $n1$ $n2$	28 92 $n1$ $n2$	1C 5C $n1$ $n2$

Moves the print position right or left a specified distance (maximum 6 inches). Ignored if the resulting position is beyond the right or left margin.

The formulas for the distance and direction are as follows:

If $n2$ is between 0 and 63, the print head moves right by $(n1 + n2 \times 256)/120$ inches

If $n2$ is between 64 and 127, the print head moves left by $(n1 + [n2 - 64] \times 256)/120$ inches

Absolute horizontal tab in inches

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > “\$” $n1$ $n2$	27 36 $n1$ $n2$	1B 24 $n1$ $n2$

Sets the next print position to $(n1 + n2 \times 256)/60$ inches from the left margin on the current line. Ignored if this position is beyond the right margin. The maximum position is 8 inches.

Absolute horizontal tab in columns

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > “f” “0” n	27 102 48 n	1B 66 30 n
	< ESC > “f” < 0 > n	27 102 0 n	1B 66 00 n

Moves the next print position to column n from the left margin, where n is between 0 and 127.

GRAPHICS COMMANDS

Print single-density 8-bit graphics

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "K" $n1$ $n2$ $m1$ $m2$...	27 75 $n1$ $n2$ $m1$ $m2$...	1B 4B $n1$ $n2$ $m1$ $m2$...

Prints bit-image graphics at 60 dots per inch horizontally. The graphic image is 8 dots high and $n1 + n2 \times 256$ dots wide. Maximum width is 8 inches (480 dots). $m1$, $m2$, ... are the dot data, each a 1-byte value from 0 to 255 representing 8 vertical dots, with the most significant bit at the top and the least significant bit at the bottom. The number of data bytes must be $n1 + n2 \times 256$. Dots beyond the right margin are ignored. At the end of bit-image printing the printer returns automatically to character mode.

Print double-density 8-bit graphics

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "L" $n1$ $n2$ $m1$ $m2$...	27 76 $n1$ $n2$ $m1$ $m2$...	1B 4C $n1$ $n2$ $m1$ $m2$...

Prints bit-image graphics at 120 dots per inch horizontally (maximum 960 dots wide). See <ESC> "K" for other information.

Print double-density, double-speed 8-bit graphics

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "Y" $n1$ $n2$ $m1$ $m2$...	27 89 $n1$ $n2$ $m1$ $m2$...	1B 59 $n1$ $n2$ $m1$ $m2$...

Prints bit-image graphics at 120 dots per inch horizontally (maximum 960 dots wide), skipping every second dot in the horizontal direction. See <ESC> "K" for other information.

Print quadruple-density 8-bit graphics

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "Z" $n1$ $n2$ $m1$ $m2$...	27 90 $n1$ $n2$ $m1$ $m2$...	1B 5A $n1$ $n2$ $m1$ $m2$...

Prints bit-image graphics at 240 dots per inch horizontally (maximum 1920 dots wide), skipping every second dot in the horizontal direction. See <ESC> "K" for other information.

Select graphics mode

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “*” <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...	27 42 <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...	1B 2A <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...

Selects one of seven graphics modes depending on the value of *n0* and prints bit-image graphics in this mode. See <ESC> “K” for information on *n1*, *n2*, *m1*, *m2*, ...

n0 Graphics mode

0	Normal-density	(60 dots per inch)
1	Double-density	(120 dots per inch)
2	Double-density, double-speed	
3	Quadruple-density	(240 dots per inch)
4	CRT graphics, mode I	(80 dots per inch)
5	Plotter graphics	(72 dots per inch)
6	CRT graphics, mode II	(90 dots per inch)

Convert graphics density

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “?” <i>n</i> <i>m</i>	27 63 <i>n</i> <i>m</i>	1B 3F <i>n</i> <i>m</i>

Converts graphics defined by subsequent <ESC> “K”, <ESC> “L”, <ESC> “Y” or <ESC> “Z” commands to a density mode defined by <ESC> “?”. *n* is “K”, “L”, “Y” or “Z”, indicating the mode to be converted. *m* is a code from <0> to <6> indicating one of the modes of <ESC> “?”.

Print 9-pin graphics

Mode	ASCII	Decimal	Hexadecimal
Std.	<ESC> “^” <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...	27 94 <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...	1B 5E <i>n0</i> <i>n1</i> <i>n2</i> <i>m1</i> <i>m2</i> ...

Prints bit-image graphics at 60 dots per inch if *n0* = 0 or 120 dots per inch if *n0* = 1. The graphics image is 9 dots high and *n1* + *n2* x 256 dots wide. Maximum width is 8 inches. Dots beyond the right margin are ignored. *m1*, *m2*, ... are byte pairs representing 9 vertical dots each. In the leftmost position, the most significant bit of *m1* is the top dot; the least significant bit of *m1* is the second dot from the bottom; the most significant bit of *m2* is the bottom dot; and the other bits of *m2* are ignored. Other byte pairs are similar. The number of data bytes must be 2 x (*n1* + *n2* x 256). At the end of bit-image printing the printer returns automatically to character mode.

DOWNLOAD CHARACTER COMMANDS

Copy standard characters from ROM into RAM

Mode	ASCII	Decimal	Hexadecimal
Std.	<ESC> “.” <0> <0> <0>	27 58 0 0 0	1B 3A 00 00 00
IBM	<FS> “.” <0> <0> <0>	28 58 0 0 0	1C 3A 00 00 00

Copies all the standard characters to the corresponding download character RAM area, overwriting any download data already present. Ignored when DIP switch 2-1 is ON.

Define draft download characters

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “&” <0> <i>n1</i> <i>n2</i> <i>m0</i> <i>m1</i> <i>m2</i> <i>m3... m11</i>	27 38 0 <i>n1</i> <i>n2 m0 m1 m2</i> <i>m3...m11</i>	1B 26 00 <i>n1</i> <i>n2 m0 m1 m2</i> <i>m3...m11</i>

Defines one or more new draft characters and stores them in RAM for later use. DIP switch 2-1 must be OFF; otherwise RAM is used as an input buffer, not for downloading characters, and this command is ignored. Draft mode must be selected before this command is executed.

n1 is the character code of the first character defined and *n2* is the character code of the last character defined. *n1* and *n2* must both be between 32 and 127 or both be between 160 and 255. *n1* must be equal to or less than *n2*. Use of character codes 32 (space) and 127 (delete code) should be avoided if possible.

Each character is defined by an attribute byte (*m0*) and 11 data bytes (*m1, m2, ..., m11*).

The most significant bit of the attribute byte is 1 if the character is an ascender (positioned entirely above the baseline) or 0 if it is a descender (descending below the baseline). The attribute byte also indicates the amount of white space to the left of the character (0 to 7 dots, specified by bits 4 to 6), and the width of the character cell, including this space (4 to 15 dots, specified by bits 0 to 3). The left space and cell width attributes are used only in proportional spacing.

Each data byte indicates eight vertical dots, with the MSB being the top dot and the LSB the bottom dot. These correspond to pins 1 to 8 or 2 to 9 of the print head, depending on whether the character is an ascender or descender.

For further details, please refer to the Appendix C.

Define NLQ download characters

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "&" <0> <i>n1</i> <i>n2 m0 m1 m2</i> <i>m3... m46</i>	27 38 0 <i>n1</i> <i>n2 m0 m1 m2</i> <i>m3...m46</i>	1B 26 00 <i>n1</i> <i>n2 m0 m1 m2</i> <i>m3...m46</i>

Defines one or more new NLQ characters and stores them in RAM for later use. DIP switch 2-1 must be OFF. NLQ mode must be selected before this command is executed. The parameters are the same as for the draft download character command except that the attribute byte specifies right space instead of character width and the dot density is doubled in each direction, so each character consists of 16 dots vertically and 23 dots horizontally and requires 46 data bytes. Dots defined by *m1* to *m23* are printed on the first pass of the head. Dots defined by *m24* to *m46* are printed on the second pass, the paper being scrolled up half a dot between the two passes. For further details, please refer to the Appendix C.

Define download characters

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> "=" <i>n1 n2</i> <DC4> <i>a0 a1 a2</i> <i>m1 m2 ...m11</i>	27 38 <i>n1 n2</i> 20 <i>a0 a1 a2</i> <i>m1 m2 ...m11</i>	1B 26 <i>n1 n2</i> 14 <i>a0 a1 a2</i> <i>m1 m2 ...m11</i>

Defines one or more new draft characters and stores them in RAM for later use. Draft mode must be selected before this command is executed. *n1* and *n2* give the number of bytes of character data that will follow. *a0* is the character code of the first character defined. *a1* and *a2* are attribute bytes. *m1* to *m11* are the character data, and are the same as in <ESC> "&." The attribute byte *a1* indicates whether the character is an ascender (not using the lowest of the nine vertical dots) or a descender (not using the highest dot) and whether it has a downward extension to 12 dots.

The attribute byte *a2* gives proportional-spacing information. Bit 7 is ignored. Bits 4 to 6 specify the offset to the first byte printed (0 to 7), enabling leading spaces in the character to be ignored. Bits 0 to 3 specify the width of the character cell (maximum 11 dots). The character will be followed by a mandatory blank dot column which is not included in this width.

Characters defined by this command can be selected by <ESC> "%"
1, <ESC> "I" 4, <ESC> "I" 5, or <ESC> "I" 6. This command is ignored when DIP switch 2-1 is ON.

Select download character set

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “%” “1”	27 37 49	1B 25 31
	<ESC> “%” <1>	27 37 1	1B 25 01

Selects the download character set. Ignored when DIP switch 2-1 is ON.

Select draft download character set

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> “I” “4”	27 73 52	1B 49 34
	<ESC> “I” <4>	27 73 4	1B 49 04

Selects the download character set and draft quality. Ignored if the NLQ Type Style switch was pressed during power-up or if DIP switch 2-1 is ON.

Select draft elite download character set

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> “I” “5”	27 73 53	1B 49 35
	<ESC> “I” <5>	27 73 5	1B 49 05

Selects the download character set, draft quality, and elite pitch (12 cpi). Ignored if the NLQ Type Style switch was pressed during power-up or if DIP switch 2-1 is ON.

Select NLQ download character set

Mode	ASCII	Decimal	Hexadecimal
IBM	<ESC> “I” “6”	27 73 54	1B 49 36
	<ESC> “I” <6>	27 73 6	1B 49 06

Selects the download character set and near letter quality. Ignored if the NLQ Type Style switch was pressed during power-up or if DIP switch 2-1 is ON.

Select ROM character set

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “%” “0”	27 37 48	1B 25 30
	<ESC> “%” <0>	27 37 0	1B 25 00

Stops using the download character set and returns to the built-in ROM character set. Ignored when DIP switch 2-1 is ON.

MACRO INSTRUCTION COMMANDS

Define macro instruction

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "+" <RS>	27 43 ... 30	1B 2B ... 1E

Cancels any existing macro instruction and replaces it with the defined instruction. The defined macro instruction consists of the characters between the "+" and <RS>. These can be any printable characters or control characters except <RS>, up to a maximum of 16 characters.

Execute macro instruction

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "+" <I>	27 43 1	1B 2B 01

Executes a previously defined macro instruction.

OTHER PRINTER CONTROL COMMANDS

Set MSB to 1

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> ">"	27 62	1B 3E

Sets the most significant bit of each subsequent byte received to 1, allowing users with a 7-bit interface to access characters with ASCII codes greater than 127.

Set MSB to 0

Mode	ASCII	Decimal	Hexadecimal
Std.	<ESC> "="	27 61	1B 3D
IBM	<FS> "="	28 61	1C 3D

Sets the most significant bit of each subsequent byte received to 0.

Accept MSB as is

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "#"	27 35	1B 23

Cancels the preceding commands and accepts the most significant bit as it is sent to the printer.

Delete last character sent

Mode	ASCII	Decimal	Hexadecimal
Both	< DEL >	127	7F

Deletes the last character received. Ignored if the last character received has already been printed, or if the last character received was all or part of a command.

Cancel last line

Mode	ASCII	Decimal	Hexadecimal
Both	< CAN >	24	18

Deletes the last line currently present in the print buffer.

Immediate print

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "i" "1"	27 105 49	1B 69 31
	< ESC > "i" < 1 >	27 105 1	1B 69 01

Selects the immediate print mode, in which the printer prints each character as soon as received. At every pause in the incoming data stream the printer scrolls the paper up about 2 inches so that the current line can be seen. When the next character is received the paper is scrolled back down and printing continues. This command is ignored when friction feed is used.

Cancel immediate print

Mode	ASCII	Decimal	Hexadecimal
Both	< ESC > "i" "0"	27 105 48	1B 69 30
	< ESC > "i" < 0 >	27 105 0	1B 69 00

Cancels the immediate print mode. The printer waits for each line to be completed before printing it, and does not scroll the paper up and down. This command is ignored when friction feed is used.

Set printer off-line

Mode	ASCII	Decimal	Hexadecimal
Std.	< DC3 >	19	13
IBM	< ESC > "Q" < 3 >	27 81 3	1B 51 03

Sets the printer off-line. The printer disregards all subsequent characters and commands except < DC1 >, which returns it to the on-line state. The printer's On Line indicator does not go off.

Set printer on-line

Mode	ASCII	Decimal	Hexadecimal
Both	<DC1>	17	11

Returns the printer to the on-line state, allowing it to receive and process all subsequent characters and commands. This command is ignored if the printer was set off-line by pressing the On Line switch on the control panel.

Bell

Mode	ASCII	Decimal	Hexadecimal
Both	<BEL>	7	07

Sounds a brief beep tone from the printer's beeper.

Bidirectional printing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "U" "0"	27 85 48	1B 55 30
	<ESC> "U" <0>	27 85 0	1B 55 00

Causes subsequent printing to be done in the normal bidirectional mode, which is faster than unidirectional printing.

Unidirectional printing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "U" "1"	27 85 49	1B 55 31
	<ESC> "U" <1>	27 85 1	1B 55 01

Causes subsequent printing to be done unidirectionally, ensuring maximum vertical alignment precision.

One-line unidirectional printing

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> "<"	27 60	1B 3C

Immediately returns the print head to the left margin, then prints the remainder of the line from left to right. Normal bidirectional printing resumes on the next line.

Manual feed

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> <0>	27 25 0	1B 19 00
	“(” “(” “0” “)” “)”	40 40 48 41 41	28 28 30 29 29

Selects manual sheet feeding even when the optional automatic sheet feeder is mounted. Ignored if DIP switch 1-4 is ON (ASF inactive).

Auto feed

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> <4>	27 25 4	1B 19 04
	“(” “(” “4” “)” “)”	40 40 52 41 41	28 28 34 29 29

Selects the automatic sheet feeder. Ignored if DIP switch 1-4 is ON (ASF inactive).

Eject paper from ASF

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “R”	27 25 82	1B 19 52
	“(” “(” “R” “)” “)”	40 40 82 41 41	28 28 52 29 29

Ejects the current page. Ignored if DIP switch 1-4 is ON (ASF inactive).

Set print start position on ASF

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “T” <i>n</i>	27 25 84 <i>n</i>	1B 19 54 <i>n</i>
	“(” “(” “T” “)” “)” <i>n</i>	40 40 84 41 41 <i>n</i>	28 28 54 29 29 <i>n</i>

Skips *n*/6 inches at the top of the page, where *n* is equal to or greater than 1. Ignored if DIP switch 1-4 is ON (ASF inactive).

Reset printer

Mode	ASCII	Decimal	Hexadecimal
Both	<ESC> “@”	27 64	1B 40

Reinitializes the printer. Clears the print buffer and returns settings to their power-up values. Does not clear the input buffer or change ASF selections.

Appendix C

DOWNLOAD CHARACTER GENERATOR

With this printer you can create new characters and symbols, download their dot data, and have them printed in place of selected characters in the regular character set. Characters that can be generated in this way range from simple but useful symbols like the check mark through complex Chinese or Japanese characters.

The process of designing new characters with paper and pencil is somewhat time-consuming. The program listed in this appendix enables you to do everything on the computer screen. It also enables you to maintain disk files of character data for downloading when required.

The creation of a car-shaped symbol as a draft character (⚡) and near-letter-quality character (⚡) is explained below.

Draft character

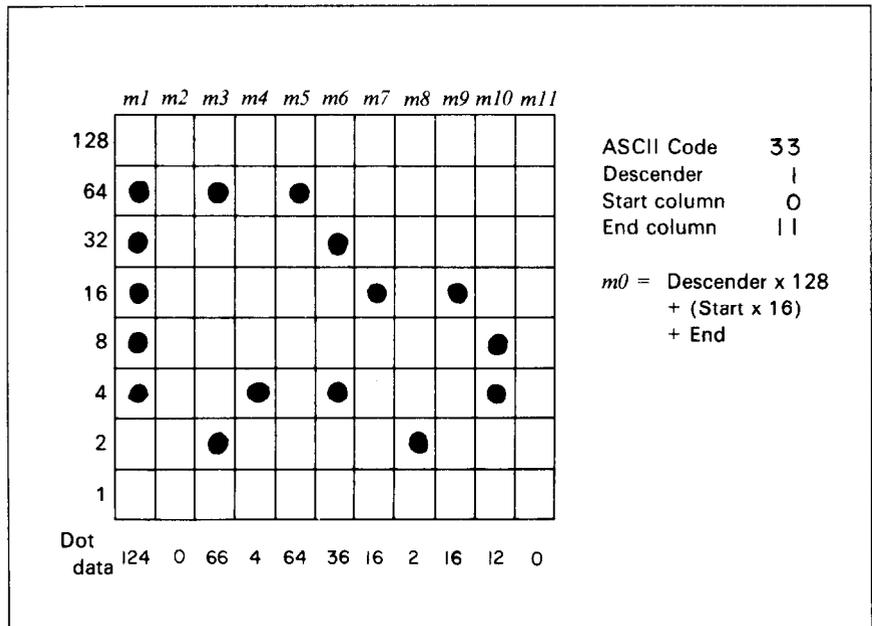


Figure C-1. Car symbol, draft quality

The dot matrix for a draft-quality character is 8 cells high and 11 cells wide. Figure C-1 shows the matrix with the car symbol filled in. Note that there are no pairs of horizontally adjacent dots. The pins in the print head cannot fire fast enough to print adjacent dots in the horizontal direction.

To the printer, a draft character is represented by 11 bytes of dot data, one byte for each column. If you are working by hand, you can calculate the data as shown in Figure C-1 and enter them via the <ESC> "&" <0> printer command. If you use the program in this appendix, proceed as follows.

The program starts by asking whether you want to read characters from an existing file. If you are going to add the car symbol to a file of download characters you have already generated, answer yes; if you are going to create a new file, answer no. The arrow on the screen toggles between Yes and No when any key except Return is pressed. The Return key enters your choice.

In the same way the program asks you to select Standard or IBM mode and draft or near letter quality, then to confirm whether to continue or start over. Continuing, on the next screen the program asks what character you want to redefine, offering the exclamation mark (!) as a suggestion. If you want to print the car symbol in place of the exclamation mark, press Return. If you want to assign the car symbol to another character, press the key of that character.

Next you must choose whether to make the car symbol an ascender or a descender. This determines how the character is seated on the line:

Ascender  Descender 

After you press Return for the ascender/descender choice, the cursor enters the character box. You can move the cursor with the numeric keypad. For example, pressing the "6" key moves to the right; pressing the "3" key moves diagonally down to the right. The function keys control the setting and clearing of dots. After F1 is pressed the cursor clears the dot in each position it is moved to. F3 causes the cursor to set dots. F2 allows the cursor to pass over dots without either setting or clearing them.

In draft mode a dot position is a 2x2 character block with the cursor located in the upper left corner of the block. When a dot is set, a 2x3 block of sharp signs is displayed, partly overlapping the dot position to the right. This reflects the fact that the printer cannot print horizontally adjacent dots. The program automatically censors adjacent dots.

By moving the cursor and pressing the F1, F2, and F3 keys you can quickly build up the dot pattern. If necessary you can clear all dots by pressing F4 and start over. When the character is complete, press Return to store the dot data in the computer's memory. The program will clear the character box and ask you to select the next character to design.

When you have finished designing characters, press the F6 key. The program will ask you whether you want to save, download, and print the characters you have designed. If you answer Yes to all three questions, your characters will be saved on a disk file and downloaded to the printer, and the entire character set from character 33 (!) to character 126 (~) will be printed out.

At any point while you are selecting or designing characters you can press F5 to skip the current character and proceed to the next character.

The program does not allow you to redefine the space character, or to define any other character as an all-blank character. Nor can you assign character codes less than 33 or greater than 126 to the characters you define.

NLQ character

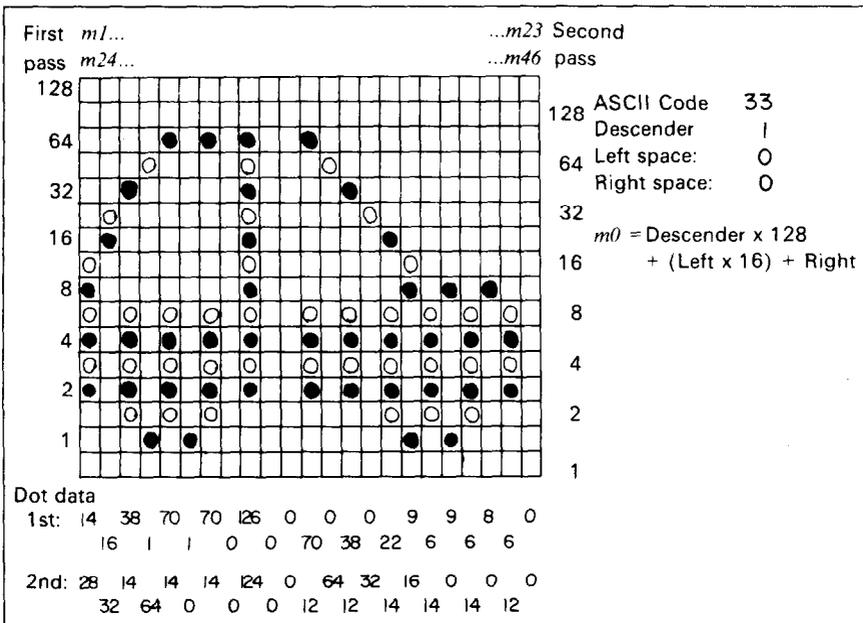


Figure C-2. Car symbol, near letter quality

If you select near letter quality, the character box is the same size but now has 16 (high) x 23 (wide) dot positions. Each dot is represented by two adjacent sharp signs, occupying its own position and the position to the right. This reflects the fact that the printer still cannot print horizontally adjacent dots, but that even skipping every other dot, the dots appear joined when printed.

A near-letter-quality character is represented by 46 bytes of dot data, two bytes for each column. Near-letter-quality characters are printed in two passes of the print head, the paper scrolling half a dot up between the passes. The first 23 bytes of dot data represent the first pass; the next 23 bytes represent the second pass. In each column the first, third, fifth, ... dots belong to the first-pass byte and the second, fourth, sixth, ... dots belong to the second-pass byte.

A maximum of 78 near-letter-quality characters can be defined.

The file created by this program contains the following printer commands:

1. `<ESC> “:” <0> <0> <0>` (standard mode) or `<FS> “:” <0> <0> <0>` (IBM mode) to copy the printer's regular characters into download memory. If you leave a download character undefined, the regular character will be printed.
2. `<ESC> “x” <0>` or `<ESC> “x” <1>` to select draft or near letter quality.
3. One `<ESC> “&” <0> <cc> <cc> <a> <pl> ...` command for each character defined. `<cc>` is the character code, `<a>` is the attribute byte, and `<pl> ...` are the 11 (draft) or 46 (near letter quality) bytes of dot data. This program uses only the most significant bit of the attribute byte. It does not set the other bits, which are concerned with proportional spacing.

This program is coded in Microsoft BASIC for IBM-PC. The WIDTH 255 command in line 1010 means infinite line width and prevents the computer from inserting unwanted line feeds in the character data. Some versions of BASIC do not need the WIDTH command. Check your BASIC manual and make any changes necessary.

```

1000 ***** DOWNLOAD CHARACTER GENERATOR *****
1010 WIDTH "LPT1:",255 :KEY OFF :CLS
1020 DIM A(126), P(126,23), Q(126,23), DT(16,24) :E$=CHR$(27) :R$=CHR$(28)
1030 KEY 1, CHR$(7) :KEY 2, CHR$(8) :KEY 3, CHR$(9)
1040 KEY 4, CHR$(10) :KEY 5, CHR$(11) :KEY 6, CHR$(12)
1050 FOR I=33 TO 126 :A(I)=-1 :NEXT I
1060 '-----
1070 LOCATE 1,1 :PRINT STRING$(25,62);
1080 PRINT " DOWNLOAD CHARACTER GENERATOR ":STRING$(25,60)
1090 '-----
1100 LOCATE 3,1 :PRINT "READ CHARACTERS FROM EXISTING FILE?"
1110 S0$="Yes" :S1$="No" :S=-1 :PX=4 :PY=1 :GOSUB 3020 :IF S THEN 1320
1120 '----- Open existing file -----
1130 LOCATE 4,20
1140 INPUT "File name":FI$
1150 OPEN "R",#1,FI$,48
1160 FIELD #1,48 AS A$
1170 '----- Read 2 initial commands -----
1180 GET #1,1
1190 IF MID$(A$,4,1)=E$ THEN IBM=0 ELSE IBM=-1
1200 IF MID$(A$,3,1)="0" THEN NLQ=0 ELSE NLQ=-1
1210 IF NLQ THEN WI=23 :HI=16 ELSE WI=11 :HI=8
1220 '----- Read data for 1 character -----
1230 FOR CC=33 TO 126 :M=CC-31
1240 GET #1,M :IF LEFT$(A$,1)=CHR$(0) THEN A(CC)--1 :GOTO 1310
1250 A(CC)=ASC(MID$(A$,2,1))
1260 FOR Y=1 TO WI
1270 P(CC,Y)=ASC(MID$(A$,Y+2,1)) :NEXT Y
1280 IF NLQ=0 THEN 1310
1290 FOR Y=1 TO WI
1300 Q(CC,Y)=ASC(MID$(A$,Y+25,1)) :NEXT Y
1310 NEXT CC :CLOSE 1
1320 '----- Select Std./IBM -----
1330 LOCATE 6,1 :PRINT "SELECT MODE"
1340 S0$="Standard mode (DIP SW. 1-6 ON )"
1350 S1$="IBM mode (DIP SW. 1-6 OFF)"
1360 S=IBM :PX=7 :PY=1 :GOSUB 3020 :IBM=S
1370 IF IBM THEN HD$=R$+" :"+STRING$(3,0) ELSE HD$=E$+" :"+STRING$(3,0)
1380 '----- Select Draft/NLQ -----
1390 LOCATE 9,1 :PRINT "SELECT QUALITY"
1400 S0$="Draft quality" :S1$="Near letter quality"
1410 S=NLQ :PX=10 :PY=1 :GOSUB 3020 :NLQ=S
1420 IF NLQ THEN HD$=CHR$(27)+"x1"+HD$ :WI=23 :HI=16 :GOTO 1440
1430 HD$=CHR$(27)+"x0"+HD$ :WI=11 :HI=8
1440 PL$=STRING$(24,"+") :HY$=STRING$(24,"-")
1450 CC=33 :CH$="1"
1460 '----- Select Continue/Start over -----
1470 LOCATE 12,1 :PRINT "CONTINUE?"
1480 S0$="Continue" :S1$="Start over"
1490 S=0 :PX=13 :PY=1 :GOSUB 3020 :IF S THEN CLS :GOTO 1070
1500 '
1510 '----- DRAW BOX -----
1520 CLS :IF NLQ THEN 1540
1530 LOCATE 1,3 :PRINT "1 2 3 4 5 6 7 8 9 0 1 " :GOTO 1550
1540 LOCATE 1,3 :PRINT "123456789012345678901234"
1550 LOCATE 2,3 :PRINT "++++"
1560 FOR N=1 TO 16
1570 IF NLQ THEN LOCATE N+2,1 :PRINT RIGHT$(STR$(N),1) :GOTO 1590
1580 IF N MOD 2 =1 THEN LOCATE N+2,1 :PRINT RIGHT$(STR$(N+1)/2,1);
1590 LOCATE N+2,2 :PRINT "!";SPC(24);"!":NEXT N
1600 LOCATE 19,3 :PRINT "++++"
1610 '----- Select character -----
1620 CH$=CHR$(CC)
1630 LOCATE 1,40 :PRINT "SELECT CHARACTER [":CH$:"]";
1640 I$=INPUT$(1) :IF " <I$ AND I$<CHR$(127) THEN CH$=I$ ELSE GOTO 1660
1650 CC=ASC(CH$)
1660 LOCATE 1,40 :PRINT "SELECTED CHARACTER : ":CH$: " "
1670 '----- Ascender or descender? -----
1680 S0$="Ascender" :S1$="Descender"
1690 S=(A(CC)=0) :PX=3 :PY=40 :GOSUB 3020 :DES=S

```

```

1700 '----- Key explanations -----
1710 LOCATE 10.40 :PRINT "F1: Clear dot"
1720 LOCATE 11.40 :PRINT "F2: Pass over"
1730 LOCATE 12.40 :PRINT "F3: Set dot"
1740 LOCATE 13.40 :PRINT "F4: Clear all dots"
1750 LOCATE 14.40 :PRINT "F5: Skip character"
1760 LOCATE 15.40 :PRINT "F6: End"
1770 LOCATE 16.40 :PRINT "RET Record character"
1780 '----- Get character -----
1790 IF A(CC)<0 THEN GOSUB 3220 :GOTO 1950
1800 IF NLQ THEN 1870
1810 '----- Draft character
1820 FOR Y=1 TO 11 :WT=128 :FOR X=1 TO 8
1830 IF (P(CC,Y) AND WT)=0 THEN 1850
1840 DT(X,Y)=1 :DT(X,Y+1)=2 :BX=X :BY=Y :CS$="***" :GOSUB 3700
1850 WT=.5*WT :NEXT X,Y :GOTO 1940
1860 '----- NLQ character
1870 FOR Y=1 TO 23 :WT=128 :FOR X=1 TO 15 STEP 2
1880 IF (P(CC,Y) AND WT)=0 THEN GOTO 1900
1890 DT(X,Y)=1 :DT(X,Y+1)=2 :BX=X :BY=Y :CS$="**" :GOSUB 3730
1900 IF (Q(CC,Y) AND WT)=0 THEN GOTO 1920
1910 DT(X+1,Y)=1 :DT(X+1,Y+1)=2 :BX=X+1 :BY=Y :CS$="***" :GOSUB 3730
1920 WT=.5*WT :NEXT X,Y
1930 '----- Modify & plot character -----
1940 X=1 :Y=1
1950 FOR Z=10 TO 12 :LOCATE Z,38 :PRINT " " :NEXT Z
1960 ST=2 :LOCATE 11,38 :PRINT "" :IF NLQ THEN 2180
1970 '----- Draft character
1980 IF DT(X,Y)=2 THEN CS$=CHR$(2)+" " :GOTO 2050
1990 IF DT(X,Y)=0 THEN 2020
2000 IF ST=1 THEN DT(X,Y)=0 :DT(X,Y+1)=0 :CS$=STRING$(3,1)+" " :GOTO 2050
2010 CS$=STRING$(3,2)+" " :GOTO 2050
2020 IF ST<3 THEN CS$=STRING$(2,1):GOTO 2050
2030 IF DT(X,Y+1)=1 THEN CS$=STRING$(2,1):GOTO 2050
2040 DT(X,Y)=1 :DT(X,Y+1)=2 :CS$=STRING$(3,2)+" "
2050 GOSUB 3680
2060 SS=ST :BX=X :BY=Y :GOSUB 3110 :IF SS=ST THEN 2140
2070 IF ST>3 THEN 2100
2080 FOR Z=10 TO 12 :LOCATE Z,38 :PRINT " " :NEXT Z
2090 LOCATE 9+ST,38 :PRINT "" :GOTO 1980
2100 IF ST=4 THEN GOSUB 3220 :GOTO 1950
2110 IF ST=5 THEN GOSUB 3220 :GOTO 1520
2120 IF ST=6 THEN 2410
2130 IF ST=7 THEN 3260
2140 IF DT(BX,BY)=2 THEN CS$="#" :GOTO 2170
2150 IF DT(BX,BY)=1 THEN CS$="***" :GOTO 2170
2160 IF DT(BX,BY)=0 AND DT(BX,BY+1)=0 THEN CS$=" " ELSE CS$=" "
2170 GOSUB 3700 :GOTO 1980
2180 '----- NLQ character
2190 IF DT(X,Y)=2 THEN CS$=CHR$(2) :GOTO 2260
2200 IF DT(X,Y)=0 THEN 2230
2210 IF ST=1 THEN DT(X,Y)=0 :DT(X,Y+1)=0 :CS$=STRING$(2,1) :GOTO 2260
2220 CS$=STRING$(2,2) :GOTO 2260
2230 IF ST<3 THEN CS$=CHR$(1) :GOTO 2260
2240 IF DT(X,Y+1)=1 THEN CS$=CHR$(1) :GOTO 2260
2250 DT(X,Y)=1 :DT(X,Y+1)=2 :CS$=STRING$(2,2)
2260 GOSUB 3720
2270 SS=ST :BX=X :BY=Y :GOSUB 3110 :IF SS=ST THEN 2360
2280 '
2290 IF ST>3 THEN 2320
2300 FOR Z=10 TO 12 :LOCATE Z,38 :PRINT " " :NEXT Z
2310 LOCATE 9+ST,38 :PRINT "" :GOTO 2180
2320 IF ST=4 THEN GOSUB 3220 :GOTO 1950
2330 IF ST=5 THEN GOSUB 3220 :GOTO 1520
2340 IF ST=6 THEN 2410
2350 IF ST=7 THEN 3260
2360 '
2370 IF DT(BX,BY)=2 THEN CS$="#" :GOTO 2400
2380 IF DT(BX,BY)=1 THEN CS$="***" :GOTO 2400
2390 IF DT(BX,BY+1)=0 THEN CS$=" " ELSE CS$=" "

```

```

2400 GOSUB 3730 :GOTO 2180
2410 '----- Wrap-up -----
2420 CLS :LOCATE 1,1 :PRINT "SAVE TO FILE?"
2430 S=-1 :PX=2 :PY=1 :S0$="Yes" :S1$="No" :GOSUB 3020
2440 IF S THEN 2530
2450 LOCATE 5,10 :PRINT "Output file name [":FI$:"] " :
2460 INPUT FO$
2470 IF FO$="" AND FI$="" THEN 2450
2480 IF FO$="" THEN FO$=FI$
2490 OPEN "R",#1,FO$,48
2500 FIELD #1,48 AS A$
2510 LSET A$=HD$+STRING$(48-LEN(HD$),0) :PUT #1,1
2520 GOSUB 3420 :CLOSE 1
2530 '
2540 LOCATE 7,1 :PRINT "DOWNLOAD TO PRINTER? (DIP SWITCH 2-1 MUST BE OFF)"
2550 S=0 :PX=8 :PY=1 :S0$="Yes" :S1$="No" :GOSUB 3020
2560 IF S THEN END
2570 LOCATE 11,1 :PRINT "PRINT CHARACTER SET?"
2580 S=0 :PX=12 :PY=1 :S0$="Yes" :S1$="No" :GOSUB 3020
2590 IF S THEN END
2600 LOCATE 15,1 :PRINT "WHICH MONITOR ARE YOU USING?"
2610 S=0 :S1$="COLOR" :S0$="MONOCRO" :PX=16 :PY=1 :GOSUB 3020 :PB=S
2620 GOSUB 3500 :LPRINT ES,"3":CHR$(50);
2630 FOR CC=33 TO 126 :LPRINT CHR$(CC);" " :NEXT CC
2640 LPRINT STRING$(10,10) :PRINT STRING$(5,10) :END
3000 '
3010 '----- SUBROUTINES -----
3020 '----- Selector routine-----
3030 LOCATE PX,PY :PRINT " " :S0$
3040 LOCATE PX+1,PY :PRINT " " :S1$
3050 IF NOT S THEN 3060 ELSE 3070
3060 LOCATE PX,PY :PRINT "=="> :LOCATE PX+1,PY :PRINT " " :LOCATE PX,PY
3070 IF S THEN 3080 ELSE 3090
3080 LOCATE PX,PY :PRINT " " :LOCATE PX+1,PY :PRINT "=="> :LOCATE PX,PY
3090 I$=INPUT$(1) :IF I$<>CHR$(13) THEN S=NOT S :GOTO 3050
3100 RETURN
3110 '----- Input check -----
3120 I$=INPUT$(1) :SK=ASC(I$) :FK=VAL(I$)
3130 IF SK>6 AND SK<14 THEN ST=SK-6 :GOTO 3210
3140 IF FK=0 OR FK=5 THEN 3120
3150 IF FK MOD 3 = 0 THEN Y=Y+1
3160 IF FK MOD 3 = 1 THEN Y=Y-1
3170 IF FK >6 THEN X=X-1
3180 IF FK <4 THEN X=X+1
3190 IF Y>WI THEN Y=WI ELSE IF Y<1 THEN Y=1
3200 IF X>HI THEN X=HI ELSE IF X<1 THEN X=1
3210 RETURN
3220 '----- Clear all dots -----
3230 FOR N=1 TO 16 :LOCATE N+2,3 :PRINT SPC(24) :NEXT N
3240 FOR X=1 TO HI :FOR Y=1 TO WI :DT(X,Y)=0 :NEXT Y,X
3250 ST=2 :X=1 :Y=1 :RETURN
3260 '----- Store character data -----
3270 FL=0
3280 IF DES THEN A(CC)=0 ELSE A(CC)=128
3290 IF NLQ THEN ZA=15 :ZB=2 ELSE ZA=8 :ZB=1
3300 FOR Y=1 TO WI :WT=128 :P(CC,Y)=0 :Q(CC,Y)=0
3310 FOR X=1 TO ZA STEP ZB
3320 IF NLQ THEN Q(CC,Y)=Q(CC,Y)+WT*(DT(X+1,Y) AND 1)
3330 P(CC,Y)=P(CC,Y)+WT*(DT(X,Y) AND 1)
3340 WT=.5*WT
3350 NEXT X
3360 FL=FL+P(CC,Y)+Q(CC,Y)
3370 NEXT Y
3380 IF FL=0 THEN A(CC)=-1
3390 BEEP
3400 CC=CC+1 :IF CC=127 THEN CC=33
3410 GOSUB 3220 :GOTO 1510
3420 '----- Output to Diskette -----
3430 FOR CC=33 TO 126 :M=CC-31
3440 IF A(CC)=-1 THEN B$=STRING$(48,0) :GOTO 3480 ELSE B$=CHR$(1)+CHR$(A(CC))

```

```

3450 FOR Y=1 TO WI :B$=B$+CHR$(P(CC,Y)) :NEXT Y
3460 IF NOT NLQ THEN B$=B$+STRING$(35,0) :GOTO 3480
3470 FOR Y=1 TO WI :B$=B$+CHR$(Q(CC,Y)) :NEXT Y
3480 LSET A$=B$ :PUT #1,M
3490 NEXT CC :RETURN
3500 '----- Output to Printer -----
3510 LPRINT HD$;
3520 FOR CC=33 TO 126
3530 IF A(CC)<0 THEN 3580
3540 LPRINT E$;"&";CHR$(0);STRING$(2,CC);:Z=A(CC) :GOSUB 3600
3550 FOR Y=1 TO WI :Z=P(CC,Y) :GOSUB 3600 :NEXT Y
3560 IF NOT NLQ THEN 3580
3570 FOR Y=1 TO WI :Z=Q(CC,Y) :GOSUB 3600 :NEXT Y
3580 NEXT CC
3590 LPRINT E$;"%1";:RETURN
3600 '
3610 IF PB THEN 3640
3620 PP=INP(&H3BD) :IF PP<128 THEN 3620
3630 OUT &H3BC,Z :OUT &H3BE,5 :OUT &H3BE,4 :GOTO 3660
3640 PP=INP(&H379) :IF PP<128 THEN 3640
3650 OUT &H378,Z :OUT &H37A,5 :OUT &H37A,4
3660 RETURN
3670 '----- Plot character -----
3680 LOCATE X*2+1,Y*2+1 :PRINT CS$
3690 LOCATE X*2+2,Y*2+1 :PRINT CS$ :RETURN
3700 LOCATE BX*2+1,BY*2+1 :PRINT CS$
3710 LOCATE BX*2+2,BY*2+1 :PRINT CS$ :RETURN
3720 LOCATE X+2,Y+2 :PRINT CS$ :RETURN
3730 LOCATE BX+2,BY+2 :PRINT CS$ :RETURN

```

Appendix D

CHARACTER SETS

This appendix gives tables of the printer's standard and IBM character sets.

The decimal character code of each character is shown in an inset to the lower right of the character.

The hexadecimal code can be found by reading the entries at the top and left edges of the table. For example, the character "A" is in column 4 and row 1, so its hexadecimal character code is 41. This is equivalent ($4 \times 16 + 1 = 65$) to decimal 65, the number in the inset.

Control codes recognized by this printer are indicated by abbreviations inside pointed brackets $\langle \rangle$.

<Sample >

Hexa- decimal	0	1	2	3	4	5	6	7
0	<NUL> 0			0 48	⊙ 64	P 80	~ 96	p 112
1		<DC1> 17	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 18	" 34	2 50	B 66	R 82	b 98	r 114
3			' 35	3 51	C 67	S 83	c 99	s 115

Character

Hexadecimal value (high order)

Control code

Decimal value

Hexadecimal value (low order)

STANDARD CHARACTER SET

Hexa- decimal	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0	48	@	80	P
1	1	<DC1> 17	33	1	49	A	81	Q
2	2	<DC2> 18	34	2	50	B	82	R
3	3	<DC3> 19	35	3	51	C	83	S
4	4	<DC4> 20	36	4	52	D	84	T
5	5	21	37	5	53	E	85	U
6	6	22	38	6	54	F	86	V
7	<BEL> 7	23	39	7	55	G	87	W
8	<BS> 8	<CAN> 24	(	8	56	H	88	X
9	<HT> 9	 25)	9	57	I	89	Y
A	<LF> 10	26	*	:	58	J	90	Z
B	<VT> 11	<ESC> 27	+	;	59	K	91	[
C	<FF> 12	28	,	<	60	L	92	\
D	<CR> 13	29	-	=	61	M	93]
E	<SO> 14	30	.	>	62	N	94	^
F	<SI> 15	31	/	?	63	O	95	_
							111	o
								 127
							106	j
							107	k
							108	l
							109	m
							110	n
							112	p
							113	q
							114	r
							115	s
							116	t
							117	u
							118	v
							119	w
							120	x
							121	y
							122	z
							123	{
							124	|
							125	}
							126	~

Hexa- decimal	8	9	A	B	C	D	E	F
0	<NUL> 128	144	160	0	@	P	`	p
1	129	<DC1> 145	! 161	1	A	Q	a	q
2	130	<DC2> 146	" 162	2	B	R	b	r
3	131	<DC3> 147	# 163	3	C	S	c	s
4	132	<DC4> 148	\$ 164	4	D	T	d	t
5	133	149	% 165	5	E	U	e	u
6	134	150	& 166	6	F	V	f	v
7	<BEL> 135	151	' 167	7	G	W	g	w
8	<BS> 136	<CAN> 152	(168	8	H	X	h	x
9	<HT> 137	 153) 169	9	I	Y	i	y
A	<LF> 138	154	* 170	:	J	Z	j	z
B	<VT> 139	<ESC> 155	+ 171	;	K	l	k	{
C	<FF> 140	156	,	<	L	\	l	;
D	<CR> 141	157	- 173	=	M	]	m	}
E	<SO> 142	158	. 174	>	N	^	n	~
F	<SI> 143	159	/ 175	? 191	O	_	o	 255

IBM CHARACTER SET #2

Hexa- decimal	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	48	@	P	^	p
1	1	<DC1> 17	!	33	1	A	Q	a
2	2	<DC2> 18	"	34	2	B	R	b
3	♥	<DC3> 19	#	35	3	C	S	c
4	♦	<DC4> 20	\$	36	4	D	T	d
5	♣	§	%	37	5	E	U	e
6	♠	22	&	38	6	F	V	f
7	<BEL> 7	23	'	39	7	G	W	g
8	<BS> 8	<CAN> 24	(	40	8	H	X	h
9	<HT> 9	 25)	41	9	I	Y	i
A	<LF> 10	26	*	42	:	J	Z	j
B	<VT> 11	<ESC> 27	+	43	;	K	{	k
C	<FF> 12	<FS> 28	,	44	<	L	\	l
D	<CR> 13	29	-	45	=	M	}	m
E	<SO> 14	30	.	46	>	N	^	n
F	<SI> 15	31	/	47	?	O	o	<DEL>

Hexa- decimal	8	9	A	B	C	D	E	F
0	Ç 128	É 144	á 160	⋮ 176	Ł 192	⋈ 208	α 224	≡ 240
1	ü 129	æ 145	í 161	⋮ 177	⊥ 193	⦏ 209	β 225	± 241
2	é 130	Æ 146	ó 162	⋮ 178	⊤ 194	⦏ 210	Γ 226	≥ 242
3	â 131	ø 147	ú 163	| 179	† 195	⋈ 211	π 227	≤ 243
4	ä 132	ö 148	ñ 164	† 180	- 196	⋈ 212	Σ 228	ƒ 244
5	à 133	ò 149	ñ 165	† 181	† 197	⦏ 213	σ 229	∫ 245
6	â 134	û 150	â 166	|| 182	† 198	⦏ 214	μ 230	÷ 246
7	ç 135	ù 151	ó 167	|| 183	|| 199	|| 215	τ 231	≈ 247
8	é 136	ÿ 152	¿ 168	¶ 184	⋈ 200	† 216	Φ 232	° 248
9	ë 137	ö 153	┌ 169	|| 185	⦏ 201	∫ 217	Θ 233	• 249
A	è 138	Û 154	┌ 170	|| 186	⋈ 202	┌ 218	Ω 234	- 250
B	ï 139	ç 155	½ 171	|| 187	⦏ 203	■ 219	δ 235	√ 251
C	ı 140	£ 156	¼ 172	|| 188	|| 204	■ 220	∞ 236	° 252
D	ì 141	¥ 157	ı 173	|| 189	= 205	|| 221	∅ 237	² 253
E	Ä 142	℞ 158	« 174	¶ 190	|| 206	|| 222	€ 238	■ 254
F	À 143	ƒ 159	» 175	¶ 191	± 207	■ 223	∩ 239	255

IBM CHARACTER SET #1

Hexa-decimal	0	1
0	<NUL> 0	16
1	1	<DC1> 17
2	2	<DC2> 18
3	3	<DC3> 19
4	4	<DC4> 20
5	5	21
6	6	22
7	<BEL> 7	23
8	<BS> 8	<CAN> 24
9	<HT> 9	 25
A	<LF> 10	26
B	<VT> 11	<ESC> 27
C	<FF> 12	<FS> 28
D	<CR> 13	29
E	<SO> 14	30
F	<SI> 15	31

Hexa-decimal	8	9
0	<NUL> 128	144
1	129	<DC1> 145
2	130	<DC2> 146
3	131	<DC3> 147
4	132	<DC4> 148
5	133	149
6	134	150
7	<BEL> 135	151
8	<BS> 136	<CAN> 152
9	<HT> 137	 153
A	<LF> 138	154
B	<VT> 139	<ESC> 155
C	<FF> 140	<FS> 156
D	<CR> 141	157
E	<SO> 142	158
F	<SI> 143	159

Other characters are identical to IBM character set #2.

The duplication of control codes enables systems with a 7-bit interface to obtain control functions when the most significant bit is set to 1 by the <ESC> ">" command.

ADDITIONAL CHARACTER SET

Hexa- decimal	0	1
0	∅ 0	▶ 16
1	☹ 1	◀ 17
2	☹ 2	↕ 18
3	♥ 3	!! 19
4	♦ 4	π 20
5	♣ 5	§ 21
6	♠ 6	- 22
7	• 7	↕ 23
8	◼ 8	↑ 24
9	○ 9	↓ 25
A	◼ 10	→ 26
B	♂ 11	← 27
C	♀ 12	L 28
D	♪ 13	↔ 29
E	♫ 14	▲ 30
F	✳ 15	▼ 31

In IBM mode, additional characters can be printed by special commands.

INTERNATIONAL CHARACTER SETS

When an international character set is selected by DIP switches 2-2 to 2-4 or by a command from software, the following changes are made in the character set:

Country	35	36	64	91	92	93	94	96	123	124	125	126	155	157
U.S.A.	#	\$	@	[	\	\]	^	~	{	|	}	~	¢	¥
FRANCE	#	\$	à	°	ç	š	^	~	é	ù	è	¨	¢	¥
GERMANY	#	\$	š	Ä	Ö	Ü	^	~	ä	ö	ü	ß	¢	¥
ENGLAND	£	\$	@	[	\	\]	^	~	{	|	}	~	¢	¥
DENMARK 1	#	\$	@	Æ	Ø	Å	^	~	æ	ø	å	¨	¢	¥
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü	¢	¥
ITALY	#	\$	@	°	\	é	^	ù	à	ò	è	ì	¢	¥
SPAIN 1	₧	\$	@	í	ñ	¿	^	~	ñ	}	~	¢	¥	
JAPAN	#	\$	@	[	¥	]	^	~	{	|	}	~	¢	¥
NORWAY	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü	¢	¥
DENMARK 2	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü	¢	¥
SPAIN 2	#	\$	á	í	ñ	¿	é	~	í	ñ	ó	ú	¢	¥
LATIN AMERICA	#	\$	á	í	ñ	¿	é	ü	í	ñ	ó	ú	¢	¥
DENMARK/NORWAY	#	\$	@	[	\	\]	^	~	{	|	}	~	ø	Ø

See page 17 for the DIP switch settings.

The commands for selecting the international character sets are:

Standard mode: <ESC> "R" *n* IBM mode: <FS> "R" *n*

Where *n* means character code *n*, i.e. CHR\$(*n*) in BASIC. The values of *n* are:

- | | | |
|-------------|-----------|-------------------|
| 0 U.S.A | 5 Italy | 10 Denmark II |
| 1 France | 6 England | 11 Spain II |
| 2 Germany | 7 Spain I | 12 Latin America |
| 3 Denmark I | 8 Japan | 13 Denmark/Norway |
| 4 Sweden | 9 Norway | |

INDEX

A

Absolute tab, 79
Ascender, 83, 90
Auto feed, 88
Automatic carriage return, 16
Automatic line feed, 17, 77
Automatic sheet feeder, 6, 16, 56, 88

B

Backspace, 77
Bail lever, 2, 7, 8, 9, 11, 12
BASIC, 25, 40, 92
Beeper, 20, 24, 27, 28, 29, 87
<BEL>, 87
Bidirectional printing, 87
Bit-image printing, 37, 45, 51, 80, 81, 82
Bold printing, 35, 62
Bottom margin, 74
Buffer, 17, 28, 53

C

Cancel command, 86
Carriage return, 77
Centering, 78
Channels of vertical tab stops, 75
Character codes, printing of all, 65
Character set commands, 64
Character sets, 54, 64, 65, 97-104
Character size and pitch commands, 66
Character spacing, 69
Cleaning, 47
Colour commands, 35
Colour printing, 54
Colour printing commands, 64
Column width, 32, 55
Commands:
 double parentheses, 34-36
 download character, 82
 font control, 59
 graphics, 80
 horizontal position, 76
 macro instruction, 85
 print size, 35
 type style, 35
 vertical position, 71
Commercial software, 31-35

Condensed pitch, 21, 51, 67
Connector, 3, 5
Control panel, 19
Courier type style, 22, 60

D

Delete, 86
Descender, 83, 90
Dimensions of printer, 55
DIP switches, 14-17, 33, 50, 51, 54, 64, 65, 72, 74, 82, 83, 84, 88
DOS commands, 37, 38, 39, 40
Dot matrix size, 54
Double parentheses commands, 34-36
Double-size characters, 69, 70
Double-strike printing, 62
Download character commands, 82
Download characters, 17, 51, 54, 82, 83, 84, 89-96
Draft quality, 22, 59, 60, 82, 84, 89, 90, 91

E

Electrical specifications, 56
Elite pitch, 21, 60, 66, 84
Emphasized printing, 51, 62
Emulation, 16, 31, 53
Entry slot, 3
Environmental requirements, 1, 56
Epson printers, 31
Escape code, 32
Escape sequences, 59
Expanded printing, 67

F

Fanfold forms:
 loading, 9, 50
 parking, 11, 27
 specifications, 55
 unparking, 12
Fixed spacing, 68
Font control commands, 59
Form feed, 74

G

Gap, 14
Graphics, 37, 45, 51, 80, 81, 82

Graphics commands, 80

H

Hard copy, 37
Hexadecimal dump, 24-26
Horizontal position commands, 76
Horizontal tabulation, 51, 79

I

IBM character sets, 64, 100-103
IBM mode, 16, 22, 45
IBM printers, 31
IBM-PC, 25, 26
Immediate print, 86
Initialization sequence, 33
Installing software, 31
Interface:
 signals, 56
 specifications, 53
 test, 13
International characters, 17, 51, 65, 104
Italic printing, 22, 35, 61

J

Justification, 78

L

Label printing, 50
Left margin, 28, 76, 77
Line feed, 72
Line spacing, 50, 55, 70, 71, 72
Locating the printer, 1

M

Macro instruction, 85
Macro instruction commands, 85
Maintenance, 47
Manual feed, 88
Margins:
 bottom, 74
 left, 28, 76, 77
 right, 28, 76, 77
 top, 7, 73
Master print mode, 68
Micro-feed, 27, 28
Microjustification, 69
Most significant bit, 85

N

Near letter quality, 22, 60, 83, 84, 91, 92
NLQ Type Style switch, 22, 24

O

Off-line, 20, 86
On Line switch, 20, 24, 87
Orator type style, 16, 22, 60, 61
Overlining, 63

P

Page feed, 27, 74
Page length, 16, 73
Page width, 32, 55
Panel pitch, 24
Panel style, 24
Paper Feed switch, 21, 24, 27, 28
Paper feed, 7, 8, 9, 10, 11, 12, 53
Paper guide, 6, 11
Paper specifications, 55
Paper-out detector, 16, 50, 74
Parking, 11, 12, 27
Pause, 20, 35
Pica pitch, 21, 66
Pitch, 21, 24, 34, 55, 66
Platen knob, 3
Power cord, 6
Power indicator, 20
Print Pitch switch, 21, 24, 27, 28
Print head, 48-50, 53
Print size commands, 35
Printer commands, 39, 51, 59
Printing gap adjustment, 14
Printing mechanism, 53
Programming, 38-46
Proportional pitch, 21, 68
PrtSc key, 37

Q

Quadruple-size characters, 69

R

Rear cover, 3, 9
Release lever, 3, 7, 9
Reset printer, 88
Reverse line feed, 72
Reverse micro-feed, 28
Ribbon cartridge, 5, 47, 53
Right margin, 28, 76, 77
ROM character set, 84

S

Sans-serif type style, 22, 60, 61
Self tests, 12, 13, 24
Setting up, 3
Single sheets:
 manual loading, 8

semiautomatic loading, 7
specifications, 55
Slash zero, 66
Small capitals, 16, 22
Software, 31-35
Specifications, 53-57
Sprocket feed, 9-12, 53
Standard character set, 17, 64, 98, 99
Standard mode, 16, 17, 21, 45
Star printers, 31
Subscripts, 63
Superscripts, 63

T

Tabulation, 51, 75, 76, 77
Test patterns, 12, 13, 24
Top cover, 3, 4, 5
Top margin, 7, 73
Top of page (form), 27, 33, 73
Tractor feed, 9-13, 53
Troubleshooting, 50-51
Type style, 22, 34, 55, 60
Type style commands, 35

U

Underlining, 62, 63
Unidirectional printing, 87
Unpacking and inspection, 1
Unparking, 12

V

Vertical position commands, 71
Vertical tabulation, 75

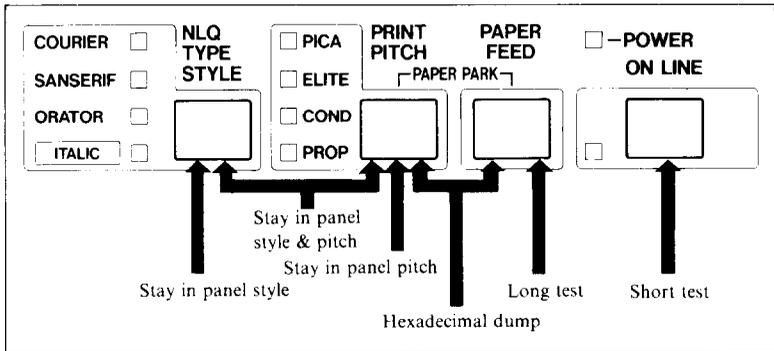
Z

Zero (slash or normal), 66

LC-10 COLOUR PRINTER REFERENCE CARD

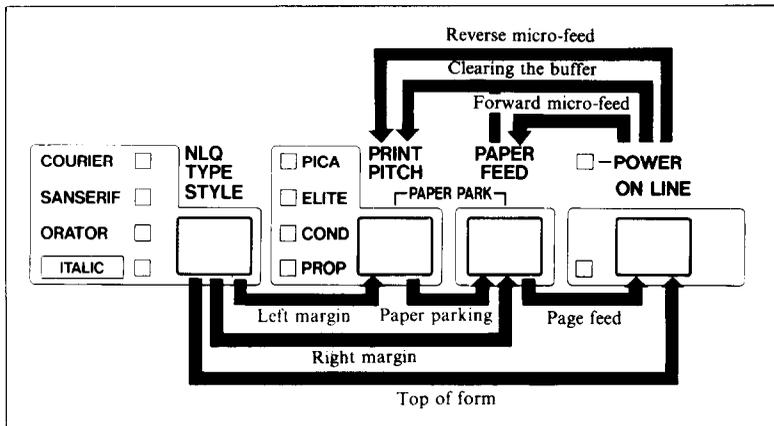
POWER-UP FUNCTIONS

In addition to their normal functions, all the control panel switches have special functions that operate if you hold them down while switching power on.



SWITCH COMBINATION FUNCTIONS

Several additional functions can be obtained by pressing the control panel switches in combinations.



DIP SWITCHES

Switch	Function	ON	OFF	Factory
1-1	Page length	11 inches	12 inches	ON
1-2	Auto CR	Yes	No	ON
1-3	Orator lower case	Small caps	Lower case	ON
1-4	Auto sheet feeder	Inactive	Active	ON
1-5	Paper-out detector	Enabled	Disabled	ON
1-6	Printer mode	Standard	IBM	ON
1-7	Character set (Std. Mode)	Italics	Graphics	ON
	Character set (IBM Mode)	Set #2	Set #1	
1-8	Auto LF	No	Yes	ON
2-1	Usage of RAM	Buffer	Download	ON
2-2	International character set	(See below)		ON
2-3			ON	
2-4			ON	

International character sets:

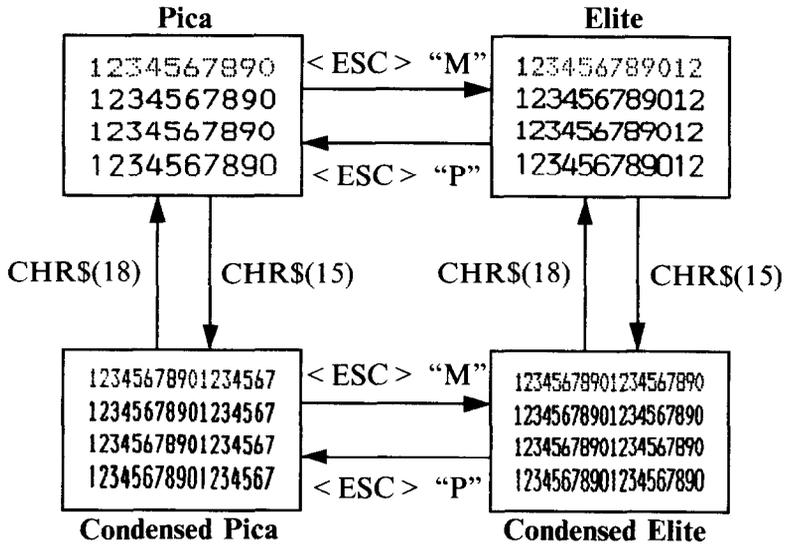
Country	2-2	2-3	2-4	Country	2-2	2-3	2-4
U.S.A.	ON	ON	ON	Denmark I *	ON	ON	OFF
France	OFF	ON	ON	Sweden	OFF	ON	OFF
Germany	ON	OFF	ON	Italy	ON	OFF	OFF
England	OFF	OFF	ON	Spain I	OFF	OFF	OFF

* Denmark/Norway when switch 1-6 is OFF and switch 1-7 is ON.

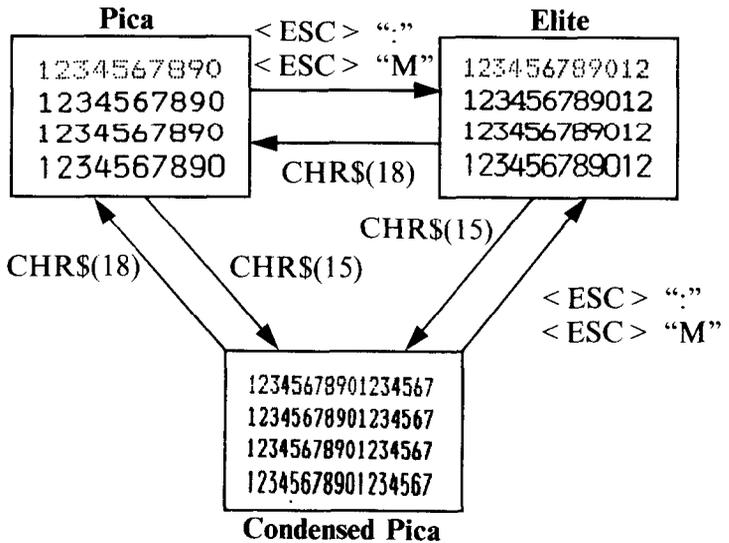
Note: DIP switches are read only at power-up. Switch power off before changing a DIP switch setting.

PRINT PITCH SELECTION

Standard mode



IBM mode



COMMAND SUMMARY IN NUMERIC ORDER

MODE	CONTROL CODE	FUNCTION	PAGE
	< BEL >	Bell	87
	< BS >	Backspace	77
	< HT >	Horizontal tab	79
	< LF >	Line feed	72
	< VT >	Vertical tab	75
	< FF >	Form feed	74
	< CR >	Carriage return	77
	< SO >	Expanded printing for one line	67
	< SI >	Condensed printing	67
	< DC1 >	Set printer on-line	87
	< DC2 >	Cancel condensed printing	67
IBM	< DC2 >	Pica pitch	66
STD	< DC3 >	Set printer off-line	86
	< DC4 >	Cancel one-line expanded printing	68
	< CAN >	Cancel last line	86
	< DEL >	Delete last character sent	86
	< ESC > < LF >	Reverse line feed	72
	< ESC > < FF >	Return to top of current page	74
	< ESC > < SO >	Expanded print for one line	67
	< ESC > < SI >	Condensed printing	67
	< ESC > < EM > < 0 >	Manual feed	88
	< ESC > < EM > < 4 >	Auto feed	88
	< ESC > < EM > "R"	Eject paper from ASF	88
	< ESC > < EM > "T" n	Set print start position on ASF	88
STD	< ESC > " " n	Increase character spacing	69
	< ESC > "!" n	Select master print mode	68
	< ESC > "#"	Accept MSB as is	85
	< ESC > "\$" n1 n2	Absolute horizontal tab in inches	79
	< ESC > "%" 0	Select ROM character set	84
	< ESC > "%" 1	Select download character set	84
	< ESC > "&" < 0 > n1 n2 m0 m1....	Define download characters	82
	< ESC > "*" n0 n1 n2 m1 m2....	Select graphics mode	81
	< ESC > "+" < RS >	Define macro instruction	85
	< ESC > "+" < 1 >	Execute macro instruction	85
	< ESC > "- " 0	Stop underlining	63
	< ESC > "- " 1	Start underlining	62
	< ESC > "/" n0	Select vertical tab channel	75
	< ESC > "0"	Set line spacing to 1/8 inch	71
	< ESC > "1"	Set line spacing to 7/72 inch	71
STD	< ESC > "2"	Set line spacing to 1/6 inch	71
IBM	< ESC > "2"	Execute < ESC > "A"	72
	< ESC > "3" n	Set line spacing to n/216 inch	71
STD	< ESC > "4"	Select italic characters	61
IBM	< ESC > "4"	Set top of page at current position	73
STD	< ESC > "5"	Select upright characters	61
IBM	< ESC > "5" < 0 >	Cancel automatic line feed	77
IBM	< ESC > "5" < 1 >	Set automatic line feed	77
	< ESC > "6"	Select IBM character set #2	65
	< ESC > "7"	Select IBM character set #1	65
	< ESC > "8"	Disable paper-out detector	74
	< ESC > "9"	Enable paper-out detector	74
IBM	< ESC > "."	Flite pitch	66
STD	< ESC > "." < 0 > < 0 > < 0 >	Copy standard characters from ROM into RAM	82
	< ESC > "<"	One-line unidirectional printing	87
STD	< ESC > "="	Set MSB to 0	85

MODE	CONTROL CODE	FUNCTION	PAGE
IBM	<ESC> "=" <i>n1 n2</i> <DC4> <i>a0 a1 a2 m1...</i>	Define download characters	83
	<ESC> ">"	Set MSB to 1	85
	<ESC> "??" <i>n m</i>	Convert graphics density	81
	<ESC> "@"	Reset printer	88
	<ESC> "A" <i>n</i>	Set line spacing to <i>n</i> /72 inch	71
	<ESC> "B" <i>n1 n2.....</i> <0>	Set vertical tab stops	75
	<ESC> "C" <0> <i>n</i>	Set page length to <i>n</i> inches	73
	<ESC> "C" <i>n</i>	Set page length to <i>n</i> lines	73
	<ESC> "D" <i>n1 n2.....</i> <0>	Set horizontal tab stops	78
	<ESC> "E"	Emphasized printing	62
	<ESC> "F"	Cancel emphasized printing	62
	<ESC> "G"	Double-strike printing	62
	<ESC> "H"	Cancel double-strike printing	62
IBM	<ESC> "I" 0	Select draft quality characters	59
IBM	<ESC> "I" 1	Select draft elite characters	60
IBM	<ESC> "I" 2	Select Sanserif characters	61
IBM	<ESC> "I" 3	Select Courier characters	60
IBM	<ESC> "I" 4	Select draft download character set	84
IBM	<ESC> "I" 5	Select draft elite download character set	84
IBM	<ESC> "I" 6	Select NLQ download character set	84
IBM	<ESC> "I" 7	Select Courier characters	60
	<ESC> "J" <i>n</i>	Perform one <i>n</i> /216-inch line feed	72
	<ESC> "K" <i>n1 n2 m1 m2</i>	Print single-density 8-bit graphics	80
	<ESC> "L" <i>n1 n2 m1 m2</i>	Print double-density 8-bit graphics	80
	<ESC> "M"	Elite pitch	66
	<ESC> "N" <i>n</i>	Set bottom margin	74
	<ESC> "O"	Cancel top and bottom margins	74
STD	<ESC> "P"	Pica pitch	66
IBM	<ESC> "P" <0>	Select fixed spacing	68
IBM	<ESC> "P" <1>	Select proportional spacing	68
IBM	<ESC> "Q" <3>	Set printer off-line	86
STD	<ESC> "Q" <i>n</i>	Set right margin	76
IBM	<ESC> "R"	Reset all tab stops	78
STD	<ESC> "R" <i>n</i>	Select international character set	65
	<ESC> "S" 0	Superscript	63
	<ESC> "S" 1	Subscript	63
	<ESC> "T"	Cancel superscript or subscript	63
	<ESC> "U" 0	Bidirectional printing	87
	<ESC> "U" 1	Unidirectional printing	87
	<ESC> "W" 0	Cancel expanded printing	67
	<ESC> "W" 1	Expanded printing	67
	<ESC> "X" <i>n1 n2</i>	Set left and right margins	77
	<ESC> "Y" <i>n1 n2 m1 m2...</i>	Print double-density, double-speed 8 bit graphics	80
	<ESC> "Z" <i>n1 n2 m1 m2...</i>	Print quadruple-density 8-bit graphics	80
	<ESC> "[@" <4> <0> <0>...	Select character height, width, and line spacing	70
IBM	<ESC> "\" <i>n1 n2</i>	Enable printing of all character codes	65
STD	<ESC> "\" <i>n1 n2</i>	Relative horizontal tab	79
IBM	<ESC> "^"	Enable printing of all character codes on next character	66
STD	<ESC> "^" <i>n0 n1 n2 m1 m2 ...</i>	Print 9-pin graphics	81
	<ESC> "_" 0	Stop overlining	63
	<ESC> "_" 1	Start overlining	63
	<ESC> "a" 0	Left justify	77
	<ESC> "a" 1	Center text	78
	<ESC> "a" 2	Right justify	78

MODE	CONTROL CODE	FUNCTION	PAGE
	<ESC> "b" <i>n0 n1 n2</i> <0>	Set vertical tab stops in channel	75
	<ESC> "c" <i>n</i>	Set top margin	73
	<ESC> "e" 0 <i>n</i>	Set horizontal tab stop every <i>n</i> columns	78
	<ESC> "e" 1 <i>n</i>	Set vertical tab stops every <i>n</i> lines	75
	<ESC> "f" 0 <i>n</i>	Absolute horizontal tab in columns	79
	<ESC> "f" 1 <i>n</i>	Feed paper <i>n</i> lines	73
	<ESC> "h" <i>n</i>	Select double or quadruple size	69
	<ESC> "j" 0	Cancel immediate print	86
	<ESC> "j" 1	Immediate print	86
	<ESC> "j" <i>n</i>	Perform one <i>n</i> /216-inch reverse line feed	72
	<ESC> "k" <i>n</i>	Select NLQ type style	60
	<ESC> "l" <i>n</i>	Set left margin	76
	<ESC> "p" 0	Select fixed spacing	68
	<ESC> "p" 1	Select proportional spacing	68
	<ESC> "r" <i>n</i>	Select printing colour	64
STD	<ESC> "t" 0	Select standard character set	64
STD	<ESC> "t" 1	Select IBM character set	64
	<ESC> "w" 0	Return to normal height	69
	<ESC> "w" 1	Print double-height characters	69
	<ESC> "x" 0	Select draft quality characters	59
	<ESC> "x" 1	Select NLQ characters	60
	<ESC> "~" 0	Select normal zero	66
	<ESC> "~" 1	Select slash zero	66
IBM	<FS> "4"	Select italic characters	61
IBM	<FS> "5"	Select upright characters	61
IBM	<FS> ":" <0> <0> <0>	Copy standard characters from ROM into RAM	82
IBM	<FS> "="	Set MSB to 0	85
IBM	<FS> "Q" <i>n</i>	Set right margin	76
IBM	<FS> "R" <i>n</i>	Select international character set	65
IBM	<FS> "\ " <i>n1 n2</i>	Relative horizontal tab	79
	"(" ("0" ")")"	Manual feed	88
	"(" ("4" ")")"	Auto feed	88
	"(" ("B" ")") "0"	Cancel double-strike printing	62
	"(" ("B" ")") "1"	Double-strike printing	62
	"(" ("C" ")") <i>n</i>	Select printing colour	64
	"(" ("F" ")") "0"	Select Courier characters	60
	"(" ("F" ")") "1"	Select Sanserif characters	61
	"(" ("F" ")") "2"	Select Orator characters with small capitals	61
	"(" ("F" ")") "3"	Select Orator characters with lower case	61
	"(" ("F" ")") "9"	Select draft quality characters	59
	"(" ("I" ")") "0"	Select upright characters	61
	"(" ("I" ")") "1"	Select italic characters	61
	"(" ("R" ")")"	Eject paper from ASF	88
	"(" ("S" ")") <i>n</i>	Select character size	70
	"(" ("T" ")") <i>n</i>	Set print start position on ASF	88

Type styles are:

Draft characters,
 Courier characters,
 Sanserif characters,
 ORATOR WITH SMALL CAPITALS, OR
 with lower case characters,
 and *ITALICS* for all styles.

Print pitches are:

Pica pitch, Elite pitch,
 Condensed pica pitch, Condensed elite pitch,
 Proportional spacing for all pitches,

Expanded, Double-height,
 Double-sized,
Quad-sized.

Colour printing:

RED, BLUE, VIOLET,
 ORANGE, GREEN, and BLACK.

Various line and character spacings:

THE SPACING HAS CHANGED
 THE SPACING HAS CHANGED

Other features:

Emphasized, Double-strike,
Underlining, Overlining,
 SUPERSCRIP^T, SUBSCRIP_T,
 Download characters: 0000 0000 0000 00
 Dot graphics:

S&S