EX-800
EX-1000

User's Guide

EPSON

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EX-800
EX-1000

User's Guide

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Introducing the EX-800 and EX-1000 Printers

The EX printer combines all the well-known virtues of previous Epson 9-pin printers with many features normally exclusive to costly 24-pin printers.

The speed of draft printing is higher than ever — 250 characters per second in draft pica mode and 300 in elite. When you have perfected a document, you can switch to one of two Near Letter Quality styles — Roman or Sans Serif.

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Draft printing is faster than ever before.
NLQ Roman is clear and typewriter-like.
NLQ Sans Serif is crisp and distinctive.
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By adding the color option kit you can upgrade your EX to a full-fledged color printer, capable of using the many programs designed for the Epson JX-80. However, unlike many color printers, you can still use inexpensive black ribbons when you do not need color.

The SelecType feature gives you access to both of the Near Letter Quality (NLQ) printing styles, two different pitches, proportional spacing and condensed print. All you have to do is press the button for the style you want. While the printer is printing, the SelecType panel shows you what choices are in effect.

If you are using software designed for an IBM® printer, you have the choice of using the EX in Epson mode or IBM printer emulation mode. Even better, you can combine the best of both worlds: the powerful Epson mode commands can now print character graphics like those used by IBM printers and computers.

Loading paper is now easier than ever. Single sheets can be loaded just by moving a lever, and the new built-in push-feed tractor lets you load a wide range of sizes of continuous paper, including labels.

If your work includes business graphics, you will find that the EX sets a new standard in speed. All graphics are now printed in bidirectional mode, almost doubling the speed of graphics printing.

About This Guide

This book is in five main sections, which you can quickly locate using the blue divider pages.

The first section takes you through a series of simple steps to get your printer set up and to test its functions. The second section then guides you through connecting the printer to your computer system and getting it working with your software. It also shows you how to use SelecType and how to take care of the printer.

Once you have mastered the basic functions, you can go on to the section on Getting More From Your Printer. This section describes the features of the printer and gives advice about controlling the printer with software.

The last two sections contain reference information, including all the details you need to use any of the printer's commands, a summary of typestyles, and some advice on solving problems.

Finally, there is a full list of terms beginning on page 231, and a comprehensive index.

Inside the back of the manual is a pull-out Quick Reference Card containing the information you will need most often. On the flap of the back cover, you will find a list of conventions used in this guide, so that you can use the flap for reference. On the inside of the flap are diagrams of the parts of the printer, which you will find useful while you are setting it up.

Note

The EX-800 and EX-1000 printers are very similar. Though the figures in this book show just the EX-800, you will find they apply to the EX-1000 printer too.

Setting Up Your Printer

Chapter 1

Setting Up the Printer

The following steps take you through unpacking the printer, locating it, assembling the parts, and carrying out a test. You will find it worthwhile to follow the instructions step by step. Open out the back flap of this guide; on the inside are diagrams to help you follow the instructions.

Note

Some steps must be carried out before plugging in the printer and turning it on. Do not plug it in until instructed to do so.

Unpacking the Printer

As you unpack the printer, check off the parts against the diagram on the next page to make sure they are all there, and that nothing has been damaged during transportation.

First remove the printer from the box and lay it on a flat surface. Remove all the foam packing supports and outer plastic coverings. When you are finished unpacking, put the packaging materials back in the box, and keep them in case you need to transport the printer in the future. If any of the parts are missing or damaged, contact your Epson dealer. (You will find the paper feed knob inserted in the foam packing material.)

There are several different versions of the printer designed for different electrical standards. The power supply type is shown on the label at the back of the printer. If this does not show the correct voltage for your country, contact your dealer. It is not possible to adjust the printer for use on another voltage.

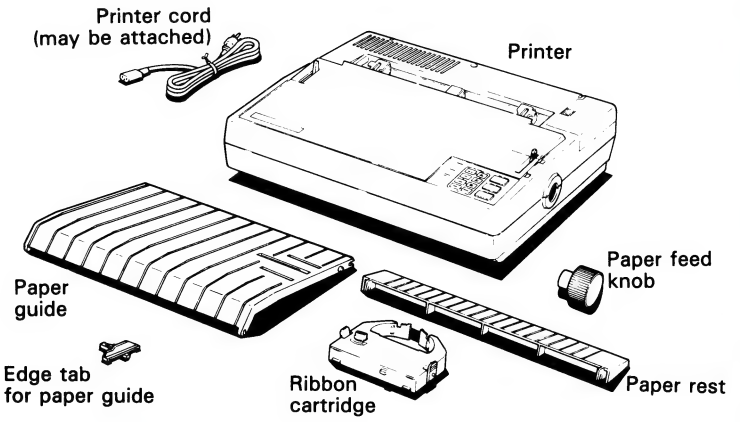


Figure 1-1. Printer parts

Now install the paper feed knob. The knob simply pushes onto the shaft on the right side of the printer, as shown below. Line up the flat side of the hole in the knob with the flat side of the shaft, then push the knob firmly into place.

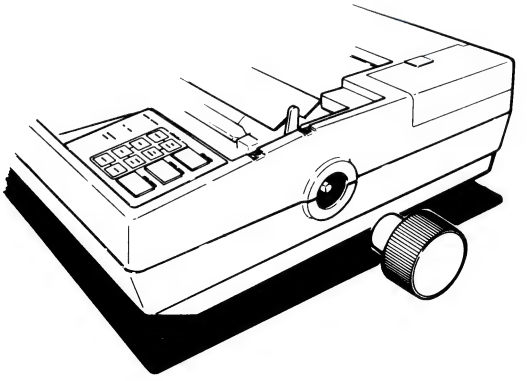


Figure 1-2. Installing the paper feed knob

Now, remove the dust cover: tilt it up and lift it away from the printer. Set it to one side while you remove the remaining packing.

Next, remove the print head protector. Lift it up and pull it to the right as shown in the figure.

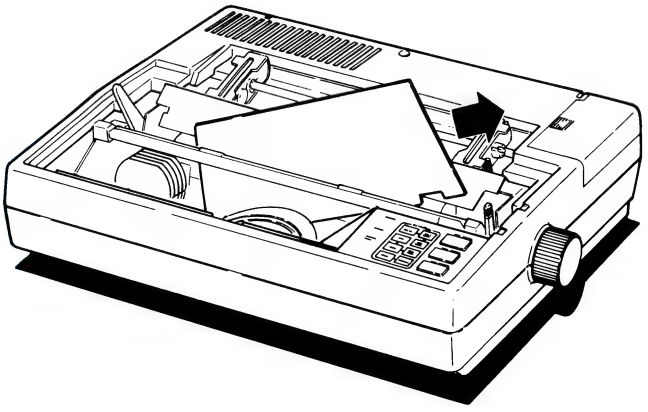


Figure 1-3. Removing the print head protector

If you need to transport the printer a long distance, you should carefully repack it following the instructions on page 64.

Choosing a Place for the Printer

When choosing a place for the printer, make sure that it is close enough to a power socket and to your computer so that the cables are not stretched and are kept clear of the back of the printer.

You should also bear the following points in mind:

- It is important to connect the printer to its own grounded power socket, avoiding sockets on the same circuit with large motors and other appliances that make sudden demands or otherwise disturb the power supply.
- Keep your entire computer system away from potential sources of interference, such as the base units of cordless telephones.
- Place the printer on a flat, stable surface: never place it on a chair, or any other unstable support.
- Choose a place that is clean and free from excessive heat (including direct sunlight), moisture, and dust.

The names of the parts of the printer are shown on the diagrams inside the back flap of this guide. Use them for reference while following the rest of the instructions.

The paper guide shown in the diagram below makes sure that paper flows smoothly and correctly. It can be installed in two ways for different kinds of paper. The paper rest is used with continuous paper to help prevent the paper from catching on the cables.

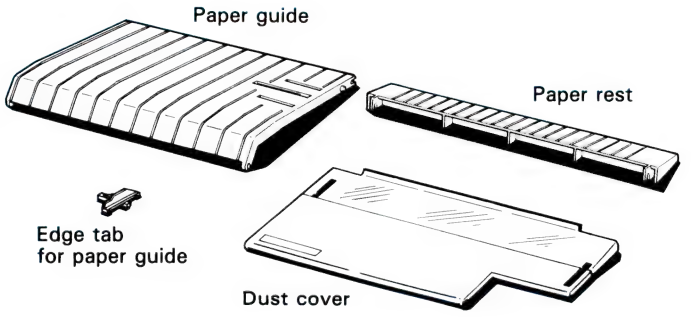


Figure 1-4. Accessories

Once the ribbon is installed, the dust cover should be replaced to reduce noise and keep the printer clean. You can easily load paper with it in place.

The control panel consists of three main parts, shown in the diagram below.

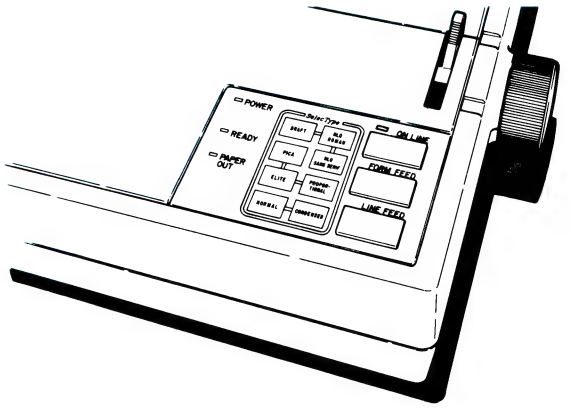


Figure 1-5. The control panel

Three large buttons at the right side control communication with the computer and let you advance the paper. The three indicators at the left show when the printer is turned on and when it is ready for use.

The remainder of the control panel is made up of eight touch switches that let you choose the print style and size and check your selection. This is a special feature called SelecType, which is fully described starting on page 57.

Installing the Ribbon

The EX uses a simple cartridge ribbon designed for convenient and trouble-free installation. If you install the color option kit, you can use a color ribbon whenever you need one, but use a normal black ribbon for day-to-day printing. Both types of ribbon are installed in the same way.

1 If you have replaced the dust cover, remove it to make it easier to install the ribbon.

2 If the printer is plugged in, make sure it is turned off.

WARNING

The power must be OFF when moving the print head. Moving the print head when the power is on can damage the printer mechanism. If the printer has been used just before changing the ribbon cartridge, allow the print head to cool down before you remove or install the ribbon.

3 Move the print head carriage to about 25 on the scale on the paper bail.

4 Remove the ribbon cartridge from its packaging and tighten the ribbon by turning the knob in the direction of the arrow.

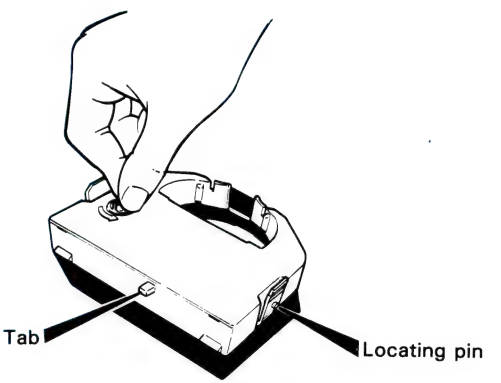


Figure 1-6. Tightening the ribbon

5 Make sure the paper bail is against the platen.

6 Hold the cartridge, gently squeezing the two ridged plastic tabs together. Then tilt it back slightly and lower it into the print head carriage so that the ribbon passes between the print head and the silver ribbon guide. The tab on the back of the ribbon cartridge should rest on top of the corresponding tab on the carriage.

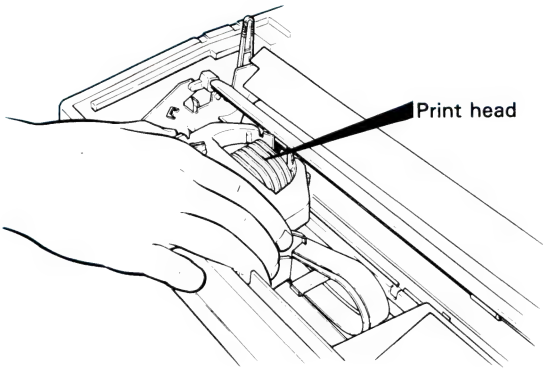


Figure 1-7. Installing the ribbon

7 Release the tabs so that the pins on the tabs click into the holes in the sides of the print head carriage.

8 Check that the ribbon is not wrinkled; then replace the dust cover.

Replacing the ribbon

The EX uses a continuous-loop, inked fabric ribbon. When your printouts become too light, you must replace the whole ribbon cartridge.

WARNING

Always use replacement ribbons designed specifically for Epson EX printers. It is not possible to use ribbons for any other series of printer, and you should never try to re-ink the ribbon.

To replace the ribbon, simply grip the cartridge by the two plastic tabs and lift it up and out of the printer. You can then install a new cartridge following the steps described above.

Installing the paper guide

The paper guide can be installed in two positions. For the purpose of testing the printer, you will need to install it to support a single sheet.

1 First, you have to assemble the paper guide. Put the edge tab into the guide frame. Holding the plastic spring, insert it into the groove as shown below.

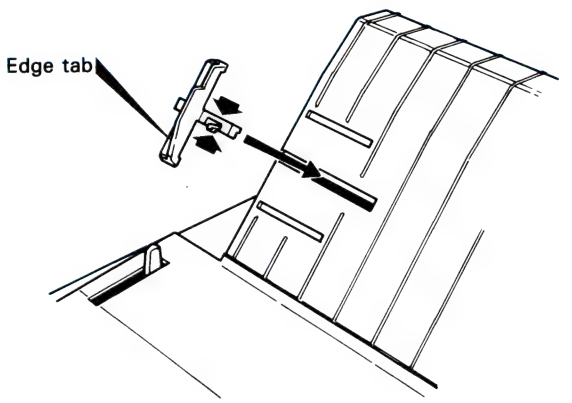


Figure 1-8. Assembling the paper guide

2 Remove the dust cover.

3 Hold the paper guide vertically, as shown below, and lower it so that the slots at either side fit onto the two pins just in front of the tractor.

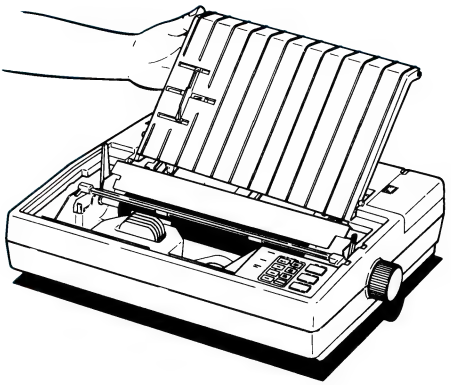


Figure 1-9. Installing the paper guide

4 Tilt the paper guide back until it rests on its pins at an angle.

5 The edge tab is movable, with a click stop for its middle position. For standard-sized paper, see that the tab is in the click-stop position. This corresponds to the extreme left printing position and is useful for aligning paper.

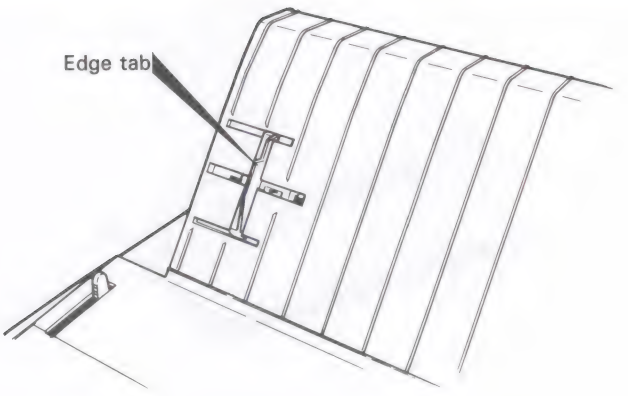


Figure 1-10. Paper guide markings

6 Replace the dust cover.

Chapter 2

Testing the Printer

The next steps tell you how to connect the printer, what happens when you turn on the power, and how to carry out the built-in self test. For the EX-800 printer, you will need a sheet of paper at least 210 mm wide (8 1/4 inches); a piece of A4 or American letter size paper is suitable. For the EX-1000, you will need B4 or legal size paper fed in sideways.

When you have completed this section, you will have samples of the printer's draft and NLQ Roman typestyles together with an important list of switch settings. You will then be ready to connect the printer to your computer system and try it with the software you will be using.

Turning On the Printer

Before connecting your printer to the power socket, you must check that the electricity is of the right voltage and frequency so that you do not damage the circuits inside the printer. The power supply type is shown on the label at the back of the printer.

If your model has a separate power cord, first connect it to the printer. Make sure that the power switch on the left side of the printer is in the off position, then plug the power cord into a properly grounded (earthed) socket.

WARNING

Before turning on the printer, make absolutely sure you have removed all packing materials. If the print head is prevented from moving when the printer is switched ON, the mechanism can be seriously damaged.

Turn the power on with the switch on the left side of the printer.

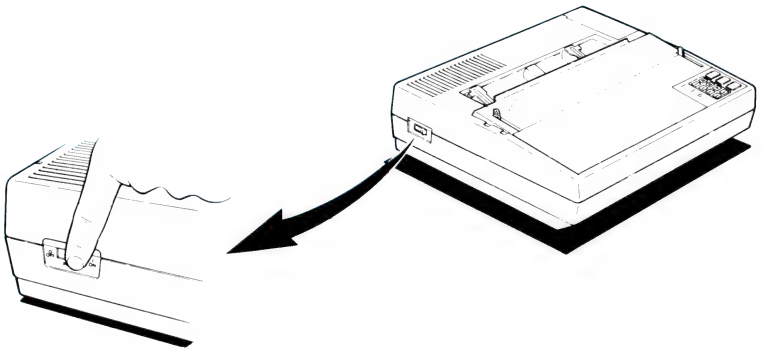


Figure 2-1. Turning on the power switch

When you turn on the printer, several important things happen:

- The print head moves back and forth and stops at the left side of the printer: this is the home position.
- If the color option kit is installed, the ribbon carriage moves up and down to set the ribbon at the correct level for printing.
- The printer is initialized and set to the default settings described on page 205.
- The green **POWER** light on the control panel comes on.
- The red **PAPER OUT** light comes on if there is no paper in the printer. At other times, this light only comes on when you try to print with no paper.

Loading a Sheet of Paper

Even if you normally use continuous paper for your work, it is simpler for the moment to test the printer using a single sheet of paper.

Note

The self test printout is 205 mm (8 inches) wide on the EX-800 and 350 mm (13.6 inches) wide on the EX-1000. Use paper that covers this width and make sure the sheet is aligned correctly. Standard A4 paper is 21 cm wide (8 1/4 inches); Standard B4 paper, in sideways, is 36 cm wide (14 1/2 inches).

1 Make sure that the printer is turned on.

2 Make sure the paper bail and paper release levers are back (and), and open or remove the dust cover.

3 Make sure the **ON LINE** light is off. If it is on, press the **ON LINE** button once.

4 Push the paper into the printer until you feel resistance, then lay it against the paper guide. Make sure the left side is aligned with the edge tab as shown below.

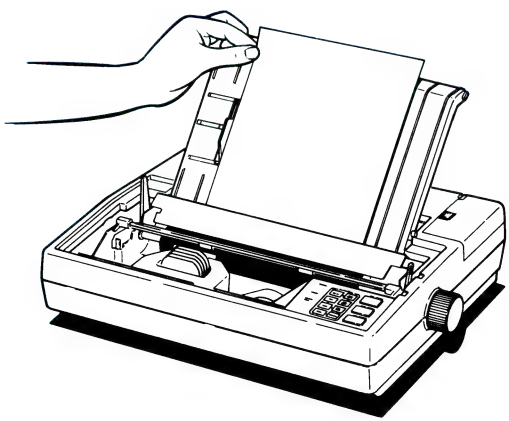


Figure 2-2. Aligning the paper

5 Pull the paper bail lever forward (). The paper should feed into the printer until it is a little past the paper bail.

6 When the paper stops, push the paper bail lever back (), and the paper should feed backward until it is just held in place at the top edge.

If the platen turns but the sheet does not load, remove the sheet from the printer and try again; make sure that the paper release lever is back () and press the paper a little more firmly into place. If nothing happens at all, make sure that the printer is turned on and that the **ON LINE** light is off, then remove the paper and try again.

7 Now turn the printer off to prepare it for the self test.

Running the Self Test

The EX has a built-in self test function that prints out the characters in its memory, even if it is not connected to a computer. This lets you check the operation of the mechanical parts of the printer — the motors, the drive cable, and the ribbon mechanism — and the print quality. You should carry out the test now to make sure that the printer has not been damaged during transport and that it is set up properly. For example, the test makes sure the ribbon has been put in correctly. If the self test works correctly, and you have trouble printing with your software, this helps you in finding and solving the problem.

The EX self test also lists the settings of the DIP switches located on the back panel so that you can easily check how the printer is set up. This part of the self test printout will be useful in the next section when you connect the EX to your computer system.

As the printer is supplied from the factory, you can make it carry out the self test in either draft quality or Near Letter Quality print.

To carry out the test in NLQ:

1 Make sure the power is turned OFF and that the dust cover is open so that you can see the printer working.

2 Hold down the **FORM FEED** button and turn the printer back on.

3 Keep holding down **FORM FEED** until printing starts, then release it.

4 Check the SelecType panel. The **NLQ ROMAN** button lights up, confirming that the self test is in NLQ Roman print.

The sequence that is printed starts something like this:

```
Ver. X.X

Condensed          OFF
Zero               0
CG Table           Italic
MODE               ESC/P
Print Quality      Draft
Country            U.S.A.
Page Length        11"
Sheet Feeder       OFF
Skip-Over-Perf.    OFF
Auto LF            OFF
Interface          Parallel

 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQR
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
```

5 The self test does not stop until you turn off the printer. Watch the printing for a few lines to make sure that everything is working normally, then turn off the printer.

You may have sufficient room on the paper to print a few lines of the draft quality self test. If not, make sure the printer is turned off, wind the paper out of the printer, and load a new sheet.

Unless the printer has been set up to print in Near Letter Quality by default (DIP switch 1-5 UP), you can also carry out the test in draft quality. To do this:

1 Make sure the printer is turned off, then position the paper using the paper feed knob.

2 Hold down the **LINE FEED** button and turn the printer back on.

3 Keep holding down **LINE FEED** until printing starts, then release it.

4 Check the SelecType panel. The **DRAFT** button lights up, confirming that the self test is in draft quality print.

The new sequence begins with the same list of settings; the characters which follow will start like this:

```
 !"#$%&´()*+,-./0123456789 abcdefghijklmno
!"#$%&´()*+,-./0123456789  abcdefghijklmnop
"#$%&´()*+,-./0123456789   abcdefghijklmnopq
#$%&´()*+,-./0123456789    abcdefghijklmnopqr
$%&´()*+,-./0123456789     abcdefghijklmnopqrs
%&´()*+,-./0123456789      abcdefghijklmnopqrst
```

5 Watch the printing for a few lines to make sure that everything is working normally, then switch off the printer.

If you are not satisfied that the printer is working properly after the self test, first check that you have set it up properly and try again. If there is still a problem, contact your Epson dealer.

Note

If you will be using the printer in IBM printer emulation mode, you can repeat the self test once the printer has been set up for that mode, as explained on page 26.

Using Your Printer

Chapter 3

Connecting the Printer to Your Computer

For the printer to receive and interpret information from your computer, the two interfaces at either end of the connecting cable need to be set up to match.

There are two main types of interface — parallel and serial. Most computer systems have either a Centronics® compatible parallel interface, or an RS-232C compatible serial interface. The EX has built-in interfaces of both types, so that with a suitable cable most computers can be connected immediately. A few computers have other types of interfaces. These computers can usually be connected to optional interface boards which can be installed inside the printer.

This section should help you decide which type of interface you need to use to make a successful connection.

Choosing an Interface

First check your computer manual if you are unsure which interface you have. Do not rely on looking at the connector at the back of your computer; the parallel interface connector on IBM and most compatible computers is of the same type as the serial connector on many other types of computer.

If your computer requires a special type of interface, refer to Appendix G, or see your Epson dealer.

If only one interface is available, all you need is a suitable cable. If both types of interface are available, it is normally better to use the parallel interface for the printer, leaving the serial port free for another device such as a modem or a plotter.

The EX has a built-in 8 Kbyte data buffer that stores characters until they are printed, quickly freeing your computer for other work. The buffer can hold around six pages of double-spaced text, so it is sufficient for most ordinary applications. Some software now lets you carry on working on one task while printing another document; this is called background printing. The EX data buffer is even more effective with this kind of software. If you often print very large amounts of text and this holds up your work, refer to the section on page 209 for details of optional buffer interfaces.

If you plan to use the parallel interface, read the section below: if you will be using the serial interface, move on to the section on page 21.

The parallel interface

Connecting a parallel interface takes only five simple steps:

1 Before connecting the printer and computer make sure they are both turned off.

2 Plug the connector into the printer.

3 The connector is secured to the printer by two clips. Squeeze the clips gently and click them into place as shown below.

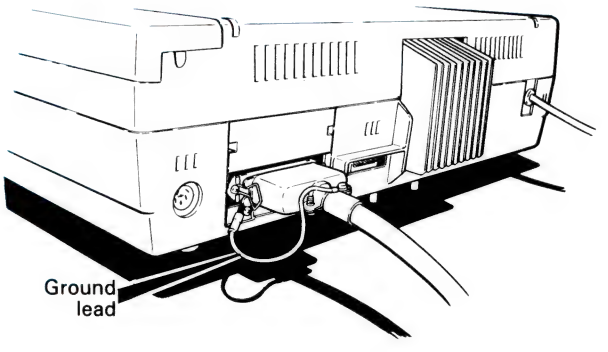


Figure 3-1. Connecting a parallel interface cable

4 Some shielded parallel cables are equipped with a ground lead. Connect this to the ground connector on the printer to protect data from interference.

5 Most computers use the same type of connector as the printer. Plug the other end of the cable into the computer, and connect the ground lead if one is provided.

Parallel interfaces require no further adjustment.

The serial interface

Computer serial ports vary considerably, so make sure you have a suitable cable for your computer. The EX can be connected directly to the serial port of most computers including the Apple® IIc.

Note

The parallel interface connector on IBM and most compatible computers is of the same type as the serial connector on many other computers like the Epson QX-16™. Do not attempt to connect the EX to an IBM or compatible computer unless you are certain that the DB-25 socket is provided for the serial and not the parallel interface.

For a serial interface, there are four switches that must be adjusted to make sure the computer and printer communicate properly. These and other necessary adjustments are described in the next chapter.

Chapter 4

Important DIP Switch Adjustments

The EX offers you many different ways of working, and you can set it up so that each time you turn on the power the printer is ready to work in the way you want. You do this by altering the settings of 16 small switches on the rear panel of the printer, known as DIP (Dual In-line Package) switches.

This section describes how to adjust the DIP switches for the first time. If you need to adjust them again, there is a summary table on the Quick Reference Card.

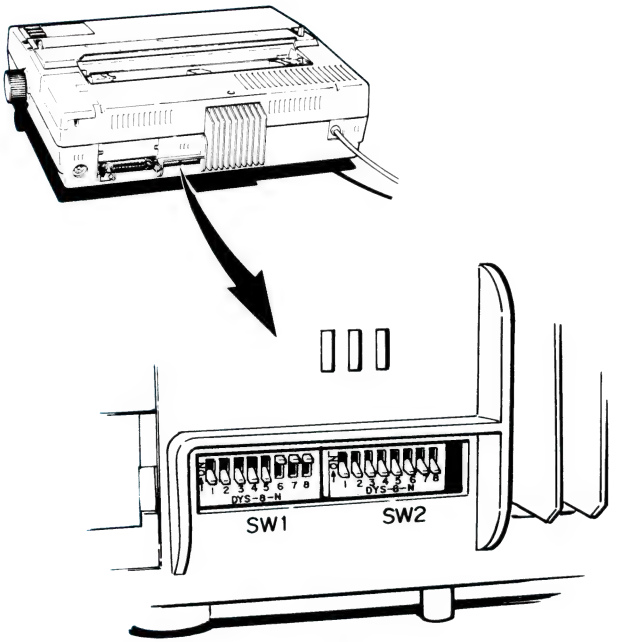


Figure 4-1. DIP switch location

The switches are divided into two groups of eight: in this book they are referred to as DIP switch 1-1 to DIP switch 2-8. The settings of these switches are printed out when you perform a self test — the printout looks something like this.

```
Condensed          OFF
Zero               0
CG Table           Italic
MODE               ESC/P
Print Quality      Draft
Country            U.S.A.
Page Length        11"
Sheet Feeder       OFF
Skip-Over-Perf.    OFF
Auto LF            OFF
Interface          Parallel
```

You will find the printout useful as you read this section.

Note

When you change a DIP switch setting, turn off the power, reset the switch, then turn on the power again. The printer checks the settings only at the time the power is turned on.

Before you try to adjust any of the DIP switches, turn the printer around so you have easy access to them. The switch settings can easily be changed with a thin pointed object, such as a small screwdriver or the cap of a ballpoint pen. The switches are ON when they are UP, and OFF when they are DOWN. In the tables that follow, factory settings of the switches are shown like this — **DOWN** and **UP**.

Adjusting the Serial Interface

Four of the DIP switches control the built-in serial interface. If you are using any other type of interface, you should see these words on your DIP switch printout:

```
Interface          Parallel
```

If so, you can skip this section and go on to Choosing the Operating Mode on page 26.

When you adjust the serial interface on the printer, you should also check and, if necessary, adjust the settings on the computer. When you have finished, the settings of both must match, or you are likely to have problems getting the printer working correctly. The command to adjust the computer may be called CONFIG or SETUP, or you may be able to make adjustments directly with your applications software.

About serial communication

Serial communication has four characteristics. Two of these are fixed in the EX serial interface and must be set on the computer. The number of start bits — signals sent to mark the start of each character — is fixed at one, and the computer must match this setting. The number of stop bits at the end of each character can be one or more: you should normally choose one.

The remaining two characteristics can be set on the printer. They are the speed at which data can be received from the computer and the way in which its reliability will be checked.

Speed is expressed as a baud rate. This is approximately the same as the number of bits per second. Around 11 bits need to be received for each character in normal printing. It is usually best to use the highest speed available — this is the factory setting — but if you find that the printing is not reliable, try a slower speed. Always remember to set the same speed on the computer and the printer.

The reliability of communications is checked by sending one additional piece of information — a parity bit. A small number of computers cannot send a parity bit: in this case choose non parity. Otherwise, it is always better to choose odd or even parity. It does not matter which you choose, as long as the settings match.

Setting the switches

The type of interface and the type of parity check for a serial interface are set with DIP switches 2-5 and 2-6:

Table 4-1. Interface type

Interface	Parity	DIP switch: 2-5	2-6
built-in parallel or any option	—	DOWN	DOWN
built-in serial	odd	DOWN	UP
built-in serial	even	UP	DOWN
built-in serial	none	UP	UP

DIP switches 2-7 and 2-8 determine the baud rate when the built-in serial interface is used. They have no effect on any optional interfaces, or on the built-in parallel interface, so if you use the serial interface only occasionally, you can still leave these switches set as you want.

Table 4-2. Baud rate (built-in)

Baud rate	DIP switch: 2-7	2-8
9600	DOWN	DOWN
4800	DOWN	UP
1200	UP	DOWN
300	UP	UP

Choosing the Operating Mode

The EX has two operating modes, ESC/P™ and IBM printer emulation mode. ESC/P stands for Epson Standard Code for Printers, which is a powerful set of commands developed by Epson and supported by almost all applications software for personal computers. This is the mode that you should find the most useful and valuable for your printing. In the rest of this guide the ESC/P mode is referred to simply as Epson mode.

The IBM printer emulation mode is for software that is designed for IBM printers. It is not necessary to use this mode for your EX to be compatible with IBM computers. As you can see from the list of Epson and IBM printer emulation mode commands beginning on page 239, the Epson mode has more commands and thus offers many more capabilities on your Epson printer.

There are only two cases in which you may want to use the IBM printer emulation mode:

1 Your software lists only IBM printers in its printer selection menu.

2 You need to use the following IBM characters:

♥ ♦ ♣ ♠ ¶ § → ← ∅

and your applications software will not print them in the Epson mode.

If you change DIP switch 1-4 from DOWN to UP and choose an IBM printer in your software's printer selection menu, your EX will behave like an IBM printer. In this way you can use most software that supports IBM printers, but you will notice that the commands do not allow you access to all the features of your Epson printer.

The Epson Character Graphics set

Half of the characters in the IBM PC (MS-DOS) character set are special character graphics and international characters. On most previous Epson printers, these characters printed as italics — now you can choose to have italics as before or to replace these with the character graphics. Your software can still print italics; you simply gain an additional set of characters.

Making the choice

The decision you make will depend upon the software you use. For most applications, it is best to choose the Epson mode and the Character Graphics set. That way you can set up your software for an Epson printer and have the full power of the Epson commands. If you have trouble printing italics, change DIP switch 1-3 to the DOWN position to choose italics instead of character graphics. If you have trouble printing character graphics, change the printer to IBM printer emulation mode by setting DIP switch 1-4 from DOWN to UP and set your software to match.

WARNING

You must always be careful to set up your printer and software to match. Although the IBM commands are based on some of the Epson commands, there are important differences which affect much software. These can result in extremely erratic printing. In particular, the line spacing and page layout are likely to be wrong, and extra characters may be printed.

DIP switch 1-3 functions differently in the two modes. It is set to the DOWN position at the factory to select the standard Epson italic character set — the DIP switch printout should include the following:

```
CG Table          Italic
```

If you want to use the Character Graphics set with Epson mode, move DIP switch 1-3 to the UP position.

In IBM printer emulation mode, you should not need to move DIP switch 1-3. This switch controls whether the print head moves when software advances the paper, but most applications packages control this function with a software command.

International Characters

In Epson mode, you can use DIP switches 1-6 to 1-8 to set up the printer to produce a slightly different character set for each of eight countries. You may need to do this to be able to print the accented characters in languages like French or Italian, or the special characters of the Scandinavian languages and Spanish. For English you have choice of the £ character or the # character.

The Epson mode character sets are shown in the table below. The numbers across the top are the codes used by the printer to recognize these characters.

Table 4-3. International characters

	35	36	64	91	92	93	94	96	123	124	125	126
USA	#	$	@	[	\	]	^	`	{	¦	}	~
France	#	$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	`	{	¦	}	~
Denmark I	#	$	@	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 I	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~

Five other character sets can be selected by a software command. To see the characters, look at page 166. For information about the command to use, see page 141.

In IBM printer emulation mode, the international characters form part of the character graphics, but they can also be replaced by control commands if you work with the USA English characters only. The same DIP switches control this choice, so it is a good idea to set them correctly whichever mode you work in.

Look at the DIP switch printout to find out what country the printer is set for. If the setting is what you want, move on to the next section on paper size. If the country or CG Table is wrong, reset the three switches according to this table (the factory settings of these switches vary from country to country):

Table 4-4. International settings

Epson mode character set	DIP switch settings 1-6	1-7	1-8	IBM printer emulation mode character set
U.S.A	UP	UP	UP	Standard (1)
France	UP	UP	DOWN	International (2)
Germany	UP	DOWN	UP	International (2)
U.K.	UP	DOWN	DOWN	International (2)
Denmark	DOWN	UP	UP	International (2)
Sweden	DOWN	UP	DOWN	International (2)
Italy	DOWN	DOWN	UP	International (2)
Spain	DOWN	DOWN	DOWN	International (2)

Choosing the Paper Size

This setting is most important if you will be using continuous paper. DIP switch 2-1 tells the printer the distance between sets of perforations across the paper so that it can keep track of the top of the page. If you want the printer to leave a gap around the perforations, this information is essential. The two paper sizes you can set this way are 11 inches (279 mm) and 12 inches (304 mm). Other page lengths can be set with a software command (see page 119).

If you are using single sheets of paper, you can select 11 inch paper size for paper up to 11 3/4 inches long (297 mm). This is because printing stops when the paper ceases to be gripped properly, in other words, when the bottom edge is about 3/4 inch (20 mm) from the print head.

If your DIP switch printout shows the correct page length, you are ready to load some paper. To set the paper size to 11 inches (279 mm), make sure DIP switch 2-1 is DOWN; to set it to 12 inches (304 mm), move the switch to the UP position.

Chapter 5

Choosing and Loading Paper

Many different sizes and types of paper can be used with the EX. The built-in adjustable tractor mechanism is easy to load and can handle a wide range of paper widths. The automatic single-sheet loading function simplifies handling of single sheets, but for greater efficiency you can add an optional automatic sheet feeder. Roll paper can also be used where required.

Choosing Paper

This section tells you what sizes of paper can be used, and gives advice on making copies. As a general guide, buy only good quality paper, as most paper feeding problems are caused by a combination of poor quality paper and bad positioning of the printer.

The table below shows the types of paper you can use.

Table 5-1. Paper types

Type of paper	Width (EX-800)	(EX-1000)
single sheets	7.15 to 8.5 inches (182 to 216 mm)	7.15 to 14.3 inches (182 to 364 mm)
continuous paper (fanfold)	4 to 10 inches (101 to 254 mm)	4 to 16 inches (101 to 406 mm)

The widths given in this table for continuous paper are for the complete width, including the perforated edge strips.

For EX-800, you can also add an optional roll paper holder, which uses paper 8.5 inches (216 mm) wide. Roll paper should be loaded in the same way as a single sheet, but without installing the paper rest.

Making multiple copies

If you want to use the EX with multi-part forms or to make carbon copies, you should make sure that there are no more than three parts to the paper you feed in. If you want to make two carbon copies, the paper must be lighter than the normal paper you use, and the total thickness should not be more than 0.16 mm. When making three copies in this way, you need to move the paper thickness lever as described on pages 42-43.

Loading Single Sheets

You loaded a single sheet of paper for the self test, but this section describes the process in more detail. The automatic sheet loading feature makes loading single sheets of paper a quick and easy process. There is no risk of the printing getting out of step with the pages, and for short documents the speed of loading combines with the speed of printing to give fast overall printing times.

On the other hand, if you print large amounts on single sheets of paper, for example, mailings on letterhead stationery, you may find it more convenient to install a sheet feeder. This is a device that holds a stack of paper and inserts a new sheet whenever required, making single sheets as easy and convenient to use as continuous paper. The sheet feeder has its own operating guide.

Installing the paper guide

When you are manually loading single sheets of paper, always have the paper guide installed. The paper guide makes sure that the paper follows the correct path (over the metal plate directly in front of the tractor). It also has markings to help align the paper. A diagram is attached to the plate showing the correct path.

Install the paper guide in the same way as before. Open the dust cover, hold the paper guide above the printer, then lower it onto the pins on either side of the tractor, and tilt it back into position. Close the dust cover once the paper guide is in place.

If you are loading roll paper, the paper guide is not needed. The paper should, however, follow the same path as single sheets, not the path under the metal plate. The lower path should be used only for continuous paper fed by the tractor.

Loading a sheet

The sequence of actions described here is important. The automatic sheet loading feature is designed to prevent you from unintentionally ejecting a piece of paper. If your sheet does not load, carefully repeat the exact sequence described here.

1 Make sure that the printer is turned on, and that the **ON LINE** light is off. If it is on, press the **ON LINE** button once.

2 Make sure the paper bail and paper release levers are back (and). Open the dust cover if you want to see that the paper is loaded properly.

3 Lay the paper against the paper guide using the edge tab to help align the paper. Push the paper into the printer until you feel resistance.

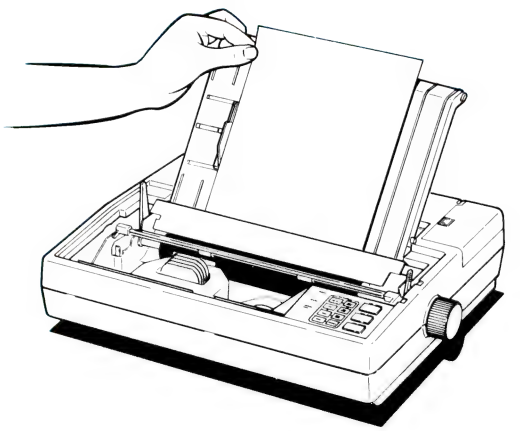


Figure 5-1. Aligning the paper

4 Pull the paper bail lever forward ( ). The paper should feed into the printer until it is a little past the paper bail.

5 When the paper stops, push the paper bail lever back ( ), and the paper should feed backward until it is just held in place at the top edge.

6 Close the dust cover.

If the platen turns but the sheet does not load, remove the sheet from the printer and try again; make sure that the paper release lever is back ( ) and press the paper a little more firmly into place.

If nothing happens at all:

- Make sure that the printer is turned on.
- Check that the **ON LINE** light is off.
- With the printer off-line, remove the paper.
- Try again.

Reloading during printing

When you print a document more than one page long, two things can happen. If your software sends characters in a continuous stream, the printer will stop printing when it reaches a point about 3/4 inch (20 mm) from the bottom of the paper and the beeper will sound. When this happens, the **ON LINE** light goes off automatically.

If your software handles printing sheet by sheet, it will probably stop sending characters at the end of a sheet and prompt you to insert more paper. In this case the **ON LINE** light may remain on, and the first thing you should do is press **ON LINE** once to turn it off.

Once the **ON LINE** light is off, remove the sheet that has just been printed; then load a new sheet in the same way as before, starting at step 3.

Loading Continuous Paper

The new push-feed tractor built into the EX-800 has several major advantages over other types. It combines the ability to handle a wide range of paper widths with an extremely low profile, and it is very easy to load.

Note

The push feed tractor must be loaded in a slightly different way from the pin-feed system on Epson FX printers and the usual pull-through type of tractor. If you are used to using other systems, make sure you follow these instructions carefully.

1 If you have been using the printer with single sheets, remove the paper guide. You need to install it later in a different way.

2 Clear enough space so that the paper can flow freely in and out of the printer. You can use a printer stand and stack the paper underneath, or use the desk as a stand placing the printer near the rear edge. Otherwise, place the printer well forward on the desk with the paper stacked behind.

3 Install the paper rest by fitting the hooks into the notches at the back of the printer as shown below. This prevents the paper from becoming tangled with the cables.

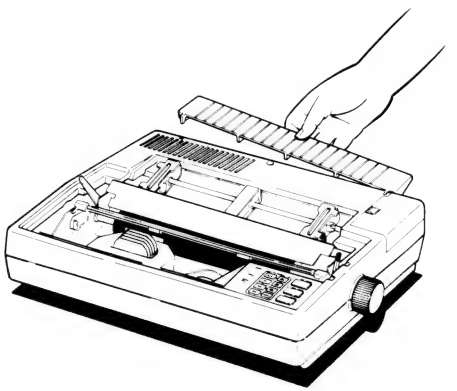


Figure 5-2. Installing the paper rest

4 Make sure the printer is turned off.

5 Open the dust cover and move the print head to about 40 on the scale on the paper bail.

6 Pull the paper bail and paper release levers forward (and) to make a free path for the paper.

7 Release the sprocket units by pushing the locking levers back, as shown below.

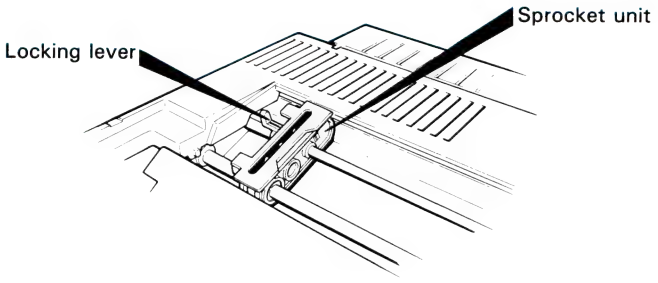


Figure 5-3. Releasing the sprocket units

8 Move the left sprocket unit all the way to the left and pull the locking lever forward to hold it in position.

Note

This should correctly position paper so that you always have a margin at the left side. If you want to print up to the left side of the paper or if your software creates a left margin, position the left sprocket unit about 3/4 inch (20 mm) from the left, so that the perforated edge of the paper will line up with the edge mark on the paper guide. Check the exact position when you finish loading.

9 Open the covers on the sprocket units as shown on the next page; then move the right sprocket unit to its approximate position, using your paper as a guide. Position the ridged paper support midway between the two sprocket units.

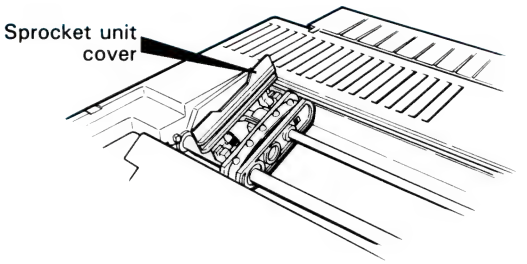


Figure 5-4. Opening the sprocket unit covers

10 Make sure that the first sheet of paper has a clean edge and that the perforated edges are still attached.

11 Fit the first four holes in the left side of the paper over the pins of the left sprocket unit, as shown below, then close the cover.

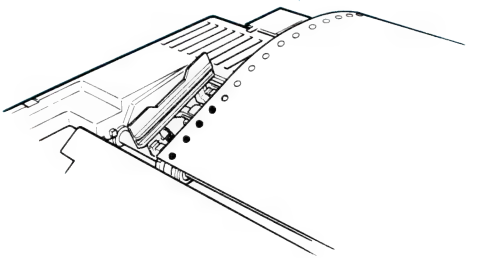


Figure 5-5. Positioning the paper

12 Now position the right sprocket unit correctly, fit the holes in the paper over the pins, and close the cover.

13 Make sure the paper is straight and has no wrinkles; then lock the right sprocket unit in place.

14 Turn the paper feed knob slowly to feed the paper under the metal plate in front of the tractor. Make sure that the paper goes beneath the metal plate and that it does not wrinkle after it reaches the platen. A diagram is attached to the plate showing the correct path.

15 Turn the knob until the paper is just past the paper bail and push the paper bail back ( ). Close the dust cover.

Installing the paper guide

To prevent the paper from tangling or being pulled back into the printer, you should always install the paper guide. This is the same part that is used to support the paper when printing on single sheets. With continuous paper, it is installed horizontally.

The paper guide has notches at either side that fit over two pins located at the sides of the tractor.

1 Hold the paper guide vertically above the printer, with the curved end down.

2 Lower the notches onto the pins as shown in the figure; then tilt the paper guide back until it lies horizontally over the paper. Move the edge tab outward.

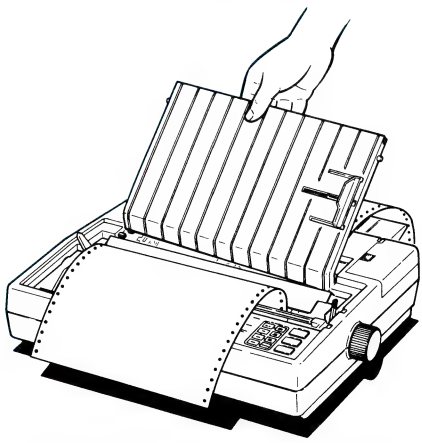


Figure 5-6. Installing the paper guide

Setting the top-of-page position

Finally, so that the printer will print exactly between the perforations of the paper, you need to fix a top-of-page position. The top-of-page position is always set to the position of the paper when the power is switched on. It is also reset whenever software initializes the printer, or sets the page length.

To set the top-of-page position, turn the printer off; then use the paper feed knob to advance the paper until the first row of perforations is aligned as shown below.

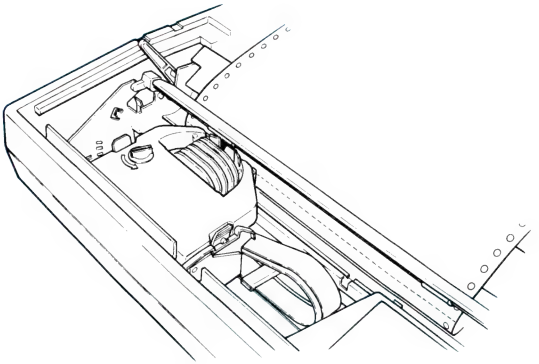


Figure 5-7. Top-of-page position

Note

When you use continuous paper, always make sure that the paper release lever is forward (). If not, paper jam would occur.

Now when you turn the printer on it remembers this position and keeps track of how far the paper has been advanced. This way, when you want to move to the top of a new page, it always knows how far to advance the paper.

WARNING

Never advance the paper using the paper feed knob while the power is turned on. You can damage the mechanism of the printer, and the printer will lose track of the top of page.

Loading Labels

If you want to use labels on a continuous backing, always choose the type that are mounted on a perforated backing sheet for use with the tractor. Labels on a shiny backing sheet will almost always slip a little if fed by friction alone. Also bear in mind that the minimum width of label that can be used is 4 inches (102 mm) including the full width of the backing paper.

The procedure for loading labels with the tractor is exactly the same as for loading continuous paper, but there are two things you should bear in mind. Labels on a backing sheet are much thicker than normal paper; before beginning to load them, adjust the paper thickness lever, as described on the next page. Also, you may want to load the labels so that printing will start at the left edge, so move the left sprocket unit about 3/4 inch (20 mm) from the left side before locking it in position.

WARNING

Never wind labels back through the printer with the paper feed knob or by using reverse line feed commands. Labels can easily peel off the backing and jam the printer. If a label does become stuck, refer the problem to your dealer.

When removing labels from the printer, tear them off at a perforation behind the platen, then feed the remainder through. It is better to waste a few labels than to risk damage to the printer mechanism.

It is also possible to buy labels on a matt backing in single sheets. There are normally no gaps between individual labels on the sheet, so that the labels are less likely to catch on the platen. These can be fed into the printer just like single sheets of paper.

Allowing for Different Paper Thicknesses

The gap between the print head and the paper can be adjusted to accommodate different thicknesses of paper and to alter the pressure that the print head applies. You will need to do this when printing on labels or making multiple copies.

Note

Before adjusting the paper thickness lever, you should always turn off the power, open the dust cover and move the print head to the middle of the printer to give good access.

The paper thickness lever has four positions. You can identify these by looking at the catch positions in the metal plate. For normal use the lever should be in the second position *away* from the platen (aligned with the notch in the plate as shown below).

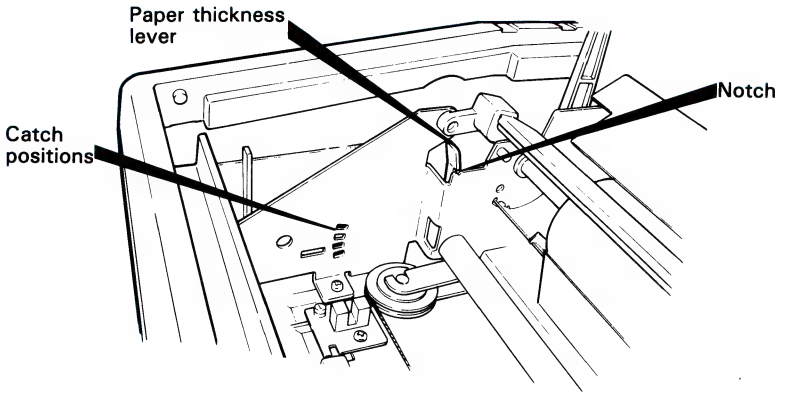


Figure 5-8. Adjusting the paper thickness lever

If the printing becomes faint, the lever may be moved toward the platen, but too much pressure can significantly shorten the life of the print head. When using thick labels, or making carbon copies which significantly increase the thickness of the paper, move the lever to the third or fourth position away from the platen.

After printing, always return the lever to the normal position.

Chapter 6

Trying your Software

Now that you have set up and tested the printer, you need to make sure that it is set up properly for the kind of work you will be doing. This chapter tells you how to start using the printer with commercial software to print things like documents, letters, and spreadsheets. Work through it to make sure you get the printer and software working well together.

Preparing the Software

Computer languages give you complete freedom in the way you control the printer, but require more knowledge for you to produce neat and tidy printouts. Application programs can look after the printer for you, but they need to be told what kind of printer you are using in order to make full use of its power.

Most software can accommodate a wide variety of printers, but you usually need to go through a process called installation to match the program to the printer. Because of the power of the Epson mode commands, almost all commercial software can control Epson printers. Many applications now also support IBM printers. The reasons you might choose to use the printer in IBM printer emulation mode are given on page 26.

You will need to consult the documentation for your software to find out the installation procedure. There is no general rule, but the program will probably list a selection of printers for you to choose from.

If you use Epson mode, then choose EX-800, or simply EX, from the list of printers. If it is not listed, look for an option for FX-85 and choose that; the EX-800 supports all the commands used by the FX-85 and a number of important new ones.

If neither of these is available, choose one of the printer types listed on the next page. These are in order of preference.

- FX
- LX
- Epson printer
- standard or draft printer.

If you use IBM printer emulation mode, choose IBM Proprinter, IBM Graphics printer, or IBM printer, in that order of preference.

If you have installed the color option kit, choose EX-800, EX, or JX-80. Do not select an IBM printer because the IBM printer emulation mode cannot make use of the color option kit.

Preparing a Test

To make sure you made all the right decisions when you prepared the printer and software, you need to run a short test. All you need is something to print out that will highlight any problems. In particular you should include in the test printout all the characters in your row of the table on page 29; these will show up any problems with the international character set you have chosen.

Turn on the computer, then the printer.

If most of your work will be word processing, create a document two or three pages long that includes the characters for your country. You do not need to fill each page; you can just type a few lines at the top of each page, then use the software command in your particular program to move to a new page. This is enough to show that the printer is moving correctly to the top of each new page. If you use a spreadsheet or other business software, again prepare a printout that includes the special characters for your country in the text. If you will be using the printer with a programming language such as BASIC, write a simple program to print out a few lines filled with each character.

A Guide to the Control Panel

Now that the system is connected up and you are ready to print for the first time, you need to know the functions of the control panel.

The control panel has four main functions:

- It controls communication with the computer
- It gives you manual control of the paper
- It tells you about the condition of the printer — for example, whether it is ready to print
- It lets you choose how you want the printout to look.

The buttons

There are three buttons at the right of the control panel.

ON LINE When the green indicator light next to this button is on, the printer is able to receive and print characters from the computer: the printer is on-line. When the light is off, the printer is off-line and cannot receive any data. Press the button to change from on-line to off-line or back again.

The printer is automatically on-line when you turn it on, unless there is no paper. It goes off-line only when you press the **ON LINE** button, or when a problem occurs. For example, it automatically goes off-line when you try to print and there is no paper. Pressing **ON LINE** then has no effect until you correct the problem.

The other two buttons function only while the printer is off-line. They let you feed the paper line-by-line, or a page at a time.

FORM FEED With the printer off-line, press this button to eject a single sheet of paper from the printer or to advance continuous paper to the top of the next page.

This button is also used to start the Near Letter Quality self test (see page 16).

LINE FEED With the printer off-line, press this button to advance the paper by one line, or hold it to down to feed the paper continuously. While the printer is turned on, always use this button to adjust the position of the paper; this way the top-of-page position is not disturbed.

This button is also used to start the draft self-test (see page 17).

WARNING

Never advance the paper with the paper feed knob while the printer is turned on. You can damage the printer mechanism.

The **FORM FEED** and **LINE FEED** buttons are also used to put the printer into a special mode called data dump mode which can be used to look at the data being sent to the printer. This is described on page 181.

The indicator lights

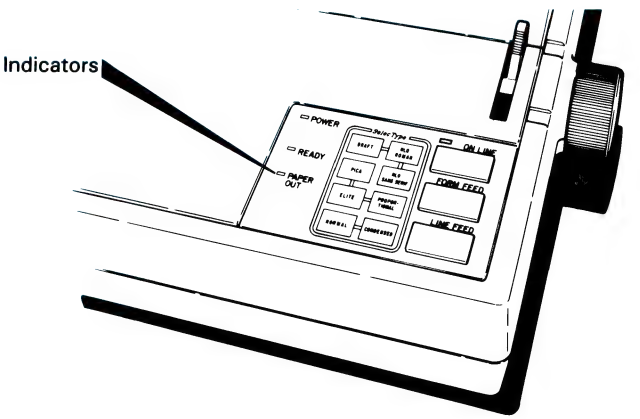


Figure 6-1. The control panel

The printer has three other indicator lights in addition to the **ON LINE** light:

POWER comes on to show that the printer is connected to the power and turned on

READY comes on when the printer is on-line and the buffer has free space for characters — it normally flashes during printing

PAPER OUT comes on when there is no paper *and* there are characters waiting to be printed (the printer also goes off-line and the beeper sounds).

The beeper

You usually hear the beeper only when the paper has run out during printing. When this happens, the printer beeps 20 times, pausing after each group of four beeps. The beeper also sounds once if a program sends the **BEL** command (ASCII code 7), or when certain faults occur in the printer itself.

If the printer beeps and stops printing but there is paper loaded, check to see if the **ON LINE** light is flashing. If so, this indicates that the print head is becoming too hot. Printing will restart when it returns to normal temperature.

If the printer beeps six times and does not print, consult your Epson dealer.

Printing the Test Document

When you have prepared a test (either a document to print with your software, or a program to run) load the printer with paper. If you are using continuous paper, make sure you set the top-of-page position properly. Check that the printer is turned on, and that the **READY** and **ON LINE** lights are on. If the **READY** light is off, make sure the computer and printer are properly connected.

When the printer is on-line and ready to print, give the software command to print your test document, or run the program. If the paper runs out and you need to load a sheet, follow the instructions in Chapter 5 to load a fresh sheet; then make sure you put the printer on-line again, so that printing can continue. If you have an obvious problem — for example, if nothing is printed at all, or if the paper does not advance after printing each line — go straight to the section on dealing with problems on page 52.

After Printing

When printing is finished, press **ON LINE** once to put the printer off-line. Lift the dust cover to check that everything has been printed.

Clearing the print buffer ...

If the last thing sent to the computer was an incomplete line, there may be characters left in the printer's data buffer, waiting to be printed. If this happens, you will see that the last line has not printed, even though the computer and printer seem to be ready for work again. You can easily print out the remaining characters by pressing **ON LINE** twice to put the printer off-line, then back on-line again.

If you notice a problem while the printer is printing, pressing **ON LINE** stops printing immediately. You can then cancel printing at the computer. However, the printer stores text in a buffer that can hold around two to three pages. Once you have stopped the computer from sending any more, you can turn the printer off to clear the data buffer and remove the paper or advance it to the next perforations with the paper feed knob. You should then wait for a few seconds before turning the printer on again.

Also check that the lines of print are correctly positioned on the paper and that they do not continue over the right edge. If there is a problem with the margins, you can correct it in future by loading the paper differently, or by using your software to adjust the margins. (To correct problems with the left margin, it is usually better to reposition the paper.)

Removing the printout

To avoid damaging the printer, do not use the paper feed knob to remove the paper. Always use the **LINE FEED** and **FORM FEED** buttons, so that the printer can keep track of the top-of-page position, preventing possible problems with misaligned pages in your next printout.

To remove a single sheet, press **FORM FEED** once: the sheet is ejected. Gently pull the paper from under the paper bail. If you are using an automatic sheet feeder, the sheet will be completely ejected, but the printer will not load another sheet immediately.

To remove a printout on continuous paper you have two options. You can press **FORM FEED** so that the first perforations after the printout are past the paper bail, then tear off at the perforations. Alternatively, you can open the dust cover and press **LINE FEED** a few times to bring the last line printed above the paper bail, then tear off against the edge of the paper bail itself. To remove continuous paper from the printer, ready to use single sheets or to move the printer, tear off the paper at the first set of perforations behind the platen, then wind the paper through forward.

Dealing with Problems

Now examine the printout for problems. Some problems may be more obvious than others, so check the international characters particularly carefully.

If you find a problem, work through this checklist to find a solution. If you need to change any DIP switch settings, remember to turn off the printer first.

Problem	Action
Nothing is printed	Check that the printer and electricity supply are turned on. Check the connection between the computer and printer. Check that the cable is the right type. Make sure the **PAPER OUT** light is off; if it is on, reload the paper and make sure the paper covers the paper out sensor. Check that the printer is on-line. Look in your operating system and software manuals to check that the computer is properly set up; you may need to use a command to configure it (sometimes called STAT or CONFIG).
READY light flickers but nothing is printed	If you are using the parallel interface, you may have an incorrect cable. If you are using a serial interface, then the serial interfaces of the computer and printer have not been set up to match each other. Check these settings following the instructions on page 26 (built-in interface) or page 217 (optional interface).

Problem	Action
All the text is printed on one line	This happens if there is no line-feed signal being supplied by the computer *or* the printer after each line of text. Try changing DIP switch 2-4 to the UP position.
A blank line is inserted after each line of text	This happens if *both* the computer and the printer supply a line feed after each line of text. If DIP switch 2-4 is UP, move it DOWN; if it is DOWN already, you may need a special printer cable: consult your Epson dealer.
Some printed characters do not match the screen	If they are international characters, check the settings of DIP switches 1-6 to 1-8 (see page 30). If they are graphics characters, check the way you have installed the software and whether you should be using the Epson Character Graphics set or the IBM printer emulation mode (see page 26).
The printout is garbled	This is most likely to happen when using a serial interface. The serial interfaces of the computer and printer may not have been set up to match each other perfectly. Check the settings following the instructions on page 26 (built-in interface) or page 217 (optional interface).

Trying again

After you have worked through the checklist and made any adjustments, switch on the printer and try printing your test file again. If the file is still not printed properly, go through the checklist again and also check your software manual to make sure you do not need to alter any settings.

If a further attempt at printing your test file is still unsuccessful, contact your Epson dealer.

Chapter 7

Using SelecType

The SelecType feature allows you to control many of the printer's features from the control panel. It provides an easy way of enhancing documents without having to learn complex software commands, and it lets you make print style decisions when you print instead of when you edit.

You can choose any of these typestyles:

```
Draft printing is faster than ever before.
NLQ Roman is clear and typewriter-like.
NLQ Sans Serif is crisp and distinctive.
```

and print them in any of these widths:

```
          Pica: ABCDEFGHIJKLMnopqrstuvwxyz
         Elite: ABCDEFGHIJKLMnopqrstuvwxyz
Proportional: ABCDEFGHIJKLMnopqrstuvwxyz
```

You can also condense your printing:

```
Condensed pica gives more characters on a line.
Condensed elite gives you even more.
```

The SelecType Panel

The SelecType touch panel (shown below) has eight buttons that control the basic style and size of the text you print. These buttons are arranged in three groups.

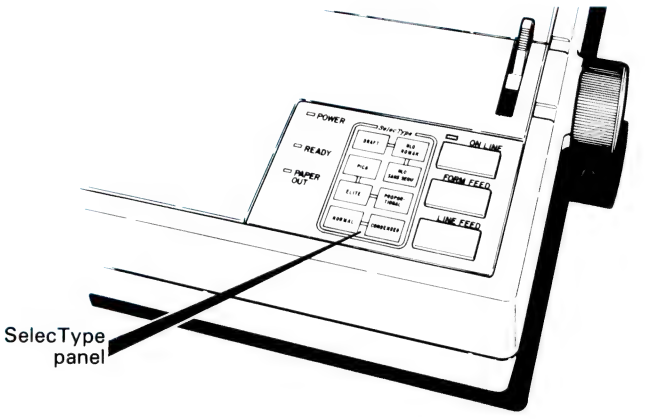


Figure 7-1. The SelecType panel

The first group of buttons selects the print quality and font. The EX has one draft and two NLQ (Near Letter Quality) fonts: Roman and Sans Serif. To select one of these fonts, simply press the button for the one you want. The button beeps and lights up to confirm your choice.

Three more buttons determine the character pitch (characters per inch). You can choose pica (10 pitch), elite (12 pitch), or proportional. Proportional width characters are the same size as pica ones, but the space allowed for each character is proportional to its size. Therefore, a narrow letter like i receives less space than a wide letter like W, giving a neater appearance to the text. You can choose any one of these pitches by pressing the appropriate button.

The last group of buttons lets you choose condensed mode with either pica or elite. In this mode all characters are about 60% of their normal width. If you select both elite and condensed, you can get up to 160 characters on a line. This is especially useful for printing out large spreadsheets on the EX-800.

If you try to combine proportional with condensed, proportional will be selected in preference to condensed, no matter which you choose first. If you select condensed first and then press the proportional button, the printer beeps three times to tell you that it is overriding condensed. (The condensed button light goes off also.) If you have already selected proportional and then press the condensed button, it beeps three times to tell you that you cannot select condensed without changing to pica or elite first.

How to Use SelecType

Now you might like to try the various SelecType possibilities by printing a short sample document created with an application program. Create a sample and then follow these two simple steps:

1 Press the button or buttons for the print styles that you want to use. Each button will confirm your selection by beeping and by lighting up.

2 Print the document using the application program's print command.

If you print a short sample two or three times using different SelecType settings, you will quickly see how easy it is to use. At any time, the lighted SelecType buttons tell you what mode the printer is using.

If SelecType Does Not Work

Some applications programs are designed to take control of all typestyle functions. Before each printing operation, these programs cancel all previous typestyle settings by sending a signal to the printer's parallel interface ($\overline{\text{INIT}}$) or by sending specific control codes to cancel certain typestyles. These signals or control codes may cancel your SelecType settings.

You will be able to see whether a program is changing your settings by watching the buttons when printing starts. If the lights change, then the program is controlling the typestyles.

If an applications program changes your SelecType settings, you have two choices:

1 Use the program's setup procedure (which could be called by another name, such as INSTALL) to remove the codes that interfere with your SelecType settings.

2 Use the printer control commands for your software instead of SelecType to control your printing. The manual for your program will tell you how to change the printing style; there is also some general advice in Chapter 11. Most programs that cancel SelecType settings also have sophisticated printer control commands that give the same results as SelecType.

Note

Any control codes in your document will also overrule the SelecType settings. Therefore, if you have a code for NLQ Roman in your document and you press the **DRAFT** SelecType button, your printing will still be in NLQ Roman.

Probably the most frequent use for SelecType is to change between NLQ and draft printing. You can use the draft mode to quickly print your first copies of a document and then switch to NLQ when you have perfected the document and are ready to print the finished product. On the EX printers, every typestyle except double-strike works the same way whether you select draft, NLQ Roman, or NLQ Sans Serif. This means you can put the printer commands in your document at any time so you can see them working at the draft stage and make corrections before the final printout.

If you use IBM printer emulation mode, SelecType has even more to offer. In Epson mode, all the features controlled by SelecType can also be controlled by your software. In IBM printer emulation mode, you can use SelecType to access features not normally available on IBM printers, such as NLQ Roman and proportional modes.

Chapter 8

Taking Care of Your Printer

Always keep the printer in a clean and safe place. Keep it away from dust, grease, moisture, and any source of heat, including direct sunlight. A safe temperature range is 40°F to 95°F (5C to 35C).

Once every three months, disconnect the printer, remove the paper and ribbon, and clean it thoroughly with a soft brush and a vacuum cleaner with a small nozzle. Try to clear away all the paper dust that gathers inside. With the power off, you can safely move the print head to clean beneath it. Be careful not to bend or damage any of the parts inside the printer.

If the outer case is dirty, clean it with a soft, clean cloth dampened with mild detergent dissolved in water. Keep the dust cover in place to prevent any water from getting inside the printer. Do not use a hard brush or cloth, and never use alcohol or a thinner to clean the printer, because it could damage the print head and the case.

Do not spray the inside of the printer with oil: unsuitable oils can damage the mechanism. If lubrication is needed, contact your Epson dealer.

The Print Head

Be particularly careful with the print head. Never move it when the printer is turned on. When the printer is printing, the print head becomes hot. If you need to change the ribbon or load continuous paper, turn the printer off and wait for a few minutes while the print head cools down.

The print head should last for about 100 million characters (assuming an average of 14 dots per character printed with a black ribbon). When it fails, one or more of the pins may fire erratically or stop firing completely, making the printout patchy. If this happens suddenly or long before the expected lifetime is over, the problem is almost certainly connected with another component of the printer.

As soon as the print head fails, stop using the printer and contact your Epson dealer for a replacement head. Do not attempt to replace the head yourself, because the printer should also be tested to make sure that no other parts are damaged.

Transporting the Printer

There are several precautions you should take when packing the printer for transportation:

- Remove the ribbon.
- If the color option kit is installed, remove it following the instructions in the separate user's guide.
- Move the print head to the left and replace the print head protector between the paper bail and the platen.
- Remove the paper rest and paper guide and pack them separately.
- Fix the dust cover in place with sticky tape.
- Remove the paper feed knob.
- Pack the printer in the original foam packing supports and box.

Getting More from Your Printer

Chapter 9

Sending Codes to the Printer

This chapter briefly describes how a computer sends codes to the printer. You may need this infomation to better understand how your printer works so that you can use more of its features. On the other hand, you may not need the rest of the chapters if your software already handles all the printer features you want. Whether or not you use the rest of this guide depends upon your software, your expertise, and your interest.

Computer-Printer Communication

Computers and printers communicate by using numerical codes to represent characters and commands. To ensure that the two devices interpret the characters in the same way, a standard code has to be used. Therefore, most manufacturers of computers, printers, and software use the ASCII (American Standard Code for Information Interchange) code system. There are sometimes slight variations in the code to accommodate characters in different languages, but these are minor.

The ASCII standard includes codes for printable characters (letters, punctuation marks, numerals, and mathematical symbols) and 33 other codes called control codes, such as the codes for sounding the beeper and performing a carriage return. Because the 33 ASCII control codes are not enough to control all possible functions of the printer, most commands that control printer functions are sequences of two or more codes. The use of sequences for commands makes possible a nearly unlimited number of printer commands.

The escape code, one of the 33 control codes, is used to signal the beginning of a sequence of codes. Therefore, most printer commands are sequences of codes, the first of which is the escape code. The ASCII abbreviation **ESC** is used for this code throughout this guide.

When you are using control codes to select functions of the printer, you will have to look at the applications program manual or the programming language manual to find the appropriate method of inserting the code into the program. Chapter 11 gives some details on the methods you might use.

Naming and Using Codes

In order to use printer codes, you need to know how your software recognizes them.

Code numbers

The commonest way of naming codes is to give the number for the code. Two different numbering systems are commonly used:

- decimal
- hexadecimal, or hex, a system often used by computer programmers.

The decimal system is the familiar one that is based on units of ten and that uses the numerals 0-9.

The hex system is based on units of 16. Instead of using the only the numerals 0 through 9, the hexadecimal system also uses the letters from A through F. For example, the decimal numbers 9, 10, 11, and 12 are expressed in hex as 09, 0A, 0B, and 0C.

Since the hexadecimal numbers used most frequently lie in the range 00 to FF hex, which is 0 to 255 in decimal, it is common to write hexadecimal numbers which are less than 16 with a zero in front, as shown above.

In this book, hex numbers are distinguished from decimal numbers by the word hex after them (for example, 1B hex). Other common ways of denoting a hexadecimal number are the following:

1BH $1B &1B &H1B <1B>H

In this book decimals have no identifying mark, but in some books decimal numbers may have a D after them as in the following examples:

11D <11>D (11)D

The command summary and the Quick Reference Card give both the decimal and hex numbers for each command.

Control code abbreviations

Each control code has been given a name that signifies the use to which it was originally put. Some of the codes still perform functions that correspond to their names, as shown in the examples below:

Function	Abbreviation	Decimal	Hexadecimal
Form feed	**FF**	12	0C
Carriage return	**CR**	13	0D
Cancel	**CAN**	24	18
Escape	**ESC**	27	1B
Delete	**DEL**	127	7F

The abbreviations are included in this guide because they are commonly used in writing about printer commands, and they may be used by your computer or software manual. In this guide they are shown in bold typeface, as in the table above. You must, however, remember that these abbreviations are not recognized by the computer or printer. Therefore, you cannot enter a code by typing the abbreviation.

Sending codes with the control key

Some of the control codes have special keys on a computer keyboard, for example, [RETURN] sends the **CR** code. To enter other control codes, you type a combination of keys.

A standard computer keyboard has a control key, marked [CTRL], which is used with the alphanumeric keys to obtain the control codes. The alphabet is matched to the ASCII codes so that [CTRL] and A pressed together produce ASCII code 1,[CTRL] and B give ASCII code 2 and so on up to [CTRL] and Z, which give ASCII code 26. ASCII code 0 is obtained using [CTRL] and @, and codes between 26 and 31 can be produced using [CTRL] and the symbols [, \,], ^ or -.

In this book, pressing [CTRL] together with another key, for example A, is printed as shown below:

[CTRL]A

In other books this might be represented in one of the following ways:

CONTROL-A, CONTROL/A, CTRL-A, CTRL/A, or ^A.

WARNING

Some computers have an [ESC] key. This sometimes sends the **ESC** code, but it may have other functions too, such as letting you leave a program. Pressing [ESC] is therefore not a reliable way of sending the **ESC** code.

Chapter 10

Enhancing Your Printing with Control Codes

The two main methods you can use to alter the appearance of your printing are by using SelecType and by sending control codes to the printer from the computer. (You can also select two typestyles—condensed and NLQ—with the DIP switches).

SelecType, as you know, controls the printing style of a whole document. Software commands, on the other hand, can be used to change anything from the entire document to a single character. This chapter shows you the features you may want to use.

What You Can Change

You can obtain many different printing effects with the EX printer, from arranging the printout on the paper to using color or giving extra emphasis to particular words and phrases.

Once you have read about the features, you may want to refer to the command summary starting on page 107. To help you find the appropriate commands, this chapter is organized in the same way as the command summary.

As you know, you can use the EX printer in either the Epson mode or the IBM printer emulation mode. The reasons for choosing one or the other are described on page 26. Although the IBM printer emulation mode commands are more limited than the Epson ones, they control similar features. Any exceptions are pointed out in the text. In addition, the IBM printer emulation mode command summary, which begins on page 148, gives the differences in detail.

Quality, fonts, and color

The most fundamental changes you can make to printing on the EX are in the print quality, type font, and color.

SelecType gives you an easy way of changing the print quality from draft to NLQ, and the font from Roman to Sans Serif. If you prefer to print in NLQ Roman most of the time, you can set DIP switch 1-5 UP. This setting makes NLQ Roman the default typestyle—the one your printer uses unless you give it other instructions through software or SelecType. If the printer is in the IBM printer emulation mode when you change the setting of this switch, the default is NLQ Sans Serif. SelecType is the only way you can get NLQ Roman in the IBM printer emulation mode.

The printout below shows the differences between draft, NLQ Roman, and NLQ Sans Serif, so that you can compare the different styles and densities:

```
Draft printing is faster than ever before.
NLQ Roman is clear and typewriter-like.
NLQ Sans Serif is crisp and distinctive.
```

If you have installed the color option kit, a software command lets you select any of seven colors including black. In addition, you can combine some of the basic colors to produce an even greater variety. Color can be used for graphics or for text, and for a whole page or a single word, whatever style it is printed in.

With the color option kit, you can use either a black or a color ribbon; the EX automatically detects the type of ribbon. Therefore, you can use black ribbon for ordinary text printing and save your color ribbons for special purposes. When a black ribbon is in use or the color option kit has not been installed, the color commands are simply ignored. There is no color command in IBM printer emulation mode.

Print size and character width

There are software commands that give control of the print size in the same way that SelecType does, and they also offer one other option — double-width printing.

Character widths are given in characters per inch (cpi), usually referred to as the pitch. For example 10 cpi is normally called 10 pitch. The two commonest widths have special names: pica (10 pitch) and elite (12 pitch). These basic character widths are suitable for general purpose printing; look at the printout below to see the difference:

```
 Pica: ABCDEFGHIJKLMnopqrstuvwxyz
Elite: ABCDEFGHIJKLMnopqrstuvwxyz
```

Pica and elite characters are all of fixed width; an i takes as much space as a W. In the third basic width available on the EX, however, each character is given space according to its actual width, so that the space between the characters is constant and the appearance is tidy. This mode is called proportional printing and does not have a pitch, since the number of characters per inch depends upon the size of the characters. As a general rule, you can remember that proportional takes up more space than 12 pitch and less than 10 pitch.

```
         Pica: ABCDEFGHIJKLMnopqrstuvwxyz
Proportional: ABCDEFGHIJKLMnopqrstuvwxyz
```

In addition to the basic widths there are two modes that change the size of other widths. These modes are double-width and condensed.

Any size of characters can be enlarged to two times its normal width with the double-width mode. This mode is useful for such purposes as emphasizing headings in reports and making displays. It is not normally used for large amounts of text.

Ten-pitch and 12-pitch can also be reduced to about 60% of their normal width with the condensed mode. This mode is particularly useful for printing wide spreadsheets because condensed elite allows you up to 160 characters on each line. Condensed can be selected with SelecType for a single print session, by setting DIP switch 1-1 UP if you use it most of the time, or with a software command. Even if you turn condensed on with the DIP switch, you can still turn it off with SelecType or the software command.

All these different widths are compatible with any of the print qualities and fonts. The examples below are in NLQ Sans Serif:

```
Condensed pica gives more characters on a line.
Condensed elite gives you even more.
Double-width pica.
Double-width elite.
```

Widening or narrowing the characters widens or narrows the spaces between words and letters also. Because word processing software usually creates a left margin by printing spaces, you may need to adjust the number of characters on a line to keep the margins correct if you change widths. For example, a left margin of five pica characters is the same as one of six elite characters.

Special effects and emphasis

The EX offers two ways of emphasizing portions of text and also allows you to use underlining, superscripts, and subscripts. These features can be controlled only by software commands, but many application programs can produce them if the program is properly installed.

Emphasized and double-strike modes both slow the printer down slightly but result in bolder text. In emphasized mode, each of the dots that form the characters is printed twice as the print head moves across the paper. The second dot is printed very slightly to the right of the first, producing darker, more fully-formed characters.

In double-strike mode, the print head goes over each line twice, with the paper advancing 1/216 of an inch after the first pass. Therefore, each character is printed twice, with the second slightly below the first. This gives a sharper appearance to the characters by filling the spaces between the dots, rather than thickening the lines.

For even greater boldness, the emphasized and double-strike can be combined. While an NLQ font is in use, however, double-strike is ignored because NLQ characters are already formed by two passes of the print head. The samples below show the effect of combining the two modes with draft printing.

```
This is draft printing: with emphasized,
                        with double-strike,
                        and with both.
```

The underline mode provides an automatic way of underlining fully any piece of text. It underlines spaces, subscripts, and superscripts without a break. Most word processing software takes advantage of this feature, but some programs use the underline character instead, taking longer to print the text. If you find this is happening, make sure that your software is correctly set up for the EX (see page 45).

```
Epson underlining is continuous.
```

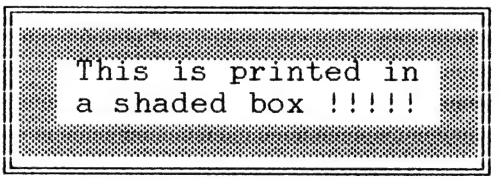
Superscripts and subscripts can be used to advantage for such purposes as printing footnote numbers or mathematical formulas. The example below shows underling and superscripts and subscripts combined in two mathematical formulas:

$$m = \frac{v^2}{rg}$$

$$\text{average} = \frac{(a_1 + a_2 + \ldots\ldots + a_n)}{n}$$

Using different character sets

The EX incorporates a new character set: Epson Character Graphics. This set allows you to take advantage of the power of the Epson mode commands and still print out the character graphics used by IBM and compatible computers and by much commercial software. For example, if your word processor can include the characters to draw boxes and shade areas, you can produce some very professional effects.



The Epson Character Graphics Set can be selected by your software or by setting DIP switch 1-3 to UP. For many applications it is best to use the DIP switch instead of the software command because the character graphics are then available as soon as you turn the printer on.

The other important change you can make to the standard character set is to change some characters for ones commonly used in other languages—chiefly European and Scandinavian—such as accented characters and symbols. In Epson mode, eight international character sets can be selected by setting DIP switches 1-6 to 1-8: USA English, French, German, UK English, Danish, Swedish, Italian, and Spanish.

In Epson mode, these eight, and five more, can also be selected by a software command. The additional character sets are the following: Norwegian, a second Danish set, Japanese, a second Spanish set, and Latin American. There are more details on page 166.

Also, in Epson mode all text characters can be printed in italics. You can use this for special emphasis or as an alternative typeface.

```
Italics are good for referring to page 1.
They give emphasis to words.
They are an attractive alternative style.
```

Page layout and other commands

The remaining commands in the command summary will not normally be needed when using commercial software. You may need some of them if you are using a printer installation program provided with an applications package, but most deal with features (such as tabs, margins, and line spacing) that are provided directly by commercial programs and are therefore only useful to you if you want to program for the printer using a programming language like BASIC.

Chapter 11

More about Application Software

Different types of applications use different features of the printer. Spreadsheets often use condensed mode for printouts and graphics mode for charts and graphs.

Client:	'84	'85	% Growth	'86	% Growth	['87]	[% Growth]
Jones	1225	1075	87.76%	1475	137.21%	1500	101.69%
Robinson	3325	3975	119.55%	4400	110.69%	4750	107.95%
Smith	2325	2650	113.98%	2725	102.83%	2700	99.08%
Thomson	550	2000	363.64%	1775	88.75%	1750	98.59%
Total:	7425	9700	130.64%	10375	106.96%	10700	103.13%

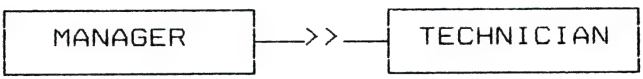
If you are drafting a complex document, you might want to make use of different typestyles and fonts.

Introduction

The EX printer makes available a ***wide*** variety of typestyles.

If you are preparing a presentation, you might want to use graphics characters, color (with the optional color kit), and features like double-width mode.

■ COMMUNICATION



This chapter gives some general guidance on the sort of techniques used to produce professional looking printouts from your software.

Word Processors

Word processors allow you a great deal of freedom in controlling the printer, while also providing easy ways of enhancing your document with simple features like bold printing, underlining, superscripts and subscripts, and changes of pitch.

Note

Different programs use different commands to achieve such effects, but the methods are usually similar. The examples in this section are based on WordPerfect 4.1 by SSI Software. To learn how to use the commands in your own word processor, read this section together with the manual for your software.

There are two basic ways in which word processing software controls the printer.

Using ready-made installations

The section on page 45 explained how to install software for use with the EX. This section tells you more about how this helps you to use the printer's features.

You can usually make use of a fixed set of printer features by using a word processor command to place markers around the text to be altered. When the document is printed, the markers are recognized and translated into suitable commands for the printer you are using. While you are editing, some programs show the markers in a distinctive way, while others display the text as it will appear — for example, in bold or italics.

Example...

Many word processors assign a special key to insert bold markers in the text, such as one of the function keys or a combination of ALT or CTRL and another key. For example, to embolden some text in WordPerfect, you press F6 once, type the text, then press F6 a second time. On the screen you might see this:

```
This is the bold function.
```

The bold markers are invisible, but if you use the reveal codes function, you see something similar to this:

```
This is the [B]bold[b] function.[HRt]
```

This method is normally restricted to features that can be found on almost all printers. Since most software comes with a set of ready-made installations for different printers, setting up is a simple process, and there is no need to remember the commands for the printer. Also, if you change to a different type of printer (for example an Epson LQ printer), all you need to do is change the way the software is set up; you do not need to change any of your documents.

Using embedded printer commands

Some programs also provide a way of placing complete printer commands in the text. With some software the command is visible in the text but distinguished by two markers, with other programs it can be hidden in the text.

This method is known as embedding commands. It has the advantage of allowing any printer command to be used in a document. To make use of it, however, you need to understand how to use the printer's commands. Different word processors have different ways of inputting the printer commands.

Example...

In WordPerfect you can embed commands by selecting Print Format and then the Insert Printer Command option. You then list the decimal codes in angle brackets, or the characters themselves without brackets. For example, the printer command to select emphasized is **ESC E**. To insert this command, you would select Insert Printer Command then type one of the following:

```
<27>E
```

or

```
<27><69>
```

The values in the first case were taken from the ASCII and decimal lines in the Command Summary (starting on page 107); in the second case, both values came from the decimal line. Whichever is used, the program interprets them correctly, and when you print, emphasized mode is turned on at this point. To turn it off you would need to include the **ESC F** command later in the document.

You see nothing in the text, but if you view the final result with the reveal codes function, you see something similar to this:

```
This is [Cmnd:<27>E]Epson[Cmnd:<27>F]
emphasized.[HRt]
```

This would produce the following printout:

This is **Epson** emphasized.

Some other systems let you input some or all of the ASCII control characters by pressing a combination of the CTRL key and the alphanumeric keys, as described on page 68. You will need to find out the exact method used by your software and find the codes or key combinations from the command summary.

Making or altering a printer installation

The printer installations that come with most word processing packages contain the information that allows the software to convert standard word processor commands into printer commands for the particular type of printer. They usually include some or all of the things in this list. The number after each one tells you the page you should refer to for more information.

- Commands to reset the printer to its default settings (sometimes called an initialization string) — 110
- Commands to alter the line spacing — 121
- Commands to change pitch — 131
- Commands to add emphasis or underlining — 135
- Widths of proportional characters — 159
- Commands to move the print head small distances — 127.

Many word processors now come with a program that allows you to alter these details to suit your way of working. It is usually a good idea to experiment first with embedded commands, then incorporate the features you like into your printer installation. Always make a backup copy of the original installation file before making any modifications.

Other Business Software

Most other business software uses similar methods to highlight or otherwise modify printouts, but there are other things to bear in mind too.

In particular, you need to be careful when installing spreadsheet programs or accounting systems that produce large printouts. This kind of program will usually divide the whole printout into segments that are printed one at a time and can then be joined together to form the complete grid. For this reason you must install the software for the correct width of printer.

For example, if you want to print in normal pica characters on an EX-800, you must install the software for an 80-column printer (EX-800 or FX-85) or make an appropriate choice when you give the command to print. If you want to print in condensed (or condensed elite) and your program has no command to change the pitch and number of characters per line, you must install the software for a 136 column printer and use SelecType or set DIP switch 1-1 UP to select condensed.

Graphics Software

The EX has the capability to produce finely detailed graphic images in black or in color (if the color option kit is installed). There are now many commercially available graphics programs designed for producing business presentations or freehand art. The EX is an ideal partner for such software, due to the exceptional speed of its bidirectional graphics printing.

When buying graphics software, always make sure it has a suitable option to allow printouts on an EX. Any program with an option for an EX or FX printer should give excellent results in black only, using different dot densities to produce a realistic scale of grays. If you have installed the color option kit, look for software that has an option for the EX or the JX-80 (color cannot be used in IBM printer emulation mode).

Many computer operating systems have their own command to print the screen image, for example, in MS-DOS, you press SHIFT and PRT SC together. This usually allows you to make screen dumps at any time, even while you are running other software. Note, however, that in some cases you may need to run a special program, such as the MS-DOS GRAPHICS program, before you can make screen dumps.

If you want to do your own graphics programming using BASIC or another programming language, you can find details of the graphics commands in Chapter 12 on page 85.

Programming Languages

This section explains the methods used to obtain special printer features using a programming language. Although the examples in this chapter use BASIC, the principles and most of the pitfalls are the same whichever programming language you happen to be using, so the information will also apply to a wide range of other languages.

As explained in the section on control codes, many of the ASCII codes that control the printer have other meanings to the computer, which may vary between different operating systems and models. Whenever you want to give a command to the printer, it is very important that the method you use does not also affect the screen or other functions of the computer. In other words, the code needs to be passed directly to the printer. Different programming languages achieve this in a number of ways, though in most cases this involves sending commands one character at a time.

In most forms of BASIC, and in particular Microsoft™ BASIC, the normal method of producing printed output is to use the LPRINT statement followed by a string to be printed, either enclosed in quotation marks, or as a variable. The following example shows both methods.

```
100 LPRINT "This is a quoted string."
110 A$ = "This is a string variable."
120 LPRINT A$
```

Individual printer control codes can then be sent by using the CHR$ function. The following example shows how this is done.

```
LPRINT CHR$(27);CHR$(48);
```

This sends ASCII codes 27 and 48 to the printer, selecting 1/8 inch line spacing.

Most versions of BASIC permit the ASCII codes in the CHR$ function to be given in either decimal (as above) or hexadecimal. Where the code corresponds to a printable character, the character itself can be quoted in the LPRINT statement. The command shown above could therefore be given in two other forms:

```
LPRINT CHR$(27);"O";
LPRINT CHR$(&H1B);CHR$(&H30);
```

In many versions of BASIC, you can also treat the printer as a file, and in a few cases this is the only way to print: Commodore® BASIC is an example. This method uses an OPEN statement to create a file and PRINT# statements to send information through the file to the printer. This example uses GW™-BASIC commands to open a file for the printer, print a message in emphasized mode, and close the file.

```
100 OPEN "LPT1:" AS #1
110 PRINT #1, CHR$(27);"E";
120 PRINT #1, "This message is in emphasized
    mode.";
130 PRINT #1, CHR$(27);"F"
140 CLOSE #1
```

A third possibility is that there may be a command that also prints all screen output on the printer (sometimes called printer echo). This is the usual method in BBC BASIC, where printer echo is selected with the command VDU 2 or by pressing CTRL B. If the normal function of the ESC key is turned off with *FX 229,1 you can then send many of the EX commands using the key combinations shown in the command summary. To send them in a program use VDU 1,n to send each code that is only for the printer.

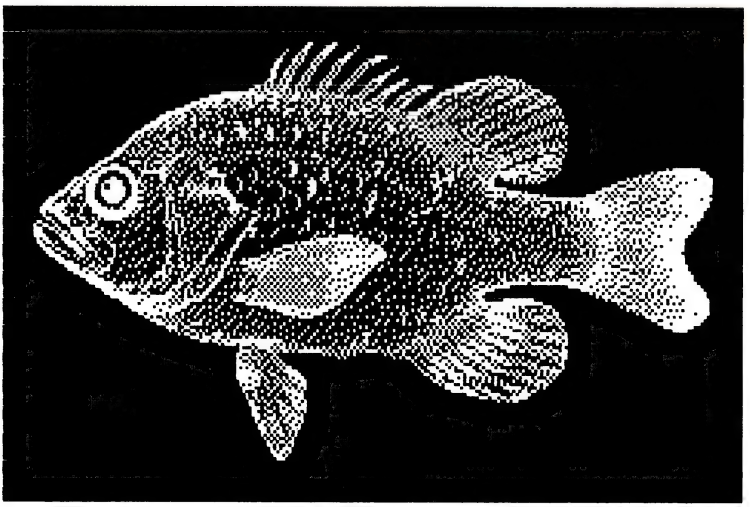
A similar method is used by Applesoft™, the version of BASIC for the Apple computer. The commands used in this case are PR#1 to switch on printer output, and PR#0 to return to screen output only. All printer interfaces for the Apple use these commands, but the method used to send control codes to the printer varies from one interface to another.

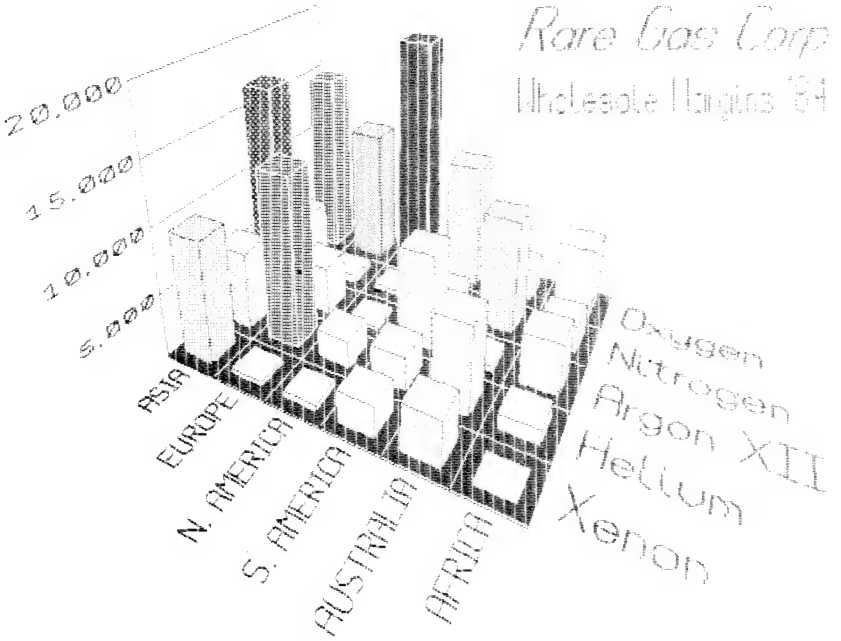
Chapter 12

Graphics and User-defined Characters

The dot graphics modes allow your EX to produce pictures, graphs, charts, or almost any other pictorial material you can devise. The user-defined character feature allows you (or a commercial software program) to put special characters in the printer's memory so that they can be printed just as if they were ordinary letters or numbers. This chapter describes the graphics commands in Epson mode. Most of the information on dot graphics also applies to IBM printer emulation mode; the exceptions are described at the end of the dot graphics section.

Because many commercial software programs use graphics, you may be able to print pictures and graphs like the ones on this page and the next simply by giving your software a few instructions. With such programs you usually create an image on your monitor and then give a command to send the image to the printer.





If you use commercial graphics software, or a package such as a spreadsheet that produces graphics, all you need to know about dot graphics is how to use the software. If you would like to understand how dot graphics are printed, or you want to do your own graphics programming, you can read this chapter for some background information and a summary of graphics techniques.

The Print Head

To understand dot graphics you need to know a little about how the print head works.

The EX print head has nine pins forming a vertical line. As the print head moves across the page, electrical impulses cause groups of the pins to fire, pressing the inked ribbon against the paper to produce a pattern of small dots. As the head moves across the paper, the pins fire time after time in different patterns to produce letters, numbers, or symbols.

Dot patterns

The EX prints graphics in the same way that pictures in newspapers and magazines are printed. If you look closely at a newspaper photograph, you can see that it is made up of many small dots. The EX also forms its images with patterns of dots, as many as 240 dot positions per inch horizontally and 72 dots per inch vertically. The images can, therefore, be finely detailed.

In its main graphics mode the EX uses only the top eight of the nine pins. To print figures taller than eight dots, the printer prints one line, then advances the paper and prints another, just as it does with text. To keep the printer from leaving gaps between the graphics lines as it does between the lines of text, the line spacing has to be reduced. The EX can then print finely detailed graphic images that give no indication that they are made up of separate lines, each no more than 8/72nds of an inch tall.

Each pass of the print head prints one piece of the total pattern, which can be as tall or short and as wide or narrow as you want. You can use as little or as much space as you like for a figure and put it anywhere on the page — on its own, or surrounded by ordinary text.

Pin labels

The graphics mode requires a method to tell the printer which pins to fire in each column. The software must send codes for the dot patterns; one number is needed for each column in a line. For each of those columns the print head prints the pattern of dots you have specified.

There are 256 possible combinations of eight pins, so a single number in the range 0-255 can be used specify which of the patterns you want. In this system, one number is assigned to each pin as shown below.

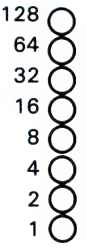


Figure 12-1. Pin numbering system

To fire a single pin, you send its number. To fire more than one pin at the same time, send the total of the numbers of those pins to the printer. For example, you fire the top pin alone by sending 128, or the the bottom pin alone by sending 1. To fire these two pins together, add 128 and 1, then send 129. The next diagram shows three more examples of how to calculate the number to fire a particular pattern of pins.

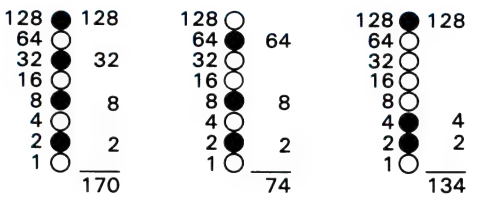


Figure 12-2. Calculating numbers for pin patterns

Before you can put these numbers in a graphics program, you need to know the format of the graphics commands.

Graphics Commands

The graphics mode commands are quite different from most other commands. For most of the other modes, such as emphasized and double-width, one command turns the mode on and another turns it off. For graphics, the command is more complicated because the command that turns on a graphics mode also specifies how many columns of graphics will be printed. After the printer receives this command, it interprets the next numbers as pin patterns and prints them on the paper.

The graphics command format

There are several different graphics commands giving different horizontal dot densities and printing speeds. However, the format is almost the same for all the commands, so the examples here keep things simple by using only the single-density graphics command, **ESC K**. In single-density graphics, there are 60 dots per inch horizontally.

The command to enter single-density graphics mode has the following format:

ASCII:	**ESC**	**K**	*n1*	*n2*
Decimal:	27	75	*n1*	*n2*
Hexadecimal:	1B	4B	*n1*	*n2*

In BASIC the command is given in this format:

```
LPRINT CHR$(27);"K";CHR$(n1);CHR$(n2);
```

ESC K specifies single-density graphics, and the next two numbers (*n1* and *n2*) specify the number of columns to be reserved for graphics.

Column reservation numbers

Even in single-density graphics mode, one line can accommodate 480 columns of graphics; in quadruple-density, almost 2000 columns can fit in a single line. Since the printer does not use decimal numbers larger than 255, the graphics commands use two numbers for reserving columns.

The commands are set up for two numbers, so you must supply two even if you need only one. When you need fewer than 256 columns, it is easy to work out *n1* and *n2*: *n1* is the number of columns you are reserving and *n2* is zero. For example, if you wish to send data for 200 columns of graphics, *n1* should be 200 and *n2* should be 0.

If you will be sending more than 256 coloumns of graphics data, *n2* is the number of complete groups of 256 columns, and *n1* is the number of columns to complete the line. For example, to send 1632 columns of graphic data, *n1* should be 96 and *n2* should be 6 because $96 + (6 \times 256) = 1632$.

If *n* is the total number of columns, you can calculate *n2* by dividing *n* by 256 and discarding the numbers after the decimal point. To find *n1*, multiply *n2* by 256 and subtract the result from *n*. Alternatively, if you are using a programming language with MOD (modulus) and INT (take integer part) functions you can use the following formulas:

n1 = *n* MOD 256
n2 = INT (*n*/256)

Graphics data

After receiving a command like **ESC K** *n1 n2*, the printer interprets the next *n* codes as graphics data, no matter what codes they are. This means that you must be sure to supply exactly the right amount of graphics data. If you supply too little, the printer will stop and wait for more data and will seem to be locked. The next data sent will then be printed as graphics, even if it is really text. On the other hand, if you supply too much graphics data, the excess will be interpreted and printed as regular text.

The first example shows how the graphics command, column reservation numbers, and data can be used to print a single line of graphics. The example is given as a BASIC program. If you prefer another programming language, the principles are exactly the same, so you can easily adapt the program.

The first line of the program specifies single-density graphics for 40 columns:

```
100 LPRINT CHR$(27);"K";CHR$(40);CHR$(0);
```

The second line is the data that is printed as pin patterns. It uses the number 74 to produce one of the patterns shown in Figure 12-2. The FOR and NEXT commands make sure that 40 columns of data are sent.

```
200 FOR X=1 TO 40: LPRINT CHR$(74);: NEXT X
```

That is the whole program. In BASIC, semicolons at the ends of the lines are very important; they prevent the computer from sending other codes after the ones you specify. In other languages you may have to use a special command to send a single code at a time. Run the program to see the result below. Although it is not as interesting as the examples at the beginning of this chapter, it shows exactly how the mode works.

WIDTH statements

Some software (including most versions of BASIC) automatically inserts carriage return and line feed codes after every 80 to 130 characters. This is usually no problem with text, but it can spoil your graphics. It means that two extra columns of graphics are printed in the middle of the ones you send, and two that you send are left over and printed as text.

In some versions of BASIC you can prevent unwanted control codes in graphics by putting a WIDTH statement at the beginning of all graphics programs. The format in many forms of BASIC is either WIDTH "LPT1:", 255 or WIDTH LPRINT 255. Check your software manual for the proper format.

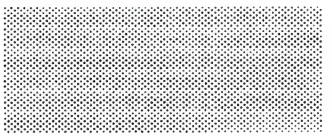
Printing taller patterns

The next example shows how several lines of graphics can be formed into a figure taller than eight dots. It incorporates several more important programming techniques for producing textured or repetitive patterns.

The program is listed below. The lines inside each pair of FOR and NEXT statements have been indented so that you can see how the program works; the spaces are not needed for the program to function properly.

```
100 WIDTH "LPT1:",255
110 LPRINT CHR$(27);"A";CHR$(8);
120 FOR R=1 TO 6
130     LPRINT CHR$(27);"K";CHR$(100);CHR$(0);
140     FOR X=1 TO 50
150         LPRINT CHR$(170);CHR$(85);
160     NEXT X: LPRINT
170 NEXT R
180 LPRINT CHR$(27);"@"
```

If you run the program, you will see how it combines six print lines into a pattern:



There are five basic steps that the program goes through to produce this kind of pattern:

1 The computer is prevented from adding any extra characters by the WIDTH statement (line 100).

2 The line spacing is changed to 8/72 of an inch — the height of the dot patterns used in the program (line 110).

3 The program goes through the graphics commands the required number of times (lines 120 and 170).

4 A new graphics command is used for each line printed (lines 130-160). This part of the program is similar to the last example, but two columns are printed each time through the loop making a total of 100.

5 The last important thing to do is to reset the printer to its default settings, including the normal line spacing (line 180).

The same steps can easily be produced in other programming languages.

Notice that the graphics command **(ESC K)** can be in effect for only one print line. To print more than one line of graphics, the graphics command must be issued before each line.

Density Varieties

Although all the examples so far in this chapter have been in the single-density graphics mode, there are six other eight-pin densities and two that use all nine pins. Nine-pin graphics is not necessary for most uses, but you can find the command **(ESC ^)** on page 147 in the Epson mode command summary.

The four most common eight-pin modes are available in both Epson and IBM printer emulation modes, and are controlled by their own commands: **ESC K, ESC L, ESC Y, ESC Z.** In Epson mode, there is also a general-purpose command for any of the eight-pin graphics modes: **ESC *.** This command is used in the same way as the individual commands, except that before *n1* and *n2* you must send the code for the graphics mode required. The different modes are summarized in the table below.

Table 12-1. Graphics densities

Mode Number	Mode name	Alternate code	Dot density (dots/inch)	Adjacent dots
0	Single Density	**ESC K**	60	possible
1	Double Density	**ESC L**	120	possible
2	High Speed Double Density	**ESC Y**	120	impossible
3	Quadruple Density	**ESC Z**	240	impossible
4	CRT Graphics	none	80	possible
5	Plotter (1:1)	none	72	possible
6	CRT Graphics II	none	90	possible
7	Double-Density Plotter	none	144	possible

The following example shows how to use the **ESC *** command to reserve 40 columns for single-density graphics. This uses mode number 0 from the table to achieve exactly the same effect as the first example using **ESC K.**

```
LPRINT CHR$(27);"*";CHR$(0);CHR$(40);CHR$(0);
```

Modes 4-7 in the table are special modes that alter the horizontal density to give proportions of a computer monitor (the CRT modes), or to match the vertical density so as to give round circles (the plotter modes).

In two modes, high-speed double-density and quadruple density, the print head cannot print two consecutive dots with the same pin, so that it can print dots in only half the possible dot positions in any one row. The higher density means that the resolution of the pattern is better than in single-density mode. However, when you design patterns, you must make sure that dots do not overlap.

Reassigning a graphics mode

Another graphics command lets you assign a different eight-pin graphics mode to one of the specific eight-pin graphics commands. You can use it with graphics software programs to quickly change the density and proportions of your printouts. Changing the graphics option changes the width without changing the height.

The command has the following format:

ASCII:	**ESC**	**?**	*c*	*m*
Decimal:	27	63	*c*	*m*
Hexadecimal:	1B	3F	*c*	*m*

In this command, *c* is a letter designating one of the four alternate graphics codes (**K**, **L**, **Y**, or **Z**) and *m* is the mode number of the new mode, as listed in Table 12-1 above.

For example, to change the **ESC K** command to select the CRT I screen graphics mode, the command in BASIC would be the following:

```
LPRINT CHR$(27);"?K";CHR$(4);
```

A little experimentation should tell you whether the reassigning code can improve your graphics printouts.

Designing your own graphics

This section takes you through the development of a graphics program. The example is not especially complicated, but it does include the same steps you would use for a more complex figure.

You should plan your figure with dots on graph paper, but before beginning to place the dots, you must decide which graphics density you want. The diagram below shows the differences between three common modes so that you can choose the one you want.

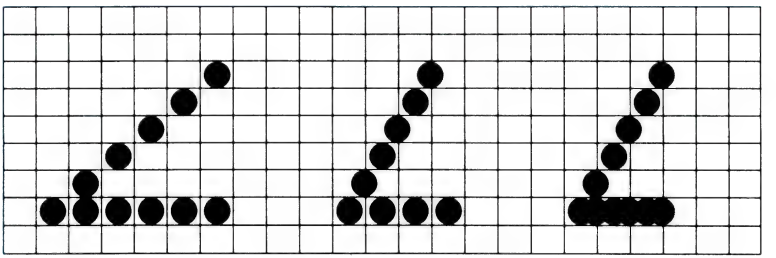


Figure 12-3. Design rules for different densities

In this figure you can see the main rules for graphic design in the three densities:

- In single density no dots can be placed on vertical lines.
- In high-speed double density, dots can be placed on vertical lines, but no dots can overlap.
- In low-speed double density, dots can be placed on vertical lines, and they can overlap.

Now look at the diagram at the top of the next page for a high-speed double-density design. It should point you in the right direction for your own designs.

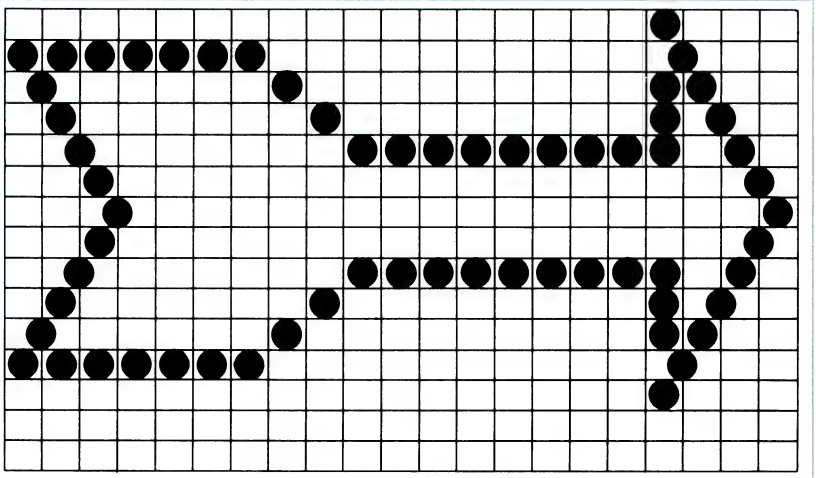


Figure 12-4. Arrow design

After plotting all the dots on a grid, you calculate the numbers for each pin pattern by dividing the design grid into separate print lines. For the arrow design, the grid was divided into two lines, each seven dots high. Then each column was examined in turn to calculate the graphics data. The results for the first line are shown below. The pin values are on the left side and the sums are at the bottom of each column.

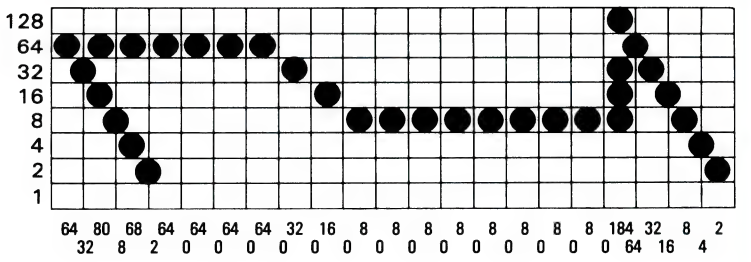


Figure 12-5. Calculating data for the arrow design

The numbers for the second line were calculated in the same way. Once the numbers for the pin patterns have been calculated, they can be put in the program in DATA statements, separated by commas.

The program works in similar way to the last example. This time it selects 7/72 inch line spacing because only seven pins are used. Because the data is not repetitive, each column of graphics data is read from the DATA statements and sent to the printer. The design is 41 dot positions wide, therefore both lines 130 and 140 use the number 41.

```
100 WIDTH "LPT1:", 255
110 LPRINT CHR$(27);"A";CHR$(7);
120 FOR ROW = 1 TO 2
130 LPRINT CHR$(27);"Y";CHR$(41);CHR$(0);
140     FOR COLUMN = 1 TO 41
150         READ N
160         LPRINT CHR$(N);
170     NEXT COLUMN
180 LPRINT
190 NEXT ROW
200 END
210 DATA 64, 32, 80, 8, 68, 2, 64, 0, 64, 0
220 DATA 64, 0, 64, 0, 32, 0, 16, 0, 8, 0
230 DATA 8, 0, 8, 0, 8, 0, 8, 0, 8, 0, 8, 0,
    8, 0
240 DATA 184, 64, 32, 16, 8, 4, 2
250 DATA 8, 16, 40, 64, 136, 0, 8, 0, 8, 0
260 DATA 8, 0, 8, 0, 16, 0, 32, 0, 64, 0,
    64, 0
270 DATA 64, 0, 64, 0, 64, 0, 64, 0, 64, 0,
    64, 0
280 DATA 116, 8, 16, 32, 64, 128, 0
```

If you want to see the figure in other densities, change the Y in line 130 to L or Z.

Graphics in IBM printer emulation mode

Graphics in IBM printer emulation mode are the same as in the Epson mode except that **ESC ***, **ESC ?** and **ESC ^** are not available. Also, if you change the line spacing with **ESC A**, you must follow it with an **ESC 2** command to put the line spacing into force.

User-defined Characters

The EX has a command that allows you to define and print characters of your own design. You can design an entirely new alphabet or typeface, create mathematical or scientific symbols, or create graphic patterns to serve as building blocks for larger designs. These user-defined characters work only in draft mode.

Commercial software programs are available that assist you in creating characters or simply supply you with sets of characters already created. Also, some popular applications packages make use of the user-defined character function to enhance printouts. (These characters are called download characters in some programs.)

The printout below shows a few user-defined characters to give you an idea of what can be done, but remember that you can create whatever you need or want.

When you define a character of your own, the definition is stored in temporary memory (RAM). The original character with the same code remains in the printer's permanent memory (ROM) and you can print either of them when needed.

Design grids

The process of defining a character is much like printing dot graphics because you send the printer precise instructions on where you want each dot printed. In fact, planning a user-defined character is like planning a small dot graphics pattern for the high-speed double-density graphics mode.

To design a character you use a grid that has nine dots and eleven columns, like the one on the left below. Most characters do not use the two rows below the heavy line. They are only used for characters like y and g. Also, even though you can use up to eleven columns, it is best to leave the last two blank for the space between characters.

The grid on the right side below shows a character planned out. Although there are nine pins in the EX print head, you can use only eight of them in a single user-defined character. The design below uses the top eight, but you can also use the bottom eight as explained later in this section.

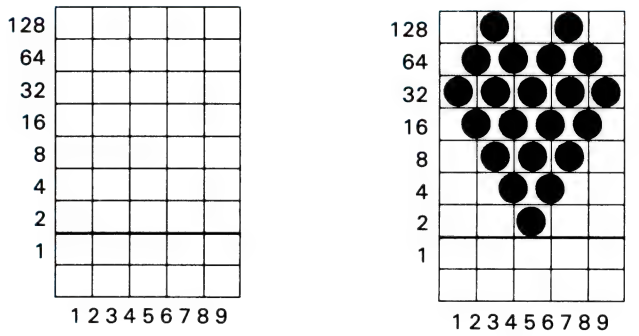


Figure 12-6. Design grids

Once the character is planned on the grid, you simply add the pin values for each column together, just as you do for graphics. Then, the next step in defining a character is to send this information to the printer.

Sending the character definition

The command to define characters has a complex format:

ASCII:	**ESC**	**&**	**NUL**	*n1*	*n2*	*a1*	*d1*	...	*dn*
Decimal:	27	38	0	*n1*	*n2*	*a1*	*d1*	...	*dn*
Hexadecimal:	1B	26	00	*n1*	*n2*	*a1*	*d1*	...	*dn*

The 0 (which is ASCII code 0 (**NUL**), not the numeral zero) allows for future enhancements. At this time it is always ASCII 0.

You can define a range of characters with a single command. The values *n1* and *n2* are the ASCII codes of the first and last characters you are defining. If you are defining only one character, *n1* and *n2* are the same. You can use any codes between 32 and 127 or 161 and 254 decimal for *n1* and *n2*, but it is best not to define decimal 32, which is the code for a space. You can also use other codes by a using the **ESC 6** and **ESC I** commands (see pages 142 and 143 of the command summary).

An example will show how to specify *n1* and *n2*. If, for instance, you wanted to redefine the characters A to Z, *n1* would be **A** (or ASCII code 65) and *n2* would be **Z** (or ASCII code 90). So the command **ESC & NUL AZ** (followed by the appropriate data) would replace the entire alphabet of capital letters.

Following the specification of the range of characters to be defined in this command is one number (*a1*) that specifies the width of the character and whether it uses the top eight pins or the bottom eight pins.

The last part of the character definition is the actual data that defines the dot patterns for each column of each character. Since a character can use up to eleven columns, you must supply eleven data numbers for each character even if some of the columns are blank.

An example character definition program should make the process clear:

```
100 LPRINT CHR$(27);"xO";
110 LPRINT CHR$(27);"&";CHR$(0);
120 LPRINT "@@";
130 LPRINT CHR$(136);
140 FOR I=1 TO 11
150    READ A: LPRINT CHR$(A);
160 NEXT I
170 LPRINT "@ @ @ @ @"
180 LPRINT CHR$(27);"%";CHR$(1);
190 LPRINT "@ @ @ @ @"
200 LPRINT CHR$(27);"%";CHR$(0);
210 LPRINT "@ @ @ @ @"
220 END
230 DATA 32, 80, 168, 84, 42, 84,
         168, 80, 32, 0, 0
```

In line 100, the **ESC x 0** command selects draft style printing.

The actual character definition starts in line 120. The two at signs (@) in line 130 are *n1* and *n2*, the range of characters being defined (in this case, a range of one). Line 140 contains *a1*.

The information about the actual character design (which is contained in the data statements at the end of the program) is sent to the printer in the loop between lines 150 and 170.

The example program above defines a heart and places it in the area of RAM reserved for ASCII code 64; this corresponds to the at sign in the characters in the ROM. The next part of the program (lines 170-210) prints out a three line sample. The first and third lines appear as the normal at sign; the second line contains the heart that was defined. Run the program to see the printout below:

As you can see, both sets of characters (the original ROM characters that the printer normally uses and the user-defined character set) remain in the printer available for your use. The command to switch between the two sets is used in lines 180 and 200. The format is:

ASCII:	**ESC**	%	*n*
Decimal:	27	37	*n*
Hexadecimal:	1B	25	*n*

If *n* is **0** (or **NUL**), the normal ROM character set is selected (this is the default). If *n* is equal to **1** (or **SOH**), the user-defined character set is selected. If you select the user-defined character set before you have defined any characters, the command is ignored; the ROM characters will still be in use.

You can switch between character sets at any time, even in the middle of a line. To try it, place semicolons at the end of lines 170 and 190 in the program above.

Copying ROM to RAM

After running the program above, if you select the user-defined character set and try to print other characters, the only one that will print is the heart. If you send the code for a character that is not defined, nothing is printed, not even a space; it is as if it was not sent at all.

In many cases, you will want to redefine only a few of the characters to suit your needs, leaving the rest of the alphabet as it is. As you have seen, it is possible to switch back and forth between the normal character set and the user-defined character set. Normally, it is more convenient to copy all of the standard characters from ROM to the area of RAM that holds the user-defined character set. The format of the command to do this is as follows:

ASCII:	**ESC**	**:**	**NUL**	**NUL**	**NUL**
Decimal:	27	58	0	0	0
Hexadecimal:	1B	3A	00	00	00

If you use this command at the beginning of a program, then define the special characters you want to change, you can then select the user-defined character set and use it as your normal character set. There is then no need to switch back and forth between sets.

Note

This command will cancel any user-defined characters you have already created. You must send this command to the printer before you define characters.

Specifying the width and height

The example used 136 for *a1* (in line 130 of the definition program), but you can use other values. The number *a1* specifies two things: the width and the position of the character on the grid. The width is used when the character is printed in proportional mode and makes sure that the spacing around it remains even.

If you want a character to use the bottom eight pins, change the values on the design grid as shown below.

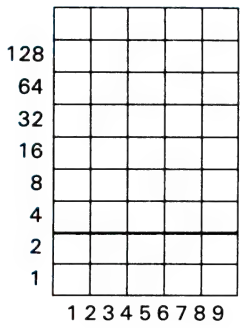


Figure 12-7. Designing for the bottom eight rows

A value of 136 is suitable for all characters that use the top eight pins and start in column 1 and finish in column 9. For a character the same width, but printed with the bottom eight pins, *a1* should be 8. For any other character follow these rules to calculate *a1*:

1 If you design a character narrower than nine columns, balance the number of empty columns on either side. Now, starting with *a1* equal to 8, subtract 1 for every blank column on the right and add 16 for every blank column on the left.

2 If the character should be printed with the top eight pins, add 128.

For example, if a character uses the top eight pins and starts in column 3 and ends in column 7, the calculation is as follows:

- start with *a1* = 8
- subtract 2 for two blank columns on the right, giving *a1* = 6
- add 32 for two blank columns on the left, giving *a1* = 38
- add 128 to print with the top eight pins, so that *a1* = 166.

Mixing print styles

The user-defined characters can be used in combination with most print styles (except NLQ, of course). For example, emphasized and double-width work well with user-defined characters. The sample below shows the heart character defined earlier printed in various styles.

Other considerations

Keep in mind that user-defined characters are stored in RAM, which is not permanent. Whenever the printer power is turned off or your computer sends an initialization ($\overline{\text{INIT}}$) signal, all of the user-defined characters are lost. If you use the **ESC @** command, the ROM set is selected, but the user-defined characters are not lost. For example, some computers send an $\overline{\text{INIT}}$ signal each time BASIC is loaded or when certain applications programs start up, and most computers do it if you have to reset them.

The IBM printer emulation mode has a different method of defining characters. See page 157 in the command summary if you are interested.

User's Reference

Appendix A

Command Summary

This appendix lists and describes all the commands, both Epson (ESC/P) mode and IBM printer emulation mode, available on the EX. This summary is divided by topics, but there is a list of the commands in numerical order beginning on page 239. If you know which command you are looking for, consult the numerical list to find the page number where it is described.

The Quick Reference Card at the end of the book contains a list of the commands divided by topic, with page number references that direct you to full explanations of the commands. The numerical list and the Quick Reference Card also show the differences between the Epson mode and the IBM printer emulation mode.

This appendix lists and describes Epson mode commands and IBM printer emulation mode commands separately. Within each group they are divided into the following subjects:

Printer operation
Data control
Vertical motion
Horizontal motion
Overall printing style
Print size
Print enhancement
Word processing
Character sets
User-defined characters
Graphics

Each command has a format section and a comment section. The format section gives the ASCII, decimal, hexadecimal, and control key codes for the command; the comment section describes the effect of the command and gives any additional information necessary for using it.

The format section is as shown below:

Format:

ASCII code:	the sequence in standard ASCII characters
Decimal:	the sequence in decimal numbers
Hexadecimal:	the sequence in hexadecimal numbers
Control:	the sequence in control characters (if appropriate)

All four formats are equivalent, and it should be easy to pick the one most suited to your purpose. For instance a BASIC programmer might refer to the first and second formats whereas somebody using a word processor would be likely to refer to the second, and a machine code programmer would use the third format.

The control format shows the series of keys you should press to input the code directly from the keyboard of the computer. These codes can be sent by holding down the control key while you press one of the normal character keys. For example, CTRL **A** means that you hold down the control key and press the A key. When there is no control key line in the format section, the control key method of sending the code is not generally suitable.

Variables are represented by italicized letters: for example, *n*, *n1*, *m*. The variables are explained in the comments. If a variable can have only one of two control key values, both are shown in the format section: for example, CTRL **@/A**. If the variable can have more than two control key values, these are explained in the comment section.

Note

Some application programs have their own uses for control key sequences. These should not be confused with the control key values shown here.

For the following commands that use only 0 or 1 for the variable, either the ASCII codes 1 and 0 or the ASCII characters **1** and **0** can be used:

ESC s, ESC i, ESC U, ESC x, ESC p, ESC W, ESC S, ESC -, and **ESC %**

For example, in BASIC you can turn on double-width with either of these statements:

```
LPRINT CHR$(27);"W";CHR$(1);
LPRINT CHR$(27);"W1";
```

These correspond to the following sequences:

ESC W SOH or **ESC W 1**

Examples

The simplest type of command consists of a single character to be sent to the printer. For instance, to print in condensed mode the code format is:

ASCII code:	**SI**
Decimal:	15
Hexadecimal:	0F
Control:	CTRL **O**

The code can be sent from the keyboard by pressing CTRL and **O** together, or from a program by sending the code 15 directly.

More complex commands consist of two or more character codes. For example, to print in proportional mode the code format is:

ASCII code:	**ESC**	**p**	*n*
Decimal:	27	112	*n*
Hexadecimal:	1B	70	*n*
Control:	CTRL **[**	**p**	CTRL **A/@**

In this case *n* can be either 1 or 0, to begin or end proportional printing. To turn ON proportional print from BASIC the command would be:

```
LPRINT CHR$(27);"p1";
```

If the software package permits commands to be input from the keyboard, the key sequence to turn OFF proportional printing would be CTRL and **[** together, **p** alone and then CTRL and @ together.

Epson Mode

This portion of the Command Summary lists and describes all the Epson (ESC/P) commands.

Printer Operation

Initialization

ESC @ — Initialize Printer

Format:

ASCII code:	**ESC**	@
Decimal:	27	64
Hexadecimal:	1B	40
Control:	CTRL [	@

Comments:

Resets the printer mode and clears the buffer of printable data preceding the command. See page 205 for details.

DC1 — Select Printer

Format:

ASCII code:	**DC1**
Decimal:	17
Hexadecimal:	11
Control:	CTRL **Q**

Comments:

Returns the printer to the selected state if it has been deselected by the printer deselect code **(DC3)**. Does not select the printer if it has been switched off line by pressing the ON LINE button.

DC3 — Deselect Printer

Format:

ASCII code:	**DC3**
Decimal:	19
Hexadecimal:	13
Control:	CTRL **S**

Comments:

Puts the printer off-line until the select printer code **(DC1)** is received. The printer cannot be reselected with the ON LINE button.

ESC s — Turn Half Speed Mode On/Off

Format:

ASCII code:	**ESC**	**s**	*n*
Decimal:	27	115	*n*
Hexadecimal:	1B	73	*n*
Control:	CTRL **[**	**s**	CTRL **@/A**

Comments:

If *n* = 1, the mode is turned on;
If *n* = 0, it is turned off.

ESC i — Turn Immediate Mode On/Off

Format:

ASCII code:	**ESC**	**i**	*n*
Decimal:	27	105	*n*
Hexadecimal:	1B	69	*n*
Control:	CTRL **[**	**i**	CTRL **@/A**

Comments:

If *n* = 1, the mode is turned on;
If *n* = 0, it is turned off.
In this mode the printer prints on a character by character basis rather than line by line as in the normal print mode. It also moves the paper up so that the user can see the printing and then moves it back down. This command is ignored if the automatic sheet feeder is selected.

ESC <

Select Unidirectional Mode (one line)

Format:

ASCII code:	**ESC**	<
Decimal:	27	60
Hexadecimal:	1B	3C
Control:	CTRL [	<

Comments:

Printing is normally bidirectional. This command selects unidirectional printing for one line only. (It is cancelled by a carriage return.) The print head moves to the extreme left (home) position, and printing takes place from left to right.

ESC U

Select Unidirectional Mode

Format:

ASCII code:	**ESC**	**U**	*n*
Decimal:	27	85	*n*
Hexadecimal:	1B	55	*n*
Control:	CTRL [	**U**	CTRL @/**A**

Comments:

If *n* = 1, the mode is turned on;
if *n* = 0, it is turned off.
Printing is normally bidirectional. This command selects unidirectional printing for more accurate positioning during text or graphics printing.

ESC 8 — Disable Paper Out Sensor

Format:

ASCII code:	**ESC**	**8**
Decimal:	27	56
Hexadecimal:	1B	38
Control:	CTRL [	**8**

Comments:

Turns off the paper out sensor so that you can print to the end of a single sheet of paper.

ESC 9 — Enable Paper-Out Sensor

Format:

ASCII code:	**ESC**	**9**
Decimal:	27	57
Hexadecimal:	1B	39
Control:	CTRL [	**9**

Comments:

Cancels **ESC 8**. Therefore, the printer beeper sounds and printing stops when the printer reaches a point 3/4 of an inch (20mm) from the end of the paper. When this happens, the printer automatically goes off-line.

ESC EM — Turn Sheet Feeder Mode On/Off

Format:

ASCII code:	**ESC**	**EM**	*n*
Decimal:	27	25	*n*
Hexadecimal:	1B	19	*n*
Control:	CTRL **[**	CTRL **Y**	*n*

Explanation:

The values for *n* are as shown below:

ASCII	Dec	Hex	Function
0	48	30	Turns the mode off
1	49	31	Selects bin 1
2	50	32	Selects bin 2
4	52	34	Turns the mode on
R	82	52	Ejects a sheet

The values **1**, **2**, and **R** are applicable to the EX-1000 only. The command should not be used unless the sheet feeder is installed. It is ignored if any value other than those listed above is used for *n*, and it can be used to override the setting of DIP switch 2-2.

MSB control

Note that MSB is the most significant bit. MSB control (**ESC =**, **ESC >**, and **ESC #**) does not work for graphics or user-defined characters.

ESC = — Set MSB to 0

Format:

ASCII code:	**ESC**	=
Decimal:	27	61
Hexadecimal:	1B	3D
Control:	CTRL **[**	=

Comments:

Sets the MSB of all incoming data to 0. Some computers always send data with the MSB set to 1, which means that the EX will always print italics or character graphics. **ESC =** can overcome this problem.

DEL — Delete Character

Format:

ASCII code:	**DEL**
Decimal:	127
Hexadecimal:	7F

Comments:

Removes the previous text character on the print line but does not affect control codes.

Vertical Motion

Form feeding

FF — Form Feed

Format:

ASCII code:	**FF**
Decimal:	12
Hexadecimal:	0C
Control:	CTRL **L**

Comments:

Prints the data in the print buffer and advances the paper to the top of the next page according to the current page length.

ESC C — Set Page Length in Lines

Format:

ASCII code:	**ESC**	**C**	*n*
Decimal:	27	67	*n*
Hexadecimal:	1B	43	*n*
Control:	CTRL **[**	**C**	(see below)

Comments:

Sets the page length to *n* lines in the current line spacing. The value of *n* must be between 1-127, and can therefore be represented by a control character or an ordinary keyboard character. The top-of-page position is set to the current line.

ESC C NUL — Set Page Length in Inches

Format:

ASCII code:	**ESC**	**C**	**NUL**	*n*
Decimal:	27	67	0	*n*
Hexadecimal:	1B	43	00	*n*
Control:	CTRL **[**	**C**	CTRL @	(see below)

Comments:

Sets the page length to *n* inches. The value of *n* must be between 1-22 (CTRL **A** - CTRL **V**). The top-of-page position is set to the current line.

ESC N — Set Bottom Margin

Format:

ASCII code:	**ESC**	**N**	*n*
Decimal:	27	78	*n*
Hexadecimal:	1B	4E	*n*
Control:	CTRL [	**N**	(see below)

Comments:

Sets a bottom margin of *n* lines in the current line spacing. The value of *n* must be between 1-127, and can be sent by a control character. The size of the bottom margin is not affected by subsequent changes in the line spacing, but it is cancelled if the page length is altered with **ESC C** or **ESC C NUL**. If DIP switch 2-3 is UP, the bottom margin (skip-over-perforation) is set to one inch when the power is turned on.

ESC O — Cancel Bottom Margin

Format:

ASCII code:	**ESC**	**O**
Decimal:	27	79
Hexadecimal:	1B	4F
Control:	CTRL [	**O**

Comments:

Cancels the bottom margin set by **ESC N**. Overrides DIP switch 2-3.

LF — Line Feed

Format:

ASCII code:	**LF**
Decimal:	10
Hexadecimal:	0A
Control:	CTRL **J**

Comments:

When this command is received, the data in the print buffer is printed and the paper advances one line in the current line spacing.

ESC 0 — Select 1/8 Inch Line Spacing

Format:

ASCII code:	**ESC**	**0**
Decimal:	27	48
Hexadecimal:	1B	30
Control:	CTRL **[**	**0**

Comments:

Sets the line spacing to 1/8 inch for subsequent line feed commands. The **0** is the digit zero and not ASCII code 0.

ESC 1 — Select 7/72 Inch Line Spacing

Format:

ASCII code:	**ESC**	**1**
Decimal:	27	49
Hexadecimal:	1B	31
Control:	CTRL [	**1**

Comments:

Sets the line spacing to 7/72 inch for subsequent line feed commands. The **1** is the digit one and not lower case L or ASCII code 1.

ESC 2 — Select 1/6 Inch Line Spacing

Format:

ASCII code:	**ESC**	**2**
Decimal:	27	50
Hexadecimal:	1B	32
Control:	CTRL [	**2**

Comments:

Sets the line spacing to 1/6 inch for subsequent line feed commands. The **2** is the digit two and not ASCII code 2. This is the default at power on.

ESC 3 — Select *n*/216 Inch Line Spacing

Format:

ASCII code:	**ESC**	**3**	*n*
Decimal:	27	51	*n*
Hexadecimal:	1B	33	*n*

Comments:

Sets the line spacing to *n*/216 inch for subsequent line feed commands. The **3** is the digit three and not ASCII code 3. The value of *n* must be between 0-255.

ESC A — Select *n*/72 Inch Line Spacing

Format:

ASCII code:	**ESC**	**A**	*n*
Decimal:	27	65	*n*
Hexadecimal:	1B	41	*n*

Comments:

Sets the line spacing to *n*/72 inch for subsequent line feed commands. The value of *n* must be between 0-85.

ESC J — Perform *n*/216 Inch Line Feed

Format:

ASCII code:	**ESC**	**J**	*n*
Decimal:	27	74	*n*
Hexadecimal:	1B	4A	*n*

Comments:

Advances the paper *n*/216 inch. The value of *n* must be between 0-255. This command produces an immediate line feed but does not affect subsequent line spacing and does not produce a carriage return.

ESC j — Perform *n*/216 Inch Reverse Line Feed

Format:

ASCII code:	**ESC**	**j**	*n*
Decimal:	27	106	*n*
Hexadecimal:	1B	6A	*n*

Comments:

Reverse feeds the paper by *n*/216 inch. Note that **ESC j** should not be used near the end of the paper or when printing self-adhesive labels. If the sheet feeder is selected, this command is ignored. Accuracy of reverse feeding cannot be guaranteed for values of *n* greater than 18; *n* must be in the range 0-255.

Margins

ESC l — Set Left Margin

Format:

ASCII code:	**ESC**	**l**	*n*
Decimal:	27	108	*n*
Hexadecimal:	1B	6C	*n*

Comments:

Sets the left margin to *n* columns in the current pitch, with the maximum value of *n* as follows: 78 in pica, 93 in elite, 133 in condensed, and 156 in condensed elite. Settings made in the proportional mode are treated as pica. This command clears previous tab settings and all previous characters in the print line. Use lowercase **l** (for left), not the numeral one. The minimum space between the margins is the width of one double-width pica character.

ESC Q — Set Right Margin

Format:

ASCII code:	**ESC**	**Q**	*n*
Decimal:	27	81	*n*
Hexadecimal:	1B	51	*n*

Comments:

Sets the right margin to *n* columns in the current pitch. The maximum value of *n* is as follows: 79 in pica, 95 in elite, 136 in condensed, and 159 in condensed elite. Settings made in the proportional mode are treated as pica. This command clears previous horizontal tab settings and all previous characters in the print line. The minimum space between the margins is the width of one double-width pica character.

BS — Backspace

Format:

ASCII code:	**BS**
Decimal:	8
Hexadecimal:	08
Control:	CTRL **H**

Comments:

Prints out data in the print buffer, then moves the print position one space to the left. The code is ignored if the print position is at the left of the printer, or if **ESC a 1, 2,** or **3** has been sent. In Epson mode, if this code is received immediately after graphics printing, the print position of subsequent data is moved back to the point at which graphics printing started.

ESC $ — Move to Absolute Dot Position

Format:

ASCII code:	**ESC**	**$**	*n1*	*n2*
Decimal:	27	36	*n1*	*n2*
Hexadecimal:	1B	24	*n1*	*n2*

Comments:

This sequence specifies the distance from the left margin that subsequent characters are to be printed, using this formula: total number of dots = $n1 + (n2 \times 256)$. Each dot equals 1/60 of an inch. If the position specified is beyond the right margin, the sequence is ignored and the previous setting remains effective.

ESC \ — Move to Relative Dot Position

Format:

ASCII code:	**ESC**	\	*n1*	*n2*
Decimal:	27	92	*n1*	*n2*
Hexadecimal:	1B	5C	*n1*	*n2*

Comments:

Determines the position (relative to the current positon) at which printing of following data will start. To find *n1* and *n2*, first calculate the displacement required in dots. If the displacement is to the left, subtract it from 65536. Send the resulting number using this formula: total number of dots = $n1 + (256 \times n2)$. The command is ignored if it would move the print position outside the current margins. A dot is 1/120th of an inch.

Horizontal tabbing

HT — Tab Horizontally

Format:

ASCII code:	**HT**
Decimal:	9
Hexadecimal:	09
Control:	CTRL **I**

Comments:

Advances the print position to the next horizontal tab setting. The default settings are at intervals of eight characters in the default pitch, and tab positions are not affected by subsequent changes in character pitch.
Some software and some computers convert **HT** characters to spaces instead of sending them directly.
This command is ignored if any justification mode other than left justification has been selected by the **ESC a** command.

ESC D — Set Horizontal Tabs

Format:

ASCII code:	**ESC**	**D**	*n1*	*n2*	...	**NUL**
Decimal:	27	68	*n1*	*n2*	...	0
Hexadecimal:	1B	44	*n1*	*n2*	...	00

Comments:

This command allows setting of up to 32 horizontal tabs, which are entered as *n1*, *n2*, *n3* etc. (in the range 1 to 137) with the **NUL** character terminating the command. The tab settings must be entered in ascending order. **ESC D NUL** clears all tabs. The settings on power up or after an **ESC @** command are every eight characters. The tab settings do not change if the character pitch is changed. For proportional printing the size of pica characters determines the tab positions.

Overall Printing Style

ESC x — Select NLQ or Draft

Format:

ASCII code:	**ESC**	**x**	*n*
Decimal:	27	120	*n*
Hexadecimal:	1B	78	*n*
Control:	CTRL **[**	**x**	CTRL **@/A**

Comments:

If *n* = 0, this command selects the draft mode;
if *n* = 1, it selects the Near Letter Quality (NLQ) mode.
NLQ mode temporarily overrides double-strike mode.

ESC k — Select NLQ Font

Format:

ASCII code:	**ESC**	**k**	*n*
Decimal:	27	107	*n*
Hexadecimal:	1B	6B	*n*
Control:	CTRL **[**	**k**	CTRL **@/A**

Comments:

If *n* = 0, the NLQ font is Roman;
if *n* = 1, the NLQ font is Sans Serif.
Note that the value of *n* must equal 00 hex or 01 hex, not **0** or **1**.
If the printer is in draft mode when this command is sent, the change has no effect until NLQ mode is reselected.

ESC r — Select Printing Color

Format:

ASCII code:	**ESC**	**r**	*n*
Decimal:	27	114	*n*
Hexadecimal:	1B	72	*n*
Control:	CTRL **[**	**r**	(see below)

Comments:

The variable *n* selects the printing color according to the table below.

n	Control key	Color
0	CTRL **@**	Black
1	CTRL **A**	Red
2	CTRL **B**	Blue
3	CTRL **C**	Violet
4	CTRL **D**	Yellow
5	CTRL **E**	Orange
6	CTRL **F**	Green

ESC !

Master Select

Format:

ASCII code:	**ESC**	!	*n*
Decimal:	27	33	*n*
Hexadecimal:	1B	21	*n*

Comments:

Selects any valid combination of the following modes: pica, elite, proportional, condensed, emphasized, double-strike, double-width, italic, and underline. For further details, see the typestyle summary starting on page 175.

Print Size and Character Width

ESC P

Select Pica Pitch

Format:

ASCII code:	**ESC**	**P**
Decimal:	27	80
Hexadecimal:	1B	50
Control:	CTRL [	**P**

Comments:

Selects pica pitch (10 characters per inch). Because pica is the default pitch, this command is normally used to cancel elite pitch.

ESC M — Select Elite Pitch

Format:

ASCII code:	**ESC**	**M**
Decimal:	27	77
Hexadecimal:	1B	4D
Control:	CTRL **[**	**M**

Comments:

Elite pitch has 12 characters per inch.

ESC p — Turn Proportional Mode On/Off

Format:

ASCII code:	**ESC**	**p**	*n*
Decimal:	27	112	*n*
Hexadecimal:	1B	70	*n*
Control:	CTRL **[**	**p**	CTRL **@/A**

Comments:

If *n* = 1, the mode is turned on;
If *n* = 0, it is turned off.
The width of proportional characters varies from character to character. Therefore, a narrow letter like i receives less space than a wide letter like W. The proportional widths are given in the character tables which start on page 159.
This command overrides condensed.

SI — Select Condensed Mode

Format:

ASCII code:	**SI**
Decimal:	15
Hexadecimal:	0F
Control:	CTRL **O**

Comments:

Prints characters at about 60% of their normal width. For example, the condensed pica mode has 17 characters per inch. Proportional mode cannot be condensed, and proportional will override condensed.

ESC SI — Select Condensed Mode

Format:

ASCII code:	**ESC**	**SI**
Decimal:	27	15
Hexadecimal:	1B	0F

Comments:

Duplicates the **SI** command.

DC2 — Cancel Condensed Mode

Format:

ASCII code:	**DC2**
Decimal:	18
Hexadecimal:	12
Control:	CTRL **R**

Comments:

Cancels condensed printing set by **SI**, **ESC SI**, or DIP switch 1-1.

SO — Select Double-width (one line)

Format:

ASCII code:	**SO**
Decimal:	14
Hexadecimal:	0E
Control:	CTRL **N**

Comments:

Double-width mode doubles the width of all characters. This mode is cancelled by a carriage return (**CR**), line feed (**LF**), form feed (**FF**), or **DC4**.

ESC SO — Select Double-width (one line)

Format:

ASCII code:	**ESC**	**SO**
Decimal:	27	14
Hexadecimal:	1B	0E

Comments:

Duplicates the **SO** command.

DC4 — Cancel Double-width (one line)

Format:

ASCII code:	**DC4**
Decimal:	20
Hexadecimal:	14
Control:	CTRL **T**

Comments:

Cancels one-line double-width printing selected by **SO** or **ESC SO**, but not double-width printing selected by **ESC W** or **ESC !**.

ESC W — Turn Double-width Mode On/Off

Format:

ASCII code:	**ESC**	**W**	*n*
Decimal:	27	87	*n*
Hexadecimal:	1B	57	*n*
Control:	CTRL [	**W**	CTRL @/A

Comments:

If *n* = 1, the mode is turned on;
if *n* = 0, it is turned off.
Double-width mode doubles the width of all characters.

Print Enhancement

ESC E — Select Emphasized Mode

Format:

ASCII code:	**ESC**	**E**
Decimal:	27	69
Hexadecimal:	1B	45
Control:	CTRL [	**E**

Comments:

Makes text bolder by printing each dot twice, with the second dot slightly to the right of the first.

ESC F — Cancel Emphasized Mode

Format:

ASCII code:	**ESC**	**F**
Decimal:	27	70
Hexadecimal:	1B	46
Control:	CTRL [	**F**

Comments:

Cancels emphasized, the mode selected by **ESC E.**

ESC G — Select Double-Strike Mode

Format:

ASCII code:	**ESC**	**G**
Decimal:	27	71
Hexadecimal:	1B	47
Control:	CTRL [	**G**

Comments:

Makes text bolder by printing each line twice, with the second printing slightly below the first. In NLQ the mode is not available but is not cancelled.

ESC H — Cancel Double-Strike Mode

Format:

ASCII code:	**ESC**	**H**
Decimal:	27	72
Hexadecimal:	1B	48
Control:	CTRL [	**H**

Comments:

Turns off the double-strike mode selected by **ESC G.** In IBM printer emulation mode, this command cancells the Sans Serif set by SelecType.

ESC S NUL — Select Superscript Mode

Format:

ASCII code:	ESC	S	NUL
Decimal:	27	83	0
Hexadecimal:	1B	53	00
Control:	CTRL [	S	CTRL @

Comments:

Prints characters about two-thirds of the normal height in the upper part of the character space.

ESC S SOH — Select Subscript Mode

Format:

ASCII code:	ESC	S	SOH
Decimal:	27	83	1
Hexadecimal:	1B	53	01
Control:	CTRL [	S	CTRL A

Comments:

Prints characters about two-thirds of the normal height in the lower part of the character space.

ESC T — Cancel Superscript/Subscript

Format:

ASCII code:	ESC	T
Decimal:	27	84
Hexadecimal:	1B	54
Control:	CTRL [	T

Comments:

Cancels either superscript or subscript.

ESC -

Turn Underlining On/Off

Format:

ASCII code:	**ESC**	-	*n*
Decimal:	27	45	*n*
Hexadecimal:	1B	2D	*n*
Control:	CTRL [	-	CTRL @/**A**

Comments:

If *n* = 1, the mode is turned on;
if *n* = 0, the mode is turned off.
This mode provides continuous underlining, including spaces.

Word Processing

ESC a

NLQ Justification

Format:

ASCII code:	**ESC**	**a**	*n*
Decimal:	27	97	*n*
Hexadecimal:	1B	61	*n*
Control:	CTRL [	**a**	(see below)

Comments:

This command selects justification as follows:

n = 0 selects left justification
n = 1 selects centering
n = 2 selects right justification
n = 3 selects full justification
The control key equivalents are CTRL @ - CTRL **C**.
The default setting is *n* = 0. Full justification (*n* = 3) is performed when the buffer becomes full, and **HT** and **BS** are invalid except in *n* = 0 mode. For *n* = 3 there must be no carriage returns within a paragraph.

ESC SP — Set Intercharacter Space

Format:

ASCII code:	**ESC**	**SP**	*n*
Decimal:	27	32	*n*
Hexadecimal:	1B	20	*n*
Control:	CTRL [	**(space)**	(see below)

Comments:

Sets the amount of space added to the right of each character, in addition to the space already allowed in the design of the character. The number of dots is determined by *n*, which should be between 0-63. A dot is 1/120th of an inch. The default value is 0.

Character Sets

ESC t — Select Character Table

Format:

ASCII code:	**ESC**	**t**	*n*
Decimal:	27	116	*n*
Hexadecimal:	1B	74	*n*
Control:	CTRL [	**t**	CTRL @/**A**

Comments:

Selects the character table used by codes 128-255.
If *n* = 0, italics are used;
if *n* = 1, the Epson Character Graphics are used.
Selecting Epson Character Graphics does not disable italic printing. Italic printing can still be selected by **ESC 4**.
Duplicates the function of DIP switch 1-3.
Note that the value of *n* must equal 00 hex or 01 hex, not **0** or **1**.

ESC 4 — Select Italic Mode

Format:

ASCII code:	**ESC**	**4**
Decimal:	27	52
Hexadecimal:	1B	34
Control:	CTRL [	**4**

Comments:

Causes characters to be printed in the italic character set. This command is valid even if the Epson Character Graphics set has been selected by **ESC t** or DIP switch 1-3, but not all character graphics are italicized.

ESC 5 — Cancel Italic Mode

Format:

ASCII code:	**ESC**	**5**
Decimal:	27	53
Hexadecimal:	1B	35
Control:	CTRL [	**5**

Comments:

Cancels the italic mode selected by **ESC 4**.

ESC R — Select an International Character Set

Format:

ASCII code:	**ESC**	**R**	*n*
Decimal:	27	82	*n*
Hexadecimal:	1B	52	*n*

Comments:

The variable *n* selects the international character set as shown below. The table on page 166 includes all the international characters.

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

User-defined Characters

Note: See Chapter 12 on page 85 for sample programs and full information on this topic.

ESC & — Define User-Defined Characters

Format:

ASCII code:	**ESC**	**&**	**NUL**	*d1*	*d2*	...	*dn*
Decimal:	27	38	0	*d1*	*d2*	...	*dn*
Hexadecimal:	1B	26	00	*d1*	*d2*	...	*dn*

Comments:

This command allows characters to be redefined in the draft mode.

ESC : — Copy ROM Into RAM

Format:

ASCII code:	**ESC**	:	**NUL**	**NUL**	**NUL**
Decimal:	27	58	0	0	0
Hexadecimal:	1B	3A	00	00	00

Comments:

This code copies the characters in the ROM into RAM so that specific characters can be redefined.

ESC % — Select User-Defined Set

Format:

ASCII code:	**ESC**	%	*n*
Decimal:	27	37	*n*
Hexadecimal:	1B	25	*n*

Comments:

This code selects the user-defined set if $n = 1$ and the normal set if $n = 0$. **ESC &** is required to define the character set.

ESC 6 — Printable Code Area Expansion

Format:

ASCII code:	**ESC**	**6**
Decimal:	27	54
Hexadecimal:	1B	36
Control:	CTRL [	**6**

Comments:

When the Epson italic characters are selected, ASCII codes 128 to 159 and 255 are usually not printable. These codes become printable upon input of the **ESC 6** code, which allows the use of these codes for user-defined characters. This is the default setting when Epson character graphics are selected.

ESC 7 — Cancel ESC 6

Format:

ASCII code:	**ESC**	**7**
Decimal:	27	55
Hexadecimal:	1B	37
Control:	CTRL [	**7**

Comments:

Cancels **ESC 6** setting. Input of this code causes the printer to ignore all codes except control codes in ASCII codes 128 to 159 and 255. This is the default setting when Epson italic characters are selected.

ESC I — Printable Code Area Expansion

Format:

ASCII code:	**ESC**	**I**	*n*
Decimal:	27	73	*n*
Hexadecimal:	1B	49	*n*
Control:	CTRL [	**I**	CTRL @/**A**

Comments:

ASCII codes 0 to 31 and 128 to 159 are usually not printable. These codes become printable upon input of the **ESC I** code if *n* = 1, which allows the use of these codes for user-defined characters. If *n* = 0, this command returns 0 to 31 and 128 to 159 to non-printable codes.

Note: See Chapter 12 on page 85 for sample graphics programs.

ESC K — Select Single Density Graphics Mode

Format:

ASCII code:	**ESC**	**K**	*n1*	*n2*
Decimal:	27	75	*n1*	*n2*
Hexadecimal:	1B	4B	*n1*	*n2*

Comments:

Turns on single density 8-pin graphics mode.
If *d* is the total number of columns required:
n1 = *d* MOD 256
n2 = INT (*d* / 256)
This command must be followed by *d* data numbers.

ESC L — Select Double Density Graphics Mode

Format:

ASCII code:	**ESC**	**L**	*n1*	*n2*
Decimal:	27	76	*n1*	*n2*
Hexadecimal:	1B	4C	*n1*	*n2*

Comments:

Turns on low-speed double density 8-pin graphics mode.
If *d* is the total number of columns required:
n1 = *d* MOD 256
n2 = INT (*d* / 256)
This command must be followed by *d* data numbers.

ESC Y Select High Speed Double Density Graphics Mode

Format:

ASCII code:	**ESC**	**Y**	*n1*	*n2*
Decimal:	27	89	*n1*	*n2*
Hexadecimal:	1B	59	*n1*	*n2*

Comments:

Turns on high-speed double density 8-pin graphics mode.
If *d* is the total number of columns required:
n1 = *d* MOD 256
n2 = INT (*d* / 256)
This command must be followed by *d* data numbers.

ESC Z Select Quadruple Density Graphics Mode

Format:

ASCII code:	**ESC**	**Z**	*n1*	*n2*
Decimal:	27	90	*n1*	*n2*
Hexadecimal:	1B	5A	*n1*	*n2*

Comments:

Turns on quadruple density 8-pin graphics mode.
If *d* is the total number of columns required:
n1 = *d* MOD 256
n2 = INT (*d* / 256)
This command must be followed by *d* data numbers.

ESC * — Select an 8-pin Graphics Mode

Format:

ASCII code:	**ESC**	*	*m*	*n1*	*n2*
Decimal:	27	42	*m*	*n1*	*n2*
Hexadecimal:	1B	2A	*m*	*n1*	*n2*

Comments:

Turns on 8-pin graphics mode *m*. See the table below for details on the 8 modes available.

If *d* is the total number of columns required:

n1 = *d* MOD 256

n2 = INT (*d* / 256).

This command must be followed by *d* data numbers.

Table A-1. Graphic densities

Mode (*m*)	Mode name	Alternate code	Dot density (dots/inch)	Adjacent dots
0	Single Density	**ESC K**	60	possible
1	Double Density	**ESC L**	120	possible
2	High Speed Double Density	**ESC Y**	120	impossible
3	Quadruple Density	**ESC Z**	240	impossible
4	CRT Graphics	none	80	possible
5	Plotter (1:1)	none	72	possible
6	CRT Graphics II	none	90	possible
7	Double-Density Plotter	none	144	possible

ESC ? — Reassign Graphics Mode

Format:

ASCII code:	**ESC**	?	*s*	*n*
Decimal:	27	63	*s*	*n*
Hexadecimal:	1B	3F	*s*	*n*

Comments:

Changes one graphics mode to another. The variable *s* is a character (**K**, **L**, **Y** or **Z**), which is reassigned to a mode *n* (0-6).

ESC ^ — Select 9-Pin Graphics Mode

Format:

ASCII code:	**ESC**	^	*m*	*n1*	*n2*
Decimal:	27	94	*m*	*n1*	*n2*
Hexadecimal:	1B	5E	*m*	*n1*	*n2*

Comments:

Turns on 9-pin graphics mode. The variable *m* defines the density of print (0 for single and 1 for double). If *d* is the total number of columns required:

n1 = *d* MOD 256

n2 = INT (*d* / 256)

They are followed by 2 × *d* data bytes (two data items for each column of print).

IBM Printer Emulation Mode

The Epson and IBM printer emulation modes share many of the same commands. Therefore, this summary does not describe the commands that are already described in the Epson mode command summary. The commands that are the same as Epson commands are listed below, and the commands that are different are described in detail, divided into the same categories used in the Epson command summary.

You can also see the differences between the two modes in the numerical list of commands beginning on page 239 and on the Quick Reference Card.

Commands That Are the Same as Epson Commands

Printer operation

DC1, ESC U, ESC 8, ESC 9, BEL

Data buffer control

CR, CAN

Paper feed control

FF, ESC C, ESC C NUL, ESC N, ESC O, LF, ESC 0, ESC 1, ESC 3, VT, ESC B

Print head control

BS, HT

Print size/character width

SI, ESC SI, SO, ESC SO, DC4, ESC W, ESC E, ESC F, ESC G, ESC H, ESC S, ESC T, ESC-

Graphics

ESC K, ESC L, ESC Y, ESC Z

Note that IBM printer emulation mode graphics are the same as Epson mode graphics except that **ESC ***, **ESC ?**, and **ESC ^** are not available.

Printer Operation

ESC Q ETX — Deselect Printer

Format:

ASCII code:	**ESC**	**Q**	**ETX**
Decimal:	27	81	3
Hexadecimal:	1B	51	03
Control:	CTRL **[**	**Q**	CTRL **C**

Comments:

Places the printer in an off-line state until the printer is turned off and back on or until it receives a **DC1** code.

ESC 2 — Select Programmable Line Spacing

Format:

ASCII code:	**ESC**	**2**
Decimal:	27	50
Hexadecimal:	1B	32
Control:	CTRL [	**2**

Comments:

Selects the line spacing stored in memory by **ESC A**. If no **ESC A** command has been sent, **ESC 2** sets the line spacing to 1/6 of an inch. (The **2** is the digit two and not ASCII code 2.)

ESC A — Set *n*/72 Inch Line Spacing

Format:

ASCII code:	**ESC**	**A**	*n*
Decimal:	27	65	*n*
Hexadecimal:	13	41	*n*

Comments:

Sets the line spacing to *n*/72 of an inch. This value is stored in memory until the printer receives the **ESC 2** command to put it into effect. The value of *n* must be between 0-85.

ESC J — Perform *n*/216 Inch Line Feed

Format:

ASCII code:	**ESC**	**J**	*n*
Decimal:	27	74	*n*
Hexadecimal:	1B	4A	*n*

Comments:

Advances the paper by one line at a spacing of *n*/216 of an inch. The value of *n* must be between 0-255. This command produces an immediate line feed but does not affect subsequent line spacing. It does not produce a carriage return unless DIP switch 1-3 is DOWN.

ESC 4 — Set Top of Page

Format:

ASCII code:	**ESC**	**4**
Decimal:	27	52
Hexadecimal:	1B	34
Control:	CTRL [	**4**

Comments:

Sets the current position as top of page.

ESC 5 — Turn Automatic Line Feed On/Off

Format:

ASCII code:	**ESC**	**5**	*n*
Decimal:	27	53	*n*
Hexadecimal:	1B	35	*n*
Control:	CTRL [	**5**	CTRL @/**A**

Comments:

If *n* = 1, the printer adds a line feed to each carriage return. If *n* = 0, it does not. This command duplicates the function of DIP switch 2-4.

ESC X — Set Left and Right Margins

Format:

ASCII code:	**ESC**	**X**	*n1*	*n2*
Decimal:	27	78	*n1*	*n2*
Hexadecimal:	1B	4E	*n1*	*n2*

Comments:

The left margin column is set to *n1* in the current pitch, ignoring double-width, and the right margin column is set to *n2*. The minimum distance between the two margins is 1/2 inch. The first column is number 1, not number 0.

ESC D — Set Horizontal Tabs

Format:

ASCII code:	**ESC**	**D**	*n1*	*n2*	...	**NUL**
Decimal:	27	68	*n1*	*n2*	...	0
Hexadecimal:	1B	44	*n1*	*n2*	...	00

Comments:

This command allows setting of up to 32 horizontal tabs, which are entered as *n1*, *n2*, *n3* etc. (in the range 1 to 137) with the **NUL** character terminating the command. The tab settings must be entered in ascending order. **ESC D NUL** clears all tabs. The settings on power up or after an **ESC @** command are every eight characters. The tab settings change if the character pitch is changed, except that double-width has no effect on the tab positions.

ESC R — Restore Default Tab Settings

Format:

ASCII code:	**ESC**	**R**
Decimal:	27	82
Hexadecimal:	1B	52
Control:	CTRL [	**R**

Comments:

Resets all vertical and horizontal tab settings (set by **ESC B** and **ESC D**) to their defaults.

Overall Printing Style

ESC I — Select Font

Format:

ASCII code:	**ESC**	**I**	*n*
Decimal:	27	73	*n*
Hexadecimal:	1B	49	*n*
Control:	CTRL [	**I**	(see below)

Comments:

Selects one of the fonts shown below, according to the value of *n*.

n	Control key	Font
0	CTRL @	standard draft
2	CTRL **B**	standard NLQ (Sans Serif)
4	CTRL **D**	user-defined draft
6	CTRL **F**	user-defined NLQ

ESC :

Select Elite Pitch

Format:

ASCII code:	**ESC**	:
Decimal:	27	58
Hexadecimal:	1B	3A
Control:	CTRL [	:

Comments:

Elite pitch has 12 characters per inch.

DC2

Cancel Condensed/Elite

Format:

ASCII code:	**DC2**
Decimal:	18
Hexadecimal:	12
Control:	CTRL **R**

Comments:

Cancels condensed and elite printing, and selects pica printing. The command does not cancel double-width.

ESC _ — Turn Overscore Mode On/Off

Format:

ASCII code:	**ESC**	_	*n*
Decimal:	27	95	*n*
Hexadecimal:	1B	5F	*n*
Control:	CTRL [	_	CTRL @/**A**

Comments:

If *n* = 1 or **1**, the command selects overscore;
if *n* = 0 or **0**, the command cancels overscore.

Character Sets

ESC 6 — Select International Character Set

Format:

ASCII code:	**ESC**	**6**
Decimal:	27	54
Hexadecimal:	1B	36
Control:	CTRL [	**6**

Comments:

Selects the international character set (table 2). See the character tables starting on page 168.

ESC 7 — Select Standard Character Set

Format:

ASCII code:	**ESC**	**7**
Decimal:	27	55
Hexadecimal:	1B	37
Control:	CTRL [	**7**

Comments:

Selects standard IBM character set (table 1) if international character set (table 2) has been previously selected. See the character tables starting on page 168.

ESC \ — Print Characters from Symbol Set

Format:

ASCII code:	**ESC**	\	*n1*	*n2*	*data*
Decimal:	27	92	*n1*	*n2*	*data*
Hexadecimal:	1B	5C	*n1*	*n2*	*data*

Comments:

Prints a number of characters from the IBM symbol set. The number of characters = *n1* + (*n2* × 256). See the character tables starting on page 168 for the symbol set and the codes to use for *data*. Unpredictable results may occur if too much or too little data is sent.

ESC ^ — Print One Character from Symbol Set

Format:

ASCII code:	**ESC**	^	*c*
Decimal:	27	94	*c*
Hexadecimal:	1B	5E	*c*

Comments:

Prints a single character (*c*) from the symbol set. See the character tables starting on page 168 for the symbol set and the codes to use for *c*.

ESC =

Format:

ASCII code:	**ESC**	=	*n1*	*n2*	...	*nk*
Decimal:	27	61	*n1*	*n2*	...	*nk*
Hexadecimal:	1B	3D	*n1*	*n2*	...	*nk*

Comments:

If *c* is the total number of characters to be defined,
b = (*c* × 13) + 2
n1 = *b* MOD 256
n2 = INT (*b*/256)
n3 = 20 in all cases
n4 = the code of the first character to be defined
n5 = 0 if the top 8 pins are used;
n5 = 128 for the bottom 8
n6 = 0 in all cases
n7 through *nk* are the data numbers that define the characters, with 11 data numbers for each character

n5 through *nk* must be repeated for each character.

The data numbers for each character are determined as shown on the grid for the Epson mode on page 100. To print a user-defined character, you must use **ESC I**, which is described on page 153.

Appendix B

Character Tables

This appendix contains tables of the complete Epson mode US character set, the variations between the 13 Epson international character sets, and the IBM printer emulation mode character sets. The tables give the codes in decimal and hexadecimal, and also supply the proportional width of each character.

Epson Mode (US ASCII)

The first half of this table covers the standard US ASCII character codes from 0 to 127 and includes the ASCII names of the characters and control keys where appropriate. The remainder of the table shows two characters for each code: one from the standard italic character table and one from the Epson character graphics table. These are selected by **ESC t** or DIP switch 1-3. In the case of character graphics, two proportional widths are shown, where appropriate, for the normal character and the italic form (selected with the **ESC 4** command).

Decimal	Hex	Control key	Character	ASCII name
0	00	CTRL @	**NUL**	null
1	01	CTRL A	**SOH**	start of heading
2	02	CTRL B	**STX**	start of text
3	03	CTRL C	**ETX**	end of text
4	04	CTRL D	**EOT**	end of transmission
5	05	CTRL E	**ENQ**	enquiry
6	06	CTRL F	**ACK**	acknowledge
7	07	CTRL G	**BEL**	bell
8	08	CTRL H	**BS**	back space
9	09	CTRL I	**HT**	tab horizontally
10	0A	CTRL J	**LF**	line feed
11	0B	CTRL K	**VT**	tab vertically
12	0C	CTRL L	**FF**	form feed
13	0D	CTRL M	**CR**	carriage return
14	0E	CTRL N	**SO**	shift out
15	0F	CTRL O	**SI**	shift in
16	10	CTRL P	**DLE**	data link escape
17	11	CTRL Q	**DC1**	device control 1
18	12	CTRL R	**DC2**	device control 2
19	13	CTRL S	**DC3**	device control 3
20	14	CTRL T	**DC4**	device control 4
21	15	CTRL U	**NAK**	negative acknowledge
22	16	CTRL V	**SYN**	synchronous idle
23	17	CTRL W	**ETB**	end of transmitted block
24	18	CTRL X	**CAN**	cancel line
25	19	CTRL Y	**EM**	end of medium
26	1A	CTRL Z	**SUB**	substitute
27	1B	CTRL [	**ESC**	escape
28	1C	CTRL \	**FS**	file separator
29	1D	CTRL]	**GS**	group separator
30	1E	CTRL ^	**RS**	record separator
31	1F	CTRL _	**US**	unit separator

Dec	Hex	Character	Width	Dec	Hex	Character	Width
32	20	**SP**	12	73	49	I	8
33	21	!	5	74	4A	J	11
34	22	"	8	75	4B	K	12
35	23	#	12	76	4C	L	12
36	24	$	12	77	4D	M	12
37	25	%	12	78	4E	N	12
38	26	&	12	79	4F	O	12
39	27	'	5	80	50	P	12
40	28	(	6	81	51	Q	12
41	29	)	6	82	52	R	12
42	2A	*	12	83	53	S	12
43	2B	+	12	84	54	T	12
44	2C	,	7	85	55	U	12
45	2D	-	12	86	56	V	12
46	2E	.	6	87	57	W	12
47	2F	/	10	88	58	X	10
48	30	0	12	89	59	Y	12
49	31	1	8	90	5A	Z	10
50	32	2	12	91	5B	[	8
51	33	3	12	92	5C	\	10
52	34	4	12	93	5D	]	8
53	35	5	12	94	5E	^	12
54	36	6	12	95	5F	_	12
55	37	7	12	96	60	`	5
56	38	8	12	97	61	a	12
57	39	9	12	98	62	b	11
58	3A	:	6	99	63	c	11
59	3B	;	6	100	64	d	11
60	3C	<	10	101	65	e	12
61	3D	=	12	102	66	f	10
62	3E	>	10	103	67	g	11
63	3F	?	12	104	68	h	11
64	40	@	12	105	69	i	8
65	41	A	12	106	6A	j	9
66	42	B	12	107	6B	k	10
67	43	C	12	108	6C	l	8
68	44	D	12	109	6D	m	12
69	45	E	12	110	6E	n	11
70	46	F	12	111	6F	o	12
71	47	G	12	112	70	p	11
72	48	H	12	113	71	q	11

Dec	Hex	Character	Width
114	72	r	11
115	73	s	12
116	74	t	11
117	75	u	12
118	76	v	12
119	77	w	12
120	78	x	10
121	79	y	12
122	7A	z	10
123	7B	{	9
124	7C	¦	5
125	7D	}	9
126	7E	~	12
127	7F	**DEL**	

The upper half of the character set (from 128-255) begins on the opposite page.

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
128	80	**NUL**		Ç	12	12
129	81	**SOH**		ü	11	12
130	82	**STX**		é	10	11
131	83	**ETX**		â	12	12
132	84	**EOT**		ä	12	11
133	85	**ENQ**		à	12	11
134	86	**ACK**		å	12	11
135	87	**BEL**		ç	10	11
136	88	**BS**		ê	12	12
137	89	**HT**		ë	10	11
138	8A	**LF**		è	10	11
139	8B	**VT**		ï	8	10
140	8C	**FF**		î	10	11
141	8D	**CR**		ì	8	8
142	8E	**SO**		Ä	12	12
143	8F	**SI**		Å	12	12
144	90	**DLE**		É	12	12
145	91	**DC1**		æ	12	12
146	92	**DC2**		Æ	12	12
147	93	**DC3**		ô	10	12
148	94	**DC4**		ö	10	11
149	95	**NAK**		ò	10	11
150	96	**SYN**		û	11	11
151	97	**ETB**		ù	11	11
152	98	**CAN**		ÿ	12	11
153	99	**EM**		Ö	12	12
154	9A	**SUB**		Ü	12	12
155	9B	**ESC**		¢	11	11
156	9C	**FS**		£	12	12
157	9D	**GS**		¥	12	12
158	9E	**RS**		₧	12	12
159	9F	**US**		ƒ	11	12
160	A0	**SP**	12	á	12	11
161	A1	*!*	10	í	8	10
162	A2	*"*	10	ó	10	12
163	A3	*#*	12	ú	11	11
164	A4	*$*	11	ñ	11	12
165	A5	*%*	12	Ñ	12	12
166	A6	*&*	12	ª	12	11
167	A7	*'*	5	º	12	12
168	A8	*(*	8	¿	12	11
169	A9	*)*	8	⌐	12	12
170	AA	***	12	¬	12	12

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
171	AB	+	12	½	12	12
172	AC	,	8	¼	12	12
173	AD	-	12	¡	5	10
174	AE	.	7	«	12	12
175	AF	/	10	»	12	12
176	B0	0	12	▒	12	
177	B1	1	9	▒	12	
178	B2	2	12	▒	12	
179	B3	3	12	│	12	
180	B4	4	12	┤	12	
181	B5	5	12	╡	12	
182	B6	6	11	╢	12	
183	B7	7	12	╖	12	
184	B8	8	12	╕	12	
185	B9	9	11	╣	12	
186	BA	:	8	║	12	
187	BB	;	9	╗	12	
188	BC	<	10	╝	12	
189	BD	=	11	╜	12	
190	BE	>	9	╛	12	
191	BF	?	11	┐	12	
192	C0	@	12	└	12	
193	C1	A	12	┴	12	
194	C2	B	12	┬	12	
195	C3	C	12	├	12	
196	C4	D	12	─	12	
197	C5	E	12	┼	12	
198	C6	F	12	╞	12	
199	C7	G	12	╟	12	
200	C8	H	12	╚	12	
201	C9	I	10	╔	12	
202	CA	J	12	╩	12	
203	CB	K	12	╦	12	
204	CC	L	10	╠	12	
205	CD	M	12	═	12	
206	CE	N	12	╬	12	
207	CF	O	12	╧	12	
208	D0	P	12	╨	12	
209	D1	Q	12	╤	12	
210	D2	R	12	╥	12	
211	D3	S	12	╙	12	
212	D4	T	12	╘	12	
213	D5	U	12	╒	12	

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
214	D6	*V*	11	╔	12	
215	D7	*W*	12	╫	12	
216	D8	*X*	12	╪	12	
217	D9	*Y*	12	┘	12	
218	DA	*Z*	12	┌	12	
219	DB	*[*	11		12	
220	DC	\	7		12	
221	DD	*]*	11		12	
222	DE	^	10		12	
223	DF	_	12		12	
224	E0	`	5	α	12	12
225	E1	*a*	11	ß	11	11
226	E2	*b*	11	Γ	10	12
227	E3	*c*	11	π	12	12
228	E4	*d*	12	Σ	10	12
229	E5	*e*	11	σ	11	12
230	E6	*f*	12	µ	11	12
231	E7	*g*	11	τ	12	12
232	E8	*h*	11	Φ	10	12
233	E9	*i*	9	Θ	12	12
234	EA	*j*	10	Ω	12	12
235	EB	*k*	11	δ	12	11
236	EC	*l*	9	∞	12	12
237	ED	*m*	11	∅	12	12
238	EE	*n*	10	∈	10	10
239	EF	*o*	11	∩	10	12
240	F0	*p*	11	≡	12	12
241	F1	*q*	11	±	12	12
242	F2	*r*	10	≥	10	10
243	F3	*s*	11	≤	10	10
244	F4	*t*	10	⌠	12	12
245	F5	*u*	11	⌡	12	12
246	F6	*v*	10	÷	12	12
247	F7	*w*	12	≈	12	12
248	F8	*x*	12	°	8	8
249	F9	*y*	11	∙	6	6
250	FA	*z*	12	·	6	6
251	FB	*{*	10	√	12	12
252	FC	*|*	9	^{n}	8	8
253	FD	*}*	10	^{2}	8	8
254	FE	~	12	■	8	8
255	FF		12		12	12

Epson International Character Sets

There are 12 character codes between 35 and 126 that can represent more than one character each, according to the international character set you select. You can make the choice either by setting DIP switches 1-6 to 1-8 or by using the **ESC R** command.

The table below shows all 13 character sets, together with the number you would use with **ESC R** to select each one. The DIP switch combinations to select any of the first eight character sets can be found on page 202.

As an example, you can select the Spain I character set using the **ESC R BEL** command. In BASIC this would be as follows:

```
LPRINT CHR$(27);"R";CHR$(7);
```

Note that once a character set has been selected, italic versions of these characters can also be printed by using the **ESC 4** command in the normal way or, if the italic character table is selected, by adding 128 to the character codes at the top of the table.

Table B-1. International characters

		35	36	64	91	92	93	94	96	123	124	125	126
0	USA	#	$	@	[	\	]	^	`	{	¦	}	~
1	France	#	$	à	°	ç	§	^	`	é	ù	è	¨
2	Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
3	UK	£	$	@	[	\	]	^	`	{	¦	}	~
4	Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
5	Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spain I	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
8	Japan	#	$	@	[	¥	]	^	`	{	¦	}	~
9	Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
11	Spain II	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
12	Latin America	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú

Table B-2 Proportional widths

Characters	Widths: Normal	Italic	Characters	Widths: Normal	Italic
à	12	11	§	10	12
è	12	11	ß	11	11
ù	11	11	Æ	12	12
ò	10	11	æ	12	12
ì	8	8	Ø	12	12
°	8	8	ø	12	11
£	12	12	¨	8	9
¡	5	10	Ä	12	12
¿	12	11	Ö	12	12
Ñ	12	12	Ü	12	12
ñ	11	12	ä	12	11
¤	12	12	ö	10	11
Pt	12	12	ü	11	12
Å	12	12	É	12	12
å	12	11	é	12	11
ç	11	11	¥	12	12

IBM Printer Emulation Mode

This table shows the characters available in IBM printer emulation mode.

There are two main character tables: standard (CG Table 1) and international (CG Table 2). The standard table is selected when DIP switches 1-6 to 1-8 are all UP; the international table is selected by any other setting of these three switches. You can also switch between the two tables using the **ESC 6** and **ESC 7** commands.

The symbol set cannot be selected explicitly. To print characters from the symbol set use either the **ESC** ^ command or **ESC** \. If you use one of these commands to send a non-printable code, a blank is printed. For example, to print the ¶ symbol in BASIC the command is as follows:

```
LPRINT CHR$(27);"^";CHR$(20);
```

All three tables are the same for codes in the range 32 to 127, and the symbol table is identical to the international table from 128 to 255.

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Symbol set	Width
0	00	**NUL**	**NUL**		12
1	01	**SOH**	**SOH**		12
2	02	**STX**	**STX**		12
3	03	**ETX**	♥	♥	12
4	04	**EOT**	♦	♦	10
5	05	**ENQ**	♣	♣	12
6	06	**ACK**	♠	♠	12
7	07	**BEL**	**BEL**		12
8	08	**BS**	**BS**		12
9	09	**HT**	**HT**		12
10	0A	**LF**	**LF**		12
11	0B	**VT**	**VT**		12
12	0C	**FF**	**FF**		12
13	0D	**CR**	**CR**		12
14	0E	**SO**	**SO**		12
15	0F	**SI**	**SI**		12
16	10	**DLE**	**DLE**		12
17	11	**DC1**	**DC1**		12
18	12	**DC2**	**DC2**		12
19	13	**DC3**	**DC3**		12
20	14	**DC4**	**DC4**	¶	12
21	15	**NAK**	§	§	10
22	16	**SYN**	**SYN**		12
23	17	**ETB**	**ETB**		12
24	18	**CAN**	**CAN**		12
25	19	**EM**	**EM**		12
26	1A	**SUB**	**SUB**	→	12
27	1B	**ESC**	**ESC**	←	12
28	1C	**FS**	**FS**		12
29	1D	**GS**	**GS**		12
30	1E	**RS**	**RS**		12
31	1F	**US**	**US**	Ø	12

Dec	Hex	Character	Width	Dec	Hex	Character	Width
32	20	**SP**	12	73	49	I	8
33	21	!	5	74	4A	J	11
34	22	"	8	75	4B	K	12
35	23	#	12	76	4C	L	12
36	24	$	12	77	4D	M	12
37	25	%	12	78	4E	N	12
38	26	&	12	79	4F	O	12
39	27	'	5	80	50	P	12
40	28	(	6	81	51	Q	12
41	29	)	6	82	52	R	12
42	2A	*	12	83	53	S	12
43	2B	+	12	84	54	T	12
44	2C	,	7	85	55	U	12
45	2D	-	12	86	56	V	12
46	2E	.	6	87	57	W	12
47	2F	/	10	88	58	X	10
48	30	0	12	89	59	Y	12
49	31	1	8	90	5A	Z	10
50	32	2	12	91	5B	[	8
51	33	3	12	92	5C	\	10
52	34	4	12	93	5D	]	8
53	35	5	12	94	5E	^	12
54	36	6	12	95	5F	_	12
55	37	7	12	96	60	`	5
56	38	8	12	97	61	a	12
57	39	9	12	98	62	b	11
58	3A	:	6	99	63	c	11
59	3B	;	6	100	64	d	11
60	3C	<	10	101	65	e	12
61	3D	=	12	102	66	f	10
62	3E	>	10	103	67	g	11
63	3F	?	12	104	68	h	11
64	40	@	12	105	69	i	8
65	41	A	12	106	6A	j	9
66	42	B	12	107	6B	k	10
67	43	C	12	108	6C	l	8
68	44	D	12	109	6D	m	12
69	45	E	12	110	6E	n	11
70	46	F	12	111	6F	o	12
71	47	G	12	112	70	p	11
72	48	H	12	113	71	q	11

Dec	Hex	Character	Width
114	72	r	11
115	73	s	12
116	74	t	11
117	75	u	12
118	76	v	12
119	77	w	12
120	78	x	10
121	79	y	12
122	7A	z	10
123	7B	{	9
124	7C	¦	5
125	7D	}	9
126	7E	~	12
127	7F		12

The upper half of the character set (from 128-255) begins on the next page.

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
128	80	**NUL**	Ç	12
129	81	**SOH**	ü	11
130	82	**STX**	é	10
131	83	**ETX**	â	12
132	84	**EOT**	ä	12
133	85	**ENQ**	à	12
134	86	**ACK**	å	12
135	87	**BEL**	ç	10
136	88	**BS**	ê	12
137	89	**HT**	ë	10
138	8A	**LF**	è	10
139	8B	**VT**	ï	8
140	8C	**FF**	î	10
141	8D	**CR**	ì	8
142	8E	**SO**	Ä	12
143	8F	**SI**	Å	12
144	90	**DLE**	É	12
145	91	**DC1**	æ	12
146	92	**DC2**	Æ	12
147	93	**DC3**	ô	10
148	94	**DC4**	ö	10
149	95	**NAK**	ò	10
150	96	**SYN**	û	11
151	97	**ETB**	ù	11
152	98	**CAN**	ÿ	12
153	99	**EM**	Ö	12
154	9A	**SUB**	Ü	12
155	9B	**ESC**	¢	11
156	9C	**FS**	£	12
157	9D	**GS**	¥	12
158	9E	**RS**	₧	12
159	9F	**US**	ƒ	11
160	A0	á	á	12
161	A1	í	í	8
162	A2	ó	ó	10
163	A3	ú	ú	11
164	A4	ñ	ñ	11
165	A5	Ñ	Ñ	12
166	A6	ª	ª	12
167	A7	º	º	12
168	A8	¿	¿	12
169	A9	⌐	⌐	12
170	AA	¬	¬	12

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
171	AB	½	½	12
172	AC	¼	¼	12
173	AD	¡	¡	5
174	AE	«	«	12
175	AF	»	»	12
176	B0	⋮	⋮	12
177	B1	▒	▒	12
178	B2	▓	▓	12
179	B3	│	│	12
180	B4	┤	┤	12
181	B5	╡	╡	12
182	B6	╢	╢	12
183	B7	╖	╖	12
184	B8	╕	╕	12
185	B9	╣	╣	12
186	BA	║	║	12
187	BB	╗	╗	12
188	BC	╝	╝	12
189	BD	╜	╜	12
190	BE	╛	╛	12
191	BF	┐	┐	12
192	C0	└	└	12
193	C1	┴	┴	12
194	C2	┬	┬	12
195	C3	├	├	12
196	C4	─	─	12
197	C5	┼	┼	12
198	C6	╞	╞	12
199	C7	╟	╟	12
200	C8	╚	╚	12
201	C9	╔	╔	12
202	CA	╩	╩	12
203	CB	╦	╦	12
204	CC	╠	╠	12
205	CD	═	═	12
206	CE	╬	╬	12
207	CF	╧	╧	12
208	D0	╨	╨	12
209	D1	╤	╤	12
210	D2	╥	╥	12
211	D3	╙	╙	12
212	D4	╘	╘	12
213	D5	╒	╒	12

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
214	D6	╓	╓	12
215	D7	╫	╫	12
216	D8	╪	╪	12
217	D9	┘	┘	12
218	DA	┌	┌	12
219	DB			12
220	DC			12
221	DD			12
222	DE			12
223	DF			12
224	E0	α	α	12
225	E1	ß	ß	11
226	E2	Γ	Γ	10
227	E3	π	π	12
228	E4	Σ	Σ	10
229	E5	σ	σ	11
230	E6	µ	µ	11
231	E7	τ	τ	12
232	E8	Φ	Φ	10
233	E9	Θ	Θ	12
234	EA	Ω	Ω	12
235	EB	δ	δ	12
236	EC	∞	∞	12
237	ED	∅	∅	12
238	EE	∈	∈	10
239	EF	∩	∩	10
240	F0	≡	≡	12
241	F1	±	±	12
242	F2	≥	≥	10
243	F3	≤	≤	10
244	F4	⌠	⌠	12
245	F5	⌡	⌡	12
246	F6	÷	÷	12
247	F7	≈	≈	12
248	F8	°	°	8
249	F9	•	•	6
250	FA	·	·	6
251	FB	√	√	12
252	FC	n	n	8
253	FD	2	2	8
254	FE	■	■	8
255	FF			12

Appendix C

Typestyle Summary

The EX can produce a wide range of different typestyles by combining different character widths, print qualities, and amounts of emphasis. In addition, whatever typestyle you use, you can include superscripts and subscripts and also use the underline feature. This section summarizes the different typestyles available in Epson mode so that you can choose one and quickly find out how to obtain it.

Note

Some of these typestyles can also be obtained in IBM printer emulation mode. The main exceptions are the combinations in NLQ Roman or italics. Also, the master select command is not available, and each feature must be set using SelecType or individual commands.

Some of the features shown in the tables on the following pages can be obtained in a number of ways. For example condensed printing can be selected by:

- setting DIP switch 1-1 UP
- using SelecType
- using the **SI** command
- using the master select command.

Each table shows the typestyles available in each character width, divided into groups for each print quality. The letters MISwiy are used because they are a typical selection of wide, medium, and narrow characters and they clearly show the effect of different character widths.

If you are choosing a style for a whole document, you can set the character width, print quality, and normal or condensed characters using SelecType. Then you can set italic, emphasized, double-strike or double-width modes using their individual commands.

Alternatively, you can use the master select command to set everything but the print quality and font, and to add underlining if you want. The master select command has the following format:

ASCII:	**ESC**	**!**	*n*
Decimal:	27	33	*n*
Hexadecimal:	1B	21	*n*

n is a number that identifies the typestyle you want. To find the value of *n* for a particular style, refer to this table and add up the numbers for the features you want:

Table C-1. Master select numbers

Feature	Decimal	Hex	SelecType	Comments
pica	0	00	yes	not proportional
elite	1	01	yes	not proportional
proportional	2	02	yes	
condensed	4	04	yes	not proportional
emphasized	8	08	no	
double-strike	16	10	no	not with NLQ
double-width	32	20	no	
italic	64	40	no	
underline	128	80	no	

For example, to print a title, you may want to use double-width pica characters and print them in double-strike mode. You need to add three numbers together:

pica	0
double-strike	16
double-width	32
	—
n =	48

To use this combination you need to include this master select command in your program or document:

ASCII:	**ESC**	!	0
Decimal:	27	33	48
Hexadecimal:	1B	21	30

The typestyle tables that follow include the master select numbers you need to select each typestyle. The print quality and font must be set separately, either using SelecType or the **ESC x** and **ESC k** commands (see page 129).

There are three more things to take into account when using the master select command:

1 Master select cancels any of the listed features that you do not try to set. For example, if you have already set a different character width, and you try to use master select to set emphasized double-strike, the character width will also be reset to normal pica.

2 Proportional overrides pica, elite and condensed.

3 Double-strike is ignored when printing in NLQ.

Pica (10-Pitch)

	regular		condensed		double-width		condensed double-width	
Draft								
regular	MISwiy	0	MISwiy	4	MISwiy	32	MISwiy	36
emphasized	MISwiy	8	MISwiy	12	MISwiy	40	MISwiy	44
double-strike	MISwiy	16	MISwiy	20	MISwiy	48	MISwiy	52
emphasized d-s	MISwiy	24	MISwiy	28	MISwiy	56	MISwiy	60
italic	MISwiy	64	MISwiy	68	MISwiy	96	MISwiy	100
emphasized	MISwiy	72	MISwiy	76	MISwiy	104	MISwiy	108
double-strike	MISwiy	80	MISwiy	84	MISwiy	112	MISwiy	116
emphasized d-s	MISwiy	88	MISwiy	92	MISwiy	120	MISwiy	124
NLQ Roman								
regular	MISwiy	0	MISwiy	4	MISwiy	32	MISwiy	36
emphasized	MISwiy	8	MISwiy	12	MISwiy	40	MISwiy	44
italic	MISwiy	64	MISwiy	68	MISwiy	96	MISwiy	100
emphasized	MISwiy	72	MISwiy	76	MISwiy	104	MISwiy	108
NLQ Sans Serif								
regular	MISwiy	0	MISwiy	4	MISwiy	32	MISwiy	36
emphasized	MISwiy	8	MISwiy	12	MISwiy	40	MISwiy	44
italic	MISwiy	64	MISwiy	68	MISwiy	96	MISwiy	100
emphasized	MISwiy	72	MISwiy	76	MISwiy	104	MISwiy	108

Elite (12-Pitch)

	regular		condensed		double-width		condensed double-width	
Draft								
regular	MISwiy	1	MISwiy	5	MISwiy	33	MISwiy	37
emphasized	MISwiy	9	MISwiy	13	MISwiy	41	MISwiy	45
double-strike	MISwiy	17	MISwiy	21	MISwiy	49	MISwiy	53
emphasized d-s	MISwiy	25	MISwiy	29	MISwiy	57	MISwiy	61
italic	MISwiy	65	MISwiy	69	MISwiy	97	MISwiy	101
emphasized	MISwiy	73	MISwiy	77	MISwiy	105	MISwiy	109
double-strike	MISwiy	81	MISwiy	85	MISwiy	113	MISwiy	117
emphasized d-s	MISwiy	89	MISwiy	93	MISwiy	121	MISwiy	125
NLQ Roman								
regular	MISwiy	1	MISwiy	5	MISwiy	33	MISwiy	37
emphasized	MISwiy	9	MISwiy	13	MISwiy	41	MISwiy	45
italic	MISwiy	65	MISwiy	69	MISwiy	97	MISwiy	101
emphasized	MISwiy	73	MISwiy	77	MISwiy	105	MISwiy	109
NLQ Sans Serif								
regular	MISwiy	1	MISwiy	5	MISwiy	33	MISwiy	37
emphasized	MISwiy	9	MISwiy	13	MISwiy	41	MISwiy	45
italic	MISwiy	65	MISwiy	69	MISwiy	97	MISwiy	101
emphasized	MISwiy	73	MISwiy	77	MISwiy	105	MISwiy	109

Proportional

	regular		double-width	
Draft				
regular	MISwiy	2	MISwiy	34
emphasized	MISwiy	10	MISwiy	42
double-strike	MISwiy	18	MISwiy	50
emphasized d-s	MISwiy	26	MISwiy	58
italic	MISwiy	66	MISwiy	98
emphasized	MISwiy	74	MISwiy	106
double-strike	MISwiy	82	MISwiy	114
emphasized d-s	MISwiy	90	MISwiy	122
NLQ Roman				
regular	MISwiy	2	MISwiy	34
emphasized	MISwiy	10	MISwiy	42
italic	MISwiy	66	MISwiy	98
emphasized	MISwiy	74	MISwiy	106
NLQ Sans Serif				
regular	MISwiy	2	MISwiy	34
emphasized	MISwiy	10	MISwiy	42
italic	MISwiy	66	MISwiy	98
emphasized	MISwiy	74	MISwiy	106

Appendix D

Solving Problems

This appendix explains what you can do if you have problems with your printer. First there is a description of an important fault-finding technique: data dump mode. Then there is a description of the warnings given by the beeper. The remainder of the section is divided into the kinds of problems you may encounter. Many of the solutions involve checking DIP switch settings: remember that you can print out the current DIP switch settings by running a self test as described on page 16.

Data Dump Mode

It is often useful to be able to check whether certain characters are being received correctly by the printer — for example, when you suspect that your computer may be unable to send certain control codes. The printer has a facility called data dump mode in which all characters sent to the printer are printed in hexadecimal, in the form of a table.

If the characters are printable, they appear in the column on the right as their true ASCII characters, as shown below. The characters printed take full account of whether the printer is set up for Epson mode or IBM printer emulation mode, and of the international character set and character table that are selected. Non-printable codes, such as control codes, are shown in this column as a dot.

```
Data Dump Mode
0000 1B 40 1B 52 00 1B 74 01 1B 36 12 1B 50 1B 70 00   .@.R..t..6..P.p.
0001 07 0D 41 70 70 65 6E 64 69 78 20 44 0D 1B 33 24   ..Appendix D..3$
0002 0A 53 6F 6C 76 69 6E 67 20 50 72 6F 62 6C 65 6D   .Solving Problem
0003 73 0D 0A 0D 0A 54 68 69 73 20 41 70 70 65 6E 64   s....This Append
0004 69 78 20 65 78 70 6C 61 69 6E 73 20 77 68 61 74   ix explains what
0005 20 79 6F 75 20 63 61 6E 20 64 6F 20 69 66 20 79    you can do if y
```

The far left column of the table contains a four digit hex number indicating the number of lines of data printed up to that point; each line contains 10 hex items of data.

To turn on data dump mode, hold down both LINE FEED and FORM FEED and turn on the printer. Keep your fingers on the buttons until the words Data Dump Mode are printed. When the dump is finished, press ON LINE twice to make sure that any characters remaining in the buffer are printed. Data dump mode can be turned off by turning off the printer; it is also cancelled by an $\overline{\text{INIT}}$ signal from the computer.

The data dump above was made while writing this appendix. By comparing the column of characters at the right with the table of hex codes, you can see that the capital A (for Appendix) in the third row, was printed as 41 — the hex equivalent of 65.

You can use the table of character codes (page 159) to find out what character corresponds to each code. The advantage of data dump mode is that all printer commands and codes are printed without affecting the operation of the printer.

If you look at the first character of the dump, you can see that the **ESC** character appears in hex as 1B, and in the character column as a dot. To find out the command, look at the next character — 40 hex (@) — and refer to the numerical list of commands on page 239. To decode a series of commands it is a good idea to use a highlighter pen to highlight each command in turn, as shown below.

```
Data Dump Mode
0000 1B 40 1B 52 00 1B 74 01 1B 36 12 1B 50 1B 70 00   .@.R..t..6..P.p.
0001 07 0D 41 70 70 65 6E 64 69 78 20 44 0D 1B 33 24   ..Appendix D..3$
0002 0A 53 6F 6C 76 69 6E 67 20 50 72 6F 62 6C 65 6D   .Solving Problem
0003 73 0D 0A 0D 0A 54 68 69 73 20 41 70 70 65 6E 64   s....This Append
0004 69 78 20 65 78 70 6C 61 69 6E 73 20 77 68 61 74   ix explains what
0005 20 79 6F 75 20 63 61 6E 20 64 6F 20 69 66 20 79    you can do if y
```

In this way you can quickly determine that before printing, the word processor sent seven commands to set up the printer followed by a **BEL** character to sound the beeper.

Command	Function
ESC @	Initialize printer (see page 205)
ESC R NUL	Select USA English character set
ESC t SOH	Select Epson Character Graphics
ESC 6	Printable code expansion
DC2	Cancel condensed mode
ESC P	Select Pica pitch
ESC p NUL	Cancel proportional
BEL	Sound beeper

Beeper Error Warnings

This section describes errors that are indicated by the beeper. When the beeper sounds, it usually indicates that the printer is out of paper. The buzzer can also be sounded by any program that sends the ASCII code 7, and by certain error conditions in the printer itself.

Beeper sounds 20 times and printer stops

If the printer beeps 20 times and will not print, the paper out sensor is not covered properly. Turn the printer off and check to see if the paper is loaded correctly. If the paper is loaded correctly, turn the printer back on and try to print again. If the printer beeps and still does not print, consult your dealer.

Beeper sounds once and printer stops

If the printer beeps just once and stops printing, check the READY and ON LINE lights. If the READY light is off and the ON LINE light is flashing, this means that the print head is becoming too hot and the printer has stopped to protect it from damage. When the print head cools down, the printer beeps once more, the ON LINE and READY lights come on again, and printing resumes; you do not have to do anything to restart the printing. You should not worry if this happens, and it is only likely to happen during long periods of graphics printing.

Beeper sounds six times and printer stops

If the printer beeps six times (in two groups of three), there is a problem with the print head and ribbon carriage. Turn off the printer and refer the problem to your dealer.

Common Problems

This section describes various problems you might encounter when printing and offers solutions. If you think the problem is related to your computer, look at the section on page 195.

Not printing properly

Printer does not print at all...

If your printer does not print, check the following:

- Make sure that the printer is turned on — the POWER light should be on.
- Make sure that the printer is on-line — the ON LINE light should be on.
- Make sure that the printer is connected to the computer by a suitable cable.
- Make sure that the printer is only connected to one interface and that DIP switches 2-5 and 2-6 are set correctly to select that interface (see page 203).

If the program you are using allows you to choose between screen output and printer output, make sure that you have selected printer output.

If the printer still does not print, try the self-test procedure (see page 16). If the self test works correctly, the printer is all right, and the problem lies elsewhere. If the self test does not work, contact your dealer.

Printer prints one character then stops...

This is probably due to a communications problem between the printer and the computer you are using, which can occur if you are using a serial interface. The EX uses the DTR signal and the X-on/X-off protocol (via TXD) to tell the computer whether it is ready to receive characters or whether it is busy printing. Refer to your computer's documentation and ensure that the computer is using one of these systems. You may also need to check your cable wiring or ask your dealer to do it for you.

Printing is patchy or faint...

Check that the ribbon is seated correctly and that the pins at either side are located properly in the holes in the ribbon carriage. If you have been using the ribbon for a long time or for a large amount of printing, it may need replacing. The life of a black ribbon is about three million characters.

Printing is uneven or intermittent...

The ribbon cartridge must be set at the correct height or it is possible for the top or bottom pins to completely miss the ribbon. This can happen if the ribbon is incorrectly installed or if the color option kit has been removed. Check that the pins on the ribbon cartridge are properly located in the holes in the ribbon carriage. If you have removed the color option kit, consult the user's guide to check that the ribbon carriage is set correctly.

It is also possible for the print head to wear out if the printer is used frequently and for long periods at a time. Some symptoms of this are:

- a white horizontal gap along each line of the printout (one pin has stopped working)
- lower case letters like g, p and y being printed without their descenders (the bottom pin has stopped working)
- no printing at all (all the pins have stopped working)
- some dots darker than others (one or more pins have started to stick).

Contact your dealer for a replacement print head. Never attempt to replace it yourself because other parts of the printer should be checked at the same time.

READY light flickers but nothing is printed...

Data is getting through to the printer but is not being interpreted correctly. Check the cables and, if you are using a serial interface, make sure that both the printer and computer are using the same baud rate, number of start and stop bits and the same parity.

ON LINE light flashes and nothing is printed...

This indicates that the print head is becoming too hot. Printing restarts when the temperature returns to normal and no data is lost. You do not need to do anything to restart printing. This is only likely to happen if you print a lot of graphics.

Printing is garbled

Alternate lines are printed backwards...

This may happen if you have been using a word-processing program set up for a daisy-wheel printer and then switch to using an EX. It happens because some daisy-wheel printers need every other line to be sent backwards so that the reverse movement of the daisy wheel will print it correctly. The EX automatically compensates for the print direction therefore the combined result is backwards printing. Look at your software manual for information on how to adjust the program.

All printing is garbled...

Make sure that the interface lead is plugged in firmly. If you are using a serial interface, make sure that both the computer and printer are set to use the same number of data bits per word (7 or 8) and that they both use the same parity, baud rates, and number of start and stop bits.

If you suspect a fault in the printer mechanism, try the self-test procedure.

If you are using an IBM or compatible computer, see the section on IBM problems on page 196.

Self-test pattern is garbled...

If the test pattern printed is not as described on page 16, the printer is faulty. Refer the problem to your dealer. If the pattern is printed but is patchy or faint, check that the ribbon is installed correctly.

Typestyles

Print style changes during printing...

Watch the SelecType panel to see whether the computer is sending out characters that the printer interprets as commands to change styles. (Remember that software can also select other typestyles.)

The ASCII **ESC** code, 27 (1B hex), is interpreted by the printer as meaning that the next character will be a printer command. With certain settings of the printer, ASCII code 155 (9B hex) will also be treated as an **ESC** character. If one of these characters is sent out as part of a document that is being printed (for example, if you include color codes in a BBC BASIC program listing), the printer may produce strange results.

Printer will not change to the correct mode...

Two combinations of print modes are not available: condensed and proportional, and NLQ and double-strike. If you try to set two modes that are not available as a combination, one will have priority over the other. If you try to select proportional and condensed, you will get proportional width. However, if you then cancel proportional, condensed will be selected. Selecting NLQ overrides double-strike in the same way.

Some or all of the text is in italics or graphics...

ASCII codes in the range 128-255 are used in Epson text mode to signify italics or character graphics, depending on the character table selected with DIP switch 1-3 or **ESC t**. In binary — the number system used to communicate with the computer — these codes all have the most significant bit (MSB) set to 1. If all text is printed in italics or graphics, the computer is probably setting the MSB of every character. Try using the **ESC** = command, or refer to your computer's manual for a solution.

If you are using a serial interface, and some characters, but not all, are printed in italics or graphics, then the settings of the serial interface on the computer and printer need to be checked to see whether the parity settings agree with each other.

A similar problem can occur if you use an operating system command, like the MS-DOS PRINT command, to print a file from a word processor. Commercial software often uses the MSB to recognize certain commands, therefore files in a special format sometimes cannot be printed without using the software itself.

Some characters will not print correctly...

This can happen if you are working with a computer that is set up for a particular country, and the printer is not set up in the same way.

For example, on many British computers, the £ sign has the same ASCII code as the printer's # symbol — ASCII code 35 (23 hex). In Epson mode, the £ sign is assigned ASCII code 35 in the UK English character set; in the other character sets this code represents the # character. In IBM printer emulation mode both characters are included in the international character set (see page 168), though you may need to use a special sequence of keys to enter one of the characters from the keyboard. Consult your computer or software manual for details.

In this example, if £ characters appear on the printer as #, you can solve the problem by switching to the UK character set. The same principle applies to obtaining other international characters. Use the DIP switch settings to make a permanent change, or the **ESC R** command to make a temporary change. For more on international character sets, see page 166.

Margins and tabs

Problems with horizontal tabs...

A few computers will not allow ASCII character code 9 (the tab character — **HT**) to be sent to the printer. Others convert the **HT** code to a fixed number of spaces (usually eight or nine). Look at your computer's manual if you think this is the case.

If horizontal tabs do not work, and you are also altering the left and right margins, ensure that you set the margins before setting the tabs.

Printer will not print a full width page...

If you are not able to get a full page in width, try resetting the margins by switching the printer off and on again. You may need to change the print width with a command like the WIDTH LPRINT command in Microsoft BASIC. See your computer documentation.

The printout is too wide for the paper...

Cancel printing immediately; if ink gets on the platen, it can be transferred to the back of your printouts.

If you are using a word processor, check that the margins are set suitably. If you are using a spreadsheet with EX-800, make sure it is installed for 80-column or try using SelecType to select condensed or elite condensed to fit more characters on a line.

If you are using an operating system command, such as the MS-DOS PRINT command, or a programming language, you can usually control the number of characters printed before the computer sends a carriage return. For example in many forms of BASIC you can set the line length to 132 to suit condensed print with the following command:

```
WIDTH LPRINT 132
```

You can achieve the same effect in MS-DOS with this command:

```
MODE LPT1: 132
```

Graphics problems

Strange dot patterns appear in a graphics printout...

If you find strange dot patterns appearing in the middle of your graphics and at the end of the line of graphics there are text characters you did not intend, your computer may be automatically sending a carriage return (**CR** — 0D hex) and line feed (**LF** — 0A hex) when you did not expect them. This problem can usually be solved by changing the print width with a command like the WIDTH LPRINT 255 command in Microsoft BASIC.

Also, if you are using an optional serial interface, make sure that the DIP switch settings on the interface select an 8-bit data word, as opposed to a 7-bit word.

Many computers have problems sending one or more of the codes between 0 and 13. Try to avoid these characters if possible. You may also be able to bypass the printer interface software which removes them.

Be sure that no other commands or carriage returns come between the graphics command and its data.

Printer freezes when printing graphics...

If the printer freezes in graphics mode, you have sent too few columns of data. The printer expects a certain number of pin patterns, determined by the column reservation numbers — *n1* and *n2*. It will wait patiently until the quota is fulfilled. Take extra care with 9-pin graphics mode since it requires two data bytes for each column of graphics.

Text appears as random graphics characters...

If you interrupt the computer while it is printing in graphics mode, for example during a screen dump, it may not reset the printer to text mode. If not, the next text printed will be interpreted by the printer as graphics data. Turn off the printer and turn it back on again to reset it.

Paper feeding problems

You have difficulty loading paper...

Several new features have been incorporated into the EX to make loading paper as easy as possible. If you experience problems, refer to the chapter on choosing and loading paper on page 31. Repeat the loading procedure, carefully following the steps described there, bearing the following points in mind:

- Always use the paper guide horizontally for continuous paper and upright for single sheets; it is not needed for roll paper.
- Feed continuous paper below the metal guide and single sheets or roll paper above it. The diagram on the guide shows the two paths.
- Make sure the paper release lever is forward when you are using continuous paper.
- Always have DIP switch 2-2 DOWN when manually loading single sheets; before inserting a sheet, make sure the printer is off-line.

Printer runs out of paper during a long document...

The paper out sensor on the EX allows you to print to within 3/4 inch (20 mm) of the bottom of a sheet of paper. When the end of the paper passes the detector the printer carries on printing until another 1 1/2 inches (40 mm) of paper have been fed through. The printer then signals the computer that it is out of paper and automatically puts itself off-line. You can then put in more paper and press ON LINE to resume printing.

If you are using continuous paper, note that you cannot reset the top-of-page position without turning off the printer and losing data, so try to load the new batch of paper so that the vertical position of the print head on the new paper is approximately where printing finished on the old paper.

Paper feeding is irregular...

This can happen if the software is sending IBM printer commands while the printer is in Epson mode, and vice versa. This is because of differences in the way the **ESC 2** and **ESC A** commands work.

Check that the software is installed to match the setting of DIP switch 1-4. If this switch is UP, your software should be installed for an IBM printer. If it is DOWN, the software must be installed for one of the Epson printers listed on page 45.

Regular gaps appear in printouts...

This usually happens if either the software or the printer is set up to leave a top and bottom margin on each sheet, but is set for the wrong paper size. First check the settings in your software, then make a DIP switch printout to check the printer.

The same problem can also occur if you install your software for an Epson 24-pin printer rather than an EX because some software uses the **ESC J** command to perform line feeds. If this is the case, you should also notice that the line spacing is slightly too large. This is because the **ESC J** command is based on intervals of 1/180 inch on 24-pin printers and 1/216 inch on 9-pin printers such as the EX.

Also, the skip-over-perforation option may have been selected by setting DIP switch 2-3 UP. This is usually used to leave gaps around the perforations of continuous paper. If the top-of-page setting is not in line with the top line of the paper or the page length is not set correctly for the paper you are using, the gaps may be in the middle of each sheet, or may vary in position.

If you are using simple software that is not controlling the page layout and the DIP switches are set for skip-over-perforation, line up the paper so that the top of a page is about 1/2 inch (10-15 mm) above the top of the print head. Then turn the printer off and on to reset the top-of-page position.

A self-adhesive label gets stuck on the platen...

If a self-adhesive label comes off its backing, it may stick behind the platen. If this happens, stop using the printer immediately and take it to a qualified service person or your dealer. Do not attempt to remove the label yourself.

The printout contains blank lines or is all on one line...

First check that your software is set up for single line spacing. If the software is set up correctly, you may need to alter a DIP switch setting.

At the end of each line of text, the printer needs a carriage return character (**CR** — 0D hex) to reset the print position to the left margin of the paper, followed by a line feed character (**LF** — 0A hex) to advance the paper by one line. Some computers and software send out both characters themselves, while others send a carriage return and expect the printer to supply the line feed. To check what the printer is receiving, place the printer in data dump mode (see page 181) and send a few lines from the computer. Check the data dump to see whether each line you sent ends with 0D 0A (**CR-LF**) or just 0D (**CR**).

DIP switch 2-4 defines whether the printer should execute a line feed at the end of each line or wait for the computer to supply it. If both are supplying a line feed, the paper will advance by two lines at the end of each line instead of just one. To solve this, set DIP switch 2-4 DOWN. If neither is supplying a line feed, the printout will all be on one line. In this case, set DIP switch 2-4 UP.

With some computers, the parallel interface cable may need to be modified to avoid this problem. Refer to your dealer for a suitable cable.

The computer indicates a problem

Computer says the printer is not ready or has no paper...

Make sure that the printer is plugged in, turned on and on-line, and that the computer is set up to send printed output to the correct interface. Your computer may have a program called STAT, CONFIG or SETUP that allows you to choose which interface printer data is sent to.

Computer says that no printer is connected...

Some computers, when you turn them on, check to see if a printer is connected and switched on. Even if the printer is connected but turned off, the computer may assume that no printer is present and refuse to send data to the printer from then on. Try turning on the printer before the computer.

Some software causes the computer to stop working...

Some application programs monitor pin 11 on the parallel interface and will not run if they think the printer is busy. It is not possible to solve the problem by modifying the cable because this connection is essential for normal operation. If you have this kind of problem, start the software with the printer switched on and on-line.

Alterations to DIP switch settings are ignored...

DIP switch changes only come into effect when the printer is turned on. If the switches are changed while the printer is already on, they will not affect the printer until it is turned off and then back on again.

Solutions for Specific Computers

Many of the computers mentioned below are supplied with both a serial and a parallel interface. The parallel interface should normally be used for the printer, leaving the serial interface free for extra peripherals like a modem. Most software packages support both kinds of interface, but the parallel interface provides more sophisticated control of data transfer.

Amstrad and Apricot

These computers have pin 14 of their parallel interface permanently connected to signal ground and also add a line feed to each carriage return. You will need a cable without this connection, otherwise all your printouts will have double line spacing. Refer to your dealer for a suitable cable.

Atari® computers

There are some problems with using Atari BASIC's LPRINT statement. Use the PRINT# statement instead, if this is possible.

Acorn Electron and BBC Microcomputer (BBC BASIC)

When using BBC BASIC on either of these computers or the special version prepared for CP/M™ computers, all text sent to a printer will normally be sent to the screen also. VDU 2 turns on the printer and VDU 3 turns it off.

When sending printer commands, use the VDU 1, *n* command instead of PRINT; this sends the character with ASCII code *n* (decimal) to the printer only. If the **ESC** character is sent to the computer, it stops the program. Similarly, if you send a **FF** character to the computer, it clears the screen.

This example shows how to print a single sentence on the screen and the printer, and enlarge one of the words without stopping the program. It uses **ESC W SOH** to start enlarged, and **ESC W NUL** to turn it off.

```
100 VDU 2
110 PRINT "There is one ";
120 VDU 1,27,1,87,1,1
130 PRINT "enlarged";
140 VDU 1,27,1,87,1,0
150 PRINT " word in this line."
160 VDU 3
```

Commodore® computers

Commodore home computers do not use standard ASCII. You will need a special interface that converts between Commodore codes and normal ASCII.

IBM PC and compatibles

IBM PC BASIC inserts a carriage return and line feed (**CR-LF**) after each 80 characters you send it. It also adds a line feed to each carriage return included explicitly in an LPRINT statement. Use the BASIC statement WIDTH LPRINT 255 to remove this problem. The 255 is a special number that prevents the computer system from inserting a **CR-LF** into the line unless there is one in your program.

The extra line feed character is usually no problem, unless you want to send ASCII code 13 on its own as part of a graphics program or a character definition. To do this, use the OPEN statement to assign a file number to the printer (LPT1:) and use the PRINT# statement in place of LPRINT. You also need to use a slightly different WIDTH statement. To prepare the printer in this way, use a line like this:

```
100 OPEN "LPT1:" AS #1 : WIDTH #1, 255
```

A third problem exists with IBM PC BASIC release 2.0. This version cannot send ASCII code 26 (1A hex) either with LPRINT or with PRINT#. Try to avoid including this code in your programs.

PC-DOS and MS-DOS problems

The IBM (MS-DOS) character set...

The IBM PC and compatible computers that run the MS-DOS operating system use an extended ASCII character set including graphics and international characters. These are characters with ASCII codes of 0 to 31 and greater than 127. The section on page 26 explains how you can set up the EX to print these characters and page 45 explains how you should set up your software to match.

If you do not achieve a good match between the printer and the software, you may find that the printer changes its style of printing unpredictably, or that italics are printed. There are three solutions.

1 Many pieces of software can be configured for an EX printer, and will then print the characters that caused problems.

2 Other software may have an FX installation that either downloads user-defined characters in place of the italic character set or simply prints the italic characters. Such software will probably function perfectly if you set DIP switch 1-3 UP to select the Epson character graphics set. If not, check with your dealer to find out whether you can obtain an upgrade for the software that supports the EX.

3 If the software does not function well with either Epson character set, you can set DIP switch 1-4 UP to select IBM printer emulation mode. This limits the features you can use, so you should check whether you can obtain a software upgrade for the EX.

Problems with the PRINT command and CTRL P...

The PRINT command lets you print out a file from disk; pressing CTRL P causes all screen output to be copied to the printer. Both techniques can suffer from the same problems.

If your printer is connected to the serial interface, you must redirect printer output to the serial port rather than the parallel port. The command to do this is as follows:

```
MODE LPT1:=COM1:
```

The computer adds a carriage return and line feed after every 80 or 132 characters (80 is the default). To change to 132 characters on each line, use the following command:

```
MODE LPT1: 132
```

If you need these settings for all your work, include them in the file named AUTOEXEC.BAT.

The computer does not separate long printouts into separate pages. To avoid printing on the perforations of continuous paper, set DIP switch 2-3 UP.

Problems with screen dumps...

If you are using Epson mode and text mode screen dumps include italics rather than the graphics characters displayed on your monitor, try setting DIP switch 1-3 to UP.

If you find you cannot make graphics screen dumps by pressing SHIFT PRT SC, you need to use the GRAPHICS command. This command need only be given once unless you have to reset the computer.

Technical Information

Appendix E

DIP Switch Settings

The EX has sixteen DIP (Dual In-line Package) switches that allow you to change many of the printer's settings to suit your normal way of working. The DIP switches are in two groups of eight, mounted on the back panel, as shown below.

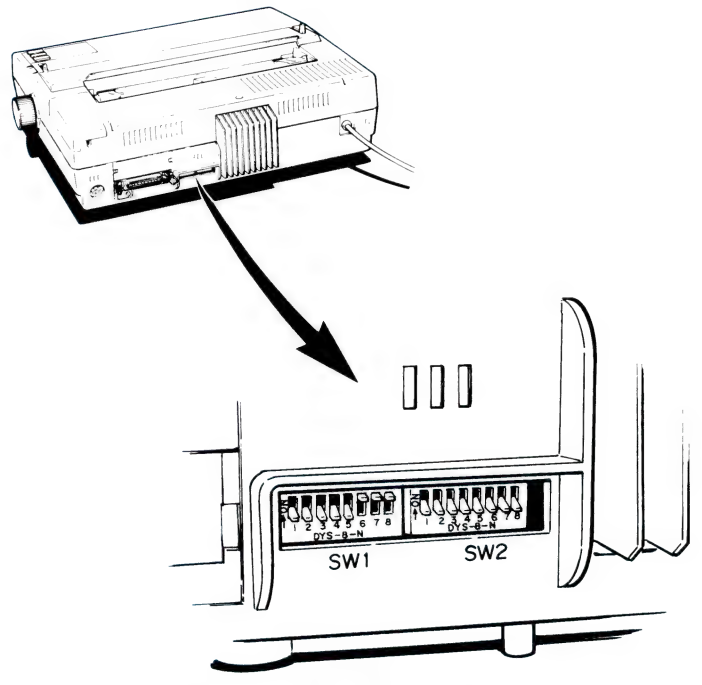


Figure E-1. DIP switch location

Each set of switches is numbered from 1-8 so that DIP switch 1-1 means the switch at the far left side; the one at the far right is DIP switch 2-8. To gain access to the DIP switches, remove continuous paper and the paper rest, disconnect the cables, and turn the printer to face you. The switches can easily be changed with a thin, pointed object such as a small screwdriver.

Note

When you change a DIP switch setting, turn off the power, reset the switch or switches, then turn on the power again. The printer checks and recognises new settings only at the time the power is turned on.

The following tables describe the switches and their functions. In each case the shaded settings are those set at the factory. Where no shading is shown the settings vary from country to country.

The first two tables summarize the two groups of switches. The remaining three show how some of the DIP switches work in combination to let you choose from a wider selection of options.

Table E-1. DIP switch group 1

Switch number	Function	Action when UP	Action when DOWN
1-1	Select condensed or normal characters	Condensed	Normal
1-2	Select slashed or unslashed zero	Ø	O
1-3	**Epson:** Select character table*	Graphics	Italics
1-4	Select printer commands	IBM printer emulation mode	ESC/P (Epson)
1-5	Select print quality	NLQ	Draft
1-6 1-7 1-8	Select international character set	See table E-3	

*In IBM printer emulation mode, setting this switch DOWN causes a **CR** to be added after **LF** or **ESC J**.

Table E-2. DIP switch group 2

Switch number	Function	Action when UP	Action when DOWN
2-1	Select page length	12 inch	11 inch
2-2	Select automatic sheet feeder mode	Selected	Cancelled
2-3	Skip-over-perforation	1 inch	None
2-4	Add line feed after carriage return	**CR** + **LF**	**CR** only
2-5 2-6	Select interface type and serial parity	See table E-4	
2-7 2-8	Select serial baud-rate	See table E-5	

International Character Sets

Thirteen international character sets are available in Epson mode. Eight of these are selected by DIP switches 1-6 to 1-8 and the remaining five (Japan, Norway, Denmark II, Spain II and Latin America) can be selected with the **ESC R** command, which is described on page 141. To see the characters available in each character set, refer to the table on page 166.

In IBM printer emulation mode, you can select only two character sets; the standard character set (table 1) and the international character set (table 2). You can see the differences by looking at the IBM character tables starting on page 168. There is also a command to let you print any of the characters in the international character set and eight additional characters. Together these form the symbol set. The symbol set cannot be selected permanently because it causes printer commands to be ignored.

The DIP switch settings to select the different character sets are as follows:

Table E-3: International settings

Epson mode character set	DIP switch settings			IBM printer emulation mode character set
	1-6	1-7	1-8	
USA English	UP	UP	UP	Standard
French	UP	UP	DOWN	International
German	UP	DOWN	UP	International
UK English	UP	DOWN	DOWN	International
Danish	DOWN	UP	UP	International
Swedish	DOWN	UP	DOWN	International
Italian	DOWN	DOWN	UP	International
Spanish	DOWN	DOWN	DOWN	International

The type of interface and the type of parity check for a serial interface are set with DIP switches 2-5 and 2-6:

Table E-4. Interface type

Interface	Parity	DIP switch 2-5	2-6
Built-in parallel *or* any option	—	DOWN	DOWN
Built-in serial	odd	DOWN	UP
Built-in serial	even	UP	DOWN
Built-in serial	none	UP	UP

= Factory setting

Serial interface baud rate

DIP switches 2-7 and 2-8 determine the baud rate when the built-in serial interface is used. They have no effect on any optional interfaces, or on the built-in parallel interface, so if you use the serial interface only occasionally, you can still leave these switches set as you want.

Table E-5. Baud rate (built-in)

Baud rate	DIP switch 2-7	2-8
9600	DOWN	DOWN
4800	DOWN	UP
1200	UP	DOWN
300	UP	UP

= Factory setting

Appendix F

Initialization and Default Settings

There are three ways in which the printer can be initialized (returned to a fixed set of conditions): whenever it is turned on, when it receives an $\overline{\text{INIT}}$ signal at the parallel interface (pin 31 becomes LOW), and when software sends the **ESC @** command. These three kinds of initialization have slightly different effects; most conditions are reset in all three cases, but some are only reset when the printer is turned on or when it receives an $\overline{\text{INIT}}$ signal.

In particular, **ESC @** resets the typestyle to the current SelecType settings, whereas the other two methods reset the typestyle according to the DIP switches. Also, **ESC @** does not check whether any DIP switches have been altered since the printer was turned on; instead it uses the old settings.

The following conditions are always reset:

- The print head returns to the home position.
- If the color option kit is installed, the ribbon carriage is reset to print in black.
- Interface signals are reset, and the printer is put on-line.
- The current line of characters is cleared.
- Margins and vertical tab settings are cleared, line spacing is set to 1/6 inch, horizontal tabs are set at every eighth position and vertical tab channel 0 is selected.
- The page length and skip-over-perforation are set according to DIP switches 2-1 and 2-3, and the top-of-page position is set to the current line.
- The ROM characters are selected, and the Epson mode character table and international character set are reset according to DIP switches 1-3 and 1-6 to 1-8.

In addition, when the printer is initialized by turning on the power or by an $\overline{\text{INIT}}$ signal, the data buffer is cleared of all text.

Appendix G

Choosing and Setting Up Optional Interfaces

This section gives you the following information:

- a summary of Epson interfaces compatible with the EX
- help in choosing the right interface for a particular job
- help in identifying an existing serial interface board
- instructions for installing internally mounted interface boards
- advice on altering serial interface settings.

Compatible Interfaces

You can use a number of optional interfaces that supplement the built-in parallel and serial interfaces and the standard 8 Kbyte data buffer. These fall into three main categories:

- IEEE-488 and other special interfaces, which allow connection to computers with other interface requirements (the Apple interface is installed in the computer rather than the printer)
- Buffer interfaces, which provide a larger data buffer to release the computer for other tasks when printing large amounts of text
- Serial interfaces providing a wide range of baud rates and other additional features not available with the standard interface.

The following Epson interfaces are compatible with EX printers and add features not available using the built-in interfaces. Note that some of these are no longer available, and that others are not available in all countries.

Table G-1. Interfaces compatible with EX

Interface number	Name
#8131	Apple II parallel interface (no graphics)
#8132(W)	Apple II intelligent parallel interface
#8133	Apple II intelligent parallel interface
#8143	Serial interface with baud rate selectable between 75 and 9600
#8145	RS-232C/current loop interface type 2
#8148	Intelligent serial interface
#8149	Buffered serial interface (32 Kbyte)
#8149M	Buffered serial interface (128 Kbyte)
#8161	IEEE-488 interface
#8165	Intelligent IEEE-488 interface
#8172	Buffered parallel interface (32 Kbyte)
#8172M	Buffered parallel interface (128 Kbyte)

If you are using an optional internal interface, set DIP switches 2-5 and 2-6 to DOWN, and do not connect anything to the parallel interface.

Choosing an Interface

The following comments about each group of interfaces should help you make sure you get or already have the interface to suit your application.

IEEE-488 and Apple interfaces

The IEEE-488 system allows you to connect computers, printers, disk drives, and many types of other data handling equipment so that they can share data freely. Epson offers two types of IEEE-488 interfaces to allow you to connect an EX printer to such a network. The #8161 offers the basic ability to operate in the IEEE-488 address and listen-only modes. In addition to this, the #8165 has an 8 Kbyte data buffer and a line monitor function, which provides a diagnostic printout of IEEE-488 commands received through the interface.

The Apple II, II+ and IIe computers do not have a printer interface as a standard feature. Epson produces parallel interface boards for the Apple, which have software to control the functions of the printer, taking account of the particular requirements of the Apple operating system. With one of these interfaces installed in the Apple, no additional interface is needed in the printer. The #8131 interface controls only basic functions of the printer; the #8132(W) and #8133 have software supporting sophisticated graphics. (The #8132(W) is no longer produced.)

EX printers can be used directly with an Apple IIc using a suitable cable.

Buffer interfaces

If you often print very large amounts of text and your software does not have a background printing facility to let you carry on working, a buffer interface can be installed to free the computer more quickly for other tasks. Serial and parallel buffer interfaces are available to increase the printer's data buffering capacity to either 32 Kbytes or 128 Kbytes (about 10 and 40 pages respectively). You can find the number for the interface board you need from the table below.

Table G-2. Buffer interfaces

	Serial	Parallel
32 Kbytes:	#8149	#8172
128 Kbytes:	#8149M	#8172M

Serial interfaces

The built-in serial interface on EX printers is suitable for almost all applications. However, if you need an interface that allows different serial settings, such as word length or baud rate, or that conforms to the Current Loop standard rather than RS-232C, you can install an optional interface.

There are three Epson serial interfaces suitable for EX printers. All three offer a wide range of baud rates, a choice of 7-bit or 8-bit data, and support Current Loop operation in addition to RS-232C. They also offer a selection of other features:

1 X-on/X-off protocol is a system in which the printer transmits a signal to the computer to indicate that it cannot accept more data, and a second signal when it is once more ready.

2 The loopback self-test mode allows direct testing of the functions of the interface without connecting a computer; line monitor mode is rather like the EX data dump mode.

The table below shows the other features of each type to help decide which is most suitable.

Table G-3. Interface features

	#8143	#8145	#8148
X-on/X-off control	yes	no	yes
Self-test	no	loopback	loopback/ line monitor
Built-in data buffer	none	2 Kbytes	2/8 Kbytes

Identifying a serial interface board

If you already have a serial board but don't know which type it is, work through this section to identify it.

All Epson interfaces have Epson's name printed on them, and only Epson boards are covered by this guide. The board may have an identification code printed on it; if so, it will be a four digit number beginning with an eight. If it does have a number, this should correspond to one of the codes in the table below.

If the board has no identification code, or if you are unsure whether the number you have located is the correct code, check the number of DIP switches on the board against the table opposite.

Table G-4. Number of DIP switches

Interface number	DIP switch group	
	1	2
#8143	8	none
#8145	8	4
#8148	8	6
#8149(M)	8	8

Installing an Interface

Before you can do this you need to take off the printer's cover.

Removing and replacing the printer cover

WARNING

High voltages are present inside the printer when the power is turned on. Do not remove the cover unless the printer is turned OFF. Also, beware of touching contacts on the circuit board of the printer because many of the components are sensitive to static electricity and can be destroyed by the charge that may build up on your body.

1 Turn off the power to both the printer and the computer and disconnect both the power cable and the interface cable from the printer.

2 Remove the dust cover and paper guide.

3 Remove the sheet feeder if one is installed.

4 Remove the ribbon and move the print head to the middle of the printer.

5 Remove the screws retaining the upper casing of the printer, using a cross-head type screwdriver.

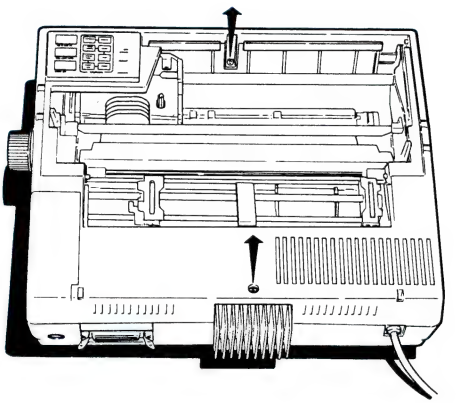


Figure G-1. Removing the screws

6 With the printer facing you, unclip the side of the control panel as shown opposite and lift it up slightly to release it from the case.

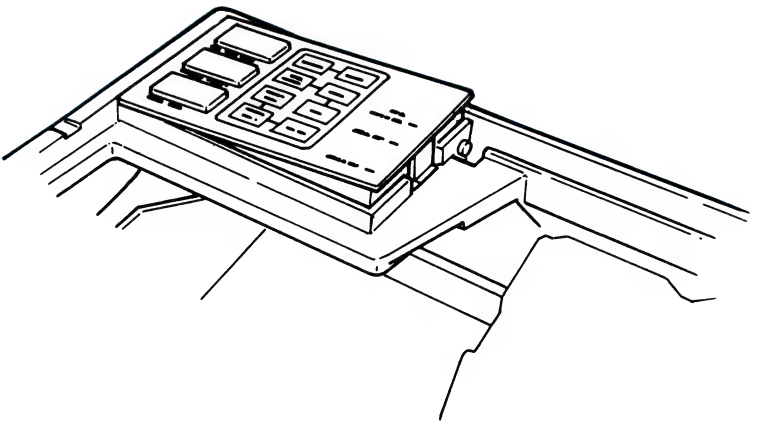


Figure G-2. Unclipping the control panel

7 At each side of the front panel there is a retaining clip, as shown below. The one at the right is reached through the control panel opening. Reach behind the cable and gently press the two clips to release the front edge of the upper case.

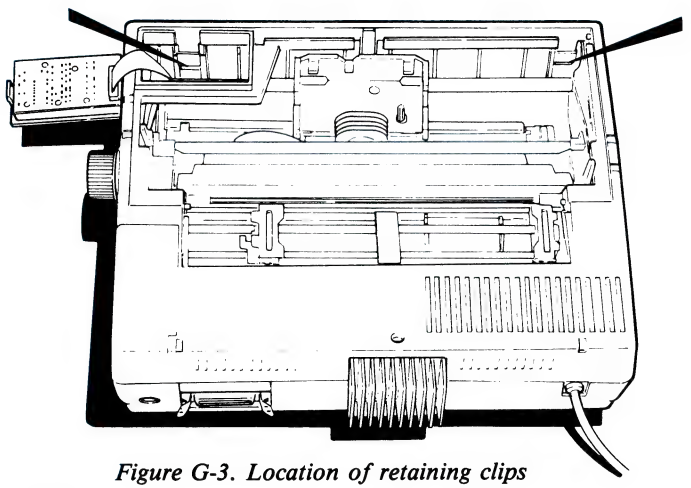


Figure G-3. Location of retaining clips

8 Tilt the upper case up and slip the control panel through the opening, being careful not to strain the connector linked to the control panel.

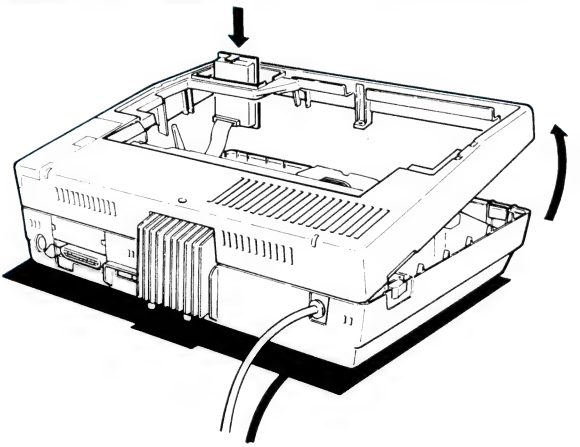


Figure G-4. Removing the upper case

9 Lift the upper case to release the hinges at the rear edge, then lift it away from the printer.

To replace the cover, reverse steps 2 to 9.

Inserting the interface board

1 Remove the upper case of the printer, following the steps described in the previous section.

2 Remove the blanking plate above the parallel connector to allow access to the new interface connector when the case is re-assembled.

3 Locate the three supports on which the interface board will rest, and the screw at the rear of the circuit board labelled FG. These are shown in the diagram opposite. The screw marked FG is the connection for the frame ground wire. Connect the frame ground wire before inserting the interface.

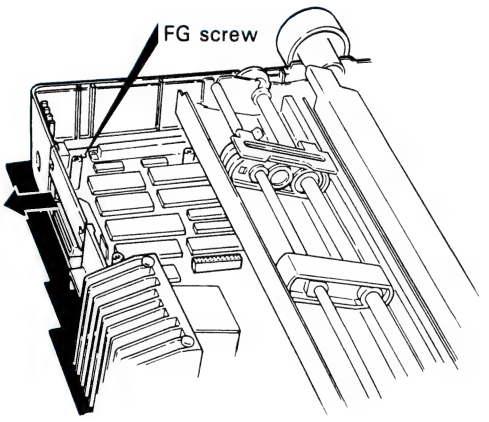


Figure G-5. Location of frame ground screw (FG)

4 Insert the interface board beneath the printer mechanism, as indicated by the lines in the diagram below, and plug it into the connector marked CN2 on the main circuit board of the printer.

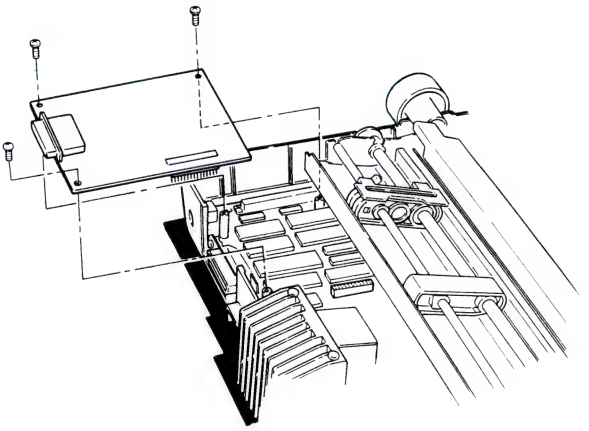


Figure G-6. Inserting the interface board

5 Secure the board to the three supports using the screws provided.

6 Connect the frame ground wire to the FG terminal tag on the interface board, as shown in the diagram.

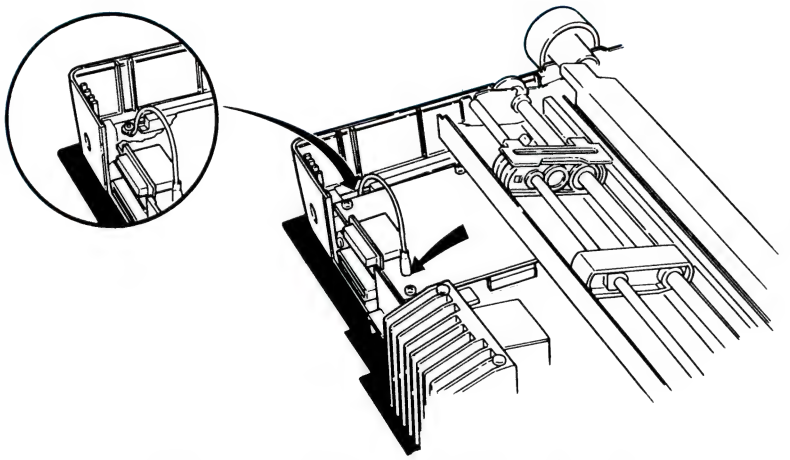


Figure G-7. Connecting the frame ground wire

7 Reassemble the printer, reversing the procedure described in the previous section.

Altering Serial Interface Settings

If you are using an optional serial interface, you may need to alter the communications protocol of the printer or the computer for them to communicate properly. The protocol used by the printer is decided by one or two groups of DIP switches located on the serial interface board; the protocol used by the computer can probably be altered by a software command. It is essential that the printer and computer use compatible protocols.

If you can, adjust the settings on the computer rather than the interface board as the interface is set up at the factory to give optimum performance in a wide range of conditions. If your dealer has installed the interface for you, he or she should also be able to adjust the computer and interface to achieve a good match.

If you need to alter the settings on the interface yourself, perhaps in order to use a different computer, the tables below will help you match the computer and interface. The settings given in the table cover the conventions used by the computer and printer as data is transferred. There are other DIP switches and jumpers, but for most purposes you only need change the switches described here. The other settings are described in the manual supplied with the interface.

For interfaces #8143, #8148 and #8149(M) the baud rates are set by the following switches:

Table G-5. Baud rate (optional)

Interface number	Switches used			
#8143	1-7	1-1	1-4	1-3
#8148	1-5	1-6	1-7	1-8
#8149(M)	2-5	2-6	2-7	2-8
Baud rate	**Switch settings**			
300	ON	OFF	ON	OFF
600	ON	OFF	OFF	ON
1200	ON	OFF	OFF	OFF
2400	OFF	ON	ON	OFF
4800	OFF	ON	OFF	ON
9600	OFF	ON	OFF	OFF

For the #8145 interface the switch settings are given below:

Table G-6. Baud rate for #8145

Baud rate	Switch 1-1	Switch 1-2	Switch 1-3	Switch 1-4
300	ON	OFF	ON	OFF
600	ON	OFF	OFF	ON
1200	ON	OFF	OFF	OFF
2400	OFF	ON	ON	OFF
4800	OFF	ON	OFF	ON
9600	OFF	ON	OFF	OFF

The other settings you need to match on your computer and printer are as follows.

Table G-7. Other settings

Function	Number of data bits	Parity check	Parity check	Even/odd parity
Switch ON	7 bits	enabled	disabled	even
Switch OFF	8 bits	disabled	enabled	odd
Interface number	Switches used			
#8143	1-2	1-6		1-5
#8145	2-1		1-7	1-8
#8148	1-1	1-2		1-3
#8149(M)	2-1	2-2		2-3

Appendix H

Technical Specifications

This appendix lists the technical details of the EX-800 printer.

Printing

Printing method

Impact dot matrix

Printing speed

300 characters per second per line in draft elite, 250 characters per second per line in draft pica, and 50 characters per second per line in Near Letter Quality pica

Paper feed speed

Approximately 84 ms/line at 1/6 inch line spacing

Printing direction

Bidirectional logic-seeking for both text and graphic printing. Unidirectional available by software command.

Character sizes

All except superscript and subscript are 3.1 mm high; superscript and subscript characters are 1.4 mm high in draft and 2.1 mm in NLQ Roman. The widths, characters per inch (CPI) and maximum characters per line (CPL) are given below:

Mode	Width (mm)	CPI	Max. CPL	
			EX-800	EX-1000
Pica	2.1	10	80	136
Elite	2.1	12	96	163
Condensed Pica	1.05	17	137	231
Condensed Elite	1.05	20	160	272

Line spacing

1/6 inch, or programmable in increments of 1/216th inch.

Paper

Number of copies

Up to 3 sheets, including the original. Total thickness not to exceed 0.16 mm

Paper width

EX-800:

Continuous feed	4″ to 10″ (101 mm to 254 mm)
Single-sheet	7.15″ to 8.5″ (182 mm to 216 mm)
Roll	8.5″ (216 mm)

EX-1000:

Continuous feed	4″ to 16″ (101 mm to 406 mm)
Single-sheet	7.15″ to 14.3″ (182 mm to 364 mm)

Ribbon

Cartridge, exclusive to EX, black (#8763) or color (#8764)

Life expectancy (in characters, at 14 dots/character):

Black ribbon: 3 million

Color ribbon:

Black	2 million
Red	1 million
Blue	1 million
Yellow	1 million

MCBF

5 million lines (excluding the print head)

Print head life

Black ribbon: 100 million characters, at 14 dots/character
Color ribbon: 50 million characters, at 14 dots/character

Dimensions and weight

EX-800:

Height: 4.7 inches (119 mm)
Width (with paper feed knob): 17.6 inches (447 mm)
Depth: 14.9 inches (378 mm)
Weight: 22 lbs. (10 kg)

EX-1000:

Height: 4.8 inches (121 mm)
Width (with paper feed knob): 24.4 inches (618 mm)
Depth: 15.3 inches (388 mm)
Weight: 25.2 lbs. (11.4 kg)

Electrical

Voltage

120V AC, 220V AC, or 240V AC ±10%
Non-switchable

Consumption

120 VA

Frequency

49.5 Hz - 60.5 Hz

Insulation resistance

10 MΩ between AC power line and chassis

Dielectric strength

120 V model can withstand 1 kV rms applied between AC line and chassis for 1 minute, or 1.25 kV rms for 1 second
220/240 V model can withstand 1.25 kV rms applied between AC line and chassis for 1 minute, or 1.5 kV rms for 10 seconds

Environment

Temperature

Operation: 40°F to 95°F (5 C to 35 C)
Storage: −30°F to 150°F (−30 C to 65 C)

Humidity

Operation: 10% to 80% without condensation
Storage: 5% to 85% without condensation

Shock

Operation: Up to 1 G within 1ms
Storage: Up to 2 G within 1ms

Vibration

Operation: Up to 0.1 G at up to 55 Hz
Storage: Up to 0.5 G at up to 55 Hz

Interfaces

See next appendix.

Appendix I

Interface Specifications

The EX is equipped with both a parallel and a serial interface. Both are described in this appendix.

WARNING

No two interface cables should be plugged into the printer at the same time. This may damage your printer.

The Parallel Interface

This interface offers:

- connection using a standard 36 pin AMPHENOL 57-30360 connector
- synchronization of data transfer by external $\overline{\text{STROBE}}$ pulses
- handshaking using $\overline{\text{ACKNLG}}$ and BUSY signals
- a full complement of control connections providing a comprehensive interface
- TTL-compatible signal levels on all interface connections for data and control
- paper end detection through the BUSY, PE and $\overline{\text{ERROR}}$ signals, with all warnings under software control.

The table shows the purpose of each connection. In this table, the direction of signals is given relative to the printer. Where necessary, fewer connections may be used, but this may prevent the computer from controlling certain functions.

Table I-1. Parallel Interface

Signal pin	Return pin	Signal	Direction	Description
1	19	$\overline{\text{STROBE}}$	in	Pulses on this line cause data to be read in
2	20	DATA 1	in	These signals represent data sent to the printer. A HIGH level represents a binary 1 digit
3	21	DATA 2	in	
4	22	DATA 3	in	
5	23	DATA 4	in	
6	24	DATA 5	in	
7	25	DATA 6	in	
8	26	DATA 7	in	
9	27	DATA 8	in	
10	28	$\overline{\text{ACKNLG}}$	out	Pulse to show printer is ready for more data
11	29	BUSY	out	Signal set HIGH to show printer cannot accept data
12	30	PE	out	Signal set HIGH to show printer is out of paper
13	—	—	—	Connected to +5 V via 3.3 kOhms
14	—	$\overline{\text{AUTO FEED XT}}$	in	If this is LOW, a line feed is added to each carriage return (See note)
15	—	NC	—	Not used
16	—	0 V	—	Signal ground level
17	—	CHASSIS GROUND	—	Connected to printer chassis; not to signal ground
18	—	NC	—	Not used
19-30	—	GND	—	Signal ground for pins 1-12

Signal pin	Return pin	Signal	Direction	Description
31	—	$\overline{\text{INIT}}$	in	LOW pulse of more than 50 μs causes printer to be initialized
32	—	$\overline{\text{ERROR}}$	out	This is LOW when there is no paper, printer is off-line, or an error occurs
33	—	GND	—	Signal ground level
34	—	NC	—	Not used
35	—	—	—	Connected to +5V via 3.3 kOhms
36	—	$\overline{\text{SLCT IN}}$	in	**DC1** and **DC3** codes can only enable and disable printer when this signal is HIGH (See note)

Note that DIP switch 2-4 can be used to override the $\overline{\text{AUTO FEED XT}}$ signal. If this DIP switch is UP, the line is held LOW and the computer cannot then control the $\overline{\text{AUTO FEED XT}}$ signal. Also, the $\overline{\text{SLCT IN}}$ signal can be fixed low by joining jumper J1.

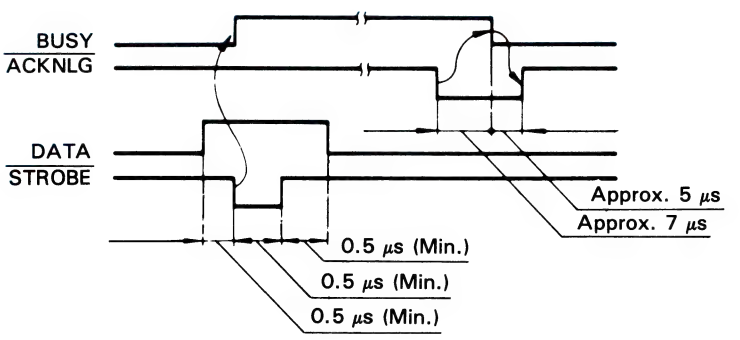


Figure I-1. Parallel interface timing

The Serial Interface

The EX standard serial interface is an RS-232C asynchronous interface with the following characteristics:

Data format

1 start bit
Data word length: 8 bits
Odd, even or no parity
1 stop bit

Signal level

Mark (1) −3 V to −27 V
Space (0) +3 V to +27 V

Handshaking

Handshaking by DTR signal or X-on/X-off. The DTR signal changes to mark — meaning the printer is not ready to receive data — when the number of bytes free in the input buffer goes down to 256. The signal changes to space — meaning that the printer is now ready — when the number of bytes free in the input buffer rises to 528.

Error handling

All errors are ignored.

Connector

6-pin DIN connector.

In this table, the direction of signals is given relative to the printer.

Table I-2. Serial interface

Pin number	Signal	Signal direction	Description
1	TXD	out	Transmits data for X-on/ X-off
2	DTR	out	Whether or not the printer is ready to receive data
3	RXD	in	Receives data
4	NC		Not used
5	SG	-	Signal ground level
6	FG	-	Printer chassis ground

The pins are arranged like this:

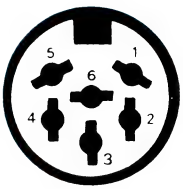


Figure I-2. Serial interface

This is the view from the back of the printer.

Glossary

Note that these definitions apply specifically to printers. Where a word is italicized, see that topic for more information.

Application program
Software designed to perform a specific task, such as word processing or accounting

ASCII
American Standard Code for Information Interchange. A standardized coding system for letters and symbols. It is used by nearly all manufacturers of computers, printers, and software.

Baud rate
A measure of the speed of data transmission. Roughly equivalent to bits per second. In practice approximately 11 bits are required for each character.

Bidirectional printing
Printing in which the print head goes from left to right only on every other line. On the other lines it goes from right to left. This increases the speed of the printing because the head prints in both directions.

Binary
See *Number systems*.

Bit
A binary digit (0 or 1). The smallest unit used by a printer or computer. See also *Number systems*.

Buffer
See *Memory*.

Carriage return
A control code that returns the print position to the left margin. In bidirectional printing the print head may not actually move to the left margin.

Compressed
See *Condensed.*

Condensed
A print width approximately 60% the width of standard characters. For example, condensed pica has 17 characters per inch (cpi). Formerly called compressed.

Configure
To prepare a piece of equipment or a progam so that it will work with other equipment.

Continuous-feed paper
This paper has pin-feed holes in half-inch tear-off strips on each side and is perforated between pages. After printing you remove the tear-off strips and separate the pages. Also called fan-fold paper.

Control code
The ASCII standard includes codes for printable characters and 33 other codes, which are called control codes. These are the codes for such functions as sounding the beeper and performing a carriage return.

Cut sheet feeder
See *Sheet feeder.*

Data dump
A trouble-shooting feature. When the printer is in the data dump mode, each code that it receives is printed in hexadecimal notation. Sometimes called hex dump.

Decimal
See *Number systems.*

Default

Values or settings that take effect when the equipment is turned on, reset, or initialized. For example, pica width is usually the default width, which means that the printer prints in pica unless it is told to use another width.

DIP switches

Small switches in a printer that control various printer functions. DIP stands for Dual In-line Package. These switches can change the printer's defaults.

Dot graphics

A graphic design formed by patterns of dots.

Dot matrix

A method of printing in which letters and symbols are formed by patterns of individual dots.

Double-width

A print width in which each character is twice as wide as normal characters. Double-width was formerly known as expanded.

Double-strike

A print mode in which each character is printed twice, with the second slightly below the first.

Draft

One of two methods of printing on the EX. Draft uses a minimum number of dots per character for high-speed printing, and NLQ reduces the print speed to increase the print quality.

Elite

A pitch with 12 characters per inch.

Emphasized

A printing mode in which each dot is printed twice, with the second slightly to the right of the first.

Escape (ESC)
A special control code used to begin most printer commands.

ESC/P
Abbreviation for Epson Standard Code for Printers, a set of commands developed by Epson and supported by almost all applications software for personal computers.

Expanded
See *Double-width*.

Form
In printer terminology this term is usually equivalent to page, as in form feed or top of form.

Form feed (FF)
A control code and a button that advances the paper to the top of the next page.

Hexadecimal (hex)
See *Number systems*.

Hex dump
See *Data dump*.

Initialize
Return the printer to its *defaults*.

Interface
The connection between the computer and the printer. A serial interface transmits data one bit at a time and a parallel interface transmits data one character or code at a time.

Italic
A typestyle in which the characters slant. *This sentence is italicized.*

Line feed (LF)

A control code or button that advances the paper one line space.

Line space

The distance that the paper moves between lines. Standard line spacing is 1/6th of an inch, but it can be changed by software commands.

Memory

A printer, like a computer, has a memory. When you print files from a computer, the information is quickly sent to the printer's memory. The printer then uses this information at a slower rate to print the file, thus releasing the computer for other work. Sometimes called a buffer.

Near Letter Quality (NLQ)

One of two methods of printing on the EX. Near Letter Quality reduces the print speed and increases the number of dots per character to increase the print quality. Draft uses a minimum number of dots per character for high-speed printing.

Number systems

Three number systems are commonly used with printers:

Decimal is base 10 and uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. (This is the system with which most people are familiar.)

Hexadecimal (hex) is base 16 and uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. This is frequently used by programmers. Any decimal number between 0 and 255 can be expressed by a two-digit hex number.

Binary is base 2 and uses only the digits 0 and 1. All information in computer systems is handled in binary form and represented by electrical signals that are ON or OFF. A binary digit is often called a bit; any decimal number between 0 and 255 can be expressed by an 8-bit binary number.

Paper-out sensor
A small switch behind the platen that sends a signal when it is not in contact with paper. This signal usually stops the printer.

Parallel interface
An interface is the connection between the computer and the printer. There are two types: a parallel interface transmits data one character or code at a time, and a serial interface transmits data one bit at a time.

Pica
A character width with 10 characters per inch (cpi). This is usually the standard or default character width.

Pitch
Indicates the number of characters per inch (cpi). For example, 10 pitch printing is 10 cpi.

Platen
The black roller that provides a backing for the printing.

Proportional printing
Printing in which the space given to each character is proportional to its width. A capital W, for example, receives much more space than a lowercase i.

RAM
Random Access Memory. The portion of the printer's memory used as a buffer and for storing user-defined characters. All data stored in RAM is lost when the printer is turned off.

Reset
Returning a printer to its defaults, with either an escape code, an $\overline{\text{INIT}}$ signal, or by turning the printer off and on.

ROM
Read Only Memory. The portion of the printer's memory that is permanent. The printer uses the information in the ROM, but the information cannot be changed.

Self test

A method of checking the operation of the printer. When the self test is turned on, the printer prints the characters that are stored in its ROM.

Serial interface

An interface is the connection between the computer and the printer. There are two types: a serial interface transmits data one bit at a time, and a parallel interface transmits data one character or code at a time.

Sheet feeder

A device that automatically feeds single sheets of paper into a printer. Sometimes called a cut sheet feeder

Subscript mode

Prints characters about two-thirds of the normal height in the lower part of the character space.

Superscript mode

Prints characters about two-thirds of the normal height in the upper part of the character space.

Top of form

See *Top of page.*

Top of page

A setting that tells the printer where the top of page is so that it can begin printing in the proper place and can correctly advance the paper when it receives a *form feed.*

Tractor

The part of the printer that moves continuous-feed paper through the printer.

Unidirectional printing

Printing in one direction only. Allows more precise vertical alignment than *bidirectional printing.*

User-defined characters

Characters defined and stored by the user. Sometimes called download characters.

Command Index

Note that for commands from **ESC SO** onwards, the decimal and hexadecimal columns show only the second code.

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
BEL	7	07	Beeper	116	116
BS	8	08	Backspace	127	127
HT	9	09	Tab horizontally	128	128
LF	10	0A	Line feed	121	121
VT	11	0B	Tab vertically	124	124
FF	12	0C	Form feed	118	118
CR	13	0D	Carriage return	117	117
SO	14	0E	Select double-width (1 line)	134	134
SI	15	0F	Select condensed mode	133	133
DC1	17	11	Select printer	111	111
DC2	18	12	Cancel condensed mode	133	
DC2	18	12	Cancel condensed/elite		154
DC3	19	13	Deselect printer	111	
DC4	20	14	Cancel double-width (1 line)	134	134
CAN	24	18	Cancel line	117	117
DEL	127	7F	Delete character	118	
ESC SO	14	0E	Select double-width (1 line)	134	134
ESC SI	15	0F	Select condensed mode	133	133
ESC EM	25	19	Turn sheet feeder mode on/off	115	
ESC SP	32	20	Set intercharacter space	139	
ESC !	33	21	Master select	131	
ESC #	35	23	Cancel MSB control	116	
ESC $	36	24	Move to absolute dot position	127	
ESC %	37	25	Select user-defined set	142	
ESC &	38	26	Define user-defined characters	141	
ESC *	42	2A	Select graphics mode	146	
ESC -	45	2D	Turn underlining on/off	138	138
ESC /	47	2F	Select vertical tab channel	125	
ESC 0	48	30	Select 1/8 inch line spacing	121	121
ESC 1	49	31	Select 7/72 inch line spacing	122	122
ESC 2	50	32	Select 1/6 inch line spacing	122	
ESC 2	50	32	Programmable line spacing		150
ESC 3	51	33	Select n/216 inch line spacing	122	122
ESC 4	52	34	Select italic mode	140	
ESC 4	52	34	Set top of page		151

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC 5	53	35	Cancel italic mode	140	
ESC 5	53	35	Automatic line feed on/off		151
ESC 6	54	36	Printable code area expansion	142	
ESC 6	54	36	International character set		155
ESC 7	55	37	Cancel ESC 6	143	
ESC 7	55	37	Select standard character set		156
ESC 8	56	38	Disable paper out sensor	114	114
ESC 9	57	39	Enable paper out sensor	114	114
ESC :	58	3A	Copy ROM into RAM	142	
ESC :	58	3A	Select elite pitch		154
ESC <	60	3C	Unidirectional mode (1-line)	113	
ESC =	61	3D	Set MSB to 0	115	
ESC =	61	3D	Define user-defined characters		157
ESC >	62	3E	Set MSB to 1	116	
ESC ?	63	3F	Reassign graphics mode	147	
ESC @	64	40	Initialize the printer	110	
ESC A	65	41	Select n/72 inch line spacing	123	
ESC A	65	41	Set n/72 inch line spacing		150
ESC B	66	42	Set vertical tabs	124	124
ESC C	67	43	Set page length in lines	119	119
ESC C NUL	67	43	Set page length in inches	119	119
ESC D	68	44	Set horizontal tabs	129	152
ESC E	69	45	Select emphasized mode	135	135
ESC F	70	46	Cancel emphasized mode	136	136
ESC G	71	47	Select double-strike mode	136	136
ESC H	72	48	Cancel double-strike mode	136	136
ESC I	73	49	Printable code area expansion	143	
ESC I	73	49	Select font		153
ESC J	74	4A	Perform n/216 inch line feed	123	151
ESC K	75	4B	Single density graphics	144	144
ESC L	76	4C	Double density graphics	144	144
ESC M	77	4D	Select elite pitch	132	
ESC N	78	4E	Set bottom margin	120	120
ESC O	79	4F	Cancel bottom margin	120	120
ESC P	80	50	Select pica pitch	131	
ESC Q	81	51	Set right margin	126	
ESC Q ETX	81	51	Deselect printer		149
ESC R	82	52	International character set	141	
ESC R	82	52	Restore default tab settings		153
ESC S NUL	83	53	Select superscript mode	137	137
ESC S SOH	83	53	Select subscript mode	137	137
ESC T	84	54	Cancel superscript/subscript	137	137
ESC U	85	55	Select unidirectional mode	113	113
ESC W	87	57	Turn double-width on/off	135	135
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ESC Y	89	59	High speed dbl. den. graphics	145	145
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**ESC **	92	5C	Move to relative dot position	128	

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
**ESC **	92	5C	Print from symbol set		156
ESC ^	94	5E	Nine-pin graphics	147	
ESC ^	94	5E	One character from symbol set		156
ESC _	95	5F	Overscore on/off		155
ESC a	97	61	NLQ justification	138	
ESC b	98	62	Set vertical tabs in channels	125	
ESC i	105	69	Immediate mode on/off	112	
ESC j	106	6A	Perform reverse line feed	123	
ESC k	107	6B	Select NLQ font	130	
ESC l	108	6C	Set left margin	126	
ESC p	112	70	Proportional mode on/off	132	
ESC r	114	72	Select printing color	130	
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ESC t	116	74	Set character table	139	
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Command descriptions and definitions of terms are not indexed here. For page references for specific commands, see the Command Index beginning on page 239 or the Quick Reference Card. For definitions of terms, see the glossary beginning on page 231.

A

B

C

T

U

V

W

Z

Conventions Used in This Guide

This table explains the symbols and typefaces used in this book.

Example	Meaning
CTRL	Symbols like this are keys you press on the computer.
FORM FEED	Words shown like this represent buttons you press on the printer or lights on the control panel.
`Type this`	Text printed like this is what you type into your computer or what is displayed on the screen.
CTRL C	A line like this means hold down the CTRL key while typing the letter C.
n1	Items printed like this can have a number of values: here you would enter some data that you determine, not the letters n1.
ESC R	Text printed like this is the ASCII name of a command you would send to the printer to select one of its features.

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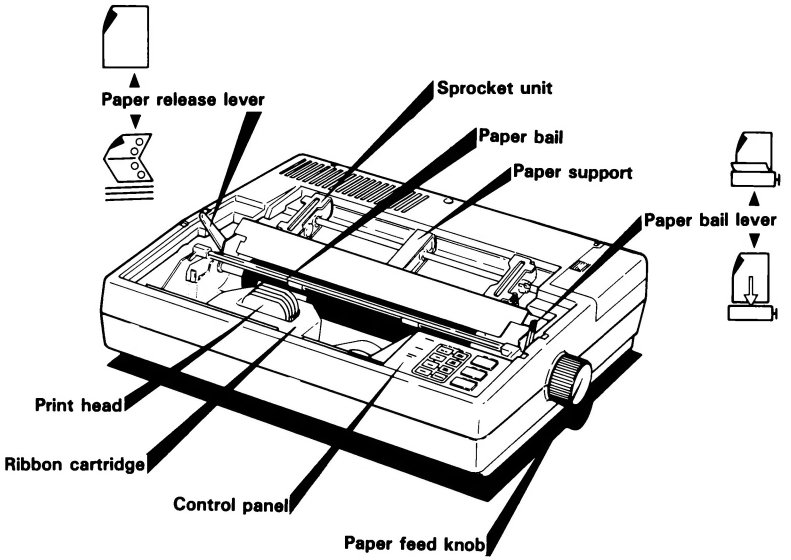
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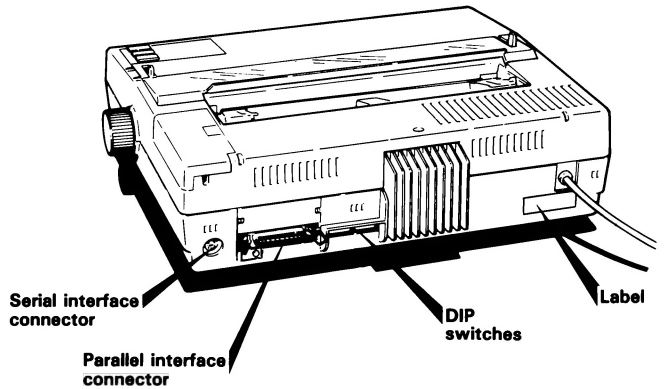
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Parallel interface connector
DIP switches
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