EPSON®

EX-800/1000

User's Manual

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IMPORTANT SAFETY INSTRUCTIONS

1. Read all of these instructions and save them for later reference.

2. Follow all warnings and instructions marked on the product.

3. Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

4. Do not use this product near water.

5. Do not place this product on an unstable cart, stand, or table. The product may fall, causing serious damage to the product.

6. Slots and openings in the cabinet and the back or bottom are provided for ventilation; to ensure reliable operation of the product and to protect it from overheating, these openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should never be placed near or over a radiator or heat register. This product should not be placed in a built-in installation unless proper ventilation is provided.

7. This product should be operated from the type of power source indicated on the marking label. If you are not sure of the type of power available, consult your dealer or local power company

8. This product is equipped with a S-wire grounding type plug, a plug having a third (grounding) pin. This plug will only fit into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the purpose of the grounding-type plug.

9. Do not locate this product where the cord will be walked on.

10. If an extension cord is used with this product, make sure that the total of the ampere ratings on the products plugged into the extension cord do not exceed the extension cord ampere rating. Also, make sure that the total of all products plugged into the wall outlet does not exceed 15 amperes.

11. Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short out parts that could result in a risk of fire or electric shock. Never spill liquid of any kind on the product.

12. Except as specifically explained in the Users Manual, do not attempt to service this product yourself. Opening or removing those covers that are marked "Do Not Remove" may expose you to dangerous voltage points or other risks. Refer all servicing in those compartments to service personnel.

13. Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

    A. When the power cord or plug is damaged or frayed.

    B. If liquid has been spilled into the product.

    C. If the product has been exposed to rain or water.

    D. If the product does not operate normally when the operating instructions are followed. Adjust only those controls that are covered by the operating instructions since improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal operation.

    E. If the product has been dropped or the cabinet has been damaged.

    F. If the product exhibits a distinct change in performance, indicating a need for service.

PQ277

Contents

Command Summary

Reference

Introduction

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

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

```
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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- The Color Option Kit makes your EX a fully-fledged 7-color printer, capable of using the many programs designed for the Epson JX-80 color printer. Even with the color unit, however, you can still use inexpensive black ribbons when you don't 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 EX is printing, the SelecType panel shows you what choices it's using.

- 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 by just moving a lever, and the new built-in push-feed tractor lets you load a wide range of widths of continuous-feed paper, including labels.

- For graphics, the EX sets a new standard in speed. By using the bidirectional mode it almost doubles the speed of graphics printing.

About this Manual

To make it easier to set up your new EX-800 or EX-1000, this manual includes a 10-step guide. This guide, which is printed on the inside of the back flap, summarizes the first chapter's setting up instructions.

The blue-edged divider pages are another aid to using the manual. They make it easy to find the section of the manual you need. In addition to Setting Up Your printer, there are four other sections.

Using Your Printer covers the basic functions, Print Features and Graphics describes more advanced functions, and the last two sections contain reference information, including all the details you need to use any of the printer's commands, and some advice on solving problems.

Finally, there is a glossary and a comprehensive index, and inside the back of the manual is a pullout quick reference card containing the information you need most.

Chapter 1

Setting Up the Printer

Setting up your EX printer is easy Simply follow the steps in this chapter.

Note
Although this manual covers both the EX-800 and the EX-1000, the illustrations show only one printer (the EX-800) because the only difference between the two is that the EX-1000 can use wider paper.

1 Unpacking the Printer

As you unpack the printer, see that all the parts in Figure l-l are there and that none of them has been damaged during transportation. (You'll find the paper feed knob inserted in the foam packing material.)

Figure 1-1.
The printer parts
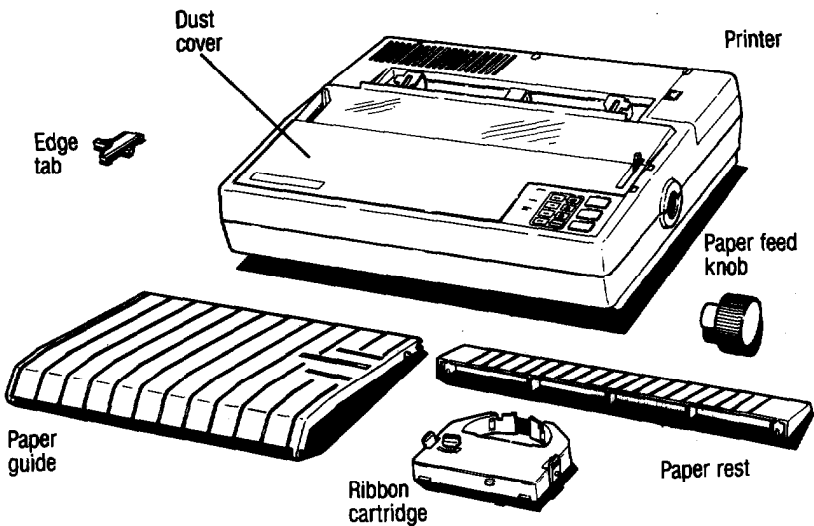
Caution

Do not plug in the power cord yet. You should perform the first three steps before you plug in the printer and turn on the power,

Remove the tape that holds the dust cover in place during shipping and take the cover off the printer. Simply tilt the dust cover up and lift it off.

Installing the paper feed knob

Install the paper feed knob on the right side of the printer, as shown in Figure 1-2. 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.

Now that you've installed the paper feed knob, use it to remove the sheet of paper that is behind the printer's platen (the black roller).

Removing the print head protector

Remove the print head protector by lifting it up and pulling it to the right as shown in Figure 1-3 below.

Figure 1-2.
Installing the paper feed knob
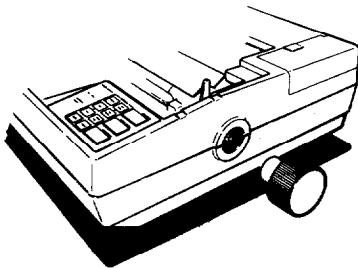
Figure 1-3.
Removing the print head protector
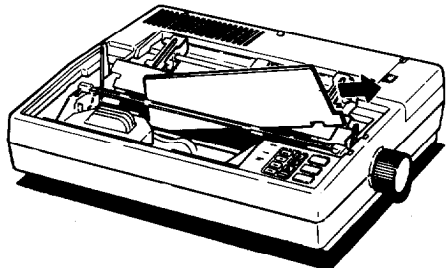
When you are finished unpacking, put the packaging materials and the head protector in the box and keep them in case you need to transport the printer. Full details on transporting the printer are in Appendix D.

2 **Choosing a Place for the Printer**

The printer must be close enough to the computer for the cable to reach. Also keep the following tips in mind:

• Place the printer on a flat, stable surface-never 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.

• Use a grounded outlet-one that has three holes to match the power plug on the printer. Don't use an adapter plug.

• Avoid sockets on the same circuit with large motors or other appliances that might disturb the power supply

• Keep your entire computer system away from potential sources of interference such as the base units of cordless telephones.

3 **Installing the Ribbon**

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

1. Remove the dust cover.

2. If the printer is plugged in, see that it is turned off.

WARNING

The power must be OFF when you move the print head. Otherwise, you may damage the printer mechanism. Also, if you've been using the printer just before changing the ribbon cartridge, be careful not to touch the print head because it becomes hot during use.

3. Move the print head carriage to about 25 on the ruler 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, as shown in Fire 1-4.

5. Make sure the paper bail is against the platen.

6. Hold the cartridge, gently squeezing the two ridged plastic **tabs** together; then lower it (as shown in Figure 1-5 below) into the print head carriage. As you lower it, see that the tab on the back of the cartridge rests on the corresponding **tab** on the carriage and that the ribbon passes between the print head and the silver ribbon guide.

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

Figure 1-4.
Tightening the ribbon
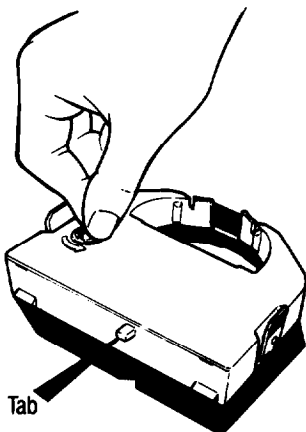
Figure 1-5.
Installing the ribbon

Tab

Print head
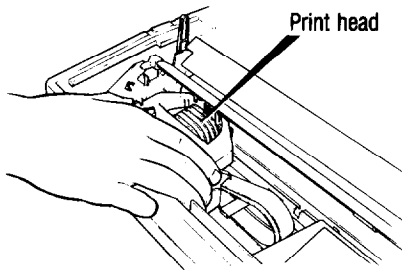
8. Turn the ribbon tightening knob again to see that the ribbon moves freely

Replacing the ribbon . . .

The EX-800 uses a continuous-loop, inked fabric ribbon. When your printing becomes too light, replace the whole ribbon cartridge.

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 remove the old 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 as described above.
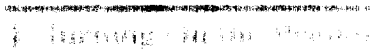
Before plugging in the power cord, see that the power switch on the left side of the printer (see Figure 1-6 below) is turned off; then plug the power cord into a properly grounded socket.

Warning:
Before turning on the printer, be absolutely sure you have removed all packing materials. Turning on the printer when the print head cannot move may seriously damage the mechanism.

Figure 1-6.
Turning on the printer
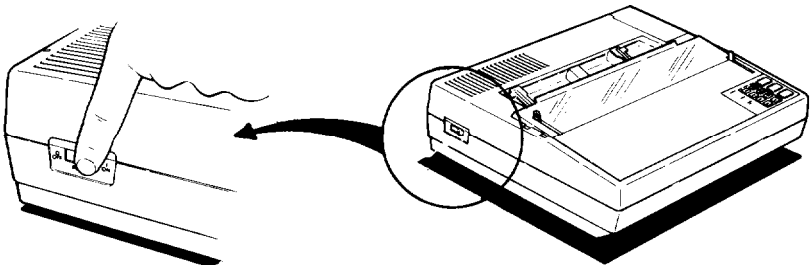
Now, turn the power ON with the switch on the left side of the printer. When you turn on the printer, several important things happen:

- The print head moves back and forth and stops at the left side of the printer; this is the home position.

- The ribbon carriage moves up and down to set the ribbon at the correct level for printing.

- The printer is *initialized* and set to certain *default* settings (which are fully described in Appendix E).

- The green power light on the control panel comes on.

5 Operating the Control Panel

The control panel consists of three sections, shown in Figure 1-7 below.

The three buttons on the right side control advancing the paper and communication with the computer. The four indicator lights show when the printer is turned on and when it is ready to use.

Figure 1-7.
The control panel
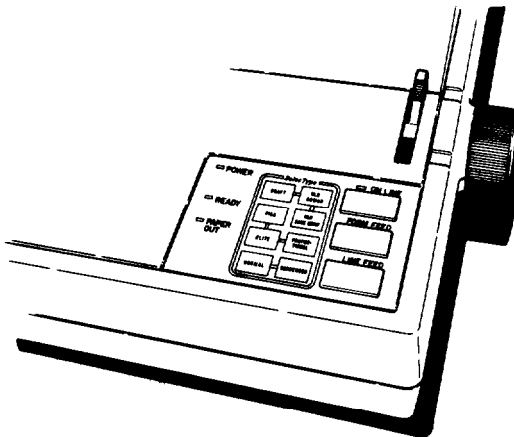
The buttons

There are three buttons on the right side of the control panel.

ON LINE   The green light next to this button indicates that the
            printer is able to receive and print data from the
            computer. 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 from off line to on line. The printer
            automatically goes off line when you try to print without
            paper in the printer. Pressing the ON LINE button then has
            no effect until you load paper.

The other two buttons work only when the printer is off line.

FORM FEED   This button ejects a single sheet of paper or advances
            continuous paper to the next top of form.

LINE FEED   This button advances the paper one line each time you
            press it or continuously if you hold it down. When the
            printer is turned on, use this button to advance paper.

Remember not to use the paper feed knob while the printer is turned
on. You can damage the printer mechanism.

The indicator lights

In addition to the ON LINE light, the printer has three other lights.

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

READY   This comes on when the printer is on line and ready to
            print. It normally flickers during printing.

PAPER OUT   This comes on when the printer is out of paper.

The remain   f the control panel is made up of eight touch
switches that let you choose the print style and size. This is a special
feature called SelecType, which is fully described in Chapter 4.

6 Installing the Paper Guide

You can install the paper guide in two different positions. Right now you need to install it to support a single sheet. Before you begin, remove the dust cover so that you can see what you are doing.

The edge tab

First, put the edge tab into the guide. Squeeze it together as shown in Figure 1-8 and insert the tab into the groove. Then move the edge tab so that it is about 1 ¾-inch from the left edge of the paper guide.

The paper guide

Second, install the guide itself. Hold the paper guide vertically and lower it so that the slots on either side fit onto the two pins as shown in Figure 1-9 below. Then tilt the. paper guide back until it rests at an angle.

Figure 1-8.
Installing the edge tab
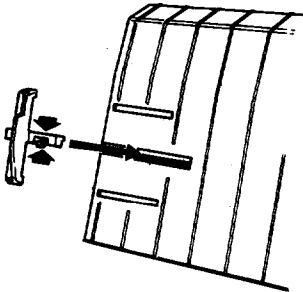
Figure 1-9.
Installing the paper guide
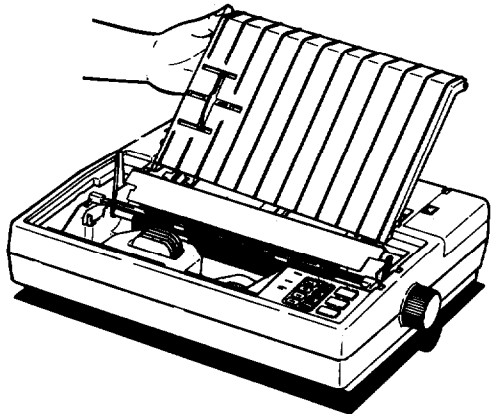
7 Loading Paper

Even if you normally use continuous paper, it is simpler to test the printer using a single sheet of paper. If you have an EX-1000, be sure to use 14-inch-wide paper so that none of the self test prints on the platen.

Paper loading icons...

Roth levers on the EX have icons (small pictures) beside them. These icons (shown below) remind you whether to push the lever back or pull it forward **when you load** paper.

Paper release lever

Single sheets

Continuous feed

Paper bail lever

Printing

Single sheet loading

Now load a sheet of paper:

1. Turn the printer ON first. Do not put the paper in the printer before you turn it on.

2. Remove the dust cover

3. Push the paper release and paper bail levers back. Note that the paper bail lever must be in the printing (back) position now. You will move it to the single-sheet loading (forward) position in step 5.

4. Make sure the ON LINE light is OFF If it is ON, press the ON LINE button once.

5. Place the paper on the paper guide with its left edge next to the edge tab as shown in Figure 1-10 below. Push the paper firmly into the printer, then let go of it.

6. Pull the paper bail lever forward to the single-sheet loading position (indicated by the icon). This makes the paper feed into the printer until it is past the paper ball.

7. When the paper stops, push the paper bail lever back to the printing position. This makes the paper feed backward until only its top edge is under the paper bail.

If the platen (the black roller) turns but the paper does not load, remove the paper from the printer and try again, starting at Step 3. This time press the paper a little more firmly into place.

If nothing happens at all, see that the printer is turned ON and that the **ON LINE** light is off. Then remove the paper and try again.

Figure 1-1O.
Aligning the paper

Paper
bail

Setting Up the Printer
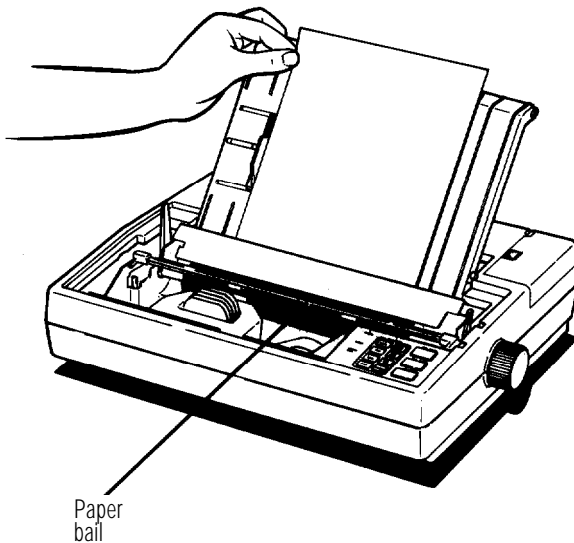
8 **Running the Self Test**

The EX has a built-in self test that prints out the characters in its memory so that you can see that the printer is working properly

The self test also prints the settings of the printer's DIP switches. This part of the printout will be useful in the next section of this manual.

Before running the self test, make sure that paper is loaded in the printer and that the power is OFF

To run the self test in the Near Letter Quality (NLQ) mode, hold down the **FORM** FEED button while you turn the printer on. When the printing starts, release the **FORM FEED** button.

The self test first prints the version number of the printer and 11 lines of DIP switch settings. Then it prints the characters from its memory The test continues until you turn the printer off. Part of a typical self test is shown below.

```
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
 !"#$%&'()*+,-. /0X23456769: ; <=>?@ABCDEFGHIJ
!"#$%&'()*+,-. /0123456769: ; <=>?BABCDEFGHIJK
"#$%&'()*+,-. /0123456769: ;<=>?@ABCDEFGHIJKL
#$%&'()*+,-. /0123456769: ; <=>?@ABCDEFGHIJKLM
$%&'()*+,-. /0123456769: ; <=>?@ABCDEFGHIJKLMN
%&'(>*+,-. /0123456769: ;<=>?@ABCDEFGHIJKLMNO
&'()*+,-. ,'0123456789: ;<=>?@ABCDEFGHIJKLMNOP
*o*+,-. /0123456789: ;<=>?BABCDEFGHIJKLMNOPQ
o*+,-. /0123456789: ;<=>?@ABCDEFGHIJKLMNOPQR
```

To run the same test in the draft mode, hold down the **LINE FEED** button instead of the **FORM FEED** button while you turn the printer on. The EX cannot print a draft self test, however, if the NLQ DIP switch is on. Therefore, if the Print Quality line of the self test printout says 'Print Quality NLQ," you cannot print a draft test without changing a DIP switch. (DIP switches are explained in Appendix E.)

9 Connecting the Printer to Your Computer

Your EX printer has two separate interface connections. Therefore, you must be sure to use the one that your computer requires.

The two interfaces are a Centronics® compatible parallel interface and an RS-232C compatible serial interface. If you have a suitable cable, you can connect most computers immediately

The few computers that require other interfaces can usually use one of the optional interface boards described in Appendix F Check your computer's manual if don't know which interface to use.

The parallel interface

More connecting a parallel interface cable, see that both the printer and computer are turned off. Then plug the connector into the printer as shown in Fire 1-11. Next squeeze the clips gently and click them into place.

Some parallel cables have a ground wire. Connect this wire to the ground screw on the printer to protect data from interference. Then plug the other end of the cable into the computer and connect the ground wire on the computer end of the cable if it has one.

Parallel interfaces require no further adjustment.

The serial interface

For the serial interface, you should use an Epson serial interface cable. Use #8239 for the Apple® IIc, #8297 for the IBM* PC and compatibles, and #8293 for most other computers with a DB-25 socket, including the Apple IIe with serial interface. (Although you can use the serial interface with an IBM or compatible computer, it is usually best to connect your EX to the parallel port of an IBM or compatible computer.)

The serial interface also requires the setting of four DIP switches. See the section on serial interfaces in Appendix C for information on how to set them.

10 Setting the DIP Switches

The EX has sixteen switches that allow you to change many of the printer's settings to suit your individual needs. These switches, known as DIP (Dual In-line Package) switches, are in the back of the printer See Figure 1-12 below.

Figure 1-11.
Connecting the parallel cable
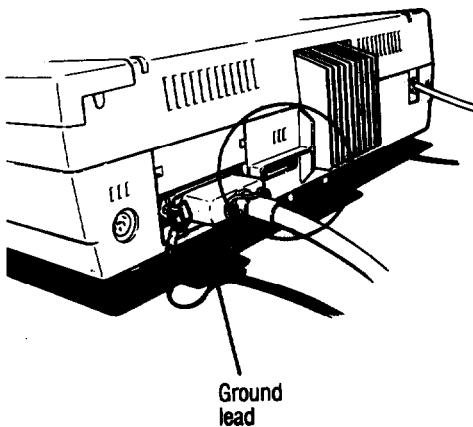
Figure 1-12.
DIP switch location

Ground
lead
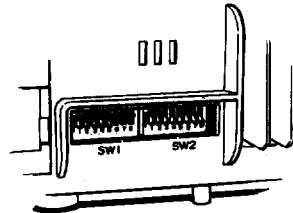
The switches are in two groups of eight and are numbered from l-l to 2-8. As you can see in the example below, the first part of the self test shows the settings of the switches.

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 your own self test printout helpful as you use this section.

Before you change any DIP switch settings, turn the printer around to give you easy access to the switches. You can easily turn the switches on and off 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, shaded boxes indicate the factory settings.

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 recognizes new settings only at the time you turn the power on.

Interface settings
If you are using a parallel interface, the interface line of the self test DIP switch printout should be the following:

Interface	Parallel

If the interface line does not say Parallel, turn switches 2-5 and 2-6 OFF

If you are using a serial interface, turn to Appendix C, which gives full information on serial interfaces.

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, a powerful set of commands developed by Epson and supported by almost all application software for personal computers. This is the mode that you should find the most useful and valuable for your printing. The rest of this manual refers to the ESC/P mode simply as the Epson mode.

The IBM printer emulation mode is for software that is designed only 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 in Appendix A, the Epson mode has more commands and many more capabilities.

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 characters and your application software will not print them in the Epson mode:

<p align="center">♥ ♦ ♣ ♠ → ←</p>

If you select IBM printer emulation mode with the DIP switch and choose an IBM printer in your software's printer selection menu, your EX will behave as an IBM printer does. 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.

DIP switch 1-4 controls the choice of operating modes. Turning the switch OFF selects Epson mode, and turning it ON selects IBM printer emulation mode.

The Epson character graphics set

Half of the characters used by IBM PCs and compatibles are special character graphics and international characters. On most previous Epson printers, these characters printed as italics. With the EX, however, you can print the character graphics without losing italics or any of the power of the Epson commands.

DIP switch 1-3 controls the choice between the italic character and graphic character tables (called CG table in the DIP switch printout). Turning the switch ON selects the character graphic table, and turning it OFF selects the italic table. Remember that italics are still available even if you select the character graphic table.

Because only Epson mode has italics, DIP switch 1-3 has a different function in the IBM printer emulation mode; In that mode the EX adds a carriage return to each line feed if DIP switch 1-3 is OFF For most IBM printer emulation mode applications, you should not have to change the setting of this switch.

Making the choice

The decision you make about the operating mode and the character graphics set depends upon the software you use. For most applications, choose the Epson mode and the Character Graphics set (DIP switch 1-4 OFF and DIP switch 1-3 ON). 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 OFF to choose italics instead of character graphics. On the other hand, if you have trouble printing character graphics, change the printer to IBM printer emulation mode by setting DIP switch 1-4 ON 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, important differences affect much software. These differences can cause erratic printing. In particular, line spacing and page layout are likely to be wrong, and extra characters may appear

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Other DIP switch settings

Appendix E summarizes all the DIP switch settings in a group of tables. See that appendix for reference or further information.

Chapter 2

Choosing and Loading Paper

The EX printer can accommodate many different sizes and types of paper, using either its automatic singlesheet loading feature or its built-in adjustable tractor.

The tractor is easy to use and can handle a wide range of paper widths. The automatic singlesheet loading feature handles individual sheets quickly and easily, and for greater efficiency you can add an optional automatic sheet feeder.

Choosing Paper

Without installing any accessories, you can use single-sheet paper from 7¼ to 8½ inches wide and continuous paper from 4 to 10 inches wide (including the perforated edge strips).

You can also add an optional roll paper holder, which uses paper 8½ inches wide. You load roll paper the same way you load single sheets, except that you do not use the paper guide.

Carbon copies

If you use multi-part forms or carbon copies in the EX, use no more than three sheets or parts at a time, with a total thickness of no more than 0.16 mm. Also change the paper thickness setting as described at the end of this chapter.

Loading Single Sheets

You have already loaded singlesheet paper using the automatic sheet loading feature in Step 7 of the setup chapter This feature gives you short printing times by combining fast loading with fast printing.

If you print large amounts on single sheets of paper, however, you may find it more convenient to use an automatic sheet feeder. This is an optional 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 automatic sheet feeder has its own user's manual.

Reloading during printing

When you print a document more than one page long using single sheets of paper, there are two different ways your software can allow you to load a new sheet at the end of a page.

- If your software sends characters in a continuous stream, the printer stops printing when it reaches the bottom of the paper and sounds the beeper. When this happens, the **ON LINE** light goes off automatically

- If your software handles printing page by page, it probably stops sending characters at the end of a page and prompts you to insert more paper. In this case the **ON LINE** light probably remains on, and the first thing you should do is press the **ON LINE** button once to turn it off.

Once the ON **LINE** light is off, remove the sheet that has just been printed and load a new sheet in the same way as before.

Loading Continuous-feed Paper

The new push-feed tractor built into the EX 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 easy to load.

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

Begin by seeing that the printer is turned off. If you have been using the printer with single sheets, remove the paper guide. You will install it in a different way

Clear enough space around the printer so that the paper has an unobstructed path in and out of the printer. There are three common methods of arranging a printer and continuous paper:

- Using a printer stand with the paper stacked underneath it.

- Using a desk or table as a stand, with the printer near the rear edge and the paper on the floor or on a shelf.

- Putting the printer on a desk or table and stacking the paper behind the printer.

   Now follow these steps to load continuous paper in your EX.

1. Install the paper rest by fitting its hooks into the notches at the back of the printer, as shown in Figure 2-1. This prevents incoming paper from catching on the cable.

2. Remove the dust cover and move the print head to about 40 on the ruler on the paper bail.

3. Pull the paper bail and paper release levers forward.

4. Release the sprocket units by pushing the locking levers back, as shown in Figure 2-2.

Figure 2-l.
Installing the paper rest
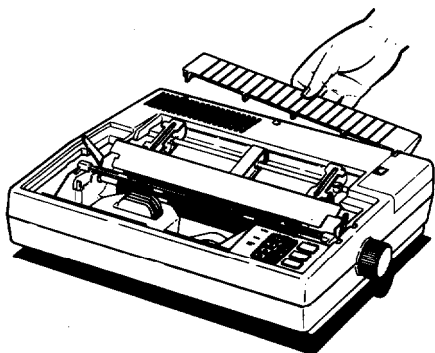
Figure2-2.
Releasing the sprocket units

Sprocket
Unit
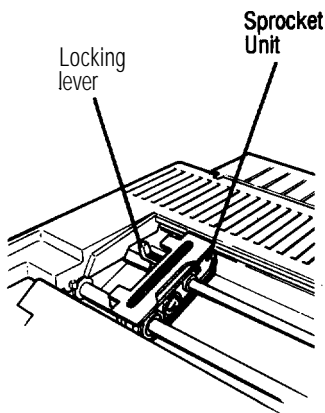
Locking
lever

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

Note

With the sprocket unit in this position, you always have a margin at the left side. If you want to print without a left margin or if your software creates a margin, move the left sprocket unit about 3/4 inch from the left side, so that the perforated edge of the paper fines up with the number 1 on the ruler on the paper bail. Check the exact position when you finish loading.

6. Open the covers on the sprocket units as shown in Figure 2-3, then move the right sprocket unit to its approximate position, using your paper as a guide. Put the ridged paper support midway between the two sprocket units.

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

8. Fit the first four holes in the left side of the paper over the pins of the left sprocket unit, as shown in Figure 2-4; then close the cover.

9. Now move the right sprocket unit so that you can fit the holes in the paper over the pins and close the cover.

Figure 2-3.
Opening the sprocket units

Sprocket unit
cover
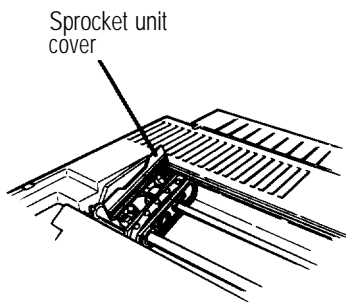
Figure 2-4.
Position@ the paper
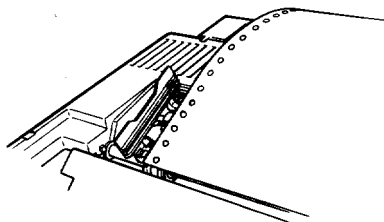
10. If the paper is straight and has no wrinkles, lock the right sprocket unit in place.

11. Turn the paper feed knob slowly to feed the paper under the metal plate in front of the tractor. (The diagram on the metal plate shows how the paper should go through.) See that the paper does not wrinkle after it reaches the platen.

12. Turn the knob until the paper is past the paper bail. Then push back the paper bail lever (the lever on the right side). The paper bail lever must be back at all times when you are printing with continuous paper.

Installing the Paper Guide

Install the paper guide to prevent the outgoing paper from being pulled back into the printer. This is the same part that supports the paper when you print on single sheets, but 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 guide above the printer, with the curved end down.

2. Lower the notches onto the pins as shown below, then tilt the paper guide back until it lies horizontally over the paper.

Figure 2-5.
Installing the paper guide
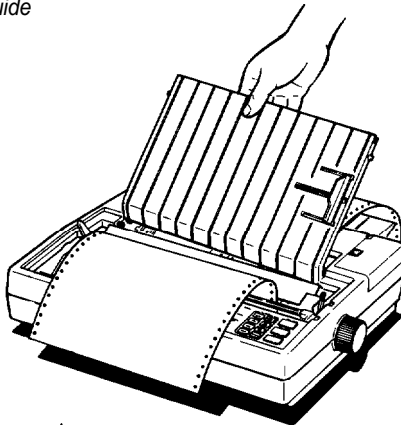
Setting the top of form position

Finally so that the printer does not print on the perforations, you need to establish a top of form position. The top of form position is the position of the paper when the power is turned on. This position is also reset whenever software initializes the printer or sets the page length.

Setting the top of form position is a simple threestep process:

1. See that the printer is turned off.

2. Use the paper feed knob to advance the paper until the first row of perforations is just above the paper bail as shown in Figure 2-6.

3. Turn the printer on.

The printer 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.

For some software, it is more convenient to set the top of form at the top of the print head. Try this if the setting above the paper bail does not work correctly with your software.

Figure 2-6.
The top of form setting
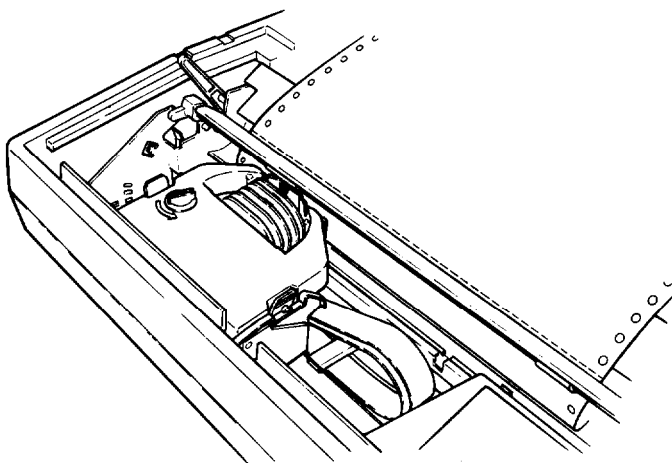
Remember that you should never advance the paper using the paper feed knob while the power is turned on. You can damage the mechanism of the printer, and the printer will lose track of the top of form position.

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 remember that the minimum width of label that can be used is 4 inches, including the full width of the backing paper.

The procedure for loading labels with the tractor is the same as for loading continuous paper, except for two points. Labels on a backing sheet are thicker than normal paper. Therefore, you must adjust the paper thickness lever, which is described at the end of this chapter. Also, if you don't want a left margin on the labels, move the left sprocket unit **about** 3/4 inch from the left side before locking it in position.

WARNING
Never turn labels backward with the paper feed knob or with reverse line feed commands. Labels can peel off the backing and jam the printer If a label does become stuck in the printer, see your authorized Epson dealer. Do not attempt to remove the labels yourself.

When you are through printing on labels, 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 damaging the printer

It is also possible to buy labels on a matte 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. You can load these with the automatic single-sheet loading feature.

The Paper Thickness Lever

You can adjust the EX to accommodate different thicknesses of paper. You need to do this when you print labels or carbon copies.

Before moving the paper thickness lever, always turn off the power, open the dust cover, and move the print head to the middle of the printer,

The paper thickness lever has four positions. You can identify these by looking at the catch positions in the metal plate, as shown in Figure 2-7.

For normal use the lever should be in the second position away from the platen (aligned with the notch in the plate shown in Figure 2-7). For printing labels or carbon copies, move the lever to the third or fourth position away from the platen.

Always return the fever to the normal position when you resume printing on normal paper.

Figure 2-7.
Paper thickness lever

Chapter 3
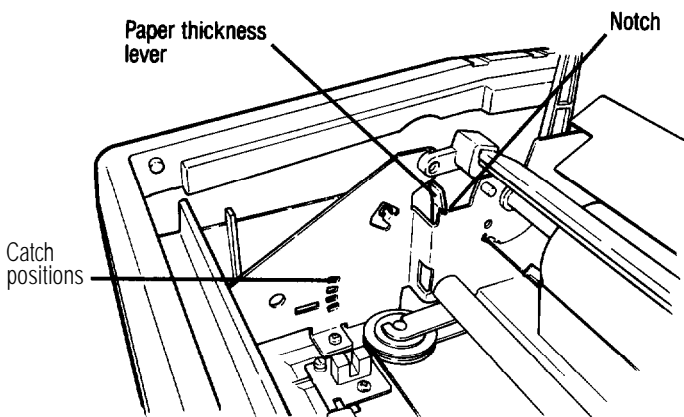
Using the EX with Application Programs

Now that you've set up and tested the printer, you need to start using it with your application programs.

Printer Selection Menus

Most application programs let you specify the type of printer you're using so that the program can take full advantage of the printer's features. Many programs provide an installation or setup procedure that presents a list of printers to choose from. If your application program has a printer selection menu, use the instructions below.

For further information on selecting a printer or sending commands from your application program, read the rest of this chapter, which covers word processors, spreadsheets, graphics programs, and programming languages.

Menu selections

If your software has a printer selection menu, simply choose EX-800 or EX-1000. If the menu does not list any EX printers, choose one of the following. They are listed in order of preference.

EX-800	EX-1000
FX-85	FX-286
FX-80 +	FX-185
FX-80	FX-100+
FX	FX-100
LX	FX
Epson printer	L x
Draft printer	Epson printer
	Draft printer

If you plan to use the 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 or Epson JX-80 color printer. Do not select an IBM printer, because the IBM printer emulation mode cannot use the color option kit.

A quick test

After setting up your application program, print a sample document
to be sure the program and the EX are communicating properly If the
document doesn't print correctly recheck the program's printer selection
and installation procedure. If you're still having trouble printing, consult
the troubleshooting section in Appendix D.

Computer-Printer Communication

Computers and printers communicate by using codes to represent
characters and commands. To be sure the two devices use the same
codes, almost all manufacturers of computers, printers, and software use
the American Standard Code for Information Interchange, which is
usually referred to by its abbreviation, ASCII.

The ASCII standard includes codes for printable characters (letters,
punctuation marks, numerals, and mathematical symbols) and 33 other
codes called control codes: The control codes are for such functions as
sounding the beeper and performing carriage returns. Because the 33
control codes are not enough to control all possible printer functions,
most printer commands are actually a sequence of two or more codes.

One of the 33 control codes, the escape code, signals the beginning of
a sequence of codes. Therefore, most printer commands are sequences
of codes, the first of which is the escape code. This manual uses the
ASCII abbreviation EX for this code.

When using control codes to select printer functions for an
application program or programming language, check the manual for
the program or language to find the appropriate method of inserting the
code into the program. Further details on the methods to use are in the
rest of this chapter.

Naming and using commands

In order to use printer commands, you should know how they are recognized by your software program. The most common way of naming codes or commands is with one of two numbering systems, decimal or hexadecimal.

The decimal system is the standard numbering system based on units of ten, using the numerals 0-9.

The hexadecimal, or hex, system is based on units of 16, and is often used by programmers. Instead of using only the numerals 0 through 9, the hex system also uses the letters A through F. For example, the decimal numbers 9, 10, 11, and 12 are 09, OA, OB, and OC in hex.

Since the most frequently used hexadecimal numbers are between 0 and FF hex (0 to 255 in decimal), it's common to write hexadecimal numbers that 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

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

Word Processors

In many ways, word processors demand the most from your printer When you create and print a document, you may use many print styles and fonts, reformat pages, add headers and footers, and use bold, italic, and other effects.

Once you have installed your word processor by using the lists on page 3-1, you can ordinarily use 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 your printer. On your screen some programs show the markers in a distinctive way while others display the text as it will appear-for example, in bold or italics.

This method is normally restricted to features that can be found on almost all printers, such as bold and underlining.

Some programs also provide a way of placing complete printer commands in the text. These commands may or may not be visible on your screen. This method has the advantage of allowing you to use any printer command, not just a limited set. To make use of it, however, you need to understand how to use the printers commands.

Check the manual for your word processor to see if you can place printer commands in your text. If this is possible, use the Command Summary in this manual to find the command, **and** use the manual for your word processor to find how to assign the command.

If your EX is not printing correctly check both the EX and your **word** processor and review this checklist:

[Make sure you've selected the correct printer.

[Carefully read the printer setup and installation information in your word processor's manual.

[Check the printer options that may be part of the installation or setup section (line feeds, interface, etc.).

[Make sure your **word** processor is capable of sending the proper commands to your printer.

[If you're still having difficulty printing, check the troubleshooting section in your word processor's manual and Appendix D of this manual.

Spreadsheets

Although spreadsheets seldom use as many printing styles as word processors, they do have some very specific requirements.

Installation and column width

If your spreadsheet program provides a list of printers, use the list on page 3-1 to find the proper selection. If your spreadsheet doesn't have a printer setup routine, carefully read the program's manual for information on printing.

A major concern for printing spreadsheets is the width of the printer. The EX-800 is an 80 column printer, and the EX-1000 is a 136 column printer, but by using condensed elite (explained in Chapters 4 and 5) you can print up to 160 columns on the EX-800 and 272 on the EX-1000. Therefore, if your spreadsheet asks the number of columns your printer can print, you can specify 160 or 272.

Printer commands

Unlike word processors, spreadsheet programs don't usually let you change printer commands within a spreadsheet. Instead, one style or mode of printing is used for the whole spreadsheet. With the EX, there are two main ways of sending commands to control the printing of a spreadsheet.

First, almost all spreadsheets have the capability of sending commands to a printer. Look in the manual for your spreadsheet to find out how to send printer commands. Then look in the Command Summary in this manual to find the proper codes to send.

For example, your spreadsheet might use a "setup string" to send printer commands. To prepare a setup string for condensed elite, you would look up the proper command in the Command Summary

The command for elite is ESC M, and the command for condensed is SI. Because most spreadsheets use the decimal equivalent for the commands, (also given in the Command Summary), a setup string for condensed elite might look like this:

/027/077/015

The number 027 is for the escape code, 077 is for M, and 015 is for SI (condensed).

The second method is SelecType, a feature described in Chapter 4. This feature allows you to choose print styles with buttons on the control panel.

If your spreadsheet is not printing correctly check both the EX and your spreadsheet program and review this checklist:

☐   If the program asks you to select a printer, be sure you have selected the correct one.

❏   If you're using the program's print facility recheck the EX's Command Summary to make sure you're sending the correct commands.

❑   If you're still having difficulty printing, check the troubleshooting section in your spreadsheet program's manual or Appendix D of this manual.

Graphics Programs

The EX is capable of producing finely detailed graphic images in black or in color (with the optional color kit). Chapter 6 gives specific information on the graphics commands, but the easiest way to take advantage of the EX's capabilities is with one of the many graphics programs available.

When buying graphics software, always. make sure it has a suitable option to allow printouts on an EX printer. Any program with an option for an EX or FX printer should give excellent results in black and white, using different dot densities to produce a realistic scale of grays. If you have installed a color option kit, look for software that has an option for the EX or for the Epson JX-80 color printer.

Most graphics programs have a printer selection procedure, in which case you should check the lists on page 3-1 to find the proper selection.

Programming Languages

Most users rely on application programs to send commands to the printer. An awareness of programming languages, however, can be helpful in exploring a printer's potential or troubleshooting a printing problem.

For example, if you want to set up your application program to send a command for italic printing, you can use a programming language, such as BASIC or Pascal, to do a quick printout before setting up the program.

If, on the other hand, you've set up a program to send a certain command to the printer, but it's not printing correctly you could send the same command with a programming language to find whether the problem lies with your application program, the command, or the printer.

Sending printer commands with BASIC

You can send printer commands with any programming language. The examples in this manual are written in BASIC, because BASIC is included with most computer systems.

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 the text to be printed enclosed in quotation marks, as shown below:

```
100 LPRINT "This text will be printed."
```

Individual printer control codes can be sent by using the CHR$ function with the LPRINT statement:

```
110 LPRINT CHR$(27);CHR$(@);
```

This line sends ASCII codes 27 and 69 to the printer, selecting emphasized printing.

Most versions of BASIC permit the ASCII codes in the CHR$ function to be given in either decimal (as above) or hexadecimal. Also, 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$(27);"E"
LPRINT CHR$(&HlB);CHR$(&H&)
```

As you can see, Microsoft BASIC uses &H to denote hexadecimal numbers.

If you have another version of BASIC or a different programming language, consult the manual for the language to find the correct formats for these commands.

SelecType

The SelecType feature allows you to choose printing 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.

SelecType   Choices

With SelecType you can choose any one of these three typestyles:

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

You can print in any of these widths:

        Pica: ABCDEFGHIJKLMnopqrstuvwxyz
         Elite: ABCDEFGHIJKLf'hopqrstuvwxyz
 Proportional: ABCDEFGHIJKLMnopqrstuvwxyr

You can 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 in Figure 4-1 below) has eight buttons that control the basic style and size of the text you print. When you press a button, it beeps and lights up to confirm your choice. These buttons are arranged in three groups.

The first group of buttons selects the print quality and font. The EX has one draft font 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.

Three more buttons determine the print pitch and character width. You can choose pica (10 characters per inch), elite (12 characters per inch), or proportional. 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. You can choose any one of these by pressing the appropriate button.

The last group of buttons lets you choose the condensed mode. 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 with the EX-800 and 272 with the EX-1000. This is especially useful for printing out large spreadsheets. The condensed mode, however, cannot be used with the proportional mode.

Figure 4-1.
The SelecType panel
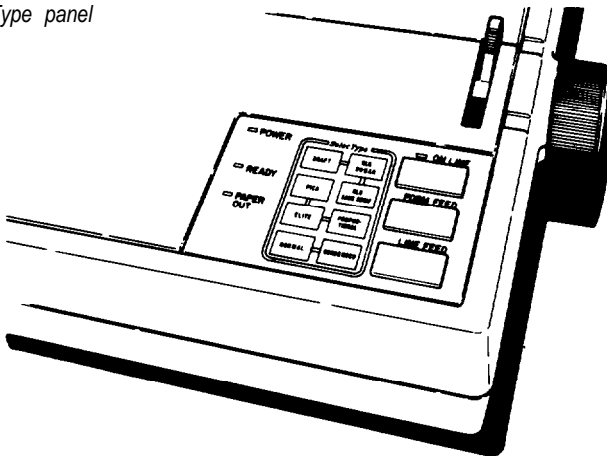
If you try to combine proportional with condensed, proportional will override condensed, no matter which you choose first. When you have selected condensed and then press the proportional button, it beeps three times to tell you that it is overriding condensed. (The condensed button light goes off also.)

If you have 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 can try the various SelecType possibilities by printing a short sample document created with an application program. Create a sample and then perform the following two 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 lighting up.

2. Print the document using your 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 SelecType because the lighted buttons tell you what mode the printer is using at any time.

lf SelecType Does Not Work

Some application programs are designed to control all typestyle functions. Before each printing operation, these programs cancel all previous typestyle settings by sending a signal (INIT) or by sending specific control codes to cancel certain typestyles. These signals or control codes may cancel your SelecType settings.

One reset signal, however, does not affect your SelecType settings. This is the ESC @ command.

You can see whether your program is changing your settings by watching the buttons when printing starts. If the lights change, the program is controlling the typestyles.

If your application 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 print control codes for your application program instead of SelecType to control your printing. The manual for your program tells you how to change the printing style. Most programs that cancel SelecType settings also have sophisticated print control commands that give the same results that SelecType does.

Note

Also remember that any control codes in your document will 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.

Two of the most frequent uses for SelecType are printing spreadsheets in condensed and changing between NLQ and draft printing. With SelecType 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.

Because the use of SelecType with the IBM printer emulation mode can produce unexpected results, it is recommended that you should not use SelecType with that mode.

Chapter 5

EX Printer Features

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. This chapter shows you the features you may want to select with your software. Once you have read about the features, you can find their commands in the Command Summary

SelecType, as you know, controls the printing style of a whole document. Software commands, on the other hand, can change anything from a single character to the entire document.

Quality, Fonts, and Color

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

The EX has two levels of print quality: draft and NLQ (Near Letter Quality). Draft printing is fast, making it ideal for drafts and other preliminary work. NLQ printing takes a little longer, but it produces more fully-formed characters for presentation-quality documents.

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.
```

SelecType gives you an easy way of changing the print quality and NLQ font, but if you prefer to print in NLQ Roman most of the time, you can select it with a DIP switch (see Appendix E). You can also choose the print quality and NLQ font with software commands.

If you have installed the color option kit, a software command lets you select any one of seven colors, and you can combine some of those colors to produce an even greater variety You can use color for graphics or for text and for a whole page or a single word.

Print Size and Character Width

To add greater variety to your documents, the EX has two pitches as well as proportional spacing and condensed printing. All four can be selected either with SelecType or a software command, and software commands also offer one other option: doublewidth printing.

Pitches and Proportional Spacing

The two pitches are pica and elite. Pica is 10 characters per inch (cpi) and elite is 12 cpi. The printout below shows the difference between the tWO.

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

Another mode is proportional. In this mode the width of the characters varies. Therefore, a narrow letter like i receives less space than a wide letter like W, as you can see in the printout below:

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

The character tables in Appendix B list the widths of all proportional characters.

Double-width and condensed

In addition to the basic pitches and the proportional mode, the EX offers two other modes that change the size of your printing. These modes are double-width and condensed.

The double-width mode doubles the width of any size of characters. This mode is useful for such purposes as emphasizing headings in reports and making displays, but is usually not suitable for large amounts of text.

```
   D o u b l e - w i d t h   p i c a
   D o u b l e - w i d t h   e l i t e
```

Pica and elite can 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 an 8-inch line and 272 on a 13½-inch line.

Condensed can be selected with SelecType, by setting a DIP switch (see Appendix E), 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.

<div align="center">
Condensed pica gives more characters on a line.

Condensed elite gives you even more.
</div>

Widening or narrowing the characters also widens or narrows the spaces between words and letters. Because word processors usually create a left margin by printing spaces, you may need to change 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 parts of your 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 they are properly installed.

Emphasized and double-strike modes both slow the printer down slightly to produce bolder text. In emphasized mode, the EX prints each character twice as the print head moves across the paper, with the second slightly to the right of the first. This produces darker, more fully-formed characters.

In doublestrike mode, the EX prints each line twice, with the second slightly below the first. This makes the characters bolder. While NLQ is in use, however, double-strike is ignored because NLQ characters are already formed by two passes of the print head.

For even greater boldness, emphasized and doublestrike can be combined. The samples on the next page show the effect of combining the two modes in draft printing.

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

Superscripts and subscripts are valuable for such purposes as printing footnote numbers or parts of mathematical formulas, and the underline mode provides an automatic way of underlining fully any piece of text. It underlines spaces, subscripts, and superscripts without a break.

The example below shows underlining with text and combined with superscripts and subscripts in a mathematical formula.

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

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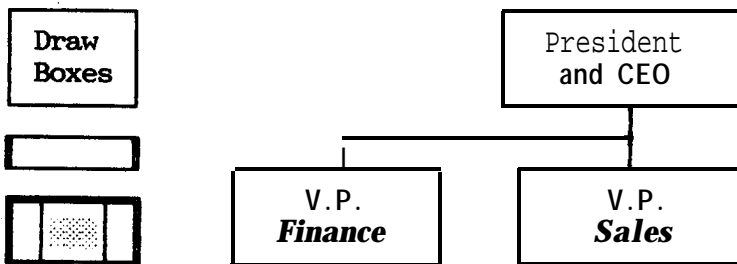
You can select the Epson Character Graphics Set with your software or by setting DIP switch 1-3 ON. For many applications it is best to use the DIP switch instead of the software command because the character graphics are then available as soon as you turn the printer on.

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, French, German, UK, Danish, Swedish, Italian, and Spanish. See Appendix E for the DIP switch settings.

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. A complete list of these characters is in Appendix B.

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

Italics give *emphasis* to words.
They are an attractive alternative style.

Page Layout and Other Commands

The remaining commands in the command summary are not normally needed when using commercial software. You may need some of them if you are using a printer installation program provided with an application 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 such as BASIC.

Chapter 6

Graphics and User-defined Characters

The dot graphics mode allows your EX to produce pictures, graphs, charts, or almost any other pictorial material you can devise, and the user-defined character feature allows you or a commercial software program to put special characters in the EXs memory so that it can print them just as if they were ordinary letters.

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 by simply giving your software a few instructions.

The quickest and easiest way to print graphics on your EX is to use a commercial graphics program. With such programs you usually create an image on your monitor and then give a command to send the image to the printer.
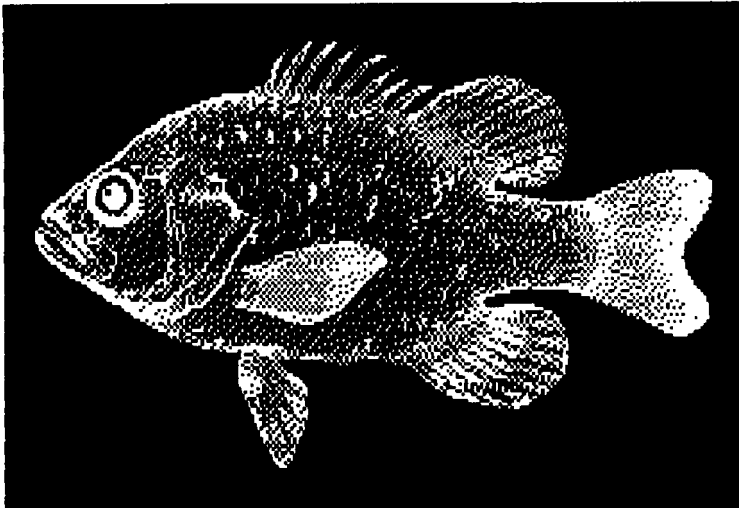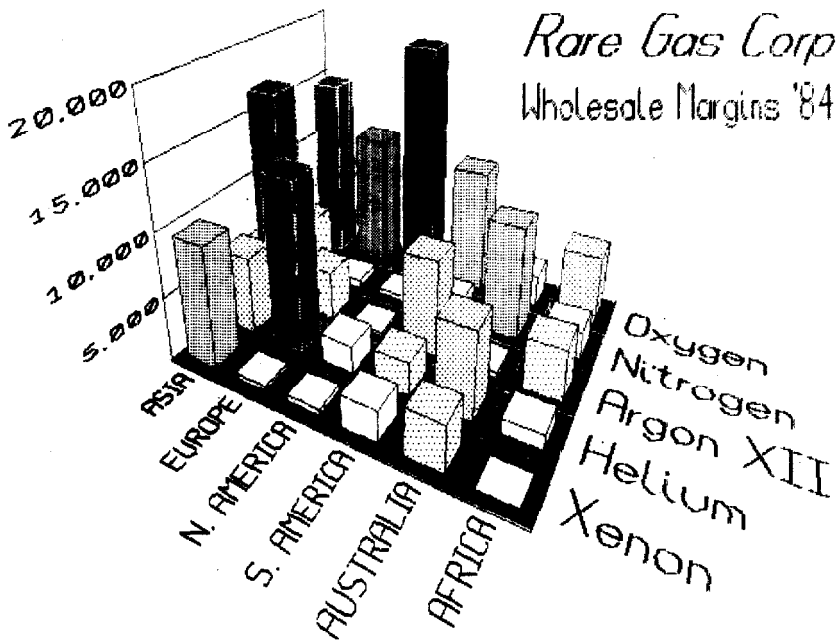
If you use commercial software that produces graphics, all you need to know about dot graphics is how to use the software. If, on the other hand, you wish to do your own programming or merely wish to understand how the EX prints graphics, read on.

The Print Head

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

The EX's print head has nine pins. As it moves across the page, electrical impulses cause the pins to fire. Each time a pin fires, it strikes the inked ribbon and presses it against the paper to produce a small dot. 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 EXs print head is able to print graphics in addition to text because graphic images are formed on the EX about 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 vertically The images printed by the EX can, therefore, be as finely detailed as the one on the first page of this chapter.

In its main graphics mode the EX prints one column of dots for each code it receives, and it uses only the top eight of the nine pins. Therefore, your graphics program must send codes for dot patterns, one number for each column in a line. For each of those columns the print head prints the pattern of dots you have specified.

To print figures taller than eight dots, the print head makes more than one pass. The printer prints one line, then advances the paper and prints another, just as it does with text.

To keep the print head from leaving gaps between the graphics lines as it does between the text lines, the line spacing must be changed to eliminate the space between lines. With a change in line spacing, the EX can 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 desire. You don't have to fill the whole page or even an entire line with your graphics figures. In fact, you can use as little or as much space as you like for a figure and put it anywhere on the page.

Pin Labels

The graphics mode requires a method to tell the printer which pins to fire in each column. Since there are 256 possible combinations of eight pins, you need a numbering system that allows you to use a single number to specify which of the 256 possible patterns you want. This numbering system is shown in Figure 6-1 on the next page.

To fire any one pin, you send its number. To fire more than one pin at the same time, add up the numbers of the pins and send the sum to the printer. Therefore, with these labels for the pins, you fire the top pin by sending 128. To fire the bottom pin, you send 1. If you want to fire only the top and bottom pins, you simply add 128 and 1, then send 129.

By adding the appropriate label numbers together, you can fire any combination of pins. Figure 61 shows three examples of how to calculate the number that fires a particular pattern of pins.

With this numbering system, any combination of the eight pins adds up to a decimal number between 0 and 255, and no numbers are duplicated. Before you can put these numbers in a graphics program, however, 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.

Figure 6-1.
Pin numbering system

```
128 ● 128      128 ○          128 ● 128
 64 ○           64 ●  64       64 ○
 32 ●  32       32 ○           32 ○
 16 ○           16 ○           16 ○
  8 ●   8        8 ●   8         8 ○
  4 ○            4 ○             4 ●   4
  2 ●   2        2 ●   2         2 ●   2
  1 ○  ----      1 ○  ----       1 ○  ----
       170            74              134
```
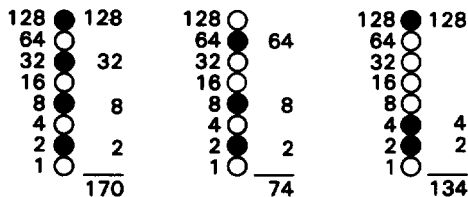
The graphics command format

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

The command to enter singledensity graphics mode is ESC K *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 reserved for graphics.

Column reservation numbers

Even in single-density graphics mode, one 8-inch line can accommodate 480 columns of graphics; in quadruple-density, almost 2000 columns can fit on the same 8-inch line. Since the printer does not use decimal numbers larger than 255, the graphics commands use two numbers for reserving columns.

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

For more than 256 columns 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* is 96 and *n2* is 6 because 96 + (6 x 256) = 1632.

You can calculate both *n1* and *n2* by dividing the total number of columns by 256. The quotient is n2 and the remainder is *n1.* If you are using a programming language with MOD (modulus) and INT (integer) functions, you can use the following formulas, in which *n* is the total number of columns.

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

Graphics data

After receiving a graphics command such as ESC K **n1 n2,** the printer prints the number of codes specified by **n1** and *n2* 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 printed as regular text.

Simple Graphics Programming

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

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 6-1. The FOR-NEXT loop sends 40 columns of data.

```
200 FOR X=1 TO 40: LPRINT CRR$(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 or 130 characters. This is usually no problem with text, but it can spoil your graphics. Two extra columns of graphics are printed in the middle of the ones you send, and 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 "LPTI:", 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 uses 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 run.

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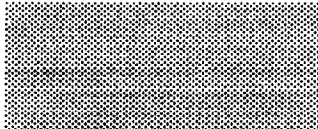
There are five basic steps that the program goes through to produce this kind of pattern.

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 (fine 110).

3. The program goes through the graphics commands the required number of times (fines 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 (fine 180).

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 singledensity 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 ^) in the Epson mode command summary

The four most common eight-pin modes are available in both Epson and IBM printer emulation modes. Their commands are 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 *nl* and *n2* you must send the code for the graphics mode required. The different modes are summarized in the table on the next page.

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

```
LPRINT CHR$(27);"*";CHR$(Ø);CHR$(4Ø);CHR$(Ø);
```

Table 6-1. Graphics modes

Option	Alternate Code	m	Horiz. density (dots/in.)
Single-density	ESC K	0	60
Double-density	ESC L	1	120
High-speed double-density*	ESC Y	2	120
Quadruple-density*	ESC Z	3	240
CRT I	none	4	80
Plotter (1:1)	none	5	72
CRT II	none	6	90
Double-density plotter	none	7	144

*Adjacent dots cannot be printed in this mode.

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. When you design patterns in these two modes, however, you must see that no dots 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 for reassigning a graphics mode is ESC ? 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 6-1.

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. Figure 6-2 shows the differences between three common modes so that you can choose the one you want.

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.

Figure 6-2.
Designing in different densities
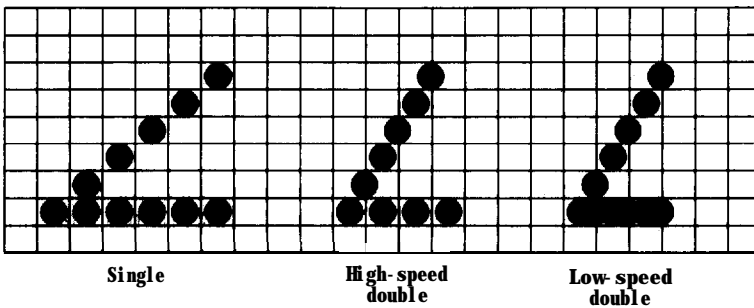
Now look at Figure 6-3, a design for a high-speed doubledensity design. It should point you in the right direction for your own designs.

After plotting 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 to calculate the graphics data. The results for the first line are shown in figure 6-4. The pin values are on the left and the sums at the bottom of each column.

Figure 6-3.
Arrow design
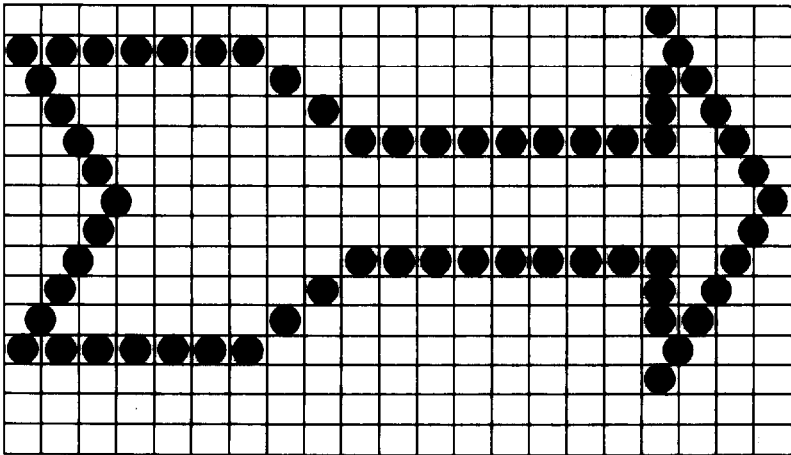
Figure 6-4.
Calculating data
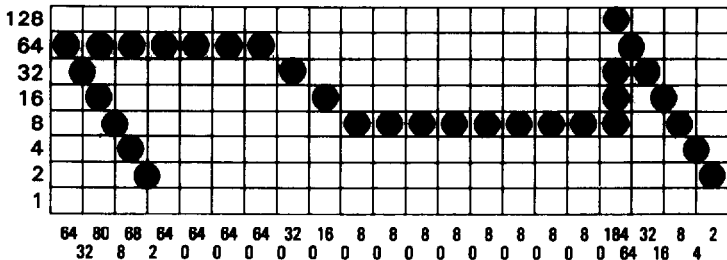
The numbers for the second line were calculated in the same way Once the numbers for the pin patterns are calculated, they are put in the program in DATA statements, separated by commas.

The program works in a 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
```

When you run this program, it produces the following printout:

$$\Sigma \mathrel{\!\cdots\!} \rangle$$

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

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.

Also, you can buy commercial software programs that assist you in
creating characters or supply you with sets of characters already created.
In addition, some popular application 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 what
you need or want.

♥   ♀   ▲   ❸

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.

To design a character you use a grid that has nine rows and eleven
columns. Figure 6-5 on the next page shows three of these grids. Most
characters do not use the two rows below the heavy line. Those rows
are only for characters with descenders, like y and g. Also, even though
you can use up to 11 columns, it is best to leave the last two blank for
the space between characters.

The grid in the middle of Figure 6-5 shows a plan for a character.
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 in Figure
6-5 uses the top eight, but you can also use the bottom eight by using
the grid on the right as explained later in this section.

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 is complex:

> *ESC & 0 nl n2 al dl.. . dn*

You can define more than one character with a single command. The
values **nl** and **n2** are the ASCII codes of the first and last characters you
are defining. If you are defining only one character, **nl** and **n2** are the
same. You can use any codes between 32 and 127 or 161 and 254
decimal for **nl** 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 using the ESC 6
and ESC I commands (see the Command Summary).

An example will show how to specify **nl** and **n2.** If, for instance, you
want to redefine the characters A to Z, **nl** is A (or ASCII code 65) and
n2 is Z (or ASCII code 90). So the command ESC & 0 AZ (followed by
the appropriate data) would replace the entire alphabet of capital letters.

Figure 6-5.
Design grids

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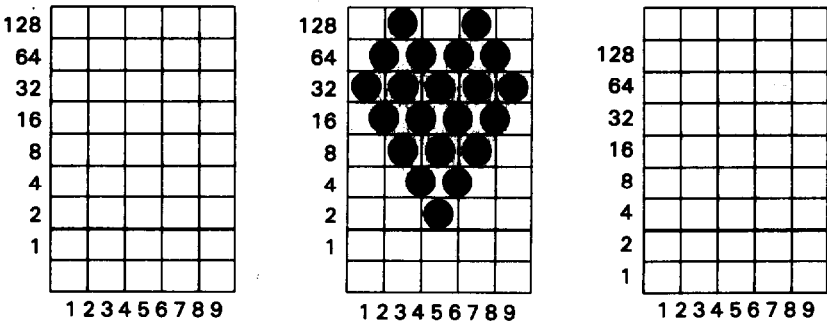
Following the specification of the range of characters to be defined in this command is one number *(al)* that specifies the width of the character and whether it uses the top eight pins or the bottom eight pins.

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$(27);"xØ";
110 LPRINT CHR$(27);"&";CHR$(Ø);
120 LPRINT "@@";
130 LPRINT CHR$(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$(Ø);
210 LPRINT "@ @ @ @ @"
220 END
230 DATA 32, 80, 168, 84, 42, 84, 168, 80, 32, Ø, Ø
```

In line 100, the ESC x 0 command selects draft style printing. The actual character definition starts in line 110. The two at signs (@) in line 120 are *n1* and *n2,* the range of characters being defined (in this case, a range of one). Line 130 contains *al.*

The information about the 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 140 and 160.

This example program defines a heart and places it in the area of RAM reserved for ASCII code 64, which corresponds to the at sign in the characters in the ROM. The next part of the program (lines 170-210) prints out a threeline sample. The first and third lines contain at signs; 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 and has the following format:

ESC % n

If *n* is 0, the normal ROM character set is selected. (This is the default.) If *n* is 1, 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 are still used.

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, 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:

Esc : 0 0 0

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 program uses 136 for *al* (in line 130 of the definition program), but you can use other values. The number al specifies two things: the width of the character and its position on the grid. The width is used when the character is printed in proportional mode.

If you want a character to use the bottom eight pins, use the third grid in Figure 6-5.

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, **al** should be 8. For any other character follow these rules to calculate **al:**

1. If you design a character narrower than nine columns, you can balance the number of empty columns on either side with the following method: Starting with **al** 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 al = 8

- subtract 2 for two blank columns on the right, giving al = 6

- add 32 for two blank columns on the left, giving **al = 38**

- add 128 to print with the top eight pins, so that al = 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 doublewidth work well with user-defined characters.

The sample below shows the heart character 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 (INIT) signal, all of the user-defined characters are lost. For example, some computers send an INIT signal each time BASIC is loaded or when certain application programs start up, and most computers do it if you have to reset them. If the program resets the printer with the ESC @ command, the ROM set is selected, but the user-defined characters are not lost.

The IBM printer emulation mode has a different method of defining characters. See page A-44 in the Command Summary if you are interested.

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 in two parts. The first part lists each command in numerical order and gives the page number where it is fully described in the second part of this appendix.

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 also 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.

The second part of this appendix lists and describes Epson mode commands and IBM printer emulation mode commands separately and the commands are divided into the following subjects:

Printer Operation	Print Enhancement
Data Control	Word Processing
Vertical Motion	Character Sets
Horizontal Motion	User-defined Characters
Overall Printing Style	Graphics
Print Size	

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

All three formats are equivalent, and it should be easy to pick the one most suited to your purpose.

> **Note**
>
> Some application programs can use control key sequences. See the
> Control Key chart on page A-3 for information on using these.

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) or LPRINT CHR$(27);"W";"1"

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: OF

This code can be sent 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 the following:

    ASCII code: ESC   n
    Decimal: 27   112   *n*
    Hexadecimal: 1B   70   n

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

LPRINT   CHR$(27);CHR$(112);CHR$(1)

Control key chart

Some application programs can use control key codes for decimal values 0-27. The table below gives you the proper values. The Control Key column indicates that you press the control key at the same time you press the key for the letter or symbol in that column. For example, you press the control key and A at the same time to send the value 1.

Some programs that use this system cannot use controls, and many programs use the control keys for other purposes.

Dec.	Hex.	Cntl. Key
0	00	@
1	01	A
2	02	B
3	03	C
4	04	D
5	05	E
6	06	F
7	07	G
8	08	H
9	09	I
10	0A	J
11	0B	K
12	0C	L
13	0D	M
14	0E	N
15	0F	O
16	10	P
17	11	Q
18	12	R
19	13	S
20	14	T
21	15	U
21	15	U
22	16	V
23	17	W
24	18	X
25	19	Y
26	1A	Z
27	1B	[

Commands in Numerical Order

This section lists all the EX commands, with their decimal and hexadecimal values. The numbers in the columns on the right are the page numbers in this appendix where a complete description of the command can be found. If the Epson and IBM printer emulation mode page numbers are the same, the command is the same in both modes and is described only in the Epson mode section.

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
BEL	7	07	Beeper	A-12	A-12
BS	8	08	Backspace	A-20	A-20
HT	9	09	Tab horizontally	A-21	A-21
LF	10	0A	Line feed	A-15	A-15
VT	11	0B	Tab vertically	A-18	A-18
FF	12	0C	Form feed	A-14	A-14
CR	13	0D	Carriage return	A-13	A-13
SO	14	0E	Select double-width (1 line)	A-26	A-26
SI	15	0F	Select condensed mode	A-25	A-25
DC1	17	11	Select printer	A-7	A-7
DC2	18	12	Cancel condensed mode	A-25	
DC2	18	12	Cancel condensed/elite		A-41
DC3	19	13	Deselect printer	A-8	
DC4	20	14	Cancel double-width (1 line)	A-26	A-26
CAN	24	18	Cancel line	A-13	A-13
DEL	127	7F	Delete character	A-13	
ESC SO	14	0E	Select double-width (1 line)	A-26	A-26
ESC SI	15	0F	Select condensed mode	A-25	A-25
ESC EM	25	19	Automatic sheet feeder on/off	A-11	
ESC SP	32	20	Set intercharacter space	A-30	
ESC !	33	21	Master select	A-23	
ESC #	35	23	Cancel MSB control	A-12	
ESC $	36	24	Set absolute print position	A-20	
ESC %	37	25	Select user-defined set	A-33	
ESC &	38	26	Define user-defined characters	A-32	
ESC *	42	2A	Select graphics mode	A-35	
ESC -	45	2D	Turn underlining on/off	A-29	A-29

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC /	47	2F	Select vertical tab channel	A-19	
ESC 0	48	30	Select 1/8-inch line spacing	A-16	A-16
ESC 1	49	31	Select 7/72-inch line spacing	A-16	A-16
ESC 2	50	32	Select 1/6-inch line spacing	A-16	
ESC 2	50	32	Select programmable line spacing		A-38
ESC 3	51	33	Select n/216-inch line spacing	A-17	A-17
ESC 4	52	34	Select italic mode	A-31	
ESC 4	52	34	Set top of form		A-39
ESC 5	53	35	Cancel italic mode	A-31	
ESC 5	53	35	Turn automatic line feed on/off		A-39
ESC 6	54	36	Printable code area expansion	A-33	
ESC 6	54	36	Select international character set		A-42
ESC 7	55	37	Cancel ESC 6	A-33	
ESC 7	55	37	Select standard character set		A-42
ESC 8	56	38	Disable paper-out sensor	A-10	A-10
ESC 9	57	39	Enable paper-out sensor	A-10	A-10
ESC :	58	3A	Copy ROM into RAM	A-32	
ESC :	58	3A	Select elite pitch		A-41
ESC (	60	3C	Select unidirectional mode (1-line)	A-9	
ESC =	61	3D	Set MSB to 0	A-11	
ESC =	61	3D	Define user-defined characters		A-44
ESC)	62	3E	Set MSB to 1	A-12	
ESC ?	63	3F	Reassign graphics mode	A-36	
ESC @	64	40	Initialize printer	A-7	
ESC A	65	41	Select n/72-inch line spacing	A-17	
ESC A	65	41	Set n/72-inch line spacing		A-38
ESC B	66	42	Set vertical tabs	A-18	A-18
ESC C	67	43	Set page length in lines	A-14	A-14
ESC C0	67	43	Set page length in inches	A-14	A-14
ESC D	68	44	Set horizontal tabs	A-22	A-40
ESC E	69	45	Select emphasized mode	A-27	A-27
ESC F	70	46	Cancel emphasized mode	A-27	A-27
ESC G	71	47	Select double-strike mode	A-28	A-28
ESC H	72	48	Cancel double-strike mode	A-28	A-28
ESC I	73	49	Printable code area expansion	A-34	
ESC I	73	49	Select font		A-41

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC J	74	4A	Perform n/216-inch line feed	A-17	A-39
ESC K	75	4B	Select single-density graphics	A-34	A-34
ESC L	76	4C	Select double-density graphics	A-34	A-34
ESC M	77	4D	Select elite pitch	A-24	A-24
ESC N	78	4E	Set skip-over-perforation	A-15	A-15
ESC O	79	4F	Cancel skip-over-perforation	A-15	A-15
ESC P	80	50	Select pica pitch	A-24	
ESC Q	81	51	Set right margin	A-20	
ESC Q3	81	51	Deselect printer		A-38
ESC R	82	52	International character set	A-32	
ESC R	82	52	Restore default tab settings		A-40
ESC S0	83	53	Select superscript mode	A-28	A-28
ESC S1	83	53	Select subscript mode	A-29	A-29
ESC T	84	54	Cancel superscript/subscript	A-29	A-29
ESC U	85	55	Turn unidirectional mode on/off	A-10	A-10
ESC W	87	57	Turn double-width on/off	A-27	A-27
ESC X	78	4E	Set left and right margins		A-40
ESC Y	89	59	High-speed double-density graphics	A-35	A-35
ESC Z	90	5A	Quadruple-density graphics	A-35	A-35
ESC \	92	5C	Set relative position	A-21	
ESC \	92	5C	Print characters from symbol set		A-43
ESC ^	94	5E	Select nine-pin graphics	A-36	
ESC ^	94	5E	Print 1 character from symbol set		A-43
ESC _	95	5F	Turn overscore on/off		A-42
ESC a	97	61	NLQ justification	A-30	
ESC b	98	62	Set vertical tabs in channels	A-19	
ESC i	105	69	Turn immediate mode on/off	A-9	
ESC j	106	6A	Perform n/216-inch reverse LF	A-18	
ESC k	107	6B	Select NLQ font	A-22	
ESC l	108	6C	Set left margin	A-19	
ESC p	112	70	Turn proportional mode on/off	A-24	
ESC r	114	72	Select printing color	A-23	
ESC s	115	73	Turn half-speed mode on/off	A-8	
ESC t	116	74	Select character table	A-31	
ESC x	120	78	Select NLQ or draft	A-22	

Epson (ESC/P) Commands

The following section 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

Comments:
Resets the printer mode and clears the buffer of printable data on the print line preceding the command.

Selection

DC1   **select Printer**

Format:
ASCII code:	DC1
Decimal:	17
Hexadecimal:	11

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

Comments:
Puts the printer into the deselected state until select printer code
(DCl) is received. The printer cannot be reselected with the ON LINE
button.

Speed

ESC s Turn Half-speed Mode On/Off

Format:
ASCII code: ESC n
Decimal: 27 115 n
Hexadecimal: 1B 73 n

Comments:
The following values can be used for n:
1: Mode is turned ON.
0: Mode is turned OFF

ESC i   **Turn Immediate Mode On/Off**

Format:
  ASCII   code: ESC   i   *n*
  Decimal: 27   105   *n*
  Hexadecimal: 1B   69   *n*

Comments:
  The following values can be used for *n:*
  1: Mode is turned ON.
  0: Mode 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.

Printing direction

E s c (**Select Unidirectional Mode (one line)**

Format:
  ASCII   code: ESC   (
  Decimal: 27
  Hexadecimal: 1B   3C

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   Turn Unidirectional Mode On/Off

Format:
    ASCII   code: ESC   U   *n*
    Decimal: 27   **85**   *n*
    Hexadecimal: 1B   **55**   *n*

Comments:
    The following values can be used for *n:*
    1: Mode is turned ON.
    0: **Mode** 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

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

Comments:
    Cancels ESC 8. Therefore, the printer beeper sounds and printing
    stops when the printer reaches a point approximately 3/4 of an inch
    from the end of the paper,

ESC EM   Turn Automatic Sheet Feed Mode On/Off

Format:

ASCII	code:	ESC	EM	*n*
Decimal:		27	25	*n*
Hexadecimal:		1B	19	*n*

Comments:

The following values can be used for *n:*

4: Mode is turned ON.

0: Mode is turned OFF

The command should not be used unless the automatic sheet feeder is installed. It is ignored if any value other than "0" or "4" is used for *n.* The command overrides the setting of DIP switch 2-2.

The variables are the characrers "0" (48 decimal or 30 hex) and "4" (52 decimal or 34 hex). Do not use 1 decimal, 01 hex, 4 decimal, or 04 hex.

MSB control

Note: MSB is the Most Significant Bit. MSB control (ESC = , ESC >, and ESC #) does not work for graphics or user-defined characters.

ESC = (equal)   Set MSB to 0

Format:

ASCII code:	ESC	=
Decimal:	27	61
Hexadecimal:	1B	3D

Comments:

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

ESC 〉   **Set MSB to 1**

Format:
    ASCII code: ESC   〉
    Decimal: 27   62
    Hexadecimal: 1B   3E
Comments:
    Sets the MSB bit of all incoming data as 1.

ESC #   **Cancel MSB Control**

Format:
    ASCII code: ESC   #
    Decimal: 27   35
    Hexadecimal: 1B   23
Comments:
    Cancels the MSB control set by ESC = or ESC >.

Beeper

BEL   **Beeper**

Format:
    ASCII code: BEL
    Decimal: 7
    Hexadecimal: 07
Comments:
    Sounds the printer's beeper.

Data Control

CR Carriage Return

Format:
ASCII code: CR
Decimal: 13
Hexadecimal: 0D

Comments:
Prints the data in the buffer and returns the print position to the left margin. A line feed may be added if DIP switch 2-4 is ON or the AUTO FEED XT line on the parallel interface is held LOW.

CAN Cancel Line

Format:
ASCII code: CAN
Decimal: 24
Hexadecimal: 18

Comments:
Removes all text on the print line, but does not affect control codes.

DEL Delete Character

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

Comments:
Removes the last text character on the print line but does not affect control codes.

Command Summary
A-13

Vertical Motion

Form feeding

FF   **Form Feed**

Format:

ASCII code:	FF
Decimal:	12
Hexadecimal:	0C

Comments:

Prints the data in the print buffer and advances the paper to the top of the next form 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

Comments:

Sets the page length to n lines in the current line spacing. The value of n must be from 1-127. The top of form position is set to the current line.

ESC C 0   **Set Page Length in Inches**

Format:

ASCII code:	ESC	C	NUL	n
Decimal:	27	67	0	n
Hexadecimal:	1B	43	00	n

Comments:

Sets the page length to n inches. The value of n must be from 1-22. The top of form position is set to the current line.

ESC N   Set Skip-over-perforation

Format:

ASCII code:	ESC	N	*n*
Decimal:	27	78	*n*
Hexadecimal:	1B	4E	*n*

Comments:

The variable *n* is the number of lines skipped between the last line printed on one page and the first line on the next page. For example, with the standard settings for line spacing (1/6inch), and page length (66 lines), ESC N 6 causes the EX to print 60 lines and then skip 6. DIP switch 2-3 performs the same function. This setting is cancelled by ESC C or ESC C NUL The value of *n* must be from 1-127.

ESC O   Cancel Skip-over-perforation

Format:

ASCII code:	ESC	O
Decimal:	27	79
Hexadecimal:	1B	4F

Comments:

Cancels the skip-over-perforation set by ESC N. Overrides the setting of DIP switch 2-3.

Line feeding

LF   Line Feed

Format:

ASCII code:	LF
Decimal:	10
Hexadecimal:	0A

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

Comments:

Sets the line spacing to 1/8 of an 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

Comments:

Sets the line spacing to 7/72 of an 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

Comments:

Sets the line spacing to 1/6 of an 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 of an inch for subsequent line feed commands. The "3" is the digit three and not ASCII code 3. The value of **n** must be from 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** of an inch for subsequent line feed commands. The value of **n** must be from 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 of an inch. The value of **n** must be from 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:

Reverses the paper by *n/216* of an inch. Note that ESC j should not be used near the end of the paper or when printing self-adhesive labels. If the automatic sheet feeder is selected, this command is ignored.

Vertical tabbing

VT   Tab Vertically

Format:

ASCII code:	VT
Decimal:	11
Hexadecimal:	0B

Comments:

Advances the paper to the next tab setting in the channel selected by ESC /. If no channel has been selected, channel 0 is used. If no vertical tabs have been selected, the paper advances one line.

ESC B   set Vertical Tabs

Format:

ASCII code:	ESC	B	*n1*	*n2*	...	NUL
Decimal:	27	66	*n1*	*n2*	...	0
Hexadecimal:	1B	42	*n1*	*n2*	...	00

Comments:

Sets up to 16 vertical tabs in the current line spacing. Tab settings are not affected by subsequent changes in line spacing. The tab settings are entered as *n1, n2,* etc., all from 1-255, in ascending order. The NUL character indicates the end of the command. All settings are stored in channel 0 (see ESC b). ESC B NUL clears the tab settings.

ESCb

Set Vertical Tabs in Channels

Format:

ASCII code:	ESC	b	c	n1	n2	...	NUL
Decimal:	27	98	c	n1	n2	...	0
Hexadecimal:	1B	62	c	n1	n2	...	00

Comments:

Functions the same as ESC B, except that the variable c selects a
channel for the vertical tabs, which must be between 0-7. Therefore,
up to eight sets of vertical tabs can be set. The channels are selected
by ESC /. To clear the tabs in channel c use ESC b c NUL.

E s c /

Select Vertical Tab Channel

Format:

ASCII code:	ESC	/	c
Decimal:	27	47	c
Hexadecimal:	1B	2F	c

Comments:

This command is used to select the vertical tab channel, with the
value of c from 0-7. All subsequent VT commands use the channel
selected by this command.

Horizontal Motion

Margins

ESC 1

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. 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 doublewidth 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. Settings made in the proportional mode are treated as pica. This command clears previous tab settings and all previous characters in. the print line. The minimum space between the margins is the width of one doublewidth pica character.

Print head movement

BS   Backspace

Format:

ASCII code:	BS
Decimal:	8
Hexadecimal:	08

Comments:

Prints out data in the print buffer, then moves the print position one space to the left. Backspacing can be performed up to, but not beyond, the left margin setting. The BS code is also ignored if ESC a, 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 $ Set Absolute Print 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** x 256). Each unit equals 1/60th of an inch. The sequence is ignored and the previous setting remains effective if the position specified is beyond the right margin.

ESC\   **Set Relative 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 position) at which printing of following data will start. To find **n1** and *n2,* first calculate the displacement required in 1/12Oths of an inch. If the displacement is to the left, subtract it from 65536. Send the resulting number using this formula: total number of dots = **n1 + (256 x n2).** The command is ignored if it would move the print position outside the current margins.

Horizontal tabbing

HT   **Tab Horizontally**

Format:

ASCII code:	HT
Decimal:	9
Hexadecimal:	09

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.

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

C̃omments:

This command allows setting of up to 32 horizontal tabs, which are entered as *n1,* n2, *n3,* etc. (from 1-137) 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, and 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*

Comments:

The following values can be used for *n:*

0: Selects the draft mode.

1: Selects the Near Letter Quality (NLQ) mode.

ESC k   Select NLQ Font

Format:

ASCII code:	ESC	k	*n*
Decimal:	27	107	*n*
Hexadecimal:	1B	6B	*n*

Comments:

This command affects only the Letter Quality typestyle, not draft.

The following values can be used for *n:*

0 = Roman

1 = Sans Serif

ESC r   Select Printing Color

Format:
ASCII code:	ESC	r	*n*
Decimal:	27	114	*n*
Hexadecimal:	1B	72	*n*

Comments:
If the color option unit is installed, the variable **n** selects the printing
color according to the table below.

n **Color**	*n* **Color**
0 Black	**4** Yellow
1 Red	**5** Orange
2 Blue	**6** Green
3 Violet	

Esc !   Master Select

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

Comments:
Selects any valid combination of the modes in the table below. The
variable **n** is determined by adding together the values of the desired
modes from the table.

Table A-1. Master Select numbers

Mode	Decimal	Hexadecimal
Pica	0	00
Elite	1	01
Proportional	2	02
Condensed	4	04
Emphasized	8	08
Double-strike	16	10
Double-width	32	20
Italic	64	40
Underline	128	80

Pica cannot be combined with elite, and proportional cannot be
condensed. If both proportional and condensed are selected,
proportional overrides condensed.

Print Size and Character Width

ESC P   Select Pica Pitch

Format:

ASCII code:	ESC	P
Decimal:	27	80
Hexadecimal:	1B	50

Comments:

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

ESC M   Select Elite Pitch

Format:

ASCII code:	ESC	M
Decimal:	27	77
Hexadecimal:	1B	4D

Comments

Selects elite pitch (12 characters per inch).

ESC p   Turn Proportional Made On/Off

Format:

ASCII code:	ESC	p	n
Decimal:	27	112	n
Hexadecimal:	1B	70	n

Comments:

The following values can be used for n:

1: Mode is turned ON.

0: Mode 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 appear in Appendix B. This command overrides condensed.

SI   Select Condensed Mode

Format:
    ASCII   code: SI
    Decimal: 15
    Hexadecimal: 0F

Comments:
    Prints characters at about 60 per cent 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

Comments:
    Cancels condensed printing set by SI, ESC SI, SelecType, or DIP
    switch 1-l.

SO   Select Double-width Mode (one line)

Format:

ASCII code:	SO
Decimal:	14
Hexadecimal:	0E

Comments:

Double-width mode doubles the width of all characters. This mode is cancelled by a carriage return or DC4.

ESC SO   Select Double-width Mode (one line)

Format:

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

Comments:

Duplicates the SO command.

DC4   Cancel Double-width Mode (one line)

Format:

ASCII code:	DC4
Decimal:	20
Hexadecimal:	14

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*

Comments:

The following values can be used for *n:*

1: The mode is turned ON.

0: The mode is turned OFF

Double-width mode doubles the width of all characters.

Print Enhancement

ESC E   Select Emphasizing Mode

Format:

ASCII code:	ESC	E
Decimal:	27	69
Hexadecimal:	1B	45

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

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

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

Comments
Turns off the double-strike mode selected by ESC G.

ESC SO   **Select Superscript Mode**

Format:
ASCII code:	ESC	S	NUL
Decimal:	27	83	0
Hexadecimal:	1B	53	0

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

ESC S 1 — Select Subscript Mode

Format:

ASCII code:	ESC	S	SOH
Decimal:	27	83	1
Hexadecimal:	1B	53	1

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

Comments:

Cancels either superscript or subscript.

ESC - — Turn Underlining Mode On/Off

Format:

ASCII code:	ESC	—	n
Decimal:	27	45	n
Hexadecimal:	1B	2D	n

Comments:

The following values can be used for n:

1: Mode is turned ON.

0: 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

Comments:

The following values can be used for n:

0: Selects left justification.
1: Selects centering.
2: Selects right justification.
3: Selects full justification.

The default setting is $n = 0$. Full justification $(n = 3)$ is performed when the buffer becomes full; HT and BS are invalid except in $n = 0$ mode. For $n = 3$ there must be no carriage returns within a paragraph. Justification can be used in NLQ only not draft.

ESC SP (space)   Set Intercharacter Space

Format:

ASCII code:	ESC	SP	n
Decimal:	27	32	n
Hexadecimal:	1B	20	n

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 units of space is equal to n, which should be from 0-63. Each unit of space is 1/120th of an inch.

Character Sets

ESC t	Select Character Table

Format:

ASCII code:	**ESC**	**t**	*n*
Decimal:	**27**	**116**	*n*
Hexadecimal:	**1B**	**74**	*n*

Comments:

Selects the character table used by codes 128-255. Selecting Epson Character Graphics does not disable italic printing. Italic printing can still be selected by ESC 4. The following values can be used for *n:*
0: Selects italics.
1: Selects Epson Character Graphics.

Duplicates the function of DIP switch 1-3. Note that the value of *n* must equal 00 hex or 01 hex.

ESC 4	Select Italic Mode

Format:

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

Comments:

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

ESC 5	Cancel Italic Mode

Format:

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

Comments:

Cancels the 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:
See Appendix B for full information on international character sets.
The following values can be used for n:

0 = USA	5 = Sweden	9 = Norway
1 = France	6 = Italy	10 = Denmark II
2 = Germany	7 = Spain	11 = Spain II
3 = UK	8 = Japan	12 = Latin America
4 = Denmark I		

User-defined Characters

Note: See Chapter 6 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 currently
selected 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
ESC & is required to define the character set. The following values
can be used for *n:*
0: Selects the normal set.
 1: Selects the user-defined set.

ESC 6   Printable Code **Area Expansion**

Format:
ASCII code:	ESC	6
Decimal:	27	54
Hexadecimal:	1B	36

Comments:
Enables the printing of codes 128 through 159 (decimal) as
characters, not control codes, which allows the use of these
characters for user-defined characters.

Esc 7   **Cancel ESC 6**

Format:
ASCII code:	ESC	7
Decimal:	27	55
Hexadecimal:	1B	37

Comments:
This code causes codes 128 through 159 to be treated as control
codes. This is the default.

ESC I   **Printable Code Area Expansion**

Format:

ASCII code:	ESC	I	*n*
Decimal:	27	73	*n*
Hexadecimal:	1B	49	*n*

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 userdefined characters. If n = 0, this command returns 0 to 31 and 128 to 159 to non-printable codes.

Graphics

Note: See Chapter 6 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 eight-pin singledensity graphics mode. The total number of columns = $n1 + (n2 \times 256)$.

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 eight-pin low-speed double-density graphics mode. The total number of columns = $n1 + (n2 \times 256)$.

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 eight-pin high-speed doubledensity graphics mode. The total number of columns = $n1 + (n2 \times 256)$.

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 eight-pin quadrupledensity graphics mode. The total number of columns = $n1 + (n2 \times 256)$.

ESC*   Select Graphics Mode

Format:

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

Comments:

Turns on graphics mode *m.* See the table below for details on the available modes. The total number of columns = $n1 + (n2 \times 256)$.

Table A-2. Graphics Modes

Option	Alternate Code	*m*	Horiz. density (dots/in.)
Single-density	ESC K	0	60
Double-density	ESC L	1	120
High-speed double-density*	ESC Y	2	120
Quadruple-density*	ESC Z	3	240
CRT I	none	4	80
Plotter (1:1)	none	5	72
CRT II	none	6	90
Double-density plotter	none	7	144

*Adjacent dots cannot be printed in this mode.

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 is 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*	*nl*	*n2*
Decimal:	**27**	**94**	*m*	*nl*	*n2*
Hexadecimal:	**1B**	**5E**	*m*	*nl*	*n2*

Comments:

Turns on 9-pin Graphics Mode. The variable **m** defines density of print (0 for single and 1 for double). The total number of columns = **nl** + **(n2** x 256). This mode requires two data items for each column of print.

IBM Printer Emulation Mode Commands

The Epson mode and the IBM printer emulation mode share many of the same commands. Therefore, this part of the summary merely lists and does not describe the commands already described in the Epson mode command summary The commands that are different are described in detail.

Commands that Duplicate 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 0, 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

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

Commands that Are Different from Epson Commands

Printer Operation

<u>ESC Q3</u>   **Deselect Printer**

Format:

ASCII code:	ESC	Q	ETX
Decimal:	27	81	3
Hexadecimal:	1B	51	03

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.

Vertical Motion

<u>ESC A</u>   **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 from 0-85.

ESC 2   Select Programmable Line Spacing

Format:

ASCII code:	ESC	2
Decimal:	27	50
Hexadecimal:	1B	32

Comments:

Executes 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 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 from 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 OFF

ESC 4   Set Top of Form

Format:
  ASCII code: ESC   4
  Decimal: 27   52
  Hexadecimal: 1B   34

Comments:
  Sets the current position as top of form.

ESC 5   Turn Automatic Line Feed On/Off

Format:
  ASCII code: ESC   5   *n*
  Decimal: 27   53   *n*
  Hexadecimal: 1B   35   *n*

Comments:
  The following values can be used for *n:*
  1: Mode is turned ON.
  0: Mode is turned OFF

  If the mode is on, the printer adds a line feed to each carriage return.
  If the mode is off, it does not. This command duplicates the function
  of DIP switch 2-4.

Horizontal Motion

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 are every eight characters. The tab settings change if the character pitch is changed, except that doublewidth has no effect on the tab positions.

ESC R   Restore Default Tab Settings

Format:

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

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*

Comments:

When *n=0,* the standard draft font is selected, when *n=2,* the standard NLQ font is selected. When *n=4,* a user-defined font is selected; when *n* = 6, a userdefined NLQ font is selected.

Print Size/ Width/Enhancements

ESC: **Select Elite Pitch**

Format:

ASCII code:	ESC	:
Decimal:	27	58
Hexadecimal:	1B	3A

Comments:

Elite pitch has 12 characters per inch.

DC2   **Cancel Condensed/Elite**

Format:

ASCII code:	DC2
Decimal:	18
Hexadecimal:	12

Comments:

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

ESC _   **Turn Overscore On/Off**

Format:

ASCII code:	ESC	_	n
Decimal:	27	95	n
Hexadecimal:	1B	5F	n

Comments:

The following values can be used for *n:*
1: Mode is turned ON.
0: Mode is turned OFF

Character Sets

ESC 6   Select International Character Set

Format:

ASCII code:	ESC	6
Decimal:	27	54
Hexadecimal:	1B	36

Comments:

Selects the international character set (Table 2). See the character set tables in Appendix B.

Esc 7   **Select Standard Character Set**

Format:

ASCII code:	ESC	7
Decimal:	27	55
Hexadecimal:	1B	37

Comments:

Selects standard character set (Table 1) if international character set (Table 2) has been previously selected. See the character set tables in Appendix B.

*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 symbol set. The number of characters = *n1* + *(n2* x 256). See the character tables in Appendix B for the symbol set and the codes to use for data.

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 in Appendix B for the symbol set and the codes to use for c.

User-Defined Characters

ESC=					**Define User-defined Characters**

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,

$B = (C \times 13) + 2$

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

The data numbers for each character are determined as shown on the grid for the Epson mode on page 6-4. To print a user-defined character, you must use ESC I, which is described on page A-41.

Appendix B

Character Tables

This appendix contains tables of the complete Epson mode character set, including the extra characters for the 13 Epson international character sets, and the IBM printer emulation mode character sets. The tables give a printout of each character, the codes in decimal and hexadecimal, and the proportional width of each character.

Epson Mode

The first half of the Epson mode table covers the standard ASCII character codes from 0 to 127. 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. The Epson character graphics are selected by ESC t or DIP switch 1-3. Where appropriate, two proportional widths are shown, one for the normal character and one for the italic form.

Table B-1. Epson mode characters

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

Table B-1, continued

Dec	Hex	Character	Width	Dec	Hex	Character	Width
32	20	SP	12	64	40	@	12
33	21	!	5	65	41	A	12
34	22	"	8	66	42	B	12
35	23	#	12	67	43	C	12
36	24	$	12	68	44	D	12
37	25	%	12	69	45	E	12
38	26	&	12	70	46	F	12
39	27	´	5	71	47	G	12
40	28	(	6	72	48	H	12
41	29	)	6	73	49	I	8
42	2A	*	12	74	4A	J	11
43	2B	+	12	75	4B	K	12
44	2C	,	7	76	4C	L	12
45	2D	–	12	77	4D	M	12
46	2E	.	6	78	4E	N	12
47	2F	/	10	79	4F	O	12
48	30	0	12	80	50	P	12
49	31	1	8	81	51	Q	12
50	32	2	12	82	52	R	12
51	33	3	12	83	53	S	12
52	34	4	12	84	54	T	12
53	35	5	12	85	55	U	12
54	36	6	12	86	56	V	12
55	37	7	12	87	57	W	12
56	38	8	12	88	58	X	10
57	39	9	12	89	59	Y	12
58	3A	:	6	90	5A	Z	10
59	3B	;	6	91	5B	[	8
60	3C	<	10	92	5C	\	10
61	3D	=	12	93	5D	]	8
62	3E	>	10	94	5E	^	12
63	3F	?	12	95	5F	_	12

Table B-1, continued

Dec	Hex	Character	Width
96	60	`	5
97	61	a	12
98	62	b	11
99	63	c	11
100	64	d	11
101	65	e	12
102	66	f	10
103	67	g	11
104	68	h	11
105	69	i	8
106	6A	j	9
107	6B	k	10
108	6C	l	8
109	6D	m	12
110	6E	n	11
111	6F	o	12
112	70	p	11
113	71	q	11
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**	

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

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
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
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	

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
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	
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	

Decimal	Hex	Italic character	Width	Graphics character	Widths: normal	italic
224	E0	`	5	α	12	12
225	E1	*a*	11	β	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	ø	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

Twelve character codes between 35 and 126 can represent more than one character each, depending upon the international character set you select. You can make the choice either by setting DIP switches 1-6 through 1-8 or by using the ESC R command.

The table below shows all 13 character sets, together with the number to use with ESC R to select each one. The DIP switch combinations to select any of the first eight character sets are in Appendix E.

Note that once a character set has been selected, italic versions of these characters can also be printed by using the ESC 4 command.

Table B-2. Epson 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-3. Proportional widths of international characters

Characters	Widths:		Characters	Widths:	
	Normal	Italic		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	A	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 section 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 143 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.

To print characters from the symbol set use either the ESC ˆ command or ESC \. For example, to print the symbol 1 in BASIC the command is as follows:

```
LPRINT CHR$(27);"^";CHR$(2Ø);
```

If you use ESC ˆ or ESC\ to send a non-printable code, a blank is printed.

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

Table B-4. IBM printer emulation mode characters

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	∅	12

Dec	Hex	Character	Width	Dec	Hex	Character	Width
32	20	**SP**	12	64	40	@	12
33	21	!	5	65	41	A	12
34	22	"	8	66	42	B	12
35	23	#	12	67	43	C	12
36	24	$	12	68	44	D	12
37	25	%	12	69	45	E	12
38	26	&	12	70	46	F	12
39	27	´	5	71	47	G	12
40	28	(	6	72	48	H	12
41	29	)	6	73	49	I	8
42	2A	*	12	74	4A	J	11
43	2B	+	12	75	4B	K	12
44	2C	,	7	76	4C	L	12
45	2D	−	12	77	4D	M	12
46	2E	.	6	78	4E	N	12
47	2F	/	10	79	4F	O	12
48	30	0	12	80	50	P	12
49	31	1	8	81	51	Q	12
50	32	2	12	82	52	R	12
51	33	3	12	83	53	S	12
52	34	4	12	84	54	T	12
53	35	5	12	85	55	U	12
54	36	6	12	86	56	V	12
55	37	7	12	87	57	W	12
56	38	8	12	88	58	X	10
57	39	9	12	89	59	Y	12
58	3A	:	6	90	5A	Z	10
59	3B	;	6	91	5B	[	8
60	3C	<	10	92	5C	\	10
61	3D	=	12	93	5D	]	8
62	3E	>	10	94	5E	^	12
63	3F	?	12	95	5F	_	12

Table B-4, continued

Dec	Hex	Character	Width
96	60	`	5
97	61	a	12
98	62	b	11
99	63	c	11
100	64	d	11
101	65	e	12
102	66	f	10
103	67	g	11
104	68	h	11
105	69	i	8
106	6A	j	9
107	6B	k	10
108	6C	l	8
109	6D	m	12
110	6E	n	11
111	6F	o	12
112	70	p	11
113	71	q	11
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

Table B-4, continued

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

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
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	a̲	a̲	12
167	A7	o̲	o̲	12
168	A8	¿	¿	12
169	A9	⌐	⌐	12
170	AA	¬	¬	12
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

Table B-4, continued

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
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
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

Decimal	Hex	Standard (CG Table 1)	International (CG Table 2)	Width
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	ø	ø	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

The Serial Interface

This appendix has the information you need to use the EX's built-in serial interface. It includes DIP switch settings, problem solving, and technical specifications. The information on the built-in parallel interface is in Chapter 1 and Appendix G, and the information on optional interfaces is in Appendix E

WARNING

Two interface cables should not be plugged into the printer at the same time. This may damage your printer.

The most important thing to keep in mind about using a serial interface is that the serial settings on the printer, computer, and software must all be the same for your EX to print properly Therefore, when you change the setting on one, you must be sure that it matches the settings on the others.

The DIP Switches

After you have connected your computer to the built-in serial interface of the EX, the first thing you need to do is change or check the settings of several DIP switches. Four of the 16 DIP switches on the EX control the built-in serial interface.

Serial communication has four characteristics. Two of these cannot be changed in the EX serial interface and must be set on the computer and software. The number of start bits is fixed at one, and the computer must match this setting. The number of stop bits can be one or more- you should normally choose one.

The remaining two characteristics can be set on the printer. They are baud rate and parity

The baud rate (which is the speed that data can be received by the printer) is set for 9600 at the factory Do not change that setting unless your computer or software manuals suggest another setting or unless your printing is not reliable at that setting. Always remember to set the same speed on the computer and the printer

---

For the parity setting you have three choices: odd, even, or non-parity Use either odd or even unless your computer requires non-parity Again, be sure that the settings on your printer and computer match.

Setting the Switches

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

Table C-1. Interface type

Interface	Parity	DIP switch 2-5 2-6
built-in parallel or any option	—	OFF OFF*
built-in serial	odd	OFF ON
built-in serial	even	ON OFF
built-in serial	none	ON ON

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. Therefore, if you use the serial interface only occasionally you can still leave these switches set the way you want them.

Table C-2. Baud rate settings

Baud rate	DIP switch 2-7 2-8	
9600	OFF	OFF
4800	OFF	ON
1200	ON	OFF
300	ON	ON

Note: Shaded items are the factory settings

Troubleshooting for Serial Interfaces

Problem	Recommendation
Printer prints one character then stops	The EX uses the DIR 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.
READY light flickers but nothing is printed	Data is getting through to the printer although it is not being printed. Make sure that both the printer and computer are using the same baud rate, number of start and stop bits, and the same parity
All printing is garbled	Make sure that both the computer and printer are set to use the same number of data bits per word (8) and that they both use the same parity, baud rates, and number of start and stop bits.

Serial Interface Specifications

The EX built-in 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(O) +3V 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 C-3. Serial interface pins

Pin number	Signal	Signal direction	Description
1	TXD	out	Transmits data for X-on/X-off
2	REV	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 as shown in Figure C-l. (The figure shows the
view from the back of the printer.)

Figure C-1.
Serial interface
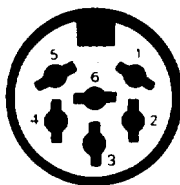
Problem Solving and Maintenance

This appendix presents solutions for possible problems, explanations of the EX's advanced features, and tips on maintaining and transporting your printer.

General Troubleshooting

Problem	Recommendation
Printer does not print	Make sure that the printer is turned on and is on line. Both the POWER and ON LINE lights should be on.
	Make sure that the printer and computer are connected. Be certain you are using the correct cable.
	Make sure the printer is connected to only one interface.
	If the program you are using allows you to choose between screen output and printer output, see that you have selected printer output.
	If the printer still does not print, try the self test procedure (see Chapter 1). If the self test works correctly, the printer is all right, and the problem lies elsewhere. If the self test doesn't work, contact your dealer.

Problem	Recommendation
Printing is patchy, faint, uneven, or intermittent	Check that the ribbon is seated correctly and that the pins at either side are located properly in the holes in the ribbon carriage.
	Check that the ribbon moves freely in the cartridge.
	If you have been using the ribbon for a long time or for a large amount of printing, it may need replacing.
	It is also possible for the print head to wear out if the printer is used frequently and for long periods at a time. 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.
	If you have removed the color option kit, consult the user's guide to check that the ribbon carriage is set correctly
All the text is printed on the same line or text is printed with an extra blank line between	This can usually be corrected by changing the setting of DIP switch 2-4. If that does not solve the problem, you may need a different cable.
Some of the characters printed do not match those in the file	If they are international characters, check the settings of DIP switches 1-6 to 1-8. If they are graphics characters, see that your software is correctly installed and that you have correctly set DIP switches 1-3 and 1-4.
Paper feeding problems	See Chapter 2 for specific instructions on loading paper
Regular gaps appear in printouts	Check the settings of DIP switches 2-1 and 2-3 to ensure that you've selected the correct paper size and that skip-over-perforation is OFF:

Problem	Recommendation
Self test pattern is garbled	If the test pattern did not print as shown in Chapter 1, 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
Beeper sounds and printer stops	If the READY light is off and the ON LINE light is flashing, the EX has stopped to allow the head to cool. Printing will soon resume; you do not have to do anything to restart it. If the ON LINE light is not flashing, turn the printer off and see that it is not out of paper and that the paper is loaded correctly Then turn the printer back on and try again. If the printer beeps and does not print again, take it to a qualified service Person.

Troubleshooting Graphics Problems

Problem	Recommendation
Strange dot patterns appear in graphics printouts	Many computers have problems sending one or more of the codes between 0 and 13. Try to avoid these characters if possible. 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.
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.

Data Dump Mode

The EX has a special feature that makes it easy for experienced printer users to find the causes of problems. The hexadecimal (hex) or data dump mode gives a printout of exactly what codes reach the printer.

Enter this mode by turning on the printer while holding down the **FORM FEED and LINE FEED buttons** at the same time. Then, when you run a program, either an application program or one you have written in any programming language, the EX prints all the codes being sent to the printer in hexadecimal format.

If the characters are printable, they appear in the column on the right as their true ASCII characters, as shown below. Non-printable codes, such as control codes, are shown in this column as a dot. The far left column of the table contains four-digit line numbers.

```
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 data dump above was made while writing this appendix. By comparing the column of characters at the right with the printout of hex codes, you can see that the capital A (for Appendix) in the third row, was printed as 41. You can use the table of character codes (Appendix B) to find out what character corresponds to each code.

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 the command, look at the next character, 40 hex (@), and refer to the numerical list of commands in Appendix B.

In this way you can quickly determine that prior to 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
ESC R 0	Select USA character set
ESC t 1	Select Epson Character Graphics
ESC 6	Printable code expansion
DC2	Cancel condensed mode
ESC P	Select pica
ESC p 0	Cancel proportional
BEL	Sound beeper

If you find code-s in your data dump that you did not enter in your program or codes you did not expect your application program to send, your computer may be changing the codes before sending them to the printer. If so, you need to adjust the program.

Data dump mode can be turned off by turning off the printer; it is also cancelled by an INIT signal from the computer.

Solutions for IBM and Compatibles

If you suspect that your computer or software is causing a problem, consult your user's manuals for those products. Some problems may arise when using operating system commands or writing your own programs in the computer's resident language. Some general advice for IBM PC and compatible users is offered in this section.

IBM PC BASIC Solutions

IBM PC BASIC inserts a carriage return and line feed (CR-LF) after each SO 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 statement or a character definition. To do this, use the OPEN statement to assign a file number to the printer (LPTl:) 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.

Maintaining 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 (5 C to 35 C).

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). 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 deafer 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.

- Move the print head to the left and replace the print head protector

- Remove the paper rest and paper guide and pack them separately

- Fix the dust cover in place with tape.

- Remove the paper feed knob.

- Pack the printer in the original foam packing supports and box.

- If the color option kit is installed, remove it, using the instructions in its user's guide.

Problem Solving and Maintenance

Appendix E

Defaults and DIP Switches

This appendix lists all of the default settings and lists and explains the settings of all the DIP switches.

Default and Initialization Settings

The EX can be initialized (returned to a fixed set of conditions) in three different ways: when it is turned on, when it receives an INIT signal at the parallel interface (pin 31 becomes LOW), and when it receives the ESC @ command.

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 print line 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 form 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 INIT signal, the data buffer is cleared of all text.

ESC @ resets the typestyle to the current SelecType settings, but 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.
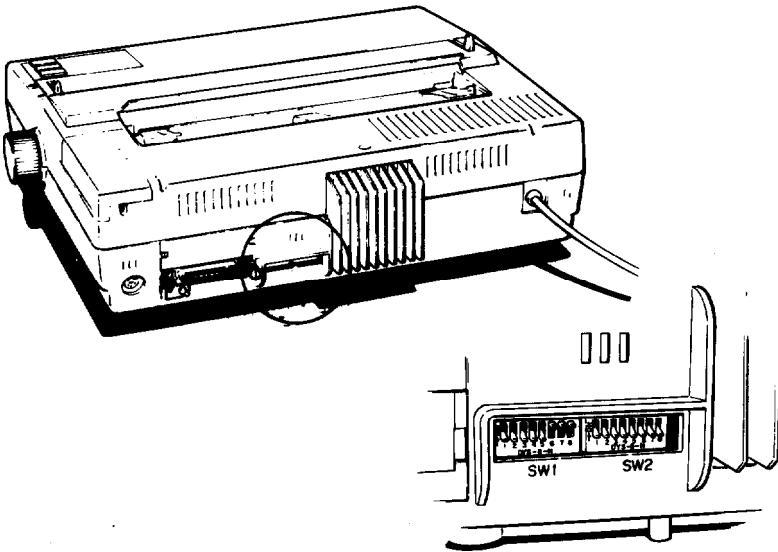
DIP Switch Settings

The EX has sixteen DIP (Dual In-line Package) switches that allow you to change many of the printer's settings to suit your individual needs. The DIP switches are in two groups of eight, mounted on the back panel, as shown in Figure E-l.

Each set of switches is numbered from 1-8 so that DIP switch l-l is the switch at the far left side and the one at the far right is DIP switch 2-8. You can easily reset the switches with a thin, pointed object such as a small screwdriver or the cap of a ballpoint pen.

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 recognizes new settings only at the time the power is turned on.

Figure E-1.
DIP switch location

The following tables describe the switches and their functions. In each case the shaded settings are those set at the factory

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 wide selection of options.

Table E-1. DIP switch group1

Switch number	Function	Action when ON	Action when OFF
1-1	Select condensed or normal characters	Condensed	
1-2	Select slashed or unslashed zero	0	
1-3	Select character table*	Graphics	
1-4	Select printer commands	IBM printer emulation mode	
1-5	Select print quality	NLQ	
1-6 1-7 1-8	Select international character set	See Table E-3	

*In IBM printer emulation mode, a CR is added to an LF or ESC J if this switch is OFF.

Table E-Z. DIP switch group 2

Switch number	Function	Action when ON	Action when OFF
2-1	Select page length	12 inch	
2-2	Select automatic sheet feeder mode	Selected	
2-3	Skip-over-perforation	1 inch	
2-4	Add line feed after carriage return	CR + LF	
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	

Note: Shaded items are the factory settings.

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 in the Command Summary For the characters available in each character set, see Appendix B.

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 in Appendix B. There is also a command to let you print any of the characters in the international character set and seven 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 shown in Table E-3.

Table E-3. International settings

Epson mode character set	DIP switch settings			IBM printer emulation mode
	1-6	1-7	1-8	
USA	ON	ON	ON	Standard
French	ON	ON	OFF	International
German	ON	OFF	ON	International
UK	ON	OFF	OFF	International
Danish	OFF	ON	ON	International
Swedish	OFF	ON	OFF	International
Italian	OFF	OFF	ON	International
Spanish	OFF	OFF	OFF	International

Note: Shaded items are the factory settings.

Interface Selection

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	—	OFF OFF
built-in serial	odd	OFF ON
built-in serial	even	ON OFF
built-in serial	none	ON ON

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. Therefore, if you use the serial interface only occasionally, you can still leave these switches set as you want them.

Table E-5. Baud rate for built in interface

Baud rate	DIP switch 2-7 2-8
9600	OFF OFF
4800	OFF ON
1200	ON OFF
300	ON ON

Note: Shaded items are the factory settings.

Appendix F

Choosing and Setting Up Optional Interfaces

This appendix contains information on Epson interfaces compatible with EX printers, instructions on choosing the right interface for a particular job, and instructions for installing internally mounted interface boards.

Compatible Interfaces

You can use a number of optional interfaces that supplement the EX's built-in parallel and serial interfaces and the standard 8K 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. Note that some of these are no longer available, and that others are not available in all countries.

#8131	Apple II 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	32K buffer serial interface
#8149M	128K buffer serial interface
#8161	IEEE-488 interface
#8165	Intelligent IEEE-488 interface
#8172	32K buffer parallel interface
#8172M	128K buffer parallel interface

If you are using an optional internal interface, set DIP switches 2-5 and 2-6 OFF and do not connect anything to the parallel interface.

Choosing an Interface

This section describes the interfaces.

IEEE-488 and Apple interfaces

The IEEE-488 system allows you to connect computers, printers, and other peripherals so that they can share data freely Epson offers two - types of IEEE438 interfaces. The #8161 offers the basic ability to operate in the IEEE-488 address and listen-only modes. The #8165 has the basic features and an 8K **data** buffer and a line monitor function, which provides a diagnostic printout of IEEE-488 commands.

The Apple II, II + and IIe computers do not have a printer interface as a standard feature. Epson produces a parallel interface board for the Apple, which has software to control the functions of the printer. With the #8131 interface installed in the Apple, no additional interface is needed in the printer. An Apple IIc requires only a suitable cable for use with the EX.

Buffered interfaces

If you often print very large amounts of text, a buffered interface can free the computer for other tasks. Serial and parallel buffered interfaces are available to increase the printer's data buffering capacity to either 32K or 128K (about 20 and 80 pages). See Table F-l.

Table F-1. Buffered Interfaces

	Serial	Parallel
32K:	#8149	#8172
128K:	#8149M	#8172M

The built-in serial interface on EX printers is suitable for almost all applications. If, however, 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.

Three Epson serial interfaces are 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 choice of other features, which are listed in Table F-2.

Table F-2. Serial interface

	#8143	#8145	#8148
X-on/X-off control	yes	no	yes
Self test	no	loopback	loopback/line monitor
Built-in data buffer	none	2K	2/8K

X-on/X-off protocol is a system in which the printer transmits a code to the computer to indicate that it cannot accept more data, and a second code when it is once more ready

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.

Identifying a serial interface board

All Epson interfaces have the EPSON name printed on them. If the board has an identification code printed on it, it will be a four digit number beginning with an eight. The number should be one of the numbers in Table F-3.

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 Table F-3.

Table F-3. 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 installing an interface, you must remove the printer's cover,

WARNING
Do not remove the cover unless the printer is turned OFF because high voltages are present inside the printer when the power is on. Also do not touch contacts on the circuit board of the printer because many of the components can be destroyed by the static electricity charge that may build up on your body

1. Turn off the power to both the printer and the computer and unplug the power cable and disconnect the interface cable from the printer.

2. Remove the dust cover and paper guide.

3. Remove the automatic 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 holding the upper casing of the printer (shown in Figure F-l), using a cross-head type screwdriver.

Figure F-1.
Removing the screws
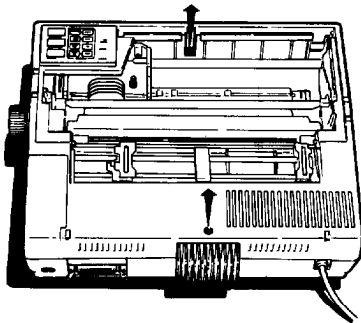
Figure F-2.
Unclipping the control panel
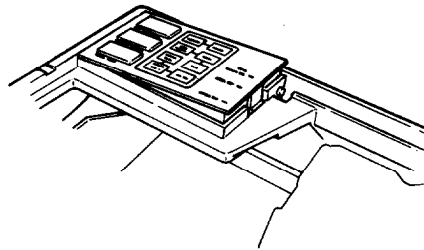
6. With the printer facing you, unclip the left side of the control panel and lift it up slightly to release it from the case (Figure F-2).

7. At each side of the front panel there is a retaining clip, as shown in Figure F-3. One 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.

8. Tilt the upper case up and slip the control panel through the opening as shown in Figure F-4, being careful not to strain the connector linked to the control panel.

9. Lift the upper case to release the hinges at the rear edge, then lift it away from the printer

    After you have removed the case, you can then follow the directions in the next section on inserting the interface board. After you have inserted the board, you replace the case by reversing steps 2 to 9.

Figure F-3.
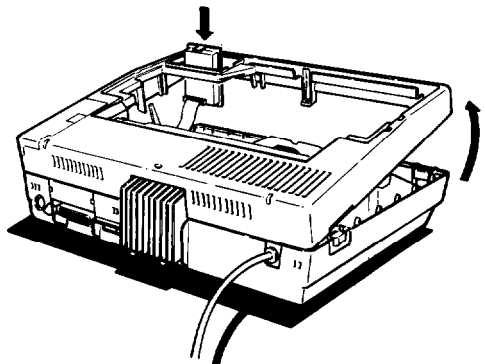Location of retaining clips
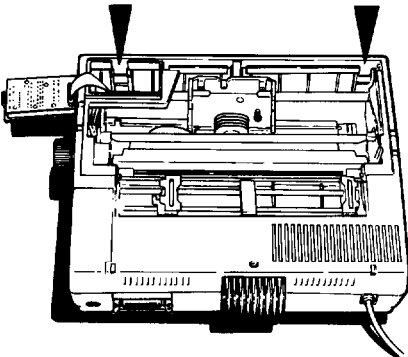
Figure F-4.
Removing the case

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 (as shown in Figure F-5) to allow access to the new interface connector when the case is reassembled.

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 also shown in Figure F-5. The screw marked FG is the connection for the frame ground wire. Connect the frame ground wire before inserting the interface.

4. Insert the interface board beneath the printer mechanism, as indicated by the lines in Figure F-6, and plug it into the connector marked CN2 on the main circuit board of the printer.

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 Figure F-7.

7. Reassemble the printer, reversing the procedure described in the previous section.

Figure F-5.
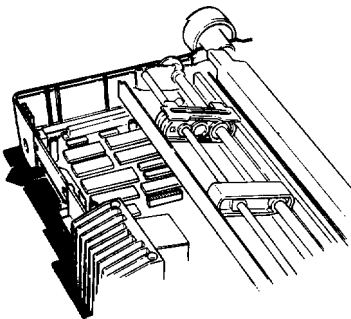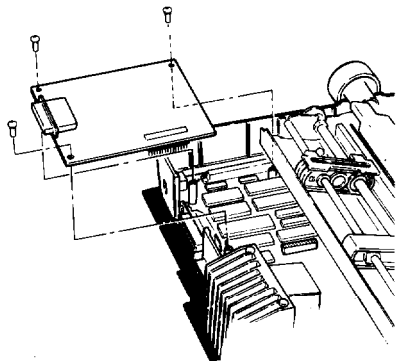*FG screw and blanking plate*

Figure F-6.
Inserting the board

Serial Interface Settings

   If you are using an optional serial interface, you may need to change
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, change the settings on the computer rather than the
interface board because 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 do need to change 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 settings described here. The other
settings are described in the manual supplied with the interface.

Figure F-7.
Connecting frame ground wire
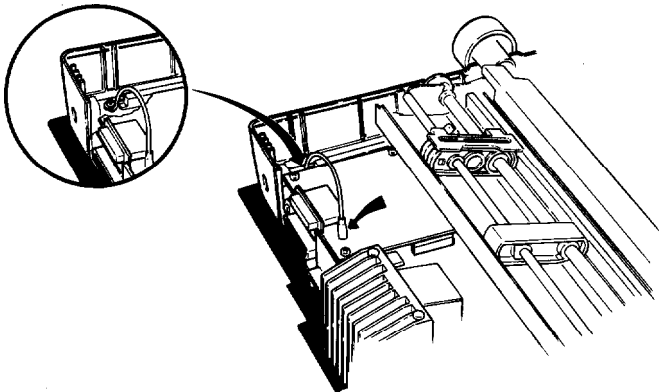
The three following tables contain all the information you need for the optional interface settings.

Table F-4. Baud rate setting

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

Table F-5. Baud rate setting 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

Table F-6. 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 G

Technical Specifications

This appendix contains the specifications for the EX-800 and the EX-1000, including the built-in parallel interface. For the specifications for the built-in serial interface, see Appendix C.

Printing

Printing method
    Impact dot matrix

Printing speed
    300 characters per second in draft elite,
    250 characters per second in draft pica,
    and 50 characters per second in Near Letter Quality pica

Paper feed speed
    Approximately 81 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 in NLQ Roman. The widths and characters per inch (CPI) are given below:

Mode	Width (mm)	CPI
Pica	2.1	10
Elite	2.1	12
Condensed Pica	1.05	17
Condensed Elite	1.05	20

Line spacing
    l&inch, or programmable in increments of 1/216th of an inch.

Paper

Number of copies
 Up to 3 sheets, including the original. Total thickness not to exceed
 0.16mm

Paper width
 Continuous feed   4" to 10"
 Single-sheet   7.15" to 8.5"
 Roll   8.5"

Mechanical

Ribbon
 Cartridge, exclusive to EX, black (#8763) or color (#8764)

 Life expectancy (in characters, at 14 dots/character):

  Black only: 3 million
  Color:
   Black: 2 million
   Red: 1 million
   Blue: 1 million
   Yellow: 1 million

MCBF
 5 million lines (excluding the print head)

Print head life
 100 million characters, at 14 dots/character

Dimensions and Weight

	EX-800	Ex-1000
Height:	4.7 in.	4.8 in.
Width (with paper feed knob):	17.6 in.	24.3 in.
Depth:	14.9 in.	15.3 in.
Weight:	22.0 lbs.	25.1 Ibs.

Electrical

Voltage:
  120V AC

Consumption
  120 VA

Frequency
  49.5 Hz - 60.5 Hz

Insulation resistance
  10 Mohms between AC power line and chassis

Dielectric strength
  Can withstand 1 kV rms applied between AC line and chassis for 1
  minute, or 1.25 kV rms for 1 second

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 lms
  Storage: Up to 2 G within lms

Vibration
  Operation: Up to 0.1 G at up to 55Hz
  Storage: Up to 0.5 G at up to 55Hz

Parallel Interface

WARNING

Two interface cables should not be plugged into the printer at the same time. This may damage your printer.

For the specifications of the serial interface, see Appendix C.

Connector pin assignments and a description of respective interface signals are shown in Table G-1.

Table G-1. Pins and signals

Signal Pin	Return Pin	Signal	Direc- tion	Description
1	19	STROBE	IN	STROBE pulse to read data in. Pulse width must be more than 0.5 microseconds at the receiving terminal.
2 3 4 5 6 7 8 9	20 21 22 23 24 25 26 27	DATA 1 DATA 2 DATA 3 DATA 4 DATA 5 DATA 6 DATA 7 DATA 8	IN IN IN IN IN IN IN IN	These signals represent information of the 1st to 8th bits of parallel data, respectively. Each signal is at HIGH level when data is logical 1 and LOW when it is logical 0.
10	28	ACKNLG	OUT	Approximately, 12-microsecond pulse. LOW indicates that data has been received and that the printer is ready to accept more data.
11	29	BUSY	OUT	A HIGH signal indicates that the printer cannot receive data. The signal goes HIGH in the following cases: 1) During data entry (ea. char. time) 2) During printing 3) When Off-Line 4) During printer-error state
12	30	PE	OUT	A HIGH signal indicates that the printer is out of paper.
13	—	SLCT	OUT	Pulled up to + 5 volts through 3.3K ohm resistance.

Table G-1. Pins and signals continued

Signal Pin	Return Pin	Signal	Direc- tion	Description
14	—	AUTO FEED X̄T̄	IN	When this signal is LOW, the paper is automatically fed 1 line after printing. (The signal level can be fixed to this by setting DIP switch 2-4 to ON.)
15	—	NC	—	Unused.
16	—	0V	—	Logic ground level.
17	—	CHASSIS GND	—	Printer's chassis ground, which is isolated from the logic ground.
18	—	NC	—	Unused.
19 - 30	—	GND	—	Twisted-pair return signal ground level.
31	—	ĪN̄ĪT̄	IN	When this level becomes LOW, the printer controller is reset to its power-up state and the print buffer is cleared. This level is usually HIGH; its pulse width must be more than 50 microseconds at the receiving terminal.
32	—	ĒR̄R̄ŌR̄	OUT	This level becomes LOW when the printer is in: 1) Paper-end state. 2) Off-line. 3) Error state.
33	—	GND	—	Same as for Pins 19 - 30.
34	—	NC	—	Unused.
35	—	—	—	Pulled up to +5V through 3.3K ohm resistance.
36	—	S̄L̄C̄T̄ ̄ĪN̄	IN	The DC1/DC3 code is valid only when this signal is "HIGH". (Internal fixing can be carried out with DIP switch pin 2-1. The level of this signal is factory-set to "LOW".)

Notes:

1. The column heading "Direction" refers to the direction of signal flow as viewed from the printer.

2. "Return" denotes the twisted-pair return, to be connected at signal ground level. For the interface wiring, be sure to use a twisted-pair cable for each signal and to complete the connection on the return side.

3. All interface conditions are based on TTL level. Both the rise and the fall times of each signal must be less than 0.2 microseconds.

4. Data transfer must be carried out by observing the $\overline{\text{ACKNLG}}$ or BUSY signal. (Data transfer to this printer can be carried out only after receipt of the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is LOW)

Data Transfer Sequence

Interface timing

Figure G-1 shows the timing for the parallel interface.

Printing enabled/disabled signals and control conditions

Table G-2 on the next page shows the relationship between printing being enabled or disabled, and the on-line/off-line condition, the printer select signal ($\overline{\text{SLCT IN}}$), and the receipt of data on/off control character, DC1 /DC3.

Figure G-1.
Parallel interface timing

Table G-2. Printing enabled/disabled signals and control conditions

On-Line (Indicator on)	SLCT IN	DC1/DC3 (Data on/off contr.)	ERROR	BUSY	ACKNLG	Printing (Disabled/enabled)
ON-LINE	LOW (Sw. 2-1/interface)	DC1/DC3 (no effect)	HIGH	HIGH/LOW	PULSED EA. CHAR.	ENABLED (normal cond.)
ON-LINE	HIGH	DC1 RECV'D	HIGH	HIGH/LOW	PULSED EA. CHAR.	ENABLED
ON-LINE	HIGH	DC3 RECV'D	HIGH	HIGH/LOW	PULSED EA. CHAR.	*DISABLED
OFF-LINE	HIGH/LOW (no effect)	DC1/DC3 (no effect)	LOW	HIGH	NOT GENERATED	DISABLED

*Even though printing is disabled, data characters are received and acknowledged, since the printer is looking for another DC1 character, which would allow it to resume printing.

Technical Specifica

Glossary

Note that these definitions apply specifically to printers. If 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.

Automatic sheet feeder
A device that automatically feeds single sheets of paper into a printer. Sometimes caked a cut sheet feeder.

Baud rate
A measure of the speed of data transmission. Usually equivalent to bits per second.

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.*

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% of 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 program 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 caked control codes. These are the codes for such functions as sounding the beeper and performing a carriage return.

Cut sheet feeder

See Automatic sheet feeder.

Data dump

A troubleshooting 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-strike
A print mode in which each character is printed twice, with the second slightly below the first.

Double-width
A print width in which each character is twice as wide as normal characters. Double-width was formerly known as expanded.

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 application software for personal computers.

Expanded
See Double-width.

Form
In printer terminology this term is usually equivalent to page.

Form feed (FF)
A control code and a button that advances the paper to the top of the next form.

Hexadecimal
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.***

L i n e f e e d
   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.

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 E 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 bail
   The part of the printer that holds the paper against the platen.

Paper-out sensor
   A small switch behind the platen that sends a signal when it is not in contact with paper.

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 width of the character varies from character to character. Therefore, 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 a command, an 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.

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

Superscript mode
Prints characters about twothirds of the normal height in the upper
part of the character space.

Top of form
A setting that enables the printer to begin printing in the proper place
and to advance the paper correctly 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 in the printer by the user Sometimes
called download characters.

Index

Command descriptions and definitions of terms are not indexed here. For page references for specific commands, see pages A-4–6 or the Quick Reference Card. For definitions of terms, see the Glossary

A

American Standard Code for Information Interchange, 3-2
Application programs, 3-1–7
ASCII, 3-2
Automatic sheet feeder, 2-1–2

B

Bail, paper, 1-10
BASIC, 3-6–7
Baud rate. See Serial interface
Beeper, D-3
Bit image graphics. See Graphics
Buffer, F-2
Business software, 3-3–6
Buttons, 1-7
Buzzer. See Beeper

C

Carbon copies, 2-1
Centronics, 1-12
Character Graphics set, 1-16,5-4
Character sets, 5-4–5
    Tables, B-1–18
Choosing a place for printer, 1-3, **2-3**
Cleaning, D-6
Color (option), 3-1, 5-1
Commands, A-1–44
Commands
    in numerical order, A-4–6
    by function, A-7–44
Commericial software, 3-1–6

Computer-printer
    communications, 3-1–3
Computer-printer connections, A-12–13
Condensed mode, 5-2–3
Continuous feed paper. See Paper
Control keys, A-3
Control panel, 1-6–7
Cut sheet feeder. See Automatic sheet feeder

D

Data Dump, D-4
Defaults, El
Dimensions of printer, G-2
DIP switches, 1-13–17, E-2–5
Double strike, 5-3–4
Double-width, 5-2–3
Draft, 5-1
Dust cover, 1-1

E

Edge tab, 1-8
Electrical specifications, G-3
Elite, 5-2
Emphasized, 5-3–4
ESC/P 1-15
Escape code **(ESC), 3-2.**
    See *also* Commands

Print head, 6-2–3, G-2
Print head protector, 1-2
Problem solving, D-1–6
Programming languages, 3-6–7
Proportional mode, 5-2
Protector, print head, 1-2

R

READY light, 1-7
Ribbon, installing, 1-3–5
Ribbon, life, G-2
Roll paper, 2-1
Roman, 5-1

S

Sans serif, 5-1
SelecType, 4-1–4
Self test, 1-11–12
Serial interfaces, built in, 1-13, C-1–4
Serial interfaces, optional, F-1–8
Setting up, 1-1–17
Single sheet. See Paper
Slashed zero, E-3
Solving problems, D-1–6
Specifications, paper
Spreadsheets, 3-4–6
Sprocket unit. See Paper, continuous feed
Start bits. See Serial interface
Stop bits. See Serial interface
Subscript, 5-4
Superscript, 5-4

T

Technical specifications, G-1–6
Top of form, 2-6
II-actor. See Paper, continuous feed
Transporting the printer, D-7
Troubleshooting, D-1–6

U

Underlining, 5-4
User-defined characters, 6-13–18

W

Word processors, 3-3–4

Z

Zero, slashed, E-3

EPSON [R]

EX-800/1000

Quick Reference

Commands by Function

The following list of commands is in the order used in the command summary (Appendix A). To find details of the command you want to use, refer to the page number in the column for your operating mode-Epson or IBM printer emulation mode.

Note that for commands consisting of two or more codes, the decimal and hexadecimal columns show only the second code.

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
Printer operation					
ESC @	64	40	Initialize the printer	A-7	
DC1	17	11	Select printer	A-7	A-7
DC3	19	13	Deselect printer	A-8	
ESC Q3	81	51	Deselect printer		A-38
ESC s	115	73	Half-speed mode on/off	A-8	
ESC i	105	69	Immediate mode on/off	A-9	
ESC ⟨	60	3C	Select unidirectional mode (1-line)	A-9	
ESC U	85	55	Turn unidirectional mode on/off	A-10	A-10
ESC 8	56	38	Disable paper-out sensor	A-10	A-10
ESC 9	57	39	Enable paper-out sensor	A-10	A-10
ESC EM	25	19	Automatic sheet feeder on/off	A-11	
ESC =	61	3D	Set MSB to 0	A-11	
ESC ⟩	62	3E	Set MSB to 1	A-12	
ESC #	35	23	Cancel MSB control	A-12	
BEL	7	07	Beeper	A-12	A-12
Data control					
CR	13	0D	Carriage return	A-13	A-13
CAN	24	18	Cancel line	A-13	A-13
DEL	127	7F	Delete character	A-13	
Vertical motion					
FF	12	0C	Form feed	A-14	A-14
ESC C	67	43	Set page length in lines	A-14	A-14
ESC C0	67	43	Set page length in inches	A-14	A-14
ESC N	78	4E	Set skip-over-perforation	A-15	A-15
ESC O	79	4F	Cancel skip-over-perforation	A-15	A-15
ESC 4	52	34	Set top of form		A-39
LF	10	0A	Line feed	A-15	A-15
ESC 0	48	30	Select 1/8-inch line spacing	A-16	A-16
ESC 1	49	31	Select 7/72-inch line spacing	A-16	A-16
ESC 2	50	32	Select 1/6-inch line spacing	A-16	
ESC 2	50	32	Select programmable line spacing		A-38
ESC 3	51	33	Select $n/216$-inch line spacing	A-17	A-17
ESC A	65	41	Select $n/72$-inch line spacing	A-17	

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC A	65	41	Set *n*/72-inch line spacing		A-38
ESC J	74	4A	Perform *n*/216-inch line feed	A-17	A-39
ESC 5	53	35	Turn automatic line feed on/off		A-39
ESC j	106	6A	Perform *n*/216-inch reverse line feed	A-18	
VT	11	0B	Tab vertically	A-18	A-18
ESC B	66	42	Set vertical tabs	A-18	A-18
ESC b	98	62	Set vertical tabs in channels	A-19	
ESC /	47	2F	Select vertical tab channel	A-19	

Horizontal motion

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC l	108	6C	Set left margin	A-19	
ESC Q	81	51	Set right margin	A-20	
ESC X	78	4E	Set left and right margins		A-40
ESC R	82	52	Restore default tab settings		A-40
BS	8	08	Backspace	A-20	A-20
ESC $	36	24	Set absolute print position	A-20	
ESC \	92	5C	Set relative position	A-21	
HT	9	09	Tab horizontally	A-21	A-21
ESC D	68	44	Set horizontal tabs	A-22	A-40

Overall printing style

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC x	120	78	Select NLQ or draft	A-22	
ESC k	107	6B	Select NLQ font	A-22	
ESC I	73	49	Select font		A-41
ESC r	114	72	Select printing color	A-23	
ESC !	33	21	Master select	A-23	

Print size

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC P	80	50	Select pica pitch	A-24	
ESC M	77	4D	Select elite pitch	A-24	A-24
ESC :	58	3A	Select elite pitch		A-41
ESC p	112	70	Proportional mode on/off	A-24	
SI	15	0F	Select condensed mode	A-25	A-25
ESC SI	15	0F	Select condensed mode	A-25	A-25
DC2	18	12	Cancel condensed mode	A-25	
DC2	18	12	Cancel condensed/elite		A-41
SO	14	0E	Select double-width (1 line)	A-26	A-26
ESC SO	14	0E	Select double-width (1 line)	A-26	A-26
DC4	20	14	Cancel double-width (1 line)	A-26	A-26
ESC W	87	57	Turn double-width on/off	A-27	A-27

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode

Print enhancement

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC E	69	45	Select emphasized mode	A-27	A-27
ESC F	70	46	Cancel emphasized mode	A-27	A-27
ESC G	71	47	Select double-strike mode	A-28	A-28
ESC H	72	48	Cancel double-strike mode	A-28	A-28
ESC S0	83	53	Select superscript mode	A-28	A-28
ESC S1	83	53	Select subscript mode	A-29	A-29
ESC T	84	54	Cancel superscript/subscript	A-29	A-29
ESC −	45	2D	Turn underlining on/off	A-29	A-29
ESC _	95	5F	Overscore on/off		A-42

Word processing

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC a	97	61	NLQ justification	A-30	
ESC SP	32	20	Set intercharacter space	A-30	

Character sets

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC t	116	74	Select character table	A-31	
ESC 4	52	34	Select italic mode	A-31	
ESC 5	53	35	Cancel italic mode	A-31	
ESC R	82	52	Select international character set	A-32	
ESC 6	54	36	Select international character set		A-42
ESC 7	55	37	Select standard character set		A-42
ESC \	92	5C	Print characters from symbol set		A-43
ESC ^	94	5E	Print 1 character from symbol set		A-43

User-defined characters

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC &	38	26	Define user-defined characters	A-32	
ESC =	61	3D	Define user-defined characters		A-44
ESC :	58	3A	Copy ROM into RAM	A-32	
ESC %	37	25	Select user-defined set	A-33	
ESC 6	54	36	Printable code area expansion	A-33	
ESC 7	55	37	Cancel ESC 6	A-33	
ESC I	73	49	Printable code area expansion	A-34	

Graphics

ASCII	Decimal	Hexadecimal	Description	Epson Mode	IBM Printer Emulation Mode
ESC K	75	4B	Single-density graphics	A-34	A-34
ESC L	76	4C	Double-density graphics	A-34	A-34
ESC Y	89	59	High-speed dbl.-density graphics	A-35	A-35
ESC Z	90	5A	Quadruple-density graphics	A-35	A-35
ESC *	42	2A	Select graphics mode	A-35	
ESC ?	63	3F	Reassign graphics mode	A-36	
ESC ^	94	5E	Select nine-pin graphics	A-36	

DIP Switch Settings

Table 1. DIP switch group 1

Switch number	Function	Action when ON	Action when OFF
1-1	Select condensed or normal characters	Condensed	Normal
1-2	Select slashed or unslashed zero	Ø	0
1-3	Select character table*	Graphics	Italics
1-4	Select printer commands	IBM printer emulation mode	ESC/P
1-5	Select print quality	NLQ	Draft
1-6 1-7 1-8	Select international character set	See Table 3	

*In IBM printer emulation mode, a CR is added to an LF or ESC J if this switch is OFF.

Table 2. DIP switch group 2

Switch number	Function	Action when ON	Action when OFF
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 4	
2-7 2-8	Select serial baud rate	See Table 5	

Table 3. International settings

Epson mode character set	DIP switch settings 1-6	1-7	1-8	IBM printer emulation mode
USA	ON	ON	ON	Standard
French	ON	ON	OFF	International
German	ON	OFF	ON	International
UK	ON	OFF	OFF	International
Danish	OFF	ON	ON	International
Swedish	OFF	ON	OFF	International
Italian	OFF	OFF	ON	International
Spanish	OFF	OFF	OFF	International

Table 4. Interface type

Interface	Parity	DIP switch 2-5	2-6
built-in parallel or any option	—	OFF	OFF
built-in serial	odd	OFF	ON
built-in serial	even	ON	OFF
built-in serial	none	ON	ON

Table 5. Baud rate for built in interface

Baud rate	DIP switch 2-7	2-8
9600	OFF	OFF
4800	OFF	ON
1200	ON	OFF
300	ON	ON

10 Steps to Printing with the EX-800/1000
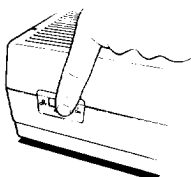
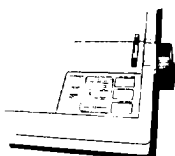### 1 Unpacking the Printer
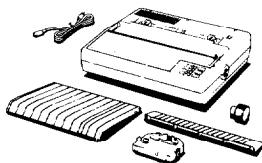
2 Choosing a Place for the Printer
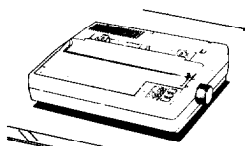
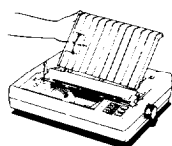### 3 Installing the Ribbon
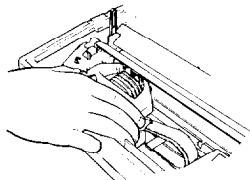
4 Turning on the Printer

5 Operating the Control Panel

6 Installing the Paper Guide

7 Loading Paper
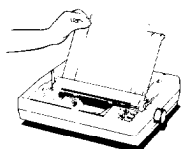
8 Running the Self-test

```
Condensed        OFF
Zero             0
CG Table         Graphic
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
```

9 Connecting the Printer to Your Computer
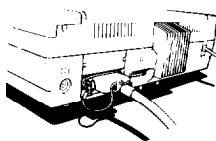
10 Setting the DIP Switches
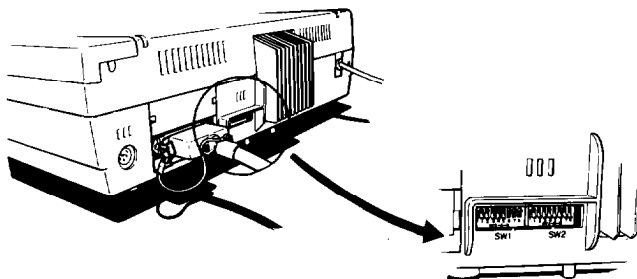
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