EPSON

SQ-2000 Printer

Operating Manual

FCC COMPLIANCE STATEMENT FOR AMERICAN USERS

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

- Reorient the receiving antenna
- Relocate the computer with respect to the receiver
- Plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems."

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

WARNING

The connection of a non-shielded printer interface cable to this printer will invalidate the FCC certification of this device and may cause interference which exceeds the limits established by the FCC for this equipment. If this equipment has more than one interface connector, do not leave cables connected to unused interfaces.

Part No. 8492004

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Introduction

The Epson SQ-2000 Ink Jet Printer gives you the versatility, speed, and graphics capability of a dot matrix printer, together with print quality close to that of a daisy wheel printer. A major advantage of the ink jet is its quiet operation, which sets it in a class by itself.

Features

Like a conventional dot matrix printer, the SQ-2000 uses dots to create each character. Instead of using a ribbon, it transfers the characters onto the paper through 24 ink nozzles. The print head cleans itself automatically, keeping the nozzles clear.

The SQ-2000 accepts a wide range of different types of paper; you don't need to buy specially manufactured stock. It's designed to work on smooth, ordinary bond paper.

The SQ-2000 offers dot graphic modes which let you create custom characters, logos, and detailed graphic designs.

About the Manual

This manual contains all the information you need to operate the SQ-2000. In the first section, you'll find the necessary details to get your SQ-2000 up and running. The second part of the manual contains information on how to take full advantage of some of the printer's special features.

Chapter 1 shows you how to print your first document in ten easy steps. Chapters 2 and 3 include a description of the control panel, information on using your printer with word processing, and some programming tutorials. Chapter 4 describes how the printer maintains itself and contains some troubleshooting suggestions.

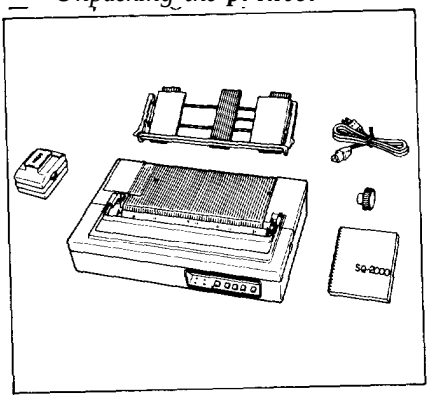
If you already know how to program a printer, you will find useful information on graphics capabilities in chapters 5 and 6. Chapters 7 and 8 contain additional programming information.

The Appendixes provide reference information for programming, instructions for installing an optional tractor feed unit, and specifications.

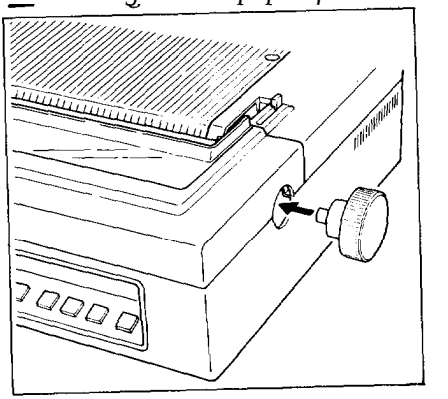
Chapter 1
10 steps to Printing

Setting up your SQ-2000 is simple and straightforward, even if you've never used a printer before. In this chapter, you'll learn how to set up your printer and perform your first printing job in 10 easy steps, shown on the next two pages.

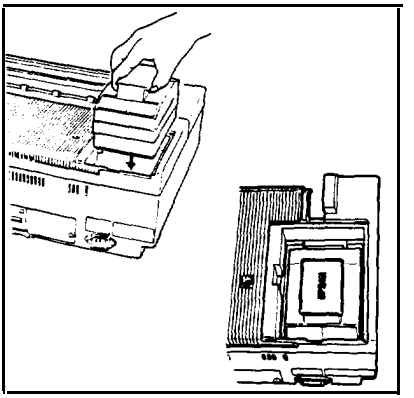
1 *Unpacking the* ***printer***



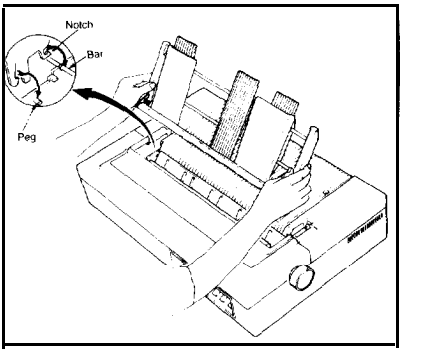
2 *Putting on the paper feed knob*



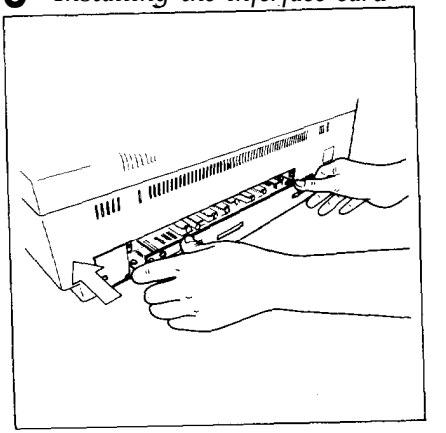
3 Installing the ink cartridge



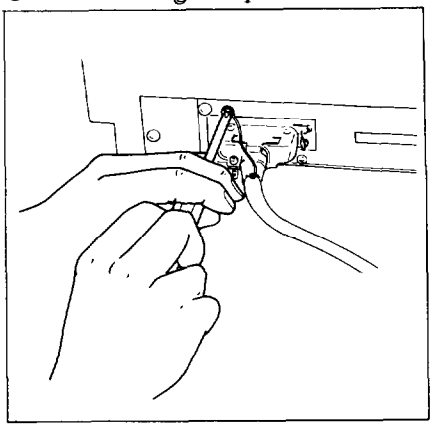
4 Setting up the paper guide



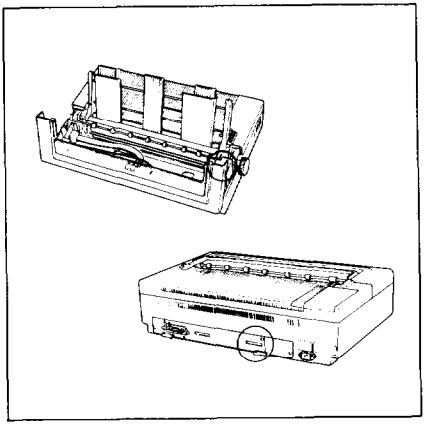
5 *Installing the inferface card*



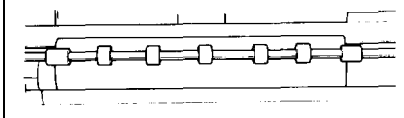
6 *Connecting the printer*



7 *Customizing the printer*



8 *Loading the paper*



9 *Self-testing the printer*

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ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
DEFGHIJKLMNOPQRSTUVWXYZ[\]^_'
EFGHIJKLMNOPQRSTUVWXYZ[\]^_'a
FGHIJKLMNOPQRSTUVWXYZ[\]^_'ab
GHIJKLMNOPQRSTUVWXYZ[\]^_'abc
HIJKLMNOPQRSTUVWXYZ[\]^_'abcd
IJKLMNOPQRSTUVWXYZ[\]^_'abcde
JKLMNOPQRSTUVWXYZ[\]^_'abcdef
KLMNOPQRSTUVWXYZ[\]^_'abcdefg
LMNOPQRSTUVWXYZ[\]^_'abcdefgh
MNOPQRSTUVWXYZ[\]^_'abcdefghi
NOPQRSTUVWXYZ[\]^_'abcdefghij
OPQRSTUVWXYZ[\]^_'abcdefghijk
PQRSTUVWXYZ[\]^_'abcdefghijkl
QRSTUVWXYZ[\]^_'abcdefghijklm
```

10 Printing your first document

MEMO

Text Don Donnison, President
All employees

As you all know, we have just entered an e
field in sensing device industry,
rared sensors.

A smart infrared sensor incorporates microc
hnology in the form of a high-speed micropr
h standard infrared sensing equipment. The
ions for a sophisticated sensing device are
imited:

Industrial robots
Industrial quality assurance
Detecting electronic equipment failure
Security systems
Aviation

We believe the advances we are asking will br
pany to the sensing device industry.

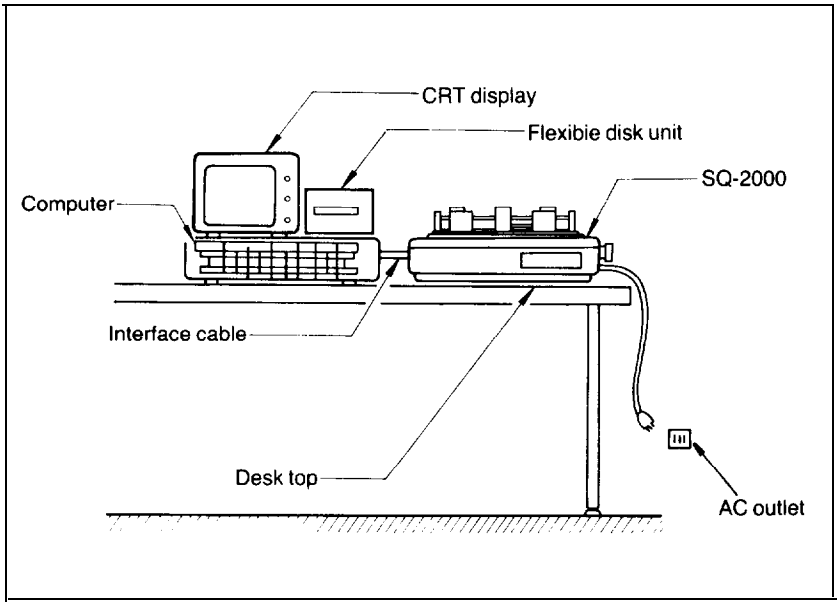

Figure 1-1. Continuous paper feeding

Selecting the Right Location

To make sure you've picked a satisfactory location for your SQ-2000, keep the following points in mind.

The location should be:

- A flat, stable surface with enough room for continuous paper feed as shown in the illustration.
- Served by an electrical outlet that cannot be turned off accidentally by a wall switch or similar switch.
- Out of direct sunlight and not exposed to grease or dust.
- Away from electrical interference from motors and high voltage power lines.
- Not subject to temperatures below 41°F (5°C) or above 95°F (35°C) when the printer is operating.
- Not subject to either extremely high or extremely low humidity.

If your location meets these conditions, you're ready to begin setting up your new printer.

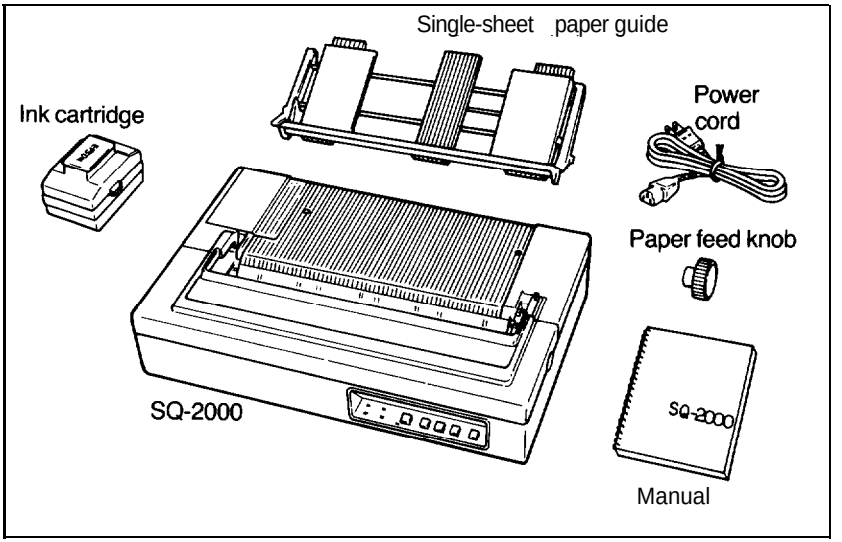

Figure ***I-2.*** *Printer parts*

1 Unpacking the Printer

Carefully lift the SQ-2000 from the carton. Remove the protective shipping material and plastic wrapping. Save these packing materials with the carton in case you need to ship or store your printer later.

Check to see that you have all the parts shown above. If a part is missing or appears damaged, contact your dealer.

You should *also* have the *printer interface card* suitable for your computer. If the back of your printer looks like the picture below, the interface card is already in place.

Caution:
Do not plug in the printer until Step 8.

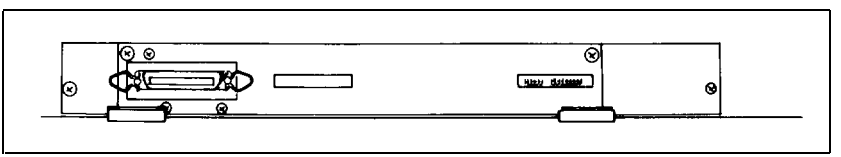

Figure 1-3. Interface card installed

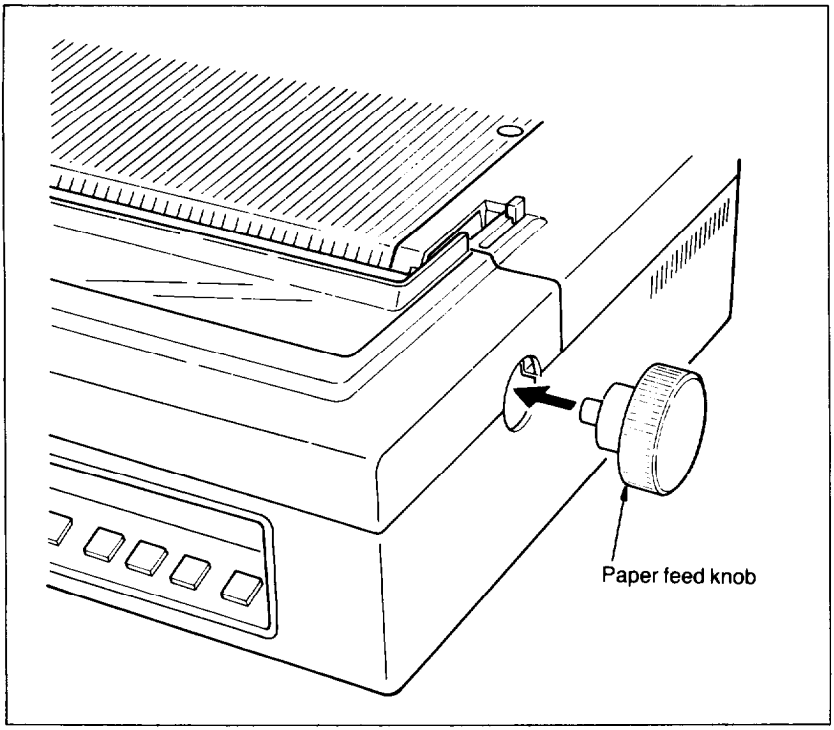

Figure 1-4. Installing the paper feed knob

2 Putting on the Paper Feed Knob

Slip the *paper* **feed** *knob* into place as shown above, aligning the knob so that it matches the flat side of the platen shaft.

Note:
If you're going to ship the printer, be sure to remove the knob to safeguard against damaging it.

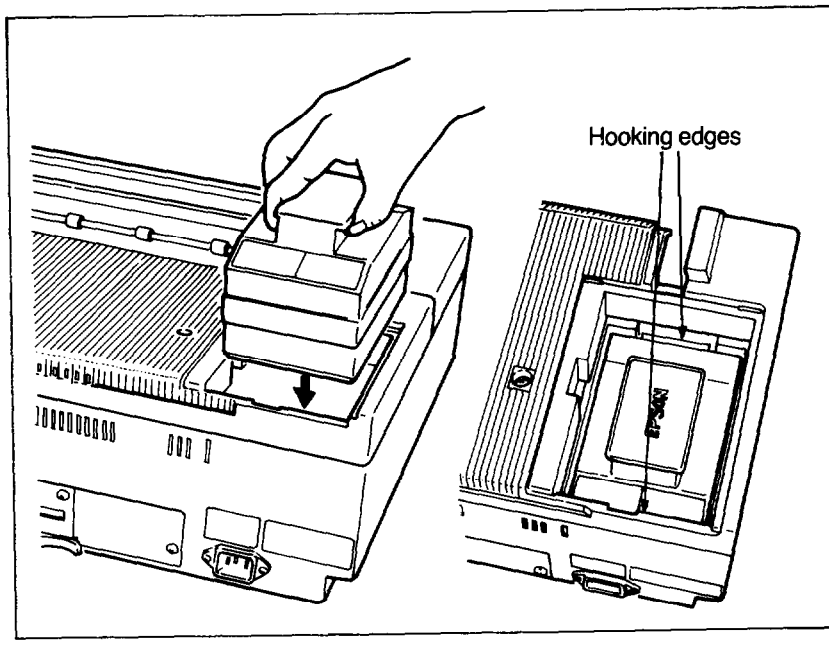

Figure 1-5. The ink cartridge

3 Installing the Ink Cartridge

Caution:
Under no circumstances should the power be switched ON when the ink cartridge has been removed.

The ink compartment is located in the left rear corner of the printer. To open the compartment, pull back and up on the lid and set it aside.

Remove the *ink cartridge tank* from its vacuum-packed wrapping.

Holding the tank with the white label toward the front of the printer, insert the tank into the compartment. The tank has a raised guide on the right side that fits snugly into a slot in the printer.

Gently press down on the tank until it stops. Do not force it.

The cartridge is completely inserted when the top of the tank is below the *two flexible hooking edges* shown above.

Now, snap the ink compartment lid back into place.

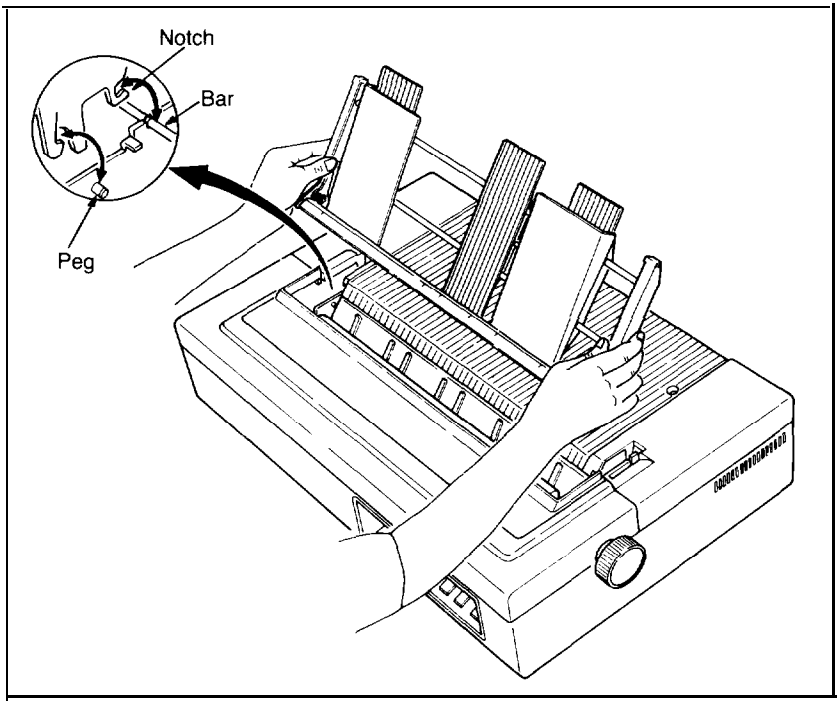

Figure 1-6. Installing the single-sheet paperguide

4 Setting Up the Single-Sheet Paper Guide

You'll use the *single-sheet paper* guide to feed individual sheets of paper into the SQ-2000.

To install this guide, hold the guide in both hands, facing the front of the printer.

With the guide tilted away from you, lower its two notched feet into the two slots shown above.

At the back of each slot is a round horizontal bar. Place the notches in the guide's feet on these two bars.

Then tilt the guide toward you and press gently until it locks into place with a click.

To remove the guide, press on the two locking levers and tilt the guide away from you. Then lift it free of the printer.

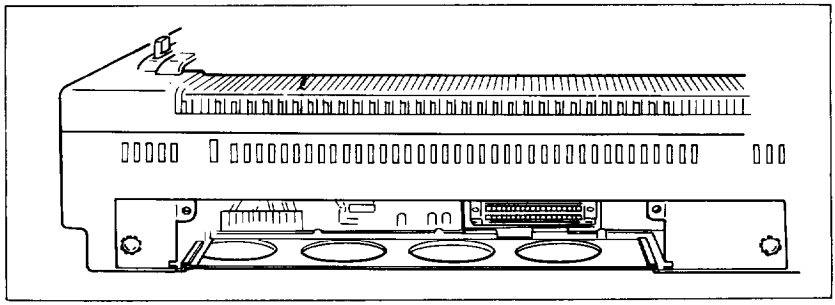

Figure 1-7. Removing the protective plate

5 Installing the Interface Card

If your printer already has the interface card installed, go ahead to Step 6. (Look back to Step 1 to see how the card looks when it is installed.)

Warning:
If you have been operating the printer, first turn it off, then unplug it before attempting to install or remove the interface card.

First, use a Phillips screwdriver to remove the two screws shown above. Set them aside carefully so they won't get lost. Take off the *U-shaped protective metal* **plate** to gain access to the printer. Remove the interface card from its package, taking care not to touch the electrical parts.

Now, ease the card into the printer by sliding it into the grooves as shown below. The metal back plate of the card should be toward you and the electrical parts should be on too.

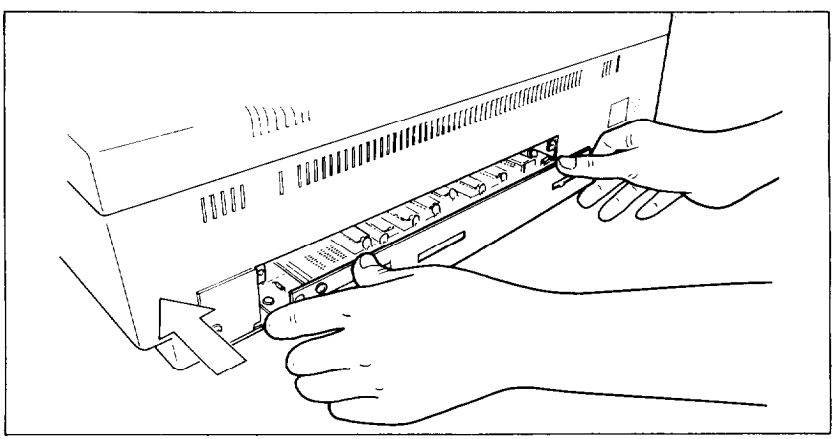

Figure Z-8. Sliding in the interface card

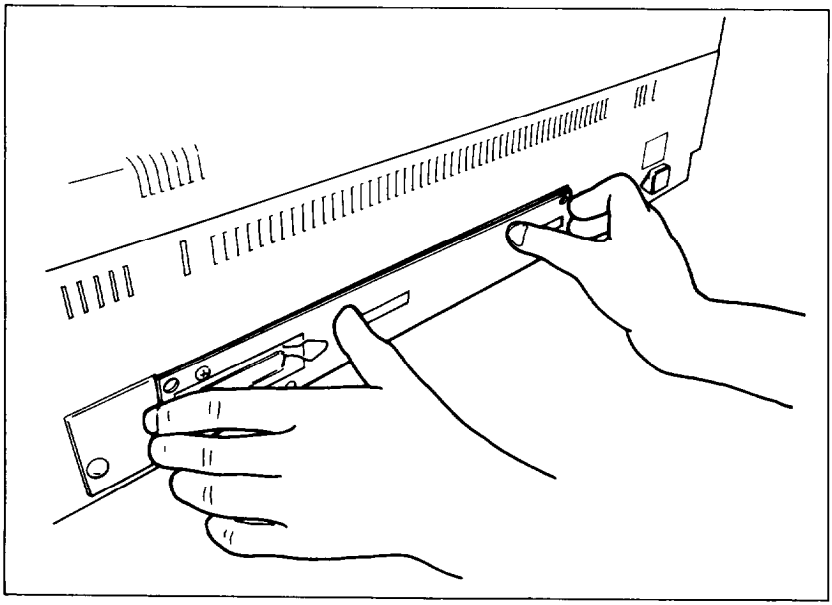

Figure l-9. Snapping the interface card into place

Use both thumbs as shown above to push the card into place. You should feel a slight resistance when there's about a quarter of an inch to go. Press gently with gradually increasing pressure until the card snaps into place.

If the card doesn't seem to align correctly, remove it carefully and try again. Be sure it is properly positioned in the grooves.

Now inspect the card. It should be firmly seated, the back plate flush with the back of the printer.

Replace the two screws you removed earlier.

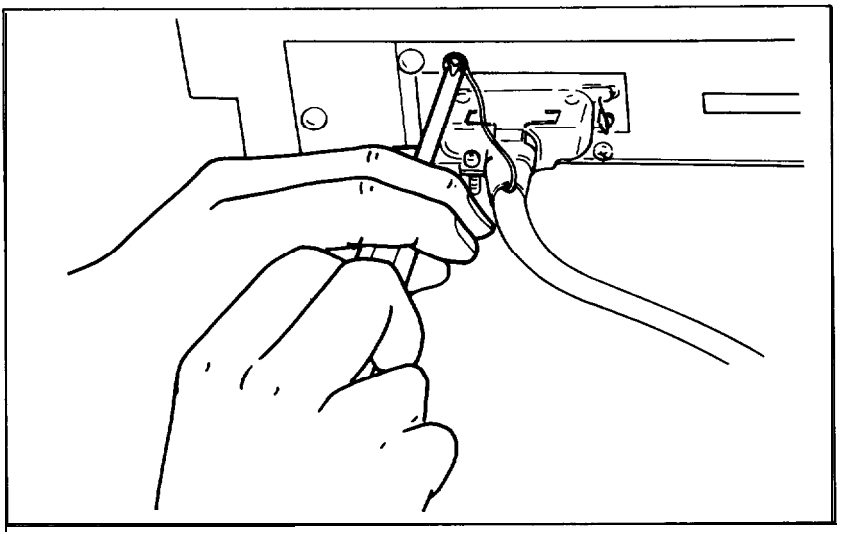

Figure l-10. Connecting the printer and computer

6 Connecting the Printer to Your Computer

To connect the SQ-2000 to your computer, you'll need either a *parallel* or *serial interface cable,* depending on your computer. Refer to the manual for your computer or check with your dealer for the proper cable.

First, make sure both the computer and printer are turned OFF. Next, plug one end of the cable into the computer and the other end into the connector on the interface card.

If the cable comes with a *grounding wire,* attach it to the grounding screws next to the sockets of both machines as shown. Connect the wire clips (or screws) to secure the plugs to their sockets.

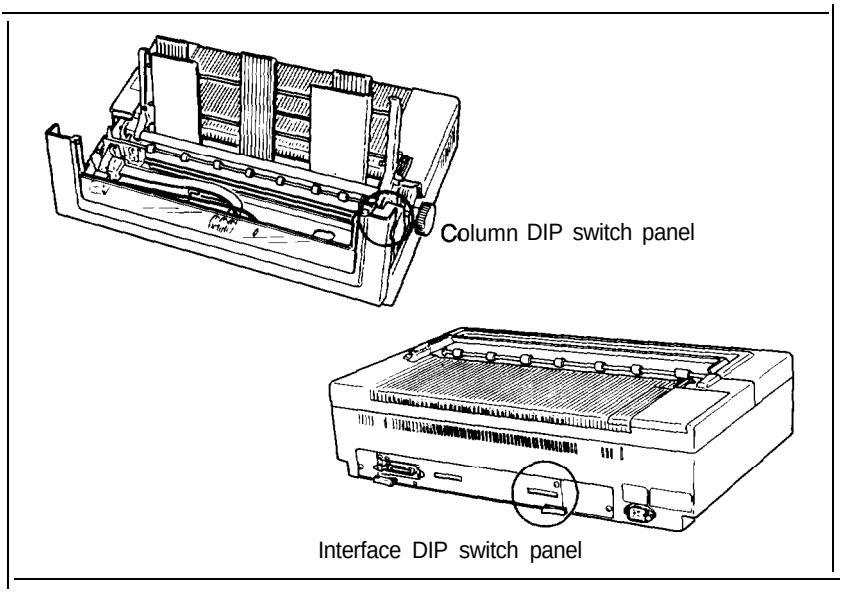

Figure l-21. Locating the DIP switches

7 Customizing the Printer

There are *two DIP switch panels* on the SQ-2000 that allow you to customize the printer to your special needs. These are shown in the picture.

The switches are preset at the factory, but they can be changed to suit a variety of applications.

For information on the DIP switches and how to change them, see Appendix D.

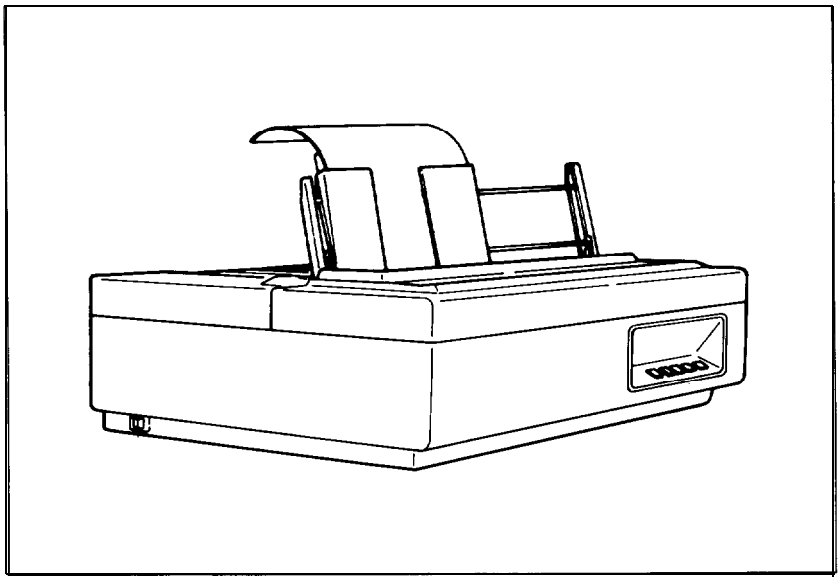

Figure l-12. Loading single-sheet paper

8 Loading Single-Sheet Paper

Before beginning the paper-loading procedure, plug in the SQ-2000 and turn it on.

When you turn the printer on, a number of things happen:

- The print head moves all the way to the left, and goes through a brief self-cleaning cycle. You'll hear a whirring noise that will last a few seconds then stop. (For more details on the SQ-2000's self-cleaning feature, see Chapter 4.)
- The indicator lights on the control panel light up. The POWER, READY, and ON LINE lights glow green, and the PAPER OUT light is red, indicating that there is no paper loaded in the printer.

Now you're ready to load paper.

1. Press the ON LINE button. The ON LINE and READY lights go out, indicating that the printer is off-line-the power is on but the printer won't print.
2. Insert a sheet of paper into the paper guide and press the SHEET FEED button. The paper automatically feeds into the printer, and the red PAPER OUT light goes out.
3. With the paper loaded, lift the dust cover and adjust the rollers on the pressure bar as shown below.

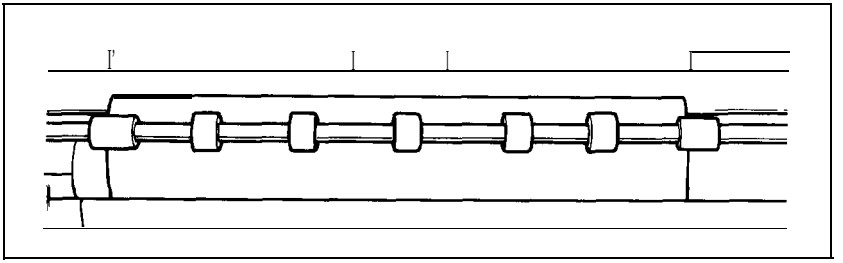

Figure 1-13. Adjusting pressure bar rollers

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ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefgh
BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghi
CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghij
DEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijk
EFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijkl
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GHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmn
HIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmno
IJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnop
```

Figure l-14. **Self-test**

9 Self-Testing the Printer

To **self-test** the printer, follow these steps:

- First, be sure that you have a sheet of paper at least 8½ inches wide loaded into the printer.
- Be sure the DIP switches under the dust cover are set to match the setting below:

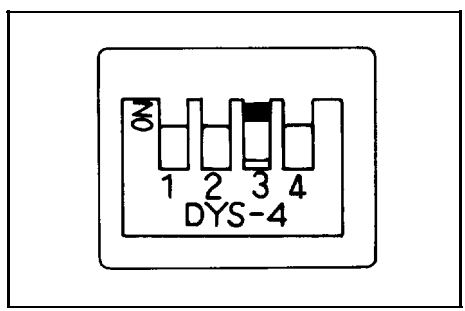

Figure l-15. DIP switch setting **for self-test**

- Adjust the paper pressure bar as shown in Step 8.
- Turn OFF the printer using its ON-OFF switch.

Now, turn ON the printer while holding down the LF button.

The printer will immediately begin printing out the self-test characters shown above.

To stop the test, simply turn OFF the printer, or wait for it to stop when it reaches the bottom of the page.

A Word About Selecting Paper

With an ink jet printer, paper absorbency is an important component for good print quality. Paper which is either too absorbent or not absorbent enough will give you less than optimum print quality.

You can see in Figure 1-16 what happens when paper is used which soaks up too much ink. The ink tends to *bleed,* causing blurred or smeared characters.

Figure 1-17 shows what can happen when paper is not absorbent enough. The characters take too long to dry and are easily smeared.

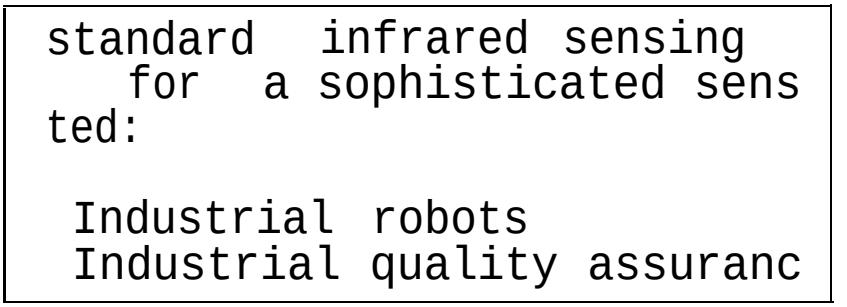

Figure I-16. Paper is too absorbent

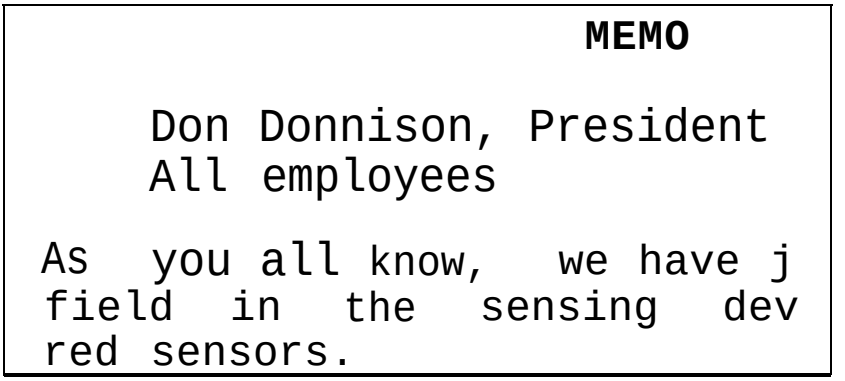

Figure l-77. Paper is not absorbent enough

Most dense-weave paper (of the quality used for business correspondence) can be used in the SQ-2000 without problems. However, it's a good practice to test the paper in your printer before purchasing a large quantity. Of course, you should also test labels and preprinted forms.

Testing your paper

To test a supply of paper, take the top sheet from the package and load it in the printer. Have your printer perform its self-test as shown in Step 9.

Now carefully look at each character in every line. If no ink bleeds, the paper should be suitable for your SQ-2000.

Then take a new sheet from the package. This time, turn the sheet over and run the self test on the reverse side of the paper. Some types of paper give you consistently better printing results on one side of the paper than on the other side.

Your printing should have the crisp appearance of the sample in Figure l-18.

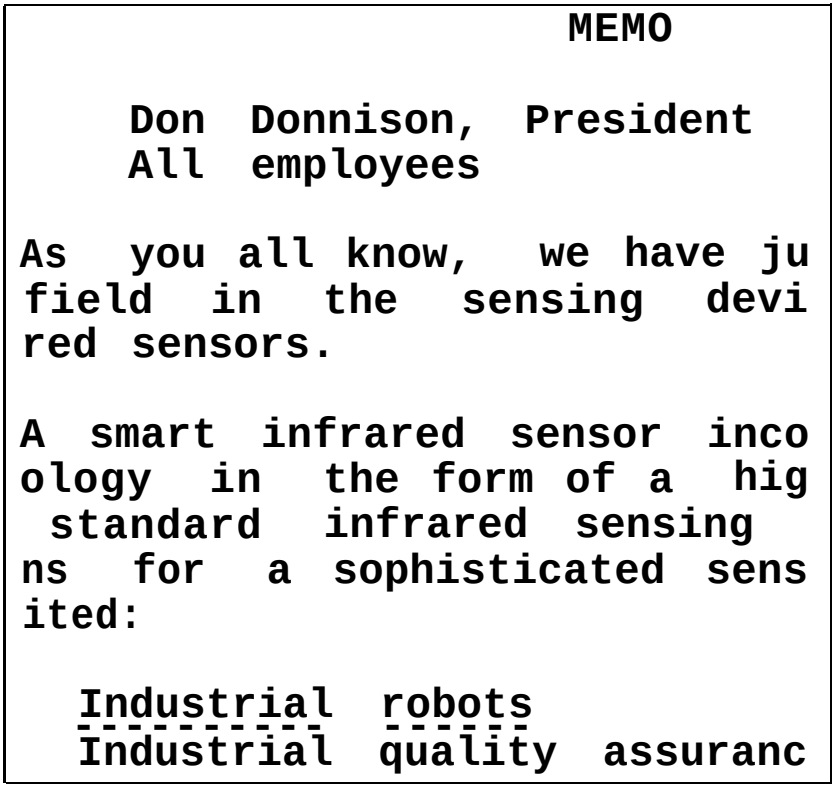

Figure l-18. Good print quality

Paper specially manufactured for use with ink jet printers can also be ordered from your Epson dealer.

10 Printing Your First Document

Now you're ready to print out your first document.

Simply follow the normal procedure for your word processor.

Additional information on printing documents can be found in Chapter 3.

MEMO

From: Don ***Donnison.*** **President**
To: All employees

AS you all know, we have just entered an exciting new **field in the sensing** device industry, "Smart" infrared sensors.

A smart infrared sensor incorporates **microcomputer technology in the** form of a high-speed microprocessor with standard infrared sensing equipment. The applications for a sophisticated sensing device are almost unlimited:

Industrial robots
Industrial quality assurance
Detecting electronic equipment failurer
Security systems
Aviation

We **believe the advances we *are* making will bring** our **company to the top** of the **sensing device industry.**

Draft quality

MEMO

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To: All employees

As you all know, we have just entered an exciting new field in the sensing device industry, "smart" infrared sensors.

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Industrial quality assurance
Detecting electronic equipment failure
Security systems
Aviation

We believe the advances we are making will bring our company to the top of the sensing device industry.

Letter quality

Figure l-19. Sample document

Chapter 2
Operation

This chapter covers the switches that control the operation of the SQ-2000, the panel indicators, and initialization sequences.

Power Switch

The main power switch is a rocker switch on the left side of the SQ-2000 towards the back. Press the front of the switch to turn the power on and the back of the switch to turn it off.

Warning:
Never turn the power on or off by the switch at the main outlet. Never turn the power on or off by inserting or removing the main cable at the outlet or the socket at the back of the machine.

The SQ-2000 goes through a sequence of cleaning immediately after being powered on and before powering off. You can damage the printer if this sequence is not carried out.

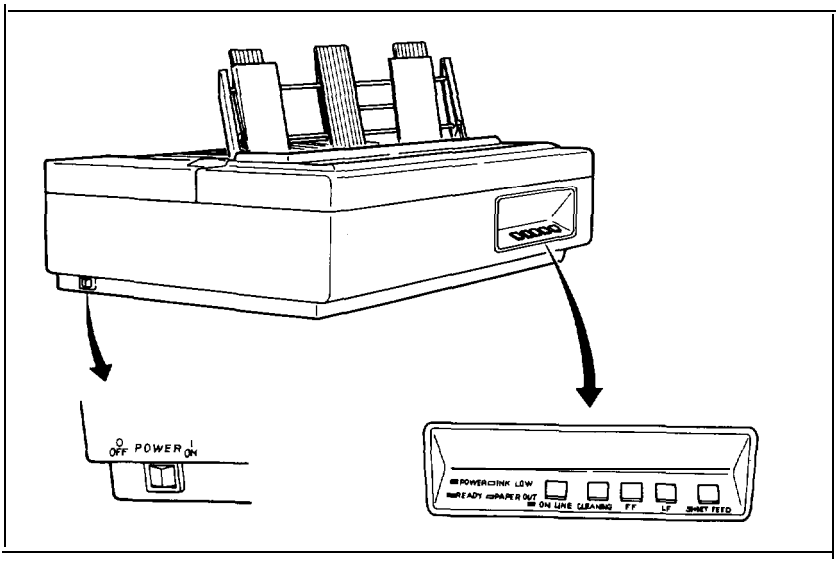

Figure 2-l. Power switch and control panel

Control Panel Buttons

The control panel buttons are on the front of the printer. You should familiarize yourself with their functions before operating your printer.

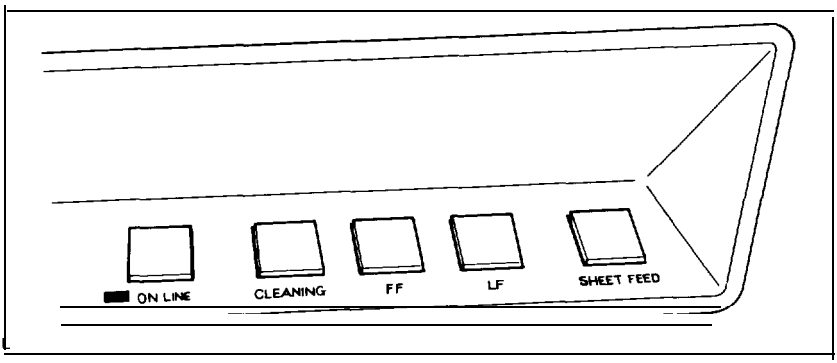

Figure 2-2. Control panel buttons

ON LINE button

This button switches between the on-line and off-line states. If the paper is properly loaded, the on-line state is automatically selected when the power switch is turned on. The SQ-2000 then stands by to receive data from the host computer.

FF (Form Feed) button

This button is effective only when the SQ-2000 is in the off-line state. When you press the FF button in the off-line state, the paper is advanced to the next top of form.

LF (Line Feed) button

This button is effective only when the SQ-2000 is in the off-line state. When you press this button in the off-line state, the paper is advanced by a single line according to the current line spacing value. If you hold down the switch, the paper continues to advance.

Note:
To advance the paper a number of lines, use the FF and/or paper feed knob. Pressing the LF switch continuously will shorten the life of the motor.

CLEANING button

This button is effective only when the SQ-2000 is in the off-line state. When you press the button at that time, the inside of the print head is cleaned. Further details of cleaning are given in Chapter 4.

SHEET FEED button

This button is effective only when the SQ-2000 is in the off-line state. When you press the button in the off-line mode, the paper bail opens and a single sheet of paper is loaded.

The first printed line is about one inch below the top edge of the form.

Indicators

The control panel has a number of lights that indicate the state of the printer. The meanings of the indicators are as follows.

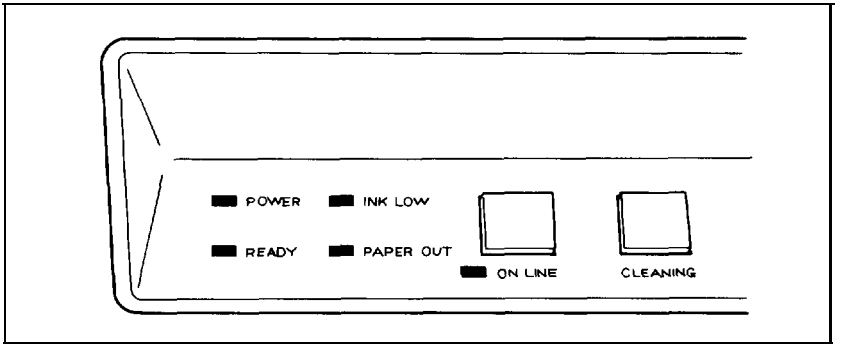

Figure 2-3. Control panel indicators

Table 2-l. Messages of panel indicator lights

Indicator	Color	ON	OFF	Blinking
POWER	Green	Power on	Power off	
ON LINE	Green	On-line state	Off-line state	see below
READY	Green	Ready to receive data	Not ready to receive data	see below
INK LOW	Red	Ink supply low	Ink supply adequate	
PAPER OUT	Red	No more paper	Paper in platen	

Meaning of blinking indicators

The ON LINE indicator will blink in the following cases:

Cause	Rate
Temperature of the print head is below 59°F	5 times a second
At power-up during head cleaning	2 times a second

The READY light will blink during data transmission. This flickering is normal.

Paper-end detector

The printer is equipped with a *paper-end detector* that warns you when the printer runs out of paper. When the printer detects that the paper has run out, printing stops, the PAPER OUT indicator goes on and the buzzer sounds.

The PAPER OUT light goes out when paper is loaded. However, printing does not restart until the ON LINE switch is pressed.

The SQ-2000 has an override which allows the paper to move approximately one inch after the end of paper has been sensed. For this reason, always remove paper using the LF or FF buttons.

If you manually remove the paper from the printer, you won't be sure the paper end has been detected. It is possible to later place the printer in the on-line state and have data lost (and printed onto the platen) if you don't follow the correct procedure.

Ink low

When the ink cartridge is nearly empty, the INK LOW indicator lights and the buzzer sounds. Only 66 additional lines (approximately one page) can be printed in this state. If the ink is low when the printer is switched on, the INK LOW indicator lights up and the printer remains off-line until the ink cartridge is replaced. To restart the printer, replace the cartridge, perform the head cleaning operation (explained in Chapter 4), and then set the printer on-line.

Buzzer

The buzzer is located on the control circuit board. It sounds for about 0.25 second in the following cases:

- When the BEL code (ASCII code <BEL>) is sent to the printer.
- When the end of the paper is detected.
- When the printer carriage malfunctions.
- When the printer is out of ink.

Note:
The buzzer can be switched off when DIP switch SW2-6 is set to ON (up). If a malfunction occurs the buzzer will sound even if the switch is set to ON.

Initialization

The SQ-2000 is *initialized* (i.e., set to a fixed set of conditions) in the following cases:

- When you turn the power switch on.
- (When you use a parallel interface) If the INIT signal is received from the host computer, causing pin 31 of the parallel interface to become LOW.
- When you give the <ESC>@ software command.

The initialization sequence proceeds as follows (except when using the software command):

1. All interface signals are reset.
2. The input buffer is cleared.
3. The ON LINE indicator goes on and the SQ-2000 waits to receive data.
4. Printer parameters are initialized to the default settings.
5. The default values of the DIP switches are set.

The <ESC> @ sequence only performs the last two operations. The DIP switch values are set to the current values even if the power has not been switched off.

Chapter 3
Using the SQ-2000

This chapter tells you how to set up your word processor or other applications software to work with the SQ-2000. If you are interested in programming with the SQ-2000, the second part of this chapter contains basic information on control codes and ESCape sequences.

Using the SQ-2000 with Word Processors

Most word processing programs today support the SQ-2000 because it uses the same commands and control codes as many Epson printers.

These programs usually have a *setup* or *installation* procedure that prepares the program to work with a printer. This is often a short question-and-answer session in which the program asks two or three basic questions about your computer and printer. To set up a program for use with the SQ-2000, you would give the following answers:

Question	Answer
What type of computer are you using?	Your computer's type
What type of printer are you using?	Choose LQ-1500 if listed. If not listed, choose FX-80 or FX-100. If specific models are not listed, choose "Epson printer." (When new printers are released, it takes time to update the lists, so by choosing another Epson printer, you will still be sending the correct codes.)

What type of interface are you using?	Parallel or serial (this will depend on the interface board in the SQ-2000, your computer, and the type of cable you have).

Programs that don't specifically list the SQ-2000 may ask other questions about your printer. The following questions are asked most often (the answers follow in bold).

1. Does your printer (SQ-2000) do standard backspacing? **Yes**
2. How many passes of the print head are adequate for bold-facing? **Two**

Some word processors let you redefine the printer instructions (often called *printer drivers).* To do this, you must give your word processor certain information so that it can take advantage of your printer's features. This is covered later on in this chapter, and in Appendix A.

Using the SQ-2000 with other application programs

You can also use the SQ-2000 to print other documents, such as spreadsheets, with various commercial software packages.

As with word processors, most of your printing will be straightforward. If your program has a printer selection routine, then follow the advice given above.

Programming with the SQ-2000

This section provides an overview of the ASCII code system. It also gives basic instruction on how to send control codes and ESCape sequences to the printer in order to take advantage of the SQ-2000's special features, such as italics, enlarged, or proportional typestyles.

If you already know how to program your printer, you can skip to Appendix A, "SQ-2000 Commands," and Appendix B, "ASCII Code Conversion Chart."

Computer-to-printer communications

A computer and printer communicate by means of numbered codes. If you press the letter A on the keyboard, it is translated into a numeric code, transmitted to a peripheral device (such as a video screeen or a printer) then displayed as the letter A.

To cope with the many different kinds of computers and printers used today, a standard set of codes has been developed. This set of codes is called the American Standard Code for Information Interchange, or ASCII for short. Almost all computers use these *ASCII* codes to communicate with printers.

There are ASCII codes for all of the letters in the alphabet, both upper- and lowercase, and for the numbers from 0 to 9. The ASCII code also includes most punctuation marks, and some codes that control printer functions. If you refer to the ASCII chart in Appendix B, you'll find that all of these letters, numbers and punctuation marks have been assigned code numbers from 33 through 255.

ASCII codes

Although these codes are standard from computer to computer, they can be expressed in a number of different ways. The chart in Appendix B is a comparative table that lists each ASCII code as a character (A, B, C, 1,2,3) and as a *decimal* or *hexadecimal* number. For example, the letter A is represented as an A and as the decimal number 65. If you wanted to print the letter A using the BASIC language, you would use the decimal notation, written as CHR$(65).

The chart also shows the hexadecimal (or hex) value of each character. The hexadecimal numbering system is based on units of 16; our usual numbering system, decimal, is based on units of 10. In hex, the letter A is expressed as 41H (the H stands for hexadecimal).

Control codes

Most of the time you don't give this code system a thought. If you press A on the keyboard, the computer sends the code to the printer and the letter A is printed. However, some printer codes, like the one for a line feed, do not have a key on the keyboard.

These are the ASCII codes with values of less than 33. These codes are called control *codes* because they control the operation of the printer. These characters are not displayed on your screen and aren't printed as a character by your printer.

The ASCII codes 0 through 32 have commonly used abbreviations for their names, such as <LF> for a line feed. These controls are listed in Appendix A.

ESCape Sequences

There are not enough control codes for all of the advanced features of modem printers, so multiple-code control sequences have been developed. All of these control sequences begin with the control code ASCII 27, which is called *Escape.* (In this manual it is abbreviated as <ESC>.) These sequences can have more than one code following Escape, depending on the command.

The ESCape code changes the interpretation of the codes that follow it - they are interpreted as part of a printer command. For example, if the SQ-2000 receives the number 52, it prints the numeral 4 because 52 is the ASCII code for that letter. However, if the printer receives a 27 just before the 52, it turns on the italic mode, because ESCape "4" is the SQ-2000's code for italic printing, as shown in Appendix A.

This same command could also be written with "4" (including the quotation marks) in place of the 52. Many ESCape sequences are written with letters or numbers enclosed in quotation marks. These letters or numbers can be used in place of the decimal or hexadecimal values as long as they're placed in quotes. There's no functional difference between the two systems, but you might find the letters and numbers easier to remember.

Translating the ASCII code

You may also find that different manuals and programs use different terms for the same characters or functions. For example, your computer manual may say to send the decimal 10 for a line feed, while your spreadsheet program recommends a <CR> or CTRL-J for the same thing.

Appendix B contains a conversion chart for all the common names of the ASCII codes, and shows the relationship between the different forms of notation. In addition, Appendix A gives a description of all the control codes and ESCape sequences used on the SQ-2000.

How to send control codes to printer

The short program that follows illustrates the concepts of control codes and ESCape sequences. It is written in Microsoft BASIC, but it can be adapted to other forms of BASIC or other programming languages. If you have specific questions about how BASIC works, consult the program's documentation. How to overcome problems specific to your computer is covered in Chapter 8.

1. Make sure that you're in BASIC; then type the following line just as it appears here. (Don't forget to include all semicolons, even the ones at the end of the lines.)

```
10 LPRINT "NORMAL PRINTING" CHR$(lO) CHR$(13);
```

2. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

```
NORMAL PRINTING
```

This line begins with a line number, 10, then the command LPRINT. Anything that is enclosed in quotation marks after the LPRINT command is sent to the printer.

If you check the ASCII chart in Appendix B, you'll find that CHR$(lO) is the control code for a *line feed*, so when the printer receives this, it moves the paper up one line.

CHR$(13), according to the ASCII chart, is the code for carriage return, so the print head returns to the left margin and awaits the next command.

3. Next type:

```
20 LPRINT CHR$(27) "4" "ITALIC PRINTING";
```

4. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

NORMAL PRINTING
ITALIC PRINTING

This time the printer receives a CHR$(27) which is the code for ESCape or <ESC>. This tells the printer that whatever comes next should be interpreted as a printer command.

Next comes “4” -- if you look under the SQ-2000 commands in Appendix A, you’ll find that <ESC> “4” is the command for italic print. So the SQ-2000 prints “ITALIC PRINTING” in italic type.

5. Next type:

30 LPRINT CHR$(27) "5" CHR$(10) CHR$(13);

6. Now press RETURN.

In this line the printer receives the ESCape code CHR$(27), so it reads “5” as a printer code, in this case the code to turn off the italic typestyle.

The next two codes, CHR$(1O) and CHR$(13), are for line feed and carriage return respectively, as described in step 2.

7. Next type:

```
40 LPRINT CHR$(27) "p" CHR$(1) "PROPORTIONAL
   PRINTING";
50 LPRINT CHR$(27) "p" CHR$(0) CHR$(10) CHR$(13);
```

8. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING

The “p” 1 in line 40 turns on the proportional printing, and the “p” 0 in line 50 turns it off.

9. Next type:

```
60 LPRINT CHR$(27) “E” “EMPHASIZED PRINTING” ;
70 LPRINT CHR$(27) “F”;
```

10. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

```
NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING
```

The “E” in line 60 turns on the emphasized printing and the “F” in line 70 turns it off.

The program is now complete. To see it fully assembled on the screen, type LIST and press RETURN. You will see:

```
10 LPRINT “NORMAL PRINTING” CHR$(10) CHR$(13);
20 LPRINT CHR$(27) “4” “ITALIC PRINTING”;
30 LPRINT CHR$(27) “5” CHR$(1O) CHR$(13);
40 LPRINT CHR$(27) “p” CHR$(1) “PROPORTIONAL
   PRINTING”;
50 LPRINT CHR$(27) “p” CHR$(0) CHR$(10) CHR$(13);
60 LPRINT CHR$(27) “E” “EMPHASIZED PRINTING”;
70 LPRINT CHR$(27) “F”;
```

To send the entire program to the printer, type RUN, press RETURN, and the SQ-2000 prints:

```
NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING
```

Using Master Select Command

The SQ-2000 can produce over 100 different combinations of print styles. The Master Select command allows you to choose any one of these styles. The Master Select command consists of <ESC> “!" followed by a single ASCII code. The value of the ASCII code determines the printing style that is selected. A typical master select command might look like this:

```
<ESC> “!” 66
```

This command would select italic proportional print. In BASIC, the same command would look like this:

LPRINT CHR$(27) "!" CHR$(66);

You can make up your own combinations quite easily. This is possible because each print style has its own value you can use with the Master Select command. To create a "custom" Master Select Code, add the values of the print styles you wish to combine. The values of the print styles are as follows:

Elite	1
Proportional	2
Compressed	4
Emphasized	8
Expanded	32
Italic	64
Underlined	128

For example, if you want to find the code for elite emphasized italic print you would add these values:

Elite	1
Emphasized	8
Italic	64
	73

The Master Select Command you would use would look like this:

<ESC> "!" 73 (in BASIC: CHR$(27) "!" CHR$(73);)

Note:
Proportional overrides pica/elite. Compressed works only in draft print.

Some of the more popular styles the SQ-2000 can produce are shown on the next four pages. The number following each example is the ASCII code (decimal) which will select that particular print style.

Proportional print styles are shown first. These styles are available in both the letter quality and draft sets. The next page shows the printing styles that are available in the letter quality set. The final two pages show the printing styles that are available in the draft set.

The Select Print Quality command will select either the letter quality or the draft set. The select print quality command looks like this:

<ESC> “x” 0 - To select the draft set
<ESC> “x” 1 - To select the letter quality set

Table 3-1. Proportional print styles

	Pica		Expanded	
	Print Sample	**Master Select Number**	**Print Sample**	**Master Select Number**
Regular	MISwiy	2	**M I S w i y**	34
Emphasized	MISwiy	10	M I S w i y	42
Italic				
Regular	***MISwiy***	**66**	M I S w i y	98
Emphasized	***MISwiy***	74	M I S w i y	106
Underlined				
Regular	MISwiy	130	M I S w i y	162
Emphasized	MISwiy	138	M I S w i y	170
Italic underlined				
Regular	**MISwiy**	194	M I S w i y	226
Emphasized	**MISwiy**	202	M I S w i y	234

Table 3-2. Draft pica print styles

	Pica		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Number	Sample	Master Number
Regular	MISwiy	0	MISwiy	4	M I S w i y 3 2		M I S w i y	3 6
Emphasized	MISwiy	8	MISwiy	12	M i S w i y 4 0		**MISwiy**	**44**
Italic								
Regular	*MISwiy*	64	MISwiy	68	*M I S w i y* 9 6		MISwiy	100
Emphasized	***MISwiy***	72	MISwiy	76	M I S w i y 1 0 4		***MISwiy***	***108***
Underlined								
Regular	MISwiy	128	MISwiy	132	M I S w i y 1 6 0		M I S w i y	1 6 4
Emphasized	M I S w i y	1 3 6	MISwiy	140	M I S w i y 1 6 8		**MISwiy**	**172**
italic underlined								
Regular	*M I S w i y*	*1 9 2*	MISwiy	196	M I S w i y 2 2 4		MISwiy	2 2 8
Emphasized	***MISwiy***	***200***	***MISwiy***	***204***	M I S w i y 2 3 2		***MISwiy***	***236***

Table 3-3. Draft elite print styles

	Elite		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	1	MISwiy	5	M I S w i y	3 3	MISwiy	37
Emphasized	MISwiy	9	MIswiy	13	M I S w i y	4 1	MISwiy	45
Italic								
Regular	***MISwiy***	65	MISwiy	69	***M I S w i y***	***9 7***	***MISwiy***	***101***
Emphasized	***MISwiy***	73	MISwiy	71	***M I S w i y***	***1 0 5***	*MISwiy*	*109*
Underlined								
Regular	MISwiy	129	MISwiy	133	M I S w i y	1 6 1	MISwiy	165
Emphasized	MISwiy	137	MISwiy	141	M I S w i y	1 6 9	MISwiy	173
Italic underlined								
Regular	***MISwiy***	***193***	MISwiy	197	M I S w i y	2 2 5	MISwiy	229
Emphasized	***MISwiy***	***201***	*MISwiy*	*205*	***M I S w i y***	***2 3 3***	*MISwiy*	*237*

Table 3-4. Letter quality pica print styles

	Pica		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	0	MISwiy	4	**M I S w i y**	3 2	**MISwiy**	36
Emphasized	MISwiy	8	MISwiy	12	M I S w i y	4 0	MISwiy	44
Italic								
Regular	***MISwiy***	64	MISwiy	68	*M I S w i y*	9 6	**MISwiy**	*100*
Emphasized	***MISwiy***	72	MISwiy	76	***M I S w i y***	1 0 4	MISwiy	108
Underlined								
Regular	MISwiy	128	MISwiy	132	**M I S w i y**	**1 6 0**	**MISwiy**	**164**
Emphasized	MISwiy	136	MISwiy	140	M I S w i y	***1 6 8***	***MISwiy***	***172***
Italic underlined								
Regular	***MISwiy***	***192***	MISwiy	196	*M I S w i y*	*2 2 4*	*MISwiy*	*228*
Emphasized	***MISwiy***	200	MISwiy	204	***M I S w i y***	2 3 2	MISwiy	236

Table 3-5. Letter quality elite print styles

	Elite		Compressed		Expanded		Compressed Expanded	
	Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	1	MISwiy	5	M I S w i y	3 3	MISwiy	37
Emphasized	MISwiy	9	MISwiy	13	M I S w i y	4 1	MISwiy	45
Italic								
Regular	*MISwiy*	65	MISwiy	69	*M I S w i y*	9 7	*MISwiy*	101
Emphasized	*MISwiy*	73	*MISwiy*	77	*M I S w i y*	1 0 5	*MISwiy*	109
Underlined								
Regular	MISwiy	129	MISwiy	133	M I S w i y	1 6 1	MISwiy	165
Emphasized	MISwiy	137	Miswiy	141	M I S w i y	1 6 9	MISwiy	173
Italic underlined								
Regular	*MISwiy*	193	MISwiy	197	*M I S w i y*	2 2 5	*MISwiy*	229
Emphasized	*MISwiy*	201	*MISwiy*	205	*M I S w i y*	2 3 3	*MISwiy*	237

Chapter3
Using the SQ-2000

This chapter tells you how to set up your word processor or other applications software to work with the SQ-2000. If you are interested in programming with the SQ-2000, the second part of this chapter contains basic information on control codes and ESCape sequences.

Using the SQ-2000 with Word Processors

Most word processing programs today support the SQ-2000 because it uses the same commands and control codes as many Epson printers.

These programs usually have a setup or installation procedure that prepares the program to work with a printer. This is often a short question-and-answer session in which the program asks two or three basic questions about your computer and printer. To set up a program for use with the SQ-2000, you would give the following answers:

Question	Answer
What type of computer are you using?	Your computer's type
What type of printer are you using?	Choose LQ-1500 if listed. If not listed, choose FX-80 or FX-100. If specific models are not listed, choose "Epson printer." (When new printers are released, it takes time to update the lists, so by choosing another Epson printer, you will still be sending the correct codes.)

What type of interface are you using?	Parallel or serial (this will depend on the interface board in the SQ-2000, your computer, and the type of cable you have).

Programs that don't specifically list the SQ-2000 may ask other questions about your printer. The following questions are asked most often (the answers follow in bold).

1. Does your printer (SQ-2000) do standard backspacing? **Yes**
2. How many passes of the print head are adequate for bold-facing? **Two**

Some word processors let you redefine the printer instructions (often called printer drivers). To do this, you must give your word processor certain information so that it can take advantage of your printer's features. This is covered later on in this chapter, and in Appendix A.

Using the SQ-2000 with other application programs

You can also use the SQ-2000 to print other documents, such as spreadsheets, with various commercial software packages.

As with word processors, most of your printing will be straightforward. If your program has a printer selection routine, then follow the advice given above.

Programming with the SQ-2000

This section provides an overview of the ASCII code system. It also gives basic instruction on how to send control codes and ESCape sequences to the printer in order to take advantage of the SQ-2000's special features, such as italics, enlarged, or proportional typestyles.

If you already know how to program your printer, you can skip to Appendix A, "SQ-2000 Commands," and Appendix B, "ASCII Code Conversion Chart."

Computer-to-printer communications

A computer and printer communicate by means of numbered codes. If you press the letter A on the keyboard, it is translated into a numeric code, transmitted to a peripheral device (such as a video screeen or a printer) then displayed as the letter A.

To cope with the many different kinds of computers and printers used today, a standard set of codes has been developed. This set of codes is called the American Standard Code for Information Interchange, or ASCII for short. Almost all computers use these *ASCII* codes to communicate with printers.

There are ASCII codes for all of the letters in the alphabet, both upper- and lowercase, and for the numbers from 0 to 9. The ASCII code also includes most punctuation marks, and some codes that control printer functions. If you refer to the ASCII chart in Appendix B, you'll find that all of these letters, numbers and punctuation marks have been assigned code numbers from 33 through 255.

ASCII codes

Although these codes are standard from computer to computer, they can be expressed in a number of different ways. The chart in Appendix B is a comparative table that lists each ASCII code as a character (A, B, C, 1,2,3) and as a *decimal* or *hexadecimal* number. For example, the letter A is represented as an A and as the decimal number 65. If you wanted to print the letter A using the BASIC language, you would use the decimal notation, written as CHR$(65).

The chart also shows the hexadecimal (or hex) value of each character. The hexadecimal numbering system is based on units of 16; our usual numbering system, decimal, is based on units of 10. In hex, the letter A is expressed as 41H (the H stands for hexadecimal).

Control codes

Most of the time you don't give this code system a thought. If you press A on the keyboard, the computer sends the code to the printer and the letter A is printed. However, some printer codes, like the one for a line feed, do not have a key on the keyboard.

These are the ASCII codes with values of less than 33. These codes are called control *codes* because they control the operation of the printer. These characters are not displayed on your screen and aren't printed as a character by your printer.

The ASCII codes 0 through 32 have commonly used abbreviations for their names, such as <LF> for a line feed. These controls are listed in Appendix A.

ESCape Sequences

There are not enough control codes for all of the advanced features of modern printers, so multiple-code control sequences have been developed. All of these control sequences begin with the control code ASCII 27, which is called *Escape.* (In this manual it is abbreviated as <ESC>.) These sequences can have more than one code following Escape, depending on the command.

The ESCape code changes the interpretation of the codes that follow it -- they are interpreted as part of a printer command. For example, if the SQ-2000 receives the number 52, it prints the numeral 4 because 52 is the ASCII code for that letter. However, if the printer receives a 27 just before the 52, it turns on the italic mode, because ESCape "4" is the SQ-2000's code for italic printing, as shown in Appendix A.

This same command could also be written with *"4"* (including the quotation marks) in place of the 52. Many ESCape sequences are written with letters or numbers enclosed in quotation marks. These letters or numbers can be used in place of the decimal or hexadecimal values as long as they're placed in quotes. There's no functional difference between the two systems, but you might find the letters and numbers easier to remember.

Translating the ASCII code

You may also find that different manuals and programs use different terms for the same characters or functions. For example, your computer manual may say to send the decimal 10 for a line feed, while your spreadsheet program recommends a <CR> or CTRL-J for the same thing.

Appendix B contains a conversion chart for all the common names of the ASCII codes, and shows the relationship between the different forms of notation. In addition, Appendix A gives a description of all the control codes and ESCape sequences used on the SQ-2000.

How to send control codes to printer

The short program that follows illustrates the concepts of control codes and ESCape sequences. It is written in Microsoft BASIC, but it can be adapted to other forms of BASIC or other programming languages. If you have specific questions about how BASIC works, consult the program's documentation. How to overcome problems specific to your computer is covered in Chapter 8.

1. Make sure that you're in BASIC; then type the following line just as it appears here. (Don't forget to include all semicolons, even the ones at the end of the lines.)

```
10 LPRINT "NORMAL PRINTING" CHR$(10) CHR$(13);
```

2. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

```
NORMAL PRINTING
```

This line begins with a line number, 10, then the command LPRINT. Anything that is enclosed in quotation marks after the LPRINT command is sent to the printer.

If you check the ASCII chart in Appendix B, you'll find that CHR$(lO) is the control code for a *line feed*, so when the printer receives this, it moves the paper up one line.

CHR$(13), according to the ASCII chart, is the code for carriage return, so the print head returns to the left margin and awaits the next command.

3. Next type:

```
20 LPRINT CHR$(27) "4" "ITALIC PRINTING";
```

4. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

NORMAL PRINTING
ITALIC PRINTING

This time the printer receives a CHR$(27) which is the code for ESCape or <ESC>. This tells the printer that whatever comes next should be interpreted as a printer command.

Next comes “4” -- if you look under the SQ-2000 commands in Appendix A, you’ll find that <ESC> “4” is the command for italic print. So the SQ-2000 prints “ITALIC PRINTING” in italic type.

5. Next type:

```
30 LPRINT CHR$(27) "5" CHR$(10) CHR$(13);
```

6. Now press RETURN.

In this line the printer receives the ESCape code CHR$(27), so it reads “5” as a printer code, in this case the code to turn off the italic typestyle.

The next two codes, CHR$(lO) and CHR$(13), are for line feed and carriage return respectively, as described in step 2.

7. Next type:

```
40 LPRINT CHR$(27) "p" CHR$(1) "PROPORTIONAL
   PRINTING";
50 LPRINT CHR$(27) "p" CHR$(0) CHR$(10) CHR$(13);
```

8. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING

The “p” 1 in line 40 turns on the proportional printing, and the “p” 0 in line 50 turns it off.

9. Next type:

```
60 LPRINT CHR$(27) “E” “EMPHASIZED PRINTING” ;
70 LPRINT CHR$(27) “F”;
```

10. Now press RETURN, type RUN, and press RETURN again. The SQ-2000 prints:

```
NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING
```

The “E” in line 60 turns on the emphasized printing and the “F” in line 70 turns it off.

The program is now complete. To see it fully assembled on the screen, type LIST and press RETURN. You will see:

```
10 LPRINT “NORMAL PRINTING” CHR$(10) CHR$(13);
20 LPRINT CHR$(27) “4” “ITALIC PRINTING”;
30 LPRINT CHR$(27) “5” CHR$(1O) CHR$(13);
40 LPRINT CHR$(27) “p” CHR$(1) “PROPORTIONAL
   PRINTING”;
50 LPRINT CHR$(27) “p” CHR$(0) CHR$(10) CHR$(13);
60 LPRINT CHR$(27) “E” “EMPHASIZED PRINTING”;
70 LPRINT CHR$(27) “F”;
```

To send the entire program to the printer, type RUN, press RETURN, and the SQ-2000 prints:

```
NORMAL PRINTING
ITALIC PRINTING
PROPORTIONAL PRINTING
EMPHASIZED PRINTING
```

Using Master Select Command

The SQ-2000 can produce over 100 different combinations of print styles. The Master Select command allows you to choose any one of these styles. The Master Select command consists of <ESC> “!" followed by a single ASCII code. The value of the ASCII code determines the printing style that is selected. A typical master select command might look like this:

<ESC> “!” 66

This command would select italic proportional print. In BASIC, the same command would look like this:

LPRINT CHR$(27) "!" CHR$(66);

You can make up your own combinations quite easily. This is possible because each print style has its own value you can use with the Master Select command. To create a "custom" Master Select Code, add the values of the print styles you wish to combine. The values of the print styles are as follows:

Elite	1
Proportional	2
Compressed	4
Emphasized	8
Expanded	32
Italic	64
Underlined	128

For example, if you want to find the code for elite emphasized italic print you would add these values:

Elite	1
Emphasized	8
Italic	64
	73

The Master Select Command you would use would look like this:

<ESC> "!" 73 (in BASIC: CHR$(27) "!" CHR$(73);)

Note:
Proportional overrides pica/elite. Compressed works only in draft print.

Some of the more popular styles the SQ-2000 can produce are shown on the next four pages. The number following each example is the ASCII code (decimal) which will select that particular print style.

Proportional print styles are shown first. These styles are available in both the letter quality and draft sets. The next page shows the printing styles that are available in the letter quality set. The final two pages show the printing styles that are available in the draft set.

The Select Print Quality command will select either the letter quality or the draft set. The select print quality command looks like this:

<ESC> “x” 0 -- To select the draft set
<ESC> “x” 1 -- To select the letter quality set

Table 3-1. Proportional print styles

	Pica		Expanded	
	Print Sample	**Master Select Number**	**Print Sample**	**Master Select Number**
Regular	MISwiy	2	**M I S w i y**	34
Emphasized	MISwiy	10	M I S w i y	42
Italic				
Regular	***MISwiy***	**66**	M I S w i y	98
Emphasized	***MISwiy***	74	M I S w i y	106
Underlined				
Regular	MISwiy	130	M I S w i y	162
Emphasized	MISwiy	138	M I S w i y	170
Italic underlined				
Regular	**MISwiy**	194	M I S w i y	226
Emphasized	**MISwiy**	202	M I S w i y	234

Table 3-2. Draft pica print styles

	Pica		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	0	MISwiy	4	M I S w i y 3 2		M I S w i y 3 6	
Emphasized	MISwiy	8	MISwiy	12	M I S w i y 4 0		**MISwiy**	**44**
Italic								
Regular	*M I S w i y 6 4*		MISwiy	68	*M I S w i y* 9 6		MISwiy	100
Emphasized	***MISwiy***	7 2	MISwiy	76	M I S w i y 1 0 4		***MISwiy***	***106***
Underlined								
Regular	MISwiy	128	MISwiy	132	M I S w i y 1 6 0		M I S w i y 1 6 4	
Emphasized	M I S w i y 1 3 6		MISwiy	140	M I S w i y 1 6 8		**MISwiy**	**172**
italic underlined								
Regular	*MISwiy*	192	MISwiy	196	M I S w i y 2 2 4		MISwiy	228
Emphasized	***MISwiy***	***200***	***MISwiy***	***204***	M I S w i y 2 3 2		***MISwiy***	***236***

Table 3-3. Draft elite print styles

	Elite		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	1	MISwiy	5	M I S w i y	3 3	MISwiy	37
Emphasized	MISwiy	9	MISwiy	13	M I S w i y	4 1	MISwiy	45
Italic								
Regular	*MISwiy*	65	MISwiy	69	*M I S w i y*	*9 7*	*MISwiy*	*101*
Emphasized	*MISwiy*	73	MISwiy	77	*M I S w i y*	*1 0 5*	*MISwiy*	*109*
Underlined								
Regular	MISwiy	129	MISwiy	133	M I S w i y	1 6 1	MISwiy	165
Emphasized	MISwiy	137	MISwiy	141	M I S w i y	1 6 9	MISwiy	173
Italic underlined								
Regular	*MISwiy*	*193*	MISwiy	197	M I S w i y	2 2 5	MISwiy	229
Emphasized	*MISwiy*	*201*	*MISwiy*	*205*	*M I S w i y*	*2 3 3*	*MISwiy*	*237*

Table 3-4. Letter quality pica print styles

	Pica		Compressed		Expanded		Compressed Expanded	
	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	0	MISwiy	4	M I S w i y	3 2	MISwiy	36
Emphasized	**MISwiy**	**8**	**MISwiy**	**12**	M I S w i y	4 0	MISwiy	44
Italic								
Regular	***MISwiy***	64	MISwiy	68	*M I S w i y*	*9 6*	**MISwiy**	*100*
Emphasized	***MISwiy***	72	**MISwiy**	**76**	***M I S w i y***	1 0 4	MISwiy	108
Underlined								
Regular	MISwiy	128	MISwiy	132	**M I S w i y**	**1 6 0**	**MISwiy**	**164**
Emphasized	**MISwiy**	**136**	MISwiy	**140**	M I S w i y	***1 6 8***	***MISwiy***	***172***
Italic underlined								
Regular	***MISwiy***	***192***	**MISwiy**	**196**	*M I S w i y*	*2 2 4*	*MISwiy*	*228*
Emphasized	***MISwiy***	200	**MISwiy**	204	***M I S w i y***	2 3 2	MISwiy	236

Table 3-5. Letter quality elite print styles

	Elite		Compressed		Expanded		Compressed Expanded	
	Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number	Print Sample	Master Select Number
Regular	MISwiy	1	MISwiy	5	M I S w i y	3 3	MISwiy	37
Emphasized	MISwiy	9	MISwiy	13	M I S w i y	4 1	MISwiy	45
Italic								
Regular	*MISwiy*	65	MISwiy	69	*M I S w i y*	9 7	*MISwiy*	101
Emphasized	*MISwiy*	73	*MISwiy*	II	*M I S w i y*	1 0 5	*MISwiy*	*MISwiy* 109
Underlined								
Regular	MISwiy	129	MISwiy	133	M I S w i y	1 6 1	MISwiy	165
Emphasized	MISwiy	137	MISwiy	141	M I S w i y	1 6 9	MISwiy	173
Italic underlined								
Regular	*MISwiy*	193	MISwiy	197	*M I S w i y*	2 2 5	*MISwiy*	229
Emphasized	*MISwiy*	201	*MISwiy*	205	*M I S w i y*	2 3 3	*MISwiy*	237

Chapter 4
Printer Care and Maintenance

In this chapter, you'll learn about the self-cleaning feature and other operating aspects of the printer. There's also a trouble-shooting chart you can use to quickly solve any little problems that might arise.

As you'll see, the SQ-2000 is not only easy to use -- it's also simple to maintain on a daily basis. Periodic attention by a service technician is necessary, however.

The Ink Jet Print Head

If you're familiar with dot-matrix printers, you know that they print characters made up of numerous tiny dots. The SQ-2000 is similar in some ways, but significantly improves on earlier dot-matrix technology. Rapid-drying ink has replaced the ink ribbon. Miniature nozzles release the dots directly onto the page.

The result is faster printing with almost no noise. Moreover, because the SQ-2000's print head releases the ink from 24 nozzles arranged in two columns, each character is more sharply defined.*

* In letter quality mode

How Automatic Print Head Cleaning Works

Each time you turn on the printer it goes through a brief cleaning cycle in which cleaning solvent is sprayed through the nozzles. When you turn the printer off, it cleans itself again.

Moreover, during printing the SQ-2000 periodically pauses for a few moments to clean the print head's lower nozzles, which don't get used as much and are more liable to become clogged.

A reservoir contained in the disposable ink cartridge supplies the cleaning solvent. Used solvent flows back into the cartridge to a separate location.

Ink is also kept from accidentally drying in the nozzles by another automatic feature: Any time the printing stops for a minute or more, the print head returns to its storage position and the nozzles are automatically capped.

Caution:
Never unplug or otherwise turn off the printer without first switching it off using the main power switch.

Turning off the printer from a remote source defeats the automatic cleaning operation and can permit ink to dry in the ink nozzles. If this occurs, the print head may be damaged and have to be replaced.

For this reason, avoid plugging the printer into an outlet which is controlled by a wall switch or similar switch.

Cleaning the print head while printing

Occasionally you may want to give the print head an additional cleaning while engaged in printing.

First, make sure the printer is off-line. Clean the print head by pressing the CLEANING button for a few moments, then releasing. This makes the printer go through its cleaning cycle for about 15 seconds. (see Figure 4-l).

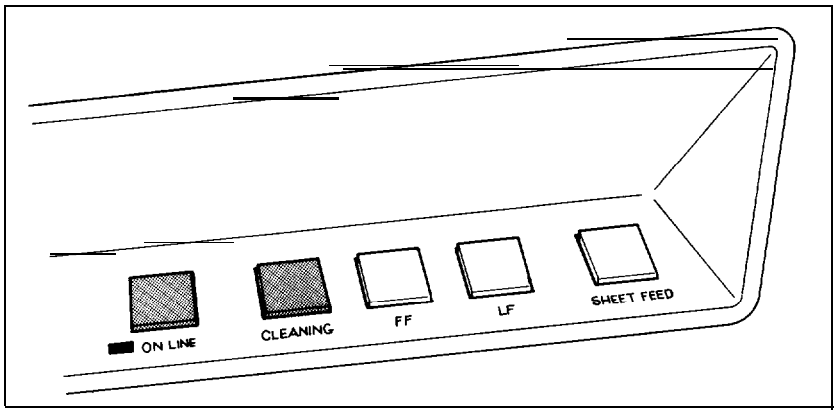

Figure 4-Z. Buttons for cleaning during printing

This time the print head did something different. It performed the cleaning action, but first it stopped for several seconds in front of the revolving rubber "brush" next to the storage station. That gave it an additional scrubbing to remove dirt and other deposits.

To resume printing, simply press the ON LINE button again and the printing starts from the point of interruption.

For more extensive cleaning

At those times when the short cleaning cycle may not be enough, or when the printer has not been used for some time, you can put the SQ-2000 through a more thorough cleaning.

If you've been printing, first let the printing stop on its own so no data will be lost. Turn off the printer. Then, turn it back on while holding down the CLEANING button.

This cycle takes about two minutes, including a quiet period in which the solvent is allowed to soak into the print head to dissolve ink deposits.

Special cleaning

When you know you won't use the printer for several weeks or longer, if it's to be moved long distances, or stored at temperatures over 95°F, you need to take an important precaution.

You must put the SQ-2000 through another cleaning cycle. But when this one ends, air has replaced the ink in the print head and tubes to keep ink from drying in them.

Turn off the printer while holding down the CLEANING but-

ton. This special cleaning also takes about two minutes.

Be careful not to unplug the printer too quickly. As with the other extended cleaning cycle, there's a quiet period during which solvent is allowed to soak into the print head and other parts.

Wait for the POWER light to go out. That's your signal the printer is ready to be stored or transported.

Summary of Cleaning Cycles

Here's a brief summary of the cleaning cycles:

- The printer automatically cleans itself when it is turned on and periodically during operation.
- If you notice a slight deterioration in print quality, push the ON LINE button to make the printer go off-line. Then press the CLEANING button for a few moments. To resume printing, press the ON LINE button again.
- For a more extensive cleaning, wait for the printing to stop, then turn the printer off. Turn it back on again while pressing the CLEANING button.
- When the printer won't be used for an extended period, or is to be stored or transported, clear the printing parts of ink by turning the printer off while holding down the CLEANING button. Let the POWER indicator go out before unplugging the printer.

Troubleshooting Guide

The SQ-2000 is often able to tell when something goes wrong, such as when paper has jammed or someone forgot to replace the ink cartridge. It does that through special sensing devices.

When such a problem occurs, you may be alerted by a warning light or buzzer. Or the printer just won't operate.

The following troubleshooting guide provides some of the more common problems that may arise during normal operation. To save time (and perhaps some embarrassment), be sure to refer to it before you call in service personnel.

Troubleshooting Guide

Problem	Possible Cause	Check	To Solve It	See Page
Printer will not operate at all after being turned on.	Printer is not on-line with computer.	• Check to see if ON LINE indicator is glowing.	• Press ON LINE button to make printer go on-line.	16, 24
	Ink cartridge is not set in place or pushed down far enough.	• Check if the ink cartridge is installed and that it is not down past the hooking edges.	• Set ink cartridge, pushing it down until hooking edges show.	9
	No ink in cartridge.	• Check to see if INK LOW indicator is glowing.	• Turn off printer. Replace ink cartridge. Turn on printer and press CLEANING button.	9, 27
Print head will not move or printer stops printing.	Paper loaded incorrectly.	• Check to see if paper is properly inserted or possibly jammed.	• Reload paper.	15
	Printing has reached bottom of page.	• Check to see whether PAPER OUT indicator is glowing.	• Remove printed page with FF button and load new sheet.	27
Dots are missing	Dirty print head due to paper lint, ink deposits, etc.		• Do brief cleaning by pressing CLEANING button. Repeat.	44

Problem	Possible Cause	Check	To Solve It	See Page
Dots still missing after normal cleaning cycle.	Dirty print head.		• Do extended cleaning.	45
	Ink cartridge faulty.	• Check ink cartridge for effective use period.	• Turn printer off. Replace with new ink cartridge with unexpired effective period. Clean after replacement.	9, 44
Print "bleeds" and has blurred appearance.	Paper is too coarse or overly absorbent.	• Do printer self-test and inspect result.	• Use other side of paper. • Replace with paper having denser weave.	18
Print smudges, dries too slowly.	Paper not absorbent enough.	• Check several sheets of paper stock with printer self-test.	• Use other side of paper. • Replace with paper that meets absorbency requirements.	18
Print appears distorted--dots either too coarse or dense or appear wavy.	Print head is dirty.		• Do normal cleaning operation.	44
	Interference by wind or air from powerful fan.	• Check if printer is exposed to strong wind or fan.	• Relocate printer out of air current.	-
Print appears distorted while using continuous paper.	Tension not correct on continuous paper.	• Check if tractor sprockets are positioned correctly. • Check if paper guide skids are evenly spaced.	• Move right sprocket so paper is pulled taut. • Spread paper guide skids evenly.	E-4

Problem	Possible Cause	Check	To Solve It	See Page
Paper has ink stains or splotches.	Paper setting method is wrong.	• Check to see that paper pressure bar is properly set with end rollers at the edge of the paper.	• Adjust rollers on paper pressure bar.	16, E-4
	Ink has been sprayed onto platen.	• Inspect platen for ink.	• Clean the platen.	–
Continuous paper feeds irregularly: tension on paper is uneven.	Obstruction behind platen is binding paper.	• Check if paper scrap has become caught behind platen.	• Remove platen to remove obstruction.	--

Chapter 5
User-Defined Characters

With the SQ-2000, it is possible to define and print characters of your own design. This can be useful if you want to design an entirely new alphabet or typeface. You can also create characters for special applications (for example, mathematical or scientific symbols). Or, you may want to create graphic patterns with user-defined characters to serve as building blocks for larger designs. How these are done is the subject of this chapter.

Dot-Matrix Printing

In order to use *user-defined characters,* you need to understand how *dot-matrix printing* works. The process is called dot-matrix printing because each character is composed of small dots arranged on a matrix, or *grid.* To see how that character grid gets printed, let's take a look at the print head itself.

The print head

The SQ-2000 print head does not print an entire character at one time. Instead, it prints dots one column at a time. The print head contains 24 ink nozzles that appear to be arranged in a vertical column. If you were to remove the print head and look at the nozzles, you would see two staggered columns of 12 nozzles. However, the timing is such that they print as one continuous column of 24 nozzles.

As the print head moves across the page, electrical impulses cause the appropriate nozzles to release ink against the the paper, causing a single dot to print with each impulse. Figure 5-1 shows the print head as it prints a capital H. In the first column, six nozzles release ink, and in the next four columns, one nozzle releases ink. In the last column six nozzles release ink again.

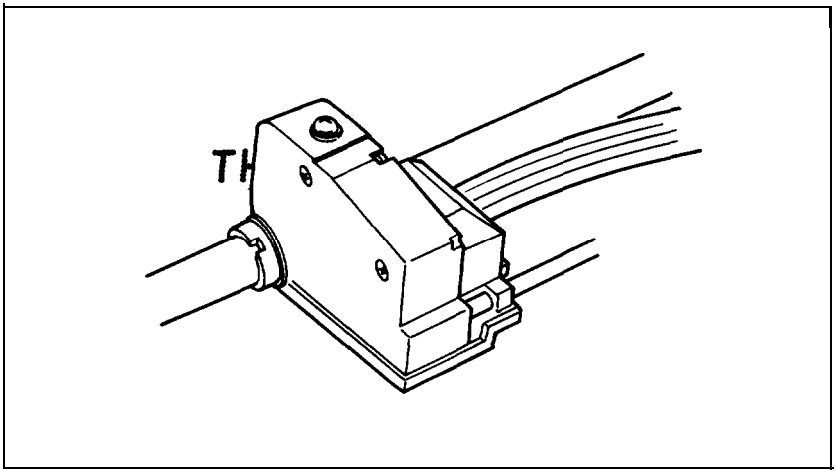

Figure 5-1. The print head

The print matrix

Now that you know how the print head works, it's important to understand how the characters are defined and stored in the SQ-2000's memory. As mentioned earlier, each character is composed of a series of dots arranged on a matrix.

The matrix is 24 dots high-one dot for each nozzle on the SQ-2000 print head. The width of the character matrix is dependent upon the character set in use. For *draft characters,* the grid is nine dots wide. *Letter quality characters* are defined on a grid which is 15 dots wide, but the dots are placed closer to each other. *The* grid for *proportional characters* is 37 dots wide, with the dots spaced even more closely.

Figure 5-2 shows two of the character matrixes with the dots used to print the letter H. All of the SQ-2000's characters are stored in the same manner.

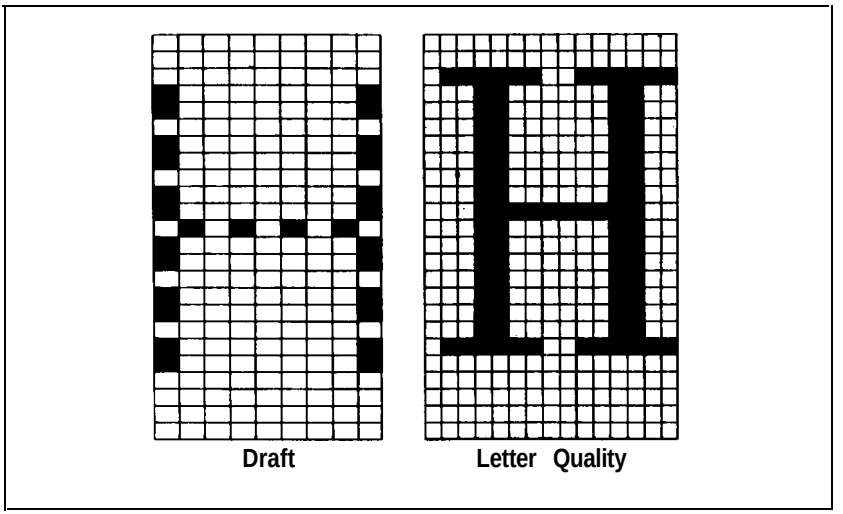

Figure *5-2. Character grids*

Defining Your Own Characters

With the knowledge of how the SQ-2000 stores and prints characters, you are ready to define your own.

The first step in defining characters is to lay out the dots on a grid just as you want them to print. (The grids are exactly the same as those Epson has used to define the standard character sets.) In Figure 5-3 you can see a user-defined character, a modem capital A.

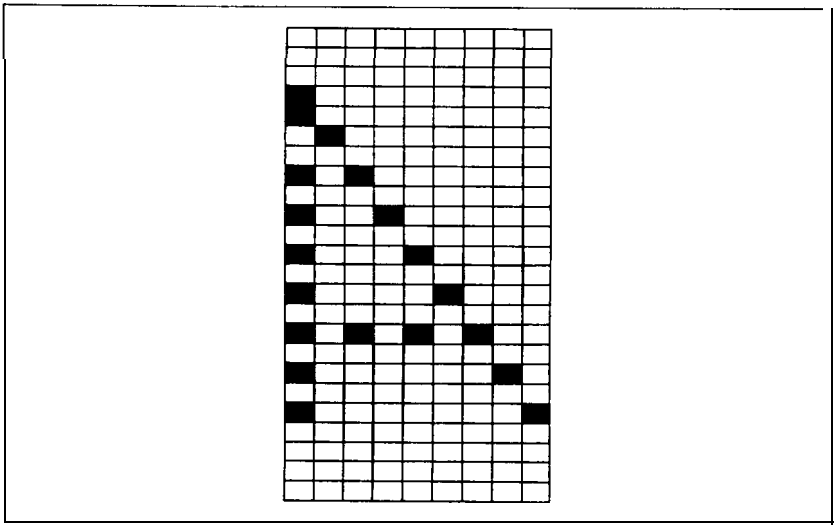

Fig. 5-3. User-defined character

Next, you translate the dot pattern you've created on paper to a numeric format so you can send the information to the SQ-2000. Every dot has an assigned value. Each vertical column (which has a maximum of 24 dots) is first divided into three groups of eight dots. Each group of eight dots is represented by one byte, which consists of eight bits. Hence, one bit represents each dot.

Each bit is a power of two, so that the bits within each byte have values of 1,2,4,8,16,32,64, and 128. In the vertical column of dots, the bits are arranged so that the most significant bit (which has a value of 128) is at the top and the least significant bit (which has a value of 1) is at the bottom.

Figure 5-4 shows how to use this method to calculate the data bytes for the first column of our letter A. Each bit that represents a dot has a value of 1; each bit that represents a space has a value of 0. To the right of the column the binary numbers are converted to decimal value.

This last step is merely for convenience. The data you send to the SQ-2000 can be in any form (binary, decimal, or hexadecimal) that you can use with your program language. We've chosen to use decimal numbers because the example programs in this manual are written in BASIC and everyone is familiar with decimals.

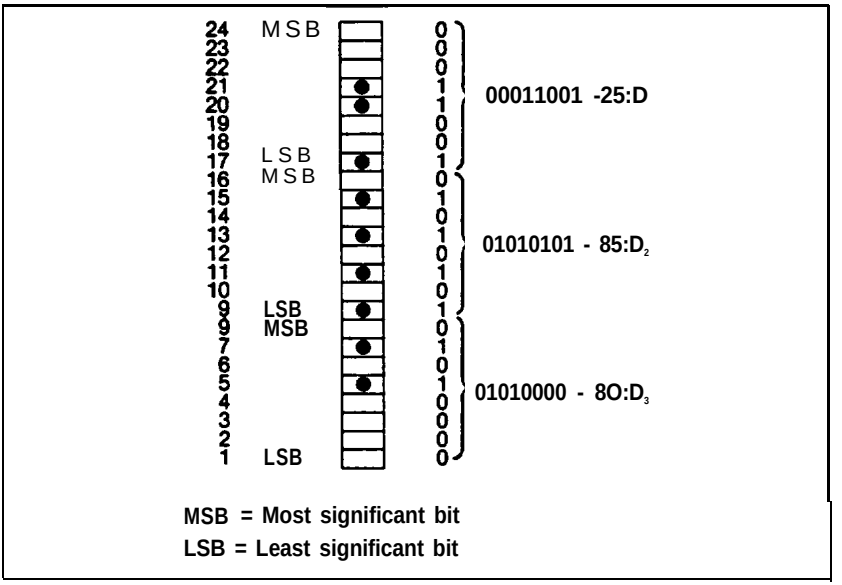

Figure 5-4. Data bytes for -he first column of a new *capital A*

You've seen how to design a character by laying out the dots on a grid, translating the dots to binary information, and then converting the binary numbers to decimal equivalents. The next (and final) step in defining a character is to send this information to the printer.

Sending information to the SQ-2000

The SQ-2000 command to define characters is one of the more complex in its repertoire. The format of the command is this:

<ESC> "&" <NUL> *nl n2* data

The <ESC> "&" is simple enough; that's a format you should be quite familiar with by now. The <NUL> (which is ASCII code 0) allows for future enhancements. At this time it is always ASCII code 0.

With the SQ-2000, you can define many characters with a single command. The n1 and *n2* bytes are used to specify a range of ASCII codes for the characters you will define. You then have to provide character definition data for all of the characters in that range to follow.

Note:
The entire range of ASCII decimal codes (from 0 to 127) can be used for user-defined characters, but a caution is in order. Characters with ASCII decimal values below 32 are usually reserved as control codes by both your computer and your printer. While these characters can be replaced by user-defined characters, it should be avoided because of the effect on the normal control codes.

To see how to specify nl and *n2,* let's use an example. If, for instance, you wanted to redefine the characters A through Z, nl would be "A" (or ASCII decimal 65) and *n2* would be "Z" (ASCII decimal 90). So the command <ESC> "&" <NUL> "AZ" (followed by the appropriate data) would replace the entire alphabet of capital letters.

In some instances, you may want to redefine a single character. In this case, *nl* and *n2* would have the same value. Our example at the end of this section does just that; it defines only the "A" character which is replaced by a new letter A.

Following the specification of the range of characters to be defined in this command is the data that defines the characters. The data is in this form:

do, d1, d2, Dl, D2, . . . Dd1x3

The first three bytes are used to specify the width of the character and the space to be allowed on either side of it. The left margin (in dot columns) is specified by d0 and the right margin is specified by *d2.* The second byte *(d1)* specifies the number of columns of dots that are printed by the character. By varying the width of the character itself and the spaces around it, you can actually create proportional width characters that print at draft speed.

When defining draft quality characters, the number of printed columns *(dl)* cannot exceed 9, and the sum of *d0 + dl + d2* cannot exceed 12.

The last part of the character definition is the actual data that defines the dot patterns for each character. Since it takes three bytes to specify the dots in one vertical column of dots, the SQ-2000 expects *d1x3* bytes of data to follow *d2.*

An example character definition should make this clear:

```
10 '*** User-defined character: Capital A ***
20 '
30 'Select draft
40 LPRINT CHR$(27) "x' CHR$(0);
50 '
60 'Define download character
70 LPRINT CHR$(27) "&" CHR$(0);
80 '
90 'beginning and ending at A
100 LPRINT "AA";
110 LPRINT CHR$(2) CHR$(10) CHR$(1);
120 '
130 'left margin, # of digits, right margin
140 FOR I=1 TO 10*3
150   READ A
160   LPRINT CHR$(A);
170 NEXT
180 '
190 'Print a sample
200 LPRINT "AAAAAAAAAAAAA"
210 '
220 'Select download
230 LPRINT CHR$(27) "%" CHR$(1);
240 LPRINT "AAAAAAAAAAAAA"
250 '
260 'Deselect download
270 LPRINT CHR$(27) "%"  CHR$(0);
280 LPRINT "AAAAAAAAAAAAA"
290 END
300 DATA 25,85,80,4,0,0,1,1,0
310 DATA 0,64,0,0,17,0,0,4,0
320 DATA 0,1,0,0,0,64,0,0,16
330 DATA 0,0,0,
```

In line 40, the <ESC> "x" command selects draft style printing. You'll see why later in this chapter.

The actual character definition, using the command syntax explained above, starts in line 70. The two A's in line 100 represent n1 and n2, the range of characters being defined (in this case, a range of one). Line 110 contains d0, dl, and *d2*. The information about the actual character design (which is contained in the data statements at the end of the program) is sent to the printer in the loop between lines 140 and 170.

Printing User-Defined Characters

If you entered the example program above, you defined a capital A and placed it in the RAM location for ASCII decimal 65 (replacing the standard "A"). You can now print out a three-line sample of your work. The first and third lines (printed by lines 200 and 280 of the program) print the normal A; the second line (line 240) prints the A that you defined.

This is the result.

```
AAAAAAAAAAAAA
AAAAAAAAAAAAA
AAAAAAAAAAAAA
```

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 230 and 270. It is:

<ESC> "%" n

If n is equal to 0, the normal ROM character set is selected (this is the default). If n is equal to 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 will still be in use.

You may switch between character sets at any time-even in the middle of a line. To try it, place a semicolon at the end of lines 200 and 240 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 capital A. Since no other characters are in the user-defined RAM area, nothing else prints. Other characters sent to the printer don't even print as spaces; it's as if they were not sent at all.

In many cases, you will want to redefine only a few of the characters to suit your needs; the rest of the alphabet will work fine as it is. As you have seen, it is possible to switch back and forth at will between the normal character set and the user-defined character set. It is, however, rather inconvenient.

Therefore, the SQ-2000 has a command which allows you to copy all of the standard characters from ROM to the user-defined character set. The command format is:

<ESC> ":" <NUL> <NUL> <NUL>

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

Using this command you can create a short sequence of codes that will copy normal characters to the user-defined character set, define your special characters, and select the user-defined character set. You can now print with the user-defined set as your normal character set. You'll never need to switch back and forth between sets.

How Print Mode Affects User-Defined Characters

In the example program above, before you defined the new capital A, you selected the SQ-2000's draft print mode. By doing this, you caused any user-defined characters to print as draft characters because user-defined characters assume the mode that is in effect at the time they are defined.

The modes that affect user-defined characters are draft, letter quality, and proportional printing. The <ESC> "x" n command selects between draft (n=0) and letter quality (n=l). The <ESC> "!" n (Master Select) or <ESC> "p"' n (n=l) commands are used to select proportional printing.

The commands for defining characters, selecting the user-defined character set, and copying ROM are exactly the same for each of the user-defined print styles. The print mode in effect when the characters are defined determines the mode of the user-defined characters.

The print mode determines the size of the grid upon which the characters are designed and the speed at which they print. Table 5-l shows the different character grid sizes for each of the print modes.

Table 5-1. *User-defined character* design *grids*

	d1 (maximum)	*dO+d1+d2* (maximum)
Draft	9	12
Letter Quality	15	18
Proportional	37	

Draft mode characters

As you have seen, draft characters are designed on a grid which is 24 dots high by 9 dots wide (plus up to three columns of dots for space between characters). User-defined draft characters print at the same high speed as normal draft characters, even though they may print with more dots and may even be designed for proportional spacing.

There is, however, one restriction on designing characters for draft printing. Dots in the same row may not print in adjacent columns. That is, there must be an empty dot position to the left and to the right of each dot that prints (the space on either side of the character counts as an empty dot position). Therefore, in a character grid that is nine dots wide, a maximum of five dots will print in any row.

For vertical spacing, there is no such restriction. You can print a solid column of 24 dots if you wish.

Letter quality characters

If you select letter quality printing with the <ESC> "x" 1 command, you can design your user-defined characters on a grid which is 24 dots high by 15 dots wide. Each character can be as wide as 18 dots, including space on either side of the character. The dot columns are spaced closer together horizontally than draft style dot columns (the horizontal dot spacing is l/180-inch when printing pica width-as opposed to l/120-inch for draft characters).

Unlike draft characters, there are no restrictions on which dots can print. You can print a solid box of 360 (15x24) dots if you wish. This, coupled with the closer dot spacing, allows you to design characters with higher resolution. The drawback is speed. Normal letter quality characters print more slowly than draft characters; the same is true of the user-defined character set.

Proportional mode characters

Selecting the proportional character mode yields user-defined characters of the highest resolution. Characters can be designed on a grid which is 24 dots high by 37 dots wide. Horizontal dot spacing for proportional characters is 1/360-inch-quite fine indeed! And, like letter quality characters, there are no limits on dot placement. You can use all of the dot positions without restriction.

Mixing Print Styles

Each of the three user-defined character modes (draft, letter quality, and proportional) can be used in combination with most of the SQ-2000's various print styles. For instance, italic, elite, and emphasized styles all work with user-defined characters. The characters you design will be altered to give each of these printing effects.

Mixing the three types of user-defined characters is not permitted. For example, you select the draft attribute and define some characters. Then you select proportional printing and define some more. In this case, the first character definitions will be destroyed. Only one type of character definition may be stored in RAM at any time.

If you define characters in one mode, then switch to another mode and select the user-defined character set, the command will be ignored and nothing will print. However, the user-defined characters definitions remain unaffected. If you switch back to the mode in which they were defined, you can then select and print them.

Other considerations

Keep in mind that user-defined characters are stored in RAM, which is *volatile* in nature. Whenever the printer power is turned off, all of the user-defined characters are lost. Likewise, initializing the printer will clear the user-defined character area. Initializing can be done with the <ESC> "@" command. Also, your computer sometimes sends an initialization (INIT) signal. (Some computers do this each time BASIC is loaded.)

Defining Connecting Characters

Because character definitions include information about the width of the character, including the space around the character, you can define characters that connect horizontally. This feature has a variety of useful applications. You can create: a typeface with connecting scripts, a single extra-wide character that exceeds the size limits of a single character, or graphic characters that can be used as borders.

By defining only two characters (see Figure 5-5), three different border patterns can be created.

```
10 '*** User-Defined Character: Chain Borders ***
20 '
30 'Select letter quality
40 LPRINT CHR$(27) "x" CHR$(1);
50 '
60 'Define download character
70 LPRINT CHR$(27) "&" CHR$(0);
80 '
90 'beginning at "=" and ending at ">"
100 LPRINT "=>";
110 '
120 'left margin, # of digits, right margin
130 LPRINT CHR$(0) CHR$(10) CHR$(0);
140 FOR I=1 TO 10*3
150   READ A
160   LPRINT CHR$(A);
170 NEXT
180 LPRINT CHR$(0) CHR$(14) CHR$(0);
190 FOR I=1 TO 14*3
200   READ A
210   LPRINT CHR$(A);
220 NEXT
```

```
230 '
240 'Select download
250 LPRINT CHR$(27) "%" CHR$(1);
260 '
270 'Print character 50 times
280 FOR I=1 TO 50
290   LPRINT "=";
300 NEXT:LPRINT
310 '
320 'Print character 50 times
330 FOR I=1 TO 50
340   LPRINT ">";
350 NEXT:LPRINT
351 FOR I=1 TO 25
352   LPRINT "=>";
353 NEXT
360 '
370 'Deselect download
380 LPRINT CHR$(27) "%" CHR$(0)
390 END
400 '
410 'Small chain
420 DATA 0,162,0,1,17,0,2,40,128,4,68,64,8,130,32
430 DATA 4,68,64,2,40,128,1,17,0,0,138,0,0,68,0
440 '
450 'Large chain
460 DATA 0,162,0,1,17,0,2,40,128,4,68,64,8,130,32
470 DATA 17,1,16,34,0,136,17,1,16,8,130,32,4,68,64
480 DATA 2,40,128,1,17,0,0,138,0,0,68,0
```

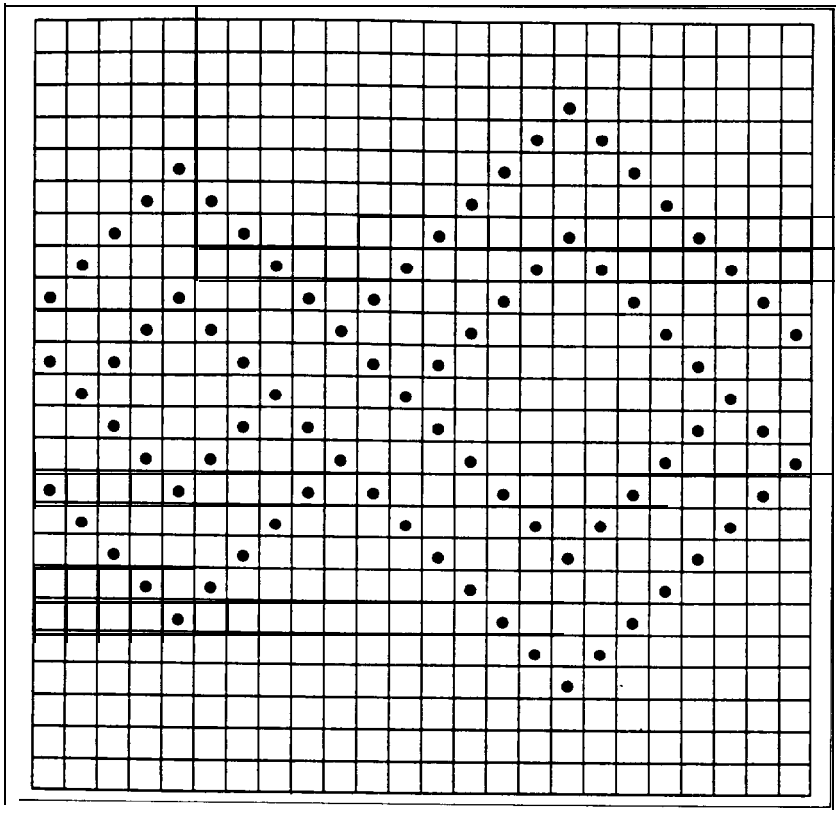

Figure 5-5. Character design grid for border characters

Here's how the program works. Line 40 selects letter quality characters; this will be the attribute of the user-defined characters. The data for the first character, which replaces the "=" sign, is sent in lines 140-170. The second character (">") is defined in program lines 190-220.

In lines 240-353, you test the new characters by printing them in three lines (individually and in combination).

Figure 5-6 shows the printout from this program.

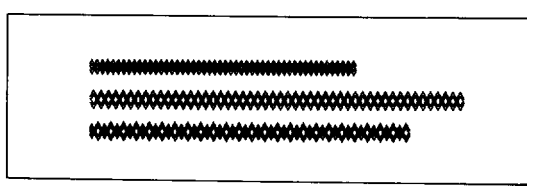

Figure 5-6. Three border designs

Characters that connect vertically

Because the SQ-2000's vertical spacing can be changed, you can also create characters that connect vertically. All you need to do is change the line spacing so that there is no extra space between lines. The following program shows how this technique can be used to print an integral sign that is two lines high.

```
10 '*** User-defined Character; Integral Sign ***
20 '
30 'Select proportional
40 LPRINT CHR$(27) "p" CHR$(1);
50 LPRINT CHR$(27) ":" CHR$(0) CHR$(0) CHR$(0)
60 LPRINT CHR$(27); "&";     CHR$(0);
70 LPRINT "ef";
80 LPRINT CHR$(4) CHR$(28) CHR$(5);
90 FOR I=1 TO 28*3
100 READ A
110 LPRINT CHR$(A);
120 NEXT
130 LPRINT CHR$(4) CHR$(28) CHR$(5);
140 FOR I=1 TO 28*3
150 READ A
160   LPRINT  CHR$(A);
170 NEXT
180 'Print a sample
190 LPRINT CHR$(27) "3" CHR$(12);
200 LPRINT CHR$(27) "%" CHR$(1);
210 LPRINT "e";
220 LPRINT CHR$(27) "S" CHR$(0) "1" CHR$(27) "T";
230 LPRINT "e";
240 LPRINT CHR$(27) "S" CHR$(0) "1" CHR$(27) "T"
250 LPRINT "     (aX+bY)";
260 LPRINT CHR$(27) "S" CHR$(0) "2" CHR$(27) "T";
270 LPRINT "dxdy"
280 LPRINT "f";
290 LPRINT CHR$(27) "S" CHR$(1) "0" CHR$(27) "T";
300 LPRINT "f";
310 LPRINT CHR$(27) "S" CHR$(l) "0" CHR$(27) "T"
320 LPRINT CHR$(27) "@"
330 END
340 'Top half (e)
350 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
360 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
370  DATA  0,63,255,0,0,0,3,255,255,0,0,0,4,0,0,0,0,0
380 DATA 8,0,0,0,0,0,24,0,0,0,0,0,60,0,0,0,0,0
390 DATA 2,4,0,0,0,0,0,0,0,0,0,0,0,0
400 'Bottom half (f)
```

```
410 DATA 0,0,0,0,0,0,0,0,24,0,0,0,0,0,60,0,0,0,0,0,24
420 DATA 0,0,0,0,0,16,0,0,0,0,0,32,0,0,0,255,255,192
430 DATA 0,0,0,255,252, 0, 0, 0, 0, 0, 0, 0, 0, 0
440 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
450 DATA 0,0,0,0,0,0,0,0,0,0,0,0
```

The design grid is shown in Figure 5-7.

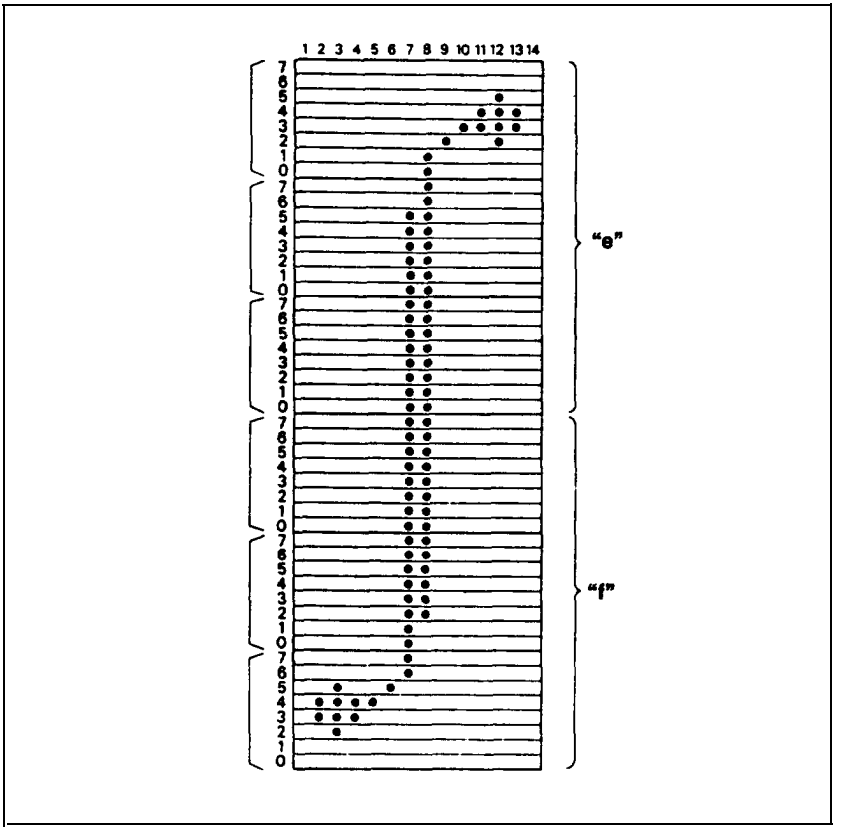

Figure 5-7. Design grid for *integral sign made* of *two vertically connecting characters*

Figure 5-8 shows the printout from this program.

$$\int_0^1 \int_0^1 (aX+bY)^2 dxdy$$

Figure 5-8. Integral *sign* made **of** two vertically connecting characters

Chapter 6
Dot Graphics

The SQ-2000 has all the dot graphics capabilities of the other Epson printers as well as the ability to produce dot graphics using all 24 of the nozzles in the print head. This gives the SQ-2000 approximately three times the vertical resolution of the other printers.

This chapter covers how the SQ-2000 produces dot graphics, explains the commands used to produce the 10 different graphics densities, and briefly describes several applications of dot graphics.

If dot graphics is a new subject to you, you may want to study the chapters on dot graphics in the User's Manual for either the Epson FX or RX series printers. These manuals, which are available at your Epson dealer, provide detailed tutorials on some of the simpler applications of dot graphics. Because of the upward compatibility between the Epson printers, the example programs presented in those manuals will work equally well on the SQ-2000 printer.

How the SQ-2000 Prints Dot Graphics

In the last chapter you learned how to address the individual nozzles in the SQ-2000's print head to create your own characters. Now you will learn how to address the individual nozzles in the print head to print any graphics you **want.**

The method of addressing the nozzles in the print head for graphics is very similar to the method used for creating user-defined characters. In fact, when you are using the 8-nozzle (also called 8-dot) graphics options, the method of nozzle addressing is much simpler.

When the SQ-2000 produces 8-dot graphics options, it prints with every third nozzle.

Each byte of data received controls the nozzles for only one vertical column of dots. This means you have to send the printer more information when printing dot graphics, but it also means that you have full control over what each print nozzle is doing.

A byte of data contains eight binary digits, or bits. Each bit controls one of the eight nozzles used for 8-dot graphics. Figure 6-l shows how a graphics data byte controls eight print head nozzles.

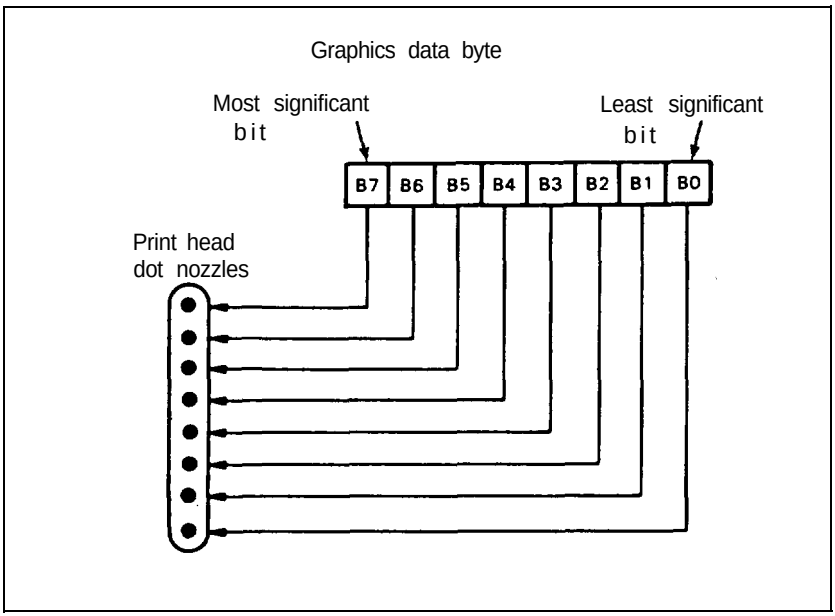

Figure 6-Z. Graphics data byte and print head nozzles

Creating binary bit patterns like this may be easy for computers, but it's difficult for humans. There is an easier way to create graphics data bytes. If you assign each of the print head nozzles a value, the value of a graphics data byte is the sum of the values of the nozzles that you want to print (see Figure 6-2).

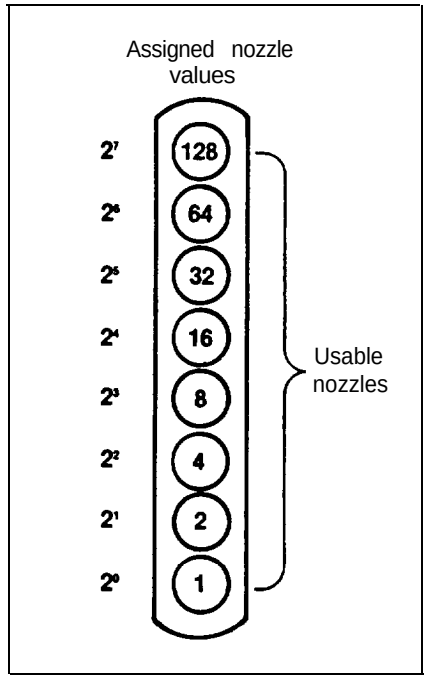

Figure 6-2. Values assigned to the print nozzles

It is not a coincidence that the values that are assigned to the pins are powers of two. These assigned values are the decimal equivalents of the binary values of the nozzles. This means that each combination of nozzle values produces a unique sum; there is never any doubt about which nozzles are supposed to print. Figure 6-3 shows some examples.

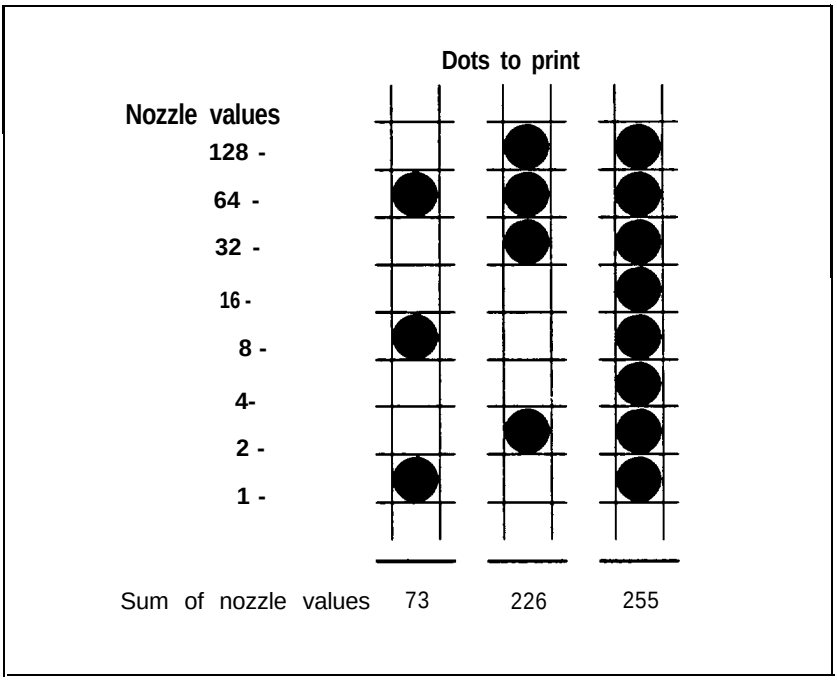

Figure 6-3. Value **of** *thegraphics data byte*

Syntax of the Graphics Command

The SQ-2000 has one command that allows you to use any of the 10 graphics options. The syntax of the command is:

<ESC> "*" s *n1 n2* data

In this command, s selects the graphics option and n1 and n2 specify the number of bytes of graphic data that follows. The available graphics options are listed in Table 6-1.

Table 6-l. Graphics options

Option	Nozzles	s	Horiz. density (dots/in.)
Single-density	8	0	60
Double-density	8	1	120
High-speed, double-density	8	2	120
Quadruple-density	8	3	240
QX-10 CRT screen	8	4	80
Other CRT screens	8	6	90
Single-density	24	32	60
Double-density	24	33	120
Other CRT screens	24	38	90
Triple-density	24	39	180

The SQ-2000 uses the formula *n1* + *n2* X 256 to determine how many bytes of graphics data to expect. To determine the values of n1 and n2, given the number of dot columns of graphics data that you want to send, use the following formulas (where X is the number of columns of graphic data):

n1 = *X* mod 256
and
n2 = X\256 (where \ represents integer division)

For example, if you wish to send 1632 columns of graphic data, *n1* would be 96 and n2 would be 6 (1632 = 96 + 6 **X** 256).

When you are using the 24-dot graphics options you must send three bytes of data for each dot column. Therefore, you refer to dot columns instead of bytes of graphics data when calculating *nl* and *n2*. (We will explain later how these three bytes are interpreted.)

The SQ-2000 will interpret the number of bytes determined by *n1* and *n2* as graphics data, no matter what codes they are. This means that you must be sure to supply enough bytes of graphic data, or the SQ-2000 will stop and wait for more data, and will seem to be locked up. If, on the other hand, you supply too much graphics data, the excess will be interpreted and printed as regular text.

Using Hand-Calculated Data to Print Graphics

With what you know now, you can use the simplest application of graphics-using hand-calculated data to print graphic images. While this method is the most tedious of those that we will explore, it is useful for small graphic elements that are used many times. Also, it helps you to develop your understanding of dot graphics.

The first step is to figure out which dots you want to print. Start by sketching your design on a piece of graph paper as shown in Figure 6-4. The design in the illustration is only eight dots high for simplicity, but it could also use multiple print lines.

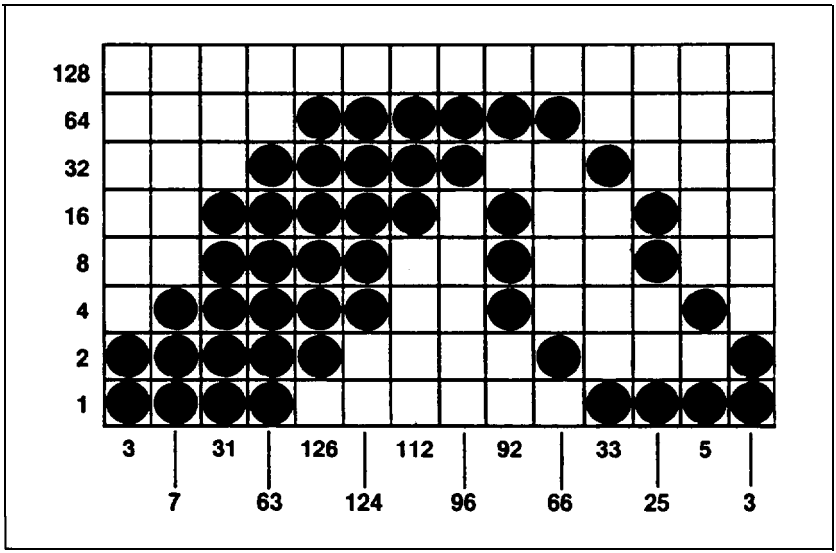

Figure 6-4. Design sketch and sum of nozzle values

Write the assigned values of the nozzles next to your design and then total the values for each column of dots. These totals are the values that will be sent to the printer as graphics data to print the design.

To print the example design using the normal density option, the complete command (including the graphics data) would be:

Command	Data
<ESC> "*" 0 14 0	3 7 31 63 126 124 112 96 92 66 33 25 5 3

And the results would look like this:

Here is a short BASIC program that will print this figure:

```
10 LPRINT CHR$(27) "*" CHR$(0) CHR$(14) CHR$(0);
20 FOR X=1 TO 14
30    READ N
40    LPRINT CHR$(N);
50 NEXT X
60  DATA  3,7,31,63,126,124,112
70  DATA  96,92,66,33,25,5,3
```

Printing Multiple Lines of 8-Dot Graphics

You could enlarge this design in order to print multiple lines of 8-dot graphics. In the next example, you are going to print three lines of 8-dot graphics. At the same time, you will triple the width to 42 columns.

To break the previous design (Figure 6-4) into three lines of 8-dot graphics, triple the number of dots in each column and break the design into what will look like three lines of 8 bits each. For example: the first column of two dots will now be a column of six dots; the second column of three dots will now be a column of nine dots, etc.

Next, triple each column for a total of 42 columns. For example, column 1 from the previous design will become columns 1,2, and 3; column 2 from the previous design will become columns 4,5, and 6, etc.

In mapping out your new design, leave some space between each of the three (8-bit) lines to total the values of each column. When you are finished, your drawing should look like Figure 6-5.

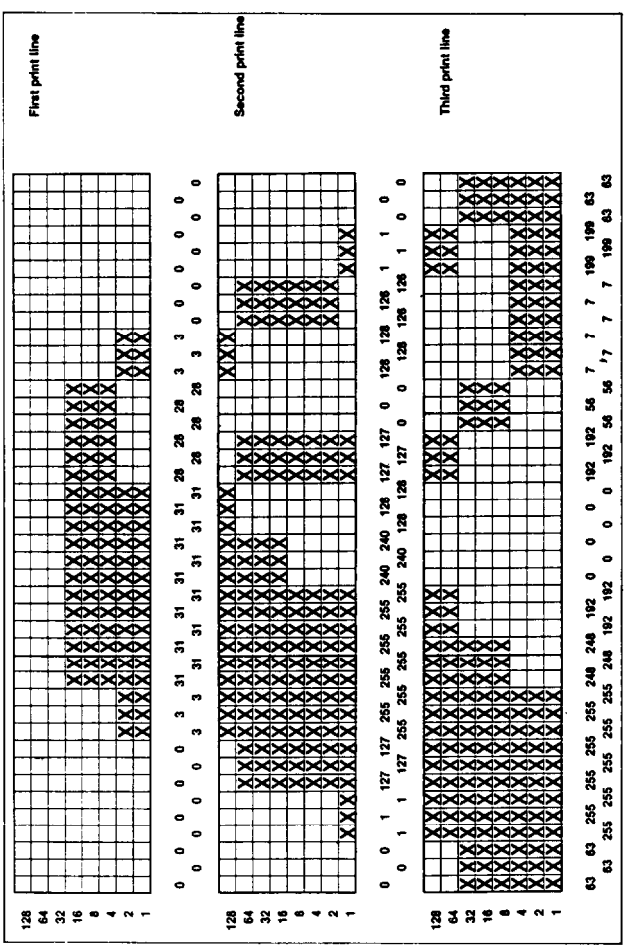

Figure 6-5. Data layout for multiple lines of 8-dot graphics

Now total the values for each column of dots. These totals are the values that are sent to the printer as graphics data for the print design. And here is a new BASIC program to print the design.

```
10 '*** Prints Graphics/Single-Density Mode ***
20 '
30 'Set line spacing 24/180
40 LPRINT CHR$(27) "3" CHR$(24); 'Set line spacing 24/180
50 FOR I=1 TO 3
60 '
70 'Select bit image mode
80 LPRINT CHR$(27) "*" CHR$(0) CHR$(42) CHR$(0);
90 FOR X=1 TO 42
100   READ N
110 LPRINT CHR$(N);
120 NEXT X
130   LPRINT
140 NEXT I
150 '
160 'Reset line spacing to l/6-inch
170 LPRINT CHR$(27) "2";
180 '
190 'Data to print first line
200 DATA 0, 0, 0, 0, 0, 0, 0, 0, 0, 3, 3, 3, 31, 31
210  DATA  31,31,31,31,31,31,31,31,31,31,28,28,28,28
220  DATA  28,28,3,3,3,0,0,0,0,0,0,0,0,0
230 '
240 'Data to print second line
250 DATA 0, 0, 0, 1, 1, 1, 127, 127, 127, 255, 255, 255, 255,
260 DATA 255,255,255,255,240,240,240,128,128,128,127,127~127,0
270  DATA  0,0,128,128,128,126,126,1,1,1,0,0,0
280 '
290 'Data to print third line
300 DATA 63,63,63,255,255,255,255,255,255,255,255,255,248,248
310  DATA  248,192,192,192,0,0,0,0,0,0,192,192,192,56
320  DATA  56,56,7,7,7,7,7,7,199,199,199,63,63,63
```

Here's how the program works. First, set the line spacing to accommodate your new design. You will want the design to print without leaving any spaces between each line of graphics. Line 40 uses the command <ESC> "3" *n* to select *n/180-inch* line spacing. In this case, *n* = 24. When the line feed occurs, the paper will be advanced 24/180-inch.

Lines 50 and 140 set a FOR-NEXT loop which will include selecting the graphics option and printing the graphics data for each of the three (8-bit) lines. Line 80 assigns the graphics option each time one of the three lines is printed. ASCII 0 assigns S-dot, single-density printing while ASCII decimal 42 tells the printer the design will have 42 columns of data.

Lines 90-120 READ and LPRINT the 42 columns of data for each line. The LPRINT statement in line 130 causes a line feed and carriage return to occur after each line is printed. Line 170 resets the line spacing to l/6-inch (the power-on default setting).

The data in lines 200-220 correspond to the dot positions for each of the 42 columns in the first printed line of the design. Lines 250-270 are for the dot positions of the second printed line. Lines 300-320 are for the third printed line.

Run the program. Your graphics design should now look like this:

Did you have any trouble? If you did, check your commands and be sure your data statements contain the values exactly as they are shown in the program listing.

Using the 24-Dot Graphics Options

Up until now you have looked at the SQ-2000's print head as an B-dot graphics device. In reality, the SQ-2000 has 24 nozzles in its print head, and they are all available to you when using the 24-dot graphics options.

The 24 nozzles are mapped as three 8-bit bytes stacked vertically (as shown in Figure 6-6). This means that for each nozzle column of 24-dot graphics (as specified by *n1* and *n2)* you must send three bytes of graphics data.

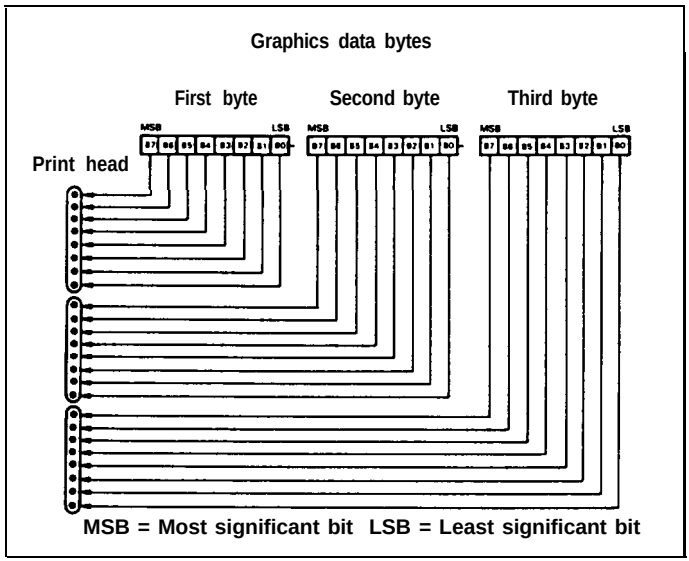

Figure 6-6. Map of 24-dot graphics

Figure 6-7 shows the design used for B-dot graphics now adapted for 24-dot graphics. In this adaptation, each dot printed using the B-dot option will be printed as a square of nine dots when using the 24-dot option.

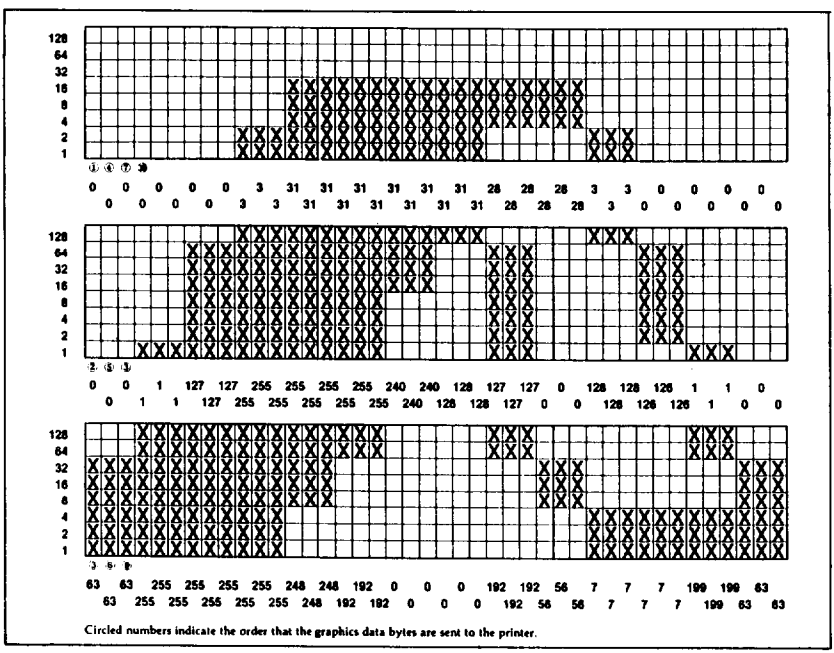

Figure 6-7. Data layout for 24-dot graphics

Here is the BASIC program adapted for 24-dot graphics.

```
10 WIDTH "LPT1:",255
20 LPRINT CHR$(27) "*" CHR$(39) CHR$(42) CHR$(0);
30 FOR X=1 TO 126
40   READ N
50   LPRINT CHR$(N);
60 NEXT X
70 LPRINT
80 DATA 0,0,63,0,0,127,0,0,255,0,3,255,0,3,255,0,15,255,0,31,255
90 DATA 0,127,255,0,255,255,1,255,255,3,255,255,7,255,255,
15,255,255
100 DATA 31,255,254,31,255,252,31,255,248,31,255,240,31,2
55,224,31,255,192
110 DATA 31,255,0,31,252,0,31,240,0,31,224,0,31,1283,0,31,2
40,0
120 DATA 31,255,192,28,255,224,28,127,240,28,15,248,30,0,
252,31,0,126
130 DATA 15,128,15,7,192,7,3,240,7,l,254,7,0,255,7,0,l27,l
35
140 DATA 0,31,199,0,7,231,0,1,247,0,0,255,0,0,127,0,0,63
```

In this program, line 20 assigns the graphics option (24-dot triple-density) with ASCII decimal 39. ASCII decimal 42 sets the number of nozzle columns at 42. Lines SO-140 contain 126 bytes of data (42 nozzle columnsX3 bytes for each nozzle column). Lines 30-60 contain the subroutine to print the design.

The resulting design will be approximately the same size as the original line design, but the dots will be printed much closer together. And this is how the new design looks:

The shape is just about the same, but the density is much greater. This design requires 126 bytes of graphics data instead of the 14 bytes that were required using the B-dot graphics option.

Notice that the dots overlap quite a bit. This design was printed using the triple-density 24-dot graphics option because the density is the same (180 dots to the inch) in both directions. Therefore, when you turned each dot of B-dot graphics into nine dots of 24-dot graphics, the shape of the design remained approximately the same.

Figure 6-8 shows the design modified to take advantage of the higher resolution of 24-dot graphics. Notice that the curves are smoother and the edges are less ragged. This illustrates the major advantage of 24-dot graphics. The vertical resolution is approximately three times that of B-dot graphics which means you can produce better-looking graphics.

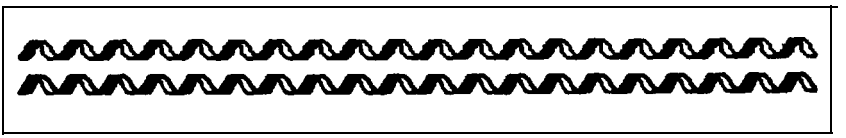

Figure 6-8. Eight-dot (top) and 24-dot (bottom) versions of the density

Using the SQ-2000 as a Plotter

One of the best applications of the SQ-2000 graphics capabilities is to print graphics images. Graphics images can range from business bar charts to computer-created art.

Since the SQ-2000 can't move the paper in both directions, it can't plot a curve continuously like a pen plotter does. To print a complete graphics image on the SQ-2000 the entire image must be assembled in the computer's memory and, when complete, sent to the printer one line at a time. (Of course, if the image can be created from the top down, it can be printed as it is created.)

In many cases, the part of the computer's memory that stores the image while it is being assembled is the same part of the computer's memory that produces the display on the screen. In other words, the image is created on the screen of the computer and then a screen dump is done to print the screen image on the printer. This method is typical of many business graphics program.

However, the SQ-2000 can print graphics with much higher resolution than that of a computer screen. This means that using the screen to create an image and then using the screen dump to print it out actually limits the quality of your graphics.

Here is a short BASIC program that sets up a buffer in the computer's memory, creates a simple graphic image, and then prints it on the SQ-2000 (see Figure 6-9).

```
100 ' *** SQ-2000 Plotter Program: 5-Point Star ***
110 '
120 ' Initialize
130 '
140 DIM BUFFER%(360,45)
150 FOR BIT = 0 TO 7 : DOT%(7 - BIT) = 2 ^ BIT : NEXT
160 X.SCALE = 20          : Y.SCALE = 20
170 X.FACTOR = 360 / X.SCALE      : Y.FACTOR = 360 /
 Y.SCALE
180 ESC$ = CHR$(27)       : LF$ = CHR$(lO)
190 '
200 ' Plot curve
210 '
220 RADIUS1 = 10          : RADIUS2 = 2
230 Xl = 20     : Yl = 10
240 DIFF = (RADIUS1 - RADIUS2)
250   FOR ANGLE = 0 TO 6.3 STEP .15
260  X2 = DIFF * COS(ANGLE) + RADIUS2 * COS(DIFF /
 RADIUS2 * ANGLE) + 10
270  Y2 = DIFF X SIN(ANGL) - RADIUS2 * SIN(DIFF / R
ADIUS2 * ANGL) + 10
280 '
290 ' Draw a line from X1, Y1 to X2, Y2
300 '
310 X.LENGTH = X2 - X1          : Y.LENGTH = Y2 - Y1
320 X.STEPS = ABS(X.LENGTH * X.FACTOR)
330 Y.STEPS = ABS(Y.LENGTH * Y.FACTOR)
340 IF X.STEPS > Y.STEPS THEN STEPS = X.STEPS ELSE
 STEPS = Y.STEPS
350 IF STEPS = 0 THEN 480
360 DELTA.X = X.LENGTH / STEPS        : DELTA-Y = Y.
LENGTH / STEPS
370   FOR COUNT = 0 TO STEPS
380   X1 = X1 + DELTA.X      * Y1 = Y1 + DELTA.Y
390 '
400 ' plot a point at Xl, Y1
410 '
420 X.POINT = X1 * X.FACTOR           : Y.POINT = Y1
* Y.FACTOR
430 COLUMN = INT(X.POINT)
440 ROW = INT(Y.POINT / 8)
450 BIT = INT(Y.POINT - ROW * 8)
```

```
460 BUFFER% (COLUMN, ROW) = BUFFER% (COLUMN, ROW)
OR DOT% (I)
470 NEXT COUNT
480 NEXT ANGLE
490 '
500 ' Print curve
510 '
520 OPEN "LPT:1" AS #1 : WIDTH #1,255
530 PRINT #1, ESC$ "3" CHR$(24);
540   FOR PRINT.LINE = 0 TO 44 STEP 3
550   PRINT #1, ESC$ "*" CHR$(39) CHR$(104) CHR$(1);
560     FOR COLUMN = 0 TO 359
570       FOR BYTE = 0 TO 2
580       PRINT #1, CHR$ (BUFFER% (COLUMN, PRINT.LINE
 + BYTE));
590       NEXT BYTE
600     NEXT COLUMN
610   PRINT #1, LF$
620   NEXT PRINT.LINE
630 PRINT #1, ESC$ "2";
640 CLOSE #1 : END
```

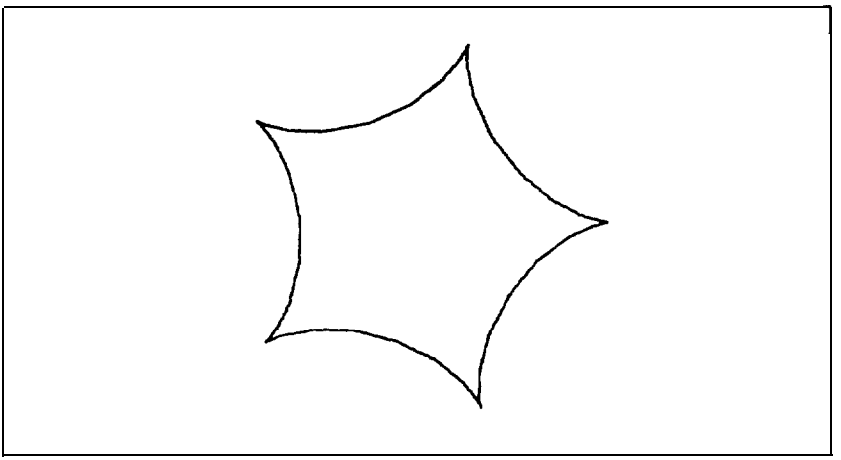

Figure 6-9. Figure produced by plotting program

The program explained here is an overly simplified plotting program. It is not efficient in its use of memory, nor is it very fast. In fact, the BASIC language itself is not very suitable for graphics programs of a very large scale. BASIC is just not fast enough to handle the massive amounts of data required for graphics. But despite its drawbacks, this program contains all the elements required, and BASIC does provide an almost universally understood format for communicating them.

First, this program allocates a section of memory to contain the graphic image that will be created. In line 140 the DIM statement defines the integer array BUFFER%( ). You will use each element of this array to store one byte of graphics data. Each element of an integer array can actually hold two bytes of graphics data, but doing so would complicate the program. Therefore, we just have to accept the inefficiency.

The figure that this program prints fits in an area two inches square, and the BUFFER%( ) array uses about 32K of memory. You can see that there is a lot of graphics data involved (even considering the inefficiency).

Line 150 creates a vector array of the powers of two. These are the values that are assigned to the nozzles in the print head. They are used in creating the image in memory.

Line 160 sets the coordinate scale of the graphics image. Setting both scale factors to 20 creates a grid 20 units on a side. Line 170 calculates the relationship between the coordinate grid and the actual dots to be printed. This program uses the 24-dot triple-density option, so the two-inch square has 360 dots in each direction.

Line 180 assigns mnemonic variables for use in the printing routine.

Lines 220-270 calculate the curve to be plotted. The curve that the sample program plots is a hypocycloid. This is the shape generated by the path of a point on a circle that is rolling around the inside of another circle. Line 220 assigns the radii of the fixed and rolling circles, respectively. Line 230 assigns the starting point of the curve (you will see why this is necessary in a moment). Line 240 calculates a constant that is used in the calculations.

Line 250 starts a loop to calculate the points on the curve. Since BASIC uses radian measure for angles, the value of ANGLE goes from 0 to just over 360 degrees, slightly more than a full circle (to ensure that there is no gap at the end). The step value must be small enough that the curve appears smooth, and not as a series of straight lines.

Lines 260 and 270 calculate the X and Y coordinates of each point on the curve (X2 and Y2).

The routine in lines 310-380 creates a line between point Xl, Yl and point X2, Y2. The routine calculates how many points need to be plotted so that no possible points are missed. Then, for each required point, the routine in lines 420-480 adds the points to the image in memory.

Line 310 calculates the horizontal and vertical projected lengths of the line. Lines 320 and 330 calculate the number of steps required in each direction so that no dots are missed. Line 340 selects the larger number of steps to use in plotting the line. Line 350 skips the rest of the routine if no steps are required.

Line 360 calculates the change in the X and Y coordinates for each step, and line 370 starts a loop to plot the points.

Line 380 advances the position of point Xl, Yl along the line to be plotted, using the rates of change calculated in line 360. Line 420 relates the point Xl, Yl to the actual dot coordinates. Lines 430 and 440 calculate the element in the array BUFFER%( ) that is to be changed, and line 450 determines which bit is to be set.

Line 460 turns on a particular dot in the array in memory. The selected element of the array is OR'ed with the value of the pin that is to print (contained in the vector array DOT%( )). The OR function is used to prevent problems in the case of the same dot being set twice.

The procedure for creating printing dots is repeated for the length of the line, and then the value of ANGLE is incremented and the procedure is repeated until the figure is complete.

After the entire figure is created in the array in memory it is sent to the printer. Since we are using a 24-dot graphics option the procedure is slightly complicated. The array in memory is structured just as the figure will print: array element 0,0 is the upper left corner, 1,0 is adjacent to it on the right, and 0,l is directly below it. But when we print the array, we must send the array elements in "stacks" of three. Each array element contains one byte of graphics data, and to control 24 nozzles we must send three bytes of data to the printer. Figure 6-10 shows the order in which we must send the array elements to the printer.

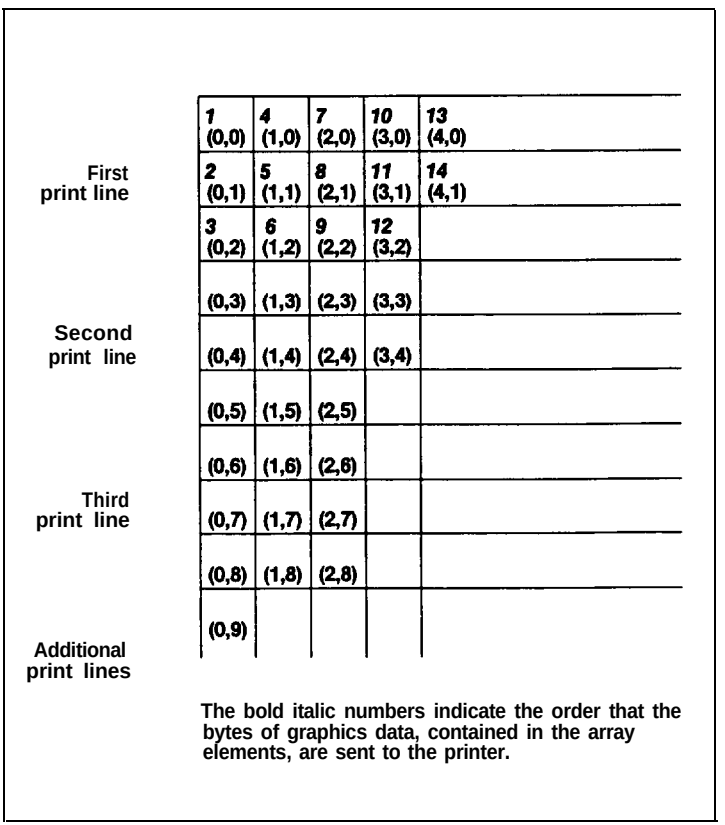

Figure 6-10. Order of array elements

The printing routine starts in line 520. This program was written on a Compaq computer, and this method of opening the printer as a file avoids most problem codes with this computer. Line 530 changes the line spacing to 24/180-inch so that there will be no gaps in the printed design.

The program uses three nested FOR-NEXT loops to print the graphics image. The first loop starts in line 540. It steps through the horizontal rows of the array BUFFER%( ). The step value is 3 because we print the array three rows at a time.

Line 550 selects the triple-density 24-dot graphics option with 360 columns of graphics data. (Remember that we must send 3 bytes of graphics data for each column.)

Line 560 starts a loop that steps through each column of the array, and line 570 starts a loop that steps through each of the three rows that make up this print line. Line 580 sends the selected bytes of graphics data to the printer. Lines 590 and 600 end the respective loops and line 610 sends a line feed to advance the paper after each line is complete. Line 620 ends the outermost loop, starting a new line.

When the entire curve is printed, lines 630 and 640 reset the printer to l/6-inch line spacing and terminate the program.

While this program is of little practical value, it illustrates the elements required to do plotting with the SQ-2000. We have used a very simple curve for illustration so that it wouldn't take too long to run. The formulas in this program can produce some striking designs with very slight modifications. If you are patient enough (this will take about 20 minutes to run), make the following changes to the program:

Line 220-Make RADIUS2 = 2.2
Line 250-Make ANGLE = 0 to 70

The resulting curve will look like Figure 6-11.

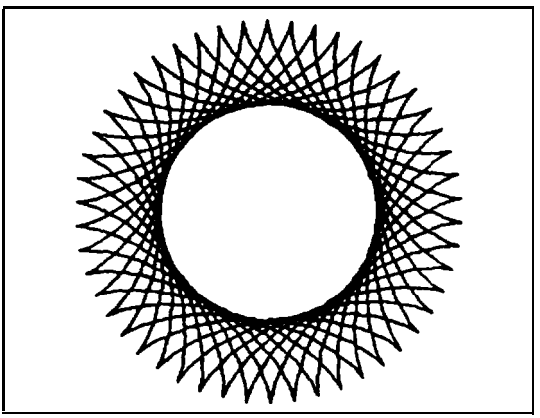

Figure 6-11. Curve produced by minor change in plotting program

Individual Graphics Options Commands

As previously mentioned, Epson printers are upward compatible. Therefore the SQ-2000 responds to commands that are also used with Epson FX and RX series printers. There are four individual graphics options commands that act very much the same as the <ESC> "*" command, but each one works for only one graphics option. Note that these commands contain one less variable than the <ESC> "*" command because they don't need to select a graphics option. They are shown in Table 6-2.

Table 6-2. Individual graphics options commands

Command	Function	<ESC> "*" Format
<ESC> "K"	**Single-density**	**<ESC> "*" *n1 n2* data**
<ESC> "L"	**Double-density**	**<ESC> "*" 1 *n1 n2* data**
<ESC> "Y"	**High-speed, double-density**	**<ESC> "*" 2 *n1 n2* data**
<ESC> "Z"	**Quadruple-density**	**<ESC> "*" 3 *n1 n2* data**

Assigning Graphics Options

The SQ-2000 has a command that allows you to change the graphics option assigned to any of the four individual graphics options commands. The command looks like this:

<ESC> "?" s *m*

Where s is the letter that represents the command that you wish to change the assignment for (i.e., K, L, Y, or Z) and *m* is the number of the graphics option (from Table 5-1) that you want to assign to it. For example, to change the <ESC> "K" command to use the QX-10 CRT screen graphics option, the command would look like this:

<ESC> "?" "K" 4

This is a quick way to change the aspect ratio of the design that you are printing. Changing the graphics option will change the width without changing the height. However, you should make this change with caution.

If you change one of the 8-dot graphics options to a 24-dot graphics option without changing the program that supplies the graphics data, you will print garbage (if the program prints at all). Remember, the 24-dot graphics options require three times as much graphics data as the 8-dot graphics options. Moreover, the data is arranged differently.

Chapter 7
Using the Hex Dump Feature

The SQ-2000 has the ability to print the hexadecimal number of each code that it receives, instead of interpreting the codes as characters and commands as it normally does. This is a great tool for locating problems in programs that work with the printer.

The hex dump feature is turned on by holding down both the LF and FF buttons while you turn the printer on. To turn it off simply turn the printer off and back on again.

When debugging a system, a good place to start is to attempt to print all the ASCII codes to see which ones don't work correctly. If you are using BASIC the following program will do the trick:

```
10 FOR X=0 TO 255
20 LPRINT CHR$( X);
30 NEXT  X
```

A perfect printout using the hex dump feature will look like Figure 7-l. Press the ON LINE button to print the last line, and remember to put the printer back on-line before you print any more.

```
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
14 15 16 17 18 19 1A 1B 1C 1D 1E 1F 20 21 22 23 24 25 26 27
28 29 2A 2B 2C 2D 2E 2F 30 31 32 33 34 35 36 37 38 39 3A 3B
3C 3D 3E 3F 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D 5E 5F 60 61 62 63
64 65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74 75 76 77
78 79 7A 7B 7C 7D 7E 7F 80 81 82 83 84 85 86 87 88 89 8A 8B
8C 8D 8E 8F 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF B0 B1 B2 B3
B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF C0 C1 C2 C3 C4 C5 C6 C7
C8 C9 CA CB CC CD CE CF D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB
DC DD DE DF E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF
F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF 0D 0A
```

Figure 7-1. Hex dump feature

Review the hex dump for missing codes or codes that have been changed or added to. Typical things to look for include: an <LF> (ASCII 0AH) added after the <CR> (ASCII 0DH) code, <HT> (ASCII 09H) changed into a series of spaces (ASCII 20H), or <FF> (ASCII 0CH) changed into a series of <LF> (ASCII 0AH) codes.

The program illustrated above could, of course, be written in any language that you wish to investigate.

Beyond finding problem codes, the hex dump feature also provides a way to check which codes are actually being sent to the printer by a program. Just turn on the hex dump feature and run the program. Then interpret the codes that are printed out.

If you are investigating a program that uses the graphics options, be prepared for a lot of printing since each byte of graphics data is printed in hex. This can be several pages of hex dump numbers. You can usually stop the printer after a couple of print lines of graphic data have been printed.

Figure 7-2 shows the hex dump printout of the first graphics demonstration program in Chapter 6. If you study the codes you can see the graphics option command and the graphics data, followed by a <CR> <LF>

```
1B  2A  00  0E  00  03  07  1F  3F  7E  7C  70  60  5C  42
21  19  05  03  0D  0A
```

Figure 7-2. Hex dump printout of Chapter 6 graphics program

Chapter 8
Programming Hints

The SQ-2000 printer can be used with many different computers. However, almost all computers have some built-in quirks that cause problems with the SQ-2000 (or any other printer, for that matter).

We're sure that the computer's designers would describe these quirks as features, because they typically solve one sort of problem-while creating another. For example, the MBASIC program, which is a widely used CP/M BASIC interpreter from Microsoft, automatically converts the horizontal tab code (ASCII 9) into a series of spaces to advance the print head to the next tab position. This is handy if your printer doesn't understand tabs, but it causes problems with a printer like the SQ-2000 that does understand tabs, and it makes it difficult to use ASCII 9 in graphics.

We will look at some of the problems that can occur on some typical computer systems. While we can't cover all the problems for every computer system, we can point out some of the more common problems and solutions. With these suggestions, and your computer's documentation, you can solve any problems you have using your computer with the SQ-2000.

High level language problems

Most of the solutions that we will discuss are directed at BASIC language interpreters. This is because high level languages tend to have more problems (or is that features?) built into them. Lower level languages, like assembly language, usually give the programmer freedom to send any code to the printer (but, of course, require more programming effort to do it).

Apple Computers

The Apple II computers present two problems when using them with a printer like the SQ-2000. First, they can only send seven bits of data to the printer, and second, they use the code ASCII 9 for internal initialization of the printer routines.

The seven-bit limitation presents the largest problem, but we have two solutions to offer. The easiest, but more expensive, solution is to purchase a printer interface card that addresses all eight bits. Your Epson dealer will help you with this.

The other solution is to POKE codes directly to the printer output port on the Apple II. You can use the following routine to do this on an Apple II Plus computer:

```
100 IF PEEK(49601)>127 THEN 100
110 POKE 49296,N
```

where N is the code that you want to send to the printer. Line 100 checks the printer's status and line 110 sends the code to the printer.

The Apple II used ASCII 9 to initialize the computer's printer routines. This code and the following character or characters are intercepted by the printer interface card and used to change the modes (in somewhat the same way the printer uses escape codes). You can divert all output to the printer instead of to the screen by sending the following lines to the printer interface card:

```
PR#1
PRINT CHR$(9) "80N"
```

Then type anything, followed by ENTER.

The CHR$(9) "BON" directs all subsequent output to the printer, up to 80 characters per line. You can cancel this by typing:

```
PRINT CHR$(9) "I"
```
or
```
PR#0
```

To avoid the problem with ASCII 9 you can change the printer initialization code to something else; this frees the ASCII 9 to go on to the printer. This routine will change the printer initialization code to ASCII 1:

```
PR#1 PRINT
CHR$(9); CHR$(1)
```

TRS-80 Computers

The TRS-80 computers are not without their own set of quirks. The TRS-80 Model I computer, for instance, does not correctly send ASCII decimal codes 0, 10, 11, and 12 to printers like the SQ-2000. A quick solution for TRS-80 Model I (and TRS-80 Model III) users to avoid sending ASCII decimal 12 (Form Feed, or <FF>) is to use its high-order counterpart ASCII decimal 140. This is achieved by adding 128 to the problem code (128 + 12 = *140).*

There are two more generic solutions for avoiding these problem codes. First, these codes can be sent directly to the printer with POKE codes. The following routine will accomplish this:

```
100 IF PEEK(14312)<>63 THEN 100
110 POKE 14312,N
```

Line 100 checks the printer's status by putting the program into a continuous loop until it finds decimal 63 in memory location 14312.

With the TRS-80 Model I and TRS-80 Model III computers, you can also modify the printer driver so that the problem codes are sent correctly to the printer. The following printer driver was written by Bob Boothe and reprinted with the permission of 80 *Microcomputing* (Wayne Green Publishers). Try the following routine for Model I users (Model III users, see the small change below).

```
10 DATA 21E837CB7E20FC211100397E32E837C9
20 READ B$: A=16571
30 FOR P-1 TO LEN(B$) STEP 2
40 B=ASC(MID$(B$,P,1)) - 48
50 IF B>9 THEN B=B - 7
60 T=ASC(MID$(B$,P + 1,1)) - 48
70 IF T>9 THEN T=T - 7
80 POKE A,B*1G + T
90 A=A+1
100 NEXT P
110 POKE 16422,187
120 POKE 16423,64
```

The program uses a machine language printer driver routine (line 10), then tells the system where the new driver is located. When you RUN the program, all codes (including those nasty problem codes) are sent directly to the printer. This driver will also work with the TRS-80 Model III with one change in line 10; change 32E837 to D3FB.

IBM Personal Computers

There are three problems in using the IBM Personal Computer BASIC (version 2.0) to drive a printer. First, the IBM-PC assumes that your print line is 80 characters wide and inserts a line feed / carriage return (<LF> <CR>) after each 80 characters you send it. Second, it adds <LF> to each <CR> in an LPRINT statement. And third, it will not send ASCII decimal 26 to the printer.

Here is the way to adjust the width when it is the only problem. Tell the computer that the print line is wider than 80 characters with this WIDTH statement:

```
WIDTH "LPT1:", 255
```

The extra line feed problem can be solved by using this in your program:

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

The statement OPEN “LPT1:” AS #l opens the printer as a random file and allows you to send any code. However, you must now use PRINT #1 rather than LPRINT in your program. This allows you to print anything, but it ignores any previous WIDTH statements so WIDTH #l, 255 is included here.

Unfortunately, this solution won’t work with DOS 1.0 because it can’t run a printer like a file. You may be able to get a free update (DOS 1.05) from your dealer. Another problem with DOS 1.0 is that it doesn’t send ASCII 7 to the printer; it just sounds the computer’s buzzer.

Sending an ASCII decimal 26 to the printer is more of a problem. We have three suggested solutions:

1. Use a machine language routine to drive the printer. The September 1983 issue of Softalk for the IBM Personal Computer has an article describing a suitable routine.

2. Write a file on diskette and then use the DOS COPY command with the /B option to send it to the printer (i.e. COPY PRNTFILE/B PRN). Open the file for random access or the ASCII decimal 26 may be interpreted as an end-of-file marker.

3. Buy a copy of Compaq DOS 2.1. The BASIC that comes with this operating system has all of the features of IBM-PC BASIC, but doesn't have the problem with ASCII decimal 26.

QX-10 Computers

There are two problems for QX-10 computer users. The first is sending more than 80 characters per line to the printer and the second problem is sending the code ASCII 9 (horizontal tab).

To get the printer to accept more than 80 characters, use this width statement (preferably at the beginning of your program):

```
WIDTH LPRINT 255
```

This will reserve extra room and a line feed (with carriage return) will not be sent after 80 characters.

Microsoft BASIC is one of those languages that has trouble sending the horizontal tab code (ASCII 9). It automatically converts ASCII 9 into a series of spaces to advance the print head to the next tab position. Since the SQ-2000 understands tabs, it can cause problems (i.e. with graphics). One way to avoid this problem is to use its high-order counterpart ASCII decimal 137. This is achieved by adding 128 to the problem code (128 + 9 = 137).

Any problem codes you find with the QX-10 can be sent directly to the printer with OUT statements. The following routine will send any code (X in the routine) to the printer:

```
100 IF (INP(&H15) AND &HF8)<>200 THEN 100
110 OUT &H14, X
120 OUT &H17, 0 : OUT &H17, 1
```

There is another way of circumventing the ASCII 9. The OUT command sends information directly to the printer without going through the MBASIC operating system. A sample program which performs this OUT routine is shown below. The program is meant to be a subroutine that sends a 9 to the printer whenever it is called.

```
500 IF INP(21) AND &H20 THEN 50 : REM check printer
    status
510 OUT 20,9 :  REM send a nine out printer port
520 OUT 23,0 : REM toggle strobe signal off
530 OUT 23,1 : REM toggle strobe signal on
540  RETURN
```

Appendix A
SQ-2000 Command Summary

This appendix gives a brief summary of the SQ-2000 commands (control codes). While this is a complete list of the commands, the descriptions are not complete in all cases. The complete descriptions of all the commands, including examples of their use, can be found in the *LQ-2500 Programmer's Manual* also available from your Epson dealer.

In some cases the explanations given here describe the apparent function of the commands, rather than the actual mechanical movements of the printer. For example, since the printer prints in both directions, the line feed command may not actually return the print head to the left margin if the next line prints from right to left, but the final effect on the printed page is the same as if it had.

The commands are organized into five logical groups: Vertical Spacing Commands, Horizontal Spacing Commands, Character Set Commands, Graphics Set Commands, and Miscellaneous Commands. The function is what the printer will do when given the proper command. The format is the correct syntax for the ASCII code that the printer understands. This code may be expressed as a symbol, a decimal value, or a hexadecimal value depending on the program you are using. Where *n* (or another italic letter) is used as a variable, it stands for a numerical value.

Vertical Spacing Commands

Function:

Line feed

Format:

Symbol	<LF>
Decimal	10
Hexadecimal	0A

Remarks:

Returns the print head to the left margin and advances the paper one line.

Function:

One-time n/180-inch line feed

Format:

Symbol	<ESC>	"J"	*n*
Decimal	27	74	*n*
Hexadecimal	1B	4A	*n*

Remarks:

Advances the paper n/180 inches. It does not execute a carriage return (n can range from 0 to 255).

Function:

Select l/8-inch line spacing

Format:

Symbol	<ESC>	"0"
Decimal	27	48
Hexadecimal	1B	30

Remarks:

Sets the line spacing for subsequent line feed commands to l/8 inch.

Function:

Select l/6-inch line spacing

Format:

Symbol	<ESC>	"2"
Decimal	27	50
Hexadecimal	1B	32

Remarks:

Sets the line spacing for subsequent line feed commands to l/6 inch.

Function:

Set n/180-inch line spacing

Format:

Symbol	<ESC>	"3"	*n*
Decimal	27	51	*n*
Hexadecimal	1B	33	*n*

Remarks:

Sets the line spacing for subsequent line feed commands to n/180 inch. l/180 inch is the vertical distance between dots on the SQ-2000 (n can range from 0 to 255).

Function:

Set n/60-inch line spacing.

Format:

Symbol	<ESC>	"A"	*n*
Decimal	27	65	*n*
Hexadecimal	1B	41	*n*

Remarks:

Sets the line spacing for subsequent line feed commands to *n/60* inches (n can range from 0 to 85).

Function:
Form Feed

Format:

Symbol	<FF>	
Decimal	12	
Hexadecimal	0C	

Remarks:
Advances the paper to the top of the next page.

Function:
Set page length by lines

Format:

Symbol	<ESC>	*"C"*	*n*
Decimal	27	67	*n*
Hexadecimal	1B	43	*n*

Remarks:
Sets the length of the page to *n* lines (n can range from 1 to 127).

Function:
Set page length by inches

Format:

Symbol	<ESC>	"C"	<NUL>	*n*
Decimal	7	67	0	*n*
Hexadecimal	1B	43	00	*n*

Remarks:
Sets the page length to *n* inches (n can range from 1 to 22).

Function:
Set bottom margin

Format:

ASCII	<ESC>	"N"	*n*
Decimal	27	78	*n*
Hexadecimal	1B	4E	*n*

Remarks:
Sets a bottom margin of n lines so that you can skip over the perforations in pin-feed paper *(n* can range from 1 to 127).

Function:

Cancel bottom margin

Format:

ASCII	<ESC>	"0"
Decimal	27	79
Hexadecimal	1B	4F

Remarks:

Sets the bottom margin to 0 lines. The command uses the letter "0", not the number zero.

Function:

Vertical tab

Format:

ASCII	<VT>
Decimal	11
Hexadecimal	0B

Remarks:

Advances the paper to the next vertical tab position. If no vertical tabs have been set, this code advances the paper one line.

Function:

Set vertical tabs

Format:

ASCII	<ESC>	"B"	*n1*	*n2*	*n3*	...	<NUL>
Decimal	27	66	*n1*	*n2*	*n3*	...	*0*
Hexadecimal	1B	42	*n1*	*n2*	*n3*	...	*00*

Remarks:

Sets the vertical tabs on lines *n1, n2, n3,* etc. You can set up to 16 vertical tab positions. The values of *n1, n2, n3,* etc. can range from 1 to 254 and must be entered in ascending order.

Function:

Select a vertical tab channel

Format:

ASCII	<ESC>	"/"	c
Decimal	27	47	c
Hexadecimal	1B	2F	c

Remarks:

This command selects one of the vertical tab channels. Subsequent vertical tab codes will advance the paper to the next vertical tab position in the selected channel (c can range from 0 to 7).

Function:

Set vertical tabs in tab channels

Format:

ASCII	<ESC>	"b"	c	*n1*	*n2*	...	<	N	U	L >
Decimal	27	98	*c*	*n1*	*n2*	...	*0*			
Hexadecimal	1B	62	*c*	*n1*	*n2*	...	*00*			

Remarks:

Sets vertical tabs on lines *n1*, *n2*, *n3*, etc. of vertical tab channel c. You can set up to 16 vertical tab positions. The values of *n1*, *n2*, *n3*, etc. can range from 1 to 254 and must be entered in ascending order (c can range from 0 to 7).

Horizontal Spacing Commands

Function:

Carriage return

Format:

ASCII	<CR>	
Decimal	13	
Hexadecimal	OD	

Remarks:

Returns the print head to the left margin. If auto-line feed is on, paper is also advanced one line.

Function:

Set right margin

Format:

ASCII	<ESC>	"Q"	*n*
Decimal	27	81	*n*
Hexadecimal	1B	51	*n*

Remarks:

Sets a right margin at *n* character columns of the current character width. The value of *n* can range from 1 to 255. This command must be sent at the beginning of a line. If a line to be printed exceeds the right margin, a carriage return and line feed will be inserted to keep the line from exceeding the right margin.

Function:

Set left margin

Format:

ASCII	<ESC>	"1"	*n*
Decimal	27	108	*n*
Hexadecimal	1B	49	*n*

Remarks:

Set the left margin at n character positions of the current character width. The value of *n* can range from 0 to 160, but if the value is too large (if it results in a left margin greater than 8 inches), the command will be ignored. This command should be placed at the beginning of a line.

Function:

Horizontal tab

Format:

ASCII	<HT>
Decimal	9
Hexadecimal	09

Remarks:

This code advances the print head to the next horizontal tab position. The default tab settings are every eight characters.

Function:

Set horizontal tabs

Format:

ASCII	<ESC>	"D"	*n1*	*n2*	*n3*	...	<NUL>
Decimal	27	68	*n1*	*n2*	*n3*	...	*0*
Hexadecimal	1B	*44*	*n1*	*n2*	*n3*	...	*00*

Remarks:

Sets horizontal tabs at positions *n1*, *n2*, *n3*, etc. You can set up to 32 horizontal tab positions. The values of *n1*, *n2*, *n3*, etc. can range from 1 to 137 and must be entered in ascending order.

Function:

Set intercharacter space

Format:

ASCII	<ESC>	<SP>	*n*
Decimal	27	32	*n*
Hexadecimal	1B	20	*n*

Remarks:

Increases the space between characters by *n* dots *(n* can range from 0 to 127).

Function:

Absolute dot position

Format:

ASCII	<ESC>	"$"	*n1*	*n2*
Decimal	27	36	*n1*	*n2*
Hexadecimal	1B	24	*n1*	*n2*

Remarks:

Moves the print head to an absolute horizontal position. The position, in inches, is determined by the formula *(n + n2 X 256)/60*. The maximum position is 13.6 inches.

Function:

Move print head

Format:

ASCII	<ESC>	"\"	*n1*	*n2*
Decimal	27	92	*n1*	*n2*
Hexadecimal	1B	5C	*n1*	*n2*

Remarks:

Moves the print head a specified distance from the last character printed. It can move the print head either left or right. The distance, in inches, is determined by the following formulas:

Draft: *(n1 + n2* x 256)/120

Letter Quality: *(n1 + n2* x 256)/180

Proportional: *(n1 + n2* x *256)/360*

To move to the left, add 64 to the calculated value for *n2. The* maximum distance is 13.6 inches. The command will be ignored if you try to move to a position outside of the current margins.

Print Style Commands

Function:
Select print mode

Format:

ASCII	<ESC>	"x"	*n*
Decimal	27	120	*n*
Hexadecimal	1B	78	*n*

Remarks:
Selects between the draft mode (n = 0) and the letter quality mode (n = 1).

Function:
Select print style (Master Select)

Format:

ASCII	<ESC>	"1"	*n*
Decimal	27	33	*n*
Hexadecimal	1B	21	*n*

Remarks:
Allows you to select multiple print styles (i.e., pica-italic-underlined) with one command. The value of *n* determines the style selected.

Function:
Select elite width print

Format:

ASCII	<ESC>	"M"
Decimal	27	77
Hexadecimal	1B	4D

Remarks:
Selects elite width (12 characters per inch) print.

Function:

Cancel elite width print

Format:

ASCII	<ESC>	"P"
Decimal	27	80
Hexadecimal	1B	50

Remarks:

Cancels elite width print and returns the SQ-2000 to pica width print.

Function:

Proportional print on/off

Format:

ASCII	<ESC>	"P"	*n*
Decimal	27	112	*n*
Hexadecimal	1B	70	*n*

Remarks:

This command either selects proportional print (*n* = 1) or cancels proportional print (n = 0).

Function:

One-line expanded width print

Format:

ASCII	<SO>
Decimal	14
Hexadecimal	0E

Remarks:

This code selects expanded width print for the remainder of the current line (unless explicitly canceled sooner).

Function:

One-line expanded width print

Format:

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

Remarks:

This command selects expanded width print for the remainder of the current line (unless explicitly canceled sooner). This command is the same as <SO>.

Function:

Cancel one-line expanded width print

Format:

ASCII	<DC4>
Decimal	20
Hexadecimal	14

Remarks:

This code can be used to cancel one-line expanded width print before the end of the line.

Function:

Expanded width print on/off

Format:

ASCII	<ESC>	"W"	*n*
Decimal	27	87	*n*
Hexadecimal	1B	57	*n*

Remarks :

Either turns expanded width print on *(n* = 1) or turns expanded width print off *(n = 0).*

Function:

Select compressed width print

Format:

ASCII	<SI>
Decimal	15
Hexadecimal	OF

Function:
Select compressed width print

Format:

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

Function:
Cancel compressed width print

Format:

ASCII	<DC2>
Decimal	18
Hexadecimal	12

Function:
Select emphasized print

Format:

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

Function:
Cancel emphasized print

Format:

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

Function:
Select italic print

Format:

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

Function:
Cancel italic print

Format:

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

Remarks:
This command cancels italic printing and returns you to the standard character set.

Function:
Underline on/off

Format:

ASCII	<ESC>	"-"	*n*
Decimal	27	45	*n*
Hexadecimal	1B	2D	*n*

Remarks:
This command turns underlining on (n = 1) or turns underlining off *(n = 0).*

Function:
Select superscripts or subscripts

Format:

ASCII	<ESC>	"S"	*n*
Decimal	27	83	*n*
Hexadecimal	1B	53	*n*

Remarks:
This command either selects superscripts (n = 0) or selects subscripts (n = 1).

Function:
Cancel superscripts and subscripts

Format:

ASCII	<ESC>	"T"
Decimal	27	84
Hexadecimal	1B	*54*

Character Set Commands

Function:

User-defined character set on/off

Format:

ASCII	<ESC>	"%"	*n*
Decimal	27	37	*n*
Hexadecimal	1B	25	*n*

Remarks:

This command either selects the user-defined character set (n = 1) or cancels the user-defined character set (n = 0).

Function:

Define user-defined characters

Format:

ASCII	<ESC>	"&"	<NUL>	*n1*	*n2*	data
Decimal	27	38	0	*n1*	*n2*	data
Hexadecimal	1B	26	00	*n1*	*n2*	data

Remarks:

Defines user-defined characters of the currently selected style. The function of this command is covered in the LQ-1500 *Programmer's Manual.*

Function:

Copy normal character set into user-defined character set

Format:

ASCII	<ESC>	":"	<NUL>	<NUL>	<NUL>
Decimal	27	58	0	0	0
Hexadecimal	1B	3A	00	00	00

Remarks:

This command copies the currently active character set into the user-defined character set.

Function:

Select international character set

Format:

ASCII	<ESC>	*"R"*	*n*
Decimal	27	82	*n*
Hexadecimal	1B	52	*n*

Remarks:

Selects one of the 11 international character sets. The following table shows the valid values of *n* and the character sets selected for each. The characters that change in the international character sets are shown below.

n	Country
0	U.S.A.
1	France
2	Germany
3	United Kingdom
4	Denmark
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
10	Denmark

0	#	$	@	[	\	]	^	'	{	¦	}	~
1	#	$	à	°	ç	§	^	'	é	ù	è	¨
2	#	$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
3	£	$	@	[	\	]	^	'	{	¦	}	~
4	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	~
5	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	#	$	@	•	\	é	^	ù	à	ò	è	ì
7	₧	$	@	¡	Ñ	¿	^	'	¨	ñ	}	~
8	#	$	@	[	¥	]	^	'	{	¦	}	~
9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

International characters

Function:

Single-density dot graphics

Format:

ASCII	<ESC>	"K"	*n1*	*n2*	data
Decimal	*27*	75	*n1*	*n2*	data
Hexadecimal	1B	4B	*n1*	*n2*	data

Remarks:

Prints single-density dot graphics at 60 dots per inch. The values of *n1* and *n2* define the number of bytes of data according to the formula *n1 + n2 X 256*. Each byte of data controls the print head nozzles in one vertical row of dots. The maximum number of bytes of data is 816.

Function:

Double-density dot graphics

Format:

ASCII	<ESC>	"L"	*n1*	*n2*	data
Decimal	*27*	*76*	*n1*	*n2*	data
Hexadecimal	1B	4C	*n1*	*n2*	data

Remarks:

Prints double-density dot graphics at 120 dots per inch. The values of *n1* and n2 define the number of bytes of data according to the formula *n1 + n2 X 256*. Each byte of data controls the print head nozzles in one vertical row of dots. The maximum number of bytes of data is 1632.

Function:

High-speed, double-density dot graphics

Format:

ASCII	<ESC>	"*Y*"	*n1*	*n2*	data
Decimal	27	89	*n1*	*n2*	data
Hexadecimal	1B	59	*n1*	*n2*	data

Remarks:

Prints high-speed, double-density dot graphics at 120 dots per inch. The values *n1* and *n2* define the number of bytes of data according to the formula *n1* + *n2* x *256*. Each byte of data controls the print head nozzles in one vertical row of dots. The maximum number of bytes of data is 1632.

Function:

Quadruple-density dot graphics

Format:

ASCII	<ESC>	"Z"	*n1*	*n2*	data
Decimal	27	90	*n1*	*n2*	data
Hexadecimal	1B	5A	*nl*	*n2*	data

Remarks:

This function prints quadruple-density dot graphics at 240 dots per inch. The values of *nl* and *n2* define the number of bytes of data according to the formula *nl* + *n2* x *256*. Each byte of data controls the print head nozzles in one vertical row of dots. The maximum number of bytes of data is 3264.

Function:

Selected density dot graphics

Format:

ASCII	<ESC>	"*"	*n1*	*n2*	data
Decimal	27	*42*	*n1*	*n2*	data
Hexadecimal	1B	2A	*n1*	*n2*	data

Remarks:

Prints dot graphics in a selected density, and with either 8 nozzles or 24 nozzles. The functions of this command are covered in the LQ-1500 *Programmer's Manual.*

Function:

Change dot graphics density

Format:

ASCII	<ESC>	"?"	*n*	*S*
Decimal	27	63	*n*	*s*
Hexadecimal	1B	3F	*n*	*s*

Remarks:

Assigns one of the graphics densities of the selected density dot graphics command to any of the four other dot graphics commands. The functions of this command are covered in the *LQ-1500 Programmer's Manual.*

Miscellaneous Commands

Function:
Delete line

Format:

ASCII	<CAN>
Decimal	24
Hexadecimal	18

Remarks:
Clears the current line from the printer's data buffer.

Function:
Delete character

For-n-rat:

ASCII	<DEL>
Decimal	127
Hexadecimal	7F

Remarks:
Deletes the character immediately preceding it, unless that character has already been printed.

Function:
Deselect printer

Format:

ASCII	<DC3>
Decimal	19
Hexadecimal	13

Remarks:
Places the SQ-2000 in an off-line state. It will ignore alI codes until it receives a select printer code.

Function:

Select printer

Format:

ASCII	<DC1>
Decimal	17
Hexadecimal	11

Remarks:

Returns the SQ-2000 to an on-line state. It enables the printer to receive data again after it has been deactivated by a deselect printer code. This code will not override the ON LINE button.

Function:

Set specified data to repeat printing

Format:

ASCII	<ESC>	"V"	*n*	data	<ESC>	"V"	<NUL>
Decimal	27	86	*n*	data	27	86	0
Hexadecimal	1B	56	*n*	data	1B	56	00

Remarks:

This command sequence will repeat data *n* times. This sequence can be nested up to five times, and the data string can contain up to 2K characters. DIP switch l-l must be in the down position to use this command sequence.

Function:

Set eighth-bit

Format:

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

Remarks:

Sets the eighth data bit to 1.

Function:
Clear eighth-bit

Format:

ASCII	<ESC>	"="
Decimal	27	61
Hexadecimal	1B	3D

Remarks:
Sets the eighth data bit to 0.

Function:
Cancel eighth-bit control

Format:

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

Remarks:
Cancels control of the eighth data bit set by either the set eighth-bit or clear eighth-bit commands.

Function:
Bell

Format:

ASCII	<BEL>
Decimal	7
Hexadecimal	7

Remarks:
Sounds the SQ-2000's buzzer.

Function:

Backspace

Format:

ASCII	<BS>
Decimal	8
Hexadecimal	8

Remarks:

Moves the print head one character to the left. This allows you to overstrike characters. (Note that the print head doesn't actually move to the left, the SQ-2000 combines the two characters and prints them as one.)

Function:

Initialize printer

Format:

ASCII	<ESC>	"@"
Decimal	27	64
Hexadecimal	1B	40

Remarks:

Resets the printer to the power-on state, including top of form.

Function:

Return print head to home position (one-line unidirectional printing)

Format:

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

Remarks:

Returns the print head to the left side of the printer.

Function:

Unidirectional printing on/off

Format:

ASCII	<ESC>	"U"	*n*
Decimal	27	85	*n*
Hexadecimal	1B	55	*n*

Remarks:

Selects unidirectional printing (*n* = 1) or returns the printer to bidirectional printing (*n* = 0).

Appendix B
ASCII Code Conversion Chart

This chart can be used to convert between the different names for ASCII codes. The codes from 0 to 32 have both decimal and hexadecimal numbers, abbreviations, and the control keys used to type them. The codes above 32 have the character that prints instead of the abbreviation.

Decimal	Hexadecimal	Abbreviation	Control key
0	00	<NUL>	Control-@
1	01	<SOH>	Control-A
2	02	<STX>	Control-B
3	03	<ETX>	Control-C
4	04	<EOT>	Control-D
5	05	<ENQ>	Control-E
6	06	<ACK>	Control-F
7	07	<BEL>	Control-G
8	08	<BS>	Control-H
9	09	<HT>	Control-I
10	0A	<LF>	Control-J
11	0B	<VT>	Control-K
12	0C	<FF>	Control-L
13	0D	<CR>	Control-M
14	0E	<so>	Control-N
15	0F	<SI>	Control-O
16	10	<DLE>	Control-P
17	11	<DC1>	Control-Q
18	12	<DC2>	Control-R
19	13	<DC3>	Control-S
20	14	<DC4>	Control-T
21	15	<NAK>	Control-U
22	16	<SYN>	Control-V
23	17	<ETB>	Control-W
24	18	<CAN>	Control-X
25	19	<EM>	Control-Y
26	1A	<SUB>	Control-Z
27	1B	<ESC>	Control-[
28	1C	<FS>	
29	1D	<GS>	
30	1E	<RS>	
31	1F	<US>	
32	20	<SP>	

Decimal	Hexadecimal	Character	Decimal	Hexadecimal	Character
33	21	!	80	50	P
34	22	"	81	51	Q
35	23	#	82	52	R
36	24	$	83	53	S
37	25	%	84	54	T
38	26	&	85	55	U
39	27	'	86	56	V
40	28	(	87	57	W
41	29	)	88	58	X
42	2A	*	89	59	Y
43	2B	+	90	5A	Z
44	2C	,	91	58	[
45	2D	-	92	5C	\
46	2E	.	93	5D	]
47	2F	/	94	5E	^
48	30	0	95	5F	_
49	31	1	96	60	`
50	32	2	97	61	a
51	33	3	98	62	b
52	34	4	99	63	c
53	35	5	100	64	d
54	36	6	101	65	e
55	37	7	102	66	f
56	38	8	103	67	g
57	39	9	104	68	h
58	3A	:	105	69	i
59	3B	;	106	6A	j
60	3C	<	107	68	k
61	3D	=	108	6C	1
62	3E	>	109	6D	m
63	3F	?	110	6E	n
64	40	@	111	6F	0
65	41	A	112	70	p
66	42	B	113	71	q
67	43	C	114	72	r
68	44	D	115	73	s
69	45	E	116	74	t
70	46	F	117	75	U
71	47	G	118	76	V
72	48	H	119	77	w
73	49	I	120	78	x
74	4A	J	121	79	y
75	4B	K	122	7A	z
76	4C	L	123	7B	{
77	4D	M	124	7C	|
78	4E	N	125	7D	}
79	4F	O	126	7E	~

Decimal	Hexadecimal	Character
127	7F	<DEL>
128	80	<NUL>
129	81	<SOH>
130	82	<STX>
131	83	<ETX>
132	84	<EOT>
133	85	<ENQ>
134	86	<ACK>
135	87	<BEL>
136	88	<BS>
137	89	<HT>
138	8A	<LF>
139	8B	<VT>
140	8C	<FF>
141	8D	<CR>
142	8E	<so>
143	SF	<SI>

Decimal	Hexadecimal	Character
144	90	<DLE>
145	91	<DC1>
146	92	<DC2>
147	93	<DC3>
148	94	<DC4>
149	95	<NAK>
150	96	<SYN>
151	97	<ETB>
152	98	<CAN>
153	99	<EM>
154	100	<SUB>
155	101	<ESC>
156	102	<FS>
157	103	<GS>
158	104	<RS>
159	105	<US>
160	106	<SP>

Decimal	Hexadecimal	Character
161	A1	‚
162	A2	"
163	A3	#
164	A4	$
165	A5	%
166	A6	&

Decimal	Hexadecimal	Character
167	A7	
168	A8	'
169	A9	)
170	AA	*
171	AB	+
172	AC	,

Decimal	Hexadecimal	Character
173	AD	-
174	AE	.
175	AF	/
176	B0	0
177	B1	1
178	B2	2
179	B3	3
180	B4	4
181	B5	5
182	B6	6
183	B7	7
184	B8	8
185	B9	9
186	BA	:
187	BB	;
188	BC	<
189	BD	=
190	BE	>
191	BF	?
192	C0	@

Decimal	Hexadecimal	Character
193	Cl	A
194	C2	B
195	C3	C
196	C4	D
197	C5	E
198	C6	F
199	C7	G
200	C8	H
201	C9	I
202	CA	J
203	CB	K
204	c c	L
205	CD	M
206	CE	N
207	CF	O
208	DO	P
209	D1	Q
210	D2	R
211	D3	S
212	D4	T
213	D5	U

Decimal	Hexadecimal	Character	Decimal	Hexadecimal	Character
214	D6	V	235	EB	k
215	D7	W	236	EC	l
216	D8	X	237	ED	m
217	D9	Y	238	EE	n
218	DA	Z	239	EF	0
219	DB	[	240	FO	P
220	DC	\	241	Fl	q
221	DD	]	242	F2	r
222	DE	^	243	F3	s
223	DF		244	F4	t
224	E0	'	245	F5	u
225	El	a	246	F6	v
226	E2	b	247	F7	w
227	E3	c	248	F8	x
228	E4	d	249	F9	y
229	E5	e	250	FA	z
230	E6	f	251	FB	{
231	E7	g	252	FC	|
232	E8	h	253	FD	}
233	E9	i	254	FE	~
234	EA	j	255	FF	

Appendix C
Widths of the Proportional Characters

This table lists the widths of the SQ-2000's proportional characters. The values given are in 360ths of an inch (for example: a value of 36 is 36/360-inch). You may need to enter these widths into a special table for your word processing program so that it can calculate the number of proportional characters that will fit on each line. The table shows: the character, its ASCII code (decimal) and lists four widths. Figure C-l shows what each of the four width values are for. The total width value is the only width that you will probably need to know. The left-space, body and right-space widths are all values that are internal to the SQ-2000.

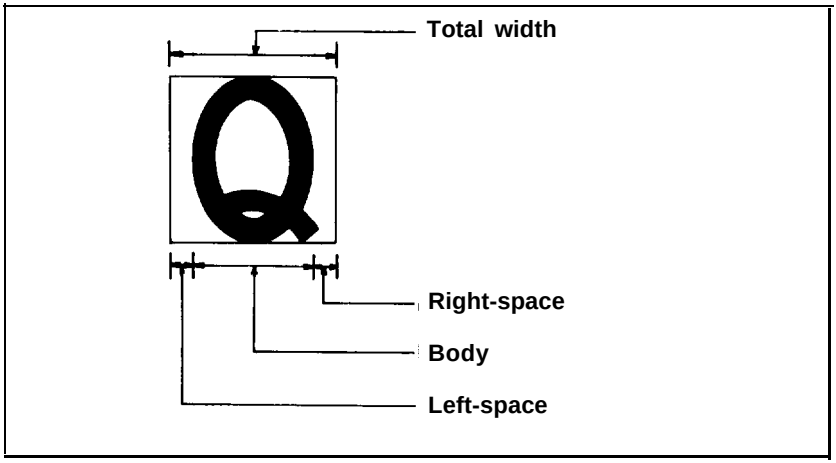

Figure C-l. Character Q and its widths

Proportional (normal)

Character	ASCII code	Left-space	Body	Right-space	Total width
	32	30	0	0	30
!	33	7	5	6	18
"	34	6	17	7	30
#	35	3	23	4	30
$	36	4	21	5	30
%	37	3	29	4	36
&	38	5	28	3	36
'	39	5	8	5	18
(	40	8	9	7	24
)	41	7	9	8	24
*	42	5	19	6	30
+	43	3	23	4	30
,	44	5	8	5	18
-	45	3	23	4	30
.	46	5	7	6	18
/	47	3	23	4	30
0	48	3	23	4	30
1	49	6	18	6	30
2	50	4	21	5	30
3	51	4	21	5	30

Proportional (normal) (continued)

Character	ASCII code	Left-space	Body	Right-space	Total width
4	52	3	23	4	30
5	53	4	21	5	30
6	54	4	22	4	30
7	55	4	21	5	30
8	56	3	23	4	30
9	57	4	22	4	30
:	58	5	7	6	18
;	59	5	7	6	18
<	60	6	17	7	30
=	61	4	21	5	30
>	62	6	17	7	30
?	63	4	21	5	30
@	64	3	29	4	36
A	65	1	33	2	36
B	66	3	28	5	36
C	67	4	28	4	36
D	68	3	29	4	36
E	69	4	28	4	36
F	70	4	28	4	36
G	71	3	31	2	36
H	72	3	31	2	36
I	73	3	17	4	24
J	74	3	23	4	30
K	75	3	31	2	36
L	76	4	28	4	36
M	77	2	37	3	42
N	78	2	31	3	36
O	79	3	29	4	36
P	80	3	29	4	36
Q	81	3	29	4	36
R	82	3	31	2	36
S	83	5	25	6	36
T	84	3	29	4	36
U	85	4	34	4	42
V	86	2	31	3	36
W	87	2	37	3	42
X	88	3	30	3	36
Y	89	2	31	3	36
Z	90	3	24	3	30
[	91	6	11	7	24
\	92	3	23	4	30
]	93	6	11	7	24

Proportional (normal) (continued)

Character	ASCII code	Left-space	Body	Right-space	Total width
^	94	5	19	6	30
_	95	2	25	3	30
`	96	5	7	6	18
a	97	2	26	2	30
b	98	4	27	5	36
c	99	3	23	4	30
d	100	5	26	5	36
e	101	3	23	4	30
f	102	2	20	2	24
g	103	4	28	4	36
h	104	4	28	4	36
i	105	2	14	2	18
j	106	3	16	5	24
k	107	4	28	4	36
l	108	2	14	2	18
m	109	3	36	3	42
n	110	4	29	3	36
o	111	2	25	3	30
p	112	3	29	4	36
q	113	5	28	3	36
r	114	3	23	4	30
s	115	5	21	4	30
t	116	3	18	3	24
u	117	3	29	4	36
v	118	2	31	3	36
w	119	2	37	3	42
x	120	2	26	2	30
y	121	4	29	3	36
z	122	4	22	4	30
{	123	6	12	6	24
¦	124	7	3	8	18
}	125	6	12	6	24
~	126	4	21	5	30
°		5	13	6	24
○		2	25	3	30
β		4	27	5	36
Ø		3	29	4	36
ø		2	25	3	30
°°		6	18	6	30
§		4	21	5	30
ü		3	30	3	36

Proportional (normal) (continued)

Character	ASCII code	Left-space	Body	Right-space	Total width
é		3	23	4	30
ä		2	26	2	30
á		2	26	2	30
a		2	26	2	30
ç		3	23	4	30
è		3	23	4	30
ì		2	14	2	18
Ä		1	33	2	36
A		1	33	2	36
É		4	28	4	36
		5	32	5	42
		2	36	4	42
ö		2	25	3	30
ò		2	25	3	30
ù		3	30	3	36
Ö		3	29	4	36
Ü		4	34	4	42
£		3	25	2	30
		3	29	4	36
Pt		2	37	3	42
ñ		4	29	3	36
Ñ		2	31	3	36
¿		5	21	4	30
¡		12	5	13	30

Proportional (superscript/subscript)

Character	ASCII code	Left-space	Body	Right-space	Total width
	32	20	0	0	20
!	33	4	3	5	12
"	34	4	11	5	20
#	35	2	16	2	20
$	36	2	15	3	20
%	37	2	19	3	24
&	38	4	17	3	24
'	39	3	6	3	12
(	40	3	9	4	16
)	41	3	9	4	16
*	42	2	15	3	20
+	43	2	15	3	20
,	44	3	6	3	12
-	45	2	15	3	20
.	46	4	5	3	12
/	47	3	14	3	20
0	48	2	15	3	20
1	49	4	13	3	20
2	50	3	13	4	20
3	51	3	14	3	20
4	52	2	15	3	20
5	53	3	14	3	20
6	54	2	15	3	20
7	55	3	13	4	20
8	56	2	15	3	20
9	57	2	15	3	20
:	58	3	5	4	12
;	59	3	6	3	12
<	60	4	11	5	20
=	61	3	13	4	20
>	62	4	11	5	20
?	63	3	14	3	20
@	64	3	18	3	24
A	65	2	20	2	24
B	66	3	17	4	24
C	67	3	17	4	24
D	68	3	17	4	24
E	69	4	15	5	24
F	70	4	17	3	24
G	71	4	16	4	24
H	72	3	17	4	24
I	73	2	11	3	16
J	74	2	15	3	20

Proportional (superscript/subscript) (continued)

Character	ASCII code	Left-space	Body	Right-space	Total width
K	75	3	18	3	24
L	76	5	15	4	24
M	77	3	21	4	28
N	78	3	17	4	24
O	79	3	17	4	24
P	80	3	17	4	24
Q	81	3	17	4	24
R	82	3	17	4	24
S	83	5	15	4	24
T	84	3	17	4	24
U	85	4	20	4	28
V	86	3	17	4	24
W	87	2	23	3	28
X	88	2	20	2	24
Y	89	2	19	3	24
Z	90	2	15	3	20
[	91	4	9	3	16
\	92	3	14	3	20
]	93	3	9	4	16
^	94	3	13	4	20
_	95	2	15	3	20
`	96	3	6	3	12
a	97	3	15	2	20
b	98	4	17	4	24
c	99	2	15	3	20
d	100	4	17	3	24
e	101	2	15	3	20
f	102	2	13	1	16
g	103	2	16	2	20
h	104	4	17	3	24
i	105	2	7	3	12
j	106	2	11	3	16
k	107	3	18	3	24
l	108	2	7	3	12
m	109	3	21	4	28
n	110	3	17	4	24
o	111	2	15	3	20
p	112	3	17	4	24
q	113	4	17	3	24
r	114	3	14	3	20
s	115	3	14	3	20
t	116	2	12	2	16

Proportional (superscript/subscript) (continued)

Character	ASCII code	Left-space	Body	Right-space	Total width
u	117	3	17	4	24
v	118	3	17	4	24
w	119	2	23	3	28
x	120	2	16	2	20
y	121	4	17	3	24
z	122	3	13	4	20
(	123	2	11	3	16
|	124	4	3	5	12
)	125	3	11	2	16
~	126	2	16	2	20
°		3	9	4	16
◌		2	15	3	20
β		2	19	3	24
Ø		3	17	4	24
ø		2	15	3	20
∞		4	11	5	20
§		4	12	4	20
ü		3	17	4	24
é		2	15	3	20
â		3	15	2	20
à		3	15	2	20
a		3	15	2	20
ç		3	15	2	20
è		2	15	3	20
ì		2	8	2	12
Á		2	20	2	24
A		2	20	2	24
É		4	15	5	24
		3	21	4	28
		3	21	4	28
ó		2	15	3	20
ò		2	15	3	20
u		3	17	4	24
Ò		3	17	4	24
Ù		4	20	4	28
£		2	16	2	20
		3	17	4	24
Pt		3	22	3	28
ñ		3	17	4	24
Ñ		3	17	4	24
¿		3	14	3	20
¡		4	3	5	12

Appendix D
Setting the DIP Switches

The SQ-2000 is provided with two sets, or panels, of dual in-line package (DIP) switches.

When these switches are preset, the printer assumes a certain set of conditions each time it is turned on or reset.

For instance, if you usually print standard-sized business documents, set the column DIP switches so that the printer always assumes the necessary printing area. But if you plan to do a number of horizontal spreadsheets, the SQ-2000 allows you to select a different page size.

Most users will find there's little need to change the switches from the factory settings (except in special instances).

Location of Switches

One set of DIP switches is located on the right beneath the dust cover (see Figure D-l). These are used to change the width of printing and allow the use of the optional cut sheet feeder. They are referred to as the *column DIP switch panel.*

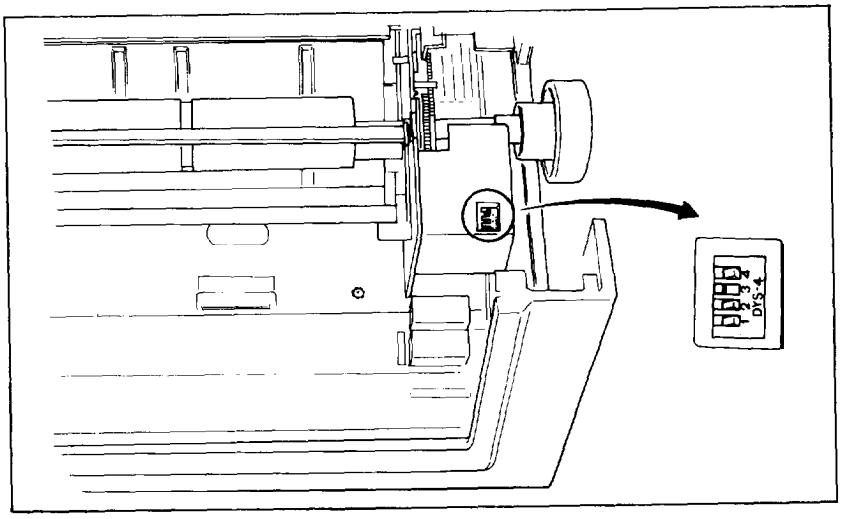

Figure D-1. Location of column DIP switch panel

The second set of switches, consisting of two or more groups, is located on the interface card at the back of the printer (see Figure D-2). The number of groups of switches depends on the type of interface you have. Two groups are common to all interfaces and are used to select various features, such as the set of international characters you'll customarily use. We'll refer to these switches as the *interface DIP switch panels.*

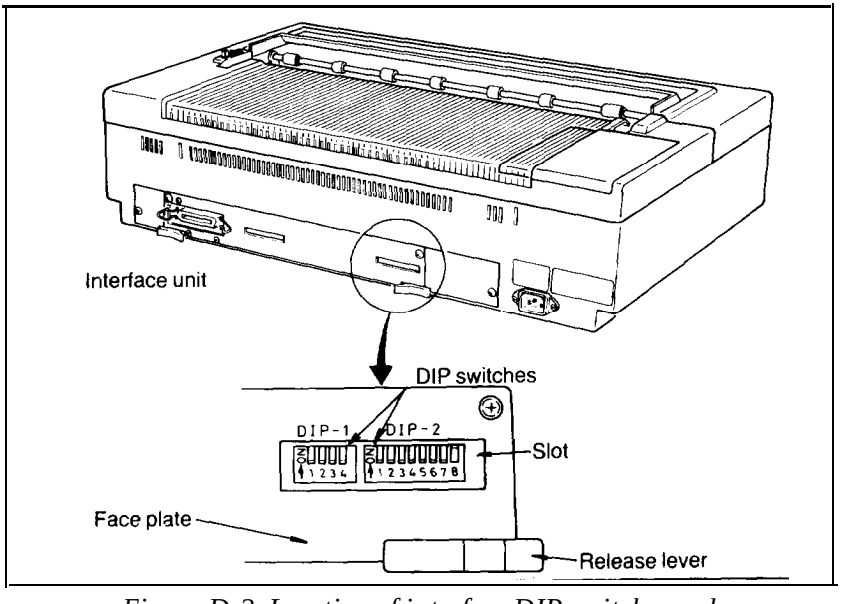

Figure D-2. Location of interface DIP switch panels

Before You Change the Switch Settings

For DIP switch changes to have effect, you must first turn off the printer.

Be sure to treat the switches gently. Avoid touching them with your hands. Static charges, dirt and oil from your fingers can harm the switches.

The switches are most easily changed with a pointed object such as a small screwdriver or ball point pen.

On each switch panel is an arrow and the word ON to indicate the ON position. You can also remember the settings on the interface switches as being ON when up and OFF when down.

Warning:
The two sets of switches described here are the only ones you should attempt to change. Do not attempt to make changes to any other switches on the main circuit board; changing the setting of the other DIP switches may result in improper operation or damage to the printer.

How the DIP switches are identified

Each switch panel contains several switches, each with its own identifying number.

Open the hinged front dust cover and look inside. The column DIP switch panel is on the right. We'll refer to these four switches as SW-1 to SW-4.

Now look at the two groups of switches on the interface on the back of the printer. These are referred to as Panel 1 (with four switches) and Panel 2 (with eight). To identify these switches, we'll first use the panel number and then the switch number. Thus, the second switch on Panel 1 is SWl-2, the third switch on Panel 2 is SW2-3, and so on.

Column DIP Switch Panel

The first three switches of this panel (SW-l to SW-3) set the width and shape of the printing area for a page. The fourth switch is used with the optional cut sheet feeder.

Table D-l shows the DIP switch settings necessary to obtain the size and shape of the different printing areas that are possible.

Set these switches according to your needs.

Table D-l. Column DIP switch setting **for** *printing area*

SW-1	Switch SW-2	SW-3	Number of columns*	Width (inch)	Paper shape and size
OFF	OFF	OFF	65	71/8	B5 vertical
OFF	OFF	ON	75	8 ¼	A4 horizontal
OFF	ON	OFF	78	8½	US. letter vertical
OFF	ON	ON	80	9½	
ON	OFF	OFF	94	10¼	B4 vertical
ON	OFF	ON	102	11	US. letter horizontal
ON	ON	OFF	109	11¾	A3 vertical
ON	ON	ON	136	14%	B4 horizontal
SW-4 ON: When using the optional cut sheet feeder OFF: When not using the optional cut sheet feeder					

*In normal (pica) character size.

Interface DIP Switch Panels

These switches customize the printer for the type of computer you have. As mentioned, up to four different switch panels may be provided depending on your interface. Full details are given in the manual that came with the interface. If you did not receive the manual, consult your dealer. You may need it later, even if the dealer installed the interface for you.

Here we'll tell you how to set the two groups of switches that are common to all interfaces.

Interface DIP switch Panel 1

The switches on Panel 1 of the interface have the functions and settings shown in Table D-2.

Table D-2. Interface DIP switch Panel 1 settings

Switch	Function	ON (up)	OFF (down)	Factory setting
SWI-1	2K-byte buffer	Disabled	Enabled	OFF
SW1 -2	Not used	-	-	OFF
SW1 -3	Automatic line feed	LF added by printer	LF needed from computer	OFF
SW1 -4	Control ROM selection	See next page		OFF

SW1-1
Set this switch to OFF if you want to use the print buffer.

This switch controls the 2K-byte print buffer. When it is OFF the buffer is used. This means information coming into the printer from the computer can be stored in the buffer until it is ready to be processed, permitting the computer to operate more efficiently.

When the switch is ON the buffer is disabled.

SW1-2
This switch is not used. It should always be OFF.

SW1-3
Set this switch to ON to add a line feed.

Some computers automatically cause the printer to advance the paper one line each time a carriage return signal is received. Others do not provide a line feed. Set this switch according to which type of computer you have. If your computer provides the automatic line feed, this switch should be OFF. If it does not provide the line feed, the switch should be ON.

The user's manual for your computer will tell you whether or not this line feed is automatically performed. You'll also know when you start to print something out using your computer (but not the printer self-test).

If you get double spacing when you want single spacing, this means both the computer and the printer are providing a line feed. Turn SW1-3 OFF.

If the second line overprints the first, neither the printer nor the computer is supplying a line feed. Therefore, turn SWl-3 ON.

SW1-4
This switch is used with a special optional ROM (read only memory) that attaches to the interface. The manual that comes with this ROM explains how this switch should be set. If your interface does not have the optional ROM, keep SW1-4 in the OFF position.

Interface DIP switch Panel 2

The second interface DIP switch panel has eight switches that select print characteristics when the SQ-2000 is turned on. Most of the functions of these switches are duplicated by software commands. The difference is that the software commands are cancelled when the printer is turned off or reset. Use this panel to set the print conditions **you'll want** whenever you turn on the printer. The software commands are explained in the separate programming manual available from your Epson dealer.

Functions of the switches on interface DIP switch Panel 2 are shown in Table D-3.

Table D-3. Interface DIP switch Panel 2 settings

Switch	Function	ON (up)	OFF (down)/	Factory setting
2-I	International character selection (See Table I-4)			ON
2-2				ON
2-3				ON
2-4	Form length	12"	11"	OFF
2-5	1" skip-over perforation	Enabled	Disabled	OFF
2-6	Buzzer	Disabled	Enabled	OFF
2-7	Print quality	LQ*	Draft**	OFF
2-8	$\overline{\text{SLCT IN}}$ signal	Fixed	Not fixed	ON

* Letter quality
** Draft: For more rapid printing in draft quality

SW2-1, SW2-2, and SW2-3

Use these three switches to select the international character sets shown in Table D-4. Their settings are shown in Table D-5.

Table D-4. International character sets

Draft Quality

0	#	$	@	[	\	]	^	'	{	¦	}	~
1	#	$	à	°	ç	§	^	'	é	ù	è	¨
2	#	$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
3	£	$	@	[	\	]	^	'	{	¦	}	~
4	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	~
5	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	₧	$	@	¡	Ñ	¿	^	'	¨	ñ	}	~
8	#	$	@	[	¥	]	^	'	{	¦	}	~
9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

Letter Quality

0	#	$	@	[	\	]	^	'	{	¦	}	~
1	#	$	à	°	ç	§	^	'	é	ù	è	¨
2	#	$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
3	£	$	@	[	\	]	^	'	{	¦	}	~
4	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	~
5	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	#	$	@	°	\	é	^	ù	à	ò	è	ì
7	₧	$	@	¡	Ñ	¿	^	'	¨	ñ	}	~
8	#	$	@	[	¥	]	^	'	{	¦	}	~
9	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

Table D-5. DIP switch settings for international characters

SW2-1	SW2-2	SW2-3	County
ON	ON	ON	U.S.A (ASCII)
ON	ON	OFF	France
ON	OFF	ON	Germany
ON	OFF	OFF	England
OFF	ON	ON	Denmark
OFF	ON	OFF	Sweden
OFF	OFF	ON	Italy
OFF	OFF	OFF	Spain

SW2-4

Set the form length with this switch. ON is 12 inches; OFF is 11 inches.

When a form feed character is sent by the computer, the paper moves to the next sheet if the optional cut sheet feeder is attached, or to the top of the next form if the optional tractor unit is being used. Set the switch according to the length of the sheets or forms you are using. The form length can also be changed temporarily under software control.

SW2-5

Set this switch to ON to automatically skip the perforations in fanfold paper.

Set this switch to OFF when you want your printing (such as program printouts) to be continuous and free from breaks caused by the printer. This switch should also be set to OFF when the word processing or other software program you are using requires complete control of the page length.

SW2-6

Set this switch to ON when you **want** to disable the printer buzzer.

Set it to OFF when you want the buzzer to work.

SW2-7

When you want high-speed printing in draft quality, turn the switch to OFF for a print speed of 176 characters per second.

Set this switch to ON for Letter Quality mode at 105 characters per second.

SW2-8

Set this switch to ON to enable the printer upon power application.

The ON LINE light on the control panel will glow when the printer and computer are on-line (in communication) when paper has been loaded. If this switch is not set to ON, some applications software may not operate properly.

Set this switch to OFF to allow the printer to be activated or deactivated by the computer.

Appendix E
Using the Optional Tractor Unit

With the optional tractor unit, your printer can use continuous paper with pin feed holes along the sides. The unit is adjustable so that the continuous paper can be any width from 4 to 15 inches.

Printer Location

When you use the tractor and continuous paper, you must locate your SQ-2000 so that the paper can flow freely in and out of the printer.

Two possible arrangements are shown in Figures E-l and E-2.

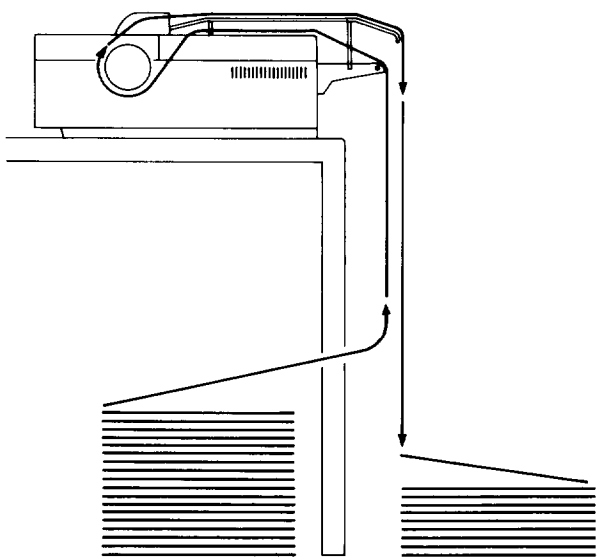

Figure E-1. Continuous paper stacked below printer

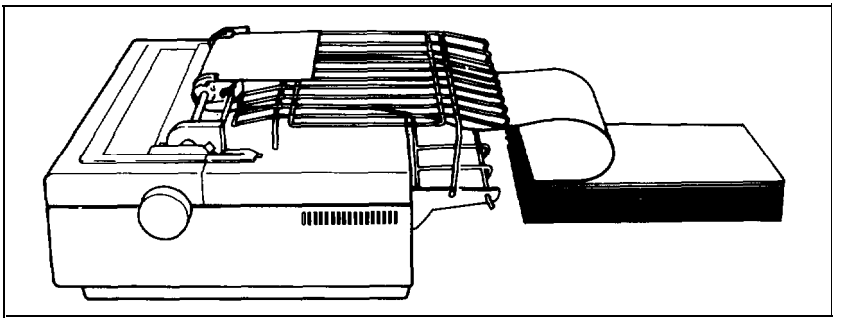

Figure E-2. Continuous *paper stacked behind printer*

Installing the Tractor Unit

To install the removable tractor unit, first pull the printer's friction lever toward the front of the printer. Open the dust cover to provide better access.

Then hold the tractor with the gears to the right as shown in Figure E-3. Slip the tractor into the two slots on the printer.

In each tractor slot are two pegs that fit into the notches on the tractor fittings. Tilt the tractor back so that the rear notches fit over the rear pegs. Then tilt the unit forward until it clicks into place. That's all there is to it.

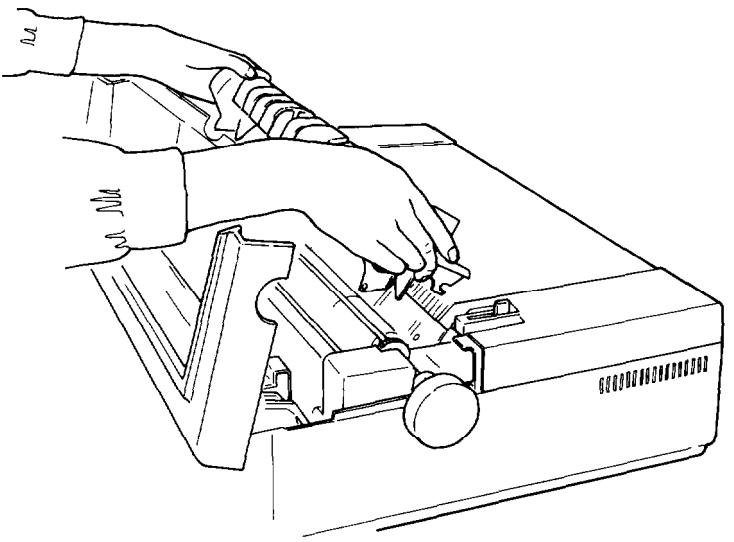

Figure E-3. *Tractor installation*

Installing the Paper Separator

Now assemble and install the paper separator as shown in Figure E-4, inserting the separator into the slots on the back of the printer. The separator keeps the paper that is coming out of the printer from being pulled back in.

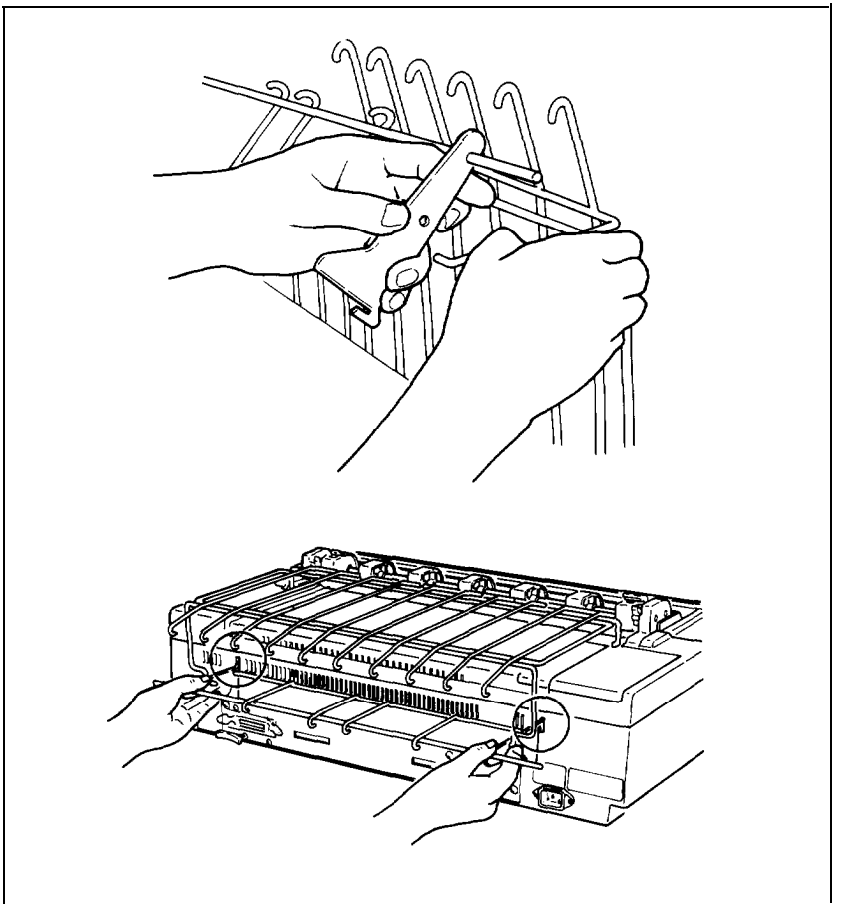

Figure E-4. Paper separator being assembled and *installed*

When you **want** to use single-sheet paper in your SQ-2000, you can easily remove the tractor unit. Just push back the two tractor release levers as shown in Figure E-5, tilt the unit up and lift it off.

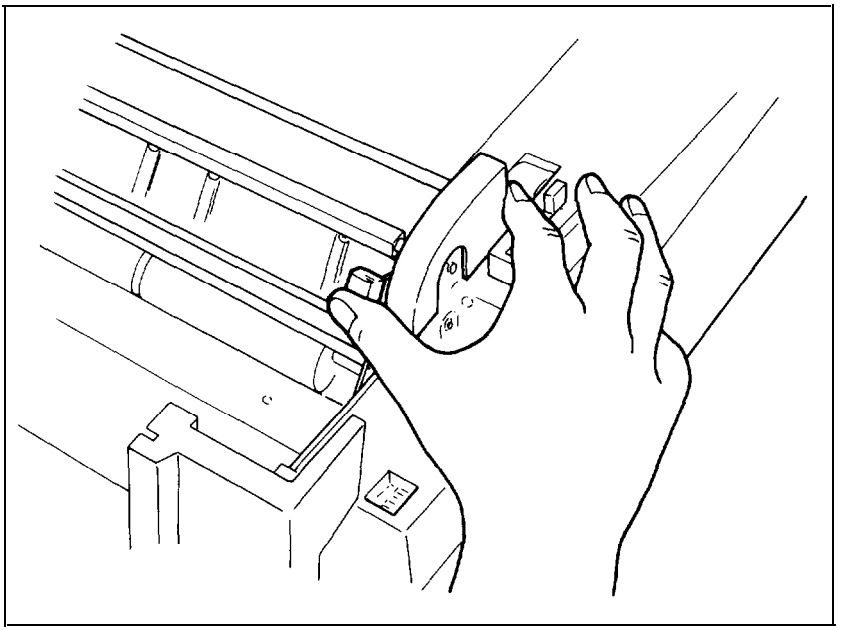

Figure E-S. Tractor release levers

Loading Continuous Paper

Once you have installed the tractor and separator, the printer is ready to accept continuous paper.

To do this you first need to adjust the printer.

Check that the DIP switch under the dust cover (SW-4 as described in Appendix D) is in the OFF position. This switch must be off except when the optional cut-sheet feeder is installed.

Push back the paper separator so that it's in a raised position on the back of the printer (see Figure E-6).

Next, pull the paper friction lever forward to move the paper pressure bar away from the platen.

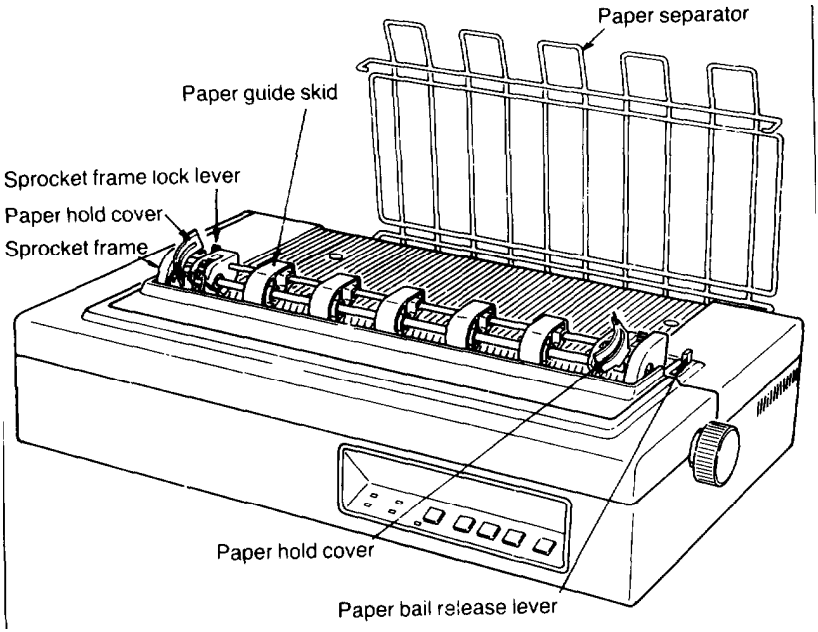

Figure E-6, Location of parts for **tractor** unit

The two wheels, or sprockets, on the tractor unit must be moved to match the width of the paper you use. The paper feeds through these sprockets using the holes near the paper's two side edges.

Move the left sprocket by releasing its locking lever. Place the sprocket about a quarter of an inch from its left-most position. Then lock it back.

Release the locking lever of the right sprocket and move it to the place you expect the holes on the right side of the paper to line up. Leave it unlocked for **now.**

Now raise the paper-holding covers on both the sprockets as they appear in Figure E-6.

Feed the paper under the paper separator (Figure E-7) and into the paper slot behind the platen. Push the paper through until it comes up between the paper pressure bar and in front of the platen.

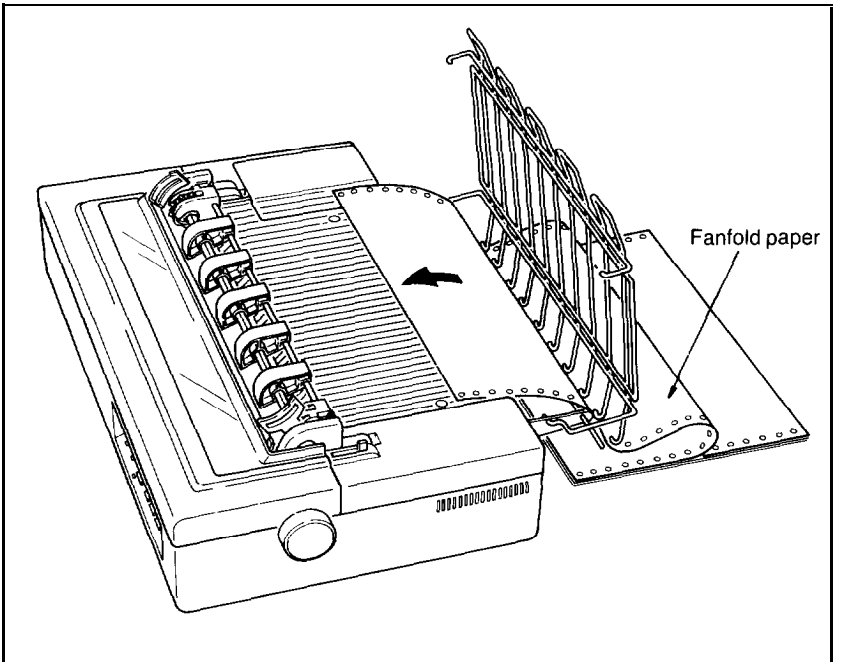

Figure E-7. Feeding the paper into the printer

Next, pull the paper up until the top is above the pin-feed holders. Fit the holes on the left side of the paper over the pins in the left holder and close the cover. Now fit the right side of the paper in the right holder, moving the holder as needed to match the width of the paper. Close the second cover-making sure that the paper has no dips or wrinkles-and lock the right holder in place.

Adjust the paper guide skids on the back of the tractor so they're evenly spaced. The paper pressure bar should remain in the open position and does not touch the paper.

Now you're ready to set the top-of-page position. Turn the paper-feed knob to advance the paper until the perforation between the first and second sheets is about l/8 of an inch below the top of the print head as shown in Figure E-8.

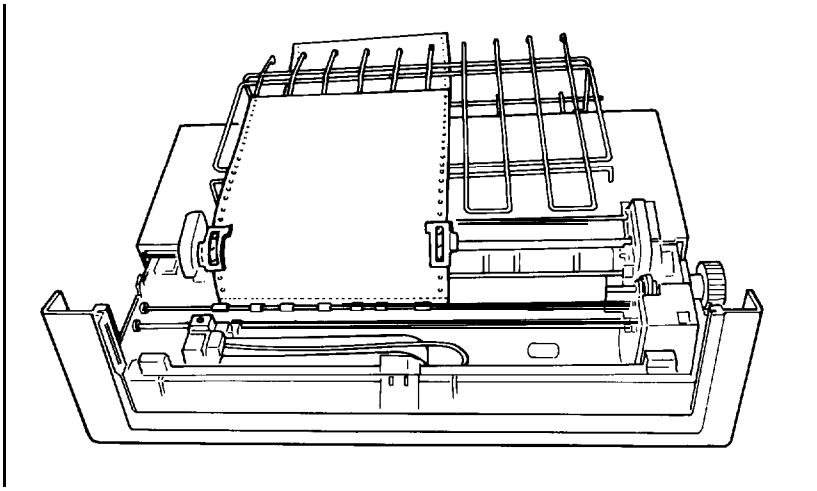

Figure E-8. Top-of-page position

When you turn on your SQ-2000 it will remember this top-of-page position and will use it when any program tells it to move to the top of the next page. If you later find that your word processing or other applications program is putting your printing too high or too low on the page, check to see that your top-of-page setting is correct.

Once you have set the top of page, each time you finish printing a document, push the ON LINE button to put the printer off-line and then push the FF button once to advance the paper. This allows you to tear off your just-printed pages, and the paper will be in the right position to begin the next document.

Appendix F
Specifications

Printing

Printing method ..... On-demand ink-jet, with 24-nozzle print head

Printing speed ..... Draft 176 characters per second Letter quality 105 characters per second

Character sets ..... 96 regular, 96 italic, 32 international characters in each of: letter quality, proportional letter quality, and draft styles.

Character matrix .....

	Normal characters	Super/ subscript
Draft	15 x 23 dots	7x 14 dots
LQ	29 x 23 dots	9x 14 dots

Column width ..... Pica: 136 columns
Pica expanded: 68 columns
Pica emphasized: 136 columns
Pica compressed: 220 columns
Elite: 163 columns
Elite expanded: 81 columns
Elite compressed: 272 columns
Proportional: 116 columns

Line spacing ..... 1/6-inch, 1/S-inch or programmable

Paper types ..... Single sheet, friction feed, 7.2 to 14.3 inches wide.
Pin feed, with optional tractor unit, 5.5 to 16 inches wide.

Printer

Dimensions	Height: 6.5 inches (165mm) 11.7 inches (296mm) with sheet guide 7.5 inches (188mm) with optional tractor unit Width: 24.5 inches (595mm) with knob Depth: 15 inches (383mm)
Weight	40 lbs (18kg) (printer only)
Power required	Voltage: 120 VAC ± 10% Frequency: 49.5 to 60.5 Hz Power consumption: 60 VA maximum 40 VA typical
Environment	Temperature: 40 to 95F (5 to 35°C) Humidity: 10 to 80% non-condensing
Ink cartridge	Black ink Cartridge life: 3 X 10^6 draft characters (depends on how frequently printer is turned off and on)
Printer MTBF	5x 10^6 lines
Print head MTBF	100x 10^6 characters

INDEX

A

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Quick Reference

SQ-2000™ Printer

Most versions of BASIC use the LPRINT command and the *CHR$(n)* function to send codes to the printer. In the *CHR$(n)* function the value *n* is the number of the code that you want to send to the printer. For example, to set a right margin at column 60, the SQ-2000 command is:

<ESC> "Q" 60
In BASIC it looks like this:
LPRINT CHR$(27) "Q" CHR$(60);

Control Codes by Function

Vertical Spacing Commands

<LF>	produces a line feed.
<ESC> "J" *n*	Advances the paper n/180 inch **(0≤*n*≤255)**.
<ESC> "0"	Sets the line spacing to *1/8 inch.
<ESC> "2"	Sets the line spacing to l/6 inch.
<ESC> "3" n	Sets the line spacing to l/180 inch (0 n 255).**(0≤*n*≤255).**
<ESC> "A" n	Sets the line spacing to n/60 inches (0 n 85).**(0≤*n*≤85).**
<FF>	Produces a form feed.
<ESC> "C" n	Sets the length of the page to n lines**(1≤*n*≤127).**
<ESC> "C" <NUL> n	Sets the page length to n inches**(1≤*n*≤22).**
<ESC> "N" n	Sets a bottom margin of n lines**(0≤*n*≤127).**
<ESC> "O"	Sets the bottom margin to 0 lines.
<VT>	Produces a vertical tab.
<ESC> "B" n1 n2 n3 ___ <NUL>	Sets up to 16 vertical tabs on lines n1, n2, n3, etc.**(1≤*n*≤254)**.
<ESC> "/" c	Selects a vertical tab channel**(0≤c≤7)**.
<ESC> "b" c n1 n2 n3 ... <NUL>	Sets up to 16 vertical tabs on lines n1, n2, n3, etc. of vertical tab channel c**(0≤c≤7)(1≤*n*≤254)**.

Horizontal Spacing Commands

<CR>	Produces a carriage return.
<ESC> "Q" n	Sets a right margin at n columns **(1≤*n*≤255)**.
<ESC> "1" n	Sets the left margin at n columns**(1≤*n*≤160)**.
<HT>	Produces a horizontal tab.
<ESC> "D"n1 n2 n3... <NUL>	Sets up to 32 horizontal tabs at character positions n1, n2, n3, etc.**(1≤*n*≤137)**.
<ESC> <SP> n	Increases the space between characters by n dots**(0≤*n*≤127)**
<ESC> "$" n1 n2	Moves the print head to an absolute horizontal position.
<ESC> "\" n1 n2	Moves the print head a specified distance from the last character printed.

Print Style Commands

<ESC> "x" *n*	Selects between draft mode (n=0) and letter quality mode.
<ESC> "!" n	Selects multiple printing styles (Master Select command).
<ESC> "M"	Selects elite pitch.
<ESC> "P"	Cancels elite pitch.
<ESC> "p" n	Turns proportional printing ON (n=1) or proportional printing OFF (n=0).
< s o >	Selects one-line expanded width print.
<ESC> <SO>	Selects one-line expanded width print.
<DC4>	Cancels one-line expanded print.
<ESC> "W" n	Turns expanded width print ON (n=1) or turns expanded width print OFF (n=0).
<SI>	Selects compressed width print.
<ESC> <SI>	Selects compressed width print.
<DC2>	Cancels compressed width print.
<ESC> "E"	Selects emphasized print.
<ESC> "F"	Cancels emphasized print.
<ESC> "4"	Selects italic print.
<ESC> "5"	Cancels italic print.
<ESC> "--" n	Turns underlining ON ***(n=1)*** or turns underlining OFF (n=0).
<ESC> "S" n	Selects superscripts (n=0) or selects subscripts (n=l).
<ESC> "T"	Cancels superscripts and subscripts.

Character Set Commands

<ESC> "%" n	Selects the user-defined character set (n=1) or cancels the user-defined character set (n=0).
<ESC> "&" <NUL> *n1 n2 data*	Defines user-defined characters**(32≤*n*≤127)**.
<ESC> "." <NUL> <NUL> <NUL>	Copies ROM character set to user-defined character set.
<ESC> "R" *n*	Selects international character set**(0≤*n*≤10)**.

Graphics Commands

<ESC> "K" n1 n2 *data*	Prints single-density dot graphics.
<ESC> "L" n1 *n2 data*	Prints double-density dot graphics.
<ESC> "Y" n1 n2 data	Prints high-speed double-density dot graphics.
<ESC> "*Z*" *n1 n2 data*	Prints quadruple-density dot graphics.
<ESC> "*" s n1 n2 *data*	prints selected-density dot graphics.
<ESC> "?" s n	Assigns graphics densities.

Miscellaneous Commands

<CAN>	Cancels the current line.
<DEL>	Deletes the preceding character.
<DC3>	Turns printer to off-line state.
<DC1>	Turns printer to on-line state.
<*ESC*> "*V*" *n data* <ESC> "V" <NUL>	Repeats *data,* n times**(1≤*n*≤255)**.
<ESC> ">"	Sets the eighth data bit to 1.
<ESC> "="	Sets the eighth data bit to 0.
<ESC> "#"	Cancels control of *the* eighth *data* bit.
<BEL>	Sounds the buzzer.
<BS>	Produces a backspace.
<ESC> "@"	Resets the printer.
<ESC> "<"	Causes the next line to be printed left-to-right.
<ESC> "U" n	Selects unidirectional printing (n=1) or bidirectional printing (n=0).

Each print style is assigned a value to be used with the Master Select command. The Master Select command consists of <ESC> '!" followed by a single ASCII code. To create a Master Select code, add the values of the print styles you want to combine.

The values of the print styles are as follows:

Elite	1
Proportional	2
Compressed	4
Emphasized	8
Expanded	32
Italic	64
Underlined	128

For example, if you want to find the code for elite emphasized italic print you would add these values:

Elite	1
Emphasized	8
Italic	64
Master Select code	73

The Master Select Command you would use would look like this:

<ESC> "!" "I" (I is ASCII 73)

DIP Switch Settings

Interface DIP switch Panel 1

Switch	Function	ON (up)	OFF (down)	Factory setting
SW1-1	2K-byte buffer	Disabled	Enabled	OFF
SW1-2	Not used	-	-	OFF
SW1-3	Automatic line feed	LF added by printer	LF needed from computer	OFF
SW1-4	Control ROM selection	See Appendix D		OFF

Interface DIP switch Panel 2

Switch	Function	ON (up)	OFF (down)	Factory setting
2-1	International character selection (See Table D-4)			ON
2-2				ON
2-3				ON
2-4	Form length	12"	11"	OFF
2-5	1" skip-over perforation	Enabled	Disabled	OFF
2-6	Buzzer	Disabled	Enabled	OFF
2-7	Print quality	LQ*	Draft**	OFF
2-8	$\overline{\text{SLCT IN}}$ signal	Fixed	Not fixed	ON

* Letter quality
** Draft quality

ASCII Code Conversion Chart

Decimal	Hexadecimal	Abbreviation	Control key
0	00	<NUL>	Control-@
1	01	<SOH>	Control-A
2	02	<STX>	Control-B
3	03	<ETX>	Control-C
4	04	<EOT>	Control-D
5	05	<ENQ>	Control-E
6	06	<ACK>	Control-F
7	07	<BEL>	Control-G
8	08	<BS>	Control-H
9	09	<HT>	Control-I
10	0A	<LF>	Control-J
11	0B	<VT>	Control-K
12	0C	<FF>	Control-L
13	0D	<CR>	Control-M
14	0E	<SO>	Control-N
15	0F	<SI>	Control-O
16	10	<DLE>	Control-P
17	11	<DCl>	Control-Q
18	12	<DC2>	Control-R
19	13	<DC3>	Control-S
20	14	<DC4>	Control-T
21	15	<NAK>	Control-U
22	16	<SYN>	Control-V
23	17	<ETB>	Control-W
24	18	<CAN>	Control-X
25	19	<EM>	Control-Y
26	1A	<SUB>	Control-Z
27	18	<ESC>	Control-[
28	1C	<FS>	
29	1D	<GS>	
30	1E	<RS>	
31	1F	<US>	
32	20	<SP>	

Dec	Hex	Chr
33	21	!
34	22	"
35	23	#
36	24	$
37	25	%
38	26	&
39	27	’
40	28	(
41	29	)
42	2A	*
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O

Dec	Hex	Chr
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U
86	56	v
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	-
96	60	’
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	0
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	(
124	7C	:
125	7D	)
126	7E	~

Dec	Hex	Chr
127	7F	<DEL>
128	80	<NUL>
129	81	<SOH>
130	82	<STX>
131	83	<ETX>
132	84	<EOT>
133	85	<ENQ>
134	86	<ACK>
135	87	<BEL>
136	88	<BS>
137	89	<HT>
138	8A	<LF>
139	8B	<VT>
140	8C	<FF>
141	8D	<CR>
142	8E	<SO>
143	8F	<SI>
144	90	<DLE>
145	91	<DCl>
146	92	<DC2>
147	93	<DC3>
148	94	<DC4>
149	95	<NAK>
150	96	<SYN>
151	97	<ETB>
152	98	<CAN>
153	99	<EM>
154	100	<SUB>
155	101	<ESC>
156	102	<FS>
157	103	<GS>
158	104	<RS>
159	105	<US>
160	106	<SF>

Dec	Hex	Chr
161	A1	/
162	A2	”
163	A3	#
164	A4	$
165	A5	%
166	A6	&
167	A7	’
168	A8	(
169	A9	)
170	AA	*
171	AB	+
172	AC	,
173	AD	-
174	AE	.
175	AF	/
176	B0	0
177	B1	1
178	B2	2
179	B3	3
180	B4	4
181	B5	5
182	B6	6
183	B7	7
184	B8	8
185	B9	9
186	BA	:
187	BB	;
188	BC	<
189	BD	=
190	BE	>
191	BF	?
192	C0	@
193	C1	A
194	C2	B
195	C3	C
196	C4	D
197	C5	E
198	C6	F
199	C7	G
200	C8	H
201	C9	I
202	CA	J
203	CB	K
204	CC	L
205	CD	M
206	CE	N
207	CF	O
208	D0	P
209	D1	Q
210	D2	R

Dec	Hex	chr
211	D3	S
212	D4	T
213	D5	U
214	D6	V
215	D7	W
216	D8	X
217	D9	Y
218	DA	Z
219	DB	[
220	DC	\
221	DD	]
222	DE	^
223	DF	-
224	E0	`
225	E1	a
226	E2	b
227	E3	c
228	E4	d
229	E5	e
230	E6	f
231	E7	g
232	E8	h
233	E9	i
234	EA	j
235	EB	k
236	EC	l
237	ED	m
238	EE	n
239	EF	o
240	F0	p
241	F1	q
242	F2	r
243	F3	s
244	F4	t
245	F5	u
246	F6	v
247	F7	w
248	F8	x
249	F9	y
250	FA	z
251	FB	{
252	FC	|
253	FD	}
254	FE	~
255	FF	

EPSON®

SQ-2000™ Printer Operating Manual

Topics Include:

10 Steps to Printing
Operation
Printer Care
Word Processing
Dot Graphics
Command Reference

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