



# *LaserPrinter 4*

APPLICATIONS MANUAL

### Trademark Acknowledgements

**LaserPrinter 4:** Star Micronics Co., Ltd.

**PageMaker:** Aldus Corporation

**Bitstream, Zapf Humanist:** Bitstream Inc.

**Canon:** Canon Inc.

**HP, LaserJet IIP:** Hewlett-Packard Company

**LaserControl:** Insight Development Inc.

**IBM PC:** International Business Machines Corp.

**Optima, Century Schoolbook:** Linotype Corporation

**Lotus 1-2-3:** Lotus Development Corporation

**MS-DOS, Microsoft BASIC, Windows, Word:** Microsoft Corporation

**Multimate:** Multimate International

**Epson, FX-850:** Seiko Epson Corporation

**WordPerfect:** WordPerfect Corporation

**Ventura Publisher:** Xerox Corporation

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# PREFACE

## ***About this manual***

This *Star LaserPrinter 4 Applications Manual* gives you the information you need to program the Star Micronics LaserPrinter 4.

Why would you read this book? Most people using a laser printer just run software packages with built-in *printer drivers*, which look after everything their computers send their printers. But many of us—small business people and home computer users, not to mention the wizards who write those software packages—want to benefit from all the new features offered by our printers.

Do you want complete control over the characters and images you print? Do you want to make your Star LaserPrinter 4 work like some earlier kind of printer? This manual provides the software help you need to get the most from your LaserPrinter 4.

Though this *Applications Manual* is really intended for intermediate to advanced computer users, we've tried to accommodate relative novices too. The information is organized so you can walk through the general theory underlying printer programming before dancing into specific details. It makes sense, therefore, to read the first three chapters before jumping into the middle.

There's a good reason to read each chapter from its start too. People learning how to use a new printer often find the terminology a barrier. So instead of burying what may be new jargon in a Glossary at the back, we define each new term the first time it appears. The whole first part of the chapter on fonts, for example, defines different aspects of a *font* (a collection of characters of the same size and style).

## ***What's in this manual?***

- In “Getting to Know Your Star LaserPrinter 4” we provide a list of the features that make this a splendid printer, to help you choose which features you want to exploit. There’s a bit on how laser printers work, inside and out. The chapter then explains software in general terms, including how to write control and Escape commands to make those features work.
- “Controlling Your Printer” examines the parameters and “superset” commands you give the Star LaserPrinter 4 to direct precisely how you want it to behave. These let you control the printer, manage page formats, and specify what you want printed.
- For most of us, the “Fonts” chapter will be useful: how to use the fonts built into the LaserPrinter 4, plus those that come on cartridges or computer disks.
- You may never look at chapters 4 and 5, which cover Star LaserPrinter 4 commands. Your LaserPrinter 4 *emulates* other printers: it imitates other printers by accepting the same commands they do. Just think of your Star LaserPrinter 4 as two printers hiding inside one unit.

If you want to write or modify a program that uses one of these printers—the Hewlett-Packard LaserJet IIP or Epson FX-850— chapters 4 and 5 show how your Star LaserPrinter 4 can emulate accordingly. The chapters first describe how to control the printer and to format pages, then how to move the print position, and finally how to use fonts and graphics.

The chapter on the LaserJet IIP is longer and more detailed than the others. That’s because you are more likely to use laser printer commands than commands for dot matrix printers. (If you have software designed only for dot matrix printers, you may have manuals for those printers anyway.) We recommend you use LaserJet IIP emulation whenever possible, with FX-850 emulation as your backup mode.

- The final “Technical Supplement” containing the command and character reference tables will probably get thumbed the most.

## **Conventions**

Incidentally, one of those Technical Supplement tables suggests a couple of typographic conventions we'll use. Base ten (decimal) numbers will generally be used here; if we have to use base sixteen numbers (*hexadecimal*) we'll expressly say so.

And second, the lowercase L is practically identical to the number one (l versus 1). Because lowercase L is used in many command descriptions, we'll use the character *l* to avoid confusion.

## ***The Star LaserPrinter 4 Operations Manual***

This manual is the companion to the *Star LaserPrinter 4 Operations Manual* that came with your printer. A laser printer is a fairly complex tool that requires care and delicate handling. So to use this *Applications Manual* best, make sure you understand that *Operations Manual* first.

Your *Operations Manual* holds essential information about the LaserPrinter 4, such as how to:

- unpack and set up your laser printer,
- connect the Star LaserPrinter 4 to your computer's serial or parallel port,
- link the LaserPrinter 4 into a network of several computers,
- configure the LaserPrinter 4 to your needs (with variables such as paper size and speed of data transfer),
- load paper and the toner cartridge,
- operate the panel switches and display,
- run the LaserPrinter 4 self-test,
- look after your printer to keep it in peak condition.

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# ***Getting to Know Your Star LaserPrinter 4***

## **CHAPTER 1**

This chapter introduces both the hardware and software aspects of the Star LaserPrinter 4's personality, from fonts and print engine to ASCII and Escape sequences.

### **1.1 STAR LASERPRINTER 4 HARDWARE**

#### ***1.1.1 Versatility***

Your Star Micronics Star LaserPrinter 4 works with practically all commercial software programs and computers. With features that go beyond Star's easy, affordable 9-pin and fast, quality-printing 24-pin dot matrix printers, the Star Laser Printer is the logical next step in the series of fine Star Micronics printers.

Your Star LaserPrinter 4 produces pages that look close to typeset quality, with up to 90,000 dots per square inch—no more NLQ (near letter quality) compromises. The Star LaserPrinter 4 produces four of those pages a minute. These numbers translate to about five times more resolution and about three times more speed than the average dot-matrix printer.

Star's new printer is remarkably versatile. You can print complicated forms (widthwise if you want) ... detailed graphs ... your own customized typestyles ... digitized photographs ... other languages (including Arabic and Japanese).

You can even print your letterhead and logo as you print your letter, and reprint them directly onto a business envelope. You don't even need to remove the paper tray to print the envelope: just slide it into the manual feed slot.

The Star LaserPrinter 4 is ideal for desktop publishing. The pages it produces make perfect photocopy or instant-print masters. And all the main desktop publishing systems, including Aldus Corporation's *PageMaker* and Xerox *Ventura Publisher*, work splendidly with the Star LaserPrinter 4. With "page makeup" programs like these you will be able— maybe for the first time— to deliver communications with the impact of top-notch graphics.

### 1.1.2 Font options

You can print with an amazingly wide variety of type fonts and sizes. The Star LaserPrinter 4 comes with seven built-in fonts, which can be printed from 8.5 points to 12 points in size (a *point* is about 1/72 of an inch).

These fonts are:

Courier	12point	Medium
Courier	12point	Bold
Courier	12point	Italic
Courier	10point	Medium
Courier	10point	Bold
Courier	10point	Italic
LinePrinter	8.5point	Medium

Besides these, you may be able to use optional cartridges and disks to give your Star LaserPrinter 4 a variety of extra fonts, such as these:

Helvet	line drawing
Letter Gothic	presentation fonts
Bar codes	optical character reader fonts universal product code

You can load your Star LaserPrinter 4's memory with fonts stored on computer disks. Literally hundreds of fonts are marketed by font-supply companies. Some fonts are even obtainable from computer "user groups" or "electronic bulletin boards". Fonts you get this way are in the public domain, which means you don't need to pay a licence fee to use them.

Ask your Star LaserPrinter 4 dealer about resources like these. Desktop publishing with laser printers is fast-changing territory, and some Star Micronics staff people have found electronic bulletin boards and computer user groups quite helpful in keeping up with the changing pace. If you invest a little time this way it may repay you well.



### **1.2.3 How your laser printer communicates**

Your computer communicates with the Star LaserPrinter 4 through either a *parallel* cable or one of two kinds of *serial* cable. The printer's *interface*, the link or boundary it shares with your computer, defines whether the printer will accept characters and commands from your computer *one byte* or *one bit* at a time.

A bit is the smallest unit of computer or printer memory. It has either a low or high electric charge, which we represent with the digits 0 and 1. Usually eight adjacent bits are grouped to form a byte. Since a byte normally represents one character, this string of bits—01000001—might represent the letter A.

The serial interface accepts just one bit at a time from your computer. A parallel interface can handle a whole byte at once, by moving data bits side-by-side along separate wires. You choose which interface method you want to use by selecting it on the control panel, as explained in your *Star LaserPrinter 4 Operations Manual*.

### **1.2.4 The Star LaserPrinter 4 is a computer**

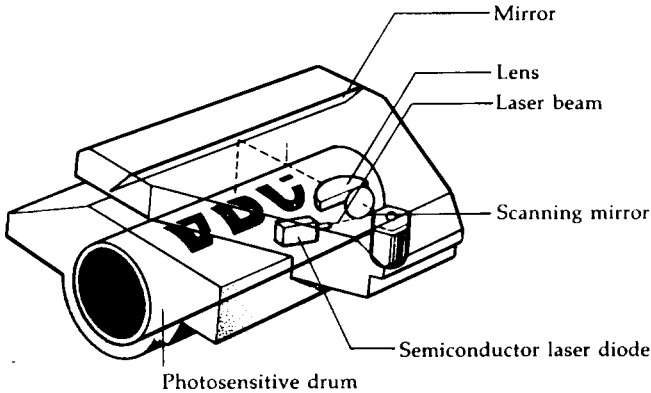
The Star LaserPrinter 4 first *maps* the characters to be printed into its own *random access memory* (RAM). That is, the printer builds a "picture" in its memory corresponding to the page you want to print. When that's done the printer can reproduce the page onto paper on its own, letting your computer get on with other work.

Your Star LaserPrinter 4 comes with one *megabyte* of RAM—the equivalent of about one million characters. A Star LaserPrinter 4 option lets you add a second megabyte of RAM if, say, you need to map full-page graphics or store more fonts. Accompanying all that RAM is another 512 kilobytes of read only memory (ROM), containing a library of internal fonts and the programs that let the Star LaserPrinter 4 emulate other printers.

An Intel 80960KA computer chip controls both the memory and the printing mechanism in the printer, called the print engine. The printer stores a whole page in RAM before printing it. (If a page is so dense that it overflows memory—a most unlikely event—the Star LaserPrinter 4 prints the page on two sheets.)

## 1.2.5 The Print engine

It's the *print engine* that forms the actual characters and graphics. The engine directs its laser, a pinpoint stream of light pulses, through mirrors and lenses onto the surface of a positively-charged rotating drum.



As the laser scans, it “draws” the page-map stored in your printer’s memory. Wherever a light pulse strikes, that tiny part of the drum drops to a neutral electrical charge. That spot then attracts fine toner powder as the drum rotates past the powder compartment.

As the drum rotates further it meets the paper. The paper itself is negatively charged by passing by a fine *corona* wire. Since opposite charges attract, the negative paper clings to the positive drum. Then heat and pressure from a roller melt or *fuse* the dots of toner onto the paper, precisely reproducing the image.

Finally the paper slides into the output bin. The paper usually comes out face down so it stacks in the correct sequence.

## 1.2 STAR LASERPRINTER 4 SOFTWARE

### 1.2.1 Binary and hexadecimal arithmetic

If you already know what hexadecimal numbers are, you can skip this section and go ahead to read about ASCII.

The decimal number system with which we're all familiar is a *positional* counting system. There's the "ones" position, the "tens" position, the "hundreds" position and so on. Each higher position is worth ten times more than the position to the right of it, since the decimal system uses the *base* of ten. Moreover, we need ten symbols to show the actual values that may be in each position.

The binary system is positional too. There's the "ones" position, the "twos" position, the "fours" position, the "eights" position and so on. In binary each position is worth only twice that of the position to its right. And we only need two symbols—0 (zero) and 1 (one)—to show the values that may be in any position. So in binary we get numbers that look like 1010 or 10001100.

The hexadecimal system is made of base-sixteen numbers. Hexadecimal is positional like the other counting systems. And each higher position is worth sixteen times as much as the position to its right.

We need sixteen different symbols to show all the possible values one hexadecimal digit could have. We can use our decimal system's ten symbols, but we've had to borrow a few more from our alphabet to get all the symbols we need. In hexadecimal, therefore, you can have a number that looks like 2C7C, or even FACE.

Here's how the decimal, binary and hexadecimal number systems compare:

<i>Decimal</i>	<i>Binary</i>	<i>Hexadecimal</i>	<i>Decimal</i>	<i>Binary</i>	<i>Hexadecimal</i>
0	0000	0	8	1000	8
1	0001	1	9	1001	9
2	0010	2	10	1010	A
3	0011	3	11	1011	B
4	0100	4	12	1100	C
5	0101	5	13	1101	D
6	0110	6	14	1110	E
7	0111	7	15	1111	F

The important thing to realize is that there's more than one way to show the same numeric value. Computer programmers, for example, occasionally use the hexadecimal system because it's so compact. (Programmers often just say "hex".) This binary number:

101001011111110100110111111011010010110100001001

looks quite a bit tidier when it is written as A5 FD 37 ED 2D 09, which means the same thing.

### **1.2.2 The ASCII table**

Where does the Star LaserPrinter 4 get the characters and instructions it needs to print in the first place? It gets them from your computer, which sends a stream of text and commands to your printer.

The program in your computer that controls everything sent to the printer (called the *printer driver*) will usually be included with your computer programs, such as your word processor. But the commands could also come from a program you've written, perhaps in *BASIC*, a programming language that uses common English words.

Internally, computers and printers use only the binary number system to represent both commands and all the alphabetic, numeric and other keyboard symbols. Nearly all of those machines use the same scheme to code those symbols, the American Standards Code for Information Interchange (ASCII).

An example: in our familiar decimal system, binary 01001010 adds up to the number 74. Depending on which program your printer is using, it can interpret that binary string 01001010 as either the number 74 or the symbol *J*. The printer stores the symbol *J* at position 74 in a table in its memory.

That eight-bit binary string, or byte, can be broken into two halves. The left or high-order part containing 0100 is called the zone portion; the right part holding the 1010 is called the digits portion. And in the hexadecimal number system, the zone and digit parts of that byte are represented as 4 and A respectively (look them up in the list above).

So the laser printer understands the symbol *J* as 01001010, which we can also represent as the decimal number 74 or the hexadecimal number 4A. We've printed this byte vertically and horizontally below, showing how it adds up to decimal 74 and hex 4A.

$$\begin{aligned}
0 \times 2^7 &= 0 \\
1 \times 2^6 &= 64 \\
0 \times 2^5 &= 0 \\
0 \times 2^4 &= 0 \\
1 \times 2^3 &= 8 \\
0 \times 2^2 &= 0 \\
1 \times 2^1 &= 2 \\
0 \times 2^0 &= 0
\end{aligned}$$

	74	Decimal
zone	digits	
0100	1010	Binary
4	A	Hexadecimal

The ASCII table in the Technical Supplement shows all these equivalent representations for the symbols your laser printer understands. The table organizes them in ascending order. In fact, ASCII is organized in a way that actually makes sense.

Flip back there for a quick look right now. See how you can slice the table into clumps of 16 or 32, based on what's in the zone portion under the hexadecimal column? These clumps make subgroups of similar symbols:

- hex 00 to 1F are the command symbols called control codes,
- hex 20 to 40 are the common keyboard symbols and numerals,
- hex 41 to 60 are capital letters and the less common keyboard symbols,
- hex 61 to 7F are lowercase letters and a few final symbols.

That takes care of the first 128 ASCII symbols. However, nearly every computer and printer manufacturer treats the second half of the table differently. Hewlett-Packard, for example, puts a variety of accented foreign language characters into positions 128-255 (often referred to as *high ASCII*). Epson gives you a choice of either italics characters or IBM character graphics.

### 1.2.3 Control codes

The ASCII table shows symbols like *J* or *2* the way they actually print on the laser printer. But ASCII includes more than just printable characters: none of the control code commands at the beginning of the table actually print. Instead, when your computer sends a control code to the laser printer it makes your printer do other things, such as sound its beeper.

Control codes mostly handle communications between your computer and the printer at the lowest level, at cable level. For example, a couple of control codes make sure the printer *buffer* (your printer's storage memory) doesn't overflow. In this book we'll indicate control codes enclosed by angle brackets to their abbreviations in the table: <FF> means the Form Feed control code, which advances the printer to the next page just as the PRINT button does.

### 1.2.4 *Escape sequences*

Control code 27, <ESC> or Escape, is a particularly important one for printers. To tell your printer all the things you might need— setting margins, saying where to print, choosing a particular font, starting graphics and so on— requires many more than just two or three dozen control codes. So the <ESC> control code has a special meaning: <ESC> means “the next character specifies a command, not something to be printed”.

Therefore if you send just the character 4 to the printer it will print a 4 and that's all. But if you send the <ESC> code just before the 4 then the printer (in FX-850 mode) will switch over to italics text. Extending the control codes this way gives you many more commands to control your printer. In fact, these “Escape sequences” make up most of the Star Laser Printer's language.

In this book we'll leave spaces between characters when we show escape sequences. You'll find

```
<ESC> (s 0p 10h 12v 0s 3T
```

a bit more readable than

```
<ESC> (s0p10h12v0s3T
```

But remember that you are not to send those spaces if you send commands to the printer.

To sum up, printer commands are of two types. A *control code* is a single-character command that tells your printer to do something, like move down one line. An *Escape sequence* controls a printer operation too, but is more than one character long. Since they are commands, neither control codes nor escape sequences are usually printable characters.

## **1.2.5 Printer drivers**

Most software packages already include the printer commands they need. The programs that send commands to the printer so you don't have to enter them yourself are called *printer drivers*.

Many programs ask you to *install* or *configure* your printer, which usually means keying into a menu the particular setup information describing your Star LaserPrinter 4. You enter such things as how you want to underline, alter line spacing, or move to a new print position.

Some programs, such as *WordPerfect* and the systems from Lotus Development Corporation, let you put printer Escape sequences before or right inside the document you want to print. To turn on boldface, for example, you might hold down special keys on your keyboard, often labelled CONTROL or ALT, as you press another key. Or you might use a special Function key, such as F6.

In fact, to take real advantage of your Star LaserPrinter 4's special abilities, you might opt for a word processor that lets you specify font changes easily. *WordPerfect* and Microsoft *Word* are strong at this, but are by no means the only good font manipulators.

If you have trouble using a particular program with your Star LaserPrinter 4, you'll probably get answers most quickly by asking your software supplier how the program interacts with your printer.

In this manual we refer to programs, fonts and other products sold by several companies. Please realize that mentioning these products does not mean Star Micronics endorses them in any way.

## **1.2.6 Sending your own printer commands**

Without a printer driver, sending control codes and Escape sequences to your printer properly requires some knowledge of a programming language like BASIC or Pascal, or at least of how to put such codes into a program. With programming languages, the computer doesn't act on the commands you put into a program until you tell it to run that program.

When you give a command to the printer from a computer program, you normally enter each part of the command as a separate character. This way you don't affect anything else happening on the computer. You often send each code or character in the command by giving its position in the ASCII table, as a decimal or hex number.

## 1.2.7 A BASIC example

Here's an example you can type in right now, to clarify what we're saying. It's written in Microsoft BASIC for a computer that uses the MS-DOS operating system, so if you have a different computer or BASIC you may have to translate a bit. We'll show commands the way they're written for an Epson dot-matrix printer because your Star LaserPrinter 4 understands those commands.

The LPRINT commands all send data to the printer. If the data is something you want printed you just put it in quotation marks. If the data is a control code you just say where it is in the ASCII table, giving its position as a regular decimal number.

BASIC usually sends a carriage return after every 80 characters, to keep the print position moving when it hits the end of a line. Unasked-for carriage returns can mess up your printing, however, so it's a good habit to put in a WIDTH statement as shown. That lets us print over the whole page area.

The <BEL> control code — ASCII code 7 — is sent in BASIC as CHR\$(7). The <ESC> code itself is CHR\$(27). And because we're using the character 4 as part of an <ESC> command, we type CHR\$(52) instead of "4".

So if you start BASIC and type these commands:

```
NEW
10 ' EXAMPLE
20 WIDTH "LPT1:",255
30 LPRINT CHR$(7)
40 LPRINT CHR$(27);CHR$(52)
50 LPRINT "ITALICS!"
60 END
RUN
```

you make the printer (in FX-850 mode) first sound its bell—most people call it a beeper— and then print the line:

*ITALICS!*

Generally, when you send a control or Escape code it stays active until you deactivate it. That's what happens in line 40 of our program above. All subsequent text will be italicized until you change it back to upright again.



Most programming languages, and some versions of BASIC, let you treat the printer as a file to which you can send data. When you write a program with one of these languages you “open” the printer file, print into it, and then “close” the file when you’re done. This programming jargon sounds funny if you’re not used to it— but it works.

A few programming languages let you send commands to the printer a third way. Applesoft BASIC is one. With it, you can switch between printer output and screen output.

### ***1.2.8 Printer emulations***

You noticed that we said “in FX-850 mode” up there? Your Star LaserPrinter 4 responds to the same escape sequence commands that several other printers use. Being able to emulate printers like the Epson FX-850 lets you use your Star LaserPrinter 4 with older programs that haven’t been updated to take advantage of laserprinters. In fact, because it emulates two of the most popular printers, you can use the Star LaserPrinter 4 with just about any microcomputer program around.

Unfortunately those printers often use different escape sequences for exactly the same function. Those printers, moreover, provide escape sequences for functions the Star LaserPrinter 4 doesn’t need, such as the Epson’s Half-Speed Command. When your printer gets a command it doesn’t support, it just ignores the command.

*Macros* are single control codes you can define yourself, which do the work of a whole long series of printer commands. If you are a programmer you will be happy to hear the Star LaserPrinter 4 supports up to 99 macros at once.

# **MEMO**

# Controlling Your Printer

## CHAPTER 2

You can control your Star LaserPrinter 4 in two ways, either through control panel *parameters* or through software *commands*. In this chapter we will consider printer controls mostly from the perspective of the control panel. However, we'll also meet four special commands, the Star LaserPrinter 4 *superset*.

Throughout this manual we approach parameters and commands the same way: overall printer-level controls first, then page-level controls (layout and print position movements), and finally character-level controls (fonts and graphics). We'll discuss these in general terms in this chapter.

The specific commands you can send to your printer to make it *emulate*, or work like, other printers are described in chapters 4 and 5. The most important fact about printer commands, though, is that you may not even need to know how to use them. If your software systems include their own printer drivers, you may want to read only this chapter and skip all of chapters 4 and 5.

## 2.1 PRINTER PARAMETERS

### 2.1.1 The control panel

The easiest way to control your Star LaserPrinter 4 is through its control panel, as explained in more detail in your *Star LaserPrinter 4 Operations Manual*.

When your printer is *online* (connected to and under the control of your computer), its control panel display shows you the printer's status. For example, the READY light blinks when the printer is warming up. The DATA light comes on whenever the printer is holding data it hasn't printed yet.

When you press the [ON LINE] button, the printer changes from normal to *offline* mode and cannot accept data from your computer. When the printer is offline you can use the other panel buttons. For instance, if you press the

[TEST/>] button for three seconds and release it just after STATUS SHEET is displayed when the laser printer is offline, it finishes printing the current page and then feeds in and prints a status sheet.

Some buttons on the panel let you perform two functions. Holding one of those buttons down, rather than quickly pressing it, selects a different operation. For example, holding down the [TEST/>] button for over six seconds after STATUS SHEET is displayed makes the Star LaserPrinter 4 print its test pattern.

### **2.1.2 Parameter settings**

From the panel you can also change the parameters that define how your printer works. *Parameter* just means “variable”. If you’re familiar with earlier kinds of printers, you’ll understand that laser printer parameters control pretty much the same things *DIP switches* do. (A DIP switch or “dual in-line package switch” is a set of small switches that control various printer functions.)

The printer stores these parameters as easy-to-use *program menu* items that you can select from the control panel. These parameters specify:

- **emulation** (what printer the Star LaserPrinter emulates)
- **number of copies** (the number of copies of each page to be printed)
- **character** (what character font to print)
- **job size** (what size of paper the printer will use)
- **layout** (how pages will be formatted)
- **paper feed** (how paper will be fed)
- **page mode** (partial or full)
- **interface** (how the printer communicates with your computer)

A *default* is the setting the Star LaserPrinter 4 will use if none is specifically selected by a program. When you first turn on or later reset your printer these default settings will take effect.

Your main use for the control panel will likely be to set the default settings you want for these parameters. However, you will probably find the panel convenient too when you want to switch between manual and automatic paper feed.

### **2.1.3 Four versions of parameters**

The Star LaserPrinter 4 actually stores four versions of these parameters:

- its “ultimate default” factory settings,

- the power-on settings in effect when you first turn on the printer,
- your initial settings for one particular session,
- and the current settings that the printer is using now.

These are in priority order. The current settings always override the initial session settings, which in turn override the power-on settings, which in turn override the factory settings.

*Factory settings* are programmed into the Star LaserPrinter 4 when it is built at the factory. Your printer keeps the factory settings for its parameters in ROM; they never change. You can copy them into the current settings or any other settings as needed. But the only way you can return to the factory defaults is from the control panel; no commands do this.

A few factory default settings are as follows:

Item	Factory default setting
Emulation	HP LaserJet IIP
Feeder	Multi-purpose tray
Number of Copies	1
Orientation	Portrait
Font	10-pitch 12-point Courier (internal)
Lines/inch	6 lines per inch

The *power-on settings* are the normal default settings. The printer keeps them even when you turn off the power. When you turn on the printer, these power-on settings get copied into the initial and current parameter settings.

You probably will not often change the Star LaserPrinter 4's *initial settings* (sometimes called "session settings"). You'll likely only change them when you want to use a different printer emulation than normal. These initial settings stay the same as the power-on settings until you change them.

On the other hand, your software will probably change the *current settings* many times within the same document, with every change of font or print style.

### **2.1.4 How to change parameters**

With the printer offline, if you press the [PROGRAM] button the printer goes into "program" mode. You can then step through the laser printer's four levels of program menu to *configure* your printer (see page 46-48, operations Manual). That's the process of changing certain printer settings so your computer and printer can communicate properly.

It's actually pretty easy. Flipping through and setting parameters from the panel is described in detail in the *Star LaserPrinter 4 Operations Manual*.

Basically, all you do is press the [ < ] or [ > ] buttons to scroll through the sequence of possible parameters and values, which is clearly shown on the panel display. You press [ v ] when you want to go down and scroll through a lower menu level. And you also press [ v ] when you want to save a particular menu item as the value for a current parameter setting.

SET POWER-UP enables you to save new settings in a permanent memory called EEPROM. The new settings can be stored even when the power is turned off. The final menu (LOAD FACTORY SET) is used when you want to start from the beginning, with the original factory settings.

## **2.2 CONTROLLING THE PRINTER**

In this section you'll meet two separate controls over how the Star LaserPrinter 4 itself works. The INTERFACE parameter controls communications between the printer and your computer. And the EMULATION parameter determines, among other things, which set of commands the printer will use. You can set these INTERFACE and EMULATION parameters on the control panel.

### **2.2.1 The INTERFACE parameter**

The INTERFACE parameter, the most basic of the Star LaserPrinter 4's *configuration* settings, defines how your computer connects to the printer. You can set the INTERFACE to either Serial or Parallel. In most single-computer environments you'll opt for the faster Parallel interface; in a multi-user network you may be better off with Serial.

The particular printer interface settings don't matter as much as making sure they match those on your computer. If you use an MS-DOS computer, you can set your computer's parameters with the MODE command. See your MS-DOS manual.

Most MS-DOS and AT-compatible computers support up to three parallel and two serial ports, which come on expansion boards you plug into your computer. When you install such boards you must set switches to indicate the number and addresses of these ports. If you specify the wrong addresses, you won't be able to print.

### **Serial interface: rate**

If you ask for the Serial interface you'll have to tell your printer more about how the data will be coming in—in particular its rate and unit size and the meanings of any special bits.

The Rate parameter specifies how fast data will be arriving, measured in *baud* (named after the French communications engineer Jean Baudot). Pick any of the following data transfer rates:

- 300 baud
- 600 baud
- 1200 baud
- 2400 baud
- 4800 baud
- 9600 baud (the default)
- 19200 baud.

Roughly, one character a second works out to 11 baud. If you're not sure how fast your computer will transmit, the general rule is to experiment. Try sending a page to print at the highest speed, and work your way down until the printer's output looks OK.

### **Serial interface: special bits**

In Serial mode you'll also have to specify if your computer sends data bits in groups of seven (most computers send eight, the default for a byte).

Sometimes an extra bit gets appended to make the sum of all bits in each character always odd or even; that's called *parity*. A parity bit can help spot transmission errors. If your computer sends that extra parity bit, you'll have to say whether it produces an even or odd number of "on" bits in the character.

You'll also have to indicate if your computer sends two *stop bits* to indicate the end of a byte, instead of one, the default. These serial interface settings are described in more detail in your *Star LaserPrinter 4 Operations Manual*.

### **Serial interface: protocol**

Finally, in Serial mode your computer will use one of three *protocols* to ensure data is sent properly. Protocol (sometimes also called "handshaking") means "who says what when", and is the way your printer tells your computer it's ready to receive data. Your computer and printer communicate by sending protocol control codes (they're at the front of the ASCII table).

Some programmers call the XON and XOFF control codes “kiss on and kiss off”; others call the same protocol DC1 and DC3 (for device control). Either way, these codes let your printer run the show, telling the computer when to start and stop sending data. Your printer asks to have data held back when its memory is nearly full or when it senses an ERROR condition.

DTR (Data Terminal Ready) protocol does the same thing slightly differently. The printer sends a continuous high-voltage signal over the cable as long as it can accept data, but drops the voltage to say “whoa” to the computer.

Look in your computer’s operations manual, in the section dealing with communications protocols, to see which is best for your system. You can stick to the printer’s defaults if your computer does not use the DTR, but does use XON/XOFF.

## **2.2.2 Checking your connections**

Your computer and printer may have trouble communicating when you first introduce them to each other. The quick way to find out if your settings and printer cable are working is to send your printer a printout from your screen (CTRL-P with MS-DOS).

When that’s done you will also have to press the print button on the printer, which makes the printer advance to a new sheet. No laser printer prints and ejects a page until it’s told to feed a form, or until it has received all the lines the page can hold.

If your Star LaserPrinter 4 doesn’t print what’s on the computer screen, recheck your connections and interface settings. With an applications program like Lotus 1–2–3 or Microsoft *Word*, you use a printer setup routine to match your computer with your printer’s operating characteristics. So double-check your software settings; your computer’s output, for example, might not be going to the proper port.

## **2.2.3 Printer emulations**

OK, you’ve got your printer and computer connected properly. Now let’s focus on how your printer works.

Your Star LaserPrinter 4 understands and uses the same commands as several earlier kinds of printers. Your printer works by emulating one of these:



- Hewlett-Packard LaserJet IIP
- Epson FX-850

Other laser printers may offer such emulations too, but often require installation of a new circuit board for each emulation. Star Micronics has built these two emulations into the Star LaserPrinter 4.

You select which emulation you want either by selecting it from the print program menu on the Star LaserPrinter 4's control panel, or by sending the printer one of the superset commands at the end of this chapter.

### ***2.2.4 What are the emulated printers like?***

Most of the time you will probably choose HP LaserJet IIP emulation, which is the default when you turn on the Star LaserPrinter 4. That's because the LaserJet IIP, like the Star LaserPrinter 4, is a laser printer. This emulation mode gives you the best control over your printer's features, and works with most popular applications programs.

The FX-850 emulation is quite powerful too. It includes all the dot-matrix printer commands (including graphics) used by hundreds of programs. Mostly, you'll choose this option when you run a program that cannot send laser printer commands.

### ***2.2.5 The Emulation parameter***

The Star LaserPrinter 4's Emulation setting defines which printer it is imitating: Hewlett-Packard LaserJet IIP or Epson FX-850.

Most of the other EMULATION values below can be changed with Escape codes as well as from the panel.

A few computers change certain control or Escape codes when sending them to the printer, which naturally causes confusion. Moreover, many programmers prefer to see hexadecimal printout when they are debugging programs. To help with these situations, you can make your Star LaserPrinter 4 print in hexadecimal rather than the usual ASCII mode by switching ON the HEX DUMP parameter setting.

## 2.2.6 Hints: The hex dump

- To make your Star LaserPrinter 4 print in hexadecimal rather than the usual ASCII symbols, press the control panel buttons that put the printer offline and in PROGRAM mode. Move to the EMULATION parameter's HEX DUMP setting and select ON.
- Some control or Escape codes can be problems on a few computers; those computers change certain codes when sending them to the printer. If you think you have this problem you need to see exactly what your printer is receiving. We recommend you run a short program that loops through and prints the ASCII table. Print in hexadecimal rather than the usual ASCII symbols.
- If you spot a problem code you can try to bypass the problem, either by sending each code directly to the printer, or by changing your system's printer driver. Such computer-specific solutions, though, are beyond the scope of this manual. We suggest that if necessary you consult another programmer more familiar with your computer.
- Actually, if you are debugging *any* program you may find this hex-dump mode helpful. It can be a great trouble-shooter.

## 2.3 CONTROLLING THE PAGE

In this section we look at two controls you have over how the Star LaserPrinter 4 handles and formats its pages: You can set values for the PAPER FEED and LAYOUT parameters on the control panel. At the end of this section we'll also preview different ways to move the print position.

### 2.3.1 The PAPER FEED parameter

The PAPER FEED parameter lets you specify both what kind of paper you want and how the paper is fed.

One convenient thing about a laser printer is that it doesn't need *continuous forms*, sometimes called *fanfold* paper. Other printers feed in a stack of forms— with pages all joined by perforations— by having sprockets engage and pull along *pinfeed* holes punched along each side of the paper. After it's printed you have to tear off the pinfeed-hole strips and then separate the pages.

With the Star LaserPrinter 4 you can print on a variety of ordinary cut sheet pages.

For the Feeder value of this PAPER FEED parameter, you first enter either multi-purpose tray, manual feed or cassette (option) to indicate where you want paper fed from. The multi-purpose tray handles various types and sizes of paper (Letter, Legal, A4, B5, Executive, OHP sheets, Labels, Envelopes). Manual feed means you feed each sheet by hand from the multi-purpose tray. The cassette tray automatically feeds single sheets, much like sheet feeders on other types of printers.

The default paper size is A4, you can specify other sizes given below too. A different-sized tray automatically selects that different paper size.

- **8.5 by 11 inch letter-size paper**
- **8.5 by 14 inch legal-size paper**
- **B5 international (used in every country except North America) (182 by 257 mm)**
- **the narrower "executive" size (7.25 by 10.5 inches)**

One other nice thing you can do is print directly on envelopes. With this Paper Size parameter you can specify envelopes in sizes, Monarch, COM-10, International C5 and DL. Then just work out where to put the address, set the orientation to landscape (see below), and slide your envelope into the multi-purpose tray!

In any emulation mode you can send your printer commands to change paper size or feed in paper manually; you can also select those parameters from the panel. Either way, a message in the printer display tells the operator what paper size to use.

### ***2.3.2 Hints: Paper, labels and transparencies***

- The best paper for the Star LaserPrinter 4 has a smooth finish and is of 60 to 105 g/m<sup>2</sup> weight. Any paper designed for photocopiers should do the trick though; Xerox 4024 and Canon NP print nicely. High quality *cotton bond* paper, which contains up to 25 percent cotton fibres, works passably well with even heavier weights.
- Be aware that any puckered or woven finish may not print as sharply as you'd like. Avoid shiny coated paper or multipart forms. And don't even *think* about putting in stapled or ripped pages.

- If you frequently change paper weights, you will probably get skewing problems— lines that print at an angle because of misfeeding. For best results, when your Star LaserPrinter 4 is first set up have the paper feeder “squared” for paper of at least 60 grams. Lighter paper, though cheaper, isn’t really the way to economize.
- Want to print on your own preprinted letterhead? Fine— so long as your logo isn’t thermographed. Thick colored ink may look luxurious, but it can also wind up stuck all over your printer’s roller. Stay away from any inks that soften at relatively low temperatures; your printer fuses pages at 200° C.

This warning applies to colored paper too, if it has been tinted with a low-temperature dye.

- When printing starts fading because the toner is low, remove the cartridge and gently rock it back and forth half a dozen times. Don’t tip it up or the toner may spill out. Redistributing the toner powder this way can keep the cartridge going for another tray of paper.
- No question, working with single label sheets is more convenient than with continuous label stock. Laser printers are faster and produce better-looking labels than other printers. But laser printers, which work by electrostatic photography rather than impact pressure, put different stresses on label paper. Each sheet has to bend over and through the guide rollers; moreover, fusing toner to the paper involves heat. You can eliminate trouble by always feeding label sheets manually.

Both Avery’s “Lasergraphic” labels and Canon’s labels seem to work fine. Your main concern is that the labels completely cover the backing sheet so it shows only at the outside margins. That way individual labels can’t easily peel off.

The safest approach is to laser-print sharp master copies on paper and then photocopy those lists onto labels. This will avoid putting your printer’s adjustment for paper thickness out of adjustment.

- If you want to print transparencies for your overhead projector, some films will actually melt in your laser printer. Stick to 3M’s medium-weight transparency film (type 501) or to Hewlett-Packard’s #92285J.

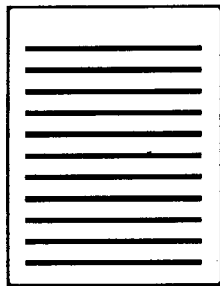
### 2.3.3 The **LAYOUT** parameter

The *layout* or *format* or *setup* of a page refers to how text is positioned on the page. Layout includes page orientation, margins and the spacing of characters across and lines down the page. You can control these with the LAYOUT parameter.

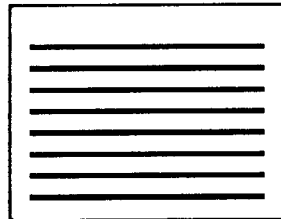
You probably won't use the LAYOUT parameter on the front panel's program menu very much though. Most of the time you'll either leave the Star LaserPrinter 4 with its default settings, or look after page formatting with commands you send from your computer.

#### Page orientation

A page's *orientation* tells you in which direction the print goes on the page. When you use *portrait* orientation the lines are printed as they are in a normal business letter, across the width of the page. A portrait painting of a person is usually vertical—hence the name.



Portrait



Landscape

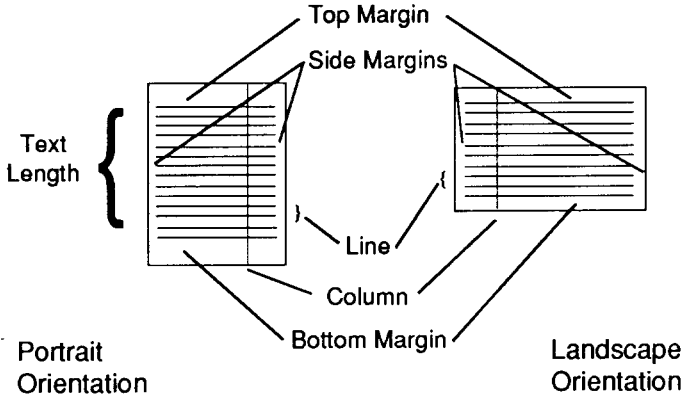
When you use *landscape* orientation the words are printed “on their sides,” vertically up the length of the page. Text written with landscape orientation only looks correct when you turn the page so its length runs side-to-side, just like the painting of a landscape.

Envelopes must be printed with landscape orientation. You also will use landscape regularly to print charts or banners, and spreadsheets or reports with so many columns they wouldn't otherwise fit on the page.

All internal fonts, and almost all cartridge and downloaded fonts, are stored in the Star LaserPrinter 4 with portrait orientation.

## Margins, columns and lines

You can change margin settings for all four edges of a page. The left and right side margins can have values from 0 to 132, defining the margin *columns* between which words and images can be printed. And the top and bottom margins can be set at anywhere from 0 to 112 lines.



The meaning of a line (sometimes called a “row”) is defined by the *vertical motion index* (VMI). The printer moves the print position down a line when it gets a Line Feed code, usually when it bumps into the right margin.

You’ll probably let your computer program set the line depth. But from the panel you can set the VMI value in increments from 1/48 to 255/48 of an inch.

### 2.3.4 Moving the print position: a preview

With dot-matrix and daisywheel printers, you pick where to print on the page either by moving the printhead back and forth or by moving the paper itself. Laser printers don’t have printheads, but the principle remains the same: you have to say exactly where on the page each picture and string of text is to go, so each page can be constructed in the printer’s memory.

Instead of talking about printheads we talk about moving the print *position* (some people call it moving the “cursor,” using the computer-screen analogy). Horizontally, you can move the print position with backspace and carriage return commands. Vertically, you can move the print position down the page by printing so many lines per inch, or by sending line-feed and half

line-feed commands. You can also move to tab settings both horizontally and vertically (handy for tables and blank forms, or making room for your diagrams).

But those aren't all. Depending on which printer emulation you are using, you can tell the Star LaserPrinter 4 to move the print position vertically or horizontally in increments of:

1/10, 1/12 or similar fractions of an inch (pitch settings),  
1/48, 1/60, 1/72, 1/120 or 1/216 inch (line or column definitions),  
1/300 inch (dots), or  
1/720 inch (tenths of a point).

These increments reflect the history of twentieth century printing. *Pitch*, referring to the number of characters printed in each horizontal inch, derives from how typewriters space their characters. *Lines* and *columns* were first used by earlier computer printers (on which they are called horizontal and vertical motion indexes). You already know about the Star LaserPrinter 4 being able to print 300 dots to the inch. And the unit by which typesetters have measured text for centuries is the *point*, about 1/72nd of an inch.

One hint about moving the print position: you can confuse yourself if you use more than one or two different units during the same session. So decide beforehand how accurately you need to move the print position (not forgetting any graphics you want to include). Then stick to the unit(s) you choose.

The commands that move the print position in all these ways are described in chapters 4 and 5, with the specific printer emulation you want to use.

## 2.4 CONTROLLING THE PRINTING

### 2.4.1 The *EMULATE ATTRIBUTES* parameter

The *EMULATE ATTRIBUTES* parameter defines font attributes and setup values (if any) for each of the Star LaserPrinter 4's two emulation modes.

A font's *attributes* or *characteristics* determine what that font will look like when it is printed. The next chapter, "Fonts," explores the details of all font attributes in more detail. But let's have a quick overview now, because you'll meet these terms on the control panel's program menu.

### **Font attributes: a preview**

Orientation (portrait or landscape as described earlier) is usually thought of as one attribute of a font; it's not really a page formatting issue. Besides orientation, the fonts with which you print have these attributes:

*Symbol set* is sometimes called "character set"— which can be confusing, since some people say "character set" when they mean a font. Symbol sets are subgroups of a font's symbols that are most appropriate for particular countries, such as the UK (£), France (à), Latin America (ñ) or Japan (¥).

*Spacing* and *pitch* are linked. Characters can be spaced on the line *proportionally*, so a narrow letter such as *i* takes less room than a wide letter like *W*. Or characters can be spaced all the same width: twelve characters to the inch is the *monospaced* spacing called 12 pitch.

*Point size* defines how big characters will print, such as 10 or 12 points high.

*Style* defines whether characters print in upright or *italic* style.

*Stroke weight* defines how **bold** a typeface prints.

Finally, *typeface* itself means the artistic design of a font. Your printer's internal typefaces include, LinePrinter and Courier. With the Star Laser-Printer 4 you can also use Helvet, Gothic, Script, Caslon, Orator and hundreds more typefaces, which you load into the printer from cartridge or computer disk.

When you enable font *setup parameters* on the control panel, it means you start off with particular font attributes as defaults when you first choose an emulation. With the FX-850 emulation you can enable proportional spacing and bold print as setup parameters. FX-850 mode also lets you start up with half of your symbol set as graphics characters instead of italics.

## **2.5 THE STAR LASERPRINTER 4 SUPERSET**

### ***2.5.1 Do you need to send commands?***

Here's an important fact: you can set nearly every one of the above parameters by sending your printer a corresponding Escape sequence command. Those Escape sequence commands will override any setting you make from the control panel.

The main thing to realize about most printer commands, though, is that you probably don't need to use them. Nearly all popular software packages



include printer drivers, which send commands to the printer so you don't have to type them yourself. Some of those programs ask you to key in set-up parameters about your printer. Other programs let you put printer commands before or inside the document you want to print.

But maybe the software you use doesn't have printer drivers for any printer your Star LaserPrinter 4 emulates: You still might not have to write printer commands yourself.

Several companies sell programs that look after laser-printing commands for such software. Ask your dealer about *LaserControl*, *Printworks for Lasers*, *PCLPak* and *RAM Resident Printmerge*. There's not much point in reinventing the wheel.

### **2.5.2 The Star LaserPrinter 4 superset**

Besides the commands that emulate other printers, your laser printer understands four other commands called the Star LaserPrinter 4 *superset*. The Star LaserPrinter *always* understands superset commands; it doesn't matter which emulation mode your printer is using at the moment. Superset Escape sequence commands start with <ESC> [ so you can quickly spot them in a list of commands.

One superset command gives you another way to switch from one emulation to another: you send the Change Emulation superset command instead of using the control panel. The second superset command lets you change the printing orientation, so you can print sideways up the length of the page, instead of across its width in the usual way. The third superset command lets you change the paper size. The fourth superset command lets you change the paper cassette.

### **2.5.3 The Change Emulation command**

You can think of the superset Change Emulation command as the key to your Star LaserPrinter 4. The Change Emulation superset command lets you switch from one set of printer commands to another "on the fly," through software.

This is the command that defines what other commands the Star LaserPrinter 4 will accept. With Change Emulation you indicate which printer emulation program you want the printer to use.

When you start a new emulation you always start a new page.

*Note:* always send Carriage Return and Form Feed (control codes <CR> and <FF>) just before you give this Change Emulation command. These force the printer to print any partial page in its memory and start a new page with the new emulation. If you forget to issue these control codes first the Star LaserPrinter 4 will do them for you—but your Change Emulation command will just reset the printer’s parameters to their initial defaults, and not give you the emulation you ask for.

You issue the Change Emulation command with the following Escape sequence:

<ESC> [ E *n*

For the value of *n* you enter a number from this table:

<i>n</i>	EMULATION
0 (zero)	HP LaserJet IIP
2	Epson FX-850

### **2.5.4 The Select Orientation command**

The Select Orientation superset command lets you change the “attitude” in which the Star LaserPrinter 4 prints.

To change from one orientation to the other you send this Select Orientation Escape sequence:

<ESC> [ O *n*

For the value *n* you put 0 (zero) for portrait orientation,  
or 1 (one) for landscape orientation.

When you send this command to print in landscape mode, the printer automatically rotates its current font so that it prints as landscape.

The spot or line where printing starts on the page is sometimes called the *origin* or *top of form*. The origin changes when you switch orientations. That starting print position is in the upper left corner for a portrait page, but in the lower left corner for a landscape page.

You probably won’t want to change orientation all that often. Every time you do, the Star LaserPrinter 4 also resets the page margins to its limits, and also how it defines lines and columns. So whenever you give the Select Orien-

tation command you may want to follow it with Escape sequences to change the side and top margins and paper length settings. (Alternatively, you could put the printer offline and reset these from the control panel, as described under LAYOUT earlier.)

### ***2.5.5 The Paper Size command***

The Paper Size superset command lets you change the paper size in which the Star LaserPrinter 4 prints.

This is the command that defines what size the Star LaserPrinter 4 will accept. You issue the Paper Size command with the following Escape sequence:

`<ESC> [ S n`

For the value of *n* you enter a number from this table:

<i>n</i>	SIZE
1	Letter size paper
2	Legal size paper
3	A4 International size paper
4	Executive size paper
5	B5 International size paper
11	Monarch size envelope
12	Com-10 size envelope
13	International DL size envelope
14	International C5 size envelope

This command controls the size that the printer should use when next feeding from the selected paper feeder. If the printer does not have the requested size, the control panel will display a message instructing you to insert the requested paper/envelope. If the operator overrides that request, the requested size is ignored and the current size is used.

### ***2.5.6 The Paper Feeder command***

The Paper Feeder superset command lets you change the paper feeder from which the printer feeds paper.

To change the paper feeder you send the Paper Feeder Escape sequence:

`<ESC> [ C n`

For the value of  $n$  you enter a number from this table:

$n$	PAPER FEEDER
1	Multi-purpose tray
2	Multi-purpose tray for one sheet, then switches to the optional cassette
4	Optional cassette
5	Optional cassette for one sheet, then switches to the Multi-purpose tray

This command, if given at the beginning of a page, controls the feeder of the sheet on which to print that page.

If the command is not at the beginning of the page, it will force a Form Feed and control the feeder of the sheet on which to print the new page which follows.

This command is ignored when the optional cassette is not installed.

The fonts you use determine what your pages will look like. In this chapter we'll first clarify the meanings of words people use when they talk about fonts.

Next we'll examine the three kinds of fonts (internal, cartridge and downloaded) that you can use on your Star LaserPrinter 4. We'll cover the particular sets of symbols you can choose for those fonts too.

Finally, we'll find out how to load the printer with your selection of fonts.

## 3.1 FONT TERMINOLOGY

### 3.1.1 *Typefaces and fonts*

First, a few definitions. A *typeface* is a family of characters with the same basic design. The artistic character design you choose establishes the "tone of voice" for all your documents.

Several variables can characterize typefaces, including weight (light, medium, bold), width (condensed or extended), and style (upright or italic). Courier, for example, is a typeface family that includes the characters in both *Courier medium italic* and **Courier bold upright**.

Let's consider these variables. *Bold* print is sometimes called "emphasized" or "double-strike". On earlier printers boldface is generated by printing each character twice; dot-matrix machines print the second impression just a hair below or to the right of the first one.

With the Star LaserPrinter 4 you can have different stroke weights in two ways, depending on which emulation you are using. You can have two different fonts, storing and switching between a bold and a medium version of the font. Or you can use just one font and set bold on and off with Escape sequences. The latter way uses just half as much font memory.

Narrow *condensed* faces used to be called “compressed”. They cram about five characters in the space where three usually go— ideal for spreadsheets. An extended face, particularly on a dot-matrix printer, goes by several names: “expanded,” “enlarged” or “double-width” printing. No matter what it’s called, extended print is wider than it is high, and can be fairly effective in page headings.

Italic characters (sometimes called “oblique”) are slanted. Ordinary upright characters are often called “roman”. Your Star LaserPrinter 4 comes with a built-in upright Courier typeface. Moreover, from *any* of the Star Laser-Printer 4’s built-in typefaces you can select a subset of upright symbols called Roman-8.

A *font* is a complete set of characters in a particular size and typeface. In the world of laser printers, the three variables mentioned above— weight, width and style— are a few *font attributes* (sometimes called “font characteristics”). Let’s consider three more attributes: font height, spacing and pitch.

### **3.1.2 Font height**

The *baseline* is the invisible line upon which characters of type sit. Since the first letter blocks were made of lead alloy, the distance from one baseline to the next is called *leading* (pronounced “ledding”). Type itself is measured from the top of an *ascender* (the part extending up in the *b* or *k*, for example) to the bottom of a *descender* (the down-stroke of the *y* or *q* ).

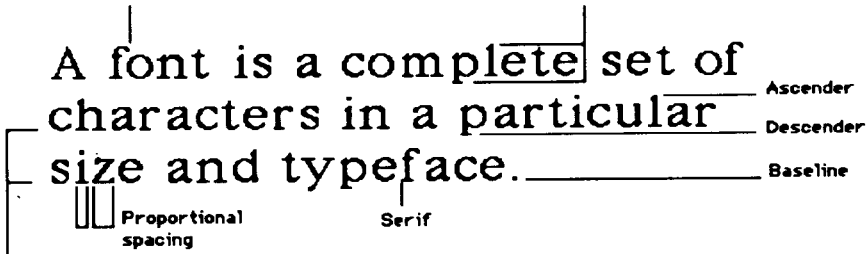
The measurements used to describe fonts are *points* and *picas* (derived from the marks and letters in medieval church almanacs). There are 12 points to the pica, and almost exactly 6 picas (72 points) to the inch.

Laser printers for computers measure *font height* in points. On laser printers the “white space” above ascenders and below descenders depends on how the *line* is defined, so the line corresponds to leading. This type you’re reading has a font height of 12 points, and is spaced a little less than 5 lines per inch.

The o has been kerned closer to the f.

The font height (24 points) is measured from ascender to descender.

A font is a complete set of characters in a particular size and typeface.



Leading is the baseline to baseline measurement.

### 3.1.3 Font spacing and pitch

You probably first heard the word *pitch* in connection with typewriters. Typewriters normally use *monospaced* spacing: they give each character the same amount of space on the line.

About half the fonts available for laser printers use monospaced spacing too. Pitch is always expressed as so many characters per inch. Ten-pitch, for example, means a font with ten characters in each inch of the line.

Typesetters for centuries have used two special sizes of type for most text. *Elite* characters are 10 points high and print 12 characters per inch. And *pica* characters are 12 points high and pitched at 10 characters to the inch. You'll often run across these monospaced font sizes in the laser printing world.

Ideally each character in a word should nestle against its neighbours so they appear evenly spaced. But adjacent round characters are apt to look too far apart, while flat-sided characters may appear too close.

*Proportional spacing* takes into account the differences in widths among letters (compare *ii* with *WW*). Proportionally spaced printing is easier to read than typewriter-style printing in which all characters, including punctuation, have the same width.

Real typesetters equip certain characters with *kerns*, letter parts that extend out to overlap adjoining letters. In this word *Type* the *y* is kerned closely against the *T*. Kerning separates great type from good type.

## 3.2 HOW THE STAR LASERPRINTER 4 STORES FONTS

### 3.2.1 *Bit-mapped fonts*

Star Micronics has earned a reputation for attractive, well-designed fonts on its printers, and this laser printer continues the tradition.

The Star LaserPrinter 4 uses *bit-mapped* fonts. Each character is made up of a pattern or “map” of dots, just like characters on a dot-matrix printer or on your computer screen. Resolution makes the difference: to make each character the Star LaserPrinter 4 uses ten or twenty times as many dots as a dot-matrix printer or computer screen does.

Every size of print you want, plus every italic or boldface version, has its own bit map and is normally considered a separate font. It takes a good deal of printer memory to hold all the fonts you might want at any given moment.

Star LaserPrinter 4 fonts can be grouped into three categories: internal, cartridge, and downloadable fonts.

### 3.2.2 *Internal fonts*

The Star LaserPrinter 4 has seven built-in *internal* fonts that reside permanently in its read-only memory (ROM). That’s why these are sometimes called “resident fonts”:

Courier	12point	Medium
Courier	12point	Bold
Courier	12point	Italic
Courier	10point	Medium
Courier	10point	Bold
Courier	10point	Italic
LinePrinter	8.5point	Medium

Courier is the face used on the most common electric typewriters. Courier is not printed with proportional spacing. The LinePrinter font, designed originally for mainframe computers, is small and designed to pack a lot of characters into every inch of print (great for spreadsheets).

With these most frequently used fonts in ROM, a page can be assembled much faster than if the fonts had to be loaded into the printer for each printing job.



### **3.2.3 Cartridge and downloaded fonts**

Your Star LaserPrinter 4 can use two other kinds of fonts, along with those built into the printer.

*Cartridge* fonts, like the internal ones, are permanently stored on ROM chips. The difference is that those ROMs are in removable cartridges. Your Star LaserPrinter 4 has a slot for one font cartridge.

A cartridge may hold anywhere from half a dozen to two dozen fonts, all differing from the internal fonts in size, style, stroke weight or symbol set. You'll find that cartridge fonts open up a wider range of typefaces too, such as Tms Romn, Prestige Elite, Helvet and Letter Gothic. Generally, cartridge and internal font typefaces are suitable for both text and headlines.

The third kind of font is neither built into your Star LaserPrinter 4 nor available just by slipping in a cartridge. You *download* this kind of font, which means you use a computer program to send characters from a computer disk to your printer's memory. Any downloaded font (sometimes called a "soft" or "installed" font) that you put into the printer's RAM disappears when you turn off the printer, so you have to download that font again next time you want it.

Downloadable fonts run the gamut from Egyptian hieroglyphics to those eye-catching decorative fonts known as *display* fonts. They also include the more exotic foreign-language characters, such as Arabic or Cyrillic, and symbol and mathematical fonts (sometimes with fractions).

How can you compare cartridge and downloadable fonts? When you use cartridge fonts you don't have to take time to download them. They don't take any of your Star LaserPrinter 4's RAM memory either. But downloadable fonts offer many more choices. Downloadable fonts usually cost less too.

The printer always knows where its internal fonts are. For each emulation program, it also keeps track of cartridge and downloaded fonts in a part of its memory called the *font table*.

So with the Star LaserPrinter 4 you can have many fonts available at any one time—the internal fonts, the fonts on any cassettes you've plugged in, and any fonts you have downloaded. You can change fonts in mid-line to emphasize a word or two whenever you want. You can mix internal, cartridge and downloaded fonts in the same document.

### 3.2.4 Hints: Where to get fonts

- You can print any downloadable font that works on the HP LaserJet IIP. Several other companies sell downloadable fonts which are compatible with your Star LaserPrinter 4. The Bitstream Corporation in Boston is one of the more popular; Conographic is another. Xerox includes a set of fonts with its *Ventura Publisher* desktop publishing software, which you can use with your printer's LaserJet IIP emulation.
- The SoftCraft company now markets a Bitstream-developed product called "Fontware". With Fontware you can generate bit-mapped fonts of any size from a library of *outline* fonts. In outline fonts each character's profile is defined just once and the printer generates any font height from that profile, which saves printer memory.

Outline fonts demand awesome computing power of the printer though, so they've been available only on laser printers considerably more expensive than the Star LaserPrinter 4. Now, with programs like Fontware, your Star LaserPrinter 4 can turn out elegant print in any size without that high price.

- Don't hesitate to ask your Star dealer where you can buy cartridge and downloadable fonts. If you really can't find the one you need, you can design and download your own customized fonts. This is no easy job, but if you're curious it's described in chapter 4.

## 3.3 SYMBOL SETS

Let's summarize briefly, to put the subject of symbol sets in context. The attributes of a font determine what that font will look like when it is printed. We covered all but orientation at the start of this chapter, and orientation in the last chapter. A font's attributes include:

- **orientation** (portrait or landscape)
- **symbol set** (which we'll look at next)
- **spacing** (monospaced or proportional)
- **pitch** (10 or 16.66 characters per inch, for example)
- **font height** (measured in points)
- **style** (upright or italics)
- **stroke weight** (light, medium or bold)
- **typeface** (Line Printer, Courier and so on)

Though they are not font attributes, such printing features as subscripts, superscripts and underlining are treated along with fonts in the following chapters. Each emulation has its own way of providing these features.

Incidentally, the best way to underline is to use the underline command in the emulation you are using, instead of backspacing and overprinting with the separate underline character ( ). If you do the latter with proportionally spaced text, you'll usually find the underlining is too long for the text.

### 3.3.1 What are symbol sets?

Keyboards differ from country to country. The British need their £ symbol, the French need their ç and é, the Spanish need their ï and ñ etc. Scientists need particular mathematical signs too. There easily could be four hundred or more possible symbols for any given font.

However, the number of symbols printers store for a font is limited to 256 slots, as in ASCII. So some symbols, or the order of some symbols, can differ in any font. Each unique selection and arrangement of symbols is a *symbol set* (sometimes called a "graphic set" or "character set").

The symbol at position 91 for example is an open bracket, [ , in the usual ASCII symbol set. But the same position holds Ä (capital A with an umlaut) in the German symbol set.

You probably won't change symbol sets very often, unless you need special symbols for your trade or regularly write in a language other than English. When you do need them, though, in one or another emulation mode your Star LaserPrinter 4 supports symbol sets for all these countries:

U.S. (ASCII)	United Kingdom	France
Germany	Sweden	Finland
Italy	Denmark	Norway
Spain		

Besides these your printer supports sets containing just symbols, such as the Greek alphabet ( $\beta$ ), logic symbols ( $\leq$ ), arrows ( $\uparrow$ ), the registered trademark symbol ( $\text{\textcircled{R}}$ ) and so on.

### ***3.3.2 Each emulation has symbol sets***

Your laser printer works by emulating or following commands developed originally for other printers. One of the Star LaserPrinter 8's advantages is that it offers you a choice of several built-in symbol sets for each font in each emulation.

The actual FX-850, printer does not use symbol sets to produce international accented characters and special symbols. Instead, the FX-850 lets you define which characters you want with parameter settings.

When your Star LaserPrinter 4 is emulating the HP LaserJet IIP, the normal default symbol set is the Roman-8 set. Roman-8 includes all the usual keyboard characters, numbers and symbols in ASCII, plus accented foreign-language characters and special symbols (but nothing for line drawing).

The Epson FX-850 emulation is really versatile. It lets you have both of those IBM symbol sets plus Epson's own standard symbol set. This Epson symbol set is unusual: it contains both upright and italic characters in the same set. You may also choose from symbol sets for all the countries mentioned above, plus a second unique set for each of Denmark and Spain.

### ***3.3.3 Default font attributes***

When you power on your printer and choose an emulation, the internal fonts start off with default attributes which you can change as needed. The default symbol sets depend on the emulation: in LaserJet IIP mode the default is Roman-8, and in Epson EX-800 mode it's Epson Std USA.

Besides these, all internal fonts default to portrait orientation, upright style (not italics) and medium boldness. The table below shows their other default attributes:

Typeface	Spacing	Pitch	Font height
Courier	monospaced	10	12 point
LinePrinter	monospaced	16.6	8.5 point

Technically, you can use any of the Star LaserPrinter 4's resident fonts when you send commands emulating a particular printer. But each emulation only prints properly with the fonts designed for it. Furthermore, you can only use symbol sets, or arrangements of those fonts, which that emulation can handle. So be aware that, if you try using fonts other than those recommended for a particular emulation, you will usually get printing in the emulation's default font.

If you want a character that's not in the font you're using, don't hesitate to grab it. Just send the Escape sequences that select your desired symbol set, print with it, then go back to your original font.

## 3.4 MANAGING FONTS

You can see which fonts are currently selected on your Star LaserPrinter 4 by printing a status sheet in offline mode, as mentioned at the beginning of this chapter. Another TEST mode menu item, described in the *Star LaserPrinter 4 Operations Manual*, also lets you print out a list of *all* the fonts available on the printer at any given moment.

### 3.4.1 Fonts

Most popular software packages, particularly word processors, let you choose fonts from within the program. They send the appropriate commands to the printer and you don't need to understand how they do it. *MultiMate* uses pitch to identify different fonts, for example, while *WordPerfect* uses print formats. The point is, you may not even have to worry about selecting which font to use.

But not all packages do the job for you. If you are in this situation, you can select any font attribute mentioned above, either from the control panel or by sending an Escape sequence command in one of the emulation modes.

If you use the control panel in program mode, select CHARACTER. Just press the [ > ] button to get to the font attribute you want to set, press [ v ]

to get to its possible values, press [ > ] to scan through them, and finally press [ v ] to slap in the value you want.

The procedures for selecting a font from a computer program is a bit more complicated, and depends on which emulation mode you are using. These font selection methods are detailed in the next two chapters.

### **3.4.2 Hints: Desktop publishing and page design**

- Desktop publishing systems help you automate your specifications for margins, cover design, typefaces, font sizes, placement of graphics and regular features. You build the specifications you want in *templates*, standard page designs you later simply call up on your screen and fill in with text.
- Some desktop publishing systems, such as Aldus's *PageMaker*, are page-oriented: you put each page together individually. These are great for shorter documents, such as newsletters, brochures and letters. Other systems, such as Xerox's *Ventura Publisher*, are document-oriented. That makes them better suited to technical manuals and long proposals or reports that go through many drafts.

Other ways in which such systems differ include whether they show on your screen what you will get on paper (code-based programs don't), how well they handle pictures, and how hard they are to learn. Think about your needs before choosing a desktop publishing system.

- A few of today's computer programs let you see several different font sizes and typefaces on your computer screen. That capability is necessary if you want to see on-screen exactly what will print on your Star Laser-Printer 4. Desktop publishers call this capability WYSIWYG— "what you see is what you get".
- When you design your pages, don't vary font size just to fit text into the space available. Go with a size that's easy to read and be consistent.  
Never be tempted to use all uppercase letters. When you want to highlight text, switch to a bold font or draw a box around it.
- Don't be afraid to use white space. White space relieves eye fatigue and looks more attractive.

### **3.4.3 Optional fonts**

Many optional fonts available for your Star LaserPrinter 4 complement its internal fonts. These can give you more variety in symbol sets, spacing, font height, style and stroke weight. To your Courier fonts, for example, you might add italics and bold, legal or math symbol sets, and sizes ranging from 7 to 14 points.

Optional fonts offer different typefaces too. Ask your Star Micronics dealer about cartridges or disks for the following:

Helvet	line drawing fonts
Letter Gothic	presentation fonts
Bar codes	optical character reader fonts
	universal product code

### **3.4.4 Using cartridge fonts**

To gain access to a font on a cartridge:

- 1) slide the cartridge you want into the slot on the front of the printer,
- 2) use either the control panel menu or a command from your computer to select the font you want (explained for each emulation in following chapters).

**Note:** Do not insert or pull cartridge out of the printer while the DATA lamp is ON.

### **3.4.5 How to download fonts**

To download fonts from computer disk you'll need more than a small 64K microcomputer. We recommend at least a 512K computer with a couple of disk drives (a hard disk is better).

Many commercial font-management programs are now on the market, including Insight Development's *LaserControl*, Blaha Software's *Hot Lead*, SoftCraft's *LaserFonts*, and the PCL printer driver in Microsoft's *Windows*. These utility programs help you download fonts, then let you access the fonts automatically from your word processor or other programs.

Most font files on disk that you buy to download into your printer have Escape sequences right in the file, which simplify the process. Usually all you have to do is copy the file from your computer into your printer (in LaserJet IIP mode you must assign a font ID number first). If you download fonts with the MS-DOS COPY utility, make sure to use the COPY /B option.

That will keep your computer from “interpreting” the data you send, which sometimes produces badly shaped characters.

OK, let’s look at a couple of examples.

### **3.4.6 Downloading a font: example one**

Example one is for a computer running just MS-DOS.

Say you’ve bought Hewlett-Packard’s Century Schoolbook fonts and want to download the regular (upright), italics and boldface characters. The HP disk labels for each file are CN100RPN.R8P, CN100IPN.R8P and CN100BPN.R8P. In case you’re interested, that’s HP’s code for CeNtury, 100 decipoints, Regular (or Italic or Bold), ProportioNal, Roman-8 symbol set, Portrait.

One of the disks you get also contains a batch file named DOWNLOAD.BAT. To load the regular upright font you make sure the printer is online, then after your computer’s A> prompt you type:

```
DOWNLOAD CN100RPN.R8P
```

When the program asks for the font ID number you key in a number between 0 and 32767. Then when the program asks whether you want the font stored permanently or temporarily you type either P or T (a temporary font disappears if you press the printer’s **RESET** button). Finally the program asks if you want to print a sample of the font and you reply Y or N for yes or no.

You then do the same for the italics and boldface files, for example typing for the italics font:

```
DOWNLOAD CN100IPN.R8P
```

The prompts will be the same, but you have to remember to use different font ID numbers for the upright, italic and boldface fonts.

### **3.4.7 Downloading a font: example two**

Example two is for a computer running Aldus Corporation’s *PageMaker* desktop publishing program with Microsoft *Windows*.

*PageMaker* provides a print driver called HPPCL.DRV, and a program called PCLPFM.EXE which creates the data it needs to print a given font. To create font data for your Century Schoolbook fonts, at the A> prompt you type:



## PCLPFM CN100\*.R8P

The asterisk, a “wildcard character,” indicates that PCLPFM is to create a data file for all three fonts— regular, italics and bold. The program asks if you want to create a file called APPNDWIN.INI to append into the *Windows* font menu file: type Y for yes.

After PCLPFM has made the font data file, with your word processor open the *Windows* file called WIN.INI and key in the font defaults you want to apply. At the section referring to the HPPCL printer driver, insert the APPNDWIN.INI file you created earlier.

That’s it! From now on your Century Schoolbook fonts will appear on the print menus of all your *Windows* applications.

With both examples, how you use the fonts depends on your applications software. As you know, sending commands to change fonts will probably require some experimenting: be patient. These commands are described in the following two chapters.

The process of downloading a font you’ve designed yourself is not so straightforward. As you can only do this in HP LaserJet IIP mode, creating and downloading fonts is described further in chapter 4.

### **3.4.8 Hints: Managing memory**

- Printing fancy stuff can be quite cumbersome for your printer. You trade off fanciness against speed: if you opt for fewer flourishes, you give your printer breathing room in memory. And that rewards you with faster output. Any of the following will slow down your laser printer:
  - text over 20 points,
  - lots of lines or patterns,
  - graphics,
  - macros,
  - justified text.
- You may choose to add an optional RAM board to your Star LaserPrinter 4 if you need to download many fonts.

- Alternatively, consider either a software or hardware print *spooler* if printing holds up your computer more than you'd like. A spooler provides a separate temporary memory space that holds the documents to be printed, and is particularly handy in a multi-user system.
- Some page makeup programs automatically download each font as needed, then flush that font from printer memory to make room for the next font. This approach can make good sense if you're sharing your printer with other people in a computer network. It keeps the printer's RAM from becoming overloaded. However, the downloading time can significantly slow down your printer's throughput.
- More typically, you will download a font in the morning (perhaps with the MS-DOS COPY command) before you print your first document, and that font will then stay in the printer's memory. If you use a single downloaded font (or macro) throughout the day, you will find it most efficient to keep it in the laser printer's memory. You definitely should download fonts this way if you use a print spooler. If you're in a network, however, make sure you don't download duplicate fonts.
- How many downloadable fonts can you have in one document? That's not so easy to answer. Most of your laser printer's memory is not available for storing fonts, because it has to store each page before printing it, as well as any macros or overlays you are using.

To see how much memory is available for extra fonts, put the printer offline and press the [TEST] button to print a status sheet. Your printer will beep and show a front-panel message if you try to overload its memory by downloading too many fonts. It then will continue printing with the closest available font to that requested.

As a general rule, you can include at least a dozen downloadable fonts in a document. Added to the internal fonts, that should be plenty—it doesn't make good design sense to mix many typefaces. A telltale sign of amateurish laser printing is too many fonts in one document.

To keep a wide variety of extra fonts in memory, however, many Star LaserPrinter 4 users (especially those sharing the printer on a network) prefer to add the optional board with the second megabyte of RAM.

# HP LaserJet IIP Commands

## CHAPTER 4

The Hewlett-Packard LaserJet IIP is an earlier kind of laser printer than your Star LaserPrinter 4. You should have no trouble running most popular software packages in HP LaserJet IIP mode, as those programs likely can send LaserJet IIP commands.

Because the LaserJet IIP *is* a laser printer, though, its commands can give you more control over your Star LaserPrinter 4 than is possible with the other built-in command sets. You will probably use this emulation's commands more than the others. Recognizing that reality, we've put more examples into this chapter.

We follow the same sequence in this chapter as we did in Chapter 2: first some printer management and page setup commands, then we'll cover commands that poise the laser "pen" over the paper, next we'll pick a font, and finally we'll lay down our words and pictures.

At the end of the chapter we describe how to create and use your own fonts, and also how to save time by writing command macros.

## 4.1 HP LASERJET IIP COMMANDS

### 4.1.1 What do LaserJet IIP commands look like?

The LaserJet IIP emulation mode includes a dozen common control codes (such as <CR> for carriage returns) and single-character Escape sequences (such as <ESC> E for resetting the printer). But all the other LaserJet IIP emulation commands you can send your Star LaserPrinter 4 look like this:

<ESC> *cc n C*

in which the *cc* prefix is a symbol or two showing the general category of commands to which this one belongs, *n* is some variable you want to use in this command, and *C* is the specific command you want performed.

Two important details make LaserJet IIP commands different from the other printer emulations. First, all Escape sequences end with a capital letter. If you don't make the last character uppercase, your printer won't know when the Escape sequence ends and will treat following characters as part of the same command.

Second, in LaserJet IIP commands each number or character you put after the <ESC> code is an actual ASCII symbol. With the other emulations, usually any number you put after an <ESC> code identifies a character in that *position* in the ASCII table.

For example, the LaserJet IIP command that sets the right margin to column 65 is:

```
<ESC> &a 65 M
```

which you would code in BASIC as:

```
10 LPRINT CHR$(27);"&a65M"
```

That command sends your printer the symbols "6" and "5," which its LaserJet IIP program interprets as the column number.

However if you were using Epson FX-850 emulation, the command that sets the right margin looks like this:

```
<ESC> Q 65
```

which in BASIC you would write this way:

```
10 LPRINT CHR$(27);"Q";CHR$(65)
```

That command sends the printer whatever character happens to be in ASCII position 65. Your printer's Epson Program, though, interprets it only as a decimal number meaning column 65.

### **4.1.2 Combining Escape sequences**

Later in this chapter we describe one way to select a font, by just specifying what font attributes you want, such as bold or proportional spacing. If you select a font by specifying every one of its attributes, you can be certain that you're selecting successfully. But it could mean a fair bit of repetitive typing each time you choose a font. This applies to other commands too, not just font selection.

Here's a way you can save yourself a few keystrokes: type in those commands that have the same command-category prefix as just one long Escape sequence. To combine commands this way, type the <ESC> and command-category prefix just once, and capitalize only the last command character.

For example, to define the style, weight and character face for the primary font, you might send these command:

```
<ESC> (s 1S  
<ESC> (s 7B  
<ESC> (s 3T
```

which would select *italics boldface Courier*. But this single command does the same thing, all with one blow:

```
<ESC> (s 1s 7b 3T
```

## 4.2 CONTROLLING THE PRINTER

### 4.2.1 Self test

You can check how your LaserPrinter 4 is printing and have a look at its parameter settings by sending this Self Test command:

```
<ESC> z
```

Notice that the z is lowercase; this is the only LaserJet IIP command that ends with a small letter. After you send a Self Test command, the printer finishes printing any pages left in its memory. Then on a new page it prints its current parameters (just important items such as number of copies and fonts in use). The printer finishes off the page with a continuous display of all the characters in its default font.

The printer also quickly checks its interface. Assuming it finds no trouble, the printer is then ready for your next page. If the printer detects a problem it shows a front panel message, which you can look up in your *Star LaserPrinter 4 Operations Manual*.

## 4.2.2 Set number of copies

You can print up to 99 copies of each of the pages you send to the printer. You may send this command anywhere within the text on a page; it will stay in effect for that and all subsequent pages until you send another such command:

`<ESC> & / n X`

All you have to do is change the *n* sign in this command to the number of pages you want. (The / character after the & is a lowercase L.)

## 4.2.3 Set feed selection

One thing you can do is print directly on envelopes as well as regular paper. You use this Feed Select command to tell your printer to select either a page from the multi-purpose, or the cassette (option):

`<ESC> & / n H`

For *n* enter one of the numbers from this table:

<i>n</i>	FEED SELECTED
0 (zero)	the printer only ejects the current page
1 (one)	the printer takes its next page from the multi-purpose tray
2	the printer takes a regular page manually
3	the printer accepts an envelope you feed in manually
4	the printer takes its next page from the paper cassette

Should an unprinted page be in the printer's memory when you give this command, the paper for that page will feed from where you've indicated. Therefore you can make this the last command on a page. The new feed setting stays in operation until you change it.

## 4.2.4 Reset

Most software packages automatically reset the printer to the initial defaults before starting a print job. It's a good idea for you to follow the same practice, just to make sure you get the settings you want.

When you want to set all your laser printer's parameters back to their initial default values (some people call this "initializing" the printer), send this command:

`<ESC> E`

The printer will finish printing any pages left in its memory before resetting the parameters. Resetting clears unneeded temporary fonts from your printer's memory. Any permanent fonts or macros you have downloaded, however, will still be there after you send a reset command. Permanent and temporary fonts are described at the end of this chapter's "Controlling Fonts" section.

### **4.2.5 Example: Printer controls**

Let's see what happens when we put these commands together. Say you have just turned on your laser printer and selected LaserJet IIP emulation on the control panel. What happens when you send the following commands to your printer?

```
<ESC> z
<ESC> E
<ESC> &/2h 2X
```

As a BASIC program these would look like this:

```
NEW
10 WIDTH "LPT1:",255
20 LPRINT CHR$(27);"z"
30 LPRINT CHR$(27);"E"
40 LPRINT CHR$(27);"&12h2X"
RUN
```

First, if it is working properly the printer prints a test print with all the characters in its default font for this emulation (Courier).

Next the printer sets all its parameter values—including feed selection and number of copies—to their initial settings.

The last command does two things: it tells the printer to accept paper you will feed in yourself, and to print each page two times. This is handy when you want two copies of a letter on preprinted letterhead.

You can now send your letter from your word processing program to the printer and feed in those pages. When you're done, you may want to send the <ESC> E command one more time.

## 4.3 PAGE ORIENTATION

You might reasonably think of page orientation as a page formatting issue. To print words widthwise on a page, however, each letter in effect has to lie on its back. So orientation is actually a font attribute, and is treated as such later on in this chapter.

### 4.3.1 Page Length

The paper tray you have installed sets the default page size for your laser printer. When you want a different size, and when you change the tray, you'll need to reset that page size. You should always change the page length *before* you send text for printing. The Page Length command sets the number of lines that can print on a page (lines per inch times the number of inches).

The Page Length command format is:

`<ESC> &ln P`

where *n* is the number of text lines on the page; it can be any number between 5 and 128.

The default number of lines is the length of the paper tray times 6 lines per inch. For 11-inch letter-size paper that works out to 66 lines (that's also the default when you haven't put in a tray).

If you don't want the default length, you should send the Page Length command *before* you send text for printing. The table below should help you pick the right number of lines. Decide which orientation and paper size you want, then use the *n* under your preferred lines/inch:

If you have set the paper feeder from the control panel to "AUTO SELECTION", a "select page length" command (`<ESC>&ln P`) will automatically select the cassette which contains the paper selected by the command. If no cassette currently contains the right size of paper, the display will ask you to insert the appropriate size of paper.



ORIENTATION	PAPER SIZE	n	
		@ 6 LINES/INCH	@ 8 LINES/INCH
Portrait	Executive	60	80
Portrait	Letter	66	88
Portrait	A4	70	93
Portrait	Legal	84	112
Landscape	Executive	43	58
Landscape	Letter	51	68
Landscape	A4	49	66
Landscape	Legal	*	58

- \* Printing landscapes on legal paper is trickier. First set on portrait mode and send the command <ESC> &/84P and then change the orientation to landscape.

An example: Say you want to manually print legal-size pages at eight lines per inch. The following commands combine manual feeding with that page length:

```
<ESC> &/2h 112P
```

If your command specifies a page length different than the paper in the tray, the printer will go offline and display a message asking for the proper tray. After you change the tray, press the **ON LINE** button to restart the printer. It doesn't hurt to print short pages on long paper. If you inadvertently print a legal-size page onto executive or letter-size paper, the printer will scroll that page across two sheets.

Also, the Page Length command puts all margins back to their defaults. So after you send it, check whether you have to send any of the following margin-setting commands.

### 4.3.2 Side margins

Margin settings define that part of the page on which the printer can print. You set side margins to particular *columns*. The width of a column differs for each font, depending on its pitch. Ten-pitch Courier, for example, puts column 30 three inches from the left edge of the page (column 0). But 12-pitch Prestige Elite puts column 30 just two and a half inches in.

You cannot set the left margin further over than the right margin. Use the following command to set the left margin, setting  $n$  to be the column number where you want the left margin to start:

```
<ESC> &a n L
```

Similarly, to set the right margin, you send this command with your desired column number:

```
<ESC> &a n M
```

If you want to put both left and right margins back to the printer's printable limits—in other words, to “clear” the side margins—send this command:

```
<ESC> 9
```

### **4.3.3 Top margin**

Vertically, the LaserPrinter 4 confines its printing to its “text length,” which should always be less than its page length. Both are measured in lines. You can change the meaning of a “line” with line-spacing commands described later in this chapter.

When you set the top margin though, it does not change, even when you change the definition of a line. You can use this command to set the top margin anytime. Just be aware that if the current print position is below your margin, you'll have to move the print position back up. Naturally, you have to keep your top margin inside the page-length limit.

Use this command to set the top margin, setting  $n$  to be the number of lines down from the top of the page that you want left blank before you start printing:

```
<ESC> &/n E
```

Note that the character following the “&” is a lowercase “L”.

### **4.3.4 Text length and the bottom margin**

By default, the LaserPrinter 4 automatically gives you top and bottom margins of the same size. So you only need to send the Text Length command when you want different top and bottom margins.

If you want a different bottom margin, first decide how many text lines will produce the margin you want. Check that they won't produce a bottom margin lower than the page length. Then send the following Text Length command, entering for  $n$  your desired number of lines:

<ESC> &/n F

The Page Length, Top Margin and Text Length commands therefore work together to set the bottom margin:

bottom margin = page length – (top margin + text length).

The bottom margin is called the “perforation region” with printers that use continuous forms. You normally want to skip the perforations between the continuous pages, but sometimes you don’t (for example when you print labels).

Though you likely won’t often want to do it, the Star LaserPrinter 4 will let you completely ignore the bottom margin too. If you choose to print below the bottom margin, remember that you might lose words or graphics in the unprintable region at the edge of the page. The command looks like this:

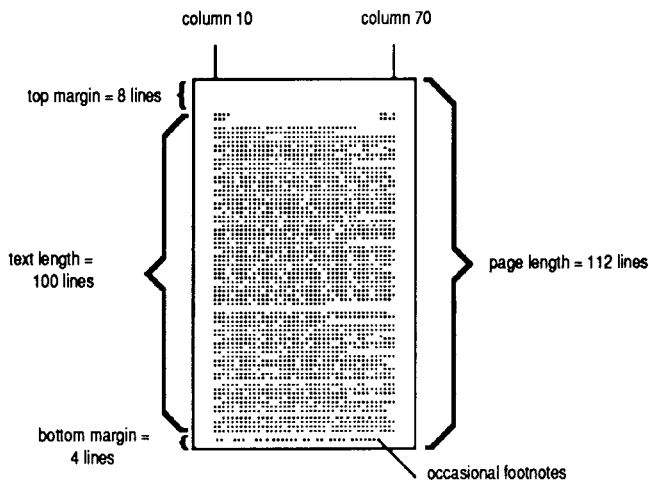
<ESC> &/n L

If you want to allow printing below the bottom margin, for *n* enter 0 (zero).

But if you want to forbid printing below the margin, which is the default, enter 1 (one).

### 4.3.5 Example: Page formatting

OK, let’s have a go at formatting a page. The picture of the page we want is just below. The actual width of the text on the page depends on which font we use. Let’s plan on using our 16.66-pitch Line Printer font at eight lines per inch.



As it prints, we also want to permit the occasional one-line footnote below the normal bottom margin. And when we're finished printing, let's reset the side margins so we can switch to our usual font width.

Here are the commands that will produce this format for us:

```
<ESC> &/112P  
<ESC> &a 10/70M  
<ESC> &/8e 100f 0L  
  
(We'll send our page here.)  
  
<ESC> 9
```

## 4.4 MOVING THE PRINT POSITION

### 4.4.1 *Many ways to move*

The LaserPrinter 4 provides excellent control over the print position—where you poise your laser “pen”. Horizontally, you can send backspace and carriage return commands. Vertically, you can move the print position down the page by printing so many lines per inch, or by sending line-feed and half line-feed commands. You can move horizontally or vertically to tab settings as well.

Those aren't all. You can also tell the Star LaserPrinter 4 to move its print position, either vertically or horizontally, in increments of:

- 1/10, 1/12 or 3/50 inch (pitch settings),
- 1/48 or 1/120 inch (line or column definitions),
- 1/300 inch (dots),
- 1/720 inch (tenths of a point).

All these commands are described below.

One hint about moving the print position: you can confuse yourself trying to use more than two different units during the same session. So decide beforehand how precise you need to be in moving the print position, not forgetting any graphics you want to include. Then stick to the unit(s) you choose.

## 4.4.2 Lines per inch

This vertical line-spacing command gives you more options than just the six or eight lines per inch of early printers. Use this command to set how many lines you want in each vertical inch of your page:

<ESC> & / *n* D

For *n* you enter the number of lines per inch you want— any of: 1, 2, 3, 4, 6, 8, 12, 16, 24 or 48. If you enter a number other than these the printer will ignore the command.

## 4.4.3 Defining the space and column

Before you use print positioning commands, you first may want to change the definitions of the line or space (sometimes called “vertical and horizontal motion indexes,” VMI and HMI). These definitions don’t actually move the print position. Instead, they define two basic units you can use in print position commands.

What’s important about the *space* is that it defines how far the print position travels for every character you print (except for proportionally spaced text). The space can also be thought of as the width of a vertical print *column*. One column width is the width of the space character in the current font, no matter whether it is monospaced or proportionally spaced.

Occasionally you may want to change space width to override the current pitch setting. Let’s look at an example. The space width comes in units of 1/120th of an inch, and the Courier font can print 10 characters per inch. Each character covers a tenth— 12/120ths— of an inch, so that font’s default space width is 12 units. If we change its space width to 6, each character would half-overlap the one before it.

If you are using <SI> and <SO> to shift between a primary and secondary font, it’s a good idea to change the space width after every shift.

To change the space width you send this command:

<ESC> & k *n* H

in which for *n* you can enter a number from 0 (zero) to 840. A width of 0 will print characters on top of each other; a width of 840 will print them seven inches apart.

### 4.4.5 Defining line depth

The *line depth* (sometimes called the “vertical motion index”) specifies how far down a page the print position will move for each line feed. You probably won’t use the line depth as much as lines-per-inch. Line depth can be more precise but it isn’t as easy to calculate. The line depth comes in multiples of 1/48th of an inch.

The important fact about the line depth is that when you change it you are changing the actual meaning of a “line”. When you increase the line depth you effectively decrease the number of lines per inch, and increase the page length.

The command you send to set the line depth looks like this:

`<ESC> &l n C`

(note that the character after the “&” is a lower-case “L”) in which for *n* you can enter a number from 0 to 336. If *n* is zero, lines will be printed on top of each other, and if 336, they will be printed 7 inches apart.

### 4.4.6 Moving the PRINT position horizontally

You can use three different units to move the print position horizontally: columns (space-widths), dots (each 1/300th of an inch), or tenths of a point (decipoints). Both columns and decipoints can be fractions to two decimal places, such as 45.75 decipoints— which provides a great degree of accuracy for graphics applications.

Moreover, for each of these you can move the print position horizontally in two ways. You can move *absolutely* from the left edge of the page. Or you can move *relatively*, away from the current print position. To show you want to move away from the current print position, you put a plus (+) or minus (–) sign before the number of units you want to move.

If you send a command that would put the print position outside either side margin, the LaserPrinter 4 will let you do just that. However, you can’t send the print position further than its printable limits at the edges of the page.

### **4.4.7 Horizontal moves: by columns, decipoints and dots**

To move the print position horizontally a number of columns, send the command:

`<ESC> &a n C`

in which for  $n$  you enter the number of columns you wish to move the print position. So to move to column 45 you send the command:

`<ESC> &a 45C`

But to move 45 columns to the right of the current print position, you send:

`<ESC> &a +45C`

To move the print position horizontally a certain number of decipoints, send the command:

`<ESC> &a n H`

in which for  $n$  you enter the number of decipoints you wish to move the print position (preceded by a + or – sign if you want to move away from the current position).

You can move the print position horizontally by dots both ways too. You can move a number of dots away from the left edge of the page, or you can move a number of dots away from the current print position.

To move horizontally this way, send the command:

`<ESC> *p n X`

in which for  $n$  you put either the number of dots away from the page edge, or (preceded by a + or – sign) the relative number of dots away from the current position.

So to move 20 dots from the left edge you send this command:

`<ESC> *p 20X`

And to move 20 dots to the left of the current position you send:

`<ESC> *p –20X`

You can also move the cursor 8 columns at a time horizontally by use of the horizontal tab command. Simply send a tab character:

<HT>

to do this. Reverse tabbing is not possible.

#### **4.4.8 Moving the print position vertically**

You can use similar units to move the print position vertically: lines, dots, or decipoints. Both lines and decipoints can be fractions to two decimal places.

You can also move the print position *absolutely* down from the top edge of the page, or *relatively*, away from the current print position. Again, to show you want to move away from the current print position you put a plus (+) or minus (-) sign before the number of units you want to move.

The important difference about moving vertically up or down is what the printer does when the print position hits the page top or bottom. If you try to move above the top margin, the print position stays right at the margin. And if you move the print position down off the page, the page is ejected and printing continues on the next page.

#### **4.4.9 Vertical moves: by lines, decipoints and dots**

To move the print position vertically a certain number of lines, send the command:

<ESC> &a n R

in which for *n* you enter the number of lines you wish to move the print position. So to move to line 45, measured from the top edge of the page, you send the command:

<ESC> &a 45R

But to move 45 lines down from the current print position, you send:

<ESC> &a +45R

To move the print position vertically a certain number of decipoints, send the command:

<ESC> &a n V



in which for  $n$  you enter the number of decipoints you wish to move the print position down (or precede the number with a + or – sign if you want to move up or down from the current position).

Finally, you can move a number of dots down from the top edge of the page, or you can move a number of dots up or down from the current print position. To move the print position up or down an absolute or relative number of dots, send the command:

`<ESC> *p  $n$  Y`

in which for  $n$  you put either the absolute number of dots down, or (preceded by a + or – sign) the relative number of dots up or down from the current position.

So to move 20 dots down you send the command:

`<ESC> *p 20Y`

And to move 20 dots up you send:

`<ESC> *p –20Y`

#### **4.4.10 Combining move commands**

One thing about moving the print position with the above commands is that they let you think of your page in terms of Cartesian coordinates.

All we mean is that you can combine horizontal and vertical movements that use the same units. If you send this command,

`<ESC> *p 40x 20Y`

the print position will move to a spot 40 dots from the left edge of the page and 20 dots down from the top edge. And if you send this one:

`<ESC> &a +40h –20V`

the print position will move right 40 decipoints and up 20 decipoints.

#### **4.4.11 Backspace**

The Backspace control code works exactly as you might expect: it moves the print position one column to the left.

`<BS>`

Moving the print position back does not destroy any characters already sent. In fact, because of that, this command can be quite useful. It lets you superimpose one character over another.

Say you want to indicate a blank space as the letter **b** with a slash / through it, an old programming symbol. Just send the **b** and then follow it with <BS> and the slash, and you get this: **b**.

#### **4.4.12 Carriage return**

The Carriage Return command by itself only moves the print position back to the left margin of the line on which it currently sits:

<CR>

If you want the print position to move down a line as well, send a separate Line Feed command each time, or use Define Automatic Line Ends (explained below) to couple these two control codes.

#### **4.4.13 Line feeds**

The Line Feed command advances the print position one line down the page. The meaning of a line is set by the Line Depth command.

To send a line feed just send this control code:

<LF>

The Half Line Feed command is the one you want for subscripts. This command moves the print position down the page one half the current line depth:

<ESC> =

To send a reverse Half Line Feed, moving the print position up to let you print a superscript, use this command:

<ESC> &a -.5 R

#### **4.4.14 Form feed**

This command, like the PRINT button, makes the printer advance to a new sheet of paper. When you send the <FF> control code you are also telling the printer to print all its stored page information. Remember to send this command to make sure any last partial page in your printer's memory gets printed:

<FF>

### **4.4.15 Define automatic line endings**

When you press the Carriage Return key what do you expect to happen? Most people think a computer keyboard should work like a typewriter, with a Carriage Return starting a new line as well.

But computer programs don't have to stick to that analogy. Some programs (particularly graphics packages) want a Carriage Return to just move the print position back to the left edge of the page. And they want a Line Feed to move down to a new line without going back to the beginning of the line.

So you can specify exactly how you want <CR>, <LF> and <FF> to work with this command:

```
<ESC> &k n G
```

For *n* enter one of the numbers from this table:

- | <i>n</i> | AUTOMATIC COMMAND   |
|----------|---|
| 0 (zero) | <CR>, <LF> and <FF> work according to their basic definitions,      |
| 1 (one)  | <CR> will also generate a <LF> (but <LF> and <FF> stay the same),   |
| 2        | <LF> or <FF> will produce a <CR> too (<CR> by itself won't change), |
| 3        | <CR> generates a <LF> too, and either <LF> or <FF> produces a <CR>. |

After you send the command <ESC> &k 2 G for example, every time the printer gets a Line Feed command it will move the print position down and over to the start of the line. When it gets a Form Feed, the printer will also move the print position back to the left.

### **4.4.16 Autowrap**

One nice thing we get used to with a word processing program is not having to worry about words going past the right margin. We don't have to listen for that typewriter bell at the margin any more.

This command does pretty much the same thing your word processing program does. The important difference is that it does not wrap words. When you turn on Autowrap, if you send too many characters for a line the laser printer prints the overflow on the next line.

If Autowrap is on, when the printer gets a character that would print beyond the right margin, it returns the print position for that character back to the left and one line down (Carriage Return and Line Feed).

The Autowrap command works like a toggle switch:

`<ESC> & s n C`

If for *n* you enter 0 (zero) then this wrap-around mode will apply.

But if for *n* you put 1 (one) this automatic wrapping of characters will not happen. The default if you don't send a command is no wrapping.

**Note:** Even when Autowrap is on, the printer will print beyond the right margin if you have sent one of the direct positioning commands described above, which move the print position past the margin.

Also, note that Autowrap doesn't move the whole word down to the next line— that's a job for a word processor, not your laser printer.

#### ***4.4.17 Pushing and popping the print position***

This provides a wonderful way to keep track of the print position. It works by letting you keep a list of up to 20 print positions.

You can “push” the current print position onto the top of the list whenever you want. Later, you can “pop” off whatever position is at the top of the list, making it the current print position.

When would you want to save and restore print positions this way? Whenever you need to interrupt what you're printing now to stick something special onto the page. This is most handy when you need to jump from text to graphics and back.

Say you've written one routine that puts the page number in the same place on every page, and another that under certain circumstances prints two heavy lines. You print merrily along until you have to print the lines. You then push the current print position to execute the line-printing routine.

But part way through that you hit the page-number spot. So you push the print position again and run the page-number routine. Then you can pop the print position to print the second line. And when that's done you pop it again to return to printing text.

As you might suspect, this can involve fairly complicated programming, typically using the macro commands described later in this chapter.

To push or pop a print position you send this command:

`<ESC> &f n S`

For *n* you enter 0 to push (save) the current print position,  
or 1 to pop (restore) the last position saved off the list.

**Note:** The last position pushed onto the list will always be the first one popped back later.

## 4.5 CONTROLLING FONTS

### 4.5.1 Font selection

The LaserJet IIP emulation lets you define and select fonts three ways: as primary and secondary fonts, or by font identification number, or by description. We'll look at the first two ways now, and explain selecting a font by its attributes a little further on.

However you choose to refer to fonts, remember that a font must be available before you select it. So if you want to select a cartridge or downloaded font, you first have to put in the cartridge or download the font.

### 4.5.2 Selecting primary or secondary fonts

Of the three selection methods, you will save the most programming time by shifting back and forth between primary and secondary fonts. That's counterbalanced, though, by the fact that you often need more than two fonts.

Typically, you use primary and secondary fonts to flip back and forth between two different symbol sets— for example IBM symbol sets 1 and 2. You can designate any two fonts, whether internal, cartridge or downloaded, as primary and secondary.

The way you show you're talking about a primary font in an Escape sequence is to follow the `<ESC>` symbol with a left parenthesis. For example,

`<ESC> (s 10 H`

means you want your primary font pitched at ten characters to the inch. Typing a right parenthesis instead means you are referring to the secondary font:

<ESC> )s 10 H

You define a font as primary or secondary as you select it. To make a font your primary or secondary font, you use font-description Escape sequences such as those just above, specifying the attributes you want.

If you don't explicitly indicate what attributes you want for the primary or secondary font, the printer will use the same default font for both. This default font's attributes include the Roman-8 symbol set, 10-pitch spacing, 12-point height, upright style, medium weight, and Courier typeface.

After your primary font is selected, you can choose it for printing by sending this Shift In control code:

<SI>

All the text you send after that command will print in the primary font.

Your laser printer shifts to the secondary font when you send this Shift Out code:

<SO>

### **4.5.3 Assigning font ID numbers**

The second way to define and select fonts is by using font ID numbers. You may prefer this method if you frequently use many fonts. While not as short as <SI> and <SO>, it's quicker than describing font attributes over and over again.

To give an ID number to an internal or cartridge font, you first make it the primary font. That is, you send a left-parenthesis Escape sequence (a font attribute command as described below) and the Shift In control code. Then, to assign an ID number to the font, you send this command:

<ESC> \*c n D

For *n* you can enter any number between 0 and 32767 as the font's ID number. (Not that you can have more than 64 fonts in the printer at once, even with the optional memory board. A printer would need an elephantine memory to hold 32767 fonts!)

### 4.5.4 Selecting downloaded fonts

The easiest way to select among downloaded fonts is to use font ID numbers.

When you download a font you make the Assign Font ID command above the first command in your sequence (see “How to download your own fonts” later in this chapter). After you’ve assigned an ID number to a downloaded font, you can select it as your primary font with this Select Font ID command:

`<ESC> ( n X`

in which *n* is your desired font’s ID number.

If you use many fonts you’ll use that command to select among them. But what if you prefer to just use `<SI>` or `<SO>` to shift between primary and secondary fonts? You want to select a downloaded font ID as your secondary font. This is the command to send:

`<ESC> ) n X`

### 4.5.5 Font attributes

The third way to select a font is to simply describe what font attributes you want. (Remember, selecting a font does not modify a font. You can’t get bold or 14-point characters if you don’t have a bold or 14-point font in the printer.)

In listing the attributes you want, it will help you to prioritize them the same way your LaserPrinter 4 does. Your printer ranks the various attributes a font can have this way (from most to least important):

- orientation
- symbol set
- spacing (proportional or monospaced)
- pitch (characters per inch)
- font height (in points)
- style (italic or upright)
- stroke weight (light to bold)
- typeface

The laser printer just zips down this chain of attributes one by one, eliminating fonts that don’t match what you want, until it gets down to one unique font that matches your request. If the printer matches down to, say, style or weight but can go no further, it will give you its closest font to your request.

And if you don't specify a particular value for some attribute, the printer assumes you want the value that attribute had in the *last* font you specified (or the default value if you've just turned on the printer). This can save you some effort: if the font you want has an attribute the same as the current font, you don't have to specify that attribute again.

### Orientation

Portrait orientation prints text across the width of a page. Landscape orientation prints text sideways up the length of a page.

The Star LaserPrinter 4 is more flexible about orientation than most other laser printers; it lets you simply rotate any portrait font to the landscape orientation or vice versa. To start you off when you change orientation, the printer resets all its margins and its column and line definitions to their default settings.

When you want to select the opposite orientation, send this command:

```
<ESC> &/n O
```

in which for  $n$  you put 0 to get portrait orientation,  
or 1 to get landscape orientation.

(Notice: the / character after the & is a lowercase L.)

### Symbol sets: a review

Each font can have many symbol sets, each being a subset of all the possible characters of the font. These subgroups include different symbols for different nations or for lawyers or artists or mathematicians. Any two symbol sets, moreover, may store the same symbol at a different font position in the printer's memory.

The default LaserJet IIP emulation symbol set is Roman-8, which includes all ASCII characters plus dozens of accented letters. But you can use any of the sets shown below. Technically you can pair any symbol set with any internal, cartridge or downloaded font; however it doesn't make much sense to print text with a math or line-drawing symbol set.

LaserJet IIP mode provides two different symbol set commands. You put a code into one command to select a *particular* symbol set for your primary or secondary font. You use the other command to select the *current* or *default* symbol set for your primary or secondary font.



## Selecting a symbol set

This first symbol set command lets you select a particular symbol set for the current font. To select a symbol set for your primary font, send this command:

<ESC> ( *n*

For *n* enter one of the following symbol codes. The first character must be a digit and the second an uppercase letter.

CODE <i>n</i>	SYMBOL SET
0A	Math-7 symbols
0B	Line Draw characters
0D	ISO 60: Norwegian
0E	Roman Extension
0F	ISO 25: French
0G	HP German
0I	ISO 15: Italian
0K	JIS ASCII
0N	ECMA-94 Latin 1
0O	OCR-A
0Q	Math-8A symbols
0S	ISO 11: Swedish
0U	US-ASCII
0Y	Bar Code 3 of 9
1D	ISO 61: Norwegian
1E	ISO UK
1F	ISO 69: French
1G	ISO 21: German
1O	OCR-B
1Q	Math-8B symbols
1S	HP Spanish
1U	Legal
2K	ISO 57: Chinese
2Q	Pi font-A symbols
2S	ISO 17: Spanish
2U	ISO IRV
3Q	OCR-B Extension
3S	ISO 10: Swedish
4S	ISO 16: Portuguese
5S	ISO 84: Portuguese

6S	ISO 85: Spanish
8M	Math-8 symbols
8Q	IBM-PC Set
8U	Roman-8
8Y	Bar Code EAN/UPC
9Q	IBM-PC Extension
10U	IBM-PC (US)
11Q	ECMA-94 7Bit
11U	IBM-PC (Denmark/Norway)
12U	PC-850
15U	Pi font symbols

To select a symbol set code for your secondary control, flip the parenthesis:

<ESC> ) *n*

and for *n* substitute your choice from the codes above.

### Selecting the current or default symbol set

Your printer can use either the primary or the secondary font as its current font. And that current font has its current symbol set. Your printer also remembers its default font and symbol set, which are Courier with Roman-8 (unless you've changed their initial parameter values through the control panel menu).

The following command lets you select one of those symbol sets for your primary font.

<ESC> ( *n* @

For *n* enter one of the following selection values for your primary font:

<i>n</i> VALUE	SELECTION
0 (zero) or 1 (one)	Selects the default symbol set
2	Selects the current font's symbol set (this forces the printer to select its best matching font)
3	Selects <i>all</i> of the default font's attributes (not just symbol set)

Similarly, you can select either the default or the current symbol set for your

3S	ISO 10: Swedish
4S	ISO 16: Portuguese
5S	ISO 84: Portuguese

To do these tasks, you can send the following command to select which symbol set you want for your secondary font:

```
<ESC> ) n @
```

For *n* enter one of the values from this table:

<i>n</i> VALUE	SELECTION
0 (zero)	Selects the default symbol set
1 (one)	Selects same symbol set as primary font
2	Selects the current font's symbol set
3	Selects all the default font's attributes (not just symbol set)

### Example: Symbol set commands

Let's take a short look at how you use these commands. Here's the scenario: You are already using the Lineprinter typeface, but want to use the German symbol set as you are writing a report for your Berlin office and need umlaut characters for several names in the report.

Then in the report you decide to use a proprietary product name, so want to nip out to grab the ® symbol on a legal cartridge font you've already loaded, then return to your German set. When your report's all done, you want to return the printer to its Roman-8 default.

Here are the commands that will do the job for us:

```
<ESC> ( 0G
```

```
.  
. .  
.
```

(you start your report here)

```
.  
. .  
.
```

```
<ESC> ( 1U ®
```

```
<ESC> ( 0G
```

```
.  
. .  
.
```

(you finish your report here)

```
.  
. .  
.
```

```
<ESC> ( 0@
```

If you had finished with <ESC> ( 3@ the printer would return to its standard Courier font, not just its Roman-8 symbol set.

### Spacing

If you specify monospaced for a font, each character prints with the same width. But if you specify proportional spacing the design of each character determines its width. To define how you want your primary font spaced, send this command:

<ESC> (s n P

in which for *n* you put 0 (zero) to get monospaced,  
or 1 (one) to get proportional spacing.

If you specify proportional spacing it doesn't matter if you also specify pitch, because spacing is a higher priority font attribute. The printer will just ignore the pitch request.

To define spacing for your secondary font, use the same numbers and just flip the parenthesis:

<ESC> )s n P

### Pitch

Pitch defines how many characters per inch you want for a monospaced-pitch font. Your Star LaserPrinter 4's internal monospaced-pitch fonts have settings of 10, 12 or 16.66 characters per inch. Cartridge or downloaded fonts with monospaced pitches often have other settings for characters per inch.

To select the pitch you want for the primary font, send this command:

<ESC> (s n H

where for *n* you put in how many characters per inch you want. For example, <ESC> (s 12 H will pack twelve characters into each inch.

The corresponding pitch command for the secondary font is:

<ESC> )s n H

You can use a different command instead of these for general character pitch setting. This command, since it doesn't have parentheses, covers both the primary and secondary fonts. It looks like this:

<ESC> &k n S

For *n* you enter a pitch code from the following table:

CHARACTERS PER INCH	PITCH CODE <i>n</i>
10 cpi (pica)	0 (zero)
16.66 cpi (condensed)	2

### Font height

The height of the characters you print is measured in point sizes. The LaserJet IIP emulation provides fonts in 6, 7, 8.5, 10, 12, 14, 16, 18, 24 and 36 point sizes. If the font height you specifically ask for is not available, the printer will select the font with the size closest to your request.

To select font height for the primary font use the following command. For *n* enter the font height in points that you want:

<ESC> (s *n* V

To select font height for the secondary font, send this command:

<ESC> )s *n* V

### Style

Style defines whether your text is printed in *italics* or upright, the way these words are. Send this command to select the style you want for the primary font:

<ESC> (s *n* S

in which for *n* you enter 0 if you want normal upright text,  
or 1 if you want italics.

To select style for the secondary font, just reverse the parenthesis and use the same *n* numbers:

<ESC> )s *n* S

Remember that style is a relatively low-priority attribute. If a particular font satisfies all higher priority attributes but doesn't come in the style you want, you'll get that font without your style.

### Stroke weight

The weight of a font defines how lightly or boldly it prints.

With LaserJet IIP emulation you can be more flexible about stroke weight than with the bold on/off commands of the other emulations. The following command gives you a range of 15 degrees of boldness, though not many fonts exploit that range.

Send this command to select a primary font with your desired stroke weight:

<ESC> (s *n* B

in which you replace *n* with a number from -7 (meaning light) to +7 (very bold). You need the negative sign to get the lighter weights. A weight of 0 (zero) produces medium print.

To select the stroke weight for the secondary font, use the same numbers with this command:

<ESC> )s *n* B

An incidental note: You will likely use optional fonts to give you boldface, so probably don't need to know this. But it's possible to print bold without even having a bold font in the printer. You just print the text you want in bold two times, with the overprint offset by 4 decipoints.

So you can use the command <ESC> &a *n* H to back up, you just need to know the width in decipoints of what you want to overprint. In a mono-spaced-pitch font like Courier that's easy: just keep track of how many characters you print. In a proportional font you'd keep track of the decipoints by using a character-width table. After backing up 4 decipoints less than the total text width you just print your text again.

## Typeface

The last attribute you can give to characters is their typeface. The design of characters is what font designers often think of as the main determinant for a font. But when you select a laser printer font, typeface sits at the bottom of the list.

To assign the particular face you want for your primary font, send this command:

<ESC> (s *n* T

For *n* enter one of the font code numbers from this table:

TYPEFACE	<i>n</i>
LinePrinter	0 (zero)
Pica	1 (one)
Elite	2
Courier	3
Helvet	4
Tms Romn	5

Gothic	6
Script	7
Prestige	8
Caslon	9
Orator	10
Presentation	11
Line Draw	12
PC Line	13
OCR	14
Bar Code	15

To assign a character face to the secondary font, just flip the parenthesis and use the same *n* numbers:

```
<ESC> )s n T
```

**Example: Font attributes**

Let's put the last half dozen font attributes together in an example. Say we want to select a nice font—a small LinePrinter—for the footnotes in a report we've finished. Let's make it our secondary font, since the body of our report is done in the primary font.

We'll go with the defaults for orientation and symbol set. But let's be specific about the other attributes, and let's remember to put them in priority order.

We decide on a monospaced of 16.66 characters per inch and a height of just seven points (footnotes should look smaller than our regular text). To keep it readable, we opt for the ordinary upright style and medium weight in the LinePrinter typeface. Our sequence of individual commands would look like this:

```
<ESC> )s 0P
<ESC> )s 16.66H
<ESC> )s 8.5V
<ESC> )s 0S
<ESC> )s 0B
<ESC> )s 0T
```

Since these font attributes all start with the same )s command-category

---

The BASIC statement we could send to select our desired font would look like this:

```
100 LPRINT CHR$(27);")sOp16.66h8.5v0s0b0T"
```

And assuming we have such a font in our printer, we'd get a font that looks like this sentence for our footnotes.

### **4.5.6 Underline**

Underlining is printing feature, not a font attribute.

You can underline in two ways: as a print feature, or with the `_` underline character. If you backspace and use the underline character, however, you often find the underline doesn't come out the same length as your text.

The underline command works better. When you turn on the underline feature this way, the printer will underline all subsequent printable characters, including spaces.

Send this command to turn on the underlining mode:

```
<ESC> &d n D
```

in which for *n* you put 0 (zero) to get fixed underline,  
or 3 to get floating underline.

And send this command to turn off the underline mode:

```
<ESC> &d @
```

### **4.5.7 How to print Escape sequences and control codes**

You use both Escape sequences and control codes to print. So how do you print Escape sequences and control codes?

But you actually *can* print commands, and in two different ways. You would do this when you want to see everything exactly as it is sent to the printer—for example, to debug a string of text and commands that doesn't print the way you think it should.

The Transparent print command prints the string of data that follows it without paying attention to any embedded Escape sequences or control codes. Transparent print even prints Carriage Return codes without zapping the print position back to the left margin.



To use Transparent print, just put this command immediately in front of your print data:

<ESC> &p *n* X

For *n* you specify the number of bytes of data you want to print .

Display Functions, like the Transparent print command, prints Escape sequences and control codes without actually executing them. But Display Functions pays attention to Carriage Return codes, so text looks more like the way it normally prints. Display Functions also prints commands as blanks, not as symbols.

Display Functions actually involves two Escape sequences, one to turn it on and another to turn it off. To turn on Display Functions, send this command just before the data you want displayed:

<ESC> Y

And to turn off Display Functions, send this command at the end of the displayed print data:

<ESC> Z

That Escape Z sequence itself prints as a blank followed by a Z.

### **4.5.8 Font control**

The Font Control command has two main functions: defining a font's status, and deleting fonts.

You can make a font either permanent or temporary with the Font Control command. This helps you control which fonts you delete, as permanent fonts do not get deleted when you reset the system. The permanent or temporary status you give to a font will apply only to the font you last specified, using one of the font ID commands described above.

When your printer's memory gets stuffed with fonts, you can also use this command to delete some of them. You can only delete fonts you've downloaded, as internal and cartridge fonts are never deleted. No text will get lost when you delete a font, even when that font is on an unprinted page in the printer's memory.

To control fonts you send this command:

<ESC> \*c *n* F

For  $n$  enter one of the numbers from this table of functions:

FUNCTION	$n$
Delete all temporary and permanent fonts	0 (zero)
Delete all temporary fonts (another way to delete all temporary fonts is to send a reset command)	1 (one)
Delete just the font with the most recently specified ID	2
Delete just the last character of the font you have downloaded	3
Make the current font ID temporary	4
Make the current font ID permanent	5
Make a temporary copy of the current font	6

A bit of explanation about that last function 6: When you give a font ID to *any* font you first need a temporary copy of that font in memory. That copy is already there for downloaded fonts. But you will need function 6 to create a temporary copy of an internal or cartridge font.

Here's how to assign ID numbers to an internal or cartridge font. You first select the font, then send the Font ID command to give it an ID number, and finally copy the font into memory with Font Control function 6. If you want that copy to stay in RAM when you reset the printer, you conclude by sending Font Control function 5.

### **4.5.9 Example: Controlling fonts**

Let's see how those last few commands work, translated into BASIC.

Pretend you want to make a short test with your current font (it doesn't matter what it is): you want to print what's in ASCII table positions 128 through 130. There's nothing there in your normal Roman-8 symbol set, but some other sets keep control codes or international characters there.

Assuming you like what you see printed from those ASCII positions, you then want to make that current font permanent. Finally, you also want to dump all the temporary fonts from printer memory to make room for some graphics you'll be printing.

Let's start with a reset and an underlined heading for your test print:

```
100 LPRINT CHR$(27);"E";
110 LPRINT CHR$(27);"&d0D";
120 LPRINT "Underlined heading for test print
      of ASCII 128 - 130";
130 LPRINT CHR$(27);"&d@"
140 LPRINT CHR$(27);"&p3X";
150 LPRINT CHR$(128);CHR$(129);CHR$(130);
160 LPRINT CHR$(12);
170 LPRINT CHR$(27);"*c5f1F";
```

Line 100 is just the <ESC> E reset command. Lines 110 and 130 turn on and off the underline feature.

Line 140 turns on transparent printing, which forces printing even for normally unprintable control codes. The three bytes you want to print are in line 150. To see what's there, you send a form feed command in line 160.

And finally, line 170 uses the font control command to make the current font permanent and then delete all temporary fonts.

### 4.5.10 Example: Assigning font numbers

Now let's do a program in BASIC. First we'll assign font numbers to the Courier and LinePrinter resident fonts and to a cartridge font, IBM PC Courier. Then we'll print samples of each font.

```
100 LPRINT CHR$(27);"(8U";
110 LPRINT CHR$(27);"(s0p10h12v0s0b3T";
120 LPRINT CHR$(15);
130 LPRINT CHR$(27);"*c1D";
140 LPRINT CHR$(27);"*c6F";
150 LPRINT CHR$(27);"(8U";
160 LPRINT CHR$(27);"(s0p16.66h8.5v0s0b0T";
170 LPRINT CHR$(15);
180 LPRINT CHR$(27);"*c2D";
190 LPRINT CHR$(27);"*c6F";
200 LPRINT CHR$(27);"(10U";
210 LPRINT CHR$(27);"(s0p106h12v0s0b3T";
220 LPRINT CHR$(15);
230 LPRINT CHR$(27);"*c3D";
240 LPRINT CHR$(27);"*c6F";
250 LPRINT CHR$(27);"1X";
260 LPRINT "Font 1 - Resident Courier"
270 LPRINT CHR$(27);"(2X";
280 LPRINT "Font 2 - Resident LinePrinter"
290 LPRINT CHR$(27);"(3X";
300 LPRINT "Font 3 - Cartridge PC Courier"
310 LPRINT CHR$(27);"1X";
320 LPRINT CHR$(12)
```

Line 100 and 110 calls the internal Courier font and line 120 makes it the primary font. Line 130 gives it font ID number 1, and line 140 makes it temporary.

Lines 150 through 190 do the same thing for the LinePrinter font, and lines 200 through 240 for the cartridge font. Notice that the cartridge font has the IBM symbol set code 10U.

Lines 250 through 300 print out samples of the three fonts. Finally, line 310 resets the default to our internal Courier font, and line 320 performs the final form feed to print the page.

## 4.6 USING YOUR OWN FONTS

### 4.6.1 *Font design is tedious*

A warning: font design is an art. Don't expect to turn out professional-looking fonts in a few hours.

Sometimes, though, you have to build your own typeface, even if you don't work with a company in the font-selling business. You may, for example, want to print your own customized company logo. It means building up characters within a *cell* or grid, perhaps 50 dots high and 35 wide—lots of dots.

Because defining your own typeface is so tedious, make sure you've checked out as many downloadable fonts as you can find from font development companies.

The next handiest way to do the job is to ask around, maybe where you bought your LaserPrinter 4, to see if you can get one of the font-creating or font-editing utility programs now on the market. *FontGen IV+* is one. Keep an eye out, too, for new word processing tools that might save you the trouble of painstakingly figuring out details like kerning.

Even with aids like these, building a custom font is an intricate process. It calls for the creation of a family of up to 200 characters sharing a common design and proportional scheme, and that's just for one type size. No mean feat.

### 4.6.2 *How to download your own fonts*

Characters that you define and store yourself are called “user-defined” characters. Let's assume you already know what text is to be in your custom font, and have designed its typeface, weight, width and style. Once you've created your own characters, you'll need to download them to your laser printer.

The process of downloading a font you've designed yourself is somewhat detailed. To download your font, you follow the following steps:

- 1) assign a font ID number to your font,
- 2) download a font header,
- 3) identify the position of each character to be downloaded,
- 4) send a character descriptor and bit map for each character,
- 5) specify whether the file is to be permanent or temporary.

## 1) Assigning a font ID to your font

To assign an ID to your font, you send this command (described above under “Assigning font ID numbers”) with an ID number for  $n$  between 0 and 32767:

```
<ESC> *c n D
```

Before sending that command though, check whether the ID number is already allocated to another font. If it is, that existing font will be deleted with the next command.

## 2) Downloading a header for your font

Even if the printer doesn’t have enough memory to create your font, it will delete any existing font with the same ID number when you download the *header* for your font.

A font’s header is the list of its attributes, which your printer uses to select that font. Each font header, 26 bytes long, is stored at the front of the font. You send a font header command to your printer just before you download the font’s characters.

The header command looks like this:

```
<ESC> )s n W
```

and must be followed immediately by the data describing the font’s attributes. The  $n$  value is the actual number of bytes of description data, almost always 26. Note: unlike other LaserJet IIP commands, you must enter the ASCII symbols 2 and 6 here, not the number 26.

Here’s a typical font header command:

```
<ESC> )s 26W 0<SUB>01000<RS>0<RS>02001<FF>0d0a00000<ETX>
```

Aside from the actual command at the front, the rest looks like gobbledygook? But there’s 26 bytes there, each one an ASCII character, each one specifying a particular font attribute. (The enclosed items with brackets are single ASCII characters that happen to be control codes.)

Each byte in the header is a number, which you send as whatever symbol happens to be stored at that numeric position in the ASCII table. Coding some of these numbers is tricky, however, and we recommend you ask your Star Micronics dealer to help you build your font header. To get you started, the table below shows what each of those bytes means:

BYTE	MEANING
0-1	header length
2	blank
3	font size
4-5	blank
6-7	baseline position for characters
8	blank
9	cell width
10	blank
11	cell height
12	orientation
13	spacing
14-15	symbol set
16-17	pitch
18-19	line spacing
20-22	blank
23	style
24	stroke weight
25	typeface

### 3) Positioning each character in your font

Before you download each character you have to tell the printer where in its font table to put it. You indicate where by sending this command:

```
<ESC> *c n E
```

For *n* you put the decimal number, between 0 and 255, of the position in the font table where you want your character stored.

Your printer's font table is just like the ASCII table. Before you send each character, say *g*, you have to say where you want to put it. In the ASCII table, *g* is at decimal position 103. So you send this command:

```
<ESC> *c 103 E
```

And immediately after it you send the bits that make up the character *g*.

### 4) Describing each character in your font

The next step is to describe each of your characters, "mapping" where you want each dot to go. Send this command before each character:

```
<ESC> (s n W
```

For *n* you enter the number of bytes you'll be sending after this command,

to describe and map your character. Sixteen bytes are needed for the description; the bit-map takes as many bytes as you've put into each character cell—perhaps two or three hundred bytes.

As with the font header, each byte in the character description is a number, sent as the symbol at that position in the ASCII table. Coding character descriptions is tricky too, so again we recommend you ask your Star Micronics dealer for help. The table below shows what the bytes in the character description mean:

BYTE	MEANING
0	description length
1	blank
2	always 14
3	always 1
4	orientation
5	blank
6-7	left offset (blank space to left of character)
8-9	top offset (blank space above character)
10-11	character width
12-13	character height
14-15	print position travel (proportional spacing only)

The bit map of the character is just the pattern of dots in the character, starting at the top left of its cell. You work your way across the cell and down to the bottom right, giving each dot a value of 0 if it's not to be printed and 1 if it is. Then you group those dots as 8-bit bytes.

### 5) Permanent or temporary?

The last step in downloading your own font is to make the font permanent or temporary, using the Font Control command described earlier. The command `<ESC> *c 4 F` will allow the font to be erased when you reset the printer. But the command `<ESC>*c 5 F` will keep your font available even after you reset the printer.



## 4.7 GRAPHICS

The Star LaserPrinter 4 offers two kinds of graphics. It prints *raster* graphics (sometimes called “bit-mapped graphics”), which specify each dot in a graphics pattern. And it prints *pattern graphics*, which prints lines and patterned blocks.

Be aware, though, that adding graphic elements always slows up printing with laser printers.

### 4.7.1 Starting Raster Graphics

The following steps should be performed (in the order shown) when printing raster graphics:

- 1) Define the resolution
- 2) Set the orientation of the graphic image
- 3) Issue the command to start graphics
- 4) Issue the command to set the compression technique (if any) of the graphical data
- 5) Send the commands which transfer the graphics data
- 6) Send the command to end graphics

Before graphics are sent to the printer, the resolution must be set. This is achieved using the following command:

```
<ESC> *t n R
```

where  $n$  can take a value of 75, 100, 150 or 300. These values represent the desired value in dots/inch (dpi) of the printed graphic image. The default resolution is 75dpi. Any further resolution commands will be ignored by the printer until a command to end graphics has been received.

To set the orientation of the graphic image, transmit the following command:

```
<ESC> *r n F
```

Where  $n$  can take a value of either 0 or 3. Where  $n=0$ , raster graphics printing will take place in the logical page orientation, and when  $n=3$ , raster graphics will be printed along the width of the physical page, regardless of the logical page orientation.

The command to start graphics must be transmitted next. This command is:

`<ESC> *r n A`

where  $n$  can take a value of either 0 or 1. When  $n=0$ , the margin for printing graphics will be the left-most printable edge of the page (this is not necessarily the same as the left text margin). If  $n=1$ , the left margin for graphics is set to the current print position, and any graphics image will appear only to the right of that margin.

Three graphic data compression formats are available for data transfer. The data compression format to be used is selected using the following command:

`<ESC> *b n M`

where  $n$  can take the value 0, 1 or 2. Any other value is interpreted as 0. A full discussion of data compression techniques is outside the scope of this manual, but a brief explanation of this command should be useful.

- Where  $n=0$ , no encoding takes place, and a simple binary transfer takes place. Bit 7 of the first byte corresponds to the first dot in a raster row, bit 6 to the second, and so on.
- Where  $n=1$ , run-length encoding takes place. This is a compression technique where the data is divided into pairs; the first byte of each pair serving as the repetition count for the data in the second pair. If the first byte of the pair is equal to zero, the data in the second byte is not repeated.
- Where  $n=2$ , the data to follow is in Tagged Image File Format (TIFF) conforming to rev.4.0 standards. The demands of space do not allow a detailed discussion of TIFF standards here, but briefly, TIFF files combine features of non-encoded and non-encoded. files. Many proprietary graphics packages use TIFF encoding when storing and transmitting graphic data.

When transferring raster graphic data, each line of raster data must be prefixed by the command:

`<ESC> *b n W`

where  $n$  gives the number of data bytes to follow (the maximum is 255 before another such command is sent). This data must follow the compression rules set in the previous command. For instance, a TIFF image interpreted in any

way other than the TIFF format will produce very strange results! Repeat sending lines of graphics data, prefixed by the above command, until the whole image has been transmitted.

To signal the end of graphic data transmission, send the following command:

```
<ESC> * r B
```

There are no parameters. The LaserPrinter 4 is now in text mode.

### **4.7.2 Rules and patterns**

Patterns and lines are easy to do.

Print shops call lines of any thickness *rules*. A printed line in fact is a rectangular area with one “skinny” dimension, from one to many dots thick. We will use the word “rules” too, to avoid confusion with the lines used to measure pages.

You follow these three steps when you use rule and pattern graphics:

- 1) Define the dimensions you need.
  - 2) Choose the graphics pattern you want to fill in those dimensions.
  - 3) Print the pattern.
- Remember to send the following rule or pattern commands in that order.

### **4.7.3 Defining rule or pattern dimensions**

Defining the dimensions of the area you want to fill just means indicating the horizontal and vertical size of the pattern, or the rule’s length and thickness. You can indicate dimensions in either dots or decipoints (tenths of a point).

At 300 dots or 720 decipoints to the inch, decipoint measurements are more accurate. The printer converts decipoint values into dots, using 2.4 decipoints to the dot. It rounds up fractions to the next integer. So 1225 decipoints would work out to 510.4 dots, and the printer rounds this up to 511 dots.

Your dimension commands specify an area to the right and down from the current print position. If you define an area larger than the page, your printer will accept the command. It will, however, cut off your pattern or rule at the boundaries of the page’s printable area.

When the printer finishes its print “map” of your rule or pattern, the print position automatically returns to the spot from which you started. That means, for instance, that you can make a lightly shaded rectangle and then start printing text right over it. This kind of box can be useful for setting off particular information from the main body of your text.

Horizontally, you can specify the rule length or horizontal pattern size in dots with this command:

`<ESC> *c n A`

in which for  $n$  you enter how many dots across the page you want the rule or pattern to be.

Alternatively, to specify the horizontal dimension for a rule or pattern in decipoints, you can print this command:

`<ESC> *c n H`

in which  $n$  is the horizontal rule or pattern size in decipoints.

Vertically, you can indicate the size of your rule or pattern in dots with this command:

`<ESC> *c n B`

in which  $n$  is the number of dots defining the thickness of the rule or the depth of the pattern.

Alternatively, to show the vertical dimension in decipoints, you send this command:

`<ESC> *c n V`

in which  $n$  is the number of decipoints in the rule’s thickness or the pattern’s vertical length.

#### ***4.7.4 Choosing and printing a rule or pattern***

You need both of the next two commands to choose and print the particular pattern you want to fill your defined area. These commands work together.

With the Print Pattern command (which actually comes second) you specify whether you want to fill your rectangular area with a solid black rule, a finely dotted gray-scale pattern, or a predefined linear pattern. And with the Specify Pattern command you can indicate which *particular* dotted or linear

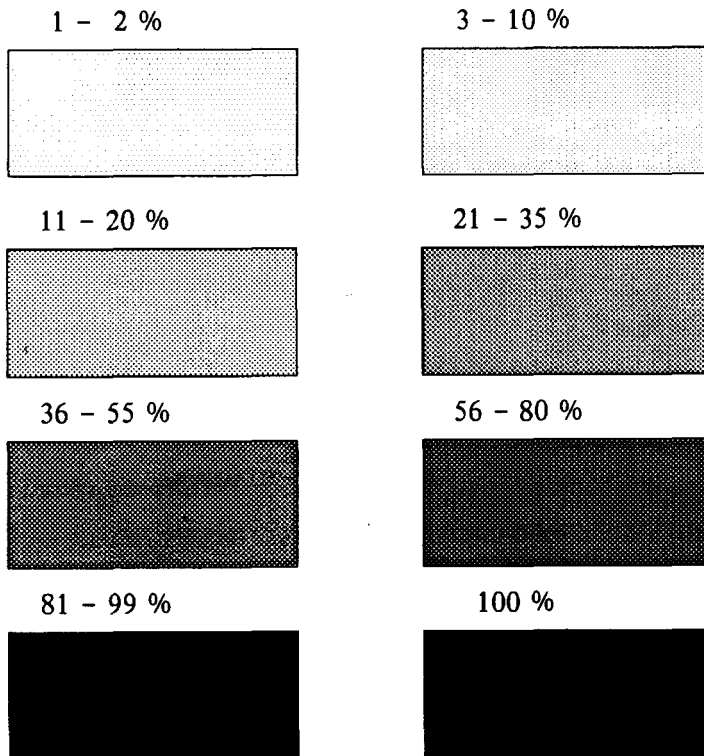
pattern you want. You always send the Specify Pattern command before the Print Pattern command, even if you want a solid black rule.

To indicate the particular pattern you want, send the following command. The general meaning of the  $n$  value you enter actually depends on the command you put after this:

`<ESC> *c  $n$  G`

If you want a solid black rule it doesn't matter what you put in for  $n$ , as the printer ignores it.

If you want a 1-scale dotted pattern, for  $n$  you enter here a percentage number from 1 to 100 indicating the density with which you want the box filled, from light to solid. Your  $n$  percentage will correspond to one of the eight gray-scale densities in the chart below.

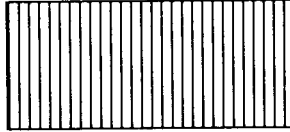


If you want a linear pattern, for  $n$  you enter here a pattern number between 1 and 6 inclusive, identifying one of the linear patterns below.

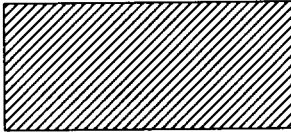
# 1



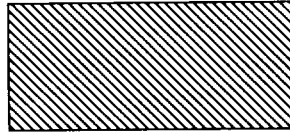
# 2



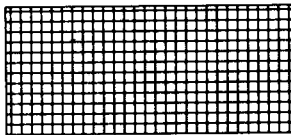
# 3



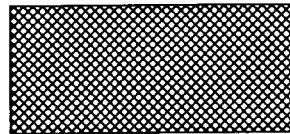
# 4



# 5



# 6



You always send the following Print Pattern command after a Specify Pattern command. This Print Pattern command identifies whether the area you have defined is to be filled with a rule, dotted gray-scale pattern, or linear pattern:

`<ESC> *c n P`

For  $n$  enter a value from the following table. (If you select a linear pattern here, but a dotted pattern in the previous Specify Pattern command, the printer will ignore this Print Pattern command.)

$n$ VALUE	PATTERN
0 (zero)	solid black
1	white
2	dotted gray-scale
3	linear

### 4.7.5 Examples: Pattern graphics

To specify a block five inches wide you could use a horizontal dimension of 1500 dots (5 inches times 300 dots). That command would look like this:

```
<ESC> *c 1500A
```

To print that area with a 25 percent gray-scale pattern, the commands you send would be:

```
<ESC> *c 25G
```

```
<ESC> *c 2P
```

But to print an area filled with the horizontal bar pattern, the commands you send would be:

```
<ESC> *c 1G
```

```
<ESC> *c 3P
```

(You could combine these commands as <ESC> \*c 1g 3P .)

## 4.8 MACROS

### 4.8.1 Using macros

There's a great shortcut that simplifies the task of sending commands to your LaserPrinter 4: use macros. A *macro* is a single control code, which you can define yourself, that does the work of a whole long series of printer commands. Any LaserJet IIP emulation command can go into a macro.

Putting macros together to automatically repeat sequences of tasks is like using a real programming language. Your Star Micronics dealer may know of some pre-written macros already available for the Star LaserPrinter 4. You'll find macros especially handy for creating letterheads and business forms, and also for setting tabs, subscripts and superscripts.

Your printer can store up to 32 macros without the optional RAM expansion. To manage printer memory you can make a macro either temporary (it disappears when you reset the printer) or permanent (it disappears only when you turn off the printer).

You assign each macro an ID number when you first define it. Use this Specify Macro ID command to specify (in place of *n*) the ID number of the macro to which you wish to refer:

```
<ESC> &f n Y
```

For example say you want to delete a macro numbered 80. You would first select that macro with the command `<ESC> &f 80Y`. Then you would delete it with the Macro Control command `<ESC> &f 8X` as described below.

### 4.8.2 Macro Control

The Macro Control command performs several jobs for you, such as defining, running and deleting macros. To manage macros you send the following command:

`<ESC> &f n X`

For *n* you enter a number from 0 (zero) to 10 to specify what macro control function you want to perform. These functions are described in the following table:

<i>n</i>	FUNCTION
0 (zero)	Start defining macro. Creates a new macro with the last specified macro number. This macro will be temporary; to make it permanent use <code>&lt;ESC&gt; &amp;f 10X</code> after your definition. The printer will make a macro of the sequence of commands that follow this one, until it gets the command to stop defining the macro.
1 (one)	Stop defining macro.
2	Execute macro. This option makes the printer run the last specified macro, changing printer parameters according to what its commands say. (The printer parameters are those you might also set from the control panel.) When the macro is done, the print position will be just where it was before you ran the macro.
3	Call macro. This option also makes the printer run the last specified macro. But before it runs the macro it saves the current parameters, and then restores them when the macro is finished. Again, when the macro is done the print position will be just where it was before you ran the macro.
4	Turn on automatic macro. This option automatically runs the last specified macro on every page you print. You can use this option to reproduce the same design on each page (a logo or form design perhaps). You can have more than one automatic



macro. As with the “call macro” option, this one saves current parameters and print position, and restores them when the macro is finished. An automatic macro will terminate if you change orientation or page length.

- 5 Turn off automatic macro. Starting with the current page, this option terminates the last specified automatic macro.
- 6 Delete all macros. This option removes all macros and automatic macros from printer memory— *even* macros you have defined as permanent with option 10 below.
- 7 Delete temporary macros. This option also deletes temporary automatic macros.
- 8 Delete last specified macro.
- 9 Make last specified macro temporary.
- 10 Make last specified macro permanent.

### **4.8.3 Example: Macros**

The following program loads and runs a macro. The macro moves an inch and a half right and down three inches from the top left corner of the page, where it prints a 25 percent gray-scale bar. It then ejects the paper.

```
100 LPRINT CHR$(27); "&f6X"  
200 LPRINT CHR$(27); "&f1Y"  
300 LPRINT CHR$(27); "&f0X"  
400 LPRINT CHR$(27); "*p450x1200Y";  
500 LPRINT CHR$(27); "*c180h7200V";  
600 LPRINT CHR$(27); "*c25G";  
700 LPRINT CHR$(27); "*c2P";  
800 LPRINT CHR$(12)  
900 LPRINT CHR$(27); "&f1X";  
1000 LPRINT CHR$(27); "&f2X";  
1100 END
```

Line 100 clears any existing macros, then line 200 specifies that this will be macro ID number 1. Line 300 starts downloading the macro.

Line 400 moves the print position to a spot 450 dots right and 1200 dots down from the top left corner of the page.

Lines 500 through 700 select the 180-dot deep and 7200-dot wide pattern and print it. Line 800 does the form feed that forces the actual printing. Line 900 ends the downloading process.

At the two line we select our macro and actually run it.

# Epson FX-850 Commands

## CHAPTER 5

The small-carriage FX-850 is one of Epson's more recent dot-matrix printers. Because of the popularity of the IBM Personal Computer, which was marketed with a modified Epson printer, thousands of software programs already work with Epson printer commands.

If you have a program that doesn't work with laser printer commands, you'll almost certainly find it will work with the commands in the Star LaserPrinter 4's FX-850 emulation mode. Your Star LaserPrinter 4 will print any documents you create with standard Epson commands.

We follow the same sequence in this chapter as we did in earlier chapters: first some printer management and page setup commands, then we'll cover commands that move the print position, and finally we'll print our document with our choice of font attributes.

## 5.1 FX-850 COMMANDS

### 5.1.2 What do FX-850 commands look like?

Most commands in the FX-850 emulation look like this:

`<ESC> C`      or      `<ESC> C n`

in which *C* is the code for the particular command you want to send. If the command includes the *n* sign it indicates a numeric variable the command needs. For example, the FX-850 command to set the right margin is this:

`<ESC> Q n`

in which *n* is the column number for the right margin. So to put the right margin at column 65 you would send this command:

`<ESC> Q 65`

Most FX-850 commands work like toggle switches: one `<ESC>` code turns on a feature and another `<ESC>` code turns it off.



- left-to-right (unidirectional) printing control <ESC> U
- print quiet (half speed) <ESC> s
- print immediate  
("incremental" or "typewriter" mode) <ESC> i

## 5.2 CONTROLLING THE PRINTER

### 5.2.1 Putting the printer online or offline

You can send <XOFF> and <XON> control codes (described in Chapter 2 under "Serial Interface") to put your printer offline and then online again. If you are using a parallel interface, any data your computer sends after you put the printer offline will not be printed.

To put the printer offline send this control code:

<XOFF>(sometimes shown as <DC3>)

To put the printer back online, either press ONLINE on the control panel or send this command:

<XON> (sometimes shown as <DC1>)

If the printer is already online when you send the <XON> command, the printer will cancel any incomplete line of print.

### 5.2.2 Reset

The FX-850 emulation reset command returns the printer to its default initial parameters. When you send this command at the end of a print job the printer will reset its parameters only after previous commands have finished. You should, however, take the precaution of putting a form feed before the reset, to make sure you lose no print data.

To reset the Star LaserPrinter 4, send this command:

<ESC> @

### 5.2.3 Bell

When you send the Bell control code the Star LaserPrinter 4 will sound its beeper for half a second (assuming you haven't turned it off with the control panel menu):

<BEL>

## 5.3 FORMATTING PAGES

### 5.3.1 Page length

You can define page length in either inches or lines—a matter of personal preference. When you first start FX-850 emulation your printer sets the page length to 11 inches and 66 lines.

The definition of a “line” depends on the lines-per-inch spacing. If you change line spacing *after* you set the page length, the page length won’t change. And if you print pages actually longer than the installed paper tray, the Star LaserPrinter 4 will print them on two sheets each.

To set a different page length in lines, enter this command:

`<ESC> C n`

For *n* you enter the number of lines you want on a page (maximum 127).

To set a different page length in inches, enter this command:

`<ESC> C <NUL> n`

For *n* you enter the number of inches in length you want the page (maximum 22).

**Note:** the print position at the moment you set page length will be your new top-of-page. When you change page length the Star LaserPrinter 4 puts the bottom margin back to its default value, so you may want to reset it.

### 5.3.2 Top and bottom margins

The FX-850 emulation provides for top and bottom margins in a unique way, combining the top-of-page (as set by page length) with the Skip-Over-Perforation command. (Remember that the dot-matrix FX-850 printer uses continuous forms, which are joined with perforations.)

By setting the Skip-Over-Perforation you can control the number of lines skipped at the bottom of one page and, if you want, at the top of the next. First make sure the print position is on the line you want to be your top margin, and set your page length. Then send this Skip-Over-Perforation command:

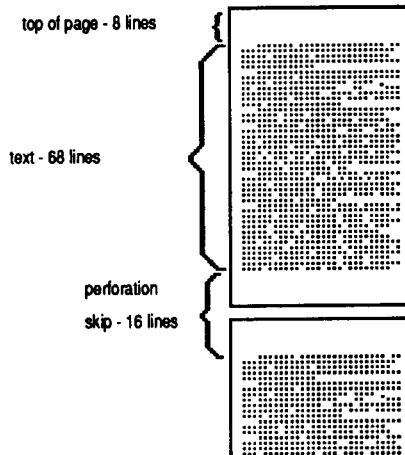
`<ESC> N n`

in which *n* is any number of lines between 1 and 127.

For example, say you have set the page length to 84 lines (legal size paper at 6 lines per inch), with the top-of-page 8 lines down. You then send:

`<ESC> N16`

This will give you 8 lines of top margin (implied by your top-of-page setting) and 8 lines of bottom margin. The printer knows you want  $84 - 16 = 68$  lines of text, so it prints those, skips 8 lines at the bottom of the first page, plus 8 more lines at the top of the next page to make up the total perforation skip of 16 lines.



If you change line spacing after giving this command, you won't affect these margin settings. However, if you change page length you will have to set the perforation skip again.

To set Skip-Over-Perforation to zero lines, send this command (the letter after the `<ESC>` code is the capital letter "O"):

`<ESC> O`

### 5.3.3 Side margins

To set the left margin to a particular column you send this command:

<ESC> / *n*

in which *n* is the column number for the left margin. (Note that the character / is a lowercase L.)

Column width is determined by the current pitch (for example 1/12 inch for 12-pitch), or is set at 1/10 inch for proportional spaced text. Once margins are set, changing the pitch does not affect margins.

Same rules apply for the right margin: you send this command:

<ESC> Q *n*

in which *n* is the column number for the right margin.

### 5.3.4 How to center or justify text

If your text processor won't center or line up text for you, your Star LaserPrinter 4 can do the job. *Justified* text prints flush against one or both side margins on both the right and left sides of the page.

You turn on the centering or justification of text with the following command:

<ESC> a *n*

For *n* enter a number from the following table:

MODE	<i>n</i>
left justification	0
centering	1
right justification	2
both sides justified	3

Backspace and horizontal tabs will only work in left-justification mode.

### 5.3.5 Line spacing

FX-850 emulation offers five different ways to vertically space lines. The default is 6 lines to the inch, but you can change line spacing with the commands in the following table. (In the first four of these commands, remember that the number following the <ESC> code is a real number, not the ASCII symbol for 0, 1, 2 or 3.)



DESIRED LINE SPACING	COMMAND	EXPLANATION
1/8 inch	<ESC> 0	(zero)
7/72 inch	<ESC> 1	(one)
1/6 inch	<ESC> 2	(the default)
increments of 1/216 inch	<ESC> 3 <i>n</i>	(in which <i>n</i> is the number of increments, maximum 255)
increments of 1/72 inch	<ESC> A <i>n</i>	(in which <i>n</i> is the number of increments, maximum 85)

## 5.4 MOVING THE PRINT POSITION

### 5.4.1 Space

The easiest command for moving the print position to the right across the page is just the space control code, the same character sent by the space bar on a keyboard:

<SP>

The actual definition of a space (which can also be thought of as the width of a print *column*) is set by the pitch.

### 5.4.2 Backspace commands

When you send the printer a backspace control code it moves the print position left one space (or, with proportional spacing, the width of the last character printed).

<BS>

The backspace code lets you print directly over the last character printed; it does not delete that character. This lets you create symbols not ordinarily available, such as **b** with a stroke / through it to represent a blank space: **b/**.

Do not backspace right after changing any font attributes, lest the first character in the new font print in the wrong spot. And don't confuse backspacing with the <DEL> control code (described later), which does erase the last character from memory.

### **5.4.3 Carriage return**

The printer moves the print position back to the left margin when you send a carriage return control code. The print position will *not* move down to the next line (unless on the control panel's menu you have set the Auto Line Feed parameter ON):

<CR>

### **5.4.5 Line feed commands**

The line spacing commands define what a "line" means for the following commands. The default vertical spacing is six lines per inch.

You use this Line Feed command to move the print position, not to the left margin, but just down the page one line:

<LF>

Variable line feed commands move the print position back to the left margin and either down or up the page, by some increment of 1/216 inch. If the move puts the print position below the bottom margin a new page starts. You move the print position *down* the page with this command:

<ESC> J *n*

and up the page with this command:

<ESC> j *n*

In both cases, the *n* is the number of 1/216 inch increments you want to move (maximum 255).

### **5.4.6 Form feed**

The Star LaserPrinter 4 only prints a page when it receives a Form Feed control code. If the last text in a document doesn't fill up a page it may not print immediately.

So to make sure one document doesn't run right into the next, it's a good idea to make sure each document ends with a final Form Feed. In the rare event you have set page length so two pages will print on one sheet, the sheet won't print until both pages are composed in memory.

The following command moves the print position to the top of the next page:

<FF>

### **5.4.7 Left-to-right printing**

The FX-850 normally prints bidirectionally, with the print position moving alternately left-to-right and right-to-left. Cutting down printhead motion does speed up printing for those earlier styles of printer— though it hardly compares with laser printing.

The problem with bidirectional printing is that the printhead can get slightly out of alignment. When you're using more primitive tools sometimes accuracy matters more than speed, so a command for plain old left-to-right printing (sometimes called "unidirectional printing") is available on Epson's printers.

The following command does nothing to improve the accuracy of your Star LaserPrinter 4, but it's included for software compatibility's sake. The command just moves the print position to the left margin, acting as a carriage return without a line feed. Normal printing resumes with the next carriage return.

To turn on left-to-right printing for just one line, this is the command:

```
<ESC> <
```

### **5.4.8 Moving horizontally from the left margin**

Two horizontal motion commands send the print position to a particular position on the line. These commands are based on FX-850 dots. Unfortunately the FX-850 offers only 60 or 120 dots per inch, rather than the Star LaserPrinter 4's usual density of 300 dots. So we'll express these moves in terms of increments of 1/60 or 1/120 inch.

One move command is an "absolute" move, to the right from the left margin. The other is a "relative" move, left or right from the current print position.

To move from the left margin in increments of 1/60 inch, you send this command:

```
<ESC> $ n1 n2
```

At the beginning of the chapter we said some command variables, like *n1* and *n2* here, could represent bytes to be added together. This is one of those commands. The *n1* represents units and *n2* represents 256-unit groups. In this move command, the actual units are the 1/60 inch increments.

To complete the command, for  $n2$  you enter the number of full groups of 256 increments you want to move. And for  $n1$  you enter the number of increments left over.

Confused? Here's an example. This command:

```
<ESC> $ 14 1
```

moves  $14 + (256 \times 1) = 270$  increments from the left margin. That works out to 270/60 inches, which is four and a half inches.

### **5.4.9 Moving horizontally from the current position**

The other horizontal move command, which moves away from the current print position, comes in smaller increments of 1/120 inch. To move this way, first decide whether you want to move right or left, and by how many 1/120 inch increments. Then send this command:

```
<ESC> \  $n1$   $n2$ 
```

To move right,  $n1 + (n2 \times 256)$  must equal the number of increments you want to move. For example, to move right two and a half inches (300/120 inches) you send this command:

```
<ESC> \ 44 1
```

because  $44 + (1 \times 256) = 300$ .

To move left is a little trickier. You first subtract your desired number of increments from 65536 (which is  $256 \times 256$ ). Then you use the same formula:  $n1 + (n2 \times 256)$  must equal that resulting number. So to move left three (360/120) inches you send this command:

```
<ESC> \ 152 254
```

That command moves the print position left three inches because

$$\begin{aligned} 65536 - 360 &= 65176 \\ &= 152 + (254 \times 256) \end{aligned}$$

### **5.4.10 Horizontal tabs**

When you use horizontal tabs you first may have to set the tab stops (up to 64 of them). It depends on whether or not you want to use the default, which

is a tab stop every eight columns. Column width depends on the horizontal spacing being used when you give this command. If you change pitch later, that won't affect tabs.

To clear the old and set new tab stops, send this Set Horizontal Tabs command:

```
<ESC> D n1 n2 ... n64 <NUL>
```

This command needs a bit of explanation. The *n1* and *n2* and so on are the column numbers where you want to set tab stops. The three dots ... just mean you can list more columns, as many as 64 in total. List them in ascending order. Either a final <NUL> (control code 0), or a column number less than that preceding it, will end the command.

To remove all horizontal tab stops, issue the Set Horizontal Tabs command with no *n* column values:

```
<ESC> D <NUL>
```

The Horizontal Tab Move command advances the print position to the next horizontal tab position (or to the left margin on the next line, if the move would go beyond the printable limit of the page). To move to a horizontal tab stop, send this command:

```
<HT>
```

### **5.4.11 Vertical tabs**

Vertical tabs work much the same way. When you send the Vertical Tab Move command, the print position moves down to the next vertical tab stop. No tabs are set when you first start FX-850 emulation.

To give the Set Vertical Tabs command, send this Escape sequence:

```
<ESC> B n1 n2 ... n64 <NUL>
```

The *n1* and *n2* and so on are the line numbers where you want to set vertical tab stops. You can set up to 64 tabs at any of up to 254 positions.

To move down to the next vertical tab stop, send the following Vertical Tab Move command. If you've set no vertical tabs the Vertical Tab Move command just moves down one line. If there are no more tab stops on the page the printer will just move down one line too.

```
<VT>
```

To remove all vertical tab stops, send this command:

```
<ESC> B <NUL>
```

### **5.4.12 Vertical tabs in channels**

This next pair of commands, which lets you store and use several different sets of vertical tabs, is rarely used. They're mostly for putting data into preprinted forms, or for unusual reports that need different tab settings on different pages.

The basic idea is that different sets of tabs get stored in what the Epson people call *channels* (think of them as separate columns of tab stops). You can store up to eight different channels, so long as they total no more than 64 tab stops.

To set tab stops for a given channel (shown here as *c*), send this command:

```
<ESC> b c n1 n2 ... n64 <NUL>
```

This is much the same as the regular vertical-tab setting command, with the addition of the channel *c* (in place of which you put a number from 0 to 7). The *n1* and *n2* and so on are the line numbers where you want to set vertical tab stops; again you can set tabs at any of up to 254 positions.

You can clear all the tabs in a channel by not following the channel number *c* with any stops, but just the <NUL>.

To move the print position to tab stops in a channel, send this command:

```
<ESC> / c
```

where *c* is the number of the channel with tab stops you want to use. If that channel has no tab stops, this command will just produce a line feed.

## **5.5 CONTROLLING FONTS**

### **5.5.1 Selecting fonts**

When you first start FX-850 emulation, the Star LaserPrinter 4 gives you 12-point ten-pitch Courier as its default font. But FX-850 commands can give you most variations on font attributes, including subscripting, superscripting and underlining. Some of the commands in this section are implemented by switching fonts, while others are derived from the current font.

In a pinch, if you want to change fonts in FX-850 mode you can use the menu on the control panel.

### **5.5.2 Orientation**

The FX-850 emulation has no command to change orientation, so use the Select Orientation superset command if you need to print in landscape mode. If the printer doesn't have enough memory in which to rotate the font, it displays that message on the panel and uses instead the closest font it has in the orientation you've chosen.

### **5.5.3 Symbol set**

The standard FX-850 symbol set is ASCII, at least for the first half of its 256 character slots. For the second half of the FX-850 symbol set you have a choice of either italics (so you don't have to switch to a separate font to get them) or character graphics.

To choose between access to italics or to character graphics, send this command:

`<ESC> t n`

in which for *n* if you enter 0 (zero) you get italics, which is the default,  
or if you enter 1 (one) you get character graphics.

### **5.5.4 International characters**

Moreover, you can overlay the symbol set with particular country-specific symbols. To choose which international symbols you wish to overlay, send this command:

`<ESC> R n`

For *n* enter from the following table the number that corresponds to the symbols you want:

<b>COUNTRY</b>	<i>n</i>
US (ASCII)	0
France	1
Germany	2
England	3
Denmark I	4
Sweden	5
Italy	6

Spain I	7
Japan	8
Norway	9
Denmark II	10
Spain II	11
Latin America	12

The particular symbols the command will give you are shown in the chart below.

COUNTRY	35	36	64	91	92	93	94	96	123	124	125	126
US (ASCII)	#	\$	@	[	\	]	^	'	{		}	~
France	#	\$	à	°	ç	§	^	'	é	ù	è	''
Germany	#	\$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
England	£	\$	@	[	\	]	^	'	{		}	~
Denmark I	#	\$	@	Æ	Ø	Å	^	'	æ	φ	å	~
Sweden	#	α	É	Ä	Ö	Å	Û	é	ä	ö	å	ü
Italy	#	\$	@	°	\	é	^	ù	à	ò	è	ì
Spain I	£	\$	@	;	Ñ	¿	^	'	''	ñ	}	~
Japan	#	\$	@	[	¥	]	^	'	{		}	~
Norway	#	α	É	Æ	Ø	Å	Û	é	æ	φ	å	ü
Denmark II	#	\$	É	Æ	Ø	Å	Û	é	æ	φ	å	ü
Spain II	#	\$	á	;	Ñ	¿	é	'	í	ñ	ó	ú
Latin America	#	\$	á	;	Ñ	¿	é	ü	í	ñ	ó	ú



### **5.5.5 Most significant bit**

Very few computers still send just seven bits to their printers, the way the Apple II + and TRS-80 did. But if you find yourself in this situation all is not lost. You can still gain access to the symbols in the upper half of the FX-850 symbol set (either italics or character graphics) with the following three commands.

These commands control the state of the eighth bit, the *high-order* or *most significant bit*, which is the leftmost bit in a binary string. None of the commands will affect data sent as graphics.

To make the eighth bit always on (1), which lets you print italics or character graphics, send this command:

<ESC> >

To keep the eighth bit always off (0), so you can only print the ordinary ASCII characters in the lower half of the symbol set, send this:

<ESC> =

To let your computer program control the eighth bit, send this command:

<ESC> #

### **5.5.6 Spacing**

When you combine proportional spacing with automatic justification you get text that looks like that in professionally typeset books. Proportional spacing also looks good without justification.

A couple of notes though: The proportional spacing command can not change a monospaced-pitch font into a proportionally spaced one. You should always have a proportionally spaced font selected when you send this command. Also, you can't condense proportionally spaced text.

To turn proportional printing on or off, send this command:

<ESC> p *n*

in which if *n* is an even number such as 2 or 4 you get proportional printing, and if *n* is an odd number such as 1 or 3 you get the last-selected monospaced pitch.

### **5.5.7 Character spacing**

FX-850 emulation lets you control the amount of space inserted after characters, sometimes called the *offset*. You might want, for example, to justify a line of print yourself.

With the Character Spacing command you can add to the distance each character advances, in increments of 1/120th inch. The command does not affect the selected pitch.

To adjust the character spacing, send this command:

<ESC> <SP> *n*

<SP> is the ASCII Space character. For *n* you enter a figure that sets the number of 1/120-inch increments by which spacing is to increase.

Your printer cancels this command when it receives another offset command.

### **5.5.8 Pitch**

You can print at 10, 12, 17 or 20 characters per inch with your laser printer's internal fonts. The FX-850 emulation default is 10-pitch. If you want a wider pitch you can put the printer offline for a second and select either 6.5 or 8.1 characters per inch on the control panel.

To select 12-pitch (often called "elite"), you send this command:

<ESC> M

After you give this command neither condensed nor extended print commands will have any effect.

To turn off 12-pitch and return to your original character spacing, send this command:

<ESC> P

### **5.5.9 Condensed print**

Condensed print (often called "compressed") is narrower than it is high, which makes it good for spreadsheets. Without changing to a new font, you can switch from 10-pitch to a condensed pitch of 17 characters per inch.

To shift into condensed print, send either of these commands:

`<SI>` or `<ESC> <SI>`

Condensed print will stay on until you select a different print mode or send the following Cancel Condensed print control code, which returns printing to the 10-pitch default:

`<DC2>`

### **5.5.10 Extended print**

Extended print is wider than it is high; FX-850 owners sometimes call it “double-width” print. Extended print looks good in headings. Selecting extended print means selecting a font with wider characters. You can select extended print either for one line or for several.

When you shift out to extended print for one line, a carriage return or a line feed will end this mode. To shift out to extended print for one line you send one of these commands:

`<SO>` or `<ESC> <SO>`

To turn on and off extended print across more than one line, send this command:

`<ESC> W n`

If for  $n$  you enter an odd number you will start extended print; if for  $n$  you enter an even number you will stop it and return to normal spacing.

You can also turn off extended print with the `<DC4>` control code. However, neither of the last mentioned ways of turning it off will work if you have turned on extended print with the Master Select command described below.

### **5.5.11 Font height**

You can print double the height of characters.

To turn on and off double-height print, send this command:

`<ESC> w n`

If for  $n$  you enter an odd number you will start double-height print; if for  $n$  you enter an even number you will stop it and return to normal height.

### 5.5.12 Style

FX-850 emulation lets you use italics characters without defining italics as a separate font, since it can store italics in the upper half of its symbol set.

To select italic characters, send this command:

<ESC> 4

And to return to upright characters, send this command:

<ESC> 5

Note: in neither of these commands do you send the actual number 4 or 5. Instead, use the ASCII symbols for those numbers.

### 5.5.13 Stroke weight

The Star LaserPrinter 4 can create bold characters by printing each character twice, slightly offset, just like the FX-850 does. To completely emulate the FX-850 your printer does this two different ways, offsetting either below the characters (*double-strike*) or to the side (*emphasized*).

To turn on bold print you send either of these two commands:

<ESC> E (emphasized print)

or

<ESC> G (double-strike)

If you send the <ESC> E command you may force the printer to select a bold font, depending on which font you are using at the moment.

You can turn off the bold print again with these commands:

<ESC> F (turn off emphasized)

or

<ESC> H (turn off double-strike)

Three notes: If you try to print subscripts or superscripts in double-strike mode, the double-strike will be turned off. (Therefore you may prefer to always use emphasized print to get bold.) The Master Select command described below can also turn off emphasized print. And <ESC> F will *not* turn off emphasized print if you set it on with the Master Select command.

### 5.5.14 Typeface

The Star LaserPrinter 4 uses Courier font as its default FX-850 font.

You use the Select Emulation superset command to switch into another emulation to select a cartridge or downloaded font, but you won't be able to bring that font back into FX-850 mode. That's because FX-850 emulation always starts with Courier as its default font.

### 5.5.15 Underline

The underline command under FX-850 emulation puts underlines under spaces as well as characters. To turn underline on or off you send this command:

`<ESC> - n`

If *n* is an odd number, underlining is turned on.

If *n* is an even number, underlining is turned off.

### 5.5.16 Master Select

The Master Select command is a shortcut you can use to specify which font you want to print with. Master Select lets you combine several commands in one—half of all the font attributes with one fell swoop. Master Select also cancels the features you do *not* select with it.

The only restriction is that you can't combine condensed or monospaced pitches with proportional spacing. If you mix them you'll just get proportional spacing.

To select among the various print options, use this command:

`<ESC> ! n`

For the value of *n* you just add up the values of each of your desired PRINT modes in this table:

PRINT MODE	<i>n</i>
10 pitch (pica)	0
12 pitch (elite)	1
proportional	2
condensed	4
bold (emphasized)	8
bold (double-strike)	16
extended	32
italics	64
underline	128

An example: Proportional bold extended looks good as a title. To get it you add up the  $n$  values for those three ( $2 + 8 + 32 = 42$ ), and send the command:

<ESC> ! 42

### **5.5.17 Subscripts and superscripts**

Subscript mode prints characters at half of the normal height, in the lower part of the line space. Superscript mode prints characters at half of the normal height, but in the upper part of the line space. You may want subscripts and superscripts for footnote numbers or mathematical formulas. The only restriction is that you can't use subscripts and superscripts with double-strike mode.

You switch to subscript or superscript mode with this command:

<ESC> S  $n$

in which if you make  $n$  any even number you get superscript mode, and if you make  $n$  any odd number you get subscript mode.

You cancel subscript or superscript mode with this command:

<ESC> T

### **5.5.18 How to cancel a line or delete a character**

When you're printing you sometimes send a line, but then change your mind and don't want to print it after all. The Cancel control code lets you erase from your printer's memory just the last line you sent. (If you cancel a line you will also cancel the extended print mode if you've been using it.)

By sending this command you make your printer cancel all the characters you have sent since the last carriage return or line feed:

<CAN>

Sometimes you want to delete from the printer's memory, before the page gets printed, just the last *character* you have sent. Don't confuse deleting a character with backspacing, which doesn't erase anything from memory. This control code deletes only the last character sent:

<DEL>

## 5.6 GRAPHICS

If you are using a commercial graphics program, such as Lotus *1-2-3*, you won't need to use the commands in this section. Usually you'll just draw your image on your screen and then send it to the printer.

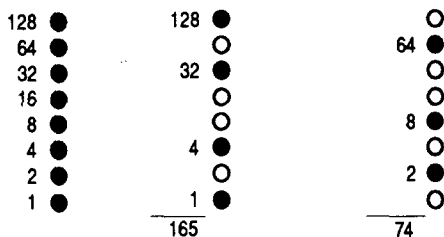
Should you want to send your own graphics commands in FX-850 emulation mode, though, it's best to start off knowing a little binary arithmetic. If you're rusty on binary you can review computer arithmetic in Chapter 1. We'll assume you already know elementary programming in the following discussion.

### 5.6.1 Printing dots

FX-850 emulation prints graphics as lines eight pin-dots high. You just specify which of the eight dots to print for each dot-wide column.

That sounds easy, but it can be a lot of work. It means specifying an eight-bit binary number 60 to 240 times per inch, right across the page. That's maybe 2000 calculations for every line! As you can imagine, graphics software uses plenty of program loops.

The figure below shows the value of each dot on the left. The examples on the right show how you would add up dots, to tell your printer what dots to print for a couple of columns:



### 5.6.2 What do graphics commands look like?

To print FX-850 graphics you have to make four decisions:

- What line spacing do you want to use?
- How many dots do you want per horizontal inch? That is, what density do you want?
- How wide is the page area on which you want to "paint" your graphics?
- What dot pattern will your data have?

Each FX-850 emulation graphics command you send does three things: it turns on the graphics mode, specifies horizontal density, and says how many columns wide the coming graphics data will be.

Graphics commands all print at the same vertical density or “resolution”—72 dots per vertical inch. The commands all look the same; where they differ is in horizontal density.

Here’s the command for the 60 dots-per-inch density:

```
<ESC> K n1 n2
```

The *n2* is the number of 256-column groups (either 0, 1 or 2). And the *n1* represents units, the number of leftover columns.

So to print just 150 columns of graphics, you would send this command:

```
<ESC> K 150 0
```

That translates to  $150 + (0 \times 256) = 150$  columns.

But to print 260 columns of graphics at the same density, you would send this command:

```
<ESC> K 4 1
```

This one translates to  $4 + (1 \times 256) = 260$  columns.

Remember to put *exactly* the right number of columns in your command. Otherwise you’ll inadvertently use text as graphics data, or vice versa. Another hint: in BASIC, the WIDTH statement can help you keep unwanted carriage returns from messing up your graphics.

### **5.6.3 Other graphics densities**









Let’s summarize: When programming graphics, you first set the line spacing to produce the effect you want (typically at 7/72 or 8/72 inch). Then you send your graphics command and data. Finally, you reset line spacing and any other text settings as needed.

How do text settings affect graphics? Neither extended print nor double-strike bold work in graphics mode. The <DEL> command doesn’t work in graphics either. And if you’re using “most significant bit” settings for an older kind of computer, graphics mode ignores them.

OK, let’s have a look at graphics commands for different densities.



COMMAND NAME	DENSITY (lines/inch)	ESCAPE SEQUENCE	GRAPHICS MODE ( <i>m</i> )
single density	60	<ESC> K <i>n1 n2</i>	0
double density	120	<ESC> L <i>n1 n2</i>	1
high-speed double density	120	<ESC> Y <i>n1 n2</i>	2
quadruple density	240	<ESC> Z <i>n1 n2</i>	3
screen graphics I	80	<ESC> * <i>m n1 n2</i>	4
plotter graphics I (single density)	72	<ESC> * <i>m n1 n2</i>	5
screen graphics II	90	<ESC> * <i>m n1 n2</i>	6
plotter graphics II (double density)	144	<ESC> * <i>m n1 n2</i>	7

MODE # 0	
MODE # 1	
MODE # 2	
MODE # 3	
MODE # 4	
MODE # 5	
MODE # 6	
MODE # 7	

You've already seen an example of the first command, <ESC> K *n1 n2*. The next three commands— with L, Y and Z following the <ESC> code— work exactly the same way.

Neither <ESC> Y nor <ESC> Z are recommended however. The FX-850 actually turns off adjacent dots to allow it to print at high speeds or densities, and your Star LaserPrinter 4 will emulate that precisely. Stick to single or double density if you want to see all the dots you are sending.

But how about the last four options? And what's that Graphics Mode column about?

Your Star LaserPrinter 4 lets you print graphics at the same densities as computer screens or plotters. The command for all four of those last options looks the same. In fact, you can use this single command for *all* graphics densities:

<ESC> \* *m n1 n2*

The only difference between this and the other graphics commands is that you specify a particular graphics mode number. That's the *m* in the last

column of the table above. If you don't use a valid mode number, the printer will ignore the command.

So this "all-purpose" graphics command means you can do our first example two different ways:

`<ESC> K 150 0` and `<ESC> * 0 150 0`

### **5.6.4 Changing a command's density**

You can actually switch the density that a graphics command normally gives you.

Why would you want to do that? If you have a program containing many `<ESC> K` commands and want to switch to double-density `<ESC> L`, it could mean changing a lot of commands. It's easier to send one command that changes the density for `<ESC> K` instead.

To change a command's normal density you send this command:

`<ESC> ? c m`

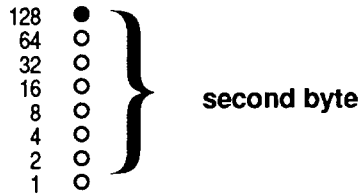
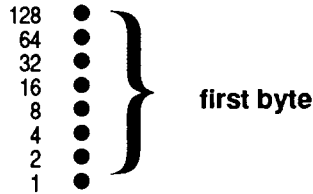
For *c* you substitute whichever command identifier you want to change (K, L, Y or Z). And for *m* you enter the mode number of the new density you want that command to have, from the table above.

### **5.6.5 Nine-pin graphics**

The Star LaserPrinter 4 readily accepts another FX-850 graphics command, for nine-pin graphics. All the graphics commands discussed so far involve eight-dot lines, but the FX-850 offers this command because its printhead actually has nine pins. The FX-850 uses it to draw another line of dots and speed up the printing.

The nine-pin graphics command, however, does not affect your Star LaserPrinter 4's speed.

Unlike the eight-dot commands, this nine-dot command needs two bytes for each column of data: one byte for the top eight pins, plus one for the bottom pin. Though only the most significant bit is actually used from the second byte, you have to send the whole thing:



To print nine-pin graphics, send this command before your graphics data:

`<ESC> ^ d n1 n2`

The variable *d* is a number indicating density. If *d* is any even number the density will be 60 dots per inch, but if *d* is an odd number the density will be 120 dots per inch.

The *n2* in this command, as with other graphics commands, means the number of 256-column groups of data you are sending (between 0 and 4). And *n1* is the number of leftover columns (0 to 255).

Why can *n2* indicate up to 4 groups, when the limit is 3 with eight-dot graphics? Because you send twice as many data bytes with nine-dot graphics.

# ***MEMO***

This final chapter in your *Star LaserPrinter 4 Applications Manual* holds two main sections. The first one will help you with your programming job, while the last provides the symbol set tables.

We've summarized all commands in ASCII order here. You'll find them organized by function in chapters 4 and 5.

The Star LaserPrinter's symbol sets have been included so that you can see exactly what characters are available to you. Roman-8 includes standard ASCII and is the default for all emulations.

## 6.1 COMMAND SUMMARY

### 6.1.1 HP LaserJet IIP Emulation Printer Commands

<i>Command</i>	<i>Function</i>	<i>Page</i>
<BS>	Backspace	59
<HT>	Horizontal tab	58
<LF>	Line feed	60
<FF>	Form feed	60
<CR>	Carriage return	60
<SO>	Select secondary font	64
<SI>	Select primary font	64
<ESC> &a n C	Position horizontal cursor in columns	57
<ESC> &a n H	Position horizontal cursor in decipoints	57
<ESC> &a n L	Set left margin	52
<ESC> &a n M	Set right margin	52
<ESC> &a n R	Position vertical cursor in rows	58
<ESC> &a n V	Position vertical cursor in decipoints	58
<ESC> &d @	Cancel underlining	74
<ESC> &d n D	Select underlining	74
<ESC> &f n S	Save and recall cursor position	63
<ESC> &f n X	Macro control	90
<ESC> &f n Y	Specify macro ID	89
<ESC> &k n G	Set line termination	61
<ESC> &k n H	Horizontal Motion Index	55
<ESC> &k n S	Select font pitch	70
<ESC> &l n C	Vertical Motion Index	56
<ESC> &l n D	Set line spacing	55
<ESC> &l n E	Set top margin	52
<ESC> &l n F	Set text length	53
<ESC> &l n H	Select paper feeder	48
<ESC> &l n L	Perforation skip	53
<ESC> &l n O	Select orientation	66
<ESC> &l n P	Select page length	50
<ESC> &l n X	Set number of copies	48
<ESC> &p n X	Transparent print data	75
<ESC> &s n C	End-of-line wrap	62
<ESC> ( n	Select primary font symbol set	67

<i>Command</i>	<i>Function</i>	<i>Page</i>
<ESC> ( n @	Select default primary font	68
<ESC> ( n X	Designate downloaded font as primary	65
<ESC> (s n B	Select primary font stroke weight	72
<ESC> (s n H	Select primary font pitch	70
<ESC> (s n P	Select primary font spacing	70
<ESC> (s n S	Select primary font style	71
<ESC> (s n T	Select primary font typeface	72
<ESC> (s n V	Select primary font height	71
<ESC> (s n W	Download character descriptor/data	81
<ESC> ) n	Select secondary font symbol set	68
<ESC> ) n @	Select default secondary font	69
<ESC> ) n X	Designate downloaded font as secondary	65
<ESC> )s n B	Select secondary font stroke weight	72
<ESC> )s n H	Select secondary font pitch	70
<ESC> )s n P	Select secondary font spacing	70
<ESC> )s n S	Select secondary font style	71
<ESC> )s n T	Select secondary font typeface	73
<ESC> )s n V	Select secondary font height	71
<ESC> )s n W	Download font descriptor	80
<ESC> *b n M	Set compression mode	84
<ESC> *b n W	Transfer raster graphics data	84
<ESC> *c n A	Define horizontal rectangle size in dots	86
<ESC> *c n B	Define vertical rectangle size in dots	86
<ESC> *c n D	Specify font ID	80
<ESC> *c n E	Specify character code	81
<ESC> *c n F	Font control	75
<ESC> *c n G	Specify pattern ID	87
<ESC> *c n H	Define horizontal rectangle size in decipoints	86
<ESC> *c n P	Print specified pattern	88
<ESC> *c n V	Define vertical rectangle size in decipoints	86
<ESC> *p n X	Position horizontal cursor in dots	57
<ESC> *p n Y	Position vertical cursor in dots	59
<ESC> *r B	End raster graphics	85
<ESC> *r n A	Start raster graphics	84
<ESC> *r n F	Specify the presentation of raster graphics	83
<ESC> *t n R	Select raster graphics resolution	83
<ESC> 9	Clear left and right margins	52
<ESC> =	Half line feed	60
<ESC> E	Reset the printer	48

<i>Command</i>	<i>Function</i>	<i>Page</i>
<ESC> Y	Enable display function	75
<ESC> Z	Disable display function	75
<ESC> [ C <i>n</i>	Select paper feeder	29
<ESC> [ E <i>n</i>	Change emulation mode	28
<ESC> [ O <i>n</i>	Select orientation	28
<ESC> [ S <i>n</i>	Select paper size	29
<ESC> z	Self test	47

## **6.1.2 Epson FX-850 Emulation Printer Commands**

<i>Command</i>	<i>Function</i>	<i>Page</i>
<BEL>	Bell	95
<BS>	Backspace	99
<HT>	Horizontal tab	103
<LF>	Line feed	100
<VT>	Vertical tab	103
<FF>	Form feed	100
<CR>	Carriage return	100
<SO>	Select extended print	109
<SP>	Space	99
<SI>	Select condensed print	109
<DC1>	Set printer on line	95
<DC2>	Cancel condensed print	109
<DC3>	Set printer off line	95
<DC4>	Cancel extended print	109
<CAN>	Cancel line	112
<DEL>	Delete last character	112
<ESC> <SO>	Select extended print	109
<ESC> <SI>	Select condensed print	109
<ESC> <SP> <i>n</i>	Increase character spacing	108
<ESC> ! <i>n</i>	Select master print mode	111
<ESC> #	Cancel MSB control	107
<ESC> \$ <i>n1 n2</i>	Move cursor to absolute dot position	101
<ESC> * <i>m n1 n2</i>	Select graphics mode	115
<ESC> - <i>n</i>	Select/cancel underlining	111
<ESC> / <i>c</i>	Select vertical tab channel	104
<ESC> 0	Set line spacing to 1/8 inch	99
<ESC> 1	Set line spacing to 7/72 inch	99
<ESC> 2	Set line spacing to 1/6 inch	99
<ESC> 3 <i>n</i>	Set line spacing to <i>n</i> /216 inch	99



<i>Command</i>	<i>Function</i>	<i>Page</i>
<ESC> 4	Select italic characters	110
<ESC> 5	Select upright characters	110
<ESC> <	One-line unidirectional printing	101
<ESC> =	Set MSB of received codes to be 0	107
<ESC> >	Set MSB of received codes to be 1	107
<ESC> ? c m	Assign graphics mode	116
<ESC> @	Reset the printer	95
<ESC> A n	Set line spacing to n/72 inch	99
<ESC> B n1 n2...<NUL>	Set vertical tab stops	103
<ESC> C <NUL> n	Set page length in inches	96
<ESC> C n	Set page length in lines	96
<ESC> D n1 n2...<NUL>	Set horizontal tab stops	103
<ESC> E	Emphasized print	110
<ESC> F	Cancel emphasized print	110
<ESC> G	Double-strike print	110
<ESC> H	Cancel double-strike print	110
<ESC> J n	Perform one n/216-inch line feed	100
<ESC> K n1 n2	Select normal density graphics	114
<ESC> L n1 n2	Select double density graphics	115
<ESC> M	Select elite pitch	108
<ESC> N n	Set bottom margin	96
<ESC> O	Clear bottom margin	97
<ESC> P	Select pica pitch	108
<ESC> Q n	Set right margin	98
<ESC> R n	Select international character set	105
<ESC> S n	Select super/subscript mode	112
<ESC> T	Cancel super/subscript mode	112
<ESC> W n	Select/cancel extended print	109
<ESC> Y n1 n2	Select high-speed double density graphics	115
<ESC> Z n1 n2	Select quadruple density graphics	115
<ESC> [ C n	Select paper feeder	29
<ESC> [ E n	Change emulation mode	28
<ESC> [ O n	Select orientation	28
<ESC> [ S n	Select paper size	29
<ESC> \ n1 n2	Move cursor to relative dot position	102
<ESC> ^ d n1 n2	Set 9-pin graphics mode	117
<ESC> a n	Select justification	98
<ESC> b c n1 n2...<NUL>	Set vertical tab stops in channel	104
<ESC> j n	Perform one n/216-inch reverse line feed	100

<i>Command</i>	<i>Function</i>	<i>Page</i>
<ESC> l n	Set left margin	98
<ESC> p n	Select/cancel proportional spacing	107
<ESC> t n	Select character set	105
<ESC> w n	Select/cancel double-height characters	109

## 6.2 SYMBOL SETS

This section gives tables of the symbol sets for the Star LaserPrinter 4. The decimal character code of each character is shown in an inset to the lower right of the character.

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

Control codes recognized by this printer are indicated by abbreviations inside pointed brackets <>.

ID Number	Symbol Name							
0D	ISO 60:							
	0	1	2	3	4	5	6	7
0	<NUL> 0			0	@	P	`	p
1		<DC1> 1	!	1	A	Q	a	q
2		<DC2> 2	"	2	B	R	b	r
3		<DC3> 3	#	3	C	S	c	

Hexadecimal value (high order) (points to column header)  
 Character (points to 'A')  
 Control code (points to <DC1>)  
 Decimal value (points to 65)  
 Hexadecimal value (low order) (points to 41)

ID Number

Symbol Name

0D

ISO 60: Norwegian

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	<DC1> 1	17	!	1 49	A 65	Q 81	a 97	q 113
2	<DC2> 2	18	"	2 50	B 66	R 82	b 98	r 114
3	<DC3> 3	19	#	3 51	C 67	S 83	c 99	s 115
4	<DC4> 4	20	\$	4 52	D 68	T 84	d 100	t 116
5	5	21	%	5 53	E 69	U 85	e 101	u 117
6	6	22	&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7	23	'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8	<CAN> 24	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9	<EM> 25	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10	<SUB> 26	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11	<ESC> 27	+	; 59	K 75	Æ 91	k 107	æ 123
C	<FF> 12	28	,	< 60	L 76	Ø 92	l 108	ø 124
D	<CR> 13	29	-	= 61	M 77	Å 93	m 109	å 125
E	<SO> 14	<RS> 30	.	> 62	N 78	~ 94	n 110	~ 126
F	<SI> 15	<US> 31	/	? 63	O 79	- 95	o 111	• 127

ID Number      Symbol Name

0E                      Roman Extension

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	48	â	À	Á	Ð
1	<DC1> 1	17	33	49	ë	î	Ă	þ
2	<DC2> 2	18	34	50	ö	ø	ã	·
3	<DC3> 3	19	35	51	û	Æ	Ð	μ
4	<DC4> 4	20	36	52	á	à	ø	¶
5	5	21	37	53	é	í	Í	‡
6	6	22	38	54	ó	ø	Ï	-
7	<BEL> 7	23	39	55	ú	æ	Ó	‡
8	<BS> 8	<CAN> 24	40	56	à	Ä	Ò	‡
9	<HT> 9	<EM> 25	41	57	è	ì	Ï	ª
A	<LF> 10	<SUB> 26	42	58	ò	Ö	ö	º
B	<VT> 11	<ESC> 27	43	59	ù	Ü	Š	«
C	<FF> 12	28	44	60	ä	É	š	■
D	<CR> 13	29	45	61	ë	ï	Ú	»
E	<SO> 14	<RS> 30	46	62	ö	ß	ÿ	±
F	<SI> 15	<US> 31	47	63	ü	Ï	ÿ	

ID Number

Symbol Name

OF

ISO 25: French

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	à 64	P 80	` 96	p 112
1		<DC1> 1 17 33 49	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	" 34	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	£ 35	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	\$ 36	4 52	D 68	T 84	d 100	t 116
5			% 37	5 53	E 69	U 85	e 101	u 117
6			& 38	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		' 39	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> 24 40	( 40	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> 25 41	) 41	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> 26 42	* 42	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> 27 43	+ 43	; 59	K 75	° 91	k 107	é 123
C	<FF> 12 28 44 60		' 44	< 60	L 76	ç 92	l 108	ù 124
D	<CR> 13 29 45 61		- 45	= 61	M 77	§ 93	m 109	è 125
E	<SO> 14 30 46 62	<RS> 30 46	· 46	> 62	N 78	ˆ 94	n 110	¨ 126
F	<SI> 15 31 47 63	<US> 31 47	/ 47	? 63	O 79	— 95	o 111	• 127

ID Number      Symbol Name

OG

HP German

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48 64 80 96 p 112			0	§	P		p
1	<DC1> 1 17 33 49 65 81 97 q 113	!	1	A	Q	a	q	
2	<DC2> 2 18 34 50 66 82 98 r 114	"	2	B	R	b	r	
3	<DC3> 3 19 35 51 67 83 99 s 115	£	3	C	S	c	s	
4	<DC4> 4 20 36 52 68 84 100 t 116	\$	4	D	T	d	t	
5	5 21 37 53 69 85 101 u 117	%	5	E	U	e	u	
6	6 22 38 54 70 86 102 v 118	&	6	F	V	f	v	
7	<BEL> 7 23 39 55 71 87 103 w 119	'	7	G	W	g	w	
8	<BS>      <CAN> 8 24 40 56 72 88 104 x 120	(	8	H	X	h	x	
9	<HT>      <EM> 9 25 41 57 73 89 105 y 121	)	9	I	Y	i	y	
A	<LF>      <SUB> 10 26 42 58 74 90 106 z 122	*	:	J	Z	j	z	
B	<VT>      <ESC> 11 27 43 59 75 91 107 ä 123	+	;	K	Ä	k	ä	
C	<FF> 12 28 44 60 76 92 108 ö 124	,	<	L	Ö	l	ö	
D	<CR> 13 29 45 61 77 93 109 ü 125	-	=	M	Ü	m	ü	
E	<SO>      <RS> 14 30 46 62 78 94 110 ß 126	.	>	N	~	n	ß	
F	<SI>      <US> 15 31 47 63 79 95 111 * 127	/	?	O	-	o	*	





ID Number      Symbol Name

OK

JIS ASCII

	0	1	2	3	4	5	6	7
0	<NUL> 0      16      32      48			0      48	@      64	P      80	`      96	p      112
1		<DC1> 1      17      33	!	1      49	A      65	Q      81	a      97	q      113
2		<DC2> 2      18      34	"	2      50	B      66	R      82	b      98	r      114
3		<DC3> 3      19      35	#	3      51	C      67	S      83	c      99	s      115
4		<DC4> 4      20      36	\$	4      52	D      68	T      84	d      100	t      116
5			%	5      53	E      69	U      85	e      101	u      117
6			&	6      54	F      70	V      86	f      102	v      118
7	<BEL> 7      23		'	7      55	G      71	W      87	g      103	w      119
8	<BS> 8      24	<CAN> (		8      56	H      72	X      88	h      104	x      120
9	<HT> 9      25	<EM> )		9      57	I      73	Y      89	i      105	y      121
A	<LF> 10      26	<SUB> *	:	58	J      74	Z      90	j      106	z      122
B	<VT> 11      27	<ESC> +	;	59	K      75	[      91	k      107	{      123
C	<FF> 12      28		,	60	L      76	¥      92	l      108	124
D	<CR> 13      29		-	61	M      77	]      93	m      109	}      125
E	<SO> 14      30	<RS> .	>	62	N      78	^      94	n      110	~      126
F	<SI> 15      31	<US> /	?	63	O      79	_      95	o      111	*      127

ID Number

Symbol Name

0N

ECMA-94 Latin 1

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	@ 64	P 80	` 96	p 112
1		<DC1> 1 17 33	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34	" 34	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35	# 35	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36	\$ 36	4 52	D 68	T 84	d 100	t 116
5			% 37	5 53	E 69	U 85	e 101	u 117
6			& 38	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39		' 39	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40	<CAN> 24 40	( 40	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41	<EM> 25 41	) 41	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42	<SUB> 26 42	* 42	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43	<ESC> 27 43	+ 43	; 59	K 75	[ 91	k 107	{ 123
C	<FF> 12 28 44		, 44	< 60	L 76	\ 92	l 108	124
D	<CR> 13 29 45		- 45	= 61	M 77	] 93	m 109	} 125
E	<SO> 14 30 46	<RS> 30 46	. 46	> 62	N 78	^ 94	n 110	~ 126
F	<SI> 15 31 47	<US> 31 47	/ 47	? 63	O 79	_ 95	o 111	* 127

ID Number

Symbol Name

ON

ECMA-94 Latin 1  
(cont.)

	8	9	A	B	C	D	E	F
0	128	144	160	° 176	À 192	Ð 208	à 224	ð 240
1	129	145	í 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	130	146	ç 162	² 178	Â 194	Ò 210	â 226	ò 242
3	131	147	é 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	132	148	α 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	133	149	¥ 165	μ 181	Å 197	Õ 213	å 229	ö 245
6	134	150	¡ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	135	151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	136	152	¨ 168	• 184	È 200	Ø 216	è 232	ø 248
9	137	153	© 169	´ 185	É 201	Û 217	é 233	ù 249
A	138	154	ª 170	º 186	Ê 202	Ü 218	ê 234	ú 250
B	139	155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	140	156	¬ 172	‡ 188	Ï 204	Ü 220	ï 236	ü 252
D	141	157	– 173	‡ 189	Í 205	Ý 221	í 237	ý 253
E	142	158	® 174	‡ 190	Î 206	Þ 222	î 238	þ 254
F	143	159	— 175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

ID Number

Symbol Name

05

ISO 11: Swedish

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	É 64	P 80	é 96	p 112
1		<DC1> 1 17 33 49	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	" 34	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	# 35	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	¤ 36	4 52	D 68	T 84	d 100	t 116
5			% 37	5 53	E 69	U 85	e 101	u 117
6			& 38	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		' 39	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> 24 40	( 40	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> 25 41	) 41	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> 26 42	* 42	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> 27 43	+ 43	; 59	K 75	Ä 91	k 107	ä 123
C	<FF> 12 28 44 60		, 44	< 60	L 76	Ö 92	l 108	ö 124
D	<CR> 13 29 45 61		- 45	= 61	M 77	Å 93	m 109	å 125
E	<SO> 14 30 46 62	<RS> 30 46	. 46	> 62	N 78	Û 94	n 110	ü 126
F	<SI> 15 31 47 63	<US> 31 47	/ 47	? 63	O 79	— 95	o 111	• 127

ID Number      Symbol Name

OU

US-ASCII

	0	1	2	3	4	5	6	7
0	<NUL> 0      16      32	0      48	@      64	P      80	'      96	p      112		
1	<DC1> 1      17      33	!	1      49	A      65	Q      81	a      97	q      113	
2	<DC2> 2      18      34	"	2      50	B      66	R      82	b      98	r      114	
3	<DC3> 3      19      35	#	3      51	C      67	S      83	c      99	s      115	
4	<DC4> 4      20      36	\$	4      52	D      68	T      84	d      100	t      116	
5	5      21      37	%	5      53	E      69	U      85	e      101	u      117	
6	6      22      38	&	6      54	F      70	V      86	f      102	v      118	
7	<BEL> 7      23      39	'	7      55	G      71	W      87	g      103	w      119	
8	<BS>      <CAN> 8      24      40	(	8      56	H      72	X      88	h      104	x      120	
9	<HT>      <EM> 9      25      41	)	9      57	I      73	Y      89	i      105	y      121	
A	<LF>      <SUB> 10      26      42	*	:      58	J      74	Z      90	j      106	z      122	
B	<VT>      <ESC> 11      27      43	+	;      59	K      75	[      91	k      107	{      123	
C	<FF> 12      28      44	,	<      60	L      76	\      92	l      108	124	
D	<CR> 13      29      45	-	=      61	M      77	]      93	m      109	}      125	
E	<SO>      <RS> 14      30      46	.	>      62	N      78	^      94	n      110	~      126	
F	<SI>      <US> 15      31      47	/	?      63	O      79	_      95	o      111	*      127	

ID Number

Symbol Name

1D

ISO 61: Norwegian

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	@ 64	P 80	` 96	p 112
1		<DC1> 1 17 33 49	!	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	"	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	\$	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	\$	4 52	D 68	T 84	d 100	t 116
5			%	5 53	E 69	U 85	e 101	u 117
6			&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> ( 40	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> ) 41	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> * 42	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> + 43	+	; 59	K 75	Æ 91	k 107	æ 123
C	<FF> 12 28 44 60		'	< 60	L 76	Ø 92	l 108	ø 124
D	<CR> 13 29 45 61		-	= 61	M 77	Å 93	m 109	å 125
E	<SO> 14 30 46 62	<RS> · 46	·	> 62	N 78	ˆ 94	n 110	126
F	<SI> 15 31 47 63	<US> / 47	/	? 63	O 79	- 95	o 111	• 127

ID Number      Symbol Name

1E

ISO UK

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48 @ 64 P 80 96 p 112			0 48	@ 64	P 80	` 96	p 112
1		<DC1> 1 17 33 49	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	" 34	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	£ 35	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	\$ 36	4 52	D 68	T 84	d 100	t 116
5			% 37	5 53	E 69	U 85	e 101	u 117
6			& 38	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		' 39	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> 24 40	( 40	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> 25 41	) 41	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> 26 42	* 42	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> 27 43	+ 43	; 59	K 75	[ 91	k 107	{ 123
C	<FF> 12 28 44 60		, 44	< 60	L 76	\ 92	l 108	124
D	<CR> 13 29 45 61		- 45	= 61	M 77	] 93	m 109	} 125
E	<SO> 14 30 46 62	<RS> 30 46	. 46	> 62	N 78	^ 94	n 110	~ 126
F	<SI> 15 31 47 63	<US> 31 47	/ 47	? 63	O 79	_ 95	o 111	* 127

ID Number

Symbol Name

1F

ISO 69: French

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0 48	à 64	P 80	µ 96	p 112
1	1	<DC1> 17	!	1 49	A 65	Q 81	a 97	q 113
2	2	<DC2> 18	"	2 50	B 66	R 82	b 98	r 114
3	3	<DC3> 19	£	3 51	C 67	S 83	c 99	s 115
4	4	<DC4> 20	\$	4 52	D 68	T 84	d 100	t 116
5	5	21	%	5 53	E 69	U 85	e 101	u 117
6	6	22	&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7	23	'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8	<CAN> 24	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9	<EM> 25	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10	<SUB> 26	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11	<ESC> 27	+	; 59	K 75	° 91	k 107	é 123
C	<FF> 12	28	,	< 60	L 76	ç 92	l 108	ù 124
D	<CR> 13	29	-	= 61	M 77	§ 93	m 109	è 125
E	<SO> 14	<RS> 30	.	> 62	N 78	^ 94	n 110	¨ 126
F	<SI> 15	<US> 31	/	? 63	O 79	- 95	o 111	• 127



ID Number

Symbol Name

1G

ISO 21: German

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	§ 64	P 80	· 96	p 112
1		<DC1> 1 17 33 49	! 33	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	" 34	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	# 35	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	\$ 36	4 52	D 68	T 84	d 100	t 116
5			% 37	5 53	E 69	U 85	e 101	u 117
6			& 38	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		' 39	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> 24 40	( 40	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> 25 41	) 41	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> 26 42	* 42	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> 27 43	+ 43	; 59	K 75	Ä 91	k 107	ä 123
C	<FF> 12 28 44 60		, 44	< 60	L 76	Ö 92	l 108	ö 124
D	<CR> 13 29 45 61		- 45	= 61	M 77	Ü 93	m 109	ü 125
E	<SO> 14 30 46 62	<RS> 30 46	· 46	> 62	N 78	~ 94	n 110	ß 126
F	<SI> 15 31 47 63	<US> 31 47	/ 47	? 63	O 79	— 95	o 111	• 127

ID Number

Symbol Name

1S

HP Spanish

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	<DC1> 1	17	!	1 49	A 65	Q 81	a 97	q 113
2	<DC2> 2	18	"	2 50	B 66	R 82	b 98	r 114
3	<DC3> 3	19	#	3 51	C 67	S 83	c 99	s 115
4	<DC4> 4	20	\$	4 52	D 68	T 84	d 100	t 116
5		21	%	5 53	E 69	U 85	e 101	u 117
6		22	&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7	23	'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8	<CAN> 24	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9	<EM> 25	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10	<SUB> 26	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11	<ESC> 27	+	; 59	K 75	i 91	k 107	{ 123
C	<FF> 12		,	< 60	L 76	Ñ 92	l 108	ñ 124
D	<CR> 13		-	= 61	M 77	¿ 93	m 109	} 125
E	<SO> 14	<RS> 30	.	> 62	N 78	° 94	n 110	~ 126
F	<SI> 15	<US> 31	/	? 63	O 79	- 95	o 111	* 127

ID Number

Symbol Name

2K

ISO 57: Chinese

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	@ 64	P 80	` 96	p 112
1		<DC1> 1 17 33	!	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34	"	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35	#	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36	¥	4 52	D 68	T 84	d 100	t 116
5			%	5 53	E 69	U 85	e 101	u 117
6			&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39		'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40	<CAN> (		8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41	<EM> )		9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42	<SUB> *	:	58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43	<ESC> +	;	59	K 75	[ 91	k 107	{ 123
C	<FF> 12 28 44		<	60	L 76	\ 92	l 108	124
D	<CR> 13 29 45		-	61	M 77	] 93	m 109	} 125
E	<SO> 14 30 46	<RS> .	>	62	N 78	^ 94	n 110	~ 126
F	<SI> 15 31 47	<US> /	?	63	O 79	_ 95	o 111	* 127

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0 48	§ 64	P 80	` 96	p 112
1	1	<DC1> 17	!	1 49	A 65	Q 81	a 97	q 113
2	2	<DC2> 18	"	2 50	B 66	R 82	b 98	r 114
3	3	<DC3> 19	£	3 51	C 67	S 83	c 99	s 115
4	4	<DC4> 20	\$	4 52	D 68	T 84	d 100	t 116
5	5	21	%	5 53	E 69	U 85	e 101	u 117
6	6	22	&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7	23	'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8	<CAN> 24	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9	<EM> 25	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10	<SUB> 26	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11	<ESC> 27	+	; 59	K 75	i 91	k 107	° 123
C	<FF> 12	28	,	< 60	L 76	Ñ 92	l 108	ñ 124
D	<CR> 13	29	-	= 61	M 77	¿ 93	m 109	Ç 125
E	<SO> 14	<RS> 30	.	> 62	N 78	ˆ 94	n 110	˜ 126
F	<SI> 15	<US> 31	/	? 63	O 79	- 95	o 111	• 127

ID Number      Symbol Name

2U

ISO IRV

	0	1	2	3	4	5	6	7
0	<NUL> 0	16 32	0 48	@ 64	P 80	` 96	p 112	
1	<DC1> 1	! 17 33	1 49	A 65	Q 81	a 97	q 113	
2	<DC2> 2	" 18 34	2 50	B 66	R 82	b 98	r 114	
3	<DC3> 3	# 19 35	3 51	C 67	S 83	c 99	s 115	
4	<DC4> 4	¤ 20 36	4 52	D 68	T 84	d 100	t 116	
5		% 21 37	5 53	E 69	U 85	e 101	u 117	
6		& 22 38	6 54	F 70	V 86	f 102	v 118	
7	<BEL> 7	' 23 39	7 55	G 71	W 87	g 103	w 119	
8	<BS> 8	<CAN> ( 24 40	8 56	H 72	X 88	h 104	x 120	
9	<HT> 9	<EM> ) 25 41	9 57	I 73	Y 89	i 105	y 121	
A	<LF> 10	<SUB> * 26 42	: 58	J 74	Z 90	j 106	z 122	
B	<VT> 11	<ESC> + 27 43	; 59	K 75	[ 91	k 107	{ 123	
C	<FF> 12	' 28 44	< 60	L 76	\ 92	l 108	 124	
D	<CR> 13	- 29 45	= 61	M 77	] 93	m 109	} 125	
E	<SO> 14	<RS> · 30 46	> 62	N 78	~ 94	n 110	~ 126	
F	<SI> 15	<US> / 31 47	? 63	O 79	- 95	o 111	* 127	

3S

ISO 10: Swedish

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	1	<DC1> 17	!	1 49	A 65	Q 81	a 97	q 113
2	2	<DC2> 18	"	2 50	B 66	R 82	b 98	r 114
3	3	<DC3> 19	#	3 51	C 67	S 83	c 99	s 115
4	4	<DC4> 20	α	4 52	D 68	T 84	d 100	t 116
5	5	21	%	5 53	E 69	U 85	e 101	u 117
6	6	22	&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7	23	'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8	<CAN> 24	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9	<EM> 25	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10	<SUB> 26	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11	<ESC> 27	+	; 59	K 75	Ä 91	k 107	ä 123
C	<FF> 12	28	,	< 60	L 76	Ö 92	l 108	ö 124
D	<CR> 13	29	-	= 61	M 77	Å 93	m 109	å 125
E	<SO> 14	<RS> 30	.	> 62	N 78	ˆ 94	n 110	ˆ 126
F	<SI> 15	<US> 31	/	? 63	O 79	— 95	o 111	• 127

	0	1	2	3	4	5	6	7		
0	<NUL> 0	16	32	0	48	Ş	P	·	p	
1	1	<DC1> 17	!	33	1	49	A	Q	a	q
2	2	<DC2> 18	"	34	2	50	B	R	b	r
3	3	<DC3> 19	#	35	3	51	C	S	c	s
4	4	<DC4> 20	\$	36	4	52	D	T	d	t
5	5	21	%	37	5	53	E	U	e	u
6	6	22	&	38	6	54	F	V	f	v
7	<BEL> 7	23	'	39	7	55	G	W	g	w
8	<BS> 8	<CAN> 24	(	40	8	56	H	X	h	x
9	<HT> 9	<EM> 25	)	41	9	57	I	Y	i	y
A	<LF> 10	<SUB> 26	*	42	:	58	J	Z	j	z
B	<VT> 11	<ESC> 27	+	43	;	59	K	Å	k	å
C	<FF> 12	28	,	44	<	60	L	Ç	l	ç
D	<CR> 13	29	-	45	=	61	M	Ö	m	ö
E	<SO> 14	<RS> 30	.	46	>	62	N	^	n	°
F	<SI> 15	<US> 31	/	47	?	63	O	-	o	•

	0	1	2	3	4	5	6	7
0	<NUL> 0	16	32	48	64	80	96	p 112
1	<DC1> 1	!	33	49	A	65	81	a 97
2	<DC2> 2	"	34	50	B	66	82	b 98
3	<DC3> 3	#	35	51	C	67	83	c 99
4	<DC4> 4	\$	36	52	D	68	84	d 100
5	5	%	37	53	E	69	85	e 101
6	6	&	38	54	F	70	86	f 102
7	<BEL> 7	'	39	55	G	71	87	g 103
8	<BS> 8	<CAN> (	40	56	H	72	88	h 104
9	<HT> 9	<EM> )	41	57	I	73	89	i 105
A	<LF> 10	<SUB> *	42	58	J	74	90	j 106
B	<VT> 11	<ESC> +	43	59	K	75	91	k 107
C	<FF> 12	'	44	60	L	76	92	l 108
D	<CR> 13	-	45	61	M	77	93	m 109
E	<SO> 14	<RS> .	46	62	N	78	94	n 110
F	<SI> 15	<US> /	47	63	O	79	95	o 111
								 112
								q 113
								r 114
								s 115
								t 116
								u 117
								v 118
								w 119
								x 120
								y 121
								z 122
								 123
								 124
								 125
								 126
								 127



	0	1	2	3	4	5	6	7
0	<NUL> 0      16      32		0      48	·      64	P      80	´      96	p      112	
1		<DC1> 1      17      33	!	1      49	A      65	Q      81	a      97	q      113
2		<DC2> 2      18      34	"	2      50	B      66	R      82	b      98	r      114
3		<DC3> 3      19      35	#	3      51	C      67	S      83	c      99	s      115
4		<DC4> 4      20      36	\$	4      52	D      68	T      84	d      100	t      116
5			%	5      53	E      69	U      85	e      101	u      117
6			&	6      54	F      70	V      86	f      102	v      118
7	<BEL> 7      23		'	7      55	G      71	W      87	g      103	w      119
8	<BS> 8      24	<CAN> (      40		8      56	H      72	X      88	h      104	x      120
9	<HT> 9      25	<EM> )      41		9      57	I      73	Y      89	i      105	y      121
A	<LF> 10      26	<SUB> *      42		:      58	J      74	Z      90	j      106	z      122
B	<VT> 11      27	<ESC> +      43		;      59	K      75	ı      91	k      107	·      123
C	<FF> 12      28		'	<      60	L      76	Ñ      92	l      108	ñ      124
D	<CR> 13      29		-	=      61	M      77	Ç      93	m      109	ç      125
E	<SO> 14      30	<RS> ·      46		>      62	N      78	¿      94	n      110	¨      126
F	<SI> 15      31	<US> /      47		?      63	O      79	-      95	o      111	*      127

ID Number

Symbol Name

8U

Roman-8

	0	1	2	3	4	5	6	7
0	<NUL> 0 16 32 48			0 48	@ 64	P 80	' 96	p 112
1		<DC1> 1 17 33 49	!	1 49	A 65	Q 81	a 97	q 113
2		<DC2> 2 18 34 50	"	2 50	B 66	R 82	b 98	r 114
3		<DC3> 3 19 35 51	#	3 51	C 67	S 83	c 99	s 115
4		<DC4> 4 20 36 52	\$	4 52	D 68	T 84	d 100	t 116
5			%	5 53	E 69	U 85	e 101	u 117
6			&	6 54	F 70	V 86	f 102	v 118
7	<BEL> 7 23 39 55		'	7 55	G 71	W 87	g 103	w 119
8	<BS> 8 24 40 56	<CAN> ( 40	(	8 56	H 72	X 88	h 104	x 120
9	<HT> 9 25 41 57	<EM> ) 41	)	9 57	I 73	Y 89	i 105	y 121
A	<LF> 10 26 42 58	<SUB> * 42	*	: 58	J 74	Z 90	j 106	z 122
B	<VT> 11 27 43 59	<ESC> + 43	+	; 59	K 75	[ 91	k 107	{ 123
C	<FF> 12 28 44 60		,	< 60	L 76	\ 92	l 108	124
D	<CR> 13 29 45 61		-	= 61	M 77	] 93	m 109	} 125
E	<SO> 14 30 46 62	<RS> . 46	.	> 62	N 78	^ 94	n 110	~ 126
F	<SI> 15 31 47 63	<US> / 47	/	? 63	O 79	_ 95	o 111	* 127

ID Number      Symbol Name

8U

Roman-8  
(cont.)

	8	9	A	B	C	D	E	F
0	128	144	160	176	192	208	224	240
1	129	145	À	Á	â	Ã	Ä	Å
2	130	146	Â	Ã	ô	Ø	ǎ	
3	131	147	È	É	û	Æ	Ð	μ
4	132	148	Ê	Ç	á	à	ø	¶
5	133	149	Ë	Ç	é	í	í	‡
6	134	150	Î	Ñ	ó	ø	Ï	-
7	135	151	Ï	ñ	ú	æ	Ó	‡
8	136	152	ˆ	ı	à	Ä	Ò	‡
9	137	153	˘	ı	è	ı	Õ	ª
A	138	154	˘	ı	ò	Ö	ö	º
B	139	155	˘	£	ù	Û	Š	«
C	140	156	˘	¥	ä	É	š	■
D	141	157	Û	§	ë	ï	Ú	»
E	142	158	Û	f	ö	ß	Ÿ	±
F	143	159	£	ç	ü	Ö	ÿ	255

ID Number

Symbol Name








10U

IBM-PC(US)

	0	1	2	3	4	5	6	7
0	0	▶		0	@	P	`	p
1	☺	◀	!	1	A	Q	a	q
2	●	†	"	2	B	R	b	r
3	♥	!!	#	3	C	S	c	s
4	♦	‡	\$	4	D	T	d	t
5	♣	§	%	5	E	U	e	u
6	♠	-	&	6	F	V	f	v
7	•	‡	'	7	G	W	g	w
8	■	↑	(	8	H	X	h	x
9	○	↓	)	9	I	Y	i	y
A	◼	→	*	:	J	Z	j	z
B	♂	←	+	;	K	[	k	{
C	♀	—	,	<	L	\	l	
D	♪	↔	-	=	M	}	m	}
E	♫	▲	.	>	N	^	n	~
F	※	▼	/	?	O	—	o	※

10U

IBM-PC (US)  
(cont.)

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

ID Number

Symbol Name

11U




IBM-PC (Denmark/Norway)

	0	1	2	3	4	5	6	7
0	◻ <sub>0</sub>	▶◻ <sub>16</sub>	◻ <sub>32</sub>	0◻ <sub>48</sub>	@◻ <sub>64</sub>	P◻ <sub>80</sub>	◻ <sub>96</sub>	p◻ <sub>112</sub>
1	☺◻ <sub>1</sub>	◀◻ <sub>17</sub>	!◻ <sub>33</sub>	1◻ <sub>49</sub>	A◻ <sub>65</sub>	Q◻ <sub>81</sub>	a◻ <sub>97</sub>	q◻ <sub>113</sub>
2	●◻ <sub>2</sub>	↓◻ <sub>18</sub>	"◻ <sub>34</sub>	2◻ <sub>50</sub>	B◻ <sub>66</sub>	R◻ <sub>82</sub>	b◻ <sub>98</sub>	r◻ <sub>114</sub>
3	♥◻ <sub>3</sub>	!!◻ <sub>19</sub>	#◻ <sub>35</sub>	3◻ <sub>51</sub>	C◻ <sub>67</sub>	S◻ <sub>83</sub>	c◻ <sub>99</sub>	s◻ <sub>115</sub>
4	♦◻ <sub>4</sub>	¶◻ <sub>20</sub>	\$◻ <sub>36</sub>	4◻ <sub>52</sub>	D◻ <sub>68</sub>	T◻ <sub>84</sub>	d◻ <sub>100</sub>	t◻ <sub>116</sub>
5	♣◻ <sub>5</sub>	§◻ <sub>21</sub>	%◻ <sub>37</sub>	5◻ <sub>53</sub>	E◻ <sub>69</sub>	U◻ <sub>85</sub>	e◻ <sub>101</sub>	u◻ <sub>117</sub>
6	♠◻ <sub>6</sub>	-◻ <sub>22</sub>	&◻ <sub>38</sub>	6◻ <sub>54</sub>	F◻ <sub>70</sub>	V◻ <sub>86</sub>	f◻ <sub>102</sub>	v◻ <sub>118</sub>
7	•◻ <sub>7</sub>	‡◻ <sub>23</sub>	'◻ <sub>39</sub>	7◻ <sub>55</sub>	G◻ <sub>71</sub>	W◻ <sub>87</sub>	g◻ <sub>103</sub>	w◻ <sub>119</sub>
8	■◻ <sub>8</sub>	↑◻ <sub>24</sub>	(◻ <sub>40</sub>	8◻ <sub>56</sub>	H◻ <sub>72</sub>	X◻ <sub>88</sub>	h◻ <sub>104</sub>	x◻ <sub>120</sub>
9	○◻ <sub>9</sub>	↓◻ <sub>25</sub>	)◻ <sub>41</sub>	9◻ <sub>57</sub>	I◻ <sub>73</sub>	Y◻ <sub>89</sub>	i◻ <sub>105</sub>	y◻ <sub>121</sub>
A	◼◻ <sub>10</sub>	→◻ <sub>26</sub>	*◻ <sub>42</sub>	:◻ <sub>58</sub>	J◻ <sub>74</sub>	Z◻ <sub>90</sub>	j◻ <sub>106</sub>	z◻ <sub>122</sub>
B	♂◻ <sub>11</sub>	←◻ <sub>27</sub>	+◻ <sub>43</sub>	;◻ <sub>59</sub>	K◻ <sub>75</sub>	[◻ <sub>91</sub>	k◻ <sub>107</sub>	{◻ <sub>123</sub>
C	♀◻ <sub>12</sub>	┌◻ <sub>28</sub>	'◻ <sub>44</sub>	<◻ <sub>60</sub>	L◻ <sub>76</sub>	\◻ <sub>92</sub>	l◻ <sub>108</sub>	◻ <sub>124</sub>
D	♪◻ <sub>13</sub>	↔◻ <sub>29</sub>	-◻ <sub>45</sub>	=◻ <sub>61</sub>	M◻ <sub>77</sub>	]◻ <sub>93</sub>	m◻ <sub>109</sub>	}◻ <sub>125</sub>
E	♫◻ <sub>14</sub>	▲◻ <sub>30</sub>	•◻ <sub>46</sub>	>◻ <sub>62</sub>	N◻ <sub>78</sub>	ˆ◻ <sub>94</sub>	n◻ <sub>110</sub>	˜◻ <sub>126</sub>
F	✳◻ <sub>15</sub>	▼◻ <sub>31</sub>	/◻ <sub>47</sub>	?◻ <sub>63</sub>	O◻ <sub>79</sub>	-◻ <sub>95</sub>	o◻ <sub>111</sub>	✳◻ <sub>127</sub>

ID Number      Symbol Name

11U

IBM-PC (Denmark/Norway)  
(cont.)

	8	9	A	B	C	D	E	F
0	Ç <span style="border: 1px solid black; padding: 0 2px;">128</span>	É <span style="border: 1px solid black; padding: 0 2px;">144</span>	á <span style="border: 1px solid black; padding: 0 2px;">160</span>	 <span style="border: 1px solid black; padding: 0 2px;">176</span>	L <span style="border: 1px solid black; padding: 0 2px;">192</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">208</span>	α <span style="border: 1px solid black; padding: 0 2px;">224</span>	≡ <span style="border: 1px solid black; padding: 0 2px;">240</span>
1	ü <span style="border: 1px solid black; padding: 0 2px;">129</span>	æ <span style="border: 1px solid black; padding: 0 2px;">145</span>	í <span style="border: 1px solid black; padding: 0 2px;">161</span>	 <span style="border: 1px solid black; padding: 0 2px;">177</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">193</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">209</span>	β <span style="border: 1px solid black; padding: 0 2px;">225</span>	± <span style="border: 1px solid black; padding: 0 2px;">241</span>
2	é <span style="border: 1px solid black; padding: 0 2px;">130</span>	Æ <span style="border: 1px solid black; padding: 0 2px;">146</span>	ó <span style="border: 1px solid black; padding: 0 2px;">162</span>	 <span style="border: 1px solid black; padding: 0 2px;">178</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">194</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">210</span>	Γ <span style="border: 1px solid black; padding: 0 2px;">226</span>	≥ <span style="border: 1px solid black; padding: 0 2px;">242</span>
3	ā <span style="border: 1px solid black; padding: 0 2px;">131</span>	ō <span style="border: 1px solid black; padding: 0 2px;">147</span>	ú <span style="border: 1px solid black; padding: 0 2px;">163</span>	<span style="border: 1px solid black; padding: 0 2px;">179</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">195</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">211</span>	π <span style="border: 1px solid black; padding: 0 2px;">227</span>	≤ <span style="border: 1px solid black; padding: 0 2px;">243</span>
4	ä <span style="border: 1px solid black; padding: 0 2px;">132</span>	ö <span style="border: 1px solid black; padding: 0 2px;">148</span>	ñ <span style="border: 1px solid black; padding: 0 2px;">164</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">180</span>	- <span style="border: 1px solid black; padding: 0 2px;">196</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">212</span>	Σ <span style="border: 1px solid black; padding: 0 2px;">228</span>	∫ <span style="border: 1px solid black; padding: 0 2px;">244</span>
5	à <span style="border: 1px solid black; padding: 0 2px;">133</span>	ò <span style="border: 1px solid black; padding: 0 2px;">149</span>	Ñ <span style="border: 1px solid black; padding: 0 2px;">165</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">181</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">197</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">213</span>	σ <span style="border: 1px solid black; padding: 0 2px;">229</span>	∫ <span style="border: 1px solid black; padding: 0 2px;">245</span>
6	á <span style="border: 1px solid black; padding: 0 2px;">134</span>	û <span style="border: 1px solid black; padding: 0 2px;">150</span>	ö <span style="border: 1px solid black; padding: 0 2px;">166</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">182</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">198</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">214</span>	μ <span style="border: 1px solid black; padding: 0 2px;">230</span>	÷ <span style="border: 1px solid black; padding: 0 2px;">246</span>
7	ç <span style="border: 1px solid black; padding: 0 2px;">135</span>	ù <span style="border: 1px solid black; padding: 0 2px;">151</span>	Ö <span style="border: 1px solid black; padding: 0 2px;">167</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">183</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">199</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">215</span>	τ <span style="border: 1px solid black; padding: 0 2px;">231</span>	≈ <span style="border: 1px solid black; padding: 0 2px;">247</span>
8	ê <span style="border: 1px solid black; padding: 0 2px;">136</span>	ÿ <span style="border: 1px solid black; padding: 0 2px;">152</span>	ç <span style="border: 1px solid black; padding: 0 2px;">168</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">184</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">200</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">216</span>	Φ <span style="border: 1px solid black; padding: 0 2px;">232</span>	° <span style="border: 1px solid black; padding: 0 2px;">248</span>
9	ë <span style="border: 1px solid black; padding: 0 2px;">137</span>	ÿ <span style="border: 1px solid black; padding: 0 2px;">153</span>	ã <span style="border: 1px solid black; padding: 0 2px;">169</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">185</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">201</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">217</span>	Θ <span style="border: 1px solid black; padding: 0 2px;">233</span>	° <span style="border: 1px solid black; padding: 0 2px;">249</span>
A	è <span style="border: 1px solid black; padding: 0 2px;">138</span>	ÿ <span style="border: 1px solid black; padding: 0 2px;">154</span>	Ä <span style="border: 1px solid black; padding: 0 2px;">170</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">186</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">202</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">218</span>	Ω <span style="border: 1px solid black; padding: 0 2px;">234</span>	· <span style="border: 1px solid black; padding: 0 2px;">250</span>
B	ï <span style="border: 1px solid black; padding: 0 2px;">139</span>	ø <span style="border: 1px solid black; padding: 0 2px;">155</span>	ł <span style="border: 1px solid black; padding: 0 2px;">171</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">187</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">203</span>	■ <span style="border: 1px solid black; padding: 0 2px;">219</span>	δ <span style="border: 1px solid black; padding: 0 2px;">235</span>	√ <span style="border: 1px solid black; padding: 0 2px;">251</span>
C	î <span style="border: 1px solid black; padding: 0 2px;">140</span>	ε <span style="border: 1px solid black; padding: 0 2px;">156</span>	ń <span style="border: 1px solid black; padding: 0 2px;">172</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">188</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">204</span>	■ <span style="border: 1px solid black; padding: 0 2px;">220</span>	∞ <span style="border: 1px solid black; padding: 0 2px;">236</span>	η <span style="border: 1px solid black; padding: 0 2px;">252</span>
D	ì <span style="border: 1px solid black; padding: 0 2px;">141</span>	Ø <span style="border: 1px solid black; padding: 0 2px;">157</span>	ı <span style="border: 1px solid black; padding: 0 2px;">173</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">189</span>	= <span style="border: 1px solid black; padding: 0 2px;">205</span>	■ <span style="border: 1px solid black; padding: 0 2px;">221</span>	φ <span style="border: 1px solid black; padding: 0 2px;">237</span>	² <span style="border: 1px solid black; padding: 0 2px;">253</span>
E	Ë <span style="border: 1px solid black; padding: 0 2px;">142</span>	Ł <span style="border: 1px solid black; padding: 0 2px;">158</span>	³ <span style="border: 1px solid black; padding: 0 2px;">174</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">190</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">206</span>	■ <span style="border: 1px solid black; padding: 0 2px;">222</span>	ε <span style="border: 1px solid black; padding: 0 2px;">238</span>	· <span style="border: 1px solid black; padding: 0 2px;">254</span>
F	À <span style="border: 1px solid black; padding: 0 2px;">143</span>	ł <span style="border: 1px solid black; padding: 0 2px;">159</span>	¼ <span style="border: 1px solid black; padding: 0 2px;">175</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">191</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">207</span>	■ <span style="border: 1px solid black; padding: 0 2px;">223</span>	∩ <span style="border: 1px solid black; padding: 0 2px;">239</span>	

ID Number

Symbol Name

12U

PC-850

	0	1	2	3	4	5	6	7
0	◻ <sub>0</sub>	▶ ◻ <sub>16</sub>	◻ <sub>32</sub>	0 ◻ <sub>48</sub>	@ ◻ <sub>64</sub>	P ◻ <sub>80</sub>	` ◻ <sub>96</sub>	p ◻ <sub>112</sub>
1	☺ ◻ <sub>1</sub>	◀ ◻ <sub>17</sub>	! ◻ <sub>33</sub>	1 ◻ <sub>49</sub>	A ◻ <sub>65</sub>	Q ◻ <sub>81</sub>	a ◻ <sub>97</sub>	q ◻ <sub>113</sub>
2	● ◻ <sub>2</sub>	† ◻ <sub>18</sub>	" ◻ <sub>34</sub>	2 ◻ <sub>50</sub>	B ◻ <sub>66</sub>	R ◻ <sub>82</sub>	b ◻ <sub>98</sub>	r ◻ <sub>114</sub>
3	♥ ◻ <sub>3</sub>	!! ◻ <sub>19</sub>	# ◻ <sub>35</sub>	3 ◻ <sub>51</sub>	C ◻ <sub>67</sub>	S ◻ <sub>83</sub>	c ◻ <sub>99</sub>	s ◻ <sub>115</sub>
4	♦ ◻ <sub>4</sub>	‡ ◻ <sub>20</sub>	\$ ◻ <sub>36</sub>	4 ◻ <sub>52</sub>	D ◻ <sub>68</sub>	T ◻ <sub>84</sub>	d ◻ <sub>100</sub>	t ◻ <sub>116</sub>
5	♣ ◻ <sub>5</sub>	§ ◻ <sub>21</sub>	% ◻ <sub>37</sub>	5 ◻ <sub>53</sub>	E ◻ <sub>69</sub>	U ◻ <sub>85</sub>	e ◻ <sub>101</sub>	u ◻ <sub>117</sub>
6	♠ ◻ <sub>6</sub>	- ◻ <sub>22</sub>	& ◻ <sub>38</sub>	6 ◻ <sub>54</sub>	F ◻ <sub>70</sub>	V ◻ <sub>86</sub>	f ◻ <sub>102</sub>	v ◻ <sub>118</sub>
7	• ◻ <sub>7</sub>	‡ ◻ <sub>23</sub>	' ◻ <sub>39</sub>	7 ◻ <sub>55</sub>	G ◻ <sub>71</sub>	W ◻ <sub>87</sub>	g ◻ <sub>103</sub>	w ◻ <sub>119</sub>
8	■ ◻ <sub>8</sub>	↑ ◻ <sub>24</sub>	( ◻ <sub>40</sub>	8 ◻ <sub>56</sub>	H ◻ <sub>72</sub>	X ◻ <sub>88</sub>	h ◻ <sub>104</sub>	x ◻ <sub>120</sub>
9	○ ◻ <sub>9</sub>	↓ ◻ <sub>25</sub>	) ◻ <sub>41</sub>	9 ◻ <sub>57</sub>	I ◻ <sub>73</sub>	Y ◻ <sub>89</sub>	i ◻ <sub>105</sub>	y ◻ <sub>121</sub>
A	■ ◻ <sub>10</sub>	→ ◻ <sub>26</sub>	* ◻ <sub>42</sub>	: ◻ <sub>58</sub>	J ◻ <sub>74</sub>	Z ◻ <sub>90</sub>	j ◻ <sub>106</sub>	z ◻ <sub>122</sub>
B	♂ ◻ <sub>11</sub>	← ◻ <sub>27</sub>	+ ◻ <sub>43</sub>	; ◻ <sub>59</sub>	K ◻ <sub>75</sub>	[ ◻ <sub>91</sub>	k ◻ <sub>107</sub>	{ ◻ <sub>123</sub>
C	♀ ◻ <sub>12</sub>	┌ ◻ <sub>28</sub>	' ◻ <sub>44</sub>	< ◻ <sub>60</sub>	L ◻ <sub>76</sub>	\ ◻ <sub>92</sub>	l ◻ <sub>108</sub>	◻ <sub>124</sub>
D	♪ ◻ <sub>13</sub>	↔ ◻ <sub>29</sub>	- ◻ <sub>45</sub>	= ◻ <sub>61</sub>	M ◻ <sub>77</sub>	] ◻ <sub>93</sub>	m ◻ <sub>109</sub>	} ◻ <sub>125</sub>
E	♪ ◻ <sub>14</sub>	▲ ◻ <sub>30</sub>	• ◻ <sub>46</sub>	> ◻ <sub>62</sub>	N ◻ <sub>78</sub>	˘ ◻ <sub>94</sub>	n ◻ <sub>110</sub>	˘ ◻ <sub>126</sub>
F	* ◻ <sub>15</sub>	▼ ◻ <sub>31</sub>	/ ◻ <sub>47</sub>	? ◻ <sub>63</sub>	O ◻ <sub>79</sub>	- ◻ <sub>95</sub>	o ◻ <sub>111</sub>	△ ◻ <sub>127</sub>



ID Number      Symbol Name

12U

PC-850  
(cont.)

	8	9	A	B	C	D	E	F
0	Ç <span style="border: 1px solid black; padding: 0 2px;">128</span>	É <span style="border: 1px solid black; padding: 0 2px;">144</span>	á <span style="border: 1px solid black; padding: 0 2px;">160</span>	⌘ <span style="border: 1px solid black; padding: 0 2px;">176</span>	Ł <span style="border: 1px solid black; padding: 0 2px;">192</span>	ø <span style="border: 1px solid black; padding: 0 2px;">208</span>	Ó <span style="border: 1px solid black; padding: 0 2px;">224</span>	- <span style="border: 1px solid black; padding: 0 2px;">240</span>
1	ü <span style="border: 1px solid black; padding: 0 2px;">129</span>	æ <span style="border: 1px solid black; padding: 0 2px;">145</span>	í <span style="border: 1px solid black; padding: 0 2px;">161</span>	⌘ <span style="border: 1px solid black; padding: 0 2px;">177</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">193</span>	Ð <span style="border: 1px solid black; padding: 0 2px;">209</span>	ß <span style="border: 1px solid black; padding: 0 2px;">225</span>	± <span style="border: 1px solid black; padding: 0 2px;">241</span>
2	é <span style="border: 1px solid black; padding: 0 2px;">130</span>	Æ <span style="border: 1px solid black; padding: 0 2px;">146</span>	ó <span style="border: 1px solid black; padding: 0 2px;">162</span>	⌘ <span style="border: 1px solid black; padding: 0 2px;">178</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">194</span>	Ê <span style="border: 1px solid black; padding: 0 2px;">210</span>	Ë <span style="border: 1px solid black; padding: 0 2px;">226</span>	= <span style="border: 1px solid black; padding: 0 2px;">242</span>
3	ā <span style="border: 1px solid black; padding: 0 2px;">131</span>	ō <span style="border: 1px solid black; padding: 0 2px;">147</span>	ú <span style="border: 1px solid black; padding: 0 2px;">163</span>	<span style="border: 1px solid black; padding: 0 2px;">179</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">195</span>	Ë <span style="border: 1px solid black; padding: 0 2px;">211</span>	Ë <span style="border: 1px solid black; padding: 0 2px;">227</span>	‡ <span style="border: 1px solid black; padding: 0 2px;">243</span>
4	ä <span style="border: 1px solid black; padding: 0 2px;">132</span>	ö <span style="border: 1px solid black; padding: 0 2px;">148</span>	ñ <span style="border: 1px solid black; padding: 0 2px;">164</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">180</span>	- <span style="border: 1px solid black; padding: 0 2px;">196</span>	È <span style="border: 1px solid black; padding: 0 2px;">212</span>	ö <span style="border: 1px solid black; padding: 0 2px;">228</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">244</span>
5	à <span style="border: 1px solid black; padding: 0 2px;">133</span>	ò <span style="border: 1px solid black; padding: 0 2px;">149</span>	Ñ <span style="border: 1px solid black; padding: 0 2px;">165</span>	Á <span style="border: 1px solid black; padding: 0 2px;">181</span>	⊥ <span style="border: 1px solid black; padding: 0 2px;">197</span>	ı <span style="border: 1px solid black; padding: 0 2px;">213</span>	Ö <span style="border: 1px solid black; padding: 0 2px;">229</span>	§ <span style="border: 1px solid black; padding: 0 2px;">245</span>
6	á <span style="border: 1px solid black; padding: 0 2px;">134</span>	û <span style="border: 1px solid black; padding: 0 2px;">150</span>	á <span style="border: 1px solid black; padding: 0 2px;">166</span>	Â <span style="border: 1px solid black; padding: 0 2px;">182</span>	ä <span style="border: 1px solid black; padding: 0 2px;">198</span>	í <span style="border: 1px solid black; padding: 0 2px;">214</span>	μ <span style="border: 1px solid black; padding: 0 2px;">230</span>	÷ <span style="border: 1px solid black; padding: 0 2px;">246</span>
7	ç <span style="border: 1px solid black; padding: 0 2px;">135</span>	ù <span style="border: 1px solid black; padding: 0 2px;">151</span>	ª <span style="border: 1px solid black; padding: 0 2px;">167</span>	À <span style="border: 1px solid black; padding: 0 2px;">183</span>	Ä <span style="border: 1px solid black; padding: 0 2px;">199</span>	î <span style="border: 1px solid black; padding: 0 2px;">215</span>	þ <span style="border: 1px solid black; padding: 0 2px;">231</span>	• <span style="border: 1px solid black; padding: 0 2px;">247</span>
8	ê <span style="border: 1px solid black; padding: 0 2px;">136</span>	ÿ <span style="border: 1px solid black; padding: 0 2px;">152</span>	¿ <span style="border: 1px solid black; padding: 0 2px;">168</span>	© <span style="border: 1px solid black; padding: 0 2px;">184</span>	Ł <span style="border: 1px solid black; padding: 0 2px;">200</span>	ï <span style="border: 1px solid black; padding: 0 2px;">216</span>	ð <span style="border: 1px solid black; padding: 0 2px;">232</span>	° <span style="border: 1px solid black; padding: 0 2px;">248</span>
9	ë <span style="border: 1px solid black; padding: 0 2px;">137</span>	Ö <span style="border: 1px solid black; padding: 0 2px;">153</span>	© <span style="border: 1px solid black; padding: 0 2px;">169</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">185</span>	ƒ <span style="border: 1px solid black; padding: 0 2px;">201</span>	Ĵ <span style="border: 1px solid black; padding: 0 2px;">217</span>	Ú <span style="border: 1px solid black; padding: 0 2px;">233</span>	“ <span style="border: 1px solid black; padding: 0 2px;">249</span>
A	è <span style="border: 1px solid black; padding: 0 2px;">138</span>	Û <span style="border: 1px solid black; padding: 0 2px;">154</span>	¬ <span style="border: 1px solid black; padding: 0 2px;">170</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">186</span>	‡ <span style="border: 1px solid black; padding: 0 2px;">202</span>	ƒ <span style="border: 1px solid black; padding: 0 2px;">218</span>	Û <span style="border: 1px solid black; padding: 0 2px;">234</span>	• <span style="border: 1px solid black; padding: 0 2px;">250</span>
B	ï <span style="border: 1px solid black; padding: 0 2px;">139</span>	ø <span style="border: 1px solid black; padding: 0 2px;">155</span>	‡ <span style="border: 1px solid black; padding: 0 2px;">171</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">187</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">203</span>	■ <span style="border: 1px solid black; padding: 0 2px;">219</span>	Û <span style="border: 1px solid black; padding: 0 2px;">235</span>	’ <span style="border: 1px solid black; padding: 0 2px;">251</span>
C	î <span style="border: 1px solid black; padding: 0 2px;">140</span>	£ <span style="border: 1px solid black; padding: 0 2px;">156</span>	‡ <span style="border: 1px solid black; padding: 0 2px;">172</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">188</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">204</span>	■ <span style="border: 1px solid black; padding: 0 2px;">220</span>	Ý <span style="border: 1px solid black; padding: 0 2px;">236</span>	³ <span style="border: 1px solid black; padding: 0 2px;">252</span>
D	ì <span style="border: 1px solid black; padding: 0 2px;">141</span>	Ø <span style="border: 1px solid black; padding: 0 2px;">157</span>	ı <span style="border: 1px solid black; padding: 0 2px;">173</span>	Ç <span style="border: 1px solid black; padding: 0 2px;">189</span>	= <span style="border: 1px solid black; padding: 0 2px;">205</span>	ı <span style="border: 1px solid black; padding: 0 2px;">221</span>	Ý <span style="border: 1px solid black; padding: 0 2px;">237</span>	² <span style="border: 1px solid black; padding: 0 2px;">253</span>
E	Ä <span style="border: 1px solid black; padding: 0 2px;">142</span>	× <span style="border: 1px solid black; padding: 0 2px;">158</span>	« <span style="border: 1px solid black; padding: 0 2px;">174</span>	¥ <span style="border: 1px solid black; padding: 0 2px;">190</span>	¶ <span style="border: 1px solid black; padding: 0 2px;">206</span>	İ <span style="border: 1px solid black; padding: 0 2px;">222</span>	- <span style="border: 1px solid black; padding: 0 2px;">238</span>	• <span style="border: 1px solid black; padding: 0 2px;">254</span>
F	Å <span style="border: 1px solid black; padding: 0 2px;">143</span>	f <span style="border: 1px solid black; padding: 0 2px;">159</span>	» <span style="border: 1px solid black; padding: 0 2px;">175</span>	⌘ <span style="border: 1px solid black; padding: 0 2px;">191</span>	¤ <span style="border: 1px solid black; padding: 0 2px;">207</span>	■ <span style="border: 1px solid black; padding: 0 2px;">223</span>	’ <span style="border: 1px solid black; padding: 0 2px;">239</span>	• <span style="border: 1px solid black; padding: 0 2px;">255</span>

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