TEXAS
INSTRUMENTS

Models 830 and 835 Printers
Technical Reference Manual

Models 830/835 Printers
Technical Reference Manual
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Changes may be periodically made to the information in this publication. Such changes will be incorporated in new editions of this manual.

Record the serial number and purchase date in the spaces provided below. The serial number is recorded on the label on the back of the printer. All correspondence concerning your printer should include both the serial number and the date you purchased it.

❑ **Model 830 Printer**   ❑ **Model 835 Printer**

   Serial Number: _____   **Purchase Date:** _____

The equipment, as well as the programs that TI has created to use with them, are tools that can help people better manage the information used in their business; but tools—including TI products—cannot replace sound judgement nor make the manager's business decisions.

Consequently, TI cannot warrant that its products are suitable for any specific customer application. The manager must rely on judgment of what is best for his or her business.

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▶ Preface

There are two ways you can control the many features of your Omni 800 Model 830 or 835:

▶ Through the front panel.

▶ Through your computer, using either commercial software or programs you've written yourself.

This *Technical Reference Guide* tells you what you need to know to take full advantage of your printer's capabilities using either of these methods.

Chapter 1: Front Panel Control gives a brief overview of how to use the printer's front panel to change printing features, both directly and through the Menu Select mode. This information is covered more thoroughly in the *Operator's Manual.*

Chapter 2: Computer Control tells you how to use the features of your software to control the printer. It contains general guidelines on installing and using software with your printer, as well as specific information on PC/MS-DOS. You'll also find tips on BASIC if you want to write your own programs.

Chapter 3: Control Code Reference provides details on the printer's features and the commands that control them. This chapter will be useful even if you don't do your own programming, because it contains information about how the printer features work and how to use them.

Chapter 4: Graphics and Custom Characters is not for the faint of heart. It describes how to program graphics and custom (downloaded) character sets, and these are complex, time-consuming jobs.

There are also a number of appendices at the end of the book containing reference material on control codes, character sets, interfacing, and product specifications.

▶ Chapter 1—Front Panel Control
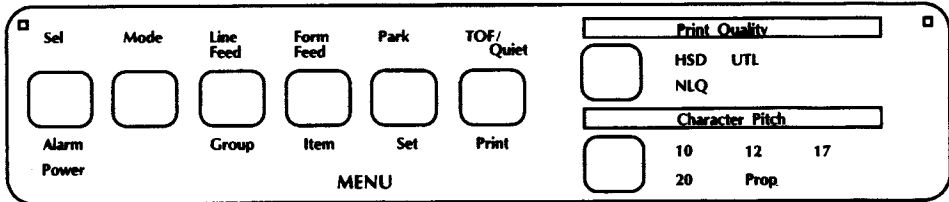
The TI 830/835's control panel gives you fingertip command over most of the printing features that affect the look of your documents. You can change basic features of each document straight from the panel. Using the Menu Select mode—entered directly from the panel—you can alter the default settings of other features.

Note	All buttons on the control panel are active regardless of whether the printer is selected or deselected.

Basic Controls
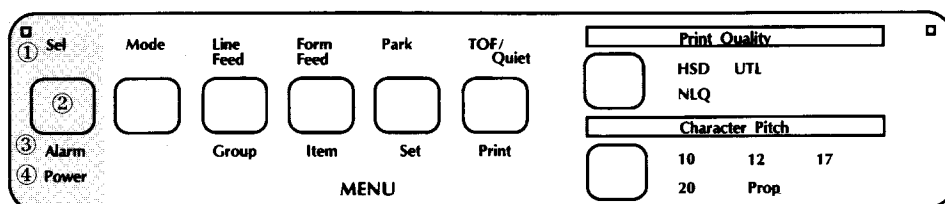
1. **Sel light**: When this light is ON, the printer is selected and ready to receive data from the computer. When the light is OFF, the printer is deselected and cannot receive data.

   When the light is blinking, the printer is in Print Suppress condition and will ignore all data until the Print Suppress condition is turned off. (See "Miscellaneous" in Chapter 3.)

2. **Sel button**: Push this button to select or deselect the printer (**Sel** light is ON or OFF).

3. **Alarm light**: This light indicates either that paper is out or that there is an internal problem requiring service.

4. **Power light**: This light indicates that the printer is turned on.

Print Characteristics

These buttons let you control basic printing features without modifying your software. Simply press a button until the selection you want lights up. You can change features when the printer is either selected or deselected.

Note   This part of the panel always reflects the state of the printer; if your software changes one of these features, the corresponding light will change too.
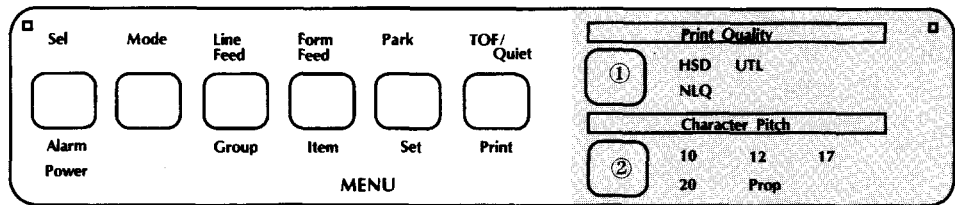
1. **Print Quality**

    NLQ: Near Letter Quality. The highest level of print quality for your most important documents. Slowest speed.

    UTL: Utility. Higher speed printing for internal documents and high-volume data printing. Lower level of print quality.

    HSD: High Speed Draft. Highest speed printing for drafts. Lowest level of print quality.

2. **Character Pitch**

    10, 12, 17, 20: These determine the width of the characters, indicated in characters per inch (cpi).

    Prop: Proportionally spaced, not available in HSD.

The Mode Button

This button controls the functions of the next four buttons on the panel by switching the printer between Print mode and Menu Select mode. When the printer is in Print mode, the functions shown above the buttons are active; this is the state of the printer when you turn it on. When the printer is in Menu Select mode, the **MENU** indicator lights, and the functions shown below the buttons are active—this lets you customize the default settings for a number of printer features directly from the control panel.

Print Mode

1. **Line Feed button**: Press this button to advance the paper one line.

2. **Form Feed button**: Press this button to advance the paper to the first print line of the next page.

3. **Park button**: Use this button with continuous-form paper. When you press it, the paper retracts from the front of the printer so you can use single sheets without completely removing the continuous forms. (See "Paper Park" in Chapter 1 of the *Operator's Manual* for details.)

4. **TOF/Quiet button**: When the printer is deselected, press this button to set the position of the first print line on the page ("top of form").
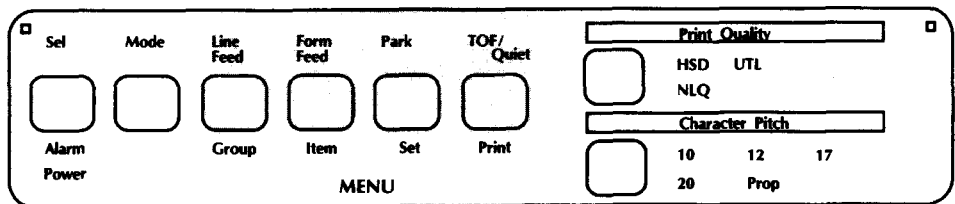
When the printer is selected, press this button to enter the Quiet mode ("Quiet" lights on the panel). This mode reduces the printer sound by printing in two passes instead of one. Return the printer to normal operation by pressing the button again with the printer selected.

Menu Select Mode

In this mode, you can customize your printer so that the features you want are automatically active when you turn it on. The selections you make on the menu are stored in the printer's permanent memory and, in effect, become default settings, although they can be changed through software commands, through the control panel, or through resetting the menu.

Note   You can override features set on the menu using either the front panel or commands sent from your computer. However, when you turn off the printer, features set by those methods will be cancelled. Features set on the menu will stay in effect, even when the printer is turned off.

To enter Menu Select mode:

Make sure the printer has ribbon and paper.

Press **Mode**.

The **Sel** light goes out and the **MENU** light goes on, indicating that the menu functions, listed below the print mode buttons, are active. If you want to print out the entire menu with its current settings, press the **Print** button. When you are ready to start changing settings, press **Group**, and the first line of the menu prints. Here's how it's arranged:

Font	Print Mode	Utility
Group of related items	**Item** within the group	Current **Set**ting for the item
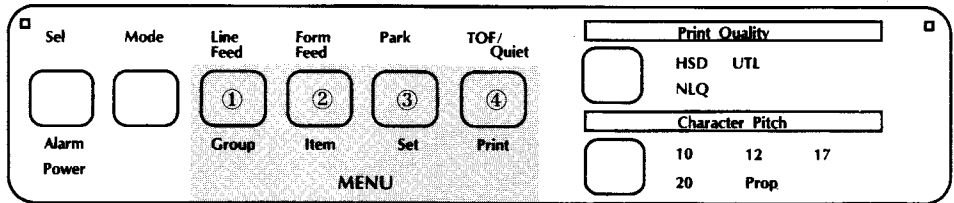
When the **MENU** light is on, the bottom button functions are active:

1,2,3: Press these buttons to move to the next **Group, Item,** and **Set**ting, respectively.

4: Press this button at any time to print a complete listing of the menu with its current settings.

Note   We recommend that you print out the menu whenever you change it, to keep for reference.

When you've made the changes you want, press **Mode** to record the changes and return to Print mode. (**MENU** light goes out.)

Appendix B gives a complete listing of menu items and factory settings. For a detailed explanation of the menu items, see "Explanation of Menu Items" in Chapter 2 of the *Operator's Manual.*

▶ Chapter 2—Computer Control

This chapter explains the basics of controlling the printer through your computer. It covers the fundamentals of setting up a software package for use with your printer, MS-DOS printing commands, and provides some tips on writing BASIC programs to control your printer. This information should help you get started; be sure to read your software documentation carefully for more details.

Commercial Software

Most of the time, your printer will be controlled by standard commercial software packages such as WordStar, Lotus 1-2-3, WordPerfect and the like. For your convenience, a brief explanation of how to use your printer with some of these programs is provided below. It must be emphasized, however, that the software documentation is the final source for this information, and some details may have changed as we go to press. Consult your software manual before attempting to install your printer.

Selecting Drivers

Commercial software packages use printer *drivers* to control the appearance of printed documents. A driver is simply a list of commands that will make a specific printer perform various functions at the request of the software. In effect, it translates what your software is saying into a command that your printer can understand. For example, if the software says to underline some text, the entry for underlining is "looked up" in the software driver, and the command listed there is sent to the printer which will respond by underlining the printed text. Use of drivers makes it possible for a program to function roughly the same way no matter which printer has been selected.

The TI 830/835 printer supports two emulations: EPSON FX 85/FX 105, and TI S1000 emulations. Many of the software packages you will use will contain drivers for the EPSON FX emulation. For some software, however,

it may be necessary to select a driver that functions *nearly* the same as a driver for EPSON FX 85/FX 105. Because command sets tend to grow in "families", this generally means that you will be selecting a driver that provides access to fewer functions, but the commands available will perform properly with your printer.

Selecting a driver for your software is usually a part of the program installation process. Changing printers may require use of an external routine, or may be possible through menu selection. Following are lists of commonly used, commercial word processing, database and graphics software packages and the routines or methods used to install and change printers:

Word Processing Software Driver Selection

Software	Installation/Modification
DisplayWrite 4.0	INSTALL
Microsoft Word 3.0	Select PRINT then OPTIONS; press F1 to list printers.
Multimate	UTIL
PFS Professional Write	Select SETUP, then SELECT PRINTER from menu
WordPerfect 5.0	Press SHIFT-F7, then s, then 2. Use the down arrow key to highlight printer. To modify, press SHIFT-F7, then s, then 3.
WordStar 3.x	WINSTALL
WordStar 4.x	WINSTALL/WSCHANGE
WordStar 2000	WS2INS

Database Software Driver Selection

Software	Installation/Modification
DBase II & III	Send print commands directly to printer in programming mode
Lotus 1-2-3	INSTALL
Lotus Symphony	INSTALL
PFS Professional File	Select SETUP, then SELECT PRINTER from menu
SuperCalc 3 and 4	From menu, select GLOBAL, then GRAPHICS, then DEVICE

Graphics Software Driver Selection

Software	Installation/Modification
GEM	Open the GEMSYS folder. Select GEMSETUP.APP. Highlight CATEGORIES, select printers and move it to the CHOSEN PRINTER along with fonts.
Harvard Graphics	Select SETUP from configuration menu, then choose printer
Harvard Total Project Manager 2.0	Select SETUP, then PRINT/PLOT (F2). From menu, select 1 for text printer or 2 for graphics printer.
Microsoft Windows 2.03	Select PRINTER when configuring the system with SETUP, or at any time by running the Control Panel (CONTROL.EXE) and selecting SETUP, then PRINTER.
PC Paintbrush	PCINSTAL
SuperProject Plus	Press ALT-4, then CTRL-D. Enter Driver location. Select.

Because there are some differences in characteristics such as speed or access to various features, you may wish to experiment with several different drivers. If you must select a driver that is not on these lists, be sure to check it thoroughly for print features such as boldface, underline and changes in pitch. Don't be surprised if boldfaced items are printed twice, underlines are misplaced, wide spaces are left between lines or the printer behaves chaotically (turn off the printer if the latter occurs). These are all characteristics of an incompatible driver selection.

Driver Modification and Embedded Commands

In some cases, commercial software packages will permit you to create and/or modify the printer driver. Even if a driver for one of the 830/835 emulations is available, this option can provide considerable room for customization. Typically, the driver modification routine will present a list of operations with some method for entering printer commands in decimal, ASCII, or hexadecimal form. This permits substitution, such as entering the italic command in place of the underline command. It also permits modification of an existing driver to better fit the 830/835. Driver modification does require a basic familiarity with your printer's command set, so you should study Chapter 3, "Control Code Reference," thoroughly before attempting it.

Some programs also permit you to control your printer directly through embedded commands. These are printer commands placed within the text manually without specifying a printer operation. Usage of these commands in programs like WordPerfect can provide access to a wide range of printer capabilities that are not ordinarily supported, or, in programs like Lotus 1-2-3, printer commands can be entered as an initialization string to set the basic format for a document. Again, a basic familiarity with your printer's command set is recommended. You should also remember that the commands themselves may be invisible or hard to decipher when the document appears on your screen.

DOS 2.0 and Higher

Most IBM PC and compatible personal computers use PC-DOS or MS-DOS as their operating system. Although DOS is much more limited in printing capabilities than word processing or graphics software, there are some commands in DOS 2.0 and higher that you can use to control your printer. For best results, only print ASCII text files from DOS. You cannot enter printer control codes from the keyboard.

If you have a T.I. PC that uses the T.I. version of DOS, some commands may be different. See you T.I. DOS Manual for more information.

DOS Commands for Printing Text Files

- ▶ PRINT *filename*

- ▶ TYPE *filename.ext* > *devicename*

- ▶ COPY *filename.ext* *devicename*

If you've used a word processor or other software package to prepare your document, it's usually easiest to use that package's print commands to print it. This is particularly true if the software lets you control a document's appearance—page length, margins, printing features, and so on.

However, if your software doesn't control these kinds of features, it's just as easy to print using DOS commands. Some packages even have a "print to disk" feature, so you can save the file on a disk in a format that DOS can later read and send to the printer.

The DOS PRINT Command

PRINT is a background utility that lets you print a file while you're running another program. Once you've given the command to print your file, you can go on to another task on your computer, without waiting until printing is finished.

Note

PRINT is not actually a DOS command, but rather a separate program provided on your DOS diskette. If you want to use the PRINT command, the DOS file PRINT.COM must be present on the disk which contains your DOS software.

In this example, we're going to print a file called NOTES.TXT, which is on the WORK subdirectory of the computer's hard disk drive (drive C:). The PRINT.COM program file is in the main (root) directory of the C: drive.

Begin by typing the following at the C> prompt, then pressing [RETURN]:

    PRINT C: \WORK \NOTES.TXT

The computer will respond by displaying the following on your screen:

    Name of list device [PRN]:

If your printer is connected to the LPT1: parallel printer port, just press [RETURN]; if it's connected to another port (LPT2:, COM1:, or COM2:), type the name of the port and press [RETURN].

Next you'll see this display:

    Resident part of PRINT installed
    C: \WORK \NOTES.TXT is currently being printed

and the file will print.

Note   If you're not sure which printer port your system uses, try pressing return to specify [PRN]. The device name PRN refers to LPT1:, the default DOS port. This is the port most printers are connected to.

Once you've used PRINT during a work session, DOS will "remember" the device you specified and won't have to ask you again where the printer is. Of course, turning off the computer or restarting it will erase this information from memory.

The DOS TYPE Command

If you don't have a copy of PRINT.COM available, you can use the TYPE command to redirect the file to your printer. If you're not using LPT1: as your printer port, substitute the name of your port for LPT1: in our example.

Example

In this example, we're going to print the file called NOTES.TXT (on the WORK subdirectory of drive C:) using the TYPE command. The DOS TYPE.EXE file is in the main (root) directory of the C: drive.

Type the following at the C> prompt, then press [RETURN]:

TYPE C:\WORK\NOTES.TXT > LPT1:

The computer will send the file NOTES.TXT to your printer.

The DOS COPY Command

Just as you use this command to copy a file from one disk or directory to another, you can use it to copy a text file from a disk to the printer. If you're not using LPT1: as your printer port, substitute the name of your port for LPT1: in our example.

Example

In this example, we're going to print the file called NOTES.TXT (on the WORK subdirectory of drive C:) using the COPY command. The DOS COPY.EXE file is in the main (root) directory of the C: drive.

Type the following at the C> prompt, then press [RETURN]:

COPY C:\WORK\NOTES.TXT LPT1:

The computer will send the file NOTES.TXT to your printer.

Changing the Default Printer Port

If your system doesn't use LPT1: to connect the printer to the computer, you can specify which port DOS should use as its default. At the DOS prompt, enter the appropriate MODE command(s).

▶ For a serial interface, first enter:

MODE COM1:9600,N,8,1,P

Then enter:

MODE LPT1:=COM1:

▶ For a parallel interface, enter:

MODE LPT2:

The serial interface board is an option for the OMNI 800 Models 830 and 835 printers. See your dealer for ordering information.

If your serial interface is COM2:, replace COM1: in the commands shown above with COM2:. Likewise, if your parallel interface is LPT3:, replace LPT2: in command above with LPT3:.

To avoid having to reenter the MODE command(s) every time you reset the computer, enter them in your computer's AUTOEXEC.BAT file. To create an AUTOEXEC.BAT file or edit an existing one, use a text editor or a word processor in a mode that allows you to create ASCII text files. If you're editing your system's AUTOEXEC.BAT file, be sure not to change or delete anything already in the file.

For more information on working with AUTOEXEC.BAT files, see your DOS manual.

BASIC Programming

The LPRINT command in BASIC makes output go to the printer rather than to the screen. To send text to the printer, simply enclose the words in double quotes:

```
LPRINT "A line of text"
```

The statement above will cause the printer to print the text, then move the printing position to the beginning of the next line. If you don't want this automatic carriage return and line feed, put a semicolon (;) after the data, outside the quote:

```
LPRINT "A line of text";
LPRINT "...and this text is on the same line"
```

For serial printers

If you're using your printer with a serial interface, you have to be sure to redirect output from the computer to the serial port you're using, either COM1: or COM2:, rather than to the default port, LPT1:. There are two ways to do this:

1. If you're using DOS, you can use the MODE command, as described on the preceding page. Then use the LPRINT command in your BASIC programs, just as we do in our examples.

2. You can also redirect output to COM1: or COM2: from within BASIC, by opening the port as a file and printing your data to that file. If you want to run any of our sample programs, you'll need to modify them. At the beginning of your program, include one of these statements:

```
OPEN "COM1:9600,N,8,1" AS #1
or
OPEN "COM2:9600,N,8,1" AS #1
```

Then, to print data, use the PRINT#1 command, being sure to include a comma between the #1 and the data:

```
PRINT#1,"A line of text"
```

Like the LPRINT command, PRINT#1 automatically moves the print position to the next line unless you use a semicolon (;) after the data.

When you send an LPRINT statement, the text between the quotation marks is converted to a string of numbers, which are then processed by the printer and output as the dot patterns that make up the individual characters. Each character is assigned a numeric value according to the American Standard Code for Information Interchange (ASCII). Since ASCII is a standard coding system, most computers, printers and other electronic devices can interpret ASCII data.

There are 256 ASCII codes. The codes from 0 to 127 are completely standardized (with a handful of minor exceptions), while those from 128 to 255 are used in a less standard way to represent a variety of special characters. The table of ASCII codes in Appendix C shows the low ASCII codes from 0 to 127.

Although most of the ASCII codes represent alphanumeric and punctuation symbols, you'll notice that the codes from 0 to 31, as well as 127, don't correspond to normal characters. These are control codes, special characters used to control a wide range of peripheral equipment, from monitors to modems to the devices that interest us here, printers.

One of the most important control codes is the ESC character, decimal 27, hexadecimal 1B. Many of the more complicated commands begin with ESC, which serves as a signal to the printer that what follows is to be interpreted as a command rather than just a string of characters.

Since the control codes don't represent any character on your keyboard, you can't send them to the printer enclosed in double quotes, as you would with text. Instead, you have to use the CHR$ function, which lets you send the decimal or hexadecimal value for a character. For example, the escape character is represented as CHR$(27), or, in hexadecimal, as CHR$(&H1B). (Notice that hexadecimal numbers in BASIC are preceded by &H to distinguish them from simple letters or decimal numbers.)

Of course, you can also use the CHR$ function to output printable characters; for instance, CHR$(65) represents the letter A. However, it's usually easier to type letters, numbers and punctuation marks, and your BASIC programs will be much easier to read if you use literal characters, enclosed in quotes, wherever possible.

Some printer commands expect you to supply a numeric value representing tab stops, line spacing, etc. These values can be entered by using the CHR$ function. Note that features which can be switched on or off with 1 and 0 can use either a literal numeral—"1" or "0"—or the value in a CHR$ function—CHR$(0) or CHR$(1).

▶ Chapter 3—Control Code Reference

This chapter describes the TI 830/835 printing and formatting features and the codes that control them. It's not just for programmers; if you want to modify your software to add a particular function, or if you want to embed extra commands in a document, you'll find the necessary information here. Even if you just use the front panel to control your printer, the explanations of the features and how they work will be helpful.

In this chapter we give both the ASCII and the decimal equivalents for each control code.

The OMNI 800 Models 830 and 835 printers can operate in two modes: the EPSON FX 85/FX 105 and the TI system 1000 (from S1000 to S1500 TI computers). This S 1000 emulation was designed to fit to the Unix and Xenix environments, when using TI terminals.

Character Style

Print Quality Control Codes

Function	Emulation	Command	
		ASCII	Decimal
Select NLQ print quality	EPSON and S1000	ESC x SOH	27 120 1
Select UTL print quality	EPSON and S1000	ESC x NUL	27 120 0
Select HSD print quality	EPSON	ESC (0	27 40 48
	S1000	ESC X (0	27 88 40 48

Use NLQ (near letter quality) printing for final drafts and important documents where appearance matters. This is the slowest of the three print modes, but the characters are crisper and more like the characters produced by a typewriter.

Use UTL (utility) printing for drafts and other documents that you want to print more quickly. This is faster than NLQ, but the print quality isn't as good.

Use HSD (high speed draft) printing for drafts and documents that you want to print as fast as possible. It is even faster than UTL, but its print quality is not as good as UTL.

You can also use your printer's front panel or the Menu Select mode to select print quality.

Emphasized and Enhanced Printing (Bold Face)

Function	Emulation	Command	
		ASCII	Decimal
Begin emphasized printing	EPSON and S1000	ESC E	27 69
End emphasized printing	EPSON and S1000	ESC F	27 70
Begin enhanced printing	EPSON and S1000	ESC G	27 71
End enhanced printing	EPSON and S1000	ESC H	27 72

Your printer produces bold face type by printing each dot of a character twice instead of only once. In emphasized printing, the pairs of dots are offset horizontally. In enhanced printing, the pairs of dots are offset vertically.

You can combine emphasized and enhanced printing for an especially bold effect. If you're using the IBM emulation for headlines, try using emphasized and enhanced printing in combination with double width characters, double height characters, or both double width and double height characters.

Typeface

| Function | Emulation | Command | | Value of n |
		ASCII	Decimal	
Select typeface	EPSON and S1000	ESC k n	27 107 n	n=0: Courier n=1: Sans Serif

Italics

| Function | Emulation | Command | |
		ASCII	Decimal
Begin italics	EPSON and S1000	ESC 4	27 52
End italics	EPSON and S1000	ESC 5	27 53

Italic printing is slanted, *like this,* and is used to lend emphasis to phrases, sentences or entire paragraphs.

If you intend to print an entire document in italics, you can select this printing style in the Menu Select mode.

Character Size

Pitch

Function	Emulation	Command	
		ASCII	Decimal
Begin 10 cpi (pica)	EPSON and S1000	ESC P	27 80
Begin 12 cpi (elite)	EPSON and S1000	ESC M	27 77

Character pitch, or width, is measured in characters per inch (cpi). For example, at 10 cpi, each character is 1/10-inch wide. The double width and compressed printing commands interact with the basic pitches listed above to produce a range of character widths: see the "Character Width Values" table on the next page.

Pitch can also be set in Menu Select mode or on the printer's control panel.

Character Width Values

Pitch	Compressed	Double Width
10 cpi	17.1 cpi	5 cpi
12 cpi	20 cpi	6 cpi
17.1 cpi	Cannot be compressed	8.5 cpi
20 cpi	Cannot be compressed	10 cpi

Compressed Printing

Function	Emulation	Command	
		ASCII	Decimal
Begin compressed printing	EPSON	SI or ESC SI	15 or 27 15
	S1000	ESC X SI	27 88 15
End compressed printing	EPSON and S1000	DC2	18

Compressed printing produces characters 17.1 cpi if the pitch is set for 10 cpi, 20 cpi if the pitch is set for 12 cpi.

When you enter the DC2 command to end compressed printing, the printer will return to whatever basic pitch was in effect before you began compressed printing.

Double Width

Function	Emulation	Command	
		ASCII	Decimal
Begin double width printing	EPSON and S1000	ESC W 1	27 87 49
End double width printing	EPSON and S1000	ESC W 0	27 88 15
Begin one-line double width printing	EPSON	ESC SO	27 14
	S1000	ESC X SO	27 88 14
End one-line double width printing	EPSON and S1000	DC4	20

Use these commands to produce characters twice as wide as regular characters. For example, if the current character pitch is 12 cpi, double width characters will print at 6 cpi. The "Character Width" table under "Pitch" in this chapter shows all the possible combinations.

The one-line double width command is especially convenient for titles and headlines, since it turns off double width printing automatically at the end of the line. If you want to cancel one- line double width printing before the line ends, send a DC4 command.

Superscripts and Subscripts

Function	Emulation	Command	
		ASCII	Decimal
Begin superscript	EPSON and S1000	ESC 0	27 48
Begin subscript	EPSON and S1000	ESC S 1	27 83 49
End superscript or subscript	EPSON and S1000	ESC T	27 84

Superscript characters are printed above the normal print line, and are used for exponents and special typographic effects (x^2). Subscripts are handy for chemical formulas (H_2O). Both are printed one-half the size of standard characters.

Superscripts and subscripts won't print as full-width characters.

Character Spacing

Proportional Spacing

Function	Emulation	Command	
		ASCII	Decimal
Begin proportional spacing	EPSON and S1000	ESC P 1	27 112 49
End proportional spacing	EPSON and S1000	ESC P 0	27 112 48

Proportional spacing adjusts the space between letters to compensate for the varying widths of individual characters. Unlike fixed spacing, where all characters are formed within a matrix of uniform width at a specified pitch, proportional spacing gives more horizontal space to wide characters, like w or M, and less to narrow characters, like I or f. The resulting print is more attractive and easier to read than fixed-space printing.

Because the characters have different widths, proportionally spaced fonts have no fixed pitch; therefore, margin settings are only approximate unless your software specifically supports proportional spacing.

Proportional spacing is available only with near letter quality (NLQ) and Utility (UTL) printing.

You can also select proportional spacing in Menu Select mode or on the printer's control panel. In addition, proportional spacing is one of the features available through the print mode combination commands.

Space between characters

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Space between characters	EPSON and S1000	ESC SP n	27 32 n	n : refer to table below

The variable "n" is the number of dots to be added to the right of each character.

CPI	Value of n (in inches)
10	1/120
12	1/144
17.1	1/206
20	1/240

Note: This command is only valid for NLQ and Utility modes.

Print Features

Underlining

Function	Emulation	Command	
		ASCII	Decimal
Begin underlining	EPSON	ESC - 1	27 45 49
	S1000	ESC X - 1	27 88 45 49
End underlining	EPSON	ESC - 0	27 45 48
	S1000	ESC X - 0	27 88 45 48

This command underscores all characters, including the space character, but does not underscore graphics or the space produced by any horizontal positioning command, including the horizontal tab character.

Unidirectional and Bidirectional Printing

Function	Emulation	Command	
		ASCII	Decimal
Begin unidirectional printing	EPSON and S1000	ESC U 1	27 85 49
(for one line only)		ESC <	27 60
Begin bidirectional printing	EPSON and S1000	ESC U 0	27 85 48

Your printer is designed to maximize speed by printing alternately from the left and right (bidirectional printing), rather than moving the printhead back to the left margin so that each line prints from left to right (unidirectional printing). Use unidirectional printing when precise vertical alignment from line to line is critical.

You can also select unidirectional graphics printing in the Menu select mode.

Composite Command

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Composite command	EPSON and S1000	ESC ! n	27 33 n	see value of n below

If you want to program a combination of print modes for a particular paragraph or line, you can save typing each command separately by using one command.

This is made possible through the specification of the variable "n" as you will see from the following table:

Print mode	Decimal	Print mode	Decimal
Underline	128	Italics	64
Double width	32	Double strike	16
Emphasized	8	Condensed	4
proportional	2	Elite	1
Pica	0		

Some of these options will not be available together. For example, it is obviously not possible to choose Elite and Pica together in one command.

Example : let's say you want to set your printer up to print a document where all the text will be underlined, double width, emphasized and enhanced (double strike). This would normally entail programming four different commands before you could start printing. With this composite command you only need to take the values for each mode from the table above:

Underlined = 128, Double Width = 32, Double Strike = 16 and emphasized = 8. Now we add these values together and incorporate the result in the command like this :

n = 128 + 32 + 16 + 8 = 184

Your command should now be CHR$(27);"!";CHR$(184) and from the receipt of this one command your printer will print an underlined, double width, emphasized and double strike text until it is changed again.

There is no need to reset each mode separately either. When you select a new combination the printer takes care of all the resettings.

Character Sets

International Character Set

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Select international character set	EPSON and S1000	ESC R n	27 82 n	n=0 to 20

This command allows you to select special character sets which replace some less-frequently used characters with symbols used in a variety of languages. To access these character sets, replace n with a value taken from the table in appendic C (page C-2).

Code area expansion

Function	Emulation	Command	
		ASCII	Decimal
Code area expansion (0-31 and 128-159)	EPSON and S1000	ESC I 1	27 73 49
Return areas to control codes	EPSON and S1000	ESC I 0	27 73 48
Code expansion area (128-159 and 255)	EPSON and S1000	ESC 6	27 54
Return areas to control codes	EPSON and S1000	ESC 7	27 55

The ESC I 1 allows you to access and print the characters stored in the ASCII areas 0 to 31 and 128 to 159 that are normally reserved for control codes.

Resetting the code expansion command returns the ASCII areas 0-31 and 128-159 to control codes.

With the ESC 6, you can open the control areas from 128 to 159 and 255 (decimal) to give access to the international characters that are stored there.

Character Sets Selection

The character sets available depend on the emulation selected.

The EPSON FX mode supports the Italic and PC character sets, very usefull in PC environments.

The S 1000 mode can be used in a wide range of applications:

Unix, Xenix and PC environments. The eleven internal character sets available allow a high flexibility.

This mode conforms to the ISO 2022 requirements : character sets invocation and designation, which is a very powerfull system when working with several international and graphics character sets.

All the character sets are selectable either through the front panel (menu selection), or through software commands (Escape sequences).

Refer to **Appendix C** for a full lising of those selection sequences for EPSON FX and S 1000 modes and the character set tables.

EPSON FX character sets

ASCII (with 21 National character sets)

EPSON italic set

EPSON italic expand 1

EPSON italic expand 2

EPSON italic expand 3

EPSON graphic set (PC)

EPSON graphic expand 1

EPSON graphic expand 2

EPSON graphic expand 3

The expand area corresponds to the control codes (7 bit and 8 bit) which can be handled as printable or executable.

S 1000 character sets

ASCII (with 21 National character sets)

ISO 8859/1

TI 928 Graphics (DEC Special graphics)

TI 931 Graphics

EPSON Italic set

DLL 256 characters

PC Extended

PC Multilingual

PC Norway

PC Portugal

PC Turkey

Page Setup
Margins

Left and Right Margins

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Set left margin	EPSON and S1000	ESC l n	27 108 n1	n1 and n2 : see values in the tables next page
Set right margin	EPSON and S1000	ESC Q n	27 81 n2	

See explanations on next page.

TI 830				
CPI	**10**	**12**	**17**	**20**
n1	$0 \leq n1 \leq 78$	$0 \leq n1 \leq 93$	$0 \leq n1 \leq 133$	$0 \leq n1 \leq 156$
n2	$2 \leq n2 \leq 80$	$3 \leq n2 \leq 96$	$4 \leq n2 \leq 137$	$4 \leq n2 \leq 160$
	$n2 \geq n1+2$	$n2 \geq n1+3$	$n2 \geq n1+4$	$n2 \geq n1+4$
TI 835				
n1	$0 \leq n1 \leq 134$	$0 \leq n1 \leq 160$	$0 \leq n1 \leq 299$	$0 \leq n1 \leq 251$
n2	$2 \leq n2 \leq 136$	$3 \leq n2 \leq 163$	$4 \leq n2 \leq 233$	$4 \leq n2 \leq 255$
	$n2 \geq n1+2$	$n2 \geq n1+3$	$n2 \geq n1+4$	$n2 \geq n1+4$

The value of the varables n1 and n2 must be within the ranges specified in the above table. Values outwith these ranges will be ignored.

When setting the right margin at 10 CPI, the right margin (n2) must be set at least two characters to the right of the left margin (n1). Therefore, n2 must be greater than or equal to n1+2; (n2 $\geq$ n1+2).

Setting the left margin does not affect the right margin. It does clear all the horizontal Tabs and resets them every 8 characters starting with the new margin as position 0.

The left margin depends on the pitch at the time of setting. If the character pitch is changed the left margin will not move to accomodate this change.

Even if you have set the printer in proportional mode, the column width will still be set in normal character size.

Default Right Margin Settings

Pitch	TI830	TI835
10 cpi/proportional	80	136
12 cpi	96	163
17.1 cpi	137	233

How to use this table

The value of the variables n1 and n2 must be within the ranges specified in the following table. Values outwith these ranges will be ignored.

When setting the right margin at 10 CPI, the right margin (n2) must be greater than or equal to n1+2; (n2 ≥ n1+2).

Setting the left margin does not affect the right margin. It does clear all the Horizontal Tabs and resets them every 8 characters starting with the new margin as position 0.

The left margin depends on the pitch at the time of setting. If the character pitch is changed the left margin will not move to accomodate this change.

Even if you have your printer set in proportional mode, the column width will still be set in normal character size.

Warning : Any graphics data after the right margin will be lost.

With text this is not the case. Should your text exceed the right margin, the first character that goes beyond the limit set will become the first character on the next line.

Top Margin

When Form Length Set commands are received, the top of form (TOF) position is set to the current line.

Tabs

Horizontal Tabs

| Function | Emulation | Command | | Value of n |
		ASCII	Decimal	
Horizontal tab	EPSON and S1000	HT	9	
Set horizontal tab stops	EPSON and S1000	ESC D n1..nk NUL	27 68 n1...nk 0	k=1 to 32
Clear all horizontal tabs	EPSON and S1000	ESC D NUL	27 68 0	

When you turn on your printer, its tab stops are automatically set for every eight columns. Each time you send a tab command (ASCII HT, decimal 9), the printhead moves eight columns to the right before printing the next character.

In the S1000 and EPSON FX emulations, you can use the ESC D n1...nk NUL command to set horizontal tab stops at specific columns on the page. As with margins, the actual position of the stops depends on the pitch you are using and won't change if you switch to a different character width. Be sure to give the stops, end the sequence with a NUL character (use CHR$(0) in BASIC).

You can set up to 32 horizontal tab stops in both emulations.

The clear command cancels any horizontal tab stops you have set and return the horizontal tab settings to the printer's default-horizontal tab stops every eight columns.

Maximum values for horizontal tab stops

Pitch	TI 830	TI 835
10 cpi/proportional	80	136
12 cpi	96	163
17.1 cpi	132	233
20 cpi	160	272

Vertical Tabs

		Command		
Function	Emulation	ASCII	Decimal	Value of n
Vertical tab	EPSON and S1000	VT	11	
Set vertical tab stops	EPSON and S1000	ESC B n1..nk NUL	27 66 n1...nk 0	n=1 to 16
Clear all vertical tab stops	EPSON and S1000	ESC B NUL	27 66 0	

When you turn the power on, your printer doesn't have any vertical tab stops. If you send a VT command with no stops set, the printer will respond with a single line feed.

You can use ESC B n1...nk NUL command to set a series of vertical tab stops in both emulations. Once you have set the stops, each time you issue a VT command the paper will move up to the next stop position. Be sure to give the stops in ascending order, and after you have specified all the stops, end the sequence with a NUL character (use CHR$(0) in BASIC).

The actual position of the stops depends on the line spacing in effect when you send the ESC B n1...nk NUL command. For example, at six lines per inch spacing, a tab stop of 24 will appear four inches from the top of the page, whereas at eight lines per inch, the stop will be positioned three inches from the top of the page. However, once you've set the vertical tab stops, their position is absolute and won't move, even if you later change the line spacing.

You can set up to 16 vertical stops in both emulations.

Line Spacing

Function	Emulation	Command ASCII	Command Decimal	Value of n
Begin 1/8-inch line spacing	EPSON and S1000	ESC 0	27 48	
Begin 7/72-inch line spacing	EPSON and S1000	ESC 1	27 49	
Begin 1/6-inch line spacing	EPSON and S1000	ESC 2	27 50	
Set variable (n/72-inch) line spacing	EPSON and S1000	ESC A n	27 65 n	n=1 to 85
Begin fine line spacing (n/216-inch)	EPSON and S1000	ESC 3 n	27 51 n	n=0 to 255

The most common spacings for text are 6 and 8 lines per inch (lpi). A spacing of 8 lpi works well with compressed character pitches and lets you fit more lines on a page.

Several of these commands let you control vertical movement in very fine units, which helps with the precise placement of graphics.

Line Feed Control

Forward Line Feed Commands

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Forward line feed	EPSON and S1000	LF	10	
Forward fine line feed (n/216" increments)	EPSON and S1000	ESC J n	27 74 n	n=0 to 255

The forward line feed command (ASCII LF, decimal 10) makes the printer print a line and then moves the print position down one line on the page.

The amount of vertical movement depends on the current line spacing. (See "Line Spacing" above for details.) This command also cancels one-line double width printing.

The fine line feed commands move the paper down in increments of n/216-inch. Unlike the LF command, they are not accompanied by a carriage return and do not cancel one-line double width printing. If you substitute 0 for n in the fine line feed commands, no line feed will be performed. The fine line feed commands are ideal for printing graphics, since they give you precise control over the vertical placement of dots in an image.

Reverse Line Feed Commands

| Function | Emulation | Command | | Value of n |
		ASCII	Decimal	
Reverse line feed n/216 inch	EPSON and S1000	ESC j n	27 106 n	n=0 to 36

Use the reverse line feed commands to move the paper up one line. The reverse one-half line feed commands will move the paper up one-half of a line. The reverse fine line feed will move the paper up in increments of n/216-inch.

Automatic Line Feed Commands

Function	Emulation	Command	
		ASCII	Decimal
LF without CR	EPSON and S1000	ESC DC2	27 18

The variable line feed command causes the printer to print the data in the print buffer and execute a line feed without carriage return.

Forms Control

Form Feed

Function	Emulation	Command	
		ASCII	Decimal
Form feed	EPSON and S1000	FF	12

When you send a form feed command, the printer prints any data that is in its buffer, and the print position moves to the top of the next page. you can also use the FORM FEED button on the control panel to feed a page through the printer.

Form Length

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Set form length by lines	EPSON and S1000	ESC C n	27 67 n	n=1 to 127
Set form length by inches	EPSON and S1000	ESC C NUL n	27 67 0 n	n=1 to 22

You can specify a form length in either inches or lines. If you will most often be using one of the standard page lengths listed on the menu, we recommend using Menu Select mode to set a default form length, and then using one of the form length commands whenever you want to change it temporarily.

When you use ESC C or ESC C NUL to change the form length, the skip over perforation setting returns to the menu default (0), and top of form is set at the current print position.

Set Vertical Format Unit (VFU)

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Set vertical format unit	EPSON and S1000	ESC b n m1..m16 NUL	27 98 n m1..m16 0	n=0 to 7 m=1 to 255
Select vertical format unit	EPSON	ESC / n	27 47 n	
	S1000	ESC X / n	27 88 47 n	

The Set Vertical Format Unit command has the same function as the vertical Tab set (ESC b) but for 8 different channels (n=0..7). In this way it is possible to define up to eight groups each with up to 16 vertical tabs which can be called up with the select Vertical Format Unit command.

This selects one of the 8 Vertical Format Units that were set up with the command 27/98/n/m1...m16/0. Where n is the number of the channel (n=0 to 7), and m is a specific line number and can be from 1 to 255.

Note: at power up the VFU channel n is set to 0.

Skip Over Perforation

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Skip over perforation	EPSON	ESC N n	27 78 n	n=1 to 127
	S1000	ESC X N n	27 88 78 n	n=1 to 127
Reset skip over perforation to default	EPSON	ESC O	27 79	
	S1000	ESC X O	27 88 79	

If skip over perforation is set to Yes on the menu, the printer will automatically skip an inch from the bottom of one page to the top of the next form. Use the ESC N n (ESC X N n in S 1000 mode) command to change the number of lines skipped. The actual amount of space skipped between pages varies with the current line spacing; however, after you have set the skip size, it won't increase or decrease if you change line spacing. The ESC O (ESC X O in S 1000 mode) command returns the perforation skip to its default.

Important

The skip over perforation feature will interfere with page formatting controlled by software packages such as word processors. If you're using a package that controls page length directly, you should set the Skip Over Perforation item in the menu to OFF.

Cut Sheet Feeder Control

Insert Page

Note	The following commands are active only when the optional Cut Sheet Feeder (CSF) is installed on the printer.

Function	Emulation	Command	
		ASCII	Decimal
Insert page	EPSON and S1000	ESC EM I	27 25 73

This command feeds a sheet of paper from the CSF to the top of form position. If paper is already in the printer, the printer will eject the page and load another.

Eject Page

Function	Emulation	Command	
		ASCII	Decimal
Eject page	EPSON and S1000	ESC EM R	27 25 82

This command prints data in the print buffer and ejects the page. A line feed code (see "Line Feed" under "Page Setup" earlier in this chapter) at the end of the page causes the next page to feed into the printer automatically.

Miscellaneous

Backspace

Function	Emulation	Command	
		ASCII	Decimal
Backspace	EPSON and S1000	BS	8

The backspace command prints any data that's in the print buffer and moves the printhead one character to the left. The actual width of the backspace depends on the current pitch. If you're using proportional spacing, the BS command moves the printhead one character width to the left as defined by the last character printed.

Carriage Return

Function	Emulation	Command	
		ASCII	Decimal
Carriage return	EPSON and S1000	CR	13

When the printer receives this command, it will print data from the print buffer and return the printing position to the beginning of the line. If Auto Line Feed is ON in the menu, the printer adds a line feed to each carriage return. This command cancels one-line double width printing.

Absolute and relative dot positioning

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Absolute dot positioning	EPSON and S1000	ESC $ n1 n2	27 36 n1 n2	n1=0 to 255 n2=0 to 3
Relative dot positioning	EPSON and S1000	ESC \ n1 n2	27 92 n1 n2	n1=0 to 255 n2=0 to 3

The absolute dot position code sets the next printing position by counting in 1/60 inch dot units from the left margin.

n1 is a decimal number between 0 and 255, n2 is a decimal number between 0 and 3.

Using these two variables you can specify the specific dot position where your printing should start. You can calculate the variables with this formula:

$$n2 = Int.(dot\ position/256)$$
$$n1 = Dot\ pos. - (n2*256)$$

Clear Buffer

Function	Emulation	Command	
		ASCII	Decimal
Clear buffer	EPSON and S1000	CAN	24
Clear buffer / master reset (set defaults)	EPSON and S1000	ESC @	27 64

This command clears all the data from the print buffer, but does not reset printing features that have been set using control codes.

Home Printhead

Function	Emulation	Command	
		ASCII	Decimal
Home printhead	EPSON and S1000	ESC <	27 60

When the printer receives this command, it will move the printhead back to the first column.

Paper-out Sensor

Function	Emulation	Command	
		ASCII	Decimal
Turn on paper-out sensor	EPSON and S1000	ESC 9	27 57
Turn off paper-out sensor	EPSON and S1000	ESC 8	27 56

The paper-out sensor detects when less than an inch of paper remains. When this happens, the alarm light goes on and the printer is deselected. This command overrides the sensor so that you can print closer to the bottom of the page. (The feature is also menu selectable.) Be careful if you use this feature, since it lets the printer continue printing when there's no more paper. This can cause loss of data and may damage the printhead. You can also override the detector manually by pressing the Sel button, which prints one line followed by a line feed.

Most Significant Bit (MSB)

Function	Emulation	Command	
		ASCII	Decimal
Set 8th data bit (MSB) to 1	EPSON and S1000	ESC >	27 62
Set 8th data bit (MSB) to 0	EPSON and S1000	ESC =	27 61
Cancel (MSB) setting	EPSON and S1000	ESC #	27 35

These commands are used to set the eighth data bit to be
always mark (binary value of 1) or space (binary value of 0).

Print Suppress

Function	Emulation	Command	
		ASCII	Decimal
Begin print suppress mode	EPSON and S1000	DC3	19
End print suppress mode	EPSON and S1000	DC1	17

When the printer receives the command to begin Print Suppress mode,
it ignores all data until it receives the DC1 code. This means that any
data will be lost. The Sel light blinks when the printer is in the Print
Suppress mode.

Delete Last Character

Function	Emulation	Command	
		ASCII	Decimal
Delete last character	EPSON and S1000	DEL	127

The CHR$(127) code deletes the last character data that was input in the
print buffer.

If the code to be deleted was a space, CHR$(32), one space will be deleted on
receipt of this command. If the last data was a horizontal rab skip, then only
one space will be seleted, not the whole skip.

If the data which is to be deleted is in the form of Bit Image graphics data
then this command is ignored.

Reset

Function	Emulation	Command	
		ASCII	Decimal
Perform Reset	EPSON and S1000	ESC @	27 64

You can reset the printer to its default menu settings, clear the print buffer, and set the Top Of Form to the current printhead position.

Half Speed Printing

Function	Emulation	Command	
		ASCII	Decimal
Switch to half speed printing	EPSON and S1000	ESC s 1	27 115 49
Switch to normal speed printing	EPSON and S1000	ESC s 0	27 115 48

The half speed command can be used to set the printer to half the normal speed when printing in the Utility mode. This has no effect on the graphics and only reduces the printer noise.

Note: Half speed printing is not available in HSD or NLQ modes.

▶ Chapter 4: Graphics and Custom Characters

Overview

One of the strengths of dot matrix printer technology is the flexibility that comes from printing patterns of dots. If you can control where the dots are printed, you can print almost any kind of graphic image. (If you look closely at a photo in a newspaper, you'll notice that it's made up of thousands of tiny dots.) You can also change the shape of the printed characters to create special symbols used in some scientific fields or whole new character sets for printing in languages like Hebrew and Russian. You can harness this power by using your 830/835's bit image graphics and custom character (also called downloaded character) features.

Programming these features yourself is a complex and tedious process—the simplest graphic image can contain several hundred dots, and designing a legible character may involve a lot of trial and error as well as considerable programming effort. Fortunately, there are many good graphics and font packages that support the printers your 830/835 emulates, and we strongly recommend that you consider using one. These packages are sophisticated programs designed to handle all those dots for you, so that you can create images and special characters easily without writing a single line of programming.

But if you really want to, you can write your own programs to produce graphics printouts and custom characters. First you should know a little about how your printer works.

Your OMNI 830 or 835 printhead has one column of 9 pins. Images are created as the pins "fire," striking the ribbon against the paper to produce dots. White spaces appear where the pins don't fire.

Whether you're programming a graphic image or designing custom characters to download to the printer, your program has to describe the pattern of dots that you want to print. Graphics and custom character data, like all other data sent to the printer, consist of a series of bytes. Each of the eight bits in a byte of graphics or custom character data corresponds to one pin on the printhead. A bit's value

can be either 1 or 0. When the printer receives the data, it interprets a bit with a value of 1 as a command to fire the corresponding pin. Bits that are set to 0 don't cause pins to fire.

You can picture the byte as a column of 8 bits. In 8-pin graphics, the body of data is a series of these columns lined up next to each other.

Instead of sending the data to the printer bit by bit, you'll probably want to convert this binary information into decimal or hexadecimal format for use with your programming language. In the figure below we show how to determine the decimal value for a given pattern of pins.

128	●	128×1=128
64	●	64×1=64
32		32×0=0
16	●	16×1=16
8		8×0=0
4	●	4×1=4
2	●	2×1=2
1	●	1×1=1

Decimal Value of this byte   215

■ Pin fired   □ Pin not fired
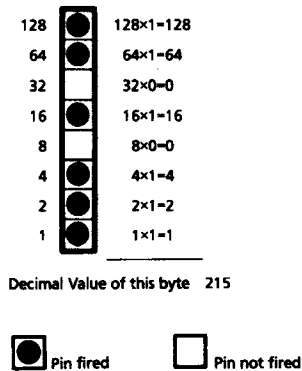
Now that you understand the basic principles, we'll go into the details of how to put the information together to form a complete image or character and how to send that information to the printer.

Graphics

Programming graphics in BASIC

One important thing to remember when you're programming graphics is not to include extraneous line feeds in your programs. Using a semicolon after the data in an LPRINT statement will keep the print position on the same line.

However, there is an additional complication: by default, BASIC assigns to all printers a maximum line length of 80 characters. After the printer has received 80 bytes of data, it will automatically perform a carriage return and line feed. Since graphics data typically consists of many bytes, it's quite easy to exceed this limit. The resulting output will be garbled. You can work around this problem by setting the line length to the maximum allowable value, 255. Put one of these statements at the beginning of your program:

▶ For printer defined as LPT1:

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

▶ For printers that have been opened as #1:

```
WIDTH #1,255
```

Dot Density

8-pin graphics, used by most DOS based graphics software, is available in both emulations of the OMNI 830/835.

You have a choice of several different horizontal dot densities for your graphics. The density is expressed in dot-per-inch (DPI). You can select 60 DPI (Normal density) , 120 DPI (Double Density) or 240 DPI (Quadruple Density).

Since the printhead pins are always the same distance apart, vertical dot density is always the same, 72 DPI (higher vertical dot density can be obtained by using n/216-inch line spacing and making multiple

print passes). If you want to print several lines of graphics that touch each other, you need to use a control code to set the line spacing to 8/72-inch (see "Line Spacing" in chapter 3).

8-Pin Graphics

60 DPI (Single Density) Graphics

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Begin single density graphics	EPSON and S1000	ESC K n1n2 [graphics data]	27 75 n1n2 [graphics data]	n1,n2=0 to 255

120 DPI (Double Density) Graphics

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Begin double density graphics	EPSON and S1000	ESC L n1n2 [graphics data]	27 76 n1n2 [graphics data]	n1,n2=0 to 255
Begin high-speed double density graphics	EPSON and S1000	ESC Y n1n2 [graphics data]	27 89 n1n2 [graphics data]	n1,n2=0 to 255

240 DPI (Quadruple Density) Graphics

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Begin quadruple density graphics	EPSON and S1000	ESC Z n1n2 [graphics data]	27 90 n1n2 [graphics data]	n1,n2=0 to 255

The variables n1 and n2 tell the printer how many bytes of graphics data to expect. Remember, the 8-pin modes have one byte of data per column. To calculate the values for these variables, first determine how many columns of dots there will be in your graphics image. Divide this number by 256 and assign the whole number result to n2; assign the remainder to n1. After the number of bytes defined by n1 and n2 is received, the printer returns to interpreting data normally.

Bit-Image graphic Density Selection

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Select bit-image graphic density	EPSON	ESC * p n1 n2	27 42 p n1 n2	n1,n2=0 to 255 p : see below
	S1000	ESC X * p n1 n2	27 88 42 p n1 n2	

The parameter "p" defines the graphic mode.

p	Mode	Dot/inch
0	Normal density	60
1	Dual density	120
2	Dual density, double speed	120
3	Quadruple density	240
4	CRT graphics	80
5	Plotter Graphics (1:1)	72
6	CRT graphics II	90
7	Plotter graphics double density	144

Note: Modes 0 to 3 are the same as ESC K,L,Y and Z. In mode 2 and 3 adjacent dots cannot be printed.

Nine pin APA-graphic-mode

Function	Emulation	Command		Value of n
		ASCII	Decimal	
Select 9 pin-graphic mode	EPSON and S1000	ESC ^ m n1 n2	27 94 m n1 n2	n1, n2 : same as 8 pin-mode

The nine-pin-graphic-mode can be used to minimise printhead movement.

If m is 0 then single density is set. If m is 1 then printing in double density is active.

Change of graphic control sequence

It is possible to assign the ESC K,L,Y,Z commands to another graphics mode with the following control string.

CHR$(27);CHR$(63);CHR$(m);CHR$(p)

ESC ? m p

Where m is one of the letters K,L,Y or Z, p is the graphic mode as described in the table previously.

Custom Characters

Your printer's custom (downloadable) character feature enables you to design your own characters and symbols, even entire character sets if you choose, and download them from your computer to the printer.

You can design and store up to 96 characters in EPSON emulation, and 256 characters in S1000 emulation. Your custom characters are assigned to keys of your choice on the keyboard. Then, whenever you need a particular character, all you have to do is invoke the custom character set and press the key assigned to your character. The actual designing of these characters requires some work on your part and can become tedious. Once again, we strongly recommend using a commercial software package to help you create new characters and download them to your printer. There are also packages that provide character sets that have already been designed for you.

Designing a Character

The technique of designing your own custom characters is much like that of designing a graphic image, but on a much smaller scale. You can design characters in either Utility or NLQ mode.

Begin by designing your character on a grid. The height and width of the grid depends on the print mode. In the Utility mode, the height of the grid for a normal character is 7 dots (though 8 dots can be used) and the maximum width of the grid is 12 columns. In the NLQ print mode, the height of the grid is 18 dots and the maximum width is 24 columns.

The grid (height) can be adjusted up or down by using the attribute byte in the print command. This byte specifies whether the character is an ascender or a descender. The attribute byte also contains other information about the character, as explained later.

The character's baseline depends on whether it is an ascender or a descender. The columns of the matrix to the left and right of your character affect where it will appear in relation to the characters on either side of it. There is one mandatory blank column at the end of the character (column 12 in UTL, column 24 in NLQ). If you don't leave blank columns, adjacent characters may appear to run right into your character.

Your arrangement of dots is translated into code that tells your printer the exact location of each dot within each column.

For example, consider the following grid design for a right arrow character in the Utility print mode.
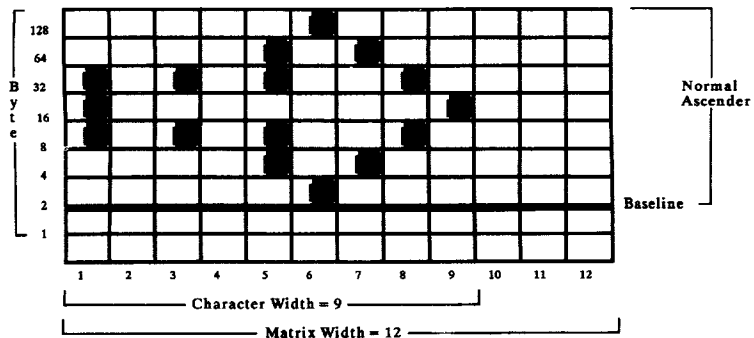
The character is 9 dots wide and is flush to the left. We'll print it in 10 cpi Utility. Just like 8-pin graphics, each byte specifies a dot column, and the value of each byte is determined by adding up the values of its bits.

Note   You cannot place two dots next to each other horizontally—you must skip one column.

4-9

Now we need to give the commands that download this data to the printer.

Downline Loadable Character Generator (DLL)

Function	Emulation	Command ASCII	Command Decimal	Value of n
Copy ROM characters to RAM	EPSON and S1000	ESC : NUL NUL NUL	27 58 0 0 0	
Download custom character	EPSON and S1000	ESC & NUL n m a p1...	27 38 0 n m a p1...	Refer to explanations below
Designate Utility DLL	EPSON and S1000	ESC % SOH NUL	27 37 1 0	
Designate normal character generator	EPSON and S1000	ESC % NUL NUL	27 37 0 0	

In addition to the normal character sets, the EPSON and S1000 modes offer a downline loadable character generator for custom-designed character patterns.

The ESCAPE sequence for loading the DLL has the following structure:

CHR$(27) "&" CHR$(0) CHR$(i) CHR$(j) CHR$(a)   CHR$(C0)...CHR$(C10)

ESC & NUL   start   stop   attribute byte 11 pattern bytes

You can create and store up to 256 characters for your personal purpose, but the characters from 0 to 31 and from 128 to 159 are not printable (unless you have selected "print Unassigned Codes").

The first step is to convert a character pattern into a string of bytes which can be transmitted to the printer. Each column is represented by one 8-bit binary number (also called a byte). This byte can be calculated by adding the decimal values of the dots that should be printed.

The attribute byte

Every new defined character which will be loaded into the DLL RAM needs a control byte, the Attribute Byte.

This Attribute Byte has three functions.

-ascender or descender

-start column (only affects proportional printing)

-stop column (only affects proportional printing)

1	X >	
2	X >	last print column of character
4	X >	
8	X >	
16	X >>	
32	X >>	first print column of character
64	X >>	
128	X >>>	ascender (0 = descender / 1 = ascender)

If you do not want to print in proportional mode you only need to specify if the character is to be printed with the top 8 pins (attribute byte = 128) or with the bottom 8 pins (attribute byte = 0).

If you are going to use proportional mode then you must define the character width including the space required between characters.

Here is a Programme Example: Loading Multiple Characters

```
10  LPRINT CHR$(27);CHR$(58);CHR$(0);CHR$(0);:
                              REM***COPY NORMAL INTO DLL CG
20  LPRINT CHR$(27);CHR$(38);CHR$(0);:
                              REM***LOAD DLL CG*********
30  LPRINT "A";"C";:          REM***LOAD FROM A TO C***
40  LPRINT CHR$(138);:        REM***SEND ATTRIBUTE BYTE FOR A
50  LPRINT CHR$(128);CHR$(96);CHR$(17);CHR$(0);CHR$(145);
    CHR$(110);CHR$(145);CHR$(0);CHR$(17);CHR$(96);CHR$(128);
60  :                         REM***SEND PATTERN DADA FOR A
70  LPRINT CHR$(4);:
                              REM***SEND ATTRIBUTE BYTE FOR B
80  LPRINT CHR$(170);CHR$(85);CHR$(170);CHR$(85);CHR$(85);
    CHR$(0);CHR$(0);CHR$(0);CHR$(0);CHR$(0);CHR$(0);
90  :                         REM***SEND PATTERN DATA FOR B
100 LPRINT CHR$(134);:        REM***ATTRIBUTE BYTE FOR C
110 LPRINT CHR$(124);CHR$(32);CHR$(16);CHR$(40);CHR$(68);
    CHR$(2);CHR$(1);CHR$(0);CHR$(0);CHR$(0);CHR$(0);
115 :                         REM***SEND PATTERN DATA FOR C
120 LPRINT "Now we have changed 'A B C' INTO    ";
130 LPRINT CHR$(27);CHR$(37);CHR$(1);CHR$(0);:
                              REM***SELECT DLL***
140 LPRINT "A B C"
150 LPRINT CHR$(27);CHR$(37);CHR$(0);CHR$(0);:
                              REM***SELECT NORMAL CG***
160 END
```

▶ Appendix A: Control Codes

Function	Control Code	
	ASCII	**Decimal**
Backspace		
Backspace	BS	8
Carriage return		
Carriage return	CR	13
Character set		
Code expansion OFF (128-159 + 255 CTRL code)	ESC 7	27 55
Code expansion ON (128-159 + 255 printable)	ESC 6	27 54
National character set	ESC R n	27 82 n
Unassigned code print OFF (CTRL code 0-31 128-159)	ESC I 0	27 73 48
Unassigned code print ON (chr$, & contr. codes)	ESC I 1	27 73 49
Character pitch		
10 CPI (pica)	ESC P	27 80
12 CPI (elite)	ESC M	27 77
** 17 CPI, 20 CPI if 12 CPI (condensed)	SI	15
** 17 CPI, 20 CPI if 12 CPI (condensed)	ESC SI	27 15
Reset condensed mode (20 -> 12 + 17 -> 10 CPI)	DC2	18
Clear buffer		
Clear buffer	CAN	24
Clear buffer/master rest (sets defaults)	ESC @	27 64

** **Notes:** Valid for EPSON mode only, please refer to the S 1000 special control codes table (page A-7).

Function	Control Code	
	ASCII	Decimal
Composite selection		
Composite selection of printmodes	ESC ! n	27 33 n
Cut sheet feeder		
CSF single sheet eject	ESC EM I	27 25 73
CSF single sheet insert	ESC EM R	27 25 82
Delete		
Delete last character (in buffer)	DEL	127
Dot position		
Dot position absolute (in 1/60 inch units)	ESC $ n1 n2	27 36 n1n2
Dot position relative (in 1/120 inch units)	ESC \ n1 n2	27 92 n1n2
Double width		
** Double width (for one line only)	ESC SO	27 14
** Double width (for one line only)	SO	14
Double width OFF (before end of line)	DC4	20
Double width OFF	ESC W 0	27 87 48
Double width ON	ESC W 1	27 87 49
Downline loadable character gene. (DLL)		
Copy standard set to DLL char. gene.	ESC : NUL NUL NUL	27 58 0 0 0
Designate DLL character set	ESC % SOH NUL	27 37 1 0
Exit DLL (to DP-mode)	ESC % NUL NUL	27 37 0 0
Load DLL character	ESC & NUL n m a p1...	27 38 0 n m a p1...

** **Notes:** Valid for EPSON mode only, please refer to the S 1000 special control codes table (page A-7).

Function	Control Code	
	ASCII	**Decimal**
Emphasized/enhanced		
Emphasized OFF	ESC F	27 70
Emphasized ON	ESC E	27 69
Enhanced OFF (double strike)	ESC H	27 72
Enhanced ON (double strike)	ESC G	27 71
Formatting		
Form feed	FF	12
Form length by inches (n=1 to 22)	ESC C NUL n	27 67 0 n
Form length by lines (n=1 to 127)	ESC C n	27 67 n
Graphic modes		
** Select 8 bit graphics	ESC * p n1 n2 v1...vk	27 42 p n1 n2 v1...vk
Select 9 bit graphics (single + double density)	ESC ^ p n1 n2 v...	27 94 p n1 n2 v...
Graphics density		
Density double (120 X 72 DPI)	ESC Y n1 n2	27 89 n1n2
Density double half speed (120 X 72 DPI)	ESC L n1 n2	27 76 n1n2
Density quadruple (240 X 72 DPI)	ESC Z n1 n2	27 90 n1n2
Density single (60 X 72 DPI)	ESC K n1 n2	27 75 n1n2
Reassign ALT. graphic codes	ESC ? m p	27 63 m p
(ESC * to ESC K,L,Y,Z)		
Horizontal tabs		
Horizontal tabulator skip	HT	9
HTABS clear	ESC D NUL	27 68 0
HTABS set by characters (k=max. 32)	ESC D n1...nk NUL	27 68 n1... nk 0

** **Notes:** Valid for EPSON mode only, please refer to the S 1000 special
control codes table (page A-7).

Function	Control Code	
	ASCII	**Decimal**
Italics		
Italics OFF	ESC 5	27 53
Italics ON	ESC 4	27 52
Line feed		
LF without CR (print data)	ESC DC2	27 18
Line feed	LF	10
Var. line feed n/216 inch (n=0 to 255)	ESC J n	27 74 n
Var. rev. line feed n/216 inch (n=0 to 36)	ESC j n	27 106 n
Line spacing		
6 LPI	ESC 2	27 50
8 LPI	ESC 0	27 48
Line spacing 7/72 inch (for 7 bit graphics)	ESC 1	27 49
Var. line spacing n/216 inch (n=0 to 255)	ESC 3 n	27 51 n
Var. line spacing n/72 inch (n=1 to 85)	ESC A n	27 65 n
Margins		
Margin left set	ESC I n	27 108 n
Margin right set	ESC Q n	27 81 n
Miscellaneous		
Half speed printing OFF	ESC s 0	27 115 48
Half speed printing ON	ESC s 1	27 115 49
MSB setting		
Cancel MSB setting	ESC #	27 35
MSB set 0	ESC =	27 61
MSB set 1	ESC >	27 62

Function	Control Code	
	ASCII	Decimal
Near Letter Quality		
NLQ auto justification (left, mid, right, full)	ESC a n	27 97 n
Select font NLQ	ESC x SOH	27 120 1
Paper out sensor		
Paper out sensor OFF	ESC 8	27 56
Paper out sensor ON	ESC 9	27 57
Print head direction		
Unidir. print (home head) for one line only.	ESC <	27 60
Unidirectional print OFF	ESC U 0	27 85 48
Unidirectional print ON	ESC U 1	27 85 49
Print suppress		
Print suppress OFF	DC1	17
Print suppress ON (no print until "DC1")	DC3	19
Proportional spacing		
Proportional spacing OFF	ESC p 0	27 112 48
Proportional spacing ON	ESC p 1	27 112 49
Skip-over perforation		
** Skip-over perforation (n=1 to 127)	ESC N n	27 78 n
** Skip-over perforation OFF	ESC O	27 79
Space between characters		
Space between characters (n=0 to 63)	ESC SP n	27 32 n

** **Notes:** Valid for EPSON mode only, please refer to the S 1000 special control codes table (page A-7).

Function	Control Code	
	ASCII	**Decimal**
Subscript/superscript		
Subscript OFF (also superscript OFF)	ESC T	27 84
Subscript ON (SOH or any odd No.)	ESC S 1	27 83 49
Superscript OFF (also subscript OFF)	ESC T	27 84
Superscript ON (NUL or any even No.)	ESC S 0	27 83 48
Underlining		
** Underline OFF (underscore)	ESC - 0	27 45 48
** Underline ON (underscore)	ESC - 1	27 45 49
Utility/draft mode		
** Designate HSD mode (SSD at 12 CPI)	ESC (0	27 40 48
Select font utility	ESC x NUL	27 120 0
Vertical format unit		
** VFU channel select (n=0 to 7)	ESC / n	27 47 n
VFU load (k=1 to 16)	ESC b n	27 98 n m1
	m1...mk NUL	...mk 0
Vertical tabs		
Vertical tabulator cancel	ESC B NUL	27 66 0
vertical tabulator set	ESC B n1...	27 66 n1...
	n16 NUL	n16 0
Vertical tabulator skip (same as LF if no tab)	VT	11

** **Notes:** Valid for EPSON mode only, please refer to the S 1000 special control codes table (page A-7).

S 1000 special control codes table

Function - S 1000 only	Control Code	
	ASCII	Decimal
Condensed	ESC X SI	27 88 15
Double width (for one line only)	ESC X SO	27 88 14
Skip-over perforation (n=1 to 127)	ESC X N n	27 88 78 n
Skip-over perforation OFF	ESC X O	27 88 79
Designate HSD mode (SSD at 12 CPI)	ESC X (0	27 88 40 48
Select 8 bit graphics (m=0 to 7)	ESC X * m n1 n2	27 88 42 m n1 n2
VFU channel select (n=0 to 7)	ESC X / n	27 88 47 n
Underlining OFF	ESC X - 0	27 88 45 48
Underlining ON	ESC X - 1	27 88 45 49

Notes: The S 1000 control sequences were built using the EPSON sequence, and adding a "X" after the escape code. This avoids any conflict with the ISO2022 control sequences.

EPSON and S 1000 non standard control code table

Function	Control Code	
	ASCII	Decimal
NLQ font select		
NLQ Courier	ESC k 0	27 107 48
NLQ San Serif	ESC k 1	27 107 49
Double Height		
Double height off	ESC w 0	27 119 48
Double on	ESC w 1	27 119 49
Dual bin CSF bin No.		
Dual 1 bin select	ESC EM 1	27 25 49
Dual 2 bin select	ESC EM 2	27 25 50
Emulation change		
Epson FX emulation	ESC { F	27 123 70
S 1000 emulation	ESC { U	27 123 85

▶ Appendix B: Menu Selections

Group	Item	Settings
Font	Print Mode	**Utility**, NLQ Courier, NLQ Sans Serif, HSD
	Pitch	**10 CPI**, 12 CPI, 17.1 CPI 20 CPI, proportional
	Style	**Normal**, Italics
	Size	**Single**, Double
General control	Emulation Mode	**EPSON FX**, S 1000
	Graphics	**Bi-directional,** Uni-direct.
	Paper Out Override	**No**, Yes
	Print registration	**0**, -1, -2, -3, -4, -5, +5, +4 , +3, +2, +1
	Operator Panel Functions	**Full Operation**, Limited Operation
Vertical Control	Print Suppress Effect.	**Yes**, No
	Buffer Size	**Normal**, Reduced
	Line Spacing	**6LPI**, 8LPI
	Form tear-Off	**Off**, On
	Skip Over Perforation	**No**, Yes
	Auto LF	**No**, Yes
	Auto Feed XT	**Invalid**, valid
	Page Length	**12"** 14" 3" 3.5" 4" 5.5" 6" 7" 8" 8.5" 11" 11 2/3"
	CSF Bin Select	**Bin-1**, Bin-2

Note: Factory settings are printed bold.

Group	Item	Settings
Symbol Sets	G0 designation (S 1000)	**ASCII**, ISO 8859, 928 Graphics, 931 Graphics, EPSON Italics, DLL, PC extended, PC multilingual, PC Norway, PC Turkey, PC Portugal
	G1 designation (S 1000)	Same as above, **ISO 8859**
	G2 designation (S 1000)	Same as above **928 Graphics**
	G3 designation (S 1000)	Same as above **931 Graphics**
	GL invocation (S 1000)	**G0**, G1, G2, G3
	GR invocation (S 1000)	**G1**, G2, G3, G0
	Printable 8 Bit control	**Yes**, no
	Language Set	**American**, French, German, British, Danish 1, Swedish 1, Italian, Spanish 1, Japanese, Norwegian, Danish 2, Spanish 2, Latin America, French Canadian, Dutch, Swedish 2, Swedish 3, Swedish 4, Turkish, Swiss 1, Swiss 2
	Zero Character	**Unslashed**, Slashed
Serial I/F Option	Parity	**None**, Odd, Even
	Serial Data 7 otr 8 Bits	**8**, 7
	Protocol	**Ready/Busy**, XON/XOFF
	Diagnostic Test	**No**, Yes
	Busy Line	**SSD-**, SSD+, DTR, RTS
	Baud Rate	**9600**, 4800, 2400, 1200, 600 300, 19200 BPS
	DSR Signal	**Valid**, Invalid
	DTR Signal	**Ready on Power Up,** on Select
	Busy Time	**200 Milliseconds**, 1 Second

Note: Factory settings are printed bold.

▶ Appendix C: Character Sets

NATIONAL CHARACTER SETS   (ESC R n)
(EPSON FX and S 1000 MODE)

ESC.R.n	Language	23	24	26	30	3C	3E	40	4F	5B	5C	5D	5E	5F	60	69	7B	7C	7D	7E
0H	AMERICAN	#	$	&	0	<	>	@	O	[	\	]	^	_	`	i	{	|	}	~
1H	FRENCH	#	$	&	0	<	>	à	O	°	ç	§	^	_	`	i	é	ù	è	¨
2H	GERMAN	#	$	&	0	<	>	§	O	Ä	Ö	Ü	^	_	`	i	ä	ö	ü	ß
3H	BRITISH	£	$	&	0	<	>	@	O	[	\	]	^	_	`	i	{	|	}	~
4H	DANISH 1	#	$	&	0	<	>	@	O	Æ	Ø	Å	^	_	`	i	æ	ø	å	~
5H	SWEDISH 1	#	¤	&	0	<	>	É	O	Ä	Ö	Å	Ü	_	é	i	ä	ö	å	ü
6H	ITALIAN	#	$	&	0	<	>	@	O	°	\	é	^	_	ù	i	à	ò	è	ì
7H	SPANISH 1	R	$	&	0	<	>	@	O	¡	Ñ	¿	^	_	`	i	¨	ñ	}	~
8H	JAPANESE	#	$	&	0	<	>	@	O	[	¥	]	^	_	`	i	{	|	}	~
9H	NORWEGIAN	#	¤	&	0	<	>	É	O	Æ	Ø	Å	Ü	_	é	i	æ	ø	å	ü
AH	DANISH 2	#	$	&	0	<	>	É	O	Æ	Ø	Å	Ü	_	é	i	æ	ø	å	ü
BH	SPANISH 2	#	$	&	0	<	>	á	O	¡	Ñ	¿	é	_	`	i	í	ñ	ó	ú
CH	LATIN AMERICA	#	$	&	0	<	>	á	O	¡	Ñ	¿	é	_	ü	i	í	ñ	ó	ú
DH	FR. CANADIAN	à	$	ë	0	<	>	à	Ø	â	ç	ê	î	Ï	ô	i	é	ù	è	û
EH	DUTCH	£	$	&	0	<	>	@	O	[	IJ	]	^	_	`	i	{	ij	}	~
FH	SWEDISH 2	#	$	&	0	<	>	É	O	Ä	Ö	Å	Ü	_	é	i	ä	ö	å	ü
10H	SWEDISH 3	§	$	&	0	<	>	É	O	Ä	Ö	Å	Ü	_	é	i	ä	ö	å	ü
11H	SWEDISH 4	§	¤	&	0	<	>	É	O	Ä	Ö	Å	^	_	é	i	ä	ö	å	ü
12H	TURKISH	ş	$	ğ	0	<	>	Ş	O	İ	Ö	Ü	ğ	_	ç	ı	i	ö	ü	ç
13H	SWISS 1	£	$	&	0	<	>	ç	O	à	é	è	^	_	`	i	ä	ö	ü	"
14H	SWISS 2	£	$	&	0	<	>	§	O	à	ç	è	^	_	`	i	ä	ö	ü	é

Character sets selection

Epson FX mode character set commands

Function	Emulation	Command	
		ASCII	Decimal
EPSON Italic, expansion 1	EPSON	ESC t 0 ESC 7	27 116 48 27 55
EPSON Italic, expansion 2	EPSON	ESC t 0 ESC 6	27 116 48 27 54
EPSON Italic, expansion 3	EPSON	ESC t 0 ESC I 1	27 116 48 27 73 49
EPSON Line Graphics, expansion 1	EPSON	ESC t 1 ESC 7	27 116 49 27 55
EPSON Line Graphics, expansion 2	EPSON	ESC t 1 ESC 6	27 116 49 27 54
EPSON Line Graphics, expansion 3	EPSON	ESC t 1 ESC I 1	27 116 49 27 73 49

All combinations are possible with ESC t 0/1, ESC 6/7, ESC I 0/1.

The ESC t 0/1 toggles between the Italic and Line graphics character sets.

The ESC 6/7 toggles between expansion 1 and 3.

The ESC I 0/1 toggles between expansion 2 and 3, or 1 and no expansion.

EPSON ITALIC CHARACTER SET (ESC t 0 ESC I 0 ESC 7)

	8	9	A	B	C	D	E	F
0	NUL			0	@	P	`	p
1		DC1	!	1	A	Q	a	q
2		DC2	"	2	B	R	b	r
3		DC3	#	3	C	S	c	s
4		DC4	$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7	BEL		'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF		*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF		,	<	L	\	l		
D	CR		-	=	M	]	m	}
E	SO		.	>	N	^	n	~
F	SI		/	?	O	_	o	DEL

C-4

EPSON ITALIC CHARACTER SET   (ESC t 0 ESC I 1 ESC 7)

	8	9	A	B	C	D	E	F
0	à	§		0	@	P	`	p
1	è	ß	!	1	A	Q	a	q
2	ù	DC2	"	2	B	R	b	r
3	ò	DC3	#	3	C	S	c	s
4	ì	DC4	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	BEL	Ä	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	Ü	)	9	I	Y	i	y
A	LF	ä	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	ü	,	<	L	\	l	|
D	CR	é	-	=	M	]	m	}
E	SO	é	.	>	N	^	n	~
F	SI	¥	/	?	O	_	o	DEL

	8	9	A	B	C	D	E	F
0	à	§		0	@	P	`	p
1	è	ß	!	1	A	Q	a	q
2	ù	DC2	"	2	B	R	b	r
3	ò	DC3	#	3	C	S	c	s
4	ì	DC4	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	BEL	Ä	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	Ü	)	9	I	Y	i	y
A	LF	ä	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	ü	,	<	L	\	l	|
D	CR	é	-	=	M	]	m	}
E	SO	é	.	>	N	^	n	~
F	SI	¥	/	?	O	_	o	DEL

	8	9	A	B	C	D	E	F
0	à	§		0	@	P	`	p
1	è	ß	!	1	A	Q	a	q
2	ù	Æ	"	2	B	R	b	r
3	ò	æ	#	3	C	S	c	s
4	ì	Ø	$	4	D	T	d	t
5	º	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	¡	Ä	'	7	G	W	g	w
8	¿	Ö	(	8	H	X	h	x
9	Ñ	Ü	)	9	I	Y	i	y
A	ñ	ä	*	:	J	Z	j	z
B	¤	ö	+	;	K	[	k	{
C	₧	ü	,	<	L	\	l	|
D	Å	É	-	=	M	]	m	}
E	å	é	.	>	N	^	n	~
F	ç	¥	/	?	O	_	o	Ø

	0	1	2	3	4	5	6	7
0	à	§	SP	0	@	P	`	p
1	è	DC1	!	1	A	Q	a	q
2	ù	DC2	"	2	B	R	b	r
3	ò	DC3	#	3	C	S	c	s
4	ì	DC4	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	BEL	Ä	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	Ö	)	9	I	Y	i	y
A	LF	å	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	ü	,	<	L	\	l	|
D	CR	é	-	=	M	]	m	}
E	SO	é	.	>	N	^	n	~
F	SI	¥	/	?	O	_	o	

EPSON PC CHARACTER SET (ESC t 1 ESC I 0 ESC 7)

	8	9	A	B	C	D	E	F
0	NUL		á	▒	└	╨	α	≡
1		DC1	í	▓	┴	╤	ß	±
2		DC2	ó	█	┬	╥	Γ	≥
3		DC3	ú	│	├	╙	π	≤
4		DC4	ñ	┤	─	╘	Σ	⌠
5			Ñ	╡	┼	╒	σ	⌡
6			ª	╢	╞	╓	μ	÷
7	BEL		º	╖	╟	╫	τ	≈
8	BS	CAN	¿	╕	╚	╪	Φ	°
9	HT	EM	⌐	╣	╔	┘	θ	•
A	LF		¬	║	╩	┌	Ω	·
B	VT	ESC	½	╗	╦	█	δ	√
C	FF		¼	╝	╠	▄	∞	η
D	CR		¡	╜	=	▌	ø	²
E	SO		«	╛	╬	▐	∈	■
F	SI		»	┐	╧	▀	∩	

	8	9	A	B	C	D	E	F
0	Ç	é	á	▦	└	╨	α	≡
1	ü	æ	í	▨	┴	╤	β	±
2	é	DC2	ó	▩	┬	╥	Γ	≥
3	â	DC3	ú	│	├	╙	π	≤
4	ä	DC4	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	ª	╢	╞	╓	μ	÷
7	BEL	ù	º	╖	╟	╫	τ	≈
8	BS	CAN	¿	╕	╚	╪	Φ	°
9	HT	ö	⌐	╣	╔	┘	θ	∙
A	LF	Ü	¬	║	╩	┌	Ω	·
B	VT	ESC	½	╗	╦	█	δ	√
C	FF	£	¼	╝	╠	▄	∞	ⁿ
D	CR	¥	¡	╜	=	▌	ø	²
E	SO	₨	«	╛	╬	▐	∈	■
F	SI	ƒ	»	┐	╧	▀	∩	DEL

EPSON PC EXPAND 2 (ESC t 1 ESC I 0 ESC 6)

	8	9	A	B	C	D	E	F
0	Ç	É	á	▒	└	╨	α	≡
1	ü	æ	í	▓	┴	╤	β	±
2	é	Æ	ó	▓	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ä	ö	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	ª	╢	╞	╓	μ	÷
7	ç	ù	º	╖	╟	╫	τ	≈
8	ê	ÿ	¿	╕	╚	╪	Φ	°
9	ë	Ö	⌐	╣	╔	┘	θ	∙
A	è	Ü	¬	║	╩	┌	Ω	·
B	ï	¢	½	╗	╦	█	δ	√
C	î	£	¼	╝	╠	▄	∞	ⁿ
D	ì	¥	¡	╜	=	▐	∅	²
E	Ä	₧	«	╛	╬	▌	∈	∎
F	Å	ƒ	»	┐	⊥	▀	∩	

	0	1	2	3	4	5	6	7
0	à	§	SP	0	@	P	`	p
1	è	DC1	!	1	A	Q	a	q
2	ù	DC2	"	2	B	R	b	r
3	ò	DC3	#	3	C	S	c	s
4	ì	DC4	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	BEL	Ä	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	Ö	)	9	I	Y	i	y
A	LF	å	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	ü	,	<	L	\	l	|
D	CR	é	-	=	M	]	m	}
E	SO	é	.	>	N	^	n	~
F	SI	¥	/	?	O	_	o	

Character sets selection

S1000 mode character set commands

The character sets selection conforms to the ISO 2022 requirements:

The character sets have to be designated and invoked according to the chart below.

The whole designation sequence is :

ESC <designation> <character set identifier>

The invocation sequence is a control code : SI. SO, SS2, SS3 or an Escape sequence.

Designation sequences table

Function	Emulation	Command	
		ASCII	Decimal
Designation character set G0 (94 characters)	S 1000	ESC (n	27 40 n
Designation character set G1	S 1000		
94 characters		ESC) n	27 41 n
96 characters		ESC - n	27 45 n
Designation character set G2	S 1000		
94 characters		ESC * n	27 42 n
96 characters		ESC . n	27 46 n
designation character set G3	S 1000		
94 characters		ESC + n	27 43 n
96 characters		ESC / n	27 47 n

Where n is the character set identifier, in the next table.

Character set indentifier table (S1000 mode only)

Character set	ASCII	Decimal	# of char.
ASCII	B	66	94 char.
ISO 8859/1	A	65	96 char.
GRAPHICS TI 928 (DEC GRAPHICS)	0	48	94 char.
GRAPHICS TI 931	9	57	94 char.
DOWNLOADED CHAR SET (DLL)	<	60	96 char.
EPSON ITALIC	I	73	96 char.
PC EXTENDED	P	80	96 char.
PC MULTILINGUAL	M	77	96 char.
PC NORWAY	N	78	96 char.
PC PORTUGAL	G	71	96 char.
PC TURKEY	T	84	96 char.

The ISO 2022 recommmandations define two types of character sets : the full 96 character sets (graphics) and the 94 character sets where the code 32 is always considered as SPACE and the code 127 is always the DELETE code.

The designation sequence changes according to the type of character set.

Invocation sequences table (S1000 mode only)

Function	ASCII	Decimal
Locking-shift zero (LS0) or shift-in (SI)	SI	15
Locking-shift one (LS1) or shift-out (SO)	SO	14
Locking-shift one right (LS1R)	ESC ~	27 126
Locking-shift two (LS2)	ESC n	27 110
Locking-shift two right (LS2R)	ESC }	27 125
Locking-shift three (LS3)	ESC o	27 111
** Locking-shift three right (LS3R)	ESC |	27 124
Single-shift two (SS2)	ESC N or 08/14	27 78 / 142
Single-shift three (SS3)	ESC O or 08/15	27 79 / 143

** **Notes:** Depending on the computer, the vertical bar may show as a broken bar.

Designation and Invocation chart

**Designation and Invocation
of control functions**

ESC I n

ESC 6 or 7 or ESC I n

0 1	2 3 4 5 6 7	8 9	10... 15
C0	GL	C1	GR

Invocation of character sets

LS0   LS1   LS1R   LS2   LS2R   LS3   LS3R

| G0 | G1 | G2 | G3 |

Designation of character sets

| ASCII | ISO 8859 | TI 928 graph. | PC EXT | PC Turkey |
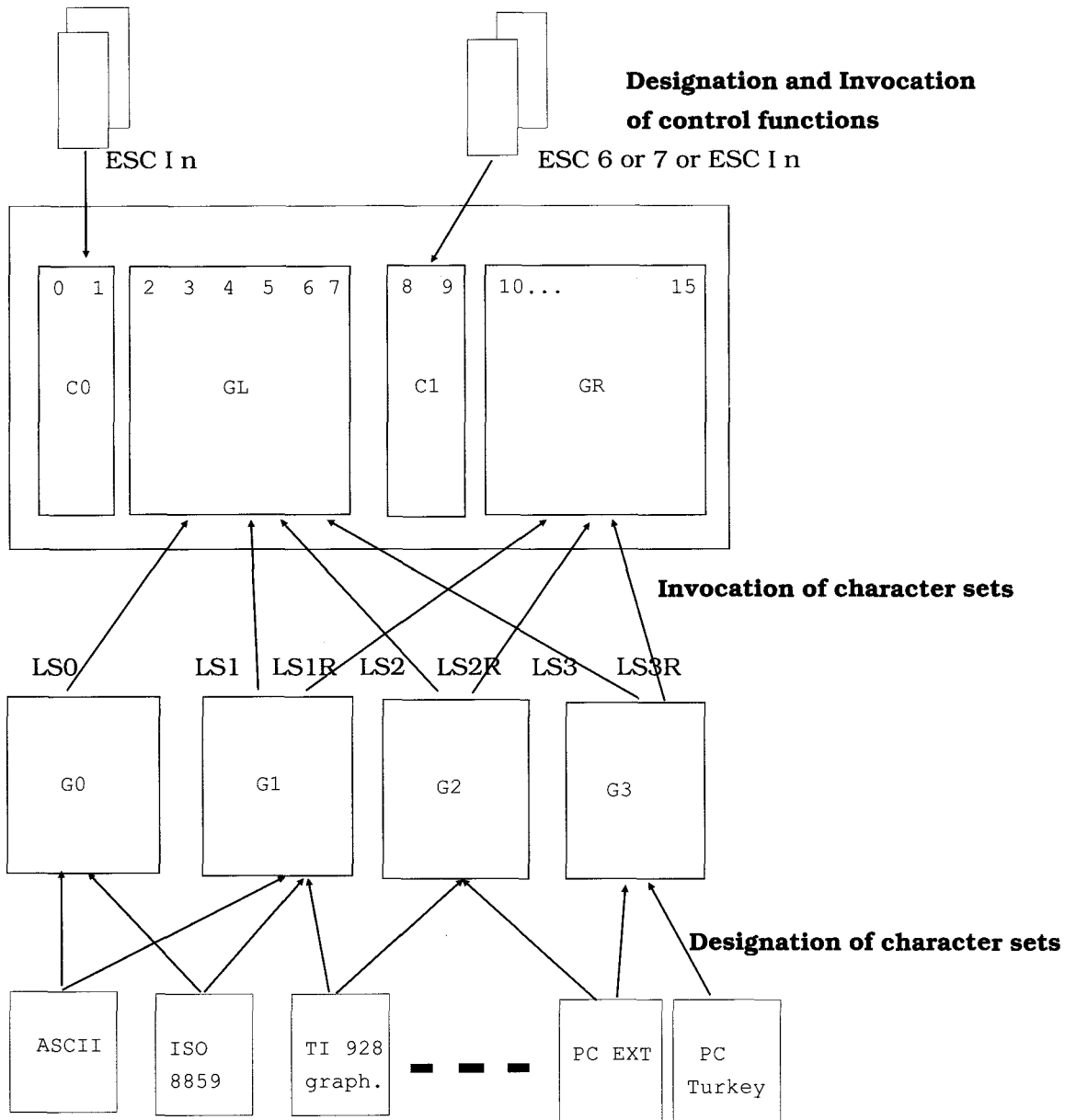
Example :

Assume you are working with ASCII, ISO 8859, TI 928 graphics and a downloaded character set:

The designations can be as follow:

ESC (B   (ASCII as G0)

ESC - A   (ISO 8859 as G1)

ESC * 0   (TI 928 graphics as G2)

ESC / <   (downloaded character set as G3)

When printing a text written with ISO 8859 international characters, the invocations are :

SI   (G0 as GL)

ESC ~   (G1 as GR)

Then, the 8 bit character set is ASCII+ISO8859.

To print a single TI 928 graphic character, a single shift two can be performed :

ESC N or SS2 (code 08/14) followed with the character to be printed.

ASCII CHARACTER SET

	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ALK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	<	L	\	l		
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	

ISO 8859 CHARACTER SET

	8	9	A	B	C	D	E	F
0	$^a_0$	^D_C		°	À	Ð	à	ð
1	$^a_1$	$^P_1$	¡	±	Á	Ñ	á	ñ
2	$^a_2$	$^P_2$	¢	²	Â	Ò	â	ò
3	$^a_3$	^s_E	£	³	Ã	Ó	ã	ó
4	^I_X	^c_C	¤	´	Ä	Ô	ä	ô
5	^N_L	^N_U	¥	µ	Å	Õ	å	õ
6	$^S_3$	^S_P	¦	¶	Æ	Ö	æ	ö
7	^I_S	^I_P	§	·	Ç	×	ç	÷
8	^H_S	^s_e	¨	¸	È	Ø	è	ø
9	^H_J	$^s_9$	©	¹	É	Ù	é	ù
A	^V_S	^s_A	ª	º	Ê	Ú	ê	ú
B	^P_B	^C_S	«	»	Ë	Û	ë	û
C	^P_U	^s_T	¬	¼	Ì	Ü	ì	ü
D	^R_I	^0_S	–	½	Í	Ý	í	ý
E	$^s_2$	^P_n	®	¾	Î	Þ	î	þ
F	$^s_9$	^A_P	‾	¿	Ï	ß	ï	ÿ

TI 928 GRAPHIC CHARACTER SET

	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P	♦	—
1	SOH	DC1	!	1	A	Q	▨	—
2	STX	DC2	"	2	B	R	⌐	—
3	ETX	DC3	#	3	C	S	⌐	—
4	EOT	DC4	$	4	D	T	⌐	├
5	ENQ	NAK	%	5	E	U	⌐	┤
6	ALK	SYN	&	6	F	V	°	⊥
7	BEL	ETB	'	7	G	W	±	┬
8	BS	CAN	(	8	H	X	⌐	│
9	HT	EM	)	9	I	Y	⌐	≤
A	LF	SUB	*	:	J	Z	⌟	≥
B	VT	ESC	+	;	K	[	⌐	π
C	FF	FS	,	<	L	\	⌐	≠
D	CR	GS	-	=	M	]	└	£
E	SO	RS	.	>	N	^	┼	·
F	SI	US	/	?	O		—	

	8	9	A	B	C	D	E	F
0				.	.	P	`	p
1			.	.	A	Q	a	q
2					B	R	b	r
3				-	C	S	c	s
4				-	D	T	d	t
5				-	E	U	e	u
6				—	F	V	f	v
7				.	G	W	g	w
8				┼	H	X	h	x
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	

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EPSON ITALIC CHARACTER SET

	8	9	A	B	C	D	E	F
0	à	§		O	@	P	`	p
1	è	ß	!	1	A	Q	a	q
2	ù	Æ	"	2	B	R	b	r
3	ò	æ	#	3	C	S	c	s
4	ì	Ø	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v
7	¡	Ä	'	7	G	W	g	w
8	¿	Ö	(	8	H	X	h	x
9	Ñ	Ü	)	9	I	Y	i	y
A	ñ	ä	*	:	J	Z	j	z
B	¤	ö	+	;	K	[	k	{
C	Ŕ	ü	,	<	L	\	l	|
D	Á	é	-	=	M	]	m	}
E	â	é	.	>	N	^	n	~
F	ç	¥	/	?	O	_	o	ø

PC EXTENDED CHARACTER SET

	8	9	A	B	C	D	E	F
0	Ç	é	á	▒	└	╨	α	≡
1	ü	æ	í	▓	┴	╤	ß	±
2	é	Æ	ó	█	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ä	ö	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	ª	╢	╞	╓	µ	÷
7	ç	ù	º	╖	╟	╫	τ	≈
8	ê	ÿ	¿	╕	╚	╪	Φ	°
9	ë	Ö	⌐	╣	╔	┘	θ	∙
A	è	Ü	¬	║	╩	┌	Ω	·
B	ï	¢	½	╗	╦	█	δ	√
C	î	£	¼	╝	╠	▄	∞	ⁿ
D	ì	¥	¡	╜	=	▌	ø	²
E	Ä	₧	«	╛	╬	▐	∈	■
F	Å	ƒ	»	┐	╧	▀	∩	

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PC MULTILINGUAL CHARACTER SET

	8	9	A	B	C	D	E	F
0	Ç	É	á	▦	└	ð	Ó	´
1	ü	æ	í	▨	┴	Ð	ß	±
2	é	Æ	ó	▩	┬	Ê	Ô	=
3	â	ô	ú	│	├	Ë	Ò	¾
4	ä	ö	ñ	┤	─	È	õ	¶
5	à	ò	Ñ	Á	┼	ı	Õ	§
6	å	û	ª	Â	ã	Í	µ	÷
7	ç	ù	º	À	Ã	Î	þ	¸
8	ê	ÿ	¿	©	╚	Ï	Þ	°
9	ë	Ö	®	╣	╔	┘	Ú	¨
A	è	Ü	¬	║	╩	┌	Û	·
B	ï	ø	½	╗	╦	■	Ù	¹
C	î	£	¼	╝	╠	■	ý	³
D	ì	Ø	¡	¢	=	¦	Ý	²
E	Ä	×	«	¥	╬	Ì	¯	■
F	Å	ƒ	»	┐	¤	■	´	

PC NORWAY CHARACTER SET

	8	9	A	B	C	D	E	F
0	Ç	É	á	▒	└	╨	α	≡
1	ü	æ	í	▓	┴	╤	ß	±
2	é	Æ	ó	▓	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ä	ö	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	ª	╢	╞	╓	µ	÷
7	ç	ù	º	╖	╟	╫	τ	≈
8	ê	ÿ	¿	╕	╚	╪	Φ	°
9	ë	Ö	⌐	╣	╔	┘	Θ	∙
A	è	Ü	¬	║	╩	┌	Ω	·
B	ï	ø	½	╗	╦	█	δ	√
C	î	£	¼	╝	╠	▄	∞	ⁿ
D	ì	Ø	¡	╜	═	█	φ	²
E	Ä	₧	«	╛	╬	█	∈	■
F	Å	ƒ	¤	┐	⊥	▀	∩	

PC PORTUGAL CHARACTER SET

	8	9	A	B	C	D	E	F
0	Ç	é	á	▓	└	╨	α	≡
1	ü	À	í	▒	┴	╤	β	±
2	é	È	ó	█	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ã	õ	ñ	┤	─	╘	Σ	∫
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	Á	ú	ª	╢	╞	╓	µ	÷
7	ç	ù	º	╖	╟	╫	τ	≈
8	ê	ï	¿	╕	╚	╪	Φ	°
9	Ê	õ	ò	╣	╔	┘	θ	·
A	è	Ü	¬	║	╩	┌	Ω	·
B	Í	¢	½	╗	╦	█	δ	√
C	Ô	£	¼	╝	╠	▄	∞	ⁿ
D	ì	ù	¡	╜	=	█	Ø	²
E	Ã	₧	«	╛	╬	█	∈	■
F	Â	ó	»	┐	╧	▀	∩	

PC TURKEY CHARACTER SET

	8	9	A	B	C	D	E	F
0	Ç	É	á	▦	└	╨	α	≡
1	ü	æ	í	▨	┴	╤	β	±
2	é	Æ	ó	▩	┬	╥	Γ	≥
3	â	ô	ú	│	├	╙	π	≤
4	ä	ö	ñ	┤	─	╘	Σ	⌠
5	à	ò	Ñ	╡	┼	╒	σ	⌡
6	å	û	Ğ	╢	╞	╓	µ	÷
7	ç	ù	ğ	╖	╟	╫	τ	≈
8	ê	İ	¿	╕	╚	╪	Φ	°
9	ë	Ö	⌐	╣	╔	┘	θ	·
A	è	Ü	¬	║	╩	┌	Ω	·
B	ï	¢	½	╗	╦	█	δ	√
C	î	£	¼	╝	╠	▄	∞	ⁿ
D	ı	¥	¡	╜	=	▌	ø	²
E	Ä	Ş	«	╛	╬	▐	∈	■
F	Å	ş	»	┐	╧	▀	∩	

▶ Appendix D: Interfacing

This appendix will help you design a *shielded* interface cable that connects your printer to your computer. This requires some knowledge of electronics—signals, wiring, soldering, and crimping—to be designed properly. If you're not technically oriented, we recommend that you purchase a *shielded* interface cable from your dealer.

Parallel Interfacing

The printer requires a Centronics-equivalent parallel cable with the following:

▶ Amphenol 57-30360 or AMP 552274-1 plug (or equivalent) with 36 pins

▶ AMP 552073-1 (or equivalent) cover

▶ Beldon (or equivalent) SHIELDED cable with twisted pair conductors. It can't exceed 16 feet (5 meters) in length and must be UL and CSA approved. The cable MUST be shielded.

Signals for Pin Assignments (Parallel):

Pin #	Signal	Return Pin #	Direction
1	Strobe	19	To Printer
2	Data 1	20	To Printer
3	Data 2	21	To Printer
4	Data 3	22	To Printer
5	Data 4	23	To Printer
6	Data 5	24	To Printer
7	Data 6	25	To Printer
8	Data 7	26	To Printer
9	Data 8	27	To Printer
10	Acknowledge	28	From Printer
11	Busy	29	From Printer
12	Paper end	30	From Printer
13	Select	No Return	From Printer
14	Autofeed	—	To printer
15	Not used	—	—
16	0V	No Return	Signal Ground
17	Chassis Gnd	No Return	Ground
18†	+5V*	—	From Printer
19-30	0V	—	Ground
31	I-Prime	—	To Printer
32	Fault	—	From Printer
33	0V	—	Signal Ground
34-36	Not Used	—	—

*50 mA maximum

†Pin 18 is controlled by a jumper plug in the printer.

RS232-C Serial Interfacing

To construct a cable for an RS232-C serial configuration, you will need:

▶ DB25P equivalent 25-pin plug, shell equivalent to DB-C2-J9.

▶ Beldon (or equivalent) *shielded* cable with twisted pair conductors. Must be UL and CSA approved. The cable MUST be shielded.

▶ The printer has a 25-pin DB-25S receptacle.

Signals for Pin Assignments (RS232-C serial):

Pin #	Signal	Symbol	Direction
1	Protective ground	PG	—
2	Transmitted data	TD	From printer
3	Received data	RD	To Printer
4	Request to send	RTS	From Printer
5	Not used	—	—
6	Data set ready	DSR	To Printer
7	Signal ground	SG	—
8-10	Not used	—	—
11	Supervisory send data	SSD	From Printer
12-19	Not used	—	—
20	Data terminal ready	DTR	From Printer
21-25	Not used	—	—

Note   See the Appendix of your *Operator's Manual* for information on menu settings for the serial interface.

Local Tests: Serial Interface

After you've configured an interface cable for your computer and printer, you may want to spend a few extra minutes making a test connector. This test connector can be used to monitor the operation of the interface. Simply follow these instructions for your serial interface.

Jumper the following pins:

```
TD      2
RD      3
RTS     4
CTS     5
CD      8
SSD     11
DTR     20
DSR     6
```

RS232-C (DB 25P Plug)

Place the printer in the circuit test mode by specifying "Yes" in response to the menu item DIAGNOSTIC TEST. Now you can run the local test:

1. Plug the test connector into the serial interface receptacle.

2. Turn the printer ON. The serial interface will check the memory function of the printer's message buffer, the interface driver and the receiver circuit, and then print all the characters in a test pattern.

3. This test can be stopped either by turning the printer OFF or by pressing the SELECT button.

4. This is what happens during the test:

▶ The printer prints this message: "LOOP TEST"

▶ The printer checks the memory function of the message buffer, then prints "OK" if the memory check is good, or "BAD" if the memory check is faulty.

▶ The signal logic is checked, and if this is faulty, "IF BAD" is also printed.

Note   If "BAD" is printed, call your dealer for assistance.

▶ Hexadecimal characters from 20 to 7F are transmitted through the TD (Transmit Data) line, and received through the RD (Receive Data) line, then written to the message buffer. The above stored data is then printed.

▶ This process repeats until the printer is turned OFF or until you press the SELECT button.

5. To restore normal operation, turn the printer off, then, while holding down the MODE button, turn the printer back on. The printer will now be in menu mode; simply step through the menu in the normal way and change the DIAGNOSTIC TEST setting to "No."

▶ Appendix E: Specifications

Print method   Impact dot matrix

Printhead   9 pin

Print speed

    High Speed Draft   300 cps (characters per second)
    Utility   250 cps
    Near Letter Quality   62.5 cps

Characters per line	**830**	**835**
at 10 cpi	80	136
at 12 cpi	96	163
at 17.1 cpi	137	233
at 20 cpi	160	272

Reliability

Mean Time Between Failures (MTBF)	5000 hours @ 25% duty cycle, 35% page density
Mean Time To Repair (MTTR)	15 minutes
Printhead life	200 million characters
Ribbon life	3 million characters

Electrical characteristics

    Voltage   220/240 V AC
    Frequency   50/60 Hz ± 2%

Interface   Centronics parallel standard
                                    RS232C serial optional

Dimensions	**830**	**835**
Size	13.6″ deep	13.6″ deep
	15.7″ wide	21.7″ wide
	4.6″ high	4.6″ high
Weight	16 lb.	20 lb.

Paper Specifications

Width	3″ to 10″ (830)
	3″ to 16″ (835)

Continuous forms
Single part forms

Weight	12 to 24 lb.
Thickness	0.0020″ to 0.0049″

Multpart—carbon lined or
pressure sensitive

Weight	9 to 11 lb.
Number of copies	Original plus 4 copies
Thickness	0.014″ max.

Multipart—interleaf

Weight	Paper: 10 to 12 lb.
	Carbon: 9 lb.
Number of copies	Original plus 4 copies
Thickness	0.014″ max.

Cut sheets (single part only)
Friction feed

Weight	12 to 24 lb.
Thickness	0.002″ to 0.0049″

With CSF 3000

Weight	16 to 24 lb.
Thickness	0.0027″ to 0.0049″

Envelopes (individual)

Weight	24 lb. max.
Thickness	0.016″ max.
Dimensions	$6\frac{1}{2}″ \times 3\frac{5}{8}″$
	$8\frac{7}{8}″ \times 3\frac{7}{8}″$
	$9\frac{1}{2}″ \times 4\frac{1}{8}″$

Card stock

Weight	120 lb. max.
Thickness	0.009″ max.
Dimensions	5″ × 8″ max.

Use with bottom feed only.
Set head gap at position 2 for 120 lb. card stock.

Labels

Carrier width		$8\frac{1}{5}''$ max. (830)
		15″ max. (835)
Total thickness		0.011″ max.

Use bottom feed only.
Do not use fabric labels.
Do not print on the edge or perforation of the label.

Transparencies

Thickness	0.004″ max.
Dimensions	$8\frac{1}{2}''$ W × 11″ L

Specifications subject to change without notice.

► Glossary

Access cover. Generally, the top cover on the printer, providing access to the printhead for changing ribbons and clearing paper jams.

ALARM light. A small red light on the printer control panel, used to indicate printer errors.

ASCII. American Standard Code for Information Interchange: A standard code which uses numbers to represent characters and control instructions.

Auto LF. Automatic Line Feed: If the automatic line feed feature is on, each carriage return sent to the printer will be accompanied by a line feed. The normal setting today is OFF; if your printer is overprinting each line, turning this feature ON may solve the problem.

AUTOEXEC.BAT. This is the batch file that is 'read' by your IBM-compatible computer immediately when you turn it on or 'boot' it.

Bail. See Paper Bail.

Bail lever. A lever on the left side of the printer (with the printer facing you) that serves to raise and lower the paper bail.

BASIC. Beginner's All-purpose Symbolic Instruction Code: One of the most popular general-purpose programming languages used with personal computers. Programming examples in this manual are written in BASIC.

Bidirectional printing. Printing both on the forward and backward passes. This feature speeds printing, but can create some alignment problems when graphics are being printed.

Bit. Binary digit. Each bit is either 1 or 0.

Bottom Feed. A configuration in which paper is fed through a slot in the bottom of the printer using a tractor feed mechanism. This setup provides a more even paper path suitable for volume printing, labels and multi-part forms.

Byte. A basic unit of information consisting of 8 bits. One byte can represent any ASCII character or any number between 0 and 255.

Cable. The term 'cable' generally denotes an interface cable—the wire and connectors used to attach the printer to the computer. Interface cables can be either parallel or serial.

Carriage Return. A carriage return is simply a command (ASCII character 13 decimal) that prints the curent line in the printer's buffer. It generally returns the printhead to the first (left) printing position. The paper is not rolled up to the next line, however, unless an Auto LF feature is on.

Character Set. Most printers have several available character sets. They may differ along several lines—by style ('font') as in Utility, Near Letter Quality, and High Speed Draft; by size, as in Pica, Elite, and Condensed; or by other features, such as Italic, Graphic, Line-Drawing, etc.

Character Size. Character size for dot-matrix printers is generally defined in terms of characters per inch—10 cpi (Pica), 12 cpi (Elite) and 17.1 cpi (Condensed).

Characters Per Inch. A measure of the width of characters. Note that 10 cpi characters are wider than 17.1 cpi characters.

Condensed. An extremely dense printing style, generally 17.1 cpi, in which the characters are very narrow. This style is generally used for printing spreadsheets and other material that is too wide for conventional type.

Continuous forms. Paper or pre-printed forms with pin feed holes along the sides. Individual sheets are joined together with perforated edges, forming one long sheet which may be fed continuously through the printer by means of a tractor feed.

Cpi. See Characters Per Inch.

Default. The default settings are the settings 'built into' a machine and assumed whenever a disruption—such as a power loss or a reset command—clears settings selected by the operator.

DIP switch. See Switches.

DOS. Disk Operating System: For personal computers, the DOS is generally either MS-DOS or PC-DOS. The operating system is the computer's basic command level.

Double width. A double width character is twice as wide as a normal character. A double width 10 cpi character, for example, would be printed at 5 cpi. This feature is useful for creating headlines.

Driver. A printer driver is a file used to 'translate' the printing requests of a software package into the commands of a specific printer.

Elite. 12 cpi printing.

Embedded Commands. Embedded commands are printer commands placed within the body of a document created by a word processor, database program, spreadsheet, etc. Because they are entered directly by the user, the software has no control over them and they may be difficult to understand when the document is reviewed on screen.

Emphasized. Emphasized is a darker form of printing created by overprinting each character with the same character moved one dot horizontally.

Emulation. When a printer 'emulates' another printer, it accepts all of that printer's commands and behaves in all respects as though it were the emulated printer. Some printers have several emulations.

Enhanced. Enhanced is a darker form of printing created by overprinting each character with the same character moved one dot vertically.

Firmware. Programming or information recorded in a permanent storage device, such as a ROM. Firmware is different from software because the user can't change it.

Form Feed. A form feed is a command or procedure that ejects the previous page and draws the current page into the printer at the first print position. The ASCII form feed command is character (decimal) 12.

Form Length. The form length is usually defined as the number of print lines that can fit onto a page. The standard length at 6 lpi is 66 lines.

Front Panel. The location of the control buttons on the front of the printer.

Graphics. Printer graphics are shapes composed of columns of 8 dots. A complete image is formed by blending a large number of these columns together. Such an image is called 'bit-mapped' because it is created from individual dots.

Hardware. The actual machinery and circuits in a computer system: keyboard, printed circuit board, printhead, etc.

Hex Dump Mode. The Hex Dump Mode is a printer setting used for diagnostics. When the printer is in this mode, it prints the hexadecimal value of each character sent to it rather than the character itself. Thus, sending the letter 'A' would cause the printer to print '41'—the ASCII hexadecimal value of 'A.'

Hexadecimal. A numbering system based upon 16 rather than 10. The letters A-F substitute for the decimal values 10-15. Hexadecimal is commonly used in computer programming because each digit represents exactly half a byte. This makes translation to and from binary easy and the notation takes less space than the equivalent decimal notation.

High Speed Draft. High Speed Draft is a fast printing setting that trades lowered print quality for speed. It is faster than Utility, but the characters are not as fully formed.

Horizontal Tabs. Horizontal tabs are the ordinary 'typewriter' style tab stops that can be set on your printer by using a tab-setting command. When the tabs are set, a tab command (ASCII character 9) moves the printhead to the next tab stop.

HSD. See High Speed Draft.

Interface. The connection between two pieces of equipment—that is, between a computer and a printer. The two basic types of interfaces are parallel and serial. The word is loosely used to mean either the method of connection or the actual hardware used to connect equipment. As a verb, it usually means the act of making the connection.

Italics. Slanted printing created by using a separate character set or by altering a 'normal' character set while printing.

LED. Light Emitting Diode: Small colored lights used by the printer to indicate printing status and error conditions.

Line Feed. A line feed command (ASCII character 10, decimal) simply advances the paper to the next printing line. Generally, it also automatically returns the printhead to the first position (Auto CR).

Line Spacing. Line spacing is generally specified in lines per inch (lpi). A common value is 6 lpi; a more condensed page may use 8 lpi.

Lines Per Inch. A measure of line spacing. When the line spacing is 6 LPI, the distance between the bottom of one line of print and the bottom of the next is 1/6″.

LPI. See Lines Per Inch.

LPRINT. The print statement in the BASIC computer language.

LPT. Abbreviation for 'lineprinter,' this is used as the printer 'name' in PC-DOS. The first printer connector is called LPT1: and LPT2: is the second.

Menu. A menu is a list of possible commands or characteristics with some means of making a selection. Printer menus reside in the printer's read-only memory (ROM) and print the current value of each item on paper. Values are changed by stepping through the possibilities using buttons on the front panel.

MODE. A PC-DOS (external) command used to set serial ports and adjust terminal settings.

Near Letter Quality. A dot-matrix print quality approaching that produced by a typewriter.

NLQ. See Near Letter Quality.

Paper Bail. An arm with several small rollers used to hold the paper against the platen.

Paper lever. A lever on the right side of the printer (with the printer facing you) that forces a paper roller against the platen for friction feeding of paper.

Paper Out Override. The printer normally senses when there is no paper, and halts. The override feature permits you to print closer to the bottom of the page when using cut sheets.

Paper Separator. The paper separator is a printer part that separates incoming paper from output to guard against misfeed.

Parallel. A parallel connection or interface is one in which data is sent one byte at a time, each bit in the byte having a separate wire. This is the most common and fastest connection for a printer.

Pica. 10 cpi printing.

Platen. The rubber-coated roller on the printer which both brings paper into the machine and serves as a backing for the striking action of the printhead's pins.

Print Quality. Print quality refers to the resolution and characteristics of a character set. Typical print qualities are Letter Quality, Near Letter Quality, Utility, High-Speed Draft.

Printhead. The printhead is the mechanism that contains the pin firing mechanism and the pins used in dot matrix printing.

RAM. Random Access Memory: A temporary memory device (integrated circuit chip). In most printers, RAM is used for temporary storage of data before printing (this type of RAM is called a 'buffer') and for storage of commands to change printing features. This type of memory is 'volatile'—that is, it is erased when the printer is turned off.

Rear Feed. A printer configuration in which paper is fed from the rear of the printer. This setup can save space, but it should not be used when printing labels.

Ribbon Cartridge. The cartridge containing the printer ribbon. You should always make sure that the cartridge is correct for the printer and is properly seated. Note that the printing ribbon cleans and lubricates the head while printing, so using the wrong ribbon can actually damage your printhead.

Rolling ASCII Self Test. A printer test in which all of the ASCII characters are printed continuously until the test is stopped or the printer is turned off.

ROM. Read-Only-Memory: A permanent storage device (integrated circuit chip). Information stored in ROM—called 'firmware'—can be 'read' but cannot be added to or changed. In most printers, ROM is used to store the dot patterns that make up the character sets, instructions for interpreting control codes, etc.

Self test. A method of testing the printer prior to connecting it to a computer. Several self test routines are available with each printer.

Serial. A serial connection or interface is one in which data is sent one bit at a time. This type of connection is generally used in data communications and on networks. It is slower than a parallel connection, but can be carried over a longer distance.

Setup. The basic procedures needed to prepare your printer for printing.

Skip Over Perforation. This feature, when activated, insures that the printer does not print across the perforation on continuous forms by providing an automatic 1″ bottom margin.

Slashed zero. The slashed zero is a zero character with a line through it to distinguish it from the character 'O.' This feature is useful in certain applications but is inappropriate for others, so your printer offers a choice between the plain zero and the slashed zero.

Software. A program or set of instructions that tells your computer or printer what to do. It's called 'soft' because, like words, it doesn't really

have a physical form the way something like a rock does. A 'software package' is a commercially prepared program or set of programs, usually sold recorded on a disk.

Standard sheet. The standard paper size is 8.5" by 11". Most printer defaults (margins, page length, top of form) are set for this standard.

Subscripts. Characters, generally of a smaller size, printed below the normal character line and used for chemical formulae, fractions, and other related functions.

Superscripts. Characters, often of a smaller size, printed above the normal character set and generally used in footnote notation.

Switches. Printer switches are generally of the DIP (dual in-line pin) type, and are found at the back of the printer. This type of switch consists of a rectangular bank with a set of individual switches, each of which may be turned on or off.

TOF. See Top of Form.

Top of Form. Your printer permits you to specify how far down the page printing will begin. This location, called the top of form position, is generally retained in memory so that, once set, all printing will start at the same place on each page.

Tractor Feed. A tractor feed mechanism is an independent unit that sits on top of the printer and is driven by the printer's gears. It has a belted pin mechanism to draw paper up through the printer. A tractor feed is often used in the bottom-feed configuration with labels or multipart forms.

Unidirectional Printing. Printing in one direction only (the left-right stroke). This is generally only used when printing very high resolution graphics which might be affected by irregularities in bidirectional feed. It is much slower than bidirectional printing.

Utility printing. A print quality used for drafts and memos. It is faster and of lower resolution than LQ or NLQ printing, but better formed and slower than HSD printing.

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