



**FormsPro 4000se Series  
FormsMaster 8000se Series  
PrintMaster 850 Series**

**Programmer's Manual**

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# INTRODUCTION

This manual describes the software interfaces supported by the FormsPro 4000se, FormsMaster 8000se and PrintMaster 850 series printers. It is written for a programmer who will be developing software for the printer, and contains information not normally needed by a printer operator/user.

Basic information on printer operation (setting the printer up, loading paper, replacing ribbons, etc.) can be found in either of the *FormsPro4000se*, *FormsMaster 8000se* or *PrintMaster 850 Series Operator's Manual* that accompanied your printer.

## How to Use This Manual

Below is a brief description of the information contained in this manual.

**INTRODUCTION** describes the contents of this manual. This chapter also provides you with an introduction to the capabilities and operation of the FormsPro 4000se, FormsMaster 8000se and PrintMaster 850 series printers.

**ANSI X3.64 EMULATION, EPSON FX EMULATION, IBM PROPRINTER EMULATION, DEC LA120/210 EMULATION, SIMPLE TTY EMULATION, PRINTEK EMULATION, AND GENICOM 3840/3410 EMULATION** are each designed as a stand-alone chapter. Each chapter provides all the information necessary to write software for a particular emulation. You may wish to refer only to the chapter for the emulation you are using, and skip the others.

**CONFIGURATION DOWNLOAD** describes how a simple text file may be used to set default values in the printer's non-volatile memory. This feature may be used as an alternative to using the printer's front panel setup and can be useful when configuring multiple printers or when configuring printers at a remote location.

**HEX DUMP MODE** describes the output of Hex Dump mode, and how it may be used to debug software problems.

**PRINTING BASIC BAR CODES** describes how to use the built in bar coding capabilities.

**ASCII CHARACTER TABLES** provides a definition of ASCII control codes, character tables, and an ASCII to Decimal to Octal to Hexadecimal conversion table.

**PRINTER RESET CONDITIONS** describes the state of the printer after a power up reset or receipt of a reset command.

**GLOSSARY** provides a reference for printer related terms.

## Printer Model Descriptions and Key Features

The Printek FormsPro 4000se, FormsMaster 8000se and PrintMaster 850 series printers are high speed, heavy duty serial dot matrix printers designed especially for printing upon hard to print forms. Such forms are often not printed adequately by other printers. The printer is also designed to be factory floor rugged while still quiet enough for the office. All models provide straight paper paths for jam free paper motion and a zero waste tear bar for demand document applications.

The operator may permanently record up to ten complete sets of form parameters which may be later selected either at the printer's control panel or from the host computer. The FormsPro 4503se and FormsMaster 8003se series printers provides three sets of tractors, any of which can be included in the form parameters for a particular form. This allows the printer to automatically unload one form and load another when selected, without requiring the operator to touch the paper. The FormsMaster 8003se series printer is also able to use the same form or paper in multiple paths and automatically continue printing from a different path after one or two paths are out of paper. For more information, refer to the *FormsMaster 8000se Series Operator's Manual*.

The printers come equipped with an industry standard parallel interface and an RS-232 serial interface. Optional interfaces which are available include Ethernet 10/100BaseT Print Server, Wireless Ethernet Print Server and a TN5250 LAN Interface

Standard bar coding capabilities include Code 39, Code 39 LOGMAR, 2-of-5, and Interleaved 2-of-5 bar codes, and OCR-A and OCR-B fonts. Bar code options include the Imager Graphics Co-Processor which expands the bar code capabilities beyond the standard Basic Bar Codes with QMS Code V v1 barcoding compatibility, and the ImagerPlus Graphics Co-Processor which adds bar code and graphic capabilities with QMS Code V v1 and v2 compatibility and Printronix IGP compatibility.

Other options include an external FormsCutter for the FormsPro 4000se Series printer and an internal FormsCutter for the FormsMaster 8000se series printer which can be used to automatically cut off each form or to separate reports. A specially designed print stand which can handle three boxes of paper, and a Setup Module to make set up of multiple printers quick and easy are also available for these models.

## Selecting Emulations

The software interface of the printer varies, depending upon which emulation is selected.

The default emulation, selected at power up, is specified by the "Emulation" value in the interface setup menu for the interface being used. Frequently, the desired emulation is specified here, and never changed again. Note that the emulation may only be specified for the serial, parallel, and EtherLink ports.

It is also possible to switch back and forth between various emulations in order to use the unique features of each. A different emulation may be selected via software with the **ESC ESC n** sequence.

Although switching emulations is essentially a seamless process, the fundamental differences between emulations may cause unanticipated results. For example, character size may vary, or tabs may work differently.



## Changing Forms/Tractor Paths

As mentioned above, Printek FormsPro 4000se, FormsMaster 8000se and PrintMaster 850 series printers have ten complete sets of forms parameters. These different parameters, or forms, may be selected either from the front panel or with escape sequences. In the FormsPro 4503se and FormsMaster 8003se series printers, selecting a different form may also select a different tractor path. The tractor path is one of the parameters which may be set for each of the ten forms in the forms menu using Setup as described in the *FormsPro 4000se or FormsMaster 8000se Series Operator's Manual*.

Escape sequences for loading forms are only available in the Epson and Printek emulations. In either chapter refer to the "Load Form" escape sequence in the "Forms and Tractors" section.

If you are using an emulation other than Epson or Printek, you may temporarily change emulations, load the new form, and then return to the previous emulation. An example of this may be found in the "Emulations" section at the end of each of the emulation chapters.



# ANSI X3.64 EMULATION

## Introduction

This section describes the control codes and escape sequences comprising ANSI X3.64 emulation. This emulation may be selected by setting “Emulation” to “ANSI X3.64” in the appropriate interface setup menu, or via software with the **ESC ESC 1** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

Many ANSI escape sequences begin with a two character Control Sequence Introducer (CSI), Escape Left Square Bracket (**ESC [**, 1B 5B hex). If 8-bit data is selected via control panel setup, these two characters may be replaced by a single character CSI, 9B hex. The sequences are always documented in this section with the two character CSI (**ESC [**), because this format seems to be much more common, and works equally well with 7-bit or 8-bit data.

Some escape sequences accept one or more numeric parameters. A numeric parameter is a decimal number represented by a string of ASCII decimal digits (“0” through “9”). Leading zeros may be supplied, but are not necessary. Due to implementation constraints, the largest value that can be accepted is decimal 255. Larger values will be treated as zero. Omitting a numeric parameter is equivalent to supplying a value of zero.

If a sequence accepts one numeric parameter, it will be represented as “*n*”. If a sequence accepts more than one numeric parameter, they will be represented as “*n1; n2; ... nx*”. Note that multiple numeric parameters are separated by a semicolon.

Most ANSI escape sequences will assume one of the following formats:

<b>ESC <i>f</i></b>	(no numeric parameters)
<b>ESC <i>n f</i></b>	(one numeric parameter)
<b>ESC <i>n1; n2; ... nx f</i></b>	(two or more numeric parameters)

The “*f*” at the end of the escape sequence represents the final character. It terminates the sequence, and specifies the function to be performed.

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*” and “*f*” above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 152 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the example.

This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Some escape sequences refer to the active column or active line. The active column is the column where the next character will be printed. Printing a character or a space will increment the active column. The active line is the line where the next character will be printed. A line feed will increment the active line. Column and line numbers begin at one, not at zero.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### End of Text

#### ETX

If "ETX/ACK" is set to "On" in the serial interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

Control code:	ETX
Hexadecimal:	03

## Character Size and Line Spacing

### Set Character and Line Spacing

ESC [ *n1* ; *n2* SP G

Sets the character and line spacing in decipoints (1/720 of an inch). The first parameter, *n1*, sets the line spacing. The second parameter, *n2*, sets the character spacing. Typical values for *n1* and supported values for *n2* are shown below. Other values for *n2* will be ignored. To change only the horizontal or only the vertical spacing, omit the other value from the sequence or set it to zero. Overrides the "Characters/Inch" value and the "Lines/Inch" value in the forms setup menu.

<u><i>n1</i></u>	<u>line pitch</u>
120	6 lpi
90	8 lpi

<u><i>n2</i></u>	<u>character pitch</u>
72	10 cpi
60	12 cpi
54	13.3 cpi
48	15 cpi
43	16.74 cpi
42	17.14 cpi
36	20 cpi

Example: The following escape sequence will select 6 lpi and 10 cpi.

Escape Sequence:	ESC	[	1	2	0	;	7	2	SP	G
Hexadecimal:	1B	5B	31	32	30	3B	37	32	20	47

Example: The following escape sequence will select 6 lpi without affecting character spacing.

Escape Sequence:	ESC	[	1	2	0	SP	G
Hexadecimal:	1B	5B	31	32	30	20	47

Example: The following escape sequence will select 10 cpi without affecting line spacing.

Escape Sequence:	ESC	[	;	7	2	SP	G
Hexadecimal:	1B	5B	3B	37	32	20	47

## Character Attributes

### Select Graphic Rendition

ESC [ *n* m

Selects the graphic rendition *n* from the following table.

<i>n</i>	<u>Rendition</u>
0	Normal
1	Emphasized
3	Italic
4	Underline

For italic mode to work correctly, an Epson FX font must be selected (check the "Font" value in the forms setup menu). The other available fonts do not include italic characters.

Example: The following escape sequence will select emphasized mode.

Escape Sequence:	ESC	[	1	m
Hexadecimal:	1B	5B	31	6D

## Horizontal Position

### Carriage Return

CR

Causes the current line to be printed, and then sets the current print position to the left margin. If "Auto LF" is set to "On" in the interface setup menu, a line feed will also be performed.

Control code:	CR
Hexadecimal:	0D

### Backspace

BS

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code:	BS
Hexadecimal:	08

**Absolute Horizontal Tab****ESC [ n `**

Sets the current print position to column  $n$ . The actual position will depend on the current character spacing. If  $n$  is less than the left margin, the active column will be set to the left margin. If  $n$  is greater than the right margin, then a line feed will be performed and the active column will be set to the left margin.

Example: The following escape sequence will set the active column to column 65.

Escape Sequence:	ESC	[	6	5	`
Hexadecimal:	1B	5B	36	35	60

**Relative Horizontal Tab****ESC [ n a**

Advances the current print position by  $n$  columns. The actual distance moved will depend on the current character spacing. Equivalent to sending  $n$  spaces (SP).

Example: The following escape sequence will advance the active column by 10 columns. If current character spacing is 10 cpi, this will cause the print position to move one inch to the right.

Escape Sequence:	ESC	[	1	0	a
Hexadecimal:	1B	5B	31	30	61

**Vertical Position****Line Feed****(or)****(or)****LF****IND****ESC D**

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:	LF
Hexadecimal:	0A
Control code:	IND
Hexadecimal:	84
Escape Sequence:	ESC D
Hexadecimal:	1B 44



**Partial Line Down**  
(or)**PLD**  
**ESC K**

Performs a half line feed. Causes the current line to be printed, and then advances the paper one half line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: PLD  
Hexadecimal: 8B  
Escape Sequence: ESC K  
Hexadecimal: 1B 4B

**Partial Line Up**  
(or)**PLU**  
**ESC L**

Performs a reverse half line feed. Causes the current line to be printed, and then retracts the paper one half line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: PLU  
Hexadecimal: 8C  
Escape Sequence: ESC L  
Hexadecimal: 1B 4C

**Absolute Vertical Tab****ESC [ n d**

Sets the current line to line  $n$  of the current form. The actual position will depend on the current line spacing.

Example: The following escape sequence will set the active line to line 12.

Escape Sequence: ESC [ 1 2 d  
Hexadecimal: 1B 5B 31 32 64

**Relative Vertical Tab****ESC [ n e**

Advances the active line by  $n$  lines. The actual distance moved will depend on the current line spacing. Equivalent to sending  $n$  line feeds (LF).

Example: The following escape sequence will advance the active line by 12 lines. If current line spacing is 6 lpi, this will cause the paper to advance one inch.

Escape Sequence: ESC [ 1 2 e  
Hexadecimal: 1B 5B 31 32 65

## Horizontal and Vertical Position

### **New Line (or)**

**NEL  
ESC E**

Causes the current line to be printed, and then sets the current print position to the left margin and performs a line feed. Equivalent to a carriage return (CR) line feed (LF) combination.

Control code: NEL  
Hexadecimal: 85  
Escape Sequence: ESC E  
Hexadecimal: 1B 45

## Form Length and Form Feed

Form length is the distance from the top of the form to the bottom of the form. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rational is that the program is then in complete control of form length, and will work on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu, so it will be correctly set for everyone using the form.

### **Form Feed**

**FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu (not available for all interfaces) allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: FF  
Hexadecimal: 0C

## Horizontal Tabs

Horizontal tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the tab stops. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. If different tab stops are to be set, the default tab stops should first be cleared.

### Horizontal Tab

**HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. Different tab stops may be set with ESC H, ESC 1, or ESC [ *n1* ; *n2* ; ... *nx* u.

Control code: HT  
Hexadecimal: 09

### Set Horizontal Tab Stop (or)

**HTS  
ESC H**

Sets a horizontal tab stop at the current print position. The tab stop is associated with the active column, not an absolute physical position. Changing character spacing will change the physical position of the tab stop.

Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. The tab stop set by this escape sequence will be added to previously set tab stops, including the default tab stops. If this is not desired, the old tab stops should first be cleared.

Control code: HTS  
Hexadecimal: 88  
Escape Sequence: ESC H  
Hexadecimal: 1B 48

### Clear Horizontal Tab Stop (or)

**ESC [ g  
ESC [ 0 g**

Clears the horizontal tab stop at the current print position. The tab stop to be cleared is associated with the active column (based upon the current character spacing), not an absolute physical position.

Escape Sequence: ESC [ g  
Hexadecimal: 1B 5B 67

### Clear all horizontal tab stops (or)

**ESC [ 2 g  
ESC [ 3 g**

Clears all currently set horizontal tab stops.

Escape Sequence: ESC [ 2 g  
Hexadecimal: 1B 5B 32 67

Escape Sequence:           ESC [ 3 g  
Hexadecimal:               1B 5B 33 67

## Vertical Tabs

Vertical tab stops are associated with lines, not absolute physical positions. Changing line spacing will change the physical position of the tab stops.

### Vertical Tab

**VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:               VT  
Hexadecimal:               0B

### Set Vertical Tab Stop (or)

**VTS  
ESC J**

Sets a vertical tab stop at the current line. The tab stop is associated with the active line, not an absolute physical position. Changing line spacing will change the physical position of the tab stop.

The tab stop set by this escape sequence will be added to previously set tab stops. If this is not desired, the old tab stops should first be cleared.

Control code:               VTS  
Hexadecimal:               8A  
Escape Sequence:           ESC J  
Hexadecimal:               1B 4A

### Clear Vertical Tab Stop

**ESC [ 1 g**

Clears the vertical tab stop at the current line. The tab stop to be cleared is associated with the active line (based upon the current line spacing), not an absolute physical position.

Escape Sequence:           ESC [ 1 g  
Hexadecimal:               1B 5B 31 67

### Clear All Vertical Tab Stops

**ESC [ 4 g**

Clears all currently set vertical tab stops.

Escape Sequence:           ESC [ 4 g  
Hexadecimal:               1B 5B 34 67



## Printer Controls

### Bell

**BEL**

Causes the printer's bell to sound.

Control code: BEL  
Hexadecimal: 07

### Select Automatic Carriage Return

**ESC [ 20 h**

Selects automatic carriage return mode. This causes the printer to automatically perform a carriage return (CR) for each line feed (LF), vertical tab (VT), or form feed (FF) that it receives. Overrides the "Auto CR" value in the interface setup menu.

Escape Sequence: ESC [ 2 0 h  
Hexadecimal: 1B 5B 32 30 68

### Cancel Automatic Carriage Return

**ESC [ 20 I**

Cancels automatic carriage return mode. Overrides the "Auto CR" value in the interface setup menu.

Escape Sequence: ESC [ 2 0 I  
Hexadecimal: 1B 5B 32 30 6C

### Reset

**ESC c**

Deletes all data on the current line and initializes the printer to the default settings for the current form.

Restores the default horizontal tab stops. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc.

Resets top of form to the current position, so it is wise to be at top of form before performing this reset. Issuing a form feed will guarantee this.

See the chapter on Printer Reset Conditions for more information.

Escape Sequence: ESC c  
Hexadecimal: 1B 63

## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120/210 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the “Emulation” value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character “0” to “7” (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the “Emulation” value in the interface setup menu.

This chapter describes ANSI X3.64 emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CR	Carriage Return
CSI	Control Sequence Introducer
ESC D	Line Feed
ESC E	New Line
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ESC H	Set Horizontal Tab Stop
ESC J	Set Vertical Tab Stop
ESC K	Partial Line Down
ESC L	Partial Line Up
ESC [ <i>n</i> 1 ; <i>n</i> 2 SP G	Set Character and Line Spacing
ESC [ <i>n</i> `	Absolute Horizontal Tab
ESC [ <i>n</i> a	Relative Horizontal Tab
ESC [ <i>n</i> d	Absolute Vertical Tab
ESC [ <i>n</i> e	Relative Vertical Tab
ESC [ <i>g</i>	Clear Horizontal Tab Stop
ESC [0 <i>g</i>	Clear Horizontal Tab Stop
ESC [1 <i>g</i>	Clear Vertical Tab Stop
ESC [2 <i>g</i>	Clear All Horizontal Tab Stops
ESC [3 <i>g</i>	Clear All Horizontal Tab Stops
ESC [4 <i>g</i>	Clear All Vertical Tab Stops
ESC [20 h	Select Automatic Carriage Return
ESC [20 l	Cancel Automatic Carriage Return
ESC [ <i>n</i> m	Select Graphic Rendition
ESC c	Reset
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
HTS	Set Horizontal Tab Stop
IND	Line Feed
LF	Line Feed
NEL	New Line
PLD	Partial Line Down
PLU	Partial Line Up
VT	Vertical Tab
VTS	Set Vertical Tab Stop





# EPSON FX EMULATION

## Introduction

This section describes the control codes and escape sequences comprising Epson FX emulation. This emulation may be selected by setting “Emulation” to “Epson” in the interface setup menu, or via software with the **ESC ESC 2** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

Some escape sequences accept one or more numeric parameters. If a sequence accepts one numeric parameter, it will be represented as “*n*”. If a sequence accepts more than one numeric parameter, they will be represented as “*n1 n2 ... nx*”.

Since numeric parameters are always encoded in one byte, their values may range from 0 to 255 decimal. Please note that the value will never be represented by a string of ASCII decimal digits (“0” through “9”). For example, a value of 66 decimal would be sent as a single byte with a hex value of 42. This is equivalent to sending the ASCII character “B”. It is entirely different than sending the two printable ASCII characters “66”.

If a numeric parameter is limited to a value of zero or one, it may be sent as a single byte with a value of 00 or 01 hex (NUL or SOH), or it may be sent as a single printable ASCII character “0” or “1” (30 or 31 hex).

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*” and “*n1 n2*” above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is contained in the appendices for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the provided example. This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Column and line numbers begin at zero, not at one. Keep this in mind when setting tabs, margins, etc.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### **Cancel Line** **CAN**

Cancels all printable text in the current print line. Does not affect any control codes or escape sequences.

Control code:           CAN  
Hexadecimal:           18

#### **Delete Character** **DEL**

Deletes the last printable character from the current line. Does not affect any control codes or escape sequences.

Control code:           DEL  
Hexadecimal:           7F

#### **End of Text** **ETX**

If "ETX/ACK" is set to "On" in the serial interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

If the printing of low symbols is enabled, ETX will be treated as a printable character instead of an I/O handshake control code.

Control code:           ETX  
Hexadecimal:           03

**Set MSB to 0****ESC =**

Sets the MSB (most significant bit) of all following data to zero. Some computers always set the MSB to one, causing all characters to print in italic mode. This escape sequence can overcome the problem. The problem can also be avoided by setting "Data Bits" to "7" in the interface setup menu.

Escape Sequence:           ESC   =

Hexadecimal:               1B   3D

**Set MSB to 1****ESC >**

Sets the MSB (most significant bit) of all following data to one. This escape sequence allows the eighth bit to be turned on, even if the computer and printer are connected via a 7-bit I/O interface. The eighth bit may be useful for 8-pin graphics data, or for accessing italic characters.

Escape Sequence:           ESC   >

Hexadecimal:               1B   3E

**Cancel MSB Control****ESC #**

Cancels the MSB (most significant bit) control set by ESC = or ESC >. This causes the eighth data bit sent from the host computer to be accepted as is.

Escape Sequence:           ESC   #

Hexadecimal:               1B   23

**Deselect Printer****(or)****DC3****XOFF**

Deselects the printer. Use of this command is discouraged, because the printer will remain offline until an operator presses the ONLINE button on the control panel.

Control code:               DC3

Hexadecimal:               13

**Character Size**

The FormsPro, FormsMaster and PrintMaster series printers are capable of supporting 10, 12, 13.3, 15, 16.7, 17.14, and 20 cpi, but most emulations support only a subset of these. Epson emulation supports 10, 12, 15, 17.14, and 20 cpi via software, but does not support 13.3 or 16.7 cpi. Every emulation supports 10 cpi, and we consider this to be the default character pitch. When you use the control panel to change the "Characters/Inch" value in the forms menu, you are actually changing the default character pitch. When the printer is turned on (or reset), it will use this character pitch. You can even use a pitch that is not supported by your emulation, such as 13.3 cpi with Epson emulation. You can override this pitch selection via software, by sending an escape sequence. This selects a user specified non-default pitch. For example, in Epson emulation, sending ESC M will select 12 cpi. Sending ESC P will re-select 10 cpi, and thus re-select the default character pitch that was selected in the form setup.

Via software escape sequences, you can select any character pitch supported by the emulation you are using. All will print as expected, unless you select 10 cpi -- because 10 cpi really selects the default character pitch from setup. If you really want 10 cpi, then you must set "Characters/Inch" to "10" in the forms menu. Likewise, if you want to use the default pitch from setup, you must not override it. Either send no character pitch sequences to the printer, or make sure you re-select 10 cpi via software.

When you select different forms, the default character pitch from setup is selected along with the form. But you will not see this default pitch if it has already been overridden via software.

**Select 10 CPI****ESC P**

Selects 10 cpi by cancelling 12 cpi and 15 cpi. Condensed mode is unaffected. The resulting character spacing will be 10 cpi, or if condensed mode is also selected, 17.14 cpi.

If "Characters/Inch" was not set to "10" in the forms menu, the specified default character pitch will be selected instead of 10 cpi.

Escape Sequence:       ESC   P  
Hexadecimal:           1B   50

**Select 12 CPI****ESC M**

Selects 12 cpi (elite mode). Cancels 15 cpi. Condensed mode is unaffected. The resulting character spacing will be 12 cpi, or if condensed mode is also selected, 20 cpi.

Escape Sequence:       ESC   M  
Hexadecimal:           1B   4D

**Select 15 CPI****ESC g**

Selects 15 cpi. Cancels 12 cpi. Condensed mode is unaffected. The resulting character spacing will be 15 cpi, even if condensed mode is also selected.

Escape Sequence:       ESC   g  
Hexadecimal:           1B   67

**Select Condensed Mode****SI****(or)****ESC SI**

Selects condensed mode. The resulting character spacing will be 17.14 cpi if 10 cpi was selected, or 20 cpi if 12 cpi was selected. If 15 cpi was selected, condensed mode will have no affect.

Control code:           SI  
Hexadecimal:           0F  
  
Escape Sequence:       ESC   SI  
Hexadecimal:           1B   0F

**Cancel Condensed Mode****DC2**

Cancels condensed mode set by SI or ESC SI.

Control code: DC2  
 Hexadecimal: 12

**Select double-wide mode (one line)  
(or)****SO  
ESC SO**

Selects double-wide mode for one line. Double-wide mode doubles the width of all characters, but does not affect character height. This mode is cancelled by a carriage return or DC4.

Control code: SO  
 Hexadecimal: 0E  
 Escape Sequence: ESC SO  
 Hexadecimal: 1B 0E

**Cancel Double-Wide Mode (one line)****DC4**

Cancels double-wide mode selected by SO or ESC SO. Does not cancel double-wide mode selected by ESC W or ESC !.

Control code: DC4  
 Hexadecimal: 14

**Double-Wide Mode****ESC W *n***Selects double-wide mode for  $n=1$ , or cancels for  $n=0$ . Double-wide mode doubles the width of all characters, but does not affect character height.

Example: The following escape sequence will select double-wide mode.

Escape Sequence: ESC W 1  
 Hexadecimal: 1B 57 31

**Double-High Mode****ESC w *n***Selects double-high mode for  $n=1$ , or cancels for  $n=0$ . Double-high mode doubles the height of all characters, but does not affect character width.

Example: The following escape sequence will select double-high mode.

Escape Sequence: ESC w 1  
 Hexadecimal: 1B 77 31

**Select Subscript or Superscript Mode****ESC S *n***

Selects subscript mode for  $n=1$ , or superscript mode for  $n=0$ . This will print characters about half the normal height, in the bottom or top half of the normal character cell.

Example: The following escape sequence will select superscript mode.

Escape Sequence:	ESC	S	0
Hexadecimal:	1B	53	30

**Cancel Subscript and Superscript Mode****ESC T**

Cancels subscript and superscript mode.

Escape Sequence:	ESC	T
Hexadecimal:	1B	54

**Character Attributes****Select Emphasized Mode****ESC E**

Selects emphasized mode. This makes characters bolder by printing an extra dot to the right of each dot normally found in the character matrix. This will cut the print speed in half, but will not require an additional pass of the print head.

Escape Sequence:	ESC	E
Hexadecimal:	1B	45

**Cancel Emphasized Mode****ESC F**

Cancels emphasized mode.

Escape Sequence:	ESC	F
Hexadecimal:	1B	46

**Select Double-Strike Mode****ESC G**

Selects double-strike mode. This makes text bolder by printing it twice. This will cut the print speed in half, because an additional pass of the print head will be required.

Escape Sequence:	ESC	G
Hexadecimal:	1B	47

**Cancel Double-Strike Mode****ESC H**

Cancels double-strike mode.

Escape Sequence:       ESC   H  
Hexadecimal:            1B   48

**Underline Mode****ESC - n**

Selects underline mode for  $n=1$ , or cancels for  $n=0$ . This mode provides continuous underlining for all characters, including spaces.

Example: The following escape sequence will turn underlining on.

Escape Sequence:       ESC   -   1  
Hexadecimal:            1B   2D   31

**Select Italic Mode****ESC 4**

Selects italic mode. This causes italic characters to be printed by setting the MSB (most significant bit) of all following printable characters to one. The effect is to map characters from the bottom half (non-italic) of the font to the top half (italic) of the font. For this to work correctly, an Epson FX font must be selected (see ESC k). The other available fonts do not include italic characters.

Escape Sequence:       ESC   4  
Hexadecimal:            1B   34

**Cancel Italic Mode****ESC 5**

Cancels italic mode. The MSB (most significant bit) of the following printable characters will be accepted as is. Italic characters may still be printed by transmitting characters with the MSB turned on.

Escape Sequence:       ESC   5  
Hexadecimal:            1B   35



**Master Print Mode Select****ESC ! *n***

Selects any valid combination of modes from the following table. The value of *n* is determined by adding together the values of the desired modes from the table.

<u><i>n</i></u>	<u>Attribute</u>
0	10 cpi
1	12 cpi
4	Condensed
8	Emphasized
16	Double-Strike
32	Double-Wide
64	Italic
128	Underline

Example: The following escape sequence will select 12 cpi condensed, resulting in 20 cpi character spacing.

Escape Sequence:           ESC   !    5  
Hexadecimal:               1B   21   05

Example: The following escape sequence will select emphasized, double-wide, and underline, for a heading that really stands out.

Escape Sequence:           ESC   !   168  
Hexadecimal:               1B   21   A8

**Character Sets****Select Draft or Letter Quality****ESC x *n***

Selects draft for *n*=0 or letter quality for *n*=1. Same as ESC k 0 or ESC k 1. Overrides the "Font" value in the forms menu.

Example: The following escape sequence will select draft print.

Escape Sequence:           ESC   x    0  
Hexadecimal:               1B   78   30

**Select Font****ESC k *n***

Select font *n* according to the following table.

<u><i>n</i></u>	<u>Font</u>
0	Epson FX Draft
1	Epson FX Letter Quality
2	Proprinter PC Draft
3	Proprinter PC Letter Quality
10	EBCDIC Draft
11	EBCDIC Letter Quality
12	OCR-A Optical Quality
13	OCR-B Optical Quality
32	Epson FX Fast Draft
33	Epson FX Draft
34	Epson FX Letter Quality
36	Proprinter PC Fast Draft
37	Proprinter PC Draft
38	Proprinter PC Letter Quality
44	PC Latin II (Slavic) Fast Draft
45	PC Latin II (Slavic) Draft
46	PC Latin II (Slavic) Letter Quality
64	EBCDIC Fast Draft
65	EBCDIC Draft
66	EBCDIC Letter Quality
71	OCR-A Optical Quality
75	OCR-B Optical Quality

Overrides the “Font” value in the forms menu. If the specified font is not installed, the “Font” value in the forms menu will be used to select the default font.

Example: The following escape sequence will select the Epson FX letter quality font.

Escape Sequence:	ESC	k	1
Hexadecimal:	1B	6B	01

**Select International Character Set****ESC R *n***

Selects the international character set as specified by the value of *n* in the following table. Overrides the "Language" value in the forms menu.

<i>n</i>	Character Set
0	United States of America
1	France
2	Germany
3	United Kingdom
4	Denmark
5	Sweden
6	Italy
7	Spain
8	Japan

The actual character substitutions are shown in the "International Character Mapping" table below. For this to work correctly, an Epson FX font must be selected (see ESC k).

	35	36	64	91	92	93	94	96	123	124	125	126
<b>USA</b>	#	\$	@	[	\	]	^	`	{		}	~
<b>France</b>	#	\$	à	°	ç	§	^	`	é	ù	è	¨
<b>Germany</b>	#	\$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
<b>England</b>	£	\$	@	[	\	]	^	`	{		}	~
<b>Denmark</b>	#	\$	@	Æ	Ø	Å	^	`	æ	ø	å	~
<b>Sweden</b>	#	¤	É	Ä	Ö	Å	Û	é	ä	ö	å	ü
<b>Italy</b>	#	\$	@	°	\	é	^	ù	à	ò	è	ì
<b>Spain</b>	Ps	\$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
<b>Japan</b>	#	\$	@	[	¥	]	^	`	{		}	~

Example: The following escape sequence will select the German character set.

Escape Sequence:           ESC   R    2  
Hexadecimal:               1B   52   02

**Character Table****ESC t *n***

Selects the Epson italic character set for *n*=0 or the Epson extended graphics character set for *n*=1. As implemented, this selects either the Epson FX font or the PC USA font. The character attribute (fast draft, draft, or letter quality) will not change.

Example: The following escape sequence will select the Epson FX font.

Escape Sequence:           ESC   t    0  
Hexadecimal:               1B   74   30

**Enable Printing of High Symbols****ESC 6**

Enables printing of character values 128 through 159 decimal. If printing is not enabled, these characters will be treated as control codes. Overrides the “Characters” value in the interface setup menu.

Escape Sequence:           ESC   6  
Hexadecimal:               1B   36

**Disable Printing of High Symbols****ESC 7**

Disables printing of character values 128 through 159 decimal. These characters will be treated as control codes. Overrides the “Characters” value in the interface setup menu.

Escape Sequence:           ESC   7  
Hexadecimal:               1B   37

**Printing of Low Symbols****ESC I n**

Enables printing of character values 0 through 31 decimal if they are not used as control codes for  $n=1$ , or disables printing for  $n=0$ . Overrides the “Characters” value in the interface setup menu.

Example: The following escape sequence will disable printing of character values 0 through 31 decimal.

Escape Sequence:           ESC   I   0  
Hexadecimal:               1B   49   30

**Line Pitch****Select 8 LPI****ESC 0**

Sets the line spacing to 1/8 of an inch per line (8 lpi). Overrides the “Lines/Inch” value in the forms menu.

Escape Sequence:           ESC   0  
Hexadecimal:               1B   30

**Set Line Spacing to 7/72”****ESC 1**

Sets the line spacing to 7/72 of an inch per line. Since the distance between print head wires is 1/72 of an inch, this is equivalent to setting seven wire spacing. This is not particularly useful for text, but may be useful for graphics if 7-bit graphics data is being sent. Overrides the “Lines/Inch” value in the forms menu.

Escape Sequence:           ESC   1  
Hexadecimal:               1B   31

**Select 6 LPI****ESC 2**

Sets the line spacing to 1/6 of an inch per line (6 lpi). This is the normal text line spacing. Overrides the “Lines/Inch” value in the forms menu.

Escape Sequence:           ESC   2  
Hexadecimal:               1B   32

**Set Line Spacing to  $n/216$ "****ESC 3 n**

Sets the line spacing to  $n/216$  of an inch per line. ( $0 \leq n \leq 255$ ). Overrides the "Lines/Inch" value in the forms menu.

NOTE: The actual resolution of the printer's paper stepper motor is  $1/288$  of an inch. When spacing is specified in  $1/216$  of an inch, the printer will actually move paper to the nearest  $1/288$  of an inch.

Example: The following escape sequence will set line spacing to one half inch.

Escape Sequence:           ESC   3   108  
Hexadecimal:               1B   33   6C

**Set Line Spacing to  $n/72$ "****ESC A n**

Sets the line spacing to  $n/72$  of an inch per line. ( $0 \leq n \leq 255$ ). Since the distance between print head wires is  $1/72$  of an inch, this is equivalent to setting  $n$  wire spacing. Overrides the "Lines/Inch" value in the forms menu.

Example: The following escape sequence will set line spacing to  $8/72$  of an inch, for use with eight wire graphics.

Escape Sequence:           ESC   A    8  
Hexadecimal:               1B   41   08

**Horizontal Position****Carriage Return****CR**

Causes the current line to be printed, and then sets the current print position to the left margin. If "Auto LF" is set to "On" in the interface setup menu, a line feed will also be performed.

Control code:               CR  
Hexadecimal:               0D

**Backspace****BS**

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code:               BS  
Hexadecimal:               08

**Vertical Position****Line Feed****LF**

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:               LF  
Hexadecimal:               0A

**Variable Distance Line Feed****ESC J *n***

Causes the current line to be printed, and then performs a single line feed of  $n/216$ ths of an inch. ( $0 \leq n \leq 255$ ). Does not change the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Example: The following escape sequence will advance the paper one half inch.

Escape Sequence:           ESC   J   108  
Hexadecimal:               1B   4A   6C

**Variable Distance Reverse Line Feed****ESC j *n***

Performs a single reverse line feed of  $n/216$ ths of an inch. ( $0 \leq n \leq 255$ ). Does not change the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Example: The following escape sequence will move the paper down one half inch.

Escape Sequence:           ESC   j   108  
Hexadecimal:               1B   6A   6C

**Form Length and Form Feed**

Form length is the distance from the top of the form to the bottom of the form. Form length may be specified either in inches, or in lines. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rational is that the program is then in complete control of form length, and will work

on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu, so it will be correctly set for everyone using the form. If correct form length cannot be guaranteed from SETUP, then each program should set the correct form length.

### Set Form Length in Lines

**ESC C *n***

Sets the form length to *n* lines at the current line spacing.  $1 \leq n \leq 255$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Form Length" value in the forms menu.

For example, an 11 inch form contains 66 lines at 6 LPI, but 88 lines at 8 LPI. If line spacing is changed after setting the form length, the physical form length (in inches) will not be changed.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 66 lines. At 6 LPI, this will result in a form length of 11 inches.

Escape sequence:	ESC	C	66
Hexadecimal:	1B	43	42

### Set Form Length in Inches

**ESC C NUL *n***

Sets the form length to *n* inches.  $1 \leq n \leq 37$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Form Length" value in the forms menu.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 11 inches, regardless of what line spacing is set.

Escape sequence:	ESC	C	NUL	11
Hexadecimal:	1B	43	00	0B

### Form Feed

**FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface menu, a carriage return will also be performed.

Control code:	FF
Hexadecimal:	0C

## Horizontal Tabs

Default horizontal tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. The default tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the default tab stops.

User defined horizontal tab stops are associated with absolute physical positions, not with columns. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary).

### Horizontal Tab

**HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. Different tab stops may be set with ESC D.

Control code: HT  
Hexadecimal: 09

### Absolute Horizontal Tab

**ESC \$ n1 n2**

Move to the specified carriage position. The position is specified in 60ths of an inch, and calculated as  inches. The position is relative to the left margin and must not exceed the right margin or it will be ignored.

Example: The following escape sequence will set the carriage position 5 inches (300/60 inches) from the left margin.

Escape Sequence: ESC \$ 44 1  
Hexadecimal: 1B 24 2C 01

### Relative Horizontal Tab

**ESC \ n1 n2**

Move the carriage position to the left or right of the current carriage position. The displacement is specified in 120ths of an inch, and calculated as  inches. The new position is relative to the current carriage position, and must fall within the left and right margins or it will be ignored. A negative displacement (2's complement) causes a move to the left.

Example: The following escape sequence will move the carriage one inch to the right.

Escape Sequence: ESC \ 120 0  
Hexadecimal: 1B 5C 78 00

Example: The following escape sequence will move the carriage one inch to the left.

Escape Sequence: ESC \ 136 255  
Hexadecimal: 1B 5C 88 FF



**Set Horizontal Tab Stops****ESC D *n1 n2 ... nx* NUL**

Clears all currently set horizontal tab stops, and sets new tab stops at column *n1*, *n2*, *n3*, etc.  $1 \geq n \geq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary). The leftmost column is column zero.

Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. The tab stops set by ESC D will replace the default tab stops. ESC D NUL will clear all tab stops, leaving no tab stops set. The default tab stops are restored by ESC @.

Example: The following escape sequence will set horizontal tab stops at half inch intervals, if character spacing is currently 10 cpi.

Escape Sequence:	ESC	D	5	10	15	20	25	30	NUL
Hexadecimal:	1B	44	05	0A	0F	14	19	1E	00

**Vertical Tabs**

Vertical tab stops are associated with absolute physical positions, not with lines. The tab stops are set relative to the current line spacing, but subsequent changes in line spacing will not affect the physical position of the tab stops.

**Vertical Tab****VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:	VT
Hexadecimal:	0B

**Set Vertical Tab Stops****ESC B *n1 n2 ... nx* NUL**

Clears all currently set vertical tab stops, and sets new tab stops at line *n1*, *n2*, *n3*, etc.  $1 \geq n \geq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stop settings are based on the current line spacing. Changing the line spacing after the tab stops are set will not affect the position of the tab stops. The first line is line zero.

ESC B NUL will clear all currently set vertical tab stops, leaving no vertical tab stops set.

Example: The following escape sequence will set vertical tab stops at line 6, 12, and 24. If line spacing is currently 6 lpi, this will result in tab stops one inch, two inches, and four inches from the top of the form.

Escape Sequence:	ESC	B	6	12	24	NUL
Hexadecimal:	1B	42	06	0C	18	00

## Horizontal Margins

Printing is allowed only within the left and right margins. Exceeding the right margin will cause line wrap, setting the current print position to the left margin and advancing the paper one line.

### Set Left Margin

**ESC I *n***

Sets the left margin to column *n* at the current character spacing. If character spacing is changed after setting the left margin, the position of the left margin will not change.

The left margin is inclusive. For example, a left margin at column 10 still allows a character to be printed in column 10.

The leftmost column is column zero. The left margin must be left of the right margin and  $\geq 13.4$  inches. Invalid left margins will be ignored. Overrides the "Left Margin" value in the forms menu.

Example: The following escape sequence will set a one inch left margin, if character spacing is currently 10 cpi.

Escape Sequence:	ESC	I	10
Hexadecimal:	1B	6C	0A

### Set Right Margin

**ESC Q *n***

Sets the right margin to column *n* at the current character spacing. If character spacing is changed after setting the right margin, the position of the right margin will not change.

The right margin is exclusive. For example, a right margin at column 75 allows a character to be printed in column 74, but not in column 75.

The leftmost column is column zero. The right margin must be right of the left margin and  $\geq 13.6$  inches. Invalid right margins will be ignored. Overrides the "Right Margin" value in the forms menu.

Example: The following escape sequence will set a right margin 7.5 inches from the left edge of the form, if character spacing is currently 10 cpi. For a standard 8.5 inch wide form, this would result in a one inch right margin.

Escape Sequence:	ESC	Q	75
Hexadecimal:	1B	51	4B

## Vertical Margins

Printing is allowed only within the top and bottom margins. Exceeding the bottom margin will set the current line to the top margin of the next form.

**Set Perforation Skip****ESC N *n***

Sets the perforation skip distance to *n* lines at the current line spacing.  $1 \leq n \leq 255$ . If line spacing is changed after setting the skip distance, the skip distance will not be changed.

The skip distance is split between the top and bottom margins, so the perforation will be centered in the resulting white space. The specified skip distance must be less than the form length, or the command will be ignored. Perforation skip is canceled by ESC O, ESC C *n* or ESC C NUL *n*. Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Example: The following escape sequence will set a two inch perforation skip distance, if the current line spacing is 6 lpi. This will result in a one inch top and bottom margin.

Escape Sequence:	ESC	N	12
Hexadecimal:	1B	4E	0C

**Cancel Perforation Skip****ESC O**

Cancels perforation skip. This is equivalent to having no top and bottom margin. Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Escape Sequence:	ESC	O
Hexadecimal:	1B	4F

**Graphics**

Graphics mode gives the user complete control over every dot position on the paper. Graphics may be printed with various horizontal densities from 60 to 240 dpi, and a vertical density of 72 dpi.

Each byte of graphics data represents a vertical column of eight dots, with the MSB (most significant bit) corresponding to the top wire of the print head. Turning a bit on causes a dot to be printed. The bit values corresponding to each wire of the print head are shown below:

wire 1	128	(80 hex)
wire 2	64	(40 hex)
wire 3	32	(20 hex)
wire 4	16	(10 hex)
wire 5	8	(08 hex)
wire 6	4	(04 hex)
wire 7	2	(02 hex)
wire 8	1	(01 hex)

The appropriate bit values are added together to fire the desired wires. For example, a byte of graphics data with the value 128 (80 hex) will fire the top wire, wire 1. A value of 192 (C0 hex) will fire the top two wires, wires 1 and 2. A value of 11 (0B hex) will fire wires 5, 7 and 8.

Each graphics sequence contains two bytes (*n1* and *n2*) that specify how many bytes of graphics data follow. The first byte, *n1*, can specify values up to 255. If that is sufficient, then *n2* is set to zero. For values greater than 255, *n2* comes into play. The *n2* byte specifies multiples of 256. For example, to specify 520 bytes of graphics data, *n1* = 8 and *n2* = 2. The bytes of graphics data are strung together to create a graphics line

that is eight dots high, and  $n1 + (n2 \times 256)$  dots long. Be sure to provide the amount of graphics data that you specify, because the printer will not leave graphics mode until it has accepted the specified number of data bytes.

If "Data Bits" is set to "7" in the interface setup menu, beware of potential problems in graphics mode. Since the MSB (most significant bit) will always be turned off, it will not be possible to fire the top wire of the print head. Worse yet, the value of  $n1$  or  $n2$  may be changed. For example, if  $n1$  specifies 200 bytes of data, and its MSB is turned off, the printer will only expect 72 bytes of data. It will exit graphics mode, and then try to print the remaining 128 bytes of graphics data as normal text characters. The result will surely not be pretty. To avoid such problems, the use of an 8-bit I/O interface for printing graphics is highly recommended.

The normal graphics modes allow every dot to be printed. High speed graphics will print twice as fast, but will not allow consecutive dots to be printed.

### 60 DPI Graphics

### ESC K $n1$ $n2$ data

Selects eight wire single density (60 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data.

Example: The following escape sequence will print six bytes of graphics data at 60 dpi. The resulting figure will resemble a backslash character, "\".

Escape Sequence:	ESC	K	6	0	128	64	32	16	8	4
Hexadecimal:	1B	4B	06	00	80	40	20	10	08	04

### 120 DPI Graphics

### ESC L $n1$ $n2$ data

Selects eight wire double density (120 dpi) graphics for  $n1 + (n2 \times 256)$  columns data.

Example: The following escape sequence will print six bytes of graphics data at 120 dpi. The resulting figure will resemble a backslash character, "\".

Escape Sequence:	ESC	L	6	0	128	64	32	16	8	4
Hexadecimal:	1B	4C	06	00	80	40	20	10	08	04

### High Speed 120 DPI Graphics

### ESC Y $n1$ $n2$ data

Selects eight wire high speed double density (120 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data. Horizontally adjacent dots may not be printed.

Example: The following escape sequence will print six bytes of graphics data at 120 dpi. The resulting figure will resemble a backslash character, "\".

Escape Sequence:	ESC	Y	6	0	128	64	32	16	8	4
Hexadecimal:	1B	59	06	00	80	40	20	10	08	04

### High Speed 240 DPI Graphics

### ESC Z $n1$ $n2$ data

Selects eight wire quadruple density (240 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data. Horizontally adjacent dots may not be printed.

Example: The following escape sequence will print six bytes of graphics data at 240 dpi. The resulting figure will resemble a backslash character, "\".

Escape Sequence:	ESC	Z	6	0	128	64	32	16	8	4
Hexadecimal:	1B	5A	06	00	80	40	20	10	08	04

### ***m* DPI Graphics**

**ESC \* *m n1 n2 data***

Selects eight wire graphics of density *m* as listed in the following table for  $n1 + (n2 \times 256)$  columns of data.

<i>m</i>	<u>Density</u>
0	60 dpi (same as ESC K)
1	120 dpi (same as ESC L)
2	120 dpi high speed (same as ESC Y)
3	240 dpi high speed (same as ESC Z)
4	80 dpi
5	72 dpi
6	90 dpi
7	144 dpi

Example: The following escape sequence will print four bytes of graphics data at 72 x 72 dpi. The resulting figure will resemble a square, since the horizontal and vertical density are the same. If some other density is chosen, the figure will resemble a rectangle.

Escape Sequence:	ESC	*	5	4	0	<	<	<	<
Hexadecimal:	1B	2A	05	04	00	3C	3C	3C	3C

## Printer Controls

### **Bell**

**BEL**

Causes the printer's bell to sound.

Control code:	BEL
Hexadecimal:	07

### **Unidirectional Mode (one line)**

**ESC <**

Selects unidirectional mode for the current line (until a carriage return is received). This will force the line to print from left to right.

Escape Sequence:	ESC	<
Hexadecimal:	1B	3C

### **Unidirectional Mode**

**ESC U *n***

Selects unidirectional mode for  $n=1$ , or bidirectional mode for  $n=0$ . Printing is normally bidirectional. Unidirectional printing provides more accurate positioning, but causes lower throughput.

Example: The following escape sequence will force unidirectional printing.

Escape Sequence:	ESC	U	1
Hexadecimal:	1B	55	31

### Reset

**ESC @**

Deletes all data on the current line and initializes the printer to the default settings for the current form.

Restores the default horizontal tab stops. Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc.

Resets top of form to the current position, so it is wise to be at top of form before performing this reset. Issuing a form feed will guarantee this.

See the chapter on Printer Reset Conditions for more information.

Escape Sequence:	ESC	@
Hexadecimal:	1B	40

## Forms and Tractors

The FormsPro 4503se and FormsMaster 8003se series printer contains three sets of paper tractors (front, center, and rear). It is possible, via software, to change to a different form that is set up to use any set of tractors. With the FormsMaster 8003se series printer, it is even possible to use some combinations of tractor paths for longer print jobs.

The "Path" value in the forms menu specifies "Front", "Center", "Rear", or PrintMaster 8003se series printer also includes, "Center+Rear", or "Front+Center+Rear" (abbreviated "Frnt+Cntr+Rear") for each form that is defined. When a form is selected, the associated set(s) of tractors is also automatically selected.

### Load Form

**ESC EM *n***

Causes the current line to be printed, and then loads paper and form parameters for form *n*.  $0 \leq n \leq 2$ . If form *n* is already loaded, this sequence is ignored. If not, the current form will be unloaded, the parameters for form *n* will be selected, and the printer will go offline to wait for the operator to install the new form and place the printer back online. In the FormsPro 4503se and FormsMaster 8003se series printer the same happens unless selecting form *n* also selects a different paper path. In that case, the current form is unloaded, the tractors are moved to engage the new path, the new form is loaded, and printing may continue. If the selected form had not been previously loaded in that path (see the *FormsPro 4000se or FormsMaster 8000se Series Operator's Manual*), then the printer will go offline until an operator has loaded the form.

The printer will not unload the current form if a previously printed form has not been torn off. In this case, the printer will go offline, sound the bell, and display the message "Too Much Paper to Unload". When an operator tears off the paper and places the printer back online, the printer will unload the current form and continue.

If the printer is unable to load the new form, it will sound the bell and display the message "No Paper to Load" and go offline to wait for an operator to clear the error.

Example: The following escape sequence will load form 2.

Escape Sequence:	ESC	EM	2
Hexadecimal:	1B	19	32

## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120/210 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the "Emulation" value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character "0" to "7" (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the "Emulation" value in the interface setup menu.

This chapter describes Epson FX emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Sorted Alphabetically

BEL	Bell
BS	Backspace
CAN	Cancel Line
CR	Carriage Return
DC2	Cancel Condensed Mode
DC3	Deselect Printer
DC4	Cancel Double-Wide Mode (one line)
DEL	Delete Character
ESC ! <i>n</i>	Master Print Mode Select
ESC #	Cancel MSB Control
ESC \$ <i>n1 n2</i>	Absolute Horizontal Tab
ESC * <i>m n1 n2 data</i>	<i>m</i> DPI Graphics
ESC - <i>n</i>	Underline Mode
ESC 0	Select 8 LPI
ESC 1	Set Line Spacing to 7/72"
ESC 2	Select 6 LPI
ESC 3 <i>n</i>	Set Line Spacing to <i>n</i> /216"
ESC 4	Select Italic Mode
ESC 5	Cancel Italic Mode
ESC 6	Enable Printing of High Symbols
ESC 7	Disable Printing of High Symbols
ESC <	Unidirectional Mode (one line)
ESC =	Set MSB to 0
ESC >	Set MSB to 1
ESC @	Reset
ESC A <i>n</i>	Set Line Spacing to <i>n</i> /72"
ESC B <i>n1 n2 ... nx</i> NUL	Set Vertical Tab Stops
ESC C NUL <i>n</i>	Set Form Length in Inches
ESC C <i>n</i>	Set Form Length in Lines
ESC D <i>n1 n2 ... nx</i> NUL	Set Horizontal Tab Stops
ESC E	Select Emphasized Mode
ESC EM <i>n</i>	Load Form
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ESC F	Cancel Emphasized Mode
ESC G	Select Double-Strike Mode
ESC H	Cancel Double-Strike Mode
ESC I <i>n</i>	Printing of Low Symbols
ESC J <i>n</i>	Variable Distance Line Feed
ESC K <i>n1 n2 data</i>	60 DPI Graphics
ESC L <i>n1 n2 data</i>	120 DPI Graphics
ESC M	Select 12 CPI
ESC N <i>n</i>	Set Perforation Skip
ESC O	Cancel Perforation Skip
ESC P	Select 10 CPI
ESC Q <i>n</i>	Set Right Margin
ESC R <i>n</i>	Select International Character Set



ESC S <i>n</i>	Select Subscript or Superscript Mode
ESC SI	Select Condensed Mode
ESC SO	Select Double-Wide Mode (one line)
ESC T	Cancel Subscript and Superscript Mode
ESC U <i>n</i>	Unidirectional Mode
ESC W <i>n</i>	Double-Wide Mode
ESC Y <i>n1 n2 data</i>	High Speed 120 DPI Graphics
ESC Z <i>n1 n2 data</i>	High Speed 240 DPI Graphics
ESC \ <i>n1 n2</i>	Relative Horizontal Tab
ESC g	Select 15 CPI
ESC j <i>n</i>	Variable Distance Reverse Line Feed
ESC k <i>n</i>	Select Font
ESC l <i>n</i>	Set Left Margin
ESC t <i>n</i>	Character Table (Italic vs. Extended)
ESC w <i>n</i>	Double-High Mode
ESC x <i>n</i>	Select Draft or Letter Quality
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
LF	Line Feed
SI	Select Condensed Mode
SO	Select Double-Wide Mode (one line)
VT	Vertical Tab
XOFF	Deselect Printer



# IBM PROPRINTER EMULATION

## Introduction

This section describes the control codes and escape sequences comprising IBM Proprinter emulation. This emulation may be selected by setting “Emulation” to “Proprinter” in the interface setup menu, or via software with the **ESC ESC 4** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

Some escape sequences accept one or more numeric parameters. If a sequence accepts one numeric parameter, it will be represented as “*n*”. If a sequence accepts more than one numeric parameter, they will be represented as “*n1 n2 ... nx*”.

Since numeric parameters are always encoded in one byte, their values may range from 0 to 255 decimal. Please note that the value will never be represented by a string of ASCII decimal digits (“0” through “9”). For example, a value of 66 decimal would be sent as a single byte with a hex value of 42. This is equivalent to sending the ASCII character “B”. It is entirely different than sending the two printable ASCII characters “66”.

If a numeric parameter is limited to a value of zero or one, it may be sent as a single byte with a value of 00 or 01 hex (NUL or SOH), or it may be sent as a single printable ASCII character “0” or “1” (30 or 31 hex).

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*” and “*n1 n2*” above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 109 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the provided example. This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Column and line numbers begin at one, not at zero. Keep this in mind when setting tabs, margins, etc.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### Cancel Line

CAN

Cancels all printable text in the current print line. Does not affect any control codes or escape sequences.

Control code: CAN  
Hexadecimal: 18

#### End of Text

ETX

If "ETX/ACK" is set to "On" in the interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

If character set 2 is selected, ETX will be treated as a printable character instead of an I/O handshake control code.

Control code: ETX  
Hexadecimal: 03

#### Deselect Printer

ESC Q *n*

Deselects the printer. Use of this command is discouraged, because the printer will remain offline until an operator presses the ONLINE button on the control panel.

For a Proprinter II or Proprinter III, *n* should be 3. For a Proprinter XL or Proprinter III XL, *n* should be 22. It does not really matter, because *n* will be ignored.

Example: The following escape sequence will force the printer offline.

Escape Sequence: ESC Q 22  
Hexadecimal: 1B 51 16

## Character Size

The FormsPro, FormsMaster and PrintMaster series printers are capable of supporting 10, 12, 13.3, 15, 16.7, 17.14, and 20 cpi, but most emulations support only a subset of these. IBM Proprinter emulation supports 10, 12, 17.14, and 20 cpi via software, but does not support 13.3, 15 or 16.7 cpi. Every emulation supports 10 cpi, and we consider this to be the default character pitch. When you use the control panel to change the "Characters/Inch" value in the forms menu, you are actually changing the default character pitch. When the printer is turned on (or reset), it will use this character pitch. You can even use a pitch that is not supported by your emulation, such as 13.3 cpi with IBM Proprinter emulation. You can override this pitch selection via software, by sending an escape sequence. This selects a user specified non-default pitch. For example, in IBM Proprinter emulation, sending ESC : will select 12 cpi. Sending DC2 will re-select 10 cpi, and thus re-select the default character pitch that was selected in the form setup.

Via software escape sequences, you can select any character pitch supported by the emulation you are using. All will print as expected, unless you select 10 cpi -- because 10 cpi really selects the default character pitch from setup. If you really want 10 cpi, then you must set "Characters/Inch" to "10" in the forms menu. Likewise, if you want to use the default pitch from setup, you must not override it. Either send no character pitch sequences to the printer, or make sure you re-select 10 cpi via software.

When you select different forms, the default character pitch from setup is selected along with the form. But you will not see this default pitch if it has already been overridden via software.

### Select 10 CPI

**DC2**

Selects 10 cpi by cancelling 12 cpi and condensed mode. If "Characters/Inch" was not set to "10" in the forms menu, the specified default character pitch will be selected instead of 10 cpi.

Control code: DC2  
Hexadecimal: 12

### Select 12 CPI

**ESC :**

Selects 12 cpi (elite mode). Condensed mode is unaffected. The resulting character spacing will be 12 cpi, or if condensed mode is also selected, 20 cpi.

Escape Sequence: ESC :  
Hexadecimal: 1B 3A

### Select Condensed Mode (or)

**SI  
ESC SI**

Selects condensed mode. The resulting character spacing will be 17.14 cpi if 10 cpi was selected, or 20 cpi if 12 cpi was selected.

Control code: SI  
Hexadecimal: 0F  
Escape Sequence: ESC SI  
Hexadecimal: 1B 0F

**Select Double-Wide Mode (one line)**  
(or)**SO**  
**ESC SO**

Selects double-wide mode for one line. Double-wide mode doubles the width of all characters, but does not affect character height. This mode is cancelled by a carriage return or DC4.

Control code:	SO
Hexadecimal:	0E
Escape Sequence:	ESC SO
Hexadecimal:	1B 0E

**Cancel Double-Wide Mode (one line)****DC4**

Cancels double-wide mode selected by SO or ESC SO. Does not cancel double-wide mode selected by ESC W or ESC !.

Control code:	DC4
Hexadecimal:	14

**Double-Wide Mode****ESC W *n***

Selects double-wide mode for  $n=1$ , or cancels for  $n=0$ . Double-wide mode doubles the width of all characters, but does not affect character height.

Example: The following escape sequence will select double-wide mode.

Escape Sequence:	ESC W 1
Hexadecimal:	1B 57 31

**Double-High Mode****ESC [ @ *n1 n2 m1 m2 m3 m4***

Selects single or double-high mode, single or double-wide mode, and single or double line feeds.

The two bytes  $n1$  and  $n2$  specify how many mode bytes ( $m1, m2, m3, m4$ ) follow. Theoretically, there may be  $n1 + (n2 \times 256)$  mode bytes. Actually,  $n2$  must be 0, and  $n1$  may be 0 to 4, but is normally 4.

$m1$  and  $m2$  must be 0 (NUL).  $m3$  and  $m4$  may be set to the values in the following tables.

<u>m3</u>	<u>hex</u>	<u>character height and line spacing</u>
0	00	no change
1	01	line feeds unchanged, single-high characters
2	02	line feeds unchanged, double-high characters
16	10	single line feeds, character height unchanged
17	11	single line feeds, single-high characters
18	12	single line feeds, double-high characters
32	20	double line feeds, character height unchanged
33	21	double line feeds, single-high characters
34	22	double line feeds, double-high characters
<u>m4</u>	<u>hex</u>	<u>character width</u>
1	01	single-wide characters
2	02	double-wide characters

Example: The following escape sequence will select double-wide and double-high mode, with double line feeds.

Escape Sequence:	ESC	[	@	4	0	0	0	34	2
Hexadecimal:	1B	5B	40	04	00	00	00	22	02

#### Select Subscript or Superscript Mode

**ESC S n**

Selects subscript mode for  $n=1$ , or superscript mode for  $n=0$ . This will print characters about half the normal height, in the bottom or top half of the normal character cell.

Example: The following escape sequence will select superscript mode.

Escape Sequence:	ESC	S	0
Hexadecimal:	1B	53	30

#### Cancel Subscript and Superscript Mode

**ESC T**

Cancels subscript and superscript mode.

Escape Sequence:	ESC	T
Hexadecimal:	1B	54

## Character Attributes

#### Select Emphasized Mode

**ESC E**

Selects emphasized mode. This makes characters bolder by printing an extra dot to the right of each dot normally found in the character matrix. This will cut the print speed in half, but will not require an additional pass of the print head. Overrides the "Impact Force" value in the forms menu.

Escape Sequence:	ESC	E
Hexadecimal:	1B	45

**Cancel Emphasized Mode****ESC F**

Cancels emphasized mode. Overrides the "Impact Force" value in the forms menu.

Escape Sequence:           ESC   F  
Hexadecimal:               1B   46

**Select Double-Strike Mode****ESC G**

Selects double-strike mode. This makes text bolder by printing it twice. This will cut the print speed in half, because an additional pass of the print head will be required.

Escape Sequence:           ESC   G  
Hexadecimal:               1B   47

**Cancel Double-Strike Mode****ESC H**

Cancels double-strike mode.

Escape Sequence:           ESC   H  
Hexadecimal:               1B   48

**Underline Mode****ESC - n**

Selects underline mode for  $n=1$ , or cancels for  $n=0$ . This mode provides continuous underlining for all characters, including spaces.

Example: The following escape sequence will turn underlining on.

Escape Sequence:           ESC   -   1  
Hexadecimal:               1B   2D   31

## Character Sets

**Select Character Set 1****ESC 7**

Selects character set 1. Disables printing of character values 0 through 31 decimal, and 128 through 159 decimal, so these characters will be treated as control codes. Overrides the "Characters" value in the interface setup menu.

Escape Sequence:           ESC   7  
Hexadecimal:               1B   37

**Select Character Set 2****ESC 6**

Selects character set 2. Enables printing of character values 0 through 31 decimal if they are not used as control codes. Enables printing of character values 128 through 159 decimal, so these characters will not be treated as control codes. Overrides the "Characters" value in the interface setup menu.



Escape Sequence:       ESC   6  
Hexadecimal:           1B   36

**Print Single Character**

**ESC ^ *n***

Prints the character *n* from the all characters chart. This sequence may be used to print a character that is normally treated as a control code.

Example: The following escape sequence will print a left arrow. This character is normally not printable, since it is treated as the ESC control code.

Escape Sequence:       ESC   ^   ESC  
Hexadecimal:           1B   5E   1B

**Print Characters**

**ESC \ *n1 n2***

Prints the next *n1* + (*n2* x 256) characters from the all characters chart. This sequence may be used to print characters that are normally treated as a control codes.

Example: The following escape sequence will print an up arrow, a down arrow, a right arrow, and a left arrow.

Escape Sequence:       ESC   \   4   0   CAN   EM   SUB   ESC  
Hexadecimal:           1B   5C   04   00   18   19   1A   1B

**Select Print Mode**

**ESC I *n***

Selects print mode *n* according to the following chart. Overrides the "Font" value in the forms menu.

<i>n</i>	<u>Print Mode</u>
0	Draft
1	Fast Draft 12 cpi
2	Letter Quality
3	Letter Quality

Example: The following escape sequence will select the IBM Proprinter letter quality font.

Escape Sequence:       ESC   I   3  
Hexadecimal:           1B   49   03

**Line Pitch**

**Select 8 LPI**

**ESC 0**

Sets the line spacing to 1/8 of an inch per line (8 lpi). Overrides the "Lines/Inch" value in the forms menu.

Escape Sequence:       ESC   0  
Hexadecimal:           1B   30

**Set Line Spacing to 7/72"****ESC 1**

Sets the line spacing to 7/72 of an inch per line. Since the distance between print head wires is 1/72 of an inch, this is equivalent to setting seven wire spacing. This is not particularly useful for text, but may be useful for graphics if 7-bit graphics data is being sent. Overrides the "Lines/Inch" value in the forms menu.

Escape Sequence:           ESC   1  
Hexadecimal:               1B   31

**Start Line Spacing****ESC 2**

Sets the line spacing to the value selected by ESC A *n*. Overrides the "Lines/Inch" value in the forms menu.

Escape Sequence:           ESC   2  
Hexadecimal:               1B   32

**Set Line Spacing to  $n/216$ "****ESC 3 *n***

Sets the line spacing to  $n/216$  of an inch per line. ( $0 \leq n \leq 255$ ). Overrides the "Lines/Inch" value in the forms menu.

NOTE: The actual resolution of the printer's paper stepper motor is 1/288 of an inch. When spacing is specified in 1/216 of an inch, the printer will actually move paper to the nearest 1/288 of an inch.

Example: The following escape sequence will set line spacing to one half inch.

Escape Sequence:           ESC   3   108  
Hexadecimal:               1B   33   6C

**Set Line Spacing to  $n/72$ "****ESC A *n***

Sets the line spacing to  $n/72$  of an inch per line. ( $0 \leq n \leq 255$ ). Since the distance between print head wires is 1/72 of an inch, this is equivalent to setting *n* wire spacing. This spacing is stored but does not take effect until ESC 2 is received. Overrides the "Lines/Inch" value in the forms menu.

Example: The following escape sequence will set line spacing to 8/72 of an inch, for use with eight wire graphics.

Escape Sequence:           ESC   A    8  
Hexadecimal:               1B   41   08

**Horizontal Position****Carriage Return****CR**

Causes the current line to be printed, and then sets the current print position to the left margin. If "Auto LF" is set to "On" in the interface setup menu, a line feed will also be performed.

Control code: CR  
Hexadecimal: 0D

**Backspace****BS**

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code: BS  
Hexadecimal: 08

**Vertical Position****Line Feed****LF**

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: LF  
Hexadecimal: 0A

**Variable Distance Line Feed****ESC J n**

Causes the current line to be printed, and then performs a single line feed of  $n/216$ ths of an inch.  $0 \leq n \leq 255$ . Does not change the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Example: The following escape sequence will advance the paper one half inch.

Escape Sequence: ESC J 108  
Hexadecimal: 1B 4A 6C

**Form Length and Form Feed**

Form length is the distance from the top of the form to the bottom of the form. Form length may be specified either in inches, or in lines. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rationale is that the program is then in complete control of form length, and will work on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu, so it will be correctly set for everyone using the form. If correct form length cannot be guaranteed from SETUP, then each program should set the correct form length.

**Set Form Length in Lines****ESC C n**

Sets the form length to  $n$  lines at the current line spacing.  $1 \leq n \leq 255$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Form Length" value in the forms menu.

For example, an 11 inch form contains 66 lines at 6 LPI, but 88 lines at 8 LPI. If line spacing is changed after setting the form length, the physical form length (in inches) will not be changed.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 66 lines. At 6 LPI, this will result in a form length of 11 inches.

Escape sequence:           ESC   C    66  
Hexadecimal:            1B   43   42

**Set Form Length in Inches****ESC C NUL n**

Sets the form length to  $n$  inches.  $1 \leq n \leq 37$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Form Length" value in the forms menu.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 11 inches, regardless of what line spacing is set.

Escape sequence:           ESC   C    NUL   11  
Hexadecimal:            1B   43   00   0B

**Form Feed****FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:            FF  
Hexadecimal:            0C

**Set Top of Form****ESC 4**

Sets top of form to the current position.

Escape Sequence:        ESC   4  
Hexadecimal:            1B   34

## Horizontal Tabs

Default horizontal tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. The default tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the default tab stops.

User defined horizontal tab stops are associated with absolute physical positions, not with columns. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary).

### Horizontal Tab

**HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. Different tab stops may be set with ESC D.

Control code: HT  
Hexadecimal: 09

### Set Horizontal Tab Stops

**ESC D *n1 n2 ... nx* NUL**

Clears all currently set horizontal tab stops, and sets new tab stops at column *n1*, *n2*, *n3*, etc.  $1 \leq n \leq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary). The leftmost column is column one.

Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. The tab stops set by ESC D will replace the default tab stops. ESC D NUL will clear all tab stops, leaving no tab stops set. The default tab stops are restored by ESC R.

Example: The following escape sequence will set horizontal tab stops at half inch intervals, if character spacing is currently 10 cpi.

Escape Sequence:	ESC	D	6	11	16	21	26	31	NUL
Hexadecimal:	1B	44	06	0B	10	15	1A	1F	00

## Vertical Tabs

Vertical tab stops are associated with absolute physical positions, not with lines. The tab stops are set relative to the current line spacing, but subsequent changes in line spacing will not affect the physical position of the tab stops.

**Vertical Tab****VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: VT  
Hexadecimal: 0B

**Set Vertical Tab Stops****ESC B *n1 n2 ... nx* NUL**

Clears all currently set vertical tab stops, and sets new tab stops at line *n1*, *n2*, *n3*, etc.  $1 \leq n \leq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stop settings are based on the current line spacing. Changing the line spacing after the tab stops are set will not affect the position of the tab stops. The first line is line one.

ESC B NUL or ESC R will clear all currently set vertical tab stops, leaving no vertical tab stops set.

Example: The following escape sequence will set vertical tab stops at line 7, 13, and 25. If line spacing is currently 6 lpi, this will result in tab stops one inch, two inches, and four inches from the top of the form.

Escape Sequence: ESC B 7 13 25 NUL  
Hexadecimal: 1B 42 07 0D 19 00

**Horizontal and Vertical Tabs****Reset Horizontal and Vertical Tab Stops****ESC R**

Clears all currently set horizontal tab stops, and returns to default horizontal tab stops. Default horizontal tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. Clears all currently set vertical tab stops.

Escape Sequence: ESC R  
Hexadecimal: 1B 52

**Horizontal Margins**

Printing is allowed only within the left and right margins. Exceeding the right margin will cause line wrap, setting the current print position to the left margin and advancing the paper one line.

**Set Left and Right Margin****ESC X *n1 n2***

Sets the left margin to column *n1* and the right margin to column *n2* at the current character spacing.  $0 \leq n1 \leq 255$ ,  $0 \leq n2 \leq 255$ . If character spacing is changed after setting the margins, the position of the margins will not change.

The left margin is inclusive, but the right margin is exclusive. For example, a left margin at column 11 still allows a character to be printed in column 11. A right margin at column 76 allows a character to be printed in column 75, but not in column 76.

The leftmost column is column one. If  $n1$  or  $n2$  is zero, the corresponding margin is not changed. The left margin must be left of the right margin and  $\geq 13.4$  inches. The right margin must be right of the left margin and  $\geq 13.6$  inches. Invalid margins will be ignored. Overrides the "Left Margin" and "Right Margin" values in the forms menu.

Example: The following escape sequence will set a one inch left margin, and will set a right margin 7.5 inches from the left edge of the form, if character spacing is currently 10 cpi. For a standard 8.5 inch wide form, this would result in a one inch right margin.

Escape Sequence:	ESC	X	11	76
Hexadecimal:	1B	58	0B	4C

## Vertical Margins

Printing is allowed only within the top and bottom margins. Exceeding the bottom margin will set the current line to the top margin of the next form.

### Set Perforation Skip

**ESC N  $n$**

Sets the perforation skip distance to  $n$  lines at the current line spacing.  $1 \leq n \leq 255$ . If line spacing is changed after setting the skip distance, the skip distance will not be changed.

The skip distance is split between the top and bottom margins, so the perforation will be centered in the resulting white space. The specified skip distance must be less than the form length, or the command will be ignored. Perforation skip is canceled by ESC O, ESC C  $n$  or ESC C NUL  $n$ . Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Example: The following escape sequence will set a two inch perforation skip distance, if the current line spacing is 6 lpi. This will result in a one inch top and bottom margin.

Escape Sequence:	ESC	N	12
Hexadecimal:	1B	4E	0C

### Cancel Perforation Skip

**ESC O**

Cancels perforation skip. This is equivalent to having no top and bottom margin. Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Escape Sequence:	ESC	O
Hexadecimal:	1B	4F

## Graphics

Graphics mode gives the user complete control over every dot position on the paper. Graphics may be printed with various horizontal densities from 60 to 240 dpi, and a vertical density of 72 dpi.

Each byte of graphics data represents a vertical column of eight dots, with the MSB (most significant bit) corresponding to the top wire of the print head. Turning a bit on causes a dot to be printed. The bit values corresponding to each wire of the print head are shown below:

wire 1	128	(80 hex)
wire 2	64	(40 hex)
wire 3	32	(20 hex)
wire 4	16	(10 hex)
wire 5	8	(08 hex)
wire 6	4	(04 hex)
wire 7	2	(02 hex)
wire 8	1	(01 hex)

The appropriate bit values are added together to fire the desired wires. For example, a byte of graphics data with the value 128 (80 hex) will fire the top wire, wire 1. A value of 192 (C0 hex) will fire the top two wires, wires 1 and 2. A value of 11 (0B hex) will fire wires 5, 7 and 8.

Each graphics sequence contains two bytes ( $n1$  and  $n2$ ) that specify how many bytes of graphics data follow. The first byte,  $n1$ , can specify values up to 255. If that is sufficient, then  $n2$  is set to zero. For values greater than 255,  $n2$  comes into play. The  $n2$  byte specifies multiples of 256. For example, to specify 520 bytes of graphics data,  $n1 = 8$  and  $n2 = 2$ . The bytes of graphics data are strung together to create a graphics line that is eight dots high, and  $n1 + (n2 \times 256)$  dots long. Be sure to provide the amount of graphics data that you specify, because the printer will not leave graphics mode until it has accepted the specified number of data bytes.

If "Data Bits" is set to "7" in the interface setup menu, beware of potential problems in graphics mode. Since the MSB (most significant bit) will always be turned off, it will not be possible to fire the top wire of the print head. Worse yet, the value of  $n1$  or  $n2$  may be changed. For example, if  $n1$  specifies 200 bytes of data, and its MSB is turned off, the printer will only expect 72 bytes of data. It will exit graphics mode, and then try to print the remaining 128 bytes of graphics data as normal text characters. The result will surely not be pretty. To avoid such problems, the use of an 8-bit I/O interface for printing graphics is highly recommended.

The normal graphics modes allow every dot to be printed. High speed graphics will print twice as fast, but will not allow consecutive dots to be printed.

### 60 DPI Graphics

### ESC K $n1$ $n2$ data

Selects eight wire single density (60 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data.

Example: The following escape sequence will print six bytes of graphics data at 60 dpi. The resulting figure will resemble a backslash character, "\".

Escape Sequence:	ESC	K	6	0	128	64	32	16	8	4
Hexadecimal:	1B	4B	06	00	80	40	20	10	08	04



**120 DPI Graphics**

**ESC L n1 n2 data**

Selects eight wire double density (120 dpi) graphics for  $n1 + (n2 \times 256)$  columns data.

Example: The following escape sequence will print six bytes of graphics data at 120 dpi. The resulting figure will resemble a backslash character, “\”.

Escape Sequence:	ESC	L	6	0	128	64	32	16	8	4
Hexadecimal:	1B	4C	06	00	80	40	20	10	08	04

**High Speed 120 DPI Graphics**

**ESC Y n1 n2 data**

Selects eight wire high speed double density (120 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data. Horizontally adjacent dots may not be printed.

Example: The following escape sequence will print six bytes of graphics data at 120 dpi. The resulting figure will resemble a backslash character, “\”.

Escape Sequence:	ESC	Y	6	0	128	64	32	16	8	4
Hexadecimal:	1B	59	06	00	80	40	20	10	08	04

**High Speed 240 DPI Graphics**

**ESC Z n1 n2 data**

Selects eight wire quadruple density (240 dpi) graphics for  $n1 + (n2 \times 256)$  columns of data. Horizontally adjacent dots may not be printed.

Example: The following escape sequence will print six bytes of graphics data at 240 dpi. The resulting figure will resemble a backslash character, “\”.

Escape Sequence:	ESC	Z	6	0	128	64	32	16	8	4
Hexadecimal:	1B	5A	06	00	80	40	20	10	08	04

**Printer Controls**

**Bell**

**BEL**

Causes the printer's bell to sound.

Control code:	BEL
Hexadecimal:	07

**Unidirectional Mode**

**ESC U n**

Selects unidirectional mode for  $n=1$ , or bidirectional mode for  $n=0$ . Printing is normally bidirectional. Unidirectional printing provides more accurate positioning, but causes lower throughput.

Example: The following escape sequence will force unidirectional printing.

Escape Sequence:           ESC   U    1  
Hexadecimal:               1B   55   31

**Automatic Line Feed****ESC 5 *n***

Selects automatic line feed mode for  $n=1$ , or cancels for  $n=0$ . Automatic line feed mode causes the printer to automatically perform a line feed (LF) for each carriage return (CR) it receives. Overrides the "Auto LF" value in the interface setup menu.

Example: The following escape sequence will select automatic line feed mode.

Escape Sequence:           ESC   5    1  
Hexadecimal:               1B   35   31

**Emulations****Select Software Interface *n*****ESC ESC *n***

Selects the software interface  $n$  according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120/210 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the "Emulation" value in the interface setup menu.

A numeric value for  $n$  may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character "0" to "7" (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the "Emulation" value in the interface setup menu.

This chapter describes IBM Proprinter emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CAN	Cancel Line
CR	Carriage Return
DC2	Select 10 CPI
DC4	Cancel Double-Wide Mode (one line)
ESC - <i>n</i>	Underline Mode
ESC 0	Select 8 LPI
ESC 1	Set Line Spacing to 7/72"
ESC 2	Start Line Spacing
ESC 3 <i>n</i>	Set Line Spacing to <i>n</i> /216"
ESC 4	Set Top of Form
ESC 5 <i>n</i>	Automatic Line Feed
ESC 6	Select Character Set 2
ESC 7	Select Character Set 1
ESC :	Select 12 CPI
ESC A <i>n</i>	Set Line Spacing to <i>n</i> /72"
ESC B <i>n1 n2 ... nx</i> NUL	Set Vertical Tab Stops
ESC C NUL <i>n</i>	Set Form Length in Inches
ESC C <i>n</i>	Set Form Length in Lines
ESC D <i>n1 n2 ... nx</i> NUL	Set Horizontal Tab Stops
ESC E	Select Emphasized Mode
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ESC F	Cancel Emphasized Mode
ESC G	Select Double-Strike Mode
ESC H	Cancel Double-Strike Mode
ESC I <i>n</i>	Select Print Mode
ESC J <i>n</i>	Variable Distance Line Feed
ESC K <i>n1 n2 data</i>	60 DPI Graphics
ESC L <i>n1 n2 data</i>	120 DPI Graphics
ESC N <i>n</i>	Set Perforation Skip
ESC O	Cancel Perforation Skip
ESC Q <i>n</i>	Deselect Printer
ESC R	Reset Horizontal and Vertical Tab Stops
ESC S <i>n</i>	Select Subscript or Superscript Mode
ESC SI	Select Condensed Mode
ESC SO	Select Double-Wide Mode (one line)
ESC T	Cancel Subscript and Superscript Mode
ESC U <i>n</i>	Unidirectional Mode
ESC W <i>n</i>	Double-Wide Mode
ESC X <i>n1 n2</i>	Set Left and Right Margin
ESC Y <i>n1 n2 data</i>	High Speed 120 DPI Graphics
ESC Z <i>n1 n2 data</i>	High Speed 240 DPI Graphics
ESC [ @ <i>n1 n2 m1 m2 m3 m4</i>	Double-High Mode
ESC \ <i>n1 n2</i>	Print Characters
ESC ^ <i>n</i>	Print Single Character
ETX	End of Text

FF	Form Feed
HT	Horizontal Tab
LF	Line Feed
SI	Select Condensed Mode
SO	Select Double-Wide Mode (one line)
VT	Vertical Tab



# DEC LA120/210 EMULATION

## Introduction

This section describes the control codes and escape sequences comprising DEC LA120/210 emulation. This emulation may be selected by setting “Emulation” to “LA120/210” in the interface setup menu, or via software with the **ESC ESC 5** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

The LA120/210 control codes and escape sequences follow the standards of the ANSI X3.64 specification. Many ANSI escape sequences begin with a two character Control Sequence Introducer (CSI), Escape Left Square Bracket (**ESC [**, 1B 5B hex). If 8-bit data is selected via control panel setup, these two characters may be replaced by a single character CSI, 9B hex. The sequences are always documented in this section with the two character CSI (**ESC [**), because this format seems to be much more common, and works equally well with 7-bit or 8-bit data.

Some escape sequences accept one or more numeric parameters. A numeric parameter is a decimal number represented by a string of ASCII decimal digits (“0” through “9”). Leading zeros may be supplied, but are not necessary. Due to implementation constraints, the largest value that can be accepted is decimal 255. Larger values will be treated as zero. Omitting a numeric parameter is equivalent to supplying a value of zero.

If a sequence accepts one numeric parameter, it will be represented as “*n*”. If a sequence accepts more than one numeric parameter, they will be represented as “*n1; n2; ... nx*”. Note that multiple numeric parameters are separated by a semicolon.

Most LA120/210 escape sequences will assume one of the following formats:

<b>ESC f</b>	(no numeric parameters)
<b>ESC n f</b>	(one numeric parameter)
<b>ESC n1; n2; ... nx f</b>	(two or more numeric parameters)

The “*j*” at the end of the escape sequence represents the final character. It terminates the sequence, and specifies the function to be performed.

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*” and “*j*” above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 109 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the provided example. This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Some escape sequences refer to the active column or active line. The active column is the column where the next character will be printed. Printing a character or a space will increment the active column. The active line is the line where the next character will be printed. A line feed will increment the active line. Column and line numbers begin at one, not at zero. Keep this in mind when setting tabs, margins, etc.



## Control Codes and Escape Sequences Grouped by Function

### Communications

**Null****NUL**

This control code is ignored by the printer.

Control code:           NUL  
Hexadecimal:           00

**Delete****DEL**

This control code is ignored by the printer.

Control code:           DEL  
Hexadecimal:           7F

**End of Text****ETX**

If "ETX/ACK" is set to "On" in the interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

Control code:           ETX  
Hexadecimal:           03

## Character Size

The FormsPro, FormsMaster and PrintMaster series printers are capable of supporting 10, 12, 13.3, 15, 16.7, 17.14, and 20 cpi, but most emulations support only a subset of these. LA120/210 emulation supports 10, 12, 13.3, and 16.7 cpi via software, but does not support 15, 17.14, or 20 cpi. Every emulation supports 10 cpi, and we consider this to be the default character pitch. When you use the control panel to change the “Characters/Inch” value in the forms menu, you are actually changing the default character pitch. When the printer is turned on (or reset), it will use this character pitch. You can even use a pitch that is not supported by your emulation, such as 15 cpi with LA120/210 emulation. You can override this pitch selection via software, by sending an escape sequence. This selects a user specified non-default pitch. For example, in LA120 emulation, sending ESC [2w will select 12 cpi. Sending ESC [w will re-select 10 cpi, and thus re-select the default character pitch that was selected in the form setup.

Via software escape sequences, you can select any character pitch supported by the emulation you are using. All will print as expected, unless you select 10 cpi -- because 10 cpi really selects the default character pitch from setup. If you really want 10 cpi, then you must set “Characters/Inch” to “10” in the forms menu. Likewise, if you want to use the default pitch from setup, you must not override it. Either send no character pitch sequences to the printer, or make sure you re-select 10 cpi via software.

When you select different forms, the default character pitch from setup is selected along with the form. But you will not see this default pitch if it has already been overridden via software.

### Set Character Spacing

ESC [ *n* w

Sets the character spacing as specified in the following table. Omitting *n* is equivalent to specifying zero.

<i>n</i>	<u>character pitch</u>
0	10 cpi
1	10 cpi
2	12 cpi
3	13.3 cpi
4	16.74 cpi
5	5 cpi
6	6 cpi
7	6.67 cpi
8	8.37 cpi

Overrides the “Characters/Inch” value in the forms menu.

Example: The following escape sequence will select 10 cpi character spacing. If “Characters/Inch” was not set to “10” in the forms menu, the specified default character pitch will be selected instead of 10 cpi.

```
Escape Sequence:   ESC  [  w
Hexadecimal:      1B  5B  77
```

Example: The following escape sequence will select 12 cpi character spacing.

```
Escape Sequence:   ESC  [  2  w
Hexadecimal:      1B  5B  32  77
```

## Character Attributes

### Select Graphic Rendition

ESC [ *n* m

Selects the graphic rendition *n* from the following table.

<u><i>n</i></u>	<u>Rendition</u>
0	Normal
1	Emphasized
3	Italic
4	Underline

For italic mode to work correctly, an Epson FX font must be selected (check the "Font" value in the forms menu). The other available fonts do not include italic characters.

Example: The following escape sequence will select emphasized mode.

Escape Sequence:	ESC	[	1	m
Hexadecimal:	1B	5B	31	6D

## Character Sets

### Select International Character Set

ESC ( *a*

Selects the international character set as specified by the character *a* in the following table. Overrides the "Language" value in the forms menu.

<u><i>a</i></u>	<u>Character Set</u>
A	United Kingdom
B	United States of America
C	Sweden
E	Denmark
H	Sweden
K	Germany
R	France

The actual character substitutions are shown in the "International Character Mapping" table below. For this to work correctly, an Epson FX font must be selected (check the "Font" value in the forms menu).

	35	36	64	91	92	93	94	96	123	124	125	126
<b>USA</b>	#	\$	@	[	\	]	^	`	{		}	~
<b>France</b>	#	\$	à	°	ç	§	^	`	é	ù	è	..
<b>Germany</b>	#	\$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
<b>England</b>	£	\$	@	[	\	]	^	`	{		}	~
<b>Denmark</b>	#	\$	@	Æ	Ø	Å	^	`	æ	ø	å	~
<b>Sweden</b>	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
<b>Italy</b>	#	\$	@	°	\	é	^	ù	à	ò	è	ì
<b>Spain</b>	Ps	\$	@	¡	Ñ	¿	^	`	..	ñ	}	~
<b>Japan</b>	#	\$	@	[	¥	]	^	`	{		}	~

Example: The following escape sequence will select the German character set.

Escape Sequence:           ESC ( K  
Hexadecimal:                1B 28 4B

## Line Pitch

### Set Line Spacing

ESC [ *n* z

Sets the line spacing as specified in the following table. Omitting *n* is equivalent to specifying zero.

<i>n</i>	line pitch
0	6 lpi
1	6 lpi
2	8 lpi
3	12 lpi
4	2 lpi
5	3 lpi
6	4 lpi

Overrides the "Lines/Inch" value in the forms menu.

Example: The following escape sequence will set line spacing to 1/6 of an inch per line (6 lpi).

Escape Sequence:           ESC [ z  
Hexadecimal:                1B 5B 7A

Example: The following escape sequence will set line spacing to 1/8 of an inch per line (8 lpi).

Escape Sequence:           ESC [ 2 z  
Hexadecimal:                1B 5B 32 7A

## Horizontal Position

### Carriage Return

CR

Causes the current line to be printed, and then sets the current print position to the left margin. If “Auto LF” is set to “On” in the interface setup menu, a line feed will also be performed.

Control code: CR  
Hexadecimal: 0D

### Backspace

BS

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code: BS  
Hexadecimal: 08

### Absolute Horizontal Tab

ESC [ *n* `

Sets the current print position to column *n*. The actual position will depend on the current character spacing. If *n* is less than the left margin, the active column will be set to the left margin. If *n* is greater than the right margin, then a line feed will be performed and the active column will be set to the left margin.

Example: The following escape sequence will set the active column to column 65.

Escape Sequence: ESC [ 6 5 `   
Hexadecimal: 1B 5B 36 35 60

### Relative Horizontal Tab

ESC [ *n* a

Advances the current print position by *n* columns. The actual distance moved will depend on the current character spacing. Equivalent to sending *n* spaces (SP).

Example: The following escape sequence will advance the active column by 10 columns. If current character spacing is 10 cpi, this will cause the print position to move one inch to the right.

Escape Sequence: ESC [ 1 0 a   
Hexadecimal: 1B 5B 31 30 61

## Vertical Position

### Line Feed

(or)

(or)

LF

IND

ESC D

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If “Auto CR” is set to “On” in the interface setup menu, a carriage return will also be performed.

Control code:	LF
Hexadecimal:	0A
Control code:	IND
Hexadecimal:	84
Escape Sequence:	ESC D
Hexadecimal:	1B 44

**Absolute Vertical Tab****ESC [ n d**

Sets the current line to line *n* of the current form. The actual position will depend on the current line spacing.

Example: The following escape sequence will set the active line to line 12.

Escape Sequence:	ESC	[	1	2	d
Hexadecimal:	1B	5B	31	32	64

**Relative Vertical Tab****ESC [ n e**

Advances the active line by *n* lines. The actual distance moved will depend on the current line spacing. Equivalent to sending *n* line feeds (LF).

Example: The following escape sequence will advance the active line by 12 lines. If current line spacing is 6 lpi, this will cause the paper to advance one inch.

Escape Sequence:	ESC	[	1	2	e
Hexadecimal:	1B	5B	31	32	65

## Horizontal and Vertical Position

### New Line (or)

**NEL**  
**ESC E**

Causes the current line to be printed, and then sets the current print position to the left margin and performs a line feed. Equivalent to a carriage return (CR) line feed (LF) combination.

Control code:	NEL
Hexadecimal:	85
Escape Sequence:	ESC E
Hexadecimal:	1B 45

## Form Length and Form Feed

Form length is the distance from the top of the form to the bottom of the form. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rationale is that the program is then in complete control of form length, and will work on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu, so it will be correctly set for everyone using the form. If correct form length cannot be guaranteed from SETUP, then each program should set the correct form length.

### Set Form Length in Lines

**ESC [ n t**

Sets the form length to  $n$  lines at the current line spacing.  $1 \leq n \leq 255$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Form Length" value in the forms menu.

For example, an 11 inch form contains 66 lines at 6 LPI, but 88 lines at 8 LPI. If line spacing is changed after setting the form length, the physical form length (in inches) will not be changed.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 66 lines. At 6 LPI, this will result in a form length of 11 inches.

Escape sequence:	ESC [ 6 6 t
Hexadecimal:	1B 5B 36 36 74

**Form Feed****FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: FF  
Hexadecimal: 0C

**Horizontal Tabs**

Horizontal tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the tab stops. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. If different tab stops are to be set, the default tab stops should first be cleared.

**Horizontal Tab****HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. Different tab stops may be set with ESC H, ESC 1, or ESC [ *n1* ; *n2* ; ... *nx* u.

Control code: HT  
Hexadecimal: 09

**Set Horizontal Tab Stop****HTS****(or)****ESC H****(or)****ESC 1**

Sets a horizontal tab stop at the current print position. The tab stop is associated with the active column, not an absolute physical position. Changing character spacing will change the physical position of the tab stop.

Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. The tab stop set by this escape sequence will be added to previously set tab stops, including the default tab stops. If this is not desired, the old tab stops should first be cleared.

Control code: HTS  
Hexadecimal: 88  
Escape Sequence: ESC H  
Hexadecimal: 1B 48  
Escape Sequence: ESC 1  
Hexadecimal: 1B 31

**Set Horizontal Tab Stops****ESC [ *n1* ; *n2* ; ... *nx* u**

Sets new horizontal tab stops at column *n1*, *n2*, *n3*, etc.  $1 \leq n \leq 255$ . The tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the tab stops. The leftmost column is column one.



Default tab stops are set at every eighth column, i.e. column 9, 17, 25, 33, 41, etc. The tab stops set by this escape sequence will be added to previously set tab stops, including the default tab stops. If this is not desired, the old tab stops should first be cleared.

Example: The following escape sequence will set horizontal tab stops at five column intervals.

Escape Sequence:	ESC	[	6	;	1	1	;	1	6	u
Hexadecimal:	1B	5B	36	3B	31	31	3B	31	36	75

Example: The following escape sequence will set a horizontal tab stop at column six.

Escape Sequence:	ESC	[	6	u
Hexadecimal:	1B	5B	36	75

### Clear Horizontal Tab Stop

(or)

ESC [ g

ESC [ 0 g

Clears the horizontal tab stop at the current print position. The tab stop to be cleared is associated with the active column (based upon the current character spacing), not an absolute physical position.

Escape Sequence:	ESC	[	g
Hexadecimal:	1B	5B	67

### Clear All Horizontal Tab Stops

(or)

(or)

ESC 2

ESC [ 2 g

ESC [ 3 g

Clears all currently set horizontal tab stops.

Escape Sequence:	ESC	2		
Hexadecimal:	1B	32		
Escape Sequence:	ESC	[	2	g
Hexadecimal:	1B	5B	32	67
Escape Sequence:	ESC	[	3	g
Hexadecimal:	1B	5B	33	67

## Vertical Tabs

Vertical tab stops are associated with lines, not absolute physical positions. Changing line spacing will change the physical position of the tab stops.

### Vertical Tab

**VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: VT  
Hexadecimal: 0B

### Set Vertical Tab Stop

**VTS**

(or)

**ESC J**

(or)

**ESC 3**

Sets a vertical tab stop at the current line. The tab stop is associated with the active line, not an absolute physical position. Changing line spacing will change the physical position of the tab stop.

The tab stop set by this escape sequence will be added to previously set tab stops. If this is not desired, the old tab stops should first be cleared.

Control code: VTS  
Hexadecimal: 8A  
Escape Sequence: ESC J  
Hexadecimal: 1B 4A  
Escape Sequence: ESC 3  
Hexadecimal: 1B 33

### Set Vertical Tab Stops

**ESC [ n1 ; n2 ; ... nx v**

Sets new vertical tab stops at line  $n1$ ,  $n2$ ,  $n3$ , etc.  $1 \leq n \leq 255$ . The tab stops are associated with lines, not absolute physical positions. Changing line spacing will change the physical position of the tab stops. The first line is line one.

The tab stops set by this escape sequence will be added to previously set tab stops. If this is not desired, the old tab stops should first be cleared.

Example: The following escape sequence will set vertical tab stops at line 7, 13, and 25. If line spacing is 6 lpi, this will result in tab stops one inch, two inches, and four inches from the top of the form.

Escape Sequence: ESC [ 7 ; 13 ; 25 v  
Hexadecimal: 1B 5B 37 3B 31 33 3B 32 35 76

Example: The following escape sequence will set a vertical tab stop at line seven.

Escape Sequence:	ESC	[	7	v
Hexadecimal:	1B	5B	37	76

### Clear Vertical Tab Stop

**ESC [ 1 g**

Clears the vertical tab stop at the current line. The tab stop to be cleared is associated with the active line (based upon the current line spacing), not an absolute physical position.

Escape Sequence:	ESC	[	1	g
Hexadecimal:	1B	5B	31	67

### Clear All Vertical Tab Stops (or)

**ESC 4  
ESC [ 4 g**

Clears all currently set vertical tab stops.

Escape Sequence:	ESC	4		
Hexadecimal:	1B	34		
Escape Sequence:	ESC	[	4	g
Hexadecimal:	1B	5B	34	67

## Horizontal Margins

Printing is allowed only within the left and right margins. Exceeding the right margin will cause line wrap, setting the current print position to the left margin and advancing the paper one line.

### Set Left and Right Margin

ESC [ *n1* ; *n2* s

Sets the left margin to column *n1* and the right margin to column *n2* at the current character spacing.  $0 \leq n1 \leq 255$ ,  $0 \leq n2 \leq 255$ . If character spacing is changed after setting the margins, the position of the margins will not change.

The margin settings are inclusive. For example, a left margin at column 11 allows a character to be printed in column 11, but not in column 10. A right margin at column 75 allows a character to be printed in column 75, but not in column 76.

The leftmost column is column one. If *n1* or *n2* is zero (or is omitted), the corresponding margin is not changed. The left margin must be left of the right margin and  $\geq 13.4$  inches. The right margin must be right of the left margin and  $\geq 13.6$  inches. Invalid margins will be ignored. Overrides the "Left Margin" and "Right Margin" values in the forms menu.

Example: The following escape sequence will set a one inch left margin, and will set a right margin 7.5 inches from the left edge of the form, if character spacing is currently 10 cpi. For a standard 8.5 inch wide form, this would result in a one inch right margin.

Escape Sequence:	ESC	[	1	0	;	7	5	s
Hexadecimal:	1B	5B	31	30	3B	37	35	73

Example: The following escape sequence will set the left margin to column 10, without affecting the right margin.

Escape Sequence:	ESC	[	1	0	s
Hexadecimal:	1B	5B	31	30	73

Example: The following escape sequence will set the right margin to column 75, without affecting the left margin.

Escape Sequence:	ESC	[	;	7	5	s
Hexadecimal:	1B	5B	3B	37	35	73

## Vertical Margins

Printing is allowed only within the top and bottom margins. Exceeding the bottom margin will set the current line to the top margin of the next form.

### Set Top and Bottom Margins

**ESC [ *n1* ; *n2* r**

Sets the top margin to line *n1* and the bottom margin to line *n2* at the current line spacing. ( $0 \leq n1 \leq 255$ ,  $0 \leq n2 \leq 255$ ). If line spacing is changed after setting the margins, the position of the margins will not change. Vertical margins are cleared by ESC [ *n* t.

The top and bottom margins are both inclusive. For example, a top margin at line 7 still allows text to be printed on line 7, but not on line 6. A bottom margin at line 60 still allows text to be printed on line 60, but not on line 61.

The first line is line one. If *n1* or *n2* is zero (or is omitted), the corresponding margin is not changed. The top margin must be above the bottom margin. The bottom margin must be below the top margin. The margins cannot exceed the form length. Invalid margins will be ignored. Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Example: The following escape sequence will set a top margin at line 7, and will set a bottom margin at line 60. For a standard 11 inch form with 6 lpi line spacing, this would result in one inch top and bottom margins.

Escape Sequence:	ESC	[	7	;	60	r
Hexadecimal:	1B	5B	37	3B	36	30 72

Example: The following escape sequence will set a top margin at line 7, without affecting the bottom margin.

Escape Sequence:	ESC	[	7	r
Hexadecimal:	1B	5B	37	72

Example: The following escape sequence will set a bottom margin at line 60, without affecting the top margin.

Escape Sequence:	ESC	[	;	60	r
Hexadecimal:	1B	5B	3B	36	30 72

## Printer Controls

### Bell

**BEL**

Causes the printer's bell to sound.

Control code: BEL  
Hexadecimal: 07

### Select Automatic Carriage Return

**ESC [ 20 h**

Selects automatic carriage return mode. This causes the printer to automatically perform a carriage return (CR) for each line feed (LF), vertical tab (VT), or form feed (FF) that it receives. Overrides the "Auto CR" value in the interface setup menu.

Escape Sequence: ESC [ 2 0 h  
Hexadecimal: 1B 5B 32 30 68

### Cancel Automatic Carriage Return

**ESC [ 20 l**

Cancels automatic carriage return mode. Overrides the "Auto CR" value in the interface setup menu.

Escape Sequence: ESC [ 2 0 l  
Hexadecimal: 1B 5B 32 30 6C

### Printer Identification (or)

**ESC [ c**  
**ESC [ 0 c**

Causes the printer to respond with ESC [ ? 2 c to identify itself as an LA120-RA printer. (The response can only be sent if serial I/O is selected.)

## Graphics

Graphics mode gives the user complete control over every dot position on the paper. Graphics may be printed with 132 dpi horizontal density and 72 dpi vertical density.

Each byte of graphics data represents a vertical column of six dots, with the LSB (least significant bit) corresponding to the top wire of the print head. Turning a bit on causes a dot to be printed. Graphics bytes are encoded in the characters '?' (hexadecimal 3F) through 'DEL' (hexadecimal 7F). The graphics encoded characters are offset by the value 3F, so the bit values corresponding to each wire of the print head are shown below:

wire 1 (top)	'@'	(40 hex - 3F hex = 1)
wire 2	'A'	(41 hex)
wire 3	'C'	(43 hex)
wire 4	'G'	(47 hex)
wire 5	'O'	(4F hex)
wire 6	'_'	(5F hex)

The appropriate bit values are added together to fire the appropriate wires. For example, the character 'P' (50 hex - 3F hex = 11 hex) will fire the top wire, wire 1, and the fifth wire, wire 5.

Each graphics sequence contains any number of bytes followed by the terminating sequence ESC \ (hexadecimal 1B 5C).

Escape Sequence:	ESC	P	q	data	data ...	ESC	\
Hexadecimal:	1B	51	71	(3F - 7F)		1B	5C

When printing graphics lines, the effective line pitch is 12 lpi. To make successive strips of a graphics image to align correctly, this lpi should be set prior to the carriage return after printing the first graphics line. The escape sequence ESC [ 3 z will accomplish this. Make sure to set the lpi back to your previous setting prior to the carriage return following the last line of graphics. For example, when printing text at 6 lpi and printing three lines of graphics:

ESC P q (data) ESC \ ESC [ 3 z (return)      prints graphics and does 1/12" line feed.

ESC P q (data) ESC \ (return)                      prints graphics and does 1/12" line feed.

ESC P q (data) ESC \ ESC [ 0 z (return)        prints graphics and does 1/6" line feed.

Note that graphics mode must be exited before issuing any escape sequence, or carriage returns and line feeds.

## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the “Emulation” value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character “0” to “7” (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the “Emulation” value in the interface setup menu.

This chapter describes DEC LA120/210 emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F



## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CR	Carriage Return
CSI	Control Sequence Introducer
DEL	Delete
ESC ( <i>a</i>	Select International Character Set
ESC 1	Set Horizontal Tab Stop
ESC 2	Clear All Horizontal Tab Stops
ESC 3	Set Vertical Tab Stop
ESC 4	Clear All Vertical Tab Stops
ESC D	Line Feed
ESC E	New Line
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ESC H	Set Horizontal Tab Stop
ESC J	Set Vertical Tab Stop
ESC [	Control Sequence Introducer
ESC [ <i>n</i> `	Absolute Horizontal Tab
ESC [ <i>n</i> a	Relative Horizontal Tab
ESC [ <i>c</i>	Printer Identification
ESC [ 0 <i>c</i>	Printer Identification
ESC [ <i>n</i> d	Absolute Vertical Tab
ESC [ <i>n</i> e	Relative Vertical Tab
ESC [ <i>g</i>	Clear Horizontal Tab Stop
ESC [ 0 <i>g</i>	Clear Horizontal Tab Stop
ESC [ 1 <i>g</i>	Clear Vertical Tab Stop
ESC [ 2 <i>g</i>	Clear All Horizontal Tab Stops
ESC [ 3 <i>g</i>	Clear All Horizontal Tab Stops
ESC [ 4 <i>g</i>	Clear All Vertical Tab Stops
ESC [ 20 h	Select Automatic Carriage Return
ESC [ 20 l	Cancel Automatic Carriage Return
ESC [ <i>n</i> m	Select Graphic Rendition
ESC [ <i>n</i> 1 ; <i>n</i> 2 r	Set Top and Bottom Margins
ESC [ <i>n</i> 1 ; <i>n</i> 2 s	Set Left and Right Margin
ESC [ <i>n</i> t	Set Form Length in Lines
ESC [ <i>n</i> 1 ; <i>n</i> 2 ; ... <i>n</i> x u	Set Horizontal Tab Stops
ESC [ <i>n</i> 1 ; <i>n</i> 2 ; ... <i>n</i> x v	Set Vertical Tab Stops
ESC [ <i>n</i> w	Set Character Spacing
ESC [ <i>n</i> z	Set Line Spacing
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
HTS	Set Horizontal Tab Stop
IND	Line Feed
LF	Line Feed
NEL	New Line
NUL	Null
VT	Vertical Tab
VTS	Set Vertical Tab Stop



# SIMPLE TTY EMULATION

## Introduction

This section describes the control codes and escape sequences comprising simple TTY emulation. This emulation may be selected by setting “Emulation” to “TTY” in the interface setup menu, or via software with the **ESC ESC 6** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

TTY emulation is unique in that it does not support any escape sequences (except for the **ESC ESC *n*** sequence, which may be used to select a different emulation).

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*”) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 109 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the provided example. This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### End of Text

**ETX**

If “ETX/ACK” is set to “On” in the interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

Control code:               ETX  
Hexadecimal:               03

### Horizontal Position

#### Carriage Return

**CR**

Causes the current line to be printed, and then sets the current print position to the left margin. If “Auto LF” is set to “On” in the interface setup menu, a line feed will also be performed.

Control code:               CR  
Hexadecimal:               0D

#### Backspace

**BS**

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code:               BS  
Hexadecimal:               08

## Vertical Position

### Line Feed

**LF**

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: LF  
Hexadecimal: 0A

## Form Length and Form Feed

Form length is the distance from the top of the form to the bottom of the form. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rationale is that the program is then in complete control of form length, and will work on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu so it will be correctly set for everyone using the form.

### Form Feed

**FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: FF  
Hexadecimal: 0C

## Horizontal Tabs

Default horizontal tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. (The first column is column zero.) The default tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the default tab stops.

### Horizontal Tab

**HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc.

Control code: HT  
Hexadecimal: 09

## Vertical Tabs

### Vertical Tab

**VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

It is not possible to set vertical tab stops in TTY emulation. If tab stops were previously set in some other emulation, they will be used.

Control code: VT  
Hexadecimal: 0B

## Printer Controls

### Bell

**BEL**

Causes the printer's bell to sound.

Control code: BEL  
Hexadecimal: 07

## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the “Emulation” value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character “0” to “7” (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the “Emulation” value in the interface setup menu.

This chapter describes TTY emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CR	Carriage Return
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
LF	Line Feed
VT	Vertical Tab



# PRINTEK EMULATION

## Introduction

This section describes the control codes and escape sequences comprising Printek emulation. This emulation may be selected by setting “Emulation” to “Printek” in the interface setup menu, or via software with the **ESC ESC 7** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

Some escape sequences accept one or more numeric parameters. If a sequence accepts one numeric parameter, it will be represented as “*n*”. If a sequence accepts more than one numeric parameter, they will be represented as “*n1 n2 ... nx*”.

Since numeric parameters are always encoded in one byte, their values may range from 0 to 255 decimal. Please note that the value will never be represented by a string of ASCII decimal digits (“0” through “9”). For example, a value of 66 decimal would be sent as a single byte with a hex value of 42. This is equivalent to sending the ASCII character “B”. It is entirely different than sending the two printable ASCII characters “66”.

If a numeric parameter is limited to a value of zero or one, it may be sent as a single byte with a value of 00 or 01 hex (NUL or SOH), or it may be sent as a single printable ASCII character “0” or “1” (30 or 31 hex).

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*” and “*n1 n2*” above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 109 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the provided example. This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Column and line numbers begin at zero, not at one. Keep this in mind when setting tabs, margins, etc.

Printek emulation was developed to allow access to the full range of hardware features available in the Printek FormsPro, FormsMaster and PrintMaster series printers. Other emulations typically support some character pitches, but not all character pitches. They do not allow the 10 different form setups to be selected via software, or allow graphics of every possible density to be printed. Printek emulation supports all of these features, and more, in one place. This makes Printek emulation the most powerful emulation available

in the printer. We encourage you to take full advantage of all the unique features available in Printek emulation. After all, these features are the reason you purchased your Printek printer.

The most common reason for using Printek emulation is to select a different form setup (and thus change tractors). Many users switch to Printek emulation (using the **ESC ESC 7** sequence), load a new form (using the **ESC L n** sequence), and then return to their standard emulation (using the **ESC ESC n** sequence). If you normally use Epson emulation, please note that the Epson sequence **ESC EM n** allows Form 0, 1, or 2 to be selected without switching to Printek emulation.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### End of Text

**ETX**

If "ETX/ACK" is set to "On" in the interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

Control code:               ETX  
Hexadecimal:               03

#### Deselect Printer (or)

**DC3  
XOFF**

Deselects the printer. Use of this command is discouraged, because the printer will remain offline until an operator presses the ONLINE button on the control panel.

Control code:               DC3  
Hexadecimal:               13

## Character Size

### Set Character Spacing

**ESC SP *n***

Sets character spacing in decipoints ( $n/720$  of an inch). Overrides the "Characters/Inch" value in the forms menu. Supported values are shown in the following table.

<u><i>n</i></u>	<u>Character Size</u>
72	10 cpi
60	12 cpi
54	13.3 cpi
48	15 cpi
43	16.74 cpi
42	17.14 cpi
36	20 cpi

Example: The following escape sequence will select 10 cpi character spacing.

Escape Sequence:	ESC	SP	72
Hexadecimal:	1B	20	48

### Double-Wide Mode

**ESC W *n***

Selects double-wide mode for  $n=1$ , or cancels for  $n=0$ . Double-wide mode doubles the width of all characters, but does not affect character height. ESC S 3 may be used to select double-high mode.

Example: The following escape sequence will select double-wide mode.

Escape Sequence:	ESC	W	1
Hexadecimal:	1B	57	31

### Select Script Modes

**ESC S *n***

Selects normal character height for  $n=0$ , subscript mode for  $n=1$ , superscript mode for  $n=2$ , or double-high mode for  $n=3$ . This is shown in the following table.

<u><i>n</i></u>	<u>Script Mode</u>
0	Script modes off
1	Subscript
2	Superscript
3	Double high

Subscript mode will print characters about half the normal height in the bottom half of the normal character cell. Superscript mode will print characters about half the normal height in the top half of the normal character cell. Double-high mode doubles the height of all characters. These modes are mutually exclusive, and none of them affect character width.

Example: The following escape sequence will select double-high mode.

Escape Sequence:	ESC	S	3
Hexadecimal:	1B	53	03

## Character Attributes

### Emphasized Mode

**ESC E *n***

Selects emphasized mode for  $n=1$ , or cancels for  $n=0$ . Emphasized mode makes characters bolder by printing an extra dot to the right of each dot normally found in the character matrix. This will cut the print speed in half, but will not require an additional pass of the print head. Overrides the "Impact Force" value in the forms menu.

Example: The following escape sequence will select emphasized mode.

Escape Sequence:	ESC	E	1
Hexadecimal:	1B	45	31

### Double-Strike Mode

**ESC D *n***

Selects double-strike mode for  $n=1$ , or cancels for  $n=0$ . Double-strike mode makes text bolder by printing it twice. This will cut the print speed in half, because an additional pass of the print head will be required.

Example: The following escape sequence will select double-strike mode.

Escape Sequence:	ESC	D	1
Hexadecimal:	1B	44	31

### Underline Mode

**ESC \_ *n***

Selects underline mode for  $n=1$ , or cancels for  $n=0$ . This mode provides continuous underlining for all characters, including spaces.

Example: The following escape sequence will turn underlining on.

Escape Sequence:	ESC	_	1
Hexadecimal:	1B	5F	31

## Character Sets

### Select Font

**ESC F *n***

Select font *n* according to the following table.

<u><i>n</i></u>	<u>Font</u>
0	Epson FX Draft
1	Epson FX Letter Quality
2	Proprinter PC Draft
3	Proprinter PC Letter Quality
10	EBCDIC Draft
11	EBCDIC Letter Quality
12	OCR-A Optical Quality
13	OCR-B Optical Quality
32	Epson FX Fast Draft
33	Epson FX Draft
34	Epson FX Letter Quality
36	Proprinter PC Fast Draft
37	Proprinter PC Draft
38	Proprinter PC Letter Quality
44	PC Latin II (Slavic) Fast Draft
45	PC Latin II (Slavic) Draft
46	PC Latin II (Slavic) Letter Qualit
64	EBCDIC Fast Draft
65	EBCDIC Draft
66	EBCDIC Letter Quality
71	OCR-A Optical Quality
75	OCR-B Optical Quality

Overrides the “Font” value in the forms menu. If the specified font is not installed, the “Font” value in the forms menu will be used to select the default font.

Example: The following escape sequence will select the OCR-B Optical Quality font.

Escape Sequence:	ESC	F	75
Hexadecimal:	1B	46	4B

### Print Single Character

**ESC \ *n***

Prints the character *n* from the selected font. This sequence may be used to print a character that is normally treated as a control code.

Example: The following escape sequence will print a left arrow, if a Proprinter font is selected. This character is normally not printable, since it is treated as the ESC control code.

Escape Sequence:       ESC   \   ESC  
 Hexadecimal:           1B   5C   1B

## Line Pitch

### Set Line Spacing to $n/288$ "

**ESC LF  $n$**

Sets the line spacing to  $n/288$  of an inch per line. ( $0 \leq n \leq 255$ ). Overrides the "Lines/Inch" value in the forms menu.

Example: The following escape sequence will set line spacing to 1/6 of an inch per line (6 lpi).

Escape Sequence:       ESC   LF   48  
 Hexadecimal:           1B   0A   30

## Horizontal Position

### Carriage Return

**CR**

Causes the current line to be printed, and then sets the current print position to the left margin. If "Auto LF" is set to "On" in the interface setup menu, a line feed will also be performed.

Control code:           CR  
 Hexadecimal:           0D

### Backspace

**BS**

Causes the current line to be printed, and then moves the current print position one space to the left. The actual distance moved depends on the current character spacing. Backspacing can be done up to, but not beyond, the left margin.

Control code:           BS  
 Hexadecimal:           08

## Vertical Position

### Line Feed

**LF**

Causes the current line to be printed, and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:           LF  
 Hexadecimal:           0A

**Reverse Line Feed****ESC ^**

Causes the current line to be printed, and then retracts the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Escape Sequence:           ESC   ^  
Hexadecimal:               1B   5E

**Form Length and Form Feed**

Form length is the distance from the top of the form to the bottom of the form. A form feed will advance the paper to the top of the next form. Some programs do not send form feeds. Instead, they count line feeds, and send the appropriate number of line feeds to fill out the page. The usual rationale is that the program is then in complete control of form length, and will work on any printer without requiring the correct form length to be set. However, the correct form length should always be set with the control panel setup. Even if the program does not use form feeds, the printer will automatically scroll a completed form up to the tear bar to be torn off. This automatic scroll is based upon form length. The easiest way to set form length is via the "Form Length" value in the forms menu, so it will be correctly set for everyone using the form. If correct form length cannot be guaranteed from SETUP, then each program should set the correct form length.

**Set Form Length in Lines****ESC FF *n***

Sets the form length to *n* lines at the current line spacing.  $1 \leq n \leq 255$ . Maximum form length is 37.9 inches. Invalid form lengths will be ignored. Overrides the "Forms Length" value in the forms menu.

For example, an 11 inch form contains 66 lines at 6 LPI, but 88 lines at 8 LPI. If line spacing is changed after setting the form length, the physical form length (in inches) will not be changed.

Resets top of form to the current position, so it is wise to be at top of form before setting form length. Issuing a form feed will guarantee this. Vertical margins are cleared.

Example: The following escape sequence will set form length to 66 lines. At 6 LPI, this will result in a form length of 11 inches.

Escape sequence:           ESC   FF   66  
Hexadecimal:               1B   0C   42

**Form Feed****FF**

Causes the current line to be printed, and then advances the paper to the top of the next form. If a top margin is set, printing will continue at the top margin. Setting "Host FF at TOF" to "No" in the interface setup menu allows a form feed to be ignored if the paper is already at top of form. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code:               FF  
Hexadecimal:               0C



## Horizontal Tabs

Default horizontal tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. The default tab stops are associated with columns, not absolute physical positions. Changing character spacing will change the physical position of the default tab stops.

User defined horizontal tab stops are associated with absolute physical positions, not with columns. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary).

### Horizontal Tab

**HT**

Advances to the next horizontal tab stop. If no tab stop exists between the active column and the right margin, the HT will be ignored. Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. Different tab stops may be set with ESC HT.

Control code: HT  
Hexadecimal: 09

### Set Horizontal Tab Stops

**ESC HT *n1 n2 ... nx* NUL**

Clears all currently set horizontal tab stops, and sets new tab stops at column *n1*, *n2*, *n3*, etc.  $1 \leq n \leq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stops are set relative to the current character spacing, but subsequent changes in character spacing will not affect the physical position of the tab stops (except that the position will be rounded up to the closest character boundary). The leftmost column is column zero.

Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. The tab stops set by ESC HT will replace the default tab stops. ESC HT NUL will clear all tab stops, leaving no tab stops set. The default tab stops are restored by ESC R.

Example: The following escape sequence will set horizontal tab stops at half inch intervals, if character spacing is currently 10 cpi.

Escape Sequence:	ESC	HT	5	10	15	20	25	30	NUL
Hexadecimal:	1B	09	05	0A	0f	14	19	1E	00

## Vertical Tabs

Vertical tab stops are associated with absolute physical positions, not with lines. The tab stops are set relative to the current line spacing, but subsequent changes in line spacing will not affect the physical position of the tab stops.

### Vertical Tab

**VT**

Causes the current line to be printed, and then advances the paper to the next vertical tab stop. If no vertical tab stops are set, then a line feed is done instead. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control code: VT  
Hexadecimal: 0B

### Set Vertical Tab Stops

**ESC VT *n1 n2 ... nx* NUL**

Clears all currently set vertical tab stops, and sets new tab stops at line *n1*, *n2*, *n3*, etc.  $1 \leq n \leq 255$ . The tab stops must be presented in ascending order. The NUL character, or any tab stop value less than the preceding one, terminates the sequence. The tab stop settings are based on the current line spacing. Changing the line spacing after the tab stops are set will not affect the position of the tab stops. The first line is line zero.

ESC VT NUL or ESC R will clear all currently set vertical tab stops, leaving no vertical tab stops set.

Example: The following escape sequence will set vertical tab stops at line 6, 12, and 24. If line spacing is currently 6 lpi, this will result in tab stops one inch, two inches, and four inches from the top of the form.

Escape Sequence: ESC VT 6 12 24 NUL  
Hexadecimal: 1B 0B 06 0C 18 00

## Horizontal and Vertical Tabs

### Reset Horizontal and Vertical Tab Stops

**ESC R**

Clears all currently set horizontal tab stops, and restores the default horizontal tab stops. Default horizontal tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc. Clears all currently set vertical tab stops.

Escape Sequence: ESC R  
Hexadecimal: 1B 52

## Horizontal Margins

Printing is allowed only within the left and right margins. Exceeding the right margin will cause line wrap, setting the current print position to the left margin and advancing the paper one line.

### Set Left and Right Margin

**ESC H n1 n2**

Sets the left margin to column  $n1$  and the right margin to column  $n2$  at the current character spacing.  $0 \leq n1 \leq 255$ ,  $0 \leq n2 \leq 255$ . If character spacing is changed after setting the margins, the position of the margins will not change.

The left margin is inclusive, but the right margin is exclusive. For example, a left margin at column 10 still allows a character to be printed in column 10. A right margin at column 75 allows a character to be printed in column 74, but not in column 75.

The leftmost column is column zero. The left margin must be left of the right margin and  $\geq 13.4$  inches. The right margin must be right of the left margin and  $\geq 13.6$  inches. Invalid margins will be ignored. Overrides the "Left Margin" and "Right Margin" values in the forms menu.

Example: The following escape sequence will set a one inch left margin, and will set a right margin 7.5 inches from the left edge of the form, if character spacing is currently 10 cpi. For a standard 8.5 inch wide form, this would result in a one inch right margin.

Escape Sequence:	ESC	H	10	75
Hexadecimal:	1B	48	0A	4B

## Vertical Margins

Printing is allowed only within the top and bottom margins. Exceeding the bottom margin will set the current line to the top margin of the next form.

### Set Top and Bottom Margins

**ESC V *n1 n2***

Sets the top margin to line *n1* and the bottom margin to line *n2* at the current line spacing. ( $0 \leq n1 \leq 255$ ,  $0 \leq n2 \leq 255$ ). If line spacing is changed after setting the margins, the position of the margins will not change. Vertical margins are cleared by ESC FF *n*.

The top and bottom margins are both inclusive. For example, a top margin at line 6 still allows text to be printed on line 6, but not on line 5. A bottom margin at line 59 still allows text to be printed on line 59, but not on line 60.

The first line is line zero. The top margin must be above the bottom margin. The bottom margin must be below the top margin. The margins cannot exceed the form length. Invalid margins will be ignored. Overrides the "Top Margin" and "Bottom Margin" values in the forms menu.

Example: The following escape sequence will set a top margin at line 6, and will set a bottom margin at line 59. For a standard 11 inch form with 6 lpi line spacing, this would result in one inch top and bottom margins.

Escape Sequence:	ESC	V	6	59
Hexadecimal:	1B	56	06	3B

## Graphics

Graphics mode gives the user complete control over every dot position on the paper. Graphics may be printed with various horizontal densities from 60 to 240 dpi, and a vertical density of 72 dpi.

Each byte of graphics data represents a vertical column of eight dots, with the MSB (most significant bit) corresponding to the top wire of the print head. Turning a bit on causes a dot to be printed. The bit values corresponding to each wire of the print head are shown below:

wire 1	128	(80 hex)
wire 2	64	(40 hex)
wire 3	32	(20 hex)
wire 4	16	(10 hex)
wire 5	8	(08 hex)
wire 6	4	(04 hex)
wire 7	2	(02 hex)
wire 8	1	(01 hex)

The appropriate bit values are added together to fire the desired wires. For example, a byte of graphics data with the value 128 (80 hex) will fire the top wire, wire 1. A value of 192 (C0 hex) will fire the top two wires, wires 1 and 2. A value of 11 (0B hex) will fire wires 5, 7 and 8.

Each graphics sequence contains two bytes ( $n1$  and  $n2$ ) that specify how many bytes of graphics data follow.  $N2$  can specify values up to 255. If that is sufficient, then  $n1$  is just set to zero. For values greater than 255,  $n1$  comes into play. The  $n1$  byte specifies multiples of 256. For example, to specify 520 bytes of graphics data, use  $n2 = 8$  and  $n1 = 2$ . The bytes of graphics data are strung together to create a graphics line that is eight dots high, and  $(n1 \times 256) + n2$  dots long. Be sure to provide the amount of graphics data that you specify, because the printer will not leave graphics mode until it has accepted the specified number of data bytes.

If "Data Bits" is set to "7" in the interface setup menu, beware of potential problems in graphics mode. Since the MSB (most significant bit) will always be turned off, it will not be possible to fire the top wire of the print head. Worse yet, the value of  $n1$  or  $n2$  may be changed. For example, if  $n2$  specifies 200 bytes of data, and its MSB is turned off, the printer will only expect 72 bytes of data. It will exit graphics mode, and then try to print the remaining 128 bytes of graphics data as normal text characters. The result will surely not be pretty. To avoid such problems, the use of an 8-bit I/O interface for printing graphics is highly recommended.

The normal graphics modes allow every dot to be printed. High speed graphics will print twice as fast, but will not allow consecutive dots to be printed.

### ***m* DPI Graphics**

**ESC \* *m n1 n2 data***

Selects eight wire graphics of density  $m$  as listed in the following table for  $(n1 \times 256) + n2$  columns of data.

<i>m</i>	Density
6	240 dpi
7	240 dpi high speed
8	180 dpi
9	180 dpi high speed
10	144 dpi
11	144 dpi high speed
12	120 dpi
13	120 dpi high speed
14	102.86 dpi
15	102.86 dpi high speed
16	90 dpi
17	90 dpi high speed
18	80 dpi
19	80 dpi high speed
20	72 dpi
21	72 dpi high speed
22	65.45 dpi
23	65.45 dpi high speed
24	60 dpi
25	60 dpi high speed

NOTE: Horizontal movement of the printer's print head is measured in intervals of 1/720 of an inch. Every supported graphics density above is an integral multiple of this resolution. For example, at 60 dpi, dots may be printed every 12/720 of an inch.

Example: The following escape sequence will print four bytes of graphics data at 72 x 72 dpi. The resulting figure will resemble a square, since the horizontal and vertical density are the same. If some other density is chosen, the figure will resemble a rectangle.

Escape Sequence:	ESC	*	20	0	4	<	<	<	<
Hexadecimal:	1B	2A	14	00	04	3C	3C	3C	3C

**m DPI Graphics**

**ESC # m n1 n2 data**

Selects eight wire graphics of density *m* as listed in the following table for  $(n1 \times 256) + n2$  columns of data.

<u><i>m</i></u>	<u>Density</u>
90	90 dpi
100	100 dpi
135	135 dpi
150	150 dpi

NOTE: Horizontal movement of the printer's print head is measured in intervals of 1/720 of an inch. The supported graphics densities above may not be an integral multiple of this resolution. For example, at 150 dpi, dots may be printed every 4.8/720 of an inch. The printer is not really capable of printing dots every 4.8/720 of an inch. It will print the dots as accurately as possible, with some at 4/720 of an inch and some at 5/720 of an inch. The overall average will be 4.8/720 of an inch.

Example: The following escape sequence will print five bytes of graphics data at 150 dpi. The resulting figure will resemble a backslash character, “\”.

Escape Sequence:	ESC	#	150	0	5	64	32	16	8	4
Hexadecimal:	1B	23	96	00	05	40	20	10	08	04

**Printer Controls**

**Bell**

**BEL**

Causes the printer's bell to sound.

Control code:	BEL
Hexadecimal:	07

**Unidirectional Mode**

**ESC U n**

Selects unidirectional mode for  $n=1$ , or bidirectional mode for  $n=0$ . Printing is normally bidirectional. Unidirectional printing provides more accurate positioning, but causes lower throughput.

Example: The following escape sequence will force unidirectional printing.

Escape Sequence:	ESC	U	1
Hexadecimal:	1B	55	31

**Automatic Modes****ESC A n**

Selects automatic modes according to the following table.

<u>n</u>	<u>Mode</u>
0	Automatic modes off
1	Automatic carriage return
2	Automatic line feed
3	Both (1 and 2)

Automatic carriage return mode causes the printer to automatically perform a carriage return (CR) for each line feed (LF), vertical tab (VT), or form feed (FF) that it receives. Overrides the "Auto CR" value in the interface setup menu.

Automatic line feed mode causes the printer to automatically perform a line feed (LF) for each carriage return (CR) it receives. Overrides the "Auto LF:" value in the interface setup menu.

Example: The following escape sequence will select automatic carriage return mode.

Escape Sequence:	ESC	A	1
Hexadecimal:	1B	41	01

**Auto Cut****ESC B n**

Selects Auto Cut On for  $n=1$ , or Auto Cut Off for  $n=0$  for the currently selected form if the optional Printek FormsCutter is installed. When Auto Cut is turned on, the FormsCutter will automatically cut off each form as it is ejected from the printer.

Example: The following escape sequence will select Auto Cut = On.

Escape Sequence:	ESC	B	1
Hexadecimal:	1B	42	31

**Cut Form****ESC C**

Ejects the current form and cuts it off if the optional Printek FormsCutter is installed.

Escape Sequence:	ESC	C
Hexadecimal:	1B	43

**Reset****ESC @**

Deletes all data on the current line and initializes the printer to the default settings for the current form.

Restores the default horizontal tab stops. Default tab stops are set at every eighth column, i.e. column 8, 16, 24, 32, 40, etc.

Resets top of form to the current position, so it is wise to be at top of form before performing this reset. Issuing a form feed will guarantee this.

See the chapter on Printer Reset Conditions for more information.

Escape Sequence:           ESC   @  
Hexadecimal:                1B   40

## Forms and Tractors

The FormsPro 4503se and FormsMaster 8003se contains three sets of paper tractors (front, center, and rear). It is possible, via software, to change to a different form that is set up to use any set of tractors. With the FormsMaster 8003se printer it is even possible to use some combinations of tractor paths for longer print jobs.

The “Tractor Path” value in the forms menu specifies “Front”, “Center”, “Rear”, “Center+Rear”, or “Front+Center+Rear” (abbreviated “Frnt+Cntr+Rear”) for each form that is defined. When a form is selected, the associated set(s) of tractors is also automatically selected.

### Load Form

**ESC L *n***

Causes the current line to be printed, and then loads paper and form parameters for form *n*.  $0 \leq n \leq 9$ . If form *n* is already loaded, this sequence is ignored. If not, the current form will be unloaded, the parameters for form *n* will be selected, and the printer will go offline to wait for the operator to install the new form and place the printer back online. In the FormsPro 4503se and FormsMaster 8003se the same happens unless selecting form *n* also selects a different paper path. In that case, the current form is unloaded, the tractors are moved to engage the new path, the new form is loaded, and printing may continue. If the selected form had not been previously loaded in that path (*see the FormsPro 4000se or FormsMaster 8000se Series Operator's Manual*), then the printer will go offline until an operator has loaded the form.

The printer will not unload the current form if a previously printed form has not been torn off. In this case, the printer will go offline, sound the bell, and display the message “Too Much Paper to Unload”. When an operator tears off the paper and places the printer back online, the printer will unload the current form and continue.

If the printer is unable to load the new form, it will sound the bell and display the message “No Paper to Load” and go offline to wait for an operator to clear the error.

Example: The following escape sequence will load form 2.

Escape Sequence:           ESC   L   2  
Hexadecimal:                1B   4C   32



## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<i>n</i>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
?	Previously Selected Emulation
@	Default Emulation

Overrides the “Emulation” value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character “0” to “7” (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the “Emulation” value in the interface setup menu.

This chapter describes Printek emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CR	Carriage Return
DC3	Deselect Printer
ESC # <i>m n1 n2 data</i>	<i>m</i> DPI Graphics
ESC %	Line Feed Boundary
ESC * <i>m n1 n2 data</i>	<i>m</i> DPI Graphics
ESC @	Reset
ESC A <i>n</i>	Automatic Modes
ESC B <i>n</i>	Auto Cut Mode
ESC C	Cut Form
ESC D <i>n</i>	Double-Strike Mode
ESC E <i>n</i>	Emphasized Mode
ESC ESC <i>n</i>	Select Software Interface <i>n</i>
ESC F <i>n</i>	Select Font
ESC FF <i>n</i>	Set Form Length in Lines
ESC G <i>n</i>	Modify Print Head Gap
ESC H <i>n1 n2</i>	Set Left and Right Margin
ESC HT <i>n1 n2 ... nx NUL</i>	Set Horizontal Tab Stops
ESC I <i>n</i>	Set Print Head Force
ESC L <i>n</i>	Load Form
ESC LF <i>n</i>	Set Line Spacing to <i>n/288</i> "
ESC R	Reset Horizontal and Vertical Tab Stops
ESC S <i>n</i>	Select Script Modes
ESC SP <i>n</i>	Set character Spacing
ESC U <i>n</i>	Unidirectional Mode
ESC V <i>n1 n2</i>	Set Top and Bottom Margins
ESC VT <i>n1 n2 ... nx NUL</i>	Set Vertical Tab Stops
ESC W <i>n</i>	Double-Wide Mode
ESC \ <i>n</i>	Print Single Character
ESC ^	Reverse Line Feed
ESC _ <i>n</i>	Underline Mode
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
LF	Line Feed
VT	Vertical Tab
XOFF	Deselect Printer

# GENICOM 3840 AND 3410 ANSI EMULATION

## Introduction

This section describes the control codes and escape sequences comprising Genicom 3840 and 3410 ANSI emulation. This emulation may be selected by setting “Emulation” to “Genicom 3840 or 3410 ANSI” in the appropriate interface setup menu, or via software with the **ESC ESC <** (3840) or **ESC ESC =** (3410) sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

Many ANSI escape sequences begin with a two character Control Sequence Introducer (CSI), Escape Left Square Bracket (**ESC [**, 1B 5B hex). If 8-bit data is selected via control panel setup, these two characters may be replaced by a single character CSI, 9B hex. The sequences are always documented in this section with the two character CSI (**ESC [**), because this format seems to be much more common, and works equally well with 7-bit or 8-bit data.

Some escape sequences accept one or more numeric parameters. A numeric parameter is a decimal number represented by a string of ASCII decimal digits (“0” through “9”). Leading zeros may be supplied, but are not necessary. Due to implementation constraints, the largest value that can be accepted is decimal 255. Larger values will be treated as zero. Omitting a numeric parameter is equivalent to supplying a value of zero.

If a sequence accepts one numeric parameter, it will be represented as ‘*p*’. If a sequence accepts more than one numeric parameter, they will be represented as ‘*p1; p2; ... px*’. Note that multiple numeric parameters are separated by a semicolon.

Most ANSI escape sequences will assume one of the following formats:

<b>ESC <i>f</i></b>	(no numeric parameters)
<b>ESC <i>n f</i></b>	(one numeric parameter)
<b>ESC <i>p1; p2; ... px f</i></b>	(two or more numeric parameters)

The ‘*f*’ at the end of the escape sequence represents the final character. It terminates the sequence, and specifies the function to be performed.

Spaces are used when documenting escape sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as ‘*p*’ and ‘*f*’ above) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **BS** is the Backspace control code (08 hex), not the two characters “B” and “S” (42 and 53 hex). An ASCII Control Code Table is provided on page 152 for your convenience. If you have any doubt about how to interpret a documented control code or escape sequence, refer to the hex representation in the example.

This should clarify any ambiguity. The examples may also be helpful when analyzing a hex dump (see Hex Dump chapter) printed by the printer.

Some escape sequences refer to the active column or active line. The active column is the column where the next character will be printed. Printing a character or a space will increment the active column. The active line is the line where the next character will be printed. A line feed will increment the active line. Column and line numbers begin at one, not at zero.

## Control Codes and Escape Sequences Grouped by Function

### Communications

#### End of Text

**EXT**

If "ETX/ACK" is set to "On" in the serial interface setup menu, then receipt of an ETX causes the printer to transmit an ACK to the host computer.

Since the ETX may be a legal value within an escape sequence, it is the user's responsibility to ensure that an ETX used for data handshake is not sent within an escape sequence. The user must also ensure that the maximum block size or the number of blocks sent at one time does not exceed the input buffer size of the printer.

ETX/ACK handshake is available only with serial I/O.

Control code:	EXT
Hexadecimal:	03

### Character Size

#### ANSI Oversized Font

**ESC [(pv);(ph)<SP>B**

#### Set Character Size

Sets the scaling of the oversize characters in percentage points. Pv is the vertical expansion, and Ph is the horizontal. The base font is a 10-point font. These settings are non-volatile, and should be set once before using the oversize font.

#### Differences from Genicom 3840 and 3410:

All Oversized Character features are supported. Expanded Mode is not supported in this printer.

#### Software Options That Affect Oversized Printing

Software Options are selected under the FormsPro, FormsMaster or PrintMaster series printer front panel Setup feature. These settings are non-volatile. One of these options affects Oversized Mode:

OPTIONS MENU	Possible Values
--------------	-----------------

Top of Oversized	On / Off
------------------	----------

When enabled, the vertical position on exiting oversized mode places the text baseline for subsequent printing so the top of the next character printed will align with the top of the oversized character cell. When disabled, the paper advances 1/8 inch on exiting oversized mode. Line/Character Spacing  
ESC [(p1);(p2)<SP>G

Sets the vertical and horizontal pitch in decipoints. Parameter (p1) is the spacing between lines and (p2) is the spacing between characters. Unspecified parameters remain at their current values. This command does not affect oversized printing selected by ESC [1t.

## Character Set

### Font And Print Modes

ESC [(p1);...(pn)m

#### Selects print modes and fonts

P1	Printing Mode
0	normal printing – resets all modes
1	set bold print
4	set underline
5	set doublewide
10 and 11	DF
12	LQ
13	DF
14	LQ
15	Italic DF
16	Italic LQ
17	Italic DF
18	Italic LQ
19	Wide DF
22	cancel bold
24	cancel underline
25	cancel doublewide

Example: set bold print

Escape Sequence:	ESC	[	1	m
Hexadecimal:	1B	5B	31	6D

### Partial Line Down (Subscript)

**PLD**

Moves paper ½ line below the current line for subscript printing.

If 8-bit control code processing is enabled then

Control Code:	PLD
Hexadecimal:	8B

### Subscript Printing

**ESC K**

Moves paper ½ line below the current line for subscript printing. ESC K is also used to return to the original line following ESC L (superscript).

If 8-bit control code processing is enabled then.

Escape Sequence: ESC K  
 Hexadecimal: 1B 4B

**Superscript Printing****PLU**

Moves paper ½ line above the current line for superscript printing.  
 If 8-bit control code processing is enabled then.

Control Code: PLU  
 Hexadecimal: 8C

**Superscript Printing****ESC L**

Moves paper ½ line above the current line for superscript printing. ESC L is also used to return to the original line following ESC K (subscript).

If 8-bit control code processing is enabled then.

Escape Sequence: ESC L  
 Hexadecimal: 1B 4C

**NOTE:** The partial line up does not respect top of form; that is, following a form feed, ESC L causes a partial line movement upward. Also, partial line down does not respect bottom of form; that is, when printing the last line on the form, ESC L causes a partial line movement downward.

**CAUTION:** When printing the last line on a form, do not send a line feed (LF) code to move directly from superscript to subscript. The LF code will be acted upon as the bottom of form terminator.

**Horizontal Position****Carriage Return****CR**

Initiates printing and returns the current print position to the left margin.

Control Code: CR  
 Hexadecimal: 0D

**Backspace****BS**

Prints the data in the print buffer, then moves the print position one character position to the left.

Control Code: BS  
 Hexadecimal: 08

**Set Auto CR ON LF****ESC [(p)h**

**P** effect

20 auto CR on LF

Control Code:	ESC	[	2	0	h
Hexadecimal:	1B	5B	32	30	68

**Reset Auto CR ON LF****ESC [(p)l**

Resets mode set by ESC [20h.

Example: reset auto CR on LF

Control Code:	ESC	[	2	0	l
Hexadecimal:	1B	5B	32	30	6C

**Horizontal Position Backwards****ESC [(p)j**

Moves the horizontal position (p) decipoints left of the current position.

Actual distance between symbols separated by this command is the argument (p) minus the current horizontal pitch (text of graphics). For example, if you print an uppercase E at 10 cpi, move backwards by (p), and print another uppercase E, then the distance between leading edges of the two characters is (p) – 72 decipoints. If you print graphics at 72 dpi, move backwards by p, and print another graphics column, then the distance between the two graphics columns is (p) – 10 decipoints.

This command enables printing left of the left margin. Any data located left of the left print reference is discarded.

Example: ESC [1080j moves the horizontal position back by 1.5 inches.

Control Code:	ESC	[	1	0	8	0	j
Hexadecimal:	1B	5B	31	30	38	30	6A

**Horizontal Position Absolute****ESC [(p)'**

Causes the print position to move (in decipoints) a specified distance from the left print reference.

Example: ESC [1080'

Control Code:	ESC	[	1	0	8	0	'
Hexadecimal:	1B	5B	31	30	38	30	60

**Horizontal Position Relative****ESC [(p)a**

Advances the current print position by the distance specified. Parameter p is specified in decipoints (720 decipoints = 1 inch).

**Example: ESC [1080a advances the print position 1.5 inches**

Control Code:	ESC	[	1	0	8	0	a
Hexadecimal:	1B	5B	31	30	38	30	61



## Vertical Position

### Line Feed

**ESC D**

Causes the current line to be printed and then advances the paper one line at the current line spacing. If "Auto CR" is set to "On" in the interface setup menu, a carriage return will also be performed.

Control Code:	LF
Hexadecimal:	0A
Escape Sequence:	ESC D
Hexadecimal:	1B 44

### Index

**IND**

Advances the paper to the next line. The current column is not changed, regardless of the status of auto CR on LF.

Control Code:	IND
Hexadecimal:	84

### Next Line

**ESC E**

Causes the current line to be printed, and then sets the current print position to the left margin and performs a line feed. Equivalent to a carriage return (CR) line feed (LF) combination.

Control Code:	NEL
Hexadecimal:	85
Escape Sequence:	ESC E
Hexadecimal:	1B 45

### Vertical Position Absolute

**ESC [(p)d**

Moves the current print position to p decipoints from the top of the form.

The following example advances the paper to 2 inches below top of form.

Example: ESC [1440d

Escape Sequence:	ESC	[	1	4	4	0	d
Hexadecimal:	1B	5B	31	34	34	30	64

### Vertical Position Relative

**ESC [(p)e**

Advances paper p decipoints. This command enables printing below the bottom margin of the current form and above the top margin of the following form. The example below advances the paper 4 1/4 inches.

Example: ESC [3060e

Escape Sequence:	ESC	[	3	0	6	0	e
Hexadecimal:	1B	5B	33	30	36	30	65

**Vertical And Horizontal Position Absolute****ESC [(p1);(p2)f**

Moves the print position to any coordinate on the page. Coordinates are measured in decipoints. Parameter p1 is the vertical coordinate, which is measured from the top print reference. Parameter p2 is the horizontal coordinate, which is measured from the left print reference. The computation of absolute positions is not influenced by margin settings. Top and left print references are adjustable from the control panel. You can print characters beyond the left, top, and bottom margin setting, but no printing is allowed beyond the right margin.

EXAMPLE: ESC [1440;2160f

Prints the next character 2 inches from the top print reference and 3 inches from the left print reference.

Escape Sequence: ESC [ 1 4 4 0 ; 2 1 6 0 f  
Hexadecimal: 1B 5B 31 34 34 30 3B 32 31 36 30 66

**Vertical Position Backwards****ESC [(p)k**

Moves the vertical position backwards to (p) decipoints above the current position. The horizontal position does not change.

If the target position is above the top margin, then the vertical position is the top margin. If no top margin is set, and the target position is above top-of-form, then the vertical position is top-of-form.

**Note:** The printer economizes vertical motion with vertical logic seeking, so this command may cause reverse paper motion in some instances and not in others. Reverse paper motion can cause problems with some forms.

Example: ESC [1080k moves the vertical position up by 1.5 inches.

Escape Sequence: ESC [ 1 0 8 0 k  
Hexadecimal: 1B 5B 31 30 38 30 6B

**Horizontal Tab****Horizontal Tab****HT**

Causes the current print position to move to the next tab stop. If no tabs are set, then the current position moves one space. If tab(s) are set but no tab(s) are set between the active print position and the right margin, then following characters on the line are either discarded or printed on the next line, depending on the status of auto wrap.

Control Code: HT  
Hexadecimal: 09

**Set Horizontal Tab****ESC H**

If 8-bit control code processing is enabled then.

Escape Sequence: ESC H  
 Hexadecimal: 1B 48

**Set Horizontal Tab Stop****HTS**

If 8-bit control code processing is enabled then.

Control Code: HTS  
 Hexadecimal: 88

**Clear Tabs****ESC [(Ps)g**

Ps	effect
0	clear horizontal tab at current print position
1	clear vertical tab at current position
3	clear all horizontal tabs
4	clear all vertical tabs

Example: Clear all horizontal tabs

Escape Sequence: ESC [ 3 g  
 Hexadecimal: 1B 5B 33 67

**Set Horizontal Tabs At Certain Positions****ESC [(p1)(p2);..(p22)u**

Sets up to 22 stops at one time. The value of p1, p2, etc. are in decipoints (1 inch = 720 decipoints).

Sets tab stops at 1 inch and 4 inches. Existing tab stops are not cleared. Margin settings have no effect on the positions of tab stops.

Escape Sequence: ESC [ 7 2 0 ; 2 8 8 0 u  
 Hexadecimal: 1B 5B 37 32 30 3B 32 38 38 30 75

**Vertical Tab****Vertical Tab****VT**

Advances paper to the next vertical tab setting . If the current print position is at or beyond the last tab setting, paper advances to the top of form. If no tabs are set, then VT is processed according to the status of emulation option strap 14.

Control Code: VT  
 Hexadecimal: 0B

**Set Vertical Tab****ESC J**

If 8-bit control code processing is enabled then

Escape Sequence: ESC J  
 Hexadecimal: 1B 4A

**Set Vertical Tab Stop****VTS**

If 8-bit control code processing is enabled then

Control Code: VTS  
Hexadecimal: 8A

**Set Vertical Tabs At Specified Positions****ESC [(p1);(p2)..(p12)v**

Sets vertical tabs at positions p1, p2, p3, etc. Up to 12 stops can be set at one time. Tab stops are measured in decipoints from the top print reference.

Example: Set tab stops at 4 and 7 inches.

Escape Sequence: ESC [ 2 8 8 0 ; 5 0 4 0 v  
Hexadecimal: 1B 5B 32 38 38 30 3B 35 30 34 30 76

**Forms Setup****Forms Setup****ESC [(p1);(p2);(p3)r**

Sets top of form and sets form length, as well as top and bottom margins, in decipoints. Parameter p1 is form length, p2 is the top margin, and p3 sets the length of white space between the baseline of the last allowed line and the end of the form. Any parameter not specified is assigned its default value. Maximum form length is 15840 decipoints (22 inches).

**Default Values**

p1	7920 decipoints	11-inch form
p2	0 decipoints	0-inch top margin
p3	0 decipoints	0-inch bottom margin

Example:

Set 8-inch form length, one-inch top margin, one-inch bottom margin.

Escape Sequence: ESC [ 5 7 6 0 ; 7 2 0 ; 7 2 0 r  
Hexadecimal: 1B 5B 35 37 36 30 3B 37 32 30 3B 37 32 30 72

**Margin Setup****ESC [(p1);(p2)s**

Sets the left and right margin in decipoints; p1 is the left margin and p2 is the right. Distances are measured from the left print reference. This command takes effect following the next line terminator (you can't set margins for the current line).

Example: Set the left margin at 0.4 inch and right margin at 6.9 inches, making a 6.5 inch print line.

Escape Sequence: ESC [ 2 8 8 ; 4 9 6 8 s

**Hexidemical:**           **1B 5B 32 38 38 3B 34 39 36 38 73**

**Form Feed**

**FF**

Advances the paper to the top margin on the next form.

Control Code:   FF

Hexidemical     0C

## Graphics

**Graphics Mode**

**ESC P(graphics) ESC \**

Graphics mode gives the user complete control over every dot position on the paper. Graphics may be printed with 72 dpi horizontal density and 72 dpi vertical density only in this emulation.

Each byte of graphics data represents a vertical column of six dots, with the LSB (least significant bit) corresponding to the top wire of the print head. Turning a bit on causes a dot to be printed.

If you wanted to fire all six wires, you would send a decimal value of 63 (3F hex) (character '?'). Byte values 0 through 31 are interpreted as control codes, so you have to add the value 64 decimal to any byte value between 0 and 31:

WEIGHT	WIRE						
1	1	?					
2	2		?				
4	3			?			
8	4				?		
16	5					?	
32	6						?
	DEC. VALUE	65	66	68	72	80	32
	CHARACTER	A	B	D	H	P	space

Each graphics sequence contains any number of bytes followed by the terminating sequence ESC \ (hexadecimal 1B 5C).

Carriage returns and line feeds are recognized control characters while in graphics mode. Note that line feeds are at 12 LPI while in graphics mode, and revert to their previous setting when graphics mode is exited. Vertical Tabs and Horizontal Tabs are not recognized by this emulation.

**Graphics Density****ESC [(p1)q**

Sets the graphics density. The printer powers up with a graphics density of 72 x 72 dpi; changes are not stored in NVRAM.

<b>p1</b>	<b>horizontal density</b>	<b>vertical density</b>
0	72 dpi	72 dpi
1	144 dpi	72 dpi
Escape Sequence:	ESC	[ 1 0 q
Hexadecimal:	1B	5B 31 30 70

**Printer Control****Bell****BEL**

Causes the printer's bell to sound.

Control Code: BEL  
Hexa decimal: 07

**Control Sequence Introducer****CSI**

The CSI character is the control function introducer for the ANSI control sequence. Control sequences are multi-character control functions that accept parameters.

Control Code: CSI  
Hexadecimal: 9B

**Oversized Font/Bar Code Mode****ESC [(p1)t**

<b>p1</b>	<b>effect</b>
0	reset special modes
1	select oversized printing
3	select bar code

Oversized printing and bar codes are explained in separate chapters. Expanded printing is not supported.

Example: select oversized printing

Escape Sequence: ESC [ 1 t  
Hexadecimal: 1B 5B 31 74

**Reset****ESC c**

Recalls the user format presently assigned to the current paper path.

Escape Sequence: ESC c  
Hexadecimal: 1B 63

## Paper Shear

### Paper Shear

ESC [(p1);(p2);<SP>{

Parameter p1 = 1 selects the paper shear.

Parameter p2 = 1 executes a cutting sequence: If the vertical position is not at top-of-form, then a form feed is executed. Paper is advanced to the shear position and cut. The shear position should be set from the control panel so that paper is cut precisely at the perforation.

Escape Sequence:	ESC	[	1	;	1	SP	{
Hexadecimal:	1B	5B	31	3B	31	20	7B

## *Printek Genicom ANSI Emulation And Genicom 3840 & 3410 ANSI Mode Differences*

The following functions in the Printek FP4000se, FM8000se and PM850 series printers Genicom ANSI Emulation have slightly different behavior than the Genicom 3840 or 3410 ANSI mode. In most cases, these differences will not affect the direct drop in replacement by the previously mentioned Printek printers.

## ANSI Bar Codes

### ANSI Bar Codes

ESC [(p1);(p2);...(p12)]

Set Bar Code Parameters

Programs all barcode parameters. Barcode Parameters are stored in non-volatile memory, and all 12 parameters should be programmed once to ensure the desired results. Factory default is for Code 3 of 9.

### Differences from Genicom 3840 and 3410:

p1 - Bar Code Style

This printer supports the following styles:

p1	Style
0	Interleaved 2 of 5
4	Code 3 of 9
13	UPC-A
16	Code 128 (subsets A, B and C)

### p12 - Human Readable Font

Only the special barcode font is supported.

## *Software Options That Affect Barcodes*

Software Options are selected under the FM8000se's front panel Setup feature. These settings are non-volatile. One of these options affects barcodes:

OPTIONS MENU Item	Description
Top of Barcode	On / Off

When enabled, the vertical position on exiting bar code mode places the text baseline for subsequent printing so the top of the next character printed will align with the top of the barcode. When disabled, the baseline for subsequent printing is 0.1 inch below the bottom of the bar code.

## Barcode Options

### Barcode Options

**ESC ]6;4;(p3);(p4)ESC \**

#### Set Options

This command enables down-line control of options affecting barcodes and oversized characters. These settings are non-volatile, and can also be set via the Setup Mode at the front panel.

#### **Differences from Genicom 3840:**

Only these options are supported in this printer:

p4 = 25 (backup to top of oversized character)

p4 = 26 (backup to top of barcode)

All other equivalent options are available through the FP4000se, FM8000se and PM850 series front panel Setup Mode.

## *Ignore Character*

This feature is accessible through the OPTIONS MENU from the FP4000se, FM8000se and PM850 series printers front panel Setup Mode. This allows a single 8 bit character to be discarded as it is received. This is useful when the host application is sending an unwanted control character, for example.

To use this feature, refer to the printers Operation Manual and go to chapter Printer Configuration. Refer to the OPTIONS MENU and turn "On" the Ignore Character feature.

**Note:** This feature should not be left active unless needed.



## Paper Path

### Paper Path

**ESC [(p1)p**

<b>p1</b>	<b>selects</b>
10	unload current path and load rear path
12	unload current path and load front path
14	unload current path and load middle path

If you send a command to change paper paths and the target path is the current path, then the printer executes a form feed.

Example: Unload the current path and load the rear path:

Escape Sequence:	ESC	[	1	0	p
Hexadecimal:	1B	5B	31	30	70

## Emulations

### Select Software Interface *n*

ESC ESC *n*

Selects the software interface *n* according to the table below.

<u><i>n</i></u>	<u>Software Interface</u>
0	Test (reserved for factory use)
1	ANSI X3.64 Emulation
2	Epson FX Emulation
3	Bar Code Mode (optional)
4	IBM Proprinter Emulation
5	DEC LA120 Emulation
6	TTY Emulation
7	Printek Emulation
;	Remote Setup Mode
<	Genicom 3840
=	Genicom 3410
?	Previously Selected Emulation
@	Default Emulation

Overrides the Emulation value in the interface setup menu.

A numeric value for *n* may be specified in two different ways, with equivalent results: a single byte with a value of 00 to 07 hex, or a single printable ASCII character “0” to “7” (30 to 37 hex).

If more than one emulation has been selected, ESC ESC ? will return to the previously selected emulation. This is particularly useful when the previous emulation is unknown. Please beware that the memory (stack) is only one level deep.

ESC ESC @ will return to the default emulation, as specified by the “Emulation” value in the interface setup menu.

This chapter describes ANSI X3.64 emulation. If a different interface is selected, the control codes and escape sequences described in this chapter will no longer be applicable.

Example: The following escape sequences will select Printek emulation, load form one, and then return to the previous emulation.

Escape Sequence:	ESC	ESC	7	ESC	L	1	ESC	ESC	?
Hexadecimal:	1B	1B	07	1B	4C	01	1B	1B	3F

## Control Codes and Escape Sequences Sorted Alphabetically

BEL	Bell
BS	Backspace
CR	Carriage Return
CSI	Control Sequence Introducer
ESC D	Line Feed
ESC E	New Line
ESC ESC n	Select Software Interface n
ESC H	Set Horizontal Tab
ESC J	Set Vertical Tab
ESC K	Subscript Printing
ESC L	Superscript Printing
ESC P <graphics> ESC \	6 Pin Graphics Mode
ESC [(p1);(p2)<SP>B	Oversize Font / Graphic Size Modification
ESC [(p1);(p2)<SP>G	Line / Character Spacing
ESC [(p)`	Horizontal Position Absolute
ESC [(p)a	Horizontal Position Relative
ESC [(p)d	Vertical Position Absolute
ESC [(p)e	Vertical Position Relative
ESC [(p1);(p2)f	Vertical and Horizontal Position Absolute
ESC [(Ps)g	Clear Tabs
ESC [(p)h	Set Auto CR on LF
ESC [(p)j	Horizontal Position Backwards
ESC [(p)k	Vertical Position Backwards
ESC [(p)l	Reset Auto CR on LF
ESC [(p1);...(pn)m	Font and Print Modes
ESC [(p1)p	Paper Path
ESC [(p1)q	Graphics Density
ESC [(p1);(p2);(p3)r	Forms Setup
ESC [(p1);(p2)s	Margins Setup
ESC [(p1)t	Oversized Font / Barcode Mode
ESC [(p1);(p2);...(p22)u	Set Horizontal Tabs at Certain Positions
ESC [(p1);(p2);...(p12)v	Set Vertical Tabs at Certain Positions
ESC [(p1);(p2)<SP>{	Paper Shear
ESC [(p1);(p2);...(p12)}	Set Barcode Parameter
ESC ]6;4;(p3);(p4)ESC \	Straps and Options
ESC c	Reset
ETX	End of Text
FF	Form Feed
HT	Horizontal Tab
HTS	Set Horizontal Tab Stop
IND	Index
LF	Line Feed
NEL	Next Line
PLD	Partial Line Down (Subscript)
PLU	Partial Line Up (Superscript)
VT	Vertical Tab
VTS	Set Vertical Tab Stop



# CONFIGURATION DOWNLOAD

The FormsPro 4000se, FormsMaster 8000se and PM850 Series printers may be completely configured for operation by using the front panel buttons to access the printer setup menus. In addition, many of the items that can be configured via the front panel setup menus can also be configured remotely as described in this chapter.

Remote setup commands are placed in a remote setup file on a host computer. This file may then be sent to the printer. The remote setup file must be a text only file with each line terminated by a Line Feed (LF) character.

The available commands listed below are shown with a combination of upper and lower case letters to enhance readability. However, the commands are not case sensitive. All characters are converted to upper case before processing (except for form names, which are contained in double quotes). White space may also be inserted to enhance readability; it will be stripped from the commands before processing.

Each line of the file is processed individually, and must conform to one of four possible formats:

1. A blank line (ignored).
2. A comment line, which begins with a semicolon ";" (ignored).
3. A heading line, which is enclosed in square brackets "[]".
4. An item setup line, of the format item=value.

Each item setup line must appear under the appropriate heading line. The first heading line in the file must be [BeginPrintekSetup]. The last heading line in the file must be [EndPrintekSetup]. All other heading lines and item setup lines are optional.

If any errors exist in the remote setup file, no changes will be made to the printer configuration. When possible, the printer will indicate the line number in the file where the first error occurred. Counting of lines begins with 1 at the [BeginPrintekSetup] heading line. Any lines preceding this will not be processed, and will not be counted.

Before sending the remote setup file to the printer, minimal setup is required via the front panel setup menus. The I/O interface to be used for remote setup must be configured appropriately to communicate with the host system, and the "Test Mode" item in the "TEST MENU" must be set to "Remote Setup".

After this is done, the printer will reset, beep the bell to alert the operator, and display the message "Waiting For Remote Setup". The remote setup file may now be sent to the printer.

After the printer receives the remote setup file (without error), all specified configuration changes will be made, the "Test Mode" item will revert back to "Off", and the printer will reset. When this reset is complete, the printer will be ready for normal interaction with the host system. Note that if the optional Setup Module is attached to the printer, it will also be updated.

The available heading lines, and item setup lines, are documented below. Note that all the legal values are shown for each item, but in use only one value may be supplied in the setup file. An example file follows these definitions.

## Remote Setup Line Definitions

```
[BeginPrintekSetup]
AlignPrint=FactoryDefaults
Forms=FactoryDefaults
Interfaces=FactoryDefaults
Options=FactoryDefaults
Security=FactoryDefaults

[Form0] ... [Form9]
MovePrintLeft=0.00 ... 9.99
MovePrintRight=0.00 ... 9.99
MovePrintUp=0.00 ... 9.99
MovePrintDown=0.00 ... 9.99
FormName="UPTO16CHARACTERS"
TractorPath=Front,Center,Rear,Center+Rear,Front+Center+Rear
AutomaticCut=No,Yes
LinesPerInch=6,8
FormLength=1 ... 227
TopMargin=0 ... 226
BottomMargin=0 ... 226
CharactersPerInch=10,12,13.3,15,16.74,17.14,20
LeftMargin=0 ... 268
RightMargin=4 ... 272
Font=Epson_FX_FD,Epson_FX_DF,Epson_FX_LQ,
    PC_English_FD,PC_English_DF,PC_English_LQ,
    PC_Latin2_FD,PC_Latin2_DF,PC_Latin2_LQ,
    DEC_LA120_FD,DEC_LA120_DF,DEC_LA120_LQ,
    EBCDIC_FD,EBCDIC_DF,EBCDIC_LQ,
    OCR_A_FD,OCR_B_FD
    Roman-8 FD, DF, LQ, ML
    Euro (858) FD, DF, LQ
    Euro (850) FD, DF, LQ
DraftSpeed=Normal,Fast
ImpactForce=Normal,High
Language=USA,France,Germany,England,Denmark,
    Sweden,Italy,Spain,Japan,Finland
Zero=Normal,Slashed
Unidirectional=No,Yes

[SerialInterface]
Emulation=ANSI_X3.64,Epson,IBM_Proprinter,DEC_LA120/210,TTY,Print
ek, Genicom 3840, Genicom 3410
AutoCR=Off,On
AutoLF=Off,On
HostFFatTOF=No,Yes
Characters=Control,Printable
MinimumBuffer=No,Yes
BaudRate=110,150,300,600,1200,2400,4800,9600,19200
DataBits=8,7
StopBits=1,2
Parity=None,Even,Odd
BusyPolarity=Low,High
DTR=Power,Online,Busy
XON/XOFF=Off,On
ETX/ACK=Off,On
```

```
[ParallelInterface]
Emulation=ANSI_X3.64,Epson,IBM_Proprinter,DEC_LAI20,TTY,Printek
AutoCR=Off,On
AutoLF=Off,On
HostFFatTOF=No,Yes
Characters=Control,Printable
MinimumBuffer=No,Yes

[Options]
MaxFormAllowed=0 ... 9
AutoScroll=Off,1 ... 15
PaperOutFault=BreakPage,ReprintPage,FinishPage
PageSize=0K ... 28K
RibbonCheck=Off,On
RibbonLife=5 ... 30
TopOfBarcode=Off, On
TopOfOversized=Off, On
CharToIgnore=0 ... 255
TruncateLines=No, Yes

[Imager/ImagerPlusInterface]
Emulation=QMSCodeVVersion2,PrintronixCodeVVersion2,PrintronixIGP
ControlCharacter=01h ... 09h,0Eh ... FFh
LineTerminator=LF,CR
BarCodeDensity=LowRes,MediumRes,HighRes,GraphicsMediumRes
QMSCharacterSet=USA,UnitedKingdom,Sweden/Finland,Norway/Denmark,
    Japan,Germany,France,Italy,Spain,PCSubset,CodeVVersion1
Translation=NotActive,Active
FreeFormat=NotActive,Active
IgnoreData=NotActive,Active
ImagerZero=Slashed,Normal
LineRegistration=NotMaintained,Maintained
VerticalDPI=72,70
VerticalTextSpacing=Version2,Version1
CodeVSpaceFields=Process,Ignore
IGPCharacterSet=ASCII,Germany,Sweden,Denmark,Norway,Finland,
    English,Dutch,France,Spain,Italy,Turkey
DeleteLogos=No,Yes
QuietMode=NotActive,Active
Spacing=IGP10/20/40,IGP30

[Security]
AlignPrint=ViewOnly,EditAllowed
FormsMenu=ViewOnly,EditAllowed
InterfaceMenu=ViewOnly,EditAllowed
OptionsMenu=ViewOnly,EditAllowed

[EndPrintekSetup]
```

## Remote Setup Example File

The following example will set up three forms. Before the forms are set up, "AlignPrint" and all "Forms" will be reset to their factory default values so that only "non-default" values have to be set.

The first form will begin printing one line from the top-of-form, be named "CHECKS", have a form length of 42 lines (7 inches at 6 LPI), and use the Epson FX Draft font.

The second form will begin printing two characters (at 10 CPI) from the left edge and two lines (at 6 LPI) from the top of the form. The name will be "INVOICES" and will use the Epson FX Draft font.

The third form will begin printing two lines (at 8 LPI) from the top edge of the form. The name will be "REPORTS", and printing will be at eight LPI with a form length of 8½ inches.

; Example setup file for three forms.

```
[BeginPrintekSetup]
AlignPrint=FactoryDefaults
Forms=FactoryDefaults

[Form0]
MovePrintDown=0.17
FormName="CHECKS"
FormLength=42
Font=Epson_FX_DF

[Form1]
MovePrintRight=0.20
MovePrintDown=0.33
FormName="INVOICES"
Font=Epson_FX_DF

[Form2]
MovePrintDown=0.25
FormName="REPORTS"
LinesPerInch=8
FormLength=68
CharactersPerInch=12

[EndPrintekSetup]
```



## HEX DUMP MODE

Hex Dump mode provides a way to print, in a readable form, all the data received by the printer. This tool is useful to programmers for diagnosing problems with control codes and escape sequences sent to the printer. Hex Dump mode may also be used to detect what commands are being sent by a particular software application to help determine which emulation mode is needed for that application.

To select Hex Dump mode, enter SETUP and use the MENU button to select the "TEST MENU". Next use the ITEM buttons to select "Test Mode" and then use the VALUE buttons to select "Hex Dump". Now press ONLINE to reset the printer. The printer will now remain in Hex Dump mode until "Test Mode" is set back to "Off" or some other value.

A sample hex dump is shown below. Note that each line shows sixteen characters, first in hexadecimal format, then in printable ASCII format. All unprintable ASCII characters (printable characters are from 21 hex to 7E hex inclusive) are represented by a period.

```
54686973 20697320 61207361 6D706C65          This.is.a.sample
20686578 2064756D 7020746F 20696C6C          .hex.dump.to.ill
75737472 61746520 68657820 64756D70          ustrate.hex.dump
666F726D 61740D0A          format..
```

When the printer is executing in Hex Dump mode, control characters and escape sequences sent to the printer are not recognized or processed. The hexadecimal representation of the control characters and escape sequences will appear in the hex dump, but no other special processing will occur.

In particular, note that ETX/ACK handshake will not operate properly in Hex Dump mode. When an ETX is received by the printer, its hexadecimal representation will be printed in the hex dump, but no ACK will be sent to the host computer. When using the printer in Hex Dump mode, it is recommended that the printer be configured for parallel I/O, serial I/O with hardware handshake, or serial I/O with XON/XOFF handshake.



# PRINTING BASIC BAR CODES

## Introduction

This section describes the control codes and escape sequences comprising bar code emulation. This emulation may be selected via software with the **ESC ESC 3** sequence. While this emulation is selected, control codes and escape sequences from other emulations are not available.

Control codes and escape sequences are used to control printer operation. An ASCII control code is a single character in the range 00 hex through 1F hex, and 7F hex. The **ESC** (Escape) control code (1B hex) is used to introduce character strings called escape sequences, which provide an extension of the commands available with ASCII control codes.

The bar code interface was designed to primarily use printable ASCII characters, instead of relying on control codes and escape sequences. The printable ASCII caret character “^” is used to introduce most bar code sequences.

Spaces are used when documenting sequences to increase readability. The spaces within the sequences are for readability only; they are not part of the sequences themselves. Characters that appear in *italics* (such as “*n*”) are not sent to the printer as is; they are used as a place holder indicating that some value must be supplied.

Multiple character strings without intervening spaces typically represent control codes. For example, **FF** is the Form Feed control code (0C hex), not two “F” characters (46 46 hex). An ASCII Control Code Table with hexadecimal equivalents is contained in the appendices for your convenience. This may be helpful when analyzing a hex dump printed by the printer.

Please note that bar code emulation is essentially a graphics preprocessor, whose sole purpose is to print bar codes. It is not possible to print normal text in bar code emulation. In order to mix text and bar codes, the text must be printed in some other emulation, before or after the bar codes are printed in bar code emulation.

The Printek FormsPro 4000se, FormsMaster 8000se and PrintMaster 850 series printers internally support the following types of basic bar codes:

Code 39 1:1:2:2 Ratio, Code 39 1:1:3:3 Ratio, Code 39 1:2:4:5 Ratio,  
Code 39 1:1:2.5:2.5 Ratio (LOGMAR Standard Density),  
Code 39 1.5:1.5:3.5:3.5 Ratio (LOGMAR Medium Density),  
Code 39 2:2:4.5:4.5 Ratio (LOGMAR Low Density),  
2-of-5 1:1:3:X Ratio, 2-of-5 1:2:3:X Ratio,  
Interleaved 2-of-5 BS Code 1:1:3:3 Ratio, Interleaved 2-of-5 BS Code 1:2:4:5 Ratio,  
Interleaved 2-of-5 BS Code 1.5:1.5:4.5:4.5 Ratio, Interleaved 2-of-5 BS Code 2:2:6:6 Ratio,  
Interleaved 2-of-5 C Code 1:1:2:2 Ratio, Interleaved 2-of-5 C Code 1:1:2.5:2.5 Ratio,  
Interleaved 2-of-5 C Code 1.5:1.5:3.5:3.5 Ratio, Interleaved 2-of-5 C Code 2:2:4.5:4.5 Ratio

These bar codes can be automatically printed with the use of a few simple bar code sequences. The height of the bar codes is easily varied. Additionally, the dimensions of the bars and spaces may be varied to produce bar codes of different widths and ratios.

Horizontal and vertical positioning sequences allow precise placement of a bar code on a label, or placement of multiple bar codes across and down the page.



## Bar Code Sequences

To print bar codes, the following sequences are used in bar code mode:

<u>BAR CODE SEQUENCE</u>	<u>FUNCTION</u>
BEL	Sound the Bell.
ESC ESC <i>n</i>	Change Emulation Mode
ETX	ETX/ACK Software Handshake.
FF	Form Feed.
LF	Fractional Line Feed (to next line boundary)
^BNxccc...c^G	Horizontal Bar Code.
^BN9xddddccc...c^G	Variable Width Horizontal Bar Code.
^Ht	Bar Code Height.
^Jtt	Relative Vertical Tab.
^Tttt	Absolute Horizontal Tab.
^_	Bar Code Pass Terminator.

These bar code sequences are described in detail in the following sections.

### Measurements in Bar Code Mode

All measurements in bar code mode are specified in tenths of an inch and/or dots.

Bar codes are printed with a graphics resolution of 144 dots per inch both horizontally and vertically.

All references to tenths of an inch are in actuality 14/144's of an inch.

All references to dots are in actuality 1/144's of an inch. The range of dots that may be specified is 0 to 15. This range is represented using hexadecimal convention. The ASCII characters '0' to '9' represent 0 to 9 dots, respectively. The ASCII characters 'A' to 'F', and 'a' to 'f', represent 10 to 15 dots, respectively.

### Entering/Exiting Bar Code Mode

Bar code mode is entered by sending the escape sequence: ESC ESC ETX (27 27 03 decimal, 1B 1B 03 hex).

Bar code mode is used only to process the bar code sequences described in this document. While in bar code mode, other printable text, text mode escape sequences and control characters, graphics data, and graphics mode escape sequences and control characters should not be sent to the printer.

To exit bar code mode, use the sequence ESC ESC ? (27 27 63 decimal, 1B 1B 3F hex) to return to the previously selected emulation mode, or you may use a different ESC ESC *n* sequence to select a different emulation mode.

## The Bar Code Control Character

Except for a few ASCII control characters supported by bar code mode, all bar code sequences are introduced by the “bar code control character”. The “bar code control character” is the printable ASCII caret character “^” (94 decimal, 5E hex).

Note in particular that the ESC control code (27 decimal, 1B hex) is not used in bar code mode. When the caret character “^” is seen in this chapter, it does not mean ESC and it does not mean “control\_” !

## Other Control Characters

**BEL** is processed and causes the printer to ring the bell. This is supported so that you may annoy the printer operator without exiting bar code mode.

**ETX** is processed so that ETX/ACK software handshake will work in bar code mode. (As an aside, XON/XOFF software handshake will also work in bar code mode. However, XON/XOFF characters are transmitted only from the printer to the host; XON/XOFF characters should not be sent to the printer.)

**FF** is supported so that you may easily reach top of form without exiting bar code mode.

**LF** advances the paper to the next line feed boundary at the currently selected line pitch. If already positioned at a line feed boundary, this will perform a full line feed, if not a partial line feed will be performed to position the paper at the next line. This allows the paper to be positioned properly for text printing after bar code mode is exited.

All other control characters are ignored in bar code mode.

## Bar Code Definition

The sequence used to define a horizontal bar code is

**^BNxccc...c^G**

<b>^B</b>	Two Character Sequence Identifier for Horizontal Bar Code Definition.
<b>N</b>	Reserved Parameter.
<b>x</b>	Bar Code Type. "a" = Code 39 1:1:2:2 Ratio "b" = Code 39 1:1:3:3 Ratio "c" = Code 39 1:2:4:5 Ratio "d" = Code 39 LOGMAR Standard Density "e" = Code 39 LOGMAR Medium Density "f" = Code 39 LOGMAR Low Density "g" = 2-of-5 1:1:3:X Ratio "h" = 2-of-5 1:2:3:X Ratio "i" = Interleaved 2-of-5 BS Code 1:1:3:3 Ratio "j" = Interleaved 2-of-5 BS Code 1:2:4:5 Ratio "k" = Interleaved 2-of-5 BS Code 1.5:1.5:4.5:4.5 Ratio "l" = Interleaved 2-of-5 BS Code 2:2:6:6 Ratio "m" = Interleaved 2-of-5 C Code 1:1:2:2 Ratio "n" = Interleaved 2-of-5 C Code 1:1:2.5:2.5 Ratio "o" = Interleaved 2-of-5 C Code 1.5:1.5:3.5:3.5 Ratio "p" = Interleaved 2-of-5 C Code 2:2:4.5:4.5 Ratio
<b>ccc...c</b>	Characters to be Bar Coded.
<b>^G</b>	Sequence Terminator. Required to signal end of character data.

The width of a defined bar code is predetermined by the definition of the bar code type. The width of all bars and spaces is automatically set.

### Example:

The following sequence defines a Code 39 LOGMAR bar code of standard density. The characters "12345" are encoded in the bar code.

**^BNd12345^G^-**



### Example:

The same character data is represented below in a low density LOGMAR bar code.

^BNf12345^G^-





## Variable Width Bar Code Definition

The sequence used to define a variable width, horizontal bar code is

**^BN9xdddccc...c^G**

^B	Two Character Sequence Identifier for Horizontal Bar Code Definition.
N	Reserved Parameter.
9	Flags Variable Width.
x	Bar Code Type. "a" = Code 39 1:1:2:2 Ratio "b" = Code 39 1:1:3:3 Ratio "c" = Code 39 1:2:4:5 Ratio "d" = Code 39 LOGMAR Standard Density "e" = Code 39 LOGMAR Medium Density "f" = Code 39 LOGMAR Low Density "g" = 2-of-5 1:1:3:X Ratio "h" = 2-of-5 1:2:3:X Ratio "i" = Interleaved 2-of-5 BS Code 1:1:3:3 Ratio "j" = Interleaved 2-of-5 BS Code 1:2:4:5 Ratio "k" = Interleaved 2-of-5 BS Code 1.5:1.5:4.5:4.5 Ratio "l" = Interleaved 2-of-5 BS Code 2:2:6:6 Ratio "m" = Interleaved 2-of-5 C Code 1:1:2:2 Ratio "n" = Interleaved 2-of-5 C Code 1:1:2.5:2.5 Ratio "o" = Interleaved 2-of-5 C Code 1.5:1.5:3.5:3.5 Ratio "p" = Interleaved 2-of-5 C Code 2:2:4.5:4.5 Ratio
ddd	Width of all Bars and Spaces. Includes Number of Dots in: Narrow Bar, Narrow Space, Wide Bar, Wide Space; respectively. Range of d is 0 to F (0 to 15 dots).
ccc...c	Characters to be Bar Coded.
^G	Sequence Terminator. Required to signal end of character data.

When defining a variable width bar code, first choose a bar code type that matches the desired bar code. Then specify the width of the bars and spaces to achieve the desired bar code density and wide:narrow ratios.

**Example:**

Bar code type "a" defines a rather dense Code 39 bar code with 1:1:2:2 ratio.

^BNa12345^G^~



The following sequence will print the same bar code, except the bar code will be four times as wide.

`^BN9a448812345^G^-`



**Example:**

Note that when choosing the bar code type off which the variable width bar code will be based, ratio is irrelevant. If a 2-of-5 bar code with ratio 3:3:9:9 (not supported directly) is desired, it may be derived from bar code types "g" and "h". The following variable width bar code definitions all produce exactly the same result.

`^BN9g339912345^G^-`



`^BN9h339912345^G^-`



Choosing any other bar code type will not achieve the desired result. The following bar code has the desired ratio, but it is a Code 39 instead of a 2-of-5 bar code.

`^BN9a339912345^G^-`



## Bar Code Height

The sequence used to specify bar code height is

**`^Htt`**

`^H` Two Character Sequence Identifier for Bar Code Height.

`tt` Height, in Tenth Inches.  
Range is 01 to 99 (0.1 to 9.9 inches).

If this sequence is not used, default bar code height is 0.3 inches. All bar codes printed together horizontally across the page must be the same height. If height is specified more than once, the latest specified height will be used.

**Example:**

To print a bar code that is only 0.1 inch high.

`^H01^BNe12345^G^-`



It would generally not be desirable to print a bar code with such a short height, because scanning of the bar code would be difficult. In most cases, the wider the bar code, the higher the bar code for ease of scanning.

**Example:**

To print a bar code that is 1.0 inch high.

`^H10^BNe12345^G^-`



**Example:**

Note that increasing the height of a bar code has no effect on the width of the bar code. To print a very large bar code, both the height and the width may need to be increased. The following sequences double the width of the medium density LOGMAR bar code, while also increasing its height.

`^H10^BN9e337712345^G^-`



## Relative Vertical Tab

The sequence used to skip vertical space is

### **^Jttd**

**^J** Two Character Sequence Identifier for Relative Vertical Tab.

**ttd** Vertical Distance, in Tenth Inches plus Dots.  
Range of tt is 00 to 99 (0.0 to 9.9 inches).  
Range of d is 0 to F (0 to 15 dots).

The distance specified is relative to the current vertical position.

### **Example:**

To print multiple bar codes down the page. Each bar code is 0.2 inches high, and is separated from other bar codes by 0.1 inch of white space.

^H02^BNd01^G^-^J010^BNd02^G^-^J010^BNd03^G^-



## Absolute Horizontal Tab

The sequence used for horizontal positioning is

### **^Tttd**

**^T** Two Character Sequence Identifier for Absolute Horizontal Tab.

**ttd** Horizontal Distance, in Tenth Inches plus Dots.  
Range of ttt is 000 to 136 (00.0 to 13.6 inches).  
Range of d is 0 to F (0 to 15 dots).

The horizontal position specified is an absolute distance, with respect to the left edge of the paper. Remember that a tenth of an inch is actually 14/144ths of an inch, so the actual distance tabbed may be slightly shorter than expected.

### **Example:**

To print multiple bar codes across the page. Bar codes are printed approximately 0, 2, and 4 inches from the left edge of the paper.

^H02^BNd01^G^T0200^BNd02^G^T0400^BNd03^G^-



## Bar Code Pass Terminator

The sequence used to terminate a bar code pass is ^-.


A bar code pass may contain vertical tabs (should precede all bar code definitions), height specification, bar code definitions, horizontal tabs, etc. Until the bar code pass terminator is received, no bar codes will be printed. When the pass terminator is received, all bar codes defined for the pass will be printed.

The following examples will help clarify use of the pass terminator. Note the very different results obtained by omitting or inserting the pass terminators.


### Example:

To print multiple bar codes across the page.

^H02^BNd01^G^T0200^BNd02^G^T0400^BNd03^G^- (Correct)




^H02^BNd01^G^-^T0200^BNd02^G^-^T0400^BNd03^G^- (Incorrect)




### Example:

To print multiple bar codes down the page.

^H02^BNd01^G^-^J010^BNd02^G^-^J010^BNd03^G^- (Correct)



^H02^BNd01^G^J010^BNd02^G^J010^BNd03^G^- (Incorrect)



Note that one bar code pass may not contain multiple bar codes separated by vertical tabs.

## Mixing Bar Codes and Text

By combining the capabilities of text mode and bar code mode, it is possible to print text above, below, and along side bar codes.

### Example:

To print a human-readable interpretation beneath a bar code. The characters "0123456789" are encoded in the following Code 39 standard density LOGMAR bar code.



0123456789

This bar code and interpretation was printed by first entering bar code mode and printing the bar code. While still in bar code mode, a relative vertical tab was done to space 0.1 inch below the bar code.

```
^H05^BNd0123456789^G^-^J010
```

Then, after returning from bar code mode to text mode, the character string " 0123456789" was printed.

### Example:

To print text along side a bar code.

Text to left of bar code.		Text to right of bar code.
------------------------------	---	-------------------------------

To print this bar code and text, all text was first printed:

"Text to left of bar code."	Text to right" of bar code."
--------------------------------	---------------------------------

While still in text mode, reverse paper motion was done to step back above the printed text. The bar code was then printed in bar code mode.

```
^H05^T0140^BNd0123456789^G^-
```



## Description of Supported Bar Code Types

### Code 39

The Code 39 character set contains 43 characters: 0-9, A-Z, -, ., \$, /, +, %, and space. A maximum bar code density of approximately 5.5 characters per inch (using type "a") may be obtained.

The printer automatically inserts a narrow space between all valid data characters. Invalid data characters will cause blank space to be inserted in the bar code. A common character (\*) is used for both start and stop delimiters. The printer will automatically insert the start/stop delimiter before and after each bar code string. Check digits are not automatically generated by the printer. If a check digit is to be used, it must be included in the bar code data by the programmer.

### 2-of-5

The 2-of-5 character set contains 10 characters, the decimal digits 0-9. A maximum bar code density of approximately 5.2 characters per inch (using type "g") may be obtained.

The printer automatically inserts a narrow space between all valid data characters. Invalid data characters will cause blank space to be inserted in the bar code. The printer will automatically insert the start delimiter before and the stop delimiter after each bar code string. Check digits are not automatically generated by the printer. If a check digit is to be used, it must be included in the bar code data by the programmer.

### Interleaved 2-of-5

Interleaved 2-of-5 bar codes encode information in both the bars and spaces in order to create a denser bar code. There are two techniques used to perform this interleave.

One technique takes the bars of an individual character and interleaves them into the spaces to create a narrower character. Since each character is interleaved individually, an even or odd number of characters may be interleaved without a problem. This technique is referred to as bar/space interleave, and is abbreviated in the previous tables as BS code.

The second and more popular technique takes the bars of two adjacent characters and interleaves them together. All of the odd positioned characters are encoded in the bars and all of the even positioned characters are encoded in the spaces. The interleaving process requires an even number of characters to work correctly. This technique is referred to as character interleave and is abbreviated in the previous tables as C code.

The two types of interleaved 2-of-5 are not compatible and bar code readers designed to read one type will probably not read the other.



# ASCII CHARACTER TABLES

## ASCII Control Code Definitions

The following table is provided as a reference to the control character descriptions as provided by the ASCII definition. Not all of these definitions are supported by the FormsPro 4000se, FormsMaster 8000se or the PrintMaster 850 series printers and some are emulation dependent. For more information consult the appropriate chapter for the emulation being used and/or the chapter on Input/Output Control Codes.

Control Code	Hexadecimal Value	Description
NUL	00	Null
SOH	01	Start of Heading
STX	02	Start of Text
ETX	03	End of Text
EOT	04	End of Transmission
ENQ	05	Enquiry
ACK	06	Acknowledge
BEL	07	Bell
BS	08	Backspace
HT	09	Horizontal Tabulation
LF	0A	Line Feed
VT	0B	Vertical Tabulation
FF	0C	Form Feed
CR	0D	Carriage Return
SO	0E	Shift Out
SI	0F	Shift In
DLE	10	Data Link Escape
DC1	11	Device Control 1 (XON)
DC2	12	Device Control 2
DC3	13	Device Control 3 (XOFF)
DC4	14	Device Control 4
NAK	15	Negative Acknowledge
SYN	16	Synchronous Idle
ETB	17	End of Transmission Block
CAN	18	Cancel
EM	19	End of Medium
SUB	1A	Substitute
ESC	1B	Escape
FS	1C	File Separator
GS	1D	Group Separator
RS	1E	Record Separator
US	1F	Unit Separator

Epson FX Fast Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	
1	è	é	ê	ë	ì	í	î	ï	ä	å	æ	ç	è	é	ê	ë	
2	ù	û	ü	ÿ	"	2	B	R	b	r	ü	ÿ	"	2	B	R	
3	ò	ø	æ	#	3	C	S	c	s	ò	ø	æ	#	3	C	S	
4	ì	ï	ø	\$	4	D	T	d	t	ì	ï	ø	\$	4	D	T	
5	°	ø	%	5	E	U	e	u	°	ø	%	5	E	U	e	u	
6	£	£	&	6	F	V	f	v	£	£	&	6	F	V	f	v	
7	ì	ï	Ä	'	7	G	W	g	w	ì	ï	Ä	'	7	G	W	
8	ç	ö	(	8	H	X	h	x	ç	ö	(	8	H	X	h	x	
9	ñ	ü	)	9	I	Y	i	y	ñ	ü	)	9	I	Y	i	y	
A	ñ	ä	*	:	J	Z	j	z	ñ	ä	*	:	J	Z	j	z	
B	ö	ö	+	;	K	[	k	[	ö	ö	+	;	K	[	k	[	
C	ü	ü	<	<	L	\	l	\	ü	ü	<	<	L	\	l	\	
D	Ä	É	-	=	M	]m	~	Ä	É	-	=	M	]m	~	Ä	É	
E	ä	é	.	>	N	^	n	~	ä	é	.	>	N	^	n	~	
F	ç	¥	/	? 0	_	o	ø	ç	¥	/	? 0	_	o	ø	ç	¥	

(LSB)

Epson FX Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	
1	è	é	ê	ë	ì	í	î	ï	ä	å	æ	ç	è	é	ê	ë	
2	ù	û	ü	ÿ	"	2	B	R	b	r	ü	ÿ	"	2	B	R	
3	ò	ø	æ	#	3	C	S	c	s	ò	ø	æ	#	3	C	S	
4	ì	ï	ø	\$	4	D	T	d	t	ì	ï	ø	\$	4	D	T	
5	°	ø	%	5	E	U	e	u	°	ø	%	5	E	U	e	u	
6	£	£	&	6	F	V	f	v	£	£	&	6	F	V	f	v	
7	ì	ï	Ä	'	7	G	W	g	w	ì	ï	Ä	'	7	G	W	
8	ç	ö	(	8	H	X	h	x	ç	ö	(	8	H	X	h	x	
9	ñ	ü	)	9	I	Y	i	y	ñ	ü	)	9	I	Y	i	y	
A	ñ	ä	*	:	J	Z	j	z	ñ	ä	*	:	J	Z	j	z	
B	ö	ö	+	;	K	[	k	[	ö	ö	+	;	K	[	k	[	
C	ü	ü	<	<	L	\	l	\	ü	ü	<	<	L	\	l	\	
D	Ä	É	-	=	M	]m	~	Ä	É	-	=	M	]m	~	Ä	É	
E	ä	é	.	>	N	^	n	~	ä	é	.	>	N	^	n	~	
F	ç	¥	/	? 0	_	o	ø	ç	¥	/	? 0	_	o	ø	ç	¥	

(LSB)

Epson FX Letter Quality

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï	
1	è	é	ê	ë	ì	í	î	ï	ä	å	æ	ç	è	é	ê	ë	
2	ù	û	ü	ÿ	"	2	B	R	b	r	ü	ÿ	"	2	B	R	
3	ò	ø	æ	#	3	C	S	c	s	ò	ø	æ	#	3	C	S	
4	ì	ï	ø	\$	4	D	T	d	t	ì	ï	ø	\$	4	D	T	
5	°	ø	%	5	E	U	e	u	°	ø	%	5	E	U	e	u	
6	£	£	&	6	F	V	f	v	£	£	&	6	F	V	f	v	
7	ì	ï	Ä	'	7	G	W	g	w	ì	ï	Ä	'	7	G	W	
8	ç	ö	(	8	H	X	h	x	ç	ö	(	8	H	X	h	x	
9	ñ	ü	)	9	I	Y	i	y	ñ	ü	)	9	I	Y	i	y	
A	ñ	ä	*	:	J	Z	j	z	ñ	ä	*	:	J	Z	j	z	
B	ö	ö	+	;	K	[	k	[	ö	ö	+	;	K	[	k	[	
C	ü	ü	<	<	L	\	l	\	ü	ü	<	<	L	\	l	\	
D	Ä	É	-	=	M	]m	~	Ä	É	-	=	M	]m	~	Ä	É	
E	ä	é	.	>	N	^	n	~	ä	é	.	>	N	^	n	~	
F	ç	¥	/	? 0	_	o	ø	ç	¥	/	? 0	_	o	ø	ç	¥	

(LSB)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	
(LSB)																	

PC Fast Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	
(LSB)																	

PC Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	
(LSB)																	

PC Letter Quality

EBCDIC Fast Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	:		0	@	P	`	p		â	ß	ï	µ	¶	ú			
1	:	!	1	A	Q	a	q		ä	À	í	í	í	í	í	í	í
2	:	"	2	B	R	b	r		å	Á	ò	ò	ò	ò	ò	ò	ò
3	:	#	3	C	S	c	s		ä	À	«	«	«	«	«	«	«
4	:	\$	4	D	T	d	t		å	Á	»	»	»	»	»	»	»
5	:	%	5	E	U	e	u		ä	À	þ	þ	þ	þ	þ	þ	þ
6	:	&	6	F	V	f	v		å	Á	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ
7	:	'	7	G	W	g	w		ä	À	ç	ç	ç	ç	ç	ç	ç
8	:	(	8	H	X	h	x		å	Á	±	±	±	±	±	±	±
9	:	)	9	I	Y	i	y		ä	À	°	°	°	°	°	°	°
A	:	*	:	J	Z	j	z		ä	À	·	·	·	·	·	·	·
B	:	+	;	K	[	k	[		ä	À	ø	ø	ø	ø	ø	ø	ø
C	:	,	<	L	\	l	\		ä	À	ø	ø	ø	ø	ø	ø	ø
D	:	-	=	M	]	m	]		ä	À	ø	ø	ø	ø	ø	ø	ø
E	:	.	>	N	^	n	^		ä	À	ø	ø	ø	ø	ø	ø	ø
F	:	/	?	O	_	o	_		ä	À	ø	ø	ø	ø	ø	ø	ø

(LSB)

EBCDIC Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	:		0	@	P	`	p		â	ß	ï	µ	¶	ú			
1	:	!	1	A	Q	a	q		ä	À	í	í	í	í	í	í	í
2	:	"	2	B	R	b	r		å	Á	ò	ò	ò	ò	ò	ò	ò
3	:	#	3	C	S	c	s		ä	À	«	«	«	«	«	«	«
4	:	\$	4	D	T	d	t		å	Á	»	»	»	»	»	»	»
5	:	%	5	E	U	e	u		ä	À	þ	þ	þ	þ	þ	þ	þ
6	:	&	6	F	V	f	v		å	Á	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ
7	:	'	7	G	W	g	w		ä	À	ç	ç	ç	ç	ç	ç	ç
8	:	(	8	H	X	h	x		å	Á	±	±	±	±	±	±	±
9	:	)	9	I	Y	i	y		ä	À	°	°	°	°	°	°	°
A	:	*	:	J	Z	j	z		ä	À	·	·	·	·	·	·	·
B	:	+	;	K	[	k	[		ä	À	ø	ø	ø	ø	ø	ø	ø
C	:	,	<	L	\	l	\		ä	À	ø	ø	ø	ø	ø	ø	ø
D	:	-	=	M	]	m	]		ä	À	ø	ø	ø	ø	ø	ø	ø
E	:	.	>	N	^	n	^		ä	À	ø	ø	ø	ø	ø	ø	ø
F	:	/	?	O	_	o	_		ä	À	ø	ø	ø	ø	ø	ø	ø

(LSB)

EBCDIC Letter Quality

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	:		0	@	P	`	p		â	ß	ï	µ	¶	ú			
1	:	!	1	A	Q	a	q		ä	À	í	í	í	í	í	í	í
2	:	"	2	B	R	b	r		å	Á	ò	ò	ò	ò	ò	ò	ò
3	:	#	3	C	S	c	s		ä	À	«	«	«	«	«	«	«
4	:	\$	4	D	T	d	t		å	Á	»	»	»	»	»	»	»
5	:	%	5	E	U	e	u		ä	À	þ	þ	þ	þ	þ	þ	þ
6	:	&	6	F	V	f	v		å	Á	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ	ÿ
7	:	'	7	G	W	g	w		ä	À	ç	ç	ç	ç	ç	ç	ç
8	:	(	8	H	X	h	x		å	Á	±	±	±	±	±	±	±
9	:	)	9	I	Y	i	y		ä	À	°	°	°	°	°	°	°
A	:	*	:	J	Z	j	z		ä	À	·	·	·	·	·	·	·
B	:	+	;	K	[	k	[		ä	À	ø	ø	ø	ø	ø	ø	ø
C	:	,	<	L	\	l	\		ä	À	ø	ø	ø	ø	ø	ø	ø
D	:	-	=	M	]	m	]		ä	À	ø	ø	ø	ø	ø	ø	ø
E	:	.	>	N	^	n	^		ä	À	ø	ø	ø	ø	ø	ø	ø
F	:	/	?	O	_	o	_		ä	À	ø	ø	ø	ø	ø	ø	ø

(LSB)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	Ø	▶		0	@	P	`	p	Ç	É	Í	Ó	Ł	đ	ó		
1	⊙	◀	!	1	A	Q	´	q	Ĉ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
2	⊙	◀	!	2	B	R	ˆ	r	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
3	♥	!!	#	3	C	S	ˆ	s	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
4	♦	!!	#	4	D	T	e	t	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
5	♣	!!	#	5	E	U	e	u	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
6	♣	!!	#	6	F	V	f	v	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
7	•	!↑	'	7	G	W	g	w	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
8	⊠	↑	(	8	H	X	h	x	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
9	◊	↓	)	9	I	Y	i	y	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
A	⊠	↓	*	:	J	Z	j	z	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
B	♩	↑	+	;	K	[	k	[	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
C	♩	↑	+	;	L	\	l	\	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
D	♩	↑	+	;	M	]m	m	]m	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
E	♩	↑	+	;	N	]n	n	]n	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
F	⊠	↓	?	?	O	_	o	_	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	

Latin 2 (Slavic) Fast Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	Ø	▶		0	@	P	`	p	Ç	É	Í	Ó	Ł	đ	ó		
1	⊙	◀	!	1	A	Q	´	q	Ĉ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
2	⊙	◀	!	2	B	R	ˆ	r	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
3	♥	!!	#	3	C	S	ˆ	s	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
4	♦	!!	#	4	D	T	e	t	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
5	♣	!!	#	5	E	U	e	u	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
6	♣	!!	#	6	F	V	f	v	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
7	•	!↑	'	7	G	W	g	w	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
8	⊠	↑	(	8	H	X	h	x	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
9	◊	↓	)	9	I	Y	i	y	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
A	⊠	↓	*	:	J	Z	j	z	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
B	♩	↑	+	;	K	[	k	[	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
C	♩	↑	+	;	L	\	l	\	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
D	♩	↑	+	;	M	]m	m	]m	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
E	♩	↑	+	;	N	]n	n	]n	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
F	⊠	↓	?	?	O	_	o	_	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	

Latin 2 (Slavic) Draft

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0	Ø	▶		0	@	P	`	p	Ç	É	Í	Ó	Ł	đ	ó		
1	⊙	◀	!	1	A	Q	´	q	Ĉ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
2	⊙	◀	!	2	B	R	ˆ	r	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
3	♥	!!	#	3	C	S	ˆ	s	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
4	♦	!!	#	4	D	T	e	t	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
5	♣	!!	#	5	E	U	e	u	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
6	♣	!!	#	6	F	V	f	v	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
7	•	!↑	'	7	G	W	g	w	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
8	⊠	↑	(	8	H	X	h	x	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
9	◊	↓	)	9	I	Y	i	y	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
A	⊠	↓	*	:	J	Z	j	z	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
B	♩	↑	+	;	K	[	k	[	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
C	♩	↑	+	;	L	\	l	\	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
D	♩	↑	+	;	M	]m	m	]m	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
E	♩	↑	+	;	N	]n	n	]n	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	
F	⊠	↓	?	?	O	_	o	_	Ċ	Ė	Ĭ	Ĳ	Ł	Đ	Ń	Ų	

Latin 2 (Slavic) Letter Quality

OCR A

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	
(LSB)																	

OCR B

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	
(LSB)																	

ML Euro (858)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	(MSB)
0																	
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
A																	
B																	
C																	
D																	
E																	
F																	



	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1																
2																
3																
4																
5																
6																
7																
8																
9																
A																
B																
C																
D																
E																
F																

ML Euro (850)

## Decimal to Octal to Hexadecimal Conversion Table

Dec	Oct	Hex	ASCII	Dec	Oct	Hex	ASCII	Dec	Oct	Hex	ASCII		
0	000	00	NUL	64	100	40	@	129	201	81	194	302	C2
1	001	01	SOH	65	101	41	A	130	202	82	195	303	C3
2	002	02	STX	66	102	42	B	131	203	83	196	304	C4
3	003	03	ETX	67	103	43	C	132	204	84	197	305	C5
4	004	04	EOT	68	104	44	D	133	205	85	198	306	C6
5	005	05	ENQ	69	105	45	E	134	206	86	199	307	C7
6	006	06	ACK	70	106	46	F	135	207	87	200	310	C8
7	007	07	BEL	71	107	47	G	136	210	88	201	311	C9
8	010	08	BS	72	110	48	H	137	211	89	202	312	CA
9	011	09	HT	73	111	49	I	138	212	8A	203	313	CB
10	012	0A	LF	74	112	4A	J	139	213	8B	204	314	CC
11	013	0B	VT	75	113	4B	K	140	214	8C	205	315	CD
12	014	0C	FF	76	114	4C	L	141	215	8D	206	316	CE
13	015	0D	CR	77	115	4D	M	142	216	8E	207	317	CF
14	016	0E	SO	78	116	4E	N	143	217	8F	208	320	D0
15	017	0F	SI	79	117	4F	O	144	220	90	209	321	D1
16	020	10	DLE	80	120	50	P	145	221	91	210	322	D2
17	021	11	XON	81	121	51	Q	146	222	92	211	323	D3
18	022	12	DC2	82	122	52	R	147	223	93	212	324	D4
19	023	13	XOFF	83	123	53	S	148	224	94	213	325	D5
20	024	14	DC4	84	124	54	T	149	225	95	214	326	D6
21	025	15	NAK	85	125	55	U	150	226	96	215	327	D7
22	026	16	SYN	86	126	56	V	151	227	97	216	330	D8
23	027	17	ETB	87	127	57	W	152	230	98	217	331	D9
24	030	18	CAN	88	130	58	X	153	231	99	218	332	DA
25	031	19	EM	89	131	59	Y	154	232	9A	219	333	DB
26	032	1A	SUB	90	132	5A	Z	155	233	9B	220	334	DC
27	033	1B	ESC	91	133	5B	[	156	234	9C	221	335	DD
28	034	1C	FS	92	134	5C	\	157	235	9D	222	336	DE
29	035	1D	GS	93	135	5D	]	158	236	9E	223	337	DF
30	036	1E	RS	94	136	5E	^	159	237	9F	224	340	E0
31	037	1F	US	95	137	5F	_	160	240	A0	225	341	E1
32	040	20	SP	96	140	60	`	161	241	A1	226	342	E2
33	041	21	!	97	141	61	a	162	242	A2	227	343	E3
34	042	22	"	98	142	62	b	163	243	A3	228	344	E4
35	043	23	#	99	143	63	c	164	244	A4	229	345	E5
36	044	24	\$	100	144	64	d	165	245	A5	230	346	E6
37	045	25	%	101	145	65	e	166	246	A6	231	347	E7
38	046	26	&	102	146	66	f	167	247	A7	232	350	E8
39	047	27	'	103	147	67	g	168	250	A8	233	351	E9
40	050	28	(	104	150	68	h	169	251	A9	234	352	EA
41	051	29	)	105	151	69	i	170	252	AA	235	353	EB
42	052	2A	*	106	152	6A	j	171	253	AB	236	354	EC
43	053	2B	+	107	153	6B	k	172	254	AC	237	355	ED
44	054	2C	,	108	154	6C	l	173	255	AD	238	356	EE
45	055	2D	-	109	155	6D	m	174	256	AE	239	357	EF
46	056	2E	.	110	156	6E	n	175	257	AF	240	360	F0
47	057	2F	/	111	157	6F	o	176	260	B0	241	361	F1
48	060	30	0	112	160	70	p	177	261	B1	242	362	F2
49	061	31	1	113	161	71	q	178	262	B2	243	363	F3
50	062	32	2	114	162	72	r	179	263	B3	244	364	F4
51	063	33	3	115	163	73	s	180	264	B4	245	365	F5
52	064	34	4	116	164	74	t	181	265	B5	246	366	F6
53	065	35	5	117	165	75	u	182	266	B6	247	367	F7
54	066	36	6	118	166	76	v	183	267	B7	248	370	F8
55	067	37	7	119	167	77	w	184	270	B8	249	371	F9
56	070	38	8	120	170	78	x	185	271	B9	250	372	FA
57	071	39	9	121	171	79	y	186	272	BA	251	373	FB
58	072	3A	:	122	172	7A	z	187	273	BB	252	374	FC
59	073	3B	;	123	173	7B	{	188	274	BC	253	375	FD
60	074	3C	<	124	174	7C		189	275	BD	254	376	FE
61	075	3D	=	125	175	7D	}	190	276	BE	255	377	FF
62	076	3E	>	126	176	7E	~	191	277	BF			
63	077	3F	?	127	177	7F	DEL	192	300	CO			
<b>Dec</b>	<b>Oct</b>	<b>Hex</b>	<b>ASCII</b>	<b>Dec</b>	<b>Oct</b>	<b>Hex</b>		<b>Dec</b>	<b>Oct</b>	<b>Hex</b>			
128	200	80		192	300	CO		193	301	C1			

# PRINTER RESET CONDITIONS

The following list describes what conditions are assumed whenever the printer is powered on, the SETUP mode is exited, or a reset escape sequence is received when the printer is operating in an emulation mode which supports such a sequence.

This list includes all variables which may be modified by the user for all emulations even though some emulations cannot modify all the variables shown. Refer to the appropriate chapter for the emulation being used.

Variable	Reset Condition
-----	-----
character pitch	according to form setup
left margin	according to form setup
right margin	according to form setup
line pitch	according to form setup
form length	according to form setup
top margin	according to form setup
bottom margin	according to form setup
font	according to form setup
impact mode	according to form setup
language	according to form setup
normal/slashed zero	according to form setup
autocut mode	according to form setup
unidirectional mode	according to form setup
top of form	set to current position
text in an incomplete line	discarded
input buffer	cleared (unless reset from host)
control of data bit 8	accepted as received
control character symbols	according to interface setup
italics	off
double high	off
compressed	off
double strike	off
double wide	off
elite	off
emphasized	off
superscript/subscript	off
underline	off
horizontal tabs	every eighth column
vertical tabs	cleared



# GLOSSARY

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange.
baud rate	The rate at which characters are transmitted over a serial interface. This is usually the same as bits per second.
binary	Base two numbering system. Digits are represented by the characters 0 and 1.
bit	A single binary digit.
control code	A single, non-printing character which is used to control the configuration or operation of the printer.
character pitch	The horizontal spacing of characters. Measured in cpi.
cpi	Characters per inch.
cps	Characters per second.
current line	The line upon which the next character will be printed.
current print position	The column on the current line where the next character will be printed.
default	Value or configuration assumed when the printer is powered on or reset.
dpi	Dots per inch. Generally used to refer to graphics density or resolution.
draft	Refers to the draft (high speed) font.
EBCDIC	Extended Binary Coded Decimal Interchange Code.
escape sequence	String of characters beginning with the escape (ESC) character which is used to control the configuration or operation of the printer. The characters which are part of this string are not printed.
font	A group of characters of a given shape or style.
hexadecimal	Base sixteen numbering system. Digits are represented by the characters 0 through 9 and a through f.
interface	The connection between the printer and the host computer.
LCD	Liquid crystal display.
LED	Light emitting diode.
line pitch	The vertical spacing of characters. Measured in lpi.
lpi	Lines per inch.

LQ	Letter Quality.
MSB	Most significant bit. In a character, this refers to bit seven (of 0 to 7).
octal	Base eight numbering system. Digits are represented by the characters 0 through 7.
off-line	Refers to the state of the printer when the "ONLINE" indicator is any color other than solid green and the printer does not respond to the host computer.
on-line	Refers to the state of the printer when the "ONLINE" indicator is solid green and the printer is responding to the commands and text received from the host computer.
OQ	Optical Quality.
parity	A method used for detecting errors within a single character transmitted or received via an interface.
reset	Initialization of various operating parameters of the printer to the value or state assumed when the printer is powered on.
top of form	The vertical position where the first line is printed on the paper. Also the position the paper is advanced to when a form feed (FF) character is received from the host or the Form Feed button is pressed on the printer's control panel.
tractors	Devices which control the movement of the paper through the printer.

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