CHAPTER 2. ANSI EMULATION

CONTROL CODE AND ESCAPE SEQUENCE ACTIVITY LEVELS

ANSI control codes and escape sequences are assigned activity levels depending on which print mode is currently active. The following charts provide Information on what to expect from the control codes and escape sequences in each printing mode.

I-IGNORED   No noticeable effect on printing will occur.

V-VALID   These sequences will not affect the printing mode in progress, but will take effect when normal printing resumes.

A–ACTIVE   This sequence will take effect immediately.
D–DATA   These control codes are used as data.

Notes

Note 1   If printer option 1 is active, either in ANSI (4800) or ANSI (4410) emulation, SO and SI will activate or deactivate this printing mode. SO and ST are VALID in bar codes and oversize-ACTIVE in expanded. Please see Appendix G, Description of Strapping options, tables 5 and 6 on page **Error! Bookmark not defined.** for details on options which affect printer operation in ANSI emulation.

Note 2   VALID during enhanced oversize-ACTIVE during normal oversize.

Note 3   Discarded while in the native mode.

Note 4   Will cause an error symbol to print (XOX).

Control Code Activity Levels

Control Code Activity Levels						
Control Code	Line Terminator	Normal	Dot Graphics	Bar Codes	Oversize	POSTNET
BEL	No	A	A	D	A	Note 4
BS	Yes	A	I	I	I	Note 4
CR	Yes	A	A	I	A	Note 4
DC1	No	A	A	D	A	Note 4
DC3	No	A	A	D	A	Note 4
DEL	No	Note 3	Note 3	D	Note 3	Note 4
FF	Yes	A	A	I	A	Note 4
HT	No	A	A	A	A	A
LF	Yes	A	A	I	A	Note 4
SI	No	A	I	Note 1	Note 1	Note 4
SO	No	A	I	Note 1	Note 1	Note 4
VT	Yes	A	A	I	A	Note 4

Escape Sequence Activity Levels

Escape Sequence	Line Terminator	Normal	Dot Graphics	Bar Codes	Oversize	POSTNET
DCS (Graphics)	No	A	I	I	A	I
Font Load	No	A	I	I	A	I
GENBCS	No	A	A	A	A	I
GENFD	No	A	A	A	A	I
GENGRM	No	A	V	A	A	I
GENHTS	No	A	A	A	A	I
GENOSM	No	A	V	V	A	I
GENSLR	No	A	A	A	A	I
GENSNC	No	A	V	V	Note 2	I
GENSPM	No	A	V	A	A	A
GENTST	Yes	A	A	I	A	I
GENVFU	Yes	A	A	A	A	I
DENVTS	No	A	A	A	A	I
GSM	No	A	V	V	A	I
HPA	Yes	A	A	A	A	I
HPB	Yes	A	A	A	A	I
HPR	No	A	A	A	A	I
HTS	No	A	A	A	A	I
HVP	Yes	A	A	A	A	I
PLD	Yes	A	I	I	A	I
PLU	Yes	A	I	I	A	I
REP	No	A	A	I	A	I
RIS	No	A	A	A	A	I
RM	No	A	A	A	A	I
SGR	No	A	V	V	Note 2	I
SM	No	A	A	A	A	I
SPI	No	A	V	V	Note 2	I
ST	No	I	A	I	I	I
TBC	No	A	A	A	A	I
VFU Load	No	A	I	I	A	I
VPA	Yes	A	A	A	A	I
VPB	Yes	A	A	A	A	I
VPR	Yes	A	A	A	A	I

CONTROL CODE DEFINITIONS

BEL   **Bell (07H):** Receipt of a BEL code causes the beeper to sound for approximately 1/2 second after any preceding printable data has been processed.

BS   **Back Space (08H):** Line terminator. The paper position remains unchanged and the print position is moved left one character space at the current CPI. If the print position is at the left margin no action is taken.

CR   **Carriage Return (0DH):** Line terminator. The print position is reset to the left margin and the paper position is left unchanged.

CSI   **Control Sequence Introducer (9BH):** Signals the beginning of an ANSI control sequence. When 8-bit data is used. CSI (9BH) can be substituted for ESC [(1BH 5BH). Also see ESC.

DC1   **Device Control 1 (11H):** Parallel and Serial Interface: Receipt of a DC1 code with the printer in local mode puts the printer online (SELECTS printer) and enables receipt of data.

Through CCU menu options, a serial interface protocol may be selected that transmits a DC1 code to the host to signal that the printer is ready to receive data.

> **NOTE**
>
> **The print position can also be set to the left margin via the CCU control panel menu using the SETUP/FORMAT/MODIFY FORMAT/PRINT CONTROL menu selection.**

DC3(Device Control 3 – 13H): Parallel and Serial Interface: Receipt of a DC3 code w

Through menu options, a serial interface protocol may be selected that transmits a DC3 code to the host to signal that the printer Is not ready to receive data.

> **NOTE**
>
> **The print position can also be set to the left margin via the CCU control panel menu using the SETUP/FORMAT/MODIFY FORMAT/PRINT CONTROL menu selection.**

ESC   **Escape (1BH):** Signals the beginning of an escape sequence. See also CSI, above.

FF	**Form Feed (0CH):** Line terminator. The paper is advanced to the next top of form position. If the EVFU is enabled and programmed, paper will advance to the next stop in channel 1.

> **NOTE**
>
> **An option strap from the CCU control panel menu using the SETUP/FORMAT/MODIFY FORMAT/GENPRTOPTS selection can disable This feature.**

HT	**Horizontal Tab (09H):** Advances the print position to the next horizontal tab location. If no tabs are set, an HT code is either converted to a space or ignored, depending on menu option settings.
LF	**Line Feed (0AH):** Line terminator. The paper is advanced to the next line. When printing horizontal dot graphics, the paper is advanced to the next dot row.
	NOTE: an option strap from the CCU control panel menu using the SETUP/FORMAT/MODIFY FORMAT/GENPRTOPTS selection can disable This feature.
SI	**Shift In (0FH):** Used to exit a Special Print Mode (GENSPM) when printer control strap A9 (Appendix G) is set.
SO	**Shift Out (0EH):** Used to enable a special, print mode (GENSPM) when ANSI emulation strap 1 is reset.
VT	**Vertical Tab (0BH):** Line terminator. The paper is advanced to the next vertical tab stop. If no tabs are set, a VT code causes a line feed. When using the EVFU, paper advances to the next stop in channel 12.
	NOTE: an option strap from the CCU control panel menu using the SETUP/FORMAT/MODIFY FORMAT/GENPRTOPTS selection can disable This feature.

ESCAPE SEQUENCE DIRECTORY

Sequence	Meaning	Page
CSI or ESC [	Control Sequence Introducer	8
CSI p1 p2 SP ~	GENEMU: Select emulation	10
ESC [p1 ; p2 SP B	GSM: Modifies vertical (p1) and horizontal (p2) character size	21
ESC [p1 ; p2 SP G	SPI: Sets LPI (p1) and/or CPI (p2) in decipoints	22
ESC H	HTS: Set a tab at current print position	20
ESC J	VTS: Set a tab at current paper position	18
ESC K	PLD: Moves print line down 3/72 inch (subscript)	15
ESC L	PLU: Moves print line up 3/72 inch (superscript)	32
ESC P	DCS: Introduces dot graphics	30
ESC Q	Self-Test: Inactive. Sequence ignored.	
ESC [p1 a	HPR: Moves print position right p1 distance (relative)	15
ESC [p1 b	REP: Dot graphics: repeat preceding character p1 times	30
ESC c	RIS: Resets printer to a known initial state	24
ESC [p1 d	VPA: Sets vertical position to p1 decipoints or lines	16
ESC [pl e	VPR: Moves paper forward p1 decipoints	16
ESC [p1; p2 f	HVP: Moves paper and print position (absolute)	16
ESC [p1 g	TBC: Clears tabs: p1=3 for horizontal	18
ESC [p1 ; p... h	SM: Set mode (PUM, LNM, proportional. character mapping)	24
ESC [p1 j	HPB: Moves print position left by decipoints or columns	16
ESC [p1 k	VPB: Moves paper backward by decipoints or lines	17
ESC [p1 ;p ... l	RM: Reset mode (PUM, LNM, proportional, character mapping)	22
ESC [p1;p ... m	SGR: Selects font styles and enhancements	22
ESC [p1 p2 ! p	GENVF2: EVFU vertical paper movement command	34
ESC [p1 ; p2 SP n		
ESC [p1 ; p2 ; p3 SP q	GENGRM: Selects graphics horizontal and vertical dot densities	31
ESC [p1; p2 ; p3 r	GENFD: Sets form length (pl), margins - top (p2), bottom (p3)	18
ESC [p1; p2 s	GENSLR: Sets margins. Left (p1), right (p2) in decipoints	19

Sequence	Meaning	Page
ESC [p1 t	Selects bar codes p1=3, quit bar code p1=0	36
ESC [p1;pn u	GENHTS: Sets horizontal tabs (p1, etc.) in decipoints or columns	20
ESC [p1 ; p12 v	GENVTS: Sets vertical tabs (p1, etc.) in decipoints or lines	20
ESC [p1 x	GENSNC: Selects international character sets	11
ESC [p1; ...;p10 }	Selects barcode parameters	
ESC [p1 SP }	GENDFC: Download Font Control: checks printer for downloaded font	25
OSC or ESC]	Operating System Command: introduces sequence	8
ESC] 5	Not implemented. Sequence ignored.	
ESC] 9	Not implemented. Sequence ignored.	
ESC] !	Begins 12-channel EVFU table loading	32
ESC \	ST: String Terminator. Exits special modes	8
ESC [p1 `	HPA: Horizontal Position Absolute	17
ESC [p1 |		
OSC 9 ; p1 ; ... ; p8-pn ST	Character Map Load	12

ANSI ESCAPE SEQUENCE CATEGORIES

The ANSI escape sequences have been separated according to functionality. Special areas of interest, such as graphics and the electronic vertical format unit (EVFU), have been described in separate sections. The functional groups are:

- Housekeeping
- Paper and Print Positioning
- Margins and Tabs
- Font Handling and Enhancements
- Graphics
- EVFU

Housekeeping Sequences

ESC [**CSI (Control Sequence Introducer):** This sequence is used to begin sequences, which generally have multiple parameters.

ESC]   **OSC (Operating System Command):** This is another special sequence introducer. Sequences which begin with OSC require the ST string terminator sequence (ESC \) to end them.

ESC **   **ST (String Terminator): Used to terminate the loading of EVFU tables. download fonts, and dot graphics strings.

ESC c   **RIS (Reset to Initial State):** Resets the printer to either the standard state shown below or to the state stored in the customer save area of memory. The RIS sequence can be disabled by ANSI option strap 3 (see Appendix G, tables 5 and 6, option 3).

RIS – Reset to Initial State	
Parameter	**State**
Font Style	Gothic Draft
Character Size	1X Vertical. 1X Horizontal
Character Pitch	10 CPI
Country Selection	USA
Code Page	457
Line Spacing	6 LPI
Partial Line Up	Reset
Partial Line Down	Reset
Bold Print	Inactive
Underline Mode	Inactive
Expanded Mode	Inactive
Proportional Mode	Reset
Horizontal Tab Table	Empty
Left Margin	None - Column 0
Right Margin	None - Maximum
Form Number	7
Page Size	7920 decipoints/ 66 lines/11 inches
Top Margin	None
Bottom Margin	None
Forms Position	Top of form - current position
Vertical Tab Table	Empty
Vertical Format Unit	Default
Graphics Density	60 H DPI, 72 V DPI, horizontal format
VFU Load In Progress	Exit (nothing saved)
Bar Code Mode	Inactive
Dot Graphics	Inactive

Decimal   27 99:
Hex: 1B 63
BASIC: CHR$(27);"c";

ESC Q   **GENTST (Self-Test):** This sequence is ignored.

Decimal: 27 102 or 120
Hex: 1B 5C or 9C
BASIC: CHR$(27);"\";

CSI p1 p2 SP ~ **GENEMU (Emulation Control):** This sequence will switch the control for the printer to another emulation. The parameters in the sequence are defined as follows:

p1 Emulation identifier. This parameter will select the particular emulation by a reference number as supplied by GENICOM engineering. The assigned numbers may be found in the table below.

p2 Reset control. The parameters of the printer to be reset or defaulted are controlled by this parameter. It will not always be possible to meet the strict definition of this parameter, so each printer will have a definition of how the reset control is implemented. The values as currently defined are:

   0 Hold values (default). All possible values for printer control (tabs, margins, page length, etc.) are to be retained.

   1 Full reset. Reset parameters to initial state.

p1	Manufacturer	Emulation
0	GENICOM	ANSI
10	GENICOM	4410 ANSI
1-19	GENICOM	Reserved
20	IBM	Graphics Printer
21	IBM	Proprinter XL 9-wire
22	Epson	FX286-e
23	IBM	Proprinter XL 24-wire
24	Epson	LQ2500
30	Data Products	ANSI
40	Printronix	P300
41	Printronix	P5008

Indeterminate Conditions
If no emulation parameter is supplied, the emulation will remain in the current state and the rest of the sequence is ignored. Other parameter values and other parameters are reserved.

Mnemonic: CSI p1 p2 SP ~
Decimal: 27 101 p1 p2 32 126
Hex: 1B 5B p1H p2H 20 7E
BASIC: CHR$(27);"p1p2 ~";

Character Set Selection

ESC [p1 x   **GENSNC (Select National Characters):** This sequence selects the national character substitution if the currently selected character style supports it. The following values may be used for p1.

p1	Country Map or Character Set
0	USA (ISO)
1	German (ISO)
2	French A (ISO)
3	French B
4	French Canadian
5	Dutch (Netherlands)
6	Italian
7	United Kingdom (ISO)
8	Spanish
9	Danish/Norwegian A
10	Danish/Norwegian B
11	Danish/Norwegian C
12	Danish/Norwegian D
13	Swedish/Finnish A
14	Swedish/Finnish B
15	Swedish/Finnish C
16	Swedish/Finnish D
17	Swiss
18	(Ignored)
19	Yugoslavian
20	United Kingdom A
21	Turkish
22	Greek
23	Italian (ISO)
24	Spanish (ISO)
437	IBM PC USA (MS Code Page 437)
850	IBM PC Multilingual (MS Code Page 850)
852	Microsoft Code Page 852 (East Europe)
853	Microsoft Code Page 853 (Turkey)
855	Microsoft Code Page 855 (Cyrillic)
860	Microsoft Code Page 860
863	Microsoft Code Page 863 (French Canadian)
864	Microsoft Code Page 864
865	Microsoft Code Page 865
866	Microsoft Code Page 866 (Russian)
867	Microsoft Code Page 867
8572	USSR GOST (Russian)
8573	Greek Code Page 437
8574	DEC Multinational (LA-210)
8575	Roman 8
8576	Polish Mazowia
8577	Turkish 8-bit Code Page
8578	Greek Code Page 851
8591	ISO 8859-1 Latin Alphabet #1

p1	Country Map or Character Set
8592	ISO 8859-2 Latin Alphabet #2
8593	ISO 8859-3 Latin Alphabet #3
8594	ISO 8859-4 Latin Alphabet #4
8595	ISO 8859-5 Latin/Cyrillic
8596	ISO 8859-6 Latin/Arabic
8597	ISO 8859-7 Latin/Greek
8598	ISO 8859-8 Latin/Hebrew
8599	ISO 8859-9 Latin Alphabet #5

Character Map Load

OSC 9 ; p1 ; ... ; p8-pn ST   **Character Map Load:** This sequence signals the beginning of a Character Map Load data transfer. Character map definitions, which follow this sequence, are stored in non-volatile memory. The character map is selected with the GENICOM Select National Characters (GENSNC) command using the p2 parameter that is specified in the load sequence for this command. The load is terminated by a String Terminator (ST) sequence. The downloaded character map replaces the USA ISO character set in character map memory.

A single character map containing 128 substitutions may be specified. A character map may be designated for either the GL table (codes 20H-7EH) or the GR table (codes 80H-FFH). Any substitutions not specified within a character map load will be mapped one-to-one. For example, code 41H will print the character normally found at location 41H (upper case A). When a character map designated as a GR map is selected by the GENSNC command (see Character Set Selection on page 11), the GL map will automatically be mapped one-to-one. A standard GL (7-bit) character map, such as French A, may be specified as the base for a downloaded GR (8-bit) character map, but an 8-bit GR map, code page 866, for example, may NOT be used as the base for a GL character map.

The complete syntax for the Character Set Load is shown below:

OSC 9 ; p1 ; p2 ... ; p8–pn ST

p1   Control Command
   0   Store new character map
   1   Erase existing character. In this case, parameters p2-pn are ignored and need not be supplied. An existing downloaded character map need not be erased before a new character map is loaded.
   All other values of p1 are reserved.

p2   GENSNC (CSI p1 x) select parameter. Values must be between 90 and 99 in order not to interfere with GENICOM standard character maps. If a downloaded character map select parameter is a value other than 90 through 99, the download character map command will be ignored.

p3   Reserved. This parameter is marked by inserting a semi-colon (;) in the command sequence.

p4   Reserved. This parameter is marked by inserting a semi-colon (;) in the command sequence.

p5   Reserved. This parameter is marked by inserting a semi-colon (;) in the command sequence.

p6   A literal string indicating the GENSNC select parameter of an existing character map (such as 437, 850, etc.) to be used as a base in which substitutions from this command sequence may be made. This string may be up to 10 characters in length and must be specified only if the downloaded character map is to use an existing map as a base. The string is terminated by a semi-colon (;). The base character map will always default to Code Page 437 if an ACT character map is specified and the downloaded character map is a GR table. If the downloaded map is a GL table, p6 must specify an existing GL table as the base or a one-to-one default base will be used.

p7   A literal string which will be used to identify the character map in the Progam Mode Font – Country menu. This string may be up to 20 characters in length and is terminated by a semi-colon (;). Note that only the first 11 characters of this string will be used for display purposes.

p8-pn A trio of parameters used to specify the actual character map substitution. A semi-colon must separate each parameter within the trio, and a semi-colon must terminate each trio. The semi-colon is not required for the last trio that immediately precedes the String Terminator (ESC \).

The elements of each trio are defined as follows:

1   A decimal number that identifies the destination character. This is the character value received from the host. For example, an upper case "A" has a decimal value of 65. Values of 32 through 126 and 128 through 255 are valid for this element.

The first element processed in the first substitution trio will define whether the map will be for GL (7-bit) or GR (8-bit) substitution. If the first element is between 32 and 126 (inclusive), the map will be GL, and the first element of each trio must also be between 32 and 126. Likewise, if the first element of the first trio is between 128 and 255, the map is a GR map and all first elements must fall between 128 and 255. The character substitution map will be discarded if this rule is violated.

2   A decimal number that identifies the source character. This is the location value of the desired character pattern in the printer font set. For example, an upper case "A" has a decimal value of 65. Values of 0 through the last

available character for the currently selected font are valid for this element.

3   Reserved. A semi-colon (;) is required to mark this element position. A zero is permitted.

Paper and Print Position Moves

ESC K **PLD (Partial Line Down):** Line terminator. The print line is moved down 3/72 inch for subscript printing. Also used to return to the original line following a partial line up (ESC L - superscript) sequence. See note below.

Decimal: 27 75
Hex: 1B 4B
BASIC: CHR(27)$;"K";

ESC L **PLU (Partial Line Up):** Line terminator. The print line is moved up 3/72 inch for superscript printing. Also used to return to the original line following a partial line down (ESC K - subscript) sequence. See note.

Decimal: 27 76
Hex: 1B 4C
BASIC: CHR$(27);"L";

NOTE

In the native mode, these sequences can be used in succession to advance or reverse the paper to another line. In the 4000 compatibility mode, they can be used in pairs to change from superscript directly to subscript or subscript directly to superscript, but can not be used to position the paper.

Also see the SScript: ON/OFF menu selection in the User's Manual.

ESC [p1 a **HPR (Horizontal Position Relative):** Line terminator. Moves the print position to the right of the current position. The distance specified by the p1 parameter is in decipoints. An HPR move exceeding the right margin sets the print position at the margin. If the p1 parameter is zero or missing, the command is ignored.

Decimal: 27 91 p1 97
Hex: 1B 5B p1 61
BASIC: CHR$(27);"[p1a";

ESC [p1 d   **VPA (Vertical Position Absolute):** Line terminator. Sets the vertical position to the value specified by p1, moving paper forward or backward to the new position. The distance specified by the p1 parameter is in decipoints. This command can be used to print inside top and bottom margins. If the specified position is not within the current page, the command is ignored. If the parameter value is omitted or less than 5 decipoints, it will result in the vertical position being set to the top of form position.

                                     Decimal: 27 91 p1 100
                                       Hex: 1B 5B p1H 64
                                       BASIC: CHR$(27);"[";CHR$(p1);"d";

ESC [p1 e   **VPR (Vertical Position Relative):** Line terminator. Increases the current vertical position by the value specified by p1. Decipoints are converted to provide the 1/144-inch moves shown in the table.

Decipoint Value	Movement In Inches
Missing or 0 - 4	No Movement
5-9	1/144 inch
10-14	2/144 inch
15-19	3/144 inch
17,280 or greater	24 inches

                                       Decimal: 27 91 p1 95
                                       Hex: 1B 5B plH 65
                                       BASIC: CHR$(27);"[";CHR$(p1);"e";

ESC [p1 ; p2 f   **HVP (Horizontal and Vertical Position):** Line terminator. Sets the vertical paper position to the value of p1 and the print position to the p2 value. Values are sent as decipoints. HVP can position printing inside margins. The vertical position can not exceed the form length and the horizontal position cannot exceed the maximum width for the printer.

                                       Decimal: 27 91 p1 52 96
                                       Hex: 1B 5B p1H 3B p2 66
                                       BASIC: CHR$(27);"[";CHR$(p1);";";CHR$(p2);"f";

ESC [p1 j   **HPB (Horizontal Position Backward):** Line terminator. Moves the print position left of the current position by the distance specified in p1. Values are sent as decipoints. The print position is set to the left margin if the p1 value would exceed the margin. An HPB with a p1 value of zero is ignored.

                                       Decimal: 27 91 p1 106
                                       Hex: 1B 5B p1H 6A
                                       BASIC: CHR$(27);"[";CHR$(p1);"j";

ESC [p1 k **VPB (Vertical Position Backwards):** Line terminator. Moves the paper in reverse by the distance specified by p1. Values can be sent as decipoints. The paper position is set to the top margin if the p1 value would exceed the margin. A VPB with a p1 value of 5 decipoints or less is ignored.

Decimal: 27 91 p1 107
Hex: 1B 5B p1H 6B
BASIC: CHR$(27);"[p1k";

ESC [p1 ' **HPA (Horizontal Position Absolute):** Line terminator. Moves the print position to the value specified in p1. Values are sent as decipoints. Position zero is column one. The print position is set to the right margin if the p1 value would exceed the margin. An HPB with a p1 value greater than 9,504 is ignored.

Decimal: 27 91 p1 96
Hex: 1B 5B p1 60
BASIC: CHR$(27);"[p1'";

Margins and Tabs

ESC H   **HTS (Horizontal Tab Set):** Sets a tab at the current print position and updates any existing horizontal tab table. A total of 22 tabs can be set if this number is exceeded, the leftmost 22 tabs will be retained.

Decimal: 27 72
Hex: 1B 48
BASIC: CHR$(27);"H";

ESC J   **VTS (Vertical Tab Set):** Sets a tab at the current paper position and updates any existing vertical tab table. A total of 12 tabs can be set. If this number is exceeded, the 12 tabs closest to the top of the page will be retained.

Decimal: 27 74
Hex: 1B 4A
BASIC: CHR$(27);"J";

ESC [p1 g   **TBC (Tab Clear):** Clears horizontal or vertical tab stops based on the p1 value as follows:

p1 = 0   Clear horizontal tab at current print position.
p1 = 1   Clear vertical tab at current paper position.
p1 = 3   Clear all horizontal tabs.
p1 = 4   Clear all vertical tabs.

More than one parameter can be used.

Example: To clear all horizontal and vertical tabs, send:

ESC [3 ; 4 g

Decimal: 27 101 p1 103
Hex: 1B 5B p1 67
BASIC: CHR$(27);"[p1;"g";

ESC [p1; p2 ; p3 r   **GENFD (Forms Definition):** Establishes the form length (p1), the top margin (p2), and the bottom margin (p3) in decipoints. Default parameters are for an 11-inch (7,920 decipoints) long form with a top and bottom margin of zero.

p1 - maximum allowable length is 24 inches (17,280 decipoints).
p2 - top of page to first print line
p3 - top of page to last printable line.

Decimal: 27 91 p1 p2 p3 r
Hex: 1B
BASIC:

Sequence	Explanation
ESC [r	Default values of 11-inch form length, zero top and bottom margins.
ESC [8280r	11.5-inch form length, default top and bottom margins of zero
ESC [;720r	Default length of 11 inches, top margin of I inch. Default bottom margin of zero.
ESC [;;7200r	Default length of 11 inches, default top margin of zero, and a 1-inch bottom margin.
ESC [7920:360:7560r	11-inch form length, ½-inch top and bottom margins

Decimal: 27 91 p1 p2 p3 114
Hex: 1B 5B p1H p2H p3H 72
BASIC: CHR$(27);"[";CHR$(p1);CHR$(p2);CHR$(p3);"r";

ESC [p1; p2 s   **GENSLR (Set Left/Right Margins):** The p parameters are distances from the left edge of the printable area of the paper. Parameter p1 sets the left margin and p2 sets the right margin. An omitted parameter clears that margin. Invalid parameters will set the left margin to zero (column 1) and the right margin to 9,504 decipoints (column 132 at 10 cpi for the 13.2-inch machines).

A new left margin takes effect following any line terminator that normally calls for a print position set to the left. A new right margin takes effect when the print position reaches the new margin.

Margin settings stored as decipoint values are enforced to the nearest 1/120 of an inch. Character printing operates at 1/120 of an inch.

Decimal: 27 91 p1 p2 115
Hex: 1B 5B p1H p2H 73
BASIC: CHR$(27);"[";CHR$(p1);CHR$(p2);"s";

NOTE
There is a physical left margin of .6 to 1.6 inches from the edge of the paper to the first printable column. This distance is adjustable by sliding all four tractors sideways. The margins set with this sequence begin at the first physical print position, not at the edge of the paper.

ESC [p1 ; p ...; u   **GENHTS (Multiple Horizontal Tab Set):** Sets up to 22 horizontal tabs. The p parameters are set in decipoints.

If more than 22 tabs are set, the highest numbered tabs (farthest right) will be pushed out of the tab table. Tabs set in front of the left margin, or beyond the right margin. are not usable. Moving the margins will make them active.

Example: To place tabs at columns 10, 20, and 40 at 10 cpi, send ESC [10;40;20u (tabs can be specified in any order).

Decimal: 27 101 p1 59 p2 59 ... p22 59 117
Hex: 1B 5B p1 3B p2 3B ... 3B p22 3B 75
BASIC: CHR$(27);"[p1;p2;p . . . ;u"

ESC [p1 ; ...; p12 ; v GENVTS (Multiple Vertical Tab Set): Sets up to 12 vertical tabs. The p parameters are set in decipoints. If more than 12 tabs are set, the 12 tabs nearest the top of form will be retained. If a tab is set in the top margin area, it will be stored but will not be active until the margin is moved. If a tab is set beyond the bottom margin, attempting to move to that tab will advance the paper to the next top of form.

Decimal: 27 101 p1 59 p2 59 ... p12 59 118
Hex: 1B 5B p1 3B p2 3B ... p12 3B 76
BASIC: CHR$(27);"[p1;p2;...p12;v";

Font Handling and Enhancements

ESC [p1; p2 SP B   **GSM (Graphic Size Modification):** This sequence modifies the vertical (p1) and horizontal (p2) size of expanded and oversized characters. When using expanded characters, the currently selected font style is used. Oversize uses its own distinct font style.

Parameter values are percentages of the normal sized character, so values over 100 are needed for expansion. Expansion factors are obtained by dividing values by 100.

Example: A parameter value of 526 would be divided by 100 to produce an expansion factor of 5 (5X expansion). Values less than 100 are treated as 1X expansion.

X1: 0-199 (Default)   **X4:** 400-499   **X7:** 700-799
X2: 200-299   **X5:** 500-599   **X8:** 800-UP
X3: 300-399   **X6:** 600-699

Mixed sizes within a line can be top or bottom justified depending on the Program Mode menu option (see VExOpt:Default and VExOpt: Baseline).

The top of an expanded character is used as the starting point for vertical paper moves (line feed). The top or bottom of oversize characters can be used depending on the state of menu option GENPRTOPTS/Group 2, Strap 13.

When this sequence is received with a value of 200 or more, expanded printing will start, providing the printer is in the text mode (not bar codes. oversize, etc.

Examples:

ESC [;200 B	X1 Vertical	X2 Horizontal
ESC [200;200 B	X2 Vertical	X2 Horizontal
ESC [800;400 B	X8 Vertical	X4 Horizontal

During vertically expanded printing, blank lines (lines with no printed characters) are not expanded from the current lpi setting.

Decimal: 27 101 p1 59 p2 32 66
Hex: 1B 5B p1 3B p2 20 42
BASIC: CHR$(27);"[p1;p2 B";

ESC [p1 ; p2 SP G   **SPI (Spacing Increment):** This sequence is used to set line spacing (p1) and character spacing or pitch (p2). If the parameter is missing or zero, the spacing will remain unchanged. In the native mode, p1 can range from 1 to 17,820 decipoints (24 inches). The printable area (between the, top and bottom margin) can not be exceeded. The range of p2 is dependent on the font and will be ignored if exceeded.

Examples of Spacing Values

LPI Spacing			CPI Spacing	
LPI	p1 (decipoints)		CPI	p2 (decipoints)
3	240		10	72
4	180		12	60
6	120		13.3	54
8	90		15	42
			16.7	36

Decimal: 27 91 p1 59 p2 32 71
Hex: 1B 5B p1 3B p2 20 47
BASIC: CHR$(27);"[p1;p2 G";

ESC [p1 ; pn... m   **SGR (Select Graphic Rendition):** Font style and enhancements (bold and underline) are selected with this sequence. One font designator plus any number of enhancements can be entered in the escape sequence using the parameter values in the following table. If the requested font is not installed, the default font is selected.

Parameter	Enhancement
0	Cancel all print enhancements
1	Bold (enhancement)
4	Underline (enhancement)
5	Double Wide
21	Underline
22	Cancel Bold
24	Cancel Underline
25	Cancel Expanded
26	Cancel Proportional

Parameter	Font
10	Default Font - Data Processing
11	Gothic Draft Font
12	Character Graphics
13	Gothic NLQ Font
14	Courier NLQ Font
15	High Speed Draft Font
16	OCR-A
17	OCR-B
18	Italic NLQ Font or Download A*
19	Correspondence or Download B*

*A download font (if loaded) overrides any other font. See Character Map Load on page 12.

ESC [p1 ; p … m   **(continued)**

    Examples:

    For Gothic NLQ font underlined send:

        ESC [4;13m

    To cancel underlining and retain Gothic NLQ - send one of the following:

        ESC [;13m   ESC [0;13m   ESC [0m   ESC [24m

Decimal:	27 101 p1 ; pn m
Hex:	1B 5B p1H 3B … pnH 6D
BASIC:	CHR$(27);"[p1;...pn m";

ESC [p1; ... pn h **SM (Set Mode):** Sets the mode or modes specified by the parameters listed below. Parameters preceded by the 'greater than' sign are privately defined modes and should be sent separately.

Parameter Number	Mode Mnemonic	Mode Function
20	LNM	Line Feed New Line Mode

LNM - Line Feed New Line Mode. When using this mode, a received line feed command causes a carriage return (new line). When LNM is reset, a line feed command only causes a vertical position move.

The following parameters are privately defined modes.

Parameter Number	Mode Mnemonic	Mode Function
>1	GENPRM	Proportional Print Mode
>2	GENC1C	C1 Control Code Mode
>5	GENCS2	Character Set 2 Mode

GENPRM (Proportional Print Mode): This mode enables proportional printing. This mode does not apply to the oversize character feature. When reset (default), characters are spaced at the current cpi.

GENC1C (C1 Control Code Mode - PC Set 1): When set, it allows the use of C1 control codes. When reset, 80H - 9FH are ignored. See Appendix E for an explanation of how character sets are mapped. The default state is set using ANSI emulation option 6 (see Appendix G, tables 5 and 6).

GENSC2 (Character Set 2 Mode - PC Set 2): Selects character set 2 of any of the 8-bit international character sets. See PC Set 2 in Appendix E for an explanation of how character sets are mapped. The default state is set using option strap 7 in the ANSI emulation options (see Appendix G, tables 5 and 6).

EXAMPLE: To print proportional, send ESC [>1h.

Decimal:	27 101 62 53 104
Hex:	1B 5B 3E 35 68
BASIC:	CHR$(27);"[p1h"; or CHR$(27);"[>p1h";

ESC [p1 ... pn 1 **RM (Reset Mode):** Resets any modes turned on by the Set Mode command above. Parameters and syntax are the same.

ESC] 5 **BFL (Begin Font Load):** This sequence will not be honored if self-test determines that the download font option is not installed. Permits downloading of customer-defined font characters into printer nonvolatile memory from the host. Loading is terminated when an ESC \ sequence is received.

Decimal:	27 93 53
Hex:	1B 5D 35
BASIC:	CHR$(27);"]5";

ESC [p1 SP }   **GENDFC (Download Font Control):** Using the serial interface, this command allows the host to see if at least one valid font is loaded (p1=2). The printer sends DCS 30H 30H ST if a font is loaded, DCS 44H 45H ST if no font is loaded. It also provides the capability to erase the download font area (p1=1).

Decimal: 27 101 p1 32 125
Hex: 1B 5B p1 20 7D
BASIC: CHR$(27);"[p1 }";

GRAPHICS

The ANSI emulation graphics mode provides both horizontal and vertical dot plotting methods. These methods enable the printing of ASCII characters in their binary code form. Since each character has a unique pattern of 1s and 0s (dots and voids) that make up its binary code, the correct placement of these binary forms enables you to form larger images on the paper.

For clarity in the text, a binary 1 (a printed dot) will be shown as an X and a binary 0 (empty dot position) will be shown as a 0.

Six-Bit Graphics

In the graphics mode, only the low order six bits of a character are used (bits 1-6). Looking at an ASCII code chart, the question mark character (?) is represented by the binary number 1111110 (bit 1 - bit 7). Since only the first 6 bits are used. a "?" would print six dots on the paper. An asterisk "*" is represented by 010101 which would print the following:

Horizontal Graphics	Vertical Graphics
0X0X0X	0 X 0 X 0 X

Notice that in horizontal graphics that the character is printed on a single horizontal dot row. In vertical graphics, the character Is printed six dots high, a character per dot column.

Using the question mark that prints all dots, a series of these characters in horizontal graphics produces a one-dot-high solid line across the paper. The same character in vertical graphics produces a six-dot high band across the paper.

By repeating, omitting and mixing characters across a page, images such as graphs, charts. and pictures can be produced.

Dot Patterns and Densities

The chart on the next page shows the dot patterns for each of the ASCII characters. Each character represents six dots or dot positions, and their spacing is dependent on the density selected. At 60 dpi density, the dots are spaced 1/60 inch apart. At 120 dpi, each character represents six dots spaced 1/120 inch apart.

This chart shows the dot patterns for the ASCII characters needed to cover all dot/void combinations. Other valid characters (although they are repeat patterns of the characters in the chart) are 20H-3FH.

Character	Value	Dots	Character	Value	Dots
@	40H	000000	'	60H	00000X
A	41H	X00000	a	61H	X0000X
B	42H	0X0000	b	62H	0X000X
C	43H	XX0000	c	63H	XX000X
D	44H	00X000	d	64H	00X00X
E	45H	X0X000	e	65H	X0X00X
F	46H	0XX000	f	66H	0XX00X
G	47H	XXX000	g	67H	XXX00X
H	48H	000X00	h	68H	000X0X
I	49H	X00X00	i	69H	X00X0X
J	4AH	0X0X00	j	6AH	0X0X0X
K	4BH	XX0X00	k	6BH	XX0X0X
L	4CH	00XX00	l	6CH	00XX0X
M	4DH	X0XX00	m	6DH	X0XX0X
N	4EH	0XXX00	n	6EH	0XXX0X
O	4FH	XXXX00	o	6FH	XXXX0X
P	50H	0000X0	p	70H	0000XX
Q	51H	X000X0	q	71H	X000XX
R	52H	0X00X0	r	72H	0X00XX
S	53H	XX00X0	s	73H	XX00XX
T	54H	00X0X0	t	74H	00X0XX
U	55H	X0X0X0	u	75H	X0X0XX
V	56H	0XX0X0	v	76H	0XX0XX
W	57H	XXX0X0	w	77H	XXX0XX
X	58H	000XX0	x	78H	000XXX
Y	59H	X00XX0	y	79H	X00XXX
Z	5AH	0X0XX0	z	7AH	0X0XXX
[	5BH	XX0XX0	{	7BH	XX0XXX
\	5CH	00XXX0	|	7CH	00XXXX
]	5DH	X0XXX0	}	7DH	X0XXXX
^	5EH	0XXXX0	~	7EH	0XXXXX
_	5FH	XXXXX0	?	7FH	XXXXXX

Legend: X=dot 0=no dot (void)

Horizontal Format

Graphics data printed in horizontal format is comprised of a stream of bytes from left to right across each dot row.

This chart shows that byte 1 (or character 1) in row 1 will print its six bits from left to right in a single dot row. The next byte (byte 2) prints its six bits, representing a character, in the same dot row across the page.

Byte➜ Row ⬇	Byte 1	Byte 2	Byte n
1	1 2 3 4 5 6	1 2 3 4 5 6	…1 2 3 4 5 6
2	1 2 3 4 5 6	1 2 3 4 5 6	…1 2 3 4 5 6
3	1 2 3 4 5 6	1 2 3 4 5 6	…1 2 3 4 5 6
.	. . . . . .	. . . . . .	…. . . . . .
.	. . . . . .	. . . . . .	…. . . . . .
6	1 2 3 4 5 6	1 2 3 4 5 6	…1 2 3 4 5 6

Vertical Format

In vertical format, each byte (or character) occupies six dot rows of one column. Each character is one dot wide and six dots high. The next character (byte 2) is printed beside the first moving from left to right across the page.

Byte➜ Row	1 bit	2 bit	3 bit	…n …bit
1	1	1	1	…1
2	2	2	2	…2
3	3	3	3	…3
4	4	4	4	…4
5	5	5	5	…5
6	6	6	6	…6

Eight-Bit Graphics

Horizontal Format

Graphics data printed in horizontal format is comprised of a stream of bytes from left to right across each dot row.

This chart shows that byte 1 (or character 1) in row 1 will print its eight bits from left to right in a single dot row. The next byte (byte 2) prints its eight bits, representing a character, in the same dot row across the page.

Byte➜ Row ⬇	Byte 1	Byte 2	Byte n
1	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	…1 2 3 4 5 6 7 8
2	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	…1 2 3 4 5 6 7 8
3	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	…1 2 3 4 5 6 7 8
.	. . . . . .	. . . . . .	…. . . . . . .
.	. . . . . .	. . . . . .	…. . . . . . .
8	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8	…1 2 3 4 5 6 7 8

Vertical Format

In vertical format, each byte (or character) occupies six dot rows of one column. Each character is one dot wide and six dots high. The next character (byte 2) is printed beside the first moving from left to right across the page.

Byte➜ Row	1 bit	2 bit	3 bit	…n …bit
1	1	1	1	…1
2	2	2	2	…2
3	3	3	3	…3
4	4	4	4	…4
5	5	5	5	…5
6	6	6	6	…6
7	7	7	7	…7
8	8	8	8	…8

Other Graphics Considerations

In horizontal format, an LF causes the paper to advance one or two dot rows based on the vertical dot density, regardless of whether 6-bit or 8-bit graphics has been selected.

In vertical format, the paper is advanced as the dot rows (6 or 8, depending on graphics mode) are printed.

Graphics Sequences

ESC P

DCS (Device Control String): Enters dot graphics mode at the density and format previously selected by the ESC [p1;p2;p3 q sequence. Following this sequence, the printer prints discrete dots and leaves spaces based on the 1s and 0s in the low order six bits of each byte received. forming graphic dot rows from left to right. To exit from dot graphics mode, use ESC \.

While in graphics mode (after ESC P and before the ESC \ sequence), 8-bit graphics can be printed instead of 6-bit by using one of the following sequences:

ESC " 1 n1 <data bytes>   60 dpi horizontal
ESC " 2 n1 <data bytes>   120 dpi horizontal
ESC " 3 n1 <data bytes>   Uses current horizontal and vertical
                              density.

n1   number of data bytes to follow
<data bytes>   n1 bytes of graphics data

When the number of bytes of 8-bit data specified by n1 have been processed, and prior to receiving an ESC \ sequence, the data will print as 6-bit graphics.

Decimal: 27 101 80
Hex: 1B 5B 50
BASIC: CHR$(27);"P";

ESC [p1 b

REP (Repeat text or dot graphics character): Repeats the single preceding character p1 times. If p1 is 0 or unspecified, it is set to 1. The maximum value for p1 is 32,767.

Decimal: 27 101 p1 98
Hex: 1B 5B p1H 62
BASIC: CHR$(27);"[p1b";

ESC [p1 ; p2 ; p3 q GENGRM: Selects the graphics mode, format, and horizontal or vertical density for dot graphics.

> ### IMPORTANT
>
> This sequence must be sent before entering the graphics mode with ESC P.

The first parameter selects the graphics mode, the second parameter selects the vertical spacing, and the third selects the horizontal dot spacing.

p1 value	Selects Graphics Format
null	Reserved: Vertical format 60h x 72v if no p2 or p3
0	Reserved: Vertical format 60h x 72v if no p2 or p3
1	Reserved: Vertical format 120h x 72v if no p2 or p3
2	Reserved: Vertical format 120h x 144v if no p2 or p3
3	Reserved: Sequence ignored
4	Horizontal format 60h x 72v if no p2 or p3
5	Similar to 4, above, if p3 = 5, 6, or 7, else ignore
6+	Reserved: Sequence ignored

Note: p2 and p3 are ignored in this mode.

p2	Selects Vertical Density
null	72dpiv (p1=4 only)
0-6	144dpiv
7+	72dpiv

p3	Selects Horizontal Density
null	60dpih (p1=4 only)
0-3	Reserved: Leave current value unchanged
4	Reserved: Leave current value unchanged
5	Reserved: 120dpih
6-7	120dpih
8-10	Reserved: 60dpih
11+	60dpih

Decimal: 27 91 p1 p2 p3 112
Hex: 1B 5B p1H p2H p3H 70
BASIC: CHR$(27);"[p1p2p3q";

ELECTRONIC VERTICAL FORMAT UNIT - EVFU

Downline vertical tab loading is accomplished through the EVFU. The EVFU allows loading a form table with a minimum form length of .33 inches (240 decipoints) and a maximum length of 24 inches (17,280 decipoints).

Since the maximum length is 24 inches, the number of lines is dependent on the lpi setting. 3 lpi = 72 lines. 4 lpi = 96 lines. 6 lpi = 144 lines, and 8 lpi = 192 lines. Exceeding the maximum causes a fault.

Downloading the EVFU

- The vertical format type must be set to VtType:Emul VFU through the control panel using the Program Mode.

- No paper instruction lead (PI) is required.

- When the printer has an EVFU table loaded, VFU will be displayed on the control panel.

ESC] !

Starts EVFU table loading sequence. Each line of the form requires an entry. Dummy values (filler codes - See Table of Channel Codes on page 5-30) are required in lines with no channel. Two bytes are required for each line of the form. Loading Is terminated by the ESC \ sequence.

```
Decimal:      27 93 33
Hex:          1B 5D 21
BASIC:        CHR$(27);"]!";
```

Loading the Table

The first table location is normally loaded with the channel 1 code. This is defined as the top of form (TOF) channel. The table may be left without channel 1, and a command to skip to channel 1 will cause a normal form feed as though there was no VFU. Two bytes are loaded for each line of the form to be controlled. One or more channel numbers may be indicated in the two-byte code.

The format of two-byte channel control code is:

Bit Number	8	7	6	5	4	3	2	1
Channel Number	x	one	6	5	4	3	2	1
First Byte	x	one	y	y	y	y	y	y

Bit Number	8	7	6	5	4	3	2	1
Channel Number	x	one	12	11	10	9	8	7
Second Byte	x	one	y	y	y	y	y	y

y: 0 = no stop in channel
     1 = stop in channel

x: bit has no meaning

Each "channel control code" pair of bytes has the capability to indicate multiple channels since each channel indication has a unique bit position, which is either ON=1 or OFF=0.

TABLE OF CHANNEL CODES						
Decimal Value		Binary Value		ASCII Character		
1	2	1	2	1	2	Remarks
64	64	1000000	1000000	@	@	Fillers: see Note
65	64	1000001	1000000	A	@	Channel 1
66	64	1000010	1000000	B	@	Channel 2
68	64	1000100	1000000	D	@	Channel 3
72	64	1001000	1000000	H	@	Channel 4
80	64	1010000	1000000	P	@	Channel 5
96	64	1100000	1000000	`	@	Channel 6
64	65	1000000	1000001	@	A	Channel 7
64	66	1000000	1000010	@	B	Channel 8
64	68	1000000	1000100	@	D	Channel 9
64	72	1000000	1001000	@	H	Channel 10
64	80	1000000	1010000	@	P	Channel 11
64	96	1000000	1100000	@	`	Channel 12

BASIC Programming Example for EVFU Table Loading

PROGRAM INSTRUCTION	REMARKS
1500 WIDTH "LPT1:" 255	Required by some BASIC languages to avoid auto LF at column 80
1510 LPRINT CHR$(27) "]l":	Enables EVFU loading.
1520 LPRINT CHR$(65)CHR$(64);	Resets TOF, Channel 1 Sao Table of Channel Codes
1530 FOR I=1 to 4	
1531 LPRINT CHR$(64)CHR$(64);	4 filler lines
1532 NEXT I	
1540 LPRINT CHR$(68)CHR$(64);	Selects Channel 3. See Table of Channel Codes
1550 FOR I=1 to 16	
1551 LPRINT CHR$(64)CHR$(64);	16 filler lines
1552 NEXT I	
1560 LPRINT CHRS$72)CHR$(64);	Selects channel 4. See Table of Channel Codes
1570 FOR I=1 to 31	
1571 LPRINT CHR$(64)CHR$(64);	31 filler lines
1572 NEXT I	
1580 LPRINT CHR$(80)CHR$(64);	Selects channel 5. See Table of Channel Codes
1590 FOR I=1 to 8	
1591 LPRINT CHR$(64)CHR$(64);	8 filler lines
1592 NEXT I	
1600 LPRINT CHR$(64)CHR$(66);	Selects channel 8. See Table of Channel Codes
1610 LPRINT CHR$(27)" \";	Exit EVFU loading.
1620 END	

EVFU Default

The default EVFU will be generated based on the current form length and lpi setting under the following conditions:

- When the printer is initialized.

- When either the forms definition or lpi setting is changed.

- When the start EVFU load escape sequence ESC It is immediately followed by the end load sequence ESC \.

- When the emulation is changed from P Series or Dataproducts, to ANSI.

The following chart shows how the default EVFU table is defined:

CHANNEL	DESCRIPTION
1	Top Margin (first line
2	Bottom Margin (last line)
3	Single Spacing
4	Double Spacing
5	Triple Spacing
6	Half Form
7	Quarter Form
8	Tenth Line
9	Bottom of Form (bottom margin)
10	Bottom of Form minus 1 line
11	Top of Form minus 1 line (last line this form
12	Top of Form

Skip to Channel Command

ESC [p1 ; p2 ! p   **GENVFU (VFU Channel Command):** Commands vertical paper movement to the channel specified by the number formed by p1 and p2. Valid channel numbers are in the range 1- 12.

> 0;1 - selects channel 1
> 0;9 - selects channel 9
> 1;1 - selects channel 11

Channel 1 is always used for TOF; channel 12 is always used for vertical tab. If the channel number is greater than 12, then the program defaults to channel 1. If the table has not been loaded and a channel command is received, it is ignored.

Decimal: 27 101 p1 ; p2 ! 112
Hex: 1B 5B p1H 3B p2H 21 70
BASIC: CHR$(27);"[p1;p2!p";

BASIC Programming Example for Skip to Channel

This is a sample program showing the use of the skip-to-channel command. It makes use of the previously loaded EVFU program.

PROGRAM INSTRUCTION	REMARKS
10 WIDTH "LPT1:",255	Required by some BASIC languages to avoid auto LF at column 80
20 LPRINT CHR$(27)"[0;1!p";	Go to top of form (channel 1)
30 LPRINT "TOP OF FORM";	Print the indicated words
40 LPRINT CHR$(27)"[0;3!p";	Go to channel 3
50 LPRINT "LINE 6";	Print the indicated words
60 LPRINT CHR$(27)"[0;4!p";	Go to channel 4
70 LPRINT "LINE 25";	Print the indicated words
80 LPRINT CHR$(27)"[0;5!p";	Go to channel 5
90 LPRINT "LINE 57";	Print the indicated words
100 LPRINT CHR$(27)"0;8!p";	Go to channel 8
110 LPRINT "END OF FORM";	Print the indicated words
120 END	

INCHES LINE

TOP OF FORM

TOP MARGIN, LINE 6

LINE 25

BOTTOM MARGIN, LINE 57

END OF FORM
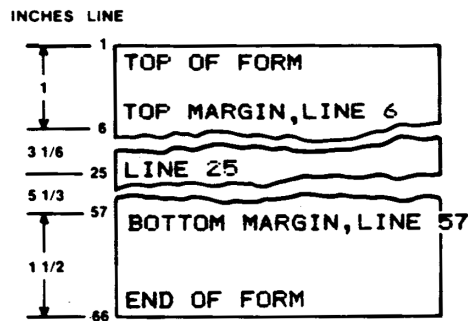
NOTE
Establish Top of Form locally before printing out forms. When executing the program, paper will slew to the top of the next form before beginning to print.

BARCODES

Thirteen different styles of barcodes and POSTNET are available. Each style (except POSTNET) can be rotated 90, 180, or 270 degrees and printed with or without a human-readable line (HRL). The barcode symbol size and density are also adjustable.

NOTE

Control sequences given in the following text show the proper syntax needed from the host. The second line has examples of code written in the BASIC program language.

Entering and Exiting Barcodes

Before the printer can print input data as barcode symbols. The barcode mode must be both selected and activated. There are two ways for this to be accomplished depending on the setting of printer option 1 for both 4800 and 4410 ANSI emulation.

Printer option 1 is used to enable the SI (shift in) and SO (shift out) ASCII codes to activate and deactivate special mode functions. In this case, the special mode function is barcodes. With option 1 enabled, code SO will turn on or activate the barcode mode. SI will turn barcodes off.

ANSI 4800/4410 Strap 1 OUT

Enter the barcode mode of printing with the following control sequence sent by the host. (See Appendix G for strapping options.)

ESC [3 t
LPRINT CHR$(27)*."[3t";

Data sent after the above sequence is interpreted and printed as barcodes.

Exit the barcode mode using:

ESC [0 t
LPRINT CHR$(27);"[0t";

ANSI 4800/4410 Strap 1 IN

(See Appendix G for strapping options.)

ESC [3 t
LPRINT CHR$(27);"[3t";
Selects the barcode special mode.

SO
LPRINT CHR$(14);
Activates barcodes and prints all received data as barcodes. (Only after it has been selected by ESC[3t above.)

SI
LPRINT CHR$15);
Deactivates barcodes and allows printing of normal text.

ESC[0t
LPRINT CHR$(27);"[0t";
Deselects barcodes.

When an ESC[0t is received before the SI code, barcodes are both deactivated and deselected.

Setting Barcode Parameters

Select the style, height, spacing, orientation, and print density for the barcode using the following escape sequence. The second line in the example (written in BASIC) shows the parameters that are the default values for the printer.

ESC[p1;p2;p3;p4;p5;p6.p7;p8;p9;p10)
LPRINT CHR$(27);"[4;9;1;2;6;2;6;2;0;0}";

p1: Style			
0	Interleaved 2 of 5	10	Codabar b/n
1	(Reserved for future use)	11	Codabar c/*
2	(Reserved for future use)	12	Codabar d/e
3	(Reserved for future use)	13	UPC-A
4	Code 3 of 9 (default)	14	UPC-E
5	EAN-8	15	Code 93
6	EAN-13	16	Code 128 (A, B, C)
7	Code 11	17	(Reserved for future use)
8	(Reserved for future use)	18	(Reserved for future use)
9	Codabar a/t	50	POSTNET (see note)

NOTE

When using POSTNET, parameters p2 through p10 are invalid. If these parameters are changed, they will be retained in memory and will affect other styles if selected. See Appendix F for more information on POSTNET.

Barcode Dimensions

p2   Barcode height in 1/12-inch increments

      Minimum: 1=l/12 inch
      Maximum: 120=10 inches
      Default: 9=9/12 inch (3 / 4 inch)
      Human-readable line is not included in height.

p3   Human-readable line

      0=Do not print human-readable line
      1=Print human-readable line (default)

p4   Narrow bar width, number x 1/120 inch

      Default: 2 (2/120 inch, approximately .017 inch)
      Range: 2, 4, 6, . . . 126

p5*   Wide bar width, number x 1/120 inch

      Default: 6 (6/120 inch, approximately . 050 inch)
      Range: 2, 4, 6, . . . 254

p6   Narrow space width, number x 1/120 inch

      Default: 2 (2/120 inch, approximately . 017 inch)
      Range: 2. 4, 6, . . .126

p7*   Wide space width, number x 1/120 inch

      Default: 6 (6/120 Inch. approximately .050 inch)
      Range: 2, 4, 6, . . . 254

p8*   Intercharacter space width, number x: 1/120 inch

      Default: 2 (2/120 inch, approximately . 017 inch)
      Range: 2, 4, 6 . . . 126

* Parameters p5, p7, and p8 are not programmable in some barcode styles since they are generated from other parameters.

p9   Barcode rotation and human-readable line (HRL) font style (if used).

- 0   No rotation - use currently selected font style, cpi, and lpi. This is the default setting.

- 1   No rotation - use special HRL font.

- 2   90-degree rotation use special HRL font

- 3   180-degree rotation use special FIRL font.

- 4   270-degree rotation use special HRL font.

p 10   Horizontal print density

- 0   60 dpi horizontal by 144 dpi vertical print density
- 1   120 dpi horizontal by 144 dpi vertical print density

Default for barcode styles 5, 6, 13, and 14 is 120 dpi.
Default for all other styles is 60 dpi.

Barcodes printed at 90 or 270 degrees rotation will print at the same speed (120 x 144) regardless of the selected horizontal density.

A missing parameter will leave the corresponding value unchanged.

IMPORTANT

If no parameters have previously been entered, then the factory default values will be used. If previous values have been sent from the host. these values will prevail until changed by the host or the printer is reset using the initialization switch.

A zero parameter value for p2–p8 will cause the default value to be selected.

Use semicolons as place holders when changing parameters.

```
LPRINT CHR$(27);"[;;;;;;;;;;1}"   Changes only parameter 10.
LPRINT CHR$(27);"15;;0}"          Changes only parameters 1 and 3.
LPRINT CHR$(27);"[16}"            Changes only the style of the barcode.
```

If no changes are made to the parameters of the barcode, the printer will use the following factory-set values.

Default Barcode Characteristics

p1=4   Code 39
p2=9   3/4 inch height
p3=1   Human-readable line printed
p4=2   Narrow bar width 1/60 inch
p5=6   Wide bar width 1/20 inch
p6=2   Narrow space width 1/60 inch
p7=6   Wide space width 1/20 inch
p8=2   Intercharacter space width 1/60 inch
p9=0   No rotation, use currently selected font
p10=0 Horizontal print density 60 dpi

Human-Readable Line (HRL)

The human-readable line is printed 0. 10 inch below the bar code symbol. The height of the HRL and the 0.10 inch space are not included in the bar code height parameter (p2).

A diamond symbol appearing in the human-readable line indicates one of the following conditions:

• Margin overrun. The data to be printed exceeds the available space remaining inside the programmed margins.

• The DEL character has been received while printing in a bar code style that permits the use of all 128 ASCH characters.

• An invalid character has been received. An example of this would be a letter "A" sent to the printer while printing a style 5 bar code. Style 5 (EAN-8) only accepts the digits 0-9.

Font Styles and Enhancements

Non-rotated bar codes can be printed with an HRL in any of the fonts available to the printer.

If enhancements are desired (e.g., bold, underline, or expanded) the HRL must be printed using the normal text mode. Print the bar code symbol(s) without the HRL first. Exit the bar code mode and print the HRL using the normal text mode with enhancements.

Rotated bar codes use a special font for the human-readable line.

Spacing and Bar Code Editing Aids

There is a 0.25-inch space called a quiet zone at the beginning and end of every bar code. As a result, the minimum distance between two horizontal bar codes will be 0.50 inch.

Most bar code styles accept commas. spaces, and horizontal tabs as delimiters to separate bar codes. A comma will add no additional space between bar codes, so the separation will be the width of the quiet zone or 0.50 inch. A space character will add 0.10 inch to the quiet zone for a total of 0.60-inch separation. A horizontal tab will add the appropriate number of empty spaces to go to the next tab.

Bar Code Readability Statement

The following information is provided to ensure that the best results are obtained from your printed bar codes.

Use bar code readers designed to operate in the visible light frequency range. Optional infrared-readable ribbon cartridges are available.

Use bar code readers designed to read medium- or low-density bar code symbols. Avoid readers with apertures less than 7 mils (. 007 inch or . 18mm).

Using bar code size parameters smaller than the default settings may produce unacceptable results.

Bar Code Program Examples

The following program examples are provided to help you become familiar with the bar code escape sequences. The programs are written in BASIC and printed using the LUST command. All bar codes are actual size.

Test Program

This is the minimum code needed to print a bar code. Use it to test the printer's ability to print bar codes when more complicated programs are not producing results.

Line 10 turns on the bar code mode. line 20 contains the data to be printed as a bar code symbol, and line 30 turns off the bar code mode.

```
10 LPRINT CHR$(27); "[3t";
20 LPRINT "1234567890";
30 LPRINT CHRS(27); "[0t";
```



```
1234567890
```

Error Symbol

This example shows the error symbol in the HRL and the error pattern in the symbol. The error pattern causes the entire symbol to be rejected by the bar code reader.

The error was caused by the lowercase "a" being inserted into the data. The default style, Code 3 of 9. accepts only uppercase A-Z, the numbers 0-9, and the characters

```
10 LPRINT CHR$(27); "[3t";
20 LPRINT "1a34567890";
30 LPRINT CHR$(27); "[0t"
```



```
1◊34567890
```

Changing Parameters

This example changes the style p1, height p2, and the HRL font p9 of the bar code. Notice that semicolons are used as place holders for the parameters not being changed.

Line 10 - change style to Code 128, change height to 1/4" (3/12"). and use the special HRL font.

```
10 LPRINT CHR$(27);
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234567890";
40 LPRINT CHR$(27); "[0t"
```


1234567890
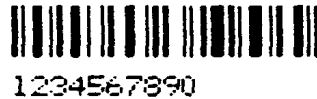
Commas and Spaces as Delimiters

When a comma delimiter is used to separate bar codes, no additional space Is added to the quiet zones. Since the ending .25-inch quiet zone of one bar code symbol meets the beginning quiet zone of the next bar code, a total of . 50 inch separates the two. Style 7 (line 5) is used for these examples since Code 11 uses both spaces and commas as delimiters.

```
10 LPRINT CHR$27); "[7}";
20 LPRINT CHR$27); "[3t";
30 LPRINT "1234,56,7890";
40 LPRINT CHR$27); "0t"
```


1234   56   7890

When spaces are used as delimiters, an additional 1 inch is added to the quiet zones. Note that multiple spaces can be used.

```
10 LPRINT CHR$27); "[3t"
20 LPRINT "1234567890";
30 LPRINT CHR$27); "[0t"
```


1234   56   7890

Horizontal Spacing

Use horizontal tabs for spacing bar code symbols across the page. Line 10 sets horizontal tabs at 1440 and 2880 decipoints (2 and 4 inches). The HT codes in lines 40 and 60 cause a jump to the next tab.

```
10 LPRINT CHR$27); "[1440;2880;u";
20 LPRINT CHR$27); "[3t";
30 LPRINT "1234";
40 LPRINT CHR$(9);
50 LPRINT "5678";
60 LPRINT CHR$(9);
70 LPRINT "9012";
80 LPRINT CHR$27); "[0t"
```
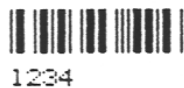

When no horizontal tabs are set, an HT code acts as a space. adding 0.1 inch to the separation. Total separation is 0.6 inch when the HT is added to the quiet zones.

Line 10 clears all previously set horizontal tabs for this example.

```
10 LPRINT CHR$(27); "[3g";
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234";
40 LPRINT CHR$(9);
50 LPRINT "5678";
60 LPRINT CHR$(9);
70 LPRINT "9012";
80 LPRINT CHR$(27); "[0t"
```
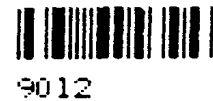

Printer Option Strap 13, Group 2 IN

Printer control strap 13 is used for positioning the paper after printing a bar code. Strap 13 IN sets the paper to the top of the bar code after printing; strap 13 OUT leaves the paper position as is after printing a bar code.

The state of strap 13 can be checked and changed using the configuration menu.

In the following examples, lines 10-30 print the bar code symbol and line 40 adds a line of text to be printed.

Examples 1 and 2 show the effect strap 13 has on the position of the text.

In example 3, the semicolon at the end of line 30 has been deleted to show that strap 13 only affects the same horizontal zone that the bar

---

code occupies. The semicolon in BASIC Is used to suppress a LF/CR after an LPRINT statement.

EXAMPLE 1: Strap 13 OUT

```
10 LPRINT CHR$(27); "[3t";
20 LPRINT "1234567890";
30 LPRINT CHR$(27); "[0t";
40 LPRINT "STRAP 13 OUT"
```


1234567890   STRAP 13 OUT

EXAMPLE 2: Strap 13 IN

```
10 LPRINT CHR$(27); "[3t";
20 LPRINT "1234567890";
30 LPRINT CHR$(27); "[0t";
40 LPRINT "STRAP 13 IN"
```


STRAP 13 IN

1234567890

EXAMPLE 3: Strap 13 OUT with no suppression of LF/CR on line 30

```
10 LPRINT CHR$(27); "[3t";
20 LPRINT "1234567890";
30 LPRINT CHR$(27); "[0t"
40 LPRINT "STRAP 13 OUT"
```


1234567890

STRAP 13 OUT

Vertical Bar Codes

- ▪ Line 10 sets parameter p9 for 90-degree rotation using the special font for the HRL.

- ▪ Line 20 turns on the bar code mode.

- ▪ Line 30 is the data to be printed as a bar code symbol.

- ▪ Line 40 turns off the bar code mode.

```
10 LPRINT CHR$(27); "[;;;;;;;;;2}";
20 LPRINT CHR$(27); "[3t";
30 LPRINT "12345";
40 LPRINT CHR$(27); "[0t"
```

Commas and spaces used as delimiters serve the same function as in horizontal bar codes. However, the quiet zones rotate with the symbol, leaving almost no horizontal separation between bar codes on the same line.

In the following examples, line 10 is used to print or inhibit the printing of the HRL (p3).

COMMAS: With HRL

```
10 LPRINT CHR$(27);
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234,5678,9012";
40 LPRINT CHR$(27); "[0t"
```

COMMAS: Without HRL

10 LPRINT CHR$(27); "[;;0)";
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234,5678,9012";
40 LPRINT CHR$(27); "10t"
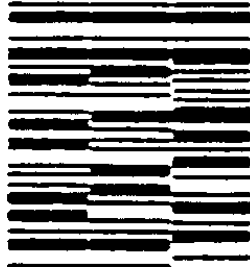
SPACES: With HRL

10 LPRINT CHR$(27);
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234   ₁5678 9012";
40 LPRINT CHR$(27); "[0t"

SPACES: Without HRL

10 LPRINT CHR$(27); "[;;0)";
20 LPRINT CHR$(27); "[3t";
30 LPRINT "1234   5678   9012";
40 LPRINT CHR$(27); "[0t"

HORIZONTAL TABS

- Line 10 sets horizontal tab stops at 1080 and 2160 decipoints (1. 5 and 3 inches).

- Lines 40 and 60 are ITT codes that cause a jump to the next tab stop.

Line 90 is a line of text to show positioning on the paper. The vertical separation between the bar code symbol and the text "A10 OUT" is the ending quiet zone.

```
10 LPRINT CHR$(27); "[1080;2160;u";
20 LPRINT CHR$(27); "[3t";
30 LPRINT "12345";
40 LPRINT CHR$(9);
50 LPRINT "12345";
60 LPRINT CHR$(9);
70 LPRINT "12345";
80 LPRINT CHR$(27); "[0t";

90 LPRINT "TEXT A-10 OUT"
```

TEXT A-10 OUT

OVERSIZE CHARACTER FONT

The oversize font is composed of special block-style characters that can be expanded 156 times the size of standard fonts. This will produce letters up to 15.25-inches (388mm) high by 13 inches (330mm) wide. Oversize characters can be rotated 90, 180, or 270 degrees.

Do not confuse oversize characters with expanded characters. The expanded character feature, (standard in your printer), expands all existing fonts up to 8 times the normal size. These characters are not rotatable.

The oversize character feature works with the ANSI protocol.

Entering and Exiting Oversize

The following sequences are used to enter, rotate, and exit oversize printing:

ESC [0 | Exit oversize printing.
ESC [1 | Select oversize font with no rotation.
ESC [2 | Select oversize font with 90-degree rotation.
ESC [3 | Select oversize font with 180-degree rotation.
ESC [4 | Select oversize font with 270-degree rotation.

LPRINT CHR$(27);"[0|";   or
LPRINT CHR$(27);"[0|";CHR$(124);

Once oversize has been turned on, it will remain on until an ESC [0 | sequence is used to turned it off. It does not turn off due to line terminators (CR and LF).

NO ROTATION   90-DEGREE ROTATION   180-DEGREE ROTATION   270-DEGREE ROTATION
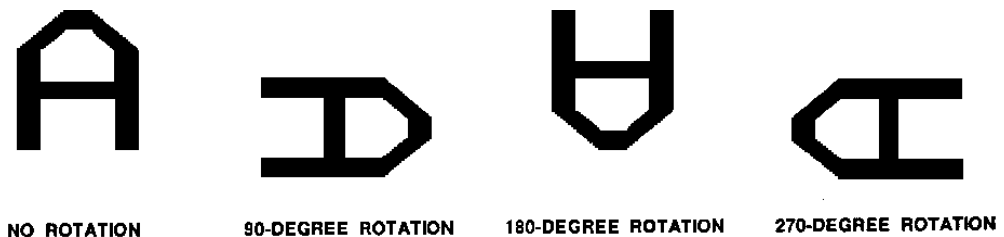
Selecting Size

ESC [p1;p2 B is the sequence used to set the vertical (p1) and horizontal (p2) size of the oversize characters. A p1 value of 300 would increase the vertical size of the character 300% or 3 times.

The last two digits of each parameter are necessary to comply with the ANSI standard, but are ignored by the printer. Using the above example for p1, any three-digit number starting with 3 (300-399) will be interpreted as 3 times normal size. Likewise, 400-499 equals 4 times, 1200-1299 equals a 12-times increase in size, and so on. The

maximum size is 15600;15600 (156 times) and the minimum or default is 200;200 (2 times).

Since this same sequence is used to change size in the expanded mode, the parameters must be cleared to normal size, ESC [100;100 B, to prevent entering expanded mode when oversize is turned off.

Mnemonic: ESC [p1; p2 B
Decimal: 27 91 p1 59 p2 66
Hex: 1B 5B p1H 3B p2 42
BASIC: CHR$(27);"[";p1;";";p2;"B";

Size Parameters for Rotation

The p1 and p2 size parameters are always relative to a rotation angle of zero degrees. That is, the characters are expanded first and then rotated.

Spacing Between Characters

For non-rotated characters and characters rotated 180 degrees, the horizontal spacing between characters is 1/60-inch times the p2 parameter.

For characters rotated 90 or 270 degrees, the horizontal spacing between characters is 3/60-inch times the p1 parameter.

Vertical spacing is dependent on vertical paper move commands (LF, CR, VPR, etc.), the state of menu option GenPrtOpts/Group 2/Strap 13, and the character size and line spacing currently in effect.

Sample Programs

Example 1

The first example shows the code used to print oversize.

Line 10 sets the size to X3 vertical (V) and X3 horizontal (H). Line 20 enters oversize printing with no rotation. Line 30 is the data to be printed. Line 40 exits oversize printing. Line 50 returns the size parameters to X 1 V - X 1 H.

```
10 LPRINT CHR$(27); "[300;300B";
20 LPRINT CHR$(27); "[1|";
30 LPRINT "ABCabc";
40 LPRINT CHR$(27); "[0|";
50 LPRINT CHR$(27); "[100;100B"
```

ABCabc

Example 2

The next two examples demonstrate the importance of setting the size parameters back to X1 V - X1 H after printing oversize. This is the same program used in Example 1 with an additional line added.

Line 60 prints 1234 in the currently selected font.

```
10 LPRINT CHR$(27); "[300;300 B";
20 LPRINT CHR$(27); "El:";
30 LPRINT "ABCabc"
40 LPRINT CHR$(27); "CO:";
50 LPRINT CHR$(27); "[100;100 B"
60 LPRINT "1234"
```

ABCabc

1234

NOTE

In BASIC, LPRINT statements automatically generate an LF/CR at the end of the line unless suppressed by a semicolon. Since line 30 does not end with a semicolon, an LF/CR occurred at the lpi in effect (still in oversize). This accounts for the vertical distance between the ABCabc line and the 1234 line.

Example 3: Showing the Importance of Resetting Scaling Factors

If line 50, which sets the size to X1 V and X1 H. is removed, the data printed in line 60 is now subject to the expanded mode of printing. Notice (below) that the 1234 printed line is expanded vertically by X3

10 LPRINT CHR$(27); "[300;300 B";
20 LPRINT CHR$(27); "El:";
30 LPRINT "ABCabc";
40 LPRINT CHR$(27); "[0:"
60 LPRINT "1234"

Printer Control Strap GenPrtOpts/Group 2/Strap 13

This printer control strap is used for positioning the paper after printing oversize characters. When this strap is set to IN, the paper is positioned at the top of the oversize character after printing; when set to OUT, the paper position remains as is after printing oversize.

The state of the printer strap can be checked and changed using the configuration menu.

In the following examples:

- Lines 10-30 print oversize characters at X3.

- Line 50 changes the oversize to X4 V by X6 H.

- Lines 70-80 print oversize and exits.

- Line 90 returns the parameters to X1 to prevent expanded printing.

- Lines 100-110 print normal text to show the effect that strap 13 has on positioning.

IMPORTANT

Line spacing was set back to normal (6 lpi) when normal text was selected in line 90. When strap 13 is IN and the paper position returns to the top of oversize, vertical moves (CR, LF, VPA, VPR) must be used to move the paper to prevent overprinting on the oversize characters.

Example 4: GenPtrOpts | Group 2 Strap 13 IN

The oversized characters and the first line of normal printing are aligned at the first print line. The second line of normal printing (Text Text Text . . .) started printing one line below Strap 13 IN and overprints the oversized text.

```
100 LPRINT CHR$(27);"[300;300B";
110 LPRINT CHR$(27);"[1|";
120 LPRINT "ABC";
130 LPRINT CHR$(27);"[400;600B";
140 LPRINT "ABC";
150 LPRINT CHR$(27);"[0|";
160 LPRINT CHR$(27);"[100;100B";
170 LPRINT "Strap 13 IN";
180 LPRINT "Text  Text  Text  Text  Text  Text  Text"
```


Example 5: GenPtrOpts | Group 2 Strap 13 OUT

Paper motion is not returned after printing oversized characters.