Chapter 7: Page Control

Contents of this Chapter

This chapter describes commands which affect a single page or a group of pages (as opposed to job control commands, which are issued at the beginning of the job and affect the entire job).

This chapter describes the following PCL commands:

7.1 Introduction

Job control commands are usually sent at print job boundaries, but page control commands are associated with a single page or group of pages. If consecutive pages have the same format, the appropriate page control commands need only be sent once for that group of pages. Page control commands determine such features as media source, size, orientation, margins, and text spacing.

7.2 Media Size

The default logical page length extends from the top edge of the physical page to the bottom edge. The width is device dependent and may not extend as far as the unprintable area on the sides.

Page Length (*Esc&l#P*) sets the logical page length for a given LMI. Page Size (*Esc&l#A*), which selects the physical page size from one of several pre-set sizes, indirectly sets logical page length (which is coincident with physical page length).

For comparison, some DeskJet 540 printable areas for standard media sizes in portrait orientation are shown below. The right edge of the printable area can be found if the left edge is known: the right edge equals the physical media width minus the left edge. On the DeskJet 540, logical page width is coincident with the sides of the printable area, but this is not the case on all devices.

Supported Media Size	Printable Area	Unprintable Area	
		Left Edge	Top Edge
US Executive 7¼″ × 10½″ 184.1 mm × 266.7 mm	6.750″ x 10.040″ 171.5 mm x 255.0 mm	0.250″ 6.3 mm	0″ 0 mm
US Letter 8½″ × 11″ 215.9 mm × 279.4 mm	8.00″ x 10.540″ 203.2 mm x 267.7 mm	0.250″ 6.3 mm	0″ 0 mm
ISO & JIS A4 8.268″ x 11.693″ 210 mm x 297 mm	8.000″ x 11.232″ 203.2 mm x 285.3 mm	0.133″ 3.4 mm	0″ 0 mm
ISO & JIS A5 5.827″ x 8.268″ 148 mm x 210 mm	5.575″ x 7.559″ 141.6 mm x 192 mm	0.125″ 3.2 mm	0″ 0 mm
JIS B5 7.165″ x 10.118″ 182 mm x 257 mm	6.832″ x 9.658″ 173.6 mm x 245.3 mm	0.167″ 4.2 mm	0″ 0 mm
US Card Stock 4″ x 6″ 101.6 mm x 152.4 mm	3.750″ x 5.291″ 95.2 mm x 134.4 mm	0.125″ 3.2 mm	0″ 0 mm
No.10 Envelopes 4 1/8″ x 9 1/2″ 104.8 mm x 241.3 mm	3.875″ x 8.791″ 98.4 mm x 223.3 mm	0.125″ 3.2 mm	0″ 0 mm

Page Length   *Esc & l # p/P*

Designates the length of the logical page for a given LMI.

Value(#)   =   Number of lines at a given LMI
Default   =   Device dependent
Range   =   0 to the maximum supported paper size (other values ignored and
current size retained)**

* A value of 0 should set page length to the operator setting if possible; otherwise, to the physical page page length if it can be sensed; otherwise, to 11 inches.

This command performs the following actions:

- Prints any unprinted pages.
- Ejects the current page if printable data has been received (FF-CR).
- Sets text length, top margin, left margin, and right margin to user defaults.
- Moves CAP to the left edge of the logical page at the top margin and floats CAP.
- Disables the automatic macro overlay.
- Defaults the picture frame anchor point.
- Defaults the picture frame.
- Defaults the PCL print direction.
- Defaults the HP-GL/2 plot size.
- Defaults the soft clip window.
- Defaults the HP-GL/2 scaling points, P1 and P2.
- Updates the HP-GL/2 pen position to the lower-left corner of the picture frame.
- Clears the HP-GL/2 polygon buffer.
- Performs an HP-GL/2 *IN* command.

The printer may select a different page size for the same line count, since lines are defined by the current LMI. This command is ignored if LMI is 0.

The following table lists the page length line values associated with some standard paper sizes. To calculate the number of lines per page, multiply lines per inch (lpi) times the length of the physical page. For example, US Letter size paper is 11 inches; therefore: $6 \times 11 = 66$.

Portrait Orientation Page Length Settings

Paper Size	6 lpi	8 lpi
Letter	66	88
Legal	84	112
A4	70	93
Executive	63	84
Ledger	102	136
A3	99	132

DEVICE NOTE: The Page Length command must be used with pre-LJII's except LJ2000 to set page size. LJII and later and the LJ2000 may use either Page Length (*Esc&l#P*) or Page Size (*Esc&l#A*). Page Size is preferred.

DEVICE NOTE: Default length may be switch-selectable. Common lengths are 8.5, 11, 12.

Page Size   *Esc & l # a/A*

Designates the size of the media as one of those listed below.

Value(#)   =   Page size (listed below)
Default   =   Device dependent
Range   =   Listed below (unsupported values are ignored)

This command performs the following actions:

- Prints any unprinted pages.
- Ejects the current page if printable data has been received (FF-CR).
- Sets text length, top margin, left margin, and right margin to user defaults.
- Moves CAP to the left edge of the logical page at the top margin.
- Disables the automatic macro overlay.
- Defaults the picture frame anchor point.
- Defaults the picture frame.
- Defaults the PCL print direction.
- Defaults the HP-GL/2 plot size.
- Defaults the soft clip window.
- Defaults the HP-GL/2 scaling points, P1 and P2.
- Updates the HP-GL/2 pen position to the lower-left corner of the picture frame.
- Clears the HP-GL/2 polygon buffer.
- Performs an HP-GL/2 *IN* command.

NOTE: A minus sign distinguishes two paper mounting positions with the same paper size. Unsigned or positive selects lengthwise; negative selects widthwise. Devices supporting one mounting position ignore the sign.

This command also sets logical page length, since the logical page is defined to extend from the top and bottom edges of the physical page.

The following table lists the current paper sizes selectable by this command.

Value	Page Description	Page Size
1	US-Executive	7.25" x 10.5"
2	US-Letter	8.5" x 11"
3	US-Legal	8.5" x 14"
4	US-EDP	11" x 14"
5	European-EDP	12" x 14"
6	Ledger	11" x 17"
7	US Government Letter	8" x 10"
8	US Government Legal	8" x 13"
9	Folio	8.3" x 13"
10	Foolscap	8.5" x 13"
11	Ledger	11" x 17"
12	C Size	17" x 22"
13	D Size	22" x 34"
14	E Size	34" x 44"
15	Mini (US-Personal)	5.5" x 8.5"
20	ISO and JIS A10	26mm x 37mm
21	ISO and JIS A9	37mm x 52mm
22	ISO and JIS A8	52mm x 74mm
Value	**Page Description**	**Page Size**

23	ISO and JIS A7	74mm x 105mm
24	ISO and JIS A6	105mm x 148mm
25	ISO and JIS A5	148mm x 210mm
26	ISO and JIS A4	210mm x 297mm
27	ISO and JIS A3	297mm x 420mm
28	ISO and JIS A2	420mm x 594mm
29	ISO and JIS A1	594mm x 841mm
30	ISO and JIS A0	841mm x 1189mm
31	ISO and JIS 2A0	1189mm x 1682mm
32	ISO and JIS 4A0	1682mm x 2378mm
40	JIS B10	32mm x 45mm
41	JIS B9	45mm x 64mm
42	JIS B8	64mm x 91mm
43	JIS B7	91mm x 128mm
44	JIS B6	128mm x 182mm
45	JIS B5	182mm x 257mm
46	JIS B4	257mm x 364mm
47	JIS B3	364 x 515mm
48	JIS B2	515mm x 728mm
49	JIS B1	728mm x 1030mm
50	JIS B0	1030mm x 1456mm
60	ISO B10	31mm x 44mm
61	ISO B9	44mm x 62mm
62	ISO B8	62mm x 88mm
63	ISO B7	88mm x 125mm
64	ISO B6	125mm x 176mm
65	ISO B5	176mm x 250mm
66	ISO B4	250mm x 353mm
67	ISO B3	353mm x 500mm
68	ISO B2	500mm x 707mm
69	ISO B1	707mm x 1000mm
70	ISO B0	1000mm x 1414mm
71	Hagaki (Japanese single-size postcard)	100mm x148mm
72	Oufuku-hagaki (round-trip postcard)	148mm x 200mm
73	Same as 24 but card, not cutsheet	105mm x 148mm
74	Index card 4x6	4″ x 6″
75	Index card 5x8	5″ x 8″

Value	Envelope Description	Envelope Size
-90	International DL (landscape)	110mm x 220mm
-81	Number 10 (landscape)	4 1/8" x 9 1/2"
80	Monarch (Letter)	3 7/8" x 7 1/2"
81	Commercial-10 (Business)	4 1/8" x 9 1/2"
82	Catalog 1	6" x 9"
90	International DL	110mm x 220mm
91	International C5	162mm x 229mm
92	International C6	114mm x 162mm
93	International C4	229mm x 324mm
100	International B5	176mm x 250mm
101	Custom	Device specific
102	Commercial-9	98mm x 225mm
103	Commercial-11	114mm x 264mm
104	Letter Envelope	8.5″ x 11″
105	US C5	6.5″ x 9.5″
106	Postfix (Italian)	114mm x 229mm
107	Custom Envelope	Device specific
108	Custom Card	Device specific
109	Standard US Invitation (5.5 Baronial)	4 3/8" x 5 3/4"
110	Japanese Long Envelope #3	120mm x 235mm
111	Japanese Long Envelope #4	90mm x 205mm

DEVICE NOTE: Pre-LJIIs ignore this command and use Page Length (*Esc&l#P*). LaserJets set logical page width to (physical width - 1/2") for US portrait sizes, to (physical width - 12mm) for European portrait sizes, to (physical length - 2/5") for US landscape sizes, and to (physical length - 10 mm) for European landscape sizes.

DEVICE NOTE: Since DJ Classic only loaded envelopes widthwise (normally specified by -81), it ignored the sign. Later DJs maintained compatibility by switching to landscape for a -81 and not changing the current orientation for an 81. DJ850C saves the current orientation when it receives an 81, excutes the command, and then restores the saved orientation when it receives a Reset, Orientation, or Page Size command specifying anything but 81. DJs below 850 change but do not save orientation.

DEVICE NOTE: "Custom" (101) allows ranges to the largest supported paper size. Custom is treated like an envelope to prompt a manual feed. LJ4+ uses (3" x 5" to 8.5" x 14") and DJ540, 660, 850 use (5" x 8.5" to 5.83" x 14"). LJ4V uses 3.9" x 5.8" to 11.7"x 17.7".

DEVICE NOTE: Color LJ supports only the value of 6 to select ledger (11x17). LJ4 and Eclipse support both 6 and 11.

Media Eject Length   *Esc & f # f/F*

Sets the length of paper to be "ejected" when a page eject is requested on variable length media devices (e.g., fanfold printers and roll feed plotters).

Value(#)   =   Media eject length in decipoints (1/720 inch)
Default   =   Device dependent (should be taken from User Default Environment)
Range   =   0 to the maximum supported paper length (command is ignored for
            other values and the current paper length is retained)

This command performs the following actions:

- If printable data has been received, it executes a FF-CR using the old media eject length.
- Sets the new media eject length.
- Sets text length, top margin, left margin, and right margin to user defaults.
- Moves CAP to the top of form at the left edge of the logical page if not already there.
- Disables the automatic macro overlay.

This command is used when the page eject length does not equal the physical page size defined by the Page Size (*Esc&l#A*) and Page Length (*Esc&l#P*) commands because of media or equipment constraints.

The media eject length need not be the same as the physical page size defined by Page Size (*Esc&l#A*) or Page Length (*Esc&l#P*). If the media eject length is shorter than the physical page size, the physical page image will be clipped to fit the media eject size. If the media eject length is longer than the physical page size, the excess length will appear after the page image (to the bottom and right of the page image so the page image is placed at the upper left edge).

DEVICE NOTE: The default media eject length on HP5000 fanfold printers is the control panel setting for page length.

Page Width   *Esc & f # g/G*

Designates the width of the logical page for a given CMI.

Value(#)   =   Logical page width in decipoints (1/720 inch)
Default   =   Device dependent
Range   =   0 to the maximum supported page width (command is ignored for
other values and the current paper length is retained) *

* If a value of 0 is received, page width should be set to the operator setting if applicable; otherwise, the default page width should be based on the physical page width if it can be sensed; otherwise to 8.5 inches portrait, 11 inches landscape orientation.

This command performs the following actions:

- Executes FF-CR on the current page if printable data has been received.
- Sets text length, top margin, left margin, and right margin to user defaults.
- Moves CAP to the top of form at the left edge of the logical page if not already there.
- Disables the automatic macro overlay.

The page width remains in effect until a new Page Width command is received or a power cycle occurs.

NOTE: This command should be used in conjunction with the Media Eject Length command (*Esc&f#F*) to fully define a variable logical page size on hardcopy devices that support setting variable page sizes. Both the Media Eject Length and Page Width commands should be transmitted at the beginning of a page prior to any printable data; otherwise, when the command is sent the current page is closed and printed.

7.3 Media Source

Media Source   *Esc & l # h/H*

Selects the media source.

Value(#)	=	-2	Preload (a sheet is loaded prior to printable data)
	=	-1	Tractor feed
	=	0	Print current page (source is unchanged)
	=	1	Tray 1 (usually the upper tray in a 2-tray system)
	=	2	Manual feed
	=	3	Manual envelope feed
	=	4	Tray 2 (usually the lower tray in a 2-tray system)
	=	5	Optional media source
	=	6	Optional envelope feeder [*]
	=	7	Autoselect
Default	=	Device dependent	
Range	=	-2 to 7 (non-existent selections cause a default)	

[*] Must be used in conjunction with an envelope selection using the *Page Size* command.

This command prints the current page and moves CAP to top of form at the left margin on the next physical page. The command remains effective until another tray is selected.

A value of 7 (autoselect) selects the current printer default source. The user, through the application, may select a particular tray for the first page or pages (e.g., a fancy cover page), then choose autoselect to pull paper from a default tray (e.g., containing standard paper). This is different than option 0, which continues printing from the currently selected source. The "default" source may be user-selected, or based upon the printer's own algorithm. The autoselect option allows the Windows driver to select the default media source at any time during printing by sending an *Esc&l7H*. The driver does not need to know which tray is loaded; it simply selects the default source, which is determined by a user setting or the printer's internal algorithm.

DEVICE NOTE: In a multibin LaserJet, *Page Size* has priority over *Media Source*: if paper is requested from a location containing an incorrect paper size, the printer selects the paper location with the currently selected size if one is available. The default paper source is determined by the default page size.

DEVICE NOTE: On the Color LaserJet, the following values mean:

1	=	Feed from main front cassette (Tray #1)
2	=	Feed from manual top rear input (Tray #2)
4	=	Feed from optional cassette or alternate feed unit cassett at the top rear
5	=	Feed from large media source (replaceable main cassette)

DEVICE NOTE: For HP5000 cutsheet printers, tray #1 is the tray with the largest paper capacity; and tray#2 is the tray with the second largest paper capacity.
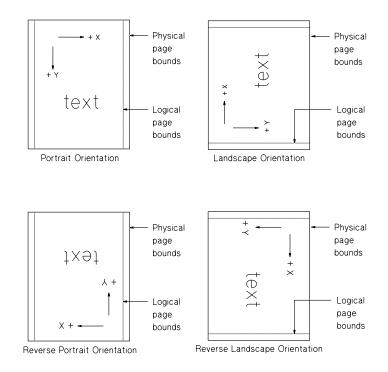
7.4 Orientation

Orientation defines the position of the logical page on the physical page. *Portrait* orientation means (0,0) is toward the top left corner of the physical page: positive X direction is to the right and positive Y direction downward. In *reverse portrait* orientation, (0,0) is toward the lower right corner of the physical page: positive X direction is to the left and positive Y direction upward.

Landscape orientation means (0,0) is toward the lower left corner of the physical page with the X direction up and the Y direction to the right. In *reverse landscape* orientation, (0,0) is toward the upper right corner of the physical page with the X direction downward and the Y direction toward the left.

Logical page orientation changes text orientation, not raster graphics orientation; for example, raster graphics will continue to print in portrait if orientation is changed from portrait to landscape. Fonts automatically rotate to the current orientation on devices having auto-rotation.

Although orientation may be changed by either the Orientation command or the Print Direction command, these two commands have different side-effects:

- Orientation ejects the page and Print Direction does not; therefore, Print Direction can be used to make orientation changes on the same page.

- Print Direction does not affect HP-GL/2 graphics unless HP-GL/2 is entered with *Esc%2B* or *Esc%3B*. HP-GL/2 graphics can always be rotated by the Orientation or "RO" commands.
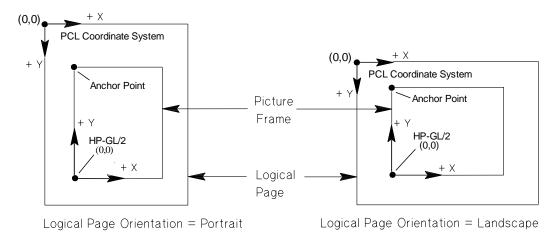
Portrait Orientation

Landscape Orientation

Reverse Portrait Orientation

Reverse Landscape Orientation

HP-GL/2 Orientation

Default HP-GL/2 orientation tracks the Orientation command (*Esc&l#O*). If HP-GL/2 was entered by *Esc%2B* or *Esc%3B*, HP-GL/2 orientation also tracks Print Direction (*Esc&a#P*).

In both coordinate systems, X-axes are parallel and increase in the same direction; Y-axes are parallel and increase in opposite directions. This remains true even if logical page orientation changes.

For more information, see Chapter 17.

How HP-GL/2 Orientation Tracks Logical Page Orientation

Orientation   *Esc & l # o/O*

Defines the position of the logical page and the default direction of print with respect to the physical page.

```
Value(#)   =   0   Portrait
           =   1   Landscape
           =   2   Reverse portrait
           =   3   Reverse landscape
Default    =   0
Range      =   0 to 3
```

This command ejects the current page if it contains printable data and opens another page in the new orientation. CAP moves to the intersection of the left margin and top of form (top margin plus 3/4 line spacing). The command is ignored if the new orientation and the current orientation are the same.

This command has the following effects:

- Prints all data received before the command
- Executes a formfeed and carriage return.
- Sets the following to their user defaults:
    - Logical page
    - Print direction
    - Page length
    - Text length
    - Top margin, left margin, right margin
    - CMI and LMI
    - Picture frame
    - Picture frame anchor point
    - HP-GL/2 plot size
    - HP-GL/2 orientation
- Disables the auto macro overlay

This command should be sent at the beginning of a page because it ejects a page containing printable data. Since this command defaults the above features, it should be followed by commands that set any desired non-default values.

NOTE: Because it ejects the page, this command cannot be used to change text orientation within a page. Print Direction (*Esc&a#P*) can be used to print multiple directions per page.

This command affects text orientation, not raster graphics orientation. For example, if orientation is changed from portrait to landscape, raster graphics will continue to print in portrait. This can cause clipping if graphics margins are insufficient.

Fonts automatically rotate to the current orientation on devices having auto-rotation.

DEVICE NOTE: Pre-LJIIIs did not rotate fonts. Orientation was a selection criterion.

DEVICE NOTE: Pre-DJ550s except 540 lock out graphics data in landscape orientation.
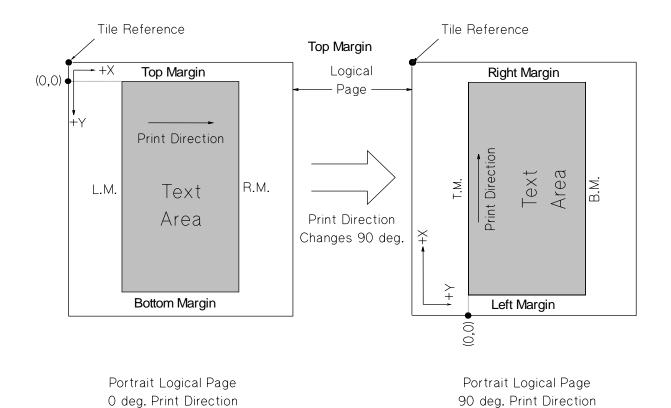
Print Direction   *Esc & a # p/P*

Rotates the logical page coordinate system with respect to its current orientation without ejecting the page. This allows orientation changes on the same page.

Value(#)   =   Degrees of rotation (ccw 90 degree increments only)
Default   =   0
Range   =   0, 90, 180, 270

This command has the following effects:

1.   The logical page coordinate system origin (0,0) rotates with the logical page. For example, rotating a default page (portrait orientation, 0° print direction) by 90° causes data to print in the landscape direction across the "portrait" page. That is, orientation is changed from portrait to landscape. Page width, length, top offset, and left offset are set appropriately.

2.   If CAP is fixed (i.e., following printable data or commands affecting CAP), it remains at the same location on the physical page. If CAP is floating (i.e., before printable data or commands affecting CAP), it remains floating.

3.   The margins are translated (as shown on the next page). For example, a print direction change from 0 to 90 degrees makes the left margin the new top margin, the top margin the new right margin, etc.

4.   The positions stored in the CAP stack are translated to reference the same location on the physical page. For example, if print direction changes from 0 to 90 degrees, stored X coordinates become Y coordinates, and vice versa. This allows the Push/Pop CAP command to store exact physical page positions, regardless of print direction.

5.   The picture frame anchor point coordinates are transformed so the anchor point and picture frame remain at the same location on the physical page.

6.   Raster mode is terminated.

7.   All subsequent print entities — raster, area fills, and characters — are rotated.

8.   The HP-GL/2 coordinate system is also rotated if the Enter HP-GL/2 command (*Esc%#B*) has been sent with a value field of 2 or 3. Unless *Esc%#B* is sent with a value of 2 or 3, print direction has no effect on HP-GL/2 graphics, which can then only be rotated by RO or the Orientation command (*Esc&l#O*).

9.   The pattern reference point (tiling) is not affected. However, the tiles may rotate to coincide with the current print direction depending on the argument passed with the Pattern Reference Point command (*Esc*p#R*).

10.   The auto macro overlay environment is not disabled, since an overlay may invoke this command.

11.   Print Direction does not default CMI.

12.   The dither matrix (*Esc*t#J*, *Esc*m#W*) is fixed and does not move with print direction or orientation..

Tile Reference

(0,0)

+X

Top Margin

+Y

Print Direction

L.M.

Text
Area

R.M.

Bottom Margin

Top Margin

Logical
Page

Print Direction
Changes 90 deg.

Tile Reference

Right Margin

T.M.

Print Direction

Text
Area

B.M.

+X

+Y

(0,0)

Left Margin

Portrait Logical Page
0 deg. Print Direction

Portrait Logical Page
90 deg. Print Direction

Changing print direction

7.5 CMI and LMI (formerly HMI and VMI)

In a fixed-space font, the Character Motion Index (CMI) defines the width of columns (horizontal text path) or the height of rows (vertical text path) used inter-character movement calculations. In a proportional font, CMI affects only the space character (unless space is downloaded as a glyph: then the printed space remains the glyph width). CMI is specified in 1/120" units.

The Line Motion Index (LMI) defines the distance between lines of print. It is the distance CAP moves for a linefeed operation. LMI is specified in 1/48 inch increments.

Character Motion Index (CMI)   *Esc & k # h/H*

In horizontal text path mode (*Esc&c#T*), CMI designates the width of columns used for horizontal movement calculations; in vertical text path mode, CMI designates the height of rows used for inter-character movement calculations.

Value(#)   =   Number of 1/120 inch increments.
Default   =   Determined by the pitch value in the default font descriptor.
Range   =   0 to 2^{32} -1

CMI defaults to the width of the invoked font's space character when:

- Any of the font's characteristics (orientation, character set, pitch, etc.) are changed.
- Primary and secondary fonts are switched via SI and SO
- Text Path Direction (*Esc&c#T*) is changed.

For fixed pitch fonts, CMI affects all printable characters, including the space and backspace characters. For proportionally spaced fonts, CMI may affect only the space character: if the space character glyph exists, CAP moves the width of the space character; otherwise CAP moves according to CMI. For dual-pitch fonts, CMI directly affects the nominal (full-width) space of the font. Other spacings are linearly scaled according to the current CMI value: charter widths are multiplied by the ratio of the CMI to nominal width.

In vertical text path direction, CMI defaults to 112% of the font height. In fixed or dual pitch fonts, CMI assumes the 112% of the fixed-pitch font height. In proportionally-spaced fonts, CMI may affect only the space character. If the space character glyph exists, CAP moves 112% of the space character height; otherwise CAP moves according to CMI.

Devices which do not have an integral number of CMI units-to-dots should implement fractional CMI units for dot addressing.

Line Motion Index (LMI)   *Esc & l # c/C*

Sets the vertical spacing between lines of print (the vertical distance CAP will move for a linefeed in horizontal text path mode, or the horizontal distance CAP will move for a linefeed in vertical text path mode).

Value(#)   =   Number of 1/48 inch increments between two consecutive lines of print.
Default   =   8
Range   =   0 to the current logical page length up to 2^{32} -1

This command performs the same functions as Line Spacing (*Esc&l#D*), except the measurement interval is in 1/48 inch increments instead of lines-per-inch (lpi). Both commands set linefeed and half linefeed spacing. To convert lpi to LMI:

$$LMI = 48.0 / lpi$$

If Page Length (*Esc&l#P*) follows an LMI change, physical page size is recalculated. Depending on the LMI modification, the printer may request a different page size.

A font change does not affect LMI.

Devices which do not have an integral number of LMI units-to-dots should implement fractional LMI units for dot addressing.

DEVICE NOTE: LJII and LJ2000 allow LMI to be set from the front panel.

Line Spacing   *Esc & l # d/D*

Sets the number of lines printed per inch.

Value(#)   =   Number of lines per inch (lpi)
Default   =   6
Range   =   0 to the current logical page length up to a maximum of 32767

A value of 0 defaults line spacing to 6.

This command performs the same function as LMI (*Esc&l#C*), except that it sets LMI in lines per inch (lpi). Both commands set linefeed and half linefeed spacing. To convert LMI to lpi:

$$lpi = 48.0 / LMI$$

DEVICE NOTE: LJIIs and later support line spacings 1-4, 6 (default), 8, 12, 16, 24, 48 lpi.

7.6 Text Path

Asian printing requires the ability to print text vertically. Text Path Direction (*Esc&c#T*) provides one horizontal and two vertical printing modes for text.

Text Path Direction   *Esc & c # t/T*

Determines the direction of CAP movement, whether vertical substitutes are applied, whether certain characters are rotated, and whether linefeeds cause vertical or horizontal movement.

Value(#)   =   -1   Rotated-character printing. Horizontal printing with full-width characters
                    rotated 90° counter-clockwise. CAP advances left to right; linefeed advances
                    top to bottom. Vertical substitutes are applied.
           =   0   Horizontal printing. CAP advances left to right; linefeed advances top to bottom.
                    No vertical substitutes are applied.
           =   1   Vertical printing. One-byte characters are rotated 90°. CAP advances top to
                    bottom; linefeed advances right to left. Vertical substutes are applied.
Default   =   0
Range   =   -1, 0, 1

A *full-width* character is a character whose escapement equals the font height. For TrueType, a full-width character's escapement in design units equals the font's scale factor. A *partial-width* character has an escapement less than the font height. *One-byte* characters are those that may be described by a symbol set size of less than 256; *two-byte* characters require a symbol set size of 256 or greater.

Rotated-character printing mode (-1), which is based on escapement, has the following effects:

- Advances CAP and linefeed in the same directions as horizontal (0) printing mode.
- Rotates full-width characters in large (multiple-byte) fonts 90° counterclockwise.
- Makes substitutions for characters that change their appearance, orientation, or positioning when written vertically.
- Affects only full-width characters, not partial-width characters.

Vertical printing mode (1), which is based on the number of bytes, has the following effects:

- Unlike 0 and -1, vertical mode advances CAP from top to bottom and linefeed from right to left.
- Rotates only one-byte characters 90°clockwise.
- Makes substitutions for characters that change their appearance, orientation, or positioning when written vertically.
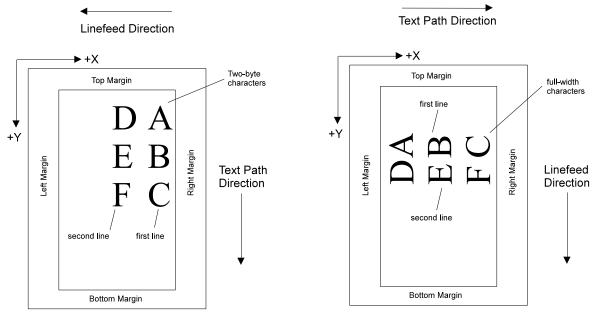
To summarize the differences between the -1, 0, and 1 modes: "0" prints rows in portrait; "1" prints columns in portrait; and "-1" prints rows as columns in landscape. The -1 parameter, based on escapement, prints partial-width characters upright and rotates full-width characters 90° counterclockwise. The 1 parameter, based on the number of bytes, prints two-byte characters upright and rotates one-byte characters 90° clockwise. Therefore, characters printed by the -1 and 1 parameters will be rotated 90° from each other.

The rotated-character mode (-1) can be used to transform a portrait page with horizontal text into a landscape page with vertical text. (The Print Direction (*Esc&a#P*) command can be used to achieve other text orientations.)

In the vertical printing mode (1), the character baseline for fixed and dual-fixed spacing fonts is vertical and through the center of the character. The starting CAP for a character is the top-center of the character. After printing the first character, CAP moves down by the CMI inter-character index (the default CMI is 112% of font height). After printing the first line, a linefeed moves CAP to the left of the current line by the linefeed distance specified by LMI.

Text Path Direction is secondary to Orientation (*Esc&l#L*) and Print Direction (*Esc&a#P*). Orientation determines the position of the logical page on the physical page (portrait, landscape, reverse portrait, reverse landscape). Print direction determines the position of the logical page coordinate system with respect to the current orientation. Then, using orientation and print direction as a reference, Text Path Direction applies the character-advance and linefeed directions. Raster graphics is unaffected and always prints along the increasing X axis of the logical page, whether in the portrait direction or as set by the Print Direction command.

For both the 1 and -1 modes, substitutions are made for characters that change their appearance, orientation, or positioning when written vertically. Vertical substitution characters are accessed through the Vertical Substitutes Character Segment downloaded with a Format 16 font (see Chapter 10).

EscE defaults text path direction, which is part of the modified print environment.

Vertical Printing Mode (1)   **Rotated-character Mode (-1)**

NOTE: In the diagrams above, the printed characters denoted by "ABCDEF" are two-byte characters in vertical printing mode (1) and full-width characters in rotated-character mode (-1). In vertical printing mode (1), two-byte characters are not rotated; in rotated-character mode (-1), partial-width characters are not rotated.

7.7 Margins and Text Area

Margins are related to the logical page, not the physical page. Since the printer can only address the area within the logical page, the actual distance from the text area to the edge of the physical page is the margin plus the distance between the edge of the physical page and the edge of the logical page.

Margins represent a physical position and do not change with subsequent CMI changes. However, margins do correspond to different character positions for different horizontal print pitches.

NOTE: Text margins and graphics margins may differ. See Chapter 13 for information on raster graphics margins.

The only way to move CAP outside the margins is with the CAP Move commands (e.g., *Esc&a#C*, *Esc&a#H*). BS is ignored when CAP is at the left margin (in horizontal text path mode).

Once outside the right or left margins, all features except CR function normally to the edge of the logical page. For example, if CAP is to the right of the right margin, data is printed and CAP updated accordingly.

Text Area: Area defined by the left margin, right margin, top margin, and text length. The text area is entirely contained by the logical page: it may be the same size, or be restricted by margins within the logical page. Characters can be printed outside the text area under the following conditions:

- CAP Move commands can position CAP outside the text area for printing anywhere within the printable area.

- If perforation skip mode is disabled, characters are printed in the perforation region, between the bottom of the text area and the top of the text area on the next page.

- If perforation skip mode is enabled, characters may still be printed in the perforation region outside the text area (using a negative relative vertical CAP move to position CAP within the top margin, or a positive relative CAP move to position CAP within the bottom margin).

DEVICE NOTE: On DJs below 1200, the perforation area includes the bottom margin of the current page and the top margin of the next page; therefore, when CAP is within the top margin area a linefeed moves CAP to the top margin if perforation skip is enabled. On LJs and the DJ1200C and above, the perforation area includes only the bottom margin of the current page; therefore, when CAP is within the top margin area a linefeed moves CAP one line down if perforation skip is enabled.

Left Margin: Distance between the left edge of the logical page and the left edge of the text area. The term "left margin" may also refer to left edge of the text area.

Right Margin: Distance between the left edge of the logical page and the right edge of the text area. The term "right margin" may also refer to right edge of the text area.

Top Margin: Distance between the top of the logical page and the top of the text area. The term "top margin" may also refer to the top edge of the text area.

Bottom Margin: Distance from the bottom of the text area to the bottom of the logical page. There is no bottom margin command. The bottom margin can only be set indirectly by setting text length when perforation skip mode is enabled. The bottom margin may be calculated by subtracting the top margin and text length (at the current LMI) from the (logical page length plus top margin).

Text Length: Distance from the top margin to the bottom of the text area. Text length has meaning only if perforation skip mode is enabled. When perforation skip is enabled, text length defines the bottom margin.

Perforation Region: Distance from the bottom of the text area on the physical page to the top of the text area on the next physical page. Enabling perforation skip (the default) causes text to be print to the end of the text area of the current page and start again at the top of form on the next page. Disabling perforation skip mode causes text to be printed to the end of the page, into the unprintable region, and onto the the top edge of the next page; text length is ignored and the top margin is ignored except when executing <FF>, which moves to the top of form. The remainder of a partial line is not carried over to the next page. Historically, this term originated with continuous feed devices.

DEVICE NOTE: On DJs below 1200, the perforation area includes the bottom margin of the current page and the top margin of the next page; therefore, when CAP is within the top margin area a linefeed moves CAP to the top margin if perforation skip is enabled. On LJs and the DJ1200C and above, the perforation area includes only the bottom margin of the current page; therefore, when CAP is within the top margin area a linefeed moves CAP one line down if perforation skip is enabled.

Top of Form: After power on or reset, CAP moves to the baseline of the first row of characters. This position, called *top of form*, is 3/4 of a line below the top margin:

$$\text{top of form} = \text{top margin} + (3/4 * \text{line spacing})$$

The phrase "move to top of form" means if the CAP is not at top of form, move it to the top of form of the next logical page.

In printers that have no means of sensing the edges of a sheet there is no guarantee that the top of form will be a specified distance from the physical edge of the sheet.

Printable Area: This is the area of the physical page in which the printer is able to place a dot; this is usually determined by the technology of the printing device. Although the text area may be larger than the printable area, text outside the printable area is lost.

Clear Horizontal Margins   *Esc 9*

Resets the left and right margins to their default positions. CAP is unchanged.

Left Margin   =   left logical page boundary (column 0)
Right Margin   =   right logical page boundary

Left Margin   *Esc & a # l/L*

Sets the left margin to the left edge of the specified column.

Value(#)   =   Column number
Default   =   Column 0 (left logical page boundary)
Range   =   0 to the right margin

If CAP is to the left of the new left margin, it moves to the new left margin; otherwise, this command does not affect CAP. Attempts to set the left margin to the right of the right margin are ignored; however, left and right margins can be set at the same location.

NOTE: Column 0 is the first column on the left edge of the logical page, not the physical page.

Right Margin   *Esc & a # m/M*

Sets the right margin to the right edge of the specified column.

Value(#)   =   Column number
Default   =   Logical page right boundary
Range   =   Current left margin minus the logical page right boundary

This command is ignored for columns preceding the left margin. Specifying a column beyond the right logical page limit sets the right margin to the right logical page limit. If CAP is to the right of the new right margin, CAP is moved to the new right margin; otherwise this command does not affect CAP.

A characters whose escapement (delta X) would carry CAP across the right margin is not printed (and CAP is unchanged) unless end-of-line wrap is enabled: then the character prints at the left margin on the next line. Attempts to set the right margin to the left of the left margin are ignored; however, left and right margins can be set to the same location.

DEVICE NOTE: LJ2000 and the LJIII and 4 series print cells that overlap the right margin. Earlier LJ's clip overlapping characters.

Top Margin   *Esc & l # e/E*

Specifies the distance between the top of the logical page and the top of the text area.

Value(#)   =   Number of lines from the top of the logical page
Default   =   ½"
Range   =   0 to the length of logical page

DEVICE NOTE: DJs below 1200 default the top margin to ½" with perforation skip enabled, and 0" with perforation skip disabled.

The top margin is specified in lines whose spacing is determined by the current line spacing. This command is ignored if the current line spacing is 0, or if a value beyond the current logical page length is received.

This command does not affect a fixed CAP until the next page. A floating CAP is placed at the baseline of the first row of characters. This position, called *top of form*, which is the vertical position of the first line of print on the logical page, is calculated by:

Top of Form = top margin in inches + (.75 x LMI in inches)

Raster also starts at the top of form.

The top margin represents a physical position: once the top margin is set, it is unaffected by subsequent changes in line spacing.

NOTE: Since this command defaults text length, it should precede Text Length (*Esc&l#F*).

Text Length   *Esc & l # f/F*

Sets length of the text area in lines from the top margin.

Value(#)   =   Number of lines
Default   =   Logical page length minus top margin minus 1/2 inch *
Range   =   0 to the logical page length minus top margin

* A negative result defaults text length to (logical page length - top margin).

This command is ignored if current LMI is 0 or a text length greater than (logical page length - top margin) is requested. A value field of 0 defaults text length.

Text length determines the bottom margin when perforation skip (*Esc&l#L*) is enabled. When perforation skip is disabled, text length is not used, but is saved

Perforation Skip Mode   *Esc & l # l/L*

Controls perforation skip mode.

```
Value(#)    =   0   Disables perforation skip mode
            =   1   Enables perforation skip mode
Default     =   1 *
Range       =   0,1
```

* Historically, the default has been device dependent; "1" is recommended.

The perforation region extends from the bottom of the text area to the top margin of the next page (see the device note below for LaserJets and DeskJets 1200 and above. Text Length (*Esc&l#F*) determines the the perforation size (and the bottom margin).

DEVICE NOTE: On DJs below 1200, the perforation area includes the bottom margin of the current page and the top margin of the next page; therefore, when CAP is within the top margin area a linefeed moves CAP to the top margin if perforation skip is enabled. On LJs and the DJ1200C and above, the perforation area includes only the bottom margin of the current page; therefore, when CAP is within the top margin area a linefeed moves CAP one line down if perforation skip is enabled.

If perforation skip is enabled:

- In horizontal text path mode, printing ends at the specified text length and then starts at the top margin of the next page.
- In vertical text path mode, printing ends at the left margin and then starts at the right margin of the next page, with the vertical position maintained.

If perforation skip is disabled:

- In horizontal text path mode, text is printed to the end of one page onto the top of the next page; bottom and top margins are ignored.
- In vertical text path mode, text is printed to the left edge of the logical page and onto the right edge of the next page. Both the right and left margins is ignored.

Except for formfeed, perforation skip has no effect on top of form.

NOTE: Disabling perforation skip may cause text outside of the printable area to be lost. Enabling perforation skip mode enables top margin and text length.

DEVICE NOTE: DJs below 1200 default the top margin to ½" with perforation skip enabled, and 0" with perforation skip disabled.