

Chapter 8: CAP

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8.1 Introduction

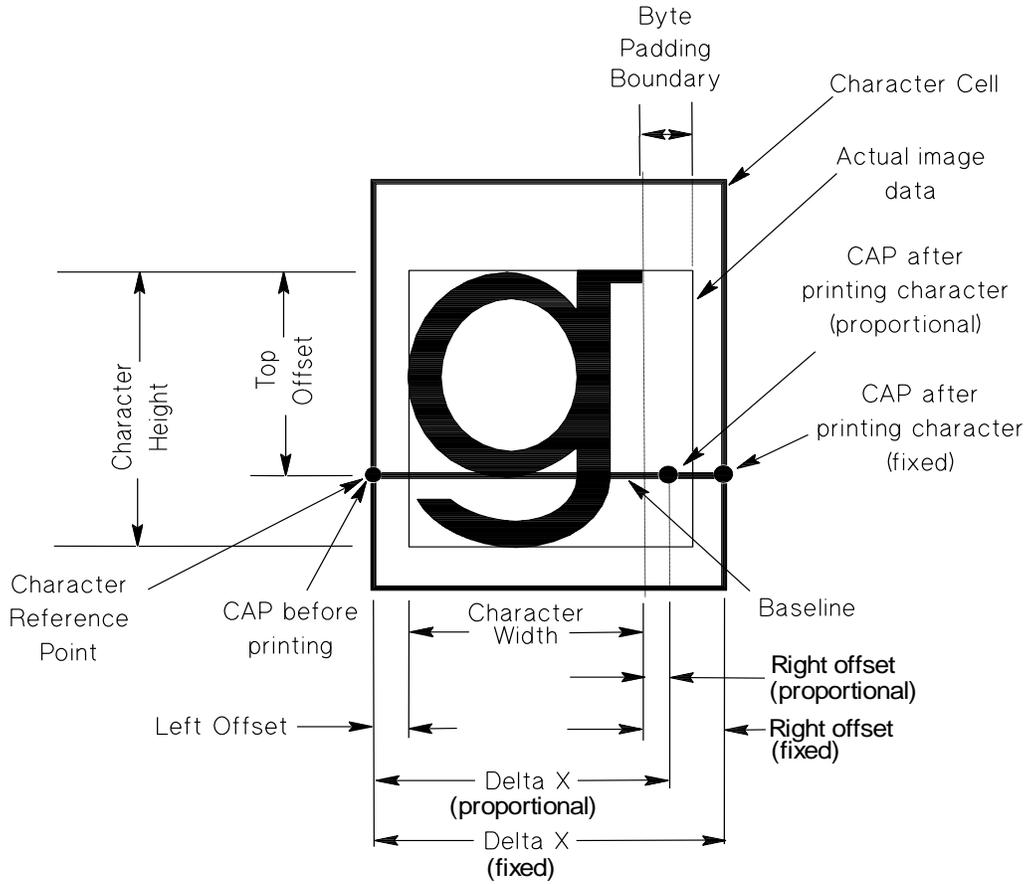
CAP (Current Active Position) is where the next character or graphics dot will be printed. The position of CAP after an image is printed depends on the type of image: text, raster graphics, vector graphics, or rectangular area fills.

CAP can be moved anywhere within the logical page using horizontal and vertical move commands.

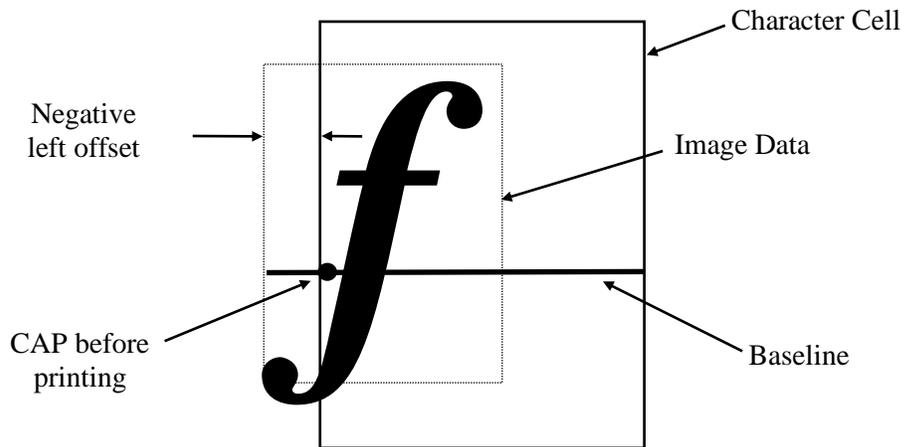
CAP for Text

Before a character is printed, CAP is the *character reference point*, on the baseline at the left of the character cell. After printing the character, CAP moves to the right by the *escapement* (delta X) of the character. The diagrams on the next page show characters having both positive and negative offsets (side bearings): i.e., the image (black) data may start before or after CAP.

For fixed-spaced fonts, CAP moves the CMI distance for each character printed (e.g., if CMI is 12/120", CAP moves 1/10" along the baseline for each character printed. For proportional-spaced fonts, the amount of space (escapement) moved for each character is obtained from font character data.



Character Cell in Portrait Orientation



Negative Left Offset (Side Bearing)

CAP for Raster Graphics

At the start of raster graphics, CAP is at the current Y position on the left graphics margin. After printing the raster image, CAP moves to the left graphics margin at the dot row following the last row of raster data. If a Raster Height command was used, CAP is finally located on the left graphics margin one dot row below the lowest part of the picture frame defined by the Raster Height command.

CAP for Vector Graphics

In HP-GL/2 mode, CAP is referred to as the *pen location*. Whenever a plotting instruction is completed, the pen location is updated so that the next instruction begins at the current point. However, there are some instructions, such as CI (circle), that do not change the current pen location. The definition of each HP-GL/2 command tells whether CAP is changed.

When entering HP-GL/2 from PCL mode, pen location can be specified as either the current CAP or the pen location prior to entering PCL mode. When entering PCL mode from HP-GL/2 mode, CAP can be specified as either the last CAP prior to entering HP-GL/2 mode, or as the last pen location prior to entering PCL mode.

NOTE: The HP-GL/2 coordinate system is different from the PCL coordinate system. See the *Vector Graphics* chapter for more information.

CAP for Rectangular Area Fills (Rules)

CAP starts printing rules at the upper left corner. CAP does not change: after printing it is in the same position as it was before printing.

Print-and-Space CAP Positioning

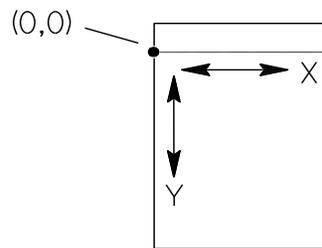
Print-and-space applications move CAP using the space, backspace, linefeed, and carriage return control codes instead of CAP Move commands.

Absolute and Relative Movement

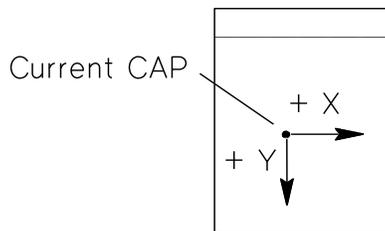
Relative motion is referenced to the current active position (CAP). *Absolute* motion is referenced to the intersection of the top margin and left edge of the logical page (0,0). A signed value field in a CAP movement command indicates relative movement.

Relative movement is used to establish a distance between objects. For example, many word processing applications use relative horizontal movement to justify a line of text. After determining the number of words on a line, the application calculates the amount of space between each word. Then relative moves are used after each word instead of the space character.

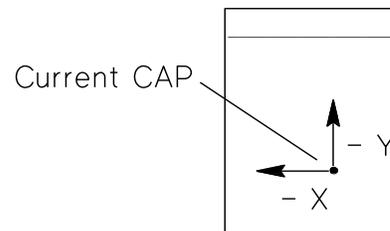
Absolute movement is used to guarantee an absolute distance from the left edge of the logical page. Placing a raster graphic on a certain spot is usually easier if the position is relative to a fixed position and not dependent on the distance from the previous image.



Absolute Motion



Positive
Horizontal or Vertical
Motion



Negative
Horizontal or Vertical
Motion

Relative Motion

Absolute/Relative CAP Movement

Units of Movement

CAP positioning may be specified in **PCL Units**, **decipoints**, or **columns** on the X axis, and in **PCL Units**, **decipoints**, or **rows** on the Y axis.

Printers may map PCL Units, decipoints, columns, and rows to an internal measuring unit. All positioning is kept in internal units and rounded to dot positions when data is printed. This eliminates errors caused by successive rounding or truncation.

DEVICE NOTE: The LJIII and 4 series use an internal measuring unit of 1/7200 inch in the PCL language and 1/9600 inch in HP-GL/2. LJII uses 1/3600 inch and DJs below 1200 use 1/3600.

Decipoints

A decipoint is 1/720 of an inch, or 1/10 of a PCL point. (A PCL point is *exactly* 1/72 of an inch; a typographic point is *approximately* 1/72 of an inch.)

Columns

The size of a column depends on the current CMI (horizontal motion index), which is initially the width of the font's space character, and changes with the selected font. For example, at 12 columns per inch (cpi) one column is 1/12th inch, and at 10 cpi one column is 1/10th inch.

PCL Units

The Unit of Measure command (*Esc&u#D*) specifies PCL Unit size in units-per-inch. The default unit for PCL movement is 1/300 of an inch. This is true even when a different printing resolution (such as 600 dpi) is selected.

PCL Units are used in the following commands:

- Move CAP Vertical (PCL Units) — *Esc*p#Y*
- Move CAP Horizontal (PCL Units) — *Esc*p#X*
- Vertical Rectangle Size (PCL Units) — *Esc*c#B*
- Horizontal Rectangle Size (PCL Units) — *Esc*c#A*

In addition, since the current units of measure setting affects how CAP movement values are rounded, it also affects the result of the following commands:

- Move CAP Horizontal (Columns) — *Esc*&#C*
- Horizontal Tab — *<HT>*

HISTORICAL NOTE: PCL Units are independent of device resolution. However, in the past some machines have used "dot" movement, which varied with device resolution. For example, one dot equals 1/180" on PJ and PJXL, 1/300" on DJ and LJ, and 1/1200" on some typesetters.

Rows

Row positioning is dependent on the current LMI (vertical motion index). LMI is the distance between consecutive lines of text. This distance varies with line spacing. For example, at six lines per inch (lpi), one line is 1/6 of an inch; and at eight lpi, one line is 1/8 of an inch.

HP-GL/2 Units

In HP-GL/2 mode, the device moves in either *plotter units* or *user units*. One plotter unit equals .025 mm (approximately .00098 in). User units can be set to any size by HP-GL/2 scaling commands. Both types of HP-GL/2 units are converted to the device resolution prior to printing.

Default CAP

When the printer is powered on or reset, CAP is determined by the current top margin, left margin, orientation, and LMI settings when the first printable data or command affecting the CAP is received. Printable data (including printable SPACE) is defined as a mark on the page or graphics character. Commands affecting CAP include ASCII data, LF, space, explicit CAP move, etc.

Floating CAP

CAP is *floating* after power-on or reset until printable data or a command affecting CAP is received. A floating CAP moves in accordance with orientation, top margin, left margin, and line spacing commands.

Fixed CAP

CAP is *fixed* after a printable character or a command affecting CAP is received. A fixed CAP is not affected by changes to the orientation, top margin, left margin, or line spacing.

Once CAP is fixed, page length or orientation changes cause a page eject (FF-CR). This is called a *conditional page eject* because it occurs only if the page is "dirty". Some PCL commands (e.g., Duplex Page Side) cause an unconditional page eject, which occurs regardless of whether CAP is fixed or floating.

8.2 Horizontal Positioning Commands

Absolute horizontal positioning is referenced to the left logical page boundary. Relative horizontal positioning is referenced to CAP.

NOTE: The control codes <BS>, <CR>, <HT>, and <SP> also move CAP horizontally. See Chapter 5 for a description of these characters.

Move CAP Horizontal (Decipoints) *Esc & a # h/H*

Moves CAP horizontally by the specified number of decipoints (1/720 inch).

Value(#) = Number of decipoints
 Default = NA
 Range = -2^{31} to $2^{31} - 1$ (up to the logical page right and left limits)

A signed value field indicates *relative* movement: plus (+) or minus (-) signs move CAP right or left relative to CAP, respectively. The absence of a sign indicates *absolute* movement: CAP moves an absolute distance from the logical page left edge.

This command ignores margins and can move CAP anywhere horizontally within the logical page. Attempts to go outside the logical page will move CAP to the appropriate logical page limit.

Devices not having an integral number of decipoints-to-dots should implement fractional decipoints for dot addressing.

Move CAP Horizontal (Columns) *Esc & a # c/C*

Moves CAP horizontally by the specified number of columns.

Value(#) = Number of columns
Default = NA
Range = -2^{31} to $2^{31} - 1$ (or to the logical page right and left limits)

A signed value field indicates *relative* movement: plus (+) or minus (-) signs move CAP right or left relative to CAP, respectively. The absence of a sign indicates *absolute* movement: CAP moves an absolute distance from the logical page left edge (column 0).

This command ignores margins and can move CAP horizontally anywhere within the logical page. Attempts to go outside the logical page will move CAP to the appropriate logical page limit.

The CMI command (*Esc&k#H*), which defines the size of a column, rounds CMI to the nearest internal unit. Devices supporting Unit of Measure (*Esc&u#D*) always round a selected font's CMI to the nearest PCL Unit, regardless of whether Unit of Measure has been specified ; however a subsequent CMI command will again round CMI to the nearest internal unit.

DEVICE NOTE: DJ850C does not round CMI to the nearest PCL Unit. Unit of Measure affects only the start of characters and PCL Unit commands.

Move CAP Horizontal (PCL Units) *Esc * p # x/X*

Moves CAP horizontally by the specified number of PCL Units.

Value(#) = Number of PCL Units
Default = NA
Range = -2^{31} to $2^{31} - 1$ (up to the logical page right and left limits)

A signed value field indicates *relative* movement: plus (+) or minus (-) signs move CAP right or left relative to CAP, respectively. The absence of a sign indicates *absolute* movement: CAP moves an absolute distance from the logical page left edge.

Unit of Measure (*Esc&u#D*) specifies the current size of a PCL Unit. If Unit of Measure is not supported or is not specified, the unit-per-inch for PCL movement defaults to 1/300 inch, or to the control panel setting, which has precedence.

This command ignores margins and can move CAP horizontally anywhere within the logical page. Attempts to go outside the logical page will move CAP to the appropriate logical page limit.

DEVICE NOTE: PJ, PJXL, and Rugged Writer use 1/180" units. DJs below 1600, PJXL300, and LJs below LJ4 use a 1/300" unit or "dot" size.

8.3 Vertical Positioning Commands

Vertical positioning may be either absolute or relative. A signed value field indicates *relative* positioning; the absence of a sign indicates *absolute* positioning. Relative positioning is referenced to CAP. Absolute vertical positioning by row is referenced to top of form; absolute vertical positioning by decipoints or PCL Units is referenced to the top margin.

Vertical CAP positioning ignores perforation skip mode, allowing the user to move into the perforation region.

NOTE: The control codes <LF> and <FF> also move CAP vertically. See Chapter 5 for a description.

Move CAP Vertical (Rows) *Esc & a # r/R*

Moves CAP to the same column position on a new line based on the active line spacing.

Value(#) = Number of rows
 Default = NA
 Range = -2^{31} to $2^{31} - 1$ (fractional values are allowed; valid to four decimal places)

A signed value field indicates *relative* movement: a minus (-) sign moves CAP upward relative to CAP; a plus (+) sign moves CAP downward relative to CAP.

Negative relative movement can extend into the top margin, where it is clamped to the logical page boundary. For this command only (not the other vertical move commands), positive relative movement can extend to the next logical page's lower boundary, where it is clamped. However, movement beyond the current logical page causes the current page to be printed.

The absence of a sign indicates *absolute* movement: CAP moves from the top of form an absolute distance computed by:

$$\text{Distance from top of logical page} = \text{top margin} + (3/4 \times \text{LMI}/48.0) + (\text{value} \times \text{LMI})/48.0$$

After power on or *EscE*, CAP moves to the top of form, if not already there.

Move CAP Vertical (Decipoints) *Esc & a # v/V*

Moves CAP to a new position along the vertical axis. If no such position exists, moves CAP to the logical page limit.

Value(#) = Number of decipoints
Default = NA
Range = -2^{31} to $2^{31} - 1$ (rounded to the first decimal place)

A signed value field indicates *relative* movement: a minus (-) sign moves CAP upward relative to CAP; a plus (+) sign moves CAP downward relative to CAP.

Negative relative movement can extend into the top margin, where it is clamped to the logical page boundary. Positive relative movement is clamped to the bottom of the current logical page.

The absence of a sign indicates *absolute* movement: CAP moves an absolute distance from the top margin.

After power on or reset, CAP moves to the top of form, if not already there.

Devices not having an integral number of decipoints-to-dots should implement fractional decipoints for dot addressing.

Move CAP Vertical (PCL Units) *Esc * p # y/Y*

Moves CAP to a new position along the Y axis. If no such position exists, the printer moves to the logical page limit.

Value(#) = Number of PCL Units
Default = NA
Range = -2^{31} to $2^{31} - 1$

A signed value field indicates *relative* movement: a minus (-) sign moves CAP upward relative to CAP; a plus (+) sign moves CAP downward relative to CAP.

Negative relative movement can extend into the top margin, where it is clamped to the logical page boundary. Positive relative movement is clamped to the bottom of the current logical page.

The absence of a sign indicates *absolute* movement: CAP moves an absolute distance from the top margin.

Unit of Measure (*Esc&u#D*) specifies the current size of a PCL Unit. If Unit of Measure is not supported or is not specified, the unit-per-inch for PCL movement defaults to 1/300 inch, or to the control panel setting, which has precedence.

After power on or *EscE*, CAP moves to the top of form, if not already there.

DEVICE NOTE: PJ, PJXL, and Rugged Writer use 1/180" units. DJs below 1600, PJXL300, and LJs below LJ4 use a 1/300" unit or "dot" size.

8.4 Saving CAP

Some situations require the device to be able to save previous CAP positions. A common application is saving CAP prior to executing, calling or overlaying a macro, and then recalling the position after the macro command has been carried out.

Push/Pop CAP *Esc & f # s/S*

Allows CAP to be stored and recalled.

Value(#)	=	0	Push CAP
	=	1	Pop CAP
Default	=	0	
Range	=	0,1	

This command uses a stack to store or recall CAP: a value of 0 *pushes* CAP, leaving the present CAP unaffected. A value of 1 *pops* CAP, restoring it as the new CAP.

As with any stack, the last item pushed is the first item popped.

If a popped CAP is outside the logical page, it is moved to the appropriate logical page boundary.

The Print Direction command (*Esc&a#P*) causes the values stored on the stack to be transformed so as to maintain their physical locations on the page.

Attempts to save more positions than the device is capable of are ignored. Attempts to recall more positions than were stored are ignored. Reset (*EscE*) discards all stored values.

DEVICE NOTE: LJ's and DJs above 1000 have a maximum CAP stack size of 20.

