Chapter 17:   Vector Graphics

Contents of this Chapter

This chapter discusses the following commands:

17.1 Introduction

PCL5 includes most of the HP-GL/2 command set (see *The HP-GL/2 Implemtor's Guide* for the entire HP-GL/2 command set). HP-GL/2 gives PCL a vector graphics capability that is often more efficient than raster graphics. This chapter describes commands that enter and exit the HP-GL/2 context and manage the scaling of HP-GL/2 graphics on the PCL logical page.

Whenever entering the HP-GL/2 context from PCL, the HP-GL/2 graphic exists only in the context of a PCL *picture frame*. The picture frame is the destination rectangle on the logical page into which the HP-GL/2 graphic is placed.

PCL *picture presentation* commands can specify the picture frame size and position. Other picture presentation commands can scale the HP-GL/2 graphic with respect to the picture frame.

However, it may not be necessary to define the picture frame or scale the HP-GL/2 graphic. The picture frame defaults to the size of the factory default PCL text area; and if SC is invoked, any HP-GL/2 graphic is automatically scaled to fit within the picture frame, whatever its size.

17.2 Entering HP-GL/2

Esc%#B enters HP-GL/2 mode and specifies whether CAP and the PCL coordinate system are inherited by HP-GL/2. The current palette is always inherited.

Enter HP-GL/2 Mode   *Esc % # B*

Causes a device to interpret data as HP-GL/2 commands instead of PCL commands.

```
Value(#)   =   -1   Stand-alone plotter mode (single context)
           =    0   Use previous or default HP-GL/2 pen position
           =    1   Use current PCL CAP
           =    2   Use PCL dot coordinate system and previous or default HP-GL/2 pen position
           =    3   Use PCL dot coordinate system and the current PCL CAP
Default    =    0
Range      =   -1 to 3 (unsupported negative values default to -1; command is ignored for other
                   unsupported values)
```

A value field of -1 is the stand-alone plotter mode: HP-GL/2 and PCL data cannot be merged on the same page, and picture presentation commands are ignored. All other values initiate a dual context mode allowing PCL and HP-GL/2 objects to be merged on the same page. A value of 1 or 3 sets the HP-GL/2 pen position and the label carriage return point to the current PCL CAP. A value of 2 or 3 transfers the current PCL dot coordinate system, including the PCL origin and axes, into the HP-GL/2 environment; the coordinate system thus established is independent of the positions of P1 and P2.

HP-GL/2 mode remains in effect until an *Esc%#A*, *EscE*, *Esc%-12345X*, or power-on.

HP-GL/2 ignores this command.

The capital "B" terminator must always be used.

Dual Context

When the value field is non-negative, HP-GL/2 and PCL contexts can both be used on the same page

- HP-GL/2 and PCL objects can be combined on the same page.
- PCL picture presentation commands can specify the size and position of the picture frame on the logical page, as well as scaling the HP-GL/2 graphic.
- The palette and color configuration are transferred between contexts.
- The current logical operation and pixel placement are transferred between contexts.
- CAP can be transferred between contexts.
- PCL orientation determines HP-GL/2 orientation.

DEVICE NOTE: LaserJets do not support values of -1, 2, and 3.

DEVICE NOTE: LaserJets in the past have sometimes set the HP-GL/2 hardclip limts one dot larger than the PCL printable area

Effects of PCL States

The following PCL state changes can affect the HP-GL/2 state:

Reset (*EscE*) or control-panel reset:

- Executes BP, or IN if BP is not supported.
- Creates a 2-pen PCL default palette.
- Defaults picture frame size to the factory default PCL text area.
- Defaults the picture frame anchor point to the upper left corner of the text area.
- Defaults HP-GL/2 plot size to the picture frame size.
- Defaults HP-GL/2 orientation to the current PCL logical page orientation.
- Does not change the SP pen number, but may change the color of that pen by defaulting the palette.

Orientation *(Esc&l#O)*, **Paper Size** (*Esc&l#A*), **Page Length** (*Esc&l#P*)

- Defaults picture frame size to the factory default PCL text area.
- Defaults the picture frame anchor point to the upper left corner (relative to the current orientation) of the PCL text area.
- Defaults P1 and P2 to the lower left and upper right corners (relative to the current orientation) of the picture frame, respectively ("IP;").
- Defaults the soft-clip window to the picture frame ("IW;").
- Clears the polygon buffer ("PM0; PM2;").
- Moves the HP-GL/2 pen position to the lower-left corner of the picture frame (P1).
- Recomputes the picture frame scale factor (ratio of the new picture frame size to previous plot size).

Picture Frame Size (*Esc*c#X*, *Esc*c#Y*), **Anchor Point** (*Esc*c#T*)

- Defaults P1 and P2 to the lower left and upper right corners of the picture frame, respectively ("IP;").
- Defaults soft-clip window to the picture frame ("IW;").
- Clears the polygon buffer ("PM0; PM2;").
- Moves the HP-GL/2 pen position to the lower-left corner of the picture frame (P1).
- Recomputes the picture frame scale factor (ratio of the new picture frame size to previous plot size).

HP-GL/2 Plot Size (*Esc*c#K*, *Esc*c#L*)

- Changes the picture frame scale factor

Palette Redefinition (*Esc*r#U*, *Esc*v#W*, *Esc*v#A*, *Esc*v#B*, *Esc*v#C*, *Esc*v#I*)

- Changes the colors selected by SP and used in patterns defined by RF and/or used by FT.

Logical Operation (*Esc*l#O*)

- ROP values are transferred between contexts.

Pixel Placement (*Esc*l#R*)

- Pixel Placement is transferred between contexts.

Render Algorithm (*Esc*j#T*)

- Changes the halftoning method employed to render non-primary colors.

DEVICE NOTE: LaserJets prior to LJ4, DeskJets below DJ1200C, PaintJet XL300, and the Color LaserJet do not allow *Esc%#A*, *Esc%#B*, or HP-GL/2 commands in PCL macro definitions.

Transferring the Coordinate System

Esc%2B and *Esc%3B* have the following additional effects:

- HP-GL/2 adopts the current PCL dot coordinate system, origin, axes, and print direction. All HP-GL/2 commands using current units will use PCL dot units.
- An implicit RO0 is issued. Any RO will move the HP-GL/2 origin to where the PCL origin would be if the PCL coordinate system were rotated by the Print Direction command (*Esc&a#P*).
- Picture frame scaling using the plot size commands (*Esc*c#K, Esc*c#L*) is disabled; images are clipped to the picture frame.
- An SC with parameters re-adopts the HP-GL/2 coordinate system and applies picture frame scaling. A subsequent *IN* or "*SC;*" will again restore the PCL dot coordinate system.

Shared State Variables

In dual context mode, the following state variables are shared:

- Current palette (whether created by *EscE, Esc*r#U*, *Esc*v#W, Esc*d#W, IN, BP*, or reprogrammed by *Esc*v#A*, *Esc*v#B*, *Esc*v#C*, *Esc*v#I, CR, NP, PC*)
- Logical operation (*Esc*l#O, MC*)
- Pixel placement (*Esc*l#R, PP*)

Single Context

When the value field is -1, the device behaves like a "stand-alone plotter".

- The current page is closed and printed. HP-GL/2 is initialized (BP/IN) and HP-GL/2 output begins on a new page. Exiting HP-GL/2 via *Esc%#A* closes and prints the current page and performs *EscE* before entering PCL. HP-GL/2 and PCL cannot be combined on the same page.
- The only PCL commands recognized are *EscE* and *Esc%#A*, or the Universal Exit command.
- PCL picture presentation directives are ignored.
- The default HP-GL/2 orientation is reverse landscape.
- HP-GL/2 hardclip limits are equal to PCL printable area.
- *EscE* retains its usual functionality.
- The command is ignored in HP-GL/2 mode.

17.3 Exiting HP-GL/2

Esc%#A exits HP-GL/2 and specifies whether the new CAP is derived from the HP-GL/2 pen position or the previous CAP.

Enter PCL Mode   *Esc % # A*

Causes a device to interpret data as PCL commands instead of HP-GL/2 commands.

```
Value(#)   =   0   Use previous PCL CAP
           =   1   Use current HP-GL/2 pen position for CAP
Default    =   0
Range      =   0,1
```

A missing or even value maps to 0; an odd value maps to 1.

The capital "A" terminator must always be used with this command.

If the current HP-GL/2 pen position is outside the PCL logical page and the value field is 1, CAP moves to the nearest point on the logical page boundary.

This command is ignored in PCL mode.

In dual context mode, the following state variables are shared:

- Current palette (whether created by *EscE, Esc*r#U*, *Esc*v#W*, *Esc*d#W, IN, BP*, or reprogrammed by *Esc*v#A*, *Esc*v#B*, *Esc*v#C*, *Esc*v#I, CR, NP, PC*)
- Logical operation (*Esc*l#O*, *MC*)
- Pixel placement (*Esc*l#R*, *PP*)

NOTE: This command is also used to transition from non-HP emulation modes to PCL mode. When making the transition from a non-HP emulation mode (e.g., Epson), an absent or 0 value field resets the PCL state environment.

DEVICE NOTE: LaserJets prior to LJ4, DeskJets below DJ1200C, PaintJet XL300, and the Color LaserJet do not allow *Esc%#A*, *Esc%#B*, or HP-GL/2 commands in PCL macro definitions.

17.4 Resetting to Defaults

Reset *Esc E*

Both HP-GL/2 and PCL recognize *EscE*. An *EscE* executed within HP-GL/2 has the following effects:

- Peforms a PCL reset (with the same effects on PCL variables as if it were executed within PCL).
- Executes an IN / BP.
- Defaults all programmable features.
- Configures a two-pen, non-modifiable black and white default PCL palette.
- Prints any partial pages of data that have been received.
- Returns to PCL parsing mode.

After *EscE*, the device should remain on-line, no data should be lost, and there should be no effect on I/O or host-to-peripheral communication.

EscE is a valid HP-GL/2 terminator and has all the functionality of IN, as well as defaulting:

- Color palette
- Logical page orientation
- Picture frame
- Picture frame anchor point
- HP-GL/2 plot size

Within an HP-GL/2 label when Transparent Data is off (TD = 0), *EscE* resets a device and switches to PCL mode. When TD = 1, *EscE* is interpreted as data and does not cause a reset.

EscE, page length, page size, and orientation commands do not eject pages containing no print data (characters, raster graphics, or HP-GL/2 graphics).

At power-on or *EscE*, all programmable features are defaulted:

Picture frame:	Defaults to the PCL text area.
Picture frame anchor point:	Defaults to the left edge of the logical page at default top margin.
Plot size:	Defaults to the picture frame size.
Scale factor:	Defaults to 1. No scaling is performed.
P1 and P2:	Default to the lower-left and upper-right picture frame corners, respectively. The lower-left corner is at HP-GL/2 position (0,0) with user scaling off.
Soft-clip window:	Defaults to the picture frame.

HP-GL/2 Factory Environment Defaults

Character Group

- Character set = device dependent
- Font spacing = device dependent
- Pitch = device dependent
- Height = device dependent
- Posture = device dependent
- Stroke weight = device dependent
- Typeface = device dependent
- Character direction = horizontal
- Character direction mode = absolute
- Character size mode = absolute
- Character width = device dependent
- Character height = device dependent
- Character slant = 0
- Extra horizontal space = 0
- Extra vertical space = 0
- Character fill mode = solidly fill characters with current pen without edging
- Label origin = 1
- Label terminator = non-printing
- Transparent data mode = off

Vector Group

- Plotting mode = absolute
- Pen state = up

Polygon Group

- Polygon buffer = cleared
- Polygon mode = off

Line and Fill Attribute Group

- Line type = solid
- Line type repeat length = 4% of the diagonal distance from P1 to P2
- Line cap = butt
- Line join = mitered
- Miter limit = 5
- Pen color = default HP-GL/2 palette
- Pen width selection mode = metric, pen widths = 0.35 mm
- Selected pen = 1 (black)
- Symbol mode = off
- Fill type = solid (bidirectional), odd-even fill algorithm
- User-defined line type = eight standard line types as defined by LT
- Area fill anchor corner = (0,0) plotter units
- User-defined fill types = solid fill

Configuration and Status Group

- Scale mode = off (units are plotter units)
- Window = PCL default picture frame (PCL default logical page less 1/2" at the top and the bottom)
- Coordinate system orientation = orientation of PCL default logical page coordinate system
- P1, P2 = lower left, upper right corners, respectively, of picture frame

HP-GL/2 Modified Print Environment

The modified print environment consists of the current settings for the following:

- Current font
- Primary font
- Secondary font
- Primary font attributes
- Secondary font attributes
- Label terminator
- Label direction
- Label direction mode (abs/rel)
- Extra horizontal space
- Extra vertical space
- Character size mode (abs/rel)
- Character width
- Character height
- Character slant
- Label origin
- Character fill mode
- Area fill anchor corner
- Fill type
- Line type
- Line type mode (abs/rel)

- Line type repeat length
- Plotting mode (abs/rel)
- Selected pen
- Pen state (up/down)
- Symbol mode (on/off)
- Soft clip window
- Current scaling information
- P1x
- P1y
- P2x
- P2y
- Pen width selection mode (rel/metric)
- Pen width units
- Pen width
- Transparent data mode
- Line cap
- Line join
- Miter limit
- Coordinate system orientation
- Current active position

The following items in the HP-GL/2 context are not part of the modified print environment:

- User-defined raster fill patterns
- Polygon buffer
- Parser state

The macro overlay environment does not include any of the HP-GL/2 settings.

17.5 Picture Presentation Commands

The default picture frame (PCL text area) normally defines the plot's destination; but picture presentation directives can be used to modify the size and position of the picture frame, as well as the plot size with respect to the picture frame.

The General Process

The following command sequence is suggested. Some steps are unnecessary or are automatically:

1. Position the picture frame on the logical page (anchor point).
2. Size the picture frame, if necessary.
3. Position the plot in the picture frame, if necessary.
4. Scale the plot to the picture frame, if necessary.
5. Enter HP-GL/2.
6. Send the HP-GL/2 commands describing the graphic.
7. Exit HP-GL/2.

Positioning the Picture Frame

The picture frame position on the logical page is determined by the Picture Frame Anchor Point command (*Esc*c#T*), which places the upper-left corner of the picture frame at CAP.

Picture Frame Anchor Point   *Esc * c # t/T*

Sets the location of the picture frame anchor point to the PCL CAP

```
Value(#)    =   0   -    Picture frame anchor point is set to CAP
Default     =   Left edge of the logical page at the default top margin
Range       =   0 (all other values are ignored)
```

The picture frame anchor point defines the the upper-left corner of the picture frame. *Upper-left* refers to the corner whose PCL X and Y coordinates are minimized when print direction is 0.

Reset (*EscE*), Page Length (*Esc&l#P*), Page Size (*Esc&l#A*), Orientation (*Esc&l#O*), or the absence of a command defaults the anchor point to the left edge of the logical page at the default top margin. Print direction (*Esc&a#P*) has no effect on the physical location of the anchor point or the picture frame.

This command has the following additional effects:

- Defaults P1 and P2 to the lower-left and upper-right corners of the picture frame, as viewed from the current orientation.
- Resets the soft-clip window to the PCL picture frame boundaries.
- Clears the polygon buffer.
- Sets CAP to the lower-left corner (P1) of the picture frame (viewed in the current orientation).
- Sets the Label Carriage Return point to the lower-left (P1) corner of the picture frame (viewed in the current orientation).

Sizing the Picture Frame

Default picture frame width is the width of the logical page; default length is the default text length (which extends the length of the physical page except for 0.5" at the top and bottom edges). The picture frame size commands (*Esc*c#X*, *Esc*c#Y*) described below can modify these default dimensions.

Horizontal Picture Frame Size (decipoints)   *Esc * c # x/X*

Specifies the horizontal size of the window on the logical page allocated for an HP-GL/2 plot.

Value(#)   =   Horizontal size in decipoints
Default   =   Width of the current logical page
Range   =   0 to 2^{32} -1 (fractional values allowed; valid to 4 decimal places)

The picture frame's horizontal aspect is parallel to the current PCL X-axis. Once specified, subsequent orientation and print direction changes do not affect picture frame position and dimensions.

Horizontal picture frame size defaults to the logical page width if no parameter or a parameter of 0 is sent, or following a reset, page length, page size, orientation or UEL command.

This command has the following additional effects:

- Defaults P1 and P2 to the lower-left and upper-right corners of the picture frame.
- Resets the soft-clip window to the PCL picture frame boundaries.
- Clears the polygon buffer.
- Updates CAP and the Label carriage-return point to the lower-left corner of the picture frame (P1), as viewed from the current orientation.

Vertical Picture Frame Size (decipoints)   *Esc * c # y/Y*

Specifies the vertical size of the window in the logical page allocated for an HP-GL/2 plot.

Value(#)   =   Vertical size in decipoints
Default   =   Distance between the default top and bottom margins (default text length)
Range   =   0 to 2^{32} -1 (fractional values allowed; valid to 4 decimal places)

The picture frame's vertical aspect is parallel to the current PCL Y-axis. Once specified, subsequent orientation and print direction changes do not affect picture frame position and dimensions.

Vertical picture frame size defaults to the default PCL text length if no parameter or a parameter of 0 is sent, or following a reset, page length, page size, orientation command, or UEL command.

This command has the following additional effects:

- Defaults P1 and P2 to the lower-left and upper-right corners of the picture frame.
- Resets the soft-clip window to the PCL picture frame boundaries.
- Clears the polygon buffer.
- Updates CAP and the Label carriage-return point to the lower-left corner of the picture frame (P1), as viewed from the current orientation.

Positioning the Plot

The orientation of the HP-GL/2 plot within the picture frame depends upon:

- Logical page orientation
- RO, the HP-GL/2 rotate command
- The value field of *Esc%#B*
- Print direction if HP-GL/2 is entered with *Esc%2B*.

PCL print direction does not affect the physical position and dimensions of the picture frame, the picture frame anchor point, or HP-GL/2 orientation (except when using *Esc%2B* or *Esc%3B*).

Effect of *Esc%2B* or *Esc%3B*

Esc%2B and *Esc%3B* transfer the PCL coordinate system, origin, and unit of measure. This allows HP-GL/2 to operate in the PCL coordinate system. *Esc%2B* and *Esc%3B* also ignore the picture-frame scaling of the Plot Size commands *Esc*c#K* and *Esc*c#L*.

Logical Page Tracking

Default HP-GL/2 orientation tracks PCL logical page orientation. In the default HP-GL/2 orientation (RO0), the origin is at the lower-left corner of the picture frame. Both the PCL and HP-GL/2 X-axes increase in the same direction; but the Y-axes increase in opposite directions.
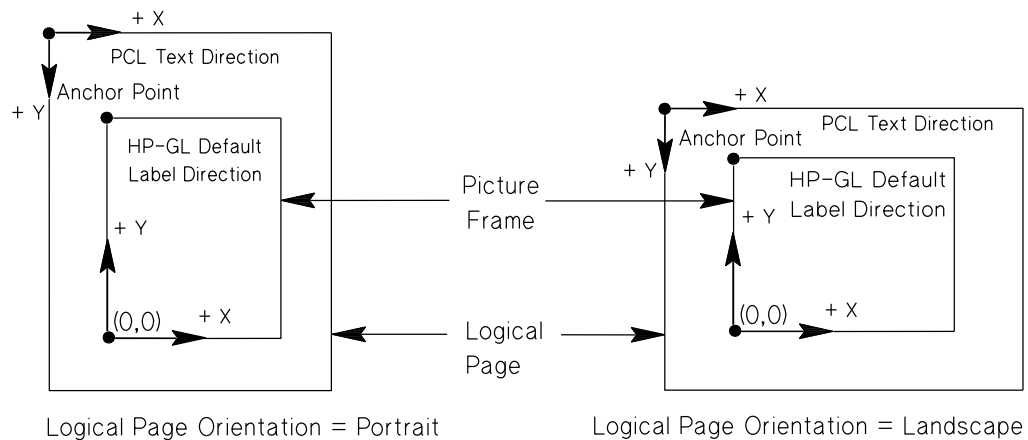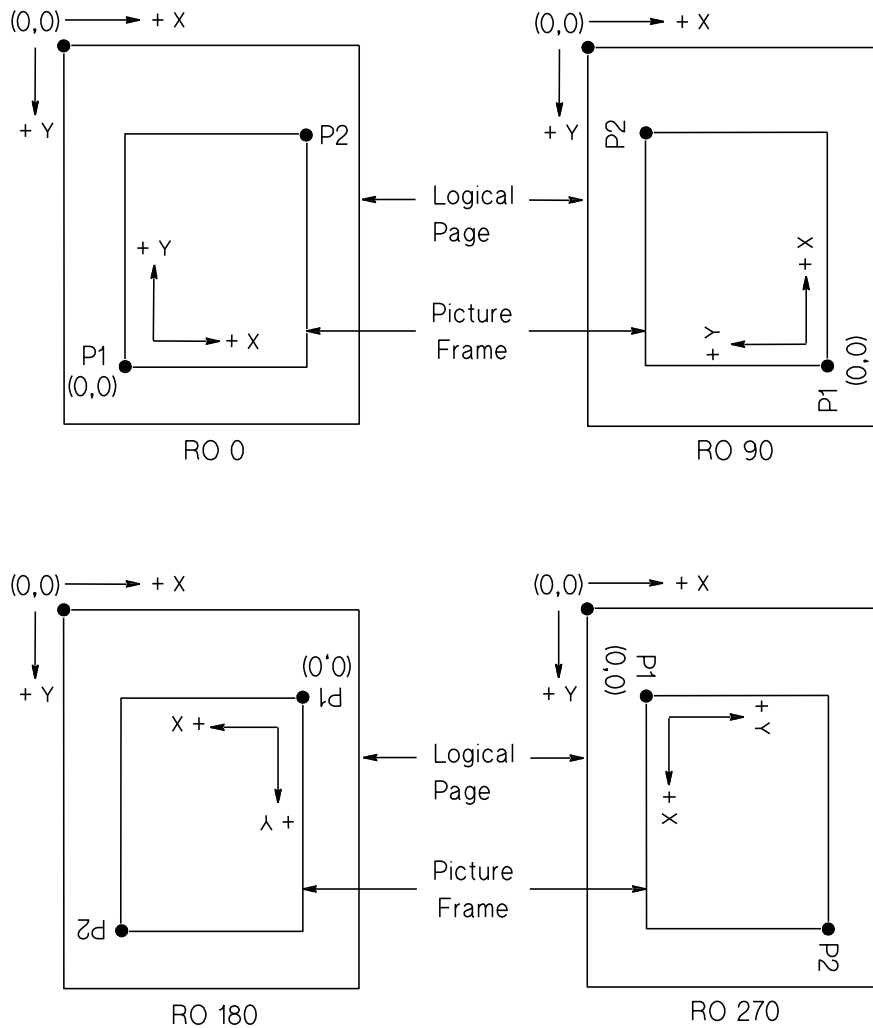

How HP-GL/2 Orientation Tracks PCL Logical Page Orientation

Modifying the Orientation with RO

RO can modify the default HP-GL/2 orientation. RO0 moves the default HP-GL/2 coordinate system origin to the lower-left corner of the PCL picture frame. (The lower-left corner is that in which the PCL X-coordinate is minimized and the Y-coordinate maximized when print direction is defaulted.)

NOTE: Entering HP-GL/2 with *Esc%2B* or *Esc%3B* implicitly executes RO0.

(Logical page orientation is portrait.)

How RO Modifies the Default HP-GL/2 Orientation

Fitting the Plot to the Picture Frame

When an HP-GL/2 plot is to be placed into the picture frame on the PCL logical page, there are three possible outcomes:

- A *page-size independent* plot (specified entirely in user-units by SC) is automatically scaled to fit into the picture frame — user-scaling.

- A *page-size dependent* plot (specified in absolute units) is scaled to fit into the picture frame by specifying horizontal and vertical plot size (*Esc*c#K*, *Esc*c#L*) — picture frame scaling.

- Unless the plot size commands (*Esc*c#K*, *Esc*c#L*) are used, a *page-size dependent* plot using absolute units is not scaled. The plot is clipped if it extends beyond the effective window.

Page-Size Independent Plots

The parameters of many HP-GL/2 commands are interpreted according to the *current units* in effect:

- If user scaling (SC) is in effect, current units are in ***user units***. User units are defined by the two scaling points P1 and P2, which specify opposite corners of user-coordinate space.

- If user scaling (SC) is not in effect, current units are in absolute ***plotter units***. One plotter unit equals 0.025 mm or 0.00098 inches.

A plot specified entirely in user units (SC) is automatically sized to fit the picture frame. Such a plot is page-size independent if it satisfies the following requirements:

- No positioning or drawing command parameter is in plotter units.
- Scaled mode (SC, types 0 or 1, not type 2) is used exclusively.
- Scalable fonts (SB) are used exclusively.
- Either the default P1 and P2 locations are used, or their positions are specified by IR.
- Either the default window is used, or the window is specified in user units.
- Only the SR mode is used for labels; SI is not used.
- Only the DR mode is used for label direction.
- The pen width selection mode (WU) is relative, not metric.
- The pattern length for line types (LT) is relative, not metric.
- Stick fonts should use relative or no pen width.

Scaling with Plot Size Commands

Page-size dependent plots (those originally specified in absolute units) are rendered in their original native size and clipped to the picture frame if necessary. However, the Plot Size commands (*Esc*c#K*, *Esc*c#L*) can scale the plot to the picture frame — picture frame scaling. The printer uses the sizes specified by these commands to compute a horizontal and a vertical *scale factor* (the ratio of a picture frame dimension to the corresponding plot dimension). The plot is then scaled to fit the picture frame in each dimension. The plot's aspect ratio is maintained only if the specified plot sizes have the same aspect ratio as the picture frame.

For example, if the original HP-GL/2 drawing is 8.5" wide by 7" high, sending *Esc*c8.5k7L* scales the plot as necessary to fit into the picture frame. If the horizontal plot size is specified as 12" when the horizontal picture frame size is 6", the horizontal scale factor is 1:2, and the plot's horizontal dimension is reduced to 1/2 its original size. If the ratio is 2:1, the plot's horizontal dimension is enlarged to twice its original size.

If user scaling (SC) is not in effect and the picture frame and plot are not the same size, current units are in *picture frame units*, which are plotter units multiplied by the picture frame scale factor.

Some commands operate only on absolute units. For example, SI parameters are always in centimeters. The picture frame scale factor is applied to the parameters of these commands.

Scaling also affect labels printed with a bitmap font (SB1). As with SI and SR, the bitmap font most closely matching the desired character size will be used.

The scale factor modifies sizes specified as parameters to SI, SD, and AD. For example, if a 14-point font is requested and the scale factor is 1/2, a 7-point font is selected if available.

The Effective Window

When drawing an HP-GL/2 plot, the intersection of four boundaries delimits the area on the physical page where a vector graphics image can be printed:

- Hard clip limits: the HP-GL/2 physical printing limits.
- Soft clip limits: temporary HP-GL/2 boundaries defined by IW or IR.
- Logical page: the current PCL logical page boundaries.
- Picture frame: the current PCL picture frame.
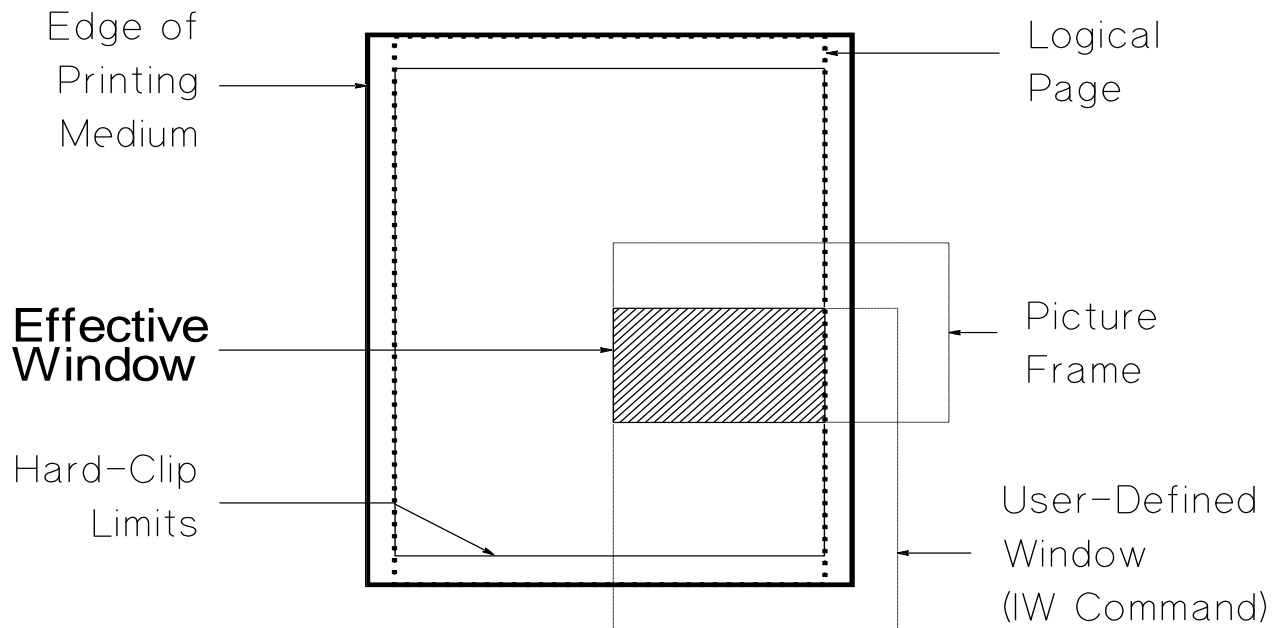
Horizontal Plot Size   *Esc * c # k/K*

Specifies the horizontal size of the imported HP-GL/2 plot.

Value(#)   =   horizontal size in inches
Default   =   Picture frame width
Range   =   0 to 2^{32} -1 (fractional values allowed; valid to 4 decimal places)

The horizontal plot size determines the horizontal scale factor used to fit the drawing into the PCL picture frame. For example, if horizontal plot size is 12" and picture frame width is 4", the horizontal scale factor is 1:3. The horizontal component of the image would be reduced to one-third its original size to fit into the picture frame.

Plot width defaults to picture frame width, with no scaling (i.e., the plot is rendered in its original size and clipped to the picture frame if necessary), if the value field is zero, or following a reset, page length, page size, orientation, or UEL command.

Vertical Plot Size   *Esc * c # l/L*

Specifies the vertical size of the imported HP-GL/2 plot

Value(#)   =   Vertical size in inches
Default   =   Picture frame length
Range   =   0 to 2^{32} -1 (fractional values allowed; valid to 4 decimal places)

The vertical plot size value determines the vertical scale factor used to fit the drawing into the PCL picture frame. For example, if vertical plot size is 7" and picture frame height is 14", the vertical scale factor is 2:1. The vertical component of the image would be enlarged to twice its original size to fit into the picture frame.

Plot height defaults to picture frame height, with no scaling (i.e., the plot is rendered in its original size and clipped to the picture frame if necessary), if the value field is zero, or following a reset, page length, page size, orientation, or UEL command.

17.6 HP-GL/2 Modifications in the PCL Context

The functionality of the following HP-GL/2 commands is modified in the PCL context.

CR   Color Range

Can be used to change the black and white references for palettes created by *IN*, *BP*, or *Esc*v#W*. The new references are remembered when the context is changed back to PCL. This command is ignored if the current palette was created by *Esc*r#U* or *EscE*.

FT   Fill Type

The following additional *fill_types* are imported from PCL when the HP-GL/2 context is entered with a zero or positive parameter.

> 21: PCL predefined pattern
> 22: PCL user-defined pattern

Fill_type 21 selects PCL predefined patterned fill. *Option 1* specifies the pattern type. A fill type is specified using a value between 1 and 6. *Option 2* is ignored if present.

Fill_type 22 selects a PCL user-defined fill previously specified by *Esc*c#W*. *Option 1* specifies the PCL ID of the user-defined fill pattern. *Option 2* is ignored if present. If option 1 is invalid for any reason (e.g., deleted pattern), a solid fill in the current pen color is selected.

NP   Number of Pens

Changes the number of palette entries after *IN*, *BP*, or *Esc*v#W*. This command is ignored if the current palette was created by *Esc*r#U* or *EscE*.

The size and contents of the current palette depend upon where it was created (*Esc*v#W*, *Esc*d#W*, *IN*, or *BP*) and whether it has been reprogrammed (*Esc*v#A, Esc*v#B, Esc*v#C, Esc*v#I*, or *PC*). *NP* can increase or decrease the size of the current palette. If *NP* increases the current palette size, additional entries will contain black. If *NP* reduces the current palette size, the excess indices are eliminated. In either case, the bits-per-index value which indicates the size of the palette is adjusted accordingly.

PC   Pen Color Assignment

Changes the color of pens in a palette created by *IN*, *BP*, or *Esc*v#W*. This command is ignored if the current palette was created by *Esc*r#U* or *EscE*.

SV   Screened Vectors

The following additional screen types are imported from PCL when the HP-GL/2 context is entered with a zero or positive parameter.

> 21: PCL predefined pattern
> 22: PCL user-defined pattern