Chapter 18: Macros

Contents of this Chapter

This chapter discusses the following PCL commands:

18.1 Introduction

A macro is a group of PCL commands and data created by the user that may reside on cartridge or be downloaded and stored in a device's user memory. Once stored, a macro can be executed repeatedly by a single command, using an assigned macro ID.

Macros eliminate the need to repeatedly download the same information, thus saving transmission time. However, the trade-off is the consumption of user memory. An example of a macro might be the printing of a company letterhead. The letterhead is created as a macro and stored in the printer. Whenever the letter is printed, a macro command prints the letterhead.

The number of macros that can be stored in user memory is limited to either 32767, the number of macro IDs that can be assigned, or by the available memory.

DEVICE NOTE: LaserJets prior to LJ4, DeskJets below DJ1200C, PaintJet XL300, and the Color LaserJet do not support HP-GL/2 commands or picture frame directives within macros.

18.2 Creating Macros

Macro creation entails the following steps:

1. **Designate a macro identification number** with the Macro ID command (*Esc&f#Y*). Any macro already assigned this number is deleted.

2. **Start the macro definition** with the Macro Control command (*Esc&f0X*). Subsequent commands and data are to be stored as a macro.

3. **Send the commands in the macro**. The macro commands and data are sent to the printer in the intended order of execution.

4. **Stop the macro definition** with the Macro Control command (*Esc&f1X*), which identifies the end of the macro definition.

18.3 Invoking Macros

Macros are invoked with the Macro Control command (*Esc&f#X*). There are three ways to invoke a macro:

- Call
- Execute
- Overlay

Calling a Macro

A **called** macro restores the original modified print environment (except for CAP) upon completion.

Executing a Macro

An **executed** macro does not restore the original modified print environment upon completion. Changes made by the macro are retained.

Overlaying

A macro **overlay** is the final operation each time a page is printed. A macro overlay restores the original modified print environment upon completion. During execution, a macro overlay uses the overlay environment, which is a combination of user defaults and the modified print environment.

18.4 Managing Macros

Macros are managed like fonts. They are automatically designated **temporary** at definition and are deleted during a printer reset unless designated **permanent**. The Macro Control command (*Esc&f#X*) designates macros as temporary or permanent. Temporary and permanent macros are removed from memory at power off.

Several PCL mechanisms can explicitly delete macros from user memory. Macros may be deleted explicitly by the Macro Control command (*Esc&f#X*), or implicitly by *EscE*, control panel reset, macro definition, and self test.

18.5 The Modified Print Environment

The modified print environment consists of all current feature settings. Settings altered by escape sequences are recorded in the modified print environment. A macro **call** or **overlay** saves the current modified print environment and restores it following completion. The modified print environment consists of the following state variables:

JOB CONTROL
    Left and top registration
    Copy count
    Job separation
    Media destination

PAGE CONTROL
    Size, Length
    Orientation
    Print direction
    Media source

MARGINS
    Left, Right, Top, Bottom
    Perforation skip

FONTS
    Primary selected font
    Secondary selected font
    Primary font attributes
    Secondary font attributes
    Font ID
    Character code

TEXT
    EOL wrap
    Line termination
    HMI, VMI/Line spacing
    Underline mode
    Text Parsing
    Text Path Direction

COLOR
    Foreground color

    Number of raster planes
    Gamma value
    Render algorithm
    Downloaded dither
    Current palette
    Palette select ID
    Palette control ID
    Monochrome print mode
    Viewing illuminant
    Finish mode
    Lightness setting
    Saturation setting
    Color treatment
    Color lookup tables
    Primary chroma values
    White point
    Primary gamma values
    Primary gain values
    Primary encoding values

RASTER
    Raster mode
    Presentation
    Compression method
    Source width and height
    Resolution
    Left graphics margin
    Scale algorithm
    Destination width and height

AREA FILLS
    Current Pattern
    Pattern ID
    Horizontal and vertical rectangle size
    Pattern reference point

MACROS
    Macro ID

PRINT MODEL
    Logical operation
    Source and pattern transparency

The following items are not part of the modified print environment.

    Overlay
    CAP, and the CAP stack
    Raster seed row
    Downloaded fonts/macros

NOTE: CAP is not part of the modified print environment: CAP is not saved when a macro is called, nor is it restored upon completion. The Push/Pop CAP command (*Esc&f#S*) can be used to save and recall CAP.

The HP-GL/2 Modified Print Environment

On printers allowing HP-GL/2 commands within macros, the HP-GL/2 modified print environment must be saved when a macro is called or enabled for overlay. The HP-GL/2 modified print environment consists of the following:

Alternate font definition	Last symbol position
Anchor corner mode	Last vector
Carriage return position	Last zero-length vector
Chacter width	Line attributes
Character fill type	Line type mode
Character size	Logical page boundaries
Character slant	Orientation
Clip tolerance	Palette
Clip window	Pen hardclip limits
Coordinate system orientation	Pen width
Curently selected pen	Pen width mode
Current font selection	Pen width unit mode
Current pen position	Physical size
Default hardclip limits	Picture frame
Extra horizontal space	Plotting mode (abs/rel)
Extra vertical space	Scaling
Fill type	Screen
Input window	Skip vector flag
Input window mode	Standard font definition
Label direction	Symbol mode
Label direction mode	Thin vector flag
Label origin	Transparency
Label terminator	Transparent data mode
Last pen down	Zero length vector flag

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

DEVICE NOTE: LaserJets prior to the LaserJet 4, PaintJet XL300, DeskJets prior to DeskJet 1200C, and the Color LaserJet do not support HP-GL/2 commands within macros. This includes Enter HP-GL/2 (*Esc%#B*) as well as the picture frame directives (*Esc*c#T*, *Esc*c#X*, *Esc*c#Y*, *Esc*c#K*, and *Esc*c#L*).

18.6 The Overlay Print Environment

The overlay print environment is the same as the modified print environment except that CAP and CAP stack are also saved. After the overlay is completed, the saved feature settings are restored.

18.7 Rules Governing Macros

1.   A macro may span multiple pages, since commands causing page ejects are allowed in a macro (e.g., Form Feed, Page Length).

2.   A macro may call or execute another macro, which in turn may call or execute another macro; two levels of nesting (i.e., three total levels) are allowed. Attempting another level is ignored.

3.   Other than call and execute, no macro operations may occur within a macro.

4.   Reset (*EscE*) is not allowed in a macro.

5.   A macro enabled for overlay is executed on each page until the macro is disabled or deleted, reset occurs, or page length, page size, or orientation is changed. The macro overlay is executed last on each page; i.e., it is the final operation before each page is printed.

6.   If page length, size, or orientation is changed, or the primary font is deleted during a call or overlay, the following actions are necessary to restore the original modified print environment:

     •   If the original page length or size was different than the current length or size, the current page is closed and all pages are printed. Page length and size are changed to the original value, and CAP is set to (0,0).

     •   If the original orientation was different than the current orientation, the page is closed and printed, the original orientation is set, and CAP is set to (0,0).

     •   If the primary or secondary font was deleted, the font select commands are used to select the closed font.

     DEVICE NOTE: LaserJets prior to LJIII except LJ2000 ignore any font download or font deletion commands within a macro.

7.   A multiple-page macro may be enabled for overlay. However, when the macro causes a page eject, it must not cause the overlay to re-invoke the overlay (i.e., once overlay is in progress, it cannot be invoked again until the current overlay is finished).

18.8 Macro Commands

Macro ID   *Esc & f # y/Y*

Specifies an ID number for use in subsequent macro commands.

Value(#)   =   Macro ID number
Default   =   0
Range   =   0 to 2^{32} -1

A unique identification (ID) number should be designated prior to the definition of a macro; this number is then associated with the macro, and subsequent macro operations are accomplished using the macro ID number. If a macro is already associated with this ID number, the existing macro is deleted from user memory during the definition of the new macro.

Macro Control   *Esc & f # x/X*

Provides mechanisms for definition, invocation, and deletion of macros. This command is ignored if the macro does not exist.

Value(#)	Function
0	Start macro definition (last ID specified)
1	Stop macro definition
2	Execute macro (last ID specified)
3	Call macro (last ID specified)
4	Enable macro for overlay (last ID specified)
5	Disable overlay
6	Delete all macros
7	Delete all temporary macros
8	Delete macro (last ID specified)
9	Make macro temporary (last ID specified)
10	Make macro permanent (last ID specified)
11	Create bitmap of macro

0, 1 Start Macro Definition or Stop Macro Definition cause the following action:

- A macro with the same ID as the current Macro ID state variable is deleted (even if it is permanent). A new macro is created, marked as temporary, and assigned the current Macro ID as its identifier.

- All data (including binary data) is parsed, but not executed, and stored as the definition of Macro ID until a Stop Macro Definition or reset (control panel or EscE) is received. The entire macro is discarded if out-of-memory occurs during the macro definition.

2   *Execute Macro* causes the following action:

- Processing from the I/O buffer halts, the current parser state is saved, and the parser is reset to the "top level".

- The macro specified by Macro ID is executed using the current user's environment. This is done by parsing and executing the raw macro data as input (as if it had come from the I/O).

- Upon completion of the macro, the parser state is restored and processing resumes with the next character in the I/O buffer.

3   *Call Macro* causes the following action:

- Processing from the I/O buffer is halted, current parser state and current user's environment are saved, and the parser is reset to the "top level".

- The macro specified by Macro ID is executed using the current user's environment. This is done by parsing and executing the raw macro data as input (as if it had come from the I/O).

- Upon completion of the macro, the parser state and the user's environment are restored, and processing resumes with the next I/O buffer character.

4   *Enable Macro for Overlay* marks the macro specified by *Macro ID* as the auto macro overlay for each user page and performs the following action whenever a user page is closed (before being sent out for printing):

- Processing from the I/O buffer is halted, current parser state and current user's environment are saved, and the parser is reset to the "top level".

- The overlay environment is created using the default values for most of the state variables and some variables from the current user's environment.

NOTE: The overlay environment is newly created on each page, just before the macro is executed.

- The auto macro overlay macro is executed using the overlay environment.

- Upon macro completion, the current page is closed and printed, the parser state and the user's environment are restored, and processing resumes with the next I/O buffer character.

NOTE: If the auto macro overlay is disabled before the current page is ejected, the overlay will not appear on that page.

NOTE: If the specified macro does not exist, the overlay is disabled and no macro is enabled.

NOTE: Any macro previously enabled for auto macro overlay is disabled.

5   *Disable Overlay* disables the auto macro overlay, starting with the current page.

NOTE: Commands that change page length, page size, or orientation disable the auto macro overlay after the command has been executed.

6   **Delete All Macros** deletes all temporary and permanent macros. This command disables the auto macro overlay.

7   **Delete All Temporary Macros** deletes all temporary macros. If this command deletes the auto macro overlay, it disables the auto macro overlay.

8   **Delete Macro** deletes the macro specified by the Macro ID state variable. If this command deletes the auto macro overlay, it disables the auto macro overlay.

9   *Make Macro Temporary* sets the state of the macro specified by *Macro ID* to temporary.

10   *Make Macro Permanent* sets the state of the macro specified by *Macro ID* to permanent.

11   *Create Bitmap of Macro* creates the static overlay bitmap, which can then be managed by using the other macro control values*.*

Static overlay is a hardware/software performance enhancement that rasterizes a macro into a full-page bitmap that is then used for subsequent printing. Static overlay can improve the printing performance of large static images like electronic forms. It is best used for large complex images that are used repeatedly, such as billing invoices to the HP5000.

Prior to rasterizing the macro, the current modified print environment is saved and replaced with the overlay environment; after rasterization, the previous modified print environment is restored. The resulting bitmap is stored in memory, designated temporary (by default), and assigned the same ID as the macro from which it was generated.

NOTE: The bitmap version of a macro can be printed only if the macro is enabled and invoked as an automatic overlay. Otherwise, if the macro is called or executed, the native version of the macro (text and PCL commands) will be used.

Since the bitmap version of a macro has the same ID as the native version, operations such as making a macro permanent or temporary, or deleting a macro affects both versions. For example, deleting a macro by ID deletes both the native and bitmap versions of that macro.

A value field of 11 modifies the other macro operations as follows:

1. Unchanged.

2. Unchanged.

3. Execute macro using the native version only (last ID specified).

4. Call macro using the native version only (last ID specified).

5. Enable macro for automatic overlay. If the bitmap version exists (i.e., the macro has been rasterized with *Esc&f11X*), it will be printed when the macro is invoked implicitly through a page eject such as <FF>.

6. Disable auto overlay.

7. Delete native and bitmap versions of all macros.

8. Delete native and bitmap versions of temporary macros.

9. Delete native and bitmap versions of macro (last ID specified).

10. Make native and bitmap versions of macro temporary (last ID specified).

The generation of a static overlay bitmap closes and prints all open pages. Re-rasterizing a macro with an existing static overlay bitmap deletes the existing bitmap and creates a new one from the native version with current environment settings.

The bitmap version can be printed only when the macro is invoked through auto overlay. The native version is used when the macro is called or executed.

Multiple static overlays can be used within the same print job. To switch bitmap images, enable the auto overlay of the macro with the desired bitmap; the previously enabled macro will be disabled.

A printer not supporting static overlay ignores an *Esc&f11X* and uses the native version for printing.

A bitmap's size and orientation correspond to the page size and orientation settings at the time the macro is rasterized.

Macro bitmaps are static and non-positionable: once created, orientation and size cannot be changed. Each bitmap spans the entire current page size and cannot be cropped or repositioned. In addition, a macro generated into a bitmap can span a maximum of one page; that is, no escape sequences or control characters are allowed in the macro that will cause a page to be closed (page eject, FF, etc)

Assigning an existing ID to a new macro deletes the native and bitmap versions of the existing macro.

HP5000 F1XX DEVICE NOTES:

If the page size/orientation of the bitmap to be printed does not correspond to the current page size/orientation settings, the printer stops with the error message "STATIC OVERLAY WRONG PAGE SIZE", and the printer state goes to "NOT READY". The operator can either press CANCEL or READY. If the operator presses READY, printing will continue, but only the data is printed. The bitmap will not be printed until the page size/ orientation settings match that of the bitmap.

The macro that is generated into a bitmap can span a maximum of one page. If a macro being generated into a bitmap spans more than one page, the error message "STATIC OVERLAY PAGE OVERFLOW" is displayed, and the printer state goes to "NOT READY". If the operator presses READY, the printer will resume printing, but the native version will be used if the macro is enabled and invoked for auto overaly.

If the printer does not have enough memory to store the bitmap while the macro is being generated, the portion of the bitmap that has already been created is deleted. The message "GSP MEMORY FULL, STATIC OVERLAY CANNOT BE RASTERIZED" is displayed on the V24 terminal. The printer does not stop. However, subsequent printing if the macro is enabled and invoked for auto overlay will be done with the native version. Note that exceeding the available memory may cause the printer to hang or slow down

Examples

To define a macro with an ID of 7, send:

> *Esc&f7y0X*
>> **...**
>> Escape sequences, control codes, and data
>> **...**
> *Esc&f1X*

To make the macro with an ID of 7 permanent, send:

> *Esc&f7y10X*

To enable the macro with an ID of 7 for automatic overlay, send:

> *Esc&f7y4X*

To delete the macro with an ID of 7, send:

> *Esc&f7y8X*

Macro Overlay Example

The following illustrates the definition of a letterhead macro:

Esc&f1Y	Specify the Macro ID as 1.
Esc&f0X	Start the Macro Definition.
Esc&a540h360V	Position logo at (540,360) decipoints in the coordinate system.
*Esc*t150R*	Set graphics resolution to 150 dots-per-inch.
*Esc*r1A*	Start raster image of logo.
*Esc*b60W [Raster data]*	Send the first raster line.
... ...	
*Esc*b60W [Raster data]*	Send the last raster line.
*Esc*rC*	Stop raster graphics.
Esc&a540h780V	Position for lettering at (540,780) decipoints.
Esc(1X	Select font with ID of 1.
ABC Corp. Post Office Box 15 Fred, Texas 83707	Text Text Text

Esc&a540h960V	Position first rule at (540,960) decipoints.
Esc*c10v4680H	Set rule height and width.
Esc*c0P	Print the first rule.
Esc&a540h980V	Position the second rule at (540,980) decipoints.
Esc*c0P	Print the second rule.
Esc&a1200v540H	Position for first line of text at (540,1200) decipoints.
Esc&f1X	Stop Macro Definition.

This macro can now be **executed, called,** or enabled for **overlay**.