Chapter 18: Macros

Contents of this Chapter

- Introduction ............................................................................................................. 18-1
- Creating Macros ...................................................................................................... 18-2
- Invoking Macros ...................................................................................................... 18-2
- Managing Macros .................................................................................................... 18-3
- The Modified Print Environment .............................................................................. 18-3
- The Overlay Print Environment .............................................................................. 18-5
- Rules Governing Macros ........................................................................................ 18-6
- Macro Commands .................................................................................................... 18-7

This chapter discusses the following PCL commands:

Macro ID ................................................................. $Esc&f#Y................................. 18-7
Macro Control .......................................................... $Esc&f#X................................. 18-7

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:

<table>
<thead>
<tr>
<th>JOB CONTROL</th>
<th>Number of raster planes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left and top registration</td>
<td>Gamma value</td>
</tr>
<tr>
<td>Copy count</td>
<td>Render algorithm</td>
</tr>
<tr>
<td>Job separation</td>
<td>Downloaded dither</td>
</tr>
<tr>
<td>Media destination</td>
<td>Current palette</td>
</tr>
<tr>
<td>PAGE CONTROL</td>
<td>Palette select ID</td>
</tr>
<tr>
<td>Size, Length</td>
<td>Palette control ID</td>
</tr>
<tr>
<td>Orientation</td>
<td>Monochrome print mode</td>
</tr>
<tr>
<td>Print direction</td>
<td>Viewing illuminant</td>
</tr>
<tr>
<td>Media source</td>
<td>Finish mode</td>
</tr>
<tr>
<td>MARGINS</td>
<td>Lightness setting</td>
</tr>
<tr>
<td>Left, Right, Top, Bottom</td>
<td>Saturation setting</td>
</tr>
<tr>
<td>Perforation skip</td>
<td>Color treatment</td>
</tr>
<tr>
<td>FONTS</td>
<td>Color lookup tables</td>
</tr>
<tr>
<td>Primary selected font</td>
<td>Primary chroma values</td>
</tr>
<tr>
<td>Secondary selected font</td>
<td>White point</td>
</tr>
<tr>
<td>Primary font attributes</td>
<td>Primary gamma values</td>
</tr>
<tr>
<td>Secondary font attributes</td>
<td>Primary gain values</td>
</tr>
<tr>
<td>Font ID</td>
<td>Primary encoding values</td>
</tr>
<tr>
<td>Character code</td>
<td>RASTER</td>
</tr>
<tr>
<td>TEXT</td>
<td>Raster mode</td>
</tr>
<tr>
<td>EOL wrap</td>
<td>Presentation</td>
</tr>
<tr>
<td>Line termination</td>
<td>Compression method</td>
</tr>
<tr>
<td>HMI, VMI/Line spacing</td>
<td>Source width and height</td>
</tr>
<tr>
<td>Underline mode</td>
<td>Resolution</td>
</tr>
<tr>
<td>Text Parsing</td>
<td>Left graphics margin</td>
</tr>
<tr>
<td>Text Path Direction</td>
<td>Scale algorithm</td>
</tr>
<tr>
<td>COLOR</td>
<td>Destination width and height</td>
</tr>
<tr>
<td>Foreground color</td>
<td></td>
</tr>
</tbody>
</table>
### 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 (\textit{Esc}+6+6) 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:

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

   \textbf{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.

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

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.

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 overlay.

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:

\texttt{Esc}\&f7y0X

...  
Escape sequences, control codes, and data

...  
\texttt{Esc}\&f1X

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

\texttt{Esc}\&f7y10X

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

\texttt{Esc}\&f7y4X

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

\texttt{Esc}\&f7y8X

Macro Overlay Example

The following illustrates the definition of a letterhead macro:

\texttt{Esc}\&f1Y \quad \text{Specify the Macro ID as 1.}

\texttt{Esc}\&f0X \quad \text{Start the Macro Definition.}

\texttt{Esc}\&a540h360V \quad \text{Position logo at (540,360) decipoints in the coordinate system.}

\texttt{Esc}\*150R \quad \text{Set graphics resolution to 150 dots-per-inch.}

\texttt{Esc}\*r1A \quad \text{Start raster image of logo.}

\texttt{Esc}\*b60W [Raster data] \quad \text{Send the first raster line.}

...  
...  

\texttt{Esc}\*b60W [Raster data] \quad \text{Send the last raster line.}

\texttt{Esc}\*rC \quad \text{Stop raster graphics.}

\texttt{Esc}\&a540h780V \quad \text{Position for lettering at (540,780) decipoints.}

\texttt{Esc}\*1X \quad \text{Select font with ID of 1.}

ABC Corp.  \quad \text{Text}
Post Office Box 15  \quad \text{Text}
Fred, Texas 83707  \quad \text{Text}
18 - 12  Macros

\textit{Esc\&a540h960V}  
Position first rule at (540,960) decipoints.

\textit{Esc\*c10v4680H}  
Set rule height and width.

\textit{Esc\*c0P}  
Print the first rule.

\textit{Esc\&a540h980V}  
Position the second rule at (540,980) decipoints.

\textit{Esc\*c0P}  
Print the second rule.

\textit{Esc\&a1200v540H}  
Position for first line of text at (540,1200) decipoints.

\textit{Esc\&fIX}  
Stop Macro Definition.

This macro can now be \textbf{executed}, \textbf{called}, or enabled for \textbf{overlay}. 