HP-UX 11i v3 International Printing Features

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Abstract

This paper discusses general concepts of printing different kinds of international characters and the focuses are on international printing using HP's PCL or PostScript® printers on the HP-UX 11i v3 operating system environment. This paper refers to such as I18N[1] printing.

Intended Audience

This paper is primarily intended for general users and system administrators who have the need to print international characters on the HP-UX 11i v3 operating system environment. Some of the content of this paper also contains technical details that are intended for developers and system integrators and is not covered in other documents.

Overview of I18N Printing on HP-UX

This paper talks about how to use I18N Printing on HP-UX 11i v3. The term local-language character printing is also used in this paper when the focus is on printing characters for a certain language rather than printing characters from a number of different languages at the same time. The content of this paper is valid for the HP-UX 11i v3 operating system environment but might be changed in a future release.

Characters and Fonts for Printing

In the context of printing, a character is an abstract symbol whereas a glyph is a specific rendering of a character. Glyphs are organized into fonts. A font defines glyphs for a particular character set in a particular typeface. Printing text that contains local language characters requires the use of fonts that support a particular set of local language characters.

Fonts required for local-language character printing are acquired in the following three ways:

- The printer has built-in fonts that support the local language.
- The printer does not have the required built-in fonts, but it can accept an optional font cartridge or font disk that contains the required local language fonts. The fonts can be either permanently installed or temporarily downloaded for certain print jobs.
- The print job itself embeds all the required font data from font files that are available within the operating system to make all the local language characters printable.

Sometimes a combination of these approaches can be used. A print job can use built-in fonts for some characters but can include the required fonts for other characters that the printer does not support.

Most European languages can be covered in simple single-byte character sets like ISO Latin 1, 2, or 9. The number of characters in these character sets is small enough and the market is big enough that many printers support those character sets natively. For other character sets with large number of characters, such as Asian languages, printers with built-in fonts might not be the best solution. In such cases, alternative approaches by printers are available to support the large number of characters. Various options for handling the large number of characters, such as optional font cartridge, downloading fonts and embedding fonts in print jobs, can also be implemented. Because of the large character repertoire supported by Asian languages, upgrading the amount of printer memory might be required for optimal performance.

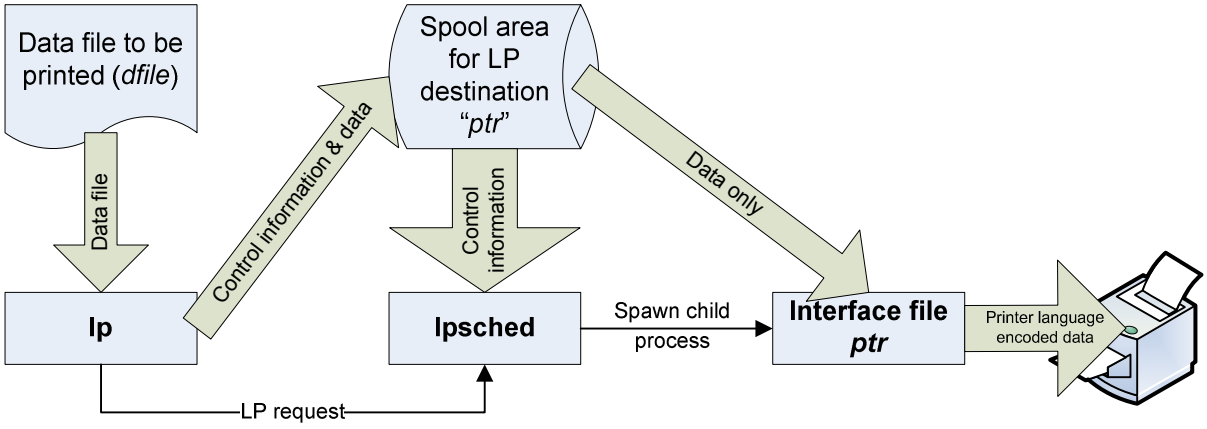
HP-UX supports various ways of using fonts for printing local language characters. HP-UX printing features are designed to utilize the best font-handling methods for each printer type and configuration.

[1] I18N is an abbreviation for the word internationalization, which has 18 characters between the letters "i" and "n."

I18N Printing Support on HP-UX

The HP-UX operating system supports the printing of local language characters in text files and web pages[2] for various types of printers. HP-UX uses the Line Printer Spooling System (LP spooler) for printer management. Figure 1 below illustrates the way LP spooler handles print requests in HP-UX. The LP spooler relies on printer model files to properly format and structure the incoming data into a format or language that printers can understand directly. The `lp` command that sends the print request to the LP spooler (`lpsched`) can use the `-o` option to pass parameters to the model files in order to alter the LP spooler behavior.

Figure 1. LP spooler handling a printing request in HP-UX



Sample lp command: lp -d*ptr* -o"*options*" *dfile*

One of the most important pieces of information that users have to inform the printing subsystem when doing I18N printing is the character-set encoding (codeset), which is used to encode characters in the input files. Depending on the codeset being used, the same set of byte sequences can mean completely different characters in different codesets. Unless the computer world can standardize on a universal encoding standard, such as Unicode, and abandon legacy codesets, users will continue to encounter problems when specifying codesets. Therefore, using the correct codeset information is critical in I18N printing. You can usually achieve this by passing the appropriate locale name that supports the desired codeset to the model files by via the `-o` option to the `lp` command.

Different manufacturers use different printer control languages to control their printers. In many cases, multiple printer control languages are supported by the same printer. The most widely used printer control languages include PCL, PostScript, ESC/P, and LIPS. For a more complete description of some of the common printer control languages, see Appendix A.

Table 1 shows the model files that support local-language character printing, along with the printer types or languages and the file formats supported.

[2] As displayed by the Mozilla web browser.

Table 1: Model Files for Local-Language Character Printing

Model Files	Supported Languages	Supported Printer Types	Supported Data Formats
ESCP	Chinese[i], Japanese, Korean	ESC/P	Text
LIPS4	Japanese	LIPS IV	Text
NPDLII	Japanese	NEC PDL2	Text
PCL5.asian	Chinese, Japanese, Korean	PCL5	Text, PCL data
PS.font	All languages supported by HP-UX	PostScript	Text, web pages

[i] This includes both simplified and traditional Chinese.

A model file is typically a shell script that formats incoming data into a suitable output format. Simple model files do all the formatting within the scripts. More feature-rich model files, such as `PCL5.asian` and `PS.font`, rely on external print filters to do some or most of the formatting work. For example, the `PS.font` model file uses the `psfontpf` print filter.

Some model files are generic and can support a large number of different printers that use the same printer control language, whereas others are for a specific printer type or model. Table 2 shows the printers that are supported by various model files.

Table 2: Printers Supported by Model Files

Model Files	Supported Printers
ESCP	Japanese - EPSON VP-5200 and its compatible. Korean - EPSON LQ-2080H, LQ-1570H and their compatibles. S. Chinese - EPSON LQ-1900K2+, LQ-300+ and their compatibles. T. Chinese - EPSON LQ-2080C and its compatibles.
LIPS4	Canon LPB-1820 and it compatibles.
NPDLII	NEC LL-15/30
PCL5.asian	HP PCL5 printers with or without font DIMM/CF-card[i] HP OfficeJet 7210 and its compatibles (Japanese only)
PS.font	HP printers that support PostScript level 2 or 3[ii]

[i] DIMM stands for dual inline memory module. Here it stands for memory cartridge that holds the font data. CF-card refers to compact flash memory card that holds the same font data.

[ii] PostScript level 2 or 3 printers from other manufacturers should also work with a proper PostScript Printer Description (PPD) file, even though they are not officially supported.

A number of other model files can support printing of local language characters, as shown in Table 3. However, these files are deprecated and might be removed in a future HP-UX release. The table also shows the recommended replacement model files for these. Consider using these replacement model files when you are setting up a new LP destination. For example, users of old HPC120X printers should consider replacing old printers with an ESCP printer (dot-impact) or other types of printers.

Table 3: Deprecated Model Files for Local-Language Character Printing

Deprecated Model Files	Recommended Replacement
LIPS3	LIPS4
LPS	PS.font for newer postscript printers
PCL5.nloo	PCL5.asian
PS2.nlio	PS.font
hpc120*	ESCP with newer dot-impact printers

The /usr/old/usr/lib/lp/model directory contains old versions of PCL5.asian, ESCP, and LIPS4 model files for users who want complete backward compatibility, including bug-to-bug compatibility.

The /usr/lib/lp/model directory also includes a couple of other PCL-related model files that provide some limited European languages and Japanese kana character support:

- Some model files support the r8 and k8 options for selecting the Roman8 and Kana8 character sets, respectively. These model files include PCL2, PCL3, PCL4, PCL5, HP256x.cent, hpc1208a, hp333440a, and paintjetXL300.
- Some model files support printing of a subset of UTF-8 characters that can be converted to single-byte ISO8859-* character sets. The printers must have fonts that support these character sets and must have either the cs option with the proper symbol set ID or have that character set as the printer's default. These model files include PCL4, PCL5, HPC1208a, and PaintjetXL300.

If the current locale is one of the utf8 locales and if another utf8 locale is not already specified with the -o option, the lp command automatically inserts the current locale name into the -o option list. For the second set of model files listed above, character code is converted automatically from UTF-8 to ISO8859-* character sets even if the –o option is not specified when passing UTF-8 file from a client running in an utf8 locale.

Selecting Model Files and Configuring Printers

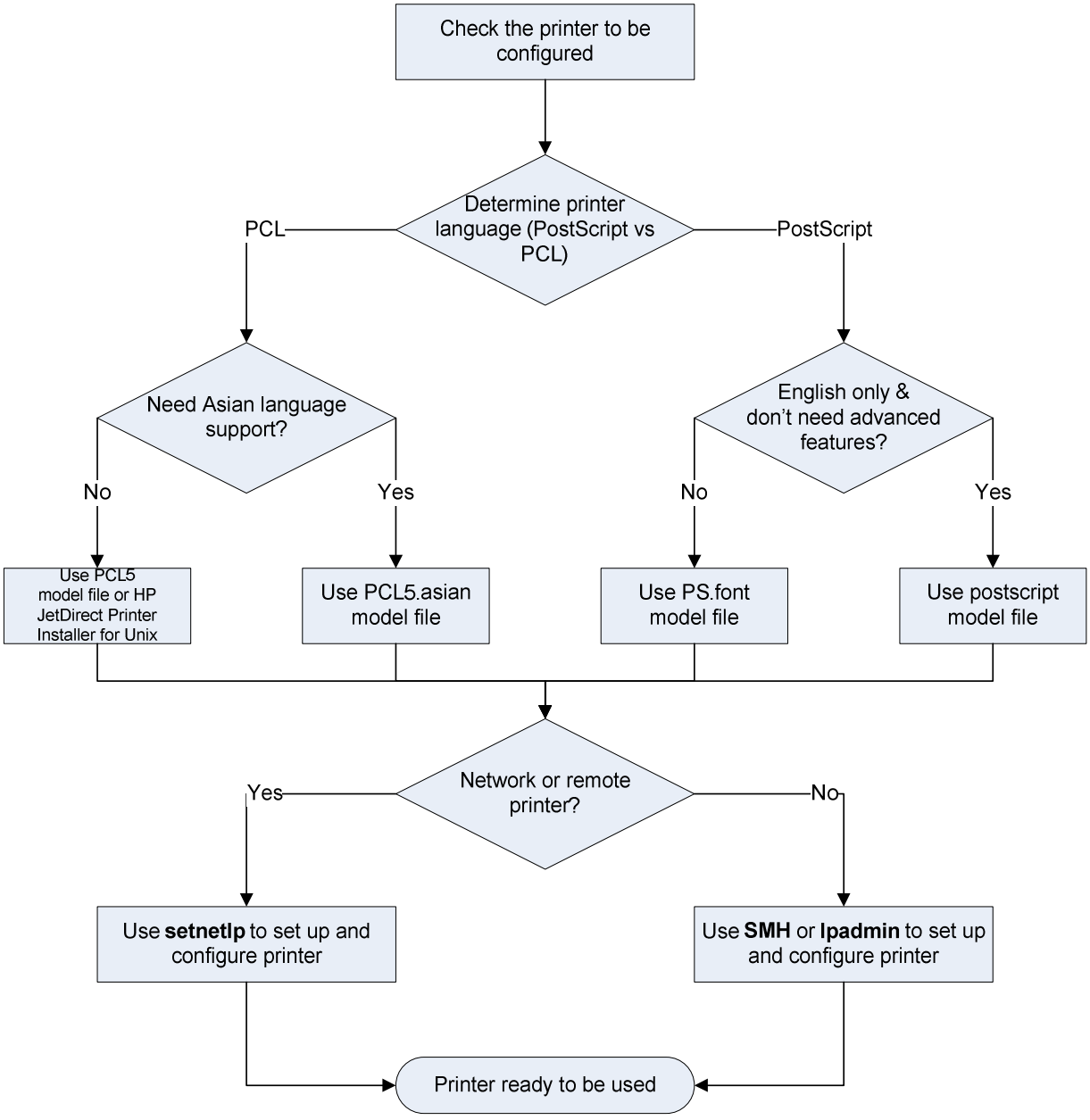
This paper focuses on printing local language characters on HP printers using the PCL5.asian and PS.font model files. For information about options that are available on other model files, check the embedded usage information in the model files. Sometimes the banner page also contains usage information.

Many new printers can support more than one printer language. For example, many HP printers can support both PCL and PostScript. In that case, you can choose to use either PS.font or PCL5.asian as the model file to control the printer. Because different model files have different features, you are free to choose the one that best meets your needs. For a comparison of the PS.font and PCL5.asian model files, see the last section.

Sometimes application needs dictate which printer language to use. For example, when instructed to print a web page, the Mozilla web browser generates PostScript output. This means the PS.font model file should be used to support this application.

Figure 2 shows a simplified view of the steps required to configure an HP printer for HP-UX. The model-file selection step might differ for printers made by other manufacturers. For information about how to configure a network or remote printer, as well as detailed descriptions of the PCL5.asian and PS.font model files, see the remaining sections of this paper.

Figure 2: Steps for Configuring HP Printers



Configuring Network and Remote Printers

Either the HP System Management Homepage (SMH) or the `lpadmin` command can be used for configuring printers that connect to the host system directly via a serial or parallel interface. For configuring network printers, you can use either the `setnetlp` configuration command or the `hppi` command in the optional HP JetDirect® Printer Installer for UNIX® software. The network printer setup capability of SMH depends on the presence of the JetDirect software.

JetDirect software is an HP technology that allows printers to be directly attached to a local area network. It is an application layer protocol that governs how the printer and computer interact. It is built on top of many lower-level protocols, such as SNMP, TCP/IP, and so on.

Because it is included with the HP-UX operating system, the `setnetlp` command is recommended for configuring network printers. This command sets up a network printer using one of the following two protocols:

- The LPD printing protocol (RFC 1179)
- The JetDirect protocol[3]

You can use either the `setnetlp` or the `hppi` command to configure JetDirect printers. The `setnetlp` command uses the system model files in the `/usr/lib/lp/model` directories. The `hppi` command uses its own set of model files for HP printers. Use the `setnetlp` command for setting up a JetDirect printer if:

- The printer must print Asian and other non-Latin 1 characters
- The printer is a non-HP printer.

Use the `hppi` command if:

- The printer needs to print only Latin 1 characters.
- The printer is an HP printer.

For printers that support both JetDirect and LPD printing protocols, the choice depends on whether or not JetDirect is the preferred communication protocol for your organization. Note, however, that JetDirect does not support control and viewing of printer status using the `lpstat` command.

The following discussion focuses on how to use the `setnetlp` command to configure a network printer. For information about how to use the `hppi` command, see the HP JetDirect Printer Installer for UNIX software documentation.

To set up a network printer using the LPD printing protocol, you must provide the following information:

- The LP destination name
- The remote host or printer name or the IP address
- The remote print queue name

For HP printers, the print queue name is usually AUTO. To find out what print queue names to use for other printers, you might need to consult the documentation or the configuration web page.

To configure a JetDirect printer, only the LP destination name and the remote host name are needed.

The `setnetlp` command has both an interactive and a non-interactive mode for setting up printers. The interactive mode is preferred because it allows the users to configure options defined in the respective model files. It also fills in some of available options automatically if it can extract information from the printer being configured.

[3] Requires the presence of the optional HP JetDirect Printer Installer for UNIX software, which also gives the `setnetlp` command the ability to detect the printing capability of the configured printer.

Quick Steps for Configuring HP Network Printers

The following example shows the procedure for setting up an HP network printer using the `setnetlp` command.

Step 1. Installing the HP JetDirect Printer Installer for UNIX software

You may find the HP JetDirect Printer Installer for UNIX software on the CD that is bundled with the printer. You can also download it from the Software & Driver Downloads page on www.hp.com by searching on HP JetDirect Printer Installer for UNIX. The current version is E.10.34. To install the downloaded file, run the following command on the depot file:

```
# /usr/sbin/swsintall -s /var/tmp/hp11e134.sd J4189-11001C
```

Verify the installation by entering the following command:

```
# /usr/sbin/swlist -l product J4189-11001C
# Initializing...
# Contacting target "systemname"...
#
# Target:  systemname:/
#

# J4189-11001C        E.10.34  Hewlett-Packard JetDirect Printer Installer for
Unix
  J4189-11001C.HPNPL  E.10.34  Hewlett-Packard JetDirect Printer Installer for
Unix
#
```

Step 2. Setting up the HP network printer

Be sure that the printer is connected to a TCP/IP network and it is on line. To configure an HP network printer, you must enter its hostname or IP address while running the `setnetlp` command. For more information about setting up its network interface, see the documentation for your printer.

Step 3. Invoking the `setnetlp` command without options.

Enter the following command:

```
# /usr/sbin/setnetlp
```

The following menu is displayed:

```
    ###################################
    #            MAIN MENU            #
    #  Network Printer Configuration  #
    ###################################

       1) Add Network Printer
       2) Remove Printer

       q) Quit

Please enter a selection: 1
```

Enter **1** to add a network printer in response to the prompt. The following menu is displayed:

```
Network Printer Configuration

     Configurable Parameters:             Current Settings
     ------------------------             ----------------
     1) Lp destination name:              [(N/A)]
     2) Network System name:              [(N/A)]
     3) Printing Protocol/Interface:      [(LPD)]
     4) Remote Printer name:              [(N/A)]
     5) lpd Banner page:                  [Disable]

     m) Model Script Selection:           [(N/A)]


     q) Quit

Select an item for change: 1
```

To set up the printer name, enter **1** (Lp destination name) in response to the prompt. The following menu is displayed:

```
Network Printer Configuration

     Configurable Parameters:             Current Settings
     ------------------------             ----------------
     1) Lp destination name:              [(N/A)]
     2) Network System name:              [(N/A)]
     3) Printing Protocol/Interface:      [(LPD)]
     4) Remote Printer name:              [(N/A)]
     5) lpd Banner page:                  [Disable]

     m) Model Script Selection:           [(N/A)]


     q) Quit

Select an item for change: 1

Currently used names:
------------------------------------------------------------
 lj1  lj2  oj1

Please enter an lp destination name: lj3
```

Next, enter the network system name or hostname of the printer after selecting option 2. The following menu is displayed:

```
Network Printer Configuration

     Configurable Parameters:             Current Settings
     ------------------------             ----------------
     1) Lp destination name:              [lj3]
     2) Network System name:              [(N/A)]
     3) Printing Protocol/Interface:      [(LPD)]
     4) Remote Printer name:              [(N/A)]
     5) lpd Banner page:                  [Disable]

     m) Model Script Selection:           [(N/A)]


     q) Quit

Select an item for change: 2
Please enter a remote system name/IP address: lj3.jp.hp.com
```

If the hostname you specify is valid and functional, the display shows the printer name and the interface changes to JetDirect, as shown in the following display.

Enter **m** to set up the model file. Then enter either a model file name or a model number. The following example shows steps for selecting the `PCL5.asian` model file.

To set up a printer for using Mozilla with an HP LaserJet printer, choose the `PS.font` model file. After you enter this choice, the configuration tool for the `PS.font` model file, `psmsgen`, is automatically invoked.

```
Network Printer Configuration

     Configurable Parameters:             Current Settings
     ------------------------             ----------------
     1) Lp destination name:              [lj3]
     2) Network System name:              [lj3.jp.hp.com]
                                          Hewlett-Packard LaserJet 4350
     3) Printing Protocol/Interface:      [JetDirect]



     m) Model Script Selection:           [(N/A)]


     q) Quit

Select an item for change: m
Model Script Configuration Selections:
  1) Select [PCL5.asian] model file
  2) Select [PS.font] model file

  s) Show model files in /usr/lib/lp/model

Select an item, enter a model name or <CR> to back: 1
```

```
Defaults of options for printer lj3

    Optional Parameters           Current Settings
    --------------------------    ----------------
     1) Banner page:              [ON]
     2) Paper Size:               [A4]
     3) Font DIMM:                [Unavailable]
     4) Language:                 [ja_JP.SJIS]

     u) Update values by the current hardware setting
     r) Reset to default values
     q) Back to the previous menu.

Select an item for change or select q: q
```

Please note that initial values for Font DIMM and Language are set based on the current configuration of your printer hardware.

```
Network Printer Configuration

     Configurable Parameters:             Current Settings
     -----------------------              ----------------
     0) Done. Make Configuration now!
     1) Lp destination name:              [lj3]
     2) Network System name:              [lj3.jp.hp.com]
                                          Hewlett-Packard LaserJet 4350
     3) Printing Protocol/Interface:      [JetDirect]



     m) Model Script Selection:           [PCL5.asian]
     c) Configure options of the Model Script

     q) Quit

Select an item for change or select 0: 0

WARNING: This operation requires lp spooler be shut down.
The spooler will be running again after this operation is done.
If there are jobs currently being printed, those are reprinted in
their entirely after spooler is started again.

OK to continue? (y/n, default-n): y
lj3 added to spooler.


Printer, lj3, has been added.
Press the return-key to return to configuration menu...
```

To complete the configuration, enter **0** to add printer destination lj3 to the LP spooler.

Configuring Remote Nonnetwork Printers

To configure a nonnetwork printer that is connected to a remote HP-UX system for printing local language characters, the `setnetlp` command should also be used to set up the LP destination using the LPD protocol. In this case, the network system name should be the hostname[4] or the IP address of the remote system, and the remote printer name should be the LP destination name of that printer on the remote system.

The model file used on the remote system for that printer should be compatible with the model file used on the local system. For maximum compatibility, the local model file should be the same as the remote model file. With this setup, two banner pages are printed by default: one from local model file and one from remote model file. Because it is difficult to suppress the remote banner page, the local banner page should be disabled so that only the remote banner page is printed. All the processing and font embedding are done in the local model file; the remote model file should just pass through the processed output of the local model file with the generation of the remote banner page.

[4] If the remote system is on a different subnet, the fully qualified hostname (e.g., lj3.jp.hp.com) is required.

PCL Printing

A number of model files are available for printing to an HP PCL5 printer. For printing Asian (CJK) characters in text or PCL data, the `PCL5.asian` model file can be used. For just printing single-byte European characters, the `PCL5` model file can be used.

When printing Asian characters using the `PCL5.asian` model file, the recommended way to select the desired character set is to supply the right locale-name option to the model file. For example, the following command prints a GB18030 encoded text file:

```
# lp -dprinter -ozh_CN.gb18030 gb18030-text-file
```

In contrast, printing single-byte European characters requires the use of the correct PCL symbol set ID with the `cs` option. For example, the following command prints a file containing Latin 1 (ISO/IEC 8859-1) characters:

```
# lp -dprinter -ocs0N latin1-file
```

In a homogeneous printing environment where files of only one European character set are printed, the printers should be configured to use that character set as the default. Setting the default symbol set ID can usually be done via the control panel. It can also be done via the administrative web page of the embedded web server for network printers. In that case, you do not need to specify the `cs` option when printing text files. Table 4 lists some of the PCL symbol set IDs that can be used to print characters with different European character-set encodings.

Table 4: PCL Symbol Set ID to Character-Set Mapping

PCL Symbol Set ID	Character Set
8U	Roman-8
0N	ISO 8859-1 Latin 1
2N	ISO 8859-2 Latin 2
5N	ISO 8859-9 Latin 5
9N	ISO 8859-15 Latin-9[i]
12N	ISO 8859-7 Greek with Euro[ii]
18N	UTF-8 (Unicode)[iii]

[i] Only newer LaserJet printers support the ISO 8859-15 character set.

[ii] Only some LaserJet printers, such as the LaserJet 1220 and LaserJet 2200, support the Greek fonts.

[iii] On selected LaserJet printers released in 2004 or later with UTF-8 firmware, such as the LaserJet 2400, 4250, and 4350 series.

Note that not all PCL printers support all the character sets listed in Table 4. Also, PCL printers typically support more character sets than are shown in the table. For a full list of character or symbol sets supported by these printers, see the appropriate printer documentation. Of the PCL5 command codes, the following two are relevant to the printing of local language characters:

- The text-parsing method provides a method for specifying character codes to select characters in large fonts (greater than 256 characters).

  `Esc &t#P`

  where # = 0, 1, 21, 31 (SJIS), 38 (HP-15), 83 (UTF-8)
- The symbol set command identifies the specific set of symbols in a font.
  The primary symbol set command is indicated as:

  `Esc (#`

  The secondary symbol set command is indicated as:

  `Esc )#`

where # can be one of the symbol set IDs shown in Table 4. By switching primary and secondary character sets using shift-in and shift-out control codes, two sets of characters can be used at the same time. For more information, see the *PCL5 Printer Language Technical Reference Manual*.

To print multi-byte characters, you must set both the symbol set ID and the corresponding text-parsing method correctly in order for the printer to print the desired characters correctly.

HP also sells an HP International Printing Solution[5] (IPS) for printing Unicode data to HP printers with UTF-8 firmware from SAP software in non-Windows® environments, such as HP-UX.

The `PCL5.asian` Model File

The `PCL5.asian` model file is a variant of the `PCL5` model file that supports printing of Asian characters. The `PCL5.asian` model file supports printing of Chinese, Japanese, and Korean (CJK) characters on HP LaserJet printers. The model file is enhanced for text and PCL printing with CJK characters in order to support the following types of applications:

- Formatted text printing for generic line printers
- Applications that use PCL for formatting and enhancing the look and feel of their printouts

The following output data formats are supported by `PCL5.asian` model file. The appropriate PCL command codes are generated to set up a printer for a specific printer control language.

Option	Output Data Format for Device
`pcl` (default)	PCL5
`pcl3`	PCL3GUI. For OfficeJet 7200 series printers, this is the only selectable and required option in this category.
`raw | r`	Without data modification.
`hpgl2`	HP-GL/2
`hpgl2_p`	HP-GL/2 (portrait mode)
`ps`	PostScript – Without data modification. The `PS.font` model file is recommended for PostScript printing.

When `pcl` or `pcl3` is selected as the data format option, `PCL5.asian` works as a PCL filter in addition to the basic text data processing. It also allows the use of Asian fonts on the host computer system. Encoding of printing data should be specified by a locale option that is used to set up PCL commands for the symbol set ID and text-parsing method. The following additional options for printing user data are available in this mode.

Option	User Data Format (PCL Modified Text-Processing Mode)
`nroff | n`	Formatted text using *nroff*(1) or *man*(1) (manpage printing).
`pr`	Formatted text using *pr*(1).
`ascii | a`	Printing PostScript data as text. Without this option, printing PostScript data might switch output data format to PostScript.

Configuring and Using Printers with `PCL5.asian`

When you configure HP network printers, you should use the `setnetlp` command with the HP JetDirect Printer Installer for UNIX.

[5] Currently, the IPS is sold to meet the requirement of the SAP software only.

Table 5 and Table 6 list the features and options supported by the `PCL5.asian` model file for the HP LaserJet and HP OfficeJet series printers. These options can be specified via the `-o` option at the `lp` command line when its printer destination uses the `PCL5.asian` model file. Some options are optional and some are required to be specified explicitly. Default values of these options can be customized by modifying the model file that is a shell script and written in plain text.

When a printer is configured using the terminal user interface (TUI) mode of the `setnetlp` command, some required options could be pre-customized by taking advantage of JetDirect tools when HP JetDirect Printer Installer for UNIX is installed. For additional customization of the `PCL5.asian` model file, the model file can be edited directly using a text editor. The model file configured for a specific printer is placed under the `/etc/lp/interface/`, `/etc/lp/interface/model.orig`, or `/etc/lp/interface/netlp.asx` directory using the same file name as the LP spooler queue name. If an application does not allow specification of optional parameters with the `lp` command to print data, you must customize the model file for the printer with the required values for the application.

Table 5: General Features Supported by `PCL5.asian` for HP LaserJet Series Printers

Feature	Option	Description
Locale option - character code of printing user data (required, default=C)	**ja_JP.SJIS**	Japanese HP-15 (Shift-JIS) JIS X 0208 :1990 CP-932
	ja_JP.eucJP	Japanese EUC JIS X 0208 :1990 JIS X 0212 :1990
	ja_JP.utf8	Japanese UTF-8 JIS X 0213 :2004 ISO 10646
	ko_KR.eucKR	Korean EUC KS X 1001 :2002
	ko_KR.utf8	Korean UTF-8 KS X 1005-1 ISO 10646
	zh_CN.hp15CN	Simplified Chinese HP-15 GB2312-1990
	zh_CN.gb18030	Simplified Chinese GB18030 GB18030
	zh_CN.utf8	Simplified Chinese GB18030 ISO 10646
	zh_HK.hkbig5	Traditional Chinese Hong Kong BIG5 HKSCS 2004
	zh_HK.utf8	Traditional Chinese Hong Kong UTF-8 HKSCS 2004 ISO 10646
	zh_TW.ccdc	Traditional Chinese CCDC
	zh_TW.big5	Traditional Chinese BIG5 HP BIG5 enhanced
	zh_TW.eucTW	Traditional Chinese Taiwanese EUC CNS 11643 plane 1-7,12,15
	zh_TW.utf8	Traditional Chinese UTF-8 ISO 10646 CNS 11643 plane 1-7,12,15

	C.utf8	Other UTF-8 Unicode 5.0
User defined character (optional)	**udc#**	Full path of UDC file. When file is null, ~/.nlio_udc is used. When ~/.nlio_udc does not exist, /var/asx/udc/sys.udc is used.
	udcf	Use the first data file for lp command as UDC.
	umap#	Full path to a UDC code font mapping file.
Multiple pages per sheet (optional)	**2 | half**	2 pages in one sheet
	4 | quarter	4 pages in one sheet
Orientation (default = portrait)	**port | portrait**	Print in portrait mode
	land | landscape	Print in landscape mode
Left/Right margin (optional)	**lm#**	Set left margin at # column
	rm#	Set right margin at # column
Lines per page (optional)	**tl#**	Set lines per page with #
Character size/pitch (default=12)	**10**	Set pitch of narrow/wide characters to 9/4.5 cpi
	12	Set pitch of narrow/wide characters to 12/6 cpi
	c	Set pitch of narrow/wide characters to 20/10 cpi
	height#	Set primary character size to # point.
	fp#	Set primary character pitch to # cpi.
	hsi#	Set horizontal space increment (1/120inch)
	psp	Set primary char to proportional spacing. Character widths of downloaded fonts are determined based on the glyph of fonts.
	fsp	Set primary char to fixed spacing. Character widths of downloaded fonts for half/full are fixed to 1:2.
Line spacing (optional)	**lpi#**	Set lines per inch. Default is 6 lines per inch.
	vsi#	Set vertical space increment to #/48 inch
Font/typeface setting (optional)	**mincho**	Set primary typeface to mincho for Japanese
	gothic	Set primary typeface to gothic for Japanese
	batang	Set primary typeface to batang for Korean
	dotum	Set primary typeface to dotum for Korean
	simsun	Set primary typeface to simsun for simplified Chinese
	simhei	Set primary typeface to simhei for simplified Chinese
	ming	Set primary typeface to ming for traditional Chinese
	kai	Set primary typeface to kai for traditional Chinese
	pming	Set primary typeface to pming for traditional Chinese
	type#	Set primary typeface to #
	style#	Set primary character style to #
	i | italic	Set primary character style to italic

	b | bold	Set primary character style to bold
	upright	Set primary character style to upright
	weight#	Set primary character weight to #
Font embedding (required, default=dimm)	**dimm**	Printer has Asian font DIMM/CF-card
	nodimm	Printer doesn't have Asian font DIMM/CF-card, host's fonts are used for printing
	This option is required by PCL processing module of `PCL5.asian` to determine whether the target printer has optional font memory or not. The option should be consistent with the printer hardware configuration for the specified Asian locale option.	
Banner (default=yb)	**nb**	Disable banner page
	yb	Enable banner page
Duplex (optional)	**d | double**	Enable duplex printing
	nd | ndouble	Disable duplex printing
Multi-copy (optional)	**mopy**	Designate printer to handle multi-copy specified by `lp -n#` option at printer side.
Tray selection (optional)	**ub | ubin**	Use upper input tray
	lb | lbin	Use lower input tray
	ubb | ubbin	Use upper input tray for banner page
	lbb | lbbin	Use lower input tray for banner page
Page size slection (required default=A4)	**a3 | A3**	Select A3 paper
	a4 | A4	Select A4 paper
	b4 | B4	Select B4 paper
	b5 | B5	Select B5 paper
	legal	Select legal paper
	letter	Select letter paper
	hagaki	Select hagaki paper
	oufuku	Select oufuku hagaki paper
Page range selection (optional)	**P#[:#]**	Set starting and optional end printing page
Printing resolution (required default=dpi600)	**dpi3 | dpi300**	Set 300 dpi printing resolution
	dpi6 | dpi600	Set 600 dpi printing resolution
	dpi12 | dpi1200	Set 1200 dpi printing resolution
Data format (required default=pcl)	**pcl**	Printing in PCL mode (default)
	r | raw	Raw mode (content of files sent directly to printer)
	n | nroff	nroff manpage printing
	pr	pr output
	hpgl2	Print in HP-GL/2 mode (landscape), and reset after the job.
	hpgl2_p	Print in HP-GL/2 mode (portrait), and reset after the job.
	a | ascii	Print PostScript file as text

Print option list	**options**	Print list of available options with banner page

For configuring HP OfficeJet printers, use the `setnetlp` command in interactive TUI mode with JetDirect software to set up the printer with the right customization options (`pcl3` and `nb)`. With the `pcl3` option, `PCL5.asian` generates data for printer device in PCL3GUI printer language that is supported by the OfficeJet 7210 series of printers, and also accepts user data that is enhanced with PCL commands for character attributes such as size, weight, and typeface.

Table 6: General Features Supported by PCL5.asian for HP OfficeJet Series Printers

Feature	Option	Description
Character code selection (required, default=C)	**ja_JP.SJIS**	Japanese HP-15 (Shift-JIS) JIS X 0208 :1990 CP-932
	ja_JP.eucJP	Japanese EUC JIS X 0208 :1990 JIS X 0212 :1990
	ja_JP.utf8	Japanese UTF-8 JIS X 0213 :2004 ISO 10646
	C.utf8	Other UTF-8 Unicode 4.1
User defined character (optional)	**udc#**	Full path of UDC file. When file is null, ~/.nlio_udc is used. When ~/.nlio_udc does not exist, /var/asx/udc/sys.udc will be used.
	udcf	Use the first data file for lp command as UDC.
	umap#	Full path to a UDC code font mapping file.
Multiple pages per sheet (optional)	**2 | half**	2 pages in one sheet
	4 | quarter	4 pages in one sheet
Orientation (default = portrait)	**port | portrait**	Print in portrait mode
	land | landscape	Print in landscape mode
Left/Right margin (optional)	**lm#**	Set left margin at # column
	rm#	Set right margin at # column
Lines per page (optional)	**tl#**	Set lines per page with #
Character size/pitch (default=12)	**10**	Set pitch of narrow/wide characters to 9/4.5 cpi
	12	Set pitch of narrow/wide characters to 12/6 cpi
	c	Set pitch of narrow/wide characters to 20/10 cpi
	height#	Set primary character size to # point.
	fp#	Set primary character pitch to # cpi.
	hsi#	Set horizontal space increment (1/120inch)
	psp	Set primary char to proportional spacing. Character widths of downloaded fonts are determined based on the glyph of fonts.
	fsp	Set primary char to fixed spacing. Character widths of downloaded fonts for narrow/wides are fixed to 1:2.

Line spacing (optional)	**lpi#**	Set lines per inch. Default is 6 lines per inch.
	vsi#	Set vertical space increment to #/48 inch
Font/typeface setting (optional)	**mincho**	Set primary typeface to mincho for Japanese
	gothic	Set primary typeface to gothic for Japanese
	type#	Set primary typeface to #
	style#	Set primary character style to #
	i | italic	Set primary character style to italic
	b | bold	Set primary character style to bold
	upright	Set primary character style to upright
	weight#	Set primary character weight to #
Duplex (optional)	**d | double**	Enable duplex printing
	nd | ndouble	Disable duplex printing
Printing resolution (required default=dpi600)	**dpi3 | dpi300**	Set 300 dpi printing resolution
	dpi6 | dpi600	Set 600 dpi printing resolution
Page control (optional)	**rev**	Outputting pages in reverse order
Output Data format (required)	**pcl3**	Printing to OfficeJet printer (PCL3GUI)
User Data format (optional)	**n | nroff**	nroff man page printing
	pr	pr output
	Text (PCL modified)[i]	

[i] When neither `nroff` nor `pr` is specified, the default data format is UNIX-style plain text with optional embedded PCL commands.

Asian Font Memory Support for HP LaserJet Series Printers

For the HP LaserJet series, HP and partner vendors (such as JITCO [http://www.jitco.net/]) provide optional font-memory accessory products (DIMM or CF card)[6]. These products enhance printing performance and reduce usage of host system resources for printing CJK characters. Font-memory products for CJK characters are supported by `PCL5.asian` for various HP-UX releases.

The `PCL5.asian` model file has two printing modes – with DIMM or without DIMM. The mode is controlled by setting either the `dimm` or the `nodimm` option. In `dimm` mode, `PCL5.asian` assumes that the printer has installed the Asian font-memory DIMM/CF card that corresponds to the specified locale option. It is used as the primary fonts on the printer and the host's fonts are used only for characters not provided by the Asian font memory. As each CJK font DIMM includes the most frequently used characters, printing with DIMM achieves the best printing performance and decreases the workload of the host computer system for its spooling and font-rendering overhead.

In `nodimm` mode, `PCL5.asian` assumes that the printer does not have the installed Asian font DIMM/CF card and it uses host's CJK fonts. The `PCL5.asian` model file works as a PCL filter that emulates the font DIMM/CF card. It is recommended that the font DIMM/CF card should be removed when using `nodimm` option because the font memory could negatively impact the printer's default font-handling behavior.

The interactive user interface of `setnetlp` allows you to configure the predefined value of this important option. Alternatively, you can modify this option by editing the configured interface file directly.

[6] Font memories for printing in PCL and PostScript modes are separate products.

PCL Modified Text Processing (PCL Cooked) Mode Printing

The `PCL5.asian` model file parses the input file to identify PCL commands that control character attributes (such as typeface, size, weight, and font) in the printing data so that the appropriate Asian fonts on the host can be used and downloaded to the printer on demand.

For text printing using the `PCL5.asian` model file, setting the locale option generates PCL5 command sequences, including the appropriate text-parsing method and symbol set ID commands to set up printer to print text encoded in the specified locale.

Users can embed symbol set ID and text-parsing method setup commands to set up other combinations of these commands, such as for printing special PCL data that has been supported by the `raw` mode option. By specifying that the text-parsing method and the symbol set ID be embedded in the printing data, users can generate a multilingual printing in a single printing job. However, using this method requires a good knowledge of the PCL5 printer language.

In PCL-modified text-processing mode, the specific PCL symbol set used by the Asian font memory is selected based on the current Asian locale setting. The PCL5.asian model file converts those Asian characters in the printing user data to the specific encoding of that PCL symbol set. For printing characters that are not available in the Asian font memory, appropriate glyphs of those characters are downloaded to the printer from the host using PCL symbol set 8U. Table 7 shows the default PCL symbol set ID and font numbers selected for each of the supported Asian locales.

Table 7: PCL5.asian PCL Mode Locale to PCL Symbol Set ID Mapping

Locale Option	PCL Symbol Set ID Added for Printing Device Data	PCL Font Numbers Supported for Printing User Data and Option
zh_CN.gb18030 zh_CN.hp15CN zh_CN.utf8	18C (8U)	37058 (simsun), 37110 (simhei), 37357 (simkai), 37366 (simfang)
ja_JP.SJIS ja_JP.eucJP ja_JP.utf8	19K (8U)	28752 (mincho), 28825 (gothic)
ko_KR.eucKR	19H (8U)	43088 (batang), 43161 (dotum), 43160 (gulrim), 43768 (gungse)
ko_KR.utf8	18H (8U)	
zh_TW.big5 zh_TW.eucTW zh_HK.hkbig5 zh_TW.utf8 zh_HK.utf8	18T (8U)	33269 (ming), 33261 (kai)
C.utf8	(undef or 0U) (8U)	All of the above

The Asian font numbers listed in Table 7 are originally those of the font DIMM or CF-card for the corresponding languages. When a font DIMM/CF-card is assumed to be available (that is, is specified by the `dimm` option), it is used for printing characters that are included in the font memory. For printing characters that belong to the same typeface but are not included in the font memory, the host's fonts are used by downloading the character while switching the symbol set to 8U.

The Asian fonts support feature of `PCL5.asian` is activated only in the input data context of PCL symbol sets 18C, 19K, 19H, 18H, 18T, or 0U. When a PCL command selecting the other PCL symbol sets is found in the input sequence, `PCL5.asian` passes the remaining character sequence through without conversion until one of the supported PCL symbol sets is encountered. Similarly, when the PCL text-parsing method is set to a value other than 31 (SJIS) or 38 (HP-15), the `PCL5.asian` model file passes through the input data without processing until either 31 or 38 is set for the text-parsing method. The current version of the PCL5.asian model file does not use the other PCL symbol set IDs or text-parsing methods, such as the UTF-8 symbol set ID and text-parsing method. Rather, the PCL data

and commands in the printing user data associated with those commands pass through the model file without modification.

When one of the CJK utf8 locale options is specified, `PCL5.asian` can use all the available CJK glyphs for printing with the typeface listed in the table as the primary fonts. When C.utf8 is specified, PCL5.asian can switch typeface with PCL commands to any of the CJK typefaces listed in the table. This feature enables the generation of a PCL printing job that includes multiple Asian languages.

By embedding the appropriate PCL commands after switching to HP-GL/2 printing mode, Asian characters can be used within an HP-GL/2 printing job (PCL mode).

Miscellaneous Font Control Feature

`PCL5.asian` uses PCL5 font downloading feature to print characters not available on printers up to some specific number of characters. The number of characters that can be downloaded on a printer depends on the available memory on the printer. For a printer with less memory, the `-ofontmem0` option is provided. This option enables the use of any host fonts without downloading with some printing performance being sacrificed.

The `PCL5.asian` model file supports a new `nloo` option, which generates printouts that are comparable to the default font size and typeface of the `PCL5.nloo` model file. This option is provided to help users to migrate from the now deprecated `PCL5.nloo` model file.

When HP-UX is updated from a previous release, both the model file configured during the earlier release and the behavior of the file are unchanged.

The `PCL5.asian` model file uses the X font server library for accessing fonts on the host computer. Configuring additional TrueType or bitmap fonts for the X font server enables `PCL5.asian` to use these fonts for PCL printing. When a font is installed and set up at a new directory, notify `PCL5.asian` about the new font path by using the –`ofpath+`*`font-path`* option[7].

The `PCL5.asian` model file on HP-UX 11i v3 can be enhanced for finer control of pitch down to 1/7200 dpi. A version of the Asian CF-font card can have a font that uses full width spacing for 0x20 (ASCII space character). The spacing of 0x20 can be adjusted to be the same width as other ASCII characters by modifying the following line in the configured PCL5.asian interface file:

Original line	`f_base_opt="$f_base_opt -x pcl_font_size_adjust=dimm"`
Modified line	`f_base_opt="$f_base_opt -x pcl_font_size_adjust=fine"`

User-Defined Character Support

In addition to the support of text-file based bitmap font of *udc*(1) (user-defined characters), `PCL5.asian` also supports the other type of UDC fonts through the UDC Code Font Mapping File that can be specified by using the `-umap` option. With this option, you can specify the mapping between a character code point in the input file and a code point of a font. The mapping is defined in a text file specified by the `umap` option.

The following shows the syntax of a umap file:

```
# comment string
/font = font-name
input-code1  font-code1
input-code2  font-code2
       :
# comment string
/font = font-name2
input-code3  font-code3
input-code4  font-code4
       :
```

[7] For example, `-ofpath+/usr/lib/X11/fonts/myfonts/100dpi`.

For *font-name*, you can use either an XLFD[8] of the system's X font server fonts or a full path for PCF X11 fonts. The following is an example of the code font-mapping file. This example enables the use of UDC characters at 120-ku of Shift JIS.

```
# Sample UDC code font mapping file
# For ja_JP.SJIS input data
#  input-code (ku/ten) font-code
# --------------------------------
#  0xFC9F (120/01) --> U+329E
#  0xFCA0 (120/02) --> U+2702
#
#  0xFCA1 (120/03) --> U+27DA0  (X0213-2-89-15)
#  0xFCA3 (120/04) --> U+27E10  (X0213-2-89-18)
#
/font=-ricoh-hgminchol-medium-r-normal--0-0-0-0-m-0-iso10646-1
0xFC9F 0x329E
0xFCA0 0x2702

/font=-ricoh-hggothicb-medium-r-normal--0-0-0-0-m-0-iso10646p2-2
/typeface=gothic
0xFCA1 0x7DA0
0xFCA2 0x7E10

/font=-ricoh-hgminchol-medium-r-normal--0-0-0-0-m-0-iso10646p2-2
/typeface=mincho
0xFCA1 0x7DA0
0xFCA2 0x7E10
```

[8] X Logical Font Description.

PostScript Printing

Unlike other printer control languages, PostScript is a real stack-based programming language. As such, it can perform complex drawing operations in a concise manner.

Table 8 lists the PostScript-specific model files and printing modes supported by HP-UX.

Table 8: PostScript-Specific Model Files and Their Printing Modes

Model Files	PostScript Printing Modes
PS.font	Raw Local language text to PostScript with font embedding Mozilla PostScript font embedding
PS2.nlio	Raw ASCII to PostScript Japanese to PostScript for printers with Japanese fonts
postscript	Raw ASCII to PostScript

Raw mode refers to the direct printing of a PostScript data file to a PostScript printer without additional manipulation. It is also supported by a number of other non-PostScript model files such as `PCL5` or `PCL5.asian`.

Of the three PostScript-specific model files, `PS.font` is the most versatile and, therefore, is the recommended model file for PostScript printing.

The `PS.font` Model File

The HP-UX operating environment supports the printing of local language characters on PostScript printers using the `PS.font` model file. In fact, this model file is just a wrapper script for the `psfontpf` print filter. Unlike other model files, `PS.font` serves mainly as a keeper of configuration and customization information, which is passed to `psfontpf` via command-line arguments. All the actual processing work is done within the `psfontpf` print filter. From the perspective of migration from Tru64 UNIX, the `psfontpf` print filter has similar capabilities as the `wwpsof` and `ppdof` print filters in Tru64 UNIX.

The `psfontpf` print filter is a generic text-to-PostScript converter that converts the various single-byte and multi-byte characters used in an international environment to a printable PostScript file. The filter embeds all the required PostScript font data within the PostScript code, if necessary. Therefore, print jobs that include local language characters can be printed on printers where local language fonts are not present. The `psfontpf` print filter also supports embedding font data to PostScript files generated by the Mozilla web browser. By making the Mozilla web browser use an LP destination with the `PS.font` model file, web pages containing non-Latin 1 characters can print correctly on a PostScript printer.

In order for the `psfontpf` print filter to print local language characters correctly, you must instruct `psfontpf` what character-set encoding is used by the input characters. You can do this by specifying either the locale with that character-set encoding or the name of the character-set encoding directly. Specifying the locale name is preferable to the encoding name because more information is associated with a locale, such as the fonts to be used. This is especially important for CJK ideographic characters, for which specifying the correct locale ensures that the proper glyphs will be used for printing. As the `psfontpf` print filter converts all characters internally to Unicode, codeset names with no Unicode conversion support are not supported by the print filter.

The psfontpf printer filter supports only PostScript level 2 and level 3 printers, which encompasses most PostScript printers in use today. The following are some of the more important features of the psfontpf PostScript print filter:

- Supports all printers that have a PostScript level 2 or level 3 interpreter.
- Supports most device-specific features specified in the Adobe® PostScript printer description file for that printer, such as selection of input tray and output bin.
- Supports Unicode bidirectional algorithm for reordering bidirectional text.[9]
- Supports vertical printing of wide Asian ideographic characters.
- Supports automatic embedding of font data (TrueType[10] or bitmap) in the output PostScript stream for those characters that are not natively supported by the printers.
- Supports automatic font embedding of PostScript file generated by the Mozilla web browser.
- Supports user-defined command-line options and macros.

PostScript printer description (PPD) files are text files that provide a uniform approach to using the diverse features of devices that contain PostScript interpreters. Such features include page size, methods of paper handling, font availability, and finishing features, such as duplex printing and stapling. The PPD file contains the PostScript language code that activates each feature.

Two basic types of keywords are available in a PPD file: main keywords and option keywords. Main keywords denote a device feature, such as the set of available page sizes (*PageSize) or input slots (*InputSlot). Option keywords, which modify main keywords, describe the list of available options for a feature. For example, the option keywords for the main keyword *PageSize describe the available page sizes, such as letter, legal, A4, and so on.

The psmsgen PS.font Model File Configuration Tool

The psmsgen tool is a terminal-based configuration tool that is used to configure the PS.font model file or its derivatives to set up various PostScript printer options and printing defaults. You can use the psmsgen tool in either of the following ways to configure the model file:

- Create a customized model-file template in the /usr/lib/lp/model directory. You can then use the template to configure a new printer. For example:

  ```
  # psmsgen [-o model_file_name] [ppd-file]
  ```

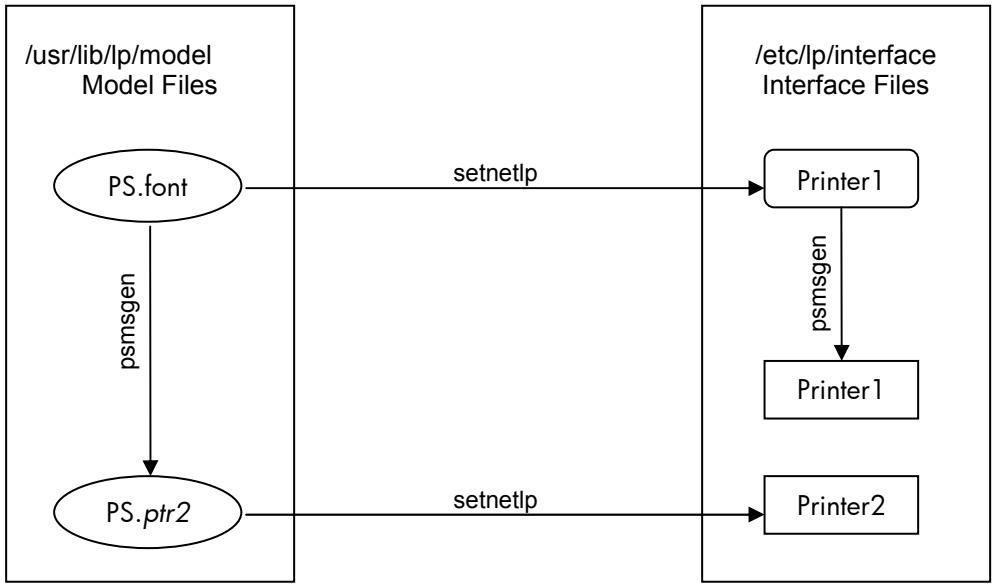
- Use the generic PS.font model file to configure a new printer. Then use the –m option to the psmsgen command to configure the interface file in the /etc/lp/interface directory. For example:

  ```
  # psmsgen [-p printer_model] –m interface-file
  ```

The first method is preferred for configuring a group of similar PostScript printers at the same time. The second method is preferred for configuring a single PostScript printer or several different printers. Figure 3 shows the two alternative ways of configuring the PS.font model file. This example uses the setnetlp command to set up the LP destinations.

[9] Shaping of complex text like Arabic and Thai is not yet supported.
[10] Embedding of TrueType fonts is supported only on PostScript level 3 printers.

Figure 3: Two Ways to Configure the `PS.font` Model File



The prerequisite for configuring a specific PostScript printer is the availability of a PPD file for that printer. The `PS.font` model file can also be used without a PPD file, but many of the printer's device-specific capabilities, such as duplex printing and selection of input tray, might not be available for use. In addition, the `psfontpf` print filter defaults to PostScript level 2 without a PPD file and thus lacks the capability to use TrueType fonts.

The HP-UX operating system includes PPD files for most of the current HP PostScript printers. To properly configure non-HP PostScript printers, you need to get the right PPD files from the printer manufacturers. Some manufacturers might post the PPD files on their driver download web sites. You might also be able to use PPD files obtained from other operating systems, depending on licensing and copyright restrictions.

When `psmsgen` is invoked and the PPD file is not provided in the command line or defined in the interface file to be modified, `psmsgen` prompts you to select a PPD file first from those available in the `/usr/lib/lp/psfontpf/ppd` directory. A two-level PPD selection menu is displayed. First, you must select from a list of monochrome or color printers from different manufacturers. Optionally, you can import an external PPD file, which is put into the `/usr/lib/lp/psfontpf/ppd` directory for future use.

After you select the manufacturer and the type of printer, a list of printer models in that category is displayed. Select the printer model that matches the printer to be configured.

The `psmsgen` configuration tool is tightly integrated with the `setnetlp` tool for setting up network printers. The `setnetlp` tool calls `psmsgen` automatically when the `PS.font` model file or its derivative is selected for setting up an LP destination.

The `psmsgen` configuration tool enables system administrators to customize and configure the following settings of `PS.font`-derived printer interface files:

- Set default locale
- Set optional user configuration file
- Set printer installable options
- Set default values for PPD features
- Set default non-PPD user options
- Set paper-size to input-tray mapping
- Add/remove alias for PPD main keywords
- Add/remove alias for PPD option keywords
- Add/remove locale name alias
- Add/remove setup macro

Because valid options that are accepted by the `psfontpf` print filter depend on the content of the PPD file as well as customization made by the users, the `psmsgen` tool also puts a usage message about available options in the configured model or interface file. The usage message is displayed when the configured model or interface file is executed directly without any option. The banner page shows the command that can be used to view the usage message.

The following execution log shows what you can expect to see when you use the `psmsgen` tool to modify an unconfigured `PS.font`-derived interface file.

```
*** PostScript Printer Configuration ***

Please select one of the following manufacturer and printer types
 1) HP black & white printers
 2) HP color printers

 i) Import an external PPD file

Please select an item, or press <CR> to quit: 1

*** PostScript Printer Configuration ***

Please select one of the following PPD files
  1) HP LaserJet 1300 PS (hpc1300s.ppd)
  2) HP LaserJet 2200 Series (hpb22007.ppd)
  3) HP LaserJet 2300 PS (hpc2325s.ppd)
  4) HP LaserJet 2300L PS (hpc2320s.ppd)
  5) HP LaserJet 2410 PS (hpc2410s.ppd)
  6) HP LaserJet 2420 PS (hpc2420s.ppd)
  7) HP LaserJet 2430 PS (hpc2430s.ppd)
  8) HP LaserJet 3015 PS (hpc3015s.ppd)
  9) HP LaserJet 3020 PS (hpc3020s.ppd)
 10) HP LaserJet 3030 PS (hpc3030s.ppd)
 11) hp LaserJet 3050 PS (hpc3050s.ppd)
 12) HP LaserJet 3380 PS (hpc3380s.ppd)
 13) hp LaserJet 3390 PS (hpc3390s.ppd)
 14) HP LaserJet 4100 PS (hpb41007.ppd)
 15) HP LaserJet 4200 PS (hpc4200s.ppd)
 16) HP LaserJet 4200L PS (hpc420xs.ppd)
 17) HP LaserJet 4240 PS (hpc4240s.ppd)
 18) HP LaserJet 4250 PS (hpc4250s.ppd)
 19) HP LaserJet 4300 PS (hpc4300s.ppd)
 20) HP LaserJet 4345 mfp PS (hpc4345s.ppd)
 21) HP LaserJet 4350 PS (hpc4350s.ppd)
 22) HP LaserJet 5000 Series (hp5000_7.ppd)
 23) HP LaserJet 5100 (hp5100_7.ppd)
 24) HP LaserJet 8150 PS (hpb81507.ppd)
 25) HP LaserJet 9000 PS (hpb90007.ppd)
 26) HP LaserJet 9040 mfp PS (hpc904ms.ppd)
 27) HP LaserJet 9050 mfp PS (hpc905ms.ppd)
 28) HP LaserJet 9050 PS (hpc9050s.ppd)
 29) HP LaserJet 9055 MFP PS (hpc9055s.ppd)
 30) HP LaserJet 9065 MFP PS (hpc9065s.ppd)

Please select an item, or press <CR> to quit: 3

*** PostScript Printer Configuration ***

Current printer model = HP LaserJet 2300 PS
Please select one of the following actions
 1) Set default locale                       [C]
 2) Set user configuration file              [None]
 3) Set printer installable options          [0]
 4) Set default values for PPD features      [0]
 5) Set default user options                 [0]
 6) Set paper size to input tray mapping     [0]
 7) Add/Remove alias for PPD main keywords   [0]
 8) Add/Remove alias for PPD option keywords [0]
 9) Add/Remove locale name aliases           [0]
10) Add/Remove setup macros                  [0]

 s) Show all current settings
 q) Quit
 x) Save changes and exit

Please select an item:
```

The following sections describe each of the available options in more detail.

Default Locale

Default locale is the locale where the `psfontpf` print filter runs if no explicit locale is set in the command line. You should set the default locale to the one that is the most frequently used in the computer system. This is especially important for applications whose printing interfaces do not allow the specification of additional printing options. In this case, if the text file to be printed is not in an

encoding that matches the default locale set in the printer interface file, the printer produces output with unexpected characters. To support those applications properly, you might need to set up multiple LP destinations of the same printer with different default locales.

User Configuration File

The `psfontpf` print filter allows the use of an optional user configuration file to provide additional font information or for customization. See *psfontpf*(1M) for the format of the user configuration file. Typically, system administrators do not need to set up the optional user configuration file. The following is a list of system-provided user configuration files:

- `font-dimm-jp-euc.pscf` – for printers with Japanese eucJP PostScript font DIMM or flash card
- `font-dimm-jp-sjis.pscf` – for printers with Japanese SJIS PostScript font DIMM or flash card
- `font-dimm-jp.pscf` – for printers with both Japanese eucJP and SJIS PostScript font DIMM or flash card
- `nlio.pscf` – for backward compatibility with `PS2.nlio` model file on the command-line option level

Printer-Installable Options

Most current printers have additional installable options or option packages, such as a duplexer that can be ordered with the printer. These installable options affect the capability and functionality provided by the printers. The `psfontpf` print filter needs to know what installable options are there in the printers to activate all the available features. Setting the right printer installable options should be the first step you take when you configure the printer, because this affects what users see in the other PPD-related configuration entries.

Default PPD Options

The PPD file usually provides default values for all the defined PPD features, such as page size and input tray. However, those default values might not be optimal. You might need to change the default values to meet your needs or your organization's requirements (for example, duplex printing for paper conservation). Depending on the PPD file and the installable options selected, different PPD features are shown in the file. Set the default values for the PPD features that are most important to you.

Default Non-PPD User Options

Some `psfontpf` features, such as banner page printing or number of lines per page, are not related to the PPD file. The only way to set default values for such features is to specify the list of non-PPD related, default user options. Those options are placed in front of the user-supplied command-line options so that the default values can be overridden. For example, specifying `nb lines=70` causes the print filter to disable banner page printing and print 70 lines per page by default.

Another example of a non-PPD option is that the default of truncating long text lines. To enable line wrapping for long lines as the default, specify `wrap` in the default user options field.

Paper Size to Input Tray Mapping

Setting up the paper size to input tray mapping enables the `psfontpf` print filter to select the right input tray when just the paper size is given or the paper size when just the input tray name is given.

PPD Main Keyword and Option Keyword Aliases

Both the main keywords and option keywords defined in the PPD files are typically verbose to make them easier to understand. Consequently, however, they are hard to type in the command line. To streamline typing, the `psmsgen` tool allows you to define aliases for those keywords.

Locale Alias

For local-language character printing, locale is one of the most important options that you specify. To make typing the locale name easier, users can define an alias for the locale name, like "Japanese" for ja_JP.SJIS.

Setup Macro

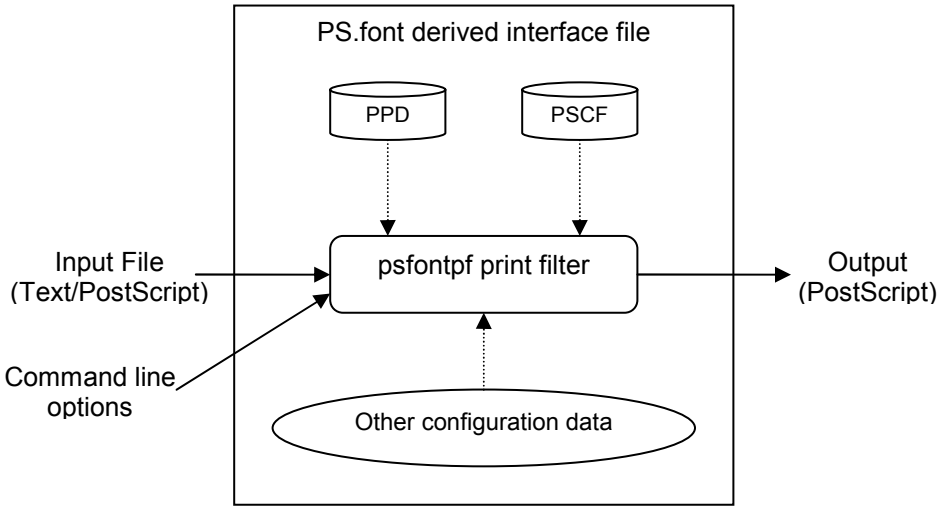
A setup macro is used for representing a number of individual command-line options or keyword-option pairs by a simple, easily remembered word. For example, to print 160 narrow characters per line in landscape mode, you can define l160 as a macro for the option sequence `landscape width=160`. This feature also enables users to use a simple name to indicate complicated PPD features with mutual dependencies.

By assigning aliases to PPD keywords and by creating setup macros, you can create a set of consistent printing options in a heterogeneous printing environment with printers from different manufacturers.

Features of the psfontpf Print Filter

Figure 4 illustrates all the different input that the `psfontpf` print filter gets from within a `PS.font`-derived printer interface file.

Figure 4: Relationship Between psfontpf and PS.font-Derived Interface File



PPD – PostScript printer description file
PSCF – psfontpf configuration files

The `psmsgen` configuration tool sets up the PPD file to be used, as well as a user configuration file, if applicable. The tool also sets up other configuration data such as default locale, printer-installable options, and so on. In addition to the optional user configuration file, the `psfontpf` print filter reads in a system configuration file as well as a locale-specific configuration file, if present, under the `/usr/lib/lp/psfontpf/pscf` directory. These configuration files are used to provide the following information:

- Font files or font names to use for different language environments and their locations in the file system and the typeface names

- Language, codeset, and locale aliases
- Setup macros
- Unicode character language font mapping sequence
- Default Unicode bidirectional algorithm state
- Iconv galley characters and custom conversions

All the fonts defined in the configuration files are associated with a language tag, which is simply the language and territory part of the locale name (for example, en_US or ja_JP). When printing non-Unicode characters, only the fonts associated with the language tag of the current locale are used. If the current language tag is not one that is defined within the configuration files, it defaults to the en_US language tag.

When printing Unicode characters, however, all fonts that are associated with different language tags can be used. In these instances, the Unicode character language-font mapping sequence is useful. It determines the sequence of language-tag associated fonts that are checked for whether they have the glyph for a given Unicode character.

Typically, a locale-specific configuration file defines the Unicode character language-font mapping sequence. It might also define the default Unicode bidirectional algorithm state, which can be on or off by default.

These are the reasons why the recommended way to provide codeset information to the `psfontpf` print filter is by passing the right locale name. If you need to print out characters in a codeset that is not supported by any of the HP-UX locales, but the corresponding codeset-to-Unicode converters exist, the codeset name can be explicitly specified in the command line. Even in this case, it is helpful to provide a locale name to designate the language tag to be used.

For Unicode text that is prefixed by a Unicode Byte Ordering Mark (BOM – U+FEFF), the `psfontpf` print filter can automatically detect the Unicode transformation format of the Unicode text. If a BOM is not there, user must explicitly state the Unicode transformation format name (for example, UTF-16BE).

User Options Supported by the `psfontpf` Print Filter

The `psfontpf` print filter accepts a large number of `-o` options supplied by the `lp` command to modify its behavior. These options can be classified into two broad types:

- A single keyword
- A keyword-option pair (*keyword=option*)

Because the list of acceptable options is expanded by the inclusion of PPD and other user customizations provided by the users when invoking the `psmsgen` tool, the list of all user options can vary. Some options are specific to text printing, whereas others apply to both text and PostScript printing. Table 9 and Table 10 describe all the built-in user options supported by the `psfontpf` print filter, for text printing only and for both text and PostScript printing, respectively.

Table 9: Built-in Text Trinting Only psfontpf `-o` User Options

Feature	Options	Description
Unicode algorithms	**bidi=*bvalue***	Specifies the state of the Unicode bidirectional algorithm: **off** – disable **on** – right-to-left printing for lines begun with strong right-to-left character **rtol** – force right-to-left printing for all lines **auto** – on for Unicode, off for other codesets (default)
	nform=*NF*	Specifies the Unicode normalization form to be used for Unicode text data. The valid values are **NFC** (default), **NFD**, **NFKC**, **NFKD** or **None**.
Page margins	**bm=*bottom-margin*** **tm=*top-margin*** **lm=*left-margin***	Specifies the bottom, top, left, right, and page margins. Setting the page margin sets the same value to all four side margins. The unit can be **in** for inch (default), **pt** for point, **cm,** or **mm**.

	rm=*right-margin* **pm=*page-margin***	
Character size and line spacing	**cpi=*char-per-inch***	Specifies the number of printed narrow characters per inch.
	hmi=*hmotion-index*	Specifies the horizontal motion index of a character. The unit of the index is 1/120 inch. The value can be wider or narrower than the value specified in the **cpi** parameter. In that case, the character is printed further apart or closer together. Its default value is the same as the **cpi** parameter in 1/120 inch unit.
	lines=*lines* **length=*lines***	Specifies the number of lines per page.
	lpi=*lines-per-inch*	Specifies the number of lines per inch.
	nofixwh **nf**	Specifies that width-to-height aspect ratio of the printed characters is allowed to change according to the specified **cpi**/**lpi** and related options. By default, the aspect ratio remains the same, which results in the addition of extra padding spaces between characters or between lines.
	vmi=*vmotion-index*	Specifies the vertical motion index value which determines the height of a line. The unit of the index is 1/48 inch. This is equivalent to 48 ÷ *lines-per-inch*.
	width=*width*	Specifies the width of the page in columns.
Page printing control	**even**	Prints only the even pages.
	odd	Prints only the odd pages.
	pages=*m*:*n*	Specifies the range of pages to be printed. Starting with the page number *m* and ending at page number *n* inclusively.
	pn	Prints page number in the lower left corner of the page.
Orientation	**land** **landscape**	Prints in landscape mode; that is, the printed output is parallel to the long side of the page.
	port **portrait**	Prints in portrait mode; that is, the printed output is parallel to the short side of the page.
Miscellaneous character formatting & control	**indent=*indent***	Specifies the amount of indentation in columns (default = 0).
	italic	Prints nroff format underlined characters in italic font, if available.
	prtctrl	Prints control characters and suppresses page break.
	roman	Causes the use of local Roman character set (JIS Roman for Japanese and ISO646-KR for Korean) when printing ASCII character in a Japanese or Korean locale except for Unicode text file.
	textcolor=*color*	Specifies the color of the output text for a color printer. The currently supported colors include black, red, green, blue, yellow, magenta, and cyan.
	vprint	Specifies vertical writing mode for Chinese, Japanese, and Korean multibyte characters. When this option is activated, multibyte CJK characters are printed vertically in a rotated orientation; however, other single-byte characters in the text are still printed horizontally.
	[no]wrap	Enables/disables line wrapping (default = `nowrap`).

Table 10: Built-in Text and Postscript Psfontpf -o User Options

Feature	Options	Description
	code=*codeset*	Specifies the codeset of input text file. This option should only be used if the given codeset is not supported by an existing locale

Character code selection		or is a Unicode transformation format.[11]
	locale=*locale-name*	Specifies the locale setting in which the filter processes the input file. By default, the locale setting when the command is started will be used.
Banner page	**banner** **yb**	Enables banner page printing (default).
	nobanner **nb**	Disables banner page printing.
Paper and tray selection	**btray=*input-tray***	Selects the input paper tray to be used for printing the banner page. The *input-tray* name is printer dependent and is specified in the PPD file, if supplied.
	itray=*input-tray*	Selects the input paper tray that supplies paper for the print job. The *input-tray* name is printer dependent and is specified in the PPD file, if supplied.
	obin=*output-bin*	Selects the output bin where the print job will be deposited. The *output-bin* name is printer dependent and is specified in the PPD file, if supplied.
	paper=*paper-size*	Specifies the paper size. Valid values are: Letter (the default2 if no PPD file is specified), Executive, Legal, Tabloid, A0, A1, A2, A3, A4, A5, A6, B0, B1, B2, B3, B4, B5, and B6. Not all paper sizes are supported by a certain printer. The printer can also support paper sizes not listed above. Invalid paper size setting may cause the output to be truncated. If a PPD file is specified, invalid values will be ignored.
Font control	**font=*fontname***	Specifies that the fonts associated with the given *fontname* should be selected for printing, if available, instead of the default fonts as specified in the `psfontpf` configuration files. The *fontname* parameter can be an actual font name or font file path or a typeface name.
	nopfont **np**	Specifies that non-Latin 1 printer fonts should not be used for printing. This option may be useful if the printer fonts cover less characters than that are supported by the operating system fonts and there is a need to print those extra characters with consistent fonts. This is somewhat similar in functionality to the `nodimm` option of `PCL5.asian`.
	nowc	Specifies that padding spaces be added around narrow TrueType glyph that should be displayed as a wide character (default).
	remap	Specifies that non-BMP Unicode characters in Mozilla PostScript file will be mapped to private use characters in the BMP so that those characters are printable. This option may interfere with fonts that have characters defined in the private use characters range of the BMP. And if the input file has a lot of non-BMP characters, the BMP private use area may not be large enough to print all of them. This feature is off by default.
	uwidth2=*Unicode-Range*	Specifies the list of Unicode ranges (separated by comma without space) that should be regarded as full width character (width 2) irrespective of the value returned by the wcwidth() function when printing Unicode characters.
	widenchar **wc**	Specifies that narrow TrueType glyphs should be widened (doubled in width) when they are displayed as a wide character (opposite of nowc).
Input format	**format=*input-format***	Specifies the data format of the input file. Valid values are **text** or **ascii** (for text printing), or **post** or **ps** (for PostScript printing). Otherwise, the print filter will automatically detect if the input file

[11] This option has no effect on PostScript printing.

		is text or PostScript.
Duplex	**side=*side***	Prints the job in a way specified by the *side* variable. Its possible values are: 1 | one_sided | one_sided_simplex Prints only one side of the sheet. 2 | two_sided | two_sided_duplex Prints on both sides of the sheet; the second side is reached by flipping the sheet about its left edge, as in the binding of a book. tumble | two_sided_tumble Prints on both sides of the sheet, but prints the opposite way up on each side, so that the second side can be read by flipping the sheet along its top axis.
User-defined characters	**udc=*udc-file***	Specifies the user-defined character raster font as specified in the *udc*(1). The print filter will look for UDC file in the `/usr/lib/asx/UDC` directory if an absolute path is not specified.
	umap=*umap-file*	Specifies the UDC code font mapping file to be used for mapping user defined characters to code points in TrueType and bitmap fonts. The format of the `umap` file is the same as that of the `PCL5.asian` model file with the exception that `psfontpf` works better with actual font file names than the XLFD names.
PPD keyword option	**opt=*keyword:option***	Selects the given PPD option keyword as the value of the PPD main keyword.
Setup macro	**setup=*macro***	Specifies the use of the option lists associated with the given macro name.

In addition to the built-in options listed in Table 9 and Table 10, the `psfontpf` print filter accepts additional options derived from the PPD file and user-defined options and aliases, as specified with the `psmsgen` command. The embedded help message within the `PS.font`-derived interface file contains a list of all the other supported non-built-in options.

A keyword-option pair (*keyword=option*) not matching any of the built-in keyword-option pairs above is treated as the selection of the given PPD option keyword as the value of the given PPD main keyword. This is equivalent to the use of the option `opt=`*`keyword:option`*.

A standalone option (without =) not matching any of the built-in standalone options above is treated as one of the followings in descending order:

- A setup macro name
- A locale name or locale alias
- A page size name, (such as A4)
- An input tray name
- A codeset name or Unicode transformation format name
- A font name or typeface name

The print filter tries to match the option name against the list of valid options in each category from top to bottom. If the option name matches none of the valid options, the option is ignored.

Some of the built-in options are, in fact, aliases of PPD options listed in the following table. Therefore, specifying the corresponding PPD options is equivalent to using the built-in options.

Built-in Options	Corresponding PPD Options
itray=input-tray	InputSlot=input-tray
obin=output-bin	OutputBin=output-bin
paper=paper	PageSize=paper
side=1	Duplex=None
side=2	Duplex=DuplexNoTumble
side=tumble	Duplex=DuplexTumble

Text Printing Notes

Most European mono-spacing fonts, such as Courier, have glyphs with a width-to-height aspect ratio of about 0.6. Most CJK fonts containing ideographic characters have glyphs shaped like a square with an aspect ratio of 1. As an ideographic character is expected to have the same width as two ASCII characters, those ASCII characters must have an aspect ratio of 0.5. That is why ASCII characters printed in an Asian locale sometimes look taller and narrower than ASCII characters printed in the C or other European locales. Many CJK fonts also contain half-width ASCII characters with an aspect ratio of 0.5 and are adjusted for a better match with the corresponding ideographic characters.

When printing Unicode files, the `psfontpf` print filter determines whether any full-width characters, like a CJK ideographic character, appear in the text file. If the file contains no full-width characters, the other characters are printed with the natural aspect ratio of 0.6, unless this ratio is overridden by the use of another font containing narrow characters with a 0.5 aspect ratio. When the file contains some full-width characters, the half-width ASCII characters are printed with an aspect ratio of 0.5.

By default, the Courier font in the printer is used to print ASCII characters. To make the ASCII characters look better when mixed with full-width ideographic characters, you might need to substitute (download) the glyphs of the half-width ASCII characters in the CJK fonts, as you would with the ideographic character. This can be done if the `psfontpf` configuration file defines `12` as the value of the `latin1 font type` entry.

In portrait mode, letter-size paper holds 60 lines of 80-column text, whereas A4-size paper holds 66 lines of 80-column text by default. In landscape mode, the default is 45 132-column lines for both paper sizes. For other paper sizes, the `psfontpf` print filter defaults to the use of 11-point fonts with number of lines per page and characters per line determined by the current page size and page margins.

You can change these default values by explicitly specifying the following groups of options, in descending order of priority:

- `hmi, vmi`
- `cpi, lpi`
- `width, lines/length`

These options are interrelated, and changing one might force the others to change. For example:

lines-per-inch = lines/(page-height – top-margin – bottom-margin)

In such cases, an option you specify at a later time might invalidate a previously specified, related option. For example, a letter-size page (8.5 inches x 11inches) with a page margin of 0.5 in and 6 lines per inch typically prints 60 lines per page. If you specify 66 as the number of lines per page (lines) forces the lines-per-inch value to become 6.6.

When conflicting `hmi` and `cpi` options are specified, one of the following can occur:

- If the `hmi` option specifies character spacing wider than the `cpi` option, extra space is added between characters to satisfy both options.
- If the `hmi` option specifies character spacing narrower than the `cpi` option, the `hmi` option takes precedence. The character width is reduced to a level that is dictated by the `hmi` option.

Similarly, when conflicting `hmi/cpi` and width options are specified, one of the following can occur:

- If the `hmi/cpi` option specifies a character-per-line number greater than the `width` option, the `width` option dictates how many single-width characters are printed per line, with an effectively larger right margin.
- If the `hmi/cpi` option specifies a character-per-line number less than the width `option`, the `width` option is ignored.

Similar interactions occur among the `vmi`, `lpi` and `lines` options.

By default, the width-to-height aspect ratio of the printed characters does not change as a result of interactions among `hmi/cpi` and `vmi/lpi`. For instance, changing the value of the `lpi` option also affects `cpi`, and vice versa. The `nofixwh` or `nf` option enables `lpi` and `cpi` to be independent of each other, resulting in the printing of compressed or widened characters based on what `lpi` and `cpi` values are specified.

Mozilla PostScript Printing Notes

When printing PostScript files generated by the Mozilla Web browser, the codeset portion of the current locale is immaterial, because Mozilla encodes all the characters using Unicode. However, the language and territory portion of the locale name is significant because it helps to determine the set of fonts to be used if language-related information is not encoded in the PostScript files themselves.

Non-BMP[12] characters on Web pages cannot be printed by default. However, by specifying the `-oremap` option to remap those characters to a private use area of BMP, the characters can be printed properly. This option might not work if too many non-BMP characters need to be printed.

Font Control and Selection

The set of bitmap and TrueType fonts used by the `psfontpf` printer filter are controlled by the font information stored in the system configuration file. However, the following methods of using fonts other than those defined in the system configuration file, are available:

- Use the `font=`*`fontname`* option to specify the font to be used. Specify this value as an `lp -o` option or as the default user option when configuring the interface file using the `psmsgen` tool.
- Define the set of custom fonts to be used in an optional user configuration file, and select that user configuration file when configuring the interface file using the `psmsgen` tool.
- Use the `udc=`*`udc-font`* option to use the *udc*(1) format user-defined character raster font.
- Use the `umap=`*`umap-file`* option to use the UDC code font-mapping file.

For the `psfontpf` print filter, use of the `font` option does not exclude the use of other system fonts; it simply sets the given font to be the preferred one. You can still use other fonts if a character cannot be found in the given font.

You can specify multiple font options in the command line. The ones positioned later in the line have higher priority than the ones positioned earlier in the line. The *`fontname`* parameter can be any of the following:

- A typeface name to select a particular typeface from the system fonts
- A PostScript font name, when selecting one of the printer supported fonts
- A pathname to a TrueType or PCF bitmap font

[12] Unicode Base Multilingual Plane (U+0000 – U+FFFD).

- An XLFD font name[13]

Because the `psfontpf` print filter uses the Unicode character map (cmap) in the TrueType font, old TrueType fonts without a Unicode `cmap` section are not supported. When a TrueType or a PCF bitmap font is specified, additional font attributes can be appended after the font name, separated by commas. The supported font attributes are as follows:

- `cs=`*`codeset`*
  Specifies the codeset name for the bitmap font only.
- `vs=`*`vertical-shift`*
  Specifies the vertical shift factor (default=0) that is used to shift the character up (positive) or down (negative).
- `sf=`*`scaling-factor`*
  Specifies the scaling factor (default=1) that is used to scale the font larger (> 1) or smaller (< 1).

For example, the `font=/tmp/sjis.pcf,cs=SJIS` option specifies a bitmap font called `sjis.pscf`, which is encoded in the Japanese SJIS encoding.

Like the `PCL5.asian` model file, the `psfontpf` print filter also supports the use of the `umap` file to specify code to UDC font mapping. However, TrueType fonts are supported only through the direct specification of the font file pathname in the `umap` file. Scalable XLFD names that can be accessed only via the X font server are not supported.

[13] The `psfontpf` print filter does not support the specification of additional font paths for looking up XLFD font. The only way to add font paths is through the use of user configuration file.

Comparison of PCL5.asian and PS.font Model Files

Many of the capabilities of the PCL5.asian and PS.font model files are similar, but there are also some subtle differences. For instance, the same text file printed by the PCL5.asian model file might look slightly different from that of the PS.font model file because of differences in font selection and sizes.

Table 11 compares the PCL5.asian and PS.font model files. Use this table to choose the model file that is best for your printing environment.

Table 11: Comparison of PCL5.asian and PS.font Model Files

Model File	**PCL5.asian**	**PS.font**
Printing speed	The PCL5 printer language is simpler. So the print job usually completes faster.	The PostScript printer language is more complex. So a PostScript print job is usually a bit slower than the corresponding PCL5 print job.
Printer memory	PCL5.asian requires less printer memory than PS.font for similar print jobs.	PS.font requires more printer memory than PCL5.asian for similar print jobs.
Printer control language	PCL5	PostScript
Multiple pages per sheet	Support printing 2 or 4 pages per sheet of paper.	Not currently supported.
Mozilla web pages	Does not support printing of web pages from Mozilla.	Support the printing of non-Latin 1 characters in web pages as displayed by the Mozilla web browser.
Non-CJK language support	Can provide limited support for European character sets as long as they are supported directly by the printer.	Can support all the non-CJK character sets supported by the HP-UX operating system (e.g., Hebrew, Arabic).
Bidirectional printing	Not supported	Supported as specified by the Unicode bidirectional algorithm.
Configurability	Allow a limited amount of configuration and customization by the setnetlp command and direct file editing.	Allow more configuration and customization than PCL5.asian via the psmsgen configuration tool.

Appendix A: Common Printer Control Languages

ESC/P

The ESC/P printer control language was originally created by Epson to control their dot-matrix printers. It is now a de facto standard for dot-matrix printers from various printer manufacturers.

The ESC/P printer control language is an escape sequences and control characters based printer control language. Different control characters and escape sequences are used to activate and deactivate different features of the printers. For example, the escape sequence "ESC 0" is used to select 1/8-inch line spacing. Dozens of different escape sequences and a selected number of control characters are defined in this printer control language.

HP-GL

The Hewlett-Packard Graphics Language (HP-GL) is a vector-based printer control language, whereas most other common printer control languages are raster-based. This is a de facto standard for almost all plotters. The language is formed from a series of two letter codes, followed by optional parameters.

HP-GL/2 is part of the HP PCL5 language.

LIPS

Both LIPS III and LIPS IV are different versions of the same printer control language created by Canon for its printers. Like ESC/P, they are escape sequences and control characters base printer control languages.

PCL

HP developed the PCL (Printer Command Language) printer language to standardize access to printer features. It has become a de facto industry standard that is also supported by other printer manufacturers.

PCL levels 1 through 5e/5c are escape-sequenced based languages like ESC/P that are processed and interpreted in the order they are received.

PCL6 consists of mainly the following two components:

- PCL6 Enhanced
- PCL6 Standard

PCL6 Standard is equivalent to PC5e/5c for providing backward compatibility. PCL6e Enhanced is a stack-based, object-oriented protocol similar to PostScript. However, it uses binary binding as opposed to ASCII binding in PostScript. In other words, commands are expressed in binary operators rather than ASCII text.

The currently supported PCL levels are:

- PCL3+ (mono) and PCL3c+ (color) for HP DeskJet and HP PhotoSmart products.
- PCL3GUI for HP DesignJet and some DeskJet series printers.
- PCL5e (PCL5 enhanced) for monochrome LaserJet printers
- PCL5c for color LaserJet printers
- PCL6 for newer LaserJet printers

Support of PCL5 and especially PCL6 requires more processing resource on the printer side. Therefore, less work is needed on the driver side. PCL3 and its derivatives are simpler and require less processing resource on the printer side. However, the driver must perform more tasks to render the page before sending the command sequences to the printer.

PJL

Printer Job Language (PJL) was developed by HP for providing job-level control that cannot be accomplished with PCL, PostScript, or other printer languages. To provide this control, PJL functions "above" the level of PCL and other printer languages, providing four major functions:

- Printer language switching between jobs
- Job separation
- Printer configuration
- Status read-back from the printer to the host computer

Other printer manufacturers might use their own job-control language similar to PJL for these job-level functions.

PostScript

PostScript is a stack-based page description language created by Adobe Systems. It comprises a group of ASCII text commands and codes that describe graphic elements and indicate where they are to appear in the printed page. A PostScript printer contains a PostScript interpreter that interprets the PostScript commands and executes them. There are three levels of PostScript – level 1, 2, and 3. PostScript level 1 is now obsolete and current PostScript printers support either level 2 or level 3.

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