HP LaserJet 4V/4MV Printer Developer's Quick Reference Guide

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Printing History

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Conventions

The following conventions are used throughout this manual:

Bold is used to emphasize important information in the text or to highlight text to be entered from your computer's keyboard.

Italic type is used for titles that refer to manuals or documents, to indicate selections to be made, or for emphasis.

Note	Notes contain important information that is set off from the text.

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Chapter 1: LaserJet 4V/4MV Features

This chapter provides an introduction to the LaserJet 4V/4MV LaserJet printer features. This information will aid you in estimating the amount of time required to support the LaserJet 4V/4MV printers.

LaserJet 4V/4MV will support enhanced PCL5, bi-directional communication (IEEE STD 1284), Resolution Enhancement technology, 45 scalable typefaces, Memory Enhancement technology, and EconoMode printing, as do the LaserJet 4 Plus/4M Plus printers. The LaserJet 4V/4MV will also include a 16 page-per-minute engine (for letter size paper), 11x17 support, user configurable data buffers, PJL lockout, environment savings, MIO version 6.0, and an optional PostScript disk.

LaserJet 4V is primarily targeted towards the general office using DOS/Windows PCL whereas LaserJet 4MV is targeted towards the Macintosh/PostScript users in the general office as well as the electronic publishing and CAD markets.

LaserJet 4V/4MV printers have been designed to maintain a high level of compatibility with previous models of LaserJet printers. This means you can leverage parts of your existing LaserJet 4 Plus/4M Plus drivers into LaserJet 4V/4MV drivers.

This guide will assume that you have four other pieces of HP documentation. Two pieces of this documentation are available separately from this kit. These documents are the *PCL 5 Comparison Guide* (HP part # 5961-0602) and the *Printer Job Language Technical Reference Manual* (HP part # 5961-0603). These guides have been updated for all LaserJet printers up through the LaserJet 4MP printer, as of 9/93 or later. The third and fourth pieces of documentation are the Big Three Developer's Documentation (the Big Three printers are the LaserJet 4ML, LaserJet 4P, and the LaserJet 4MP) and the LaserJet 4 Plus/4M Plus Developer's Documentation.

Also a part of the LaserJet 4V/4MV tool kit is the PostScript implementation guide for LaserJet 4V/4MV. This guide, when used in conjunction with the "PostScript® Language Reference Manual Second Edition", or the "*Red Book*" from Adobe Systems, will describe the PostScript implementation in the LaserJet 4V/4MV.

The technical features of LaserJet 4 Plus/4M Plus and The Big Three printers have been fully documented in the aforementioned guides. The PCL, PJL and PostScript in LaserJet 4V/4MV are essentially the same as what has been implemented in LaserJet 4 Plus/4M Plus and The Big Three. If these guides mention LaserJet 4 Plus/4M Plus or Big Three support of a particular command or feature, you can assume LaserJet 4V and LaserJet 4MV likewise support the command. This guide will point out the differences between the LaserJet 4V/4MV printers and the LaserJet 4 Plus/4M Plus printers.

You may also need the *LaserJet 4 Developer's Guide.* It contains many programming suggestions, software tools, and font metrics files for all LaserJet 4 family printers. If you need a copy of the *LaserJet 4 Developer's Guide* contact the Developer's Program at 619-592-8308.

Features of the LaserJet 4V Printer

- LaserJet 4 family print quality of 600 dots per inch with Resolution Enhancement® technology and Microfine toner, producing hard copy at a maximum speed of 16 pages per minute for letter size paper.
- Intellifont and TrueType scaling technologies on board.
- 45 scalable typefaces -- 35 Intellifont, 10 TrueType.
- Two standard paper cassette trays: One 250 sheet paper cassette that supports letter/A4 paper sizes and one 250 sheet paper cassette that supports 11x17/A3 paper sizes. A standard 100 sheet MP tray. Optional trays for each of the following paper sizes: 250 sheet trays for legal, JIS B4, and JIS B5 and a 500 sheet universal paper tray.
- Memory Enhancement technology, allows enhanced graphics performance in standard memory. Also allows up to 11x17 (A3) printing with standard memory.
- 4 Megabytes base memory, upgradeable to a total of 68 Megabytes (four 16MB SIMMS plus 4MB base memory).
- 4 physical SIMM slots accepting RAM, font or personality options. No font cartridge slots.
- BiTronics parallel interface plus Modular I/O (MIO) 6.0 support for optional LAN or printer sharing cards, automatic I/O switching.
- I/O Buffering for faster return to application.
- Resource saving. Saves environment during changes in resolution, page protect, and personality switch.
- Job overlap. The ability of the printer to process more than one job at a time. Maintains engine speed when printing multiple jobs. Throughput on back-to-back PostScript jobs is unaffected by change in resolution, page protect, or personality.
- PJL, front panel, and disk lockout for better security and printer sharing.
- A top (correct order) output tray, holding 250 pages.
- Enhanced Printer Job Language (PJL).
- Enhanced PCL 5 Printer Language.
- Ability to accept downloaded bitmapped and scalable fonts, limited only by the amount of available printer memory.
- EconoMode printing can greatly reduce toner usage. This reduces the cost per page and extends the life of the consumable toner cartridge.
- Standard LaserJet 4-like front panel.
- Environmentally conscious -- reduced power consumption (less than 30W/hour in standby mode), recycled paper support, EPA Energy Star certified.

- PCL and HP-GL/2 support for ROP3, Microsoft Windows compatible raster operations.

Features of the LaserJet 4MV Printer

- LaserJet 4MV is a superset of LaserJet 4V.
- LaserJet 4 family print quality of 600 dots per inch with Resolution Enhancement® technology and Microfine toner, producing hard copy at a maximum speed of 16 pages per minute.
- Intellifont and TrueType scaling technologies on board.
- 80 scalable typefaces -- 35 Intellifont, 10 TrueType, and 35 PostScript.
- Two standard paper cassette trays: One 250 sheet paper cassette that supports letter/A4 paper sizes and one 250 sheet paper cassette that supports 11x17/A3 paper sizes. A standard 100 sheet MP tray. Optional trays for each of the following paper sizes: 250 sheet trays for legal, JIS B4, and JIS B5 and a 500 sheet universal paper tray.
- Memory Enhancement technology, allowing for enhanced graphics performance in standard memory. Also allows up to 11x17 (A3) printing with standard memory.
- 4 Megabytes base memory plus an 8MB SIMM, upgradeable to a maximum of 52 Megabytes (three 16MB SIMMS plus 4MB base memory).

  NOTE: In order to obtain the maximum memory of 52 Megabytes, the standard 8 MB SIMM would need to be replaced with a 16 MB SIMM.
- Adobe PostScript Level 2 SIMM.
- JetDirect Peripheral Interface card that supports Netware, Lan Manager, EtherTalk, Localtalk, and TCP/IP.
- 2 physical SIMM slots accepting RAM, font or personality options. No font cartridge slots.
- BiTronics parallel interface plus Modular I/O (MIO) 6.0 support for optional LAN or printer sharing cards, automatic I/O switching.
- I/O Buffering for faster return to application.
- Resource saving. Saves environment during changes in resolution, page protect, and personality switch.
- Job overlap. The ability of the printer to process more than one job at a time. Maintains engine speed when printing multiple jobs. Throughput on back-to-back PostScript jobs is unaffected by change in resolution, page protect, or personality.
- PJL, front panel, and disk lockout for better security and printer sharing.
- A top (correct order) output tray, holding 250 pages.
- Enhanced Printer Job Language (PJL).

- Enhanced PCL 5 Printer Language.
- Ability to accept downloaded bitmapped and scalable fonts, limited only by the amount of available printer memory.
- EconoMode printing can greatly reduce toner usage. This reduces the cost per page and extends the life of the consumable toner cartridge.
- Standard LaserJet 4-like front panel.
- Environmentally conscious -- reduced power consumption (less than 30W/hour in standby mode), recycled paper support, EPA Energy Star certified.
- PCL and HP-GL/2 support for ROP3, Microsoft Windows compatible raster operations.
- Optional 40MB PostScript Disk. Installable on the formatter board.

Feature Comparison

A matrix is provided comparing LaserJet 4V with the LaserJet 4 Plus and LaserJet 4Si printers. This matrix will assist you in easily identifying the differences between the three printers.

Feature	HP LaserJet 4V	HP LaserJet 4 Plus	HP 4Si
Printer Language	**Enhanced PCL 5**	Enhanced PCL 5	Enhanced PCL 5
Print Speed	**Up to 16 ppm**	Up to 12 ppm	Up to 17 ppm
Max. Text Resolution	**600 x 600 dpi**	600 x 600 dpi	600 x 600 dpi
Resolution Enhancement Technology	**Yes** **ON or OFF** **Light, Medium, or Dark**	Yes ON or OFF Light, Medium, or Dark	Yes ON or OFF
Graphics resolution with - standard memory			
75 DPI	1 page	1 page	1 page
100 DPI	1 page	1 page	1 page
150 DPI	1 page	1 page	1 page
200 DPI	1 page	1 page	1 page
300 DPI	1 page	1 page	1 page
600 DPI	1 page**	1 page**	1 page**
Paper Sizes Supported	**Letter, Legal, 11x17, Exec., A4, A3, JIS B4, JIS B5, Custom up to 11.7 x 17.7**	Letter, Legal, A4, Exec.	Letter, Legal, A4, Exec.
Envelope Sizes	**Com10, Monarch, DL, C5, B5, JPost, JPostD**	Com10, Monarch, DL, C5, B5	Com10, Monarch, DL
Number of Input trays	**2 Standard (Letter/A4 or 11x17/A3)** **Univ. Paper Tray - Opt.** **Legal - Opt.** **B4 (Japanese) - Opt.** **B5 (Japanese) - Opt.**	2 Standard (1 removable and one multipurpose) 4 with optional lower cassette and optional envelope feeder	2 Standard (3 with optional envelope feeder installed)
Input Tray Capacity (Sheets)	**MP Tray - 100** **Letter/A4 Tray - 250** **11x17/A3 Tray - 250** **Univ. Paper Tray - 500**	MP Tray - 100 Paper Tray - 250 Opt. Lower Tray - 500 Opt. Env. Feeder - 75	Upper Tray - 500 Lower Tray - 500 Envelope Feeder - 100 Optional Feeder - 1500
Manual Feed	**MP Tray** **(Feed paper and Env.)**	MP Tray (Feed paper and Env.)	On top of Upper Tray On top of Lower Tray (Feed paper and Env.)
Output Tray Capacity (sheets)	**Top Tray - 250**	Top Tray - 250	Upper Bin - 500 Rear Tray - 50 Opt. Bin - 2000
Correct Order Output	**Yes**	Yes	Yes
Face Up Output	**No**	No	Yes
Paper path	**Front to back (C path)**	Rear to front (C path)	Front to back (C path)
Output Bin Full Sensor	**No**	No	Yes

Job Offset	**No**	No	Yes (Config. Menu Item)
Envelope Feeder	**No**	Yes (optional)	Yes - Opt.
Duty Cycle (Sheets)	**35 k/month**	20 k/month	75 k/month
EconoMode	**Yes** **ON or OFF**	Yes ON or OFF	No
MEt	**Yes**	Yes	No
Duplex Support	**No**	Yes - Opt.	Yes - Opt.
Memory -Standard Optional Max. Optional Memory	**4 MB** **1, 2, 4, 8, & 16 MB SIMMS** **68 MB**	2 MB 1, 2, 4 & 8 MB SIMMS 66 MB	2 MB 1, 2, 4 & 8 MB SIMMS 32 MB
SIMM Slots	**4**	4	4
I/O Configurations	**Parallel BiTronics, MIO**	Serial, Parallel BiTronics, MIO	Parallel BiTronics, MIO
MIO Slots	**1**	1	2
Cartridge Slots	**0**	1	2 Slots named C1 & C2
User Display	**Vacuum Fluorescent Display (VFD)**	Vacuum Fluorescent Display (VFD)	Liquid Crystal
Environment Saving	**Yes**	Yes	Yes
Font Scaling Technologies	**Intellifont, TrueType, Adobe (opt.)**	Intellifont, TrueType, Adobe (opt.)	Intellifont, TrueType, Adobe (opt.)
Additional Language Support	**PostScript Level 2** **IBM Proprinter/Epson**	PostScript Level 2 IBM Proprinter/Epson	PostScript Level 2 IBM Proprinter/Epson
Language Switching between PostScript and PCL	**Yes**	Yes	Yes
Disk Support	**40 Mb - Opt.** **Internal - ATA/IDE interface***** **Must have PostScript**	No	No
MIO Version	**6.0**	5.1	5.1
Printer Management Language (PML) Support	**Yes (MIO only)**	No	No
Power Save Mode	**Yes**	Yes	Yes
Processor	**Intel 33.3 MHz 80960 CF**	Intel 25 MHz 80960 KA	Intel 25 MHz 80960 CF
Front Panel Languages	**14 (Includes Turkish, Polish, and Japanese)**	13	10
Two Byte PCL	**Yes**	No	No

** Many 600 DPI full pages will print in base memory
PostScript ROM or SIMM needed
Personality SIMM needed
Additional memory is required for 600 DPI PostScript

*** ATA stands for "AT Attachment", referring to the IBM PC-AT bus. IDE stands for "Intelligent Driver Electronics."

Supported Type

The set of internal type offered by LaserJet 4V/4MV printers are designed to fully meet the printing needs of many LaserJet customers.

The PCL type offering of LaserJet 4V/4MV printers are identical to the type offered in the LaserJet 4 Plus/4M Plus and LaserJet 4 printers. LaserJet 4V/4MV printers contain 7 fixed space scalable typefaces and 38 proportionally spaced scalable typefaces for a total of 45 typefaces. Of these, 10 of the typefaces are True Type format, 35 are Intellifont format. LaserJet 4V/4MV printers also offer a Lineprinter 16.67 pitch bitmap font. The 35 PostScript typefaces are what has become known as the standard "PostScript 35."

If you need information concerning font selection and/or metrics for the PCL type in LaserJet 4V/4MV printers, you may obtain this information from the *PCL 5 Developer's Guide*, referenced earlier in this chapter.

Symbol Sets

The following table lists the internal symbol sets supported by the PCL typefaces of LaserJet 4V/4MV printers. They are the same as the LaserJet 4 Plus/4M Plus printer with the exception of the Windows 3.1 (Japanese) symbol set.

Symbol Set	**Command**
Roman-8	$^{E}_{C}$(8U
ECMA 94 (Latin 1)	$^{E}_{C}$(0N
PC-8 (IBM-8)	$^{E}_{C}$(10U
PC-8 DN (Denmark Norway)	$^{E}_{C}$(11U
PC-850 (IBM-850)	$^{E}_{C}$(12U
Legal	$^{E}_{C}$(1U
ISO 4 (United Kingdom)	$^{E}_{C}$(1E
ISO 6 (ANSI ASCII)	$^{E}_{C}$(0U
ISO 11 (Swedish: names)	$^{E}_{C}$(0S
ISO 15 (Italian)	$^{E}_{C}$(0I
ISO 17 (Spanish)	$^{E}_{C}$(2S
ISO 21 (German)	$^{E}_{C}$(1G
ISO 60 (Norwegian v1)	$^{E}_{C}$(0D
ISO 69 (French)	$^{E}_{C}$(1F
Ventura Math	$^{E}_{C}$(6M
Ventura International	$^{E}_{C}$(13J
Ventura US	$^{E}_{C}$(14J
PS Math	$^{E}_{C}$(5M
PS Text	$^{E}_{C}$(10J
Math-8	$^{E}_{C}$(8M
Pi Font	$^{E}_{C}$(15U
Microsoft Publishing	$^{E}_{C}$(6J
Windows (prior to 3.1)	$^{E}_{C}$(9U
DeskTop	$^{E}_{C}$(7J
ISO 8859/2 Latin 2	$^{E}_{C}$(2N
ISO 8859 /2 Latin 5	$^{E}_{C}$(5N
Windows 3.1 Latin 5	$^{E}_{C}$(5T
Windows 3.1 Latin 2	$^{E}_{C}$(9E
PC-8 TK, Code Page 437T	$^{E}_{C}$(9T
Macintosh	$^{E}_{C}$(12J
PC-852 Latin 2	$^{E}_{C}$(17U
Windows 3.1	$^{E}_{C}$(19U
Windows 3.1 Japanese	$^{E}_{C}$(19K

Paper Handling

Multipurpose Input Tray

LaserJet 4V provides a multipurpose input tray as one of two paper sources which come standard with the printer; this tray will be referred to as the MP TRAY. The MP TRAY has a capacity of 100 sheets of 20 lb. copier paper. Envelopes should be fed one at a time with the seal on the right hand side. The tray supports nine different paper sizes: Letter, Legal, 11x17, Executive, A4, A3, JIS B4, JIS B5, and custom. There are seven different envelope types that can also be used in this tray: Japanese Postcard, Japanese Double Postcard, Com10, Monarch, C5, DL, and B5. The tray has an adjustable paper guide for center justifying the different media sizes. Printer sensors can identify if the tray is empty or occupied. The tray has no paper size sensor so size must be specified through interaction with the front panel and paper size key or through software applications.

The MP TRAY can be configured as an automatic paper feed source, a source for manual paper feed, or as FIRST. The default configuration is FIRST. The standard cassette is, by default, the single automatic paper feed source. When MP is FIRST, if there is paper in the MP tray, it will be printed from there if another paper source has not been requested.

Standard Cassette Input Tray

LaserJet 4V has two user adjustable cassette frames, which come standard with the printer, one cassette holds Letter/A4 size paper and the other holds 11x17/A3 size paper. They attach to the bottom of the printer body, one at a time. Printer sensors can identify the absence/presence of a tray in the cassette and the absence/presence of paper in the tray, as well as the paper size in the tray. Each tray has a capacity of 250 sheets. The standard cassette does not support envelope input or executive paper.

Optional Cassette Input Tray and Envelope Feeder

Optional paper cassette trays will be available for LaserJet 4V. They will include trays for B4 (Japanese), B5 (Japanese), and legal paper. A universal paper tray will also be available as an optional tray. Two models will be available, one for Letter paper sizes and the other for A4 paper sizes. They will hold 500 sheets and be adjustable for letter, legal, 11x17, A4, A3, B4 (Japanese). The optional cassettes do not support envelope input. The LaserJet 4V printer does not have an optional envelope feeder. All envelopes must be fed through the MP TRAY with no more than 1 envelope being in the tray at one time. Envelopes should be fed with the flap facing up on the right-hand side. Executive paper will also be fed through the MP TRAY and not through the paper cassettes.

Face-down Output Stacker

The standard output stacker, which is located on the top of the print engine, provides correctly ordered output of 250 sheets. There is no paper full sensing for the LaserJet 4V printer. There is also no mechanical job offset provided on this printer.

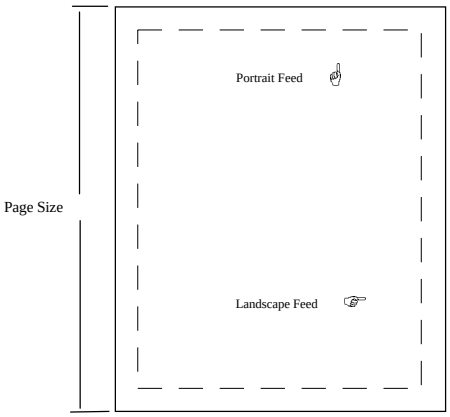
Paper Feed Orientation

The paper feed orientation for LaserJet 4V is different from most HP LaserJet printers; most page sizes will be fed with the long edge (Landscape) first rather than the short edge (Portrait)

first. The following table lists the page size, page dimensions, edge (where the printable area begins), supported paper trays and escape commands.

Page Size (feed direction*)	**Dimensions** (inches)	**Edge** (inches)	**Paper Tray Support**	**Page Selection Command**
Letter (Landscape)	8.5 x 11.0	.17	MP, PC, LC	$E_{C\&l2A}$
Legal (Portrait)	8.5 x 14.0	.17	MP, PC, LC	$E_{C\&l3A}$
11x17 (Portrait) (Front Panel)	11.0 x 17.0	.17	MP, PC, LC	$E_{C\&l6A}$
Exec (Landscape)	7.25 x 10.5	.17	MP	$E_{C\&l1A}$
A4 (Landscape)	8.27 x 11.69	.17	MP, PC, LC	$E_{C\&l26A}$
A3 (Portrait)	11.69 x 16.54	.17	MP, PC, LC	$E_{C\&l27A}$
JIS B4 (Portrait)	10.12 x 14.33	.17	MP, PC, LC	$E_{C\&l46A}$
JIS B5 (Landscape)	7.16 x 10.12	.17	MP, PC, LC	$E_{C\&l45A}$
Japanese Postcard (Portrait)	3.94 x 5.83	.17	MP	$E_{C\&l71A}$
Japanese Dbl. Postcard (Portrait)	5.83 x 7.87	.17	MP	$E_{C\&l72A}$
Com10 Envelope (Portrait)	4.12 x 9.5	.17	MP	$E_{C\&l81A}$
Monarch Envelope (Portrait)	3.87 x 7.5	.17	MP	$E_{C\&l80A}$
C5 Envelope (Portrait)	6.38 x 9.01	.17	MP	$E_{C\&l91A}$
DL Envelope (Portrait)	4.33 x 8.66	.17	MP	$E_{C\&l-90A}$
B5 Envelope (Portrait)	6.93 x 9.84	.17	MP	$E_{C\&l100A}$
Custom (Portrait)	11.7 x 17.7 (maximum)	.17	MP	$E_{C\&l101A}$

*To avoid user confusion, any paper size that can be fed landscape (both sides less than 11.75 in.), will be fed landscape, except envelopes which will be fed portrait with the seal on the right hand side. NOTE: The Japanese postcard sizes are considered envelopes.



Paper Mount Requests

After running out of paper or receiving a new paper size request, the printer cannot start new pages until one of the following occurs: (1) The requested paper is loaded in the requested tray, (2) The operator overrides the paper mount request by pressing "CONTINUE", (3) If the requested tray is auto-selectable, the user can load the correct paper in any auto-selectable tray; otherwise, the paper has to be loaded in the requested tray. The override in option (2) will remain in effect until a new paper size request or paper out. This scheme is used to bring the printing process into synchronization with the current formatter requests for paper and tray selection. This also guarantees explicit tray selections are preserved.

Dedicated Manual Feed

The LaserJet 4V printer provides no dedicated manual feed slot like some other members of the LaserJet family. Manual feed can be simulated through PCL using the "ESC&l2H" or PJL using the "@PJL DEFAULT MANUALFEED=ON" or "@PJL SET MANUALFEED=ON." With MPTRAY_MAN, when a manual feed job is requested, the user is prompted to place a sheet of paper on top of the stack of paper in the multipurpose tray. The user will then press "ONLINE" when the sheet is in place and ready to be picked. The prompt will disappear until the next manually fed page is requested. The user also has the option of overriding the manual feed request. When prompted to place a sheet of paper in the MP Tray, the user can override the manual feed request by pressing the "CONTINUE" key; printing will then continue from an auto selectable tray with the paper size requested by the paper mount. If there is no auto selectable tray with the paper size specified by the manual feed request, a paper mount will occur; the user has the option of overriding its paper mount by pressing the "CONTINUE" key again.

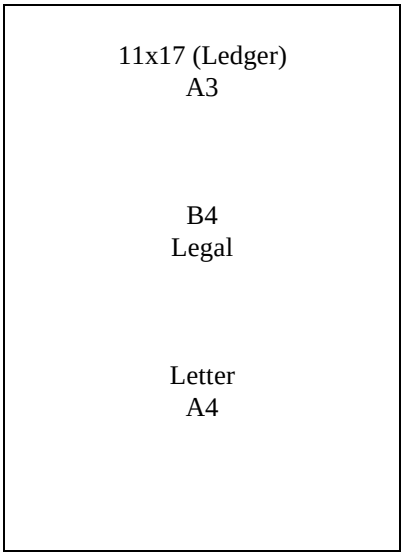
Tray Selection Commands

The tray selection commands for the LaserJet 4V/4MV printer are as follows:

ESC&l#H	MP = 4
	PC = 1
	LC = 5
	PCL request for manual feed = 2

Universal Paper Cassette

A Universal Paper Cassette which holds 500 sheets of paper will be an option for the LaserJet 4V/4MV printers. When loading paper into the cassette, the tray will need to be configured for the correct paper size. The guides in the tray tell the printer what size paper is installed. The following diagram shows where the edge of each size paper will be in the cassette. The A4 and letter size paper should be installed in the tray with the long edge of the paper facing the front of the tray. The other supported paper sizes (11x17, A3, B4, and legal) will be installed in the tray with the short edge of the paper facing the front of the tray. This tray will not support envelopes.



Chapter 2: PJL Language Enhancements

The following section details features which are unique to the HP LaserJet 4V/4MV printer's PJL implementation or have been modified from previous implementations. This section, when used in conjunction with the *PCL 5 Printer Language Technical Reference Manual* (PN 5961-0509) and the *PCL 5 Comparison Guide* (PN 5961-0602), provide a complete list and description of the available HP LaserJet 4V/4MV printer PJL features.

Language Enhancements

The HP LaserJet 4V/4MV printers support Hewlett-Packard's Printer Control Language (PCL), Hewlett-Packard Graphics Language (HP-GL/2) and Printer Job Language (PJL). You may be familiar with one or more of these languages. There are no changes to HP-GL/2 or PCL in the HP LaserJet 4V/4MV printers since the HP LaserJet 4P/4MP implementation. Please refer to the *HP LaserJet 4 Developer's Guide* for the most recent changes in these two languages. The following is a list of the new PJL features supported by the HP LaserJet 4V/4MV printers.

PJL

Printer Job language was first introduced with the LaserJet IIISi printer. The HP LaserJet 4V/4MV printers use the HP LaserJet 4 Plus/4M Plus implementation of PJL (which is an extension of the LaserJet 4, 4P, and 4MP implementations) except where the feature set of the LaserJet 4V/4MV does not merit their use. Please refer to the *HP LaserJet 4 Developer's Guide*, chapter 3, for an in depth discussion of the HP LaserJet 4's implementation of PJL. An additional PJL command has been added for the PostScript disk. The command is "DISKLOCK." More information is available for this command under DISKLOCK in this chapter.

Localization

The HP LaserJet 4V/4MV will not implement PJL localization. All input to and output from PJL will be in English.

Job Abort

LaserJet 4V/4MV will not provide a job abort mechanism in PJL.

String Token Length

LaserJet 4V/4MV will truncate string tokens to a maximum length of 80 characters.

System Switching

LaserJet 4V/4MV will not support system switching. LaserJet 4V/4MV's implementation of PJL will only allow personality switching.

Punt Protection

LaserJet 4V/4MV implements page protection the same as LaserJet 4 Plus/4M Plus; the page protection is set through the control panel or via PJL. LaserJet 4V/4MV will also have MEt (Memory Enhancement Technology), which attempts to guarantee page protection for all paper sizes. Unless there is a problem with MEt, the user should never see a page punt. If a punt occurs, a new menu item will appear on the control panel that allows the user to configure MEt to be very conservative, thereby guaranteeing that the page will not punt, although the printer may run out of memory while trying to print the page. This variable will always be available via PJL.

Password Protection For Default Values

LaserJet 4V/4MV will provide password protection for PJL commands used to change the default values of the environment variables. The optional disk for LaserJet 4MV will have a disk write lock option through PJL commands.

Non Roman-8 Symbol Sets

LaserJet 4V/4MV will only provide support for the Roman-8 symbol set in PJL.

Job Control Commands

This section states which job commands and variables are supported in the HP LaserJet 4V/4MV printers.

JOB:

LaserJet 4V/4MV will implement the NAME, START, END and PASSWORD options of the JOB command. It will **NOT** implement the OFFSET option.

Syntax:

@PJL JOB [NAME = "job name"] [START = first page]
[END = last page] [PASSWORD = number]
[<CR>] <LF>

EOJ:

LaserJet 4V/4MV will fully implement the EOJ command as specified for the LaserJet 4P and 4MP.

LaserJet 4V/4MV will fully implement all environment commands as specified for the LaserJet 4P and 4MP. The supported environment variables that are different or modified are listed below.

@PJL EOJ [NAME = "job name"] [<CR>] <LF>

Paper Size Variable:

The paper size variable includes the same variables as the LaserJet 4P and 4MP. In addition, LaserJet 4V/4MV will support Ledger, JIS B4, JIS B5, Japanese Postcard, Japanese Double Postcard, and Custom.

Note: "Ledger" will be used as the PJL paper size variable instead of "11x17" because alphabetical characters are required.

Page Protection Variable:

LaserJet 4V/4MV will include MEt, which will be invoked on any page that is determined to be too complex to print without punting. MEt attempts to guarantee page protection for all media sizes. For this reason, the choices for page protection have been limited to ON and AUTO. AUTO will cause MEt to run as it always does, while ON will make MEt very conservative. This variable should only be set to ON if the user has a page that punts with page protection set to AUTO.

Power Save Time Variable:

Syntax:

POWERSAVE={OFF|ON}

POWERSAVETIME = {15 | 30 | 60 | 120 | 180}

DEFAULT = 30

Sets the default duration in minutes before the printer enters power save mode. The factory default value is 30 minutes. Any unsupported integer value will be snapped to the closest supported value. Floating point values will be truncated; if the resulting integer is not one of the supported values, the integer value will then be snapped to the closest supported value.

MP Tray Variable:

Syntax:

MPTRAY = {CASSETTE | MANUAL | FIRST}$_1$

DEFAULT = FIRST

Returns the default configuration of the MP tray for the job. The factory default value is FIRST.

Input Tray Lock-out Variables:

Syntax:

INTRAY1 = {LOCKED | UNLOCKED}$_1$

INTRAY2 = {LOCKED | UNLOCKED}$_1$

INTRAY3 = {LOCKED | UNLOCKED}$_1$

DEFAULT = UNLOCKED

Returns the auto selection lock status for the input trays. The factory default value for all three variables is UNLOCKED.

The INTRAY1 variable corresponds to the MP tray. The INTRAY2 variable corresponds to the standard cassette. The INTRAY3 variable corresponds to the optional cassette. The INTRAY3 variable is only a valid variable if the optional cassette is currently installed. If it is not installed, attempts to inquire the value of this variable will act as if INTRAY3 was an unknown variable.

Mem Config Menu:

The following list specifies the set of device specific environment variables corresponding to the Mem Config menu on the front panel. These variables are reset to their factory default values by the @PJL INITIALIZE command. The variables in this menu may only be changed by the @PJL DEFAULT command; they will not be affected by the @PJL SET command. NOTE: If any of the variables in this menu are modified, a memory reconfiguration will be performed and all perishable data in the printer will be lost.

Variable	Description
RESOURCESAVE	Default setting for resource saving
<PERSONALITY>RESOURCESAVESIZE	Memory to be allocated for PCL resource saving
IOBUFFER	Default setting for I/O Buffering
IOSIZE	Memory to be allocated for I/O buffering

Resource Savings Variable:

Syntax:

RESOURCESAVE = {AUTO | OFF | ON}$_1$

Sets the default for resource saving. The valid values for any given time are dependent upon the amount of memory installed in the printer and the number of personalities installed in the printer. When this value is set to ON, the value of each personality's RESOURCESAVESIZE will determine how much memory will be reserved for each personality's resource save area. When the value is set to AUTO, the amount of memory used for resource saving is based on some heuristic value and is not configurable by the user. If the value is set to OFF, no resource saving is performed. Changes in this value will not take effect until a reset of some sort has been performed, perhaps an automatic reset that will be invisible to the user. If a value is received that is invalid because of the printer configuration (e.g. a value of ON in the PCL-only printer), it will be ignored.

Personality Resource Saving Size Variable:

Syntax:

LPARM:<Personality> RESOURCESAVESIZE = {0 | min | ... | max }$_1$

Sets the amount of memory to be allocated for each personality's resource save area, where <Personality> is the personality name (PCL, POSTSCRIPT...). Each installed personality that supports resource saving will have one of these items.

The minimum value will be 0. The maximum value will be determined by the amount of memory installed in the printer, the amount of memory already allocated to other personalities for resource saving and I/O buffering, and the amount of memory that must be reserved to print the largest page size at 600 DPI in all personalities.

This value is only used if RESOURCESAVE is set to ON; otherwise it is ignored.

Any values not divisible by 100K will be rounded to the nearest 100K. A value of 0K for a specific personality will turn resource saving off for that personality. If the value specified is greater than the maximum, it will be set to the maximum amount. In both cases a PJL warning message will be returned to the host.

For information on the amount of memory that is available for resource saving in each printer configuration, refer to Appendix B.

I/O Buffer Variables:

Reconfiguring the size of the I/O buffers via the data stream is rather difficult. The user may try to send I/O to the printer while the I/O buffers are being reconfigured, which would result in the I/O being eaten up until the reconfiguration is complete. While it is not anticipated that these commands will be used often, they will be used at least occasionally. For this reason, a special communication sequence has been proposed between the printer and this software so that the I/O buffers may be reconfigured via the data stream without I/O being lost.

This sequence assumes that the printer is idle; any I/O being sent by other users will be lost.

1. The software sends the job which includes a PJL command that will change the configuration of the I/O buffers.

2. The software also sends an @PJL ECHO command at the end of the job, followed by a UEL.

3. The printer sends the echo command back to the host.

4. After the end of the job, the printer goes offline and reconfigures the I/O buffers.

5. The software may resume sending data after it sees the printer go back online.

6. If the software does not see the printer go offline and then back online within 5 seconds of the echo, it may assume that there is an error on the printer.

I/O Buffer Variable:

Syntax:

IOBUFFER = {AUTO | ON | OFF}$_1$

Sets the default value for I/O buffering. The default and valid values are determined by the amount of memory and the number of personalities that are installed in the printer. The IOBUFFER affects both MIO and Bi-tronics.

When this value is set to AUTO, the amount of memory allocated for I/O buffering is based on some heuristic value and is not configurable by the user. When this value is set to ON, the user may configure the amount of memory to be used for I/O buffering by setting the value of IOSIZE. When this value is set to OFF, no I/O buffering will be performed.

Changes in this value will not take effect until a reset of some sort has been performed, perhaps an automatic reset that will be invisible to the user.

I/O Buffer Size Variable:

Syntax:

IOSIZE = {0 | ... | max}$_1$

Sets the amount of memory (in Kbytes) to be used for I/O buffering. This value is only used when IOBUFFER is set to ON.

The minimum value for IOSIZE is 0. The maximum value for this variable will be determined by the amount of memory installed in the printer, the number of installed personalities, the amount of memory already allocated for resource saving, the memory required by the system, and the memory required to print a 600 DPI page in any installed personality.

If the maximum value is less than 100K, any values not divisible by 10K will be rounded to the nearest 10K. If the maximum value is greater than or equal to 100K, any values not divisible by 100K will be rounded to the nearest 100K.

If the value specified is greater than the maximum, it will be set to the maximum amount and a PJL warning message will be sent to the host. A value of 0 will set the IOBUFFER variable to OFF.

CPLOCK:

Syntax:

CPLOCK = { ON | OFF}$_1$

Sets the default control panel lockout state. The factory default value is OFF.

If set to ON, any attempt by the user to change an NVRAM variable from the front panel will generate a warning on the control panel display that indicates that the control panel menus are locked. This feature is used primarily in networked or printer sharing configurations. This variable can only be set by a secure PJL job (See the PJL security chapter for more information); it does not appear in any control panel menu. This variable may only be manipulated by the DEFAULT, INQUIRE, and DINQUIRE commands.

DISKLOCK:

Syntax:

DISKLOCK = { ON | OFF}$_1$

Sets the default disk write lockout state. The factory default value is OFF.

If set to ON, the disk is in read only mode; this prevents disk writes, file deletes, and disk reformats. If set to OFF, the disk is in read/write mode. This variable can only be set by a secure PJL job (See the PJL security chapter for more information); it does not appear in any control panel menu. This variable may only be manipulated by the DEFAULT, INQUIRE, and DINQUIRE commands.

PASSWORD:

Syntax:

PASSWORD = { 0 | ... | 65535}$_1$

Sets the default password for PJL security. The factory default value is 0.

If the current password value is 0, the PJL security is disabled and all PJL jobs are considered to be secure. If the current value is non-zero, the PJL JOB command must contain the correct value for the PASSWORD option in order to use the PJL DEFAULT and INITIALIZE commands. This variable can only be manipulated by the DEFAULT, INQUIRE, and DINQUIRE commands.

Status Readback Commands

LaserJet 4V/4MV will implement all status readback commands as specified for the LaserJet 4P and 4MP. This includes the INQUIRE, DINQUIRE, INFO, ECHO, USTATUS, and USTATUSOFF commands. PJL status readback responses will not be localized in LaserJet 4V/4MV.

Variables:

The INFO VARIABLES command will be implemented in LaserJet 4V/4MV as specified for the LaserJet 4P and 4MP. LaserJet 4V/4MV will support the RANGE and ENUMERATED variable types, as well as the READONLY versions of these two variable types. It will also support the TABLE variable type. It will not support the LINES variable type.

The list of variables is discussed in logical groups in this section, but the list will be output as a single response.

Status Readback Error Response:

A special unsolicited error response is returned when a status response cannot be generated because there is insufficient memory in the printer, or if the response exceeds the status readback cap. PJL solicited status is capped at 5K bytes per I/O port. PJL unsolicited status is capped at 5K bytes per I/O port. Personality solicited status is capped at a total of 5 solicited responses. The following is the error response. Note that this response is unsolicited and is always returned, regardless of the current values of any of the USTATUS variables.

@PJL USTATUS
CODE=30010

Identification:

The INFO ID command will return the following response:
@PJL INFO ID
"LASERJET 4V"

Configuration:

The INFO CONFIG command will return a response similar to the following:

@PJL INFO CONFIG

```
IN TRAYS [3 ENUMERATED]
    INTRAY1 MP
    INTRAY2 PC
    INTRAY3 LC
OUT TRAYS [1 ENUMERATED]
    NORMAL FACEDOWN
PAPERS [16 ENUMERATED]
    LETTER
    LEGAL
    A4
    EXECUTIVE
    LEDGER
    A3
    JISB4
    JISB5
    CUSTOM
    COM10
    MONARCH
    DL
    C5
    B5
    JPOST
    JPOSTD
LANGUAGES [2 ENUMERATED]
    PCL
    POSTSCRIPT
USTATUS [4 ENUMERATED]
    DEVICE
    JOB
    PAGE
    TIMED
MEMORY MANAGEMENT [4 TABLE]
    MEMORY          AMOUNT          UTILIZATION
    SYSTEM          2097152         512000
    PCL             500             21
    POSTSCRIPT      1100            330
MEMORY=2097152
DISPLAY LINES=1
DISPLAY CHARACTER SIZE=16
PAGE COUNT=1492
SERIAL NUMBER=' 'AAAA000000' '
FORMATTER NUMBER=' 'S04601027KB' '
DISK MODEL NUMBER=' 'HP C3014A' '
DISK SERIAL NUMBER=' 'JP932412X8' '
DISK FIRMWARE REVISION=' 'K2A4A059' '
DISK LOCK STATUS=OFF
FIRMWARE DATECODE=' '19940601 V7.0' '
```

The third input tray line (INTRAY3 LC) will only be output if the lower cassette is installed. The list of languages will vary depending on which personalities are installed. The amount of memory reported will vary depending on how much extra RAM is installed. The disk-related information shown above is displayed only when the optional PostScript disk is installed.

Memory:

The INFO MEMORY command will return a response similar to the following:

@PJL INFO MEMORY
TOTAL=1000000
LARGEST=250000

The actual numbers will depend on how much memory is available and the size of the largest free block.

Note that the TOTAL number is a snapshot of memory while the PJL parser is running. This number may not be valid when a personality is actually invoked (especially if a personality switch or a resolution or page protection change takes place prior to the personality invocation). In order to get accurate values for free memory available when in a personality, personality-specific commands should be used.

Status:

LaserJet 4V/4MV will fully implement the INFO STATUS command, including the DISPLAY and ONLINE fields.

Page Count:

LaserJet 4V/4MV will fully implement the INFO PAGECOUNT command. The format of the response is:

@PJL INFO PAGECOUNT
51687

Variables:

The INFO VARIABLES command will be implemented in LaserJet 4V/4MV. LaserJet 4V/4MV will support the RANGE and ENUMBERATED variable types, as well as the READONLY versions of these two variable types. It will also support the TABLE variable type. It will not support the LINES variable type.

Printing Menu:

The following list specifies the set of device specific environment variables corresponding to the printing menu on the front panel. Appendix C, "LaserJet 4V Menu Map", illustrates the options available on the LaserJet 4V control panel.

COPIES=1 [2 RANGE]
    1
    999
PAPER=LETTER [16 ENUMERATED]
    LETTER
    LEGAL
    A4
    EXEC
    11x17
    A3

JIS B4
JIS B5
CUSTOM
COM10
MONARC
C5
DL
B5
JPOST
JPOSTD

ORIENTATION=PORTRAIT [2 ENUMERATED]
PORTRAIT
LANDSCAPE

FORMLINES=60 [2 RANGE]
5
128

MANUALFEED=OFF [2 ENUMERATED]
OFF
ON

RET=MEDIUM [4 ENUMERATED]
OFF
LIGHT
MEDIUM
DARK

ECONOMODE=OFF [2 ENUMERATED]
OFF
ON

BINDING=LONGEDGE [2 ENUMERATED]
LONGEDGE
SHORTEDGE

Job Menu:

The following list specifies the set of device specific environment variables corresponding to the job menu on the front panel:

RESOLUTION=600 [2 ENUMERATED]
600
300

PERSONALITY=AUTO [3 ENUMERATED]
AUTO
PCL
POSTSCRIPT

TIMEOUT=15 [2 RANGE]
5
300

PWRSAVE=30 [7 ENUMERATED]
OFF
15
30
60
120
240
360

The list of personalities under the PERSONALITY variable will vary depending on which personalities are installed.

Configuration Variables:

The following list specifies the set of device specific environment variables corresponding to the configuration menu on the front panel, as well as some additional configuration variables which do not appear on any menus. All of the variables in this section are read only variables:

MPTRAY=FIRST [3 ENUMERATED READONLY]
FIRST
CASSETTE
MANUAL
INTRAY1=UNLOCKED [2 ENUMERATED READONLY]
UNLOCKED
LOCKED
INTRAY2=UNLOCKED [2 ENUMERATED READONLY]
UNLOCKED
LOCKED
INTRAY3=UNLOCKED [2 ENUMERATED READONLY]
UNLOCKED
LOCKED
CLEARABLEWARNINGS=ON [2 ENUMERATED READONLY]
JOB
ON
AUTOCONT=OFF [2 ENUMERATED READONLY]
OFF
ON
LOWTONER=ON [2 ENUMERATED READONLY]
ON
OFF
INTRAY1SIZE=LETTER [16 ENUMERATED READONLY]
LETTER
LEGAL
A4
EXEC
LEDGER
A3
JIS B4
JIS B5
CUSTOM
COM10
MONARC
C5

DL
B5
JPOST
JPOSTD
INTRAY2SIZE=LETTER [7 ENUMERATED READONLY]
LETTER
LEGAL
A4
LEDGER
A3
JIS B4
JIS B5
INTRAY3SIZE=LETTER [6 ENUMERATED READONLY]
LETTER
LEGAL
A4
LEDGER
A3
JIS B4

The INTRAY3 and INTRAY3SIZE variables will not appear in the list if the lower paper cassette if not installed. The INTRAY4SIZE variable will not be supported in LaserJet 4V/4MV.

Memory Configuration Variables:

The following list specifies the set of device specific environment variables corresponding to the memory configuration menu on the front panel:

RESOURCESAVE=AUTO [3 ENUMERATED]
AUTO
OFF
ON
LPARM:<Personality> RESOURCESAVESIZE=0 [2 RANGE]
0
MAX MEMORY AVAILABLE
IOBUFFER=AUTO [2 ENUMERATED]
AUTO
OFF
IOSIZE=0 [2 RANGE]
0
MAX MEMORY AVAILABLE

PJL Security

LaserJet 4V/4MV will support the PJL security mechanism. There are three aspects of PJL security: the first is Control Panel Lock, the second aspect is NVRAM protection from the PJL DEFAULT and INITIALIZE commands, and the third is DISKLOCK.

A PJL secure job starts with a JOB command which contains the correct value for the PASSWORD option and ends when another JOB or EOJ command is encountered. Only a PJL secure job is allowed to change NVRAM default values. Three security variables, PASSWORD, CPLOCK, and DISKLOCK are discussed in more detail in the PJL VARIABLES section. The

factory default value for the PASSWORD is zero (0). This is a reserved value that is used to indicate that PJL security is disabled. When PJL security is disabled, every print job is considered a PJL secure job.

LaserJet 4V/4MV uses data stream commands to enable or disable the control panel lockout mechanism by setting the PJL variable CPLOCK to ON or OFF. When set to ON, the control panel security mechanism is enabled. When set to OFF, the control panel security mechanism is disabled. If the security mechanism is enabled, the CPLOCK variable may only be modified within a secure PJL job. If the control panel security mechanism is enabled and the user attempts to modify a menu item, when the user presses the enter key, the control panel will display the message “MENUS LOCKED” for approximately five seconds.

LaserJet 4V/4MV’s security mechanism can be used to enable/disable the PJL DEFAULT and INITIALIZE commands from actually changing NVRAM. If the PJL security mechanism is enabled (PASSWORD not equal to 0), the PJL DEFAULT commands must be encompassed by a secure PJL job. If the PJL parser encounters a DEFAULT or INITIALIZE command that is not in a secure job, a PJL semantic error (27003) will be generated if verbose device status is enabled. If the PJL security is disabled (PASSWORD equal to 0) any valid DEFAULT or INITIALIZE command will change NVRAM.

The optional disk will also provide a DISKLOCK feature. When the value of DISKLOCK is OFF, then disk writes will be allowed. When the value of DISKLOCK is ON, disk writes will not be allowed and it will not be possible to format the disk, download fonts to the disk, delete disk fonts, etc. The DISKLOCK variable can be changed with the PJL DEFAULT command. It cannot be changed with the PJL SET command. It can only be changed from a PJL privileged job (i.e. the PJL password is required.) The factory default value of DISKLOCK is OFF. The DISKLOCK variable is stored in printer NVRAM and not on the disk itself.

Chapter 3: Power Save

The purpose of this section is to specify the power save feature for the LaserJet 4V/4MV printer. This document provides a description of the user interface for the power save feature, a high-level view of the implementation, and the expected power savings provided by this feature.

Overview

The idea of power save mode is to reduce the printer's power consumption to a minimum amount after a certain period of disuse. On the LaserJet 4V/4MV printer this will be accomplished by turning the fuser off after a period of disuse specified by the user via the control panel or PJL.

The printer will enter power save mode after the specified time in all printer states. The printer display will change to "00 POWERSAVE" only if there are no clearable warnings or device attendance messages pending at the display.

The length of time the fuser will remain on before the printer enters power save mode may be configured via the control panel or PJL.

Control Panel

The power save menu item will appear in the Job Menu after the Timeout item. The item choices will appear as:

PWRSAVE=30 MIN
1 HR
2 HRS
3 HRS
OFF
15 MIN

The default value will be 30 minutes.

PJL

The power save value will be readable and writable via PJL. Because of the data types supported by PJL, there are two variables used in setting the power save feature: one to turn power saving on or off, and one to set the time value.

The SET and DEFAULT commands may be used to set the power save variables; however, since a power save setting for a job doesn't make sense, the DEFAULT command should be used.

@PJL {SET | DEFAULT} POWERSAVE={ OFF | ON }
@PJL {SET | DEFAULT} POWERSAVETIME={ 15 | 30 | 60 | 120 | 180 }

The power save value may be read with the INQUIRE or DINQUIRE command.

@PJL {INQUIRE|DINQUIRE} POWERSAVE
@PJL {INQUIRE|DINQUIRE} POWERSAVETIME

The power save variable will also appear in the list of variables returned by the INFO VARIABLES command.

A PJL error code will be returned to the host when the printer enters power save mode, regardless of the state of the front panel display. The code that will be returned is 35078. An

error code of 10001 will be returned along with the display string when and if the display changes to “00 POWERSAVE”.

Display Messages

When in power save mode, the display will only change to indicate that the fuser is shut down if there are no other messages pending except “00 READY”. In this case, the display will say “00 POWERSAVE”. In any other case, such as a printer error or warning message being displayed, the user will have no indication that the printer is in power save mode.

When the printer exits power save mode, an “02 WARMING UP” message will be displayed unless power save was exited because of a key press. In this case, the “02 WARMING UP” message will be suppressed so that the user can continue pressing keys without the “02 WARMING UP” message overwriting any message that was already displayed.

Exiting Power Save Mode

Power save mode will be exited if printable I/O (not a status readback request) is received, a key is pressed, paper is inserted or removed, or a door is opened. These actions usually indicate that the user is getting ready to print a page. The printer exits power save mode and warms the fuser before the I/O is received, so the first page isn’t delayed while waiting for the fuser to warm. Note that a status readback request does not necessarily indicate that a user is preparing to print, so the printer will answer the request without exiting power save mode.

When the printer exits power save mode the fuser will be warmed to operating temperature; keys may be pressed while the fuser is warming, but no pages will be printed until the fuser is warm. The length of time that it takes to warm the fuser is dependent upon the amount of time the fuser was off. The LaserJet 4V/4MV engine takes approximately 44 seconds to warm the fuser when the printer has been in power save mode.

Expected Power Savings

The amount of power saved while in power save mode is dependent upon the amount of time the printer is in power save mode. The break-even point at which the printer uses less power in power save mode than in normal printer mode is approximately 12 minutes. The following table estimates the power consumption for the LaserJet 4V printer both in and out of power save mode for several time values. The numbers shown for power save mode include the power used to warm the fuser when power save mode is exited.

Elapsed Idle Time	With Power Save	Without Power Save
30 minutes	15 watt-hours	30 watt-hours
2 hours	42 watt-hours	120 watt-hours
8 hours	150 watt-hours	480 watt-hours
24 hours	438 watt-hours	1440 watt-hours

Chapter 4: Resource Saving

The purpose of this section is to specify the resource saving feature for the LaserJet 4V and LaserJet 4MV printers. Resource saving is a feature that was originally introduced in the LaserJet 4Si. It provides a way of maintaining resources for different printer personalities. In the LaserJet 4, 4M, 4Si, LaserJet 4 Plus, and LaserJet 4V printers, any switch in resolution, page protect mode, or personality causes the previous personality to lose all of its resources. The resource saving feature allows these resources to be maintained by the personality.

Overview

Terminology

A *resource* refers to data that has been downloaded to the printer. After it has been downloaded, a resource can then be used in the same job or subsequent jobs. Typically, a resource can also be explicitly deleted by sending additional commands to the printer.

Examples of resources include PCL soft fonts, symbol sets, macros, and patterns, and PostScript fonts, forms, and patterns.

A resource can also be referred to as an *entity*.

A *memory pool* is a block of printer memory that is used for a specific purpose. Examples of memory pools include the I/O buffer pool, which is used to hold incoming I/O data, and the personality pool, which is used by a personality such as PCL to hold its resources and other memory allocations.

Memory Reconfiguration

In the LaserJet IIISi, 4, 4M, 4Si, LaserJet 4 Plus, and LaserJet 4V printers, any switch in resolution or page protect mode causes a *memory reconfiguration*, which in turn causes the current personality to lose all of its resources.

This reconfiguration is necessary because each different resolution/page protect combination requires a different amount of memory for the strips or frame buffer, ranging from about 200K for 300/OFF up to 5 megabytes for 600/LEGAL. The strips or frame buffer are allocated out of the personality memory pool, which is also used by a personality to hold its resources and other allocations. In order to change the amount of memory allocated for imaging, everything in the personality memory pool has to first be deallocated. This causes the current personality to lose any resources that it might have had.

A switch in personality also causes a memory reconfiguration. Because there is only one personality memory pool that is shared by all of the personalities, when a language switch occurs, everything in the memory pool has to be deallocated before the new personality can use it.

Environment Save Areas

In order to allow resources to be maintained, some additional memory pools have to be created. In addition to the main personality memory pool, which is shared by all personalities, an additional memory pool is created for each personality for which resource saving has been enabled. These pools are known as *environment save areas*.

During a switch in resolution, page protect mode, or personality, the memory in the environment save areas remains untouched. This provides a place for personalities to store resources that they wish to maintain. The usage of environment save areas is somewhat personality-dependent. PCL and PostScript personalities will be explained later.

Runtime Area

When resource saving is enabled, the main personality memory pool is split into the environment save areas and the *runtime area*. The runtime area is a pool that is shared by all personalities. The currently active personality has total control of the runtime area. It uses it for all temporary memory allocations involved with printing the current job. When a personality switch occurs (or a switch in resolution or page protect mode), all memory in the runtime area is lost.

The runtime area is also known as the *temporary pool*.

Differences from the LaserJet 4Si

The implementation of resource saving in the LaserJet 4V and LaserJet 4MV printers will differ from that of the LaserJet 4Si in several ways.

On the LaserJet 4Si, resource saving cannot be enabled unless at least two personalities are installed in the printer. LaserJet 4V/4MV will remove this restriction so that resource saving can be used with PCL-only printers. In addition to allowing the user to specify the exact amount of memory for each personality's environment save area as on the LaserJet 4Si, LaserJet 4V/4MV will also provide an AUTO setting. If the AUTO setting is selected, the printer will automatically allocate an appropriately sized environment save area for each personality. The AUTO setting will be the factory default on the LaserJet 4V/4MV printers.

The LaserJet 4Si requires 10 megabytes of installed memory on a simplex printer for resource saving to be enabled. This number will be smaller on LaserJet 4V/4MV and will depend on how many personalities are installed.

On the LaserJet 4Si, the resource saving configuration could only be changed from the control panel. LaserJet 4V/4MV will also allow resource saving to be enabled or disabled using PJL commands, and will allow the size of each environment save area to be specified using PJL commands.

On the LaserJet 4Si, when more resources are downloaded than will fit into a personality's environment save area, a 25 XXXX MEM FULL error is displayed (where 'XXXX' is the name of the personality such as 'PCL' or 'PS'). This error takes the printer offline until the user hits continue (the error is also auto-continuable). On the LaserJet 4V/4MV printers, a WM XXXX MEM FULL clearable warning will be displayed instead of the error. The clearable warning will not take the printer offline.

Resource Saving Operation

Control Panel

Resource saving can be configured from the front panel. The MEMCONFIG menu will allow configuration of both the resource saving and the I/O buffering features.

The RESRCSAVE item can be set to three different values: OFF, ON, and AUTO. If the value is set to OFF, no resource saving will be performed for any personality.

Value = ON

If the value is set to ON, then resource saving will be enabled. An additional item for each installed personality that supports resource saving will appear after the RESRCSAVE item. These items will include the name of the personality as in PCL MEM or PS MEM. The user can use these items to set the size of the environment save areas for each personality. The values will range from some minimum value to some maximum value in steps of 100K. An option of 0K will also be available to disable resource saving for an individual personality.

Value = AUTO

If the value is set to AUTO, then resource saving will be enabled for all installed personalities that support resource saving. The size of the environment save areas will be automatically configured by the printer. This value is the factory default.

If PCL is the only installed personality, then AUTO and OFF will be the only possible choices for resource saving. The ON setting will not appear. In this case, almost all of PCL's available memory will be allocated for resource saving. This is possible because PCL can utilize its environment save area for all types of memory allocations, including temporary allocations associated with a job. There is no benefit to allowing the user to explicitly configure the size of PCL's environment save area, if PCL is the only installed personality.

If there are two or more installed personalities, then the RESRCSAVE item can be set to any of its three values. However, the item will not appear until at least a certain amount of memory is installed in the printer, depending on the number and type of installed personalities.

Configuration Matrix

The chart in Appendix B shows the possible resource saving configurations for a PCL-only printer, and for a printer with both PCL and PostScript.

If "Not Configurable" appears in the table, then that setting (either AUTO or ON) is not available for the RESRCSAVE item for the particular configuration. If "NotConfigurable" appears in both the AUTO and the ON columns, then the RESRCSAVE item will not appear in the MEMCONFIG menu for that configuration.

The numbers in the table assume that the I/O buffering feature is set to AUTO. If more memory is allocated by the user for I/O buffering than would be allocated by the AUTO setting, then the maximum setting numbers in the chart are smaller by that amount.

Configuration Changes

After the RESRCSAVE item setting is changed, or after the size of any of the environment save areas is changed, a front panel reset is required to activate the change. It has not been decided whether this reset will be automatic or whether a 10 RESET TO SAVE message will be used to prompt the user. When the front panel reset activates the configuration change, all personalities will lose their resources and all unprocessed print jobs will be lost.

PJL

Resource saving can also be configured using the @PJL DEFAULT command. The RESOURCESAVE variable can be set to OFF, AUTO, or ON to enable or disable resource saving. In determining which values are valid at any given time, PJL follows the same rules as the control panel.

For each personality that supports resource saving, the size of its environment save area can be configured using the @PJL DEFAULTLPARM:<personality> RESOURCESAVESIZE command. Again, the valid values are determined by the same rules used by the control panel.

Note that these PJL variables are special; the @PJL SET command cannot be used with them.

When the resource saving configuration is changed using PJL commands, all personalities will lose their resources.

The @PJL INFO CONFIG command will return a table which will indicate the amount of resource saving memory which is allocated to each installed personality, as well as the amount of memory which is actually being used by each personality.

For exact details on the LaserJet 4V/4MV PJL implementation, refer to the LaserJet 4V/4MV PJL chapter.

Clearable Warnings

Several new clearable warnings are associated with the resource saving feature.

When the printer powers up, a WM MEM CNFIG N/A warning may be displayed. This indicates that either I/O buffering, resource saving, or both are not available because of configuration changes. Typically this occurs if the user removes memory from the printer, or adds a new personality.

A WM CHK MEM CNFIG warning may be displayed when the printer powers up. This indicates that the printer does not have enough memory to support the current settings for resource saving and I/O buffering. Typically this occurs if the user removes memory from the printer.

When the user overflows the environment save area for a personality by downloading too many resources, a WM XXXX MEM FULL warning will be displayed. The ‘XXXX’ is the name of the relevant personality such as ‘PCL’ or ‘PS’. Exactly when this warning appears is somewhat personality-dependent; refer to the PCL and PostScript personalities sections following for details on this warning.

For more details on these clearable warnings, refer to the LaserJet 4V/4MV Control chapter.

Self Test

The self test page will contain some information about resource saving. If there is not enough memory installed in the printer to enable resource saving, the self test printout will indicate how much additional memory is needed.

If there is enough memory installed to support resource saving, then the self test printout will indicate how much total memory is available for resource saving and how much memory is currently allocated for resource saving. If resource saving is enabled for any personality, then the printout will indicate how much memory is allocated for each installed personality and how much resource saving memory is actually being used by each personality.

PCL Resources

The PCL entities that are saved when the resource saving feature is enabled include all permanent soft fonts, macros, symbol sets, and user-defined patterns. All types of permanent soft fonts are included (bitmap, resolution-specified bitmap, bound and unbound scalable Intellifont, and bound and unbound scalable TrueType). This also includes copy/assigned soft fonts that have been made permanent (except for fonts copy/assigned from a cartridge). Both types of user-defined symbol sets (MSL and Unicode) and both types of user-defined patterns (300 dpi and resolution-specified) are included. Temporary entities are not included. No HPGL entities are included (such as raster fills).

PCL Resource Saving Functionality

If PCL resource saving is enabled, the PCL personality has two memory areas available to it: the runtime area and its environment save area. PCL attempts to manage this memory as efficiently as possible.

PCL Runtime Area Usage

The runtime area is primarily used by PCL for temporary memory associated with a single job. Temporary memory allocations include items such as raster graphics, scaled characters in the font cache, and HPGL vectors and polygons. Temporary allocations also include downloaded soft fonts, symbol sets, patterns, and macros, when they are first downloaded. Under the PCL definition, all downloaded entities are initially temporary; an additional escape sequence is required to make them permanent.

When some temporary memory is needed, PCL first tries to make the allocation out of the runtime area. If this fails, then it tries to make the same allocation out of its environment save area. There may be free memory in the environment save area if it is not completely full of resources. If there is not enough memory in either pool, then a 20 MEM OVERFLOW error is displayed. In most cases, the job will not print correctly if this happens.

Making PCL Resources Permanent

When a temporary soft font, symbol set, macro, or pattern is made permanent (via an escape sequence), then it becomes a resource that needs to be saved. PCL attempts to move it from the runtime area into the environment save area. Then if a memory reconfiguration takes place, the resource will automatically be saved in the environment save area. If the move fails because there is not enough free memory in the environment save area, then a WM PCL MEM FULL clearable warning is displayed. This warning will not affect the current job, but if a memory reconfiguration takes place, the resource will not be saved.

Making PCL Resources Temporary

When a permanent soft font, symbol set, macro, or pattern is made temporary (via an escape sequence), PCL attempts to move it from the environment save area back into the runtime area, since it no longer needs to be saved. If the move fails because there is not enough free memory in the runtime area, then the entity remains in the environment save area. No errors or warnings are produced in this case, and the job is unaffected. When a memory reconfiguration takes place, the resource will not be saved (as would be expected).

PCL Powerup Initialization

When PCL first starts up, it allocates a certain amount of memory out of its environment save area that is not associated with any downloaded resources. This memory includes its global variables, as well as certain data structures used to track things like internal fonts and symbol sets. This initial memory usage implies that the user does not have exactly the amount of resource saving memory configured on the front panel; the actual amount of free memory is the amount configured minus the amount PCL uses during initialization. Currently, PCL uses about 75K in a base system, but this number can increase if additional font or macro SIMMs are installed. The amount of memory that PCL uses during initialization can be found by printing a self test before downloading any resources.

PCL 600 dpi Bitmap Soft Fonts and Patterns

On the LaserJet 4, 4M, and 4Si printers, when the printer is operating at 300 dpi and a 600 dpi bitmap font or a 600 dpi pattern is downloaded, the font or pattern is ignored and the data is consumed. This was done because the 600 dpi entity cannot be used at 300 dpi.

However, when PCL resource saving is enabled, any permanent 600 dpi bitmap font or pattern that is downloaded when the printer is operating at 300 dpi is preserved in the environment save area. Then if a switch to 600 dpi occurs, the font or pattern can be used without having to download it again.

PCL Free Memory Command

If PCL resource saving is enabled, the PCL free memory escape sequence returns the total amount of free memory in the runtime area and the PCL environment save area (added together). The largest free block that is reported is the maximum of the largest free block in the runtime area and the largest free block in the environment save area.

PCL Job Boundary Functionality

Resource saving does not affect any job boundary functionality, except that permanent entities are saved in the environment save area. As on the LaserJet 4, 4M, and 4Si printers, an escape E is performed by PCL at the end of a job, which deletes all temporary entities.

PostScript Resources

The PostScript resources which are saved when the resource saving feature is enabled consist of all entries which are made in PostScript's Virtual Memory (VM) area 0. In other words, all procedures, definitions, and downloads which are made behind the server loop are saved in PostScript's environment save area.

Examples of what may be saved behind the server loop include fonts, forms, patterns, dictionaries, procedures, and definitions.

PostScript Resource Saving Functionality

The resource saving feature for PostScript is comprised of a two tier approach; the first tier involves temporary RAM usage, while the second tier involves "permanent resource" RAM usage.

When resource saving is enabled, PostScript will allocate all of its operating environment from the runtime area, except VM save level 0. VM 0 is the area in which PostScript stores items defined behind the server loop. In a LaserWriter type printer (where PostScript is the only language, and also controls the printer's operating system) all resources defined behind the server loop remain persistent across job boundaries.

The first tier of resource saving comes from the fact that an attempt is made to keep PostScript's operating environment intact, by having all other personalities run in PostScript's frame buffer. If PCL only runs within the frame buffer space, PostScript will experience a substantial performance increase since it won't need to rebuild its VM on each initialization following a PCL job, and items such as font cache will remain intact following a PCL job. If PCL is not able to run within the frame buffer space, it will allocate space out of the runtime area, which may cause PostScript to completely re-initialize on its next invocation.

The second tier of resource saving is that items defined outside the server loop are explicitly stored outside in PostScript's environment save area, which is never corrupted by PCL, and is therefore available for PostScript to use at any time.

When PostScript is notified that a PCL job is pending, it will make an attempt to reorganize its VM and to free up as much space in the runtime area as possible, such that PostScript may be able to resume execution if PCL does not destroy the runtime area.

PostScript Resource Saving Error Conditions

When an attempt is made to download more items into the save area than there is room to do so, a VM error or limitcheck will be issued by PostScript. Any definitions which were made before the error will remain intact, and should not be lost due to the error.

The VM error or limitcheck may be visible to the user through the on board error handler, which can be enabled from the front panel, although with many VM errors, sometimes PostScript is not able to print the error page due to VM limits (which are causing the error). The VM error or limitcheck will always be visible by monitoring the back channel data (status readback).

PostScript Save Area Status

It is possible to determine approximately how much memory has been used in PostScript's environment save area, and how much memory is available in the environment save area. This is accomplished by executing the "vmstatus" command behind the server loop. The values for "used", and "unused" roughly correspond to the size of the used and unused portions of the environment save area.

Clearing the PostScript Save Area

Executing the “quit” command outside the server loop causes all data in VM 0 to be destroyed, thereby clearing PostScript’s save area, and reboots PostScript.

Chapter 5: LaserJet 4V PCL Updates

Introduction

Enhanced PCL 5 is one of the two printer control languages in the LaserJet 4V printer. The major part of the language is documented in the *PCL 5 Printer Language Technical Reference Manual*. The *PCL 5 Comparison Guide* documents new additions to the PCL printer language. All PCL commands added by the LaserJet 4P or 4MP, are supported by LaserJet 4V. This chapter describes differences between LaserJet 4V and the LaserJet 4P and 4MP. This chapter also serves as an extension of both the *PCL 5 Printer Language Technical Reference Manual* and *PCL 5 Comparison Guide*.

Enhanced PCL 5 is a very powerful printer language. It provides a rich set of commands to accomplish almost any printing need. Font selection and scaling, vector graphics, rules, image layering, macros, and raster graphics are a few of the major features of Enhanced PCL 5. There is often several different ways to accomplish a printing task with Enhanced PCL 5. Printing features not directly supported by a specific PCL command can usually be emulated using other PCL commands. This is true of some Two Byte printing features. Some features are directly supported, and other features can be emulated. Those features that must be emulated are mentioned in this chapter.

It may be important to document a few terms important to Asian printing. These terms will serve to give the reader a basis of understanding and educate those unfamiliar with Asian printing.

Terms

Current Active Position (CAP): Location on the LaserJet page where the next character or graphics dot will be printed. The CAP can be explicitly moved using horizontal and vertical move commands.

Gaiji: Vendor extended characters and end-user defined characters (EUDC) which are not part of a character set standard. Examples of gaiji are names of places and people. Some computer manufacturers provide their own vendor-specific gaiji with their system fonts.

Galley character: Character which is printed when an undefined character code is received. In some products, a galley character is printed as four dots in a square pattern.

Large Symbol Set: A symbol set which contains more than 256 characters. Also known as large character set.

Large Fonts: Fonts bound to large symbol sets, Font Type 3.

SIDM: Serial-Impact Dot Matrix. Sometimes used to refer to dot-matrix printer personalities, such as ESC/P.

Typeface String: A substitute string which is printed on a PCL Typeface List for a specified font instead of a system default string.

Unicode: 2-byte international character encoding standard for information processing.

Vertical Clusters: Characters, usually numbers, which are grouped side-by-side in vertical writing. Examples include vertical pairs and vertical triplets.

Vertical Substitutes: Characters which change their orientation, position, or appearance depending on writing direction are identified in a vertical substitute table. In TrueType fonts the glyphs corresponding to these characters are identified in a glyph metamorphosis (mort) table.

PCL Differences

Text Parsing Method

The PCL Text Parsing Method command (**Esc&t#P**) is a new command which allows the user to specify characters codes in large fonts. This command tells the PCL parser that character codes received after the command should be interpreted as 1-byte or 2-byte character codes according to the method specified.

The following text parsing methods are implemented in the LaserJet 4V:

Value (#) = **0,1**. All character codes are processed as one-byte characters.

Value (#) = **21**. Character codes in the range of 0x21-0xFF are processed as the first byte of a two-byte character. The following byte is processed as the second byte of the two-byte character. All other character codes are processed as one-byte values. This method can be used for parsing two-byte characters in Asian seven-bit encoding specifications. These include the JIS X0208 (Japan Industrial Standard) encoding specification, as well as the GB 2312-80 (Mainland China) and KS C5601 (Korean Standard) seven-bit encoding specifications.

Value (#) = **31**. Character codes in the range of 0x81-0x9F and 0xE0-0xFC are processed as the first byte of a two-byte character. The following byte is processed as the second byte of the two-byte character. All other character codes are processed as one-byte values.

Value (#) = **38**. Character codes in the range of 0x80-0xFF are processed as the first byte of a two-byte character. The following byte is processed as the second byte of the two-byte character. All other character codes are processed as one-byte values. This method can be used for parsing Asian eight-bit encoding specifications. Examples include the KS C5601-1989 and GB 2312-80 eight-bit encoding specifications and the Big Five and TCA encoding specifications.
:

Value (#) = **2**. Strict 2-byte parsing. This would be used to parse Unicode.

Value (#) = **3,4**. Place holder for 3 byte and 4 byte parsing, respectively.

Value (#) = **32,33**. Place holder for Shift-GB and Shift-CCDC parsing, respectively.

Character Text Path Direction (Vertical Writing)

In previous products, PCL only supported text printing in the horizontal direction. Asian markets require both horizontal and vertical writing. True "WYSIWYG" vertical writing is not supported but can be emulated with other PCL commands.

The Character Text Path Direction command (**ESC&c#T**) supports horizontal printing with horizontal characters, vertical printing with vertical characters, and horizontal printing with vertical rotated characters.

The following values are implemented in the LaserJet 4V:

Value (#) = **0**. Horizontal printing (CAP advances left to right; linefeed advances top to bottom) with horizontal (upright) characters.

Value (#) = **-1**. Horizontal printing; full-width characters in Large Fonts are rotated counter-clockwise 90 degrees (vertical rotated characters); vertical substitutes are made for vertical characters; all other characters are unaffected by this setting.

Vertical characters are characters which change their appearance, orientation, or positioning when written vertically. Examples for fonts include parentheses, brackets, and punctuation. Vertical characters are accessed through the vertical substitutes table, which is built from the TrueType mort table (more information later in this Chapter).

The -1 mode has the effect of transforming a portrait page with horizontal text into a landscape page with vertical text. The PCL Print Direction command can be used to achieve other text orientations.

Postcard and B5 support

Single-size (*hagaki*) and round-trip (*oufuku-hagaki*) postcard support has been added to the PCL Paper Size command in the LaserJet 4V. The LaserJet 4V also added support for JIS B5 paper. The PCL Page Size command (**ESC&l#A**) has been modified to accept three additional values.

Value (#) = **45**. A selection value of 45 selects a JIS B5 sized piece of paper (182mm x 257mm). The maximum image area allowed by the LaserJet 4V on JIS B5 is 170mm x 245mm in Portrait, and 247mm x 170mm in Landscape orientation. JIS B5 paper may be loaded into the paper cassette of the LaserJet 4V. This paper may also be manually fed. JIS B5 paper should not be confused with the International B5 envelope size (Value # = 100). The envelope may only be manually fed, but the JIS B5 paper may be loaded into the paper cassette. International B5 envelopes are still supported by the LaserJet 4V. For instructions on configuring the LaserJet 4V paper cassette for JIS B5 paper, see the *LaserJet 4V User's Guide.*

Value (#) = **71** This paper size selects a postcard with dimensions of 100mm x 148mm. The maximum image area is 88mm x 136mm in Portrait, 138mm x 88mm in Landscape orientation.

Value (#) = **72** This paper size value selects the double postcard. The dimensions are 200mm x 148mm. The maximum image area is 136mm x 188mm in Portrait, 190mm x 136mm in Landcape orientation.

Large Fonts

The LaserJet 4V extended the ROM format for TrueType bound fonts to accomodate large bound fonts. These extensions include support for the vertical substitutes table, galley character table, typeface strings, and a new format for the character/glyph handle directory.

Large soft fonts can be downloaded using the new Font Format 16 (Universal Font) of the PCL Download Font command (**Esc)s#W [font definition]**). Large fonts are designated as Font Type 3 (16-bit fonts.) Font Format 16 is identical in structure to Font Format 15 (Univeral Scalable Font) except that the size field for data segments has been enlarged from 16 bits to 32 bits. Font Format 15 has been described in the Soft Font Creation chapter of the *PCL 5 Printer Language Technical Reference Manual.*

The LaserJet 4V has implemented new Font Format 15 and 16 data segments to download galley character tables, vertical substitution tables, and typeface strings. The LaserJet 4V supports Large fonts in TrueType format only.

The font format for TrueType bound fonts has been extended to include optional data segments to support galley characters, vertical substitution characters, and typeface strings These new segments were added primarily to support Large (Font Type 3) Fonts.

New Segments

Galley Characters:

The *Microsoft Windows Version 3.1 Microsoft Standard Character Set Specification* states "that when there is an output request for a character of a specified typeface, even if the glyph corresponding to the specified character code does not exist, some glyph data will be output. For double-byte characters, the glyph of the default character defined for the given TrueType font is used. For single-byte characters, the glyph at 0xA5 (small dot, U+FF65) is used.

Vertical Substitution Characters:

Asian TrueType fonts typically contain special-case characters which change their position, orientation, or appearance depending on whether they are printed as horizontal or vertical text. Examples include parentheses, braces, line draw characters, and small kana. In TrueType fonts, these "vertical substitution" characters are specified within a glyph metamorphosis (**mort**) table.

Typeface Strings:

In most Asian Windows 3.1 implementations, font names are displayed in local language, not in English. By using the Typeface String Segment, font names can be displayed in local languge on the "Typeface List" (also known as the "Font List") generated by the printer. Since the "typeface name" string in HP's existing font format did not support the notion of non-ASCII characters, we defined an optional "Typeface String" segment.

Character Enhancements:

LaserJet 4V's TrueType implementation can algorithimically alter characters to simulate slanted characters for italics and "thicken" character strokes to simulate bold characters. This enhancement segment is only supported by Font Format 16 Large fonts. Other character

enhancements may be desired. Some of these can be accomplished with other PCL 5 features, others are not available in the LaserJet 4V.

Vertical Rotation:

When LaserJet 4V Windows 3.1 is writing TrueType vertical text it uses the TrueType's "sTypeDescender" value to determine around what point to rotate full-width characters. To be compatible with Windows, the "-1" Text Path Direction command should do the same; however, "sTypeDescender" is not currently downloaded with TrueType fonts. This optional segment allows for this value to be downloaded.

All these new segments may be considered optional. The following new values are defined for Font Format 15 and Font Format 16 segmented font data:

Value	Mnemonic*	Data Segment
18243	GC	Galley Character Segment
22100	VT	Vertical Substitute Segment
21574	TF	Typeface String Segment

*The mnemonic is obtained when the two bytes of this big-endian word are treated as ASCII characters.

Each segment contains three parts: a Segment Identifier, Segment Size, and Data Segment. The Segment Identifiers for the new segments are the values in the previous table. The Data Segments for the new segments are defined below. All three segments are optional. The data types shown (for example: UI means Unsigned Integer) for the fields of these new segments match the data types explained in the chapter for Soft Font Creation of the *PCL 5 Printer Language Technical Reference Manual*.

Galley Character Segment

The Galley Character Segment specifies character codes of characters to be printed when specified characters are missing in the font. The segment definition is shown below:

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Format=0		1
2	Default Galley Character		3
4	Number of Regions (n)		5
6	Region #1 Upper Left Character Code		7
8	Region #1 Lower Right Character Code		9
10	Region #1 Galley Character		11
...	...		...
6*n	Region #n Upper Left Character Code		6*n+1
6*n+2	Region #n Lower Right Character Code		6*n+3
6*n+4	Region #n Galley Character		6*n+5

Figure 1: Galley Character Segment

Default Galley Character (UI) - Character code of the character to be printed when a specified character is not within any of the defined regions.

Number of Regions (UI) - Number of regions for which galley characters are defined. Regions are defined for a table in which the first byte of the character code specifies the row and the second byte specifies the column.

Region #x Upper Left Character Code (UI) - Character code defining the upper left corner of Region #x.

Region #x Lower Right Character Code (UI) - Character code defining the lower right corner of Region #x.

Region #x Galley Character (UI) - Character code of the character to be printed when a character within Region #x is missing from the selected font.

If the value of the galley character field is 0xFFFF, then if the font contains a missing character glyph, that glyph is printed. The missing character glyph can be downloaded using the PCL Download Character command with a character code = 0xFFFF and a glyph ID = 0.

If both the character specified by the original character code and by the galley character code are missing, the CAP is advanced in accordance with previous PCL rules for missing characters, i.e. it is advanced according to the current setting of HMI (Horizontal Motion Index).

The galley character segment will be invalid if the format number is not supported or if the segment size declared in the Segment Size field is larger or smaller than required for the number of regions (N). If the segment is invalid, the font download will be ignored.

Galley character segments can be downloaded with any Font Format 15 or Font Format 16 font, regardless of font type.

The following is an Galley Character Segment which follows the Windows specification:

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Format = 0		1
2	Default Galley Character = 0xFFFF		3
4	Number of Regions (n) = 1		5
6	Region #1 Upper Left Character Code = 0x0000		7
8	Region #1 Lower Right Character Code = 0x00FF		9
10	Region #1 Galley Character = 0x00A5		11

Figure 2: Galley Character Segment Example

In this example there is one galley character region. This region is applied to all one-byte characters (character codes 0x0000-0x00FF); any missing character in this region is replaced with the character at character code location 0x00A5. Any missing characters falling into this region (e.g. character codes 0x0100 - 0xFFFF) are replaced with the default galley character. Since in this example the Default Galley Character field = 0xFFFF, the missing character glyph will be printed if it is present in the font.

Vertical Substitution Segment

The Vertical Substitution Segment contains pairs of glyph IDs. Each pair specifies the horizontal and vertical glyph ID for a character. The segment can be built directly from a mort table which contains a vertical substitution array. The segment definition is shown below:

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Horizontal Glyph ID #1		1
2	Vertical Glyph ID #1		3
...	...		...
4*n-4	Horizontal Glyph ID #N		4*n-3
4*n-2	Vertical Glyph ID #N		4*n-1
4*n	End of table mark #1 = 0xFFFF		4*n+1
4*n+2	End of table mark #2 = 0xFFFF		4*n+3

Figure 3: Vertical Substitution Segment

The Horizontal Glyph ID field is used by the TrueType rasterizer as an ID number for the horizontal glyph data associated with a given character. The Vertical Glyph ID field contains the ID number for the vertical glyph data associated with the same character.

The vertical glyphs can be downloaded using the PCL Download Character command using a character code = 0xFFFF.

A mort table in Microsoft's Asian TrueType fonts typically contains a fixed-length header of 76 bytes followed by the vertical substitution array which follows the segment format described here. However, the header is designed to be variable-length, and the location of the vertical substitution data may be elsewhere in mort tables in future fonts.

If the Font Type is not Type 3 (16-bit fonts), this data segment will be ignored.

If the value pairs are not sorted by horizontal glyph ID, the data segment will be invalid. If the End of table mark #1 is not 0xFFFF, the data segment will be invalid. The location of the end of the table is determined using the Segment Size field. If the segment is invalid, the font download will be ignored.a

Typeface String Segment

The Typeface String segment is optional. The purpose of this segment is to provide a substitute string to print for this font when doing a PCL Typeface List printout. It has the following structure:

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Embedded Font Name Flag	Substitute String Length	1
2 ...	Substitute String Character List		3 ...

Figure 4: Typeface Sample Segment

Embedded Font Name Flag (UB) - A non-zero value in this field is used to indicate that the substitute string contains the font name. In this case, the font name is printed as part of the substitute string. A zero value in this field is used to indicate that the ASCII name of the font (from the Font Name field) should be printed in addition to the substitute string. In LaserJet 4V the ASCII name is printed in the Line Printer font at 16.67 pitch. However, the exact manner may be product-dependent.

Substitute String Length (UB) - the number of UI characters in the Substitute String Character List.

Substitute String Character List (array of UI) - the characters which make up the substitute string. Each character is represented as an UI value in the native mapping of the font. Native mapping refers to the character mapping method that the font is a part of. If the font is a bound font, then the values will be accessed by their character codes values, if the fonts are unbound, then the MSL or UGL numbers will be used. By using UI values, it is possible to avoid having to specify a text parsing method for the string.

The typeface string segment will be invalid if the segment size declared in the Segment Size field is larger or smaller than required for substitute string length, or if the Segment Size is an odd number of bytes. If the segment is invalid, the font download will be ignored.

Typeface string segments can be downloaded with any Font Format 15 or Font Format 16 font, regardless of font type.

The following shows an example of typeface sample segments for two downloaded fonts. The first is for MS Mincho, and has the embedded font name flag set to true. The second is for MS Gothic, and has the embedded font name flag set to false.

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Embedded Font Name Flag = 1	Substitute String Length = 4	1
	Substitute String Character List =		
2	0x826c		3
4	0x8272	(Note that these are full-	5
6	0x96be	width Shift-JIS character	7
8	92a9	codes for "MS" and Kanji "Mincho")	9

Figure 5: Typeface Sample Example (MS Mincho)

Byte	15(MSB) 8	7 (LSB)0	Byte
0	Embedded Font Name Flag = 1	Substitute String Length = 6	1
	Substitute String Character List=		
2	0x826c		3
4	0x8272		5
6	0x8353	(Note that these are full-	7
8	0x8356	width Shift-JIS character	9
10	0x8362	codes for "MS", and	11
12	0x834e	katakana for "Gothic")	13

Figure 6: Typeface Sample Example (MS Gothic)

Other Asian Printing Features

This section mentions features which are required for a full Asian printing solution which are not explicitly supported by PCL, but can be accomplished using PCL commands as implemented in LaserJet 4V.

Gaiji Characters

If gaiji characters are handled as bitmap fonts on the host, rather than being inserted into already existing fonts, then the host driver can send them as raster or as a downloaded bitmap font.

Vertical Clusters

Vertical clusters include vertical pairs and vertical triplets. In vertical pair printing, two narrow characters are written side-by-side horizontally while the current writing direction is vertical. These characters are typically half-width, although exceptions exist. An application or driver can print vertical groups by explicitly positioning the CAP between each character.

Vertical Underlining

In vertical writing, the underline appears to the right of the text when doing normal line advance. A driver can perform vertical underline by using the PCL Fill Rectangular Area (Rules) command.

Future Features

This section describes features which have been proposed or suggested for PCL for future Asian printing solutions but are not implemented in the LaserJet 4V.

Unicode-Compatible Text Parsing Method

This may be desirable for Windows-NT printing.

Associated Fonts

This may be required in future products to support gaiji and vendor-unique extensions added to preexisting fonts.

Associated Symbol Set Maps

The user may wish to make minor changes to an existing large symbol set. In this case it would not be efficient for the user to have to download a copy of the entire symbol set, nor for PCL to store the entire symbol set.

Explicit Vertical Cluster Support

This was not considered a requirement for the LaserJet 4V since it can be done through a PCL driver.

Character Enhancements

Many SIDM printers support outlining, shadowing, and italic special effects on bitmap fonts. This was not considered a requirement for the LaserJet 4V. Some of these can be easily be emulated using other PCL commands.

Dual-pitch fonts

An example of a multipitch font is a font which only contains half-width and full-width characters. It is not required in the LaserJet 4V for TrueType fonts, since TrueType does not have a concept of dual pitch. It may be required for Asian bitmap fonts.

HP-GL/2 Changes

HP-GL/2 currently has no mechanism for dealing with large fonts or large symbol sets. The two Kanji TrueType fonts cannot be accessed while in HP-GL/2 mode of PCL 5.

PCL 5 Programming Suggestions

The flexibility of PCL 5 allows for the placement of text and image data on the printed page in many fashions. Almost every output feature is either directly supported by PCL 5 or it can be emulated.

For the HP LaserJet 4V/4MV there are several printing considerations that must be taken into account such as font metric calculation and printer initialization. A software application usually maintains strict control of the positioning and placement of items on the printed page. This is usually desired so the printed output can be accurately represented on the computer's screen (i.e. WYSIWYG), or line and page endings can be predicted and controlled. Predicting font

character widths and heights is crucial in representing accurate emulation of several Asian printing features.

There are Asian printing requirements that are not directly supported by a specific PCL command. One should not worry about this, since most of these features can be emulated with other commands. Features such as vertical underlining, vertical clusters, and some character enhancements are several of these "emulate-able" features. This chapter will explore these features, and provide PCL 5 commands to accomplish printing with these features. The following sections supplement programming tips from the *PCL 5 Developer's Guide* to discuss specific considerations for the HP LaserJet 4V/4MV.

Print Job Initialization

The LaserJet 4 example in the "Tips for Efficient Programming" chapter of the *PCL 5 Developer's Guide* shows a print job initialization example which can be used for PCL 5 jobs.

This example is nearly identical to the LaserJet 4 example from the *PCL 5 Developer's Guide*. The only difference is that it includes a PJL command to set the default PCL symbol set to WIN3.1J.

```
<ESC>%-12345X@PJL<CR><LF>
@PJL SET RESOLUTION=600<CR><LF>
@PJL PAGEPROTECT=OFF<CR><LF>
@PJL RET=MEDIUM<CR><LF>
@PJL SET LPARM:PCL SYMSET=WIN3.1J<CR><LF> <-This command added
@PJL ENTER LANGUAGE=PCL<CR><LF>
<ESC>E<ESC>&l1x1h26a0o8c6e60F<ESC>&a5L<ESC>&t31P<ESC>(19K<ESC>(s1p10v0s0b28752T
```

The commands in the above example are explained in more detail in the "Tips for Efficient Programming" chapter of the *PCL 5 Developer's Guide*.

The last two lines in the above example is a PCL 5 initialization string. This set of commands would reset the printer, specify 1 copy, specify the paper tray as a paper source, choose A4-size paper, select portrait orientation, VMI=8 (6 LPI), set top margin to 6 lines, select a text length of 60 lines, a 5-column left margin, Shift-JIS parsing, WIN3.1J symbol set, and a proportional, 10-point upright, text-weight MS-Mincho font.

After the PCL print data, the following commands would be used to complete the job:

```
<ESC>E<ESC>%-12345X
```

Font Metric Calculation

Accurate character placement relies on the ability to predict character width and height. As a character's point size changes so does its width and height.

In proportionally spaced fonts character widths also vary from character to character within the font. Variable character widths add complexity to maintaining accurate line widths, page breaks, or WYSIWYG operation. To support most proportionally spaced fonts, font metrics must be extracted from the metric files supplied from the font vendor. The extraction software as well as instructions on using the metric information is in the *PCL 5 Developer's Guide*.

Character Enhancements

The LaserJet 4V/4MV supports PCL pseudo-bold and pseudo-italic character enhancements. These enhancements can be applied to the internal MS-Mincho and MS-Gothic fonts. They can also be applied to a soft TrueType font if a suitable "character enhancements" segment is downloaded with the font header.

The enhancements are selected using PCL font selection commands. The pseudo-italic enhancement can be selected using the PCL Style command. The pseudo-bold enhancement can be selected by the PCL Stroke Weight command. The bold levels which can be applied to the internal MS-Mincho and MS-Gothic fonts are Semi Bold, Demi Bold, Bold, and Extra Bold. For example, to select a 10 point Extra Bold Italic MS-Mincho, the following PCL command would be used:

<ESC>(19K<ESC>(s1p10v1s4b28752T

In the above command, Italics style (1s) and Extra Bold weight (4b) are selected. Since there is not an Extra Bold Italic MS-Mincho font resident in the printer, pseudo-italics and pseudo-bolding algorithms are applied to characters printed from the regular MS-Mincho font.

If a soft font is selected using the "Font Selection by ID" command (e.g. <ESC>(#X), the font is selected without any character enhancements applied. To select a soft font by ID with character enhancements, first select the font by ID, then select the desired attributes. For example, assume a soft font is downloaded with ID = 1 and a character enhancements segment indicating that pseudo-bold and pseudo-italics character enhancements can be applied. The following command can be used to select that font with those enhancements:

<ESC>(1X<ESC>(s1s3B

Other font effects, such as character shadowing, strikethrough, and gray-shading can be accomplished using the print model. Examples of these features are demonstrated in the *PCL 5 Developer's Guide*.

Note: HP-GL/2 as implemented in LaserJet printers has no mechanism for parsing 2-byte characters. Therefore, HP-GL/2 character transformations (e.g. SI and SR commands) cannot be applied to these characters.

Chapter 6: PostScript Paper Handling

The purpose of this section is to specify the PostScript paper handling features for the LaserJet 4V and LaserJet 4MV printers. The focus is on information and features not contained in other, more generic PostScript documents. Adobe's *PostScript® Language Reference Manual (Second Edition)*, should be used as a reference for additional PostScript feature information.

PS Paper Handling Overview

The process of selecting a sheet of paper, envelope, or other media upon which a page is printed is governed by the *paper handling model* currently active in the printer. Proper use of a paper handling model is very important for printers having multiple paper trays or sources. Having the job select the appropriate paper tray is especially important in shared printer environments where the alternative of walking some distance to the printer to manually select media is not desirable.

Specific paper handling models are chosen in PostScript through a distinct initialization of the Page Device. The Page Device in PostScript is an abstraction of the page output system in the printer. Initialization of Page Device attributes is performed through the **setpagedevice** operator. The current attributes of the page device are stored in the **currentpagedevice** dictionary.

The source of media for a printer may be any installed source, such as upper and lower paper trays, and multi-purpose trays. This section discusses how to set up various strategies for media selection **setpagedevice** for Page Device initialization. For specific information about the PostScript Page Device model and its behavior see the *PostScript Language Reference Manual (Second Edition)* and the *PostScript Language Supplement* for your printer's revision of PostScript (included later in this document).

> Note: Driver writers use printer description files named **.ppd** (for most drivers) and **.wpd** (for some MS-Windows drivers) to manage paper handling among different PostScript printers. For more information, see Adobe's device driver development kits.
>
> PostScript programmers use the **stopped** operator to trap incompatible **setpagedevice** operations, allowing their files to print on different PostScript platforms. For more information on the stopped operator, see the *PostScript Language Reference Manual (Second Edition)*.

PS Paper Handling

"Installed", "Inserted", and Tray Status

In this section there are references to trays being **installed** or **installed *and* inserted** and the affect on PostScript paper handling. A tray is considered **installed** when the printer detects that the tray is available (configured, but not necessarily ready to use). A tray is considered **inserted** when the tray is ready for use and media is present in the tray.

HP LaserJet printers with PostScript installed support the following three models for media selection during the printing process:

1. HP-Specific Level 2 Paper Handling Model
2. Adobe-Standard Level 2 Paper Handling Model
3. Level 1 Model Paper Handling Model

The activation and use of these paper handling models will be discussed in the following sub-sections.

The DeferredMediaSelection Key

A top-level key in the page device dictionary has been added by Adobe to core PostScript for LaserJet 4V/4MV named DeferredMediaSelection. This key determines the active PostScript Level 2 paper handling model. If DeferredMediaSelection is set to *true* in PostScript for HP LaserJet printers, the HP-Specific Level 2 Paper Handling Model is active. If this key is set to *false* (usually the default value), the Adobe-Standard Level 2 Paper Handling Model is active. Specific behavior based on the setting of this key will be discussed in the following sub-sections.

HP-Specific Paper Handling Model (DeferredMediaSelection = true)

The HP-Specific Model allows PostScript users to obtain paper handling behavior consistent with that exhibited by PCL. This is important for users that print both PostScript *and* PCL jobs on their printers. Previous HP LaserJets (i.e. HP LaserJet 4M) with PostScript installed used a unique approach to achieve this consistency. This was accomplished through a combination of using **PageSize** policy 2 and specific settings of the **MediaType** key for individual trays designating installed paper size. That approach had two main drawbacks: (1) the approach was non-standard and difficult to use and (2) the performance of the implementation was not optimal since the model was not part of core Adobe PostScript. The method of using **PageSize** policy 2 with specific **MediaType** settings for tray selection is incompatible with current PostScript products, is no longer supported, and may no longer be used. Older drivers using this tray selection method will not function properly for current HP LaserJets with PostScript installed.

HP-Specific Paper Handling may now be enabled through Adobe PostScript using the standard operators **DeferredMediaSelection** and **MediaPosition** as explained in this section. With **DeferredMediaSelection** set to true, all media matching normally performed by **setpagedevice** against the **InputAttributes** dictionary is disabled. Instead, media requests for **PageSize** and **MediaPosition** (defined below) are passed from PostScript to the printer's system software to be matched when the product needs to pick paper.

HP *strongly* recommends that all new driver development use the HP-Specific Paper Handling Model explained in this section. You *must* use the HP-Specific Model if you wish to take advantage of tray locking to prevent special media (such as three-hole punch or expensive letter-head) from accidentally being used. However, media attribute matching for tray preference against keys such as **MediaType**, **MediaWeight**, and **MediaColor** will not work under deferred media selection since the **InputAttributes** dictionary is ignored.

When **DeferredMediaSelection** is true, **PageSize** policies 0 and 1 work as described in the *PostScript Language Reference Manual (Second Edition)*. **PageSize** policy 2 and policies 3-6 behave like PageSize policy 0. If you rely on Policies 3-6 to scale your paper in European or other markets, you must not use deferred media selection (see the following sub-section on the Adobe-Standard Paper Handling Model).

> Note: PostScript **PageSize** policies are only invoked with **DeferredMediaSelection** = true when an illegal page size is requested (one which the printer does not support). For example, with **PageSize** set to [360 316] (unsupported size), and a PageSize policy of 1 (ignore), and **DeferredMediaSelection** true, PostScript would ignore the page size request and pull media from the default tray, imaging to the page size of the default tray (which may be different from the requested page size).

The MediaPosition Key and HP-Specific Paper Handling

For HP LaserJets with PostScript installed, HP-Specific paper handling is in effect when **DeferredMediaSelection** is set to true. The **MediaPosition** key has been added to the **currentpagedevice** dictionary to indicate preference for a particular tray or media slot to be used in the printer's media selection process. **MediaPosition** values along with combinations of **PageSize** determine the behavior of HP-Specific paper handling.

MediaPosition may either be null or set to an integer value. When **MediaPosition** is set to null, no preference for a particular tray is assumed and page size matching begins at the default tray in the order specified by the printer's system software (not the PostScript priority array).

When **MediaPosition** is set to an integer value it corresponds to a product's paper trays as follows:

Media Position	PostScript Slot Number	Mid-Range Printer Tray name (a)	High-End Printer Tray Name (b)
0	0	Paper Cassette	Upper Cassette
1	1	Lower Cassette	Lower Cassette
2	2	Envelope Feeder	Envelope Feeder
3	3	Multipurpose Tray	

(a) A LaserJet 4-class mid-range printer

(b) A LaserJet 4Si-class network printer

Note: The mapping between **MediaPosition** and PostScript slot number is constant. However, the mapping between **MediaPosition** and product tray name is product-specific. The following is the mapping between media position and tray name.

Media Position	Tray Name
0	PC Tray (Upper Tray)
1	LC Tray (Lower Tray)
3	MP Tray (Multipurpose Tray)

Note: This printer does not support an envelope feeder.

The Multipurpose Tray is only available as a general-purpose tray to PostScript when it is configured as a CASSETTE (*not* FIRST or MANUAL) through the control panel menus or via PJL. However, manual feed jobs will always be able to use the Multipurpose Tray if it functions as the manual feed slot for the printer (as in the HP LaserJet 4M).

General HP Paper Handling Algorithm

Here is the general algorithm for selecting media in the HP-Specific Model (**DeferredMediaSelection** is true) when **PageSize** and **MediaPosition** (requested tray) are specified:

If requested **PageSize** is supported by the printer AND

requested tray contains media of requested **PageSize** *(locked or unlocked)*

Then print from requested tray (*whether locked or unlocked*)

Otherwise...

If requested **PageSize** is available in an alternate unlocked tray

Then print from matching unlocked tray selected by printer's firmware

(does not involve PostScript priority array for selection)

Otherwise...

prompt the user to mount the proper size in the requested tray

The following is an algorithm to be used in conjunction with the algorithm above to understand printer behavior if paper runs out under the HP-Specific model.

If paper runs out while printing AND tray is ***unlocked***

Then search other unlocked trays for same size paper

Otherwise...

If paper runs out while printing AND tray is ***locked***

Then... don't look elsewhere for same size paper and prompt the user to mount the proper size in the requested tray

Note: The method of prompting the user for media is implementation-dependent and may be carried out through several means (i.e. a control panel display, indicator lights, or through a printer status display at the user's workstation).

HP-Specific Paper Handling Examples

This sub-section contains several HP-Specific paper handling examples which should be useful to PostScript driver-writers and other programmers. For the behavior of exception conditions that may occur, refer to the *General HP Paper Handling Algorithm* explained previously in this section.

HP-Specific Automatic Tray Selection

When the user desires automatic tray selection based on a requested page size, only the **PageSize** key should be specified in **setpagedevice** with MediaPosition set to null (default).

For example, if the Paper Cassette (position 0) in a printer contains LETTER-size paper and the Lower Cassette (position 1) contains LEGAL-size paper a request of:

<< /DeferredMediaSelection true /PageSize [612 792] >> **setpagedevice**

will cause the job to print on media from the Paper Cassette.

Using the tray settings in the above example, a request of:

<< /DeferredMediaSelection true /PageSize [612 1008] >> **setpagedevice**

will cause the job to print on media from the Lower Cassette.

HP-Specific Tray and Media Size Selection

When the user desires a specific tray and a specific paper size, both the **MediaPosition** key and the **PageSize** key should be specified in **setpagedevice**.

For example, if the Paper Cassette (position 0) and Lower Cassette (position 1) contains LETTER-size paper, a request of:

<< /DeferredMediaSelection true

/MediaPosition 1

/PageSize [612 792]

>> **setpagedevice**

will cause the job to print from the Lower Cassette.

If the Multipurpose tray (position 3) contains LEGAL-size paper, a request of:

<< /DeferredMediaSelection true

/MediaPosition 3

/PageSize [612 1008]

>> **setpagedevice**

will cause the job to print from the Multipurpose tray.

If the Paper Cassette (position 0) were the only tray installed and inserted and contains LETTER-size paper, a request of:

<< /DeferredMediaSelection true

```
        /MediaPosition 0

        /PageSize [612 1008]

    >> setpagedevice
```

will cause the printer to issue a mount message for LEGAL size paper for the Paper Cassette (i.e. “PC MOUNT LEGAL”).

HP-Specific Manual Feed Request

When the user desires to manually feed a specific size page, both the ManualFeed key and the PageSize key should be specified in **setpagedevice**.

For example:

```
    << /DeferredMediaSelection true

        /ManualFeed true

        /PageSize [612 792]

    >> setpagedevice
```

will cause the job to print on the LETTER-size media in the manual feed slot.

A request of:

```
    << /DeferredMediaSelection true

        /ManualFeed true

        /PageSize [595 842]

    >> setpagedevice
```

will cause the job to print on the A4-size media in the manual feed slot.

Note: If **PageSize** is not specified along with **ManualFeed**, the job will request the default **PageSize** value.

HP-Specific Portrait/Landscape Selection

A job will print in *portrait* orientation if the x and y size values are specified in the top-level PageSize array. To achieve *landscape* orientation, simply swap the x and y values for the desired page size.

For example, a job following the operators shown below will print in landscape orientation from the Lower Cassette with LETTER-size paper:

```
<< /DeferredMediaSelection true

    /MediaPosition 1

    /PageSize [792 612]

>> setpagedevice
```

A job following the operators shown below will print in landscape orientation from the Multipurpose tray with a COM10-size envelope:

```
<< /DeferredMediaSelection true

    /MediaPosition 3

    /PageSize [684 297]

>> setpagedevice
```

Note: Landscape pages may also be produced without page device operations by using the PostScript **rotate** and **translate** operators in the body of the PostScript job.

Adobe-Standard Paper Handling Model (DeferredMediaSelection = false)

When **DeferredMediaSelection** is false, the Adobe-Standard Paper Handling Model is in effect as described under the Device Setup section in the *PostScript Language Reference Manual (Second Edition)*. This is the default for most HP LaserJet printers with PostScript installed. The Adobe-Standard model should be active when the driver writer or programmer needs paper handling compatibility with generic or non-HP Level 2 PostScript printers (i.e. Apple LaserWriter) or with Level 1 drivers.

Under the Adobe-Standard Model, **setpagedevice** attempts to find a paper tray by matching values of top-level media request keys (**PageSize**, **MediaType**, **MediaColor**, and **MediaWeight**) against corresponding values in each tray's **InputAttributes** entry. The priority array is consulted when there is more than one tray that matches the media request. Null-valued media request keys do not effect the tray matching algorithm.

The **PageSize** key in each InputAttributes sub-dictionary for a tray is initialized automatically by PostScript at the beginning of each job. Each tray's **PageSize** values are read either from paper size sensors or a value stored in NVRAM (non-volatile memory). The actual source (sensor or NVRAM) of a tray's paper size is product-specific.

Policies and the Adobe-Standard Model

Media request policies are in effect in the Adobe-Standard Model. These policies specify the action to be taken when a specific media request key value cannot be matched. A wide variety

of behaviors may be obtained by altering the various media request policies. For various policy behaviors and information on how to set up the Policies dictionary see the Adobe *PostScript® Language Reference Manual (Second Edition).*

The key elements of the **Policies** dictionary are set to the following values for LaserJet 4V/4MV:

```
Policies <<
/OutputDevice       0
/PolicyNotFound     1
/PageSize           0
/PolicyReport       {pop}
>>
```

Assume these default values for examples of the Adobe-Standard paper handling given in this section.

The MediaPosition Key and the Adobe-Standard Model

HP recommends that you limit use of the **MediaPosition** key to the HP-Specific Model. If you do not use the key (**MediaPosition** = null), the selection process is not altered from the standard described in the *PostScript Language Reference Manual (Second Edition)* and in *PostScript Language Supplements* published by Adobe.

If **MediaPosition** is used with DeferredMediaSelection set to false, **setpagedevice** will *attempt* to satisfy the request for the specified slot based on the active matching policies before searching other available slots. The matching behavior for **MediaPosition** is similar to that of other media keys in that a specific **MediaPosition** setting does not explicitly set a specific tray to be used for the media source. The actual tray selected depends on the overall matching process which is driven by the policy settings for the media request keys.

Adobe-Standard Paper Handling Examples

The default **Policies** dictionary with PageSize policy of 0 will insure that an unsuccessful page size match by **setpagedevice** will cause a PostScript configuration error, causing the job to fail. The error may be reported back to the originating workstation or a description printed at the printer depending upon the printer's settings. This type of job failing behavior may be more appropriate for shared or networked printers since the printer will not wait on paper tray prompts to the user (as in the HP-Specific model).

All of the following examples assume that DeferredMediaSelection is false.

Adobe-Standard Automatic Tray Selection

When the user desires automatic tray selection based on a requested page size, only the PageSize key should be specified in **setpagedevice** with **MediaPosition** set to null (default).

For example, if the Paper Cassette (position 0) in a printer contains LETTER-size paper and the Lower Cassette (position 1) contains LEGAL-size paper, a request of:

```
<< /PageSize [612 792] >> setpagedevice
```

will cause the job to print on media from the Paper Cassette.

Using the tray settings in the above example, a request of:

```
<< /PageSize [612 1008] >> setpagedevice
```

will cause the job to print on media from the Lower Cassette.

If more than one tray matches the **PageSize** request, the first matching tray is chosen based on the current **Priority** array. If no tray which is installed and inserted contains LETTER-size media, the above **setpagedevice** call will fail and consult the **PageSize** policy.

Adobe-Standard Tray Selection by Media Matching

In general, there is a two-step process for media matching. Step A involves initializing tray-specific media attribute keys (**PageSize**, **MediaColor**, **MediaType**, etc.) in the **InputAttributes** dictionary. This step may be performed in an unencapsulated job (outside the server loop) or at the front of a PostScript job. Step B follows Step A and involves setting media matching policies and setting the top-level media matching keys for tray selection at the front of the PostScript job.

When media attributes other than **PageSize** are required for a tray, they must be set up prior to setting the top-level media request keys. For example, the following code will initialize the **InputAttributes** dictionary to indicate that tray 0 contains LETTER-size media with an unspecified media type, and tray 1 contains LETTER-size media with a media type of TRANSPARENCY.

Sample Step A for Media Attribute Matching

```
<<      /Input Attributes
        <<0
                << /PageSize [612 792]
                <<      /PageSize [612 792] >>
                        /MediaType (TRANSPARENCY)>>
        >>
>>      setpagedevice
```

Note: The **InputAttribute** sub-dictionary's **PageSize** key is a required key when setting additional input attributes for a tray. This is the case even though the **PageSize InputAttribute** key is initialized automatically by PostScript. All other keys are optional. The **setpagedevice** operator will fail if the **PageSize** value does not match the size read from the tray's sensors. If the product does not have tray sensors, **PageSize** in **InputAttributes** for a specific tray may usually be overridden. Also, unlike the top-level page device keys, settings for a slot in **InputAttributes** are not cumulative, meaning you cannot set media keys for a tray one-at-a-time.

The **MediaType** and **MediaColor** keys may be set to any PostScript string and may be defined by the PostScript programmer as any string descriptive of the corresponding tray.

PostScript code for Step B with a media request for transparencies is included in the job below. The job will print only from a LETTER-size tray with the TRANSPARENCY media type.

Sample Job with Media Attribute Matching

```
<< /Policies
        <<          /MediaType      0
                    /PageSize       0
        >>
>>setpagedevice
<</MediaType (TRANSPARENCY)
   /PageSize [612 792]
>>setpagedevice
/Times-Roman 12 selectfont
72 72 moveto
(Near the bottom left-hand corner.)  show showpage
```

MediaType policy 0 and **PageSize** policy 0 were chosen above to abort the job if a tray with transparencies could not be found.

Note: When the printer power is cycled from off to on, all media attribute settings in the **InputAttributes** dictionary except **PageSize** are lost. Also, if a printer does not support environment saving (e.g. the HP LaserJet 4/4M does not), then anytime the printer switches from PostScript to PCL the media attribute settings in the **InputAttributes** dictionary are lost.

Adobe-Standard Manual Feed Request

When the user desires manual feed for a specific paper size, both the **ManualFeed** key and the **PageSize** key should be specified in **setpagedevice**.

For example:

```
<<  /ManualFeed true

     /PageSize [612 792]

>> setpagedevice
```

will cause the job to print on the LETTER-size media in the manual feed slot.

A request of:

```
<<  /ManualFeed true

     /PageSize [595 842]

>> setpagedevice
```

will cause the job to print on the A4-size media in the manual feed slot.

Note: If **PageSize** is not specified along with **ManualFeed**, the job will request the default **PageSize** value.

Adobe-Standard Portrait/Landscape Selection

A job will print in *portrait* orientation if the x and y size values are specified in the top-level PageSize array. To achieve *landscape* orientation, simply swap the x and y values for the desired page size.

For example, a job following the operators shown below will print in landscape orientation from the first LETTER-size tray defined by the current Priority array:

```
<< /PageSize [792 612]

>> setpagedevice
```

A job following the operators shown below will print in landscape orientation from the first LEGAL-size tray defined by the current Priority array:

```
<< /PageSize [1008 612]

>> setpagedevice
```

Note: Landscape pages may also be produced without page device operations by using the PostScript **rotate** and **translate** operators in the body of the PostScript job.

Emulating the Level 1 **setpapertray** Operator

Normally, the **MediaPosition** key is only used to achieve specific results under the HP-Specific Paper Handling Model. However, using the **MediaPosition** key in conjunction with **DeferredMediaSelection** set to false allows emulation of the Level 1 **setpapertray** operator. The following code will emulate the behavior of the Level 1 setpapertray operator:

```
<< /DeferredMediaSelection false

    / Policies  <<      /PageSize 1

                        /MediaType 1

                        /MediaColor 1

                        /MediaWeight 1

                        /MediaPosition 0

                    >>

    /MediaPosition  slotNumber

>> setpagedevice
```

where *slotNumber* is the integer value representing the desired slot

The job following the above **setpagedevice** call will pull from the desired slot and image to the size of media contained in the desired slot.

Multiple Copies

Three separate mechanisms determine the number of copies to be output:

- **NumCopies** = Level 2 Page Device key
- **#copies** = Level 1 entry in Systemdict
- COPIES = control panel setting

The NumCopies key

If the **NumCopies** entry in the page device is not null, it specifies the number of copies of each page of the document to produce regardless of the active paper handling model. For example, the following job will always print three copies:

```
<< /NumCopies 3
```

>> **setpagedevice**

/Times-Roman 12 selectfont

100 600 moveto

(Three Copies) show showpage

NumCopies with a null value indicates that **showpage** and **copypage** should consult the value of **#copies** in the current dictionary stack each time they are executed.

The COPIES Value in NVRAM

Additionally, the printer's persistent value (COPIES) for number of copies in NVRAM may also be specified from the control panel or PJL. At the beginning of each job, if the NVRAM value of COPIES has changed and the current value of **NumCopies** is not null, the NVRAM value is copied into **NumCopies**. If the NVRAM value of COPIES has changed and the value of **NumCopies** is null, the NVRAM value is copied into **#copies**.

If the **NumCopies** entry is set persistently in an unencapsulated job (outside the server loop), the value is copied back to the NVRAM value of COPIES at the end of the job.

Setting **#copies** in an unencapsulated job causes its value to be retained for subsequent jobs (semi-persistent operation), but does not affect either the **NumCopies** entry or the control panel setting of COPIES.

In an initialized printer, the default value of COPIES is 1 in NVRAM, the value of **NumCopies** is null, and the value of **#copies** is 1.

Paper Jam Recovery

Enabling jam recovery in a printer insures that the printer retains a full page of data until the corresponding printed page is successfully dropped into the *exit* tray. In Level 2 PostScript, this option is enabled or disabled by the current value of the **ExitJamRecovery** key in the page device dictionary. Jam recovery may also be enabled or disabled through PJL. If **ExitJamRecovery** is true, the printer re-prints pages which jammed in transit to the exit tray. If **ExitJamRecovery** is false and a jam occurs, the printer cancels the current job.

The following PostScript operation placed at the beginning of a job will enable jam recovery:

<< /ExitJamRecovery true >>**setpagedevice**

Setting jam recovery using the **ExitJamRecovery** parameter only affects the current job.

Jam recovery may be activated through PJL as follows:

<ESC>%12345X@PJL SET LPARM:POSTSCRIPT JAMRECOVER=ON<LF>

<ESC>%12345X

Note: The above PJL sequence turns jam recovery on for the PostScript job which follows and does not affect PCL jobs. To persistently turn on jam recovery for PostScript jobs use the **DEFAULT** argument instead of **SET** following @PJL.

Depending on the product, enabling jam recovery can reduce printer throughput (or require more memory to maintain the throughput possible without jam recovery), especially on printers with duplex capability. The factory default for **ExitJamRecovery** is product-specific.

For more information on jam recovery behavior for your printer, see the *LaserJet 4V/4MV User's Manual.*

Level 1 Paper Handling Operators

Level 1 paper handling behavior may be achieved by using compatible Level 1 operators. However, the Level 2 **setpagedevice** operator should not be used in conjunction with Level 1 paper handling operators. Several Level 1 paper handling operators exhibit product-specific behavior.

Level 1 Page Size Operators

The Level 1 page size operators are used to select page sizes and establish imaging areas. The actual imaging area is product-specific and may be found in your *LaserJet 4V/4MV User's Guide*. Text or graphics falling outside the imaging area will be clipped. These operators do not request a specific tray. However, the operators do set a specific media size which will affect the tray selection process.

The following Level 1 page size operators are supported:

Note: Operators for additional paper sizes will be added to this section at a future time.

letter - Establishes a device-specific imaging area centered on an 8.5 by 11.0 inch page.

legal - Establishes a device-specific imaging area centered on an 8.5 by 14.0 inch page.

11x17 - Establishes a device-specific imaging area centered on an 11.0 by 17.0 inch page (portrait orientation).

ledger - Establishes a device-specific imaging area centered on an 11.0 by 17.0 inch page (landscape orientation).

executivepage - Establishes a device-specific imaging area centered on a 7.25 by 10.50 inch page.

a3 - Establishes a device-specific imaging area centered on an 11.69 by 16.54 inch page.

a4 - Establishes a device-specific imaging area centered on a 8.27 by 11.69 inch (210 by 297 mm) page.

jb4 - Establishes a device-specific imaging area centered on an 10.12 by 14.33 inch page.

jb5 - Establishes a device-specific imaging area centered on a 7.16 by 10.12 inch (176.0 by 249.9 mm) page.

com10envelope - Establishes a device-specific imaging area centered on a 4.125 by 9.50 inch envelope.

monarcenvelope - Establishes a device-specific imaging area centered on a 3.875 by 7.50 inch envelope.

c5envelope - Establishes a device-specific imaging area centered on a 6.38 by 9.01 inch envelope.

dlenvelope - Establishes a device-specific imaging area centered on a 110 by 220 mm envelope.

b5envelope - Establishes a device-specific imaging area centered on a 6.95 by 9.84 inch (176.0 by 249.9 mm) envelope.

postcard - Establishes a device-specific imaging area centered on a 3.94 by 5.84 inch page.

doublepostcard - Establishes a device-specific imaging area centered on a 5.83 by 7.87 inch page.

Level 1 Tray Selection Operators

The following operators are used for input tray selection. Operators used to change persistent parameters are marked with an asterisk (*). Refer to the *LaserJet 4V PostScript Language Printer Addendum* and the *PostScript Language Reference Manual Supplement* for more information on these operators.

Note: Paper sizes supported in manual feed only will not have a corresponding "tray" operator.

integer **setdefaultpapertray***

Writes the requested tray number into the **MediaPosition** key in the **pagedevice** dictionary passed to **setpagedevice**. Also writes the **MediaPosition** policy to 0, and the **PageSize, MediaColor, MediaWeight,** and **MediaType** policies to 1.

defaultpapertray *integer*

If the value of **MediaPosition** in the current pagedevice is notnull, returns the value of **MediaPosition**. Otherwise, returns the first element of the **Priority** array in the **InputAttributes** of the current pagedevice dictionary.

integer **setpapertray**

Writes the requested tray number into the **MediaPosition** key in the pagedevice dictionary passed to **setpagedevice**. Also writes the **MediaPosition** policy to 0, and the **PageSize, MediaColor, MediaWeight,** and **MediaType** policies to 1.

papertray *integer*

If the value of **MediaPosition** in the current pagedevice is not null, returns the value of **MediaPosition**. Otherwise, returns the first element of the **Priority** array in the **InputAttributes** of the current pagedevice dictionary.

manualfeed *boolean*

Controls whether paper is fed manually *(true)* or from a paper tray *(false).* Note that **manualfeed is** not an operator. It is a variable defined in statusdict. This value can be changed using any of the operators **put** or **def,** e.g. **/manualfeed *true* def.**

lettertray

If letter paper is available in any tray, the frame buffer size is set to **letter** and the tray containing letter paper is selected. If letter paper is not found in any tray, a rangecheck error is raised.

legaltray

If legal paper is available in any tray, the frame buffer size is set to **legal** and the tray containing legal paper is selected. If legal paper is not found in any tray, a rangecheck error is raised.

11x17tray
ledgertray

If 11x17 paper is available in any tray, the frame buffer size is set to **11x17** and the tray containing 11x17 paper is selected. If 11x17 paper is not found in any tray, a rangecheck error is raised.

executivetray

If executive paper is available in any tray, the frame buffer size is set to **executive** and the tray containing executive paper is selected. If executive paper is not found in any tray, a rangecheck error is raised.

a3tray

If A3 paper is available in any tray, the frame buffer size is set to **a3** and the tray containing a3 paper is selected. If a3 paper is not found in any tray, a rangecheck error is raised.

a4tray

If A4 paper is available in any tray, the frame buffer size is set to **a4** and the tray containing a4 paper is selected. If letter paper is not found in any tray, a rangecheck error is raised.

jb4tray

If B4 paper is available in any tray, the frame buffer size is set to **b4** and the tray containing b4 paper is selected. If b4 paper is not found in any tray, a rangecheck error is raised.

jb5tray

If B5 paper is available in any tray, the frame buffer size is set to **b5** and the tray containing b5 paper is selected. If b5 paper is not found in any tray, a rangecheck error is raised.

com10envelopetray

If Com10 envelopes are available in any tray, the frame buffer size is set to **com10envelope** and the tray containing Com10 envelopes is selected. If Com10 envelopes are not found in any tray, a rangecheck error is raised.

monarcenvelopetray

If monarch envelopes are available in any tray, the frame buffer size is set to **monarcenvelope** and the tray containing monarch envelopes is selected. If monarch envelopes are not found in any tray, a rangecheck error is raised.

c5envelopetray

If C5 envelopes are available in any tray, the frame buffer size is set to **c5envelope** and the tray containing c5 envelopes is selected. If c5 envelopes are not found in any tray, a rangecheck error is raised.

dlenvelopetray

If DL envelopes are available in any tray, the frame buffer size is set to **dlenvelope** and the tray containing dl envelopes is selected. If dl envelopes are not found in any tray, a rangecheck error is raised.

b5envelopetray

If B5 envelopes are available in any tray, the frame buffer size is set to **b5** and the tray containing b5 envelopes is selected. If b5 envelopes are not found in any tray, a rangecheck error is raised.

boolean **setdojamrecovery***

Sets the **ExitJamRecovery** key in the pagedevice dictionary to boolean.

postcardtray

If postcards are available in any tray, the frame buffer size is set to **postcard** and the tray containing postcards is selected. If postcards are not found in any tray, a rangecheck error is raised.

doublepostcardtray

If doublepostcards are available in any tray, the frame buffer size is set to **doublepostcard** and the tray containing doublepostcards is selected. If doublepostcards are not found in any tray, a rangecheck error is raised.

dojamrecovery *boolean*

Returns the value of the pagedevice parameter **ExitJamRecovery**.

Level 1 and setpagedevice Incompatibility

Paper handling features tend to be device- and vendor-specific and can cause PostScript code to be non-portable. This is an issue when writing a program or designing a driver to include Level 2 paper handling features in a job that may be executed on Level 1 printers. The *PostScript Language Reference Manual (Second Edition)* explains the use of the **stopped** operator to encapsulate potentially incompatible statements. However, the **stopped** operator alone cannot be used to resolve all Level 1/Level 2 incompatibilities. This section demonstrates the proper use of the **stopped** operator to resolve **setpagedevice** incompatibilities with Level 1 printers.

The **setpagedevice** operator will cause a job failure on Level 1 printers in a **stopped** context if double-angled brackets are used to define dictionary contents. For example, the following execution on a Level 1 will not fail gracefully:

```
{<</PageSize [612 792]>>setpagedevice} stopped pop
```

Level 1 PostScript will raise a syntax error when the first double-angled bracket is scanned and the job will be flushed, even though the **setpagedevice** operator is encapsulated.

To avoid job failure in this case, use the **put** operator for dictionary definition instead of the double-angled brackets. The following media selection operation will fail gracefully on Level 1 PostScript:

```
{1 dict dup /PageSize[612 792] put setpagedevice} stopped pop
```

Again, avoiding the use of double-angled brackets for **setpagedevice** is only necessary if you intend to run a Level 2 job on a Level 1 printer. If you routinely take advantage of other commands unique to Level 2 in a job, or do not wish to have Level 1 compatibility, always use the double-angled brackets for dictionary definition.

Chapter 7: PostScript Disk

The PostScript disk available on the LaserJet 4MV printer will support all Adobe standard file operators as outlined on pages 350-351 in the ***PostScript Language Reference Manual, Second Edition*** by Adobe Systems Incorporated. We will also support the disk/file system device parameters outlined in the ***PostScript Language Reference Manual Supplement For Version 2013***. In addition, the LaserJet 4MV printer will support several PostScript Level 1 compatibility operators that pertain to the disk. These operators are standard for PostScript printer disks. Following is a summary of those operators present in **statusdict** and **systemdict**. The information about these operators was extracted from the ***PostScript Language Reference Manual Supplement For Version 2013*** by Adobe Systems Incorporated. Information about Level 2 Device Operators can also be found in this supplement.

Note: The interaction between PostScript operators and the DISKLOCK, disk full, and disk not installed features are currently being defined.

statusdict compatibility operators

setuserdiskpercent - (*int* **setuserdiskpercent**) Essentially a no-op - pops an integer off the stack.

userdiskpercent - (**userdiskpercent** *int*) Essentially a no-op - returns 0.

setdosysstart - (*bool* **setdosysstart**) Sets the system parameter **StartupMode** according to the value of *bool*. **StartupMode** is set to 1 if *bool* is *true* and set to 0 if *bool* is *false.*

dosysstart - (**dosysstart** *bool*) Returns *false* if and only if the value of the system parameter **StartupMode** is 0. The system parameter **StartupMode** must be present for the compatibility operator **dosysstart** to be present.

diskstatus - (**diskstatus** *free total*) Returns the number of disk pages (a page is 1024 characters) free and the total number of pages available on all writeable disk devices. This is determined by searching all device parameter sets named %disk*% that have a **Writeable** parameter set to *true*. The * represents zero or more additional characters in the name. *free* is the sum of the **Free** parameters from all such parameter sets, and *total* is the sum of the **LogicalSize** parameters from all such parameter sets.

diskonline - (**diskonline** *bool*) Returns *true* if and only if a writeable disk device is mounted. This is determined by searching all device parameter sets named %disk*%, where * represents zero or more additional characters in the name. If the **Writeable** parameter is *true* for any of the sets searched, *bool* is set to *true*, otherwise it is set to *false*. Note that a disk parameter set with **Writeable** *true* need not have an initialized file system.

initializedisk - *(pages action* **initializedisk**) Initializes each writeable disk, setting the disk device parameters **LogicalSize** and **InitializeAction** to the value of *pages* and *action*+1, respectively.

systemdict compatibility operators

devdismount - *(string* **devdismount**) sets to *false* the **Mounted** device parameter boolean of the parameter set corresponding to the device specified by *string.*

devforall - (*proc scratch* **devforall**) Enumerates all known storage devices. For each storage device, **devforall** copies its name into the supplied *scratch* string, pushes a string object that is the substring of *scratch* that was actually used, and calls *proc.* **devforall** does not return any results of its own, but *proc* may do so.

devformat - (*string pages format* **devformat**) Sets the **LogicalSize** device parameter of the parameter set corresponding to the device specified by *string* to the value specified by *pages*. It then sets the **InitializeAction**, in the same parameter set, to the value of *format*+1.

devmount - (*string* **devmount** *bool*) Sets to *true* the **Mounted** device parameter boolean of the parameter set corresponding to the device specified by *string.* It then returns the resulting value of **Mounted** by reading it from the same parameter set. *True* indicates that the device was successfully mounted or was already mounted. *False* indicates that the device cannot be mounted at this time.

devstatus - (*string* **devstatus** *false)* (if device not found)

(*string* **devstatus** *searchable writeable hasNames mounted removable searchOrder freePages size true* (if device found)

Takes a device name identified by *string* from the stack. If the device name is unknown, *false* will be left on the stack only. If the device name is found, it pushes various file system attributes for the device on the stack. These attributes are: *searchable, writeable, hasNames, mounted, removable, searchOrder, freePages,* and *size.*

searchable	Indicates whether device will be searched when looking for a file with no device name prefix in its name.
writeable	Indicates whether files on this device can be written

hasNames	Indicates whether the device supports named files.
mounted	Indicates whether the device is mounted.
removable	Indicates whether the media within the device can be removed
searchOrder	Indicates the priority at which the device participates when searching for a file in operations in which no device has been specified.
freePages	Indicates the amount of free space (in pages).
size	Indicates the current size of the PostScript software file system (in pages).

Chapter 8: PostScript Printing Memory Recommendations

PostScript Printing Memory Recommendations

Page Size/ Feature	300 dpi	600 dpi
Letter	3 MBytes	6 MBytes
Legal	3 MBytes	7 MBytes
11x17	4 MBytes	11 MBytes
Executive	3 MBytes	5 MBytes
A4	3 MBytes	6 MBytes
A3	4 MBytes	12 MBytes
JIS B5	3 MBytes	5 MBytes
JIS B4	3 MBytes	8 MBytes
Custom	4 MBytes	12 MBytes
I/O Buffering	10 MBytes	
Resource Saving	11 MBytes	

Hewlett-Packard recommends installing an additional 8 Mbytes of memory (12 Mbytes total) to print all supported paper sizes at 600 dpi.

If a complex page fails to print, the menu items IO BUFFER and RESRCSAVE in the MEM CONFIG MENU may be turned to OFF to make more memory available to PostScript. If the page still fails to print, additional memory is required.

Appendix A: LaserJet 4V/4MV Messages

Device Status/Control Panel Messages

Device status messages communicate the current state of the printer to the operator. Device status messages are identified by mnemonics 00-09, 15, and 17. Whenever the device is ready and not busy (i.e., not performing a 'RESET', 'TEST', etc.), the message '**00-READY_____**' is displayed. When the device is performing a function such as a "RESET' or a 'TEST', a device status message is displayed. When the function execution is complete, the display returns to the '**00-READY_____**' message. All device status messages are displayed in the selected display language (except for the power-on '05 SELF TEST' message and the '08 COLD RESET' message).

Both the alpha and the mnemonic portions of all status messages are continuously displayed.

Note that '_' in the following messages represent blank spaces.

- **'00_READY_____'.**
  This message is displayed whenever the device is online and ready for data and no status or device attendance messages are pending at the display.

- **'00_OFFLINE_____'.**
  This message is displayed whenever the device is offline and there are no error messages pending at the display.

- **'00_POWERSAVE____'.**
  This message indicates that the printer is in power save mode. This message may be cleared by any key press, an error condition, or the receipt of printable data.

- **'02_WARMING_UP___'.**
  This message is displayed while the fuser is warming up.

- **'04_SELF_TEST____'.**
  This message is displayed during execution of the continuous self test. Pressing the 'ONLINE' key exits self test mode. If the device is in the process of printing when the 'ONLINE' key is pressed, the device finishes printing the buffered pages before exiting continuous self test mode and returning to the online state. During the printing portions of continuous self test, the display does NOT change to '06_PRINTING_TEST'.

- **'05_SELF_TEST____'.**
  This message is displayed during execution of self test (this includes power-on self test). This status indicates that the printer is performing the non-printing portion of the test. When the non-printing portion of the self test has completed successfully, the display changes to '06_PRINTING_TEST'.

- **'06_PRINTING_TEST'.**
  This message is displayed during the formatting and printing of the self test printout. When the self test is completed, the printer returns to the ready state but remains offline. Only one self test

printout is printed per invocation of the self test; the number of copies selected via the operator control panel or an escape sequence does not affect the number of self test printouts printed.

- **'06_TYPEFACE_LIST'.**
  This message is displayed while the 'TYPEFACE LIST' is being formatted and printed. Upon successful completion of the 'TYPEFACE LIST', the device returns to the ready state but remains offline.

- **'06_DEMO_PAGE____'.**
  This message is displayed while the 'DEMO PAGE' is being formatted and printed. Upon successful completion of the 'DEMO PAGE', the device returns to the ready state but remains offline.

- **'06_CONFIG_PAGE__'.**
  This message is displayed while the 'CONFIG PAGE' is being formatted and printed. Upon successful completion of the 'CONFIG PAGE', the device returns to the ready state but remains offline.

- **'07_RESET_____'.**
  This message is displayed during execution of a reset from the operator control panel. When the reset is completed, the printer returns to the ready state and automatically goes online (the operator does not have to push the 'ONLINE' key).

- **'08_NVRAM_INIT___'.**
  This message is displayed during the initialization of NVRAM. NVRAM can be initialized when it becomes full so the most recent personalities can gain access to the NVRAM.

- **'08_COLD_RESET___'.**
  This message is displayed during the execution of a 'COLD RESET'. When the reset is completed, the device returns to the ready state but remains offline. Because 'COLD RESET' changes all user-hard and user-soft defaults to their factory settings, the operator must press the 'ONLINE' key to indicate that the I/O type and configuration, symbol set, and auto continue mode have been configured correctly before the printer goes to the online state.

- **'09_MENU_RESET___'.**
  This message is displayed during the execution of a 'RESET MENU' from the operator control panel. 'RESET MENU' changes the user-soft defaults to their factory settings. When the reset is completed, the device returns to the ready state and automatically goes online (the operator does not have to push the 'ONLINE' key).

- **'09_RST_ACTIVE_IO'.**
  This message is displayed during the execution of an Active I/O Reset from the operator control panel. When the reset is completed, the device returns to the ready state and automatically goes online (the operator does not have to push the 'ONLINE' key).

- **'09_RESET_ALL_I/O'.**
  This message is displayed during the execution of an All I/O Reset from the operator control panel. When the reset is completed, the device returns to the ready state and automatically goes online (the operator does not have to push the 'ONLINE' key).

- **'10_RESET_TO_SAVE'.**
  This message is displayed whenever the user soft menu is exited or the printer is put online after the menus have been entered and the default configuration has been changed and there is either

buffered data, temporary macros or fonts, user-defined patterns, and/or user-defined symbol sets. The operator can press the '(RESET)' key to reset the printer and go online, or press the '(CONTINUE)' key to go offline without a manual reset, or press the 'ONLINE' key to go online without a manual reset. This message is priority 3.

- **'15_ENGINE_TEST__'.**
  This message is displayed during the execution of a print engine self test. When the test print has completed, the device returns to the ready state but remains offline.

- **'16_TONER_LOW____'.**
  This message indicates that the printer is almost out of toner when "LOW TONER' is set to 'CONT'. This message is first displayed when there are between 100 and 300 more pages which can be printed with the amount of toner remaining in the printer. While this condition persists, this message is displayed in the background; the printer remains online but instead of displaying '00_READY________' it displays '16_TONER_LOW____'. This message is priority 28.

- **'18_MIO_INIT'.**
  This message is displayed when the MIO card is in the process of initializing. This is a status message; during initialization the MIO is not active, but since LaserJet 4V supports I/O switching the printer remains online. Display will clear automatically (this may take up to five minues, depending on the MIO card and network connectivity).

- **'18_MIO_NOT_READY'.**
  This message is displayed when the MIO card is not ready. The Bi-Tronics parallel port will continue to operate normally. The operator may attempt to clear the display by turning the printer off, removing the MIO card, and then turning the printer on. Pressing '(CONTINUE)' will not clear this error.

- **'68_READY/SERVICE'.**
  This message indicates that NVRAM is full. Some menu items will not be saved to NVRAM. The '00 READY' message becomes '68 READY/SERVICE' to remind the operator of the problem. This message has the same priority as the '00 READY' message.

- **'W1_IMAGE_ADAPT__'.**
  Clearable warning indicating that adaptive data compression had to resort to Lossy compression to fit the raster graphics in the available memory. This has caused a data loss in the raster output.

- **'W2_INVALID_PERS_'.**
  Clearable warning indicating that PJL encountered a request for a personality that did not exist in the printer. The job was aborted and no pages printed.

- **'W3_JOB_ABORTED__'.**
  Clearable warning indicating that the personality for the current job could not be run in the available memory. The job was aborted and no pages printed.

- **'WM_JOB_600/11X17'.**
  Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of '11X17' to fit in the available memory.

- **'WM_JOB_600/A3'.**

Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of 'A3' to fit in the available memory.

- **'WM_JOB_600/LGL'.**
  Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of 'LGL' to fit in the available memory.

- **'WO_JOB_600/A4'.**
  Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of 'A4' to fit in the available memory.

- **'W9_JOB_600/LTR'.**
  Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of 'LTR' to fit in the available memory.

- **'W8_JOB_600/OFF'.**
  Clearable warning indicating that the job parameters of resolution and page protection could not be met with the available memory. The job was downgraded to a resolution of 600 DPI and page protect of 'OFF' to fit in the available memory.

- **'WM_JOB_300'.**
  Clearable warning indicating that the PostScript job could not be printed in 600 DPI so the job was printed at 300 DPI.

- **'WM_MEM_CNFIG_N/A'.**
  This warning indicates that because of configuration changes either I/O buffering, resource saving, or both are not available.

- **'WM_CHK_MEM_CNFIG'.**
  Clearable warning indicating that the printer does not have enough memory to use the current settings of I/O buffering and resource saving. Usually occurs after removing memory from the printer.

- **'WM_XXXX_MEM_FULL'.**
  The resource save area for personality 'XXXX' is full. To continue printing, press 'CONTINUE'. Some data will be lost.

- **'WD_DISK_NOT_INIT'.**
  Clearable warning indicating that the PostScript disk has not been properly initialized. To continue printing, press '(CONTINUE)'.

- **'WL_WARNINGS_LOST'.**
  Clearable warning indicating the buffer of clearable warning overflowed and subsequent warning have been lost. Warning will continue to be discarded until this warning is acknowledged. Not possible on LaserJet 4V.

Device Attendance Messages

Device attendance messages communicate to the device operator that they must perform some action such as adding paper or clearing a paper jam. Device attendance messages are identified by numeric mnemonics 10-14 and 16 and also by language (i.e. English, French) dependent mnemonics such as MP, ST, etc. in the case of English. Device attendance messages such as '12_PRINTER_OPEN', 'MP_LOAD_LETTER__', etc., disappear from the display once attended. All device attendance messages are displayed in the selected display language.

The mnemonic portion of device attendance messages flashes at a 1Hz rate, 0.5 seconds on and 0.5 seconds off. The alpha portion of these device attendance messages is continuously displayed.

- **'12_PRINTER_OPEN_'.**
  This message is displayed whenever the engine senses that the upper main body of the printer is not closed properly. After the printer's upper main body is latched properly, the device status message '02_WARMING UP' may appear in the display, depending on whether the fuser is warm or not. Pressing either the '(CONTINUE)' or the 'ONLINE' key, after the '00 READY' message appears, causes the printer to go online.

- **'13_PAPER_JAM____'.**
  This message is displayed when the engine senses a paper jam. The operator must open the printer, remove the jammed paper, close the printer, and press either the '(CONTINUE)' or the 'ONLINE' key to resume printing. Note the printer must be opened to clear the paper jam error.

- **'14_NO_TONER_CART'.**
  This message indicates that the toner cartridge is either not installed or not correctly installed in the printer. To correct this error, the operator must insert a toner cartridge or make sure the installed cartridge is fully seated. Pressing either the '(CONTINUE)' or the 'ONLINE' key after installing the cartridge, causes the printer to go online.

- **'16_TONER_LOW____'.**
  This message indicates that the printer is almost out of toner when 'LOW TONER' is set to 'STOP'. This message is first displayed when there are between 100 and 300 more pages which can be printed with the amount of toner remaining in the printer. This message causes the printer to go offline until the operator presses the 'CONTINUE' key or replaces the toner cartridge. If the operator presses the 'CONTINUE' key the printer goes online and changes the low toner message from a device attendance message to a device status message.

- **'MF_FEED_[Paper size]'.**
  This message is displayed whenever there is a request for a sheet of paper to be manually fed. '[Paper size]' may be one of the following: 'LETTER', 'LEGAL', 'A4', 'EXEC', '11x17', 'A3', 'COM10', 'MONARCH', 'C5', 'DL', 'JIS B4', and 'JIS B5', (paper) or 'B5', 'JPOST', and 'JPOSTD' (envelope).

- **'MF_FEED_[Envelope size]'.**
  This message is displayed whenever there is a request for an envelope to be manually fed. '[Envelope size]' may be one of the following: 'COM10', 'MONARC', 'DL', 'C5', 'B5', 'JPOST', 'JPOSTD', or 'ENVELOPE'.

  If the user has specified via the select media size escape sequence 'Esc&l#A' the size of the envelope which the envelope data is to be formatted for, that size is used. If the user has not specified a size via the select media size escape sequence, the envelope is formatted for the

default media. If the envelope is being formatted for an area which is not the size of any of the envelopes in the preceding list, the '[Envelope Size]' field is set to 'ENVELOPE'.

- **'xx_LOAD_[Paper size]'.**
  This message is displayed whenever there is a user request for a paper size that is not currently installed in the printer. The 'xx' is either 'MP', 'PC', or 'LC', indicating a paper load of the MP tray, standard cassette, or optional lower cassette, respectively. '[Paper size]' may be one of the following: 'LETTER', 'LEGAL', 'A4', 'EXEC', '11x17', 'A3', 'COM10', 'MONARCH', 'C5', 'DL', 'JIS B4', and 'JIS B5' (paper) or 'B5', 'JPOST', and 'JPOSTD' (envelope). After the requested paper cassette is loaded, the device automatically goes online (the operator does not have to press the 'ONLINE' key). If the requested paper size does not match the size of the paper in the installed cassette, pressing the '(CONTINUE)' key allows the operator to print on the loaded paper; however, the output is formatted for the requested paper size and thus image clipping may occur. Printing continues until the page length or media size is set again or until a data stream personality reset or control panel reset function is performed. 'xx' depends on the current tray and the type of paper requested. This message is also generated when the current tray runs out of paper and no other auto-selectable trays contain that size of paper.

- **'xx_LOAD_[Envelope size]'.**
  This message is displayed whenever there is a user request for an envelope size that is not currently installed in the pirnter. The 'xx' is 'MP', indicating a envelope load of the MP tray. '[Envelope size]' may be one of the following: 'COM10', 'MONARC', 'DL', 'C5', 'B5', 'JPOST' and 'JPOSTD'. After the requested envelope size is loaded into the MP tray, the device automatically goes online (the operator does not have to press the 'ONLINE' key). If the requested envelope size does not match the size of the envelopes in the requested tray, pressing the '(CONTINUE)' key allows the operator to print on the loaded envelopes; however, the output is formatted for the requested envelope size and thus image clipping may occur. Printing continues until the page length or media size is set again or until a data stream personality reset or control panel reset function is performed . This message is also generated when the current tray runs out of envelopes and no other auto-selectable trays contains that size of envelopes.

- **'xx_TRAY_EMPTY'.**
  This message is displayed when a tray, not currently selected, has run out of paper. The 'xx' is either 'PC', or 'LC', indicating an empty standard cassette or optional lower cassette, respectively. The 'xx' portion of the message does not blink. the printer remains online.

The following tables summarize the messages for paper mounts and manual feed requests for the MP Tray, Standard cassette, and optional lower cassette for all paper sizes and envelope sizes supported by LaserJet 4V. The '_' in the messages in the following table represent blank spaces.

Media Size	Manual Sheet Feed	MP Tray
Letter	MF_FEED_LETTER	MP_LOAD_LETTER
Legal	MF_FEED_LEGAL	MP_LOAD_LEGAL
A4	MF_FEED_A4	MP_LOAD_A4
Executive	MF_FEED_EXEC	MP_LOAD_EXEC
Ledger (11x17)	MF_FEED_LEDGER	MP_LOAD_LEDGER
A3	MF_FEED_A3	MP_LOAD_A3
Japanese B4	MF_FEED_JIS_B4	MP_LOAD_JIS_B4
Japanese B5	MF_FEED_JIS_B5	MP_LOAD_JIS_B5
Custom (11.7x17.7)	MF_FEED_CUSTOM	MP_LOAD_CUSTOM
COM10	ME_FEED_COM10	MP_LOAD_COM10

Monarch	ME_FEED_MONARCH	MP_LOAD_MONARCH
C5	ME_FEED_C5	MP_LOAD_C5
DL	ME_FEED_DL	MP_LOAD_DL
B5	MF_FEED_B5	MP_LOAD_B5
Japanese Postcard	ME_FEED_JPOST	MP_LOAD_JPOST
Japanese Double Postcard	MF_FEED_JPOSTD	MP_LOAD_JPOSTD

Media Size	Standard Cassette	Optional Lower Cassette
Letter	PC_LOAD_LETTER	LC_LOAD_LETTER
Legal	PC_LOAD_LEGAL	LC_LOAD_LEGAL
A4	PC_LOAD_A4	LC_LOAD_A4
Ledger (11x17)	PC_LOAD_11x17	LC_LOAD_11x17
A3	PC_LOAD_A3	LC_LOAD_A3
JIS B4	PC_LOAD_JIS_B4	LC_LOAD_JIS_B4
JIS B5	PC_LOAD_JIS_B5	-

Error Messages

Error messages communicate data and print errors to the device operator. Data errors are identified by mnemonics 20-29. Print errors are identified by mnemonics 40-49. All errors in this category are affected by the user-hard default setting for 'AUTO CONT'. If 'AUTO CONT' is 'ON', the device displays an error message and goes offline for ten seconds. After ten seconds the printer automatically returns to the online state. If 'AUTO CONT' is 'OFF', the device displays an error message and goes offline and remains offline until the operator presses the '(CONTINUE)' key. All error messages are displayed in the selected display language.

The mnemonic portion of all error messages flashes at a 1 Hz rate, 0.5 seconds on and 0.5 seconds off. The alpha portion of all error messages is continuously displayed.

Note that '_' in the following messages represent blank spaces.

- **'20_MEM_OVERFLOW'.**
  This message indicates that more data has been received from the computer than fits in the printer's internal memory. To continue printing, press the '(CONTINUE)' key. Only the amount of data that fits in the printer's internal memory is printed.

- **'21_PRINT_OVERRUN'.**
  This message indicates that the page formatting process was not fast enough for the printer. Press the '(CONTINUE)' key to continue printing. There may be some data loss on the page that was being formatted when the error occurred.

- **'22_PAR_IO_ERROR'.**
  This error indicates that the printer's parallel buffer has overflowed during a busy state. Pressing the '(CONTINUE)' key resumes printing but results in a loss of data.

- **'22_MIO_ERROR'.**
  This error indicates that the printer's MIO buffer has overflowed during a busy state. Pressing the '(CONTINUE)' key resumes printing but results in a loss of data.

- **'40_MIO_ERROR'.**
  This error indicates that an MIO connection has been abnormally broken. To continue printing, press the '(CONTINUE)' key.

- **'41.x_ERROR'.**
  This error indicates that a temporary error has occurred in the printed page. To correct the error, remove the paper from the output paper tray. To continue printing press the '(CONTINUE)' key. The page on which the error occurred is automatically reprinted. The X indicates the exact cause of the error, as described below.

'x'	Error
1	Noisy VSREQ signal
2	Beam detect malfunction
3	Paper pick misfeed
4	Late VSYNC
5	Unknown state

- **'41.3_PAPER_ERROR'.**
  This message indicates that a temporary error has occurred in the printed page. The cause of this error is the paper in the tray is different than the size of paper indicated. To correct the error, remove the paper from the output paper tray. To continue printing press the '(CONTINUE)' key. NOTE: This error is not auto-continuable.

- **'42_OPT_INTERFACE'.**
  For previous products this error indicated a problem with the XIO interface. LaserJet 4V will need to map this error to an MIO error.

- **'43_OPT_INTERFACE'.**
  For previous products this error indicated a problem with the XIO interface. LaserJet 4V will need to map this error to an MIO error.

Service Messages

Service messages communicate device failures to the operator. Service messages have mnemonics 50-70. The operator may attempt to clear service conditions such as '51_ERROR' by pressing the '(CONTINUE)' key. The operator may attempt to clear service conditions such as '61_SERVICE' by power cycling the device. If a condition persists after either pressing the '(CONTINUE)' key or power cycling the printer, service is required. Service messages are not affected by the user-hard default setting for 'AUTO CONT'. All service messages are displayed in the selected display language; except during the initial power-on self test.

The mnemonic portion of all service messages flashes at a 1 Hz rate, 0.5 seconds on and 0.5 seconds off. The alpha portion of all service messages is continuously displayed. Note that '_' in the following messages represent blank spaces.

- **'50_SERVICE'.**
  This error indicates a fusing assembly malfunction. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'51_ERROR'.**
  This message indicates a beam detect malfunction. Press the '(CONTINUE)' key to resume printing.

- **'52_ERROR'.**
  This message indicates a scanner malfunction. Press the '(CONTINUE)' key to resume printing.

- **'53-XY-ZZ_ERROR'.**
  This message indicates an error on a RAM SIMM. Press the '(CONTINUE)' key to resume printing. If a SIMM device caused the error, the device will not be configured. User the table below to decode the X, Y, and ZZ values.

  X - Hardware Type:
  0: ROM
  1: RAM

  Y - Hardware Device:
  0: On board RAM/ROM
  1: SIMM slot one (closest to processor)
  2: SIMM slot two
  3: SIMM slot three
  4: SIMM slot four

  ZZ - Hardware Type:
  0: Unsupported memory
  1: Unrecognized memory
  2: Unsupported memory size
  3: Failed RAM test
  4: Exceeded maximum RAM size
  5: Exceeded maximum ROM size
  6: Invalid SIMM speed
  7: SIMM reporting information incorrectly
  8: SIMM RAM parity error

- **'55_ERROR'.**
  This message indicates a printer command error, meaning that commands cannot be exchanged between the print engine and its controller. Pressing the '(CONTINUE)' key clears the error and resumes printing.

- **'57_SERVICE'.**
  This message indicates a main motor failure.

- **'58_SERVICE'.**
  This message indicates a fan motor failure.

- **'61.x_SERVICE'.**
  This message indicates a parity error when accessing the SIMM in slot 'x'. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'62.x_SERVICE'.**
  This message indicates a problem with the internal memory. Where an 'x' value of 0 indicates internal, 1-4 indicates SIMM slots 1-4. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'63_NEEDS_SERVICE'.**
  This message occurs only at power up and indicates the destructive RAM test failed.

- **'63_SERVICE'.**
  This message indicates the internal RAM memory test failed. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'64_SERVICE'.**
  This message indicates a scan buffer error. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'65_SERVICE'.**
  This message indicates a dynamic RAM controller error. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'67_SERVICE'.**
  This message indicates a miscellaneous interface hardware error. Attempt to clear the error by power cycling the printer. If the error persists, service is required.

- **'68_ERROR'.**
  This message indicates a recoverable error has been detected in the NVRAM. Press the '(CONTINUE)' key to clear the error, then verify the control panel settings; one or more fields have been reset to their factory defaults during error recovery.

- **'68_SERVICE'.**
  This message indicates NVRAM is full. Press the '(CONTINUE)' key to clear the display. The '00 READY' message becomes '68 READY/SERVICE' to remind the operator of the condition.

- **'70_ERROR'.**
  The firmware cartridge/SIMM cannot be executed. The cartridge is not designed for this formatter or the cartridge parameters are inappropriate for this hardware environment.

- **'71_ERROR'.**

The firmware cartridge/SIMM cannot use this version of the BIOS.

- **'72_SERVICE'.**
  The font cartridge/SIMM has been removed while the firmware was trying to read it. This causes an address error. This message is a special case of a 79 ERROR to indicate the cause of the problem.

- **'79_SERVICE(XXXX)'.**
  The firmware has detected an unrecoverable error. Attempt to clear the error by power cycling the printer. The XXXX indicates the error type, this number should be reported to a software engineer.

- **'80_SERVICE(XXXX)'.**
  The firmware has been informed of an unrecoverable error by the MIO card. Attempt to clear the error by power cycling the printer. The XXXX indicates the error type, this number should be reported to a software engineer.

- **'81_SERVICE(XXXX)'.**
  The firmware has detected an error found during manufacturing of the formatter board. This error should never reach the field, but in case it does the error can be handled in one of two ways. You can continue from the error by pressing the '(CONTINUE)' key or you can erase the error by doing a cold reset to the printer. User's should report this error to a service representative.

- **'FS_DISK_FAILURE'.**
  This message indicates the PostScript disk failed self-test. Press the '(CONTINUE)' key to clear the error.

79 Service Codes

Code	Task	Description
0101	PS	Configuration table pointer nil
0102	PS	Unrequested read message received
0105	PS	Unrequested delay complete message received
0106	PS	Unrequested inquiry acknowledge message received
0107	PS	Unrequested clear I/O acknowledge message received
0108	PS	PS_init_complete called, but PS_state is not PS_INIT2_STATE
0109	PS	Unrequested image message received
010A	PS	Unrequested open frame complete message received
010B	PS	Unrequested/invalid semaphore message received
010C	PS	Unrequested write packet flush message received
010D	PS	Unable to create I/O related subpool
010E	PS	Unrequested NVEE response message received
010F	PS	Unrequested USTATUS configuration message
0110	PS	Unrequested USTATUS configuration change handshake
0111	PS	Unrequested Set IO Configuration handshake
0112	PS	Unrequested frame release handshake
0113	PS	No channels message received before phase 2 init
0115	PS	Unable to start PJL during initialization
0116	PS	Unrequested entity directory delete handshake
0117	PS	Unrequested entity directory build handshake
0118	PS	Unrequested status purge handshake
0119	PS	Unrequested IP stack release handshake
011A	PS	Unrequested IP stack allocation handshake
011B	PS	Unrequested device attendance handshake
011C	PS	Unrequested INFO STATUS handshake
011D	PS	Unrequested handshake for "start I/O buffer relocation"
011E	PS	Unrequested handshake for "finish I/O buffer relocation"
0120	PS	Invalid "forced online" semaphore
0121	PS	PJL Personality is Position Dependent
0122	PS	Wrong type frame for open frame handshake
0123	PS	Unrequested one frame release handshake
0124	PS	Unrequested environment save config handshake
0125	PS	Unrequested page buffer acquire handshake
0126	PS	Unrequested release I/O buffer pool handshake
0127	PS	Unrequested super offine handshake
0128	PS	Unrecognized file system hand shake

0303	IOP	Invalid opcode
0315	IOP	Unexpected port
0316	IOP	Bad queue remove
0317	IOP	Unexpected timer expired
0319	IOP	Unexpected inactive response
031b	IOP	Unexpected clear response
031c	IOP	Unexpected clear response
0320	IOP	Invalid buffer type
0321	IOP	Invalid ustatus type

0322	IOP	Write buffer not in RAM
0324	IOP	Invalid port destination for write
0325	IOP	Extra timer going
0328	IOP	Unable to release to DMA
0329	IOP	Improper IOC using DMA

0400	EI	Bad state
0401	EI	Status packet queue, no memory
0402	EI	Control queue, no memory
0403	EI	Attempting to duplex an envelope
0405	EI	No page associated with this strip

0500	PAGE	PG task is in an unknown state
0501	PAGE	No strip returned in mailbox of STRIP_BUILT msg that was expected
0502	PAGE	Unable to find page token associated with a strip that was printed by the EI task
0504	PAGE	EI received an image strip out of sequence
0505	PAGE	During the abort process, PG received an abort end signal from a task it was not expecting
0506	PAGE	During the abort process, PG received an abort end signal from a task other than itself
0507	PAGE	During the abort process, PG was unable to properly recover all strips from EI
0508	PAGE	During the abort process, PG was unable to properly recover all strips from IP
0509	PAGE	No page token was in mailbox of NEW_PAGE msg
050A	PAGE	No page token was in mailbox of OPEN_FRAME msg
050B	PAGE	No image strip was in mailbox of STRIP_COMPLETE msg
050C	PAGE	Attempt to attach a frame to a committed page
050D	PAGE	Engine signaled invalid page complete
050E	PAGE	Multiple pages attached to a single frame
050F	PAGE	The personality interface is telling PG to release all its frames when PG currently has none
0510	PAGE	While attaching frame images to strips, PG found the frame images were out of sequence
0511	PAGE	Hang in last page mode
0512	PAGE	Unknown frame type
0513	PAGE	The personality interface sent an ACQUIRE_FRAME msg with no frames in the mailbox
0514	PAGE	The frame image area is smaller than what the strip intermediate is expecting
0515	PAGE	Trying to attach a strip frame to a page when no strip frames of the given resolution is owned by PG
0516	PAGE	Trying to attach a full frame to a page when no full frames of the given resolution is owned by PG
0517	PAGE	The PG task is unable to find the associated back side page token of a front side page token after the pages have been printed
0518	PAGE	The PG task is unable to find the associated back side page token of a front side page token after the pages have been transferred to the output bin.
0519	PAGE	Duplex prediction error

051A	PAGE	During the abort process, PG was unable to find the associated back side page token of a font side page token.
051B	PAGE	The PG task was unable to find the associated page token of strip that is ready to be sent to the IP task for imaging
051C	PAGE	A committed page token was received without a frame
051D	PAGE	A page token was received with an invalid frame type
051E	PAGE	Trying to unattach a frame from a page token but the frame is already unattached
051F	PAGE	A release frame request from the personality interface came when there were no release request structures left in the queue
0520	PAGE	A strip was imaged by the IP, PG could not find the page token associate with the strip
0521	PAGE	In an attempt to convert a full frame to a pseudo frame type, could not find the frame on the free full frame queue
0522	PAGE	PG received a page token during last page mode
0523	PAGE	PG received a transferred page token from EI that it was not expecting
0524	PAGE	PG acquired a frame which it already owned

0601	IP	State error
0602	IP	Strip error
0603	IP	Allocation error
0604	IP	Timeout error
0605	IP	Intermediate error
0606	IP	Bucket error
0607	IP	Selftest error
0608	IP	Unnecessary image error
0609	IP	Semaphore error

0801	DM	Acknowledge from wrong task error
0802	DM	Configuration pointer error
0803	DM	no emergency pool memory for message
0804	DM	Invalid entity module
0805	DM	Invalid memory type
0806	DM	Invalid memory unit
0807	DM	Entity not installed
0808	DM	No memory for entity directory

0900	SD	Invalid initialization state

0B01	DG	Invalid initialization state
0B02	DG	NVRAM compare fail
0B03	DG	Unable to allocate NVRAM structures
0B04	DG	NVRAM write fail

0D03	PIO	Invalid opcode on parallel
0D14	PIO	Unable to allocate parallel buffer
0D16	PIO	Bad queue remove on parallel
0D1A	PIO	Unexpected first byte on parallel
0D1F	PIO	Unexpected inactive message on parallel

0D27	PIO	Unable to reconfigure I/O buffering

0E01	MIO	Unable to allocate MIO buffer
0E02	MIO	Invalid state on MIO
0E03	MIO	Invalid opcode on MIO
0E04	MIO	Invalid opcode on MIO without card
0E05	MIO	Invalid opcode on MIO
0E06	MIO	Invalid peripheral MIO request
0E08	MIO	Invalid PGP command
0E09	MIO	In mailbox valid not set
0E14	MIO	Unable to allocate MIO buffer
0E17	MIO	Unexpected timer expired
0E1A	MIO	Unexpected first byte on MIO
0E26	MIO	String for set_io_config too big
0E27	MIO	Unable to reconfigure I/O buffering

1003	SIO	Invalid opcode on serial
1014	SIO	Unable to allocate serial buffer
1016	SIO	Bad queue remove on serial
101A	SIO	Unexpected first byte on serial
101F	SIO	Unexpected inactive message on serial
1027	SIO	Unable to reconfigure I/O buffering

1101	PML	Unrequested buffer received
1102	PML	No memory available
1103	PML	Out of sequence numbers

1201	FS	File system out of memory or invalid message opcode.
120D	FS	Invalid file system subopcode.
1210	FS	Bad parameter passed in call to IDE disk driver.
1211	FS	Internal defect in IDE disk driver.
1212	FS	Illegal re-entrant call to IDE disk driver.

4041	PSLIBGEN	PSLIBinit terminated abnormally
4047	PSLIBGEN	Invalid page state detected in PersClosePage
4049	PSLIBGEN	Invalid response for system state variable
404F	PSLIBGEN	Personality page complete signal queue overflow
4051	PSLIBGEN	Unable to allocate memory
4053	PSLIBGEN	Call to CloseIntermediate failed
4055	PSLIBGEN	Error during commit buffer
4057	PSLIBGEN	Personality back block or stack pointer is NULL
4058	PSLIBGEN	Event control error
4059	PSLIBGEN	Error during call to PersReadData or PersReturnReadData
405A	PSLIBGEN	Error during call to PersSaveReadData
405B	PSLIBGEN	Error during call to psWriteData or AcknowledgeWritePacket
405C	PSLIBGEN	Error during call to PersFlushData
405D	PSLIBGEN	Invalid options in PersOpenPage
405E	PSLIBGEN	Insufficient number of personalities

405F	PSLIBGEN	PERS called unimplemented interface routine
4060	PSLIBGEN	NVEE response did not match inquiry
4061	PSLIBGEN	PJL global variables pointer is NULL
4062	PSLIBGEN	Personality global variables pointer is NULL
4063	PSLIBGEN	Personality terminated with a crash condition
4064	PSLIBGEN	Personality terminated, wrong interface version
4065	PSLIBGEN	Unable to allocate frame buffer
4066	PSLIBGEN	Bad parameters to PersWrite Data
4067	PSLIBGEN	Bad parameters to PersFlushData
4069	PSLIBGEN	Too many installed personalities
406A	PSLIBGEN	Too many installed PDD personalities
406B	PSLIBGEN	No PJL personality
406C	PSLIBGEN	No PJL personality stack
406D	PSLIBGEN	No PJL personality back block
406E	PSLIBGEN	No PJL personality globals
406F	PSLIBGEN	Can't find back block for current personality
4071	PSLIBGEN	Frame buffer size lookup error
4072	PSLIBGEN	Bad parameters to PersOpenPage
4073	PSLIBGEN	Error during call to PersClosePage
4074	PSLIBGEN	Bad page disposition - Clear duplex
4075	PSLIBGEN	Bad page disposition - Missing backside
4076	PSLIBGEN	Bad page disposition - Missing frontside
4077	PSLIBGEN	Ran out of page header frames
4078	PSLIBGEN	Ran out of page tokens
407A	PSLIBGEN	Reconfigure frames with open pages
407B	PSLIBGEN	Personality created too many frames
407C	PSLIBGEN	Calculated top of gray doesn't match parameter
407D	PSLIBGEN	Bad strip configuration
407E	PSLIBGEN	Personality left a page open

4082	PSLIBIP	Insufficient memory for page intermediate
4083	PSLIBIP	No strips on the page
4084	PSLIBIP	PersPageOpen no memory for page intermediate structures
4085	PSLIBIP	No memory for page intermediate structures
4086	PSLIBIP	Invalid rotation angle in PersRotate
408D	PSLIBIP	PersPutRule invalid X value
4094	PSLIBIP	Invalid bitmap returned form PersCloseBitmap
4095	PSLIBIP	Corrupted page intermediate data structures
4096	PSLIBIP	Page intermediate lost or corrupted
4097	PSLIBIP	Bitmap lost or corrupted
4098	PSLIBIP	Image lost or corrupted
4099	PSLIBIP	PSLIBIP state stack underflow
409A	PSLIBIP	PersPutScaledImage, invalid vertScale parameter
409B	PSLIBIP	PersPutScaledImage, invalid horizScale parameter
409C	PSLIBIP	Invalid descSize field in PersSetPattern
409D	PSLIBIP	Error during pslibip_attach_strip strip recovery
409E	PSLIBIP	Lost frame buffer
409F	PSLIBIP	No sort slot in pslibip_attach_strip

40A1	PSLIBMET	Image pointer shouldn't be non-NIL

40A2	PSLIBMET	Bad image class detected
40A3	PSLIBMET	Invalid intermediate opcode detected
40A4	PSLIBMET	Bad image scale value detected
40A6	PSLIBMET	Couldn't get free page buffer

40B0	PJLLIBES	Unable to create subpool
40B1	PJLLIBES	Couldn't allocate PDD global variables
40B2	PJLLIBES	Couldn't allocate global variables
40B3	PJLLIBES	Couldn't allocate personality stack
40B5	PJLLIBES	Couldn't allocate personality back block
40B6	PJLLIBES	Memory reconfiguration failed

40C1	PJLLIB	Waiting for device attendance handshake, received some other message
40C3	PJLLIB	Could not find any valid personality to invoke
40C4	PJLLIB	PJL parser reported firmware crash
40C5	PJLLIB	PJL parser reported bad system interface version
40C6	PJLLIB	PJL parser could not allocate sufficient memory

40E0	PSLIBCOMP	No QSTATE1 memory
40E1	PSLIBCOMP	No QSTATE2 memory
40E2	PSLIBCOMP	Golden block overflow

40F0	PSLIBMEM	Out of memory at initialization time
40F1	PSLIBMEM	Could not create memory pool

411F	PERS	Scalable buffer overflow
4140	PERS	Bad font format
4143	PERS	Font does not exist
4144	PERS	Font error detected in auto rotate
4145	PERS	Font does not exist (CTG)

9E19	OS	Emergency pool extends beyond pdd_base after memory resizing

XX01	XX	No MCBs
XX02	XX	Bad stack
XX03	XX	Bad memory size
XX04	XX	Over memory border
XX05	XX	Bad memory allocation
XX06	XX	Bad memory free
XX07	XX	Bad memory format
XX08	XX	Bad memory deallocation
XX09	XX	Bad memory reallocation
XX0A	XX	No FCBs
XX0C	XX	Stack overflow
XX0E	XX	No emergency pool
XX13	XX	TCB semaphore has NIL link
XX14	XX	Task tried to suspend not in user state
XX15	XX	No personality pool

XX16	XX	No IO pool
XX17	XX	No PDD Buffer pool
XX19	XX	Bad PDD base
XX20	XX	Bad PDD pool start
XXFF	XX	Opcode crash

XXAA	80960	Arithmetic fault
XXAB	80960	Constraint fault
XXAC	80960	Floating point fault
XXAD	80960	Machine fault
XXAE	80960	Operation fault
XXAF	80960	Protection fault
XXBA	80960	Trace fault
XXBB	80960	Type fault
XXBF	80960	Address fault
XXCF	80960	MIO fault
XXDF	80960	Hardware video under run

01	personality
02	IOC
03	IOP
04	EI
05	PG
06	IP
07	CP
08	DM
09	SD
0A	KB
0B	NV
0C	DG
0D	PIO
0E	MIO
0F	MIO2
10	SIO
11	PML
12	FS
1E	OS
20	H/W
40	PSLIB
41	Personality
8X	OS service called by task X
9E	OS service called by OS

80 Service Codes

Code	Description
0001	MIO card attempted a BUFFER_CONFIGURATION before an IDENTIFY
0002	Invalid buffer negotiation during configuration
0003	MIO card does not support host-to-printer communication
0004	MIO card does not support SELF_TEST_DESCRIPTION for self tests 1 and 2
0005	Invalid Peripheral General Purpose packet address received from the MIO card
0006	MIO card did not set the CLR_RSP OR TM_OUT bits of the peripheral mailbox during initialization
0007	MIO card was reset for unknown reasons. This occurs if the CLR_RS or TM_OUT bits of the peripheral mailbox are set after initialization has occurred
0009	Peripheral General Purpose watchdog has expired
0019	Buffer configuration request not received
001A	Selftest has overrun expected time limit
001B	An individual MIO test within the overall system test has overrun the expected time limit
001F	MIO not accepting commands from printer
0020	MIO card did not set the CLR_RSP bit during initialization within the "time to completion" value (plus 1 second)
0033	MIO card returned invalid status to a READ_DATA request
0034	MIO card returned invalid status to a WRITE_DATA request
0035	MIO card specified invalid maximum buffer length in BUFFER_CONFIGURATION request
0036	MIO card returned invalid status to an ASCII_IO_CONFIGURATION request
0037	MIO card returned invalid status to an INQUIRE_IO_STATUS request
0039	MIO card returned invalid status to an IO_DESCRIPTION request
003A	MIO card returned invalid status to a SET_PERIPHERAL_DISPLAY request
003B	MIO card returned invalid status to an ASYNC_PERIPHERAL_STATUS request
003C	MIO card returned invalid status to a SELF_TEST request
003D	MIO card returned invalid status to a SELF_TEST_DESCRIPTION request
003E	Unknown peripheral name return status
003F	Unknown write retrieve return status
0050	MIO card returned an ASCII_IO_CONFIGURATION buffer less than 6 bytes
0051	MIO card returned an IDENTIFY buffer less than 7 bytes
0052	MIO card sent an ASYNC_IO_STATUS request with a buffer length less than 7 bytes
0053	MIO card returned an INQUIRE_IO_STATUS buffer less than 7 bytes long
0054	MIO card returned a read packet never given to it. This will occur if the printer owns more read packets than the number of new read packets received.
0055	MIO card returned an IO_DESCRIPTION string longer than 32 characters or not NULL terminated
0056	MIO card returned "Error Encountered" status to a SELF_TEST request with a buffer length less than 2 bytes
0057	MIO card returned an ASCII_IO_CONFIGURATION item string longer than 13 characters, not NULL terminated, or zero length
0058	MIO card returned an ASCII_IO_CONFIGURATION parameter string longer than 14 characters, not NULL terminated, or zero length
0059	MIO card returned a SELF_TEST fail message longer than 32 characters or not NULL terminated
005A	Display message packet not properly terminated

005B	MIO card returned SELF_TEST_DESCRIPTION buffer length less than 2 bytes
005C	MIO card returned a SELF_TEST_DESCRIPTION self test type different than the command modifier
005D	MIO card returned an IDENTIFY MIO version earlier than 4.0
005E	MIO card does not support command modifiers 0 and 1 of the IO_DESCRIPTION request
005F	MIO card returned ASCII_STATUS with invalid return status
0060	MIO card returned SET_IO_CONFIGURATION with invalid return status
01XX	MIO card specific error. The hex value XX was in the peripheral mailbox error byte
02XX	MIO card specific error. The hex value XX was the fail code in response to a SELF_TEST request
03XX	IO card specific error. The hex value XX was the first byte of the INQUIRE_IO_STATUS response buffer
04XX	MIO card specific error. The hex value XX was the first byte of the ASYNC_IO_STATUS request buffer

PJL Error Codes

The following list specifies the set of PJL error codes and corresponding front panel display string for informational messages:

PJL Error Code	Display String
10001	00 READY (ready)
10001	[Pers. ready mesg] (ready)
10001	[PJL RDYMSG] (ready)
10001	68 READY/SERVICE (ready)
10003	02 WARMING UP
10004	05 SELF TEST
10005	07 RESET
10006	16 TONER LOW
10011	18 MIO INIT
10011	18 MIO NOT READY
10013	04 SELF TEST
10014	06 PRINTING TEST
10015	06 TYPEFACE LIST
10016	15 ENGINE TEST
10017	06 DEMO PAGE
10018	09 MENU RESET
10019	09 RST ACTIVE IO
10020	09 RESET ALL I/O
10021	08 COLD RESET
10022	06 CONFIG PAGE

The following list specifies the set of PJL error codes and corresponding front panel display string for background and foreground paper mounts:

PJL Error Code	Display String
11xyy	[Background paper mount]
41xyy	[Foreground paper mount]

The printer remains online during a [Background paper mount] (such as LC TRAY EMPTY). The printer is offline during a [Foreground paper mount] (such as LC LOAD LETTER). The 'x' character in the PJL error codes for background and foreground paper mounts correspond to one of the following tray codes:

x = Tray Code	Tray
0	MP Tray
1	Manual Feed
2	PC Tray
3	LC Tray

The 'yy' characters in the PJL error codes for background and foreground paper mounts correspond to one of the following media size codes:

yy = Media Code	Media Size
00	Unknown paper
01	Unknown envelope
02	Letter paper
03	Legal paper
04	A4 paper
05	Exec. paper
06	11x17 paper (Ledger)
07	A3 paper
08	COM10 envelope
09	Monarch envelope
10	C5 envelope
11	DL envelope
12	JIS B4 paper
13	JIS B5 paper
14	B5 envelope
15	Custom
16	Japanese Postcard
17	Japanese Double Postcard

The following list specifies the set of PJL error codes and corresponding front panel display strings for auto continuable conditions:

PJL Error Code	Display String
30016	20 MEM OVERFLOW
30017	21 PRINT OVERRUN
30018	40 SER IO ERROR
30018	40 MIO ERROR`
30027	22 SER IO ERROR
30027	22 PAR IO ERROR
30027	22 MIO ERROR
30034	41.X ERROR
30035	68 ERROR
30036	68 SERVICE

The following list specifies the set of PJL error codes and corresponding front panel display strings for conditions where operator intervention may be required.

PJL Error Code	Display String
35029	W1 IMAGE ADAPT
35031	W2 INVALID PERS
35032	WL WARNINGS LOST
35037	W3 JOB ABORTED
35039	W9 JOB 600/LTR
35040	WO JOB 600/A4
35041	W8 JOB 600/OFF
35073	WM CHK MEM CNFIG
35074	WM MEM CNFIG N/A
35076	WM XXXX MEM FULL
35078	00 POWERSAVE
35081	WM JOB 300
35982	WD DISK NOT INIT
35084	WM JOB 600/LGL
35085	WM JOB 600/A3
35086	WM JOB 600/11x17

The following list specifies the set of PJL error codes and corresponding front panel display strings for conditions where operator intervention is required.

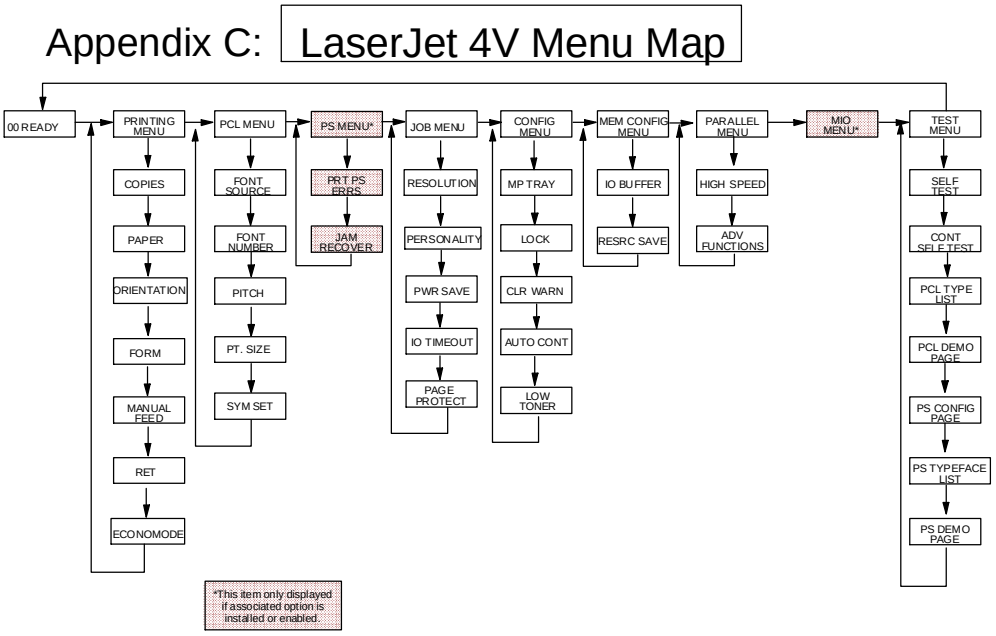
PJL Error Code	Display String
40021	12 PRINTER OPEN
40022	13 PAPER JAM
40010	14 NO TONER CART
40024	FE CARTRIDGE
40026	PC INSTALL
40038	16 LOW TONER
40046	F1 INSERT CART
40047	FR REMOVE CART
40048	[PJL OPMSG]
40049	[PJL STMSG]
40050	50 SERVICE
40051	51 ERROR
40052	52 ERROR
40053	53-XY-ZZ ERROR
40054	54 ERROR
40055	55 ERROR
40056	56 ERROR
40057	57 SERVICE
40058	58 SERVICE
40059	59 ERROR
40061	61.X SERVICE
40062	62.X SERVICE
40063	63 SERVICE
40064	64 SERVICE
40065	65 SERVICE
40067	67 SERVICE
40069	70 ERROR
40070	71 ERROR

40071	72 SERVICE
40079	00 OFFLINE
40083	FS DISK FAILURE

Appendix B: I/O Buffering and Resource Saving Table

I/O Buffering and Resource Saving Table									
Installed Memory		PostScript Installed?		I/O Buffering				Resource Saving	
			Auto	MIN (on)	Max (on)		Auto	MIN (on)	Max (on)
4M		No	10K	10K	100K		NC	NC	NC
5M		No	100K	10K	1000K		NC	NC	NC
4M+XM		No	X * 100K	10K	Calc (<=XM)		NC	NC	NC
< 10M		Yes	NC	NC	NC		NC	NC	NC
10M		Yes	10K	10K	100K		NC	NC	NC
11M		Yes	100K	10K	Calc (<=1M)		PMIN	0, PMIN	Calc (<=1M)
12M		Yes	200K	10K	Calc (<=2M)		PMIN+PAUTO	0,PMIN	Calc (<=2M)
12M+XM		Yes	X*100K	10K	Calc (<=XM)		PMIN+(X-1) * PAUTO	0,PMIN	Calc (<=XM)
1) PMIN - minimum resource saving size for a given personality									
2) PAUTO - amount of AUTO resource saving memory added per megabyte for a given personality									
3) Calc (<=XM) - calculated value; depends on current configuration; not to exceed XM									
4) Currently PMIN = 400K (PCL) and 400K (PS) and PAUTO = 100K (PCL) and 100K (PS), but is subject to change									

Appendix C: LaserJet 4V Menu Map



HEWLETT PACKARD

*If two MIO cards are installed then an MIO Menu 2 will be displayed.

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