Hewlett-Packard Company

Color LaserJet 4500

Product Developer's Guide

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Introduction

HP Color LaserJet 4500 is based on the new Canon P340 engine. The primary objective of the HP Color LaserJet 4500 printer is to break new ground as the lowest cost, shared color workgroup printer. The firmware feature set delivered is intended to support this objective. The HP Color LaserJet 4500 printer's key marketing messages include:

- **Communicate more effectively**
  - Very high definition output
  - Unparalleled media flexibility
- **More effectiveness for less money**
  - Monochrome laser cost of operation
  - Best color cost per page
- **Easy to use solutions**
  - Fewer interventions
  - Easy consumable management
  - HP leading systems solutions
- **Less time and effort to produce output**

Product Configurations

4500 Base Model C4084A

16 ppm monochrome, 4 ppm color, 600 dpi, 400 sheet input capacity, 250 sheet output capacity, 32 MB RAM.

4500N Network Model C4089A

Base model plus network card and additional memory (64 MB RAM).

4500DN Duplexer - Network Model C4094A

Network model plus duplexer, 500-sheet feeder, and additional memory (64 MB RAM).

Terminology

DIMM	Acronym for Dual In-line Memory Module; a narrow printed circuit board that holds RAM memory chips.
EIO	Extended I/O. Second generation protocol of MIO.
Media	A sheet of printable media on which two images can be printed (one on each side). Used interchangeably with the term *paper*.
Media Size	The physical size of a sheet of media (Letter, Legal, A4, Com10).
Media Type	The physical characteristics of a sheet of media (Plain, Letterhead, Recycled, 3-Hole, Transparencies, Yellow Colored).
Tray 1	Multi-purpose tray. An additional input tray on the front of the printer that can be used to input small quantities of media.
Paper Bin	One of the physical output containers that hold media.
Paper Tray	One of the physical input containers that holds media.
PML	Peripheral Management Language. A language for reading and setting printer features and monitoring printer activity asynchronously from the print data being sent to the printer.
Universal paper tray	Input paper tray that holds the following sizes: LTR, A4, LGL, EXE, A5, B5JIS, B5ISO (as custom), and OHT.

Differences between HP Color LaserJet Printers

Following are comparisons between HP Color LaserJet 4500, HP Color LaserJet 5/5M, and HP Color LaserJet 8500 in the areas of print speed, print quality, and optional accessories.

HP Color LaserJet 5/5M Incompatibility Summary

The following list identifies the features, options, and accessories for HP Color LaserJet 5/5M that are not compatible with the HP Color LaserJet 4500 printer.

- HP Color LaserJet 5/5M PostScript SIMMs cannot be used in the HP Color LaserJet 4500 printer.
- HP Color LaserJet 5/5M memory SIMMs cannot be used in the HP Color LaserJet 4500 printer.
- HP Color LaserJet 4500 control panel and menu structure is different.
- HP Color LaserJet 5/5M toner cartridges cannot be used in the HP Color LaserJet 4500 printer.
- HP Color LaserJet 5/5M paper trays cannot be used in the HP Color LaserJet 4500 printer.
- HP Color LaserJet 4500 does not have an optional 250 sheet rear feed unit.
- HP Color LaserJet 5/5M does not support the HP Color LaserJet 4500 optional 500-sheet feeder.
- HP Color LaserJet 4500 has a different set of built-in fonts than HP Color LaserJet 5/5M. The HP Color LaserJet 4500 printer's fonts are compatible with HP LaserJet 5/5M/5N/5N and HP LaserJet 4000/5000/8000.
- HP Color LaserJet 4500 does not support PCL commands for saturation, lightness or color table downloads.
- HP Color LaserJet 4500 has only screen match and vivid color treatments.
- SRGB is the supported color space for the HP Color LaserJet 4500 printer. Luminance-chromonance and cRGB color spaces are not supported.
- PCL5C render algorithms 'snap to primaries' and 'snap black to white and all others to black' are not supported.
- HP Color LaserJet 4500 does not support 11x17-inch paper.
- HP Color LaserJet 5/5M MIO cards are not compatible with the HP Color LaserJet 4500 printer's EIO slots.
- Envelopes, labels and glossy paper (not glossy film) are supported on the HP Color LaserJet 4500 printer.

- HP Color LaserJet 4500 has job cancel.
- HP Color LaserJet 4500 can print legal color pages.
- HP Color LaserJet 4500 supports glossy media, which is paper. HP Color LaserJet 5/5M supported glossy film.
- HP Color LaserJet 4500 duplexes color and monochrome pages.
- The colors printed by HP Color LaserJet 4500 and HP Color LaserJet 5/5M will be different in response to the same file.
- HP Color LaserJet 4500 does not have manual feed, but has implemented TRAY 1=FIRST.
- HP Color LaserJet 4500 uses screen match as the default color treatment, HP Color LaserJet 5/5M used vivid.
- HP Color LaserJet 4500 has a smaller imagable area, which may change the text layout. Using a HP Color LaserJet 5/5M driver with the HP Color LaserJet 4500 printer maybe a workaround for this problem.

External Differences

The externally noticeable differences between HP Color LaserJet 4500 and HP Color LaserJet 5/5M are:

- HP Color LaserJet 5/5M supports 11x17 paper while the HP Color LaserJet 4500 printer does not. Because of this, the HP Color LaserJet 4500 printer is smaller than HP Color LaserJet 5/5M.
- HP Color LaserJet 4500's Tray 1 is in the front of the printer.
- HP Color LaserJet 4500's optional paper tray is underneath the printer, the HP Color LaserJet 5/5M optional tray is a rear feed unit.
- HP Color LaserJet 4500 supports PostScript font DIMMS.
- HP Color LaserJet 4500 uses a bidirectional parallel cable (IEEE 1284-C compliant) with a "C-size connector to the printer, the HP Color LaserJet 5/5M uses a B cable.

HP Color LaserJet 5/5M Incompatibility

- HP Color LaserJet 4500 cannot use the HP Color LaserJet 5/5M fast raster driver.

HP Color LaserJet 8500 Incompatibilities

- HP Color LaserJet 4500 has an on-line help function associated with the control panel.
- HP Color LaserJet 4500 has JetReady, hardware ready bits.
- HP Color LaserJet 4500 has JetSend.
- HP Color LaserJet 8500 prints 11x17 color pages, the HP Color LaserJet 4500 printer does not print 11x17.

PostScript Differences between HP Color LaserJet 4500 and HP Color LaserJet 8500

Native Color Model

HP Color LaserJet 4500	CMY	**HP Color LaserJet 8500**	CMYK

Language Level

HP Color LaserJet 4500	Level 2 revision 2014 with selected features from 2015, 2016, and 2017.	**HP Color LaserJet 8500**	Level 3.

Color Smart Color Treatment Commands

HP Color LaserJet 4500	Uses the same ColorSmart commands as HP Color LaserJet 5/5M.	**HP Color LaserJet 8500**	Custom solution using a printer specific dictionary.

Color Smart Halftones

HP Color LaserJet 4500	Uses HP supplied halftones designed for the HP Color LaserJet 4500.	HP Color LaserJet 8500	Uses HP supplied halftones designed for the HP Color LaserJet 8500.

Gloss Finish

HP Color LaserJet 4500	Key added to the page dictionary. Allows a gloss finish to be placed on a matte media.	HP Color LaserJet 8500	Will ignore gloss finish command.

Driver compatibility

HP Color LaserJet 4500	HP Color LaserJet 8500 driver will ignore HP Color LaserJet 4500 specific settings and the file will print.	HP Color LaserJet 8500	HP Color LaserJet 4500 specific settings will be ignored and the file will print.

Print Speed and Print Quality

Attribute	HP Color LaserJet 4500	HP Color LaserJet 5/5M	HP Color LaserJet 8500
Monochrome print speed	16 ppm	10 ppm	24 ppm
Full color print speed	4 ppm	2 ppm	6 ppm
Engine resolution	600 dpi	300 dpi	600 dpi
Finish	• Matte finish for plain paper • Glossy finish for plain and glossy paper • Color transparencies	• Matte finish for paper • Glossy finish for transparencies and gloss media	• Matte finish for plain paper • Matte finish for glossy film • Color transparencies
Grayscale	8-bit grayscale for text, images and vectors, no h/w Ret.	4-bit grayscale with no h/w REt. PCL supports f/w anti-aliasing for text and images, not for rotated fonts. PostScript supports f/w anti-aliasing for text but not images.	8-bit grayscale for text, images, and vectors.

Optional Accessories

Accessory	HP Color LaserJet 4500	HP Color LaserJet 5/5M	HP Color LaserJet 8500
500 sheet tray	Yes	No	No
2000 sheet tray	No	No	Yes
Duplexer	Yes	No	Yes
250 sheet rear feed unit	No	Yes	No
SIMM RAM memory modules	No	Yes	No
DIMM RAM memory modules	Yes	No	Yes
PostScript SIMM	No, PS resident	Yes	No, PS resident
Font DIMMS (see note)	Yes	No	Yes
Multi Bin Mailbox – 8 slots	No	No	Yes
Disc	No	No	Yes
Flash	No	No	No

Note: Font DIMMS include Arabic, Cyrillic, Hebrew, Greek and special fonts.

HP Parallel Port Cable Recommendations

The Parallel port located on the back of the HP Color LaserJet 4500 printer is IEEE 1284 compliant. Therefore, HP recommends that you use an IEEE 1284 compliant parallel cable that is 10 meters or less in length to connect the host computer to the printer. In addition, this parallel cable must be designed to plug into the high-density C style connector on the printer end. Below is a table of HP recommended cables for use with the HP Color LaserJet 4500 printer.

HP IEEE 1284C Compliant Parallel Cables

HP Part Number	Length	Connector Type	Compatibility
C2946A	3 meters/9 feet	A to C (DB-25 to 36-pin high-density)	HP LaserJet 6P/6MP HP LaserJet 4500
C2947A*	10 meters/32 feet	A to C (DB-25 to 36-pin high-density)	HP LaserJet 6P/6MP HP LaserJet 4500

*IEEE 1284 compatible computer is required on the host end of this cable.

Consumables

Consumable	Life	Approximate Replacement Frequency
Cyan toner cartridge	6K pages	3 months
Yellow toner cartridge	6K pages	3 months
Magenta toner cartridge	6K pages	3 months
Black toner cartridge	9K pages	4.5 months
Drum Kit	25,000 black and white only pages, or 6,250 color pages	12.5 months for black and white only pages or 3 months for color pages.
Transfer Kit	100,000 black and white only pages, or 25,000 color pages	50 months for black and white only pages or 12.5 months for color pages.
Fuser Kit	100,000 black and white only pages, or 50,000 color pages	50 months for black and white only pages or 25 months for color pages.

Note: Approximate average A4/letter-size page count based on 5% coverage of individual toner colors. Page counts are only estimations and usage conditions and print patterns may cause results to vary.

JetDirect Connectivity Options

- EIO Ethernet card – 10Base T
- EIO Combo Card – Ethernet (10Base T and 10Base 2) and LocalTalk (DIN-8)
- EIO Token Ring card – DB9 and RJ45
- EIO Ethernet 10/100 card – 10Base T and 100TX

Memory

4, 8, 16, 32, and 64-Mbytes DIMM (100-pin, non-parity, synchronous SDRAM DIMMs only).

Media Handling

HP Color LaserJet 4500 has both built-in and optional paper handling devices, which are described below.

Built-in Media Handling Devices

The base HP Color LaserJet 4500 product has one 250 sheet input paper tray (Tray 2) and a multi-purpose tray (Tray 1) that holds 150 sheets of 20 pound paper, 50 sheets of overhead transparencies (OHT), 12 Com 10 envelopes, or sheets of labels. There is a 250-sheet facedown output bin on the top of the printer and a 100-sheet face-up output bin on the backside of the printer.

Optional Media Handling Devices

Optional paper handling devices supported by the HP Color LaserJet 4500 printer include a 500-sheet paper feeder (Tray 3) and a duplexer, both of which are user installable.

Supported Media Sizes for the HP Color LaserJet 4500 Printer

The following table shows the paper sizes supported which input sources support each size, and which output sources support each size.

Media Size	Tray 1	Tray 2	Tray 3	Duplex Unit*	Control Panel Name
Letter (8.5 x 11.0 inches)	✓	✓	✓	✓	LETTER
A4-ISO (210 x 297 mm)	✓	✓	✓	✓	A4
Legal (8.5 x 14 inches)	✓	✓	✓	✓	LEGAL
Executive (7.25 x 10.5 inches)	✓	✓	✓	✓	EXEC
B5 - Japan (182 x 257 mm)	✓	✓	✓	✓	JIS B5
A5 (148.5 x 210 mm)	✓	✓			A5
Universal* (215.9 x 355.6 mm)	✓	✓**	✓**		CUSTOM
Envelopes					
B5 Envelope (176 x 250 mm)	✓				B5
Com10 Envelope (4.125 x 9.5 inches)	✓				COM10
C5 Envelope (162 x 229 mm)	✓				C5
DL Envelope (110 x 220 mm)	✓				DL
Monarch (3.875 x 7.5 inches)	✓				MONARC

*Duplex unit supports only 17-28 lb. Bond equivalent media.

** Trays 2 and 3 use "Custom" size for the physical configuration available on these trays for B5 ISO, and Tray 3 additionally uses "Custom" size for the physical configuration available for A5. These trays do not support ranges of custom sizes like tray 1.

Caution: Transparencies are not supported to the rear bin.

The printer automatically detects the media size of tray 2 and the optional 500-sheet tray based on the tray's physical configuration.

Supported Media Types for the HP Color LaserJet 4500 Printer

The predefined Media Types supported by the HP Color LaserJet 4500 printer are contained in the following table. The Media Type is the ASCII string reported by the formatter firmware to application drivers via PML and is the string used by the PDLs to select a Media Type for a given page or pages. The Control Panel Name is used in control panel messages. Unlike the Control Panel Names, the predefined Media Types are NOT localized at the printer for each of the supported languages (they may be localized by the driver).

Media Type	Detail on type	Control Panel Name
Plain[1]	16-28 lb. Bond	PLAIN
Preprinted	16-28 lb. Bond	PREPRINTD
Letterhead	16-28 lb. Bond	LTRHEAD
Transparency[2]	HP Color LaserJet Transparency Film	TRNSPRNCY
Gloss	32 lb. Bond = 80lb.Book	GLOSS
Prepunched	16-28 lb. Bond	PREPUNCHD
Labels[2,3,4]	Any good quality label	LABELS
Bond	16-28 lb. Bond	BOND
Recycled	All types	RECYCLED
Color	16-28 lb. Bond	COLOR
Heavy[4]	28 lb. – 36 lb. (Canon), 43 lb. (HP)	HEAVY
Card Stock[2,3,4]	32-43 lb.	CARDSTOCK
[1] The factory default Media Type. [2] HP Color LaserJet transparency film (letter and A4-size) HP Color LaserJet (4500/8500) glossy media (letter and A4-size) Not supported in the duplex unit. [3]Not available for tray 2 and 3. [4]Special print modes are used.		

Media Compatibility

		HP Color LaserJet 5/5M	*HP Color LaserJet 4500*	*HP Color LaserJet 8500*
Sizes	A5, B5		X	X
	Exec	X	X	X
	A4, Letter	X	X	X
	Legal	X (black & white only)	X	X
	Tabloid	X (black & white only)		X
	A3, 11x17	X		X

		(black & white only)		
Types	Plain	X	X	X
	Transparencies	X	X	X
	Glossy Film	X	*Possibly*	*Possibly*
	Glossy Paper		*Possibly*	*Possibly*
	Labels		X	X
	Envelopes		X	X
Weights	16-19 lb. (60-74g/m^2)		X	X
	20-24 lb. (75-90g/m^2)	X	X	X
	25-42 lb. (91-157g/m^2)		X	X
	43-60 lb. (158-225g/m^2)			X

Paper Jam Recovery

As with all HP LaserJet family products, the HP Color LaserJet 4500 printer will support Paper Jam Recovery. Paper Jam Recovery is a feature of the printer that insures that when a paper jam occurs, all pages affected by the jam will be re-printed. During this recovery, the printer might reprint several good pages that were printed before the paper jam due to sensor limitations. However, it is better to err on the conservative side instead of losing pages. Unfortunately, the user will have to sort out the duplicated pages.

When Paper Jam Recovery is disabled for a job, pages in the paper path will not be reprinted. Loss of pages is probable if a jam occurs during a job for which Paper Jam Recovery is disabled.

Control Panel

The HP Color LaserJet 4500 control panel is designed to be much less complex than the control panels of either HP Color LaserJet or HP Color LaserJet 5/5M. The HP Color LaserJet 4500 uses the same general display as HP LaserJet 5/5M/5N/5N with minor key position changes to accommodate the area provided on the engine for a control panel. The display used on the HP LaserJet 5/5M/5N/5N product has undergone extensive usability testing with very favorable results. The same general display is also used on HP LaserJet 4000.

The display is a 2x16 LCD. There are six keys and three LEDs. By using the same display as HP LaserJet 4000 we can gain cost leverage.

Rhino (Real Help is Now Online)

Control panel messages which display the help symbol (white "?" mark on black background) have additional help. Real Help Is Now Online (RHINO) consists of a key on the front panel, which when pressed, will display the "help message." One display's worth of the message is shown, and upon additional presses of the -> key, the next portion of the message is displayed. Error messages that require multiple actions by the user have the help messages added for clarity.

Control Panel Differences from HP Color LaserJet/HP Color LaserJet 5/5M

- The menu, item, and value (formerly +/-) keys are all rocker switches permitting both forward and backward movement on one key.
- There is a general, multi-purpose "GO" key that covers online/offline, continue, and form-feed.
- There is a job cancel key to kill the job currently being printed.
- There is no manual feed LED.

- Status messages no longer have a numerical prefix.
- Menus may be traversed without pressing a key to go offline.
- All items applicable on a per-job basis such as copies, font, pitch, orientation, and form size remain in the menus since these items are important for large customers using their own drivers. We have appropriate utilities to support changing these items through PML if deemed appropriate.
- There is an online help functions for error messages that require complex actions.
- HP Color LaserJet 4500 has the control panel localized in 13 languages.

I/O

HP Color LaserJet 4500 printer provides enhanced communications between the host computer and the printer. The printer includes a built-in P1284 parallel interface and two EIO slots for additional I/O possibilities.

EIO

EIO is the second generation of the Modular I/O (MIO) interface which provides HP products with a proprietary expansion slot. The EIO slot is a general-purpose expansion slot suitable for supporting I/O cards, disk drives, graphics co-processors, and other accessories. The EIO specification describes the mechanical, electrical, and accessory class identification of EIO accessories. The HP Color LaserJet 4500 printer has two EIO interface slots which can be used for an Intelligent I/O (IIO) card.

Intelligent I/O

Intelligent I/O cards comply with the EIO and IIO specifications and replace MIO cards. All capabilities defined in the IIO Specification revision 1.BL are supported. The HP Color LaserJet 4500 IIO implementation supports a superset of MIO functionality including:

- Multiple stream channels (allows PJL unsolicited status to be routed to the correct host).
- Multiple datagram channels (allows many hosts to interact with DM, via PML, nearly simultaneously).
- Printer information required by specific I/O links.
- Card supplied self-test pages and menus.
- Clink and disc are not supported on the HP Color LaserJet 4500 printer.

Three IIO JetDirect cards available:

- 10 Base T (twisted pair Ethernet)
- Combo-10 Base T, 10 Base 2 (coax), 10 Base 100 and LocalTalk
- Token Ring

P1284

The HP Color LaserJet 4500 printer contains a built-in parallel port that supports the bi-directional protocol known within HP as "Bitronics." This protocol has been more formally defined in the IEEE 1284 specification and is referred to as P1284. The P1284 interface supports a superset of the HP LaserJet 5 printer. The capabilities include:

- Centronics® compatibility

- IEEE P1284 (Bitronics)
  - ECP
  - Device ID

- IEEE P1284.4 (MLC)
  - Imaging system (PCL, PostScript, PJL) stream channel
  - Device management (PML) datagram channel

- Of the two connectors allowed by the specification, the HP Color LaserJet 4500 printer supports the "C" connector, the same as the second parallel port on the HP LaserJet 5P. Most other HP LaserJet products support the "B" connector.

The HP Color LaserJet 4500 printer will ship with a 10Base-T/100Base-T card: J3113A HP JetDirect 600N 10/100TX. While this card does not work in HP Color LaserJet or HP Color LaserJet 5/5M, it will work in HP LaserJet 4000, and should work in any of the other HP LaserJet 4000/5000/8000 products.

PML

One of the major weaknesses of the PJL feature in HP Color LaserJet and HP Color LaserJet 5/5M was that the PJL commands had to be sent to the printer as part of the data stream. Therefore, these commands could be backed up behind a large job or could be blocked on one channel because another channel was continuously busy. PML (Peripheral Management Language) fixes this problem by creating a second logical channel through which the host can communicate directly with the printer without the communications backing up in the data stream. PML can be received and processed on one channel while another channel is receiving and processing data. PML is the primary means of controlling and monitoring the printer.

Environmental Concerns

One of the goals of the HP Color LaserJet 4500 printer program is to design a more environment friendly printer. Features that support this goal include "sleep mode" to reduce power consumption during idle time, the ability to use recycled paper, and a new toner cartridge design to reduce waste. The HP Color LaserJet 4500 printer is not Blue Angel certified; although all certification criteria were met except that the HP Color LaserJet 4500 printer uses Azo in the yellow toner.

Sleep Mode

The HP Color LaserJet 4500 printer includes a power saving idle mode referred to as "sleep mode." The HP Color LaserJet 4500 printer meets the requirements of the EPA Energy Star program and will be Energy Star certified. This requires the printer to reduce its power consumption to a maximum of 45 Watts (as measured from the wall outlet) after 60 minutes of inactivity. The amount of idle time before going into sleep mode is configurable by the user with the default being 60 minutes. The user can also disable sleep mode. The HP Color LaserJet 4500 printer is able to receive and respond to PML requests and other network communications without coming out of sleep mode.

Recycled Paper

The HP Color LaserJet 4500 printer is designed and tested to ensure that the jam rate is acceptable when using recycled paper from any paper tray.

Acoustics

Operation/position-

L_{PA} 56 dB(A) printing

L_{PA} 48 dB(A) idle

Bystander 1m-

L_{PA} 52 dB(A) printing

L_{PA} 44 dB(A) idle

Sound power-

L_{WAD} 6.6 bels (A) printing

L_{WAD} 5.8 bels (A) idle

The HP Color LaserJet 4500 printer met the printing sound power goal (6.7 bels). Impulse noises during printing are a significant contributor to the measurement. Idle noise levels are higher than our goals.

PCL Functionality Overview

Fonts

The HP Color LaserJet 4500 printer supports the same fonts as HP LaserJet 5/5M/5N/5N and HP LaserJet 4000/5000/8000.

Features

- ColorSmart
  - Color spaces
  - Color treatments
  - Hardware assisted halftoning
  - Multiple palette management
- Raster
  - Palette management
  - Scaling
  - Compression modes
  - Pixel encoding modes
  - JPEG encoding
- Device Specific Issues
  - Media finish
  - Media type
  - Media size – up to legal size printed in color
  - Multiple Input/Output Tray Support
- Duplex

- MET

PostScript Functionality Overview

Following is a list of the PostScript features for the HP Color LaserJet 4500 printer.

- Prints 600 dpi contone in base memory:
  - Prints 24 bit text and graphics in contone in base memory.
  - Prints images at least at 8 bit.
- Printing at speed (4 ppm color and 16 ppm monochrome).
  - Passes HP Color LaserJet 5/5M performance tests.
- ColorSmart
  - Provides object tagging for text, graphics, and images.
  - Allows user to specify halftone and color rendering intent for each object (text, graphics and image).
  - Operator compatible with HP Color LaserJet 5/5M color rendering intent.
- Halftones
  - Uses HP hardware for halftoning.
  - Allows users to download halftones.
- CRDs
  - Uses HP hardware for color calibration.
  - Allows user to download CRDs.
  - "Shares" color table data with other personalities.
- Font support
  - Fonts are the same as HP LaserJet 4000.
  - Font DIMMs are supported.
- PostScript is integrated into the base firmware system.
- Paper handling support.
  - Jam recovery.
  - Duplex support.
- Calibrated CMYK, CIE based DEFG support.

Forms and Macros

Forms Solution

The objective of the HP Color LaserJet 4500 forms solution is to provide the customer with a solution for storing, managing, and using forms information. The leveraged solutions are heavily biased toward PCL as the language of choice in managing forms.

It is not a HP Color LaserJet 4500 printer objective to provide a solution which is compatible with the HP LaserJet 4Si printer, or with any third party approaches that use Flash SIMM unless they conform to published standards for the personality interface (Volumes 1 and 2), or with applications written to work with the Lexmark Optra C using any non HP documented features.

PCL Macro Approach

Forms are implemented within the PCL language as macros. A macro is simply a list of PCL and HPGL commands tagged with a macro ID number. When the macro is enabled as an overlay (form), the

commands are executed by PCL after a partial and temporary reset of the printer. The resulting page looks like a preprinted form had been put into the input paper tray.

Macros are managed like fonts. A macro can be downloaded with job persistence (temporary macros). A macro may be made "permanent," which means it persists until the printer is powered off. A macro may also be read from a plug-in DIMM module sold by a form's vendor. In each of these cases an ID number ranging from 0 to 32767 identifies a macro.

The HP Color LaserJet 4500 printer does not support a file system or a disk. Therefore, macros may not be identified with alphanumeric ID's or written to flash DIMMS.

Service Provider Interface

The Service Provider mechanism provides a method for a number of "Service Providers" (sets or libraries of code) to provide or request services to or for one another and with other resources within the printer. Communication is provided by a static call table interface known as the Service Provider Interface. Service Providers are structured as entities and generally conform to the definitions of the HP LaserJet 5Si firmware code base Personality Interface documentation. The Providers are spawned and managed by the Service Provider Manager task.

The HP Color LaserJet 4500 printer implements the Service Provider Interface in a manner consistent with the HP LaserJet 4000 product. In the HP Color LaserJet 4500 printer, the interface is used to support the JetSend implementation only. The entire interface has been implemented with only minor exceptions. However, the focus is to support JetSend and only those portions of the interface required for JetSend will receive thorough testing.

JetSend

The HP Color LaserJet 4500 printer supports the JetSend device to device communication protocol. This protocol allows JetSend enabled devices, connected to the Internet, to transfer data directly without going through a computer or other server. It is expected that this will provide a solution for scanners or other digital source devices to print directly to a HP Color LaserJet 4500 printer. Customer uses would be for convenience color copies or color fax.

The JetSend functionality allows a sending device to negotiate for paper size, resolution, image size and orientation, and then transfer data directly to the printer via one of the supported encodings. Currently, resolution is limited to no more than 300dpi in order to limit transfer times. Future enhancements are planned to take advantage of the Hardware Ready Bit path to print high-resolution data at high speed.

JetReady (Hardware Ready Bits)

The JetReady concept is based on using a host-RIP (Raster Image Processor) to render RGB, convert the RGB to YCC and then compress the resulting bitmap using JPEG and/or MRC (Mixed Raster Content). JetReady provides a path directly into the printer's hardware imaging pipeline. It bypasses the rendering system that resides in the firmware using the printer's hardware to decompress. JetReady as implemented for the HP Color LaserJet 4500 printer uses a vendor unique command in PCL-XL to pass device specific data to the printer from a JetReady driver.

Localization

The following table highlights some of the key localization items for the HP Color LaserJet 4500 printer and which languages apply.

Language	Quick Reference Card	Control Panel	Labels	User Guide	Win '95 Driver	Win 3.1 Driver	Win NT 4.0 Driver	Win NT 5.0 Driver	Internal Pages
English	✓	✓	✓	✓	✓	✓	✓	✓	✓
German	✓	✓	✓	✓	✓	✓	✓	✓	✓
French	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spanish	✓	✓	✓	✓	✓	✓	✓	✓	✓
Swedish	✓	✓	✓	✓	✓	✓	✓	✓	✓
Norwegian	✓	✓	✓	✓	✓	✓	✓	✓	✓
Italian	✓	✓	✓	✓	✓	✓	✓	✓	✓
Russian	✓	✓	✓	✓	✓	✓	✓	✓	
Dutch	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chinese, traditional and simplified	✓		✓	✓	✓	✓	✓	✓	
Finnish	✓	✓	✓	✓	✓	✓	✓	✓	✓
Danish	✓	✓	✓	✓	✓	✓	✓	✓	✓
Korean	✓		✓	✓	✓	✓		✓	
Portuguese	✓	✓	✓	✓	✓	✓	✓	✓	✓
Arabic									
Czech	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hungarian									
Polish	✓	✓	✓	✓	✓	✓	✓	✓	✓
Japanese, Katakana and Kanji	✓	✓	✓	✓	✓	✓	✓	✓	

Media Handling

The following section specifies the media handling model as it relates to the media handling features of the HP Color LaserJet 4500 printer (16 ppm monochrome, 4 ppm full color, 600 dpi.

Objectives

The primary objective of the HP Color LaserJet 4500 media handling model is to assist users in exploiting the full capabilities of the HP Color LaserJet 4500 printer and to provide functionality appropriate for a mid-range network printer. Furthermore, the HP Color LaserJet 4500 printer may use special media at times for specific color performance. This media can be expensive, and media handling characteristics need to minimize this media's unintentional use. Other model considerations are HP LaserJet family compatibility, with both past and future products, and utilizing all the printer's media handling features while maintaining throughput at maximum engine speed.

The HP Color LaserJet 4500 media-handling model uses the HP LaserJet 4000/5000/8000's model as a basis. Deviations from HP LaserJet 4000/5000/8000's model do exist when appropriate for the HP Color LaserJet 4500 printer's usage model or when necessary to minimize firmware schedule risk.

Conventions

Exact control panel messages as well as control panel key names appear in uppercase. Specific bin and tray names appear capitalized. Areas of uncertainty are bracketed or indicated by three question marks and will be updated when more information is available.

Definitions

The following list gives the common interpretation for some of the words used in this document.

Auto-Selection	A method of selecting an input tray or output bin by which the selection is made automatically by the formatter firmware.
Custom-sized Paper	Paper, which is of a size not explicitly supported by a particular engine. For example, 8 x 10 paper is not explicitly supported by the HP Color LaserJet 4500 engines, but the engine is physically capable of imaging 8 x 10 paper.
Engine	The part of the HP Color LaserJet 4500 product that controls the actual printing process and media movement through this process.
Explicit-Selection	A method of selecting an input tray or output bin by which the selection is made by a data stream command sequence.
Formatter	The part of the HP Color LaserJet 4500 product that receives user data, formats a page and controls the engine.
Media	A sheet of printable media on which two images can be printed (one on each side). Used interchangeably with the term *paper*.
Media Size	The physical size of a sheet of paper (Letter, Legal, A4, Com10).
Media Type	The physical characteristics of a sheet of paper (Plain, Letterhead, Recycled)
Page, Image	The impression printed on one side of a piece of paper.
Paper	A sheet of printable media. Used interchangeably with the term *media*.
Paper Bin	One of the physical output containers that hold media.
Paper Tray	One of the physical input containers that hold media.
PML	Peripheral Management Language.
PDL	Page Description Language.
Printer	The entire HP Color LaserJet 4500 product as a user would view it.
Universal-sized Paper	Term used to denote paper of an unknown size. If a sheet's size is denoted as universal, the engine will treat it as if it is the largest size supported by that engine.
User Configurable Setting	A configuration setting that influences the actions of the printer. Typical interfaces used to alter the settings include the control panel and commands via the data stream.
User Software	Used in sending a data stream of command sequences to the printer.

Basic Hardware Media Handling Features

This section introduces the standard hardware media handling features of the HP Color LaserJet 4500 model so that these features may be referenced later in this document.

Standard media handling features:

- One Multi-Purpose Input Paper Tray (Tray 1)
- One Standard Input Paper Tray (Tray 2)
- One Face-Down Output Paper Bin
- One Face-Up Output Paper Bin

Multi-Purpose Input Paper Tray (Tray 1)

- Non-removable multi-purpose tray.
- Supports both sheets and envelopes.
- Tray capacity of 150 sheets of 20 pound paper or 10 Com10 envelopes.
- A user configurable, software setting identifies the Media Size and the Media Type the printer expects to be loaded in **Tray 1** since there are no internal sensors for this purpose.
- A sensor internal to the printer automatically detects if the tray is empty.
- Can be configured to be in either "Cassette" or "First" mode (see the section Tray 1 Configuration).

Standard Input Paper Tray (Tray 2)

- Removable tray.
- Tray capacity of 250 sheets of 20 pound paper.
- Adjustable with stop positions for several, specific media sizes.
- Printer automatically detects the media size of Tray 2 based on tray's physical configuration.
- A user configurable, software setting identifies the Media Type the printer expects to be loaded in Tray 2.
- A sensor internal to the printer automatically detects if the tray is empty.

Facedown Output Paper Bin

- Located at the top of the printer, provides for facedown correct ordered output.
- Can accommodate any media size supported by the paper trays.
- Approximate bin capacity of 250 sheets of standard 20 pound paper.
- There are no software user options or configurable parameters for the output bin. Media is sent to this bin when the rear output door is closed.
- A sensor internal to the printer detects whether the bin is full, forcing the printer to halt. The printer will go off-line and issue the Control Panel message:

  REMOVE PAPER
  TOP OUTPUT BIN

  The user must remove some or all of the paper in that bin in order to resume printing.

Face-Up Output Paper Bin

- Located at the back of the printer, provides for face-up reverse order output.
- Can accommodate any media size supported by the paper trays and is recommended for special or stiff media that needs a more straight through path than the Facedown Output Paper Bin provides.
- Approximate bin capacity of 50 sheets of standard 20 pound paper.
- There are no software user options or configurable parameters for the output bin. Media is sent to this bin when the rear output door is open.
- No sensor detects whether the bin is full.

Optional Hardware Media Handling Features

This section introduces the optional hardware media handling features of the HP Color LaserJet 4500 printer. The optional media handling features:

- One Optional Input Paper Tray (Tray 3)
- One Optional Duplex Unit

Optional Input Paper Tray (Tray 3)

An Optional Lower Cassette Unit can be attached to the printer. When the printer is powered ON, sensors internal to the printer detect the presence or absence of this optional unit and the printer takes the appropriate action during configuration. This unit provides:

- A slot for one removable tray.
- Tray capacity of 500 sheets of 20 pound paper.
- Adjustable with stop positions for several, specific media sizes (see the section Supported Media Sizes for the HP Color LaserJet 4500 printer).
- Automatic detection of the media size of Tray 3 based on the tray's physical configuration and position of the tray's media size knob.
- A user configurable, software setting that identifies the Media Type the printer expects to be loaded in Tray 3.
- A sensor internal to the printer that automatically detects if the tray is empty.

The paper path for Tray 3 passes through Tray 2. If Tray 2 is partially pulled out or removed, the media from Tray 3 cannot be fed into the printer. In the case that the user tries to print from Tray 3, the printer goes off line and generates the following message informing the user that Tray 2 must be installed:

INSTALL TRAY 2

Optional Duplex Unit

An Optional Duplex Unit can be attached to the printer. When the printer is powered ON, sensors internal to the printer detect the presence or absence of this optional unit and the printer takes the appropriate action during configuration.

The Duplex Unit, when installed, allows backside printing on sheets of paper. To print a duplex page, the backside of the paper is printed first. Once the backside is finished printing, the paper is sent to the Duplex Unit where the paper is physically flipped over. The printer will then pull the paper from the Duplex Unit and print the front side.

Duplex printing is only available when the Facedown Output Paper Bin is selected. This bin is selected by physically closing the rear output tray door. If the rear output door is open (Face-Up Output is selected), only simplex printing is available. If the rear output door is opened while paper is in motion during duplex printing, paper jams or misprints can result.

The duplex unit will be flushed before printing is halted due to any reason other than a fatal error or printer malfunctions. For example, the duplex unit will be flushed before a Media Mount Request is issued to insure media is not left in the duplex unit that would cause problems if the user performs a reset or cycles power.

Input Paper Tray Selection

The major role of the HP Color LaserJet 4500 media-handling model is to choose the proper tray given a request to print a page. The purpose of the media-handling model is to resolve the requested media and/or tray with the available media and/or trays on the printer at the time of the request. In the case where the application does not specify the media or tray, the printer selects from the default values. When a tray is not specified, or if the specified tray is empty, the printer can auto-select a paper tray from which to feed. Although the Auto-Selection process can get fairly involved, the idea is simply to choose a tray or to switch to another tray if possible. If a tray can be selected that satisfies the request, the printing continues.

Certain requests for media may not be able to be satisfied. For instance, if the request is for legal size but no legal size media is loaded in the printer, then the printer will clear the paper path (if some pages are being printed), go off-line and generate a message prompting the user to load the appropriate media. This load message is called a Media Mount Request. After the correct media is loaded (or the user overrides the Media Mount Request), the message goes away and the printing continues.

A condition can develop that needs to be communicated even when the print requests can be satisfied. This condition occurs if a tray is removed, is out of paper, or runs out of paper but printing can still take place because the desired media is available in another tray. The printer will generate a message informing the user of the condition if the tray in question is not currently being used or the printer can auto-select to another paper tray. This message is called a Paper Tray Not Ready Warning. These messages are called background messages because the printer does not have to stop and wait for user intervention.

The Paper Tray Selection Process

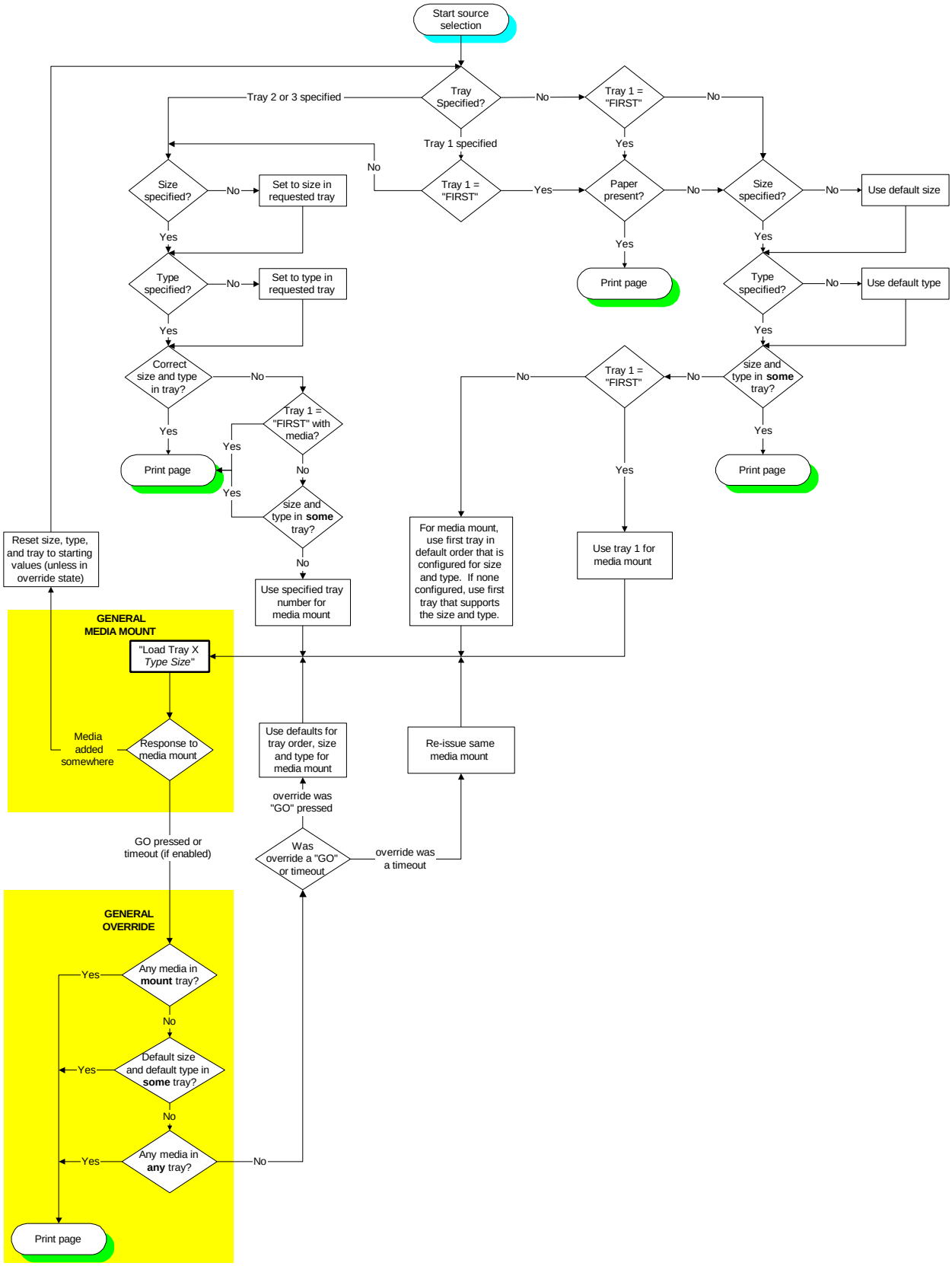
HP Color LaserJet 4500's tray selection process centers around the concept of selecting the proper paper tray based on matching the requested Media Size and Media Type with the actual Media Size and Media Type contained in a paper tray. On the HP Color LaserJet 4500 printer, all paper trays are considered auto-selectable, except for Tray 1 (the Multi-Purpose Tray) when it is configured in First mode (Tray 1=First). This means the formatter firmware can select from any of the paper trays that satisfy a Media Size and Media Type request. For example, if more than one paper tray had the same size and type of media, the formatter could continue printing without user intervention by switching to a paper tray containing the same size and type of media when the currently selected paper tray is empty or removed.

In the case where a specific paper tray is requested, that paper tray is given preference if it contains the requested size (and type if also specified). Otherwise, the formatter firmware will look for the requested media in another paper tray.

If multiple paper trays have the requested size/type loaded, no paper tray is requested, and Tray 1 is configured in Cassette mode, then the priority of paper tray selection for HP Color LaserJet 4500 printer is as follows:

1. Tray 3, the Optional Paper Tray (if installed).
2. Tray 2, the Standard Paper Tray.
3. Tray 1, the Multi-Purpose Tray.

The following flowchart illustrates the HP Color LaserJet 4500's tray selection process (along with Media Mount Request behaviors):


Start source selection
Tray Specified?
Tray 2 or 3 specified
No
Tray 1 = "FIRST"
Tray 1 specified
Yes
Size specified?
Set to size in requested tray
Tray 1 = "FIRST"
Paper present?
Size specified?
Use default size
Type specified?
Set to type in requested tray
Print page
Use default type
Correct size and type in tray?
Tray 1 = "FIRST" with media?
size and type in some tray?
Print page
Reset size, type, and tray to starting values (unless in override state)
For media mount, use first tray in default order that is configured for size and type. If none configured, use first tray that supports the size and type.
Use tray 1 for media mount
Use specified tray number for media mount
GENERAL MEDIA MOUNT
"Load Tray X Type Size"
Media added somewhere
Response to media mount
Use defaults for tray order, size and type for media mount
Re-issue same media mount
override was "GO" pressed
Was override a "GO" or timeout
override was a timeout
GO pressed or timeout (if enabled)
GENERAL OVERRIDE
Any media in mount tray?
Default size and default type in some tray?
Any media in any tray?
Print page

Media Size Setup

Setting up the Media Size for a particular paper tray is relatively straightforward on the HP Color LaserJet 4500 printer. All paper trays (with the exception of the Multi-Purpose Tray, which is described below) can detect the size of media currently installed. Therefore, the engine itself dictates which size media the paper tray contains. The formatter firmware only supports those media sizes supported by the engine. If a PDL (Page Description Language) does not specify a Media Size or requests a size not supported by the engine, the formatter firmware will format the page to the Default Paper Size. The Default Paper Size is set at the factory to be Letter or A4 (depending on the intended country of the printer) and can be changed by using the Control Panel or via PML (Peripheral Management Language).

Setting the Multi-Purpose Tray's Media Size

The Multi-Purpose Tray cannot automatically detect the Media Size it currently contains. In order to use the Multi-Purpose Tray as a cassette, the user must inform the formatter firmware, via the Control Panel or PML, what size is installed in this tray.

This is done via the control panel when media is placed in the Multi-Purpose Tray (that is, the formatter detects when the tray transitions from empty to not empty). When this occurs, the following message will be issued:

TRAY 1 SIZE =
{*Media Size*}{*}

Where:
Media Size is the Control Panel media size name. An asterisk (*) is displayed for the currently selected Media Size.

Example:

TRAY 1 SIZE =
LETTER*

The Media Size initially displayed will be the last size configured for the tray, except if a media mount request for the tray is pending, in which case the requested size is initially displayed. The user may cycle through the available media sizes by pressing the VALUE + or VALUE - key. Once the desired media size is being displayed, it is selected when the user presses the SELECT key causing an asterisk (*) to appear in the display message. When the GO key is pressed, the message is removed. Note that if 30 seconds after placing media in this tray the user has not pressed a key, the displayed media size will automatically be selected. Also, if all the media is removed from the tray whose size is being configured, the above message is removed and the tray is considered empty. The Media Size for the Multi-Purpose Tray may be set up at anytime by using the Control Panel or via PML.

Support for Custom Media

The HP Color LaserJet 4500 printer is capable of performing 1-sided printing of custom paper from Tray 1 (the Multi-Purpose Tray) and supports cassettes that allow infinite size adjustability within a certain range. The list of paper size options for Tray 1 include "Custom," which should be used when the user intends to feed a non-standard paper size. Duplex support for custom sizes is not available.

In order to facilitate custom paper support, the printer driver software should send page dimensions for each page of a job. The formatter can utilize this information to pick the closest universal paper size to what the user requested and specify that size to the engine.

Trays 2 and 3 do not have full custom support; rather, they use "Custom" to print specific sizes that are physically supported in the tray but not explicitly supported on the HP Color LaserJet 4500 printer. Trays 2 and 3 have specific settings for B5ISO, a size not explicitly supported, and Tray 3 has a specific setting for A5, a size not explicitly supported in Tray 3. When the trays are configured for B5ISO or Tray 3 is configured for A5, "Custom" size will be used for the tray selection process and reported through the personality interface and PML. Trays 2 and 3 do not have the true custom size support like Tray 1 for a range of media dimensions.

The normal tray auto-selection logic will apply when more than one tray contains custom paper. That is, if Tray 1 is set up as containing a custom media size and if the engine reports that one or more other trays contain Custom, then the Media Types, First mode and user-requested tray information will be considered in an attempt to pull from the tray with the desired custom paper for a particular page.

Supported Media Sizes for HP Color LaserJet 4500

Media Size	Tray 1	Tray 2	Tray 3	Duplex Unit	Control Panel Name
Letter (8.5 x 11.0 inches)	✓	✓	✓	✓	LETTER
A4-ISO (210 x 297 mm)	✓	✓	✓	✓	A4
Legal (8.5 x 14 inches)	✓	✓	✓	✓	LEGAL
Executive (7.25 x 10.5 inches)	✓	✓	✓	✓	EXEC
B5 - Japan (182 x 257 mm)	✓	✓	✓	✓	JIS B5
A5 (148.5 x 210 mm)	✓	✓			A5
Universal (215.9 x 355.6 mm)	✓	✓*	✓*		CUSTOM
B5 Envelope (176 x 250 mm)	✓				B5
Com10 Envelope (4.125 x 9.5 inches)	✓				COM10
C5 Envelope (162 x 229 mm)	✓				C5
DL Envelope (110 x 220 mm)	✓				DL
Monarch (3.875 x 7.5 inches)	✓				MONARC

* Trays 2 and 3 use "Custom" size for the physical configuration available on these trays for B5ISO, and Tray 3 additionally uses "Custom" size for the physical configuration available for A5. These trays do not support ranges of custom sizes like Tray 1.

Unexpected Media Size Error

If the printer detects a size fed from a tray different than what was specified the following error will be generated:

41.3 UNEXPECTED
PAPER SIZE

This message will alternate with:

CHECK PAPER
IN TRAY {*tray number*}

The user must press **GO** to continue. This error cannot be auto-continued. Typically, this error will not be issued for Tray 1 = First mode or when a tray is configured as "Custom" size (Cassette mode). One possibility does exist in these conditions where the unexpected size error would be issued. This possibility is explained in the section Media Size and Color Engine Performance.

Media Size and Color Engine Performance

When printing color and the media length is longer than A4 (297 mm), the printer will shift into an eight-pass mode. Whenever the media size is unknown, the firmware and engine must assume the maximum size media or risk a misprint error due to an unexpected media size. The engine is configured as "Universal" so that custom sizes can be fed. Situations where eight-pass color mode will occur are as follows:

- Any tray with its size configured as Legal.
- Tray 1 = First and no size information is passed from the driver or when the size information is greater than A4 length.
- Tray 1 = Cassette, its size is configured as Custom, and no size information is passed from driver or when the size information is greater than A4 length.
- Internal Universal Trays that automatically tell the engine to select the large universal size.

The HP Color LaserJet 4500 engine will accept two different "Universal" sizes. One universal size corresponds to Legal length paper and, when used for color, forces the slow eight pass mode. The smaller universal size corresponds to A4 length and allows normal 4-pass color mode. When Tray 1 = FIRST, or a media size of "Custom" is used, the HP Color LaserJet 4500 media handling firmware will utilize page dimensions provided by the driver software when available so that the smaller universal size, and thus the normal four pass mode, will be used whenever possible to achieve maximum throughput.

Choosing the smaller universal size based on page dimensions to achieve maximum throughput has the following risk. If a user specifies a small custom size and actually tries to print on a media longer than A4, the HP Color LaserJet 4500 engine considers this condition a misprint due to an unexpected paper size. An unexpected size misprint error will then be issued.

Media Type Set Up

On the HP Color LaserJet 4500 printer, there is not an automatic detection mechanism in the trays for determining the currently installed Media Type. Therefore, the user (or printer administrator) must inform the printer, via the Control Panel or system utility, what Media Type is contained in each of the paper trays. Since the factory default setting for all paper trays will be Plain, users who do not use different types of media will never have to change these settings. Transparencies are automatically detected during the actual print process so the correct printing parameters can be used, but the Media Type setting for the tray from which the transparency was fed is not changed based on this detection.

Media Type Set Up via the Control Panel

The Media Type for each installed paper tray is set up via the Control Panel or via PML. There is one additional time when the Media Type for the Multi-purpose Tray can also be setup. This is when a Media Mount request for Tray 1 is pending, the requested Media Size or Type is different from Tray 1's configured Media Size or Type, and paper is (re) loaded into Tray 1. A Control Panel message to set up the Media Type, prior to setting up the Paper Size, is displayed:

TRAY 1 TYPE =
{*Media Type*}{*}

Where:
Media Type is the control panel *Media Type*. An asterisk (*) is display for the currently selected *Media Type*.

Examples:

TRAY 1 TYPE =
BOND*

Although at this point it is most likely that the desired *Media Type* is being displayed, the user may cycle through the available *Media Type*s by pressing the VALUE + or VALUE - key. Once the desired *Media Type* is being displayed, it is selected when the user presses the SELECT key, causing an asterisk (*) to appear in the display. Pressing the GO key causes the message to be removed. Note that if 30 seconds after placing paper in either one of these trays the user has not pressed a key, the displayed *Media Type* will automatically be selected (as well as the Paper Size, even though a Paper Size configuration message is not displayed). Also, if all of the paper is removed from the tray whose type is being configured, the above message is removed and the tray is considered empty and not configured.

Media Type when Tray 1 = First

Although Tray 1 (the Multi-Purpose Tray) is configured with a Media Type, if Tray 1 = First, the Media Type setting is ignored. It is the user's responsibility to make sure the correct type of media (as well as size) is fed into the printer via the Multi-Purpose Paper Tray.

Supported Media Types for HP Color LaserJet 4500 Printer

The predefined Media Types supported by the HP Color LaserJet 4500 printer are contained in the following table. The Media Type is the ASCII string reported by the formatter firmware to application drivers via PML and is the string used by the PDLs to select a Media Type for a given page or pages. The Control Panel Name is used in control panel messages. Unlike the Control Panel Names, the predefined Media Types are NOT localized at the printer for each of the supported languages (they may be localized by the driver).

Media Type	**Control Panel Name**
Plain[4]	**PLAIN**
Preprinted	**PREPRINTD**
Letterhead	**LTRHEAD**
Transparency[3]	**TRNSPRNCY**
Gloss	**GLOSS**
Prepunched	**PREPUNCHD**
Labels[1,2,3]	**LABELS**
Bond	**BOND**
Recycled	**RECYCLED**
Color	**COLOR**
Heavy[2]	**HEAVY**
Card Stock[1,2,3]	**CARDSTOCK**

[1] Not available for tray 2 and 3.
[2] Special print modes used (see section **10 Special Print Modes**).
[3] Not supported in duplex unit.
[4] The factory default Media Type.

Predefined Media Types

If the PDL does not specify a Media Type for a given page, the formatter firmware will set the requested Media Type to the Media Type in the requested tray, or, if no tray is requested, the formatter firmware will set the requested Media Type to the default Media Type. If the PDL requests a Media Type for a given page that is not supported by the printer, the formatter firmware will behave as if no media type was specified.

Unexpected Media Type Error

The printer can automatically sense transparencies. In some situations, if there is a type mismatch between the type for which a tray is configured, and the type that actually feeds from that tray, the printer cannot print the page with optimal print quality. In these situations, an error message will be generated:

41.5 UNEXPECTED
PAPER TYPE

This message will alternate with:

CHECK PAPER
IN TRAY {*tray number*}

The user must press GO to continue. This error cannot be auto-continued. Note that for Tray 1, this error is only issued if Tray 1 is in Cassette mode.

Tray 1 Configuration

The multipurpose tray has two modes of operation: Tray 1 = First, and Tray 1 = Cassette.

Tray 1 = First

This mode is the default mode for Tray 1. This mode is aimed at satisfying those times when the user wants to change the printer's standard auto-selection process and have the printer select the media sitting in Tray 1. This mode causes the following behaviors:

- Tray 1 media is selected first when Tray 1 media is present (unless the user software has explicitly requested another tray).
- Tray 1 is assumed to have the correct Media Size and Media Type. The size and type will not be confirmed in the actual printing process.
- User software can override Tray 1 = First by explicitly requesting another input tray.
- When the user software requested tray becomes empty, Tray 1 will become the current tray if media is present.

Note: Duplex support is available from Tray 1 when configured as Tray 1 = First; however, it is the user's responsibility to make sure the duplex unit supports the actual media loaded in tray 1.

Tray 1 = Cassette

In this mode, user configurable settings identify the Media Size and Media Type the printer expects to be loaded in Tray 1 since there are no internal sensors in Tray 1 for this purpose. Using this Media Size and Media Type, Tray 1 behaves like a standard tray with respect to auto-selection.

Output Paper Bin Selection Process

Output Bin Names

Many products have user-defined names for Output Bins. These user-defined names are important when multi-bin external output paper handling devices are attached to the printer. Support for external devices is not yet defined for the HP Color LaserJet 4500 printer. The HP Color LaserJet 4500 printer does not use user-defined names for Output Bins at this time.

The Output Bin Selection Process

The HP Color LaserJet 4500 printer has two possible media destinations: The Facedown Output Bin, located at the top of the printer, and the Face-up Output Bin, located at the back of the printer. These bins are selected by physically opening or closing the rear output bin door. When the rear output bin door is

open, the media goes to the Face-up Output Bin. When it is closed, media goes to the Facedown Output Bin.

No rear door open sensors are present and no automatic bin selection is available, so the user cannot be given an output choice via PML or the Control Panel.

Opening the rear output bin door to select the Face-up Output Bin has the side effect of disabling the duplex unit for the HP Color LaserJet 4500 printer. Duplex printing is only supported when the Facedown Output Bin is physically selected.

Media Mount Requests

A Media Mount Request is the condition that occurs when the printer needs user intervention in order to start/resume printing because the requested size and/or type of paper is currently not available. This event causes a Control Panel message to be displayed and the condition reported to the user via PML (assuming PML traps are enabled). The HP Color LaserJet 4500 printer will only issue a Media Mount Request when it is unable to print a page due to the fact that the printer cannot continue until the correct Media Size or Media Type is added or verified.

General Media Mount Request Messages

For all Media Mount Requests, the Control Panel will display the following:

TRAY {Tray Number} LOAD
{Media Type} {Media Size}

Where:

- *Tray Number* is the number of the tray (1 for the MP Tray, 2 for the Standard Tray, and 3 for the Optional Tray).
- *Media Type* is the Control Panel media type name.
- *Media Size* is the Control Panel media size name.

Examples:

TRAY 2 LOAD
PREPUNCHD LETTER

For Letter size Three Hole paper.

TRAY 1 LOAD
PLAIN A4

For A4 size Plain White paper.

Note that for General Media Mount requests, the users may load (and set up the Media Type, if required) the requested size/type paper in any input tray in order to satisfy the mount request.

Page Formatting and Overriding

It is the responsibility of the PDL (Page Description Language) personality to determine the size in which a page is to be formatted. Different PDLs have different methods for deciding the proper size to format a page. Once this decision is made and the page is created to a particular size, the printer will attempt to print the page on the same size media in which the page was formatted. This assumes the requested Media Type matches the actual Media Type. If the page cannot be printed due to a size/type mismatch, a Media Mount Request is issued. To resume printing, the user may either load one of the Input Paper Trays with the requested size/type paper or 'override' the Media Mount Request. If an override is performed, the page may print on a different size paper than that for which it was formatted. This situation might cause part of the page to be clipped (if printed on smaller size paper) or the page to have wider/longer margins than normal (if printed on a larger size paper). During an override, the page may also be printed on a different media type than the one that was requested.

For all PDL personalities, it is important to remember that the formatter firmware cannot detect what size paper is being used when Tray1=First or when printing on custom paper. It will always assume the user is feeding the requested size paper and it will "line up" the page accordingly.

Overriding Media Mount Requests

The override behavior is explained below (or can be followed in the flowchart in the section, The Paper Tray Selection Process):

Media Mount Request Conditions	Override Behavior
General Media Mount Request	An override causes the requested size and type to be overridden. Media will be chosen according to the following priority: 1. Any media in the tray for which Media Mount was issued. 2. Default Size and Default Type in some tray. 3. Any media in any tray. If an override successfully finds some media on which to print, that new Media Size and Media Type will be used for the overridden size and type combination for the remainder of the job or until a new override occurs within a job. Different size and type combinations requested within the job will still be honored.

In cases where the paper trays are searched for specific media, the Media Mount Request Tray will be checked first, then the trays will be searched according to the order given in the section, The Paper Tray Selection Process.

There are different methods in which to initiate an override to a Media Mount Request. Each one is discussed in a separate section below.

Overriding via the Control Panel

Overriding of a General Media Mount Request can be done via the Control Panel by pressing the GO key.

Overriding via a Time-out (General Media Mount)

The printer can be configured, via PML, to time-out after a certain amount of time has elapsed (user selectable). When the time-out occurs, the printer will automatically override the Media Mount Request. Note that the default is that the printer will not time-out (the printer will wait until the user directly responds to the Media Mount Request). The override action due to a time-out is the same as if the user had pressed GO.

Overriding via the Host

If the host system has Status Readback capability, the printer can inform the user, via an application utility or driver using PML, that there is a Media Mount Request. The user could be given the option to override the media mount via PML.

Automatic A4/Letter Override

The HP Color LaserJet 4500 printer supports an automatic override feature for Letter and A4 sizes. If a job requests Letter size but no tray is setup for Letter size, A4 will be pulled instead if it is available. Conversely, if a job requests A4 size but no tray is setup for A4, Letter will be pulled instead if it is available. Note that if any of the printer's trays are configured for the requested paper, the auto-override will not take place (even if the tray is empty). This feature may be enabled/disabled via PML or the control panel and is disabled by factory default.

Paper Tray Not Ready Warning

A Paper Tray Not Ready Warning is defined as a warning to the user (via a Control Panel message and a PML trap) when one of the paper trays becomes unavailable. The printer does not stop for these warning messages.

On the HP Color LaserJet 4500 printer, Control Panel Paper Tray Not Ready Warnings are not issued for the Multi-Purpose Tray. However, a user may query the state of all trays via PML.

Only one Control Panel Paper Tray Not Ready Warning can be issued at a time. Therefore, once a request is issued indicating a paper tray is unavailable, all other Paper Tray Not Ready Messages will be ignored until the first request is satisfied (for example, the tray is filled with media). If multiple paper trays are unavailable at the same time (such as at power-up), a Control Panel Paper Tray Not Ready Warning is issued for the first unavailable tray according to the order given in the section, The Paper Tray Selection Process. The following is the format of a Control Panel Paper Tray Not Ready Warning:

TRAY {Tray Number} EMPTY
{Media Type} {Media Size}

TRAY {*Tray Number*} OPEN

Example:

TRAY 3 EMPTY
BOND LETTER

TRAY 2 OPEN

Of course, PML Paper Tray Not Ready Warnings are issued anytime a tray is detected as becoming unavailable. Also, PML may be used to determine the status of all paper trays at any given time.

Refilling a Paper Tray

The Media Size (for the Multi-Purpose Tray only) and the Media Type (for all trays) are stored in the printer's NVRAM. It is possible for a user to confuse the printer if media was changed while the printer was powered down. This limitation will exist so that the user will not be required to re-configure the Media Size for the Multi-Purpose Tray and the Media Types for all Paper Trays every time the printer is power-cycled.

Refilling Cassette Type Paper Trays

Whenever a Cassette Type Paper Tray (Trays 2 and 3) is opened and no other higher priority Control Panel message is pending, the following background message is displayed:

TRAY {*Tray Number*} OPEN

Example:

TRAY 2 OPEN

The user may load the tray with any size/type media that is supported by that tray. If a different size paper is loaded into the tray, the tray itself will need to be re-configured to hold the newly loaded paper size. However, if a new Media Type is loaded into the tray, the user will need to re-configure the Media Type via the Control Panel's Tray Menu.

Refilling the Multi-Purpose Tray

In the case of the Multi-purpose Tray , there is no TRAY 1 OPEN or TRAY 1 EMPTY message associated with the refilling process. However, since the engine does not detect media sizes for this tray, the user will be responsible for configuring the Media Size via the Control Panel or via PML. Like the Cassette-Type Trays, if a new Media Type is loaded into these trays, the Media Type must be configured via the Control Panel's Tray Menu.

Special Print Modes

The HP Color LaserJet 4500 printer will automatically detect OHTs (overhead transparencies). When this media is detected, a special print mode will be used to ensure optimum color performance. Configuring a tray for "Transparency" will not force the printer to use a special print mode. The sensor will detect and determine the actual media and set the appropriate print mode.

A glossy finish mode can be forced by setting the finish mode through the printer driver software. However, configuring a tray for the Media Type of "Gloss" will not force the printer to use a special print mode for a high gloss toner finish.

Configuring a tray for the Media Types of "Cardstock," "Heavy," or "Labels" will result in the printer using a special print mode for thick media to ensure proper fusing. Any media pulled from a tray configured with these types will print in a special mode.

Special print modes are also needed for Envelope sizes on the HP Color LaserJet 4500 printer. If Tray 1 is configured for an envelope size (or if a print job requests an envelope size when Tray 1 = FIRST) a special fusing mode will be used. If envelopes are printed from Tray 1 while it is configured as "Custom" size, then the special print modes will not be used and some fusing problems can occur.

Note that the color performance or fusing is enhanced with these special print modes, but throughput performance is typically reduced.

Paper Jam Recovery

As with all HP LaserJet family products, the HP Color LaserJet 4500 printer will support Paper Jam Recovery. Paper Jam Recovery is a feature of the printer that insures that when a paper jam occurs, all pages affected by the jam will be reprinted. During this recovery, the printer might reprint several good pages that were printed before the paper jam due to sensor limitations. However, it is better to err on the conservative side instead of losing pages. Unfortunately, the user will have to sort out the duplicated pages.

When Paper Jam Recovery is disabled for a job, pages in the paper path will not be reprinted. Loss of pages is probable if a jam occurs during a job for which Paper Jam Recovery is disabled.

PJL Features

The Printer Job Language (PJL) was developed by a multi-divisional committee to facilitate personality switching in Hewlett-Packard printers and to allow two way communications between the host computer and the printer. The definition of PJL leaves several of the details to each printer. The purpose of this document is to specify these details for the HP Color LaserJet 4500 printer.

PJL is divided into two components -- commands and variables. The HP Color LaserJet 4500 printer's PJL commands are implemented in core code provided by the HP LaserJet 5Si firmware code base project team and documented in the PJL Technical Reference Manual. This document describes the PJL environment variables implemented in the HP Color LaserJet 4500 printer.

Trademarks

- **PCL** is a trademark of Hewlett-Packard Corporation.
- **PostScript** is a trademark of Adobe Systems Incorporated.

References

- PJL Technical Reference Manual, Edition 8, 5/96, Part Number 5961-0938.
- Printer Job Language External Reference Specification, Rev. A.03.03, 12/4/96, document number A-5959-6588-1.

Localization

The HP Color LaserJet 4500 printer will not implement PJL localization. All input to and output from PJL will be in English.

String Token Length

The HP Color LaserJet 4500 printer will truncate string tokens to a maximum length of 80 characters.

Non ROMAN-8 Symbol Sets

The HP Color LaserJet 4500 printer will only provide support for the ROMAN-8 symbol set in PJL.

Enter Command

The following list specifies the current set of personality names in which the HP Color LaserJet 4500 printer supports. Note that since personalities can be added dynamically to the HP Color LaserJet 4500 printer after its release, the HP Color LaserJet 4500 printer can support more personalities than are listed here.

Personality	Name of Document Describing The Personality
PCL	PCL Implementor's Guide, version 4.4
PCLXL	PCL XL Imaging Protocol Feature Reference Manual
POSTSCRIPT	PostScript Language Reference Manual

JOB Command

The HP Color LaserJet 4500 printer will implement the NAME, START, END and PASSWORD options of the JOB command. It will not implement the OFFSET option.

Variables

The following sections describe all the PJL variables that are intended for use by the end user. Since personalities can be added to the HP Color LaserJet 4500 printer after its release, the HP Color LaserJet 4500 printer may support more personality-specific variables than are listed here.

For all alphanumeric-type variables, any attempts to set unsupported values will result in the value being ignored, and a 25-016 error will be produced.

Note that the environment variables listed in the Configuration Variables section are read-only variables and may not be set. Any attempt to set one of those variables will result in a 27-004 semantic error.

General PJL Environment Variables

The following is a list of PJL environment variables that are not printer language specific. Most of the environment variables can be set with either the **SET** or **DEFAULT** commands and read with the **INQUIRE** and **DINQUIRE** commands. Exceptions are noted.

AUTOCONT

Syntax: **AUTOCONT = {OFF | ON}**

Default Value: **ON**

SET: YES **DEFAULT: YES** **INQUIRE: YES** **DINQUIRE: YES**

PJL INITIALIZE: NO **DEFAULT SAME AS CURRENT: YES**

Sets and returns the auto continue configuration. If set to **ON**, the printer will automatically continue when a continuable error is encountered. If set to **OFF**, the printer will go offline until the GO key is pressed or until the PML object, CONTINUE, is set.

The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **RESET** and **INITIALIZE** commands do not affect the value of this variable.

BINDING

Syntax: **BINDING = {LONGEDGE | SHORTEDGE}**

Default Value: **LONGEDGE**

Used to read or set the relationship of the front and back images on pages printed in duplex. The printer will only use this variable if the optional duplex unit is installed. This variable is reset to the factory default value when an **INITIALIZE** command is issued.

BITSPERPIXEL

Syntax: **BITSPERPIXEL = {8}**

Default Value: **8**

This variable determines how many bits are used to define each pixel. While this variable can be set, it always snaps to a value of 8 since that is the only value supported by the HP Color LaserJet 4500 printer.

CLEARABLEWARNINGS

Syntax: **CLEARABLEWARNINGS = {JOB | ON}**

Default Value: **JOB**

Used to read and set the setting for displaying clearable warnings. If the value is set to **JOB**, then clearable warnings generated by a job will only be displayed until the start of the next job. If the value is set to **ON**, then clearable warnings will be displayed until the user acknowledges them.

The **INQUIRE** and **DINQUIRE** commands will always return the same values for this variable. The **RESET** and **INITIALIZE** commands do not affect the value of this variable.

COPIES

Syntax: **COPIES = {1 | ... | 999}**

Default Value: **1**

Used to read or set the number of copies for each page of the job. Integer values less than **1** will be snapped to **1**. Integer values greater than **999** will be snapped to **999**. Floating point values will be truncated. If the resulting integer is out of range, the integer value will be snapped to the appropriate limit. This variable is reset to the factory default value when an **INITIALIZE** command is issued.

COURIER

Syntax: **COURIER = {REGULAR | DARK}**

Default Value: **REGULAR**

Used to read or set which version of the Courier font that will be used. REGULAR is the courier available on the HP LaserJet 4 and 4 Plus. DARK is the courier available on the HP LaserJet 3. This variable is reset to the factory default value when an **INITIALIZE** command is issued.

CPLOCK

Syntax: **CPLOCK = {OFF | MINIMUM | MODERATE | MAXIMUM | ON}**

Default Value: **OFF**

Used to read or set the default control panel lockout state. **OFF** = lock setting 0, **MINIMUM** = lock setting 1, **MODERATE** = lock setting 2 and both **MAXIMUM** and **ON** = lock setting 3. The value **ON** is provided for backward compatibility. This feature is used primarily in networked or printer sharing configurations.

This variable can only be set by a secure PJL job.

This variable can only be set by the **DEFAULT** command.

DUPLEX

Syntax: **DUPLEX = {OFF | ON}**

Default Value: **OFF**

Used to read or set the duplex mode setting. If the variable is set to **ON**, both sides of the paper will be printed on (duplex printing). If the variable is set to **OFF**, only a single side of each sheet of paper will be printed on (simplex printing).

The printer will only use this variable if the optional duplex unit is installed.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

FORMLINES

Syntax: **FORMLINES = {5 | ... | 128}**

Default Value: **60**

Used to read or set the number of lines per page for a job. Integer values less than **5** will be snapped to **5**. Integer values greater than **128** will be snapped to **128**. Floating point values will be truncated. If the resulting integer is out of range, the integer value will be snapped to the appropriate limit.

This variable is tied to both the **PAPER** and **ORIENTATION** variables. If the value of either of those variables is changed, then the **FORMLINES** variable is automatically updated to maintain the same line spacing.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

INTRAY1SIZE

Syntax: **INTRAY1SIZE = {LETTER | LEGAL | A4 | A5 | B5 | JISB5 | EXECUTIVE | CUSTOM | COM10 | C5 | DL | MONARCH}**

Default Value: **LETTER or A4 (same as CRPAPER)**

Used to read the size of paper that paper tray 1, the multi-purpose tray, is configured to hold.

This variable is read-only. The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **SET**, **RESET**, and **INITIALIZE** commands do not affect the value of this variable.

INTRAY2SIZE

Syntax: **INTRAY2SIZE = {LETTER | LEGAL | A4 | A5 | JISB5 | EXECUTIVE | CUSTOM | UNKOWNPAPER}**

Default Value: **(see description)**

Used to read the size of paper that tray 2, the standard cassette, is configured to hold.

There is no true default value for this variable since the printer will report the size of paper the tray is configured to hold. If the tray is pulled out, this variable will return **UNKNOWNPAPER**.

This variable is read-only. The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **SET**, **RESET**, and **INITIALIZE** commands do not affect the value of this variable.

INTRAY3SIZE

Syntax: **INTRAY3SIZE = {LETTER | LEGAL | A4 | A5 | JISB5 | EXECUTIVE | CUSTOM}**

Default Value: **(see description)**

Used to read the size of paper that paper tray 3, the optional cassette, is configured to hold.

There is no true default value for this variable since the printer will report the size of paper the tray is configured to hold. If the optional cassette unit is installed but the tray is pulled out, this variable will return **UNKNOWNPAPER**.

The **INTRAY3SIZE** variable is only valid if the optional cassette unit is installed. If it is not installed, attempts to inquire the value of this variable will act as if **INTRAY3SIZE** was an unknown variable.

This variable is read-only. The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **SET**, **RESET**, and **INITIALIZE** commands do not affect the value of this variable.

IOBUFFER

Syntax: **IOBUFFER = {AUTO | ON | OFF}**

Default Value: **AUTO**

Used to read and set the I/O buffering feature. The amount of memory and the number of personalities that are installed in the printer determine the default and valid values.

When this variable 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 variable is set to **ON**, the user may configure the amount of memory to be used for I/O buffering by setting the value of the **I/O BUFFER SIZE** variable. When this variable is set to **OFF**, no I/O buffering will be performed.

Both the current and default variables are set when either the **SET** or **DEFAULT** command is used and the **INQUIRE** and **DINQUIRE** commands will always return the same value. The **SET**, **RESET**, and **INITIALIZE** commands do not affect the value.

IOSIZE

Syntax: **IOSIZE = {10 | . . . | max}**

Default Value: **10**

Used to read or set the amount of memory to be used for I/O buffering. This value is only used when **IOBUFFER** is set to **ON**.

The minimum value for **IOSIZE** is **10**. The maximum value for this variable will be determined by several factors including: The amount of memory installed in the printer, the number of installed personalities, 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 and a PJL warning message will be sent to the host.

This variable is reset to the factory default value when an **INITIALIZE** command is issued. It can only be set with the **DEFAULT** command. Changes to this variable will not take effect until the next job boundary at which time a memory reconfiguration will take place destroying all perishable data in the printer.

JOBATTR

Syntax: **JOBATTR = "Attribute String"**

Default Value: **empty string**

Appends its value to a list of job attribute strings associated with the current job, which can be read through the PML object JOB-INFO-JOB-ATTR*n*. The attributes are stored in a first in first out job queue of fixed maximum size.

This variable is used by host operating system software to associate internal printer job identifiers with the operating system, which can be used to identify the job in its domain.

This variable is write only and does not appear when using the **INFO VARIABLES** command. It can only be set with the **SET** command. This variable is reset to the factory default value when an **INITIALIZE** command is issued.

JOBID

Syntax: **JOBID = {OFF | ON}**

Default Value: **OFF**

Used to enable or disables the job ID information returned at the start and end of jobs.

It is not necessary to be in Service Mode to set this variable.

Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

LANG

Syntax: **LANG = {ENGLISH | FRENCH | GERMAN | ITALIAN | SPANISH | SWEDISH | DANISH | NORWEGIAN | DUTCH | FINNISH | PORTUGUESE | POLISH | CZECH | RUSSIAN | JAPANESE}**

Default Value: **ENGLISH**

Used to read or set the current or default language for the control panel display and unsolicited status feedback display panel messages. This command will cause an immediate change in the language of the display messages.

LOWTONER

Syntax: **LOWTONER = {STOP | CONTINUE}**

Default Value: **CONTINUE**

Returns or changes how the printer processes a low toner event. If this variable is set to STOP, printing will stop when a toner low message occurs. If this variable is set to CONTINUE, a toner low message will be generated but printing will continue.

MPTRAY

Syntax: **MPTRAY = {FIRST | CASSETTE}**

Default Value: **FIRST**

Used to read the configuration of tray 1, the multi-purpose tray.

This variable is read-only. The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **SET**, **RESET**, and **INITIALIZE** commands do not affect the value of this variable.

ORIENTATION

Syntax: **ORIENTATION = {PORTRAIT | LANDSCAPE}**

Default Value: **PORTRAIT**

Used to read or set the page orientation for the job.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

OUTBIN

Syntax: **OUTBIN = {UPPER }**

Default Value: **UPPER**

This variable is read-only. It returns the default output bin.

NOTE: On the HP Color LaserJet 4500 printer there are two standard output bins. Since the printer cannot detect which one paper will go to, they are both considered **UPPER** by this variable.

OUTLINEPOINTSIZE

Syntax: **OUTLINEPOINTSIZE = {0…999}**

Default Value: **72**

OUTLINEPOINTSIZE will be used to set the point size that Postscript uses to switch from printing characters as bitmaps to printing them as outlines.

OUTTONER

Syntax: **OUTTONER = {STOP | CONTINUE}**

Default Value: **STOP**

Returns or changes how the printer processes a toner out event. If this variable is set to **STOP**, printing will stop when a toner out event occurs. If this variable is set to **CONTINUE**, a toner out message will be generated but printing will continue.

PAPER

Syntax: **PAPER = {LETTER | LEGAL | A4 | A5 | B5 | JISB5 | EXECUTIVE | CUSTOM | COM10 | C5 | DL | MONARCH}**

Default Value: **LETTER**

Used to read or set the default paper size of the printer.

The **INQUIRE** and **DINQUIRE** commands will always return the same values for a given variable. The **RESET**, and **INITIALIZE** commands do not affect the value of this variable.

PASSWORD

Syntax: **PASSWORD = {0 | . . . | 65535}**

Default Value: **0**

Used to set the password for PJL security and to determine if the password is enabled or disabled. If the current password value is 0, PJL security is disabled and all PJL jobs are considered to be secure.

An **INQUIRE** or **DINQUIRE** command will return a response of **DISABLED**. If the current value is non-zero, PJL security is enabled and the **JOB** command must contain the correct value for the **PASSWORD** option in order to use the **DEFAULT** and **INITIALIZE** commands. An **INQUIRE** or **DINQUIRE** command will return a response of **ENABLED**.

This variable can only be set by the **DEFAULT** command.

PERSONALITY

Syntax: **PERSONALITY = {AUTO | PCL | POSTSCRIPT | . . .}**

Default Value: **AUTO**

Used to read or set the personality for implicit switching.

Note that the value string for each installed personality is defined by the personality itself. The **AUTO** option is always available. If a job is sent without an **ENTER LANGUAGE** command and the **PERSONALITY** variable is set to **AUTO**, the context switcher is invoked to determine which personality to route the job to.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

PLANESINUSE

Syntax: **PLANESINUSE = {1 | 3}**

Default Value: **3**

This variable defines the number of planes of data in a job. A value of 1 indicates a monochrome job while a value of 3 indicates a color job.

POWERSAVE

Syntax: **POWERSAVE = {ON | OFF}**

Default Value: **ON**

Used to read or set the power saving feature. If **POWERSAVE** is set to **ON**, the value for **POWERSAVETIME** will determine how long the printer must remain inactive before the power saving mode is entered.

POWERSAVETIME

Syntax: **POWERSAVETIME = {1 | 30 | 60 | 120 | 240 | 480}**

Default Value: **60**

Used to read or set the number of minutes the printer must remain inactive before entering powersave mode.

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.

REPRINT

Syntax: **REPRINT = {OFF | ON}**

Default Value: **OFF**

When this item is set to **ON**, the printer will automatically reprint pages after the paper jam is cleared. When this item is set to **OFF**, the printer will not reprint pages following a paper jam. Printing performance may be increased with this setting.

RESOLUTION

Syntax: **RESOLUTION = {600}**

Default Value: **600**

While this variable can be set, it always snaps to a value of 600 since that is the only resolution supported by the HP Color LaserJet 4500 printer.

TIMEOUT

Syntax: **TIMEOUT = {5 | . . . | 300}**

Default Value: **15**

Used to read or set the default duration of I/O time-outs in seconds. Integer values less than **5** will be snapped to **5**. Integer values greater than **300** will be snapped to **300**. Floating point values will be truncated. If the resulting integer is out of range, the integer value will be snapped to the appropriate limit.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

PCL Specific Variables

The following variables are specific to the PCL personality and must be set using the LPARM: PCL option.

FONTNUMBER

Syntax: **FONTNUMBER = {0 | 1 | . . . | N}**

Default Value: **0**

Used to read or set the number of the font that will be used by PCL as the default font for a job. The valid range for this variable depends on the value of the **FONTSOURCE** variable. If the font source contains a default marked font, the values start at **0**; otherwise, the values start at **1**. The upper limit depends on the number of installed fonts in the font source, but cannot exceed **999**.

Integer values outside the valid range will be ignored. Floating point values will be truncated. If the resulting integer is out of range, the value will be ignored. If the value is ignored, then a 25-014 error will be produced.

This variable is tied to both the **FONTSOURCE** and **SYMSET** variables. If the value of the **FONTSOURCE** variable changes, then the **FONTNUMBER** variable is automatically changed to the lowest numbered font in the new font source (either 0 or 1, depending on whether the new font source contains a default marked font). This applies to both explicit changes of the **FONTSOURCE** variable as well as changes to the **FONTSOURCE** variable that are side effects of certain events (see the discussion of the **FONTSOURCE** variable).

If the value of the **SYMSET** variable changes, then the **FONTNUMBER** variable is automatically changed to the lowest numbered font in the current font source (either 0 or 1).

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

FONTSOURCE

Syntax: **FONTSOURCE = {I | M1 | M2 | M3 | S}**

Default Value: **(see description)**

Used to read or set the font source, which PCL will use to find the default font for a job. The factory default value depends on the font sources currently installed. If a ROM DIMM with a default-marked font is installed, the default font source is the ROM DIMM. Lower numbered units have higher priority over higher numbered units, so M1 is the highest priority ROM DIMM. Otherwise, the default value is I.

The valid values for this variable depend on the currently installed font base. Only locations that contain one or more fonts are legal values. If a font source is specified which does not at the time contain any fonts, then the value is ignored and a 27-001 semantic error is produced.

Certain events cause the value of this variable to be automatically changed. If the currently set font source is **S** and all soft fonts are deleted, then the value of this variable is automatically changed to the factory default value. Also, if the currently set font source is **S**, the currently set font number is the highest-numbered soft font. If any soft font is deleted, then the value of this variable is automatically changed to the factory default value.

The list of font sources will vary depending on what ROM DIMMs and Flash DIMMs are installed in the printer. A device will only appear in the list if the device is installed and there are valid fonts on it. The **S** option will only appear if one or more permanent soft fonts currently exist.

The font number range will be the range of fonts for the current font source only. The lower limit will be **0** if the current font source contains a default-marked font; otherwise it will be **1**. The upper limit will vary depending on how many fonts are in the current font source.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

PITCH

Syntax: **PITCH = {0.44 | 0.45 | . . . | 99.99}**

Default Value: **10.00**

Used to read or set the default pitch of the PCL default font (if the default font is a fixed pitch scaleable font) in units of characters per inch.

The pitch value can be specified to two decimal points. Any additional digits beyond two decimal points will be truncated. If the value is less than **0.44**, the value will be snapped to **0.44**. If the value is greater than **99.99**, the value will be snapped to **99.99**.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

PTSIZE

Syntax: **PTSIZE = {4.00 | 4.25| . . . | 999.75}**

Default Value: **12.00**

Used to read or set the default height of the PCL default font (if the default font is a proportional scaleable font) in units of points.

The point size value is significant only to a quarter of a point. If the value is not a multiple of **0.25**, the value will be rounded down to the nearest multiple of **0.25**. If the value is less than **4.00**, the value will be snapped to **4.00**. If the value is greater than **999.75**, the value will be snapped to **999.75**.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

SYMSET

Syntax: **SYMSET = {PC8 | ROMAN8 | ISOL1 | ISOL2 | ISOL5 | ISOL6 | PC775 | PC8DN | PC850 | PC852 | PC8TK | PC1004 | WINL1 | WINL2 | WINL5 | WINBALT | DESKTOP | PSTEXT | LEGAL | ISO4 | ISO6 | ISO11 | ISO15 | ISO17 | ISO21 | ISO60 | ISO69 | WIN30 | MCTEXT}**

Default Value: **PC8**

Used to read or set the default symbol set for the job.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

PostScript Specific Variables

PRTPSERRS

Syntax: **PRTPSERRS = {OFF | ON}**

Default Value: **OFF**

This variable enables or disables the printing of a PostScript error page.

This variable is reset to the factory default value when an **INITIALIZE** command is issued.

Other Personality Variables

Each add-on personality can have its own set of personality-specific PJL variables. Variables will not be listed in this document; they should be documented separately by the project teams who are implementing the add-on personalities.

INFO Command Examples

INFO ID

INFO ID returns the following response:

```
@PJL INFO ID
"HP Color LaserJet 4500"
```

INFO CONFIG

INFO CONFIG command returns a response similar to the following:

```
@PJL INFO CONFIG
IN TRAYS [2 ENUMERATED]
        INTRAY1
        INTRAY2
DUPLEX
OUTPUT BINS [1 ENUMERATED]
        UPPER
PAPERS [12 ENUMERATED]
        LETTER
        LEGAL
        A4
        EXECUTIVE
        COM10
        MONARCH
        C5
        DL
        JISB5
        B5
        CUSTOM
        A5
```

```
LANGUAGES [3 ENUMERATED]
        PCLXL
        PCL
        POSTSCRIPT
USTATUS [4 ENUMERATED]
        DEVICE
        JOB
        PAGE
        TIMED
MEMORY=25165824
DISPLAY LINES=2
DISPLAY CHARACTER SIZE=16
```

INFO MFQ

INFO MFQ command returns a response similar to the following:

```
@PJL INFO MFQ
TOTAL=146598112
LARGEST=146407408
FREE BLOCKS=6
MFQx1000=1000
# FREE MPA BLOCKS=1
VXworks Bytes Free=930336
VXworks Largest Block=907808
VXworks Num Free Blocks=9
System Resource Pool Space Available=233920
System Resource Pool Largest Block=233696
System Resource Num Free Blocks=6
```

INFO MEMORY

INFO MEMORY command returns a response similar to the following:

```
@PJL INFO MEMORY
TOTAL=144279312
LARGEST=124551152
```

INFO PAGECOUNT

INFO PAGECOUNT command returns a response similar to the following:

```
@PJL INFO PAGECOUNT
2473
```

INFO STATUS

INFO STATUS command returns a response similar to the following:

```
@PJL INFO STATUS
CODE=10023
```

```
DISPLAY="PROCESSING JOB"
ONLINE=TRUE
```

INFO VARIABLES

INFO VARIABLES command returns a response similar to the following:

```
@PJL INFO VARIABLES
LANG=ENGLISH [15 ENUMERATED]
        CZECH
        DANISH
        DUTCH
        ENGLISH
        FINNISH
        FRENCH
        GERMAN
        ITALIAN
        JAPANESE
        NORWEGIAN
        POLISH
        PORTUGUESE
        RUSSIAN
        SPANISH
        SWEDISH
COPIES=1 [2 RANGE]
        1
        999
DUPLEX=ON [2 ENUMERATED]
        OFF
        ON
BINDING=LONGEDGE [2 ENUMERATED]
        LONGEDGE
        SHORTEDGE
PAPER=LETTER [12 ENUMERATED]
        LETTER
        LEGAL
        A4
        EXECUTIVE
        COM10
        MONARCH
        C5
        DL
        JISB5
        B5
        CUSTOM
        A5
ORIENTATION=PORTRAIT [2 ENUMERATED]
        PORTRAIT
        LANDSCAPE
```

RESOLUTION=600 [1 ENUMERATED]
600
PERSONALITY=AUTO [3 ENUMERATED]
AUTO
PCL
POSTSCRIPT
TIMEOUT=15 [2 RANGE]
5
300
MPTRAY=FIRST [2 ENUMERATED]
FIRST
CASSETTE
CLEARABLEWARNINGS=JOB [2 ENUMERATED]
JOB
ON
AUTOCONT=ON [2 ENUMERATED]
OFF
ON
LOWTONER=CONTINUE [2 ENUMERATED]
STOP
CONTINUE
INTRAY1SIZE=LETTER [12 ENUMERATED READONLY]
LETTER
LEGAL
A4
EXECUTIVE
COM10
MONARCH
C5
DL
JISB5
B5
CUSTOM
A5
INTRAY2SIZE=LETTER [7 ENUMERATED READONLY]
LETTER
LEGAL
A4
EXECUTIVE
JISB5
CUSTOM
A5
INTRAY3SIZE=LETTER [7 ENUMERATED READONLY]
LETTER
LEGAL
A4
EXECUTIVE
JISB5

CUSTOM
A5
CPLOCK=OFF [5 ENUMERATED]
OFF
MINIMUM
MODERATE
MAXIMUM
ON
PASSWORD=DISABLED [2 RANGE]
0
65535
POWERSAVE=ON [2 ENUMERATED]
OFF
ON
POWERSAVETIME=60 [6 ENUMERATED]
1
30
60
120
240
480
IOBUFFER=AUTO [3 ENUMERATED]
AUTO
ON
OFF
IOSIZE=100 [2 RANGE]
100
100
COURIER=REGULAR [2 ENUMERATED]
REGULAR
DARK
FORMLINES=60 [2 RANGE]
5
128
REPRINT=OFF [2 ENUMERATED]
OFF
ON
BITSPERPIXEL=8 [1 ENUMERATED]
8
PLANESINUSE=3 [2 ENUMERATED]
1
3
OUTTONER=STOP [2 ENUMERATED]
STOP
CONTINUE
OUTLINEPOINTSIZE=72 [2 RANGE]
0
999

```
LPARM:PCL FONTSOURCE=I [1 ENUMERATED]
        I
LPARM:PCL FONTNUMBER=0 [2 RANGE]
        0
        88
LPARM:PCL PITCH=10.00 [2 RANGE]
        0.44
        99.99
LPARM:PCL PTSIZE=12.00 [2 RANGE]
        4.00
        999.75
LPARM:PCL SYMSET=PC8 [29 ENUMERATED]
        PC8
        ROMAN8
        ISOL1
        ISOL2
        ISOL5
        ISOL6
        PC775
        PC8DN
        PC850
        PC852
        PC8TK
        PC1004
        WINL1
        WINL2
        WINL5
        WINBALT
        DESKTOP
        PSTEXT
        LEGAL
        ISO4
        ISO6
        ISO11
        ISO15
        ISO17
        ISO21
        ISO60
        ISO69
        WIN30
        MCTEXT
LPARM:POSTSCRIPT PRTPSERRS=OFF [2 ENUMERATED]
        OFF
        ON
```

INFO USTATUS

INFO USTATUS command returns a response similar to the following:

```
@PJL INFO USTATUS
DEVICE=VERBOSE [3 ENUMERATED]
        OFF
        ON
        VERBOSE
JOB=ON [2 ENUMERATED]
        OFF
        ON
PAGE=ON [2 ENUMERATED]
        OFF
        ON
TIMED=0 [2 RANGE]
        5
        300
```

Service Mode Variables

The following section describes special PJL variables that are used in printer development, testing, manufacturing and field service. These variables will not appear in the documentation that is released to the public -- they are for internal use only.

BIGDATA

Syntax: **BIGDATA = {OFF | ON}**

Default Value: **OFF**

The purpose of this variable is to increase the system's capacity to store outbound I/O data. It increases the maximum amount of data allowed per channel from 5k to more than 72M. It is useful for testing when massive amounts of backchannel data are produced. Setting this variable ON will allow the size of the back channel memory pool to be increased. However, since this pool is allocated at boot time, the user MUST REBOOT THE PRINTER for this change to take affect.

Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

CLEARALLCOUNTERS

Syntax: **CLEARALLCOUNTER = {YES | NO}**

Default Value: **NO**

Clears all page counters kept by the engine. It is intended for use by manufacturing to reset counters back to zero after testing.

CLEARERRORLOG

Syntax: **CLEARERRORLOG = {YES | NO}**

Default Value: **NO**

Clears all entries in the error log.

COLORCALIBDATAHI

Syntax: **COLORCALIBDATAHI**

Default Value: **N/A**

This read-only variable returns high-resolution halftone sensor readings, the absolute page count of the last calibration and CRC's for glossy and regular halftone maps.

COLORCALIBDATALO

Syntax: **COLORCALIBDATALO**

Default Value: **N/A**

This read-only variable returns low-resolution halftone sensor readings, the absolute page count of the last calibration and CRC's for glossy and regular halftone maps.

COLORCALIBFLAG

Syntax: **COLORCALIBFLAG = {ON | OFF}**

Default Value: **ON**

When set to **ON, h**alftone maps for high and low resolution halftones are built immediately with the current sensor reading and user adjustments. PPS message requesting calibration is enabled and halftone map building is enabled. When set to **OFF,** cchsInitHalftone() is called, halftone source is set to ROM, and halftone maps are initialized to unity. PPS messaging to request calibration is disabled and halftone map building is disabled.

COLORCALIBINTERVAL

Syntax: **COLORCALIBINTERVAL = { -32768| … | 32767 }**

Default Value: **100**

If the value is 0 and the **COLORCALIBFLAG** = **ON**, send message to PPS requesting DMAX and 2 density measurements. If the value is -1 and **COLORCALIBFLAG** = **ON**, send message to PPS requesting 2 density measurements (no DMAX). If the value is >0, set the calibration frequency to the specified number of pages.

COLORPAGES

Syntax: **COLORPAGES = {0| . . . | MAXPAGECOUNT}**

Default Value: **n/a**

This is used to read and write the color page count. maxpagecount is 2^{24} -1 though the maximum value that can be set via PJL is 9,999,999. When the number of pages exceeds maxpagecount, the value will roll to zero. This should never happen since maxpagecount is more than 16 times the rated life of the engine. The value of this variable will always be less than or equal to the value of **PAGES**. This counter will reset to zero when the variable **CLEARALLCOUNTERS** is set to YES.

CRCMODE

Syntax: **CRCMODE = {ON | OFF | PAPER}**

Default Value: **OFF**

This variable determines whether or not CRC's are calculated in the firmware for each page. **OFF** means that no CRC's are produced. **ON** enables the generation and reporting of CRC's and pages are not printed. **PAPER** enables the generation and reporting of CRC's and pages are printed. When CRC's are enabled, the string, which is returned for each page, has the following format:

Page <page ID> 0 <FW CRC> <bit count>

CRPAPER

Syntax: **CRPAPER = {LETTER | A4}**

Default Value: **LETTER (US)**

A4 (Europe)

Used to read or set the cold reset paper size. If set to **LETTER**, the printer's default paper size will be set to letter size when a cold reset is performed. If set to **A4**, the printer's default paper size will be set to A4 when a cold reset is performed. Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

DDIMODE

Syntax: **DDIMODE = ON**

Default Value: **N/A**

When **DDIMODE** is set to the value **ON**, all processes are shutdown and the DDI code is entered just beyond the handshake on the parallel port. This has the affect of starting up the DDI system thinking that it has just detected a successful handshake.

NOTES:

- The only valid value for this variable is on.
- DDI is a separate system from the normal printer firmware system. The only way to exit DDI and return the printer to normal operation is to cycle power.
- This is an additional method for entering DDI -- not the only method. Boot up firmware still needs to look for the DDI handshake on the parallel port and branch appropriately if detected.

DIAGNOSTICS

Syntax: **DIAGNOSTICS = {ON | OFF}**

Default Value: **OFF**

Used to enable or disable the printer's diagnostic mode, which allows access to PJL and PCL commands. These commands are not intended for use by the customer, only by Hewlett-Packard internal personnel.

This variable can only be set by the **DEFAULT** command.

FORMATTERNUMBER

Syntax: **FORMATTERNUMBER = {<alphanumeric token>}**

Default Value: **XXX000**

Contains the formatter's serial number. The value is a 6 character alphanumeric token.

FUSERCOUNT

Syntax: **FUSERCOUNT = {0| . . . | MAXPAGECOUNT}**

Default Value: **n/a**

This is used to read and write the fuser maintenance count value. maxpagecount is 2^{24} -1. When the number of pages exceeds maxpagecount the value returned is undefined. This should not be a problem since that value is more than 16 times the rated life of the engine. This counter will reset to zero when the variable **CLEARALLCOUNTERS** is set to YES.

FWREVISION

Syntax: **FWREVISION**

Default Value: **N/A**

This read-only variable returns the firmware revision string. This is the same string that is printed on the configuration page.

JOBIDVALUE

Syntax: **JOBIDVALUE = {0 | ... | 32767}**

Default Value: **n/a**

Used to read or set the current job ID. This variable is only available when DIAGNOSTICS = ON.

KEYDELAY

Syntax: **KEYDELAY = {0 | … | 7FFFFFFF}**

Default Value: **0**

MEMORYREAD

Syntax: **MEMORYREAD**

Default Value: **N/A**

This variable can only be used with the **INQUIRE** command. Using **@PJL INQUIRE MEMORYREAD** causes a memory dump starting at the value of **STARTADDRESS** and dumping **SIZE** bytes. **@PJL SET STARTADDRESS** = <address> **and @PJL SET SIZE** = <numbytes> must be done before **@PJL INQUIRE MEMORYREAD**.

NOTE: Access of an invalid address will produce a 79 Service error.

EXAMPLE:
Memory read of 64 bytes starting at address 0x9fe00500:

```
@PJL SET STARTADDRESS=h9fe00500
@PJL SET SIZE=H40
@PJL INQUIRE MEMORYREAD
```

produces this:

```
  @PJL INQUIRE MEMORYREAD
  Address:   0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F ASCII:
  9fe00500  b0 0e c5 9f f0 0f c5 9f 54 10 c5 9f 88 12 c5 9f
........T.......
  9fe00510  fc 17 c5 9f 14 2a c5 9f 70 2a c5 9f 34 21 c5 9f
.....*..p*..4!..
  9fe00520  fc 07 c0 9f e0 df c0 9f 3c 0d c0 9f 70 47 c0 9f
........<...pG..
  9fe00530  54 0a c0 9f 18 b0 c1 9f 00 00 00 00 3c b0 c1 9f
T...........<...
```

MODELNAME

Syntax: **MODELNAME = {<alphanumeric token>}**

Default Value: **"HP Color LaserJet 4500"**

This variable contains the model name of the printer. Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

MODELNUMBER

Syntax: **MODELNUMBER = {<alphanumeric token>}**

Default Value: **"C4084A"**

This variable contains the model number of the printer. Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

NOINFORMATIONALUSTATUS

Syntax: **NOINFORMATIONALUSTATUS = {OFF | ON}**

Default Value: **OFF**

This variable enables/disables the "Processing Job" message from returning in the status readback stream. A value of off means that the message will be sent.

NVRAMREAD

Syntax: **NVRAMREAD**

Default Value: **N/A**

This variable can only be used with the **INQUIRE** command. Using **@PJL INQUIRE MEMORYREAD** causes a memory dump starting at the value of **STARTADDRESS** and dumping **SIZE** bytes. **@PJL SET STARTADDRESS** = <address> **and @PJL SET SIZE** = <numbytes> must be done before **@PJL INQUIRE MEMORYREAD**.

NOTE: Access of an invalid address will produce a 79 Service error.

EXAMPLE:
Memory read of 50 bytes starting at address 0:

```
@PJL SET STARTADDRESS=h0
@PJL SET SIZE=H32
@PJL INQUIRE NVRAMREAD
```

produces this:

```
@PJL INQUIRE NVRAMREAD
Address:   0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F ASCII:
00000000  b0 0e c5 9f f0 0f c5 9f 54 10 c5 9f 88 12 c5 9f
........T.......
00000010  fc 17 c5 9f 14 2a c5 9f 70 2a c5 9f 34 21 c5 9f
.....*..p*..4!..
00000020  fc 07 c0 9f e0 df c0 9f 3c 0d c0 9f 70 47 c0 9f
........<...pG..
00000030  54 0a                                           T.
```

PAGES

Syntax: **PAGES = {0| . . . | MAXPAGECOUNT}**

Default Value: **n/a**

This is used to read and write the color page count, which is the total number of pages the engine has printed. maxpagecount is 2^{24} -1 though the maximum value that can be set via PJL is 9,999,999. When the number of pages exceeds maxpagecount, the value will roll to zero. This should never happen since maxpagecount is more than 16 times the rated life of the engine. The value of this variable will always be greater than or equal to the value of **PAGES**. This counter will reset to zero when the variable **CLEARALLCOUNTERS** is set to YES.

SENDKEY

Syntax: **SENDKEY = {GO | ENTER | MENU | BACKMENU | ITEM | UPITEM | PLUS | MINUS | JOBCANCEL}**

Default Value: **GO**

Setting this variable to one of its values has the same affect as pressing that key on the control panel.

SERIALNUMBER

Syntax: **SERIALNUMBER = {<alphanumeric token>}**

Default Value: **XXXXXXXXXX**

This variable contains the print engine's serial number. The value is a 10 character alphanumeric token. Both the current and default variables are set when either the **SET** or **DEFAULT** command is used.

SERVICEMODE

Syntax: **SERVICEMODE = {HPBOISEID | EXIT}**

Default Value: **n/a**

Used to enable or disable **SERVICE MODE**. The printer will never power up in service mode, regardless of the last setting of this variable.

HPBOISEID is the password to enter **SERVICE MODE**. Service mode commands are not available unless the printer is in this mode. **EXIT** will disable **SERVICE MODE**. If a query is done on the SERVICEMODE variable when it is set to anything but HPBOISEID, it will return a "?" meaning the printer is not in service mode.

SERVICE MODE is a mode on the HP Color LaserJet 4500 printer, which is only accessible to service representatives and the factory. It exists to allow the service representative and factory personnel to set the page count -- representing the age of the printer, set the cold reset value for paper size, enable skipping of HP demo pages, and enable diagnostics.

When service mode is enabled, all variables may be read by the **DINQUIRE** and **INQUIRE** commands. Both commands will return the same value. All variables may be set with the **DEFAULT** or **SET** commands. Both commands will affect the same copy of the variables. These variables will not be affected by the **INITIALIZE** command.

When the security mechanism is disabled, any attempt to read or write these variables will return a PJL error message to the host indicating the variable specified in the PJL command is not supported.

SIZE

Syntax: **SIZE = {0 | … | MAXADDRESS}**

Default Value: **0**

This variable is used specify the number of bytes to be returned for a **@PJL INQUIRE NVRAMREAD** or a **@PJL INQUIRE MEMORYREAD** command.

NOTE: The STARTADDRESS and SIZE must be specified in this format:

h|H<hex number>

until the PJL parser has been enhanced to accept real hex numbers. This is a temporary fix using the alphanumeric type. Currently the PJL parser will only accept decimal numbers for a numeric type value. The PJL parser will be enhanced in the near future to accept either hex or decimal numbers. At that time this syntax will accept either a hex number specified as 0x<hex number> or a <decimal number>.

STARTADDRESS

Syntax: **STARTADDRESS = {0 | … | MAXADDRESS}**

Default Value: **0**

This variable specifies the starting address for a memory dump using either a **@PJL INQUIRE NVRAMREAD** or a **@PJL INQUIRE MEMORYREAD** command. The PJL variable **SIZE** specifies the number of bytes to be returned.

NOTE: The STARTADDRESS and SIZE must be specified in this format:

h|H<hex number>

until the PJL parser has been enhanced to accept real hex numbers. This is a temporary fix using the alphanumeric type. Currently the PJL parser will only accept decimal numbers for a numeric type value. The PJL parser will be enhanced in the near future to accept either hex or decimal numbers. At that time this syntax will accept either a hex number specified as 0x<hex number> or a <decimal number>.

TRANSFERCOUNT

Syntax: **TRANSFERCOUNT = {0| . . . | MAXPAGECOUNT}**

Default Value: **n/a**

This is used to read and write the transfer belt maintenance count value. maxpagecount is 2^{24} -1. When the number of pages exceeds maxpagecount the value returned is undefined. This should not be a problem since that value is more than 16 times the rated life of the engine. This counter will reset to zero when the variable **CLEARALLCOUNTERS** is set to YES.

Correlation Between PJL, PML and the Control Panel

Variable	PML Object	Control Panel	
		Menu	Item
AUTOCONT	AUTO-CONTINUE	Configuration Menu	Auto Continue
BINDING	prtMediaPathDefaultIndex	Printing Menu	Binding
BITSPERPIXEL	DEFAULT-BITS-PER-PIXEL	n/a	n/a
CLEARABLEWARNINGS	n/a	Configuration Menu	Clearable Warnings

Variable	PML Object	Control Panel	
		Menu	Item
COPIES	DEFAULT-COPIES	Printing Menu	Copies
COURIER	n/a	Printing Menu	Courier
CPLOCK	prtConsoleDisable	n/a	n/a
DUPLEX	prtMediaPathDefaultIndex	Printing Menu	Duplex
FORMLINES	DEFAULT-LINES-PER-PAGE	Printing Menu	Form Length
INTRAY1SIZE	TRAY1-MEDIA-SIZE-LOADED	Paper Handling Menu	Tray 1 Size
INTRAY2SIZE	TRAY2-MEDIA-SIZE-LOADED	n/a	n/a
INTRAY3SIZE	TRAY3-MEDIA-SIZE-LOADED	n/a	n/a
IOBUFFER	IO-BUFFERING	I/O Menu	I/O Buffer
IOSIZE	IO-BUFFER-SIZE	I/O Menu	I/O Buffer Size
JOBATTR	job-info-attr-*x*; $0 > x < 16$	n/a	n/a
JOBID	CURRENT-JOB-PARSING-ID	n/a	n/a
LANG	prtGeneralCurrentLocalization prtConsoleLocalization	Special power on key press	n/a
LOWTONER	LOW-MARKING-AGENT-PROCESSING	Configuration Menu	Toner Low
LPARM:PCL FONTNUMBER	PCL-DEFULAT-FONT-NUMBER	Printing Menu	PCL Font Number
LPARM:PCL FONTSOURCE	PCL-DEFAULT-FONT-SOURCE	Printing Menu	PCL Font Source
LPARM:PCL PITCH	PCL-DEFAULT-FONT-WIDTH	Printing Menu	PCL Font Pitch
LPARM:PCL PTSIZE	PCL-DEFAULT-FONT-HEIGHT	Printing Menu	PCL Font Point Size
LPARM:PCL SYMSET	prtInterpreterDefaultCharSetIn	Printing Menu	PCL Symbol Set
LPARM:POSTSCRIPT PRTPSERRS	POSTSCRIPT-PRINT-ERRORS	Configuration Menu	Print PS Errors
MPTRAY	MP-TRAY	Paper Handling Menu	Tray 1 Mode
ORIENTATION	prtInterpreterDefaultOrientation	Printing Menu	Orientation
OUTLINEPOINTSIZE	n/a	n/a	n/a
OUTTONER	n/a	Configuration Menu	Toner Out
PAPER	DEFAULT-MEDIA-SIZE	Paper Handling Menu	Default Size
PASSWORD	n/a	n/a	n/a
PERSONALITY	prtChannelDefaultPageDescLangIndex	Configuration Menu	Personality
PLANESINUSE	n/a	n/a	n/a
POWERSAVE	ENERGY-STAR	Configuration Menu	Powersave
POWERSAVETIME	ENERGY-STAR	Configuration Menu	Powersave
REPRINT	REPRINT	Configuration Menu	Jam Recovery
RESOLUTION	DEFAULT-HORIZONTAL-BLACK-RESOLUTION, DEFAULT-VERTICAL-BLACK-RESOLUTION	n/a	n/a
TIMEOUT	IO-TIMEOUT	I/O Menu	I/O Timeout

Service Mode Variable	PML Object	Control Panel	
		Menu	Item
BIGDATA	n/a	n/a	n/a
CLEARALLCOUNTERS	n/a	n/a	n/a
CLEARERRORLOG	n/a	Service Menu	Clear Event Log
COLORCALIBFLAG	n/a	n/a	n/a
COLORCALIBLO	n/a	n/a	n/a
COLORCALIBHI	n/a	n/a	n/a
COLORPAGES	n/a	Service Menu	Color Page Count
CRCMODE	n/a	n/a	n/a
CRPAPER	n/a	Service Menu	Cold Reset Paper

Service Mode Variable	PML Object	Control Panel	
		Menu	Item
DDIMODE	n/a	Special power on key press	n/a
DIAGNOSTICS	n/a	n/a	n/a
FORMATTERNUMBER	n/a	n/a	n/a
FUSERCOUNT	n/a	Service Menu	Fuser Maint Count
FWREVISION	n/a	n/a	n/a
JOBIDVALUE	CURRENT-JOB-PARSING-ID	n/a	n/a
KEYDELAY	n/a	n/a	n/a
MEMORYREAD	n/a	n/a	n/a
MODELNAME	MODEL-NAME	n/a	n/a
MODELNUMBER	MODEL-NUMBER	n/a	n/a
NOINFORMATIONALUSTATUS	n/a	n/a	n/a
NVRAMREAD	n/a	n/a	n/a
PAGES	prtMarkerLifeCount	Service Menu	Total Page Count
SENDKEY	n/a	Press a key	n/a
SERIALNUMBER	SERIAL-NUMBER	Service Menu	Serial Number
SERVICEMODE	n/a	Special power on key press	n/a
SIZE	n/a	n/a	n/a
STARTADDRESS	n/a	n/a	n/a
TRANSFERCOUNT	n/a	Service Menu	Transfer Maint Count

Vagaries of the INFO VARIABLES Command

As stated in the PJL Technical Reference Manual, the command **INFO VARIABLES** returns a list of environment and printer language-dependent variables. The value returned for each variable is the same value returned by the **INQUIRE** command. In the HP Color LaserJet 4500 printer, this command only returns information for the PJL variables that are accessible to the end-user. The HP Color LaserJet 4500 printer does not return information on service mode variables, regardless of the service mode setting. In addition, the variables **JOBATTR** and **JOBID** do not appear in the list.

The following is a list of interactions and dependencies of PJL variables reported by this command.

- **BINDING** -- This variable only appears if **DUPLEX=ON**.
- **INTRAY2SIZE=UNKNOWNPAPER** -- This is the response when tray two is pulled from the printer. However, the value **UNKNOWNPAPER** does not appear in the list of enumerations.
- **INTRAY3SIZE** -- This variable only appears if tray 3, the optional paper tray, is installed.
- **POWERSAVETIME=1** -- This value is reported if **POWERSAVE=OFF**.
- **IOSIZE** -- The report of this variable changes based on the setting of **IOBUFFER**.

If IOBUFFER=AUTO,
IOSIZE=100 [2 RANGE]
100
100

If IOBUFFER=OFF,
IOSIZE=0 [2 RANGE]
0

0

If IOBUFFER=ON,
IOSIZE=10 [2 RANGE] ← The value can be any valid value within the supported range.
10
134700 ← The upper bound of the range is based on how much memory is in the system.

PJL Security

The HP Color LaserJet 4500 printer will support the PJL security mechanism. There are two aspects of PJL security: the first is Control Panel Lock. The second aspect is NVRAM protection from the PJL **DEFAULT** and **INITIALIZE** commands.

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. 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.

The HP Color LaserJet 4500 printer 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 **"ACCESS DENIED"** for approximately five seconds.

The HP Color LaserJet 4500 printer'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.

HP Color LaserJet 4500 PostScript

The HP Color LaserJet 4500 printer feature set requires some changes to the PostScript language. This document describes those changes. These features include:

- Color adjustments as specified by ColorSmart, CMYK Ink Sets, and Rendering Intents
- Halftoning as specified by ColorSmart
- Ability to put a gloss finish on matte paper
- Ability to operate the printer in monochrome mode
- Debugging commands which will not be in the HP Color LaserJet 4500 printer when shipped

Color Adjustments

The HP Color LaserJet 4500 printer allows the user to specify a rendering intent through three different mechanisms. In each case these are applied in the PostScript Device Color Space Conversion functionality block.[1]

Color Smart Color Treatments

ColorSmart allows for the rendering intent of color specifications for different types of objects to be one of two intents:

- MatchScreen -- Device colors are to be interpreted in such a way as to render colors which most closely match those on a CRT display. This constricts the printer gamut.
- Vivid – Device colors are to be interpreted in such a way as to utilitize the entire printer gamut.

The HP Color LaserJet 4500 printer is able to detect three different types of objects based on the painting operator in the PostScript input stream. These objects are:

Object Type	Painting Operators	Examples
Text	show, ashow, widthshow, awidthshow, xshow, xyshow, yshow, glyphshow, cshow, kshow	Characters fonts
Graphics	fill, eofill, stroke, ufill ueofill, ustroke, rectfill, rectstroke	Vectors, line art
Image	image, colorimage, imagemask	Raster, Photos

The HP Color LaserJet 4500 printer implements the following commands in globaldict. These are the same commands used by HP Color LaserJet 5/5M:

Command	Effect
`true ColorSmartColorMatching`	Does not do anything. The HP Color LaserJet 4500 printer is always in ColorSmart mode.
`false ColorSmartColorMatching`	Resets color treatments to default. In the HP Color LaserJet 4500 printer, this means all objects use `MatchScreen`. Note: The HP Color LaserJet 4500 printer always remains in ColorSmart mode. You cannot turn it off!

[1] PostScript Red Book, Adobe System Inc., p. 179.

`MatchScreen ColorSmartTextAdjustment`	Render text objects with `MatchScreen` intent.
`Vivid ColorSmartTextAdjustment`	Render text objects with `Vivid` intent.
`NoAdj ColorSmartTextAdjustment`	Render text objects with `MatchScreen` intent. Note: This option is provided for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use this.
`MatchScreen ColorSmartGraphicsAdjustment`	Render graphics objects with `MatchScreen` intent.
`Vivid ColorSmartGraphicsAdjustment`	Render graphics objects with `Vivid` intent.
`NoAdj ColorSmartGraphicsAdjustment`	Render graphics objects with `MatchScreen` intent. Note: This option is provided for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use this.
`MatchScreen ColorSmartImageAdjustment`	Render image objects with `MatchScreen` intent.
`Vivid ColorSmartImageAdjustment`	Render image objects with `Vivid` intent.
`NoAdj ColorSmartImageAdjustment`	Render image objects with `MatchScreen` intent. Note: This option is provided for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use this.

CMYK Ink Sets

This method only applies to 4 color specifications such as `DeviceCMYK` and `CIEBasedDEFG`. The CMYK can be rendered according to various intents based on the customer's Ink Set. This method allows the user to communicate to the HP Color LaserJet 4500 printer the type of Ink Set the CMYK values are based on.

Command	**Effect**
`<< /CMYKInkSet 0 >> setpagedevice`	This is the printer default. CMYK is rendered in the traditional PostScript fashion. Transfer functions are applicable.
`<< /CMYKInkSet 1 >> setpagedevice`	Render CMYK colors based on SWOP Ink Set. Note: Transfer functions have no effect.
`<< /CMYKInkSet 2 >> setpagedevice`	Render CMYK colors based on Euro Ink Set. Note: Transfer functions have no effect.
`<< /CMYKInkSet 3 >> setpagedevice`	Render CMYK colors based on Toyo Ink Set. Note: Transfer functions have no effect.
`<< /CMYKInkSet 4 >> setpagedevice`	Render CMYK colors based on Pantone Ink Set. Note: Transfer functions have no effect.

Rendering Intents (PostScript v. 2016 feature)

Version 2016 PostScript[2] defines a method for specifying a user rendering intent which then installs a color rendering dictionary (CRD.) Hence, this method is only applicable when the color space is one of the following device independent color spaces: `CIEBasedA`, `CIEBasedABC`, `CIEBasedDEF`, and `CIEBasedDEFG`.

The user specifies the rendering intent by sending the findcolorrendering operator. This returns the name of a CRD. The user must then call `findresource` followed by `setcolorrendering` to actually install the CRD.

Command	Effect
`/AbsoluteColorimetric findcolorrendering`	Returns the name `AbsoluteColorimetric.none.EnhancedHalftone.` The effect of this CRD is to treat all objects as `Vivid`.
`/RelativeColorimetric findcolorrendering`	Returns the name `RelativeColorimetric.none.EnhancedHalftone.` The effect of this CRD is to treat all objects as `MatchScreen`.
`/Saturation findcolorrendering`	Returns the name `Saturation.none.EnhancedHalftone.` The effect of this CRD is to treat all objects as `Vivid`.
`/Perceptual findcolorrendering`	Returns the name `Perceptual.none.EnhancedHalftone.` The effect of this CRD is to treat all objects as `MatchScreen`.

Interactions between ColorSmart, CMYK Ink Set, and Rendering Intent

Color Space	Color Treatment	CMYK Ink Set	Rendering Intent	Result
`DeviceRGB`	`MatchScreen` `Vivid`	NA	NA	ColorSmart color treatment is applied.
`DeviceCMYK`	`MatchScreen` `Vivid`	Def SWOP Euro Toyo Pantone	NA	CMYK Ink Set conversion is applied and ColorSmart color treatment is ignored.
`DeviceGray`	NA	NA	NA	No ColorSmart treatment is performed for gray-scale colors.
`CIEBasedA`	NA	NA	NA	No ColorSmart treatment is performed for gray-scale colors.

`CIEBasedABC`	`MatchScreen`
	`Vivid`
		NA	`Absolute`
			`Relative`
			`Saturation`
			`Perceptual`
				Rendering Intent takes precedence over ColorSmart color treatment for all objects.

[2] PostScript Language Reference Manual Supplement For Version 2016, Adobe Systems Inc. , p. 176-p181.

CIEBasedDEF	MatchScreen Vivid	NA	Absolute Relative Saturation Perceptual	Rendering Intent takes precedence over ColorSmart color treatment for all objects.
CIEBasedDEFG	MatchScreen Vivid	Def SWOP Euro Toyo Pantone	Absolute Relative Saturation Perceptual	CMYK Ink Set conversion is applied and the rendering intent and Colorsmart color treatments are ignored.

ColorSmart Halftoning

ColorSmart allows the user to specify different types of halftones to be applied to the three object types (text, graphics, images.)

Command	Effect
Halftone3 ColorSmartTextHalftone	Apply halftone 3 to text objects. This is the printer default.
Halftone1 ColorSmartTextHalftone	Apply halftone 1 to text objects.
Detail ColorSmartTextHalftone	Apply halftone 3 to text objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
Smooth ColorSmartTextHalftone	Apply halftone 2 to text objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
Basic ColorSmartTextHalftone	Apply halftone 2 to text objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
Halftone2 ColorSmartGraphicsHalftone	Apply halftone 2 to graphics objects. This is the printer default.
Halftone1 ColorSmartGraphicsHalftone	Apply halftone 1 to graphics objects.
Detail ColorSmartGraphicsHalftone	Apply halftone 2 to graphics objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
Smooth ColorSmartGraphicsHalftone	Apply halftone 1 to graphics objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
Basic ColorSmartGraphicsHalftone	Apply halftone 1 to graphics objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.

`Halftone2 ColorSmartImageHalftone`	Apply halftone 2 to image objects.
`Halftone1 ColorSmartImageHalftone`	Apply halftone 1 to image objects. This is the printer default.
`Detail ColorSmartImageHalftone`	Apply halftone 2 to image objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
`Smooth ColorSmartImageHalftone`	Apply halftone 1 to image objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.
`Basic ColorSmartImageHalftone`	Apply halftone 1 to image objects. This version of the command exists for backward compatibility only. The HP Color LaserJet 4500 printer drivers should not use it.

Gloss Finish

This feature allows the user to specify the application of a gloss finish on matte paper.

Command	**Effect**
`<< /GlossFinish true >> setpagedevice`	A gloss finish is applied to matte paper.
`<< /GlossFinish false >> setpagedevice`	The normal finish is applied to matte paper. This is the printer default.

Monochrome mode

Adobe defines the native color model [3]of the printer to be the "color model to which all colors are converted before rendering." the HP Color LaserJet 4500 printer's internal color mode is DeviceCMY. However, the user can instruct the HP Color LaserJet 4500 printer to behave in monochrome mode (DeviceGray).

Command	**Effect**
`<< /ProcessColorModel /DeviceCMY >> setpagedevice`	HP Color LaserJet 4500 is in color mode. This is the printer default.
`<< /ProcessColorModel /DeviceGray >> setpagedevice`	HP Color LaserJet 4500 is in monochrome mode.

If any of the other color spaces are specified, the HP Color LaserJet 4500 printer converts them to DeviceCMY.

[3] PostScript Printer Description File Format Specification Version 4.2, Adobe Systems Inc., p. 117.

Debugging commands

The following commands are only in the HP Color LaserJet 4500 printer firmware for the purpose of debugging. When the HP Color LaserJet 4500 printer ships, these commands should be removed from globaldict.

Command	Effect
`CCHSTestEnable`	CCHS conversion for ScreenMatch and CMYK Ink Sets are enabled. This is the printer default.
`CCHSTestDisable`	All calls to CCHS are bypassed.
`ColorSmartTestDisable`	No swapping of colors is performed. This is the printer default.
`ColorSmartTestEnable`	Swaps colors based on the ColorSmart setting. MatchScreen causes red and green to swap values; otherwise, red is swapped with blue.

HP Color LaserJet 4500 PCL

Terminology

This section will define any special terms needed to understand the document.

PCL	HP developed printer language that provides the highest level of communication between the system and the printer. "PCL" is a register trademark of Hewlett-Packard and should only be used as an adjective in literature.
HP-GL/2	HP's Graphics Language, Version 2.
PCL5 or PCL5e	The merging of the PCL and HP-GL/2 languages.
PCL5c	PCL with color extensions as documented in PCL 5 Color Technical Reference Manual.
PCL XL	A protocol for communicating with devices that produce text and graphics pages.
PCL6	The combination of PCL5c or PCL5e and PCL XL.
LPI	Lines Per Inch

Overview of HP Color LaserJet 4500's Implementation of the PCL Language

The implementation of the PCL language for the HP Color LaserJet 4500 printer is a mixture of code from various implementations: HP LaserJet 5Si firmware code base, HP Color LaserJet 5/5M, HP LaserJet 5/5M/5N/5N, and others. The driving forces behind this effort are:

- Compatibility with monochrome laser printers such as the HP LaserJet 5M and color laser printers such as the HP Color LaserJet 5.
- A firmware architecture based on a common imaging system for the PostScript, PCL 5, and PCL 6 languages. While this architectural change is not visible to customers, it has a profound impact on how the printer firmware is delivered.

PCL 5c Functionality

Fonts

The HP Color LaserJet 4500 printer's PCL implementation will support the same fonts as the HP LaserJet 5M.

Customer Visible Features

Color independent features will be compatible with the HP LaserJet 5M and color features of the HP Color LaserJet 5 (and if possible DJ 1220C). The following is a summary of the Functionality for this printer:

- Supported character sets and default character sets are the same as the HP LaserJet 5.
- Text Processing
  - Asian font character and font support
- Printer Control
  - Forms are supported by implementing the Alphanumeric IDs as discussed in Forms Support.
  - The duplex commands shown in Supported PCL Job Control Commands are supported and will be compatible with the HP LaserJet 5.
  - There will be a HP Color LaserJet 4500 printer specific self-test page generated by the self-test command discussed in Printer Diagnostics.
  - The color command Driver Function Configuration only supports setting lightness, saturation, and color treatments. A special, **internal usage only**, version of this command is supported for color maps. Not supported are under-color removal and scaling algorithms.

- See Internal HP Sequences for specifics and "Color Features" for more information.
- Page Control
  - The HP Color LaserJet 4500 will support ISO A5 and B5 paper sizes in addition to the media supported by the HP LaserJet 5. See "Supported PCL Page Control, Media Size Commands,".
- Media handling is discussed in "Media Handling"
- CAP Movement
- Font Selection
- Downloading Fonts
- Downloading Characters
- Unbound Fonts and Downloaded Symbol Sets
- Macros
- Status Readback

Color dependent features will be compatible with HP Color LaserJet 5/5M when possible:

- Raster Graphics
  - Foreground color will not interact with color raster graphics as in the HP Color LaserJet 5/5M printer.
- See "Raster" for a discussion of raster features.
- PCL Color
  - The CIE L* a* b* color space is not supported since the C&HS does not provide support for this color space.
  - Adjustment of black and white points for the RGB and CMY color spaces are not supported by not supporting the long form of the RGB and CMY CID command.
  - The Luminance-Chrominance spaces color space is not supported in the "Configure Image Data command (Supported PCL Imaging Mode Commands). See "Color Spaces."
  - Not supporting Color Lookup Tables (UnSupported PCL Color Lookup Table Commands).
  - Not supporting download color map (Unsupported PCL Device Specific Control Commands). A special version of this command will only be available to internal developers not customers.
  - Select color treatment (Unsupported PCL Device Specific Control Commands) will map the following treatments to `Screen Match`: `Business blue`, `Transparency`, `Out of gamut (DIC)`, `CIE Lab Match (DIC)`. See "Color Adjustments and Treatments."
  - A new color treatment can be selected via Select color treatment This treatment will cause the internal, color calibration color table to be loaded in hardware.
  - Scaling Algorithm and under-color removal options to the Driver Function Configuration command (Unsupported PCL Device Specific Control Commands) are not supported.
  - The following render algorithms are not supported and will be **ignored**: "snap to primaries," "snap black to white and other colors to black," and all monochrome render algorithms. See Supported PCL Halftone Algorithm Commands. All other render algorithms have a HP Color LaserJet 4500 printer unique implementation. See "Supported PCL Halftone Algorithm Commands".
  - The Finish Mode command is supported for the duration of a PCL job.
  - The Monochrome Print Mode command will only be effective at the beginning of a job (before the page is marked) and its effect will last for the job. This behavior is supported by the driver, other behaviors are implementation dependent and unsupported.
- See "Color" for a discussion of color features.
- The Color Print Model
- The compatibility target for rops is the HP Color LaserJet, not the HP Color LaserJet 5/5M.
- Vector Graphics
- Status Readback

Features not visible to customers

The following features of this implementation of the PCL language are not visible to the customer but are tied up in how the product is delivered:

- Modular architecture designed with the premise of the common imaging system:
  - Use of the Font Manger and Text Engine subsystems to achieve text compatibility
    - mass storage for font storage
    - faster TrueType rasterizer
- Use of a Graphics Engine, rather than a PCL imaging system. The Graphics engine hides the details of the lower level firmware architectures.
  - Contone color
  - Exploiting hardware support where possible through the Graphics and Text engines.
- Common PCL[56]/PostScript memory management.
- Internal Pages are emitted upon command either from the front panel or via the PCL Self-test command
- Raster repair to the extend that:
  - Non-sequential raster will be buffered and sent to the graphics engine in logical order.
  - The commitment of the image to the graphics engine will be delayed as long as possible thereby including as much as possible into a single image.

PCL 5c Backward Compatibility

Design Guidelines

We will use the following design guidelines in priority order:

1. HP LaserJet 5M is the design target for text and graphics placement.
2. HP Color LaserJet 5/5M is the design target for color command compatibility.
3. Randomly verify DeskJet 1200C files, identify differences, and address them on a case-by-case basis when feasible.

Rationale

Objectives: The following are the two objectives for meeting customer needs:

1. Minimize monochrome text reflow and graphic replacements versus the HP LaserJet 5M, wherever feasible. This requirement is deemed (by the customers) as more important than color matching.
2. The HP Color LaserJet 4500 will have the best color output quality possible. Customers want the best print quality from the HP Color LaserJet 4500 printer even if this reduces color matching to HP Color LaserJet, HP Color LaserJet 5/5M, and the DeskJet 1200C.

Installed Base: We'd like to be compatible with the following existing printers, which are numbered in the order of the size of the installed base:

1. HP LaserJet 5/5M/5N/5N:
   - PCL 5e 600 dpi monochrome text and forms
2. DeskJet 1200C
   - PCL 5c 300 dpi color half-tones
   - This printer is especially important for non-GUI DOS drivers.
3. HP Color LaserJet 5/5M
   - PCL 5c 300 dpi contone which is a superset of the DeskJet 1200C PCL 5.

Given the mix of printers and drivers existing in our target market, the HP Color LaserJet 4500 printer must accept input from the HP LaserJet 5/5M/5N/5N, HP Color LaserJet and DeskJet 1200C drivers, in that priority order.

PCL Color Features

The HP Color LaserJet 4500 printer is the latest color printer for WCD, following on the heels of the release of a 300 DPI, contone printer (HP Color LaserJet 5/5M). There are color issues specific to the HP Color LaserJet 4500 printer dealing with:

- Color Lookup Tables and Color Maps
- Finish Mode
- Monochrome Print Mode
- Color Adjustments and Treatments
- Viewing Illuminant and Gamma Commands
- Color Spaces
- Halftone and contone support
- Rendering Algorithms
- Under-Color Removal
- Raster Scaling Algorithm

Color Lookup Tables and Downloaded Color Maps

The information sent with the Download Color Map command and the Color Lookup Tables will be ignored.

A special version of the Download Color Maps command is provided only to internal developers and not customers. Similarly, a new, internal-usage-only command, Switch to Device Table, has been added to switch the halftoning services to use a device color table. This feature is used when generating the HP Color LaserJet 4500 Configuration Page.

Finish Mode

The finish for a page can be either matte or glossy. This request ejects the page at the point where the command is encountered.

Monochrome Print Mode

A job can be rendered in color or in a gray scale equivalent. This request must be sent to the printer before any printable data and cannot be changed after printable data has been received. If the command is received after printable data then the command is ignored.[1]

Color Adjustments and Treatments

Only two customer-visible color treatments are supported.

- Vivid
- Screen Match

A third treatment, Load (Internal) Calibration Table, will cause the device to load the color table used for color calibration into hardware and use that table for rendering color on the page.

Requests for "other color treatments will be ignored. As will requests for color adjustments of Lightness and Saturation

Viewing Illuminant and Gamma Commands

Viewing illuminant and gamma correction won't be supported.[3]

Under-Color Removal

This command will be ignored.

Scaling Algorithm

This command will be ignored since the printer is only going to do pixel replicated scaling. If other scaling algorithms are implemented then this command will be extended to control them.

Color Spaces

The HP Color LaserJet 4500 printer supports the following color spaces:

- Device Independent Colorimetric RGB (cRGB).
- Device Dependent RGB (RGB).
- Device Dependent Black (K) -- gray scale or monochrome.

PCL5c requirements added the following color space:

- Device Cyan, Magenta, Yellow (CMY) color space[4].

The HP Color LaserJet 4500 Color Processing Architecture requires support for the following color space:

- Standard RGB (sRGB)

in place of cRGB. Therefore support is dropped for cRGB and use of the CID command to set the color space to cRGB will set the color space to sRGB.

The following table provides a cmparison of printer support for color spaces

	Printer Support for Color Spaces			
Color Space	**HP Color LaserJet 4500**	**HP Color LaserJet 5/5M**	**HP Color LaserJet**	**DJ1200C**
RGB	Yes	Yes	Yes	Yes
CMY	Yes	Yes	Yes	?
cRGB	sRGB	RGB	Yes	?
CIE L*a*b	No	Yes	Yes	?
Luminance-Chrominance spaces	No	Yes	Yes	?
Standard RGB	Yes	No	No	No

Unsupported color spaces will be ignored. Therefore, rendering will proceed in the color space in effect when the command to switch to the unsupported color space was encountered.

Black and White Reference Points

Support for setting the black and white reference points for the RGB and CMY color spaces is dropped. This is accomplished by not supporting the long for the RGB and CMY CID commands.

Halftone and Contone Support

The following halftoning methods are supported:

- Device Best
- Hi LPI
- Low LPI or basic contone

The remaining algorithms will be ignored. See "Halftone Algorithms."

User-defined Halftones

The HP Color LaserJet 4500 printer will not (as the HP Color LaserJet 5/5M did not) support user-defined half tones [UHALFTN]. Therefore, the command in "User-Defined Dithers" is effectively ignored.

Note: The NV RAM variable PLANESINUSE is used to communicate the Monochrome Print Mode command's intent to the backend of the print system. The value cannot be changed in the middle of the page.

- This was added for the HP Color LaserJet 5/5M and not documented in implementor's guide.
- The CMY color space was added since the graphics engine[GEIF] supports the device CMY space, thus simplifying the specification and support of PCL palettes. Simple color and CID default palettes require a CMY palette.
- This is unique to the HP Color LaserJet 5/5M.

PCL Raster Features

Requirements for the HP Color LaserJet 4500 printer Raster Processing:

1. Accepts all PCL raster commands.
2. Ignores Raster Scale Algorithm and Raster Seed row source commands.
3. Operates in a limited and fragmented memory environment.
4. Has a firmware architecture that will accept an unordered raster stream and perform limited or basic raster healing.
5. Is independent of feed direction and device orientation.
6. Supports both Monochrome and Color Devices with the appropriate compilation switches.
7. Uses the Graphics Engine[GEIF] and the Common Object Marking Architecture [COMA] to:
    - Manage formatting of raster blocks into internal format.
    - Perform scaling, rotation, translation, and resolution changes.
    - Perform clipping of data outside the logical page.
    - Interpret the raster's color specification into device color.
    - Accept all resolutions (75 to 600) and perform operations to transform the image to device resolution.
    - Do raster scaling.

Well-behaved Raster

Well-behaved raster is a sequence of PCL raster commands that describe a complete image, start at the top left hand corner, and proceed to the bottom of the image.

With Ill-behaved Raster, on the other hand, problems occur when the raster blocks are not transferred in sequence (blocks 1, 4, 3, and 2 are transferred in that order). Further complications arise if multiple sequences are used to transfer portions of the same image. In situations like this the PCL system could be fooled into thinking that the raster is four images instead of four parts of the same image. The creation of spurious edges and the application of nearest neighbor half-toning or scaling algorithms such as error-diffusion or linear interpolation compound the problem. This situation creates visible lines within the image and other errors called stitching artifacts that are created when the blocks of raster data are merged into a single raster image.

Healing Raster

Various techniques or heuristics are applied to heal the disjoint raster blocks into a single raster block thereby avoiding stitching problems. Delaying the commitment of the raster image to the graphics engine performs the healing function.

Committing the Image to the Graphics Engine

The raster system will delay the ending of an image so that disjoint raster transfers can be treated as single image. The following list shows the conditions when the raster must be closed:

- Just before the end page call is made to the graphics engine, but after any macro overlay is complete.

- Before the PCL orientation changes.
- Before logical page width or length are changed.
- Before the registration changes.
- Before the logical page home position changes.
- When the source or pattern transparency is opaque and we are ending a raster graphics section.
- Before a change in the current pattern.
- Before a change in the tile reference point for the current pattern.
- Before a change in transparency modes.
- Before a change in the height and width of the destination raster image.
- When a CID command changes the raster data formats or color definitions.
- When palette commands change color definitions.
- When a delete, push/pop or select palette operation occurs.

Color PCL Raster

Color raster images can be composed (conceptually) of three color planes of data, which describe the image. How this data is transferred to the printer is set by the pixel encoding mode portion of the Configure Image Data command. There are two major formats: by plane or by pixel.

Pixel Encoding by Plane

Planar encoding uses successive data planes, each providing one bit for each pixel in a row. Each plane builds upon the preceding planes until the pixels in a row are fully defined. A pixel is not fully defined until it has received all the planes for that row. For data encoded, indexed by plane, the planes in a row form index numbers that define a pixel by selecting a palette entry. For example, an 8-entry palette requires 3 planes. The highlighted bits below compose the index of the color of the third pixel in the first row.

Esc*b#Vrow 1plane 1b1 b1 b1 b1 b1 b1...Esc*b#Vplane 2b2 b2 b2 b2 b2 b2...Esc*b#Wplane 3b3 b3 b3 b3 b3 b3...Esc*b#Vrow 2plane 1b1 b1 b1 b1 b1 b1...

Pixel Encoding Directly

When encoded by pixel, each pixel is fully specified before any bits are sent for the next pixel. For example, for data encoded indexed by plane -- for a 16-color palette, every group of four bits in the data stream defines a pixel. The highlighted (c4...c1) group below defines the palette index value for the second pixel in the first row.

Esc*b#Wrow 1:b4 b3 b2 b1c4 c3 c2 c1...Esc*b#Wrow 2:b4 b3 b2 b1...

Color Specifications: Indexed or Direct

Each bit in the raster image (whether in planar or pixel mode) has a color attribute. This attribute can be either an index into the color palette or a direct color description in any of the color spaces supported by the device.

Filling the Raster Area

The raster area is defined as a bounded raster picture and calls for the PCL raster system to "zero-fill" missing and incomplete rows, as well as clipping data outside the raster area.

In a monochrome device zero is the absence of data, which is identical to white -- nothing is printed. In a color device using a monochrome or CMY color space, zero represents white. However, if the RGB palette is chosen, or the user programs a palette, then something other than white (perhaps black) will be printed when zero filling is performed.

Missing Rows

When the Raster Y Offset command is used in place of a series of zero length Transfer Row commands, then zero filling to represent null data cannot be distinguished from rows where the color specification or index is zero. Therefore, colored (non-white) areas may appear when the color space is not monochrome or CMY.

Incomplete Rows

This situation occurs when the data transferred does not fill to the raster source width. As with missing rows, distinguishing null or absent data from data with and color specification or index of zero is very difficult.

Use-Case Analysis

Case 1: well-formed raster with a single image on the page

This case deals with a large raster image that takes most of the logical page. There may be text before or after the image, but none to the left or right. Since the raster is well formed or well behaved, the image attributes, destination size, and height for example, have been set by the commands in the raster prologue. This implies that the raster image attributes have been completely specified without recourse to default values or values from a previous image. Furthermore, the raster data is transferred smoothly as a contiguous image either top to bottom, or bottom to top. Partial rows might be encountered and will be filled with a zero value.

- Monochrome raster -- The default mode is Black and White where index 0 in the palette is white or effectively transparent.
- Color Raster -- The three (supported) Simple Color palettes: are monochrome, RGB, and CMY. Two of which have white (or transparent) for index 0, and the third, RGB has black for index 0. A simple zero filling for incomplete raster lines will give either transparent or black depending on the selected palette. The Configure Image Data command further complicates matters by defining palettes where any color can be assigned to index 0. HP Color LaserJet and HP Color LaserJet 5/5M simply zero filled partial lines and leave it up to the driver to select the appropriate value for index 0 to preserve the users intent.

Case 2: Well formed raster with multiple, small images on the page

This case deals with mixed images and text -- text wrapped around images as well as interspersed in the text. Two separate images, which were aligned in the page, were transmitted as a single row with transparent fill between them so that the text would show.

- Monochrome Raster -- In this case, a zero fill between the two images works, since, zero is white.
- Color images -- Color images cannot have a zero fill, since in the RGB color space (and potentially user defined palettes) this would color between the images.

Case 3: Lazy raster with a single image on a page

This is the case of ill-behaved raster -- no raster prologue, just transfer commands. Here, the current values or system defaults are applied to the image. Since there is no clue what the dimensions of the image are, it must be buffered until one of the closing conditions is encountered. Furthermore, there's no guarantee that the rows will arrive in sequential order. Buffering the data will order it for the eventual transfer to the G.E. Since neither the source or destination sizes are given, the size of the transferred image will be used and no scaling will be required.

- Monochrome Raster -- The HP LaserJet 5Si firmware code base raster manager assumed that the width of the image was the size of the first row transferred.
- Color Raster -- The Logical page width is the default width of the image. Therefore, the rows are filled with index zero. This will give unintended results when accepting input from an HP LaserJet 5/5M/5N/5N driver and a palette other than the monochrome and CMY palettes are used.

Case 4: Lazy raster with multiple, small images on a page

As in case 3, the input must be buffered to determine the image size. Furthermore, the problems discussed in Case 2 also apply.

Case 5: Raster Prologue used with unordered transfers

This is a modification of the middle case above. The image attributes are stated, but the rows are not transferred in sequential order. There are large jumps on the positive and negative Y direction. Here we can supply fill values that are discarded if the area is later transferred. This does require buffering for coherency before transferring the image to the G.E.

Asian Font Support

The HP LaserJet 5Si firmware code base and therefore the HP Color LaserJet 4500 printer's PCL implements the following PCL commands which support Asian Font printing:

Command	Sequence	Page
Character Text Path Direction	Esc&c#T	Supported PCL Text Path Commands
Text Parsing Method	Esc&t#P	Supported PCL Text Processing Commands
Download Font	Esc)s#W[font def]	Supported PCL Download Font Commands

Forms Support

The implementation of Alphanumeric IDs will be used to support forms.

PCL5c Commands

The PCL5 escape sequences are divided into the following groupings:

- Text Processing
- Printer Control
- Page Control
- CAP Movement
- Font Selection
- Downloading Fonts
- Downloading Characters
- Unbound Fonts and Downloaded Symbol Sets
- Raster Graphics
- Color
- The Color Print Model
- Vector Graphics
- Macros
- Status Readback
- Obsolete Codes
- Other -- Configure Raster Data
- Undocumented PCL Commands or Undocumented Uses

Text Processing

These commands deal with the processing of character codes other than escape sequences.

Supported PCL Text Processing Commands

Command	Sequence	Range		Compatible
Backspace	BS	--		HP LaserJet 5/5M/5N/5N
Bell	BEL	--		HP LaserJet 5/5M/5N/5N
Carriage Return	CR	--		HP LaserJet 5/5M/5N

Display Functions Mode On	EscY	~		HP LaserJet 5/5M/5N
Display Functions Mode Off	EscZ	~		HP LaserJet 5/5M/5N
Disable Underline Mode	Esc&d@	~		HP LaserJet 5/5M/5N
Enable Underline Mode	Esc&d#D	0-2	Fixed position	HP LaserJet 5/5M/5N
		3,4[1]	Floating position	HP LaserJet 5/5M/5N
End-of-Line Wrap	Esc&s#C	0-1		HP LaserJet 5/5M/5N
Form Feed	FF	~		HP LaserJet 5/5M/5N
Horizontal Tab	HT	~		HP LaserJet 5/5M/5N
Line Feed	LF	~		HP LaserJet 5/5M/5N
Line Termination	Esc&k#G	0-3		HP LaserJet 5/5M/5N
Null	NUL	--		HP LaserJet 5/5M/5N
Shift In	SI	--		HP LaserJet 5/5M/5N
Shift Out	SO	--		HP LaserJet 5/5M/5N
Space	SP	~		HP LaserJet 5/5M/5N
Text Parsing Method[2]	Esc&t#P	0,1		HP LaserJet 5/5M/5N
		21	2 byte for chars, 1 byte for codes	HP LaserJet 5/5M/5N
		31	Shift JIS	HP LaserJet 5/5M/5N
		38	Depends on 8th bit of first byte	HP LaserJet 5/5M/5N
Transparent Data Mode	Esc&p#X	0-32767		HP LaserJet 5/5M/5N

Unsupported PCL Text Processing Commands

Command	Sequence	Range
Escapement Encapsulated Text	Esc&p#W	

Footnotes:
1. Responses to all other values are implementation specific.
2. PCL command in the HP Color LaserJet 4500 printer, but not in either the HP Color LaserJet or HP Color LaserJet 5/5M.

Printer Control

These commands deal with PCL job control, printer diagnostics, device-specific printer control, and undocumented HP escape sequences.

Supported PCL Job Control Commands

Command	Sequence	Range	Compatible

Reset	EscE	~	HP LaserJet 5/5M/5N[4]
Alphanumeric IDs[3]	Esc&n#W	2 – 216 Default, Plain, Letterhead, Preprinted, Labels, Transparency, Prepunched, Bond, Recycled, Color, Cardstock Heavy	HP Color LaserJet 4500
Media Destination	Esc&l#G	0-3	HP LaserJet 4000
Simplex/Duplex	Esc&l#S	0-2	HP LaserJet 5/5M/5N
Duplex Page Side Selection	Esc&a#G	0-2	HP LaserJet 5/5M/5N
Left Registration	Esc&l#U	(-32767)-(+32767)	HP LaserJet 5/5M/5N
Top Registration	Esc&l#Z	(-32767)-(+32767)	HP LaserJet 5/5M/5N
Copies	Esc&l#X	1-32767	HP LaserJet 5/5M/5N
Unit Of Measure[5]	Esc&u#D		HP LaserJet 5/5M/5N
Peripheral Configuration	Esc&b#W	RENAME, JOB, TYPE	HP LaserJet 5/5M/5N
Universal Language Exit (UEL)	Esc%-12345X		HP LaserJet 5/5M/5N

Unsupported PCL Job Control Commands

Command	Sequence	Range
Job Separation	Esc&l#T	1
Negative Motion	Esc&a#N	0-1

Printer Diagnostics

This command provides self-testing ability in the printer.

Supported PCL Printer Diagnostic Commands

Command	Sequence	Range	Compatible
Self-test	Escz	~	HP Color LaserJet 4500

Device Specific Control

These commands provide device specific control.

Unsupported PCL Device Specific Control Commands

Command	Sequence	Range
Gray Balance	Esc*b#B	
Dry Timer	Esc&b#T	
Color Raster Graphics Depletion	Esc*o#D	
Mechanical Print Quality	Esc*o#Q	
Print Quality	Esc*o#M	
Media Type	Esc&l#M	0 Plain Paper 1 Bond Paper 2 Special Paper 3 Glossy Film

		4 Transparency Film

Internal HP Sequences.

Supported PCL Internal HP Sequences Commands

Command	Sequence	Range	Compatible
Select Default Font (Primary)	Esc(#@	0 to 3	HP LaserJet 5/5M/5N
Select Default Font (Secondary)	Esc)#@	0 to 3	HP LaserJet 5/5M/5N
Driver Function Configuration[8]	Esc*o3W643	Color treatmentVivid	HP Color LaserJet 4500
	Esc*o3W646	Color treatmentScreen Match	HP Color LaserJet 4500
	Esc*o3W647	Color treatmentLoad (Internal) Calibration Table	HP Color LaserJet 4500

A special version of the Driver Function Configuration: Download Color Maps command is provided to internal developers and not customers.

Unsupported PCL Device Specific Control Commands

Command	Sequence	Range
Driver Function Configuration[9]	Esc*o#W[device_id data]	data bytes: 0-232-1 device_id: 0-5,7
Lightness	Esc*o#W60	-100—100
Saturation	Esc*o#W61	-100—100
Under-color removal	Esc*o#W62	0-255
Scaling Algorithm	Esc*o#W63	0-3
Color treatment: No Adjust	Esc*o3W640	
Color treatment: Business Blue	Esc*o3W641	
Color treatment: Transparency	Esc*o3W642	
Color treatment: Out of Gamut	Esc*o3W644	
Color treatment: CIE Lab Match	Esc*o3W645	
Download color map	Esc*o#W65	1, 3
Underware Function Configuration	Esc&i#W[data]	0 - 232-1

Footnotes:
5. PCL command in the HP Color LaserJet 4500 printer but not in either HP Color LaserJet or HP Color LaserJet 5/5M.
8. Command not supported by HP LaserJet 5/5M/5N and appears in the PCL 5c Color Technical Reference Manual.
9. Command not supported by the HP LaserJet 5/5M/5N

Page Control

These commands affect a single page or group of pages (as opposed to job control commands, which are issued at the beginning of a job and affect the entire job). The sequences are divided into the following topics:

- Media Size
- Media Source
- Orientation

- CMI and LM
- Text Path
- Margins and Text area

Media Size

The default logical page extends from the top edge of the physical page to the bottom edge. The width is device dependent and may not extend as far as the unprintable area on the sides.

Supported PCL Page Control, Media Size Commands

Command	Sequence	Range	Compatible
Page Length	Esc&l#P	Device Specific	HP LaserJet 5/5M/5N
Page Size[10]	Esc&l#A	1 Executive	HP LaserJet 5/5M/5N
		2 Letter[11]	HP LaserJet 5/5M/5N
		3 Legal	HP LaserJet 5/5M/5N
		25 ISO A5	HP Color LaserJet 4500
		26 A4[12]	HP LaserJet 5/5M/5N
		80 Monarch Envelope	HP LaserJet 5/5M/5N
		81 Comm. 10 Envelope	HP LaserJet 5/5M/5N
		90 Intl. DL Envelope	HP LaserJet 5/5M/5N
		91 Intl. C5 Envelope	HP LaserJet 5/5M/5N
		100 Intl. B5 Envelope	HP LaserJet 5/5M/5N
		101 Custom	HP LaserJet 5/5M/5N

Unsupported PCL Page Control, Media Size Commands

Command	Sequence	Range
Media Eject Length	Esc&f#F	
Page Width	Esc&f#G	

Media Source

Selects the media source.

Supported PCL Media Source Commands

Command	Sequence	Range	Compatible
Media Source	Esc&l#H	0 Current Page, source unchanged	HP LaserJet 4000/5000/8000
		1 Tray 2: removable Standard Input Paper Tray[13]	HP LaserJet 4000/5000/8000
		2, 3 Manual feed	HP LaserJet 4000/5000/8000
		4 Tray 1: non-removable Multi-Purpose Input Paper Tray	HP LaserJet 4000/5000/8000
		5[14] Tray 3: Optional Input Paper Tray	HP LaserJet 4000/5000/8000
		7 Auto-select	HP LaserJet 4000/5000/8000
		8 Third Cassette	HP LaserJet 5Si
		20-39 Values for external paper hander	HP LaserJet 5Si

Unsupported PCL Media Source Commands

Command	Sequence	Range

Media Source	Esc&l#H	-2 Preload -1 Tractor feed 3 Manual Envelope Feed 6 Optional Envelope feeder

Orientation

Orientation defines the position of the logical page on the physical page.

Supported PCL Orientation Commands

Command	Sequence	Range	Compatible
Page Orientation	Esc&l#O	0-3	HP LaserJet 5/5M/5N
Print Direction	Esc&a#P	0, 90, 180, 270	HP LaserJet 5/5M/5N

CMI and LMI

In a fixed-space font the Character Motion Index (CMI) defines the width of columns or height of rows depending on the text path. In a proportional font, the CMI affects only the space character. The Line Motion index (LMI) defines the distance between lines of print.

Supported PCL CMI and LMI Commands

Command	**Sequence**	**Range**	**Compatible**
Character Motion Index (CMI)	Esc&k#H	0 -- 232-1	HP LaserJet 5/5M/5N
Line Motion Index (LMI)	Esc&l#C	0 -- logical Page Length up to 232-1	HP LaserJet 5/5M/5N
Line Spacing	Esc&l#D	0 -- logical Page Length up to 32767	HP LaserJet 5/5M/5N

Text Path

Asian Printing requires the ability to print text vertically or horizontally.

Supported PCL Text Path Commands

Command	**Sequence**	**Range**	**Compatible**
Character Text Path Direction[15]	Esc&c#T	−1 Rotated	HP LaserJet 5/5M/5N
		0 Horizontal	HP LaserJet 5/5M/5N

Unsupported PCL Device Specific Control Commands

Command	**Sequence**	**Range**
Character Text Path Direction	Esc&c#T	1 - Vert.

Margins and Text Area

Margins are related to the logical page, not the physical page. Since the printer can only address the area within the logical page, the actual distance from the text area to the edge of the physical page is the margin plus the distance between the edge of the physical page and the edge of the logical page. The text areas is the area defined by the left, right, top margins and the text length.

Supported PCL Margin and Text Area Commands

Command	**Sequence**	**Range**	**Compatible**
Clear Margins	Esc9	~	HP LaserJet 5/5M/5N
Left Margin	Esc&a#L	0-Right Margin	HP LaserJet 5/5M/5N
Perforation Skip Mode	Esc&l#L	0-1	HP LaserJet 5/5M/5N
Right Margin	Esc&a#M	Left margin-Right	HP LaserJet 5/5M/5N

		bound	
Text Length	Esc&l#F	0-(Page Length-Top Margin)	HP LaserJet 5/5M/5N
Top Margin	Esc&l#E	0-Page Length	HP LaserJet 5/5M/5N

Footnotes:
11. The default paper in the USA.
12. The default paper in Europe.
13. PCL Escape sequence (command) not supported by the HP Color LaserJet 5/5M firmware.
14. PCL command in the the HP Color LaserJet 4500 printer but not in either the HP Color LaserJet or HP Color LaserJet 5/5M.

CAP Movement

CAP (Current Active Position) is where the next character or graphics dot will be printed. The commands for manipulating the CAP are grouped as follows:

- Horizontal Positioning Commands
- Vertical Positioning Commands
- Saving the CAP

Horizontal Positioning Commands

Absolute horizontal positioning is referenced to the left logical page boundary. Relative horizontal positioning is reference to CAP. A signed value field indicates relative positioning; the absence of a sign indicates absolute positioning.

Supported PCL Horizontal Positioning Commands

Command	Sequence	Range	Compatible
Move CAP Horizontal (decipoints)	Esc&a#H	(-32767)-(+32766)	HP LaserJet 5/5M/5N
(PCL Units)	Esc*p#X	(-32767)-(+32767)	HP LaserJet 5/5M/5N
(Columns)	Esc&a#C	(-32767)-(+32767)	HP LaserJet 5/5M/5N

Vertical Positioning Commands

Vertical positioning may be either absolute or relative. A signed value field indicates relative positioning; the absence of a sign indicates absolute positioning.

Supported PCL Vertical Positioning Commands

Command	Sequence	Range	Compatible
Move CAP Vertical (Decipoints)	Esc&a#V	(-32767)-(+32767)	HP LaserJet 5/5M/5N
(PCL Units)	Esc*p#Y	(-32767)-(+32767)	HP LaserJet 5/5M/5N
(Rows)	Esc&a#R	(-32767)-(+32767)	HP LaserJet 5/5M/5N

Saving the CAP

Some situations require the device to be able to save previous CAP positions.

Supported PCL Saving CAP Commands

Command	Sequence	Range	Compatible
Push/Pop CAP	Esc&f#S	0-1	HP LaserJet 5/5M/5N

Font Selection

A font is a group of symbols that have similar characteristics such as symbol set, spacing, height, and stroke weight. A user selects one font for printing at any one time. Fonts may be selected by characteristics or ID. The commands for selecting fonts are grouped as follows:

- Primary and Secondary fonts
- Selection by Attribute
- Selection by ID

Primary and Secondary fonts

PCL devices may maintain two independent font selection tables, which provide access to a primary font and a secondary font.

Supported PCL Primary and Secondary Font Commands

Command	Sequence	Range	Compatible
Primary Font (Shift In)	SI	~	HP LaserJet 5/5M/5N
Secondary Font (Shift Out)	SO	~	HP LaserJet 5/5M/5N

Font Selection by Attribute

The user requests a font by designating its attributes with the following commands.

Supported PCL Font Selection by Attribute Commands

Command	Sequence	Range	Compatible
Primary Font Symbol Set	Esc(ID	?	HP LaserJet 5/5M/5N
Secondary Font Symbol Set	Esc)ID	?	HP LaserJet 5/5M/5N
Primary Font Spacing	Esc(s#P	0 -- 2	HP LaserJet 5/5M/5N
Secondary Font Spacing	Esc)s#P	0 -- 2	HP LaserJet 5/5M/5N
Primary Font Pitch	Esc(s#H	>0.00	HP LaserJet 5/5M/5N
Secondary Font Pitch	Esc)s#H	>0.00	HP LaserJet 5/5M/5N
Primary Font Height	Esc(s#V	>0.00	HP LaserJet 5/5M/5N
Secondary Font Height	Esc)s#V	>0.00	HP LaserJet 5/5M/5N
Primary Font Style	Esc(s#S	0 -- 32767	HP LaserJet 5/5M/5N
Secondary Font Style	Esc)s#S	0 -- 32767	HP LaserJet 5/5M/5N
Primary Font Stroke Weight	Esc(s#B	-7 -- 7	HP LaserJet 5/5M/5N
Secondary Font Stroke Weight	Esc)s#B	-7 -- 7	HP LaserJet 5/5M/5N
Primary Font Typeface	Esc(s#T	0 -- 65535	HP LaserJet 5/5M/5N
Secondary Font Typeface	Esc)s#T	0 -- 65535	HP LaserJet 5/5M/5N

Unsupported/Obsolete PCL Font Selection by Attribute Commands

Command	Sequence	Range
Primary Font Quality[16]	Esc(s#Q	Device Specific
Secondary Font Quality[16]	Esc)s#Q	Device Specific

Footnotes:
16. PCL command not supported in the HP LaserJet 5/5M/5N, HP Color LaserJet, or HP Color LaserJet 5/5M.

Selection by ID

Downloaded fonts can be specified by their ID numbers.

Supported PCL Font Selection by ID Commands

Command	Sequence	Range	Compatible
Font Selection by ID (Primary)	Esc(#X	0-32767	HP LaserJet 5/5M/5N
Font Selection by ID (Secondary)	Esc)#X	0-32767	HP LaserJet 5/5M/5N

Downloading Fonts

There are two parts to font downloading:

- Font definition, discussed in this section.
- Character definition, discussed in "Downloading Characters."

Supported PCL Download Font Commands

Command	Sequence	Range	Compatible
Font ID	Esc*c#D	0-32767	HP LaserJet 5/5M/5N
Download Font	Esc)s#W[font def]	0-65535	HP LaserJet 5/5M/5N
Font Control	Esc*c#F	0-6	HP LaserJet 5/5M/5N

Downloading Characters

As described in "Downloading Fonts," font downloading consists of

- Downloading the font definition.
- Downloading the individual characters in the font.

The commands in this section deal with the individual characters in a downloaded font.

Supported PCL Download Font Characters Commands

Command	Sequence	Range	Compatible
Character Code	Esc*c#E	0-65535	HP LaserJet 5/5M/5N
Download Character	Esc(s#W[Character Definition]	0-32767	HP LaserJet 5/5M/5N

Unbound Fonts and Downloaded Symbol Sets

A bound font is restricted to a single symbol set. An unbound font contains the union of multiple symbol sets described by a Symbol Index. Symbol sets may be downloaded. The supported commands are shown in the table below.

Supported PCL Downloaded Symbol Set Commands

Command	Sequence	Range	Compatible
Symbol Set Code	Esc*c#R	0-65535	HP LaserJet 5/5M/5N
Symbol Set Control	Esc*c#S	0,1,2,4,5	HP LaserJet 5/5M/5N

Download Symbol Set	Esc(f#W[symbol set definition]	0-32767	HP LaserJet 5/5M/5N

Raster Graphics

These commands deal with raster (bitmap) graphics. The commands are grouped as follows:

- Raster Mode
- Raster Data Transfer
- Raster Compression
- Raster Scaling

Raster Mode

Raster mode is a restricted state, which can be entered and exited either explicitly or implicitly. The implicit enter and exit operations are not recommend but are supported.

- With Implicit Raster Mode Entrance, the transfer raster and raster Y offset commands by themselves can cause the PCL interpreter to enter raster mode.
- Explicit Raster Mode Exit Text or non-raster commands end raster mode. However, raster healing can be used to stitch together non-contiguous blocks of raster that are really part of the same image The heuristics used to determine what raster images a transfer belongs with is the crux of the backward compatibility issue.

Supported PCL Raster Mode Commands

Command	Sequence	Range	Compatible
End Raster Graphics[17]	Esc*rB	~	HP Color LaserJet 5/5M
End Raster	Esc*rC	~	HP Color LaserJet 5/5M
Raster Presentation Mode	Esc*r#F	0, 3	HP Color LaserJet 5/5M
Raster Resolution	Esc*t#R	75, 150, 200, 300, 600	HP Color LaserJet 5/5M
Source Raster Height	Esc*r#T	0-Logical Page Bound	HP Color LaserJet 5/5M
Source Raster Width	Esc*r#S	0-Logical Page Right	HP Color LaserJet 5/5M
Start Raster	Esc*r#A	0, 1, 2, 318	HP Color LaserJet 5/5M
Raster Y Offset	Esc*b#Y	0-32767	HP Color LaserJet 5/5M

Unsupported PCL Raster Mode Commands

Command	Sequence	Range
Raster X Offset	Esc*b#X	0-logical page

Raster Data Transfer

The raster transfer commands define how many bytes are to be interpreted as binary raster data, rather than as ASCII data. The data may be encoded either by plane or by row.

Supported PCL Raster Data Transfer Commands

Command	Sequence	Range	Compatible
Transfer Raster by Plane	Esc*b#V[data]	0-32767	HP Color LaserJet 5/5M
Transfer Raster by Row/Block	Esc*b#W[data]	0-32767	HP Color LaserJet 5/5M

Raster Compression

Compressed data formats can improve data transfer throughput and efficiency. There are several different compression modes, which determine how the raster data in the transfer raster commands is interpreted.

Supported PCL Raster Compression Commands

Command	Sequence	Range	Compatible
Compression Method	Esc*b#M	0 – unencoded	HP Color LaserJet 5/5M
		1 -- Run-length	HP Color LaserJet 5/5M
		2 -- TIFF rev 4.0	HP Color LaserJet 5/5M
		3 -- Delta row	HP Color LaserJet 5/5M
		5 -- Adaptive (block-based)	HP Color LaserJet 5/5M

Unsupported PCL Raster Compression Commands

Command	Sequence	Range
Seed Row Source	Esc*b#S	0 - number of active plans[19]
Compression Method	Esc*b#M	4 -- unencoded (block based)[19] (monochrome only) 6 -- CCITT Grp 3 1[19] (monochrome only) 7 -- CCITT Grp 3 2D19(monochrome only) 8 -- CCITT Grp 4[19] 9 -- Compressed replacement delta row[19]

Raster Scaling

Scale mode (controlled by the start raster command) renders a raster image in the desired size independent of device resolution. The scaling factor is implicitly carried in the destination size of the raster image.

Supported PCL Raster Scaling Commands

Command	Sequence	Range	Compatible
Destination Raster Width[20]	Esc*t#H	0-32767	HP Color LaserJet 5/5M
Destination Raster Height[20]	Esc*t#V	0-32767	HP Color LaserJet 5/5M

Unsupported PCL Raster Scaling Commands

Command	Sequence	Range
Scale Algorithm[21]	Esc*t#K	0-3

Footnotes:
17. Obsolete Code -- Esc*rC is the preferred End Raster Graphics PCL sequence.
18. PCL command only supported in DF1200C, HP Color LaserJet, and HP Color LaserJet 5/5M.
19. PCL command NOT supported in the HP Color LaserJet and HP Color LaserJet 5/5M.
20. PCL command only supported in the HP Color LaserJet and HP Color LaserJet 5/5M.
21. PCL command not supported in the HP Color LaserJet or HP Color LaserJet 5/5M.

Color

Except for HP-GL/2 vector graphics, PCL color uses the raster commands described in "Raster Graphics" in addition to the commands described in this section. The commands are grouped as follows:

- Simple Color Mode
- PCL Imaging Mode
- Palette Operations
- Foreground Color
- Halftone Algorithms
- User-Defined Dithers
- Color Lookup Tables
- Gamma Correction
- Viewing Illuminant
- Page Media Color Commands

Simple Color Mode

The Simple color command creates a fixed-sized palette, whose color specifications cannot be modified.

Supported PCL Simple Color Commands

Command	Sequence	Range	Compatible
Simple Color	Esc*r#U	-3,1,322,23,24	HP Color LaserJet 5/5M

PCL Imaging Mode

PCL Imaging Mode, entered by the Configure Image Data (CID) command, creates a variable-size programmable palette. It provides multiple color spaces, pixel encoding modes, and reprogrammable palettes.

Supported PCL Imaging Mode Commands

Command	Sequence	Byte(s)	Description	Range	Compatible
Configure Image Data[25]	Esc*v#W[binary data]	0.	Color Space	0 (Device RGB)	HP Color LaserJet 4500
				1 (Device CMY)	HP Color LaserJet 4500
				2 (Standard RGB)	HP Color LaserJet 4500
		1.	PEM0	(Index/Plane)	HP Color LaserJet 4500
				1(Index/Pixel)	HP Color LaserJet 4500
				2 (Direct/Plane)	HP Color LaserJet 4500
				3 (Direct/Pixel)	HP Color LaserJet 4500
		2.	Bits/Index	0 -- 8	HP Color LaserJet 4500
		3.	Bits/Primary #1	0 -- 8	HP Color LaserJet 4500
		4.	Bits/Primary #2	0 -- 8	HP Color LaserJet 4500
		5.	Bits/Primary #3	0 -- 8	HP Color LaserJet 4500

Unsupported PCL Imaging Mode Commands

Command	Sequence	Byte(s)	Description	Range
Configure Image Data[25]	Esc*v#W[binary data]	0.	Color Space	4 Luminance-Chrominance 3 CIE L*a*b*
long form, Luminance-Chrominance	Esc*v122W4	6-121	color space definition	
long form, CIE L*a*b* only	Esc*v29W3...	6-9	min L*all 32 bit, single precision numbers	
		10-13	max L*14-17min a*all 32 bit, single precision numbers	
		18-21	max a*	
		12-25	min b*all 32 bit, single precision numbers	
		26-29	max b*	
long form, RGB/CMY only	Esc*v16W	0		
	Esc*v16W	1		
		6 & 7.	white ref #1	0 -- 215
		8 & 9.	white ref #2	0 -- 215
		10 & 11.	white ref #3	0 -- 215
		12 & 13	black ref #1	0 -- 215
		14 & 15	black ref #2	0 -- 215
		16 & 17	black ref #3	0 -- 215
long form, CRGB only	Esc*v85W	2		
		6 -- 8, 4 ignored	color space set to sRGB	

Palette Operations

A palette is a collection of colors that are selected by their index numbers. Each palette entry associates in an index number with three primary color components.

Supported PCL Palette Operation Commands

Command	Sequence	Range	Compatible
Assign Color Index	Esc*v#I	0-2 current palette size-1	HP Color LaserJet 5/5M
Color Component 1	Esc*v#A	(-32767)-(+32767)	HP Color LaserJet 5/5M
Color Component 2	Esc*v#B	(-32767)-(+32767)	HP Color LaserJet 5/5M
Color Component 3	Esc*v#C	(-32767)-(+32767)	HP Color LaserJet 5/5M
Palette Select by ID	Esc&p#S	0-32767	HP Color LaserJet 5/5M
Palette Control ID	Esc&p#I	0-32767	HP Color LaserJet 5/5M
Palette Control	Esc&p#C	0, 1, 2, 6	HP Color LaserJet 5/5M
Push/Pop Palette	Esc*p#P	0,1	HP Color LaserJet 5/5M

Unsupported PCL Palette Operation Commands

Command	Sequence	Range
Palette Configuration	Esc*d#W	

Foreground Color

All PCL marking entities utilize "foreground color" to select a color from the current palette. Foreground color will not interact with color raster graphics as in the HP Color LaserJet 5/5M printer.

Supported PCL Foreground Color Commands

Command	Sequence	Range	Compatible
Foreground Color	Esc*v#S	0-(size of current palette - 1)	HP Color LaserJet 4500

Halftone Algorithms

Color printers may use halftoning algorithms to modify a printed image by changing the way pixels are rendered. The render algorithm command provides a choice of existing algorithms or a user-defined pattern create with the download dither matrix command.

Supported PCL Halftone Algorithm Commands

Command	Sequence	Range	Compatible
Render Algorithm	Esc*t#J	0 contone (bed+ 300 lpi) (CC&HS Hi)	HP Color LaserJet 4500
		3 Device-best dither (CC&HS Best)	HP Color LaserJet 4500
		15 Smooth contone (bed+ 150 lpi) (CC&HS Hi)	HP Color LaserJet 4500
		18 basic contone (bed+ 100 lpi) (CC&HS Lo)	HP Color LaserJet 4500

Unsupported PCL Halftone Algorithm Commands

Command	Sequence	Range
Render Algorithm	Esc*t#J	1 snap to primaries 2 snap black to white and other colors to black 4 Error Diffusion 5 Device-best dither (monochrome) 6 Error-diffusion (monochrome) 7 Cluster ordered dither 8 monochrome cluster ordered dither 9 user define dither 10 user-defined dither (monochrome) 11 Ordered dither 12 Ordered dither (monochrome) 13 Noise ordered dither 14 Noise ordered dither (monochrome) 16 mono-detail: contone 300 lpi 17 mono-smooth -- contone 150 lpi 19 mono basic -- contone 100 lpi

User-Defined Dithers

The download dither matrix command, which provides user-defined dithers, in effect halftone screens, is not supported. The rationale is given in "User-defined Halftones."

Unsupported PCL User-Defined Dither Commands

Command	Sequence	Range
Download Dither Matrix	Esc*m#W[data]	7-32767

Color Lookup Tables

Color lookup tables, which map input data into a new output range based on point-by-point conversions, can modify input data for both device-dependent and device-independent color spaces.

Unsupported PCL Color Lookup Table Commands

Command	Sequence	Range
Color Lookup Tables	Esc*l#W[data]	0 -- 770

Gamma Correction

Color monitors appear incorrect when given a linear ramp of some color. Gamma correction improves perceptual correctness by adjusting the brightness or darkness of the color data sent from the monitor.

Unsupported PCL Gamma Correction Commands

Command	Sequence	Range
Gamma Correction	Esc*t#I	0.0-32767.0

Viewing Illuminant

Printed colors undergo a hue shift under different illuminations. The set viewing illuminant command specifies the x and y chromaticities of a relative white point that can be used for a given illuminant.

Unsupported PCL Viewing Illuminant Commands

Command	Sequence	Range
Set Viewing Illuminant	Esc*i#W[data]	8

Page Media Color Commands

Printed output can be modified as desired. Both the Monochrome Print Mode and the Finish Mode commands apply only to an entire PCL job. Both commands must be sent to the printer before any printable data. The commands cannot be changed after printable data has been received except by a Reset command which returns the printer to a matte finish in the case of the Finish Mode command and current rendering mode in the case of the Monochrome Print Mode command. If the command is received after printable data then the command is ignored.

Supported PCL Page Media Color Commands

Command	Sequence	Range	Compatible
Monochrome Print Mode	Esc&b#M	0,1	HP Color LaserJet 4500
Finish Mode	Esc&b#F	0 = Matte, 1 = Glossy	HP Color LaserJet 4500

Footnotes:
22. PCL command range supported in HP Color LaserJet and HP Color LaserJet 5/5M
23. PCL command range supported by PaintJet XL 300
24. PCL command range supported by DeskJet 1200C.
26. PEM -- Pixel Encoding Mode.
27. Bits/Index -- the size of the palette to make.
28. Color Space.
29. Bits/Primary.

30. red: x -- the x chromaticity coordinate for the red primary. The first 2 bytes are the most significant part of the single precision floating point number.
30. red: y -- the y chromaticity coordinate for the red primary. The first 2 bytes are the most significant part of the single precision floating point number.

The Color Print Model

The PCL print model allows images and characters to be filled with color and patterns. Images include raster graphics, rectangular area fills, font characters, and HP-GL/2 objects. The commands are grouped as follows:

- Logical Operations
- Transparency Modes
- Pixel Placement
- Patterns
- User-Defined Patterns
- Rectangular Area Fills (Rules)
- Arbitrary Masking

Logical Operations

The print model defines how logical operations are applied to source, texture, and destination.

Supported PCL Logical Operation Commands

Command	Sequence	Range	Compatible
Logical Operation	Esc*l#O	0-255	HP Color LaserJet or HP Color LaserJet 4500

Transparency Modes

Transparency modes define how white source and pattern affect the destination. White source and pattern pixels are either transparent and have no effect on the destination, or they are opaque and appear white on the destination.

The default PCL print model is that source and pattern transparence modes are transparent, and the logical operation is Texture or Source.

Supported PCL Transparency Mode Commands

Command	Sequence	Range	Compatible
Source Transparency Mode	Esc*v#N	0-1	HP Color LaserJet or HP Color LaserJet 4500
Pattern Transparency Mode	Esc*v#O	0-1	HP Color LaserJet or HP Color LaserJet 4500

Pixel Placement

By default, the printer places pixels at the intersections of a device-dependent grid that covers the printable area on a page. There are two pixel placement models:

- Grid intersection which places pixels at the intersection points of the grid.
- Grid centered, which places pixels at the center of the squares, formed by the grid.

Supported PCL Pixel Placement Commands

Command	Sequence	Range	Compatible
Pixel Placement	Esc*l#R	0,1	HP Color LaserJet 5/5M

Patterns

The commands for applying patterns to text and raster images are shown in the following table.

Supported PCL Pattern Commands

Command	Sequence	Range	Compatible
Current Pattern	Esc*v#T	0-4	HP Color LaserJet 5/5M
Pattern ID	Esc*c#G	0-32767	HP Color LaserJet 5/5M

User-Defined Patterns

User defined patterns, which are downloaded to the printer are shown in the following table.

Supported PCL User-Defined Pattern Commands

Command	Sequence	Range	Compatible
Download Pattern	Esc*c#W[data]	0 -- 65535	HP Color LaserJet 5/5M
Pattern Control	Esc*c#Q	0,1,2,4,5	HP Color LaserJet 5/5M
Pattern Reference Point	Esc*p#R	0,1	HP Color LaserJet 5/5M

Rectangular Area Fills (Rules)

Rules are a special case of source images: source transparency mode has no effect, since the rectangular area is conceptually viewed as an all 1's source. Rules may be filled using patterns or textures.

Supported PCL Rectangular Area Fill Commands

Command	Sequence	Range	Compatible
Fill Rectangular Area	Esc*c#P	0-5	HP Color LaserJet 5/5M
Horizontal Rectangle Size (decipoints)	Esc*c#H	0-32767	HP Color LaserJet 5/5M
Horizontal Rectangle Size (PCL Units)	Esc*c#A	0-32767	HP Color LaserJet 5/5M
Vertical Rectangle Size (decipoints)	Esc*c#V	0-32767	HP Color LaserJet 5/5M
Vertical Rectangle Size (PCL Units)	Esc*c#B	0-32767	HP Color LaserJet 5/5M

Arbitrary Masking

Applications that perform gradient shading on polygons or clips images to polygons, benefit the most from arbitrary clipping and masking in the PCL language. The clip mask allows drivers to create a mask that will be used on subsequent drawing primitives.

Unsupported PCL Arbitrary Masking Commands

Command	Sequence	Range
clip mask	Esc*l#P	

Vector Graphics

PCL5 includes most of the HP-GL/2 command set. This section describes commands that enter and exit the HP-GL/2 context and manage the scaling of HP-GL/2 graphics to the PCL page.

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

PCL, HP-GL/2 Context Switching

These commands allow the device to switch between PCL and HP-GL/2.

Supported PCL, HP-GL/2 Context Switching Commands

Command	Sequence	Range		Compatible
Enter PCL mode	Esc%#A	0	Use PCL CAP	HP LaserJet 5/5M/5N
		1	Use GL pen position for CAP	HP LaserJet 5/5M/5N
Enter HP-GL/2 mode	Esc%#B	0	Use previous or default GL pen position	HP LaserJet 5/5M/5N
		1	Use PCL CAP	HP LaserJet 5/5M/5N

Unsupported PCL, HP-GL/2 Context Switching Commands

Command	Sequence	Range
Enter HP-GL/2 mode	Esc%#B	-1, 2, 3

Picture Presentation Commands

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

Supported Picture Presentation Commands

Command	Sequence	Range	Compatible
Picture Frame Anchor Point	Esc*c#T	0	HP LaserJet 5/5M/5N
Picture Frame Horizontal Size (Decipoint)	Esc*c#X	0-32767	HP LaserJet 5/5M/5N
Picture Frame Vertical Size (Decipoints)	Esc*c#Y	0-32767	HP LaserJet 5/5M/5N
Plot Horizontal Size	Esc*c#K	0-32767	HP LaserJet 5/5M/5N
Plot Vertical Size	Esc*c#L	0-32767	HP LaserJet 5/5M/5N

HP-GL/2 Modifications in the PCL Context

The functionality of the following HP-GL/2 commands is modified in the PCL Context:

- CR -- Color Range
- FT -- Fill Type
- NP -- Number of Pens
- PC -- Pen Color Assignment
- SV -- Screened Vectors

Macros

A macro is a group of PCL commands and data created by a user. The commands for macros are shown in Supported PCL Macro Commands.

Supported PCL Macro Commands

Command	Sequence	Range	Compatible
Macro Control	Esc&f#X	0-10	HP LaserJet 5/5M/5N
Macro ID	Esc&f#Y	0 -- 32767	HP LaserJet 5/5M/5N

Status Readback

Status readback lets the user obtain status information from the printer.

Supported PCL Status Readback Commands

Command	Sequence	Range	Compatible
Echo	Esc*s#X	(-32767)-(+32766)	HP LaserJet 5/5M/5N
Flush All Pages	Esc&r#F	0, 1	HP LaserJet 5/5M/5N
Free Space	Esc*s1M	1	HP LaserJet 5/5M/5N
Inquire Entity	Esc*s#I	0-4	HP LaserJet 5/5M/5N
Location Type	Esc*s#T	0-5,7	HP LaserJet 5/5M/5N
Location Unit	Esc*s#U	0 -- 2^{32} - 1	HP LaserJet 5/5M/5N

Other PCL Commands

Other Supported PCL Commands

Command	Sequence	Range
Alphanumeric IDs for Media Types	Esc&n#W	

Other Unsupported PCL Commands

Command	Sequence	Range
Configure Raster Data (CRD)	Esc*g#W	6 -- 232-1
Cluster Printing	Esc&c#W	
Media Source for Multi-tray input devices	Esc&l#H	8, 20-39

Undocumented Uses of PCL Commands

The following command(s) are internally supported uses of unsupported commands, each with a special case.

Supported Internal Uses of PCL Commands

Command	Sequence	Range	Description

Driver Function Configuration:	Esc*o#W[*device_id function_index data*]	#: number of bytes in the command *device_id*: 8 *function_index*: which function selected *data*: data (if any) for the function)	These commands are only for internal use.
Down Load Color Table	Esc*o#W[85 *LUT data*]	#: The size of the CCHS color table + 2 *device_id*: 8 *function_index*: 1 *data*: CCHS color table	Download the data into the CC&HS color tables. The table size can be as large as 64K bytes
Switch to Device Table	Esc*o3W647	#: 3 *device_id*: 6 *function_index*: 4 *data*: 7, use calibration LUT	Causes PCL to indicate to the Page task that the calibration color table is to be used for the page. This is used by the Configuration Page

Undocumented PCL Commands or Undocumented Uses of PCL Commands

The following PCL commands are supported by the HP Color LaserJet 4500 printer but are either a use of an obsolete command for testing or some internal use or new undocumented (in PCL implementer's guide) PCL commands for similar purposes.

Supported Internal Uses of Obsolete PCL Commands

Sequence	**Range**	**Compatible**	**Description**
Esc*z#X	5	HP LaserJet 5/5M/5N.	Self test and font list. The font list is selected by first pushing a parameter of 3 using PushSpecial
	7	HP LaserJet 5/5M/5N.	Allocate a large block of memory
	8	HP LaserJet 5/5M/5N	Allocate a precise block of memory
	12	HP LaserJet 5/5M/5N.	Deallocate all of the memory blocks
	20	HP LaserJet 5/5M/5N.	Allocate a large block of env save memory
	21	HP LaserJet 5/5M/5N.	Allocate a precise block of env save memory
	22	HP LaserJet 5/5M/5N.	Deallocate all of the env save memory blocks
	23	HP LaserJet 5/5M/5N.	Returns the amount of free memory in the env save area
	24	HP LaserJet 5/5M/5N.	Returns the amount of free memory in the run time area
	25	HP LaserJet 5/5M/5N.	Sets the variable, clearMemoryAfterMove true.
	30	HP LaserJet 5/5M/5N.	Occupy gross back block of memory. Allocate a total of (256 * parm) bytes.
	31	HP LaserJet 5/5M/5N.	DeallocateMemBackBlocks: Deallocates all of the specially allocated memory blocks.
	50,51,54	HP LaserJet 5/5M/5N.	lsetCRCtestInvokes dbSetCRCTest (in base/sec/pslibdbcalltab.c) with 0, 1, 2 respectively.

	53	HP LaserJet 5/5M/5N.	Invokes dbSetSolicitedStatusPort (in pslibio.c via the debug call table in pslibdbcalltab.c) to enable/disable the solicited status port override. The value on the top of the parameter stack is used: 0 disables, 1 enables the parallel channel and 2 the serial channel.
	55	HP LaserJet 5/5M/5N.	Invokes `dbDisableStatusCap` (in pslibio.c via the debug call table in pslibdbcalltab.c) to disable the status readback message caps.
	56	HP LaserJet 5/5M/5N.	Invokes `dbSetPrintAndCRC` in the debug call table in pslibdbcalltab.c to set the global flag to CRC the page and still print it to false.
	57	HP LaserJet 5/5M/5N.	Invokes `dbSetPrintAndCRC` to set the global flag to CRC the page and still print it to true.
	58	HP LaserJet 5/5M/5N.	Invokes the PCL self-test routine to create a font printout.
	59	HP LaserJet 5/5M/5N.	Print the HP Color LaserJet 4500 configuration page.
	60	HP Color LaserJet 4500	Print the menu map page.
	61	HP Color LaserJet 4500	Print the density adjustment page.

	90	HP LaserJet 5/5M/5N.	Return the value of several PCL variables depending on the parameter value:
			`PageSize`
			Symset -- not done
			`ViewingOrient`
			`VMI`
			`CopyCount`
			Pitch, not done
			Point size, not done
			Any other value will return "BAD VAR ID"

	206	HP LaserJet 5/5M/5N.	Calls `PersGetStripConfig` to get strip parameters for a given media size, x, y, width and height.
	207	HP LaserJet 5/5M/5N.	Return information about a given physical x,y from the IP.
	501		
	600		
	713	HP LaserJet 5/5M/5N.	Make memory pattern
	714	HP LaserJet 5/5M/5N.	Select pattern by id
	715	HP LaserJet 5/5M/5N.	Delete pattern by id
	716	HP LaserJet 5/5M/5N.	Make a race-patterns golden line buffer
	717	HP LaserJet 5/5M/5N.	Set raster op to passed value
	718	HP LaserJet 5/5M/5N.	Force black pattern in PCL and NULL in PSLIB
	719	HP LaserJet 5/5M/5N.	Initialize characterization patterns
	798	HP LaserJet 5/5M/5N.	Invokes unknown routine: `dbBlockMemoryAllocsFrom((uint32) parm1,-1)`
	950	HP LaserJet 5/5M/5N.	Invoke `dbSelfTestFlushed` from `debugCallTable`

Supported, Undocumented PCL Commands

Command	Sequence	Range	Compatible	Description

PushSpecial	Esc*z#P	-2^{32} -- $2^{32}-1$	HP LaserJet 5/5M/5N.	This sequence allows data to be pushed onto a stack and then referenced by variations of the Exec Special command.

Unsupported Internal Uses of Obsolete PCL Commands

Command	**Sequence**	**Range**	**Description**
ExecSpecal	Esc*z#X	0	Close raster and set log op w/ top of stack
		1	PersSetWindow(parm1, parm2, parm3, parm4)
		2	Set current pattern to be a bitmap character
		3	Set current pattern (hatched patterns)
		4	Set current pattern (shaded patterns)
		6	Set primary symbol set to id 88
		9	Move cursor horizontally outside the scope of the logical page
		10	Same as 9 but vertically
		11	Scaling and placement of a given character
		52	Outputs (via SRSendResponse) a single character (ASCII 7). This is currently used in testing to synchronize the printer.
		60	PCL debug routine to dummy up and print a full page of raster.
		61	Invokes `dbSetIOConfig` in the debug call table in pslibdbcalltab.c
		62	Invokes `dbSetIOConfig` in the debug call table in pslibdbcalltab.c
		63	Invokes `dbSendGetMIOInfo` in the debug call table in pslibdbcalltab.c
		70	Invoke unknown routine: `IFFixedPoint`
		80	Invokes `dbSetPowerSaveTimer` in the debug call table in pslibdbcalltab.c -- reset the powersave timer to a new delay (in sec.)
		100	Invokes `dbSetTrayTestMode` in the debug call table in pslibdbcalltab.c to enable and disable the tray test mode -- set to false.

		101	Invokes `dbSetTrayTestMode` in the debug call table in pslibdbcalltab.c to enable and disable the tray test mode -- set to true.
		110, 112	Added to support HP LaserJet 4Si job recovery and now empty
		113	Added to support HP LaserJet 4Si job recovery: invokes `PersLastPage`
		114	Added to support HP LaserJet 4Si job recovery: invokes `dbWaitForLastPageAck`, defined in pslibpage.c, which forces the system to wait for the last page ack.
		200	Invokes `dbSetFrameAlign` an (apparently) obsolete function.
		201	Invokes an unknown function: `dbSetStripHeight`
		202	Invokes `SetClearFlag` which changes the clear/no-clear flag for `PersClosePage`().
		203	Invokes an unknown function: `dbSetFrameManagingPers`
		204	Closes the current raster image and calls `PersOpenFrame` to render the page.
		205	Commit the current page to a frame buffer, then try to scribble on the frame.
		300, 301, 302	HP LaserJet 5Si firmware code base raster manager debugging routines for raster picture ID discrimination.
		303	Force PCL raster compression method for any mem-out cycle
		311	Force a PCL raster CloseRaster call
		312	Do a memory cycle with `PersMemoryCycle`
		400, 401	Calls routines to set and get printer names via `CURRENT_PRINTER_NAME`
		402, 403	Calls routines to set and get printer types via `CURRENT_LOCALTALK_TYPE`
		404, 405	Calls routines to set and get job names via `CURRENT_JOB_NAME`
		406	Uses `PersSetDefault` to set an item to a value

		407	Uses `PersSetNVRAM` to set an item to a value
		408	Get a specific NVRAM variable using `PersGetDefault`
		500	Terminate PCL with a language-specific exit language command
		501	Invokes `dbOverrideDeadlockTimeout`, a debug function in pslibio.c to pass a new deadlock timeout value to IOP, via pslibdbcalltab.c
		502	Invokes `TTScalerSpotSize`, a base/src/ttfm.c function to alter the spot size of TrueType
		600	Pauses PCL for a given number of milliseconds
		700	Calls `IPSetIPCharacterize` to set up for IP characterization
		701	Trapezoid put
		702	Rule put
		703	Triangle put
		704	Vector put
		705	Image put
		706	Run put
		707	Patterned rule put
		708	Turn off IP characterization
		710	Null strip put
		711	Thin vector put
		712	`IPCharCreateClipSrc`
		720	Same as 7 but memory is kept on list 2
		721	Same as 8 but memory is kept on list 2
		722	Same as 12, but for list 2
		730	Same as 7 but memory is kept on list 3
		731	Same as 8 but memory is kept on list 3
		732	Same as 12, but for list 3
		796	Invokes unknown routine: `dbBlockMemoryAllocsFrom((uint32)parm1,1)`
		797	Invokes unknown routine: `dbBlockMemoryAllocsFrom((uint32)parm1, parm2)`
		780	Debug memory manager in system simulator
		799	Attempts to cause a memory out by trying to allocate 100,000,000 bytes.

		800	Invoke `dbInitProcedureArray` from the `debugCallTable`.
		801	Invoke `dbEnableProcedureTrace` from `debugCallTable`
		802	Invoke `dbDisableProcedureTrace` from `debugCallTable`
		803	Invoke `dbStartTraceProcedure` from `debugCallTable`
		804	Invoke `dbStopTraceProcedure` from `debugCallTable`
		900, 901	Invoke memmgr.c routine `dbFragmentCheck` via `debugCallTable` and print/return the value with `SRMemoryQuotient`
		1000	Invoke `dbResetFillStripDelay` from `debugCallTable`
		1001	Invoke `dbSetFillStripDelay` from `debugCallTable`
		1010	Invoke `dbSetServiceError` from pslibdm.c via `debugCallTable` with given service error parameter.
		1100	Invoke `PersFSCtl` with argument: `FS_WARNING_DISK_NOT_INIT`
		1101	Invoke `PersFSCtl` with argument: `FS_WARNING_DISK_FAILURE`

HP Color LaserJet 4500 Control Panel

This section provides a detailed design specification for the HP Color LaserJet 4500 printer control panel. The HP Color LaserJet 4500 printer has the following features:

- Based on Canon's P340 engine
- 4 PPM color, 16 PPM monochrome
- 600 DPI for both monochrome and color
- Letter, A4, and legal size color output
- 150 sheet/10 envelope input tray and 250 sheet input tray standard
- Additional 500 sheet input tray option
- Duplex option
- IIO (Intelligent I/O)
- 2x16 backlit LCD display

Control Panel Objectives

The HP Color LaserJet 4500 printer is a mid-range network printer designed to serve one or more workgroups. Its physical location will be close to the user, but it will not typically be used as a private desktop printer. The control panel is there to make the printer easier to use. It provides all the information that is required at the physical printer such as paper type to load or paper jam location. It also supports any control functions that must be performed at the printer such as network card setup.

Although the HP Color LaserJet 4500 printer is a sequel to the HP Color LaserJet printer, its device monitor is highly leveraged from the HP LaserJet 5 monochrome printer. In addition, the HP LaserJet 5 control panel has undergone extensive usability testing with favorable results and was also chosen by the HP LaserJet 4000/5000/8000 printers. Consequently, the HP LaserJet 5 control panel as implemented by the HP LaserJet 4000/5000/8000 printers is the model for the HP Color LaserJet 4500 printer to maintain a high level of usability and consistency with other HP LaserJet printers.

The HP Color LaserJet 4500 printer menus will be somewhat different than those of previous printers in an effort to improve usability. This affects arrangement, ordering, and labeling of the menus. Note also that postscript for the HP Color LaserJet 4500 printer is integrated into the base firmware and maintained by HP. As a result, the sharp division between PostScript and everything else as seen in the menus of previous printers is no longer necessary. Consideration was also given to eliminating the job specific menu items such as font, number of copies, etc. However, the HP LaserJet 5Si did remove many of these items from its menus. Since its release the number one issue reported to the response center has been the removal of font selection from the menus. Consequently, the HP Color LaserJet 4500 printer retains the job specific menu items.

Conventions

Exact control panel text as well as control panel key names appear in uppercase. \\ in the middle of a control panel message indicates a line break. Terminology or abbreviations that may not be universally known are defined at the end of this document.

Hardware Overview

The HP Color LaserJet 4500 control panel has the following features:

- 2x16 blue backlit LCD
- 3 push button keys labeled GO, CANCEL JOB, and SELECT
- 3 rocker switches labeled MENU, ITEM, and VALUE
- 2 green LEDs labeled READY and DATA
- 1 orange LED labeled ATTENTION

The display will support the following character sets for localization:

- Roman-8
- Latin-2
- Latin-5
- Latin/Cyrillic
- Katakana

The control panel is laid out as follows:

Functional Description

The control panel serves several purposes. These include communication of device status, device control, and option selection via menus.

Device Status

Device status is communicated in several ways. Textual information may be displayed on the character display. The LEDs are also available for device status. Finally, status information can be sent to a host by means of PJL and PML objects.

Character Display

The HP Color LaserJet 4500 display can display messages up to 32 characters long divided into two lines with the break at an appropriate place in the message. Alternating messages are also supported with a three-second delay before each new message is displayed.

There are five categories of messages that can be displayed: status messages, warning messages, attention messages, critical error messages, and help messages. These are listed at the end of this document. Status and error messages generated by various I/O devices are detailed in the manuals for those devices.

Status Messages

Status messages reflect the current state of the printer. They inform the user of normal printer operation and do not require user interaction to clear them. They change as the state of the printer changes. Whenever the printer is ready, not busy, and has no pending warning messages, the status message READY will be displayed if the printer is online or OFFLINE if it is not. Other messages will be displayed when applicable. A complete list of status messages are listed at the end of this document. Note that the current background status message may be replaced by a message specified either with the PJL RDYMSG DISPLAY command or the PML BACKGROUND-STATUS-MSG-LINE1-PART1 or BACKGROUND-STATUS-MSG-LINE2-PART1 objects.

Warning Messages

Warning messages report data and print errors to the user. They are important enough that the user should acknowledge them, but not serious enough to take the printer offline and stop the printing process. They are usually transient in nature, but affect the output, making it important to have a record of their occurrence. Warnings typically alternate with the READY or OFFLINE messages and will remain on the display until the user presses the GO key, or if CLEARABLE WARNINGS is set to JOB in the Configuration Menu, until a job boundary is reached. These messages appear in LIFO (most recent first) order with duplicates removed. A complete list of warning messages is listed at the end of this document.

Attention Messages

Attention messages inform the user that some action must be taken such as adding paper or clearing a paper jam. In general these messages cause the printer to go offline and wait until the user attends to the situation, at which time the message will be cleared from the display. For some errors, the printer could continue printing without user intervention. If AUTO CONTINUE is set to ON in the Configuration Menu, the printer will automatically attempt to return to the online state. A complete list of attention messages is listed at the end of this document.

Critical Error Messages

Critical error messages communicate device failure to the user. Some of these may successfully be cleared as a result of action by the user. In general, a power cycle is required for the printer to resume normal operation. If the error persists, a call to service is likely needed. These messages are not affected by the AUTO CONTINUE setting. A complete list of these error messages is listed at the end of this document.

Help Messages

Help messages provide additional information to the user to help resolve an error condition or understand a status message. Any message that ends with an inverse video question mark (light character on dark background) has a help message associated with it, which may be viewed by pressing the ITEM key.

LED Indicators

There are three LED indicators on the HP Color LaserJet 4500 control panel. These are used to indicate ready (online/offline) state, data activity, and presence of an error condition.

Ready LED

State	Description
Off	The printer is offline and therefore unable to accept data on any of its I/O channels.
On	The printer is online and able to receive data on any of its I/O channels.
Flashing	The printer is attempting to go offline, generally in response to a user request to enter the menus or temporarily stop printing the current job. While in this state the printer will display PLEASE WAIT while it stops processing the current job and flushes all active pages from the paper path. The flash rate is 500 mS on/500 mS off.

Data LED

State	Description
Off	No data is being received or processed in the printer.
On	Processed data is present in the printer, but more data (possibly just an end of job indicator) is needed to complete the job. Generally this state is caused by a backward compatible PCL job with no job control commands.
Flashing	Data is being received on at least one I/O channel and/or data is being processed by the active personality. The flash rate is 500 mS on/500 mS off.

Attention LED

State	Description
Off	There are currently no errors requiring attention from the user.
On	A critical error has occurred and the firmware system has halted (cannot flash the LED).
Flashing	An error has occurred requiring user interaction with the printer. The flash rate is 250 mS on/250 mS off.

Device Control

Several different kinds of device control are available at the control panel. These include setting the printer on and offline, continuing a stopped job, selecting new default values for printer parameters, and canceling the currently printing job.

Initial Powerup

During initial powerup the printer will display two lines of stars (**********). During this time the control panel keys are not active and any errors that occur will be displayed but not localized. The display changes to INITIALIZING when the individual tasks begin their initialization. The control panel keys are still not active at this point, but any error messages will be localized. Once the initialization completes, the printer goes online and displays the READY message. The keys are now active.

Powerup Key Sequences

Holding down certain key(s) can access certain types of special printer functions when the power switch is first turned on. These include display language selection, cold reset initialization, extended diagnostics, and activation of service mode. These sequences are intended to be used only by factory trained personnel or under the direction of response center engineers.

Display Language Selection

The display language is selected as follows:

1. Hold down the SELECT key.
2. Power cycle the printer.
3. Release the SELECT key when SELECT LANGUAGE (in English) appears on the display.
4. Wait for LANGUAGE=\\ENGLISH* (or other current language) to appear.
5. Use the VALUE key to scroll through the choices. Note that the currently selected language is marked with an asterisk (*).
6. Press SELECT to select the currently displayed language.
7. Press GO to exit language selection.

The printer will then use the selected language on the display. This will remain the default language through subsequent power cycles until another selection is made through the powerup key sequence. If the GO key is pressed rather than making a language selection, the printer goes online, and the previously selected language is used. The available languages are:

- Czech
- Danish
- Dutch
- English
- Finnish
- French
- German
- Italian
- Japanese (Katakana)
- Norwegian
- Polish
- Portuguese
- Russian
- Spanish
- Swedish

Cold Reset Initialization

A cold reset is performed as follows:

1. Hold down the GO key.
2. Power cycle the printer.
3. Release the GO key when COLD RESET (in English) appears on the display.

Cold reset will reset all printer variables to their factory default values except for some variables that are set using the service mode menu (serial number, cold reset paper size, and registration values) as well as the display language.

Perform Extended Diagnostics

Extended printer diagnostics may be performed as follows:

1. Hold down the ITEM- key.
2. Power cycle the printer.
3. Release the ITEM- key when DIAGNOSTICS\\MODE (in English) appears on the display.

Activation of Service Mode

Service mode is activated as follows:

1. Hold down the MENU+ and VALUE+ keys.
2. Power cycle the printer.
3. Release the MENU+ and VALUE+ keys when SERVICE MODE (in English) appears on the display.

The printer will remain offline after the boot process is complete. The Service Menu will now appear as the first available menu. Pressing the GO keys exits Service Mode and deactivates the Service Menu.

Control Panel Key Descriptions

The control panel contains the following keys:

- GO
- CANCEL JOB
- MENU
- ITEM
- VALUE
- SELECT

GO Key

The GO key operates in the same manner as the HP LaserJet 5 GO key. It combines the functions of the ONLINE, CONTINUE, and FORMFEED keys from prior printers. The following chart details the functions of this key.

Printer State							**GO Key Action**					
On line	Off line	Offline Error	Warning	Paper Moving	Data	Power Save	Go Off line	Go On line	Clear Error if Clearable and Go Online	Clear Warning if Clearable	Form Feed	Exit Power Save
		◆							◆			
		◆				◆			◆			◆
		◆			◆				◆			
		◆			◆	◆			◆			◆
		◆		◆					◆			
	◆							◆				
	◆					◆		◆				◆
	◆				◆			◆				
	◆				◆	◆		◆				◆
	◆		◆					◆		◆		
	◆		◆			◆		◆				◆
	◆		◆		◆			◆		◆		
	◆		◆		◆	◆		◆				◆
◆							◆					
◆						◆						◆
◆					◆						◆	
◆					◆	◆						◆
◆				◆			◆					
◆			◆				◆			◆		
◆			◆			◆						◆
◆			◆		◆					◆	◆	
◆			◆		◆	◆						◆
◆			◆	◆			◆			◆		

Assumptions:

1. Having both an error and a warning message is possible, but since the user will not see the warning message, it is not included as a valid combination. Cases in which the printer is offline with an error will behave in the same manner regardless of whether a warning condition also exists.
2. An offline error with paper moving means that the error was just detected, and the printer is in the process of flushing the pipeline and going offline.
3. In the highlighted rows, pressing the GO key will clear any clearable warnings one at a time. When no clearable warnings remain, the GO key will cause the other action (either going on/offline or form feeding) to occur. One key press will cause one action, except in the cases of exiting powersave when the printer is not online.
4. The following sets are mutually exclusive items:
   - paper moving and powersave
   - paper moving and data
   - offline error and offline (redundant)
   - online and offline

CANCEL JOB Key

The cancel job key causes the currently printing job to be terminated. The printer will stop picking paper, deliver all pages currently in the paper path to their destination, discard all incoming I/O until a job boundary is detected, and clear any continuable errors associated with the killed job. The next job (if any) will then begin printing. While the job is being canceled, CANCELING JOB is displayed.

If the printer is idle, NO JOB TO CANCEL is displayed. Note that this key is ignored if the menus are active.

MENU Key

The MENU key accesses the menus used to set printer variables. This key is a rocker switch permitting both forward and backward movement through a list of available menus.

ITEM Key

The ITEM key steps through the items in a particular menu. This key is a rocker switch permitting both forward and backward movement through the menu items. It is also used to enter the help system and move forward and backward through the help messages.

VALUE Key

The VALUE key steps through the value choices for a particular menu item. This key is a rocker switch permitting both forward and backward movement through the values. Holding the key down will cycle through the values more quickly. This key has been labeled "+" in the past or implemented as two keys labeled "+" and "-."

SELECT Key

The SELECT key is used to select the value currently shown on the display. This key has been known as ENTER in the past.

Control Panel Key Actions

The following chart shows the key actions based on the current state of the printer.

Key	PowerSave	Idle	Continuable Error	Data	Processing Job	In Menus	In Help System
Go	*	*	*	*	*	exit menus	exit help
Cancel Job	exit powersave mode	display NO JOB TO CANCEL	if data is present, cancel job and clear error, otherwise display NO JOB TO CANCEL	cancel job	cancel job	ignored	exit help and cancel job
Menu	exit powersave mode, go	go offline and enter	go offline and enter menus	go offline and enter	go offline and enter	next or previous	exit help

	offline, and enter menus	menus		menus	menus	menu	
Item	exit powersave mode	enter help system (if help msg is indicated)	enter help system (if help msg is indicated)	enter help system (if help msg is indicated)	enter help system (if help msg is indicated)	next or previous item	next or previous help message
Value	exit powersave mode	ignored	ignored	ignored	ignored	next or previous value	exit help
Select	exit powersave mode	ignored	ignored	ignored	ignored	select currently displayed value	exit help

* See the table in the GO Key section.

Control Panel Security

Control panel security has been expanded for the HP Color LaserJet 4500 printer over previous printers. In the past, locking the control panel denied a user access to all control panel menus. The HP Color LaserJet 4500 printer and HP LaserJet 4000/5000/8000 are both introducing the concept of multiple levels of security, permitting locking of only administrative menus to locking of all menus as well as the CANCEL JOB key. The levels of security currently available are:

Lock Setting	**Items Locked**
0	No items are locked
1	All items in the following menus are locked: Configuration Menu I/O Menu Calibration Menu Resets Menu
2	All items in the following menus are locked: Configuration Menu I/O Menu Calibration Menu Resets Menu Paper Handling Menu
3	All items in the following menus are locked: Configuration Menu I/O Menu Calibration Menu Resets Menu Paper Handling Menu Information Menu Printing Menu In addition, the CANCEL JOB key is disabled.

Control panel security is supported via PJL and PML as follows:

- The factory default for this mechanism is 0 (disabled).
- Data stream commands are used to enable or disable the security mechanism. For PJL, the CPLOCK variable may be set to one of the numerical values listed above. The corresponding PML object is prtConsoleDisable.
- The PJL variable PASSWORD is used to control access to the CPLOCK variable. If the PJL password is enabled, CPLOCK may only be modified by a PJL job that contains the correct password value. The HP Color LaserJet 4500 printer PML does not support a password object; prtConsoleDisable alone is used to control locking for PML.
- If the user attempts to modify a locked menu item, the message ACCESS DENIED\\MENUS LOCKED will be displayed for approximately five seconds after the SELECT key is pressed. This message is not sent to the host even when unsolicited PJL status is enabled.

- A cold reset will disable the control panel security mechanism.
- The status of CPLOCK and PASSWORD will be printed on the configuration page printout. The password itself will not appear.

Menus

Menus are used to select new default values for printer parameters and obtain information about the printer. A complete list of all printer menus is listed at the end of this document. All menu text is displayed in the currently selected display language. Values are set in the following manner:

1. Press the MENU key until the desired menu appears.
2. Press the ITEM key to locate the menu item to change.
3. Press the VALUE key to locate the appropriate value for the menu item. Note that the current value for the item is marked with an asterisk in the rightmost character position of the display.
4. Press the SELECT key to select the currently displayed menu item value. It will be marked with an asterisk to indicate that the selection was successful. Note that in some cases there are no values for a particular item. In this case the SELECT key causes the action specified by the item itself to occur (for example, PRINT MENU\\MAP).

The printer always goes offline when the menus are entered; however, if the printer is currently printing a job when the MENU key is pressed, it will go offline after delivering all pages currently in the paper path to their destination.

The MENU, ITEM, and VALUE keys all permit both forward and backward movement through their displays. Holding the VALUE key down will scroll through the choices at the rate of approximately four values per second (useful for items with a large number of choices). In some cases the scrolling increment is larger (for the copies item it is 10). These exceptions will be noted in the discussion of those particular items.
Menu selection may be exited as follows:

- Pressing the GO key will cause the printer to return to the online state if there are no pending errors.
- An idle period (no key presses) of two minutes will also cause the printer to return to the online state. Note that if the printer was offline when the menus were entered, no idle period exists, and the printer will stay in the menus until the GO key is pressed.
- Scrolling past the first/last menu item will also return the printer to the state it was in when the menus were entered. If that state was the online state, the printer will wait two seconds for additional key presses before actually going online to avoid unnecessary state changes in case the user wishes to continue scrolling through the menus. Note that the displayed message will change to READY so that the user will receive feedback for the key press, but the Ready LED will remain off until the two seconds with no key presses has passed.

The available menus for selecting new default values for printer parameters or displaying printer information are:

- Service Menu
- Information Menu
- Paper Handling Menu
- Configuration Menu
- Printing Menu
- I/O Menu
- Calibration Menu
- Resets Menu
- <other menus>

Service Menu

This menu only appears if Service Mode has been activated by the appropriate powerup key sequence. The printer will always be offline while in the Service Menu. The Service Menu provides the following options:

- Serial Number
- Transfer Maint Count
- Fuser Maint Count
- Color Page Count
- Total Page Count
- Cold Reset Paper
- Clear Event Log
- Cyan Registration
- Magenta Registration
- Yellow Registration
- Top Margin
- Tray 1 Left Margin
- Trays 2 and 3 Left Margin
- Print Registration Page

Set Serial Number

This item permits the setting of the printer's serial number. This number is unique for each printer and is stamped on the case. It is stored on the formatter so it can be printed on the configuration page. If the formatter must be replaced, it is important to set the new board to the same value. The number can be updated as follows:

1. XXXXXXXXXX will be displayed with a cursor under the most significant digit. Note that the digits may be alphabetic or numeric.
2. Use the VALUE key to adjust the digit as desired.
3. Press SELECT when the desired value is reached. The cursor will move to the next digit.
4. Repeat steps 2 and 3 for all digits.
5. Pressing SELECT after the least significant digit will return the cursor to the most significant digit.
6. Press the GO key when input is complete. The new value will not be stored until this key is pressed. Note that GO may be pressed at any time during the input process to exit the serial number entry item.

Transfer Maint Count

This item is needed to keep track of the number of pages printed since the transfer kit was last changed. If the formatter must be replaced, this number must be transferred to the new board. The process for changing this number is the same as for changing the serial number except that there are only seven digits, and all are numeric.

Fuser Maint Count

This item is needed to keep track of the number of pages printed since the fuser kit was last changed. If the formatter must be replaced, this number must be transferred to the new board. The process for changing this number is the same as for changing the serial number except that there are only seven digits, and all are numeric.

Color Page Count

This item is needed to keep track of the number of color pages printed by the engine during its lifetime. If the formatter must be replaced, this number must be transferred to the new board. The process for changing this number is the same as for changing the serial number except that there are only seven digits, and all are numeric.

Total Page Count

This item is needed to keep track of the total number of pages printed by the engine during its lifetime. Although this number is available from the engine, it is possible that the DC controller on the engine may fail, causing the value to be lost. As a safeguard, the number is stored in the formatter's NVRAM. If the formatter must be replaced, this number must be transferred to the new board. The process for changing this number is the same as for changing the serial number except that there are only seven digits, and all are numeric.

Cold Reset Paper

This item allows the factory default paper size to be specified. This is important because LETTER is the standard paper size in the U.S. while Europe typically uses A4 size paper. The choices are:

- LETTER [default]
- A4

Clear Event Log

This item clears the internal event log. When it is selected, the event log will be cleared. If there are no entries in the event log, EVENT LOG EMPTY will be displayed instead of CLEAR EVENT\\LOG.

Top Margin/Tray 1 Left Margin/Trays 2 and 3 Left Margin

All of these items are values supplied by the engine supplier for each particular engine. They are used by the print engine code to provide uniform printing across engines. Although these numbers are available from the engine, it is possible that the DC controller on the engine may fail, causing the values to be lost. As a safeguard, the numbers are stored in the formatter's NVRAM. If the formatter must be replaced, these numbers must be transferred to the new board.

- 00-15 [typical = 07]

Print Registration Page

This item prints a registration page from the specified tray. The menu item actually appears as: PRINT REGISTR'TN\\PAGE TRAY=n

- 1-3 [default = 1]

Information Menu

The following printer information is available for displaying or printing:

- Print Menu Map
- Print Configuration
- Print Config Continuous
- Print Font List
- Show Event Log
- Remaining Life

Print Menu Map

This item prints a map showing the layout and current settings of the HP Color LaserJet 4500 menus. The printout will be formatted for the default paper size specified in the Printing Menu. PRINTING\\MENU MAP will be displayed while the page is being printed.

Print Configuration

This item prints a configuration page containing information about the printer such as serial number, page count, list of installed accessories, current settings for printer parameters, and event log. The printout will be formatted for the default paper size specified in the Printing Menu. PRINTING\\CONFIGURATION will be displayed while the page is being printed.

Print Config Continuous

This item prints the configuration page continuously until the CANCEL JOB key is pressed. CONTINUOUS PAGE\\PRESS CANCEL JOB will be displayed while pages are being printed.

Print Font List

This item prints a list of all the fonts available in the HP Color LaserJet 4500 printer. This includes PCL fonts and PS fonts. These may be internal, located on DIMM, or downloaded. The printout will be formatted for the default paper size specified in the Printing Menu. PRINTING\\FONT LIST will be displayed while the page is being printed.

Show Event Log

This item displays the event log entries. Events are displayed in a LIFO (last in, first out) manner. If the event log is empty, EVENT LOG EMPTY will be displayed. The format is as follows:

```
AA BB CCCC\\DDDDDDD or AA BB.CC.CC\\DDDDDDD
 | | | | |
 | | | | suberror codes (decimal)
 | | | page number at which the error occurred
 | | error code (hex)
 | error number (decimal)
event log entry number (1-50)
```

The first format is used for error numbers 49, 55, 68, 79, and 8X. All others use the second format. The event log can contain a maximum of 50 entries. If the event log overflows, the oldest entries are discarded. Note that the event log can be cleared from the Service Menu if necessary.

Remaining Life

This item shows the percentage of usable life left for each of the following consumables:

- TRANSFER=nnn% (transfer kit)
- FUSER=nnn% (fuser kit)
- DRUM=nnn% (drum kit)

This information is provided on the control panel as well as on the configuration page in the event that it may not be possible to print a page. The intent is to provide the user with ongoing information for estimating when it will be necessary to replace the consumables.

Paper Handling Menu

The Paper Handling Menu allows the user to set options that determine how the printer selects media for a particular print job. The options are as follows:

- Tray 1 Mode
- Tray 1 Size
- Tray 1 Type
- Tray 2 Type
- Tray 3 Type
- A4/Letter Override
- Default Size

Tray 1 Mode

Tray 1 may be configured to be used either as a regular paper cassette or as a priority tray. When the tray is configured as a priority tray, it will always be selected first unless it is empty or another tray was specifically requested. Configuration choices are:

- FIRST -- [default]
- CASSETTE

Tray 1 Size

Tray 1 does not contain a size sensor, so the size of the paper loaded in it must be specified. This item only appears if TRAY 1 MODE is set to CASSETTE. Available sizes are:

Paper:

- LETTER -- [default if COLD RESET PAPER is set to LETTER in Service Menu]
- A4 -- [default if COLD RESET PAPER is set to A4 in Service Menu]
- LEGAL
- EXEC
- JIS B5
- A5
- CUSTOM

Envelopes:

- B5
- COM10
- C5
- DL
- MONARC

Tray 1 Type

This item allows the user to specify the type of paper present in Tray 1. It only appears if TRAY 1 MODE is set to CASSETTE. Available types are:

- PLAIN -- [default]
- PREPRINTD
- LTRHEAD
- TRNSPRNCY
- GLOSS
- PREPUNCHD
- LABELS
- BOND
- RECYCLED
- COLOR
- HEAVY
- CARDSTOCK

Tray 2 Type

This item allows the user to specify the type of paper present in Tray 2. The choices are the same as for Tray 1 except for LABELS and CARDSTOCK, which are not available.

Tray 3 Type

This item allows the user to specify the type of paper present in Tray 3. It only appears if the optional Tray 3 is installed in the printer. The choices are the same as for Tray 1 except for LABELS and CARDSTOCK, which are not available.

A4/Letter Override

This item allows the user to override strict paper size checking between A4 and letter size paper. If the item is set to YES, a job requests letter size paper, and there is not any in any of the paper trays, but there is A4 size paper, the job will print on the A4 paper rather than issuing a paper mount request. The reverse is also true: an A4 job will print on letter size paper if A4 is not available. The choices are:

- NO [default]
- YES

Default Size

This item allows the user to select the default paper size. Choices are the same as for TRAY 1 SIZE.

Configuration Menu

The Configuration Menu allows the user to configure various aspects of printer operation. These are as follows:

- Powersave
- Personality
- Clearable Warnings
- Auto Continue
- Toner Low
- Toner Out
- Jam Recovery
- Print PS Errors

Powersave

This item allows the user to change the amount of time the printer must remain inactive before entering powersave mode. The choices are:

- OFF
- 1 MINUTE
- 30 MINUTES
- 1 HOUR -- [default]
- 2 HOURS
- 4 HOURS
- 8 HOURS

Personality

This item allows the user to select the default personality for an implicit personality switch. The choices are:

- AUTO -- Personality is determined by context switcher. [default]
- PCL – PCL 5c
- PS -- PS (emulated PostScript)

Clearable Warnings

This item allows the user to specify the device's handling of clearable warning messages. The choices are:

- JOB -- Warning message displayed until the end of the job which generated it. [default]
- ON -- Warning message is displayed until the GO key is pressed.

Auto Continue

This item allows the user to specify the device's reaction to continuable errors. In both cases the printer displays an error message and goes offline. The choices are:

- ON -- Printer automatically returns to the online state immediately. [default]
- OFF -- Printer remains offline until the GO key is pressed.

Note that when AUTO CONTINUE is set to ON there is no delay before the printer returns online. Other printers have traditionally waited for some period of time (10 seconds) before returning online. Since the

goal for the HP Color LaserJet 4500 printer is unattended printing, there is no reason to wait since it is unlikely that someone will be in a position to observe that it has gone offline.

Toner Low

This item allows the user to specify the device's response to a toner low condition. The choices are:

- CONTINUE -- The printer displays a warning message and continues to print. The user can press SELECT to change the toner cartridge. [default]
- STOP -- The printer displays an attention message and goes offline. The user must press SELECT and change the toner cartridge before printing can continue.

Toner Out

This item allows the user to specify the device's response to a toner out condition. Since there are four toner cartridges in the HP Color LaserJet 4500 printer, the user may wish to continue printing even though one has run out, particularly if a color cartridge is out and the print job is monochrome. The choices are:

- STOP -- The printer displays an attention message and goes offline. The user must press SELECT and change the toner cartridge before printing can continue. [default]
- OVERRIDE -- The printer displays an attention message and goes offline. The user can press GO for a one-time override and continue printing. It is then up to the user to decide when to press SELECT and change the toner cartridge since no further warnings will be issued.

Jam Recovery

This item allows the user to decide whether the printer should attempt to automatically recover from paper jams. This is needed because of the large amount of memory it takes to store the information needed to recover from a paper jam and the detrimental effect that can have on print speed. The choices are:

- OFF -- Do not attempt to recover from paper jams. [default]
- ON -- Attempt to recover from paper jams.

Print PS Errors

This item allows the user to enable/disable printing of PS error pages. The choices are:

- OFF -- Do not print PS error messages. [default]
- ON -- Print PS error messages.

Printing Menu

The Printing Menu allows the user to configure various job-related parameters. While it could be argued that these items should not be set universally for a printer in a network environment, there is sufficient evidence from the response center calls received on another printer that did remove these items to indicate that there are many users out there who require the ability to set them via the control panel. The configurable items are:

- Copies
- Orientation
- Form Length
- Duplex
- Binding
- PCL Font Source
- PCL Font Number
- PCL Font Pitch
- PCL Font Point Size
- PCL Symbol Set
- Courier
- Append CR to LF

Copies
This item allows the user to select the number of copies to print. Valid values are:

- 1...999 --[default = 1, scroll step size is 10]

Orientation
This item allows the user to select the orientation of the printing on the page. The choices are:

- PORTRAIT -- Short edge is top of page. [default]
- LANDSCAPE -- Long edge is top of page.

Form Length
This item allows the user to specify the maximum number of lines that may be printed on a page before an automatic formfeed is done. Valid values are:

- 5...128 LINES -- [default = 60, scroll step size is 10]

Note that the value actually stored by the printer is calculated from the number of lines selected and the current page length (which is a combination of media size and orientation). If the default media size or orientation changes, the value displayed for form length will also change.

Duplex
This item allows the user to specify two-sided printing. It only appears if there is a duplexer installed in the printer. The choices are:

- OFF -- Print on only one side of the page. [default]
- ON -- Print on both sides of the page.

Binding
This item only appears if DUPLEX is set to ON. It permits the user to specify how the document will be bound so that the printer can correctly orient the front and backsides of the page. The choices are:

- LONG EDGE -- Tops of both sides are printed at the same edge of the paper. [default]
- SHORT EDGE -- Tops of front and backsides are at opposite ends of the paper.

PCL Font Source
This item allows the user to select the source of the default font. This font will serve as the default font for both the PCL primary and secondary fonts. Note that if for some reason the selected font is no longer available (soft font deleted, DIMM removed), the default font will revert back to the factory default. Note also that there is no provision for selecting a default PS font because PS jobs always have the font specified. Plain text files with no formatting information included will always be printed in PCL mode. The font source choices are:

- INTERNAL -- Font resides in the base printer ROMs. [default]
- SOFT -- Font was downloaded.
- SLOT 1/2/3 -- Font resides on a DIMM in slot 1, 2, or 3.

PCL Font Number
This item allows the user to select the number of the default font. Note that these numbers are assigned by the printer firmware and are not related to the ID number assigned to a soft font when it is downloaded or copy/assigned. The source and number of each font appear on the font list that can be printed from the Information Menu. The factory default font is the internal, PC-8, portrait, 10-pitch, 12-point, upright, medium Courier font. Valid values are:

- 0...999 -- [default = 0, scroll step size is 5]

PCL Font Pitch

This item appears only if the font specified by source and number is a contour font and is a fixed spaced font. Valid values are:

- 0.44...99.99 -- [default = 10.00, increment size is 0.01, scroll step size is 1.00]

PCL Font Point Size

This item appears only if the font specified by source and number is a contour font and is a proportional spaced font. Valid values are:

- 4.00...999.75 -- [default = 12.00, increment size is 0.25, scroll step size is 1.00]

PCL Symbol Set

This item allows the user to select a symbol set from the control panel. The symbol set does not have to be compatible with the selected font; the font selection algorithm will resolve incompatibilities. The choices are:

- PC-8 [default]
- PC-775
- WIN L1
- LEGAL
- ISO-21
- ROMAN-8
- PC-8 DN
- WIN L2
- ISO-4
- ISO-60
- ISO L1
- PC-850
- WIN L5
- ISO-6
- ISO-69
- ISO L2
- PC-852
- WINBALT
- ISO-11
- WIN 3.0
- ISO L5
- PC-8 TK
- DESKTOP
- ISO-15
- MC TEXT
- ISO L6
- PC-1004
- PS TEXT
- ISO-17

Courier

This item allows the user to specify the version of the Courier font that will be used. The style of this font has changed slightly which causes problems for users who wish to update isolated pages of a large document that was printed on an older printer. The choices are:

- REGULAR -- Current version of Courier (also available on the HP LaserJet 4). [default]
- DARK -- Version of Courier available on the HP LaserJet III.

Append CR to LF

This item allows the user to specify that a carriage return will be appended to each line feed character in the data stream (text only, does not affect raster data). This is useful for UNIX users who may be sending pure text with no job control. In such an environment a job that is supposed to look like this:

```
Text line 1
Text line 2
Text line 3
```

often ends up looking like this:

```
Text line1
Text line2
Text line 3
```

because UNIX indicates a newline using only the line feed control code.

Note that even if normal CR-LF pairs appear in the text, adding an extra carriage return will not cause problems. The choices are:

- NO -- Do not alter the data stream. [default]
- YES -- Append a carriage return to each line feed character in textual data.

I/O Menu

The I/O Menu allows the user to configure the printer's I/O. The configurable items are:

- I/O Timeout
- I/O Buffer
- I/O Buffer Size
- Parallel High Speed
- Parallel Adv Functions

I/O Timeout

This item allows the user to select the I/O timeout period in seconds. Valid values are:

- 5...300 SECONDS -- [default = 15, scroll step size is 10]

I/O Buffer

This item allows the user to enable/disable I/O buffering. The choices are:

- AUTO -- I/O buffering is done. The printer will use a heuristic algorithm to determine the amount of memory to allocate to each port on an as needed basis. [default]
- OFF -- No I/O buffering is done.
- ON -- I/O buffering is done. A new menu item will appear allowing the user to allocate memory for I/O buffering.

Note that this item will only appear if there is sufficient memory available to allow I/O buffering. Also, changing this item causes a printer reset and loss of all buffered data, macros, temporary fonts, etc.

I/O Buffer Size

This item appears only if I/O BUFFER is set to ON. The memory for the I/O buffers is specified for the printer as a whole and is divided up between the ports on an as needed basis by the firmware. The value *nnnnnnK* is the number of kilobytes of memory to be reserved for I/O buffering. It must be a multiple of 10 Kbytes and in the range from 0 to the maximum amount of memory determined to be available for I/O buffering based on the amount of memory installed in the printer, which personalities are installed, and various memory requirements of the printer.

Pressing the VALUE key will increment/decrement this value by 10K if the current value is less than 100 Kbytes, and 100K otherwise. The default value is 10K.

Note that changing this item causes a printer reset and loss of all buffered data, macros, temporary fonts, etc.

Parallel High Speed

This item allows the user to select the speed at which the parallel port communicates with the host. This item can be set to the following values:

- YES -- Faster parallel communications for connections with newer computers. [default]
- NO -- Slower parallel communications for connections with older computers.

Parallel Adv Functions

This item allows the user to turn bi-directional parallel communication on or off. Valid values are:

- ON -- Bitronics parallel port (bi-directional). [default]
- OFF -- Parallel port is not bi-directional.

Calibration Menu

The Calibration Menu allows the user to modify the toner density for each of the four toner colors. The internal calibration system should be sufficient for most users. This menu is intended to provide fine tuning capability for those users with critical color matching requirements. The configurable items are:

- Print Calibration Page
- Cyan Density
- Magenta Density
- Yellow Density
- Black Density
- Reset Density Values

Print Calibration Page

This item prints a page that demonstrates the effects of various toner density settings.

Cyan/Magenta/Yellow/Black Density

This item permits modification of the cyan/magenta/yellow/black toner density setting. Valid values are:

- -5...+5 -- [default = 0]

Reset Density Values

This item resets all density values to their default value (0).

Resets Menu

The Resets Menu allows the user to reset various aspects of the printer. The configurable items are:

- Reset Memory
- Restore Factory Settings
- New Transfer Kit
- New Fuser Kit

Reset Memory

Resetting the printer from the control panel clears the page buffer, removes all perishable personality data (such as macros and temporary fonts), and returns all printing environment parameters to their user soft defaults (values that have been set via the control panel). The active I/O input buffer is also cleared. This

may result in a DATA RECEIVED message on the control panel. Otherwise, the message RESETTING MEMORY is displayed.

A control panel reset is the same as a data stream personality reset, except that in the case of PCL 5's <ESC>E, the printer prints the buffered data before returning all printing environment variables to their user soft default values. Note that the intended use of this function is as a job separator; resetting memory during a user's job can have unexpected results.

The RESETTING MEMORY message is displayed until the reset is completed and the printer returns to an online state, provided there are no errors that will take the printer offline. While a reset is being performed, all control panel keys are ignored.

Restore Factory Settings

This item works like RESET MEMORY except that the printing environment parameters and the user-soft defaults are returned to their factory default settings except for the items noted in the Menu Details section. RESTORING\\FACTORY SETTINGS is displayed on the control panel while the reset is in progress. In general this can be thought of as a cold reset without having to power cycle the printer.

New Transfer Kit/New Fuser Kit

These items will only appear when a status message indicating user maintenance is needed is present. These messages prompt the user to replace various consumables in the printer such as the transfer kit and fuser kit. The status message must be cleared manually since the printer cannot detect when the maintenance is actually done. In addition to clearing the messages, these menu items reset any page counts maintained for the purpose of determining consumable life. The user is prompted with SELECT IF DONE on the second line of these menu items.

<other menus>

Each I/O card installed in the printer may supply its own menu. These menus may request a particular location in the list of menus, so they may appear before, between, or after the previously described menus. For details on the available menu items, see the manual for the card installed.

Control Panel Messages

Status Messages

Note: Messages ending with the "?" character have an associated help message.

Status Message	Description
ACCESS DENIED MENUS LOCKED	The control panel security mechanism is enabled and the user has attempted to modify a menu item. When the user presses the SELECT key this message will be displayed for approximately five seconds.
CALIBRATION EXECUTING	The printer is executing an internal color calibration. Printing is suspended until the calibration process has been completed.
CANCELING JOB	The printer is in the process of canceling a job. The message will continue to be displayed until the job is stopped, the paper path flushed, and any remaining incoming data on the active data channel is received and discarded.
CHECKING PRINTER	The engine is performing an internal test. When it is finished, the printer remains offline.
CLEARING PAPER FROM PRINTER	The printer jammed or was turned on and paper was detected where it should not be. It is attempting to eject these pages automatically.
COLD RESET	The cold reset powerup key sequence has been entered. Most printer variables will be reset to their factory default values. [not localized]
CONTINUOUS PAGE PRESS CANCEL JOB	The printer configuration page is being printed continuously. Pressing the CANCEL JOB key will terminate the continuous printing of the page.
DATA RECEIVED	The printer has received and processed data and is waiting for a formfeed.
DIAGNOSTICS MODE	The extended diagnostics powerup key sequence has been entered. [not localized]
EIO X INITIALIZING YYY alternates with DO NOT POWER OFF	The EIO device in slot X is initializing. YYY is a value that increments every 10 seconds in order to assure the user that activity is still going on and the printer has not locked up.
EVENT LOG EMPTY	The user selected SHOW\\EVENT LOG from the INFORMATION MENU, but the event log has no entries. This message also replaces the CLEAR EVENT\\LOG item in the SERVICE MENU if the event log has no entries.
INITIALIZING	This message is displayed during powerup, as soon as the individual tasks begin initialization.
NO JOB TO CANCEL	The user pressed the CANCEL JOB key, but there is no active job or buffered data to cancel. This message is displayed for approximately 2 seconds before the printer is returned to the online READY state.
OFFLINE	The device is offline, and there are no error messages pending on the display.
PAGE CANNOT PRINT NOW alternates with RETRY WHEN PRINTING STOPS	An internal page has been requested while the printer is printing an incoming job. Interrupting the job to print the internal page would corrupt the job's environment and potentially cause the job to finish printing incorrectly after the internal page completed. Consequently, internal pages are not permitted to interrupt jobs and can only be printed when the printer is idle.
PLEASE WAIT	The device is in the process of flushing the pipeline so it can go offline or go into the menus.
POWERSAVE ON	The printer is in the powersave mode. This message may be cleared by any key

	press, an error condition, or the receipt of printable data.
PRINTING CALIBRATION PAGE	The color calibration page is being generated. The printer will return to the online READY state upon completion of the page.
PRINTING CONFIGURATION	The printer configuration page is being generated. The printer will return to the online READY state upon completion of the page.
PRINTING FONT LIST	The personality typeface list is being generated. The printer will return to the online READY state upon completion of the page.
PRINTING MENU MAP	The printer menu map page is being generated. The printer will return to the online READY state upon completion of the page.
PRINTING REGISTRATION PG	The registration page is being generated. The printer will return to the online READY state upon completion of the page.
PROCESSING JOB	The device is actively processing a user's job.
READY	The printer is online and ready for data with no status or device attendance messages pending. Note: This message has a help message associated with it even though it is not explicitly indicated.
RESETTING MEMORY	This message is displayed during execution of a RESET MEMORY printer reset.
RESETTING VALUES FINISHED	The color calibration density values have been reset to their default values.
RESTORING FACTORY SETTINGS	This message is displayed during the execution of a RESTORE FACTORY\\SETTINGS printer reset and also during a powerup COLD RESET.
SELECT LANGUAGE	The language selection powerup key sequence has been entered. The printer will prompt the user to select a new control panel display language once it has completed its initialization process. [not localized]
SERVICE MODE	The service mode powerup key sequence has been entered. The printer will remain in Service Mode until the GO key is pressed. [may appear localized or unlocalized depending on the point in the bootup process]
WARMING UP	The printer fuser is heating up and printing will continue as soon as it is at the proper temperature.

Warning Messages

Note: Messages ending with the "?" character have an associated help message.

Warning Message	Description
EIO X NOT FUNCTIONAL	The EIO slot specified by X is not functional.
MEMORY SHORTAGE JOB CLEARED	The printer ran out of free memory while attempting to print the job. The remainder of the job was canceled.
MEMORY SHORTAGE PAGE SIMPLIFIED?	The printer's 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. Adding memory or reducing the complexity of the page may improve the print quality.
PAGE SIMPLIFIED?	The printer's 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. Adding memory will not correct this problem, but reducing the complexity of the page may improve the print quality.
PRINTER LANGUAGE NOT AVAILABLE ?	PJL encountered a request for a personality that does not exist in the printer. The job is aborted and no pages will be printed.
TONER CMYK LOW ?	A toner low condition has been detected. The toner cartridge may be changed at this time by pressing the *SELECT* key or by opening and closing the toner door (top cover). Otherwise printing will continue. This message is generated if TONER LOW in the CONFIGURATION MENU is set to CONTINUE.
TONER CMYK OUT ?	A toner out condition has been detected. The toner cartridge may be changed at this time by pressing the *SELECT* key or by opening and closing the toner door (top cover). Otherwise printing will continue. This message is generated if TONER OUT in the CONFIGURATION MENU is set to OVERRIDE, the TONER OUT message has already been displayed, and the *GO* key has been pressed to effect the override and continue printing.

Attention Messages

Note: Messages ending with the "?" character have an associated help message.

Attention Message	Description
13.XX PAPER JAM *alternates with* CHECK ALL REAR DOORs ***OR*** CHECK MIDDLE FRONT DRAWER ***OR*** CHECK FRONT DUPLEX DRAWER *alternates with* FOR HELP PRESS THE ? KEY 13.1 JAM: OPEN MIDDLE DRAWER *alternates with* CHECK IN REAR OF DRAWER *alternates with* FOR HELP PRESS THE ? KEY	A paper jam has occurred where XX is detailed below. This message alternates with the jam access point. *XX* *Description* 0 Media delay jam at paper feed area. 1 Media delay jam at fusing unit. 2 Media stay jam at fusing unit. 3 Media delay jam at media reversing area. 4 Media stay jam at media reversing area. 5 Media delay jam at media path to duplexer. 6 Media stay jam at media path to duplexer. 7 Media remaining jam at the paper path. 8 Door open jam. 9 Irregular paper jam at the paper path. 10 Too short paper jam at the paper path. 11 Too long jam at the paper path.
20 INSUFFICIENT MEMORY *alternates with* PRESS GO TO CONTINUE *Alternates with* FOR HELP PRESS THE ? KEY	More data has been received from the computer than fits in the printer's internal memory. To continue printing, press the ***GO*** key. Only the amount of data that fits in the printer's internal memory for the current page is printed before moving on to the next page. To cancel the job, press the ***CANCEL JOB*** key. Adding memory or reducing the complexity of the partial page may permit the job to print successfully.
22 EIO X BUFFER OVERFLOW *alternates with* PRESS GO TO CONTINUE	The printer's EIO card in slot X has overflowed its I/O buffer during a busy state. Pressing the ***GO*** key resumes printing but results in a loss of data.
22 PARALLEL I/O BUFFER OVERFLOW *alternates with* PRESS GO TO CONTINUE	The printer's parallel buffer has overflowed during a busy state. Pressing the ***GO*** key resumes printing but results in a loss of data.
40 EIO X DATA ERROR *alternates with*	A connection with the card in EIO slot X has been abnormally broken. To continue printing, press the ***GO*** key.

PRESS GO TO CONTINUE	
41.3 UNEXPECTED PAPER SIZE *alternates with* CHECK PAPER IN TRAY X *alternates with* FOR HELP PRESS THE ? KEY	The user has loaded a tray with paper that is a different size than the size that the tray is configured for. The error can be corrected by putting the proper size paper in the tray or reconfiguring the tray for the paper size it contains and pressing the ***GO*** key.
41.5 UNEXPECTED PAPER TYPE *alternates with* CHECK PAPER IN TRAY X *alternates with* FOR HELP PRESS THE ? KEY	The user has loaded a tray with paper, which is a different type than the type that the tray is configured for. The error can be corrected by putting the proper type paper in the tray or reconfiguring the tray for the paper type it contains and pressing the ***GO*** key.
68 NVRAM error check SETTINGS *alternates with* PRESS GO TO CONTINUE	One or more printer settings saved in the non-volatile storage device is invalid and has been reset to its factory default. The user should check the printer settings to determine which value(s) changed.
68 NVRAM FULL CHECK SETTINGS *alternates with* PRESS GO TO CONTINUE	This message indicates a non-volatile storage device is full. Some settings may have been reset to their factory defaults. The user should check the printer settings to determine which value(s) changed.
BAD DUPLEXER CONNECTION *alternates with* FOR HELP PRESS the ? KEY	The duplexer is not connected properly.
CANNOT DUPLEX CHECK REAR BIN *alternates with* CANNOT DUPLEX CHECK PAPER *alternates with* FOR HELP PRESS THE ? KEY	The printer cannot duplex either because the rear output bin has been opened during printing, an overhead transparency has been detected, or the paper is not a size supported by the duplexer.
CANNOT DUPLEX CLOSE REAR BIN	The printer cannot duplex because the rear output bin is open.
CLOSE TOP COVER	The top cover needs to be closed.
CLOSE FRONT	The duplex feeding area door needs to be closed.

DUPLEX DRAWER	
CLOSE MIDDLE FRONT DRAWER	The ITB access drawer needs to be closed.
CLOSE UPPER FRONT DRAWER	The OPC access drawer needs to be closed.
CLOSE UPPER REAR DOOR	The paper delivery door needs to be closed.
DRUM ERROR REPLACE KIT ?	An error has been detected with a component of the drum kit. The drum kit should be replaced.
DRUM LIFE LOW REPLACE KIT ?	The drum kit is near the end of its expected life or the waste toner has reached some threshold and will be full soon. It could be replaced at this time.
DRUM LIFE OUT REPLACE KIT ?	The drum kit has reached the end of its expected life and should be replaced.
DUPLEX ERROR CHECK DUPLEXER *alternates with* FOR HELP PRESS THE ? KEY	The duplex unit has an error.
FUSER LIFE LOW REPLACE KIT ?	The fuser kit is near the end of its expected life. It could be replaced at this time.
FUSER LIFE OUT REPLACE KIT ?	The fuser kit has reached the end of its expected life. It should be replaced.
INSTALL TRAY 2	Insert tray 2 into the printer so that printing from tray 3 can continue/start.
MEMORY FULL STORED DATA LOST	There is no available memory in the printer. The current job may not print correctly, and some resources (like downloaded fonts) may have been deleted.
MEMORY SETTINGS CHANGED	The I/O buffering settings had to be changed by the printer because there is no longer enough memory to use the previous settings.
PAGE TOO COMPLEX TO PRINT *alternates with* PRESS GO TO CONTINUE *alternates with* FOR HELP PRESS THE ? KEY	The page could not be printed. Pressing the ***GO*** key will cause printing to continue (with noticeably poor results on this page); pressing the ***CANCEL JOB*** key will terminate the entire job. Adding memory will not correct this problem, but reducing the complexity of the page may allow it to print successfully.
PRESS GO TO PRINT *alternates with* PRESS SELECT TO CHANGE TONER	The top cover has been opened and closed while not in toner cartridge replacement mode. Pressing the ***GO*** key will cause printing to continue; pressing the ***SELECT*** key will enter the toner replacement menu.
REMOVE PAPER TOP OUTPUT BIN	The top output bin is full and should be emptied.
TONER CMYK LOW	A toner low condition has been detected. The toner cartridge must be changed at this time by pressing the ***SELECT*** key. This message is

alternates with PRESS SELECT TO CHANGE TONER *alternates with* FOR HELP PRESS THE ? KEY	generated if **TONER LOW** in the **CONFIGURATION MENU** is set to **STOP.**
TONER CMYK OUT *alternates with* PRESS SELECT TO CHANGE TONER *alternates with* FOR HELP PRESS THE ? KEY	A toner out condition has been detected. The toner cartridge must be changed at this time by pressing the ***SELECT*** key. This message is generated if **TONER OUT** in the **CONFIGURATION MENU** is set to **STOP.**
TONER CMYK OUT <GO> TO PRINT *alternates with* PRESS SELECT TO CHANGE TONER *alternates with* FOR HELP PRESS THE ? KEY	A toner out condition has been detected. The toner cartridge may be changed at this time by pressing the ***SELECT*** key. Pressing the ***GO*** key will cause printing to resume without changing the cartridge. This message is generated if **TONER OUT** in the **CONFIGURATION MENU** is set to **OVERRIDE.**
TONER POSITION [COLOR]=[STAT E] ?	The user has pressed ***SELECT*** when a toner low/out message was displayed. This message indicates the current state of a particular toner cartridge. [COLOR] will be CYAN, MAGENTA, YELLOW, or BLACK. [STATE] will be OK, LOW, OUT, or MISSING.
TRANSFER KIT LOW REPLACE KIT ?	The transfer kit is near the end of its expected life. It could be replaced at this time.
TRANSFER KIT OUT REPLACE KIT ?	The transfer kit has reached the end of its expected life. It should be replaced.
TRAY X EMPTY [TYPE] [SIZE]	The specified tray is empty and needs to be filled but the current job does not need this tray to print correctly.
TRAY X LOAD [type] [size] *alternates with* **NOTHING** *OR* CHECK CONTROL PANEL SETTINGS *OR* VERIFY TRAY X MEDIA SIZE KNOB *alternates with* FOR HELP PRESS THE ? KEY	The user needs to put the specified paper type and paper size into the requested paper tray number. Pressing ***GO*** will override this paper mount, causing the page to be printed on the media currently loaded in the highest priority input tray. TRAY X LOAD type] [size] if **TRAY 1 MODE** in the **PAPER HANDLING MENU** is set to **FIRST** CHECK CONTROL PANEL SETTINGS if **TRAY 1 MODE** in the **PAPER HANDLING MENU** is set to **CASSETTE** or Tray 2 is the applicable tray VERIFY TRAY X MEDIA SIZE KNOB if Tray 3 is the applicable tray

TRAY X OPEN	The specified tray (2 or 3) is open or not closed completely.
TRAY X SIZE= [size] ?	Media has been loaded into Tray 1. The most recently configured size will be displayed with an asterisk next to it. The ***VALUE+*** and ***VALUE-*** keys may be used to view all possible sizes. Pressing ***SELECT*** will select the currently displayed size. Pressing ***GO*** will remove the message.
TRAY X TYPE= [TYPE] ?	Media has been loaded into Tray 1. The most recently configured type will be displayed with an asterisk next to it. The ***VALUE+*** and ***VALUE-*** keys may be used to view all possible types. Pressing ***SELECT*** will select the currently displayed type. Pressing ***GO*** will remove the message.
WASTE Toner FULL REPLACE DRUM KIT *alternates with* FOR HELP PRESS THE ? KEY	The waste toner receptacle is full. The drum kit must be replaced at this time.

Critical Error Messages

Note: Messages ending with the ? character have an associated help message.

Critical Error Message	***Description***
49 ERROR (XXXX) CYCLE POWER	A critical firmware error has occurred. In the past these have been designated as 79 SERVICE(XXXX). The field service personnel typically replace the formatter in such cases, which is usually not the problem. To avoid excessive warranty costs, the error has been renamed. Pressing the ***ITEM***- and ***SELECT*** keys simultaneously will display specific information about the error, such as source module and line number. Any key press will continue scrolling through the available information. See the 49 ERROR Codes section for a list of these error codes. [not localized]
50.X FUSER ERROR *alternates with* FOR HELP PRESS THE ? KEY	A fuser error has occurred where X is detailed below. Power cycle the printer to continue. *X* *Description* 1 Low fuser temperature. 2 Fuser warm up service. 3 High fuser temperature. 4 Faulty fuser. 5 Fuser mismatch. 6 Fuser heater cutoff. 7 Fuser motor malfunction.
51 LASER ERROR *alternates with* FOR HELP PRESS THE ? KEY	A laser error has occurred due to beam detect error or laser failure. Power cycle the printer to continue.
52 SCANNER ERROR *alternates with* FOR HELP PRESS THE ? KEY	A scanner failure has occurred. Power cycle the printer to continue.
53.XY.ZZ PRINTER ERROR *alternates with* PRESS GO TO CONTINUE	A memory error has been detected. If a DIMM device caused the error, the device will not be configured. Pressing the ***GO*** key will cause the memory test to continue. [not localized] Values of X, Y and ZZ are as follows: *X* *Memory Type* 0 ROM 1 RAM *Y* *Device Location* 0 On board 1 DIMM Slot 1 2 DIMM Slot 2 3 DIMM Slot 3 *ZZ* *Error Number* 0 Unsupported memory/invalid DIMM speed. 1 Unrecognized memory (presence detect bad). 3 Failed RAM test.
54.X PRINTER ERROR	A printer error has occurred where X is detailed below. Power cycle the printer to continue.

alternates with FOR HELP PRESS THE ? KEY	*X* *Description* 1 Internal power failure. 2 Carousel rotation failure. 3 Density sensor out of range. 4 Optional equipment not available. 5 Waste toner sensor malfunction. 6 OHT sensor malfunction.
55 DC CONTROLLER ERROR *alternates with* FOR HELP PRESS THE ? KEY	A printer error has occurred in which the print engine is no longer communicating with the formatter. This could be due to a communication failure between the formatter and the DC controller, a DC memory abnormality, or a problem with the IC on the DC controller.
57.X FAN ERROR *alternates with* FOR HELP PRESS THE ? KEY	A fan error has occurred where X is detailed below. Power cycle the printer to continue. *X* *Description* 1 Fan 1 motor malfunction. 2 Fan 2 motor malfunction.
57.3 FAN ERROR *alternates with* CLOSE UPPER FRONT DRAWER *alternates with* FOR HELP PRESS THE ? KEY	The upper front drawer may appear to be closed, but the fan's electrical connection is not complete.
62 NO SYSTEM	The printer firmware is missing. [not localized]
62.X PRINTER ERROR	This message indicates a problem with the internal memory of the printer. This message may also appear when emulating code if a breakpoint is set. If this is the case pressing ***ITEM-*** and ***SELECT*** simultaneously will continue past the error. [not localized] *X* *Description* 0 Internal memory (bad CRC on firmware code). 1 Memory in DIMM slot 1. 2 Memory in DIMM slot 2. 3 Memory in DIMM slot 3.
62.M BAD MPTR	The firmware ran out of memory trying to build the static entity directory. [not localized]
79 SERVICE(XXXX) PRINTER ERROR	This message indicates a hardware exception occurred. Pressing the ***ITEM***- and ***SELECT*** keys simultaneously will display specific information about the exception, such as source module and line number. Any key press will continue scrolling through the available information. See the 79 and 80 Error Codes section for a list of these error codes. [not localized]
8X SERVICE(XXXX) EIO ERROR	This message indicates a critical IIO failure. Pressing the ***ITEM***- and ***SELECT*** keys simultaneously will display specific information about the failure, such as source module and line number. Any key press will continue scrolling through the available information. . See the 79 and 80 Error Codes section for a list of these error codes. X is the slot number of the device (1-3) or the slot number plus 5 for card supplied errors (6-8). [not localized]
DENSITY	A density sensor out of range error was detected during a color calibration.

SENSOR OUT OF RANGE *alternates with* CLEAN DENSITY SENSOR ?	Power cycle the printer to continue.
INSTALL DRUM KIT *alternates with* FOR HELP PRESS THE ? KEY	The drum kit is missing and should be installed.
REINSTALL TRANSFER BELT *alternates with* FOR HELP PRESS THE ? KEY	The transfer belt has broken or was not installed correctly, requiring replacement or reinstallation of the transfer kit.

49 ERROR Codes

ALL TASKS 49 ERROR Codes	
Code	***Description***
XX80	Create message queue failed.
XX81	Open message queue failed.
XX82	Receive message failed.
XX83	Send message failed.
XX84	Message queue is full.
XX85	Unlink message queue failed.
XX86	Message queue notify failed.
XX87	Set attributes for message queue failed.
XX88	Get attributes for message queue failed.
XX89	Message contained unexpected opcode.
XX8A	Init semaphore failed.
XX8B	Destroy semaphore failed.
XX8C	Open semaphore failed.
XX8D	Close semaphore failed.
XX8E	Unlink semaphore failed.
XX8F	Semaphore wait failed.
XX90	Semaphore try wait failed.
XX91	Post semaphore failed.
XX92	Semaphore get value failed.
XX93	Create watchdog timer failed.
XX94	Start watchdog timer failed.
XX95	Cancel watchdog timer failed.
XX96	Delete watchdog timer failed.
XX97	Spawn task failed.
XX98	Delete task failed.
XX99	Restart task failed.
XX9A	Lock task failed.
XX9B	Unlock task failed.
XX9C	Lock interrupt failed.
XX9D	Unlock interrupt failed.
XX9E	Enable interrupt failed.
XX9F	Disable interrupt failed.
XXA0	Interrupt context failed.
XXA1	Set interrupt vector failed.
XXA2	Get interrupt vector failed.
XXA3	Connect interrupt failed.
XXA4	Required task not found.
XXA5	Bad memory pool ID.
XXA6	No memory.
XXA7	No client index free.
XXA8	Bad memory allocation.
XXA9	Bad memory ID.
XXAA	Bad client.
XXAB	Bad memory deallocation.
XXAC	Bad memory reallocation.

XXAD	Bad kill client.
XXAE	Bad memory free.
XXAF	Unprotected client.
XXB0	LJOS semaphore error.
XXB1	HP global semaphore error on current task.
XXB2	HP global semaphore not initialized.
XXB3	HP global semaphore unlock without lock.
XXFE	General error (no code specified - ASSERT macro used).

Where XX is:

00	INITMGR		10	PML
01	PS		11	FS
02	unknown		12	SRV
03	PE		13	IDE
04	PPS		14	PJL
05	CP		15	CMP
06	PG		16	CMP2
07	DM		17	CAL
08	KB		18	TIO
09	NV		19	XIO
0A	IOP		1A	TESTPERS
0B	IIO1		1B	TLITST
0C	IIO2		1C	DUMPTST
0D	IIO3		1D	VIO
0E	PIO		20-3F	transient task
0F	XIP			

INITMGR TASK 49 ERROR Codes

Code	*Description*
0001	InitMgr task table overflow. Too many tasks in the system.
0002	Error creating InitMgr incoming message queue.
0003	Error creating watchdog timer.
0004	Error spawning a task.
0005	Empty incoming message during spawn.
0006	Received spawn acknowledge from wrong task.
0007	Error starting watchdog timer during spawn.
0008	Watchdog timeout during spawn.
0009	Error canceling watchdog timer during spawn.
000A	Unexpected incoming message during spawn.
000B	Error opening an outgoing task message queue.
000C	Error closing an outgoing task message queue.
000D	Error sending "install hooks" message.
000E	Error starting watchdog timer during install hooks.
000F	Error starting watchdog timer during init.
0010	Watchdog timeout during install hooks.
0011	Watchdog timeout during init.
0012	Error canceling watchdog timer during install hooks.
0013	Error canceling watchdog timer during init.
0014	Empty incoming message during install hooks.
0015	Empty incoming message during init.

0016	Unexpected incoming message during install hooks.
0017	Unexpected incoming message during init.
0018	Error deleting watchdog timer.
0019	Error sending "system initialized" message.
001A	Error sending message from watchdog timer.
001B	Received hook acknowledge from wrong task.
001C	Error sending "initialize" message.
001D	Received message with invalid "from" field during init.
001E	No tasks found to spawn.
001F	Invalid task entry pint in TASK entity.
0020	Error receiving message during spawn.
0021	Error receiving message during install hooks.
0022	Error receiving message during init.
0023	Out of memory.
0024	Error trying to delete a task.
0025	Error adding task delete hook.
0026	Number of non-transient tasks inconsistent.
0027	Duplicate message queue name found in TASK entity.
0028	Unexpected message from init manager during init.

PS TASK 49 ERROR Codes

Code	*Description*
0101	PS configuration table pointer NULL.
0102	PS blew out PS message queue table.
0103	PS non-existent message queue.
0104	PS back error.
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 init complete called, but PS state is not PS INIT2 state.
0109	PS unrequested image message received.
010A	PS open frame complete message received.
010B	PS unrequested/invalid semaphore message received.
010C	PS unrequested write packet flush message received.
010E	PS unrequested NVEE response message received.
010F	PS unrequested USTATUS configuration message.
0110	PS unrequested USTATUS configuration change handshake.
0111	PS unrequested set I/O configuration handshake.
0112	PS unrequested frame release handshake.
0113	PS no channels message received before phase 2 init.
0114	PS PML reply unexpected.
0115	PS PML reply location error.
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.
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 offline handshake.
0128	PS unrequested FS response.
0129	PS unrequested PP task stack release.
012A	PS unrequested PP task stack acquire.
012B	PS unrequested paper speed response.
012C	PS job status.
012D	PS job monitor queue error.
012F	PS bad memrec request.
0130	PS zero length message.
0131	PS could not create message queue.
0132	PS expected init message.
0133	PS expected install hooks message.
0134	PS open initmgr message queue error.
0135	PS unexpected opcode.
0136	PS no current personality.
0137	PS could not delete task.
0138	PS could not destroy personality semaphore.
0139	PS open PG message queue error.
013A	PS no PE task.
013B	PS open PE message queue error.
013C	PS no IOP task.
013D	PS open IOP message queue error.
013E	PS no DM task.
013F	PS open DM message queue error.
0140	PS open PML message queue error.
0141	PSLIBGEN PSLIBinit terminated abnormally.
0142	PSLIBGEN resource leak discovered turning mem reconfig.
0143	PSLIBGEN attempt to destroy active personality.
0144	PSLIBGEN no IP stack.
0145	PSLIBGEN no valid PJL personality found.
0146	PSLIBGEN unknown opcode.
0147	PSLIBGEN duplexing error.
0148	PSLIBGEN invalid response for system state variable.
0149	PSLIBGEN no PP stack.
014F	PSLIBGEN no memory for page complete signal message.
0151	PSLIBGEN unable to allocate memory.
0153	PSLIBGEN call to CloseIntermediate failed.
0155	PSLIBGEN error during commit buffer.
0157	PSLIBGEN personality back block or stack pointer is NULL.
0158	PSLIBGEN event control error.
0159	PSLIBGEN error during call to PersReadData or PersReturnReadData.
015A	PSLIBGEN error during call to PersSaveReadData.
015B	PSLIBGEN error during call to psWriteData or AcknowledgeWritePacket.
015C	PSLIBGEN error during call to PersFlushData.
015D	PSLIBGEN invalid options in PersOpenPage.

015E	PSLIBGEN insufficient number of personalities.
015F	PSLIBGEN PERS called unimplemented interface routine.
0160	PSLIBGEN NVEE response did not match inquiry.
0161	PSLIBGEN PJL global variables pointer is NULL.
0163	PSLIBGEN personality terminated with a crash condition.
0164	PSLIBGEN personality terminated, wrong interface version.
0165	PSLIBGEN unable to allocate frame buffer.
0166	PSLIBGEN bad parameters to PersWriteData.
0169	PSLIBGEN too many installed personalities.
016A	PSLIBGEN too many installed PDD personalities.
016B	PSLIBGEN NULL personality.
016C	PSLIBGEN error spawning PJL.
016D	PSLIBGEN error spawning PERS.
016E	PSLIBGEN error PERS respawned.
016F	PSLIBGEN error opening background semaphore.
0170	PSLIBGEN background semaphore exists.
0171	PSLIBGEN error posting background semaphore.
0172	PSLIBGEN bad parameters to PersOpenPage.
0174	PSLIBGEN bad page disposition - clear duplex.
0175	PSLIBGEN bad page disposition - missing backside.
0176	PSLIBGEN bad page disposition - missing frontside.
0177	PSLIBGEN ran out of page header frames.
0178	PSLIBGEN ran out of page tokens.
0179	PSLIBGEN bad virtual frame state.
017A	PSLIBGEN stranded virtual frame discovered.
017D	PSLIBGEN fminit failed.
017E	PSLIBGEN no IP table.
0182	PSLIBIP insufficient memory for page intermediate.
0183	PSLIBIP no strips on the page.
0184	PSLIBIP PersPageOpen: no memory for page intermediate structures.
0185	PSLIBIP no memory for page intermediate structures.
0186	PSLIBIP invalid rotation angle in PersRotate.
018D	PSLIBIP PersPutRule invalid X value.
0192	PSLIBIP state push error.
0193	PSLIBIP invalid bitmap returned from PersCloseBitmap.
0194	PSLIBIP corrupted page intermediate data structures.
0195	PSLIBIP page intermediate lost or corrupted.
0196	PSLIBIP bitmap lost or corrupted.
0197	PSLIBIP image lost or corrupted.
0198	PSLIBIP state stack underflow.
0199	PSLIBIP PersPutScaledImage, invalid vertScale parameter.
019A	PSLIBIP PersPutScaledImage, invalid horizScale parameter.
019B	PSLIBIP invalid descSize field in PersSetPattern.
019C	PSLIBIP error during pslibip attachstrip strip recovery.
019D	PSLIBIP lost frame buffer.
019E	PSLIBIP no sort slot in pslibip attachstrip.
019F	PSLIBIP resource leak detected.
01A0	PSLIBMET image pointer not NULL.
01A1	PSLIBMET bad image class.
01A2	PSLIBMET invalid op.
01A3	PSLIBMET bad scale value.

01A5	PSLIBMET no page buffer.
01A7	PSLIBIP threshold data.
01A8	PSLIBIP NULL image block.
01A9	PSLIBIP zero high pattern.
01AA	PSLIBIP bad pattern width.
01AB	PSLIBIP NULL ref block.
01AC	PSLIBIP ref count not zero.
01B6	PSLIBES memory reconfiguration failed.
01B7	PSLIBES active pers.
01C1	PJLLIB waiting for device attendance handshake, received some other message.
01C2	PJLLIB security system.
01C3	PJLLIB could not find any valid personality to invoke.
01C4	PJLLIB parser reported firmware crash.
01C5	PJLLIB PJL parser reported bad system interface.
01C6	PJLLIB PJL parser could not allocate sufficient memory.
01C7	PJLLIB bad USTATUS code.
01C8	PJLLIB rogue deallocation.
01E0	PSLIBCOMP no QSTATE1 memory.
01E1	PSLIBCOMP no QSTATE2 memory.
01E2	PSLIBCOMP no QSTATE3 memory.
01E3	PSLIBCOMP golden block overflow.
01E4	PSLIBCOMP M32 decomp buffer overflow.
01E5	PSLIBCOMP M32 dissect misc error.
01E6	PSLIBCOMP lossy decomp overflow.
01E8	PSLIBCOMP unsupported strip decomp.
01E9	PSLIBCOMP LZS8 image overflow.
01EB	PSLIBCOMP LZS8 decomp overflow.
01EC	IPDECOMP LZS8 decomp overflow.
01ED	IPDECOMP LZS8 strip D overflow.
01EE	PSLIBCOMP LZS8 test error.
01EF	PSLIBCOMP any NoComp error.
01F0	PSLIBMEM uninitialized ES area.
01F8	IPCHARIZ memory out.
01F9	IPCHARIZ memory out1.

PE TASK 49 ERROR Codes

Code	*Description*
0351	Failed to do a new on an object (memory failure).
0352	Failed to construct the print engine subsystem.
0353	Unexpected NULL pointer.
0354	page added to a job that has received an End of Job event.

PPS TASK 49 ERROR Codes

Code	*Description*
0400	OS error.
0401	Task error.
040A-10	Strip errors.
0414-27	Pers errors.
0428-30	Video errors.
0432-3E	Video memory errors.

0446-57	Raster errors.
045A-65	Page errors.
046E-6F	Init errors.
0470-72	Print errors.
0473	PE error.
0474-75	CCHS errors.
04B4-BD	Reserve IP.
04C8-CB	BIOS errors.
04CF-FF	BIOS errors common to PPS, CMP, and CMP2. See table after **CMP TASK**.

CP TASK 49 ERROR Codes

Code	*Description*
0501	Message to be displayed was NULL.
0502	Too many alternating messages.
0503	Illegal localization string format.
0504	Illegal localization option.

DM TASK 49 ERROR Codes

Code	*Description*
0700	Invalid message opcode received from NV task.
0701	Invalid message opcode received.
0702	Invalid message opcode received from DM PML.
0703	Invalid message opcode received from PS task.
0704	Invalid message queue designated for database send.
0705	Memory allocation failed.
0706	No states on DM state queue.
0707	Invalid DBM message opcode designated for database send.

KB TASK 49 ERROR Codes

Code	*Description*
0801	Invalid key received.

NV TASK 49 ERROR Codes

Code	*Description*
0901	Out of range index value for NVRAM.

IOP TASK 49 ERROR Codes

Code	*Description*
0A01	Invalid opcode.
0A02	IOC not found.
0A03	IOC command not supported by IOC.
0A04	IOC channel not found.
0A05	Unit channel not found.
0A06	Invalid IOC mailbox.
0A07	Max channel number exceeded.
0A08	Invalid write buffer status.
0A09	Unrequested solicited write message.
0A0A	Connection manager not found.
0A0B	Unit not found.
0A0C	Online during buffer reconfig.

0A0D	Active buffer missing during buffer reconfiguration.
0A0E	Pending buffer missing during buffer reconfiguration.
0A0F	Invalid buffer origin.
0A10	Menu not found.
0A11	Config page not found.
0A12	Device ID string size exceeded.
0A50	Request outstanding.
0A51	Activity during reinit.
0A52	Activity during clear all.
0A53	Activity during clear last active.
0AB0	Sleep failed.

IIO1/IIO2/IIO3 TASK [X = B for slot 1, C for slot 2, D for slot 3] 49 ERROR Codes	
Code	***Description***
0X01	Invalid return status.
0X02	Invalid opcode.
0X03	ASCII status too long.
0X04	Config string too long.
0X05	Unknown packet received.
0X06	Unknown CGP packet.
0X07	Invalid identify CGP number.
0X08	Invalid menu config response modifier.
0X09	Invalid reclaim response modifier.
0X0A	Request not understood.
0X0B	Invalid restart request modifier.
0X0C	Invalid config page request modifier.
0X0D	Config page duplicate registration.
0X0E	Config page max registered.
0X0F	Config page invalid unregistration.
0X10	Invalid menu change request modifier.
0X11	Menu duplicate registration.
0X12	Menu max registered.
0X13	Menu invalid unregistration.
0X14	Invalid CSH image request modifier.
0X15	Datagram received invalid command.
0X16	Datagram received error.
0X17	Datagram returned invalid return status.
0X18	Buffer received invalid command.
0X19	Buffer received error.
0X1A	Buffer received invalid return status.
0X1B	Datagram returned invalid command.
0X1C	Datagram returned error.
0X1D	Datagram returned not understood.
0X1E	Buffer returned invalid command.
0X1F	Buffer returned error.
0X20	Buffer returned not understood.
0X21	Buffer returned invalid return status.
0X22	Invalid menu action.
0X23	Invalid datagram number.

0X24	Unknown datagram status.
0X25	Invalid datagram size.
0X26	Invalid I/O control request modifier.
0X50	Waiting on PGP buffers.
0X51	Not ready.
0X52	Request outstanding.
0X53	Max card outstanding packets reached.
0XB0	Sleep failed.

PIO TASK 49 ERROR Codes

Code	*Description*
0E01	No read buffer available.
0E02	No datagram buffer available.
0E03	MLC channel not found.
0E04	MLC channel not in table.
0E05	Invalid event for state.
0E06	Channel does not exist.
0E07	Read request sent to invalid channel.
0E08	Write request sent to invalid channel.
0E09	Invalid datagram status.
0E0A	Unknown MLC buffer type.
0E0B	No datagram for request.
0E0C	No datagram buffer available.
0E20	IOC invalid opcode.
0E21	Route lost not inserted by IOC.
0E22	Unknown datagram request.
0E23	MLC invalid opcode.
0EB0	Sleep failed.

XIP TASK 49 ERROR Codes

Code	*Description*
0F01	Invalid endpoint.
0F02	Invalid message.
0F03	Unknown protocol.
0F04	Invalid opcode.
0F05	File descriptor unavailable.

PML TASK 49 ERROR Codes

Code	*Description*
1001	Unrequested PML buffer.
1002	No memory.
1003	Out of sequence numbers.
1004	No trap buffer available.
1005	Bad channel.
1006	Bad MIB list.
1007	Bad queue remove.
1008	Short list not empty.
1009	Bad request ID delayed return.
100A	Bad request ID resetting.
100B	Non-existent message queue.

100C	Could not create message queue.
100D	Zero length message.
100E	Expected "install hooks" message.
100F	Expected "init" message.
1010	Missing vital partner.
1011	Open partner message queue error.
1012	Open InitMgr message queue error.
1013	Internal message queue send error.
1014	Internal message queue receive error.

CMP/CMP2 TASK [XX = 15 for CMP, 16 for CMP2] 49 ERROR Codes

Code	*Description*
XX00-31	OS errors.
XX32-33	Init errors.
XX3C	Task error.
XX46-4D	Errors.
XX4E	Invalid source color space.
XX4F	Error.
XX50	Invalid destination color space.
XX51	Invalid method in config rec.
XX52	Error.
XX53	Change queue invalid method.
XX54-55	Errors.
XX56	Invalid method.
XX57-58	Errors.
XX5A-5E	Task errors.
XX64	Decompression - premature decompression.
XX65	Decompression - invalid source color space.
XX66	Decompression - invalid destination color space.
XX67	Decompression - invalid handle.
XX68	Decompression - invalid dimensions.
XX69	Decompression - invalid depth.
XX6A	Decompression - can t supply memory.
XX6E-71	BIOS errors.
XX78-7C	Exif errors.
XX7D	Exif - invalid sacrifice quality value.
XX7E-8A	Exif errors.
XX8B	Exif - invalid init values.
XX8C	Pers - invalid raw data.
XX8D	Pers - fast raster decomp error.
XX8E	Pers - invalid dimensions.
XX8F	Pers - invalid raw data unsupported.
XX90	Pers - invalid copern exif type.
XX91	Pers - invalid cmp exif type.
XX96-99	List errors.
XX9A	List - invalid depth.
XX9B	List error.
XXCF-FF	BIOS errors common to PPS, CMP, and CMP2. See following table.

PPS/CMP/CMP2 TASK [XX = 04 for PPS, 15 for CMP, 16 for CMP2] 49

ERROR Codes	
Code	***Description***
XXCE	Error not found in switch statement (should never happen).
XXCF	Unknown interrupt from Key 1.
XXD0	PCI config write to enable byte lane swapping failed.
XXD1	Need call to bCSCConvertContinue (not necessarily an error).
XXD2	CSC conversion or byte swapping function failed to complete DMA.
XXD3	Hardware assist function timed out waiting for DMA.
XXD4	PageQ underflow.
XXD5	Invalid component specification.
XXD6	Illegal component #1 HSF.
XXD7	Illegal Huffman decode parameters.
XXD8	Undefined Huffman table.
XXD9	Undefined Q table.
XXDA	Invalid VSF.
XXDB	Invalid HSF.
XXDC	Invalid number of components.
XXDD	Invalid image size parameters.
XXDE	Invalid precision.
XXDF	Invalid Huffman table ID.
XXE0	Invalid Q table ID.
XXE1	Invalid precision - baseline only supports 8-bit.
XXE2	Illegal restart marker.
XXE3	Invalid parameter for JPEG baseline.
XXE4	Invalid JPEG segment.
XXE5	Invalid JPEG file.
XXE6	HiLite error - illegal configuration write.
XXE7	HiLite error - data decode illegal EOI.
XXE8	HiLite error - data decode illegal Huffman code.
XXE9	HiLite error - data decode illegal restart.
XXEA	HiLite error - data decode error.
XXEB	HiLite error - data decode illegal run length.
XXEC	HiLite error - data encode error.
XXED	LY reverse DMA pixel count not divisible by 32.
XXEE	Lossy stripQ underflow.
XXEF	Lossy line count not divisible by 8.
XXF0	Lossy pixel count not divisible by 8.
XXF1	Lossless stripQ underflow.
XXF2	LL reverse DMA pixel count not divisible by 32.
XXF3	SALTO error - illegal string produced during compression.
XXF4	…same as above from Key 2.
XXF5	SALTO error - illegal end of record.
XXF6	…same as above from Key 2.
XXF7	SALTO error - illegal reset dictionary.
XXF8	…same as above from Key 2.
XXF9	SALTO error - reserved codeword.
XXFA	…same as above from Key 2.
XXFB	SALTO error - invalid grow.
XXFC	…same as above from Key 2.
XXFD	Master abort or target abort, Key 1.
XXFE	Master abort or target abort, Key 2.

XXFF	Not enough data

TIO TASK 49 ERROR Codes

Code	*Description*
1800	Invalid opcode.
1801	Invalid datagram status.
1802	Invalid channel type.
18B0	Sleep failed.

XIO TASK 49 ERROR Codes

Code	*Description*
1900	Invalid opcode.
1901	Invalid server opcode.
1902	Invalid command.
1903	Channel not found.
1904	Endpoint not found.
19B0	Sleep failed.

GED TASK 49 ERROR Codes

Code	*Description*
3C01	General GED failure.
3C02	General GED warning.
3C03	GED memory out.
3CFF	GED invalid operation request.

TASK 80-BF 49 ERROR Codes

Code	*Description*
80XX	PS or ŝ 0x80 with the task ID when it does an OS_STOP. To determine the
…	correct task ID, remove the most significant bit from the first two digits of the
BFXX	error code, then look up the error.

TASK FF 49 ERROR Codes

Code	*Description*
FFXX	Processor exception where XX is the vector number of the exception.

79 and 80 SERVICE Codes

79 SERVICE Codes	
Code	***Description***
	None currently in use.

8X SERVICE Codes [X = card slot # (1-3) or the slot # plus 5 for card supplied errors (6-8)]	
Code	***Description***
0180	Major Failure.
0181	Reclaim timeout.
0182	Invalid data length.
0183	Zero data length.
0184	Unknown return status.
0185	Invalid I/O channel.
0186	Invalid peripheral unit.
0188	Master abort.
0189	Target abort.
018A	Invalid IIO buffer.
018B	Invalid max outstanding packet header field.
018C	Invalid channel mapping response.
0301	No PGP buffers.
0302	Channel table full.
0303	Producer index not reset.
0304	Consumer index not reset.
0305	Queue position size too small.
0306	Transport overflow.
0307	No overflow packets.
0308	Invalid identify response.
0309	Invalid channel map return status.
0310	Invalid reclaim return status.
0312	Datagram invalid buffer.
0313	Max stream channels.
0314	Max datagram channels.
0315	Card reset failed.
0316	Selftest failure.
0317	Unknown PGP packet.
0318	Duplicate I/O channel.

Menu Details

Default values are shaded. A ◆ in either of the last two columns indicates that the variable is reset to its factory default value for a cold reset (at powerup) or a RESTORE FACTORY SETTINGS selection from the RESETS MENU

Menu	Item	Value	Cold Reset	Menu Reset
SERVICE MENU	SERIAL NUMBER	US*aannnnnn* (a=alpha)		
		JP*aannnnnn* (n=numeric)		
	TRANSFER MAINT	*nnnnnn* default: 0	◆	
	COUNT			
	FUSER MAINT	*nnnnnn* default: 0	◆	
	COUNT			
	COLOR PAGE	*nnnnnn* default: 0	◆	
	COUNT			
	TOTAL PAGE	*nnnnnn* default: 0	◆	
	COUNT			
	COLD RESET	LETTER		
	PAPER	A4		
	CLEAR EVENT			
	LOG			
	CYAN	00...15 typical: 07		
	REGISTRATION			
	MAGENTA	00...15 typical: 07		
	REGISTRATION			
	YELLOW	00...15 typical: 07		
	REGISTRATION			
	TOP MARGIN	00...15 typical: 07		
	TRAY 1	00...15 typical: 07		
	LEFT MARGIN			
	TRAYS 2 AND 3	00...15 typical: 07		
	LEFT MARGIN			
	PRINT REGISTRATION	1,2,3 default: 1		
	PAGE TRAY			
INFORMATION MENU	PRINT MENU			
	MAP			
	PRINT			
	CONFIGURATION			
	PRINT CONFIG			
	CONTINUOUS			
	PRINT			
	FONT LIST			
	SHOW			
	EVENT LOG			
	REMAINING LIFE	TRANSFER=nnn%		
		FUSER=nnn%		
		DRUM=nnn%		
PAPER HANDLING MENU	TRAY 1 MODE	FIRST	◆	◆
		CASSETTE		

	TRAY 1 SIZE	LETTER	◆	◆
		A4		
		LEGAL		
		EXEC		
		JIS B5		
		A5		
		CUSTOM		
		B5		
		COM10		
		C5		
		DL		
		MONARC		
	TRAY 1 TYPE	PLAIN	◆	◆
		PREPRINTD		
		LTRHEAD		
		TRNSPRNCY		
		GLOSS		
		PREPUNCHD		
		LABELS		
		BOND		
		RECYCLED		
		COLOR		
		HEAVY		
		CARDSTOCK		
	TRAY 2 TYPE	same choices as TRAY 1 TYPE	◆	◆
	TRAY 3 TYPE	same choices as TRAY 1 TYPE	◆	◆
	A4/LETTER	NO	◆	◆
	OVERRIDE	YES		
	DEFAULT SIZE	same choices as TRAY 1 SIZE	◆	◆
CONFIGURATION MENU	POWERSAVE	OFF	◆	
		1 MINUTE		
		30 MINUTES		
		1 HOUR		
		2 HOURS		
		4 HOURS		
		8 HOURS		
	PERSONALITY	AUTO	◆	◆
		PCL		
		PS		
	CLEARABLE	JOB	◆	
	WARNINGS	ON		
	AUTO CONTINUE	ON	◆	
		OFF		
	TONER LOW	CONTINUE	◆	
		STOP		
	TONER OUT	STOP	◆	
		OVERRIDE		

	JAM RECOVERY	OFF	◆	◆
		ON		
	PRINT PS ERRORS	OFF	◆	◆
		ON		
PRINTING MENU	COPIES	1...999 default: 1	◆	◆
	ORIENTATION	PORTRAIT	◆	◆
		LANDSCAPE		
	FORM LENGTH	5...128 LINES default: 60	◆	◆
	DUPLEX	OFF	◆	◆
		ON		
	BINDING	LONG EDGE	◆	◆
		SHORT EDGE		
	PCL FONT SOURCE	INTERNAL	◆	◆
		SOFT		
		SLOT *n* (*n* = 1,2,3)		
	PCL FONT NUMBER	0...999 default: 0	◆	◆
	PCL FONT PITCH	0.44...99.99 default: 10.00	◆	◆
	PCL FONT POINT	4.00...999.75 default: 12.00	◆	◆
	SIZE			
	PCL SYMBOL SET	PC-8 (default), ROMAN-8, ...	◆	◆
	COURIER	REGULAR	◆	◆
		DARK		
	APPEND CR TO LF	NO	◆	◆
		YES		
I/O MENU	I/O TIMEOUT	5...300 SECONDS default: 15	◆	◆
	I/O BUFFER	AUTO	◆	
		OFF		
		ON		
	I/O BUFFER SIZE	*nnnnnnK* default: 10K	◆	
	PARALLEL HIGH	YES	◆	
	SPEED	NO		
	PARALLEL ADV	ON	◆	◆
	FUNCTIONS	OFF		
CALIBRATION MENU	PRINT			
	CALIBRATION PAGE			
	CYAN	-5...+5 default: 0	◆	◆
	DENSITY			
	MAGENTA	-5...+5 default: 0	◆	◆
	DENSITY			
	YELLOW	-5...+5 default: 0	◆	◆
	DENSITY			
	BLACK	-5...+5 default: 0	◆	◆
	DENSITY			
	RESET DENSITY			

	VALUES			
RESETS MENU	RESET MEMORY			
	RESTORE FACTORY			
	SETTINGS			
	NEW TRANSFER KIT			
	SELECT IF DONE			
	NEW FUSER KIT			
	SELECT IF DONE			
<other menus>	supplied by installed cards			

Glossary of Terms

CMYK - The toner colors available in the printer: cyan, magenta, yellow, and black.

DM - Device monitor. This constitutes "central control" for the printer.

I/O - Input/Output. Generally refers to hardware used to interface printers with computers.

IIO - Intelligent Input/Output.

LCD - liquid crystal display. A hardware device to display alpha-numeric data.

LIFO - Last in, first out.

localized - Translated into the currently selected display language.

NVRAM - Non-volatile RAM. Memory that retains its data when the printer is powered down.

PCL - A printer personality that is escape sequence (command) driven.

personality - A printer page description language such as PCL or PS. It is used to assist users in selecting fonts and graphics and placing them in some order on the printed page.

PJL - Printer Job Language. PJL provides job-level control that cannot be accomplished with PCL or PostScript. It supports printer language switching between jobs, job separation, printer configuration, and status readback from the printer.

PML - Peripheral Management Language. Within printers and up to the I/O interface, HP utilizes this language for control of peripherals. Within the I/O mechanism to the outside world, PML is converted to SNMP.

PS - A printer personality originally developed by Adobe Corporation. The HP Color LaserJet 4500 printer uses emulated PostScript.

SNMP - Simple Network Management Protocol.