North American Response Centers

HP 3000 APPLICATION NOTE

LASER PRINTERS

A SOFTWARE AND HARDWARE OVERVIEW

HEWLETT PACKARD

September 15, 1986
Document P/N 5958-5824/2638

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LASER PRINTERS

This Application Note addresses the Printer Support Package (PSP) software and the hardware upon which it can be run. It is not intended as a substitute for formal training on the PSP software but rather as a clarification of some of the issues. At the end of this note there is a discussion of the Laser Printer Family and an explanation of which laser printers can and cannot support PSP. In addition to comparing the features of the different laser printers, some common errors encountered on the laser printer error trailer page are included in the addendum.

PSP SOFTWARE

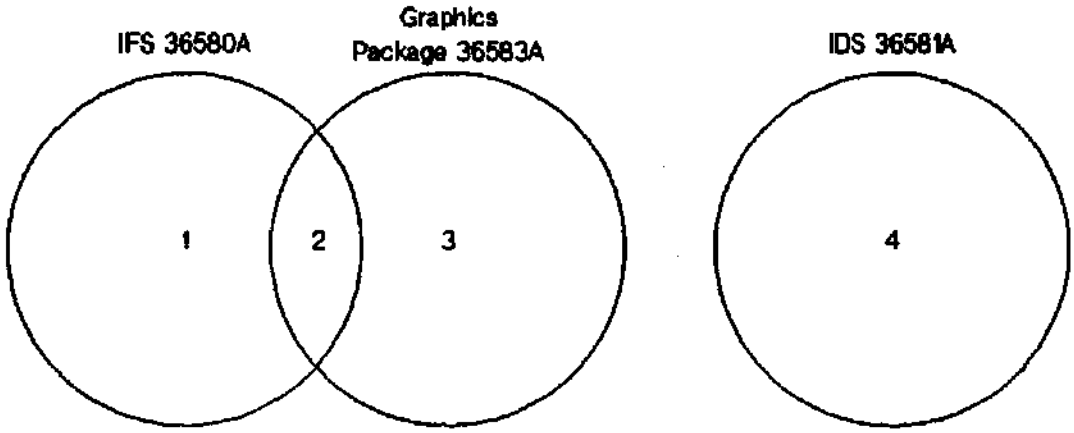
PSP software (*P/N 36584A*) consists of Interactive Formatting System (IFS) (*P/N 36580A*), Interactive Design System (IDS) (*P/N 36581A*) and Graphics Package (*P/N 36583A*).

IFS includes the non-graphics intrinsics and the standard character fonts. It lets you create your own environment files with the desired fonts, orientation, size and logical pages per physical page and allows programmatic access via the intrinsics.

IDS is comprised of IDSFORM and IDSCHAR (IDSCHAR was discontinued in September, 1985) and enables the creation of forms, logos, signatures and character fonts which can be printed via IFS environment files.

Graphics Package (which contains both graphics and non-graphics intrinsics) permits an interface to HPDRAW, DSG3000 and EZCHART and supports the Laser Printing System (LPS) Interpreter, Figmaker Program and Vector-to-Raster Conversion. The intrinsics may be programmatically accessed from various languages. The Graphics Package is necessary to convert vector data (e.g. HPDRAW) for printing to a laser printer instead of a plotter.

Diagram of the Interrelationships of the PSP (36584A) Components



1. IFS Program plus a set of Standard Character Fonts
2. Non-Graphics Intrinsics (Environment Access Only)
3. Graphics Intrinsics, LPS Interpreter, Figmaker Program and Vector-to-Raster Conversion
4. IDSFORM and IDSCHAR

NOTE: IFS and the Graphics Package overlap while IDS is separate and distinct. Also no mention is made of the Standard Environment Files because they are included with the hardware.

INTERACTIVE FORMATTING SYSTEM (IFS)

IFS allows you to specify formatting and print options for printing to a laser printer and is the vehicle for printing forms and characters (or logos) which are created with the IDS software. You can place (and position) forms on logical pages, select the size and position of the logical pages on the physical page and enable or disable the multi-copy forms option. The program also allows you to select the character font(s) which will be used to print data to the logical page and specify the orientation of character fonts upon the logical page and logical pages upon the physical page.

After an environment has been compiled it no longer needs to access to its form files, character font files or vertical format control files since IFS converts all of these components into a disc file that is passed to the laser printer prior to generating the output.

It is very important to remember the following rules when you are creating environment files:

- Orientation for both character fonts and logical pages is in relation to the the paper motion direction.
- The logical page orientation determines the positioning of the cursor after a logical page eject and the cursor movement after successive carriage returns/line feeds.
- The character font orientation determines the direction the text is written on the logical page.
- Logical page orientation differs between an HP2680A and an HP2688A. For the HP2680A, landscape orientation is the same orientation as the paper movement while portrait orientation is a 90 degree clockwise rotation from the paper movement; for an HP2688A, portrait orientation is the same orientation as the paper movement and landscape orientation is a 270 degree rotation.
- Specify a logical page no bigger than 7.5 inches by 10.25 inches if you want to copy an environment file between an HP2680A and an HP2688A (change the device number after you copy it).
- Vertical Format Control files (VFCs) are associated with logical pages rather than physical pages. VFCs are used on the laser to print files which have been created for impact printers thereby making it unnecessary to modify the data files or the application program.

Environment files are device specific; HP2680A environment files should be printed on an HP2680A laser and HP2688A environment files should be printed on an HP2688A laser. Due to the differences in resolution and paper motion between the two printers, an HP2680A environment printed on an HP2688A laser printer will be reduced 40% and rotated while an HP2688A environment printed on an HP2680A laser printer will be enlarged 67% and rotated. This creates a potential for the logical page not fitting on the physical page.

IFS uses a series of menus to create an environment. This note will not discuss every menu and/or field, but will will explain some of the areas which may need clarification.

Physical Page Menu

Number of copies field should agree with the number of forms specified on **Multi-Copy Forms Menu** if you are using multi-copy forms. (Note: Do not specify a form on both the **Multi-Copy Forms Menu** and the **Logical Page Forms Menu** because this can cause data saturation.)

If **Initial primary character font number** and **Initial secondary character font number** fields are left blank, the primary character font will be the lowest numbered character font in the environment file and the secondary character font will be the next lowest numbered.

If **Default Form File** is not specified, the **Form File** section(s) of the **Logical Page Forms** menu must reference it.

Logical Page Menu

Distance from left and **Distance from top** refer to the location of the logical page upon the physical page when the physical page is viewed in the same orientation as the logical page. (Default is logical page centered on the physical page.)

Overriding line spacing allows you to set the line spacing for printing data instead of having it computed from the primary character font or the font which you may specify in the **Font number for VFC** field. (This field is ignored if **No VFC** is specified on the **Vertical Format Control** menu.)

Left Margin defines how many characters to move in from the logical page boundary before starting to print. The default is zero. Any application (e.g. TDP) margin settings will be added to this setting rather than replacing it.

Font number for VFC allows you to specify a character font other than the primary character font to be used for line spacing.

Logical Page Forms Menu

Form 1 and **Form 2** refer to the name of the forms you want included on the logical page. If you are printing multi-copy forms, only specify the master forms on this menu.

Form File 1 and **Form File 2** allow you to specify the form files the forms reside in. If they are in the default form file and if you have specified it on the **Physical Page Menu**, you may leave these fields blank.

Position on Page contains 6 blocks which allow you to specify the general position of the form on the logical page (upper left corner, center top, upper right corner, left center, center, right center, lower left corner, center bottom and lower right corner.)

Manual Positioning allows you to position your form more precisely on the logical page. You may move your form (with the upper left corner of the logical page considered the starting point) down and to the right in units of inches, centimeters, millimeters or dots. (Remember 180 dots per inch for the HP2680A and 300 dots per inch for the HP2688A.)

Type of VFC allows you to select the vertical format control for your data. If you select S, the default VFC will be used and line spacing will be predicated upon the choice you made in the **Logical Page Menu**; an F indicates that you will supply vertical format control via a special file (the name of the file must be included) and N indicates that the cell height of the character beint printed will control the

linespacing. **Top Margin** indicates how may lines to skip before starting to print. (Note that **No VFC** causes the line feed after printing to be equal to the height of the last character on the line due to the HP3000 using a post-space mode.)

Character Font Menu

This is a fairly straightforward menu as far as the fields are concerned but there are some points to keep in mind.

Point size is 72 points per inch and **Height** refers to the character cell rather than the individual character. Therefore, if you want a character that is 1/3 inches tall, use 36 point rather than 24 point to allow for the additional space in the character cell.

ASCII Character Code: Lowest Highest is specified when you only want to use a limited range of characters from a character file. This saves compilation time and comarea space.

Character fonts are device specific so you must select a file created for the HP2680A or the HP2688A; only COUR8088.CHARSETS.SYS may be specified for either a HP2680A or a HP2688A environment file. (IFS checks for validity at compilation time.)

Miscellaneous Information

HP2688A Warning: If you specify a portrait length (or a landscape width) of 10.25 inches, IFS will issue the message `Part of the page is in the unprintable margine area`. Ignore the warning -- it will not appear at compilation.

PSPERR 102 Assertion 2 Build Triplet Failed usually indicates a form that is bigger than its logical page or, on the HP2688A before IFS A.02.06, specifying a logical page of 11.75 inches (A4 paper).

VFC Files: Using a "0" for the number of lines parameter can result in the VFC file being ignored on versions of IFS prior to A.02.06.

VFC Files: When using channel skipping to go between logical pages, the spooler issues an error if the VFC channel selected cannot be found on the next active logical page. Due to the versatility and flexibility of the laser printer, IFS allows the user to specify a unique VFC for each logical page. Therefore, the laser printer only looks at the VFC associated with the logical page.

FSERR 74: Run IFS with NOCB and you should have sufficient stack space.

PSPERR 237: Environments created with IFS A.02.06 (T-Delta2) can't be run on IFS A.02.03 (T-Delta1).

INTERACTIVE DESIGN SYSTEM (IDS)

IDS is comprised of IDSFORM and IDSCHAR which were initially designed for use on the on the HP2647A, HP2647F and HP2648A terminals. IDSFORM (versions A.02.01 and later) has been expanded to include additional terminals via the use of two character commands instead of function keys. The additional terminals which support IDSFORM are HP150A/B/C HP2393A (configured as an HP2628A), HP2623A, HP2625A (with graphics option #523), HP2627A and HP2628A (with graphics option #523). IDSCHAR and the hardware upon which it runs (HP2647A, HP2647F and HP2648A terminals, HP9874A digitizer and HP9111A graphics tablet) were discontinued in September, 1985.

IDSFORM

IDSFORM is used to create forms which can be compiled within an IFS environment and printed to the laser printer. The forms can contain text, lines, boxes and shading which remain constant, as well as fields designed to accept input data. Care must be taken in the design of the form to minimize corrections to it since IDSFORM has no "garbage collection" and "holes" created by deletions may or may not be used by later additions. This fact, plus some other restrictions, leads to several rules you should observe when creating a form.

- Design the form (to scale) on paper. Determine its size, the location of lines and boxes, the location of headings, the character fonts which will be used for the headings and the character fonts which will be used for any data to be printed to the form.

- Design the form in IDSFORM. The Form Definition Menu can only be accessed during the initial creation of the form so be sure to specify a size which can be used on the target device (if you aren't sure whether it will be used on an HP2680A or an HP2688A, use 7.5 inches by 10.25 inches) and a "Lines per unit" which is compatible with the character font selected for data.

- Do as much of your work as possible at the subform rather than the form level. There is a 6,000 word limitation at the form level but each subform has a limit of 10,000 words.

- Create fields (and name them) for any area which has a potential of having data written to it. Fields are the only areas which can contain headings and/or be written to programmatically. (IFS and IDSFORM allow you to programmatically write data directly to electronic fields on electronic forms or you may use the "print and space" method.)

- If you are including a logo in a form, be sure that the field is big enough to contain it. If the logo still won't print, check its proportional boundaries. The proportional boundaries are ignored in everything but IDSFORM.

- If you plan to hold a subform at the main menu and then recall it to a form, be sure the subform is slightly smaller than the form. This is a problem (not a feature) which will be fixed in a later version.

- Try to limit heading text to 78 characters per line. This is the maximum that is supported. If you need more, set up adjacent fields and specify a horizontal heading position of "right" for the left field and "left" for the right field.

IDSCHAR

IDSCHAR must be run on an HP2647A, HP2647F or an HP2648A terminal. It is used to create characters or logos which are stored in Cell Files (Character Font Files or Logo Files) for later access from IDSFORM or IFS. A cell is the basic unit in which a character or logo is designed and it is a simulation of a single character cell of the target printing device. Cells may be initially created at the terminal as a cell or may be derived from an outline. Outlines (initial guide for placing dots within the cell) are created with either an HP9874A digitizer or an HP9111A graphics tablet and then filled with dots via the "fill" command. Cells created at the terminal must be filled manually. Both Character Font Files and Logo Files may contain only one outline per file.

Cell sizes are specified in dots (from 1 by 1 to 255 by 255) and the character size derived from the dot size will depend upon the target device. e.g. 30 dots high by 18 dots wide gives 12 point (or 6 lines per inch) on the HP2680A but a height of 50 dots is required to give the same size character on an HP2688A Since there are 180 dots per inch on the HP2680A and 300 dots per inch on the HP2688A.

The file format of older versions of IDSCHAR differs from the new format and must be converted to the new format before the file can be accessed by IDSFORM or IFS. The conversion occurs automatically when the file is accessed by the new version of IDSCHAR.

Since not only IDSCHAR but also the terminals, the digitizer and the graphics tablet it utilizes are now discontinued, Hewlett-Packard has developed an alternative to its use. The Output Design Service (ODS) at the Boise Division can provide customized fonts, logos, signatures and figures which are fully supported and guaranteed. Contact your local Sales Office for further information.

GRAPHICS PACKAGE

The Graphics Package includes non-graphics intrinsics (also supplied with IFS) and graphics intrinsics (not supplied with IFS) which can be programmatically accessed from Basic, CobolII, Fortran, Pascal and SPL. These allow you to interface with the environment file and to print figures which have been created with HPDRAW, DSG3000, EZCHART or FIGMAKER. Figures must be converted from vector data to raster data (raster data consists of 0s and 1s which represent dots to be placed on the paper) in order to print on the laser. The CONVERTRASTER intrinsic converts a pure raster file (usually received from a non-HP source) into a partitioned raster file format which is printable on on the laser printer.

Laser Printing System Interpreter

The Laser Printing System (LPS) Interpreter is comprised of a series of commands which are analogous to the graphics and non-graphics intrinsics. The LPS commands are not comparable to the intrinsics on a one-to-one basis (some of the non-graphics intrinsics are for device initialization and information gathering) but the remaining commands and intrinsics approximate each other and perform the same functions. Since the LPS commands are interspersed with the data, more versatility (with less effort) is possible in printing and formatting the output. LPS may be run interactively or you may use a text file which consists of text to be printed, formatting commands and control characters. Text files must be "kept" unnumbered. When you run LPS interactively, text is spooled to the laser printer as each line is entered so text files are advisable for large amounts of data.

FIGMAKER Program

FIGMAKER is a figure maker utility provided with the Graphics Package which allows you to create your own figures in a figure file independently of any other graphics subsystem. The figures are treated in the same way as those created with HPDRAW and are accessible via the graphics intrinsics, the LPS Interpreter graphics commands, HPDRAW and Text Data Processing (TDP). FIGMAKER may be run interactively or you can create a figure by supplying an ASCII file of figure maker commands. For any but the simplest figures, it is better to use the ASCII file since the figure is created as each command is entered and there is no way to "undo" a command. (If you want to modify a figure, you have to re-enter all of the commands that were required to create the figure.)

FIGMAKER files created with earlier versions of software must be converted for use with the current version of IFS. This is accomplished by running FUPDATE. For figure files created with a character set other than USASCII, run FUPDATE and specify PARM=lang (lang=the character set).

LASER PRINTER FAMILY

The HP2680A, HP2685B, HP2686A, HP2687A, HP2688A and HP2689A printers all use electrophotographic technology but there are differences not only in their size and capabilities but also in the software which can run upon them. Only the HP2680A, HP2685B and the HP2688A support the complete Printer Support Package (PSP) software. The others support a portion of it but not all.

The HP2689A is an HP2680A connected to an IBM machine via an HP26029A Controller. It can print environment files which have been compiled on an HP3000 system then downloaded and translated on the HP26029A controller.

The HP2687A (which is now discontinued) is a text printer only. It has no downloadable environments or graphics capabilities.

The HP2686A Laserjet can print downloadable Laserjet fonts and forms when connected to an HP150 (downloadable fonts are not yet compatible with an HP3000) but does not support PSP software.

HARDWARE COMPARISONS

The HP2680A is a 45 page per minute laser printer with 180 dot-per-inch resolution. It uses tractor feed and can support paper widths from a minimum of 6.5 inches to a maximum of 12.7 inches (including tractor strips) and paper lengths from 3.0 inches to 17.0 inches. Length refers to the direction in which the paper moves through the printer and is defined as the paper measurement between inter-page perforations; page lengths of multiple 0.5 inch increments may be used. The standard (and recommended) paper size is 12.0 inches wide and 8.5 inches long which allows a print area of 11.0 inches by 7.5 inches. (The tractor strips for this size paper are each 0.5 inches wide and 0.5 inches is required on the left and right sides of the page for the unprintable region created by the seam on the electrophotographic drum.) It comes with the standard environment files (in the HPENV group in the SYS account) and requires no other software to utilize them (i.e., environment files can be accessed via a file equation.)

The HP2685B is an HP2680A which has been set up as a remote print station for IBM and other mainframes. It generally includes some combination of equiptment such as an HP2680A, an HP3000 CPU, two HP7945A drives, an HP9144A tapedrive and an HP2392A console. All of the information delineated above for the HP2680A is applicable to the HP2685B. Any references to the HP2680A in this Application Note should be construed as referring to the HP2685B as well.

The HP2688A is a 12 page per minute laser printer with 300 dot per inch resolution. It has a sheet feeder and can support either 8.5 inch by 11.0 inch paper or A4 (European standard) size paper. It has a printable surface of 7.75 inches by 10.25 inches on 8.5 inch by 11.0 inch paper because it requires .375 inches on the top and the bottom for the seam and .375 inches on either side of the paper for the rollers to draw it through. Interactive Formatting System (IFS) and the Graphics Package (as well as the standard environment files) are included in the standard purchase price.

Graphic Comparison of the HP2680A and the HP2688A

	HP2680A	HP2688A
PRINT SPEED	45 pages per minute	12 pages per minute
RESOLUTION	180 X 180 dots per inch	300 X 300 dots per inch
PAPER FEED	Tractor	Cut Sheet
DRUM	Magnetic Drum	OPC Belt
SOFTWARE INCLUDED	Standard Environments	Standard Environments, Graphics Package and Interactive Formatting System
PAPER SIZES	6.5" wide X 3.0" long/ 12.7" wide X 17" long	8.5" X 11" & A4 Paper
*PRINTABLE REGION	7.5" X 11"	7.75" X 10.25"
ORIENTATION:		
LANDSCAPE	0 Degrees	270 Degrees
PORTRAIT	90 Degrees	0 Degrees
REVERSE LANDSCAPE	180 Degrees	90 Degrees
REVERSE PORTRAIT	270 Degrees	180 Degrees
CONSTRAINTS:	Up to 8 multi-copy (carbon copies) forms Up to 32 logical pages per physical page Up to 32 character fonts downloadable to the printer Up to 30 forms per physical page **Up to 255 characters per scan line Up to 20,000 characters on a physical page	

*For a physical paper size of 8.5 inches by 11 inches (net of tractor strips.)

**Note: A raster scan line is always perpendicular to the motion of the paper and the length of the paper is always measured in the direction of the paper motion (e.g. 8.5 inch length for an HP2680A and 11 inch for an HP2688A) with corresponding scan lines of 11 inches for the HP2680A and 8.5 inches for the HP2688A.

Common Printing Errors Shown on the Laser Printer Trailer

Clipping indicates an attempt to print outside the bounds of a logical page or in the unprintable region. Clipping applies to characters, pictures and forms. If any portion of a character cell extends beyond the logical page, the whole character is clipped.

Data Saturation occurs when the character processor cannot keep up with the Machine Control System (the hardware/firmware system responsible for the actual printing processes of the laser). Printing stops on the current page and the rest of the page is flushed (is blank), the drum rotates and printing resumes on the next page. The flushed data is lost.

> **Causes**: More than 255 character cells on a scan line or approximately 20,000 character cells on a physical page.
>
> **Contributing factors**: Overstrike, vertical cell overlap, special characters, 4:1 reduction, shading. (Bold print does not cause data saturation.)

Additional information regarding trailer messages can be found in *The HP3000 Communicator, Volume 2, Issue 1*, pages 8-35 through 8-40.

SUMMARY

Printer Support Package (PSP), in its entirety, is supported only on the HP2680A or HP2688A laser printers.

PSP is comprised of the Interactive Formatting System (IFS), Graphics Package and the Interactive Design System (IDS) which are 3 separate products.

Purchase of the HP2680A includes the standard environment files.

Purchase of the HP2688A includes the standard environment files, Graphics Package, and IFS.

The standard environment files can be used for printing but cannot be modified without IFS.

IFS

Components	Capabilities
A set of standard character fonts	Create or modify files programatically
Non-graphic intrinsics	Access environment files programatically
Print forms, fonts and logos from IDS	

GRAPHICS PACKAGE

Components	Capabilities
Non-graphics intrinsics	Access environment files programatically
Graphics intrinsics	Access figure files
LPS Interpreter	Graphics and non-graphics commands
FIGMAKER Program	Create figures
Vector-to-Raster Conversion	Print figures to the laser

IDS

Components	Capabilities
IDSFORM	Create electronic forms
IDSCHAR (Discontinued 9/85)	Create character fonts and logos