

5 Memory Usage

Introduction

In some situations, the amount of available memory for printing pages may be smaller than that required for printing. To make more effective use of the available printer memory, newer HP PCL 5 printers incorporate new methods for managing memory. This smaller amount of available memory is made more usable by:

- Memory Enhancement technology, MEt, (available on all HP LaserJet 6, LaserJet 5, and LaserJet 4 family printers except the 4, 4M, 4Si and 4SiMx)
- Adaptive Data Compression, ADC, (available on HP LaserJet 4, 4M, 4Si, 4SiMx and DeskJet 1200C printers)
- Following recommended practices for transmitting data, especially raster graphics, to the printer
- For the HP LaserJet 4L, using Raster Graphics Adaptive Compression (PCL compression mode five)

All HP LaserJet 4, 5 and 6 family printers have internal programming for optimizing the use of limited memory. HP LaserJet 4, 4M, 4Si, 4SiMx, and DeskJet 1200C printers compress raster graphics data using a system called Adaptive Data Compression or ADC. The other HP LaserJet 4 / 5 / 6 printers use MEt to compress not only raster graphics data, but also to compress fonts, improve memory usage for page protection, and provide an overall improvement in memory efficiency. Both systems operate automatically and without any intervention from the user.

The HP Color LaserJet printer has memory management features similar to MEt, but has additional features for color processing.

Operation of ADC and MEt

The goal of ADC is to automatically and transparently reduce Memory Out errors caused by raster graphics pages. MEt extends this goal to reducing all Memory Out errors and eliminating Print Overrun errors.

During the printing of a page, if available printer memory becomes low, all HP LaserJet 4, 5, and 6 family printers and the HP Color LaserJet printer have the ability to automatically compress any already-stored raster graphics data using a variety of compression techniques. This allows the printing of many raster graphics pages which would have caused a Memory Out error on previous HP LaserJet printers having the same amount of memory.

With ADC or MEt, PCL 5 printers can typically print a full page of raster graphics in base memory without a memory out. This is especially true for line art and typical business graphics. Other types of graphics such as scanned photographs (especially if a technique called error-diffusion is used), cannot always be printed as easily by ADC or MEt as can line art graphics. Fortunately, another internal printer feature, **Image Adapt**, can be called upon to make the page fit in memory.

Image Adapt

Image Adapt is only used as a last resort for compressing raster graphics data and as such will rarely be seen. It reduces a raster graphic image to one-fourth its original size by trading off some of the image's fine detail. This loss of fine detail is often not noticeable.

Image Adapt can be disabled on some of the HP LaserJet 4, 5, and 6 family printers if required, but the technique varies. On the HP LaserJet 4, 4M and 4Si the user will have to add more memory to effectively remove the need for Image Adapt. Image Adapt can be disabled on some of the other HP LaserJet 4, 5, and 6 family printers by using a PjL command (refer to the respective printer user manuals for further information—the Color LaserJet printer does not utilize Image Adapt). If Image Adapt is turned off, more pages will cause Memory Out errors.

All HP LaserJet 4, 5, and 6 family printers also include enhancements to improve the internal storage of raster graphics data.

Additional MEt Features

With MEt, font data can also be compressed. All downloaded bitmap characters and characters scaled from internal or downloaded scalable outlines can be compressed. The amount of memory savings varies with the size of the characters involved (larger is better) but character sizes can typically be cut in half. This allows roughly twice as many fonts to be downloaded or scaled using a MEt-enhanced LaserJet printer as previously allowed on printers without MEt.

In prior PCL 5 printers, if the page could not be rendered as fast as the laser printed it, a Print Overrun error occurred unless page protection was manually turned on and memory was added to accommodate it. With MEt, the manual setting of Page Protection and the additional memory required to facilitate it is obsolete. MEt automatically assesses the complexity of the page being printed and if too complex turns on a new form of page protection which uses compression to remove the requirement for additional memory.

In rare circumstances MEt's assessment of the page may prove to be incorrect. For these cases there is some amount of control over this Page Protection process depending upon which MEt-equipped printer is being used. Page Protection may be explicitly turned on or off to avoid the complexity assessment and either always or never perform the page protection process. See the appropriate user manual for details.

MEt also includes other internal memory-saving techniques which improve the amount of memory required for the printer's internal representation of your page.

ADC and MEt Notes

For raster graphics compression to perform at its best it is recommended that the "Recommendations For Sending Data to the Printer," described below, be followed.

Character bitmaps can only be compressed if they can be stored uncompressed in contiguous printer memory first. This requirement implies that large point size characters may require more printer memory than would seem necessary.

During MEt's Page Protection, portions of the internal representation of the page are discarded to make room for other aspects of the page protection process. If a memory out condition occurs during this process (unlikely, but possible) a white band will be seen on the page. The best way to remedy this situation is to add memory to the printer.

Recommendations For Sending Data to the Printer

The HP PCL 5 printers perform best in terms of speed and memory utilization if the recommendations made below are followed. Failure to follow these recommendations will not harm the printer, but may increase the chances of a memory out condition or increase the time to print a page.

- **Ordered Images** — Raster Graphic images or pictures should be sent from top to bottom with the data in one band (start raster, end raster pair). If one band is not possible, as few as possible multiple bands may be used as long as they exactly follow each other and are sent in top-to-bottom order. Also, multiple bands should be as large as possible.
- **Band Sizes** — If an image is sent in bands (start raster, end raster pairs), the bands should be multiples of 32 lines high. This is especially critical for landscape graphics. If there is no way to send multiples of 32-line high bands, multiples of four for band height should be used. This allows Image Adapt to work better.

- **Avoid Non-Raster Commands** — During the transmission of sequential raster bands non-raster commands should be avoided. This includes cursor positioning commands.
- **Separation of Images** — If more than one image or picture is to be printed on a page, it is best to keep them separate. Separation consists of assuring that the new image starts with a new start raster command and that the one image does not exactly follow the next image (separate the image by at least one line vertically and sixteen pixels horizontally). This constraint improves the operation of Image Adapt.
- **Rectangular Images** — All HP LaserJet 4 family printers perform best if raster images are sent as rectangular images to the printer. This entails keeping the right margin of the image constant and keeping all lines the full image width (no lines are truncated). Also, avoid skipping lines. When whole blank lines appear in the image, either send zeroed data row(s) or use the Raster Y-Offset command.
- **Avoid Unnecessary Print Model Use** — Print model modes, other than source and pattern transparent, degrade memory efficiency. (This restriction is not true for the HP Color LaserJet printer.) For best results do not use an opaque source unless there is an image known to already be on the page in the same area. Following the other rules listed in this section minimizes the impact of using non-transparent print model modes.
- **Avoid Tall, Narrow Images** — For ADC, images which are taller than they are wide by more than eight to one disable the printer's ability to automatically separate images upon the page (this restriction is not true for the HP Color LaserJet printer). This violation is desirable in the case where the above rules are violated and multiple images are rendered as one image and sent to the printer as one combined image. Sending raster data as a checkerboard with non-full width bands sent left to right and top to bottom also disables the printer's automatic image separation. In general, for all HP LaserJet printers, tall, narrow images should be avoided since they typically require more memory.

- **Wide Patterns** — Patterns can use up a lot of memory— avoid them if possible. Avoid patterns which, in their final orientation, are not 1, 2, 4, 8, 16 or 32 (32 is for all but the 4L) bits wide. Patterns of other sizes will be tiled out to the full width of the page and can consume a large amount of memory (since the HP Color LaserJet printer does not perform this way, it is not a factor for this printer). Note that a landscape pattern that is 16 wide by 5 high would become 5 wide by 16 high when rotated and be subjected to being tiled across the page.
- **Avoid Unnecessary Pattern Selection** — In HP-GL/2, avoid issuing redundant Fill Type (FT) and Line Type (LT) commands. These commands may cause patterns to be rebuilt and tiled for each invocation.
- **Avoid Many Small Polygons** — In HP-GL/2 avoid entering and exiting polygon mode repeatedly as it fragments memory. If possible send down fewer, larger polygons.
- **Download Font Characters as Needed** — All PCL 5 printers operate best if fonts and outlines downloaded do not include information for characters which are not used upon the current page. It is also best to download bitmap characters in the orientation which they will be used.

Note

When deleting font characters and patterns, remember that if a pattern or font character is used on the current page, any deletion commands affecting it will not be executed until the page is printed.

Raster Graphics Adaptive Compression (Method 5)

Raster Graphics Adaptive Compression (Set Compression Method Command, mode 5) is implemented on the HP LaserJet IIIP, Color LaserJet, all LaserJet 4, 5, and 6 family printers, and the DeskJet 1200C and 1600C printers.

This compression method allows the host to compress data using a combination of PCL compression modes to obtain optimum compression (refer to the *PCL 5 Printer Language Technical Reference* manual, Set Compression Method Command, for details).

An added benefit of this method for the HP LaserJet 4L and LaserJet IIIP printers is that the data is not decompressed upon entry to the printer provided the image is portrait, 300 dpi, transparent print model and no patterns are being used. This allows the LaserJet 4L and IIIP to print many pages which would otherwise require more memory. As an added benefit these pages print faster. The other HP LaserJet 4, 5, and 6 family printers decompress the data upon entry to the printer and rely upon ADC or MEt to compress the data if required.

For the HP LaserJet 4L printer it is critical that the image actually compress (not expand) if Adaptive Compression is used since MEt does not operate upon images meeting the requirements for delayed decompression.

