



hp designjet  
10ps/20ps

Color Accuracy  
In A Proofing  
Workflow

Software  
Application Note

## **HOW TO GET GOOD COLOR ACCURACY IN A PROOFING WORKFLOW**

### Notes about the document

This document is based on the hp designjet 10PS and 20PS series printers.

This document contains both Mac and PC screenshot versions. The look and feel is almost the same (minor differences due to using different operating systems) although names and functionality are the same.

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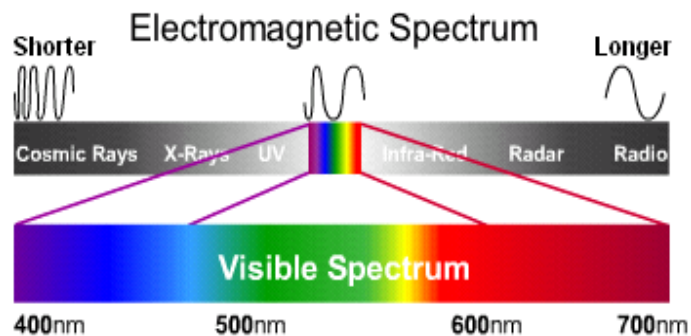
# 1. Introduction to Color Management

To get color accuracy from your press using an HP Designjet 10ps or 20ps printer, you will need to understand three things: the *basics of colors* applied to the computer industry, the different *color workflows* in the graphics industry and how to get *maximum performance from your printer*. In this section we are going to talk about the first subject.

## 1.1 What is color?

Objects appear to be certain colors because of their ability to reflect or absorb light waves. There are thousands of light waves that are visible to the human eye. The basis of sight is the network of light sensors in our eyes.

These sensors respond to different wavelengths by sending unique patterns of electrical signals to the brain where they are processed into the sense of sight – of light and of color.



Our individual perception of color is also affected by various environmental factors such as changes in lighting, object matter or the proximity of colors to each. As our memory recognizes distinct colors, we then associate a name. That is why people may see colors differently when seeing the same light waves reflected from an object. That is why we often hear conversations like “this color is darker or lighter or has some yellow...”

In conclusion we can say that Color results from the interaction between light, the object and the viewer. Therefore, color is a viewer-dependable, abstract concept. In general, differences in how humans perceive colors do not seriously affect our lives. In the realm of the graphic artist and the commercial printing industries, differences in color perception often affect the success of a print job.

## 1.2 The Problem: Color in the computer world

As we have said, objects can reflect or absorb light waves. For instance, ink absorbs light and televisions reflect light. This is why, when playing with ink, if you mix all the inks you will get black (absence of light) and, on the other hand, in order to have black in a television, you do not have to send any light (then, it will not reflect any light).

The following color models characterize these two kinds of objects:



- **RGB (Red, Green, and Blue)** is the color model for those devices that emit light, such as monitors or scanners. A color is represented as a combination of Red, Green and Blue (basics colors). With the combination of these three basics colors you describe all the color space of the related device.



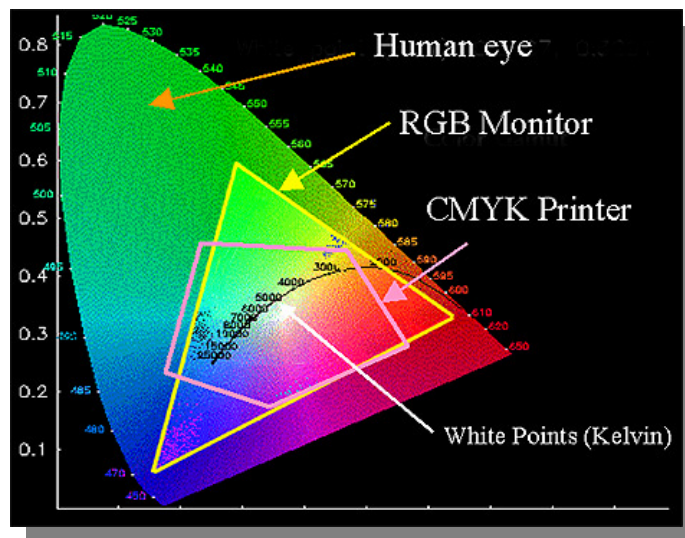
- **CMYK (Cyan, Magenta, Yellow and Black)** is the color model of those devices that reflect light, such as printer or presses. A color is represented as a combination of Cyan, Magenta and Yellow inks. With the combination of these three basics colors you describe all the color space of the device. Black ( $K^1$ ) is used to get better results for black objects

Therefore when creating an RGB image, with a scanner or using the monitor, we should convert the colors of this image to CMYK before printing. **Unfortunately RGB and CMYK color models do not represent the same color spaces<sup>2</sup>**: you can have colors in an RGB device that you cannot represent in CMYK and vice versa. The following graphic illustrates how colors visible to the human eye are greater than those reproduced by RGB or CMYK color models and also how these two color models do not match each other (note: a white point is the center of the color space).

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<sup>1</sup> The letter K is used for black to avoid confusion with blue the B

<sup>2</sup> A Color Space, also called Color Gamut, is the range of colors that a particular device can reproduce.



Also, different CMYK devices have different CMYK color spaces and different RGB devices have different RGB color spaces.

One clear example is printers that can use indoor inks or outdoors inks. The printer (hardware) is the same, however you will have two different color spaces due to the fact that they are using different chemistry for the inks<sup>3</sup> (dye-based versus pigmented). For the same reason, they need to work with different media as ink interaction with a media substrate depends on its chemistry. That is the main reason why the **CMYK color space depends on the type of inks and media that you are going to use.** If this is the case using the same printer you can easily imagine how different results can be with printers using different technologies and therefore using different ink chemistry.

The same happens with RGB devices. Another clear example is when two different monitors from the same manufacturer have their white point at 9000 Kelvin degrees and 6500 Kelvin degrees respectively. Colors are going to be different because even if they have the same color space, the center of this color space is in a different position. The situation is obviously worst when comparing monitors from different manufacturers.

Finally, there are some color models that are not device dependent, they are purely mathematical, like the L\*a\*b color model from the International Color Consortium. These color models cannot be found in any device but are useful when doing mathematical transformations, as explained in the next section.

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<sup>3</sup> Light will be reflected differently depending on the ink chemistry. In some cases the difference is great and in others it is slight.

### 1.3 The Solution: Color Management

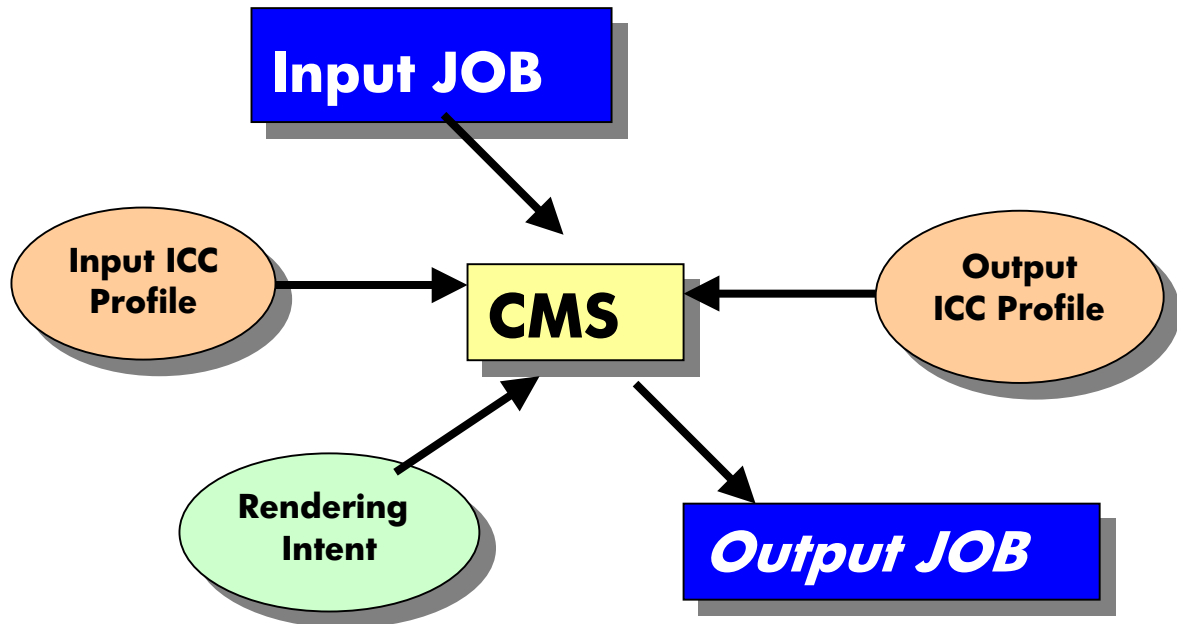
There can be no direct conversion from RGB images to CMYK and vice versa. The colors that do not match are called “out-of-the-gamut” colors. The industry has found two mechanisms to reduce color differences as much as possible by:

- On the one hand, characterizing the device as accurately as possible to know the color space a particular device can output.
- On the other hand, finding a way to convert, as efficiently as possible, one given color space to another.

The solution:

- a) Profile the color space of each particular device: to properly characterize a device, we need to create an ICC profile. Simply, this standard file acts as a dictionary to translate device’s color spaces (regardless is CMYK or RGB) to a non-device dependent color space (like L\*a\*b from the International Color Consortium). There are several commercially available profiling tools that will help you to create an ICC profile specifically for your device.
- b) Color conversion: This is the same as converting colors from the ICC profile that defines the color space of the input device to the ICC profile that defines the color space of the output device. **This is done using Color Management Systems (CMS)**. CMS are applications that, using mathematical algorithms, try to make a best fit of one ICC profile to another., the hard work will be for those colors that exist in one ICC profile but not with the other.

We can describe any CMS by the following 4 settings:



- **CMS**: It may be either the application or the operating system or the hp designjet software RIP.
- **Input ICC Profile**: Description of the device's color space that you want to emulate. Usually a CMS allows you to define different ICC profiles for each color model (CMYK, RGB, L\*a\*b\*, Grayscale,...) since a job may have different objects with different color models. Some of the common ones are:
  - RGB Input Profile; when you want to emulate an RGB device such as a monitor or a scanner.
  - CMYK Input Profile; when you want to emulate a CMYK device such as a printer, a proofer or a press.
  - Grayscale Input Profile; when you want to emulate a Grayscale device. Not frequently used nowadays.
  - L\*a\*b\* Input Profile; To indicate that the color of the image is defined using this color space. In this case, there is no emulation as L\*a\*b\* is non-device dependant and no device associated to this color space.
- **Output ICC Profile**; Description of the color space of the device you are going to use for output of the job. Depending on the device, you have to select:



- RGB Output ICC Profile; when the output is an RGB device such as a monitor. This ICC Profile will depend on the manufacturer and usually it is highly recommended you use a color engine to create and specify the ICC profile for a particular monitor.
- CMYK Output ICC Profile; when the output is a CMYK output such as a printer, a proofer or a press. Remember that these profiles are media, ink and print quality dependant.

Here we cannot match non-dependant color models as they do not have a device associated (they are pure mathematics).

- **Rendering Intent**: This setting specifies how the Input ICC profile best fits to the Output ICC profile. Depending on the final output you want to achieve (if the job is for a business presentation, or is to be used as a proof or for printing a photographic image) you may choose among four different rendering intents:
  - Use **Saturation** for getting a vivid final output. It is suitable for business graphics (charts, presentations, etc.). Not recommended for color matching.
  - Use **Perceptual** for getting a most pleasing final output from your original RGB image. It is suitable for photographic content.
  - Use **Relative Colorimetric** suitable for proofing with CMYK input (when you have selected SWOP, Euro, Toyo, DIC or your press profile as ICC CMYK input). This rendering will provide maximum color accuracy. It is suitable for press proofing.
  - Use **Absolute Colorimetric** for press proofing (like Relative Colorimetric) but using paper color emulation.

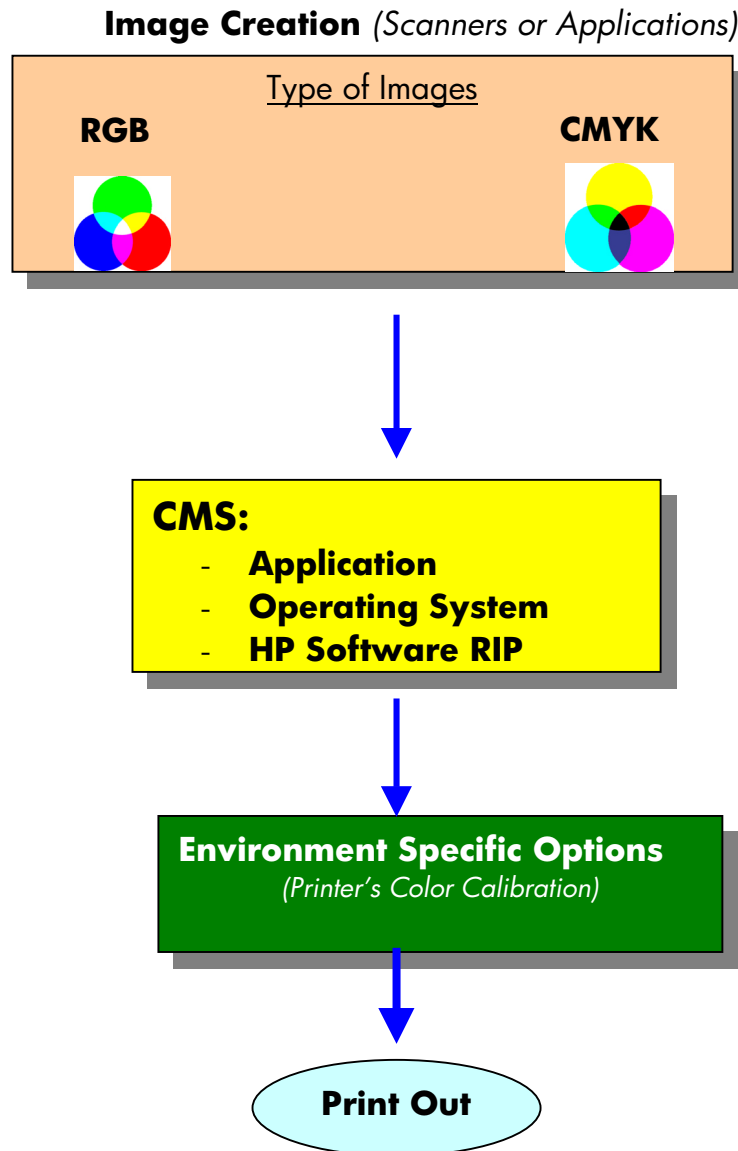
Finally, there are some CMS applications that have different color paths for printing and for display. The intention is to create a color calibrated system where *what you see is what you get*. In these cases, as we state in the recommended workflow section, as the CMS we recommend using the HP Designjet software rip for the printing path and the application or operating system CMS for the monitor<sup>4</sup>. Our recommendation is to deactivate the printing path of the application CMS and activate the visualization path. If an application mixes both paths, then the recommendation is to use just the HP Designjet CMS.

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<sup>4</sup> The HP Designjet 10ps or 20ps software rip CMS is focus on the printing path.

## 2. Recommended Color Management Workflow

For the best color management workflow, we identify three main variables when talking about color management workflows:



- a) Type of images to print (top box): There are different combinations: printing CMYK images, printing RGB images and printing both RGB and CMYK images.

- b) Color Management Software to use (yellow box): Here we can use either the application or the software rip that comes with the printer.
- c) Environment specific options (green box). Ink lays differently depending on the kind of media, humidity of the environment, temperature and so on.

These are our recommendations:

- a) **Type of images to print: We strongly recommend using CMYK when generating a proof (simulating a press). The use of RGB is recommended only for experimentation or when generating "final use" (not a proof) hardcopy, e.g. when printing photo enlargements from digital camera input.**

Also, when dealing with different images that have different ICC profiles, we strongly recommend converting them to a unique ICC profile. Using that path, we can ensure using the same color information for a file.

- b) **Color Management Software: We strongly recommend using Hewlett-Packard's Color Management Software** that comes as part of the HP Designjet 10ps or 20ps software RIP **for printing**. This CMS has been specifically designed to take the maximum performance of your HP Designjet 10ps or 20ps printer in combination with the HP Proofing media. Setting-up the printer with the right ICC profiles is going to be critical and in the next section we will discuss this set up.

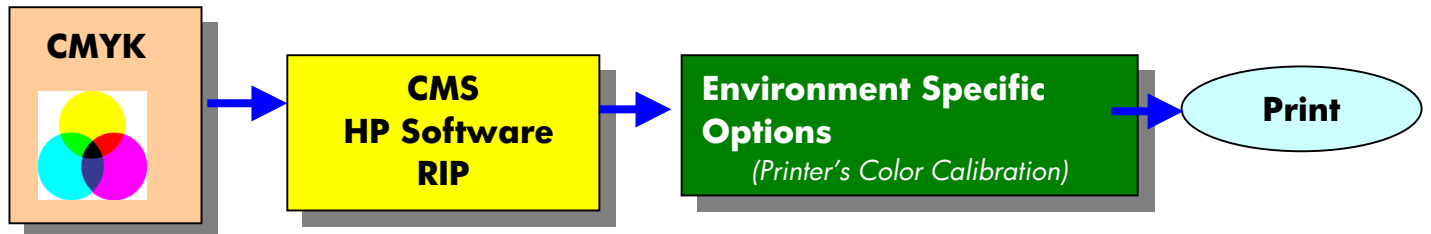
When using the CMS to output to a monitor, we recommend you use the application CMS.

If you prefer to use the application or the operating system color management (ColorSync for MAC and Microsoft ICM for Windows), then uncheck the Hewlett-Packard's Color Management. **It is not recommended that you apply more than one color management at the same time.** When not using Hewlett-Packard's Color Management with HP Proofing media, color accuracy cannot be guaranteed.

- c) **Environment Specific Options**: To ensure color accuracy and color repeatability **you must calibrate the printer**. You should perform one single calibration for each set of same environmental conditions, same paper and same ink you are going to use to print. **This should be done**

**regardless of which CMS is used.** The “calibrating the printer” section explains how to do calibration.

Summarizing, the **recommended workflow for a proofing environment** is:

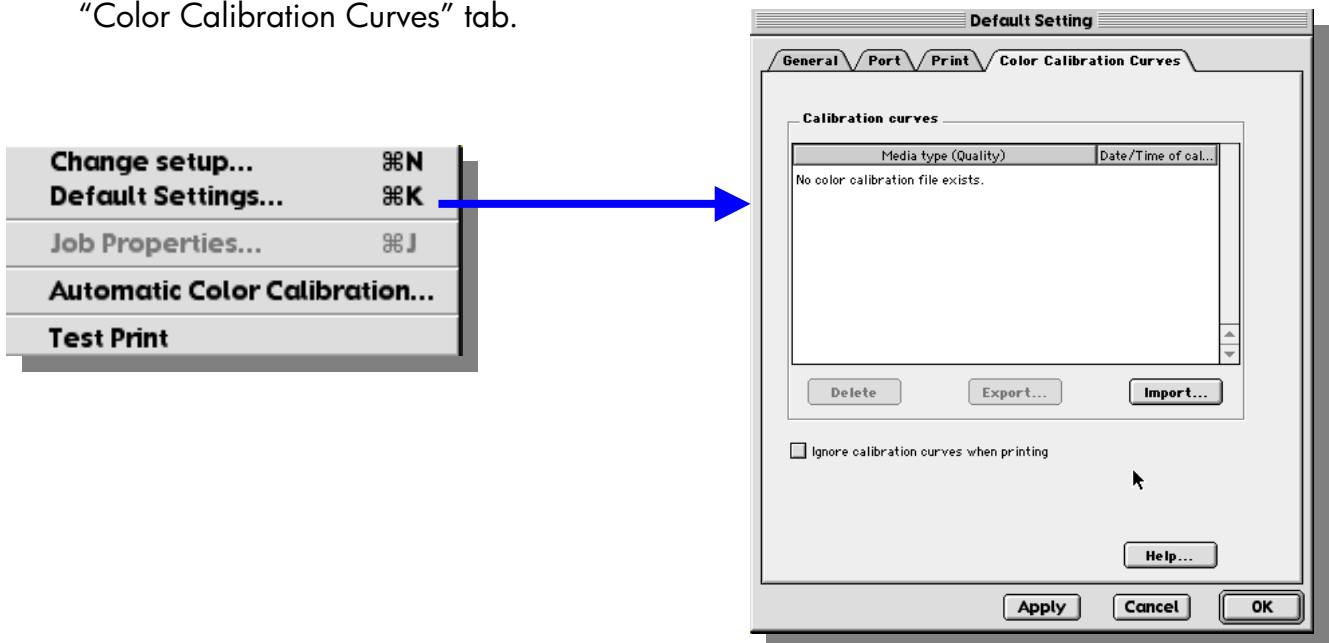


### 3. Environment Specific Options

Although this section is related to the last step of the recommended color workflow, we recommend you do it at the beginning so when you print from your application can you guarantee the final result. Also, it is the step that requires very little changes once it has been set-up correctly.

#### 3.1 Launching the Printer's Color Calibration

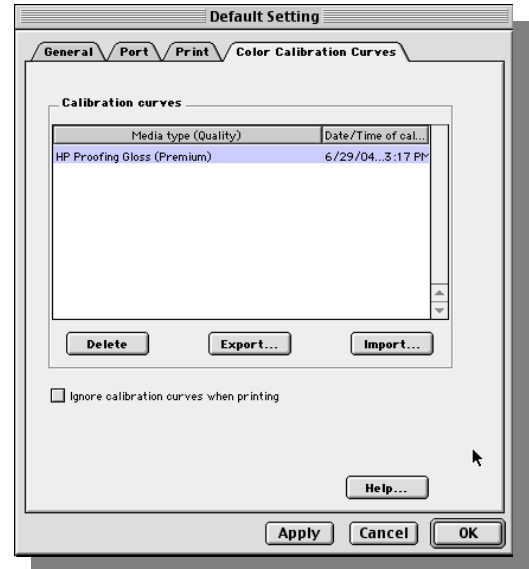
Before starting to work, make sure you have the printer color calibrated. To check calibration, go to "Setup" menu and then to "Default Settings". Then press the "Color Calibration Curves" tab.



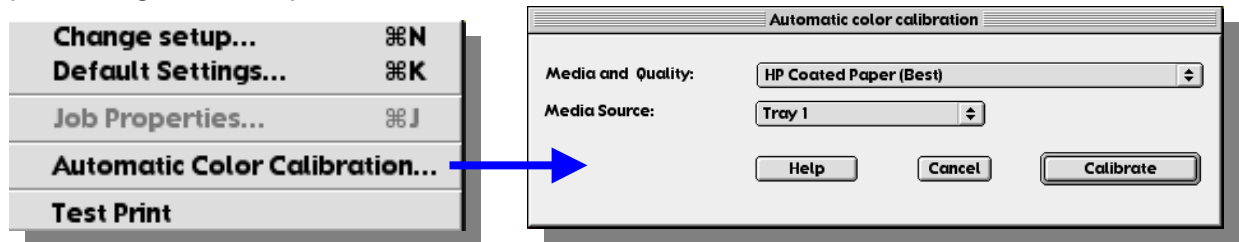
For each color calibration performed, an entry in the calibration curves' list will appear. It will contain the information about media used, print mode used and time when the calibration was performed.

**Notice that you need to have performed 1 calibration for each combination of: *print quality* (Fast, Mode, Best or Premium) and *paper* you want to use.**

As a recommendation, start calibrating all the **HP Proofing media** since they are the ones that are going to give you better results for proofing (for color matching).

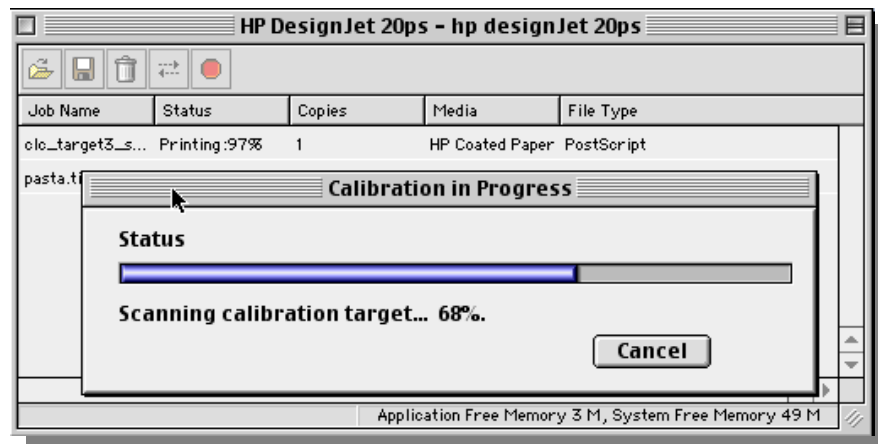


If you do not have the Color Calibration performed for the media type and the print mode you are going to use, then trigger an Automatic Color Calibration process: go to "Setup" menu and then to "Automatic Color Calibration".



Then, select the media and print quality desired (appear in the same field) and the media source (to pick the paper) and press the "Calibrate" button. If you are using a non-HP media, select the HP media that is most like yours. The printer will print a color calibration pattern. Once printed, it will automatically feed the paper back in and read the values that are sent back to the software RIP.

**Remember to perform a new calibration any time you change the print heads or any time you change your environmental conditions (humidity, temperature, etc). When changing ink cartridges a new calibration is not needed.**



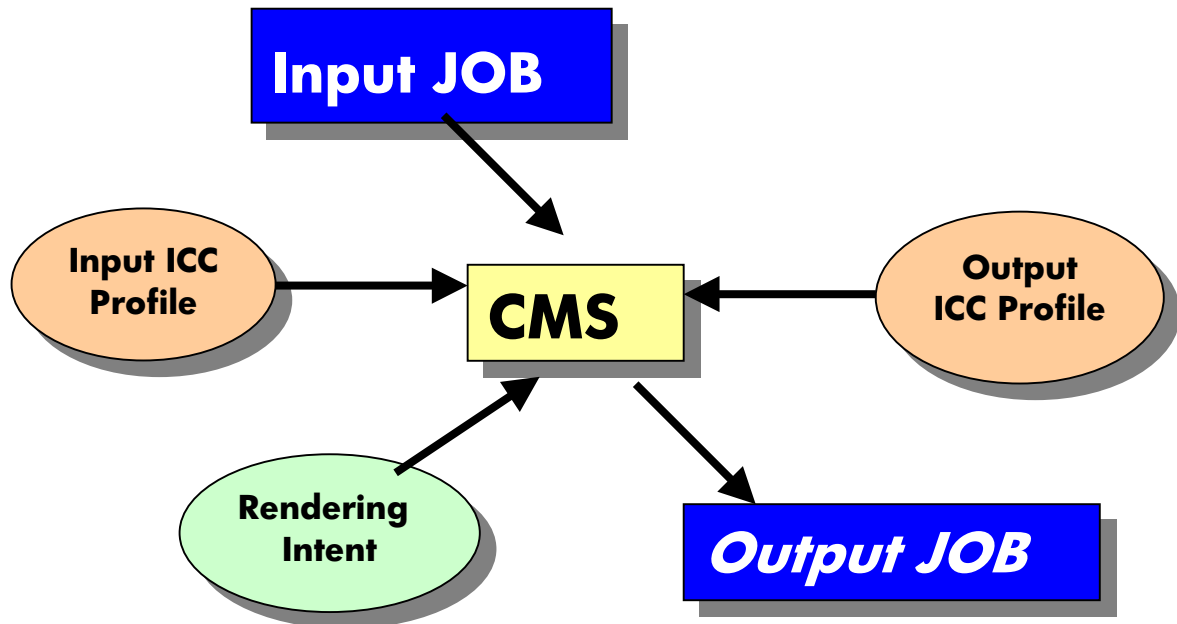
### 3.2 hp software rip's color settings

To understand the color settings (of the HP software rip) the best thing to do is to set up the default color settings. Notice that these settings are independent of the color calibration settings. Whereas the color calibration settings seen in the previous section gather information about environmental conditions, the color settings refer to the final color you want to achieve.

Default settings will be applied to the job if you:

- a) drag & drop a file into the software rip and the job does not have any embedded color information. Usually there are two types of files that come with color information embedded: EPS files and Tiff files. The software rip will understand the color information embedded in an EPS file and will override (with the default settings) the color information that comes with the Tiff files.
- b) printing through application and you do not change any setting of the postscript driver that can be found in the "Printer Specific Options" section of the Adobe PostScript driver. Later, we will look at the driver's settings and you will see that all the color settings we are going to explain here are also applicable to the printer's driver.

Let's remember the CMS Workflow and identify each part with the settings of the software RIP:

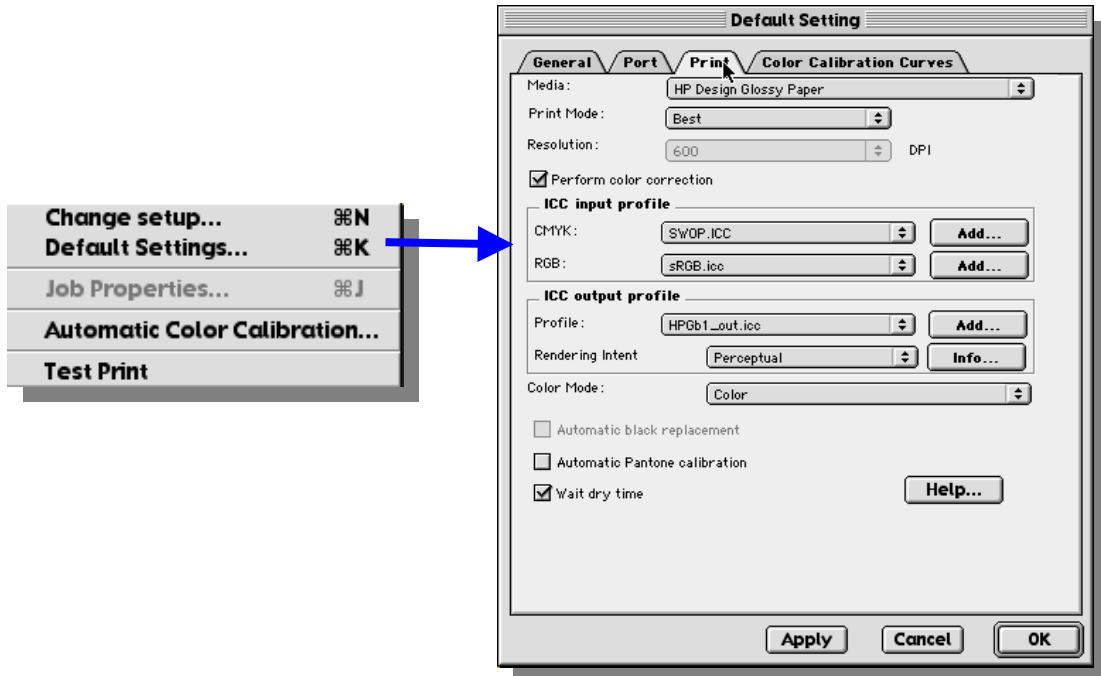


Where:

- **CMS**: HP Designjet 10ps or 20ps software RIP
- **Input Profile**: two options, for RGB images and for CMYK images
- **Output Profile**: Automatically selected by the software rip depending on your combination of media and print quality
- **Rendering Intent**: You can choose among the four possible options depending on the final objective of your print.



Let's see how this is mapped in the HP Designjet software rip. Go to the "Setup" menu of the software RIP, and click on "Default Settings". Once there:

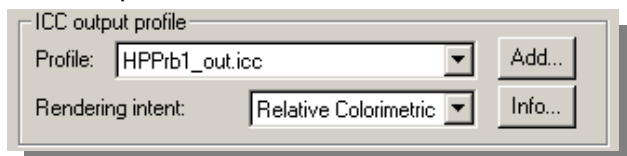
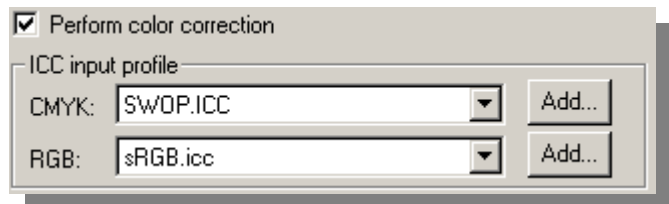


- **Choose the type of media and print quality you are going to use.** This will automatically update your choice of Output ICC profile.
- **Enable "Perform Color Calibration"** check box.

- In the **ICC Input profile**, select as CMYK the ICC profile of the printer or press you want to emulate, and in RGB the ICC profile of the monitor or scanner you want to emulate<sup>5</sup>.

The Software RIP comes with some color spaces standards for presses (SWOP.ICC for US, EURO.ICC for Europe and TOYO.ICC and DIC.ICC for Japan) but you can add the ICC profile of your press or printer. Just click on the "Add" button and select the ICC profile that describes it. The same applies for monitors.

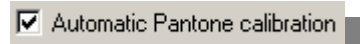
- In the **ICC output profile**, do not worry about the *Profile*



<sup>5</sup> Note: In order to emulate your monitor 100% you will need to have a very good and stable monitor plus an ICC profile that describes the specific color spaces of that monitor. Regular monitors offer visible variance of the same color in different areas of the screen.

setting, it is chosen automatically based on the media type and print mode but you should change the Rendering Intent depending on the final objective of the print:

- i. Use **Saturation** for getting a vivid final output. It is suitable for business graphics (charts, presentations, etc.). Not recommended for color matching.
  - ii. Use **Perceptual** for getting a most pleasing final output from your original RGB image. It is suitable for photographic content.
  - iii. Use **Relative Colorimetric** suitable for proofing with CMYK input (when you have selected SWOP, Euro, Toyo, DIC or your press profile as ICC CMYK input). This rendering will provide maximum color accuracy. It is suitable for press proofing
  - iv. Use **Absolute Colorimetric** for press proofing (like Relative Colorimetric) but using paper color emulation.
- Finally, **check the “Automatic Pantone Calibration” box when using Pantone Colors**<sup>6</sup>. Pantone colors are a standard color table in the press industry. Usually, when defining a Pantone color in the application, the application stores that color using the Pantone color name instead of a conversion into CMYK<sup>7</sup>. Then, if Automatic Pantone Calibration is checked, the software rip will read the Pantone color name and will apply the best conversion possible to CMYKcm using internal built-in Pantone tables. Pantone tables for HP Proofing media (HP Proofing Glossy, HP Proofing Semi-gloss and HP Proofing Matte) have been certified by Pantone Inc.
    - Click OK to finish



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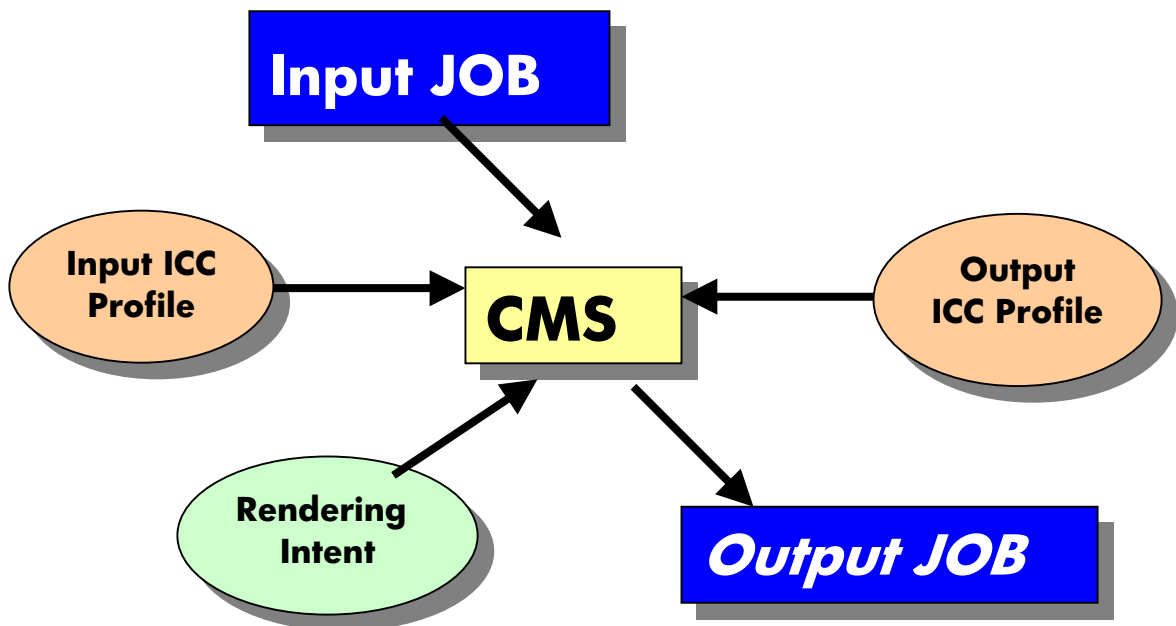
<sup>6</sup> Note: The Pantone coverage will depend on the media and print mode selected.

<sup>7</sup> Note: Although Adobe PhotoShop supports this feature, the software rip does not support the way it handles it.

## 4. Printing from Applications

This section discusses how to implement the recommended color management workflow path seen in Section 2 for the most important applications.

Remember that all the Color Management Systems (CMS), regardless of whether they are from applications, from operating systems or from a RIP, follow this diagram (in the document we will refer to this diagram as “generic CMS diagram”):



What usually happens is that each CMS uses its own nomenclature for its components. For instance, some applications call the “Input ICC profile”, “working space”, others call “Rendering Intent” just “Intent” but when you read their description in the user’s manual you notice they are the same.

There are some CMS applications that have different color paths for printing and for display. The intention is to create a color calibrated system where *what you see is what you get*. In these cases, as we state in the recommended workflow section, as the CMS we recommend using the HP Designjet software rip for the printing path and the application or operating system CMS for the monitor<sup>8</sup>. Our recommendation is to deactivate the printing path of the application CMS and activate the visualization path. If an application mixes both paths, then the recommendation is to use just the HP Designjet CMS.

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<sup>8</sup> The HP Designjet 10ps or 20ps software rip CMS is focus on the printing path.

Finally remember to refer to the application users manual or support when you want to know more about a particular application.

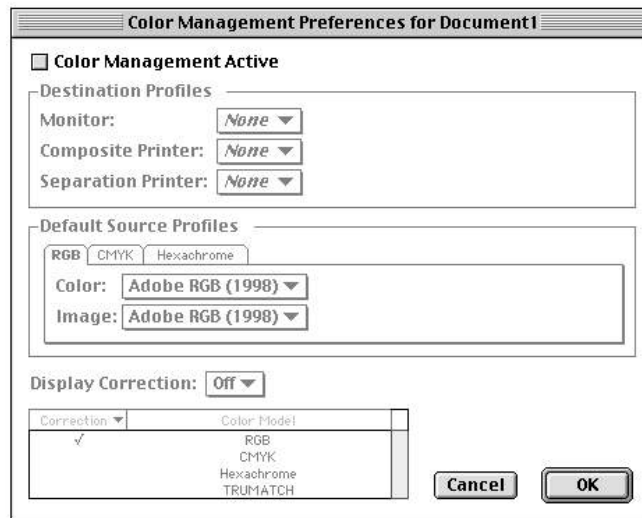
## 4.1 Printing from QuarkXPress 4.0

### 4.1.1 Quark Color Management

By default, QuarkXPress 4.0 does not come with any Color Management built-in. You can install several extensions either from Quark or from other 3<sup>rd</sup> party vendors that will work as Color Management systems for Quark.

Quark provides for free an extension for Color Management called “Quark CMS”. We have not had very good results when using Quark CMS XTension. If you want to use it anyway, here is an explanation of its CMS:

- Go to “Edit” menu
- Select “Preferences->Color Management”.
- Then we recommend you disable the “Color Management Active” check box.



Here you have the similarity with the generic CMS diagram:

- “Destination profiles” would be the “*ICC Output Profile*”. We just recommend changing the monitor setting (**We strongly recommend to use None in the printer’s fields and leave the printing path to be converted by the HP CMS**).

- “Default Source Profiles” would be the “ICC Input Profile”. Quark differentiates between image and objects (color) and requests ICC profiles for RGB, CMYK and Hexachrome color models

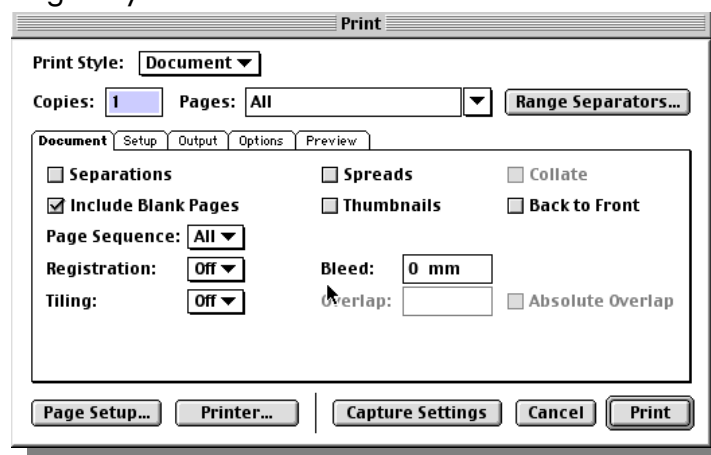
For other color management XTensions, please refer to the vendor information.

#### 4.1.2 Printing Path for MAC

This section describes all the settings that must be modified or checked before sending the job to print. We are going to talk about both, the usual QuarkXPress settings as well as how to modify the Software RIP settings.

In order to access Quark’s print path, go to “File->Printer” menu option.

Note: We are not covering all the options but the relevant ones to obtain the right color and the right layout. The rest can be consulted in the QuarkXPress help.

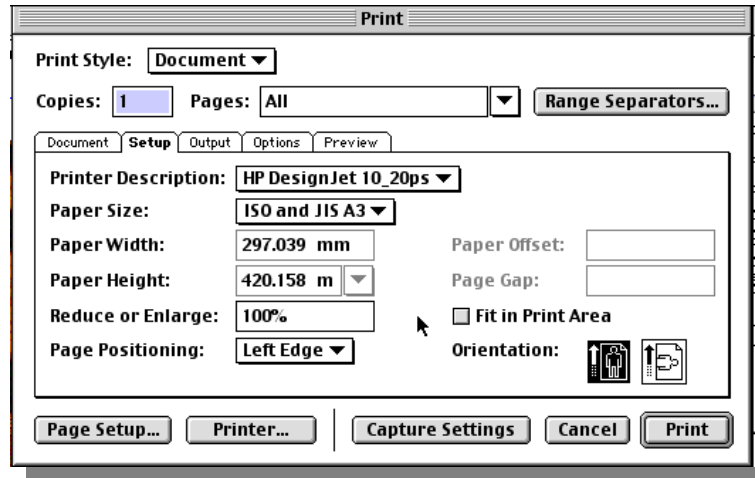


As we have said, the recommended path is to use the HP color management system in the HP software rip. You may change the default settings using the printer driver through the application. In order to access to the printer driver, you may:

- a) If you wish to access to Page Setup section, click on the “Page Setup...” button
- b) If you wish to access to the Printer Specific settings, click on the “Printer...” button

Both settings are described in detail in the section called “Printer driver settings”. Even so, there are some settings of Quark’s printing path that you need to know about:

## In the "Setup" tab.



The Print dialog box Setup tab lets you specify printing information such as printer type, paper size, page orientation, and scale.

- Printer Description: Specify the appropriate PostScript Printer Description (PPD) file for your PostScript printer. You can find the PPD file for your HP Designjet 10ps or 20ps in the following default directories:

For MAC and HP Designjet 10ps: "HDD::hp designjet 10PS:PPD"

For MAC and HP Designjet 20ps: "HDD::hp designjet 20PS:PPD"

For PC and HP Designjet 10ps: "C:\Program Files\hp designjet 10PS\PPD\"

For PC and HP Designjet 20ps: "C:\Program Files\hp designjet 20PS\PPD\"

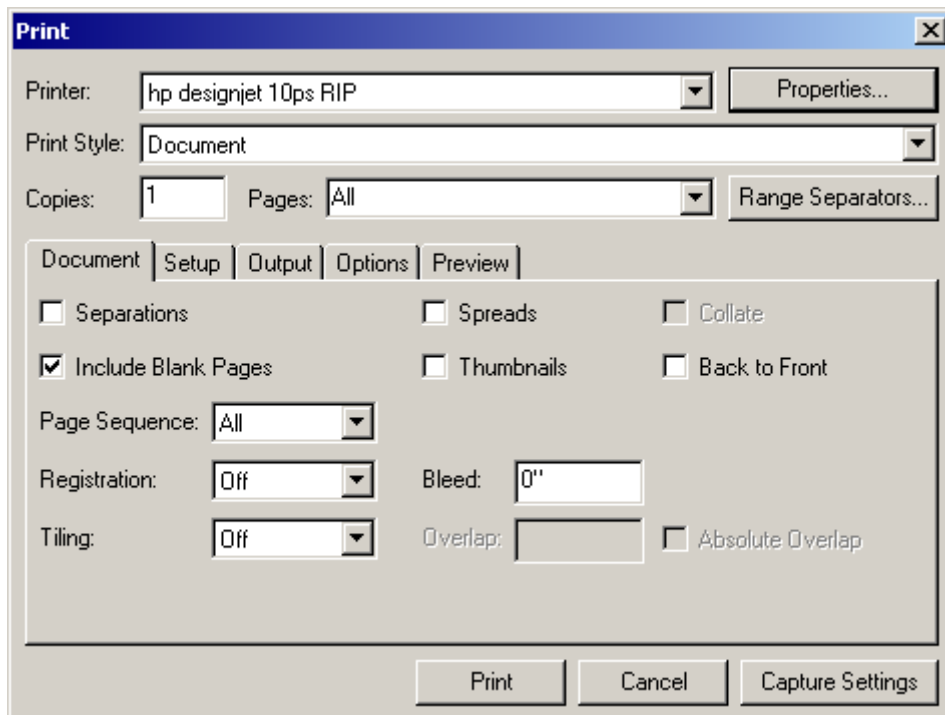
When you do this, the Paper Size, Paper Width, and Paper Height fields will automatically be filled with default information supplied by the PPD

In order to complete the printing path, you need to access the printer specific settings by clicking on "Printer..." button and then changing "General" to "Printer Specific Options". Refer to the section "Printer driver settings for MAC" to complete the process.

### 4.1.3 Printing Path for Windows

We have the same features in Mac and in Windows. The only difference is how to access the printer specific options in order to complete the printing path.

To access the printer specific options you need to access “Properties...” button beside the printer’s name. Refer to the section “Printer driver settings for Windows” to complete the process.



## 4.2 Printing from Adobe PhotoShop 6.0

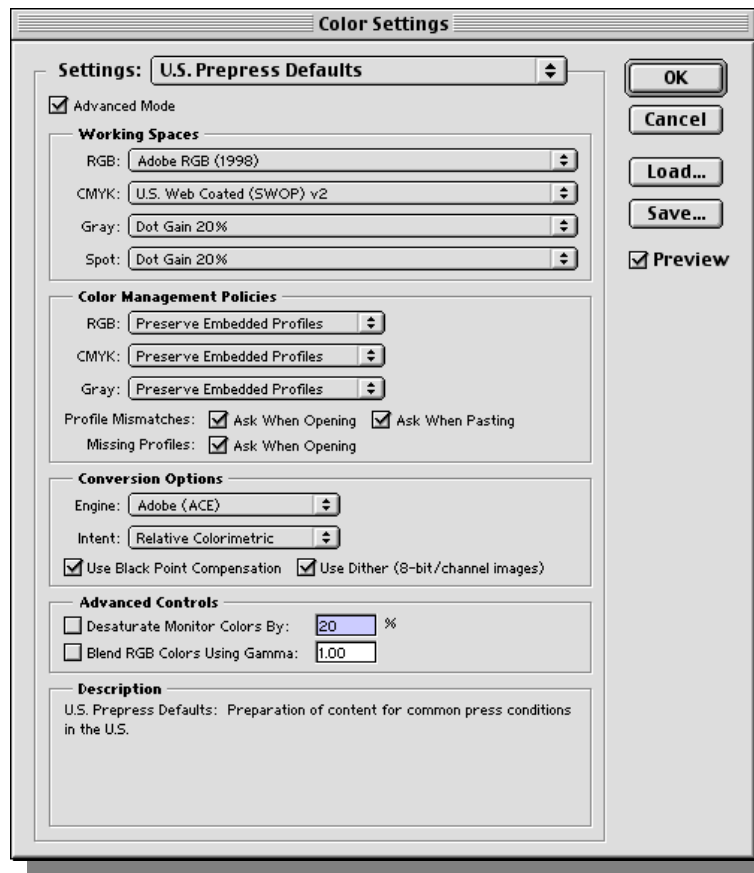
### 4.2.1 PhotoShop 6.0 Color Management

The Adobe PhotoShop 6.0 color management has a dual color management path: one for the visualization and another for the printer. Now we are going to talk about the visualization path and in the section 4.1.3 we will talk about the printing path.

Our recommendation for the visualization path is:

- Go to "Edit->Color Settings".
- Enable "Advance Mode" check box
- Now change the field "Settings" to:
  - "US Prepress defaults" or "Europe Prepress defaults" or "Japan Prepress defaults" when you want to emulate the standards for presses.
  - "Color Management Off" if you do not want Adobe PhotoShop to modify the colors
- Choose the appropriate Rendering Intent depending on the final goal of the image.





Apart from the recommendation, here you have the analogy between the Adobe CMS settings and the CMS settings shown in the generic CMS diagram in case you want to make changes to them:

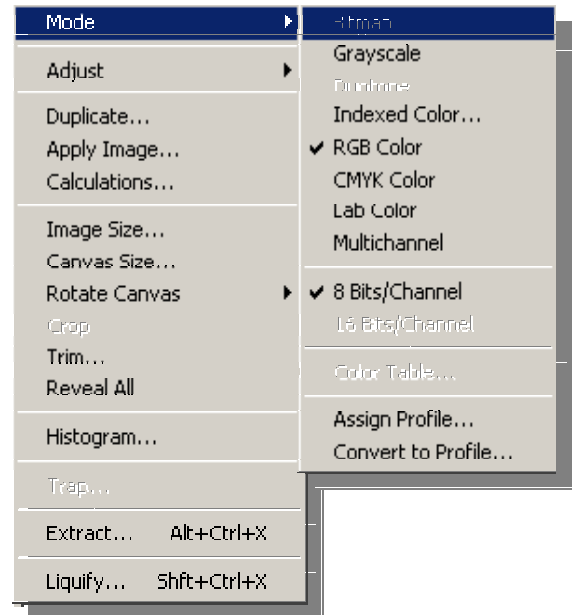
- **CMS:** Adobe PhotoShop offers a variety of CMS in the field. You can change your CMS by selecting a different one in the “Engine” field.
- **Input ICC profiles:** The Input ICC profiles are the ones that appear in the part of the “Working Spaces” area. As you can see, you may define one for a RGB, CMYK, and Grayscale color modes. Spot is an option that only Adobe PhotoShop has and that is not going to affect our printing workflow.
- **Output ICC profiles:** This part is not covered here but in the printing path
- **Rendering Intent:** It is the setting called “Intent”. There you can choose among the four possible options already described.

## 4.2.2 Changing the file type

In order to change the file type of your image (RGB, CMYK, Grayscale, etc.) once the image has been opened; go to “Image->Mode” menu.

**Remember we recommend working with CMYK images for press proofing.**

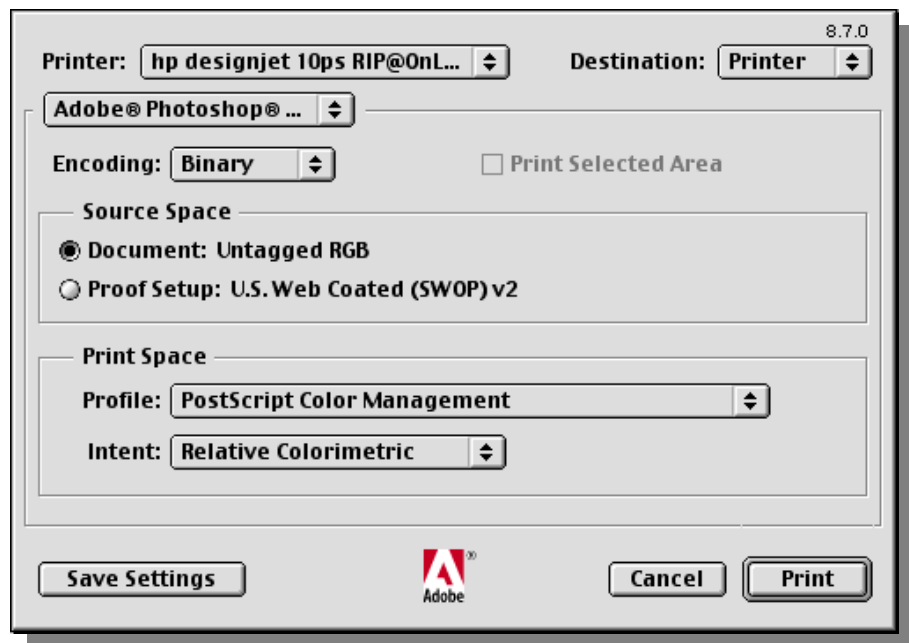
Once changed, save the file as TIFF in order to have a CMYK TIFF image.



### 4.2.3 Printing Path in MAC

In order to access the printing path:

- Go to "File->Print".
- Select your printer in the "Printer" field
- In the drop-down menu, change the "General" to "Adobe PhotoShop 6.0".  
The following screen will appear:



- Once here, Select **"Document"** for the **Source Space section** (ICC Input Profile)
- And let the printer perform the color pipeline in the printing path by selecting **"PostScript Color Management"** in the **Profile field of the Print Space section** (ICC Output Profile)
- Select the appropriate "Intent" option.
- Finally change "Encoding" to Binary.

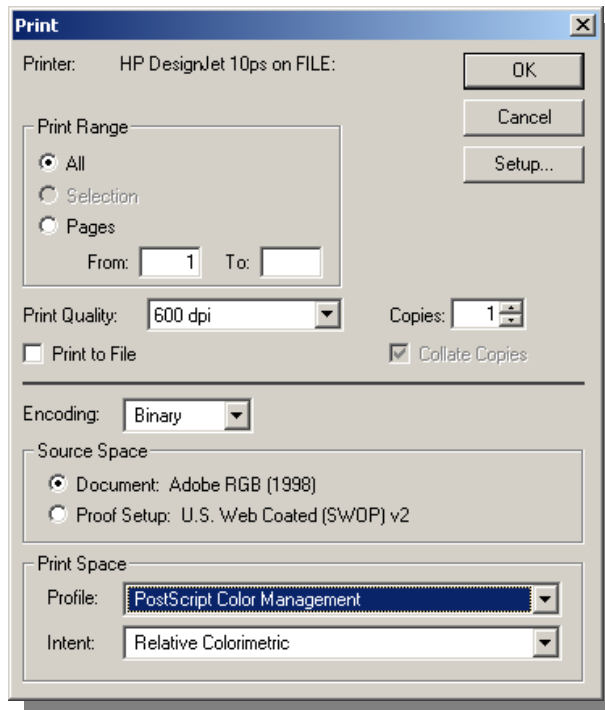
To complete the printing path, you need to access to the printer specific settings by changing "Adobe PhotoShop 6.0" tab to "Printer Specific Options". Refer to the section "Printer driver settings for MAC" to complete the process

#### 4.2.4 Printing path for Windows

The printing path for Windows is very similar to MAC. In fact, there are no differences in features but there are in their location:

- Go to “File->Print”
- Choose the right printer in “Printer” field. To change it, click on “Setup...” button.

In the bottom part of the window, you will see there is an area called **“Source Space”** (ICC Input Profile). **Select the Document option.** In the **“Print Space”** area (ICC Output Profile) **choose “PostScript Color Management” in the Profile field and the pertinent rendering intent in the Intent field.**



Also, as a recommendation for the rest of settings:

- **“Encoding”** is Binary (except in Windows NT that should be ASCII)

To complete the printing path, you have to access to the printer specific settings by clicking on “Setup...” button and then the “Properties...” button beside the printer name. Refer to the section “Printer driver settings for Windows” to complete the process.

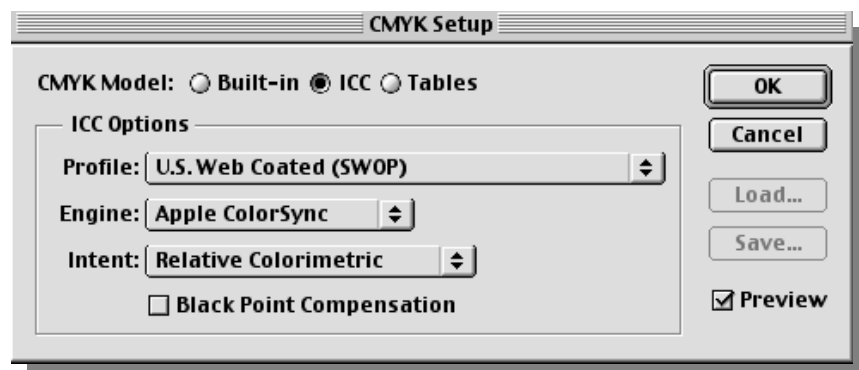
## 4.2.5 Printing from Adobe PhotoShop 5.5

### 4.2.6 PhotoShop 5.5 Color Management

The Color Management System (CMS) of Adobe PhotoShop 5.5 is different to Adobe PhotoShop 6.0. Menus are different for configuring CMYK or RGB settings.

Our recommendation for the visualization path is:

- Go to “File->Color Settings->CMYK Setup...”
- Choose “ICC” radio button
- Choose the appropriate Profile (that is the ICC Input profile):
  - “US Prepress defaults” or “Europe Prepress defaults” or “Japan Prepress defaults” when you want to emulate the standards for presses.
- Choose the appropriate Rendering Intent depending on the final goal of the image.
- Disable Black Point Compensation for proofing<sup>9</sup>

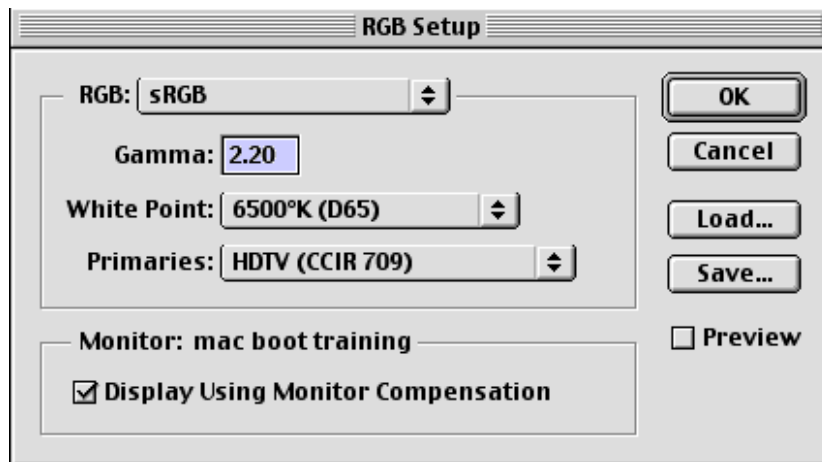


Now, let's go to define the RGB path and do the same.

- Go to “File->Color Settings->RGB Setup...”
- There you can select the ICC profile of your monitor. If you do not have any, select the standard sRGB
- Make sure the White Point value is 6500K and leave the other values by default.

---

<sup>9</sup> Because black point compensation expands the lightness range of the destination space, you should disable it for proofing conversions,

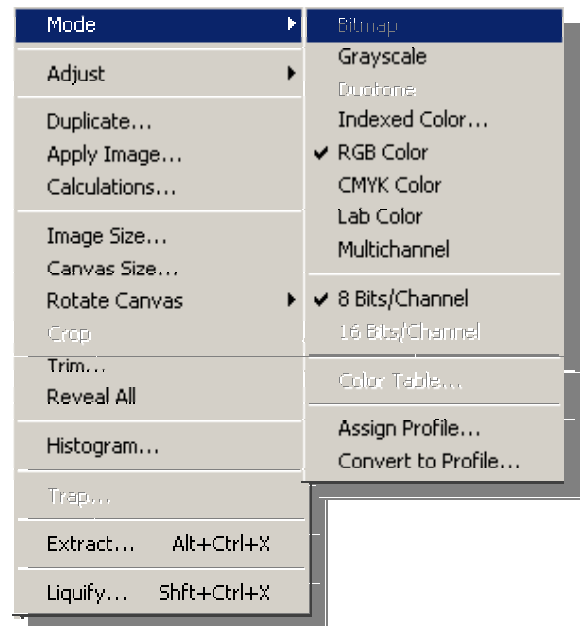


For further information about other press standards and other intents, go to section on “Configuring the printing”.

#### 4.2.7 Changing the file type

To change the file type of your image (RGB, CMYK, Grayscale, etc.) once the image has been opened, go to “Image->Mode” menu.

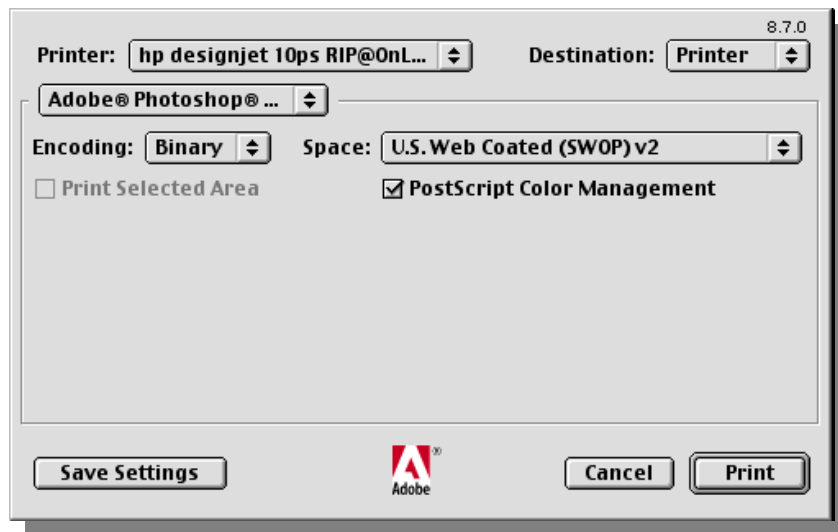
**Remember we recommend working with TIFF CMYK images for press proofing.**



## 4.2.8 Printing Path for MAC

In order to access the printing path:

- Go to "File->Print".
- Select your printer in the "Printer" field
- Change the drop-down menu "General" to "Adobe PhotoShop 5.5". The window below will appear:



- Select "Encoding" to Binary
- **Enable the "PostScript Color Management" check box** (with that option you are letting the printer take control of the color pipeline of the printing path)
- **Select the Space of your document** (what you selected as ICC Input Profile). For instance *US. SWOP* for proofing in US as is shown in the screen shot)

To complete the printing path, you need to access the printer specific settings by changing "Adobe PhotoShop 5.5" tab to "Printer Specific Options". Refer to the section "Printer driver settings for MAC" to complete the process.

## 4.2.9 Printing from Adobe Illustrator 9.0

### 4.2.10 Illustrator 9.0 Color Management

Illustrator 9.0 CMS is similar to PhotoShop 6.0. Therefore, Adobe Illustrator 9.0 color management also has a “dual” color management path: one for the visualization and another for the printer. Now we are going to talk about the visualization path and later we will see the printing path for t MAC & Windows.

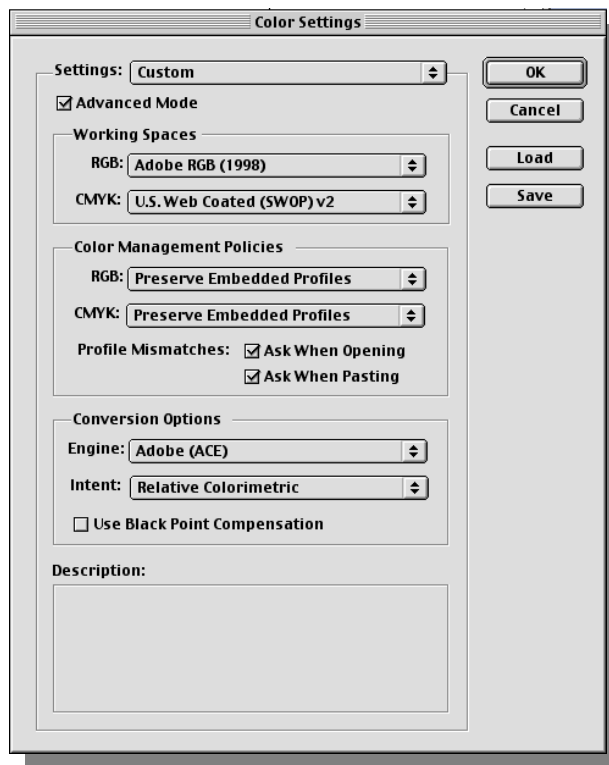
Our recommendation for the visualization path is:

- Go to “Edit->Color Settings”.
- Enable “Advance Mode” check box
- Now change the field “Settings” to:
  - “US Prepress defaults” or “Europe Prepress defaults” or “Japan Prepress defaults” when you want to emulate the standards for presses.
  - “Color Management Off” if you do not want Adobe PhotoShop to modify the colors
- Choose the appropriate Rendering Intent depending on the final goal of the image.
- Disable Black Point Compensation for proofing<sup>10</sup>

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<sup>10</sup> Because black point compensation expands the lightness range of the destination space, you should disable it for proofing conversions,





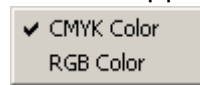
Apart from the recommendation, here you have the analogy between the Adobe CMS settings and the CMS settings shown in the generic CMS diagram in case you want to make changes to them:

- **CMS**: Adobe Illustrator offers a variety of CMS in the field. You can change your CMS by selecting a different one in the “Engine” field.
- **Input ICC profiles**: The Input ICC profiles are the ones that appear in the part of the “Working Spaces” area. As you can see, you may define one for RGB, CMYK, and Grayscale color modes. Spot is an option that only Adobe Illustrator has and that is not going to affect our printing workflow.
- **Output ICC profiles**: This part is not cover here but in the printing path
- **Rendering Intent**: It is the setting called “Intent”. There you can choose among the four possible options already described.

#### 4.2.11 Changing the document color mode

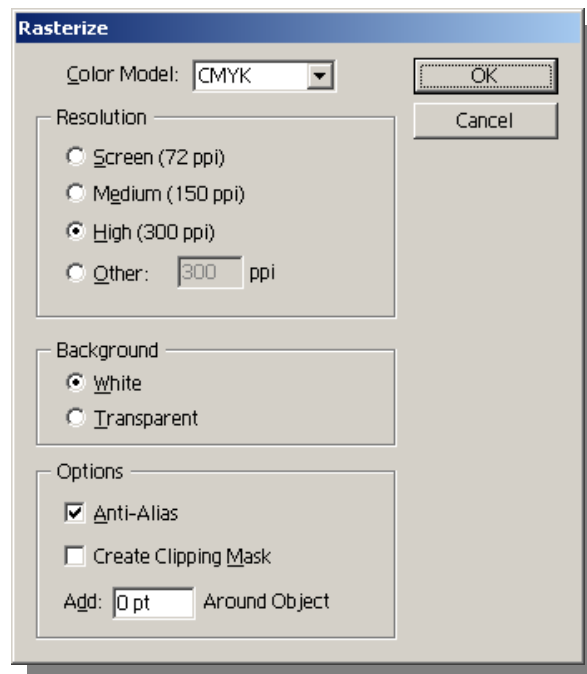
Adobe Illustrator allows you to select the color mode of the document (for any object to be included in the job with the exception of imported images). You have two options: RGB or CMYK. **We recommend CMYK.** To choose CMYK:

- Go to “File->Document Color Mode” and choose the format you want to use (the current color mode will appear at the right of the window’s name).



#### 4.2.12 Changing the type file

To convert any RGB image to CMYK, regardless of whether the document color mode is in CMYK, if the image imported (using “File->Place”) is an RGB image, the image will remain RGB. To change it, select the image and go to “Object->Rasterize”.



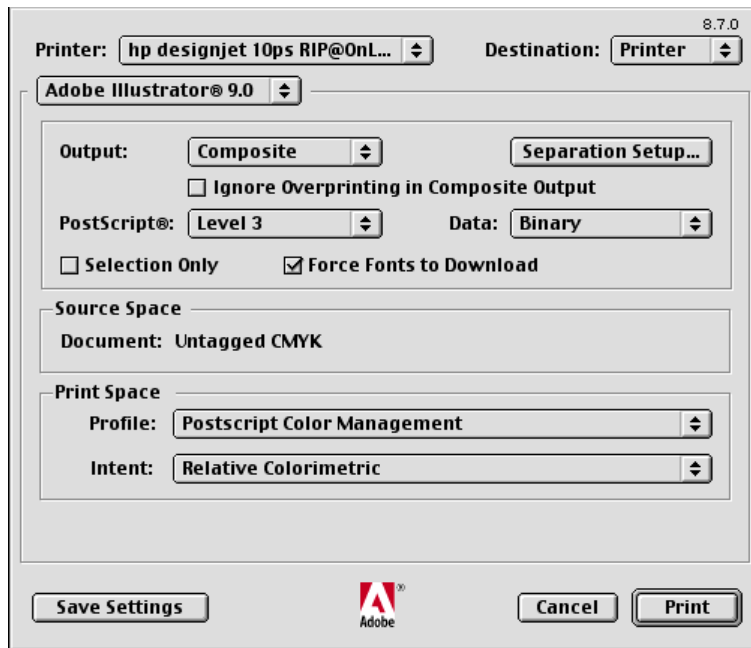
Here you will be able to change the color model of the image. Also, you will be able to change other image settings like resolution, type of background and you can apply some techniques to improve the visualization of the image (use of Anti-Alias option always recommended).

Once changed, save the file as TIFF in order to have a CMYK TIFF image.

## 4.2.13 Printing path for MAC

To access the printing path for MAC:

- Go to "File->Print".
- Choose the right printer in "Printer" field
- Change from "General" to "Adobe Illustrator 9.0".
- Then, if your job does not have any associated ICC profile, in the "Source Space" (ICC Input Profile) field you will see "Document: Untagged CMYK" or "Document: Untagged RGB"
- If your job has an associated ICC profile, the field "Source Space" will indicate which and will let you choose the Print Space (ICC Output Profile) and the Intent (Rendering Intent). If so, **choose "PostScript Color Management" and the pertinent rendering intent.**



Also, as a recommendation for the rest of the settings:

- "**Output**" is Composite
- "**PostScript**" is Level 3
- "**Data**" is Binary
- Check "**Force Fonts to Download**" check box.

The printer does not support "Separation Setup...", which allows you to work with the different CMYK.

To complete the printing path, you have to access the printer specific settings by changing “Adobe Illustrator 9.0” to “Printer Specific Options”. Refer to the section “Printer driver settings for MAC” to complete the process.

#### 4.2.14 Printing path for Windows

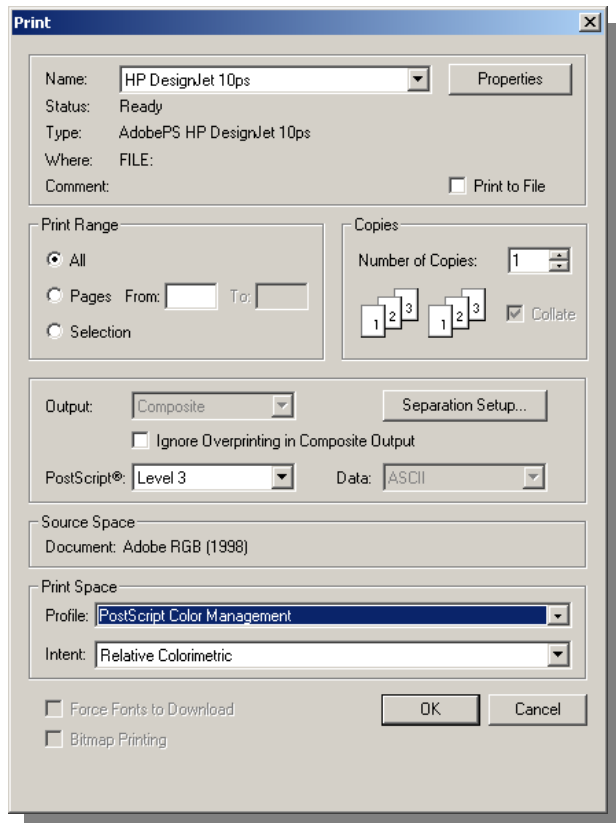
The printing path for Windows is very similar to the MAC. The only difference is in the location of settings:

- Go to “File->Print”
- Choose the right printer in “Name” field
- In the bottom part of the window, you will see that there is a field called “Source Space” (ICC Input Profile). If your job does not have any associated ICC profile, in this field you will see “Document: Untagged CMYK” or “Document: Untagged RGB”
- If an ICC profile is associated, the field “Source Space” will indicate which and will let you choose the Print Space (ICC Output Profile) and the Intent (Rendering Intent). If so, **choose “PostScript Color Management” and the appropriate rendering intent.**

Also, as a recommendation for the rest of the settings:

- **“Output”** is Composite
- **“PostScript”** is Level 3
- **“Data”** is Binary (except in Windows NT that is ASCII)
- Check **“Force Fonts to Download”** check box.

The printer does not support “Separation Setup...”, which allows you to work with the different CMYK.



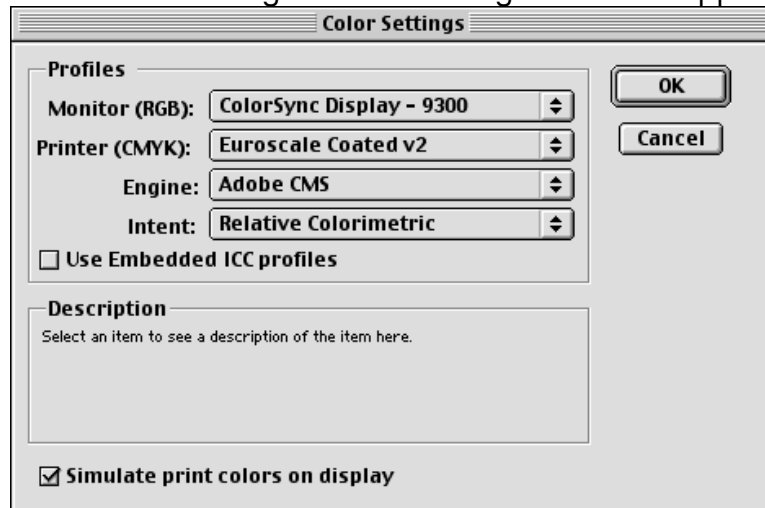
To complete the printing path, access the printer specific settings by clicking on the “Properties” button beside the printer name. Refer to the section “Printer driver settings for Windows” to complete the process.

## 4.3 Printing from Adobe Illustrator 8.0

### 4.3.1 Illustrator 8.0 Color Management

To access the visualization color path of Illustrator 8.0:

- Go to "File->Color Settings". The following screen will appear:



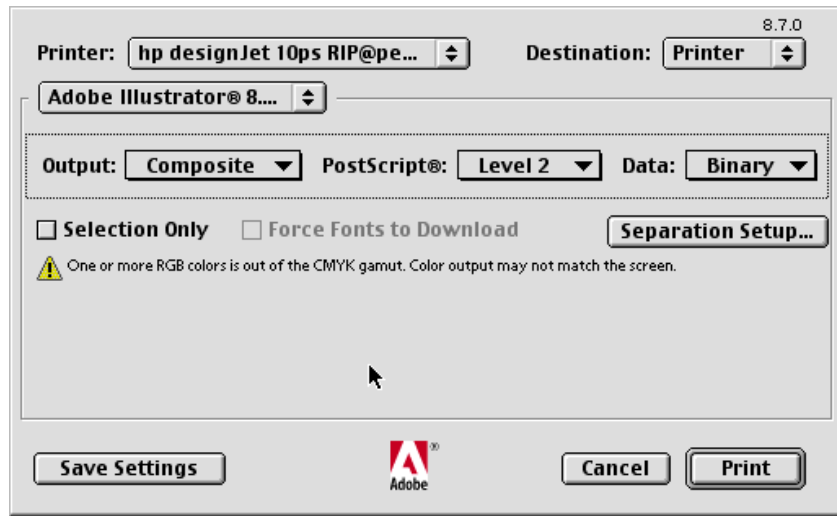
- The settings are:
  - Monitor (RGB): Input ICC profiles for RGB Images
  - Printer (CMYK): Input ICC profiles for CMYK Images
  - Engine: The application that is going to act as CMS (the HP Designjet 10ps or 20ps software RIP does not appear as it is not a plug-in of Illustrator)
  - Intent: Rendering Intent.

Remember that the Output Profiles are going to be selected in the printing menu

### 4.3.2 Printing path for MAC

To access the printing path:

- Go to “File->Print”.
- Choose the right printer in “Printer” field
- Change from “General” to “Adobe Illustrator 8.0”.



Choose:

- **Output:** Composite
- **PostScript:** Level 3
- **Data:** Binary (except in Windows NT where the recommended is ASCII)
- Check **Force Fonts to Download**

The printer does not support “Separation Setup...”, which allows you to work with the different CMYK.

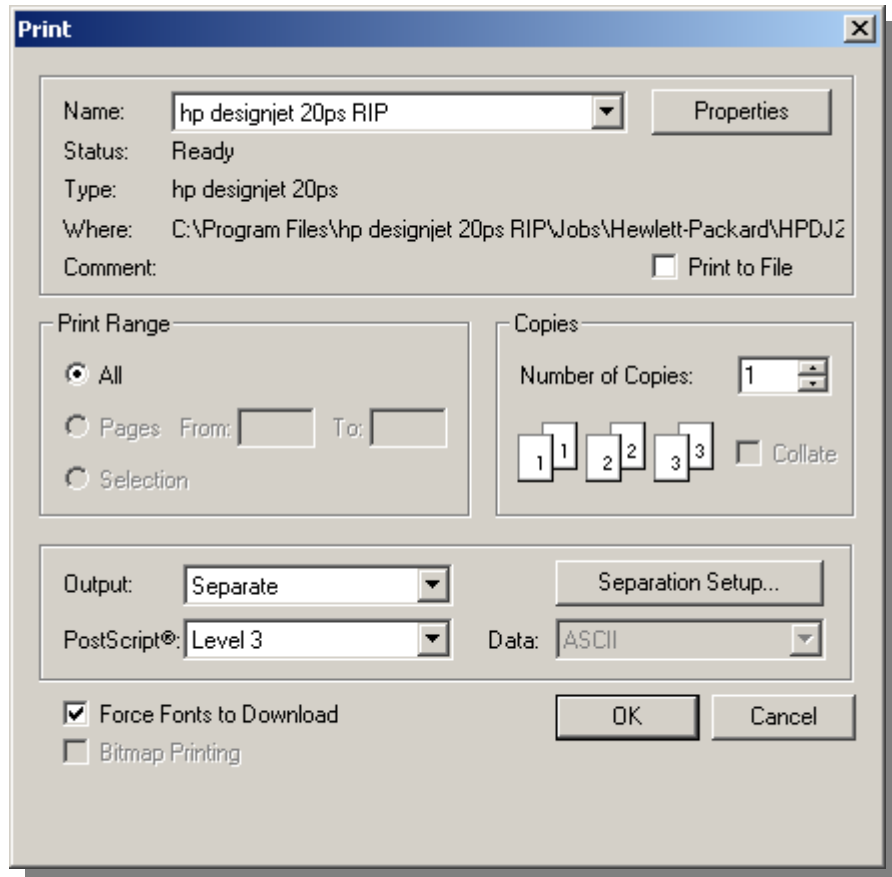
After changing settings, go to “Printer Specific Options” and change the printer driver settings. For further information go to the “Printer driver settings” section.

To complete the printing path, you need to access the printer specific settings by changing “Adobe Illustrator 8.0” tab to “Printer Specific Options”. Refer to the section “Printer driver settings for MAC” to complete the process.

### 4.3.3 Printing path for Windows

To access the printing path:

- Go to "File->Print".
- Choose the right printer in "Name" field
- Select "Level 3" in the PostScript field
- Change "Data" to ASCII if working in Windows NT



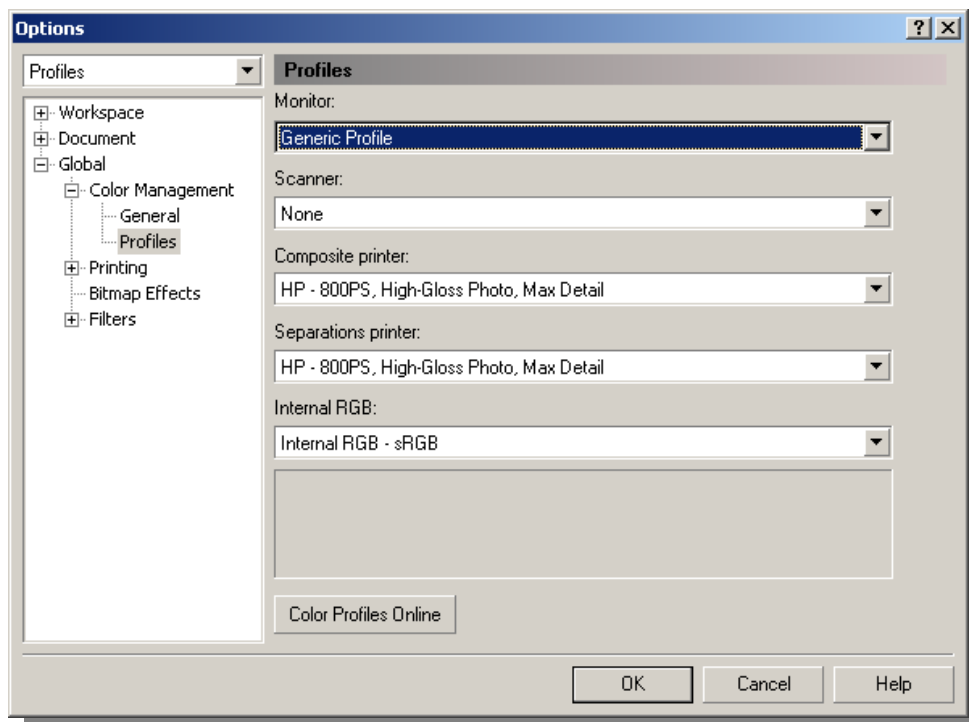
To complete the printing path, access the printer specific settings by clicking on the "Properties" button beside the printer name. Refer to the section "Printer driver settings for Windows" to complete the process.

## 4.4 Printing from Corel Draw 9.0

### 4.4.1 Corel Draw 9.0 Color Management

To modify settings for the monitor path:

- Go to "Tools->Color Management".
- Expand the "Global" menu from the menu on the left and select "Profiles"
- there select:
  - Monitor: Select the ICC profile that describes your monitor (ICC Output Profile to get the best approximation possible of your color settings on your monitor)
  - Scanner: Select the ICC Profile of your scanner.
  - **Composite Printer: Select None**
  - Separations printer: select the ICC profile of your press. By default, there are no ICC press standards to choose although there is an option to search for them on the Internet
  - Internal RGB: Input ICC profile for your RGB images.





## 4.4.2 Changing the type file

In Corel Draw, we talk about bitmaps and vector objects.

To convert any bitmap to CMYK color mode you should:

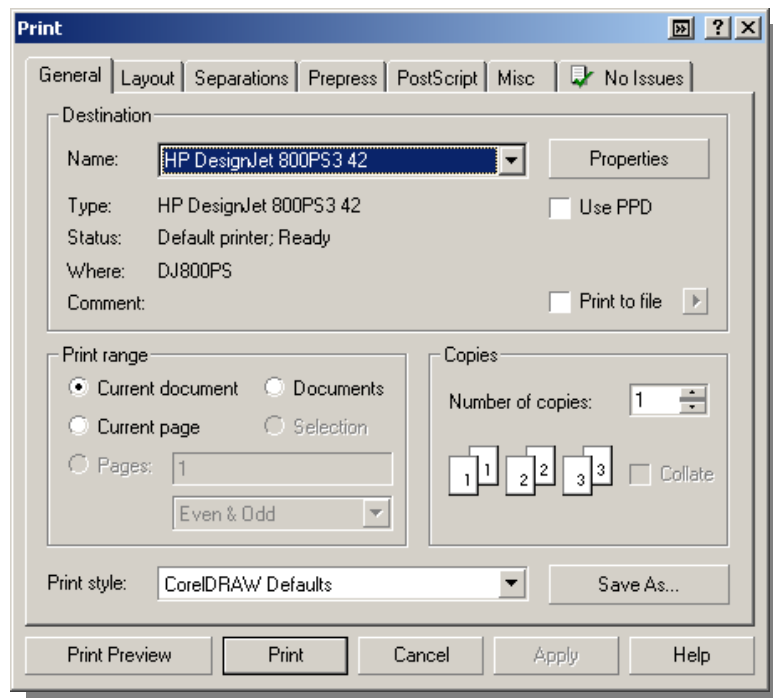
- Go to the Pick tool
- Click Bitmaps -> Mode ->CMYK Color

On the other hand, when converting a vector to CMYK you should:

- Select the object with the Pick tool
- Click Bitmaps->Convert to Bitmap
- From the Color List box, choose the color mode to be saved with the bitmap
- Enable any of the following check boxes:
  - Anti-Aliasing – smoothes the edges of the bitmap
  - Dithered – improves the transitions between colors
  - Transparent Background – makes the background of the bitmap transparent
  - Use Color Profile – applies the current color profile

## 4.4.3 Printing path for Windows

To access the printing path, go to “File->Print”



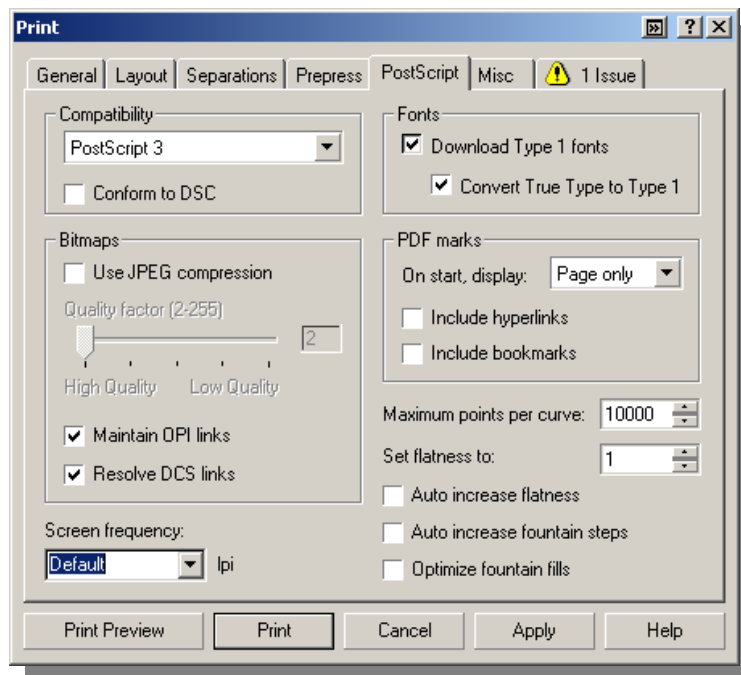
A window like the one above, will pop-up. In the “General” tab, select the option “Use PPD” and then browse looking for the right PPD for your printer in the following directories:

For PC and HP Designjet 10ps: “C:\Program Files\hp designjet 10PS\PPD\”

For PC and HP Designjet 20ps: “C:\Program Files\hp designjet 20PS\PPD\”

And finally, in the PostScript tab select:

- **Compatibility**: PostScript Level 3
- **Fonts**: download fonts



Finally, to disable Corel Draw color management, go to “Misc.” tab and disable the “Use Color Profile” check box.

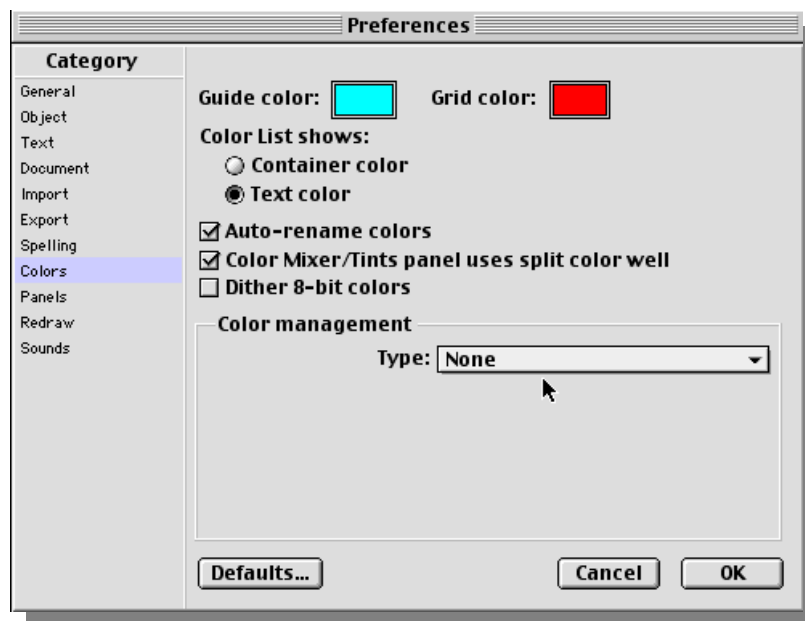
To complete the printing path, you need to access the printer specific settings by going to “General” tab and then click on “Properties” button. Refer to the section “Printer driver settings for Windows” to complete the process.

## 4.5 Printing from Macromedia Freehand 9

### 4.5.1 Freehand 9.0 Color Management

Freehand 9.0 does not have its own CMS and relies on 3<sup>rd</sup> parties. We are going to work with ColorSync that is the CMS offered by the MAC operating system:

- Go to “File->Preferences”
- Select “Colors” from the right list



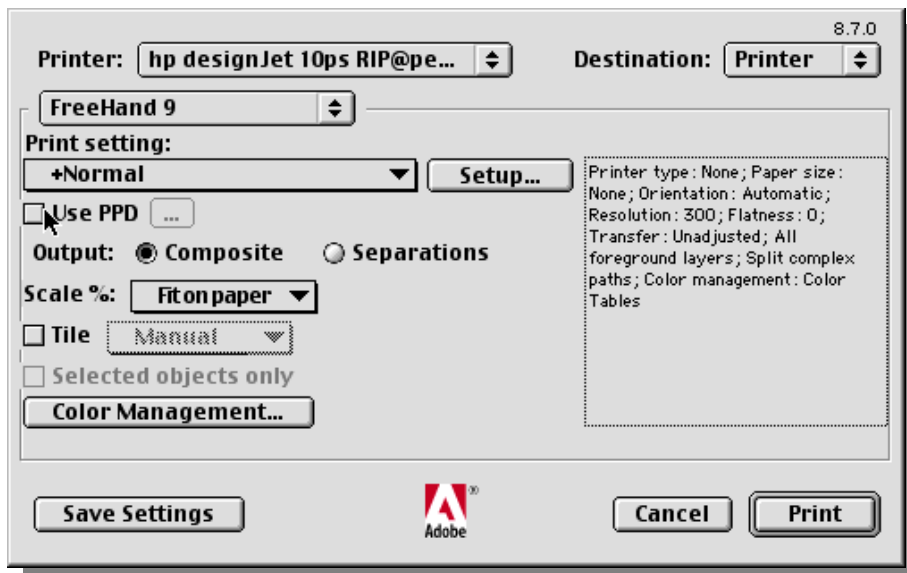
- Change the “Type” field in the Color Management area to “Apple ColorSync”
- Click on “Setup” button to access the ColorSync properties
- Here you have a recommendation for the ColorSync settings:
  - Monitor: Select the ICC profile of your monitor. It is an ICC Output Profile to match the output you want on your monitor.
  - Monitor simulates: Select “Separation Printer” as what we want to emulate is the final press. This indicates which ICC profile has to be taken as an Input profile to get the maximum match on the monitor (related to the previous setting)
  - Separation Printer: Use the ICC profile of your press or choose a regional standard ICC press profile like SWOP for US or Euro for Europe. It is a CMYK ICC Input profile.
  - Intent: Select the pertinent Rendering Intent (Relative or Absolute for CMYK proofing)

- **Disable “Composite simulates separations”**
- Default RGB image source: Use this setting if the file follows an RGB standard. It is an RGB ICC Input profile.

## 4.5.2 Printing path for MAC

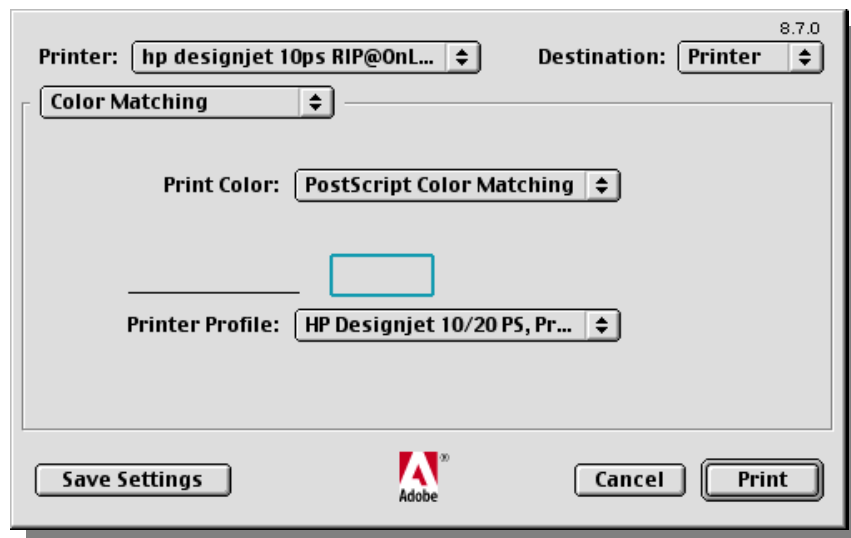
To access the printing path, go to “File->Print”. Once there, change the printer to the HP Designjet 10ps or 20ps model.

Change from “General” to “Freehand 9” section. A window like the screenshot below appears.



Steps to perform:

- Check the “Use PPD” box. Then you will see how you can choose the PPD of the printer. You can find the PPD file for your HP Designjet 10ps or 20ps in the following default directories:  
 For MAC and HP Designjet 10ps: “HDD::hp designjet 10PS:PPD”  
 For MAC and HP Designjet 20ps: “HDD::hp designjet 20PS:PPD”  
 For PC and HP Designjet 10ps: “C:\Program Files\hp designjet 10PS\PPD\”  
 For PC and HP Designjet 20ps: “C:\Program Files\hp designjet 20PS\PPD\”
- Then change from “Freehand 9” to “Color Matching”



- Select in **“Print Color” “PostScript Color Management”** and let the printer take control of the color workflow for printing
- We recommend also selecting the appropriate Printer Profile (ICC Output Profile). Remember that this profile depends on the media and print quality

To complete the printing path, you need to access the printer specific settings by changing “Freehand 9” tab to “Printer Specific Options”. Refer to the section “Printer driver settings for MAC” to complete the process.

## 4.6 Printing from Adobe InDesign 1.5

### 4.6.1 InDesign 1.5 Color Management

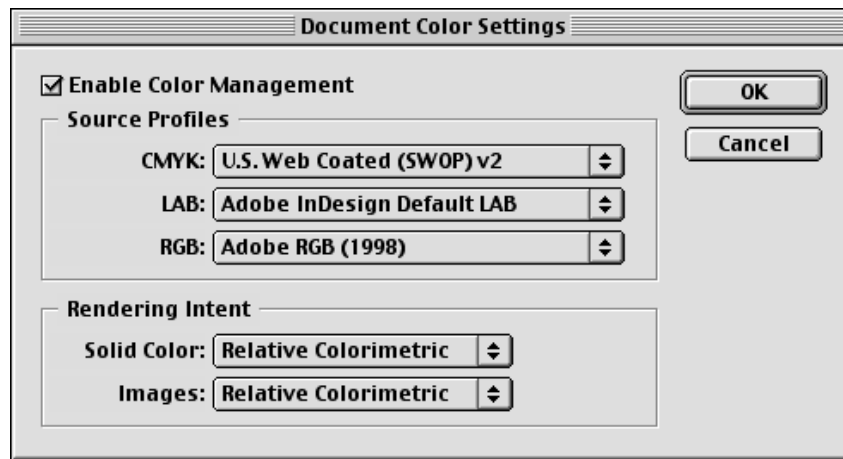
Adobe InDesign Color Management is split in two different menus:

- Document Color Settings contains ICC Input profiles and the Rendering Intent (split into Solid Color and Images).
- Application Color Settings contains the ICC Output profiles and the selection of which software you want to act as CMS.

As you can see a big difference is that the printing color path is not in the “File->Print” menu but in the “Color Settings” menu of the application. **This may confuse some customers that may expect to select ICC Output profiles when going to print and they have to select them before going to print.**

Let’s see in detail what are the options for the visualization color path:

- Go to “File->Color Settings->Document Color Settings” if you are using a MAC computer and go to “Edit->Color Settings->Document Color Settings” if you are in Windows.

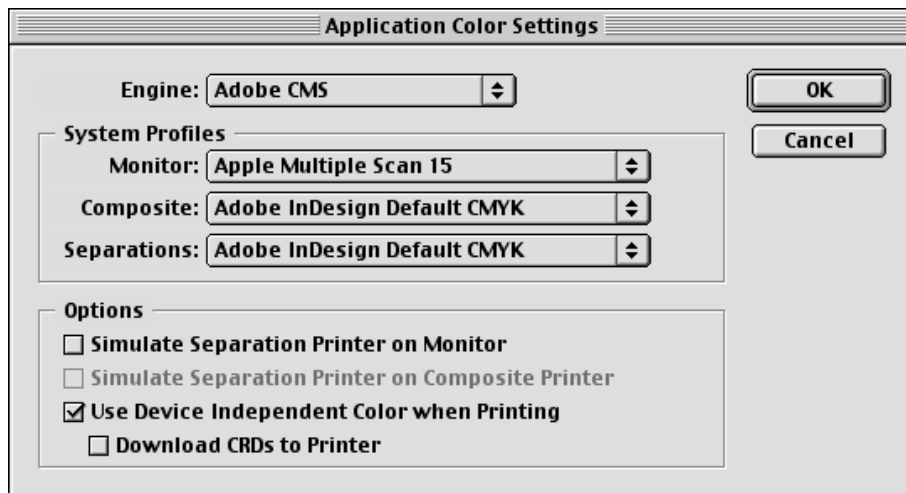


- Enable the “Enable Color Management” check box.
- Fill in the values for the “Source Profiles” area (ICC Input Profile area):
  - CMYK: For proofing select your regional press standard.
  - LAB: This will apply to an image that has L\*a\*b\* information
  - RGB: Place here your monitor or scanner ICC Profile. Use the default if you do not have it.
- Select in the Rendering Intent the appropriate value (Relative or Absolute for CMYK proofing) and make the same selection in the Solid Color than in Images.

#### 4.6.2 Printing path for MAC

As said in the previous section, InDesign does not have the CMS of the printing path in the printing menu. So we must change the Application Color Settings before sending the file to print:

- Go to “File->Color Settings->Application Color Settings”



- **Enable “Use Device Independent Color when Printing”** check box. This setting assigns color control to the software rip.

Now we are ready to send to print:

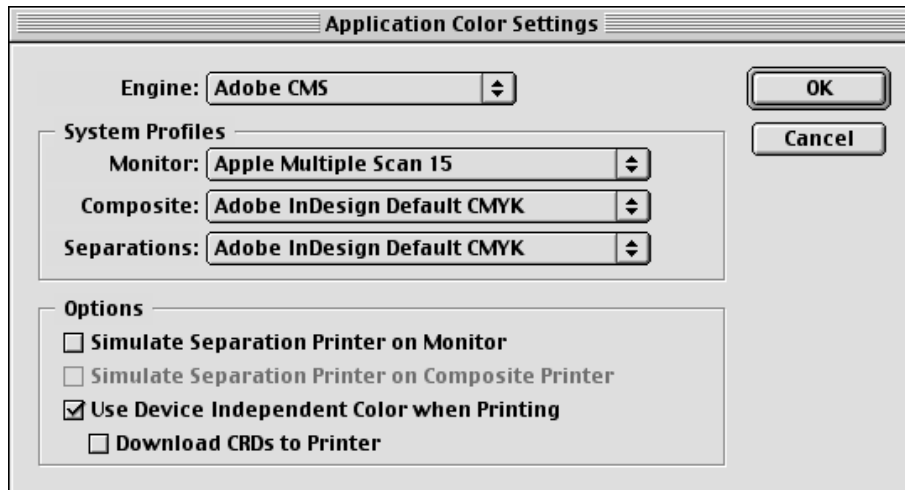
- Go to “File->Print”.
- Change from “Advance Page Control” to the “Printer Specific Options”
- Refer to the section “Printer driver settings for MAC” to continue the process.

Moreover you will see that there is another section called “Color”. If you go there, you will have the possibility to separate colors and change the screening. The HP Designjet 10ps or 20ps does not support these settings. We recommend selecting “composite” and leaving the other settings by default.

### 4.6.3 Printing path for Windows

As said in the previous section, InDesign does not have the CMS of the printing path in the printing menu. So, we must change the Application Color Settings before sending the file to print:

- Go to “Edit->Color Settings->Application Color Settings”



- **Enable “Use Device Independent Color when Printing”** check box. This setting assigns color control to the software rip.

Now we are ready to send to print:

- Go to “File->Print”.
- Change from “Advance Page Control” to the “Printer Specific Options”
- Refer to the section “Printer driver settings for MAC” to continue the process.

Moreover you will see that there is another section called “Color”. If you go there, you will have the possibility to separate colors and change the screening. The HP Designjet 10ps or 20ps does not support these settings. We recommend selecting “composite” and leaving the other settings by default.



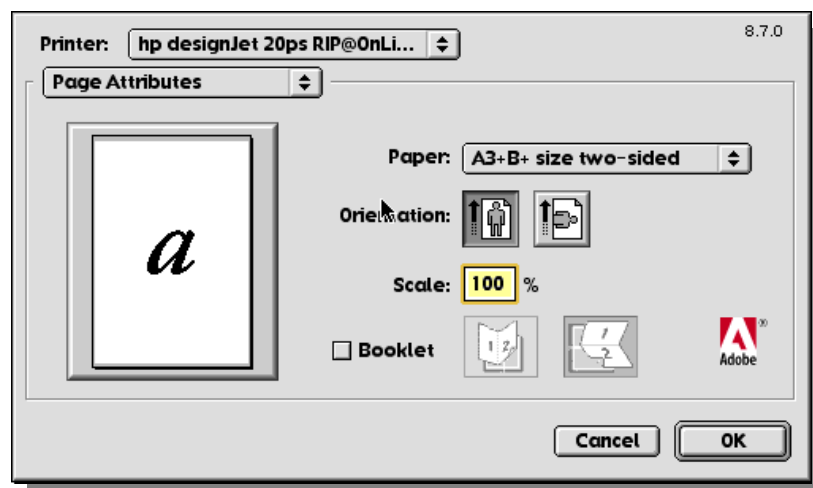
## 5. Printer driver settings

Hewlett-Packard Designjet 10ps or 20ps have been specially developed to work with the Adobe PostScript driver. Although other drivers may work also without problem, we recommend using the Adobe PostScript driver at all times.

For this reason, the information in this section is based on the Adobe PostScript. For other PostScript drivers please refer to the vendor's information but they should be very similar. For instance, in the next section we talk about the LaserWriter provided by Apple in their entire Macintosh range and you will see how the functionality is very similar to the Adobe PostScript driver.

### 5.1 Page Setup info for MAC

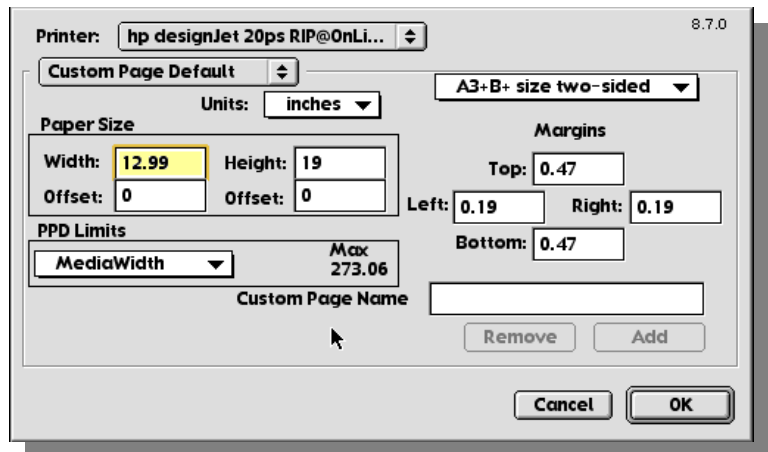
In "Page Attributes" you will be able to change the Page Size information of the document.



You will have a long list of standards media types to choose or you may also create a custom page size. In any of the cases remember the following important points:

- The printer has the following hardware margins:

The driver cannot override these margins. This means that, if for instance you select an A3/B page size, the printable area will be the A3/B size minus the margins. This information is included as “Margins” and it is passed to the application but it is the responsibility of the customer to fill them out when creating a custom page size as, if they are overwritten, you may face clipping problems without warning from the application.



Note: Although most of applications check for possible clipping problems, not all applications do before sending the job to print.

- The second point is that you notice there is paper size for regular and two-sided (duplex) mode. The reason is because in duplex mode, the top and the bottom hardware margins are equal.

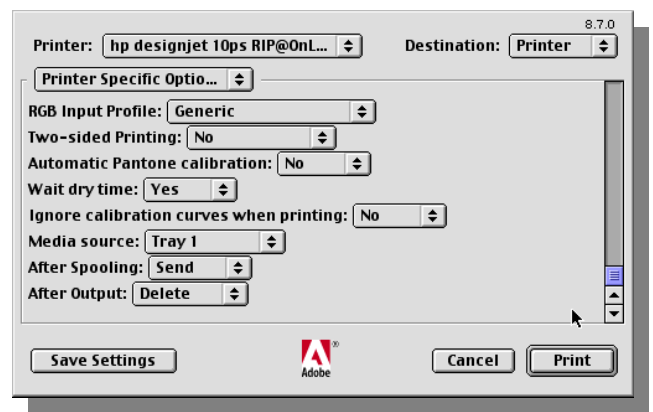
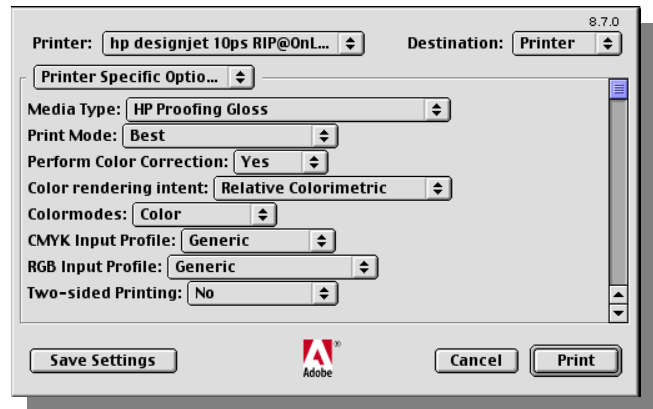
## 5.2 Changing the default settings in MAC

When the Adobe PostScript driver appears, change the drop-down list “General” to “Printer Specific Options” tab. This tab has the same color printer’s settings that we see in the chapter “Environment Specific Options”

Let's have a look at the screenshots. As the list is long, you can move upwards or downwards by using the scroll bar placed on the left. The following two screenshots captures all the settings:

Let's have a look to all the color settings:

- Check Media Type: Make sure you select the media type you are going to use. **We recommend using HP Proofing media.**
- Check Print Mode: Select the print quality you want to use. **We recommend using Normal for drafts and Best for final jobs.**
- Perform Color Correction: **Select YES** in order to use the Hewlett-Packard Color Management System embedded in the software RIP. If you select NO, color accuracy cannot be guaranteed.
- Color Rendering Intent: Choose the right rendering intent depending on the idea of the print:
  - Use **Saturation** for getting a vivid final output. It is suitable for business graphics (charts, presentations, etc.). Not recommended for color matching.
  - Use **Perceptual** for getting a most pleasing final output from your original RGB image. It is suitable for photographic content.
  - Use **Relative Colorimetric** suitable for proofing with CMYK input (when you have selected SWOP, Euro, Toyo, DIC or your press profile as ICC CMYK input). This rendering will provide maximum color accuracy. It is suitable for press proofing.
  - Use **Absolute Colorimetric** for press proofing (like Relative Colorimetric) but using paper color emulation.
- CMYK Input Profile: Choose the ICC profile to use to emulate your CMYK device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.
- RGB Input Profile: Choose the ICC profile to use to emulate your RGB device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.

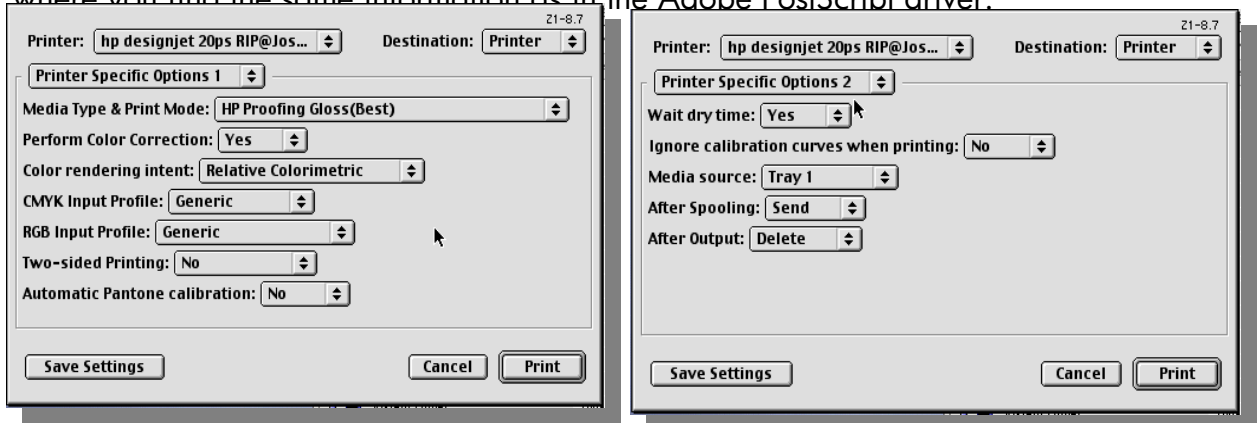


- Automatic Pantone Calibration: When you want to use the Pantone tables embedded in the software RIP and that gives you the better color accuracy possible with the HP Designjet 10ps or 20ps series printer.
- Ignore Calibration Curves when printing: **Select *NO*** to include in the color pipeline all the information from the color calibration. If you select YES, color repeatability from print to print and from printer to printer cannot be guaranteed.

For further information about the non-related color settings please consult your User's Manual CD.

### 5.3 LaserWriter driver's settings

LaserWriter driver's settings are the same as the Adobe PostScript driver's settings. The minor difference is that instead of having a scroll bar option in the "Printer Specific Options" tab to move upwards and downwards, here you have two different tabs named "Printer Specific Options 1" and "Printer Specific Options 2" where you find the same information as in the Adobe PostScript driver.



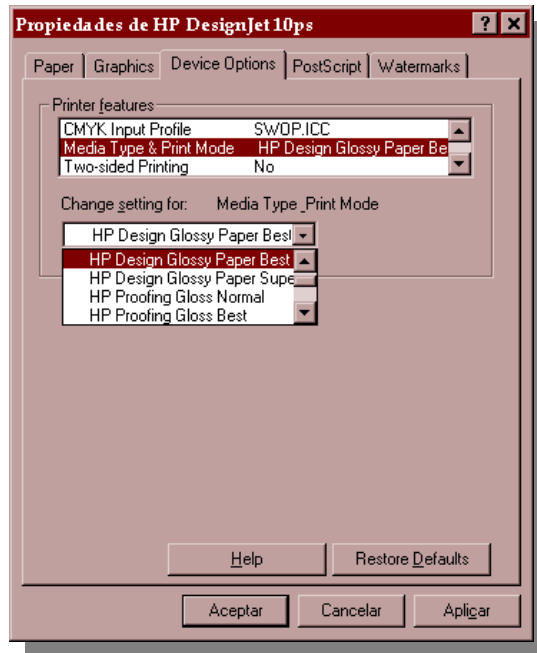
## 6. Changing the default settings in Windows

In terms of functionality, there are no differences between the MAC and the Windows versions. However, the Adobe PostScript driver uses different naming and places settings in a different way depending on the operating system

### 6.1 Windows 98 and Me

To access the Printer Specific Options in the Adobe PostScript Windows driver for Windows 98 and Millennium (Me) you should click on the printer' settings and then go to "Device Options" tab.

There you will find a window like the one below where you have all the settings seen in the RIP:



There are two main sections: the *Printer Features*, where you will find all the software rip settings and the "*Media Type and Print Mode*" combination.

#### Printer Features

The settings that appear in the Printer Features section and that affect the color pipeline are:

- Perform Color Correction: **Select YES** to use the Hewlett-Packard Color Management System embedded in the software RIP. If you select NO, color accuracy cannot be guaranteed.
- Color Rendering Intent: Choose the right rendering intent depending on the idea of the print:
  - Use **Saturation** for getting a vivid final output. It is suitable for business graphics (charts, presentations, etc.). Not recommended for color matching.
  - Use **Perceptual** for getting a most pleasing final output from your original RGB image. It is suitable for photographic content.
  - Use **Relative Colorimetric** suitable for proofing with CMYK input (when you have selected SWOP, Euro, Toyo, DIC or your press profile as ICC CMYK input). This rendering will provide maximum color accuracy. It is suitable for press proofing.
  - Use **Absolute Colorimetric** for press proofing (like Relative Colorimetric) but using paper color emulation.
- CMYK Input Profile: Choose the ICC profile to use to emulate your CMYK device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.
- RGB Input Profile: Choose the ICC profile to use to emulate your RGB device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.
- Automatic Pantone Calibration: When you want to use the Pantone tables embedded in the software RIP and that gives you the better color accuracy possible with the HP Designjet 10ps or 20ps series printer.
- Ignore Calibration Curves when printing: **Select NO** in order to include in the color pipeline all the information from the color calibration. If you select YES, color repeatability from print to print and from printer to printer cannot be guaranteed.

#### Media Type and Print Mode

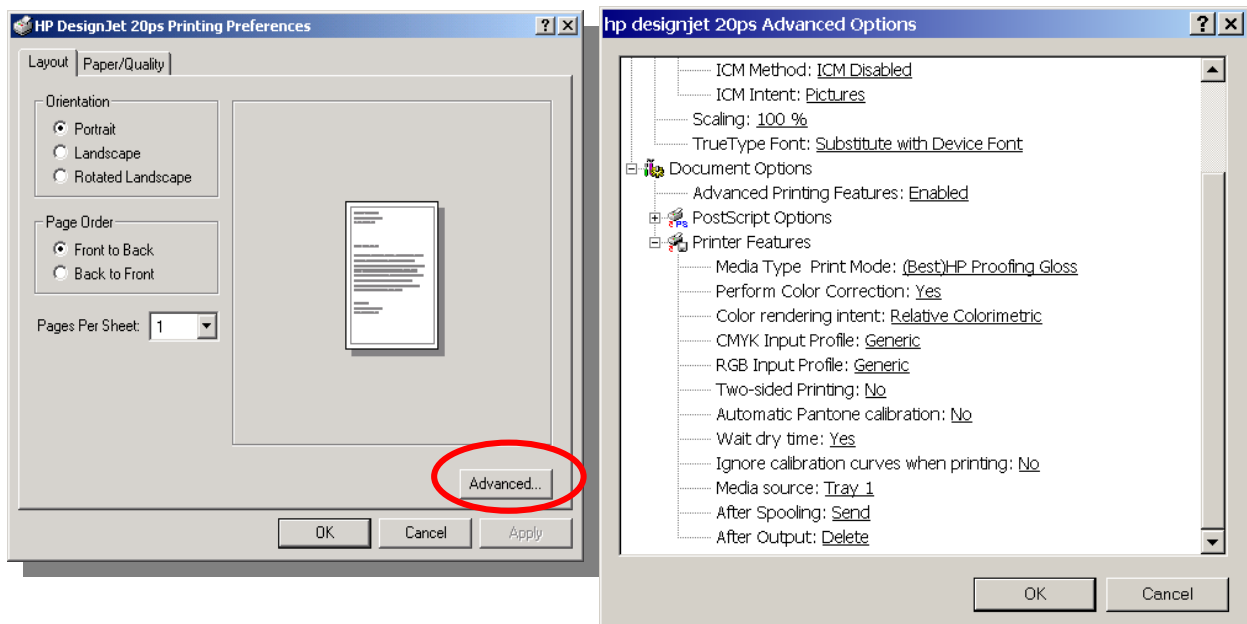
As a difference with the MAC driver, you have in one unique field both settings: Media Type and Print Mode. For that setting, **we strongly recommend using HP Proofing media and Best Mode**

For further information about the non-related color settings please consult your User's Manual CD.

## 6.2 Windows NT and 2000

To access the Printer Specific Options in the Adobe PostScript Windows driver for Windows NT and 2000:

- Click on the printer' settings
- Go to "Layout" tab
- Click on "Advanced..." button
- And then go to "Document Options-> Printer Features"



The settings that appears in the Printer Features section and that affect the color pipeline are:

- Media Type and Print Mode: **We recommend selecting HP Proofing media** (either matte, semi-gloss or glossy) **and Best print quality**
- Perform Color Correction: **Select YES** in order to use the Hewlett-Packard Color Management System embedded in the software RIP. If you select NO, color accuracy cannot be guaranteed.
- Color Rendering Intent: Choose the right rendering intent depending on the idea of the print:
  - Use **Saturation** for getting a vivid final output. It is suitable for business graphics (charts, presentations, etc.). Not recommended for color matching.
  - Use **Perceptual** for getting a most pleasing final output from your original RGB image. It is suitable for photographic content.



- Use **Relative Colorimetric** suitable for proofing with CMYK input (when you have selected SWOP, Euro, Toyo, DIC or your press profile as ICC CMYK input). This rendering will provide maximum color accuracy. It is suitable for press proofing
- Use **Absolute Colorimetric** for press proofing (like Relative Colorimetric) but using paper color emulation.
- CMYK Input Profile: Choose the ICC profile to use to emulate your CMYK device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.
- RGB Input Profile: Choose the ICC profile to use to emulate your RGB device. If you select "By default" the CMS of the software rip will apply the settings defined as defaults and that we modified at the beginning of the document.
- Automatic Pantone Calibration: When you want to use the Pantone tables embedded in the software RIP and that gives you the better color accuracy possible with the HP Designjet 10ps or 20ps series printer.
- Ignore Calibration Curves when printing: **Select NO** in order to include in the color pipeline all the information from the color calibration. If you select YES, color repeatability from print to print and from printer to printer cannot be guaranteed.

For further information about the non-related color settings please consult your User's Manual CD.

## 7. Further information

### 7.1 What happens with jobs with color embedded?

Some of the file formats do have color information embedded into the job. Usually, they have information about the ICC profile used to generate the document.

The common files that have this feature are:

- **EPS (Encapsulated PostScript):** EPS files are a combination of a PostScript file plus a set of settings used to create the EPS file. Among these settings there is color information.
- **TIFF (Tagged-Image File Format):** TIFF is a very flexible file format that can have different information. Like EPS, you can combine in the same TIFF file image data and settings and also you can find color settings. For further information about TIFF, visit the web address <http://home.earthlink.net/~ritter/tiff/>

Once we know that, what happens when these files formats are used?

If we import EPS or TIFF images into an application, usually their color setting will not be overridden by the application CMS.

On the other hand, if we import EPS or TIFF images directly into the software RIP (by just drag & drop into the software RIP queue), the color settings of the EPS will override the software RIP's default settings but not the TIFF file. In that case, default values will be applied.

Remember that if you open an EPS or TIFF image using an application, and then you use the Adobe PostScript driver to send the image to the printer, you are not sending EPS or TIFF information but PostScript that does not contain color information embedded. In this case, either you prefer the color management to be done by the application or by the software rip, as we have seen in the previous sections.

## 7.2 Where to find the printer PPD?

A PPD is a file that contains the specific information of a printer. PPD stands for PostScript Printer Descriptor and is only needed for PostScript drivers.

The PPD for the HP Designjet 10ps can be found at:

For MAC : "HDD::hp designjet 10PS:PPD"

For Windows: "C:\Program Files\hp designjet 10PS\PPD\  
(when using the default installation paths)

Similarly, the PPD for the HP Designjet 20ps can be found at:

For MAC : "HDD::hp designjet 20PS:PPD"

For Windows: "C:\Program Files\hp designjet 20PS\PPD\  
(when using the default installation paths)

Also, they can be found on the HP Designjet 10ps or 20ps software rip CD-ROM, in the folder called "PPD"

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