Working with Scans & Digital Camera Files for Professional Printing

With the aid of the DMA standard calibration print this document will enable you to... Calibrate your monitor for accurate print output, configure your computer settings for professional, photo quality printing and gain a basic understanding of output resolutions, colour profiles, file formats and image optimisation routines.

1. How many PPI (Pixels Per Inch) do I need in a scan for sharp prints?

Digital Masters Australasia is the sole NSW supplier of Photo CD and Pro Photo CD film scanning services. Photo CDs scans are supplied as multi-resolution 48bit Lab Colour 'ImagePacs'...

'Commercial Photo CD' ImagePacs: **5x** resolutions up to 2,048 x 3,072 pixels =   **36Mb** 48bit RGB.
'Pro Photo CD' ImagePacs: **6x** resolutions up to 4,096 x 6,144 pixels = **144Mb** 48bit RGB.

Here is a table of print sizes from Photo CD at typical magazine/brochure resolution...

Photo CD	48bit File Size	Pixel Size	Image Size @ 225dpi (150 line screen)		
1/16 Base	144 Kb	128 x 192 pixels	0.57" x 0.85"	or	1.5cm x 2.2cm
1/4 Base	516 Kb	256 x 384 pixels	1.13" x 1.71"	or	2.9cm x 4.3cm
Base	2.2 Mb	512 x 768 pixels	2.27" x 3.41"	or	5.8cm x 8.7cm
4x Base	9 Mb	1,024 x 1,536 pixels	4.55" x 6.82"	or	11.6cm x 17.3cm
16x Base	36 Mb	2,048 x 3,072 pixels	9.1" x 13.66"	or	23.1cm x 36.6cm
64x Base	144 Mb	4,096 x 6,114 pixels	18.2" x 27.3"	or	46.2cm x 69.1cm

The rule of thumb for scan ordering is to request a ppi (pixels per inch) that is 50% to 100% more than the 'line screen' ruling of the 4 colour print process where the image is being used. So if...

Newspaper Images are printed with a coarse 80 line screen we only need a scan of 120 - 160ppi.

Brochure and Magazine Images use a 133 - 150 line screen so we need scans at 200 - 300ppi.

High Quality Art is often printed with a 200 line screen so we need a scan at 300 - 400ppi.

Inkjet Prints 'dither' 4 - 12 colours of ink/pigment 'dots' to emulate the appearance of millions of true colours. Because of this dithering and ink/pigment diffusion in the paper fibres these printers rarely achive more visual resolution than 220dpi (Dots Per Inch). 150ppi to 180ppi is quite sufficient.

Big Poster Prints need remarkably low ppi due to long viewing distances: 150dpi down to 75ppi.

Asy you can see you do not 'Use 300dpi for everything'. 300dpi was the resolution of the first laser printers and it stuck. If in doubt do some resolution tests and see for yourself - You may be shocked!

2. Why do I need to calibrate my system?

Today you can open big RGB (Red, Green, Blue) scans, adjust density, contrast, colour, resize, change file formats and convert to CMYK (Cyan, Yellow, Magenta, Black) for press work. Remember, though, YOU are then responsible for the final resolution, tonality and colour accuracy of the print output.

To ensure your monitor is showing the image as it will actually print buy the best CRT (Glass Tube) monitor you can afford (Sony, La Cie, Mitsubishi, Eizo etc.). and calibrate it. Many LCD displays are not suitable forprofessional colour proofing except for VERY expensive SWOP (Standard Web Offset Printing) certified units. Monitors should be viewed in LOW daylight balance light. Always use a neutral grey screen 'desktop/wallpaper' so you can easily spot any colour casts in the images.

PhotoShop uses industry standard ICC colour profiles for device/print colour matching and 'Soft Proof-ing' (Emulating print apperance on-screen). It also installs an 'Adobe Gamma Control Panel' that will 'walk you through' a BASIC monitor calibration process. For real accuracy though we use and recommend GretagMacbeth's award winning 'EyeOne' display calibrator.

3. Are your PhotoShop 'Colour Settings' configured for professional printing?

PhotoShop is supplied with colour management routines that used ICC colour profiles to assist with screen to print colour matching and allow colourspace conversion for different types of image viewing and output methods. **Unfortunately PhotoShop's default colour setting is sRGB - A limited gamut colourspace aimed at rationalising the colours in images to match the average $150 consumer monitor' sRGB is not suitable professional printing!** Many print imaging professionals soon discovered that this sRGB was stripping their full tonal range RGB files down to a limited colour range, sRGB colourspace - Permanently!

Below is the 'Colour Settings' dialogue box that **YOU MUST RE-CONFIGURE to Adobe RGB** for top quality print output. Your monitor properties/advanced/colour management should also use Adobe RGB.

PhotoShop's 'Colour Settings' should be configured for print...

Color Settings

Settings: Custom

Advanced Mode

Working Spaces
RGB: sRGB IEC61966-2.1
CMYK: Photoshop 5 Default CMYK
Gray: Gray Gamma 1.8
Spot: Dot Gain 20%

Color Management Policies
RGB: Preserve Embedded Profiles
CMYK: Preserve Embedded Profiles
Gray: Preserve Embedded Profiles
Profile Mismatches: ☑ Ask When Opening ☑ Ask When Pasting
Missing Profiles: ☑ Ask When Opening

Conversion Options
Engine: Adobe (ACE)
Intent: Perceptual
☑ Use Black Point Compensation ☑ Use Dither (8-bit/channel images)

Advanced Controls
☐ Desaturate Monitor Colors By: 20 %
☐ Blend RGB Colors Using Gamma: 1.00

Description
sRGB IEC61966-2.1: Reflects the characteristics of the average PC monitor. This standard space is endorsed by many hardware and software manufacturers, and is becoming the default color space for many scanners, low-end printers, and software applications. Ideal space for Web work, but not recommended for prepress work (because of its limited color gamut).

OK
Cancel
Load...
Save...
☑ Preview

sRGB is the PhotoShop default colourspace or 'Gamut'. It is a limited range colourspace for web only. Select Adobe RGB for professional printing!

The '2.1' relates to the monitor 'Gamma' (Not 'Gamut') 2.1 is the contrast of a TV or a low quality monitor. You need g. 1.8 which matches print contrast.

1. **Tick the box:** 'Advanced Mode'

2. **Set Working Spaces:**

   RGB: 'Adobe RGB'
   The most common or 'generic' wide range colourspace with a print Gamma of 1.8 (NOT 2.1)

   CMYK: 'PhotoShop Default' is the most commonly used colourspace. (But check with your print house with each job!)

   Grey: 'Grey Gamma 1.8' The Gamma refers to how the tones are distributed. Prints need a Gamma of g1.8 - a cheap uncalibrated monitor is about 2.1.

3. **Set Colour Management Policies:**
   RGB: 'Preserve embedded profiles'
   CMYK: 'Preserve embedded profiles'
   Gray: 'Preserve embedded profiles'

4. **Tick ALL the boxes:**
   Profile Mismatches etc. 'Ask '

5. **Set Conversion Options:**
   'Adobe ACE' and 'Perceptual'

6. **Tick the box:** 'Preview'

It is likely that your PhotoShop settings have never been configured and the default settings for 'sRGB' are still in place. As you can see in the 'Description' dialogue above: "sRGB Reflects the characteristics of the average PC monitor" (Uncalibrated) & "low-end printers. Not recommended for prepress work because of limited colour gamut"

'Adobe RGB (1998)' is the professional Gamma 1.8, print tonal range colourspace. It is the required colour profile for fine art and press imaging. Check the 'preferences' settings on all your devices, Monitors, scanners and digital cameras to ensure they have not also been set to sRGB!

4. I don't have a monitor calibrator? How do I adjust my screen to match a 'Hard Proof'

If you do not have a monitor calibration device such as a GretagMacBeth 'EyeOne' you can often use 'Adobe Gamma' control panel and hardware controls to adjust your monitor to match a reference print...

Print our 'RGB Calibration Image.jpg' (from: www.digitalmasters.com.au/scrapbook) using PhotoShop's 'Print with Preview'. Tick 'Show More Options' select 'Color Management' The document 'source space' should be 'Adobe RGB'. 'Print Space' requires you to select the appropriate ICC profile for your printer's media set (paper & ink combination). The rendering 'intent' should be 'Perceptual' (for Photographic Images). Make sure your printer driver has the right paper type selected and the driver's 'colour management' is set to 'No adjustment'. (The ICC profile will control the output adjustments).

Allow an hour for ink colours to 'settle' and you have a 'Hard Proof'! In PhotoShop select your media profile in 'Soft Proof - Custom', View the proof alongside the monitor. Open the image in PhotoShop and use the 'Adobe Gamma Control Panel' and monitor settings to 'tweak' the monitor to match. Dead easy - and you can see the actual process at work!

5. I double click on files but they won't open?

Get into the habit of actually 'Opening' a file or document from within an application rather than double clicking on the document's Icon. E.g. Open the PhotoShop Application. (We use PhotoShop 7.0.1 as a reference from here on). Go to the menu bar, then 'File' then 'open' then select the document through the Finder/Navigator and 'Open'. The reason for this is to avoid applications other than PhotoShop opening the image. This is not only annoying but the image will not display accurately on Windows based systems unless you are viewing from within a PhotoShop window. Apple Mac systems calibrate their monitors at the hardware level not the software level but you never know what some applications do to the image display!

6. How do I handle 'Missing Profiles' and 'Embedded Profile Mismatches'?

Now you have set up PhotoShop and your monitor to work to a professional print standards with images you know you are supplying 'print-ready files' but what about those files supplied to you files with 'Missing profiles' and 'Profile Mismatches' (usually sRGB) that you want to optimise for print...
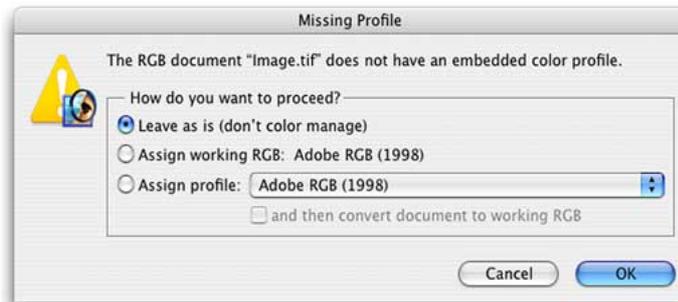
When a profile is 'missing' you have no ICC colour profile 'Embedded' in the image. This happens when the camera file or scan originates from a system with no colour management or the 'Tag' has dropped out after being wrongy saved. **Tick the button 'Leave as is' to see the image with the original colour values.**

When you get a profile 'mismatch' (sRGB) you have a 'Web/Screen' ICC colour profile embedded or 'Tagged' in the image that is unsuitable for Adobe RGB printing. The sRGB file may have originated from an amateur digital camera or consumer digital mini-lab system. (All Digital Masters scans are supplied with 'Adobe RGB' as the source profile and open into the Adobe RGB workspace with no warnings) **Tick 'Leave as is' to see the image with the 'Tagged' colour values then 'Convert' to the Adobe RGB workspace.**

'Convert' to Adobe RGB - **DO NOT 'Assign'** the Adobe RGB profile to move images into the correct **workspace!** By using 'Convert' to Adobe RGB to bring the image into your workspace the image appearance will not change but you will have relocated and changed the numeric values of all the colours and tones to 'Fit' the proper professional printing, Adobe RGB, workspace. Sadly though you won't get back all the extra colours that were not captured when the original image was scanned as sRGB or discarded when a full colour range 'RAW' camera file was converted 'down' to sRGB.

7. Why do my images need sharpening?

When film is scanned the is image softened due to light scatter in optical path, film emulsion causing microscopic flare and the effects of edge aliasing that all scanners create when 'assembling' the image.

The $100,000 Kodak 4050 scanner we use illuminates the film with a laser etched light prism - narrow enough to stop the highlights scattering into the shadows but broad enough to 'wrap around' dust and scratches. It uses the worlds best Schneider Apochromatic Macro lens - but you will still need to apply sharpening.

Digital sharpening creates an 'edge contrast effect'. Adjacent tone boundaries are lightened and darkened to increase the edge contrast. This helps trap printing inks and stop ink colours bleeding together.

Always use a copy of the file or a seperate image layer before sharpening. Use 'Unsharp Masking' (A term from old film-based sharpening masks). View an A4 image at 100%, try 200 - 350% with a radius of 0.6 -1.0. Try thresholds of 1 - 10: Increasing will smooth skin tones and reduce grain but you may get 'water colour painting' effects. Sharpening looks far less in the print.
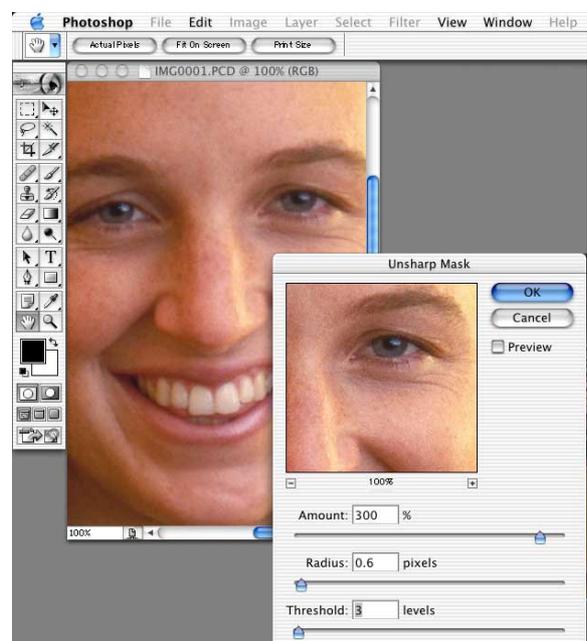
Photo: ©Robert Hamilton. Photography on the Rocks. 2003

8. How do I adjust the brightness and contrast of my scans?

There will be occasions when to want to alter the appearance of a scan by either bringing out more shadow and mid-tone details in a scene or increasing the contrast for more 'punch' or dramatic effect.

Do not use the 'Brightness and Contrast' slider - use 'Adjust Levels' for basic adjustments and 'Curves' for subtle contrast manipulations within the tonal range . Lets use levels to make a quick tonal adjustment...
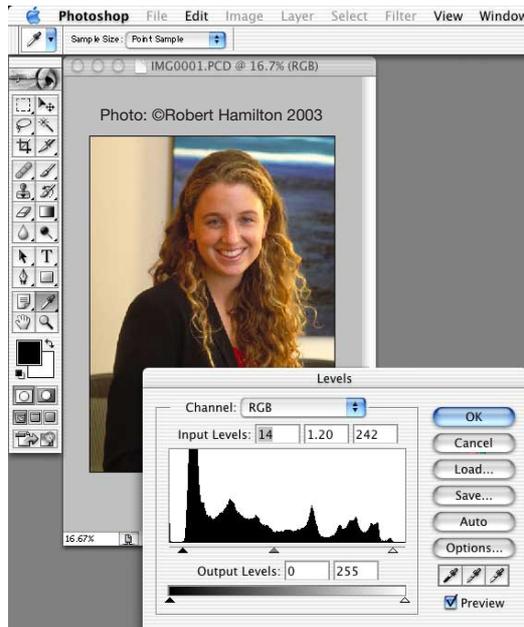
The first thing we do is bring in the black triangle to the left edge of the histogram (the black waveform shape) to ensure the image reaches full black within the shadow areas.

Bringing in the white triangle up to the right edge of the histogram will clean up the highlights and make the image more brilliant but don't 'clip' the highlights and lose details!

The middle grey triangle can be moved left or right to adjust the contrast or distribution of the mid-tones.

The droppers can be used to neutralise shadows, mid greys and highlights. Use with care. The highlight and mid tone droppers are really useful but the shadow dropper can do more harm than good as most film has a colour cast in the deep shadow areas that is best left alone!

Occasionally you may try and bring out detail in the shadows and discover nothing there but grey murk. This happens when you have a scan from a scanner with a poor tonal capture range. Below left is a 48bit Photo CD scan compared with a desktop scanner image. There is full shadow detail in the Photo CD scan - Lightening the other image reveals nothing!
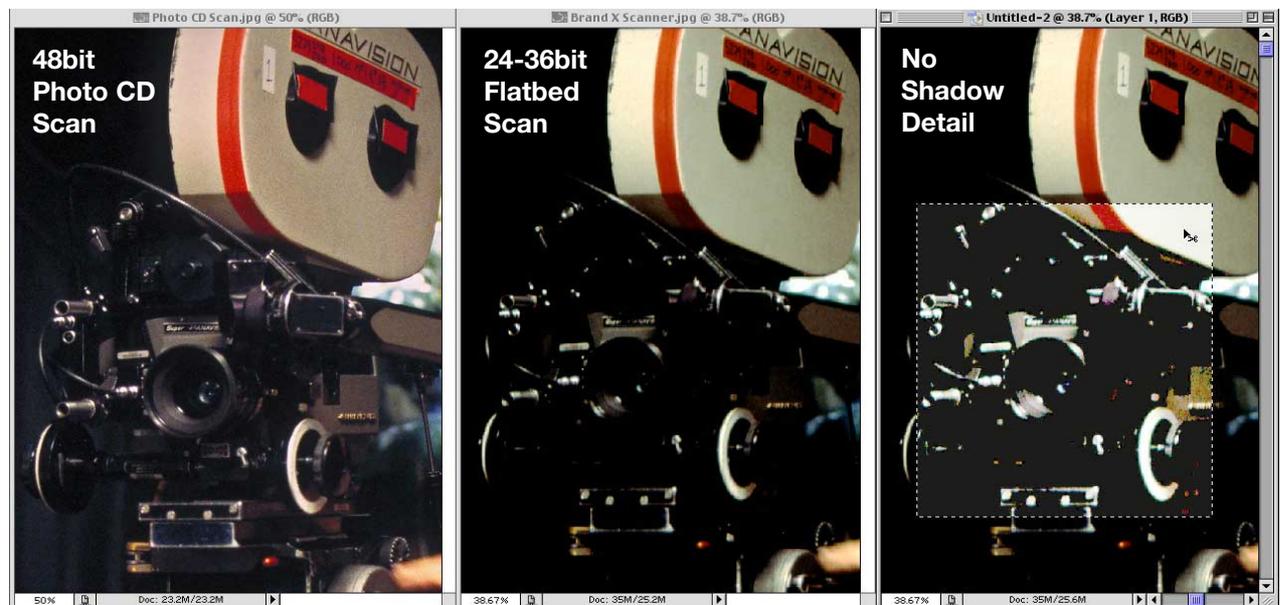
Photo: ©Paul Tiller 2003

9. How do I save files for print and archiving?

Always save a **'Master' RGB .tif** (Tagged Image Format) file of every image. Do not use compression of any sort and **Tick the box 'IBM PC' for Windows compatibility** (Mac systems will still open the file). **Tick the box 'Embed Profile'** (Adobe RGB 1998). This 'Master' file can be opened in any imaging application, 'Placed' into page layouts and should be archived as the 'Digital Master File'. **For security you should also save a .JPG (Joint Photographic Experts Group) version of the same file with minimum compression.** Sometimes the .TIF header in the file can get damaged but a .JPG will often 'Survive'.

10. How do I create extra files for other uses?

If you need a CMYK file, or a smaller image, open the MASTER FILE and 'Save a Copy as...' **Do NOT save over the Digital Master RGB File!** When you sample an IMAGE file down to a smaller size use, 'Bicubic Sampling'- you will also need to add a little sharpening again. If you need a compressed image for eMailing, 'Save a Copy as...' JPG. **Try never to use JPG below level 5** JPG is 'Lossy' compression and you will degrade your image too much. 7+ is best! Don't use JPG copies as a master - Perform all work on the Digital Master then save another copy!

Quick Tutorial: Working with Photo CD and Pro Photo CD Scans...

Kodak Pro Photo CD has been available for over 16 years and is the preferred file format of major Image Libraries, Scientific & Government Archives and Movie Stills Units. All of our Photo CD services originate from a $400,000 Kodak Photo Imaging Workstation using the **PRO** Photo CD software not the amateur Photo CD master software. The Photo CD scans are unique in that the PCD file format is a 48bit tonal range 'ImagePac' in 'RAW' Lab colour enabling ICC profiling and a choice of 5 or 6 resolutions when opened,

The Kodak Pro Photo CD is a special '100 year life' heavy duty gold foil backed disc that can be used over and over until full. All Photo CD scans can be embedded with colour profiles that provide full prepress level colour management. This is the recommended procedure...

Open via PhotoShop's 'Open File' routine...
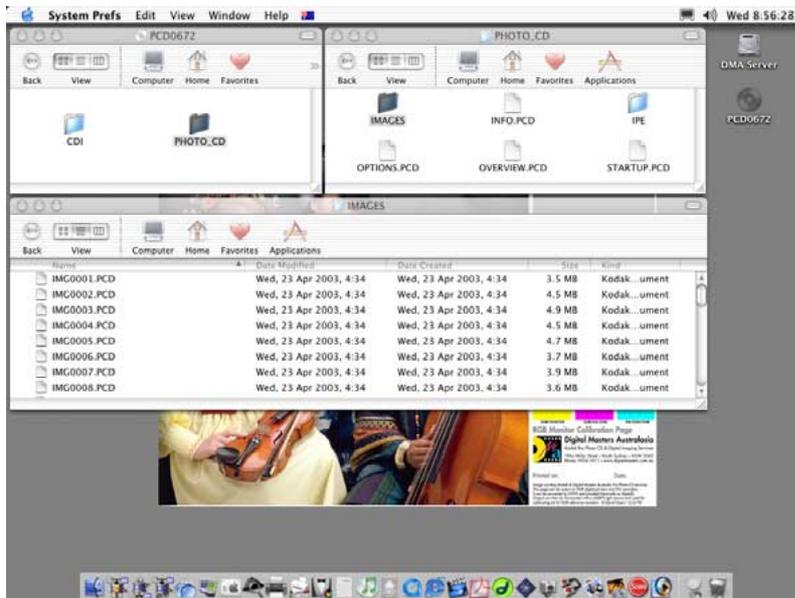
The 'Images' Folder:

The files you should use are in the 'Images' folder which is inside the 'Photo CD' folder.

They are 48 bit Photo CD ImagePacs named, 'IMGxxxx.PCD'

Do not double click the icons as you may be asked which imaging application to use to open the file if your file association parameters are not configured properly.
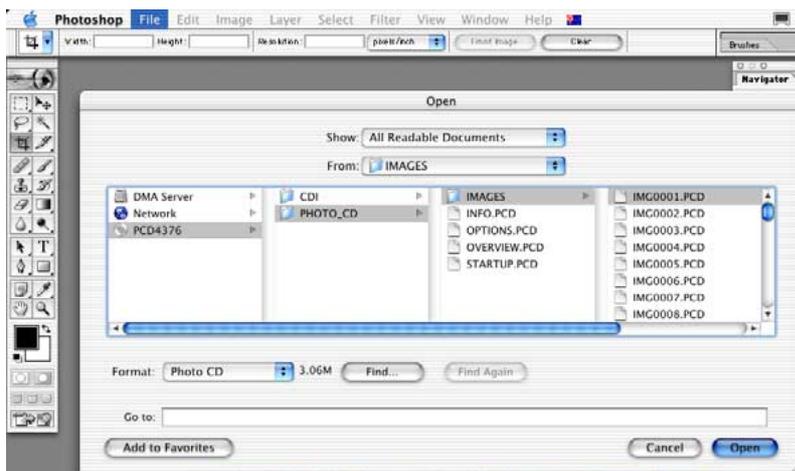
Launch PhotoShop first.

Then open with PhotoShop's 'Open File' routine.
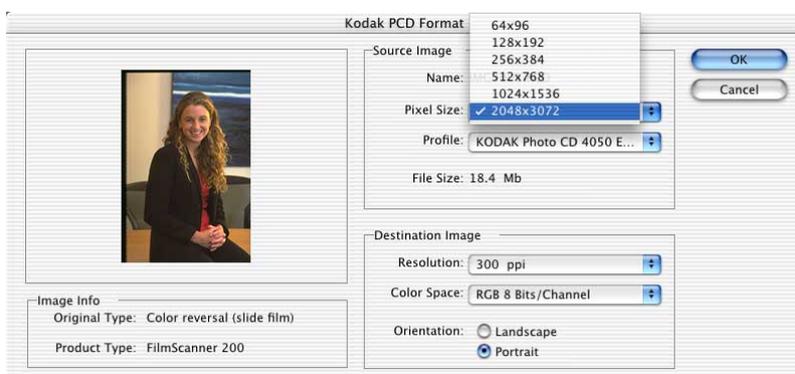
The Photo CD image preview.

First choose one of the five (six with Pro Photo CD) image sizes listed in pixel resolution. Here we have chosen 2,048 x 3,072 pixels which would be fine for an A4 page or an 8" x 10" Photographic Print.

Photo: ©Robert Hamilton 2003
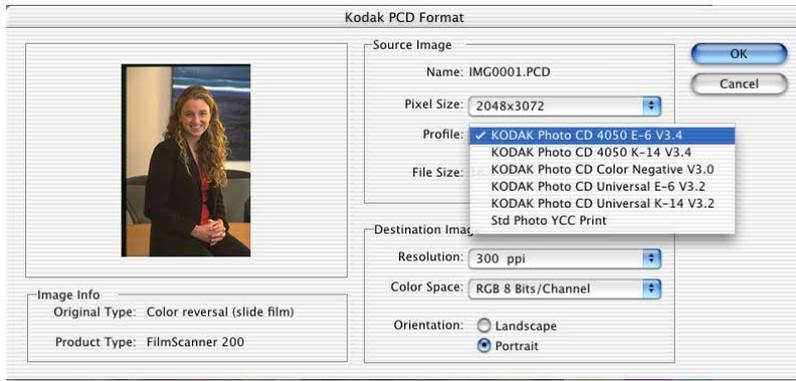
Photo: ©Robert Hamilton 2003

Photo CD colour management.

You can select the profile that matches the source of the image.

We use the Kodak 4050 Pro Photo CD Scanner profile with the 4050 E6 (Ektachrome) and the K-14 (Kodachrome) film profiles.

You can experiment with profiles but NEVER use the amateur 'Photo CD' basic 24bit profile for print)
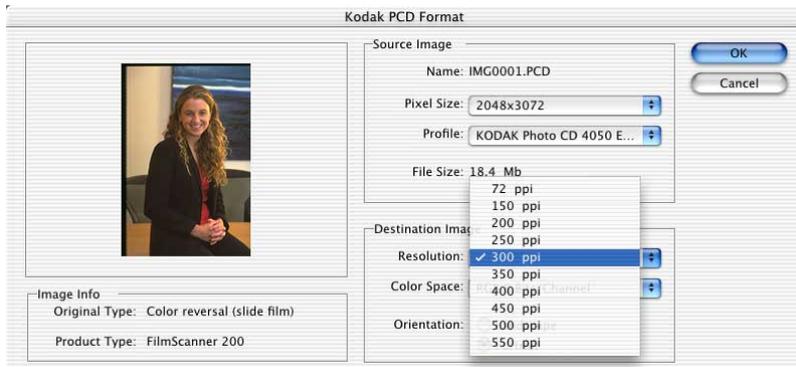
Photo: ©Robert Hamilton 2003

Choose the output PPI.

Here we have chosen 300ppi for use in the client's range of 150-175 line screen pre press publications.

(See page one for info on other image resolutions and sizes)
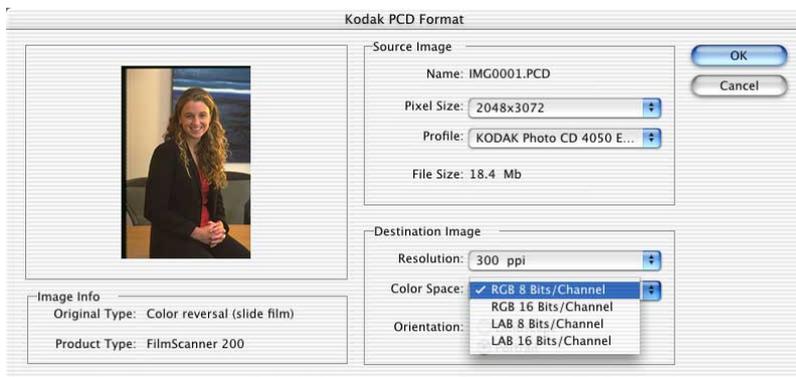
Photo: ©Robert Hamilton 2003

Choose the Destination Colour Space.

Here we have chosen RGB at 8 Bits/Channel (24bit) to suit basic magazine & brochure print specifications.

LAB colour is the biggest (48bit) colour space option. It is is used by Photoshop for colourspace calculations and supplied to museums for 'Digital Master' file archiving.
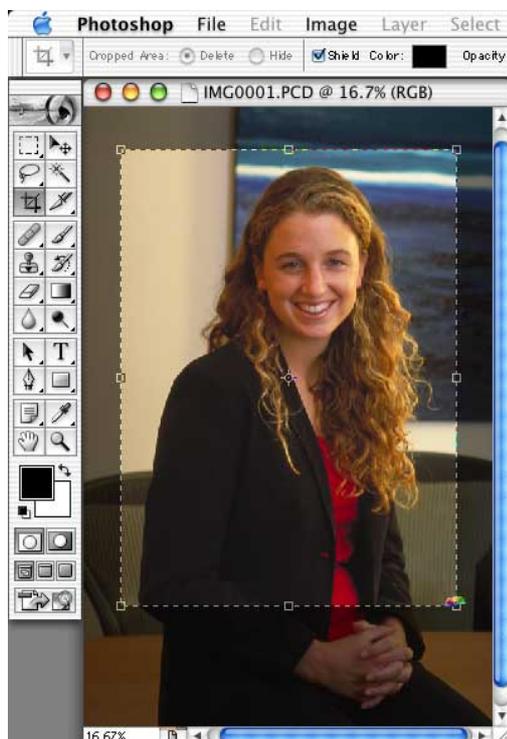
Photo: ©Robert Hamilton 2003

Open the file!

ALL the above settings will be remembered by the software so you only need to enter your image requirements once per session!

Crop the image.

Don't forget that you are now making the image smaller!

The big crop made on the left has reduced our A4 scan down to about A5 or 6" x 8" Always open a big file!

If you need larger image scans choose the 6 Resolution Pro Photo CD service which goes up to A2, (72Mb RGB - 144Mb 48bit RGB).

The crop tool rotates as well so this is a good time to line up any horizons and verticals!
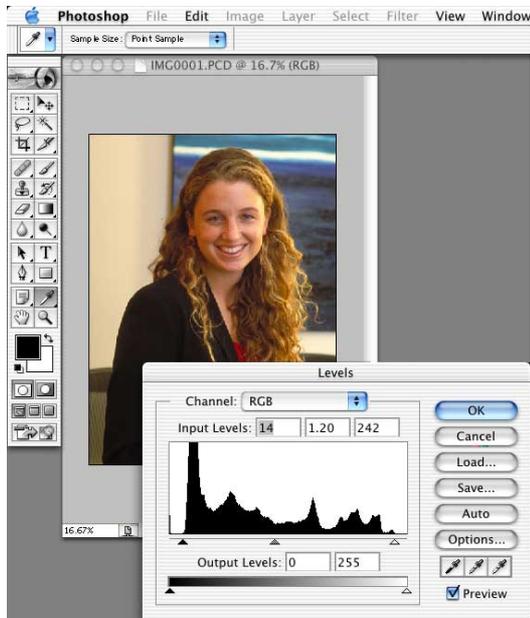
Photo: ©Robert Hamilton 2003

Adjust Image Levels.

Bring in the black triangle to the left edge of the histogram to maximise the black in the shadows.

Bring in the white triangle to the right edge of the histogram to clean up the highlights.

The middle grey triangle can be moved to adjust the contrast.

The eye droppers can be used to neutralise highlights and midtones. The shadows dropper is often best left alone!

Tip: hold down the option/alt key when using highlight/shadow sliders to visualise the hi/low range!
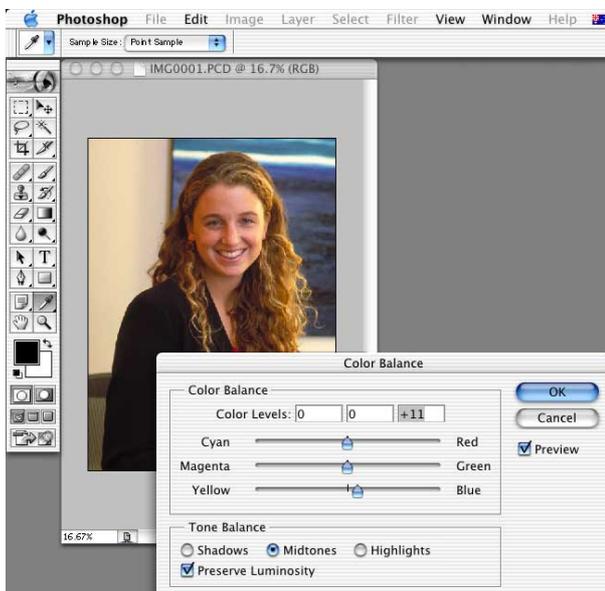
Photo: ©Robert Hamilton 2003

Adjust Colour Balance.

Using the RGB sliders we can adjust the colours to suit our preferences or get rid of colour casts from mixed lighting.

Here we are removing some yellow from the interior tungsten lighting on the right.

Remember that you can select small areas to apply local colour corrections!

Tip: If you use the highlight & midtone eyedroppers you may not need any colour correction.
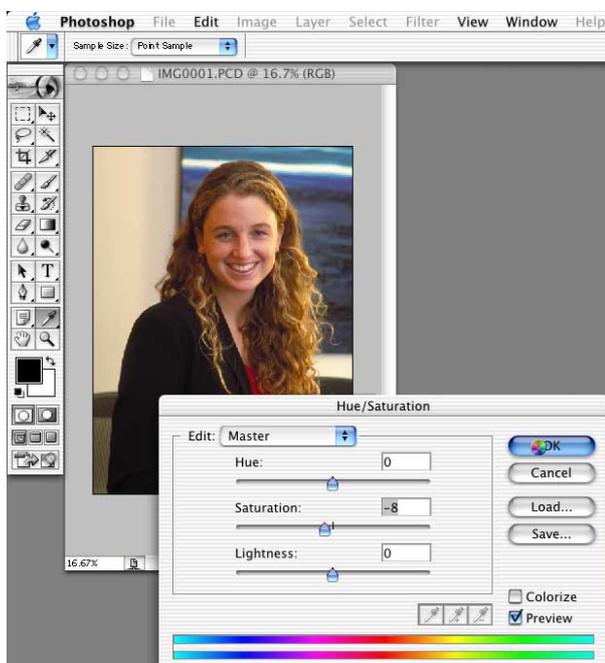
Photo: ©Robert Hamilton 2003

Adjust Saturation.

People often forget this one. Skintones often benefit with a little less and Tourist Scenes and some product shots can take 15 - 30% more.

Make sure you monitor has not faded with age or you will overdo it!

Tip: Saturation, Colour Balance and Levels can be applied within 'non-destructive' layers called, 'Adjustment Layers' in case you wan't to change the settings back a little after final proofing!
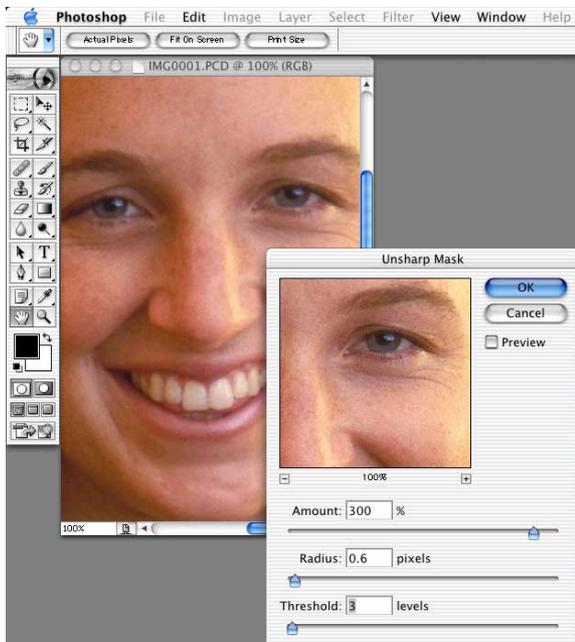
Photo: ©Robert Hamilton 2003

Sharpen with Unsharp Masking.

All scans need some sharpening. Photo CD scans are supplied RAW to allow for image retouching.

If you intend to do a lot of image retouching don't sharpen yet. Leave this stage until you have finished the job and run off a final 'scaled-to-print' file!

USM allows full control over sharpening effects and lets you smooth out film grain and areas with skintones.

Always work at 100% view.

Here we have selected a relatively high sharpness of 300% but this is offset by small radius of 0.6 and a threshold setting of 3 is used to keep the film grain smooth.
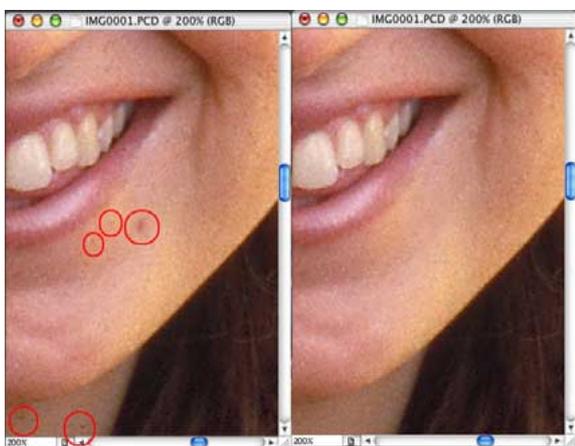
Photo: ©Robert Hamilton 2003

Digital 'Spotting'.

In the old days we used a fine brush to put spots of dye on prints to cover dust specks: 'Print Spotting'

No matter how well film is cleaned before scanning there is always some embedded dust & scratches needing 'Digital Spotting'.

By spending a few minutes with the 'Rubber Stamp' tool and the 'Heal' brush you can clean up the image.

A good time to be a hero and remove any small skin blemishes!
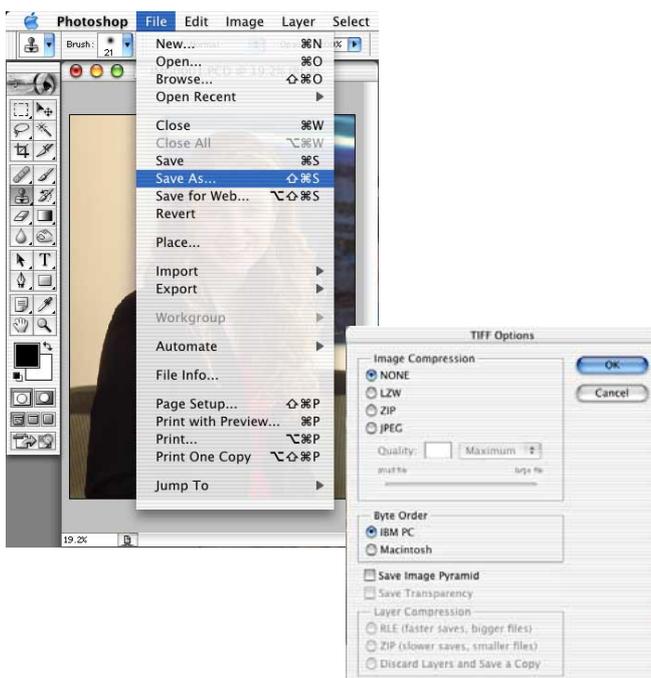
Saving Files.

Your image is still called 'IMG0001.PCD' so you need to save it with a suitable name.

For maximum compatibility save the file as TIF with NO image compression and as IBM /PC for Windows applications and tick: 'Embed Colour Profile: 'Adobe RGB'.

This file is now your MASTER file for archiving. You can convert extra COPIES of this file to CMYK, sample them down, or compress them for eMailing but NEVER save over this master file and degrade it. CMYK files, sRGB files and JPG compressed files can NEVER be restored to a quality level as good as the Master Adobe RGB TIF file!

Questions regarding this document can be eMailed to David Myers: david@digitalmasters.com.au

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LUCAS FILM Starwars Episodes II and III Volume Pro Photo CD Scanning
BAZMARK FILM Moulin Rouge StockCube™ Pro Photo CD Scanning & Image Database
NSW FILM & TELEVISION OFFICE StockCube™ Locations Database,
volume scanning, digital reprography, Imaging & training
SOUTHCORP Development of wine products Photography & Product Lighting Standards
NSW UNIVERSITY NEPEAN Design of Imaging Labs and Supply of Equipment
NSW COLLEGE OF FINE ARTS StockCube™ Pro Photo CD Scanning & Image Database
APPLE COMPUTER Product Launch Presentations
BELL SOUTH (Pre Optus) Australian Third Carrier Proposal Presentations
OPTUS Launch & Distributor Presentations
TELSTRA Corporate Presentations
BHP Corporate Presentations Image Library
NESTLE Digital Photography, Imaging & Presentations
MINOLTA Digital Photography, Magazine Advertising & Poster Design
CANON Pro Photo CD Image Library
LAND ROVER Discovery Launch Presentations
MITSUBISHI Pajero Launch Presentations
PEUGEOT Car Launch Presentations
NISSAN Truck Launch Presentations
HYUNDAI Car Launch Presentations
BRITISH AIRWAYS Promotional Presentations
WESTFIELD Retailers e-Commerce Imaging Solutions
BAULDERSTONE HORNIBROOK Pro Photo CD Image Library
PACIFIC POWER Pro Photo CD Image Library
STATE RAIL City Link Launch Presentations & Imaging Systems
Dpt. MINERAL RESOURCES Pro Photo CD & Digital Reprography of Historic Glass Plate Library
DAVID MALIN IMAGING Pro Photo CD Scanning for Leading Astronomy Publications & Image Library
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