

# Creating your ICC Colour Profiles

Ian Calhaem, Forensic Imaging Limited, Auckland

---

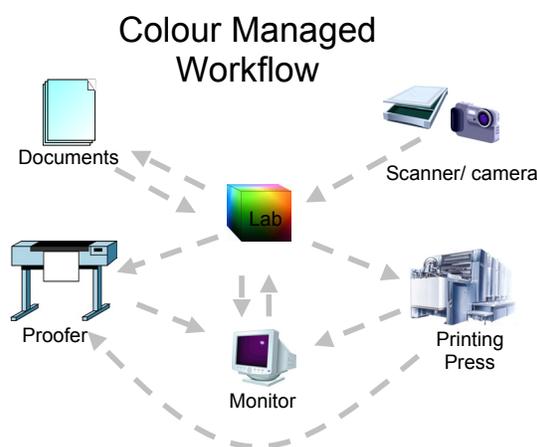
An ICC profile is a software description of how a particular device handles colour. It contains a map of what colours are printable and how the colours should be changed if an unprintable colour is sent to the device. A profile can be considered to be a description of what happens to a colour as it passes through each part of the system.

It is important to remember that a colour profile allows you the user to obtain consistent colours from a number of different devices, but it does not colour correct a poor image. At best, colour management will alert you to a poor image before it appears on the Press.

As shown in the diagram below, where each arrow represents an ICC profile, the workflow must allow for colour transformations in different directions. For instance, the monitor can be both an input device and an output device.

## Monitor Profiles

Programs such as Adobe Gamma are designed to create a simple colour profile for the monitor. These were bundled with some versions of Adobe Photoshop and other software. However, they are based on the assumption that the monitor conforms to a generic standard, and this is seldom if ever the case. Such profiles will be of limited quality and should certainly not be used for colour editing. When establishing a full colour managed workflow it is important to turn off any program that tries to create and manage the colour output to the screen.



For a windows based computer Adobe Gamma is turned off by removing the shortcut from the startup folder, whilst on a Macintosh it is turned off by removing the appropriate extensions from the extension manager.

An accurate monitor profile can only be created using specialised hardware and software. The hardware – a spectrophotometer, is a precision instruments and expensive. If you are viewing only, and not editing colours on the monitor, an alterative solution is to use a system developed by the colour-manufacturing experts GretagMacbeth – ICSync\*. This product consists of profile making software and specially calibrated film swatches. The eye is used as the measuring instrument to compare the colour on the monitor with the colour of the swatch.

This does not produce the same quality profile as would be obtained with a spectrophotometer, but is still far superior to that produced by pure software such as Adobe Gamma. It is available for both Macintosh and Windows computers, but only for CRT monitors. Flat screen monitors (LCDs) require full instrument calibration due to their non-linearity.

A full instrument calibration is created by first linearising the monitor, and then measuring the colours produced by special software that displays a series of known colours. Different sets of colours are used for different types of monitor. The lcd monitor uses many more colours than are needed to profile a crt monitor. The colours are measured using a spectrophotometer.

Most profiling software will automatically install the monitor profile into the operating system. Applications such as Photoshop 6 and above will then use this profile for display.

When a profile has been created for a monitor it is important to understand that you must not touch the brightness and contrast controls – otherwise a new profile will be needed! I recommend labelling calibrated monitors to tell users to leave the controls alone.



**WARNING!**

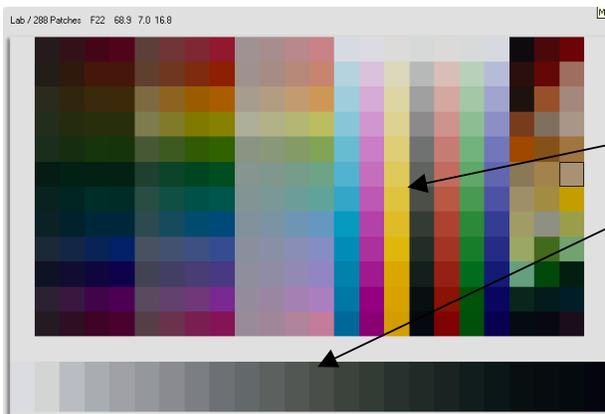
This is a calibrated Monitor  
do NOT alter contrast or  
brightness controls

**Scanner and Camera Profiles**

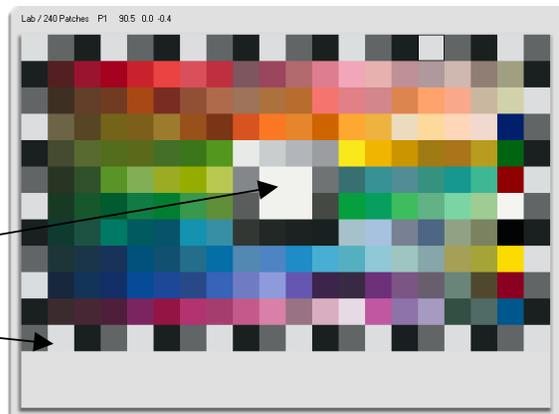
Scanners and Digital camera are profiled in a similar way to the monitor, except that the target is a physical colour chart of known measured colours. Just as different colours were used for different types of monitor, so too are different charts used for different scanners and cameras. It is important to scan the test chart using the same workflow as will be used in production. I.e. if the camera usually produces jpeg files, then the test chart should also be a jpeg. However, since jpeg format is lossy and colours will be altered, it is recommended that tiff format be used when colour is important.

Since most devices are unable to load a profile directly into the image, this is usually done in Photoshop (or equivalent) by assigning the appropriate profile on input. In photoshop this is done by choosing “do not colour manage” as the input option, then choosing “image – assign profile”.

Few scanners and cameras provide a linearisation function. It is therefore even more important to ensure that the test chart contains suitable colour swatches to allow the profile to correct the linearisation.



**Scanner target**  
Linearisation swatches  
Colour and grayscale



**Camera target**  
White balance target  
Linearisation swatches

## Proofer Profile

To profile a proof printer, it must be first linearised, and then a test chart of known colours is printed. It is important to ensure that the printing process is the same as will be used later for the actual proof printing with one exception... all colour management in the application should be turned off but linearisation should be on. Only the high-end proofing devices allow for linearisation.

The spectrophotometer is then used to measure the printed colours and the profile is created using special profiling software.

This profile is then installed in the operating system as part of the printer driver software. Details of how this is used for digital proofing will be explained later.

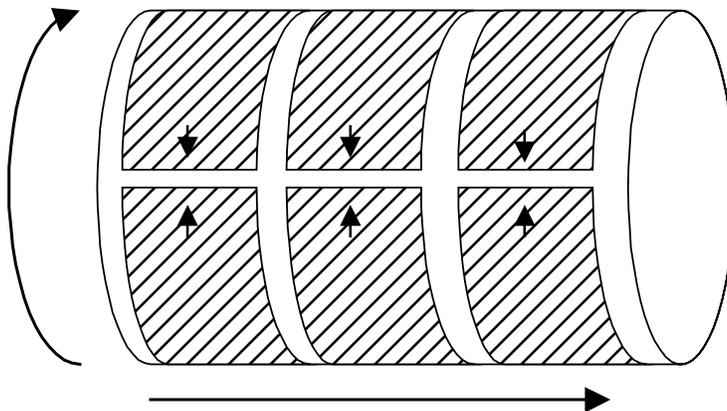
## Profiling a Press

As with the other devices, the first consideration is to ensure that the press has been linearised. However, a press is more complicated to profile than other devices. In fact the press profile is often referred to as a system profile and not a device profile. The reason for this is that a number of factors outside the Press itself affect the Press profile.

Linearisation is achieved by creating a test file containing defined percentages of each of the ink colours, usually cyan, magenta, yellow and black. This file is output through the rip with all colour correction turned off. Plates are created and the output is printed on the press. The densities are then measured and a linearisation curve is calculated for each colour. These are installed in the rip and the file is output a second time, with the correction turned on. If the linearisation has been successful, each of the swatches will now correctly represent the input percentage. I.e. a 10% dot will output as 10%, and so on.

In practice, the output will show variations across the press and around the cylinder. It is therefore important to layout the test page so that the variation can be averaged in both directions.

This process should be carried out for each cylinder.



Once the press has been linearised it is time to output the test charts and build the ICC profile.

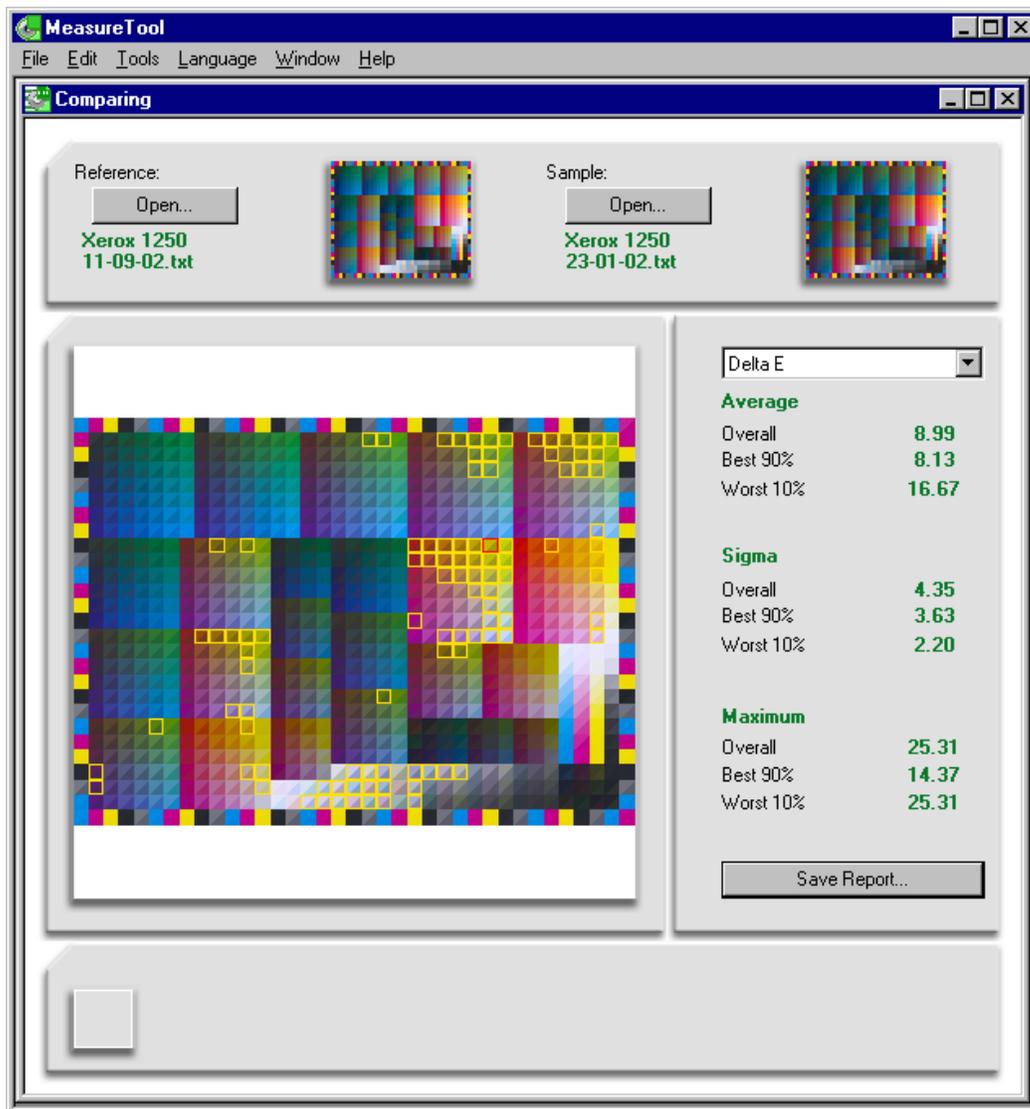
It is important to print the test chart across and around the cylinder, as was done for the linearisation pages. It is usual to print the pages head to head as shown by the arrows as this assists in measuring any variations across the cylinder. Profiling targets should be printed on one side of the paper only.

The test charts should be printed on a press that has reached its normal operating condition e.g. has had time to warm up. A good strategy is to print the test chart at the end of a normal commercial job. Several test charts should be collected from each cylinder so that the results can be averaged.

Each chart is then measured using a spectrophotometer to record the spectral content of each colour swatch. This is a time consuming task and there are no shortcuts. It is a task that is worth doing well to obtain a good reliable ICC profile. When measuring, place a few sheets of the paper stock behind the target to ensure that there is no show through.

The colour bars around the edge of the charts are measured and used to compensate for slight variations in ink duct settings across the cylinder.

Charts from each cylinder are then compared to ensure that consistent results are being obtained and then the charts from different cylinders are compared. On a properly set up press the variations between cylinders should be small. However, the process of profiling a press often reveals defects, such as incorrect blanket pressures on one of the cylinders. This should be corrected before reprinting the charts. One of the positive outcomes of creating a colour profile for a press is the press knowledge that is gained along the way.

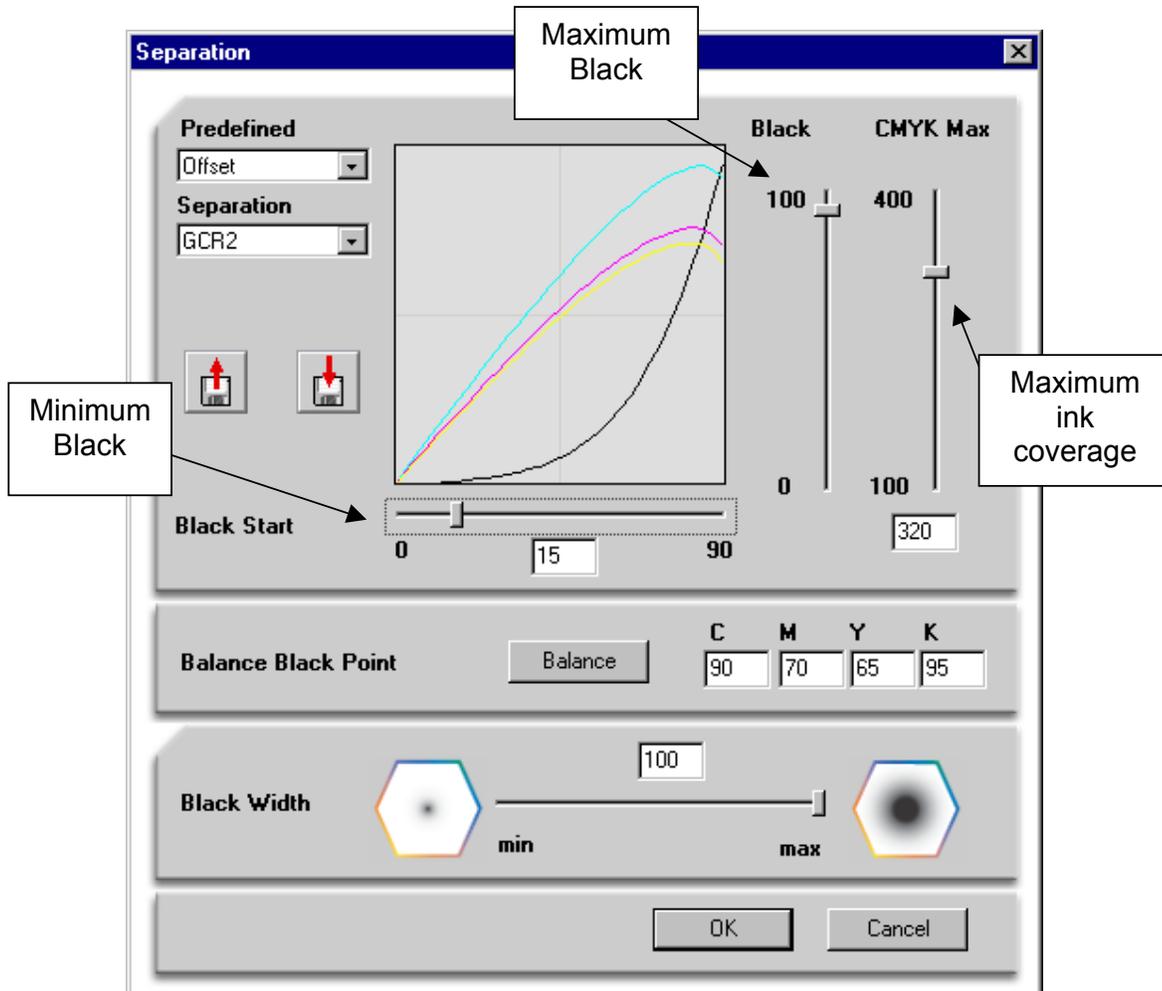


The difference in colours is measured in terms of Delta E, the distance between two colours measured in 3-dimension colour space. A rule of thumb is that two colours are said

to match to the human eye if the Delta E is 3 or less. In the sample comparison shown above, the charts are a poor match and the variations are easily detected by eye.

When consistent results have been obtained from all cylinders, it is time to create the profile.

The results from each cylinder are averaged and the results are then compared to the theoretical values defined on the test chart. The profiling software then uses these values to calculate the colour maps. It is also necessary to input the desired settings for items such as GCR, minimum black replacement, maximum Black, and total ink coverage. These are functions that vary with the type of press and the paper stock. E.g. newsprint is more absorbent than offset paper and therefore requires a lower total ink setting.



Finally, after all the hard work you will have created an ICC profile for your press. It is worth checking the colour gamut and measuring a number of spot colours on the test chart to ensure that the rendering intents are working as intended, and that no obvious errors exist in the colour mapping. However, further testing will be carried out when this profile is combined with the digital proofer profile to produce colour-managed proofs.



# Colour Management

LET FORENSIC IMAGING MAKE COLOUR MANAGEMENT WORK FOR YOU

Ian Calhaem ph (09) 579-0512 Mob (025) 936-785 Email <a href="mailto:IanCalhaem@Forensic-Imaging.co.nz">IanCalhaem@Forensic-Imaging.co.nz</a>	David Brown ph (09) 528-2318 Mob (021) 594-715 Email <a href="mailto:David.Brown@Forensic-Imaging.co.nz">David.Brown@Forensic-Imaging.co.nz</a>
--	--

