TECHNICAL GUIDE

COLOUR MANAGEMENT

DEVICE CALIBRATION

Second Edition

FESPA
profit for purpose

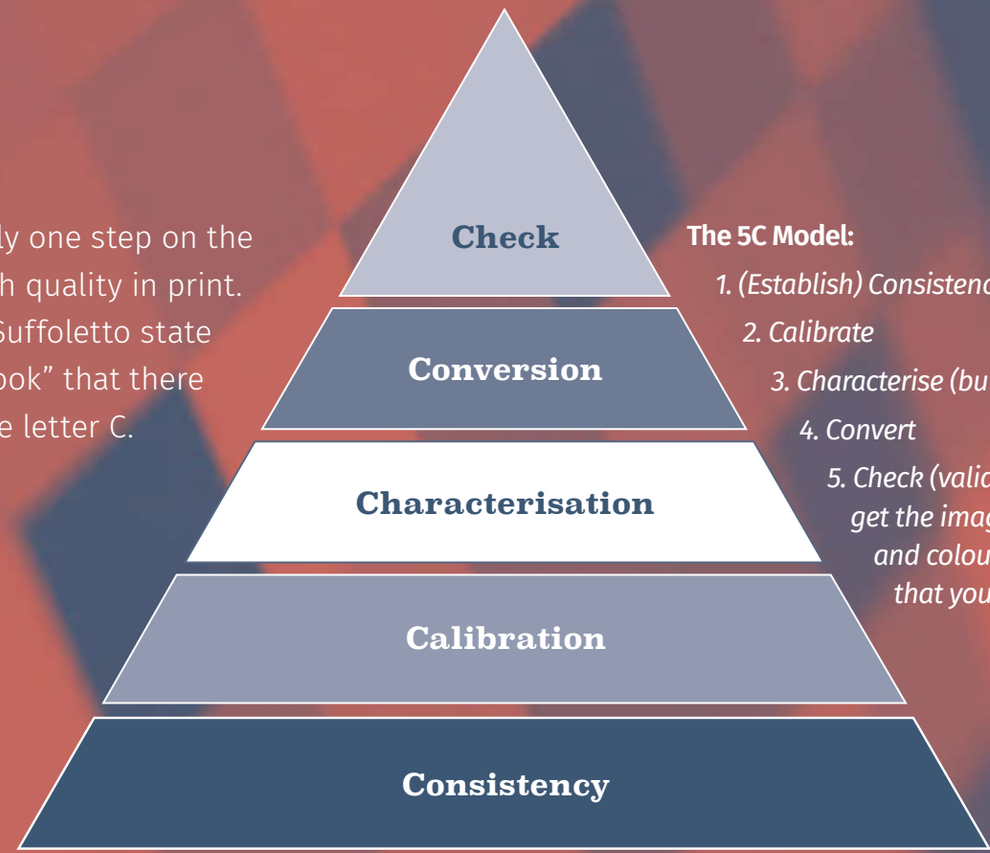
Calibrating your colour devices

For a printing company, one of the key skillsets required is the ability to efficiently and accurately manage colours. This normally includes being able to reproduce photographic images in a pleasing and realistic way. It requires careful handling of brand colours used for example in logos, so they are accurately reproduced with no or close to negligible colour deviation. But it's not good enough to be able to this just on a good day, a one-off lucky shot.

To be profitable over time you must be able to establish a colour quality level that offers both predictability and repeatability, day after day, week after week. In order for this to be possible we need to understand how to calibrate each colour related device in the workflow to it's optimum, and maintain this state over time. A device operates in the context of an environment, in a workflow, which means we need to have a strategy for colour management that includes the whole workflow and the environment where the devices operate. This strategy can be achieved by applying the 5Cs of process control.

The 5Cs

Calibrating a device is actually only one step on the way to achieve consistent and high quality in print. The authors Adams, Sharma and Suffoletto state in the “Color Management Handbook” that there are four steps, all starting with the letter C. To that we add a fifth, Check.



The 5C Model:

1. (Establish) Consistency

2. Calibrate

3. Characterise (build ICC-profiles)

4. Convert

5. Check (validate) that you get the image quality and colour accuracy that you expected

Calibration is just one of the five major steps to ensure that a device can be colour managed in an accurate and reliable way.

Consistency

Consistency includes making sure the environment is suitable for the device, and identifying all parameters necessary for the stable and predictable behaviour of the device. Establishing consistency in wide format digital printing includes some obvious requirements like well maintained printheads for an even and constant flow of ink. But there are other perhaps less obvious needs. Before installing a wide format digital press we need to ensure that the very foundation of the press is stable and strong enough. Remembering that the two most problematic factors which will prevent a machine behaving consistently are vibration and heat, we need to ensure that the floor itself is both solid and extremely even. To achieve accuracy across the whole print area of a wide format flatbed press, the floor it stands on must be perfectly even, which may not always be the case in general industrial buildings.

As for temperature it is a good idea to install temperature control, and this goes for humidity as well. To keep temperature and humidity stable and within the ideal range is key for the predictable behaviour of print substrates which are the most significant factor influencing colour appearance. A general rule of thumb says that a temperature of around 20° C and a humidity not below 50% is good for humans, printing machines and most substrates. If the humidity goes well under 50% the risk of banding and other problems increases significantly.

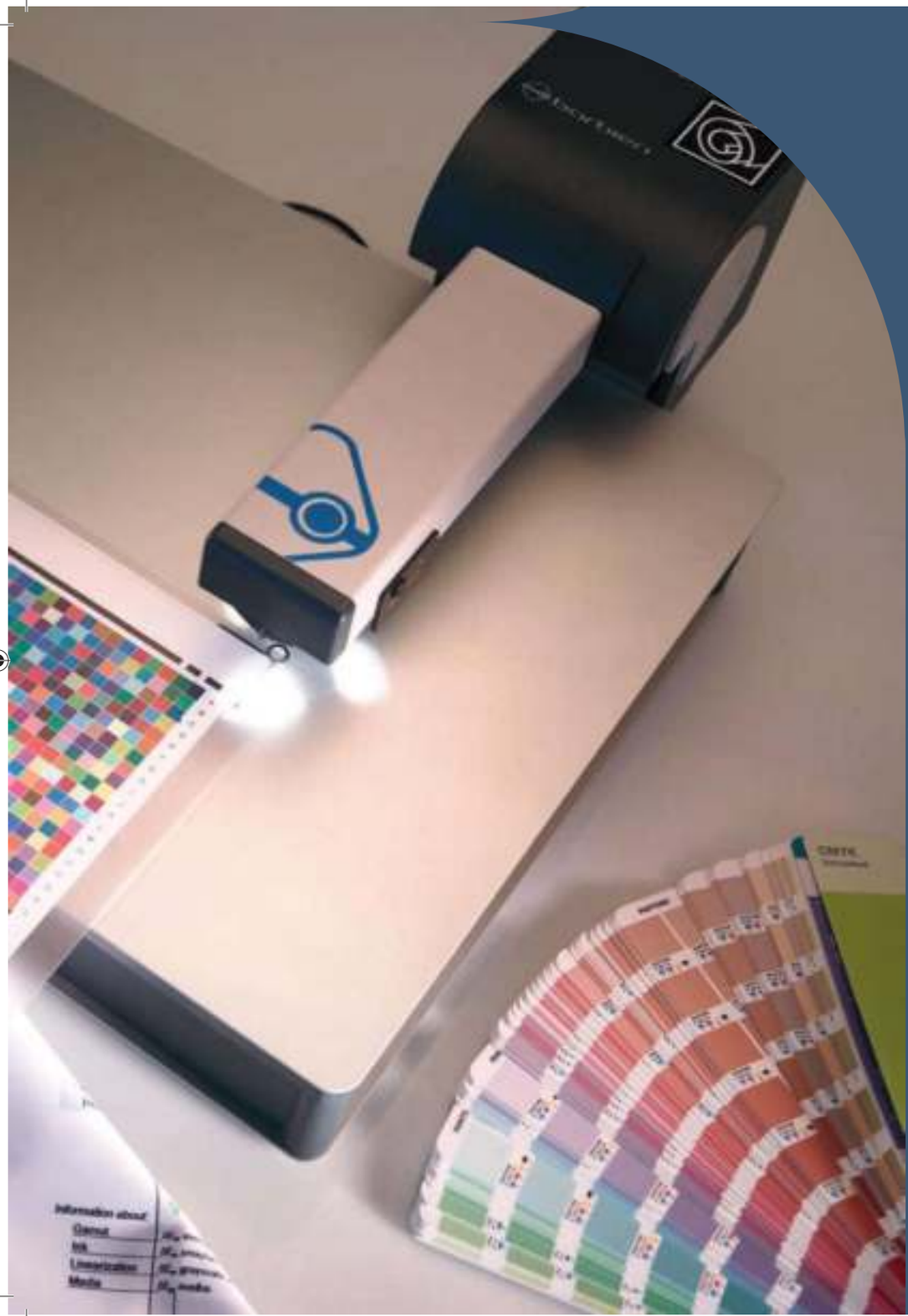
Other devices need to be checked for consistency and vulnerabilities according to their function. For example a viewing booth is difficult to calibrate, but we can check at what interval the tubes need to be replaced, and make sure that the booth's care is in line with the manufacturer's recommendations for service and maintenance. A viewing booth should not stand close to a window for instance, since the light outside will vary, and so cause inconsistency when evaluating prints and proofs. The same goes for a monitor used for softproofing. It shouldn't be used close to a window or other strong light sources, and it should always be equipped with a hood to cut out ambient light.

Calibration

The second C stands for Calibration. Depending on the technology used in the printer, this can include alignment of the printheads, testing out the optimal amount of ink laid down on a certain substrate, suitable shuttle speed for a certain print mode and so on. Once those crucial parameters are established, linearisation is required to ensure that for example 50% cyan really comes out as 50%, give or take 1%. This is to be certain that the whole scale of tinted colours comes out as it should including mid, quarter and three quarter tones.

When performing calibration and linearisation it is necessary to use the right tool. In most cases this is a spectrophotometer, which can also act as a densitometer, but not all spectrophotometers are suitable for all types of substrates. For example when calibrating the printer to print on glass or transparent plastic, you will need a special type of spectrophotometer designed for such measurements, for example the Barbieri Spectro LFP.

The Barbieri Spectro LFP can measure both reflective and transparent substrates and supports scan mode.

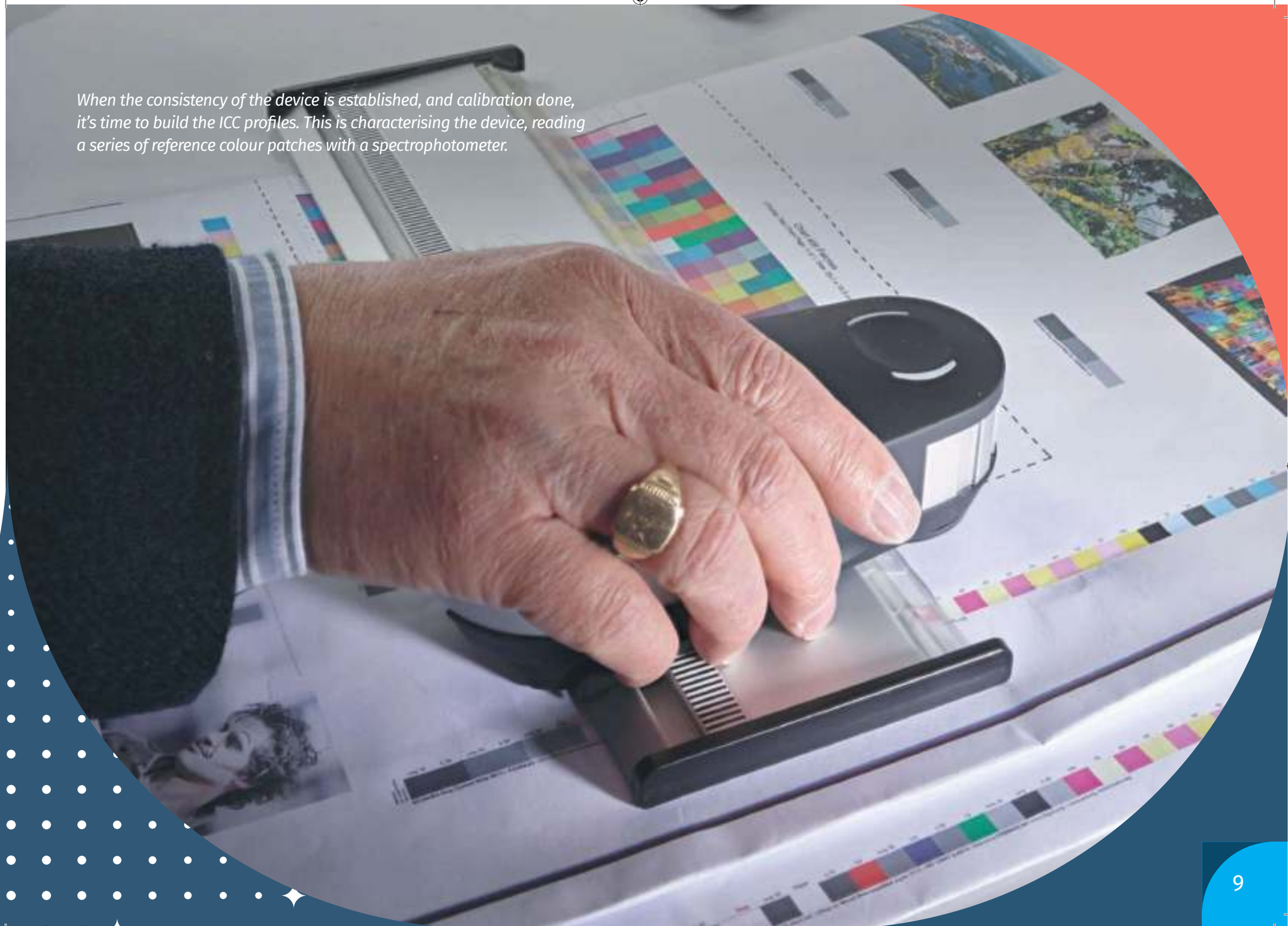


When calibrating a monitor the linearisation stage is where you make sure the greyscales are reproduced smoothly, following the gamma value you have decided on. You may also need to calibrate the measuring device itself, at regular intervals. If you use several measuring devices you should make sure they measure colours in the same way. This is called checking for inter-instrument accuracy. In the worst case if one of your measuring devices is faulty, it will lead to the faulty calibration or validation of a device. This is avoided by regularly checking the inter-instrument accuracy.

Characterisation

Once the device, for example a printer, is correctly and carefully calibrated it's time to create ICC profiles. We use the technology developed by the International Color Consortium (ICC) to do this, and the process is called characterisation, the third C in the 5C model. Normally characterisation is done by printing or displaying a series of colour patches, and then measuring them using a spectrophotometer suitable for the type of substrate.

The numeric equivalents of the colours are described in the ICC profile and we can then use the ICC profile to simulate the final printed colour results on a high end, colour accurate monitor, for instance to proof them. Alternatively we can simulate the printed result on another press or printer, if we use an equivalent substrate. ICC profiles also convey the characteristics of a certain printing condition, so it's important to save the metadata that describes all the parameters that were applied when this particular ICC profile was created. This includes substrate, print mode, resolution, ink, black generation used (UCR or GCR), and Total Ink Coverage, TIC (also called Total Area Coverage, TAC). It's only possible to achieve colour consistency over time, if we keep track of the key parameters and settings required to reproduce the very same colour appearance later, using a particular ICC profile.



When the consistency of the device is established, and calibration done, it's time to build the ICC profiles. This is characterising the device, reading a series of reference colour patches with a spectrophotometer.

Conversion

Now we are ready for the fourth C, Conversion. There are many ways to describe colours in the workflow, including brand colours. Photos might be in RGB, as captured with a digital camera, or converted to some variation of CMYK. But very seldom is the colour the blend we will need in our particular printer. Corporate logos are often colour coded with the special spot colour they ideally should be printed with, but this colour is commonly converted to a CMYK mix using the inks in our printer, which will produce an as close as possible match. This means that the incoming artwork's colour encoding needs to be converted to the closest match when using the inks in our wide format printer, for instance. This conversion can be done beforehand by the designer or client when they create a PDF that is ready to print, as long as they have the correct settings which should ideally have been communicated in advance.

Conversion can also be done later in the process, if it isn't exactly clear which substrate or print engine will be used for the final output. A modern Raster Image Processing (RIP) system will have a colour management module that can take care of this step, and if properly managed, we will have an end result that matches expectations. The beauty of using ICC profiles correctly is that we can decide on a reference standard. With a reference standard we can reproduce the same results on many different devices, getting a predictable and consistent colour appearance across multiple output paths. Alternatively we can optimise the colour conversion to use the full gamut of the device and create photorealistic reproductions, using the full capacity of that printing device. This is especially attractive for output onto wide format digital devices with a very high output gamut.

For spot colours the ICC profiles help us to achieve as close a match as possible when using a CMYK colour mix, but we might need to finetune this by building a special spot colour library. This allows us to reach the smallest colour deviation possible on the printer. Many digital printers can use additional inks to reach an even larger gamut than is possible just using only the CMYK inks, and when properly managed this benefits the reproduction of spot colours.

Colour Quality Control

If we apply the 5Cs, including checking, to our colour quality strategy, and keep track of all the parameters needed to set up the RIP that drives the printer, we will achieve reliable colour consistency.

This is what brand owners and print buyers want from their print service providers. It is definitely a challenge, but with good housekeeping and suitable training your staff can absolutely achieve it.

Published by FESPA Limited
Holmbury
The Dorking Business Park
Station Road
Dorking
RH4 1HJ

t +44 1737 240788
f +44 1737 233734
e info@fespa.com
www.fespa.com

FESPA
profit for purpose