Color Management Systems

TECHKON APPLICATION NOTE 9

1 Why Color Management ?

The availability of cheap color scanners and printers has caused a boom in the usage of color in desktop publishing. Unfortunately, these devices haven't always been able to faithfully reproduce colors. A scanned color picture often shows different colors on the computer monitor. Similarly, a color print-out differs from the original or from the printed output of a printing machine. Reproducing the colors or the master generally requires laborious post-processing or adjustments.

A color management system makes the various color-processing devices such as scanners, digital cameras, color printers or offset-printing machines speak the same language in terms of the color information that is to be processed, thus ensuring optimal color conformity. Colors can thus be processed digitally with ease and without the need for manual corrections.

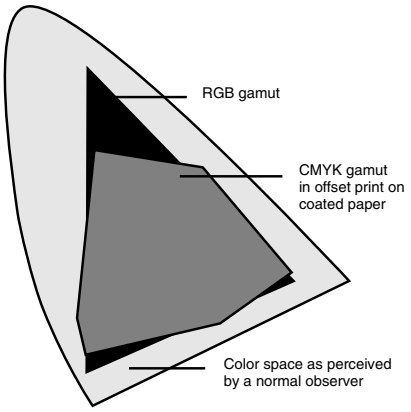
2 Causes for color inconsistencies among the various components

Each color input and output device interprets color information specifically due to differing technologies.

An RGB-scanner, for instance, defines each individual image element with three values for the sum of the primary colors red, green and blue. A sensor supplies the values for each color. Depending on resolution and manufacture, two different scanners will transfer different RGB-values to the computer for the same color master. Monitors, too, display colors by using shares of red, green and blue. Individual color jets control the mix for each pixel. RGB-color systems are not standardized. Equal RGB-values may show different colors on different monitors.

Printed images are generally created by printing the process colors cyan, magenta, yellow as well as black. The output devices receive the color information in terms of four values for the shares of C, M, Y and K (each ranging from 0 to 100%). In turn, the actual color printed depends on different device-specific parameters such as print matter, type of ink, ambient temperature, etc.

In addition, each input and output device features a certain color gamut which determines which colors from the theoretic color space are actually processed, resp. displayed. The color spaces of different components do not conform with each other. Certain colors appearing on a screen may not be reproduced in offset-print *(Picture 1)*.



Picture 1: RGB and CMYK gamut in the Lab-color space

3 The ICC standard

The problem mentioned above has been solved by describing color information in an absolute color space regardless of device and by characterizing (resp. profiling) the components involved in the color process, such as scanner, digital camera, monitor and printer.

Leading companies from the computer and printing industry have convened the **I**nternational **C**olor **C**onsortium (**ICC**) to create a standard color management system independent of device and platform. The standard is based on the description of measurable color information in a Lab- (respective XYZ-) color space regardless of device. In this color space, a color is clearly defined by three values L, a and b and can be measured with TECHKON colorimeters. All input and output devices involved in color processing have been characterized by so-called ICC-profiles These profiles describe the association of device-specific color representations such as RGB or CMYK in the deviceless Lab-color space while considering each individual device's color gamut.

4 Components of a color management system

A major result of ICC-standardization has been the development of the system extension ColorSync for Apple Macintosh computers. ColorSync is the nucleus for the color adaptation of differing color spaces and ensures processing and administration of ICC-profiles.

Special profiling programs are used to develop ICC-color profiles for the different input and output devices. With **TECHKON's ColorManager series** you can elaborate individual color profiles for all input and output components.

To achieve color adaptation among the individual color-processing devices, you need to use ICC-profiles in the digital workflow. Among the available options for this purpose are applications such as QuarkXPress, PageMaker or Photoshop. In the future, more and more applications and device drivers will directly support ColorSync.

5 Elaborating ICC-profiles on TECHKON colorimeters

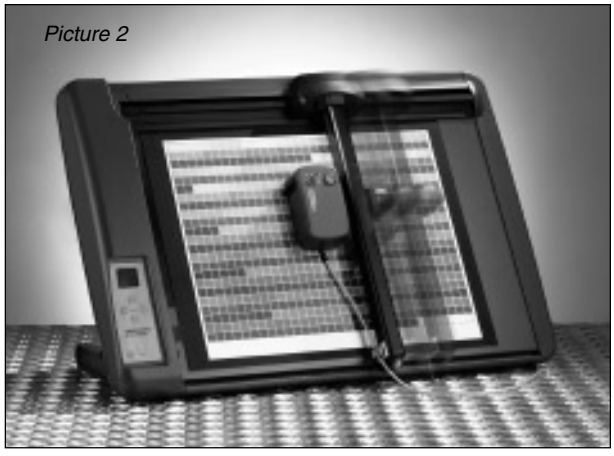
Use the CP-series of TECHKON colorimeters as well as the SP-series of spectrophotometers to create ICC-profiles for color output devices. The devices work in conjunction with the ICC-profiling software Monaco Print, ColorBlind, Heidelberg PrintOpen and Logo ProfileMaker.

The first step consists of printing a so-called test shape on the color output device for which you wish to create an ICC-profile. This test shape contains several color patches printed from differing shares of the process colors (e.g. CMYK). The next steps consists of measuring the color patches in sequence with a TECHKON color measurement device. The measurement device is directly connected to the computer via a data cable and measurement readings are automatically read by the profiling program.

As a last step, the program calculates an ICC-output profile based on the associated reference color data (e.g. CMYK-values) and the measured, absolute Lab-color data. Individual profiles for different printing conditions (paper, ink) are elaborated for each output device (e.g. inkjet-printer, digital proofer, offset-printer).

TECHKON's **TestChart Reader TCR** *(Picture 2)* provides an easy way to automatically measure the often large number of color patches on a test shape. The color measurement device is placed into the movable arm of the TestChart Reader which drives over the individual measurement patches.

Picture 2



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