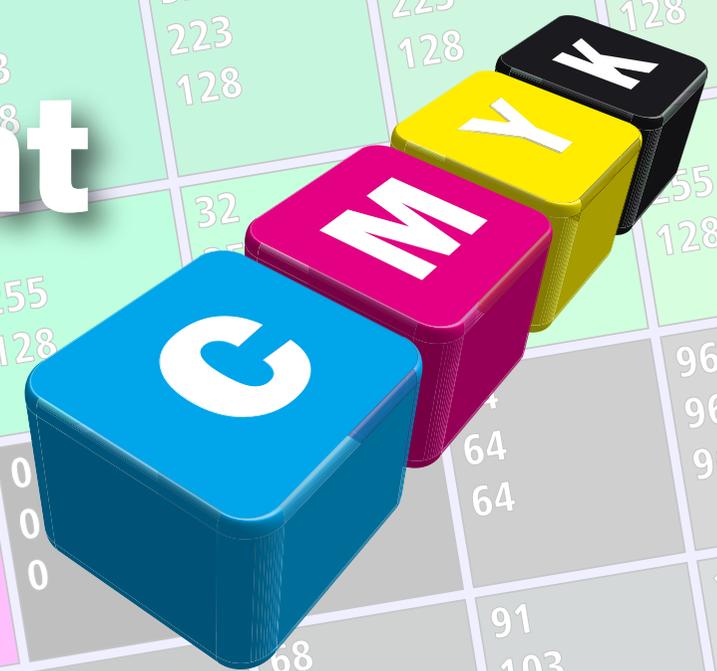


Introduction

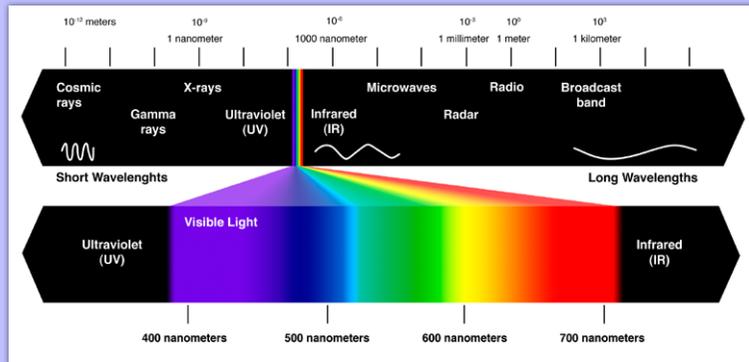
to

Color Management

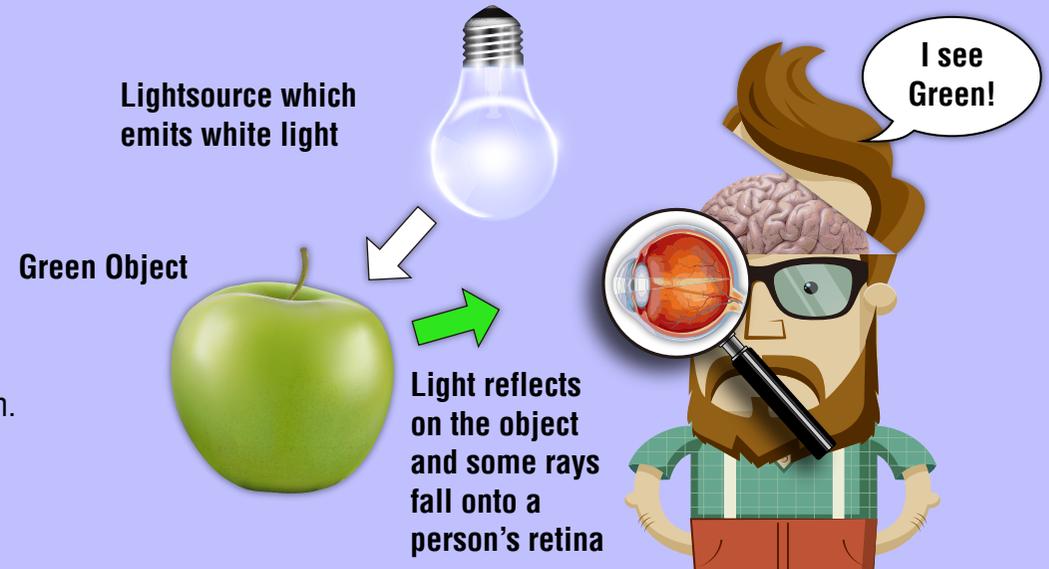


What is Color? How is Color seen by a human eye?

1. Color is the name we give to light that can be seen by a human eye. Light is an electromagnetic wave with a certain wavelength and an amount of energy. Our eyes can only detect a limited amount of the light that is surrounding us.



2. In 1931, two scientists of the International Commission on Illumination (In French : Commission Internationale de l'Eclairage or CIE in short) made an attempt to create a link between the physical wavelengths of light and how the human vision perceived this as colors. The results of this research still forms the base for nowadays CIE Color Space that is used inside the modern softwares.



3. Once we understand how we see color, we immediately see that we have an issue when it comes down to printers and ink. The problem is, that we do not fully control the light which is touching our retina. We only control the reflection.

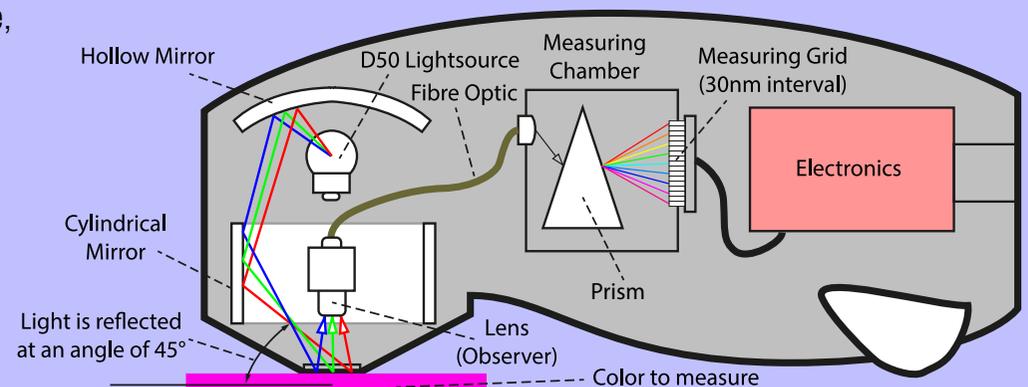
4. So in order to try and control the light that we see on a certain mix of CMYK (or other) ink, we need to define a standard lightsource (D38, D50, D65 or F7) and viewing conditions. This means that all the color evaluation done on printwork, is only valid when viewed under the exact same conditions as the observer inside the profiling device measured the colors during the profile creation.



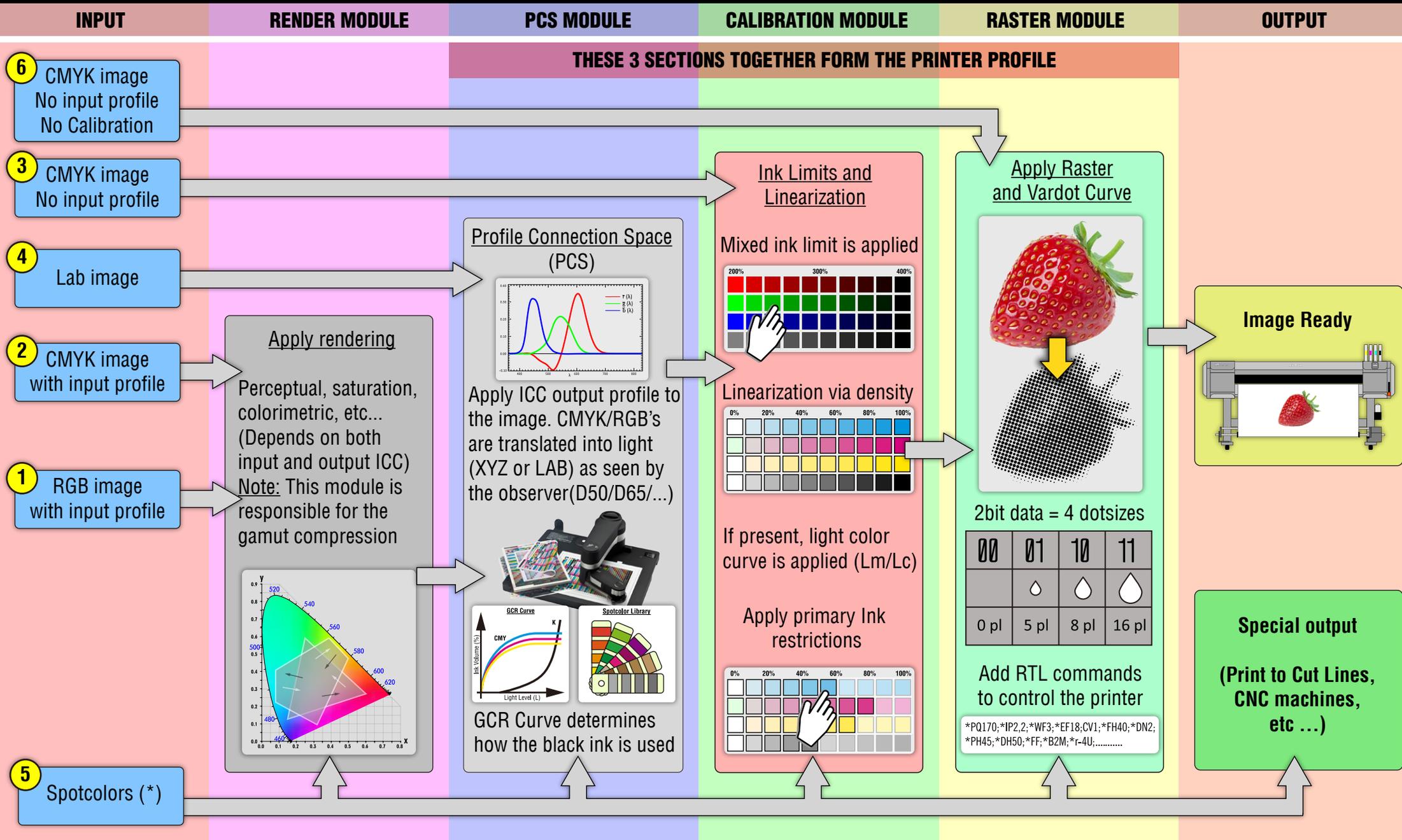
Viewing booth for print evaluation

5. When we use an Eye-one to make our profile, all the colors produced by the printer, are measured with a D50 lightsource, where the light falls down on the color under 45° . The light is seen by an observer directly above the color, who has a 2° viewing angle. The wavelengths of the light falling onto the observer are measured per 30nm interval.

XRite Eye-One (Handheld Spectral Measurement Device) Section View



COLOR SPACE TRANSLATION INSIDE RIP SOFTWARE (A chart to help you explain how the inside of a RIP functions)



(*) A spotcolor is a programmed color, inside an EPS or PDF file. It does not have a specific color value, instead, it has a name (In Illustrator this can be set via the swatches). 3 options :

- The spotcolor will be translated into a color that is a mix of the normal inks. This can be done via Lab value (to match a pantone color for example) or by CMYK value to print pure ink values.
- The spotcolor is linked to a special ink (example : White Ink or varnish on the 426UF printer). The rip will assign the spotcolor to that ink channel.
- The spotcolor is not used for printing (example : Print to Cut lines). In this case, the rip will translate the colored shape into a format used by a cutter (HPGL language).

Note : In rasterimages, this can be done via Alpha channels or sometimes even via transparency. This is supported in the TIFF format.

How to manipulate these settings as a User

1 RGB image with input profile

RGB file

ICC Profile Setup

CMYK Image	EuroscaleCoated.icc
CMYK Vector	EuroscaleCoated.icc
RGB Image	sRGB_IEC61966_21.icm
RGB Vector	sRGB_IEC61966_21.icm
Custom Image	No Profile Selected

With RGB Input Profile

Detailed description: This screenshot shows the Photoshop interface with a strawberry image. A magnifying glass highlights the '(RGB/8#)' label in the top-left corner. A yellow arrow points from a yellow circle labeled 'RGB file' to this label. Below the image is the 'ICC Profile Setup' dialog box. The 'Profiles' tab is active, showing 'EuroscaleCoated.icc' for both CMYK and RGB image and vector options. A yellow arrow points from a yellow circle labeled 'With RGB Input Profile' to the 'sRGB_IEC61966_21.icm' dropdown for the RGB Image option.

2 CMYK image with input profile

CMYK file

ICC Profile Setup

CMYK Image	EuroscaleCoated.icc
CMYK Vector	EuroscaleCoated.icc
RGB Image	sRGB_IEC61966_21.icm
RGB Vector	sRGB_IEC61966_21.icm
Custom Image	No Profile Selected

With CMYK Input Profile

Detailed description: This screenshot shows the Photoshop interface with a strawberry image. A magnifying glass highlights the '% (CMYK/8)' label in the top-left corner. A yellow arrow points from a yellow circle labeled 'CMYK file' to this label. Below the image is the 'ICC Profile Setup' dialog box. The 'Profiles' tab is active, showing 'EuroscaleCoated.icc' for both CMYK and RGB image and vector options. A yellow arrow points from a yellow circle labeled 'With CMYK Input Profile' to the 'sRGB_IEC61966_21.icm' dropdown for the RGB Image option.

3 CMYK image No input profile

CMYK file

ICC Profile Setup

CMYK Image	No Profile Selected
CMYK Vector	No Profile Selected
RGB Image	sRGB_IEC61966_21.icm
RGB Vector	sRGB_IEC61966_21.icm
Custom Image	No Profile Selected

Switch off CMYK Input Profile

Detailed description: This screenshot shows the Photoshop interface with a strawberry image. A magnifying glass highlights the '% (CMYK/8)' label in the top-left corner. A yellow arrow points from a yellow circle labeled 'CMYK file' to this label. Below the image is the 'ICC Profile Setup' dialog box. The 'Profiles' tab is active, showing 'No Profile Selected' for both CMYK and RGB image and vector options. A yellow arrow points from a yellow circle labeled 'Switch off CMYK Input Profile' to the 'No Profile Selected' dropdown for the CMYK Image option.

With a valid and complete output profile

Detailed description: This screenshot shows the 'ProductionHouse Media Manager' application. The 'Media Library' is open, displaying a list of printer profiles. The profile '10m_720x1080_WF4 Var' is highlighted. A yellow arrow points from a yellow circle labeled 'With a valid and complete output profile' to this profile.

With a valid and complete output profile

Detailed description: This screenshot shows the 'ProductionHouse Media Manager' application. The 'Media Library' is open, displaying a list of printer profiles. The profile '10m_720x1080_WF4 Var' is highlighted. A yellow arrow points from a yellow circle labeled 'With a valid and complete output profile' to this profile.

With an output profile (ICC can be present, but is not a must in this case)

Detailed description: This screenshot shows the 'ProductionHouse Media Manager' application. The 'Media Library' is open, displaying a list of printer profiles. The profile '10m_720x1080_WF4 Var' is highlighted. A yellow arrow points from a yellow circle labeled 'With an output profile (ICC can be present, but is not a must in this case)' to this profile.

How to manipulate these settings as a User

4

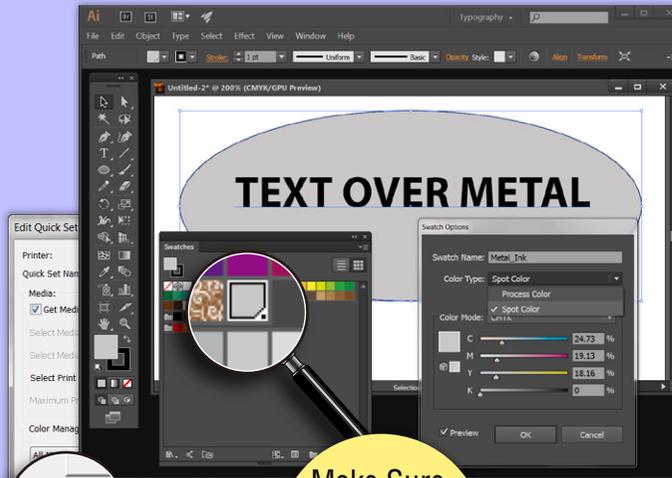
Lab image



Lab file

5

Spotcolors (*)



Make Sure your RIP is set to use spotcolors

6

CMYK image
No input profile
No Calibration

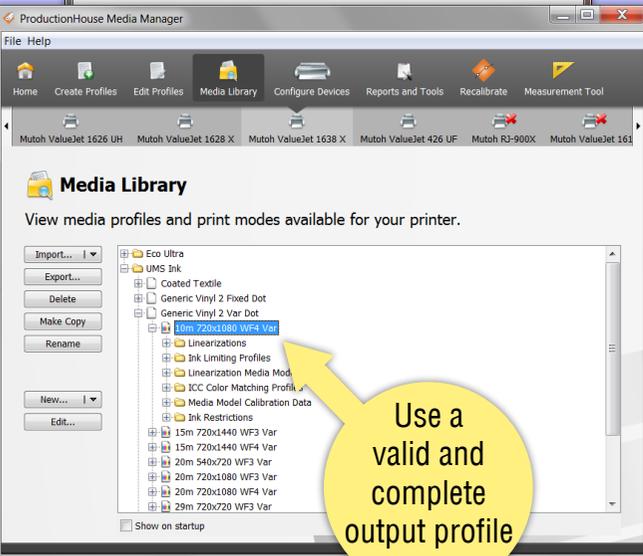
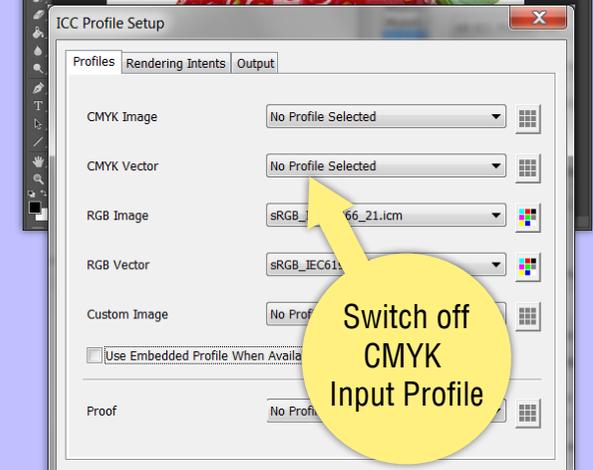


CMYK file

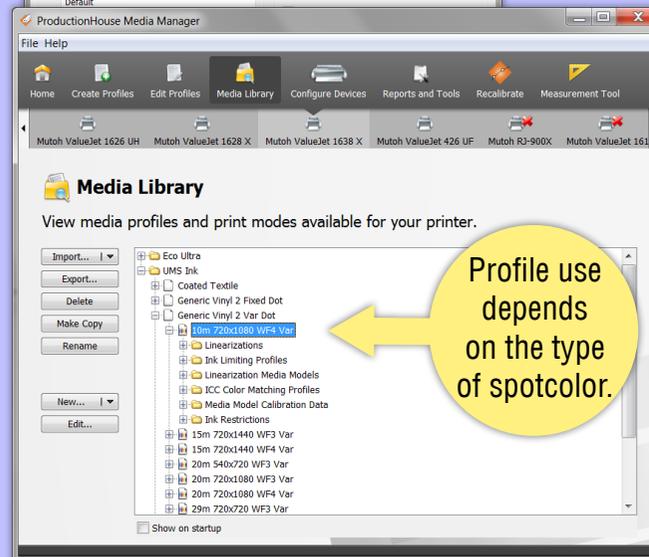
Don't bother about input profiles



Switch off CMYK Input Profile



Use a valid and complete output profile



Profile use depends on the type of spotcolor.

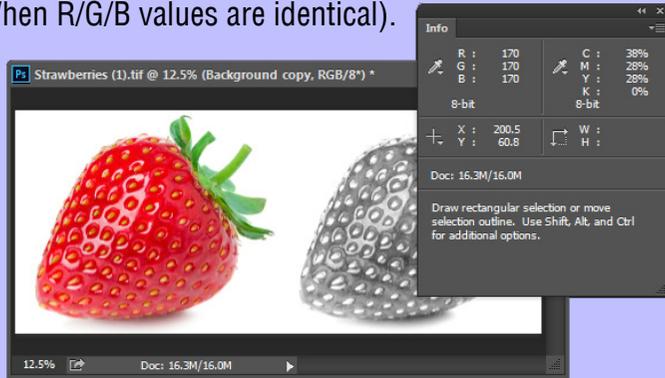


Use an empty profile (only print mode settings)

1 RGB image with input profile

Ideal for reproduction of photographic prints. All photographic material starts from RGB. Every conversion to another

profile comes with loss. In RGB you always have a gray reference (When R/G/B values are identical).



2 CMYK image with input profile

When Color Management is used correctly, there is not much difference between the printout of CMYK or RGB images. CMYK

was the only way to go in the past, since the images were tuned on ink levels (in screenprinting) and not via color values.

The only advantage of a CMYK image nowadays is that you have a bit less gamut compression compared to an RGB image. This enables you to put a little bit more “color punch” in the image.

You have a link between the CMYK values and the ink output (Although this idea is not 100% correct with modern RIP software. When you have a mix of CMYK that makes a Black color, and you lower your CMYK to make it brown, you might end up with more ink instead of less).

The downside of CMYK is that you do not have a gray reference. A second downside is the 100% values instead of the 8 bit 0-255 value. Inside the CMYK also works with 0-255 values, but some tools (like the photoshop paint bucket) do not give you access to these values.

3 CMYK image No input profile

This is an Interesting option. Sometimes, you can have a reason to work on ink level

instead of working with colors. For example, if you want to print pure yellow, or pure black for small text that needs to be extra sharp.



4 Lab image

In case you have access to the Lab value of a color (for example, if you have measured it with a spectrometer) or if you have access to the Lab list of the pantone colors

(You can even find them via Photoshop, when you fill an area in a Lab TIFF with a Pantone color from the picker, and then use the Color Info to get the Lab value of that specific pantone).



5 Spotcolors (*)

As pointed out earlier, spotcolors are programmed colors. You can fill them with an RGB or CMYK value, but that is only for On-Screen viewing purposes.

A spotcolor can only work inside a programmable image (PDF or EPS). When used inside a TIFF, it will be converted to a process color.

Spotcolors are typically used for pantone reproduction, specialty inks and print to cut lines.

6 CMYK image No input profile No Calibration

This is rarely used for normal printing. With this, you control your ink channels directly, without any link to a reference.

It is used sometimes for testprinting, to observe what the ink is capable of, or to make test targets.

One special field in which these might be used is the traffic sign business, because there it is not possible to create a profile on the reflective materials, and you use only 4 or 8 colors in total, which are defined via a pure ink channel percentage.

Color Reproduction

Color reproduction is a complex matter because it depends on many variables. Besides that, one of the main problems is the lack of a reference. A small comparison : When you want to communicate length dimensions with someone, you simply say : The image should measure 120cm by 80cm, up to 1mm precise. The other person can go and buy a rollmeter in any hardware store (which will be calibrated according to the metric system), of which you know that these dimensions are in range, and he can also in his head form an idea of what 120cm and 80cm should be like.

But when you say to someone, the color should be $L = 49 / a = 56 / b = -30$ up to $\Delta E 5$ precision , most of the times, they have no idea what you are talking about. They also lack a metering device to confirm their final color, or they are not even sure if their printer can produce that kind of color. Also, when you try to make a reference to a color, you will notice that this is almost non existing. Even the Coca Cola red of the Italian Coke-cans is not identical to the Coke-red in Belgium. Keep in mind that color cannot be communicated in RGB or CMYK values (unless you are using colorcharts made on the same device). Pantone is of course an option, but only in case it is used correctly.

Factors with minimal influence on Color issues



More common factors which can lead to Color "issues"



Factors which are usually the cause of Color issues

